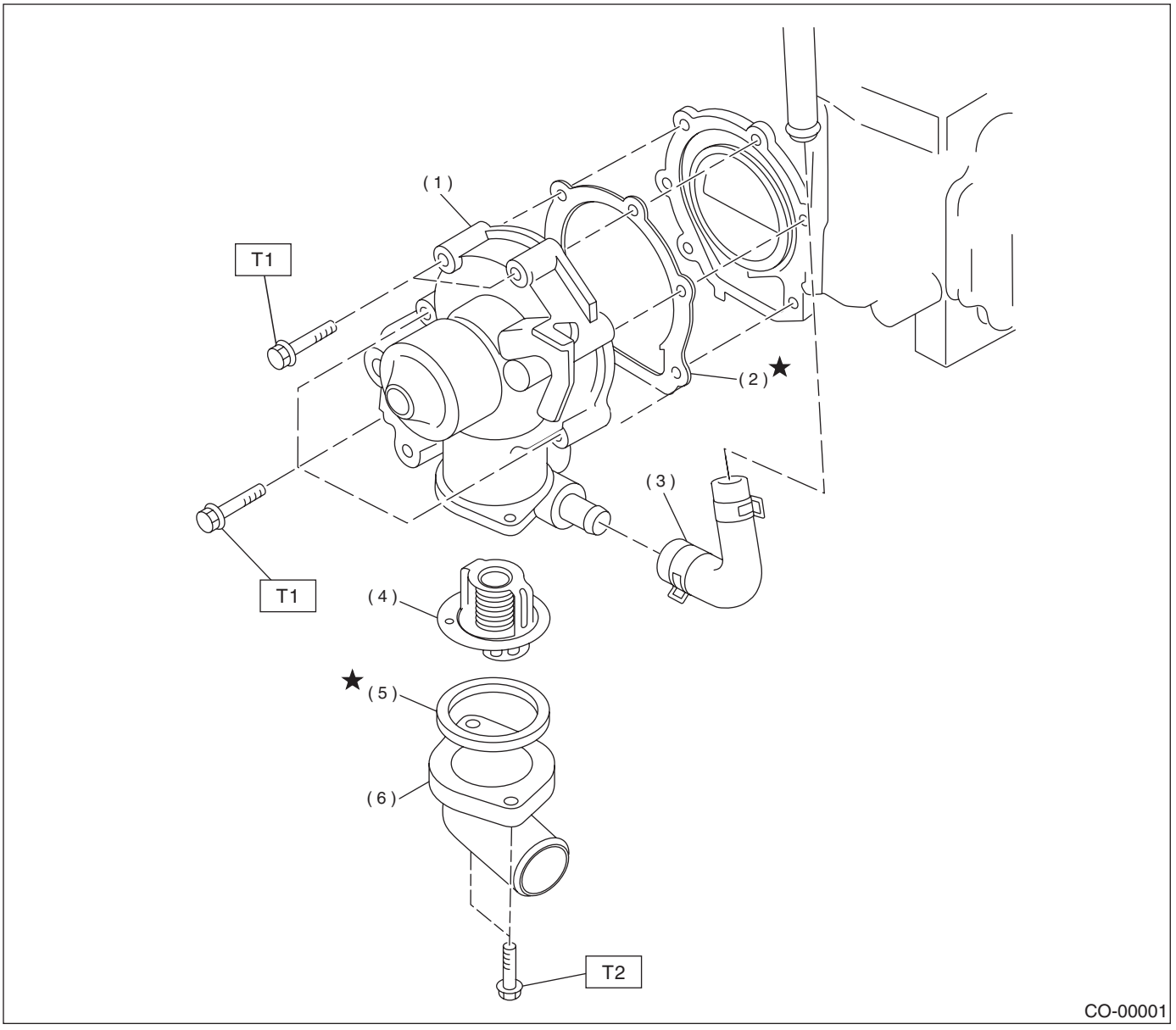
1. General Description

A: SPECIFICATIONS

Cooling system			Electric fan + Forced engine coolant circulation system
Total engine coolant capacity ℓ (US qt, Imp qt)			MT: Approx. 6.8 (7.2, 6.0) AT: Approx. 6.7 (7.1, 5.9)
Water pump	Type		Centrifugal impeller type
	Discharge performance I	Discharge	18 ℓ (4.8 US gal, 4.0 Imp gal)/min.
		Pump speed—pressure leak	1,000 rpm — 7 kPa (0.7 mAq, 2.3 ftAq)
		Engine coolant temperature	80°C (176°F)
	Discharge performance II	Discharge	70 ℓ (18.5 US gal, 15.4 Imp gal)/min.
		Pump speed—pressure leak	3,000 rpm — 55 kPa (5.6 mAq, 18.4 ftAq)
		Engine coolant temperature	80°C (176°F)
	Discharge performance III	Discharge	153 ℓ (40.4 US gal, 33.7 Imp gal)/min.
		Pump speed—pressure leak	6,000 rpm — 217 kPa (22.1 mAq, 72.5 ftAq)
		Engine coolant temperature	80°C (176°F)
	Impeller diameter		74 mm (2.91 in)
	Number of impeller vanes		8
	Pump pulley diameter		60 mm (2.36 in)
	Clearance between impeller and case	Standard	0.4 — 1.6 mm (0.016 — 0.063 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 opening bore		35 mm (1.38 in)
Radiator fan	Motor		75 W (main fan) 75 W (sub fan)
	Fan diameter × Blade		300 mm (11.81 in) × 5 (main fan) 300 mm (11.81 in) × 4 (sub fan)
Radiator	Type		Down flow, pressure type
	Core dimensions		691.5 × 340 × 16 mm (27.22 × 13.39 × 0.63 in)
	Cap valve opening pressure		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)

B: COMPONENT

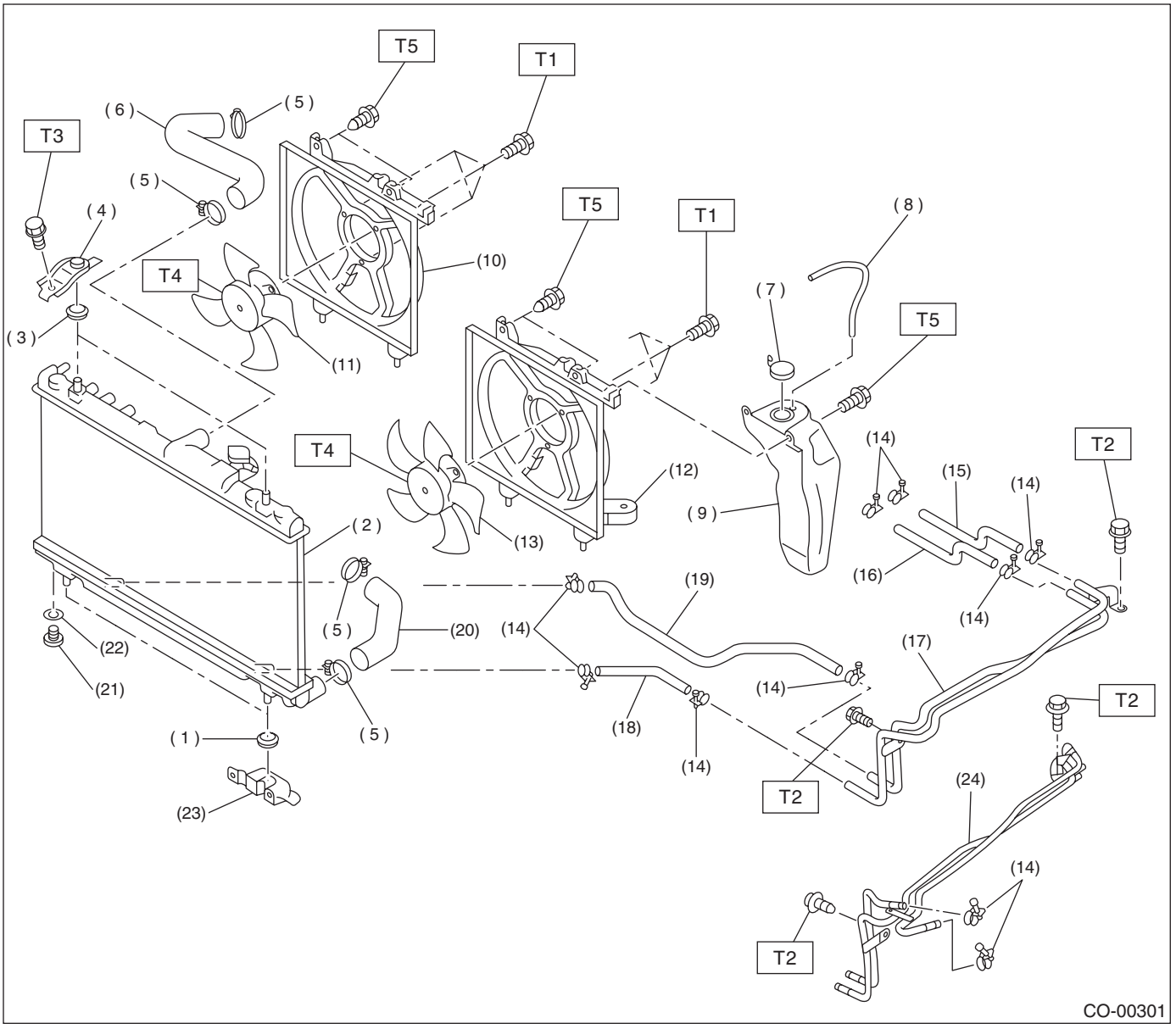
1. WATER PUMP



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

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



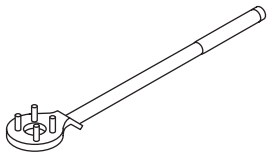
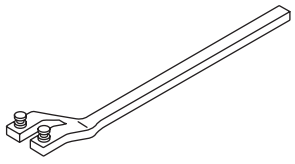
(1) Radiator lower cushion
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clamp
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Overflow hose
(9) Engine coolant reservoir tank
(10) Sub fan shroud
(11) Radiator sub fan and sub fan motor ASSY
(12) Main fan shroud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

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

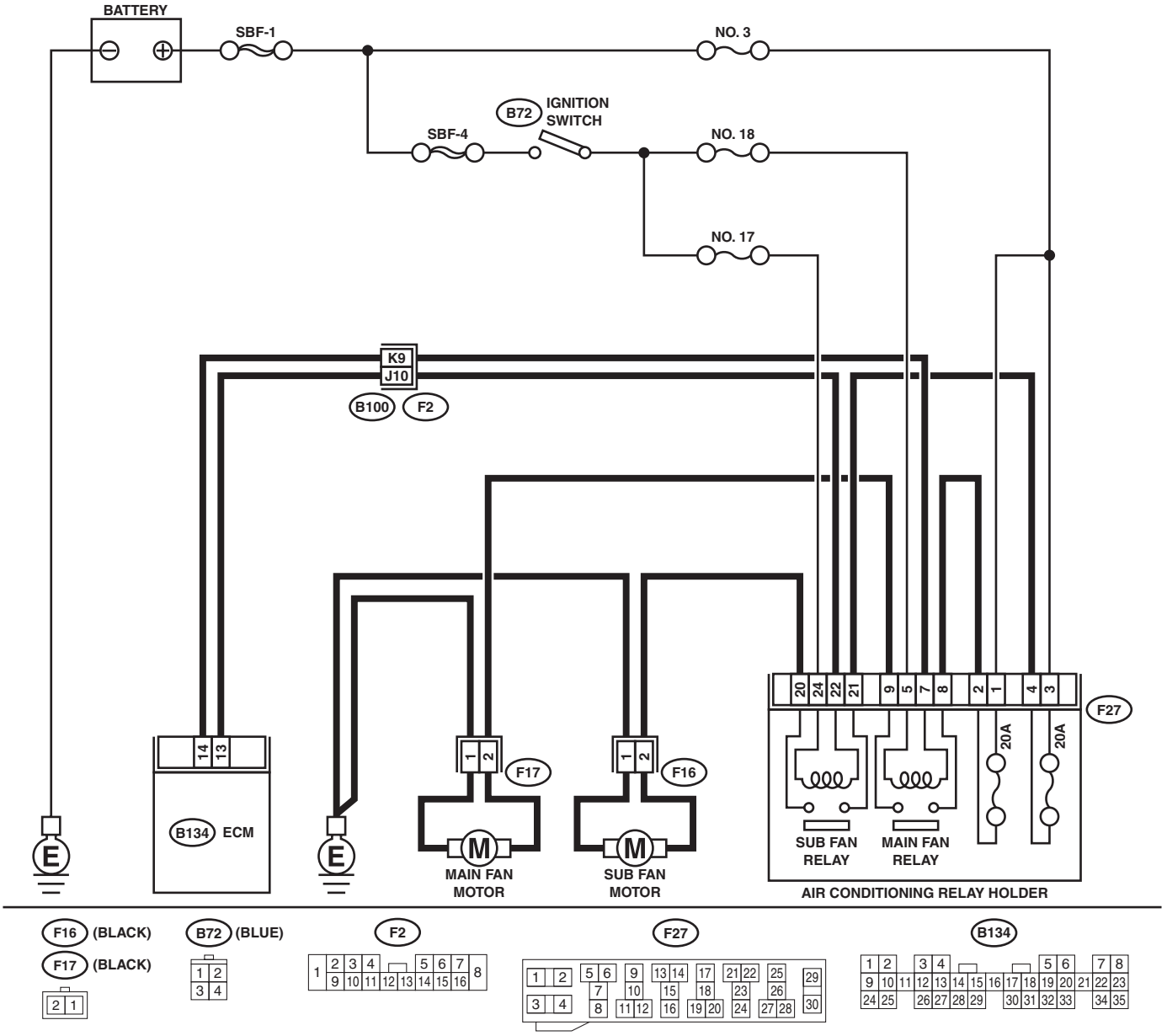
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation 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 ground cable from battery.

D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for fixing crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	• Used for removing and installing camshaft sprocket. • Camshaft sprocket wrench (499207100) is also available.

2. Radiator Main Fan System

A: SCHEMATIC



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B: INSPECTION

DETECTING CONDITION:

Condition:

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

TROUBLE SYMPTOM:

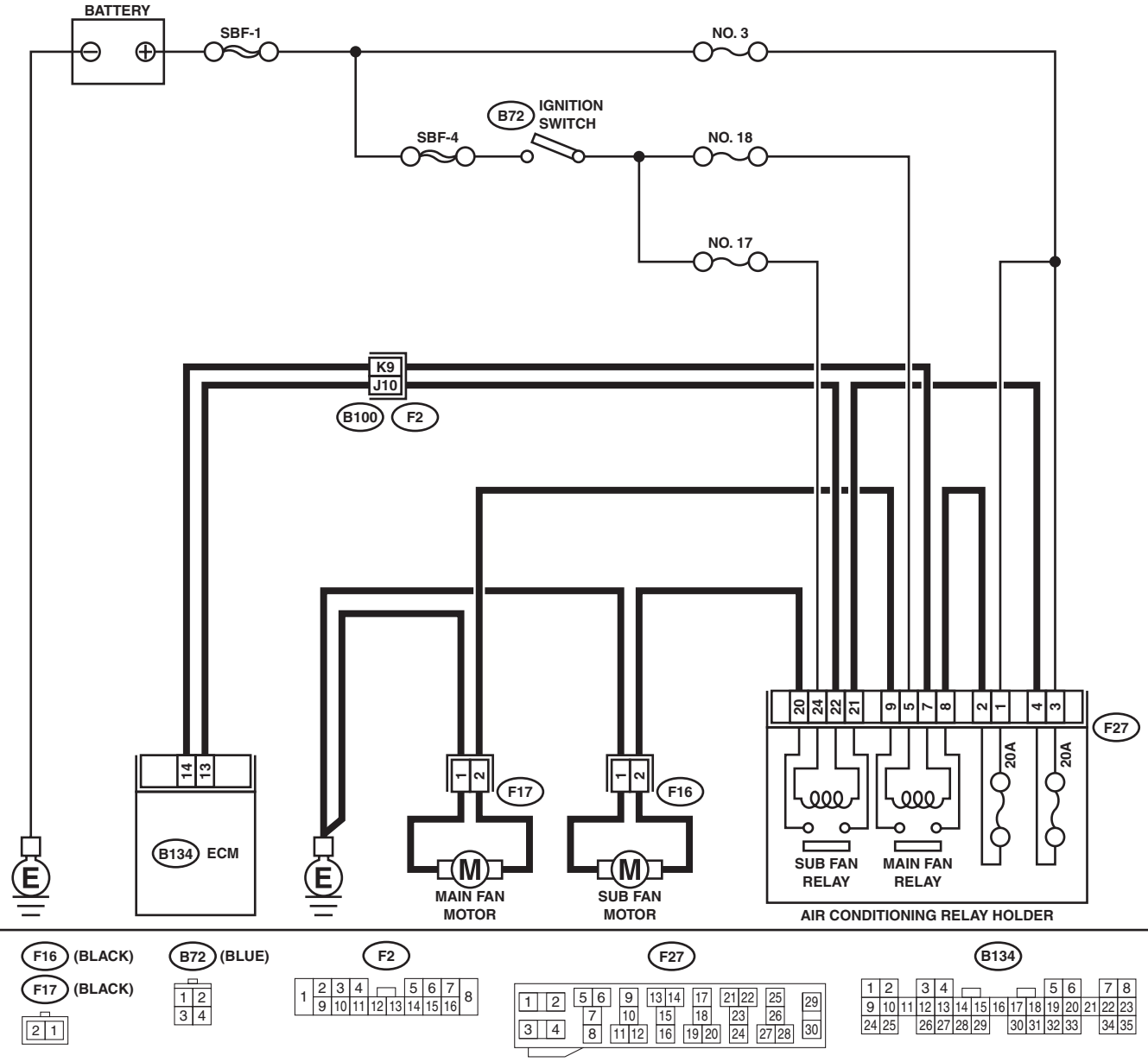
- Radiator main fan does not rotate under the above conditions.

	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO MAIN FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1) Turn ignition switch to OFF. 2) Disconnect connector from 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 ignition switch to ON. 5) Measure voltage between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **5.**
2	**CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 1 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair 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?	Repair poor contact in main fan motor connector.	Go to step **4.**
4	**CHECK MAIN FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of main fan motor connector.	Does the main fan rotate?	Repair poor contact in main fan motor connector.	Replace main fan motor with a new one.
5	**CHECK POWER SUPPLY TO MAIN FAN RELAY.** 1) Turn ignition switch to OFF. 2) Remove main fan relay from A/C relay holder. 3) Measure voltage between main fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 8 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **6.**	Go to step **7.**
6	**CHECK POWER SUPPLY TO MAIN FAN RELAY.** 1) Turn ignition switch to ON. 2) Measure voltage between main fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 5 (+) — Chassis ground (–):***	Is the measured value more than 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?	Replace fuse.	Go to step **8.**

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.** Measure 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 10 V?	Repair open circuit in harness between 20 A fuse and main fan relay terminal.	Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.
9	**CHECK FUSE.** 1) Turn ignition switch to OFF. 2) Remove fuse No. 18 from joint box. 3) Check fuse.	Is the fuse blown out?	Replace fuse.	Repair open circuit in harness between main fan relay and ignition switch.
10	**CHECK MAIN FAN RELAY.** 1) Turn ignition switch to OFF. 2) Measure resistance of main fan relay. ***Terminal*** ***No. 8 — No. 9:***	Is the measured value more than 1 MΩ?	Go to step **11.**	Replace main fan relay.
11	**CHECK MAIN FAN RELAY.** 1) Connect battery to terminals No. 5 and No. 7 of main fan relay. 2) Measure resistance of main fan relay. ***Terminal*** ***No. 8 — No. 9:***	Is the measured value less than 1 Ω?	Go to step **12.**	Replace main fan relay.
12	**CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.** Measure resistance of harness between main fan motor connector and main fan relay terminal. ***Connector & terminal*** ***(F17) No. 2 — (F27) No. 9:***	Is the measured value less than 1 Ω?	Go to step **13.**	Repair 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 ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between main fan relay connector and ECM connector. ***Connector & terminal*** ***(F27) No. 7 — (B134) No. 14:***	Is the measured value less than 1 Ω?	Go to step **14.**	Repair 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?	Repair poor contact connector.	Contact with SOA (distributor) service.

3. Radiator Sub Fan System

A: SCHEMATIC



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B: INSPECTION

NOTE:
Radiator sub fan system is for model with A/C.

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 ignition switch to OFF. 2) Disconnect connector from 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 ignition switch to ON. 5) Measure voltage between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 2 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **5.**
2	**CHECK GROUND CIRCUIT OF SUB FAN MOTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 1 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair 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?	Repair poor contact in sub fan motor connector.	Go to step **4.**
4	**CHECK SUB FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of sub fan motor connector.	Does the sub fan rotate?	Repair poor contact in sub fan motor connector.	Replace sub fan motor with a new one.
5	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn ignition switch to OFF. 2) Remove sub fan relay from A/C relay holder. 3) Measure voltage between sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 21 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **6.**	Go to step **7.**

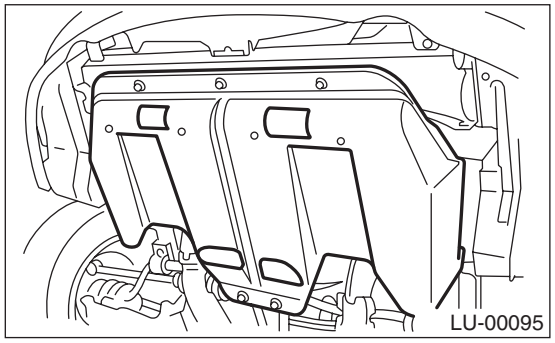
	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn ignition switch to ON. 2) Measure voltage between sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 24 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **10.**	Go to step **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?	Replace fuse.	Go to step **8.**
8	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.** Measure 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 10 V?	Repair open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.
9	**CHECK FUSE.** 1) Turn ignition switch to OFF. 2) Remove fuse No. 17 from joint box. 3) Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between sub fan relay and ignition switch.
10	**CHECK SUB FAN RELAY.** 1) Turn ignition switch to OFF. 2) Measure resistance of sub fan relay. ***Terminal*** ***No. 20 — No. 21:***	Is the measured value more than 1 MΩ?	Go to step **11.**	Replace sub fan relay.
11	**CHECK SUB FAN RELAY.** 1) Connect battery to terminals No. 22 and No. 24 of sub fan relay. 2) Measure resistance of sub fan relay. ***Terminal*** ***No. 20 — No. 21:***	Is the measured value less than 1 Ω?	Go to step **12.**	Replace sub fan relay.
12	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** Measure resistance of harness between sub fan motor connector and sub fan relay terminal. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 20:***	Is the measured value less than 1 Ω?	Go to step **13.**	Repair open circuit in harness between sub fan motor and sub fan relay connector.
13	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between sub fan relay connector and ECM connector. ***Connector & terminal*** ***(F27) No. 22 — (B134) No. 13:***	Is the measured value less than 1 Ω?	Go to step **14.**	Repair 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?	Repair poor contact connector.	Contact with SOA (distributor) service.

4. Engine Coolant

A: REPLACEMENT

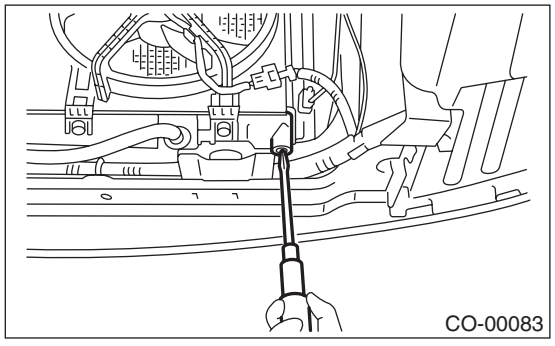
1. DRAINING OF ENGINE COOLANT

1) Lift-up the vehicle.
2) Remove under cover.



3) Remove drain cock to drain engine coolant from radiator.

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



2. FILLING OF ENGINE COOLANT

1) Fill cooling system conditioner from filling port.

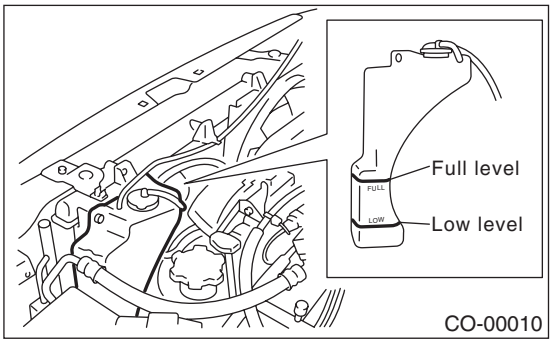
Cooling system protecting agent:
COOLING SYSTEM CONDITIONER (Part No. SOA635071)

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

Engine coolant amount for refill:
MT model;
Approx. 6.8 ℓ (7.2 US qt, 6.0 Imp qt)
AT model;
Approx. 6.7 ℓ (7.1 US qt, 5.9 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.

3) Fill engine coolant into reservoir tank up to upper level.

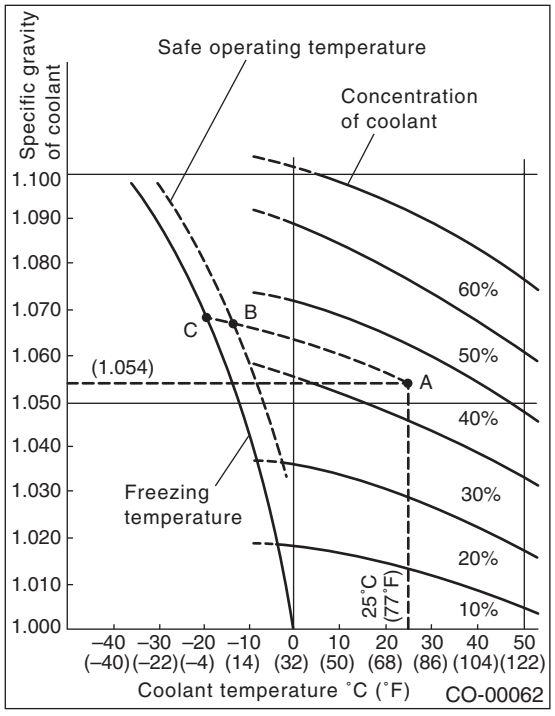


4) Attach radiator cap and reservoir tank cap properly.
5) Warm-up engine completely for more than five minutes at 2,000 to 3,000 rpm.
6) If engine coolant level drops in radiator, add engine coolant to filler neck position.
7) If engine coolant level drops from upper level of reservoir tank, add engine coolant to upper level.
8) Attach radiator cap and reservoir tank cap properly.

B: INSPECTION

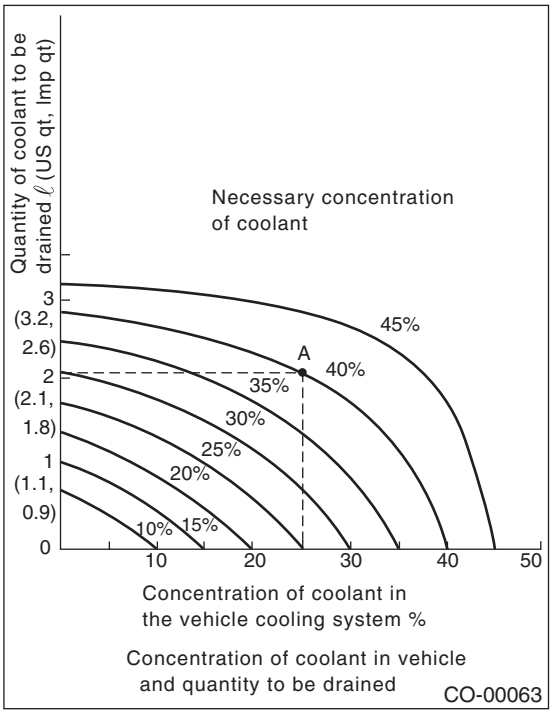
1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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.
[Example]
If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (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

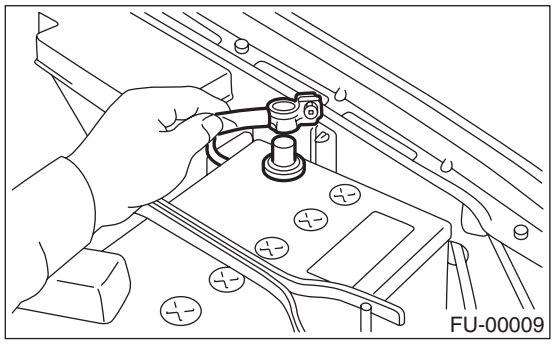
To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50).
The amount of coolant that should be replaced can be determined 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.



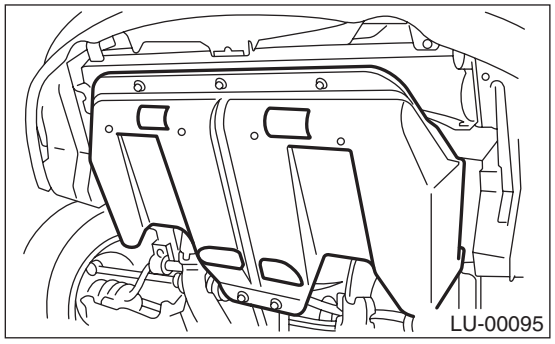
5. Water Pump

A: REMOVAL

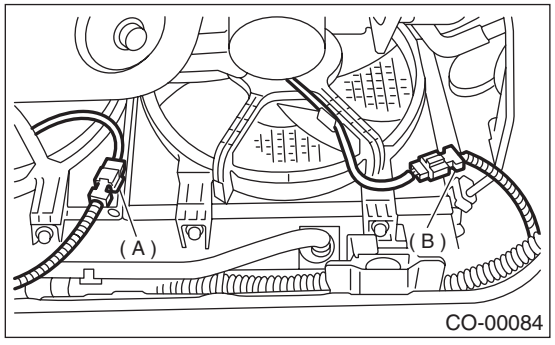
1) Disconnect ground cable from battery.



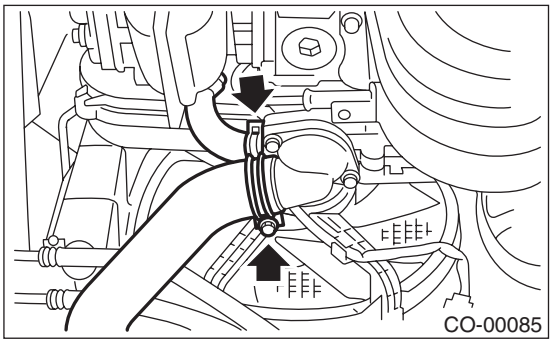
2) Lift-up the vehicle.
3) Remove under cover.



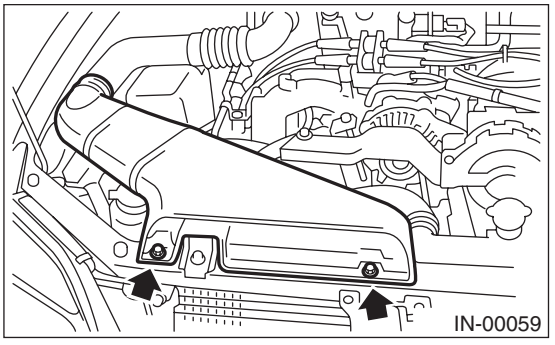
4) Drain engine coolant completely.
<Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect connectors from radiator main fan (A) and sub fan (B) motors.



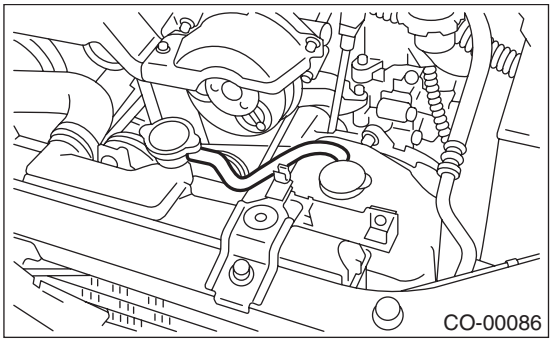
6) Disconnect radiator outlet hose and heater by-pass hose from water pump.



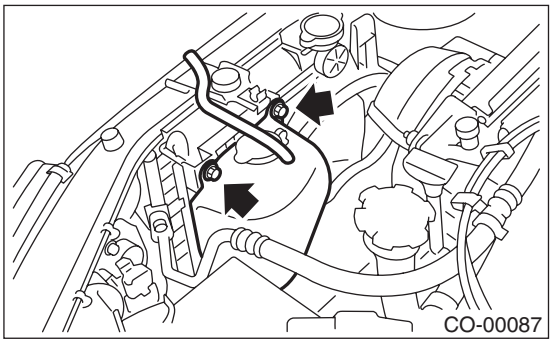
7) Lower the vehicle.
8) Remove air intake duct.



9) Disconnect overflow hose.

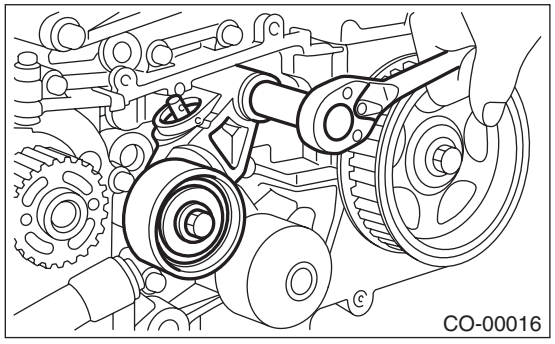


10) Remove reservoir tank.

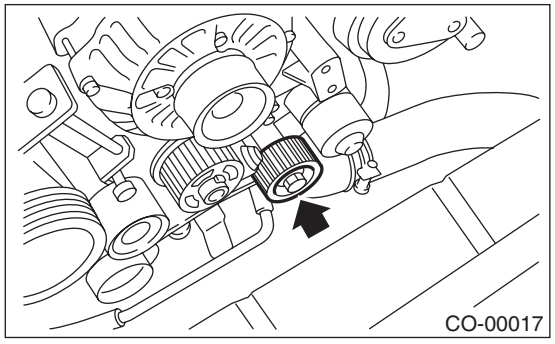


11) Remove radiator main fan and sub fan assemblies. <Ref. to CO(H4SO)-25, REMOVAL, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-27, REMOVAL, Radiator Sub Fan and Fan Motor.>

12) Remove V-belts.
<Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
13) Remove timing belt.
<Ref. to ME(H4SO)-44, TIMING BELT, REMOVAL, Timing Belt.>
14) Remove automatic belt tension adjuster.

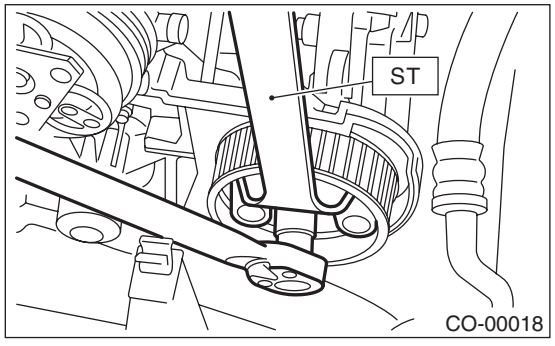


15) Remove belt idler No. 2.

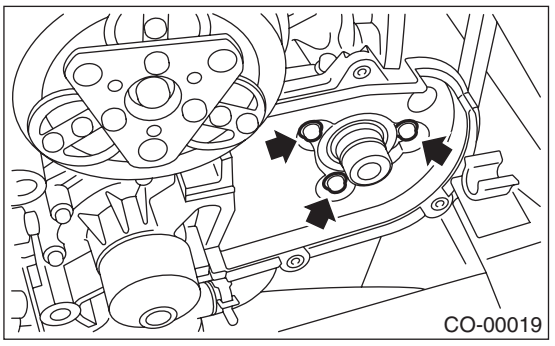


16) Remove left-hand camshaft sprocket by using ST.
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

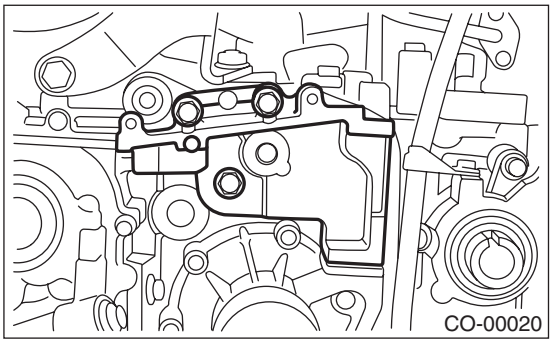
NOTE:
Camshaft sprocket wrench (499207100) is also available.



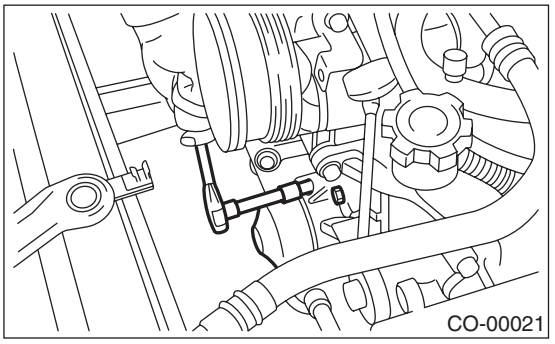
17) Remove left-hand belt cover No. 2.



18) Remove tensioner bracket.



19) Remove water pump.

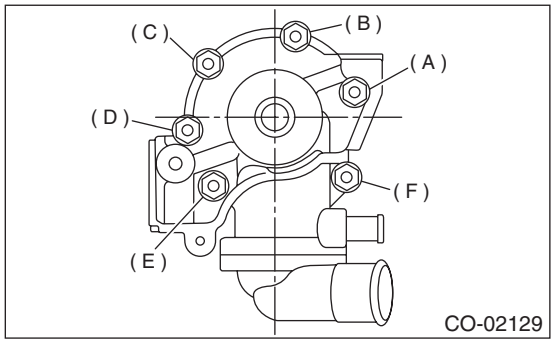


B: INSTALLATION

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

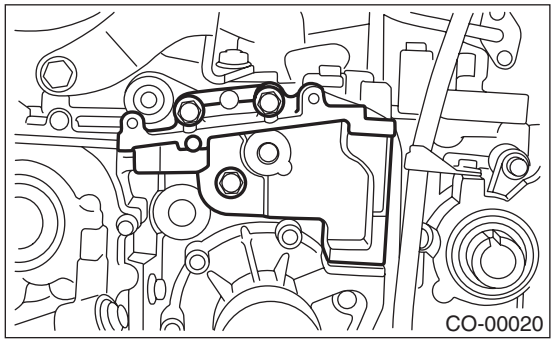
NOTE:
- Replace gasket with a new one.
- When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.

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)



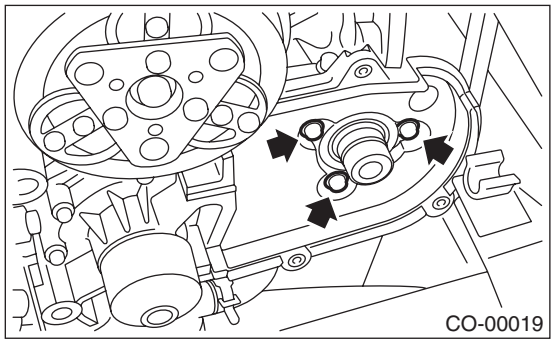
2) Install tensioner bracket.

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



3) Install left-hand belt cover No. 2.

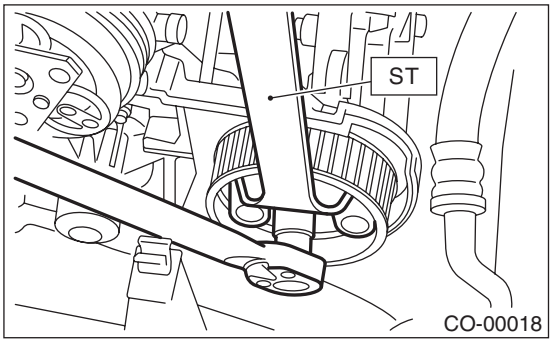
Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



4) Install left-hand camshaft sprockets by using ST.
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

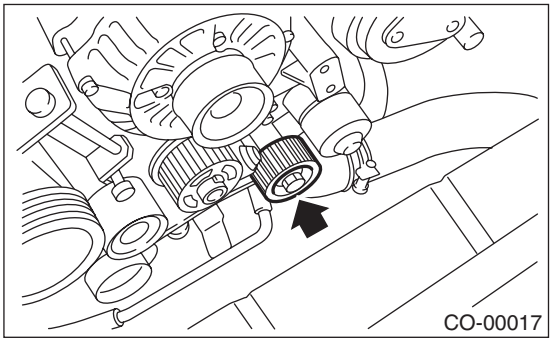
NOTE:
Camshaft sprocket wrench (499207100) is also available.

Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)



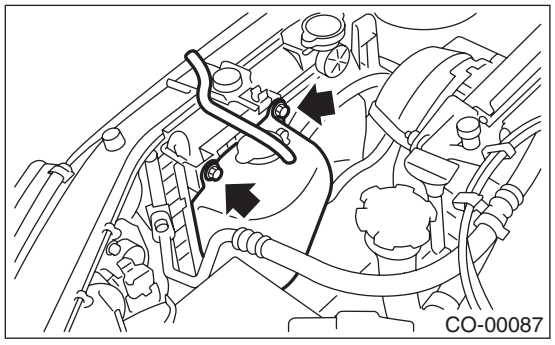
5) Install belt idler No. 2.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

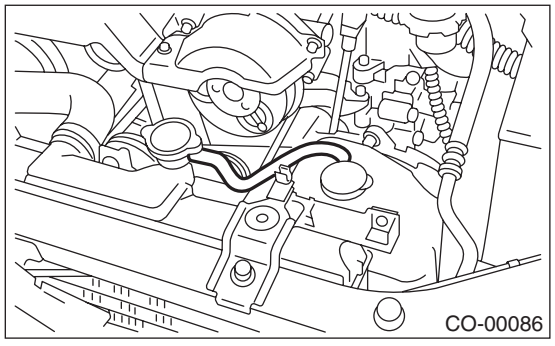


6) Install automatic belt tension adjuster which tension rod is held with pin. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
7) Install timing belt. <Ref. to ME(H4SO)-46, TIMING BELT, INSTALLATION, Timing Belt.>
8) Install V-belts. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>
9) Install radiator main fan and sub fan motor assemblies. <Ref. to CO(H4SO)-25, INSTALLATION, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-27, INSTALLATION, Radiator Sub Fan and Fan Motor.>

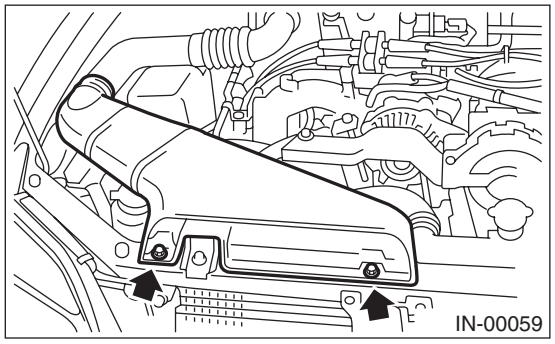
10) Install reservoir tank.



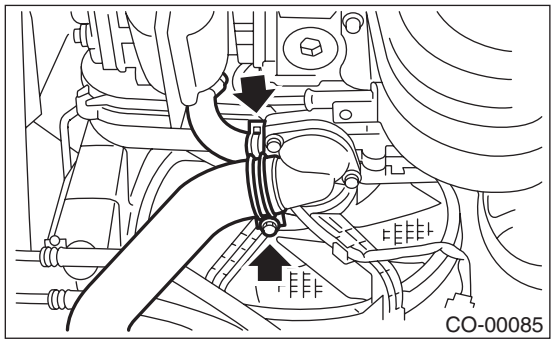
11) Connect overflow hose.



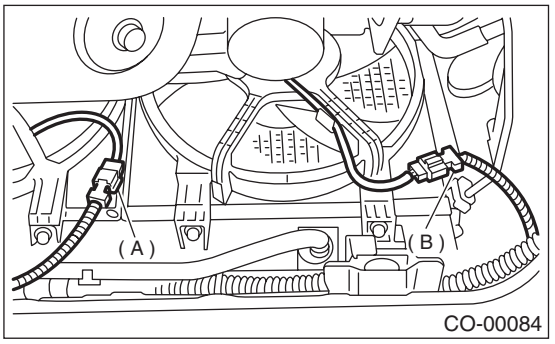
12) Install air intake duct.



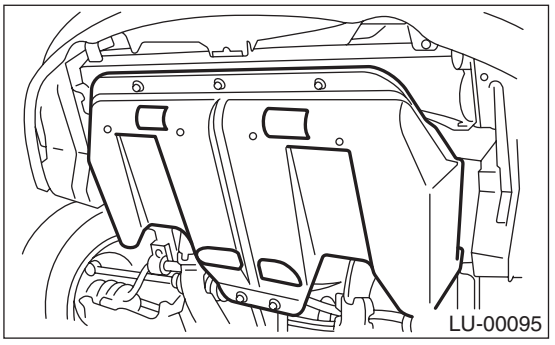
13) Lift-up the vehicle.
14) Connect radiator outlet hose and heater by-pass hose to water pump.



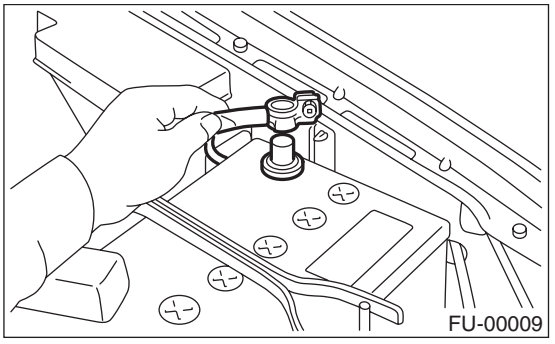
15) Connect connectors to radiator main fan (A) and sub fan (B) motors.



16) Install under cover.



17) Lower the vehicle.
18) Connect battery ground cable.

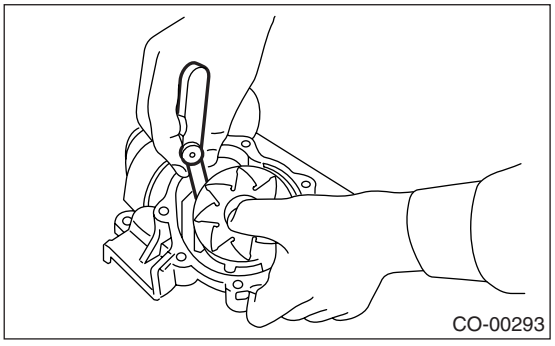


19) Fill coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1) Check water pump bearing for smooth rotation.
2) Check water pump pulley for abnormalities.
3) Inspect the impeller for crack or deformation.
4) Check clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.4 — 1.6 mm (0.016 — 0.063 in)

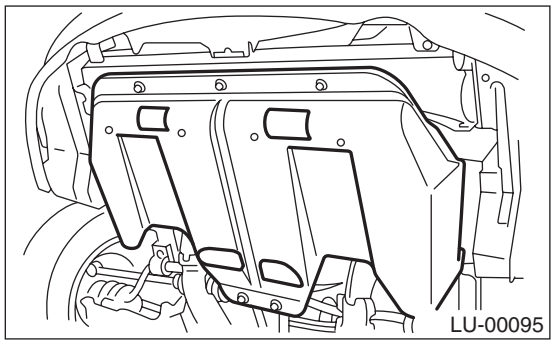


5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.

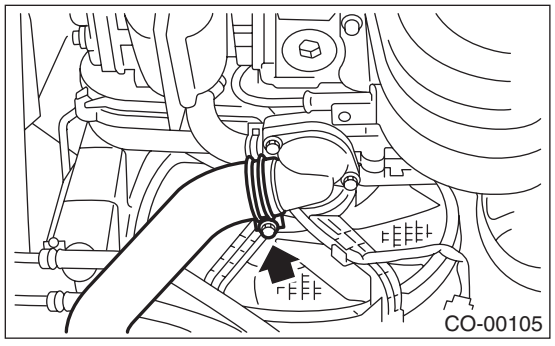
6. Thermostat

A: REMOVAL

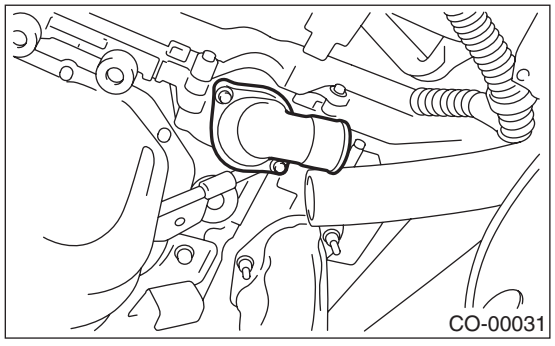
1) Lift-up the vehicle.
2) Remove under cover.



3) Drain engine coolant completely. <Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect radiator outlet hose from thermostat cover.



5) Remove thermostat cover and gasket, and pull out the thermostat.

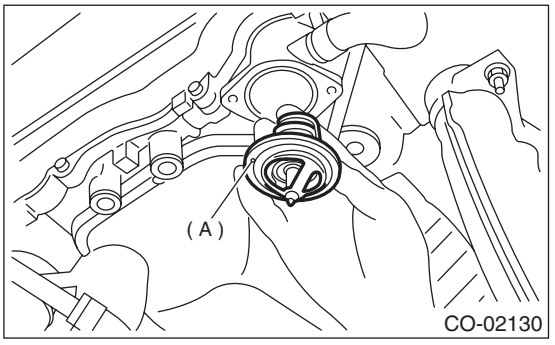


B: INSTALLATION

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

NOTE:
- Replace gasket with a new one.
- Thermostat must be installed with jiggle pin (A) facing the front side.

Tightening torque:
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)

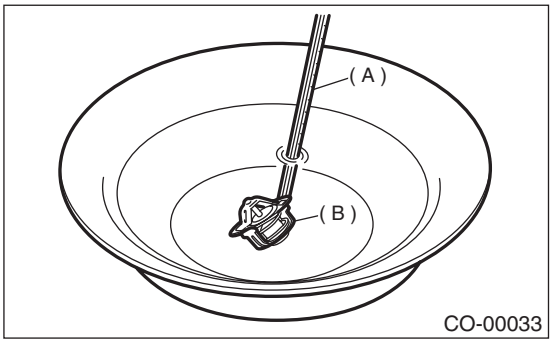


2) Fill coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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. If the measured temperature is within the specified range, the condition of thermostat is normal.

Specified value:
Starts to open:
76.0 — 80.0°C (169 — 176°F)
Fully opens:
91°C (196°F)

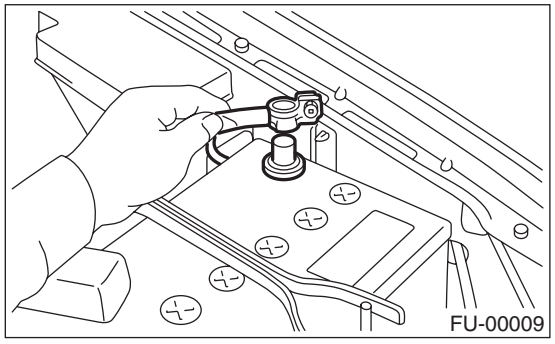


(A) Thermometer
(B) Thermostat

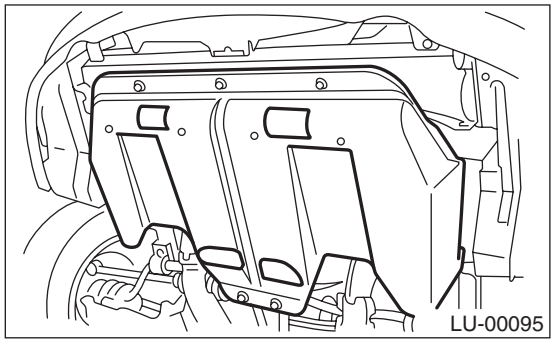
7. Radiator

A: REMOVAL

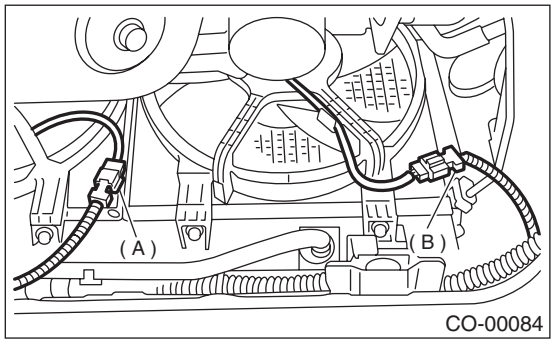
1) Disconnect battery ground cable.



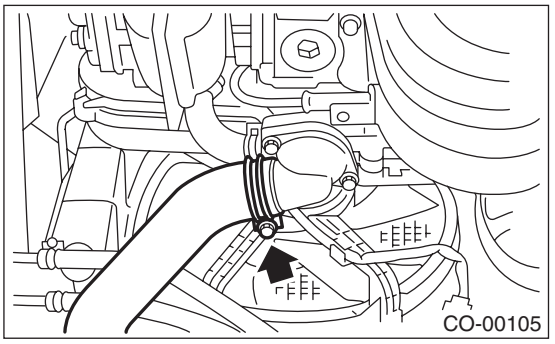
2) Lift-up the vehicle.
3) Remove under cover.



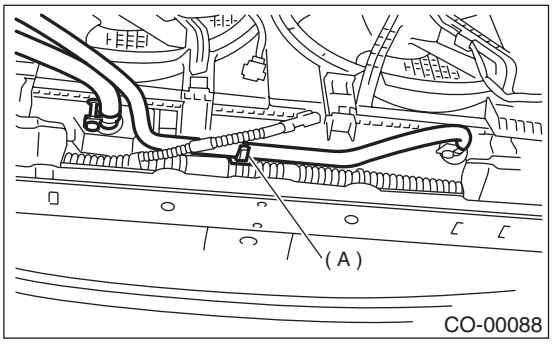
4) Drain engine coolant completely. <Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect connectors of radiator main fan (A) and sub fan (B) motor.



6) Disconnect radiator outlet hose from thermostat cover.

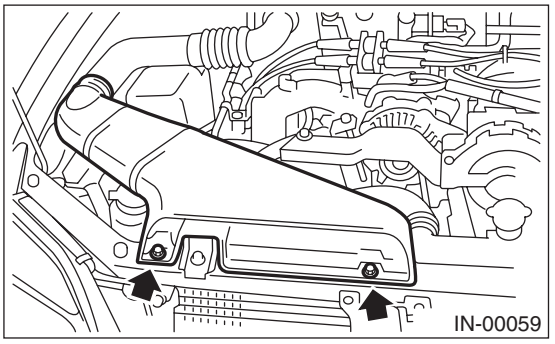


7) Disconnect ATF cooler hoses from radiator. (AT vehicles only)

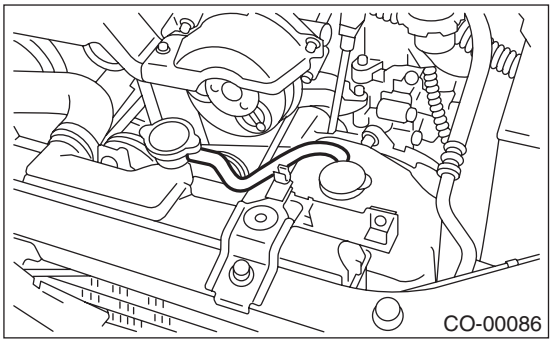


(A) Clip

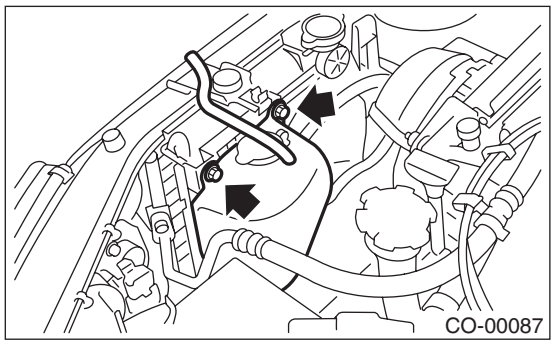
8) Lower the vehicle.
9) Remove air intake duct.



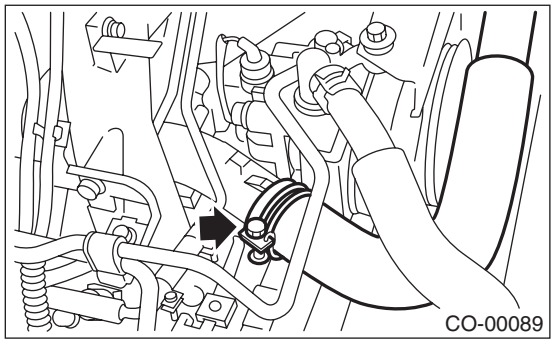
10) Disconnect overflow hose.



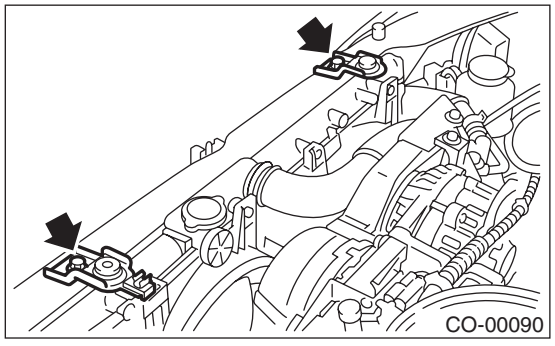
11) Remove reservoir tank.



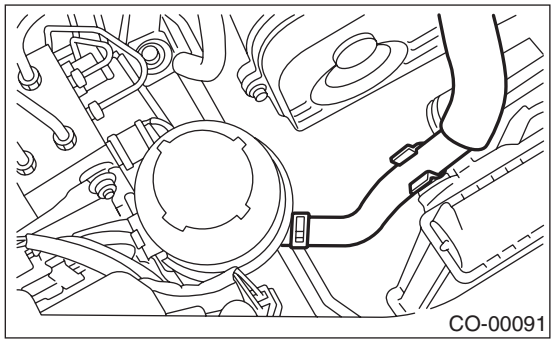
12) Disconnect radiator inlet hose from engine.



13) Remove radiator upper brackets.

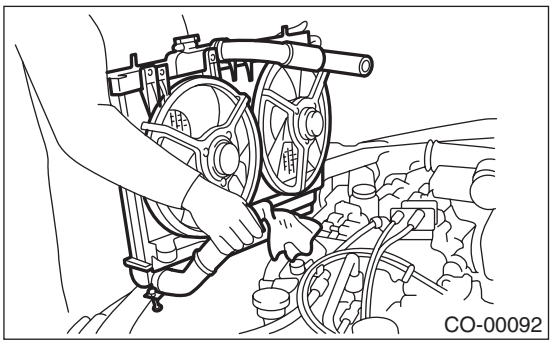


14) Detach power steering hose from the clip on the radiator.



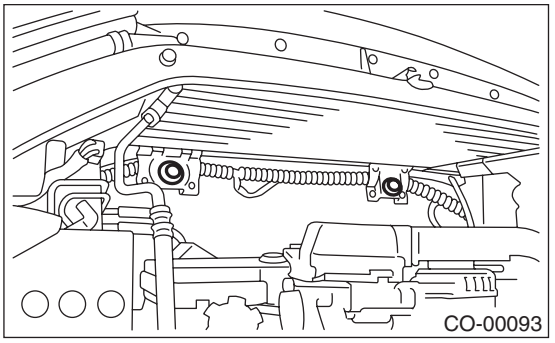
15) While slightly lifting radiator, slide it to left.

16) Lift radiator up and away from vehicle.



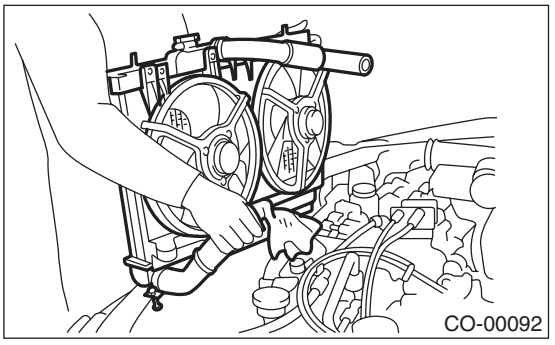
B: INSTALLATION

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



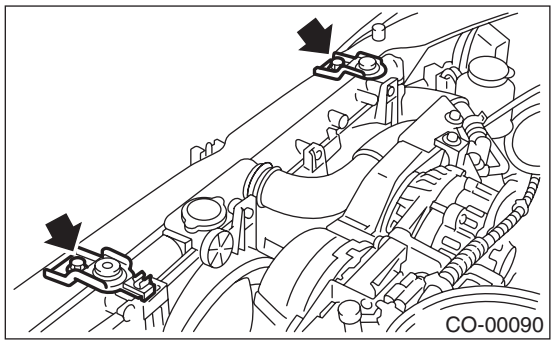
2) Install radiator while fitting radiator pins to cushions.

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

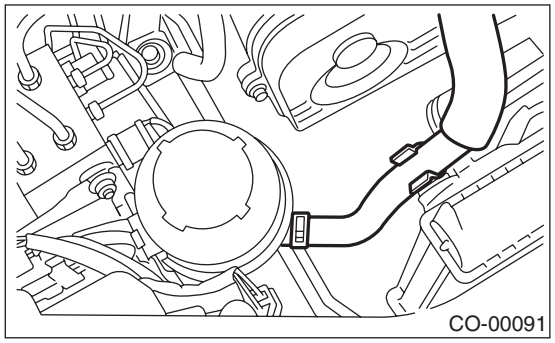


3) Install radiator brackets and tighten bolts.

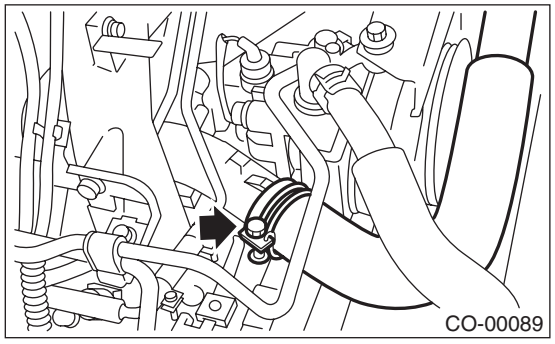
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



4) Attach power steering hose to the radiator.

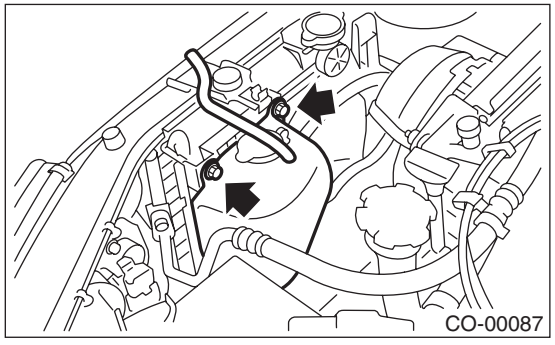


5) Connect radiator inlet hose.

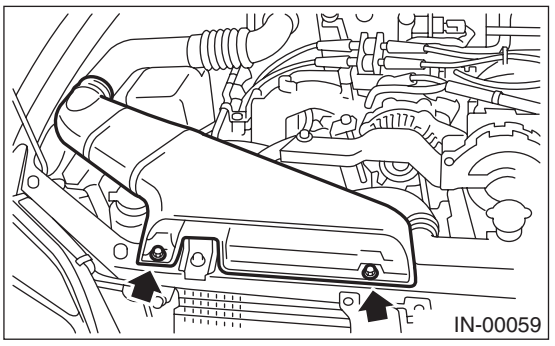


6) Install reservoir tank.

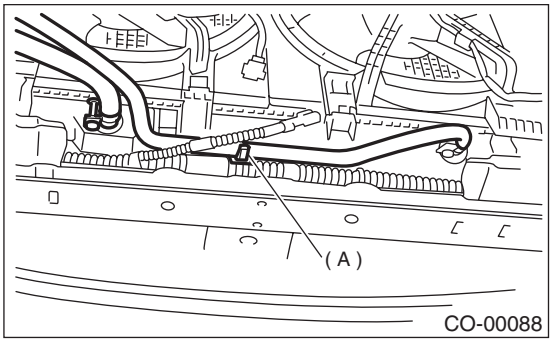
Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



7) Install air intake duct.

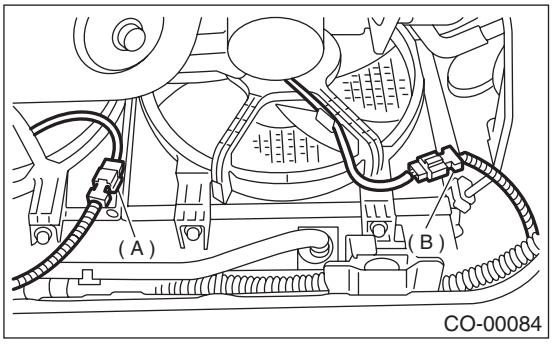


8) Lift-up the vehicle.
9) Connect ATF cooler hoses. (AT vehicles only)

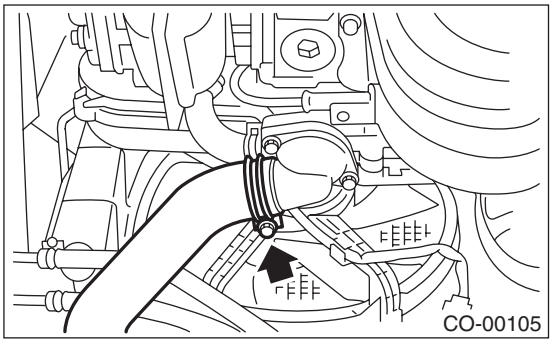


(A) Clip

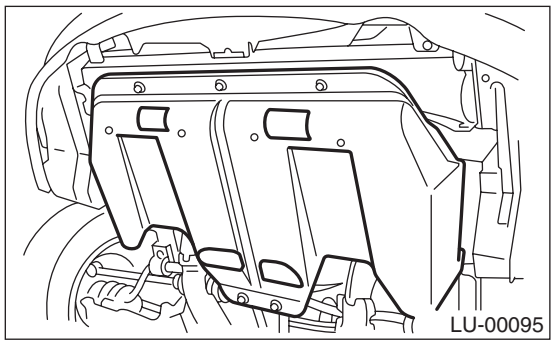
10) Connect connectors to radiator main fan motor (A) and sub fan motor (B).



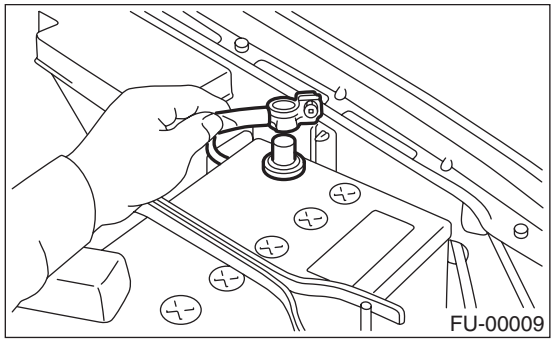
11) Connect radiator outlet hose.



12) Install under cover.



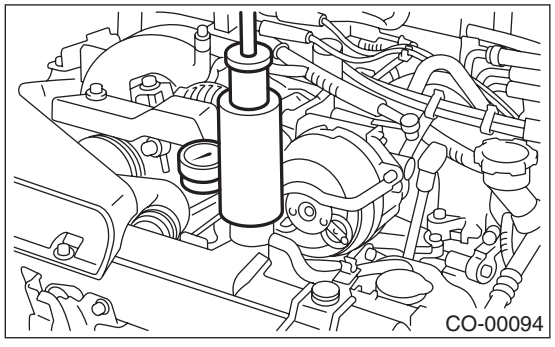
13) Lower the vehicle.
14) Connect battery ground cable.



15) Fill coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
16) Check ATF level. <Ref. to 4AT-31, INSPECTION, Automatic Transmission Fluid.>

C: INSPECTION

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



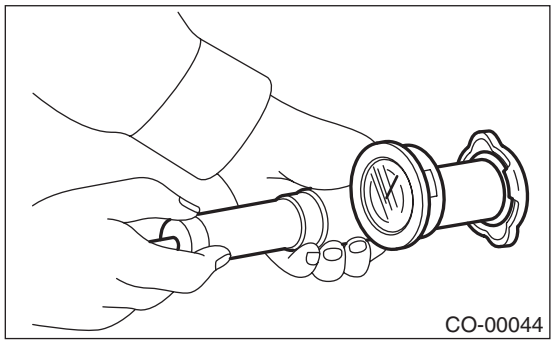
2) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to radiator to check if:
   (1) Engine coolant leaks at/around radiator.
   (2) Engine coolant leaks at/around hoses or connections.

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 not to deform filler neck of radiator when installing or removing tester.

8. Radiator Cap

A: INSPECTION

1) Attach radiator cap to tester.



2) Increase pressure until 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/cm^2, 14 — 18 psi)

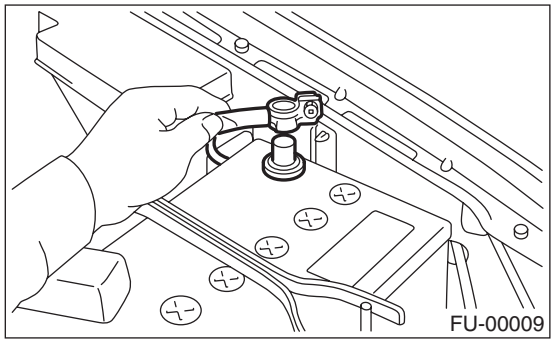
Service limit pressure:
83 kPa (0.85 kg/cm^2, 12 psi)

CAUTION:
Be sure to remove foreign matter and rust from the cap before installing tester. Otherwise, results of pressure test will be incorrect.

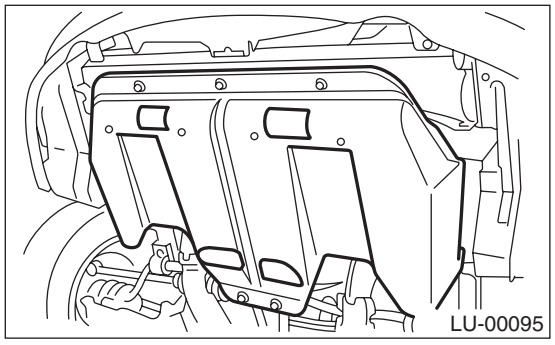
9. Radiator Main Fan and Fan Motor

A: REMOVAL

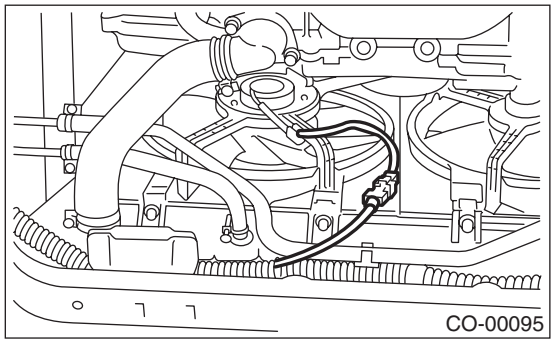
1) Disconnect battery ground cable.



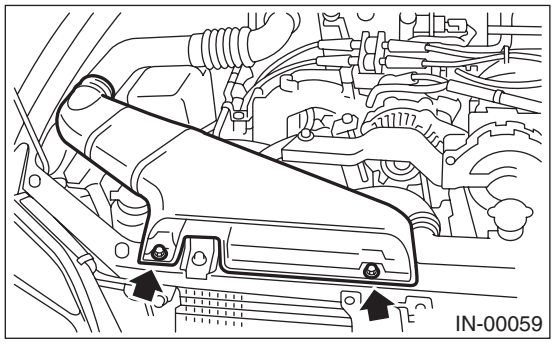
2) Lift-up the vehicle.
3) Remove under cover.



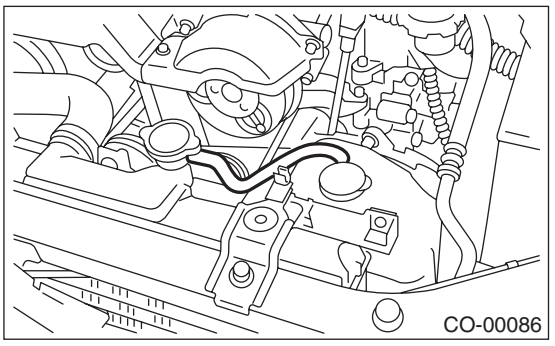
4) Disconnect connector of main fan motor.



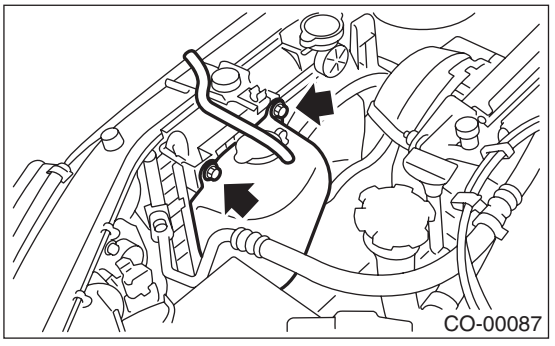
5) Lower the vehicle.
6) Remove air intake duct.



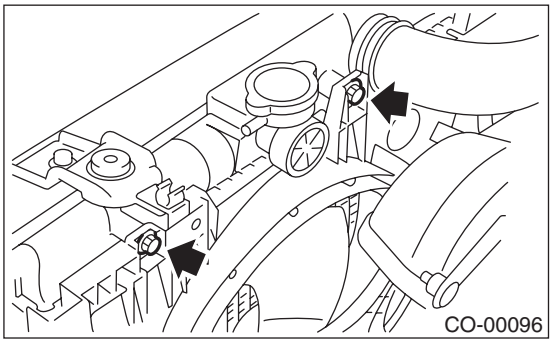
7) Disconnect overflow hose.



8) Remove reservoir tank.



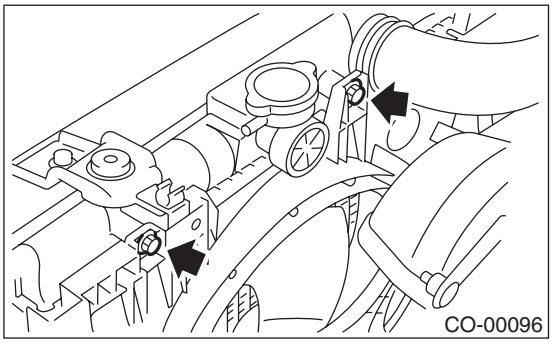
9) Remove radiator main fan motor assembly.



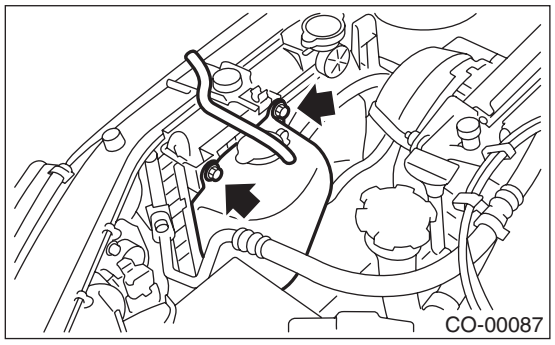
B: INSTALLATION

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.

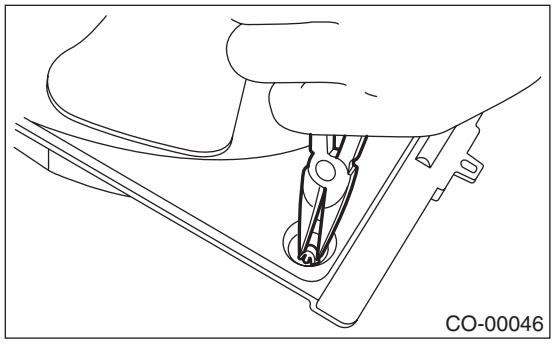


Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

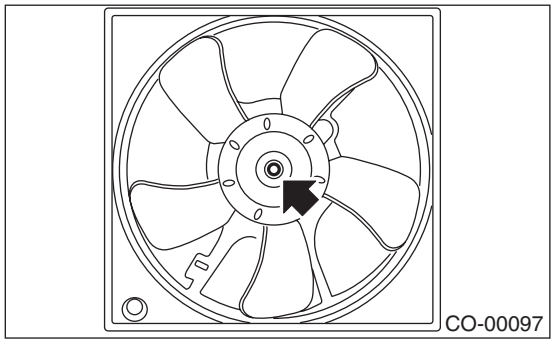


C: DISASSEMBLY

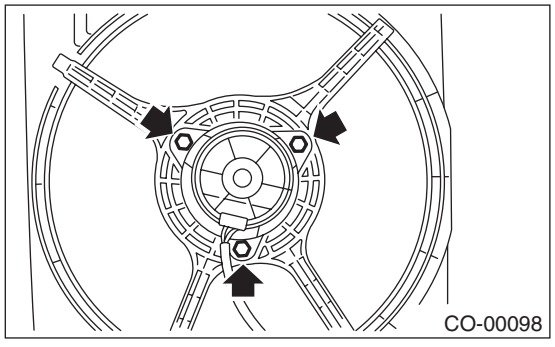
1) Remove clip which holds motor connector onto shroud.



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



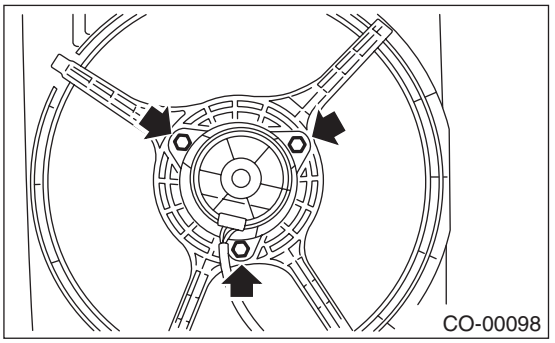
3) Remove bolts which install fan motor onto shroud.



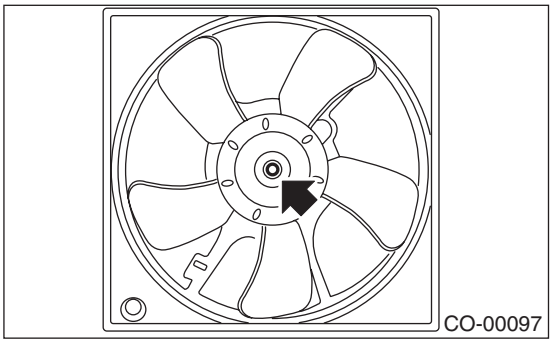
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

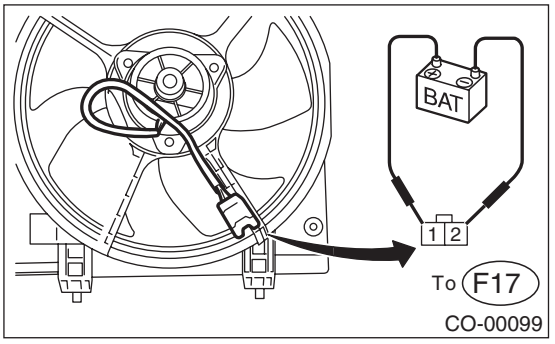


Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



E: INSPECTION

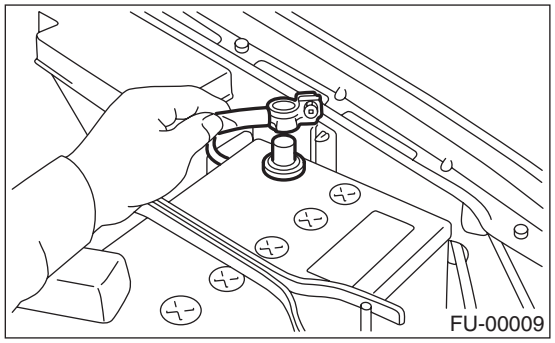
1) Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of main fan motor connector.
2) Make sure the main fan motor operates properly. Replace it if it doesn't.



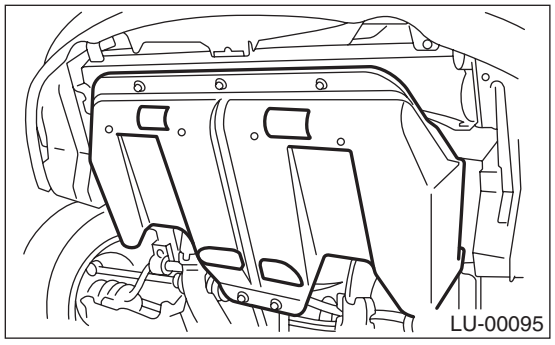
10.Radiator Sub Fan and Fan Motor

A: REMOVAL

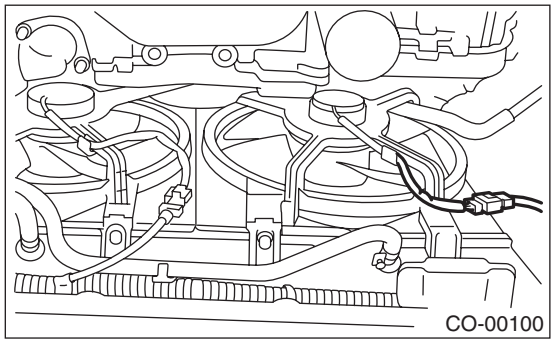
1) Disconnect battery ground cable.



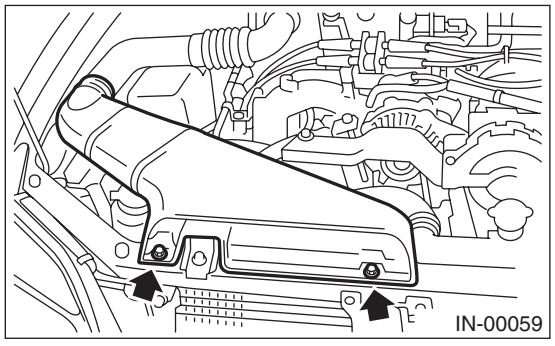
2) Lift-up the vehicle.
3) Remove under cover.



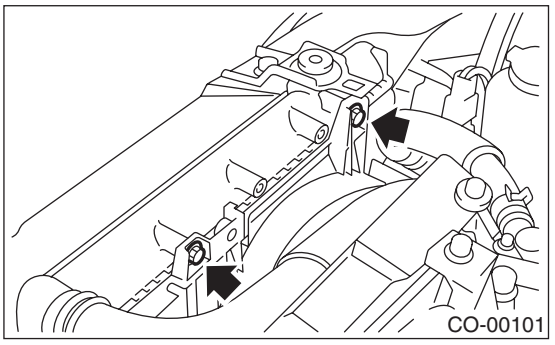
4) Disconnect connector of sub fan motor.



5) Lower the vehicle.
6) Remove air intake duct.



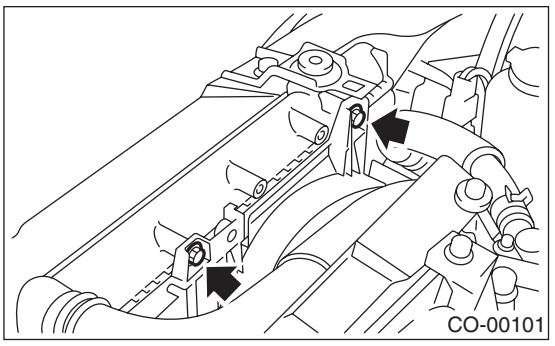
7) Remove bolts which hold sub fan shroud to radiator.
8) Remove radiator sub fan shroud through the under side of vehicle.



B: INSTALLATION

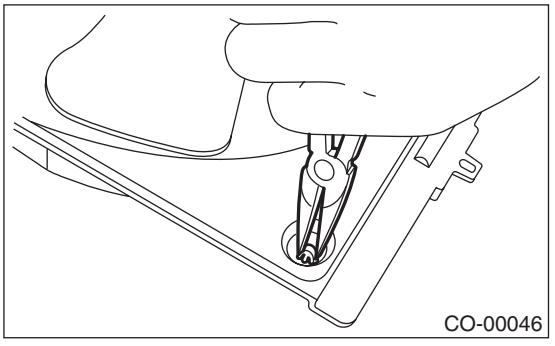
Install in the reverse order of removal.

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

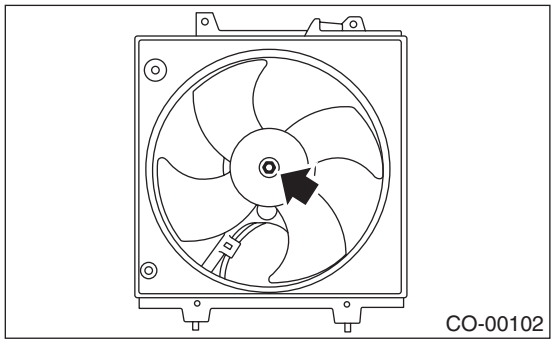


C: DISASSEMBLY

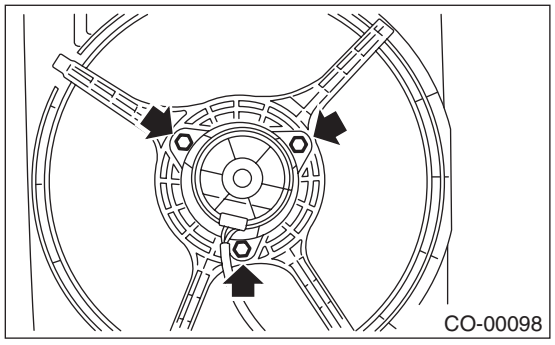
1) Remove clip which holds motor harness onto shroud.



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



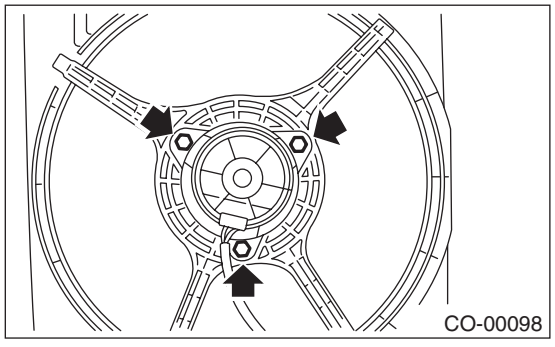
3) Remove bolts which install fan motor onto shroud.



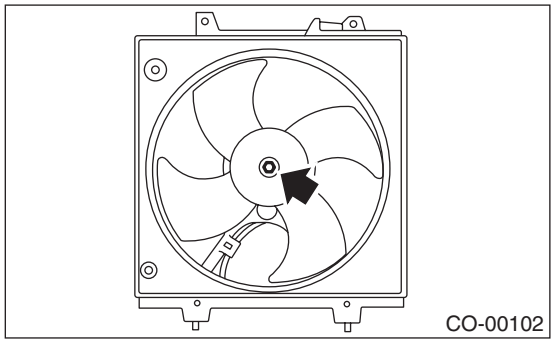
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

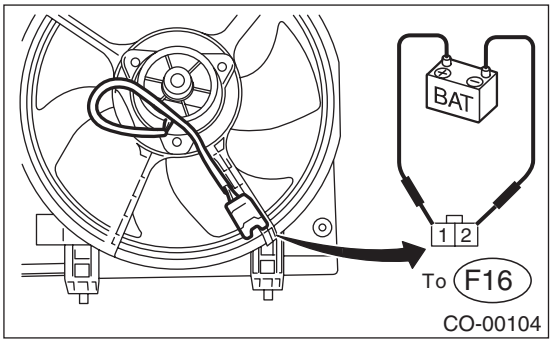


Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



E: INSPECTION

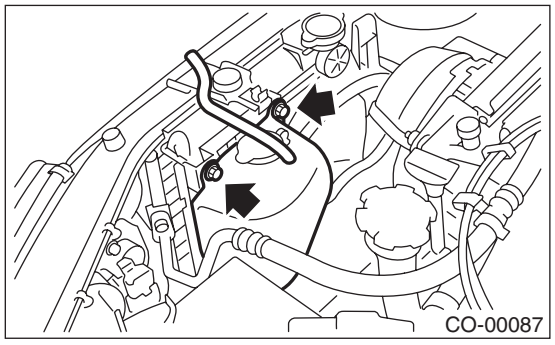
1) Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of sub fan motor connector.
2) Make sure the sub-fan motor operates properly. Replace it if it doesn't.



11.Reservoir Tank

A: REMOVAL

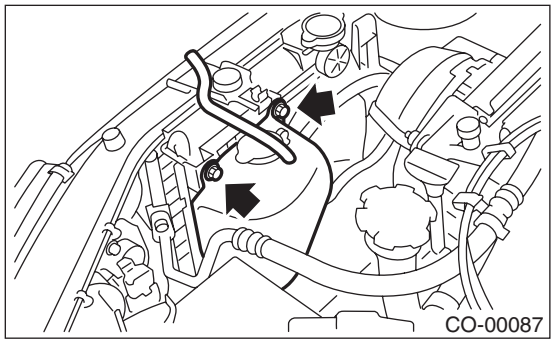
1) Disconnect overflow hose from radiator filler neck position.
2) Remove bolts which install reservoir tank onto radiator main fan shroud.
3) Remove reservoir tank.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.9N·m (0.50 kgf-m, 3.6 ft-lb)



C: INSPECTION

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

12.Engine Cooling System Trouble in General

A: INSPECTION

Trouble		Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair.
	b. Loosness of 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, ENGINE, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Engine oil mixed in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system. <Ref. to EN(H4SO)-2, ENGINE, 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. 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. Malfunction of 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.

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 ground cable from battery.

2. Front Catalytic Converter

A: REMOVAL

Front catalyst is built in center exhaust pipe. Therefore, the removal procedure is the same as that for the center exhaust pipe. <Ref. to EX(H4SO)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

Front catalyst is built in center exhaust pipe. Therefore, the installation procedure is the same as that for the center exhaust pipe. <Ref. to EX(H4SO)-8, INSTALLATION, Center 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.

3. Rear Catalytic Converter

A: REMOVAL

Rear catalyst is built in center exhaust pipe. Therefore, the removal procedure is the same as that for the center exhaust pipe. <Ref. to EX(H4SO)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

Rear catalyst is built in center exhaust pipe. Therefore, the installation procedure is the same as that for the center exhaust pipe.<Ref. to EX(H4SO)-8, INSTALLATION, Center Exhaust Pipe.>

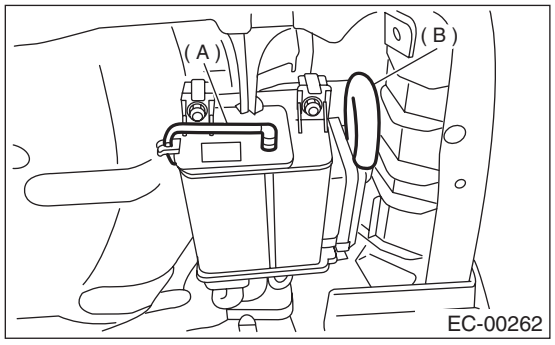
C: INSPECTION

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

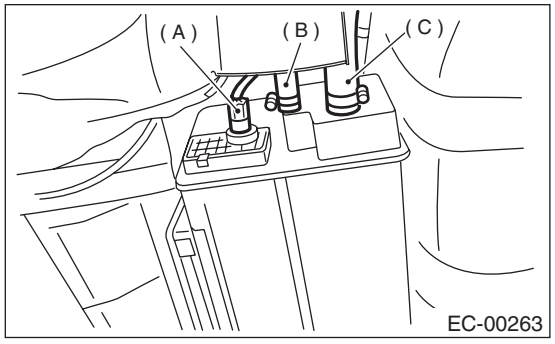
4. Canister

A: REMOVAL

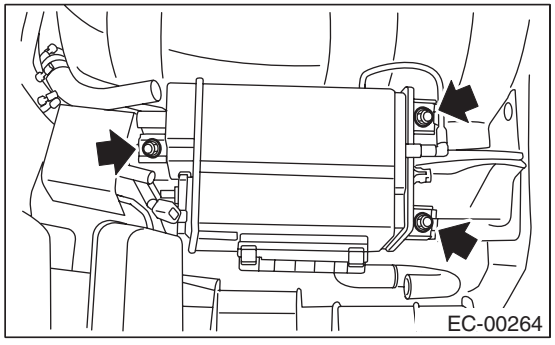
1) Lift-up the vehicle.
2) Disconnect connector (A) from drain valve.
3) Disconnect evaporation hoses (B) and (C) from canister.



4) Disconnect quick connector (A) from canister.
5) Disconnect evaporation hoses (B) and (C) from canister.



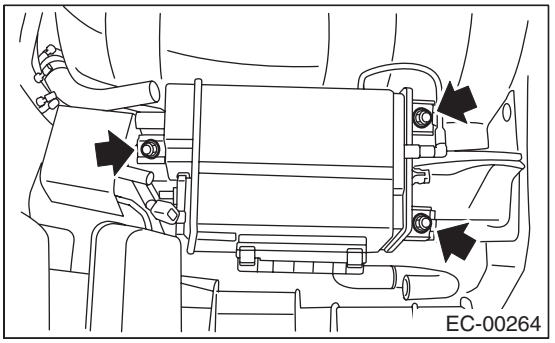
6) Remove the canister from vehicle.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
23 N·m (2.3 kgf-m, 17 ft-lb)



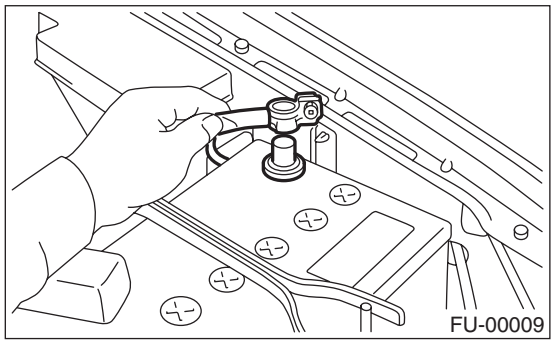
C: INSPECTION

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

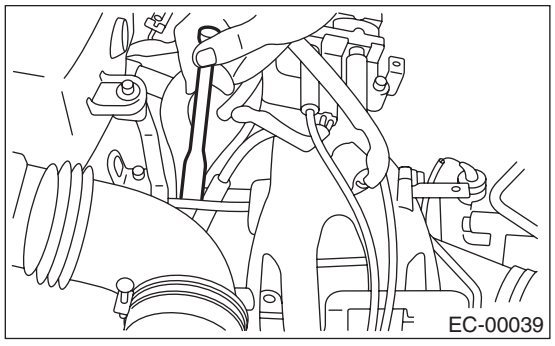
5. Purge Control Solenoid Valve

A: REMOVAL

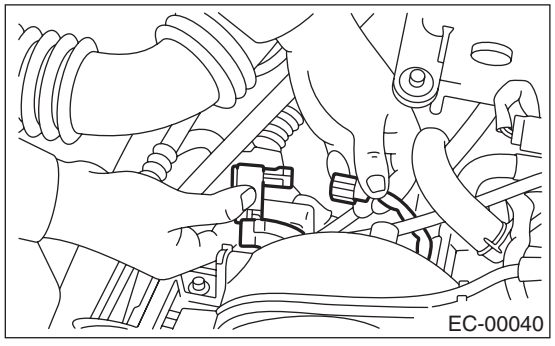
1) Disconnect battery ground cable.



2) Remove 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 connector and hoses from purge control solenoid valve.

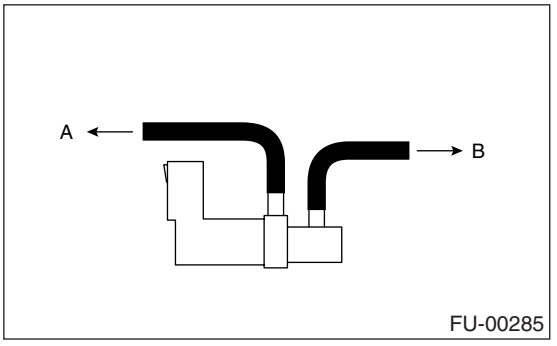


B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
19 N·m (1.9 kgf-m, 14 ft-lb)

CAUTION:
Connect the evaporation hoses as shown in the illustration.



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

C: INSPECTION

Make sure hoses are not cracked or loose.

6. EGR Valve

A: REMOVAL

For work procedures, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-37, REMOVAL, EGR Valve.>

B: INSTALLATION

For work procedures, refer to “FU(H4SOH4SO)” section. <Ref. to FU(H4SO)-37, INSTALLATION, EGR Valve.>

7. Main Fuel Level Sensor

A: REMOVAL

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

B: INSTALLATION

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

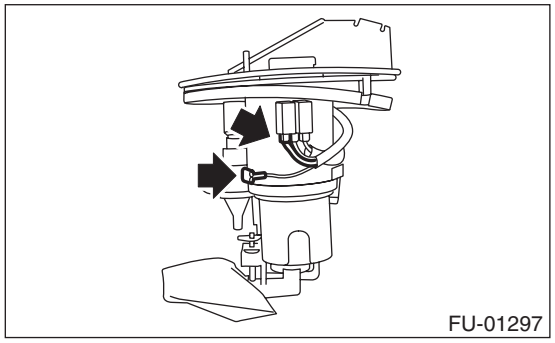
8. Fuel Temperature Sensor

A: REMOVAL

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

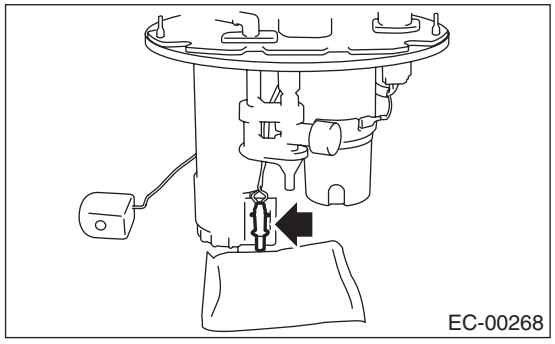
NOTE:
Fuel temperature sensor is built in fuel pump assembly.

1) Remove fuel pump assembly. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Pump.>
2) Disconnect connector from fuel pump bracket.



3) Remove fuel temperature sensor.

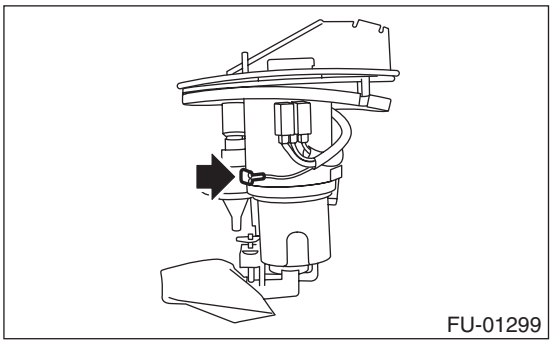
NOTE:
When replacing fuel temperature sensor, also replace fuel level sensor. <Ref. to FU(H4SO)-68, REMOVAL, Fuel Level Sensor.>



B: INSTALLATION

1) Install in the reverse order of removal.

WARNING:
- **Ground cable must be connected.**
- **Spark may occur and ignite if fuel is nearby.**



9. Sub Fuel Level Sensor

A: REMOVAL

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

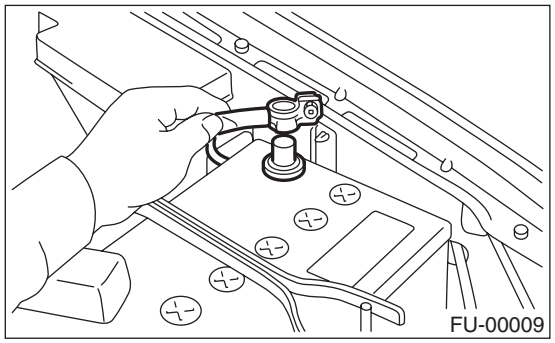
B: INSTALLATION

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

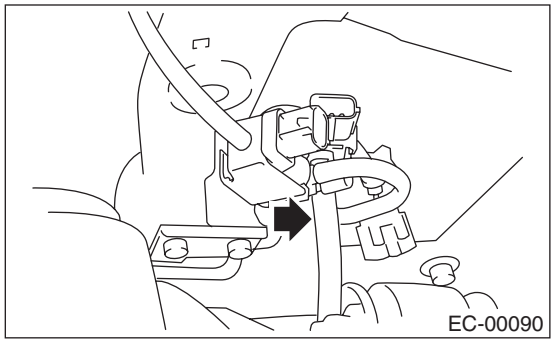
10.Fuel Tank Pressure Sensor

A: REMOVAL

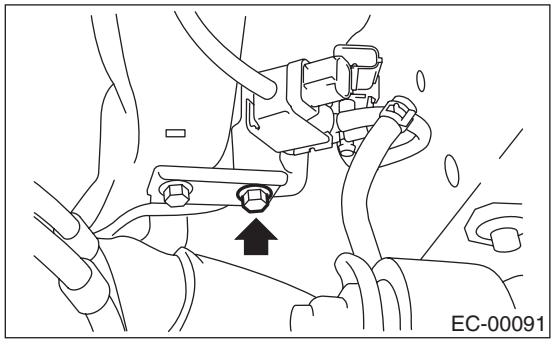
1) Set the vehicle on the lift.
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect battery ground cable.



4) Lift-up the vehicle.
5) Disconnect connector from fuel tank pressure sensor and fuel tank sensor control valve.
6) Disconnect pressure hose from fuel tank pressure sensor.

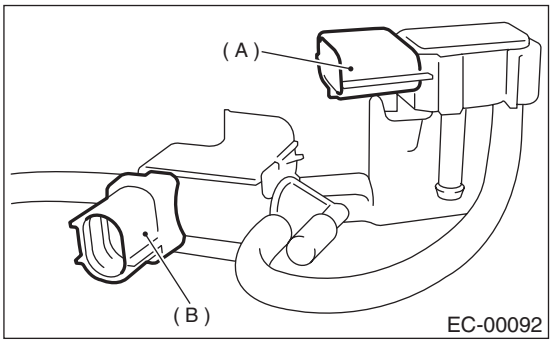


7) Remove fuel tank pressure sensor and fuel tank sensor control valve with bracket.



8) Remove fuel tank sensor control valve from bracket.

NOTE:
Fuel tank pressure sensor cannot be removed because it is integral with bracket.

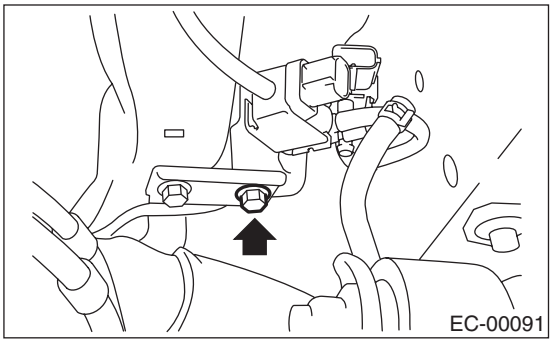


(A) Fuel tank pressure sensor
(B) Fuel tank sensor control valve

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



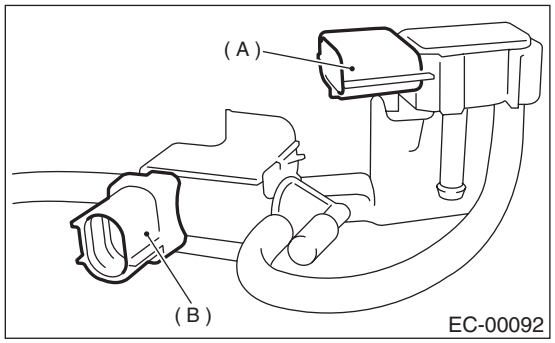
C: INSPECTION

Make sure that hoses are not cracked or loose.

11.Fuel Tank Sensor Control Valve

A: REMOVAL

1) Remove fuel tank pressure sensor. <Ref. to EC(H4SO)-11, REMOVAL, Fuel Tank Pressure Sensor.>
2) Remove fuel tank sensor control valve from bracket.



(1) Fuel tank pressure sensor
(2) Fuel tank sensor control valve

B: INSTALLATION

Install in the reverse order of removal.

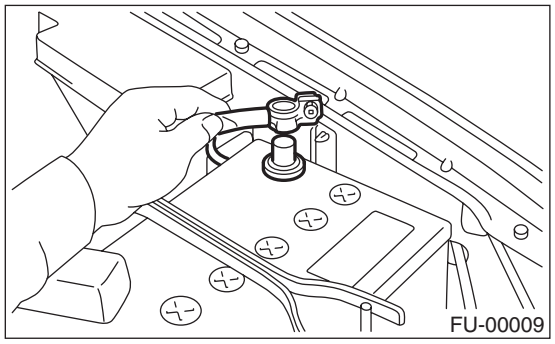
C: INSPECTION

Make sure that hoses are not cracked or loose.

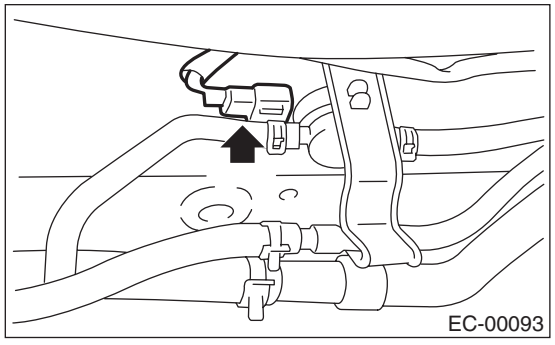
12.Pressure Control Solenoid Valve

A: REMOVAL

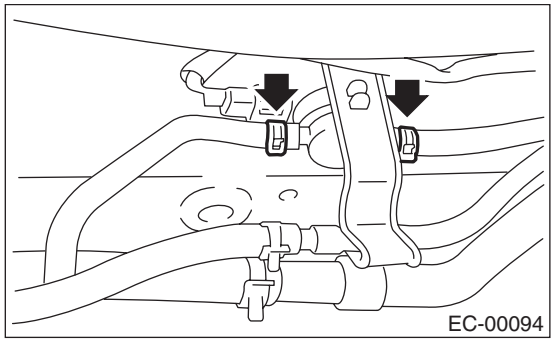
1) Set the vehicle on the lift.
2) Disconnect battery ground cable.



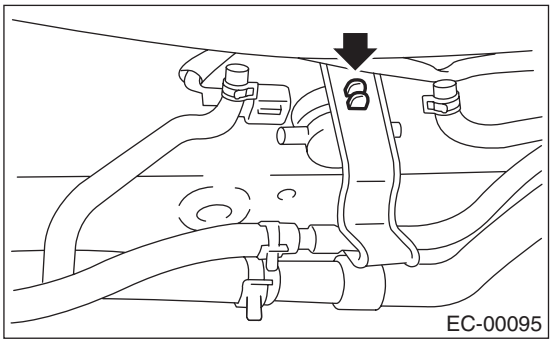
3) Lift-up the vehicle.
4) Disconnect connector from pressure control solenoid valve.



5) Disconnect two evaporation hoses from pressure control solenoid valve.



6) Remove pressure control solenoid valve from bracket.



B: INSTALLTION

Install in the reverse order of removal.

C: INSPECTION

Make sure that hoses are not cracked or loose.

13.Drain Filter

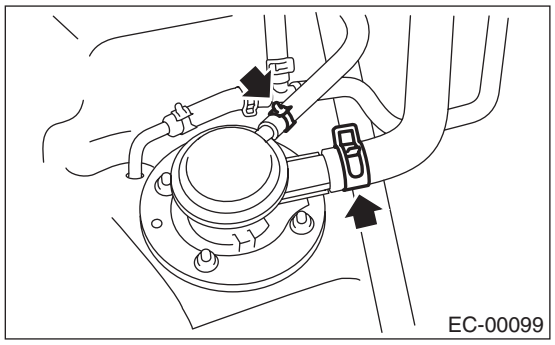
A: SPECIFICATIONS

Drain filter is built in the canister, and it is a part which cannot be disassembled.

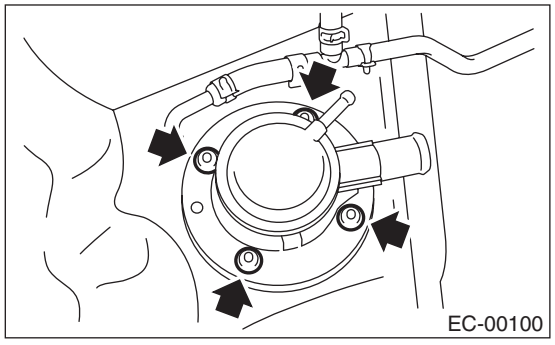
14.Vent Valve

A: REMOVAL

1) Remove fuel tank. <Ref. to FU(H4SO)-51, REMOVAL, Fuel Tank.>
2) Move clips, and disconnect hoses from vent valve.



3) Remove nuts which install vent valve on fuel tank.

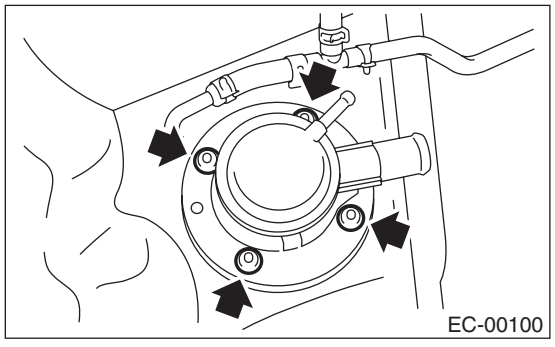


B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Replace rubber seat with a new one.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



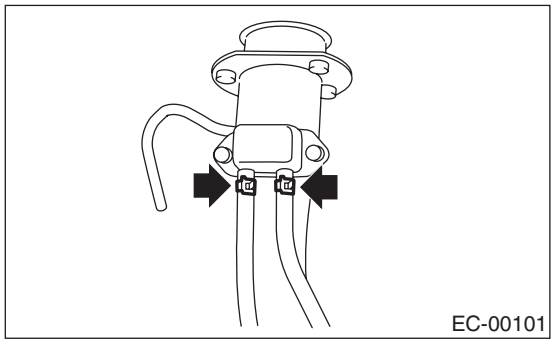
C: INSPECTION

Make sure that hoses are not cracked or loose.

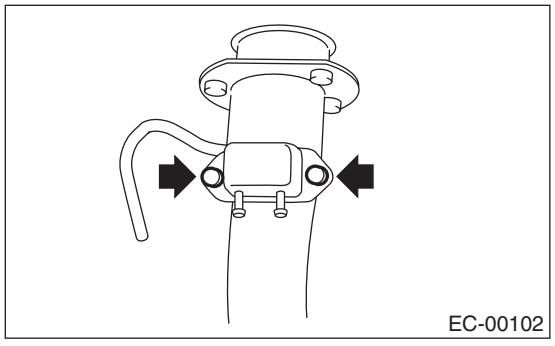
15.Shut Valve

A: REMOVAL

1) Drain fuel from fuel tank. <Ref. to FU(H4SO)-51, REMOVAL, Fuel Tank.>
2) Remove fuel filler pipe. <Ref. to FU(H4SO)-59, REMOVAL, Fuel Filler Pipe.>
3) Disconnect evaporation hoses from shut valve.



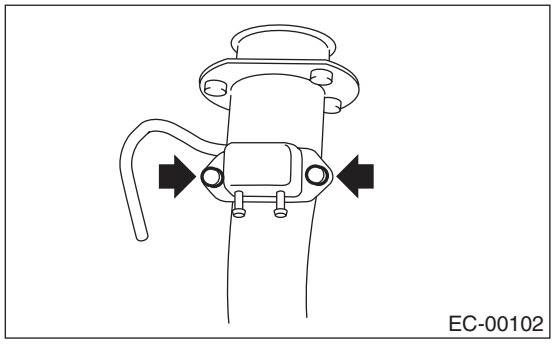
4) Remove shut valve from fuel filler pipe.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



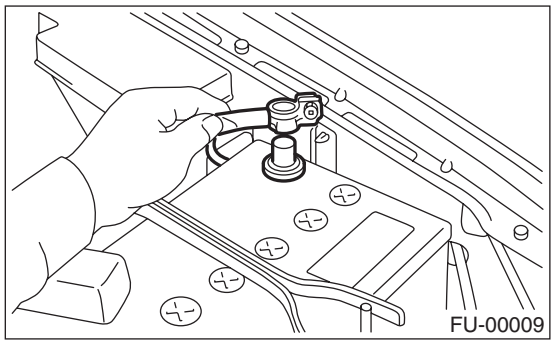
C: INSPECTION

Make sure that hoses are not cracked or loose.

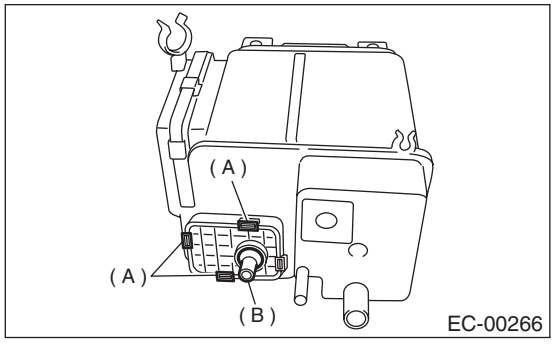
16.Drain Valve

A: REMOVAL

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



3) Lift-up the vehicle.
4) Remove canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
5) Remove clip (A), and then remove drain valve (B) from canister.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

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

MEMO:

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?	Go to step **2.**	Inspection using “Diagnostics for Engine Start Failure”. <Ref. to EN(H4SO)-64, Diagnostics for Engine Starting Failure.>
2	**CHECK ILLUMINATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).**	Does CHECK ENGINE malfunction indicator lamp illuminate?	Go to step **3.**	Inspection using “General Diagnostics Table”. <Ref. to EN(H4SO)-371, 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 general scan tool to data link connector. 3) Turn ignition switch to ON and the Subaru Select Monitor or general scan tool switch to ON. 4) Read DTC on the Subaru Select Monitor or general scan tool.	Does the Subaru Select Monitor or general scan tool indicate DTC?	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)-53, Engine Malfunction Indicator Lamp (MIL).>
4	**PERFORM THE DIAGNOSIS.** 1) Inspect using “Diagnostics Procedure with Diagnostic Trouble Code (DTC)”. NOTE: <Ref. to EN(H4SO)-92, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> NOTE: Carry out the basic check, only when DTC about automatic transmission is shown on display. <Ref. to EN(H4SO)-41, Read Diagnostic Trouble Code.> 2) Repair the trouble cause. 3) Perform the clear memory mode. <Ref. to EN(H4SO)-50, Clear Memory Mode.> 4) Perform the inspection mode. <Ref. to EN(H4SO)-42, Inspection Mode.>	Does the Subaru Select Monitor or general scan tool indicate DTC?	Inspect using “Diagnostics Procedure with Diagnostic Trouble Code (DTC)”. NOTE: <Ref. to EN(H4SO)-92, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Complete the diagnosis.

2. AUTOMATIC TRANSMISSION

When trouble code about automatic transmission is shown on display, carry out the following basic check. After that, carry out the replacement or repair work.
1) ATF level check <Ref. to 4AT-31, Automatic Transmission Fluid.>
2) Differential gear oil level check <Ref. to 4AT-32, Differential Gear Oil.>
3) ATF leak check <Ref. to 4AT-31, Automatic Transmission Fluid.>
4) Differential gear oil leak check <Ref. to 4AT-32, Differential Gear Oil.>
5) Stall test <Ref. to 4AT-34, Stall Test.>
6) Line pressure test <Ref. to 4AT-36, Line Pressure Test.>
7) Transfer clutch pressure test <Ref. to 4AT-38, Transfer Clutch Pressure Test.>
8) Time lag test <Ref. to 4AT-35, Time Lag Test.>
9) Road test <Ref. to 4AT-33, Road Test.>
10) Shift characteristics <Ref. to 4AT-38, Transfer Clutch Pressure Test.>

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 no.			miles
Weather	❑ Fine ❑ Cloudy ❑ Rainy ❑ Snowy ❑ Various/Others:		
Outdoor temperature	°F (°C)		
	❑ 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	❑ ON/❑ OFF
Cooling fan	❑ ON/❑ OFF	Car phone	❑ ON/❑ OFF
Front wiper	❑ ON/❑ OFF	CB	❑ ON/❑ OFF
Rear wiper	❑ ON/❑ OFF		

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 ❑ VDC warning light ❑ Engine oil pressure warning light
b) Fuel level
• Lack of gasoline: ❑ Yes/❑ No • Indicator position of fuel gauge: • Lack of gasoline occurred in the past: ❑ Yes/❑ No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: ❑ Yes/❑ No
• What:
d) Intentional connecting or disconnecting of hoses: ❑ Yes/❑ No
• What:
e) Installing of 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.

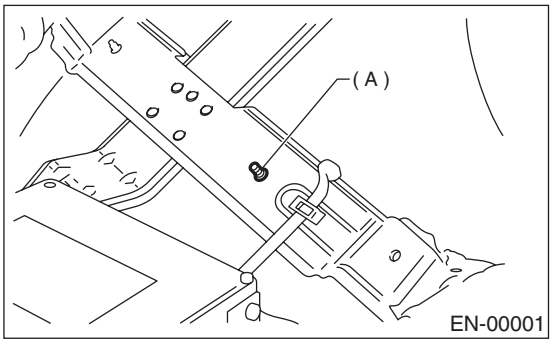
CAUTION:
• All Airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
• Be careful not to damage Airbag system wiring harness when servicing the engine control module (ECM), transmission control module (TCM), main relay and fuel pump relay.

2) Never connect the battery in reverse polarity.
• The ECM will be destroyed instantly.
• The fuel injector and other part 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 alternator, and this voltage may damage electronic parts such as 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 ECM from the located position, disconnect two cables on battery.
• Otherwise, the ECM may be damaged.

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

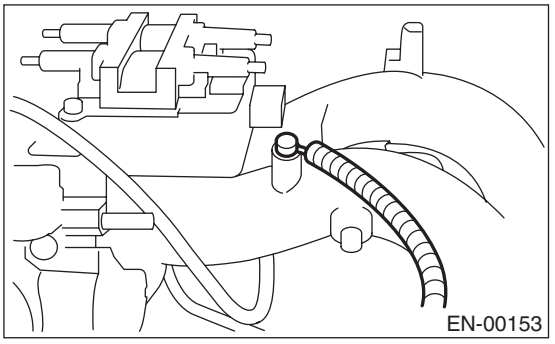
7) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on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

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

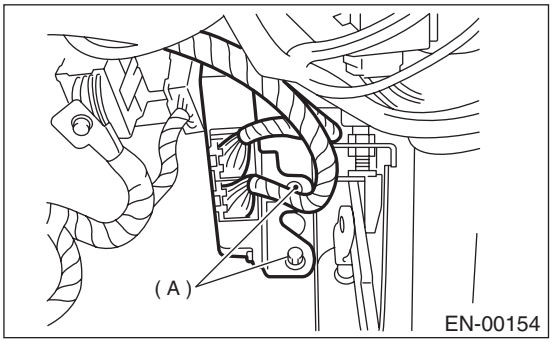


(A) Stud bolt

9) Use engine grounding terminal or 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 rotating with 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.

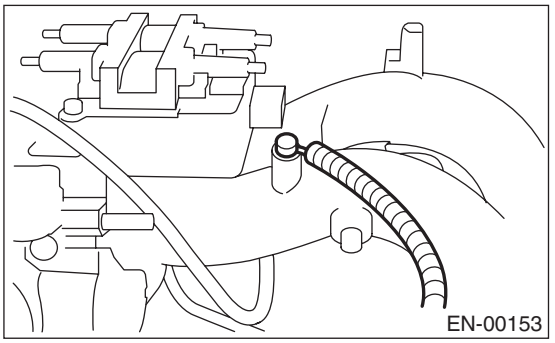
Standard voltage: 12 V

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. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
• Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
• The OBD system incorporated with the vehicles within this engine family complies with OBD-II Regulations. The OBD system monitors the components and the system malfunction listed in Engine Section which affects on emissions.
• When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
• The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer when it detects a malfunction first.
• If the OBD system detects the various malfunctions including the 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, malfunction indicator light is turned off, but DTC remains at on-board computer.
• When troubleshooting the vehicle which complies with OBD-II Regulations, connect the Subaru Select Monitor or general scan tool to the vehicle.

2. ENGINE AND EMISSION CONTROL SYSTEM

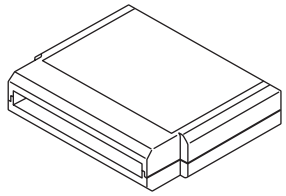
• The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture

to the engine for all the various operating conditions through the use of the latest electronic technology.
With this system fuel, which is pressurized at a constant pressure, is 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 in 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

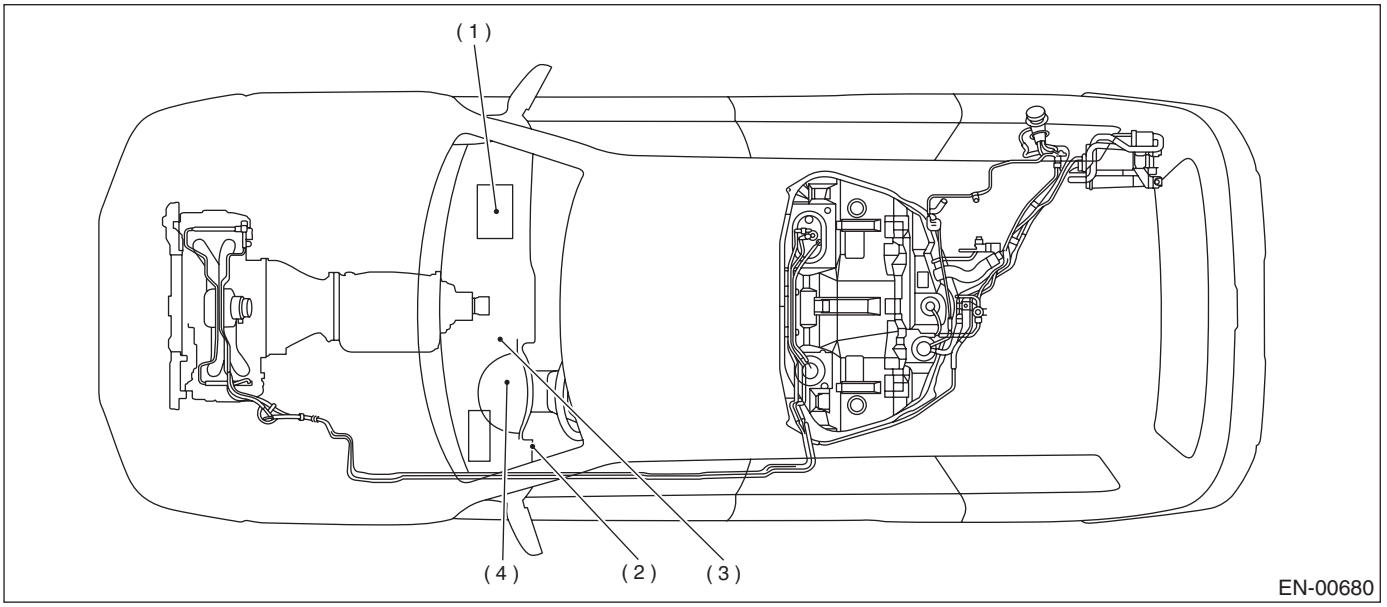
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA260	24082AA260	CARTRIDGE	Troubleshooting for electrical systems.
ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.

4. Electrical Components Location

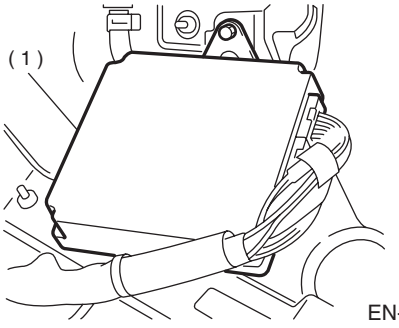
A: LOCATION

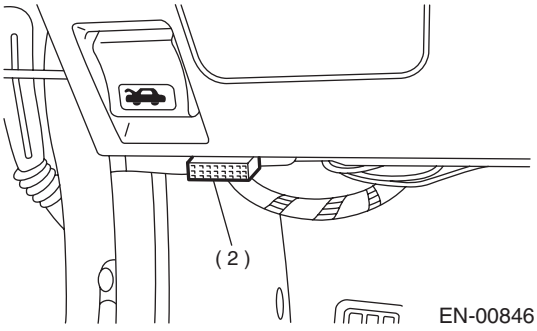
1. ENGINE

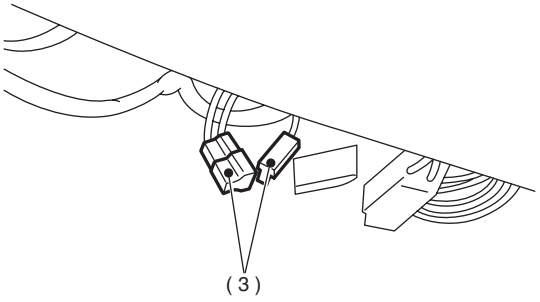
• MODULE

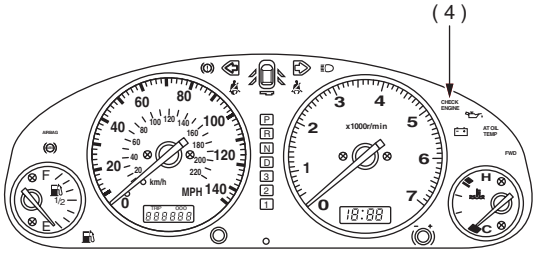


(1) Engine control module (ECM)
(2) Data link connector (for Subaru Select Monitor and general scan tool)
(3) Test mode connector
(4) CHECK ENGINE malfunction indicator lamp (MIL)

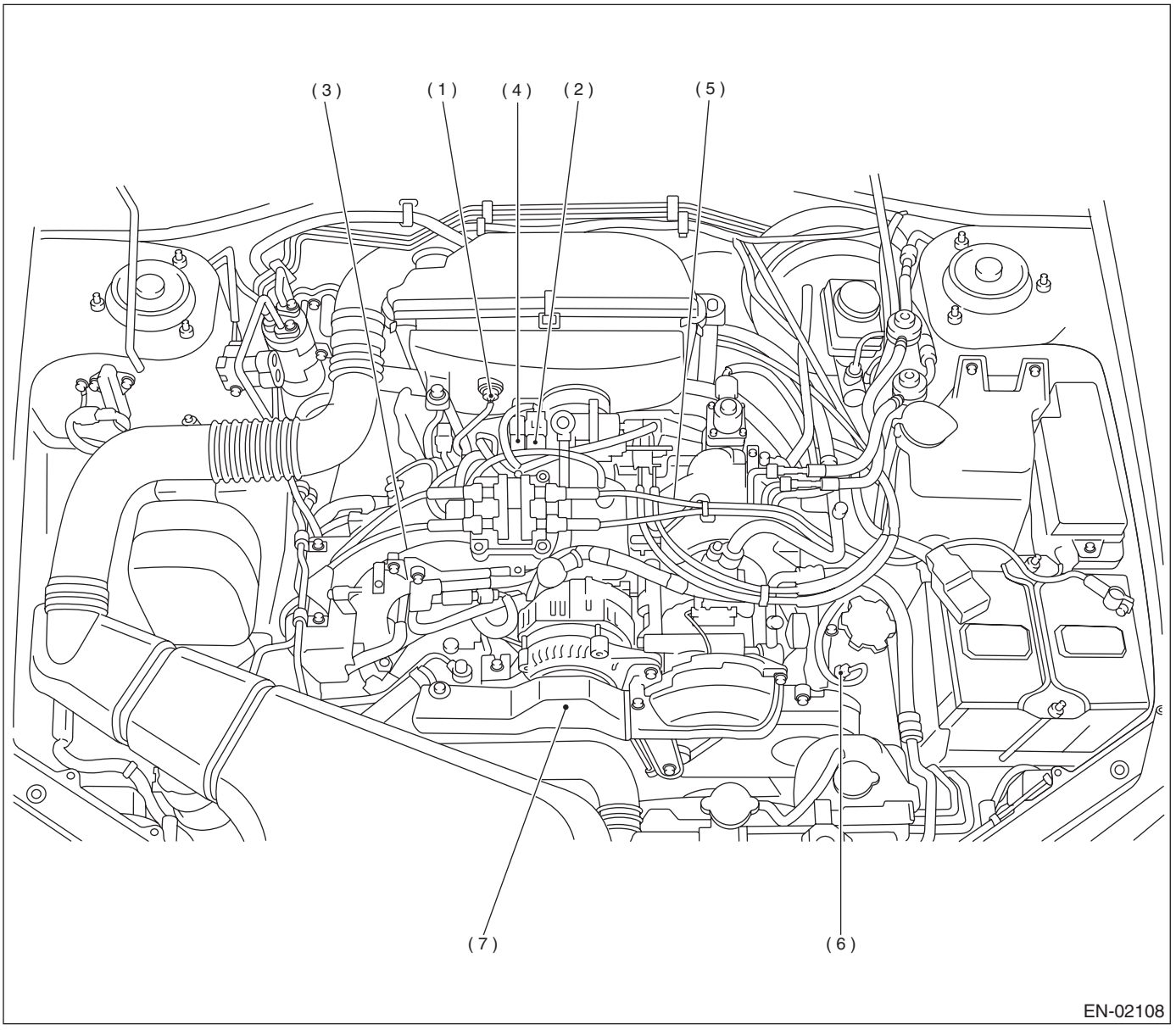




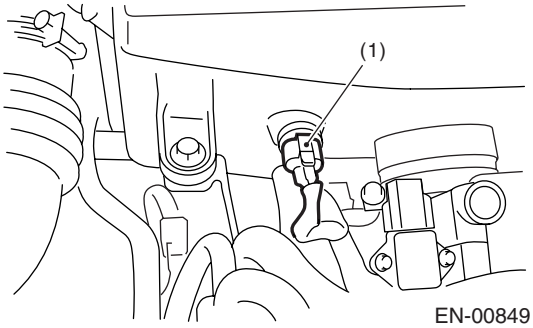




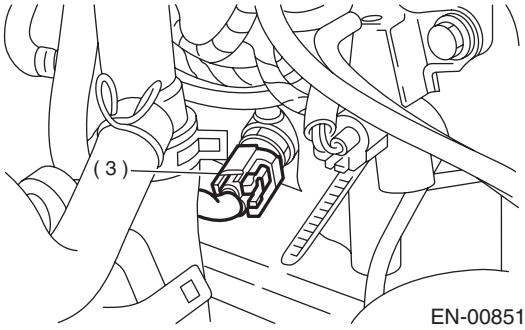
• SENSOR



(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


(1)
EN-00849

(2)
EN-00850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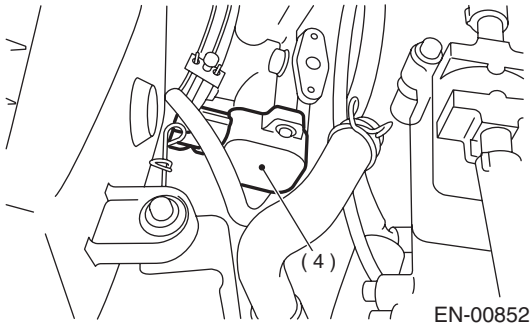
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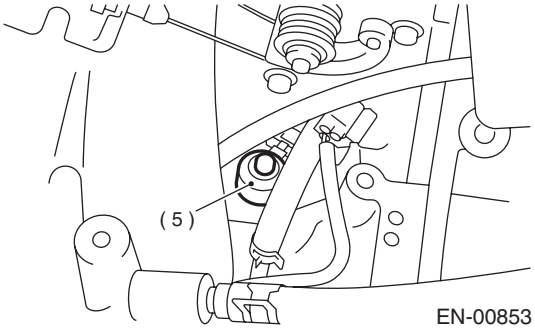
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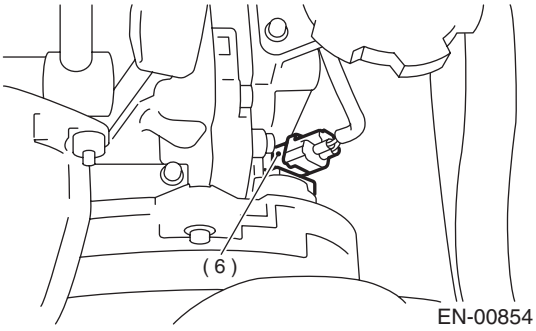
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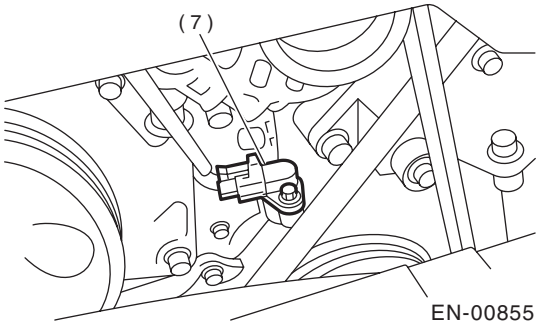
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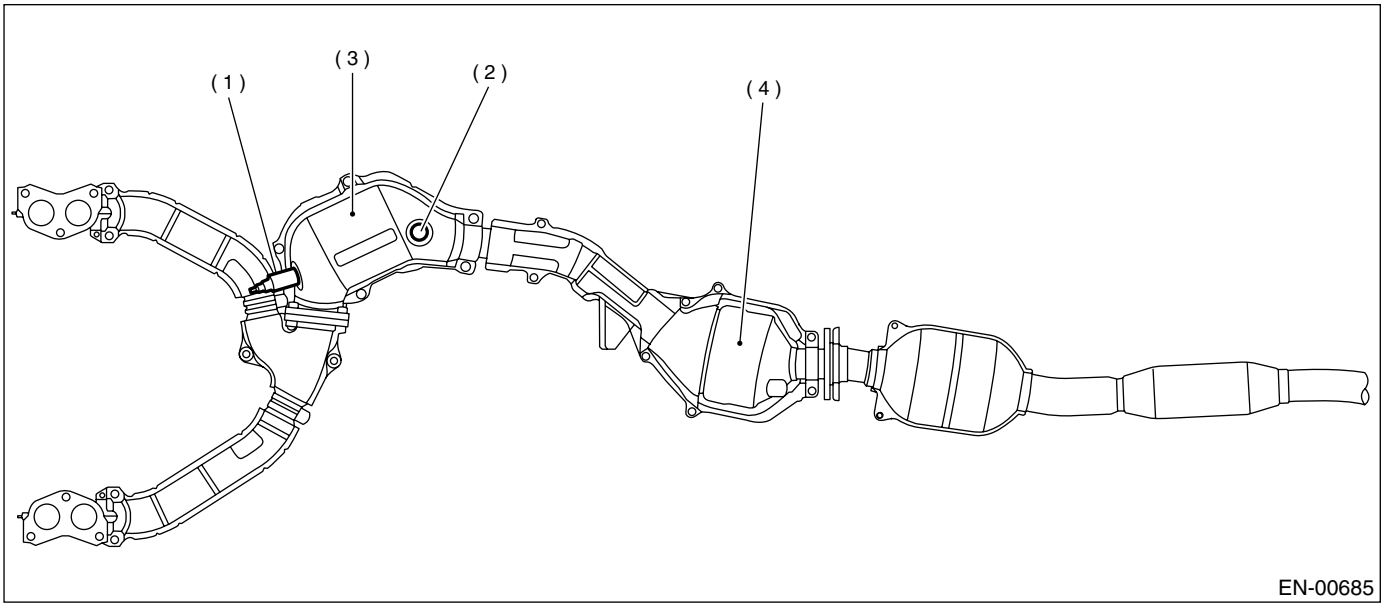
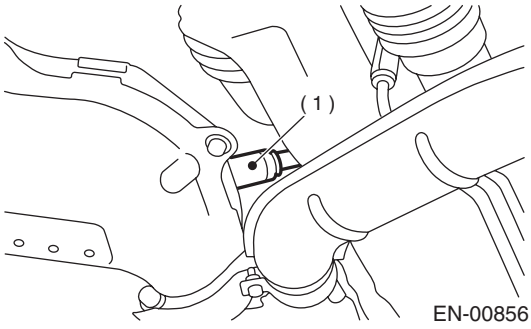
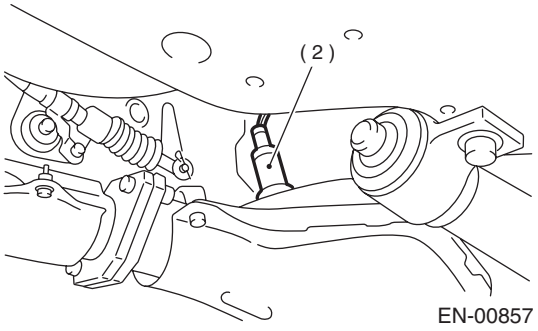
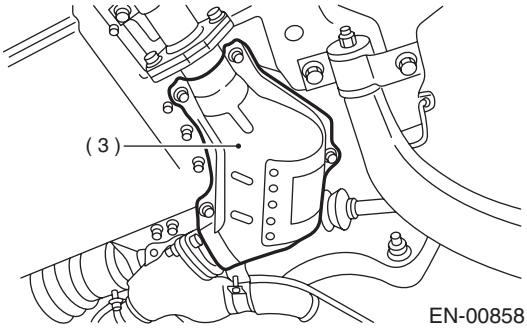
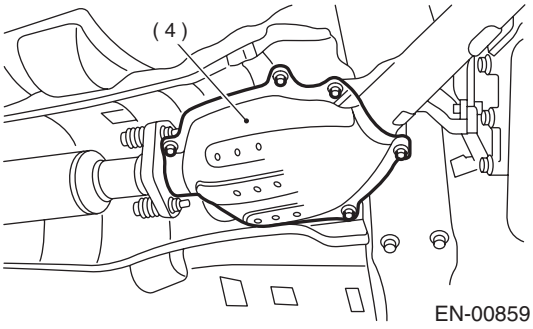


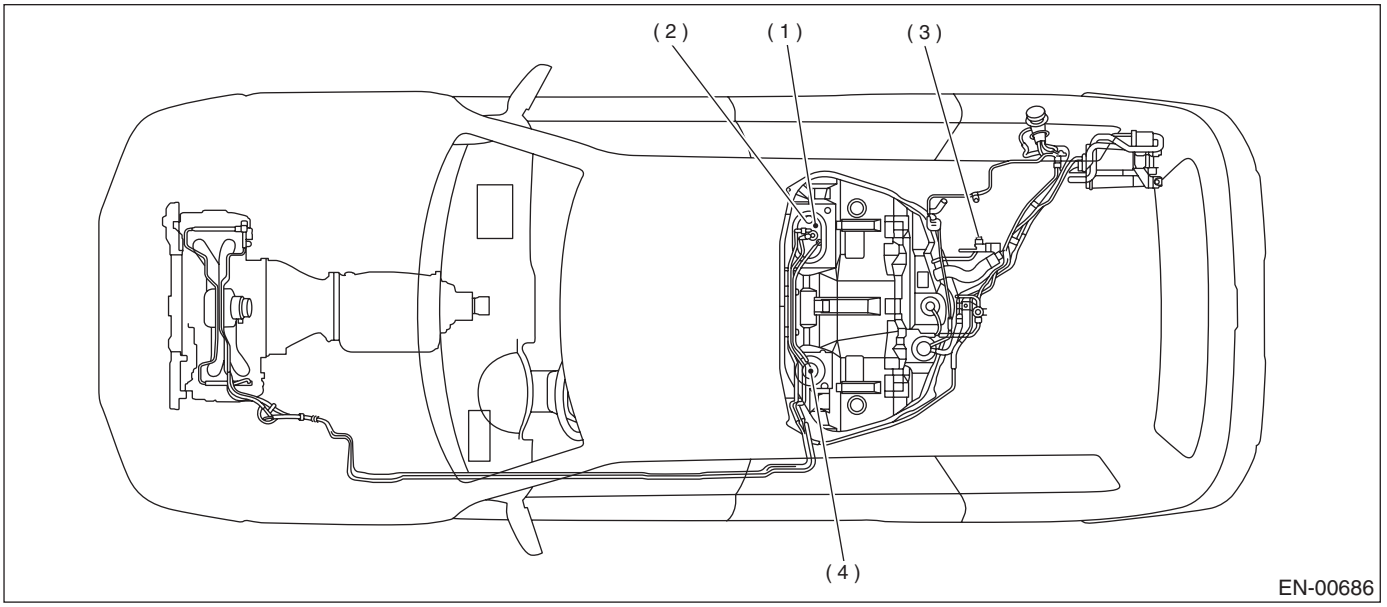
(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Front catalytic converter
(4) Rear catalytic converter



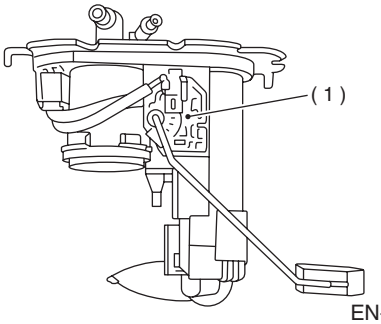


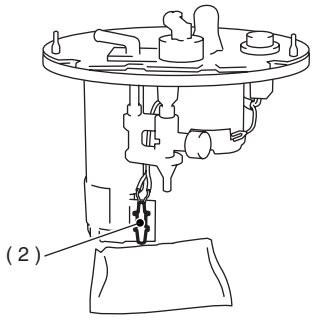


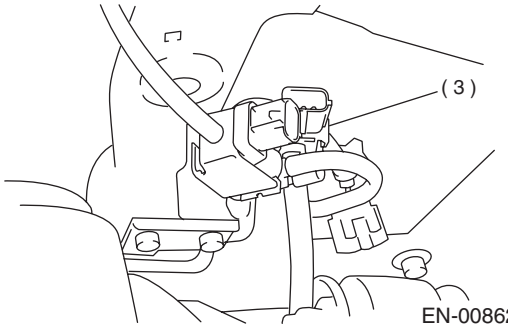


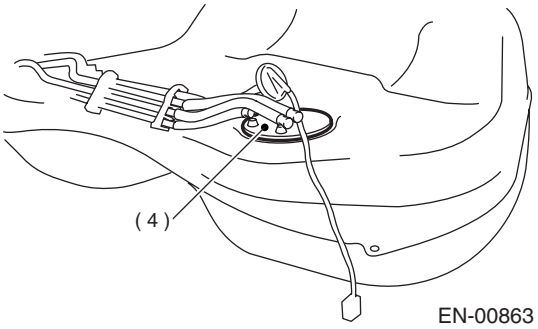


(1) Fuel level sensor
(2) Fuel temperature sensor
(3) Fuel tank pressure sensor
(4) Fuel sub level sensor

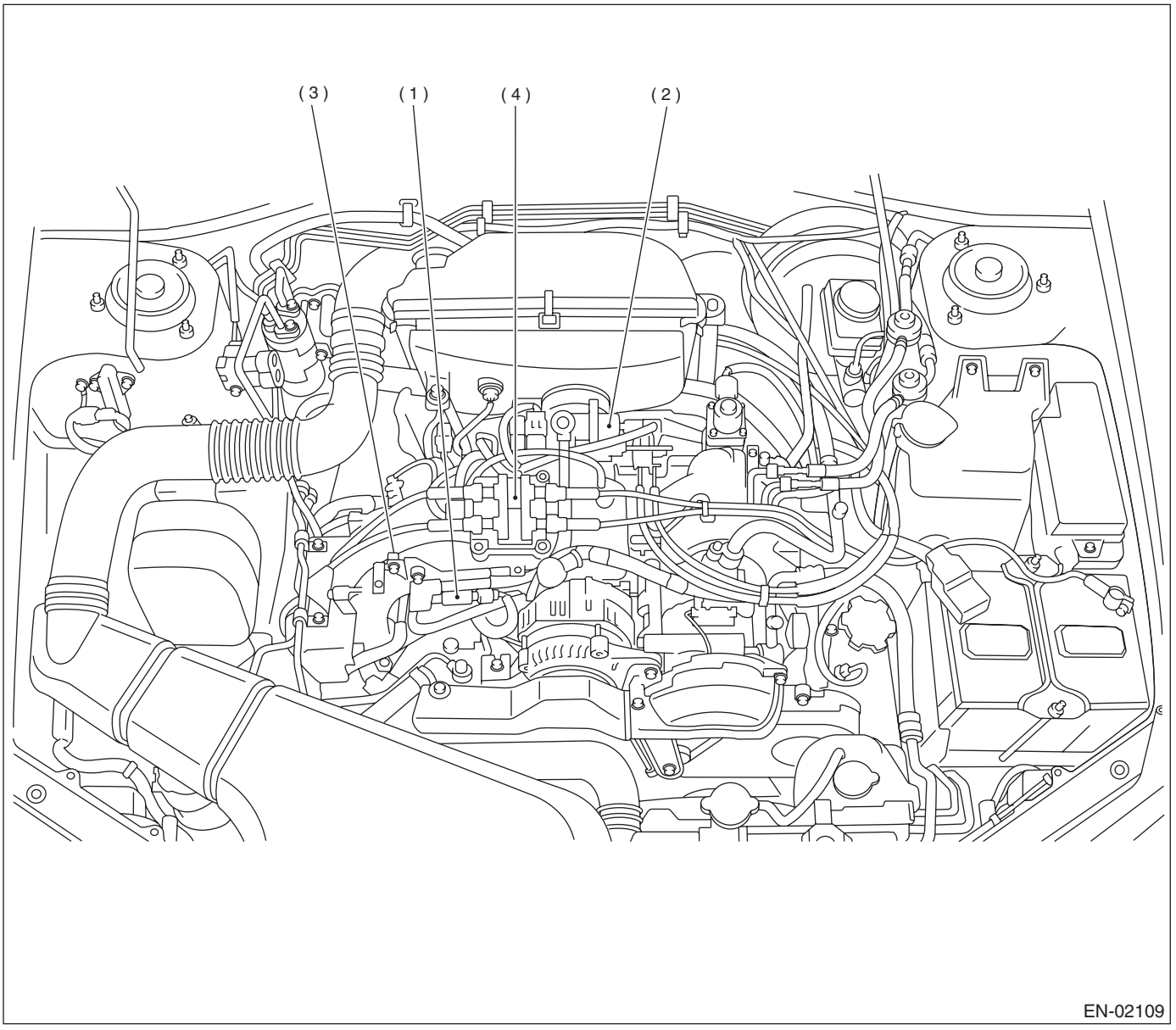




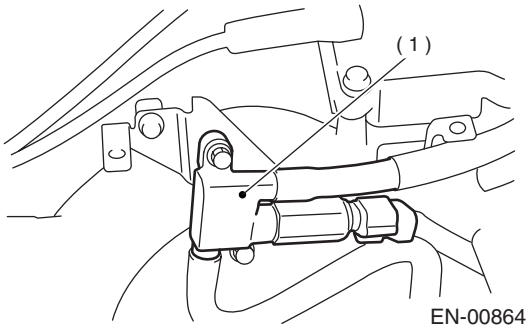




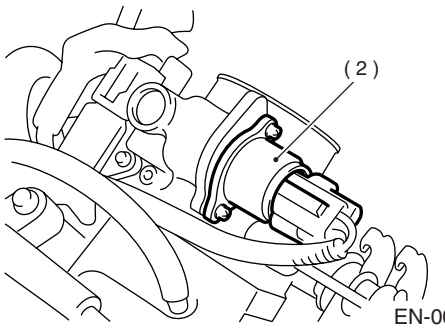
• SOLENOID VALVE, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS



(1) Air assist injector solenoid valve
(2) Idle air control solenoid valve
(3) Purge control solenoid valve
(4) Ignition coil & ignitor ASSY



EN-00864



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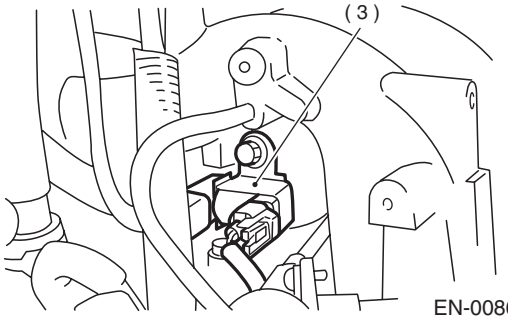
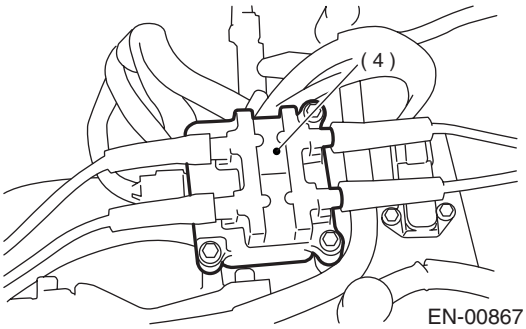
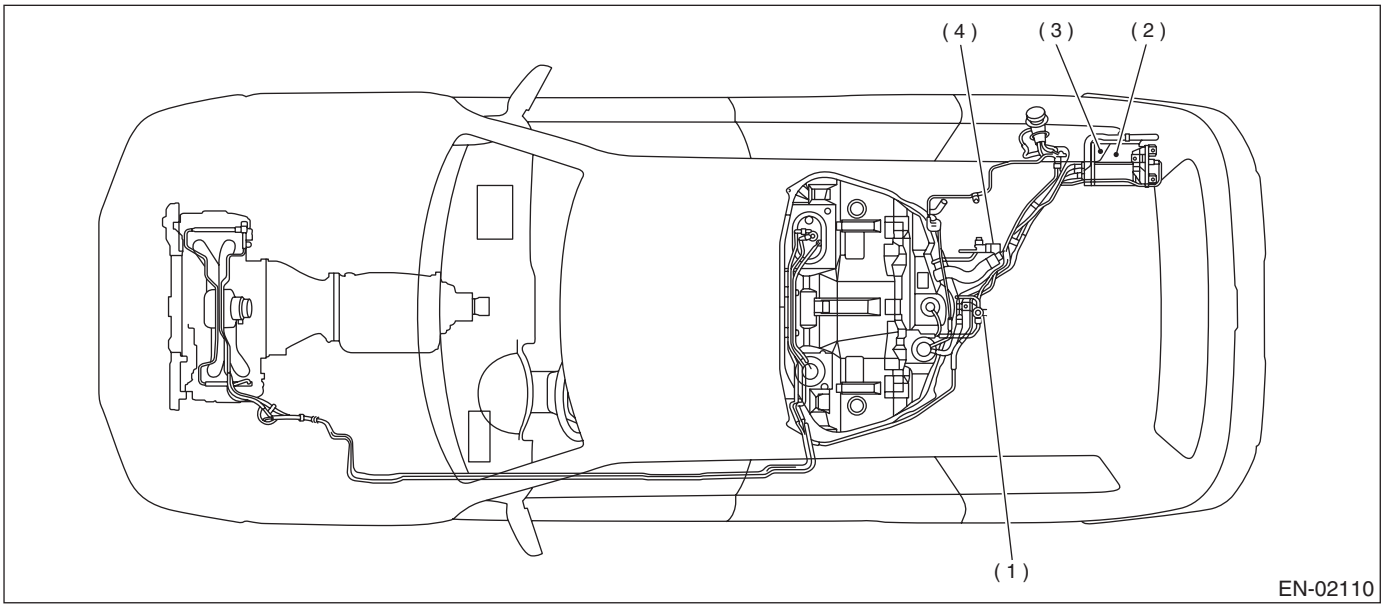


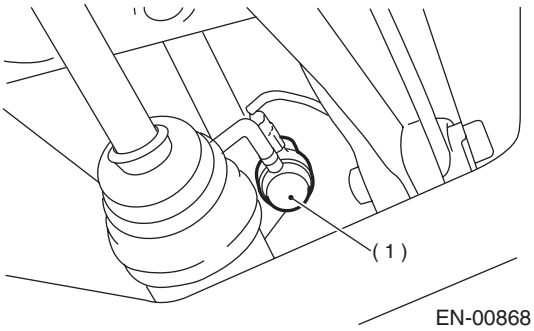
EN-00866

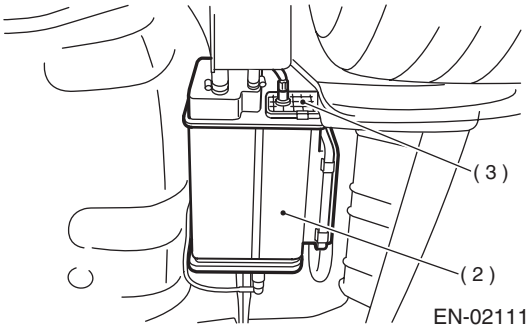


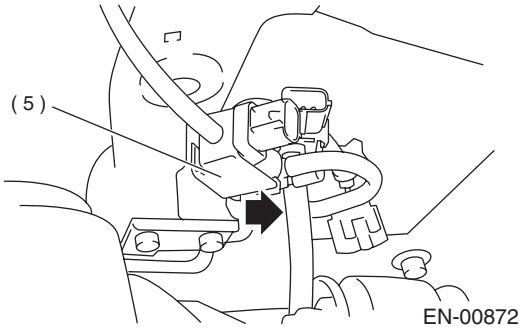
EN-00867



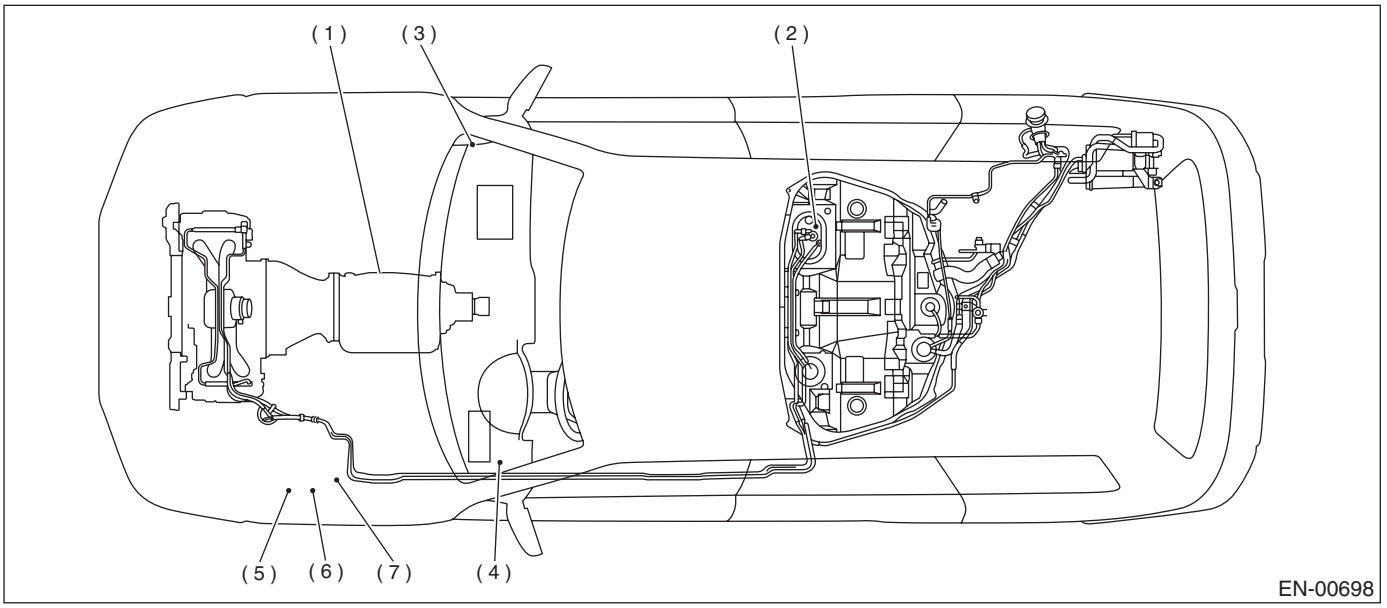
(1) Pressure control solenoid valve
(2) Canister (built-in drain filter)
(3) Drain valve (integrated with canister)
(4) Fuel tank sensor control valve



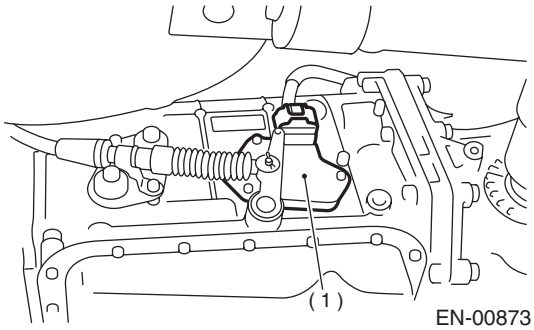




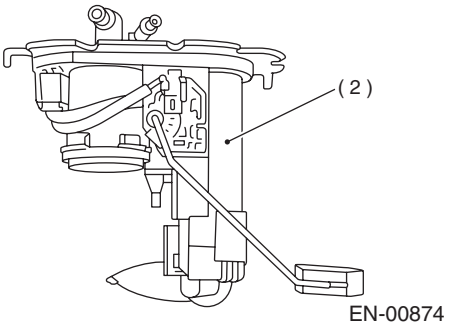
MEMO:



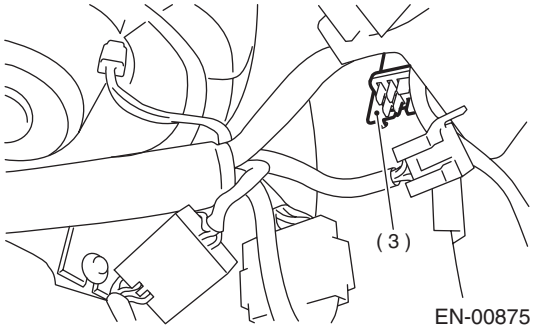
(1) Inhibitor switch
(2) Fuel pump
(3) Main relay
(4) Fuel pump relay
(5) Radiator main fan relay
(6) Radiator sub fan relay
(7) Starter



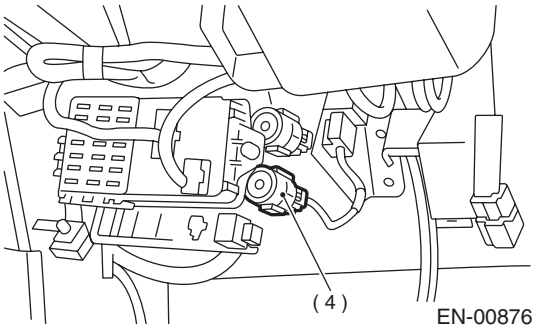
EN-00873



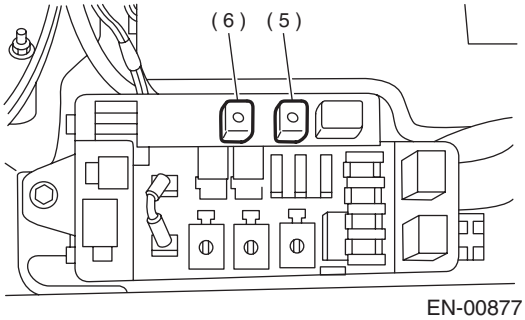
EN-00874



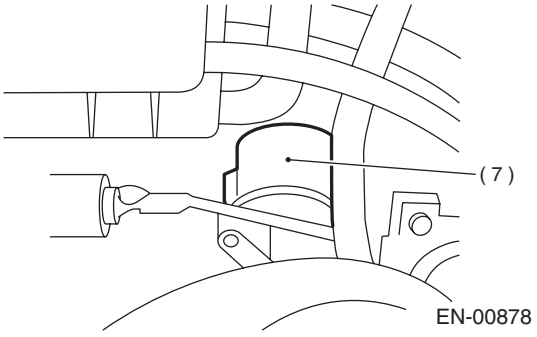
EN-00875



EN-00876



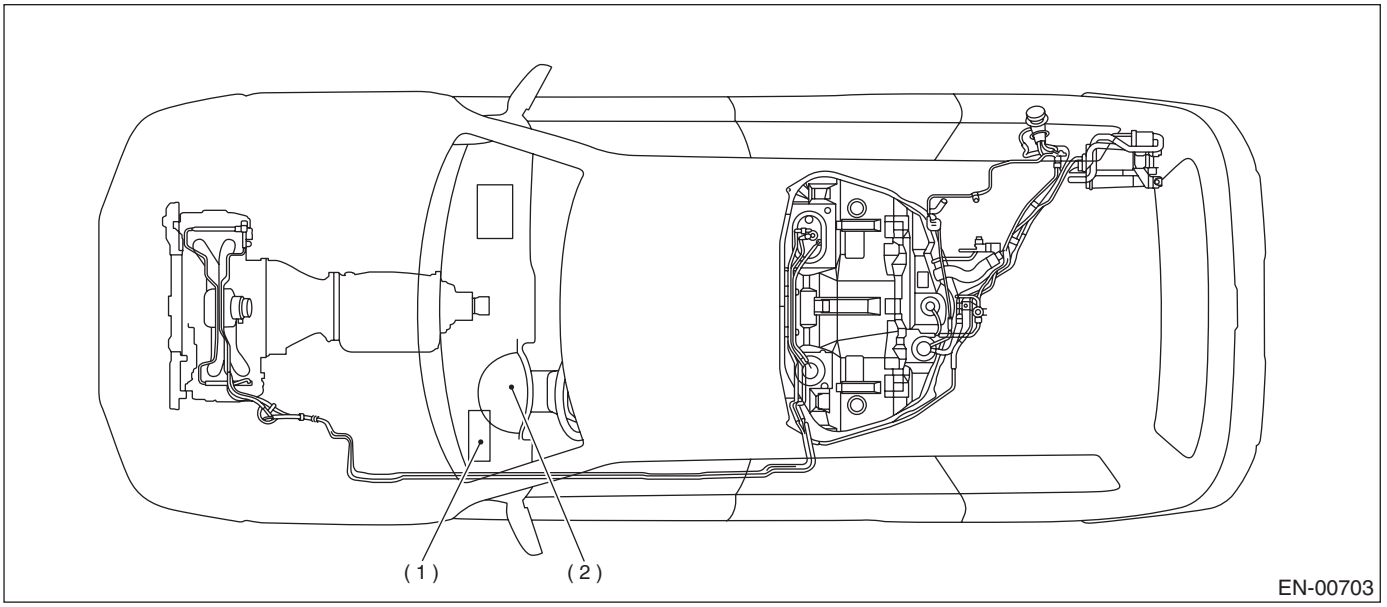
EN-00877



EN-00878

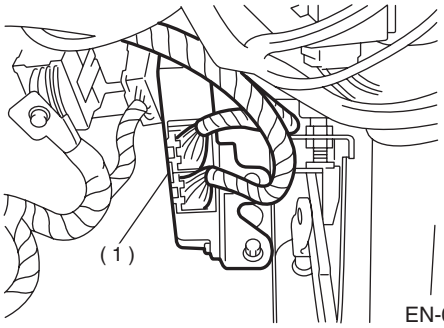
2. TRANSMISSION

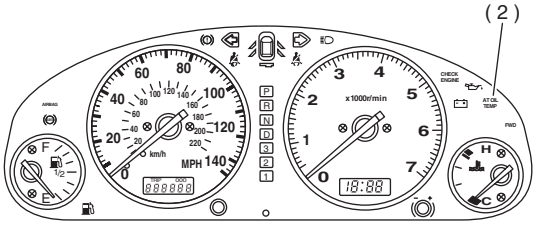
• MODULE



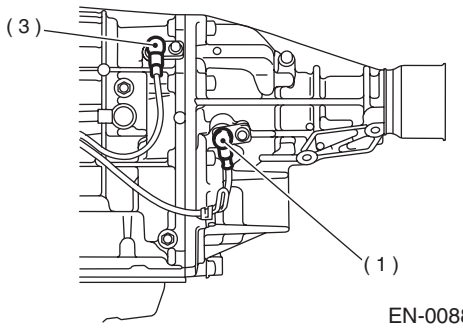
(1) Transmission Control Module (TCM) (for AT vehicles)

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

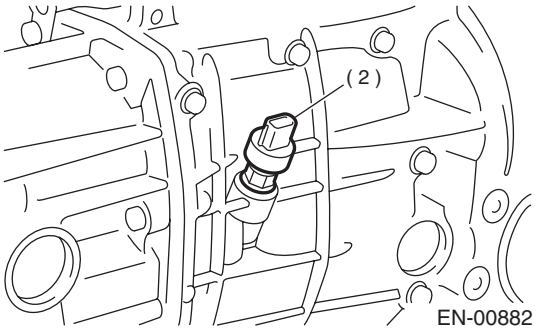




• SENSOR

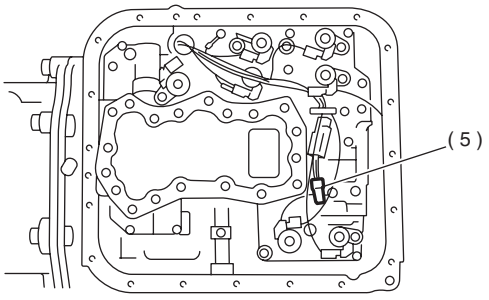


EN-00881

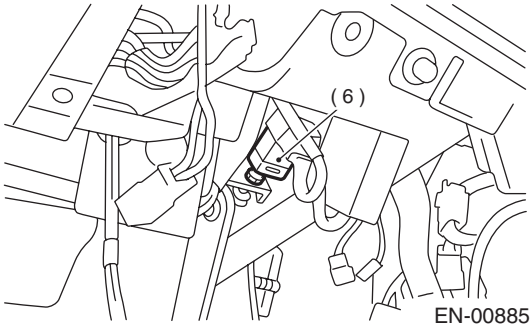


EN-00882

EN-00883



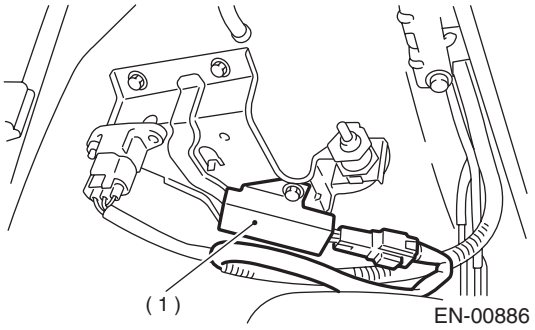
EN-00884

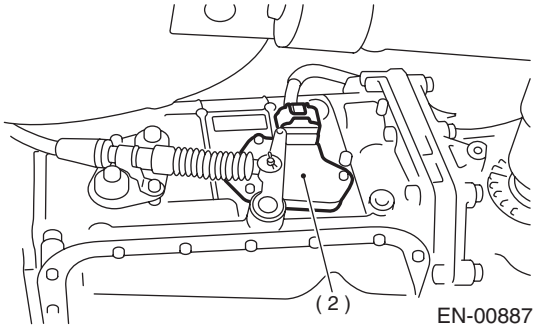


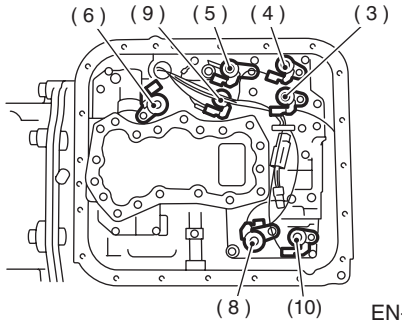
EN-00885

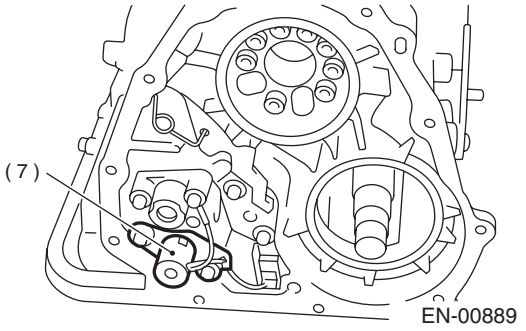
(1) Rear vehicle speed sensor (for AT vehicles)
(2) Front vehicle speed sensor (for MT vehicles)
(3) Front vehicle speed sensor (for AT vehicles)
(4) Torque converter turbine speed sensor
(5) ATF temperature sensor (for AT vehicles)
(6) Brake light switch

• SOLENOID VALVE AND SWITCH (AT VEHICLES)



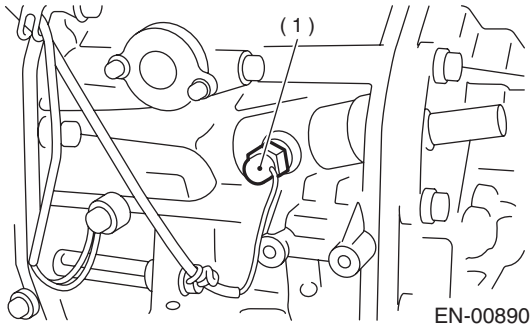






(1) Dropping resistor
(2) Inhibitor switch
(3) Shift solenoid valve 1
(4) Shift solenoid valve 2
(5) Line pressure duty solenoid
(6) Lock-up duty solenoid
(7) Transfer duty solenoid
(8) 2-4 brake duty solenoid
(9) Low clutch timing solenoid valve
(10) 2-4 brake timing solenoid valve

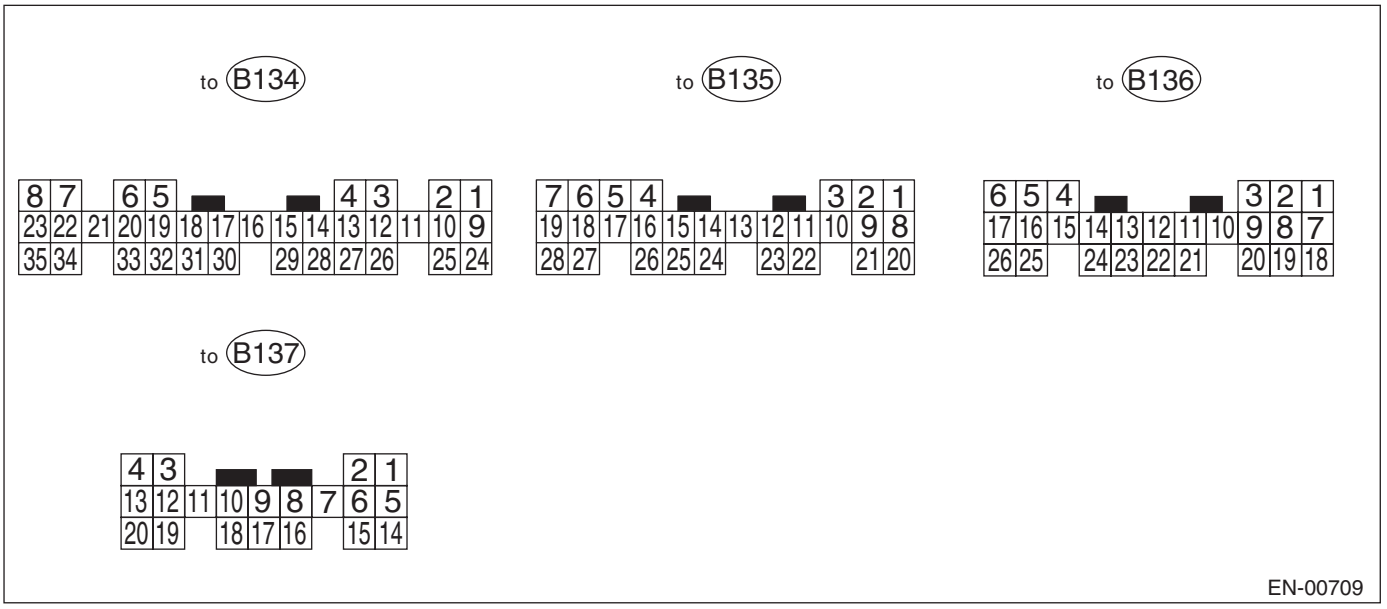
• SOLENOID VALVE AND SWITCH (MT VEHICLES)



(1) Neutral position switch

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

A: ELECTRICAL SPECIFICATION



Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crankshaft position sensor	Signal (+)	B135	7	0	–7 — +7	Sensor output waveform
	Signal (–)	B135	17	0	0	—
	Shield	B135	28	0	0	—
Camshaft position sensor	Signal (+)	B135	6	0	–7 — +7	Sensor output waveform
	Signal (–)	B135	18	0	0	—
	Shield	B135	20	0	0	—
Throttle position sensor	Signal	B135	13	Fully closed: 0.2 — 1.0 Fully opened: 4.2 — 4.7		—
	Power supply	B135	3	5	5	—
	GND (sensor)	B135	19	0	0	—
Rear oxygen sensor	Signal	B135	14	0	0 — 0.9	—
	Shield	B137	15	0	0	—
	GND (sensor)	B135	19	0	0	—
Front oxygen (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 temperature sensor	Signal	B135	12	1.0 — 1.4	1.0 — 1.4	After warm-up the engine.
	GND (sensor)	B135	19	0	0	After warm-up the engine.
Vehicle speed signal		B137	10	0 or 5	0 or 5	“5” and “0” are repeatedly displayed when vehicle is driven.
Starter switch		B136	20	0	0	Cranking: 8 — 14

Content		Connector 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: 0 OFF: 12±0.5		Switch is ON when gear is in neutral position.
Neutral position switch (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	B135	16	2.8	2.8	—
	Shield	B135	27	0	0	—
Back-up power supply		B135	9	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power supply		B135	1	10 — 13	13 — 14	—
		B135	2	10 — 13	13 — 14	—
Sensor power supply		B135	3	5	5	—
Ignition control	#1, #2	B134	33	0	1 — 3.4	Waveform
	#3, #4	B134	32	0	1 — 3.4	Waveform
Fuel injector	#1	B134	34	10 — 13	1 — 14	Waveform
	#2	B134	23	10 — 13	1 — 14	Waveform
	#3	B134	22	10 — 13	1 — 14	Waveform
	#4	B134	8	10 — 13	1 — 14	Waveform
Idle air control solenoid valve	Signal 1	B134	20	—	1 — 13	Waveform
	Signal 2	B134	6	—	1 — 13	Waveform
	Signal 3	B134	5	—	1 — 13	Waveform
	Signal 4	B134	19	—	1 — 13	Waveform
Fuel pump relay control		B134	11	ON: 0.5, or less OFF: 10 — 13	0.5, or less	—
A/C relay control		B134	9	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 1 control		B134	14	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 2 control		B134	13	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	With A/C vehicles only
Self-shutoff control		B136	12	10 — 13	13 — 14	—
Malfunction indicator lamp		B134	28	—	—	Light “ON”: 1, or less Light “OFF”: 10 — 14
Engine speed output		B134	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 signal		B136	15	8	8	—
Purge control solenoid valve		B134	29	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Fuel temperature sensor		B137	5	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Fuel level sensor		B135	25	0.12 — 4.75	0.12 — 4.75	—
Fuel tank pressure sensor	Signal	B135	26	2.3 — 2.7	2.3 — 2.7	The value obtained after the fuel filler cap was removed once and recapped.
	Power supply	B135	3	5	5	—
	GND (sensor)	B135	19	0	0	—

ENGINE CONTROL MODULE (ECM) I/O SIGNAL

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Pressure control solenoid valve		B134	4	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Drain valve		B134	3	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Fuel tank sensor control valve		B134	1	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
EGR solenoid valve	Signal 1	B134	18	0 or 10 — 13	0 or 10 — 13	—
	Signal 2	B134	17	0 or 10 — 13	0 or 10 — 13	—
	Signal 3	B134	16	0 or 10 — 13	0 or 10 — 13	—
	Signal 4	B134	15	0 or 10 — 13	0 or 10 — 13	—
AT diagnosis input signal		B137	19	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	Waveform
Small light switch		B137	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Blower fan switch		B137	13	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Rear defogger switch		B137	4	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sensor signal 1		B136	13	—	2.05 — 2.25	—
Front oxygen (A/F) sensor signal 2		B136	22	—	1.75 — 1.95	—
Pressure sensor		B135	15	4.0 — 4.8	1.1 — 1.9	—
Intake air temperature sensor		B137	6	3.15 — 3.33	3.15 — 3.33	Intake air temperature: 25°C (75°F)
SSM/GST communication line		B137	16	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	—
GND (sensors)		B135	19	0	0	—
GND (injectors)		B134	35	0	0	—
GND (ignition system)		B136	26	0	0	—
GND (power supply)		B134	7	0	0	—
GND (control systems)		B137	14	0	0	—
		B135	21	0	0	—
GND (oxygen sensor heater 1)		B136	5	0	0	—
GND (oxygen sensor heater 2)		B136	16	0	0	—

6. Engine Condition Data

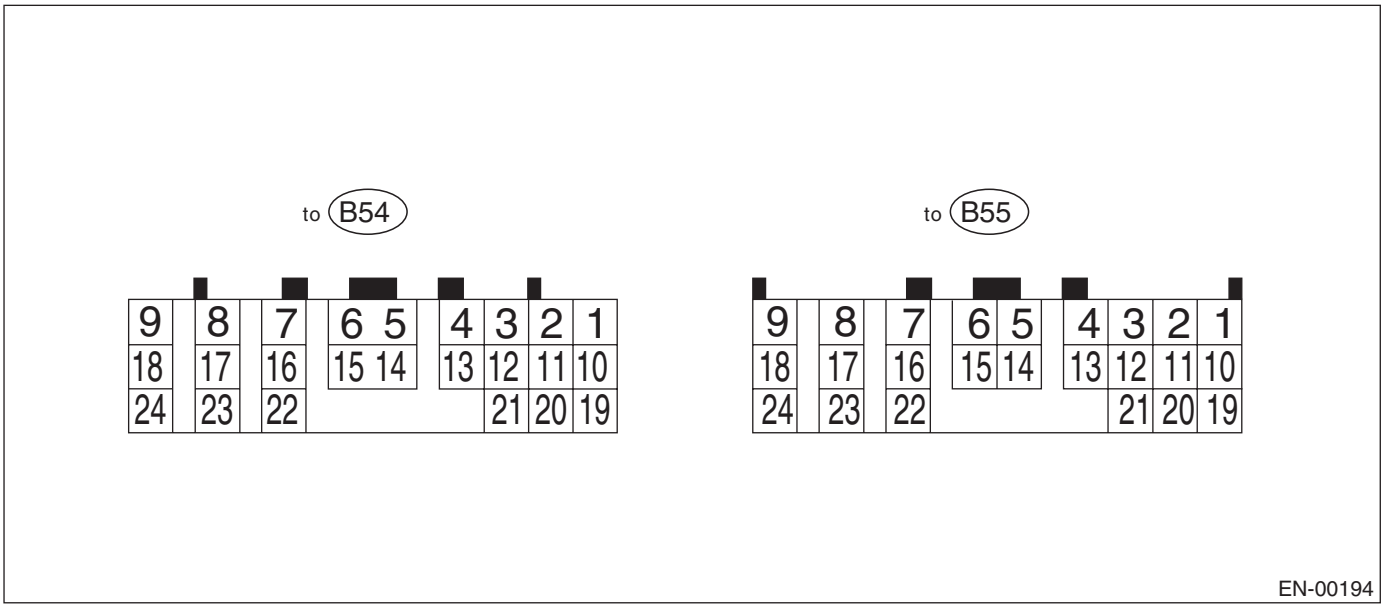
A: ELECTRICAL SPECIFICATION

Content	Specified data
Engine load	1.3 — 2.6 (%): Idling
	5.4 — 10.9 (%): 2,500 rpm racing

Measuring condition:
- After warm-up the engine.
- Gear position is in “N” or “P” position.
- A/C is turned OFF.
- All accessory switches are turned OFF.

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

A: ELECTRICAL SPECIFICATION



NOTE:
Check with ignition switch ON.

Content		Connector No.	Terminal No.	Measuring conditions	Voltage (V)
Back-up power supply		B55	6	Ignition switch OFF	10 — 16
Ignition power supply		B54	23	Ignition switch ON (with engine OFF)	10 — 16
		B54	24		
Inhibitor switch	“P” range switch	B55	23	Selector lever in “P” range	Less than 1
				Selector lever in any other than “P” range	More than 8
	“N” range switch	B55	22	Selector lever in “N” range	Less than 1
				Selector lever in any other than “N” range	More than 8
	“R” range switch	B55	17	Selector lever in “R” range	Less than 1
				Selector lever in any other than “R” range	More than 9.5
	“D” range switch	B55	8	Selector lever in “D” range	Less than 1
				Selector lever in any other than “D” range	More than 9.5
	“3” range switch	B55	18	Selector lever in “3” range	Less than 1
				Selector lever in any other than “3” range	More than 9.5
	“2” range switch	B54	10	Selector lever in “2” range	Less than 1
				Selector lever in any other than “2” range	More than 9.5
	“1” range switch	B54	1	Selector lever in “1” range	Less than 1
				Selector lever in any other than “1” range	More than 9.5
Brake switch		B55	24	Brake pedal depressed	More than 10.5
				Brake pedal released	Less than 1
ABS signal		B54	19	ABS switch ON	Less than 1
				ABS switch OFF	More than 6.5

Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
Throttle position sensor	B55	1	Throttle fully closed.	0.3 — 0.7	—
			Throttle fully open.	4.3 — 4.9	
Throttle position sensor power supply	B55	2	Ignition switch ON (with engine OFF)	4.8 — 5.3	—
ATF temperature sensor	B55	11	ATF temperature 20°C (68°F)	2.9 — 4.0	2.1 k — 2.9 k
			ATF temperature 80°C (176°F)	1.0 — 1.4	275 — 375
Rear vehicle speed sensor	B55	3	Vehicle stopped.	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Front vehicle speed sensor	B55	5	Vehicle speed at most 10 km/h (6 MPH)	Less than 1←→More than 4	—
Torque converter turbine speed sensor	B55	12	Vehicle stopped.	0	450 — 650
			Vehicle speed at least 20 km/h (12 MPH)	More than 1 (AC range)	
Vehicle speed output signal	B55	13	Vehicle speed at most 10 km/h (6 MPH)	Less than 1←→More than 4	—
Engine speed signal	B55	4	Ignition switch ON (with engine OFF).	More than 10.5	—
			Ignition switch ON (with engine ON).	8 — 11	
Cruise set signal	B54	11	When cruise control is set (SET lamp ON).	Less than 1	—
			When cruise control is not set (SET lamp OFF).	More than 6.5	
Torque control 1 signal	B54	13	Ignition switch ON (with engine ON)	More than 9	—
Torque control 2 signal	B54	21	Ignition switch ON (with engine ON)	More than 9	—
Torque control cut signal	B54	2	Ignition switch ON	8	—
AT load signal	B55	20	Engine idling after warm-up	1.2 — 1.8	—
Shift solenoid 1	B54	7	1st or 4th gear	More than 9	10 — 16
			2nd or 3rd gear	Less than 1	
Shift solenoid 2	B54	6	1st or 2nd gear	More than 9	10 — 16
			3rd or 4th gear	Less than 1	
Line pressure duty solenoid	B54	9	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Dropping resistor	B54	18	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
Lock-up duty solenoid	B54	16	When lock up occurs.	More than 8.5	10 — 17
			When lock up is released.	Less than 0.5	
Transfer duty solenoid	B54	15	Fuse on FWD switch	More than 8.5	10 — 17
			Fuse removed from FWD switch (with throttle fully open and with select lever in 1st gear).	Less than 0.5	

TRANSMISSION CONTROL MODULE (TCM) I/O SIGNAL

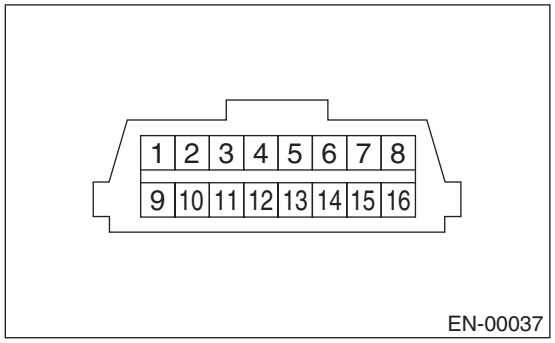
Content	Connector No.	Terminal No.	Measuring conditions	Voltage (V)	Resistance to body (ohms)
2-4 brake duty solenoid	B54	8	Throttle fully closed (with engine OFF) after warm-up.	1.5 — 4.0	2.0 — 4.5
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake duty solenoid resistor	B54	17	Throttle fully closed (with engine OFF) after warm-up.	More than 8.5	9 — 15
			Throttle fully open (with engine OFF) after warm-up.	Less than 0.5	
2-4 brake timing solenoid	B54	5	3rd gear	More than 9	10 — 16
			1st gear	Less than 1	
Low clutch timing solenoid	B54	14	2nd gear	Less than 1	10 — 16
			4th gear	More than 9	
Sensor ground line 1	B55	10	—	0	Less than 1
Sensor ground line 2	B55	21	—	0	Less than 1
System ground line	B55	9	—	0	Less than 1
		19			
FWD switch	B55	14	Fuse removed.	6 — 9.1	—
			Fuse installed.	Less than 1	
FWD indicator lamp	B54	12	Fuse on FWD switch	Less than 1	—
			Fuse removed from FWD switch.	More than 9	
Data link signal (Subaru Select Monitor)	B55	7	—	—	—
		16	—	—	
AT diagnosis signal	B54	4	Ignition switch ON	Less than 1 ←→ More than 4	—

8. Data Link Connector

A: NOTE

1) This connector is used both for general scan tools and the Subaru Select Monitor.
2) Terminal No. 4 to No. 6 of the data link connector is used for the Subaru Select Monitor signal.

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



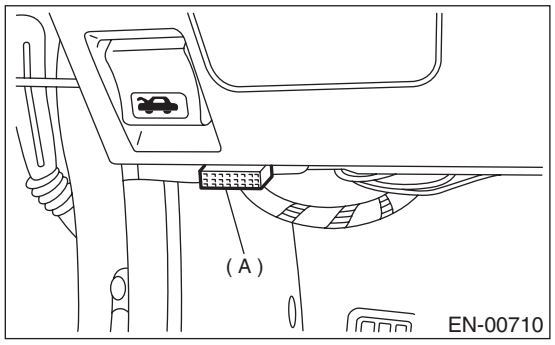
Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	K line of ISO 9141 CARB
3	Blank	11	Blank
4	Blank	12	Ground
5	Blank	13	Ground
6	Flash Write	14	Blank
7	Blank	15	Blank
8	Blank	16	Blank

9. General Scan Tool

A: OPERATION

1. HOW TO USE GENERAL SCAN TOOL

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



3) Using the general scan tool, call up diagnostic trouble code(s) and freeze frame data.
General scan tool functions consist of:
(1) MODE $01: Current powertrain diagnostic data
(2) MODE $02: Powertrain freeze frame data
(3) MODE $03: Emission-related powertrain 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 General Scan Tool Operation Manual.)

NOTE:
For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

2. MODE $01 (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refers to data denoting the current operating condition of analog input/output, digital input/output and/or the powertrain system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
01	Number of emission-related powertrain trouble codes and MIL status	ON/OFF and number
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 diagnosis system	—

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

3. MODE $02 (POWERTRAIN FREEZE FRAME DATA)

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

4. MODE $03 (EMISSION-RELATED POWERTRAIN DIAGNOSTIC TROUBLE CODE)

Refer to Read Diagnostic Trouble Code for information about data denoting emission-related powertrain diagnostic trouble codes. <Ref. to EN(H4SO)-41, 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).

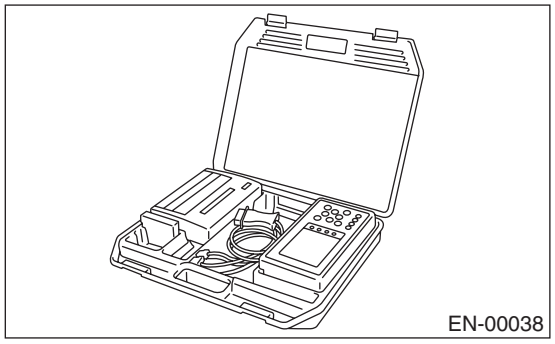
NOTE:
Refer to general scan tool manufacturer's instruction manual to clear or reset emission-related diagnostic information (MODE $04).

10. Subaru Select Monitor

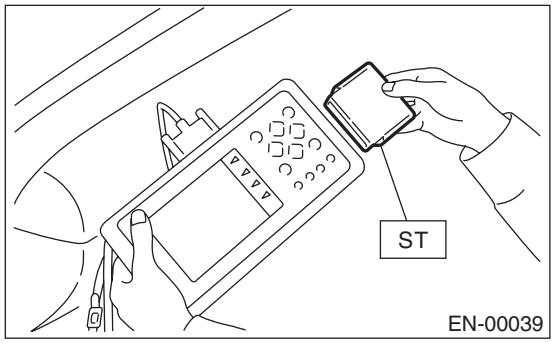
A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

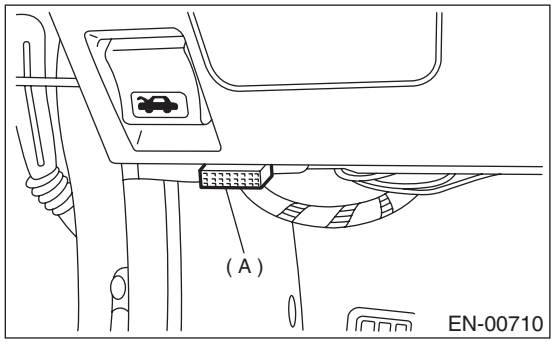
1) Prepare Subaru Select Monitor kit. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>



2) Connect diagnosis cable to Subaru Select Monitor.
3) Insert cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>



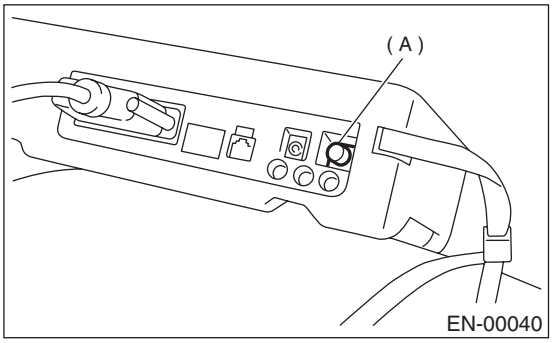
4) Connect Subaru Select Monitor to data link connector.
(1) Data link connector (A) located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

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

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



(A) Power switch

6) Using 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 DTC. <Ref. to EN(H4SO)-41, 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 DTC. <Ref. to EN(H4SO)-41, Read Diagnostic Trouble Code.>

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

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the «Data Display Menu» display screen, select the {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 Width 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 value	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 psig
Intake manifold relative pressure signal	Mani. Relative Pressure	mmHg or kPa or inHg or psig
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg or kPa or inHg or psig
A/F correction (short term fuel trim) by rear oxygen sensor	A/F Correction #3	%
Long term whole fuel trim	A/F Learning #1	%
Front oxygen (A/F) sensor heater current	Front O2 Heater #1	A
Rear oxygen sensor heater voltage	Rear O2 Heater Voltage	A
Canister purge control solenoid valve duty ratio	CPC Valve Duty Ratio	%
Fuel tank pressure signal	Fuel Tank Pressure	mmHg or kPa or inHg or psig
Fuel temperature signal	Fuel Temp.	°C or °F
Fuel level signal	Fuel Level	V
Intake air temperature signal	Intake Air Temp.	°C or °F
Learned ignition timing	Learned Ignition Timing	deg
EGR control signal	No. of EGR Steps	STEP
Identification signal of AT vehicle	AT vehicle ID Signal	AT/MT
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 compressor 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

Contents	Display	Unit of measure
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF
Engine torque control signal #1	Torque Control Signal #1	ON or OFF
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	Rich/lean
Pressure control solenoid valve	PCV Solenoid Valve	ON or OFF
Drain valve	Vent. Solenoid Valve	ON or OFF
Starter switch signal	Starter Switch	ON or OFF
Idle switch signal	Idle Switch Signal	ON or OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF
Fuel tank sensor control valve signal	Fuel tank sensor control valve	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 assist injector solenoid valve signal	Assist Air Sol. Valve	ON or OFF
Power steering switch signal	P/S Switch	ON or OFF

NOTE:
- For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
- For select monitor display details, refer to the following.

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

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {Current Data Display & Save} and press the [YES] key.
6) On the «Data Display Menu» display screen, select the {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 diagnosis code	Number of Diag. 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 catalyst	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	O2 Heater Diagnosis	Complete or incomplete
Air fuel ratio control system for bank 1	Fuel System for Bank 1	ON or OFF
Engine load data	Calculated load valve	—
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 psig
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 signal	Mass Air Flow	g/s
EGR signal	EGR System	No support
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	—
Front oxygen (A/F) sensor equipment	Oxygen sensor #11	Supported
Oxygen sensor equipment	Oxygen sensor #12	Supported
Front oxygen (A/F) sensor output signal	A/F Sensor #11	V

NOTE:
For detailed operation procedure, 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 the {Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {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 Bank 1	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 psig
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH

NOTE:
For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

7. LED OPERATION MODE FOR ENGINE

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the «Data Display Menu» display screen, select the {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.
Pressure control solenoid valve	PCV Solenoid Valve	ON or OFF	When pressure control solenoid valve is in function.
Drain valve	Vent. Solenoid Valve	ON or OFF	When drain valve is in function.
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 procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

8. READ CURRENT DATA FOR AT.

1) On the «Main Menu» display screen, select the {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 displayed the information of transmission type.
4) On the «Transmission Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the «Data Display Menu» display screen, select the {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
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 procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
For select monitor display details, refer to the following.

11.Read Diagnostic Trouble Code

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

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

NOTE:
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {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 procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

3. GENERAL SCAN TOOL

Refers to data denoting emission-related powertrain diagnostic trouble codes.
For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

NOTE:
Refer to general scan tool manufacturer's instruction manual to access emission-related powertrain 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)-48, Drive Cycle.>

DTC No.	Item
P0031	HO2S Heater control circuit low (Bank 1 Sensor 1)
P0032	HO2S Heater control circuit high (Bank 1 Sensor 1)
P0037	HO2S Heater control circuit low (Bank 1 Sensor 2)
P0038	HO2S Heater control circuit high (Bank 1 Sensor 2)
P0066	Air assisted injector control circuit or circuit low
P0067	Air assisted injector control circuit high
P0068	Manifold absolute pressure/barometric pressure circuit range/performance
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
P0131	O2 sensor circuit low voltage (Bank 1 Sensor 1)
P0132	O2 sensor circuit high voltage (Bank 1 Sensor 1)
P0134	O2 sensor circuit no activity detected (Bank 1 Sensor 1)
P0137	O2 sensor circuit low voltage (Bank 1 Sensor 2)
P0138	O2 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
P0340	Camshaft position sensor “A” circuit (Bank 1 or Single sensor)
P0341	Camshaft position sensor “A” circuit range/performance (Bank 1 or Single sensor)
P0447	Evaporative emission control system vent control circuit open
P0448	Evaporative emission control system vent control circuit shorted
P0452	Evaporative emission control system pressure sensor low input
P0458	Evaporative emission control system purge control valve circuit low
P0461	Fuel level sensor circuit range/performance
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 intermittent/erratic/high
P0512	Starter request circuit
P0519	Idle air control circuit system performance
P0565	Cruise control on signal
P0604	Internal control module random access memory (RAM) error
P0691	Cooling fan 1 control circuit low
P0692	Cooling fan 1 control circuit high
P0703	Torque converter/brake switch “B” circuit
P0705	Transmission range sensor circuit (PRNDL input)

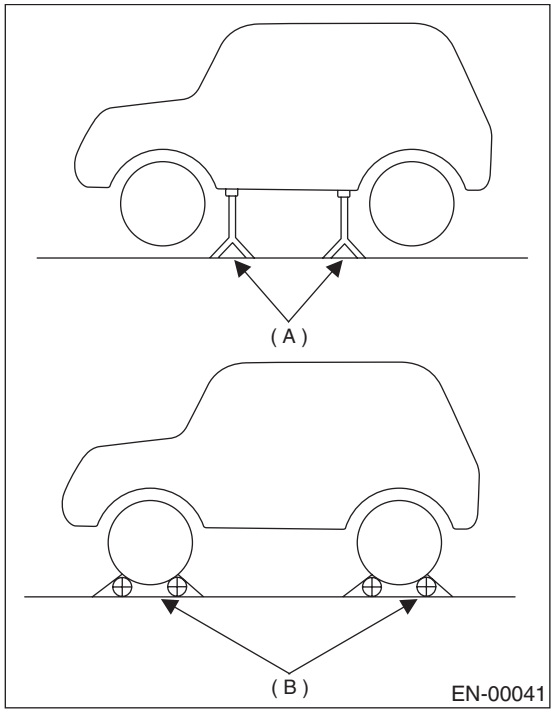
DTC No.	Item
P0710	Transmission fluid temperature sensor circuit
P0716	Input/turbine speed sensor circuit range/performance
P0720	Output speed sensor circuit
P0726	Engine speed input circuit range/performance
P0731	Gear 1 incorrect ratio
P0732	Gear 2 incorrect ratio
P0733	Gear 3 incorrect ratio
P0734	Gear 4 incorrect ratio
P0741	Torque converter clutch circuit performance or stuck off
P0743	Torque converter clutch circuit electrical
P0748	Pressure control solenoid “A” electrical
P0753	Shift solenoid “A” electrical
P0758	Shift solenoid “B” electrical
P0771	Shift solenoid “E” performance or stuck off
P0778	Pressure control solenoid “B” electrical
P0785	Shift/timing solenoid
P0851	Neutral switch input circuit low
P0852	Neutral switch input circuit high
P0864	TCM communication circuit range/performance
P0865	TCM communication circuit low
P0866	TCM communication circuit high
P1110	Atmospheric pressure sensor circuit malfunction (low 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
P1492	EGR solenoid valve signal #1 circuit malfunction (low input)
P1493	EGR solenoid valve signal #1 circuit malfunction (high input)
P1494	EGR solenoid valve signal #2 circuit malfunction (low input)
P1495	EGR solenoid valve signal #2 circuit malfunction (high input)
P1496	EGR solenoid valve signal #3 circuit malfunction (low input)
P1497	EGR solenoid valve signal #3 circuit malfunction (high input)
P1498	EGR solenoid valve signal #4 circuit malfunction (low input)
P1499	EGR solenoid valve signal #4 circuit malfunction (high input)
P1510	ISC solenoid valve signal #1 circuit malfunction (low input)
P1511	ISC solenoid valve signal #1 circuit malfunction (high input)
P1512	ISC solenoid valve signal #2 circuit malfunction (low input)
P1513	ISC solenoid valve signal #2 circuit malfunction (high input)
P1514	ISC solenoid valve signal #3 circuit malfunction (low input)
P1515	ISC solenoid valve signal #3 circuit malfunction (high input)
P1516	ISC solenoid valve signal #4 circuit malfunction (low input)
P1517	ISC solenoid valve signal #4 circuit malfunction (high input)
P1518	Starter switch circuit low input
P1560	Back-up voltage circuit malfunction
P1698	Engine torque control cut signal circuit malfunction (low input)
P1699	Engine torque control cut signal circuit malfunction (high input)
P1700	Throttle position sensor circuit malfunction for AT
P1711	Engine torque control signal #1 circuit malfunction
P1712	Engine torque control signal #2 circuit malfunction
P2227	Barometric pressure too low

DTC No.	Item
P2228	Atmospheric pressure sensor circuit malfunction (high input)
P2229	A/F sensor micro-computer problem

1. PREPARATION FOR THE INSPECTION MODE

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

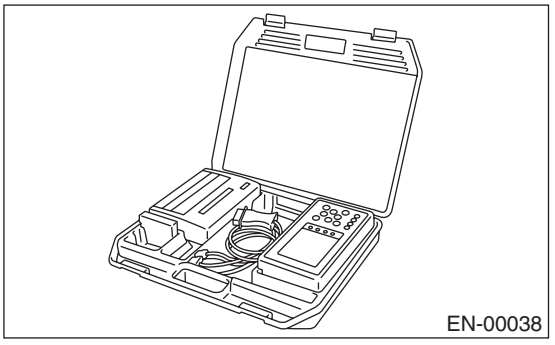
WARNING:
• Before raising the vehicle, ensure parking brakes are applied.
• Do not use a pantograph jack in place of a safety stand.
• Secure a rope or wire to the front and rear towing or tie-down hooks to prevent the lateral runout of front wheels.
• Do not abruptly depress/release clutch pedal or 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.



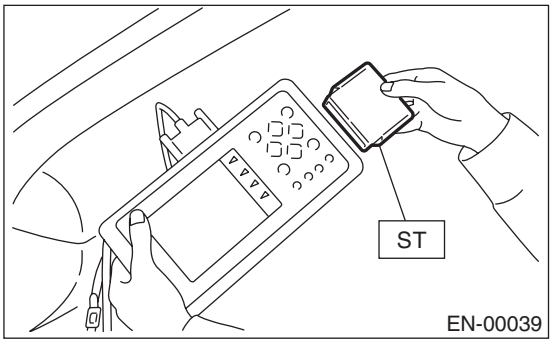
(A) Safety stand
(B) Free rollers

2. SUBARU SELECT MONITOR

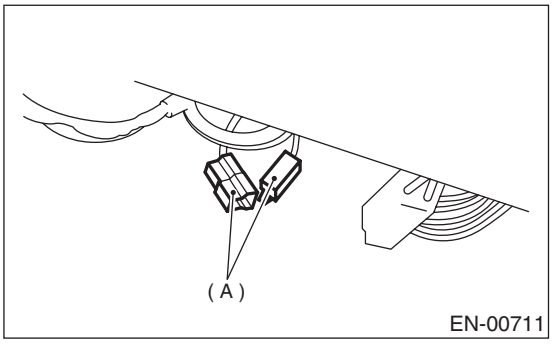
1) After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)-50, Clear Memory Mode.>
2) Warm up engine.
3) Prepare Subaru Select Monitor kit. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>



4) Connect diagnosis cable to Subaru Select Monitor.
5) Insert cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>

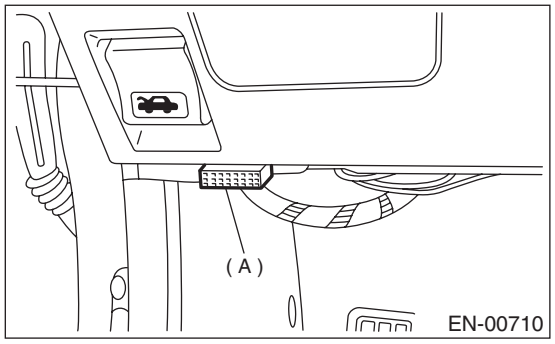


6) Connect test mode connector (A) at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



7) Connect Subaru Select Monitor to data link connector.

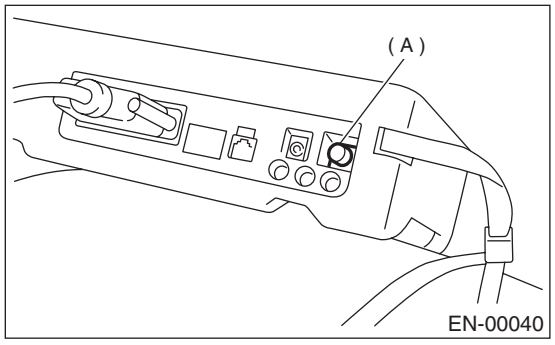
(1) Connect Subaru Select Monitor to data link connector (A) located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

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

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



(A) Power switch

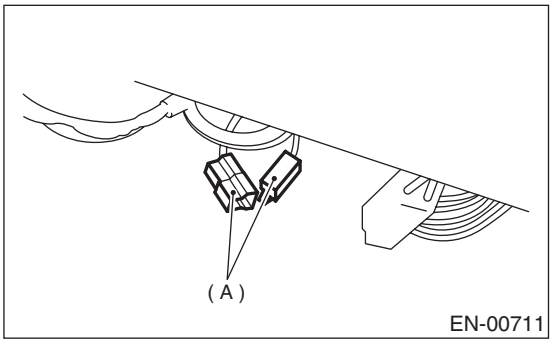
9) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
10) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
11) Press the [YES] key after displayed the information of engine type.
12) On the «Engine Diagnosis» display screen, select the {Dealer Check Mode Procedure} and press the [YES] key.
13) When the “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 trouble still remains in the memory, the corresponding diagnostic trouble code (DTC) appears on the display screen.

NOTE:
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>
• Release the parking brake.
• The speed difference between front and rear wheels may light either the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

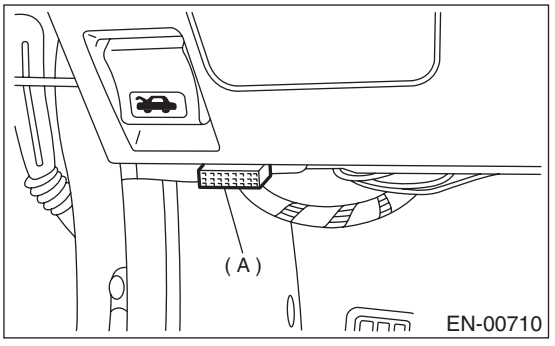
3. GENERAL SCAN TOOL

1) After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data: <Ref. to EN(H4SO)-50, Clear Memory Mode.>
2) Warm up engine.
3) Connect test mode connector (A) at the lower side of the instrument panel (on the driver's side), to the side of the center console box.



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

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



5) Start the engine.

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

6) Using the selector lever or shift lever, turn the “P” position switch and the “N” position switch to ON.
7) Depress the brake pedal to turn the brake switch ON. (AT vehicles)
8) Keep engine speed in the 2,500 — 3,000 rpm range for 40 seconds.
9) Place the selector lever or shift lever in the “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 light the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

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

NOTE:
• For detailed operation procedures, refer to the General Scan Tool Instruction Manual.
• For detailed concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

13.Drive Cycle

A: OPERATION

There are 3 drive patterns for trouble diagnosis. Driving in the specified pattern allows to diagnose the 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 fuel remains approx. half amount [20 to 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)], and battery voltage is 12V or more.
2) After performing diagnostics and cleaning the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)-50, Clear Memory Mode.>
3) Separate test mode connector.

NOTE:
- Except for water temperature specified items at starting, diagnosis is carried out after engine warm up.
- Carry out diagnosis which is marked * on DTC twice, Then, after finishing 1st diagnosis, stop engine and do the second time at the same condition.

2. AFTER RUNNING 20 MINUTES AT 80 KM/H (50 MPH), IDLE ENGINE FOR 1 MINUTE.

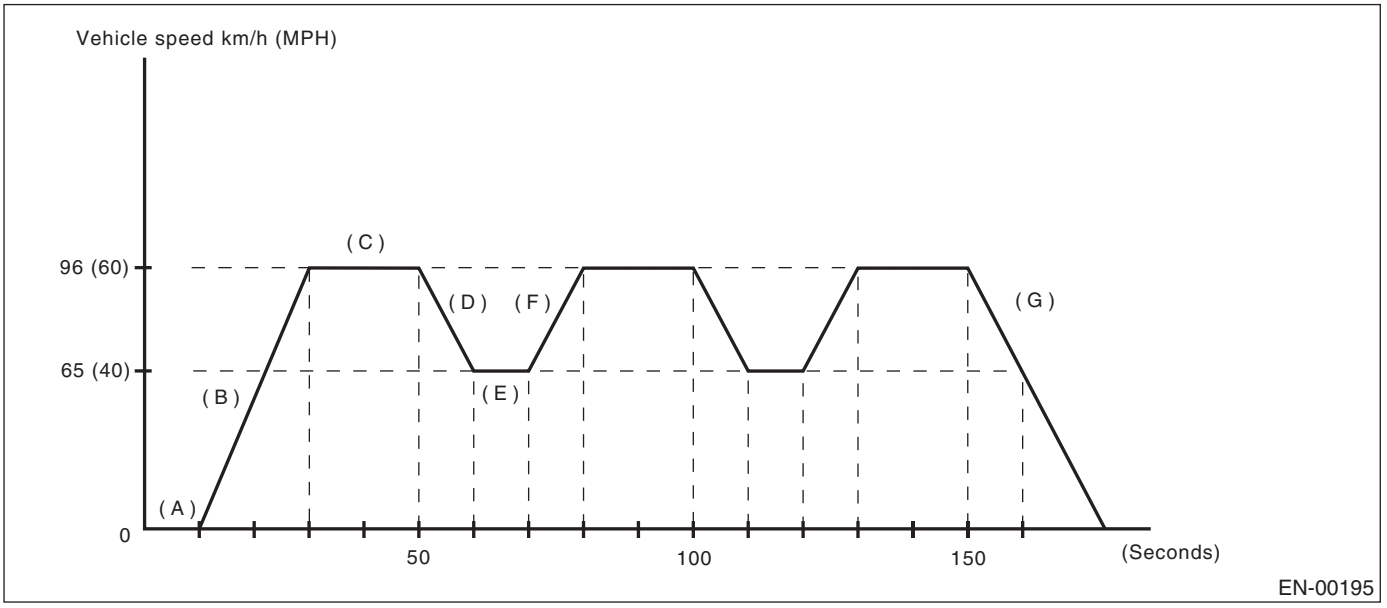
DTC No.	Item	Condition
P0030	HO2S Heater control circuit (Bank 1 Sensor 1)	—
*P0111	Intake air temperature circuit range/performance	Coolant temperature at start is less than 30°C (86°F).
*P0125	Insufficient coolant temperature for closed loop fuel control	Coolant temperature at start is less than 20°C (68°F).
*P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	Coolant temperature at start is less than 55°C (131°F).
*P0130	O2 Sensor circuit (Bank 1 Sensor 1)	—
*P0133	O2 Sensor circuit slow response (Bank 1 Sensor 1)	—
*P0181	Fuel temperature sensor “A” circuit range/performance	—
*P0420	Catalyst system efficiency below threshold (Bank 1)	—
*P0442	Evaporative emission control system leak detected (small leak)	—
*P0451	Evaporative emission control system pressure sensor range/performance	—
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	—
*P0461	Fuel level sensor circuit range/performance	—
*P0464	Fuel level sensor circuit intermittent	—
*P1137	O2 Sensor circuit (Bank 1 Sensor 1)	—
P1443	Vent control solenoid valve function problem	—
*P1448	Fuel tank sensor control valve range/performance	—

3. IDLE FOR 10 MINUTES

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

DTC No.	Item	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.
(B) Accelerate to 97 km/h (60 MPH) within 20 seconds.
(C) Drive vehicle at 97 km/h (60 MPH) for 20 seconds.
(D) Decelerate with fully closed throttle to 64 km/h (40 MPH).
(E) Drive vehicle at 64 km/h (40 MPH) for 10 seconds.
(F) Accelerate to 97 km/h (60 MPH) within 10 seconds.
(G) Stop vehicle with throttle fully closed.

DTC No.	Item	Condition
*P0065	Air assisted injector control range/performance	—
*P0121	Throttle/pedal position sensor/switch “A” circuit range/performance	—
*P0126	INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION	—
*P0139	O2 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	—
*P0400	Exhaust gas recirculation flow	—
*P2096	Post catalyst fuel trim system too lean bank 1	—
*P2097	Post catalyst fuel trim system too rich bank 1	—

14.Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {Clear Memory} and press the [YES] key.
5) When the `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 ISC must be initialized. To do this, turn the ignition switch to the ON position. Wait 3 seconds before starting the engine. (AT vehicles only)
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

2. SUBARU SELECT MONITOR (OBD MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
3) Press the [YES] key after displayed the information of engine type.
4) On the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {4. Diagnosis Code(s) Cleared} and press the [YES] key.
6) When the “Clear Diagnostic Code?” is shown on the display screen, press the [YES] key.
7) Turn 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 the ignition switch to the ON position. Wait 3 seconds before starting the engine.
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

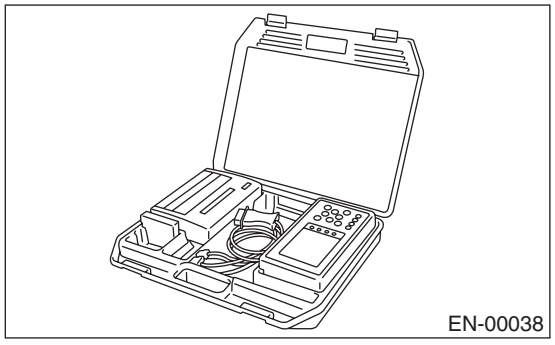
3. GENERAL SCAN TOOL

For clear memory procedures using the general scan tool, refer to the General Scan Tool Instruction Manual.
After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, turn the ignition switch to the ON position. Wait 3 seconds before starting the engine.

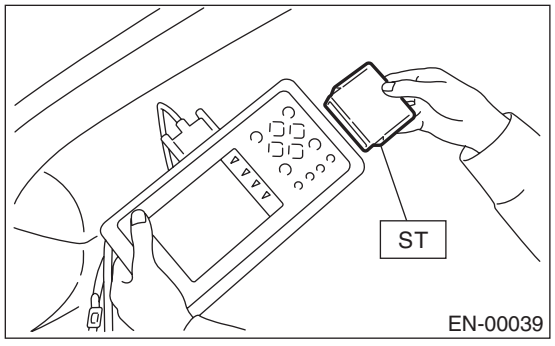
15.Compulsory Valve Operation Check Mode

A: OPERATION

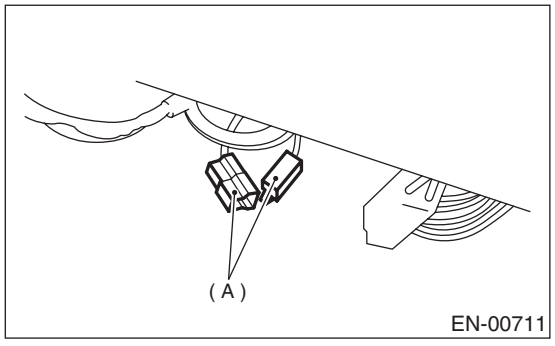
1) Prepare Subaru Select Monitor kit. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>



2) Connect diagnosis cable to Subaru Select Monitor.
3) Insert cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)-8, PREPARATION TOOL, General Description.>

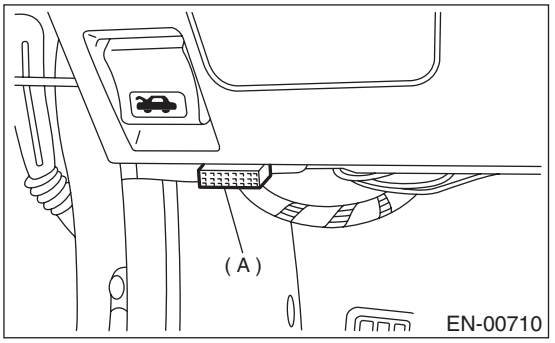


4) Connect test mode connector (A) at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



5) Connect Subaru Select Monitor to data link connector.

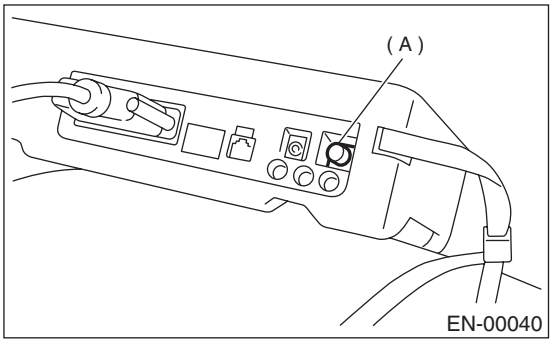
(1) Connect Subaru Select Monitor to data link connector (A) located in the lower portion of the instrument panel (on the driver's side).



(2) Connect diagnosis cable to data link connector.

CAUTION:
Do not connect scan tools except for Subaru Select Monitor and 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 the {2. Each System Check} and press the [YES] key.
8) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
9) Press the [YES] key after displayed the information of engine type.
10) On the «Engine Diagnosis» display screen, select the {System Operation Check Mode} and press the [YES] key.
11) On the «System Operation Check Mode» display screen, select the {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.

- 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 assist injector solenoid valve operation check	AAI Solenoid Valve
Compulsory fuel tank pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory drain valve operation check	Vent Control Solenoid Valve
Fuel tank sensor control valve operation check	Fuel Tank Sensor Control Valve

NOTE:

- The following parts will be displayed but not functional.

Display
ASV Solenoid Valve
FICD Solenoid
Pressure Switching Sol. 1
Pressure Switching Sol. 2
Turbo Pressure Control Solenoid
Exhaust Bypass Valve
EGR Valve Solenoid

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

16.Engine Malfunction Indicator Lamp (MIL)

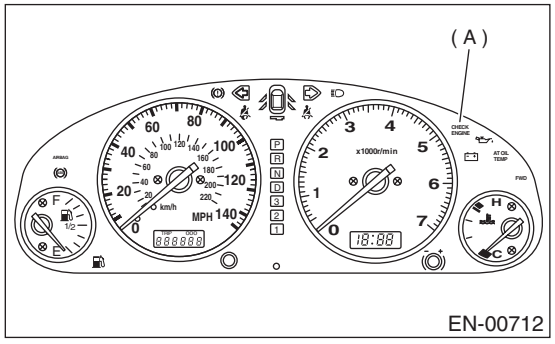
A: PROCEDURE

1. Activation of check engine malfunction indicator lamp (MIL). <Ref. to EN(H4SO)-54, 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)-56, 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)-58, 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)-60, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT BLINK 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)-62, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 HZ., Engine Malfunction Indicator Lamp (MIL).>

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

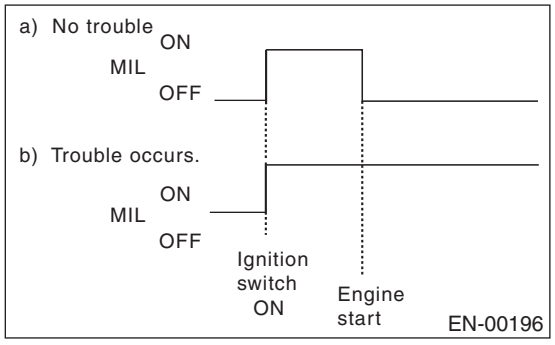
1) When ignition switch is turned to ON (engine off), the CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter illuminates.

NOTE:
If the MIL does not illuminate, perform diagnostics of the CHECK ENGINE light circuit or the combination meter circuit. <Ref. to EN(H4SO)-56, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON., Engine Malfunction Indicator Lamp (MIL).>

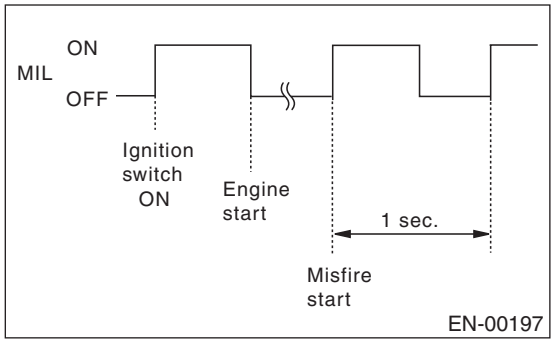


(A) Malfunction indicator lamp (MIL)

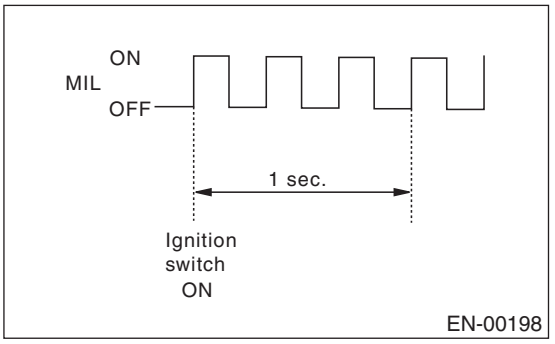
2) After starting the engine, the MIL goes out. If it does not, either the engine or the emission control system is malfunctioning.



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



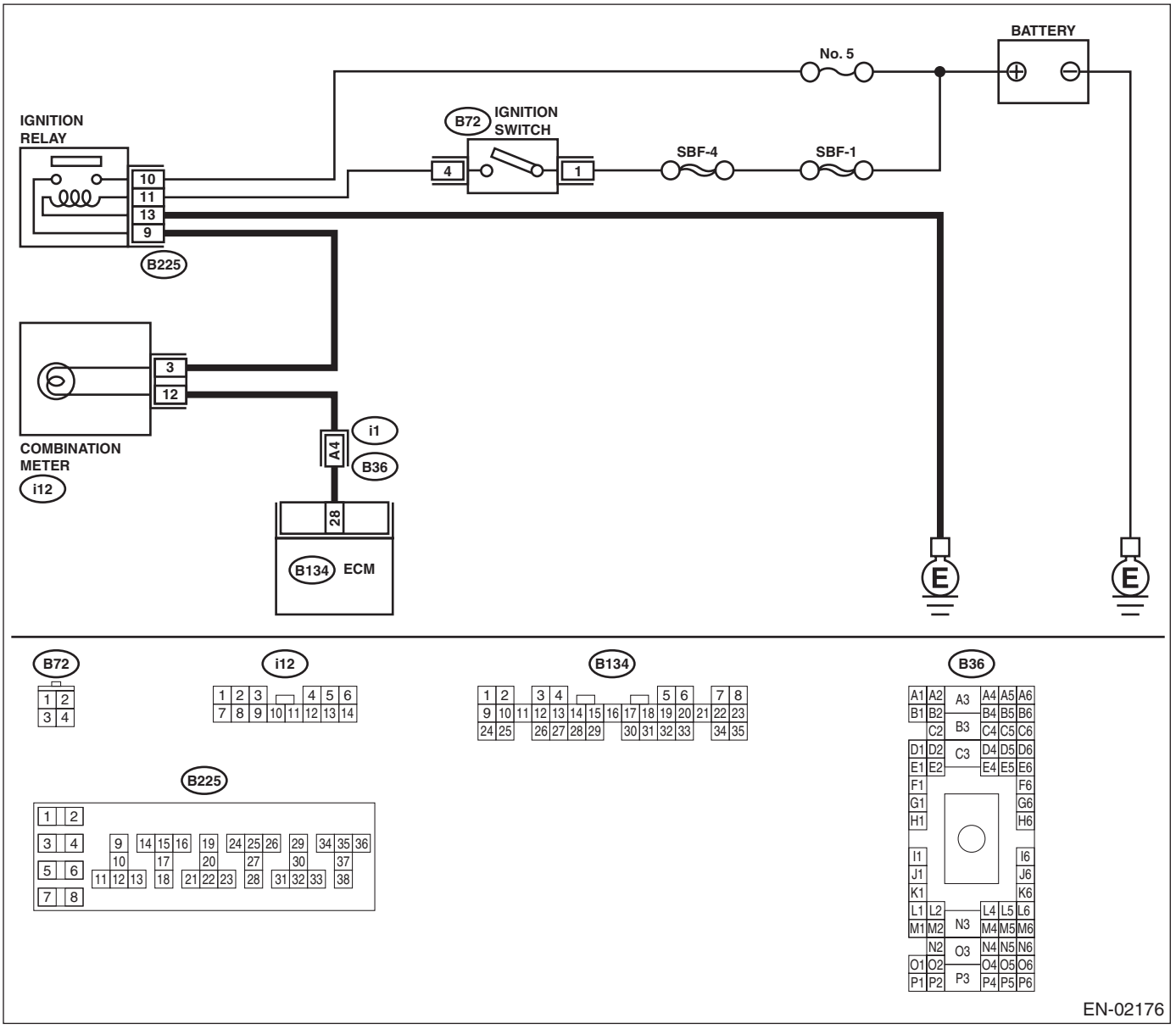
4) When ignition switch is turned to ON (engine off) or to “START” with the test mode connector connected, the MIL blinks at a cycle of 3 Hz.



MEMO:

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 ignition switch is turned ON (engine OFF), MIL does not come on.
- **WIRING DIAGRAM:**



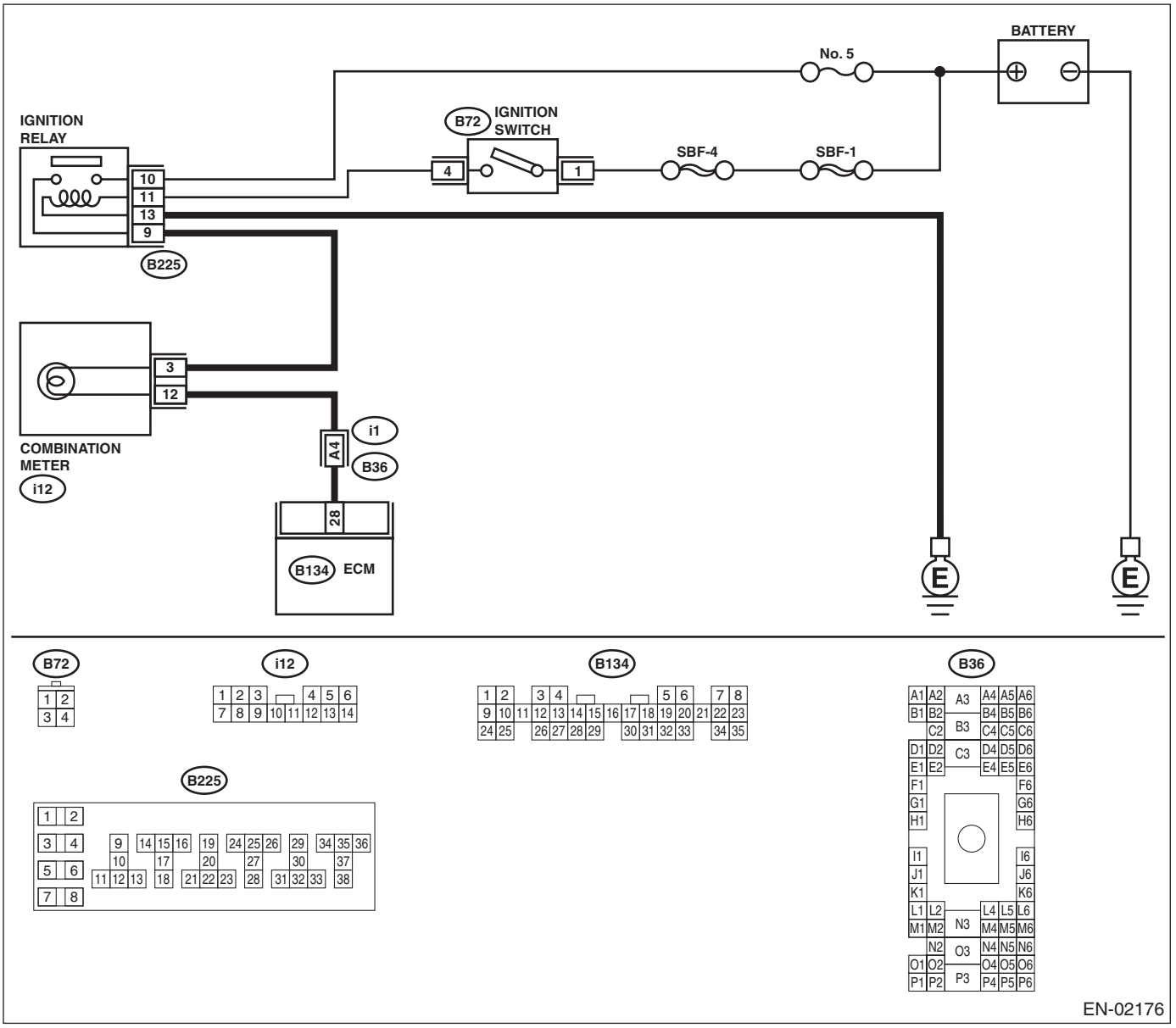
EN-02176

	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 28 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **4.**	Go to step **2.**
2	**CHECK POOR CONTACT.**	Does the MIL come on when shaking or pulling ECM connector and harness?	Repair poor contact in ECM connector.	Go to step **3.**

	Step	Check	Yes	No
3	**CHECK ECM CONNECTOR.**	Is ECM connector correctly connected?	Replace ECM. <Ref. to FU(H4SO)-45, 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 combination meter. <Ref. to IDI-13, Combination Meter Assembly.> 3) Disconnect connector from ECM and combination meter. 4) Measure resistance of harness between ECM and combination meter connector. ***Connector & terminal*** ***(B134) No. 28 — (i12) No. 12:***	Is the measured value less than 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 POOR CONTACT.** Check poor contact in combination meter connector.	Is there poor contact in combination meter connector?	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 voltage between combination meter connector and chassis ground. ***Connector & terminal*** ***(i12) No. 3 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **7.**	Check the following and repair if necessary. NOTE: • Broken down ignition relay. • Blown out fuse (No. 5). • If replaced fuse (No. 5) blows easily, check the harness for short circuit of harness between fuse (No. 5) and ignition relay connector. • Open or short circuit in harness between fuse (No. 5) and battery terminal • Open circuit in harness between fuse (No. 5) and ignition relay connector • Poor contact in ignition relay connector • Poor contact in ignition switch connector
7	**CHECK LAMP BULB.** Remove engine malfunction indicator lamp bulb.	Is lamp bulb condition OK?	Repair combination meter connector.	Replace lamp bulb.

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 engine runs, trouble code is not shown on Subaru select monitor or general scan tool display.
- **WIRING DIAGRAM:**

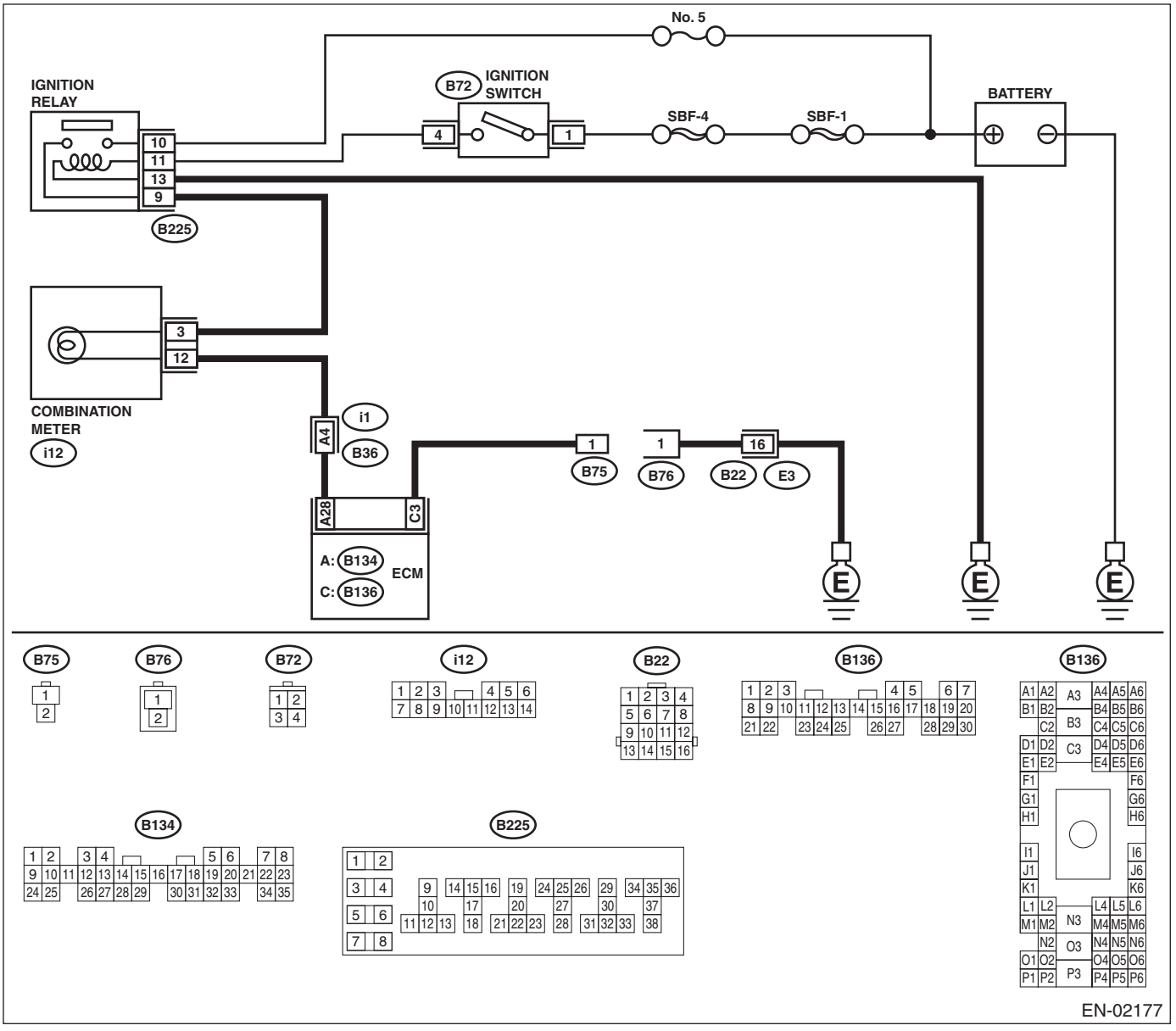


Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Turn ignition switch to ON.	Does the MIL come on?	Repair short circuit in harness between combination meter and ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

MEMO:

E: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT BLINK AT A CYCLE OF 3 HZ.

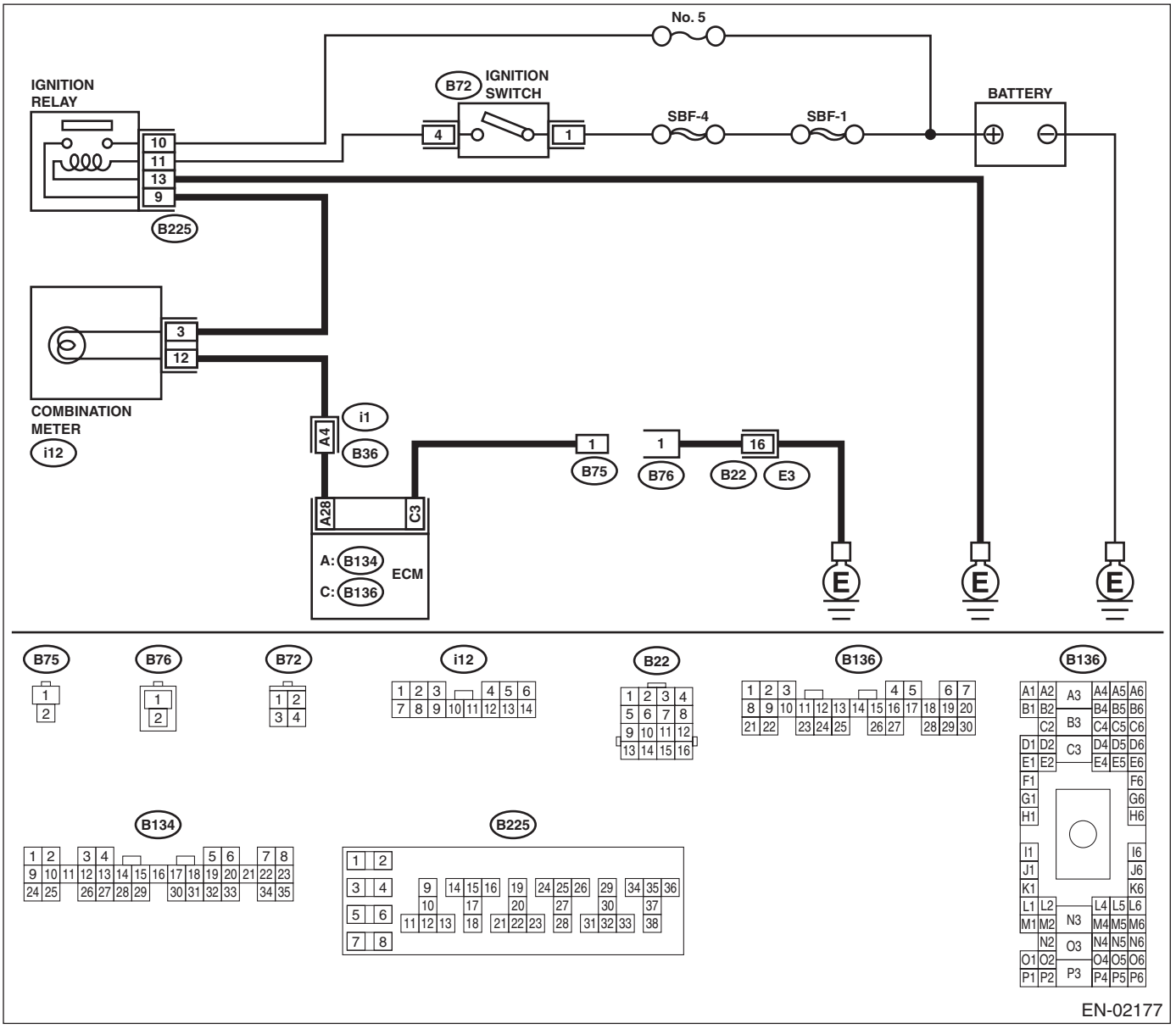
- **DIAGNOSIS:**
  - The CHECK ENGINE malfunction indicator lamp (MIL) circuit is open or shorted.
  - Test mode connector circuit is in open.
- **TROUBLE SYMPTOM:**
  - When inspection mode, MIL does not blink at a cycle of 3 Hz.
- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).** 1) Turn ignition switch to OFF. 2) Disconnect test mode connector. 3) Turn ignition switch to ON. (engine OFF)	Does the MIL come on?	Go to step **2.**	Repair the MIL circuit. <Ref. to EN(H4SO)-56, 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 connector from ECM. 3) Turn ignition switch to ON.	Does the MIL come on?	Repair ground 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 connector from ECM. 3) Measure resistance of harness between test mode connector and chassis ground. ***Connector & terminal*** ***(B76) No. 1 — Chassis ground:***	Is the measured value less than 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 POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Go to step **5.**
5	**CHECK HARNESS BETWEEN ECM AND TEST MODE CONNECTOR.** 1) Connect test mode connector. 2) Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 3 — Chassis ground:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair open circuit in harness between ECM and test mode connector.
6	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

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

- **DIAGNOSIS:**
  - Test mode connector circuit is shorted.
- **TROUBLE SYMPTOM:**
  - MIL blinks at a cycle of 3 Hz when ignition switch is turned to ON.
- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK TEST MODE CONNECTOR.** 1) Disconnect test mode connector. 2) Turn ignition switch to ON.	Does MIL flash on and off?	Go to step **2.**	System is in good order. NOTE: MIL blinks at a cycle of 3 Hz when test mode connector is connected.

Step		Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM CONNECTOR AND ENGINE GROUNDING TERMINAL.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 3 — Chassis ground:***	Is the measured value more than 1 MΩ?	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Repair short circuit in harness between ECM and test mode connector.

17.Diagnostics for Engine Starting Failure

A: Procedure

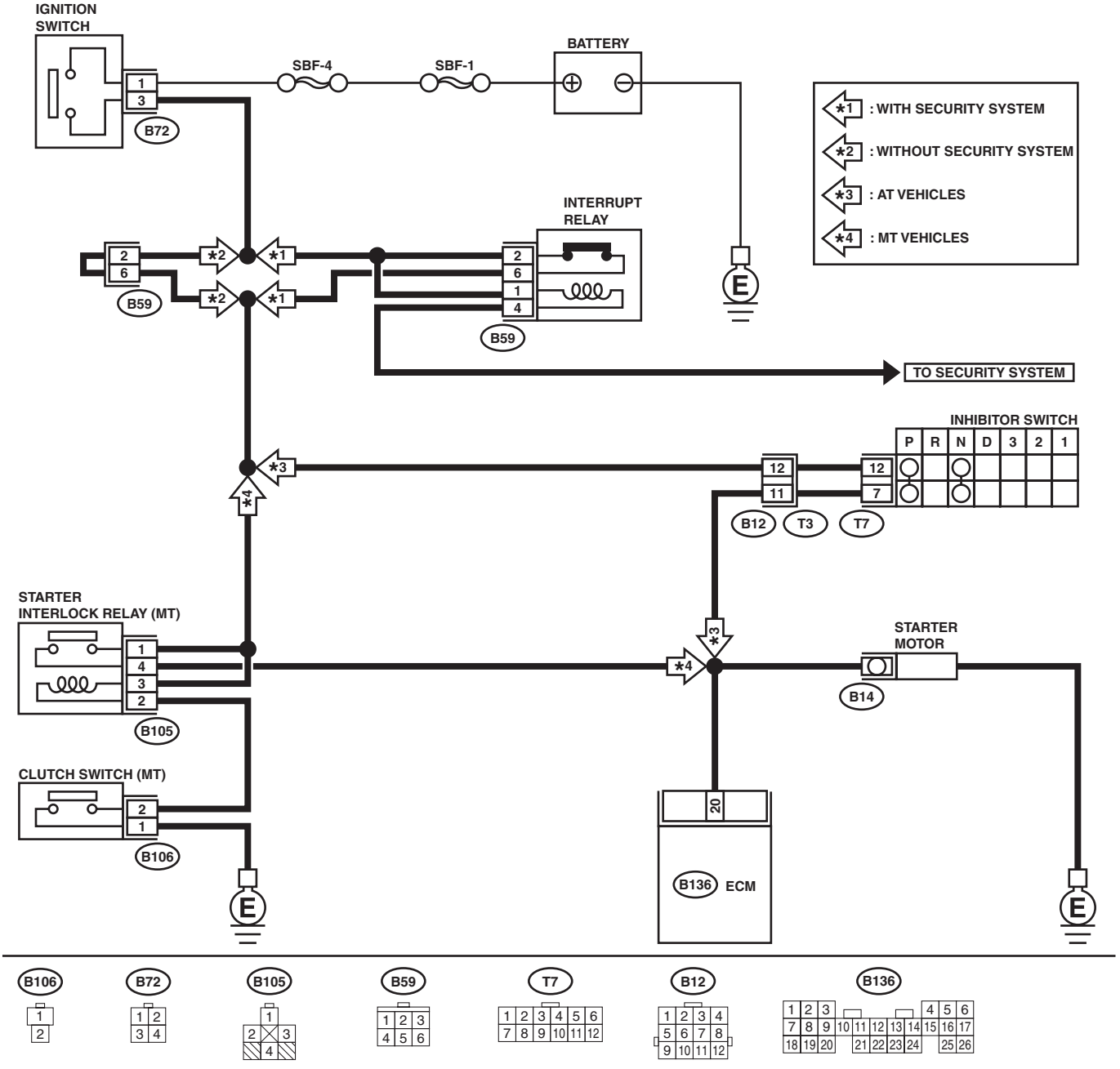
1. Inspection of starter motor circuit. <Ref. to EN(H4SO)-66, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
2. Inspection of ECM power supply and ground line. <Ref. to EN(H4SO)-70, CONTROL MODULE POWER SUPPLY AND GROUND LINE, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ignition control system. <Ref. to EN(H4SO)-74, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
4. Inspection of fuel pump circuit. <Ref. to EN(H4SO)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel injector circuit. <Ref. to EN(H4SO)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

MEMO:

B: STARTER MOTOR CIRCUIT

CAUTION:
After repair or replacement of malfunctioning parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)-50, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-42, Inspection Mode.> .

- **WIRING DIAGRAM:**



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	Step	Check	Yes	No
1	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operates, when turning the ignition switch START?	Go to step **2.**	Go to step **3.**
2	**CHECK DTC.**	Is DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Repair poor contact in ECM connector.
3	**CHECK INPUT SIGNAL FOR STARTER MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn the 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 (−):*** NOTE: •On AT vehicles, place the selector lever in the "P" or "N" position. •On MT vehicles, depress the clutch pedal.	Is the measured value more than 10 V?	Go to step **4.**	Go to step **5.**
4	**CHECK GROUND CIRCUIT OF STARTER MOTOR.** 1) Turn the 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 5 Ω?	Check the starter motor. <Ref. to SC(H4SO)-7, Starter.>	Repair open circuit of ground cable.
5	**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 10 V?	Go to step **6.**	Repair open circuit in harness between ignition switch and battery, and check fuse SBF No. 4 and SBF No. 1.
6	**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. ***Terminals*** ***No. 1 — No. 3:***	Is the measured value less than 5 Ω?	Go to step **7.**	Replace the ignition switch.
7	**CHECK TRANSMISSION TYPE.**	Is the target AT vehicle?	Go to step **8.**	Go to step **10.**

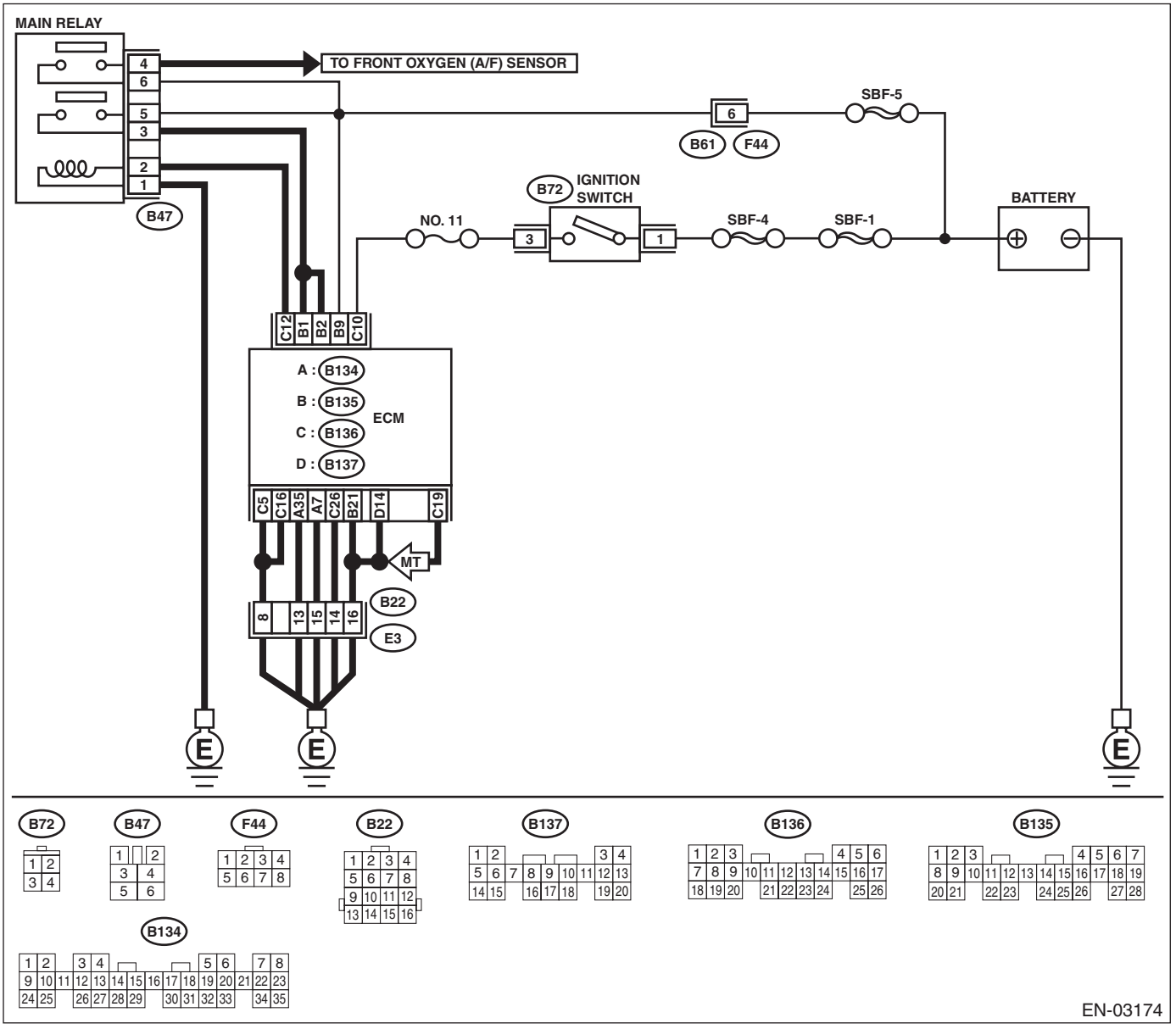
	Step	Check	Yes	No
8	**CHECK INPUT VOLTAGE OF INHIBITOR SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Connect the connector to ignition switch. 4) Measure the input voltage between inhibitor switch connector terminal and engine ground while turning ignition switch to ST. ***Connector & terminal*** ***(B12) No. 12 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Go to step **9.**	Repair open or ground short circuit in harness between inhibitor switch and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-24, INSPECTION, Security System.>
9	**CHECK INHIBITOR SWITCH.** 1) Place the selector lever in the “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 1 Ω?	Repair open or ground short circuit in harness between inhibitor switch and starter motor.	Replace the inhibitor switch. <Ref. to 4AT-51, REMOVAL, Inhibitor Switch.>
10	**CHECK INPUT VOLTAGE OF STARTER INTERLOCK RELAY.** 1) Turn the 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*** ***(B105) No. 1 (+) — Chassis ground (–):*** ***(B105) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **11.**	Repair open or ground short circuit in harness between starter interlock relay and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-24, INSPECTION, Security System.>
11	**CHECK STARTER INTERLOCK RELAY.** 1) Connect the battery to starter interlock relay terminals No. 3 and No. 2. 2) Measure the resistance between starter interlock relay terminals. ***Terminals*** ***No. 4 — No. 1:***	Is the measured value less than 1 Ω?	Go to step **12.**	Replace the starter interlock relay.
12	**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 1 Ω?	Go to step **13.**	Repair open circuit of ground cable.
13	**CHECK CLUTCH SWITCH.** 1) Measure the resistance between clutch switch terminal while depressing the clutch pedal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Go to step **14.**	Replace the clutch switch. <Ref. to CL-31, REMOVAL, Clutch Switch.>

Step		Check	Yes	No
14	**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*** ***(B105) No. 2 — Chassis ground:***	Is the measured value less than 1 Ω?	Repair ground short circuit in harness between starter interlock relay and starter motor.	Repair open circuit in harness between starter interlock relay and clutch switch.

C: CONTROL MODULE POWER SUPPLY AND GROUND LINE

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode. <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.>

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK MAIN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove main relay. 3) Connect battery to main relay terminals No. 1 and No. 2. 4) Measure resistance between main relay terminals. ***Terminals*** ***No. 3 — No. 5:*** ***No. 4 — No. 6:***	Is the measured value less than 10 Ω?	Go to step **2.**	Replace main relay.
2	**CHECK GROUND CIRCUIT OF ECM.** 1) Disconnect connector from ECM. 2) Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 — Chassis ground:*** ***(B134) No. 35 — Chassis ground:*** ***(B135) No. 21 — Chassis ground:*** ***(B136) No. 5 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:*** ***(B136) No. 26— Chassis ground:*** ***(B137) No. 14 — Chassis ground:*** ***(B136) No. 19 — Chassis ground (MT):***	Is the measured value less than 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 voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 9 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **4.**	Repair ground short circuit of power supply circuit.
4	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 10 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **5.**	Repair open or ground short circuit of power supply circuit.
5	**CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 12 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit in harness between ECM connector and main relay connector.
6	**CHECK OUTPUT VOLTAGE FROM ECM.** 1) Connect connector to ECM. 2) Turn ignition switch to ON. 3) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 12 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **7.**	Replace ECM.
7	**CHECK INPUT VOLTAGE OF MAIN RELAY.** Check voltage between main relay connector and chassis ground. ***Connector & terminal*** ***(B47) No. 2 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **8.**	Repair open circuit in harness between ECM connector and main relay connector.

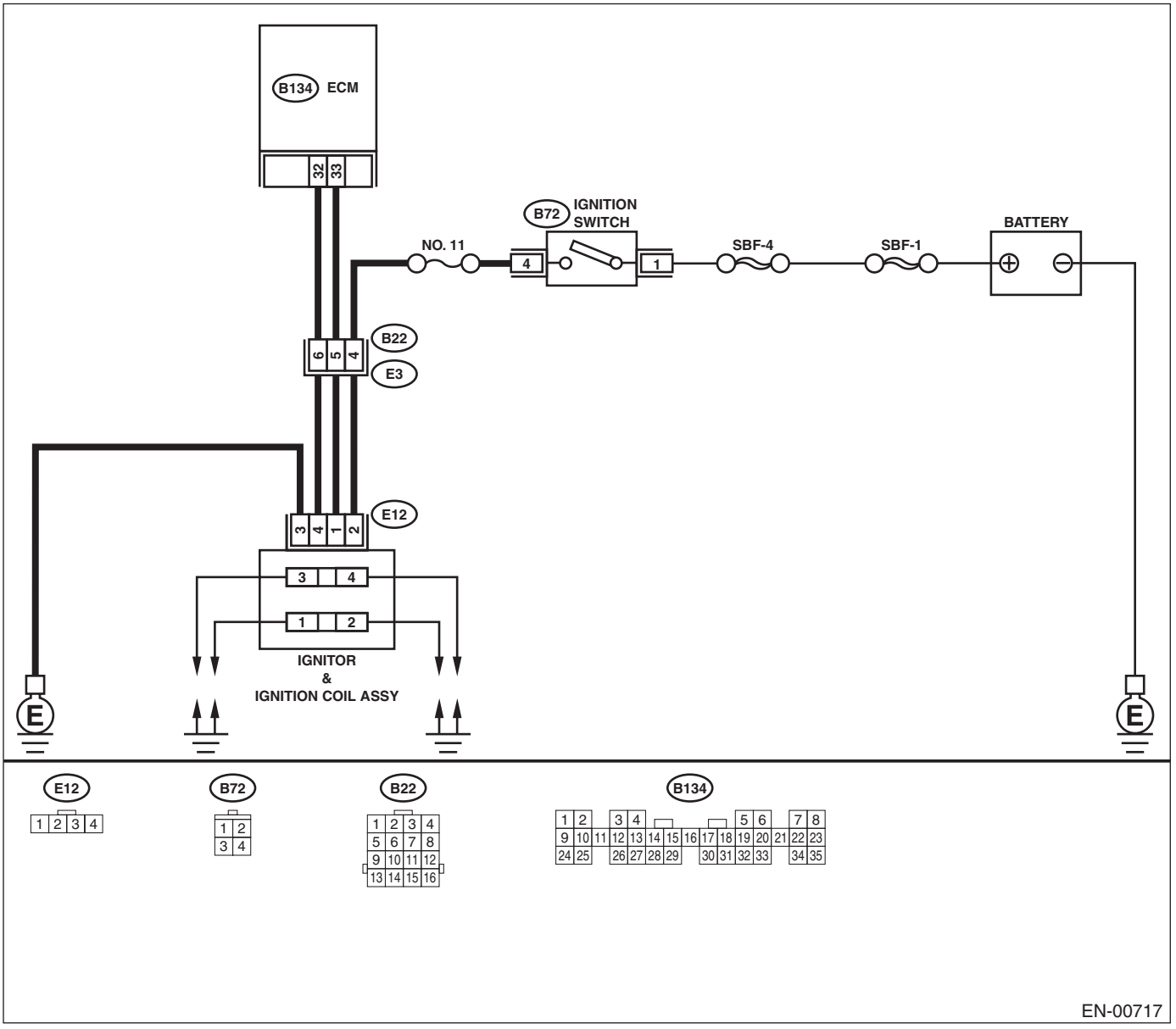
	Step	Check	Yes	No
8	**CHECK GROUND CIRCUIT OF MAIN RELAY.** 1) Turn ignition switch to OFF. 2) Measure resistance between main relay connector and chassis ground. ***Connector & terminal*** ***(B47) No. 1 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **9.**	Repair open circuit between main relay and chassis ground.
9	**CHECK INPUT VOLTAGE OF MAIN RELAY.** Measure 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 10 V?	Go to step **10.**	Repair open or ground short circuit in harness of power supply circuit.
10	**CHECK INPUT VOLTAGE OF ECM.** 1) Connect main relay connector. 2) Turn ignition switch to ON. 3) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 1 (+) — Chassis ground (–):*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Check ignition control system. <Ref. to EN(H4SO)-74, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair open or ground short circuit in harness between ECM connector and main relay connector.

MEMO:

D: IGNITION CONTROL SYSTEM

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4SO)-5, INSPECTION, Spark Plug.>	Is the spark plug's status OK?	Go to step **2.**	Replace the spark plug.

	Step	Check	Yes	No
2	**CHECK IGNITION SYSTEM FOR SPARKS.** 1) Remove plug cord cap from each spark plug. 2) Install new spark plug on plug cord cap. **CAUTION:** **Do not remove spark plug from engine.** 3) Contact spark plug's thread portion on engine. 4) While opening throttle valve fully, crank engine to check that spark occurs at each cylinder.	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4SO)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **3.**
3	**CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSEMBLY.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ignition coil & ignitor assembly. 3) Turn ignition switch to ON. 4) Measure 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 10 V?	Go to step **4.**	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 connectors
4	**CHECK HARNESS OF IGNITION COIL & IGNITOR ASSEMBLY GROUND CIRCUIT.** 1) Turn ignition switch to OFF. 2) Measure resistance between ignition coil & ignitor assembly connector and engine ground. ***Connector & terminal*** ***(E12) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	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
5	**CHECK IGNITION COIL & IGNITOR ASSEMBLY.** 1) Remove spark plug cords. 2) Measure resistance between spark plug cord contact portions to check secondary coil. ***Terminals*** ***No. 1 — No. 2:*** ***No. 3 — No. 4:***	Is the measured value within 10 to 15 kΩ?	Go to step **6.**	Replace ignition coil & ignitor assembly. <Ref. to IG(H4SO)-7, Ignition Coil and Ignitor Assembly.>
6	**CHECK INPUT SIGNAL FOR IGNITION COIL & IGNITOR ASSEMBLY.** 1) Connect 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 10 V?	Go to step **7.**	Replace ignition coil & ignitor assembly. <Ref. to IG(H4SO)-7, Ignition Coil and Ignitor Assembly.>

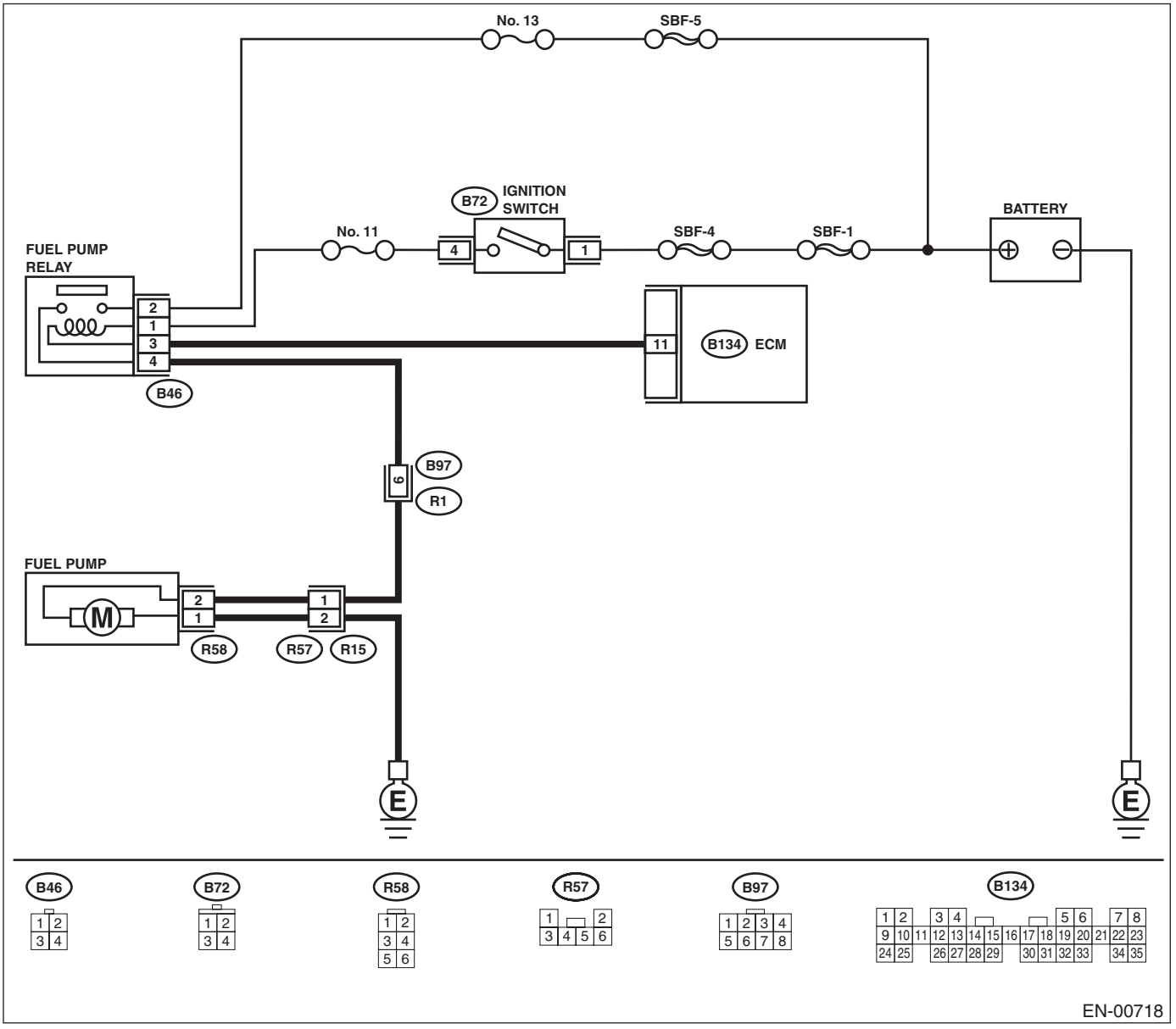
	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Disconnect connector from ignition coil & ignitor assembly. 4) Measure resistance of harness between ECM and ignition coil & ignitor assembly connector. ***Connector & terminal*** ***(B134) No. 33 — (E12) No. 1:*** ***(B134) No. 32 — (E12) No. 4:***	Is the measured value less than 1 Ω?	Go to step **8.**	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
8	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.** Measure resistance of harness between ECM and engine ground. ***Connector & terminal:*** ***(B134) No. 32 — Engine ground:*** ***(B134) No. 33 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair ground short circuit in harness between ECM and ignition coil & ignitor assembly connector.
9	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check fuel pump circuit. <Ref. to EN(H4SO)-78, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>

MEMO:

E: FUEL PUMP CIRCUIT

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



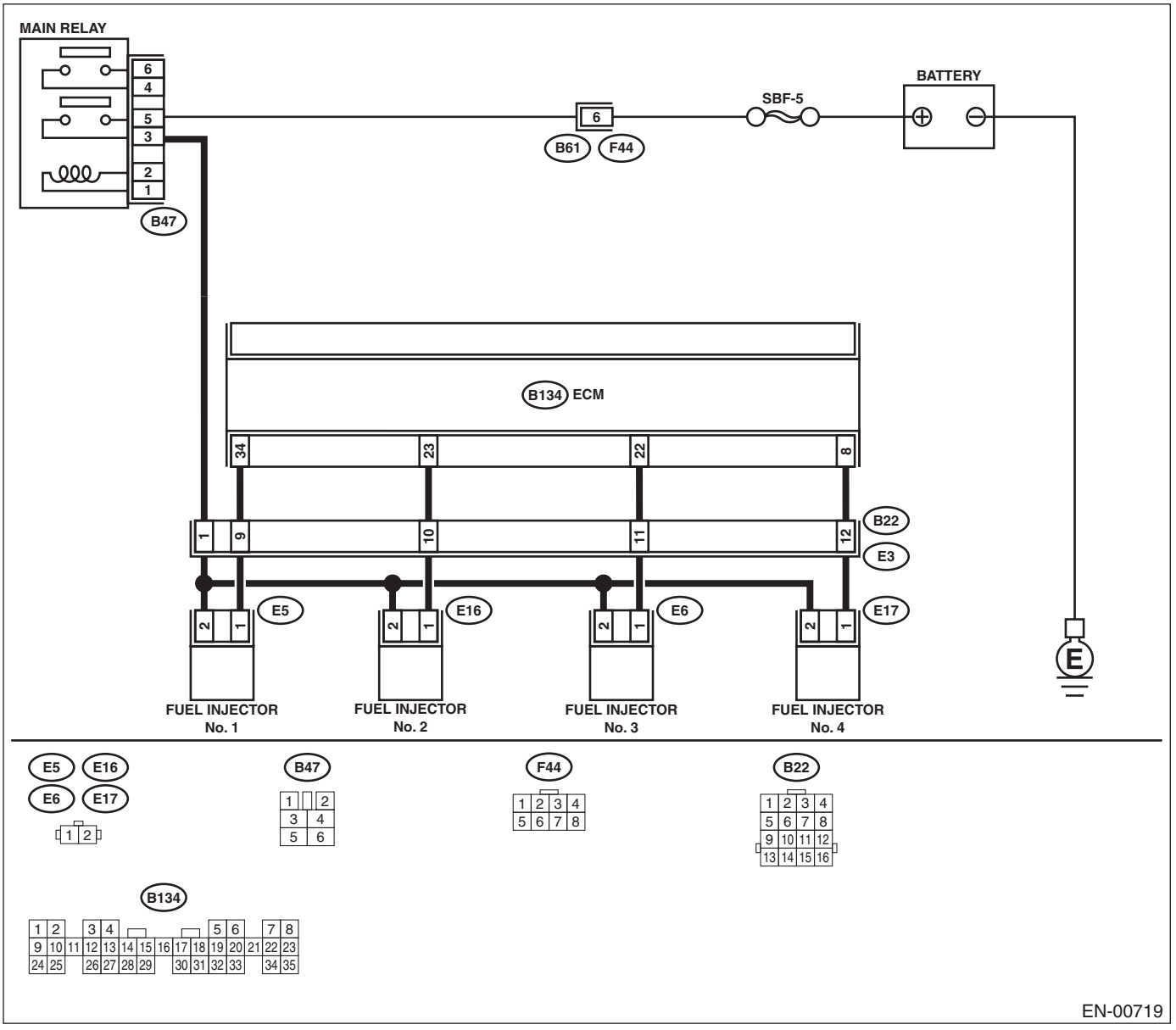
	Step	Check	Yes	No
1	**CHECK OPERATING SOUND OF FUEL PUMP.** Make sure that fuel pump is in operation for two seconds when turning ignition switch to ON. NOTE: Fuel pump operation can also be executed using Subaru Select Monitor (Function mode: FD01). For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.>	Does fuel pump produce operating sound?	Check fuel injector circuit. <Ref. to EN(H4SO)-82, 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 fuel pump access hole lid located on the right rear of trunk compartment floor (Sedan) or luggage compartment floor (Wagon). 3) Disconnect connector from fuel pump. 4) Measure resistance of harness connector between fuel pump and chassis ground. ***Connector & terminal*** ***(R58) No. 1 — Chassis ground:***	Is the measured value less than 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 voltage of power supply circuit between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 2 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Replace fuel pump. <Ref. to FU(H4SO)-66, 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 resistance of harness connector between fuel pump and fuel pump relay. ***Connector & terminal*** ***(R58) No. 2 — (B46) No. 4:***	Is the measured value less than 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 connectors
5	**CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.** Measure resistance of harness between fuel pump and fuel pump relay connector. ***Connector & terminal*** ***(R58) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair short circuit in harness between fuel pump and fuel pump relay connector.

	Step	Check	Yes	No
6	**CHECK FUEL PUMP RELAY.** 1) Disconnect connectors from fuel pump relay and main relay. 2) Remove fuel pump relay and main relay with bracket. 3) Connect battery to fuel pump relay connector terminals No. 1 and No. 3. 4) Measure resistance between connector terminals of fuel pump relay. ***Terminals*** ***No. 2 — No. 4:***	Is the measured value less than 10 Ω?	Go to step **7.**	Replace fuel pump relay. <Ref. to FU(H4SO)-47, Fuel Pump Relay.>
7	**CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.** 1) Disconnect connectors from ECM. 2) Measure resistance of harness between ECM and fuel pump relay connector. ***Connector & terminal*** ***(B134) No. 11 — (B46) No. 3:***	Is the measured value less than 1 Ω?	Go to step **8.**	Repair open circuit in harness between ECM and fuel pump relay connector.
8	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check fuel injector circuit. <Ref. to EN(H4SO)-82, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

MEMO:

F: FUEL INJECTOR CIRCUIT

CAUTION:
- **Check or repair only malfunctioning parts.**
- **After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode. <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.>**
- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK OPERATION OF EACH FUEL INJECTOR.** While cranking the engine, check that each fuel injector emits “operating” sound. Use a sound scope or attach a screwdriver to injector for this check.	Does the fuel injector produce “operating” sound?	Check fuel pressure. <Ref. to ME(H4SO)-26, INSPECTION, Fuel Pressure.>	Go to step **2.**

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY TO EACH FUEL INJECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel injector. 3) Turn ignition switch to ON. 4) Measure 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 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 connector from ECM and fuel injector. 2) Measure resistance of harness between ECM and fuel injector connector. ***Connector & terminal*** ***(B134) No. 34 — (E5) No. 1:*** ***(B134) No. 23 — (E16) No. 1:*** ***(B134) No. 22 — (E6) No. 1:*** ***(B134) No. 8 — (E17) No. 1:***	Is the measured value less than 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 resistance of harness between ECM and fuel injector connector. ***Connector & terminal*** ***(B134) No. 34 — Chassis ground:*** ***(B134) No. 23 — Chassis ground:*** ***(B134) No. 22 — Chassis ground:*** ***(B134) No. 8 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair ground short circuit in harness between ECM and fuel injector connector.
5	**CHECK EACH FUEL INJECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between each fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 5 to 20 Ω?	Go to step **6.**	Replace faulty fuel injector.
6	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Inspection using “General Diagnostic Table”. <Ref. to EN(H4SO)-371, INSPECTION, General Diagnostic Table.>

18.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC No.	Item	Index
P0030	HO2S Heater control circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-92, DTC P0030 — HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater control circuit low (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-94, DTC P0031 — HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater control circuit high (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-98, DTC P0032 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater control circuit low (Bank 1 Sensor 2)	<Ref. to EN(H4SO)-100, DTC P0037 — HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater control circuit high (Bank 1 Sensor 2)	<Ref. to EN(H4SO)-104, DTC P0038 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0065	Air assisted injector control range/performance	<Ref. to EN(H4SO)-106, DTC P0065 — AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0066	Air assisted injector control circuit or circuit low	<Ref. to EN(H4SO)-108, DTC P0066 — AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0067	Air assisted injector control circuit high	<Ref. to EN(H4SO)-110, DTC P0067 — AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	Manifold absolute pressure/barometric pressure circuit range/performance	<Ref. to EN(H4SO)-112, DTC P0068 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold absolute pressure/barometric pressure circuit low input	<Ref. to EN(H4SO)-114, 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)-118, DTC P0108 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake air temperature circuit range/performance	<Ref. to EN(H4SO)-122, DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake air temperature circuit low input	<Ref. to EN(H4SO)-124, 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)-126, 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)-130, 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)-132, DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P0121	Throttle/pedal position sensor/switch “A” circuit range/performance	<Ref. to EN(H4SO)-136, DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/pedal position sensor/switch “A” circuit low input	<Ref. to EN(H4SO)-138, 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)-142, 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)-144, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION	<Ref. to EN(H4SO)-146, DTC P0126 — SUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	<Ref. to EN(H4SO)-149, DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0130	O2 sensor circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-150, DTC P0130 — O2 SENSOR CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 sensor circuit low voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-154, DTC P0131 — O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 sensor circuit high voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-156, DTC P0132 — O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O2 sensor circuit slow response (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-158, DTC P0133 — O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 sensor circuit no activity detected (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-160, DTC P0134 — O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 sensor circuit low voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)-162, DTC P0137 — O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 sensor circuit high voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)-164, DTC P0138 — O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O2 sensor circuit slow response (Bank 1 Sensor 2)	<Ref. to EN(H4SO)-168, DTC P0139 — O2 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)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System too rich (Bank 1)	<Ref. to EN(H4SO)-170, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel temperature sensor “A” circuit range/performance	<Ref. to EN(H4SO)-174, DTC P0181 — FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel temperature sensor “A” circuit low input	<Ref. to EN(H4SO)-176, DTC P0182 — FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P0183	Fuel temperature Sensor “A” circuit high input	<Ref. to EN(H4SO)-178, 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)-181, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 misfire detected	<Ref. to EN(H4SO)-181, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 misfire detected	<Ref. to EN(H4SO)-181, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 misfire detected	<Ref. to EN(H4SO)-182, 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)-190, 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)-192, 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)-194, DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft position sensor “A” circuit range/performance	<Ref. to EN(H4SO)-196, DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft position sensor “A” circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)-198, DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft position sensor “A” circuit range/performance (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)-200, DTC P0341 — CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0400	Exhaust gas recirculation flow	<Ref. to EN(H4SO)-204, DTC P0400 — EXHAUST GAS RECIRCULATION FLOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst system efficiency below threshold (Bank 1)	<Ref. to EN(H4SO)-208, DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0442	Evaporative emission control system leak detected (small leak)	<Ref. to EN(H4SO)-212, 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)-217, 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)-221, 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	<Ref. to EN(H4SO)-224, DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P0452	Evaporative emission control system pressure sensor low input	<Ref. to EN(H4SO)-226, 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)-230, 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)-233, 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)-237, 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	<Ref. to EN(H4SO)-242, DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative emission control system purge control valve circuit high	<Ref. to EN(H4SO)-246, DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel level sensor circuit range/performance	<Ref. to EN(H4SO)-248, DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel level sensor circuit low input	<Ref. to EN(H4SO)-250, 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)-254, 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)-258, DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT—, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0483	Cooling fan rationality check	<Ref. to EN(H4SO)-261, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0502	Vehicle speed sensor circuit low input	<Ref. to EN(H4SO)-264, DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0503	Vehicle speed sensor intermittent/erratic/high	<Ref. to EN(H4SO)-264, DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle control system RPM lower than expected	<Ref. to EN(H4SO)-266, 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)-268, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter request circuit	<Ref. to EN(H4SO)-270, DTC P0512 — STARTER REQUEST CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0519	Idle air control circuit system performance	<Ref. to EN(H4SO)-272, DTC P0519 — IDLE AIR CONTROL CIRCUIT SYSTEM PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P0565	Cruise control on signal	<Ref. to EN(H4SO)-274, DTC P0565 — CRUISE CONTROL ON SIGNAL —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal control module random access memory (RAM) error	<Ref. to EN(H4SO)-276, 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)-279, 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)-283, 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)-286, DTC P0703 — TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0705	Transmission range sensor circuit (PRNDL Input)	<Ref. to 4AT-101, CHECK INHIBITOR SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>
P0710	Transmission fluid temperature sensor circuit	<Ref. to 4AT-40, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0716	Input/turbine speed sensor circuit range/performance	<Ref. to 4AT-52, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output speed sensor circuit	<Ref. to 4AT-48, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0726	Engine speed input circuit range/performance	<Ref. to 4AT-38, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	Gear 1 incorrect ratio	<Ref. to EN(H4SO)-288, DTC P0731 — GEAR 1 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0732	Gear 2 incorrect ratio	<Ref. to EN(H4SO)-288, DTC P0732 — GEAR 2 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	Gear 3 incorrect ratio	<Ref. to EN(H4SO)-288, DTC P0733 — GEAR 3 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0734	Gear 4 incorrect ratio	<Ref. to EN(H4SO)-289, 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)-290, DTC P0741 — TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque converter clutch circuit electrical	<Ref. to 4AT-84, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0748	Pressure control solenoid “A” electrical	<Ref. to 4AT-76, DTC 75 LINE PRESSURE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0753	Shift solenoid “A” electrical	<Ref. to 4AT-60, DTC 71 SHIFT SOLENOID 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift solenoid “B” electrical	<Ref. to 4AT-64, DTC 72 SHIFT SOLENOID 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0771	Shift solenoid “E” performance or stuck off	<Ref. to 4AT-68, DTC 73 LOW CLUTCH TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0778	Pressure control solenoid “B” electrical	<Ref. to 4AT-80, DTC 76 2-4 BRAKE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0785	Shift/timing solenoid	<Ref. to 4AT-80, DTC 76 2-4 BRAKE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P0851	Neutral switch input circuit low	<Ref. to EN(H4SO)-292, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> and <Ref. to EN(H4SO)-294, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral switch input circuit high	<Ref. to EN(H4SO)-296, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> and<Ref. to EN(H4SO)-300, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0864	TCM communication circuit range/performance	<Ref. to EN(H4SO)-304, DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0865	TCM communication circuit low	<Ref. to EN(H4SO)-306, DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0866	TCM communication circuit high	<Ref. to EN(H4SO)-308, DTC P0866 — TCM COMMUNICATION CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1134	A/F sensor micro-computer problem	<Ref. to EN(H4SO)-310, DTC P1134 — A/F SENSOR MICRO-COMPUTER PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1137	O2 sensor circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)-312, DTC P1137 — O2 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)-316, 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)-320, DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent control solenoid valve function problem	<Ref. to EN(H4SO)-322, 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)-324, 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)-328, DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1448	Fuel tank sensor control valve range/performance	<Ref. to EN(H4SO)-330, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1492	EGR solenoid valve signal #1 circuit malfunction (low input)	<Ref. to EN(H4SO)-332, DTC P1492 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1493	EGR solenoid valve signal #1 circuit malfunction (high input)	<Ref. to EN(H4SO)-332, DTC P1493 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1494	EGR solenoid valve signal #2 circuit malfunction (low input)	<Ref. to EN(H4SO)-332, DTC P1494 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P1495	EGR solenoid valve signal #2 circuit malfunction (high input)	<Ref. to EN(H4SO)-332, DTC P1495 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1496	EGR solenoid valve signal #3 circuit malfunction (low input)	<Ref. to EN(H4SO)-332, DTC P1496 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)— , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1497	EGR solenoid valve signal #3 circuit malfunction (high input)	<Ref. to EN(H4SO)-332, DTC P1497 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1498	EGR solenoid valve signal #4 circuit malfunction (low input)	<Ref. to EN(H4SO)-334, DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1499	EGR solenoid valve signal #4 circuit malfunction (high input)	<Ref. to EN(H4SO)-336, DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1510	ISC solenoid valve signal #1 circuit malfunction (low input)	<Ref. to EN(H4SO)-264, DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1511	ISC solenoid valve signal #1 circuit malfunction (high input)	<Ref. to EN(H4SO)-338, 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 malfunction (low input)	<Ref. to EN(H4SO)-338, 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 malfunction (high input)	<Ref. to EN(H4SO)-338, 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 malfunction (low input)	<Ref. to EN(H4SO)-338, 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 malfunction (high input)	<Ref. to EN(H4SO)-338, 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 malfunction (low input)	<Ref. to EN(H4SO)-340, 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 malfunction (high input)	<Ref. to EN(H4SO)-342, 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)-345, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up voltage circuit malfunction	<Ref. to EN(H4SO)-348, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC No.	Item	Index
P1698	Engine torque control cut signal circuit malfunction (low input)	<Ref. to EN(H4SO)-350, 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 malfunction (high input)	<Ref. to EN(H4SO)-352, DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1700	Throttle position sensor circuit malfunction for AT	<Ref. to 4AT-44, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1711	Engine torque control signal #1 circuit malfunction	<Ref. to EN(H4SO)-354, 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)-356, DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post catalyst fuel trim system too lean bank 1	<Ref. to EN(H4SO)-358, DTC P2096 — POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post catalyst fuel trim system too rich bank 1	<Ref. to EN(H4SO)-364, DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2227	Atmospheric pressure sensor circuit range/perfomance	<Ref. to EN(H4SO)-369, DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2228	Atmospheric pressure sensor circuit malfunction (low input)	<Ref. to EN(H4SO)-369, DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2229	Atmospheric pressure sensor circuit malfunction (high input)	<Ref. to EN(H4SO)-370, DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

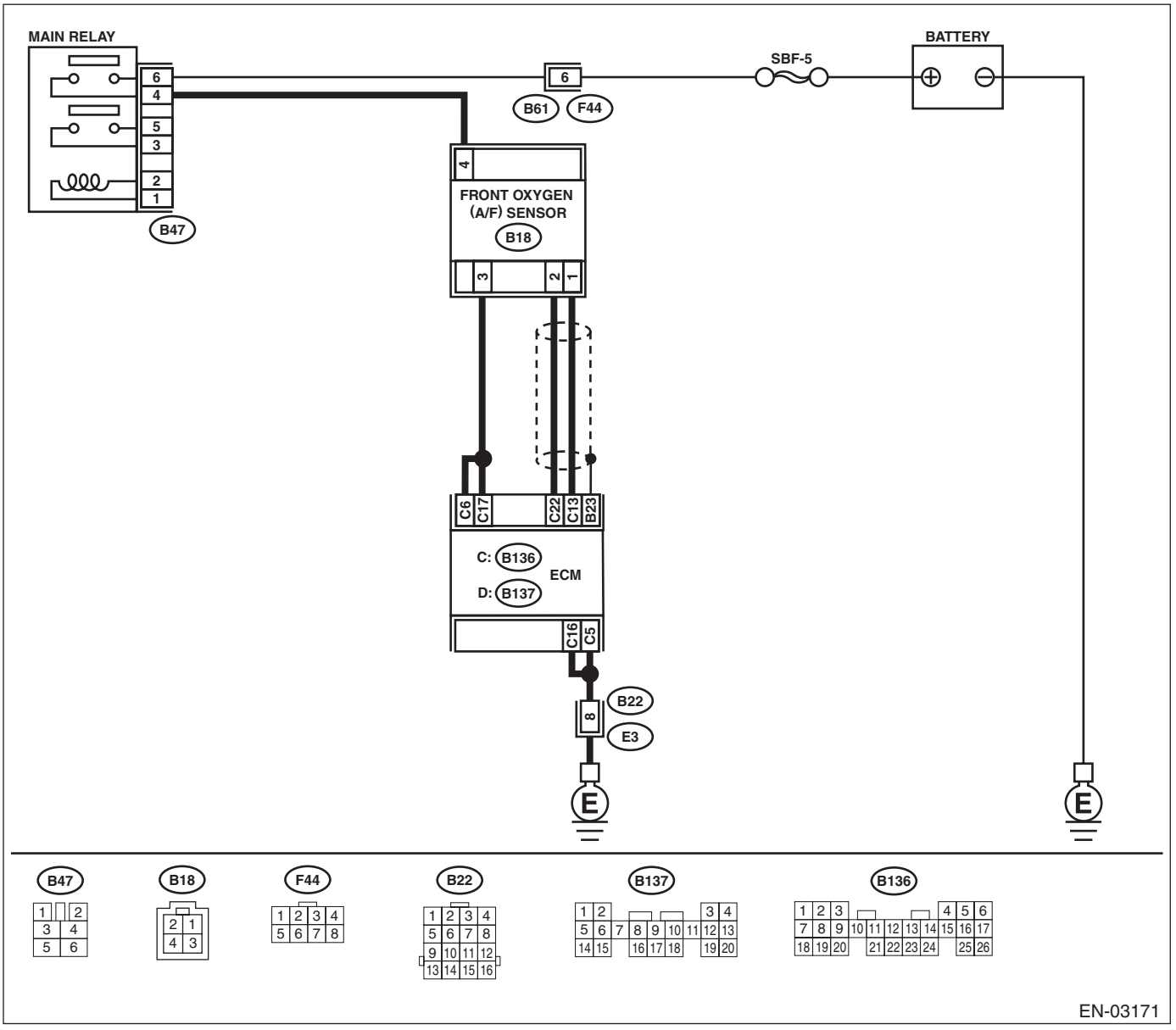
19.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P0030 — HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



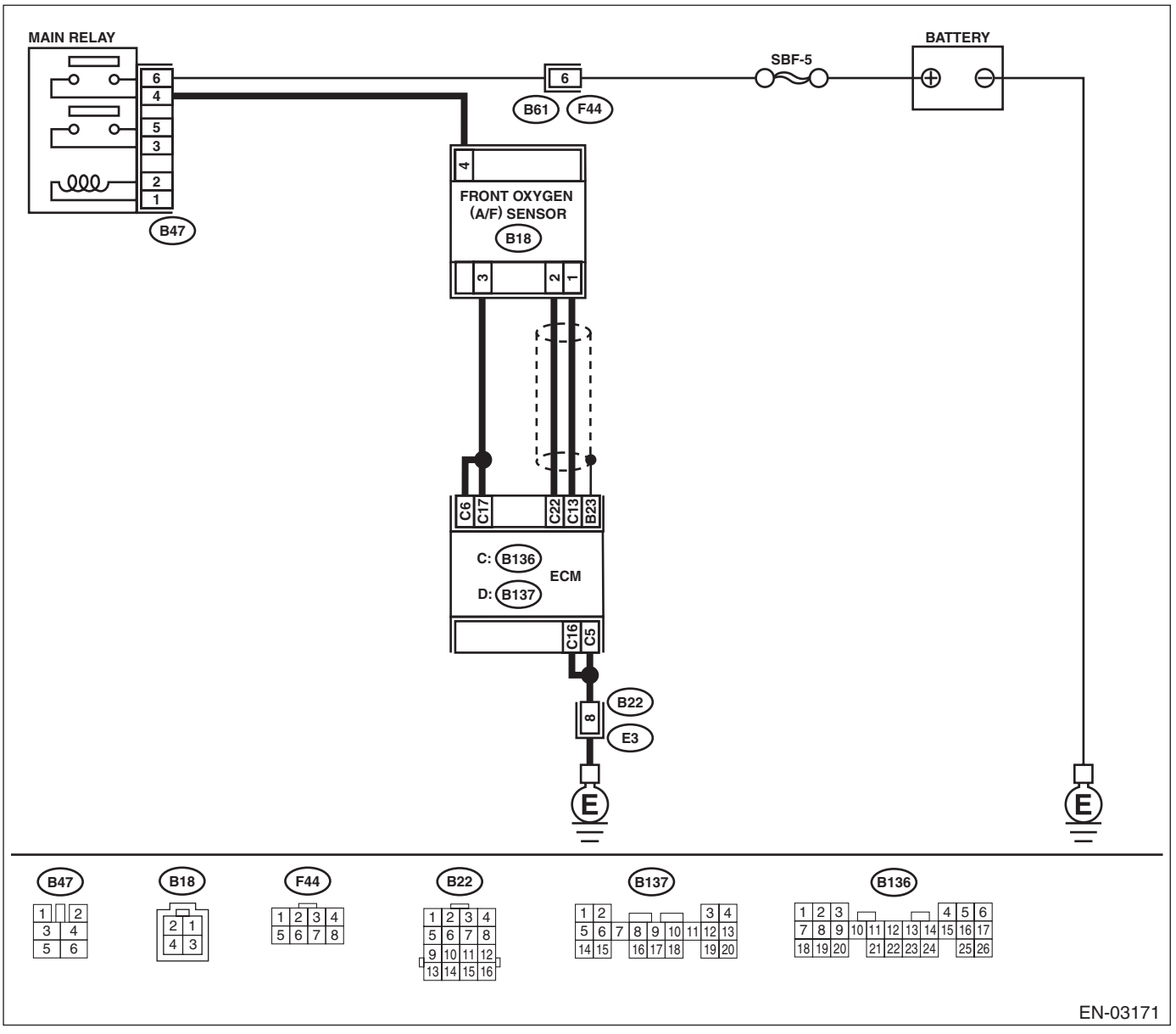
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Start and warm-up engine. 2) Turn ignition switch to OFF. 3) Disconnect connectors from ECM and front oxygen (A/F) sensor. 4) Measure harness resistance between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 6 - (B18) No. 3:*** ***(B136) No. 17 - (B18) No. 3:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair open circuit between ECM and front oxygen (A/F) sensor connector.
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure harness resistance between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 13 - (B18) No. 1:*** ***(B136) No. 22 - (B18) No. 2:***	Is the measured value less than 1 Ω?	Go to step **3.**	Repair open circuit between ECM and front oxygen (A/F) sensor connector.
3	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure harness resistance between main relay and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B47) No. 4 — (B18) No. 4:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair open circuit between ECM and front oxygen (A/F) sensor connector.
4	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure resistance between terminals in front oxygen (A/F) sensor connector. ***Terminal*** ***No.3 - No.4:***	Is the measured value less than 5 Ω?	Go to step **5.**	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>
5	**CHECK POOR CONTACT.** Check ECM and front oxygen (A/F) sensor connector for poor contact.	Is there any poor contact in ECM and front oxygen (A/F) sensor connector.	Repair poor contact in ECM and front oxygen (A/F) sensor connector.	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P1132 and P0141 at the same time?	Go to step **2.**	Go to step **5.**

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from front oxygen (A/F) sensor. 3) Turn ignition switch to ON. 4) Measure voltage between front oxygen (A/F) sensor connector and engine ground. ***Connector & terminal*** ***(B18) No. 4 (+) — Engine ground (–):***	Is the measured value more than 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 front oxygen (A/F) sensor connector • Poor contact in main relay connector
3	**CHECK GROUND CIRCUIT OF ECM.** Measure 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 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 engine 2) Read data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •OBD-II scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 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 **6.**
5	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Start and idle the engine. 2) Measure 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 1.0 V?	Go to step **7.**	Go to step **6.**
6	**CHECK OUTPUT SIGNAL FROM ECM.** Measure 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 1.0 V shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair poor contact in ECM connector.	Go to step **7.**

Step		Check	Yes	No
7	**CHECK FRONT OXYGEN (A/F) SENSOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between front oxygen (A/F) sensor connector terminals. ***Terminals*** ***No. 3— No. 4:***	Is the measured value less than 10 Ω?	Repair harness and connector. NOTE: In this case, repair the following: • Open or ground short circuit 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 front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

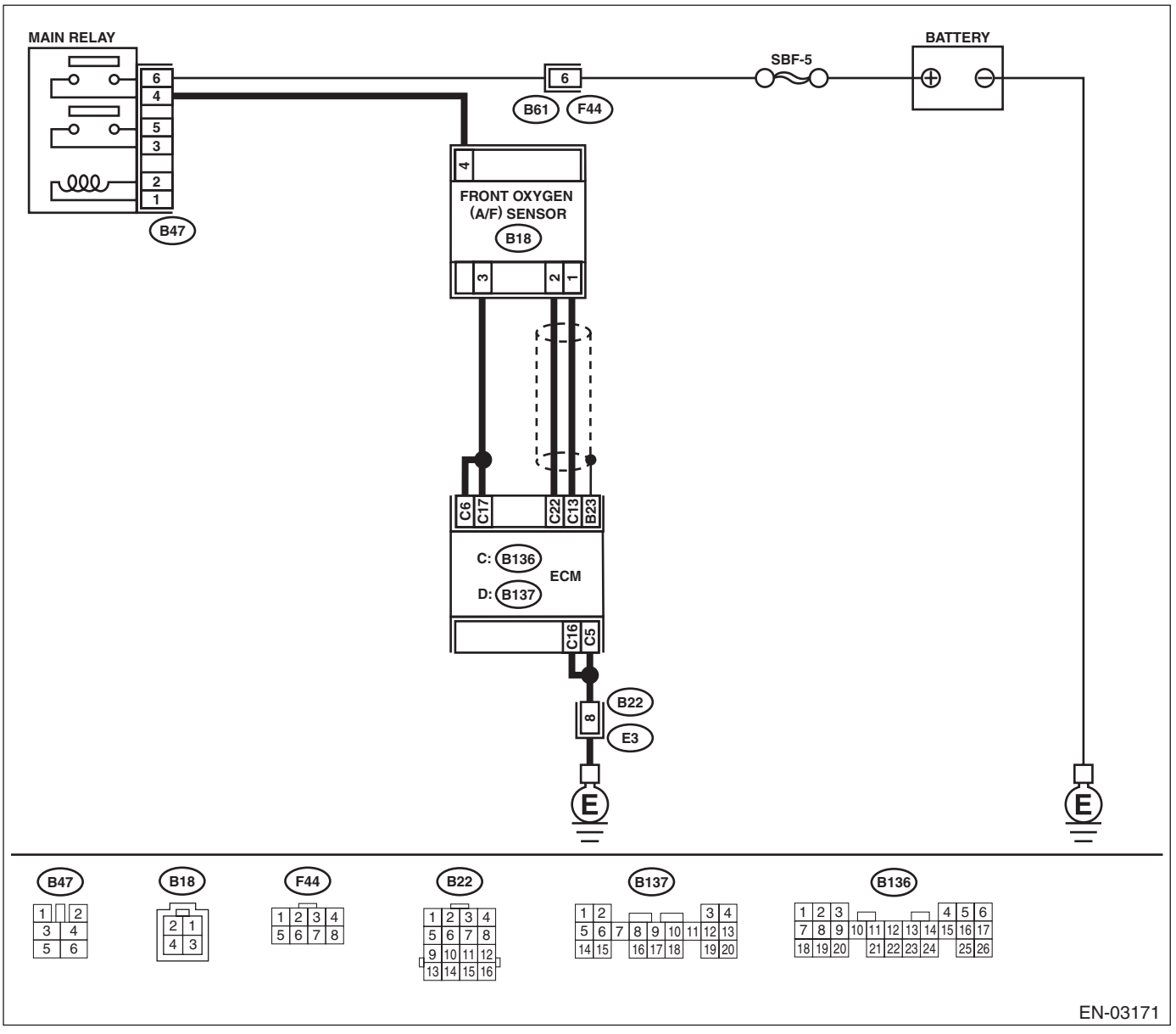
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



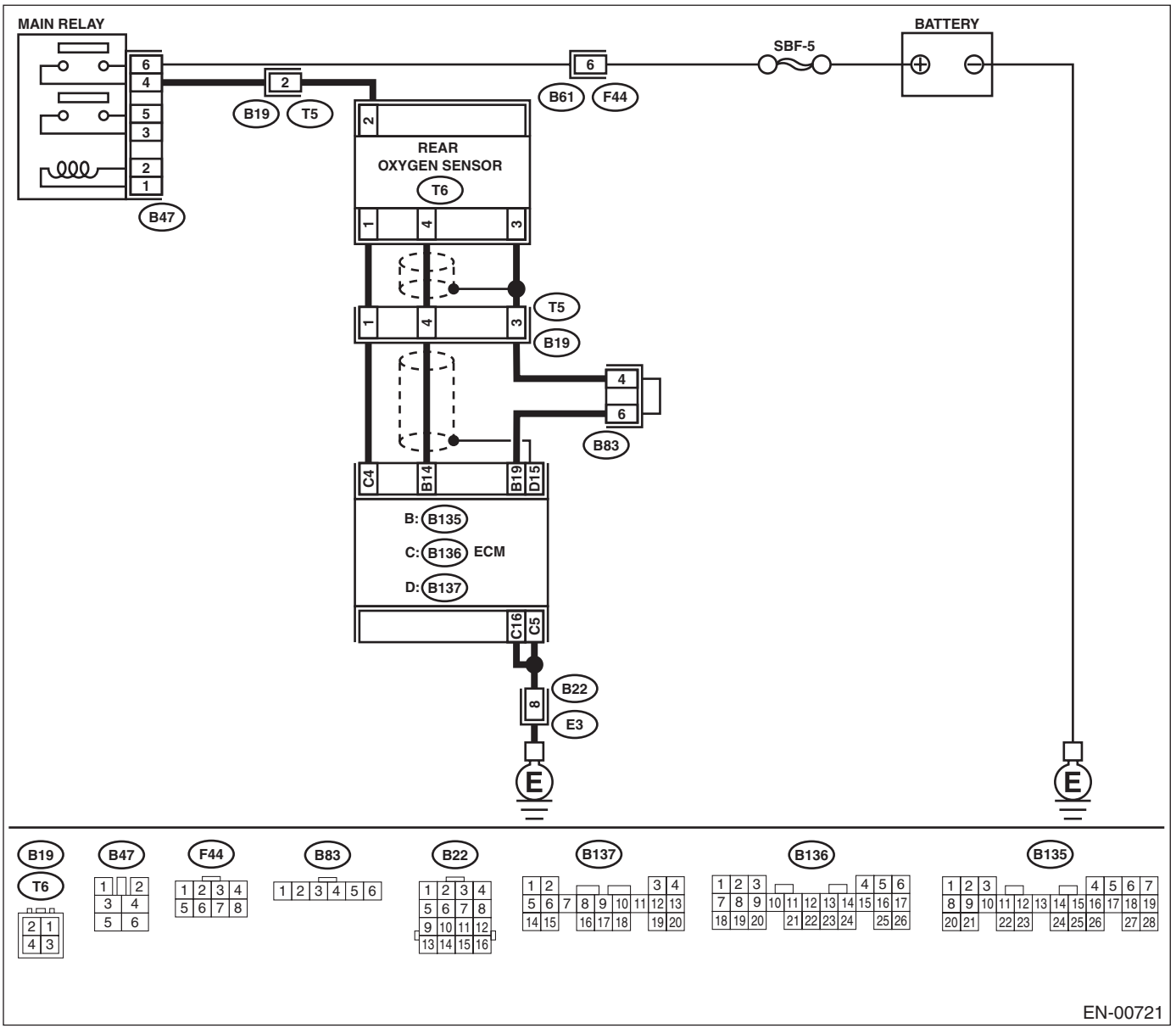
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 6 (+) — Chassis ground (–):*** ***(B136) No. 17 (+) — Chassis ground (–):***	Is the measured value more than 8 V?	Go to step **3.**	Go to step **2.**
2	**CHECK FRONT OXYGEN (A/F) SENSOR HEATER CURRENT.** 1) Turn ignition switch to OFF. 2) Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector. 3) Turn ignition switch to ON. 4) Read data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 2.3 A?	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	END
3	**CHECK OUTPUT SIGNAL FROM ECM.** Measure 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 8 V when shaking harness and connector of ECM?	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	END

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK GROUND CIRCUIT OF ECM.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure 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 5 Ω?	Go to step **3.**	Go to step **2.**
2	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of rear oxygen sensor heater current using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •OBD-II scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 0.2 A?	Repair 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 voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 4 (+) — Chassis ground (–):***	Is the measured value less than 1.0 V?	Go to step **6.**	Go to step **4.**
4	**CHECK OUTPUT SIGNAL FROM ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 4 (+) — Chassis ground (–):***	Is the measured value less than 1.0 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **5.**
5	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Disconnect connector from rear oxygen sensor. 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 4 (+) — Chassis ground (–):***	Is the measured value less than 1.0 V?	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Repair battery short circuit in harness between ECM and rear oxygen sensor connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
6	**CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure voltage between rear oxygen sensor connector and engine ground or chassis ground. ***Connector & terminal*** ***(T6) No. 2 (+) — Chassis ground (–):***	Is the measured value more than 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 rear oxygen sensor connector • Poor contact in coupling connector

Step		Check	Yes	No
7	**CHECK REAR OXYGEN SENSOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between rear oxygen sensor connector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 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 rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.>

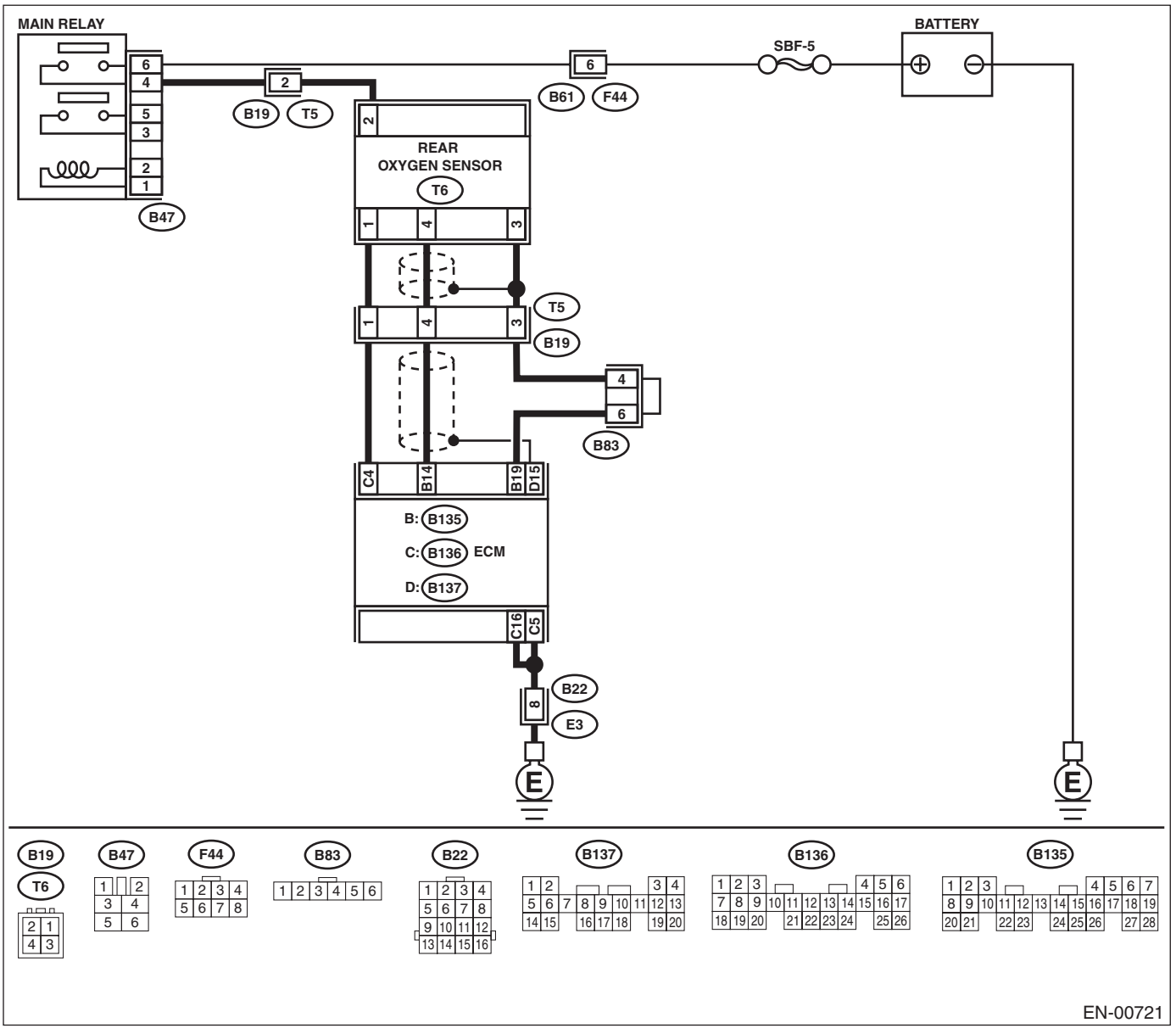
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 4 (+) — Chassis ground (–):***	Is the measured value more than 8 V?	Go to step **2.**	Go to step **3.**

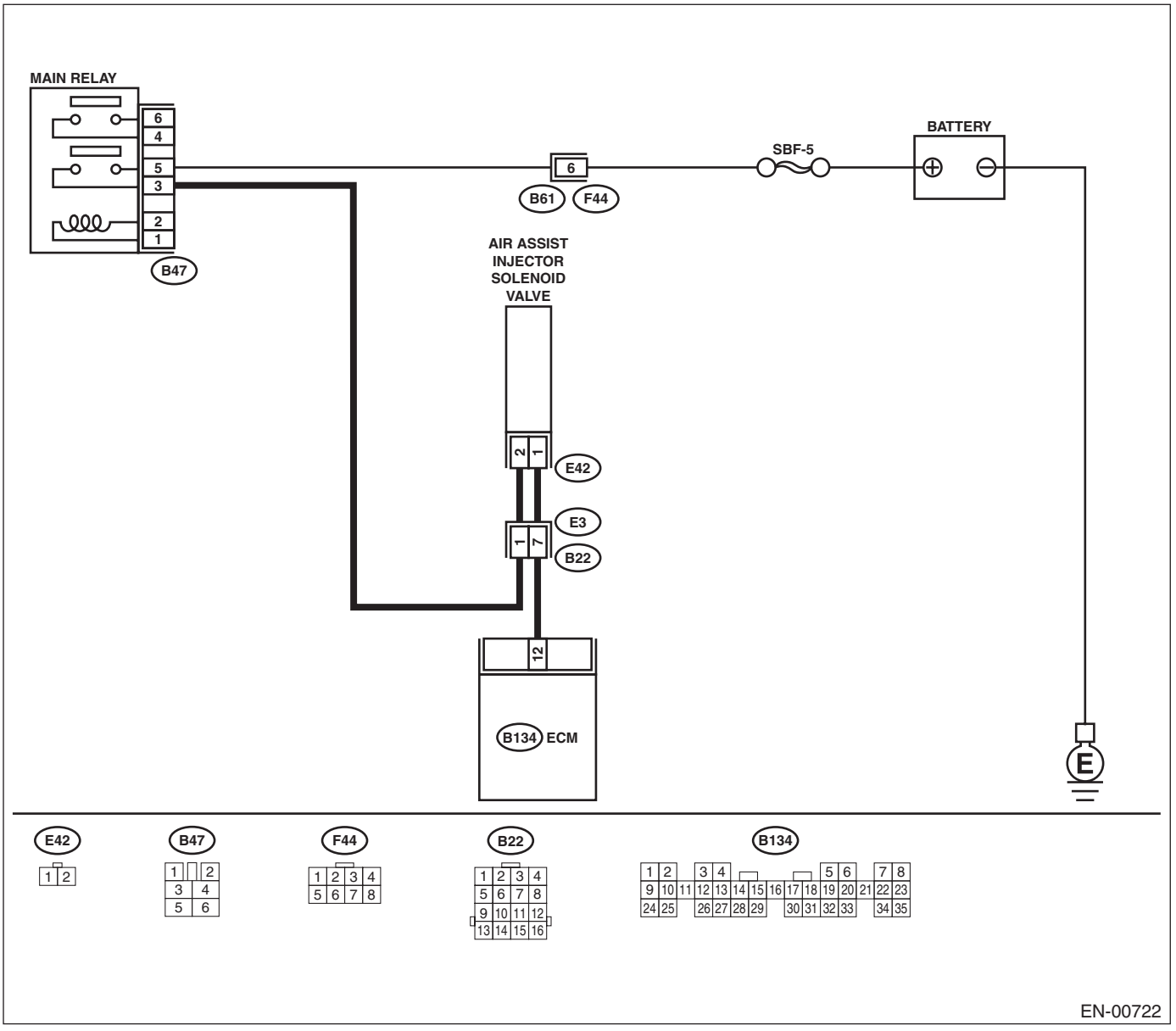
Step		Check	Yes	No
2	**CHECK CURRENT DATA.** 1) Turn ignition switch to OFF. 2) Repair battery short circuit in harness between ECM and rear oxygen sensor connector. 3) Turn ignition switch to ON. 4) Read data of rear oxygen sensor heater current using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 7 A?	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	END
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	END

F: DTC P0065 — AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



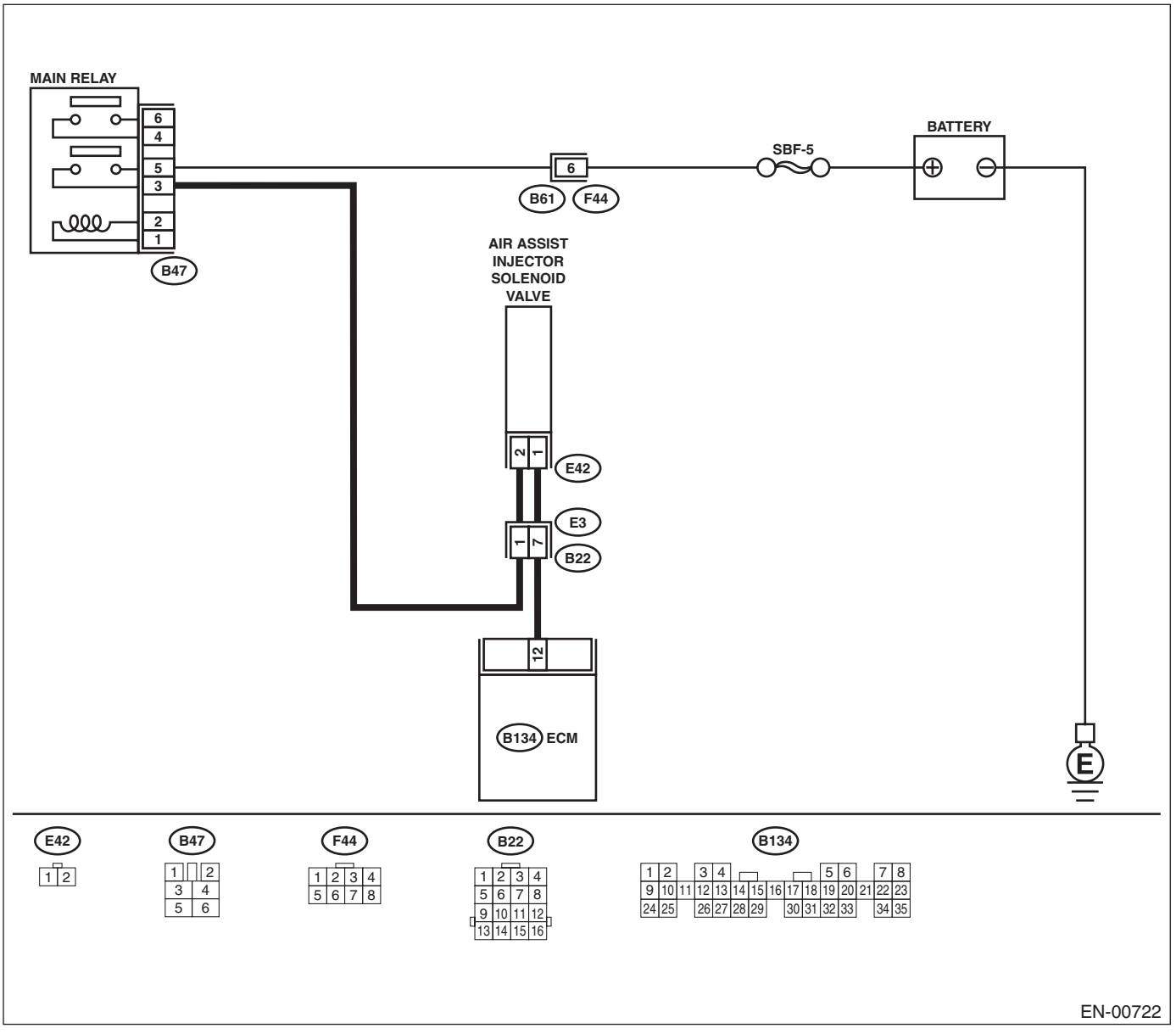
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK AIR ASSIST INJECTOR SOLENOID VALVE OPERATION.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box. 3) Turn ignition switch to ON. 4) Operate air assist injector solenoid valve. NOTE: Air assist injector solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to the "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.>	Does air assist injector solenoid valve produce operating sound?	Go to step **3.**	Replace air assist injector solenoid valve. <Ref. to FU(H4SO)-36, Air Assist Injector Solenoid Valve.>
3	**CHECK AIR BY-PASS HOSES.** Use your mouth to blow through air by-pass hose to make sure that there is a smooth air flow (no clogging).	Is air by-pass hose clogged?	Repair or replace air by-pass hoses.	Go to step **4.**
4	**CHECK FUEL INJECTOR.** 1) Turn ignition switch to OFF. 2) Remove fuel injector. <Ref. to FU(H4SO)-38, Fuel Injector.> 3) Check for clogged fuel injectors.	Is fuel injector clogged?	Replace fuel injector. <Ref. to FU(H4SO)-38, Fuel Injector.>	Replace air assist injector solenoid valve. <Ref. to FU(H4SO)-36, Air Assist Injector Solenoid Valve.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



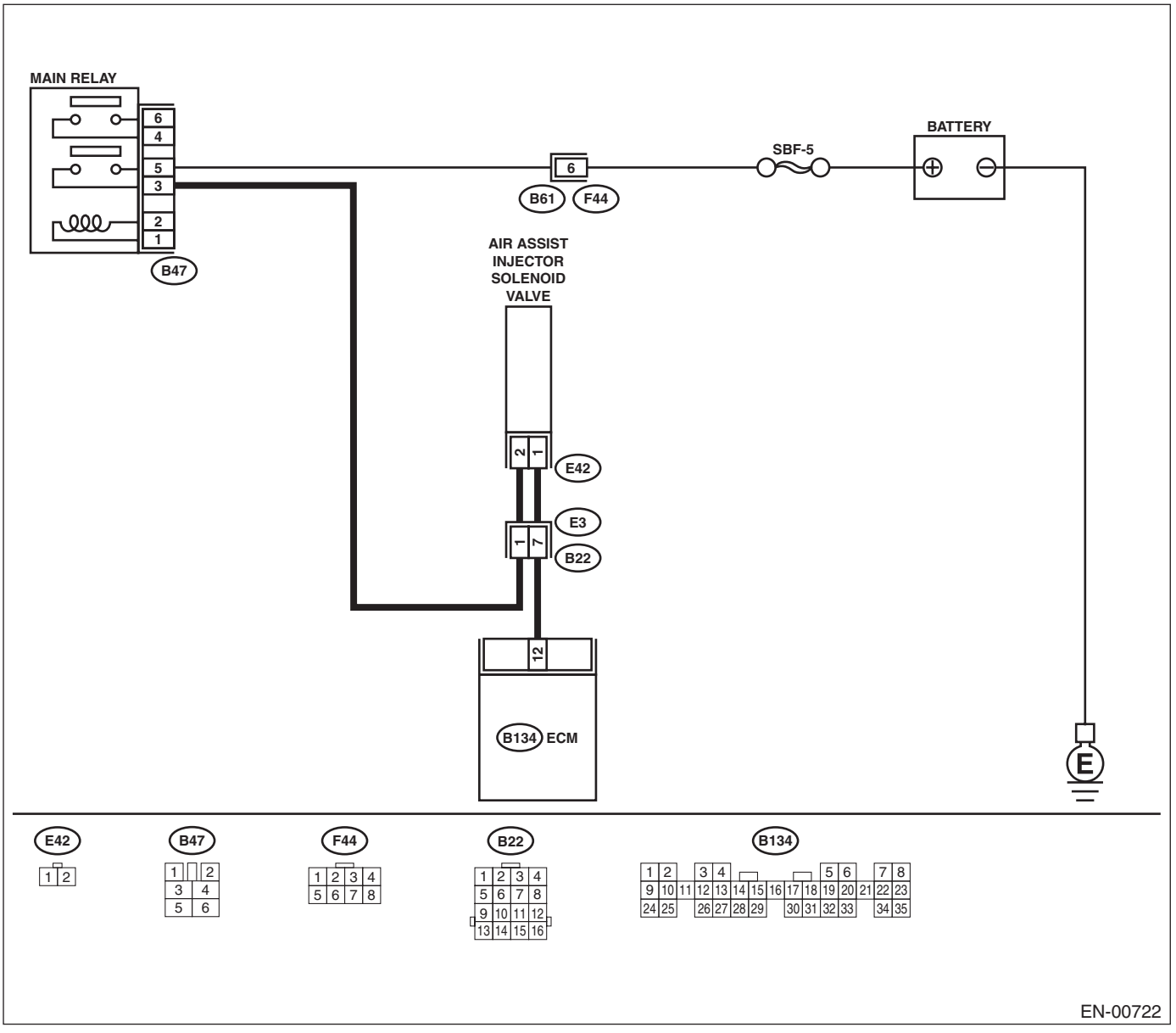
Step		Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 12 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair poor contact in ECM connector.	Go to step **2.**
2	**CHECK POWER SUPPLY TO AIR ASSIST INJECTOR SOLENOID VALVE.** 1) Turn ignition switch to OFF. 2) Disconnect connector from air assist injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between air assist injector solenoid valve and engine ground. ***Connector & terminal*** ***(E42) No. 2 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between air assist injector solenoid valve and main relay connector • Poor contact in coupling connector
3	**CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and air assist injector solenoid valve connector. ***Connector & terminal*** ***(B134) No. 12 — (E42) No. 1:***	Is the measured value less than 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 assist injector solenoid valve connector • Poor contact in coupling connector
4	**CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR.** Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 12 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair ground short circuit in harness between ECM and air assist injector solenoid valve connector.
5	**CHECK POOR CONTACT.** Check poor contact in ECM and air assist injector solenoid valve connectors.	Is there poor contact in ECM and air assist injector solenoid valve connectors?	Repair poor contact in ECM and air assist injector solenoid valve connectors.	Replace air assist injector solenoid valve. <Ref. to FU(H4SO)-36, Air Assist Injector Solenoid Valve.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



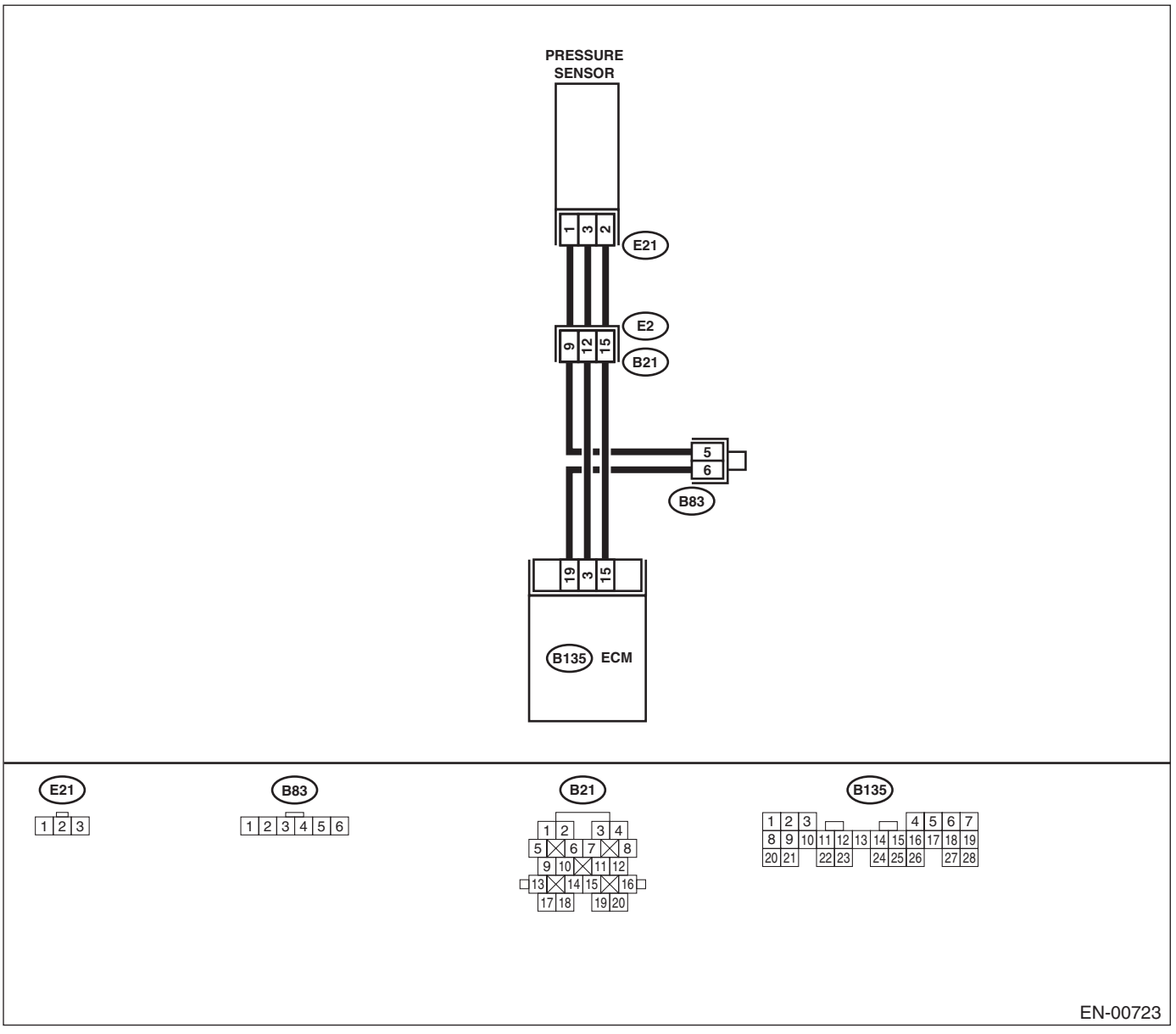
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 12 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **3.**
2	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Disconnect connector from air assist injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 12 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Replace air assist injector solenoid valve <Ref. to FU(H4SO)-36, Air Assist Injector Solenoid Valve.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>
3	**CHECK INPUT SIGNAL FROM ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 12(+) — Chassis ground (–):*** Does the measured value exceed the specified value by shaking harness and connector of ECM while monitoring the value with voltage meter?	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Contact with 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 —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



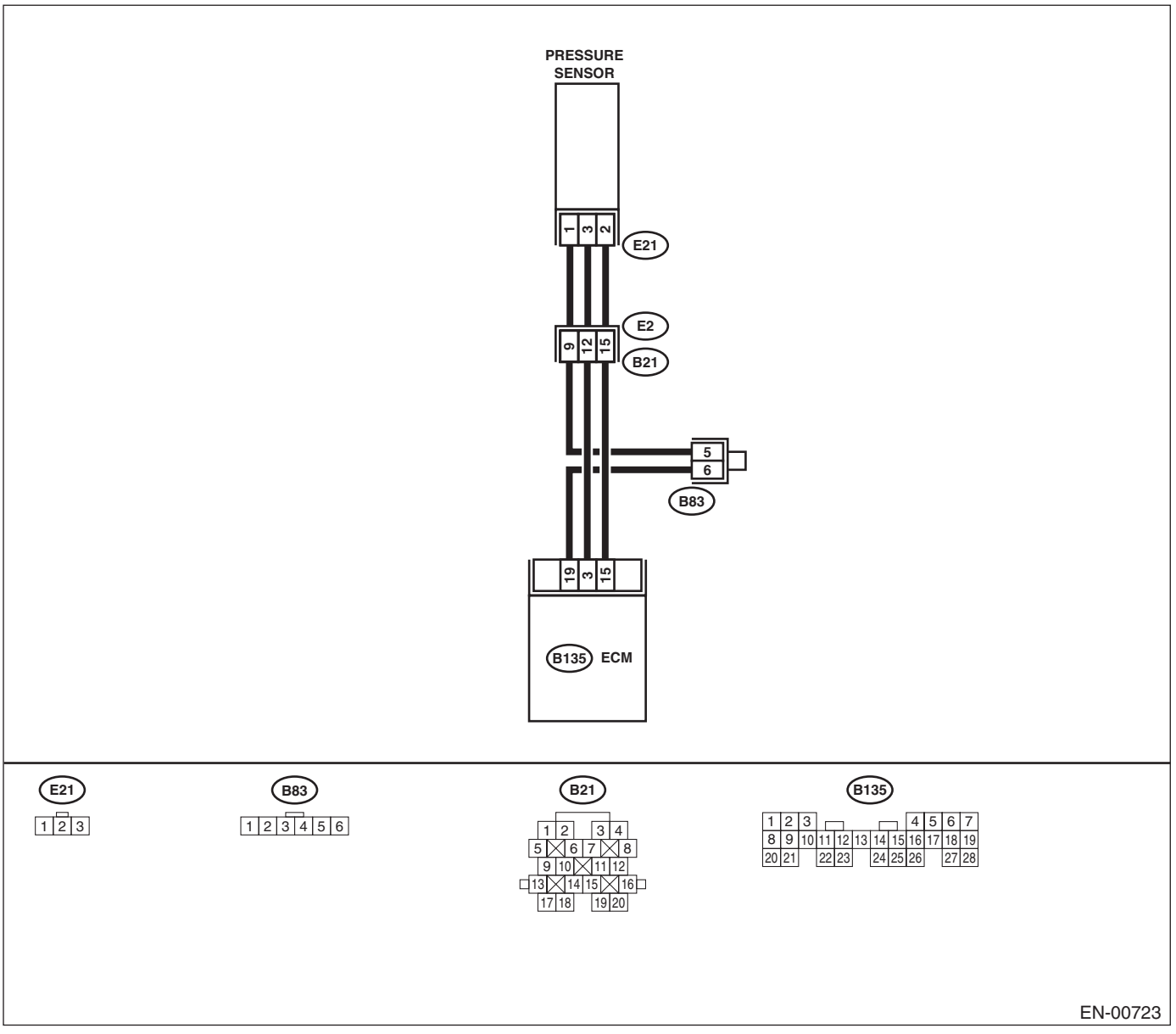
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step **3.**
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 shift lever in the selector lever in "N" or "P" position. 3) Turn A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. Is the measured value within the specified range? NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual. Specification:	Is the measured value within 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) when turning ignition switch ON, or within 20.0 to 46.7 kPa (150 to 350 mmHg, 5.91 to 13.78 inHg) when idling?	Go to step **4.**	Replace intake air temperature sensor and pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>
4	**CHECK THROTTLE POSITION.** Read data of throttle position signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 5% when throttle is fully closed?	Go to step **5.**	Adjust or replace throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>
5	**CHECK THROTTLE POSITION.**	Is the measured value more than 85% when throttle is fully open.	Replace pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>	Replace 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:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg)?	Go to step **3.**	Go to step **2.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM and pressure sensor connector.	Is there poor contact in ECM or pressure sensor connector?	Repair poor contact in ECM or pressure sensor connector.	Even if MIL lights up, the circuit has returned to a normal condition at this time.
3	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V?	Go to step **5.**	Go to step **4.**
4	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 15 (+) — Chassis ground (–):***	Is the measured value less than 0.2 V?	Go to step **7.**	Go to step **6.**
6	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Read data of atmospheric absolute pressure signal using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Is the measured value more than 13.3 kPa (100 mmHg, 3.94 inHg) when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **7.**
7	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from pressure sensor. 3) Turn ignition switch to ON. 4) Measure voltage between intake air temperature sensor and pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 3 (+) — Engine ground (–):***	Is the measured value more than 4.5 V?	Go to step **8.**	Repair open circuit in harness between ECM and pressure sensor connector.

	Step	Check	Yes	No
8	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and pressure sensor connector. ***Connector & terminal*** ***(B135) No. 19 — (E21) No. 1:***	Is the measured value less than 1 Ω?	Go to step **9.**	Repair open circuit in harness between ECM and pressure sensor connector.
9	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** Measure resistance of harness between pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 2 — Engine ground:***	Is the measured value more than 500 kΩ?	Go to step **10.**	Repair ground short circuit in harness between ECM and intake air temperature and pressure sensor connector.
10	**CHECK POOR CONTACT.** Check poor contact in intake manifold pressure sensor connector.	Is there poor contact in intake manifold pressure sensor connector?	Repair poor contact in pressure sensor connector.	Replace pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>

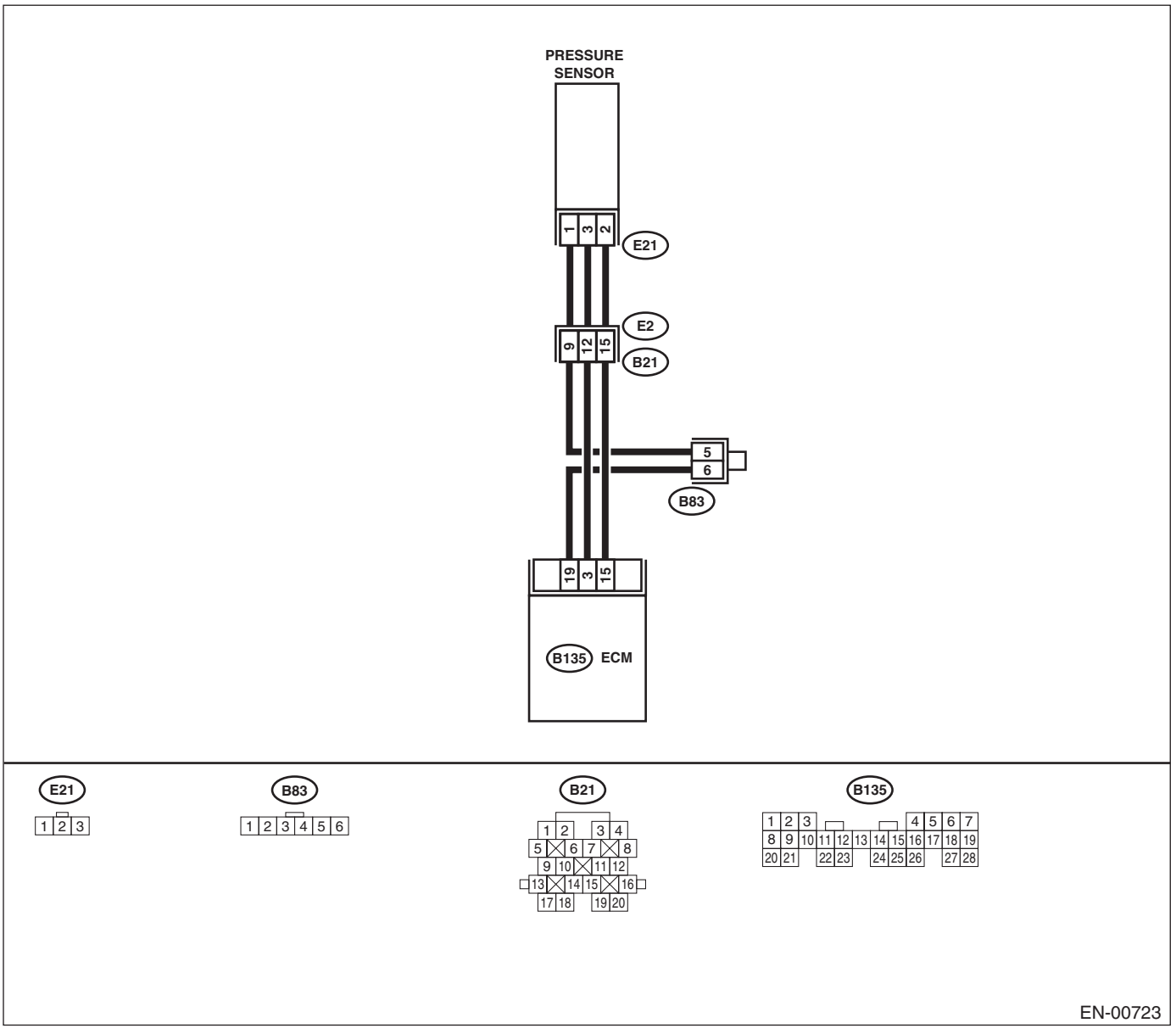
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Go to step **9.**	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 15 (+) — Chassis ground (–):***	Is the measured value less than 0.2 V?	Go to step **6.**	Go to step **5.**
5	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Read data of atmospheric absolute pressure signal using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Is the measured value more than 13.3 kPa (100 mmHg, 3.94 inHg) when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **6.**
6	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from pressure sensor. 3) Turn ignition switch to ON. 4) Measure voltage between pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 3 (+) — Engine ground (–):***	Is the measured value more than 4.5 V?	Go to step **7.**	Repair open circuit in harness between ECM and pressure sensor connector.

	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and pressure sensor connector. ***Connector & terminal*** ***(B135) No. 15 — (E21) No. 2:*** ***(B135) No. 19 — (E21) No. 1:***	Is the measured value more than 1 Ω?	Go to step **8.**	Repair open circuit in harness between ECM and pressure sensor connector.
8	**CHECK POOR CONTACT.** Check poor contact in pressure sensor connector.	Is there poor contact in pressure sensor connector?	Repair poor contact in pressure sensor connector.	Replace pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>
9	**CHECK HARNESS BETWEEN ECM AND PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF and Subaru Select Monitor or the general scan tool switch to OFF. 2) Disconnect connector from pressure sensor. 3) Turn ignition switch to ON and Subaru Select Monitor or the general scan tool switch to ON. 4) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Repair battery short circuit in harness between ECM and pressure sensor connector.	Replace pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>

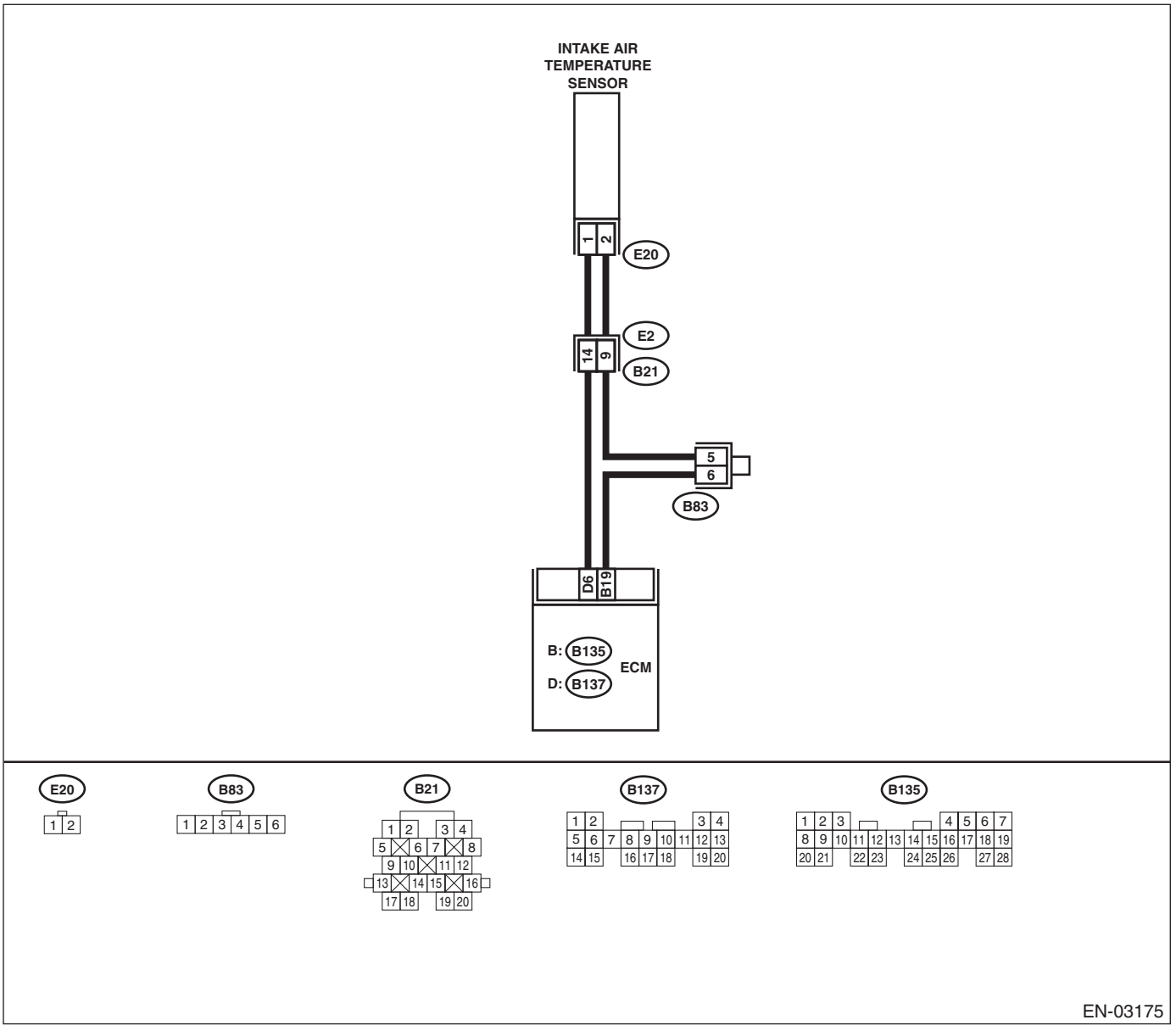
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



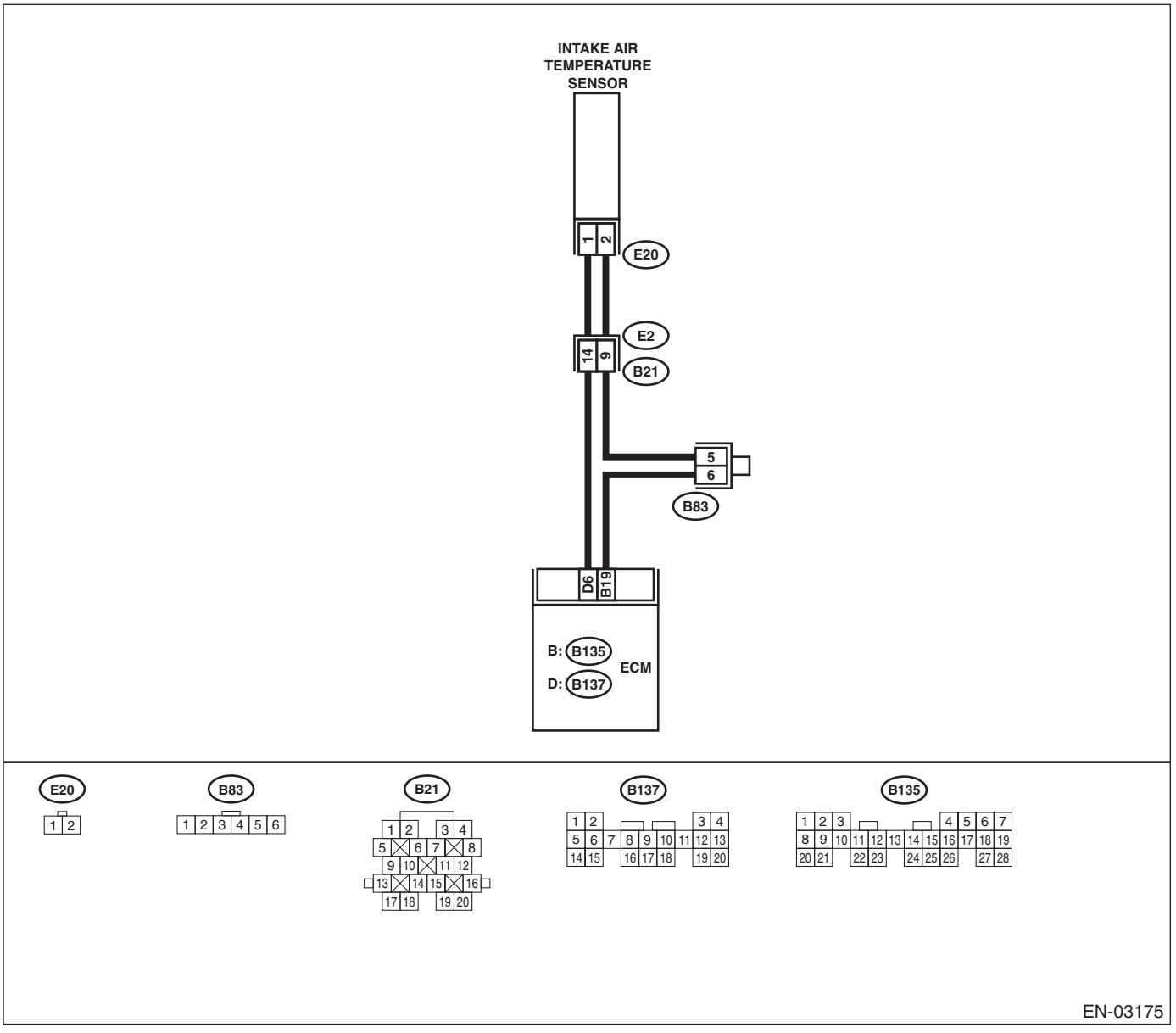
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0111.	Go to step **2.**
2	**CHECK ENGINE COOLANT TEMPERATURE.** 1) Start the engine and warm it up completely. 2) Measure engine coolant temperature using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 75 to 95°C (167 to 203°F)?	Replace intake air temperature sensor. <Ref. to FU(H4SO)-34, REMOVAL, Intake Air Temperature Sensor.>	Inspect DTC P0125 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



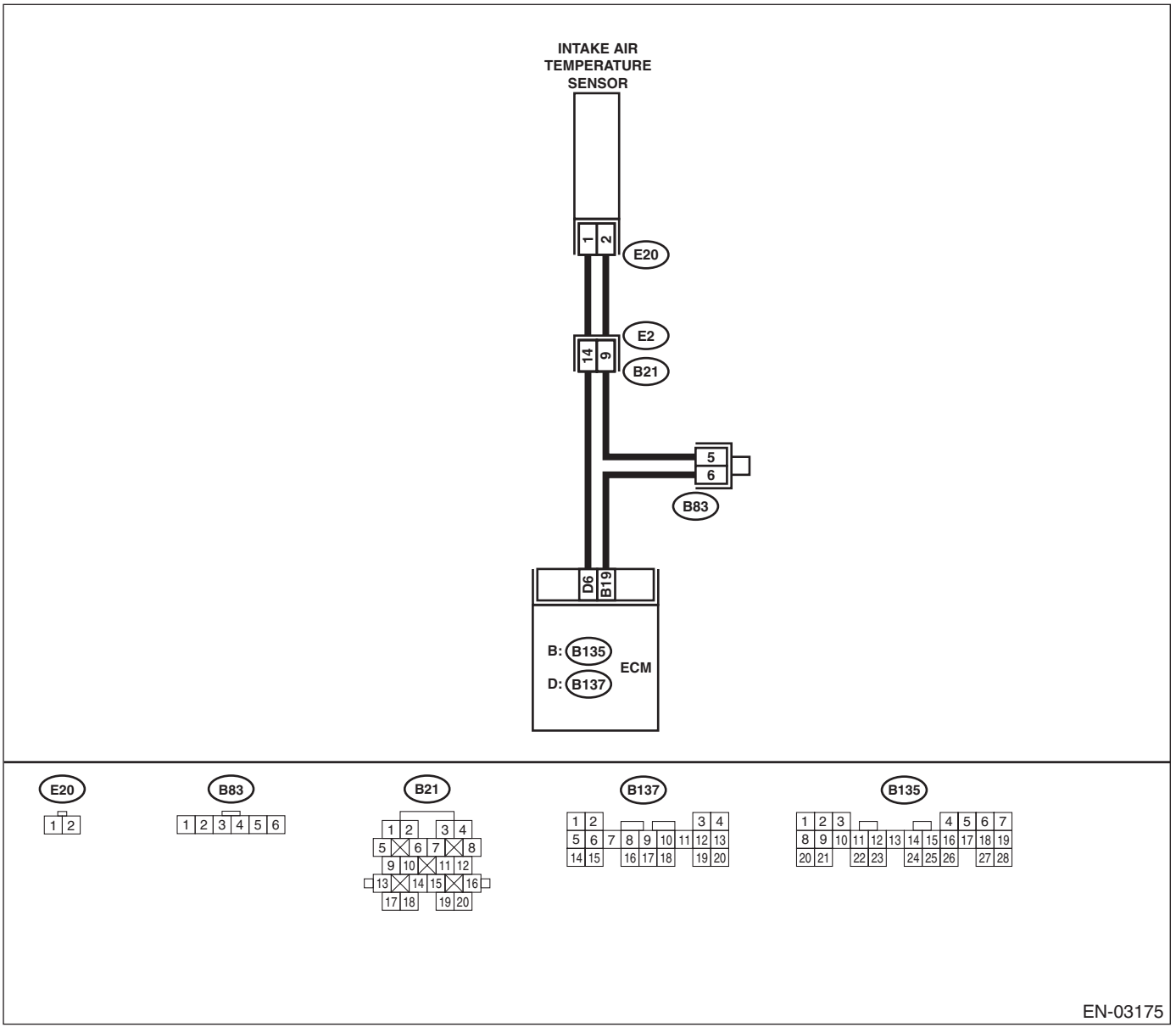
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of intake air temperature sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 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 connector from intake air temperature and pressure sensor. 3) Turn ignition switch to ON. 4) Read data of intake air temperature sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Replace intake air temperature sensor. <Ref. to FU(H4SO)-34, REMOVAL, Intake Air Temperature Sensor.>	Repair ground short circuit in harness between intake air temperature sensor and ECM connector.

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of intake air temperature sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –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 connector from intake air temperature sensor. 3) Measure voltage between intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(E20) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit 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 voltage between intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(E20) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit 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 voltage between intake air temperature and pressure sensor connector and engine ground. ***Connector & terminal*** ***(E20) No. 1 (+) — Engine ground (–):***	Is the measured value more than 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

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance of harness between intake air temperature and pressure sensor connector and engine ground. ***Connector & terminal*** ***(E20) No. 2 — Engine ground:***	Is the measured value less than 5 Ω?	Replace intake air temperature sensor. <Ref. to FU(H4SO)-34, REMOVAL, 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

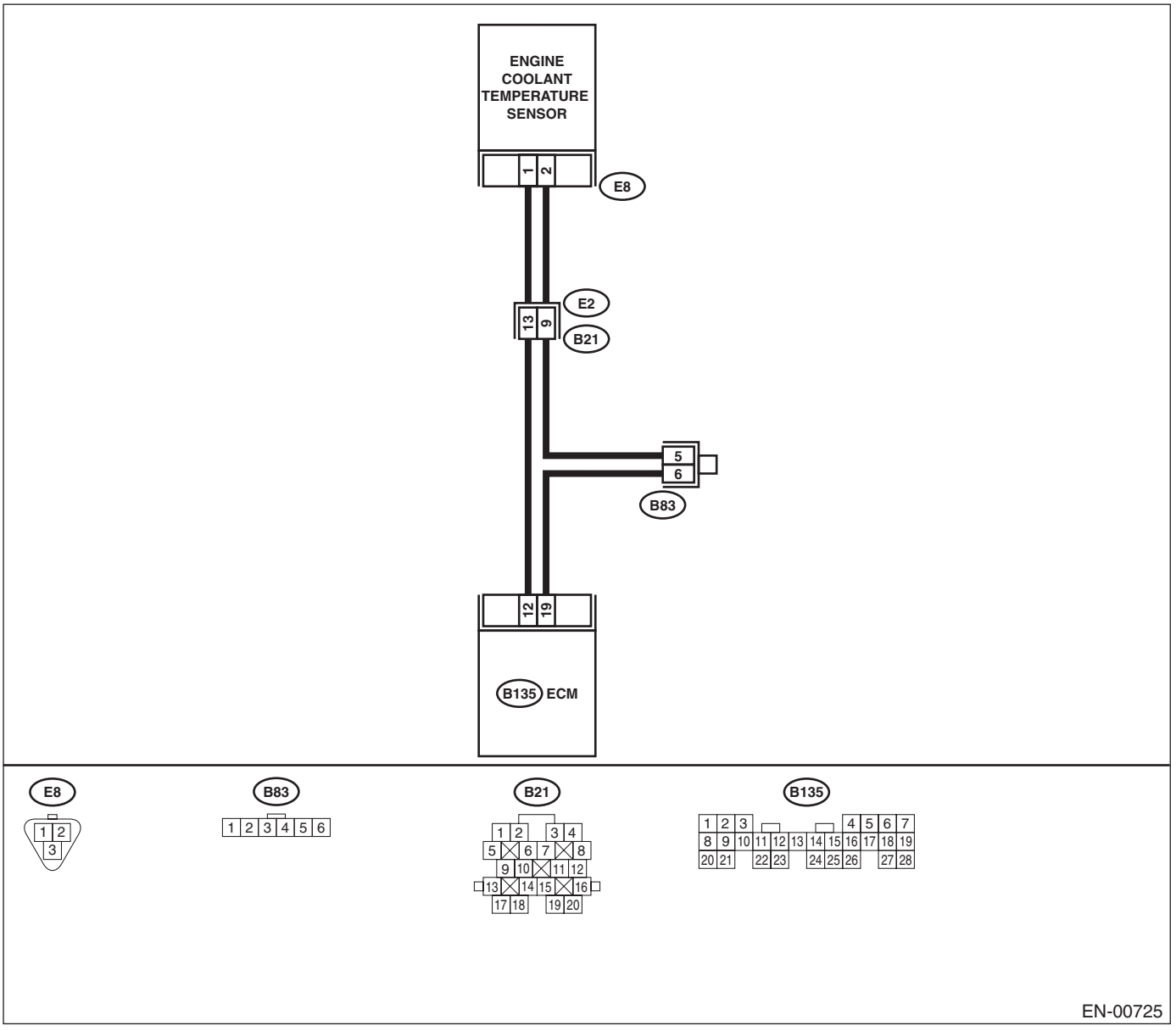
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Hard to start
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



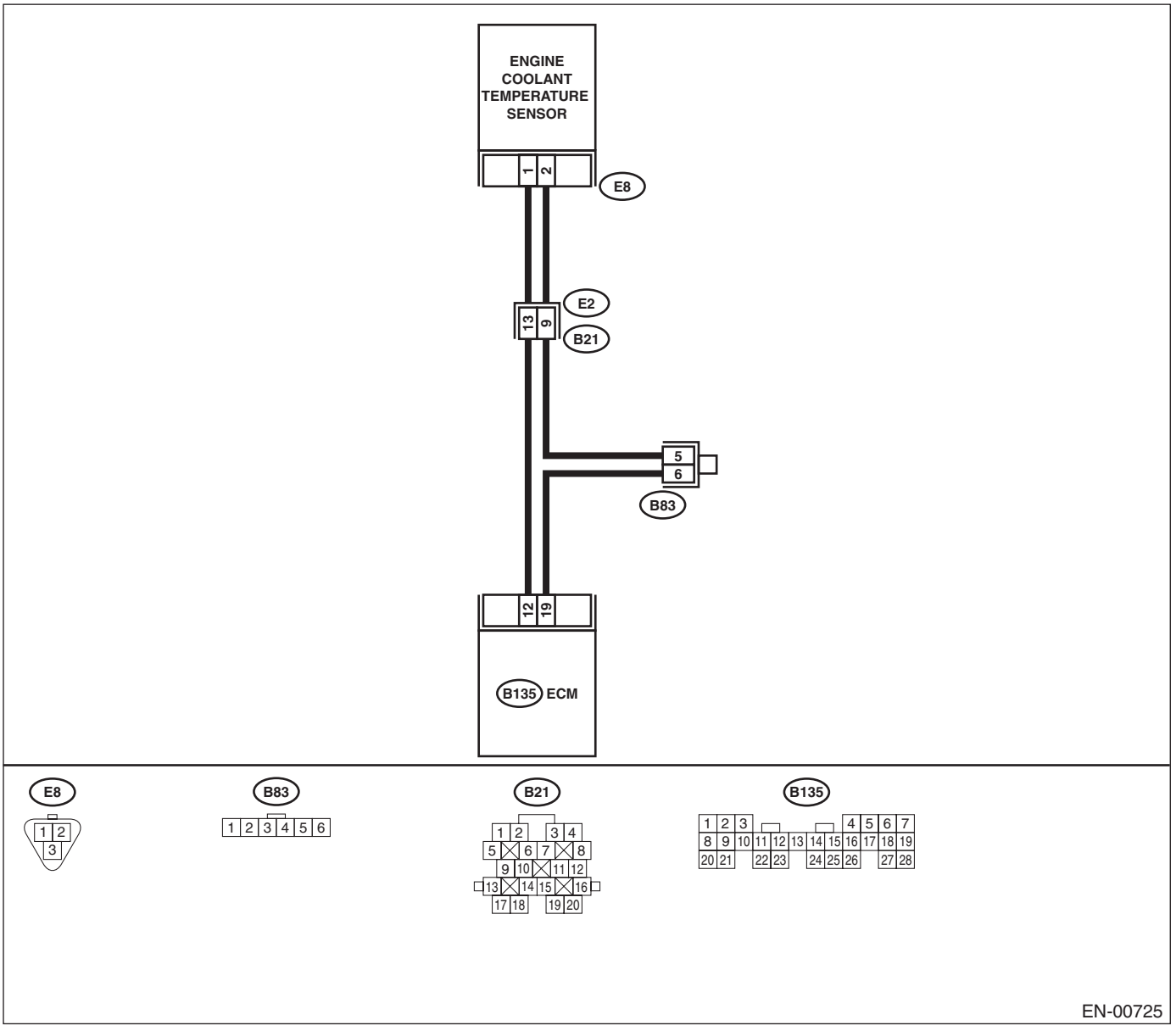
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 120°C (248°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 connector from engine coolant temperature sensor. 3) Turn ignition switch to ON. 4) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Replace engine coolant temperature sensor. <Ref. to FU(H4SO)-27, REMOVAL, Engine Coolant Temperature Sensor.>	Repair ground short circuit in harness between engine coolant temperature sensor and ECM connector.

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Hard to start
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –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 connector from engine coolant temperature sensor. 3) Measure voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit 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 voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** Measure voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (–):***	Is the measured value more than 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

Step		Check	Yes	No
5	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure 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 5 Ω?	Replace 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

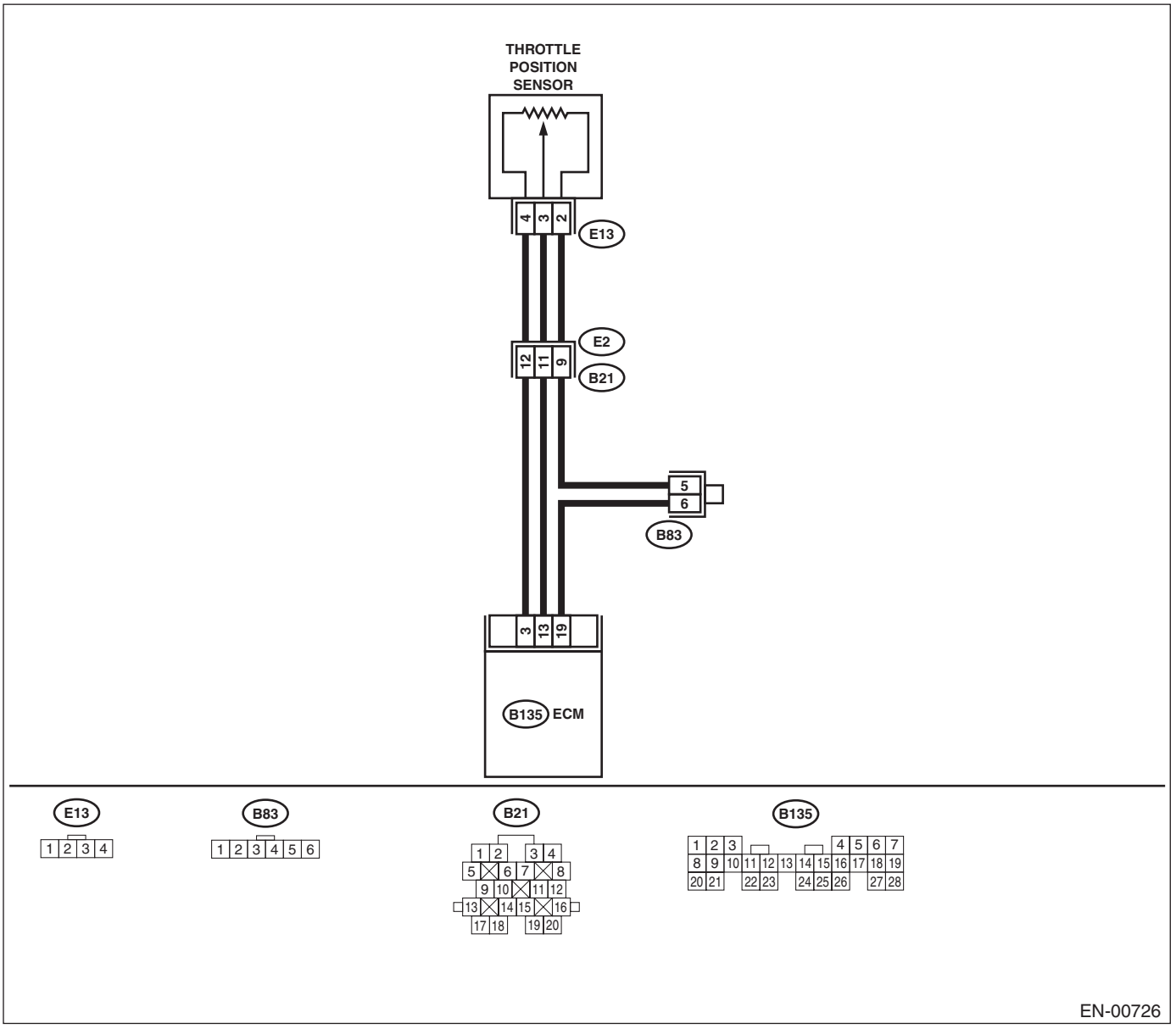
MEMO:

Q: DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



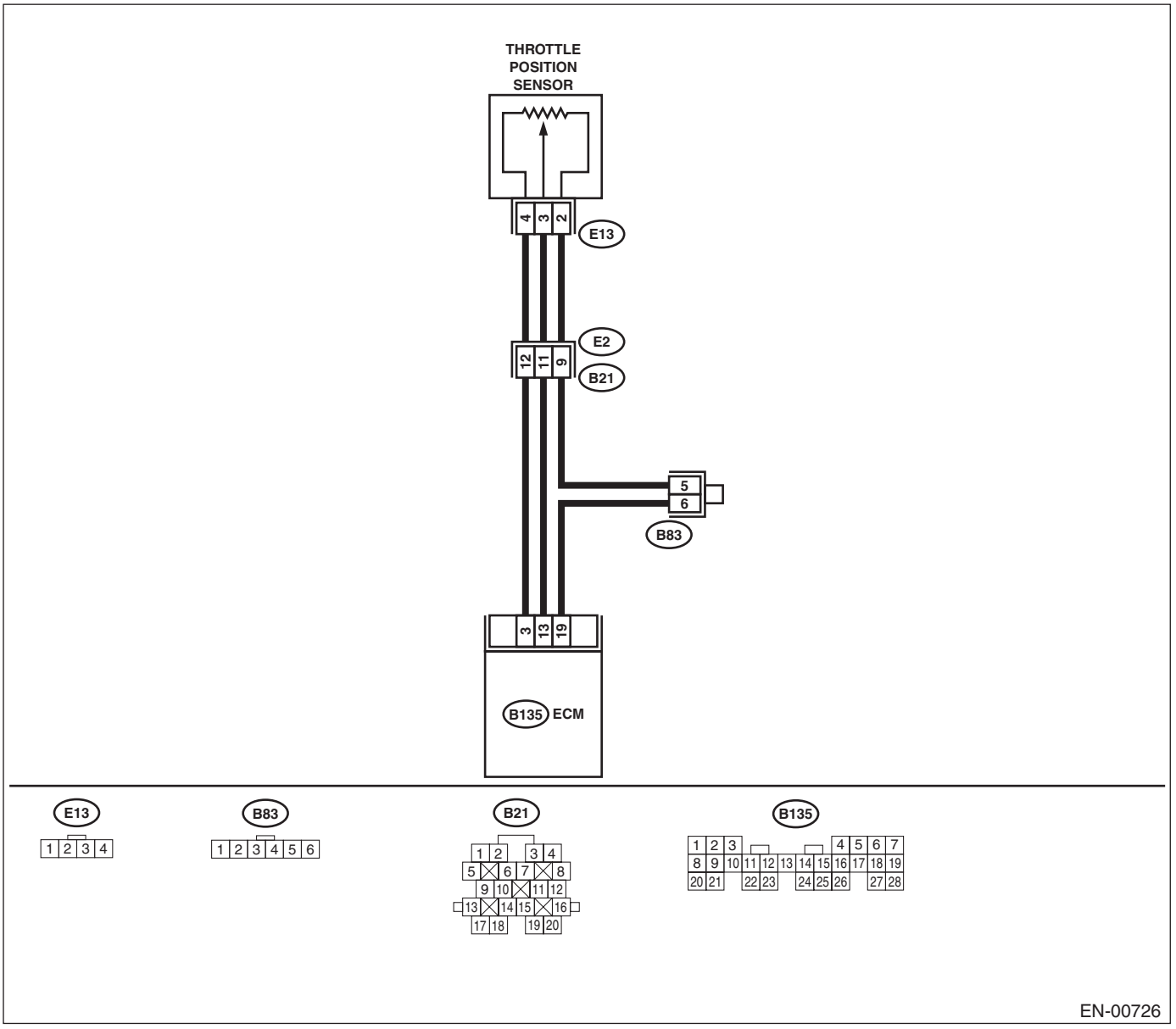
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0121.	Replace throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of throttle position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 0.1 V?	Go to step **2.**	Even if MIL lights up, the circuit has returned to a normal condition at this time. 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 INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground while throttle valve is fully closed. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 3 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 13 (+) — Chassis ground (−):***	Is the measured value less than 0.1 V?	Go to step **6.**	Go to step **5.**
5	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Measure voltage between ECM connector and chassis ground.	Is the measured value more than 0.1 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from throttle position sensor. 3) Turn ignition switch to ON. 4) Measure voltage between throttle position sensor connector and engine ground. ***Connector & terminal*** ***(E13) No. 4 (+) — Engine ground (−):***	Is the measured value more than 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 resistance of harness between ECM connector and throttle position sensor connector. ***Connector & terminal*** ***(B135) No. 13 — (E13) No. 3:***	Is the measured value less than 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 resistance of harness between throttle position sensor connector and engine ground. ***Connector & terminal*** ***(E13) No. 3 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair ground short circuit in harness between throttle position sensor and ECM connector.
9	**CHECK POOR CONTACT.** Check poor contact in throttle position sensor connector.	Is there poor contact in throttle position sensor connector?	Repair poor contact in throttle position sensor connector.	Replace throttle position sensor. <Ref. to FU(H4SO)-31, Throttle Position Sensor.>

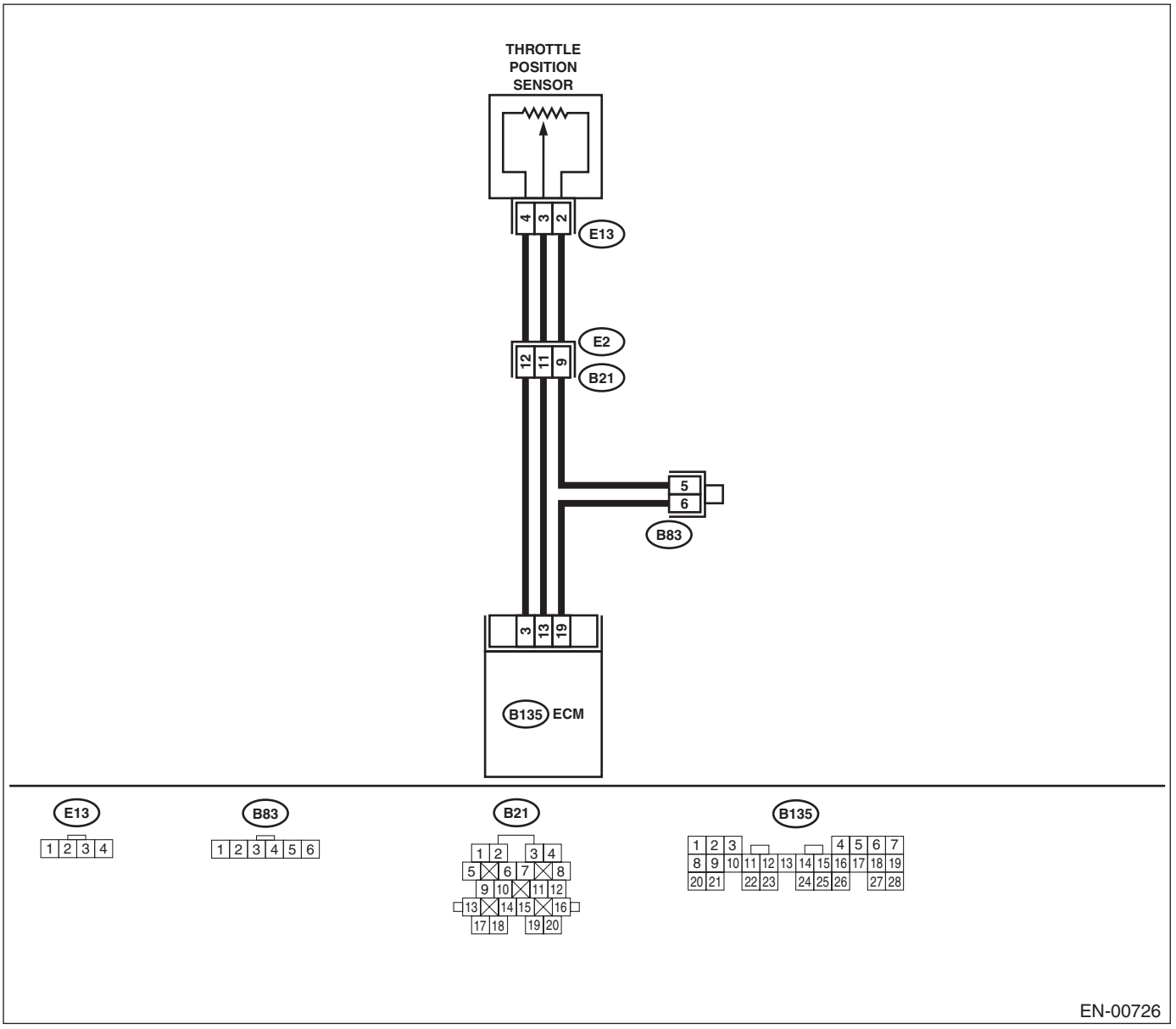
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



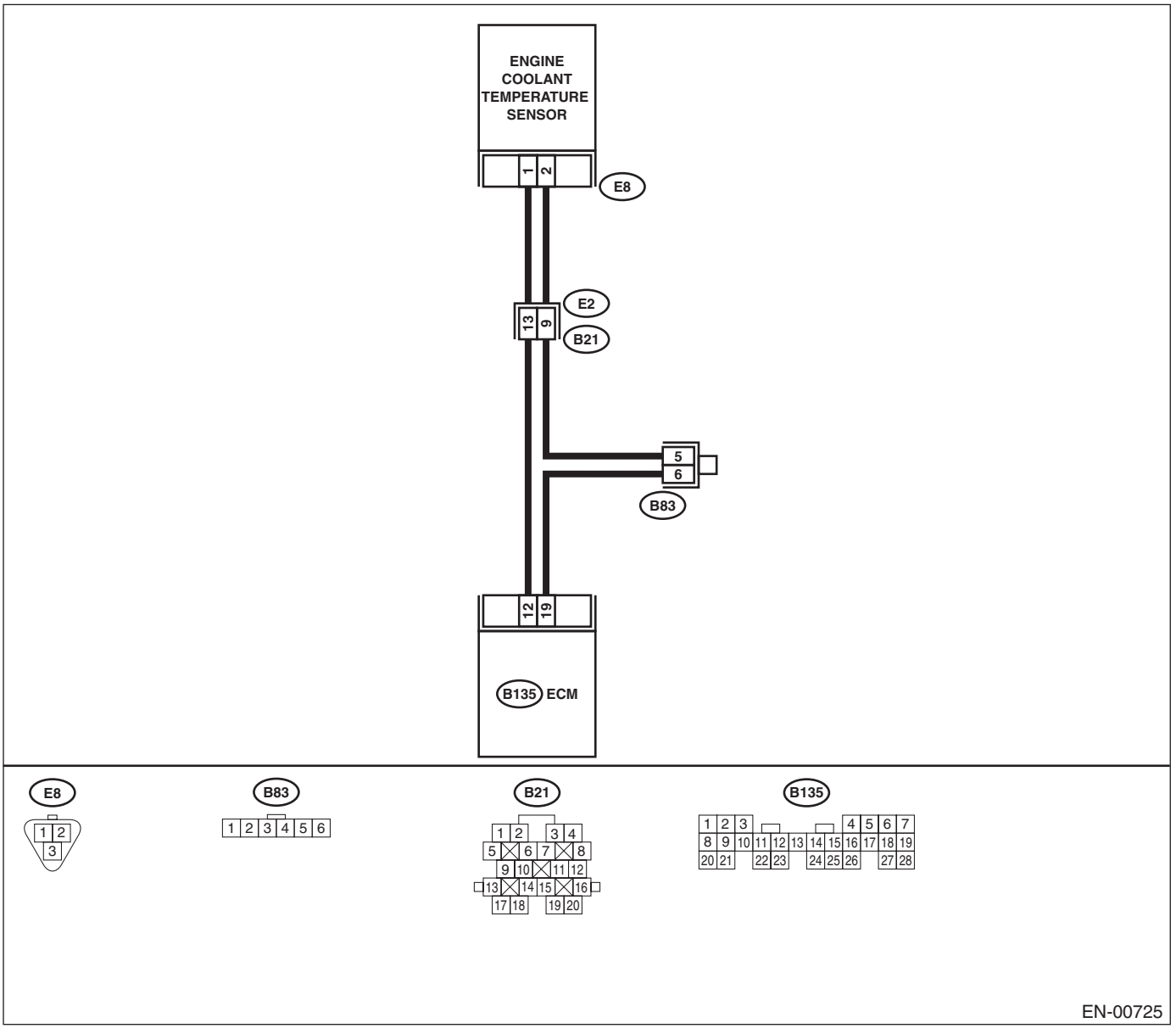
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of throttle position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 4.9 V?	Go to step **2.**	Even if MIL lights up, the circuit has returned to a normal condition at this time. 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 connector from throttle position sensor. 3) Measure resistance of harness between throttle position sensor connector and engine ground. ***Connector & terminal*** ***(E13) No. 2 — Engine ground:***	Is the measured value less than 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 voltage between throttle position sensor connector and engine ground. ***Connector & terminal*** ***(E13) No. 3 (+) — Engine ground (−):***	Is the measured value more than 4.9 V?	Repair battery short circuit in harness between throttle position sensor and ECM connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Replace 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:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Engine would not return to idling.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



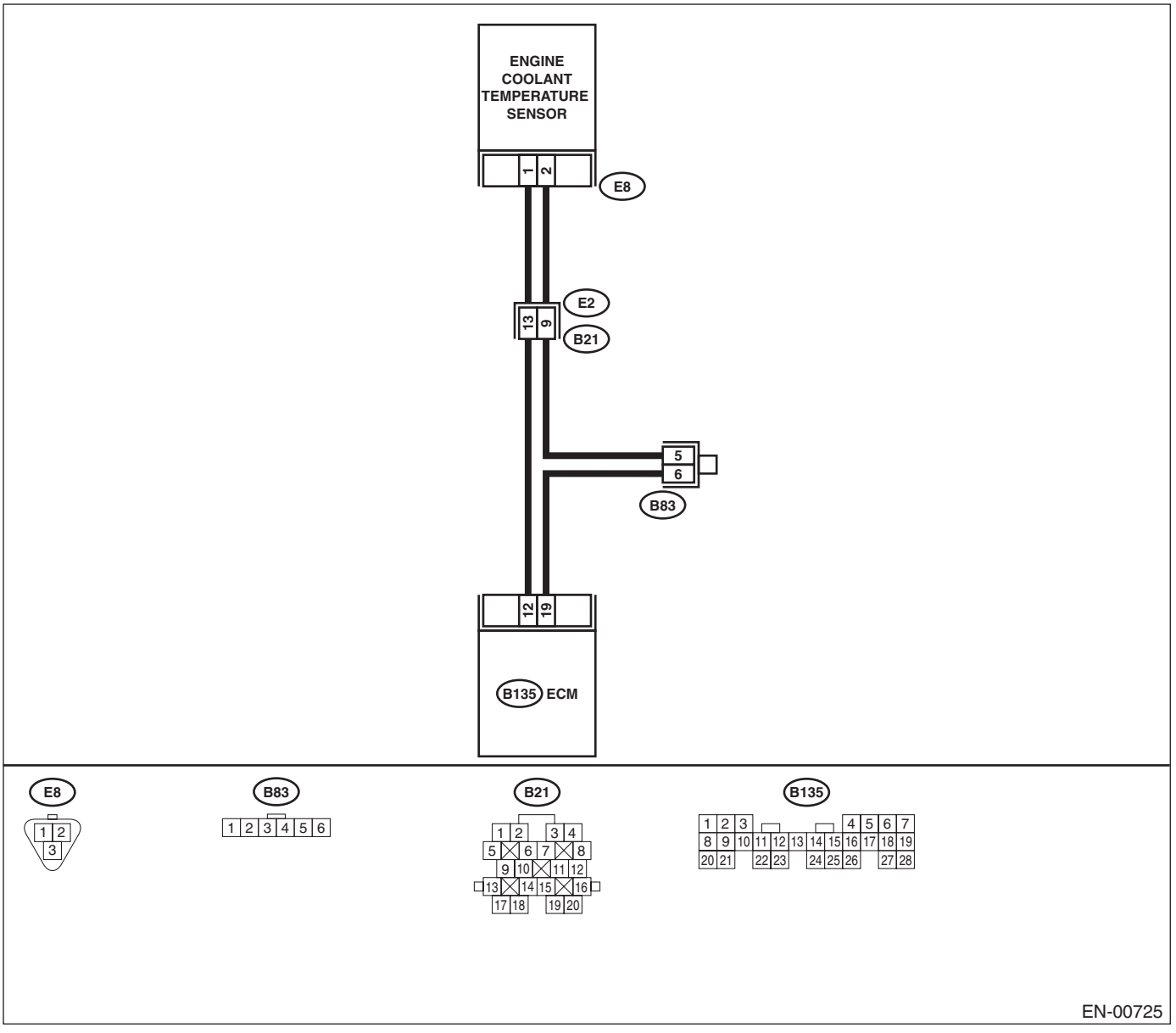
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0125.	Go to step **2.**
2	**CHECK THERMOSTAT.**	Does thermostat remain opened?	Replace thermostat. <Ref. to CO(H4SO)-19, Thermostat.>	Replace engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>

U: DTC P0126 — SUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —

- **DTC DETECTING CONDITION:**
  - Detected when two consecutive driving cycles with malfunction is occurred.
  - GENERAL DESCRIPTION <Ref. to GD(H4SO)-51, DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Hard to start
  - Erroneous idling
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** Measure the resistance between terminals of engine coolant temperature sensor when the engine is cold and when the engine is warmed up. ***terminal*** ***No. 1 — No. 2:***	Does the resistance value change between the condition when the engine is cooled and when it is warmed up?	Go to step **3.**	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>
3	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from engine coolant temperature sensor. 3) Measure voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to ON. 2) Measure voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step **5.**
5	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** Measure voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 (+) — Engine ground (−):***	Is the measured value more than 4 V?	Go to step **6.**	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

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure 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 5 Ω?	Contact your SOA Service Center.	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

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Thermostat remains open.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

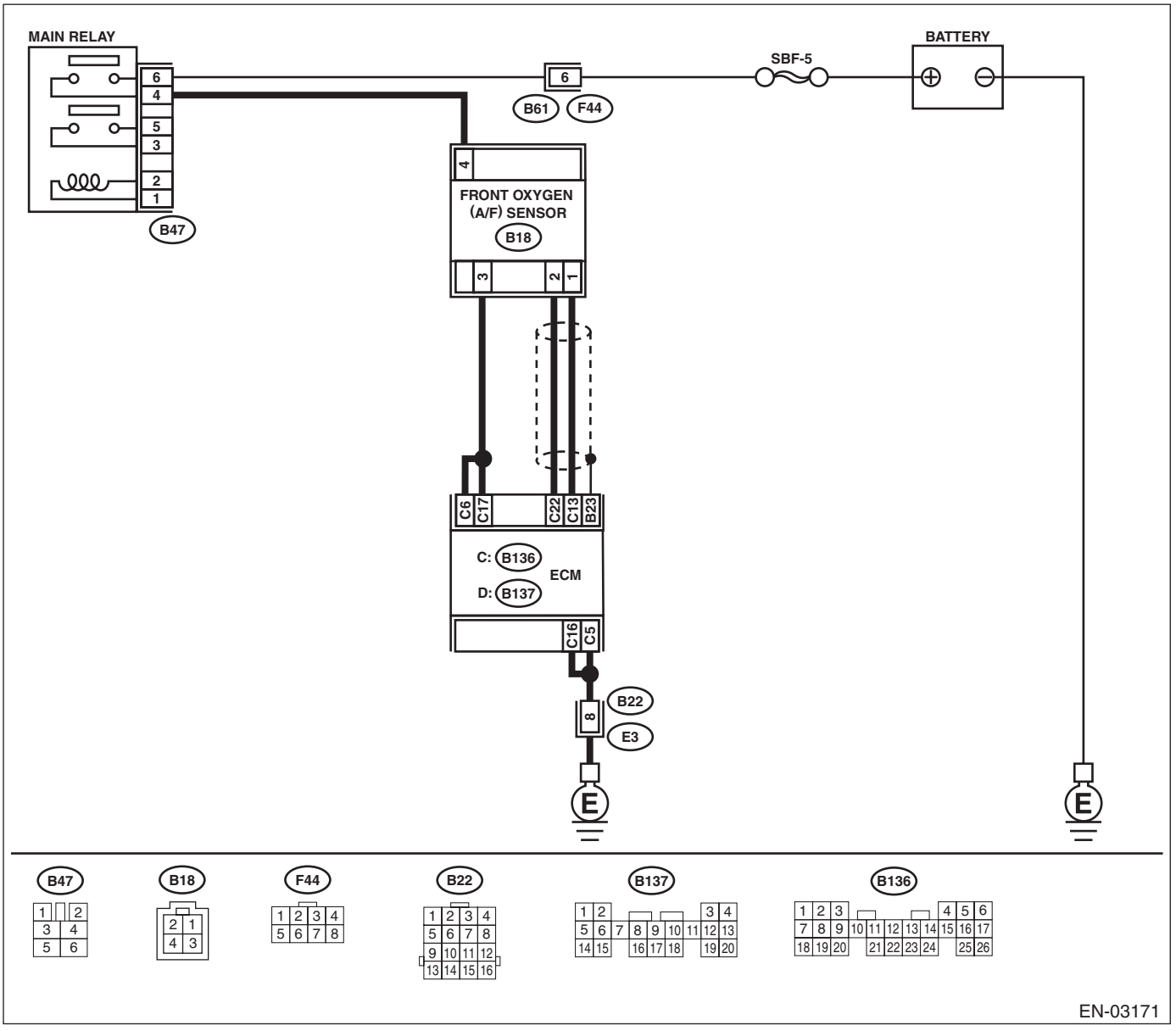
	Step	Check	Yes	No
1	**CHECK VEHICLE CONDITION.**	Has engine operated at idle or has vehicle been driven with part of engine submerged under water?	In this case, it is not necessary to inspect DTC P0128.	Go to step **2.**
2	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **3.**
3	**CHECK TIRE SIZE.**	Are all four wheels same as the specified size?	Go to step **4.**	Replace tire.
4	**CHECK ENGINE COOLANT.**	Are coolant level and mixture ratio of cooling water to anti-freeze solution correct?	Go to step **5.**	Replace engine coolant. <Ref. to CO(H4SO)-12, REPLACEMENT, Engine Coolant.>
5	**CHECK RADIATOR FAN.** 1) Start the engine. 2) Check radiator fan operation.	Does radiator fan continuously rotate for more than 3 minutes during idling?	Repair radiator fan circuit. <Ref. to CO(H4SO)-25, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-27, Radiator Sub Fan and Fan Motor.>	Replace thermostat. <Ref. to CO(H4SO)-19, Thermostat.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** 1) Start engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read data of front oxygen (A/F) sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15 V?	Go to step **3.**	Go to step **4.**
3	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** 1) Race engine at speeds from idling to 5,000 rpm for a total of 5 cycles. 2) Read data of front oxygen (A/F) sensor signal during racing using Subaru Select Monitor or general scan tool. NOTE: •Normally, A/F mixture ratio is rich with racing engine. •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.	Is the measured value more than 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 connector from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance between ECM and front oxygen (A/F) sensor. ***Connector & terminals*** ***(B136) No. 13 — (B18) No. 1:*** ***(B136) No. 22— (B18) No. 2:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair open circuit between ECM and front oxygen (A/F) sensor.
5	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.** Measure resistance between ECM and chassis ground. ***Connector & terminals*** ***(B136) No. 13 — Chassis ground:*** ***(B136) No. 22 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

Step		Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any malfunction in exhaust system?	Repair or replace malfunctioning parts.	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

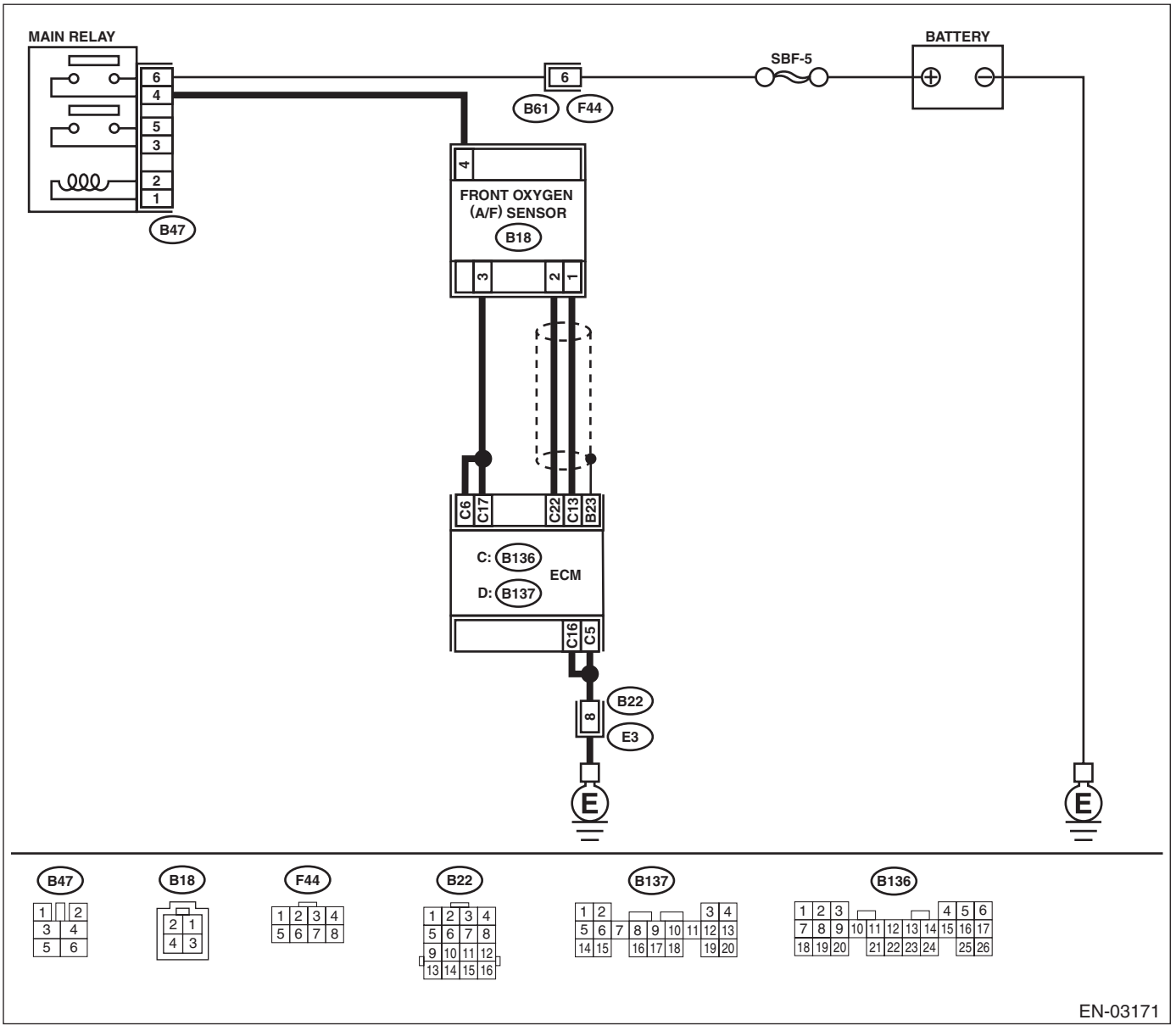
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



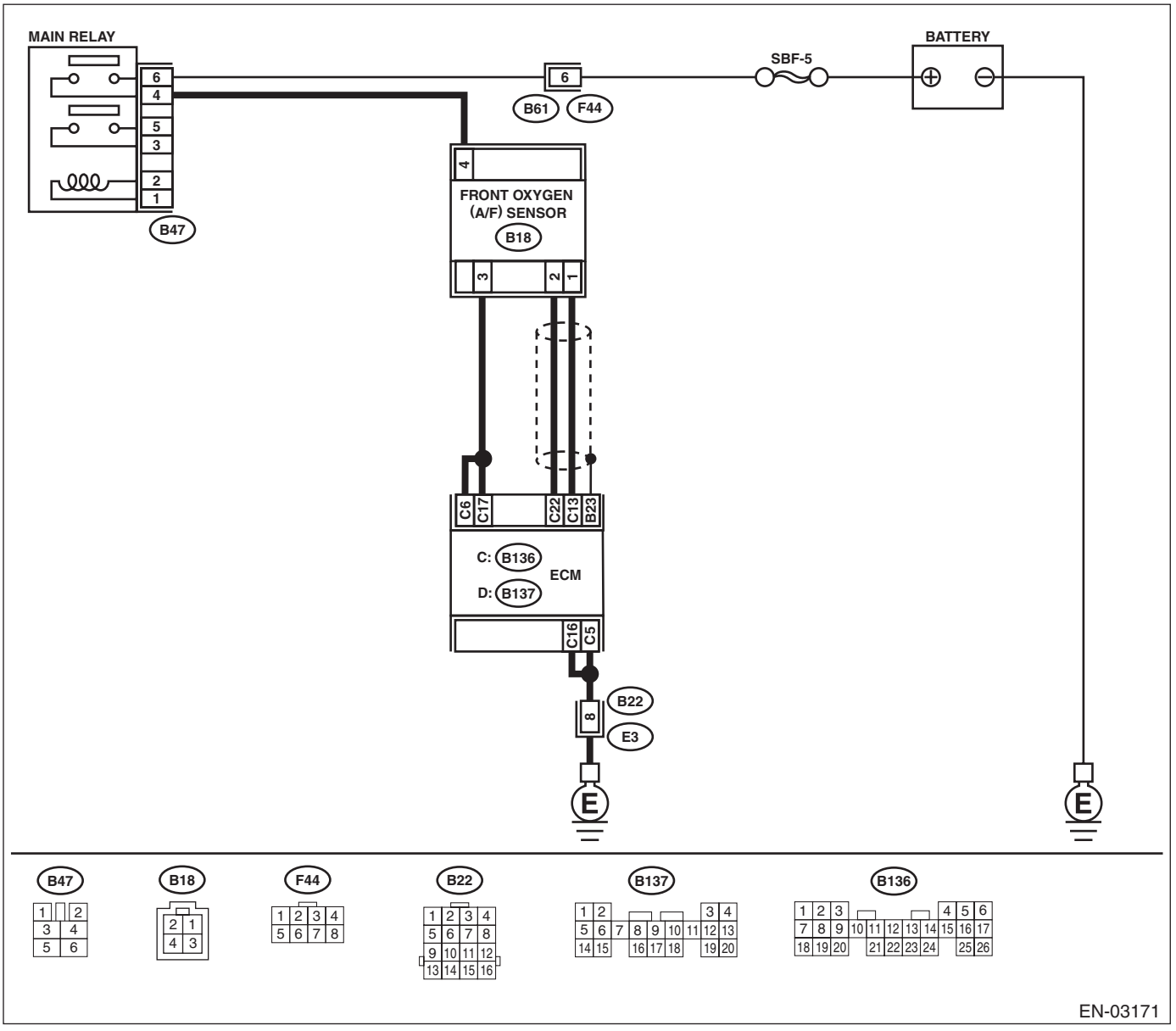
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 13 — Chassis ground:*** ***(B136) No. 22 — Chassis ground:***	Is the measured value more than 1 MΩ?	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>	Repair short circuit between ECM and front oxygen (A/F) sensor connector.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



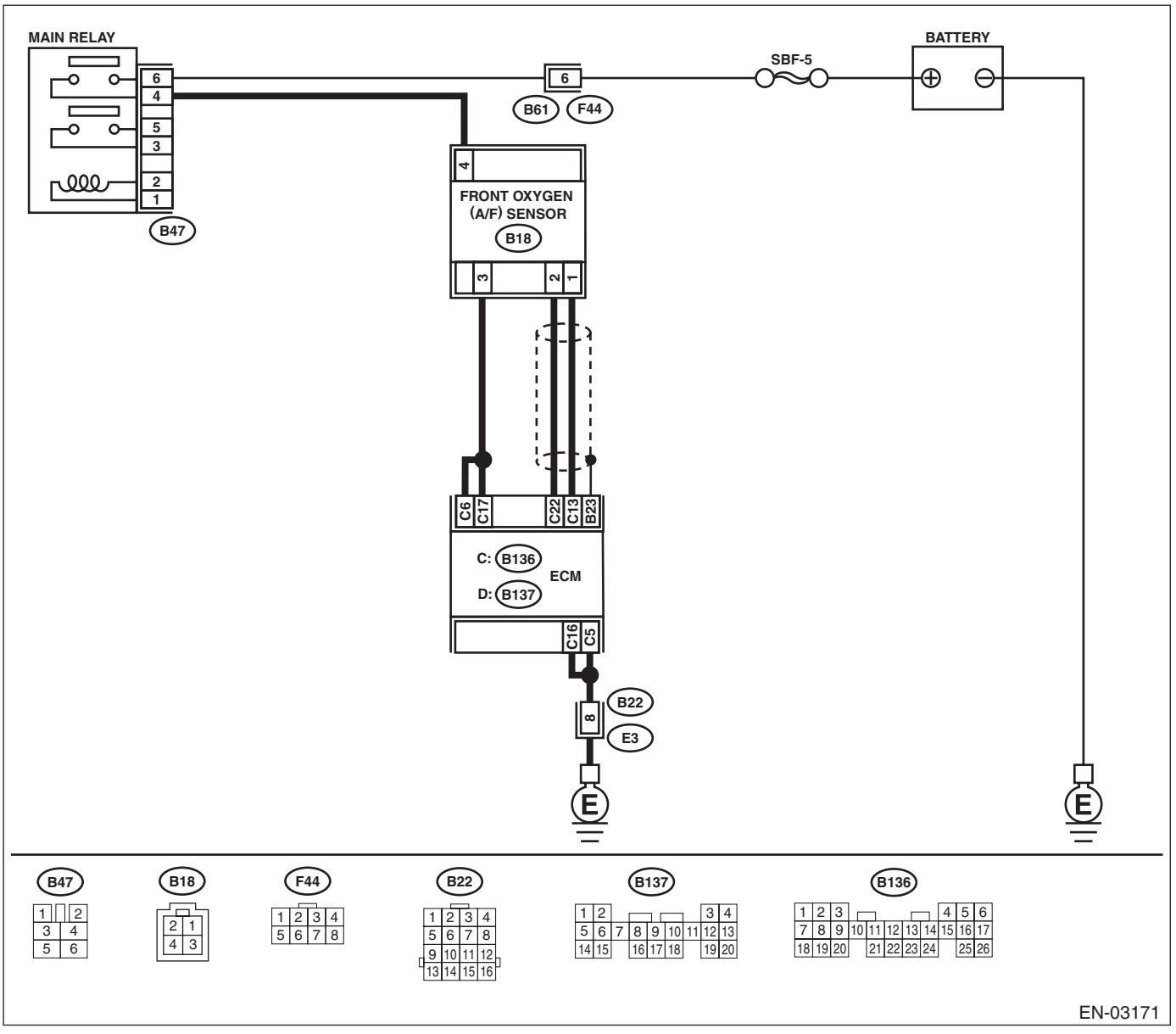
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure voltage of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 13 (+) — Chassis ground (-):*** ***(B136) No. 22 (+) — Chassis ground (-):***	Is the measured value more than 8 V?	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>	Repair battery short circuit 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:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



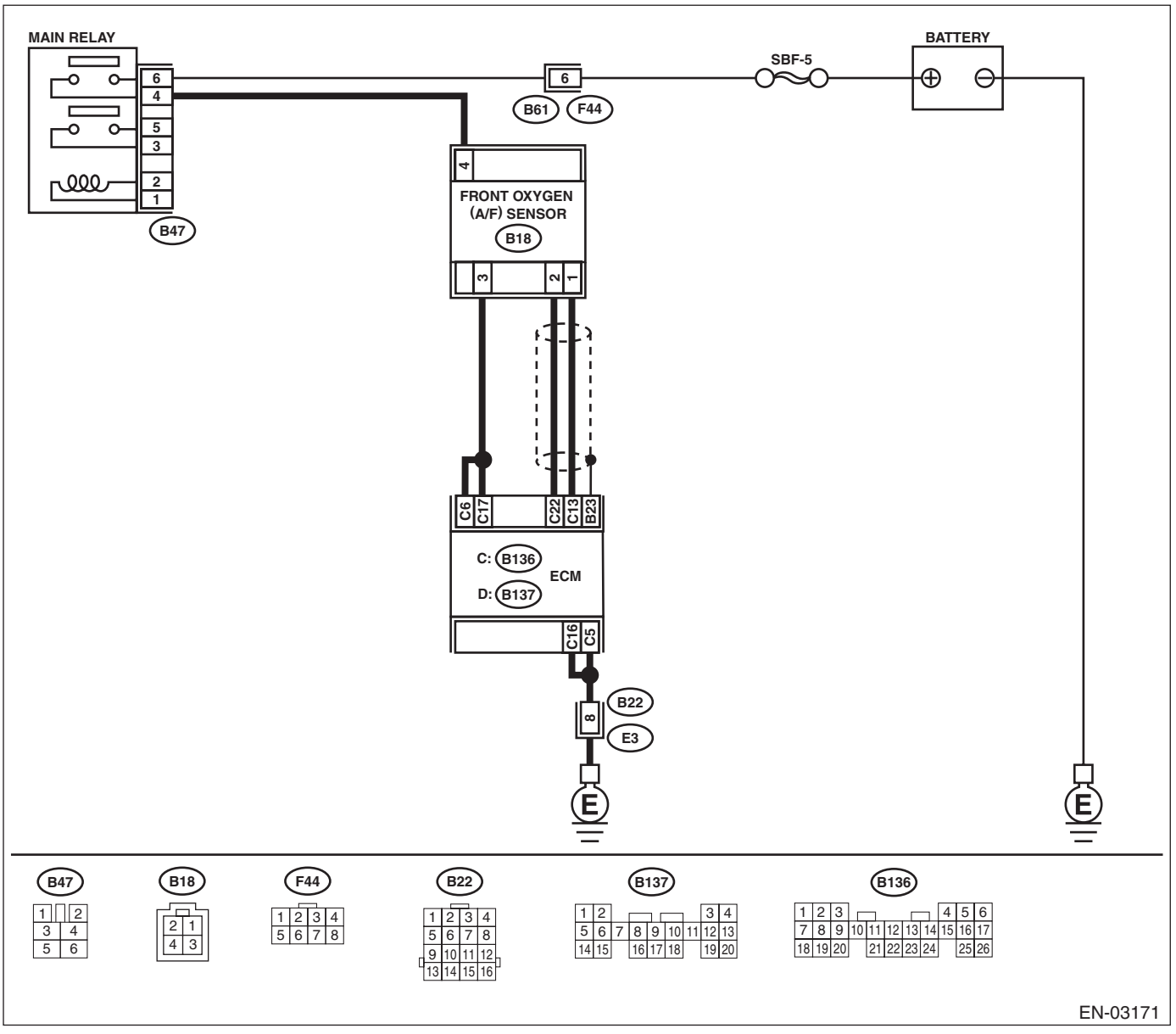
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0133.	Go to step **2.**
2	**CHECK 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	Is there any malfunction in exhaust system?	Repair exhaust system.	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

AA:DTC P0134 — O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



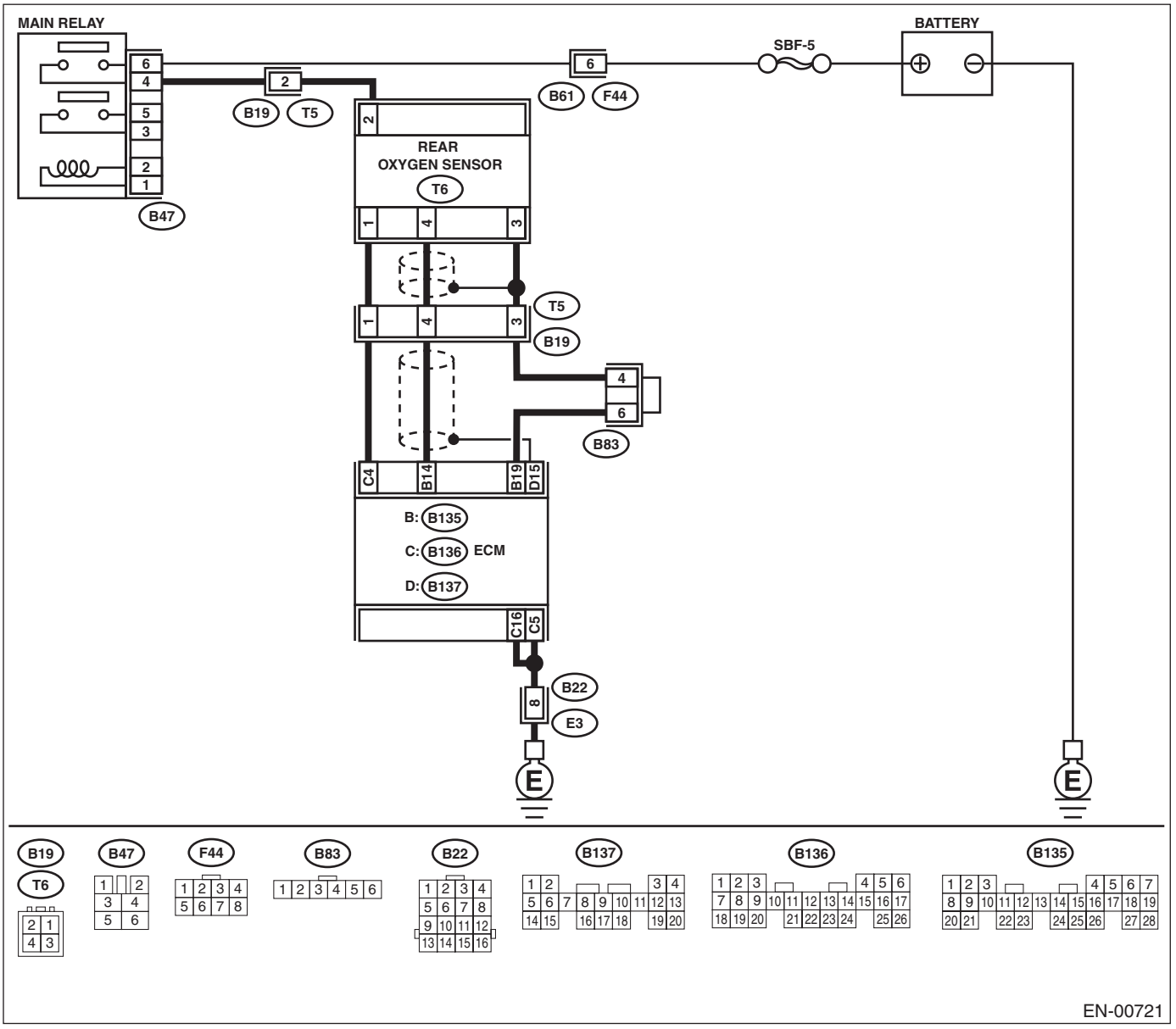
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 13 — (E18) No. 1:*** ***(B136) No. 22 — (B18) No. 2:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fornt oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector
2	**CHECK POOR CONTACT.** Chack poor contact in front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair poor contact in front oxygen (A/F) sensor connector.	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



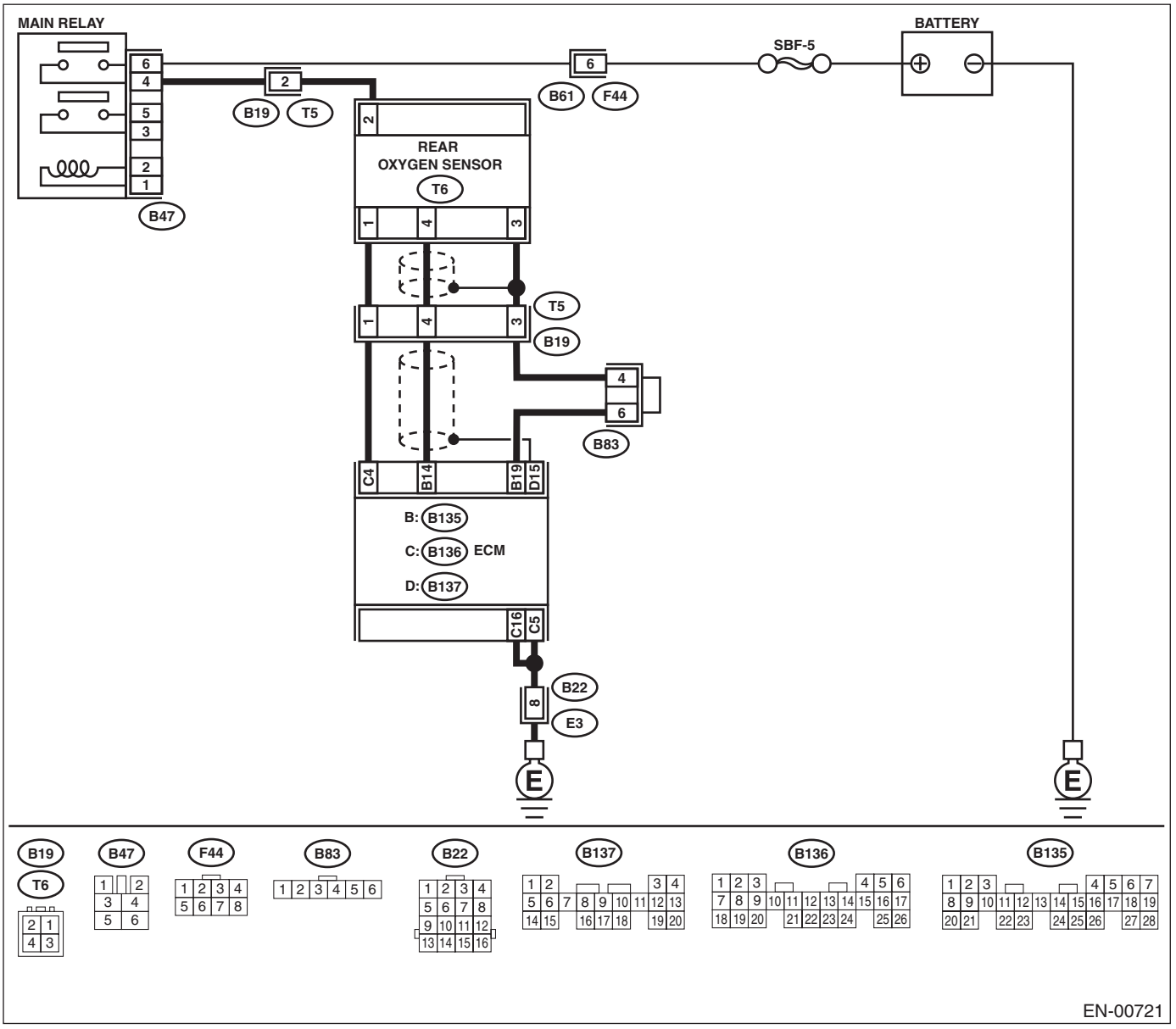
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0131, P0132 or P0134?	Repair referring procedure for P0131, P0132 and P0134. NOTE: In this case, checking procedure for P0137 is not necessary.	Go to step **2.**
2	**CHECK REAR OXYGEN 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 for two minutes. 2) Read data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 connectors from ECM and rear oxygen sensor. 3) Measure resistance of harness between ECM and rear oxygen sensor connector. ***Connector & terminal*** ***(B135) No. 14 — (T6) No. 4:*** ***(B135) No. 19 — (T6) No. 3:***	Is the measured value more than 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 connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure voltage between rear oxygen sensor harness connector and engine ground or chassis ground. ***Connector & terminal*** ***(T6) No. 4 (+) — Engine ground (−):***	Is the measured value within 0.2 to 0.5 V?	Replace rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen 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
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any malfunction in exhaust system?	Repair or replace malfunctioning parts.	Replace rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.>

AC:DTC P0138 — O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTCX displayed?	Check DTC referring "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, CHECKING procedure for P0138 is not necessary.	Go to step **3.**
2	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and race engine until the engine speed reaches to 5,000 rpm and release accelerator pedal rapidly. 2) Read data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 connectors from ECM and rear oxygen sensor. 3) Measure resistance of harness between ECM and rear oxygen sensor connector. ***Connector & terminal*** ***(B135) No. 14 — (T6) No. 4:*** ***(B135) No. 19 — (T6) No. 3:***	Is the measured value more than 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 connector from rear oxygen sensor. 3) Turn ignition switch to ON. 4) Measure voltage between rear oxygen sensor harness connector and engine ground or chassis ground. ***Connector & terminal*** ***(T6) No. 4 (+) — Engine ground (−):***	Is the measured value within 0.2 to 0.5 V?	Replace rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen 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

Step		Check	Yes	No
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any malfunction in exhaust system?	Repair or replace malfunctioning parts.	Replace rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.>

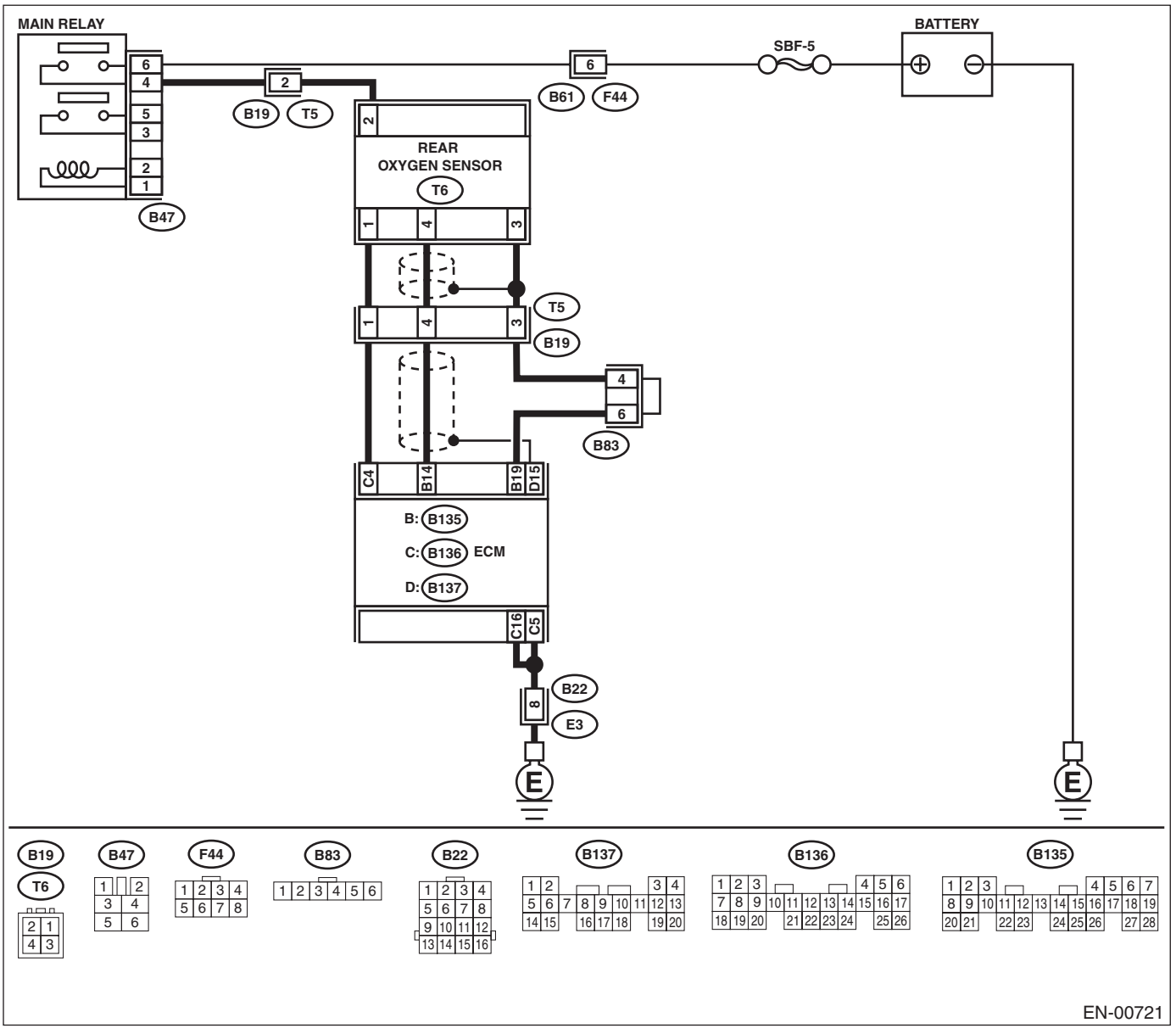
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0139.	Replace rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.>

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

NOTE:
For the diagnostic procedure, refer to DTC P0172. <Ref. to EN(H4SO)-170, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Poor driving performance

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair exhaust system.	Go to step **3.**
3	**CHECK EGR VALVE.**	Is EGR valve clogged?	Replace EGR valve.	Go to step **4.**
4	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step **5.**
5	**CHECK PURGE CONTROL SOLENOID VALVE.**	Is purge control solenoid valve clogged?	Replace purge control solenoid valve.	Go to step **6.**
6	**CHECK PCV VALVE.**	Is PCV valve clogged?	Replace PCV valve.	Go to step **7.**

	Step	Check	Yes	No
7	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release fuel pressure. (1) Disconnect 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 connector to fuel pump relay. 3) Disconnect fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. **Warning:** **Before removing 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.	Is the measured value within 284 to 314 kPa (2.9 to 3.2 kg/cm^2, 41 to 46 psi)?	Go to step **8.**	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
8	**CHECK FUEL PRESSURE.** After connecting pressure regulator vacuum hose, measure fuel pressure. **Warning:** **Before removing 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.	Is the measured value within 206 to 235 kPa (2.1 to 2.4 kg/cm^2, 30 to 34 psi)?	Go to step **9.**	Repair the following items. **Fuel pressure too high** • Malfunctioning pressure regulator • Clogged fuel return line or bent hose **Fuel pressure too low** • Malfunctioning pressure regulator • Improper fuel pump discharge • Clogged fuel supply line

	Step	Check	Yes	No
9	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm-up completely. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 70 to 100°C (158 to 212°F)?	Go to step **10.**	Replace engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>
10	**CHECK INTAKE MANIFOLD 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 A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 24.0 to 41.3 kPa (180 to 310 mmHg, 7.09 to 12.20 inHg) when idling or within 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) when turning ignition switch ON?	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace intake air temperature and pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>

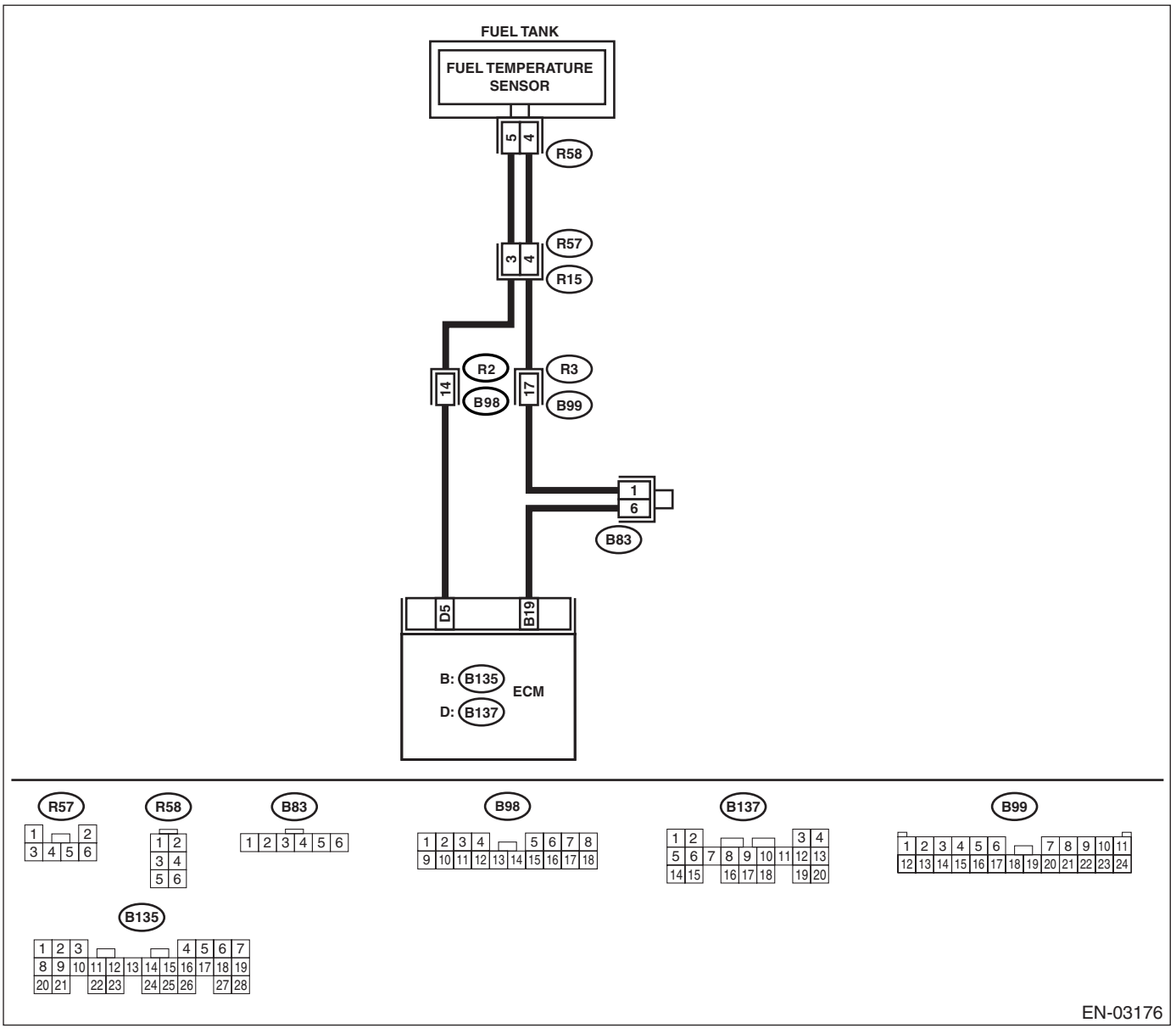
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



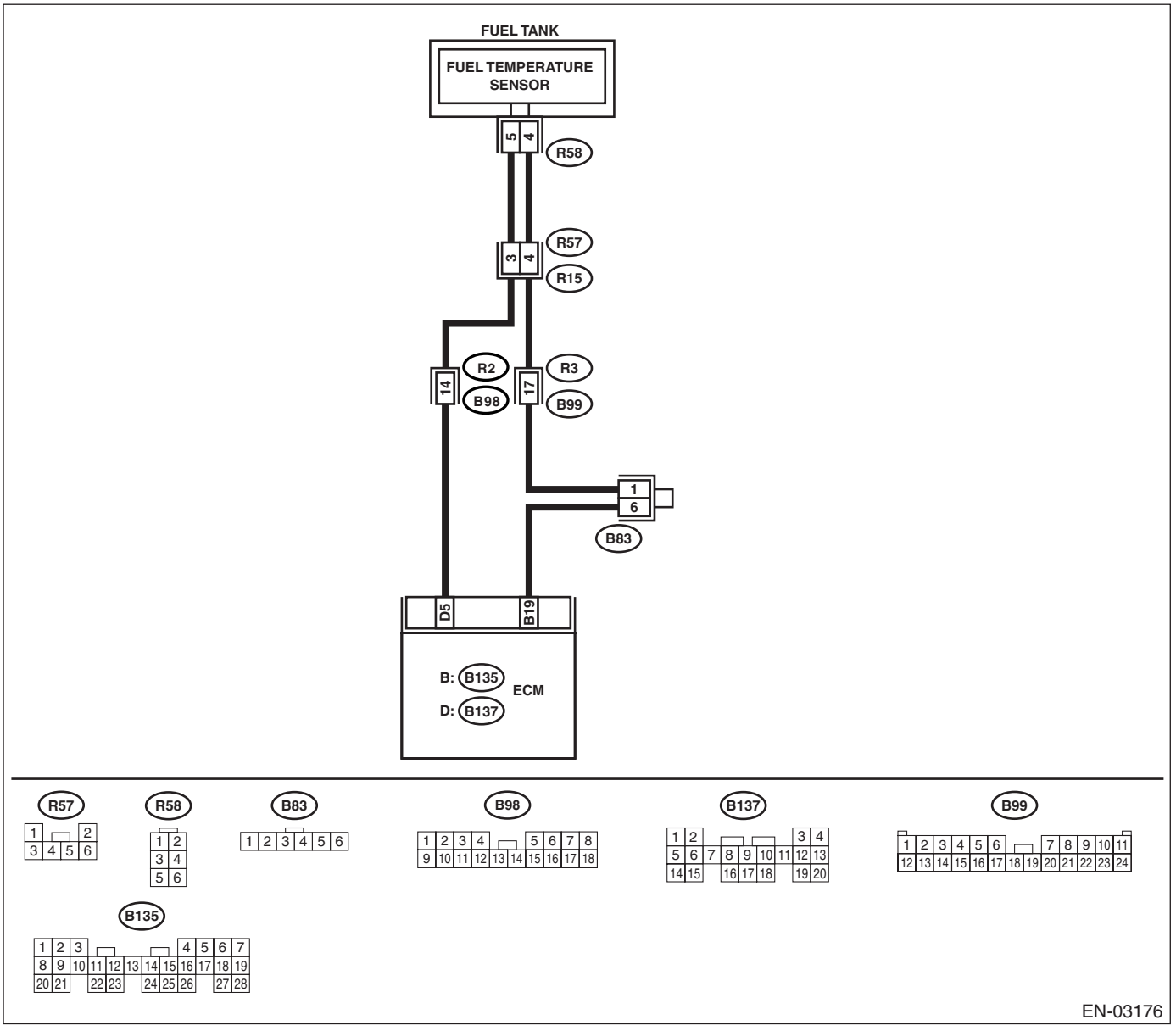
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0181.	Replace fuel temperature sensor. <Ref. to EC(H4SO)-9, Fuel Temperature Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03176

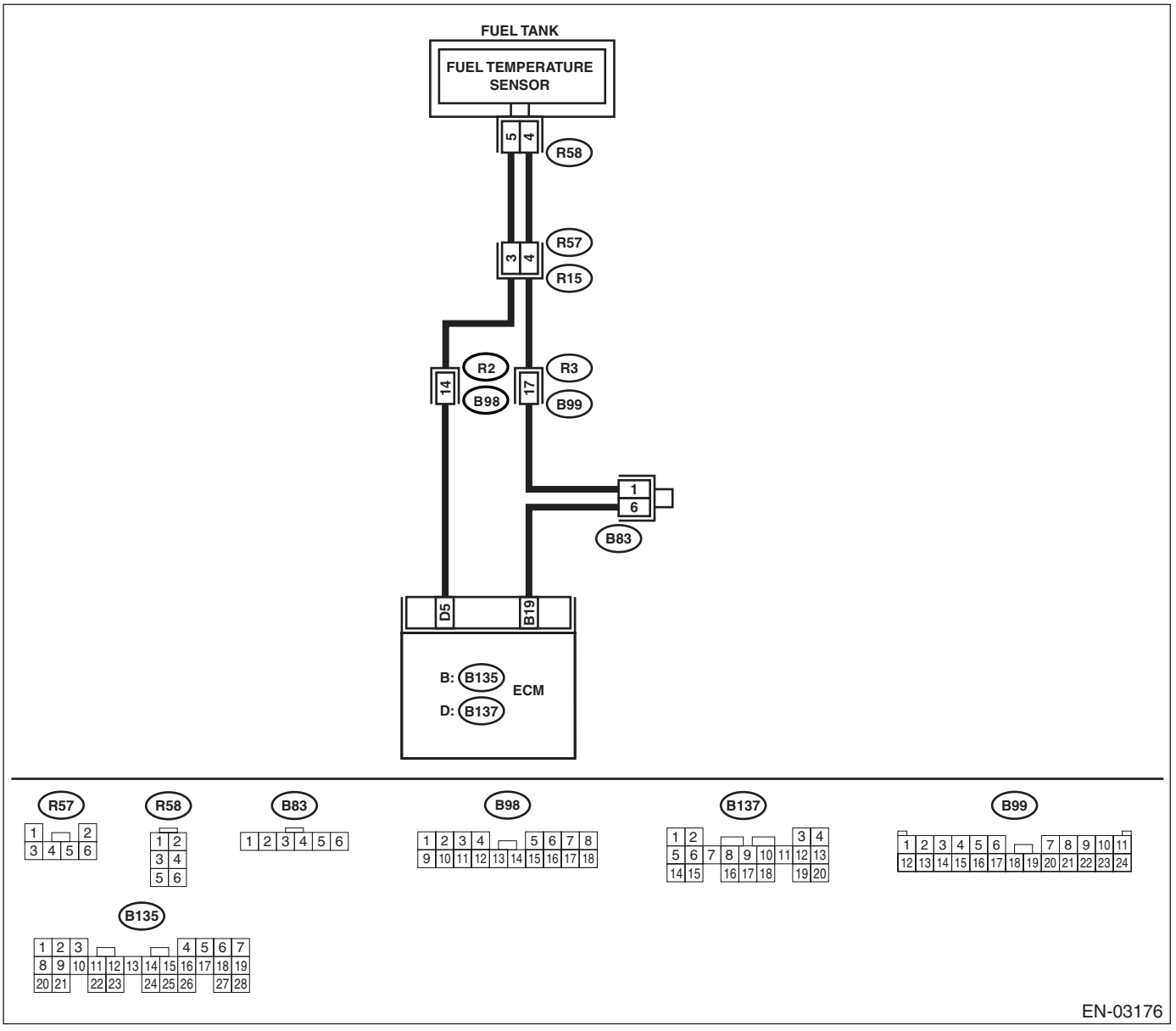
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of fuel temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 150°C (302°F)?	Go to step **2.**	Even if MIL lights up, the circuit has returned to a normal condition at this time.
2	**CHECK CURRENT DATA.** 1) Turn ignition switch to OFF. 2) Remove access hole lid. 3) Disconnect connector from fuel pump. 4) Turn ignition switch to ON. 5) Read data of fuel temperature sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Replace fuel temperature sensor. <Ref. to EC(H4SO)-9, Fuel Temperature Sensor.>	Repair ground short circuit in harness between fuel pump and ECM connector.

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start engine. 2) Read data of fuel temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –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 connectors • Poor contact in joint connector
2	**CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Remove access hole lid. 3) Disconnect connector from fuel pump. 4) Measure voltage between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 5 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit 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 voltage between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 5 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and fuel pump connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.** Measure voltage between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 5 (+) — Chassis ground (–):***	Is the measured value more than 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 connectors

Step		Check	Yes	No
5	**CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance of harness between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 4 — Chassis ground:***	Is the measured value less than 5 Ω?	Replace fuel temperature sensor. <Ref. to EC(H4SO)-9, 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 connectors • 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)-182, 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)-182, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AL:DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

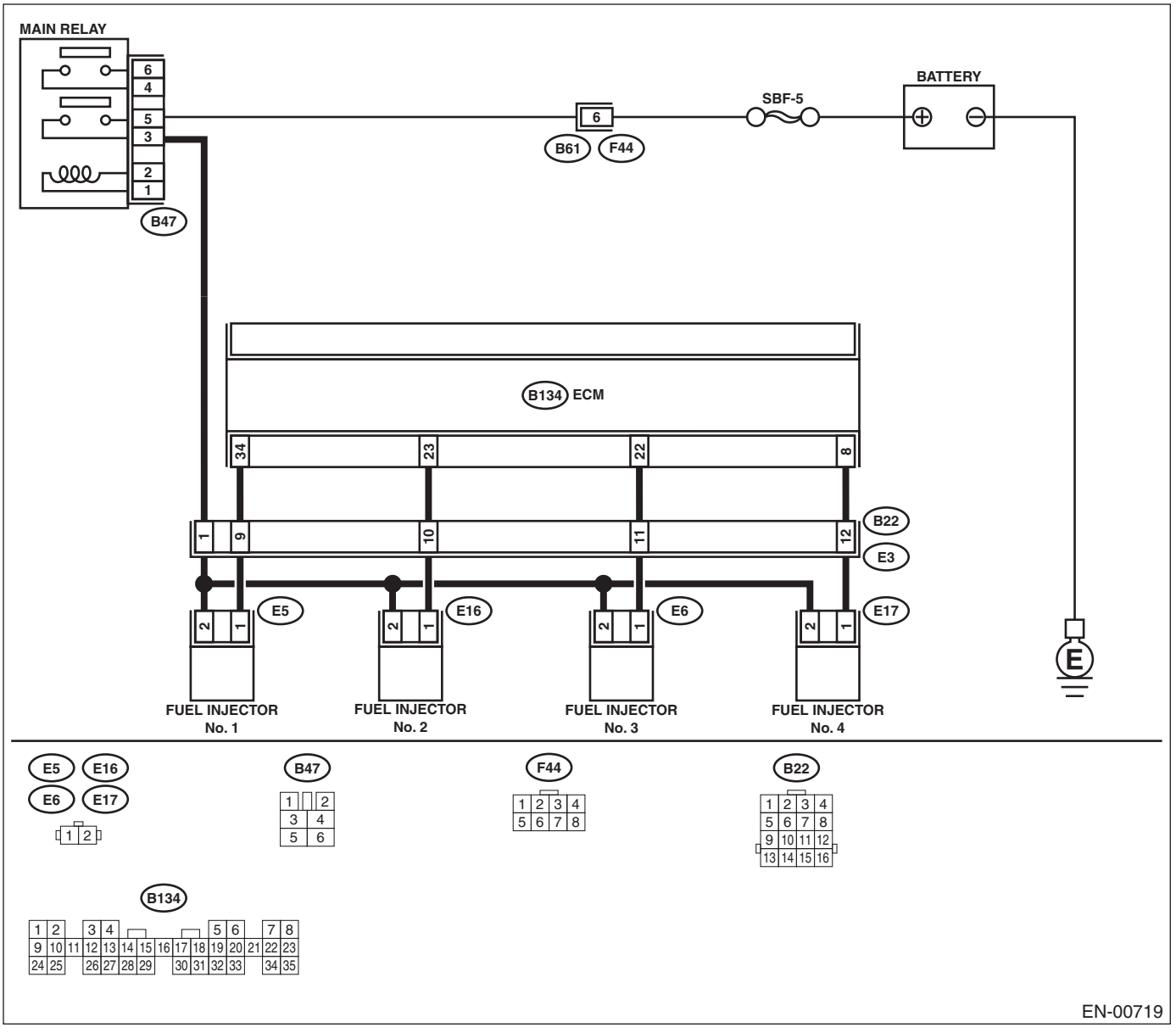
NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)-182, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AM:DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
  - Detected simultaneously at occurrence of malfunction. (When a misfire which could damage catalyst occurs.)
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Erroneous idling
  - Rough driving

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> 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 voltage between ECM connector and chassis ground on malfunctioning cylinders. ***Connector & terminal*** ***#1 (B134) No. 34 (+) — Chassis ground (–):*** ***#2 (B134) No. 23 (+) — Chassis ground (–):*** ***#3 (B134) No. 22 (+) — Chassis ground (–):*** ***#4 (B134) No. 8 (+) — Chassis ground (–):***	Is the measured value more than 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 connector from fuel injector on malfunctioning cylinders. 3) Measure voltage between ECM connector and engine ground on malfunctioning 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 less than 10 Ω?	Repair ground short circuit in harness between fuel injector and ECM connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR.** Measure resistance of harness connector between ECM connector and fuel injector on malfunctioning cylinders. ***Connector & terminal*** ***#1 (B134) No. 34 — (E5) No. 1:*** ***#2 (B134) No. 23 — (E16) No. 1:*** ***#3 (B134) No. 22 — (E6) No. 1:*** ***#4 (B134) No. 18 — (E17) No. 1:***	Is the measured value less than 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 resistance between fuel injector terminals on malfunctioning cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 5 to 20 Ω?	Go to step **6.**	Replace faulty fuel injector. <Ref. to FU(H4SO)-38, Fuel Injector.>

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY LINE.** 1) Turn ignition switch to ON. 2) Measure voltage between fuel injector and engine ground on malfinctioning 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 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 malfunctioning cylinders • Poor contact in coupling connector • Poor contact in main relay connector • Poor contact in fuel injector connector on malfunctioning cylinders
7	**CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel injector on malfunctioning cylinder. 3) Turn ignition switch to ON. 4) Measure voltage between ECM connector and chassis ground on malfunctioning cylinders. ***Connector & terminal*** ***#1 (B134) No. 34 (+) — Chassis ground (–):*** ***#2 (B134) No. 23 (+) — Chassis ground (–):*** ***#3 (B134) No. 22 (+) — Chassis ground (–):*** ***#4 (B134) No. 8 (+) — Chassis ground (–):*** Does the measured value exceed the specified value?	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and fuel injector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **8.**
8	**CHECK FUEL INJECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between fuel injector terminals on malfunctioning cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace malfunctioning fuel injector <Ref. to FU(H4SO)-38, Fuel Injector.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **9.**
9	**CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is camshaft position sensor or crankshaft position sensor loosely installed?	Tighten camshaft position sensor or crankshaft position sensor.	Go to step **10.**
10	**CHECK CRANKSHAFT SPROCKET.** Remove timing belt cover.	Is crankshaft sprocket rusted or does it have broken teeth?	Replace crankshaft sprocket. <Ref. to ME(H4SO)-50, Crankshaft Sprocket.>	Go to step **11.**

	Step	Check	Yes	No
11	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt.>	Go to step **12.**
12	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **13.**	Replenish fuel so fuel meter indication is higher than the “Lower” level. After replenishing fuel, Go to step **13.**
13	**CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL).** 1) Clear memory using Subaru Select Monitor. <Ref. to EN(H4SO)-50, Clear Memory Mode.> 2) Start engine, and drive the vehicle more than 10 minutes.	Is the MIL coming on or blinking?	Go to step **15.**	Go to step **14.**
14	**CHECK CAUSE OF MISFIRE DIAGNOSED.** NOTE: Disconnected spark plug code, etc.	Was the cause of misfire diagnosed when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	(1) Repair poor contact. NOTE: In this case, repair the following: • Poor contact in ignitor connector • Poor contact in ignition coil connector • Poor contact in fuel injector connector on malfunctioning cylinders • Poor contact in ECM connector • Poor contact in coupling connector (2) If there is no poor contact, contact SOA (distributor). Before contacting, the following items must be checked: • Fuel for condition • Fuel additives • Spark plug for condition • Plug code for condition • Engine oil for condition

Step		Check	Yes	No
15	**CHECK AIR INTAKE SYSTEM.**	Is there any malfunction in air intake system?	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 **16.**
16	**CHECK MISFIRE SYMPTOM.** 1) Turn ignition switch to ON. 2) Read diagnostic trouble code (DTC). •Subaru Select Monitor <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Operation Manual. NOTE: Perform diagnosis according to the items listed below.	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step **21.**	Go to step **17.**
17	**CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0301 and P0302?	Go to step **22.**	Go to step **18.**
18	**CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0303 and P0304?	Go to step **23.**	Go to step **19.**
19	**CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0301 and P0303?	Go to step **24.**	Go to step **20.**
20	**CHECK DIAGNOSTIC TROUBLE CODE (DTC) ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0302 and P0304?	Go to step **25.**	Go to step **26.**
21	**ONLY ONE CYLINDER**	Is there any malfunction in that cylinder?	Repair or replace malfunctioning parts. NOTE: Check the following items. • Spark plug • Spark plug cord • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Step		Check	Yes	No
22	GROUP OF #1 AND #2 CYLINDERS	Are there malfunctions in #1 and #2 cylinders?	Repair or replace malfunctioning parts. NOTE: • Check the following items. • Spark plugs • Fuel injectors • Ignition coil • Compression ratio • If no abnormal is discovered, check for “IGNITION CONTROL SYSTEM” of #1 and #2 cylinders side. <Ref. to EN(H4SO)-74, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
23	GROUP OF #3 AND #4 CYLINDERS	Are there malfunctions in #3 and #4 cylinders?	Repair or replace malfunctioning parts. NOTE: • Check the following items. • Spark plugs • Fuel injectors • Ignition coil • If no abnormal is discovered, check for “16. D: IGNITION CONTROL SYSTEM” of #3 and #4 cylinders side. <Ref. to EN(H4SO)-74, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	GROUP OF #1 AND #3 CYLINDERS	Are there malfunctions in #1 and #3 cylinders?	Repair or replace malfunctioning parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Step		Check	Yes	No
25	GROUP OF #2 AND #4 CYLINDERS	Are there malfunctions in #2 and #4 cylinders?	Repair or replace malfunctioning parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
26	CYLINDER AT RANDOM	Is the engine idle unstable?	Go to DTC P0171. <Ref. to EN(H4SO)-170, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace malfunctioning parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Compression ratio

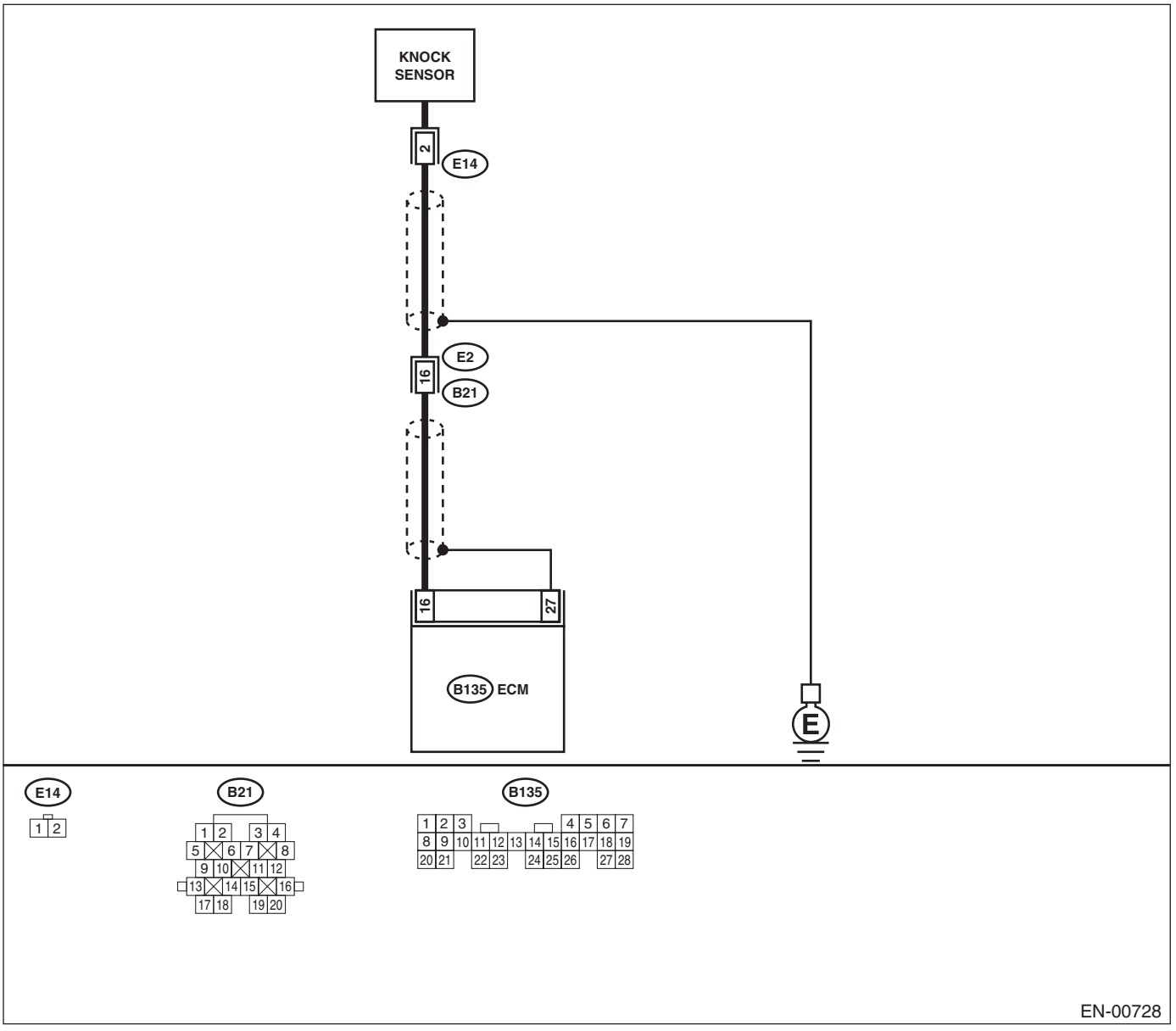
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Poor driving performance
  - Knocking occurs.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



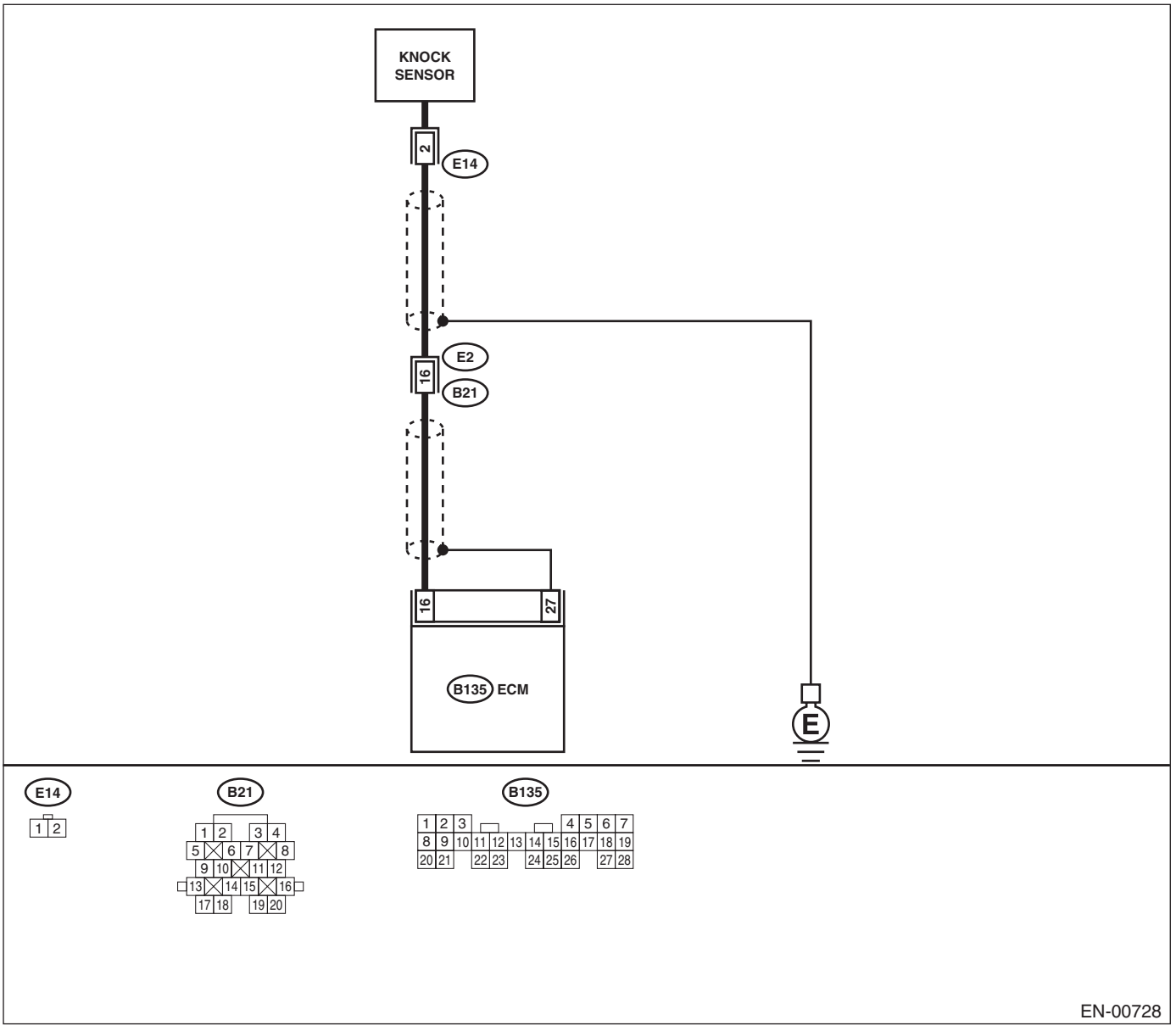
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance between ECM harness connector and chassis ground. ***Connector & terminal*** ***(B135) No. 16 — Chassis ground:***	Is the measured value more than 700 kΩ?	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 connector from knock sensor. 2) Measure resistance between knock sensor connector terminal and engine ground. ***Terminal*** ***No. 2 — Engine ground:***	Is the measured value more than 700 kΩ?	Go to step **3.**	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
3	**CHECK CONDITION OF KNOCK SENSOR INSTALLATION.**	Is the knock sensor installation bolt tightened securely?	Replace 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:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Poor driving performance
  - Knocking occurs.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



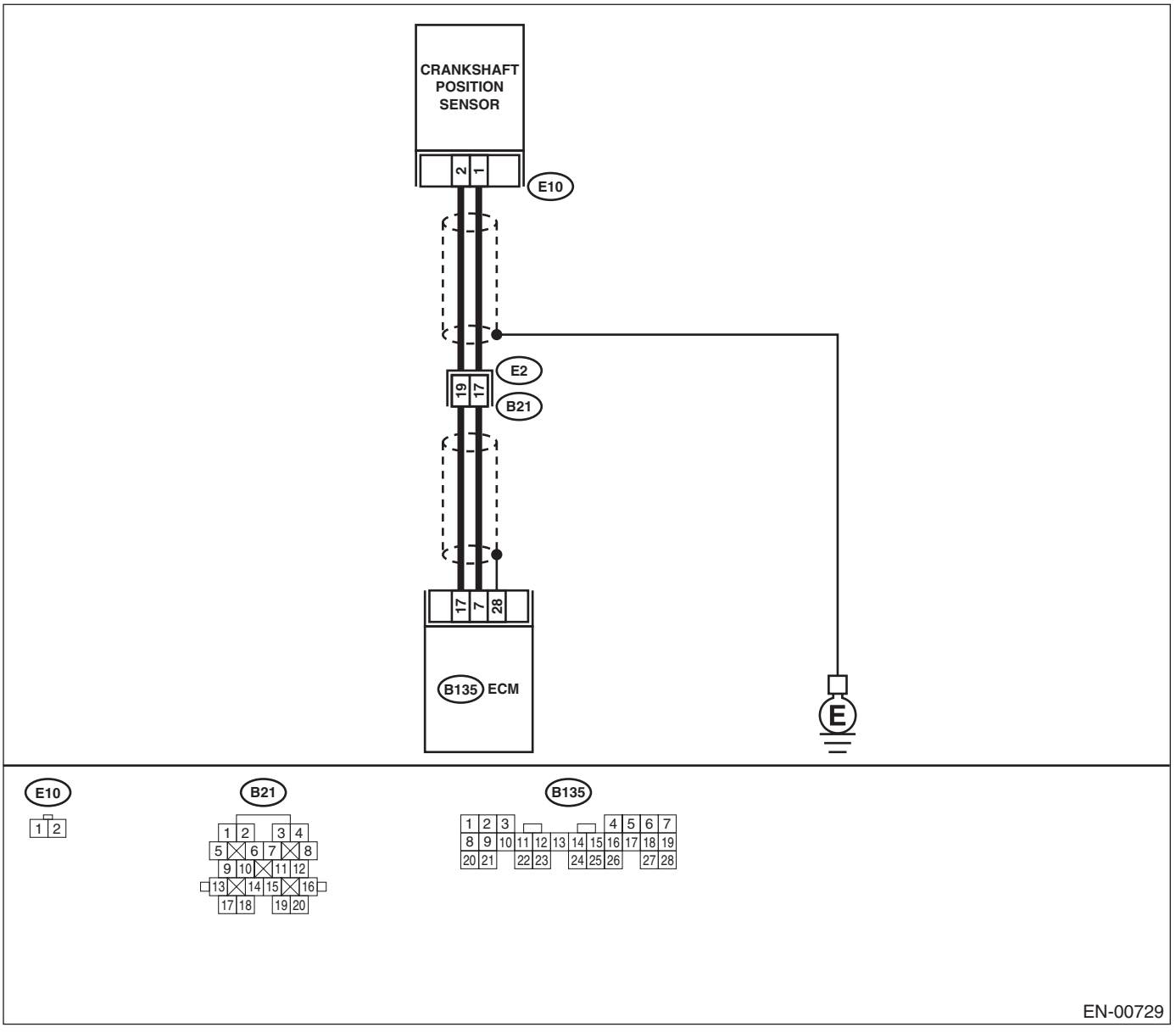
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.** Measure resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 16 — Chassis ground:***	Is the measured value less than 400 kΩ?	Go to step **2.**	Go to step **3.**
2	**CHECK KNOCK SENSOR.** 1) Disconnect connector from knock sensor. 2) Measure resistance between knock sensor connector terminal and engine ground. ***Terminal*** ***No. 2 — Engine ground:***	Is the measured value less than 400 kΩ?	Replace knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.>	Repair ground short circuit in harness between knock sensor connector and ECM connector. NOTE: The harness between both connectors is shielded. Repair short circuit of harness together with shield.
3	**CHECK INPUT SIGNAL FOR ECM.** 1) Connect connectors to ECM and knock sensor. 2) Turn ignition switch to ON. 3) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 16 (+) — Chassis ground (−):***	Is the measured value more than 2 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time. (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:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Engine does not start.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



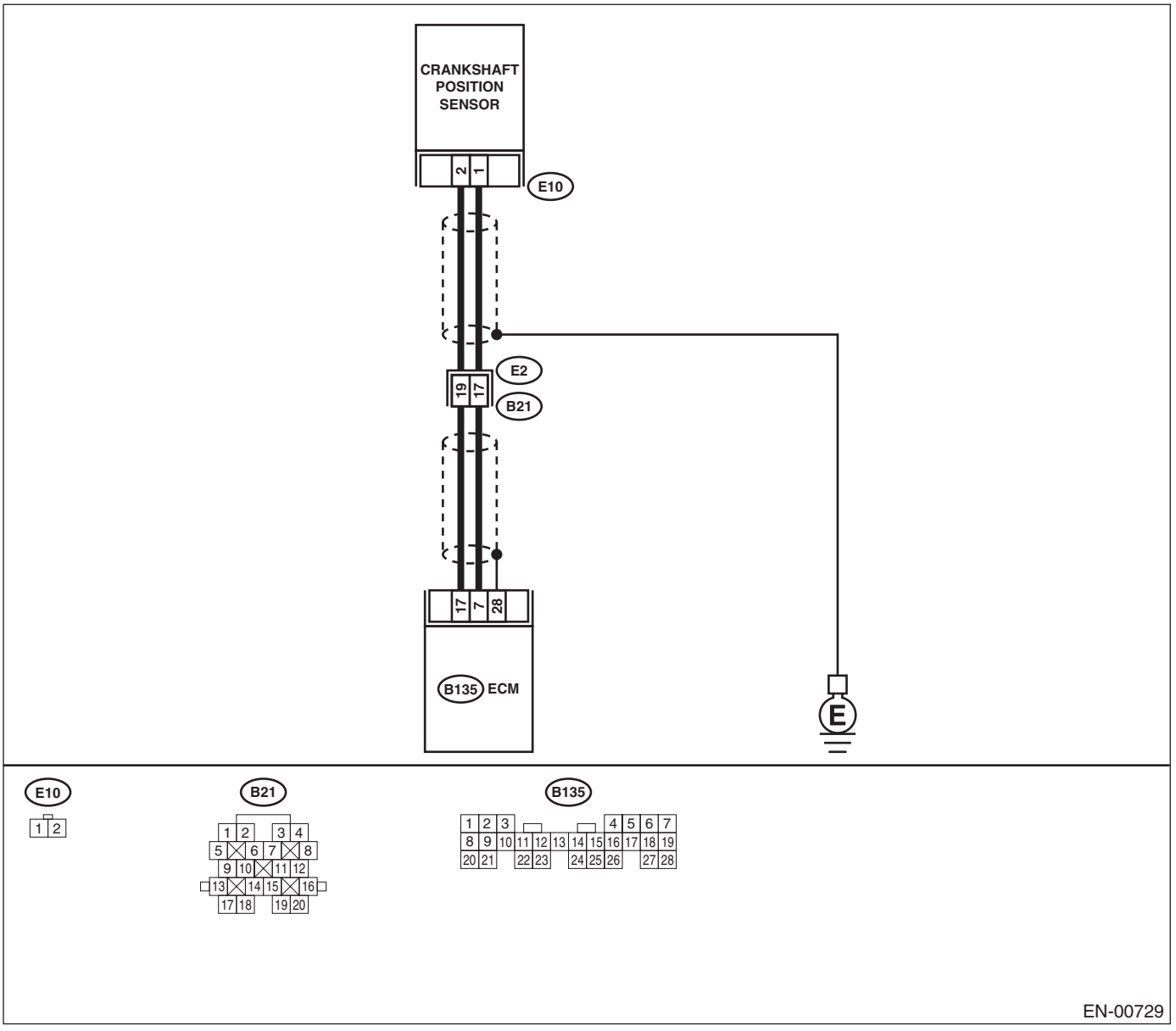
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from crankshaft position sensor. 3) Measure resistance of harness between crankshaft position sensor connector and engine ground. ***Connector & terminal***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

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Engine does not start.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



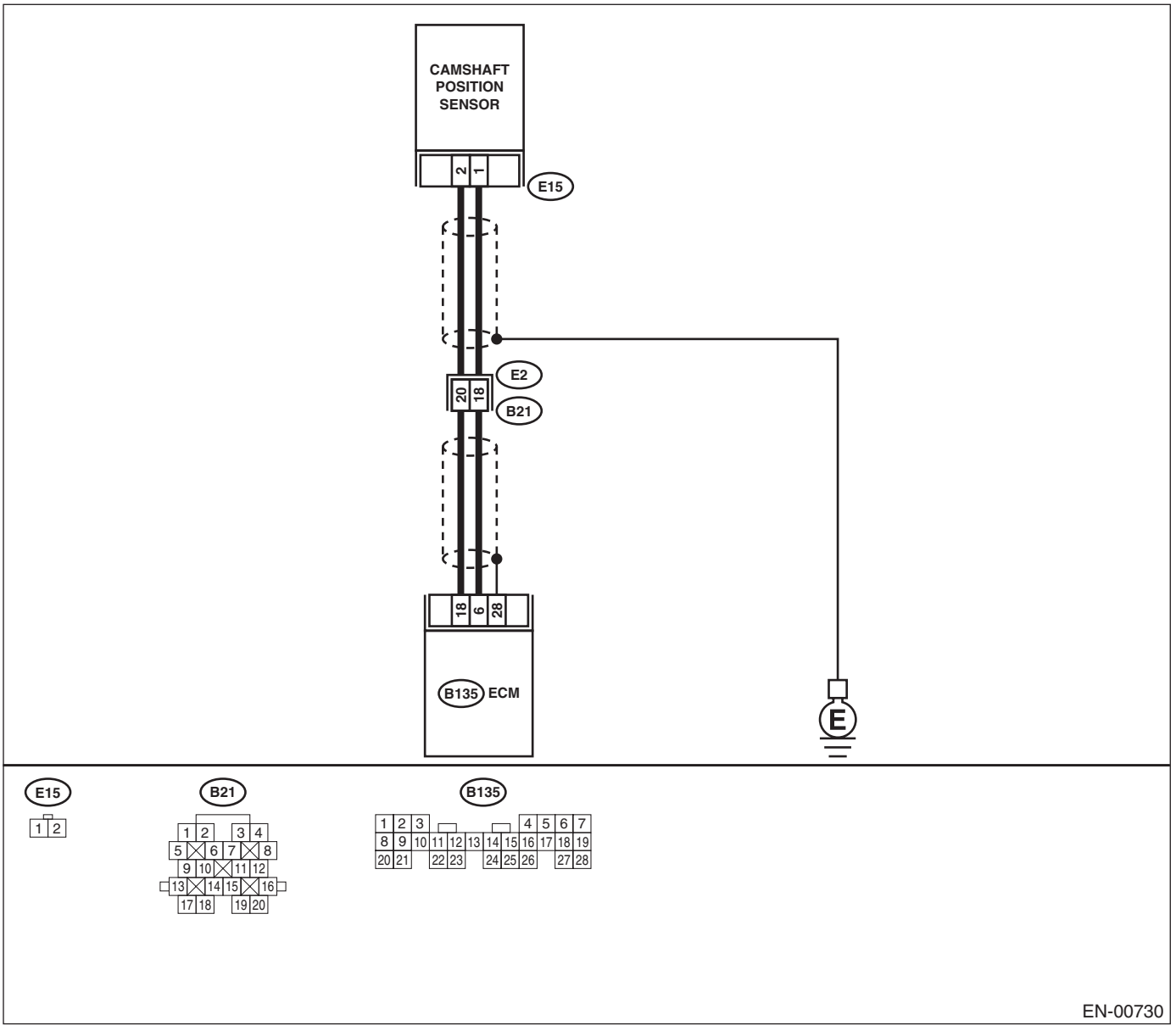
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect DTC P0335 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.** Turn ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **3.**	Tighten crankshaft position sensor installation bolt securely.
3	**CHECK CRANKSHAFT SPROCKET.** Remove front belt cover.	Are crankshaft sprocket teeth cracked or damaged?	Replace crankshaft sprocket. <Ref. to ME(H4SO)-50, Crankshaft Sprocket.>	Go to step **4.**
4	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt.>	Replace 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:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Engine does not start.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



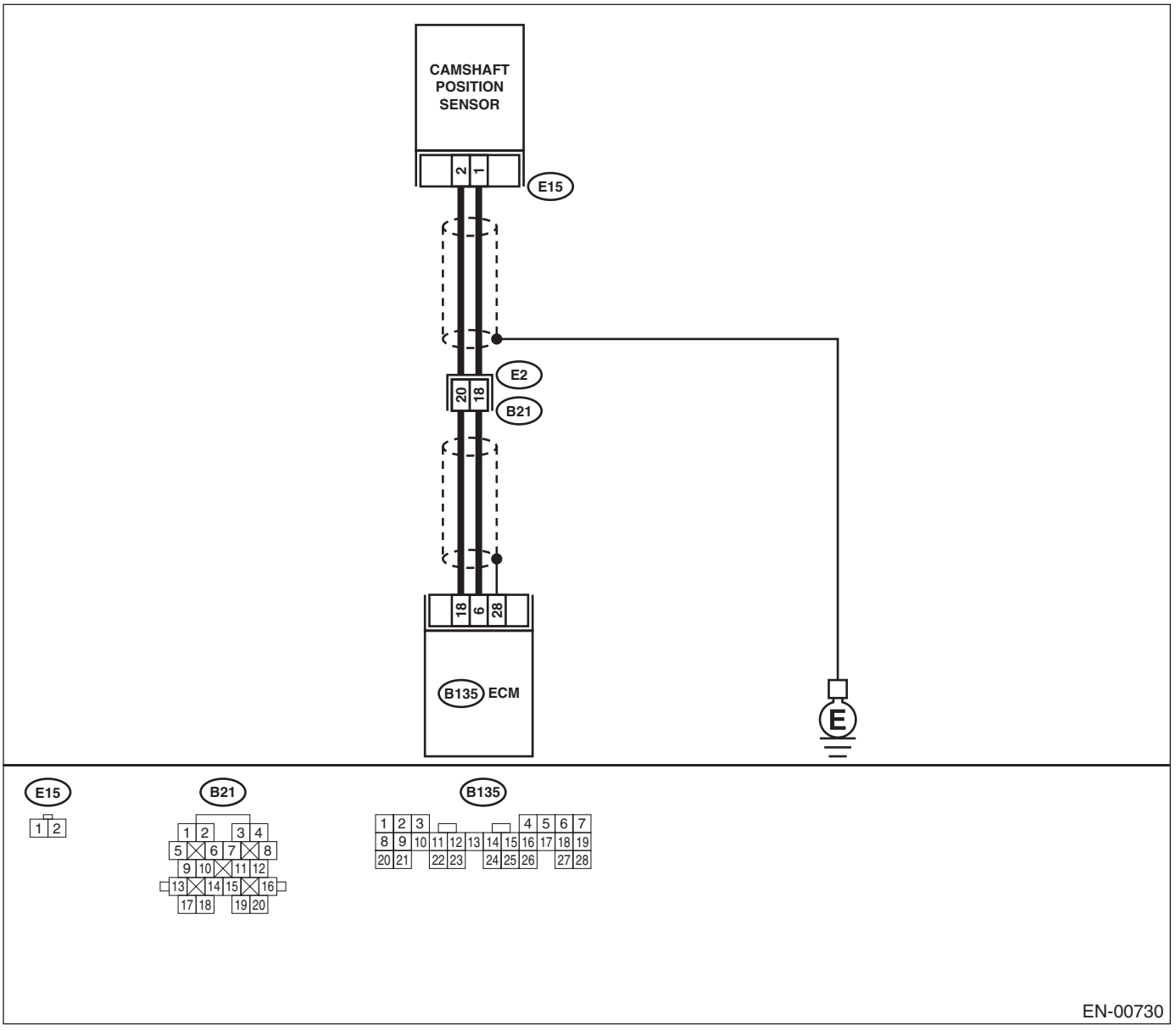
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from camshaft position sensor. 3) Measure resistance of harness between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15)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

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Engine does not start.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect DTC P0340 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from camshaft position sensor. 3) Measure resistance of harness between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15) No. 1 — Engine ground:***	Is the measured value more than 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 resistance of harness between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15) No. 1 — Engine ground:***	Is the measured value less than 10 Ω?	Repair ground short circuit in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.	Go to step **4.**
4	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR.** Measure resistance of harness between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15) No. 2 — Engine ground:***	Is the measured value less than 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?	Go to step **6.**	Tighten camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** 1) Remove camshaft position sensor. 2) Measure resistance between connector terminals of camshaft position sensor. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 1 to 4 kΩ?	Go to step **7.**	Replace camshaft position sensor. <Ref. to FU(H4SO)-29, Camshaft Position Sensor.>

	Step	Check	Yes	No
7	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.** Turn ignition switch to OFF.	Is the camshaft position sensor installation bolt tightened securely?	Go to step **8.**	Tighten camshaft position sensor installation bolt securely.
8	**CHECK CAMSHAFT SPROCKET.** Remove front belt cover.	Are camshaft sprocket teeth cracked or damaged?	Replace camshaft sprocket. <Ref. to ME (H4SO)-, Camshaft Sprocket.>	Go to step **9.**
9	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn camshaft using ST, and align alignment mark on camshaft sprocket with alignment mark on timing belt cover LH.	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt.>	Replace camshaft position sensor. <Ref. to FU(H4SO)-29, Camshaft Position Sensor.>

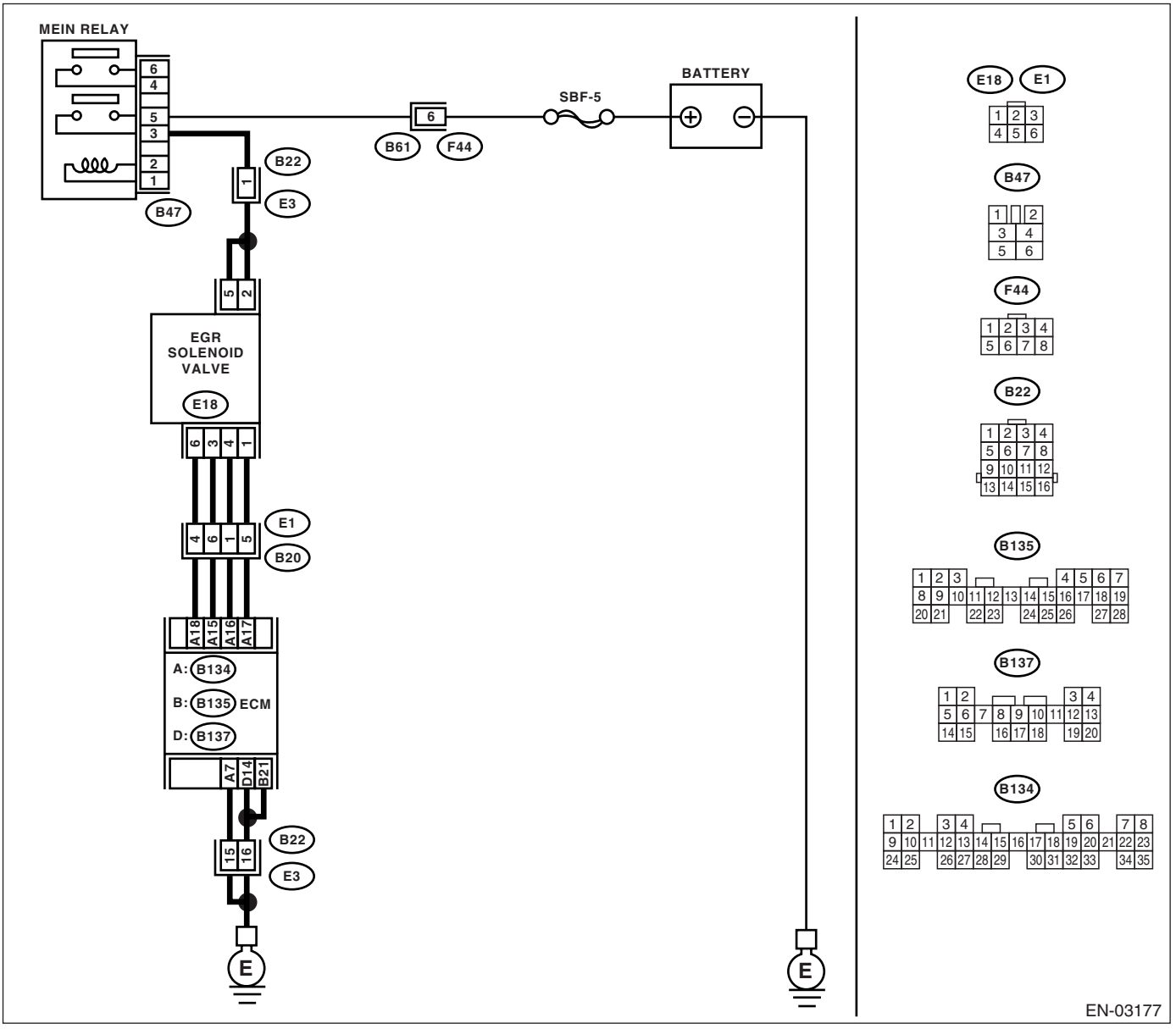
MEMO:

AT:DTC P0400 — EXHAUST GAS RECIRCULATION FLOW —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Poor driving performance on low engine speed
  - Erroneous idling
  - Poor driving performance.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK CURRENT DATA.** 1) Start engine. 2) Rear the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 53.3 kPa (400 mmHg, 15.75 inHg)?	Check if EGR valve, intake manifold pressure sensor and throttle body are securely installed.	Go to step **3.**
3	**CHECK POWER SUPPLY TO EGR SOLENOID VALVE.** 1) Disconnect connector from EGR solenoid valve. 2) Turn ignition switch to ON. 3) Measure voltage between EGR solenoid valve and engine ground. ***Connector & terminal*** ***(E18) No. 2 — Engine ground:*** ***(E18) No. 5 — Engine ground:***	Is the measured value more than 10 V?	Go to step **4.**	Repair open circuit in harness between main relay and EGR solenoid valve connector.
4	**CHECK EGR SOLENOID VALVE.** Measure resistance between EGR solenoid valve terminals. NOTE: Make sure there are no foreign objects caught between EGR solenoid valve and valve seat. ***Terminals*** ***No. 1 — No. 2:*** ***No. 3 — No. 2:*** ***No. 4 — No. 5:*** ***No. 6 — No. 5:***	Is the measured value within 20 to 30 Ω?	Go to step **5.**	Replace EGR solenoid valve. <Ref. to FU(H4SO)-37, EGR Valve.>
5	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect connectors to ECM and EGR solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 15 — Chassis ground:*** ***(B134) No. 16 — Chassis ground:*** ***(B134) No. 17 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:***	Does the measured value change within 0 to 10 V?	Repair poor contact in ECM connector.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN EGR SOLENOID VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from EGR solenoid valve and ECM. 3) Measure resistance of harness between EGR solenoid valve and ECM connector. ***Connector & terminal*** ***(B134) No. 18 — (E18) No. 6:*** ***(B134) No. 17 — (E18) No. 1:*** ***(B134) No. 16 — (E18) No. 4:*** ***(B134) No. 15 — (E18) No. 3:***	Is the measured value less than 1 Ω?	Go to step **7.**	Repair open circuit in harness between ECM and EGR solenoid valve connector.
7	**CHECK HARNESS BETWEEN EGR SOLENOID VALVE AND ECM CONNECTOR.** Measure resistance of harness between EGR solenoid valve and chassis ground. ***Connector & terminal*** ***(E18) No. 1 — Chassis ground:*** ***(E18) No. 3 — Chassis ground:*** ***(E18) No. 4 — Chassis ground:*** ***(E18) No. 6 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **8.**	Repair short circuit in harness between main relay and EGR solenoid valve connector.
8	**CHECK POOR CONTACT.** Check poor contact in ECM and EGR solenoid valve connector.	Is there poor contact in ECM and EGR solenoid valve connector?	Repair poor contact in ECM and EGR solenoid valve connector.	Even if MIL lights up, the circuit has returned to a normal condition at this time.

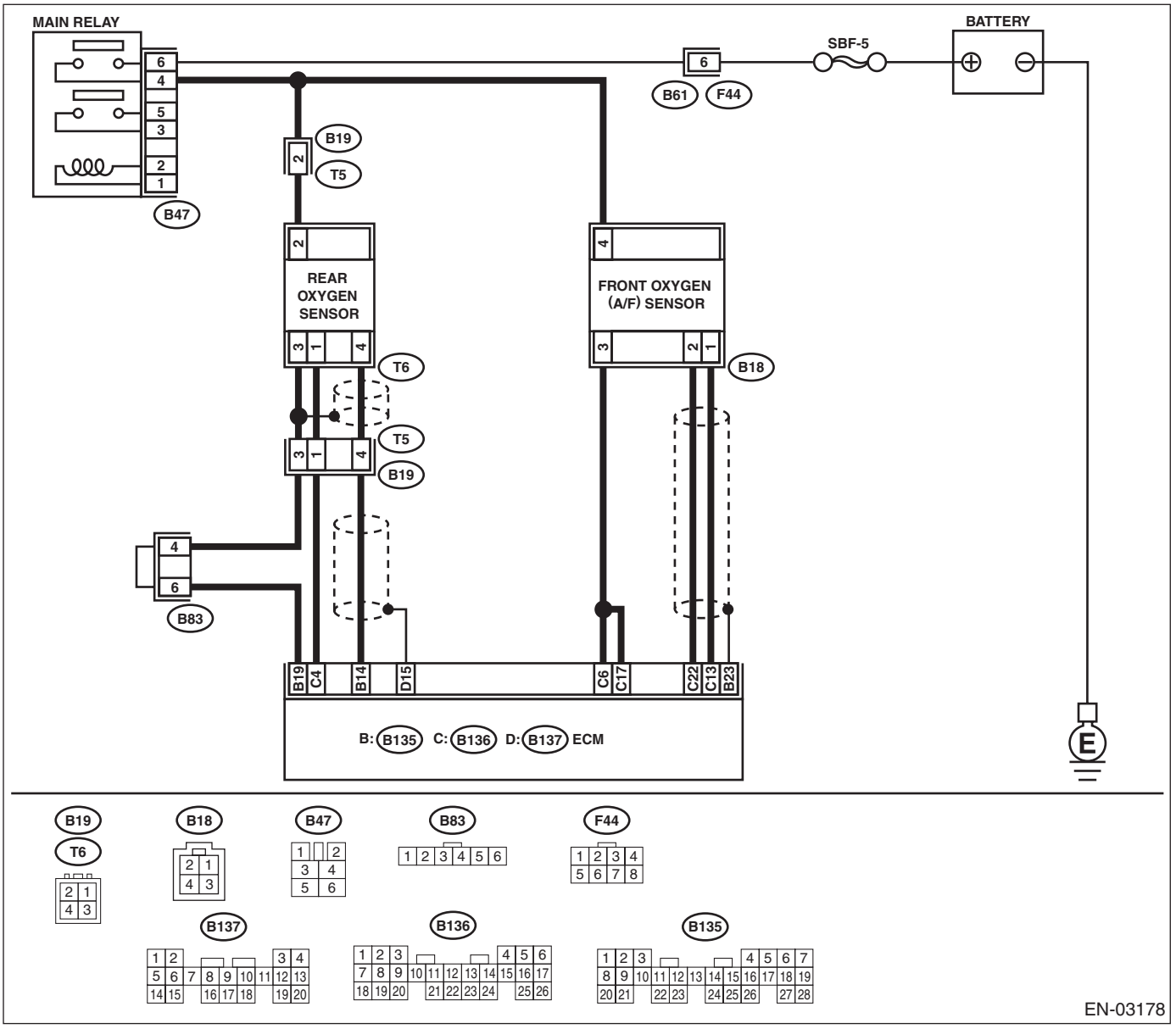
MEMO:

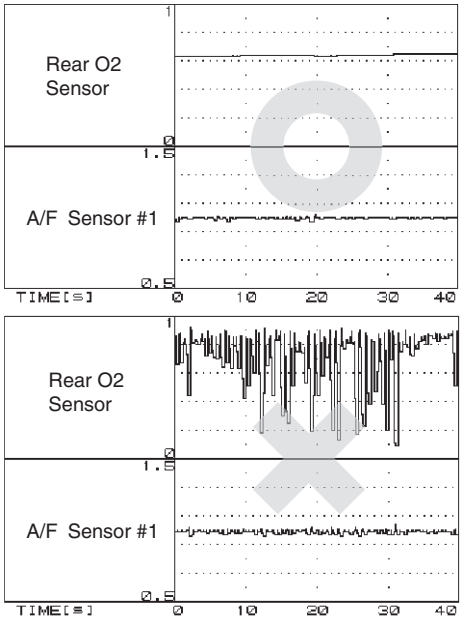
AU:DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —

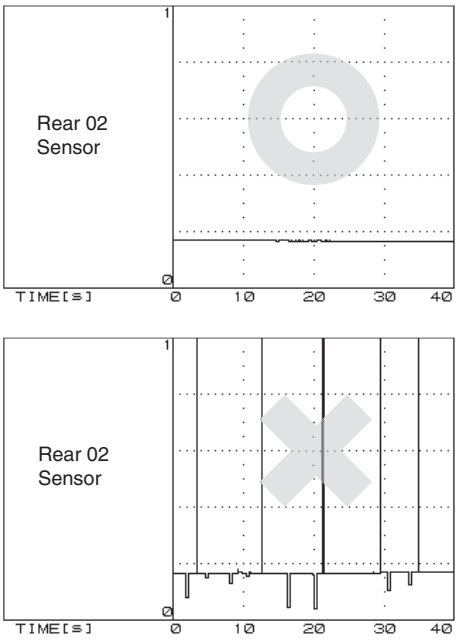
- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Idle mixture is out of specifications.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0420.	Go to step **2.**
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. 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 •Loose part and improper installation of front oxygen (A/F) sensor or rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace the exhaust system. <Ref. to EX(H4SO)-2, General Description.>	Go to step **3.**
3	**CHECK WAVEFORM DATA ON SUBARU SELECT MONITOR (WHILE DRIVING).** 1) Drive the vehicle at a constant speed of 80 — 112 km/h (50 — 70 MPH). 2) Keep the condition of step 1) for 5 minutes, then read the waveform data in a driving condition using Subaru Select Monitor.  EN-04680	Is normal waveform pattern displayed?	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.	Go to step **4.**

	Step	Check	Yes	No
4	**CHECK WAVEFORM DATA ON SUBARU SELECT MONITOR (WHILE IDLING).** 1) Idle the engine. 2) Under the condition of step 1), read the waveform data using Subaru Select Monitor.  EN-04681	Is normal waveform pattern displayed?	Go to step **10.**	Go to step **5.**
5	**CHECK REAR OXYGEN SENSOR VOLTAGE.** 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 3,000 rpm. (Max. 2 minutes) 2) Read the voltage of rear oxygen sensor using Subaru Select Monitor. NOTE: •For MT model, depress the clutch pedal. •Subaru Select Monitor For detailed operation procedure, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Is the voltage more than 490 mV?	Go to step **9.**	Go to step **6.**
6	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Does water enter the connector?	Dry the water thoroughly.	Go to step **7.**
7	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. ***Connector & terminal*** ***(B135) No. 14 — (T6) No. 4:*** ***(B135) No. 19 — (T6) No. 3:***	Is the resistance more than 3 Ω	Repair the open circuit of harness between ECM and rear oxygen sensor connector.	Go to step **8.**

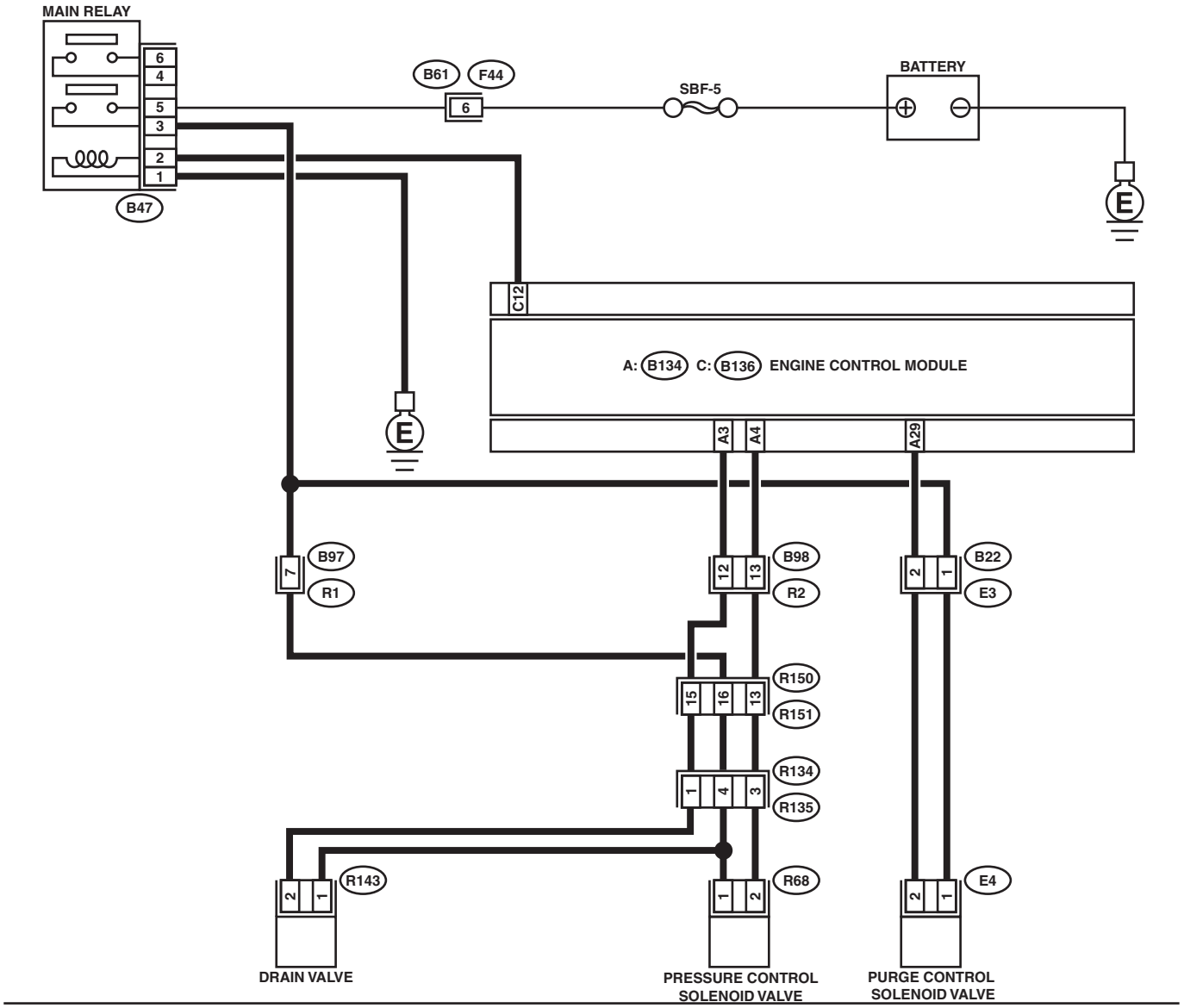
	Step	Check	Yes	No
8	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(T6) No. 4 (+) — Chassis ground (−):***	Is the voltage 0.2 — 0.5 V?	Go to step **11.**	Repair the harness and connector. NOTE: Repair the following. • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor and ECM connector • Poor contact in ECM connector
9	**CHECK REAR OXYGEN SENSOR VOLTAGE.** 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the voltage of rear oxygen sensor using Subaru Select Monitor. NOTE: •For MT model, depress the clutch pedal. •Subaru Select Monitor For detailed operation procedure, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Is the voltage 250 mV or less?	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.	Go to step **6.**
10	**CHECK CATALYTIC CONVERTER.**	Is the catalytic converter damaged?	Replace the catalytic converter. <Ref. to EC(H4SO)-3, Front Catalytic Converter.>	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.
11	**CHECK REAR OXYGEN SENSOR SHIELD.** 1) Turn the ignition switch to OFF. 2) Bare the harness sensor shield on the body side of rear oxygen sensor connector. 3) Measure the resistance between sensor shield and chassis ground.	Is resistance less than 1 Ω	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-44, Rear Oxygen Sensor.>	Repair the open circuit of rear oxygen sensor harness.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Gasoline smell
  - 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 malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03179

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is there any other DTC on display?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC code is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **3.**	Tighten fuel filler cap securely.
3	**CHECK FUEL FILLER CAP.**	Is the genuine fuel filler cap used?	Go to step **4.**	Replace with a 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?	Repair or replace fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-59, Fuel Filler Pipe.>	Go to step **5.**
5	**CHECK DRAIN VALVE.** 1) Connect test mode connector. 2) Turn ignition switch to ON. 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)-51, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step **6.**	Replace drain valve. <Ref. to EC(H4SO)-17, Drain Valve.>
6	**CHECK PURGE CONTROL SOLENOID VALVE.** 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)-51, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step **7.**	Replace purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7	**CHECK PRESSURE CONTROL SOLENOID VALVE.** 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)-51, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step **8.**	Replace pressure control solenoid valve. <Ref. to EC(H4SO)-13, Pressure Control Solenoid Valve.>
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 evaporative emission control system line?	Repair or replace fuel line. <Ref. to FU(H4SO)-72, Fuel Delivery, Return and Evaporation Lines.>	Go to step **9.**

	Step	Check	Yes	No
9	**CHECK CANISTER.**	Is canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **10.**
10	**CHECK FUEL TANK.** Remove fuel tank. <Ref. to FU(H4SO)-51, Fuel Tank.>	Is fuel tank damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace fuel tank. <Ref. to FU(H4SO)-51, 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 or disconnections of hoses or pipes in evaporative emission control system?	Repair or replace hoses or pipes.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

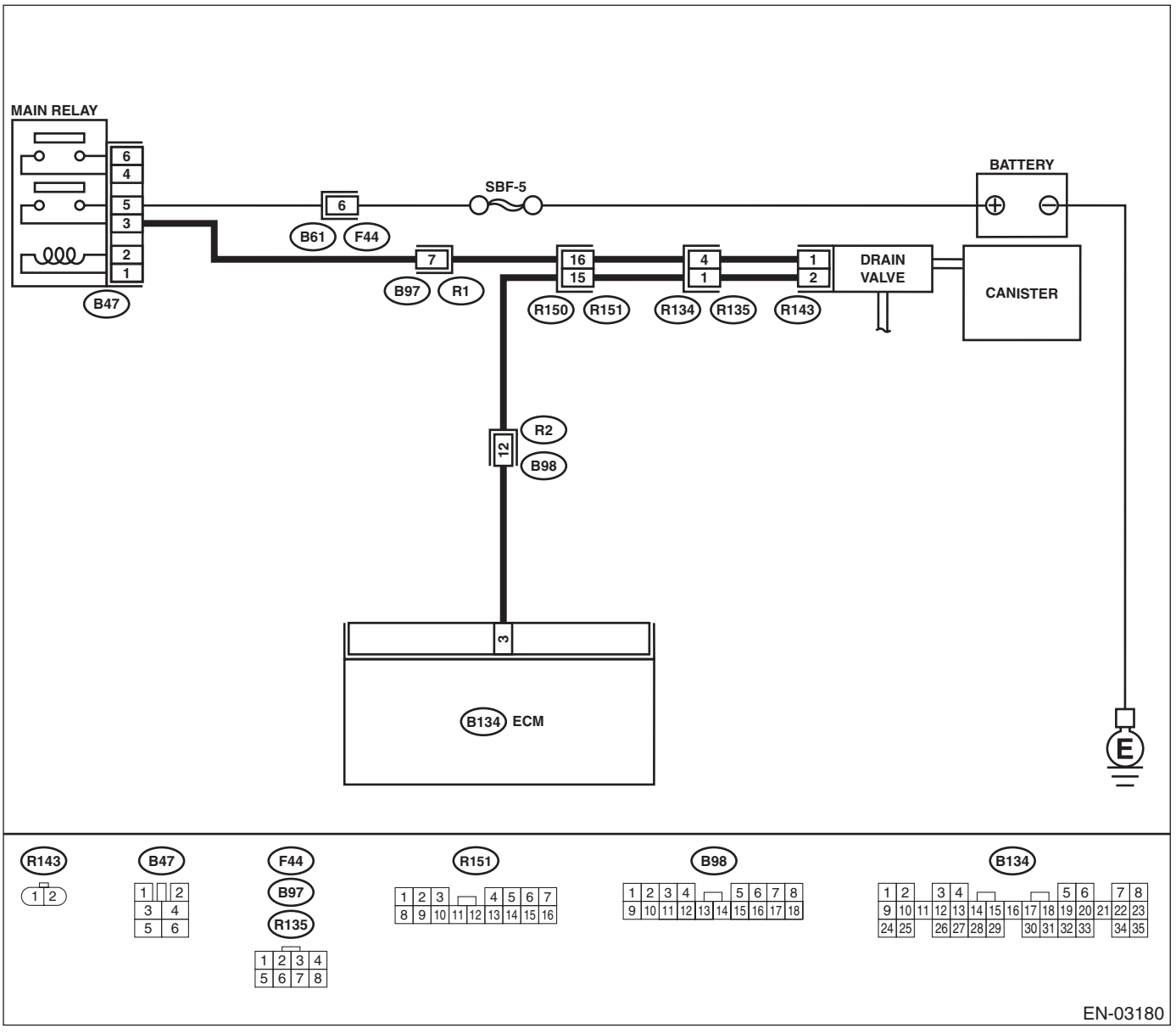
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Even if MIL lights up, the circuit has returned to a normal condition at this time. (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 connectors
3	**CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from drain valve and ECM. 3) Measure resistance of harness between drain valve connector and chassis ground. ***Connector & terminal*** ***(R143) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit in harness between ECM and drain valve connector.
4	**CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.** Measure resistance of harness between ECM and drain valve connector. ***Connector & terminal*** ***(B134) No. 3 — (R143) No. 2:***	Is the measured value less than 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 connectors
5	**CHECK DRAIN VALVE.** Measure resistance between drain valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 10 to 100 Ω?	Go to step **6.**	Replace drain valve. <Ref. to EC(H4SO)-17, Drain Valve.>

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO DRAIN VALVE.** 1) Turn ignition switch to ON. 2) Measure voltage between drain valve and chassis ground. ***Connector & terminal*** ***(R143) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 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 connectors • Poor contact in main relay connector
7	**CHECK POOR CONTACT.** Check poor contact in drain valve connector.	Is there poor contact in drain valve connector?	Repair poor contact in drain valve connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

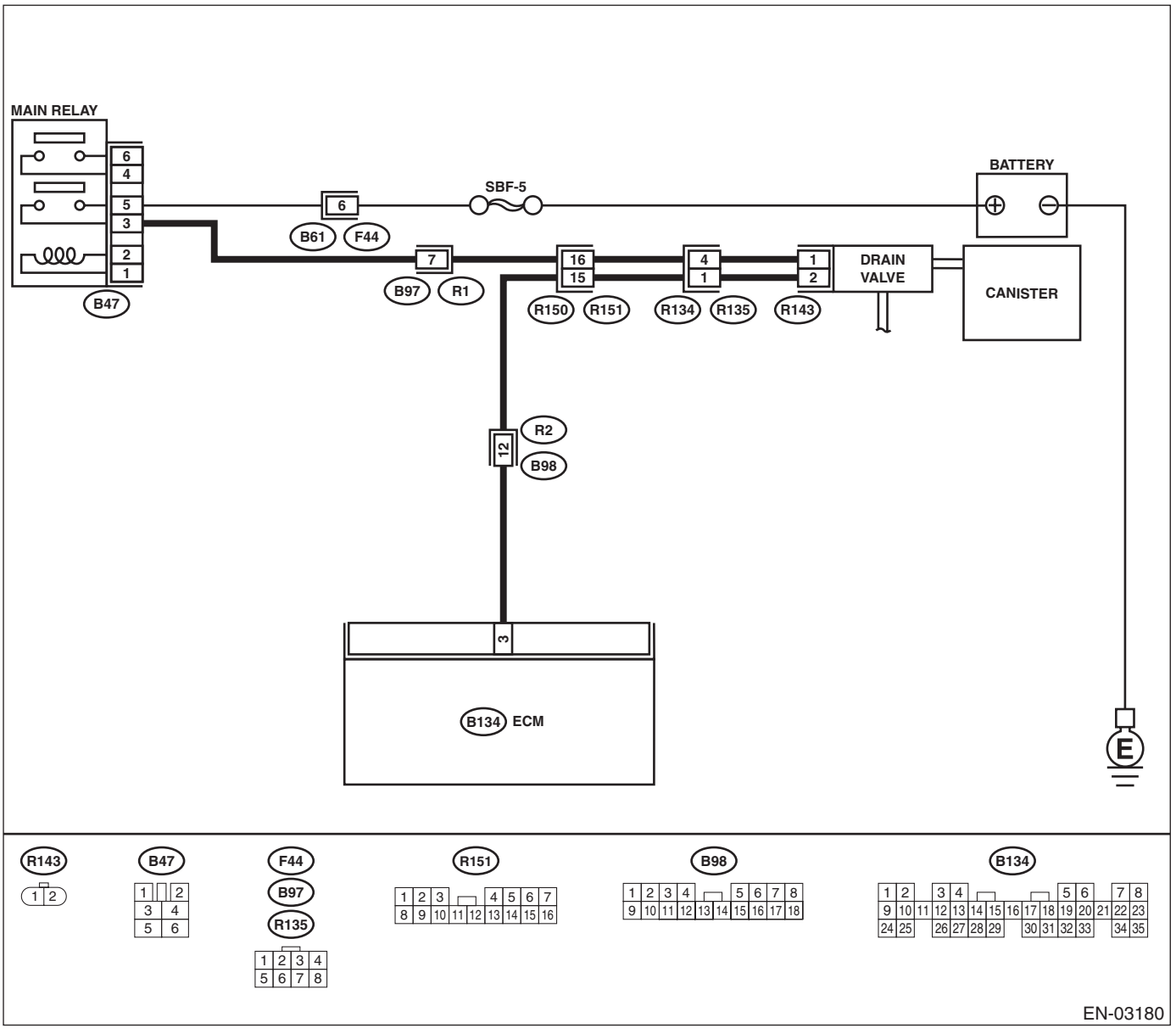
MEMO:

AX:DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



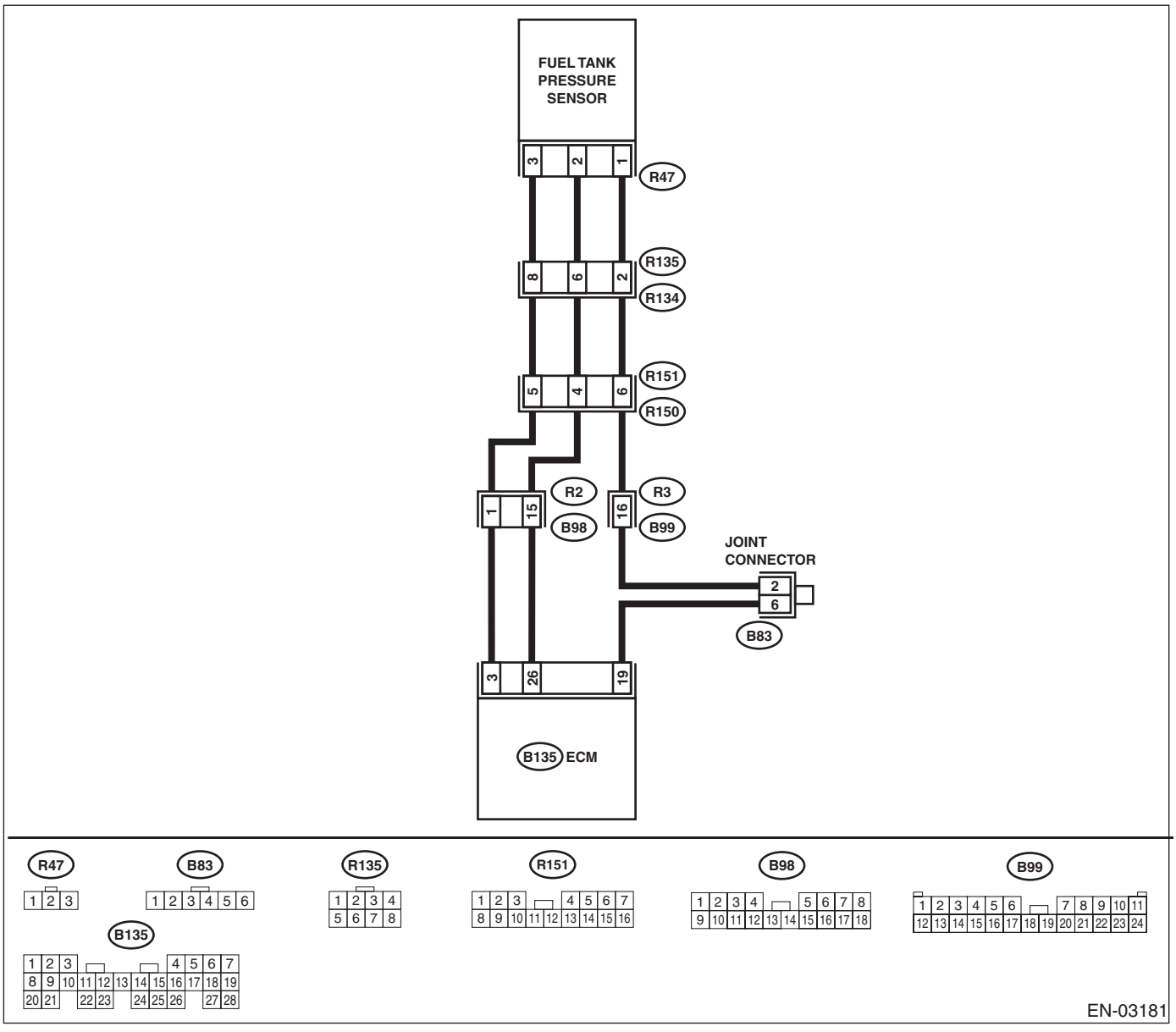
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating drain valve, measure voltage between ECM and chassis ground. NOTE: Drain valve operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode".<Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **2.**	Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.
2	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
4	**CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from drain valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and drain valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **5.**
5	**CHECK DRAIN VALVE.** 1) Turn ignition switch to OFF. 2) Measure resistance between drain valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace drain valve <Ref. to EC(H4SO)-17, Drain Valve.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **6.**
6	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

AY:DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



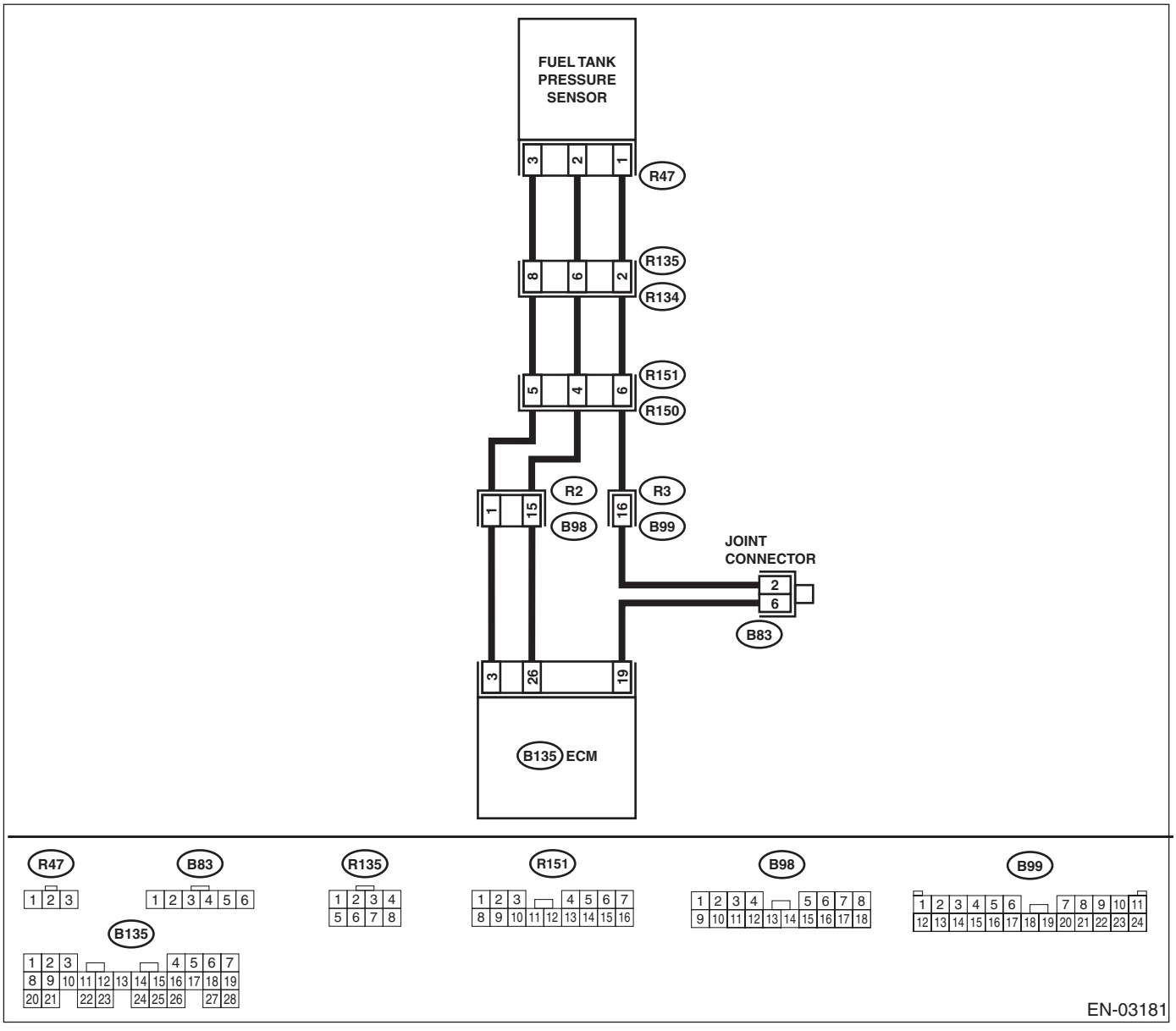
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is there any DTC on display?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step **3.**	Tighten fuel filler cap securely.
3	**CHECK 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	Is there any malfunction in pressure/vacuum line?	Repair or replace hoses and pipes.	Replace fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn ignition switch to OFF. 2) Remove fuel filler cap. 3) Install 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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –2.8 kPa (–21.0 mmHg, –0.827 inHg)?	Go to step **2.**	Even if MIL lights up, the circuit has returned to a normal condition at this time.
2	**CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 26 (+) — Chassis ground (–):***	Is the measured value less than 0.2 V?	Go to step **6.**	Go to step **5.**
5	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Read data of fuel tank pressure sensor signal using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Does the measured value change when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **6.**
6	**CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.** 1) Turn ignition switch to OFF. 2) Remove rear seat cushion. 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure voltage between rear wiring harness connector and chassis ground. ***Connector & terminal*** ***(R134) No. 8 (+) — Chassis ground (–):***	Is the measured value more than 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

Step		Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and rear wiring harness connector. ***Connector & terminal*** ***(B135) No. 19 — (R134) No. 2:***	Is the measured value less than 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 resistance of harness between rear wiring harness connector and chassis ground. ***Connector & terminal*** ***(R134) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair ground short circuit in harness between ECM and rear wiring harness connector.
9	**CHECK FUEL TANK CORD.** 1) Disconnect connector from fuel tank pressure sensor. 2) Measure resistance of fuel tank cord. ***Connector & terminal*** ***(R135) No. 8 — (R47) No. 3:***	Is the measured value less than 1 Ω?	Go to step **10.**	Repair open circuit in fuel tank cord.
10	**CHECK FUEL TANK CORD.** Measure resistance of fuel tank cord. ***Connector & terminal*** ***(R135) No. 2 — (R47) No. 1:***	Is the measured value less than 1 Ω?	Go to step **11.**	Repair open circuit in fuel tank cord.
11	**CHECK FUEL TANK CORD.** Measure resistance of harness between fuel tank pressure sensor connector and chassis ground. ***Connector & terminal*** ***(R47) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **12.**	Repair ground short circuit in fuel tank cord.
12	**CHECK POOR CONTACT.** Check poor contact in fuel tank pressure sensor connector.	Is there poor contact in fuel tank pressure sensor connector?	Repair poor contact in fuel tank pressure sensor connector.	Replace fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

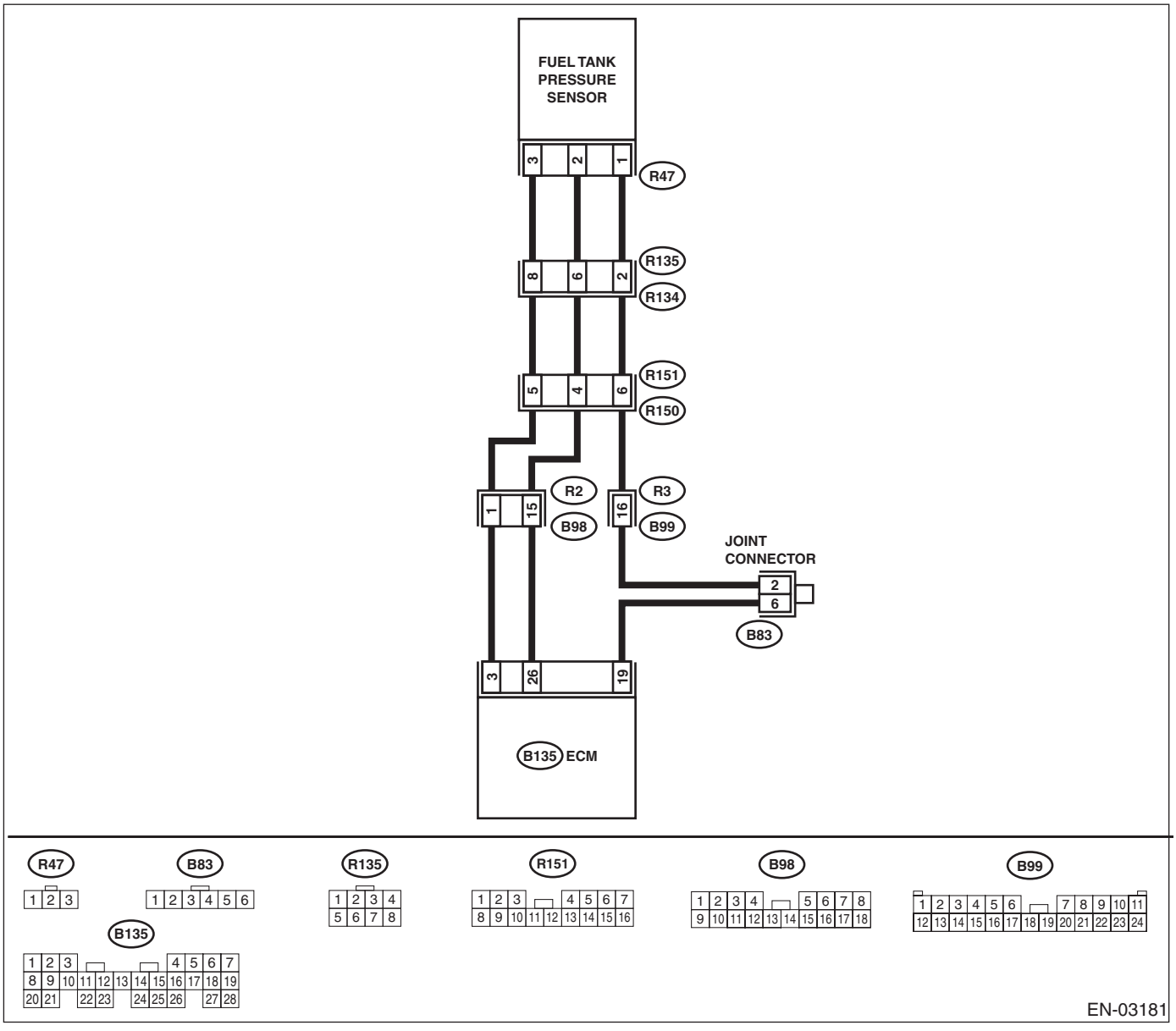
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn ignition switch to OFF. 2) Remove fuel filler cap. 3) Install fuel filler cap. 4) Turn ignition switch to ON. 5) Read data of fuel tank pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?	Go to step **12.**	Go to step **2.**
2	**CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
4	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 26 (+) — Chassis ground (–):***	Is the measured value less than 0.2 V?	Go to step **6.**	Go to step **5.**
5	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Read data of fuel tank pressure sensor signal using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Does the measured value change when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step **6.**
6	**CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.** 1) Turn ignition switch to OFF. 2) Remove rear seat cushion (Sedan) or move rear seat cushion (Wagon). 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure voltage between rear wiring harness connector and chassis ground. ***Connector & terminal*** ***(R134) No. 8 (+) — Chassis ground (–):***	Is the measured value more than 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

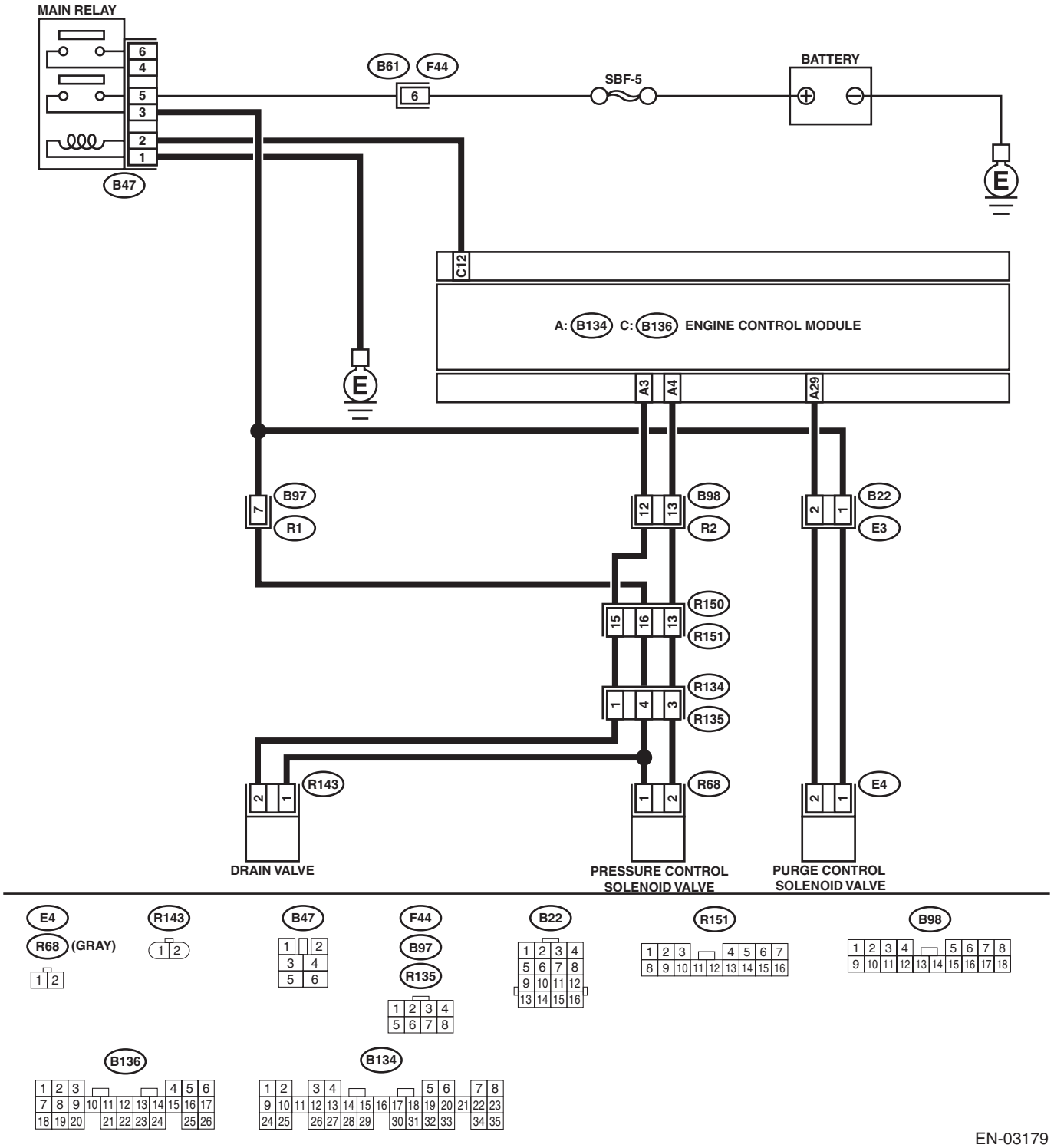
Step		Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and rear wiring harness connector. ***Connector & terminal*** ***(B135) No. 26 — (R134) No. 6:***	Is the measured value less than 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 HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS.** Measure resistance of harness between rear wiring harness connector and chassis ground. ***Connector & terminal*** ***(B135) No. 19 — (R134) No. 2:***	Is the measured value less than 1 Ω?	Go to step **9.**	Repair ground short circuit in harness between ECM and rear wiring harness connector.
9	**CHECK FUEL TANK CORD.** 1) Disconnect connector from fuel tank pressure sensor. 2) Measure resistance of fuel tank cord. ***Connector & terminal*** ***(R135) No. 6 — (R47) No. 2:***	Is the measured value less than 1 Ω?	Go to step **10.**	Repair open circuit in fuel tank cord.
10	**CHECK FUEL TANK CORD.** Measure resistance of fuel tank cord. ***Connector & terminal*** ***(R135) No. 2 — (R47) No. 1:***	Is the measured value less than 1 Ω?	Go to step **11.**	Repair open circuit in fuel tank cord.
11	**CHECK POOR CONTACT.** Check poor contact in fuel tank pressure sensor connector.	Is there poor contact in fuel tank pressure sensor connector?	Repair poor contact in fuel tank pressure sensor connector.	Replace fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>
12	**CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel tank pressure sensor. 3) Turn ignition switch to ON. 4) Read data of fuel tank pressure sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?	Repair battery short circuit in harness between ECM and fuel tank pressure sensor connector.	Replace fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Gasoline smell
  - 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 malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03179

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC code is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **3.**	Tighten fuel filler cap securely.
3	**CHECK FUEL FILLER CAP.**	Is the genuine fuel filler cap used?	Go to step **4.**	Replace with a 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?	Repair or replace fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-59, Fuel Filler Pipe.>	Go to step **5.**
5	**CHECK DRAIN VALVE.** 1) Connect test mode connector. 2) Turn ignition switch to ON. 3) Operate drain valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step **6.**	Replace drain valve. <Ref. to EC(H4SO)-17, Drain Valve.>
6	**CHECK PURGE CONTROL SOLENOID VALVE.** Operate purge control solenoid valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step **7.**	Replace purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7	**CHECK PRESSURE CONTROL SOLENOID VALVE.** Operate pressure control solenoid valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step **8.**	Replace pressure control solenoid valve. <Ref. to EC(H4SO)-13, Pressure Control Solenoid Valve.>
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 evaporative emission control system line?	Repair or replace fuel line. <Ref. to FU(H4SO)-72, Fuel Delivery, Return and Evaporation Lines.>	Go to step **9.**

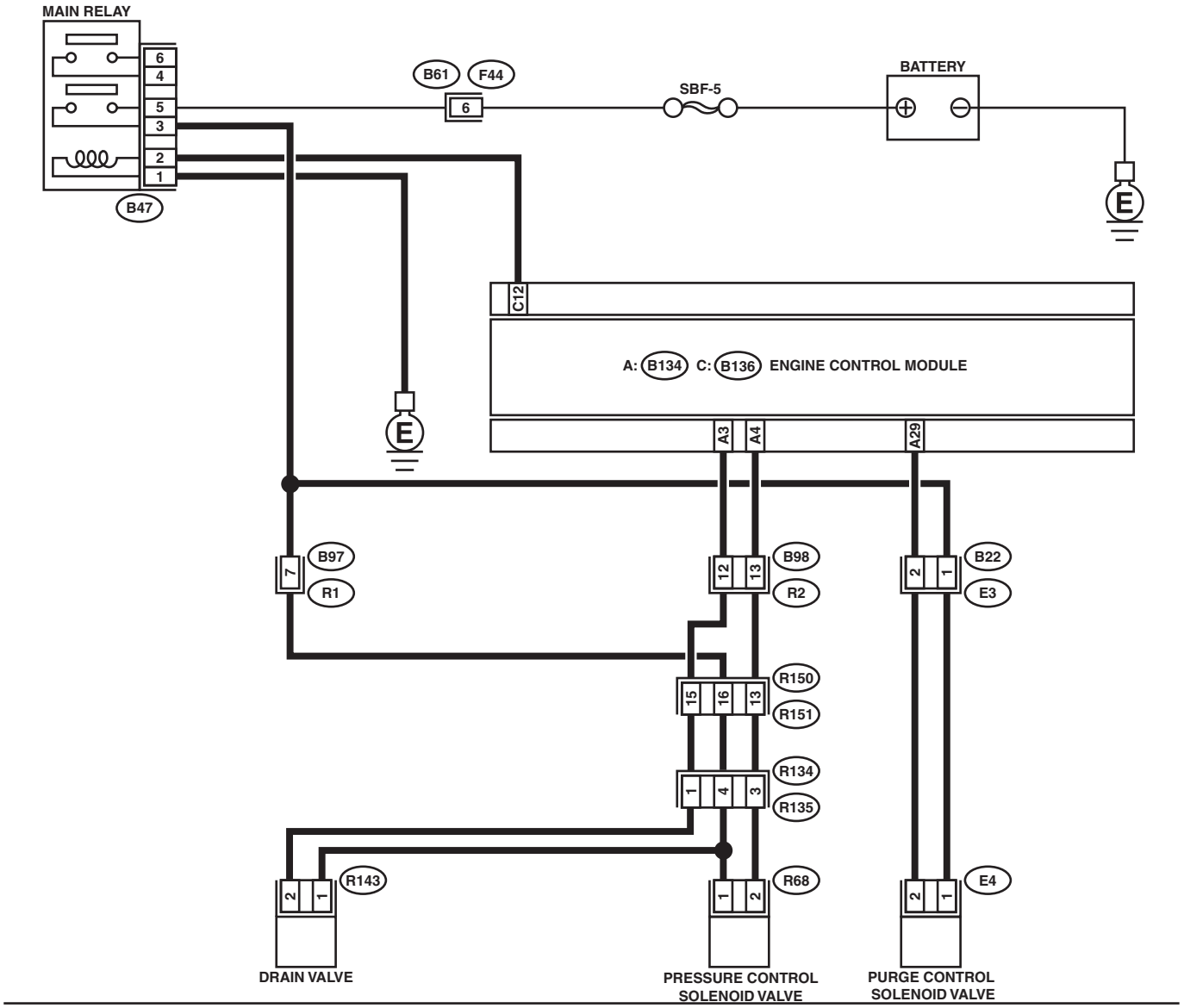
	Step	Check	Yes	No
9	**CHECK CANISTER.**	Is canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **10.**
10	**CHECK FUEL TANK.** Remove fuel tank. <Ref. to FU(H4SO)-51, Fuel Tank.>	Is fuel tank damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace fuel tank. <Ref. to FU(H4SO)-51, 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 or disconnections of hoses or pipes in evaporative emission control system?	Repair or replace hoses or pipes.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Gasoline smell
  - Fuel filler cap loose or missing

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03179

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC code is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **3.**	Tighten fuel filler cap securely.
3	**CHECK FUEL FILLER CAP.**	Is the genuine fuel filler cap used?	Go to step **4.**	Replace with a 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?	Repair or replace fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-59, Fuel Filler Pipe.>	Go to step **5.**
5	**CHECK DRAIN VALVE.** 1) Connect test mode connector. 2) Turn ignition switch to ON. 3) Operate drain valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step **6.**	Replace drain valve. <Ref. to EC(H4SO)-17, Drain Valve.>
6	**CHECK PURGE CONTROL SOLENOID VALVE.** Operate purge control solenoid valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step **7.**	Replace purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7	**CHECK PRESSURE CONTROL SOLENOID VALVE.** Operate pressure control solenoid valve. 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)-51, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step **8.**	Replace pressure control solenoid valve. <Ref. to EC(H4SO)-13, Pressure Control Solenoid Valve.>
8	**CHECK CANISTER.**	Is canister damaged?	Repair or replace canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **9.**

	Step	Check	Yes	No
9	**CHECK FUEL TANK.** Remove fuel tank. <Ref. to FU(H4SO)-51, Fuel Tank.>	Is fuel tank damaged?	Repair or replace fuel tank. <Ref. to FU(H4SO)-51, 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?	Repair or replace hoses or pipes.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

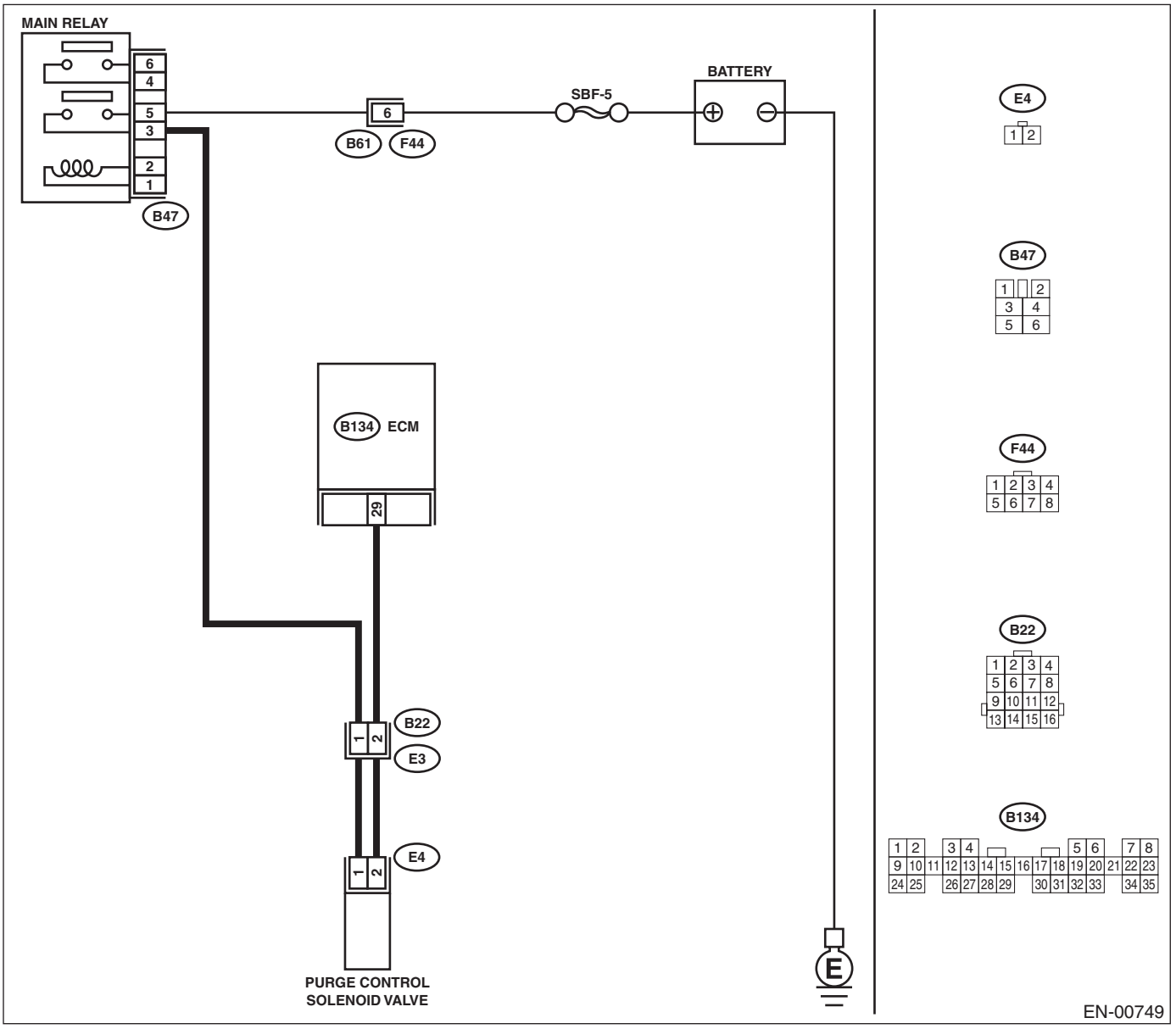
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 29 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time. Contact with SOA service center. 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 connectors from purge control solenoid valve and ECM. 3) Measure resistance of harness between purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 2 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in harness between ECM and purge control solenoid valve connector.
3	**CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** Measure resistance of harness between ECM and purge control solenoid valve of harness connector. ***Connector & terminal*** ***(B134) No. 29 — (E4) No. 2:***	Is the measured value less than 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 purge control solenoid valve. 2) Measure resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 10 to 100 Ω?	Go to step **5.**	Replace purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
5	**CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.** 1) Turn ignition switch to ON. 2) Measure voltage between purge control solenoid valve and engine ground. ***Connector & terminal*** ***(E4) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **6.**	Repair open circuit in harness between main relay and purge control solenoid valve connector.

Step		Check	Yes	No
6	**CHECK POOR CONTACT.** Check poor contact in purge control solenoid valve connector.	Is there poor contact in purge control solenoid valve connector?	Repair poor contact in purge control solenoid valve connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

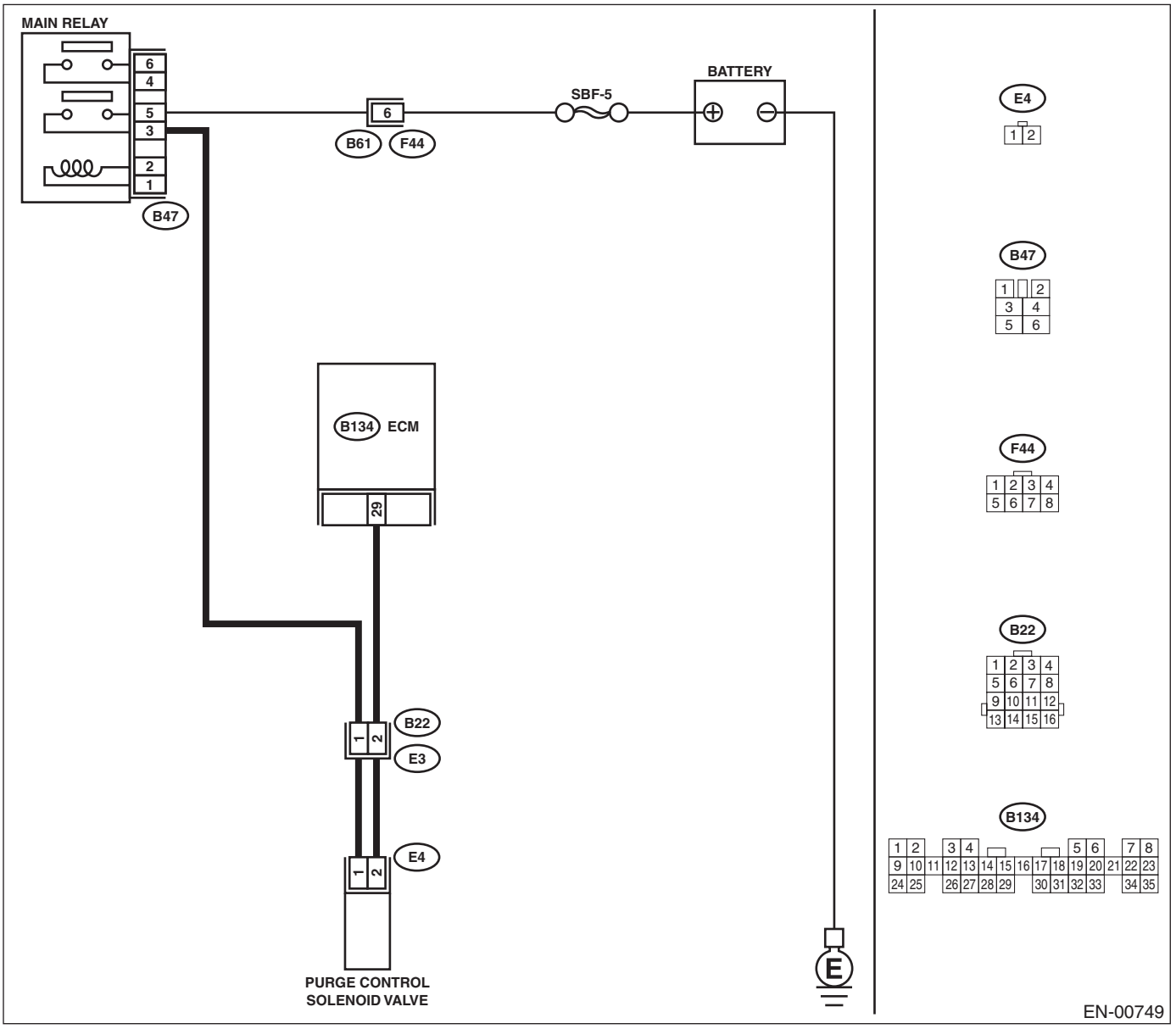
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



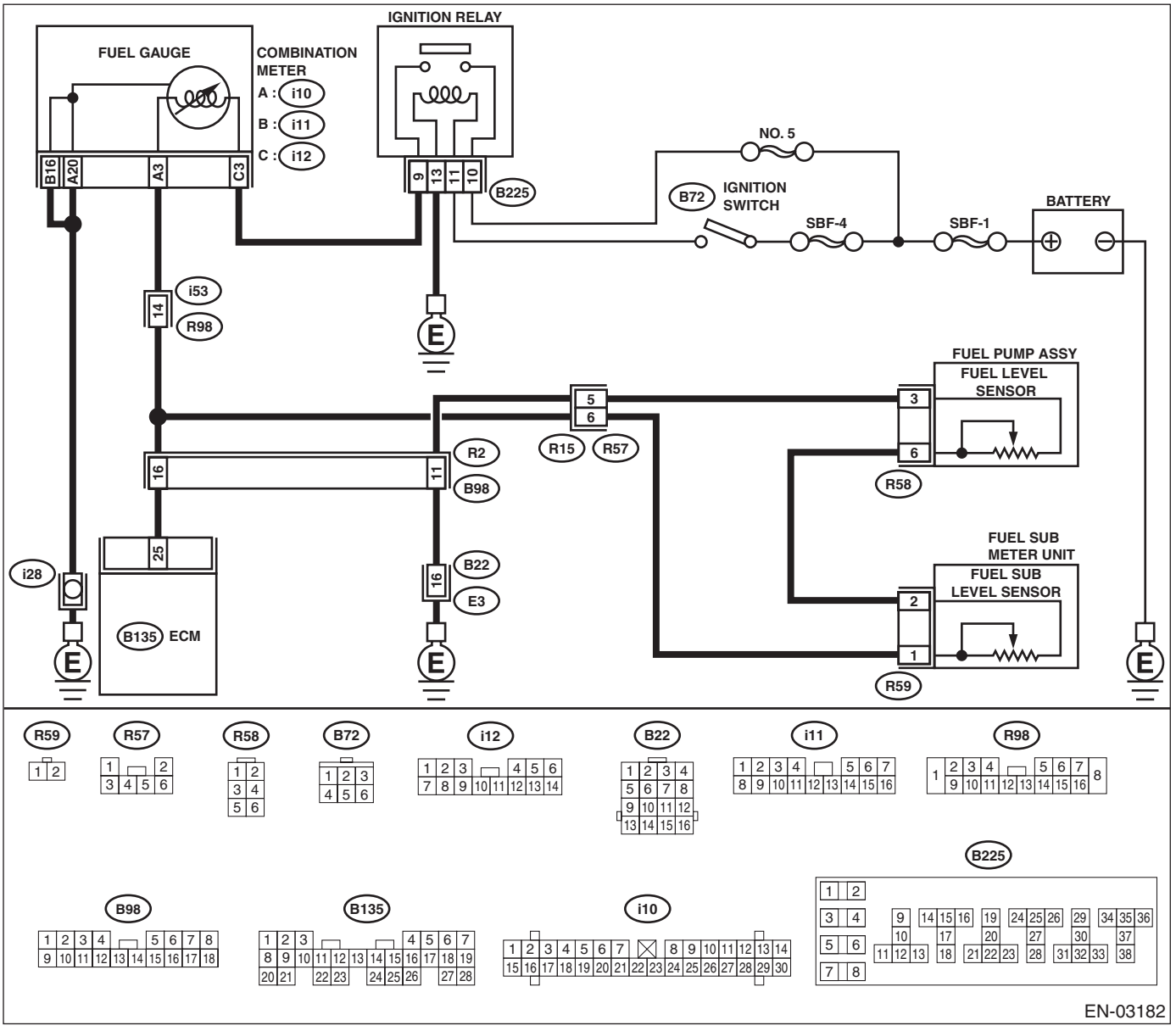
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box. 3) Turn ignition switch to ON. 4) While operating purge control solenoid valve, measure voltage between ECM and chassis ground. NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 29 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.
2	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 29 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
4	**CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from purge control solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 29 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and purge control solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **5.**
5	**CHECK PURGE CONTROL SOLENOID VALVE.** 1) Turn ignition switch to OFF. 2) Measure resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace purge control solenoid valve <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **6.**
6	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

BF:DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



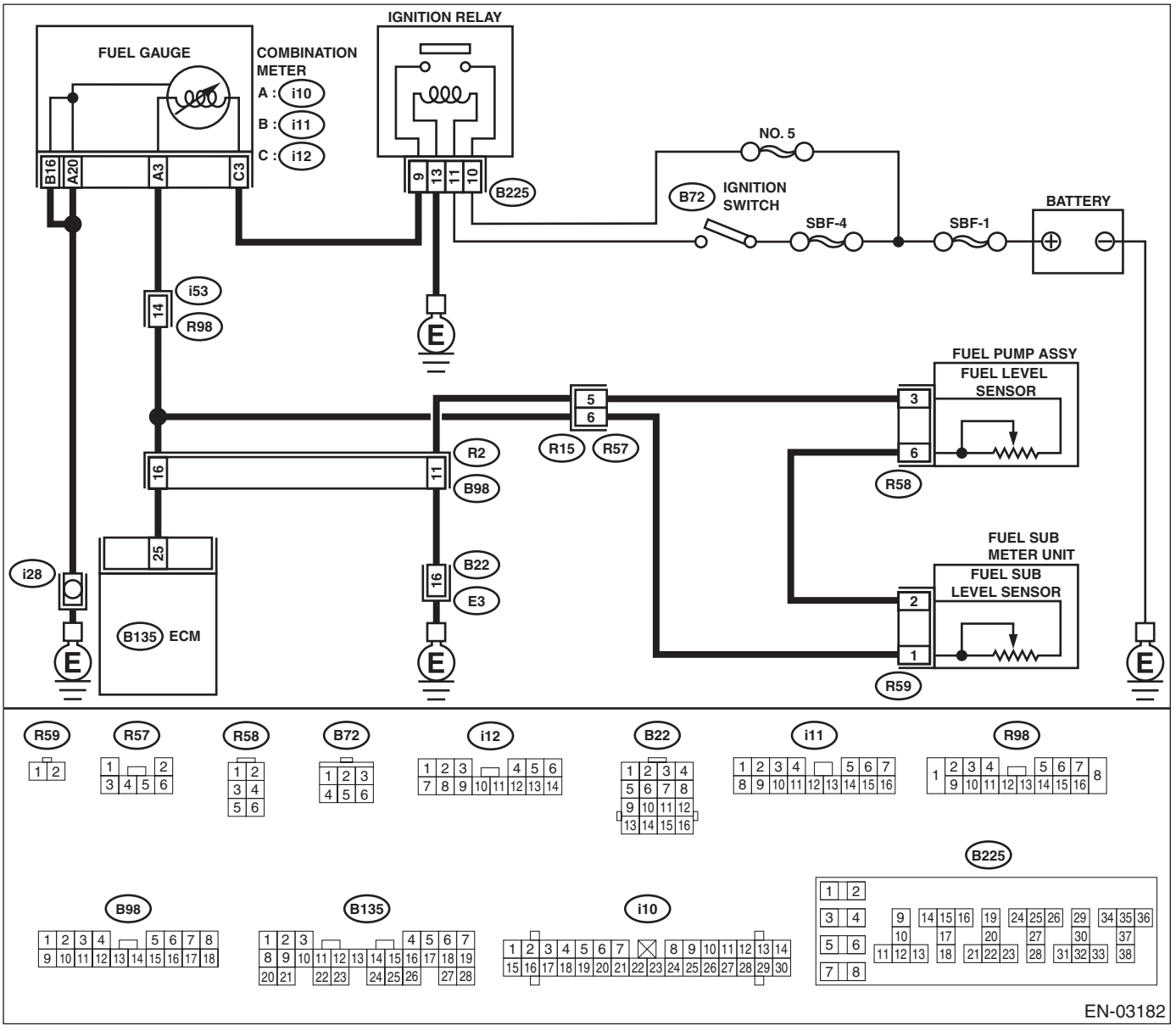
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect this trouble.	Replace fuel level sensor <Ref. to FU(H4SO)-68, Fuel Level Sensor.> and fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.**	Does speedometer and tachometer operate normally?	Go to step **2.**	Repair or replace combination meter. <Ref. to IDI-4, Combination Meter System.>

	Step	Check	Yes	No
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. (Engine OFF) 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Is the measured value less than 0.12 V?	Go to step **6.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.)** Read data of fuel level sensor signal using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.>	Is the measured value less than 0.12 V when shaking harness and connector of ECM?	Repair poor contact in ECM connector.	Even if MIL lights up, the circuit has returned to a normal condition at this time. 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 connectors
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 voltage of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Is the measured value more than 0.12 V?	Go to step **4.**	Go to step **7.**
5	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER.** 1) Turn ignition switch to OFF. 2) Disconnect connector from connector (i10) and ECM connector. 3) Measure resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 25 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit in harness between ECM and combination meter connector.
6	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER.** Measure resistance between ECM and combination meter connector. ***Connector & terminal*** ***(B135) No. 25 — (i10) No. 3:***	Is the measured value less than 10 Ω?	Repair or replace 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 connector from fuel sub level sensor. 3) Measure resistance between fuel sub level sensor and chassis ground. ***Connector & terminal*** ***(R59) No. 1 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **8.**	Repair ground short circuit in fuel tank cord.

	Step	Check	Yes	No
8	**CHECK FUEL TANK CORD.** 1) Disconnect connector from fuel pump assembly. 2) Measure resistance between fuel pump assembly and chassis ground. ***Connector & terminal*** ***(R59) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair ground short circuit in fuel tank cord.
9	**CHECK FUEL LEVEL SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel pump assembly. <Ref. to FU(H4SO)-66, Fuel Pump.> 2) Measure resistance between fuel level sensor and terminals with its float set to the full position. ***Terminals*** ***No. 3 — No. 6:***	Is the measured value within 0.5 to 2.5 Ω?	Go to step **10.**	Replace fuel level sensor.
10	**CHECK FUEL SUB LEVLE SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.> 2) Measure resistance between fuel sub level sensor and terminals with its float set to the full position. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 0.5 to 2.5 Ω?	Repair poor contact in harness between ECM and combination meter connector.	Replace fuel sub level sensor.

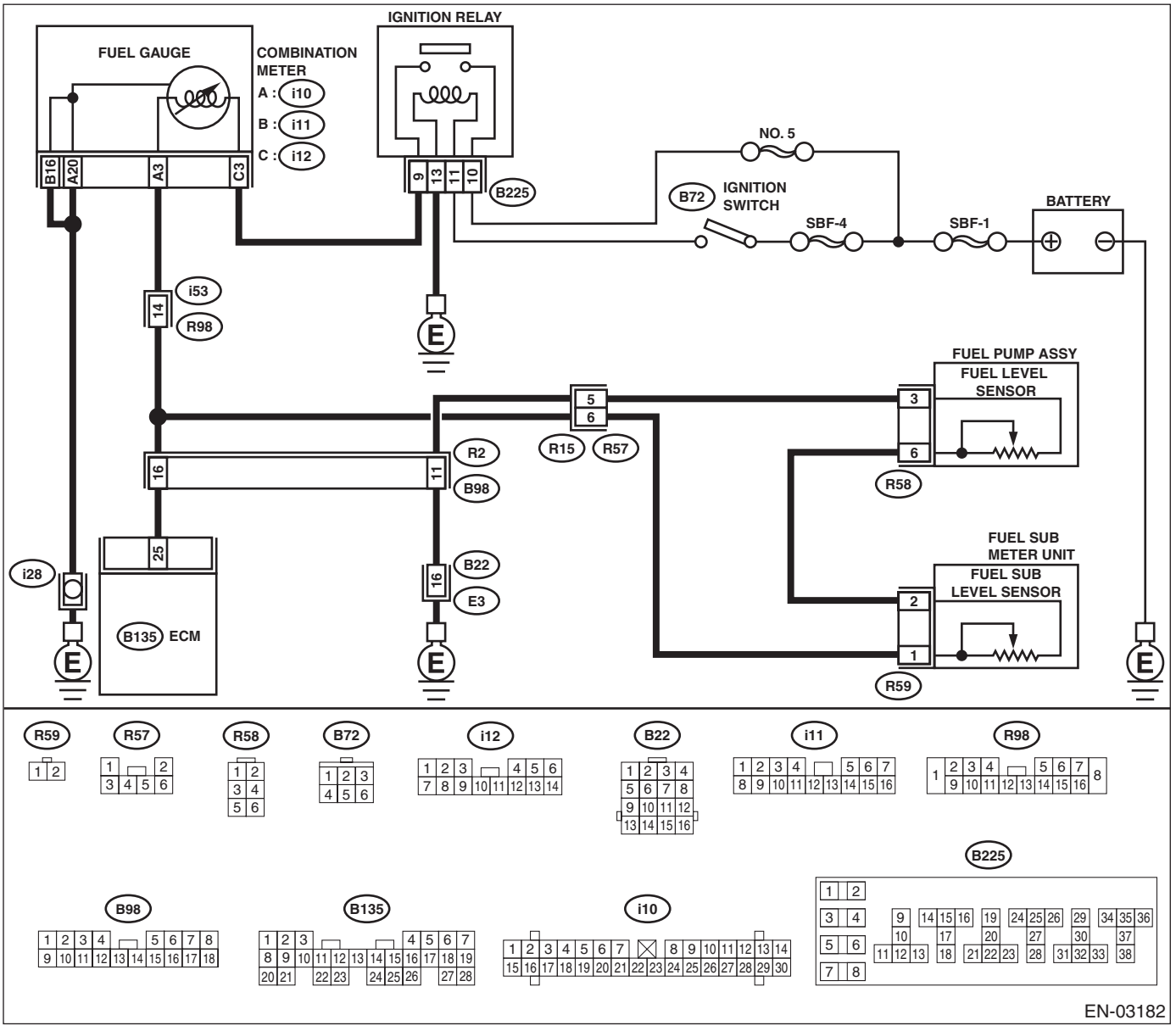
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.**	Does speedometer and tachometer operate normally?	Go to step **2.**	Repair or replace combination meter. <Ref. to IDI-4, Combination Meter System.>

	Step	Check	Yes	No
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. (Engine OFF) 2) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Is the measured value more than 4.75 V?	Go to step **3.**	Even if MIL lights up, the circuit has returned to a normal condition at this time. 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 combination meter connector (i10) and ECM connector. 3) Turn ignition switch to ON. 4) Measure voltage of harness between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Is the measured value more than 4.75 V?	Repair battery short circuit between ECM and combination meter connector.	Go to step **4.**
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 resistance between ECM and fuel tank cord. ***Connector & terminal*** ***(B135) No. 25 — (R15) No. 6:***	Is the measured value less than 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 resistance between fuel tank cord and chassis ground. ***Connector & terminal*** ***(R15) No. 5 — Chassis ground:***	Is the measured value less than 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 connectors
6	**CHECK FUEL TANK CORD.** 1) Disconnect connector from fuel level sensor. 2) Measure resistance between fuel level sensor and coupling connector. ***Connector & terminal*** ***(R57) No. 5 — (R58) No. 3:***	Is the measured value less than 1 Ω?	Go to step **7.**	Repair open circuit between coupling connector and fuel level sensor.
7	**CHECK FUEL TANK CORD.** 1) Disconnect connector from fuel sub level sensor. 2) Measure resistance between fuel level sensor and fuel sub level sensor. ***Connector & terminal*** ***(R58) No. 6 — (R59) No. 2:***	Is the measured value less than 1 Ω?	Go to step **8.**	Repair open circuit between fuel level sensor and fuel sub level sensor.

	Step	Check	Yes	No
8	**CHECK FUEL TANK CORD.** Measure resistance between fuel sub level sensor and coupling connector. ***Connector & terminal*** ***(R57) No. 6 — (R59) No. 1:***	Is the measured value less than 1 Ω?	Go to step **9.**	Repair open circuit between coupling connector and fuel sub level sensor.
9	**CHECK FUEL LEVEL SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel pump assembly. <Ref. to FU(H4SO)-66, Fuel Pump.> 2) While moving fuel level sensor float up and down, measure resistance between fuel level sensor terminals. ***Terminals*** ***No. 3 — No. 6:***	Is the measured value more than 54.5 Ω?	Replace fuel level sensor. <Ref. to FU(H4SO)-68, Fuel Level Sensor.>	Go to step **10.**
10	**CHECK FUEL SUB LEVEL SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.> 2) While moving fuel sub level sensor float up and down, measure resistance between fuel sub level sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value more than 41.5 Ω?	Replace fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.>	Replace combination meter. <Ref. to IDI-13, Combination Meter Assembly.>

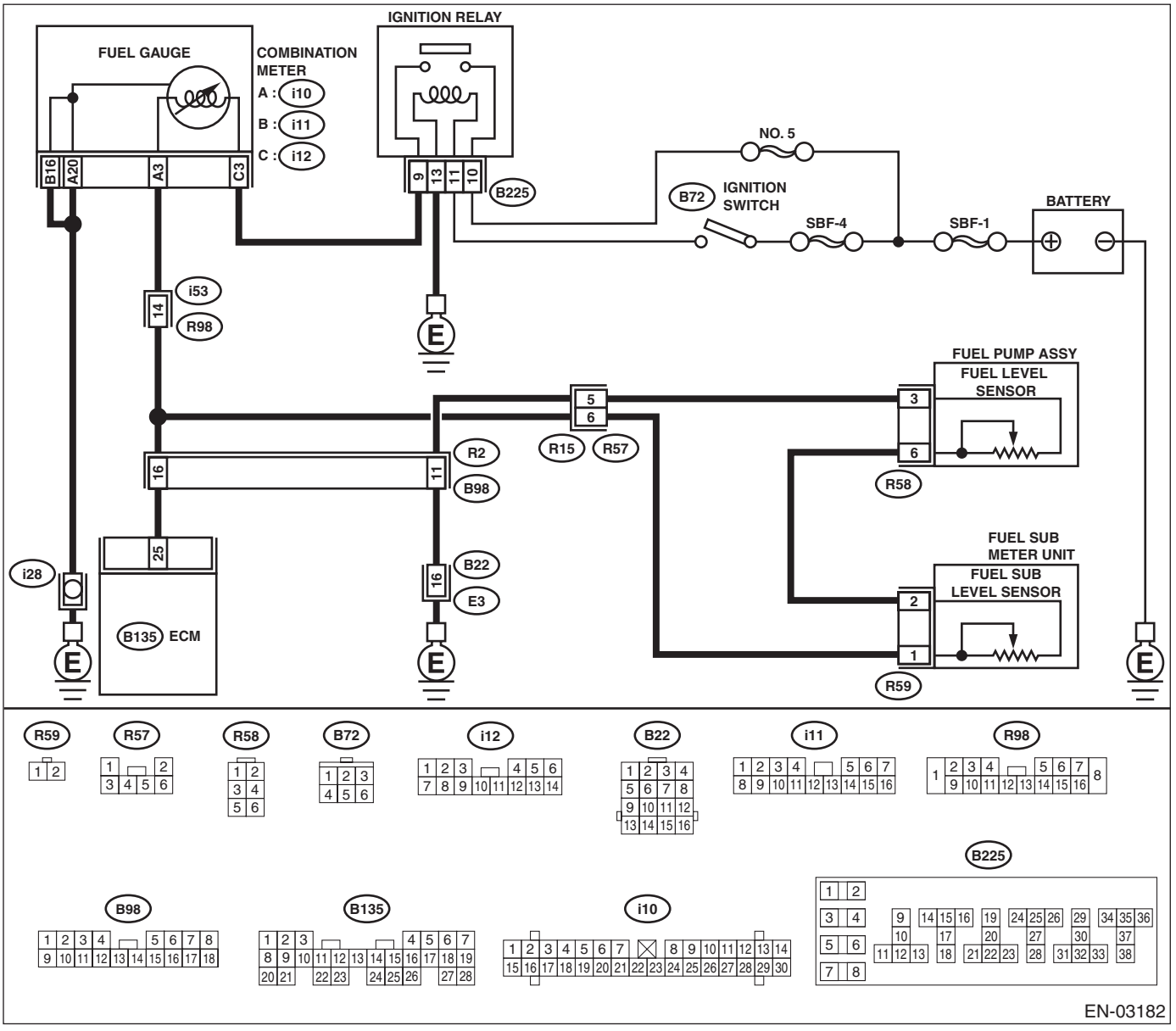
MEMO:

BI: DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT—

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL LEVEL SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel pump assembly. <Ref. to FU(H4SO)-66, Fuel Pump.> 2) While moving fuel level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. ***Terminals*** ***No. 3 — No. 6:***	Does the resistance change smoothly?	Go to step **3.**	Replace fuel level sensor. <Ref. to FU(H4SO)-68, Fuel Level Sensor.>
3	**CHECK FUEL SUB LEVEL SENSOR.** **Warning:** **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.** 1) Remove fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.> 2) While moving fuel sub level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. ***Terminals*** ***No. 1 — No. 2:***	Does the resistance change smoothly?	Repair poor contact in ECM, combination meter and coupling connectors.	Replace fuel sub level sensor. <Ref. to FU(H4SO)-69, Fuel Sub Level Sensor.>

MEMO:

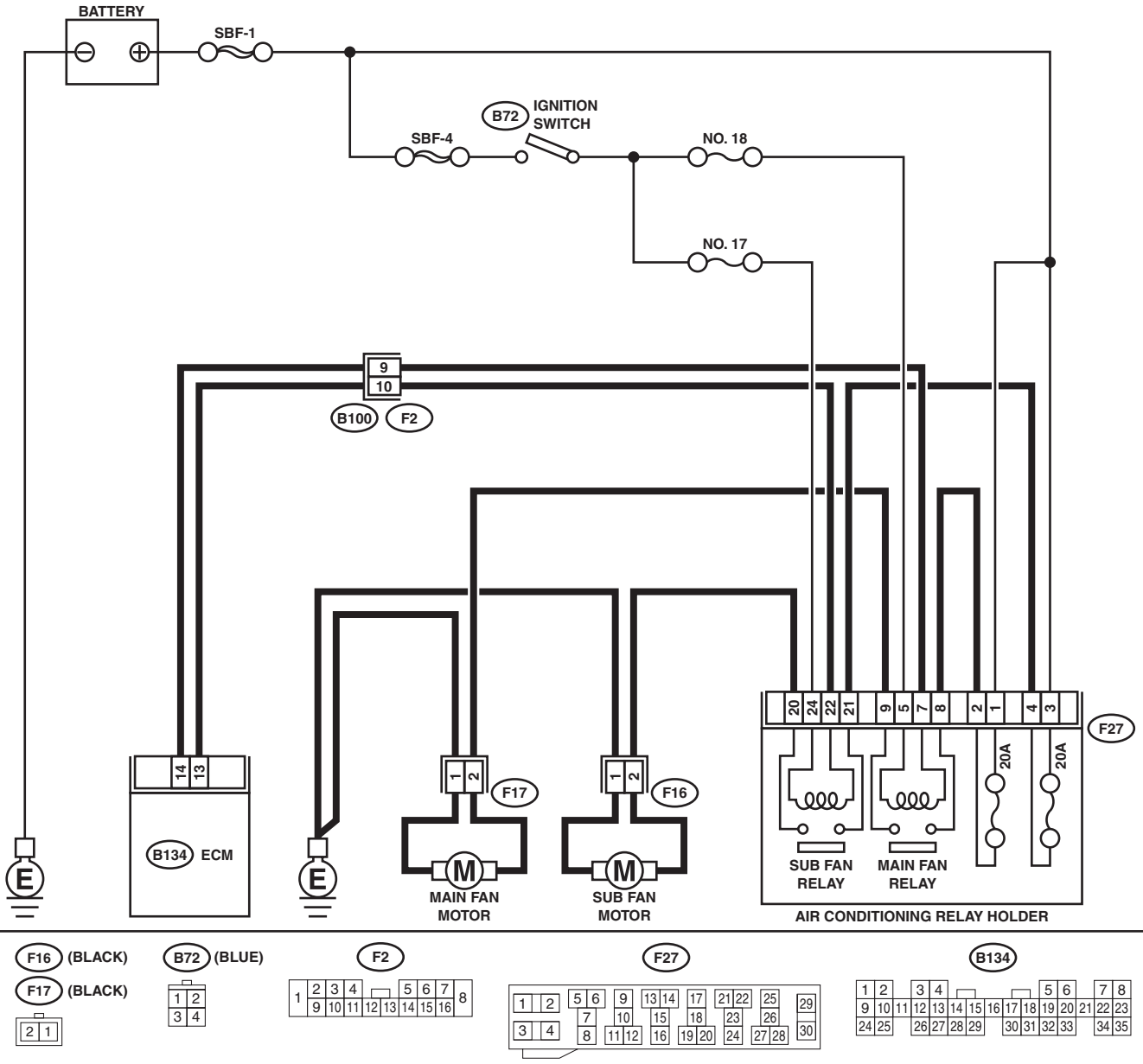
BJ:DTC P0483 — COOLING FAN RATIONALITY CHECK —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Occurrence of noise
  - Overheating

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

NOTE:
If the vehicle, with the engine idling, is placed very close to a wall or another vehicle, preventing normal cooling function, the OBD system may detect malfunction.

- **WIRING DIAGRAM:**



EN-03183

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Check radiator fan and fan motor. <Ref. to CO(H4SO)-25, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-27, Radiator Sub Fan and Fan Motor.>

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

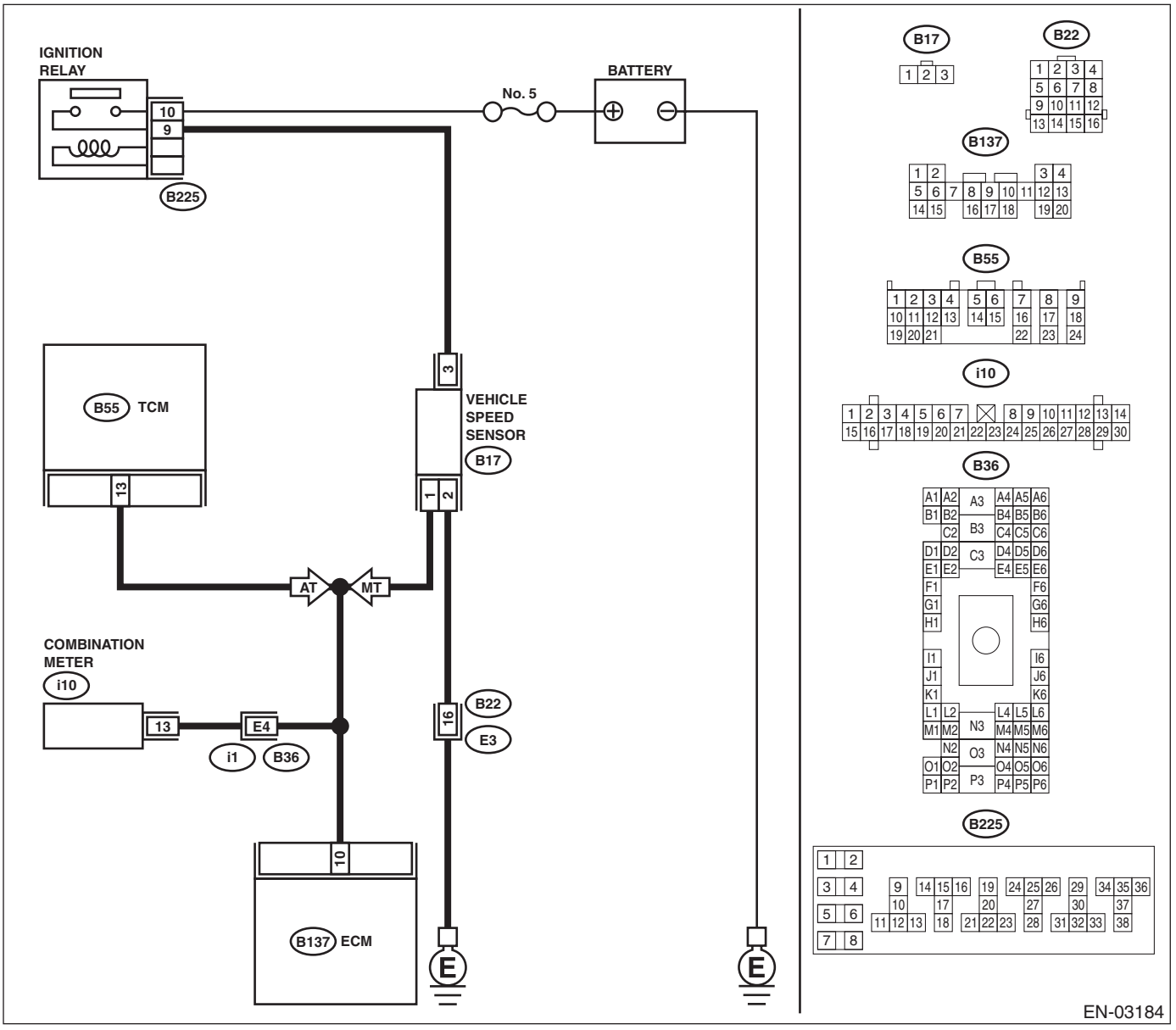
NOTE:
For the diagnostic procedure, refer to DTC P0503. <Ref. to EN(H4SO)-264, DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BL:DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



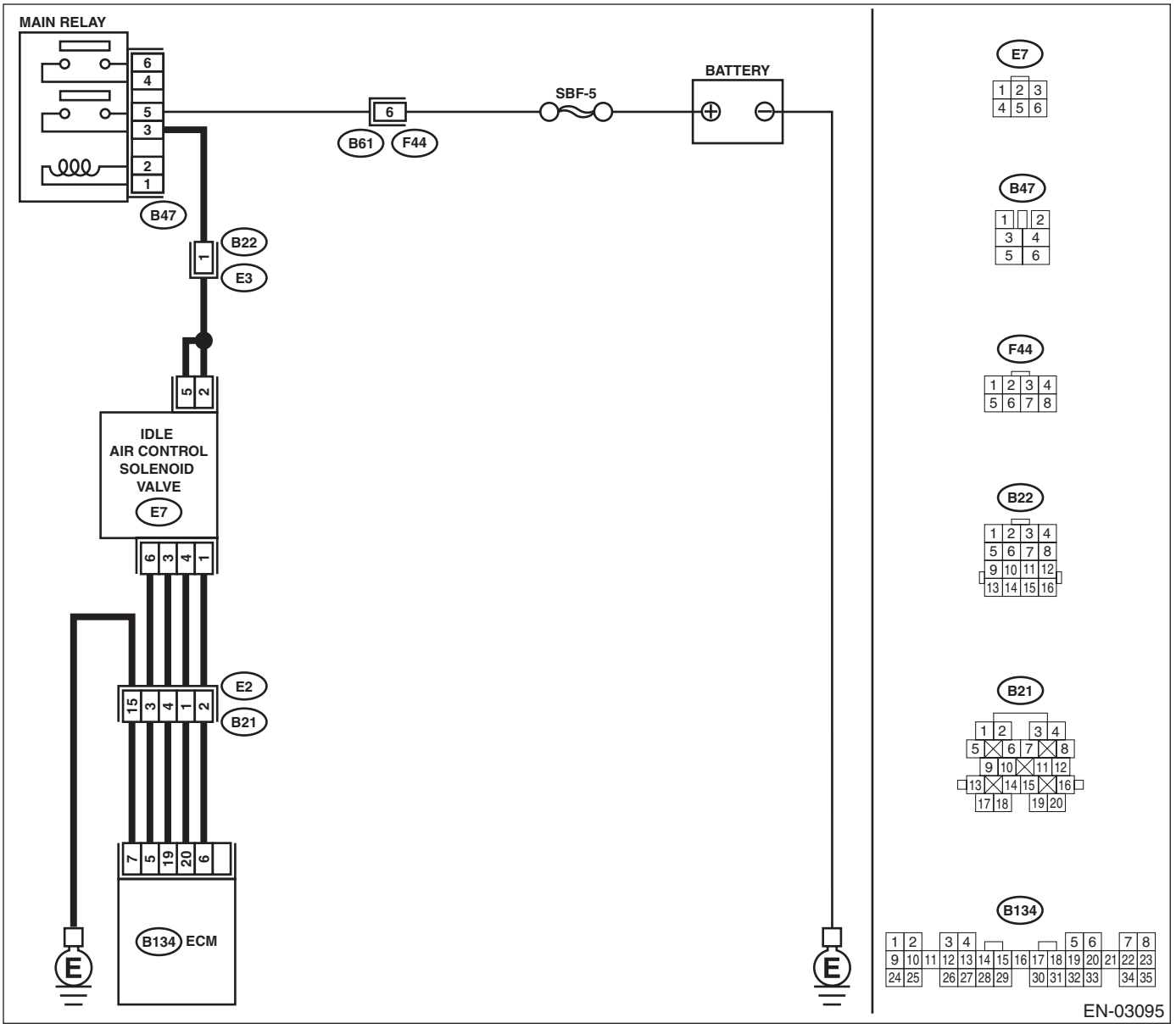
	Step	Check	Yes	No
1	**CHECK TRANSMISSION TYPE.**	Is the transmission type AT?	Go to step **2.**	Go to step **3.**
2	**CHECK DTC P0720 ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0720?	Check front vehicle speed sensor signal circuit. <Ref. to 4AT-48, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Go to step **3.**
3	**CHECK SPEEDOMETER OPERATION IN COMBINATION METER.**	Does speedometer operate normally?	Go to step **4.**	Check speedometer and vehicle speed sensor. <Ref. to IDI-15, Speedometer.> and <Ref. to 4AT-54, Front Vehicle Speed Sensor.> and <Ref. to 4AT-59, Rear Vehicle Speed Sensor.> and <Ref. to 4AT-60, Torque Converter Turbine Speed Sensor.>
4	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from combination meter. 3) Measure resistance between ECM and combination meter. ***Connector & terminal*** ***(B137) No. 10 — (i10) No. 13:***	Is the measured value less than 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

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Engine is difficult to start.
  - Engine does not start.
  - Erroneous idling
  - Engine stalls.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



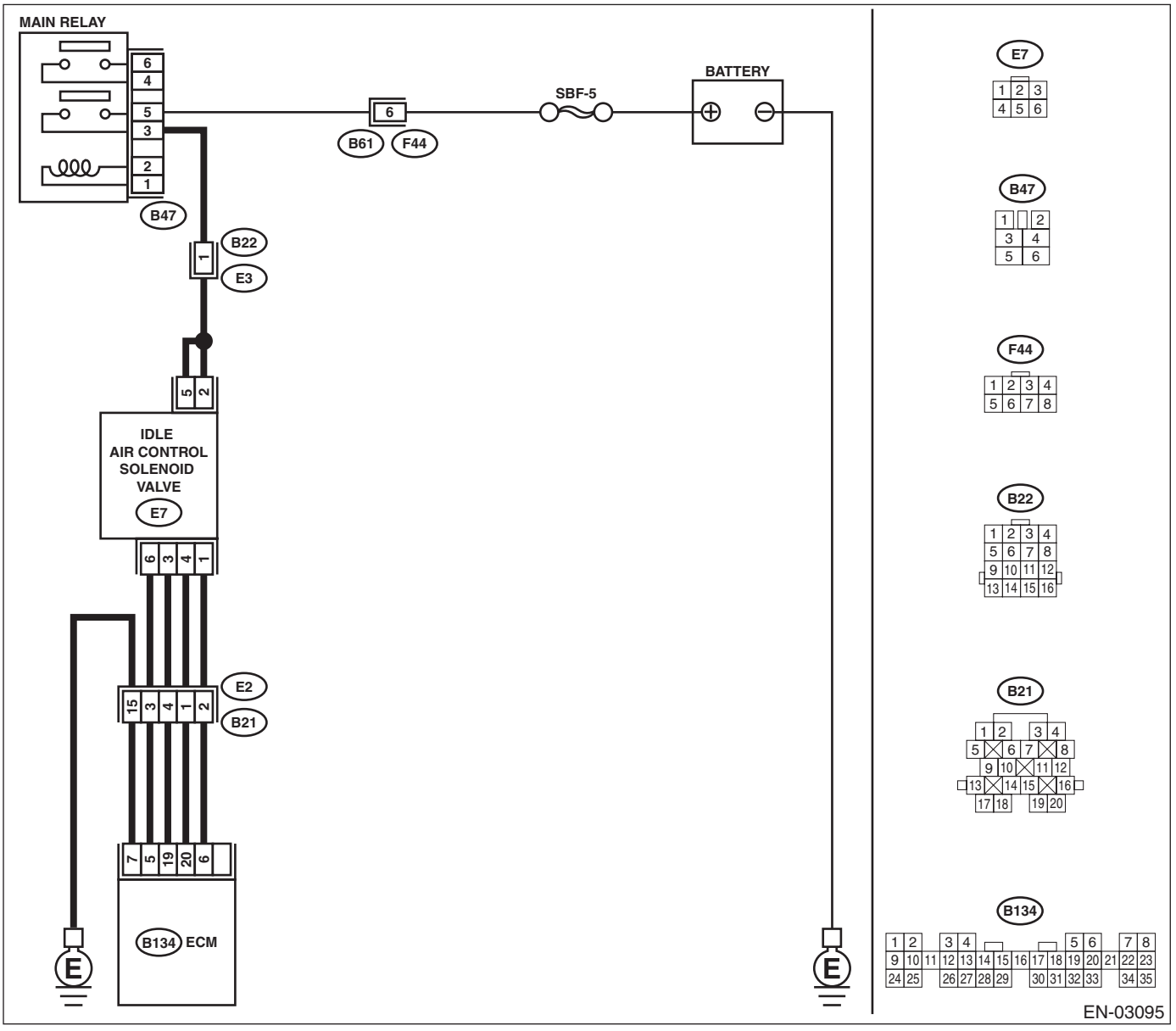
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0506.	Go to step **2.**
2	**CHECK AIR BY-PASS LINE.** 1) Turn ignition switch to OFF. 2) Remove idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-35, REMOVAL, Idle Air Control Solenoid Valve.> 3) Remove throttle body from intake manifold. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> 4) Using an air gun, force air into idle air control solenoid valve installation area. Confirm that forced air subsequently escapes from throttle body interior.	Does air flow out?	Replace idle air control solenoid valve. <Ref. to FU(H4SO)-35, INSTALLATION, Idle Air Control Solenoid Valve.>	Replace throttle body. <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Engine keeps running at higher revolution than specified idling revolution.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



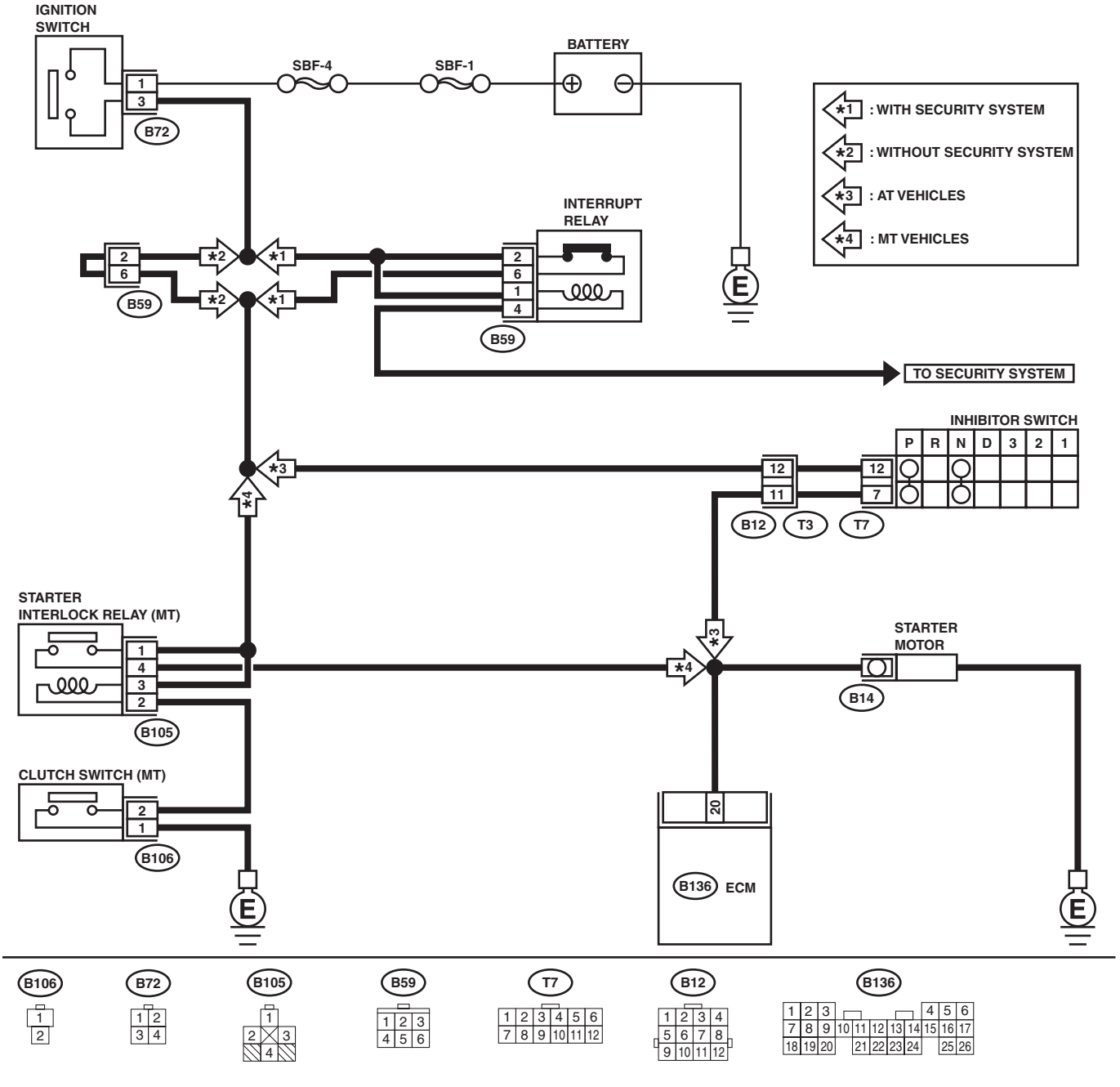
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0507.	Go to step **2.**
2	**CHECK AIR INTAKE SYSTEM.** 1) Turn ignition switch to ON. 2) Start engine, and idle it. 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 any fault in air intake system?	Repair air suction and leaks.	Go to step **3.**
3	**CHECK THROTTLE CABLE.**	Does throttle cable have play for adjustment?	Go to step **4.**	Adjust throttle cable. <Ref. to SP(H4SO)-6, Accelerator Control Cable.>
4	**CHECK AIR BY-PASS LINE.** 1) Turn ignition switch to OFF. 2) Remove idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-35, REMOVAL, Idle Air Control Solenoid Valve.> 3) Confirm that there are no foreign particles in by-pass air line.	Are foreign particles in by-pass air line?	Remove foreign particles from by-pass air line.	Replace idle air control solenoid valve. <Ref. to FU(H4SO)-35, Idle Air Control Solenoid Valve.>

BO:DTC P0512 — STARTER REQUEST CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Failure of engine to start

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-00715

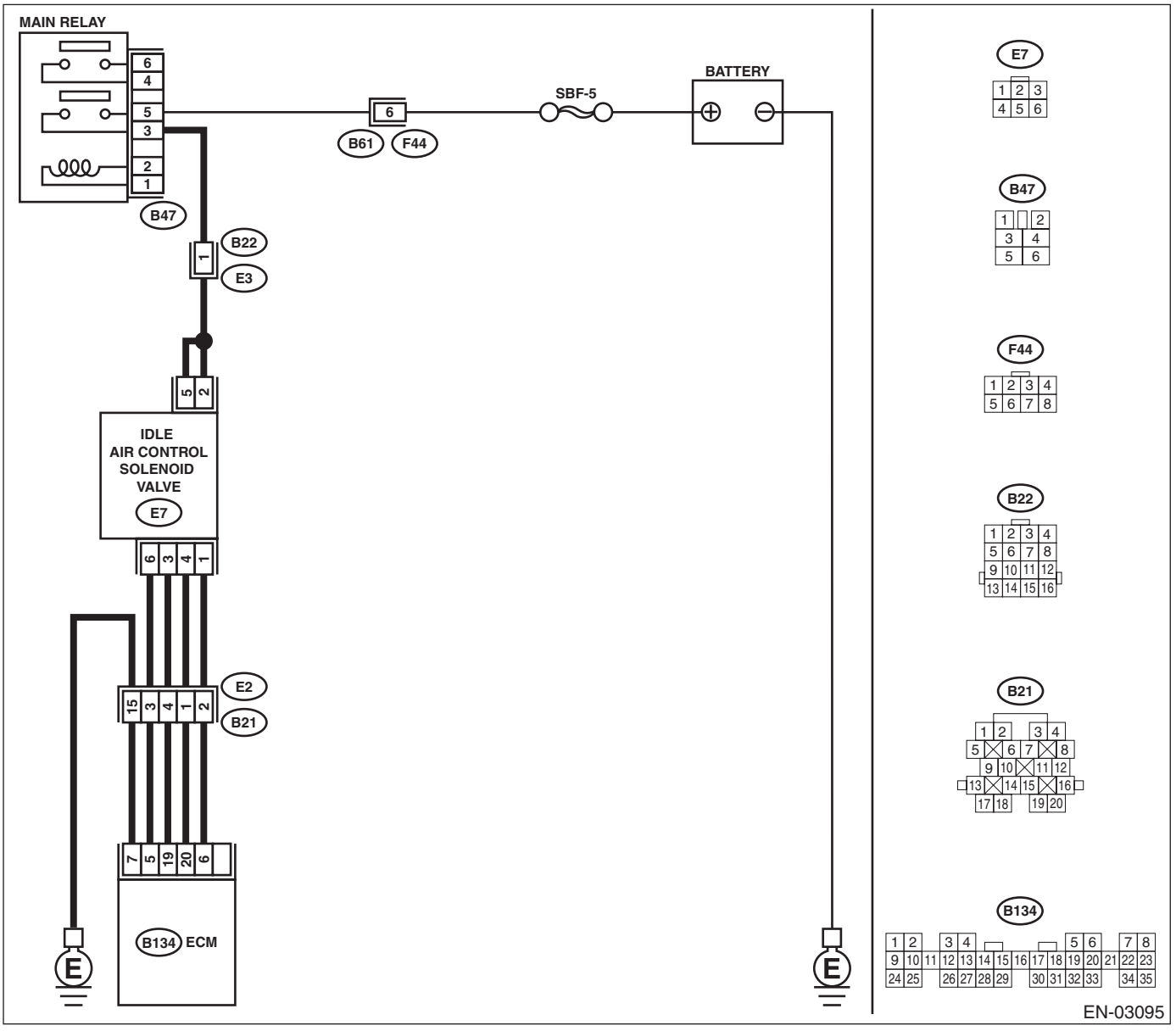
Step		Check	Yes	No
1	**CHECK OPERATION OF STARTER MOTOR.** NOTE: Place the inhibitor switch in “P” or “N” position (AT). Depress the clutch pedal (MT).	Does starter motor operate when ignition switch to “ON”?	Repair battery short circuit in starter motor circuit.	Check starter motor circuit. <Ref. to EN(H4SO)-64, Diagnostics for Engine Starting Failure.>

BP:DTC P0519 — IDLE AIR CONTROL CIRCUIT SYSTEM PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine keeps running at higher revolution than specified idling revolution.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



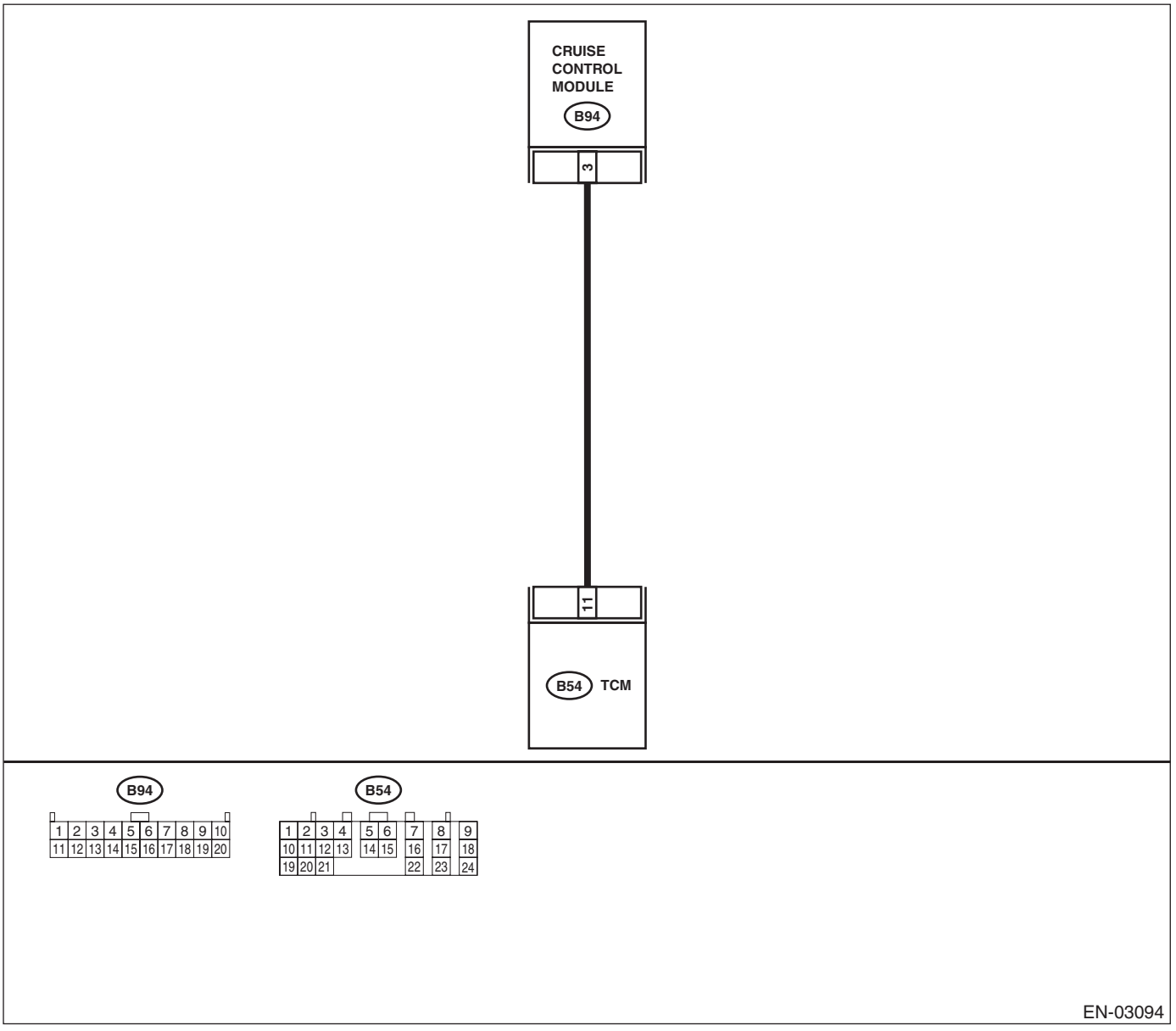
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0519.	Go to step **2.**
2	**CHECK AIR INTAKE SYSTEM.** 1) Turn ignition switch to ON. 2) Start engine, and idle it. 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 any malfunction in air intake system?	Repair air suction and leaks.	Go to step **3.**
3	**CHECK THROTTLE CABLE.**	Does throttle cable have play for adjustment?	Go to step **4.**	Adjust throttle cable. <Ref. to SP(H4SO)-6, Accelerator Control Cable.>
4	**CHECK AIR BY-PASS LINE.** 1) Turn ignition switch to OFF. 2) Remove idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-35, REMOVAL, Idle Air Control Solenoid Valve.> 3) Confirm that there are no foreign particles in by-pass air line.	Are foreign particles in by-pass air line?	Remove foreign particles from by-pass air line.	Replace idle air control solenoid valve. <Ref. to FU(H4SO)-35, Idle Air Control Solenoid Valve.>

BQ:DTC P0565 — CRUISE CONTROL ON SIGNAL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



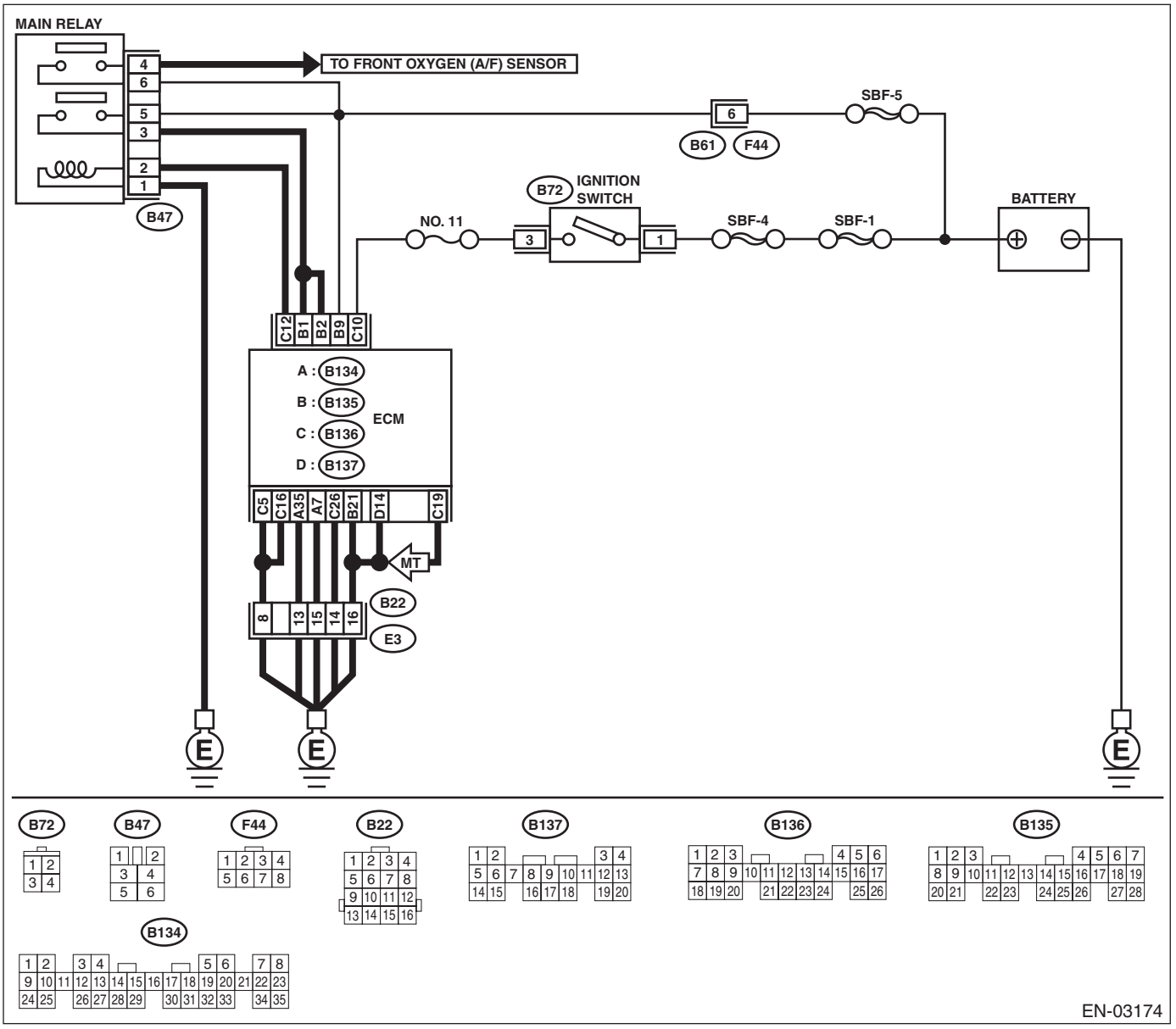
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from TCM and CCM. 3) Measure resistance of harness between TCM and CCM connector. ***Connector & terminal*** ***(B54) No. 11 - (B94) No. 3:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair open circuit in harness between TCM and CCM connector.
2	**CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR.** Measure resistance of harness between TCM and chassis ground. ***Connector & terminal*** ***(B55) No. 22 - Chassis ground: (with SPORT shift)*** ***(B54) No. 11 - Chassis ground: (without SPORT shift)***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair short circuit in harness between TCM and CCM connector.
3	**CHECK INPUT SIGNAL FOR TCM.** 1) Connect 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) Cruise control main switch to ON. 5) Move selector lever to “D” and slowly increase vehicle speed to 50 km/h (31 MPH). 6) Cruise control command switch to ON. 7) Measure voltage between TCM and chassis ground. ***Connector & terminal*** ***(B54) No. 11 - Chassis ground:***	Is the measured value less than 1 V?	Go to step **4.**	Check cruise control command switch circuit. <Ref. to CC-8, INSPECTION, Cruise Control Command Switch.>
4	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Engine does not start.
  - Engine stalls.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step	Check	Yes	No
1 **CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the related DTC using List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	A temporary poor contact.

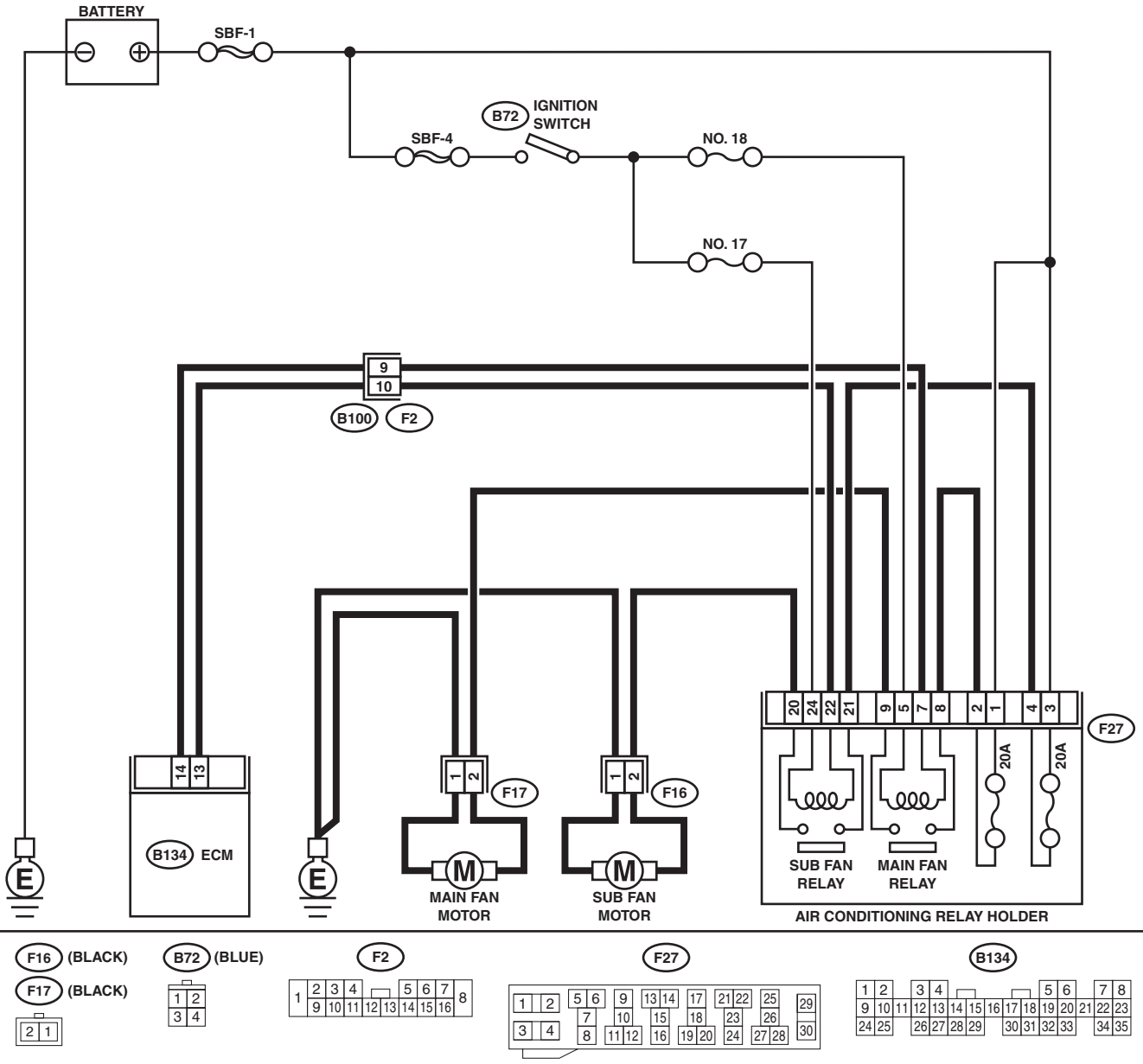
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Radiator fan does not operate properly.
  - Overheating

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03183

	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating radiator fan relay, measure voltage between ECM terminal and ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode".<Ref. to EN(H4SO)-34, Subaru Select Monitor.> ***Connector & terminal*** ***(B134) No. 14 (+) — Chassis ground (−):***	Is the measured value within 0 to 10 V?	Repair poor contact in ECM connector.	Go to step **2.**
2	**CHECK GROUND SHORT CIRCUIT IN RADIATOR FAN RELAY 1 CONTROL CIRCUIT.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and remove main fan relay from A/C relay holder. 3) Measure resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 14 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in radiator fan relay 1 control circuit.
3	**CHECK POWER SUPPLY FOR RELAY.** 1) Turn ignition switch to ON. 2) Measure voltage between fuse and relay box (F/B) connector and chassis ground. ***Connector & terminal*** ***(F27) No. 5 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **4.**	Repair open circuit in harness between ignition switch and fuse and relay box (F/B) connector.
4	**CHECK MAIN FAN RELAY.** 1) Turn ignition switch to OFF. 2) Measure resistance between main fan relay terminals. ***Terminal*** ***No. 5 — No. 7:***	Is the measured value within 87 to 107 Ω?	Go to step **5.**	Replace main fan relay.
5	**CHECK OPEN CIRCUIT IN MAIN FAN RELAY CONTROL CIRCUIT.** Measure resistance of harness between ECM and main fan relay connector. ***Connector & terminal*** ***(B134) No. 14 — (F27) No. 7:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and main fan relay connector • Poor contact in coupling connector
6	**CHECK POOR CONTACT.** Check poor contact in ECM or main fan relay connector.	Is there poor contact in ECM or main fan relay connector?	Repair poor contact in ECM or main fan relay connector.	Contact with SOA service center.

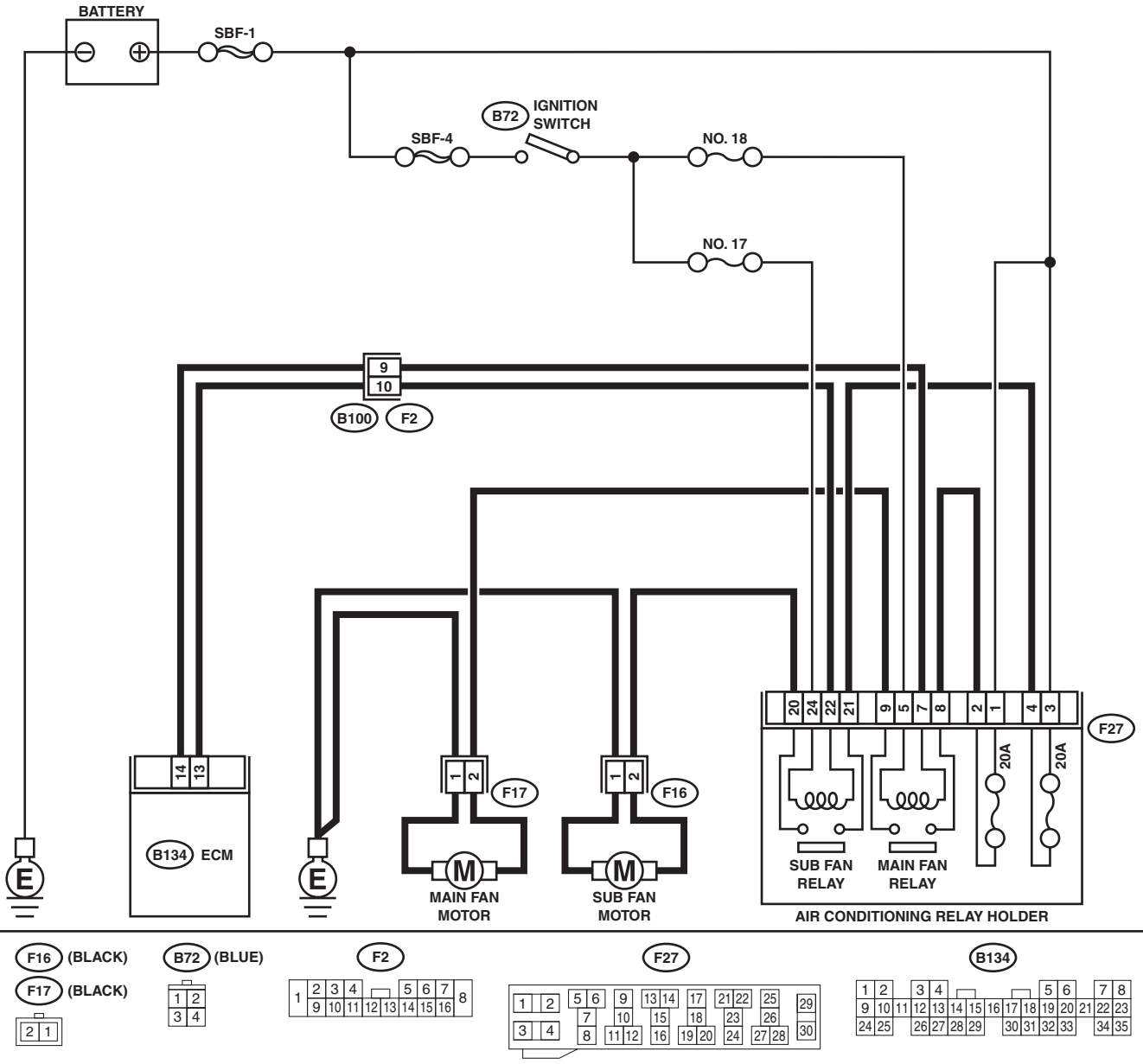
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Radiator fan does not operate properly.
  - Overheating

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-03183

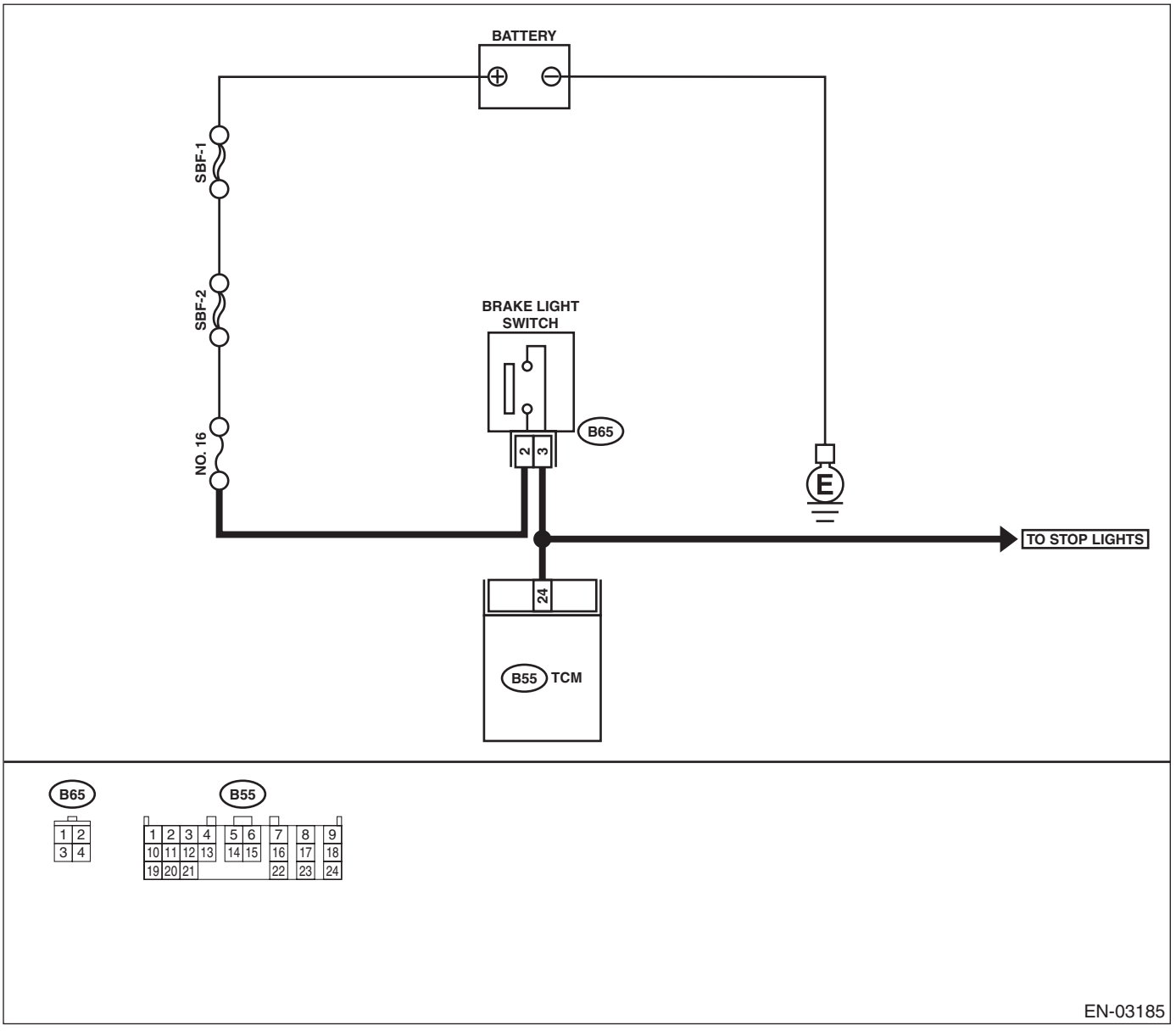
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box. 3) Turn ignition switch to ON. 4) While operating radiator fan relay, measure voltage between ECM and chassis ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode".<Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 14 (+) — Chassis ground (−):***	Is the measured value within 0 to 10 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.	Go to step **2.**
2	**CHECK SHORT CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT.** 1) Turn ignition switch to OFF. 2) Remove main fan relay and sub fan relay. (with A/C models) 3) Disconnect test mode connector. 4) Turn ignition switch to ON. 5) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 14 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in radiator fan relay control circuit.	Go to step **3.**
3	**CHECK MAIN FAN RELAY.** 1) Turn ignition switch to OFF. 2) Remove main fan relay. 3) Measure resistance between main fan relay terminals. ***Terminal*** ***No. 5 — No. 7:***	Is the measured value less than 1 Ω?	Replace main fan relay.	Go to step **4.**
4	**CHECK SUB FAN RELAY.** 1) Remove sub fan relay. 2) Measure resistance between sub fan relay terminals. ***Terminal*** ***No. 22 — No. 24***	Is the measured value less than 1 Ω?	Replace sub fan relay.	Go to step **5.**
5	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

BU:DTC P0703 — TORQUE CONVERTER/BRAKE SWITCH "B" CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



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

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR.** 1) Disconnect connectors from TCM and brake light switch. 2) Measure resistance of harness between TCM and brake light switch connector. ***Connector & terminal*** ***(B55) No. 24 — (B65) No. 3:***	Is the measured value less than 1 Ω?	Go to step **3.**	Repair or replace 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 resistance of harness between TCM and chassis ground. ***Connector & terminal*** ***(B55) No. 24 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit in harness between TCM and brake light switch connector.
4	**CHECK INPUT SIGNAL FOR TCM.** 1) Connect connectors to TCM and brake light switch. 2) Measure voltage between TCM and chassis ground. ***Connector & terminal*** ***(B55) No. 24 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **5.**	Adjust or replace brake light switch. <Ref. to LI-8, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
5	**CHECK INPUT SIGNAL FOR TCM.** Measure voltage between TCM and chassis ground. ***Connector & terminal*** ***(B55) No. 24 (+) — Chassis ground (−):***	Is the measured value more than 10 V when depressing the brake pedal?	Go to step **6.**	Adjust or replace brake light switch. <Ref. to LI-8, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
6	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

BV:DTC P0731 — GEAR 1 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-289, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BW:DTC P0732 — GEAR 2 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-289, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BX:DTC P0733 — GEAR 3 INCORRECT RATIO —

NOTE:
For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)-289, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BY:DTC P0734 — GEAR 4 INCORRECT RATIO —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **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 malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK THROTTLE POSITION SENSOR CIRCUIT.** Check throttle position sensor circuit. <Ref. to 4AT-44, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in throttle position sensor circuit?	Repair or replace throttle position sensor circuit.	Go to step **3.**
3	**CHECK FRONT VEHICLE SPEED SENSOR CIRCUIT.** Check front vehicle speed sensor circuit. <Ref. to 4AT-48, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in vehicle speed sensor 2 circuit?	Repair or replace vehicle speed sensor 2 circuit.	Go to step **4.**
4	**CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT.** Check torque converter turbine speed sensor circuit. <Ref. to 4AT-52, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in torque converter turbine speed sensor circuit?	Repair or replace torque converter turbine speed sensor circuit.	Go to step **5.**
5	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Go to step **6.**
6	**CHECK MECHANICAL TROUBLE.** Check mechanical trouble in automatic transmission.	Is there any mechanical trouble in automatic transmission?	Repair or replace automatic transmission. <Ref. to 4AT-33, INSPECTION, Road Test.>	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - No lock-up (after engine warm-up)
  - No shift or excessive tight corner “braking”

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK LOCK-UP DUTY SOLENOID CIRCUIT.** Check lock-up duty solenoid circuit. <Ref. to 4AT-84, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in lock-up duty solenoid circuit?	Repair or replace lock-up duty solenoid circuit.	Go to step **3.**
3	**CHECK THROTTLE POSITION SENSOR CIRCUIT.** Check throttle position sensor circuit. <Ref. to 4AT-44, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in throttle position sensor circuit?	Repair or replace 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 4AT-52, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in torque converter turbine speed sensor circuit?	Repair or replace torque converter turbine speed sensor circuit.	Go to step **5.**
5	**CHECK ENGINE SPEED INPUT CIRCUIT.** Check engine speed input circuit. <Ref. to 4AT-38, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in engine speed input circuit?	Repair or replace engine speed input circuit.	Go to step **6.**
6	**CHECK INHIBITOR SWITCH CIRCUIT.** Check inhibitor switch circuit. <Ref. to 4AT-101, CHECK INHIBITOR SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Is there any malfunction in inhibitor switch circuit?	Repair or replace inhibitor switch circuit.	Go to step **7.**
7	**CHECK BRAKE LIGHT SWITCH CIRCUIT.** Check brake light switch circuit. <Ref. to 4AT-99, CHECK BRAKE SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Is there any malfunction in brake light switch circuit?	Repair or replace brake light switch circuit.	Go to step **8.**

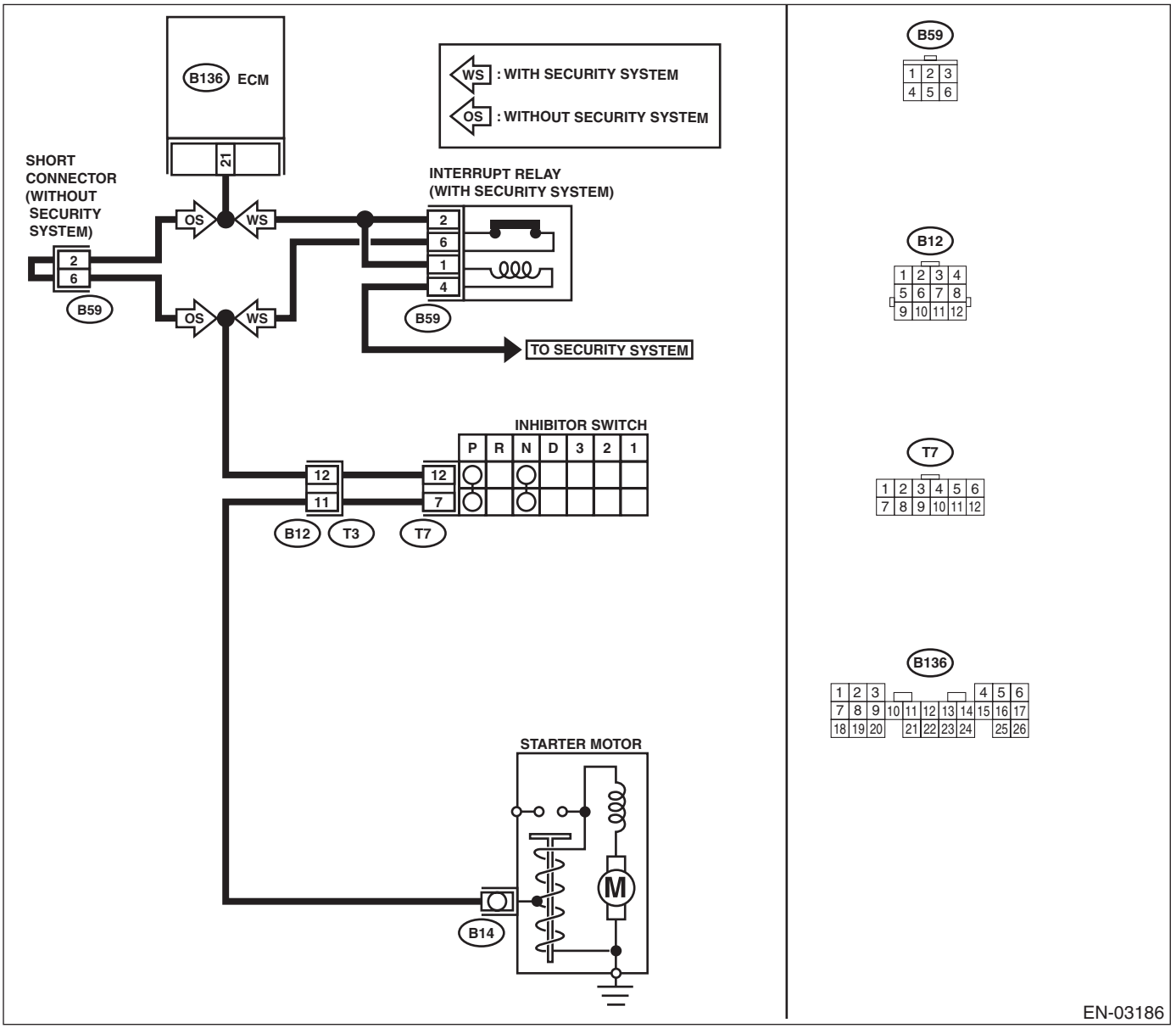
	Step	Check	Yes	No
8	**CHECK ATF TEMPERATURE SENSOR CIRCUIT.** Check ATF temperature sensor circuit. <Ref. to 4AT-40, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any malfunction in ATF temperature sensor circuit?	Repair or replace ATF temperature sensor circuit.	Go to step **9.**
9	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Go to step **10.**
10	**CHECK MECHANICAL TROUBLE.** Check mechanical trouble in automatic transmission.	Is there any mechanical malfunction in automatic transmission?	Repair or replace automatic transmission. <Ref. to 4AT-33, INSPECTION, Road Test.>	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



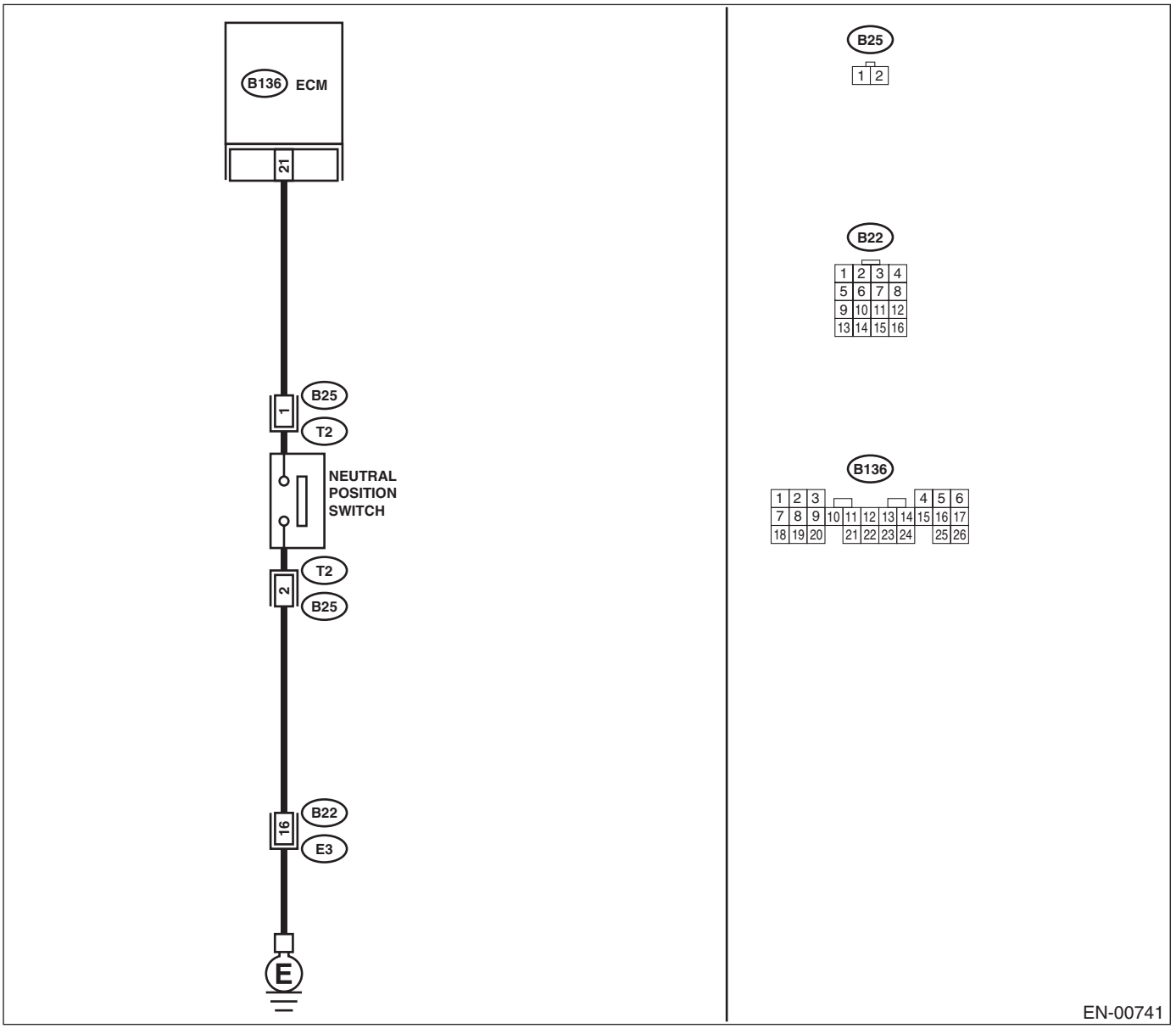
	Step	Check	Yes	No
1	**CHECK SELECTOR CABLE CONNECTION.**	Is there any malfunction in selector cable?	Repair or adjust selector cable connection. <Ref. to CS-31, Select Cable.>	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Place the select lever in any other than “P” or “N” range. 3) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time.	Go to step **3.**
3	**CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and transmission harness connector (T3). 3) Measure resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 21 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit in harness between ECM and transmission harness connector.
4	**CHECK TRANSMISSION HARNESS CONNECTOR.** 1) Disconnect connector from inhibitor switch. 2) Measure resistance of harness between transmission harness connector and engine ground. ***Connector & terminal*** ***(T3) No. 12 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair ground short circuit in harness between transmission harness and inhibitor switch connector.
5	**CHECK INHIBITOR SWITCH.** Measure resistance between inhibitor switch connector terminals in select lever in any other than “P” or “N” position. ***Terminals*** ***No. 7 — No. 12:***	Is the measured value more than 1 MΩ?	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace inhibitor switch. <Ref. to 4AT-50, Inhibitor Switch.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



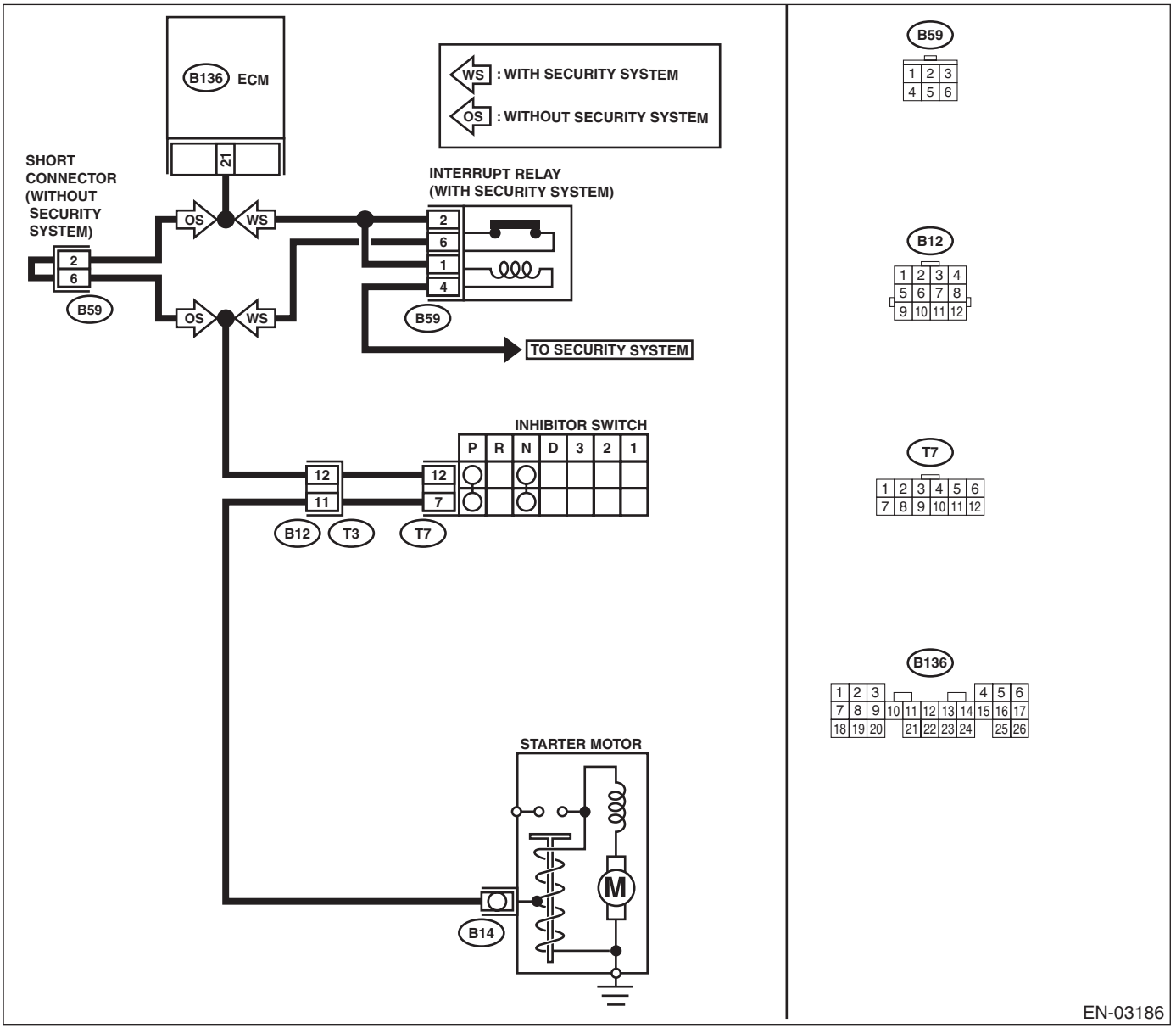
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Place the shift lever in neutral position. 3) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **2.**	Go to step **4.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Place the shift lever in any other than neutral position. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value more than 5 V?	Go to step **3.**	Go to step **4.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK NEUTRAL POSITION SWITCH.** 1) Turn ignition switch to OFF. 2) Disconnect connector from transmission harness. 3) Place the shift lever in neutral position. 4) Measure resistance between transmission harness and connector terminals. ***Connector & terminal*** ***(T2) No. 1 — No. 2:***	Is the measured value 1 MΩ or less?	Go to step **5.**	Repair open circuit in transmission harness or replace neutral position switch.
5	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.** 1) Disconnect connector from ECM. 2) Measure resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit in harness between ECM and transmission harness connector.
6	**CHECK POOR CONTACT.** Check poor contact in transmission harness connector.	Is there poor contact in transmission harness connector?	Repair poor contact in transmission harness connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK SELECTOR CABLE CONNECTION.**	Is there any malfunction in selector cable?	Repair or adjust selector cable connection. <Ref. to CS-31, Select Cable.>	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground in select level “N” and “P” positions. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **3.**	Go to step **5.**
3	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground in select level “N” and “P” positions. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **5.**
4	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector.	Repair poor contact in ECM connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short in harness between ECM and inhibitor switch connector.	Go to step **6.**
6	**CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM and inhibitor switch. 3) Measure resistance of harness between ECM and inhibitor switch connector. ***Connector & terminal*** ***(B136) No. 21 — (T7) No. 12:***	Is the measured value less than 1 Ω?	Go to step **7.**	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

	Step	Check	Yes	No
7	**CHECK INHIBITOR SWITCH GROUND LINE.** Measure resistance of harness between inhibitor switch connector and engine ground. ***Connector & terminal*** ***(T7) No. 7 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **8.**	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 grond line • Poor contact in satrter motor connector • Poor contact in starter motor ground • Starter motor
8	**CHECK INHIBITOR SWITCH.** Measure resistance between inhibitor switch connector terminals in select level “N” and “P” positions. ***Terminal*** ***No. 7 — No. 12:***	Is the measured value less than 1 Ω?	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace inhibitor switch. <Ref. to 4AT-50, Inhibitor Switch.>

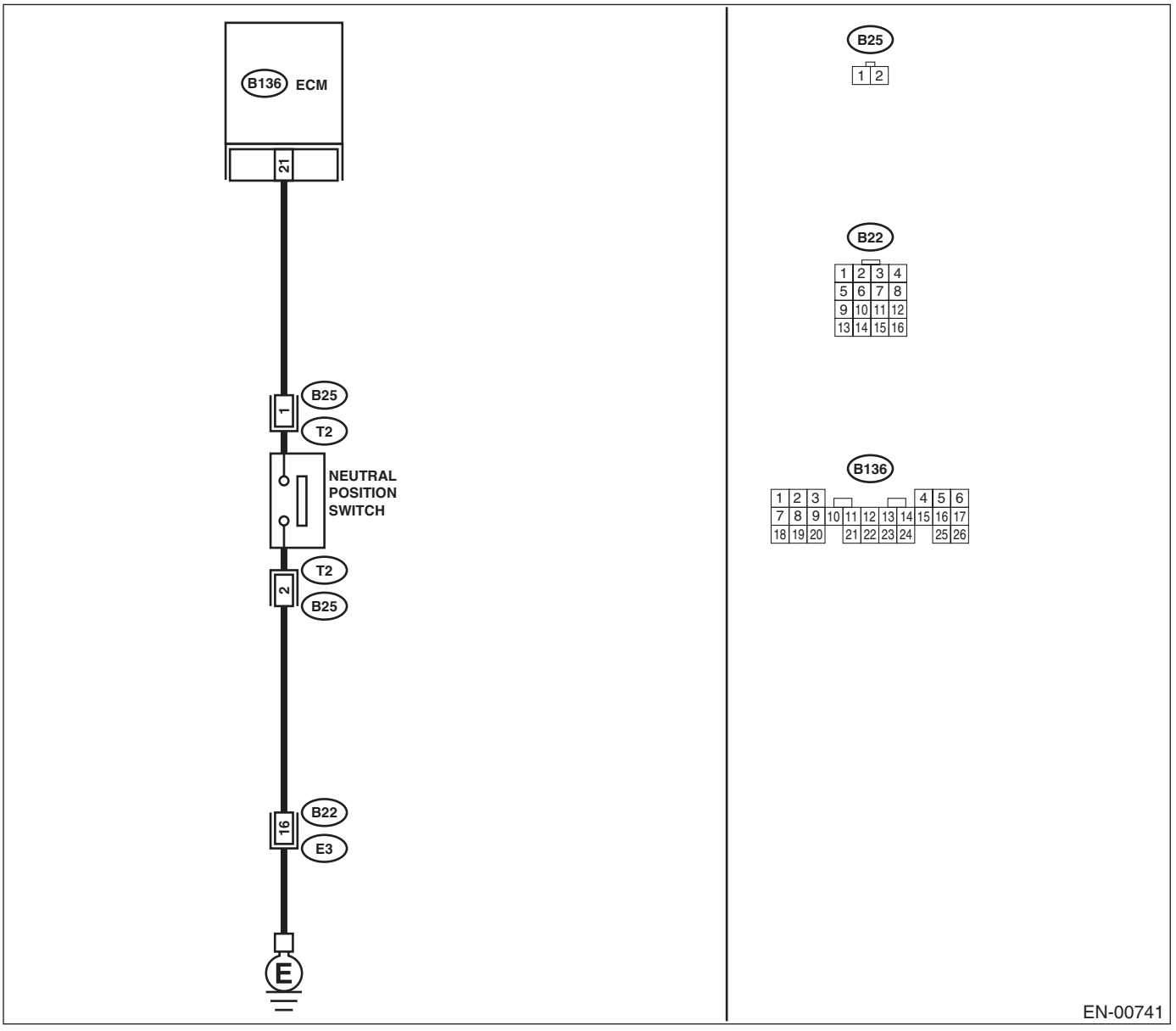
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Erroneous idling

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



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

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

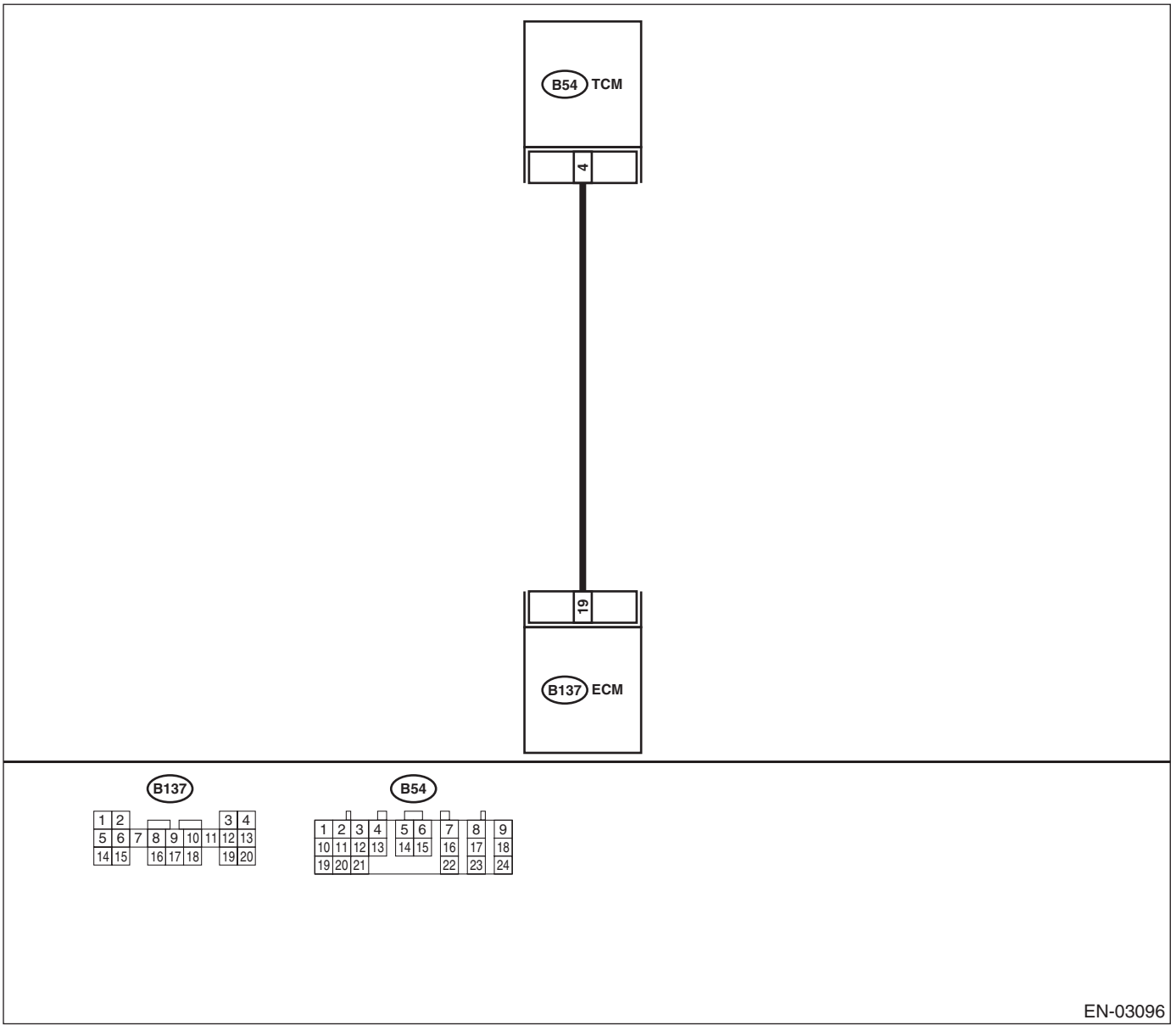
MEMO:

CE:DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



Step		Check	Yes	No
1	**CHECK DRIVING CONDITION.** 1) Start and warm-up the engine until the radiator fan makes one complete rotation. 2) Drive the vehicle.	Is AT shift control functioning properly?	Go to step **2.**	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

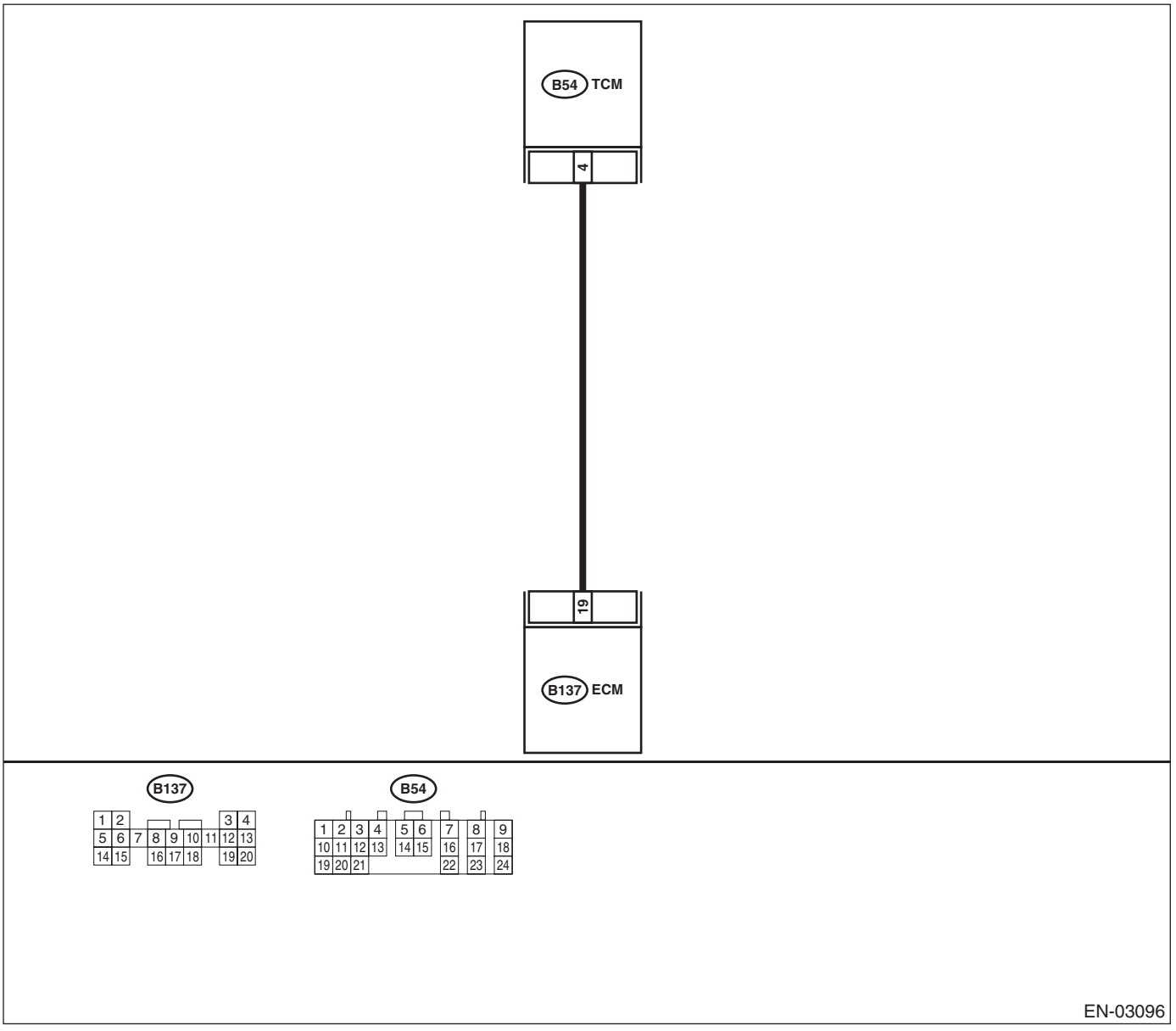
Step		Check	Yes	No
2	**CHECK ACCESSORY.**	Are car phone and/or CB installed on vehicle?	Repair grounding line of car phone or CB system.	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

CF:DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



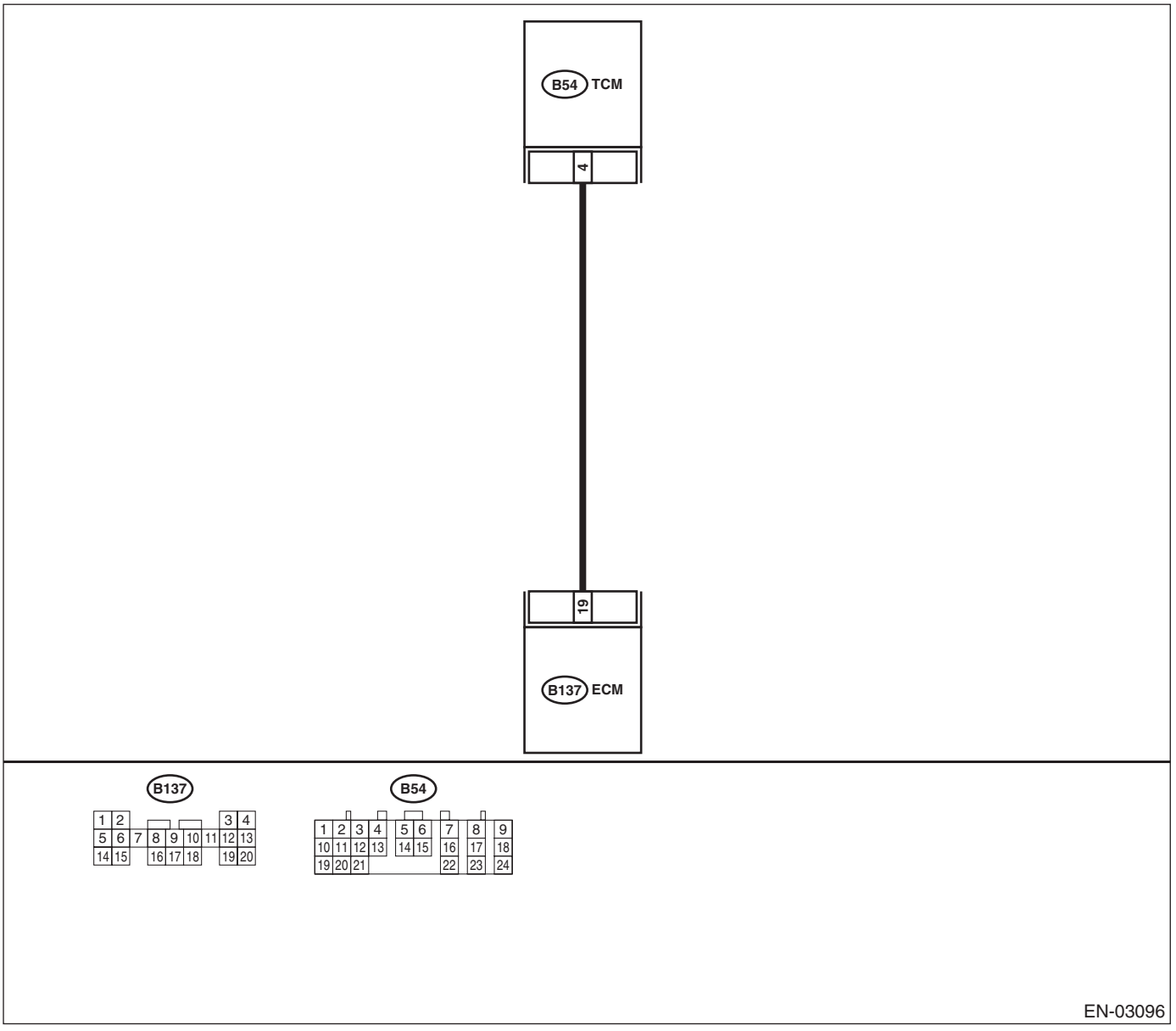
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **2.**	Even if MIL lights up, the circuit has returned to a normal condition at this time. 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 connector from ECM and TCM. 3) Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 19 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in harness between ECM and TCM connector.
3	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect connector to ECM. 2) Turn ignition switch to ON. 3) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value more than 5 V?	Go to step **4.**	Repair poor contact in ECM connector.
4	**CHECK TROUBLE CODE FOR AUTOMATIC TRANSMISSION.** Read trouble code for automatic transmission. <Ref. to 4AT-21, Read Diagnostic Trouble Code (DTC).>	Does trouble code appear for automatic transmission?	Inspect trouble code for automatic transmission. <Ref. to 4AT-38, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

CG:DTC P0866 — TCM Communication circuit high —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



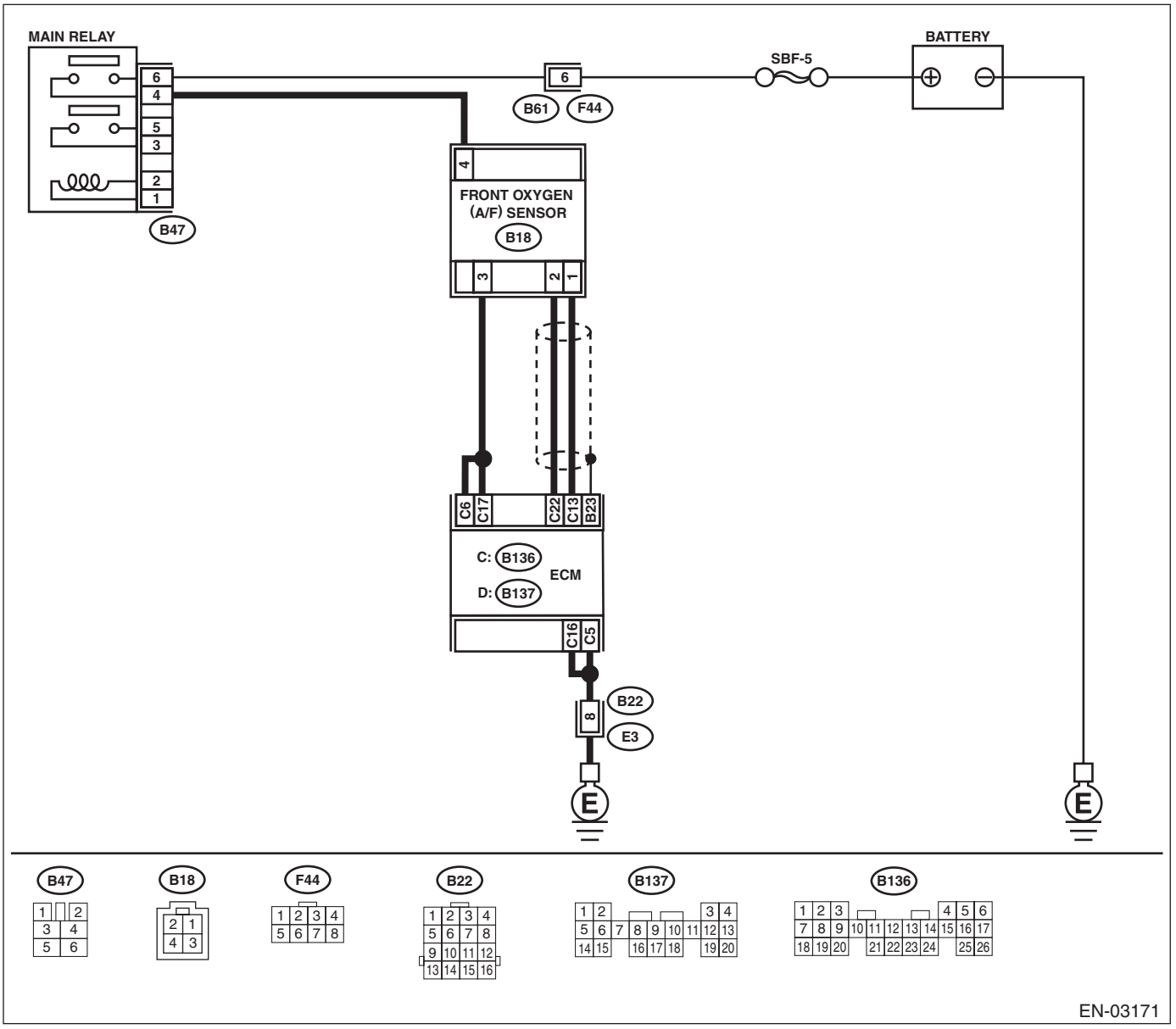
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **2.**
2	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value more than 4 V?	Go to step **5.**	Go to step **3.**
3	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Repair poor contact in ECM connector.	Go to step **4.**
4	**CHECK OUTPUT SIGNAL FROM ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 19 (+) — Chassis ground (−):***	Is the measured value within 1 to 4 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time. NOTE: In this case, repair the following: • Poor contact in ECM connector • Poor contact in TCM connector	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** Measure voltage between TCM and chassis ground. ***Connector & terminal*** ***(B54) No. 4 (+) - Chassis ground (-):***	Is the measured value more than 4 V?	Go to step **6.**	Repair open circuit in harness between ECM and TCM connector.
6	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Check TCM power supply line and grounding line.

CH:DTC P1134 — A/F SENSOR MICRO-COMPUTER PROBLEM —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



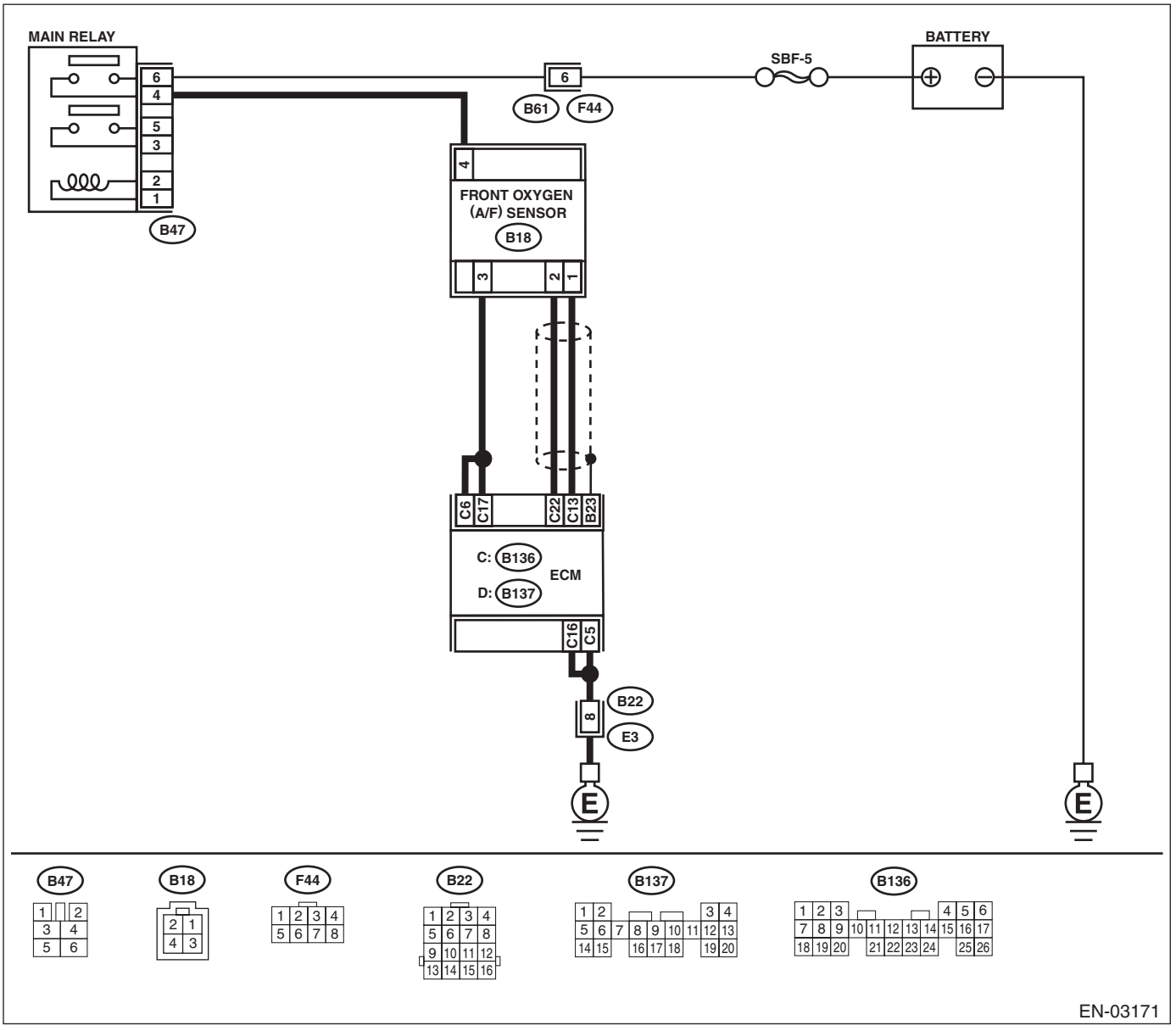
Step	Check	Yes	No
1 **CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the related DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P1134.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** 1) Start engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read data of front oxygen (A/F) sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15?	Go to step **3.**	Go to step **4.**
3	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** Race engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: •Normally, A/F mixture ratio is rich with racing engine. •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.	Is the measured value more than 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 connector from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance between ECM and front oxygen (A/F) sensor. ***Connector & terminals*** ***(B136) No. 13 — (B18) No. 1:*** ***(B136) No. 22 — (B18) No. 2:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair open circuit between ECM and front oxygen (A/F) sensor.
5	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.** Measure resistance between ECM and chassis ground. ***Connector & terminals*** ***(B136) No. 13 — Chassis ground:*** ***(B136) No. 22 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

	Step	Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any malfunction in exhaust system?	Repair or replace malfunctioning parts.	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>

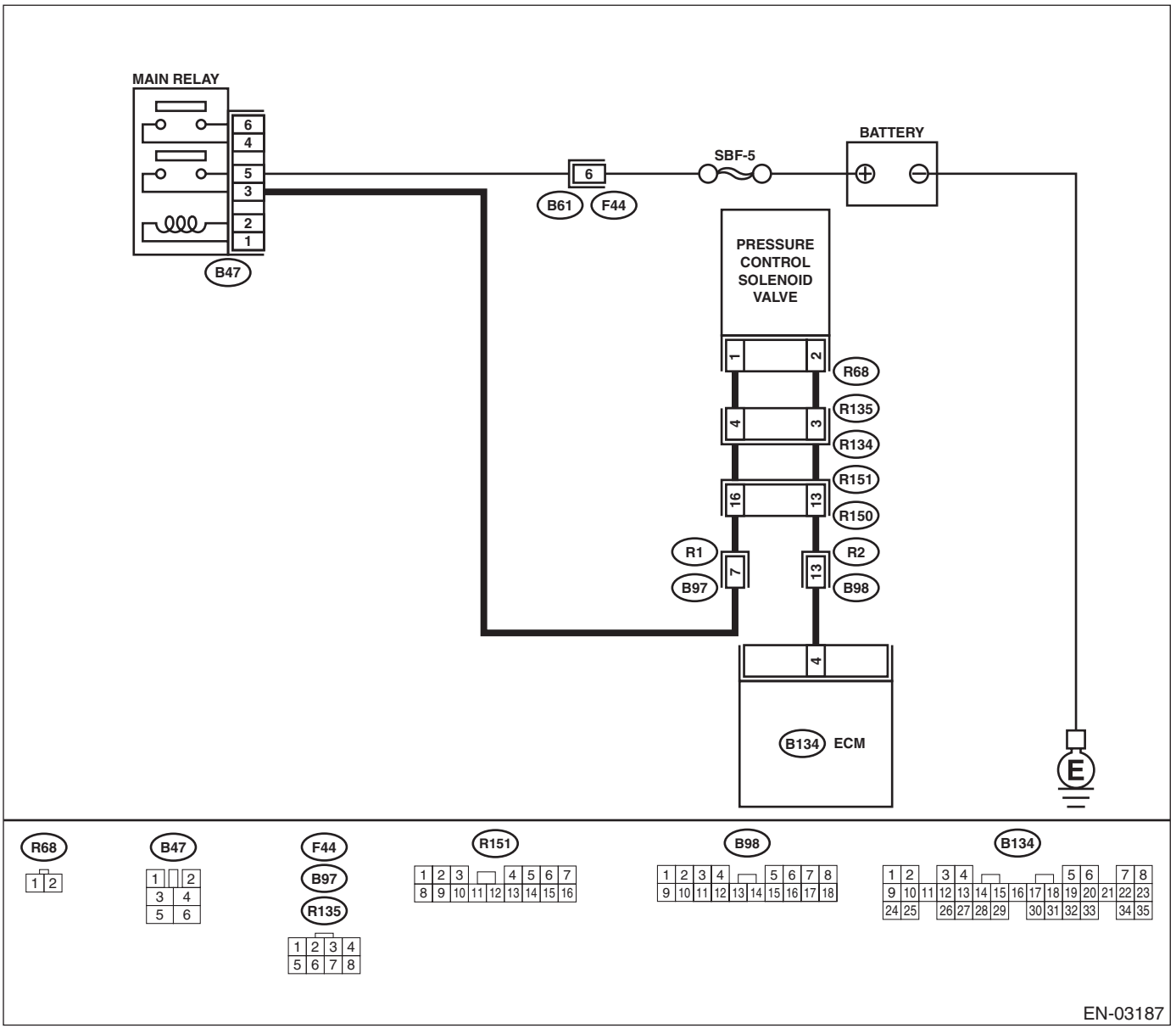
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 4 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact with 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 connectors from pressure control solenoid valve and ECM. 3) Measure resistance of harness between pressure control solenoid valve connector and chassis ground. ***Connector & terminal*** ***(R68) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit in harness between ECM and pressure control solenoid valve connector.
4	**CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** Measure resistance of harness between ECM and pressure control solenoid valve connector. ***Connector & terminal*** ***(B134) No. 4 — (R68) No. 2:***	Is the measured value less than 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 connectors
5	**CHECK PRESSURE CONTROL SOLENOID VALVE.** Measure resistance between pressure control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 10 to 100 Ω?	Go to step **6.**	Replace pressure control solenoid valve. <Ref. to EC(H4SO)-13, Pressure Control Solenoid Valve.>

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO PRESSURE CONTROL SOLENOID VALVE.** 1) Turn ignition switch to ON. 2) Measure voltage between pressure control solenoid valve and chassis ground. ***Connector & terminal*** ***(R68) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 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 connectors • Poor contact in main relay connector
7	**CHECK POOR CONTACT.** Check poor contact in pressure control solenoid valve connector.	Is there poor contact in pressure control solenoid valve connector?	Repair poor contact in pressure control solenoid valve connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

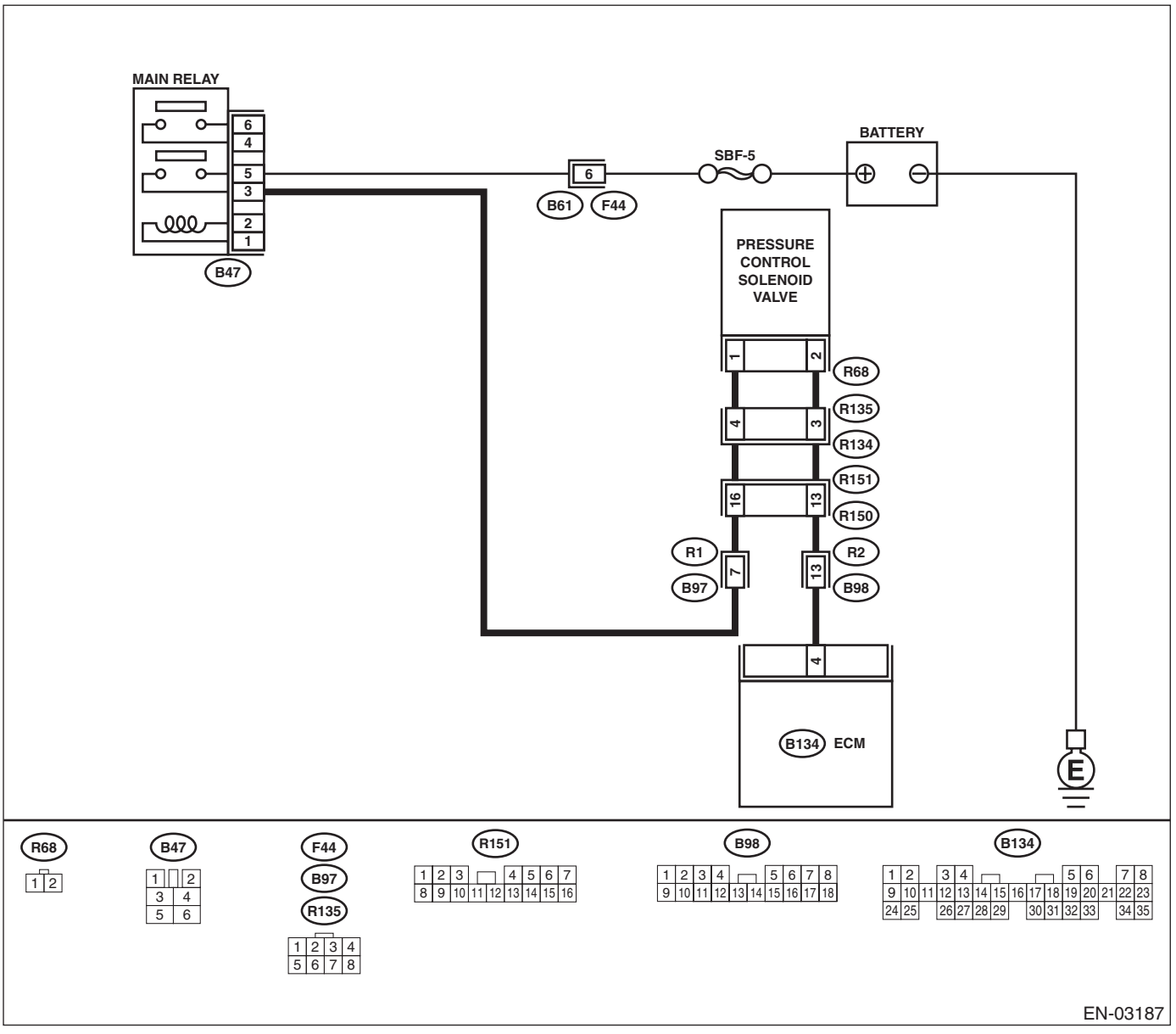
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



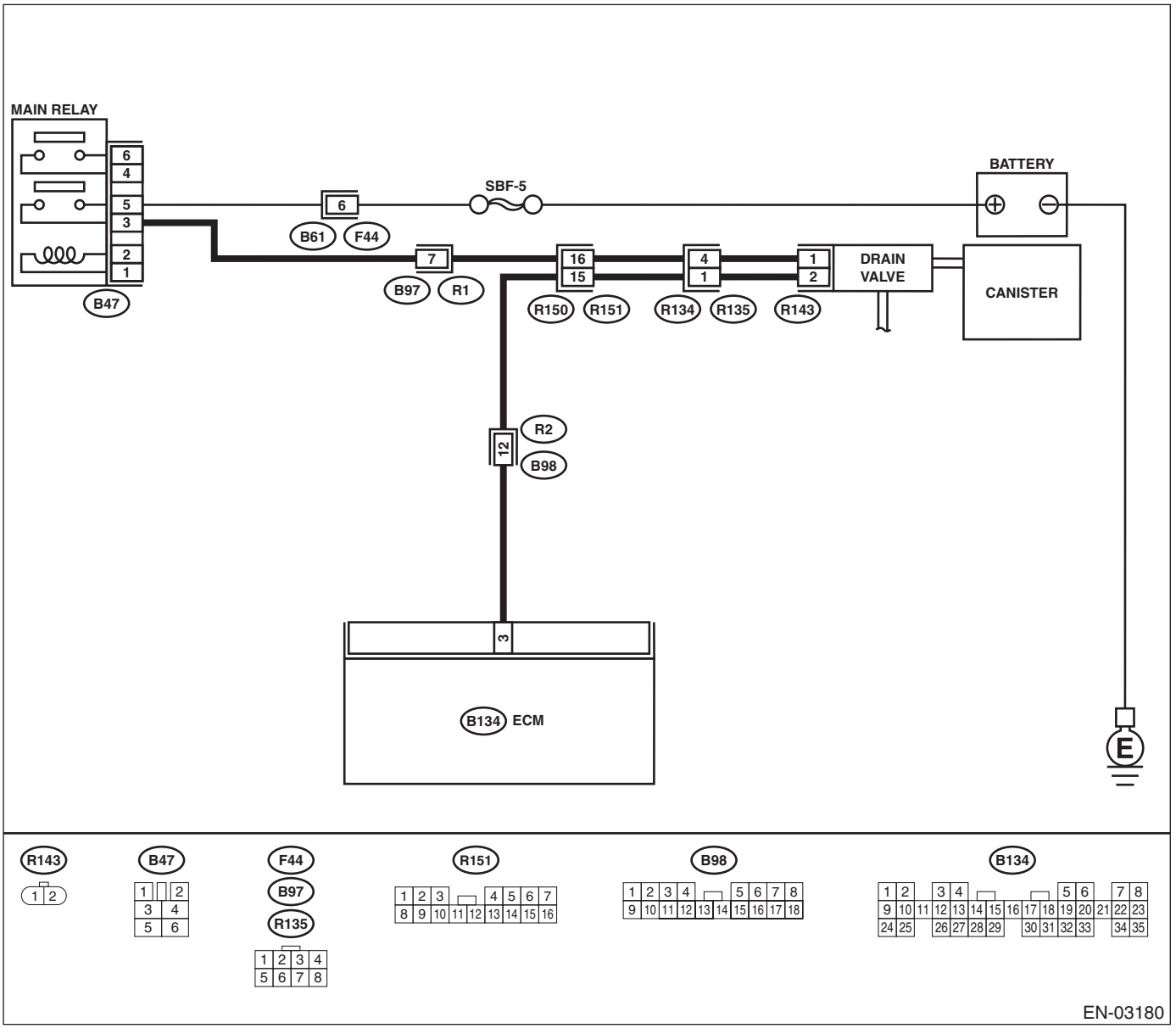
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side), to the side of the center console box. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. NOTE: Pressure control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 4 (+) — Chassis ground (–):***	Is the measured value within 0 to 10 V?	Go to step **2.**	Even if MIL light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.
2	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 4 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
4	**CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from pressure control solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 4 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and pressure control solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **5.**
5	**CHECK PRESSURE CONTROL SOLENOID VALVE.** 1) Turn ignition switch to OFF. 2) Measure resistance between pressure control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace pressure control solenoid valve <Ref. to EC(H4SO)-13, Pressure Control Solenoid Valve.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **6.**
6	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Improper fuel supply

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



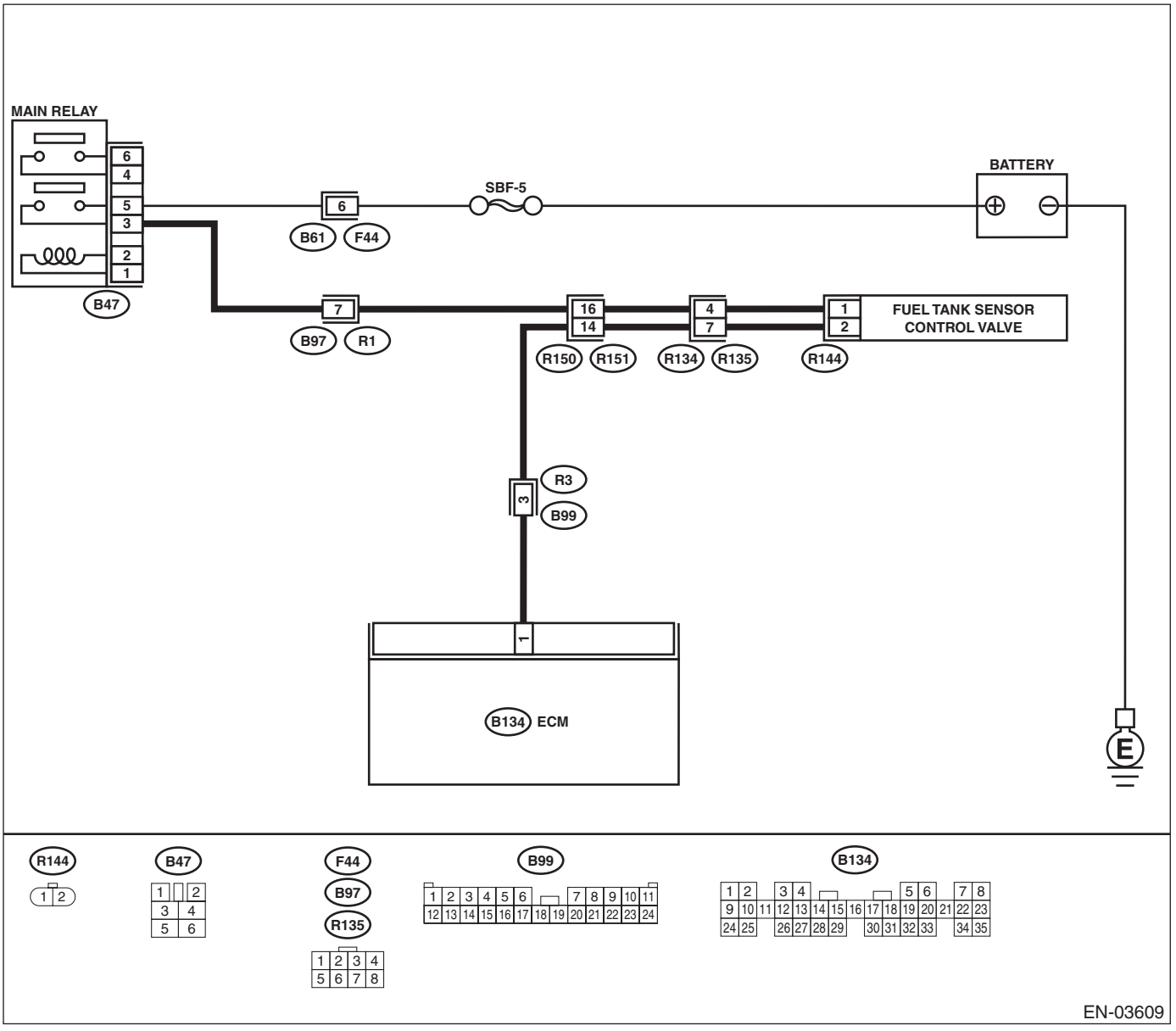
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK DRAIN HOSE.** Check the following items. •Clogging of canister drain hose	Is drain hose clogged?	Repair or replace the malfunctioning part.	Go to step **3.**
3	**CHECK DRAIN VALVE OPERATION.** 1) Turn ignition switch to OFF. 2) Connect test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to the "Compulsory Valve Operation Check Mode".<Ref. to EN(H4SO)-51, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace drain valve. <Ref. to EC(H4SO)-17, Drain Valve.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Even if MIL lights up, the circuit has returned to a normal condition at this time. (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 connectors
3	**CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from fuel tank sensor control valve and ECM. 3) Measure resistance of harness between drain valve connector and chassis ground. ***Connector & terminal*** ***(R144) No. 2 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit in harness between ECM and fuel tank sensor control valve connector.
4	**CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR.** Measure resistance of harness between ECM and fuel tank control solenoid valve connector. ***Connector & terminal*** ***(B134) No. 1 — (R144) No. 2:***	Is the measured value less than 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 connectors
5	**CHECK FUEL TANK SENSOR CONTROL VALVE.** Measure resistance between fuel tank sensor control valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 10 to 100 Ω?	Go to step **6.**	Replace fuel tank control solenoid valve. <Ref. to EC(H4SO)-12, Fuel Tank Sensor Control Valve.>

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO FUEL TANK CONTROL SOLENOID VALVE.** 1) Turn ignition switch to ON. 2) Measure voltage between fuel tank sensor control valve and chassis ground. ***Connector & terminal*** ***(R144) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 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 connectors • Poor contact in main relay connector
7	**CHECK POOR CONTACT.** Check poor contact in fuel tank sensor control valve connector.	Is there poor contact in fuel tank sensor control valve connector?	Repair poor contact in fuel tank sensor control valve connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

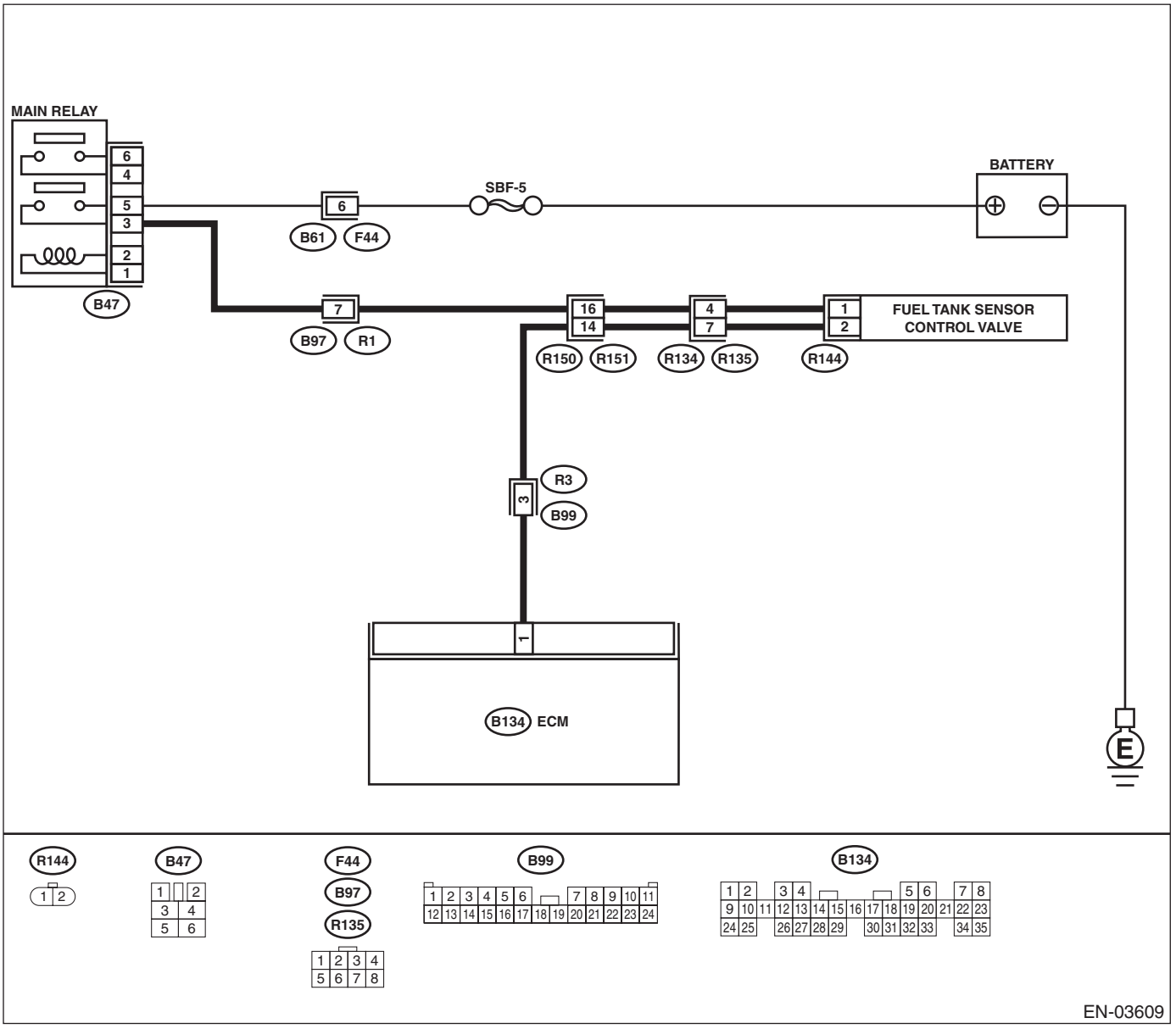
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



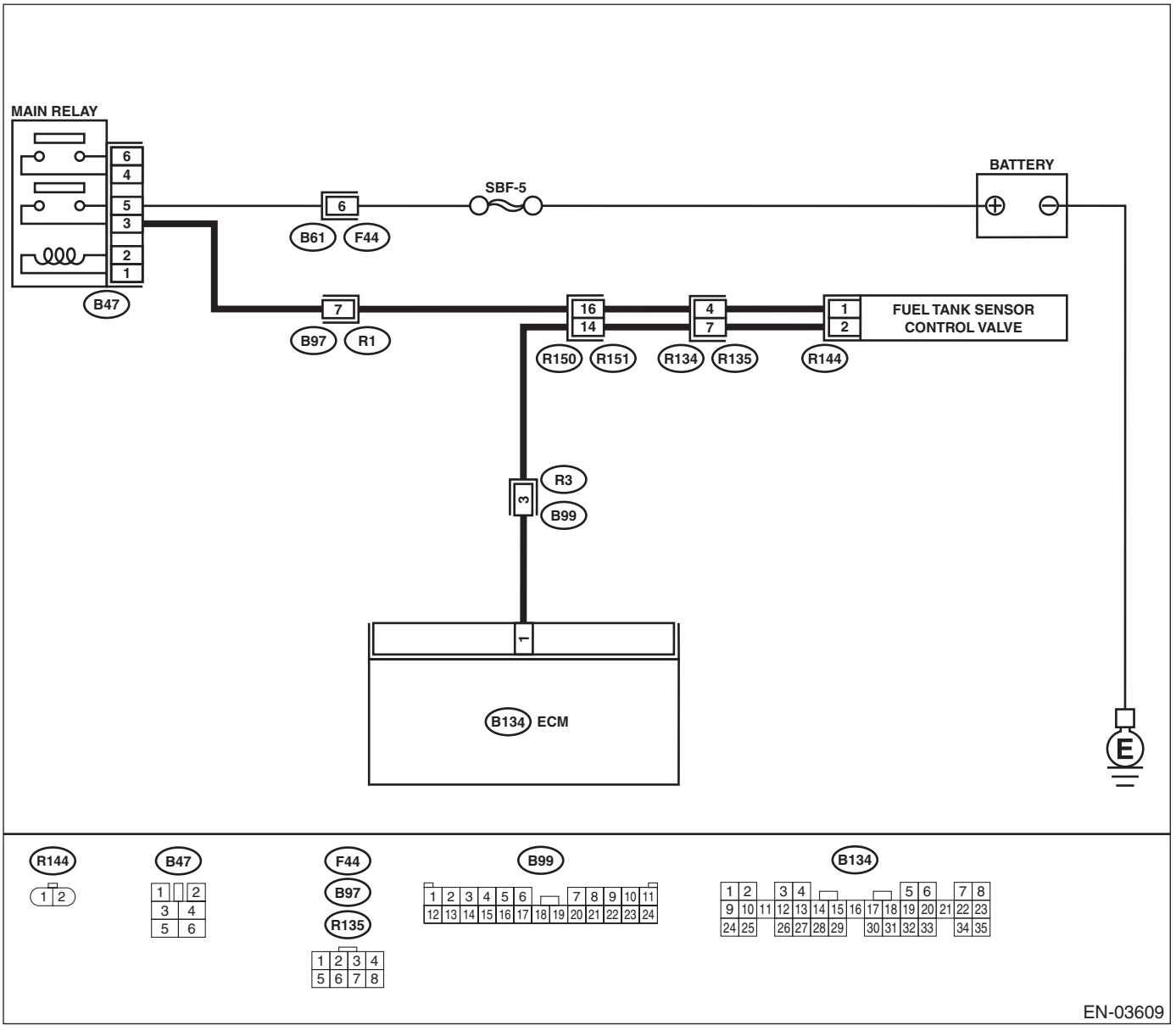
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Go to step **2.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
3	**CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel tank sensor control valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and fuel tank sensor control valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **4.**
4	**CHECK DRAIN VALVE.** 1) Turn ignition switch to OFF. 2) Measure resistance between fuel tank sensor control valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace fuel tank sensor control valve <Ref. to EC(H4SO)-12, Fuel Tank Sensor Control Valve.> and ECM <Ref. to FU(H4SO)-45, Engine Control Module.>	Go to step **5.**
5	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

CO:DTC P1448 — Fuel tank sensor control valve range/performance —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	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?	Go to step **3.**	Tighten fuel filler cap securely.
3	**CHECK 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	Is there any malfunction in pressure/vacuum line?	Repair or replace hoses and pipes.	Replace fuel tank pressure sensor. <Ref. to EC(H4SO)-11, Fuel Tank Pressure Sensor.>

CP:DTC P1492 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)-334, DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CQ:DTC P1493 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)-336, DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CR:DTC P1494 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)-334, DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CS:DTC P1495 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)-336, DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CT:DTC P1496 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)—

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)-334, DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CU:DTC P1497 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)-336, DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

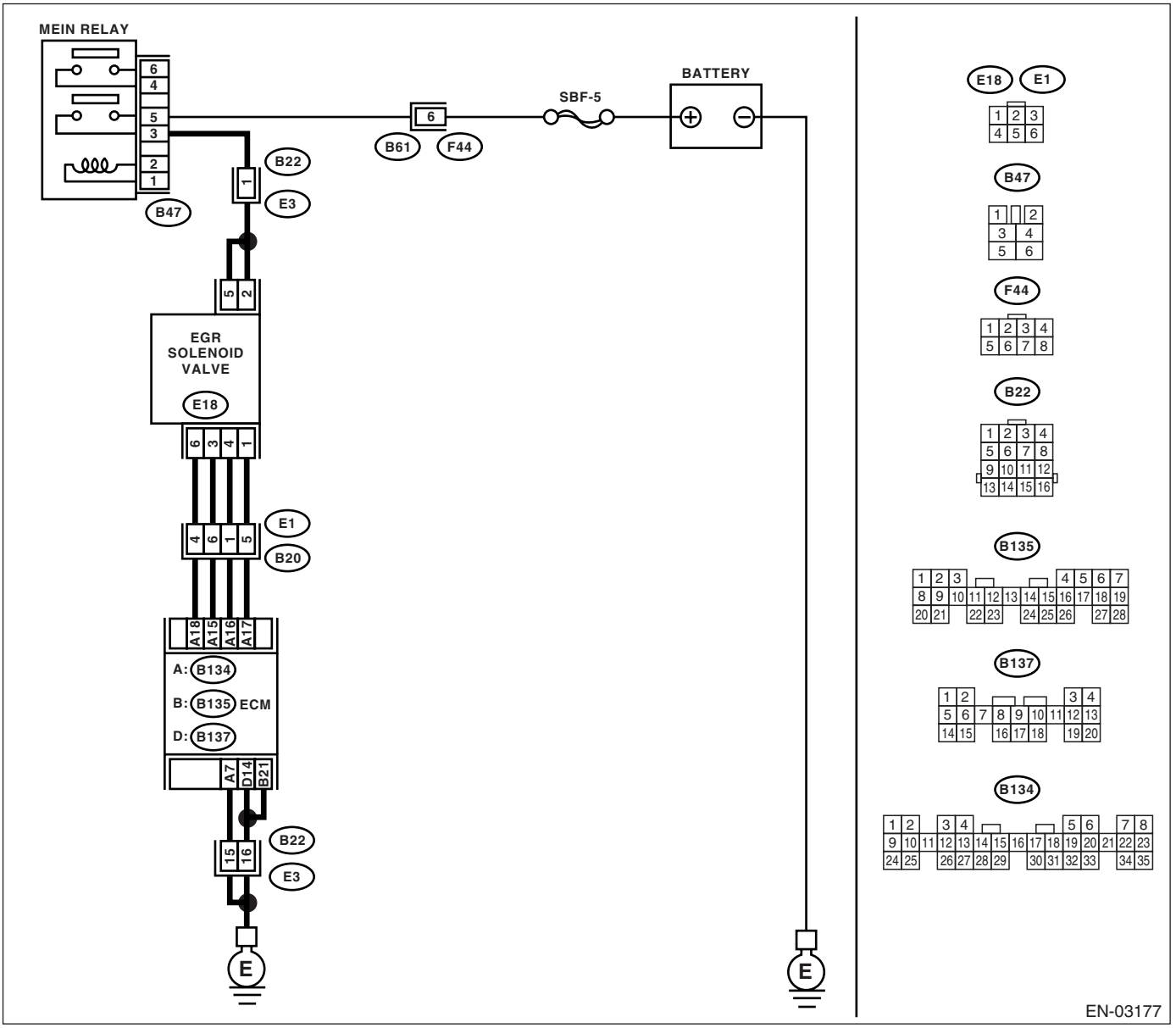
MEMO:

CV:DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Engine breathing

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



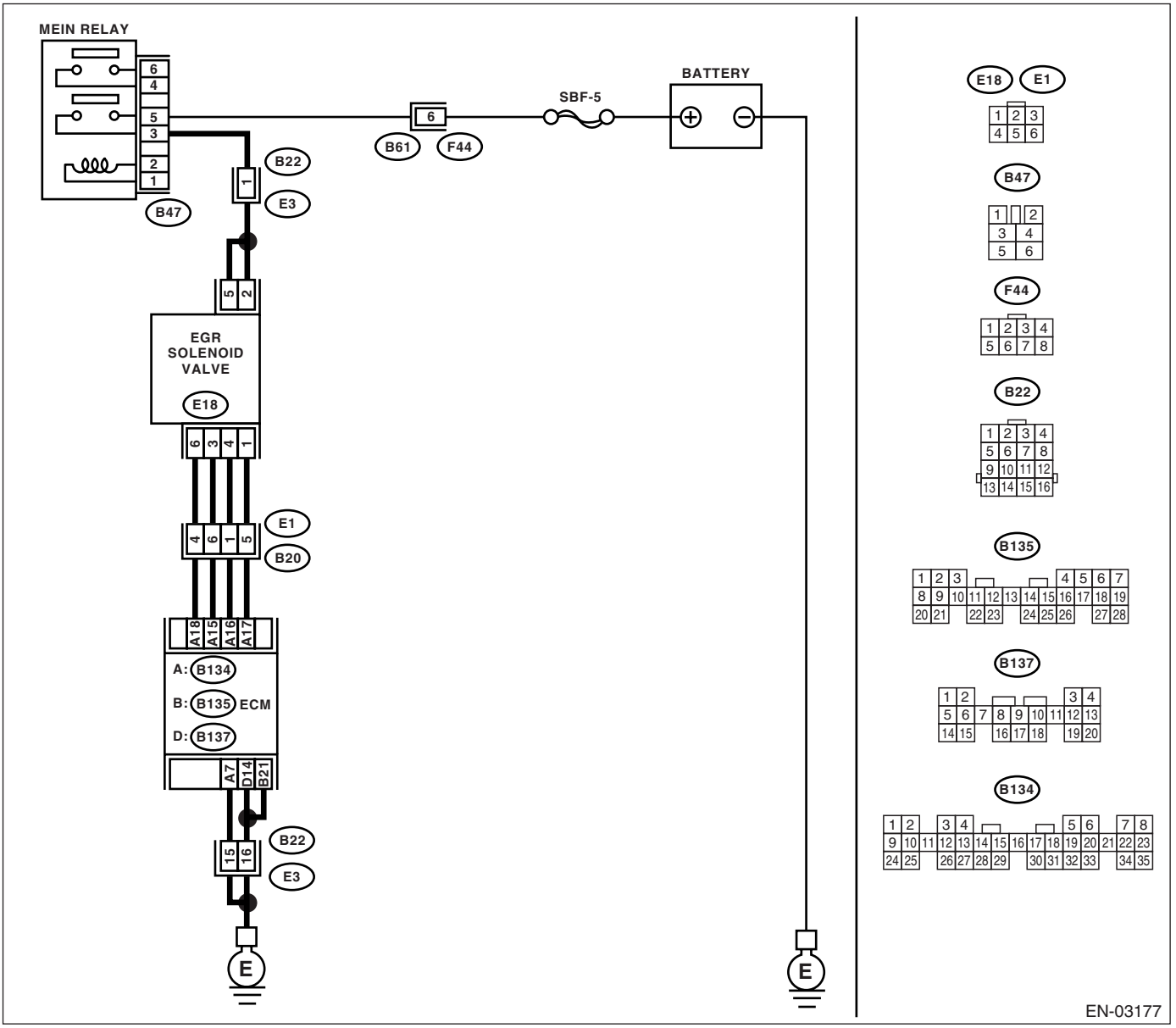
	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO EGR SOLENOID VALVE.** 1) Turn ignition switch to OFF. 2) Disconnect connector from EGR solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between EGR solenoid valve connector and engine ground. ***Connector & terminal*** ***(E18) No. 2 (+) - Engine ground (-):*** ***(E18) No. 5 (+) - Engine ground (-):***	Is the measured value more than 10 V?	Go to step **2.**	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between EGR solenoid valve and main relay connector • Poor contact in coupling connector
2	**CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between ECM and EGR solenoid valve connector. ***Connector & terminal*** ***DTC P1492; (B134) No. 18 - (E18) No. 6:*** ***DTC P1494; (B134) No. 17 - (E18) No. 1:*** ***DTC P1496; (B134) No. 16 - (E18) No. 4:*** ***DTC P1498; (B134) No. 15 - (E18) No. 3:***	Is the measured value less than 1 Ω?	Go to step **3.**	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and EGR solenoid valve connector • Poor contact in coupling connector
3	**CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.** 1) Disconnect connector from ECM. 2) Measure resistance between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1492; (B134) No. 18 - Chassis ground:*** ***DTC P1494; (B134) No. 17 - Chassis ground:*** ***DTC P1496; (B134) No. 16 - Chassis ground:*** ***DTC P1498; (B134) No. 15 - Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair ground short circuit between ECM and EGR solenoid valve connector.
4	**CHECK POOR CONTACT.** Check poor contact between ECM connector and EGR solenoid valve connector.	Is there poor contact of ECM connector or EGR solenoid valve connector?	Repair poor contact of ECM connector or EGR solenoid valve connector.	Replace EGR solenoid valve. <Ref. to FU(H4SO)-37, EGR Valve.>

CW:DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Engine breathing

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is there any DTC on display?	Go to step **2.**	Go to step **3.**
2	**CHECK ECM GROUND CIRCUIT.** 1) Turn ignition switch to OFF. 2) Measure resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 7 - Chassis ground:*** ***(B137) No. 14 - Chassis ground:*** ***(B135) No. 21 - Chassis ground:***	Is the measured value less than 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 • Poor contact in ECM connector • Poor contact in coupling connector
3	**CHECK HARNESS BETWEEN ECM AND EGR SOLENOID VALVE CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connector from EGR solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1493; (B134) No. 18 - Chassis ground:*** ***DTC P1495; (B134) No. 17 - Chassis ground:*** ***DTC P1497; (B134) No. 16 - Chassis ground:*** ***DTC P1499; (B134) No. 15 - Chassis ground:***	Is the measured value more than 10 V?	Repair ground short circuit between ECM and EGR solenoid valve connector. After completion of repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

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

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-340, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-342, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-340, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-342, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:
For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)-340, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:
For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)-342, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

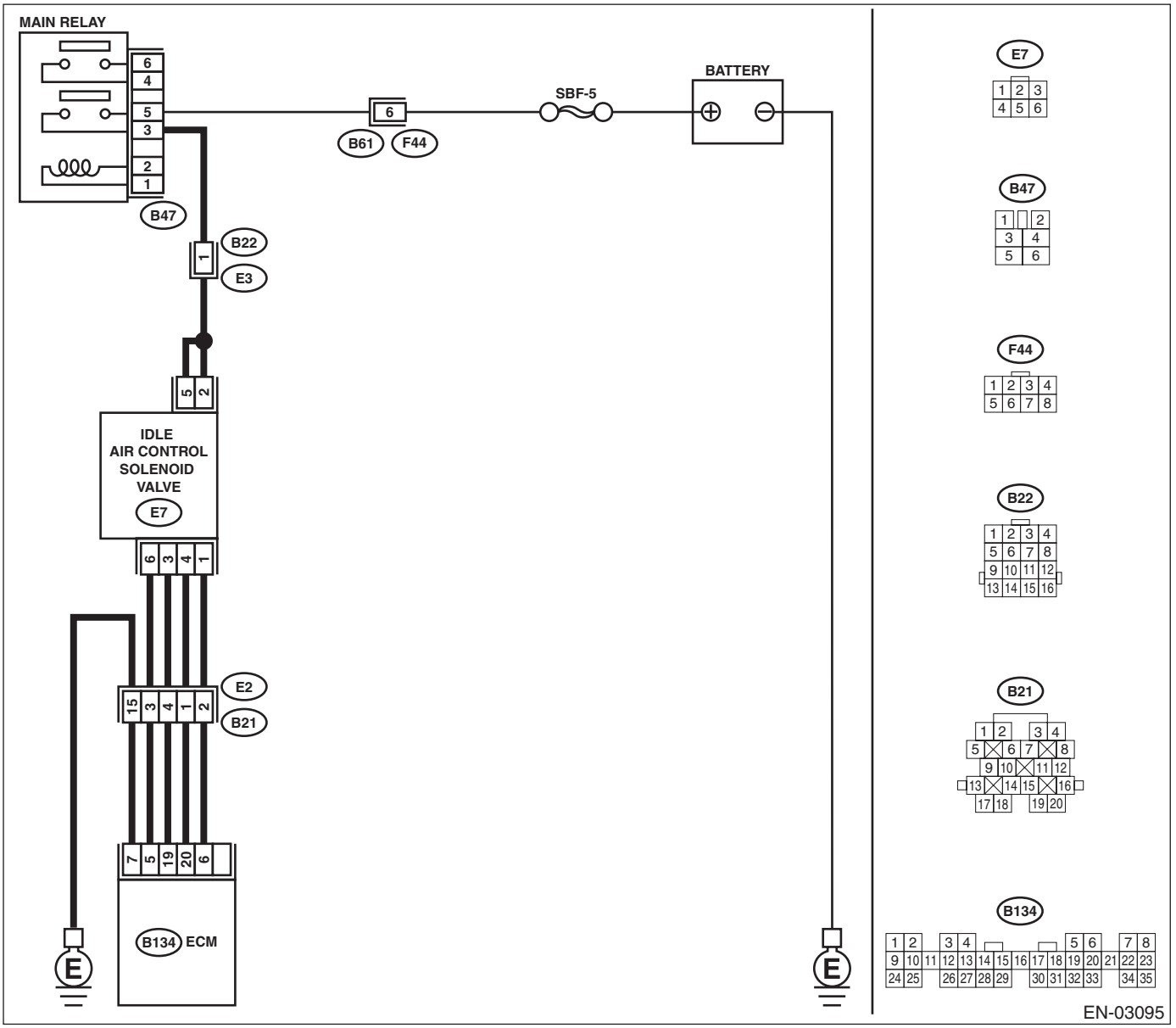
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Engine stalls.
  - Engine breathing

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



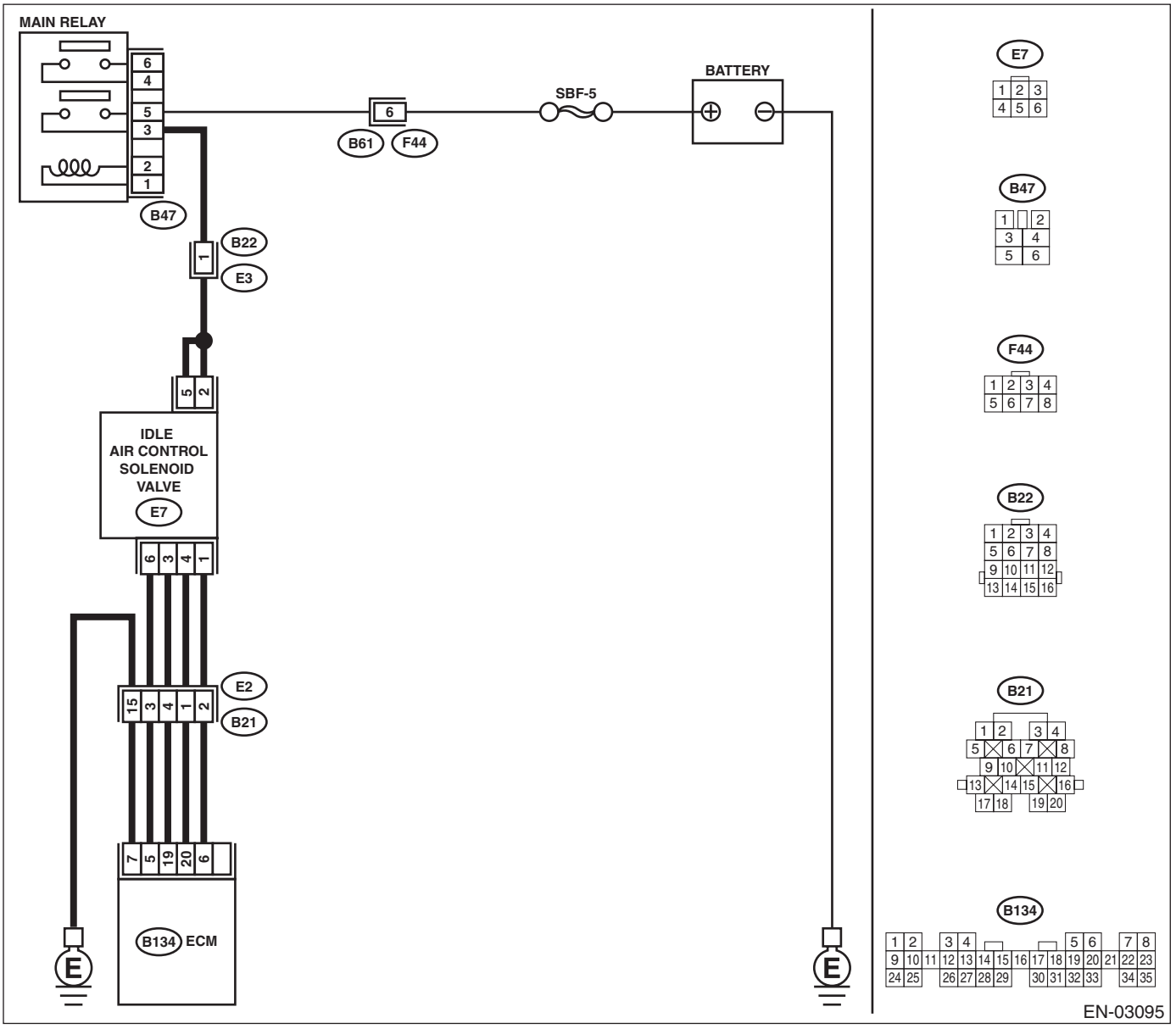
	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE.** 1) Turn ignition switch to OFF. 2) Disconnect connector from idle air control solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between idle air control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E7) No. 2 (+) — Engine ground (−):*** ***(E7) No. 5 (+) — Engine ground (−):***	Is the measured value more than 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 POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE.** Measure voltage between idle air control solenoid valve connector and engine ground.	Is the measured value more than 10 V?	Go to step **3.**	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
3	**CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure resistance between ECM and idle air control solenoid valve connector. ***Connector & terminal*** ***DTC P1510; (B134) No. 20 — (E7) No. 4:*** ***DTC P1512; (B134) No. 6 — (E7) No. 1:*** ***DTC P1514; (B134) No. 5 — (E7) No. 6:*** ***DTC P1516; (B134) No. 19 — (E7) No. 3:***	Is the measured value less than 1 Ω?	Go to step **4.**	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
4	**CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR.** 1) Disconnect connector from ECM. 2) Measure resistance between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1510; (B134) No. 20 — Chassis ground:*** ***DTC P1512; (B134) No. 6 — Chassis ground:*** ***DTC P1514; (B134) No. 5 — Chassis ground:*** ***DTC P1516; (B134) No. 19 — Chassis ground:***	Is the measured value more than 1 MΩ?	Repair ground short circuit in harness between ECM and idle air control solenoid valve connector.	Go to step **5.**
5	**CHECK POOR CONTACT.** Check 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?	Repair poor contact in ECM connector or idle air control solenoid valve connector.	Replace idle air control solenoid valve. <Ref. to FU(H4SO)-35, Idle Air Control Solenoid Valve.>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.
- **TROUBLE SYMPTOM:**
  - Rough idling
  - Engine stalls.
  - Engine speed varies.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the related DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **3.**
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Turn ignition switch to OFF. 2) Measure resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 7 — Chassis ground:***	Is the measured value less than 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 connector from idle air control solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1511; (B134) No. 20 (+) — Chassis ground (–):*** ***DTC P1513; (B134) No. 6 (+) — Chassis ground (–):*** ***DTC P1515; (B134) No. 5 (+) — Chassis ground (–):*** ***DTC P1517; (B134) No. 19 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and idle air control solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

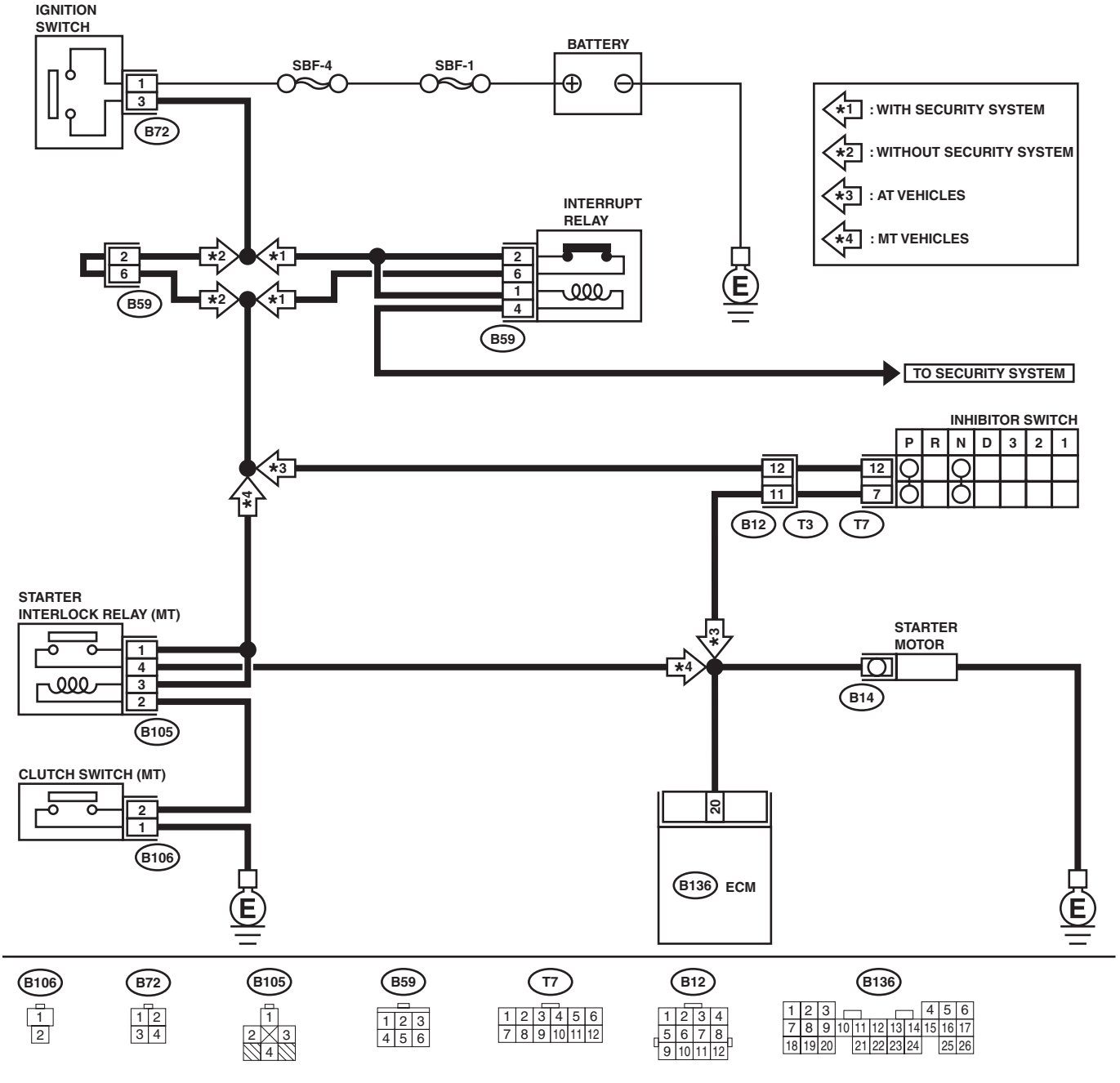
MEMO:

DF:DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Failure of engine to start

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



EN-00715

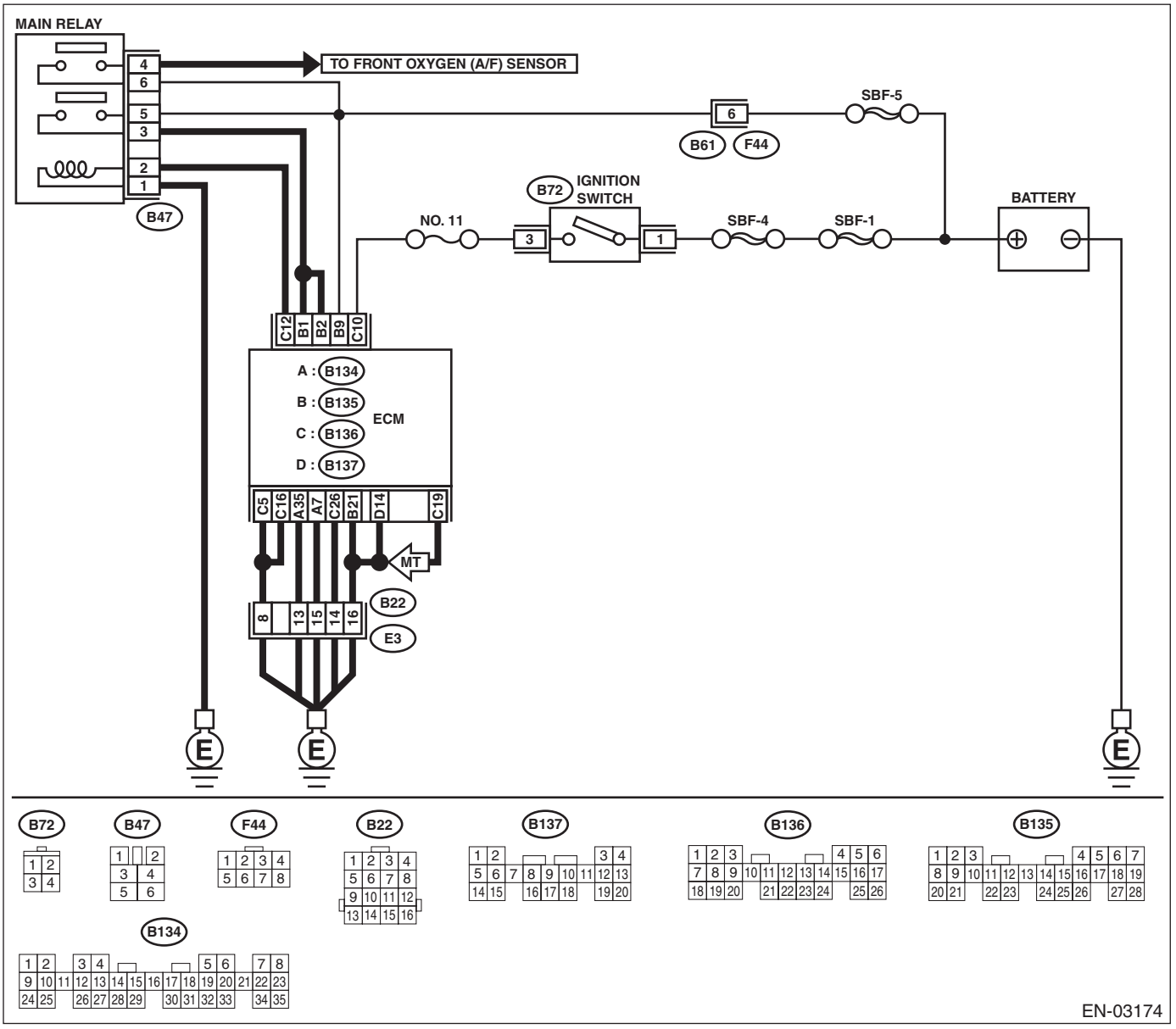
Step		Check	Yes	No
1	**CHECK OPERATION OF STARTER MOTOR.** NOTE: •Place the inhibitor switch in the “P” or “N” position. (AT) •Depress the clutch pedal. (MT)	Does starter motor operate when turning ignition switch to “ST”?	Repair harness and connector. NOTE: In this case, repair the following: • Open or ground short circuit in harness between ECM and starter motor connector. • Poor contact in ECM connector.	Check starter motor circuit. <Ref. to EN(H4SO)-66, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

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

- **DTC DETECTING CONDITION:**
  - Detected simultaneously at occurrence of malfunction.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



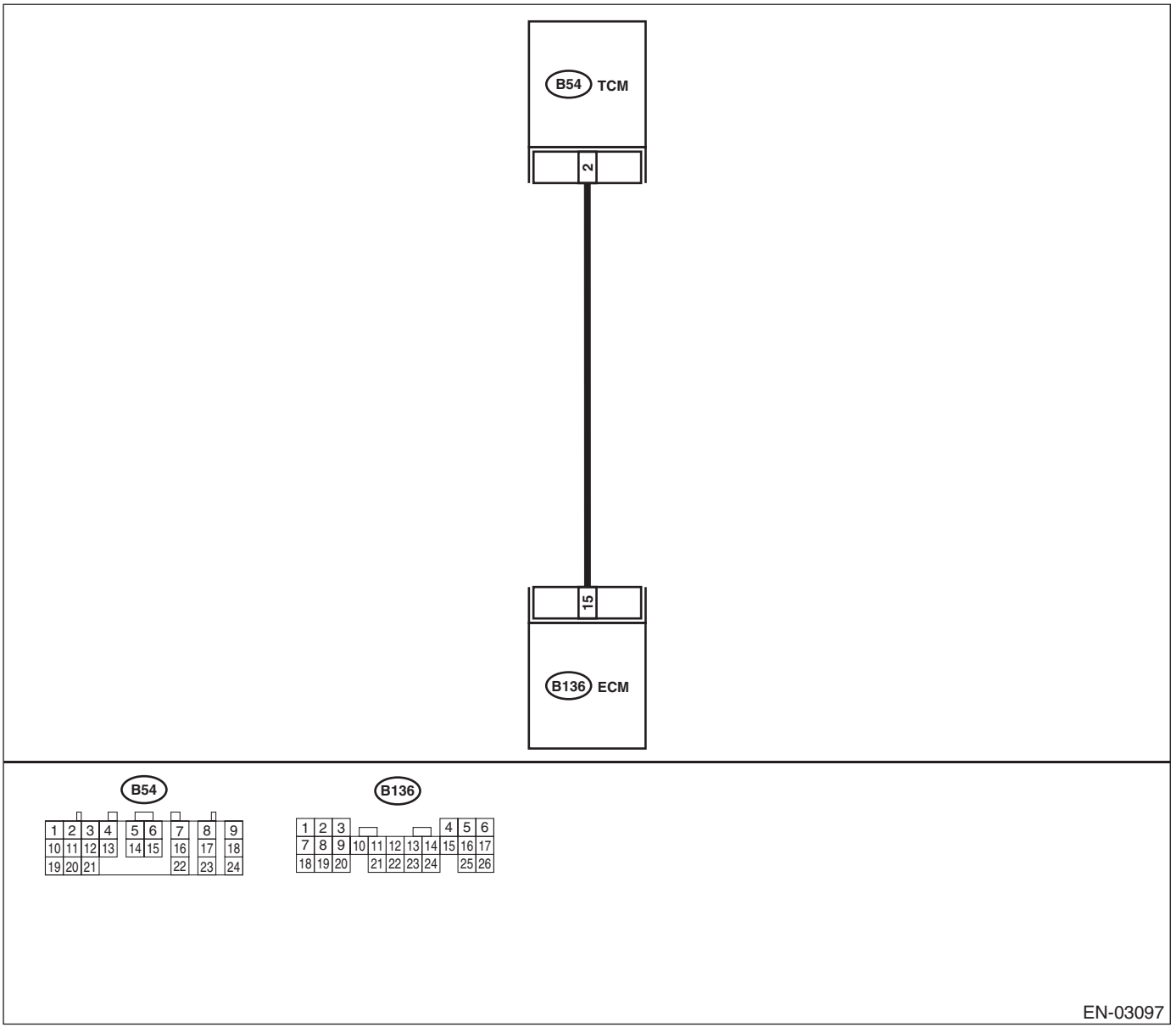
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to OFF. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair poor contact in ECM connector.	Go to step **2.**
2	**CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.** 1) Disconnect connector from ECM. 2) Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in harness between ECM connector and battery terminal.
3	**CHECK FUSE SBF-5.**	Is fuse blown out?	Replace 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

DH:DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



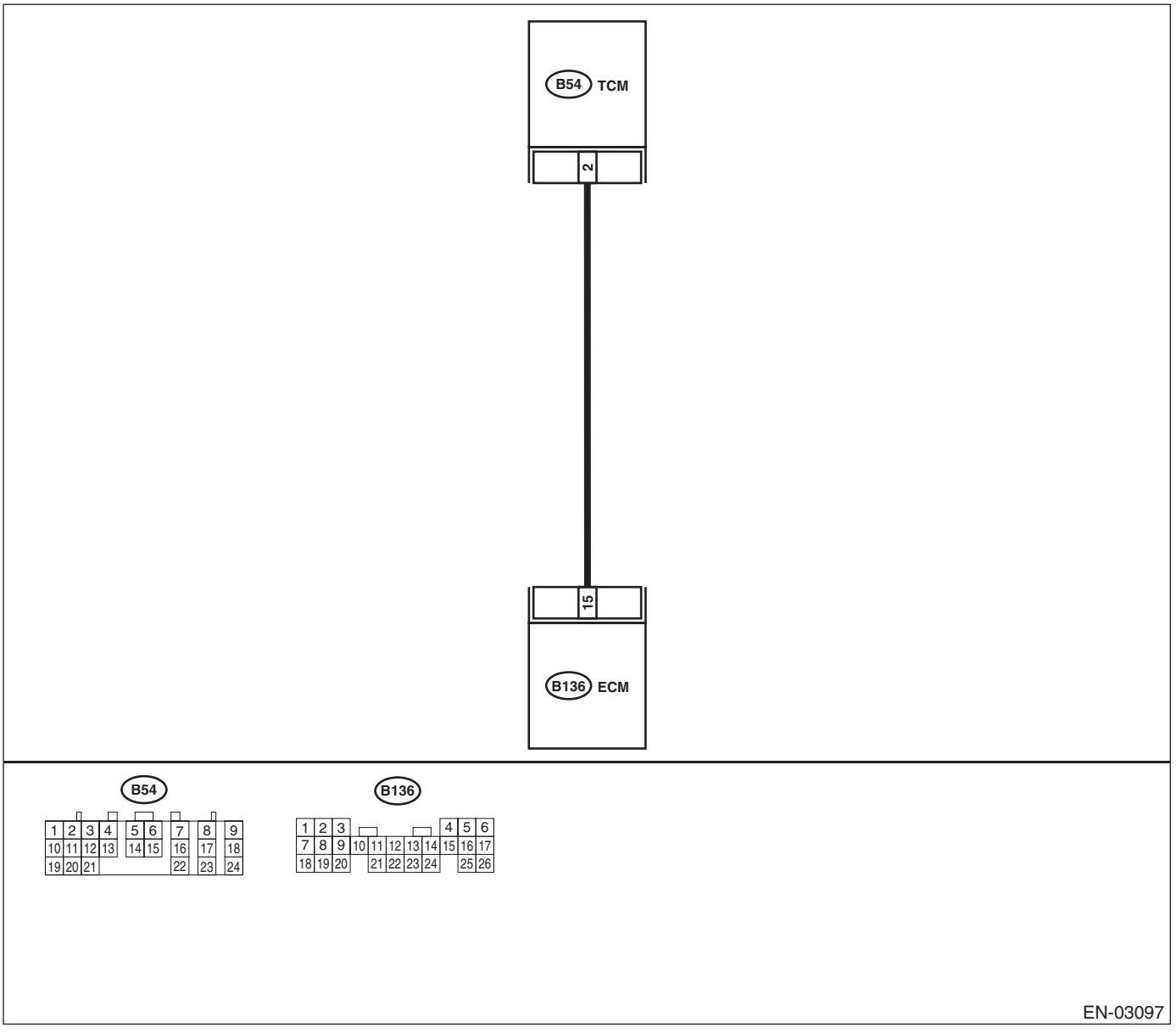
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Start engine, and warm-up the engine. 2) Turn ignition switch to OFF. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 15 (+) — Chassis ground (−):***	Is the measured value more than 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 connectors from ECM and TCM. 3) Measure resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 15 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in harness between ECM and TCM connector.
3	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** Measure resistance of harness between ECM and TCM connector. ***Connector & terminal*** ***(B136) No. 15 — (B54) No. 2:***	Is the measured value less than 1 Ω?	Repair poor contact in ECM or TCM connector.	Repair open circuit in harness between ECM and TCM connector.

DI: DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



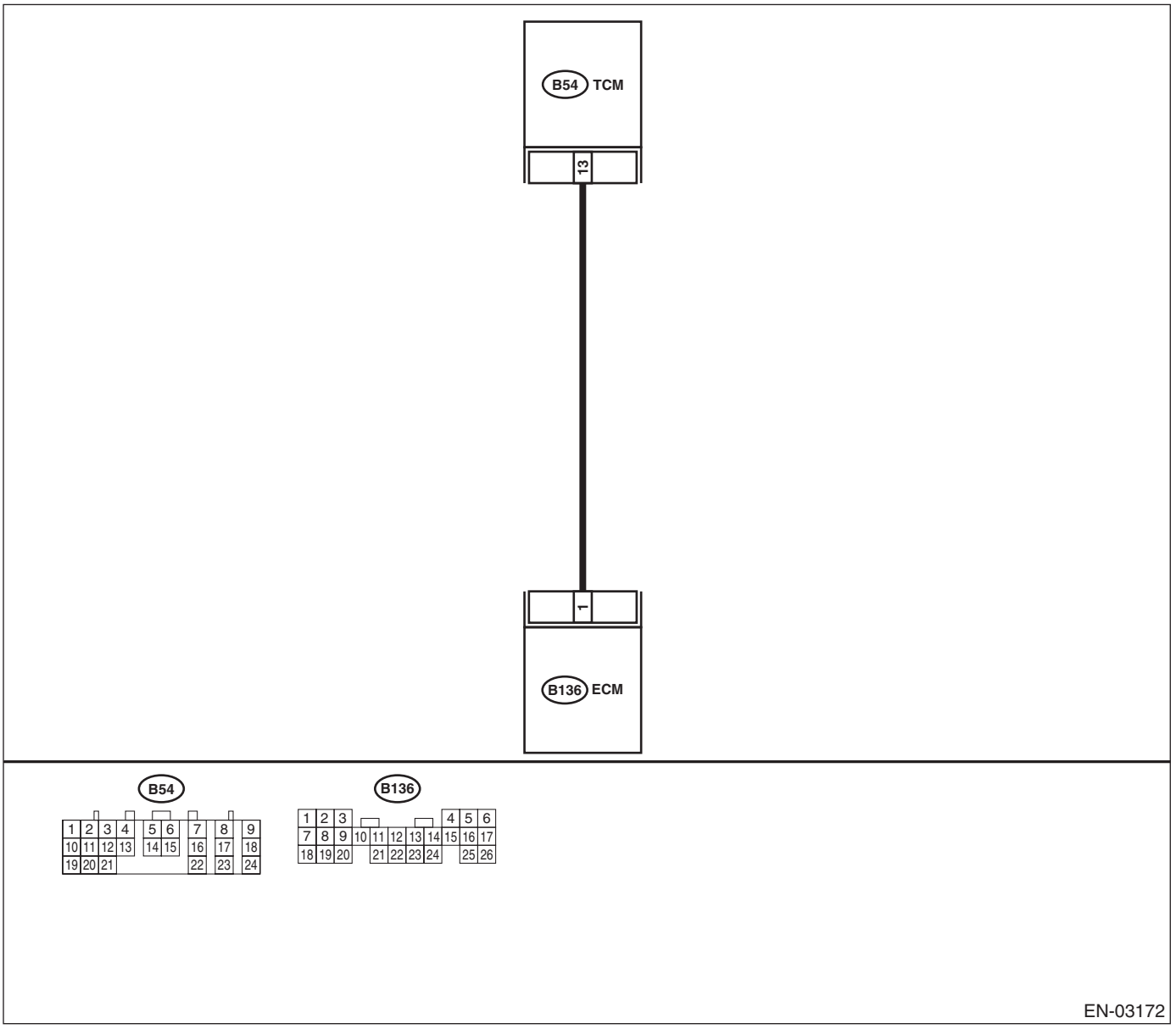
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Start engine, and warm-up the engine. 2) Turn ignition switch to OFF. 3) Disconnect connector from TCM. 4) Turn ignition switch to ON. 5) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 15 (+) — Chassis ground (−):***	Is the measured value less than 3 V?	Go to step **2.**	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>
2	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 15 (+) — Chassis ground (−):***	Is the measured value more than 10 V when shaking harness and connector of ECM?	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DJ:DTC P1711 — ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Excessive shift shock

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



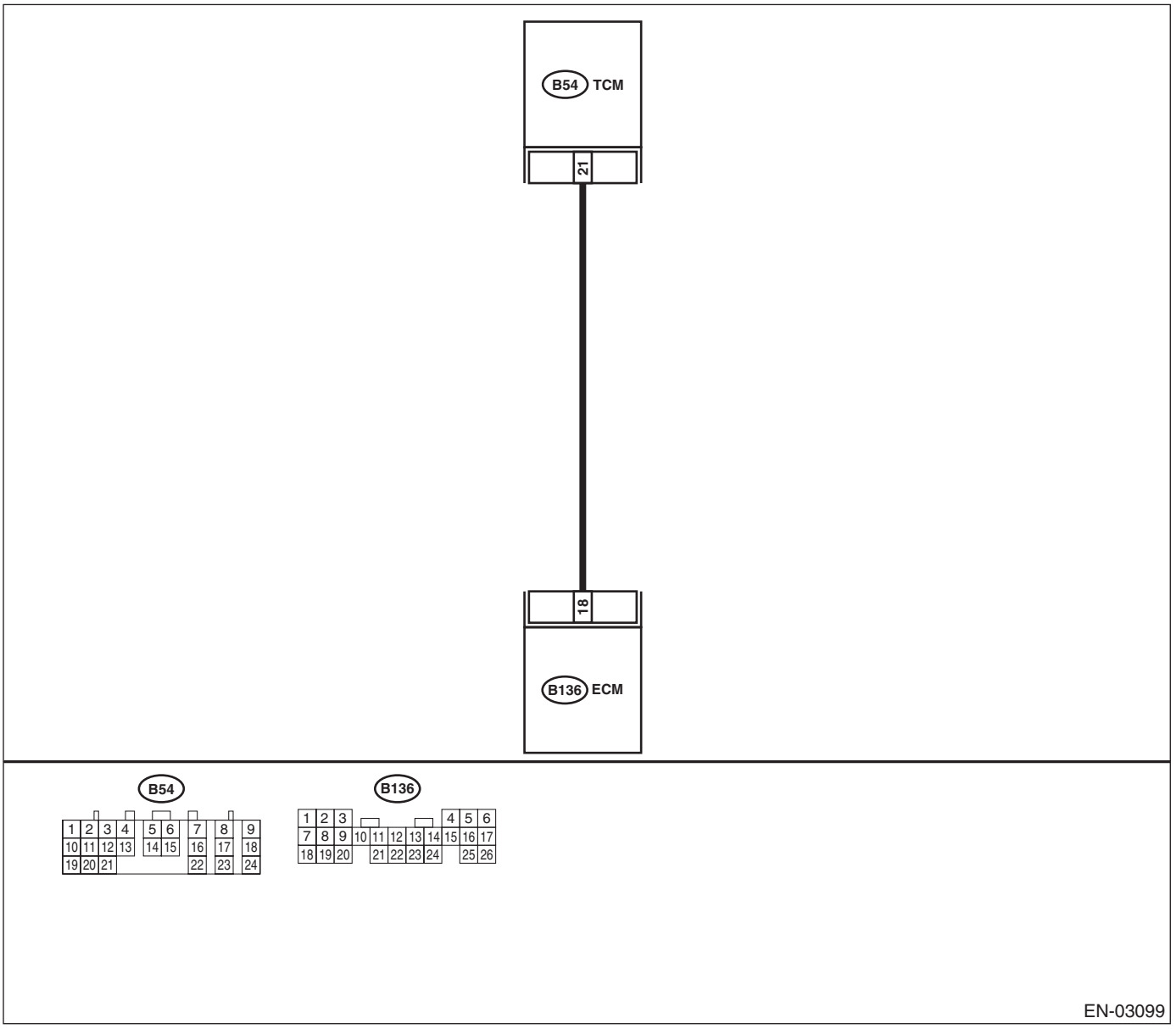
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V	Go to step **2.**	Go to step **4.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector.	Go to step **3.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and TCM. 3) Measure resistance of harness between ECM and TCM connector. ***Connector & terminal*** ***(B136) No. 1 — (B54) No. 13:***	Is the measured value less than 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 resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 1 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit in harness between ECM and TCM connector.
6	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

DK:DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction
- **TROUBLE SYMPTOM:**
  - Excessive shift shock

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



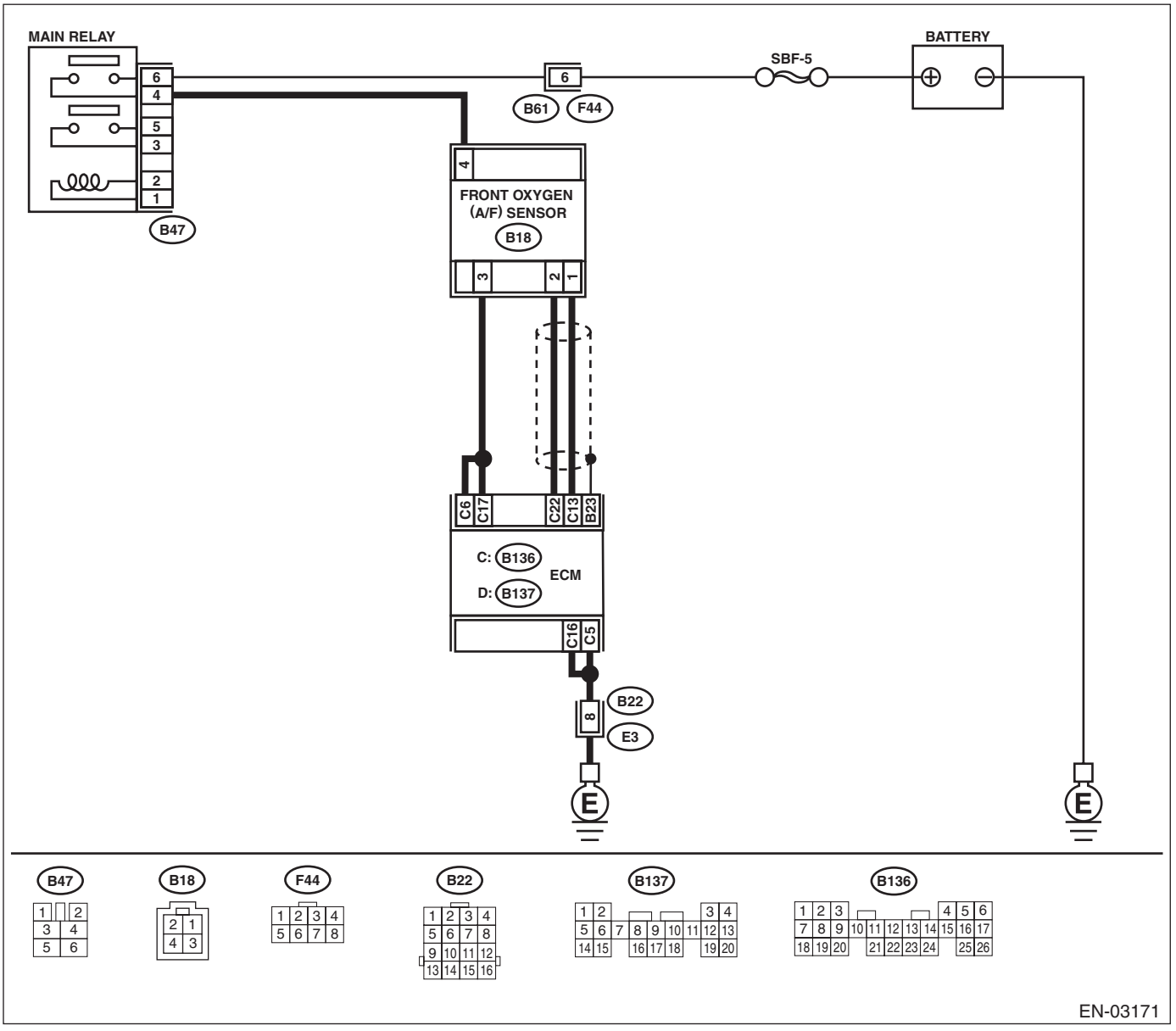
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 18 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **2.**	Go to step **4.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 18 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector.	Go to step **3.**
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact with SOA service center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and TCM. 3) Measure resistance of harness between ECM and TCM connector. ***Connector & terminal*** ***(B136) No. 18 — (B54) No. 21:***	Is the measured value less than 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 resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 18 — Chassis ground:***	Is the measured value less than 10 Ω?	Go to step **6.**	Repair ground short circuit in harness between ECM and TCM connector.
6	**CHECK POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace TCM. <Ref. to 4AT-77, Transmission Control Module (TCM).>

DL:DTC P2096 — POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1 —

- **DTC DETECTING CONDITION:**
  - Detected when a malfunction occurs in two consecutive driving cycles.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** 1) Start engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read data of front oxygen (A/F) sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15?	Go to step **3.**	Go to step **4.**
3	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** Race engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: •Normally, A/F mixture ratio is rich with racing engine. •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.	Is the measured value more than 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 connector from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance between ECM and front oxygen (A/F) sensor. ***Connector & terminals*** ***(B136) No. 13 — (B18) No. 1:*** ***(B136) No. 22 — (B18) No. 2:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair open circuit between ECM and front oxygen (A/F) sensor.
5	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.** Measure resistance between ECM and chassis ground. ***Connector & terminals*** ***(B136) No. 13 — Chassis ground:*** ***(B136) No. 22 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

	Step	Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any fault in exhaust system?	Repair or replace malfunctioning parts.	Go to step **7.**
7	**CHECK EGR VALVE.**	Is EGR valve clogged?	Replace EGR valve.	Go to step **8.**
8	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step **9.**
9	**CHECK PURGE CONTROL SOLENOID VALVE.**	Is purge control solenoid valve clogged?	Replace purge control solenoid valve.	Go to step **10.**
10	**CHECK PCV VALVE.**	Is PCV valve clogged?	Replace PCV valve.	Go to step **11.**
11	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release fuel pressure. (1) Disconnect 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 connector to fuel pump relay. 3) Disconnect fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. **Warning:** **Before removing 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.	Is the measured value within 284 to 314 kPa (2.9 to 3.2 kg/cm^2, 41 to 46 psi)?	Go to step **12.**	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

	Step	Check	Yes	No
12	**CHECK FUEL PRESSURE.** After connecting pressure regulator vacuum hose, measure fuel pressure. **Warning:** **Before removing 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.	Is the measured value within 206 to 235 kPa (2.1 to 2.4 kg/cm^2, 30 to 34 psi)?	Go to step **13.**	Repair the following items. **Fuel pressure too high** • Malfunctioning pressure regulator • Clogged fuel return line or bent hose **Fuel pressure too low** • Malfunctioning pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
13	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm-up completely. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 70 to 100°C (158 to 212°F)?	Go to step **14.**	Replace engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>
14	**CHECK INTAKE MANIFOLD 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 A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 24.0 to 41.3 kPa (180 to 310 mmHg, 7.09 to 12.20 inHg) when idling or within 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) when turning ignition switch ON?	Go to step **15.**	Replace intake air temperature and pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>

Step		Check	Yes	No
15	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure 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 1 MΩ?	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>	Repair short circuit between ECM and front oxygen (A/F) sensor connector.

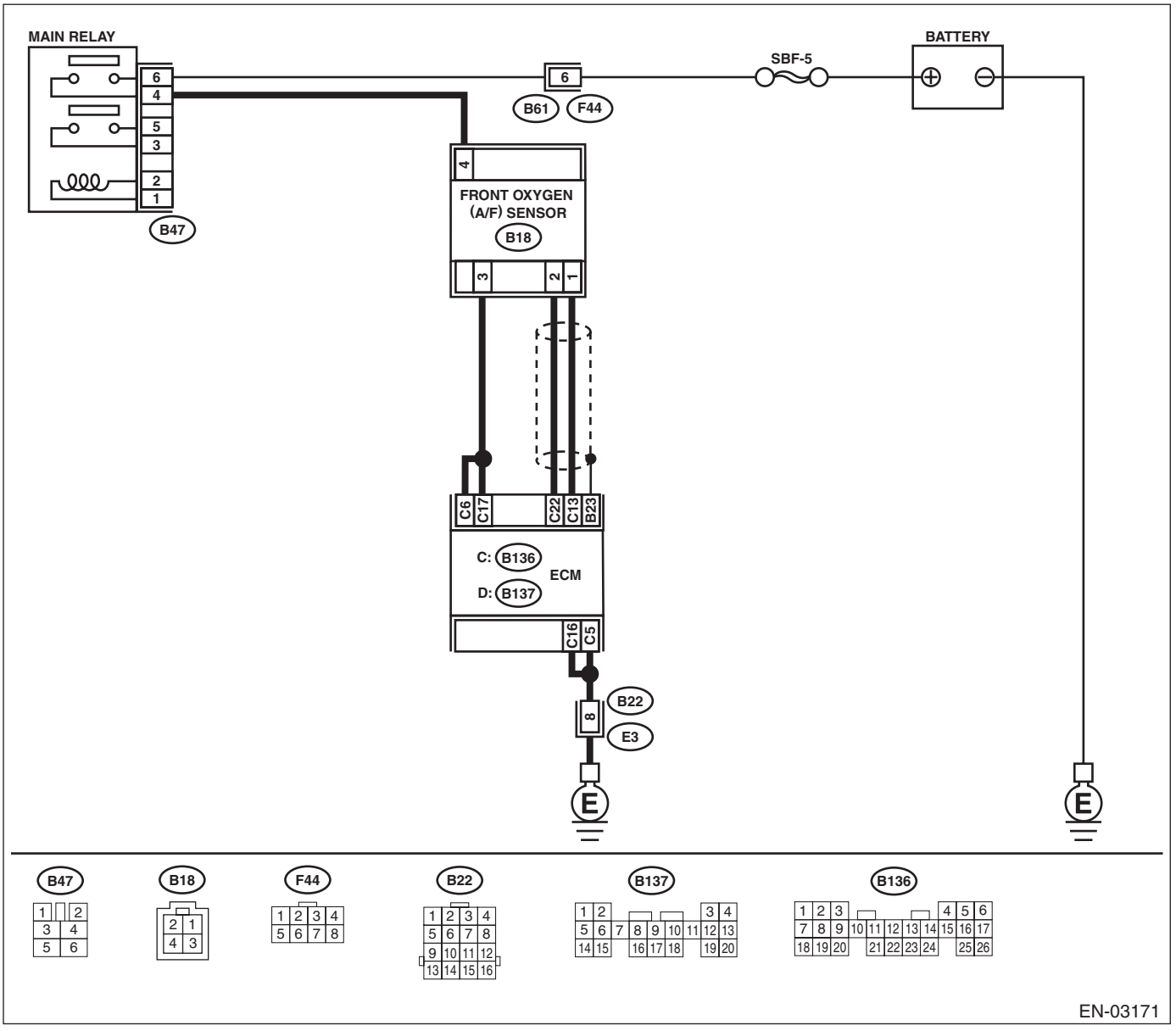
MEMO:

DM:DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —

- **DTC DETECTING CONDITION:**
  - Detected when a malfunction occurs in two consecutive driving cycles.

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** 1) Start engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read data of front oxygen (A/F) sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15?	Go to step **3.**	Go to step **4.**
3	**CHECK FRONT OXYGEN (A/F) SENSOR DATA.** Race engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: •Normally, A/F mixture ratio is rich with racing engine. •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.	Is the measured value more than 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 connector from ECM and front oxygen (A/F) sensor connector. 3) Measure resistance between ECM and front oxygen (A/F) sensor. ***Connector & terminals*** ***(B136) No. 13 — (B18) No. 1:*** ***(B136) No. 22 — (B18) No. 2:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair open circuit between ECM and front oxygen (A/F) sensor.
5	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR.** Measure resistance between ECM and chassis ground. ***Connector & terminals*** ***(B136) No. 13 — Chassis ground:*** ***(B136) No. 22 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

	Step	Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. 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	Is there any fault in exhaust system?	Repair or replace malfunctioning parts.	Go to step **7.**
7	**CHECK EGR VALVE.**	Is EGR valve clogged?	Replace EGR valve.	Go to step **8.**
8	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step **9.**
9	**CHECK PURGE CONTROL SOLENOID VALVE.**	Is purge control solenoid valve clogged?	Replace purge control solenoid valve.	Go to step **10.**
10	**CHECK PCV VALVE.**	Is PCV valve clogged?	Replace PCV valve.	Go to step **11.**
11	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release fuel pressure. (1) Disconnect 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 connector to fuel pump relay. 3) Disconnect fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. **Warning:** **Before removing 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.	Is the measured value within 284 to 314 kPa (2.9 to 3.2 kg/cm^2, 41 to 46 psi)?	Go to step **12.**	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

	Step	Check	Yes	No
12	**CHECK FUEL PRESSURE.** After connecting pressure regulator vacuum hose, measure fuel pressure. **Warning:** **Before removing 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.	Is the measured value within 206 to 235 kPa (2.1 to 2.4 kg/cm^2, 30 to 34 psi)?	Go to step **13.**	Repair the following items. **Fuel pressure too high** • Malfunctioning pressure regulator • Clogged fuel return line or bent hose **Fuel pressure too low** • Malfunctioning pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
13	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm-up completely. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 70 to 100°C (158 to 212°F)?	Go to step **14.**	Replace engine coolant temperature sensor. <Ref. to FU(H4SO)-27, Engine Coolant Temperature Sensor.>
14	**CHECK INTAKE MANIFOLD 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 A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read data of intake manifold pressure sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)-34, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 24.0 to 41.3 kPa (180 to 310 mmHg, 7.09 to 12.20 inHg) when idling or within 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) when turning ignition switch ON?	Go to step **15.**	Replace intake air temperature and pressure sensor. <Ref. to FU(H4SO)-33, Pressure Sensor.>

Step		Check	Yes	No
15	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure 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 1 MΩ?	Replace front oxygen (A/F) sensor. <Ref. to FU(H4SO)-43, Front Oxygen (A/F) Sensor.>	Repair short circuit between ECM and front oxygen (A/F) sensor connector.

DN:DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the related DTC using List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P2227.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.> NOTE: Atmospheric pressure sensor is built into ECM.

DO:DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P2228.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

DP:DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with malfunction

CAUTION:
After repair or replacement of malfunctioning parts, conduct Clear Memory Mode <Ref. to EN(H4SO)-50, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)-42, OPERATION, Inspection Mode.> .

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)-84, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P2229.	Replace ECM. <Ref. to FU(H4SO)-45, Engine Control Module.>

20.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(H4SO)-87, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Idle air control solenoid valve 2) Intake manifold pressure sensor 3) Intake air temperature sensor 4) Intake air temperature and pressure sensor 5) Ignition parts (*1) 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) Fuel injection parts (*4)
2. Rough idling	1) Idle air control solenoid valve 2) Intake manifold pressure sensor 3) Intake air temperature sensor 4) Intake air temperature and pressure sensor 5) Engine coolant temperature sensor (*2) 6) Ignition parts (*1) 7) Air intake system (*5) 8) Fuel injection parts (*4) 9) Throttle position sensor 10) Crankshaft position sensor (*3) 11) Camshaft position sensor (*3) 12) Oxygen sensor 13) 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) Intake manifold pressure sensor 6) Intake air temperature sensor 7) Intake air temperature and pressure sensor
4. Poor acceleration	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Intake air temperature and pressure sensor 4) Throttle position sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay 7) Engine coolant temperature sensor (*2) 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) A/C switch and A/C cut relay 11) Engine torque control signal circuit 12) Ignition parts (*1)
5. Engine stalls or engine speed drops or hesitates at acceleration.	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Intake air temperature and pressure sensor 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Purge control solenoid valve 8) Fuel injection parts (*4) 9) Throttle position sensor 10) Fuel pump and fuel pump relay

Symptom	Problem parts
6. Surge	1) Intake manifold pressure sensor 2) Intake air temperature sensor 3) Intake air temperature and 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) Intake air temperature and 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) Intake air temperature and pressure sensor 4) Engine coolant temperature sensor (*2) 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay

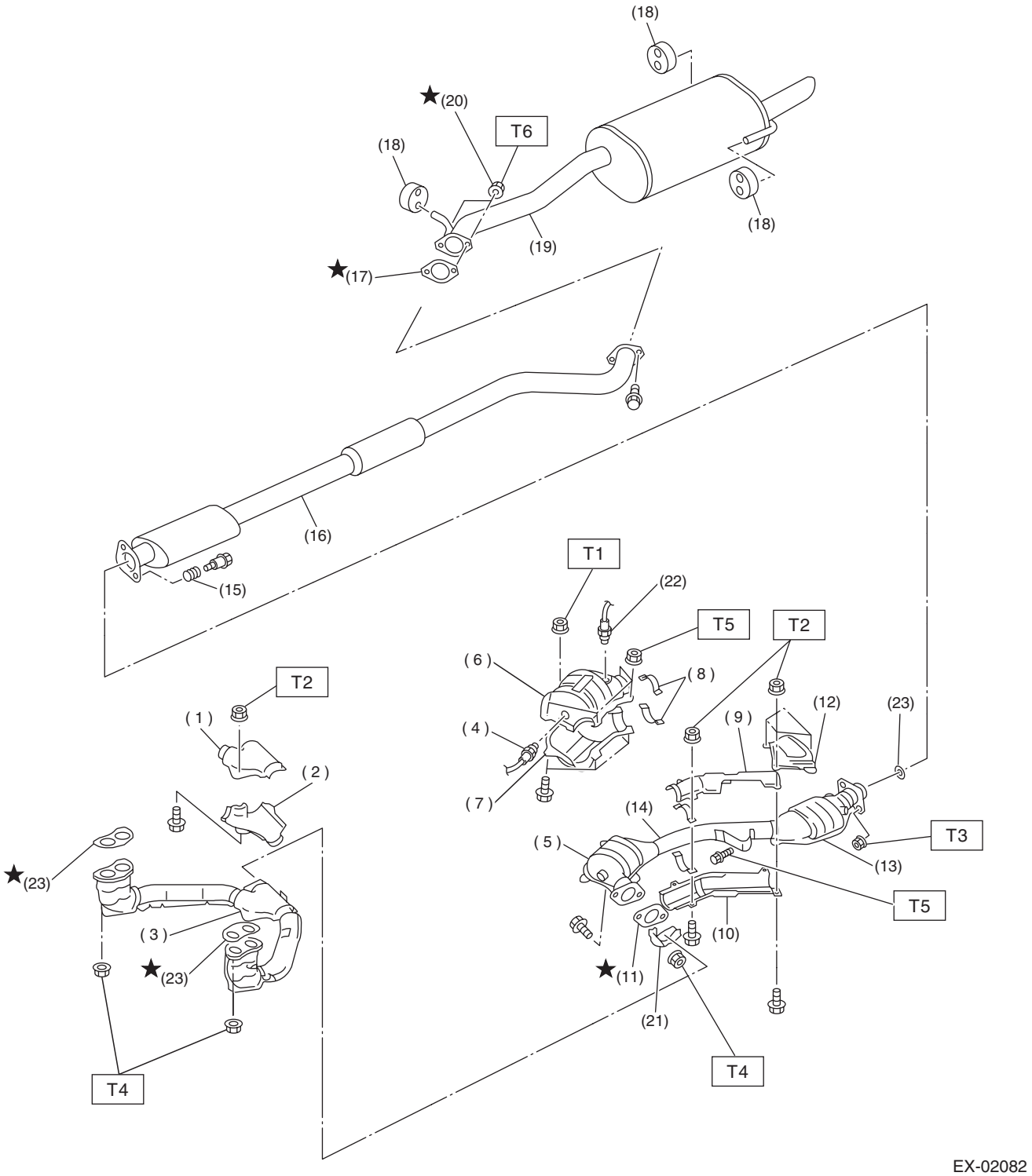
*1: Check ignition coil & ignitor assembly and spark plug.
*2: Indicate the symptom occurring only in cold temperatures.
*3: Ensure the secure installation.
*4: Check fuel injector, fuel pressure regulator and fuel filter.
*5: Inspect air leak in air intake system.
*6: Adjust accelerator cable.

2. AUTOMATIC TRANSMISSION

NOTE:
Check general diagnostics table with non-conformity symptom for automatic transmission. <Ref. to 4AT-2, Basic Diagnostic Procedure.>

1. General Description

A: COMPONENT



EX-02082

(1) Upper front exhaust pipe cover CTR
(2) Lower front exhaust pipe cover CTR
(3) Front exhaust pipe
(4) Front oxygen (A/F) sensor
(5) Front catalytic converter
(6) Upper front catalytic converter cover
(7) Lower front catalytic converter cover
(8) Clamp
(9) Upper center exhaust pipe cover
(10) Lower center exhaust pipe cover
(11) Gasket
(12) Upper rear catalytic converter cover
(13) Rear catalytic converter
(14) Center exhaust pipe
(15) Spring
(16) Rear exhaust pipe
(17) Gasket
(18) Cushion rubber
(19) Muffler
(20) Self-locking nut
(21) Protector
(22) Rear oxygen sensor
(23) Gasket

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: 30 (3.1, 22.4)
T5: 35 (3.6, 26.0)
T6: 48 (4.9, 35.4)

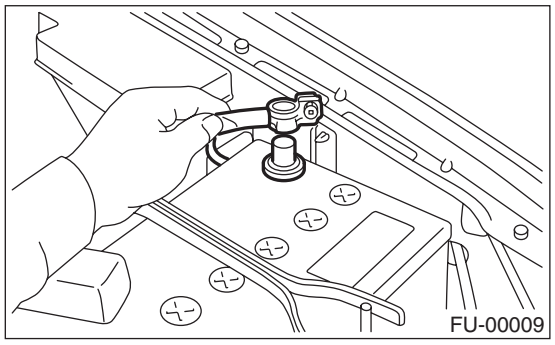
B: CAUTION

• 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 ground cable from battery.

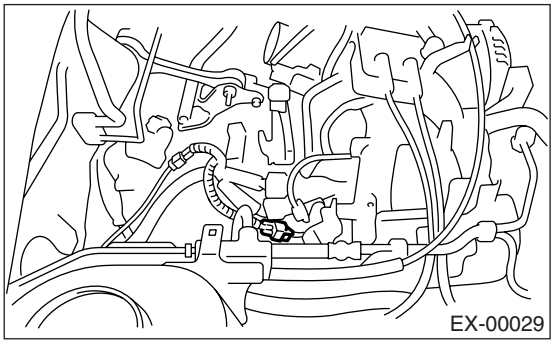
2. Front Exhaust Pipe

A: REMOVAL

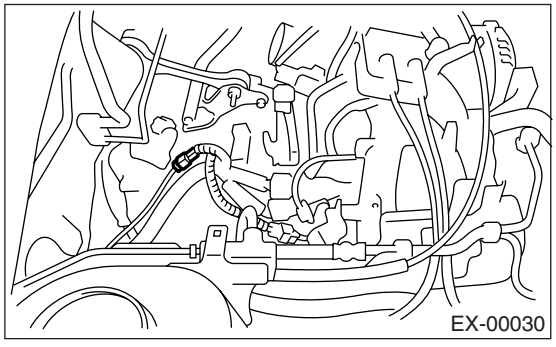
1) Disconnect battery ground cable.



2) Disconnect front oxygen (A/F) sensor connector.

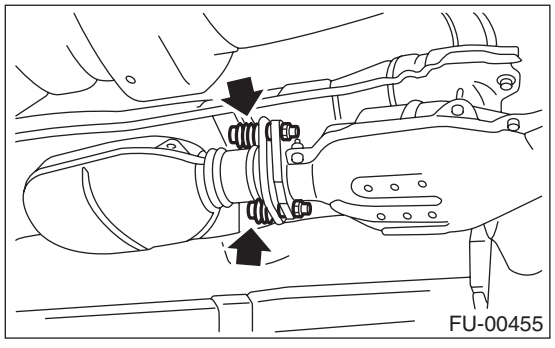


3) Disconnect rear oxygen sensor connector.

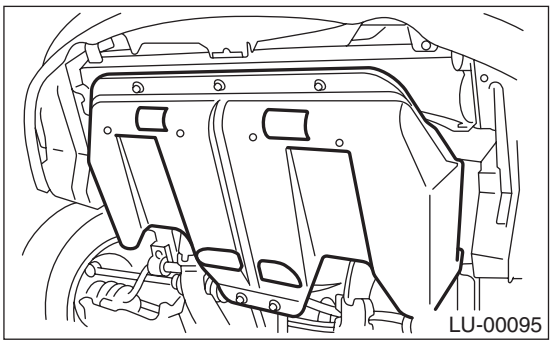


4) Lift-up the vehicle.
5) Separate front and center exhaust pipe assembly from rear exhaust pipe.

WARNING:
Be careful, exhaust pipe is hot.

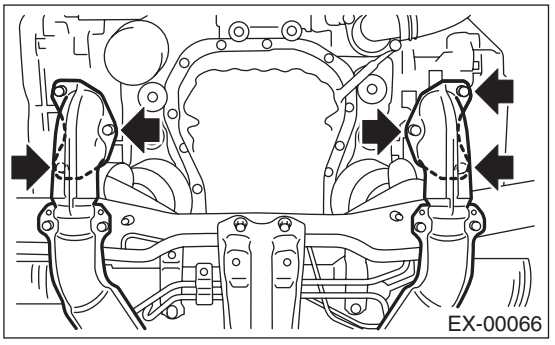


6) Remove under cover.

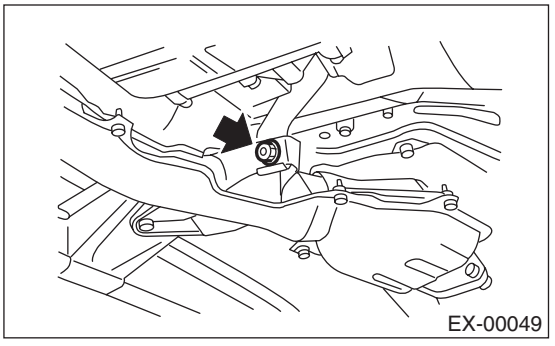


7) Remove nuts which hold front exhaust pipe onto cylinder heads.

CAUTION:
Be careful not to pull down front and center exhaust pipe assembly.



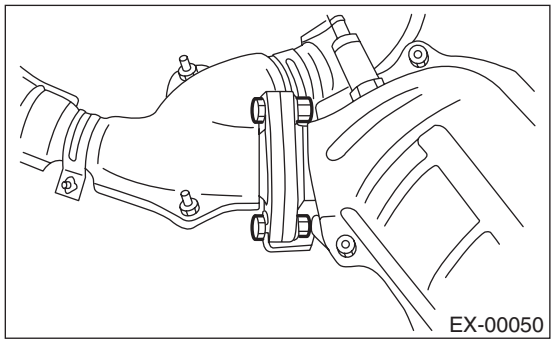
8) Remove bolt which installs front and center exhaust pipe assembly to hanger bracket.



9) Remove front and center exhaust pipe assembly from the vehicle.

CAUTION:
• Be careful not to let front and center exhaust pipe assembly fall off when removing as it is quite heavy.
• After removing front and center exhaust assembly, do not apply excessive pulling force on rear exhaust pipe.

10) Separate front exhaust pipe from center exhaust pipe.

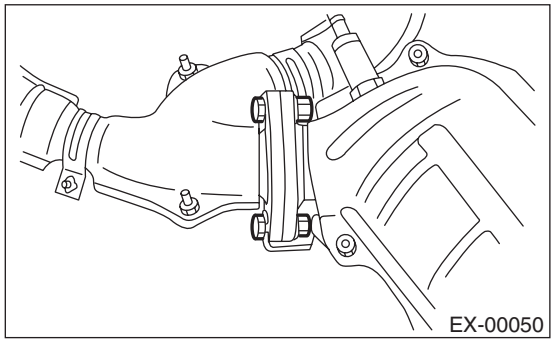


B: INSTALLATION

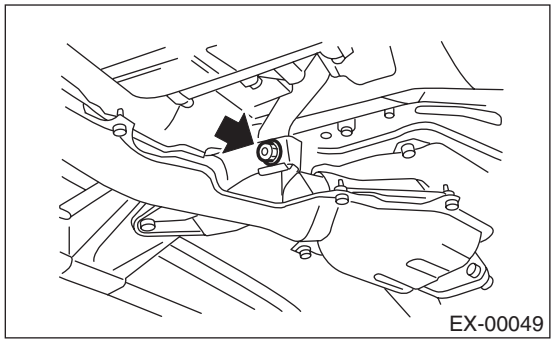
1) Install front exhaust pipe to center exhaust pipe.

NOTE:
Replace gaskets with new ones.

Tightening torque:
30 N·m (3.1 kgf-m, 22.4 ft-lb)

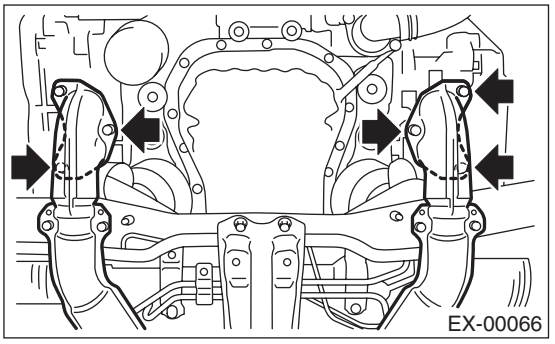


2) Install front and center exhaust pipe assembly to the vehicle.
3) Temporarily tighten bolt which installs front and center exhaust pipe assembly to hanger bracket.



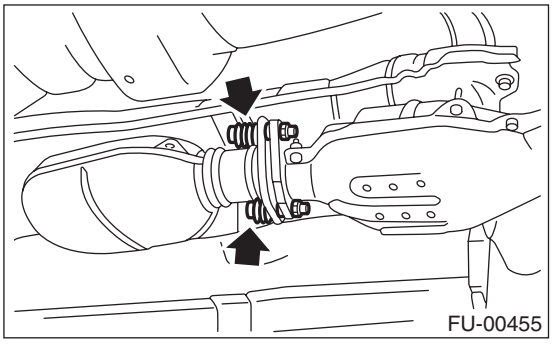
4) Tighten nuts which hold front exhaust pipe onto cylinder heads.

Tightening torque:
30 N·m (3.1 kgf-m, 22.4 ft-lb)



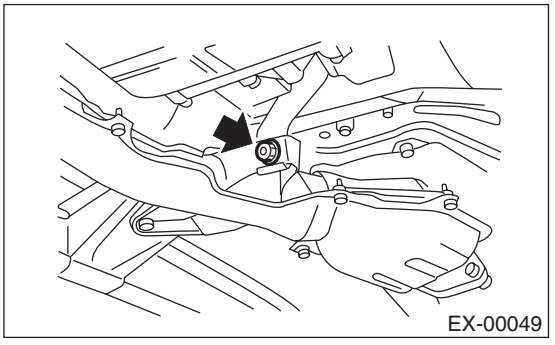
5) Install under cover.
6) Tighten bolts which install front and center exhaust pipe assembly to rear exhaust pipe.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



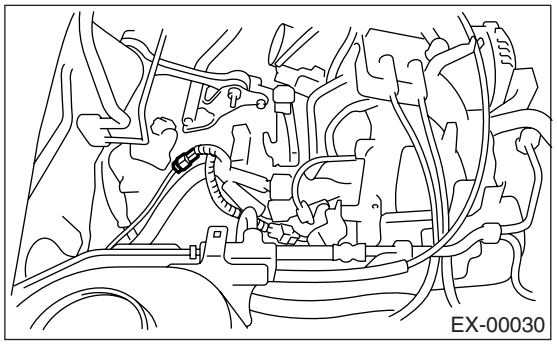
7) Tighten bolt which holds front and center exhaust pipe assembly to hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)

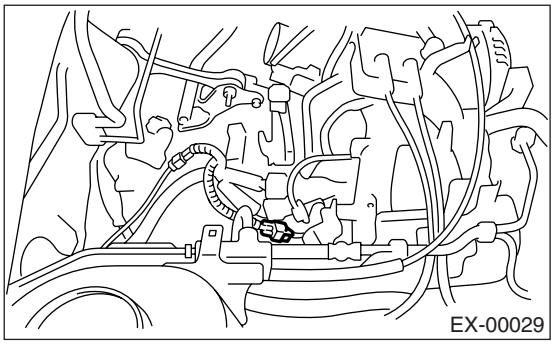


8) Lower the vehicle.

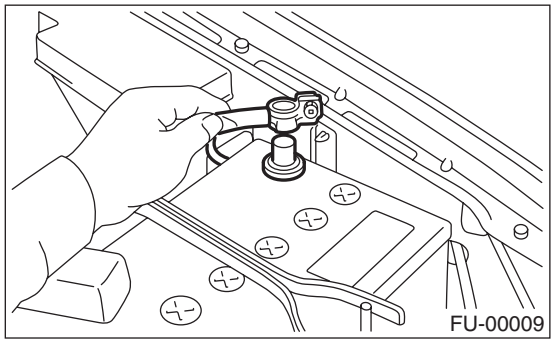
9) Connect rear oxygen sensor connector.



10) Connect front oxygen (A/F) sensor connector.



11) Connect battery ground cable.



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

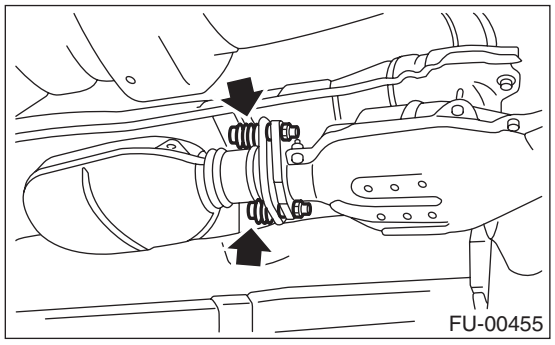
1) Make sure there are no exhaust leaks from connections and welds.
2) Make sure there are no holes or rusting.

4. Rear Exhaust Pipe

A: REMOVAL

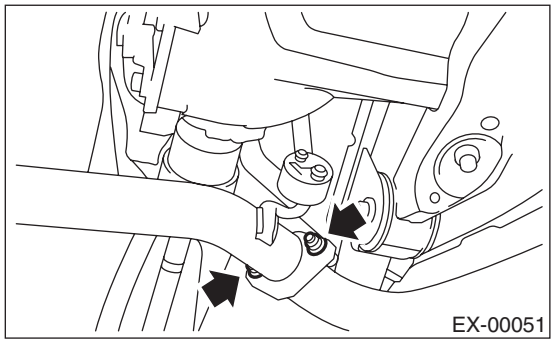
1) Separate rear exhaust pipe from center exhaust pipe.

CAUTION:
Be careful, exhaust pipe is hot.



2) Separate rear exhaust pipe from muffler.

CAUTION:
Be careful not to pull down rear exhaust pipe.



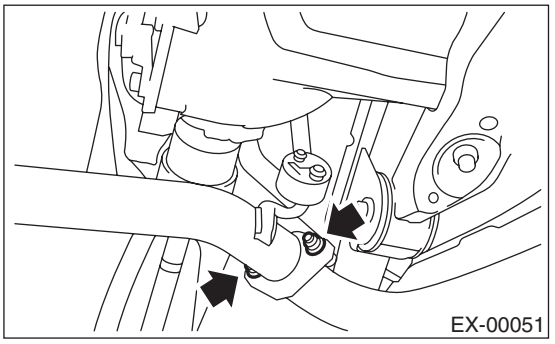
3) Remove rear exhaust pipe.

B: INSTALLATION

NOTE:
Replace gaskets and self-locking nuts with new ones.

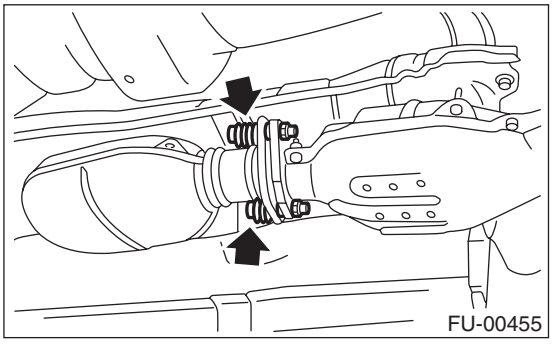
1) Install rear exhaust pipe to muffler.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)



2) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

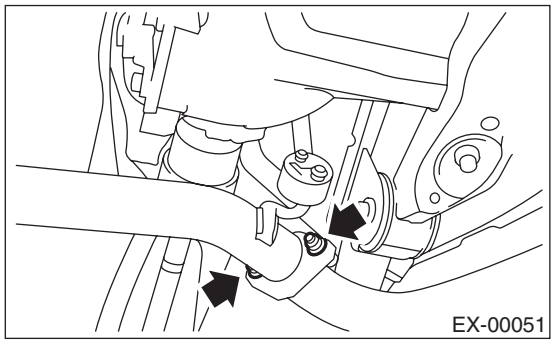
1) Make sure there are no exhaust leaks from connections and welds.
2) Make sure there are no holes or rusting.
3) Make sure the cushion rubber is not worn or cracked.

5. Muffler

A: REMOVAL

1) Separate muffler from rear exhaust pipe.

CAUTION:
Be careful, exhaust pipe is hot.

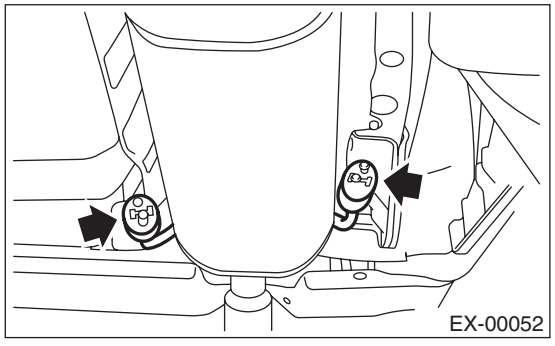


2) Remove left and right cushion rubbers.

CAUTION:
Be careful not to drop the muffler during removal.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to mating area of cushion rubbers in advance.

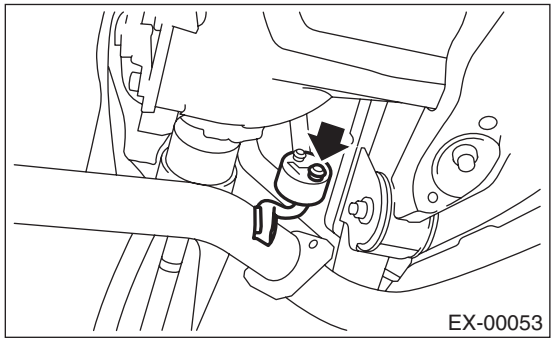
SUBARU CRC (Part No. 004301003)



3) Remove front cushion rubber, and detach muffler assembly.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to mating area of cushion rubber in advance.

SUBARU CRC (Part No. 004301003)

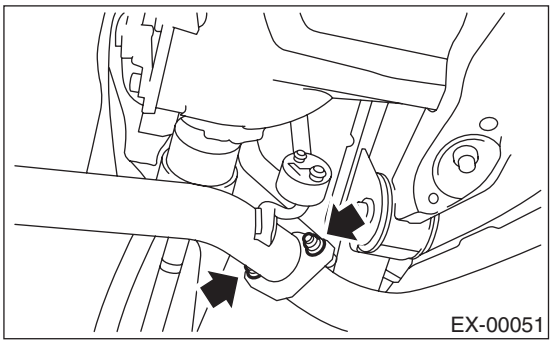


B: INSTALLATION

1) Install in the reverse order of removal.

NOTE:
Replace gasket and self-locking nuts with new ones.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 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.

1. General Description

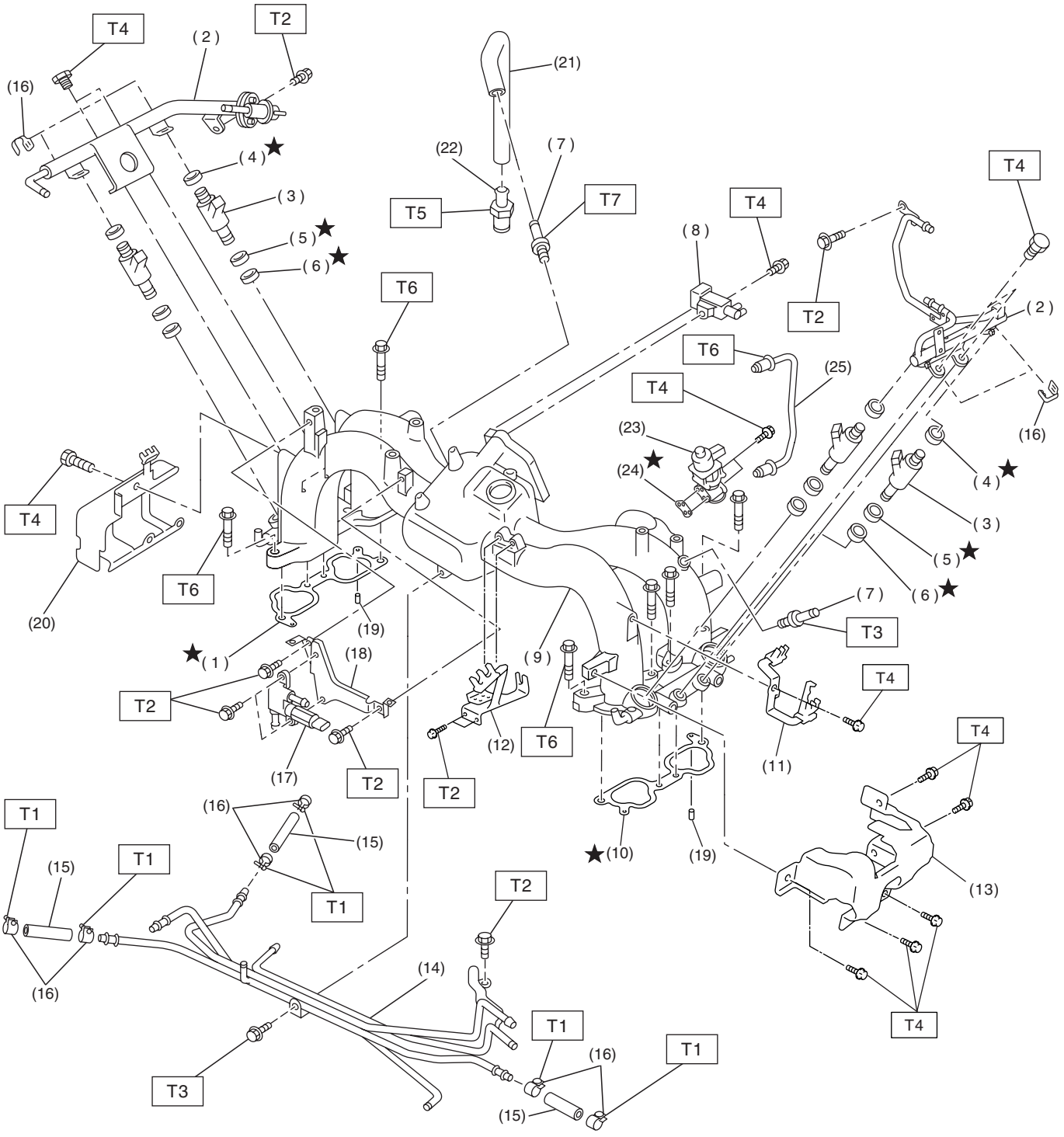
A: SPECIFICATIONS

Model		
Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 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

MEMO:

B: COMPONENT

1. INTAKE MANIFOLD

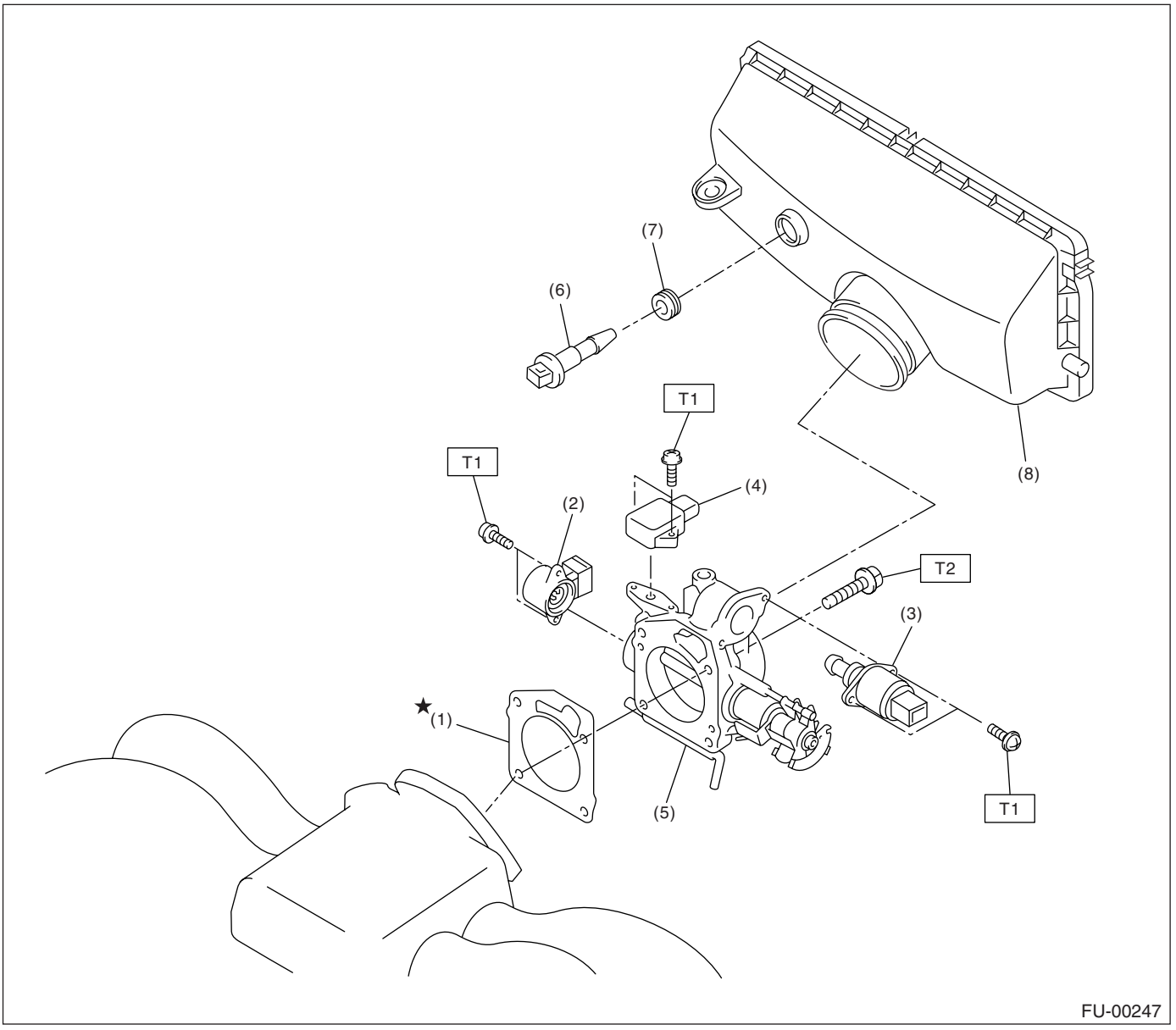


FU-02549

(1) Intake manifold gasket RH
(2) Fuel injector pipe
(3) Fuel injector
(4) O-ring
(5) O-ring
(6) O-ring
(7) Nipple
(8) Purge control solenoid valve
(9) Intake manifold
(10) Intake manifold gasket LH
(11) Plug cord holder LH
(12) Accelerator cable bracket
(13) Fuel pipe protector LH
(14) Fuel pipe ASSY
(15) Fuel hose
(16) Clip
(17) Air assist injector solenoid valve
(18) Air assist injector solenoid valve bracket
(19) Guide pin
(20) Fuel pipe protector RH
(21) PCV hose
(22) PCV valve
(23) EGR valve
(24) EGR valve gasket
(25) EGR pipe

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)
T4: 19 (0.19, 1.4)
T5: 23 (2.3, 17)
T6: 25 (2.6, 18.8)
T7: 22.5 (2.29, 16.6)

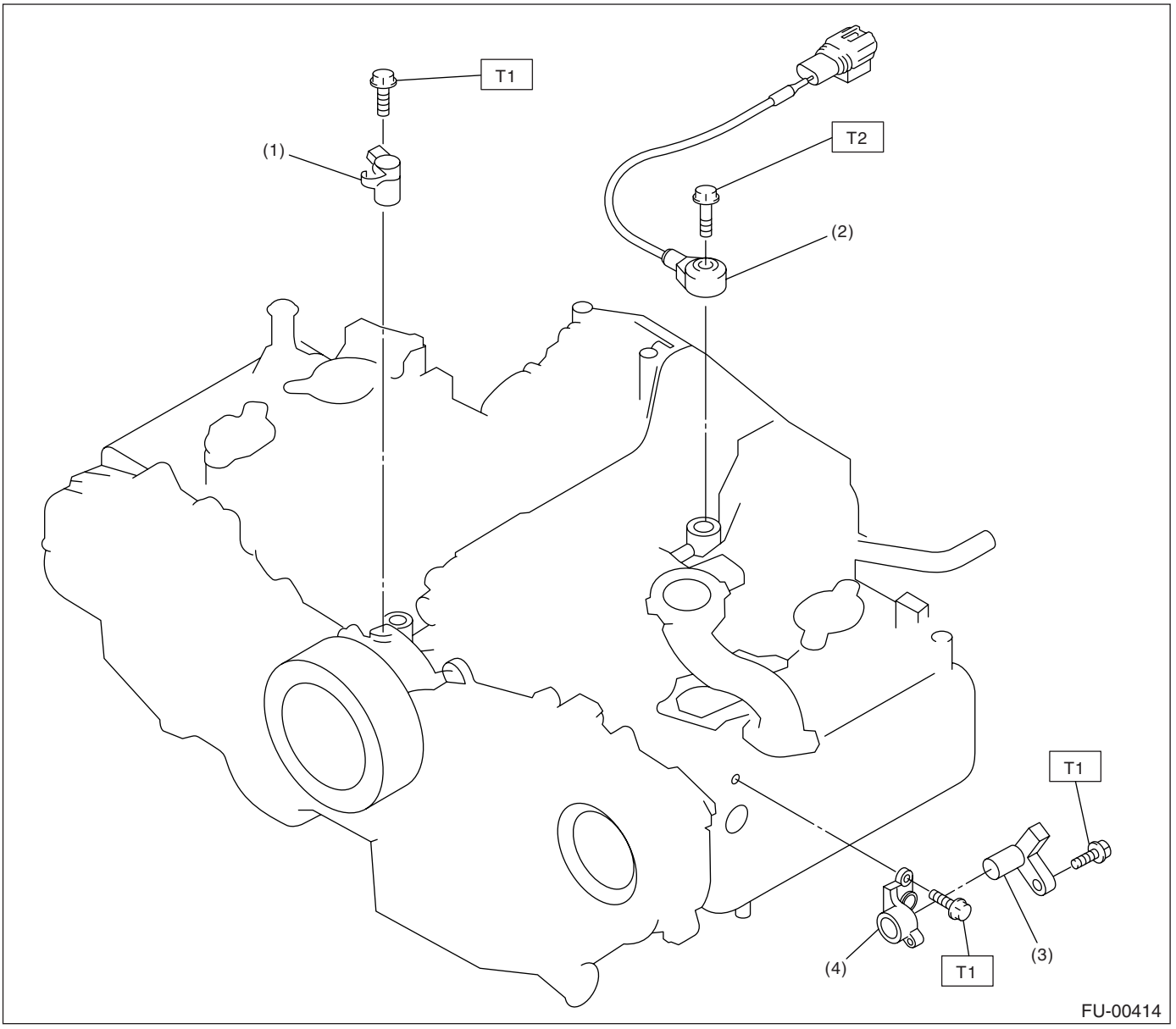
2. AIR INTAKE SYSTEM



(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: 2.4 (0.24, 1.7)
T2: 22 (2.2, 16)

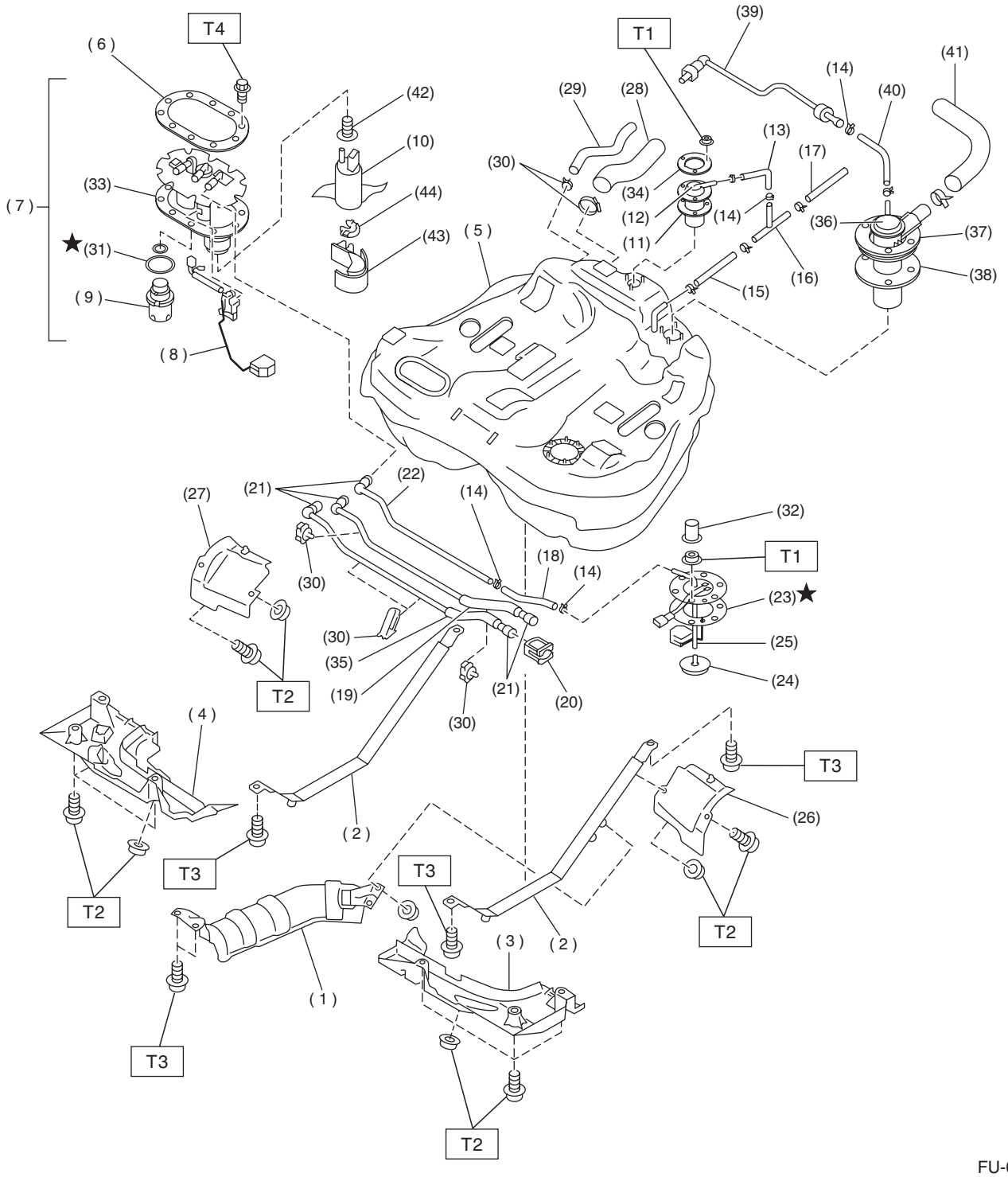
3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(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)

4. FUEL TANK

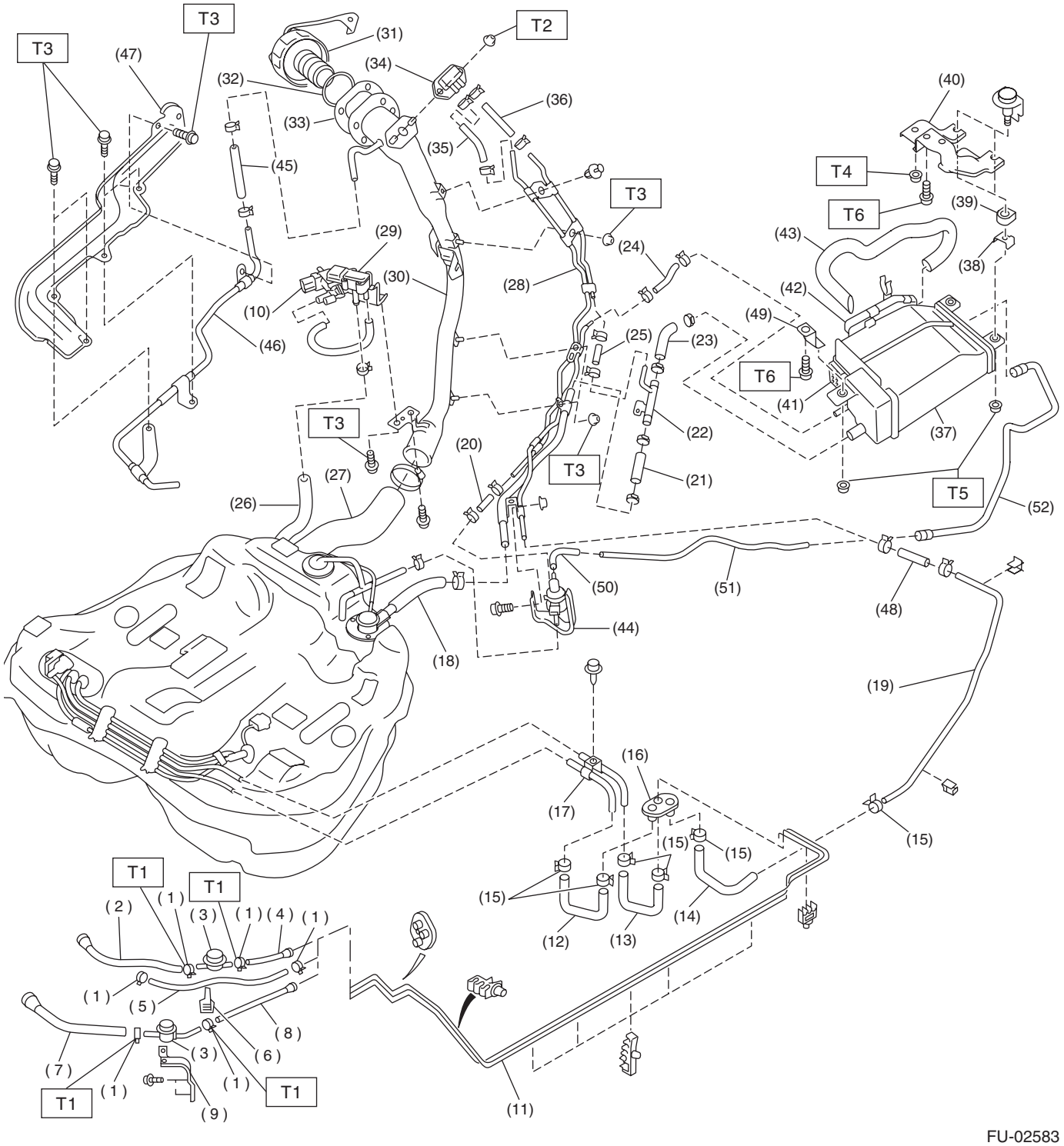


FU-02006

(1) Heat sealed cover
(2) Fuel tank band
(3) Protector LH (Front)
(4) Protector RH (Front)
(5) Fuel tank
(6) Fuel pump plate
(7) Fuel pump ASSY
(8) Fuel level sensor
(9) Fuel filter
(10) Fuel pump
(11) Fuel cut valve gasket
(12) Fuel cut valve
(13) Evaporation hose A
(14) Clip
(15) Evaporation hose C
(16) Joint pipe
(17) Evaporation hose B
(18) Jet pump hose A
(19) Fuel return tube
(20) Retainer
(21) Quick connector
(22) Jet pump tube B
(23) Fuel sub level sensor gasket
(24) Jet pump filter
(25) Fuel sub level sensor
(26) Protector LH (Rear)
(27) Protector RH (Rear)
(28) Fuel filler hose
(29) Fuel tank pressure sensor hose
(30) Clamp
(31) Gasket
(32) Cap
(33) Gasket
(34) Fuel cut valve plate
(35) Fuel delivery tube
(36) Vent valve
(37) Vent valve plate
(38) Vent valve gasket
(39) Evaporation tube
(40) Evaporation hose D
(41) Air vent hose
(42) Seal
(43) Fuel pump holder
(44) Grommet

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.45, 3.3)
T2: 18 (1.8, 13.0)
T3: 33 (3.4, 25)
T4: 5.9 (0.6, 4.3)

5. FUEL LINE



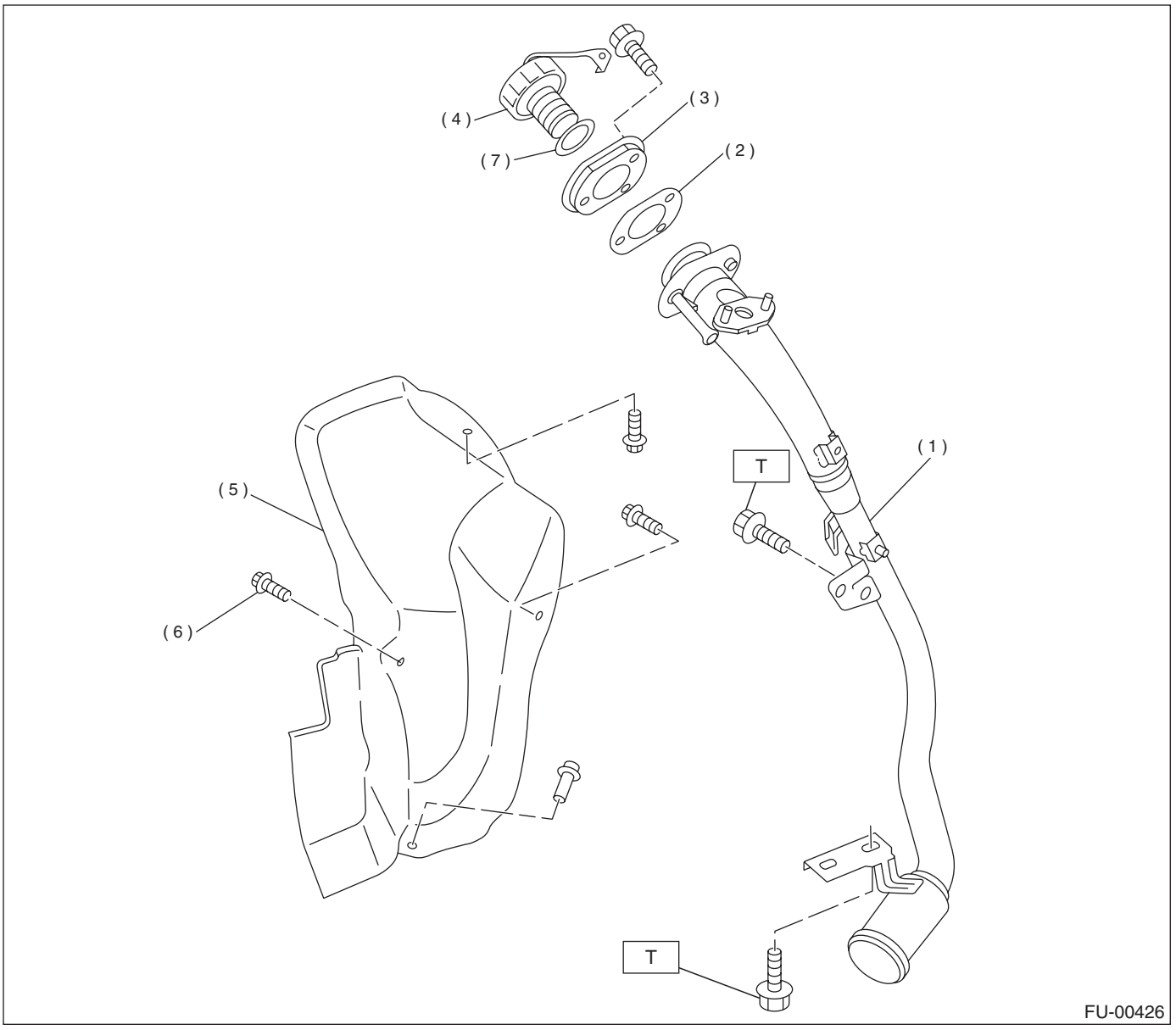
FU-02583

(1) Clamp
(2) Fuel return hose A
(3) Fuel damper valve
(4) Fuel return hose B
(5) Evaporation hose A
(6) Clip
(7) Fuel delivery hose A
(8) Fuel delivery hose B
(9) Fuel damper valve bracket
(10) Fuel tank senser control valve
(11) Fuel pipe ASSY
(12) Fuel delivery hose C
(13) Fuel return hose C
(14) Evaporation hose B
(15) Clamp
(16) Grommet
(17) Fuel pipe ASSY
(18) Air vent hose A
(19) Evaporation pipe A
(20) Evaporation hose C
(21) Air vent hose B
(22) Air vent pipe
(23) Air vent hose C
(24) Evaporation hose D
(25) Evaporation hose E
(26) Fuel tank pressure sensor hose
(27) Fuel filler hose
(28) Evaporation pipe B
(29) Fuel tank pressure sensor
(30) Fuel filler pipe
(31) Fuel filler cap
(32) Ring
(33) Packing
(34) Shut valve
(35) Evaporation hose F
(36) Evaporation hose G
(37) Canister
(38) Canister lower bracket
(39) Cushion rubber
(40) Canister upper bracket
(41) Drain valve
(42) Drain filter
(43) Drain hose
(44) Pressure control solenoid valve
(45) Evaporation hose H
(46) Evaporation pipe C
(47) Pipe protector
(48) Evaporation hose I
(49) Canister bracket (front)
(50) PCV hose
(51) PCV pipe
(52) PCV tube

Tightening torque: N·m (kgf-m, ft-lb)

T1:	***1.5 (0.15, 1.1)***
T2:	***4.5 (0.46, 3.3)***
T3:	***7.5 (0.76, 5.5)***
T4:	***18 (1.8, 13.0)***
T5:	***23 (2.3, 16.6)***
T6:	***33 (3.4, 25)***

6. FUEL FILLER PIPE



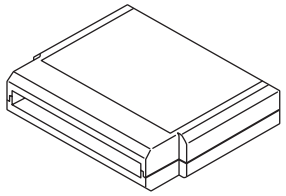
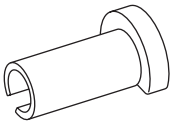
(1) Fuel filler pipe ASSY
(2) Filler pipe packing
(3) Filler ring
(4) Filler cap
(5) Filler pipe protector
(6) Clip
(7) Ring B

Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.75, 5.4)

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 ground cable from battery.
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

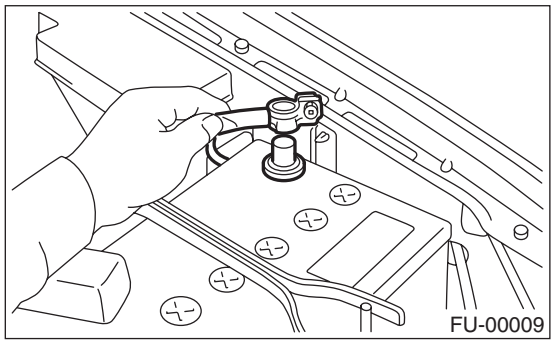
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA260	24082AA260	CARTRIDGE	Troubleshooting for electrical systems.
ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for removing quick connector in the engine room.

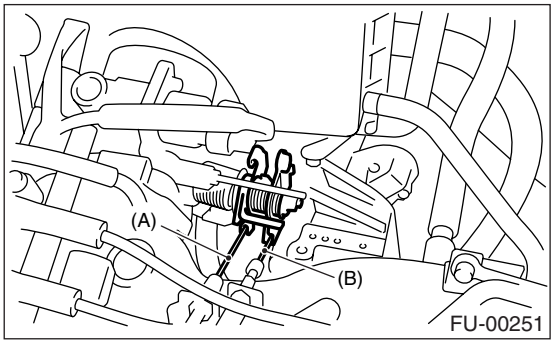
2. Throttle Body

A: REMOVAL

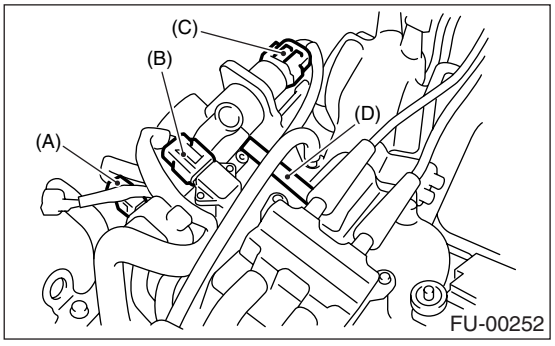
1) Disconnect ground cable from battery.



2) Remove air cleaner case.
<Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner.>
3) Disconnect accelerator cable (A).
4) Disconnect cruise control cable (B). (With cruise control model)

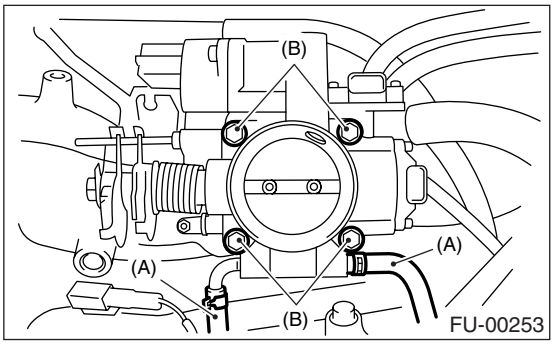


5) Disconnect connectors from idle air control solenoid valve, throttle position sensor and pressure sensor.
6) Disconnect air by-pass hose from throttle body.



(A) Throttle position sensor
(B) Pressure sensor
(C) Idle air control solenoid valve
(D) Air by-pass hose

7) Disconnect engine coolant hoses (A) from throttle body.
8) Remove bolts (B) which install throttle body to intake manifold.



B: INSTALLATION

1) Install in the reverse order of removal.
2) Install accelerator cable.
<Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>

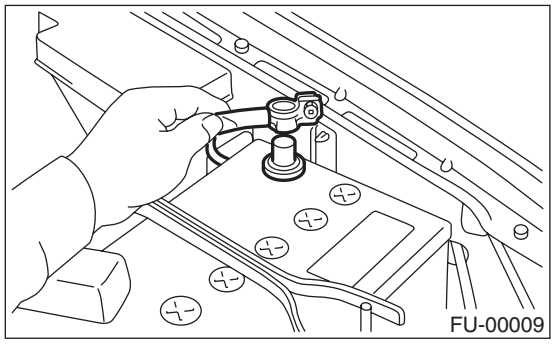
NOTE:
Always use a new gasket.

Tightening torque:
Throttle body;
22 N·m (2.2 kgf-m, 15.9 ft-lb)

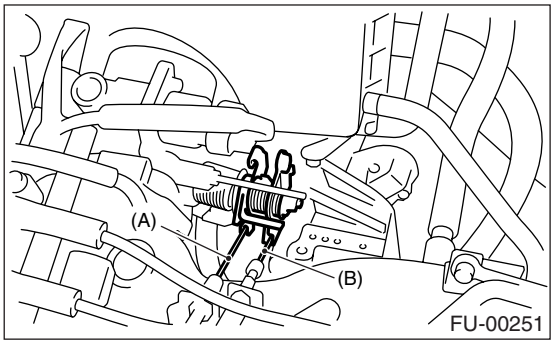
3. Intake Manifold

A: REMOVAL

1) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect battery ground cable.

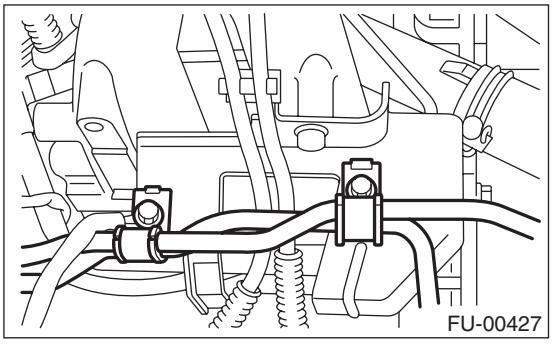


4) Remove air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
5) Disconnect accelerator cable (A).
6) Disconnect cruise control cable (B). (With cruise control model)

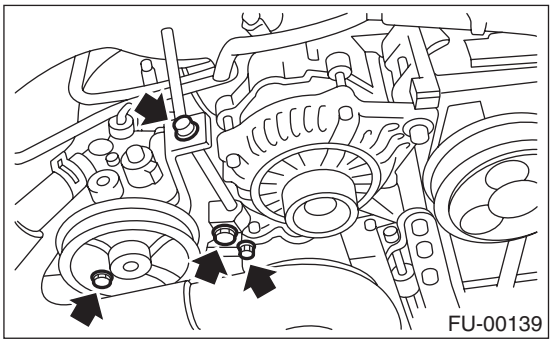


7) Remove power steering pump and tank from brackets.
(1) Remove resonator chamber.
<Ref. to IN(H4SO)-8, REMOVAL, Resonator Chamber.>
(2) Remove front V-belt.
<Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
(3) Remove bolts which hold power steering pipes onto intake manifold protector.

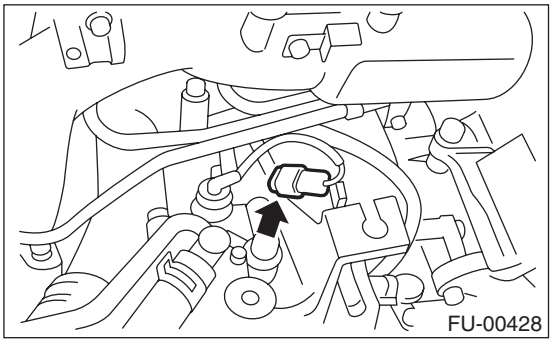
NOTE:
Do not disconnect power steering hose.



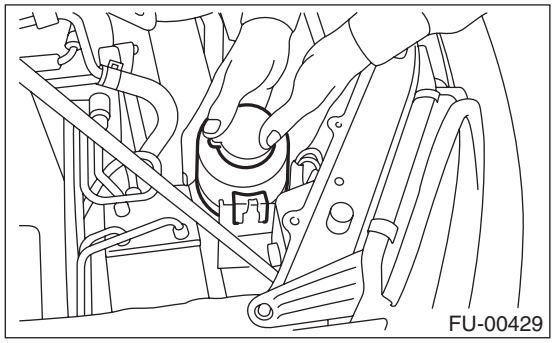
(4) Remove bolts which install power steering pump bracket.



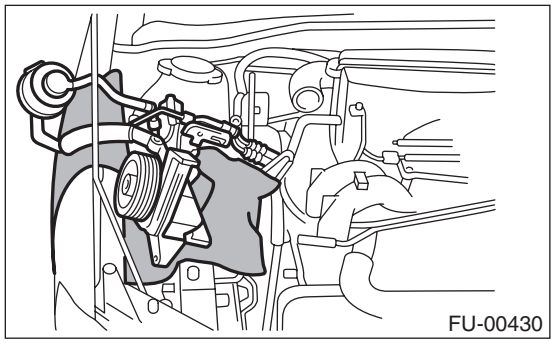
(5) Disconnect connector from power steering pump switch.



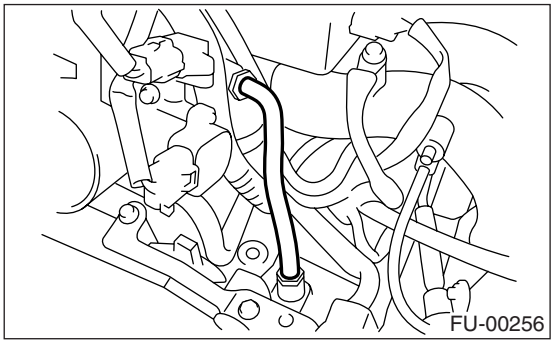
(6) Remove power steering tank from the bracket by pulling it upwards.



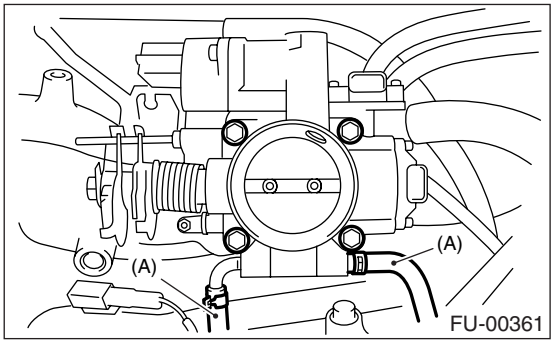
(7) Place power steering pump and tank on the right side wheel apron.



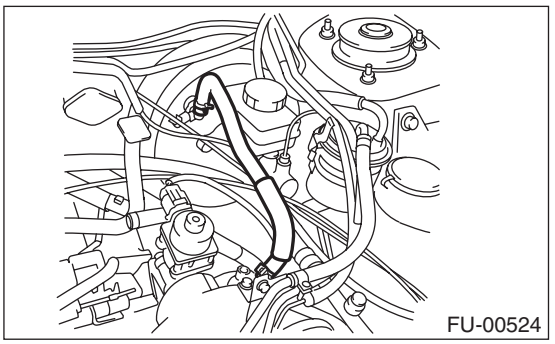
8) Disconnect spark plug cords from spark plugs.
9) Disconnect PCV hose from intake manifold.



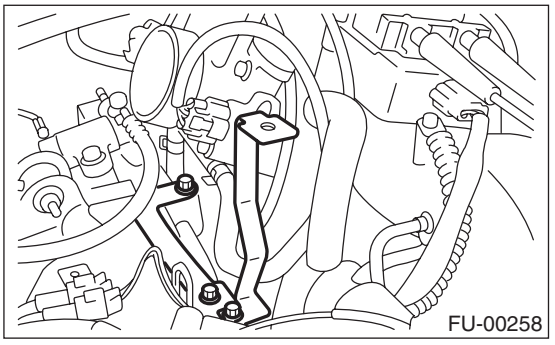
10) Disconnect engine coolant hose (A) from throttle body.



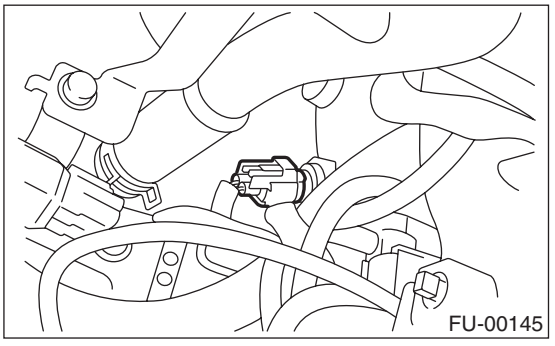
11) Disconnect brake booster hose.



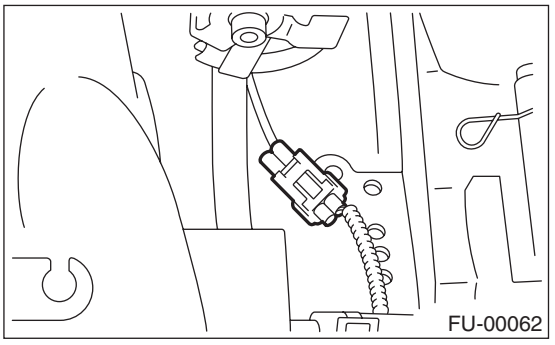
12) Remove air cleaner case stay RH and engine harness bracket, and disconnect engine harness connectors from bulkhead harness connectors.



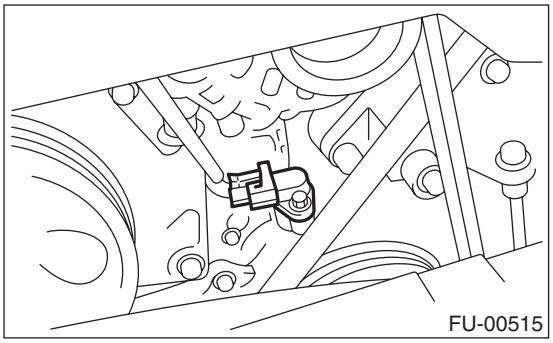
13) Disconnect connectors from engine coolant temperature sensor.



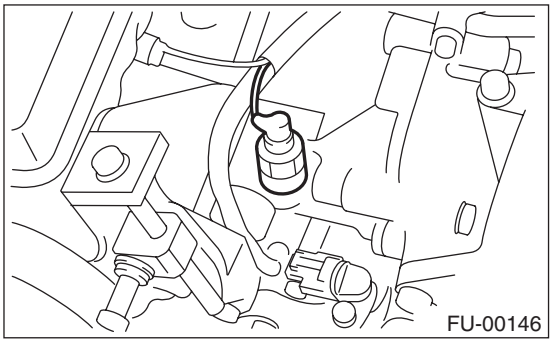
14) Disconnect knock sensor harness connector from connector bracket.
15) Disconnect knock sensor connector.



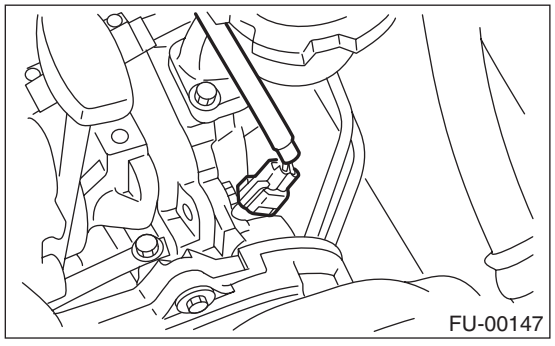
16) Disconnect connector from crankshaft position sensor.



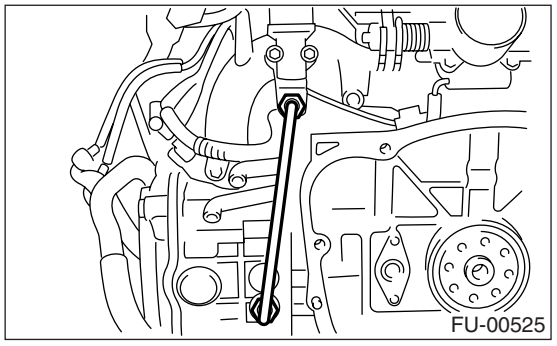
17) Disconnect connector from oil pressure switch.



18) Disconnect connector from camshaft position sensor.



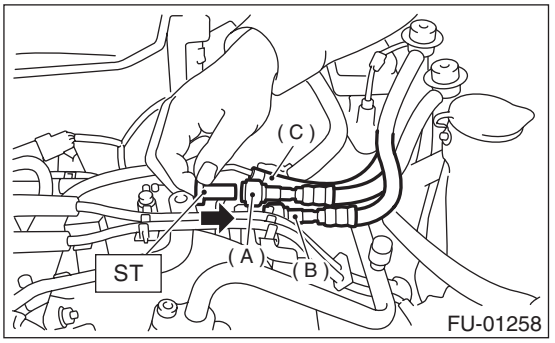
19) Remove EGR pipe from intake manifold and cylinder head.



20) Using ST, disconnect fuel hoses from fuel pipes.<Ref. to FU(H4SO)-72, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

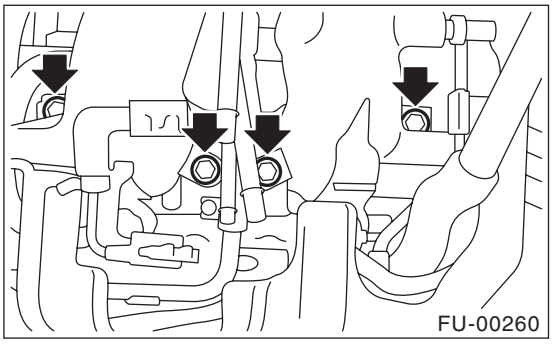
WARNING:
- **Do not spill fuel.**
- **Catch fuel from hoses in a container or cloth.**

ST 42099AE000 CONNECTOR REMOVER



(A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

21) Remove bolts which hold intake manifold onto cylinder heads, and remove intake manifold.

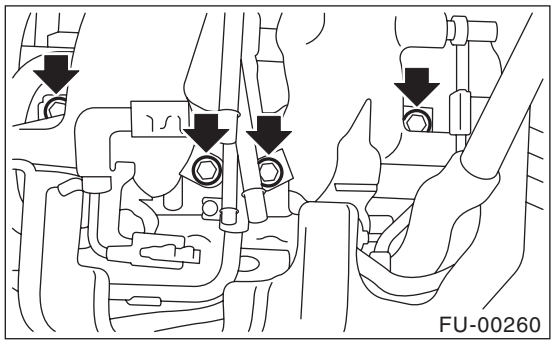


B: INSTALLATION

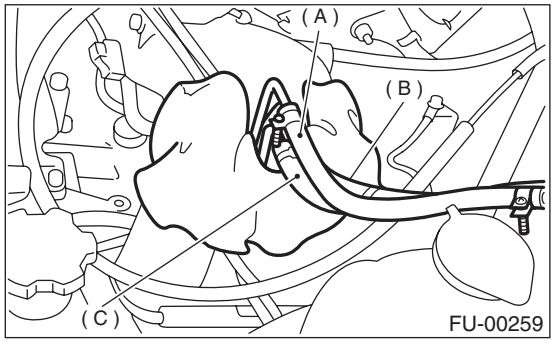
1) Install intake manifold onto cylinder heads.

NOTE:
Always use new gaskets.

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



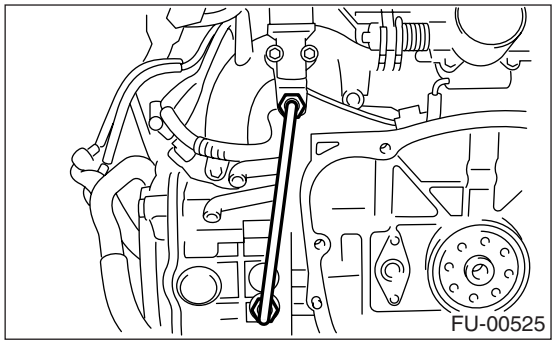
2) Connect fuel hoses.



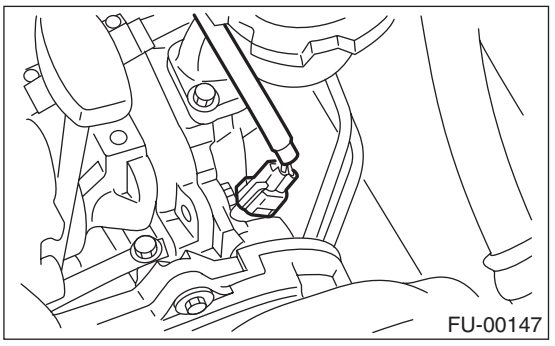
(A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

3) Install EGR pipe to intake manifold and cylinder head.

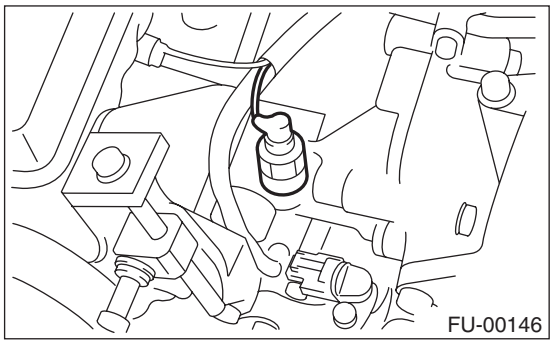
Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



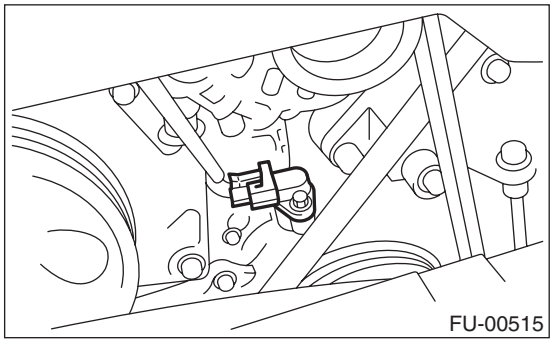
4) Connect connector to camshaft position sensor.



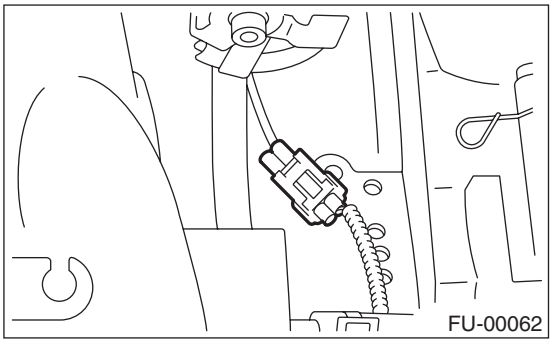
5) Connect connector to oil pressure switch.



6) Connect connector to crankshaft position sensor.

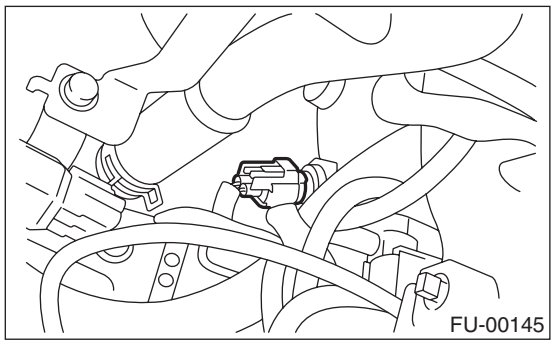


7) Connect knock sensor connector.

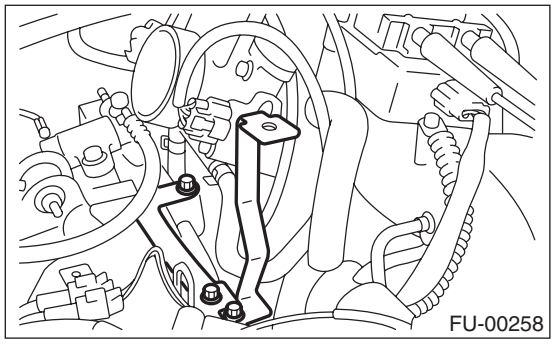


8) Install knock sensor harness connector to connector bracket.

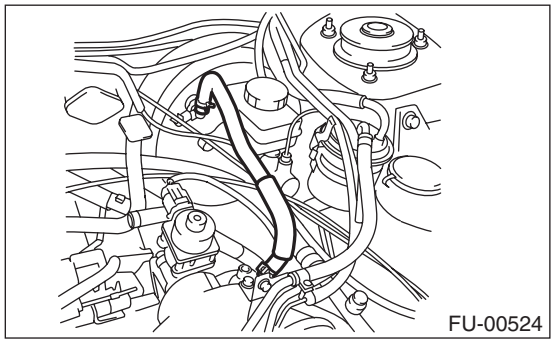
9) Connect connectors to engine coolant temperature sensor.



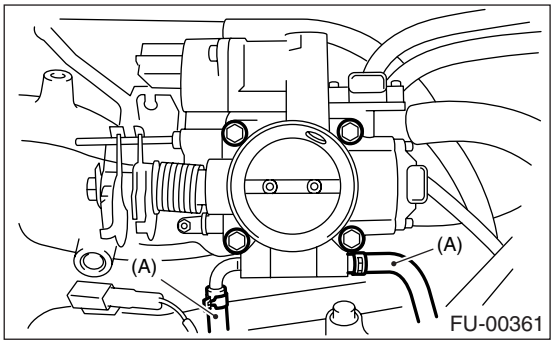
10) Install air cleaner case stay RH and engine harness bracket, and connect engine harness connectors to bulkhead connectors.



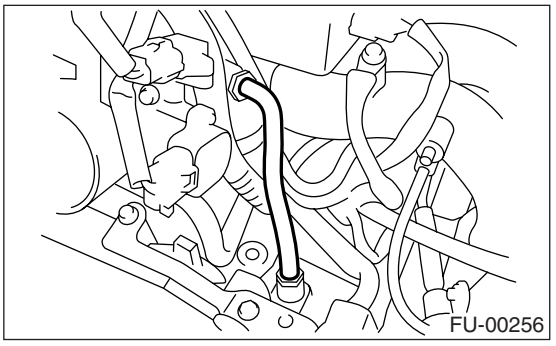
11) Connect brake booster hose.



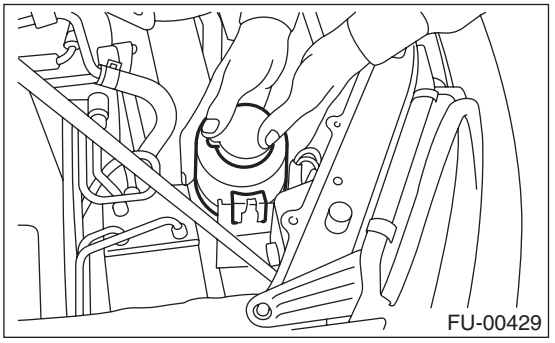
12) Connect engine coolant hose (A) to throttle body.



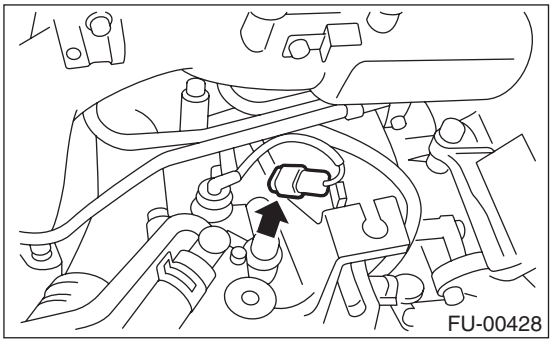
13) Connect PCV hose to intake manifold.



14) Connect spark plug cords to spark plugs.
15) Install power steering pump and tank on brackets.
(1) Install power steering tank on bracket.

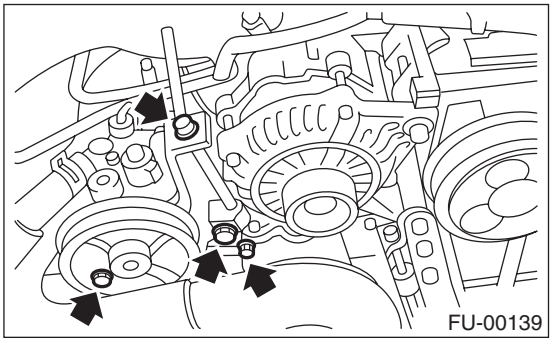


(2) Connect connector to power steering pump switch.

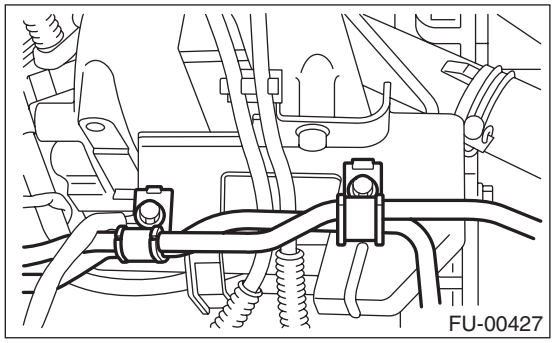


(3) Tighten bolts which install power steering pump on bracket.

Tightening torque:
22 N·m (2.2 kgf-m, 15.9 ft-lb)

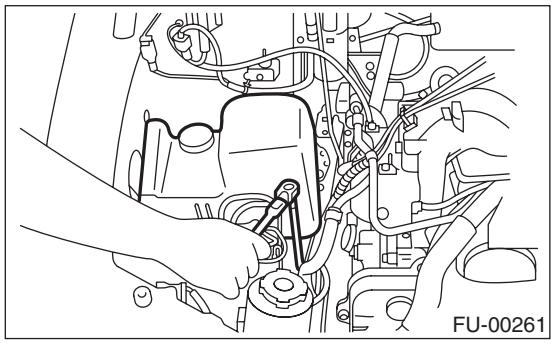


(4) Install power steering pipes onto right side intake manifold protector.

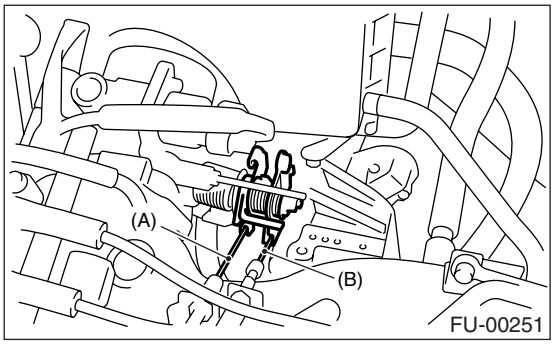


(5) Install front V-belt.
<Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>
(6) Install resonator chamber.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)

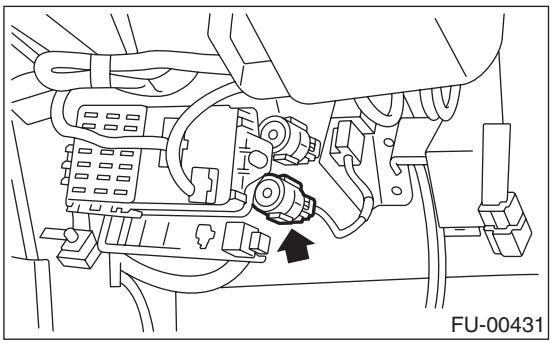


16) Connect accelerator control cable (A).
<Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>
17) Connect cruise control cable (B). (With cruise control models)

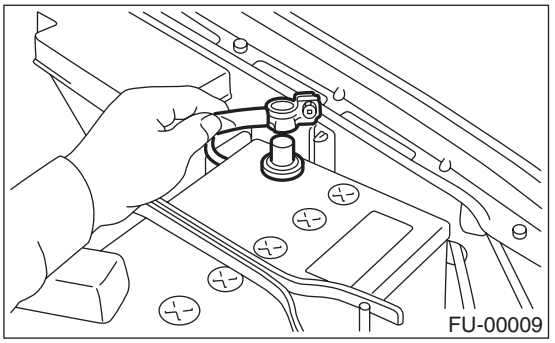


18) Install air intake duct and air cleaner case.
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner.>

19) Connect connector to fuel pump relay.

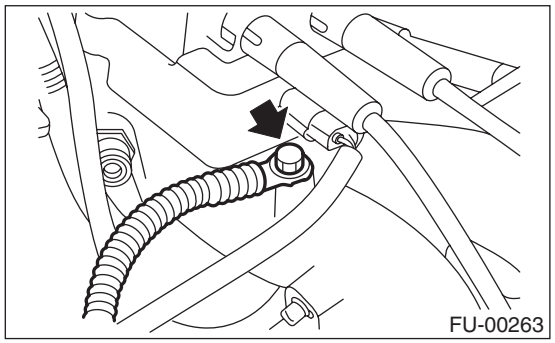


20) Connect battery ground cable.

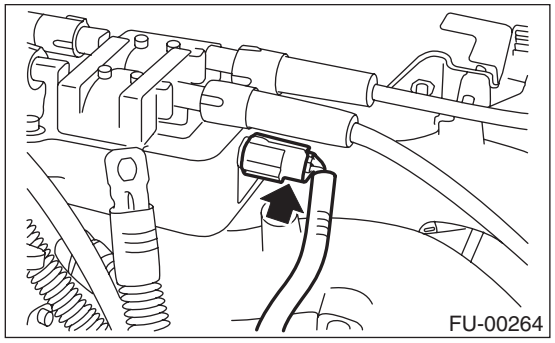


C: DISASSEMBLY

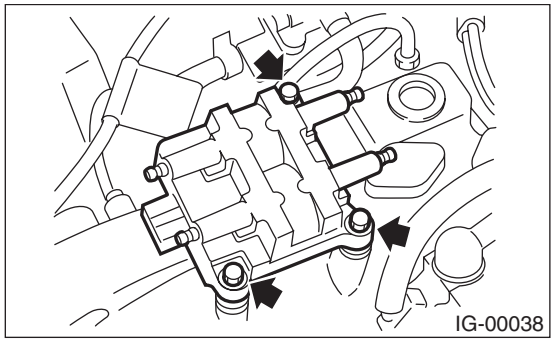
1) Disconnect engine ground terminal from intake manifold.



2) Disconnect connector from ignition coil and ignitor assembly.

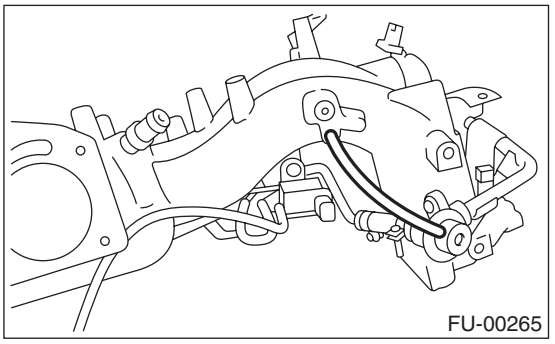


3) Remove ignition coil and ignitor assembly.

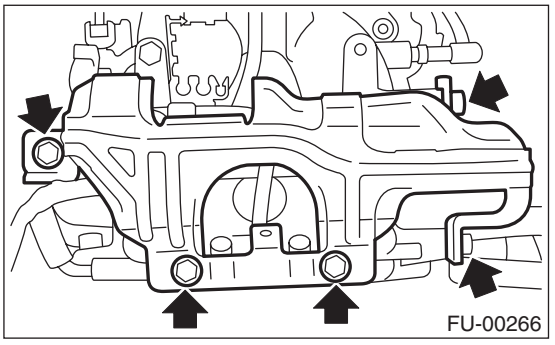


4) Remove throttle body.
<Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.>
5) Remove air assist injector solenoid valve.
<Ref. to FU(H4SO)-36, REMOVAL, Air Assist Injector Solenoid Valve.>
6) Remove EGR valve.
<Ref. to FU(H4SO)-37, REMOVAL, EGR Valve.>

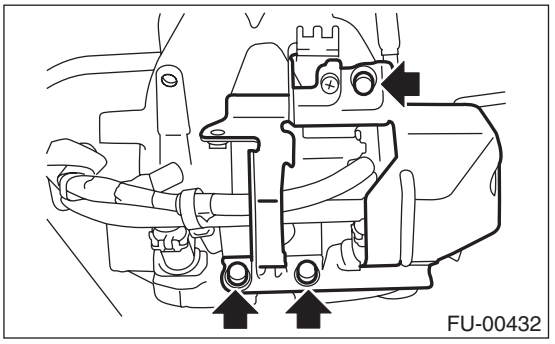
7) Disconnect pressure regulator vacuum hose from intake manifold.



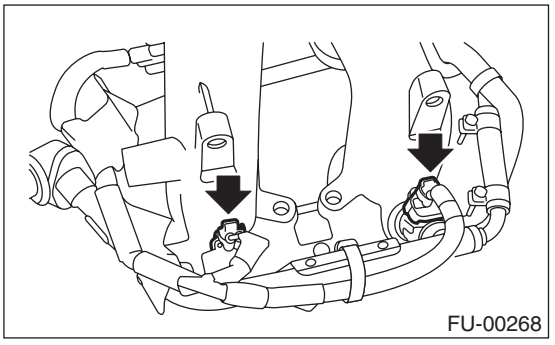
8) Remove fuel pipe protector LH.



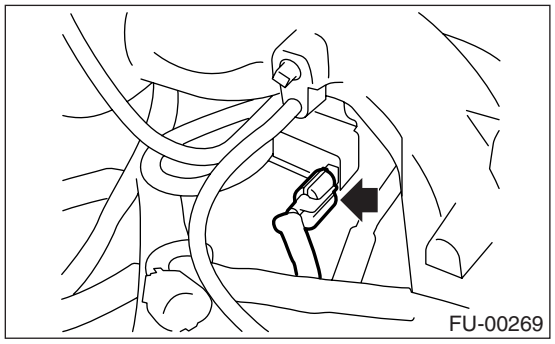
9) Remove fuel pipe protector RH.



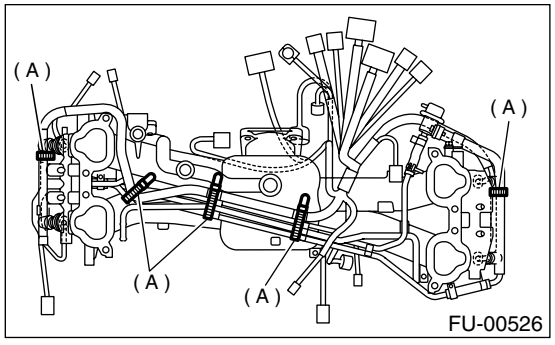
10) Disconnect connectors from fuel injectors.



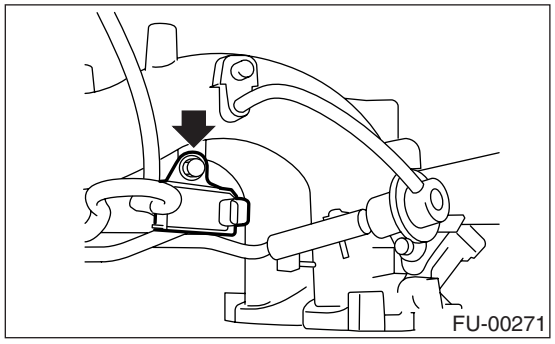
11) Disconnect connector from purge control solenoid valve.



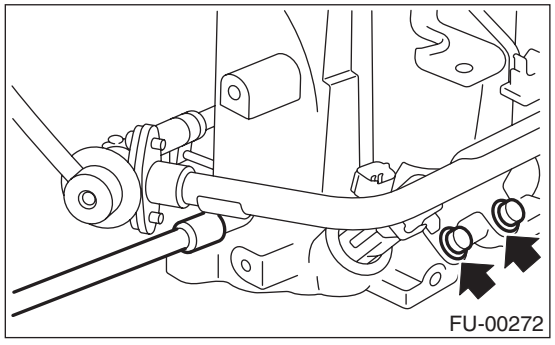
12) Disconnect air by-pass hose from purge control solenoid valve.
13) Remove harness bands (A) which hold engine harness onto intake manifold.



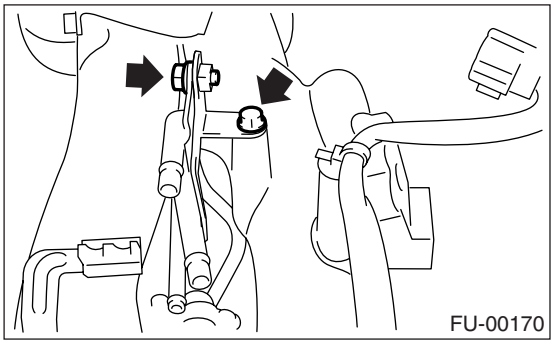
14) Remove engine harness from intake manifold.
15) Remove purge control solenoid valve.



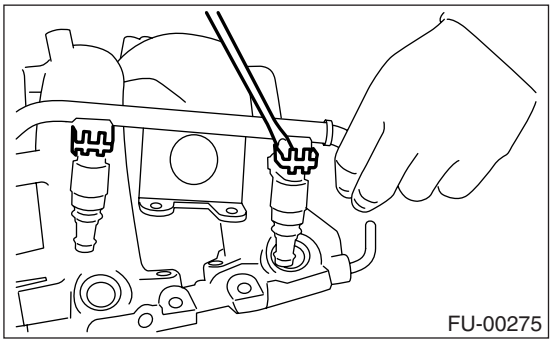
16) Remove bolt which installs injector pipe on intake manifold as shown in figure.



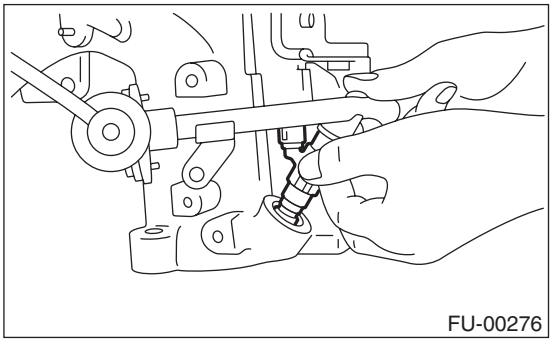
17) Remove two bolts which hold fuel pipes on the left side of intake manifold.



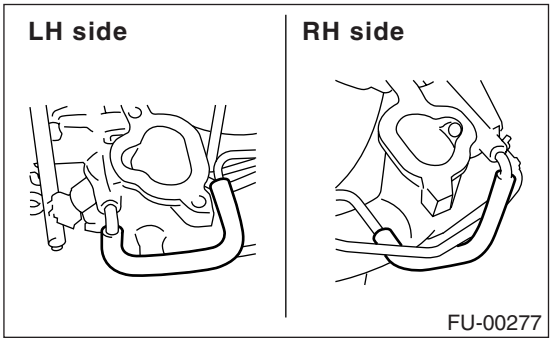
18) Remove fuel injectors.
(1) Remove fuel injector securing clip.



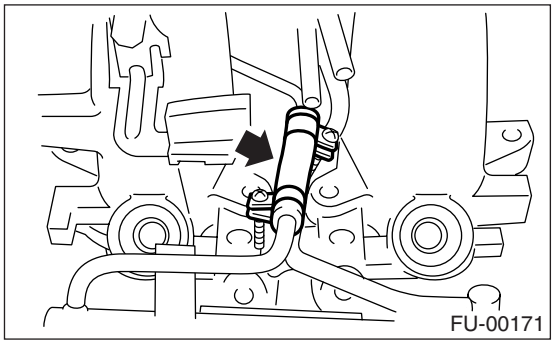
(2) Remove fuel injector while lifting up fuel injector pipe.



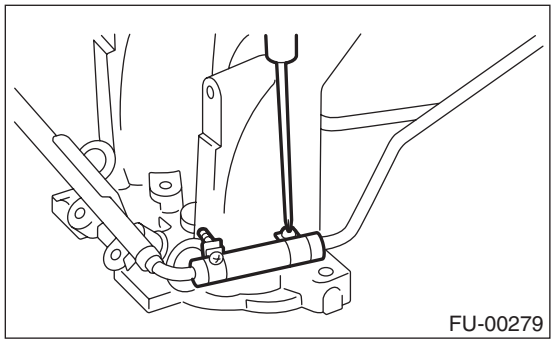
19) Disconnect air by-pass hoses from intake manifold.



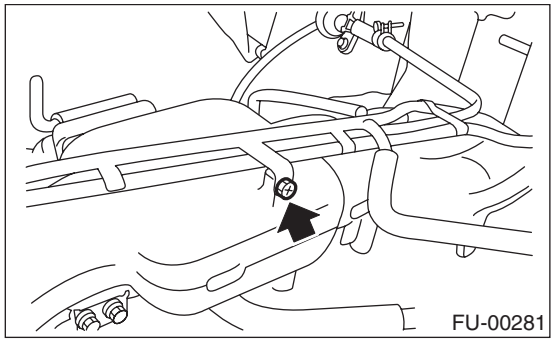
20) Loosen clamp which holds front left side fuel hose to injector pipe and remove the pipe from clamp.



21) Loosen clamp which holds front right side fuel hose to injector pipe and remove the pipe from clamp.



22) Remove fuel injector pipe.
23) Remove bolt which installs fuel pipes on intake manifold.

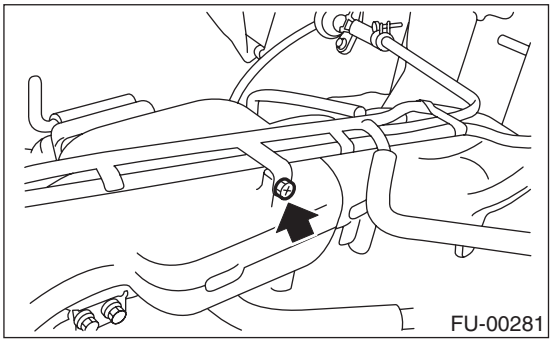


24) Remove fuel pipe assembly and pressure regulator, from intake manifold.

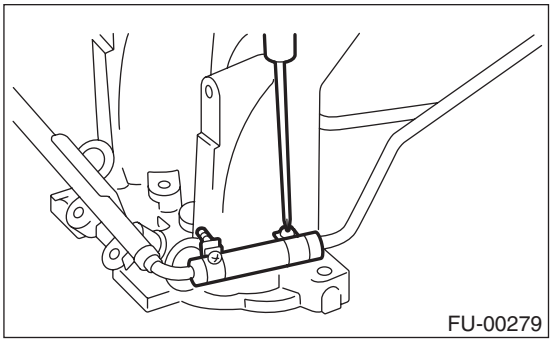
D: ASSEMBLY

1) Install fuel pipe assembly and pressure regulator, etc. to intake manifold.
2) Tighten bolt which installs fuel pipes on intake manifold.

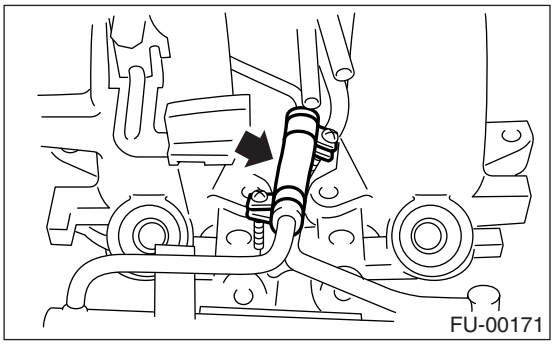
Tightening torque:
4.9 N·m (0.5 kgf-m, 3.6 ft-lb)



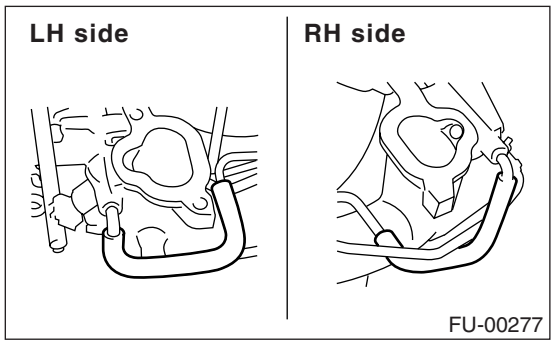
3) Connect right side fuel hose to injector pipe, and tighten clamp screw.



4) Install fuel injector pipe.
5) Connect left side fuel hose to injector pipe, and tighten clamp screw.

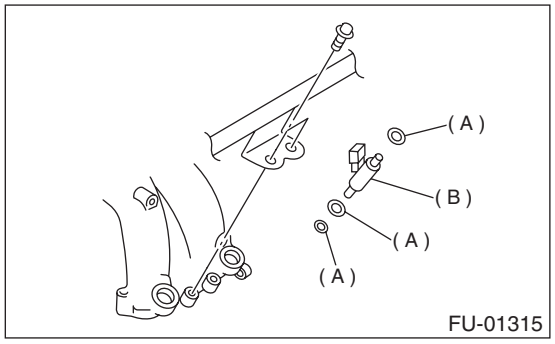


6) Connect air assist hoses.



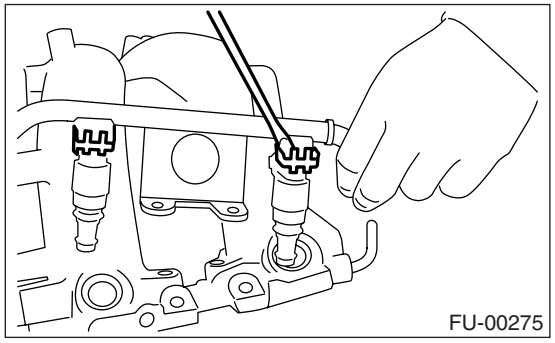
7) Install fuel injectors.

NOTE:
Always use new o-rings.



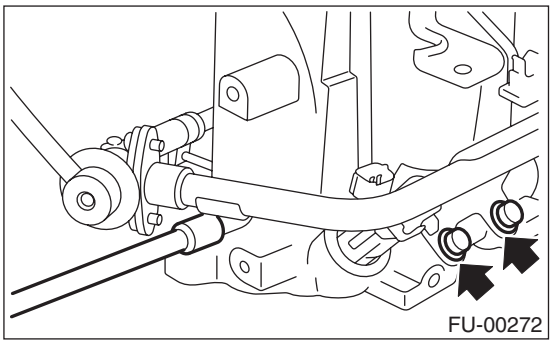
(A) O-ring
(B) Fuel injector

8) Do not forget to install the fuel injector securing clip.

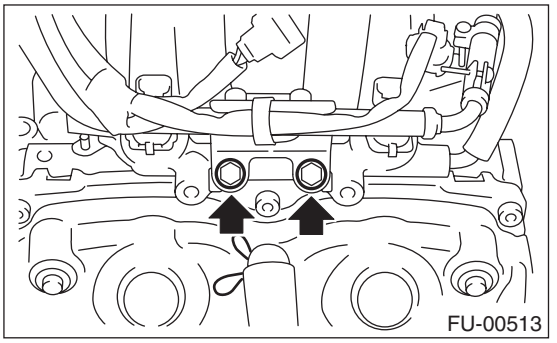


9) Tighten bolt which installs injector pipe on intake manifold.

Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

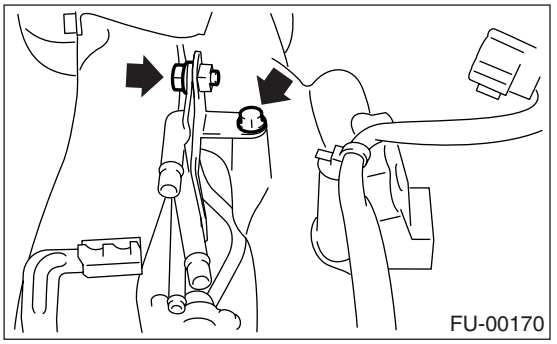


Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



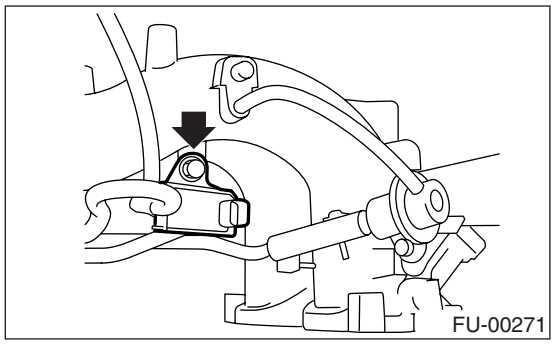
10) Tighten two bolts which install fuel pipes on the left side of intake manifold.

Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



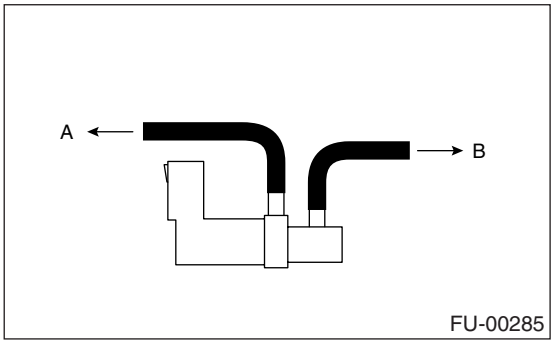
11) Install purge control solenoid valve.

Tightening torque:
19 N·m (1.9 kgf-m, 14.1 ft-lb)



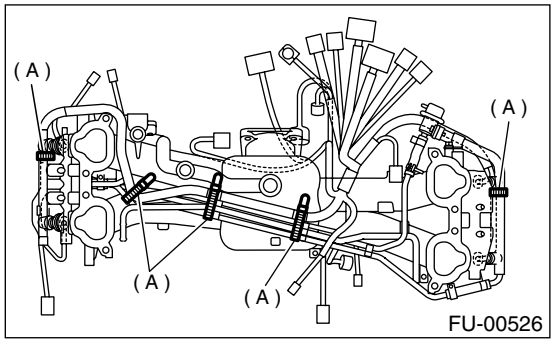
12) Connect hoses to purge control solenoid valve.

CAUTION:
Connect evaporation hoses as shown in the figure.



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

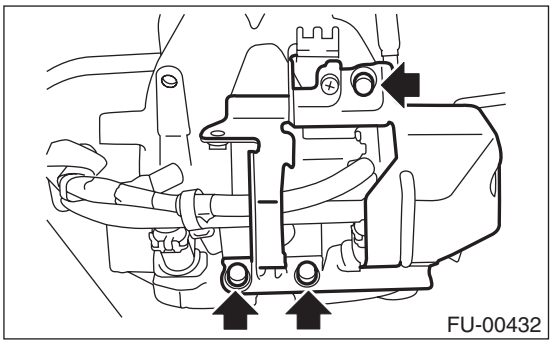
13) Install engine harness onto intake manifold.
14) Connect connectors to fuel injectors and purge control solenoid valve.
15) Hold engine harness by harness bands (A).



NOTE:
Do not use harness band on harnesses where they are supposed to be protected by the fuel pipe protector.

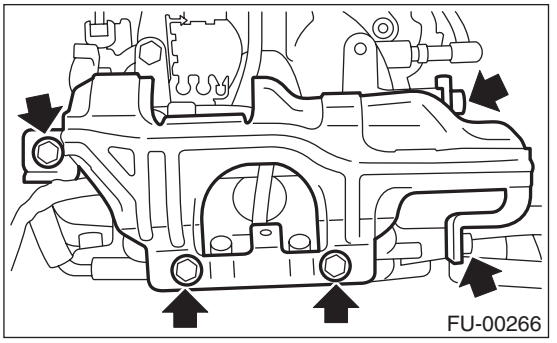
16) Install fuel pipe protector RH.

Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)

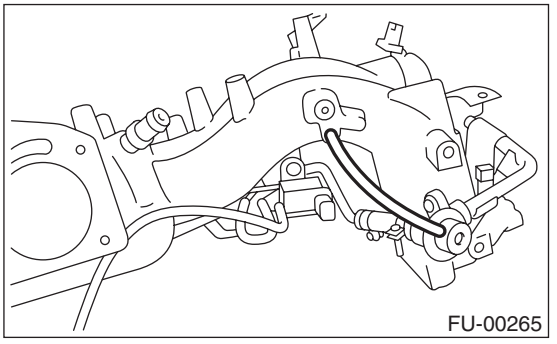


17) Install fuel pipe protector LH.

Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)

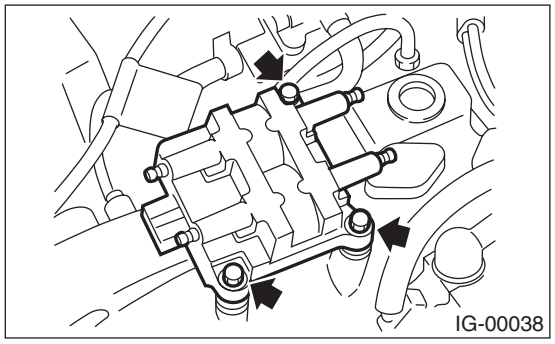


18) Connect pressure regulator vacuum hose to intake manifold.



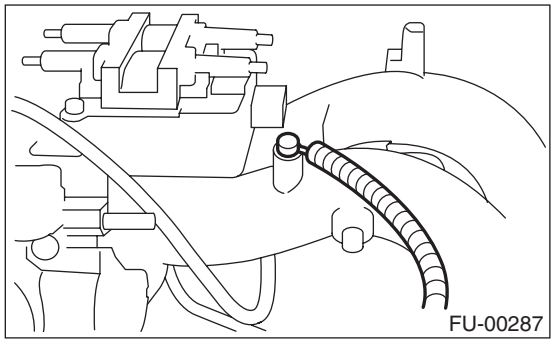
19) Install air assist injector solenoid valve to bracket.
<Ref. to FU(H4SO)-36, INSTALLATION, Air Assist Injector Solenoid Valve.>
20) Install EGR valve.
<Ref. to FU(H4SO)-37, INSTALLATION, EGR Valve.>
21) Install throttle body to intake manifold.
<Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>
22) Install ignition coil and ignitor assembly.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



23) Connect connector to ignition coil and ignitor assembly.
24) Install engine ground terminal to intake manifold.

Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



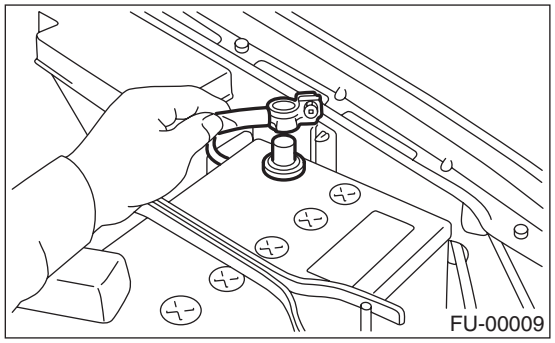
E: INSPECTION

Make sure the fuel pipe and fuel hoses are not cracked and that connections are tight.

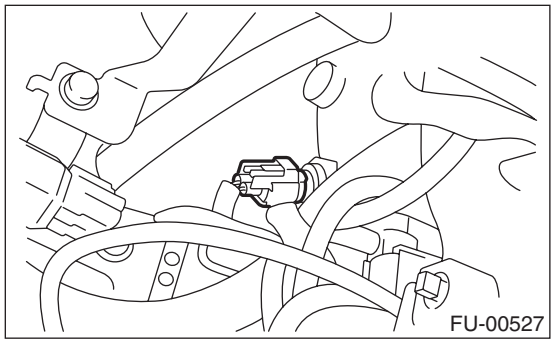
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect ground cable from battery.



2) Remove air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
3) Disconnect connector from engine coolant temperature sensor.



4) Remove engine coolant temperature sensor.

B: INSTALLATION

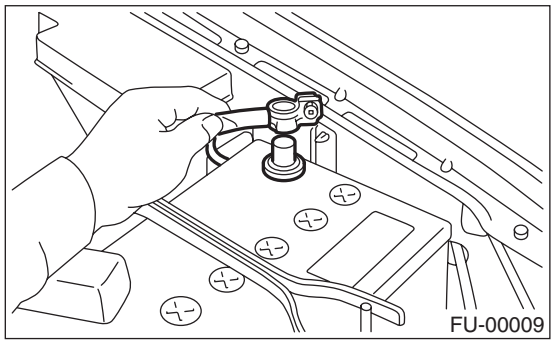
Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 1.3 ft-lb)

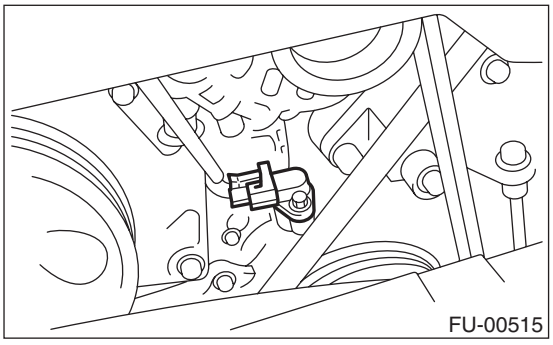
5. Crankshaft Position Sensor

A: REMOVAL

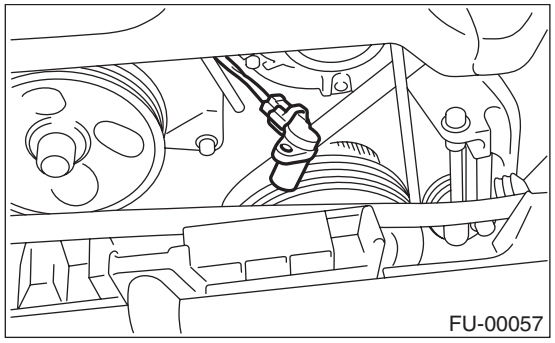
1) Disconnect ground cable from battery.



2) Remove bolt which installs crankshaft position sensor to cylinder block.



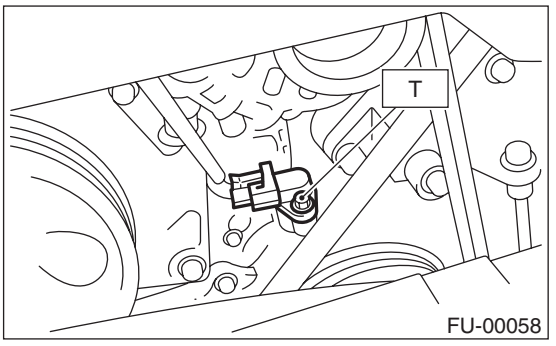
3) Remove crankshaft position sensor, and disconnect connector from it.



B: INSTALLATION

Install in the reverse order of removal.

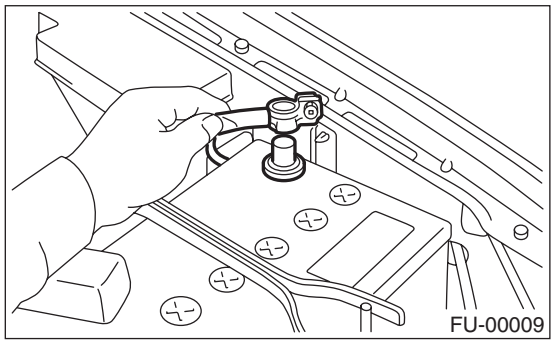
Tightening torque:
T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



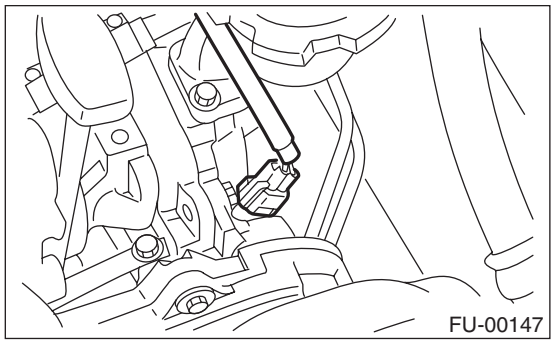
6. Camshaft Position Sensor

A: REMOVAL

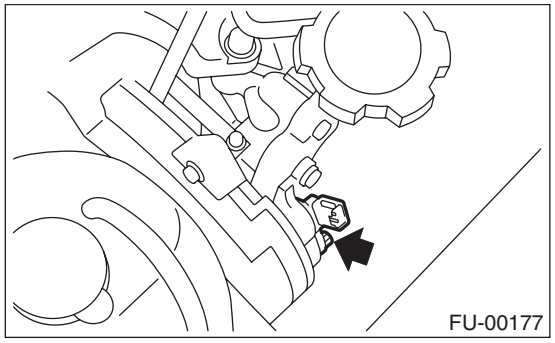
1) Disconnect ground cable from battery.



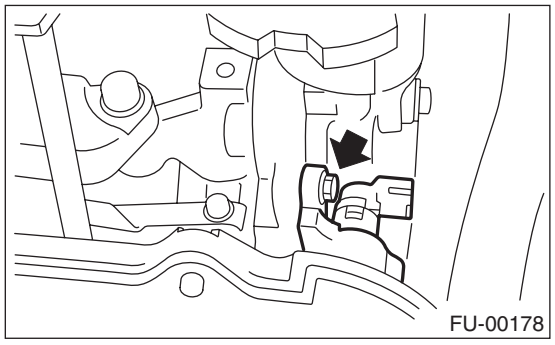
2) Disconnect connector from camshaft position sensor.



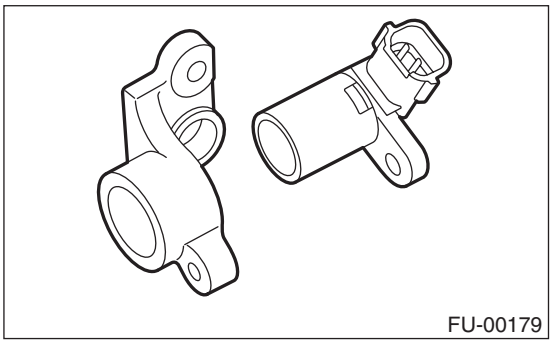
3) Remove bolt which installs camshaft position sensor to camshaft position sensor support.



4) Remove bolt which installs camshaft position sensor support to camshaft cap LH.



5) Remove camshaft position sensor and camshaft position sensor support as a unit.
6) Remove camshaft position sensor itself.



B: INSTALLATION

Install in the reverse order of removal.

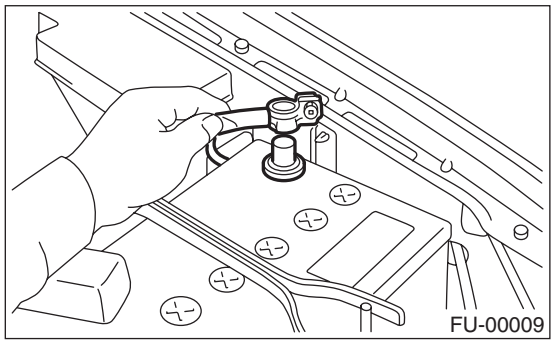
Tightening torque:

- ***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)***

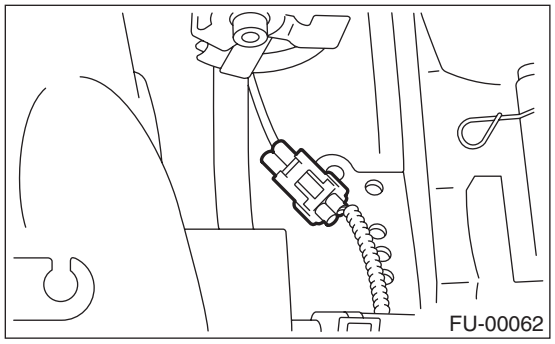
7. Knock Sensor

A: REMOVAL

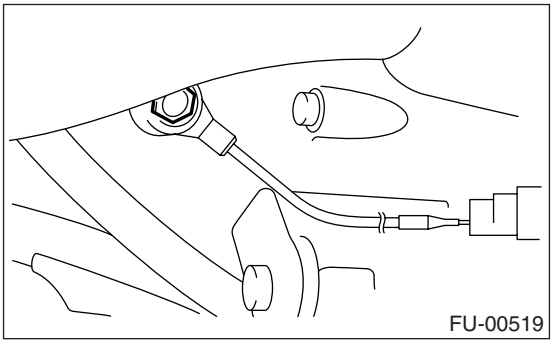
1) Disconnect ground cable from battery.



2) Remove air cleaner case.
<Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
3) Disconnect knock sensor connector.



4) Remove knock sensor from cylinder block.

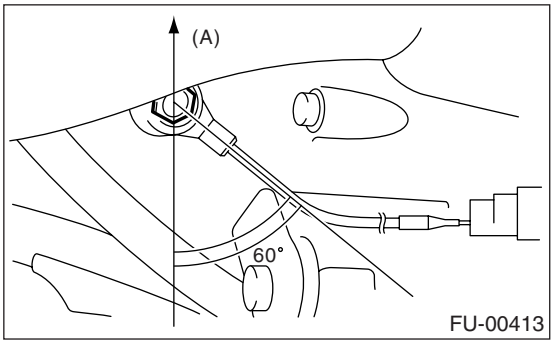


B: INSTALLATION

1) Install knock sensor to cylinder block.

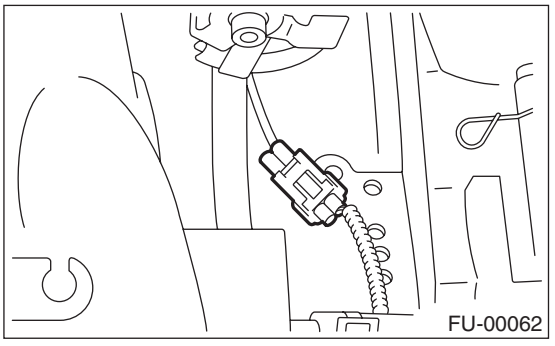
Tightening torque:
24 N·m (2.4 kgf-m, 17.4 ft-lb)

NOTE:
The extraction area of the knock sensor cord must be positioned at a 60° angle relative to the engine rear.

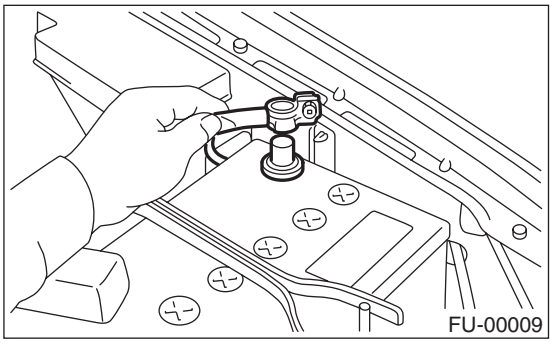


(A) Front side

2) Connect knock sensor connector.



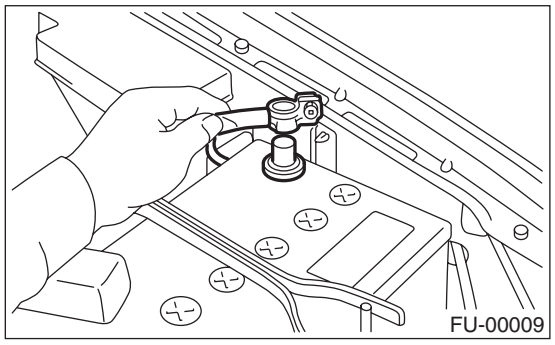
3) Install knock sensor harness connector to connector bracket.
4) Install air cleaner case.
<Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>
5) Connect battery ground cable.



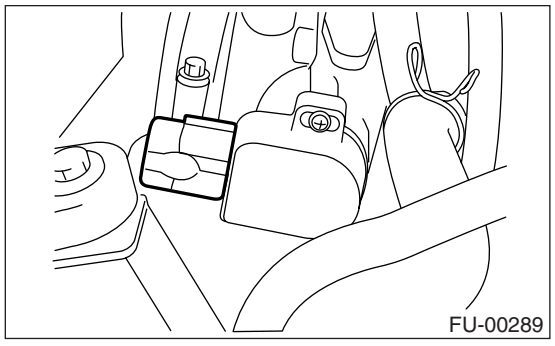
8. Throttle Position Sensor

A: REMOVAL

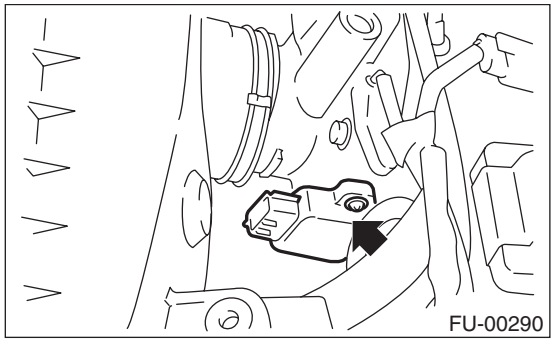
1) Disconnect ground cable from battery.



2) Disconnect connector from throttle position sensor.



3) Remove throttle position sensor holding screws, and remove it.

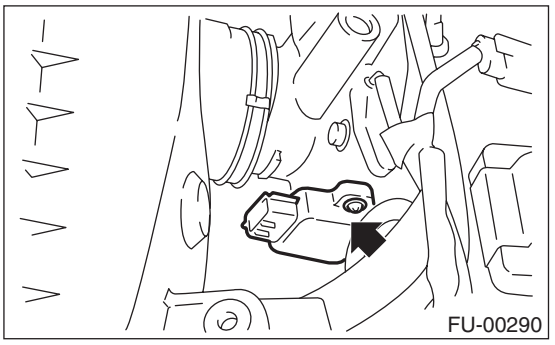


B: INSTALLATION

Install in the reverse order of removal.

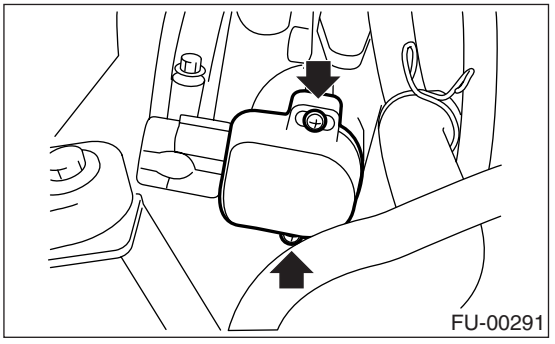
Tightening torque:
2.4 N·m (0.24 kgf-m, 1.7 ft-lb)

CAUTION:
When installing throttle position sensor, adjust to the specified data.



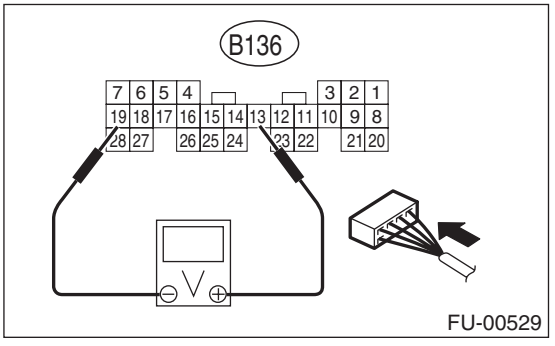
C: ADJUSTMENT

1) Turn ignition switch to OFF.
2) Loosen throttle position sensor holding screws.



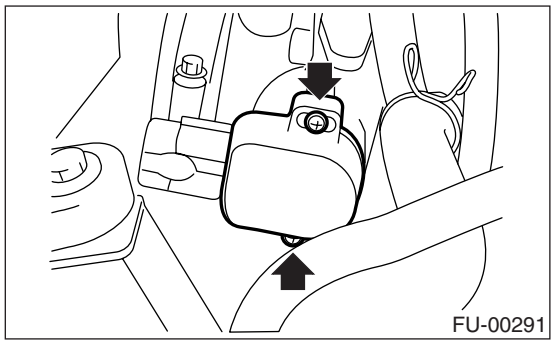
3) When using voltage meter;
(1) Take out ECM.
(2) Turn ignition switch to ON.
(3) Adjust throttle position sensor to the proper position to allow the voltage signal to ECM to be in specification.

Connector & terminal / Specified voltage
(B135) No. 13 — (B135) No. 19 / 0.45 — 0.55 V
[Fully closed.]

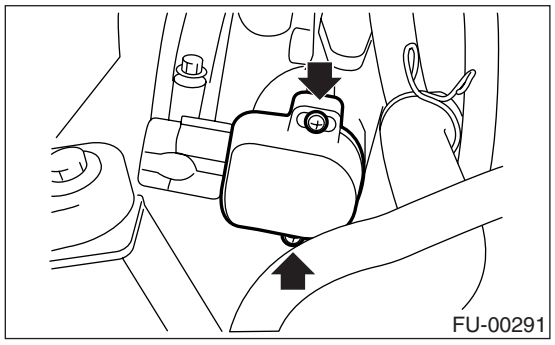


(4) Tighten throttle position sensor holding screws.

Tightening torque:
2.4 N·m (0.24 kgf-m, 1.7 ft-lb)

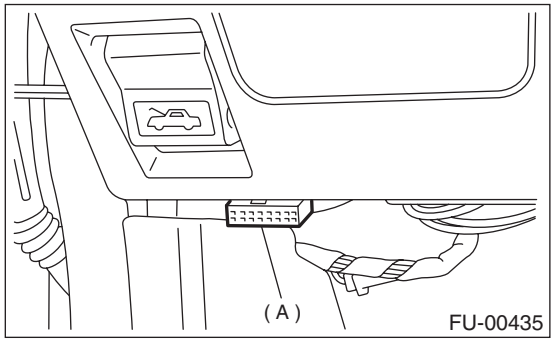


4) When using Subaru Select Monitor;
(1) Turn ignition switch to OFF.
(2) Loosen throttle position sensor holding screws.



NOTE:
For detailed operation procedures, refer to the Subaru Select Monitor Operation Manual.

(3) Insert the cartridge to Subaru Select Monitor. <Ref. to FU(H4SO)-13, PREPARATION TOOL, General Description.>
(4) Connect Subaru Select Monitor to the data link connector (A).

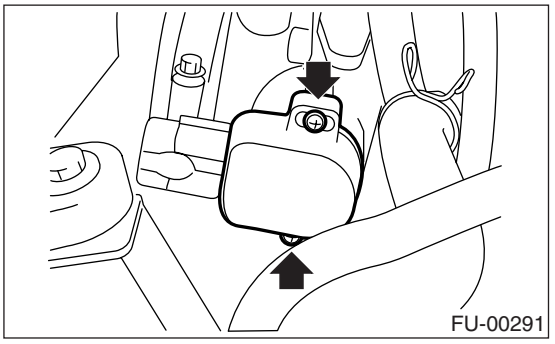


5) Turn ignition switch to ON, and Subaru Select Monitor switch to ON.
6) Select {2. Each System Check} in Main Menu.
7) Select {Engine Control System} in Selection Menu.
8) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
9) Select {1.12 Data Display} in Data Display Menu.
10) Adjust 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

11) Tighten throttle position sensor holding screws.

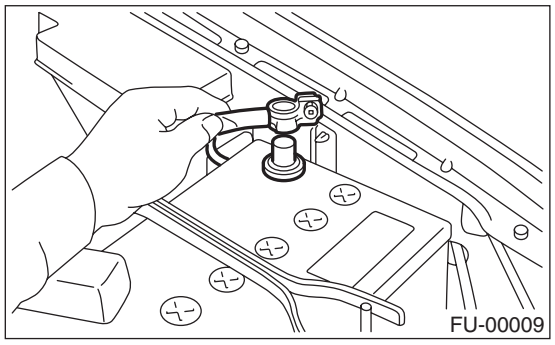
Tightening torque:
2.4 N·m (0.24 kgf-m, 1.7 ft-lb)



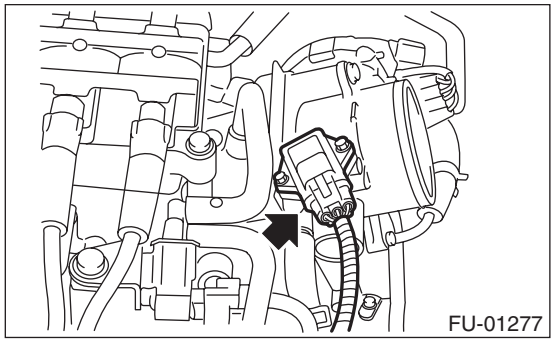
9. Pressure Sensor

A: REMOVAL

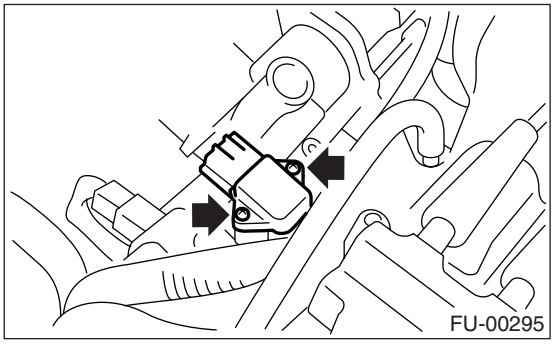
1) Disconnect ground cable from battery.



2) Disconnect connector from pressure sensor.



3) Remove pressure sensor from throttle body.

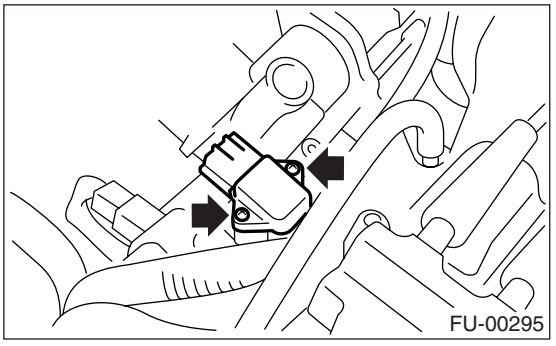


B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Replace O-ring with a new one.

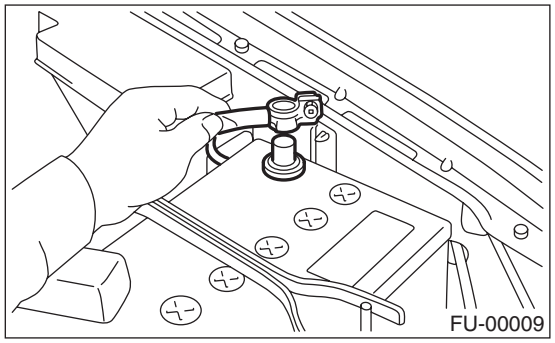
Tightening torque:
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



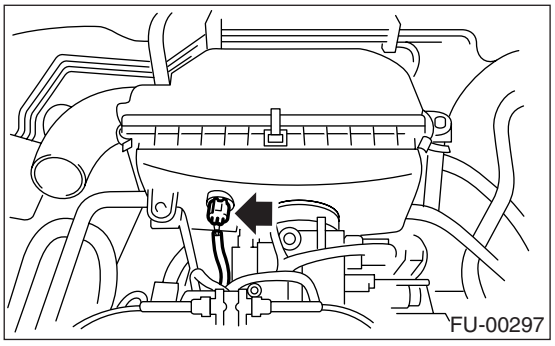
10.Intake Air Temperature Sensor

A: REMOVAL

1) Disconnect ground cable from battery.



2) Disconnect the connector from the intake air temperature sensor.
3) Remove the intake air temperature sensor from air cleaner case.



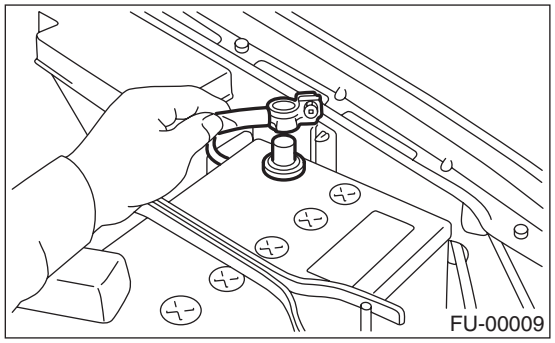
B: INSTALLATION

Install in the reverse order of removal.

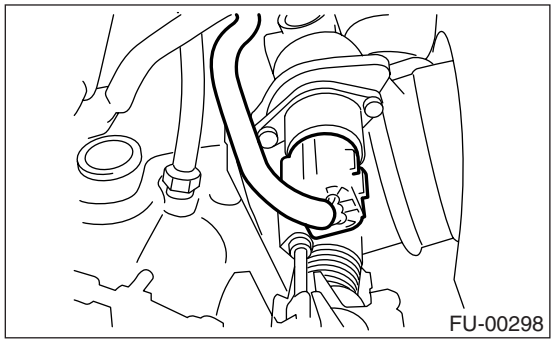
11.Idle Air Control Solenoid Valve

A: REMOVAL

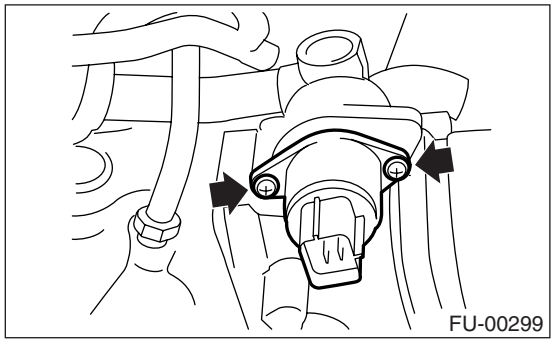
1) Disconnect ground cable from battery.



2) Disconnect connector from idle air control solenoid valve.



3) Remove idle air control solenoid valve from throttle body.

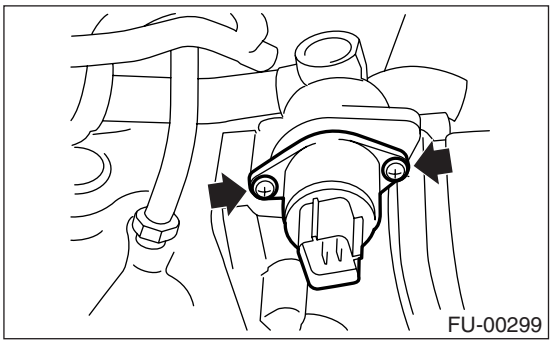


B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Always use a new gasket.

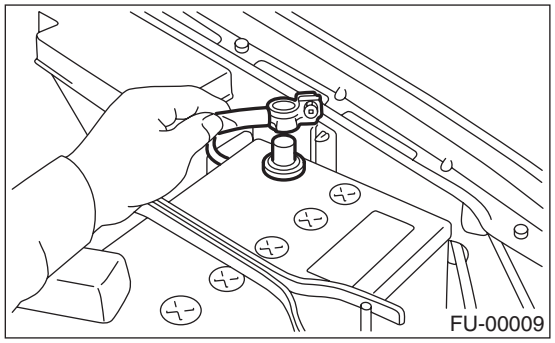
Tightening torque:
2.4 N·m (0.24 kgf-m, 1.7 ft-lb)



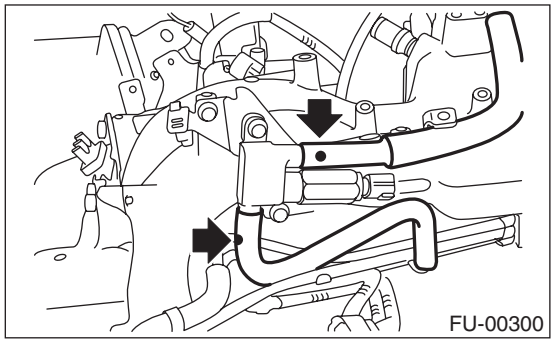
12. Air Assist Injector Solenoid Valve

A: REMOVAL

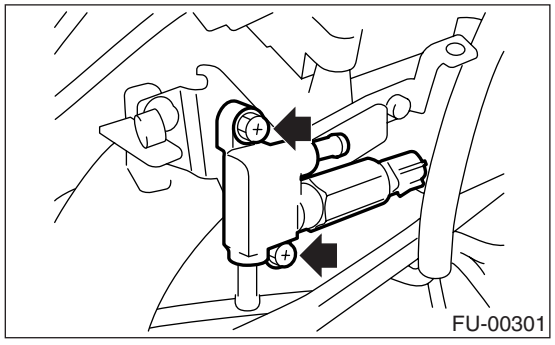
1) Disconnect ground cable from battery.



2) Disconnect connector from air assist injector solenoid valve and disconnect air by-pass hoses.



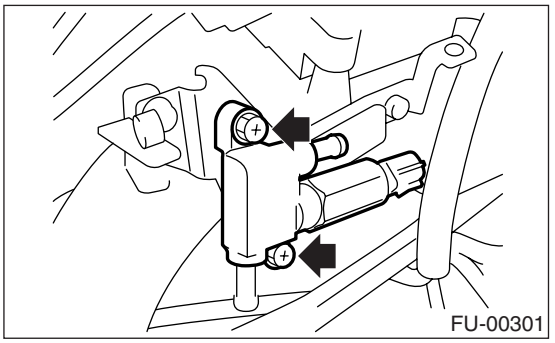
3) Remove air assist injector solenoid valve from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

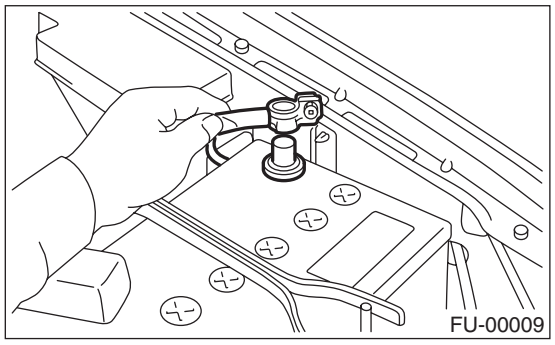
Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



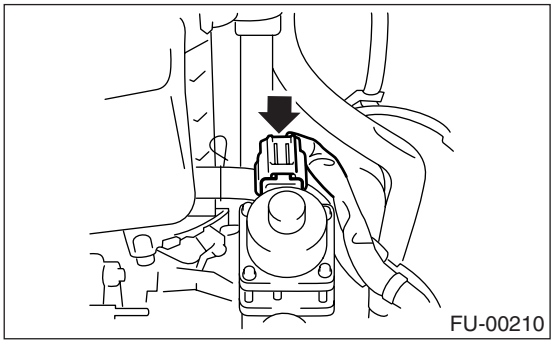
13.EGR Valve

A: REMOVAL

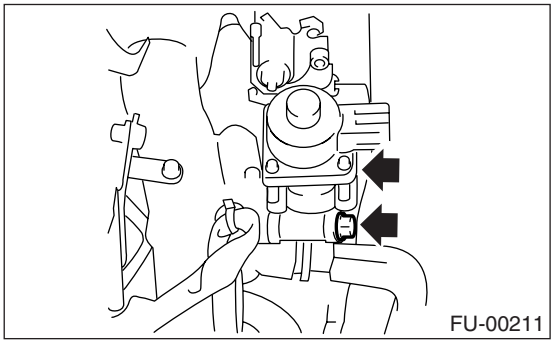
1) Disconnect ground cable from battery.



2) Disconnect connector from EGR valve.



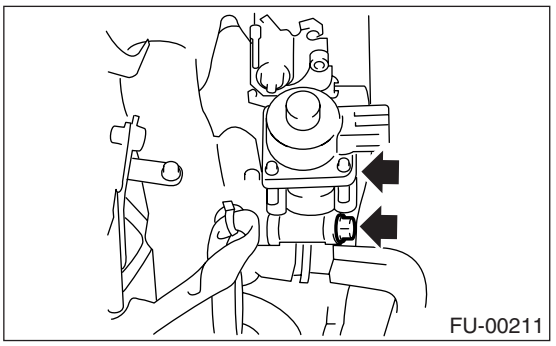
3) Remove EGR valve from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

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

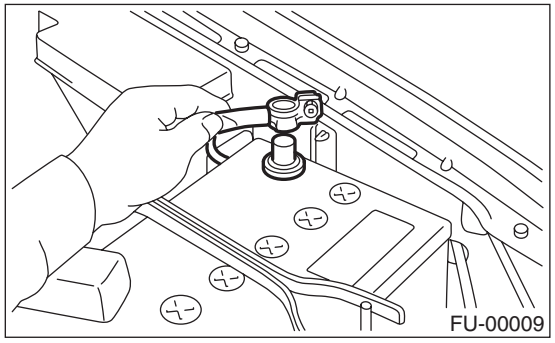


14.Fuel Injector

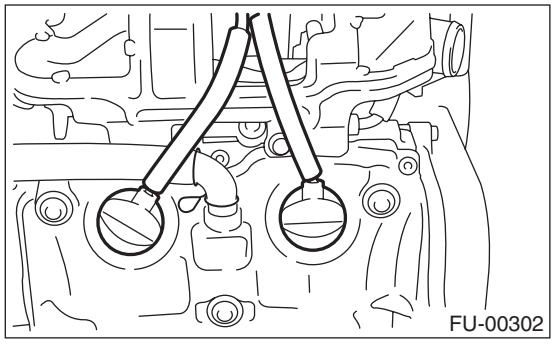
A: REMOVAL

1. RH SIDE

1) Release fuel pressure.
<Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect battery ground cable.

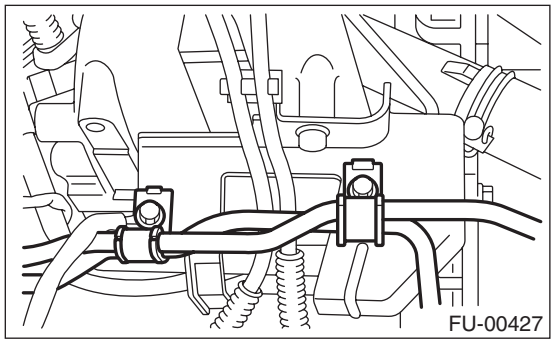

FU-00009

4) Remove resonator chamber.
<Ref. to IN(H4SO)-8, REMOVAL, Resonator Chamber.>
5) Remove spark plug cords from spark plugs (#1 and #3 cylinders).

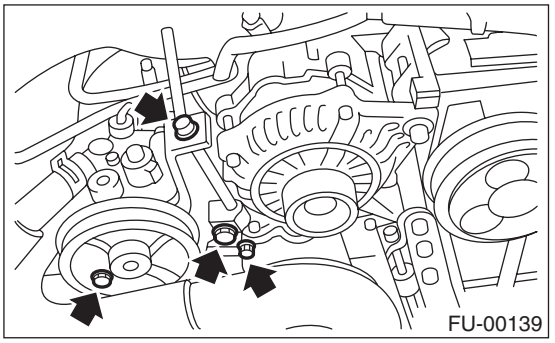

FU-00302

6) Remove power steering pump and tank from brackets.
(1) Remove front V-belt.
<Ref. to ME(H4SO)-40, REMOVAL, V-belt.>

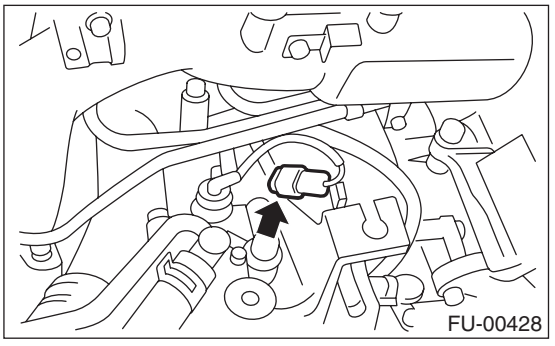
(2) Remove bolts which hold power steering pipes onto intake manifold protector.


FU-00427

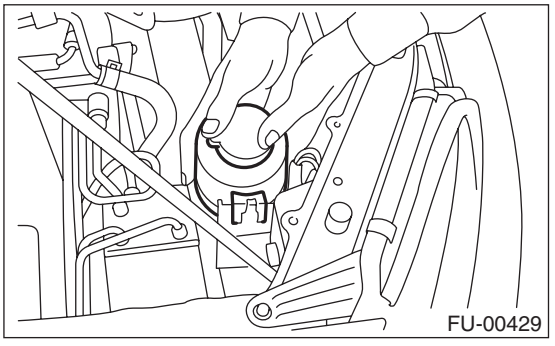
(3) Remove bolts which install power steering pump to bracket.


FU-00139

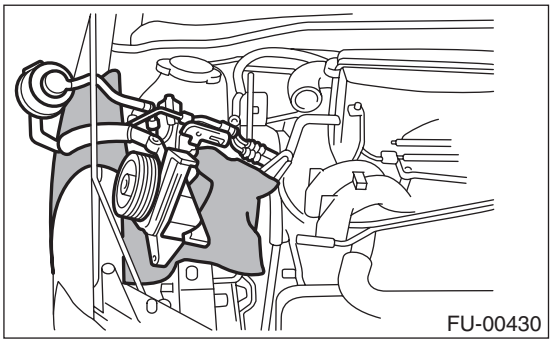
(4) Disconnect connector from power steering pump switch.


FU-00428

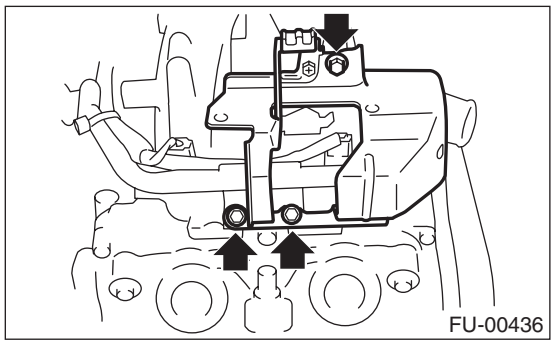
(5) Remove power steering tank from the bracket by pulling it upwards.


FU-00429

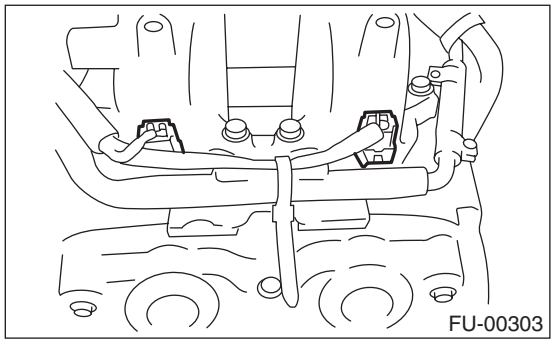
(6) Place power steering pump and tank on the right side wheel apron.


FU-00430

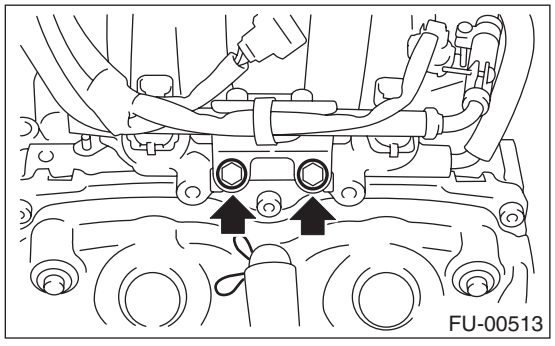
7) Remove fuel pipe protector RH.



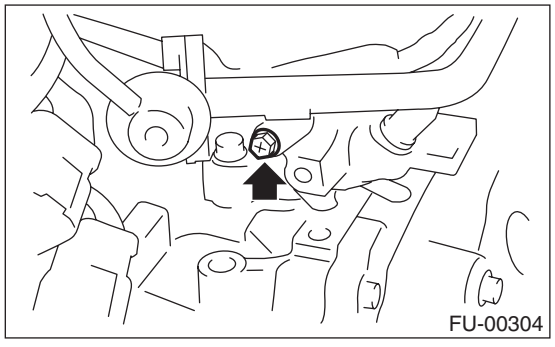
8) Disconnect connector from fuel injector.



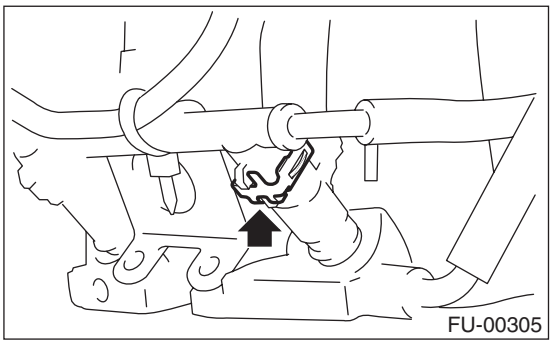
9) Remove bolts which hold injector pipe to intake manifold.



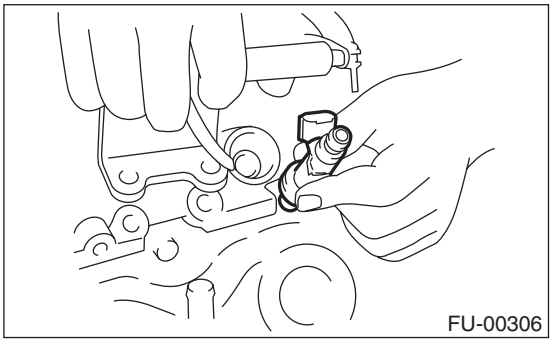
10) Remove bolt which install injector pipe to intake manifold.



11) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip.

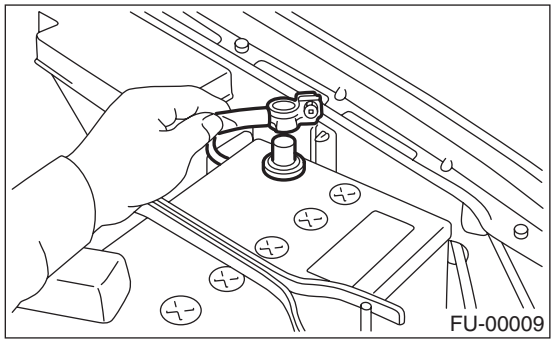


(2) Remove fuel injector while lifting up fuel injector pipe.

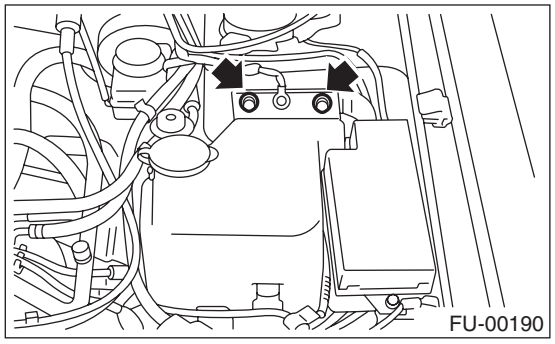


2. LH SIDE

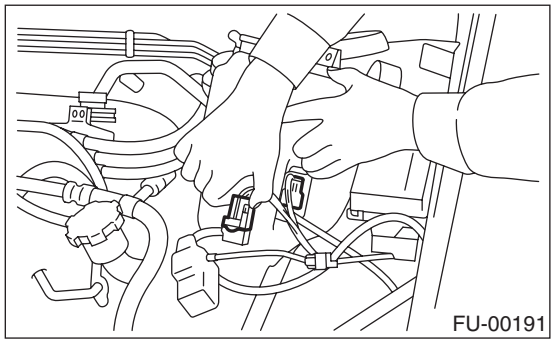
1) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect battery ground cable.


FU-00009

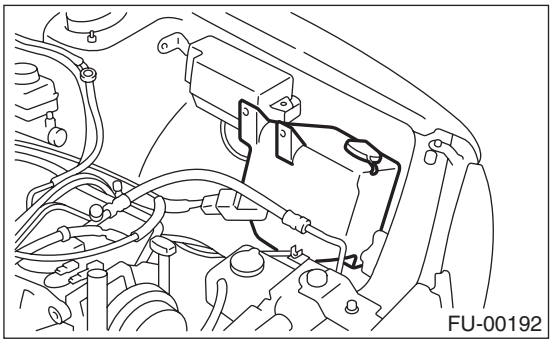
4) Remove two bolts which install washer tank on body.


FU-00190

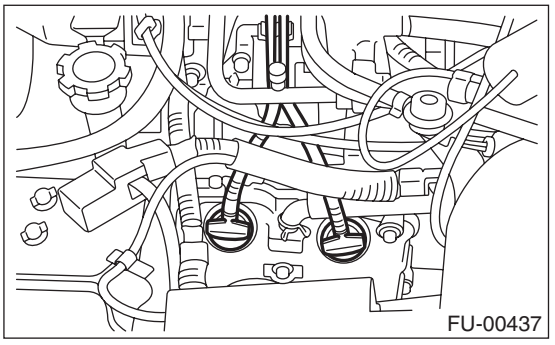
5) Disconnect connector from front window washer motor.
6) Disconnect connector from rear gate glass washer motor.


FU-00191

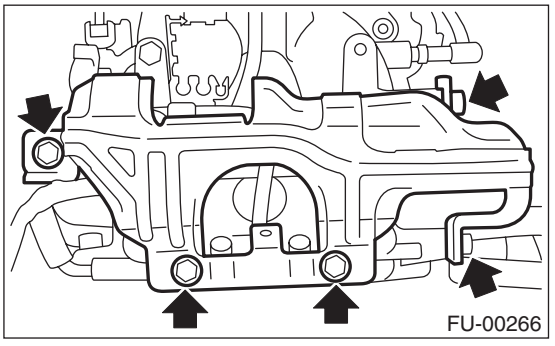
7) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
8) Move washer tank, and secure it away from working area.


FU-00192

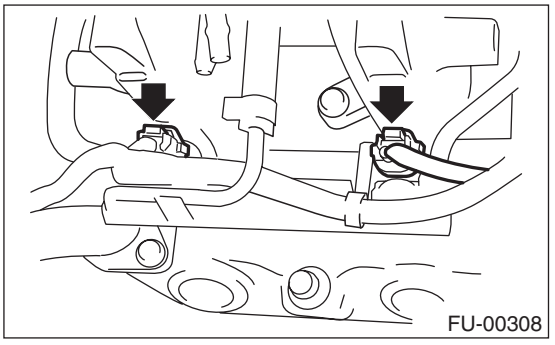
9) Remove spark plug cords from spark plugs (#2 and #4 cylinders).


FU-00437

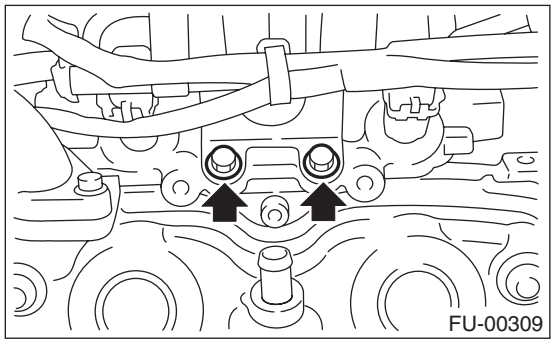
10) Remove fuel pipe protector LH.


FU-00266

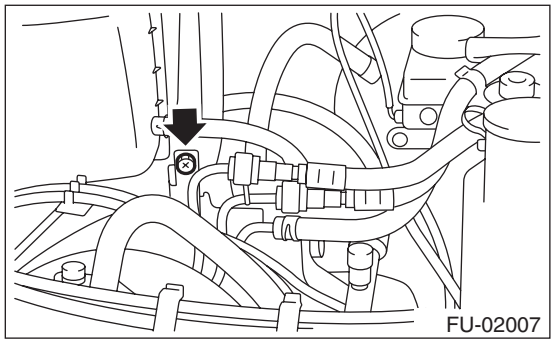
11) Disconnect connector from fuel injector.


FU-00308

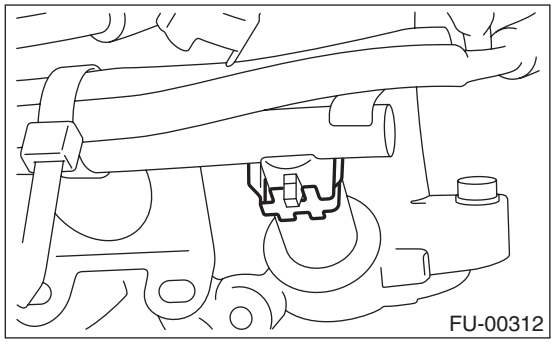
12) Remove bolt which holds injector pipe to intake manifold.



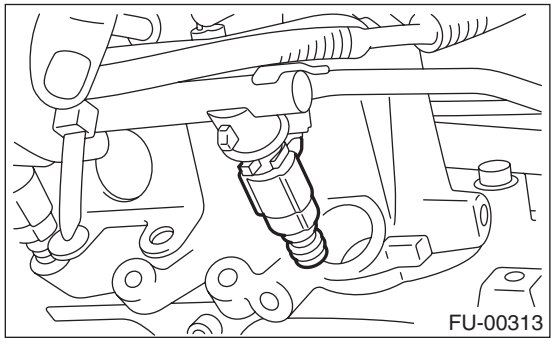
13) Remove bolt which holds fuel pipe on the left side intake manifold.



14) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip.



(2) Remove fuel injector while lifting up fuel injector pipe.

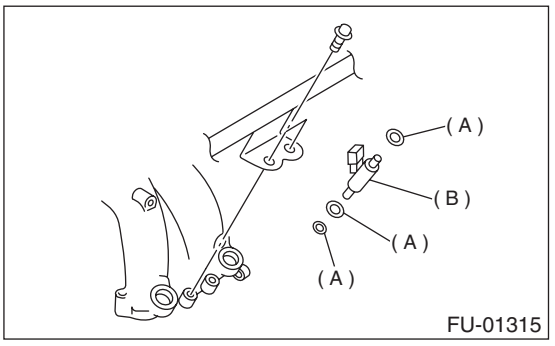


B: INSTALLATION

1. RH SIDE

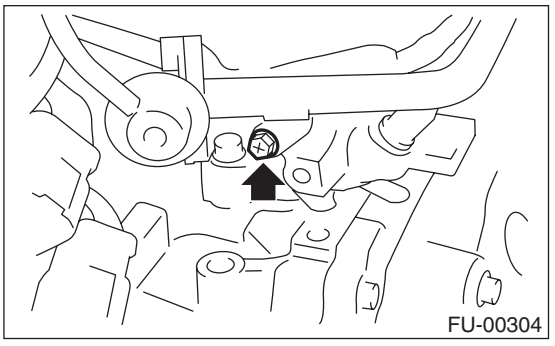
Install in the reverse order of removal.

NOTE:
Replace O-rings with new ones.

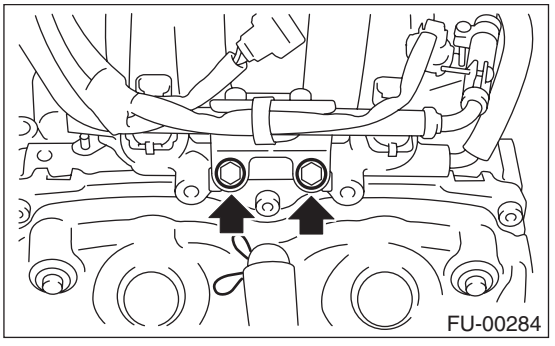


(A) O-ring
(B) Fuel injector

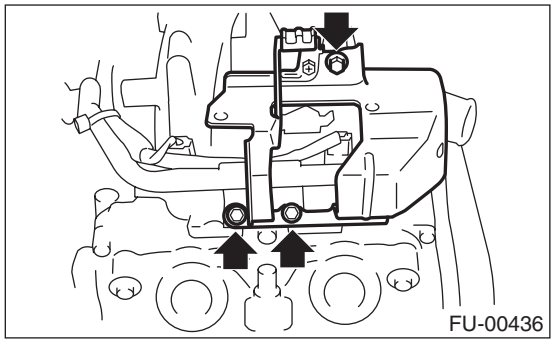
Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:
19 N·m (0.19 kgf-m, 1.4 ft-lb)



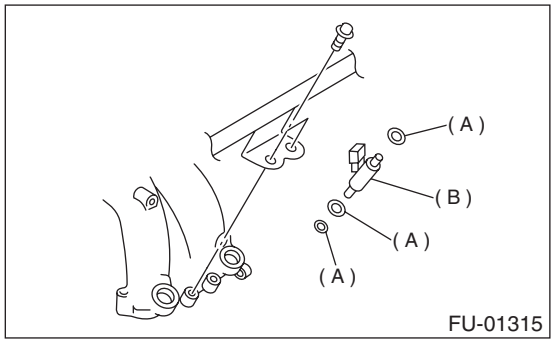
Tightening torque:
19 N·m (0.19 kgf-m, 1.4 ft-lb)



2. LH SIDE

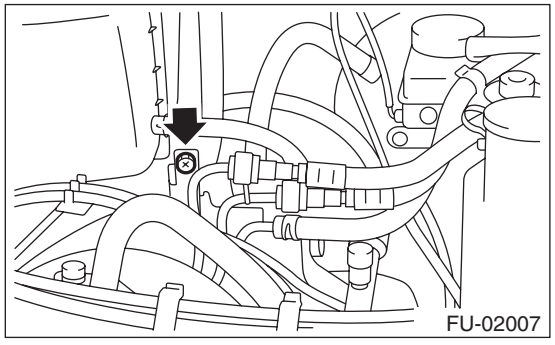
Install in the reverse order of removal.

NOTE:
Replace O-rings with new ones.

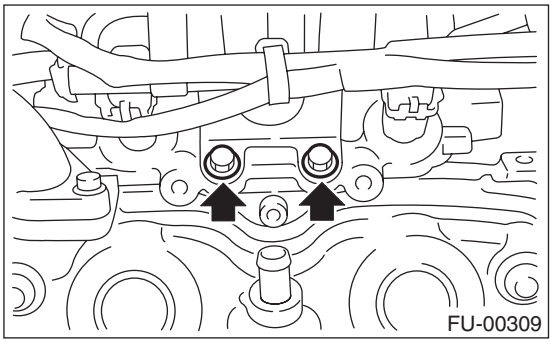


(A) O-ring
(B) Fuel injector

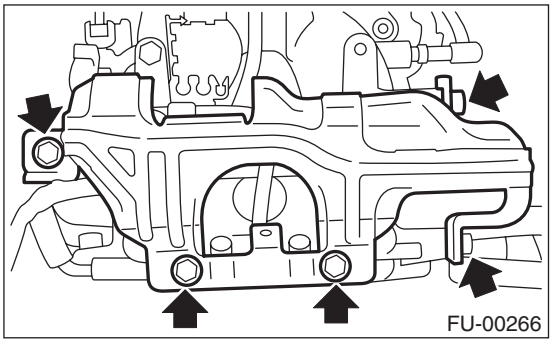
Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



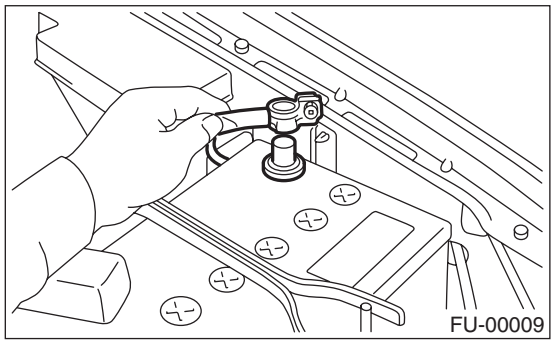
Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



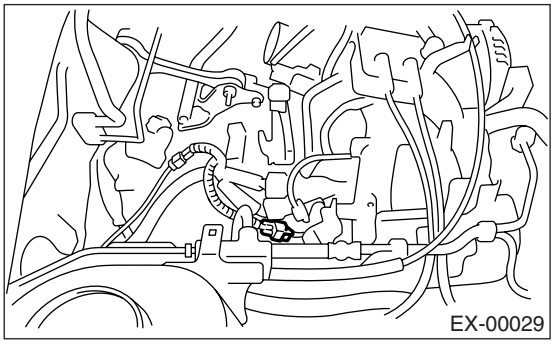
15.Front Oxygen (A/F) Sensor

A: REMOVAL

1) Disconnect ground cable from battery.



2) Disconnect connectors from engine hanger and front oxygen (A/F) sensor.

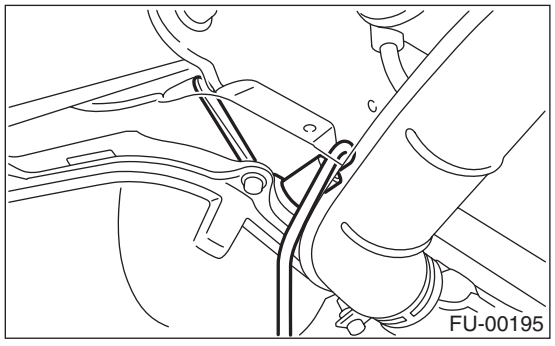


3) Lift-up the vehicle.
4) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

5) Remove 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

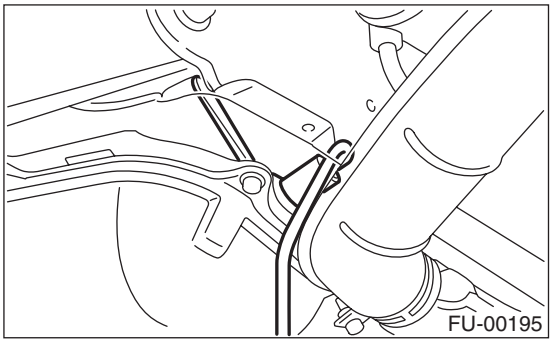
1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to threaded portion of front oxygen (A/F) sensor to make the next removal easier.

Anti-seize compound:
SS-30 by JET LUBE

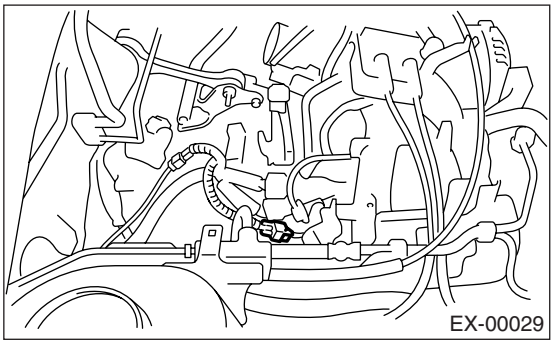
CAUTION:
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.

2) Install front oxygen (A/F) sensor.

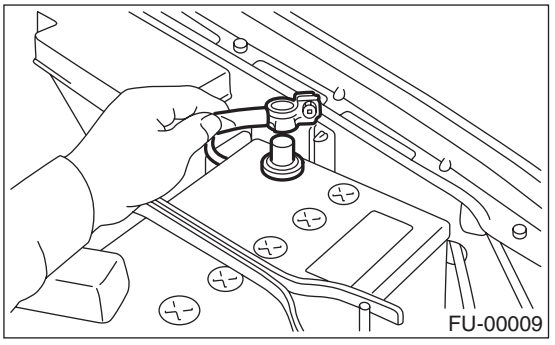
Tightening torque:
21 N·m (2.1 kgf-m, 15.2 ft-lb)



3) Lower the vehicle.
4) Connect connector of front oxygen (A/F) sensor.



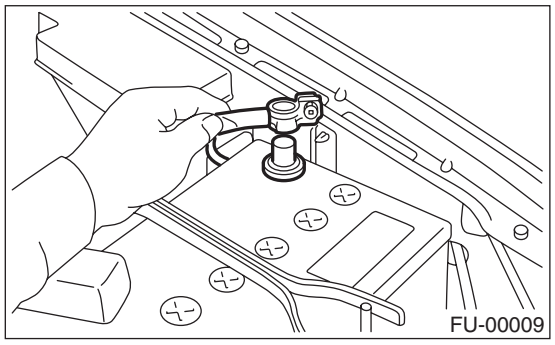
5) Connect battery ground cable.



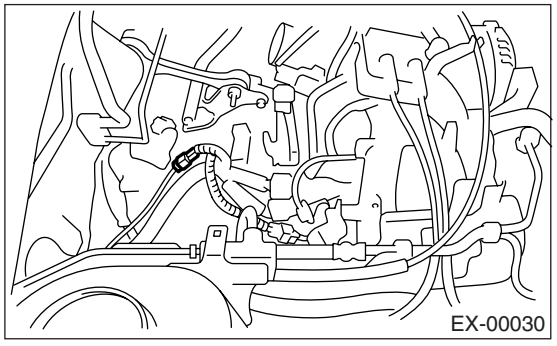
16.Rear Oxygen Sensor

A: REMOVAL

1) Disconnect ground cable from battery.



2) Disconnect connector from rear oxygen sensor.

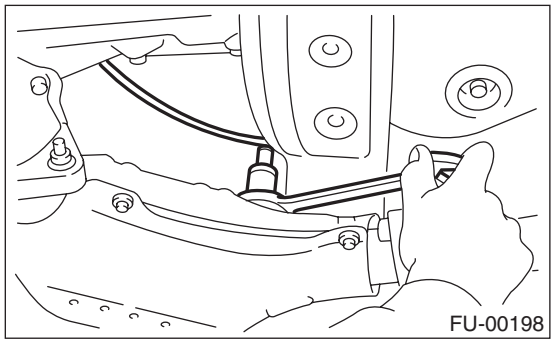


3) Lift-up the vehicle.
4) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

5) Remove rear oxygen sensor.

CAUTION:
When removing the oxygen sensor, wait until exhaust pipe cools, otherwise it will damage exhaust pipe.



B: INSTALLATION

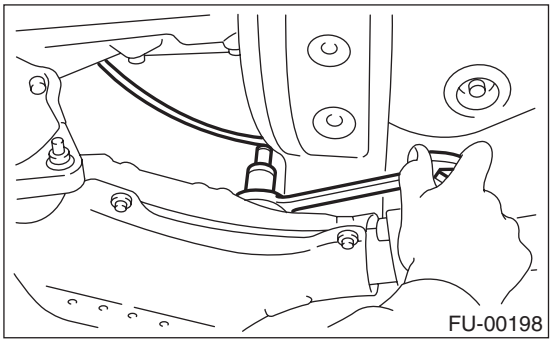
1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

CAUTION:
Never apply anti-seize compound to protector of rear oxygen sensor.

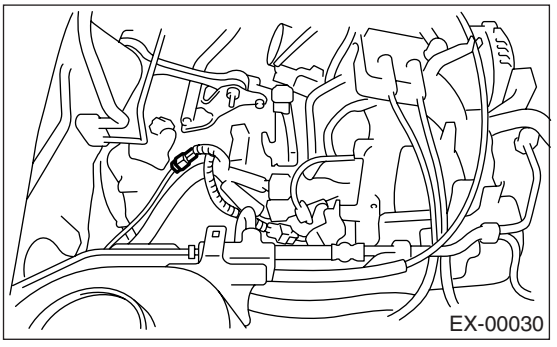
Anti-seize compound:
SS-30 by JET LUBE

2) Install rear oxygen sensor.

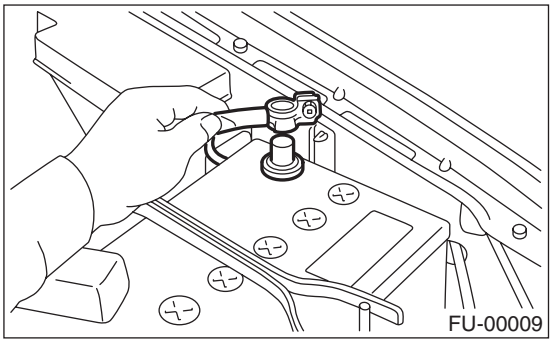
Tightening torque:
21 N·m (2.1 kgf-m, 15.2 ft-lb)



3) Lower the vehicle.
4) Connect connector to rear oxygen sensor.



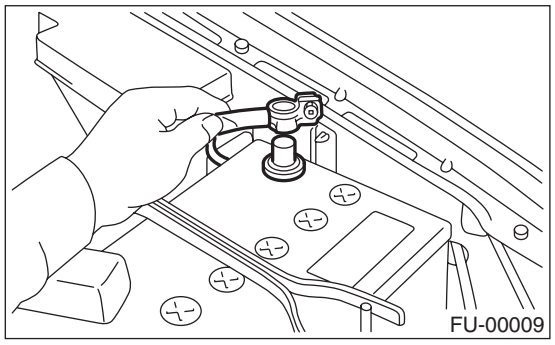
5) Connect battery ground cable.



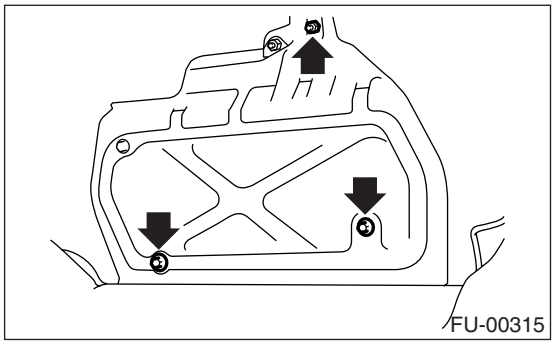
17.Engine Control Module

A: REMOVAL

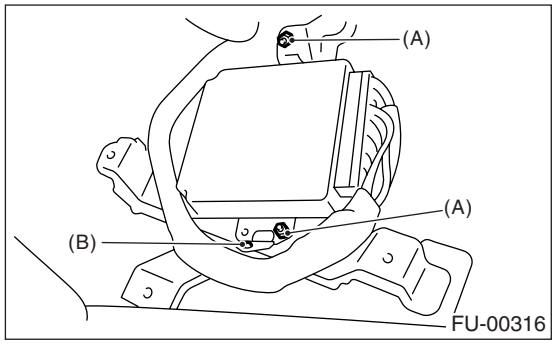
1) Disconnect ground cable from battery.



2) Remove lower inner trim of passenger side.
<Ref. to EI-42, REMOVAL, Lower Inner Trim.>
3) Detach floor mat of passenger seat.
4) Remove protect cover.



5) Remove nuts (A) which hold ECM to bracket.
6) Remove clip (B) from bracket.



7) Disconnect ECM connectors and take out ECM.

B: INSTALLATION

Install in the reverse order of removal.

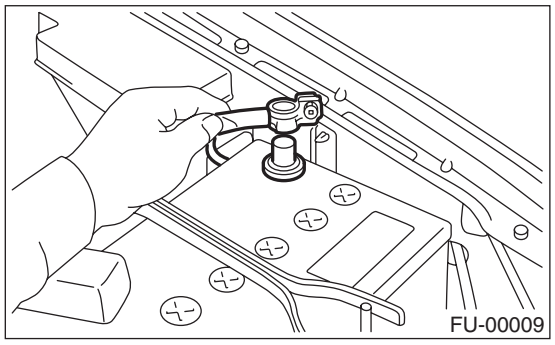
CAUTION:
When replacing ECM, be careful not to use the wrong spec. ECM to avoid any damage to the fuel injection system.

Tightening torque:
5 N·m (0.51 kgf-m, 3.7 ft-lb)

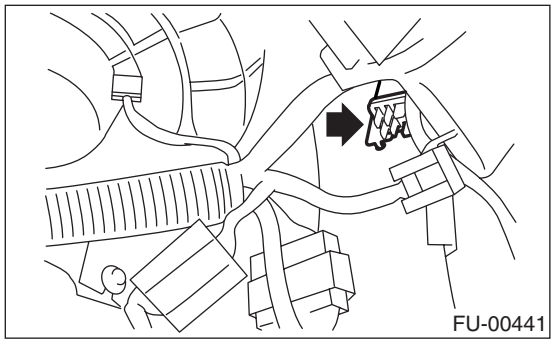
18.Main Relay

A: REMOVAL

1) Disconnect ground cable from battery.



2) Remove lower inner trim of passenger side. <Ref. to EI-42, REMOVAL, Lower Inner Trim.>
3) Disconnect connectors from main relay.
4) Remove bolt which holds main relay bracket on body.



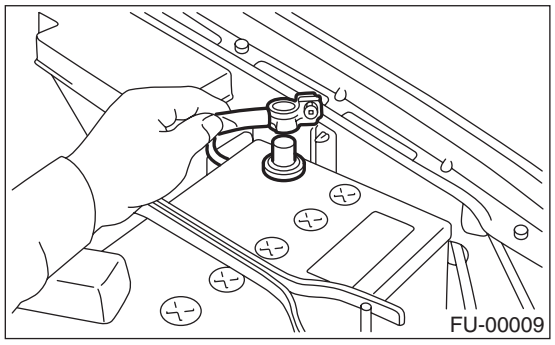
B: INSTALLATION

Install in the reverse order of removal.

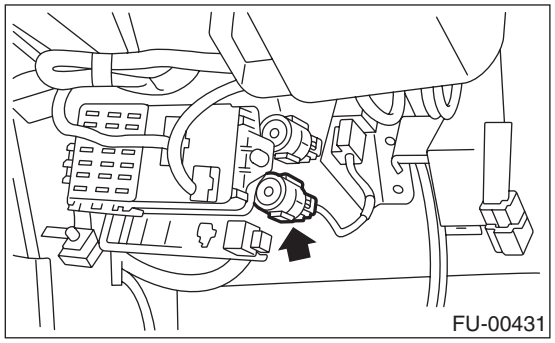
19.Fuel Pump Relay

A: REMOVAL

1) Disconnect ground cable from battery.



2) Remove lower cover. <Ref. to EI-37, REMOVAL, Instrument Panel Assembly.>
3) Disconnect connector from fuel pump relay.



4) Remove fuel pump relay from mounting bracket.

B: INSTALLATION

Install in the reverse order of removal.

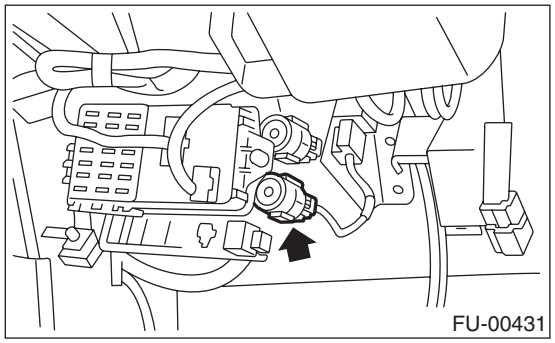
20.Fuel

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 connector from fuel pump relay.

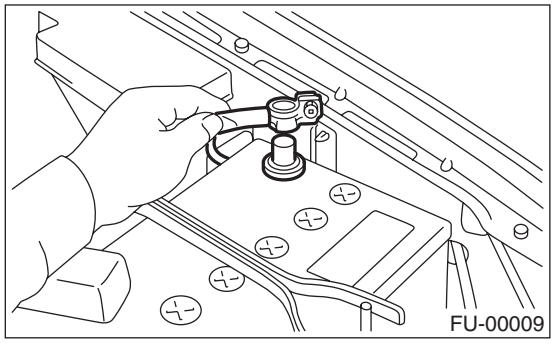


2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn ignition switch to OFF.

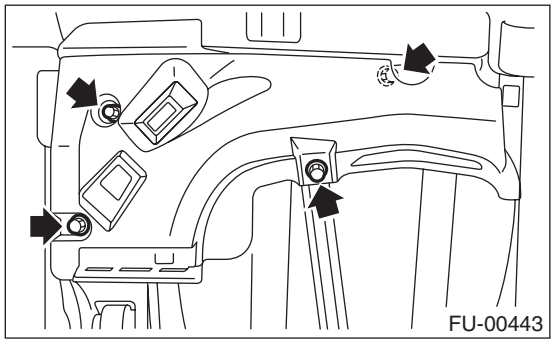
2. DRAINING FUEL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

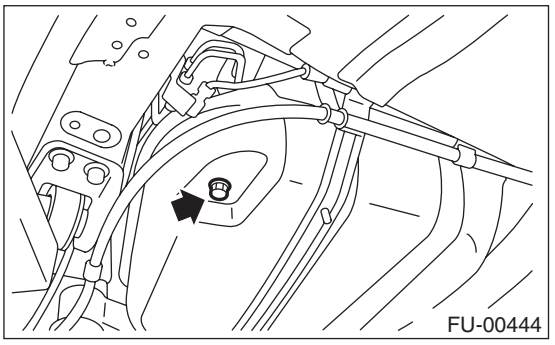
1) Set vehicle on the lift.
2) Disconnect battery ground cable.



3) Lift-up the vehicle.
4) Remove front right side fuel tank cover.

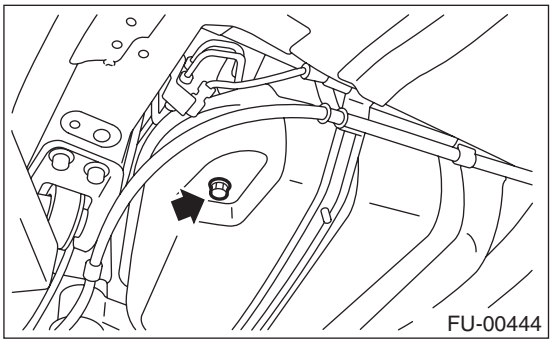


5) Drain fuel from fuel tank.
Set a container under the vehicle and remove drain plug from fuel tank.

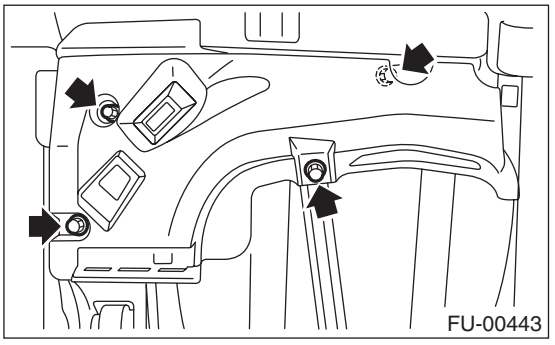


6) Tighten fuel drain plug and install front right side tank cover.

Tightening torque:
26 N·m (2.65 kgf-m, 19.2 ft-lb)

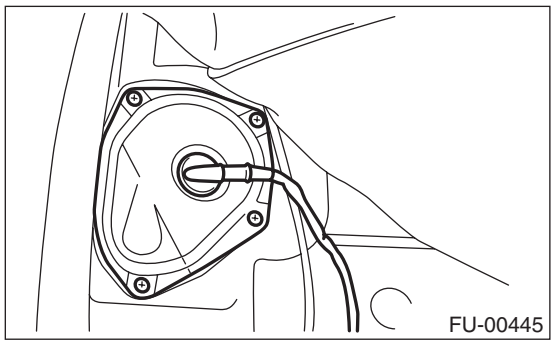


Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

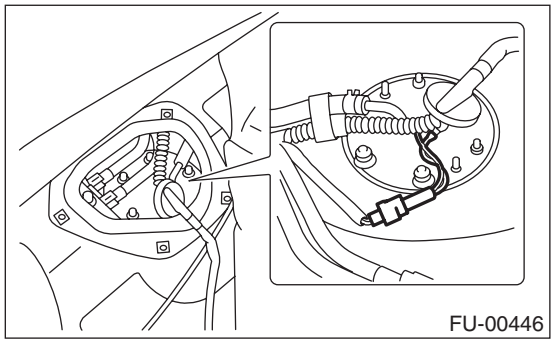


7) Lower the vehicle.

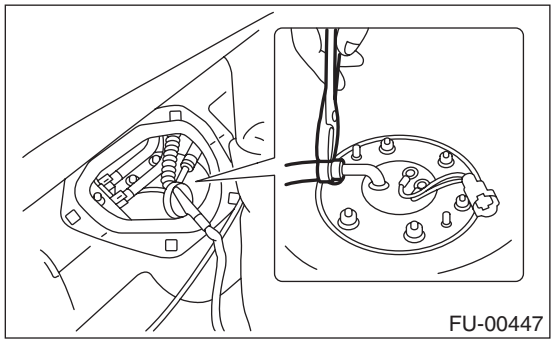
8) Remove sub service hole cover.



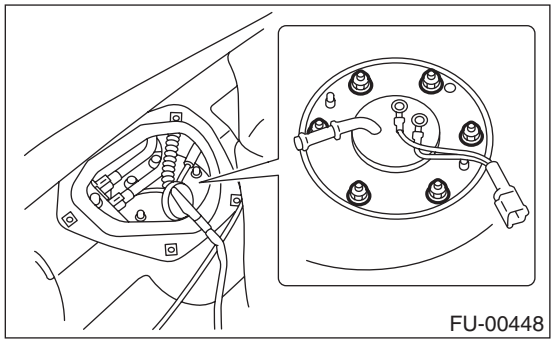
9) Disconnect connector from fuel sub level sensor.



10) Disconnect fuel jet pump hose.



11) Remove fuel sub level sensor.

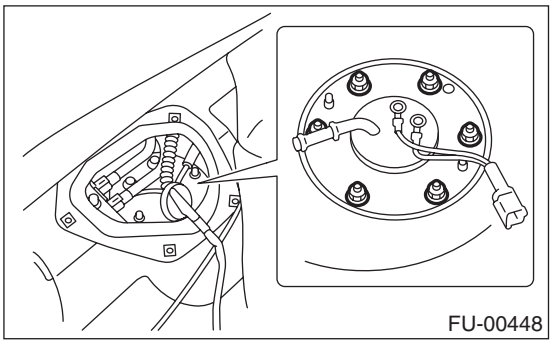


12) Drain fuel from fuel tank by using hand pump.

WARNING:
Do not use a motor pump when draining fuel.

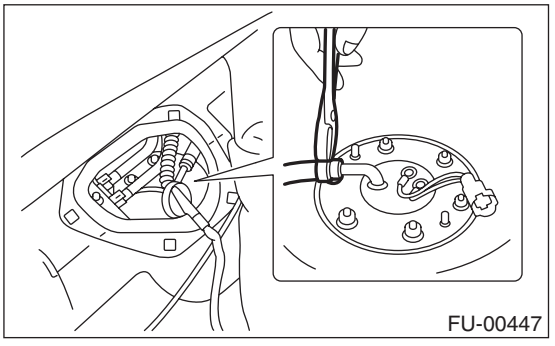
13) After draining fuel, reinstall fuel sub level sensor.

Tightening torque:
T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

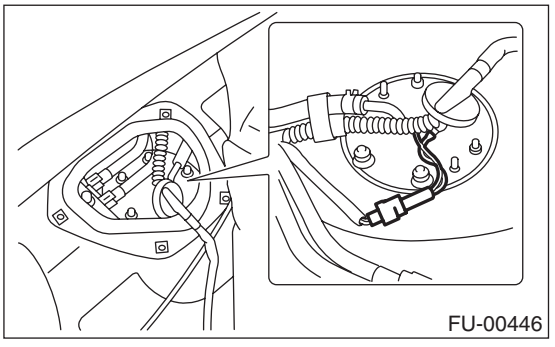


NOTE:
If you have not removed fuel tank yet, proceed with the procedure below for installation.

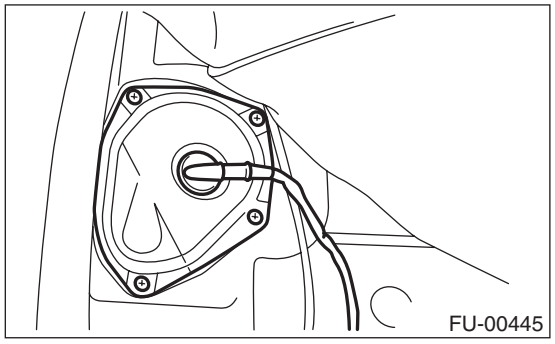
(1) Connect fuel jet pump hose.



(2) Connect connector from fuel sub level sensor.



(3) Install sub service hole cover.

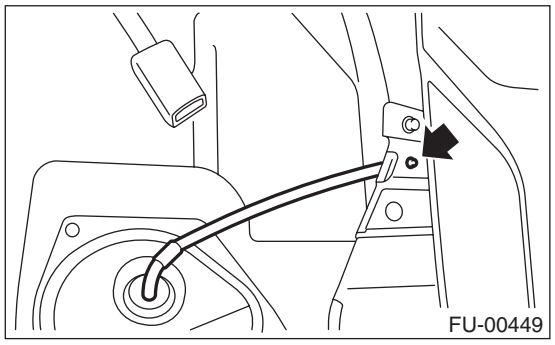


(4) Set rear seat and floor mat.

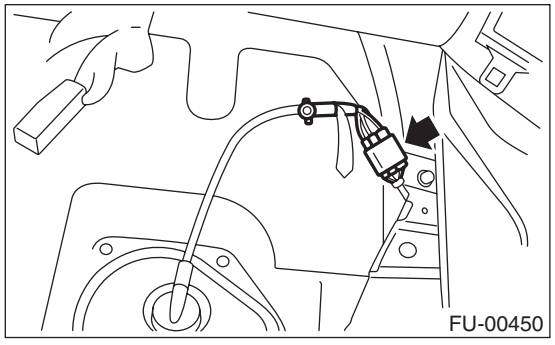
21.Fuel Tank

A: REMOVAL

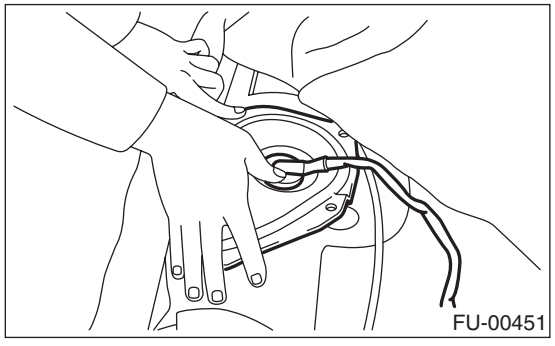
1) Set vehicle on the lift.
2) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
3) Drain fuel from fuel tank. <Ref. to FU(H4SO)-48, DRAINING FUEL, OPERATION, Fuel.>
4) Remove holder clip which secures fuel tank cord on bracket.


FU-00449

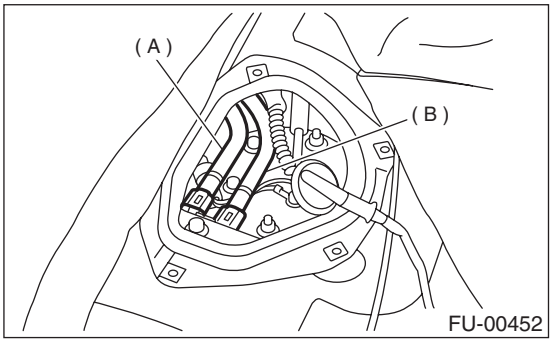
5) Disconnect connector of fuel tank cord to rear harness.


FU-00450

6) Push grommet which holds fuel tank cord on service hole cover into body side.

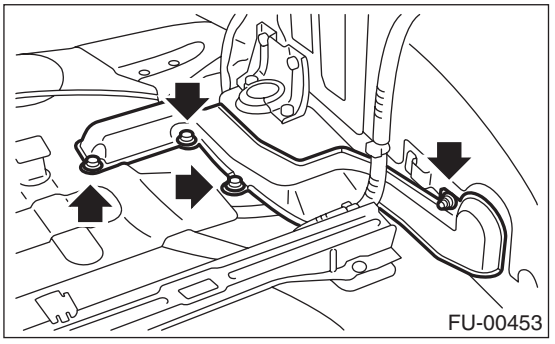

FU-00451

7) Using ST, separate quick connector of fuel delivery (A) and return hose (B).<Ref. to FU(H4SO)-72, REMOVAL, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
ST 42099AE000 CONNECTOR REMOVER

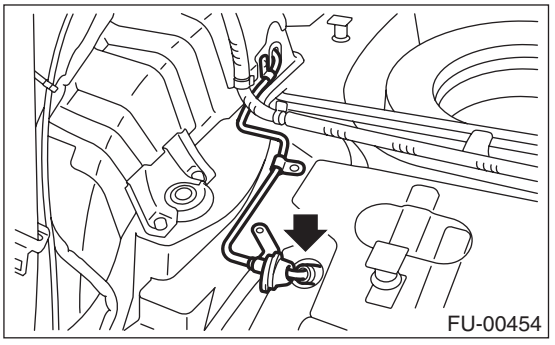


FU-00452

8) Remove parking brake cable.
   (1) Remove console box. <Ref. to EI-36, REMOVAL, Console Box.>
   (2) Remove parking brake bracket and disconnect parking brake cable from equalizer. <Ref. to PB-6, REMOVAL, Parking Brake Cable.>
9) Remove pipe protector.

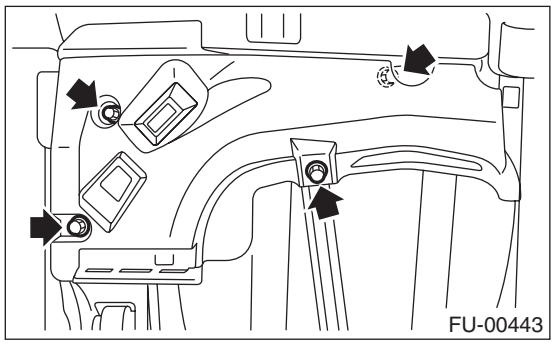

FU-00453

10) Using ST, separate quick connector of evaporation pipe. <Ref. to FU(H4SO)-72, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
ST 42099AE000 CONNECTOR REMOVER


FU-00454

11) Remove wheel nuts from rear wheels.
12) Lift-up the vehicle.
13) Remove rear wheel.

14) Remove front side fuel tank cover.

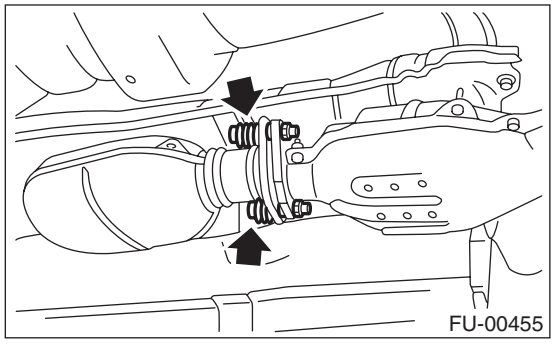


15) Remove rear exhaust pipe and muffler.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

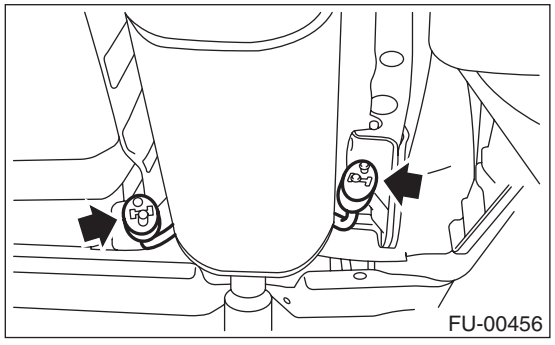
SUBARU CRC (Part No. 004301003)

(1) Separate rear exhaust pipe and center exhaust pipe.

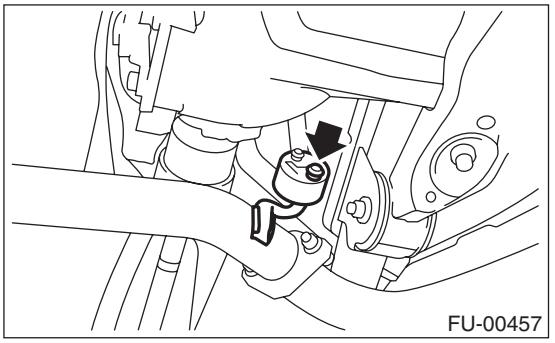


(2) Remove left and right rubber cushions.

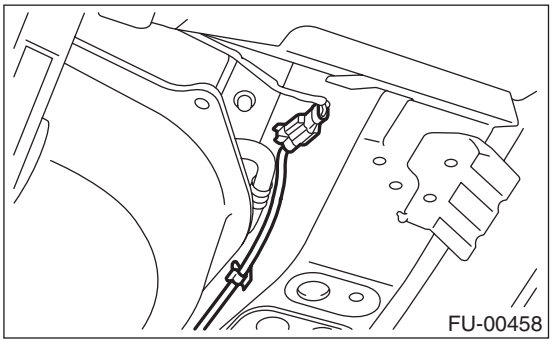
CAUTION:
Be careful not to pull down muffler.



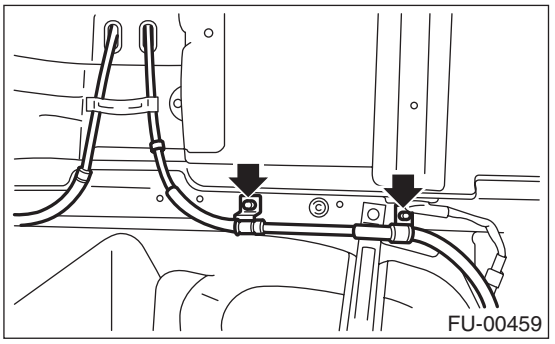
(3) Remove front rubber cushion and detach muffler assembly.



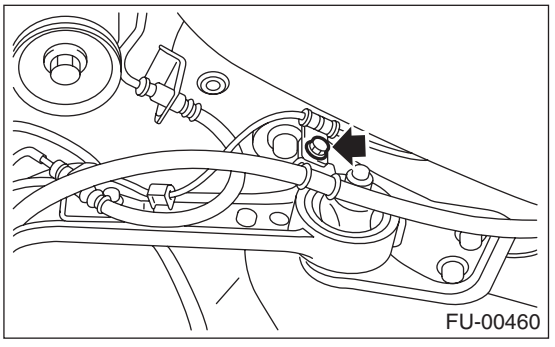
16) Remove propeller shaft. <Ref. to DS-15, REMOVAL, Propeller Shaft.>
17) Disconnect connector from ABS sensor.



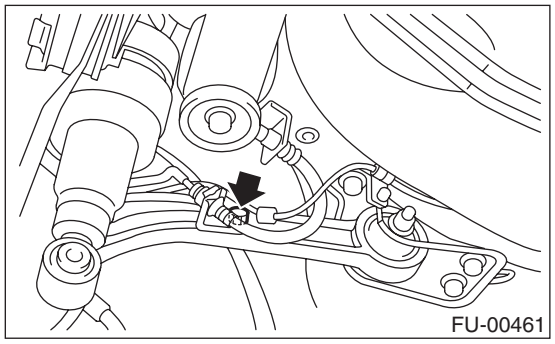
18) Remove bolts which hold parking brake cable holding bracket.
19) Remove parking brake cable from cabin by forcibly pulling it backward.



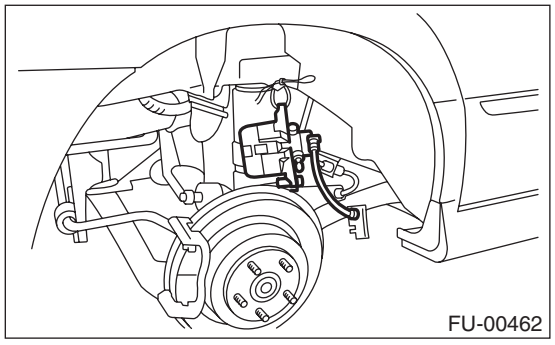
20) Remove bolts which hold parking brake cable holding bracket.



21) Remove bolts which hold rear brake hoses holding bracket.



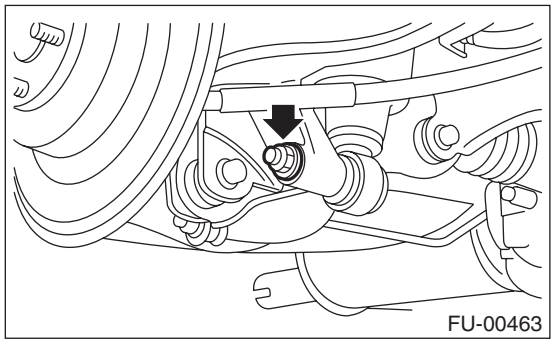
22) Remove rear brake caliper, then tie it up to the body side of the vehicle as shown in figure.



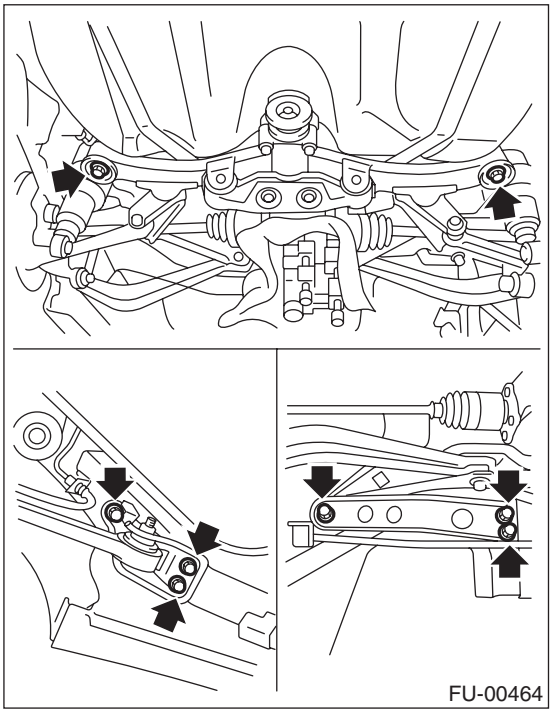
23) Remove rear suspension assembly.

WARNING:
A helper is required to perform this work.

(1) Support rear differential with transmission jack.
(2) Remove bolt which holds rear shock absorber to rear suspension arm.

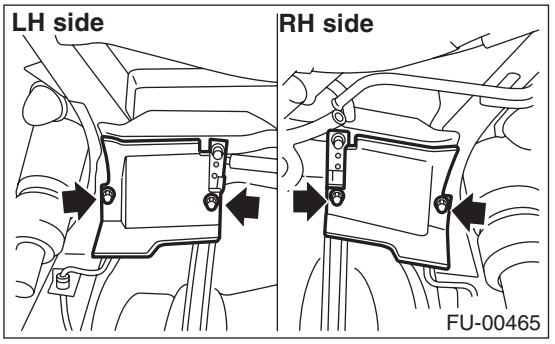


(3) Remove bolts which secure rear suspension assembly to body.

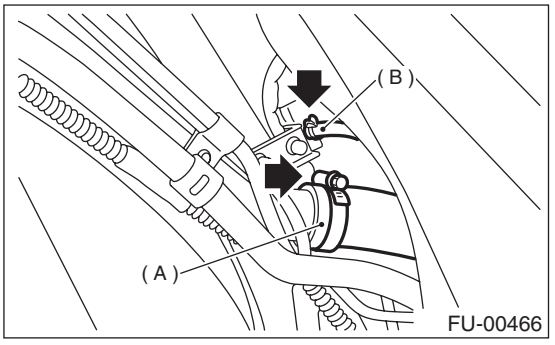


(4) Remove rear suspension assembly.

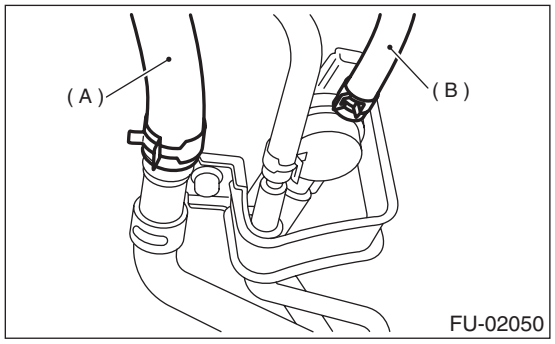
24) Remove rear side fuel tank cover.



25) Disconnect fuel filler hose (A) and fuel tank pressure sensor hose (B).

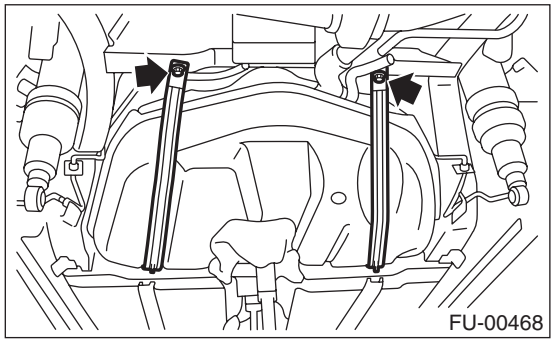


26) Disconnect air vent hose (A) from evaporation pipe assembly and disconnect evaporation hose (B) from pressure control solenoid valve.



27) Support fuel tank with transmission jack, remove bolts from bands and dismount fuel tank from the vehicle.

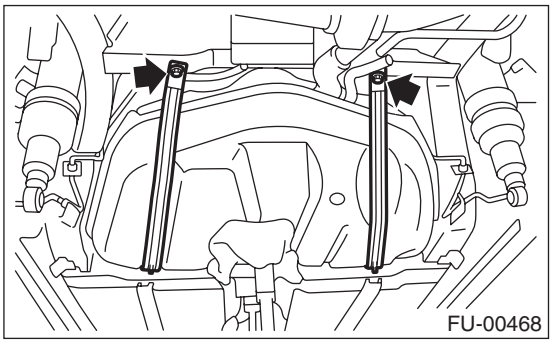
WARNING:
A helper is required to perform this work.



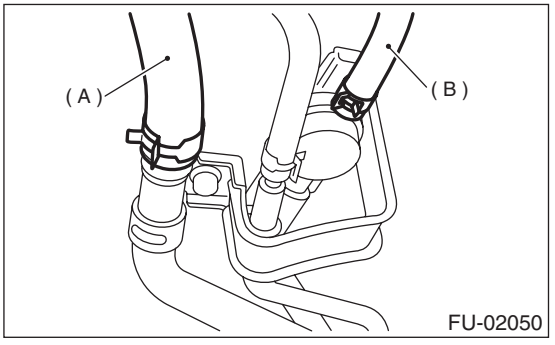
B: INSTALLATION

1) Support fuel tank with transmission jack and push fuel tank harness into access hole with grommet.
2) Set fuel tank and temporarily tighten bolts of fuel tank bands.

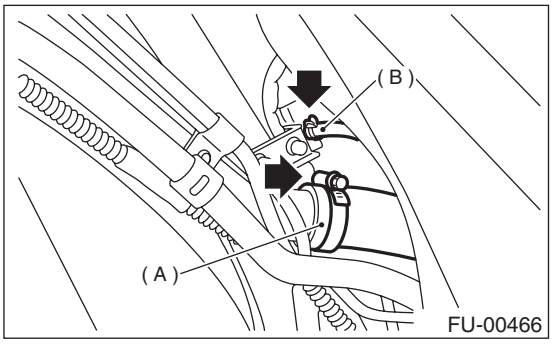
WARNING:
A helper is required to perform this work.



3) Connect air vent hose (A) to evaporation pipe assembly and connect evaporation hose (B) 10to pressure control solenoid valve.

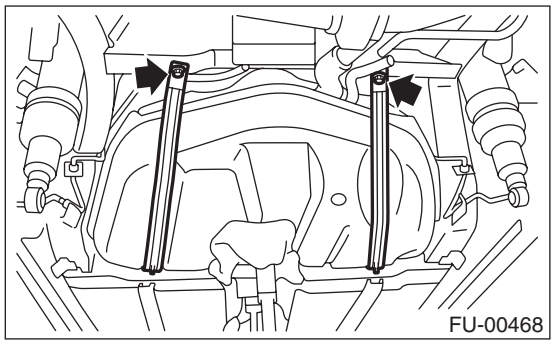


4) Connect fuel filler hose (A) and fuel tank pressure sensor hose (B).



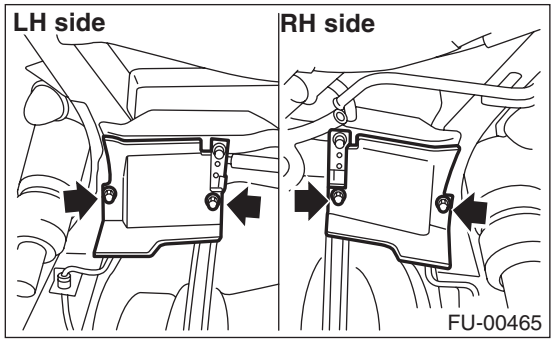
5) Tighten band mounting bolts.

Tightening torque:
33 N·m (3.4 kgf-m, 25 ft-lb)



6) Install rear side fuel tank cover.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

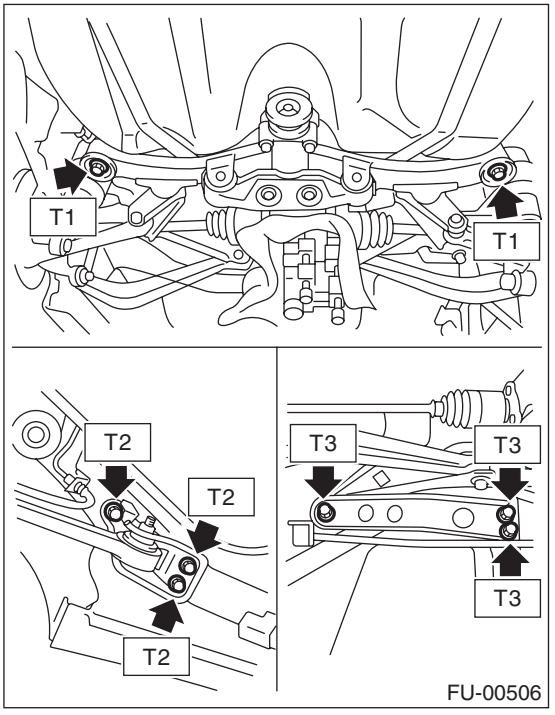


7) Install rear suspension assembly.

WARNING:
A helper is required to perform this work.

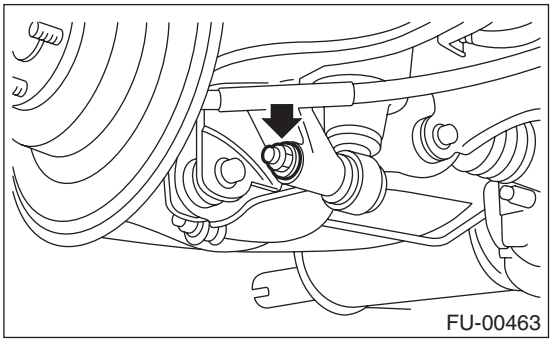
(1) Support rear suspension assembly and then tighten bolts which secure rear suspension assembly.

Tightening torque:
T1: 172 N·m (17.5 kgf-m, 127 ft-lb)
T2: 108 N·m (11.0 kgf-m, 80 ft-lb)
T3: 66 N·m (6.7 kgf-m, 48 ft-lb)

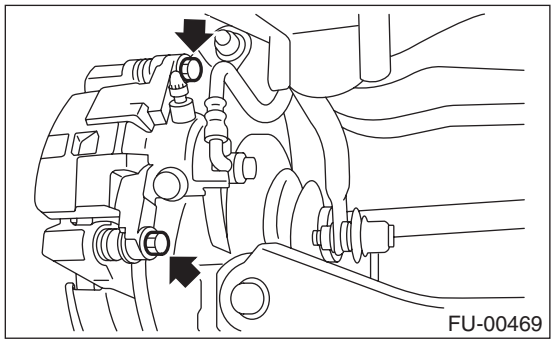


(2) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-14, INSTALLATION, Link Upper.>

Tightening torque:
157 N·m (16 kgf-m, 116 ft-lb)

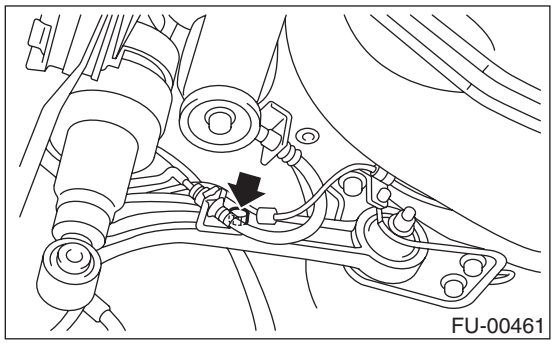


8) Install rear brake caliper. <Ref. to BR-21, INSTALLATION, Rear Disc Brake Assembly.>



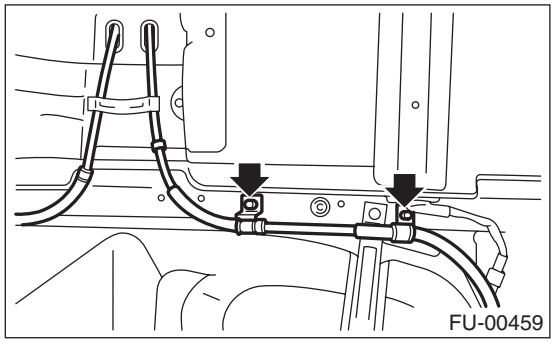
9) Tighten bolts which hold rear brake hoses holding bracket.

Tightening torque:
33 N·m (3.4 kgf-m, 25 ft-lb)

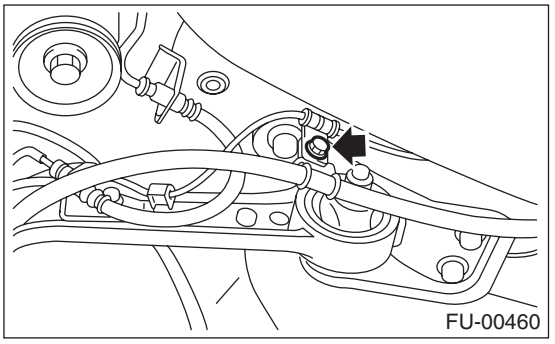


10) Install parking brake cable to cabin by forcibly pushing it forward.
11) Tighten bolts which hold parking brake cable holding bracket.

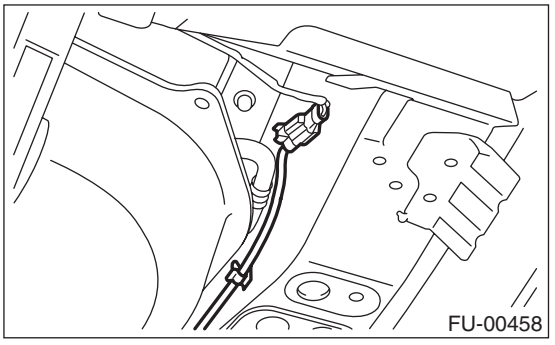
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



Tightening torque:
32 N·m (3.3 kgf-m, 23.9 ft-lb)



12) Connect connector to ABS sensor.

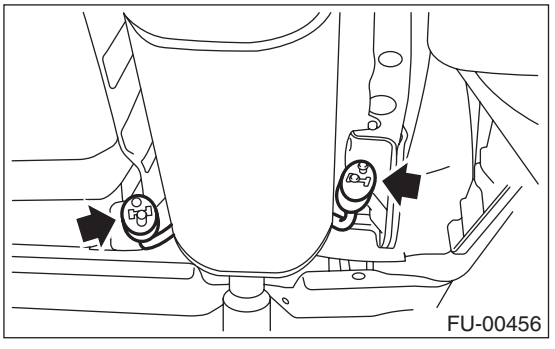


13) Install propeller shaft. <Ref. to DS-16, INSTALLATION, Propeller Shaft.>
14) Install rear exhaust pipe and muffler.

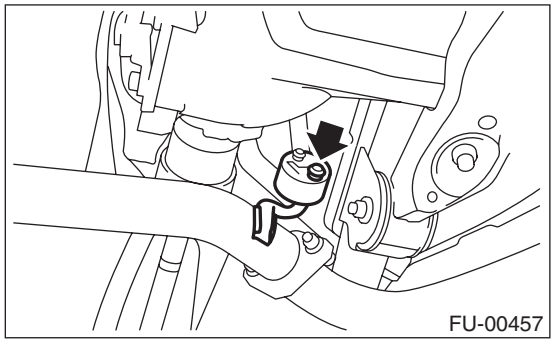
NOTE:
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.

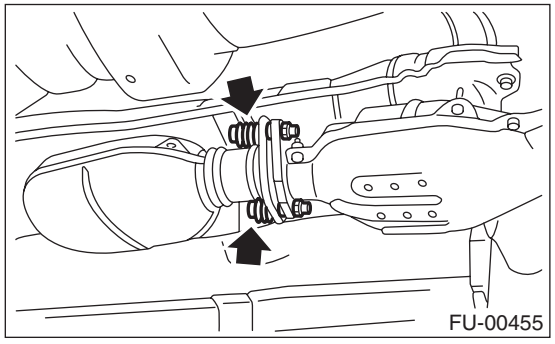


(2) Install front rubber cushion and attach muffler assembly.



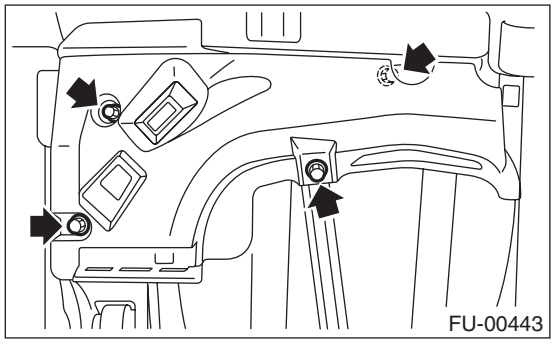
(3) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



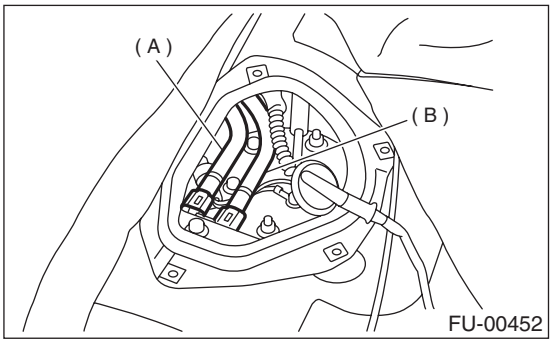
15) Install front side fuel tank cover.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



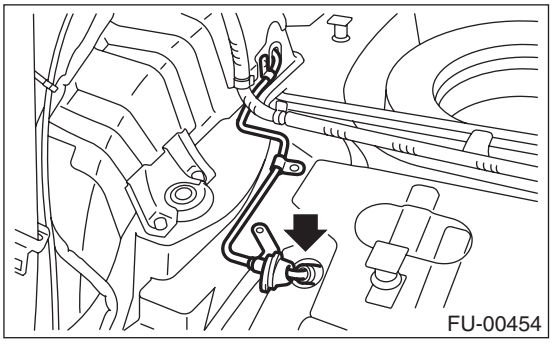
16) Install rear wheel.
17) Lower the vehicle.
18) Tighten wheel nuts to rear wheel.
19) Install parking brake cable. <Ref. to PB-5, INSTALLATION, Parking Brake Lever.>
20) Install console box. <Ref. to EI-36, INSTALLATION, Console Box.>

21) Connect fuel hoses and hold them with quick connector. <Ref. to FU(H4SO)-73, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

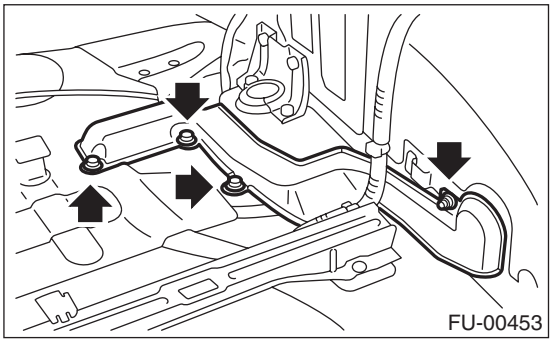


(A) Delivery hose
(B) Return hose

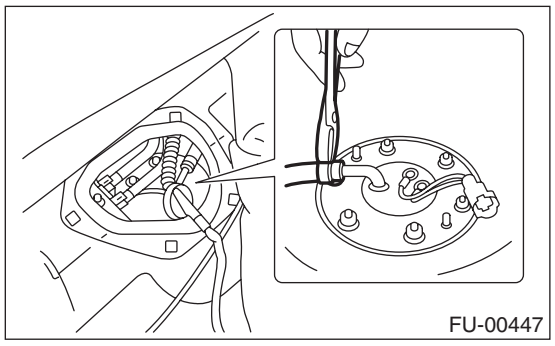
22) Connect evaporation pipe and hold it with quick connector. <Ref. to FU(H4SO)-73, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>



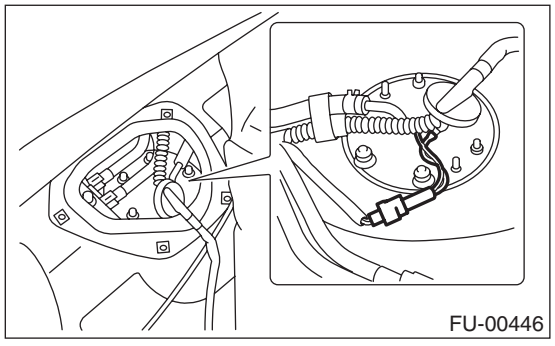
23) Install pipe protector.



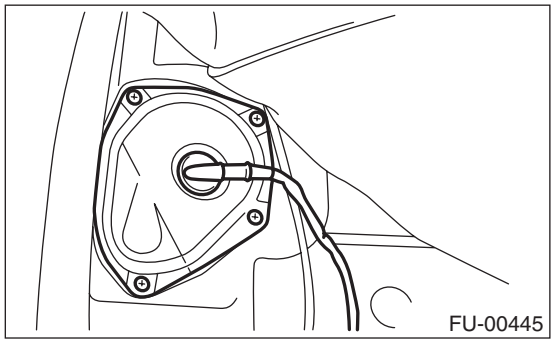
24) Connect fuel jet pump hose.



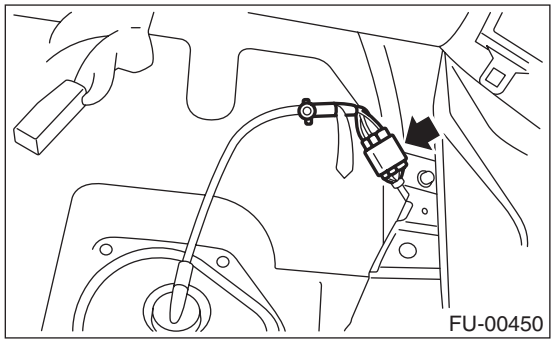
25) Connect connector to fuel sub level sensor.



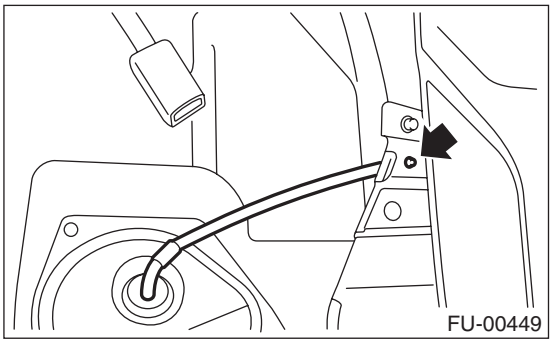
26) Install sub service hole cover.



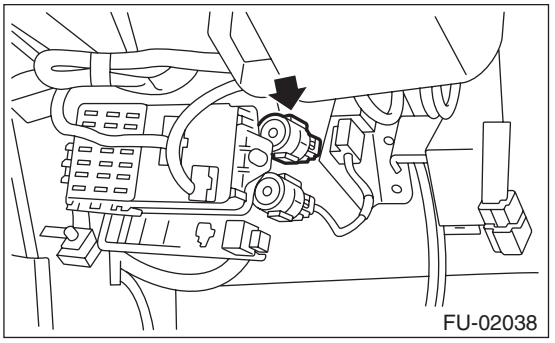
27) Connect connectors to fuel tank cord and plug service hole with grommet.



28) Install holder clip which secures fuel tank cord on bracket.



29) Set rear seat and floor mat.
30) Connect connector to fuel pump relay.



31) Adjust parking brake lever stroke. <Ref. to PB-5, ADJUSTMENT, Parking Brake Lever.>
32) Check wheel alignment and adjust if necessary. <Ref. to FS-8, INSPECTION, Wheel Alignment.>

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 that connections are tight.

22.Fuel Filler Pipe

A: REMOVAL

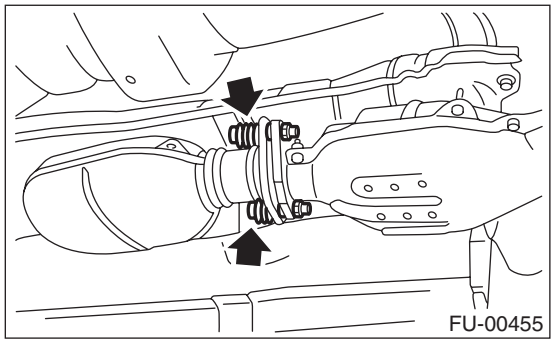
WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

1) Drain fuel from fuel tank.
<Ref. to FU(H4SO)-48, DRAINING FUEL, OPERATION, Fuel.>
2) Remove rear exhaust pipe and muffler.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

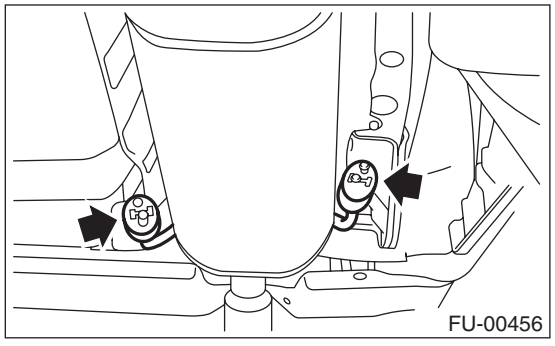
SUBARU CRC (Part No. 004301003)

(1) Separate rear exhaust pipe from center exhaust pipe.

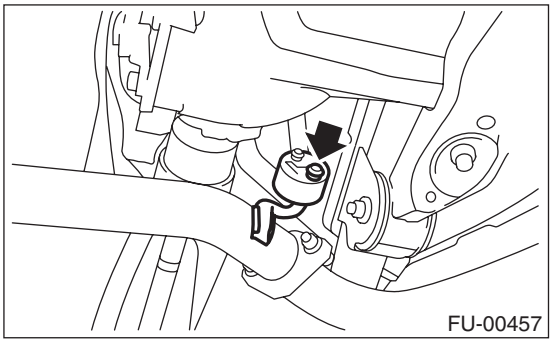

FU-00455

(2) Remove left and right rubber cushions.

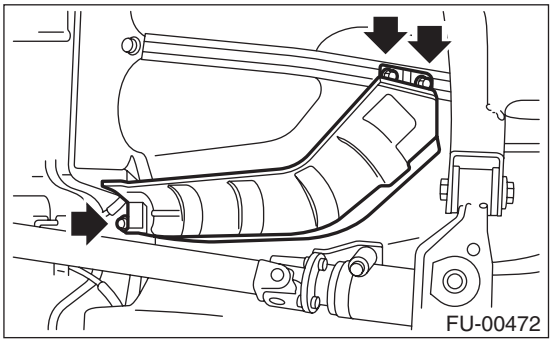
CAUTION:
Be careful not to pull down muffler.


FU-00456

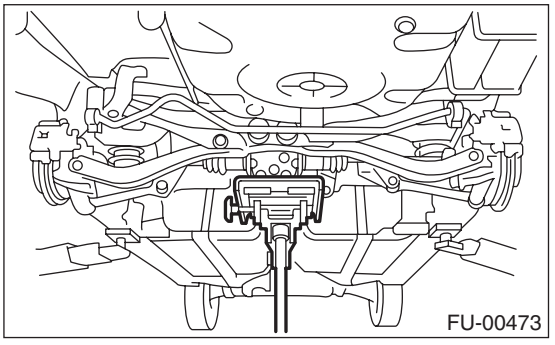
(3) Remove front rubber cushion and detach muffler assembly.


FU-00457

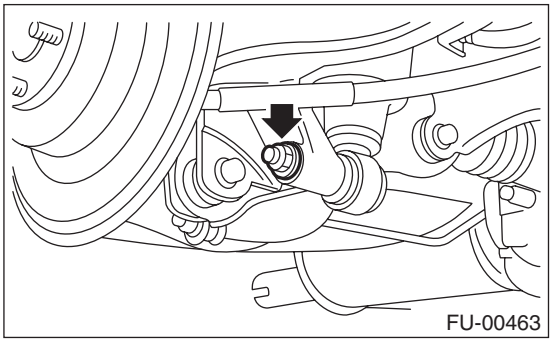
3) Remove heat sealed cover.


FU-00472

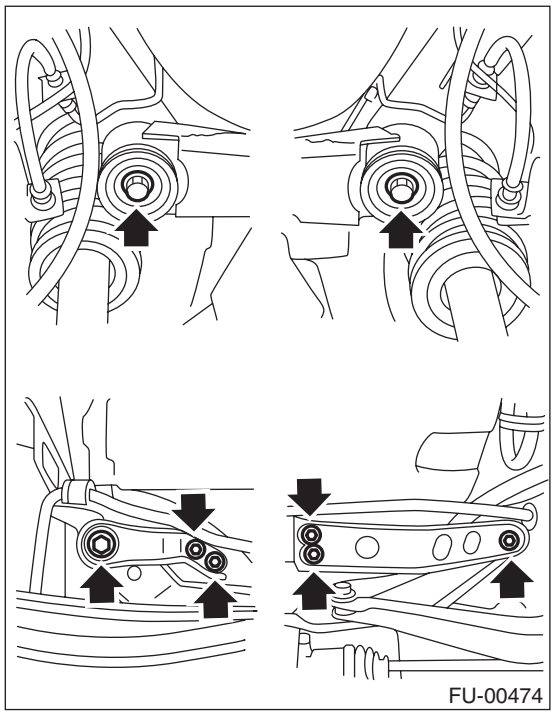
4) Place transmission jack under sub frame.


FU-00473

5) Remove bolt which holds rear shock absorber to rear suspension arm.


FU-00463

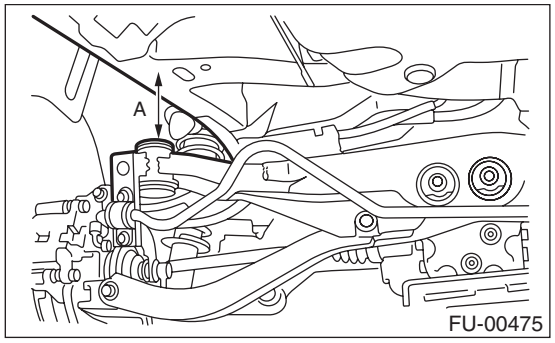
6) Remove bolts which hold rear sub frame on body.



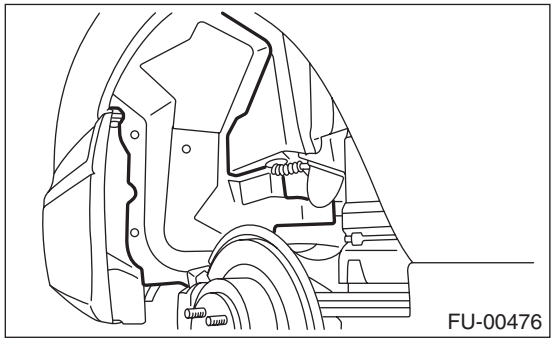
7) Lower the rear sub frame.

CAUTION:
Be sure to lower sub frame slowly.

A = 150 mm (5.91 in)

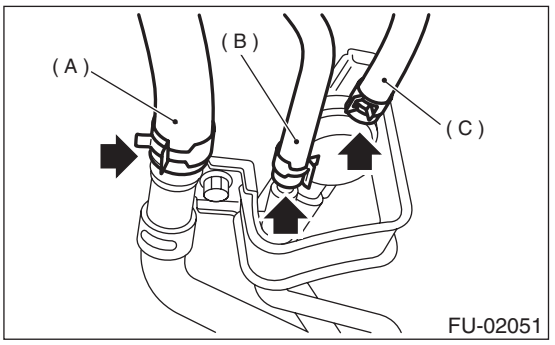


8) Remove fuel filler pipe protector.

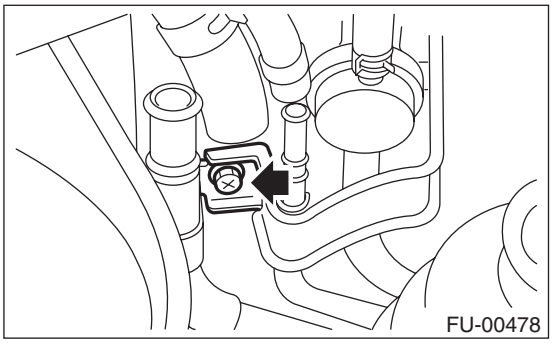


9) Disconnect air vent hose (A) and evaporation hose (B) from evaporation pipe assembly.

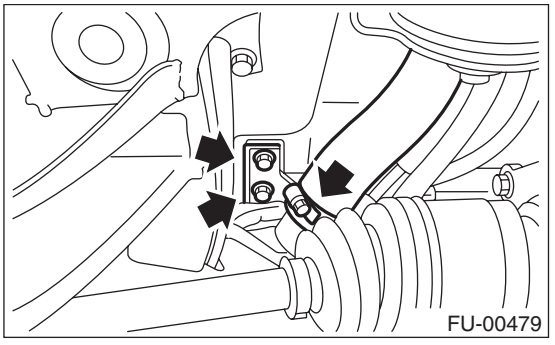
10) Disconnect evaporation hose (C) from pressure control solenoid valve.



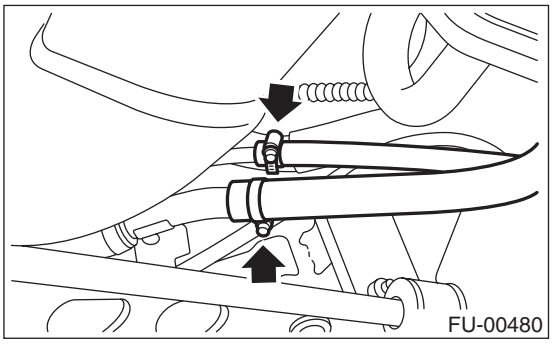
11) Remove bolt which holds evaporation pipe assembly on body.



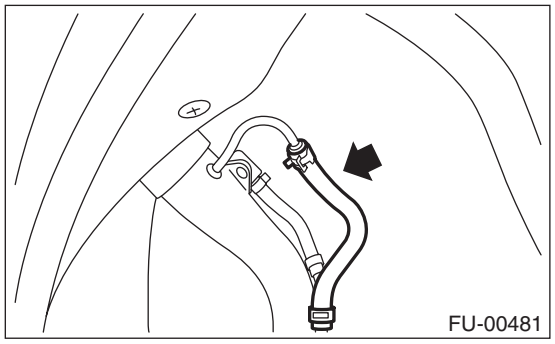
12) Disconnect fuel filler hose.
13) Remove bolt which holds fuel pressure sensor on fuel filler pipe and remove bolt which holds fuel filler pipe on body.



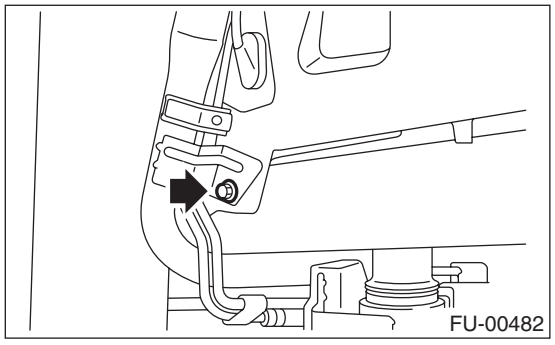
14) Disconnect canister hose from evaporation pipe assembly.



15) Disconnect evaporation hose (O) from fuel filler pipe.



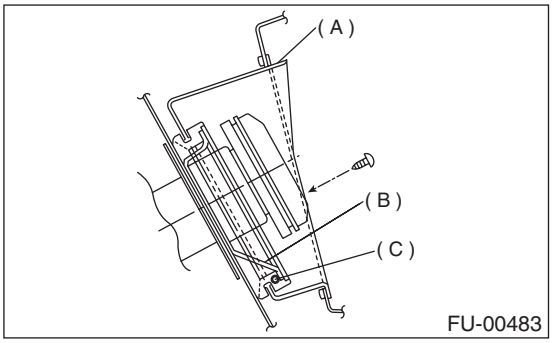
16) Remove bolt which holds fuel filler pipe to body.



17) Remove fuel filler pipe from under side of the vehicle.

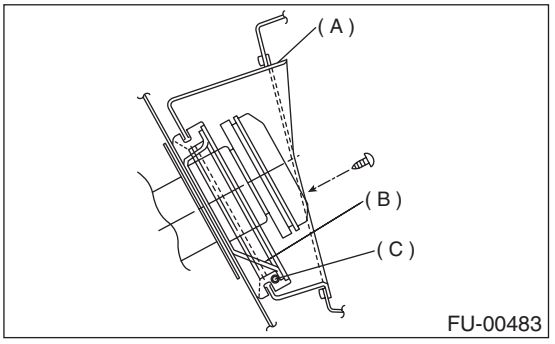
B: INSTALLATION

1) Hold fuel filler flap open.
2) Set fuel saucer (A) with rubber packing (C) and insert fuel filler pipe into hole from the inner side of apron.



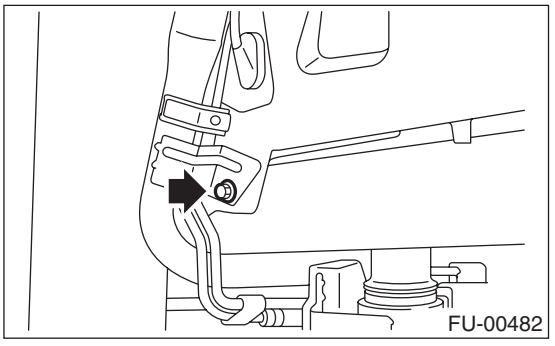
3) Align holes in fuel filler pipe neck and set cup (B), and tighten screws.

NOTE:
If edges of rubber packing are folded toward the inside, straighten it with a screwdriver.

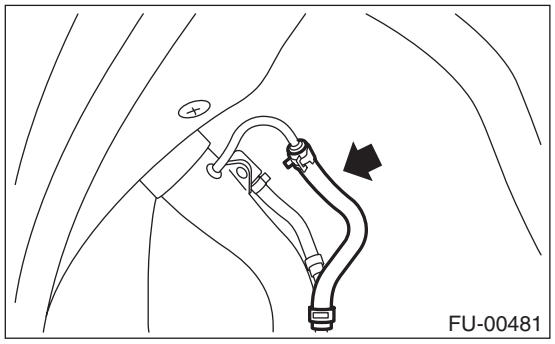


4) Tighten bolt which holds fuel filler pipe on body.

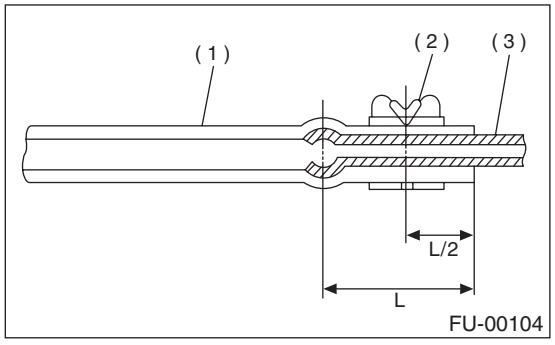
Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)



5) Insert evaporation hose approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe and hold clip.

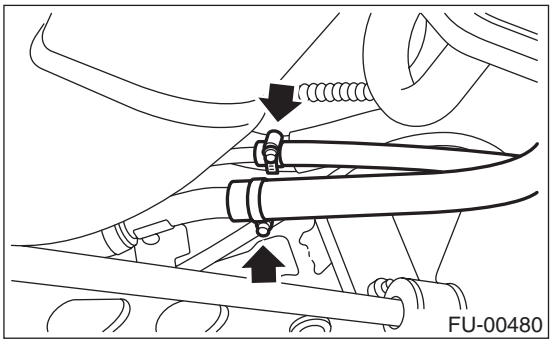


L = 27.5±2.5 mm (1.083±0.098 in)

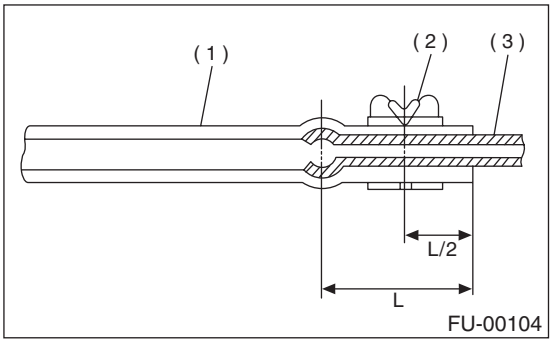


(1) Hose
(2) Clip
(3) Pipe

6) Insert canister hoses approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe assembly and tighten clamp.



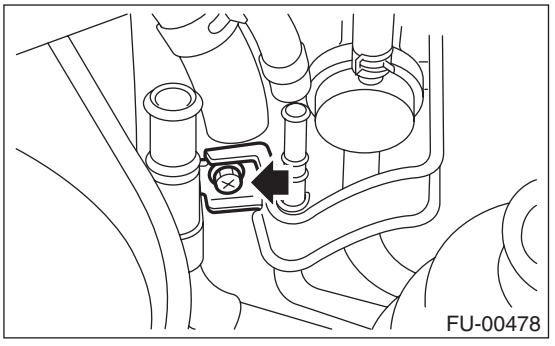
L = 27.5±2.5 mm (1.083±0.098 in)



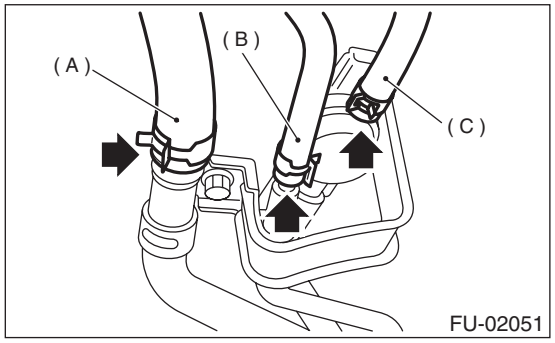
(1) Hose
(2) Clip
(3) Pipe

7) Tighten bolt which holds evaporation pipe assembly on body.

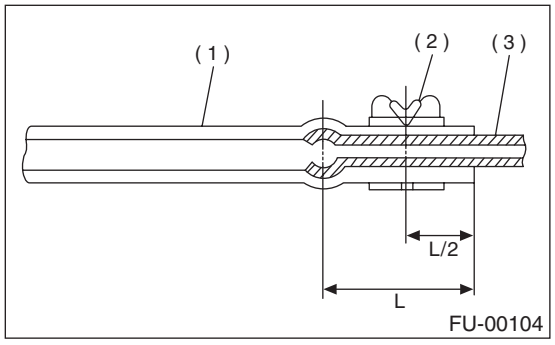
Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)



8) Insert air vent hose (A), evaporation hose (B) approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe assembly and hold clip.
9) Insert evaporation hose (C) to pressure control solenoid valve and hold clip.



L = 27.5±2.5 mm (1.083±0.098 in)

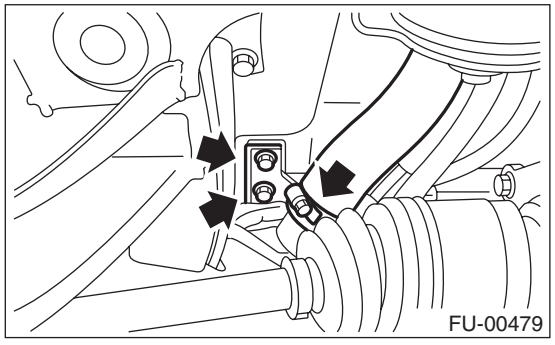


(1) Hose
(2) Clip
(3) Pipe

10) Tighten bolt which holds fuel filler pipe on body and tighten bolt which holds fuel pressure sensor on fuel filler pipe.

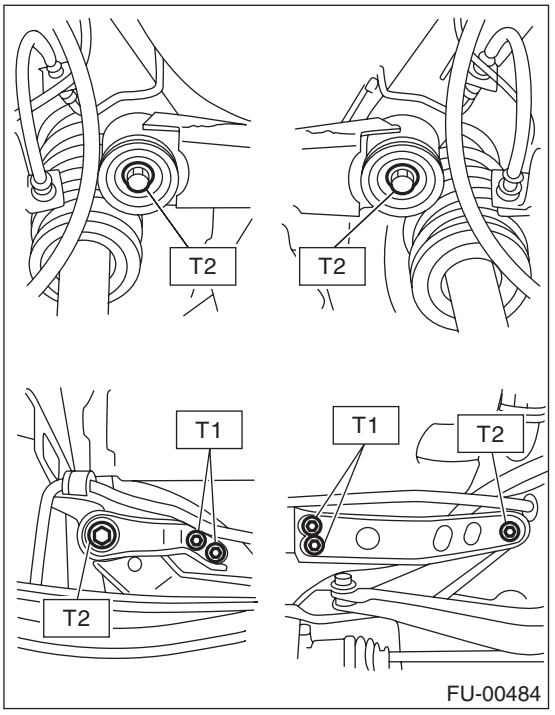
Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)

11) Insert fuel filler hose approximately 35 to 40 mm (1.38 to 1.57 in) over the lower end of fuel filler pipe and tighten clamp.



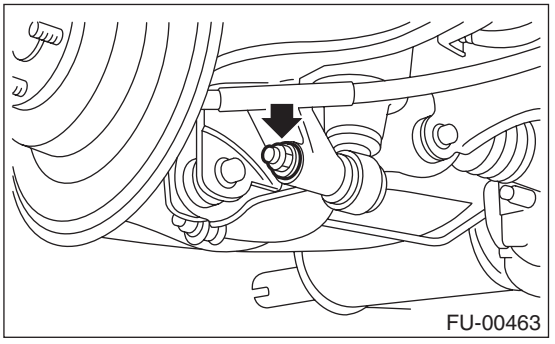
12) Jack-up the rear sub frame and tighten bolts which hold rear sub frame on body.

Tightening torque:
T1: 66 N·m (6.7 kgf-m, 48.5 ft-lb)
T2: 172 N·m (17.5 kgf-m, 127 ft-lb)

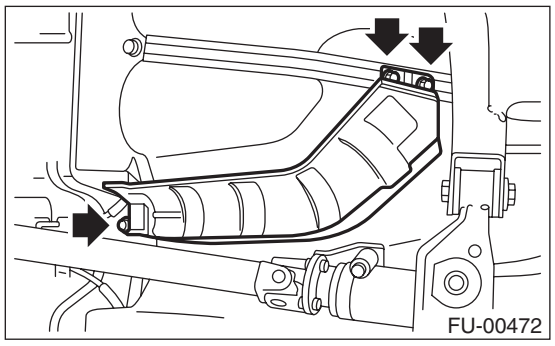


13) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-16, INSTALLATION, Rear Shock Absorber.>

Tightening torque:
157 N·m (16 kgf-m, 116 ft-lb)



14) Install heat shield cover.

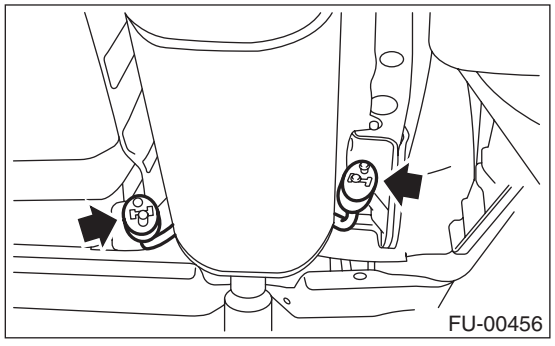


15) Install rear exhaust pipe and muffler.

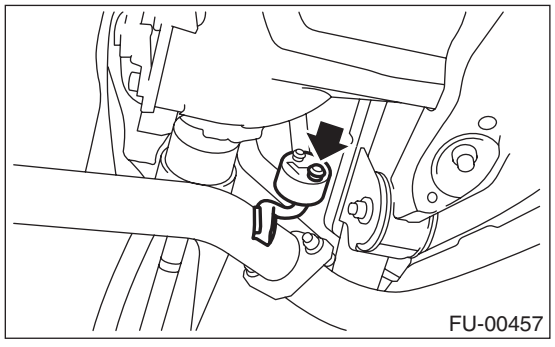
NOTE:
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.

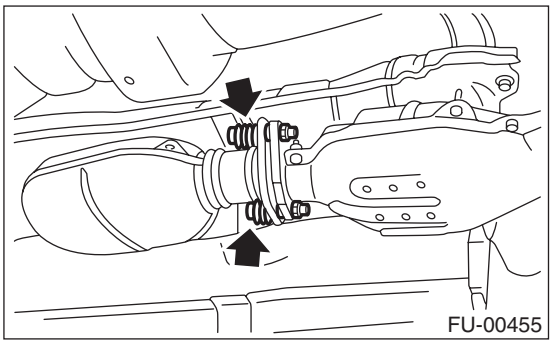


(2) Install front rubber cushion and attach muffler assembly.

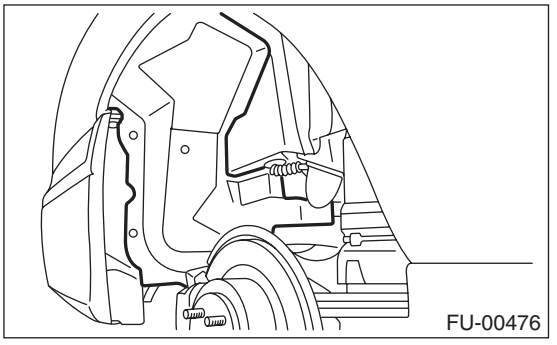


(3) Install rear exhaust pipe to center exhaust pipe.

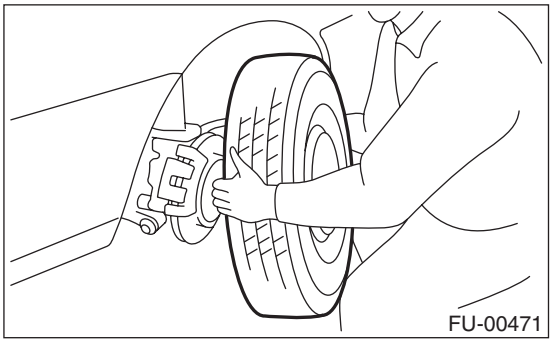
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



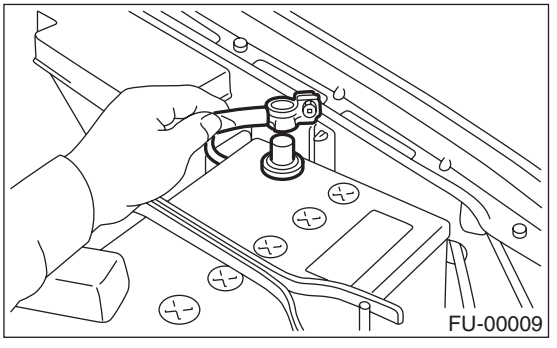
16) Install fuel filler pipe protector.



17) Install rear right wheel.



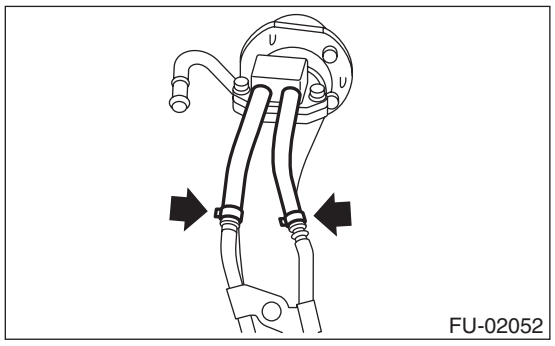
18) Lower the vehicle.
19) Tighten wheel nuts.
20) Connect battery ground cable.



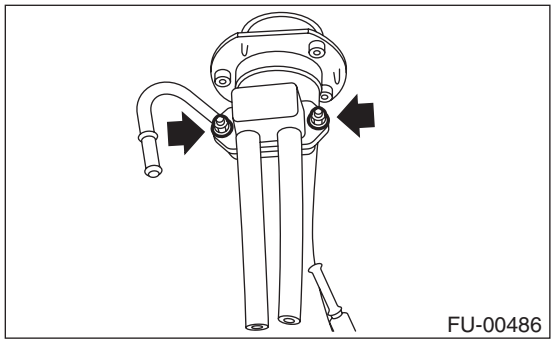
21) Remove fuel filler pipe to under side of the vehicle.

C: DISASSEMBLY

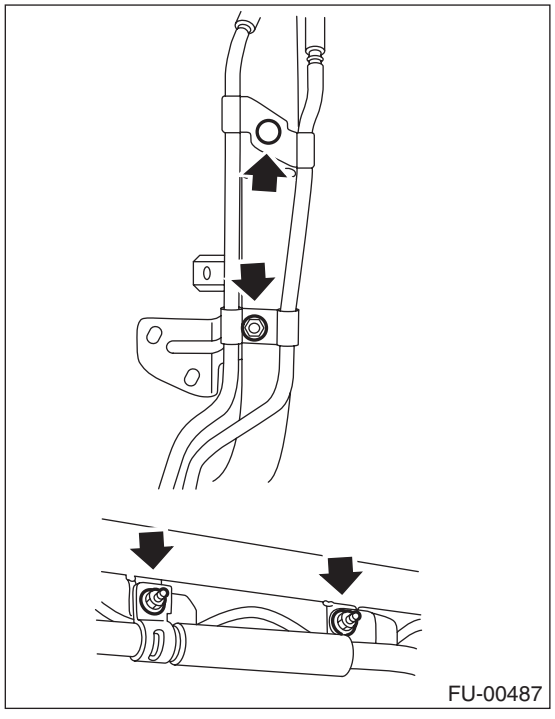
1) Disconnect evaporation hose from evaporation pipe assembly.



2) Remove shut valve from fuel filler pipe.



3) Remove nut which holds evaporation pipe assembly on fuel filler pipe.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

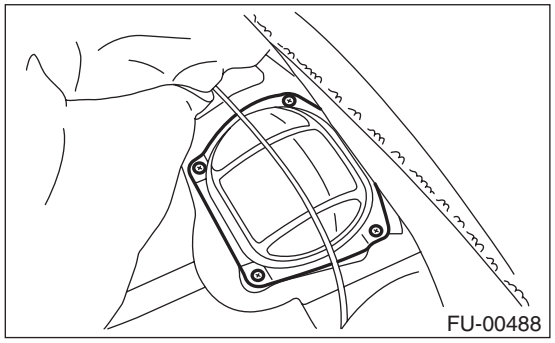
23.Fuel Pump

A: REMOVAL

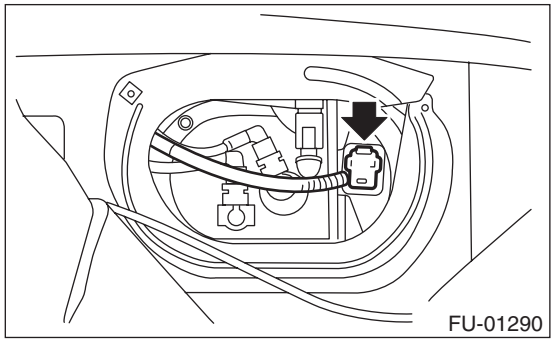
WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

NOTE:
Fuel pump assembly consists of fuel pump and fuel level sensor.

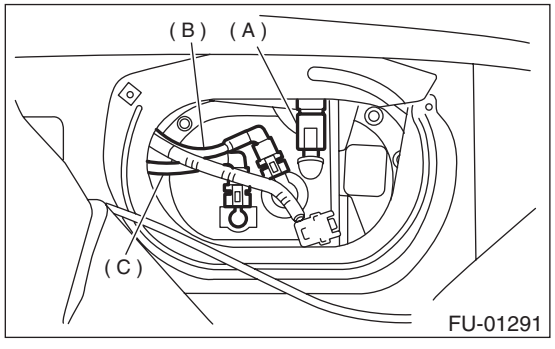
1) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Drain fuel from fuel tank.
<Ref. to FU(H4SO)-48, DRAINING FUEL, OPERATION, Fuel.>
3) Raise rear seat and turn floor mat up.
4) Remove access hole lid.


FU-00488

5) Disconnect connector from fuel pump.

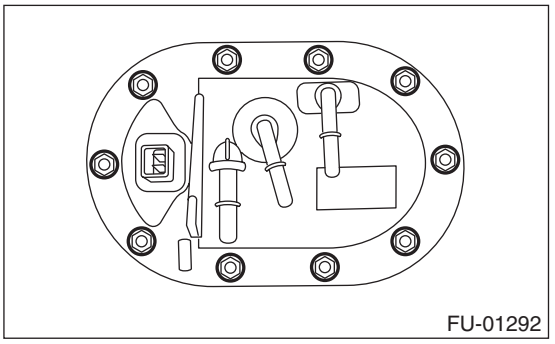

FU-01290

6) Disconnect quick connector and then disconnect fuel delivery hose (A) and return hose (B). <Ref. to FU(H4SO)-72, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



FU-01291

7) Remove nuts which install fuel pump assembly onto fuel tank.

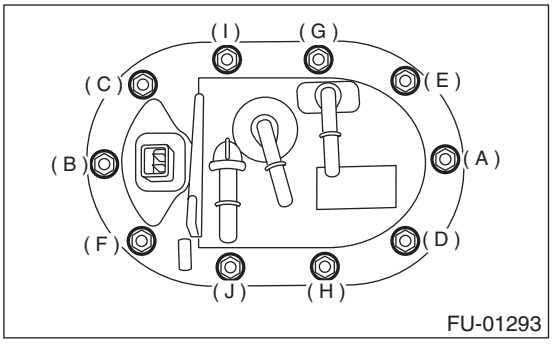

FU-01292

8) Take off fuel pump assembly from fuel tank.

B: INSTALLATION

Install in the reverse order of removal. Do the following:
(1) Always use new gaskets.
(2) Ensure sealing portion is free from fuel or foreign particles before installation.
(3) Tighten nuts in alphabetical sequence shown in figure to specified torque.

Tightening torque:
5.9 N·m (0.6 kgf-m, 4.3 ft-lb)

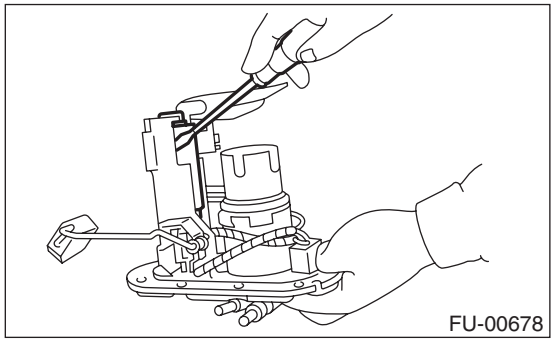


FU-01293

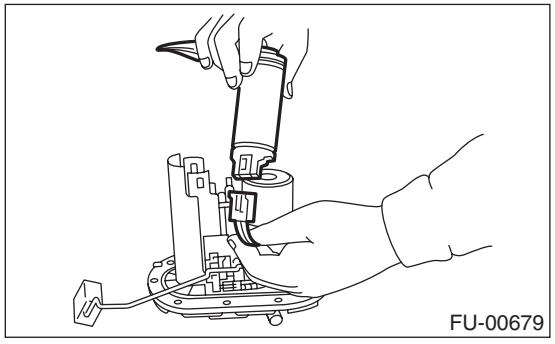
C: DISASSEMBLY

1) Remove fuel pump and pump holder.

NOTE:
When disassembling pump holder, be careful as it is installed with two pawls.



2) Disconnect connector from fuel pump.



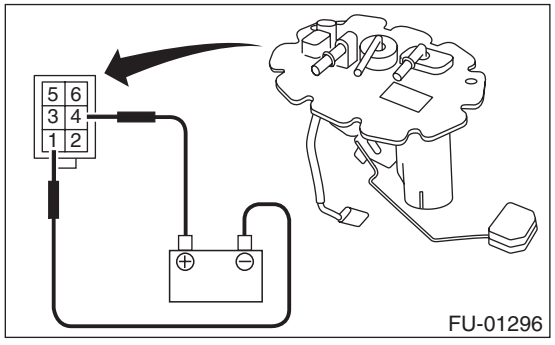
D: ASSEMBLY

Assemble in the reverse order of disassembly.

E: INSPECTION

Connect lead harness to connector terminal of fuel pump and apply battery power supply to check whether the pump operate.

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.**



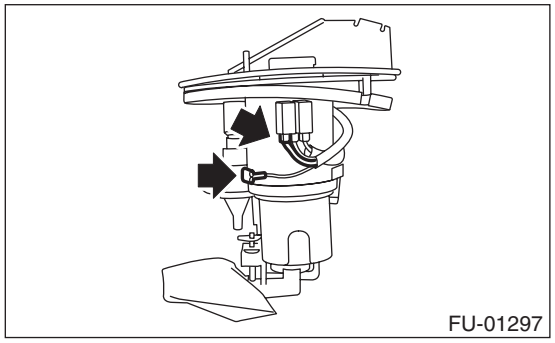
24.Fuel Level Sensor

A: REMOVAL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

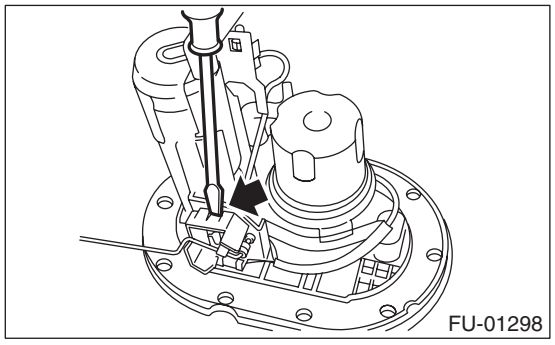
NOTE:
Fuel level sensor is built in fuel pump assembly.

1) Remove fuel pump assembly. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Pump.>
2) Disconnect connector from fuel pump bracket.


FU-01297

3) Pushing the pawls with a screwdriver, remove fuel level sensor by pulling it downwards.

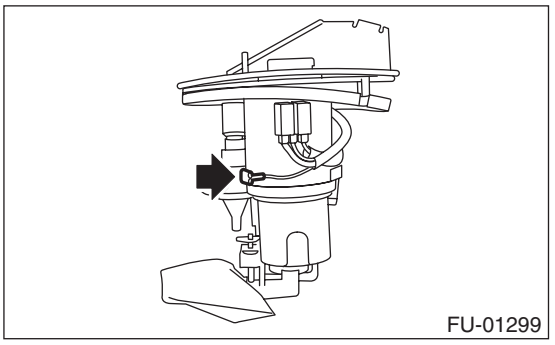
NOTE:
If the retainer pawls are broken during removal, the fuel level sensor must be replaced with a new one.


FU-01298

B: INSTALLATION

Install in the reverse order of removal.

WARNING:
- **Ground cable must be connected.**
- **Spark may occur and ignite if fuel is nearby.**

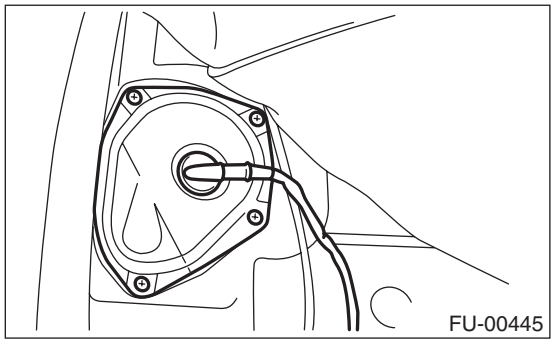

FU-01299

25.Fuel Sub Level Sensor

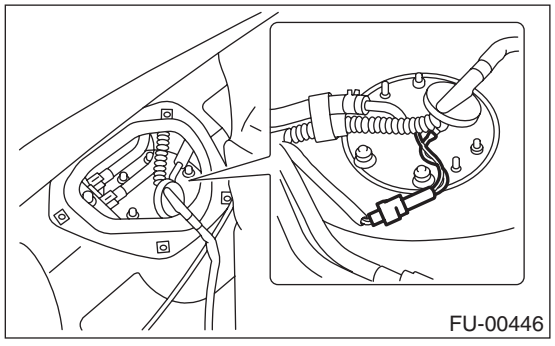
A: REMOVAL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**
- **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.**

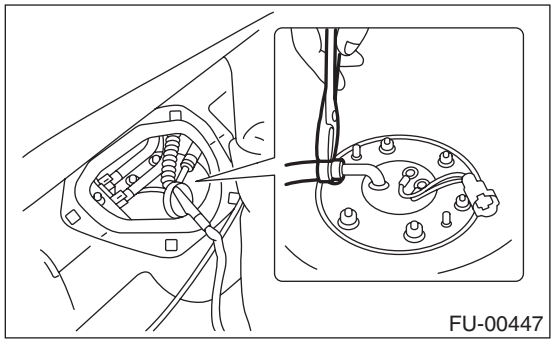
1) Drain fuel from fuel tank.
<Ref. to FU(H4SO)-48, DRAINING FUEL, OPERATION, Fuel.>
2) Remove rear seat.
3) Remove service hole cover.


FU-00445

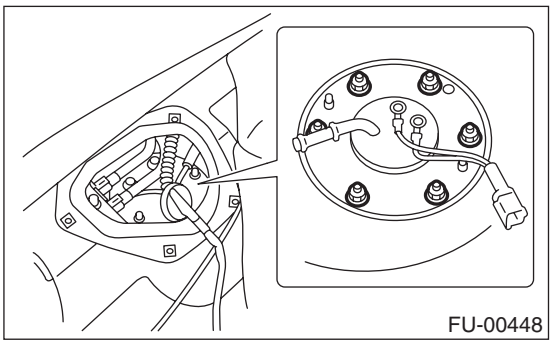
4) Disconnect connector from fuel sub level sensor.


FU-00446

5) Disconnect fuel jet pump hose.


FU-00447

6) Remove bolts which install fuel sub level sensor on fuel tank.

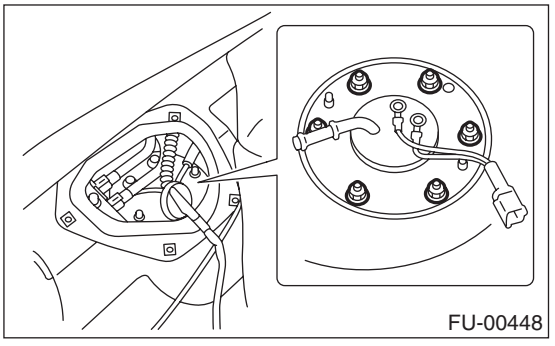

FU-00448

7) Remove fuel sub level sensor.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)


FU-00448

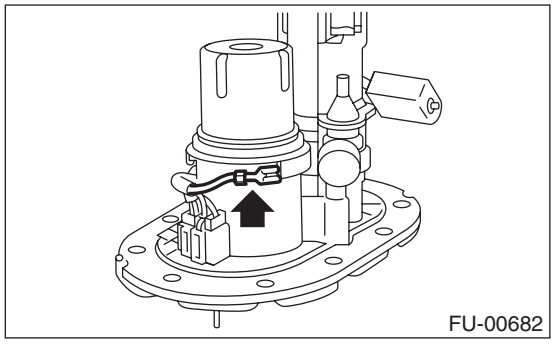
26.Fuel Filter

A: REMOVAL

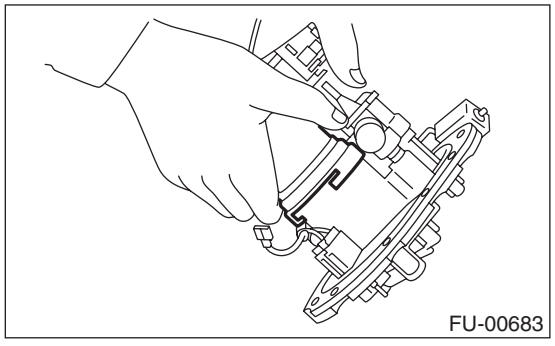
WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

NOTE:
The fuel filter is built in fuel pump assembly.

1) Release the fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Remove the fuel pump assembly. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Pump.>
3) Disconnect the ground cable from filter holder.


FU-00682

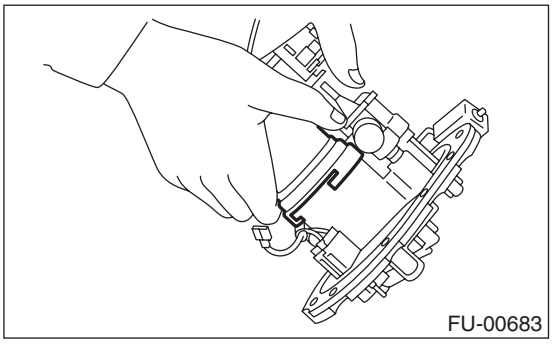
4) Remove the filter holder by turning it to the left from the body pawls, and then take out the filter.


FU-00683

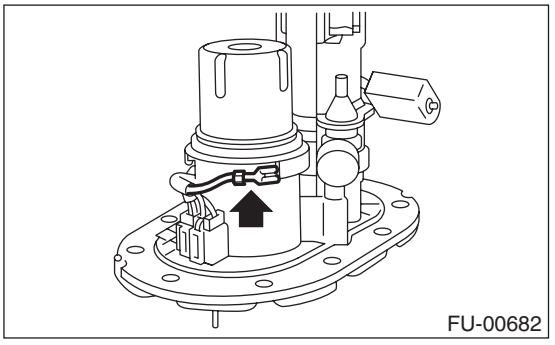
B: INSTALLATION

NOTE:
- If the fuel hoses are damaged at the connecting portion, replace it with a new one.
- If the clamps are badly damaged, replace with new ones.
- Replace the o-ring with new ones.

1) Set the O-ring on the filter holder, and then install by turning to the right.


FU-00683

2) Connect the ground cable to filter holder.


FU-00682

3) Install the fuel pump assembly. <Ref. to FU(H4SO)-66, INSTALLATION, Fuel Pump.>

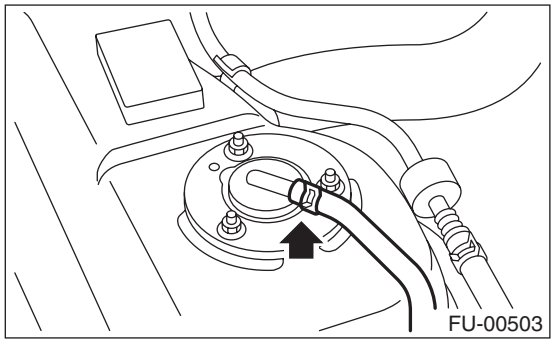
C: INSPECTION

1) Check the inside of fuel filter for dirt and water sediment.
2) If it is clogged, or if replacement interval has been reached, replace it.

27.Fuel Cut Valve

A: REMOVAL

1) Remove fuel tank. <Ref. to FU(H4SO)-51, REMOVAL, Fuel Tank.>
2) Move clip and disconnect evaporation hose from fuel cut valve.

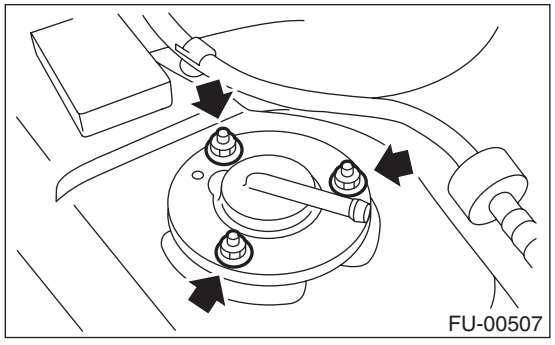


3) Remove bolts which install fuel cut valve.

B: INSTALLATION

Install in the reverse order of removal.

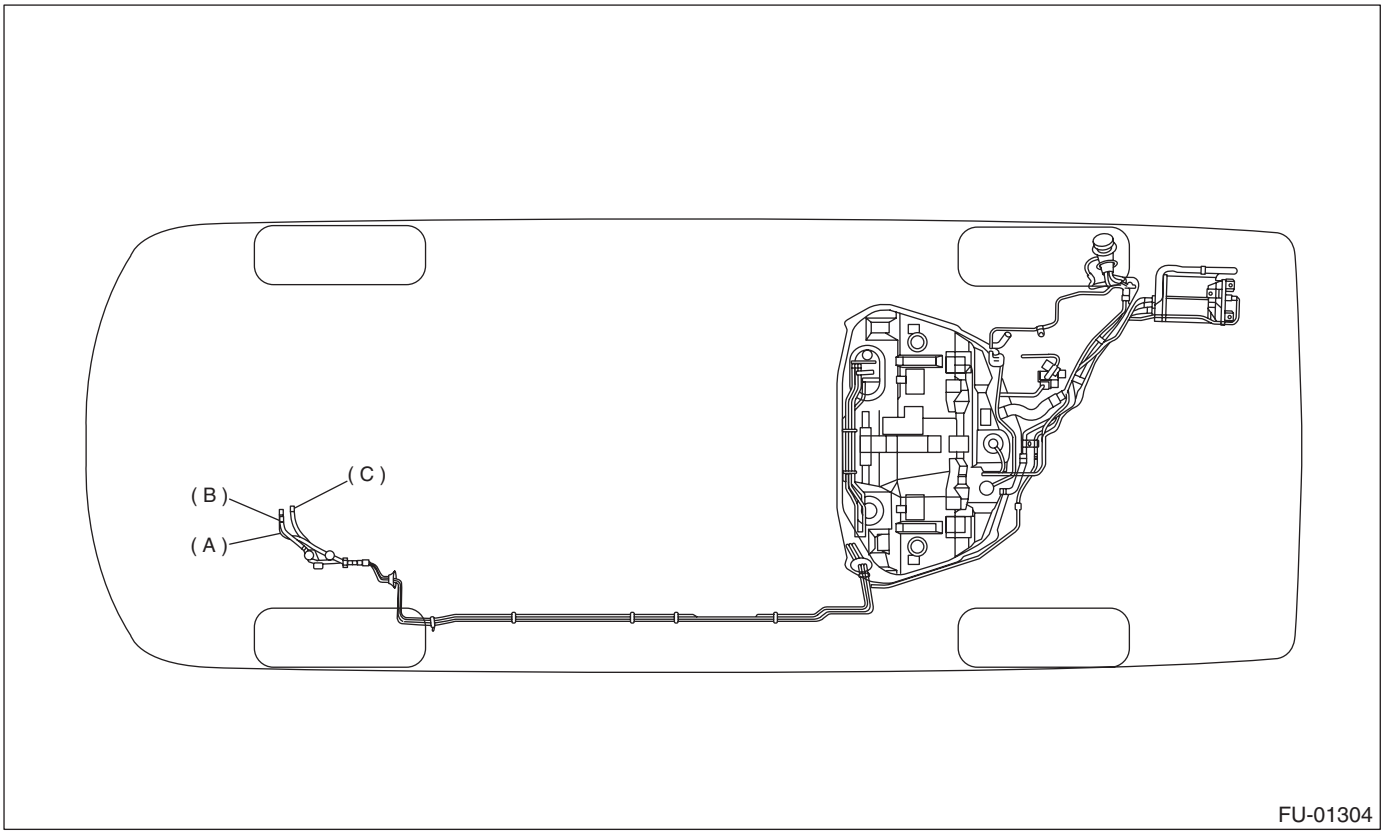
Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



28.Fuel Delivery, Return and Evaporation Lines

A: REMOVAL

1) Set vehicle on the lift.
2) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
3) Open fuel filler flap lid and remove fuel filler cap.
4) Remove fuel tank. <Ref. to FU(H4SO)-51, REMOVAL, Fuel Tank.>
5) Remove fuel filler pipe. <Ref. to FU(H4SO)-59, REMOVAL, Fuel Filler Pipe.>
6) Remove floor mat. <Ref. to EI-45, REMOVAL, Floor Mat.>
7) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.

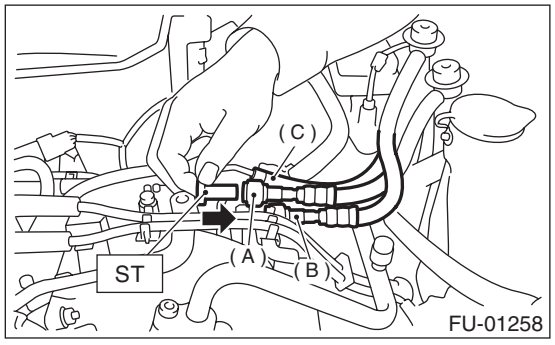


(A) Fuel delivery line
(B) Fuel return line
(C) Evaporation line

8) In engine room, detach fuel delivery hoses, return hoses and evaporation hose.

(1) Separate quick connector of fuel delivery line and return line by pushing an ST in the direction of the arrow.

(2) Remove clips, and then separate evaporation hose from pipe.



(A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

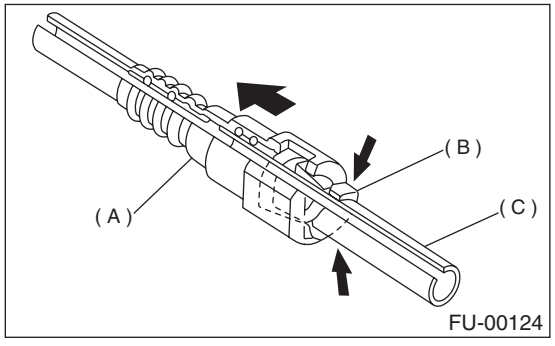
9) Separate quick connector on fuel delivery and return line.

(1) Clean pipe and connector, if they are covered with dust.

(2) Hold connector (A) and push retainer (B) down.

(3) Pull out connector (A) from retainer (B).

CAUTION:
Replace retainer with new ones except engine room.

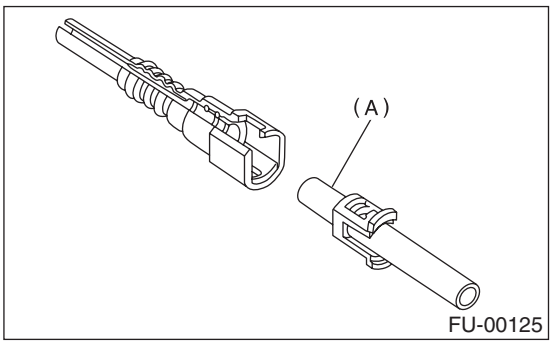


(A) Connector
(B) Retainer
(C) Pipe

B: INSTALLATION

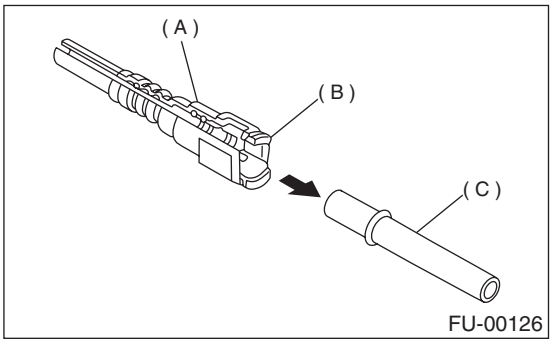
1) Connect quick connector on fuel delivery and return line.

CAUTION:
• Always use a new retainer except engine room.
• Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface (A) of pipe.



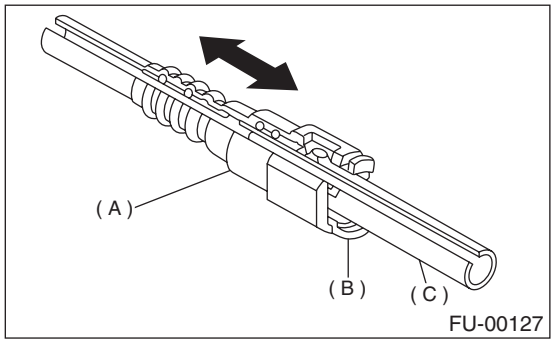
(1) Set new retainer (B) to connector (A).
(2) Push pipe into connector completely.

NOTE:
At this time, two clicking sounds are heard.



(A) Connector
(B) Retainer
(C) Pipe

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.

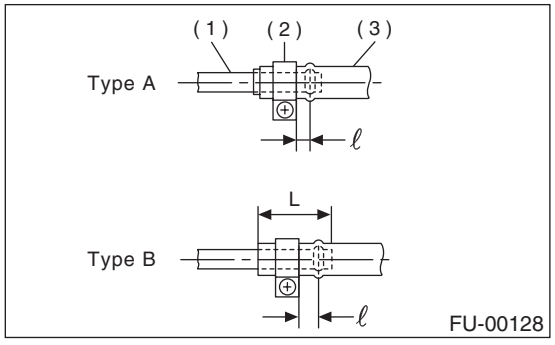


(A) Connector
(B) Retainer
(C) Pipe

2) Connect fuel delivery hose to pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).
Type A: When insertion length is specified.
Type B: When insertion length is not specified.

ℓ : 2.5±1.5 mm (0.098±0.059 in)

L: 22.5±2.5 mm (0.886±0.098 in)

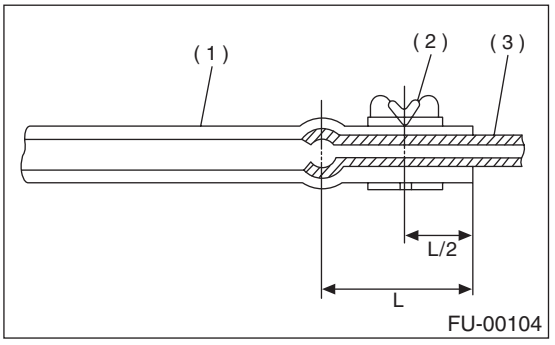


(1) Pipe
(2) Clamp
(3) Hose

3) Connect evaporation hose to pipe by approx. 15 mm (0.59 in) from hose end.

L = 17.5±2.5 mm (0.689±0.098 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.

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 fuel pump.
2)	Lowering of fuel pump function.	Replace 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.	Retightening.
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 smell inside of compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retightening.
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 level indicator		
1)	Defective operation of fuel level sensor.	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 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.
(1) 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 fuel tank. 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 water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under damaged areas below.
(2) Damaged areas
If water accumulated in the fuel filter, drain 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.

MEMO:

1. List of Diagnostic Trouble Code (DTC)

A: List

DTC	Item	Index
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-9, DTC P0030 — HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-11, DTC P0031 — HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-13, DTC P0032 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-15, DTC P0037 — HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-17, DTC P0038 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0065	Air Assisted Injector Control Range/ Performance	<Ref. to GD(H4SO)-19, DTC P0065 — AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0066	Air Assisted Injector Control Circuit or Circuit Low	<Ref. to GD(H4SO)-22, DTC P0066 — AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0067	Air Assisted Injector Control Circuit High	<Ref. to GD(H4SO)-24, DTC P0067 — AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	Manifold Pressure Sensor Range/ Performance	<Ref. to GD(H4SO)-26, DTC P0068 — MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4SO)-28, DTC P0107 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4SO)-30, DTC P0108 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Circuit Range/Performance	<Ref. to GD(H4SO)-32, DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Circuit Low Input	<Ref. to GD(H4SO)-34, DTC P0112 — INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Circuit High Input	<Ref. to GD(H4SO)-36, DTC P0113 — INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low Input	<Ref. to GD(H4SO)-38, DTC P0117 — ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High Input	<Ref. to GD(H4SO)-40, DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0121	Throttle/Pedal Position Sensor/ Switch “A” Circuit Range/Performance	<Ref. to GD(H4SO)-42, DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0122	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low Input	<Ref. to GD(H4SO)-45, DTC P0122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0123	Throttle/Pedal Position Sensor/ Switch “A” Circuit High Input	<Ref. to GD(H4SO)-47, DTC P0123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature For Closed Loop Fuel Control	<Ref. to GD(H4SO)-49, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Coolant Temperature For Stable Operation	<Ref. to GD(H4SO)-51, DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4SO)-53, DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0130	O_2 Sensor Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-55, DTC P0130 — O2 SENSOR CIRCUIT (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-57, DTC P0131 — O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O_2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-59, DTC P0132 — O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O_2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-61, DTC P0133 — O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O_2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-65, DTC P0134 — O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-67, DTC P0137 — O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O_2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-69, DTC P0138 — O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O_2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-71, DTC P0139 — O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4SO)-77, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4SO)-79, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	<Ref. to GD(H4SO)-81, DTC P0181 — FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor “A” Circuit Low Input	<Ref. to GD(H4SO)-84, DTC P0182 — FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor “A” Circuit High Input	<Ref. to GD(H4SO)-86, DTC P0183 — FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4SO)-88, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4SO)-93, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4SO)-93, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4SO)-93, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-94, DTC P0327 — KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-96, DTC P0328 — KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor “A” Circuit	<Ref. to GD(H4SO)-98, DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to GD(H4SO)-100, DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-102, DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-104, DTC P0341 — CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0400	EGR System	<Ref. to GD(H4SO)-106, DTC P0400 — EXHAUST GAS RECIRCULATION FLOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4SO)-110, DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H4SO)-114, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H4SO)-136, DTC P0447 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H4SO)-138, DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	<Ref. to GD(H4SO)-140, DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H4SO)-143, DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H4SO)-145, DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4SO)-147, DTC P0456 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to GD(H4SO)-147, DTC P0457 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission Control System Purge Control Valve Circuit Low	<Ref. to GD(H4SO)-148, DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission Control System Purge Control Valve Circuit High	<Ref. to GD(H4SO)-150, DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-152, DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor Circuit Low Input	<Ref. to GD(H4SO)-154, DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0463	Fuel Level Sensor Circuit High Input	<Ref. to GD(H4SO)-156, DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4SO)-158, DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0483	Cooling Fan Rationality Check	<Ref. to GD(H4SO)-161, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0502	Vehicle Speed Sensor Circuit Low Input	<Ref. to GD(H4SO)-163, DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0503	Vehicle Speed Sensor Intermittent/ Erratic/High	<Ref. to GD(H4SO)-164, DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Control System RPM Lower Than Expected	<Ref. to GD(H4SO)-165, DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Control System RPM Higher Than Expected	<Ref. to GD(H4SO)-167, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4SO)-169, DTC P0512 — STARTER REQUEST CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to GD(H4SO)-170, DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0565	Cruise Control On Signal	<Ref. to GD(H4SO)-171, DTC P0565 — CRUISE CONTROL ON SIGNAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4SO)-172, DTC P0604 — INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0691	Cooling Fan 1 Control Circuit Low	<Ref. to GD(H4SO)-173, DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0692	Cooling Fan 1 Control Circuit High	<Ref. to GD(H4SO)-174, DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0703	Torque Converter/Brake Switch “B” Circuit	<Ref. to GD(H4SO)-175, DTC P0703 — TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0705	Transmission Range Sensor Circuit (PRNDL Input)	<Ref. to GD(H4SO)-176, DTC P0705 — TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0710	Transmission Fluid Temperature Sensor Circuit	<Ref. to GD(H4SO)-178, DTC P0710 — TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0716	Input/Turbine Speed Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-179, DTC P0716 — INPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0720	Output Speed Sensor Circuit	<Ref. to GD(H4SO)-180, DTC P0720 — OUTPUT SPEED SENSOR CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0726	Engine Speed Input Circuit Range/ Performance	<Ref. to GD(H4SO)-181, DTC P0726 — ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0731	Gear 1 Incorrect Ratio	<Ref. to GD(H4SO)-182, DTC P0731 — GEAR 1 INCORRECT RATIO —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0732	Gear 2 Incorrect Ratio	<Ref. to GD(H4SO)-183, DTC P0732 — GEAR 2 INCORRECT RATIO —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0733	Gear 3 Incorrect Ratio	<Ref. to GD(H4SO)-184, DTC P0733 — GEAR 3 INCORRECT RATIO —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0734	Gear 4 Incorrect Ratio	<Ref. to GD(H4SO)-185, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	<Ref. to GD(H4SO)-186, DTC P0741 — TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0743	Torque Converter Clutch Circuit Electrical	<Ref. to GD(H4SO)-187, DTC P0743 — TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0748	Pressure Control Solenoid “A” Electrical	<Ref. to GD(H4SO)-188, DTC P0748 — PRESSURE CONTROL SOLENOID “A” ELECTRICAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0753	Shift Solenoid “A” Electrical	<Ref. to GD(H4SO)-189, DTC P0753 — SHIFT SOLENOID “A” ELECTRICAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0758	Shift Solenoid “B” Electrical	<Ref. to GD(H4SO)-190, DTC P0758 — SHIFT SOLENOID “B” ELECTRICAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0771	Shift Solenoid “E” Performance or Stuck Off	<Ref. to GD(H4SO)-191, DTC P0771 — SHIFT SOLENOID “E” PERFORMANCE OR STUCK OFF —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0778	Pressure Control Solenoid “B” Electrical	<Ref. to GD(H4SO)-192, DTC P0778 — PRESSURE CONTROL SOLENOID “B” ELECTRICAL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0785	Shift/Timing Solenoid	<Ref. to GD(H4SO)-193, DTC P0785 — SHIFT/TIMING SOLENOID —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low	<Ref. to GD(H4SO)-194, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High	<Ref. to GD(H4SO)-196, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0864	TCM Communication Circuit Range/Performance	<Ref. to GD(H4SO)-198, DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0865	TCM Communication Circuit Low	<Ref. to GD(H4SO)-199, DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0866	TCM Communication Circuit High	<Ref. to GD(H4SO)-200, DTC P0866 — TCM COMMUNICATION CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1134	A/F Sensor Micro-Computer Problem	<Ref. to GD(H4SO)-201, DTC P1134 — A/F SENSOR MICRO-COMPUTER PROBLEM —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1137	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-203, DTC P1137 — O2 SENSOR CIRCUIT MIDDLE ELECTRIC POTENTIAL (BANK 1 SENSOR 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4SO)-205, DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4SO)-207, DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H4SO)-209, DTC P1443 — VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1446	Fuel Tank Sensor Control Valve Circuit Low	<Ref. to GD(H4SO)-210, DTC P1446 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1447	Fuel Tank Sensor Control Valve Circuit High	<Ref. to GD(H4SO)-212, DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1448	Fuel Tank Sensor Control Valve Range/Performance	<Ref. to GD(H4SO)-214, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE—, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P1492	EGR solenoid valve signal #1 circuit malfunction (low input)	<Ref. to GD(H4SO)-217, DTC P1492 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1493	EGR solenoid valve signal #1 circuit malfunction (high input)	<Ref. to GD(H4SO)-219, DTC P1493 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1494	EGR solenoid valve signal #2 circuit malfunction (low input)	<Ref. to GD(H4SO)-221, DTC P1494 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1495	EGR solenoid valve signal #2 circuit malfunction (high input)	<Ref. to GD(H4SO)-223, DTC P1495 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1496	EGR solenoid valve signal #3 circuit malfunction (low input)	<Ref. to GD(H4SO)-225, DTC P1496 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1497	EGR solenoid valve signal #3 circuit malfunction (high input)	<Ref. to GD(H4SO)-227, DTC P1497 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1498	EGR solenoid valve signal #4 circuit malfunction (low input)	<Ref. to GD(H4SO)-229, DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1499	EGR solenoid valve signal #4 circuit malfunction (high input)	<Ref. to GD(H4SO)-231, DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1510	ISC Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-233, DTC P1510 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1511	ISC Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-235, DTC P1511 — ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1512	ISC Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-237, DTC P1512 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1513	ISC Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-239, DTC P1513 — ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1514	ISC Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-241, DTC P1514 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1515	ISC Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-243, DTC P1515 — ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1516	ISC Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-245, DTC P1516 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1517	ISC Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-247, DTC P1517 — ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1518	Starter Switch Circuit Low Input	<Ref. to GD(H4SO)-249, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to GD(H4SO)-250, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1698	Engine Torque Control Cut Signal Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-251, DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P1699	Engine Torque Control Cut Signal Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-252, DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1700	Throttle Position Sensor Circuit Malfunction For AT	<Ref. to GD(H4SO)-253, DTC P1700 — THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1711	Engine Torque Control Signal #1 Circuit Malfunction	<Ref. to GD(H4SO)-255, DTC P1711 — ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1712	Engine Torque Control Signal #2 Circuit Malfunction	<Ref. to GD(H4SO)-256, DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H4SO)-257, DTC P2096 — POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H4SO)-259, DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2227	Atmospheric Pressure Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-261, DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2228	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-262, DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2229	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-263, DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

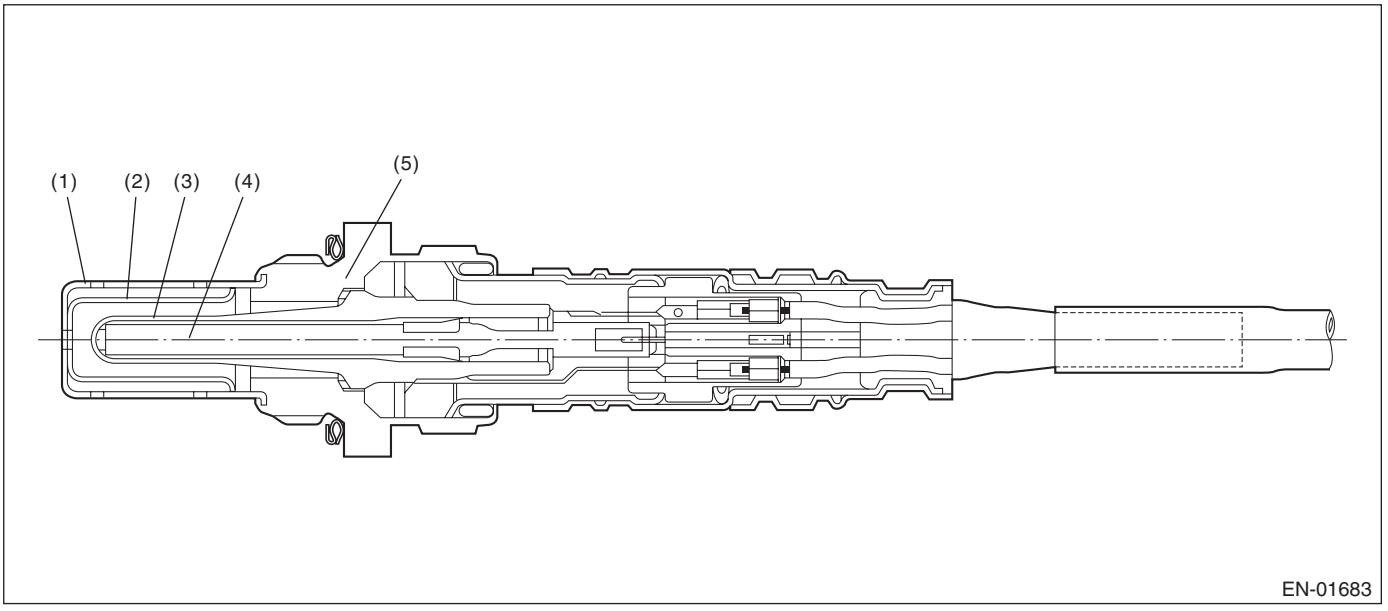
2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC P0030 — HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of front oxygen (A/F) sensor heater.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of heater malfunction NG is transmitted.
Judge NG when the front oxygen (A/F) sensor element impedance is out of the standard value.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
After heater control starting	More than 30 seconds
After fuel shut-off	More than 20 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 30 seconds after the heater continuity starting, and complete the diagnosis if making a NG judgment.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when one of the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Impedance of front oxygen (A/F) sensor	< 10 Ω or > 40 Ω

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when all of the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Impedance of front oxygen (A/F) sensor	10 Ω — 40 Ω

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

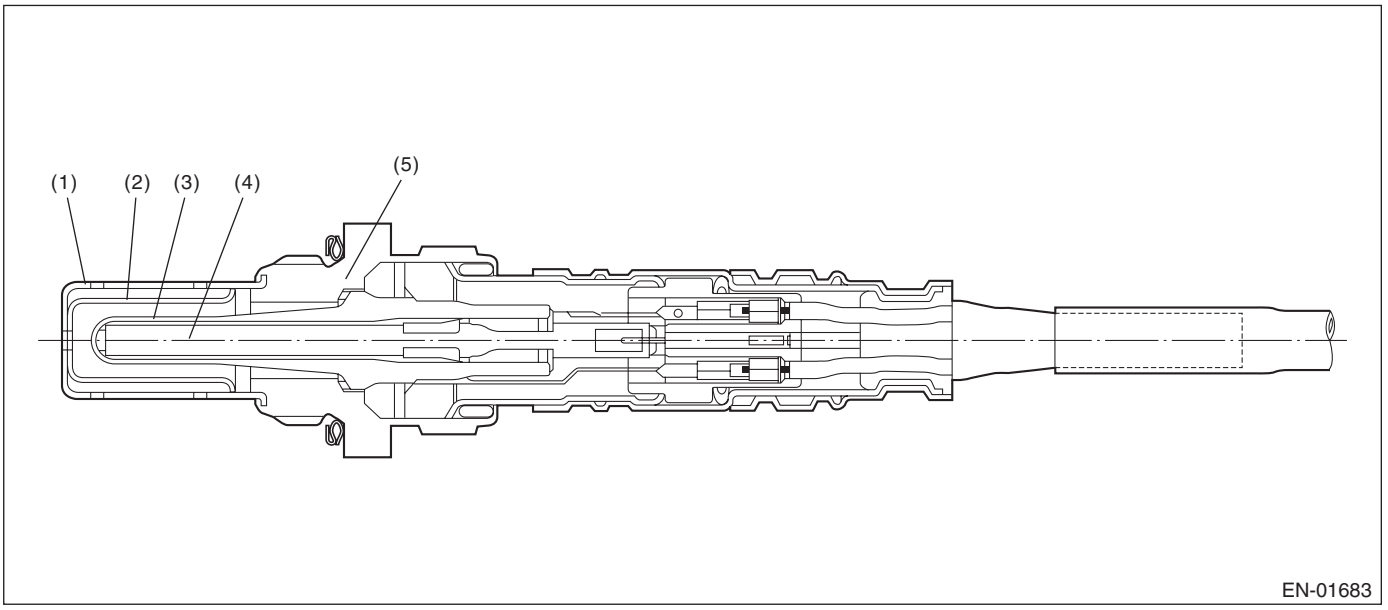
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of front oxygen (A/F) sensor heater.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit and shortage NG is transmitted.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	10.9 V or more
Heater control	In operation

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open or short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing all the malfunction criteria below becomes more then 4.5 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
Heater circuit	ON
Heater both edge voltage	< 5 V
Heater current	< 1.5 A

Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

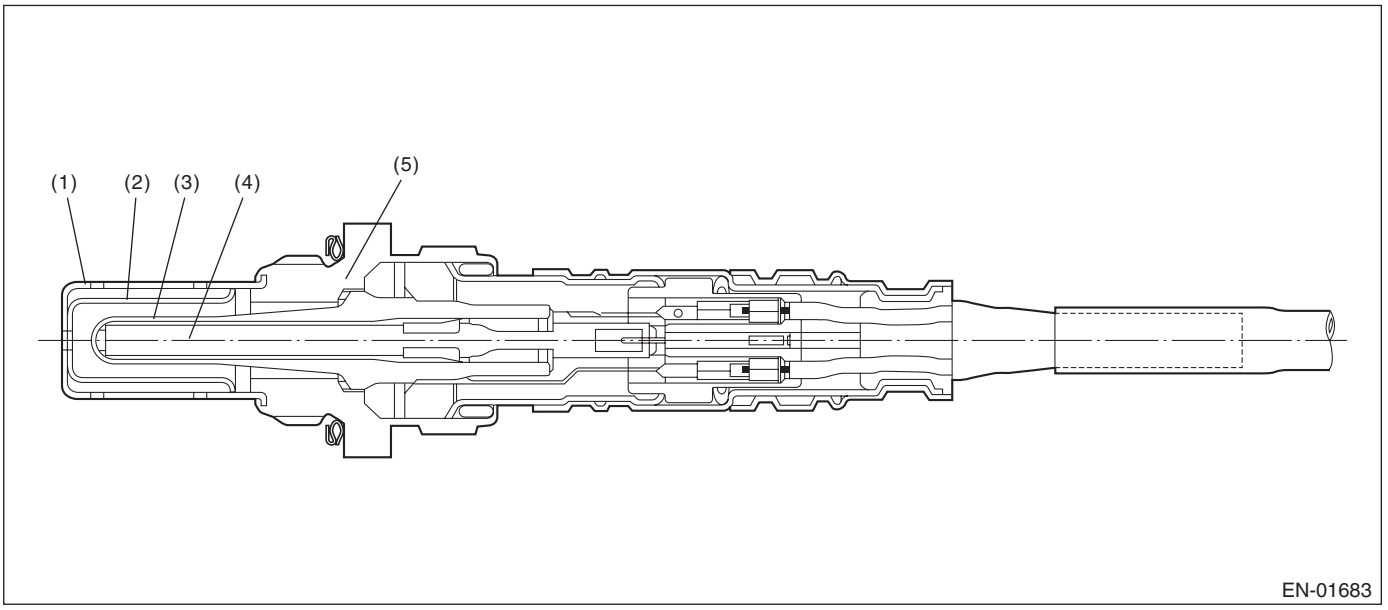
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of front oxygen (A/F) sensor heater.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit and shortage NG is transmitted.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	10.9 V or more
Heater control	In operation

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open or short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when one of the malfunction criteria below are completed.
Judgment Value

Malfunction Criteria	Threshold Value
Heater circuit	ON
Heater both edge voltage	≥ 5 V
Heater current	≥ 1.5 V
Heater current	≥ 23 A

Time Needed for Diagnosis: 4.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

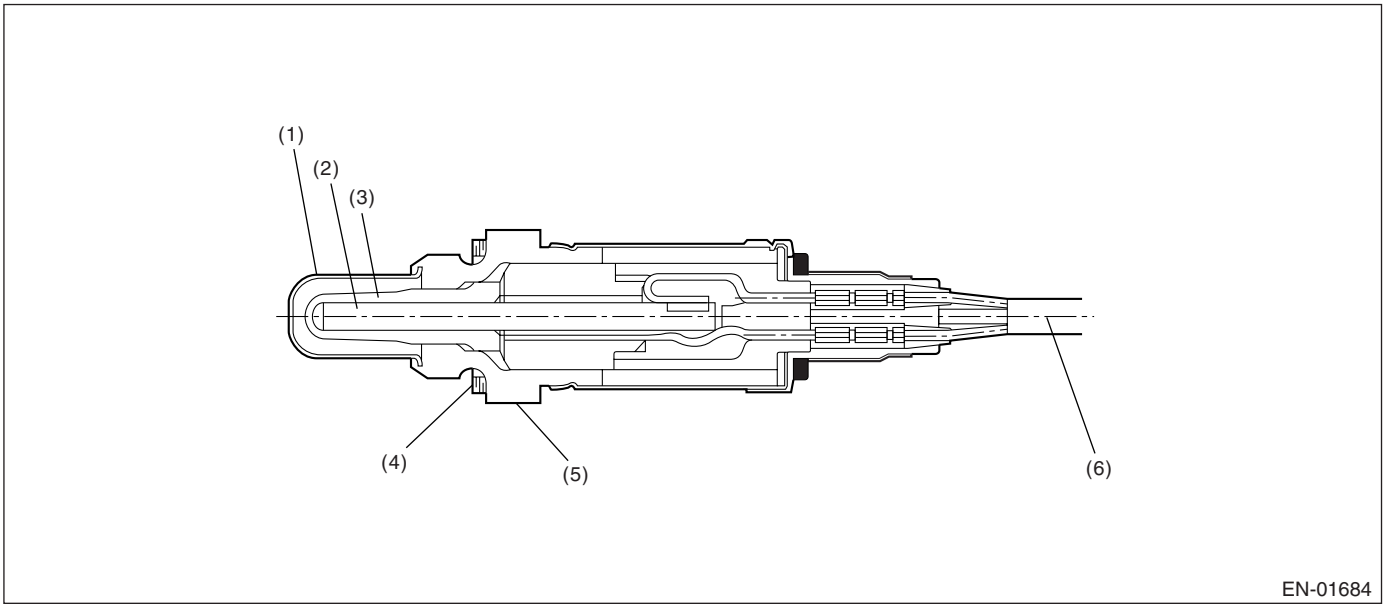
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor heater.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Protection tube
(2) Ceramic heater
(3) Zirconium tube
(4) Gasket
(5) Sensor housing
(6) Harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	≥ 500 rpm
After engine starting	10 seconds or more
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

In 10 seconds after starting the engine, perform the diagnosis just once.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes 10 seconds or more. Judge OK when the continuous time until completing none of the malfunction criteria below becomes 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
Calculated electric power	< 6 W

Time needed for diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

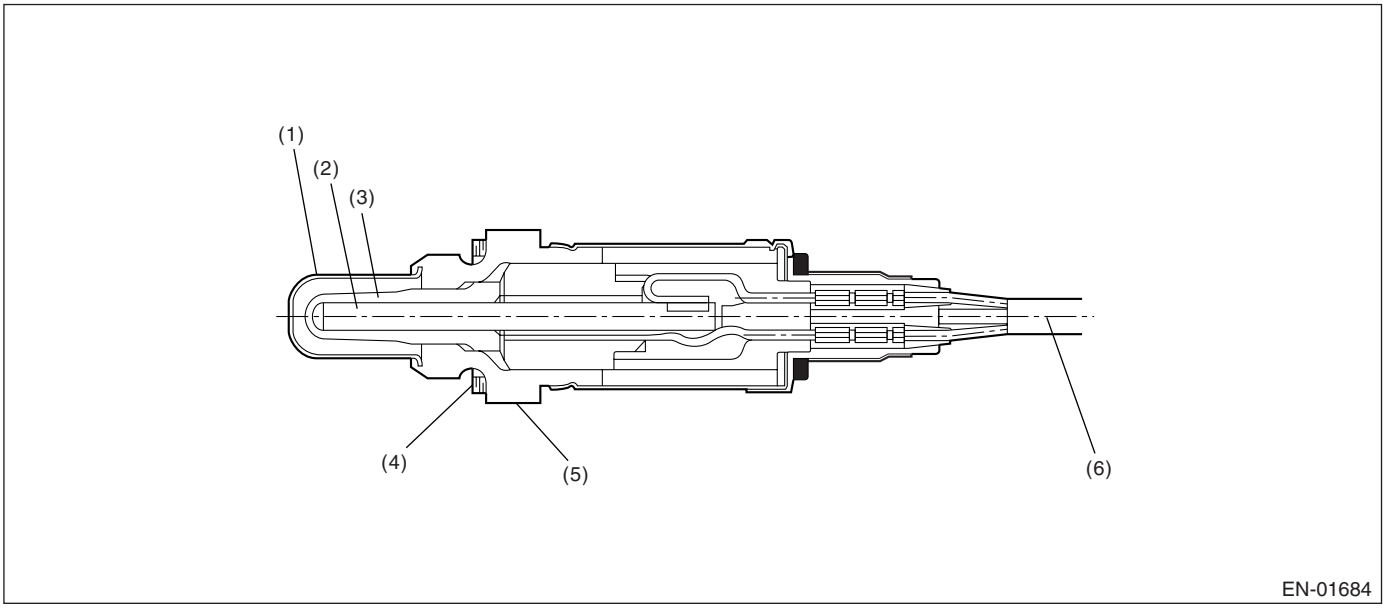
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor heater.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Protection tube
(2) Ceramic heater
(3) Zirconium tube
(4) Gasket
(5) Sensor housing
(6) Harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	≥ 500 rpm
After engine starting	10 seconds or more
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

In 10 seconds after starting the engine, perform the diagnosis just once.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes 10 seconds or more. Judge OK when the continuous time until completing none of the malfunction criteria below becomes 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
Calculated electric power	≥ 50 W

Time needed for diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

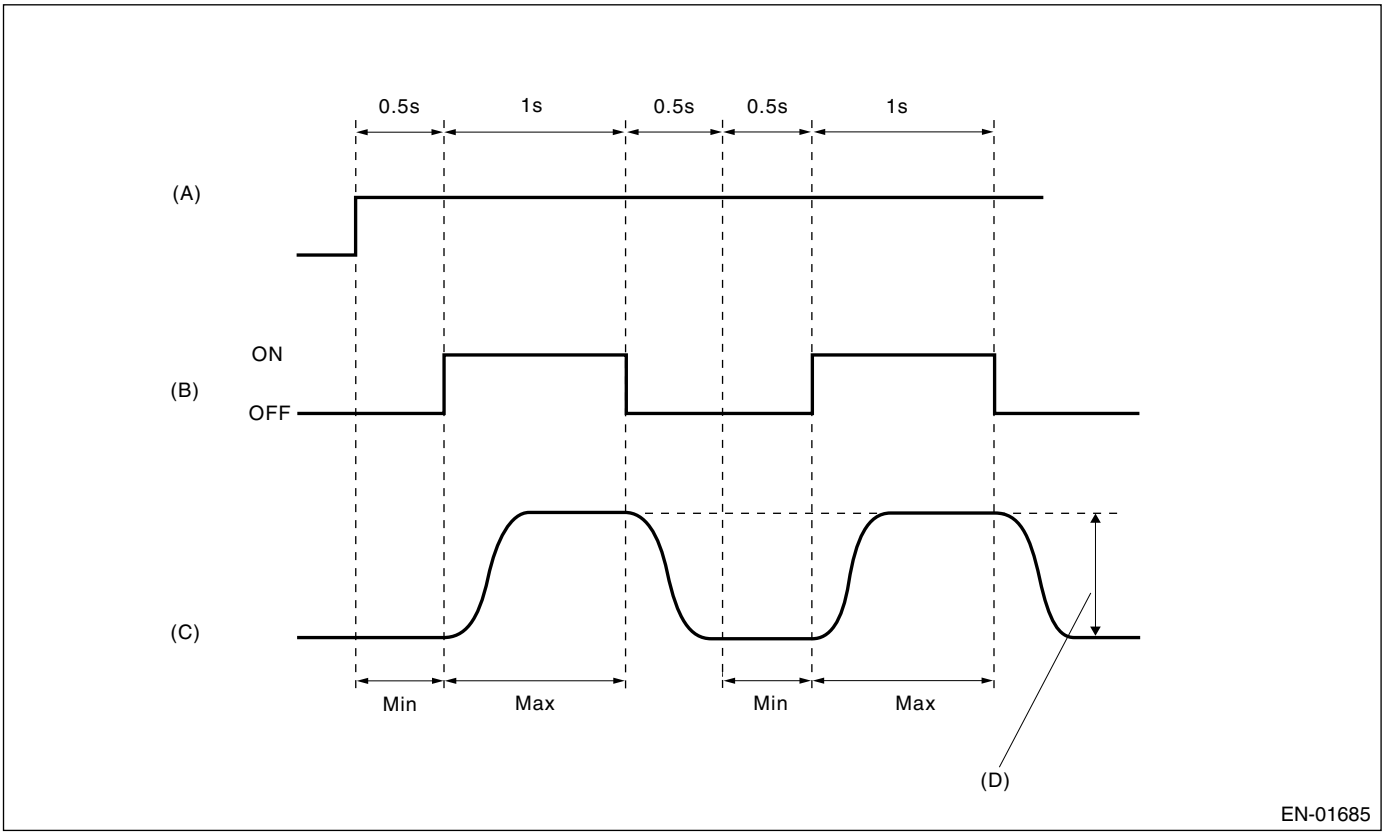
9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

F: DTC P0065 — AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE —

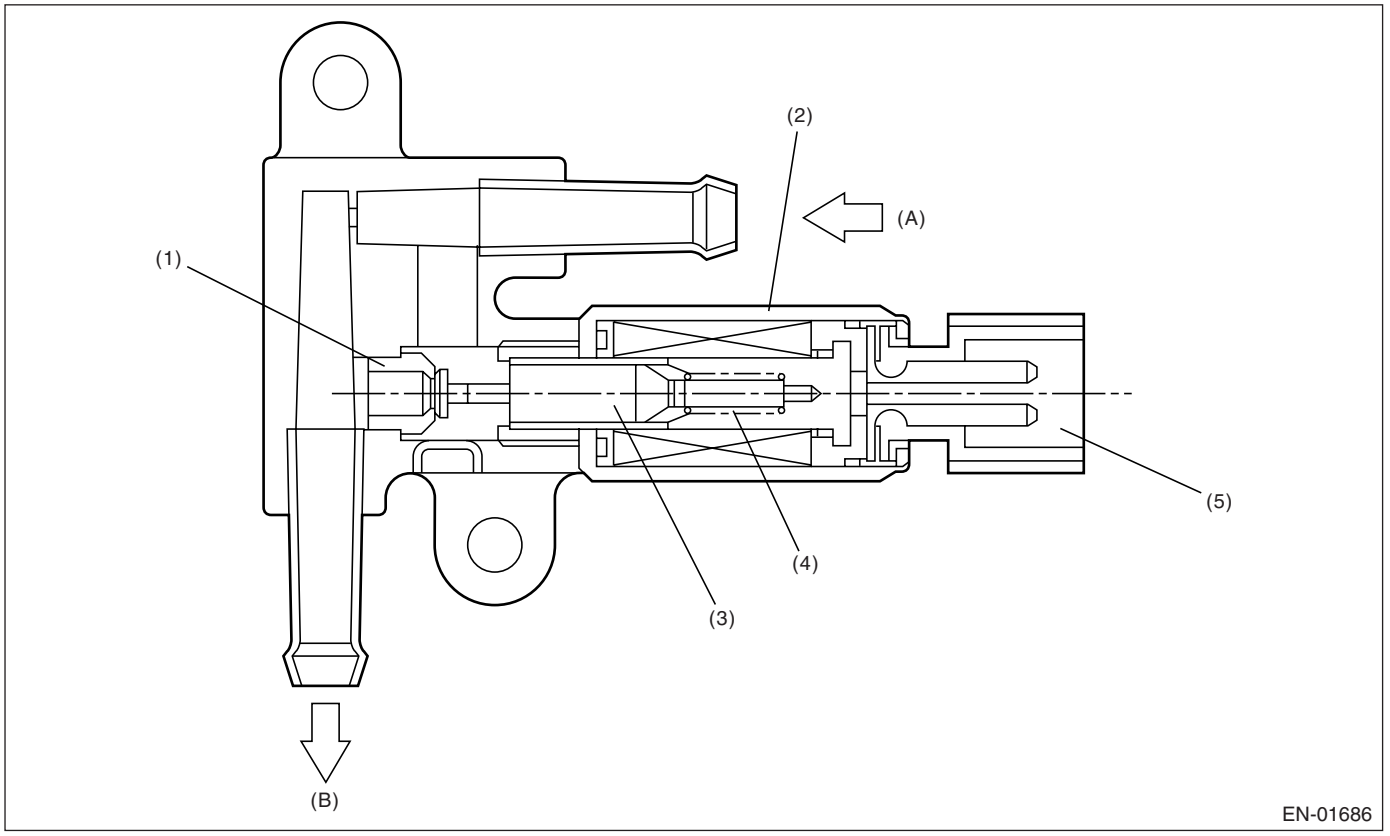
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of AAI solenoid valve.
Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during fuel cut at deceleration. At this time, opening AAI solenoid valve makes the intake manifold pressure larger. For AAI solenoid valve function diagnosis, judge OK or NG by the amount of change of intake manifold pressure when opening and closing the AAI solenoid valve.
Max. value with the valve open - Min. value with the valve closed < Threshold value → NG
Max. value with the valve open - Min. value with the valve closed ≥ Threshold value → OK



(A) Conditions executed for diagnosis
(B) AAI solenoid valve
(C) Intake manifold pressure (At normal condition)
(D) Diagnostic value

2. COMPONENT DESCRIPTION



(1) Valve seat
(2) Solenoid
(3) Plunger and valve
(4) Spring
(5) Connector
(A) From idle air control solenoid valve
(B) To injector

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75°C (167°F)
Engine speed	1300 ←→ 2300 rpm
Vehicle speed	≥ 60 km/h (37 MPH)
Atmospheric pressure	≥ 86 kPa (642 mmHg, 25 inHg)
Atmospheric-MAP	≥ 53 kPa (400 mmHg, 16 inHg)
Fuel cut event by coasting	In operation
AAI solenoid valve position	OFF (closed)
Intake manifold pressure	≥ 16.6 kPa (124.5 mmHg, 4.9 inHg)

4. GENERAL DRIVING CYCLE

Conduct a serial diagnosis during fuel cut at deceleration from approx. 100 km/h (62 MPH).
Be careful for vehicle speed and engine speed. (Diagnosis may not finish if the vehicle speed and engine speed conditions become out of specification.)

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed 2 times in a row. Judge OK and clear the NG if not completed once

Judgment Value

Malfunction Criteria	Threshold Value
Paai1 – Paai2	
Paai1; max. MAP value during AAI solenoid valve ON signal	0.7 kPa (5 mmHg, 0.2 inHg) [101 kPa (760 mmHg, 30 inHg) in atmospheric pressure]
Paai2; min. MAP value during 0.5 seconds just before changing the valve from OFF to ON	0.05 kPa (0.4mm, 0.016 inHg) [86 kPa (642 mmHg, 25 inHg) in atmospheric pressure]

Time needed for diagnosis: 9 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

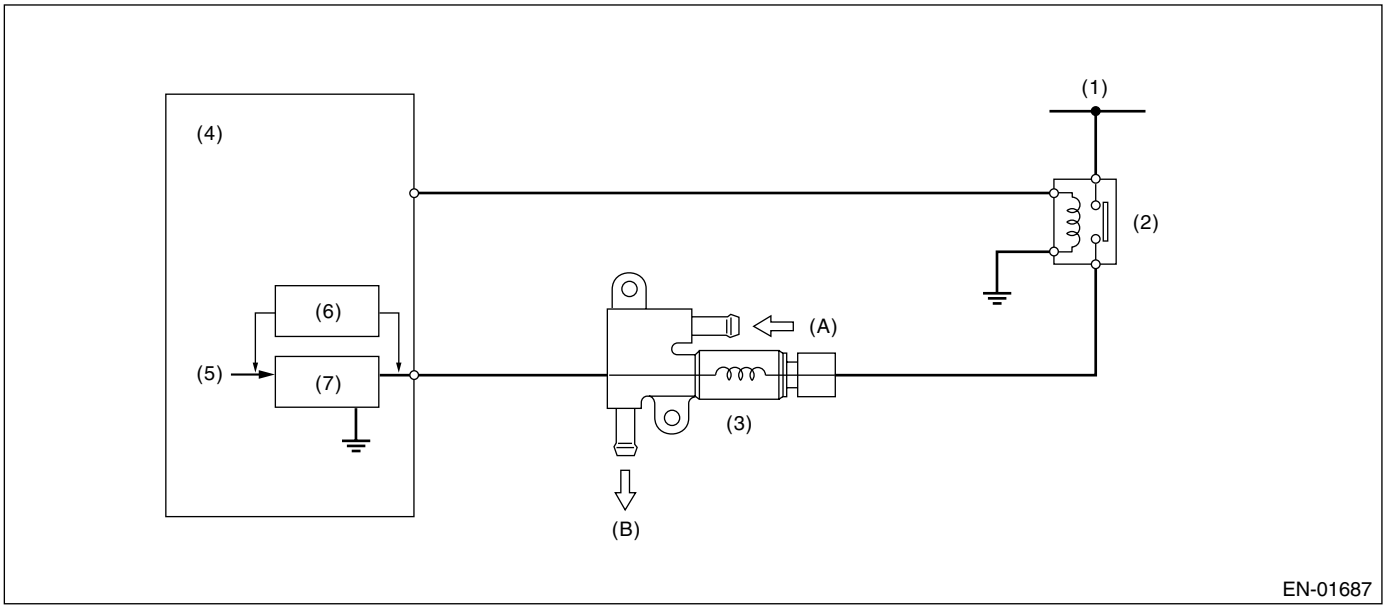
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of AAI solenoid valve. Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Battery
(2) Main relay
(3) AAI solenoid valve
(4) Engine control module (ECM)
(5) CPU
(6) Detecting circuit
(7) Switching circuit
(A) From idle air control solenoid valve
(B) To injector

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10.9 V
After engine starting	2 seconds or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis (2.5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	Low level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

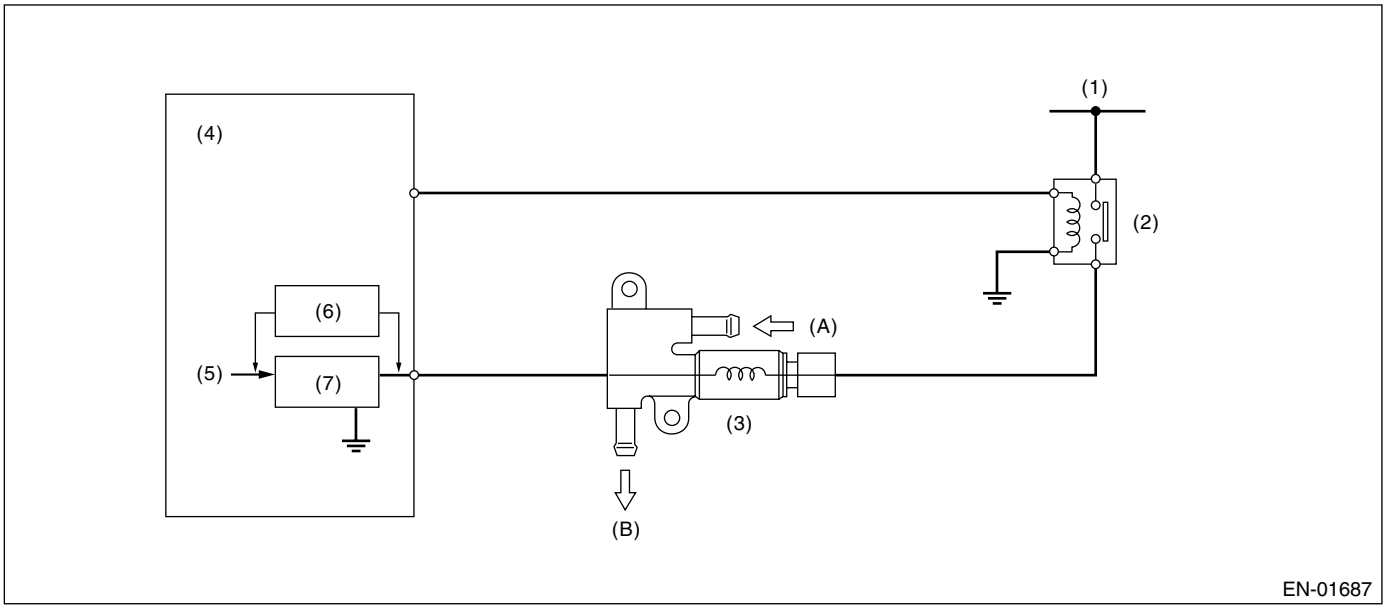
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of AAI solenoid valve. Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Battery
(2) Main relay
(3) AAI solenoid valve
(4) Engine control module (ECM)
(5) CPU
(6) Detecting circuit
(7) Switching circuit
(A) From idle air control solenoid valve
(B) To injector

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10.9 V
After engine starting	2 seconds or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	High level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

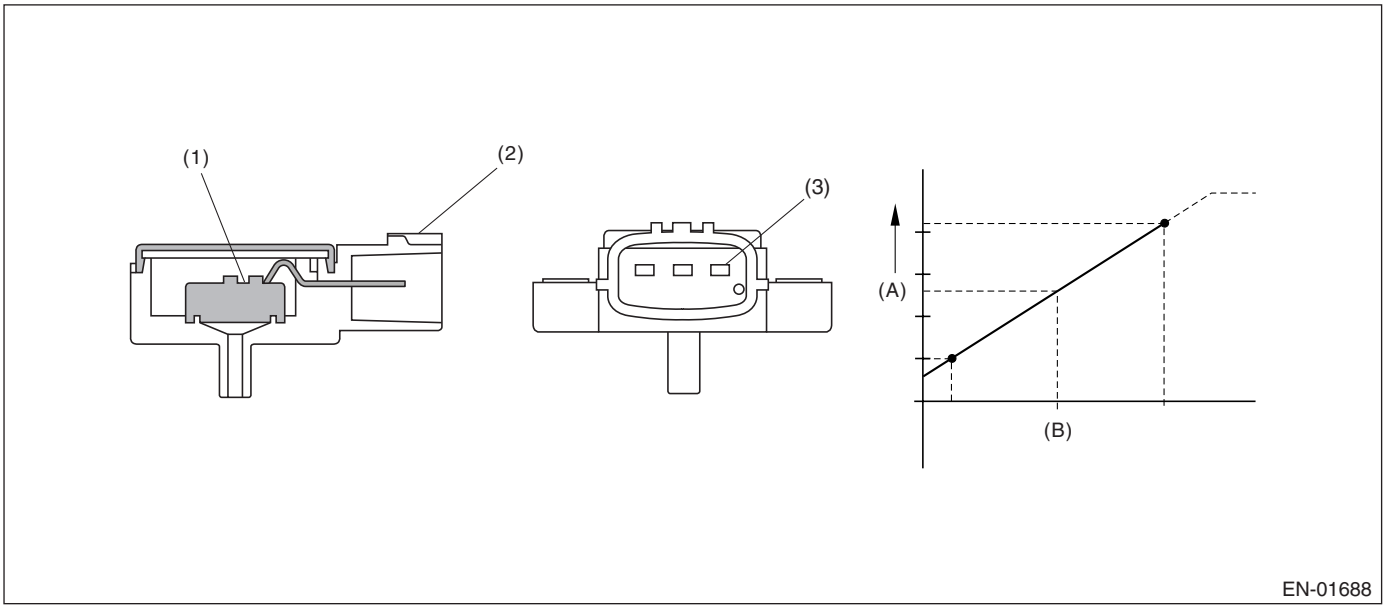
Memorize the freeze frame data. (For test mode $02)

I: DTC P0068 — MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake manifold pressure sensor output property.
Judge NG when the intake manifold pressure is small (voltage is low) regardless of the driving situation that the intake manifold pressure may be thought larger than engine speed and throttle opening. (Low side)
On the other hand, judge NG when the intake manifold pressure is large (voltage is high) regardless of the driving situation that the intake manifold pressure may be thought smaller than engine speed and throttle opening. (High side)

2. COMPONENT DESCRIPTION



(1) Pressure detecting part
(2) Connector
(3) Terminal
(A) Output voltage
(B) Input voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75°C (167°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria of Low side or High side below becomes more than the time (3 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Engine speed	> 2500 rpm
Throttle position	> 15°
Output voltage	≤ 0.985 V
(High side)	
Engine speed	600 ←→ 900 rpm
Throttle position	≤ 2°
Output voltage	> 2.81 V

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria of Low side or High side are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Engine speed	> 2500 rpm
Throttle position	> 15°
Output voltage	> 0.985 V
(High side)	
Engine speed	600 ←→ 900 rpm
Throttle position	≤ 2°
Output voltage	≤ 2.81 V

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

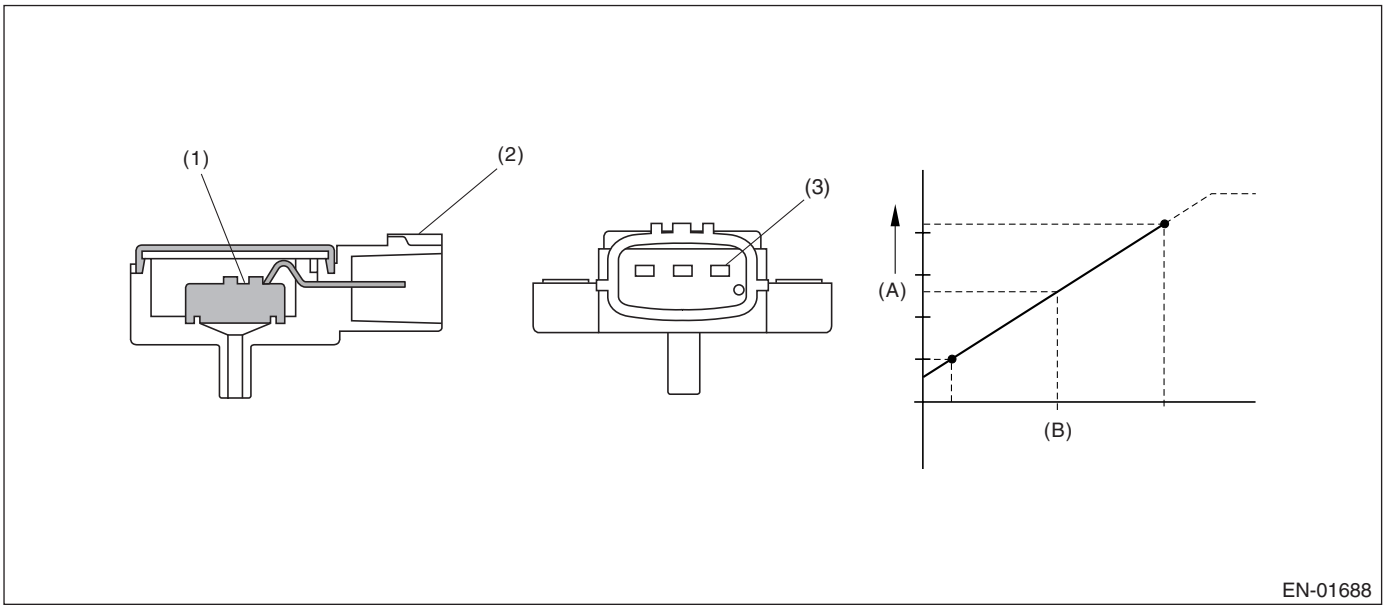
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Pressure detecting part
(2) Connector
(3) Terminal
(A) Output voltage
(B) Input voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.14 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Calculate the manifold absolute pressure using the map figured by engine speed and throttle opening grid.

9. ECM OPERATION AT DTC SETTING

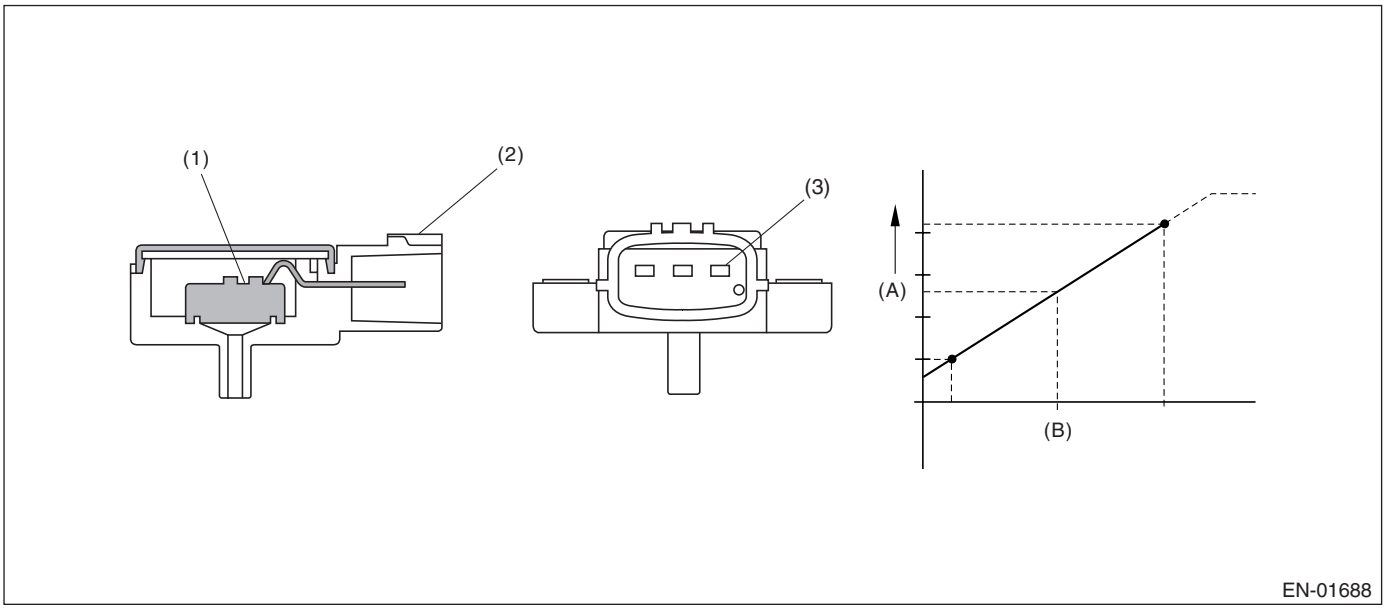
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Pressure detecting part
(2) Connector
(3) Terminal
(A) Output voltage
(B) Input voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.88 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Calculate the intake manifold pressure using the map figured by engine speed and throttle opening grid.

9. ECM OPERATION AT DTC SETTING

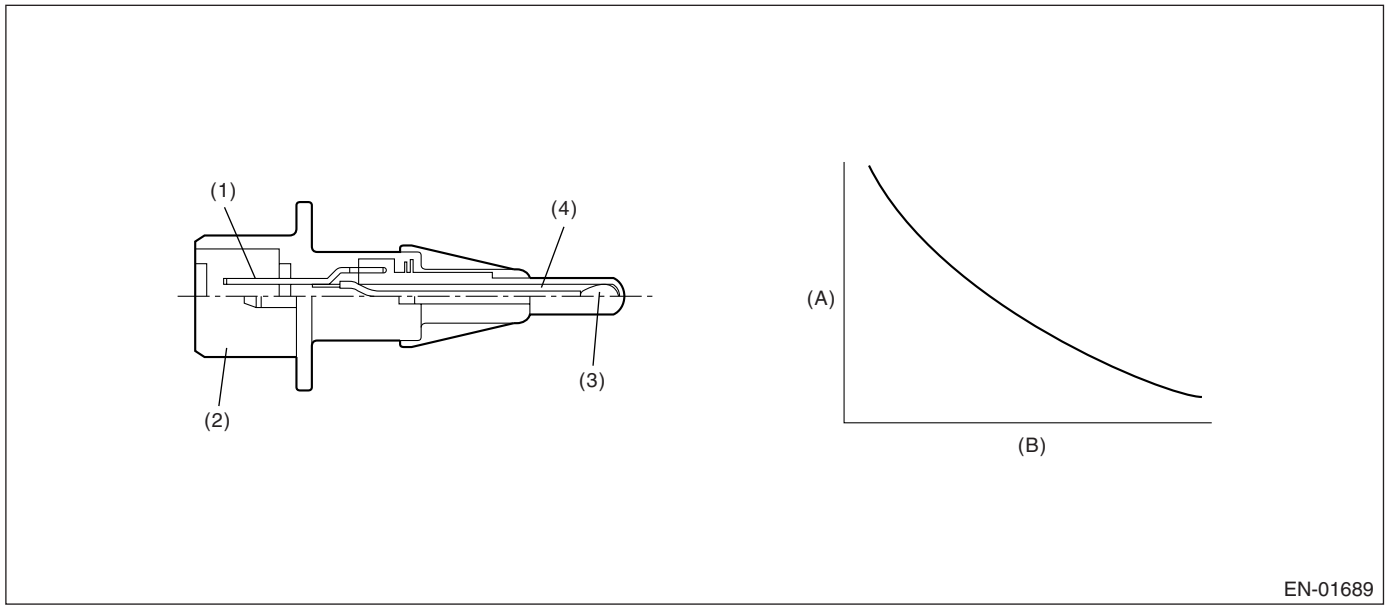
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.
Judge NG when the intake air temperature is high regardless of the driving condition that the intake air temperature may be low.

2. COMPONENT DESCRIPTION



(1) Terminal
(2) Connector
(3) Thermistor
(4) Housing
(A) Resistance value (Ω)
(B) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (3 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 40°C (104°F)
Fuel temperature	< 40°C (104°F)
Fuel level	10 ℓ (2.6 US gal, 2.2 Imp gal)
Intake air temperature	≥ 80°C (176°F)

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Intake air temperature	< 80°C (176°F)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

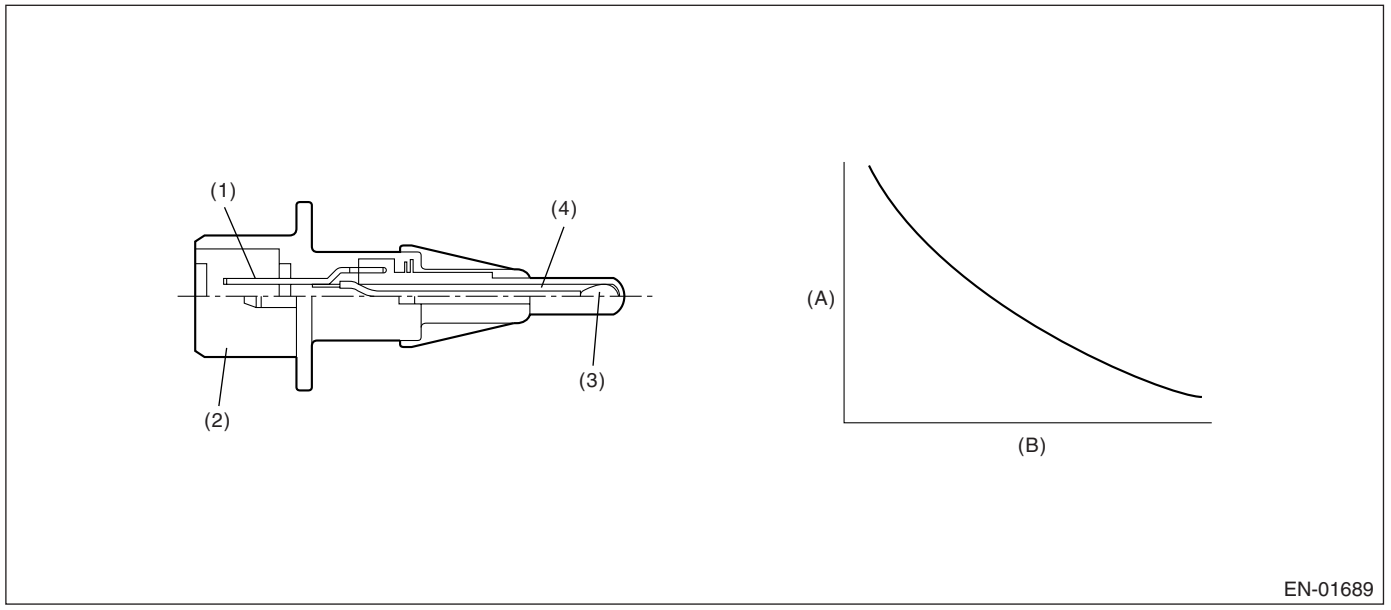
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake air temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Terminal
(2) Connector
(3) Thermistor
(4) Housing
(A) Resistance value (Ω)
(B) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

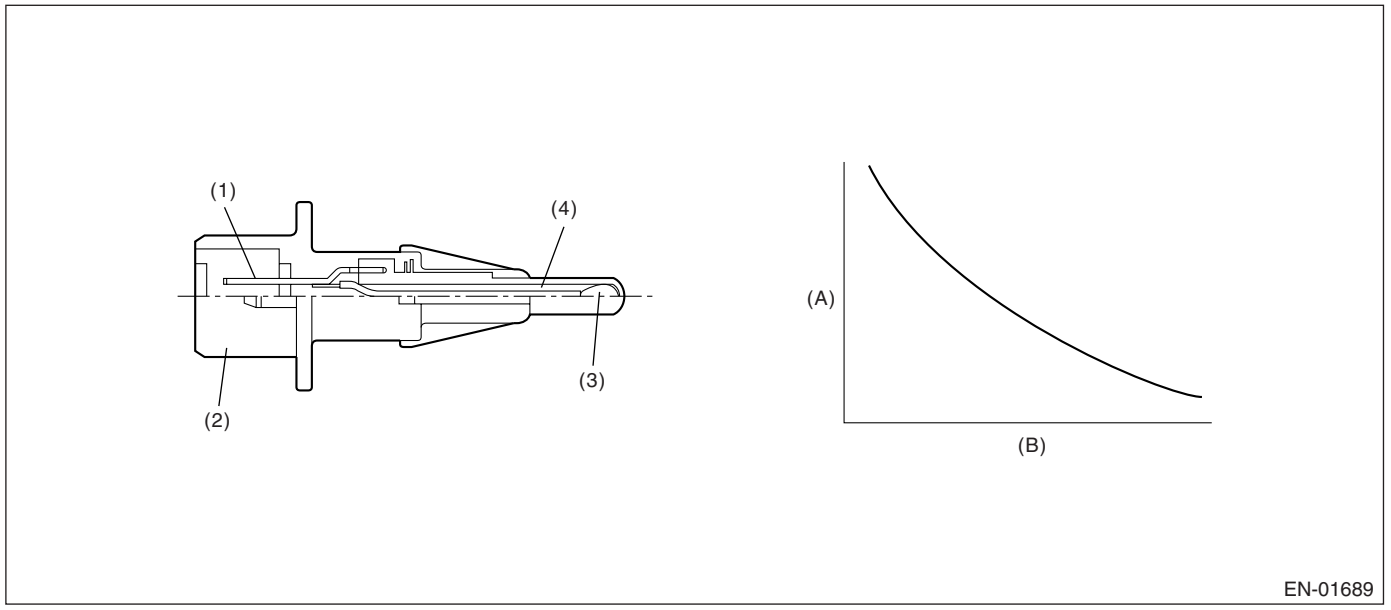
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake air temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Terminal
(2) Connector
(3) Thermistor
(4) Housing
(A) Resistance value (Ω)
(B) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.85 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

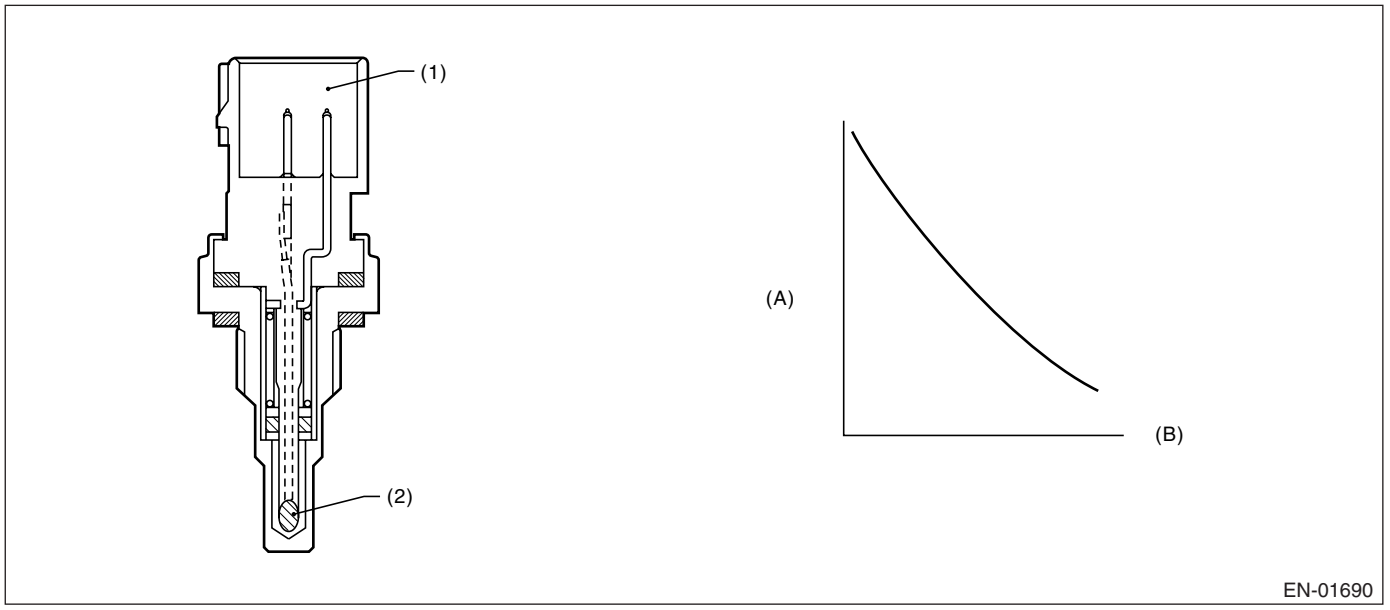
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of engine coolant temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Thermistor element
(A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.
Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.2 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Keep the engine coolant temperature at 70°C (158°F).

9. ECM OPERATION AT DTC SETTING

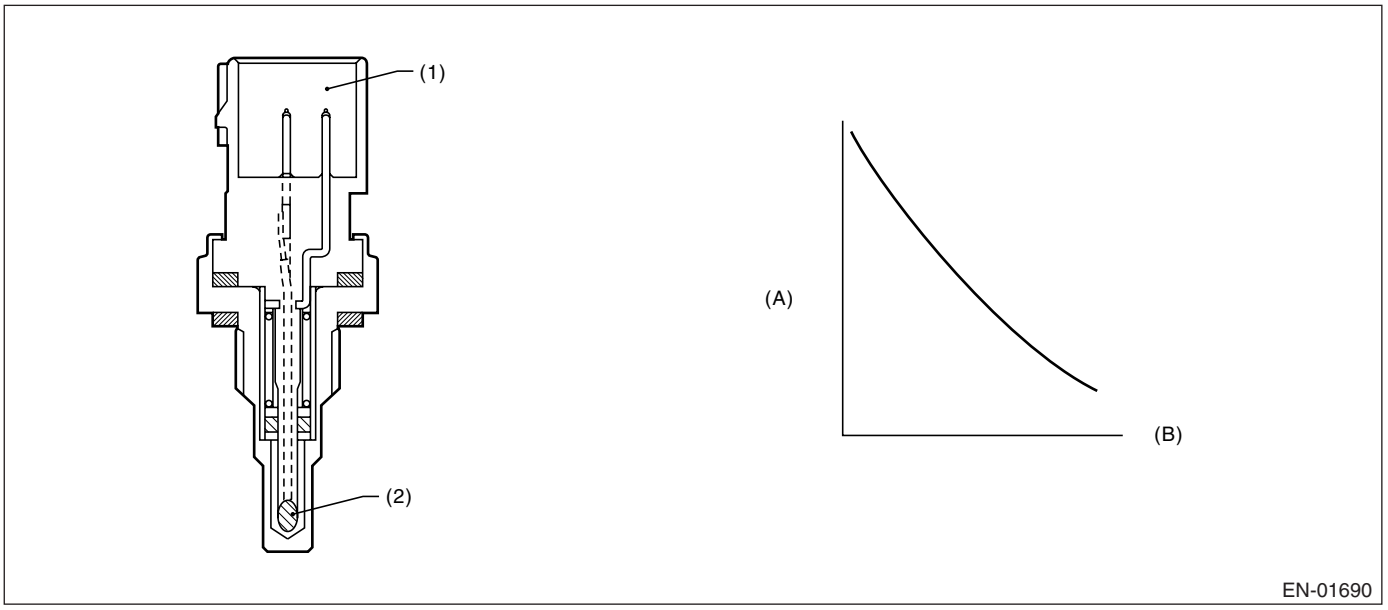
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of engine coolant temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Thermistor element
(A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.
Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.2 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.85 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Keep the engine coolant temperature at 70°C (158°F).

9. ECM OPERATION AT DTC SETTING

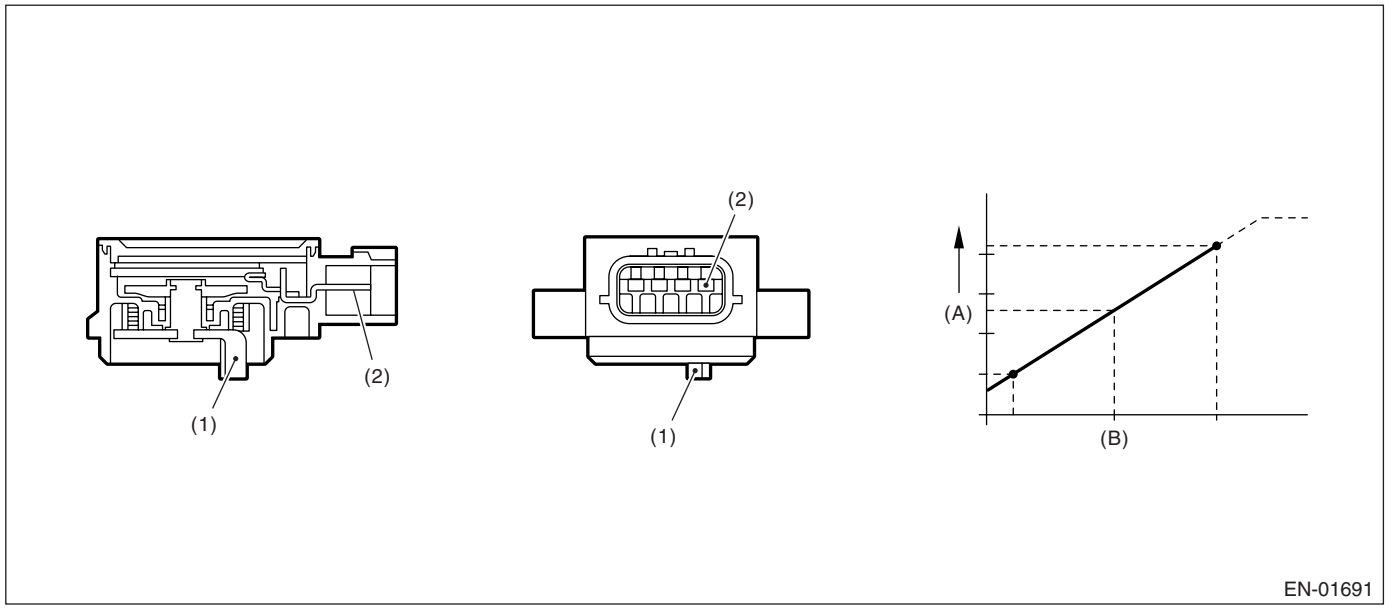
Memorize the freeze frame data. (For test mode $02)

Q: DTC P0121 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of throttle position sensor output property.
Judge NG when the throttle position value is low in spite of the driving condition that accelerator pedal seems to be depressed, or when the throttle position value is high in spite of the driving condition that accelerator pedal seems to be released from engine appearance.

2. COMPONENT DESCRIPTION



(1) Lever
(2) Terminal
(A) Output voltage
(B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Coolant temperature	≥ 75°C (167°F)

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously after starting engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria of Low side or High side below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Output voltage	≤ 0.75 V
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 90 kg (198 lb)/h
Intake manifold pressure	≥ 80 kPa (600 mmHg, 24 inHg)
(High side)	
Output voltage	≥ 1.6 V
Engine speed	600 — 1500 rpm
Amount of intake air	≤ 25 kg (55 lb)/h
Intake manifold pressure	≤ 47 kPa (352 mmHg, 14 inHg)

• Time Needed for Diagnosis:

Low side	3 seconds
High side	10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Output voltage	> 0.75 V
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 90 kg (198 lb)/h
Intake manifold pressure	≥ 80 kPa (600 mmHg, 24 inHg)
(High side)	
Output voltage	≤ 1.6 V
Engine speed	600 — 1500 rpm
Amount of intake air	≤ 25 kg (55 lb)/h
Intake manifold pressure	≤ 47 kPa (352 mmHg, 14 inHg)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the throttle position to 6.4°.

9. ECM OPERATION AT DTC SETTING

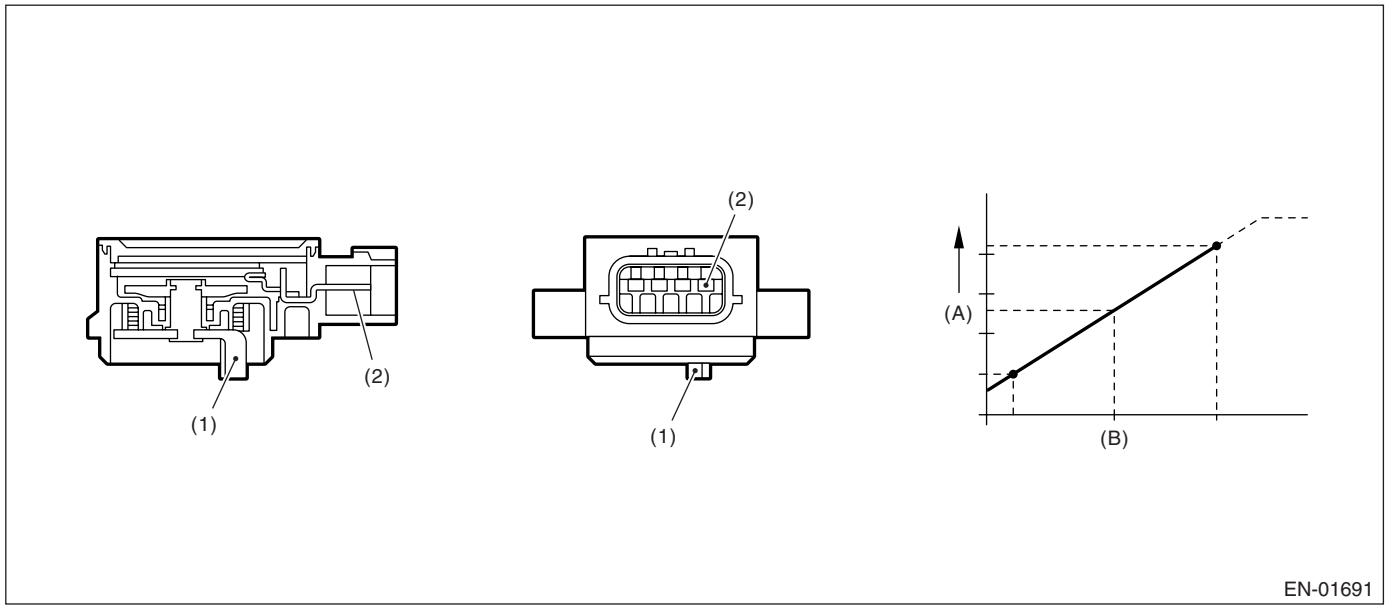
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Lever
(2) Terminal
(A) Output voltage
(B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.
Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage — closed	< 0.1 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the throttle position to 6.4°.

9. ECM OPERATION AT DTC SETTING

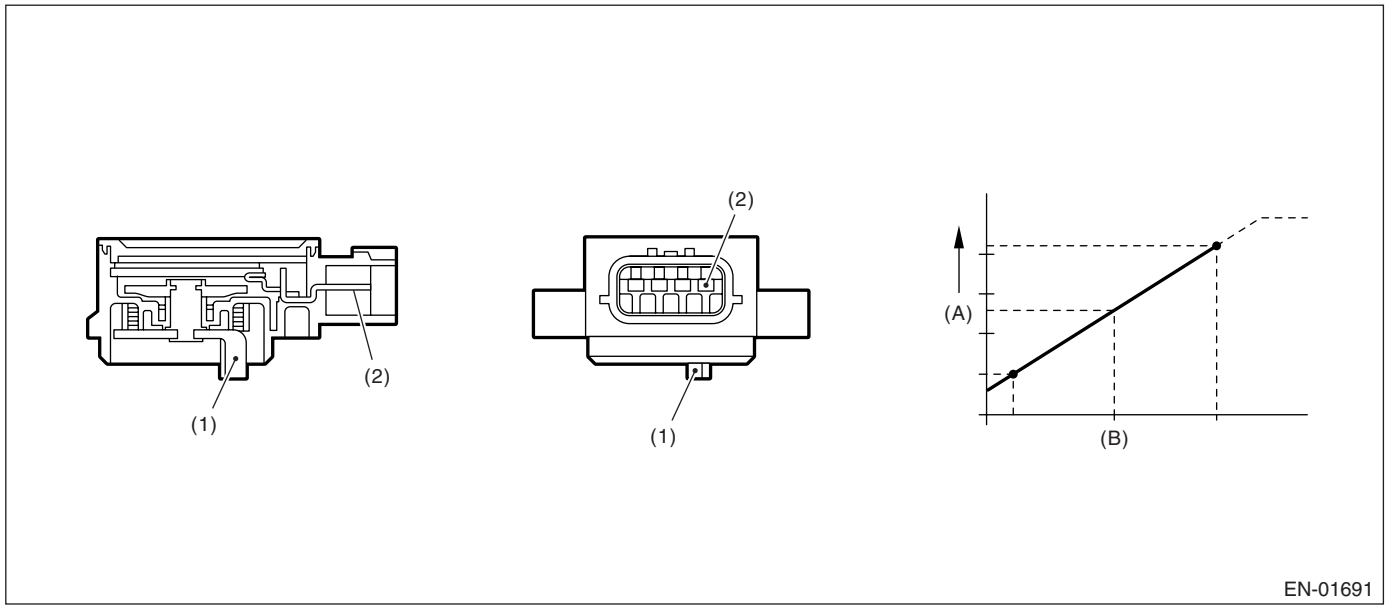
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Lever
(2) Terminal
(A) Output voltage
(B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.
Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage — WOT	≥ 4.9 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the throttle position to 6.4°.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature sensor output property. Judge NG when the engine coolant temperature does not increase after engine starting in spite of the driving condition that it seems to increase.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVE CYCLE

Always perform the diagnosis until the engine coolant temperature becomes 20°C (68°F) after starting engine with cooled condition or until NG is judged once.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear NG when the engine coolant temperature is more than 20°C (68°F) or more.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.38 V
Timer after starting the engine except fuel cut a) Timer OFF of fuel cut mode. b) The timer is counted more than 50ms + TWCNT milliseconds per 50 milliseconds under driving condition without above. TWCNT is determined as following. • Idle switch ON: TWCNT = 0 • Idle switch OFF: Refer to Map 1	≥ Judgment time

Map 1

	Vehicle speed 10 km/h (6 MPH)	Vehicle speed 24 km/h (15 MPH)	Vehicle speed 40 km/h (25 MPH)	Vehicle speed 56 km/h (35 MPH)
Temperature –20°C (–4°F)	0 ms	5 ms	10 ms	20 ms
Temperature –7°C (19°F)	0 ms	30 ms	60 ms	60 ms
Temperature 10°C (50°F)	0 ms	90 ms	180 ms	180 ms
Temperature 20°C (68°F)	0 ms	90 ms	180 ms	180 ms

Judgment time: Find from minimum engine coolant temperature.

Minimum engine coolant temperature °C (°F)	–30 (–22)	0 (32)	30 (86)	60 (140)	64.25 (147.65)
Judgment time (second)	630.05	429.5	228.95	28.4	0

Time Needed for Diagnosis: Change at minimum engine coolant temperature.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

Keep engine coolant temperature at 70°C (158°F).

8. ECM OPERATION AT DTC SETTING

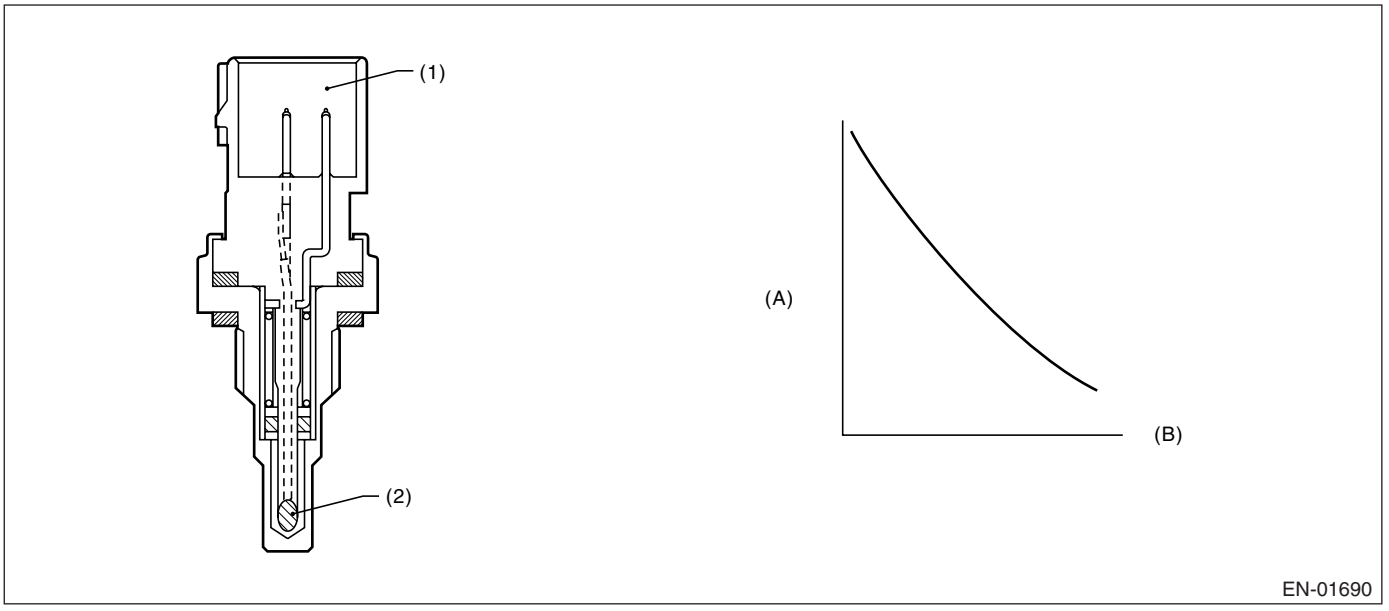
Memorize the freeze frame data. (For test mode $02)

U: DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output properly. Judge NG when the engine coolant temperature sensor output does not change whereas it seemed to change from the viewpoint of the engine condition.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Thermistor element
(A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time elapsed after engine starting	> 1 second
More than 20 seconds with idling after engine starting	Experienced
More than 20 seconds with vehicle running at 20 km/h (12 MPH) or more	Experienced

4. GENERAL DRIVING CYCLE

After idling and running for the specified time, perform the diagnosis only once for OK/NG judgment.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completedand judge OK when not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature sensor Max. voltage – Min. voltage	≤ 0.005 V

Time Needed for Diagnosis: To be determined. (It is varied by Min. engine coolant temperature and engine conditions such as vehicle speed and engine coolant temperature.)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATING AT DTC SETTING

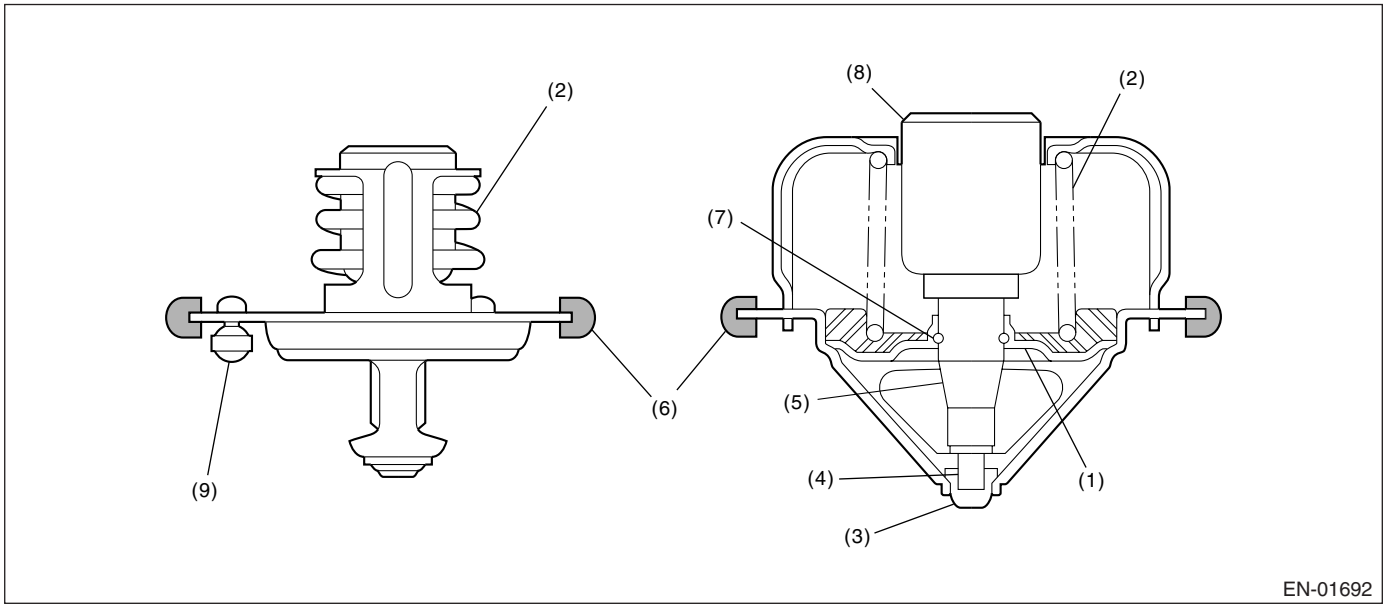
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of thermostat.
Thermostat open fixing may result in overcooling. Therefore, engine coolant temperature becomes low and the control is unable under theoretical air fuel ratio, so the exhaust deteriorate. Furthermore, it is impossible to perform the other diagnosis if the engine coolant temperature does not rise. For these reasons, thermostat open fixing diagnosis should be conducted.
Judge NG when the estimated engine coolant temperature is higher than engine coolant temperature and the difference between them is large. Judge OK when the engine coolant temperature becomes 75°C (167°F) before judging NG.

2. COMPONENT DESCRIPTION



(1) Valve
(2) Spring
(3) Stopper
(4) Piston
(5) Guide
(6) Rubber packing
(7) Stop ring
(8) Wax element
(9) Jiggle valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ambient air temperature	≥ –7°C (19°F)
Engine coolant temperature at engine starting	< 55°C (131°F)

4. GENERAL DRIVING CYCLE

After starting the engine at cool condition, always perform the diagnosis until the engine coolant temperature becomes more than 75°C (167°F).

5. DIAGNOSTIC METHOD

Judge NG when the estimated engine coolant temperature comes to 75°C (167°F) before the engine coolant temperature becomes 75°C (167°F) and the difference between them becomes more than 30°C (86°F). Judge OK when the engine coolant temperature comes to 75°C (167°F) before judging NG.

• Abnormality Judgment

Judge NG when the cumulative time becomes more than 30 seconds after completing all the malfunction criteria below.

• Judgment Value

Malfunction Criteria	Threshold Value
(Estimated-measured) coolant temperature	≥ 30°C (86°F)
Engine coolant temperature	< 75°C (167°F)
Estimated coolant temperature	≥ 75°C (167°F)
Vehicle speed	≥ 40 km/h (25 MPH)
Injector pulse	≥ 1.92 milliseconds

Time Needed for Diagnosis: 30 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
(Estimated-measured) coolant temperature	≤ 30°C (86°F)
Engine coolant temperature	≥ 75°C (167°F)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

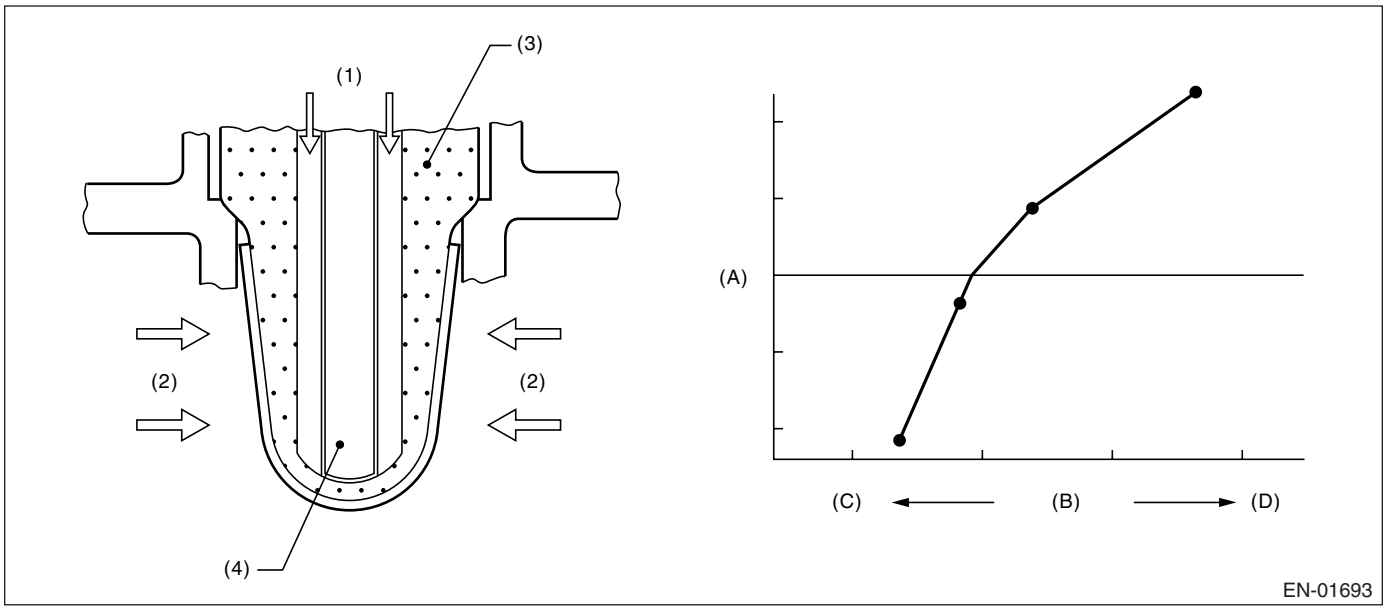
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

W: DTC P0130 — O_2 SENSOR CIRCUIT (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of front oxygen (A/F) sensor output property.
Judge NG when the front oxygen (A/F) sensor output continues to be lean.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation
Fuel shut-off event	Not in operation
Misfire rate during 200 engine revs.	≤ 1.0%
After engine starting	230 seconds or more
Engine coolant temperature	≥ 75°C (167°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 230 seconds after engine starting.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis

• Judgment Value

Malfunction Criteria	Threshold Value
A/F sensor output (VAF) Lambda fudge factor (LAMBDA)	> 2.3 V (lean) = Rich clamp at MAX limiter (1.375)

Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when the cumulative time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis

• Judgment Value

Malfunction Criteria	Threshold Value
A/F sensor output (VAF)	≤ 2.3 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

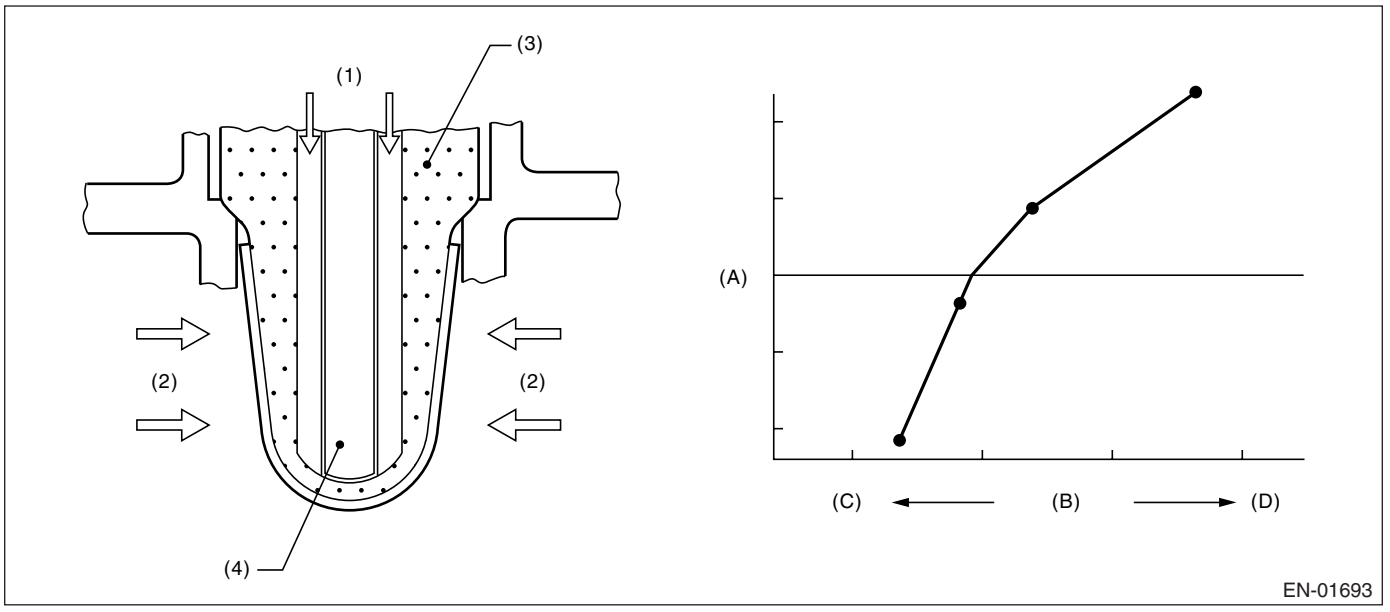
Memorize the freeze frame data. (For test mode $02)

X: DTC P0131 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the low voltage short circuit of front oxygen (A/F) sensor.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of low voltage short circuit NG is transmitted.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below is completed.
Judgment Value

Malfunction Criteria	Threshold Value
AFC voltage	< 3.5 V
AFV voltage	< 2.5 V

Time Needed for Diagnosis: 5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

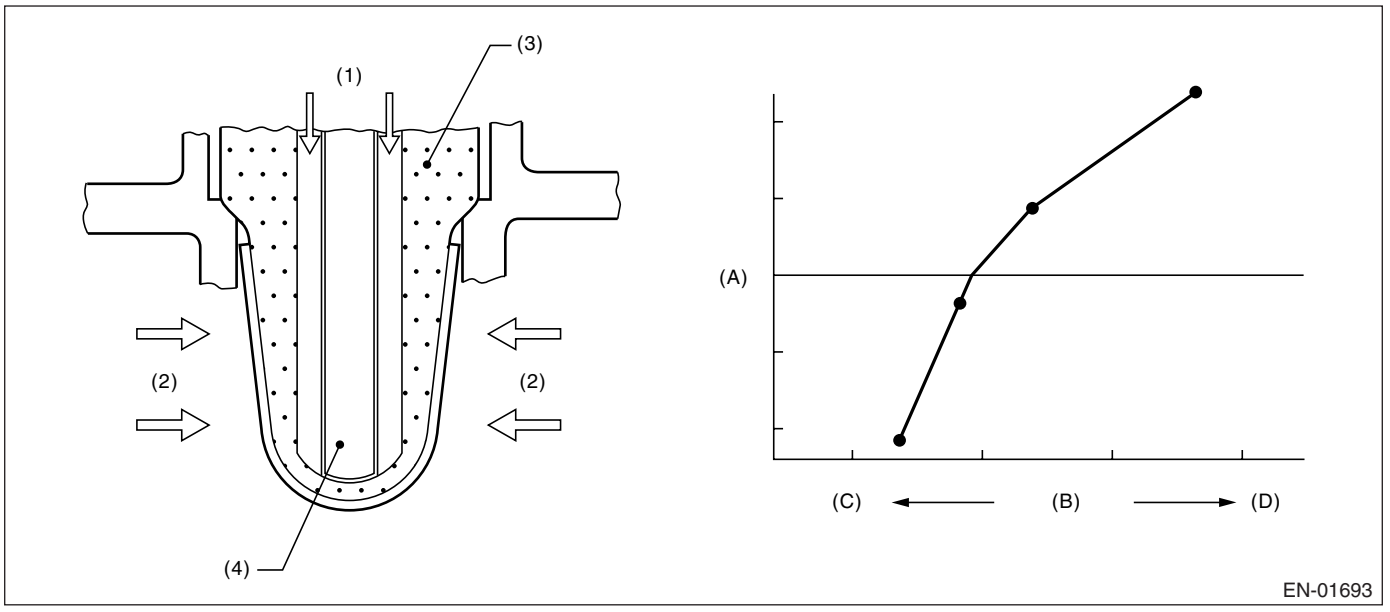
Memorize the freeze frame data. (For test mode $02)

Y: DTC P0132 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the high voltage short circuit of front oxygen (A/F) sensor.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of high voltage short circuit NG is transmitted.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
AFC voltage	> 4.5 V
AFV voltage	> 5.0 V

Time Needed for Diagnosis: 5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

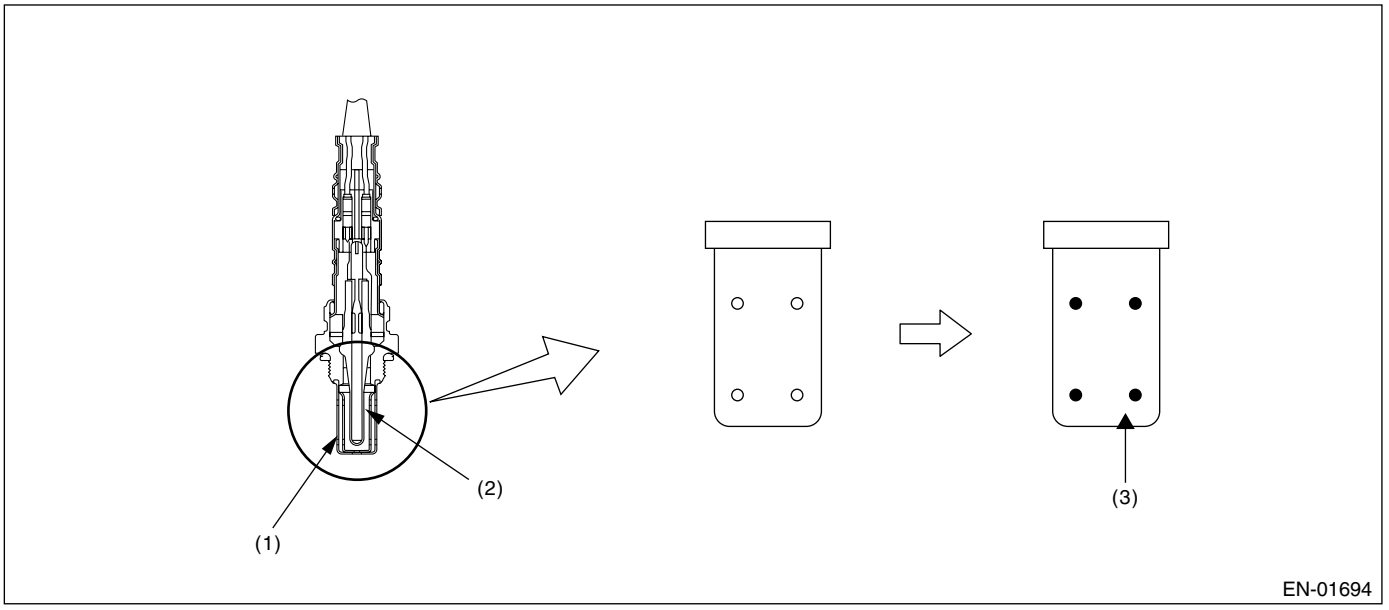
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

Z: DTC P0133 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —

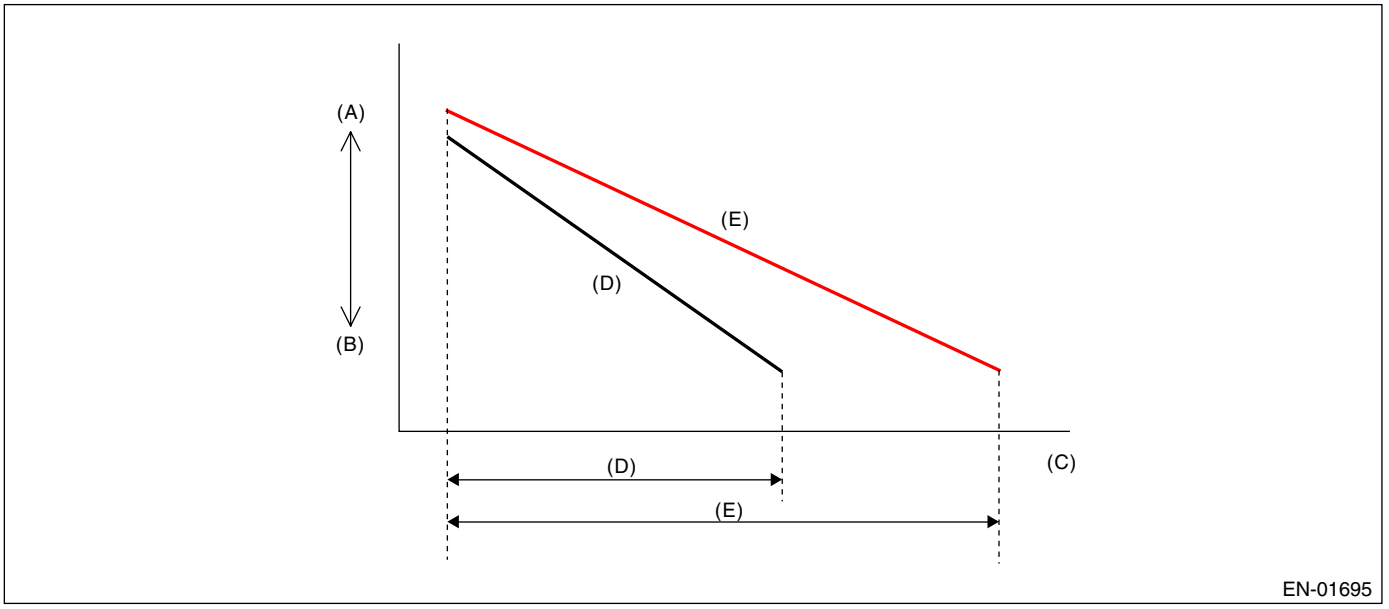
1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.
When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the cover has clogged holes, the rich to lean judgment in ECM is delayed when the change from rich to lean is caused.



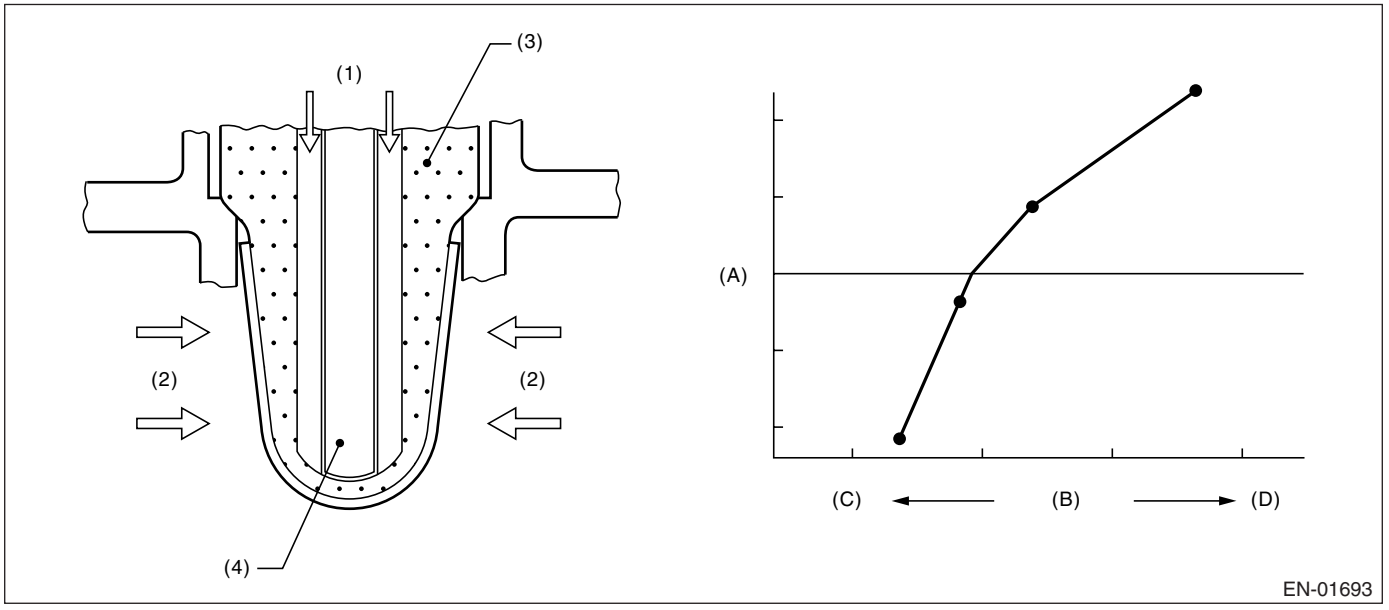
(1) Cover (2) Zirconia (3) Clogging

When abnormal, the variation period from rich to lean is longer than when normal, as shown in the figure below.
When the condition is completed, the variation time from rich to lean and vice versa is calculated by varying the desired A/F value. Judge NG when the period is long.



(A) Rich
(B) Lean
(C) Time
(D) Normal
(E) Malfunction

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Closed loop control	In operation
Average lambda	0.703 ←→ 1.375
After starting the engine	225 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Injector pulse	1.792 ←→ 4.032 milliseconds
Engine speed	1800 ←→ 3000 rpm
Vehicle speed	≥ 76 km/h (47 MPH)
Atmospheric air pressure	≥ 76 kPa (568 mmHg, 22 inHg)
Throttle position change for 90 milliseconds	< 1.60°
Impedance of lambda sensor	10 ←→ 40 Ω
Misfire rate at engine 200 rev.	≤ 1.0%

4. GENERAL DRIVING CYCLE

Perform diagnosis constantly at greater than 76 km/h (47 MPH) just once in 225 seconds after starting the engine.

5. DIAGNOSTIC METHOD

When enable conditions are completed, measure the A/F sensor output A/F value variation period by changing air fuel ratio desired value to lean and rich. Judge NG when this period is long. Judge OK when this period is short.
Judge NG when the malfunction criteria below is completed. Judge OK when the malfunction criteria below is not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Average time of 5 changes from rich to lean, and from lean to rich Response time when noise is detected is not used as data.	> See Map 5

Map 5

Engine Speed (Ne) (rpm)	1.75 — 2.25 (milliseconds)	2.25 — 2.75 (milliseconds)	2.75 — 3.19 (milliseconds)	3.19 — (milliseconds)
1800 ≤ Ne < 2100	1828	1825	1828	1828
2100 ≤ Ne < 2500	1167	976	976	911
2500 ≤ Ne < 3000	1095	976	976	911
3000 ≤ Ne	1095	872	825	825

Time Needed for Diagnosis: 2 to 12 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

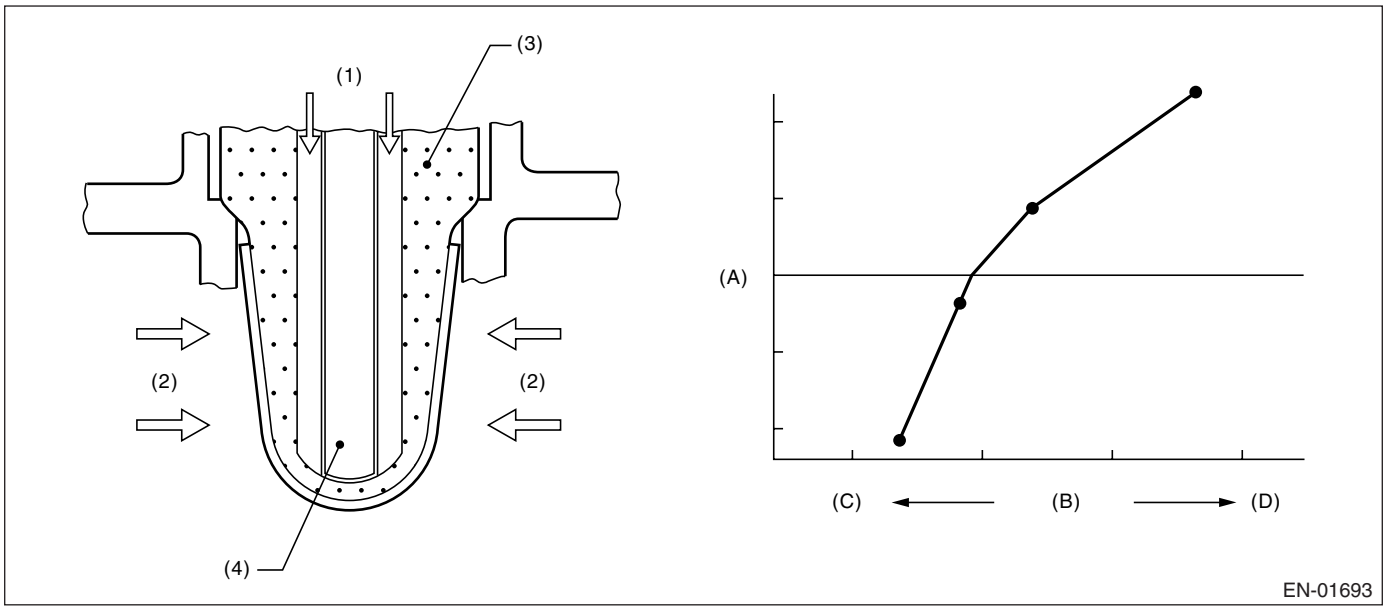
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AA: DTC P0134 — O_2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the open circuit of front oxygen (A/F) sensor.
Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit NG is transmitted.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than the time (5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Heater control	In operation
Resistance of front oxygen (A/F) sensor	> 500 Ω

Time Needed for diagnosis: 5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

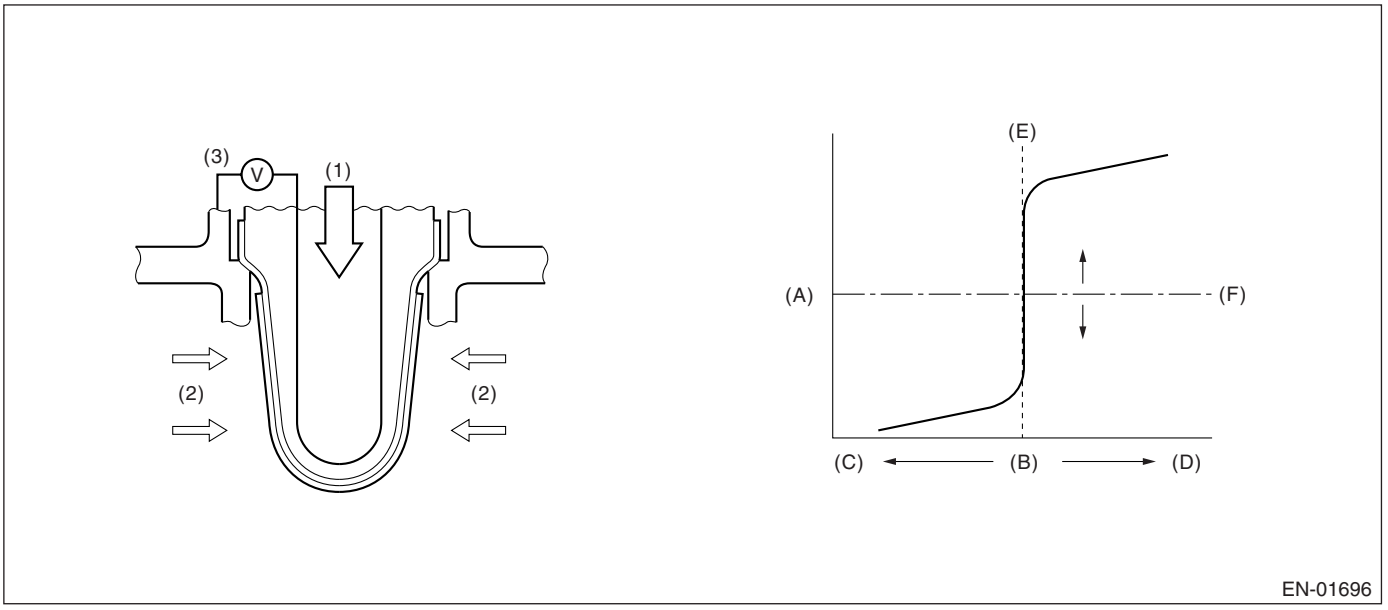
Memorize the freeze frame data. (For test mode $02)

AB:DTC P0137 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once during the closed loop.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Maximum output voltage	< 490 mV
Coolant temperature	≥ 75°C (167°F)
Injector pulse	≥ 2.24 milliseconds
Engine speed	≥ 1500 rpm
2 seconds or more fuel shut-off in decel.	Experienced
Vehicle speed	≥ 32 km/h (20 MPH)
Engine misfire	None

Time Needed for Diagnosis: 200 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
maximum output voltage	≥ 490 mV

6. DTC CLEAR CONDITION

- When the OK driving cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

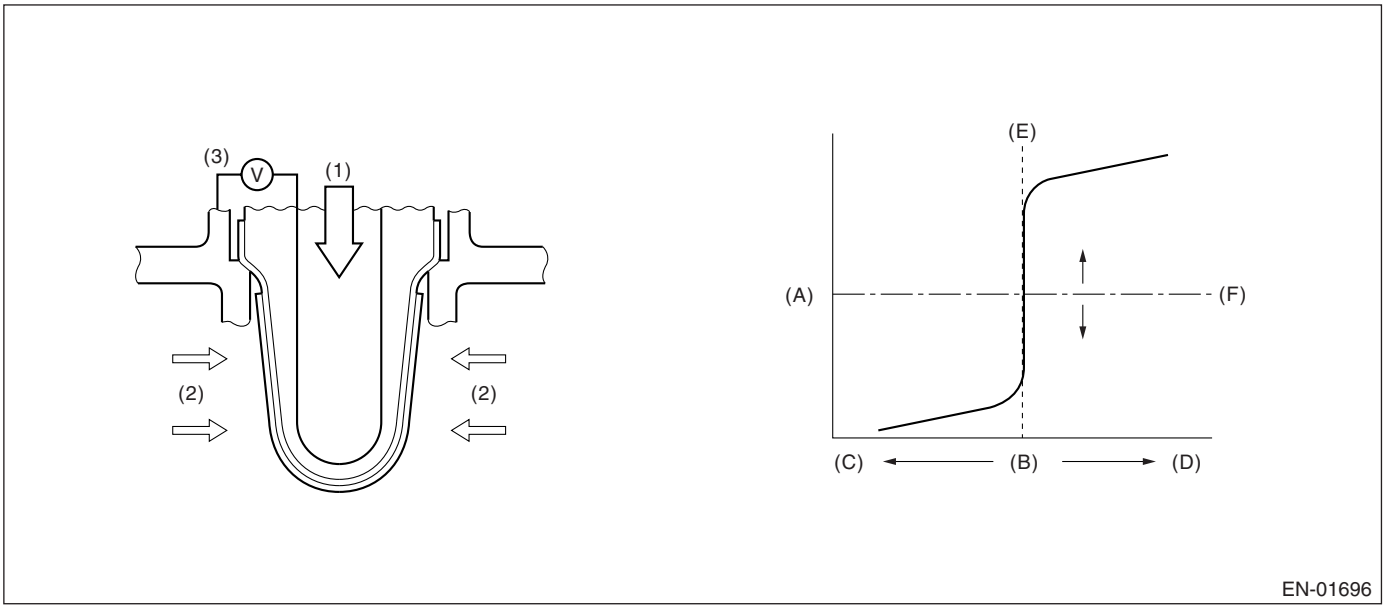
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AC:DTC P0138 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once during the closed loop.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing all the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage	≥ 250 mV
Coolant temperature	≥ 75°C (167°F)
Injector pulse	≥ 2.24 milliseconds
Engine speed	≥ 1500 rpm
2 seconds or more fuel shut-off in decel.	Experienced
Vehicle speed	≥ 32 km/h (20 MPH)
Engine misfire	None

Time Needed for Diagnosis: 200 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage	< 250 mV

6. DTC CLEAR CONDITION

- When the OK driving cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AD:DTC P0139 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —

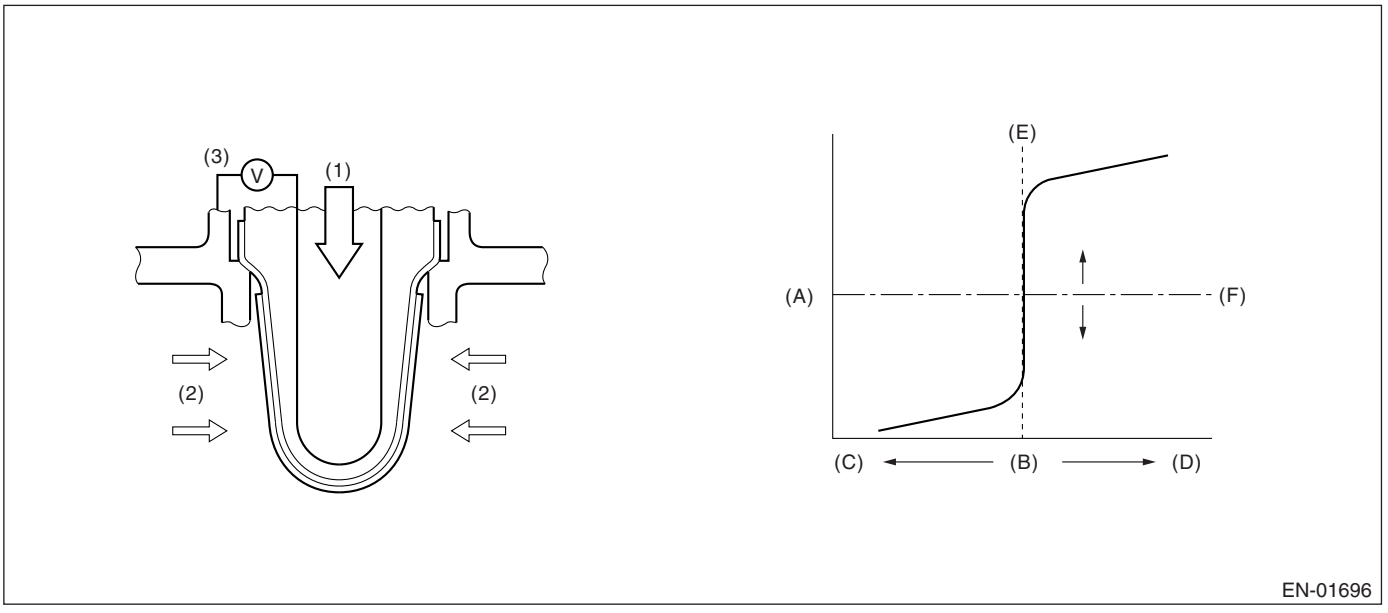
1. OUTLINE OF DIAGNOSIS

Detect the slow response of oxygen sensor.
Rich → Lean response diagnosis, Lean → Rich response diagnosis:
Judge NG, if in this case of either NG.
Judge OK, in this case of both OK.
[Rich → Lean response diagnosis]
(1) Measure the response time of oxygen sensor output signal change when A/F ratio is changed from rich to lean. Judge NG when response time is larger as from threshold value. Judge OK when it time is smaller as from threshold value.
(2) Judge NG when oxygen sensor voltage after the recovery of fuel cut at deceleration is high (rich).
[Lean → Rich response diagnosis]
(1) Measure the response time of oxygen sensor output signal change when A/F ratio is changed from lean to rich. Judge NG when response time is larger as from threshold value.
(2) Judge NG when oxygen sensor voltage after the recovery of fuel cut at deceleration is low and oxygen sensor voltage remains at low voltage.

• Diagnostic Method

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes from rich to lean. And Judge NG when the measured response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

- Rich → Lean response diagnosis

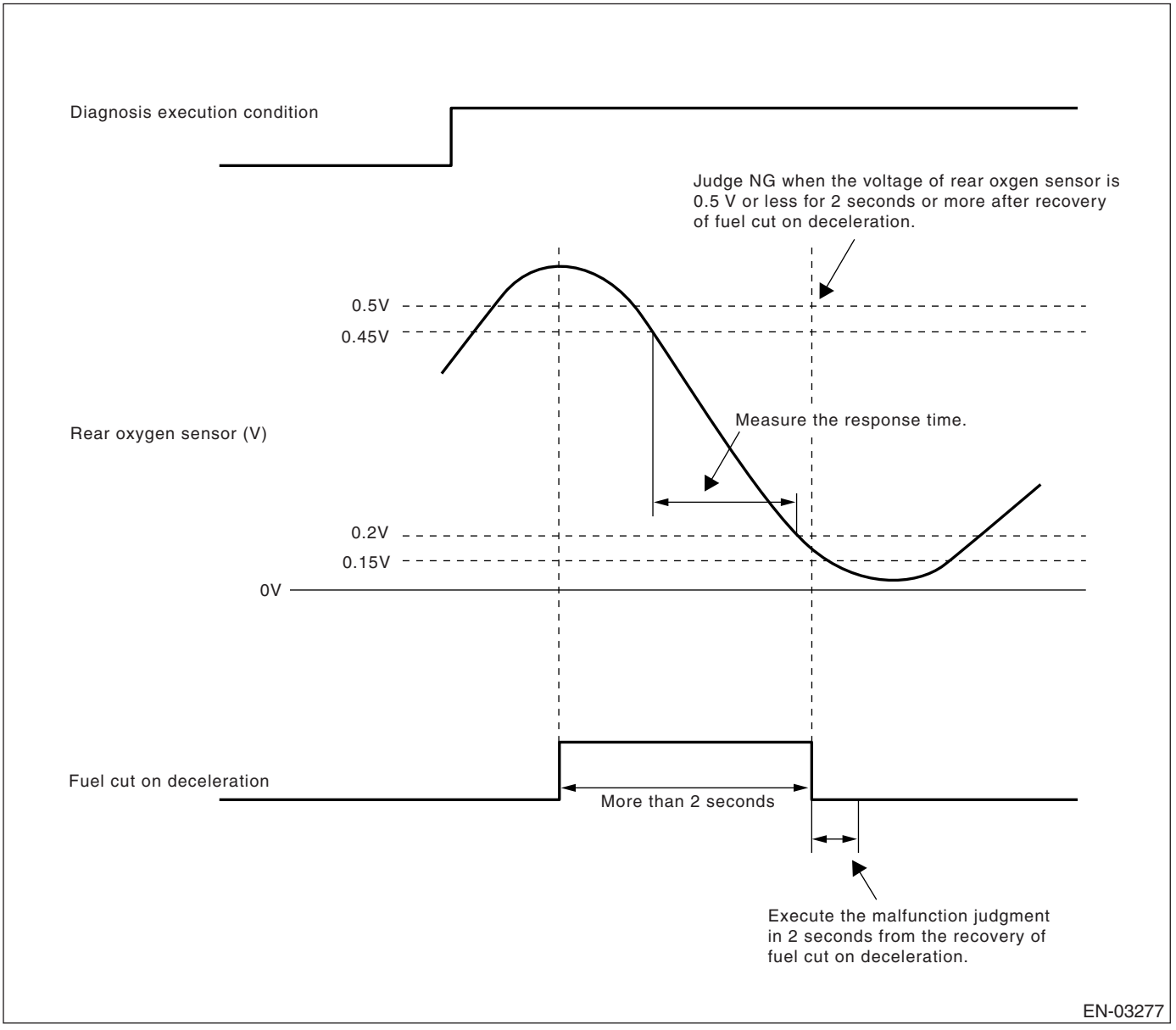
Secondary Parameters	Enable Conditions
Closed loop control with rear oxygen sensor	In operation
Time for fuel cut at deceleration is more than 2 seconds.	Experienced
After fuel cut	≥ 2 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis when fuel cut at deceleration after rapid acceleration. (Pay attention to oxygen sensor voltage for the timing of deceleration in order to calculated the diagnostic value.)

5. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes 0.5 V (rich) to 0.15 V (lean), caluculate the Min. value of response time regarded as judgment value while the output varies from 0.45 V to 0.3 V.



• Abnormality Judgment

1) Judge NG when the judgment value is larger than the threshold value after fuel cut at deceleration.
Response time (Diagnosi value) > Threshold value → Abnormal

NOTE:
Variation time of rear oxygen sensor output voltages is short during fuel cut at deceleration. Carry out the NG judgment only after the fuel cut at deceleration. As for OK judgment, without the condition of fuel cut at deceleration, judge OK if the value is below the threshold value.
Judge NG when the malfunction criteria below are completed in 2 seconds after the recovery of fuel cut at deceleration which requires 2 seconds or more.

2) Judge NG when the O_2 sensor voltage after recovery of fuel cut at deceleration is large. Judge NG when fuel cut at deceleration is also long (2s or more), and although carried out the recovery of fuel cut at deceleration, when O_2 sensor voltage is large (more than 0.5V).

• Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (450 mV O_2 output) to lean (200 mV) if voltage reduces from 500 mV to 150 mV.	> 0.53 seconds
Or, longest time when more than 500 mV	> 2 seconds

Time Needed for Diagnosis: 4 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

1) Judge Normal when the response time (diagnostic value) is smaller than threshold (judgment value) when oxygen sensor voltage changes from rich to lean, even with or without fuel cut at deceleration.
2) A normal judging is not carried out.

• Judgment Value

Judge OK when the following standards value are completed.

Malfunction Criteria	Threshold Value
Shortest time change from rich (450 mV O_2 output) to lean (200 mV) if voltage reduces from 500 mV to 150 mV.	≤ 0.53 seconds

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

10.ENABLE CONDITON

- Lean → Rich response diagnosis

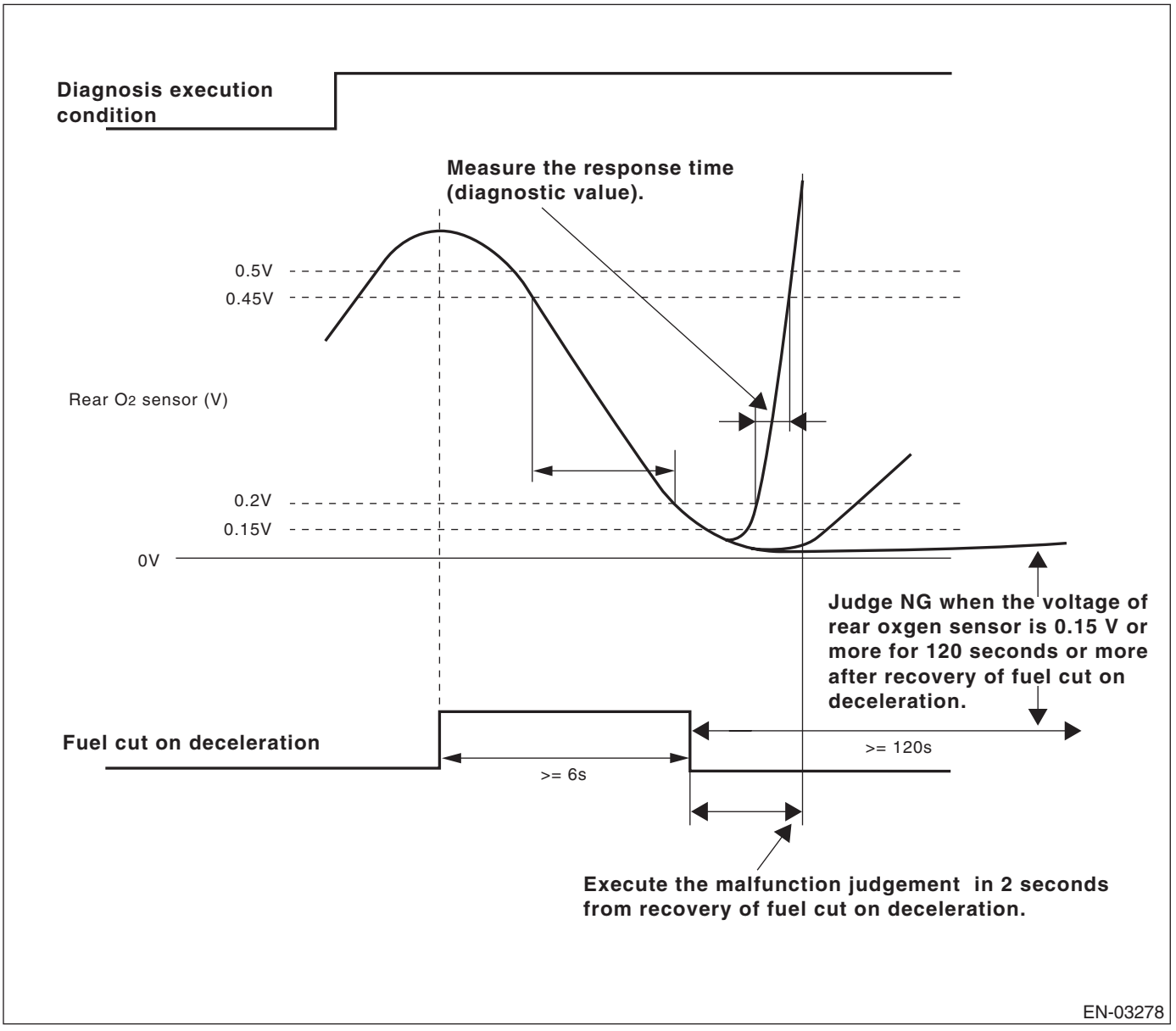
Secondary Parameters	Enable Conditions
Closed loop control with rear oxygen sensor	In operation
Vehicle speed	≥ 60 km/h (37 MPH)
Front oxygen sensor (A/F) output value x Cumulative amount of intake air for 1.5 seconds	< 800
Cumulative value of front oxygen sensor (A/F) output voltage for 1.5 seconds when front oxygen sensor (A/F) output voltage is less than 0.949.	≤ 18

11.GENERAL DRIVING CYCLE

Perform the diagnosis when fuel cut at deceleration after rapid acceleration. (Pay attention to oxygen sensor voltage for the timing of deceleration.)

12.DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes 0.15 V (lean) to 0.5 V (rich), caluculate the Min. value of response time regarded as judgment value while the output varies from 0.3 V to 0.5 V.



• Abnormality Judgment

1) Judge NG when the judgment value is larger than the threshold value after recovery of fuel cut at deceleration.
Response time (Diagnosis time) > Threshold value → Abnormal

2) Judge NG when the O_2 sensor voltage after recovery of fuel cut at deceleration is small.

• Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (200 mV O_2 output) to rich (450 mV) if voltage increases from 150 mV to 500 mV.	≥ 2 seconds
Or, longest time of 150 mV or less	≥ 120 seconds

Time Needed for Diagnosis: 124 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

1) Judge Normal when the response time (diagnostic value) is smaller than threshold (judgment value) when oxygen sensor voltage changes from rich to lean, even with or without fuel cut at deceleration.
Response Time (diagnosis value) ≤ Threshold value → Normal
2) A normal judging is not carried out.

• Judgment Value

Judge OK when the following standards value are completed.

Malfunction Criteria	Threshold Value
Shortest time change from lean (200 mV O_2 output) to rich (450 mV) if voltage increases from 150 mV to 500 mV.	< 2 seconds

13.DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

15.FAIL SAFE

Sub feedback control: Not allowed

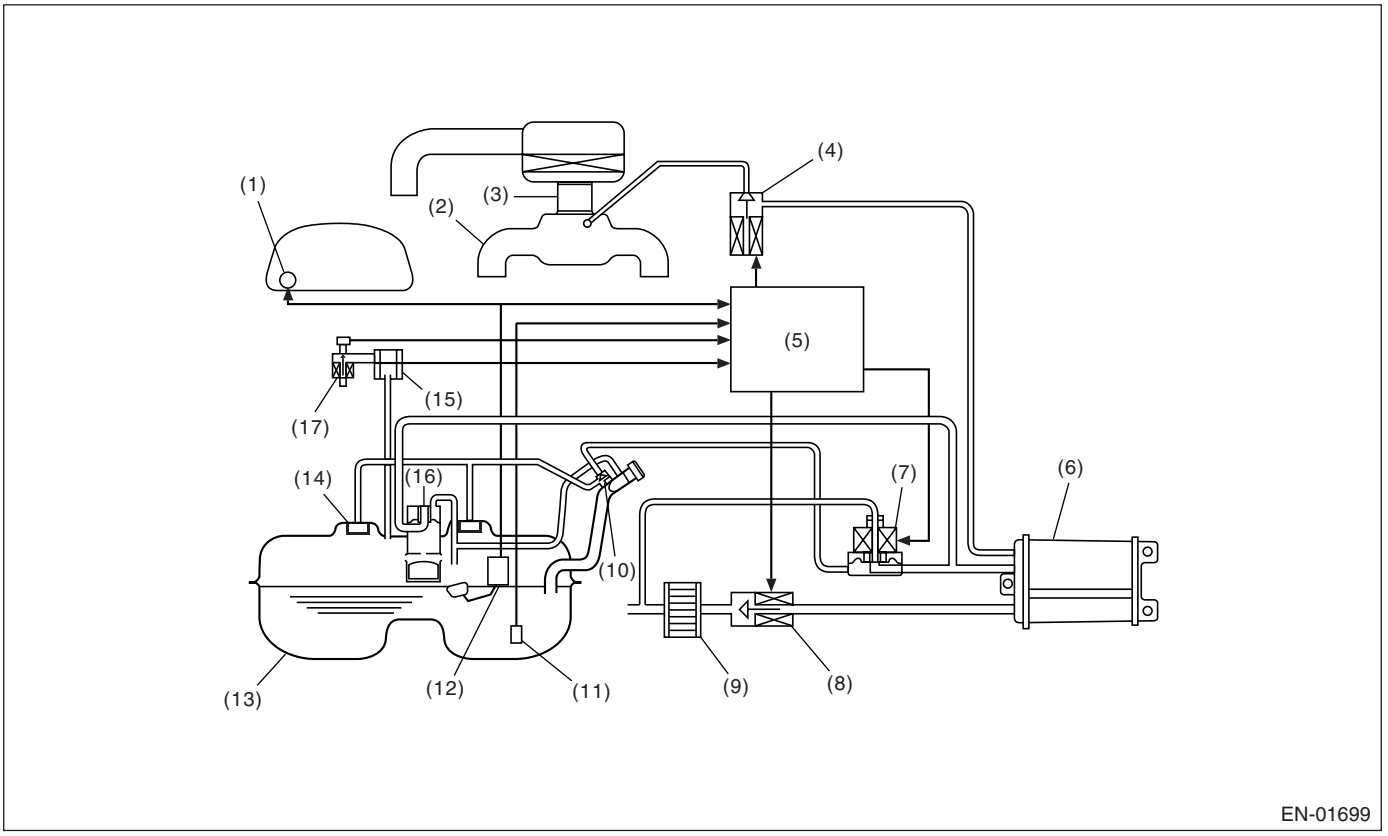
16.ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system by the amount of main feedback control.



(1) Fuel meter
(2) Intake manifold
(3) Throttle body
(4) Purge control solenoid valve
(5) Engine control module (ECM)
(6) Canister
(7) Pressure control solenoid valve
(8) Drain valve
(9) Drain filter
(10) Shut-off valve
(11) Fuel temperature sensor
(12) Fuel level sensor
(13) Fuel tank
(14) Fuel cut valve
(15) Fuel tank pressure sensor
(16) Vent valve
(17) Tank pressure switching solenoid valve

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel learning system	In operation
Engine coolant temperature	75 ←→ 110°C (167 ←→ 230°F)
Intake manifold pressure change during 50 msecs	≤ 1.95 kPa (14.6 mmHg, 0.575 inHg)
Learning value of EVAP conc. during purge	≤ 1.0
Cumulative time of canister purge after engine start	20 seconds or more
Continuous period after canister purge starting	10 seconds or more
Intake air pressure	≥ Map 3

Map 3

Engine speed (rpm)	idle	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Pressure kPa (mmHg, inHg)	ha	24.0 (180, 7.09)	27.2 (204, 8.03)	27.2 (204, 8.03)	28.3 (212, 8.35)	29.9 (224, 8.82)	32.5 (244, 9.61)	34.1 (256, 10.08)	34.1 (256, 10.08)	33.1 (248, 9.76)	33.1 (248, 9.76)

3. GENERAL DRIVING CYCLE

Perform the serial diagnoses with idling or a constant vehicle speed after engine starting.

4. DIAGNOSTIC METHOD

Judge that the malfunction occurred in fuel system when the malfunction criteria are completed for 50 seconds or more by comparing the diagnostic value (fsobd) with threshold value.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc aflmd = measured lambda lambda = short term fuel trim kblrc = long term fuel trim	≥ fsobdL1 See Map 2 fsobdL1 = lean side threshold value of fsobd

Map 2: Threshold value for fuel system malfunction criteria

Amount of air (g (oz)/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdL1 (%)	40	40	33.2	26.5	26.5	26.5	26.5

Time Needed for Diagnosis: 10 seconds × 5 times
Malfunction Indicator Light Illumination: 2 continuous driving cycles.
Judge OK when the malfunction criteria below are completed for 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	< 19%

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

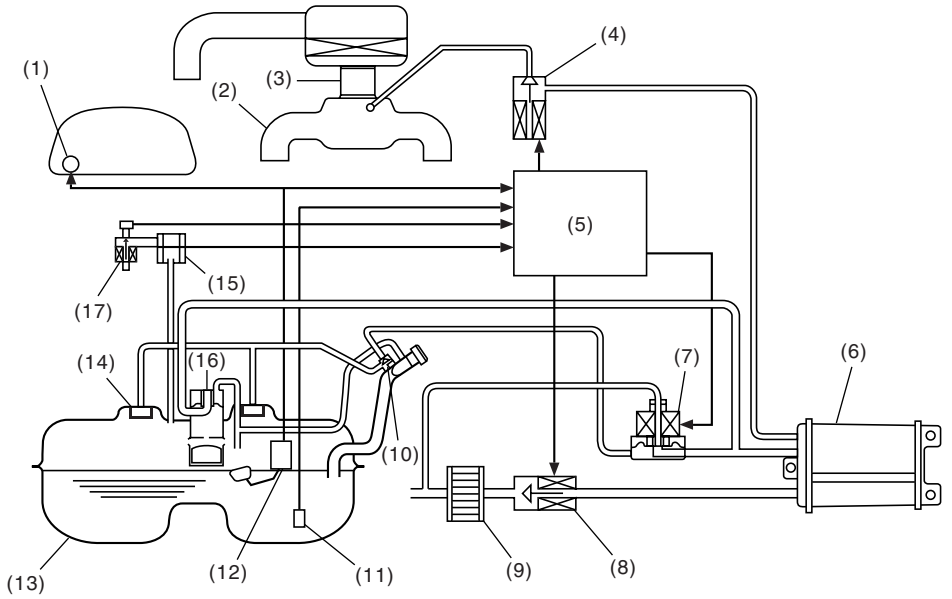
8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system by the amount of main feedback control.



EN-01699

(1) Fuel meter
(2) Intake manifold
(3) Throttle body
(4) Purge control solenoid valve
(5) Engine control module (ECM)
(6) Canister
(7) Pressure control solenoid valve
(8) Drain valve
(9) Drain filter
(10) Shut-off valve
(11) Fuel temperature sensor
(12) Fuel level sensor
(13) Fuel tank
(14) Fuel cut valve
(15) Fuel tank pressure sensor
(16) Vent valve
(17) Tank pressure switching solenoid valve

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel learning system	In operation
Engine coolant temperature	75 ←→ 110°C (167 ←→ 230°F)
Intake manifold pressure change during 50 msecs	≤ 1.95 kPa (14.6 mmHg, 0.575 inHg)
Learning value of EVAP conc. during purge	≤ 1.0
Cumulative time of canister purge after engine start	20 seconds or more
Continuous period after canister purge starting	10 seconds or more

Map 3

Engine speed (rpm)	idle	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Pressure kPa (mmHg, inHg)	ha	24.0 (180, 7.09)	27.2 (204, 8.03)	27.2 (204, 8.03)	28.3 (212, 8.35)	29.9 (224, 8.82)	32.5 (244, 9.61)	34.1 (256, 10.08)	34.1 (256, 10.08)	33.1 (248, 9.76)	33.1 (248, 9.76)

3. GENERAL DRIVING CYCLE

Perform the serial diagnoses.

4. DIAGNOSTIC METHOD

Judge that the malfunction occurred in fuel system when the malfunction criteria are completed for 50 seconds or more by comparing the diagnostic value (fsobd) with threshold value.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc aflmd = measured lambda lambda = short term fuel trim kblrc = long term fuel trim	≤ fsobdR1 See Map 2 fsobdR1 = rich side threshold value of fsobd

Map 2: Threshold value for fuel system malfunction criteria

Amount of air (g/s)	0 (0)	3.2 (0.113)	6.4 (0.226)	9.6 (0.339)	12.8 (0.451)	16 (0.564)	19.2 (0.677)
fsobdR1 (%)	–45	–45	–36	–26.5	–26.5	–26.5	–26.5

Time Needed for Diagnosis: 10 seconds × 5 times
Malfunction Indicator Light Illumination: 2 continuous driving cycles.
Judge OK when the malfunction criteria below are completed for 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	≥ –20%

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

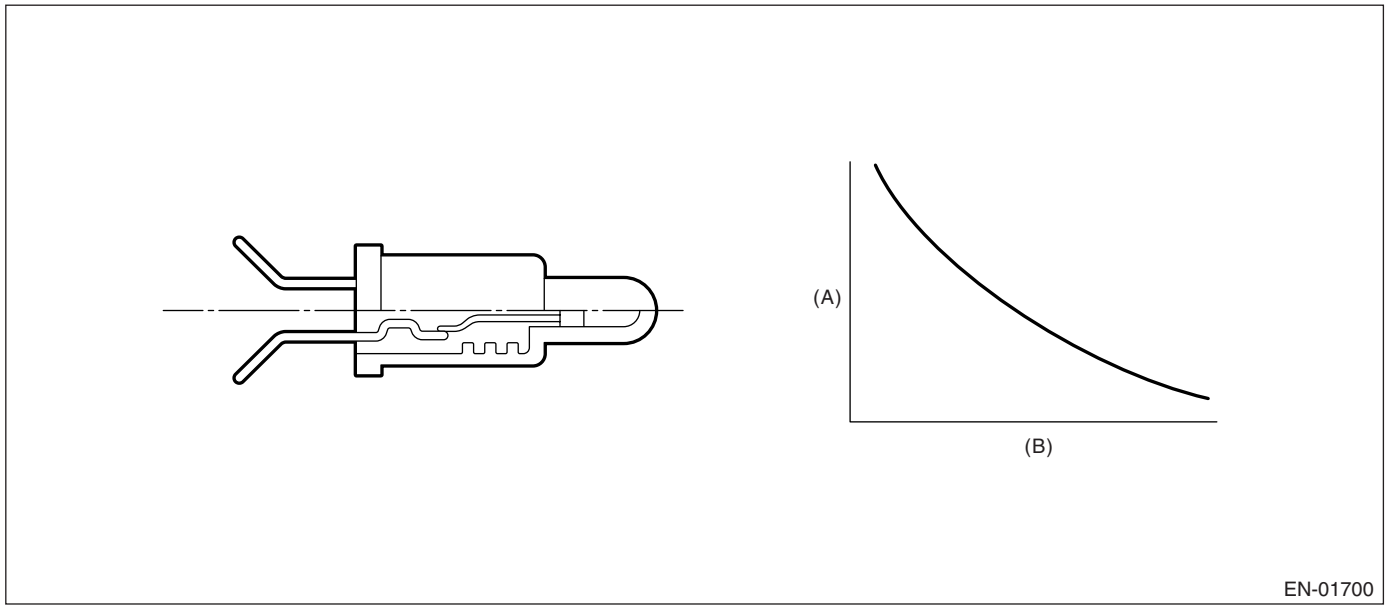
Memorize the freeze frame data. (For test mode $02)

AG:DTC P0181 — FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel temperature sensor output property.
Diagnosis is performed in two methods; namely, drift diagnosis and stuck diagnosis.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω)
(B) Fuel temperature °C (°F)

• Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and NG judgment is done.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel level	≥ 10 ℓ (2.6 US gal, 2.2 Imp gal)
After engine starting	20 seconds or more
Engine coolant temperature difference from engine start	> 10°C (50°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine coolant temperature increases more than 10°C (50°F) [increase 10°C (50°F)] from the temperature of engine starting in 20 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (120 seconds) needed for diagnosis. Also, judge OK when the malfunction criteria below is not completed. And then, clear the NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel temperature-engine coolant temperature	<10°C (50°F)
Engine coolant temperature	<80°C (176°F)

Time Needed for Diagnosis: 120 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.
Stuck Diagnosis
If the fuel temperature which must increase along with engine idling does not increase, the engine is considered to be stuck and NG judgment is done.

6. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	20 seconds or more

7. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 20 seconds and more after starting the engine.

8. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when all of the malfunction criteria below is completed.

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 550 kg (1213 lb)
Fuel temperature difference between max and min	< 3°C (37°F)

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Malfunction Criteria	Threshold Value
Fuel temperature difference between max. and min.	≥ 3°C (37°F)

Time Needed for Diagnosis: Not fixed
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

9. DTC CLEAR CONDITION

- When the OK idling was completed 40 times in a row
- When “Clear Memory” was performed

10.MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

11.FAIL SAFE

Fix the fuel temperature at 40°C (104°F).

12.ECM OPERATION AT DTC SETTING

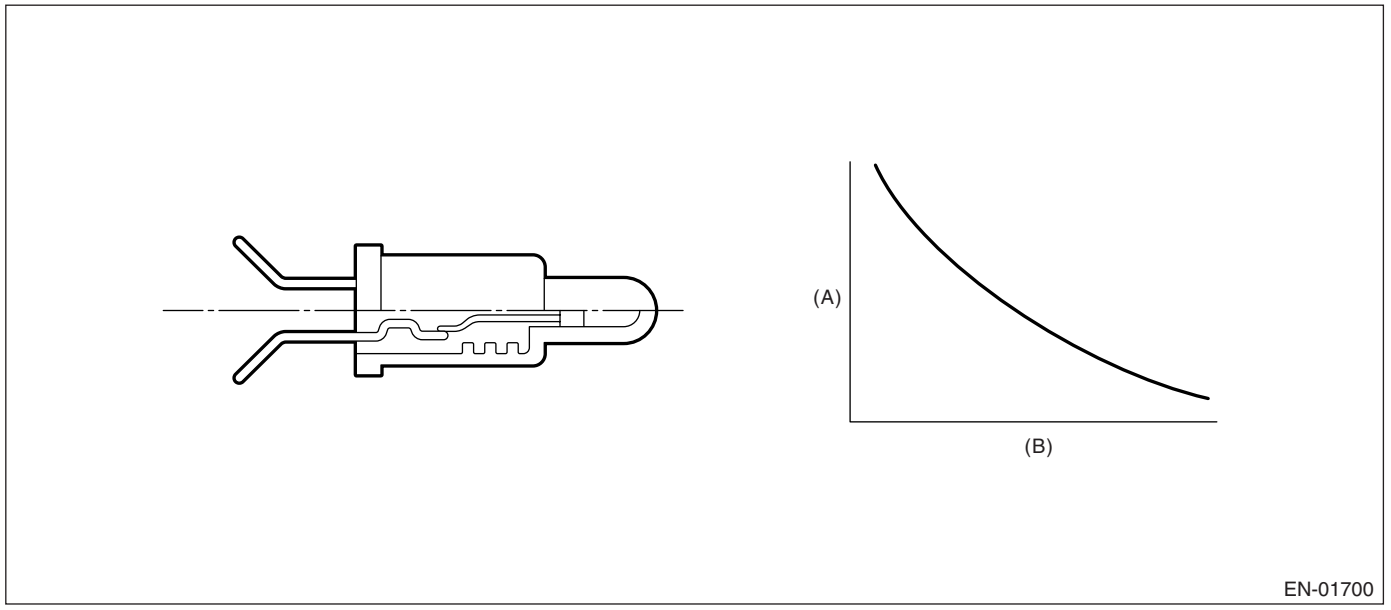
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the fuel temperature for control at 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

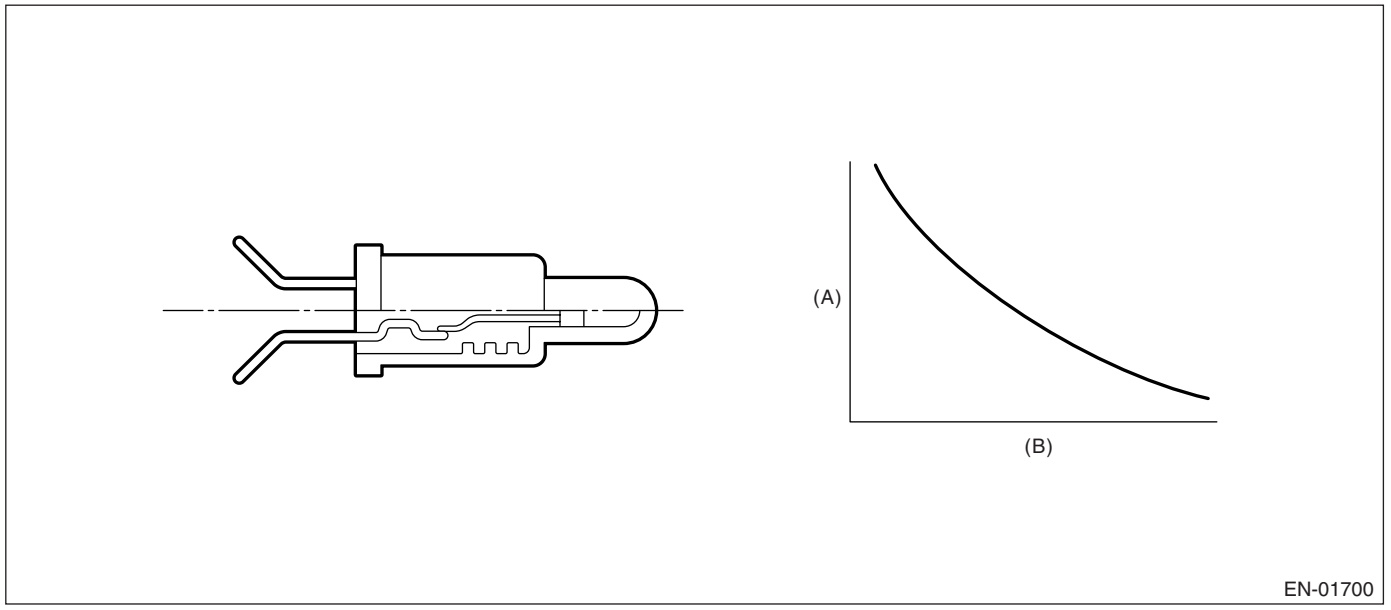
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than time (2.5 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.85 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the fuel temperature for control at 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AJ:DTC P0301 — CYLINDER 1 MISFIRE DETECTED —

1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence.
Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has three patterns below.

- Intermittent misfire (Different cylinders misfire intermittently.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): Catalyst damage misfire, FTP 1.5 times misfire
- Opposed misfire (Dual ignition equipped model as #1, #2 simultaneously ignite. NA model only.): Catalyst damage misfire, FTP 1.5 times misfire

The following detecting methods are adopted for these detection.
(1) Intermittent misfire: FTP 1.5 times misfire
  - 180° Interval Difference Method (3,550 rpm or less)
  - 720° Interval Difference Method (2,950 rpm or less)

(2) Every time misfire: Catalyst damage misfire, FTP 1.5 times misfire
  - 180° Interval Difference Method (3,550 rpm or less)
  - Pattern Recognition Method (2,950 rpm or more)

(3) Opposed misfire: Catalyst damage misfire, FTP 1.5 times misfire
  - 180° Interval Difference Method (3,550 rpm or less)
  - Pattern Recognition Method (2,950 rpm or more)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Injector pulse	≥ 1.00 milliseconds
Engine speed	450 — 6200 rpm
Fuel shut-off function	Not in operation
Fuel parameter determination	Not as extremely low volatility
Engine speed change	≥ Misfire level × –4.00
After fuel shut-off finished	15 revs. or more
(Weighted avg. value / given amount) of intake air –1.0	–0.5 ←→ 1.9
Fuel level	≥ 9 ℓ (2.4 US gal, 2.0 Imp gal)
Crankshaft position learning	Complete
Intake manifold pressure	> Value from Map 4
The change in torque during shifting	Not in operation
Throttle position change during 30 milli-seconds	–20° ←→ 20°
Engine speed (Misfire detection by oxy-gen sensor)	> 4600 rpm

Map 4

rpm	0	400	800	1200	1600	2000	2400	2800
MT (V. Speed < 64 km/h (40 MPH))	21.9 (164, 6.46)	21.9 (164, 6.46)	21.9 (164, 6.46)	19.2 (144, 5.67)	18.7 (140, 5.51)	19.2 (144, 5.67)	18.7 (140, 5.51)	19.7 (148, 5.83)
(V. Speed ≥ 64 km/h (40 MPH)) kPa (mmHg, inHg)	21.9 (164, 6.46)	21.9 (164, 6.46)	21.9 (164, 6.46)	25.6 (192, 7.56)	25.1 (188, 7.40)	25.6 (192, 7.56)	24.5 (184, 7.24)	31.5 (236, 9.29)
AT kPa (mmHg, inHg)	22.9 (172, 6.77)	22.9 (172, 6.77)	22.9 (172, 6.77)	20.3 (152, 5.98)	20.3 (152, 5.98)	21.3 (160, 6.30)	20.3 (152, 5.98)	21.9 (164, 6.46)

rpm	3200	3600	4000	4400	4800	5200	5600	6000
MT (V. Speed < 64 km/h (40 MPH))	22.9 (172, 6.77)	25.1 (188, 7.40)	28.3 (212, 8.35)	31.5 (236, 9.29)	34.7 (260, 10.24)	38.4 (288, 11.34)	41.6 (312, 12.28)	44.8 (336, 13.23)
(V. Speed ≥ 64 km/h (40 MPH)) kPa (mmHg, inHg)	32.5 (244, 9.61)	31.5 (236, 9.59)	31.5 (236, 9.59)	31.5 (236, 9.59)	34.7 (260, 10.24)	38.4 (288, 11.34)	41.6 (312, 12.28)	44.8 (336, 13.23)
AT kPa (mmHg, inHg)	25.1 (188, 7.40)	28.8 (216, 8.50)	32.0 (240, 9.45)	35.2 (264, 10.39)	37.9 (284, 11.18)	41.1 (308, 12.13)	44.3 (332, 13.07)	47.5 (356, 14.02)

3. GENERAL DRIVING CYCLE

If the condition matched, detecting misfire is possible in the engine speed of idling to high revolution.

4. DIAGNOSTIC METHOD

When the misfire occurred, the engine speed is decreased and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed, and judge whether the misfire occurs or not comparing the calculated result with judgment value.

Calculate the diagnostic value (from crankshaft position speed) → Misfire detection every single ignition (Compare diagnostic value with judgment value)
- 180° Interval Difference Method
- 720° Interval Difference Method
- Pattern Recognition Method

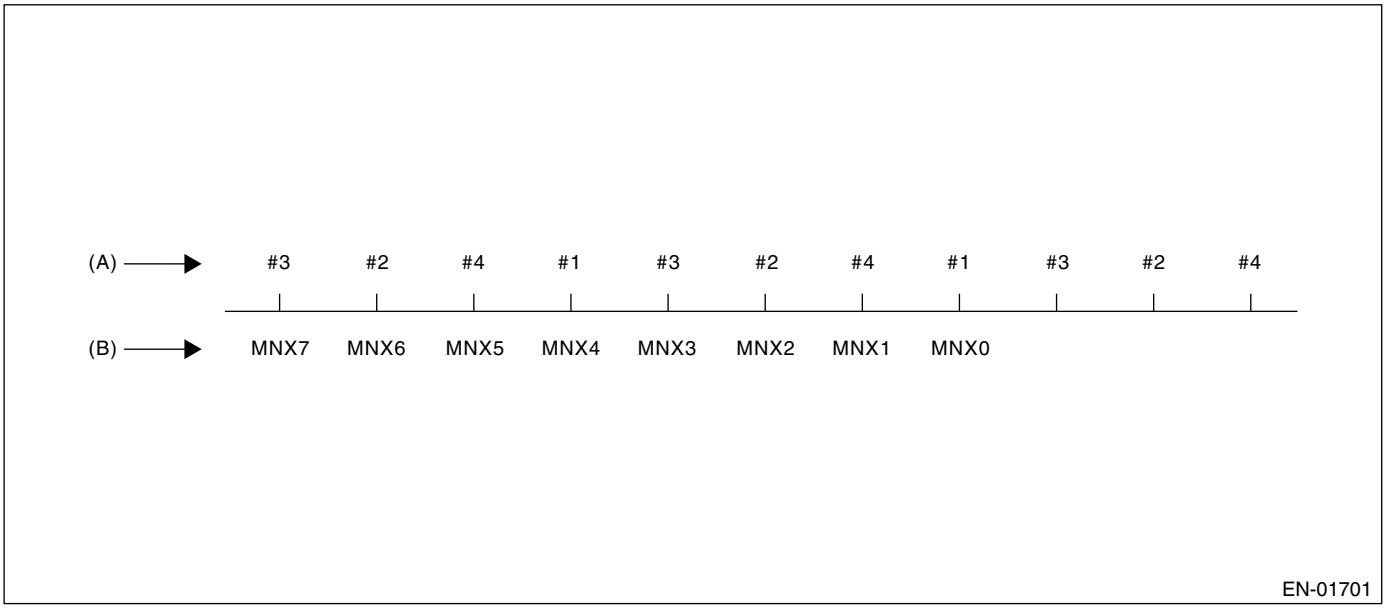
→ NG judgment (Judge misfire occurrence required by the law) (Compare number of misfire with judgment)
- FTP1.5 times misfire NG judgment
- Catalyst damage misfire NG judgment

For misfire detection, there are three methods such as 180° Interval Difference Method, 720° Interval Difference Method and Pattern Recognition Method.

• 180° Interval Difference Method, 720° Interval Difference Method

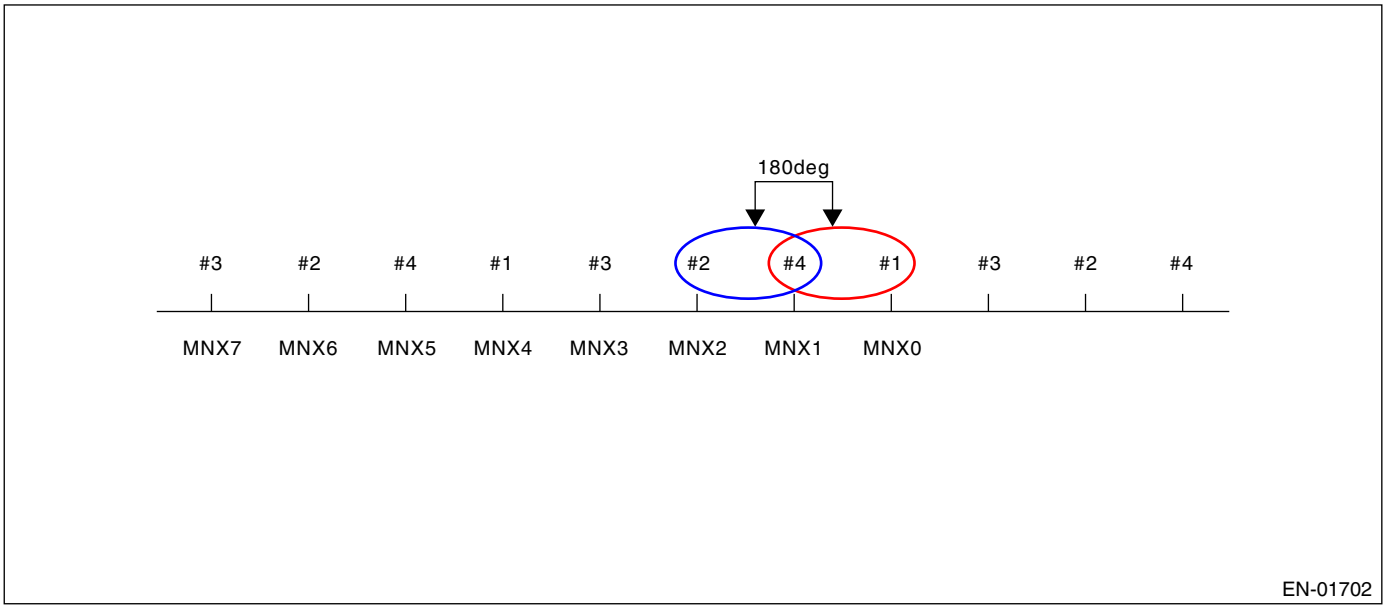
Transform the time needed for crankshaft movement from BTDC65° to BTDC10° into revolution. As the following, regard the revolution as MNX0. And then regard the former revolution as MNX1, the second former revolution as MNX2, and the third as MNX3, etc.

Use the detecting method below for misfire patterns, and judge misfire occurrence when the result calculated from the formula is out of threshold value.



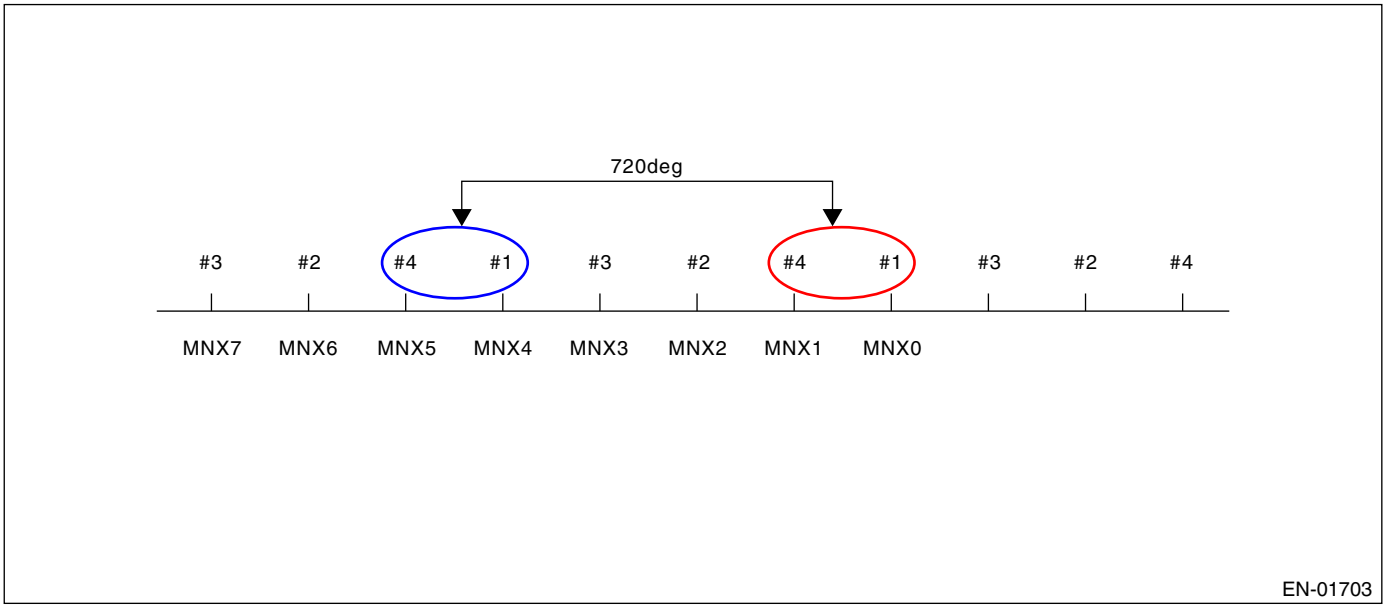
(A) Ignition order (B) Engine speed (rpm)

180° Interval Difference Method (DDNCON0)



(1) DDNCON1 = (MNX 1 – MNX 2) – (MNX 2 – MNX 3) ≤ Threshold value
(2) DDNCON0 = (MNX 0 – MNX 1) – (MNX 1 – MNX 2) ≥ Threshold value
Judge misfire when the (1) and (2) above are completed.

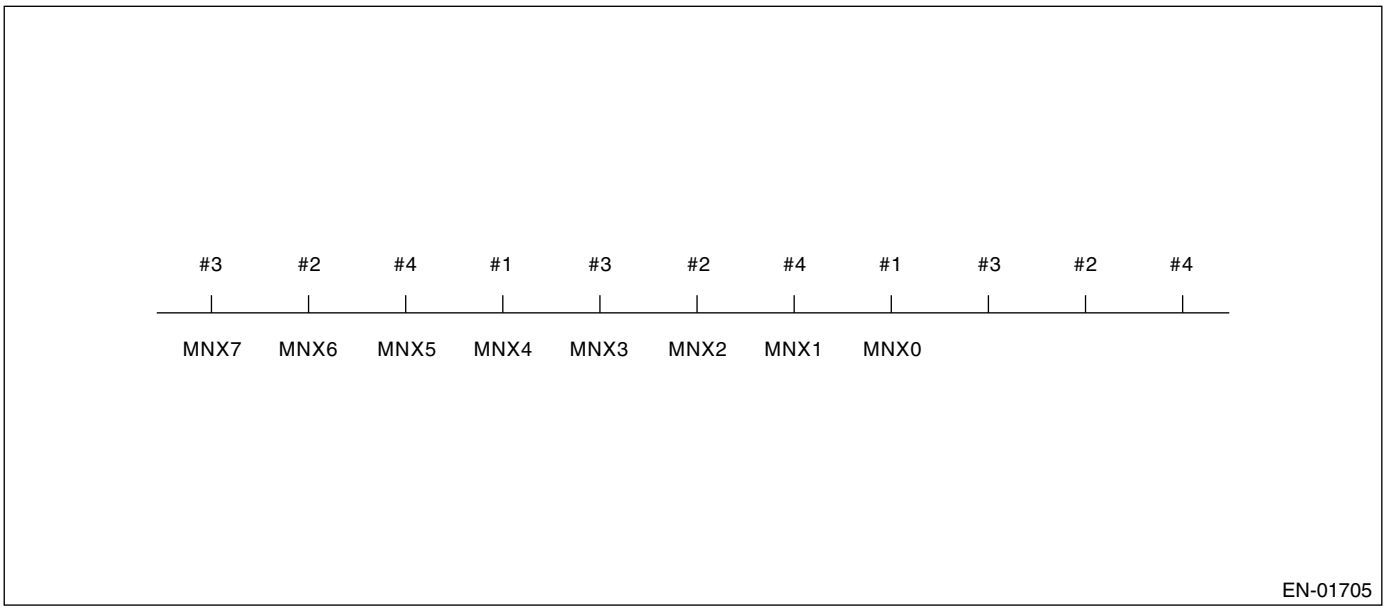
720° Interval Difference Method (DDNCYL0)



(1) DDNCYL4 = (MNX 4 – MNX 5) – (MNX 8 – MNX 9) ≤ Threshold value
(2) DDNCYL0 = (MNX 0 – MNX 1) – (MNX 4 – MNX 5) ≥ Threshold value
Judge misfire when the (1) and (2) above are completed.

• Pattern Recognition Method

Pattern Recognition Method has two patterns such as every time misfire on one cylinder and continuous misfire on two cylinders.



Every time misfire on one cylinder

Calculate the simple average (calculate MNX 0 – MNX 1) per one hundred ignitions for one cylinder (per four hundred ignitions for four cylinder).

Regard the value calculated for #1 cylinder as AVE1, #2 cylinder as AVE2, and as AVE3, AVE4 like the same way. Judge misfire occurrence when the value calculated from the following formula is larger than threshold value.

(Max. value of AVE1 to AVE4) – AVEn (n=1,2,3,4) ≥ threshold value → Judge that misfire occurs.

Continuous misfire on two cylinders

(1) Two continuous ignitions with "MNX 0 – MNX 1 ≥ threshold value" occurs.

(2) Two continuous ignitions with "MNX 0 – MNX 1 ≤ – (threshold value)" occurs.

Judge misfire occurrence on continuous two cylinders when the judgment criteria (1) and (2) above repeated for four hundred ignition.

• FTP 1.5 times Misfire (Misfire occurrence level which influences exhaust gas)

• Judgment Value

Judge malfunction when the misfire rate in 1000 revs. is large.

Malfunction Criteria	Threshold Value
FTP emission	> 1.2% in 1000 revs.

Time Needed for Diagnosis: 1000 engine revs.

Malfunction Indicator Light Illumination: 2 continuous driving cycles.

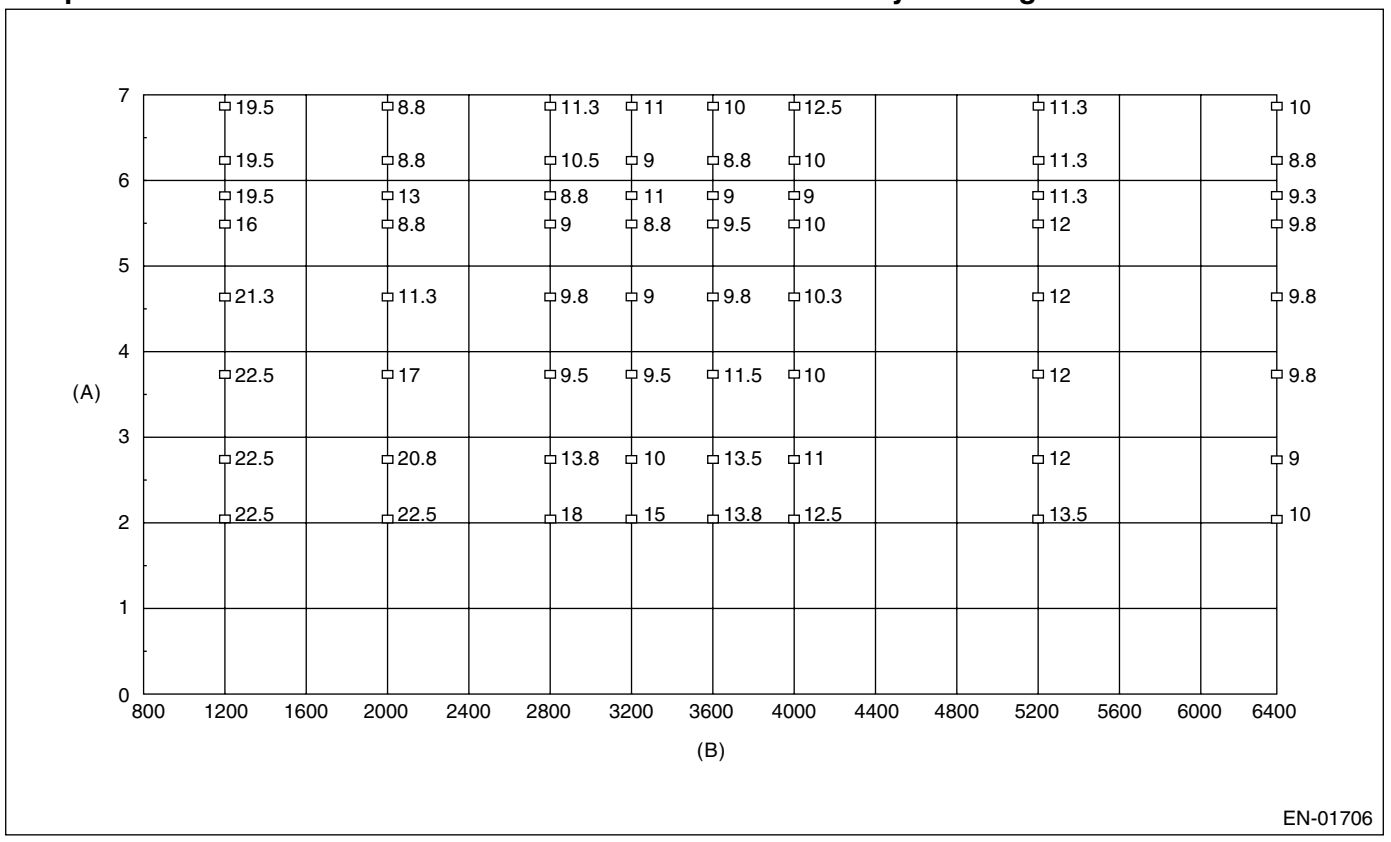
• Catalyst Damage Misfire (Misfire occurrence level which results in catalyst damage)

• Judgment Value

Judge malfunction when the misfire rate in 200 revs (400 ignitions) is large.

Malfunction Criteria	Threshold Value
Catalyst damage	> See Map 1

• Map 1 Fault criteria limit for misfire which would result in catalyst damage



(A) Basic injection pulse (millisecond) (B) Engine speed (rpm)

Time Needed for Diagnosis: 200 engine revs.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AK:DTC P0302 — CYLINDER 2 MISFIRE DETECTED —

1. OUTLINE OF DIAGNOSIS

For detecting criteria, refer to DTC P0301 — CYLINDER 1 MISFIRE DETECTED —. <Ref. to GD(H4SO)-88, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AL:DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

1. OUTLINE OF DIAGNOSIS

For detecting criteria, refer to DTC P0301 — CYLINDER 1 MISFIRE DETECTED —. <Ref. to GD(H4SO)-88, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AM:DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

1. OUTLINE OF DIAGNOSIS

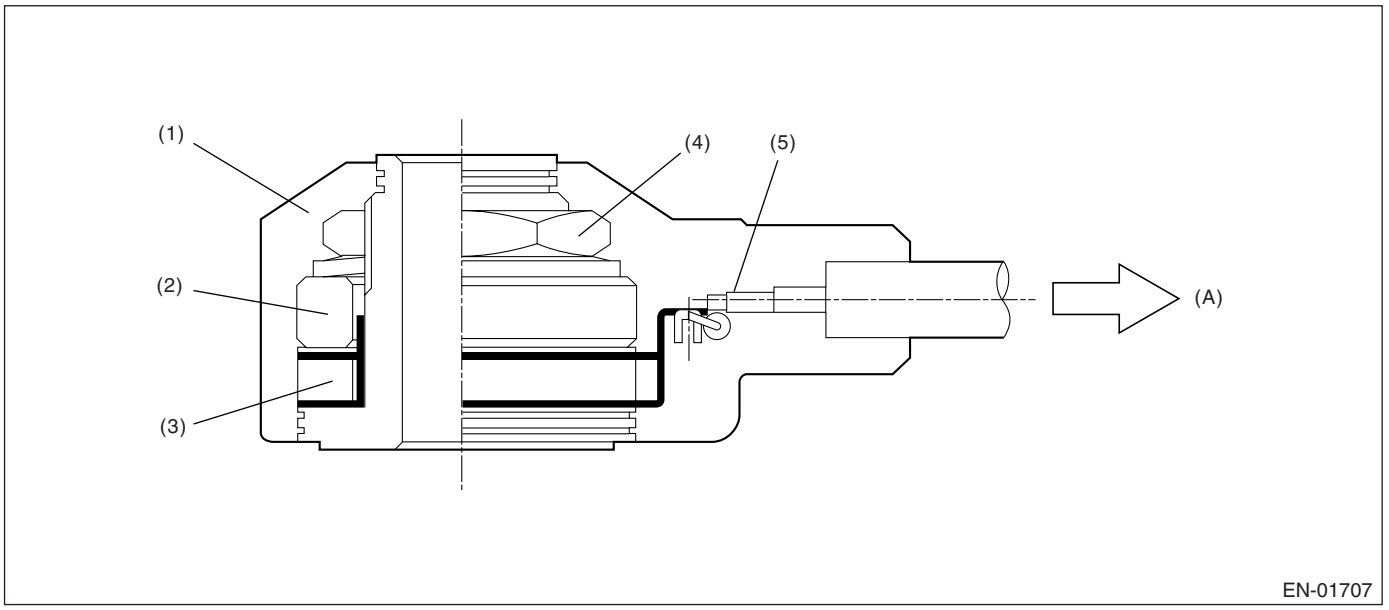
For detecting criteria, refer to DTC P0301 — CYLINDER 1 MISFIRE DETECTED —. <Ref. to GD(H4SO)-88, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance
(A) To knock sensor harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (1 second) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.6 V

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

(1) Stop whole compensation, partial compensation, knock cancel compensation in ignition timing calculation at normal.
(2) Knock cancel compensation of low engine coolant temperature is fixed value (7°CA).
(3) Stop partial compensation calculation of ignition leaning.

9. ECM OPERATION AT DTC SETTING

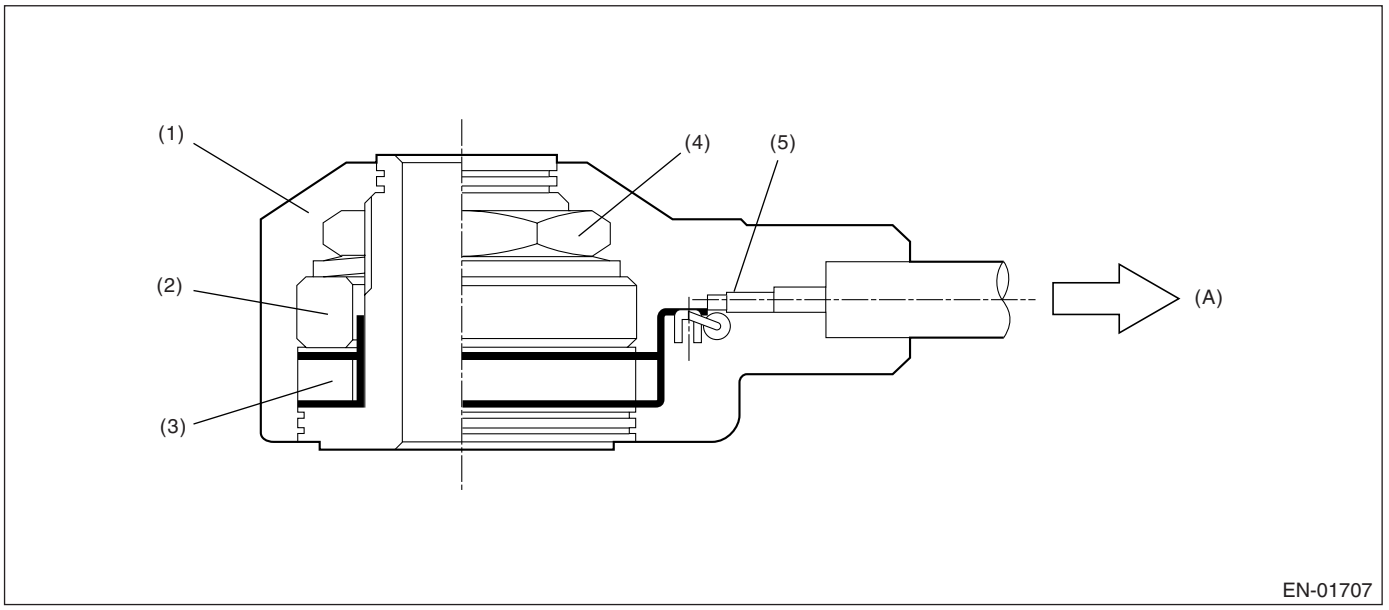
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance
(A) To knock sensor harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (1 second) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 3.5 V

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

(1) Stop whole compensation, partial compensation, knock cancel compensation in ignition timing calculation at normal.
(2) Knock cancel compensation of low engine coolant temperature is fixed value (7°CA).
(3) Stop partial compensation calculation of ignition leaning.

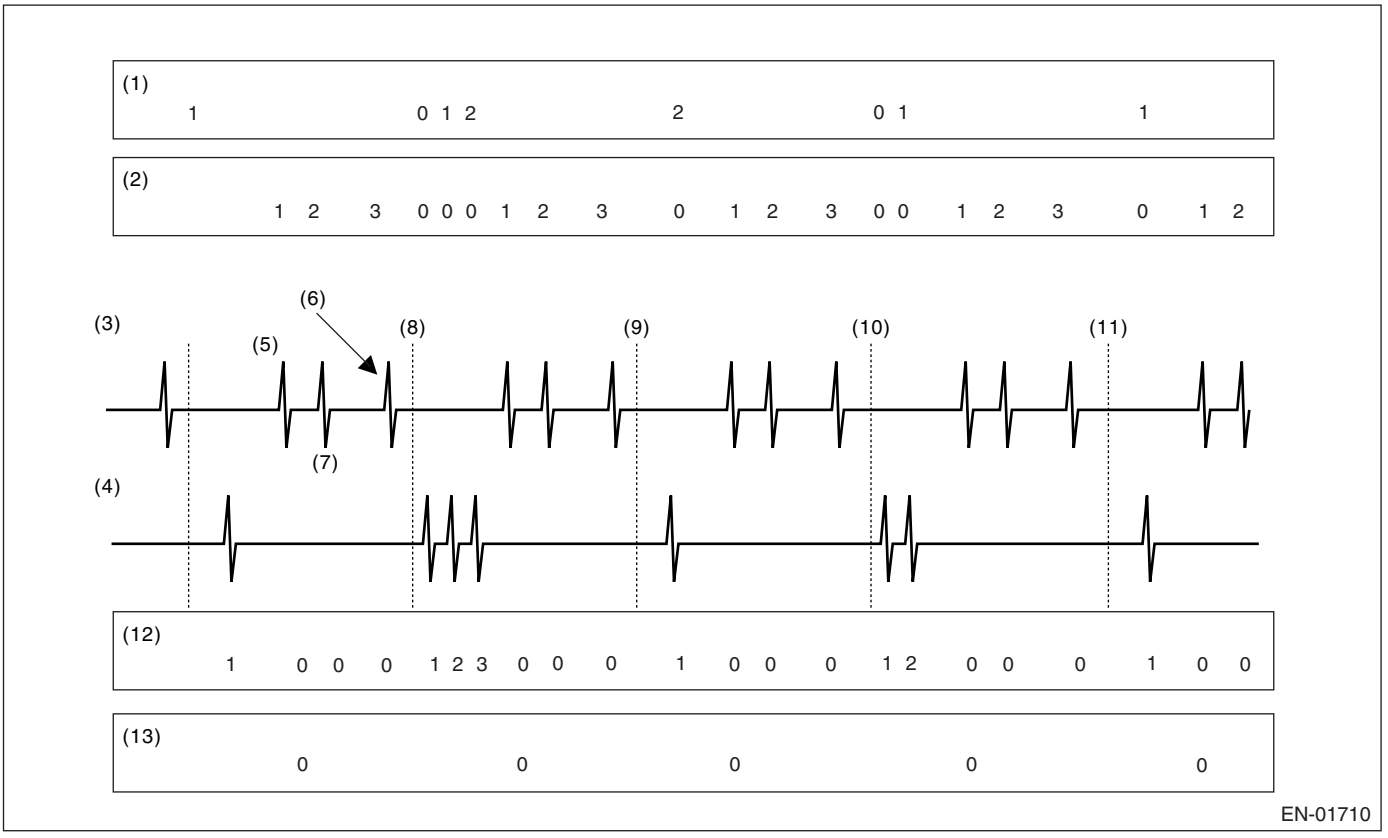
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of crankshaft position sensor.
Normally, the crankshaft position sensor signal and camshaft position sensor signal are input as shown below. But judge NG when continuing not to input the crankshaft position sensor signal.



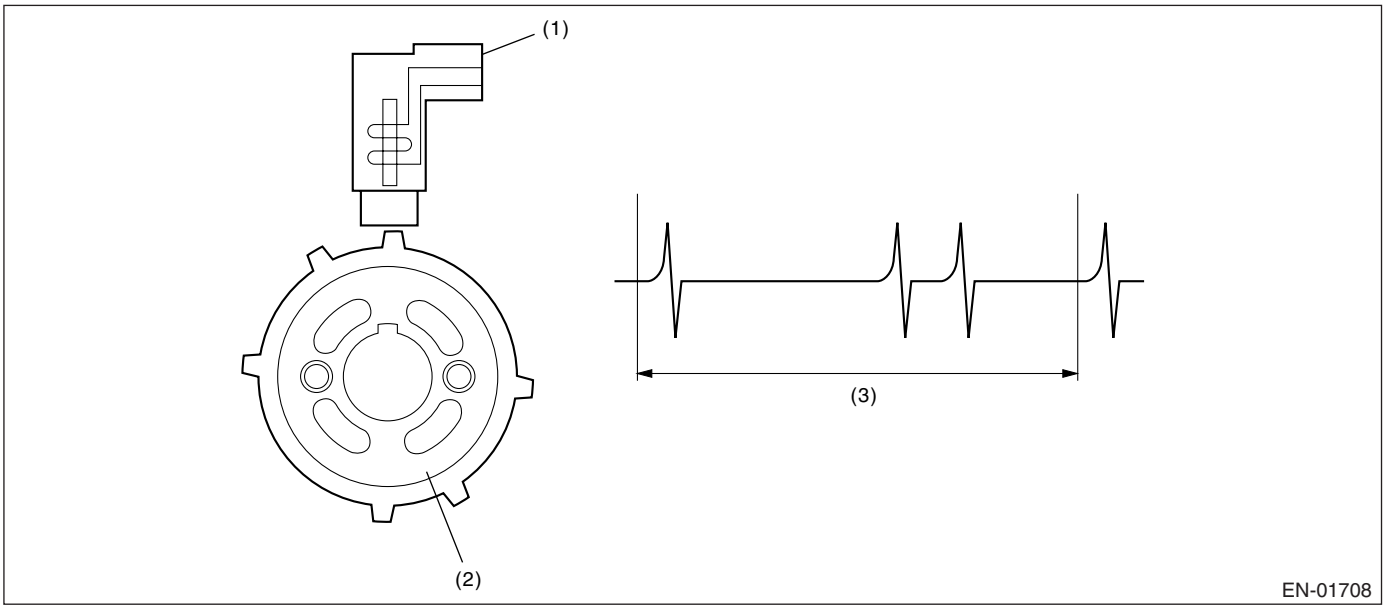
(1) NG counter of crankshaft position sensor
(2) Signal count of crankshaft position sensor
(3) Crankshaft position sensor signal
(4) Camshaft position sensor signal
(5) BTDC 97° CA
(6) BTDC 10° CA
(7) BTDC 65° CA
(8) #1 compression TDC
(9) #3 compression TDC
(10) #2 compression TDC
(11) #4 compression TDC
(12) Signal count of camshaft position sensor
(13) NG counter of relative position

• Cylinder judgment method

When inputting BTDC97°CA crankshaft position sensor signal, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

2. COMPONENT DESCRIPTION



(1) Crankshaft position sensor (2) Crankshaft sprocket (3) Crankshaft half-turn

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge OK and clear the NG when the malfunction criteria below are completed.
Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	≥ 24
Crankshaft position sensor signal	Detect in warm-up condition

When the crankshaft position sensor signal is input, clear the above camshaft position sensor signal.
Time Needed for Diagnosis: 7 revs.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

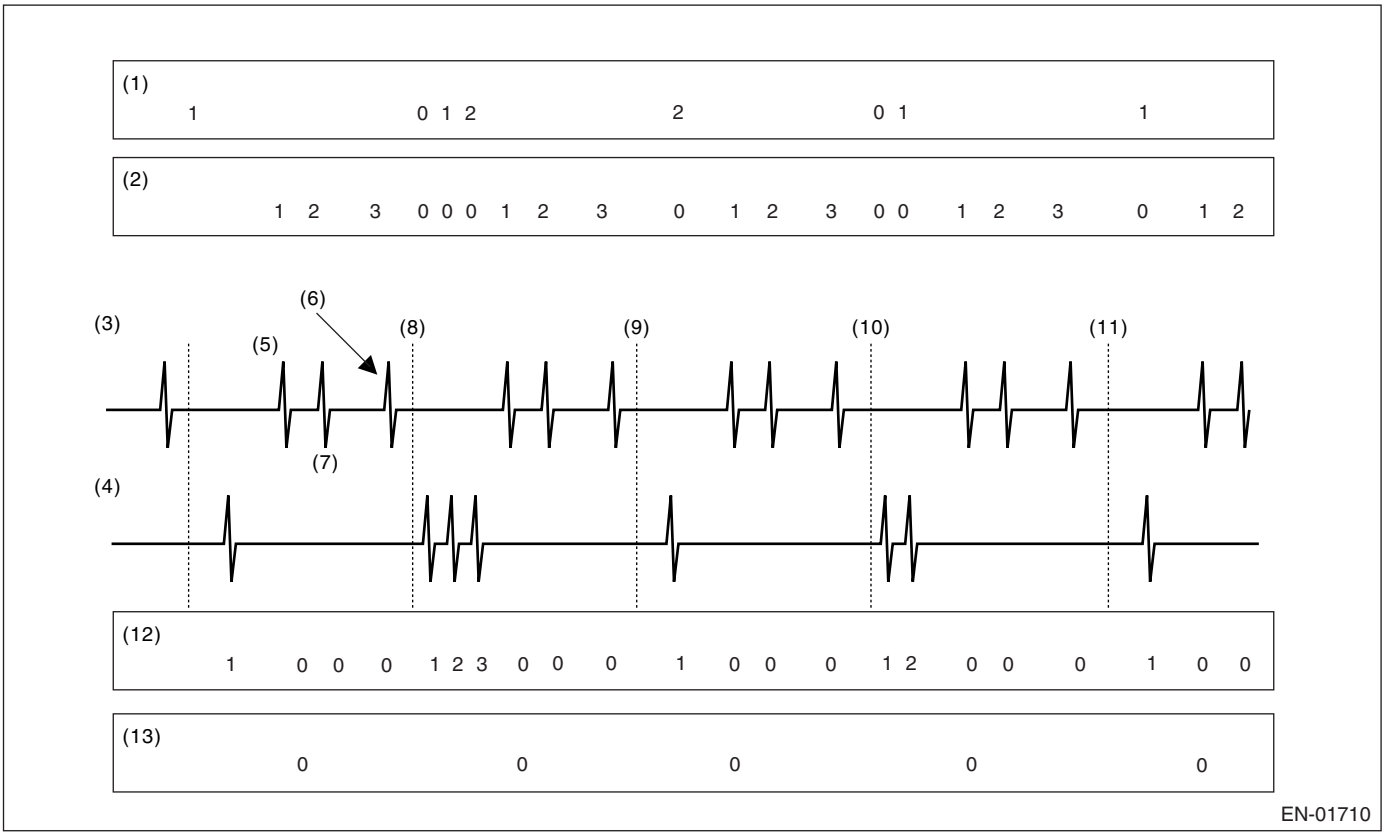
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.
Compare the normal crankshaft position sensor signal with normal camshaft position sensor signal. When each input number does not correspond, judge NG.



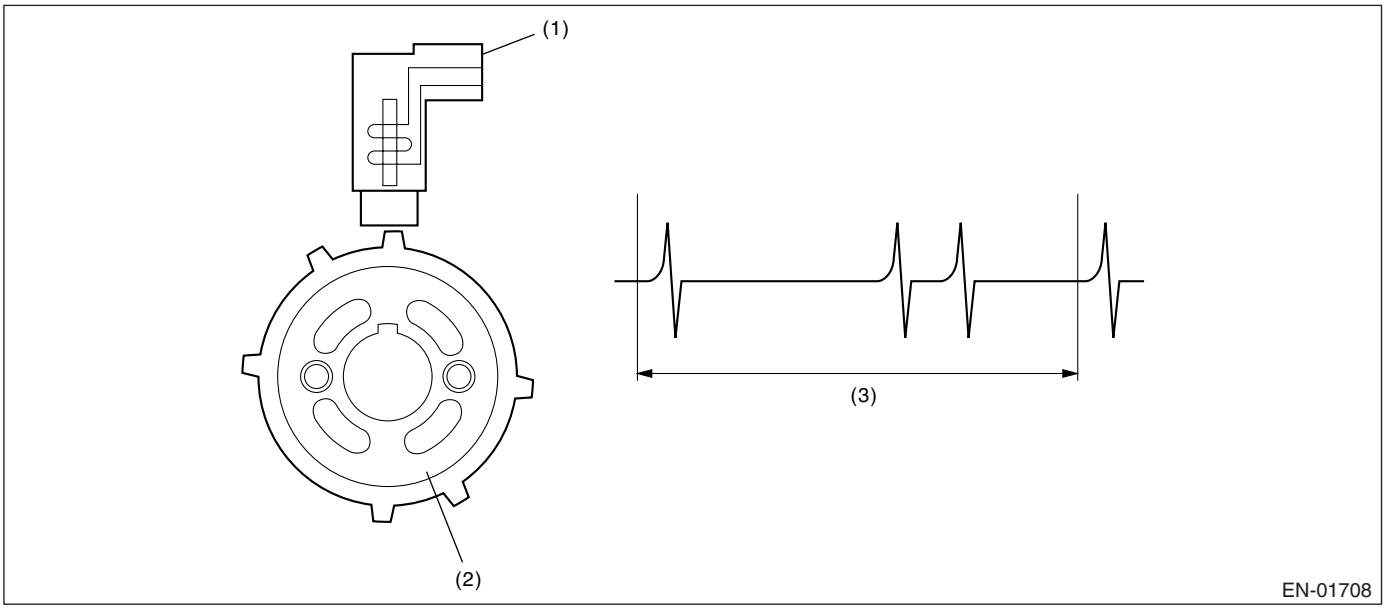
(1) NG counter of crankshaft position sensor
(2) Signal count of crankshaft position sensor
(3) Crankshaft position sensor signal
(4) Camshaft position sensor signal
(5) BTDC 97° CA
(6) BTDC 10° CA
(7) BTDC 65° CA
(8) #1 compression TDC
(9) #3 compression TDC
(10) #2 compression TDC
(11) #4 compression TDC
(12) Signal count of camshaft position sensor
(13) NG counter of relative position

• Cylinder judgment method

When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

2. COMPONENT DESCRIPTION



(1) Crankshaft position sensor (2) Crankshaft sprocket (3) Crankshaft half-turn

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When the camshaft position sensor signal is input, compare the total crankshaft position sensor signal number from occasion of previous camshaft position sensor signal input to now with crankshaft position sensor signal number at normal. Increase NG judgment counter when each number does not correspond at once. Judge NG when each number does not correspond sequentially (NG counter ≥ 32). Judge OK and clear NG when the crankshaft position sensor signal number corresponds (NG counter = 0).

Judgment Value

Malfunction Criteria	Threshold Value
Fault counter	≥ 32

Time Needed for Diagnosis: 7 revs.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

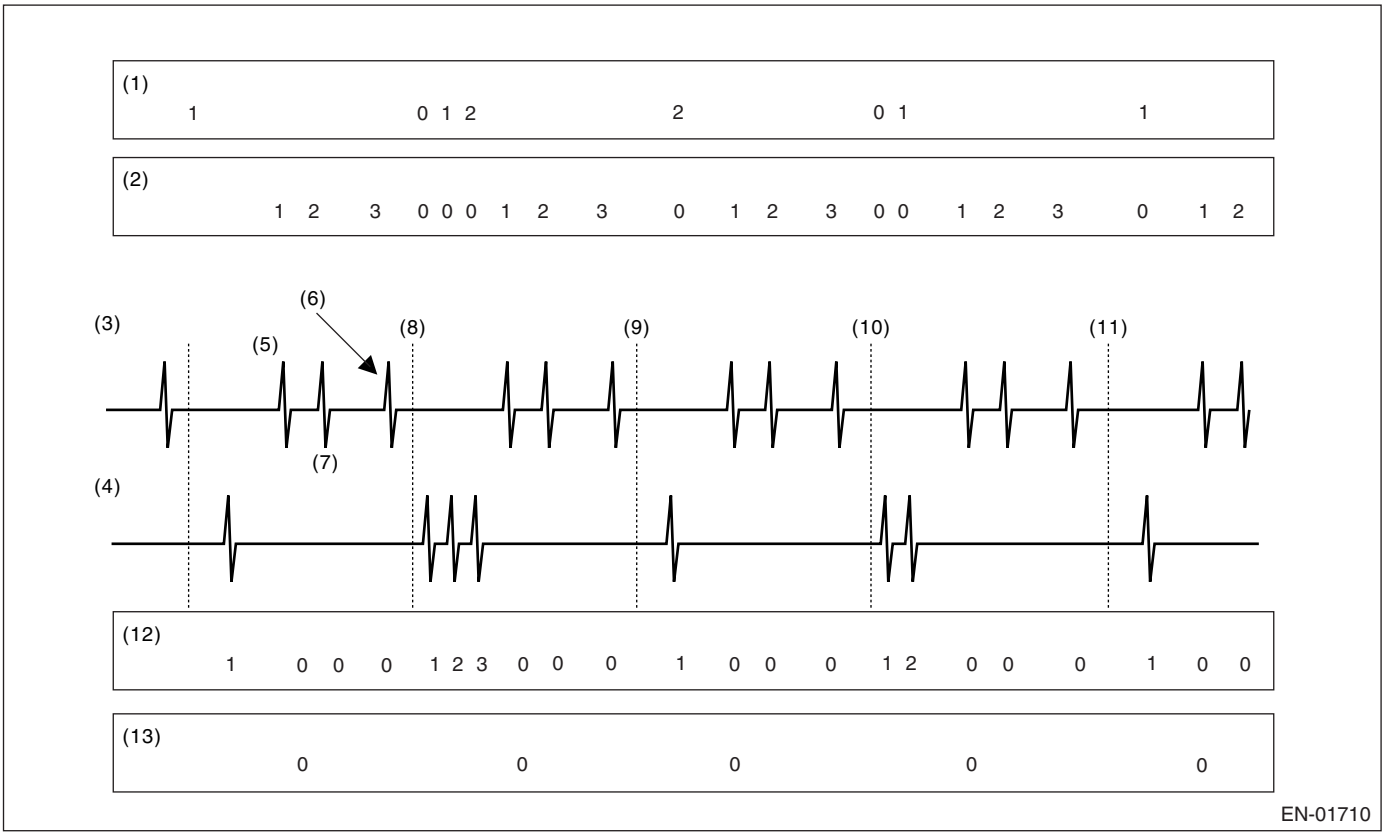
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.
Judge NG when continuing not to input the camshaft position sensor signal.



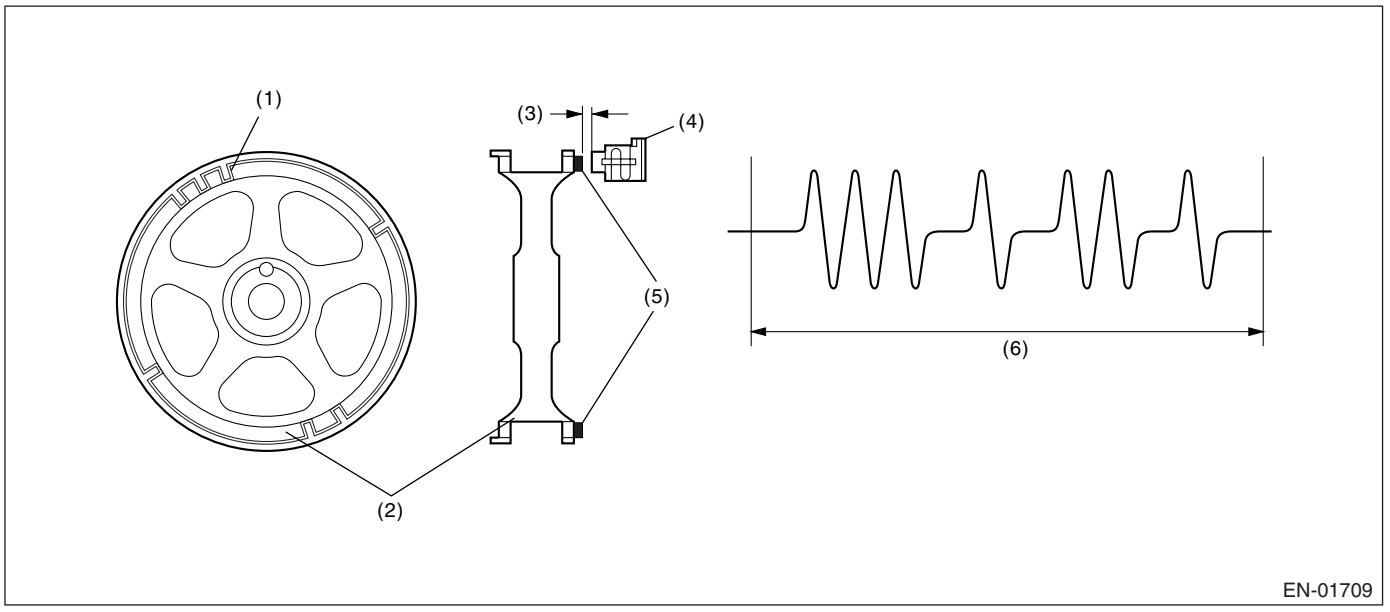
(1) NG counter of crankshaft position sensor
(2) Signal count of crankshaft position sensor
(3) Crankshaft position sensor signal
(4) Camshaft position sensor signal
(5) BTDC 97° CA
(6) BTDC 10° CA
(7) BTDC 65° CA
(8) #1 compression TDC
(9) #3 compression TDC
(10) #2 compression TDC
(11) #4 compression TDC
(12) Signal count of camshaft position sensor
(13) NG counter of relative position

• Cylinder judgment method

When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

2. COMPONENT DESCRIPTION



(1) Boss
(2) Camshaft sprocket
(3) Air gap
(4) Camshaft position sensor
(5) Boss
(6) Camshaft one turn (Crankshaft two turns)

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When many crankshaft position sensor signals were input without camshaft position sensor signal input, judge OK and clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	≥ 36
Camshaft position sensor signal	Detect in warm-up condition

Time Needed for Diagnosis: 6 revs.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

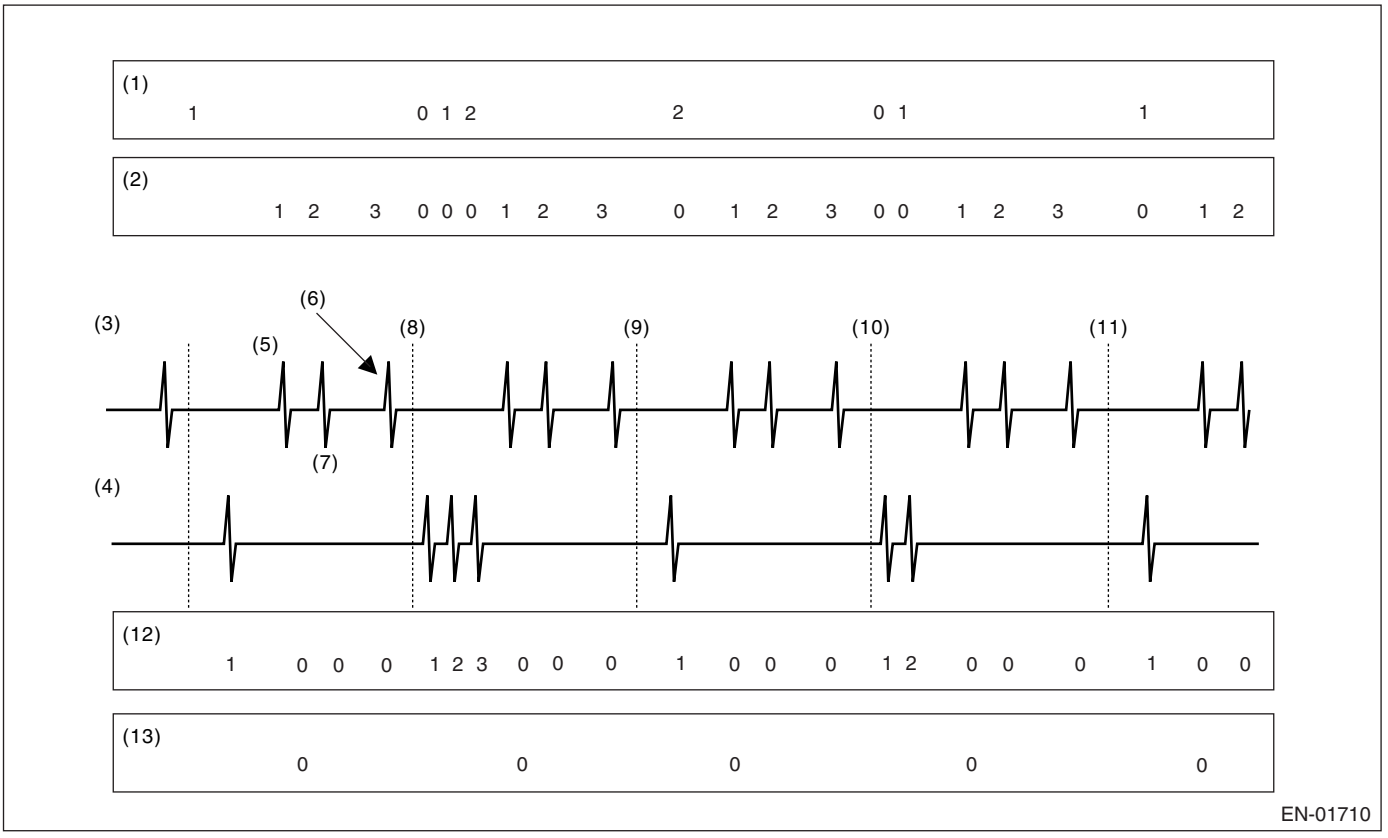
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.
Compare the normal crankshaft position sensor signal with normal camshaft position sensor signal. When each input number does not correspond, judge NG.



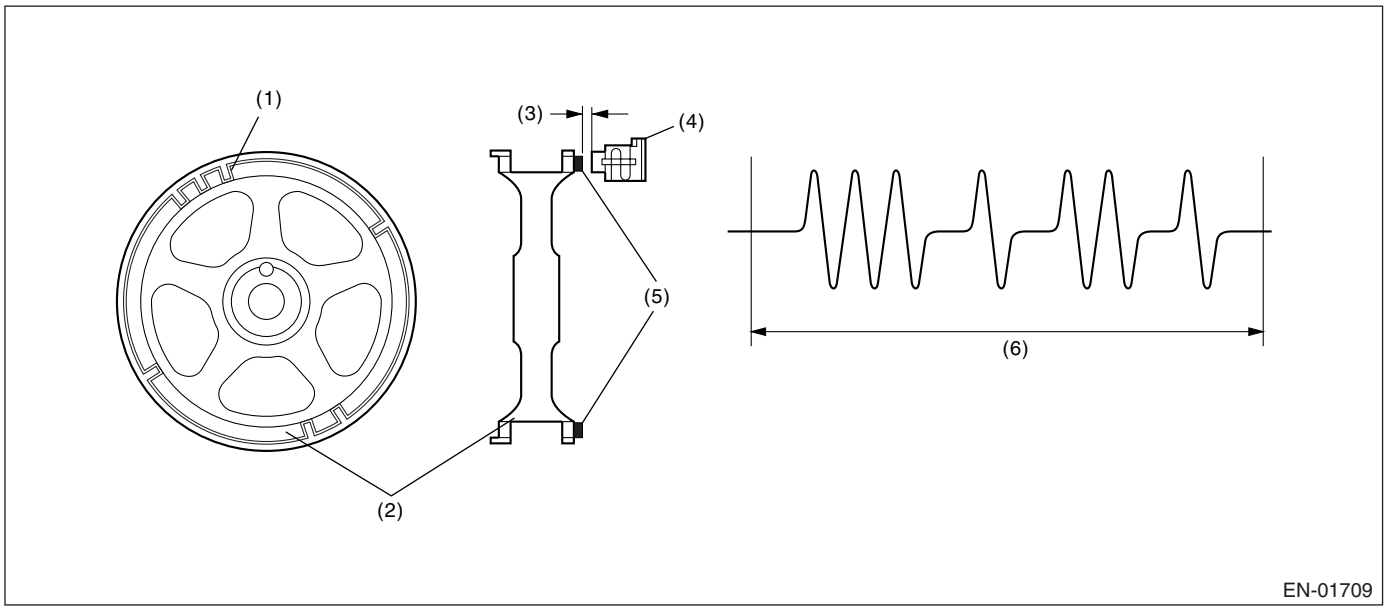
(1) NG counter of crankshaft position sensor
(2) Signal count of crankshaft position sensor
(3) Crankshaft position sensor signal
(4) Camshaft position sensor signal
(5) BTDC 97° CA
(6) BTDC 10° CA
(7) BTDC 65° CA
(8) #1 compression TDC
(9) #3 compression TDC
(10) #2 compression TDC
(11) #4 compression TDC
(12) Signal count of camshaft position sensor
(13) NG counter of relative position

• Cylinder judgment method

When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

2. COMPONENT DESCRIPTION



(1) Boss
(2) Camshaft sprocket
(3) Air gap
(4) Camshaft position sensor
(5) Boss
(6) Camshaft one turn (Crankshaft two turns)

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When BTDC97°CA crankshaft position sensor signal is input, compare the camshaft position sensor signal number in past 4 times with camshaft position sensor signal number at normal. Increase NG judgment counter when each number does not correspond at once, judge OK and clear NG when the camshaft position sensor signal is normal.

Judgment Value

Malfunction Criteria	Threshold Value
Fault counter	≥ 32

Time Needed for Diagnosis: 6 revs.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

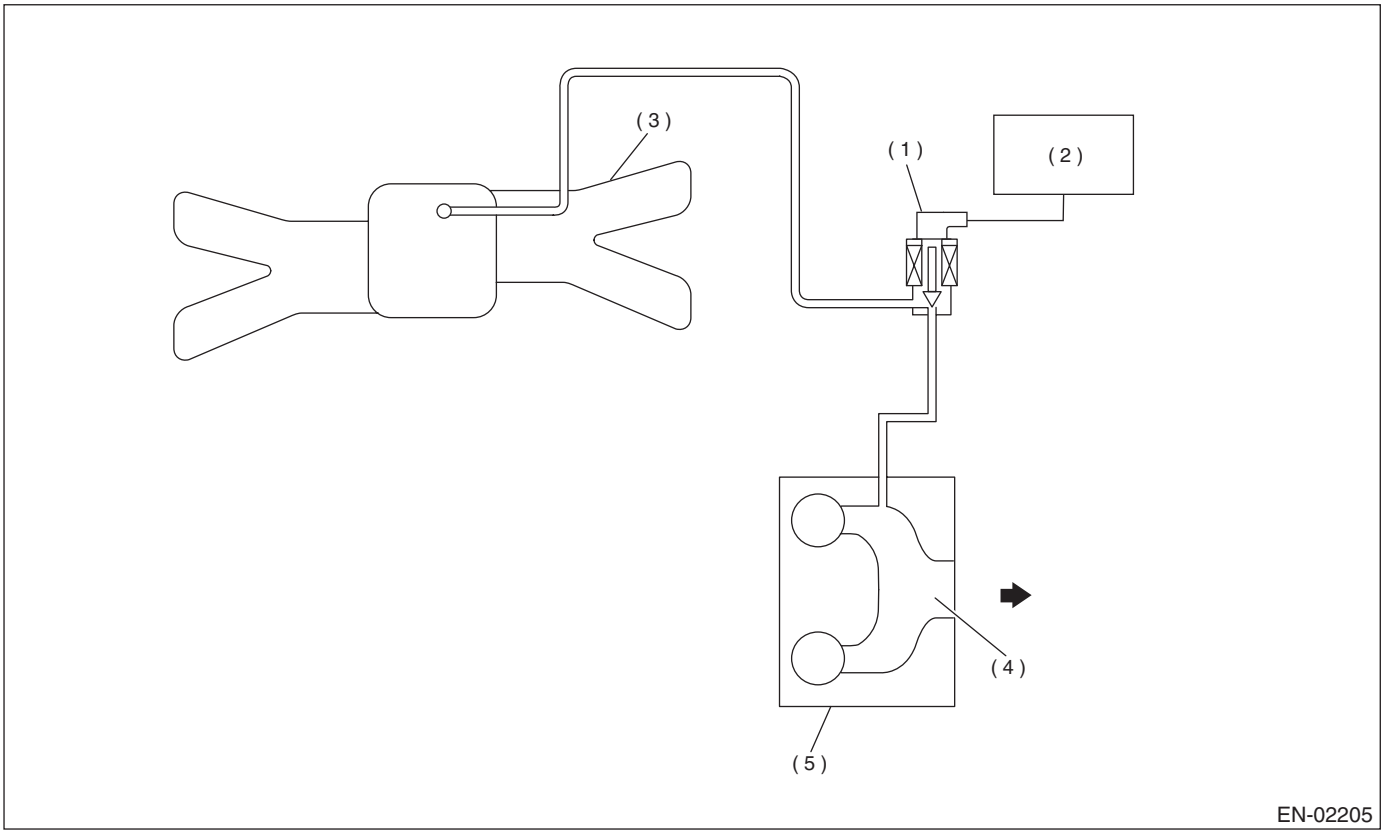
Memorize the freeze frame data. (For test mode $02)

AT:DTC P0400 — EXHAUST GAS RECIRCULATION FLOW —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of EGR system.
Intake manifold pressure (negative pressure) is stable because the throttle valve is fully closed during the fuel shut-off in deceleration. In this case, the intake manifold pressure changes when EGR valve is opened or closed. Judge EGR system is OK or NG according to intake manifold pressure change amount.

2. COMPONENT DESCRIPTION



(1) EGR valve
(2) Engine control module (ECM)
(3) Intake manifold
(4) Export port
(5) Cylinder head LH

3. ENABLE CONDITION

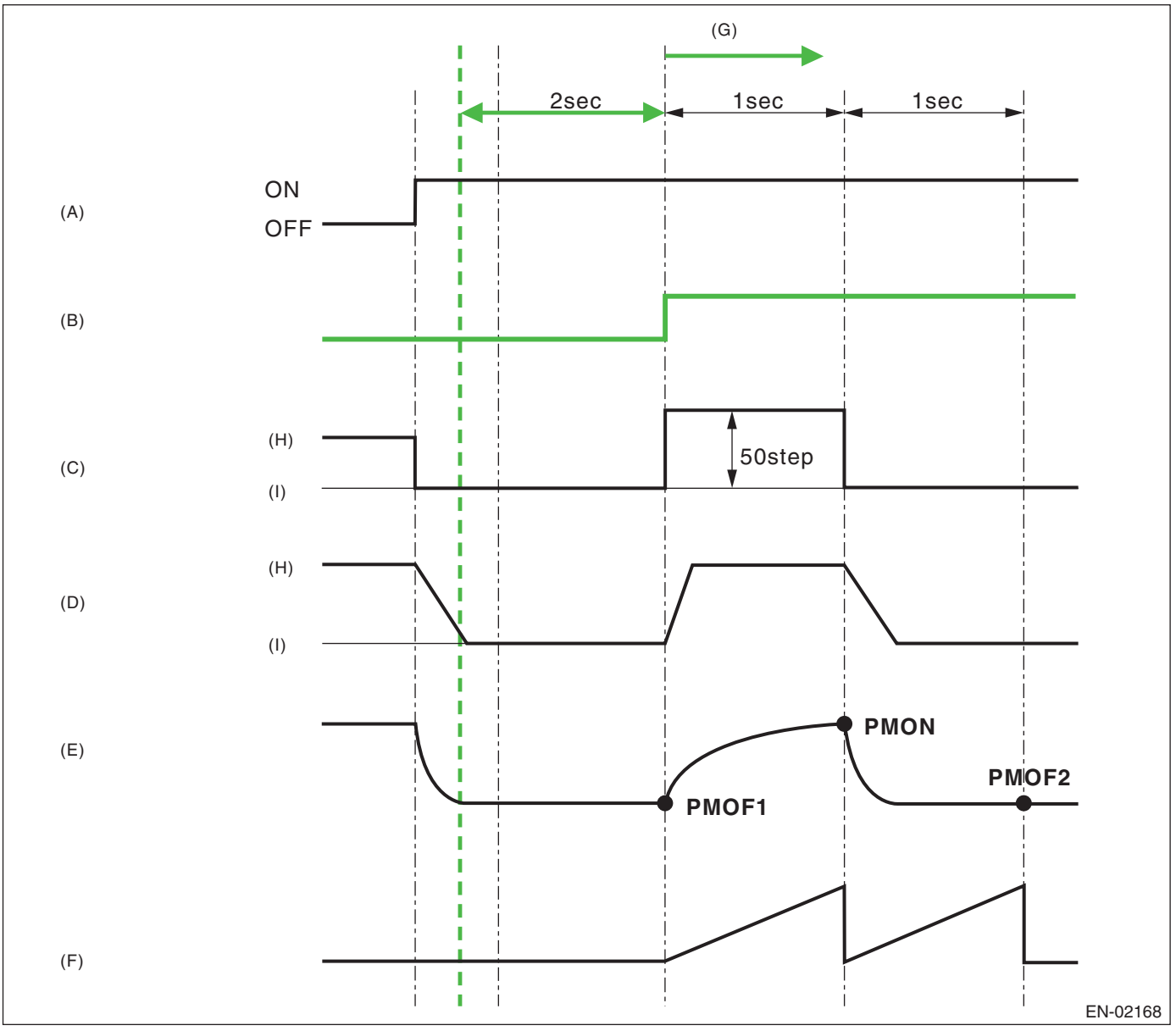
Secondary Parameters	Enable Conditions
After engine starting	40 secs. or more
Engine coolant temperature	≥ 75°C (167°F)
Engine speed	1,200 — 3,000 rpm
Intake manifold pressure	13.3 — 36.0 kPa (100 — 270 mmHg, 3.94 — 10.63 inHg)
Estimated ambient temperature	≥ 5°C (41°F)
Throttle position	< 1°
Battery voltage	> 10.9 V
Atmospheric pressure	≥ 75.7 kPa (568 mmHg, 22.36 inHg)
Vehicle speed	≥ 40 km/h (25 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF or 1 seconds changing from “ON” to “OFF”
After load input switch operation (air conditioner, power steering, lights, rear defroster, heater fun and radiator fan)	5 secs. or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at the fuel shut-off in deceleration in vehicle speed more than 40 km/h (25 MPH). Pay attention to vehicle speed and engine speed. (The diagnosis is not completed if vehicle speed and engine speed are out of condition due to deceleration.)

5. DIAGNOSTIC METHOD

Measure the pressure in the following procedures when the enable conditions are completed, and then diagnosis by calculating the result.
(1) PMOF1 is equal to the intake manifold pressure at enable condition completed, and EGR target step is set to 50 steps (almost fully opened).
(2) PMON is equal to the intake manifold pressure in 1 second after EGR target step is set 50 steps (when enable conditions are completed), and EGR target step is set to 0 step.
(3) PMOF2 is equal to the intake manifold pressure in 1 second after EGR target step is set to 0 step (in 2 seconds after enable conditions are completed).



(A) Fuel shut-off in deceleration
(B) Diagnosis enable condition
(C) EGR target step
(D) EGR actual step
(E) Intake manifold pressure (At normal condition)
(F) Diagnosis mode timer
(G) Diagnosis starts.
(H) Open
(I) Close

(4) Calculate the judged value using the following formula.
Judged value = [PMON - (PMOF1 + PMOF2)/2]
Judge NG when the malfunction criteria bellows are completed. Judge OK and clear NG when the malfunction criteria bellows are not completed.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Judged value	< 2.48 kPa (18.63 mmHg, 0.733 inHg) ≥ 146.6 kPa (1,100 mmHg, 43.31 inHg)	P0400

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

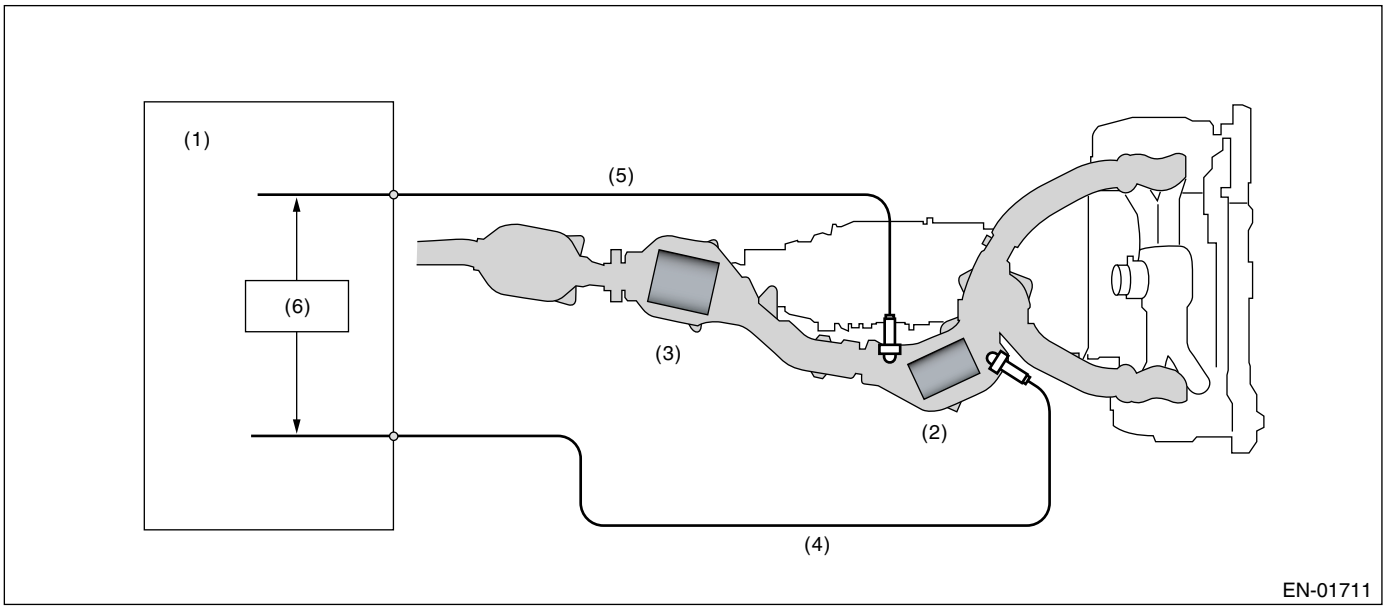
9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnosis value and trouble standard value. (For test mode $06)

AU:DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —

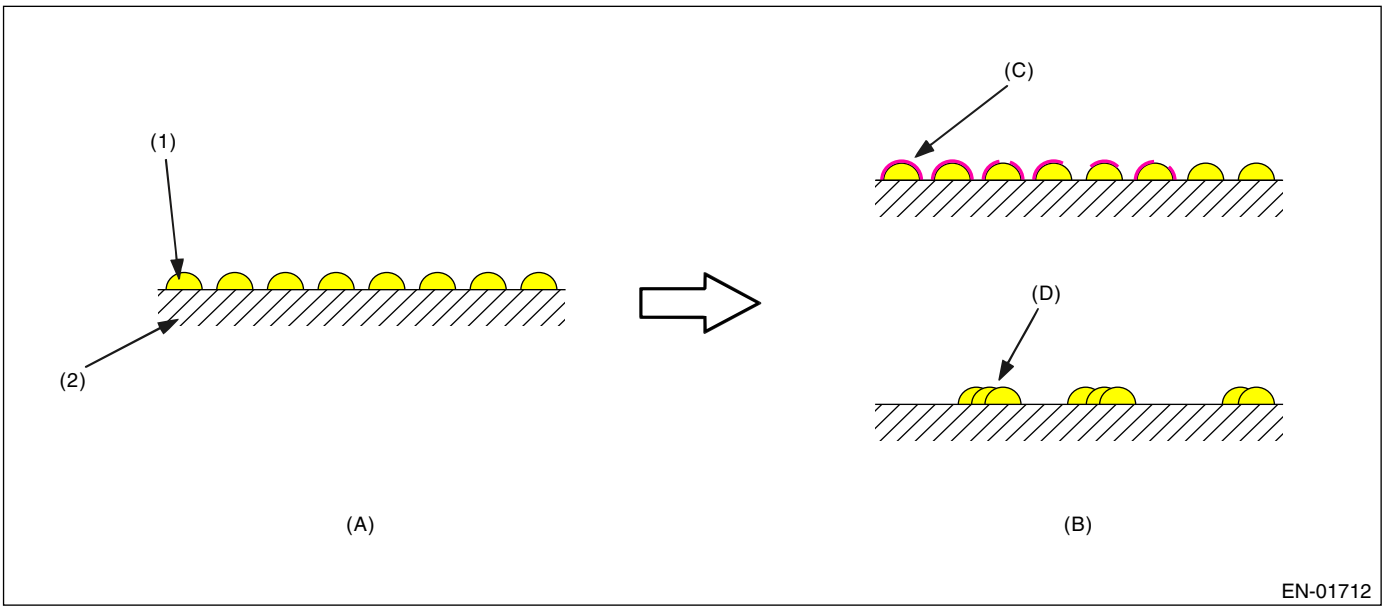
1. OUTLINE OF DIAGNOSIS

Check the catalyst efficiency deterioration.
Generally, the catalytic converter exhaust gas conversion efficiency and oxygen absorbing/removing function are inter-related. The front A/F sensor and rear oxygen sensor are therefore utilized to monitor the oxygen absorbing/removing function, and the results are used to monitor the conversion efficiency.



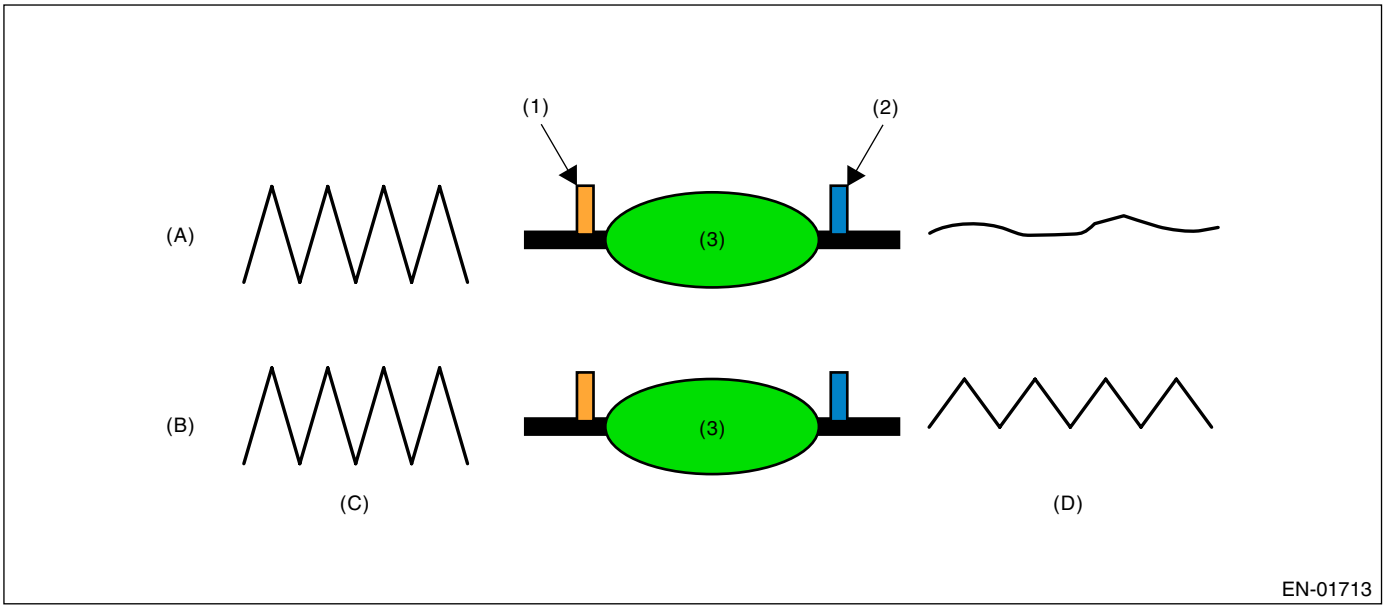
(1) Engine control module (ECM)
(2) Front catalyst converter
(3) Rear catalyst converter
(4) Front oxygen (A/F) sensor
(5) Rear oxygen sensor
(6) Diagnosis circuit

Oil adherence to the catalytic metal (an alloy of platinum and rhodium, or an alloy of platinum, rhodium and palladium) in catalyst converter or metal melting by extraordinary high temperature result in the decrease of metal surface area contacting exhaust gas. Eventually, catalytic conversion efficiency blunted and oxygen density of catalyst downstream may change.



(1) Metal (catalytic function)
(2) Monolith
(A) Normal
(B) Deterioration
(C) Oil adherence
(D) Metal melting by high temperature

Output of rear oxygen sensor changes gradually with a new catalyst, but the blunted catalyst efficiency mentioned above makes sensor output larger and inverse time shorter.
Therefore, catalyst diagnosis is conducted by monitoring the rear oxygen sensor output and comparing its output with the front A/F sensor output.



(1) Front oxygen (A/F) sensor
(2) Rear catalyst converter
(3) Catalytic converter
(A) Normal
(B) Deterioration
(C) Output waveform from the front oxygen (A/F) sensor
(D) Output waveform from the rear oxygen sensor

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Idle switch off after coolant temp 71°C (160°F)	180 seconds
Closed loop control continuous 5 seconds	Not in standstill
Vehicle speed	24 — 140 km/h (15 — 87 MPH)
Injector pulse (AT)	0.832 — 4.096 milliseconds
(MT)	0.384 — 3.840 milliseconds
Closed loop control rear oxygen sensor	In operation
Engine misfire during 400 ignitions	≤ 5 times
Lambda	0.625 — 1.375
Engine speed (AT)	600 — 3000 rpm
(MT)	1000 — 3300 rpm
Neutral position	OFF
Engine coolant temperature	≥ 75°C (167°F)
Throttle position (AT)	< 14.72°
(MT)	< 17.60°
Average AIA during diagnosis	≥ 27.0 kg (60 lb)/h
Integrated fluctuating AIA during diagnosis	> 160 kg (353 lb)/h
After fuel shut-off finished	1 seconds or more
Accumulated amount of intake air (AIA) (start condition)	0.84 kg (1.85 lb)/60 seconds
Vehicle speed (continuous 80 seconds) (start condition)	≥ 20 km/h (12 MPH)
Injector pulse (continuous 40 seconds) (start condition)	1.34 — 4.22 milliseconds
Vehicle speed (continuous 70 seconds) (start condition)	≥ 74 km/h (46 MPH)

3. GENERAL DRIVING CYCLE

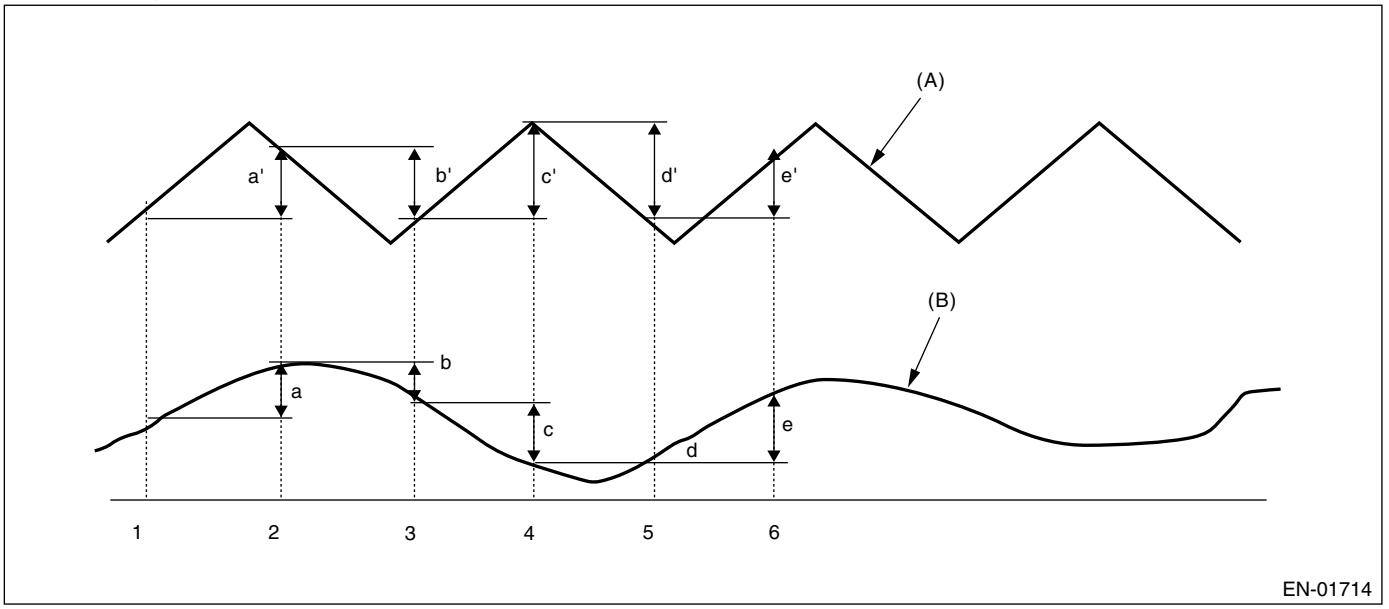
Perform the diagnosis once with a constant vehicle speed 74 km/h (40 MPH).

4. DIAGNOSTIC METHOD

• Output fluctuation accumulate method

The accumulated value of front A/F sensor output changes and the accumulated value of rear oxygen sensor output changes are determined, and the diagnostic value is calculated using the following formula.
Diagnostic value = Accumulated value of rear oxygen sensor output changes / Accumulated value of front A/F sensor output changes

• For example



(A) Front oxygen (A/F) sensor output waveform

(B) Rear oxygen sensor output waveform

Judge NG when the malfunction criteria below are completed, and judge OK when they are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Accumulated variation of output Voltage of rear oxygen sensor per 50 milliseconds divided by accumulated Variation of output voltage of front lambda sensor per 50 milliseconds	≥ 1.4

Time Needed for Diagnosis: 45 seconds
Malfunction Indicator Light Illumination: 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

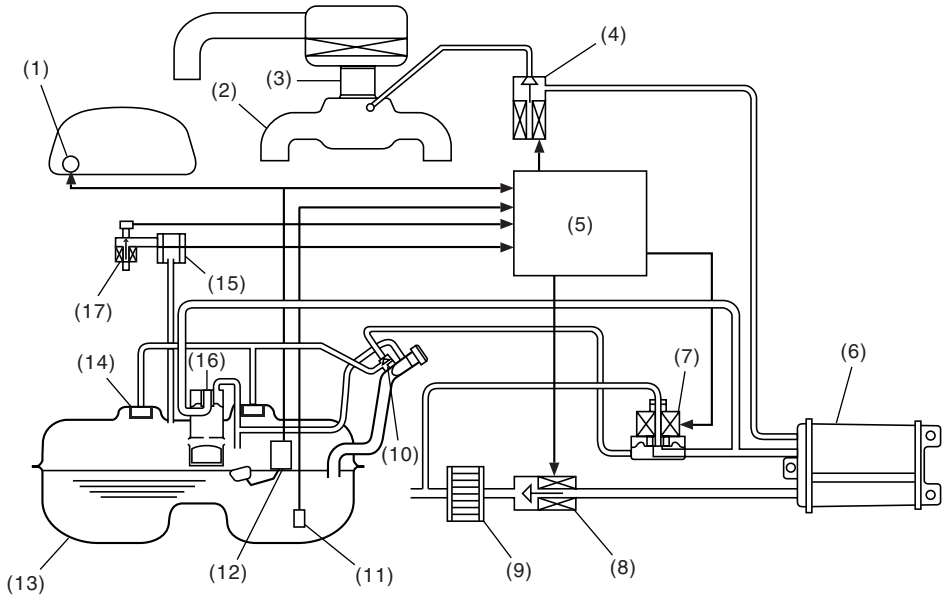
8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnosis value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.

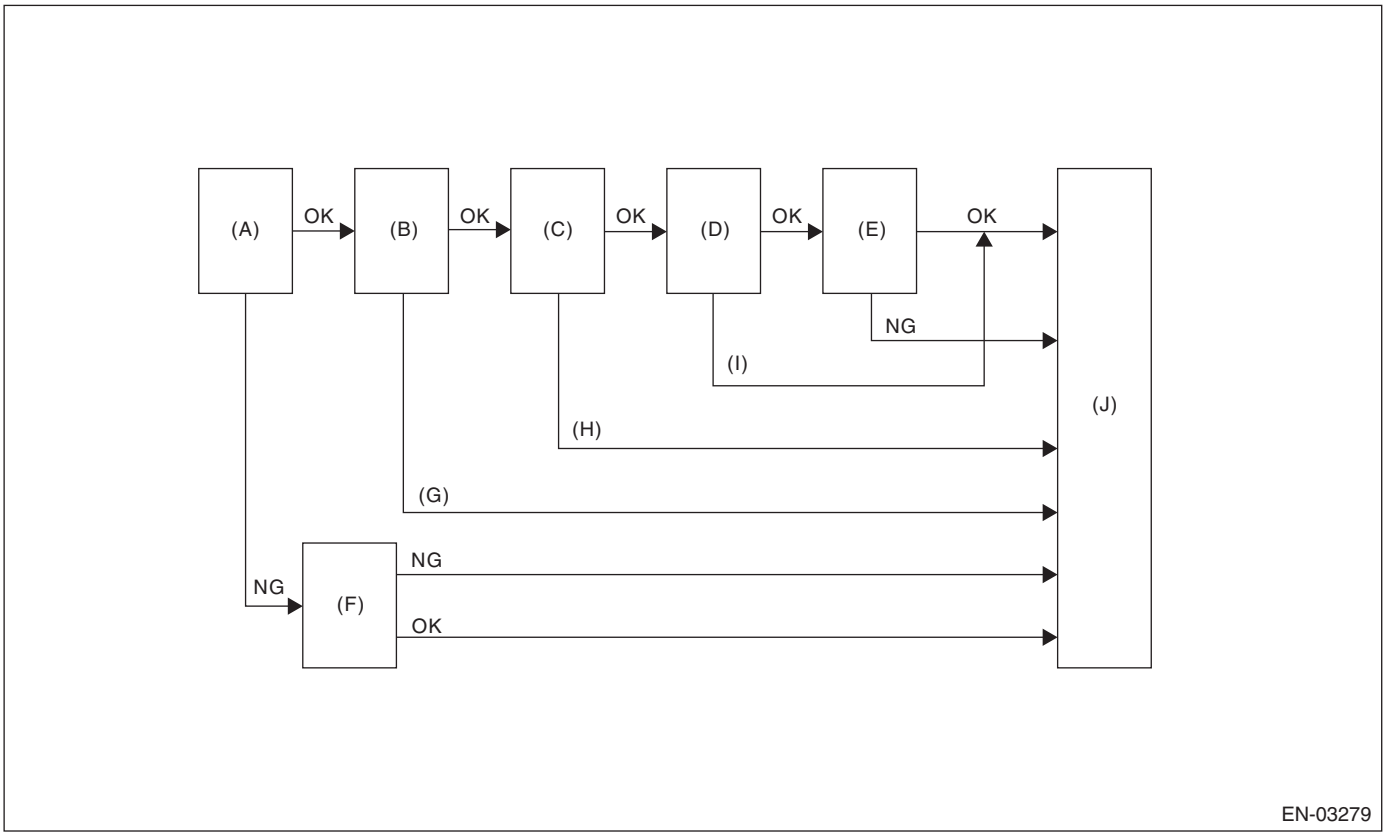


EN-01699

(1) Fuel gauge
(2) Intake manifold
(3) Throttle body
(4) Purge control solenoid valve
(5) Engine control module (ECM)
(6) Canister
(7) Pressure control solenoid valve
(8) CCV
(9) Drain filter
(10) Shut-off valve
(11) Fuel temperature sensor
(12) Fuel level sensor
(13) Fuel tank
(14) Fuel cut valve
(15) Fuel tank pressure sensor
(16) Vent valve
(17) Tank pressure switching solenoid valve

In this system diagnosis, checking for leakage and valve function is conducted by changing the fuel tank pressure, and monitoring the pressure change using the fuel tank pressure sensor. 0.04 inch diagnosis is performed in the order of mode Z, mode A, mode B, mode C, mode D and mode E, and 0.02 inch diagnosis is performed in the order of mode Y, mode A, mode B, mode C, mode D and mode E.

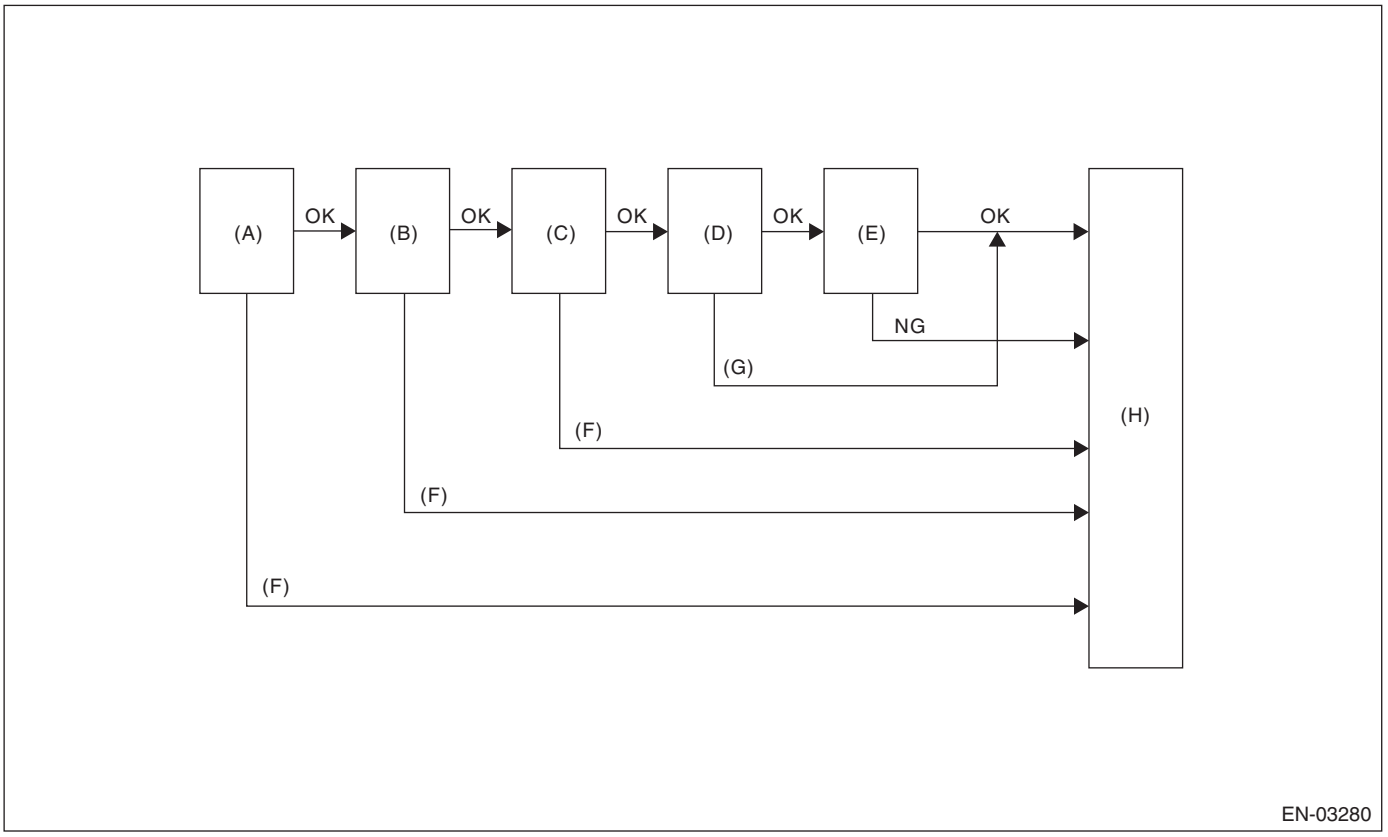
• 0.04-inch Diagnosis



(A) Mode Z
(B) Mode A
(C) Mode B
(D) Mode C
(E) Mode D
(F) Mode Z Extend
(G) Cancel
(H) Large leakage judgement
(I) Early OK
(J) END

Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve close trouble diagnosis)	Carry out purge control solenoid valve close trouble diagnosis according to tank pressure change amount after the diagnosis has started.	3 — 16 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	7 — 15.5 seconds
Mode B (Sealed negative pressure, large leakage judgment)	Introduce the intake manifold pressure to the fuel tank and reduce the tank pressure to the desired value. If the tank pressure cannot be reduced, it is diagnosed as large leakage.	5 — 35 seconds
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure becomes P2 calculation start pressure. If the tank pressure does not become the value, make advanced OK judgment.	4 — 16 seconds
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 of Mode 1. Perform the evaporation leakage diagnosis using the diagnostic value.	7 — 15.5 seconds

• 0.02-inch Diagnosis



(A) Mode Y
(B) Mode A
(C) Mode B
(D) Mode C
(E) Mode D
(F) Cancel
(G) Early OK
(H) END

Mode	Mode Description	Diagnosis Period
Mode Y (Tank pressure stabilization)	Return the tank pressure to atmosphere.	0.1 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	26 seconds
Mode B (Negative pressure sealed)	Introduce the intake manifold pressure to the fuel tank and reduce the tank pressure to the desired value.	10 — 62 seconds
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure becomes P2 calculation start pressure. If the tank pressure does not become the value, make advanced OK judgment.	5 — 20 seconds
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 of Mode 1. Perform the evaporation leakage diagnosis using the diagnostic value.	22 seconds

• Mode Table for Evaporative Emission Control System Diagnosis

• 0.04-inch Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Nearly same as atmospheric pressure [equivalent pressure of 0 kPa (0 mmHg, 0 inHg)]	Purge control solenoid valve open trouble diagnosis.	P0457
Mode A	Pressure is in proportion to amount of evaporation gas occurrence.		
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leakage judgment	P0457
Mode C	Target pressure is reached.		
Mode D	Pressure change is small.	Evaporation system is judged to have large leak [1.0 mm (0.04 in)].	P0442

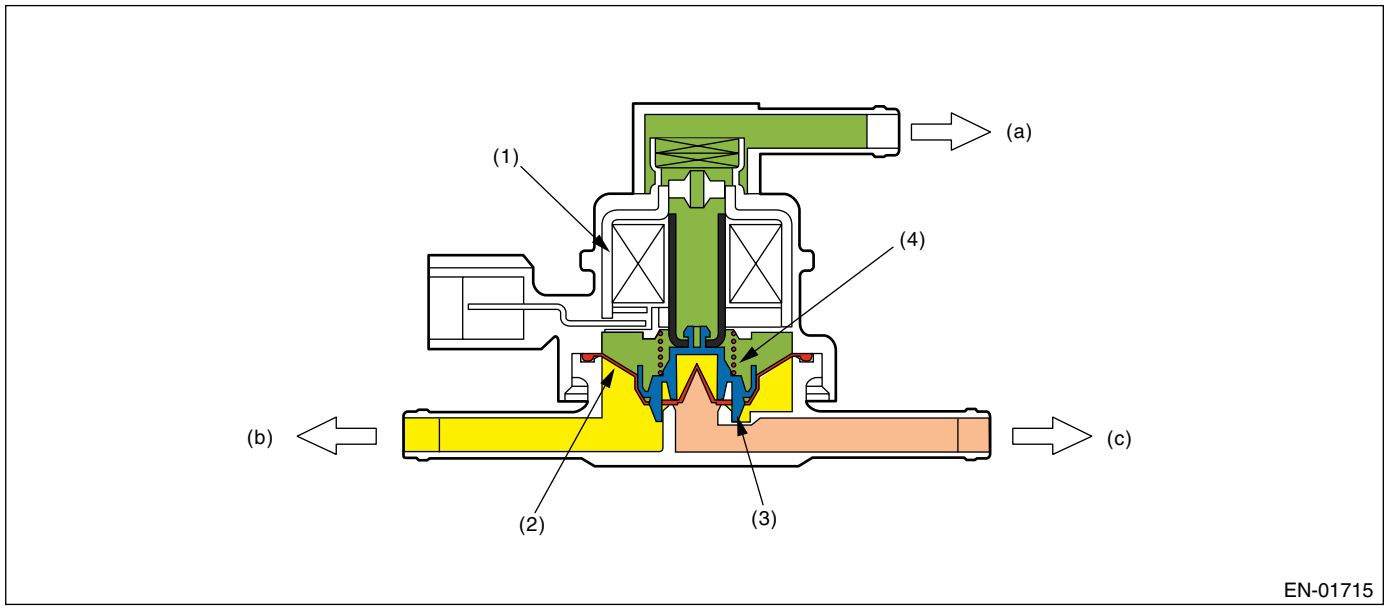
• 0.02-inch Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Y	Return to atmosphere		
Mode A	Pressure is in proportion to amount of evaporation gas occurrence.		
Mode B	Negative pressure is formed due to intake manifold negative pressure		
Mode C	Target pressure is reached.		
Mode D	Pressure change is small.	P2 measurement of small leak in system. Evaporation system is judged to have small leak [0.5 mm (0.02 in)].	P0456

2. COMPONENT DESCRIPTION

• Pressure Control Solenoid Valve

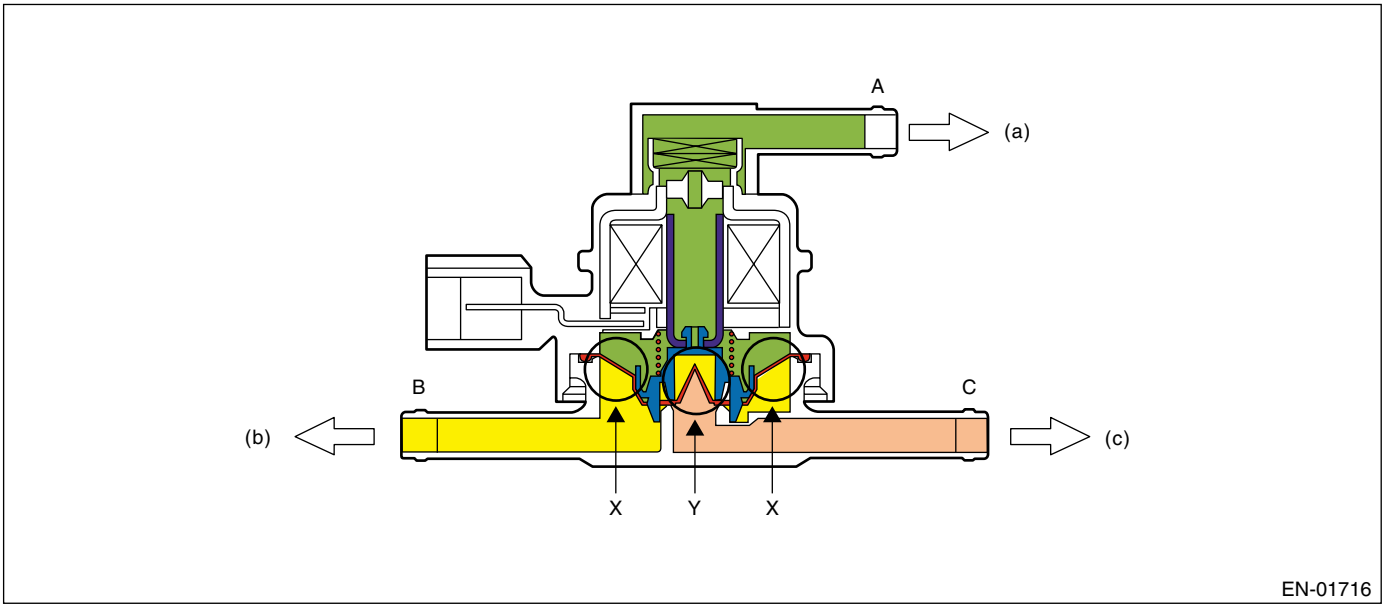
PCV controls the fuel tank pressure to be equal to the atmospheric air pressure.
Normally, the solenoid is set to OFF. And the valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.
Also the valve is able to forcibly opened by setting the solenoid to ON.



(1) Solenoid
(2) Diaphragm
(3) Valve
(4) Spring
(a) Atmospheric pressure
(b) Fuel tank
(c) Canister

• Valve Operation and Air Flow

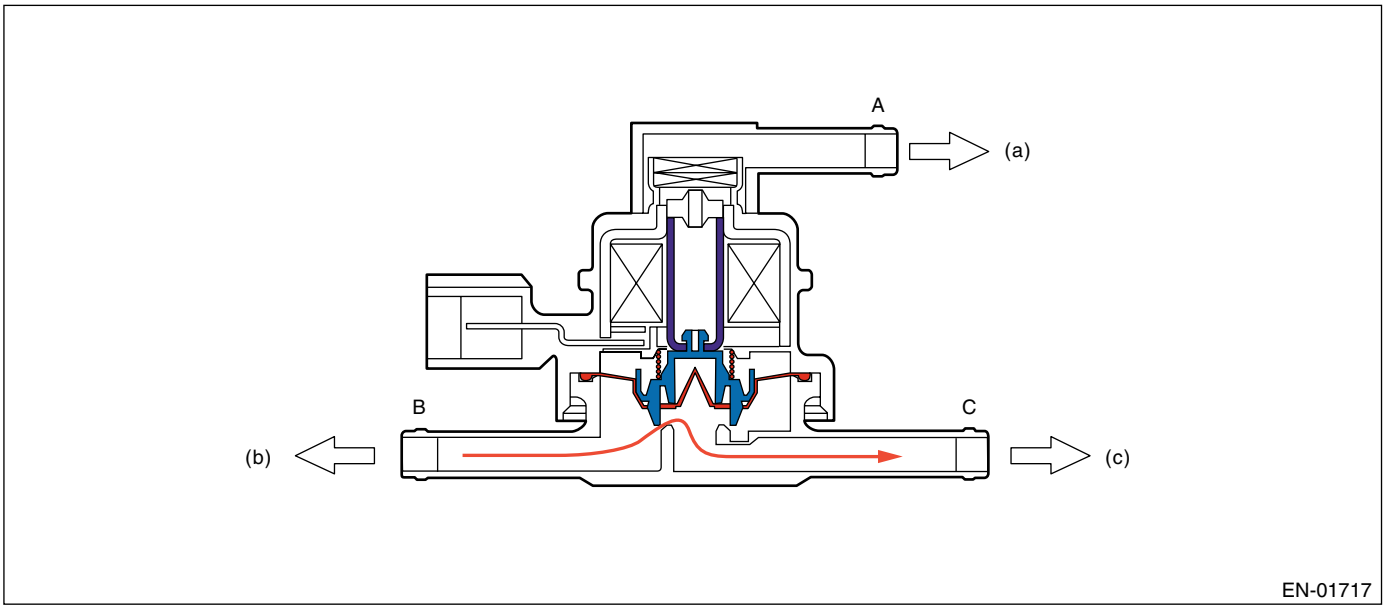
In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.
If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



(a) Atmospheric pressure (b) Fuel tank (c) Canister

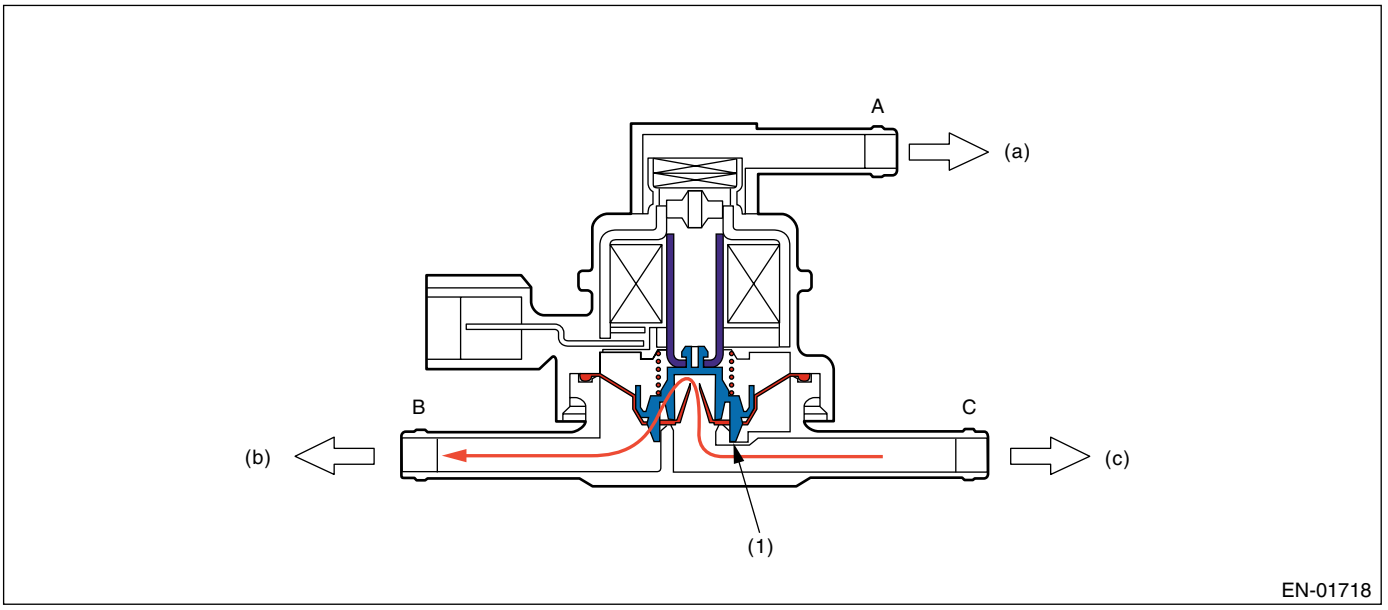
Condition of pressure	Flow
A < B (solenoid OFF)	B → C
B < C (solenoid OFF)	C → B
Solenoid ON	B ←→ C

• When A < B (Solenoid OFF)



(a) Atmospheric pressure (b) Fuel tank (c) Canister

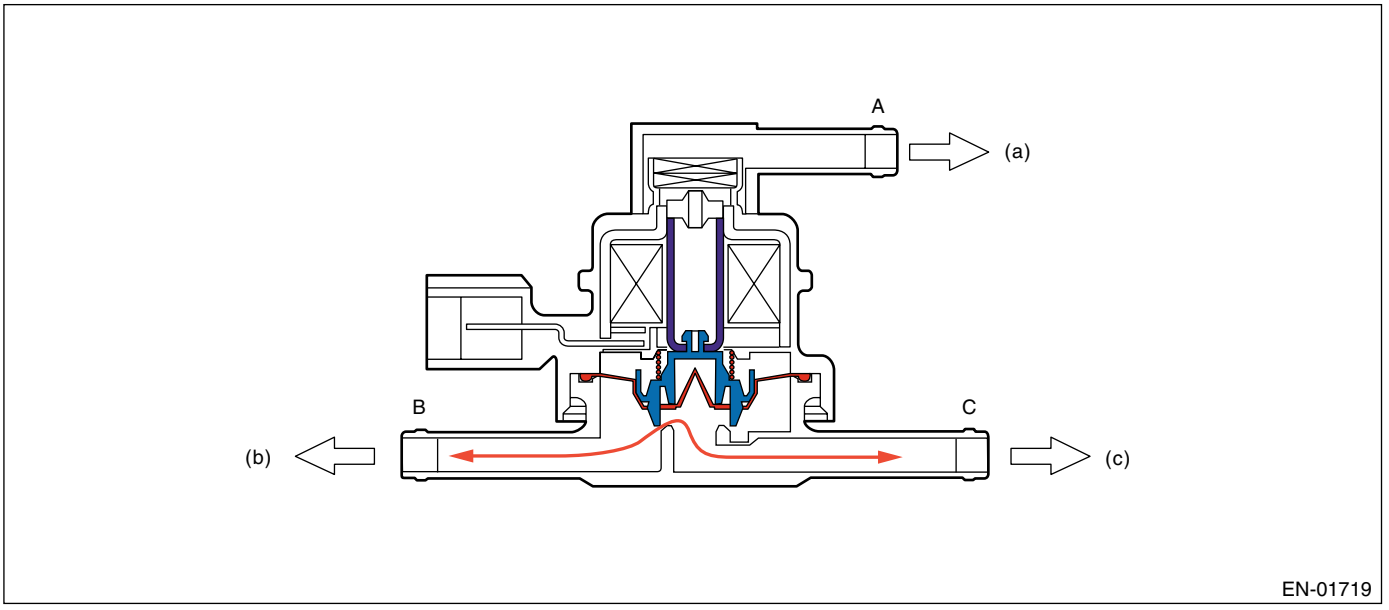
• When B < C (Solenoid OFF)



(1) Atmospheric pressure

(a) Atmospheric pressure
(b) Fuel tank
(c) Canister

• When Solenoid is ON

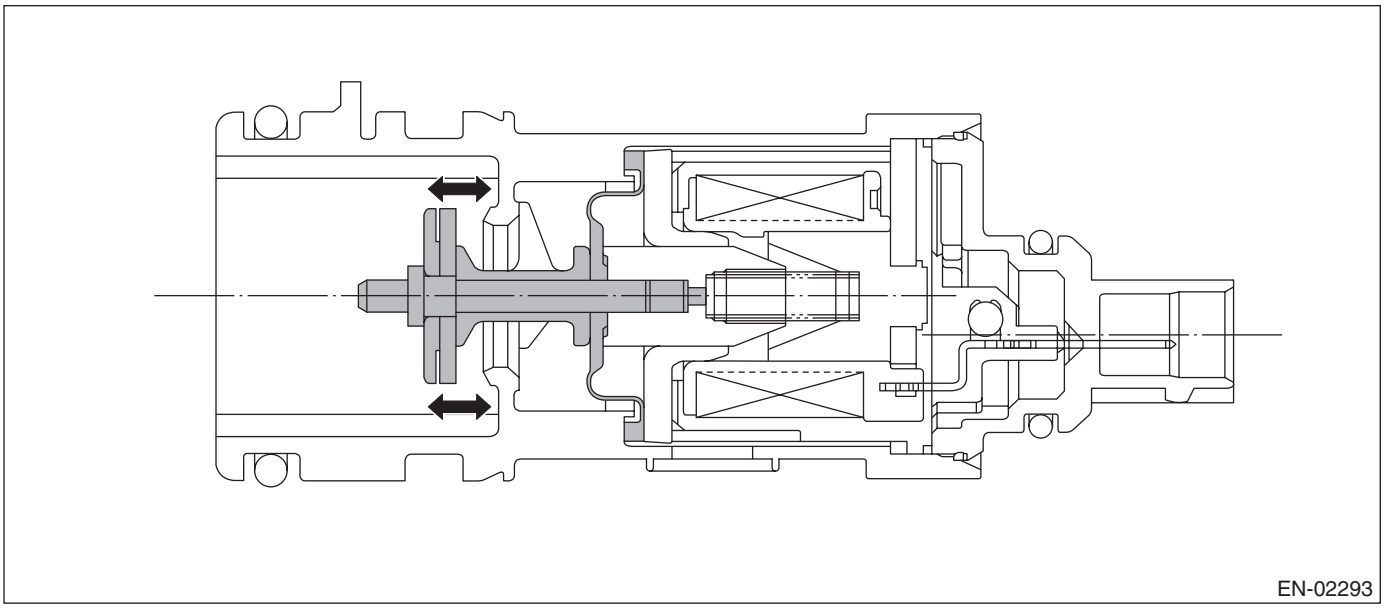


(a) Atmospheric pressure

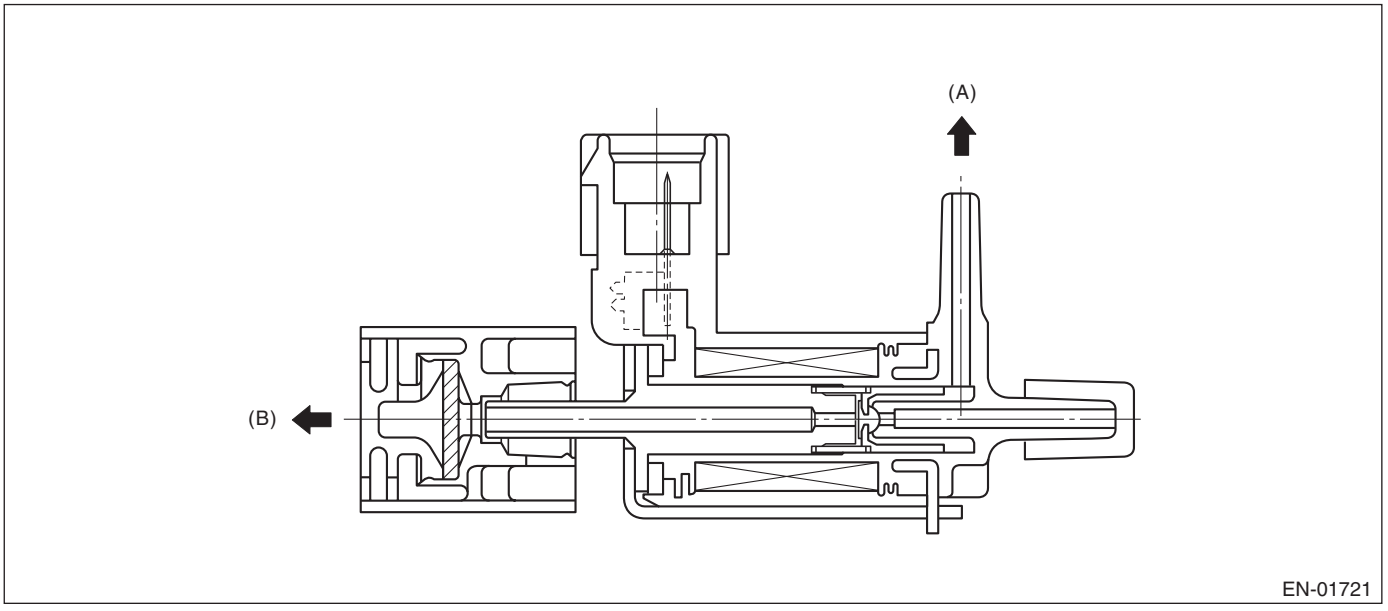
(b) Fuel tank

(c) Canister

• CCV



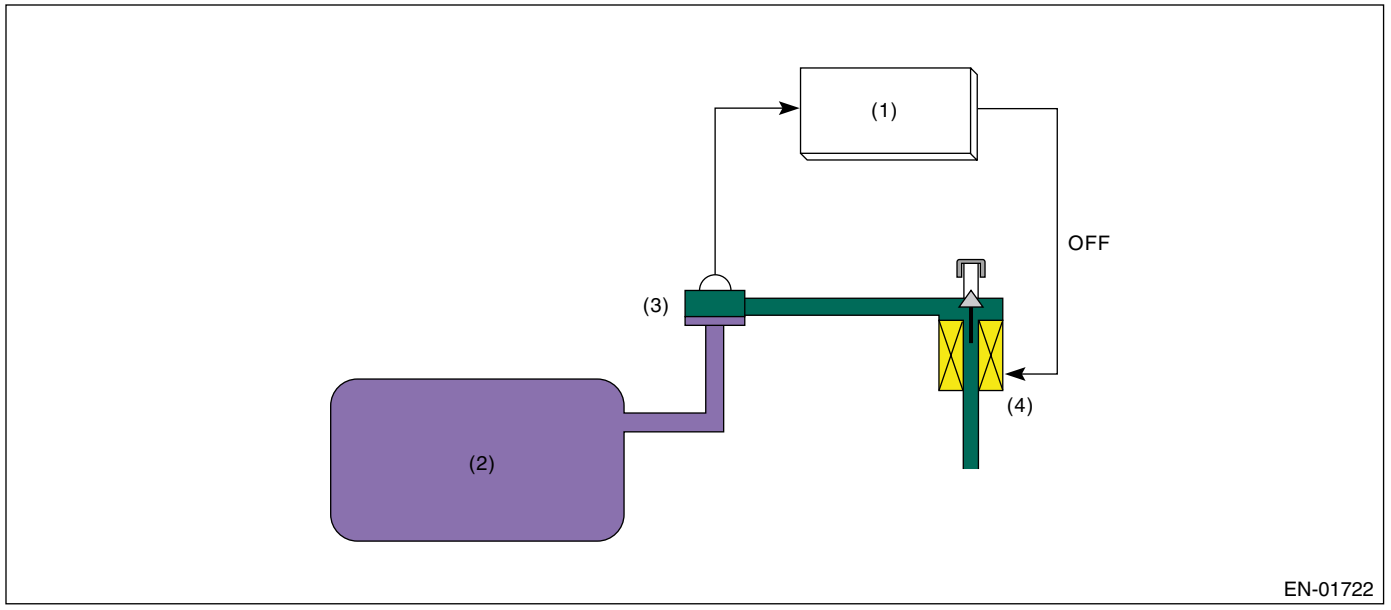
• Tank Pressure Switching Solenoid



(A) Fuel tank pressure sensor (B) Atmosphere

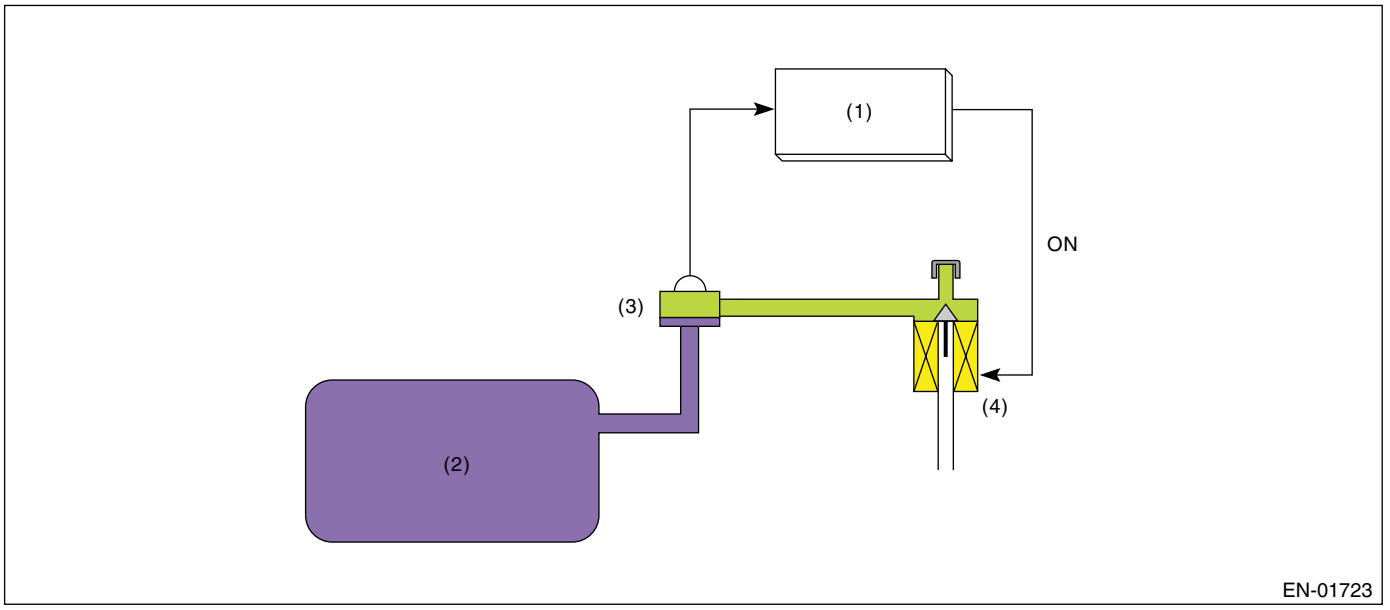
• Purpose of this solenoid

Fuel tank pressure sensor detects the difference between the atmospheric air pressure and the tank pressure and the ECM monitors the pressure difference.
Even if the tank pressure is constant, the atmospheric air pressure varies depending on the driving height, and the pressure signal transmitted to ECM will change.



(1) Engine control module (ECM)
(2) Fuel tank
(3) Fuel tank pressure sensor
(4) Atmospheric pressure switching solenoid

Especially, in the small leakage [0.5 mm (0.02 in)], minute change in the tank pressure has to be detected. This diagnosis period is long (approx. 29 seconds). And if the driving height changes during the diagnosis, the atmospheric air pressure changes. In this case, it becomes difficult to precisely detect the tank pressure variation, causing erroneous diagnosis. Therefore, using the atmospheric pressure switching solenoid, atmospheric air is sealed between the fuel tank pressure sensor and atmospheric pressure switching solenoid, maintaining the air pressure constant and enabling the detection of minute variation of tank pressure.



(1) Engine control module (ECM)
(2) Fuel tank
(3) Fuel tank pressure sensor
(4) Atmospheric pressure switching solenoid

NOTE:
ECM also has the atmospheric air pressure sensor, and always monitors atmospheric air. However, as the monitoring range is large, that is, 53 to 107 kPa (400 to 800 mmHg, 16 to 32 inHg) it is not suitable for detection of minute pressure variation.
In the case of small leakage diagnosis, the tank pressure variation is very small, that is, 0.13 to 0.27 kPa (1 to 2 mmHg, 0.04 to 0.08 inHg) and the fuel tank pressure sensor is equipped.

3. ENABLE CONDITION

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Closed air fuel ratio	In operation
Throttle angle	0.96 — 14.08°
Canister purge cumulative time	≥ 120 seconds
Engine speed	≥ 1500 rpm
Fuel tank pressure at Evap. monitoring starting	≥ −1.0 — 1.6 kPa (−7.5 — 12 mmHg, −0.295 — 0.472 inHg)
Intake manifold relative pressure	≤ −26.7 kPa (−200 mmHg, −7.87 inHg)
Vehicle speed	≥ 48 km/h (30 MPH)
Fuel level	9.6 — 48 ℓ (2.54 — 10.68 US gal, 2.11 — 10.56 Imp gal)
After engine started	More than 454 seconds
Barometric pressure	≥ 75.7 kPa (568 mmHg, 22.36 inHg)
Fuel temperature	−10 — 45°C (14 — 113°F)

Cancel Conditions

Secondary Parameters	Enable Conditions
Change of fuel level	≥ 5 ℓ (1.3 US gal, 1.1 Imp gal)/200 milliseconds
Throttle angle	≤ 0.640°
Engine speed	≥ 1500 rpm
Intake manifold relative pressure	≤ −16 kPa (−120 mmHg, −4.7 inHg)
Vehicle speed	≥ 68 km/h (42 MPH)
Compensation factor of air fuel ratio	≤ −30%
Tank pressure variation amount	≥ 0.1 kPa (0.75 mmHg, 0.03 inHg)
Fuel tank pressure change amount per 1 second	< 0.1 kPa (0.75 mmHg, 0.03 inHg)
Pressure difference between max. and min. per 1 second while monitoring	≥ 87.5 Pa (0.65 mmHg, 0.0026 inHg)
Time after finishing the previous 0.04-inch leakage diagnosis	≥ 180 seconds
Intake manifold pressure (Absolute pressure) − atmospheric pressure	−8.0 kPa (−60 mmHg, −2.36 inHg)

0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
Continuous time of completing the all conditions below.	≥ 5 seconds
Fuel tank pressure at vacuum starting	0 — 1.26 kPa (0 — 9.45 mmHg, 0 — 0.0372 inHg)
Since last incomplete diagnosis event of 0.02 inches leak	> 180 seconds
Total time of operating canister purge	More than 120 seconds
After engine started	More than 325 seconds
Fuel tank pressure below −3050 Pa (−22.87 mmHg, −0.9007 inHg) during same driving cycle	< 2 times
Fuel temperature	−10 — 35°C (14 — 95°F)
After engine start with coolant temperature of 40°C or below	< 2400 seconds
Fuel level	96 — 48 ℓ (2.54 — 10.68 US gal, 2.11 — 10.56 Imp gal)
Atmospheric pressure	≥ 75.7 kPa (568 mmHg, 22.3 inHg)
Ambient temperature	≥ −10°C (14°F)
(Ambient-fuel) temperature	< 1°C (34°F)
Closed air fuel ratio control	In operation

Cancel Conditions

Secondary Parameters	Enable Conditions
Lambda factor	< 0.75
P1	≥ 125 Pa (0.94 mmHg, 0.04 inHg)
P1	< −200 Pa (−1.5 mmHg, −0.06 inHg)
Change of fuel level	≥ 3.5 ℓ (3.7 US gal, 3.1 Imp gal)
Pressure difference between max. and min. per 1 second while monitoring	≥ 87.5 Pa (0.62 mmHg, 0.024 inHg)
Change of atmospheric pressure during calculation of P1	≥ 137.5 kPa (0.97 mmHg, 0.038 inHg)
Change of atmospheric pressure during calculation of P2	≥ 225 Pa (1.58 mmHg, 0.062 inHg)
Change of fuel level after engine starting (8 ℓ or more)	≤ 0 times
Change of engine speed after starting the diagnosis	≥ 600 rpm
Change of manifold absolute pressure after starting the diagnosis	≥ 40.0 kPa (300 mmHg, 11.81 inHg)

4. GENERAL DRIVING CYCLE

• 0.04-inch Diagnosis

• Perform the diagnosis only once in more than 454 seconds after the engine start at the constant driving speed of 48 km/h (30 MPH) or more.
• Pay attention to the fuel temperature and fuel level.

• 0.02-inch Diagnosis

• Perform diagnosis in more than 325 seconds after engine start at the constant speed of 68 km/h (42 MPH) or more, and then terminate the diagnosis when judged OK or NG.
• If not judged OK or NG, repeat the diagnosis until judged OK or NG.
• Pay attention to the fuel temperature and fuel level.

5. DIAGNOSTIC METHOD

• MODE Y (Tank pressure stabilization)

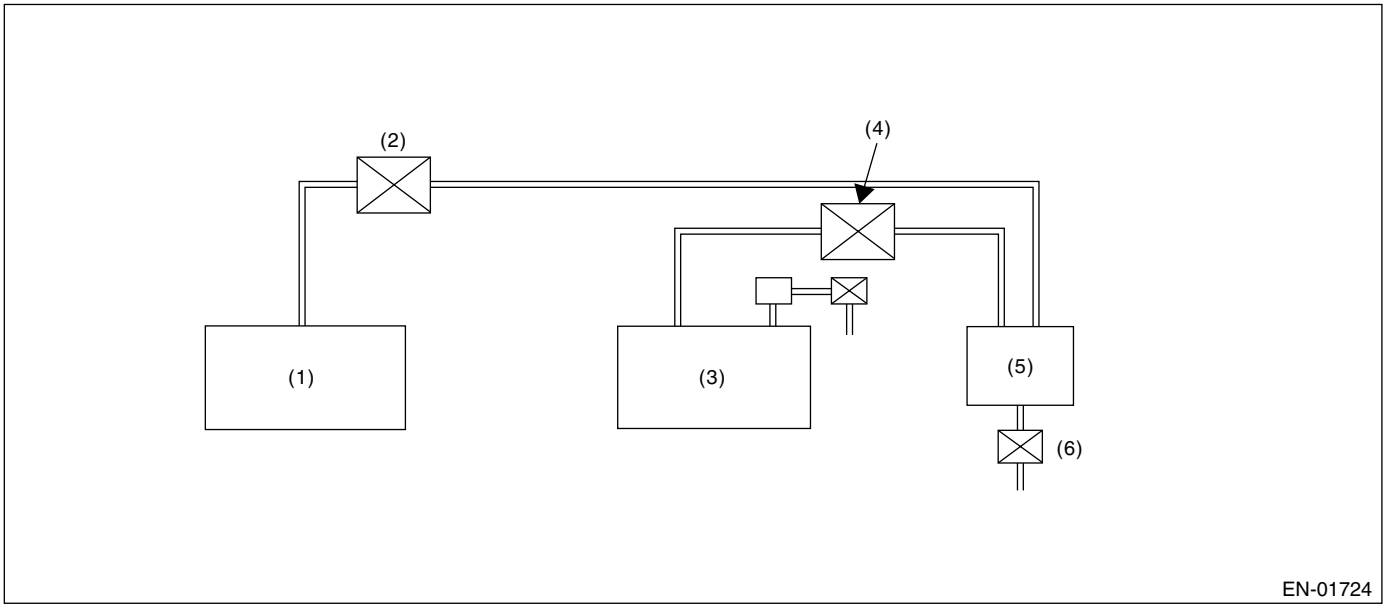
Perform the diagnosis under the conditions, and return the tank pressure to atmosphere.
Tank pressure > 0.9 kPa (67.5 mmHg, 2.7 inHg) after 0.1 seconds:
Cancel the leak check. (Change to Mode A, Tank pressure ≤ 0.9 kPa (67.5 mmHg, 2.7 inHg).)

• MODE Z (Purge control solenoid valve open trouble diagnosis)

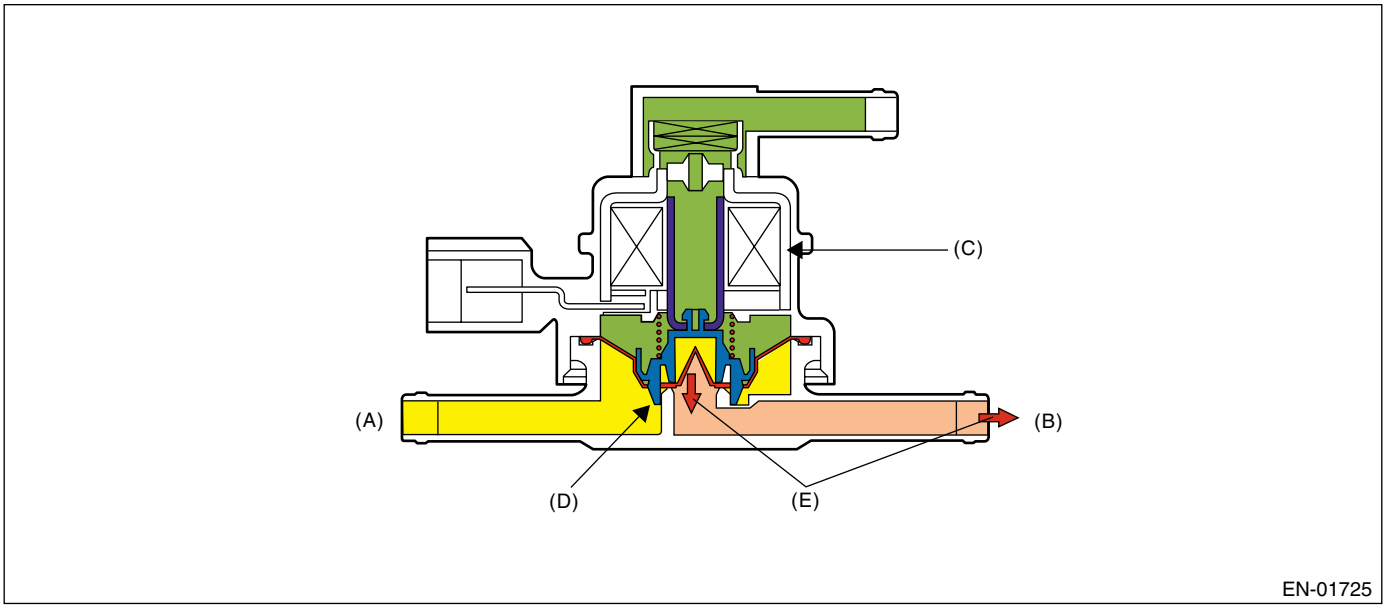
DTC P0457
DTC P1443

• Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, CPC have to operate normally. Therefore, mode Z is used to diagnose the CPC open fixation.
If the CPC open fixation trouble is detected, the EVAP system leakage diagnosis is cancelled.
If the CCV closed fixation trouble occurred, negative pressure is generated from the engine to pressure control solenoid valve when pressure control solenoid valve is closed and CPC is opened. Under this condition, the valve cannot be opened for the pressure control solenoid valve structure if the negative pressure is larger than electromagnetic force when pressure control solenoid valve solenoid is set to ON in order to open the valve.



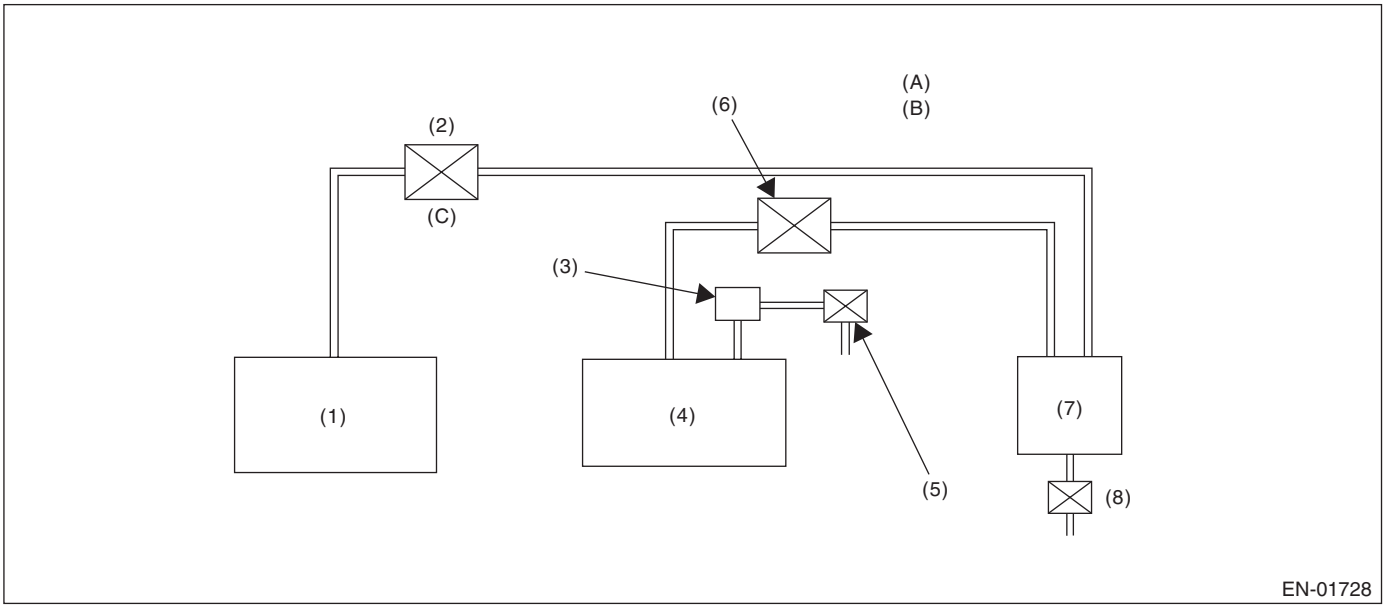
(1) Engine
(2) Purge control solenoid valve open
(3) Fuel tank
(4) Pressure control solenoid valve close
(5) Canister
(6) CCV stuck close



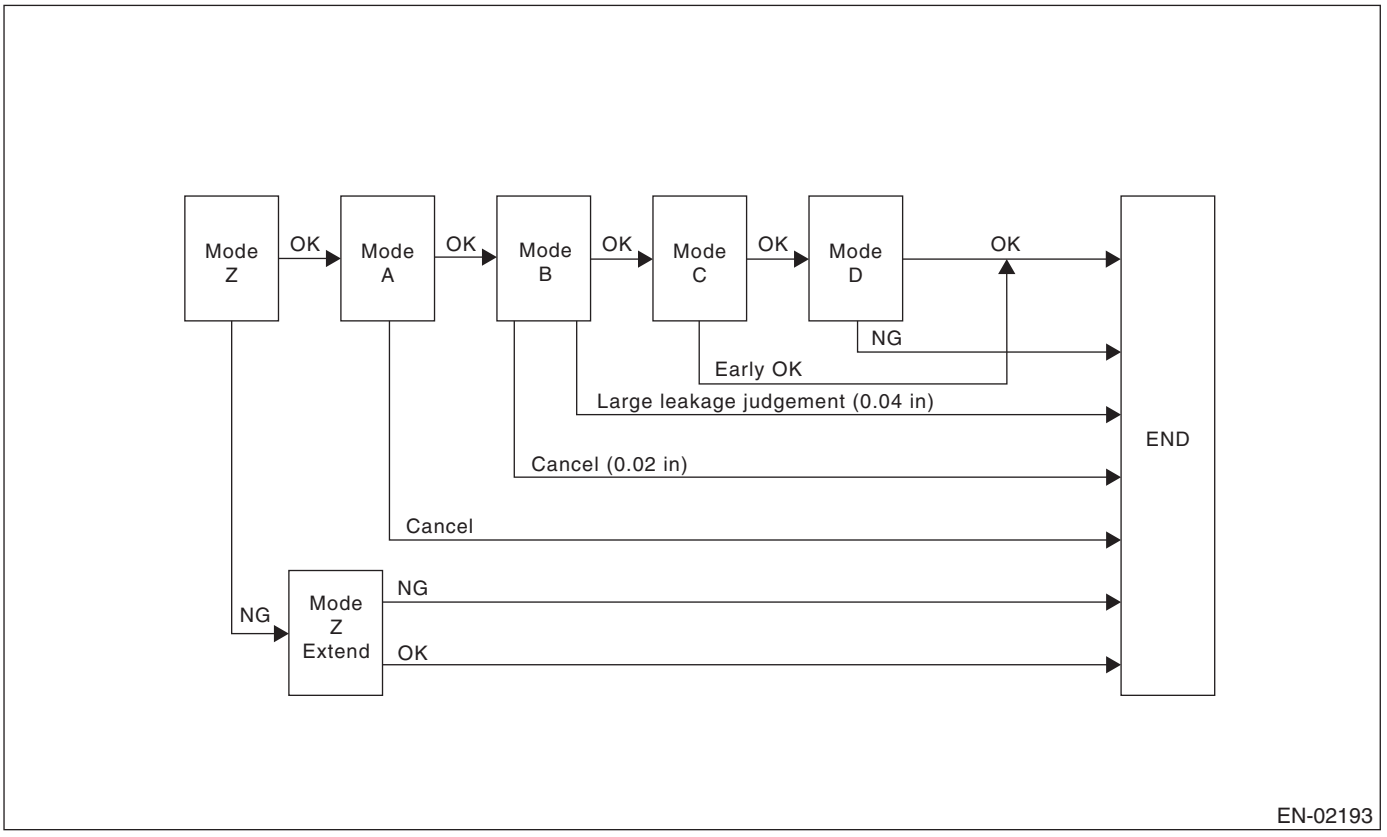
(A) To fuel tank
(B) To canister (Negative pressure)
(C) Solenoid ON
(D) Valve cannot be open.
(E) Negative pressure

• Diagnostic method

CPC open fixation diagnosis is performed in mode Z as shown in the figure below.



(1) Engine
(2) Purge control solenoid valve
(3) Canister
(4) Drain valve
(5) Pressure control solenoid valve
(6) Fuel tank
(7) Fuel tank pressure sensor
(8) Tank pressure switching solenoid valve
(A) Normal condition: mechanical control
(B) Under the diagnosis: electronic control



• Diagnosing function of CPC [P0457]

CPC functional diagnosis is performed by monitoring the tank pressure in Mode Z.

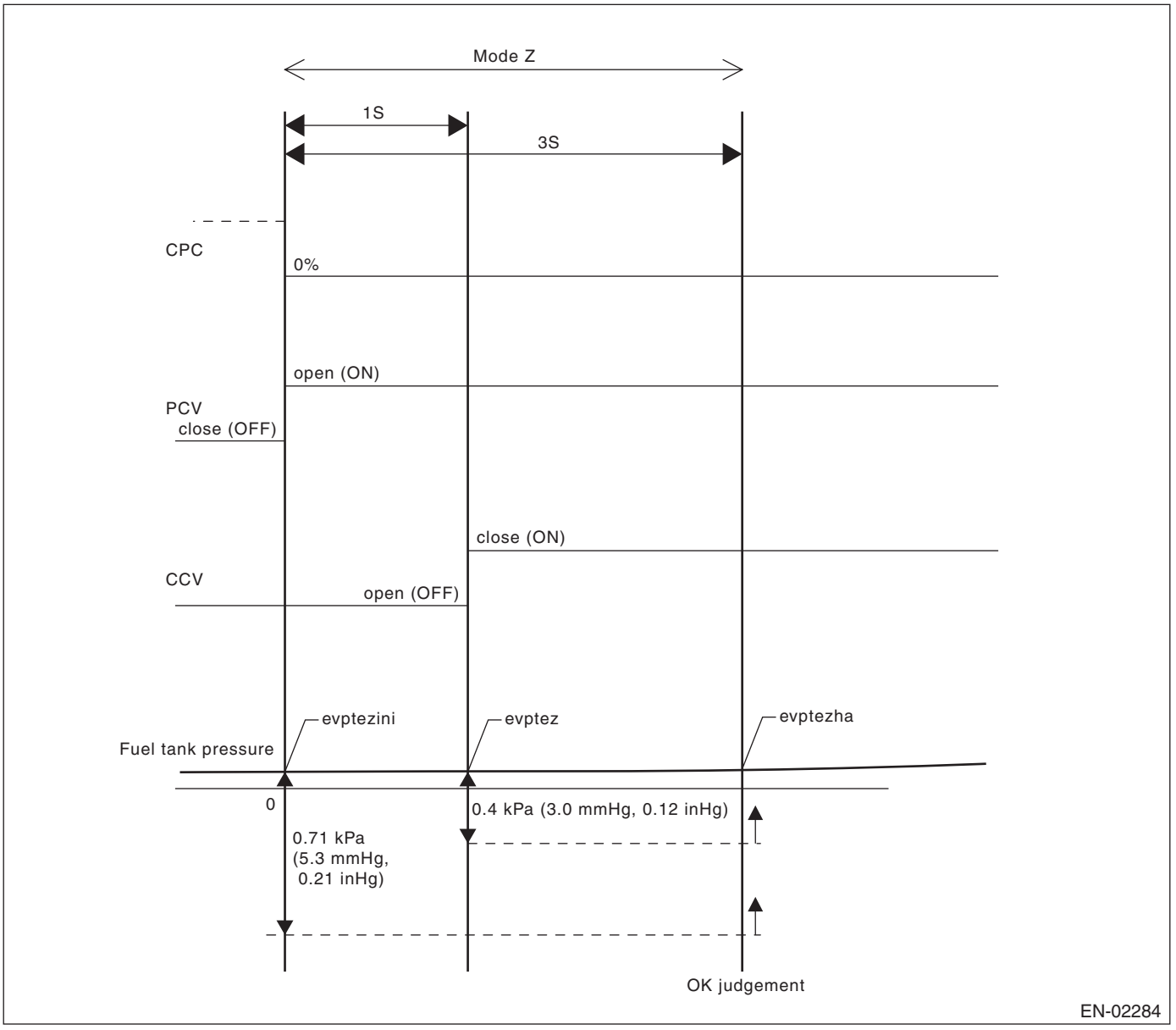
Normality Judgment

Make OK judgment in 3 seconds after Mode Z started, and change to Mode A if OK.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Tank pressure when Mode Z started) – (Tank pressure when Mode Z finished)	≤ 0.4 kPa (3 mmHg, 0.12 inHg)	P0457

• Normal Operation



• evptez – evptezha ≤ 0.4 kPa (3.0 mmHg, 0.12 inHg)

Judge normal when calculation is completed.

Abnormality Judgment

If OK judgment cannot be made, extend Mode Z 16 seconds more, and judge NG when all the criteria below are completed in 16 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Tank pressure when Mode Z started) – (Tank pressure when Mode Z finished)	> 0.6 kPa (4.5 mmHg, 0.18 inHg)	P0457
Tank pressure when Mode Z started	≤ 1.43 kPa (10.7 mmHg, 0.42 inHg)	
TIme for no fuel rolling of 2 ℓ or more	≥ 40 seconds	

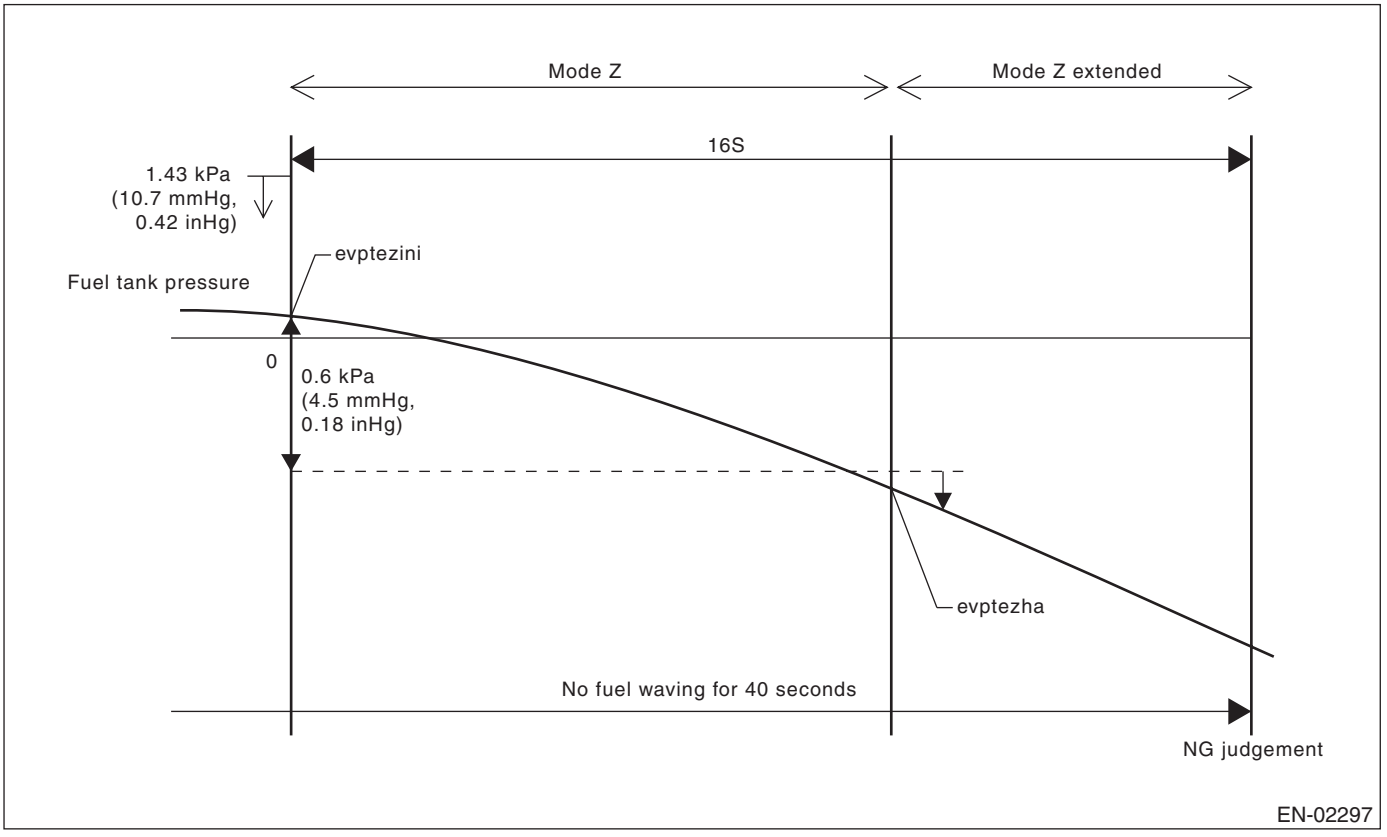
Time Needed for Diagnosis: 16 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Finish the Evap. diagnosis when making NG judgment for purge control solenoid valve open fixation.

Cancel the Evap. diagnosis when the OK/NG judgment for drain valve close fixation and purge control solenoid valve open fixation cannot be made in Mode Z.

• Purge Control Solenoid Valve Open Fixation



• evptezini ≤ 1.43 kPa (10.7 mmHg, 0.42 inHg)

• No fuel rolling of above 2 ℓ (0.79 US gal, 0.67 Imp gal) for more than 40 seconds.

Judge normal when these calculations are completed.

Cancel the evaporative emission control system diagnosis when the OK/NG judgment for purge control solenoid valve open fixation cannot be made in Mode Z.

• Leak Diagnosis

DTC P0442
DTC P0456
DTC P0457

• Diagnostic method

• The diagnostic method consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to atmospheric pressure.
• The diagnosis is divided into the following five phases.

Mode A:

Calculate the tank pressure variation amount (P1) in Mode A. After calculating P1, change to Mode B.

Mode B:

Introduce the negative pressure in the intake manifold to the tank.
Approx. 0 → –1.4 kPa (0 → –10.5 mmHg, 0 → –0.41 inHg) (0.04-in diagnosis)
Approx. 0 → –3.05 kPa (0 → –22.9 mmHg, 0 → –0.9 inHg) (0.02-in diagnosis)
When the pressure above (desired negative pressure) is reached, Mode C is entered.
In this case, if the tank pressure does not become the desired negative pressure, judge that there is a large leakage in the system.
Judge NG when the malfunction criteria below is completed.
Finish the Evap. diagnosis when judging large leak (35 seconds) in 0.04-inch diagnosis. Cancel the diagnosis (62 seconds) in 0.02-inch diagnosis.

Abnormality Judgment

Judge NG (large leak) when the criteria below are completed in the specified time.
Specified Time
High vehicle speed mode (Vehicle speed ≥ 72 km/h (45 MPH)); 35 seconds
Low vehicle speed mode (Vehicle speed < 72 km/h (45 MPH)); 18 seconds

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
(0.04-inch diagnosis) (Tank pressure when Mode Z started) – (Min. value of tank pressure during Mode B)	< 0.3 kPa (2.25 mmHg, 0.089 inHg)	P0457

Cancel the diagnosis when the NG judgment does not completed in the specified time.

Mode C:

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)
Change to Mode D when the tank pressure returns to the start level of P2 calculation.
Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

	Tank pressure when P2 calculation started	Time for immediate OK judgment
0.04-inch diagnosis	–1.3 kPa (–9.75 mmHg, –0.38 inHg)	16 seconds
0.02-inch diagnosis	–3 kPa (–22.5 mmHg, –0.89 inHg)	20 seconds

Mode D:

Monitor the pressure variation in the tank in Mode D. In this case, the tank pressure increases, that is, the pressure becomes as high as the atmospheric air pressure, because evaporator is generated. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.
After calculating P2, perform small leak diagnosis and change to Mode E if normal. Complete Evap. diagnosis if abnormal.

• After Diagnosis

Assigning P1 and P2, which are tank variations measured in Mode A and Mode B, to the formula below, judge the small leakage of the system. If the measured judgment value exceeds the threshold value, it is judged to be malfunction.

• 0.04-inch Diagnosis

Abnormality Judgment

Judge NG when the criteria below are completed and judge OK when not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – * × P1 P2 = Tank pressure varying at a specified time in mode D. P1 = Tank pressure varying at a specified time in mode A.	Map 1	P0442

* P1 ≥ 0: 1.5
P1 < 0: 1

• Map 1

	Fuel temperature 25°C (77°F)	Fuel temperature 30°C (86°F)	Fuel temperature 35°C (95°F)	Fuel temperature 40°C (104°F)	Fuel temperature 45°C (113°F)
Fuel remaining 10 ℓ (2.6 US gal, 2.2 Imp gal)	0.34 kPa (2.53 mmHg, 0.10 inHg)	0.36 kPa (2.72 mmHg, 0.11 inHg)	0.44 kPa (3.28 mmHg, 0.13 inHg)	0.45 kPa (3.38 mmHg, 0.13 inHg)	0.46 kPa (3.47 mmHg, 0.14 inHg)
Fuel remaining 20 ℓ (5.3 US gal, 4.4 Imp gal)	0.44 kPa (3.28 mmHg, 0.13 inHg)	0.49 kPa (3.65 mmHg, 0.14 inHg)	0.53 kPa (3.94 mmHg, 0.14 inHg)	0.53 kPa (3.94 mmHg, 0.14 inHg)	0.53 kPa (3.94 mmHg, 0.14 inHg)
Fuel remaining 50 ℓ (13.2 US gal, 11.0 Imp gal)	0.53 kPa (3.94 mmHg, 0.14 inHg)	0.54 kPa (4.03 mmHg, 0.16 inHg)	0.56 kPa (4.22 mmHg, 0.17 inHg)	0.64 kPa (4.78 mmHg, 0.19 inHg)	0.66 kPa (4.97 mmHg, 0.2 inHg)

• 0.02-inch Diagnosis

Abnormality Judgment

Judge NG when the criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – * × P1 P2 = Tank pressure varying at a specified time in mode D. P1 = Tank pressure varying at a specified time in mode A.	Map 2	P0456

* P1 ≥ 0: 1.5
P1 < 0: 1

• Map 2

	Fuel temperature 20°C (68°F)	Fuel temperature 25°C (77°F)	Fuel temperature 30°C (86°F)	Fuel temperature 35°C (95°F)	Fuel temperature 40°C (104°F)
Fuel remaining 10 ℓ (2.6 US gal, 2.2 Imp gal)	0.46 kPa (3.47 mmHg, 0.14 inHg)	0.46 kPa (3.47 mmHg, 0.14 inHg)	0.46 kPa (3.47 mmHg, 0.14 inHg)	0.46 kPa (3.47 mmHg, 0.14 inHg)	0.80 kPa (6.00 mmHg, 0.24 inHg)
Fuel remaining 30 ℓ (7.9 US gal, 6.6 Imp gal)	0.53 kPa (3.94 mmHg, 0.15 inHg)	0.53 kPa (3.94 mmHg, 0.15 inHg)	0.59 kPa (4.41 mmHg, 0.17 inHg)	0.66 kPa (4.97 mmHg, 0.2 inHg)	1.14 kPa (8.53 mmHg, 0.34 inHg)
Fuel remaining 50 ℓ (13.2 US gal, 11.0 Imp gal)	0.54 kPa (4.03 mmHg, 0.16 inHg)	0.59 kPa (4.41 mmHg, 0.17 inHg)	0.65 kPa (4.88 mmHg, 0.19 inHg)	0.65 kPa (4.88 mmHg, 0.19 inHg)	1.11 kPa (8.34 mmHg,0.33 inHg)

Normality Judgment

Judge OK when the criteria below are completed.

• Judgment Value

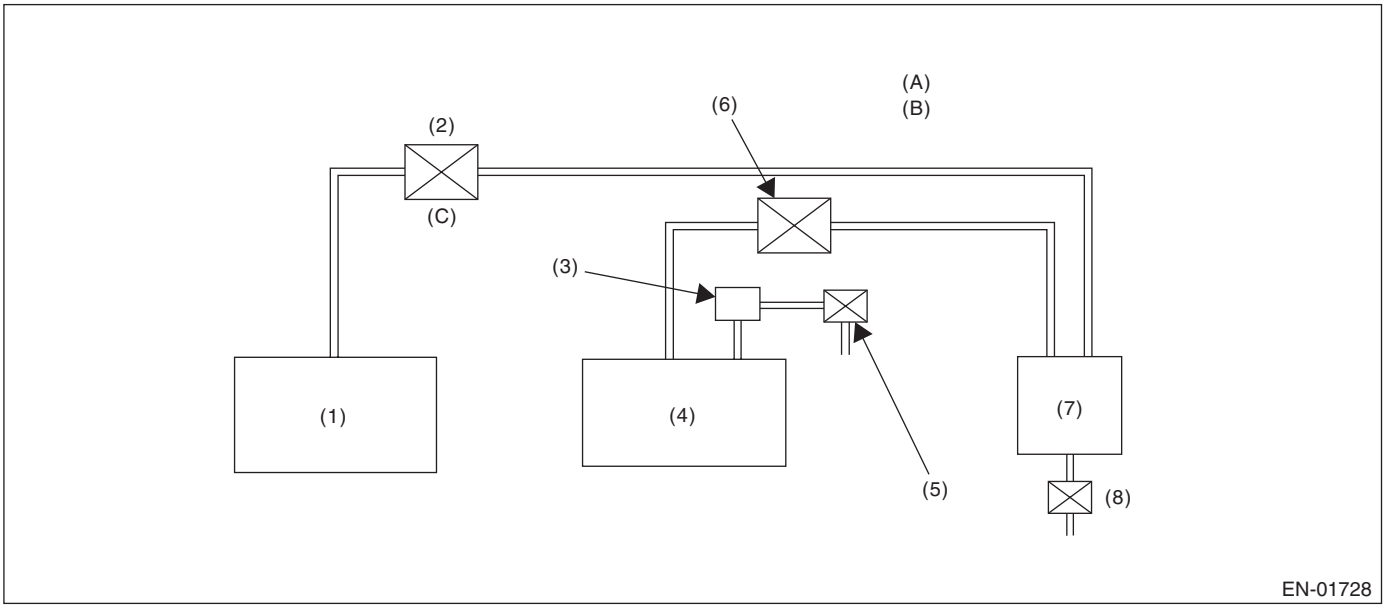
Malfunction Criteria	Threshold Value	DTC
P2 – * × P1	Map 3	P0456

* P1 ≥ 0: 1.5
P1 < 0: 1

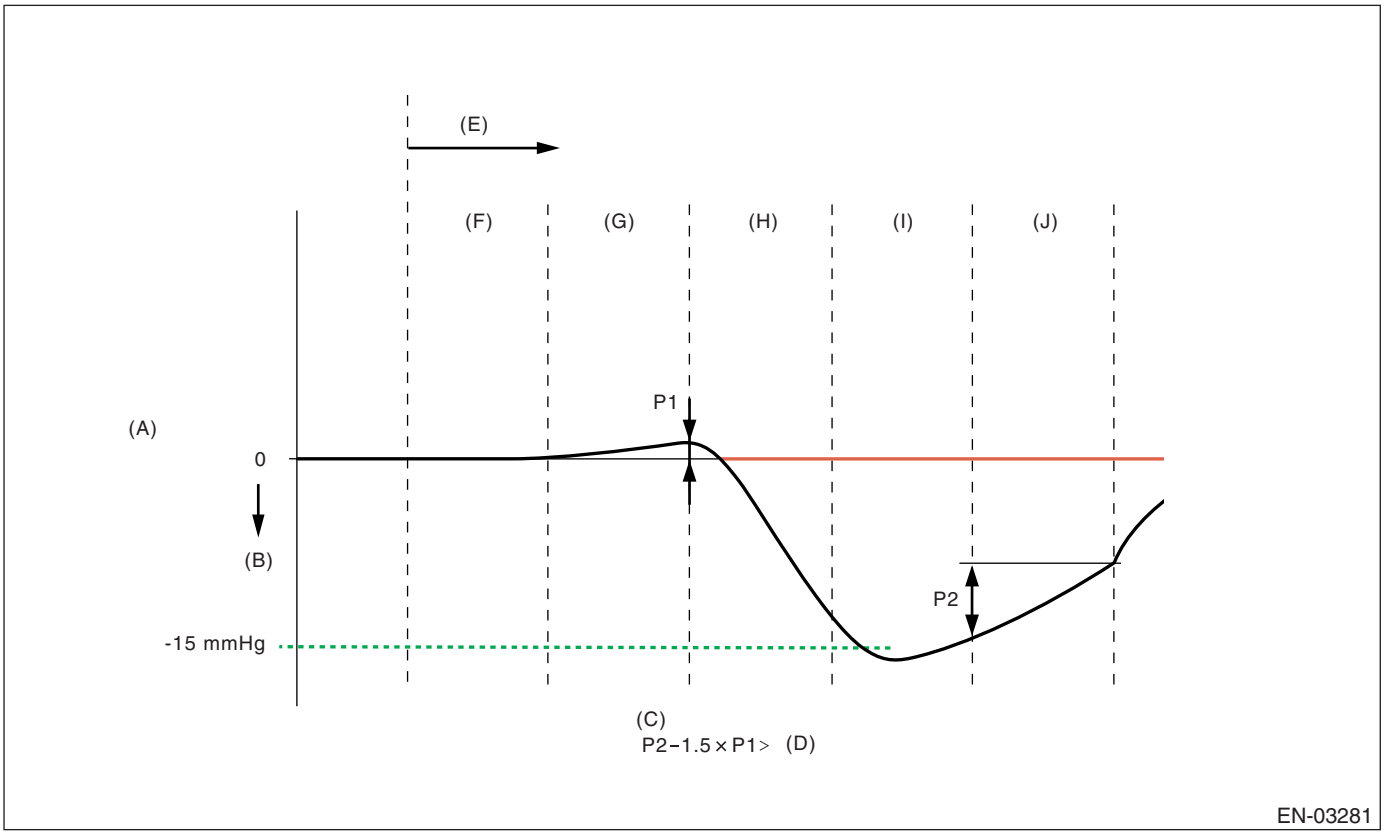
• Map 3

	Fuel temperature 20°C (68°F)	Fuel temperature 25°C (77°F)	Fuel temperature 30°C (86°F)	Fuel temperature 35°C (95°F)	Fuel temperature 40°C (104°F)
Fuel remaining 10 ℓ (2.6 US gal, 2.2 Imp gal)	0.32 kPa (2.43 mmHg, 0.096 inHg)	0.32 kPa (2.43 mmHg, 0.096 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)
Fuel remaining 30 ℓ (7.9 US gal, 6.6 Imp gal)	0.31 kPa (2.34 mmHg, 0.092 inHg)	0.36 kPa (272 mmHg, 0.107 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)
Fuel remaining 50 ℓ (13.2 US gal, 11.0 Imp gal)	0.31 kPa (2.34 mmHg, 0.092 inHg)	0.36 kPa (272 mmHg, 0.107 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)	0.39 kPa (2.91 mmHg, 0.115 inHg)

If not judged OK or NG, repeat the diagnosis.



(1) Engine
(2) Purge control solenoid valve
(3) Fuel tank pressure sensor
(4) Fuel tank
(5) Atmospheric pressure switching solenoid
(6) Pressure control solenoid valve
(7) Canister
(8) Drain valve
(A) Normal condition: mechanical control
(B) Under the diagnosis: electronic control
(C) Duty control



(A) Fuel tank internal pressure
(B) Negative pressure
(C) Small leakage
(D) Threshold value
(E) Diagnosis start
(F) Mode Z
(G) Mode A
(H) Mode B
(I) Mode C
(J) Mode D

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Atmospheric purge solenoid function malfunction; Open the pressure control solenoid valve.

9. ECM OPERATION AT DTC SETTING

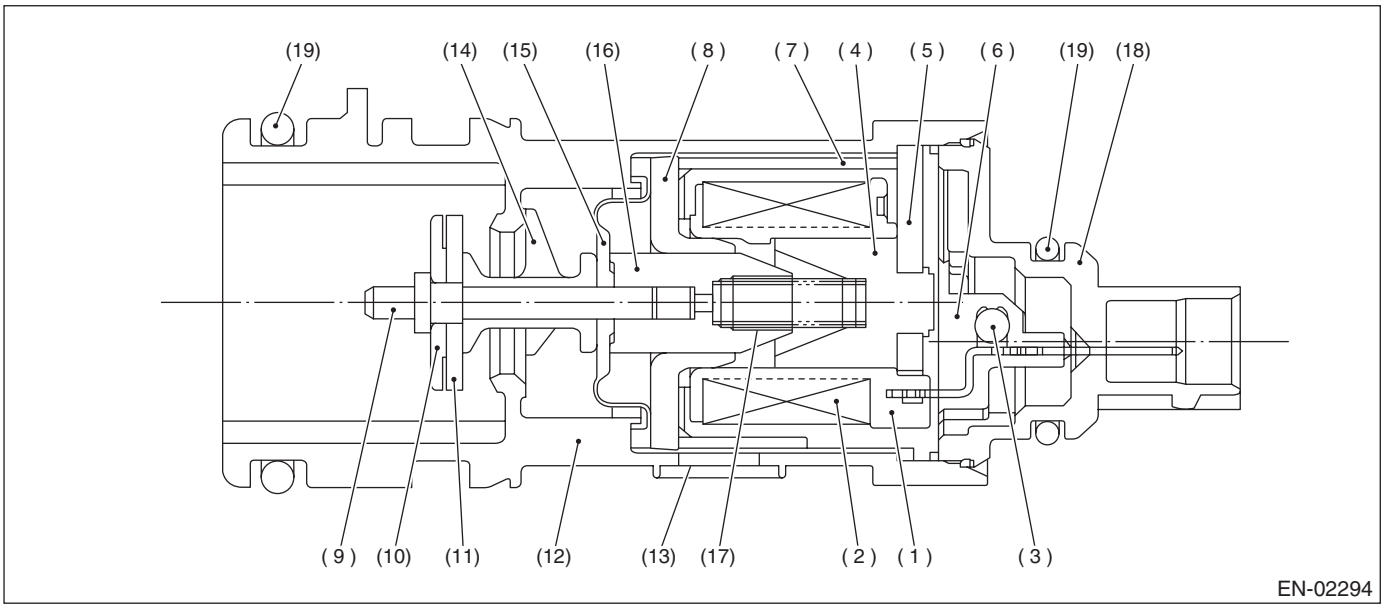
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of drain valve.
Judge NG when the ECM output level is not equal to the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Moving core
(17) Spring
(18) Cover
(19) O-ring

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After starting the engine	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after string the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below become more than time (2.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal.	Low

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal.	High

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Open PCV solenoid.

9. ECM OPERATION AT DTC SETTING

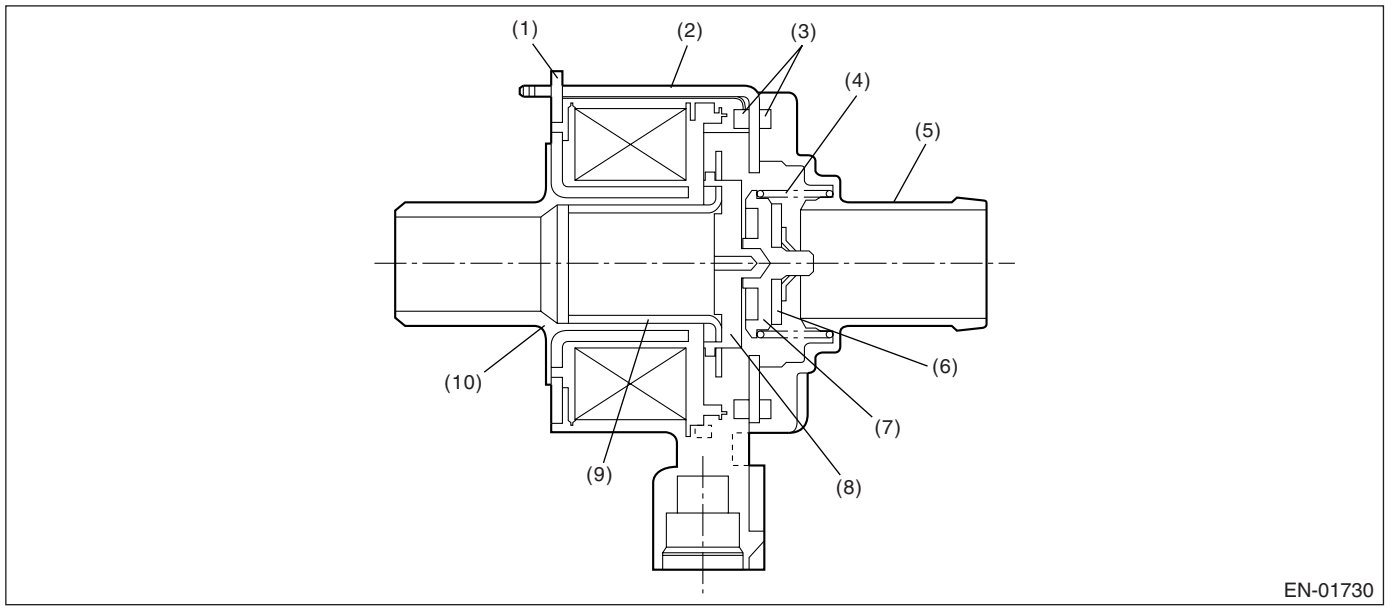
Memorize the freeze frame data. (For test mode $02)

AX:DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED —

1. OUTLINE OF DIAGNOSIS

Detect the short circuit of drain valve.
Judge NG when the ECU output level is not equal to the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Magnetic plate
(2) Yoke
(3) Packing
(4) Spring
(5) Valve seat
(6) Valve
(7) Plate
(8) Retainer
(9) Movable core
(10) Bobbin

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After starting the engine	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below become more than time (2.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal.	High

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal.	Low

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Open PCV solenoid.

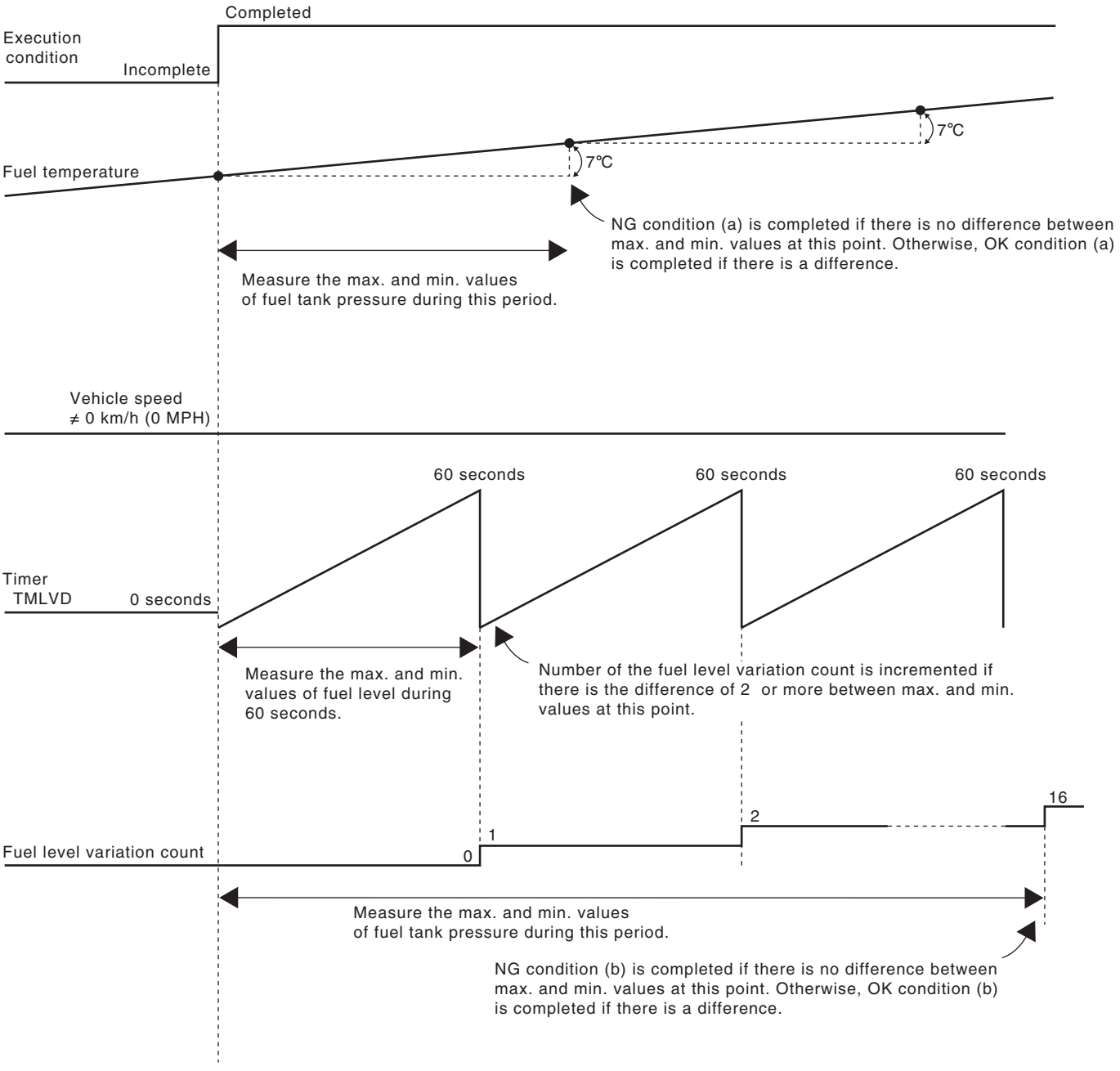
9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AY:DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tank pressure sensor output property.
Judge NG when there is little variation in the fuel tank pressure even if the vehicle is in driving status where there must be variation in the fuel tank pressure considering the fuel temperature and fuel level.



EN-01731

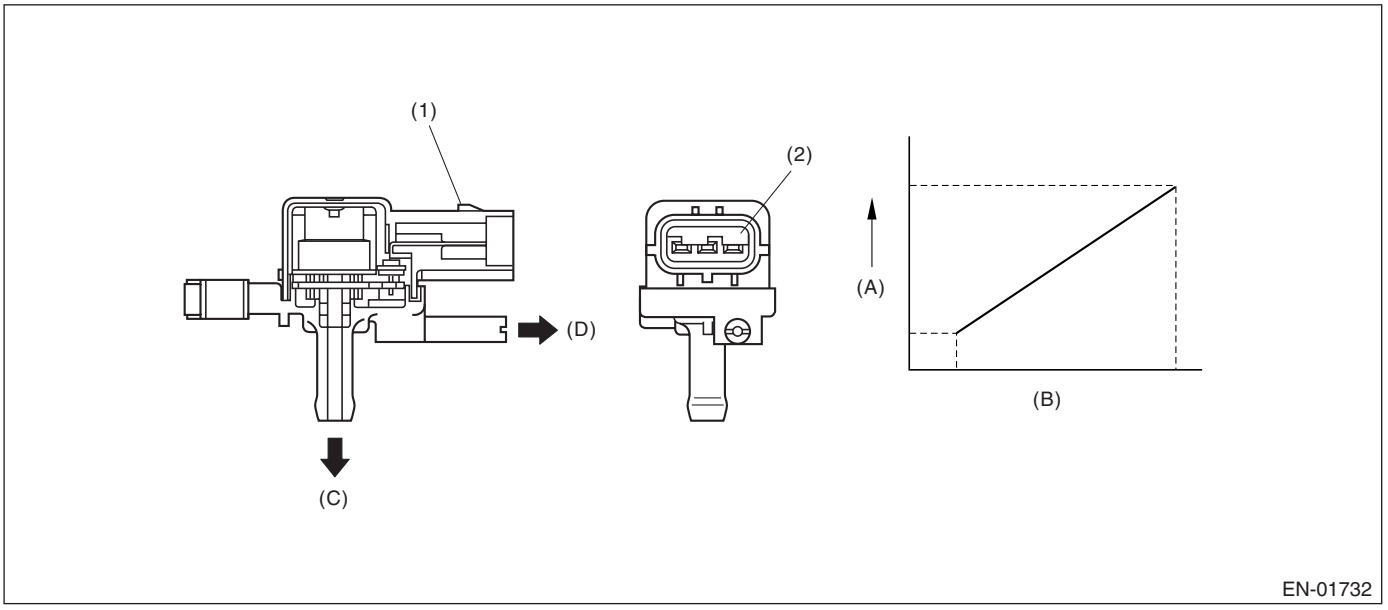
- If NG condition (a) & (b) are experienced, NG results.

(If there is OK, NG experience becomes unexperienced.)

- If OK conditions (a) & (b) are experienced, OK results.

(If there is NG, OK experience becomes unexperienced.)

2. COMPONENT DESCRIPTION



(1) Connector
(2) Terminal
(A) Output voltage
(B) Input voltage
(C) To fuel tank
(D) To tank pressure switching solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Timer after starting the engine	≥ 30 seconds
Fuel level	≥ 9 ℓ (2.4 US gal, 2.0 Imp gal)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 30 seconds after starting the engine.

5. DIAGNOSTIC METHOD

(1) There is no tank pressure variation when there is fuel temperature variation of 7°C (45°F).
(2) There is no tank pressure variation even when there is fuel level variation of 2 ℓ (0.5 US gal, 0.4 Imp gal) or more every 60 seconds.
Judge NG when both of the conditions above are experienced.

• Abnormality Judgment

Judge NG when both of the conditions below are experienced.

• Judgment Value

Malfunction Criteria	Threshold Value
Change of fuel temperature	≥ 7°C (45°F)
Max. – min. tank pressure	≤ 100 Pa (0.75 mmHg, 0.03 inHg)
Total time lapse where there is fuel level variation of 2 ℓ (0.5 US gal, 0.4 Imp gal) or more per minute.	≥ 16 minutes

Time Needed for Diagnosis: 10 minutes
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when both of the conditions below are experienced, and clear NG.

• Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During fuel temperature variation of 7°C (45°F))	> 100 Pa (0.75 mmHg, 0.03 inHg)
Change of fuel temperature	≥ 7°C (45°F)

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During time lapse below)	> 100 Pa (0.75 mmHg, 0.03 inHg)
Total time lapse where there is fuel level variation of 2 ℓ (0.5 US gal, 0.4 Imp gal) or more per minute.	≥ 10 minutes

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

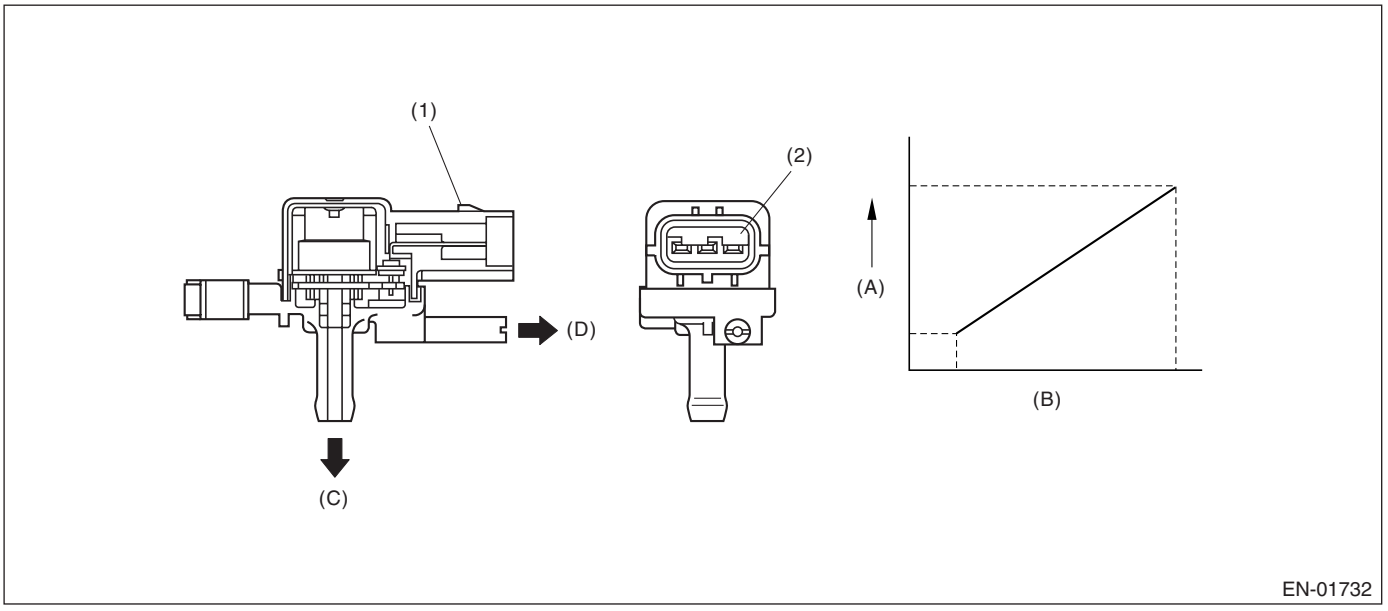
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Terminal
(A) Output voltage
(B) Input voltage
(C) To fuel tank
(D) To tank pressure switching solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
After engine starting	2 seconds or more
Pressure control solenoid valve	Opened
Vent control solenoid valve	Closed
Canister purge control solenoid valve duty ratio	≤ 0%

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all of the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.2 V

Time Needed for Diagnosis: 20 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.2 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

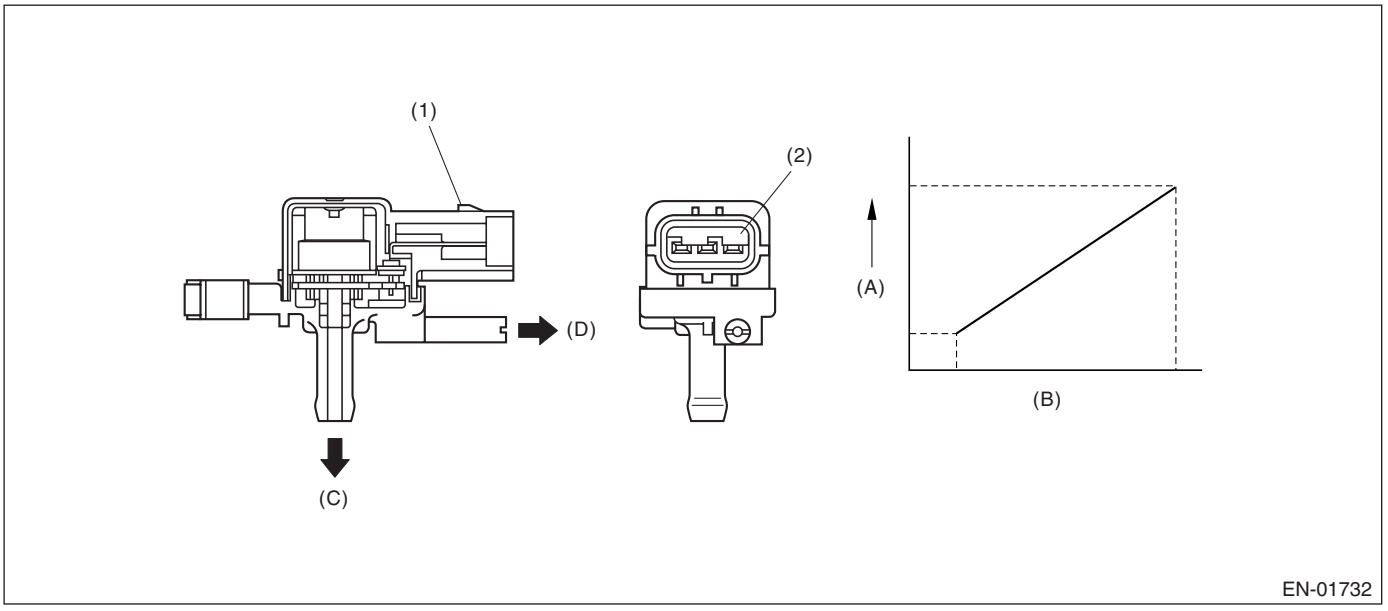
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Terminal
(A) Output voltage
(B) Input voltage
(C) To fuel tank
(D) To tank pressure switching solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
After engine starting	2 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing all of the malfunction criteria below becomes more than the time (20 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.8 V
Fuel temperature	< 35°C (95°F)
Barometric pressure	≥ 76 kPa (568 mmHg, 22.4 inHg)

Time Needed for Diagnosis: 20 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.8 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4SO)-114, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

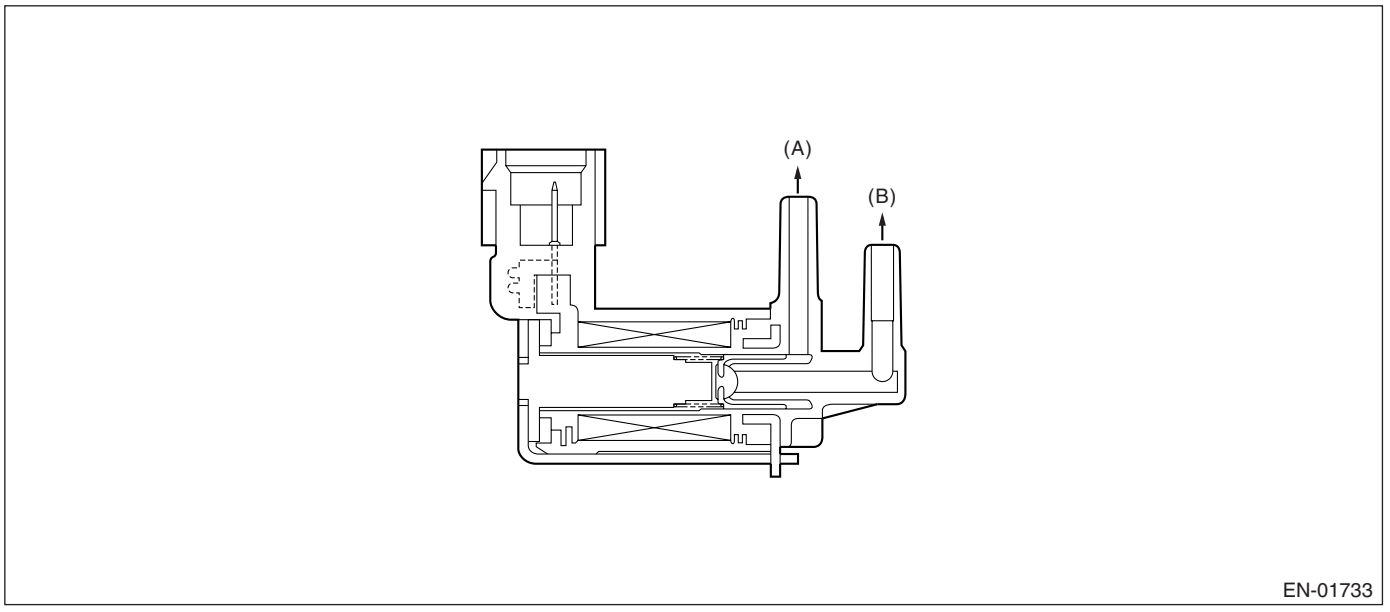
For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4SO)-114, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of purge control solenoid valve.
Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister (B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing all the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	< 75%
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the cumulative time until completing all the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	< 75%
Terminal output voltage when ECM outputs OFF signal	High

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

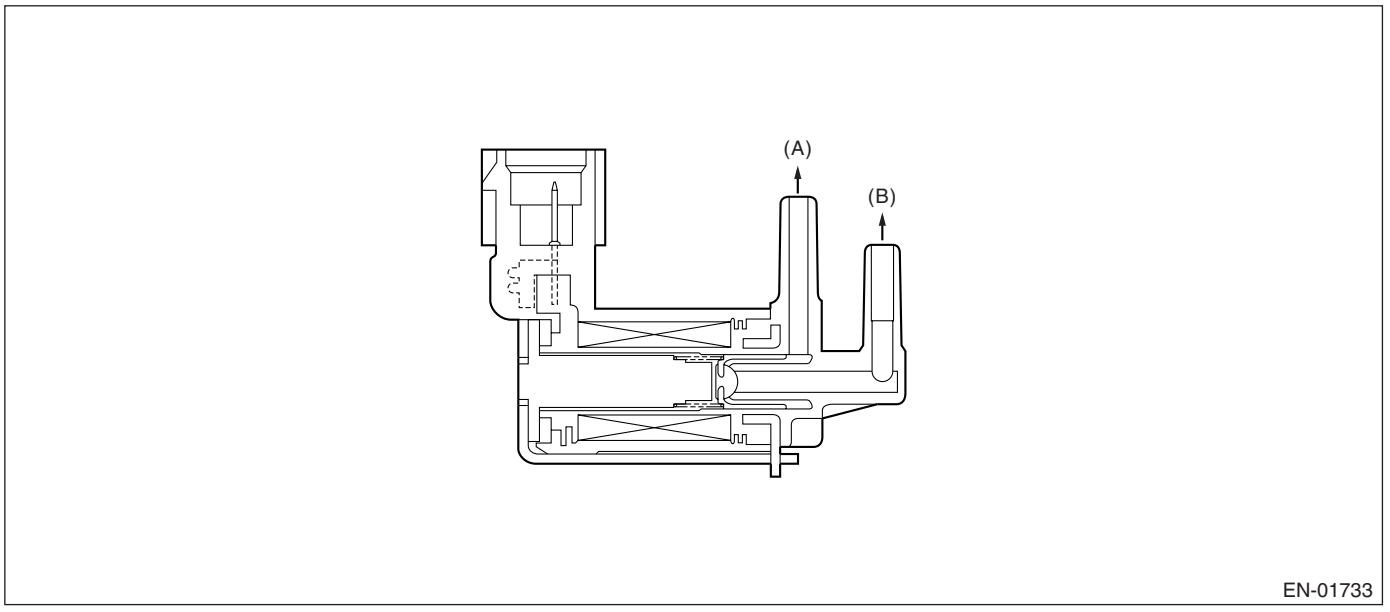
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of purge control solenoid valve.
Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister
(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	> 25%
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the cumulative time until completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	> 25%
Terminal output voltage when ECM outputs OFF signal	Low

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

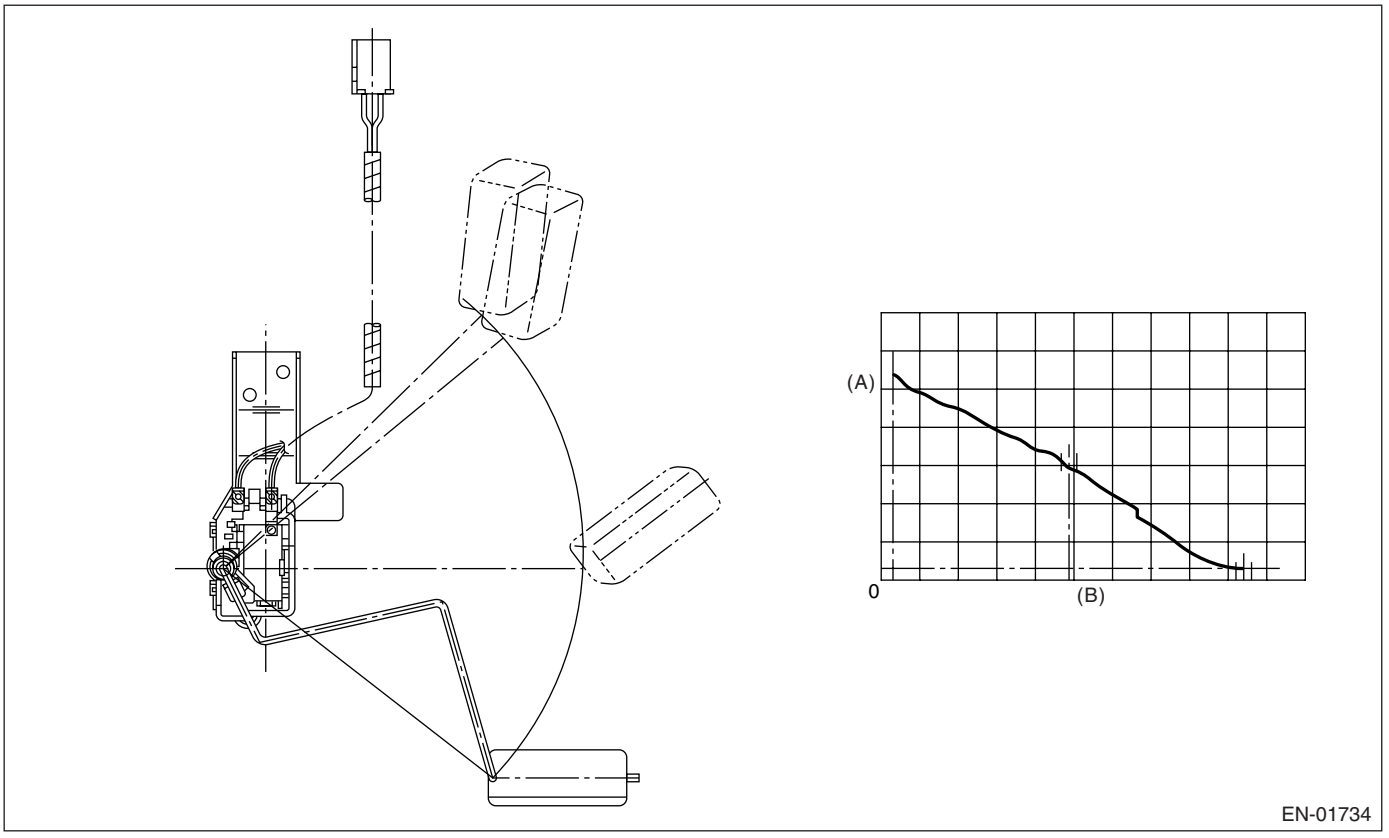
Memorize the freeze frame data. (For test mode $02)

BF:DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel level sensor output property.
Judge NG by the difference between max. and min. value of fuel level during every 160 km (100 miles) driving distance converted from vehicle speed.

2. COMPONENT DESCRIPTION



(A) Fuel level (L)
(B) Resistance (Ω)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. fuel level	< 10 ℓ (2.6 US gal, 2.2 Imp gal)
Trip distance from last fill up	≥ 160 km (100 miles)

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. fuel level	≥ 10 ℓ (2.6 US gal, 2.2 Imp gal)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

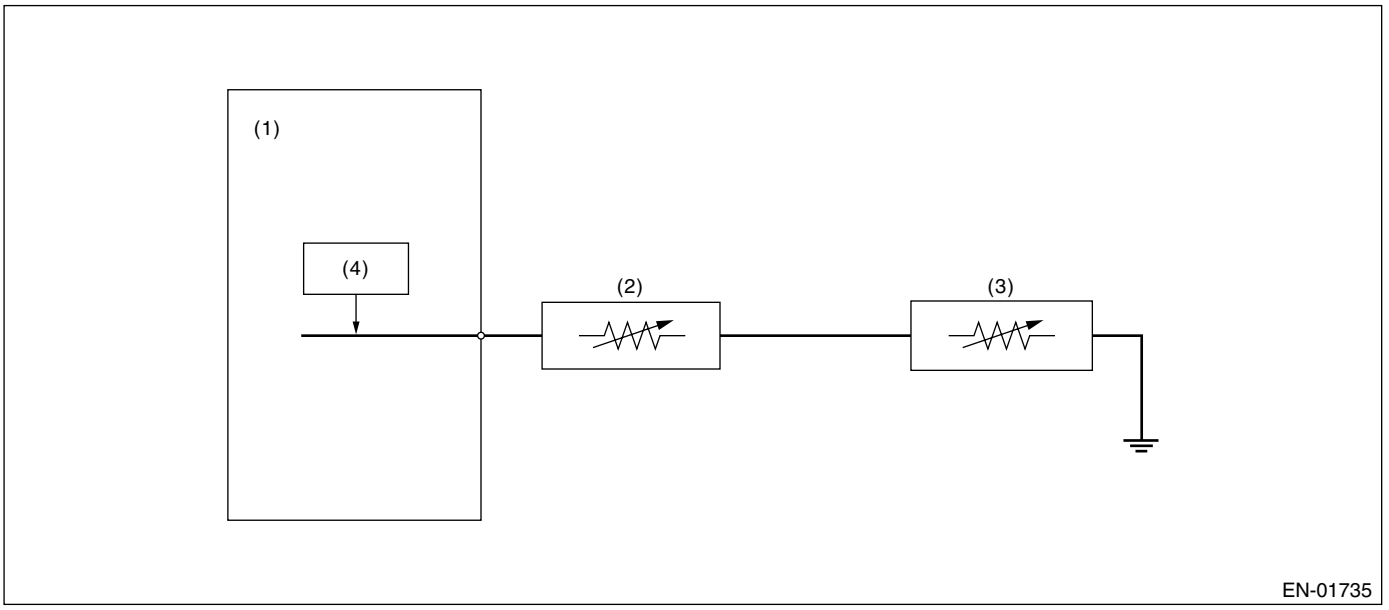
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	8 — 16 V
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and then judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.02 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

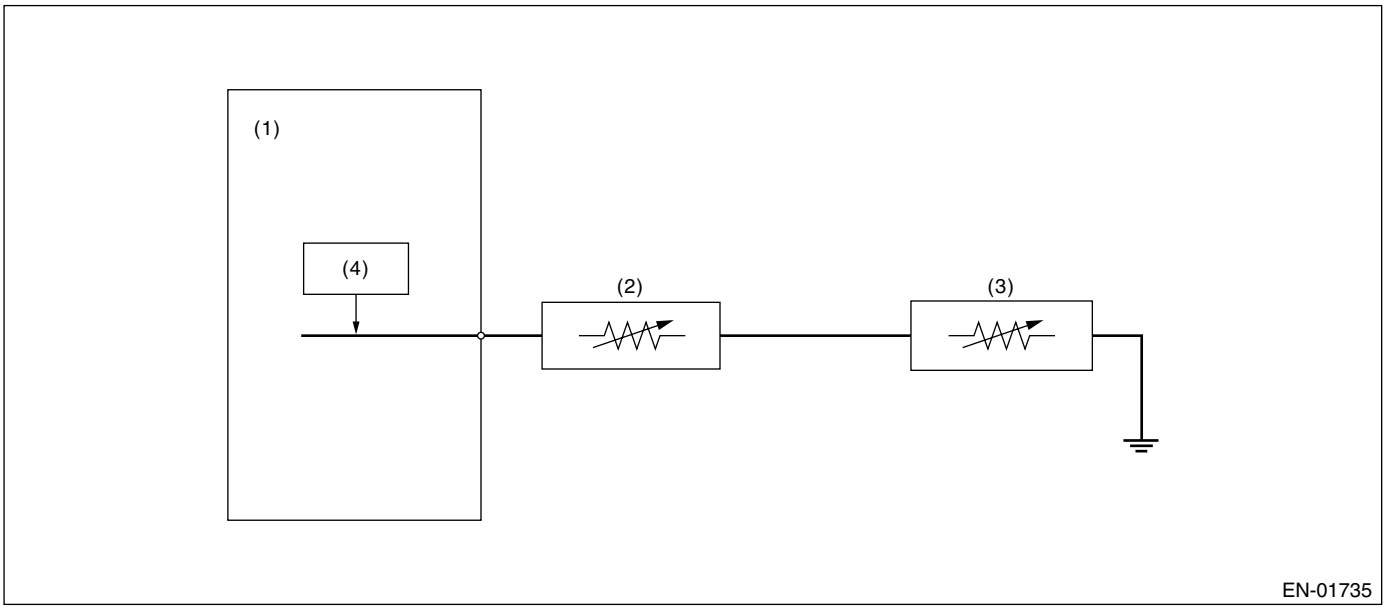
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit

3. ENABLE CONDITION

Secondary Parameter	Enable Conditions
Battery voltage	8 — 16 V
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and then judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.90 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BI: DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of unstable output from fuel level sensor because of noise.
Judge NG by comparing the max value and cumulative value of the amount of output voltage variation from fuel level sensor with threshold value.

2. ENABLE CONDITION

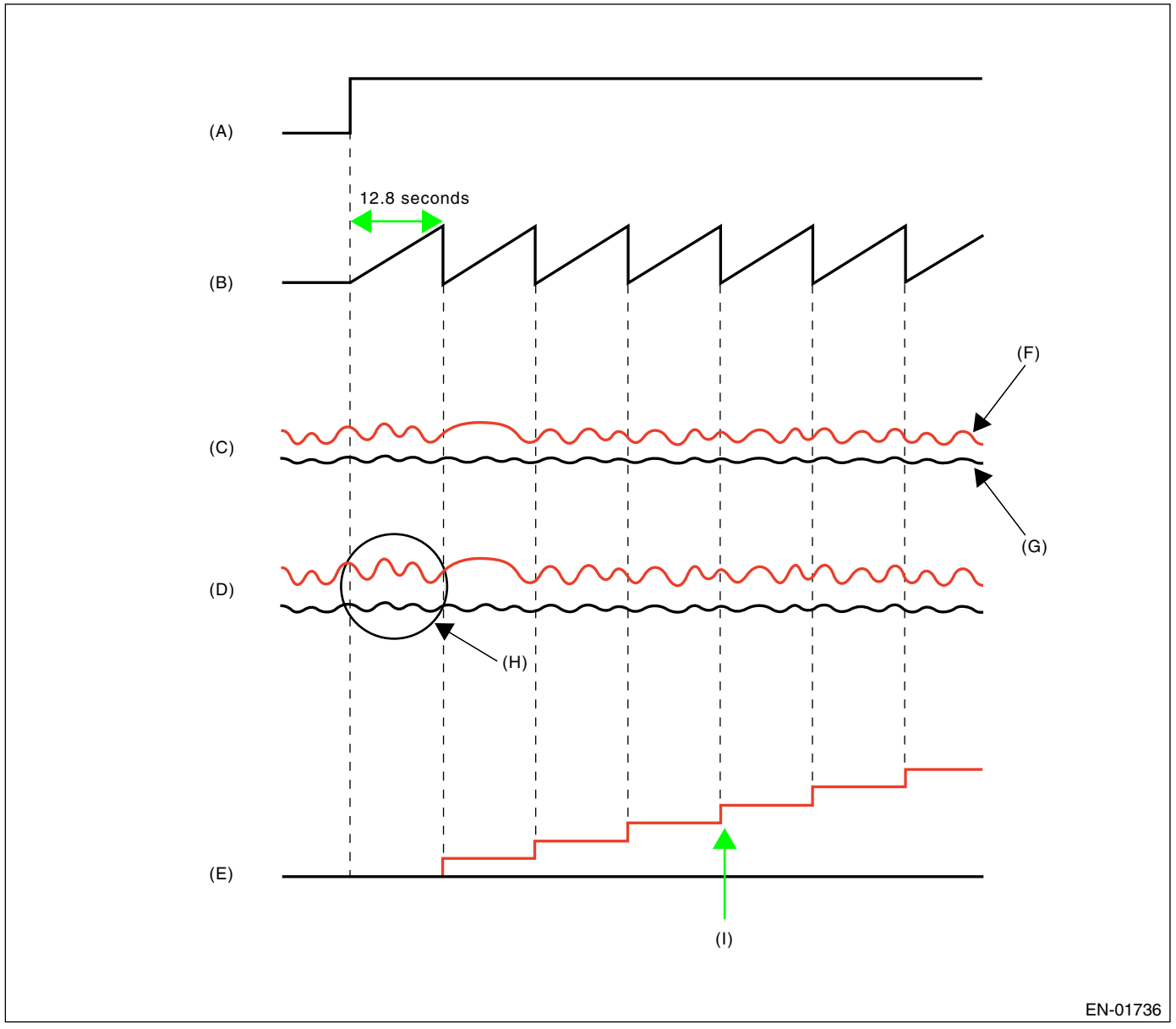
Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	> 10.9 V
After engine starting	1 second or more
Idle switch	ON
Fuel level	9.6 — 48 ℓ (2.54 — 12.68 US gal, 2.11 — 10.56 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	10 seconds or more
Ignition switch	ON
Difference between max. value and min. value of fuel tank pressure (12.8 seconds)	< 0.05 kPa (0.4 mmHg, 0.016 inHg)
Difference between max. value and min. value of battery voltage (12.8 seconds)	< 0.4 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling.

4. DIAGNOSTIC METHOD

Calculate the max. value of the amount of output voltage variation from fuel level sensor and cumulative value during 12.8 seconds. Comparing the max value and cumulative value with the threshold value, and judge OK when the both do not go over the threshold value. Otherwise, when one of them goes over the threshold, count the counter up. Judge the ECM is troubled when the counter increased 4 times in a row.



(A) Diagnosis condition
(B) Diagnosis timer
(C) Fuel level sensor A/D value
(D) Amount of Fuel level output voltage variation
(E) Diagnosis counter
(F) Malfunction
(G) Normal
(H) Regard the Max. value as delvflmx and the cumulative value as sumvfl.
(I) NG at 4 counts

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, • DVFLMAX ≥ 0.88 V • SUMVFL ≥ 14.08 V DVFLMAX is max. value of sensor output during 12.8 seconds. SUMVFL is cumulative value of sensor output deviation during 12.8 seconds.	≥ 4 times

Time Needed for Diagnosis: 12.8 seconds × 4 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
DVFLMAX	< 0.88 V
SUMVFL	< 14.08 V

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BJ:DTC P0483 — COOLING FAN RATIONALITY CHECK —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of radiator fun.
Judge NG when the engine coolant temperature decreases slowly even if the radiator fan started rotating.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 100°C (212°F)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine coolant temperature is very high (more than 100°C (212°F)).

4. DIAGNOSTIC METHOD

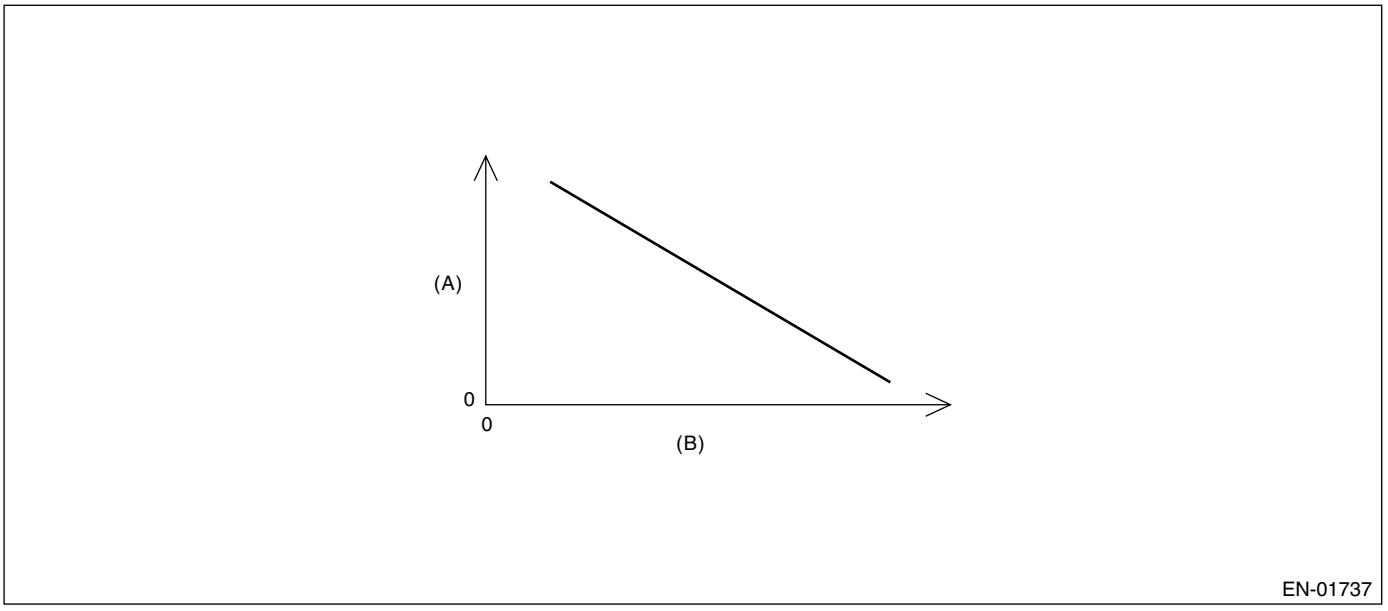
Check the engine coolant temperature (A/D value) when the radiator fan is ON since the radiator fan output turns from OFF to ON with all of the malfunction conditions below completed.

Secondary Parameters	Enable Conditions
Engine speed	600 — 900 rpm
Idle switch	ON
Vehicle speed	0 km/h (0 MPH)
Battery voltage	≥ 10.9 V

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (5 minutes) needed for diagnosis. Also Judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Radiator fan signal switching	OFF to ON
Engine coolant temperature	≥ 105°C (221°F)
Engine coolant temperature	Not decreased



(A) Engine coolant temperature °C (°F)
(B) A/D value (V)

Time Needed for Diagnosis: 5 minutes

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR METHOD

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open or short circuit of vehicle speed.
- Judge NG when the vehicle speed is low while the vehicle speed is assumed to be high.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge NG when the time of completing the malfunction criteria below becomes more than time needed for diagnosis. Judge OK when the vehicle speed is more than 4 km/h (2.5 MPH) and less than 224 km/h (140 MPH).

Judgment Value

Malfunction Criteria	Threshold Value
Low side diagnosis (1)	
Cumulative time when the malfunction criteria below are completed	≥ 20 seconds
Idle switch	OFF
Injector pulse	≥ 2.5 milliseconds
Engine speed	≥ 2800 rpm
Neutral switch	OFF
Vehicle speed signals count (353 ms)	< 1

Time Needed for Diagnosis:

Low side 20 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row.
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BL:DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —

1. OUTLINE OF DIAGNOSIS

- Detect the open or short circuit of vehicle speed.
- Judge NG when the vehicle speed is high while the vehicle speed is assumed to be low.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge NG when the time of completing the malfunction criteria below becomes more than time needed for diagnosis. Judge OK when the vehicle speed is more than 4 km/h (2.5 MPH) and less than 224 km/h (140 MPH).

Judgment Value

Malfunction Criteria	Threshold Value
High side diagnosis	
Cumulative time when the malfunction criteria below are completed	≥ 5 seconds
Idle switch	OFF
Injector pulse	≤ 2.048 milliseconds
Engine speed	≤ 2100 rpm
Neutral switch	OFF
Vehicle speed signals count (353 ms)	≥ 56

Time Needed for Diagnosis:

High 5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

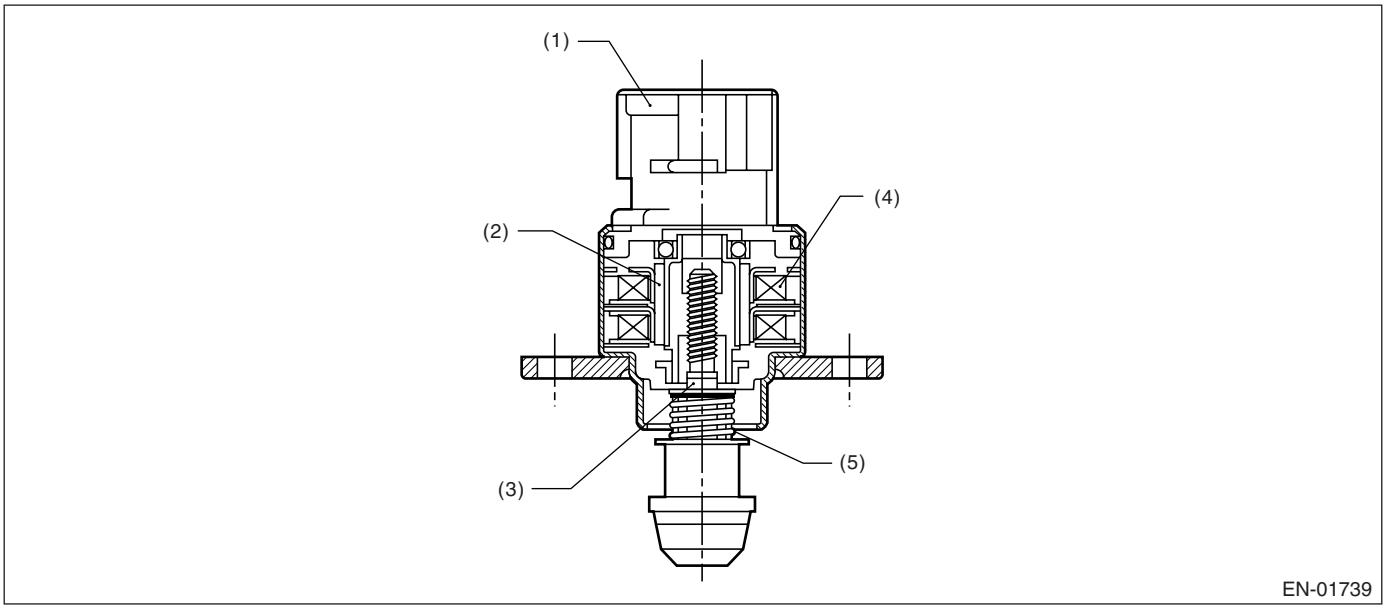
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that the engine speed does not approach to the target engine speed at idling.
Judge NG when the engine speed is lower than target engine speed and does not increase to target engine speed even though idle air control solenoid valve is opened.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Permanent magnet
(3) Shaft
(4) Coil
(5) Spring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed control in ISC	In operation
Dashpot function	0
Vehicle speed	= 0 km/h (0 MPH)
Coolant temperature	≥ 75°C (167°F)
Battery voltage	> 10.9 V
AT model or AT model neutral gear	

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously at idling after warming up engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≤ –100 rpm

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	> 100 rpm

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

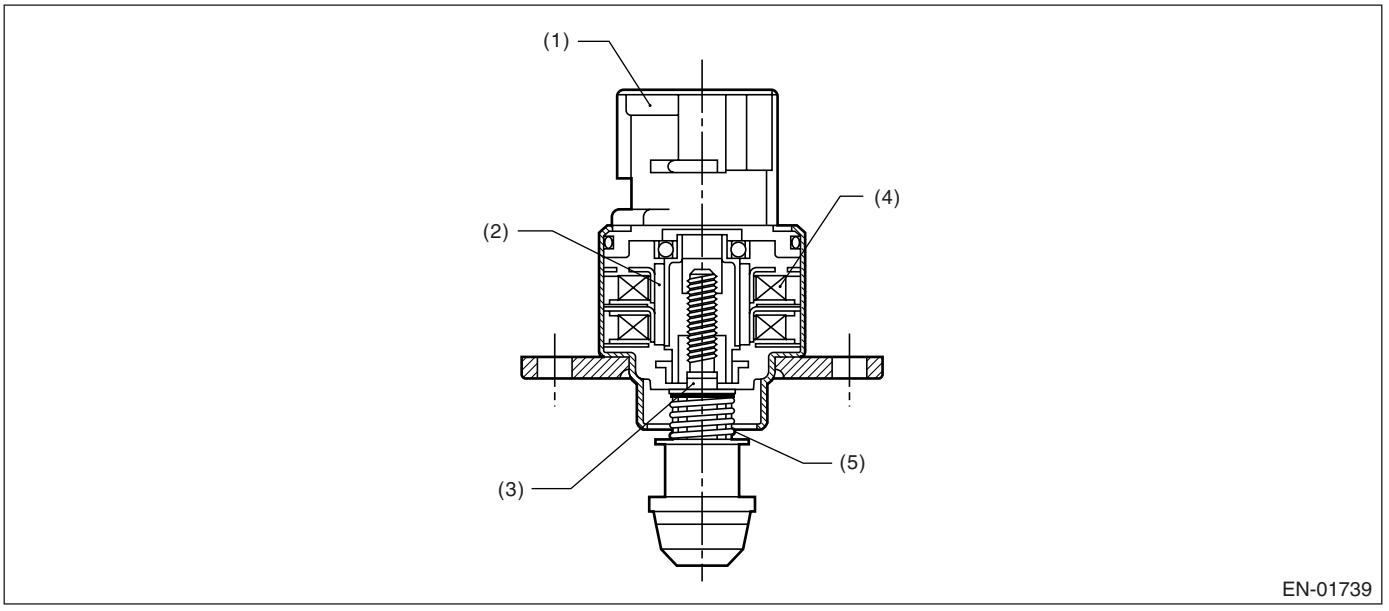
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that the engine speed does not approach to the target engine speed at idling.
Judge NG when the engine speed is higher than target engine speed and does not decrease to target engine speed even though idle air control solenoid valve is closed.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Permanent magnet
(3) Shaft
(4) Coil
(5) Spring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed control in ISC	In operation
Dashpot function	0
Vehicle speed	= 0 km/h (0 MPH)
Coolant temperature	≥ 75°C (167°F)
Battery voltage	> 10.9 V
AT model or AT model neutral gear	

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously at idling after warming up engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≥ 200 rpm

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the continuous time until completing all the malfunction criteria below becomes more than the time (2 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	< 200 rpm

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BO:DTC P0512 — STARTER REQUEST CIRCUIT —

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of starter switch.
Judge ON NG when the starter signal remains OFF after starting engine from engine stall condition.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine	Run

3. GENERAL DRIVING CYCLE

Always perform diagnosis continuously after starting engine.

4. DIAGNOSTIC METHOD

Judge NG when completing the malfunction criteria below. Judge OK and clear the NG when the starter switch is turned to ON.

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed	≥ 0 — 700 rpm
Vehicle speed	≥ 0 km/h (0 MPH)
Starter “ON” signal	Not detected

Time Needed for Diagnosis:

ON side 1 second

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of engine speed increase at idling.
- Judge NG when the engine speed is higher than and too far from the target engine speed.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Dashpot function at closed idle control	0

3. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously at idle speed.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≥ 800 rpm
ISC closed loop compensation value	= MIN value

Time Needed for Diagnosis: 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when one of the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
ISC closed loop compensation value	≠ MIN value
Cumulative time (actual – target engine speed) < 100 rpm	≥ 2 seconds
Cumulative time (engine speed < target idle speed)	≥ 2 seconds

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BQ:DTC P0565 — CRUISE CONTROL ON SIGNAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the vehicle speed is less than 20 km/h (12 MPH) and cruise control set signal remains ON for limited time.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed	≤ 20 km/h (12 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis with less than 20 km/h (12 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Canceling signal	No signal

Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of micro-computer (RAM).
- Zero clear the all normal RAM on initial routine, and judge NG when the sum of cleared RAM is not “0”.

2. ENABLE CONDITION

Perform the diagnosis without condition by initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only once immediately after the IG key is turned to ON.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed, and judge OK at the IG key turned to ON.
Judgment Value

Malfunction Criteria	Threshold Value
Sum on RAM data after data cleared operation	Not to zero

Time Needed for Diagnosis: Not determined
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of radiator fan circuit.
- Judge NG when the ECM output level and the actual terminal level are different.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and also judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM transmits OFF signal	Low level

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of radiator fan circuit.
- Judge NG when the ECM output level and the actual terminal level are different.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and also judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM transmits ON signal	High level

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Judge NG when the AT break SW circuit is battery short, ground short or open.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed change	30 to 0 km/h (18.6 to 0 MPH) 0 to 30 km/h (0 to 18.6 MPH)

3. GENERAL DRIVING CYCLE

Perform diagnosis from 30 to 0 km/h (from 18.6 to 0 MPH) of vehicle speed.
Perform diagnosis from 0 to 30 km/h (from 0 to 18.6 MPH) of vehicle speed.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
ON signal	No signal
OFF signal	No signal

Time Needed for Diagnosis: 15 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BV:DTC P0705 — TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT) —

1. OUTLINE OF DIAGNOSIS

Judge NG when the “D” range switch becomes ground short or open circuit.

2. COMPONENT DESCRIPTION

Inhibitor switch ensures the safety at engine start. This switch is installed to the right side of transmission case, and operated by selector lever. When the selector lever is in the “P” or “N” range, the engine will start because the electric circuit in inhibitor switch is closed and the starter circuit is connected. When the selector lever is in the “R”, “D”, “3”, “2” or “1” range, the electric circuit in inhibitor switch is open; therefore, the engine cannot be cranked. In the “R” range, the back-up light will illuminate because the back-up light circuit in the switch is connected. In addition to the functions above, the inhibitor switch has the circuit which detects the selected range position at the present and transmits the range signal to the TCM.

3. ENABLE CONDITION

- Enable condition A

Secondary Parameters	Enable Conditions
Shift	“N” to “3”
Vehicle speed	≥ 60 km/h (37 MPH)

- Enable condition B

Secondary Parameters	Enable Conditions
Engine speed	> 500 rpm
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis when shifting selector lever from Neutral to 3rd at vehicle speed of 60 km/h (37 MPH). (For Enable condition A)
Perform the diagnosis continuously after engine start (For Enable condition B).

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
“D” signal continuously (For Enable condition A)	Not detected
Simultaneous signal (For Enable condition B)	≥ 2

Time Needed for Diagnosis:
- 63.75 seconds (For Enable condition A)
- 10 seconds (For Enable condition B)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BW:DTC P0710 — TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT —

1. OUTLINE OF DIAGNOSIS

- Judge NG when the ATF temperature sensor is open, battery short or ground short.
- Judge NG when the ATF sensor is detective.

2. COMPONENT DESCRIPTION

ATF temperature sensor is installed to the hydraulic control valve body of transmission as a unit with transmission harness. This sensor detects ATF temperature and outputs it as electric resistance signal.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V
Output at ≥ 80km/h (50 MPH) after 5 minutes from reaching more than 4.8 V	≥ 4.7 V

Time Needed for Diagnosis: 63.75 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control ATF temperature at a constant temperature 80°C (176°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BX:DTC P0716 — INPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Judge NG when the turbine speed signal is not transmitted for some reasons.

2. COMPONENT DESCRIPTION

Torque converter turbine speed sensor (output shaft speed sensor) is installed to the outside of transmission case. This sensor detects the turbine speed of torque converter by the peripheral speed of high clutch drum connected to input shaft. And then it transmits the sine wave signal (32 pulses per rev.) to TCM. TCM calculates the ratio of the input shaft speed to vehicle speed, and then makes a judgment whether to shift or not.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 1500 rpm
Vehicle speed	≥ 40 km/h (25 MPH)
Range switch	“D”, “3”, “2” or “1”

4. GENERAL DRIVING CYCLE

Perform the diagnosis at engine speed of more than 1,500 rpm and vehicle speed of more than 40 km/h (25 MPH).

5. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below were continued for 2 seconds.
(1) Except “P”, “N”, “R” ranges and inhibitor switch is normal.
(2) Engine speed is more than 3000 rpm.
(3) Vehicle speed is 30 km/h (19 MPH) and vehicle speed sensor is normal.
(4) Turbine speed is more than 600 rpm.

Judgment Value

Malfunction Criteria	Threshold Value
Output from turbine shaft speed	< 600 rpm

Time Needed for Diagnosis: Illuminates at occurrence of trouble
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BY:DTC P0720 — OUTPUT SPEED SENSOR CIRCUIT —

1. OUTLINE OF DIAGNOSIS

Judge NG when an abnormal large signal is input to the front vehicle speed sensor, or no signal is input to the rear vehicle speed sensor.

2. COMPONENT DESCRIPTION

This vehicle speed sensor (output shaft speed sensor) is installed to the outside of transmission case. This sensor detects the front wheel speed, and transmits the sine wave signal (16 pulses per rev.) to TCM. TCM converts the signal to pulse signal, and transmits to both of the ECM and the combination meter.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed	≥ 20 km/h (12 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with more than 20 km/h (12 MPH) vehicle speed.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Number of vehicle speed sensor signals per 1 second	≥ 4698 or no signal

Time Needed for Diagnosis: 63.75 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Use the normal vehicle speed sensor signal when either of them is normal.
- Use the vehicle speed calculated from the current gear position and turbine speed when both front and rear wheels are troubled.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BZ:DTC P0726 — ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Judge NG when the engine speed is not input in the status of running the engine.

2. COMPONENT DESCRIPTION

Engine speed sensor is installed to the outside of engine body and crank part. This sensor detects the crank speed, and transmits the sine wave signal (2 pulses per rev.) to TCM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Output from mass air flow sensor	≥ 1.0 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine start.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed	≤ 400 rpm

Time Needed for Diagnosis: 63.75 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CA:DTC P0731 — GEAR 1 INCORRECT RATIO —

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	≥ 15°
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	“D”, “3”, “2” or “1”
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Continuously perform the diagnosis while depressing accelerator pedal with more than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.
(1) Vehicle speed is more than 10 km/h (6 MPH).
(2) Throttle sensor is more than a certain angle.
(3) Shifted to “D”, “3”, “2” or “1” range, and range signal is normal.
(4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (1st gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CB:DTC P0732 — GEAR 2 INCORRECT RATIO —

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	≥ 15°
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	"D", "3", "2" or "1"
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Continuously perform the diagnosis while depressing accelerator pedal with more than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.
(1) Vehicle speed is more than 10 km/h (6 MPH).
(2) Throttle sensor is more than a certain angle.
(3) Shifted to "D", "3", "2" or "1" range, and range signal is normal.
(4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (2nd gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CC:DTC P0733 — GEAR 3 INCORRECT RATIO —

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	≥ 15°
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	“D”, “3”, “2” or “1”
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Continuously perform the diagnosis while depressing accelerator pedal with more than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.
(1) Vehicle speed is more than 10 km/h (6 MPH).
(2) Throttle sensor is more than a certain angle.
(3) Shifted to “D”, “3”, “2” or “1” range, and range signal is normal.
(4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (3rd gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CD:DTC P0734 — GEAR 4 INCORRECT RATIO —

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	≥ 15°
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	“D”, “3”, “2” or “1”
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Continuously perform the diagnosis while depressing accelerator pedal with more than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.
(1) Vehicle speed is more than 10 km/h (6 MPH).
(2) Throttle sensor is more than a certain angle.
(3) Shifted to “D”, “3”, “2” or “1” range, and range signal is normal.
(4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (4th gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Judge NG when the engine speed is different from the turbine speed for some reasons at AT lock-up.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
In 4th gear position, duty ratio for duty solenoid valve	≥ 90%

3. GENERAL DRIVING CYCLE

Perform the diagnosis at 4th gear lock-up.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed ≥ (output shaft speed × 4th gear ratio × 9/8)	

Time Needed for Diagnosis: 10.2 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

Not allowed to lock up.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CF:DTC P0743 — TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the lock-up duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Lock-up duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This allows the lock-up clutch to be connected or released smoothly by controlling the lock-up control valve.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	Low level
Vc at “OFF” signal from ECM	High level

Time Needed for Diagnosis: 0.14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CG:DTC P0748 — PRESSURE CONTROL SOLENOID "A" ELECTRICAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the line pressure duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Line pressure duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This allows controlling the pressure modifier valve and accumulator control valve A, and allows the line pressure to be adjusted to the pressure appropriate for driving condition.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	Low
Vc at "OFF" signal from ECM	High

Time Needed for Diagnosis: 0.14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CH:DTC P0753 — SHIFT SOLENOID “A” ELECTRICAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the shift solenoid 1 becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Shift solenoid 1 Shift solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. Gear positions will change depending on the solenoid condition which is ON or OFF.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Collector voltage of transistor (Vc) for solenoid valve is inconsistent with signal from ECM	

Time Needed for Diagnosis: 30 milliseconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CI: DTC P0758 — SHIFT SOLENOID “B” ELECTRICAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the shift solenoid 2 becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Shift solenoid 2 Shift solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. Gear positions will change depending on the solenoid condition which is ON or OFF.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc for solenoid valve is inconsistent with signal from ECM	

Time Needed for Diagnosis: 30 milliseconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CJ:DTC P0771 — SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF —

1. OUTLINE OF DIAGNOSIS

Judge NG when the low clutch timing solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Low clutch timing solenoid Low clutch timing solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. This allows controlling the low clutch timing valve B and reverse inhibitor valve.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	Low level
Vc at "OFF" signal from ECM	High level

Time Needed for Diagnosis: 30 milliseconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CK:DTC P0778 — PRESSURE CONTROL SOLENOID "B" ELECTRICAL —

1. OUTLINE OF DIAGNOSIS

Judge NG when the 2-4 brake duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

2-4 brake duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This solenoid decreases the change gear shock by adjusting the 2-4 brake pressure during 2-4 brake operation.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	Low level
Vc at "OFF" signal from ECM	High level

Time Needed for Diagnosis: 0.14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CL:DTC P0785 — SHIFT/TIMING SOLENOID —

1. OUTLINE OF DIAGNOSIS

Judge NG when the 2-4 brake timing solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

2-4 brake timing solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. This allows controlling the 2-4 brake timing valve B and decreases the change gear shock.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	Low level
Vc at “OFF” signal from ECM	High level

Time Needed for Diagnosis: 30 milliseconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CM:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of neutral switch.
- AT: Judge NG when ECM neutral terminal input is different from reception data from TCM.
- MT: Judge NG when the neutral switch does not respond even though shift lever is changed (neutral switch is turned on or off by vehicle and engine speed).

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	1 second or more
Starter switch	OFF
Battery voltage	≥ 8 V
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

AT: Judge NG when the continuous time of condition which satisfies the malfunction criteria below becomes more than time needed for diagnosis (5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	ON (Low)
“P” range / “N” range on AT	OFF
Any other switches on AT	ON

• Normality Judgment

AT: Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	OFF (High)
“P” range / “N” range on AT	OFF
Any other switches on AT	ON

MT: Judge NG when the number of times until completing the malfunction criteria below continue 3 times in a row, judge OK when turning to OFF or ON.

• Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch on MT	ON not detected
Driving condition change a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm b) Vehicle speed 64 — 106 km/h (40 — 66 MPH) & engine speed 1600 — 2550 rpm	Change a) to b)

Time Needed for Diagnosis:

AT: Normal reception from AT is 5 seconds

MT: 3 monitoring on MT

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CN:DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of neutral switch.
- AT: Judge NG when ECM neutral terminal input is different from reception data from TCM.
- MT: Judge NG when the neutral switch does not respond even though shift lever is changed (neutral switch is turned on or off by vehicle and engine speed).

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	1 second or more
Starter switch	Turn OFF
Battery voltage	≥ 8 V
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

AT: Judge NG when the continuous time of condition which satisfies the malfunction criteria below becomes more than time needed for diagnosis (5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	OFF (High)
“P” range / “N” range on AT	ON
Any other switches on AT	OFF

• Normality Judgment

AT: Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	ON (Low)
“P” range / “N” range on AT	ON
Any other switches on AT	OFF

MT: Judge NG when the number of times until completing the malfunction criteria below continue 3 times in a row, judge OK when turning to OFF or ON.

• Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch on MT Driving condition change a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm b) Vehicle speed 64 — 106 km/h (40 — 66 MPH) & engine speed 1600 — 2550 rpm	Not detected Change a) to b)

Time Needed for Diagnosis:
AT: 5 seconds
MT: 3 monitoring on MT

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CO:DTC P0864 — TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

- Detect the communication malfunction of AT diagnosis.
- Judge NG when the communication format does not correspond.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time communication format does not correspond continued for time needed for diagnosis. Judge OK and clear the NG when the communication format corresponds.

Judgment Value

Malfunction Criteria	Threshold Value
Incorrect pattern in wiring harness for communication	≥ 60 seconds

Time Needed for Diagnosis: 60 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CP:DTC P0865 — TCM COMMUNICATION CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT diagnosis line.
- Judge NG when the signal remains Low.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8.0 V
Engine speed	≥ 500 rpm
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear the NG when the signal is turned over.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of signal line low	> 3 seconds

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CQ:DTC P0866 — TCM COMMUNICATION CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT diagnosis line.
- Judge NG when the signal remains High.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8.0 V
Engine speed	≥ 500 rpm
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear the NG when the signal is turned over.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of signal line high	> 3 seconds

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

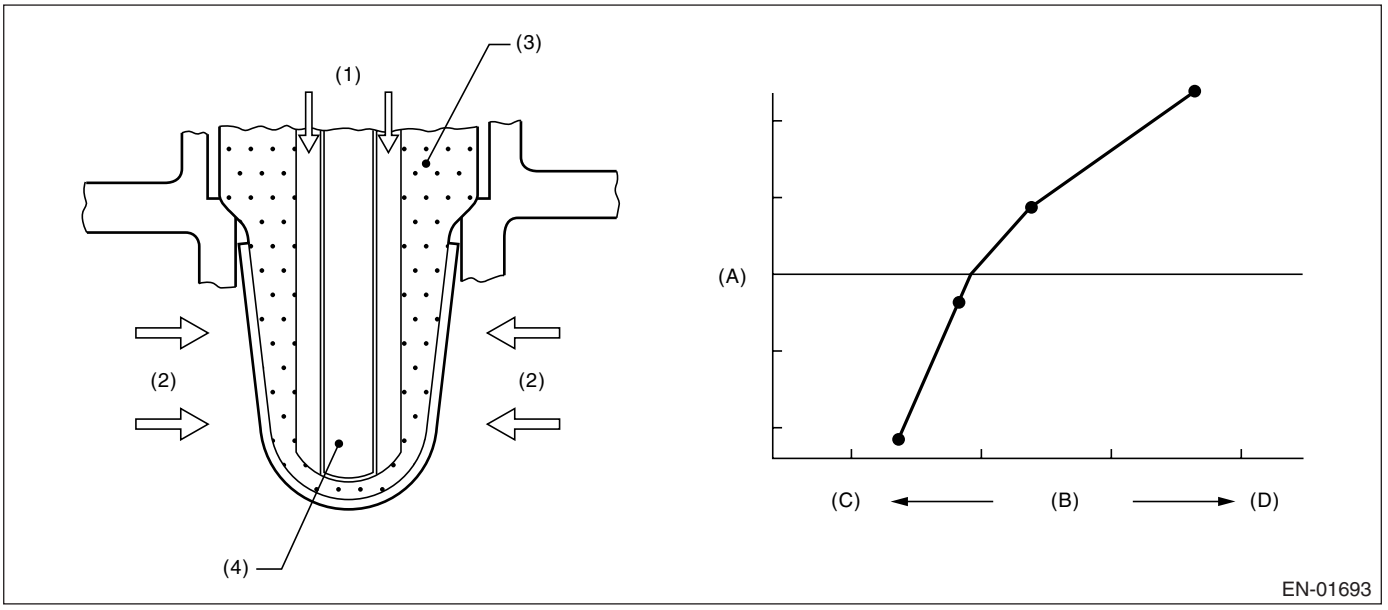
Memorize the freeze frame data. (For test mode $02)

CR:DTC P1134 — A/F SENSOR MICRO-COMPUTER PROBLEM —

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of IC communication.
- Judge NG when the communication to front oxygen (A/F) sensor control IC is unable.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
After engine starting	≥ 140 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 140 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Communication error to main CPU	≥ 250 times

Time Needed for Diagnosis: 12.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Error	None

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

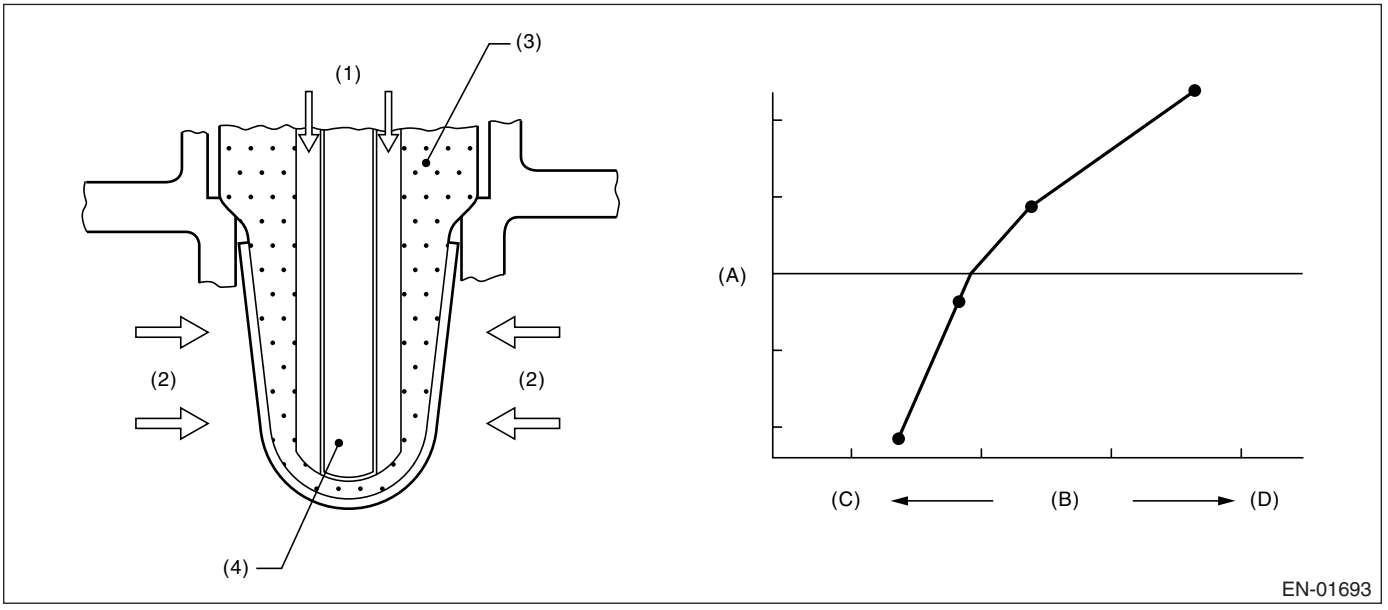
CS:DTC P1137 — O_2 SENSOR CIRCUIT MIDDLE ELECTRIC POTENTIAL (BANK 1 SENSOR 1) —

Middle Electric Potential

1. OUTLINE OF DIAGNOSIS

- Detect the output property malfunction of from oxygen (A/F) sensor.
- Judge NG when output voltage does not move to lean side or rich side.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameter	Enable Conditions
A/F sensor response diagnosis	Under diagnosis

4. GENERAL DRIVING CYCLE

Perform the diagnosis just once in 225 seconds or more after starting the engine constantly at 76 km/h (47 MPH) of vehicle speed (Same as A/F sensor response diagnosis).

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when one of the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of output voltage > 2.065 V (λ = 0.98)	3.4 seconds or more
Continuous time of output voltage < 2.180 V (λ = 1.0)	3.4 seconds or more

Time needed for diagnosis: 3.4 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Cumulative time of output voltage ≤ 2.065 V	0.2 seconds or more
Cumulative time of output voltage ≥ 2.180 V	0.2 seconds or more

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

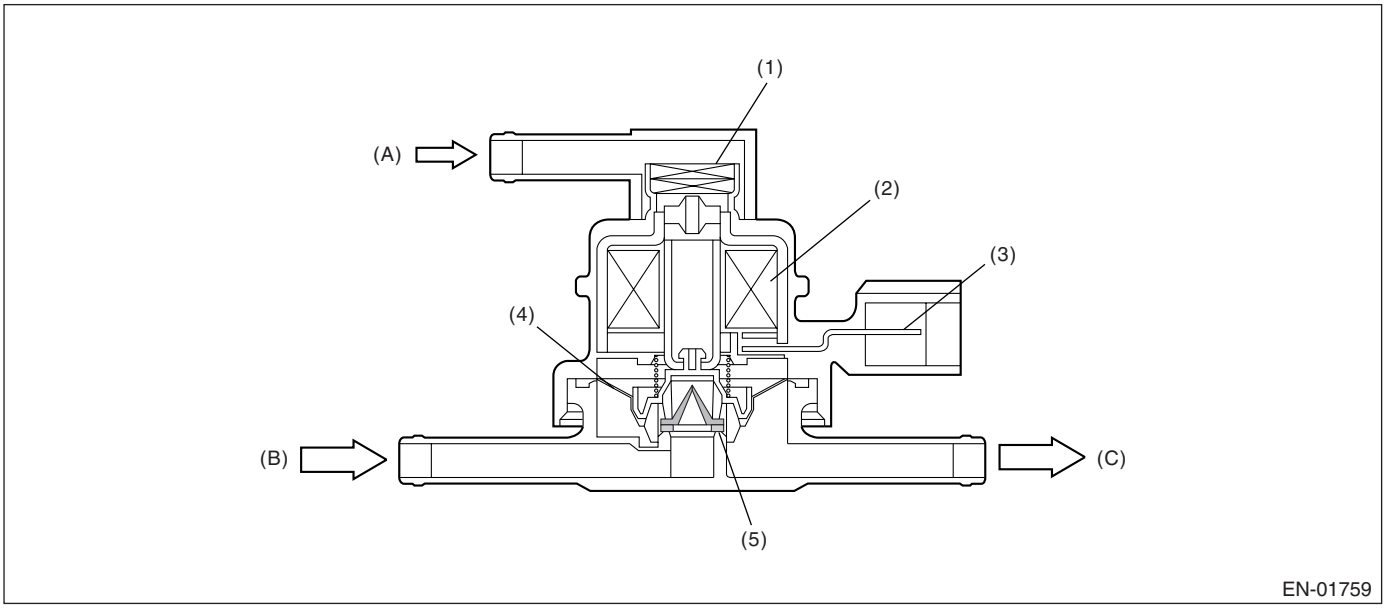
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of pressure control solenoid valve.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Filter
(2) Coil
(3) Connector terminal
(4) Diaphragm
(5) Valve
(A) Atmospheric pressure
(B) Shut-off valve
(C) To fuel tank

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	High

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

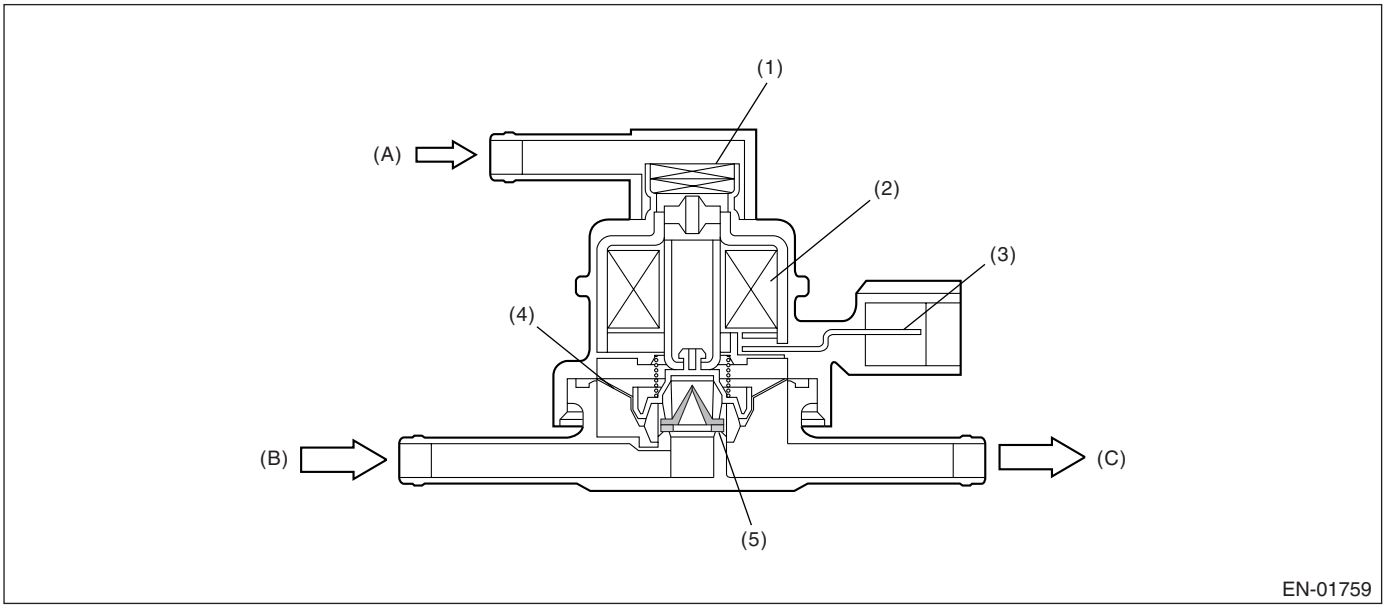
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of pressure control solenoid valve.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Filter
(2) Coil
(3) Connector terminal
(4) Diaphragm
(5) Valve
(A) Atmospheric pressure
(B) Shut-off valve
(C) To fuel tank

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	Low

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect vent control solenoid valve function problem (closed sticking). Judged NG when fuel tank pressure is low.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.7 kPa (568 mmHg, 22.36 inHg)
Fuel tank pressure when engine starts	–0.675 — 1.462 kPa (–5.06 —10.97 mmHg, 0.2 — 0.4 inHg)
Vent control solenoid valve	Open

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of condition which satisfies the malfunction criteria below becomes more than time needed for diagnosis (3 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≤ –3.50 kPa (–26.25 mmHg, –1.03 inHg)

Time Needed for Diagnosis:3 seconds
Malfunction Indicator Light Illumination: Illuminate when malfunction is detected.

• Normality Judgment

Judge OK when all the malfunction criteria below are completed, and then NG are cleared.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	> –3.50 kPa (–26.25 mmHg, –1.03 inHg)

5. DTC CLEAR CONDITION

- When the OK warm up cycle was completed 40 consecutive times
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 consecutive times
- When “Clear Memory” was performed

7. FAIL SAFE

PCV control: Open PCV solenoid valve

8. ECM OPERATION AT DTC SETTING

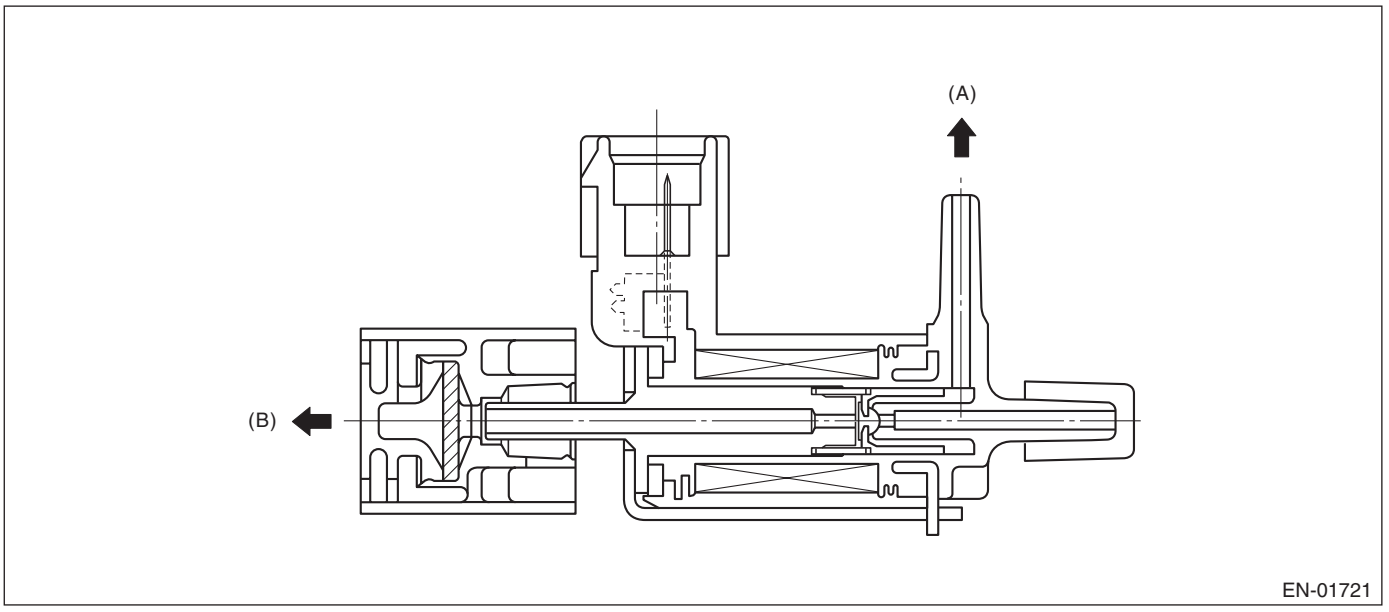
Memorize the freeze frame data. (For test mode $O2)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of fuel tank sensor control valve.
- Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) External air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM sent OFF signals	Low level

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

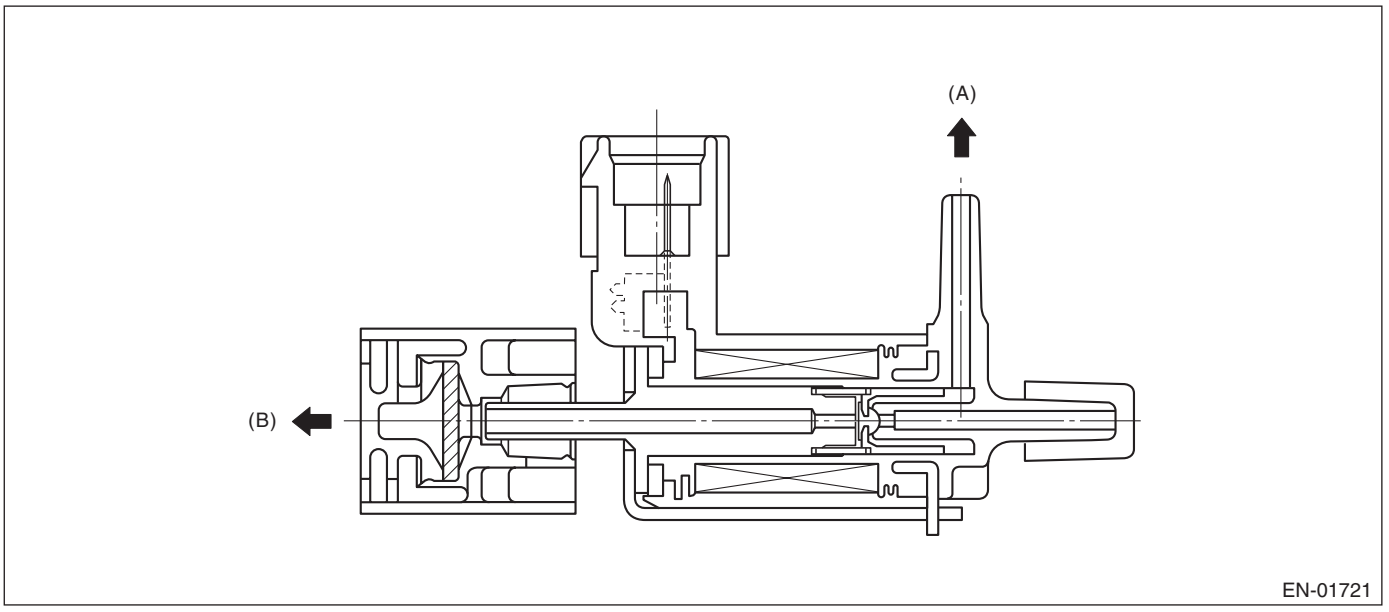
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of fuel tank sensor control valve.
- Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) External air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM sent ON signals	High level

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

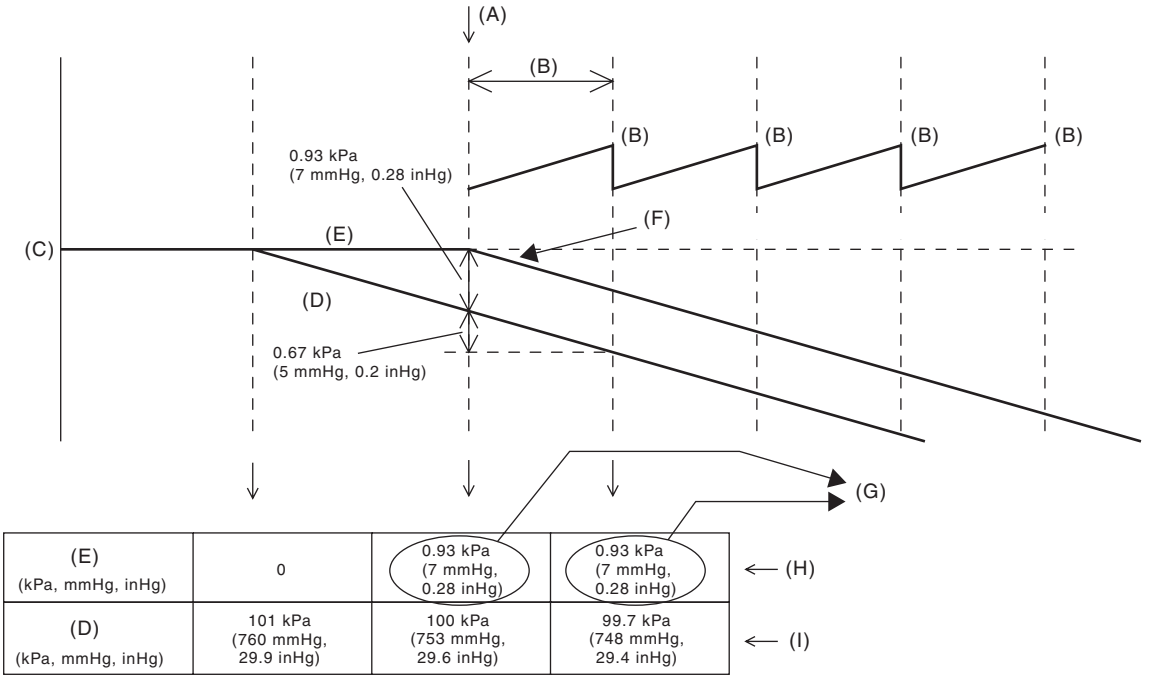
CY:DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE—

1. OUTLINE OF DIAGNOSIS

Detect the tank pressure switching solenoid function abnormality.
The tank pressure sensor is a relative pressure sensor, which normally compares the pressure with the atmospheric pressure. The tank pressure switching solenoid is a solenoid, which shifts the compare space from opening to closed during the EVAP diagnosis. Detect the malfunction that the compare space remains closed. (Not judge NG after enable condition completed but assume NG before enable condition completed.)

• Normality Judgment

Judge OK when the fuel tank pressure does not change (or changes by less than 0.67 kPa (5 mmHg, 0.2 inHg)) at atmospheric pressure changing by 0.67 kPa (5 mmHg, 0.2 inHg) or more per 80 seconds.



(E) (kPa, mmHg, inHg)	0	0.93 kPa (7 mmHg, 0.28 inHg)	0.93 kPa (7 mmHg, 0.28 inHg)	← (H)
(D) (kPa, mmHg, inHg)	101 kPa (760 mmHg, 29.9 inHg)	100 kPa (753 mmHg, 29.6 inHg)	99.7 kPa (748 mmHg, 29.4 inHg)	← (I)

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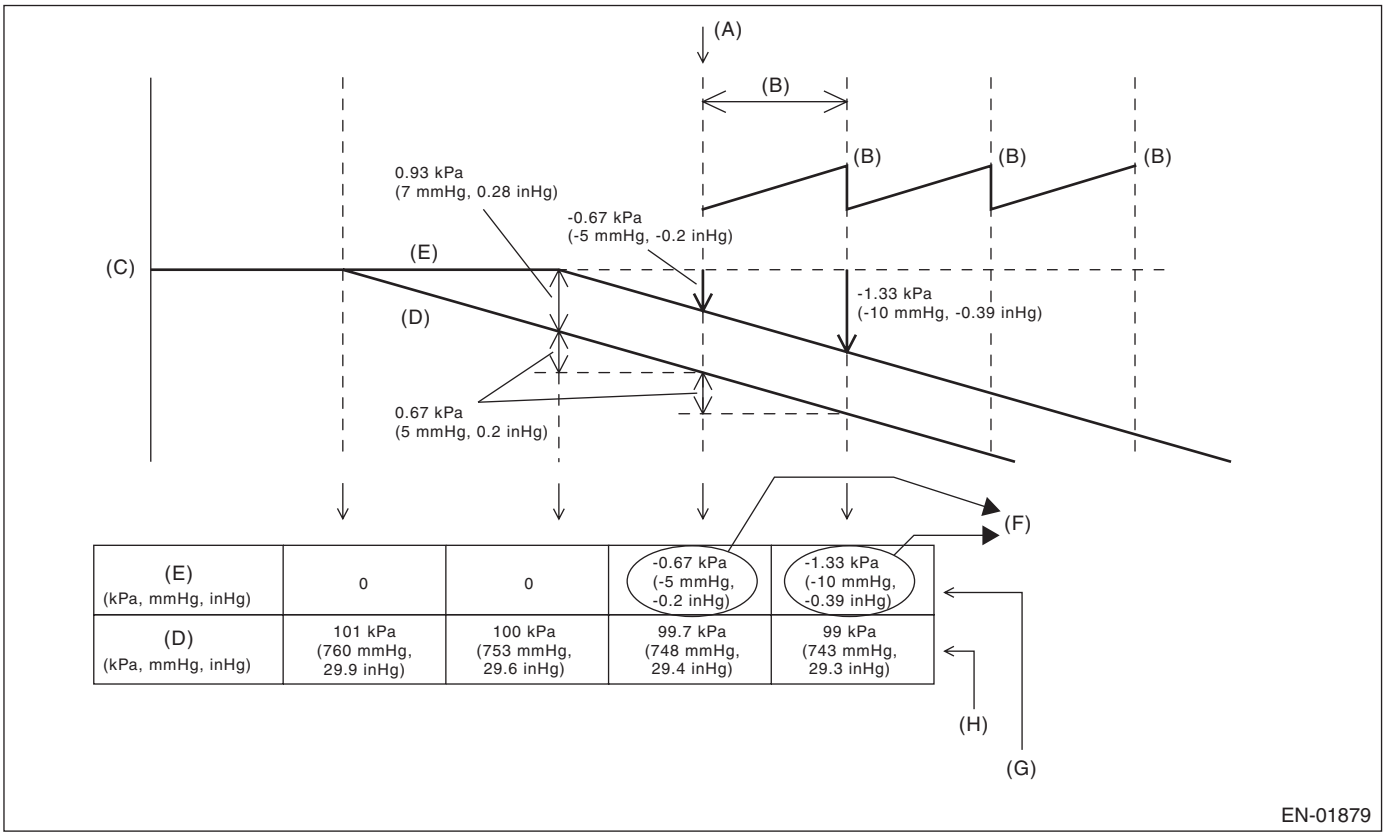
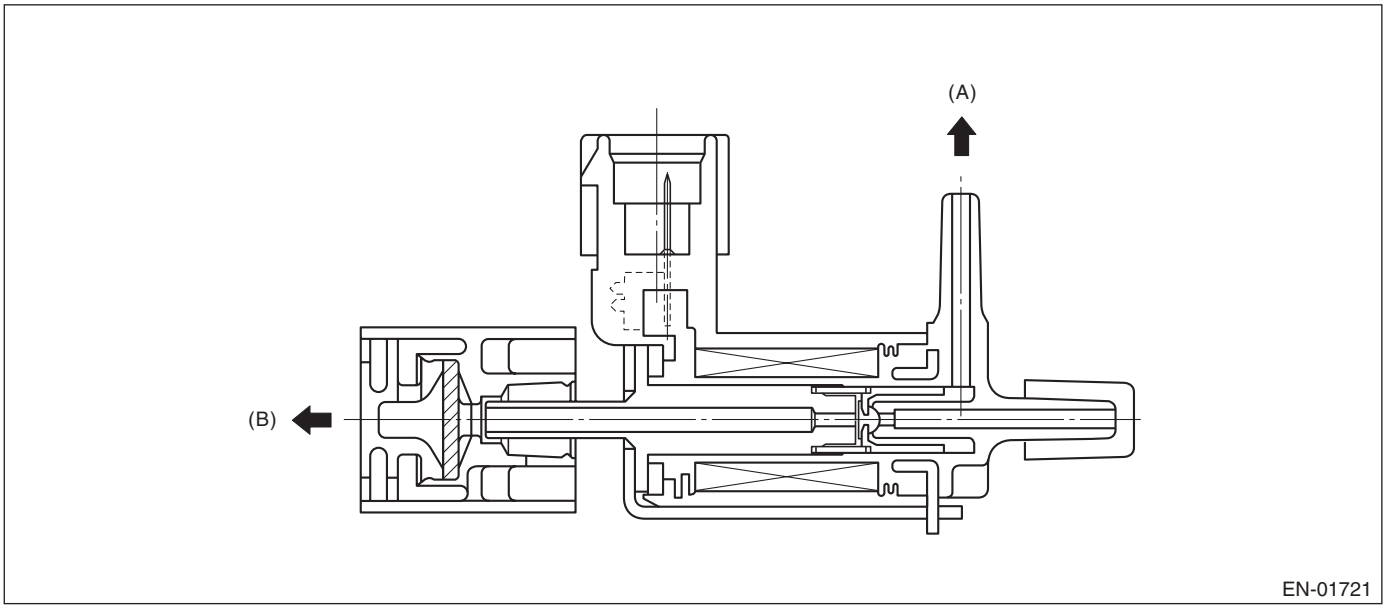
• Abnormality Judgment

Judge NG temporarily when the fuel tank pressure changes by 0.67 kPa (5 mmHg, 0.2 inHg) or more at atmospheric pressure changing by 0.67 kPa (5 mmHg, 0.2 inHg) or more per 80 seconds, and then judge NG when the previous condition is completed 5 times in a row.



(E) (kPa, mmHg, inHg)	0	0	-0.67 kPa (-5 mmHg, -0.2 inHg)	-1.33 kPa (-10 mmHg, -0.39 inHg)
(D) (kPa, mmHg, inHg)	101 kPa (760 mmHg, 29.9 inHg)	100 kPa (753 mmHg, 29.6 inHg)	99.7 kPa (748 mmHg, 29.4 inHg)	99 kPa (743 mmHg, 29.3 inHg)

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) External air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	≥ 80 seconds
Fuel level	9.6 — 48 ℓ (2.54 — 12.68 US gal, 2.11 — 10.56 Imp gal)
Fuel tank pressure	< 0 or > 1.26 kPa (< 0 or > 9.45 mmHg, < 0 or > 0.372 inHg)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 80 seconds after starting the engine. (Do not diagnose during evaporative emission control system diagnosis.)

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Count the counter up when the malfunction criteria below are completed by checking the change such as tank pressure, atmospheric pressure and fuel level during every 80 seconds. Judge NG when the count comes to the specified number (3 times).

• Judgment Value

Malfunction Criteria	Threshold Value
Change of tank pressure during 80 seconds	≥ 0.6 kPa (4.5 mmHg, 0.2 inHg)
Change of atmospheric pressure during 80 seconds	≥ 0.6 kPa (4.5 mmHg, 0.2 inHg)
Change of fuel level during 80 seconds	< 8 ℓ (2.1 US gal, 1.8 Imp gal)

Time Needed for Diagnosis: 80 seconds × 3 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Change of tank pressure during 80 seconds	≥ 0.6 kPa (4.5 mmHg, 0.2 inHg)
Change of atmospheric pressure during 80 seconds	< 0.6 kPa (4.5 mmHg, 0.2 inHg)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

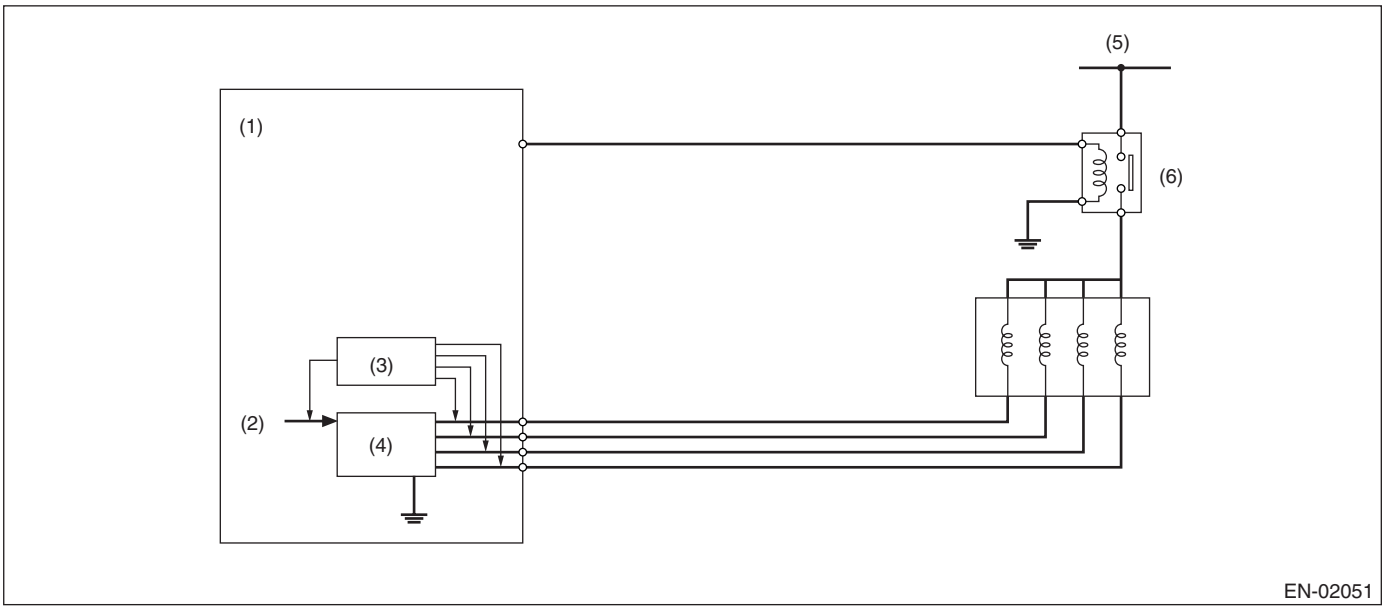
Memorize the freeze frame data. (For test mode $02)

CZ:DTC P1492 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1492 P1494 P1496 P1498
Terminal voltage level when ECM outputs ON signal	High level	P1493 P1495 P1497 P1499

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

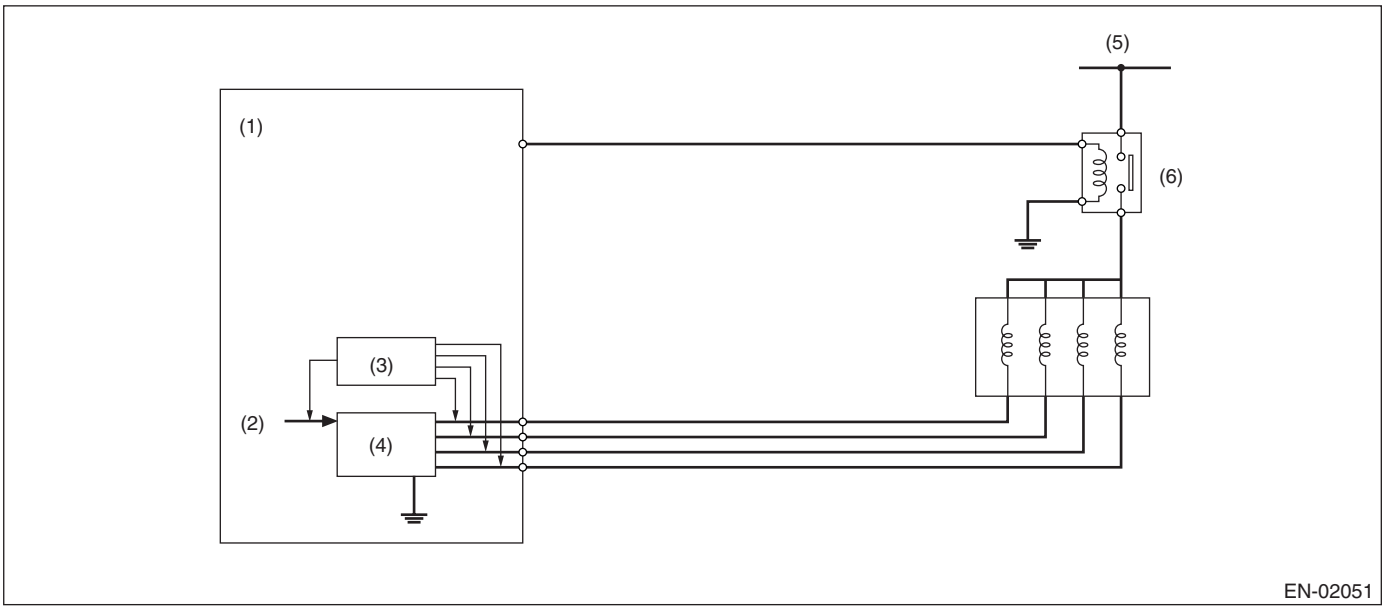
Memorize the freeze frame data. (For test mode $02)

DA:DTC P1493 — EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1492 P1494 P1496 P1498
Terminal voltage level when ECM outputs ON signal	High level	P1493 P1495 P1497 P1499

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

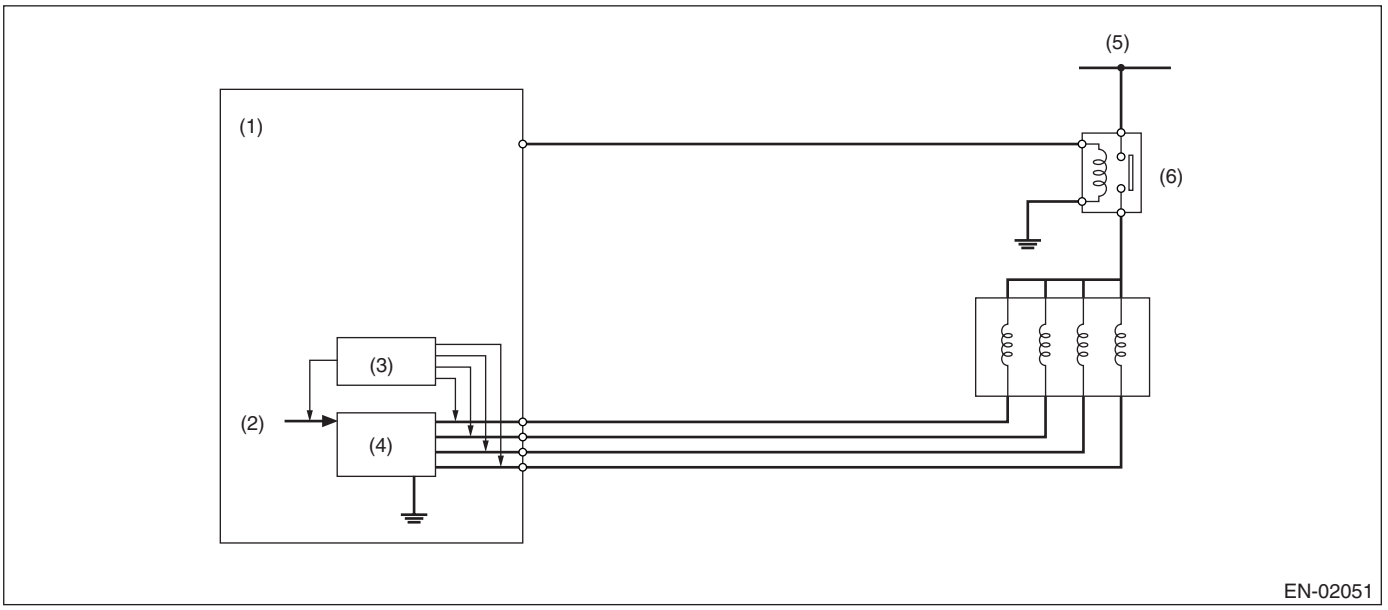
Memorize the freeze frame data. (For test mode $02)

DB:DTC P1494 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

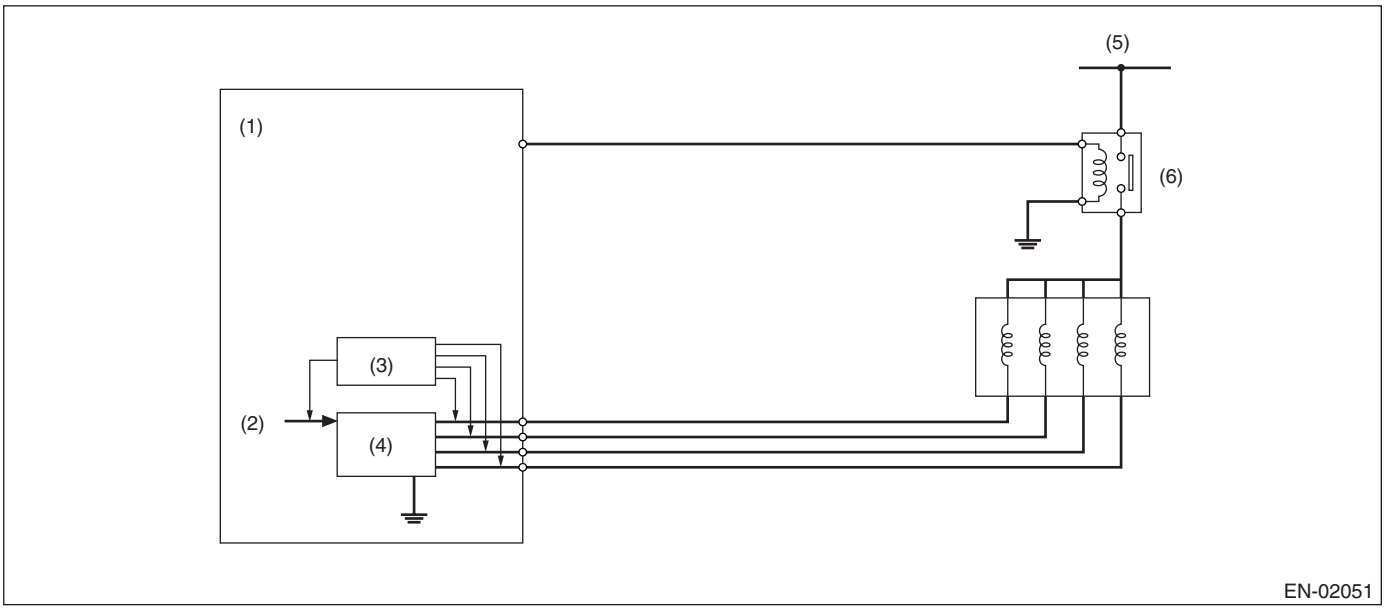
Memorize the freeze frame data. (For test mode $02)

DC:DTC P1495 — EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

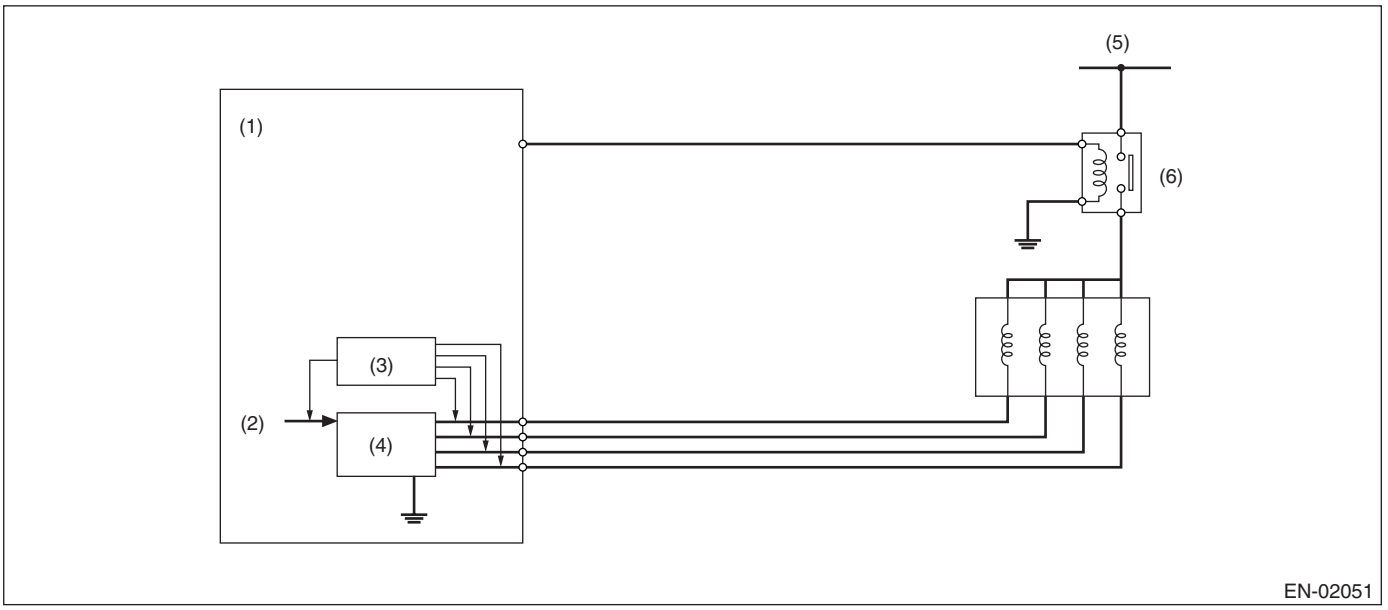
Memorize the freeze frame data. (For test mode $02)

DD:DTC P1496 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

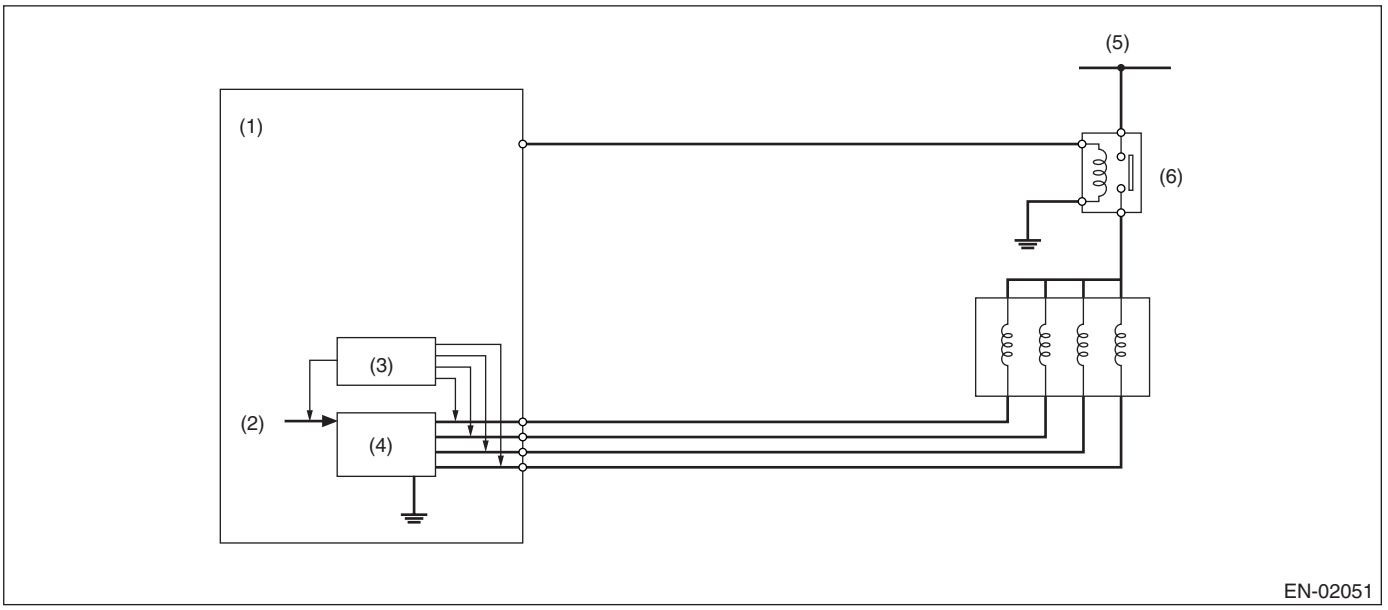
Memorize the freeze frame data. (For test mode $02)

DE:DTC P1497 — EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

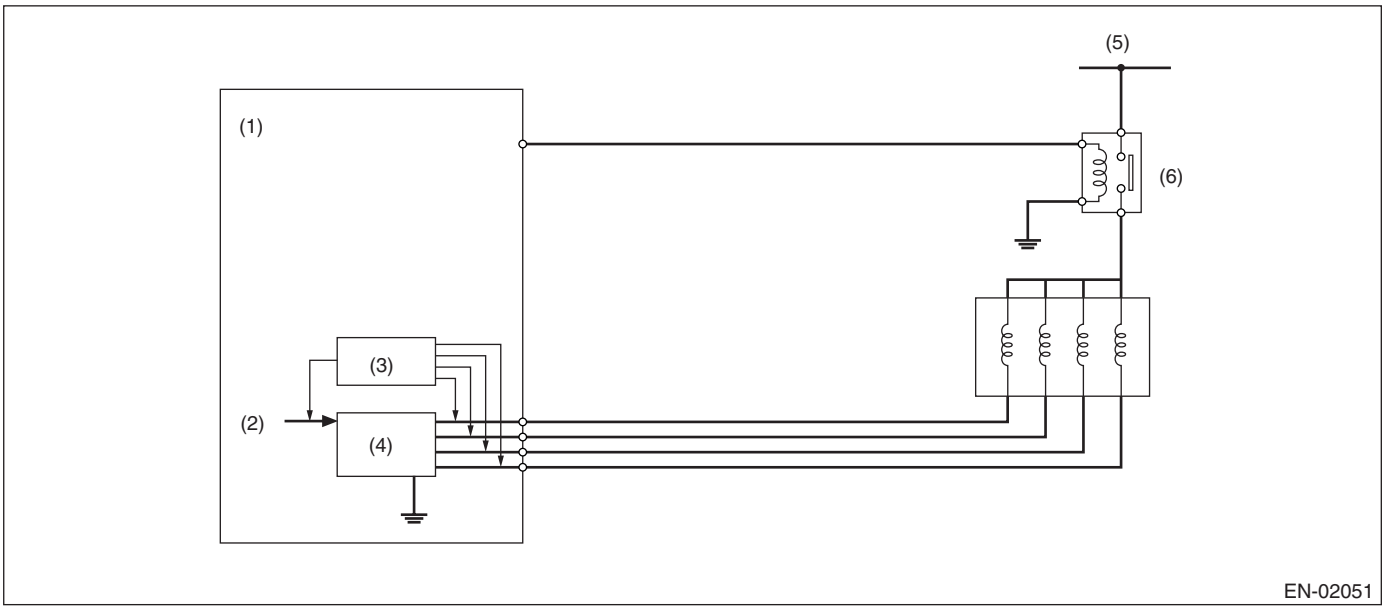
Memorize the freeze frame data. (For test mode $02)

DF:DTC P1498 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

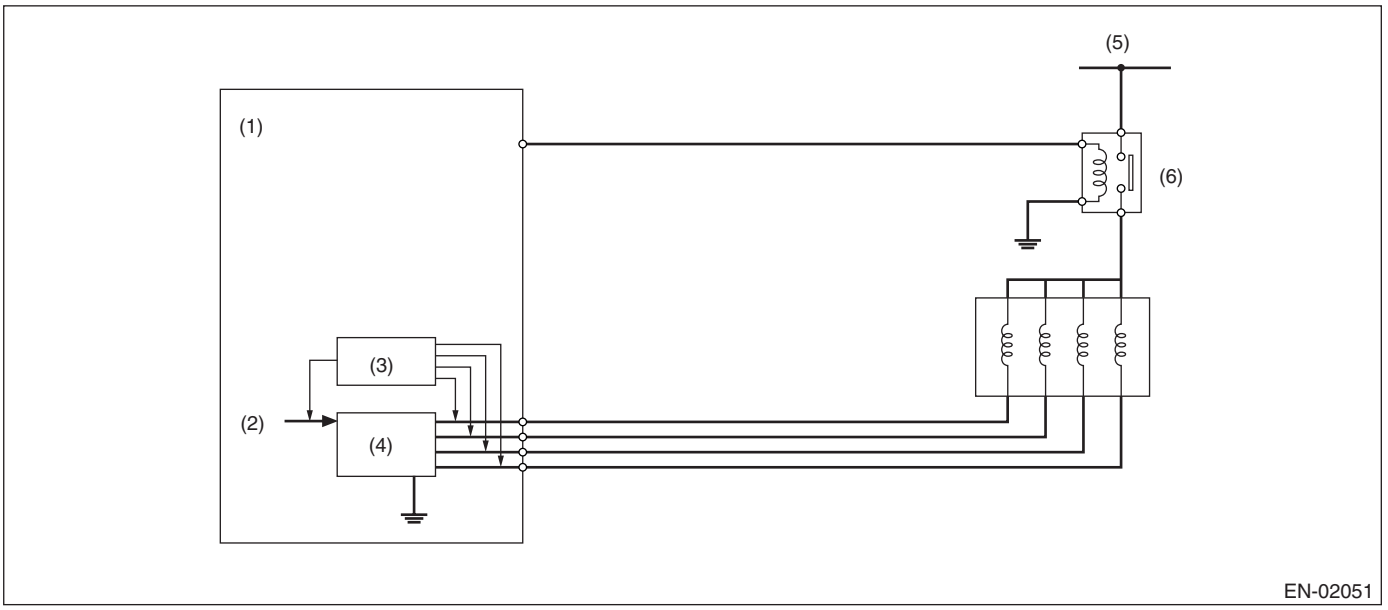
Memorize the freeze frame data. (For test mode $02)

DG:DTC P1499 — EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of EGR.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine Control Module (ECM)
(2) CPU
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
Terminal voltage level when ECM outputs OFF signal	Low level	P1292 P1294 P1296 P1298
Terminal voltage level when ECM outputs ON signal	High level	P1293 P1295 P1297 P1299

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

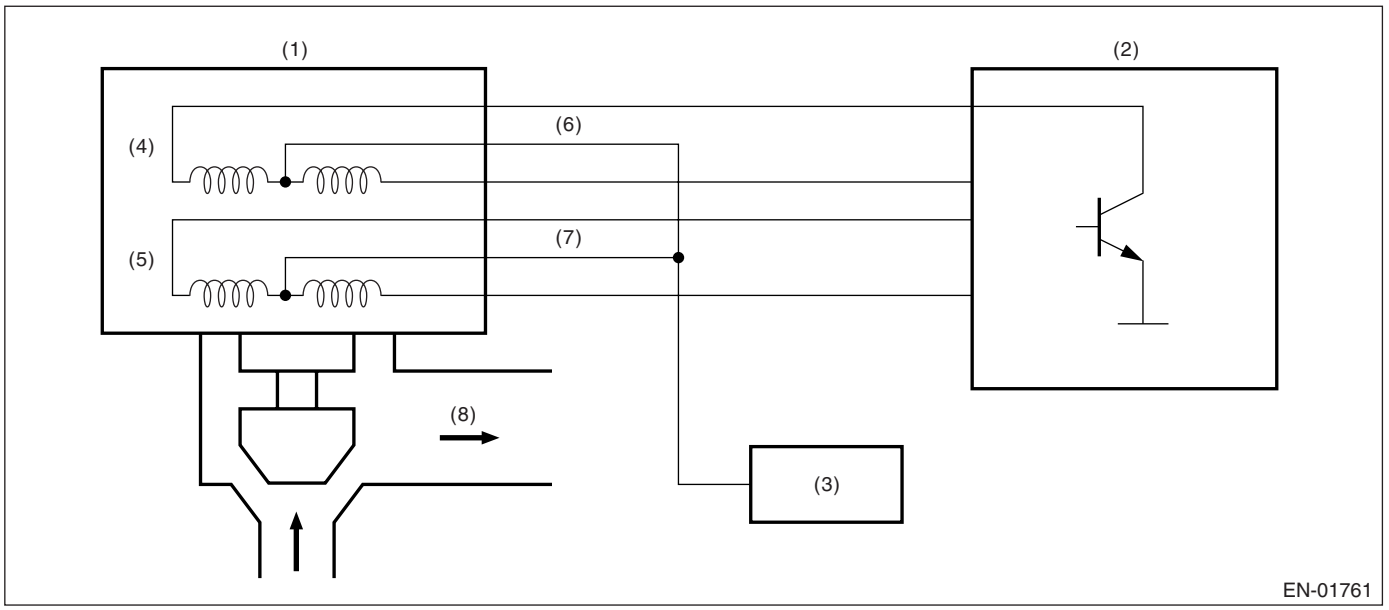
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

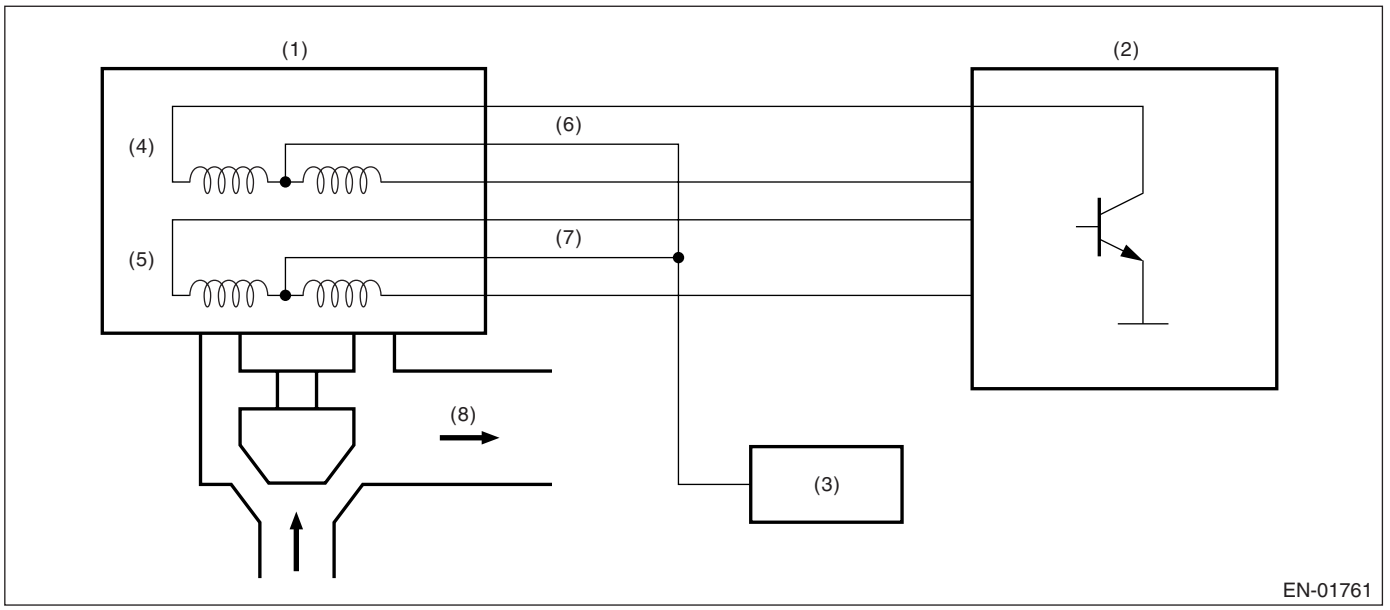
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time needed for diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

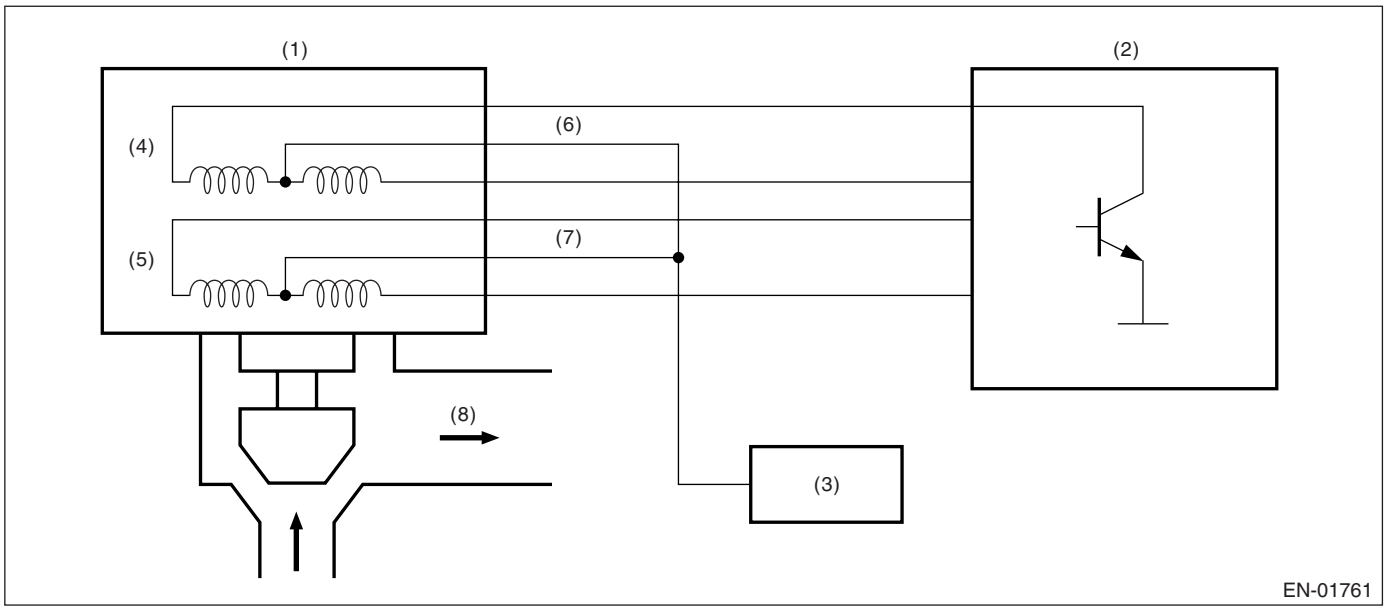
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

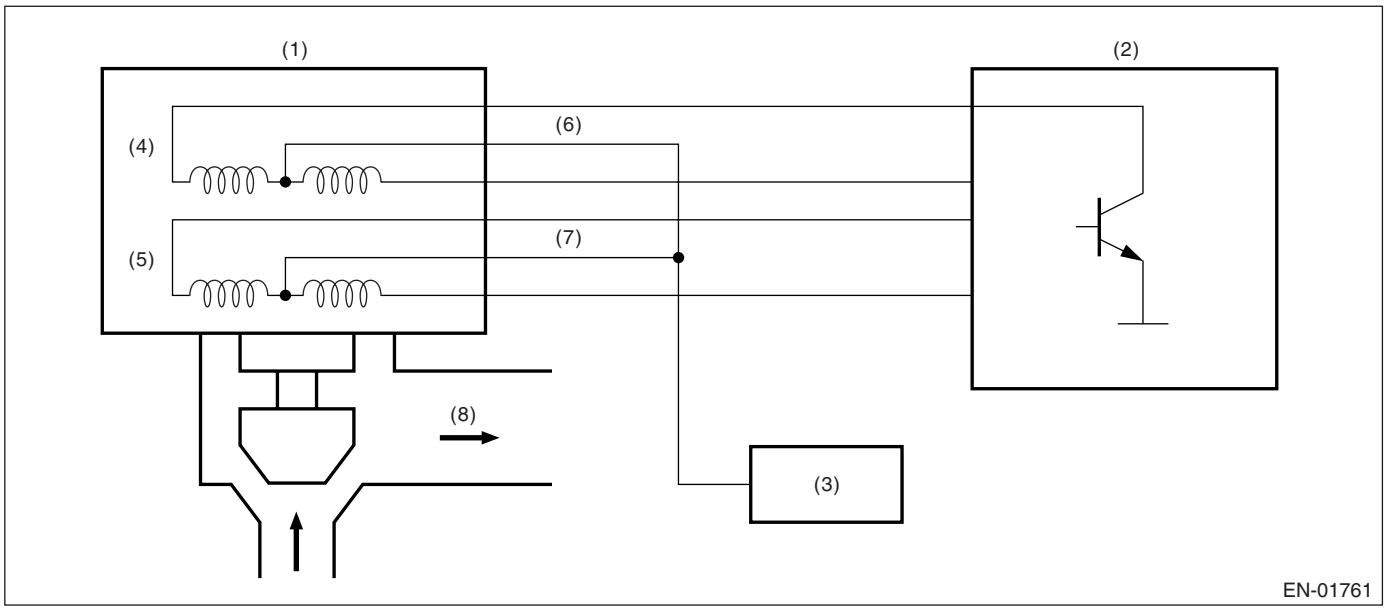
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

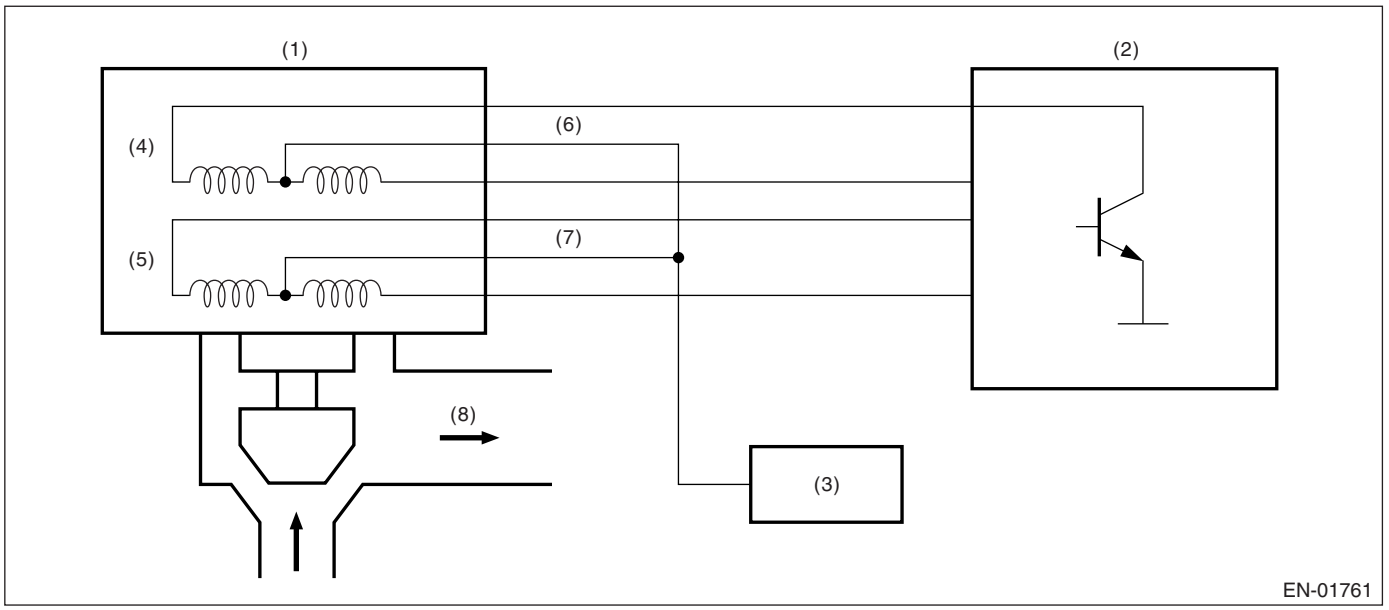
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

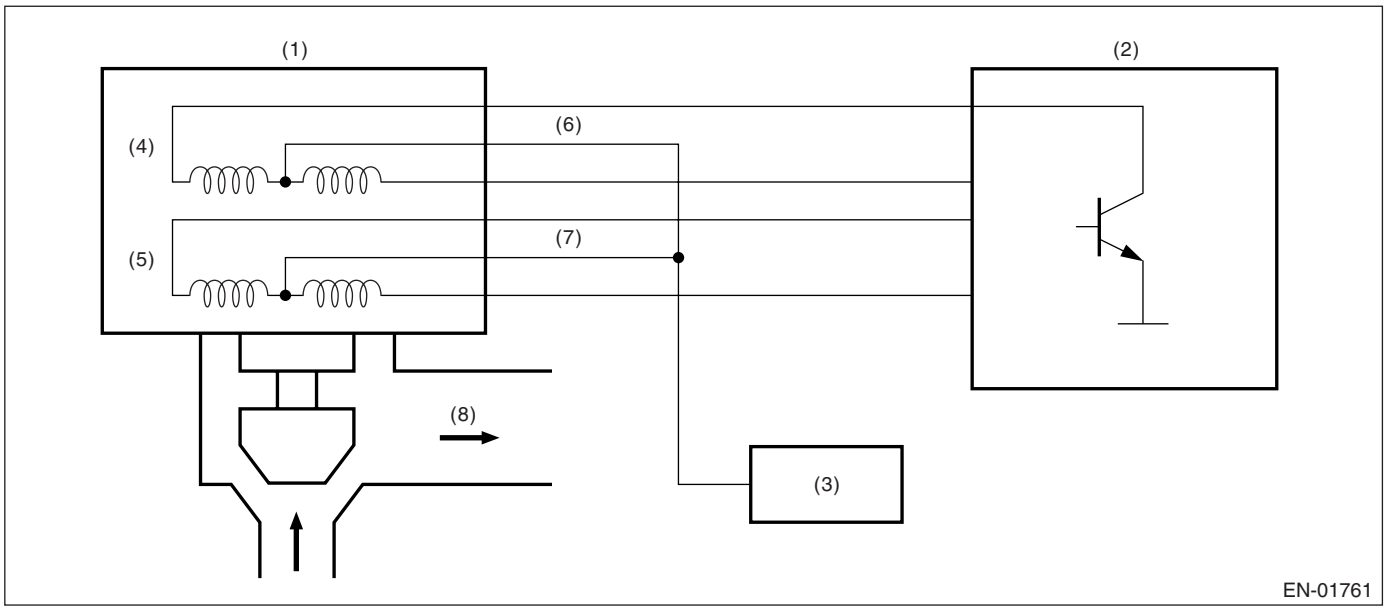
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

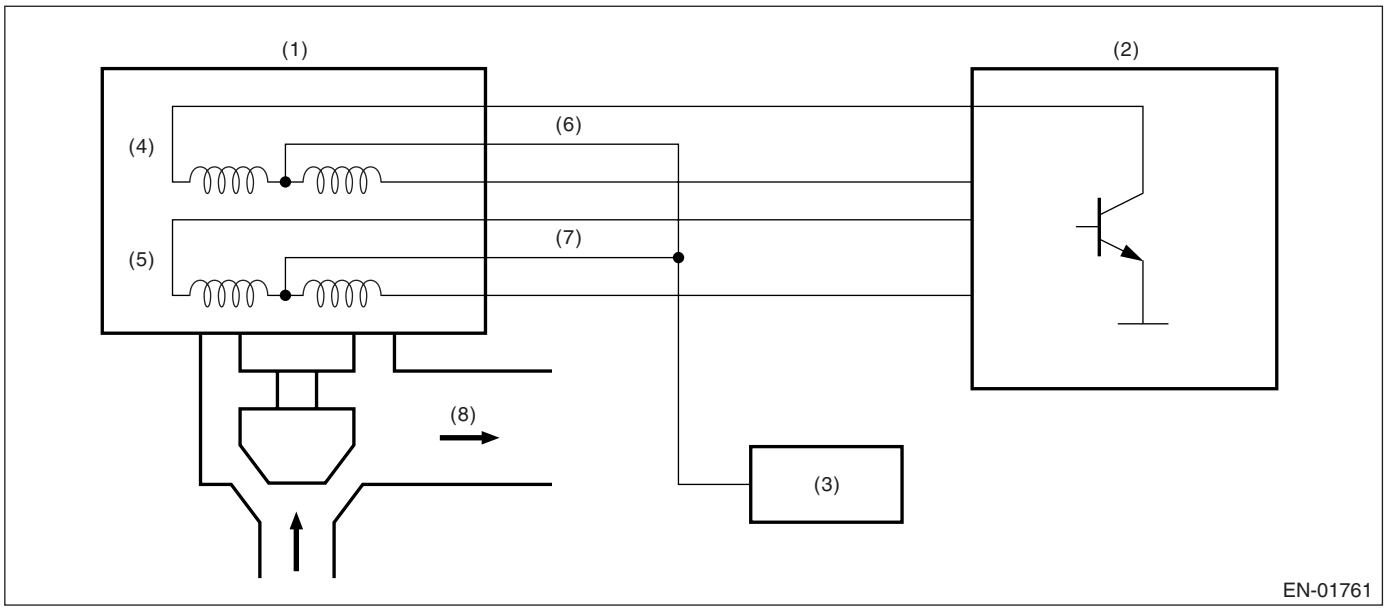
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

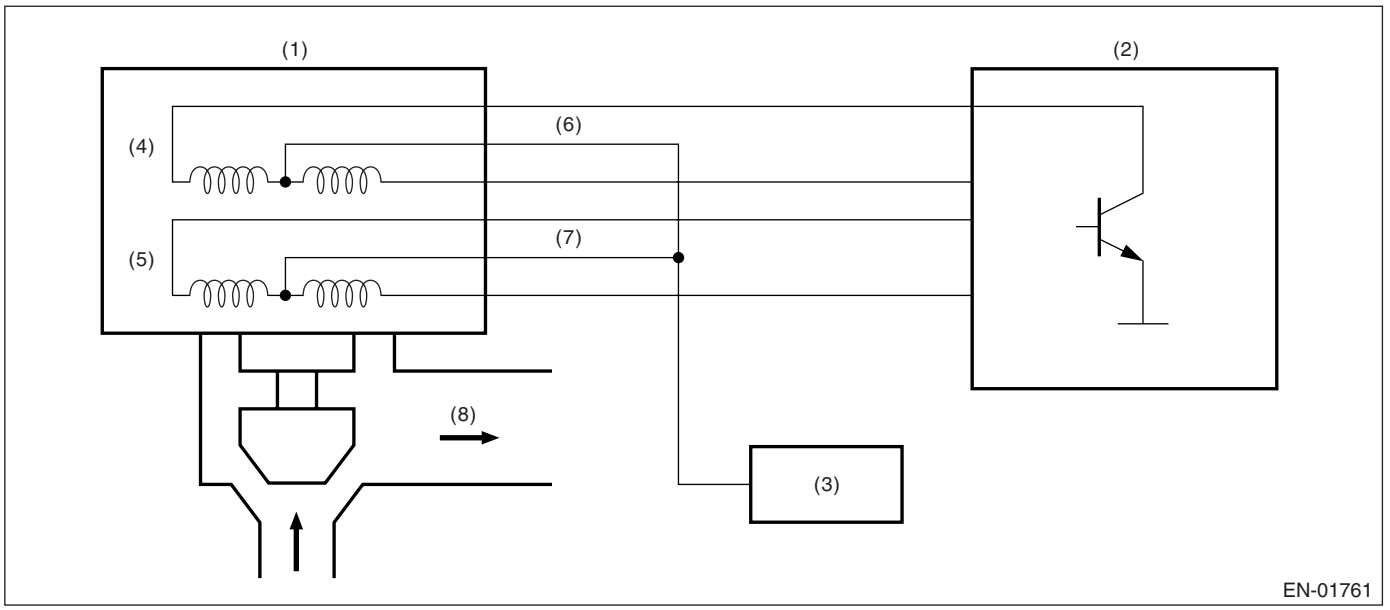
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



(1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase
(5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DP:DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of starter switch.
- Judge OFF NG when the starter signal remains ON even though engine speed and vehicle speed are high.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine	Run

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine.

4. DIAGNOSTIC METHOD

Judge NG when all the malfunction criteria below are completed after more than 10 seconds.
Judge OK when the starter switch is turned from ON to OFF, and then NG are cleared.

Judgment value

Malfunction Criteria	Threshold Value
Engine speed	≥ 1500 rpm
Vehicle speed	≥ 30 km/h (19 MPH)

Time Needed for Diagnosis

OFF side 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of back-up power supply circuit.
- Judge NG when the back-up power supply does not come to ECM regardless of the battery voltage coming.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Self-diagnosis timer after starting the engine	≥ 5 seconds
Battery voltage MVB	≥ 9.2 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously in 5 seconds after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG and clear the NG when the cumulative time until completing the malfunction criteria below becomes more than the time (5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Battery back-up voltage	Battery voltage × 0.7

Time Needed for Diagnosis: 5 seconds
Malfunction indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DR:DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT cooperative signal line.
- Judge NG when ECM output level is different from actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8.0 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	High

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DS:DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT cooperative signal line.
- Judge NG when ECM output level is different from actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8.0 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	Low

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

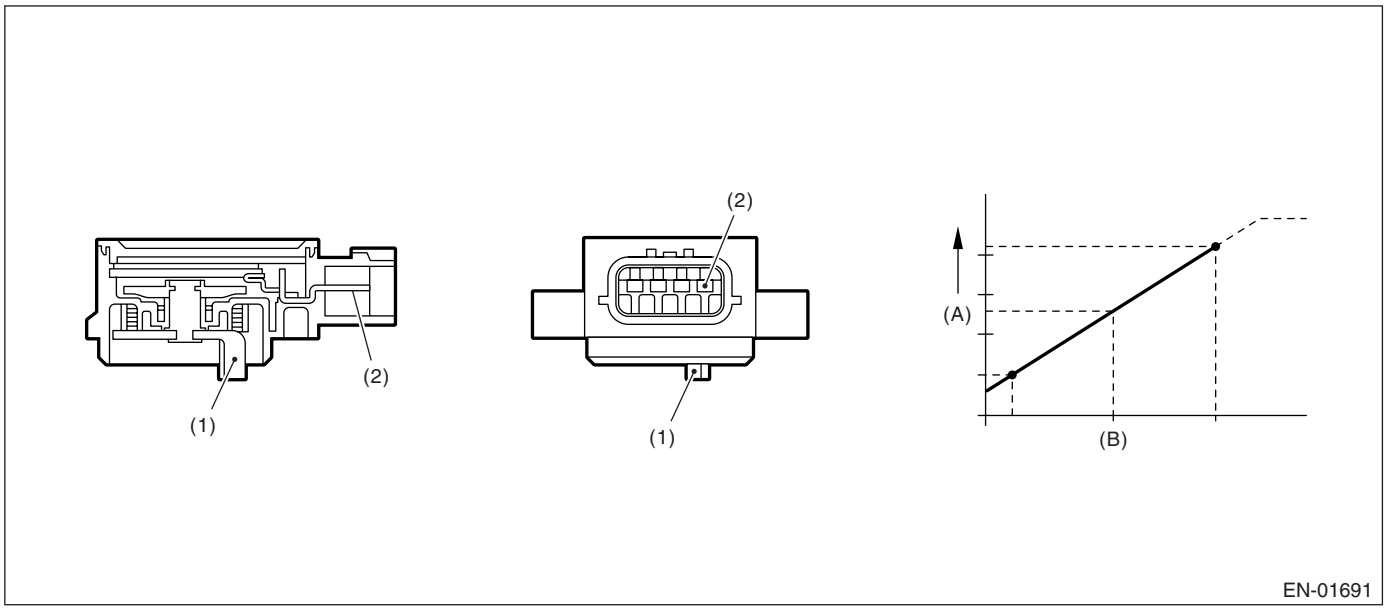
Memorize the freeze frame data. (For test mode $02)

DT:DTC P1700 — THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT —

1. OUTLINE OF DIAGNOSIS

Judge NG when the voltage from throttle sensor is out of specified value.

2. COMPONENT DESCRIPTION



(1) Lever
(2) Terminal
(A) Output voltage
(B) Throttle valve angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 or ≥ 4.6 V

Time Needed for Diagnosis: 63.75 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the throttle angle to 3/8 open, and the line pressure and 2-4B pressure to maximum.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DU:DTC P1711 — ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION —

1. OUTLINE OF DIAGNOSIS

Judge NG when detecting the difference 250 times in a row by comparing the CPU output with signal line output every 10 milliseconds.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Collector voltage of transistor (Vc) at “ON” signal from TCM	High level
Collector voltage of transistor (Vc) at “OFF” signal from ECM	Low level

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DV:DTC P1712 — ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION —

1. OUTLINE OF DIAGNOSIS

Judge NG when detecting the difference 250 times in a row by comparing the CPU output with signal line output every 10 milliseconds.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	High
Vc at “OFF” signal from ECM	Low

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

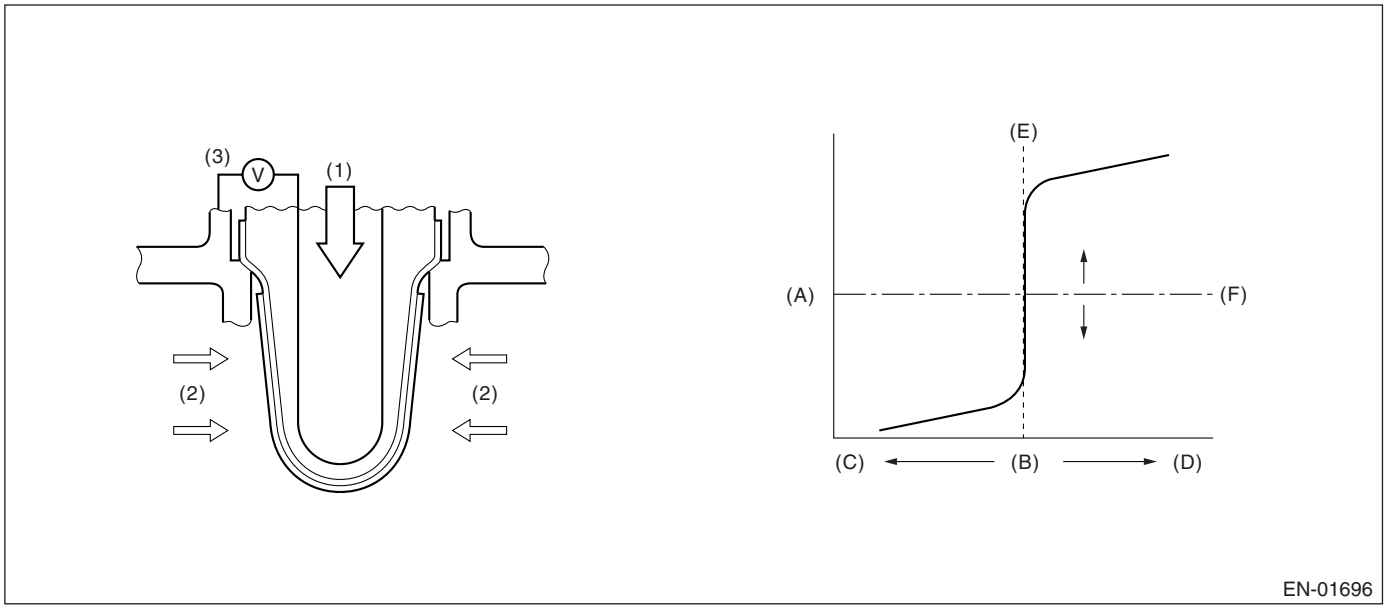
Memorize the freeze frame data. (For test mode $02)

DW:DTC P2096 — POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1 —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the amount of sub feedback control.
Judge NG when the rear oxygen sensor output does not approach to the slice level (target voltage) with the control amount sticks to rich or lean side while operating the sub feedback control.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel system monitoring with primary oxygen sensor	In operation
Target lambda with primary oxygen sensor	1.0
Closed loop control with secondary oxygen sensor	In operation
Amount of intake air	≥ 20 kg (0.71 oz)/h
Feed back control with secondary oxygen sensor	Reached to the limit value

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at a constant speed of more than 20 km/h (12 MPH).

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Calculate the continuous time from the sticking of sub feedback control amount to rich or lean side and cumulative deviation (sumdelo 2) of rear oxygen sensor voltage and slice level (target voltage).
Judge NG when the malfunction criteria below are completed after 300 seconds have passed continuously.

• Judgment Value

Malfunction Criteria	Threshold Value
sumdelo2 = sumdelo2 + (rvo2 – rsl) where: rvo2 = sensing voltage of secondary oxygen sensor rsl = target voltage of secondary oxygen sensor	< –8000 V

Time Needed for Diagnosis: 300 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the rear oxygen output is reversed, and during 4 seconds after that, the sub feedback control amount does not stick to rich or lean sides.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

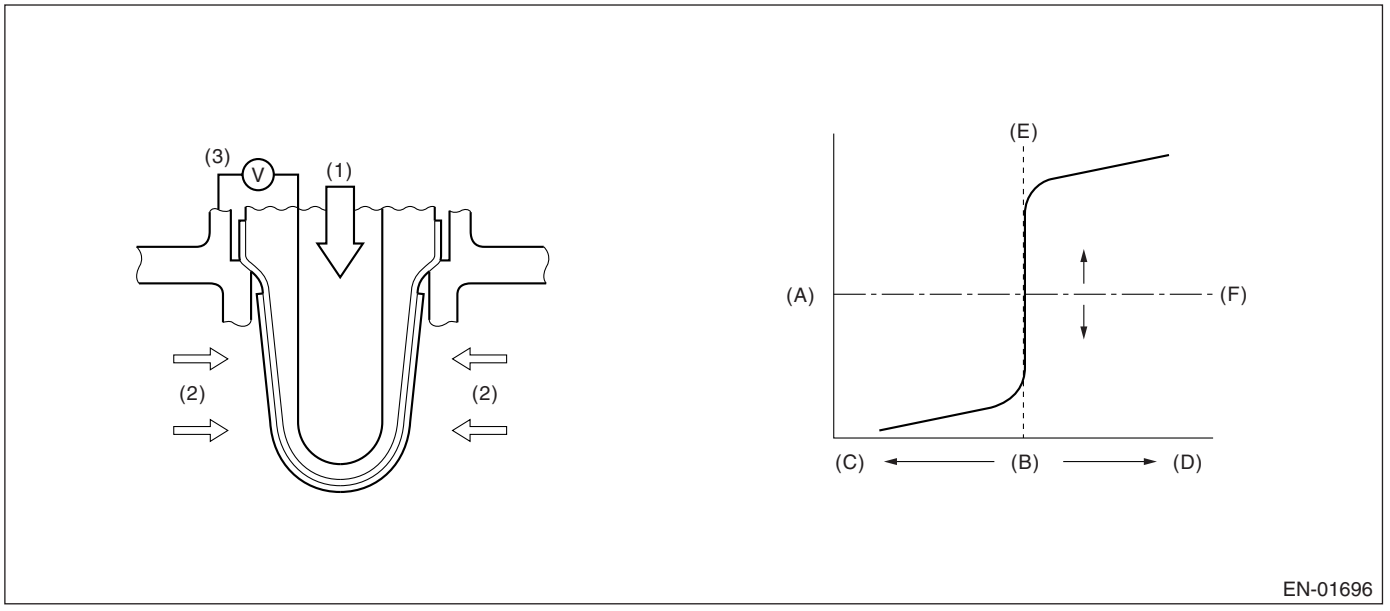
Memorize the freeze frame data. (For test mode $02)

DX:DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the amount of sub feedback control.
Judge NG when the rear oxygen sensor output does not approach to the slice level (target voltage) with the control amount sticks to rich or lean side while operating the sub feedback control.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel system monitoring with primary oxygen sensor	In operation
Target lambda with primary oxygen sensor	1.0
Closed loop control with secondary oxygen sensor	In operation
Amount of intake air	≥ 20 kg (0.71 oz)/h
Feed back control with secondary oxygen sensor	Reached to the limit value

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at a constant 80 km/h (50 MPH).

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Calculate the continuous time from the sticking of sub feedback control amount to rich or lean side and cumulative deviation (sumdelo 2) of rear oxygen sensor voltage and slice level (target voltage).
Judge NG when the malfunction criteria below are completed after 300 seconds have passed continuously.

• Judgment Value

Malfunction Criteria	Threshold Value
sumdelo2 = sumdelo2 + (rvo2 – rsl) where: rvo2 = sensing voltage of secondary oxygen sensor rsl = target voltage of secondary oxygen sensor	> 2300 V

Time Needed for Diagnosis: 300 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the rear oxygen output is reversed, and during 4 seconds after that, the sub feedback control amount does not stick to rich or lean sides.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DY:DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of atmospheric pressure sensor output property.
Intake manifold pressure and atmospheric pressure are the same from turning the IG key to ON to turning the start SW to ON. Therefore, compare the pressure from intake manifold pressure and atmospheric pressure sensors, and then judge NG when their difference is large.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Neutral switch	ON
Engine speed	< 500 rpm
Vehicle speed	< 2 km/h (1 MPH)
(MAX – MIN) manifold absolute pressure output	< 1.2 kPa (9 mmHg, 0.4 inHg)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once from the IG key turned to ON to the start SW turned to ON.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.2 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
| Atmospheric – Manifold absolute pressure |	≥ 27 kPa (200 mmHg, 8 inHg)

Time Needed for Diagnosis: 0.2 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.8 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DZ:DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of atmospheric pressure sensor.
- Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.1 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

EA:DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of atmospheric pressure sensor.
- Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.85 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

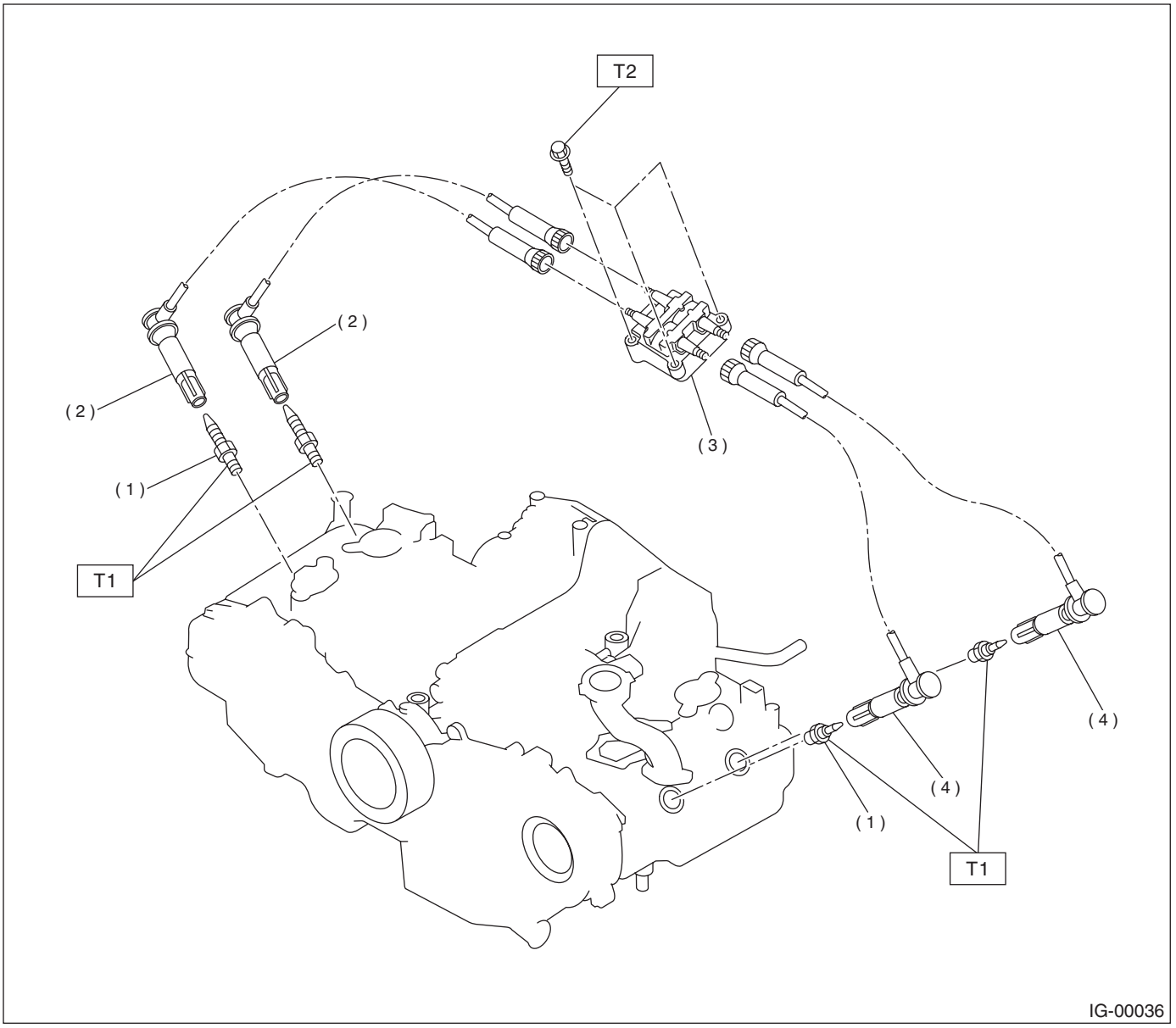
MEMO:

1. General Description

A: SPECIFICATIONS

Item			Designation	
Ignition coil and ignitor assembly	Model		FH0137	
	Manufacturer		DEMCO	
	Secondary coil resistance		12.8 kΩ±15%	
Spark plug	Type and manufacturer		RC10YC4 ..... CHAMPION	
			Alternate	BKR5E-11 ..... NGK
	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 ASSY
(4) Spark plug cord (#2, #4)

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	*21 (2.1, 15)*
T2:	*8 (0.8, 5.8)*

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 ground cable from battery.

2. Spark Plug

A: REMOVAL

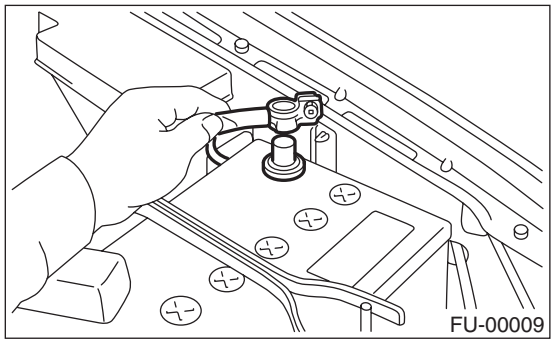
CAUTION:
All spark plugs installed on an engine, must be of the same heat range.

Spark plug:

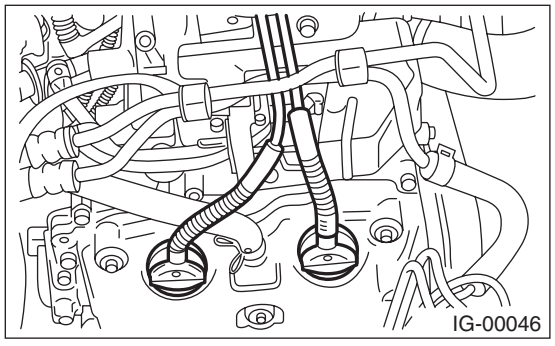
Spark plug	
CHAMPION : RC10YC4	
Alternate	NGK : BKR5E-11

1. RH SIDE

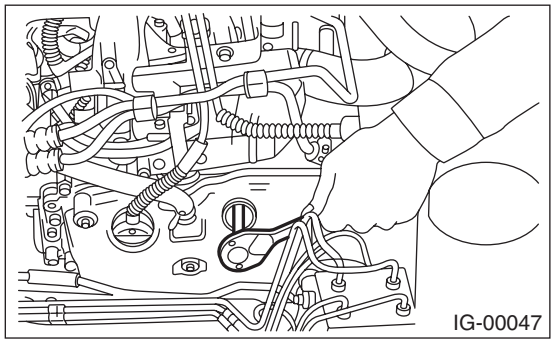
1) Disconnect ground cable from battery.



2) Remove spark plug cords by pulling boot, not cord itself.

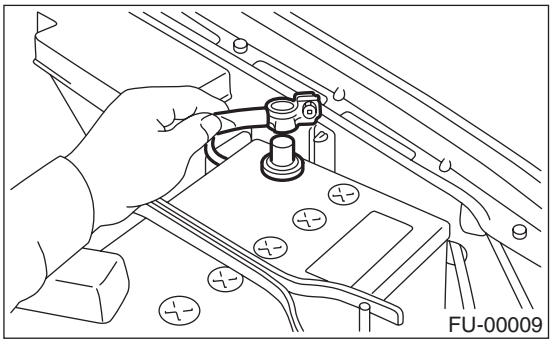


3) Remove spark plugs with the spark plug socket.

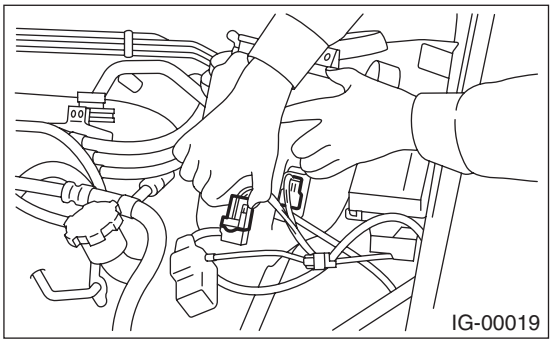


2. LH SIDE

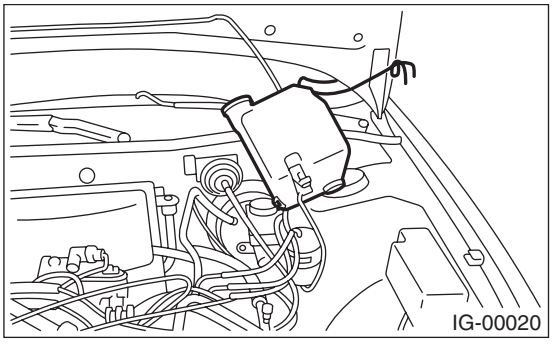
1) Disconnect battery ground cable.



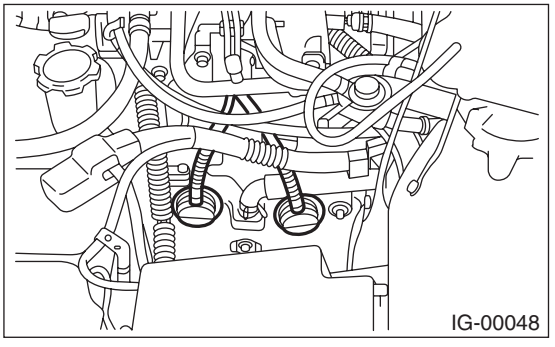
2) Disconnect washer motor connector.



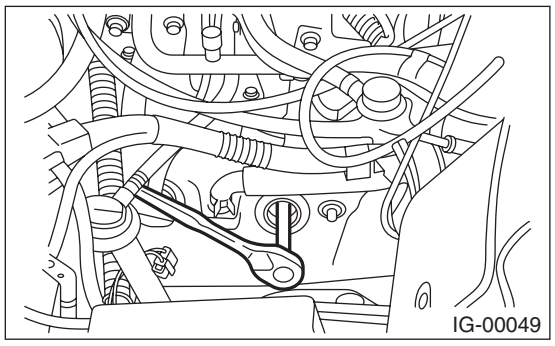
3) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
4) Remove the two bolts which hold the washer tank, then take the tank away from the working area.



5) Remove spark plugs cord by pulling boot, not cord itself.



6) Remove spark plug with the spark plugs socket.



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 ft-lb)

CAUTION:
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 approximately 1/3 of the specified torque in order to avoid over-stressing.

Tightening torque (Air cleaner case):
33 N·m (3.4 kgf-m, 24.6 ft-lb)

2. LH SIDE

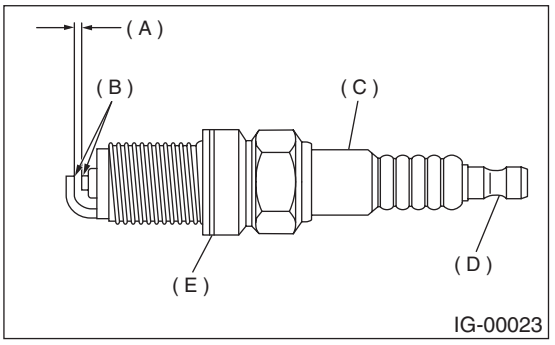
1) Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15 ft-lb)

CAUTION:
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 approximately 1/3 of the specified torque in order to avoid over-stressing.

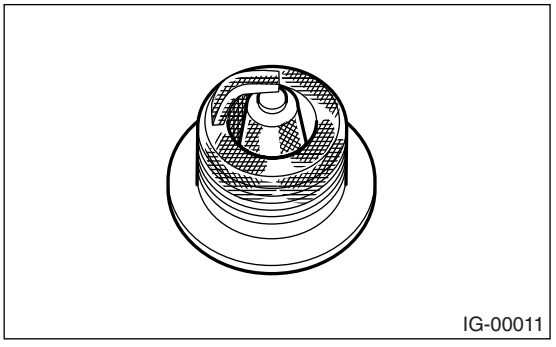
C: INSPECTION

Check electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.

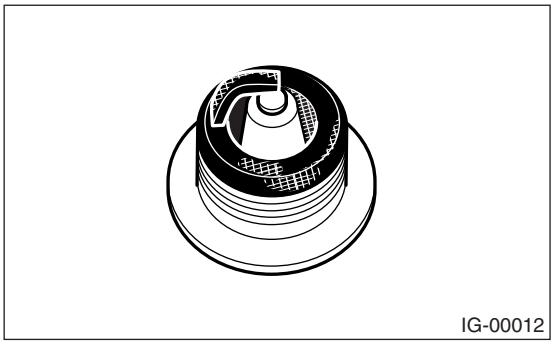


(A) Spark plug gap
(B) Carbon accumulation or wear
(C) Cracks
(D) Damage
(E) Damaged gasket

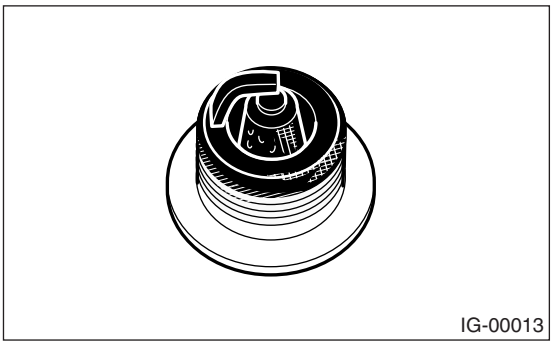
1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



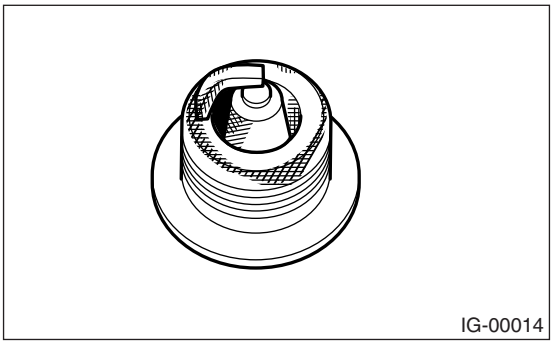
2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.



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.


IG-00013

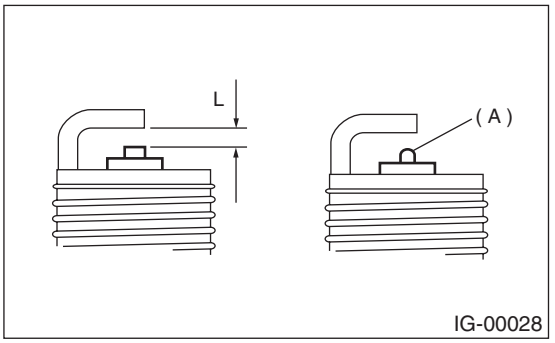
4) Overheating:
White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.


IG-00014

D: CLEANING
Clean spark plugs in a sand blast type cleaner.
Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain.
If deposits are too stubborn, replace plugs.

E: ADJUSTMENT
Correct it if the spark plug gap is measured with a gap gauge, and it is necessary.

Spark plug gap: L
1.0 — 1.1 mm (0.039 — 0.043 in)



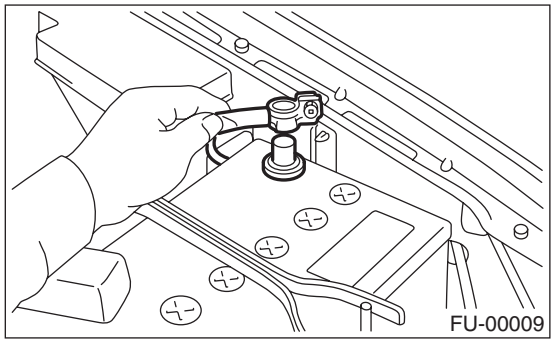
IG-00028

NOTE:
Replace with new spark plug if this area is worn to “ball” (A) shape.

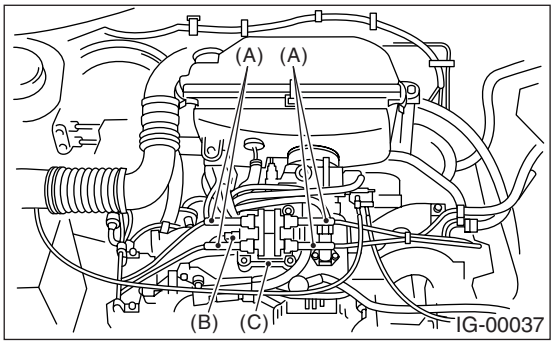
3. Ignition Coil and Ignitor Assembly

A: REMOVAL

1) Disconnect ground cable from battery.

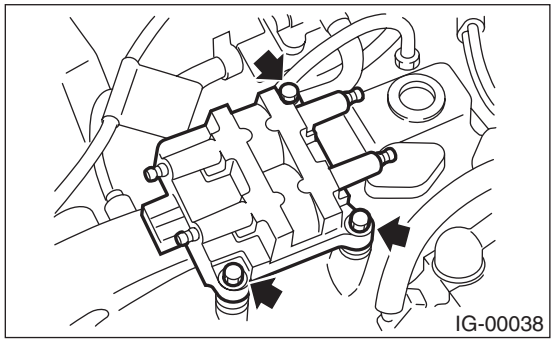


2) Disconnect spark plug cords from ignition coil and ignitor assembly.
3) Disconnect connector from ignition coil and ignitor assembly.



(A) Spark plug cord
(B) Connector
(C) Ignition coil and ignitor ASSY

4) Remove ignition coil and ignitor assembly.

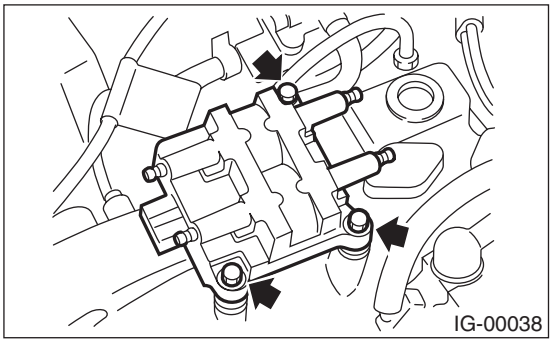


B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
8 N·m (0.8 kgf-m, 5.8 ft-lb)

CAUTION:
Be sure to connect spark plug cords to their proper positions. Failure to do so will damage unit.



C: INSPECTION

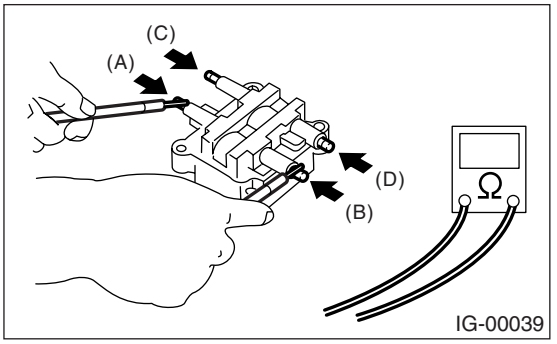
Using tester, inspect the following items, and replace if defective.

- Secondary coil resistance

CAUTION:
• If the resistance is extremely low, there is a short citcuit.
• Ignitor is built-in the coil. Therefore, the resistance of the primary coil cannot be measured.

Specified resistance:

[Secondary side]
Between (A) and (B)
12.8 kΩ±15%
Between (C) and (D)
12.8 kΩ±15%



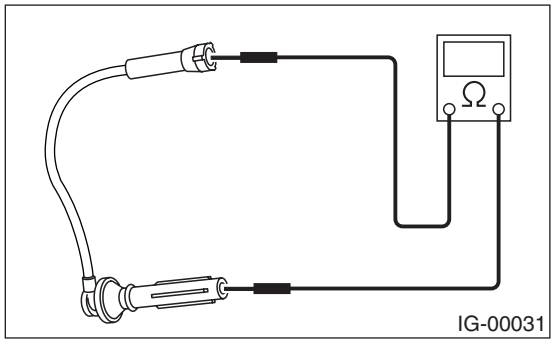
4. Spark Plug Cord

A: INSPECTION

Check for:
1) Damage to cords, deformation, burning or rust formation of terminals
2) Resistance values of cords

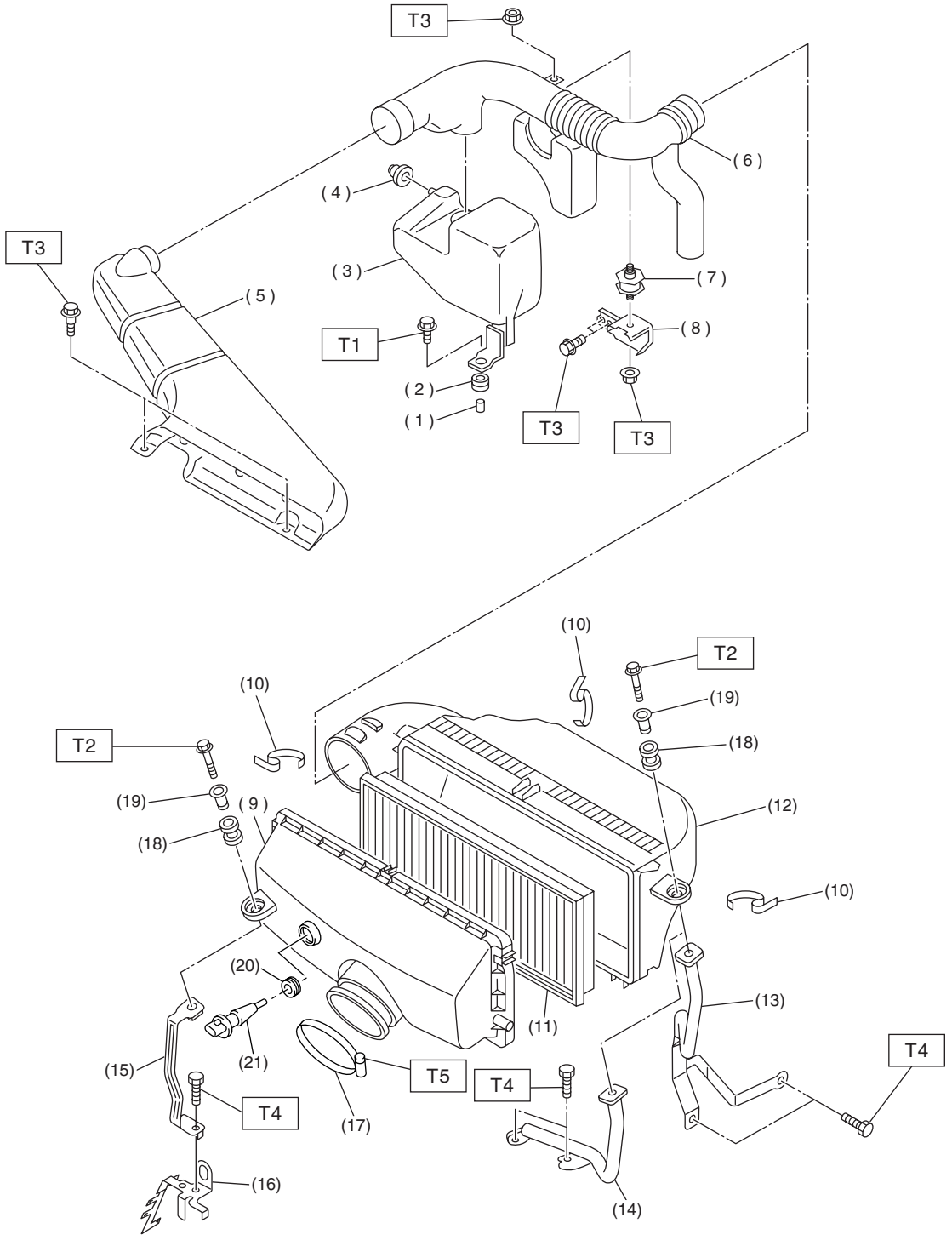
Resistance value:

#1 cord: 5.6 — 10.6 kΩ
#2 cord: 7.3 — 13.7 kΩ
#3 cord: 5.9 — 11.1 kΩ
#4 cord: 7.3 — 13.7 kΩ



1. General Description

A: COMPONENT



IN-02111

(1) Spacer
(2) Bushing
(3) Resonator chamber
(4) Cushion rubber
(5) Air intake duct A
(6) Air intake duct B
(7) Cushion
(8) Bracket
(9) Air cleaner case A
(10) Clip
(11) Air cleaner element
(12) Air cleaner case B
(13) Air cleaner case stay LH (MT vehicles)
(14) Air cleaner case stay LH (AT vehicles)
(15) Air cleaner case stay RH
(16) Engine harness bracket
(17) Clamp
(18) Bushing
(19) Spacer
(20) Grommet
(21) Intake air temperature sensor

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***33 (3.4, 24.6)***
T2:	***6.5 (0.66, 4.8)***
T3:	***7.5 (0.76, 5.5)***
T4:	***16 (1.6, 11.6)***
T5:	***3 (0.3, 2.2)***

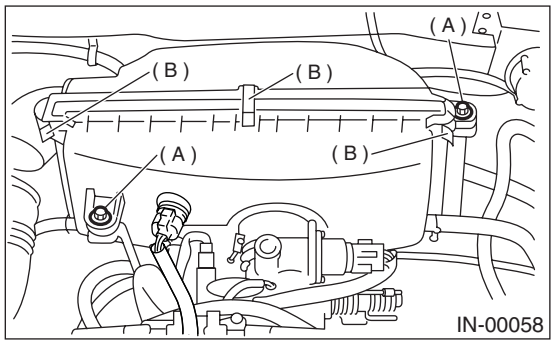
B: CAUTION

- 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 sensor or units, be sure to disconnect ground cable from battery.

2. Air Cleaner

A: REMOVAL

1) Remove bolt (A) which install air cleaner case to stays.
2) Remove the clip (B) above the air cleaner case.



3) Remove air cleaner element.

B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
Fasten with a clip after inserting the lower tab of the case.

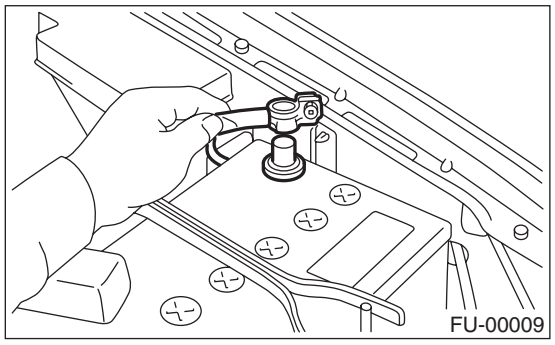
C: INSPECTION

Replace if excessively damaged or dirty.

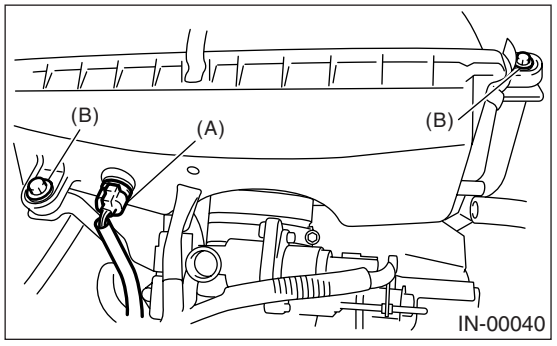
3. Air Cleaner Case

A: REMOVAL

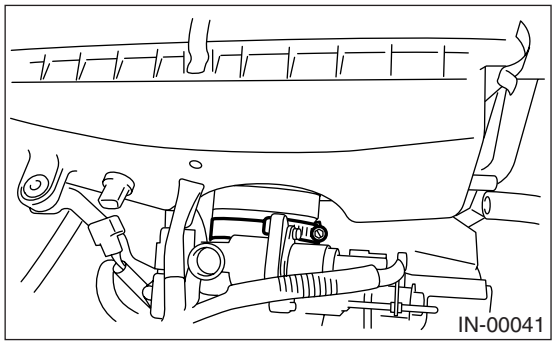
1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) of intake air temperature sensor.
3) Remove the 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.

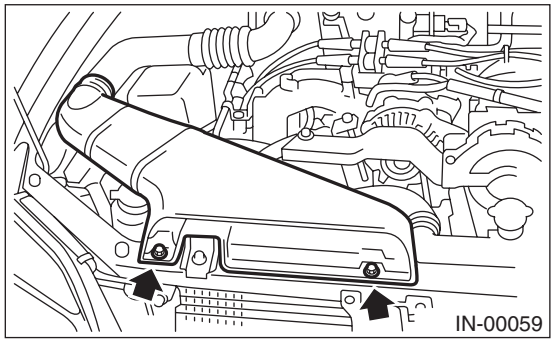
C: INSPECTION

Inspect for cracks and loose connections.

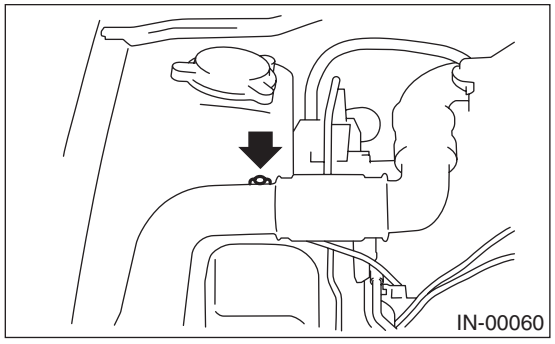
4. Air Intake Duct

A: REMOVAL

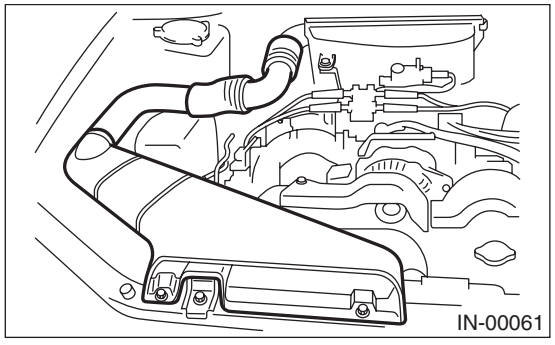
1) Remove bolts which install air intake duct on the front side of body.



2) Remove bolt which installs air intake duct on body.



3) Remove air intake ducts as a unit.



B: INSTALLATION

Install in the reverse order of removal.

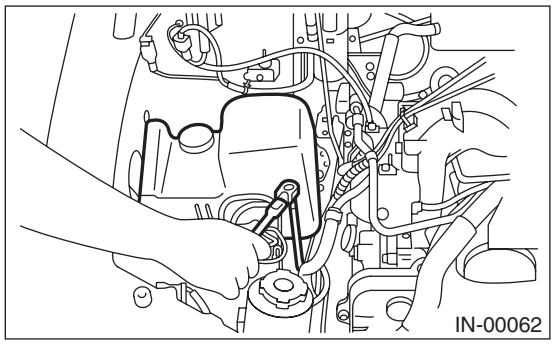
C: INSPECTION

Inspect for cracks and loose connections. Check that no foreign objects are mixed in the air intake duct.

5. Resonator Chamber

A: REMOVAL

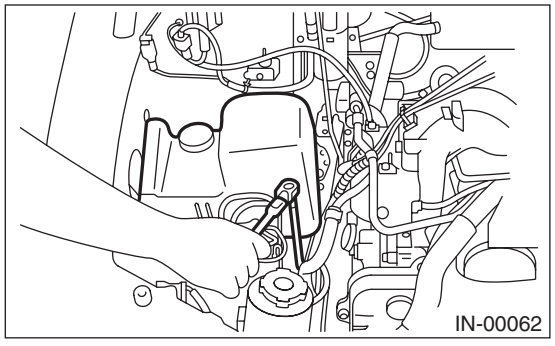
1) Remove air intake duct. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.>
2) Remove resonator chamber.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



C: INSPECTION

Inspect for cracks and loose connections.

1. General Description

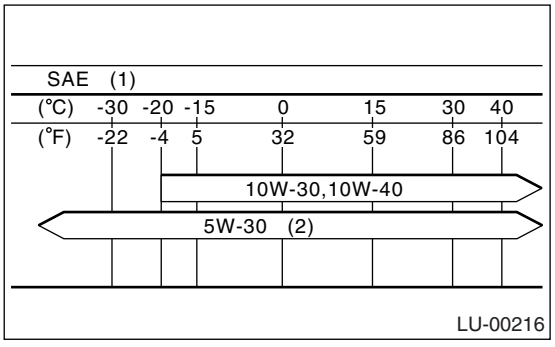
A: SPECIFICATIONS

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth		Inner rotor		9
			Outer rotor		10
	Outer rotor diameter × thickness				78 × 7 mm (3.07 × 0.28 in)
	Tip clearance between inner and outer rotor			STANDARD	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			STANDARD	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			STANDARD	0.10 — 0.175 mm (0.0039 — 0.0069 in)
				LIMIT	0.20 mm (0.0079 in)
	Capacity at 80°C (176°F)	600 rpm	- Discharge pressure		98 kPa (1.0 kg/cm^2, 14 psi)
			- Discharge quantity		3.2 ℓ (3.4 US qt, 2.8 Imp qt)/min.
		5,000 rpm	- Discharge pressure		294 kPa (3.0 kg/cm^2, 43 psi)
			- Discharge quantity		32.6 ℓ (34.5 US qt, 28.7 Imp qt)/min.
	Relief valve operation pressure				490 kPa (5.0 kg/cm^2, 71 psi)
Oil filter	Type				Type of full-flow with 3 papers
	Filtration area				910 cm^2 (141 sq in)
	By-pass valve opening pressure				157 kPa (1.6 kg/cm^2, 23 psi)
	Outer diameter × width				80 × 75 mm (3.15 × 2.95 in)
	Installation screw type				M 20 × 1.5
Oil pressure switch	Type				Type of contact point in oil
	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 (when replacing oil)					Approx. 4.0 ℓ (4.2 US qt, 3.5 Imp qt)

Recommended oil:

API classification SL with the words "Energy Conserving" (if the oil with SL grade cannot be obtained, it is okay to use SJ grade oil).

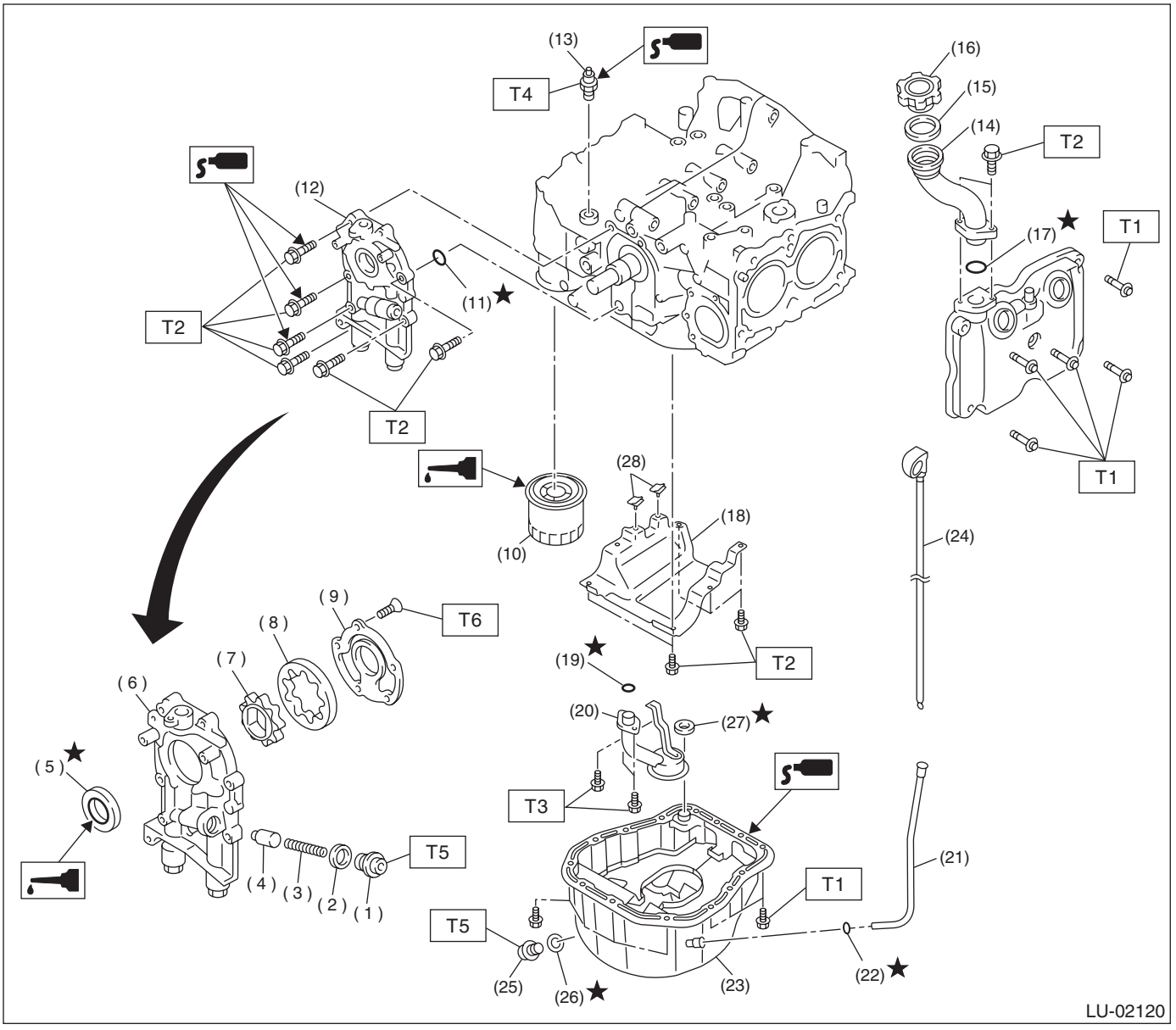
ILSAC GF-3 or the equivalent which is indicated on the container with the new API certification mark (Star burst mark).



(1) SAE Viscosity No. and Applicable Temperature
(2) PREFERRED

NOTE:
If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: ILSAC classification: GF-3 or API classification: SL
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

B: COMPONENT



(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) O-ring
(12) Oil pump ASSY
(13) Oil pressure switch
(14) Oil filler duct
(15) O-ring
(16) Oil filler cap
(17) O-ring
(18) Baffle plate
(19) O-ring
(20) Oil strainer
(21) Oil level gauge guide
(22) O-ring
(23) Oil pan
(24) Oil level gauge
(25) Drain plug
(26) Metal gasket
(27) Gasket
(28) Seal

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: 44 (4.5, 33)
T6: 5.4 (0.55, 4.0)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove 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 ground cable from battery.

D: PREPARATION TOOL

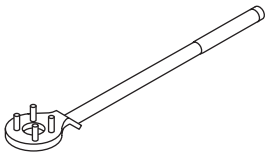
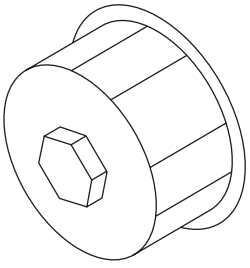
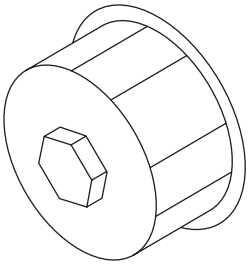
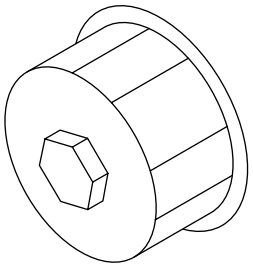
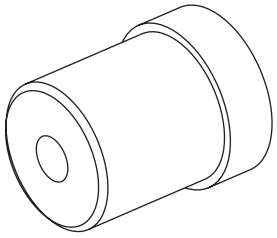
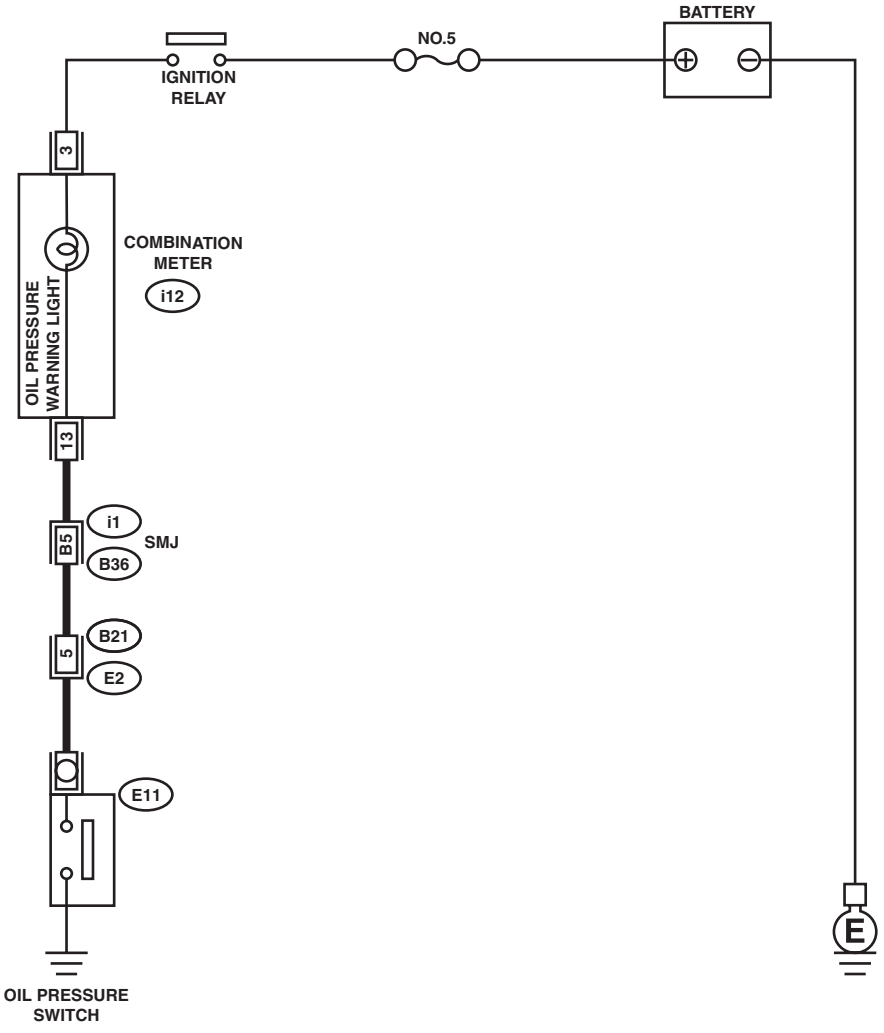
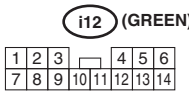
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST-498547000	498547000 [Outer diameter 80 mm (3.15 in) for oil filter]	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST18332AA000	18332AA000 [Outer diameter 68 mm (2.68 in) for oil filter]	OIL FILTER WRENCH	Used for removing and installing oil filter.

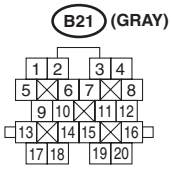
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA010	18332AA010 [Outer diameter 65 mm (2.56 in) for oil filter]	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

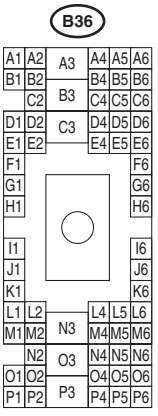
2. Oil Pressure System

A: SCHEMATIC









LU-00093

B: INSPECTION

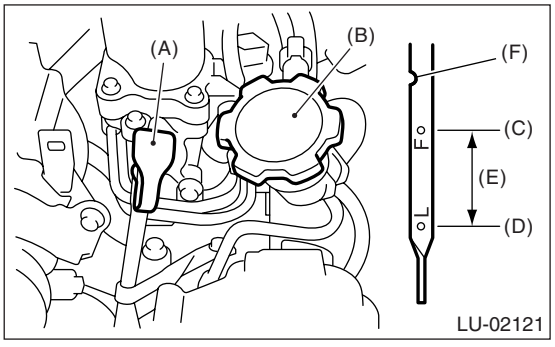
	Step	Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn ignition switch to ON. (engine OFF) 2) Check other warning lights.	Does the warning lights go on?	Go to step **2.**	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
2	**CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.** 1) Turn ignition switch to OFF. 2) Disconnect connector from the oil pressure switch. 3) Turn ignition switch 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 10 V?	Replace 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 the combination meter. ***Terminal*** ***No. 13 — No. 3:***	Is the measured value less than 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 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 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 engine oil.

NOTE:
To prevent overfilling the engine oil, do not add oil above “F” line when the engine is cold.

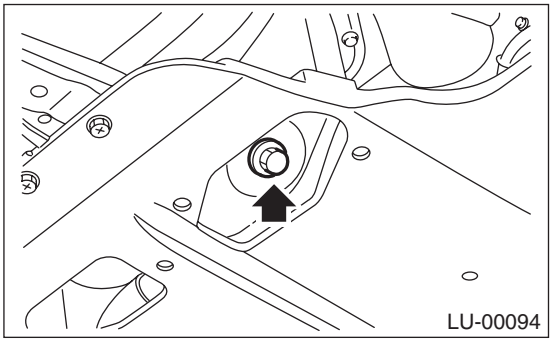


(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

B: REPLACEMENT

1) Open engine oil filler cap for quick draining of the engine oil.
2) Drain engine oil by loosening engine oil drain plug.

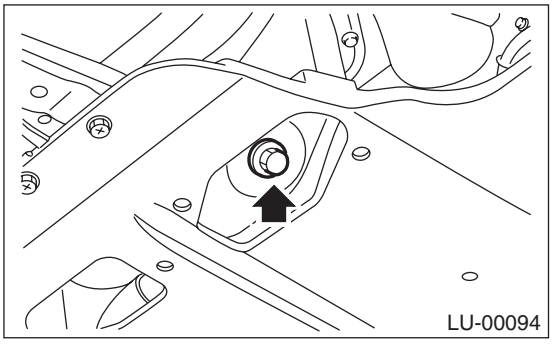
NOTE:
Use a tray to collect oil.



3) Replace drain plug gasket.
4) Tighten engine oil drain plug after draining engine oil.

NOTE:
Use new drain plug gasket.

Tightening torque:
44 N·m (4.5 kgf-m, 33 ft-lb)



5) Using engine oil of proper quality and viscosity, fill it through the oil filler duct up to upper level on level gauge. Make sure that vehicle is placed level when checking oil level. Use engine oil of proper quality and viscosity, selected in accordance with the table in figure.

Recommended oil:
<Ref. to LU(H4SO)-2, SPECIFICATIONS, General Description.>

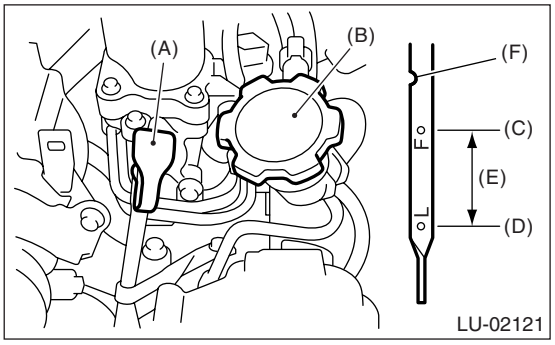
Oil amount for preparation (when replacing engine oil):
Approx. 4.0 ℓ (4.2 US qt, 3.5 Imp qt)

The proper viscosity helps vehicle get 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 ILSAC or API classification and SAE viscosity No. designated by SUBARU.

NOTE:
If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: ILSAC classification: GF-3 or API classification: SL
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

6) Close engine oil filler cap.
7) Start engine and warm it up for a time.
8) After engine stops, recheck the oil level. If necessary, add engine oil up to upper level on level gauge.

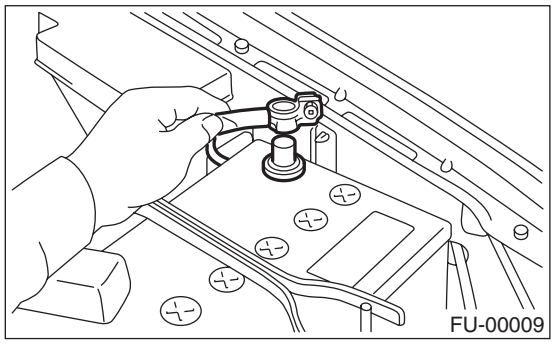


(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

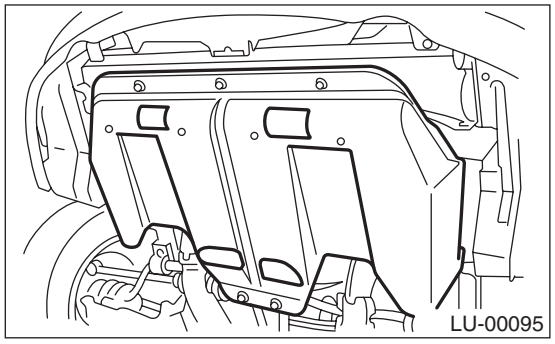
4. Oil Pump

A: REMOVAL

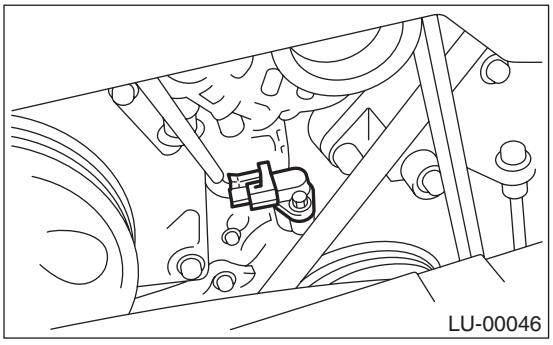
1) Disconnect ground cable from battery.



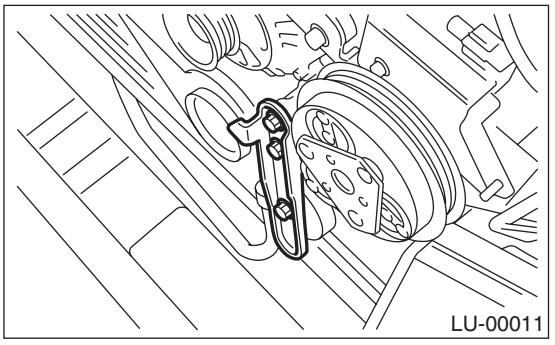
2) Lift-up the vehicle.
3) Remove undercover.



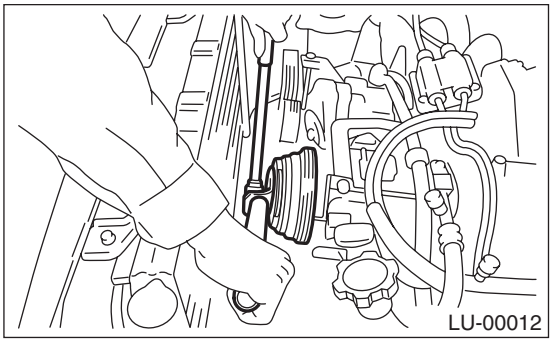
4) Lower the vehicle.
5) Remove radiator. <Ref. to CO(H4SO)-20, REMOVAL, Radiator.>
6) Remove crankshaft position sensor.



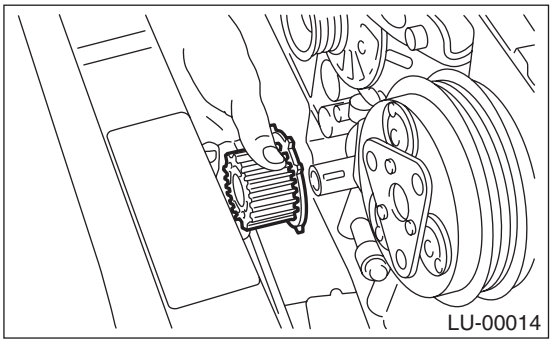
7) Remove V-belts. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
8) Remove rear side V-belt tensioner.



9) Remove crankshaft pulley by using ST.
ST 499977100 CRANKSHAFT PULLEY WRENCH

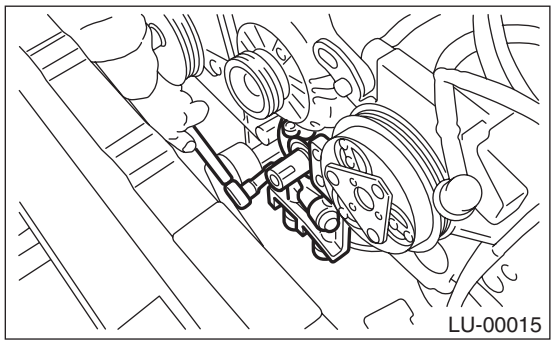


10) Remove water pump. <Ref. to CO(H4SO)-14, REMOVAL, Water Pump.>
11) Remove timing belt guide. (MT vehicle)
12) Remove crankshaft sprocket.



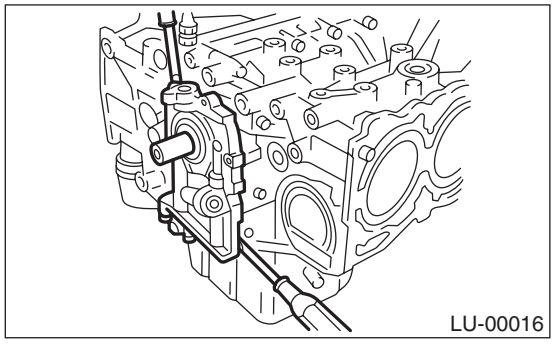
13) Remove bolts which install oil pump onto cylinder block.

NOTE:
To disassemble and check oil pump, loosen relief valve plug before removing the pump.



14) Remove oil pump by using flat-bladed screwdriver.

CAUTION:
Be careful not to scratch mating surfaces of cylinder block and oil pump.

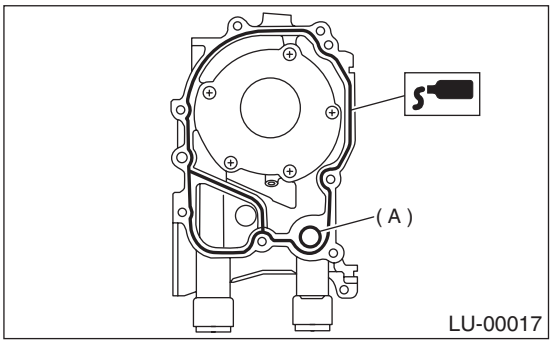


B: INSTALLATION

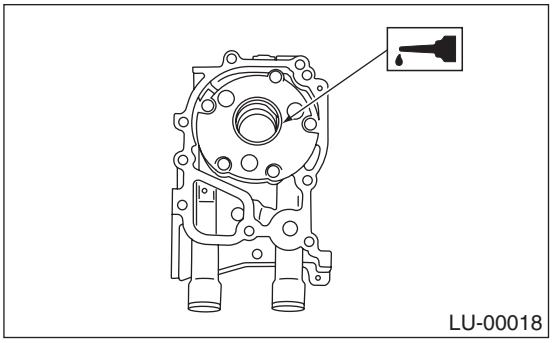
Install in the reverse order of removal.
Do the following:
1) Apply fluid gasket to matching surfaces of oil pump.

Fluid gasket:
Part No. 004403007
THREE BOND 1215 or equivalent

2) Replace O-ring (A) with a new one.



3) Apply engine oil to the inside of the oil seal.

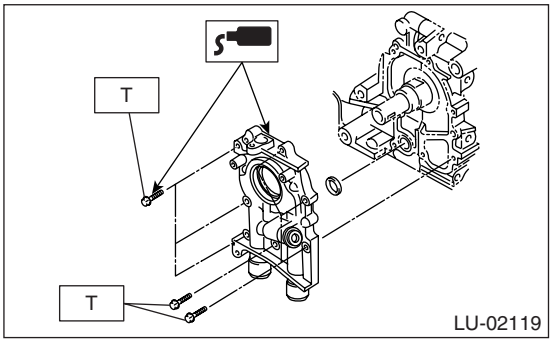


4) Position the oil pump, aligning the notched area with the crankshaft, and push the oil pump straight.

CAUTION:
- **Make sure the oil seal lip is not folded.**
- **When installing oil pump to cylinder block, do not damage oil seal.**

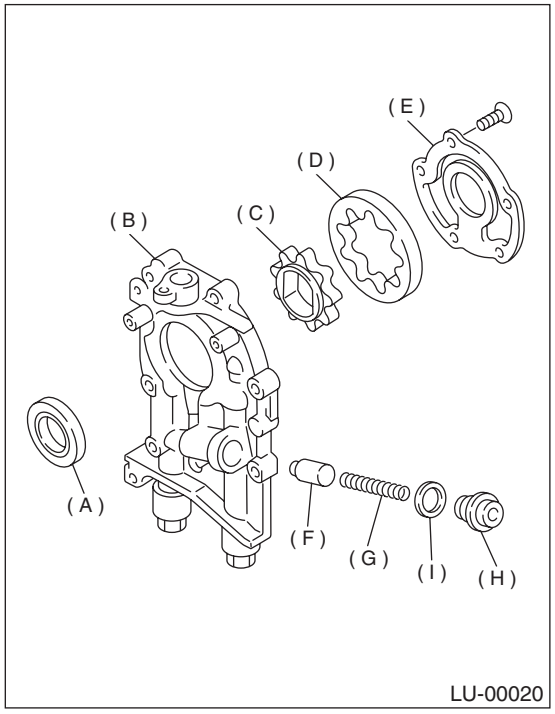
5) Install oil pump.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



C: DISASSEMBLY

Remove screws which secure oil pump cover and disassemble oil pump. Inscribe alignment marks on inner and outer rotors so that they can be replaced in their original positions during reassembly.

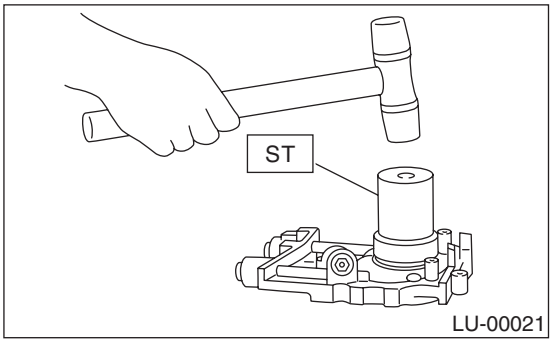


(A) Oil seal
(B) Pump case
(C) Inner rotor
(D) Outer rotor
(E) Pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

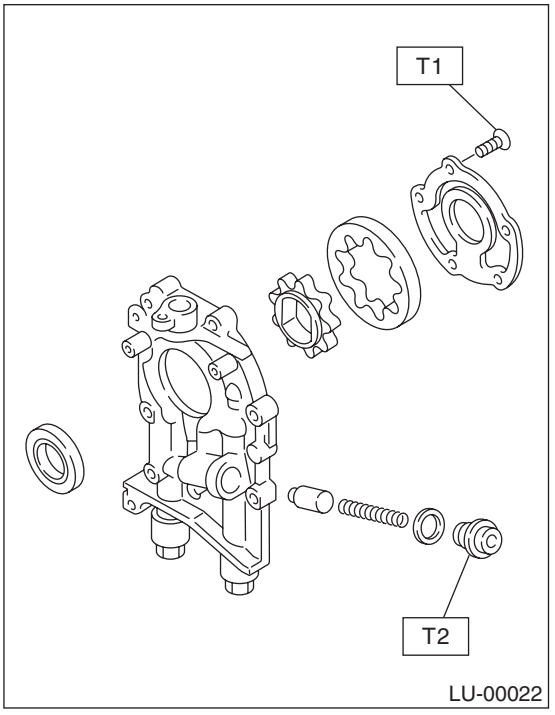
1) Install front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

NOTE:
Use a new oil seal.



2) Apply engine oil to inner and outer rotors.
3) Install inner and outer rotors in their original positions.
4) Install oil relief valve and relief valve spring.
5) Install oil pump cover.

Tightening torque:
T1: 5.4 N·m (0.55 kgf-m, 4.0 ft-lb)
T2: 44 N·m (4.5 kgf-m, 33 ft-lb)

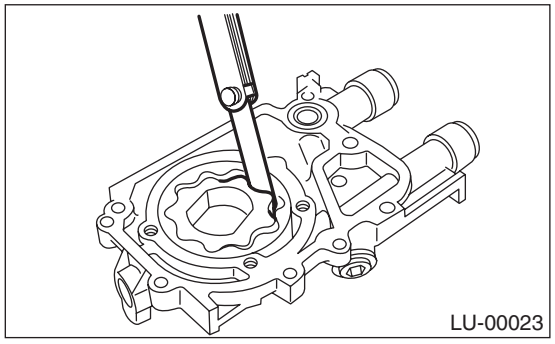


E: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a set.

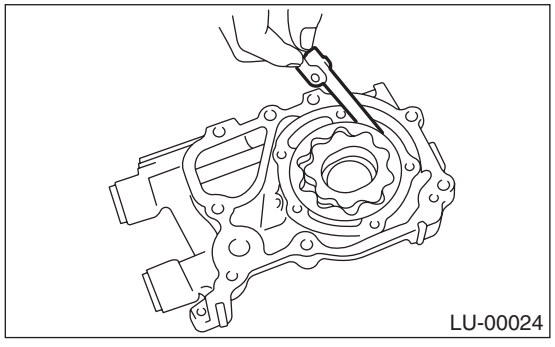
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.18 mm (0.0071 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and the cylinder block rotor housing. If the clearance exceeds the limit, replace the oil pump case.

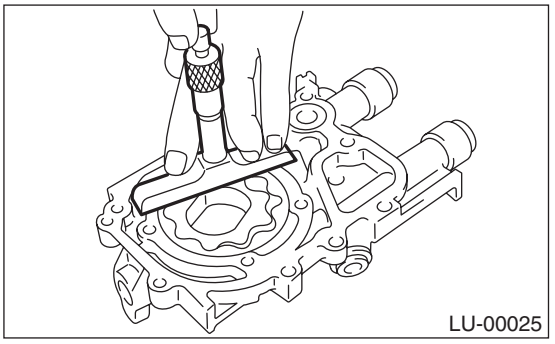
Case clearance:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)
Limit
0.20 mm (0.0079 in)



3. SIDE CLEARANCE

Measure clearance between oil pump inner rotor and pump cover. If the clearance exceeds the limit, replace rotor or oil pump case.

Side clearance:
Standard
0.02 — 0.07 mm (0.0008 — 0.0028 in)
Limit
0.12 mm (0.0047 in)



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:
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, 18.28 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

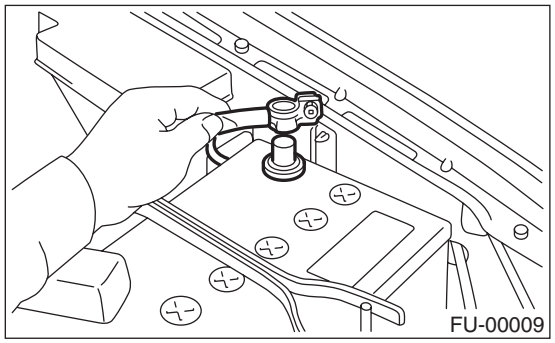
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

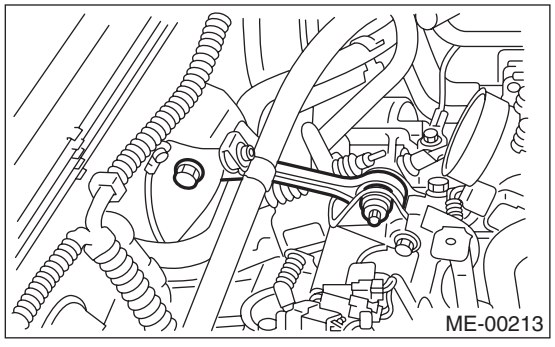
5. Oil Pan and Strainer

A: REMOVAL

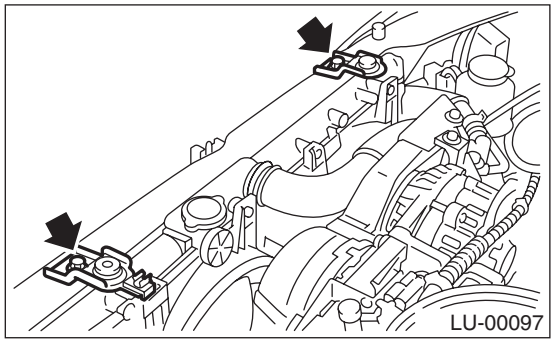
1) Set the vehicle on lift arms.
2) Remove front wheels.
3) Disconnect ground cable from battery.



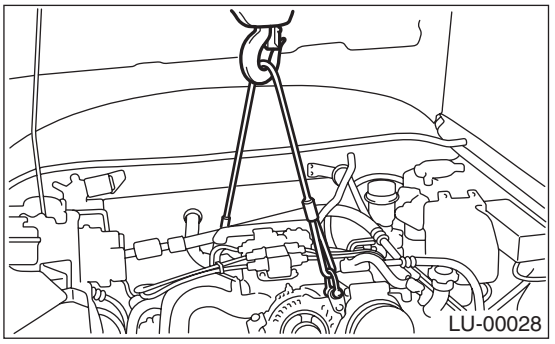
4) Remove air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
5) Remove pitching stopper.



6) Remove radiator upper brackets.



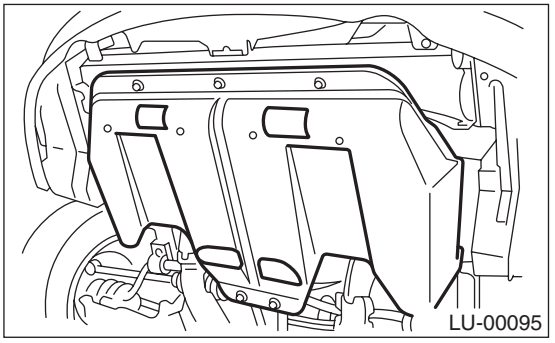
7) Support engine with a lifting device and wire ropes.



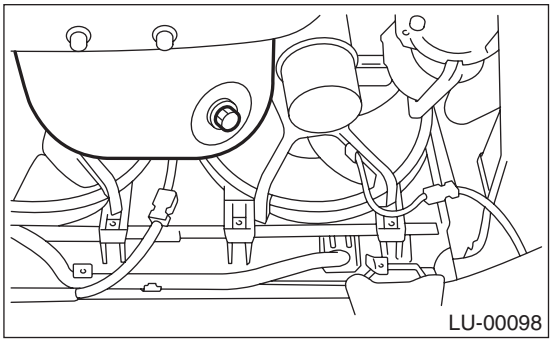
8) Lift-up the vehicle.

CAUTION:
When lifting up the vehicle, wire rope must be raised at the same time.

9) Remove under cover.

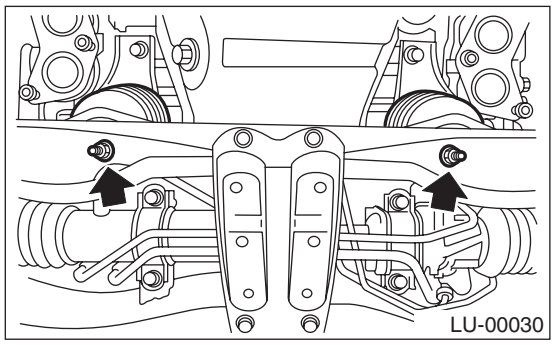


10) Drain engine oil.
Set container under the vehicle, and remove drain plug from oil pan.



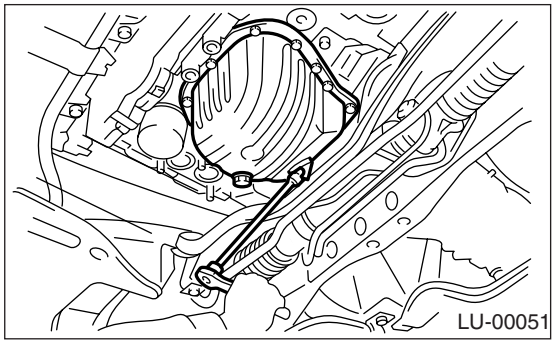
11) Remove front and center exhaust pipes. <Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.>

12) Remove nuts which secure front cushion rubber onto front crossmember.

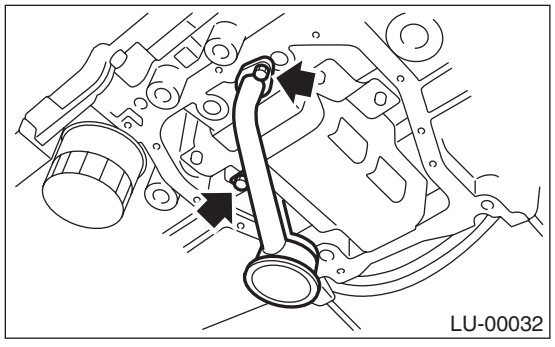


13) Remove bolts which secure oil pan on cylinder block while raising up engine.
14) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

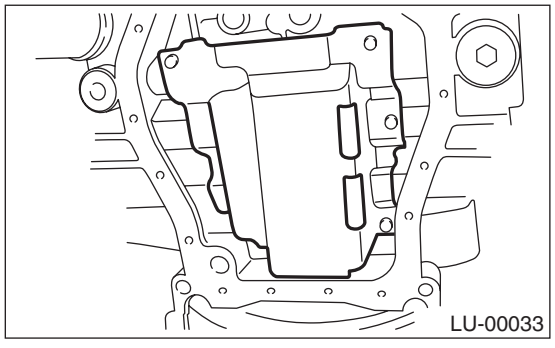
CAUTION:
Do not use a flat-bladed screwdriver or similar tool in place of oil pan cutter.



15) Remove oil strainer.



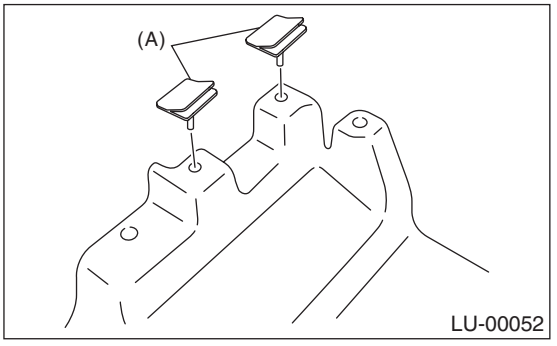
16) Remove baffle plate.



B: INSTALLATION

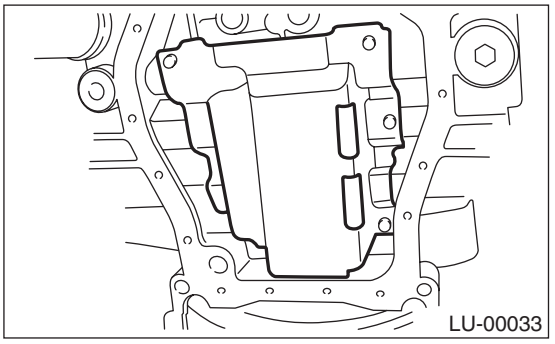
CAUTION:
Before installing oil pan, clean sealant from oil pan and engine block.

1) Make sure seal (A) is facing to the direction shown in the figure below and installed on baffle plate securely.



2) Install baffle plate.

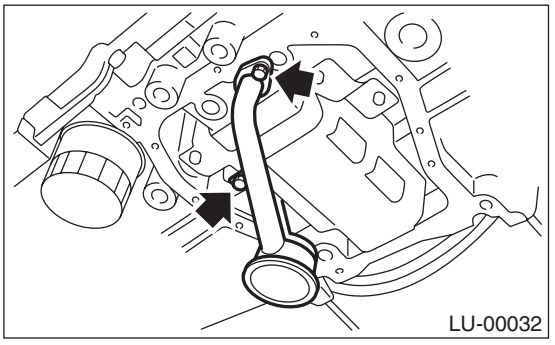
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



3) Install oil strainer onto baffle plate.

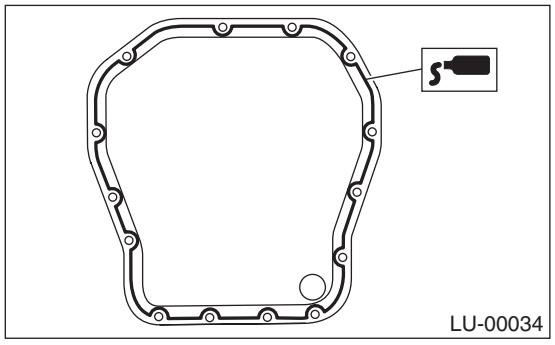
CAUTION:
Replace O-ring with a new one.

Tightening torque:
10 N·m (1.0 kgf-m, 7 ft-lb)



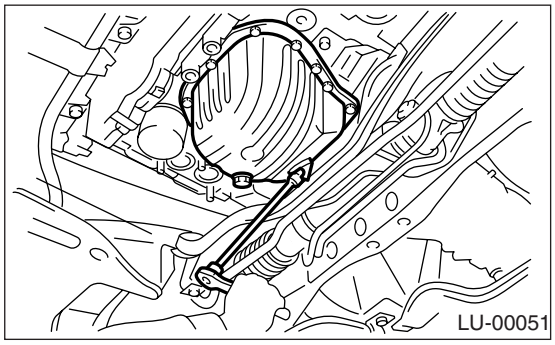
4) Apply fluid gasket to mating surfaces and install oil pan.

Fluid gasket:
Part No. 004403012
THREE BOND 1207C or equivalent



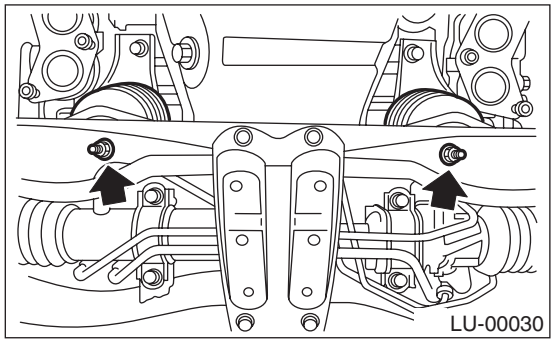
5) Install oil pan to cylinder block and tighten bolts.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



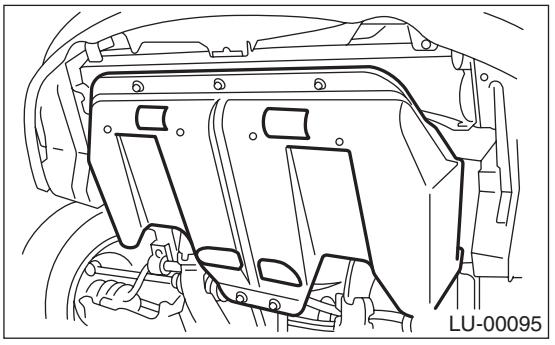
6) Lower engine onto front crossmember.
7) Tighten nuts which secure front cushion rubber onto front crossmember.

Tightening torque:
69 N·m (7.0 kgf-m, 51 ft-lb)



8) Install front and center exhaust pipes.
<Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.>

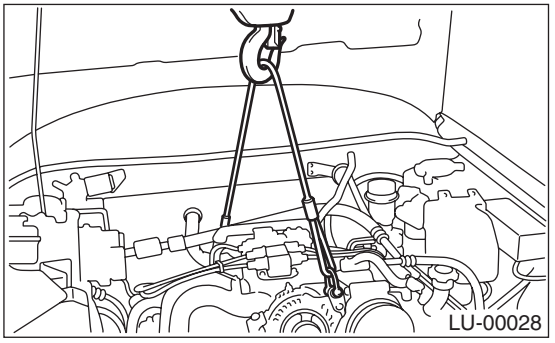
9) Install under cover.



10) Lower the vehicle.

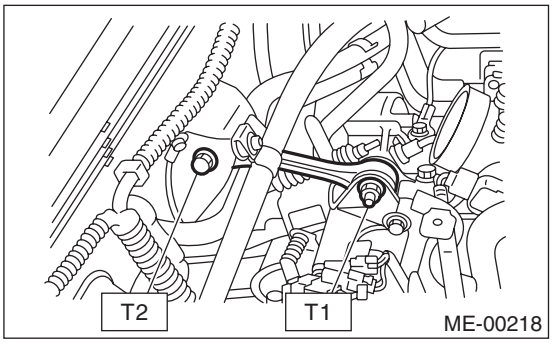
CAUTION:
When lowering vehicle, wire rope must be released at the same time.

11) Remove lifting device and wire rope.

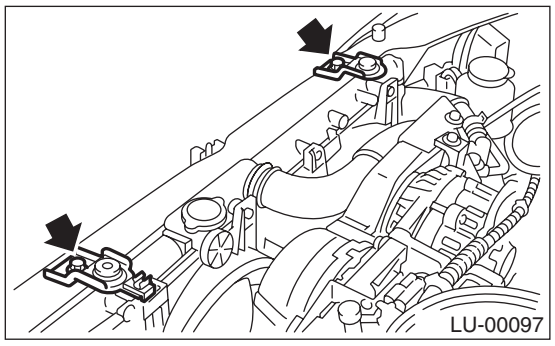


12) Install pitching stopper.

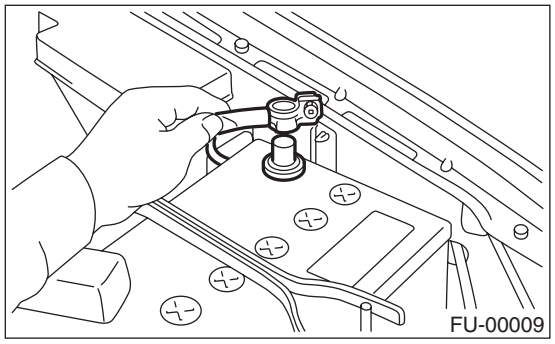
Tightening torque:
T1: 50 N·m (5.1 kgf-m, 37 ft-lb)
T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



13) Install radiator upper brackets.



14) Install air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>
15) Install front wheels.
16) Connect battery ground cable.



17) Fill engine oil. <Ref. to LU(H4SO)-8, INSPECTION, Engine Oil.>

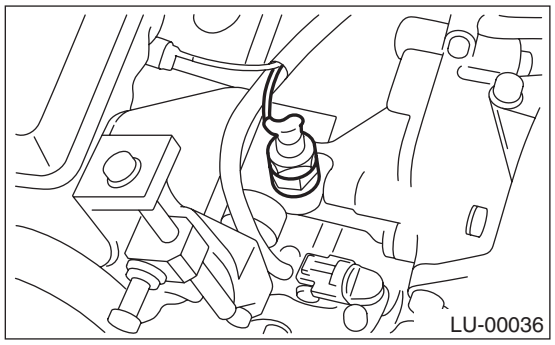
C: INSPECTION

By visual check make sure oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

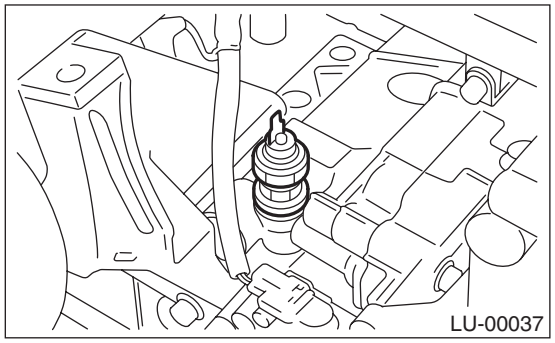
6. Oil Pressure Switch

A: REMOVAL

1) Remove generator from bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
2) Disconnect terminal from oil pressure switch.



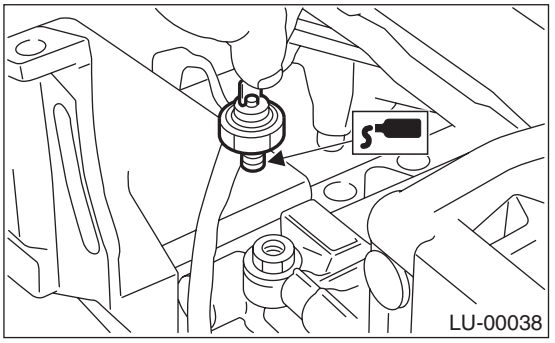
3) Remove oil pressure switch.



B: INSTALLATION

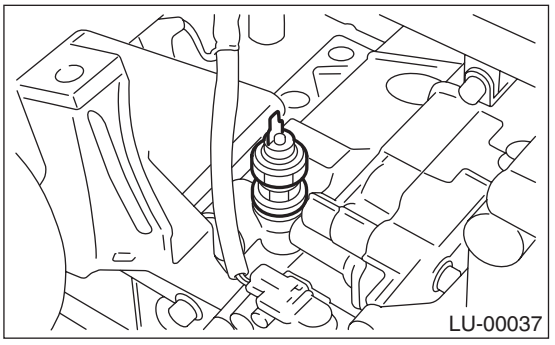
1) Apply fluid gasket to oil pressure switch threads.

Fluid gasket:
Part No. 004403042
THREE BOND 1324 or equivalent

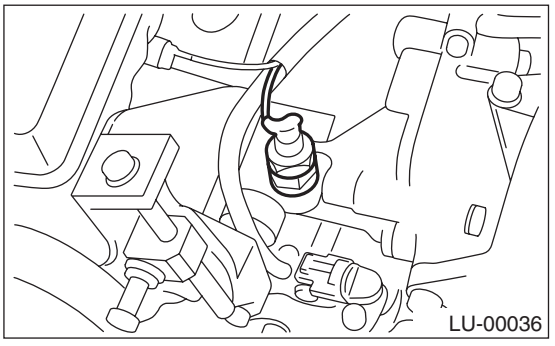


2) Install oil pressure switch onto engine block.

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



3) Connect terminal of oil pressure switch.



4) Install generator on bracket. <Ref. to SC(H4SO)-15, INSTALLATION, Generator.>

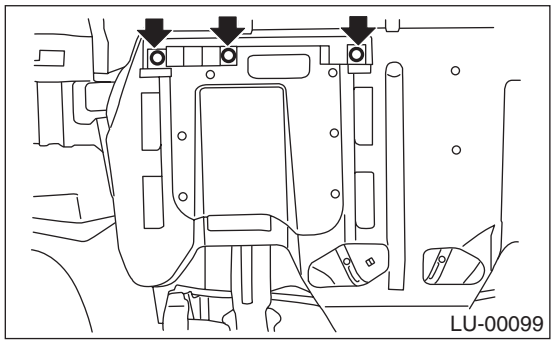
C: INSPECTION

Make sure oil does not leak or seep from where the oil pressure switch is installed.

7. Engine Oil Filter

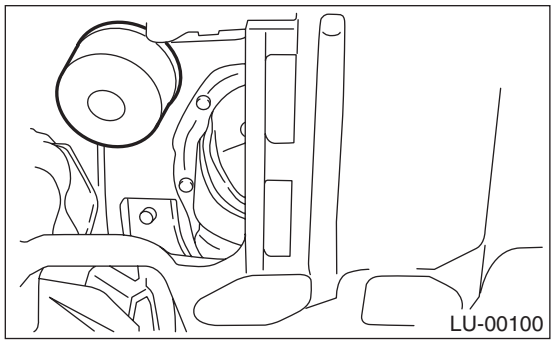
A: REMOVAL

1) Remove access lid.



2) Remove oil filter with ST.

ST	498547000	OIL FILTER WRENCH [Outer diameter 80 mm (3.15 in) for oil filter]
ST	18332AA000	OIL FILTER WRENCH [Outer diameter 68 mm (2.68 in) for oil filter]
ST	18332AA010	OIL FILTER WRENCH [Outer diameter 65 mm (2.56 in) for oil filter]



B: INSTALLATION

1) Clean oil filter mounting surface of cylinder block.

2) Get a new oil filter and thinly apply engine oil to the seal rubber.

3) Be careful not to damage seal rubber when oil filter is turned by hand and installed.

- Oil filters with 80 mm (3.15 in) and 65 mm (2.56 in) outer diameter are further tightened (about 2/3 to 3/4 rotation) with ST after seal rubber contacts a cylinder block.
- Oil filter with 68 mm (2.68 in) outer diameter is further tightened (about 1 rotation) with ST after seal rubber contacts a cylinder block or an oil cooler.

CAUTION:
Do not tighten excessively, or oil may leak.

C: INSPECTION

1) After installing oil filter, run engine and make sure that no oil is leaking around seal rubber.

NOTE:
The filter element and filter case are assembled as a set, therefore, cleaning is unnecessary.

2) Check the engine oil level. <Ref. to LU(H4SO)-8, INSPECTION, Engine Oil.>

8. Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
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 by-pass 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 of 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) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of 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).

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 x Stroke		mm (in)	99.5 x 79.0 (3.917 x 3.110)
	Displacement		cm^3 (cu in)	2,457 (150)
	Compression ratio			10.0
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm^2, psi)	1,079 — 1,275 (11.0 — 13.0, 156 — 185)
	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±0.04 (0.0079±0.0016)
		Exhaust	mm (in)	0.25±0.04 (0.0098±0.0016)
	Idling speed [At neutral position on MT, or “P” or “N” position on AT]		rpm	MT: 650±100 (No load) AT: 700±100 (No load) 850±100 (A/C switch ON)
	Firing order			1 → 3 → 2 → 4
	Ignition timing		BTDC/rpm	MT: 10°±8°/650 AT: 15°±8°/700

NOTE:
STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter US: Undersize OS: Oversize

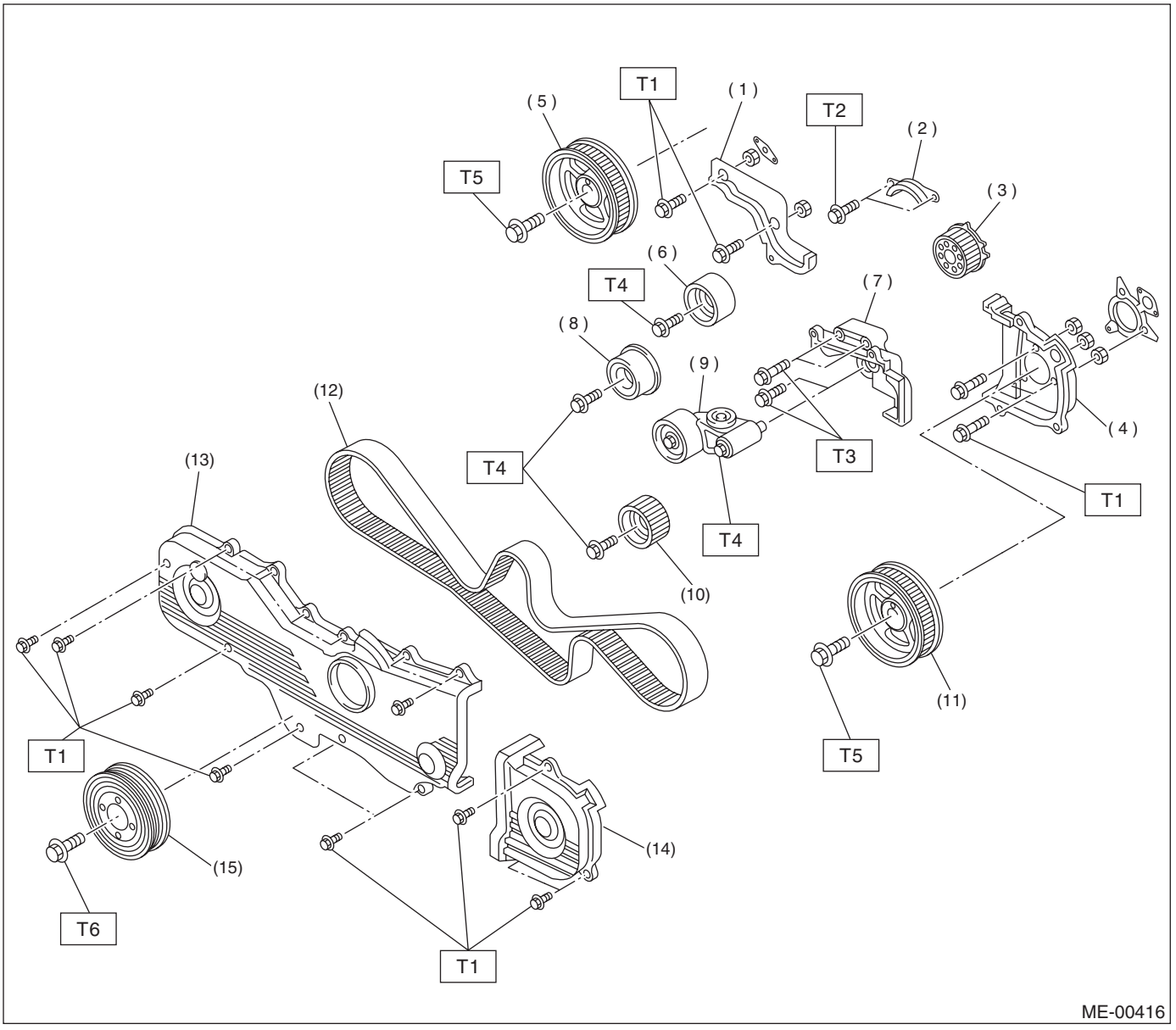
Belt tensioner adjuster	Protrusion of adjuster rod			5.2 — 6.2 mm (0.205 — 0.244 in)
Belt tensioner	Spacer O.D.			17.955 — 17.975 mm (0.7069 — 0.7077 in)
	Tensioner bushing I.D.			18.00 — 18.08 mm (0.7087 — 0.7118 in)
	Clearance between spacer and bushing		STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)
			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 (0.0010 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	39.259 — 39.359 mm (1.5456 — 1.5496 in)
			Limit	39.159 mm (1.5417 in)
	Camshaft journal O.D.			31.928 — 31.945 mm (1.2570 — 1.2577 in)
	Camshaft journal hole I.D.			32.000 — 32.018 mm (1.2598 — 1.2605 in)
	Journal 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 surface with cylinder block)			0.035 mm (0.014 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Standard height			97.5 mm (3.839 in)
Valve set	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 — 21.0 mm (0.787 — 0.827 in)
			Exhaust	16.5 — 17.5 mm (0.650 — 0.689 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) or less
	Tension/spring height		Set	214 — 246 N (22 — 25 kgf, 48 — 55 lb)/ 45.0 mm (1.772 in)
			Lift	526 — 582 N (54 — 59 kgf, 119 — 130 lb)/ 34.7 mm (1.366 in)
Cylinder block	Surface warpage limit (mating surface with cylinder head)			0.025 mm (0.0010 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Cylinder bore	STD	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			0.010 — 0.030 mm (0.0004 — 0.0012 in)*1 −0.010 — 0.010 (−0.0004 — 0.0004)*2
	Enlarging (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 — 99.745 mm (3.9262 — 3.9270 in)
		0.50 mm (0.0197 in) OS		99.975 — 99.995 mm (3.9360 — 3.9368 in)
	Standard inner diameter of piston pin hole			23.000 — 23.006 mm (0.9055 — 0.9057 in)
Piston pin	Outer diameter			22.994 — 23.000 mm (0.9053 — 0.9055 in)
	Standard clearance between piston pin and hole in 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).

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 twist per 100 mm (3.94 in) in length		Limit	0.10 mm (0.0039 in)
	Side clearance		STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)
			Limit	0.4 mm (0.016 in)
Connecting rod bearing	Oil clearance		STD	0.016 — 0.044 (0.0006 — 0.0017 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.492 — 1.501 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in) US	1.510 — 1.513 mm (0.0594 — 0.0596 in)
			0.05 mm (0.0020 in) US	1.520 — 1.523 mm (0.0598 — 0.0600 in)
			0.25 mm (0.0098 in) US	1.620 — 1.623 mm (0.0638 — 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)
Crankshaft	Bend limit			0.035 mm (0.0014 in)
	Crank pin	Out of roundness		0.003 mm (0.0001 in)
		Cylindricality		0.004 mm (0.0002 in)
		Grinding limit (Diameter)		51.750 mm (2.0374 in)
	Crank journal	Out of roundness		0.005 mm (0.0002 in)
		Cylindricality		0.006 mm (0.0002 in)
		Grinding limit (Diameter)		59.750 mm (2.3524 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 — #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 — #5	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.040 mm (0.0016 in)
Crankshaft bearing	Crankshaft bearing thickness	#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)

B: COMPONENT

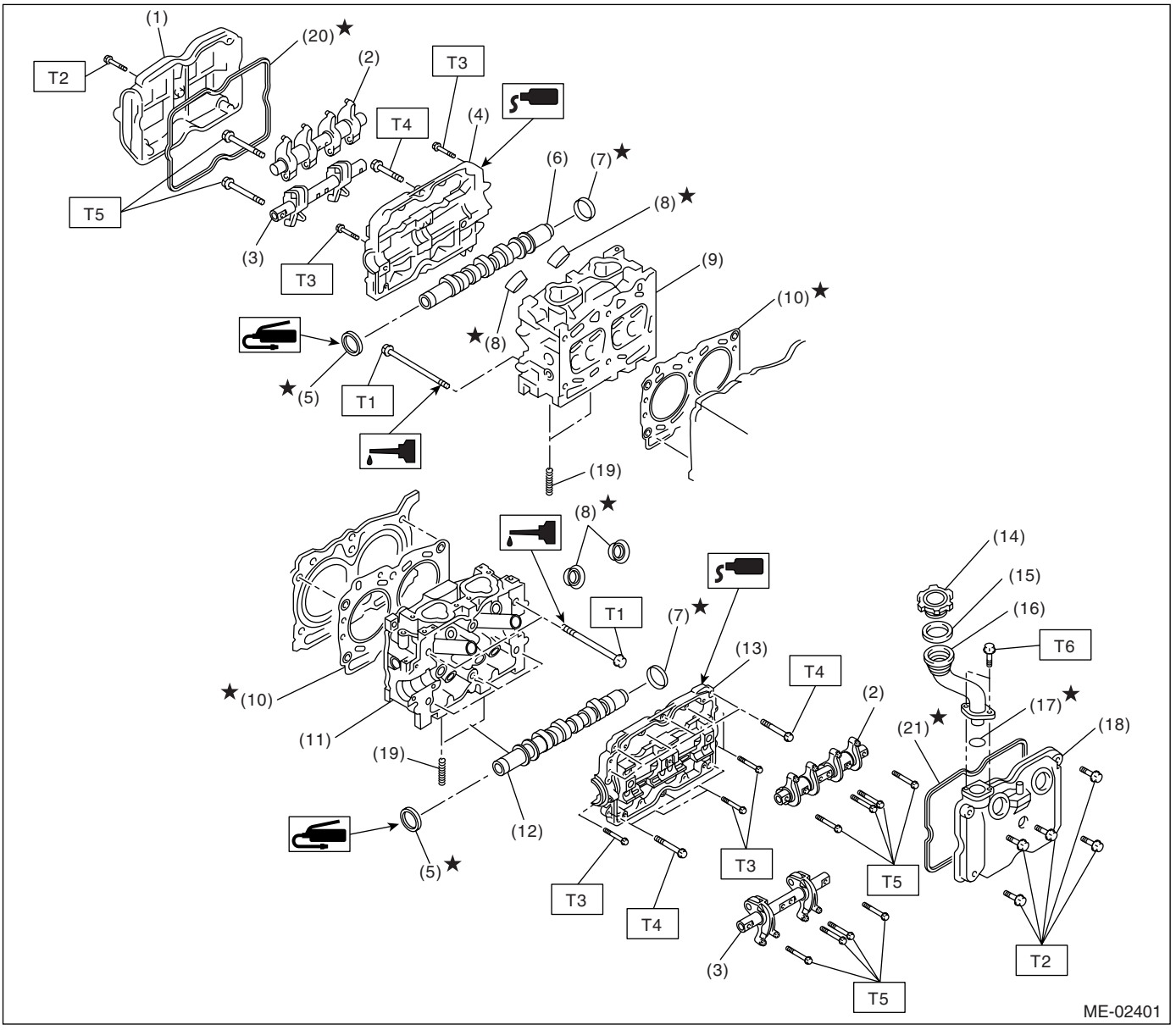
1. TIMING BELT



(1) Belt cover No. 2 (RH)
(2) Timing belt guide (MT vehicles only)
(3) Crankshaft sprocket
(4) Belt cover No. 2 (LH)
(5) Camshaft sprocket No. 1
(6) Belt idler (No. 1)
(7) Tensioner bracket
(8) Belt idler (No. 2)
(9) Automatic belt tension adjuster ASSY
(10) Belt idler No. 2
(11) Camshaft sprocket No. 2
(12) Timing belt
(13) Front belt cover
(14) Belt cover (LH)
(15) Crankshaft pulley

Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 9.75 (1.0, 7.2)
T3: 24.5 (2.5, 18.1)
T4: 39 (4.0, 28.9)
T5: 78 (8.0, 57.9)
T6: <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>

2. CYLINDER HEAD AND CAMSHAFT

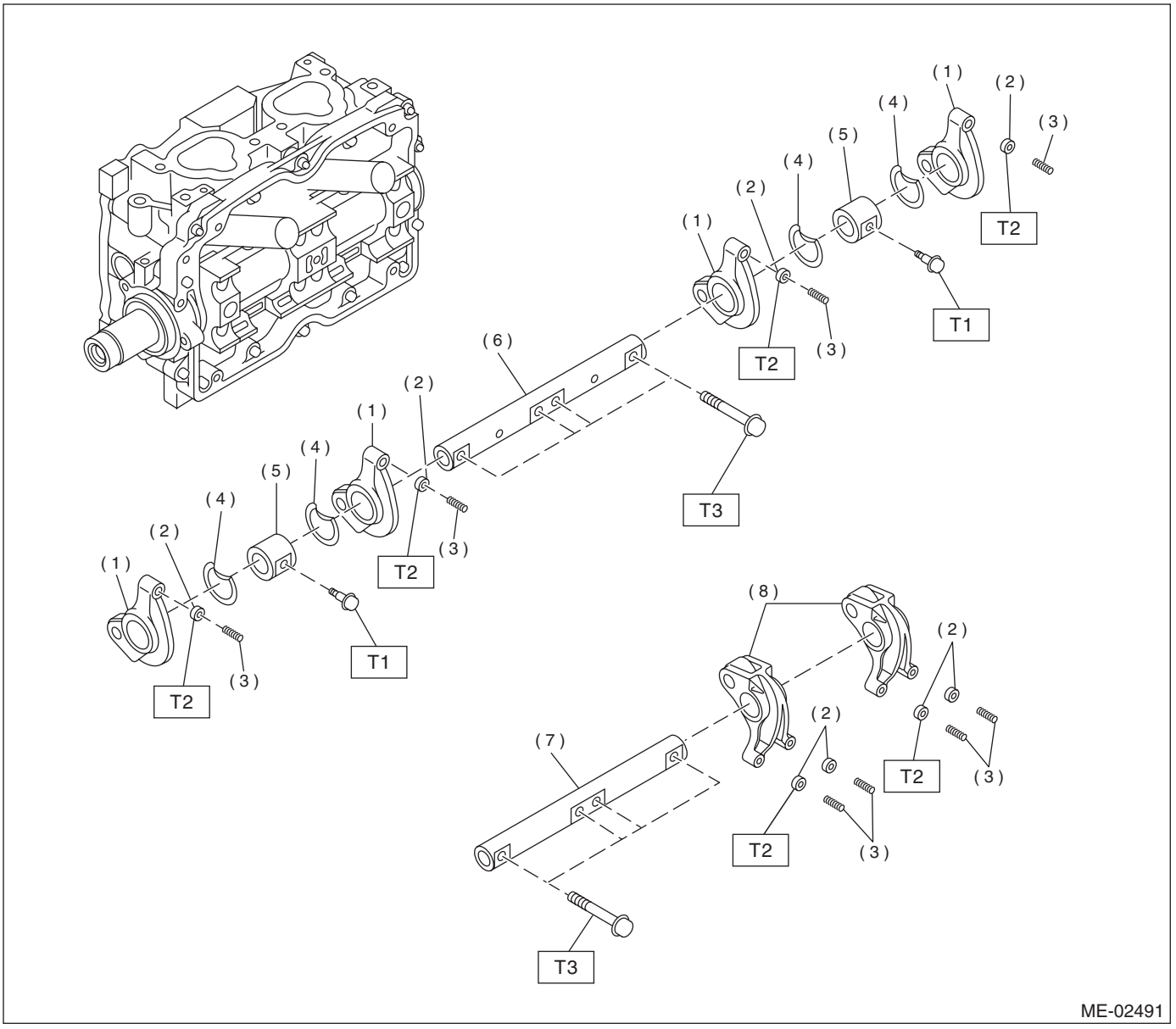


(1) Rocker cover (RH)
(2) Intake valve rocker ASSY
(3) Exhaust valve rocker ASSY
(4) Camshaft cap (RH)
(5) Oil seal
(6) Camshaft (RH)
(7) Plug
(8) Spark plug pipe gasket
(9) Cylinder head (RH)
(10) Cylinder head gasket
(11) Cylinder head (LH)
(12) Camshaft (LH)
(13) Camshaft cap (LH)
(14) Oil filler cap
(15) Gasket
(16) Oil filler duct
(17) O-ring
(18) Rocker cover (LH)
(19) Stud bolt
(20) Rocker cover gasket (RH)
(21) Rocker cover gasket (LH)

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to ME(H4SO)-58, CYLINDER HEAD, INSTALLATION, Cylinder Head Assembly.>
T2: 5 (0.5, 3.6)
T3: 9.75 (1.0, 7.2)
T4: 18 (1.8, 13.0)
T5: 25 (2.5, 18.1)
T6: 6.4 (0.65, 4.7)
T2: 5 (0.5, 3.6)
T3: 10 (1.0, 7.2)

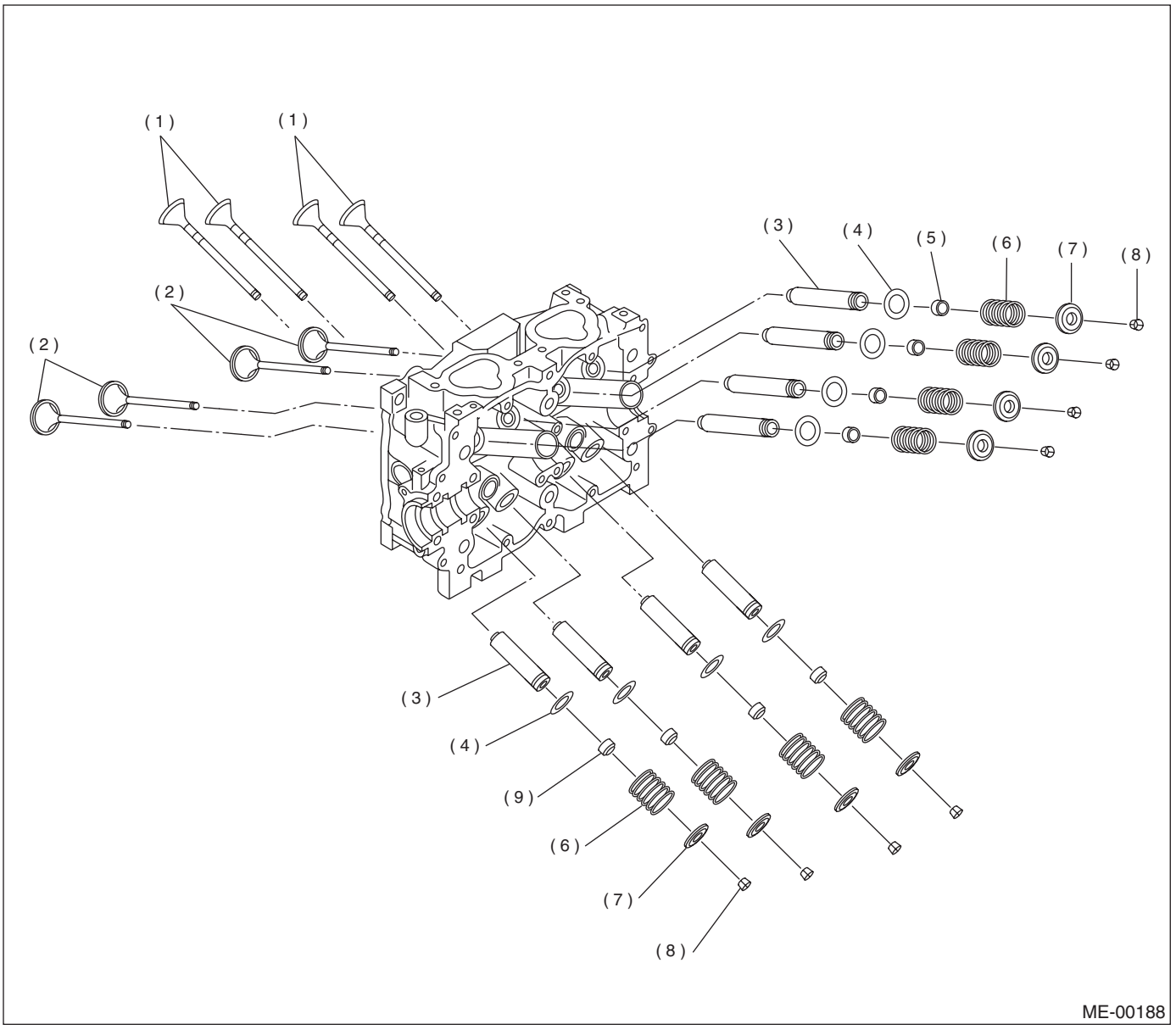
3. VALVE ROCKER ASSEMBLY



(1) Intake valve rocker arm
(2) Valve rocker nut
(3) Valve rocker adjust screw
(4) Spring
(5) Rocker shaft support
(6) Intake rocker shaft
(7) Exhaust rocker shaft
(8) Exhaust valve rocker arm

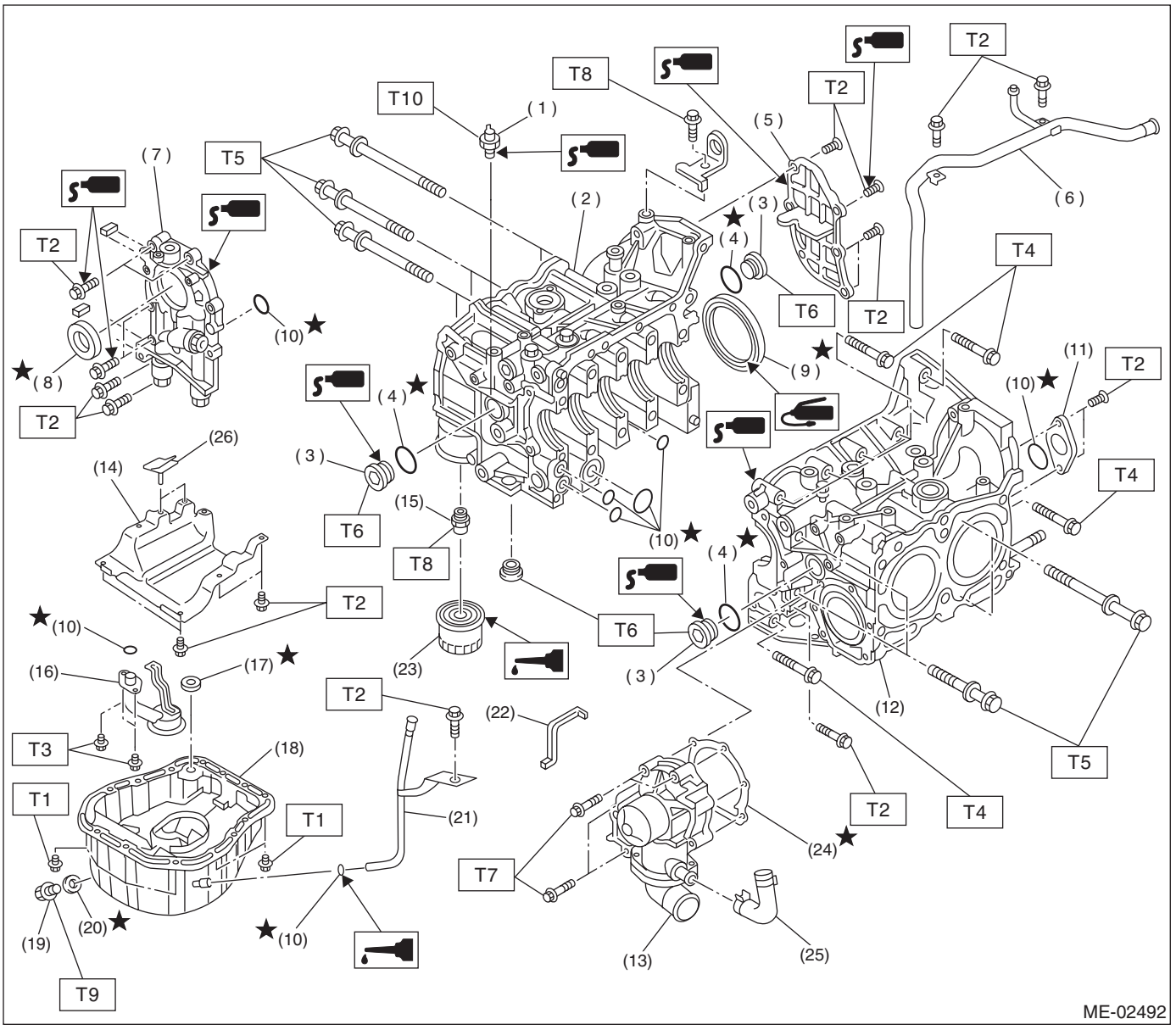
Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 9.75 (1.0, 7.2)
T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Valve guide
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Collet (valve)
(9) Exhaust valve oil seal

5. CYLINDER BLOCK

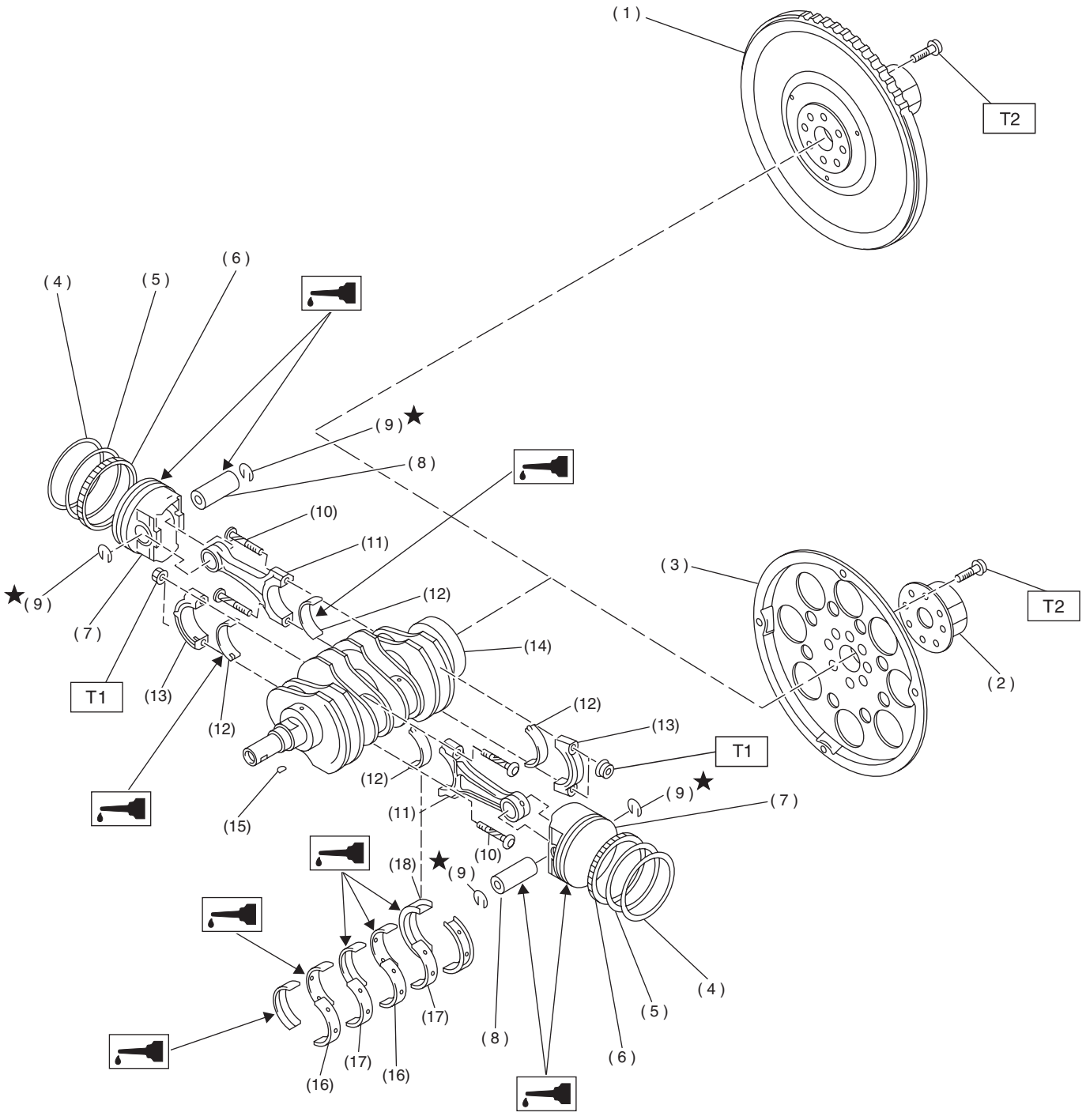


(1) Oil pressure switch
(2) Cylinder block (RH)
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block (LH)
(13) Water pump
(14) Baffle plate
(15) Oil filter connector
(16) Oil strainer
(17) Gasket
(18) Oil pan
(19) Drain plug
(20) Metal gasket
(21) Oil level gauge guide
(22) Water pump sealing
(23) Oil filter
(24) Gasket
(25) Water pump hose
(26) Seal

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)***
T4:	***25 (2.5, 18.1)***
T5:	***<Ref. to ME(H4SO)-70, INSTALLATION, Cylinder Block.>***
T6:	***70 (7.1, 51)***
T7:	***First 12 (1.2, 8.7) Second 12 (1.2, 8.7)***
T8:	***45 (4.6, 33)***
T9:	***44 (4.5, 33)***
T10:	***25 (2.5, 18.1)***

6. CRANKSHAFT AND PISTON

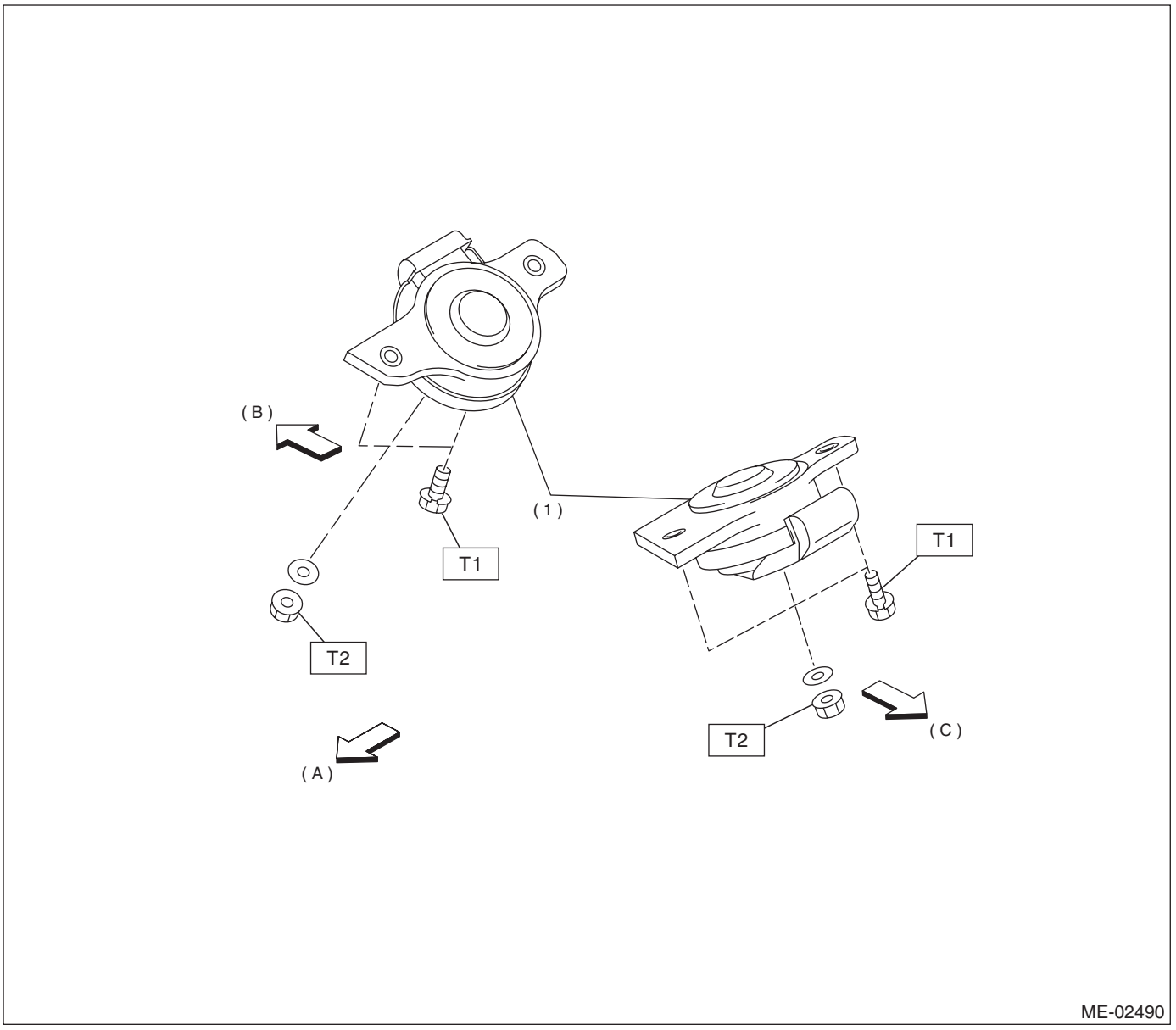


ME-02493

(1) Flywheel (MT)
(2) Reinforcement (AT)
(3) Drive plate (AT)
(4) Top ring
(5) Second ring
(6) Oil ring
(7) Piston
(8) Piston pin
(9) Snap ring
(10) Connecting rod bolt
(11) Connecting rod
(12) Connecting rod bearing
(13) Connecting rod cap
(14) Crankshaft
(15) Woodruff key
(16) Crankshaft bearing #1, #3
(17) Crankshaft bearing #2, #4
(18) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)
T1: 45 (4.6, 33)
T2: 72 (7.3, 52.8)

7. ENGINE MOUNTING



(A) Front
(B) LH
(C) RH
(1) Front cushion rubber

Tightening : N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 75 (7.7, 55.4)

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 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 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 reinstalled correctly 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

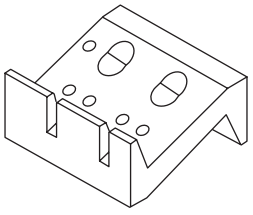
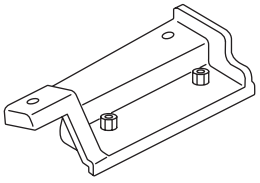
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267800	498267800	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve springs.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).

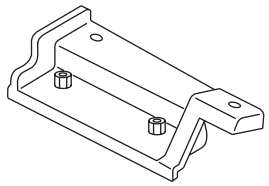
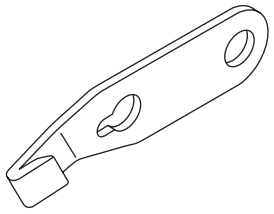
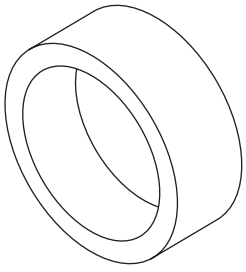
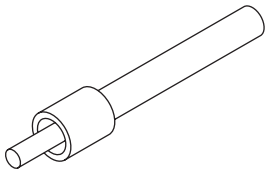
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

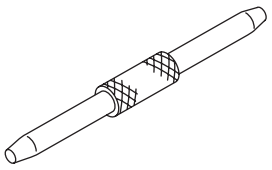
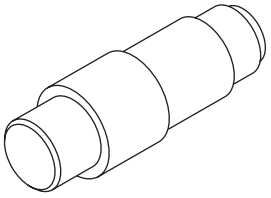
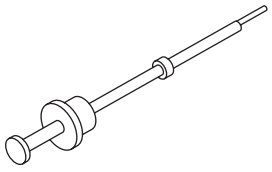
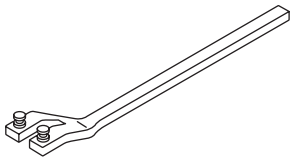
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	• Used for removing and installing camshaft sprocket. • CAMSHFT SPROCKET WRENCH (499207100) is also can be used.

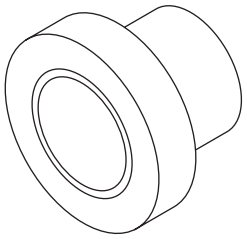
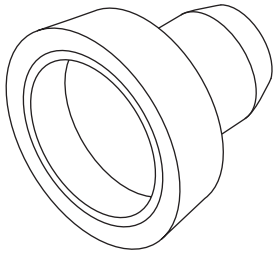
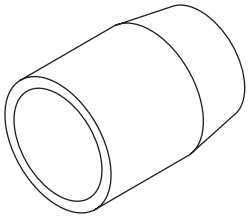
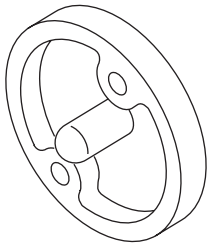
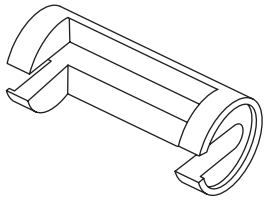
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587700	499587700	OIL SEAL INSTALLER	Used for installing cylinder head plug (camshaft, rear side).
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499597000	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).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

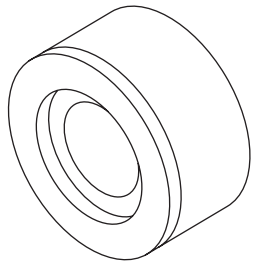
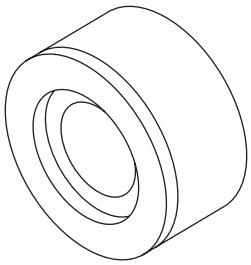
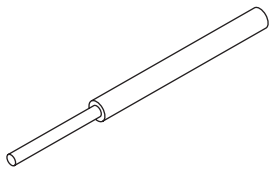
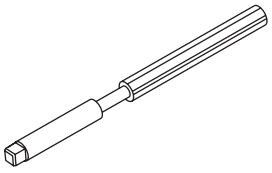
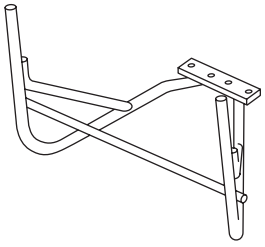
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767700	499767700 (Intake side)	VALVE GUIDE ADJUSTER	Used for installing intake side valve guides.
 ST-499767800	499767800 (Exhaust side)	VALVE GUIDE ADJUSTER	Used for installing exhaust side valve guides.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).

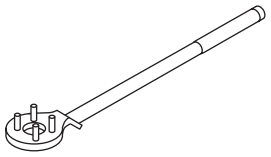
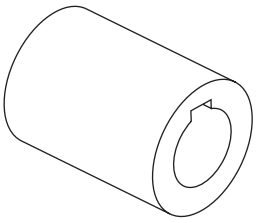
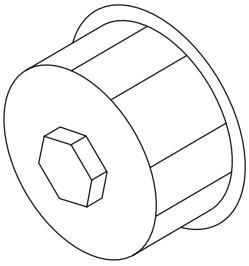
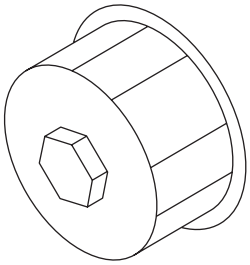
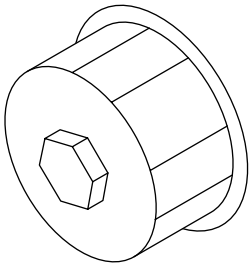
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST-498547000	498547000 (Outer diameter 80 mm (3.15 in) for oil filter)	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST18332AA000	18332AA000 (Outer diameter 68 mm (2.68 in) for oil filter)	OIL FILTER WRENCH	Used for removing and installing oil filter.
 ST18332AA010	18332AA010 (Outer diameter 65 mm (2.56 in) for oil filter)	OIL FILTER WRENCH	Used for removing and installing oil filter.

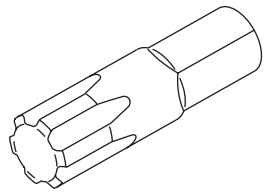
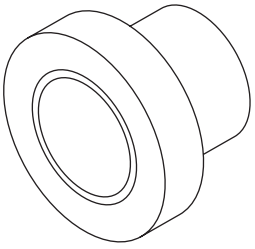
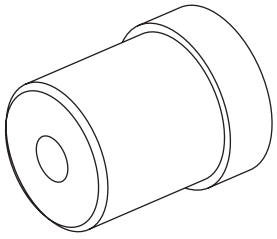
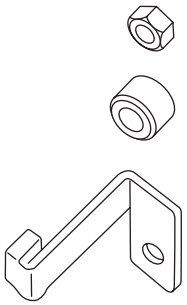
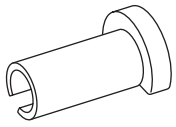
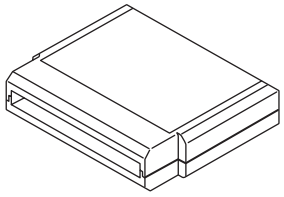
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499497000	499497000	TORX® PLUS	Used for removing and installing camshaft cap.
 ST-499587500	499587500	CAMSHAFT OIL SEAL INSTALLER	Used for installing front camshaft oil seal.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 ST42099AE000	42099AE000	CONNECTOR REMOVER	Used for removing quick connector.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA260	24082AA260	CARTRIDGE	Troubleshooting for electrical systems.
ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.

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

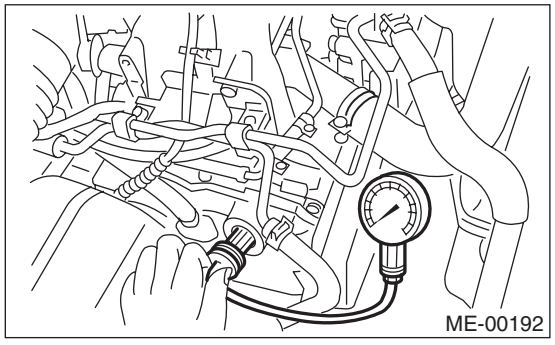
A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) After warming-up the engine, turn ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
4) Remove all the spark plugs. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
5) Fully open throttle valve.
6) Check the starter motor for suitable performance and operation.
7) Hold the compression gauge tight against the spark plug hole.

NOTE:
When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

8) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.



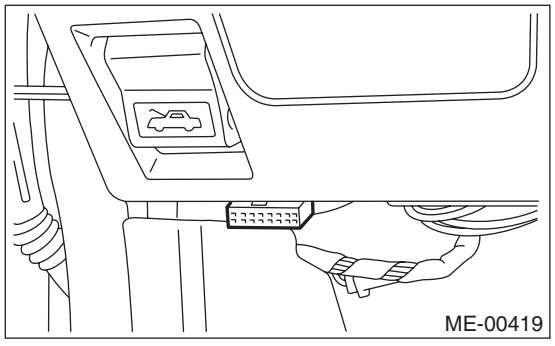
9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm and fully open throttle):
Standard;
1,275 kPa (13.0 kg/cm^2, 185 psi)
Limit;
1,079 kPa (11.0 kg/cm^2, 156 psi)
Difference between cylinders;
49 kPa (0.5 kg/cm^2, 7 psi), or less

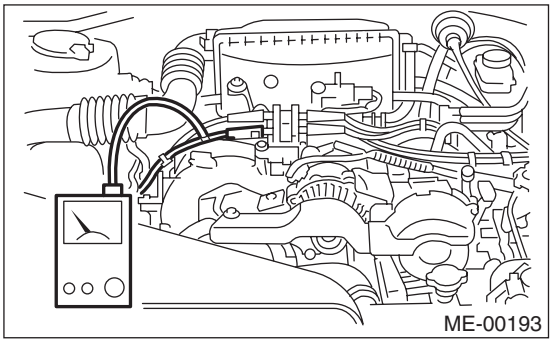
3. Idle Speed

A: INSPECTION

1) Before checking idle speed, check the following:
   (1) Ensure that air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and that hoses are connected properly.
   (2) Ensure that malfunction indicator light (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.
3) Stop the engine, and turn ignition switch to OFF.
4) When using SUBARU SELECT MONITOR <Ref. to ME(H4SO)-13, SPECIAL TOOLS, PREPARATION TOOL, General Description.>
   (1) Insert the cartridge to SUBARU SELECT MONITOR.
   (2) Connect SUBARU SELECT MONITOR to the data link connector.


ME-00419

   (3) Turn 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 read engine idle speed.
5) When using tachometer (Secondary pick-up type).
   (1) Attach the pick-up clip to No. 1 cylinder spark plug cord.
   (2) Start the engine, and read engine idle speed.


ME-00193

NOTE:
• When using the 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 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), or N or P (AT) position):
MT vehicle: 650±100 rpm
AT vehicle: 700±100 rpm

7) Check idle speed when loaded. (Turn air conditioning switch to “ON” and operate compressor for at least one minute before measurement.)

Idle speed [A/C “ON”, no load and gears in neutral (MT) or N or P (AT) position]:
850±100 rpm

NOTE:
The idle speed is adjusted automatically and manual adjusting cannot be performed. If idle speed is out of specifications, refer to General On-board Diagnosis Table under “Engine Control System”. <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>

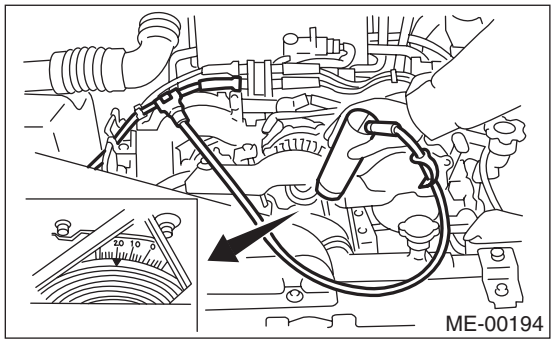
4. Ignition Timing

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 the timing light.
3) Start the engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:
MT vehicle: 10°±8°/650
AT vehicle: 15°±8°/700



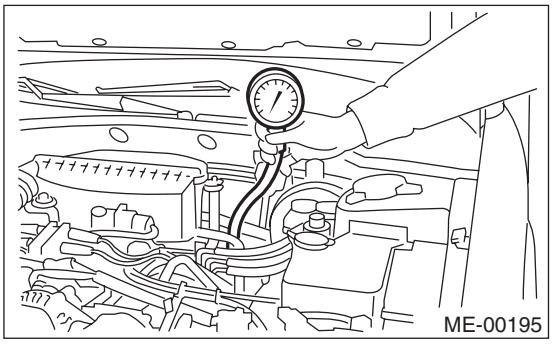
If the timing is not correct, check the ignition control system.
Refer to Engine Control System. <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm-up the engine.
2) Disconnect the brake vacuum hose and install the vacuum gauge to the hose fitting on the manifold.
3) Keep the engine at the idle speed and read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.



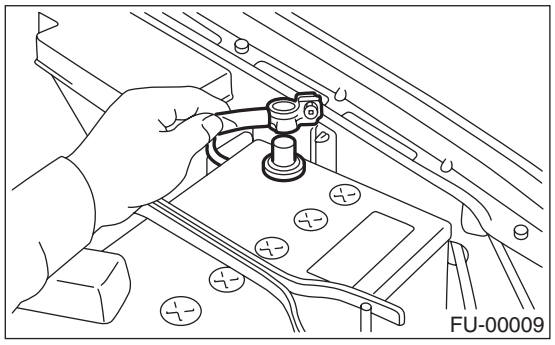
Vacuum pressure (at idling, A/C "OFF"):
Less than −60.0 kPa (−450 mmHg, −17.72 inHg)

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 certain speed, and then vibration increases as engine speed increases.	Weakend stiffness or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or idle adjustment

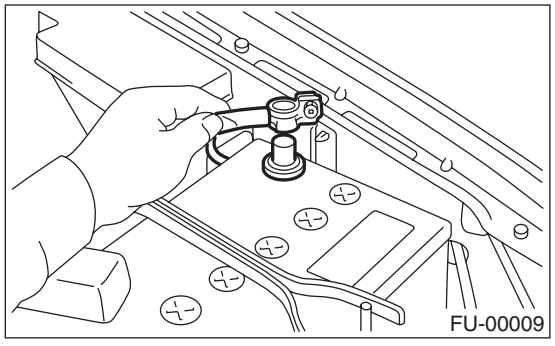
6. Engine Oil Pressure

A: INSPECTION

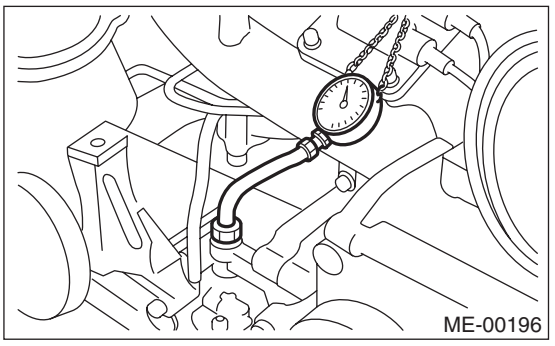
1) Disconnect battery ground cable.



2) Remove generator from bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
3) Disconnect connector from oil pressure switch.
4) Remove oil pressure switch from engine cylinder block. <Ref. to LU(H4SO)-18, REMOVAL, Oil Pressure Switch.>
5) Connect oil pressure gauge hose to cylinder block.
6) Connect battery ground cable.



7) Start the engine, and measure oil pressure.



Oil pressure:
98 kPa (1.0 kg/cm^2, 14 psi) or more at 600 rpm
294 kPa (3.0 kg/cm^2, 43 psi) or more at 5,000 rpm

CAUTION:
• If oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-20, INSPECTION, Engine Lubrication System Trouble in General.>
• If oil pressure warning light is turned ON and oil pressure is in specification, replace oil pressure switch. <Ref. to LU(H4SO)-20, INSPECTION, Engine Lubrication System Trouble in General.>

NOTE:
The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring oil pressure, install oil pressure switch. <Ref. to LU(H4SO)-18, INSTALLATION, Oil Pressure Switch.>

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

9) Install generator and V-belt in the reverse order of removal, and adjust the V-belt deflection. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

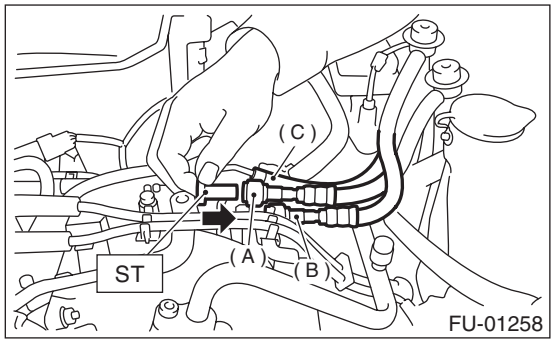
7. Fuel Pressure

A: INSPECTION

WARNING:
Before removing fuel pressure gauge, release fuel pressure.

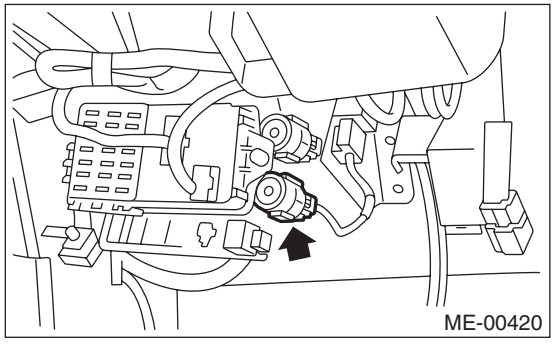
NOTE:
If out of specification, check or replace pressure regulator and pressure regulator vacuum hose.

1) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect fuel delivery hoses from fuel filter, and connect fuel pressure gauge.



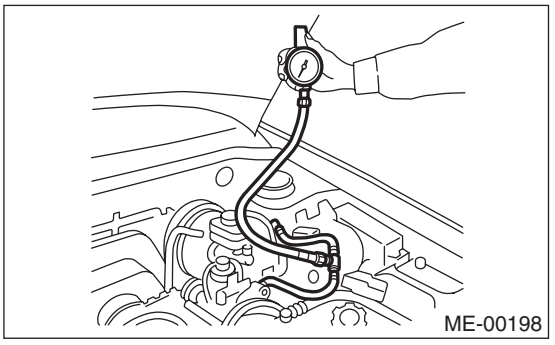
(A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

4) Connect connector of fuel pump relay.



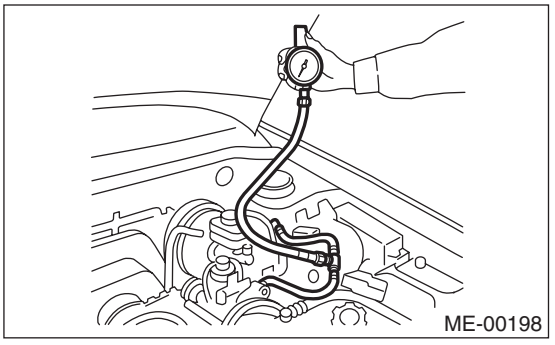
5) Start the engine.
6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

Fuel pressure:
Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)



7) After connecting pressure regulator vacuum hose, measure fuel pressure.

Fuel pressure:
Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm^2, 30 — 34 psi)



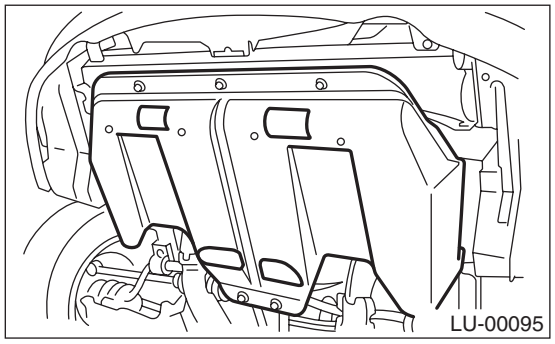
NOTE:
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.

8. Valve Clearance

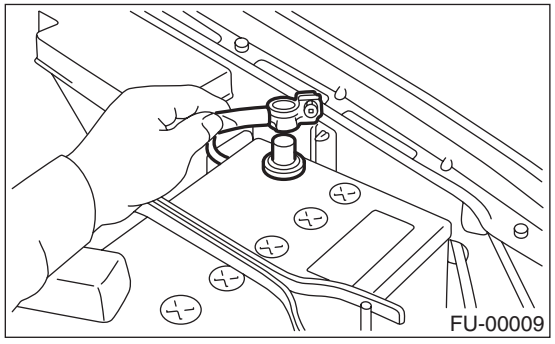
A: INSPECTION

CAUTION:
Inspection and adjustment of valve clearance should be performed while engine is cold.

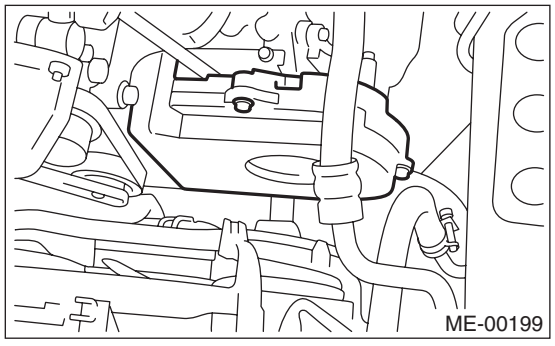
1) Set the vehicle onto the lift.
2) Lift-up the vehicle.
3) Remove under cover.



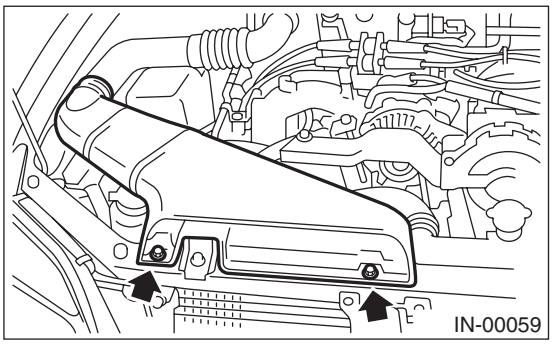
4) Lower the vehicle.
5) Disconnect battery ground cable.



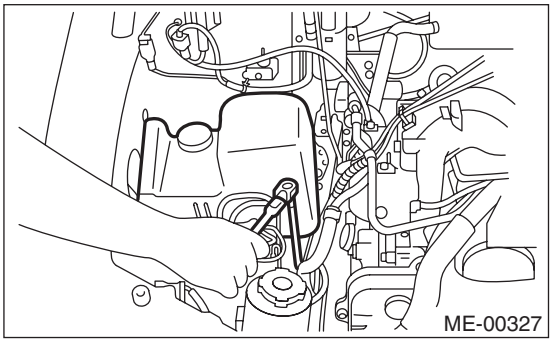
6) Remove timing belt cover (LH).



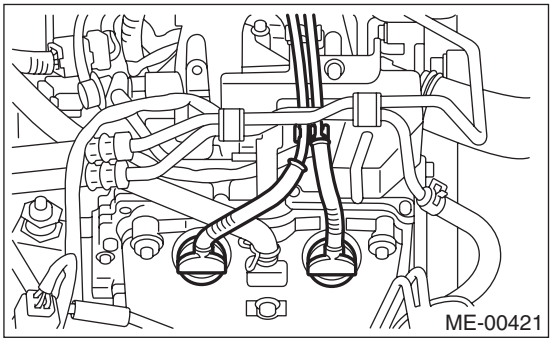
7) When inspecting #1 and #3 cylinders
(1) Remove air intake duct as a unit.



(2) Remove bolt, and then remove resonator chamber.

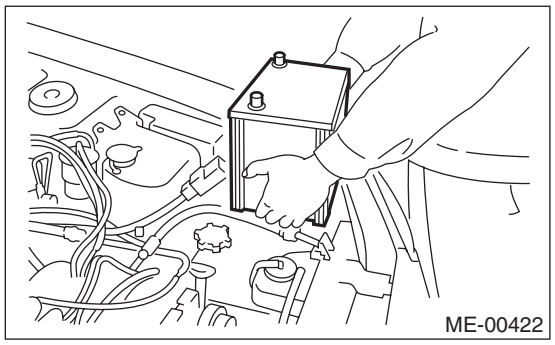


(3) Disconnect spark plug cords from spark plugs (#1 and #3 cylinders).
<Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>

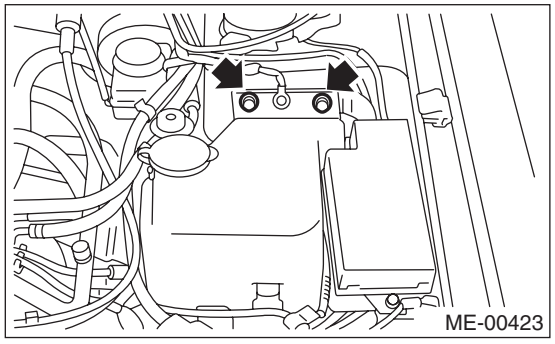


(4) Disconnect PCV hose from rocker cover (RH).
(5) Remove bolts, then remove rocker cover (RH).

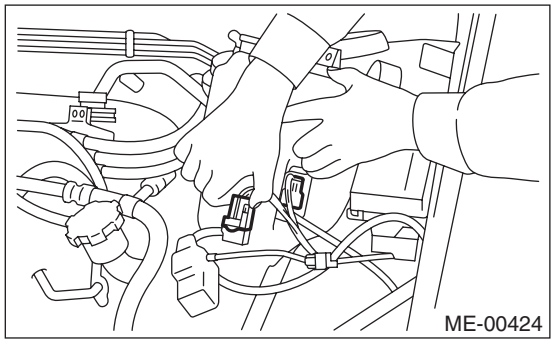
8) When inspecting #2 and #4 cylinders;
(1) Disconnect battery cables, and then remove battery and battery carrier.



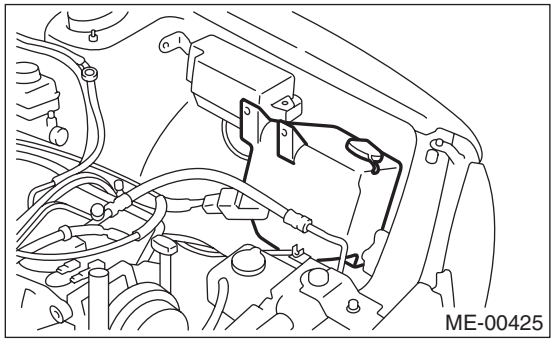
(2) Remove the two bolts which hold washer tank.



(3) Disconnect washer motor connectors.



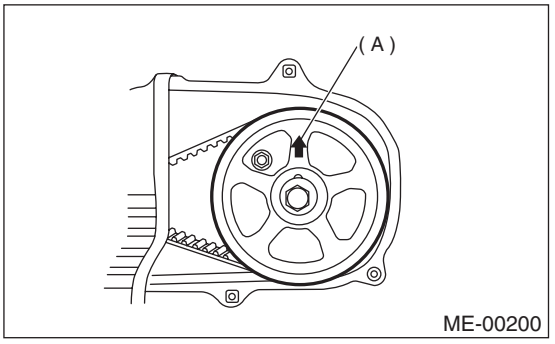
(4) Move washer tank to forward.



(5) Disconnect spark plug cords from spark plugs (#2 and #4 cylinders).
<Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
(6) Disconnect PCV hose from rocker cover (LH).
(7) Remove bolts, then remove rocker cover (LH).

9) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

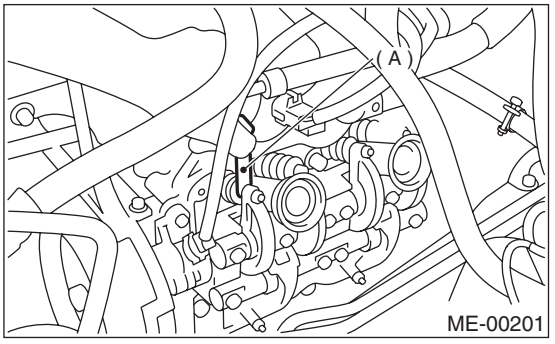
NOTE:
When arrow mark (A) on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



10) Measure #1 cylinder valve clearance by using thickness gauge.

NOTE:
• Insert the thickness gauge (A) in as horizontal a direction as possible with respect to the valve stem end face.
• Measure exhaust valve clearances while lifting-up the vehicle.

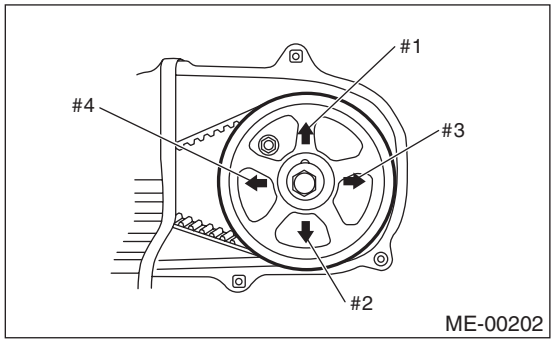
Valve clearance:
Intake;
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust;
0.25±0.04 mm (0.0098±0.0016 in)



(A) Thickness gauge

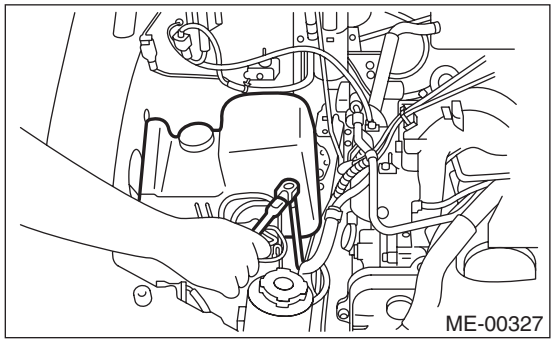
11) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
12) Similar to measurement procedures used for #1 cylinder, measure #2, #3 and #4 cylinder valve clearances.

NOTE:
• Be sure to set cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
• To set #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket 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, 24.6 ft-lb)

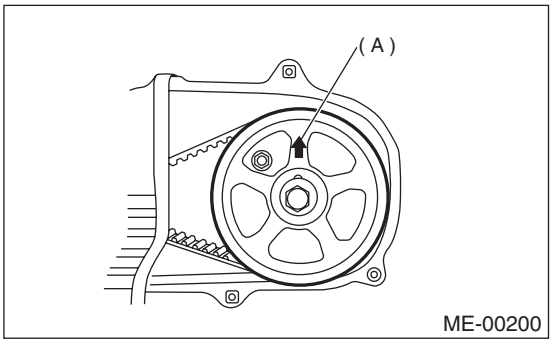


B: ADJUSTMENT

NOTE:
Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:
When arrow mark (A) on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.

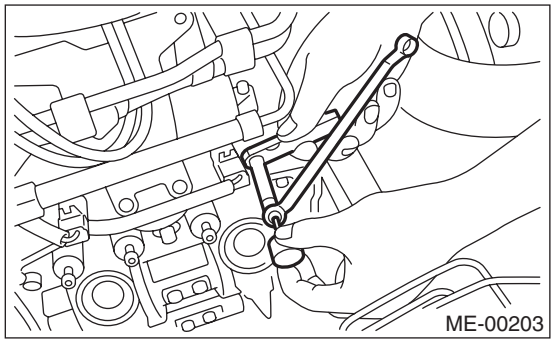


2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Place suitable thickness gauge.
(3) While noting valve clearance, tighten valve rocker adjust screw.
(4) When specified valve clearance is obtained, tighten valve rocker nut.

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)

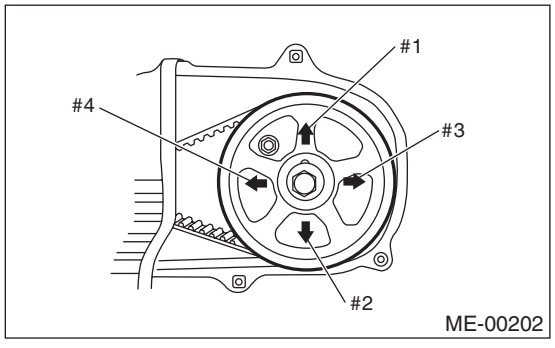
CAUTION:
• Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.
• Adjust exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake;
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust;
0.25±0.04 mm (0.0098±0.0016 in)



3) Ensure that valve clearances are within specifications.
4) Turn crankshaft two complete rotations until #1 cylinder piston is again set to top dead center on compression stroke.
5) Ensure that valve clearances are within specifications. If necessary, readjust valve clearances.
6) Similar to adjustment procedures used for #1 cylinder, adjust #2, #3 and #4 cylinder valve clearances.

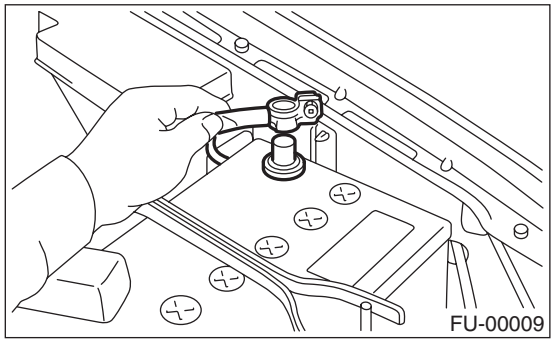
NOTE:
• Be sure to set cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
• To set #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



9. Engine Assembly

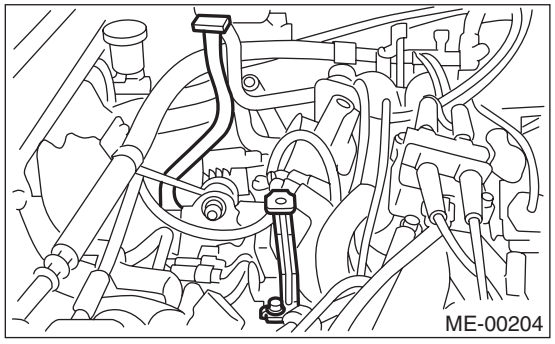
A: REMOVAL

1) Set the vehicle on a lift.
2) Open front hood fully and support with stay.
3) Raise rear seat, and turn floor mat up.
4) Release fuel pressure. <Ref. to FU(H4SO)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
5) Remove filler cap.
6) Collect refrigerant, and remove pressure hoses. (With A/C) <Ref. to AC-35, REMOVAL, Flexible Hose.>
7) Disconnect battery ground cable.

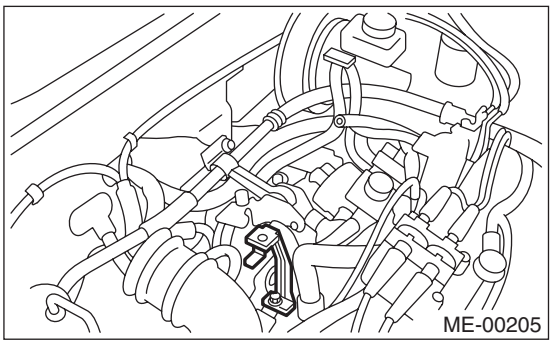

FU-00009

8) Remove air intake duct and air cleaner case. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>
9) Remove under cover.
10) Remove radiator from vehicle. <Ref. to CO(H4SO)-20, REMOVAL, Radiator.>
11) Remove ATF cooler pipe from body. <Ref. to 4AT-80, REMOVAL, ATF Cooler Pipe and Hose.>
12) Remove air cleaner case stay.

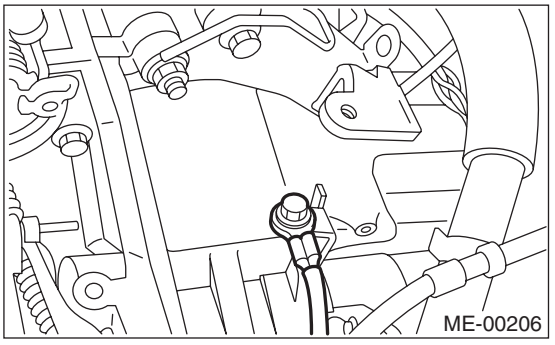
- **MT model**


ME-00204

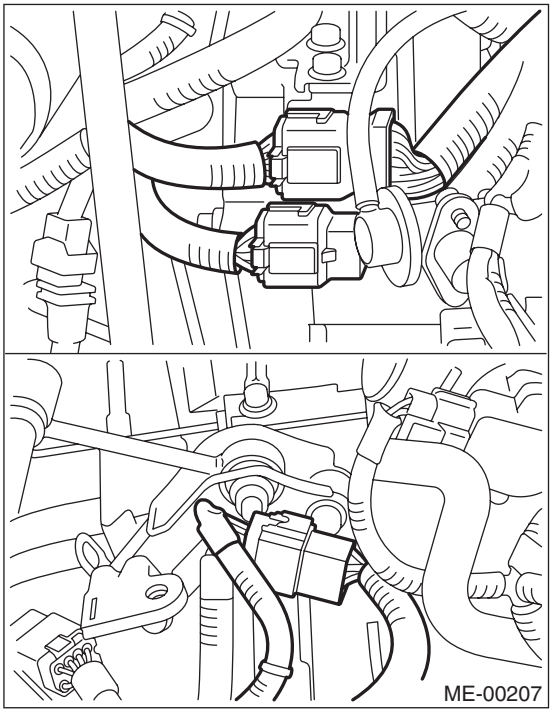
- **AT model**


ME-00205

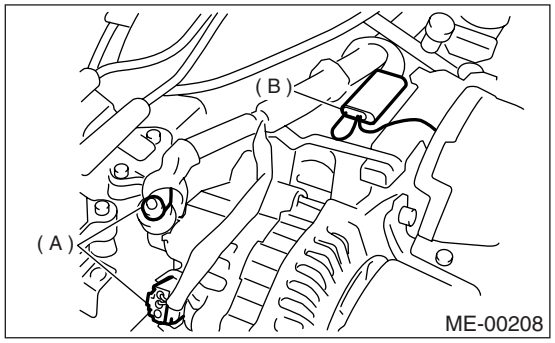
13) Disconnect the following connectors and cables.
(1) Engine ground terminal


ME-00206

(2) Engine harness connectors

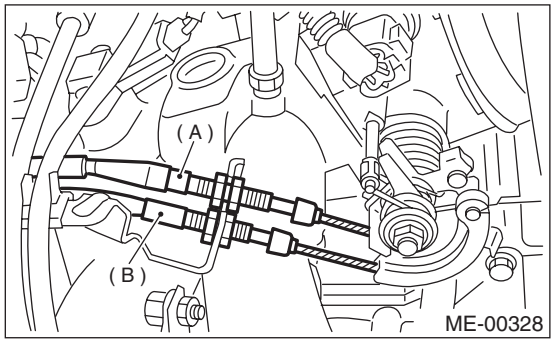

ME-00207

(3) Alternator connector, terminal and A/C compressor connector



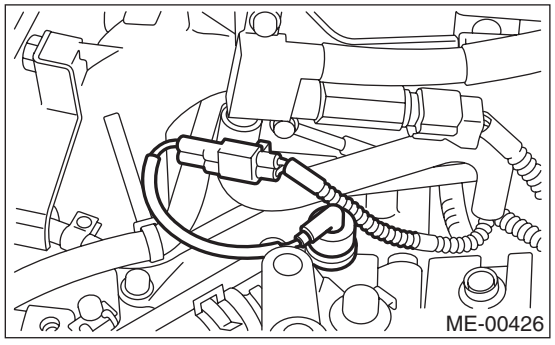
(A) Alternator connector and terminal
(B) A/C compressor connector

(4) Accelerator cable and cruise control cable



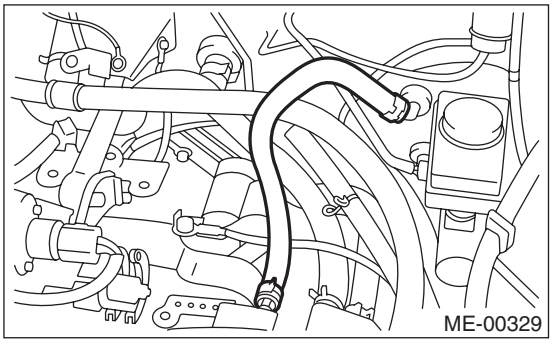
(A) Accelerator cable
(B) Cruise control cable

(5) Pressure switch

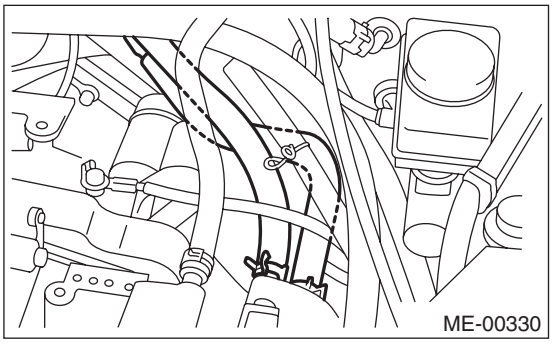


14) Disconnect the following hoses.

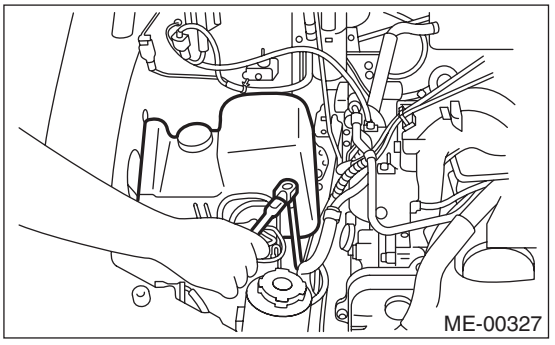
(1) Brake booster vacuum hose



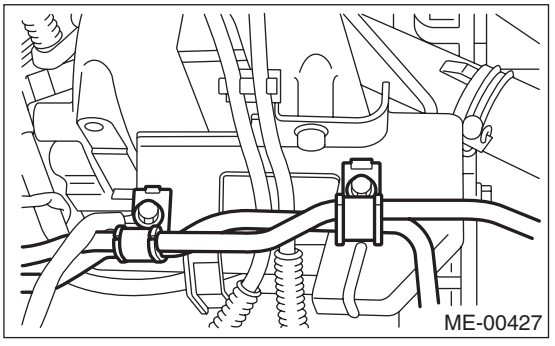
(2) Heater inlet/outlet hose



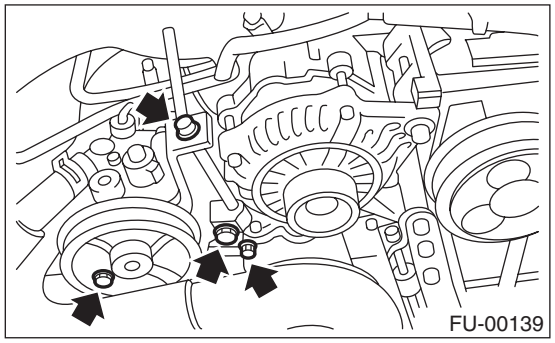
15) Remove power steering pump from bracket.
(1) Remove resonator chamber.



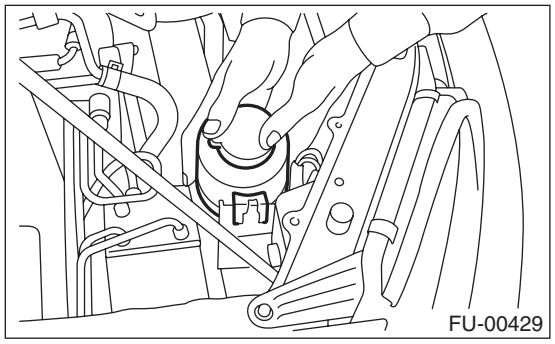
(2) Loosen lock bolt and slider bolt, and remove front side V-belt.
<Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
(3) Remove pipe with bracket.



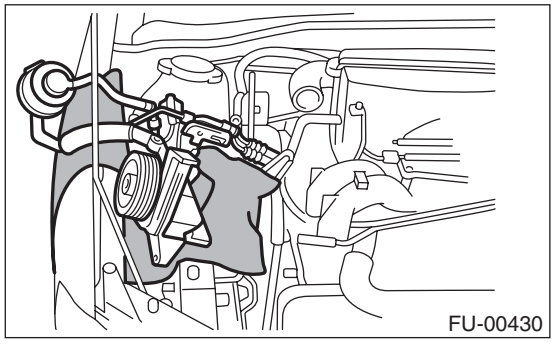
(4) Remove bolts which install power steering pump bracket.



(5) Remove power steering tank from the bracket by pulling it upward.

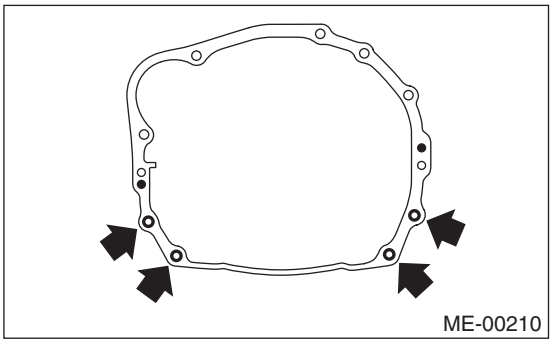


(6) Place power steering pump on the right side wheel apron.

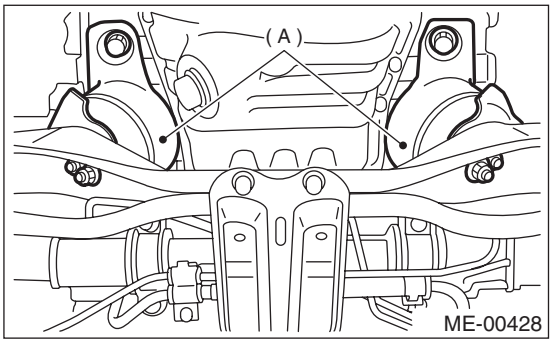


16) Remove front and center exhaust pipe.
<Ref. to EX(H4SO)-5, REMOVAL, Front Exhaust Pipe.> and <Ref. to EX(H4SO)-8, REMOVAL, Center Exhaust Pipe.>

17) Remove nuts which hold lower side of transmission to engine.



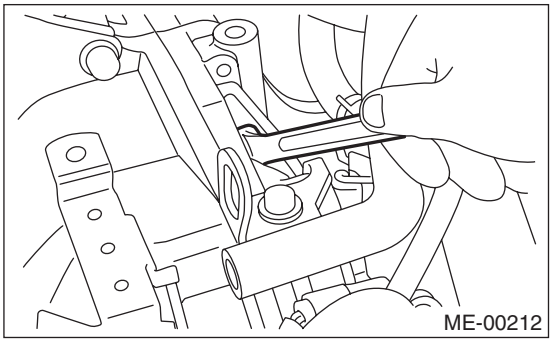
18) Remove nuts which install front cushion rubber onto front crossmember.



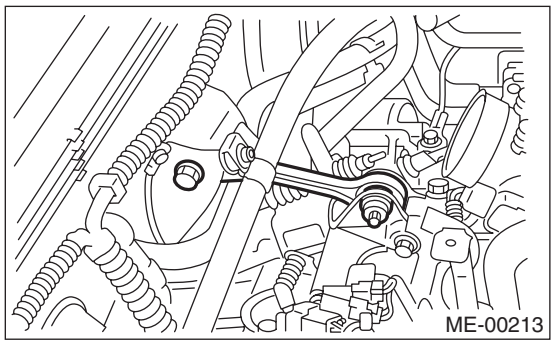
(A) Engine mount

19) Separate torque converter clutch from drive plate. (AT model)
(1) Lower the vehicle.
(2) Remove service hole plug.
(3) Remove bolts which hold torque converter clutch to drive plate.
(4) Remove other bolts while rotating the crankshaft pulley using ST.

ST 499977100 CRANK PULLEY WRENCH

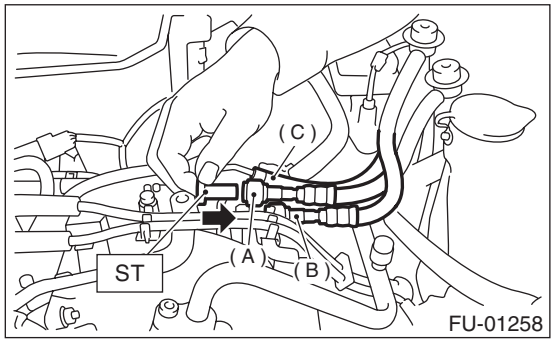


20) Remove pitching stopper.



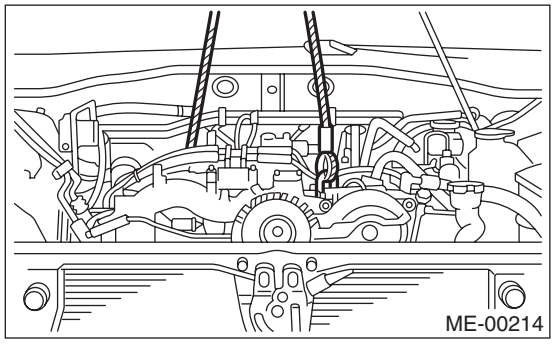
21) Disconnect fuel delivery hose, return hose and evaporation hose using ST.
ST 42099AE000 CONNECTOR REMOVER

CAUTION:
• Disconnect hose with its end wrapped with cloth to prevent fuel from splashing.
• Catch fuel from hose into container.



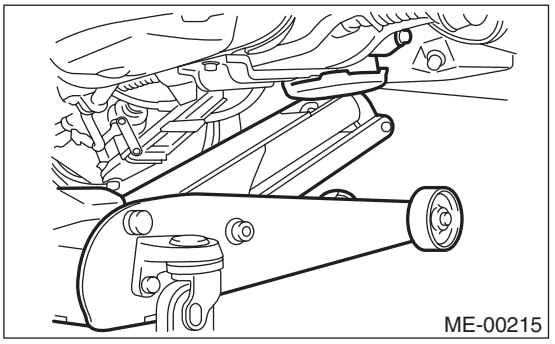
(A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

22) Support engine with a lifting device and wire ropes.

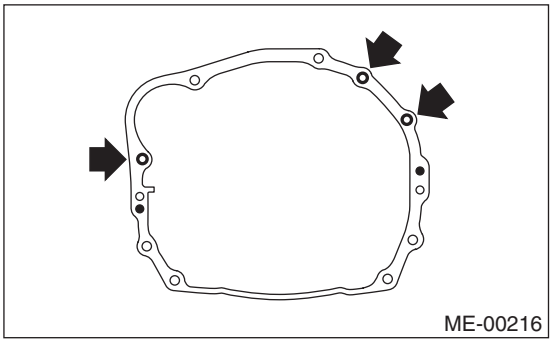


23) Support transmission with a garage jack.

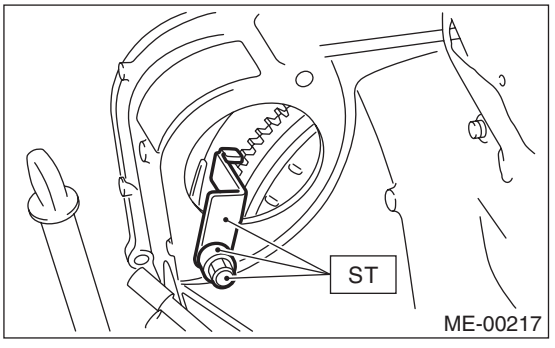
CAUTION:
Before moving engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because transmission lowers under its own weight.



24) Separation of engine and transmission.
(1) Remove starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>
(2) Remove bolts which hold upper side of transmission to engine.

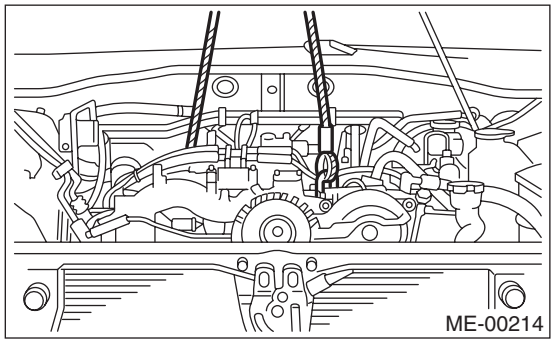


25) Install ST to torque converter clutch case. (AT model)
ST 498277200 STOPPER SET



26) Remove engine from vehicle.
(1) Slightly raise engine.
(2) Raise transmission with garage jack.
(3) Move engine horizontally until main shaft is withdrawn from clutch cover.
(4) Slowly move engine away from engine room.

CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.



27) Remove front cushion rubbers.

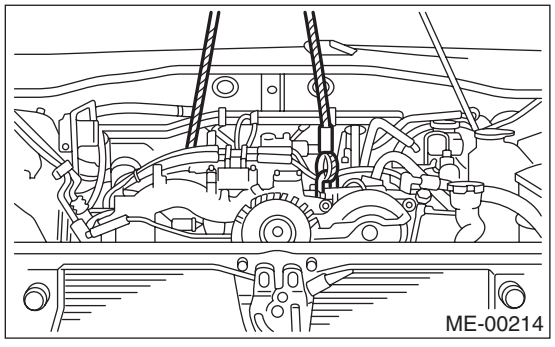
B: INSTALLATION

1) Install front cushion rubbers.

Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)

2) Install engine onto transmission.
(1) Position engine in engine room and align it with transmission.

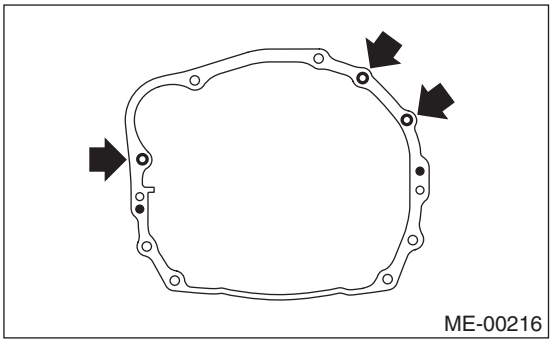
CAUTION:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.



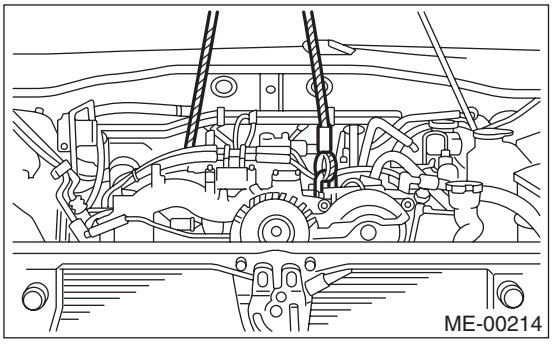
(2) Apply a small amount of grease to spline of main shaft. (MT model)

3) Tighten bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

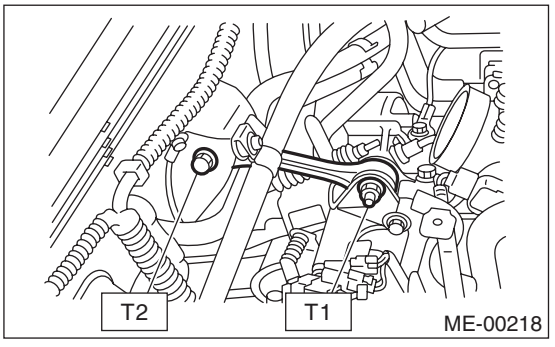


4) Remove lifting device and wire ropes.



5) Remove garage jack.
6) Install pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



7) Remove ST from torque converter clutch case. (AT model)

NOTE:
Be careful not to drop the ST into the torque converter clutch case when removing ST.

ST 498277200 STOPPER SET

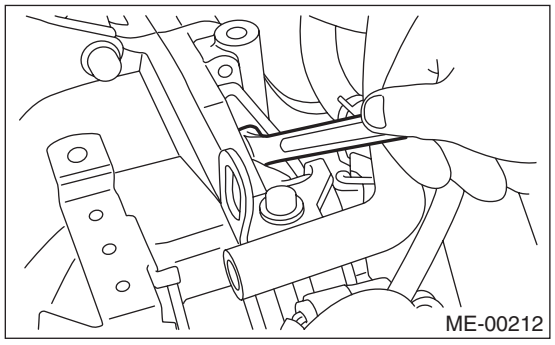
8) Install starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>

9) Install torque converter clutch onto drive plate. (AT model)
(1) Tighten bolts which hold torque converter clutch to drive plate.
(2) Tighten other bolts while rotating the crankshaft pulley by using ST.

CAUTION:
Be careful not to drop bolts into torque converter clutch housing.

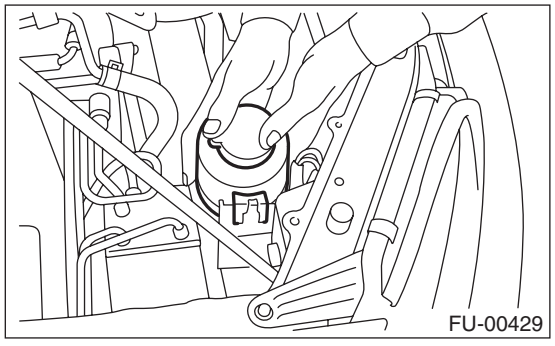
ST 499977100 CRANK PULLEY WRENCH

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


ME-00212

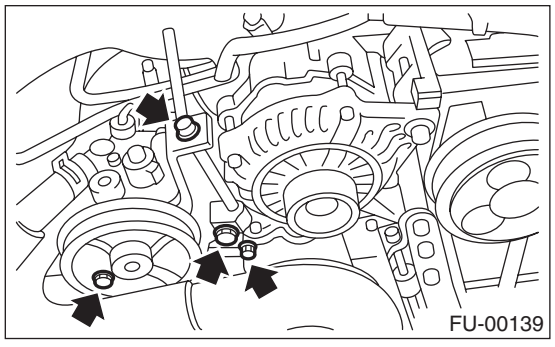
(3) Clog plug onto service hole.

10) Install power steering pump on bracket.
(1) Install power steering tank on bracket.

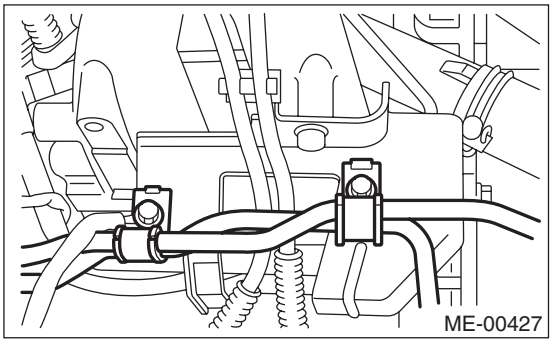

FU-00429

(2) Install power steering pump on bracket, and tighten bolts.

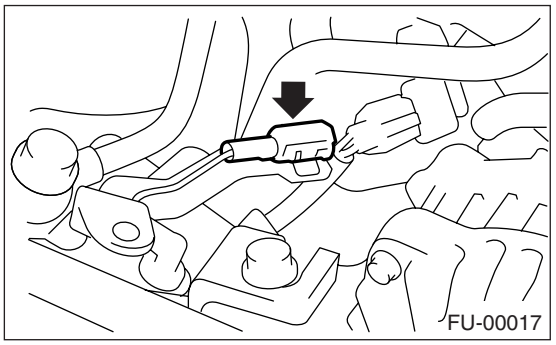
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)


FU-00139

(3) Tighten bolt which installs power steering pump bracket, and install spark plug codes.

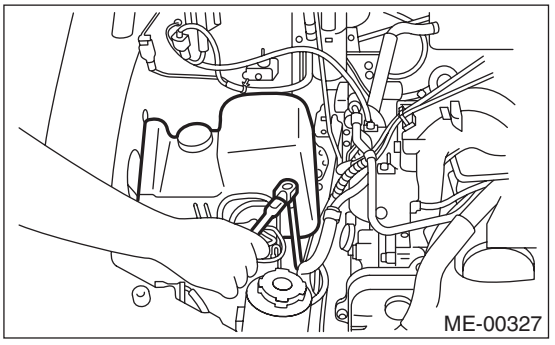

ME-00427

(4) Connect power steering switch connector.


FU-00017

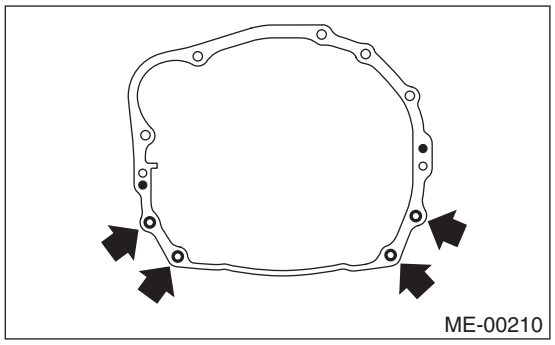
(5) Front side V-belt
Install and adjust it. <Ref. to ME(H4SO)-40, V-belt.>
(6) Install resonator chamber.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)


ME-00327

11) Tighten nuts which hold lower side of transmission to engine.

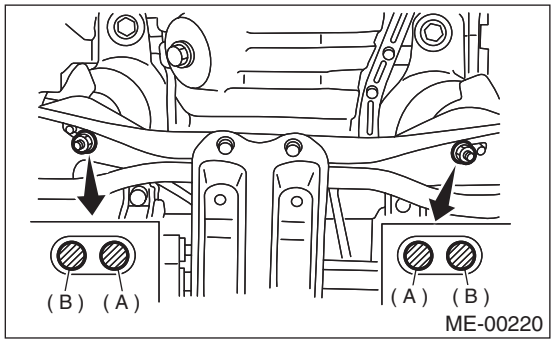
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



12) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:
75 N·m (7.7 kgf-m, 55.4 ft-lb)

CAUTION:
Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



13) Install front and center exhaust pipe.
<Ref. to EX(H4SO)-6, INSTALLATION, Front Exhaust Pipe.> and <Ref. to EX(H4SO)-8, INSTALLATION, Center Exhaust Pipe.>
14) Connect the following hoses.
(1) Fuel delivery hose, return hose and evaporation hose <Ref. to FU(H4SO)-73, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose
15) Connect the following connectors.
(1) Engine ground terminals

Tightening torque:
14 N·m (1.4 kgf-m, 10.1 ft-lb)

(2) Engine harness connectors
(3) Alternator connector and terminal
(4) A/C compressor connectors
(5) Power steering pressure switch
16) Connect the following cables.
(1) Accelerator cable
(2) Cruise control cables (With cruise control)
17) After connecting each cable, adjust them.
18) Install air cleaner case stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)

19) Install A/C pressure hoses.
<Ref. to AC-35, INSTALLATION, Flexible Hose.>
20) Install radiator to vehicle. <Ref. to CO(H4SO)-21, INSTALLATION, Radiator.>
21) Install ATF cooler pipe to body. <Ref. to 4AT-81, INSTALLATION, ATF Cooler Pipe and Hose.>
22) Install air intake duct and cleaner case.
<Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-6, INSTALLATION, Air Cleaner Case.>
23) Install under cover.
24) Install battery in the vehicle, and connect cables.
25) Fill coolant.
<Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
26) Check ATF level and correct if necessary. (AT model)
<Ref. to 4AT-31, Automatic Transmission Fluid.>
27) Charge A/C system with refrigerant.
<Ref. to AC-18, OPERATION, Refrigerant Charging Procedure.>
28) Remove front hood stay, and close front hood.
29) Take off the vehicle from lift arms.

C: INSPECTION

1) Make sure 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 engine assembly. <Ref. to ME(H4SO)-31, REMOVAL, Engine Assembly.>
2) Remove engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
Engine mounting;
35 N·m (3.6 kgf-m, 26.0 ft-lb)

C: INSPECTION

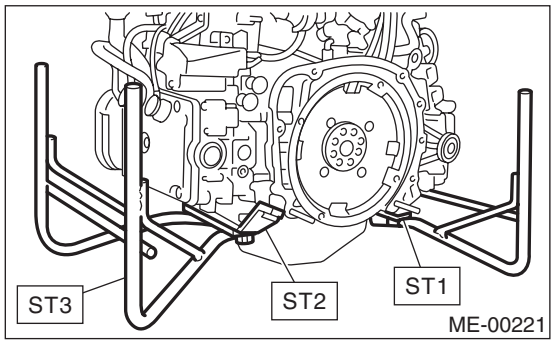
Make sure there are no cracks or other damage.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from the body, secure it in the ST 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.

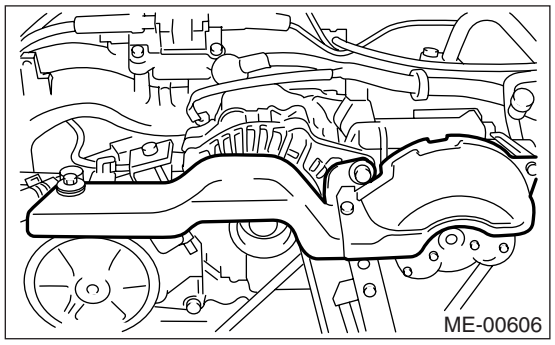
12.V-belt

A: REMOVAL

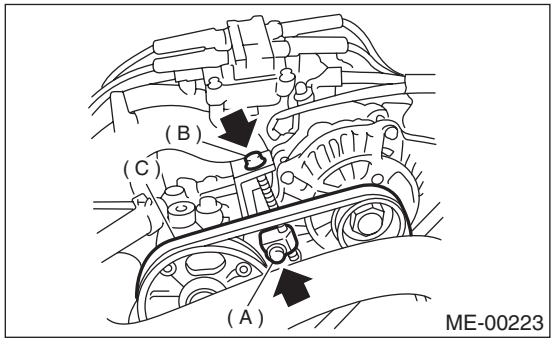
1. FRONT SIDE BELT

NOTE:
Perform the following procedures 1) to 4) with the engine installed to the body.

1) Remove V-belt cover.

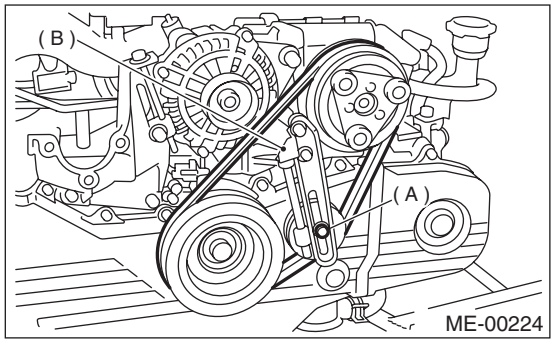


2) Loosen the lock bolt (A).
3) Loosen the slider bolt (B).
4) Remove the front side belt (C).

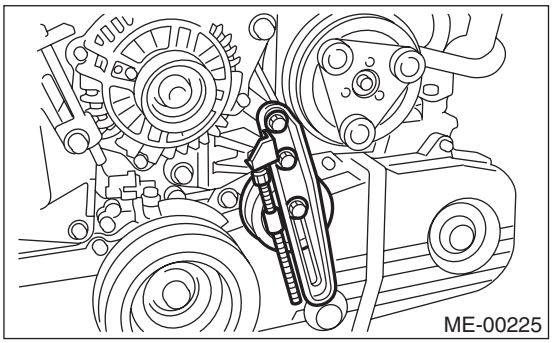


2. REAR SIDE BELT

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.

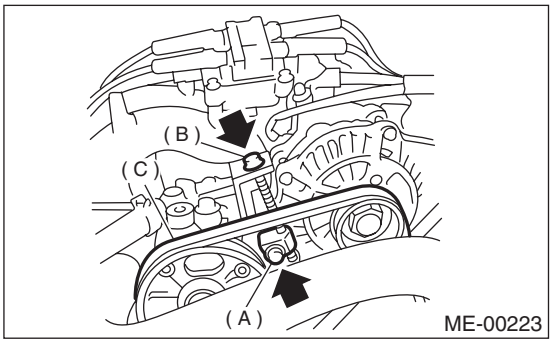


B: INSTALLATION

1. FRONT SIDE BELT

1) Wipe off any oil or water on the belt and pulley.
2) Install a belt (C), and tighten the slider bolt so as to obtain the specified belt tension <Ref. to ME(H4SO)-41, INSPECTION, V-belt.>
3) Tighten the lock bolt (A).
4) Tighten slider bolt (B).

Tightening torque:
Lock bolt through bolt:
25 N·m (2.5 kgf-m, 18 ft-lb)
Slider bolt:
8 N·m (0.8 kgf-m, 5.8 ft-lb)

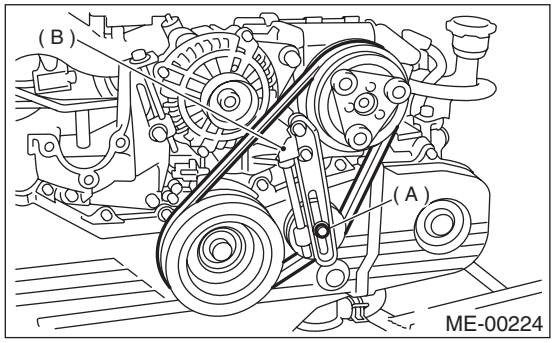


5) Install V-belt cover.

2. REAR SIDE BELT

1) Install a belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-41, 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)

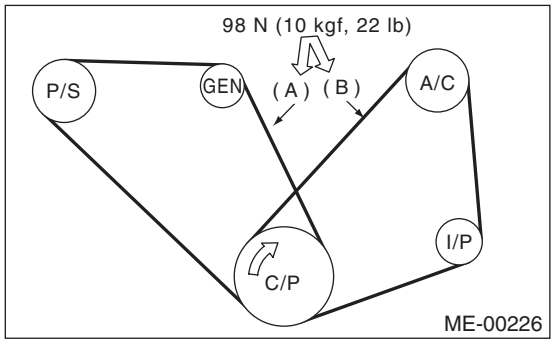


C: INSPECTION

1. WITHOUT BELT TENSION GAUGE

1) Replace belts, if cracks, fraying or wear is found.
2) Check drive belt tension and adjust it if necessary by changing 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)

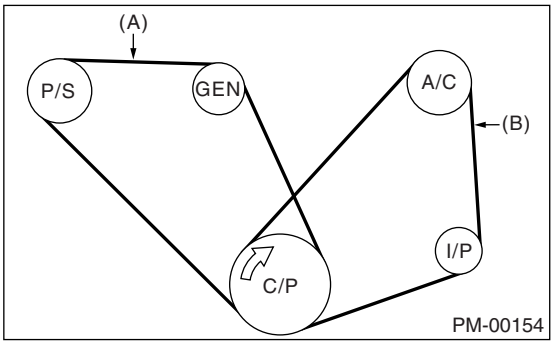


C/P	Crankshaft pulley
GEN	Generator
P/S	Power steering oil pump pulley
A/C	Air conditioning compressor pulley
I/P	Idler pulley

2. WITH BELT TENSION GAUGE

1) Replace belts, if cracks, fraying or wear is found.
2) Check drive belt tension and adjust it if necessary by changing generator installing position and/or idler pulley installing position.

Belt tension
(A)
490 — 640 N (50 — 65 kgf, 110 — 144 lb)
(B)*
350 — 450 N (36 — 46 kgf, 79 — 101 lb)



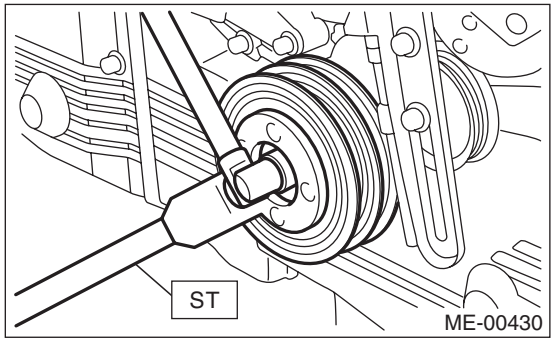
C/P	Crankshaft pulley
GEN	Generator
P/S	Power steering oil pump pulley
A/C	Air conditioning compressor pulley
I/P	Idler pulley

13.Crankshaft Pulley

A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley bolt. To lock crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH



3) Remove crankshaft pulley.

B: INSTALLATION

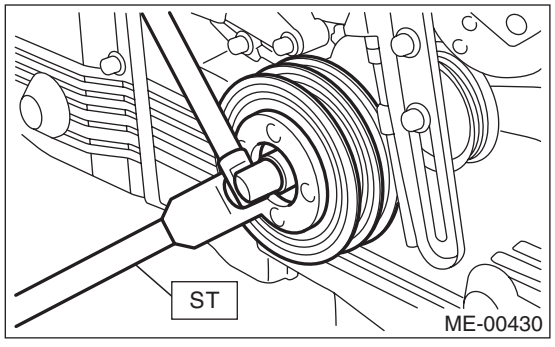
1) Install crankshaft pulley.
2) Install pulley bolt.

To lock crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley thread using compressed air.
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(4) Tighten the crankshaft pulley bolts.

Tightening torque:
180 N·m (18.0 kgf-m, 132.8 ft-lb)



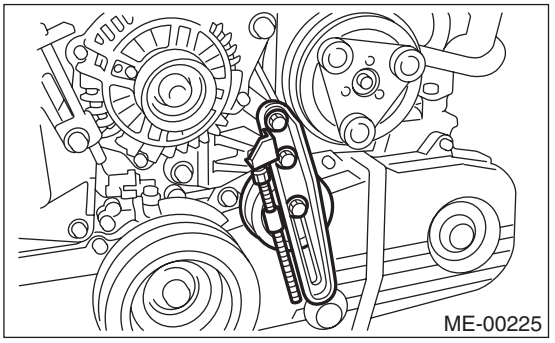
3) Confirm that the tightening angle of the crankshaft pulley bolt is 65 degrees or more. If not, conduct the following procedures (1) through (4).
(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:
12369AA011

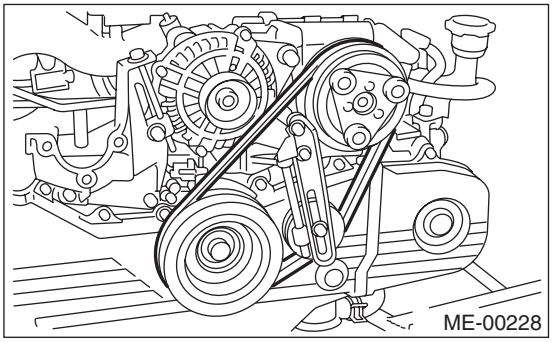
(2) Clean the crankshaft thread using compressed air.
(3) Apply engine oil to the crankshaft pulley bolt seat and thread.
(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).
(5) Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

NOTE:
Conduct the tightening procedures by confirming the turning angle of the crankshaft pulley bolt referring to the gauge indicated on the belt cover.

4) Install A/C belt tensioner.



5) Install A/C belt.



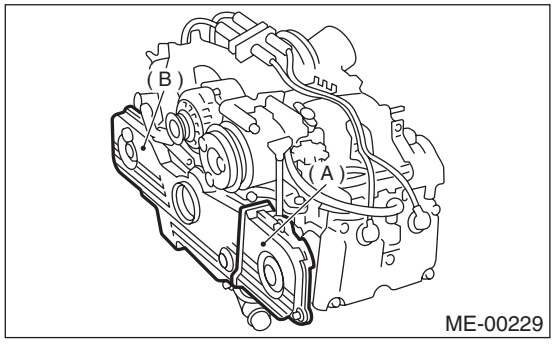
C: INSPECTION

1) Make sure the V-belt is not worn or otherwise damaged.
2) Check the tension of the belt. <Ref. to ME(H4SO)-41, INSPECTION, V-belt.>

14.Timing Belt Cover

A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove belt cover (LH).
4) Remove front belt cover.



(A) Belt cover (LH)
(B) Front belt cover

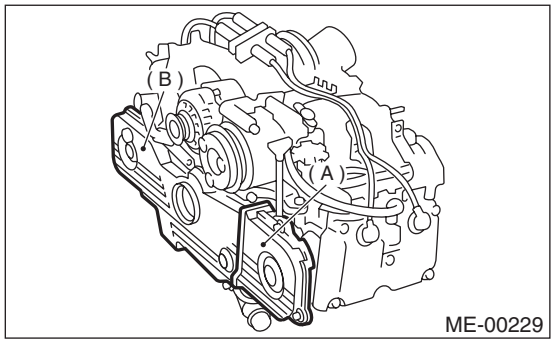
B: INSTALLATION

1) Install front belt cover.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

2) Install belt cover (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



(A) Belt cover (LH)
(B) Front belt cover

3) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
4) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

C: INSPECTION

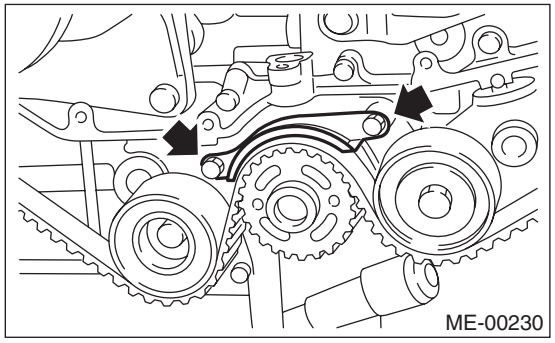
Make sure the cover is not damaged.

15.Timing Belt

A: REMOVAL

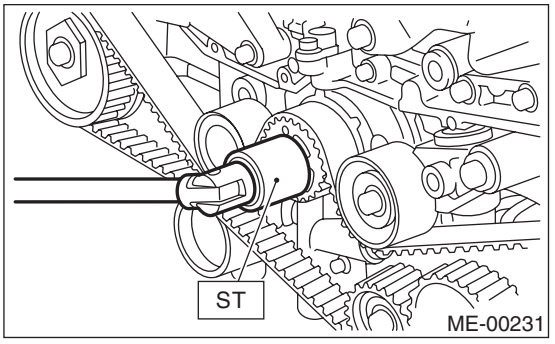
1. TIMING BELT

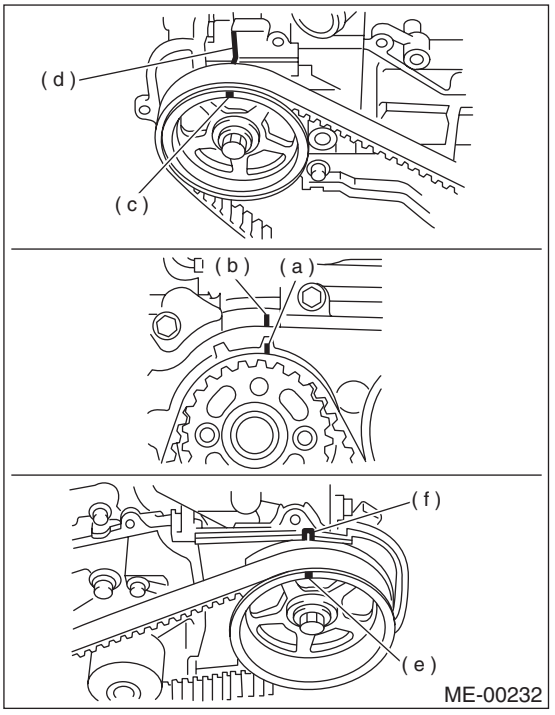
1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt guide. (MT vehicle only)



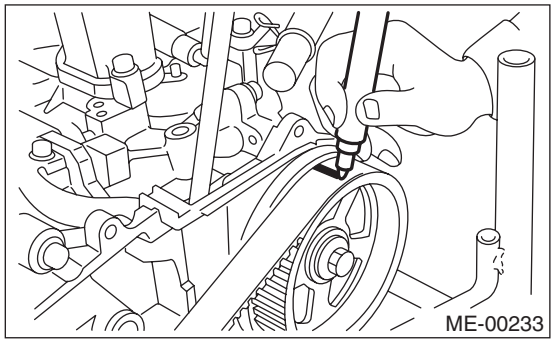
5) If alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as shown in procedures below.
   (1) Turn crankshaft using ST. Align mark (a) of sprocket to cylinder block notch (b) and ensure that right side cam sprocket 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

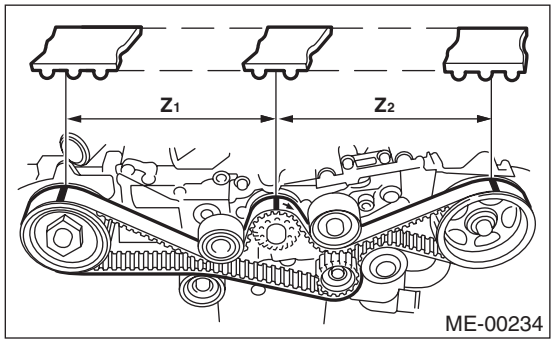




(2) Using white paint, put alignment and/or arrow marks on timing belts with reference to the crank sprocket and cam sprockets.

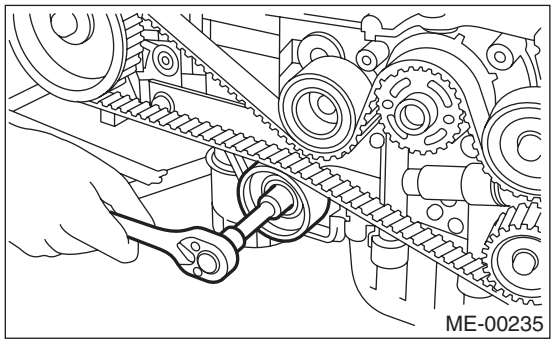

ME-00233

Specified data:
Z_1: 46.8 tooth length
Z_2: 43.7 tooth

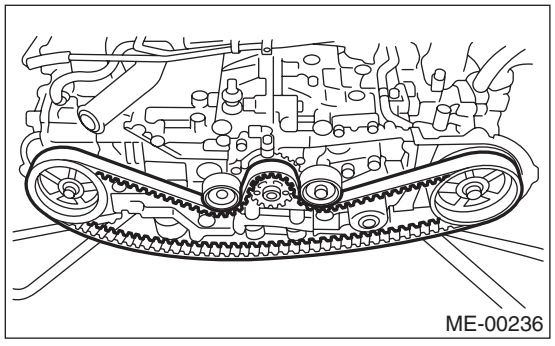


ME-00234

6) Remove belt idler (No. 2).
7) Remove belt idler No. 2.

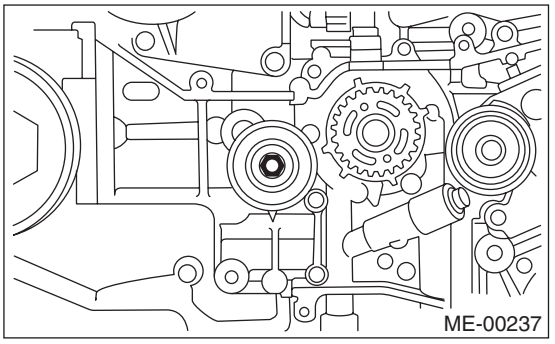

ME-00235

8) Remove timing belt.

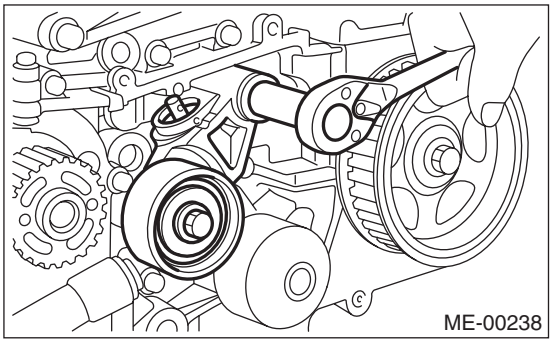

ME-00236

2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove belt idler (No. 1).


ME-00237

2) Remove automatic belt tension adjuster assembly.


ME-00238

B: INSTALLATION

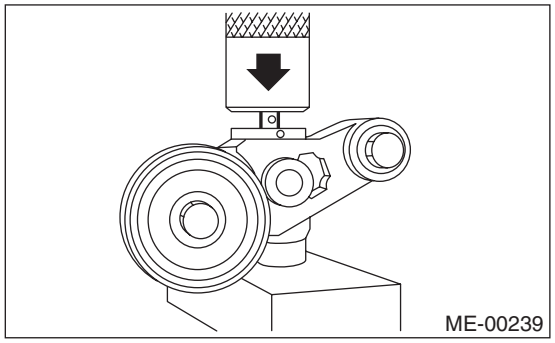
1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Preparation for installation of automatic belt tension adjuster assembly;

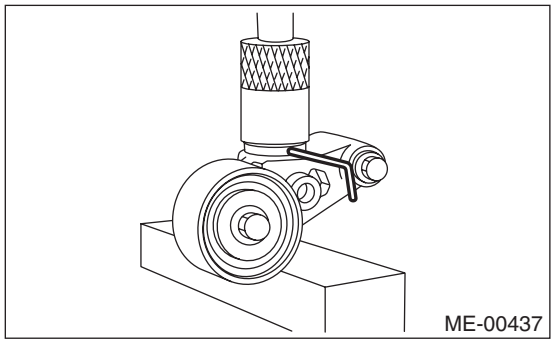
CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push adjuster rod vertically.
• Be sure to slowly move the adjuster rod down applying a pressure of 294 N (30 kgf, 66 lb).
• Press-in the push adjuster rod gradually taking more than three 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 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) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

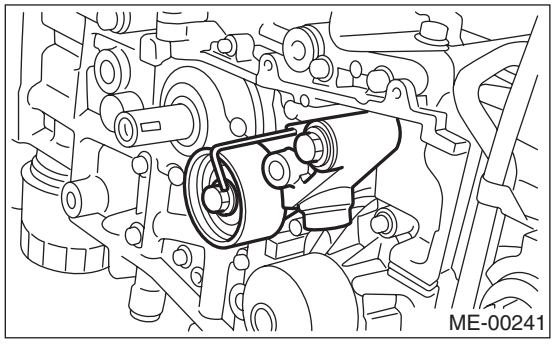


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



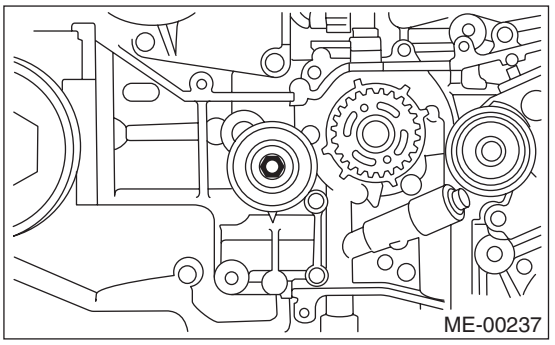
2) Install automatic belt tension adjuster assembly.

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

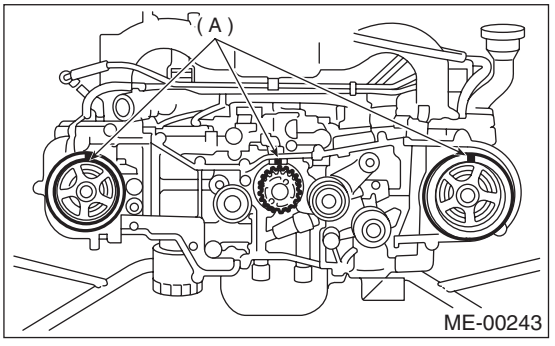
1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-45, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

2) Installation of timing belt

(1) Turn camshaft sprocket No. 2 using ST1, and turn camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

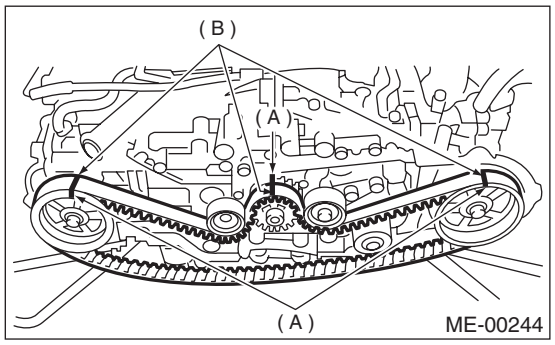
ST1 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
CAMSHAFT SPROCKET WRENCH (499207100) is also can be used.



(2) While aligning alignment mark (B) on timing belt with marks on sprockets (A), position timing belt properly.

NOTE:
Ensure belt's rotating direction is correct.

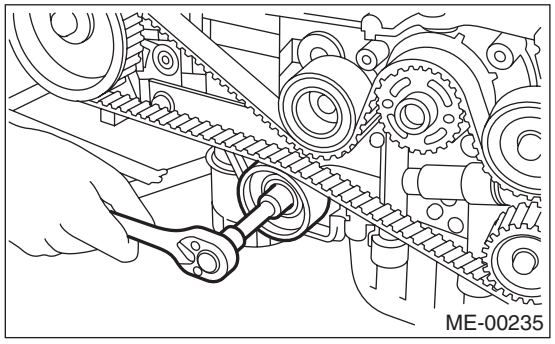


3) Install belt idler No. 2.

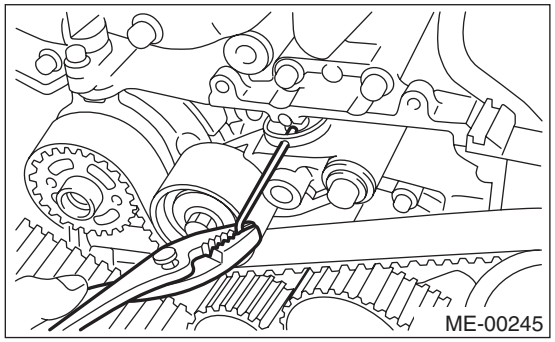
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

4) Install belt idler (No. 2).

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

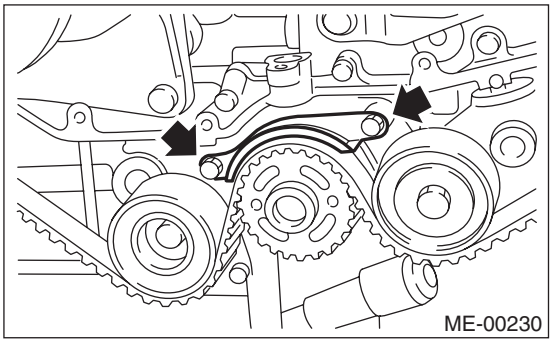


5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove stopper pin from belt tensioner adjuster.



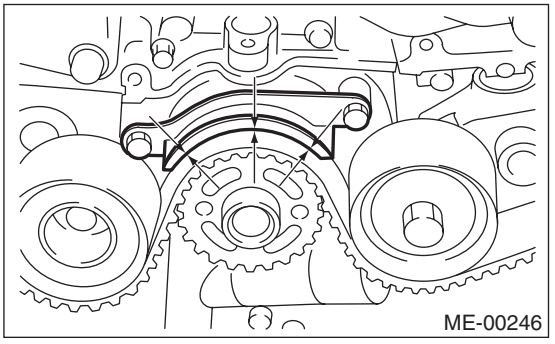
6) Install timing belt guide. (MT vehicles only)

(1) Temporarily tighten bolts.



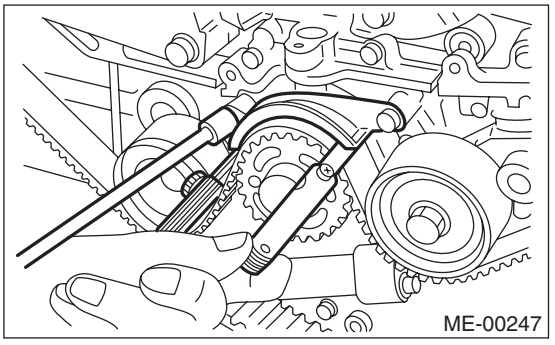
(2) Check and adjust clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten bolts.

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



7) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
8) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
9) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

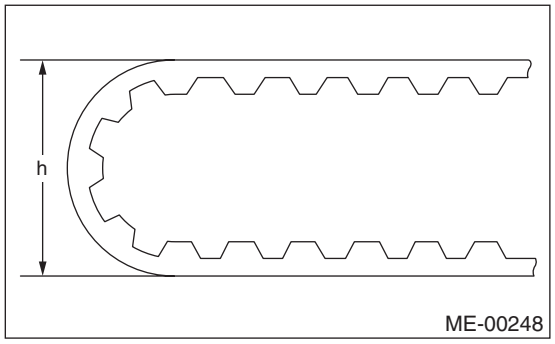
C: INSPECTION

1. TIMING BELT

1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.
2) Check the condition of back side of belt; if any crack is found, replace 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



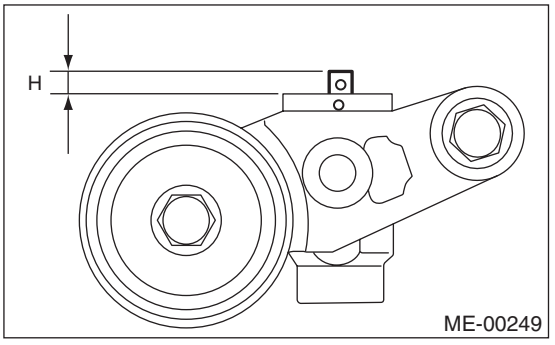
2. AUTOMATIC BELT TENSION ADJUSTER

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 stiffness.
3) If the adjuster rod is not stiff 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 stiffness.
(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

CAUTION:
• Always use a vertical type pressing tool to push the adjuster rod downward.
• Do not use a lateral type vise.
• Push adjuster rod vertically.
• Press-in the push adjuster rod gradually taking more than three 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 mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace automatic belt tension adjuster assembly if faulty.
2) Check tension pulley for smooth rotation. Replace if noise or excessive play is noted.
3) Check tension pulley for grease leakage.

4. BELT IDLER

1) Check belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check belt idler for grease leakage.

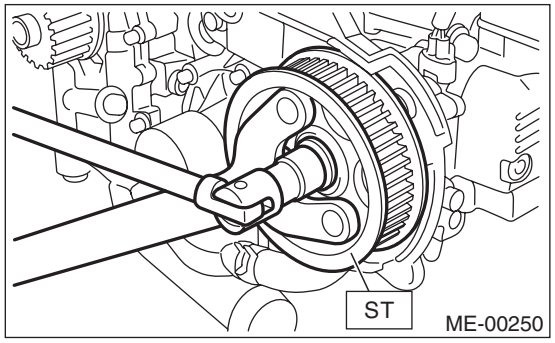
16.Camshaft Sprocket

A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
5) Remove camshaft position sensor. <Ref. to FU(H4SO)-29, REMOVAL, Camshaft Position Sensor.>
6) Remove camshaft sprocket No. 1 and No. 2. To lock camshaft, use ST.

ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
CAMSHAFT SPROCKET WRENCH (499207100) is also can be used.



B: INSTALLATION

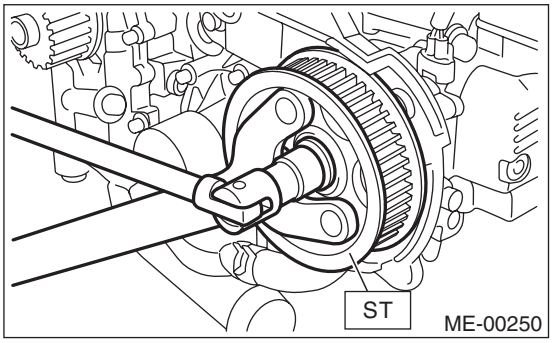
1) Install camshaft sprocket No. 1 and No. 2. To lock camshaft, use ST.

ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:
CAMSHAFT SPROCKET WRENCH (499207100) is also can be used.

Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)

CAUTION:
Do not confuse left and right side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.



2) Install camshaft position sensor.
<Ref. to FU(H4SO)-29, INSTALLATION, Camshaft Position Sensor.>
3) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
4) Install belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
5) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
6) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

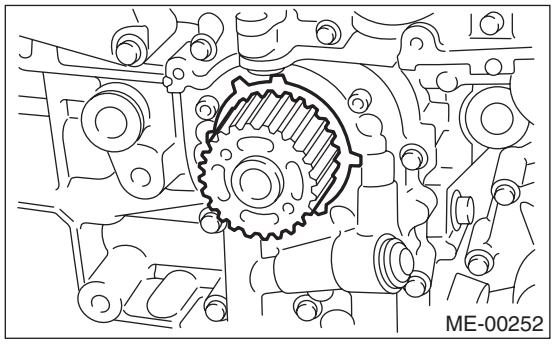
C: INSPECTION

1) Check sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check camshaft sprocket protrusion for sensor for damage and contamination of foreign matter.

17.Crankshaft Sprocket

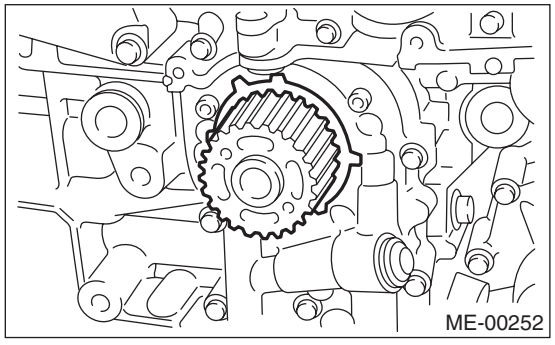
A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
5) Remove camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
6) Remove crankshaft sprocket.



B: INSTALLATION

1) Install crankshaft sprocket.



2) Install camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
3) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
4) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
5) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
6) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

C: INSPECTION

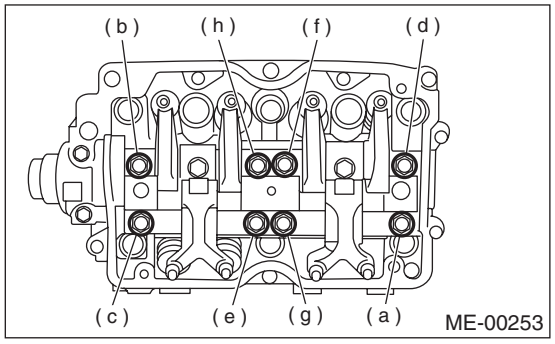
1) Check sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between sprocket and key.
3) Check crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

18.Valve Rocker Assembly

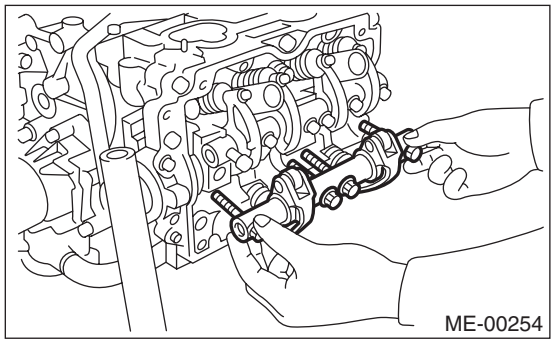
A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
5) Remove camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
6) Disconnect 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 valve rocker assembly.



(2) Remove valve rocker assembly.



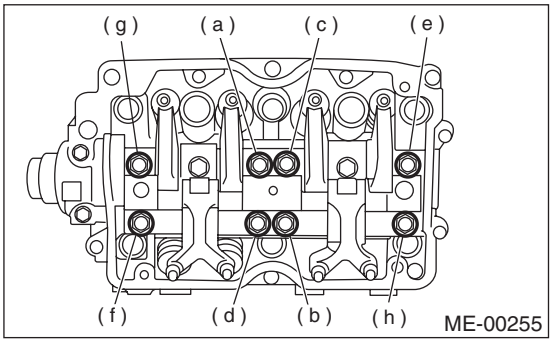
B: INSTALLATION

1) Installation of valve rocker assembly
   (1) Temporarily tighten bolts (a) through (d) in alphabetical order equally as shown in figure.

NOTE:
Do not allow valve rocker assembly to damage knock pins.

   (2) Tighten bolts (e) through (h) in alphabetical order to specified torque.
   (3) Tighten bolts (a) through (d) in alphabetical order to specified torque.

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



2) Adjust the valve clearances. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
3) Install rocker cover and connect PCV hose.
4) Install camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
5) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
6) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
7) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
8) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

C: DISASSEMBLY

1) Remove bolts which secure rocker shaft.
2) Extract rocker shaft. Remove valve rocker arms, springs, plates and shaft supports from rocker shaft.

NOTE:
Arrange all removed parts in order so that they can be installed correctly in their original positions.

3) Remove nut and adjuster screw from valve rocker.

D: ASSEMBLY

1) Install adjuster screw and nut to valve rocker.
2) Arrange 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 parts with same markings are properly assembled.

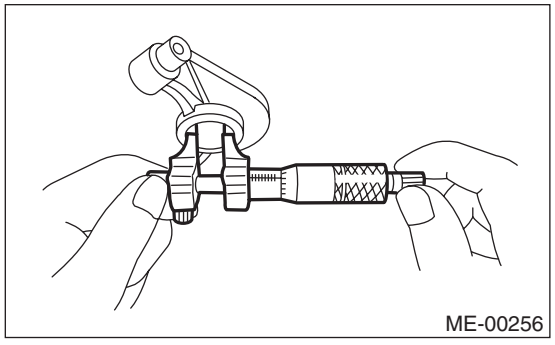
3) Install valve rocker shaft securing bolts.

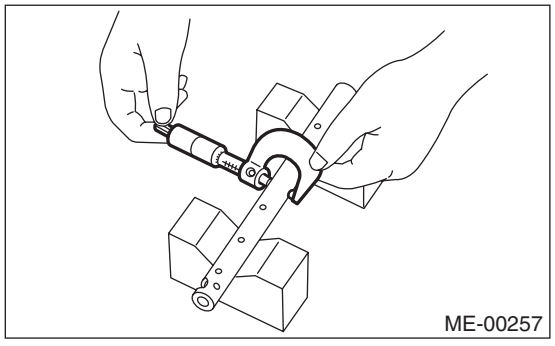
E: INSPECTION

1. VALVE ROCKER ARM AND ROCKER SHAFT

1) Measure 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 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)

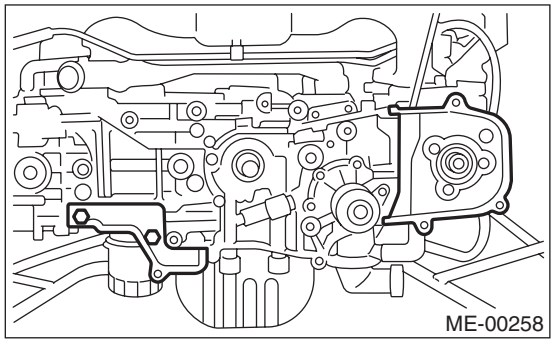
3) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace valve rocker arm.
4) Check that valve rocker arm roller rotates smoothly. If not, replace valve rocker arm.

19.Camshaft

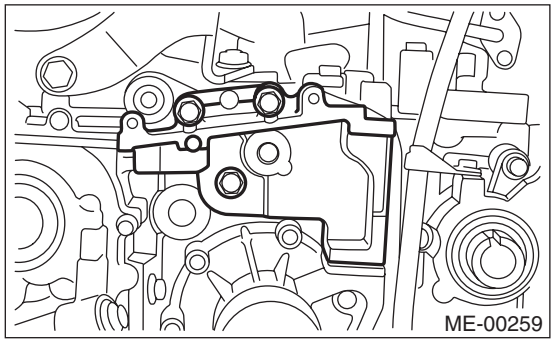
A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
5) Remove camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
6) Remove crankshaft sprocket. <Ref. to ME(H4SO)-50, REMOVAL, Crankshaft Sprocket.>
7) Remove belt cover No. 2 (LH).
8) Remove belt cover No. 2 (RH).

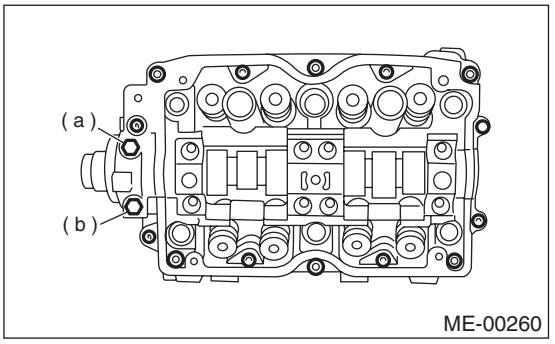
NOTE:
Do not damage or lose the seal rubber when removing belt covers.


ME-00258

9) Remove tensioner bracket.

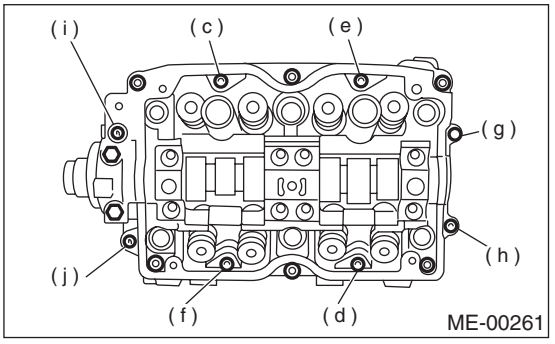

ME-00259

10) Remove camshaft position sensor support. (LH side only)
11) Remove oil level gauge guide. (LH side only)
12) Remove valve rocker assembly. <Ref. to ME(H4SO)-51, REMOVAL, Valve Rocker Assembly.>
13) Remove camshaft cap.
(1) Remove bolts (a) through (b) in alphabetical sequence.



ME-00260

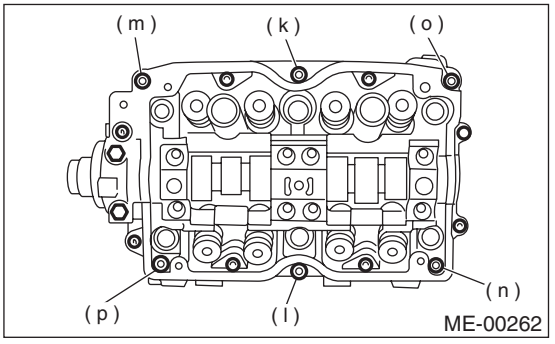
(2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.



ME-00261

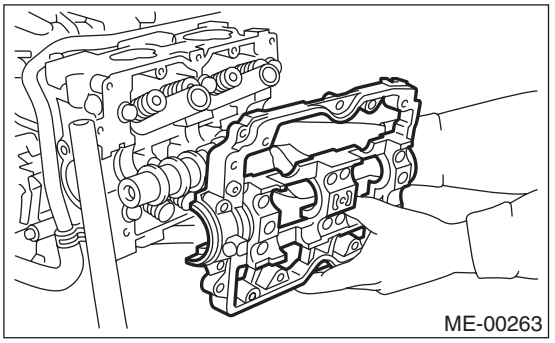
(3) Remove bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX PLUS



ME-00262

(4) Remove camshaft cap.


ME-00263

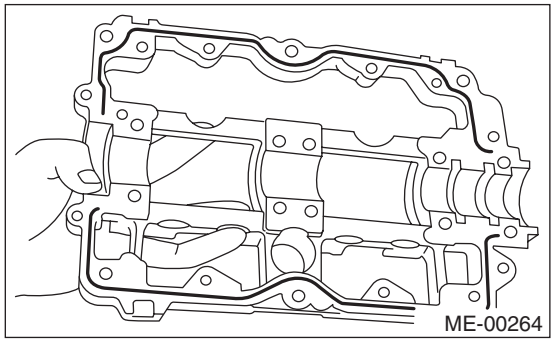
14) Remove camshaft.
15) Remove oil seal.
16) Remove plug from rear side of camshaft.

CAUTION:
- **Do not remove oil seal unless necessary.**
- **Do not scratch journal surface when removing oil seal.**

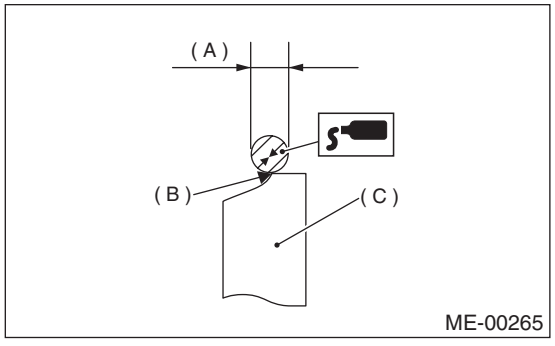
B: INSTALLATION

1) Apply a coat of engine oil to camshaft journals and install camshaft.
2) Install camshaft cap.
   (1) Apply liquid gasket on the around of camshaft cap.

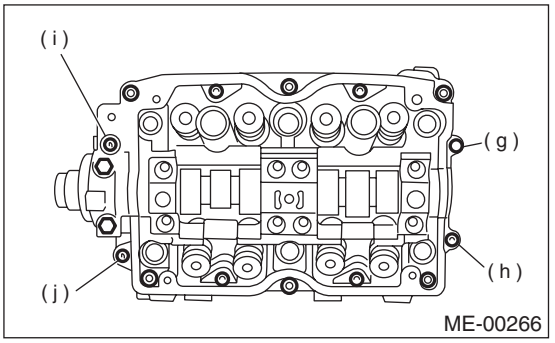
Liquid gasket:
THREE BOND 1280B
P/N K0877YA018



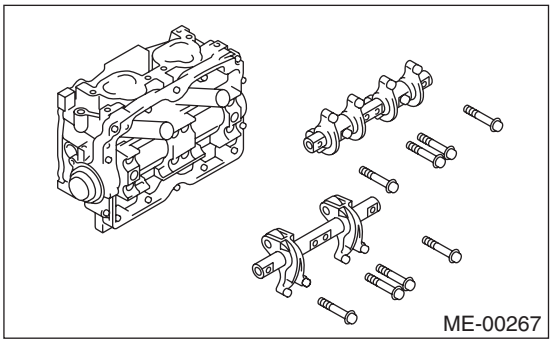
NOTE:
Thinly apply a 3 mm (0.12 in) diameter (A) continuous strip of liquid gasket along edge (B) of camshaft cap (C) mating surface.



(2) Temporarily tighten bolts (g) through (j) in alphabetical sequence.

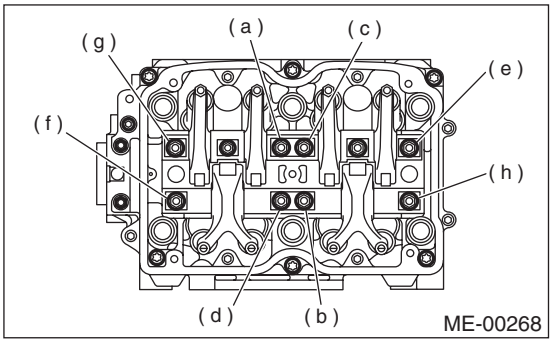


(3) Install valve rocker assembly.



(4) Tighten bolts (a) through (h) in alphabetical sequence.

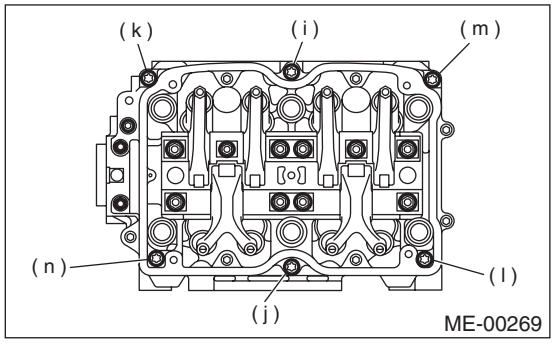
Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



(5) Tighten TORX bolts (i) through (n) in alphabetical sequence using ST.

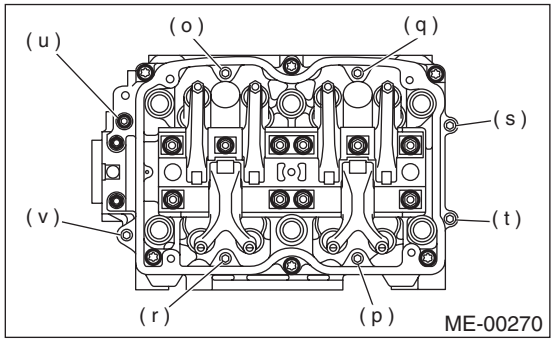
ST 499497000 TORX® PLUS

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



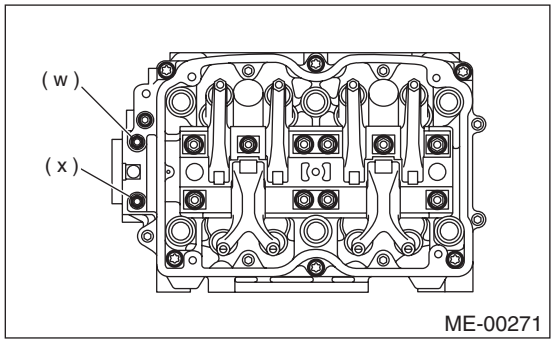
(6) Tighten bolts (o) through (v) in alphabetical sequence.

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



(7) Tighten bolts (w) through (x) in alphabetical sequence.

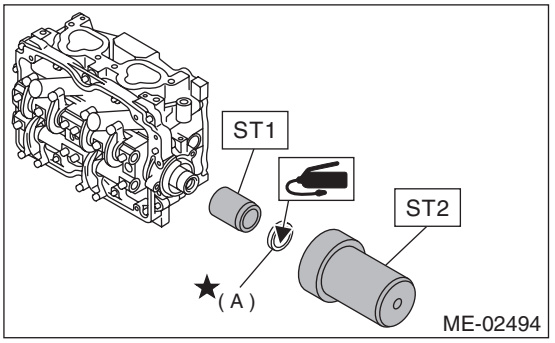
Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



3) Apply a coat of grease to oil seal lips and install oil seal (A) on camshaft using ST1 and ST2.

CAUTION:
Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE
ST2 499587500 CAMSHAFT OIL SEAL INSTALLER

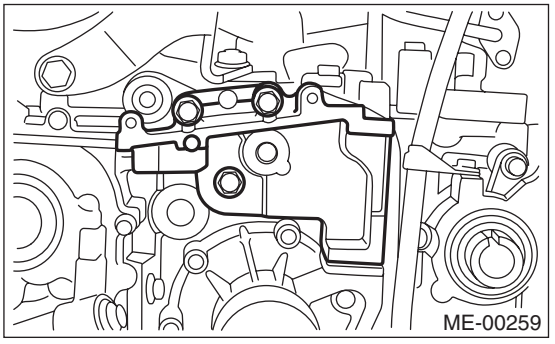


4) Install plug using ST.

ST 499587700 OIL SEAL INSTALLER

5) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
6) Install rocker cover and connect PCV hose.
7) Install oil level gauge guide. (LH side only)
8) Install camshaft position sensor support. (LH side only)
9) Install tensioner bracket.

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

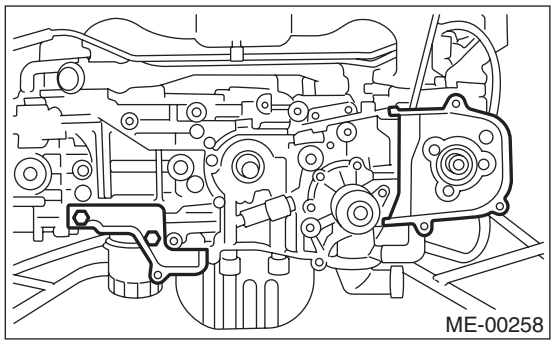


10) Install belt cover No. 2 (RH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

11) Install belt cover No. 2 (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



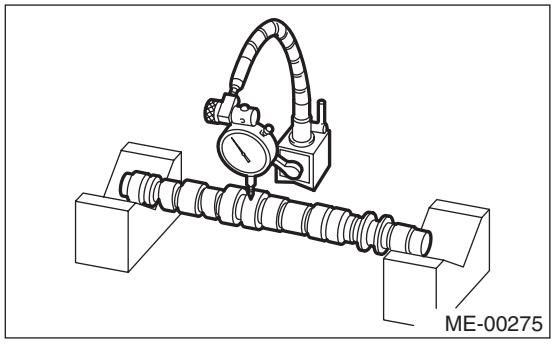
12) Install crankshaft sprocket. <Ref. to ME(H4SO)-50, INSTALLATION, Crankshaft Sprocket.>
13) Install camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
14) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
15) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
16) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
17) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

C: INSPECTION

1. CAMSHAFT

1) Measure the bend, and repair or replace if necessary.

Limit:
0.025 mm (0.0010 in)



2) Check journal for damage and wear. Replace if faulty.

3) Measure outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between the two (= oil clearance). If oil clearance exceeds specifications, replace camshaft or cylinder head as necessary.

Unit: mm (in)

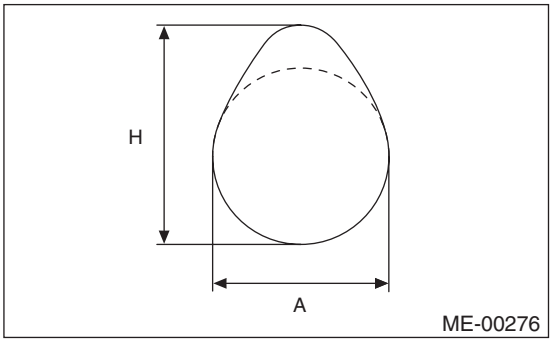
Clearance at journal	Standard	0.055 — 0.090 (0.0022 — 0.0035)
	Limit	0.10 (0.0039)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

4) Check cam face condition; remove minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

Cam height: H

Item		Unit: mm (in)
Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
	Limit	39.385 (1.5506)
Exhaust	STD	39.259 — 39.359 (1.5456 — 1.5496)
	Limit	39.159 (1.5417)

Cam base circle diameter A:
IN: 34.00 mm (1.3386 in)
EX: 34.00 mm (1.3386 in)



2. CAMSHAFT SUPPORT

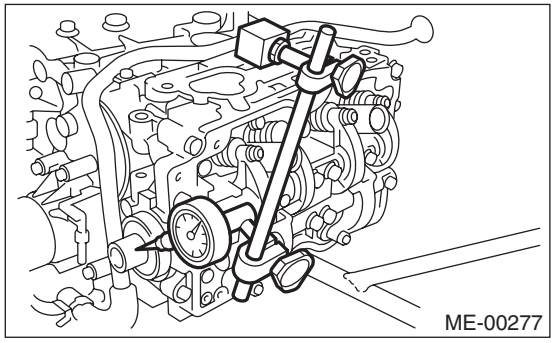
Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace camshaft support.

Standard:

0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:

0.10 mm (0.0039 in)

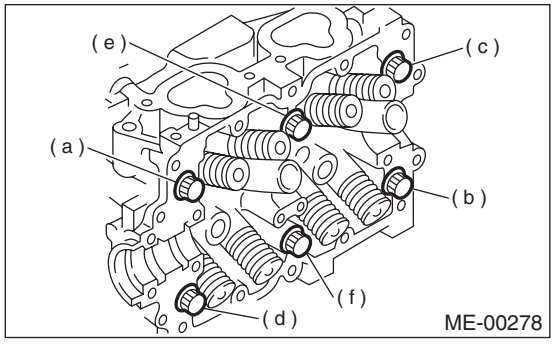


20.Cylinder Head Assembly

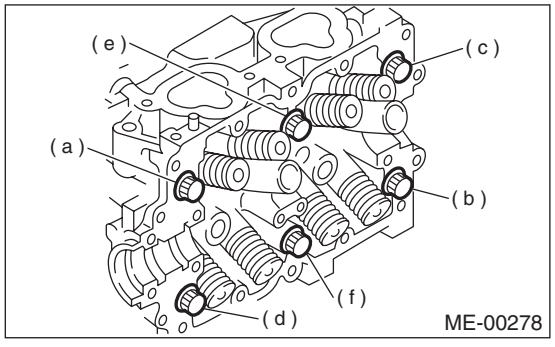
A: REMOVAL

1) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
2) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
3) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
4) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
5) Remove camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
6) Remove intake manifold. <Ref. to FU(H4SO)-15, REMOVAL, Intake Manifold.>
7) Remove bolt which installs A/C compressor bracket on cylinder head.
8) Remove valve rocker assembly. <Ref. to ME(H4SO)-51, REMOVAL, Valve Rocker Assembly.>
9) Remove camshaft. <Ref. to ME(H4SO)-53, REMOVAL, Camshaft.>
10) Remove cylinder head bolts in alphabetical sequence shown in figure.

NOTE:
Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



11) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
12) Remove bolts (a) and (c) to remove cylinder head.



13) Remove cylinder head gasket.

CAUTION:
Do not scratch the mating surface of cylinder head and cylinder block.

14) Similarly, remove right side cylinder head.

B: INSTALLATION

1. CYLINDER HEAD

1) Install cylinder head and gaskets on cylinder block.

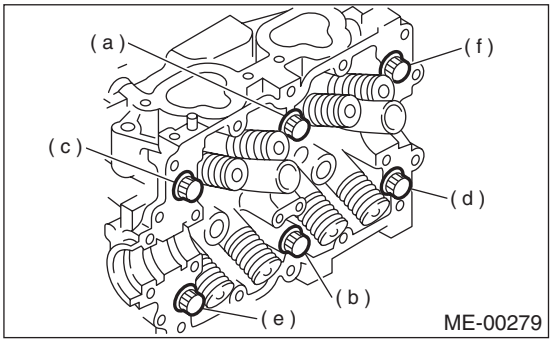
CAUTION:
- **Use new cylinder head gaskets.**
- **Be careful not to scratch the mating surface of cylinder block and cylinder head.**

2) Tighten cylinder head bolts.
(1) Apply a thin coat of engine oil to 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° with reversing order of assembly and after that back them off by 180° again.
(4) Tighten all bolts to 42 N·m (4.3 kgf-m, 31 ft-lb).
(5) Tighten all bolts by 80 to 90° in alphabetical sequence.
(6) Tighten all bolts by 40 to 45° in alphabetical sequence.

CAUTION:
Make sure that the tightening angle of bolt does not exceed 45°.

(7) Further tighten bolts (a) and (b) by 40 to 45°.

CAUTION:
Ensure that the total "re-tightening angle" [in the steps 6 and 7], do not exceed 90°.



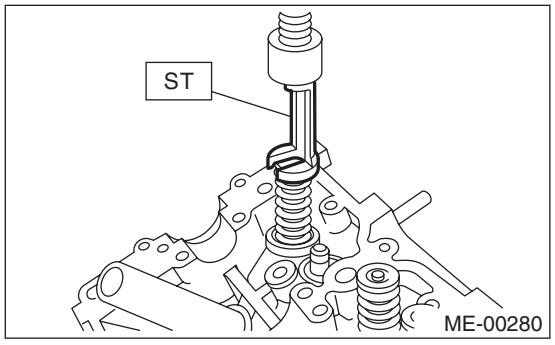
3) Install camshaft. <Ref. to ME(H4SO)-54, INSTALLATION, Camshaft.>
4) Install valve rocker assembly. <Ref. to ME(H4SO)-51, INSTALLATION, Valve Rocker Assembly.>
5) Install A/C compressor bracket on cylinder head.

6) Install intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>
7) Install camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
8) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
9) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
10) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
11) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>

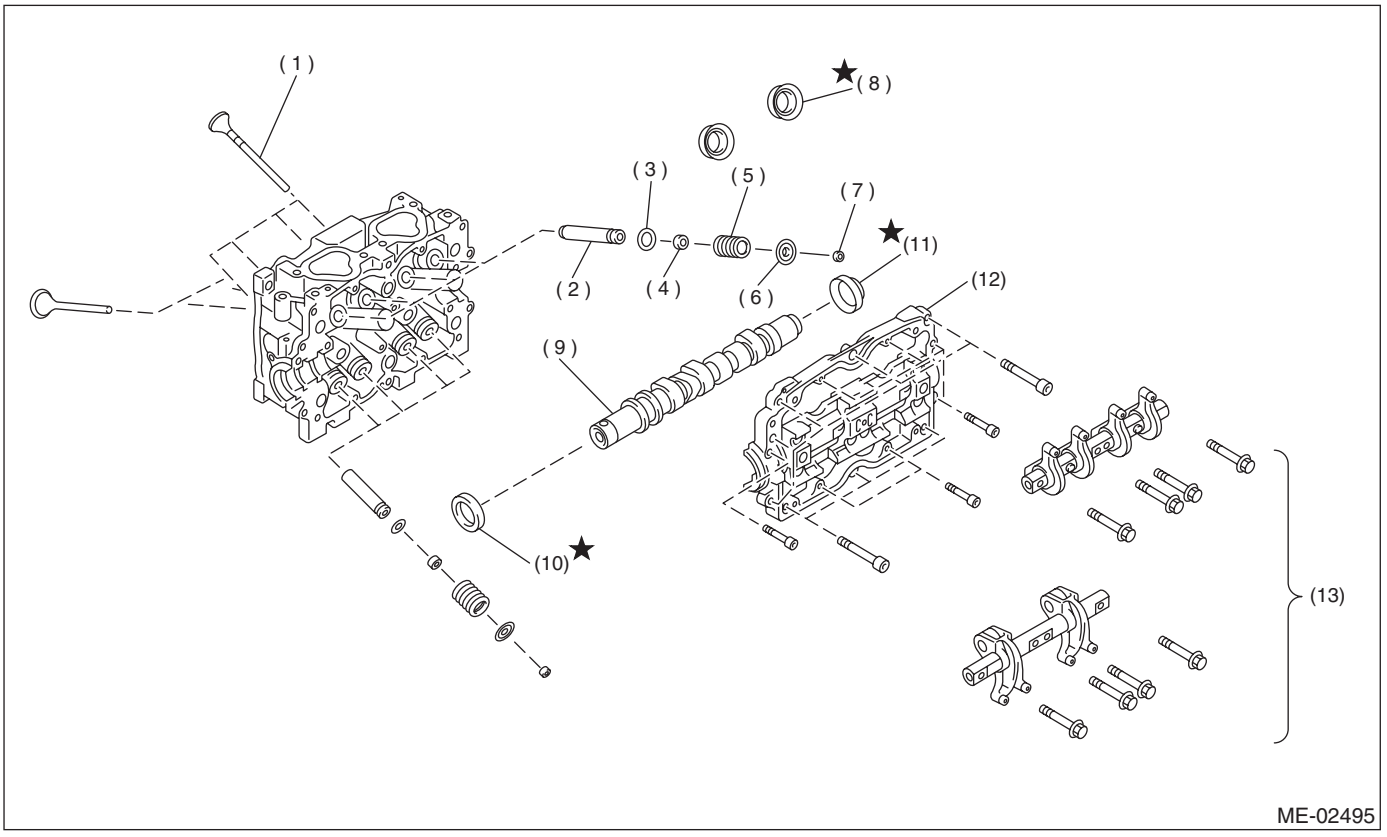
C: DISASSEMBLY

1) Place cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE
2) Set ST on valve spring. Compress valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST 499718000 VALVE SPRING REMOVER

CAUTION:
- **Mark each valve to prevent confusion.**
- **Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.**



D: ASSEMBLY



(1) Valve
(2) Valve guide
(3) Valve spring seat
(4) Oil seal
(5) Valve spring
(6) Retainer
(7) Retainer key
(8) Spark plug pipe gasket
(9) Camshaft
(10) Oil seal
(11) Plug
(12) Camshaft cap
(13) Valve rocker ASSY

1) Installation of valve spring and valve
(1) Place cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

(2) Coat stem of each valve with engine oil and insert valve into valve guide.

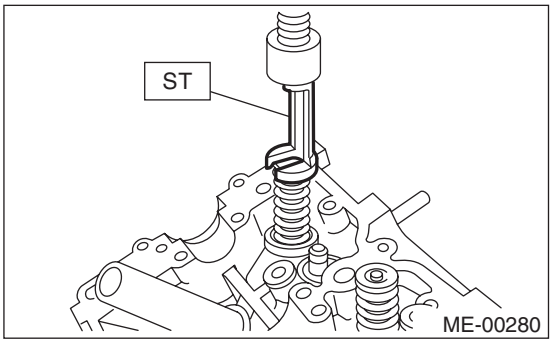
NOTE:
When inserting valve into valve guide, use special care not to damage the oil seal lip.

(3) Install valve spring and retainer.

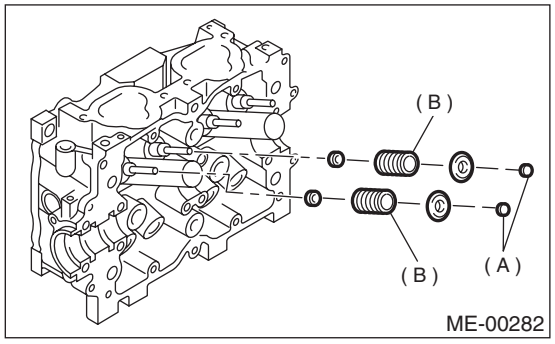
NOTE:
Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

(4) Set ST on valve spring.

ST 499718000 VALVE SPRING REMOVER



(5) Compress valve spring and fit retainer key.



(A) Retainer key
(B) Painted face

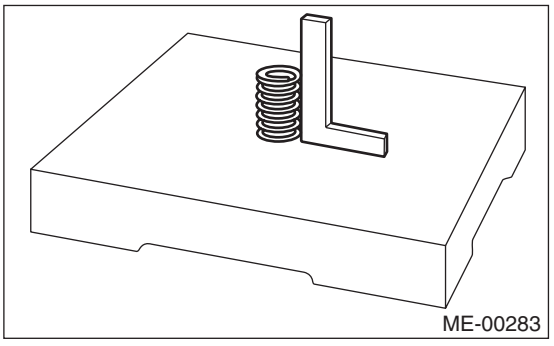
(6) After installing, tap valve spring retainers lightly with wooden hammer for better seating.

E: INSPECTION

1. VALVE SPRING

1) Check valve springs for damage, free length, and tension. Replace valve spring if it is not to the specifications presented below.
2) To measure the squareness of the 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 (22 — 25 kgf, 48 — 55 lb)/ 45.0 mm (1.772 in)
	526 — 582 N (54 — 59 kgf, 119 — 130 lb)/34.7 mm (1.366 in)



2. INTAKE AND EXHAUST VALVE OIL SEAL

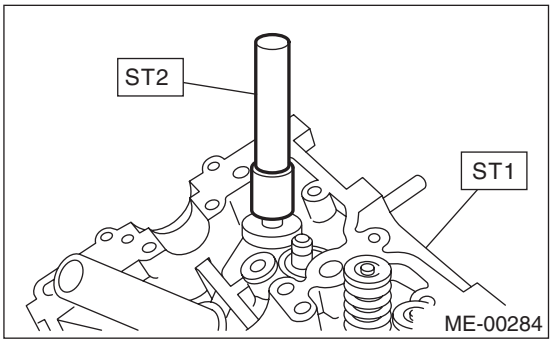
If following conditions are found, use pliers to pinch oil seal and remove it from valve, and replace it new one.
- Lip is damaged
- Spring out of place
- Reconditioning of surfaces for valve and valve seat is necessary
- Replacement of valve guide is necessary

1) Place 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 hammer or strike in.**
- **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 [Gray]
Exhaust [Green]



F: ADJUSTMENT

1. CYLINDER HEAD

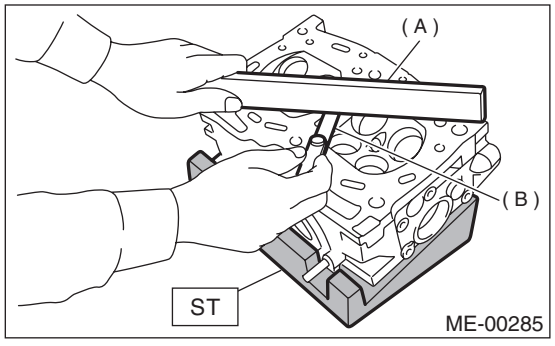
1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.
Also make sure that gasket installing surface shows no trace of gas and water leaks.
2) Place cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE
3) Measure the warping 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:
0.035 mm (0.0014 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.

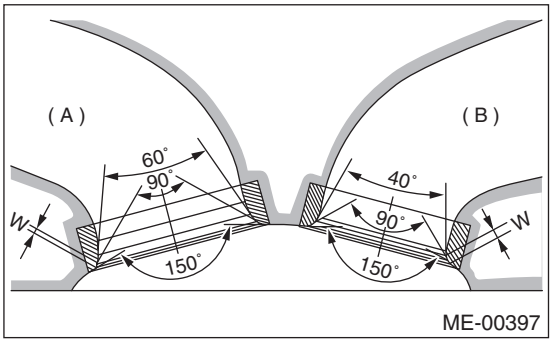


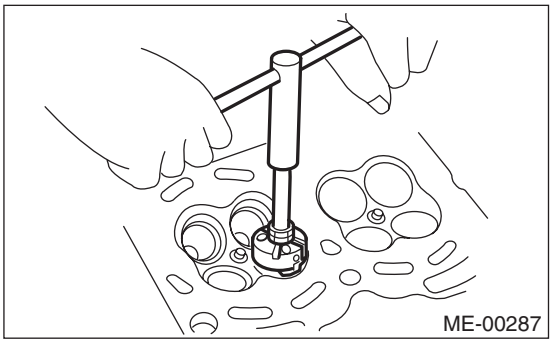
(A) Straight edge
(B) Thickness gauge

2. VALVE SEAT

Inspect intake and exhaust valve seats, and 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 0.14 — 0.8 mm (0.0055 — 0.0315 in)
Limit 1.8 mm (0.071 in)
Exhaust (B)
Standard 1.2 — 1.8 mm (0.047 — 0.071 in)
Limit 2.2 mm (0.087 in)

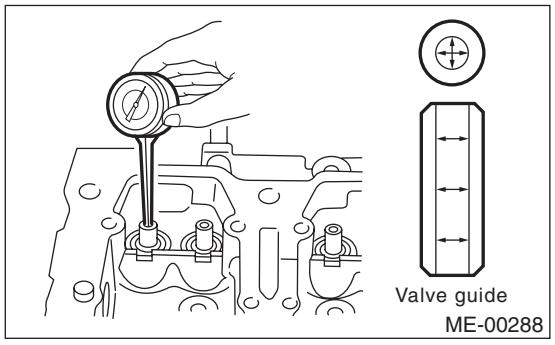


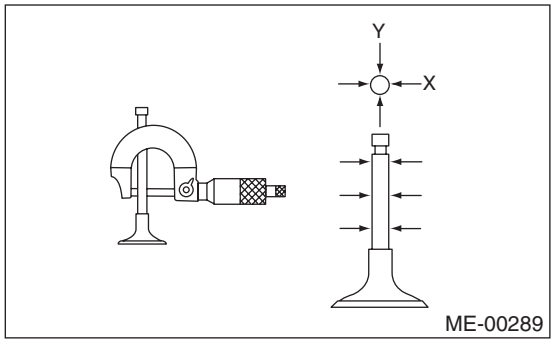


3. VALVE GUIDE

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)





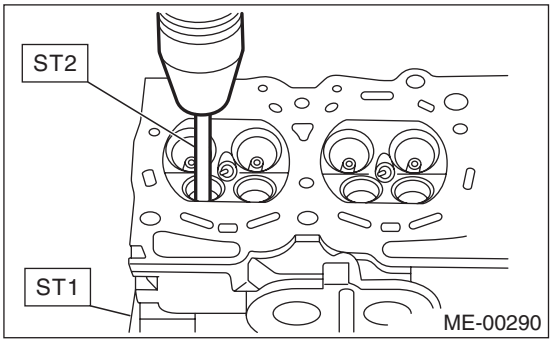
2) If the clearance between valve guide and stem exceeds the limit, replace valve guide or valve itself whichever shows greater amount of wear. See following procedure for valve guide replacement.

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)

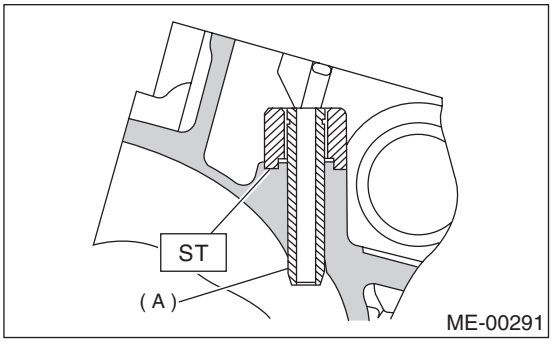
(1) Place cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.
(2) Insert ST2 into valve guide and press it down to remove valve guide.

ST1 498267800 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



(3) Turn 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

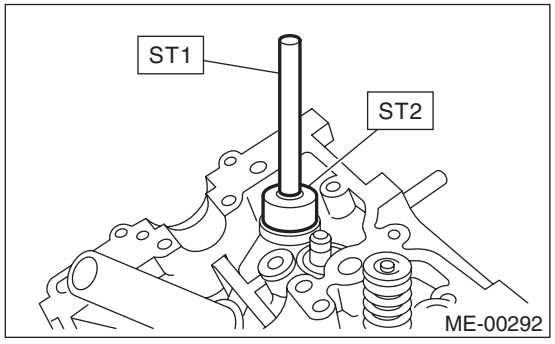


(A) Valve guide

(4) Before installing new oversize valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.

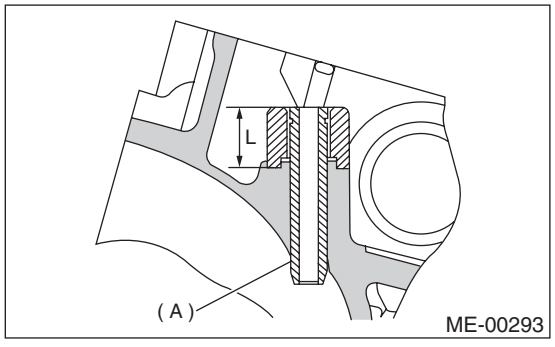
(5) Put new valve guide, coated with sufficient oil, in cylinder, and insert ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
Intake side:
ST2 499767700 VALVE GUIDE ADJUSTER
Exhaust side:
ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

Valve guide protrusion: L
Intake
20.0 — 21.0 mm (0.787 — 0.827 in)
Exhaust
16.5 — 17.5 mm (0.650 — 0.689 in)

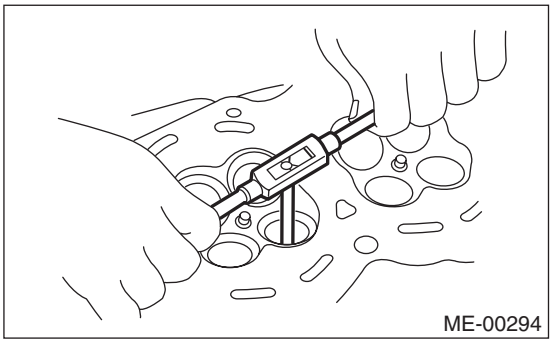


(A) Valve guide

(7) Ream the inside of valve guide with ST. Slowly rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean valve guide to remove chips.

CAUTION:
• Apply engine oil to the reamer when reaming.
• If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
• If the inner surface of the valve guide becomes lustrous and the reamer does not chips, use a new reamer or remedy the reamer.

ST 499767400 VALVE GUIDE REAMER



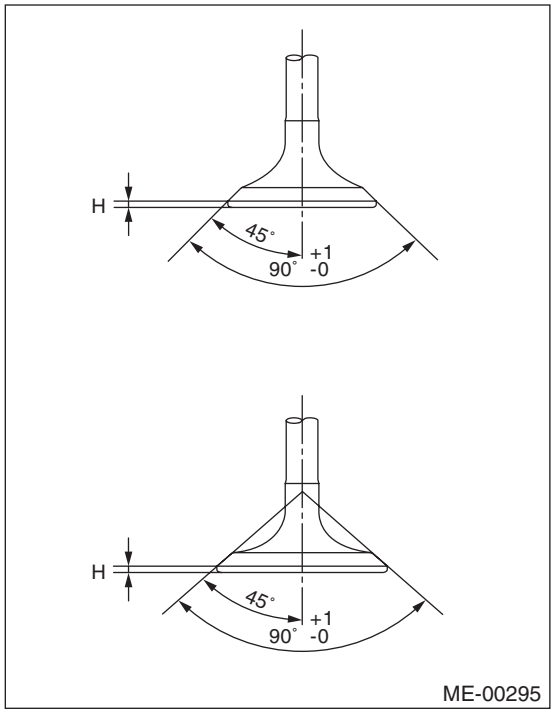
(8) Recheck the contact condition between valve and valve seat after replacing valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

H:
Intake
Standard 0.8 — 1.2 mm (0.031 — 0.047 in)
Limit 0.6 mm (0.024 in)
Exhaust
Standard 1.0 — 1.4 mm (0.039 — 0.055 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)-62, VALVE SEAT, ADJUSTMENT, Cylinder Head Assembly.> Install a new intake valve oil seal after lapping.

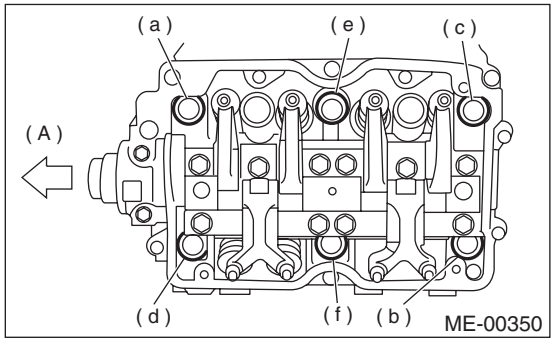
21.Cylinder Block

A: REMOVAL

NOTE:
Before conducting this procedure, drain engine oil completely.

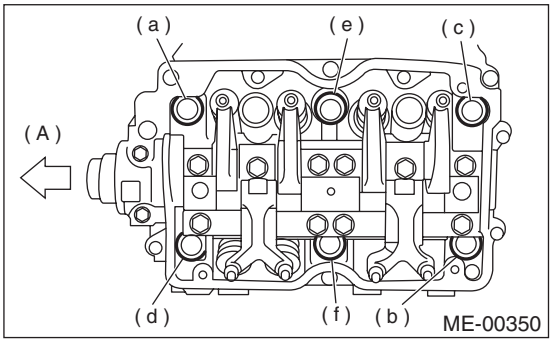
1) Remove intake manifold. <Ref. to FU(H4SO)-15, REMOVAL, Intake Manifold.>
2) Remove V-belt. <Ref. to ME(H4SO)-40, REMOVAL, V-belt.>
3) Remove crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
4) Remove timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
5) Remove timing belt. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt.>
6) Remove camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
7) Remove crankshaft sprocket. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
8) Remove generator and A/C compressor with their brackets.
9) Remove rocker cover.
10) Remove cylinder head bolts in alphabetical sequence shown in figure.

NOTE:
Leave bolts (a) and (b) engaged by three or four threads to prevent cylinder head from falling.



(A) Front side

11) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
12) Remove bolts (a) and (c) to remove cylinder head.



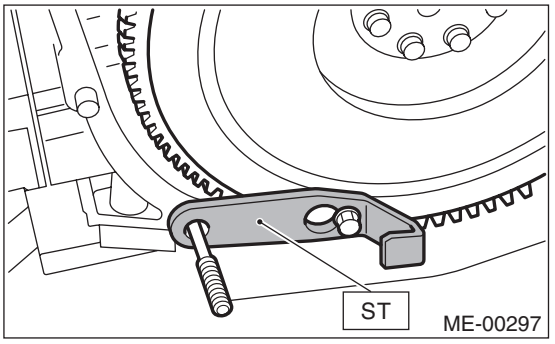
(A) Front side

13) Remove cylinder head gasket.

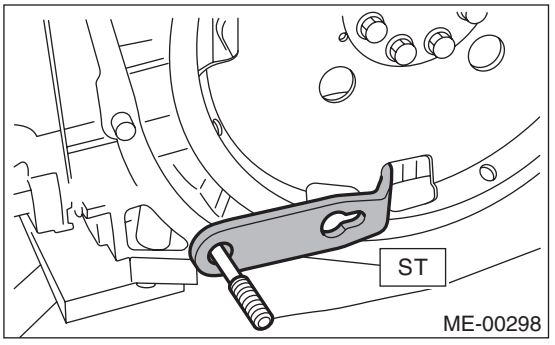
NOTE:
Do not scratch the mating surface of cylinder head and cylinder block.

14) Similarly, remove right side cylinder head.
15) Remove clutch housing cover (MT vehicles only).
16) Remove flywheel (MT vehicles only) or drive plate (AT vehicles only).
Using ST, lock crankshaft.
ST 498497100 CRANKSHAFT STOPPER

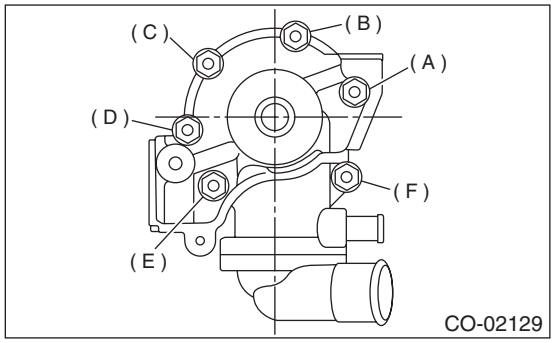
- MT model



- AT model

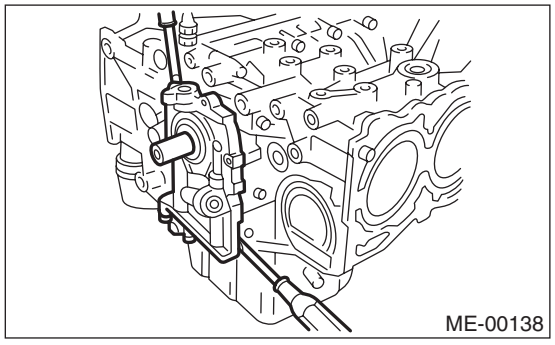


17) Remove oil separator cover.
18) Remove water by-pass pipe for heater.
19) Loosen bolts in alphabetical sequence as shown in figure and remove water pump.



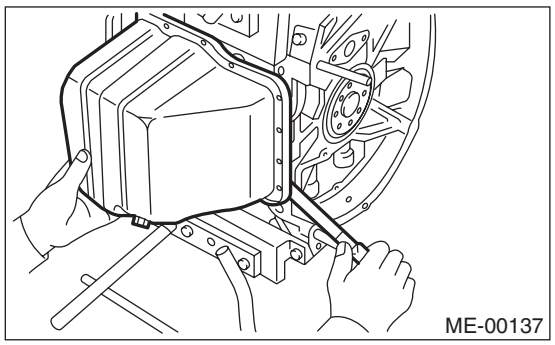
20) Remove oil pump from cylinder block.
Use a flat-bladed screwdriver as shown in figure when removing oil pump.

NOTE:
Be careful not to scratch the mating surface of cylinder block and oil pump.



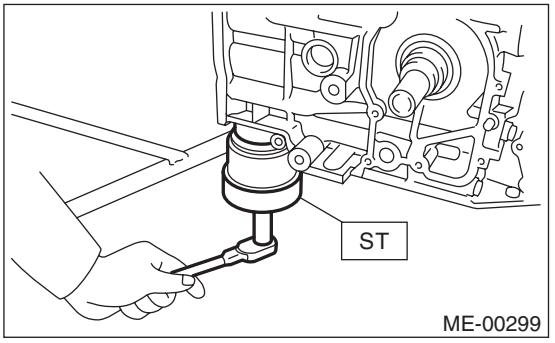
21) Removal of oil pan
(1) Turn cylinder block with #2 and #4 piston sides facing upward.
(2) Remove bolts which secure oil pan to cylinder block.
(3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance and remove oil pan.

NOTE:
Do not use a screwdriver or similar tool in place of oil pan cutter.

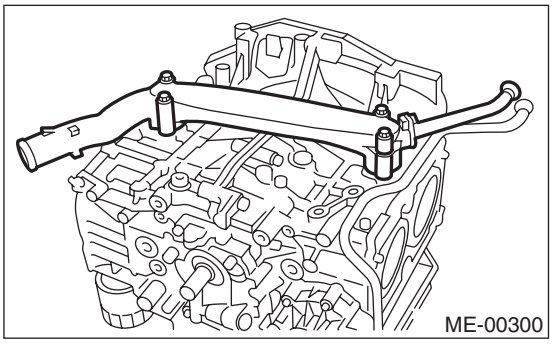


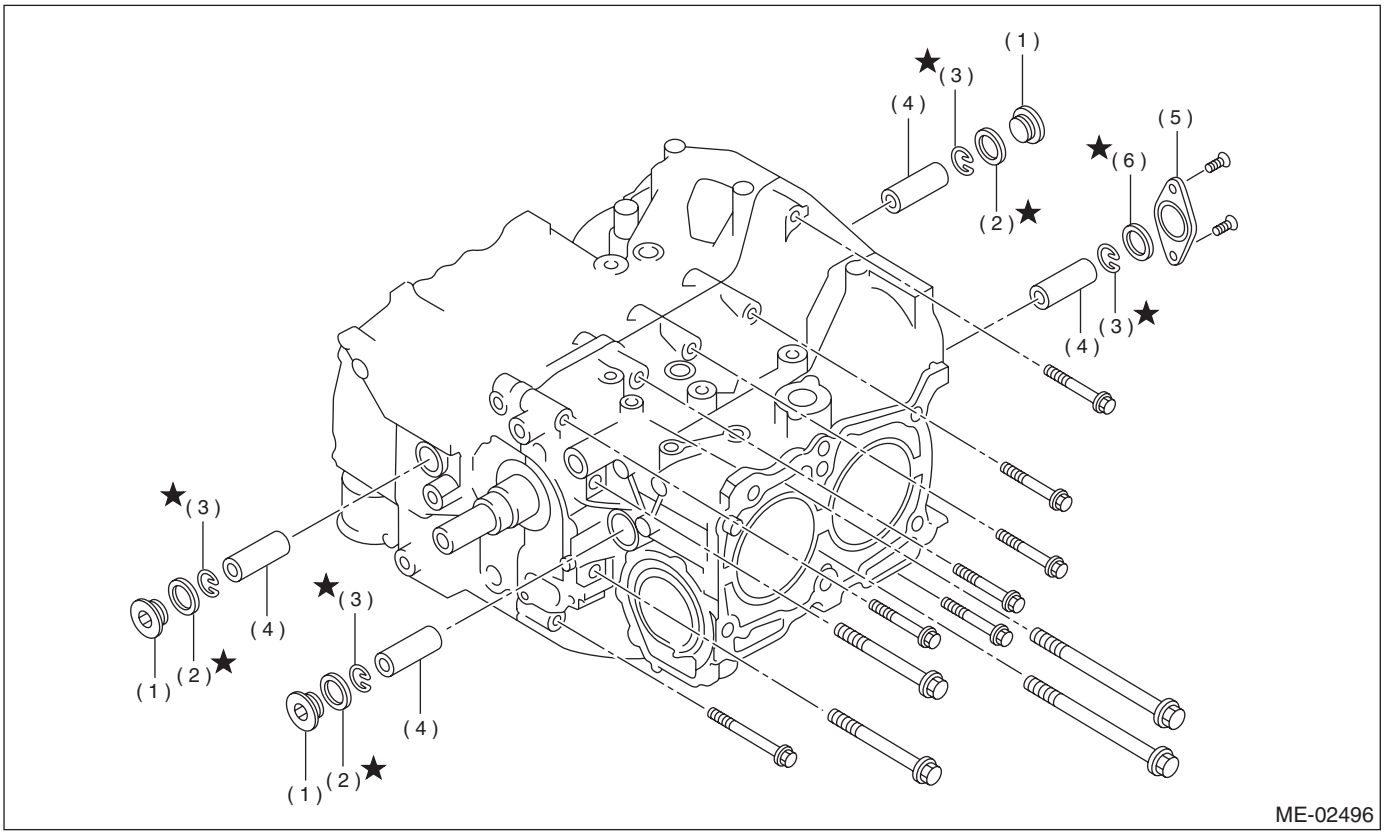
22) Remove oil strainer stay.
23) Remove oil strainer.
24) Remove baffle plate.
25) Remove oil filter using ST.

ST	498547000	OIL FILTER WRENCH [outer diameter 80 mm (3.15 in) for oil filter]
ST	18332AA000	OIL FILTER WRENCH [outer diameter 68 mm (2.68 in) for oil filter]
ST	18332AA010	OIL FILTER WRENCH [outer diameter 65 mm (2.56 in) for oil filter]



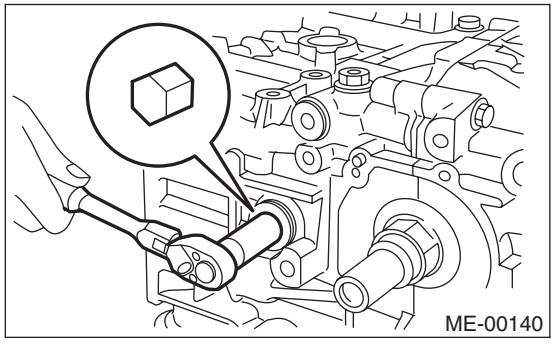
26) Remove water pipe.



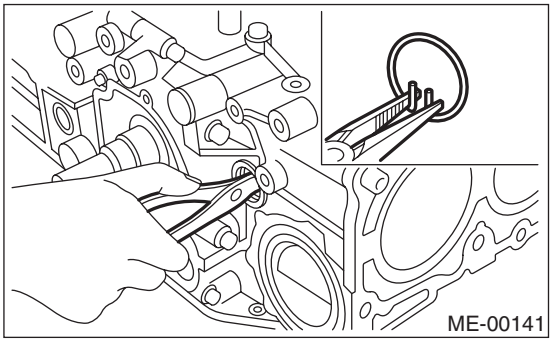


(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring

27) Remove service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].

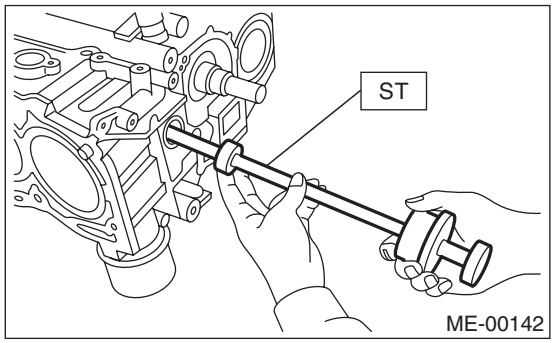


28) Rotate crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove piston snap ring through service hole of #1 and #2 cylinders.



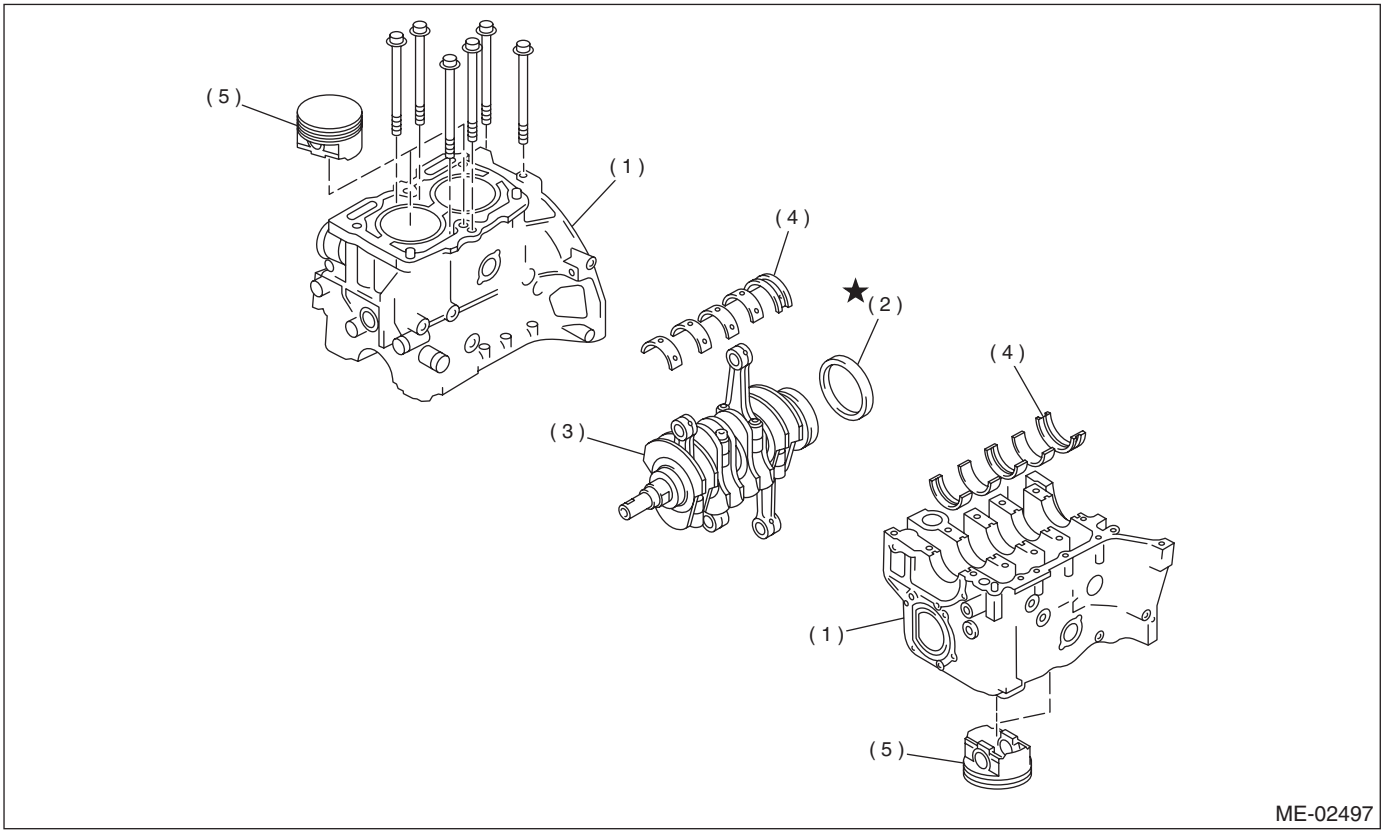
29) Draw out piston pin from #1 and #2 pistons using ST.
ST 499097700 PISTON PIN REMOVER

NOTE:
Be careful not to confuse original combination of piston, piston pin and cylinder.



30) Similarly remove piston pins from #3 and #4 pistons.
31) Remove bolts which connect cylinder block on the side of #2 and #4 cylinders.
32) Loosen bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.
33) Set up cylinder block so that #1 and #3 cylinders are on the upper side, then remove cylinder block connecting bolts.
34) Separate left-hand and right-hand cylinder blocks.

CAUTION:
When separating 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

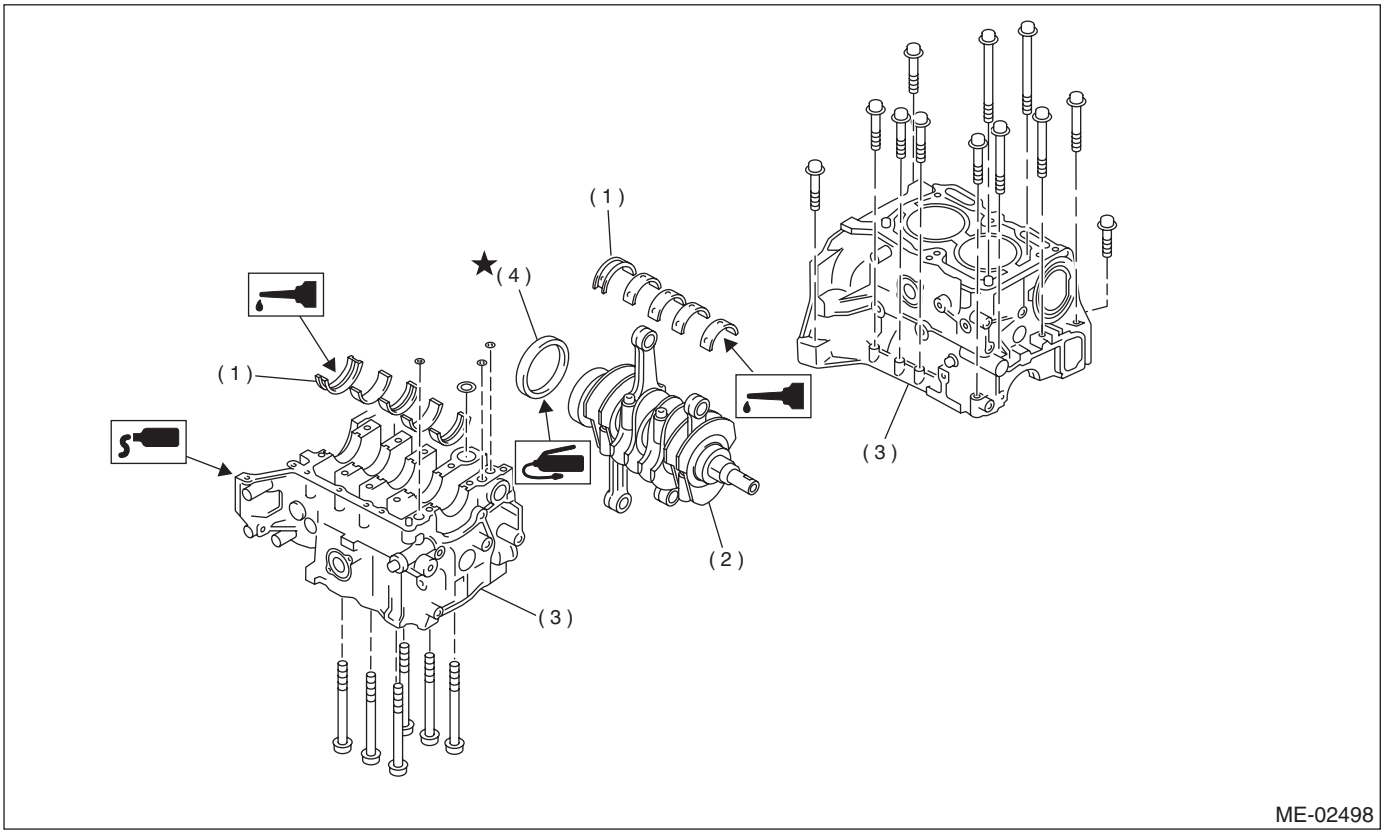
35) Remove rear oil seal.
36) Remove crankshaft together with connecting rod.
37) Remove crankshaft bearings from cylinder block using hammer handle.

NOTE:
Do not confuse combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

38) Remove pistons from cylinder block using hammer handle.

NOTE:
Do not confuse combination of pistons and cylinders.

B: INSTALLATION



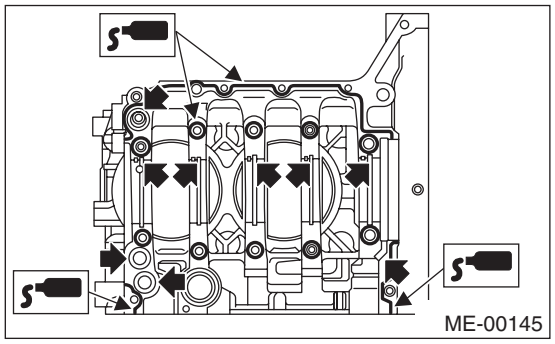
(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal

NOTE:
Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

1) Position crankshaft on the #2 and #4 cylinder block.
2) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

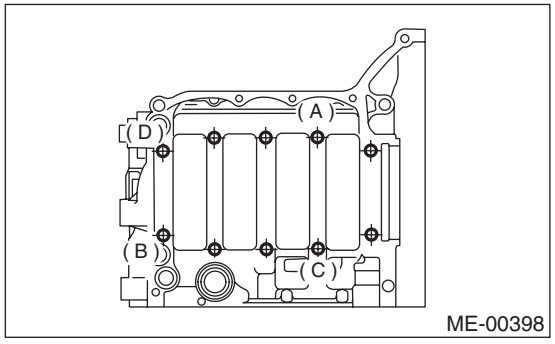
Fluid packing:
Part number 004403007
THREE BOND 1215 or equivalent

NOTE:
Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.



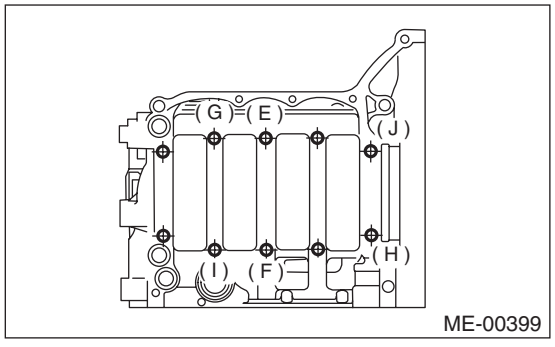
3) Coat the washers and threaded parts of the bolts with engine oil.
4) Tighten 10 mm cylinder block connecting bolts in alphabetical sequence shown in figure. (LH side)

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



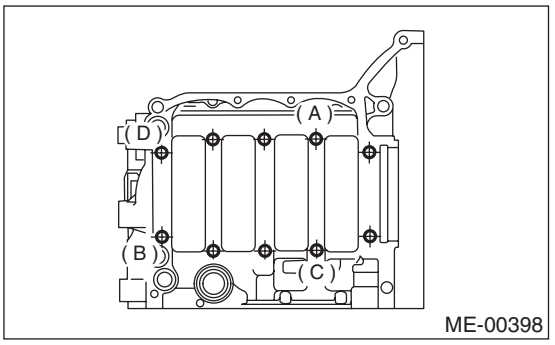
5) Tighten 10 mm cylinder block connecting bolts in alphabetical sequence shown in figure. (RH side)

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



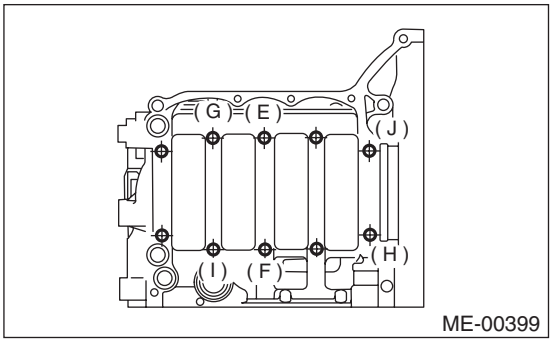
6) Tighten bolts (A to D) on left side of cylinder block more in alphabetical sequence.

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



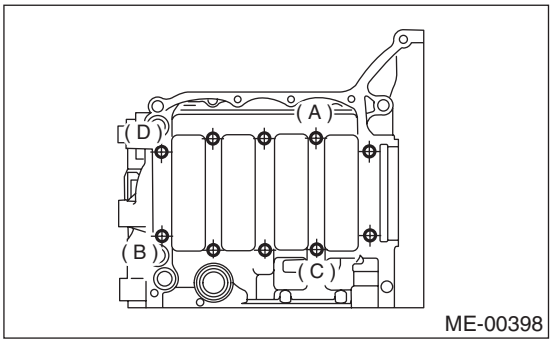
7) Tighten bolts (E to J) on right side of cylinder block more in alphabetical sequence.

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

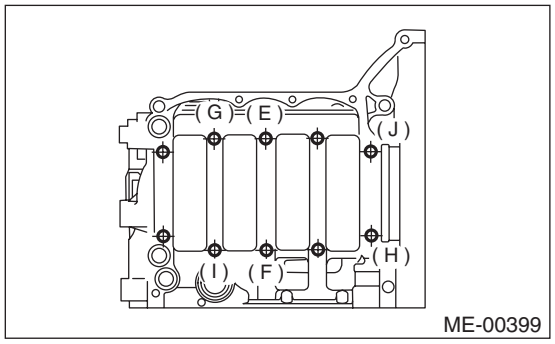


8) Tighten bolts (A and C) on left side of cylinder block 90° more in alphabetical order. And tighten bolts (B and D) more in alphabetical sequence.

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb

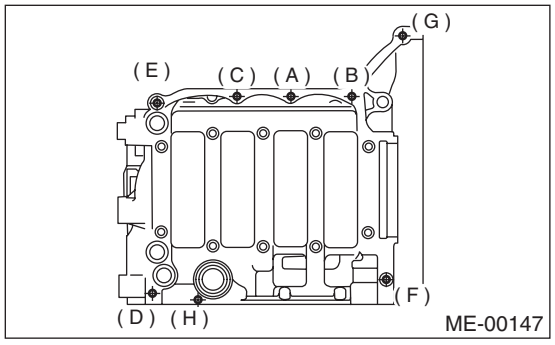


9) Tighten bolts (E to J) on right side of cylinder block 90° more in alphabetical sequence.

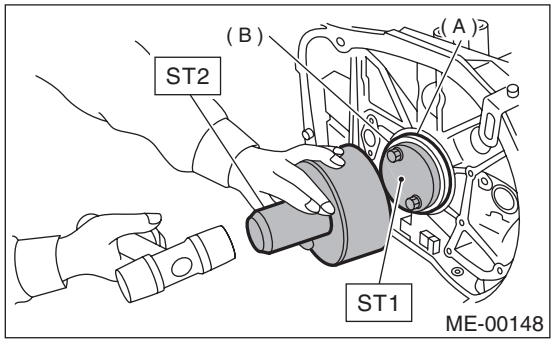


10) Tighten 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in figure.

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)

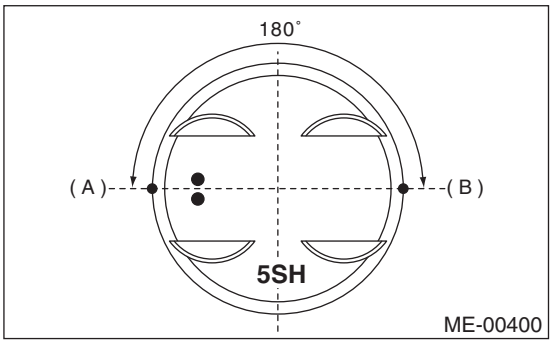


11) Install rear oil seal using ST1 and ST2.
ST1 499597100 OIL SEAL GUIDE
ST2 499587200 OIL SEAL INSTALLER

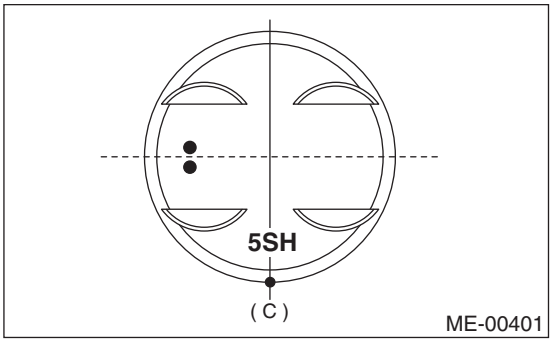


(A) Rear oil seal
(B) Flywheel attaching bolt

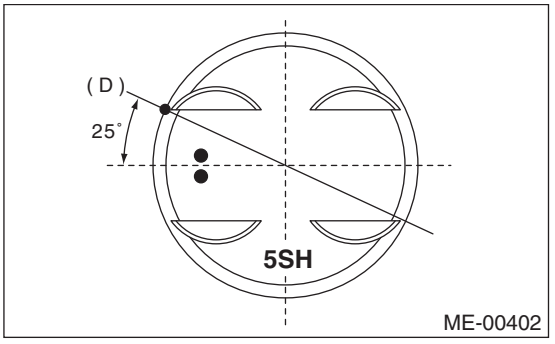
12) Position the top ring gap at (A) or (B) in the figure.
13) Position the second ring gap at 180° on the reverse side for the top ring gap.



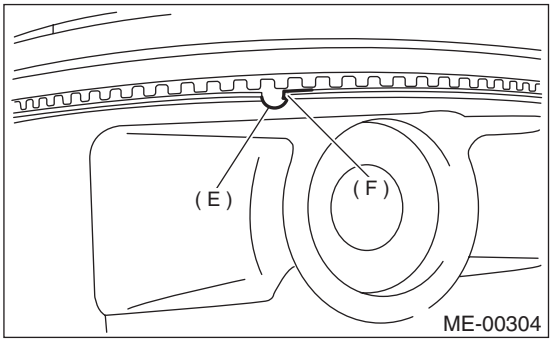
14) Position the expander gap at (C) in the figure.



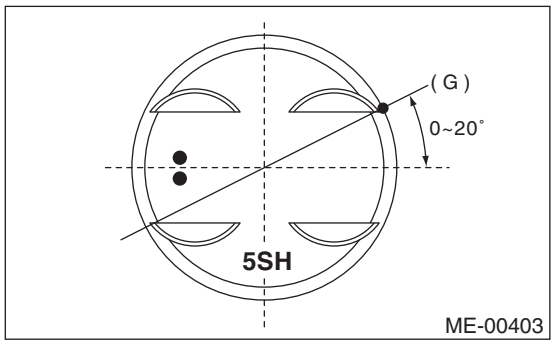
15) Position the lower rail gap at (D) in the figure.



NOTE:
Align lower rail spin stopper (F) with piston side surface hole (E).



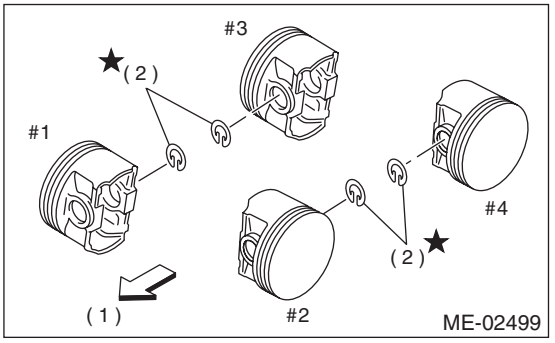
16) Position the upper rail gap at (G) in the figure.



CAUTION:
• Ensure ring gaps do not face the same direction.
• Ensure ring gaps are not within the piston skirt area.

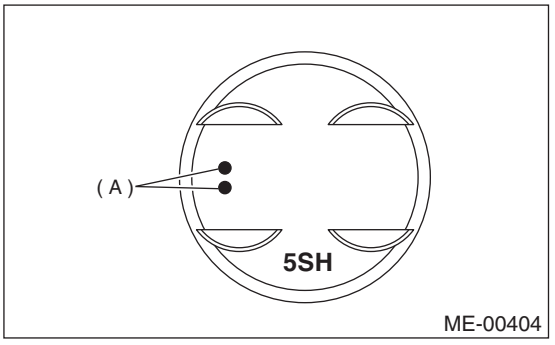
17) Install snap ring.
Install snap rings in piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

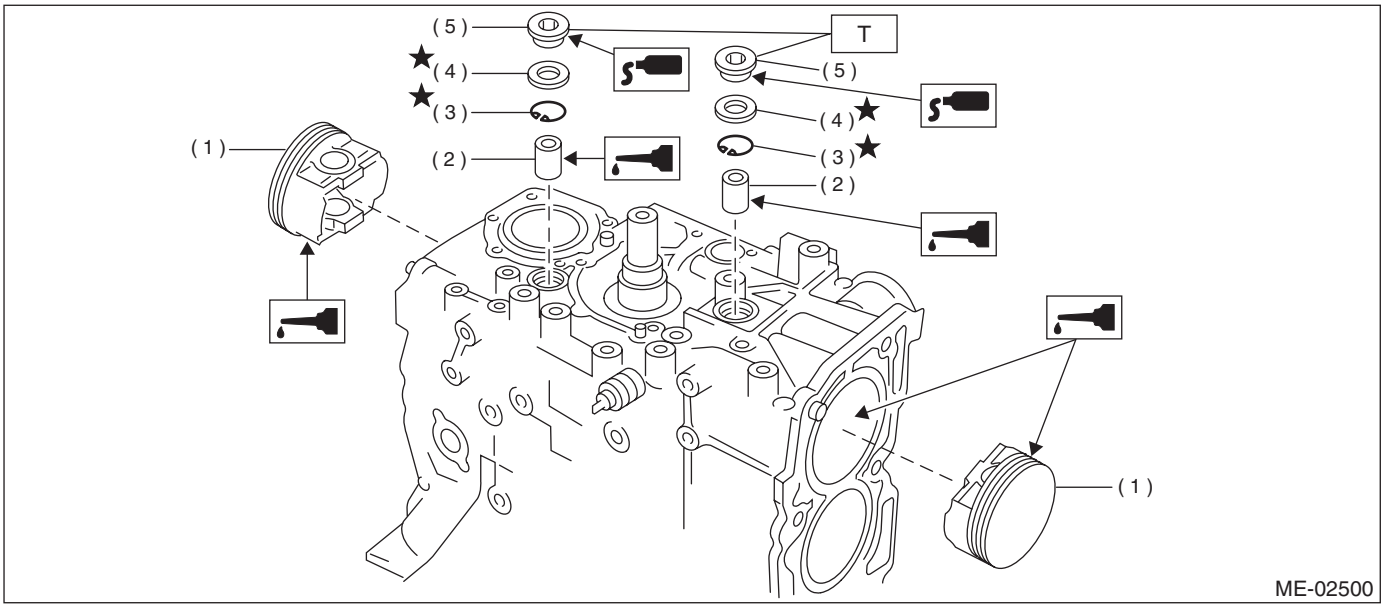
CAUTION:
Use new snap rings.



(1) Front
(2) Snap ring

CAUTION:
Piston front mark (A) faces towards the front of the engine.





(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug

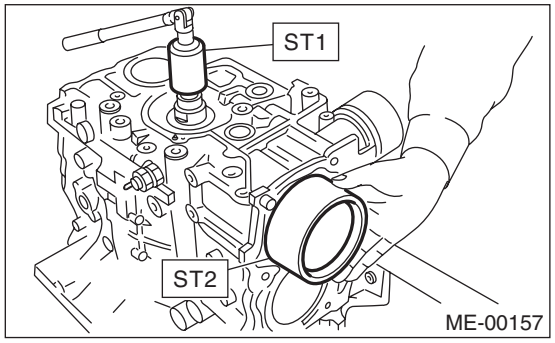
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51)

18) Installing piston
(1) Turn cylinder block so that #1 and #2 cylinders face upward.
(2) Using ST1, turn crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

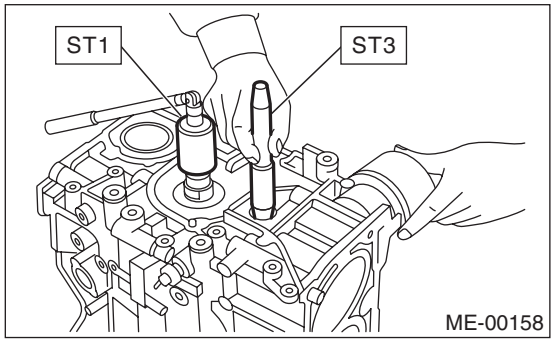
(3) Apply a coat of engine oil to pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



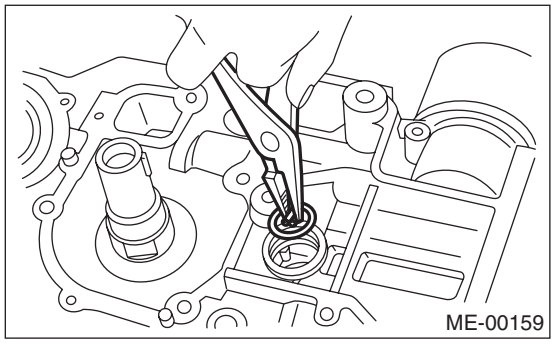
19) Installing piston pin
(1) Apply a coat of engine oil to ST3.
(2) Insert ST3 into service hole to align piston pin hole with connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



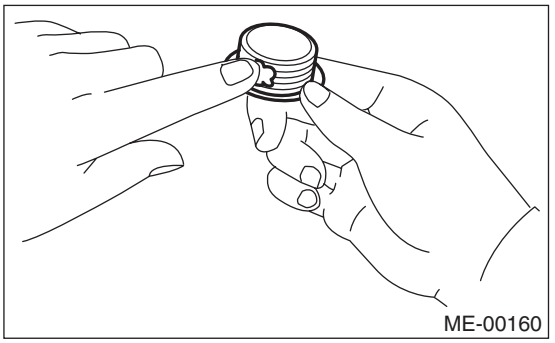
(3) Apply a coat of engine oil to piston pin and insert piston pin into piston and connecting rod through service hole.
(4) Install snap ring.

CAUTION:
Use new snap rings.



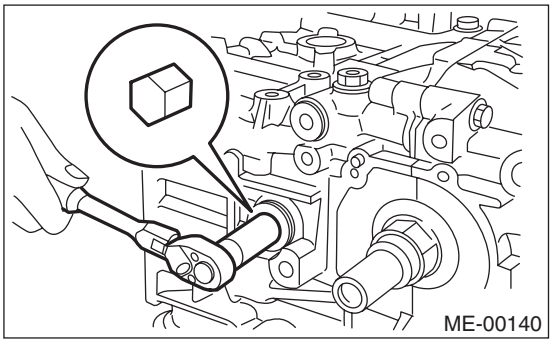
(5) Apply fluid packing around the service hole plug.

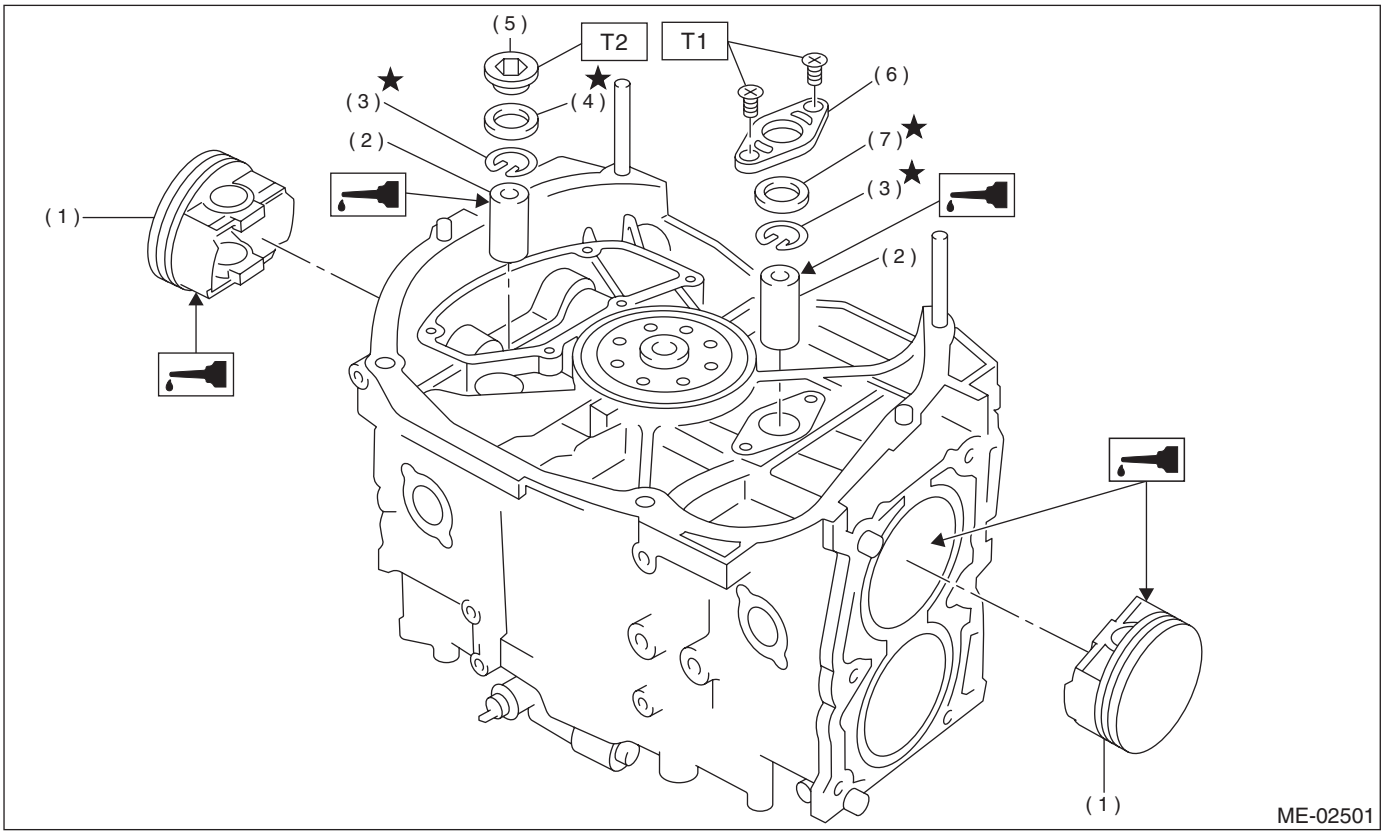
Fluid packing:
Part number 004403007
THREE BOND 1215 or equivalent



(6) Install service hole plug and gasket.

CAUTION:
Use a new gasket.



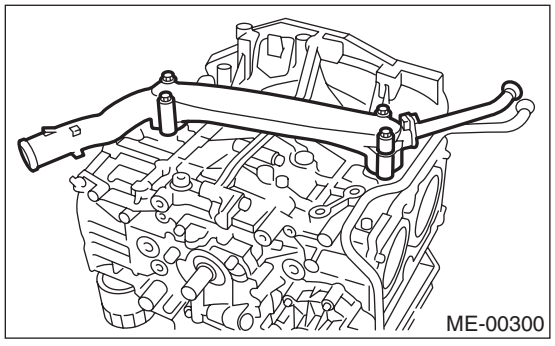


(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug
(6) Service hole cover
(7) O-ring

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 70 (7.1, 51)

(7) Turn cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install pistons and piston pins.

20) Install water pipe.



21) Install baffle plate.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

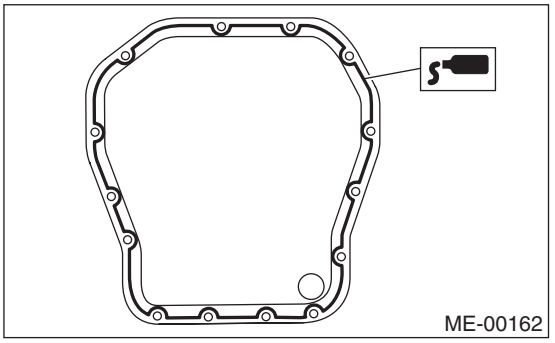
22) Install oil strainer and O-ring

Tightening torque:
10 N·m (1.0 kgf-m, 7 ft-lb)

23) Install oil strainer stay.

24) Apply fluid packing to matching surfaces and install oil pan.

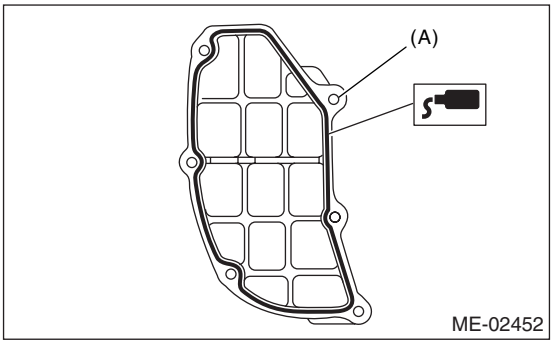
Fluid packing:
Part number 004403012
THREE BOND 1207C or equivalent



25) Apply fluid packing to matching surfaces and the bolt thread (A) as shown in the figure, and install oil separator cover.

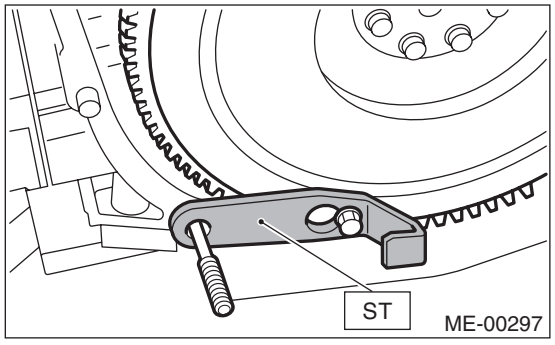
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

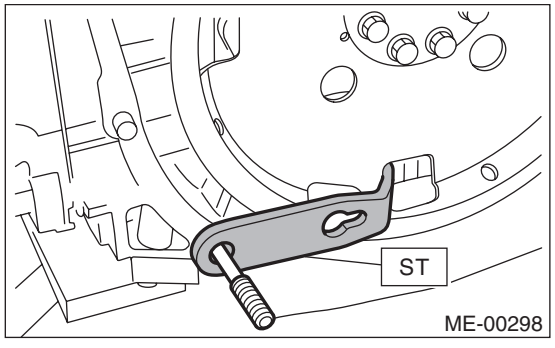
Fluid packing:
Part number 004403012
THREE BOND 1207C or equivalent



26) Install flywheel or drive plate.
To lock crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

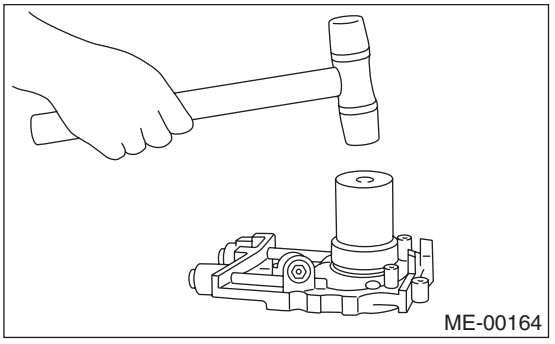
Tightening torque:
72 N·m (7.3 kgf-m, 52.8 ft-lb)





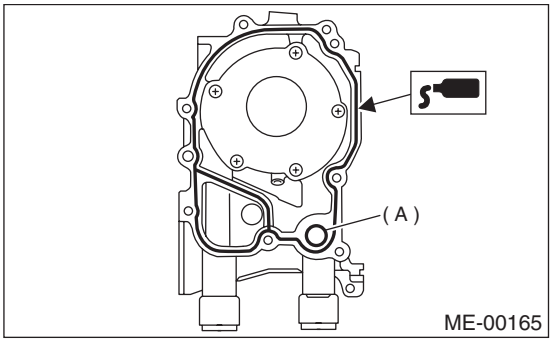
27) Install housing cover.

28) Installation of oil pump
(1) Discard front oil seal after removal. Replace with a new one using ST.
ST 499587100 OIL SEAL INSTALLER



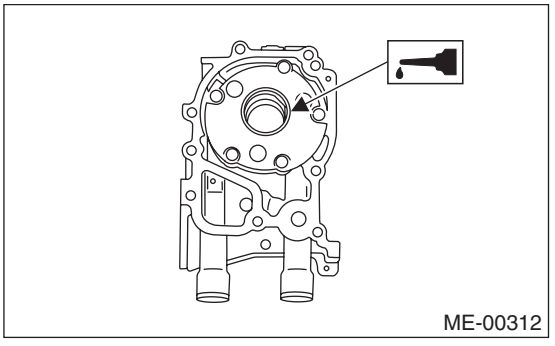
(2) Apply fluid packing to matching surface of oil pump.

Fluid packing:
Part number 004403007
THREE BOND 1215 or equivalent



(A) O-ring

(3) Apply a coat of engine oil to the inside of the oil seal.



(4) Install oil pump on cylinder block. Be careful not to damage oil seal during installation.

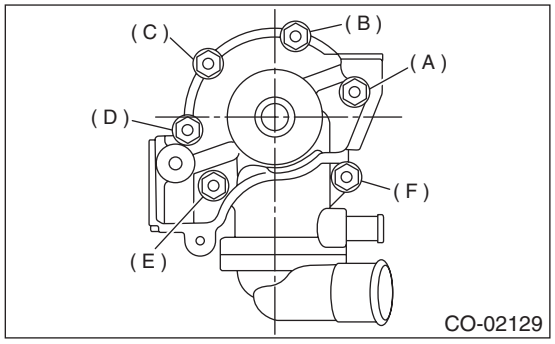
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

CAUTION:
• Do not forget to install O-ring and seal when installing oil pump.
• Align flat surface of oil pump's inner rotor with crankshaft before installation.

29) Install water pump and gasket.

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)

CAUTION:
• Be sure to use a new gasket.
• When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.

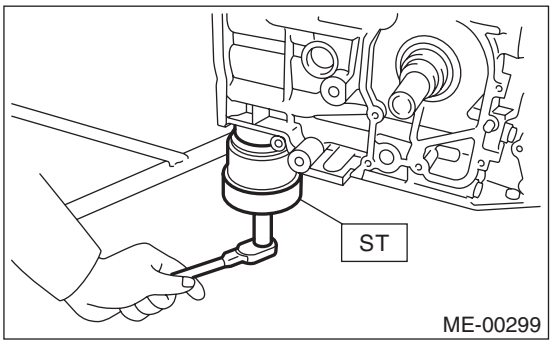


30) Install water by-pass pipe for heater.
31) Prepare oil filter and apply a thin coat of engine oil to the seal rubber.
32) Using the ST, install the oil filter.

ST	498547000	OIL FILTER WRENCH [for oil filter with 80 mm (3.15 in) outer diameter]
ST	18332AA000	OIL FILTER WRENCH [for oil filter with 68 mm (2.68 in) outer diameter]
ST	18332AA010	OIL FILTER WRENCH [for oil filter with 65 mm (2.56 in) outer diameter]

Install oil filter by turning it by hand, being careful not to damage seal rubber.
• Further tighten (approximately 2/3 to 3/4 turn) with ST the oil filter with outer diameter of 80 mm (3.15 in) or 65 mm (2.56 in) after the seal rubber contacts the cylinder block.
• Further tighten (approximately 1 turn) with ST the oil filter with outer diameter of 68 mm (2.68 in) after the seal rubber contacts the cylinder block.

CAUTION:
Do not tighten excessively, or oil may leak.

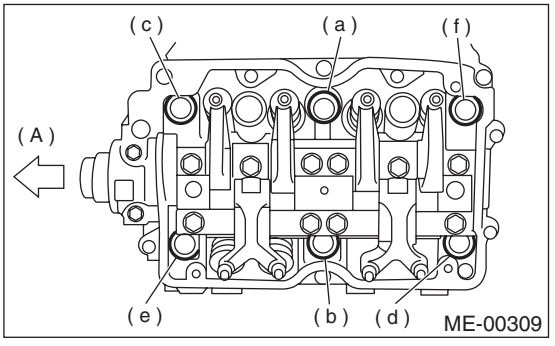


33) Tighten cylinder head bolts.
(1) Apply a thin coat of engine oil to washers and bolt threads.
(2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.
Then tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
(3) Back off all bolts by 180° with reversing order of assembly and after that back them off by 180° again.
(4) Tighten all bolts to 42 N·m (4.3 kgf-m, 31 ft-lb).
(5) Tighten all bolts by 80 to 90° in alphabetical sequence.
(6) Tighten all bolts by 40 to 45° in alphabetical sequence.

CAUTION:
Make sure that the tightening angle of bolt does not exceed 45°.

(7) Further tighten bolts (a) and (b) by 40 to 45°.

CAUTION:
Ensure that the total "re-tightening angle" [in the steps 6 and 7], do not exceed 90°.

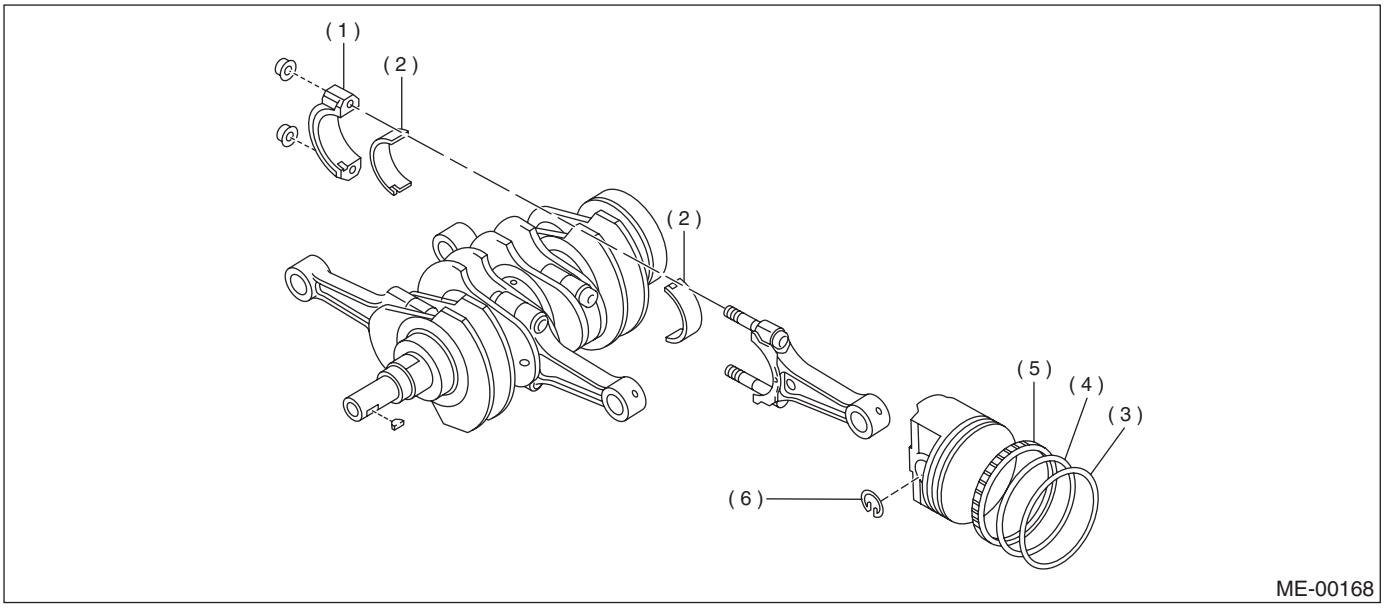


(A) Frotn side

34) Install oil level gauge guide and tighten attaching bolt (left side only).
35) Install rocker cover.
36) Install crankshaft sprocket. <Ref. to ME(H4SO)-50, INSTALLATION, Crankshaft Sprocket.>

37) Install camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
38) Install timing belt. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt.>
39) Install timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
40) Install crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
41) Install generator and A/C compressor brackets on cylinder head.
42) Install V-belt. <Ref. to ME(H4SO)-40, INSTALLATION, V-belt.>
43) Install intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>

C: DISASSEMBLY



(1) Connecting rod cap
(2) Connecting rod bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Snap ring

1) Remove connecting rod cap.
2) Remove connecting rod bearing.

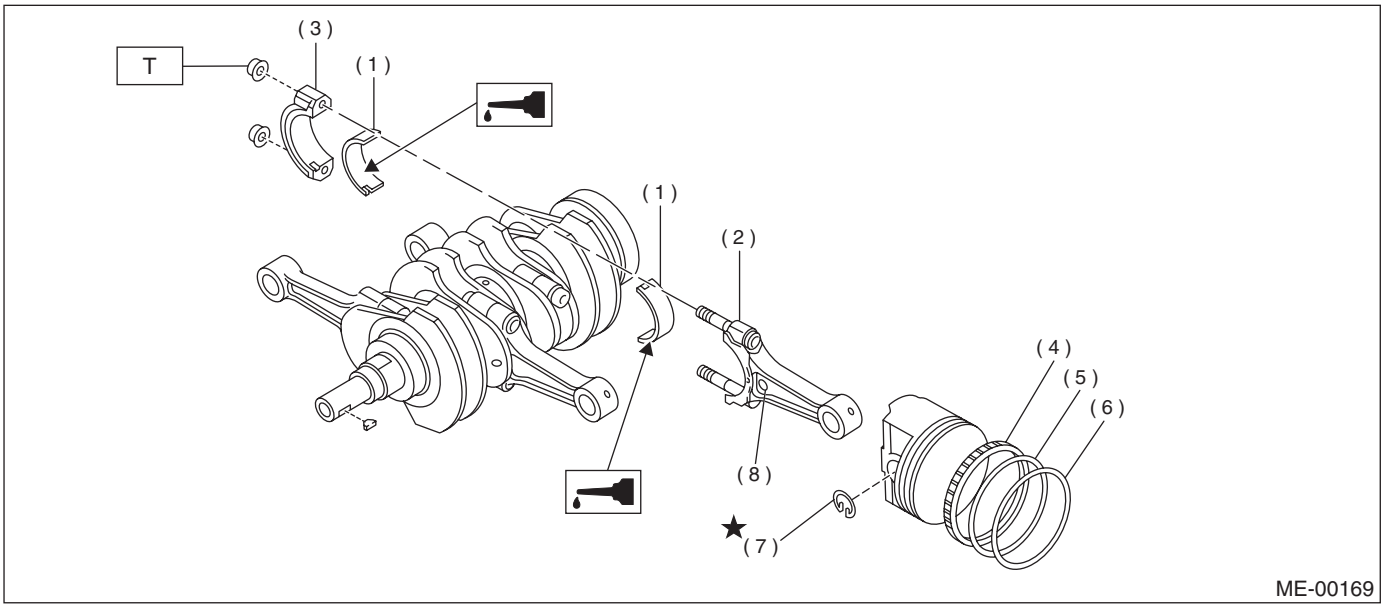
NOTE:
Arrange removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

3) Remove piston rings using the piston ring expander.
4) Remove the oil ring by hand.

NOTE:
Arrange the removed piston rings in good order to prevent confusion.

5) Remove snap ring.

D: ASSEMBLY



(1) Connecting rod bearing
(2) Connecting rod
(3) Connecting rod cap
(4) Oil ring
(5) Second ring
(6) Top ring
(7) Snap ring
(8) Side mark

Tightening torque: N·m (kgf-m, ft-lb)
T: 45 (4.6, 33)

1) Apply oil to the surfaces of the connecting rod bearings.
2) Install connecting rod bearings on connecting rods and connecting rod caps.
3) Position each connecting rod with the side marked facing forward, and install connecting rod on crankshaft.
4) Install 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 oil ring spacer, lower rail and upper rail in this order by hand. Then install second ring and top ring with a piston ring expander.

E: INSPECTION

1. CYLINDER BLOCK

1) Visually check for cracks and damage. Especially, inspect important parts by means of red lead check.
2) Check the oil passages for clogging.
3) Inspect crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.025 mm (0.0010 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder block:
201.0 mm (7.91 in)

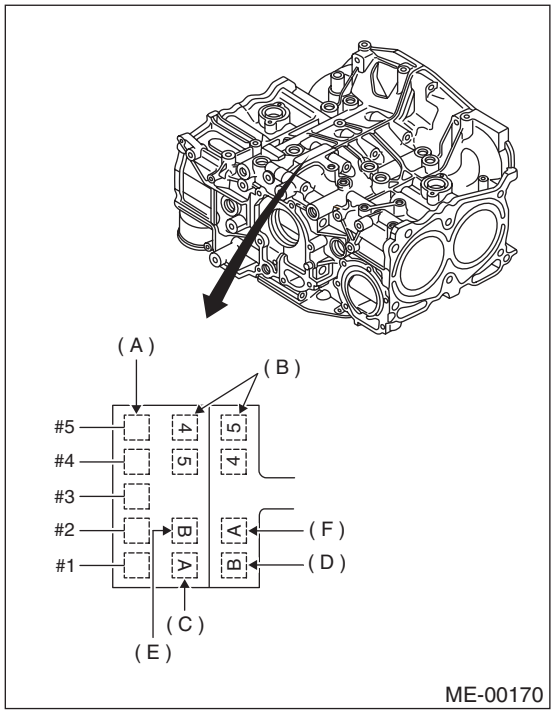
2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the cylinder block's front upper surface.

CAUTION:
Measurement should be performed at a temperature 20°C (68°F).

NOTE:
Standard sized pistons are classified into two grades, “A” and “B”. These grades should be used as a guide line 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)



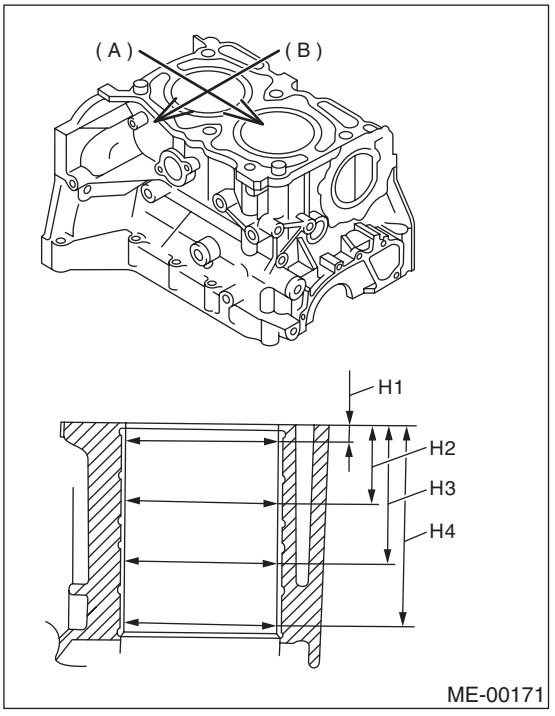
(A) Main journal size mark
(B) Cylinder block RH-LH combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

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.

CAUTION:
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)



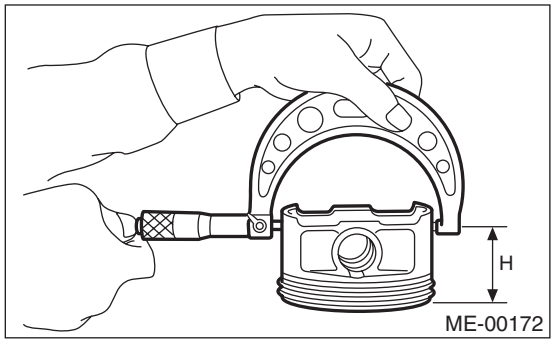
(A) Piston pin direction
(B) Thrust direction
H1 10 mm (0.39 in)
H2 45 mm (1.77 in)
H3 80 mm (3.35 in)
H4 115 mm (4.53 in)

3) When 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)

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:
37.0 mm (1.457 in)

Piston outer diameter:
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 — 99.745 mm
(3.9262 — 3.9270 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.

CAUTION:
Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):
Standard
0.010 — 0.030 mm (0.0004 — 0.0012 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, rebore 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, nor 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.

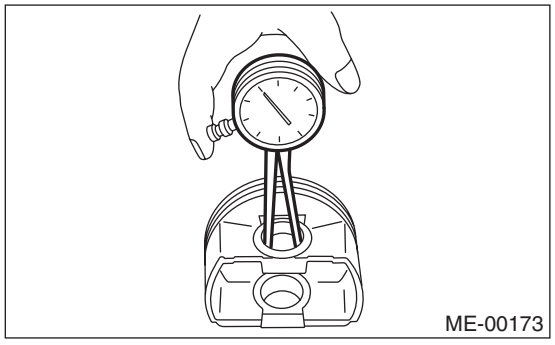
Limit of cylinder enlarging (boring):
0.5 mm (0.020 in)

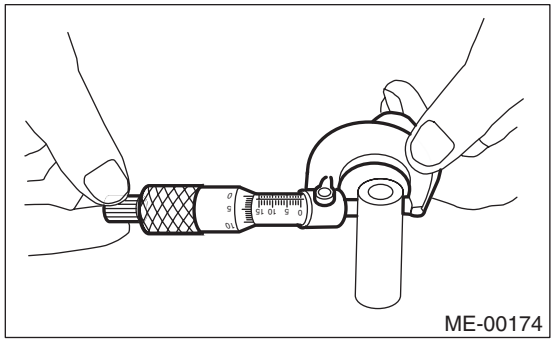
3. PISTON AND PISTON PIN

1) Check 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)-80, 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.

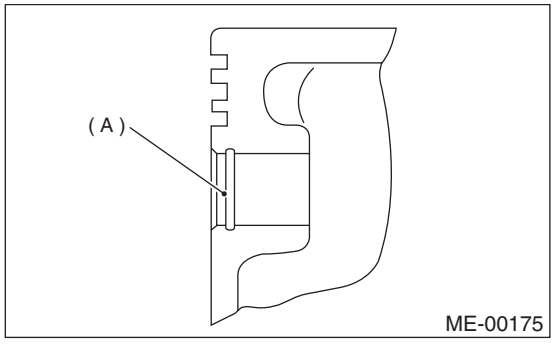
3) Make sure that piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

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)


ME-00173


ME-00174

4) Check snap ring installation groove on the piston for burr (A). If necessary, remove burr (A) from the groove so that piston pin can lightly move.



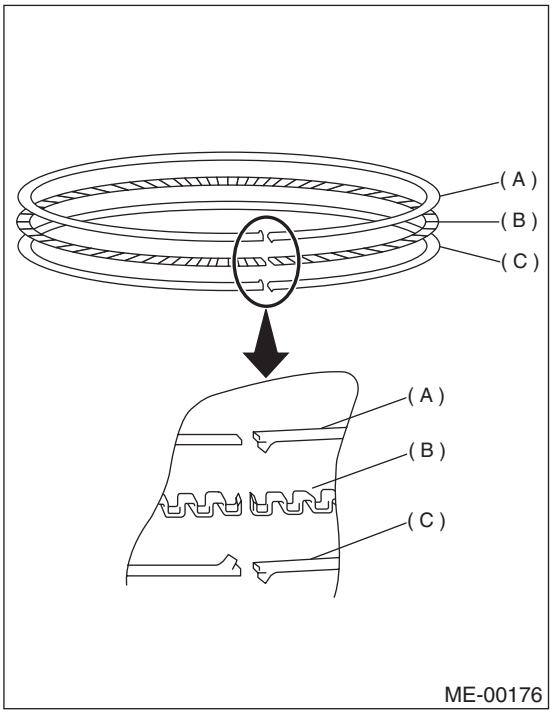
ME-00175

5) Check piston pin snap ring for distortion, cracks and wear.

4. PISTON RING

1) If piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace piston ring with a new one of the same size as the piston.

CAUTION:
• Marks are shown on the end of the top and second rings. When installing the rings to the piston, face this mark upward.
• Oil ring consists of upper rail, expander and lower rail. When installing on piston, be careful of each rail's direction.



ME-00176

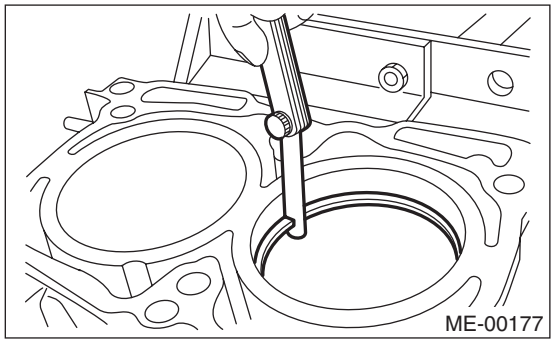
(A) Upper rail
(B) Expander
(C) Lower rail

2) Clean piston ring grove and piston ring.

3) Squarely place piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

Unit: mm (in)

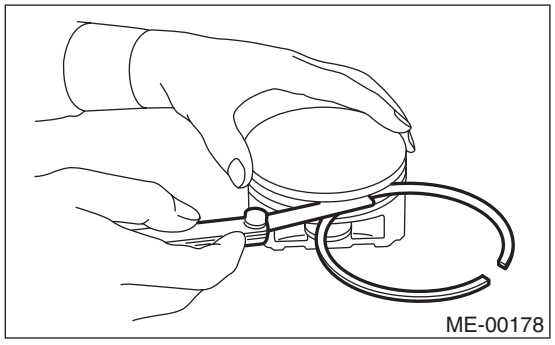
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.0146 — 0.0205)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)


ME-00177

4) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

Unit: mm (in)

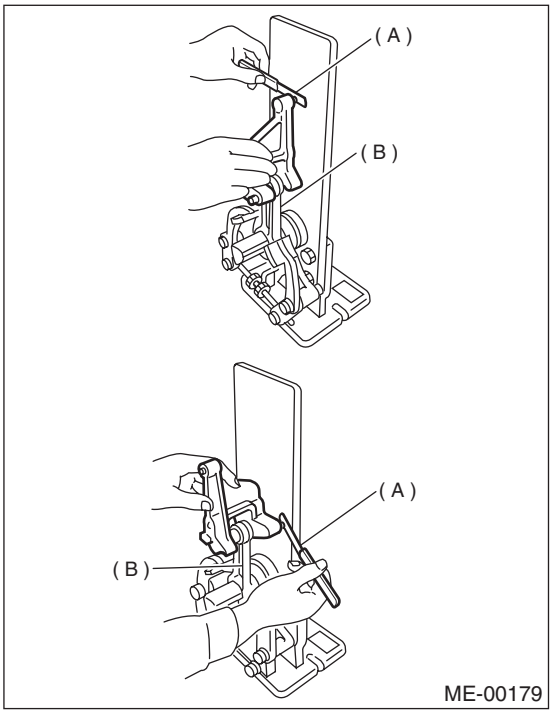
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)


ME-00178

5. CONNECTING ROD

1) Replace connecting rod, if the large or small end thrust surface is damaged.
2) Check for bend or twist using a connecting rod aligner. Replace 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)

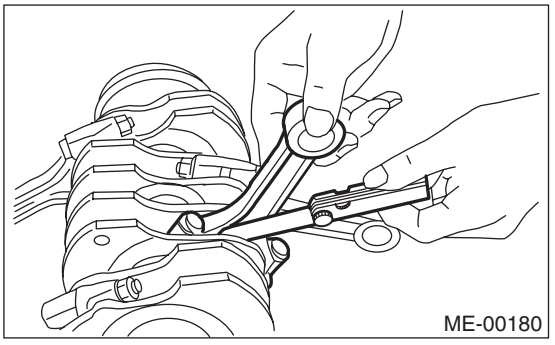


ME-00179

(A) Thickness gauge
(B) Connecting rod

3) Install connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). Replace 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)


ME-00180

4) Inspect 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.)

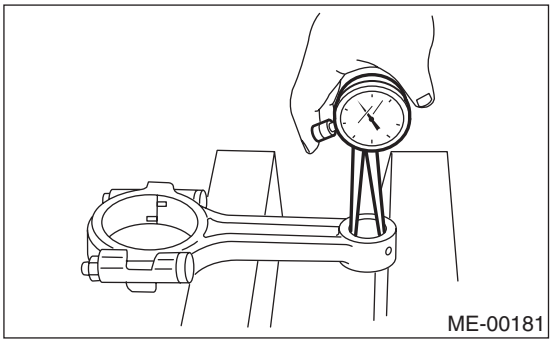
Connecting rod oil clearance:
Standard
0.016 — 0.044 mm (0.0006 — 0.0017 in)
Limit
0.050 mm (0.0020 in)

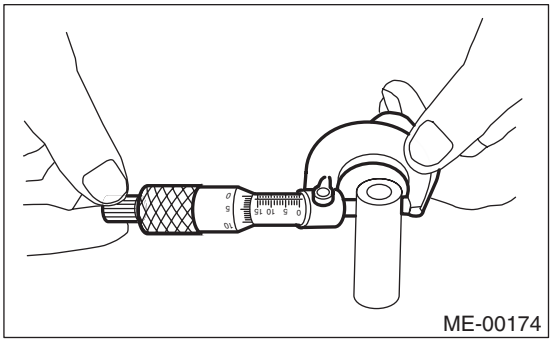
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492 — 1.501 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.510 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.520 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.620 — 1.622 (0.0638 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

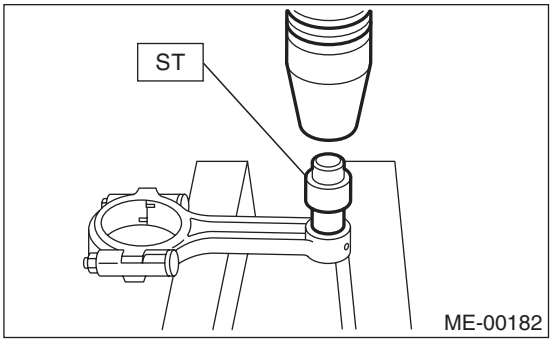
Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)
Limit
0.030 mm (0.0012 in)


ME-00181


ME-00174

7) Replacement procedure is as follows.
(1) Remove bushing from connecting rod with ST and press.
(2) Press bushing with ST and press after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



ME-00182

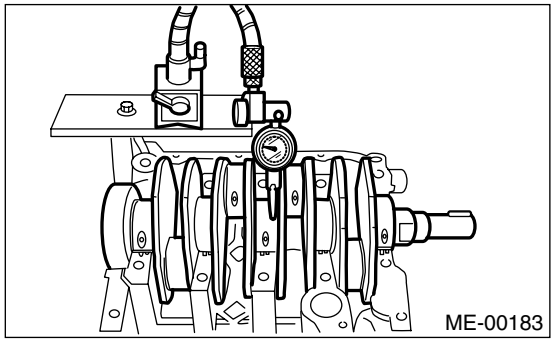
(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
(4) After completion of reaming, clean bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

NOTE:
If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position crankshaft on these bearings and measure crankshaft bend using a dial gauge.

Crankshaft bend limit:
0.035 mm (0.0014 in)

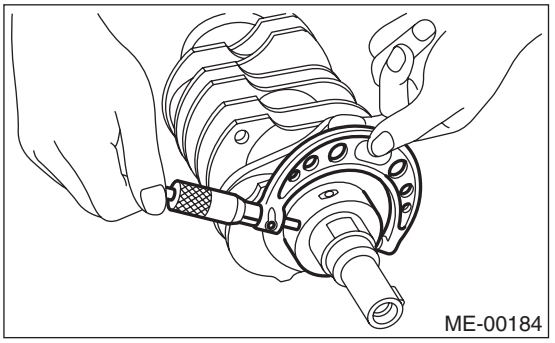


3) Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace bearing with a suitable (undersize) one, and replace or recondition crankshaft as necessary.

When grinding crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

Crank pin:
Out-of-roundness
0.003 mm (0.0001 in)
Cylindricality
0.004 mm (0.0002 in)
Grinding limit
51.750 mm (2.0374 in) dia. or less

Crank journal:
Out-of-roundness
0.005 mm (0.0002 in)
Cylindricality
0.006 mm (0.0002 in)
Grinding limit
59.750 mm (2.3524 in) dia. or less



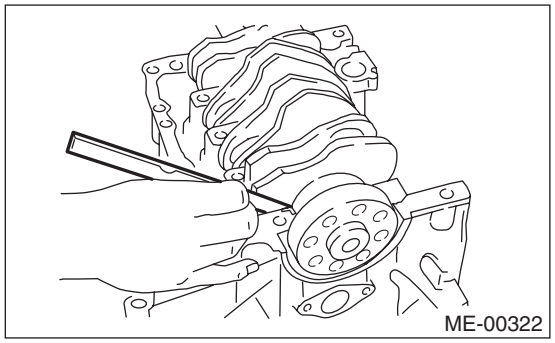
Unit: mm (in)

		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)	1.492 — 1.501 (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)	1.510 — 1.513 (0.0594 — 0.0596)
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)	1.520 — 1.523 (0.0598 — 0.0600)
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)	1.620 — 1.623 (0.0638 — 0.0639)

O.D. ... Outer Diameter

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)


ME-00322

5) Inspect 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 specification, replace defective bearing with an undersize one, and replace or recondition crankshaft as necessary.

Crankshaft	Oil clearance	#1 — #5	Standard	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.040 mm (0.0016 in)

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

TROUBLE	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	B
	• Battery	• Poor terminal connection	A
		• Run-down battery	A
		• Defective charging system	B
	• Friction	• Seizure of crankshaft and connecting rod bearing	C
		• Seized camshaft	C
		• Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	• Starter	• Defective starter	C
	• Engine control system <Ref. to EN(H4SO)-2, Basic Diagnostic Procedure.>		A
	• Fuel line	• Defective fuel pump and relay	A
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
3) Initial combustion occur.	• 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
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B

TROUBLE	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
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
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
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
		• Defective rocker cover gasket	C
	• Cooling system	• Overheating	C
	• Others	• Malfunction of evaporative emission control system	A
		• Stuck or damaged throttle valve	B
		• Accelerator cable out of adjustment	C

TROUBLE	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
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
	• Cooling system	• 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
		• Lack of 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
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	C

TROUBLE	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
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• 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	• Defective valve stem	A
		• Worn or stuck piston rings, cylinder and piston	A
	• Lubrication system	• Loosened oil pump attaching bolts and defective gasket	B
		• Defective oil filler 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

TROUBLE	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
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	B
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• 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 (Spark knock)	Sound is noticeable when accelerating with an overload.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong spark plug • Improper gasoline
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 camshaft 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 • Timing belt cover/adjacent part
Valve tappet noise	—	• Incorrect valve clearance

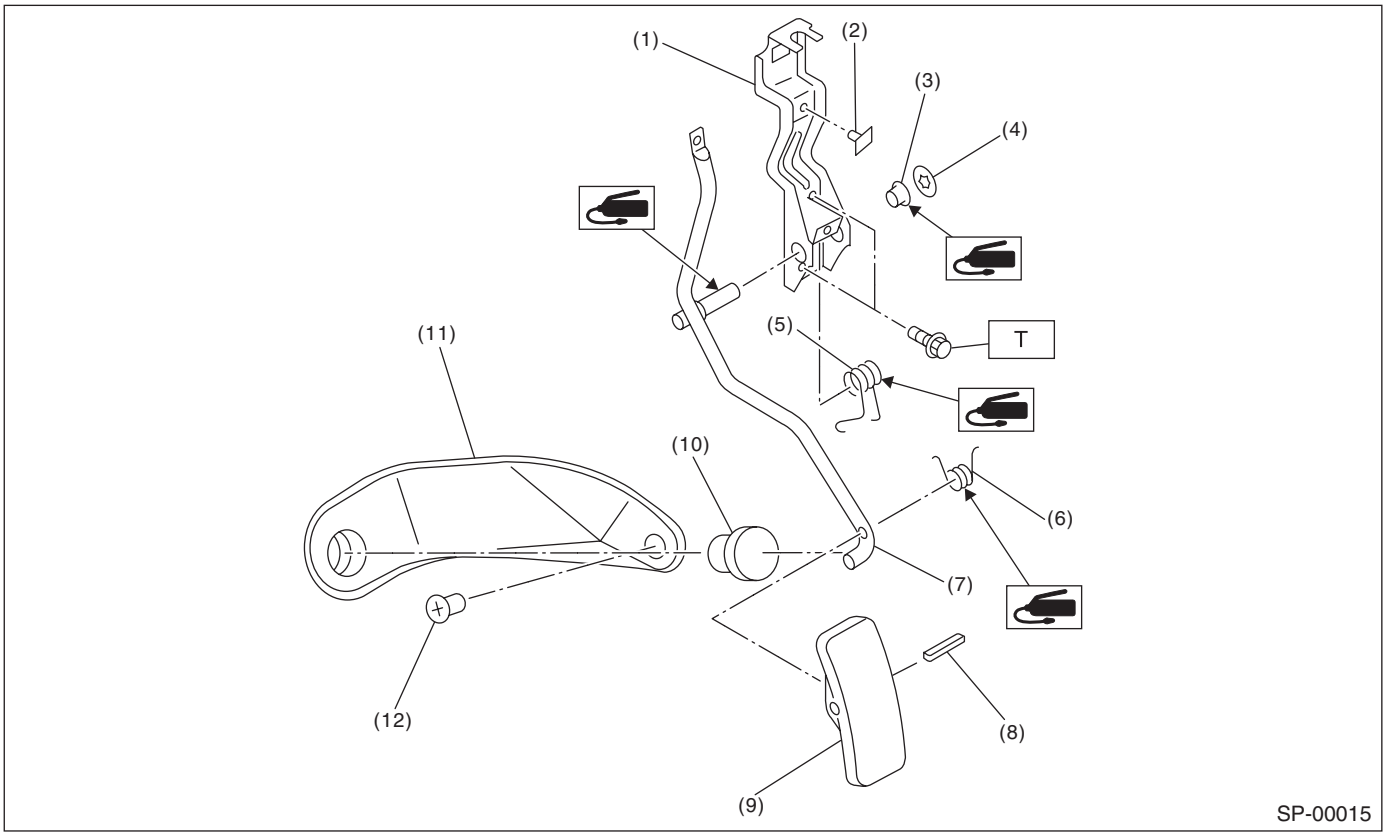
NOTE*:
When disconnecting fuel injector connector, Malfunction Indicator Light (CHECK ENGINE light) illuminates and trouble code is stored in ECM memory.
Therefore, carry out the CLEAR MEMORY MODE <Ref. to EN(H4SO)-50, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)-42, Inspection Mode.> after connecting fuel injector connector.

1. General Description

A: SPECIFICATION

Accelerator pedal	Free play	At pedal pad	0 — 4 mm (0.04 — 0.16 in)
	Stroke	At pedal pad	50 — 55 mm (1.97 — 2.17 in)

B: COMPONENT



(1) Accelerator bracket
(2) Stopper
(3) Bushing
(4) Clip
(5) Accelerator spring
(6) Accelerator pedal spring
(7) Accelerator pedal lever
(8) Spring pin
(9) Accelerator pedal
(10) Accelerator stopper
(11) Accelerator plate
(12) Clip

Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.0)

C: CAUTION

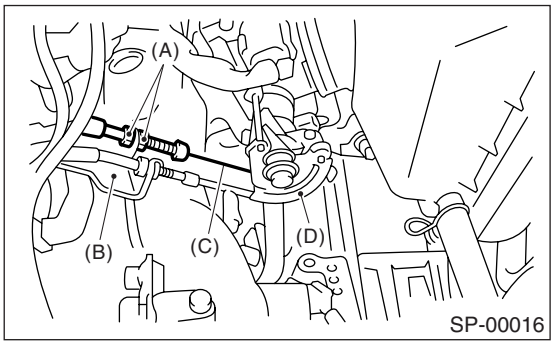
• Wear work clothing, including a cap, protective goggles, and protective shoes during operation.
• Remove contamination, including dirt and corrosion, before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust and dirt.
• Before removal, installation 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 ground cable from battery.

2. Accelerator Pedal

A: REMOVAL

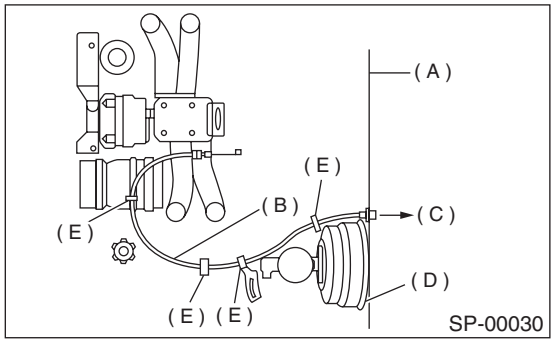
1) Disconnect ground cable from battery.
2) Remove lock nut from accelerator cable bracket.
3) Remove accelerator cable from bracket.
4) Remove accelerator cable end from throttle cam.

NOTE:
Be careful not to kink accelerator cable.



(A) Lock nut
(B) Accelerator cable bracket
(C) Accelerator cable
(D) Throttle cam

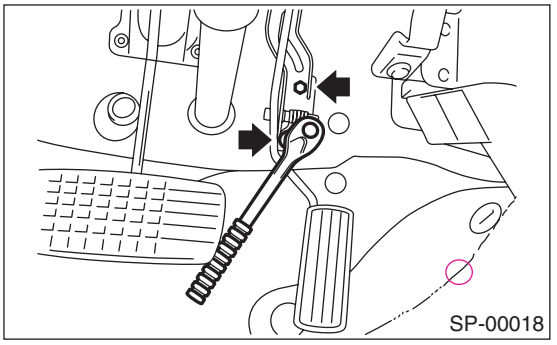
5) Remove clip inside engine compartment.



(A) Toe board
(B) Accelerator cable
(C) Accelerator pedal
(D) Brake booster
(E) Clip

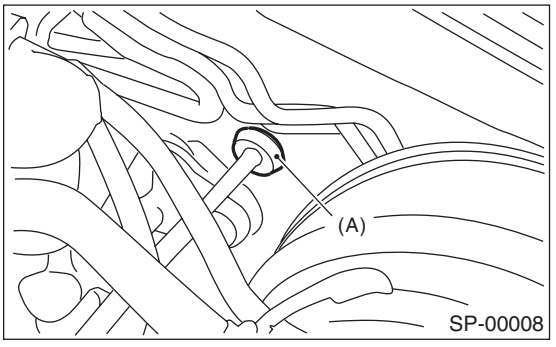
6) Remove instrument panel lower cover from instrument panel, and connector.

7) Remove accelerator pedal connecting bolt from accelerator pedal bracket.



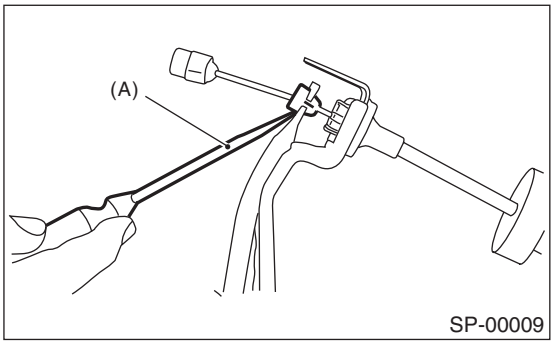
8) Disconnect grommet (A) from toe board.

NOTE:
From engine room side, push grommet (A) into hole.



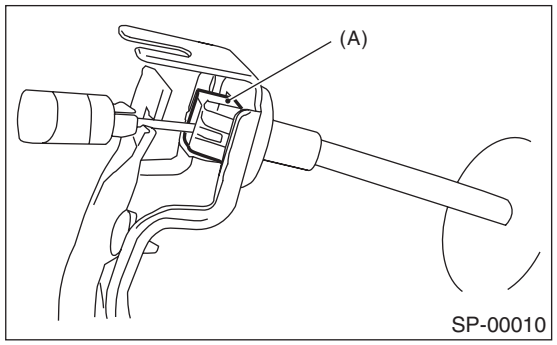
(A) Grommet

9) Pull out the cable from the toe board hole.
10) Disconnect accelerator cable bushing from accelerator pedal lever.



(A) Flat-bladed screwdriver

11) Disconnect accelerator cable stopper (A) from bracket.



(A) Accelerator cable stopper

12) Remove accelerator cable and bracket.

B: INSTALLATION

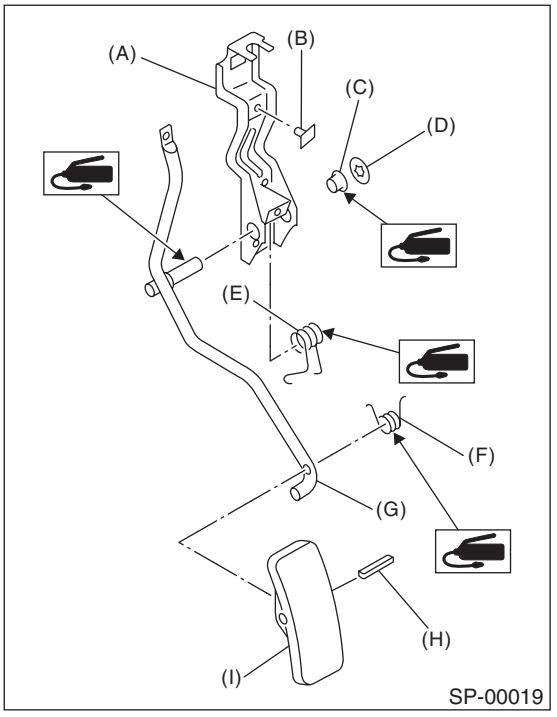
1) Install in the reverse order of removal.

NOTE:
- If cable clamp is damaged, replace it with a new one.
- Never fail to cover outer cable end with boot.
- Be careful not to kink accelerator cable.

2) Adjust after pedal installation. <Ref. to SP(H4SO)-5, ADJUSTMENT, Accelerator Pedal.>

C: DISASSEMBLY

1) Remove the clip, and then remove the accelerator pedal from the bracket.
2) Pull out the spring pin, and then remove the accelerator pedal from the accelerator pedal lever.



(A) 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.

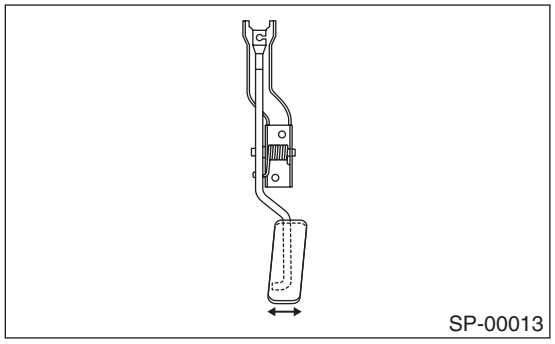
NOTE:
Clean areas as shown in the illustration and apply grease.

Grease:
Part No. 003602010 (SUNLIGHT No. 2)

E: INSPECTION

1) Lightly move pedal pad in lateral the direction to ensure pedal deflection is in specified range.
2) If excessive deflection is noted, replace bushing and clip with new ones.

Deflection of accelerator pedal:
Service limit
±2.0 mm (±0.079 in) or less

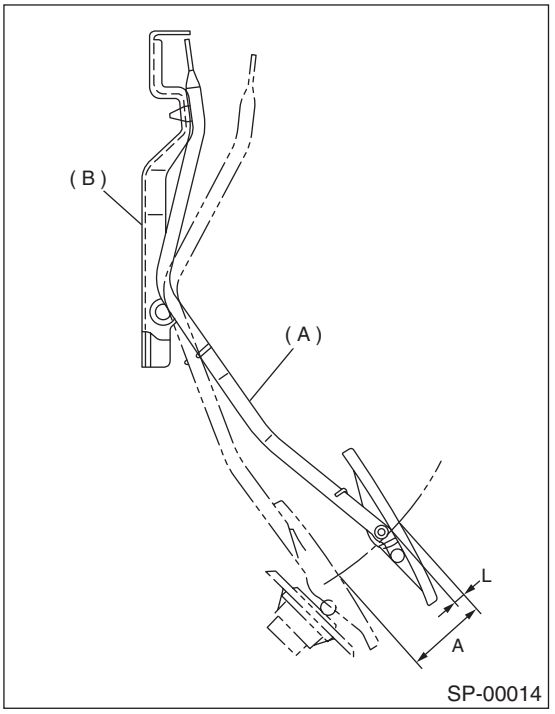


F: ADJUSTMENT

1) Check pedal stroke and free play by operating accelerator pedal by hand.
2) If it is not within specified value, adjust it by turning accelerator cable lock nut.

Free play at pedal pad: L
0 — 4 mm (0 — 0.16 in)

Stroke at pedal pad: A
50 — 55 mm (1.97 — 2.17 in)



(A) Accelerator pedal lever
(B) Accelerator pedal bracket

Accelerator cable lock nut tightening torque:
12 N·m (1.2 kgf-m, 9 ft-lb)

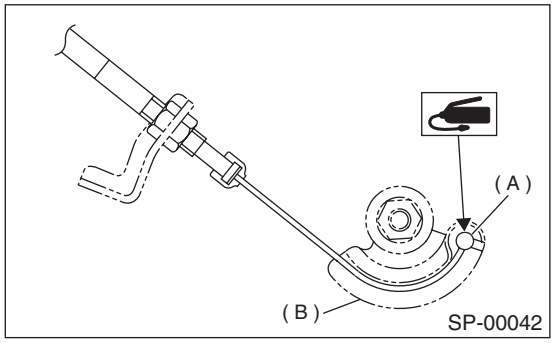
3. Accelerator Control Cable

A: REMOVAL

1) Remove accelerator pedal. <Ref. to SP(H4SO)-3, REMOVAL, Accelerator Pedal.>
2) Separate accelerator cable and accelerator pedal.

B: INSTALLATION

1) Install in the reverse order of removal.
2) Apply grease to the point (accelerator cable end on engine side) shown in the figure below.
Part No. 004404002 (Slico lube G-30M)



(A) Cable end
(B) Throttle cam

CAUTION:
• If cable clamp is damaged, replace it with a new one.
• Never fail to cover outer cable end with boot.
• Be careful not to kink accelerator cable.
• Do not apply grease except for special area.

3) Adjustment after pedal installation <Ref. to SP(H4SO)-4, INSTALLATION, Accelerator Pedal.>

C: INSPECTION

1) Make sure the inner cable is not twisted or frayed.
2) Make sure the outer cable is not cracked.

1. General Description

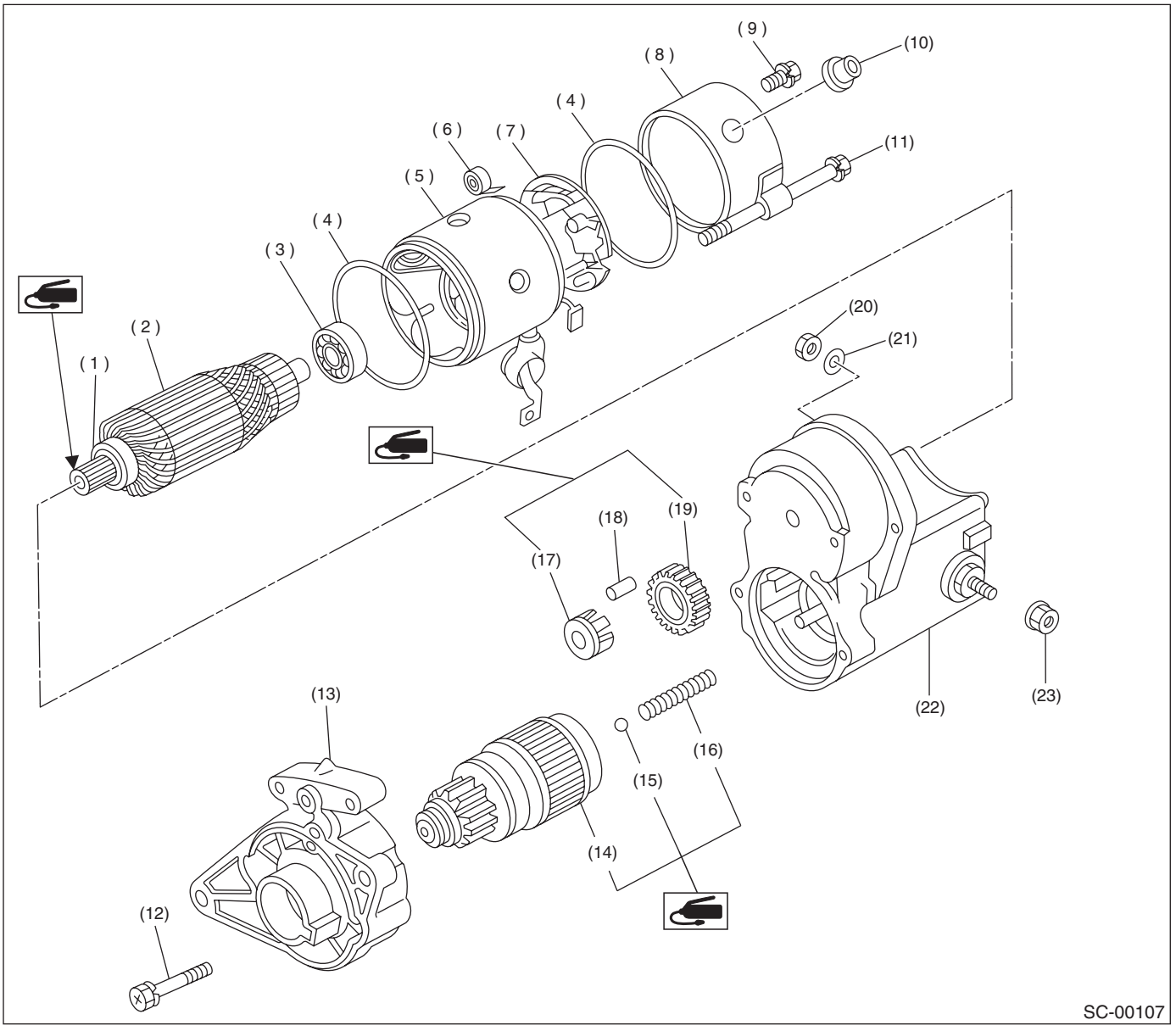
A: SPECIFICATIONS

Item			Designation	
			MT	AT
Starter	Type		Reduction type	
	Model		228000-7131	228000-7141
	Manufacturer		DENSO CORPORATION	
	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	3,000 rpm or more	2,900 rpm or more
	Load characteristics	Voltage	8 V	
		Current	280 A or less	370 A or less
		Torque	9.8 N·m (1.0 kgf-m, 7.2 ft-lb)	13.7 N·m (1.4 kgf-m, 10.1 ft-lb)
		Rotating speed	900 rpm or more	880 rpm or more
	Lock characteristics	Voltage	5 V	
		Current	800 A or less	1,050 A or less
		Torque	27.5 N·m (2.8 kgf-m, 20.3 ft-lb) or more	
Generator	Type		Rotating-field three-phase type, Voltage regulator built-in type	
	Model		A2TB2891ZC	
	Manufacturer		MITSUBISHI ELECTRIC	
	Voltage and output		12 V — 90 A	
	Polarity on ground side		Negative	
	Rotating direction		Clockwise (when observed from pulley side.)	
	Armature connection		3-phase Y-type	
	Output current		1,500 rpm — 36 A or more 2,500 rpm — 65A or more 5,000 rpm — 86 A or more	
	Regulated voltage		14.1 - 14.8 V [20°C (68°F)]	
Battery	Reserve capacity	min.	90	110
	Cold cranking ampere	A	430	490

B: COMPONENT

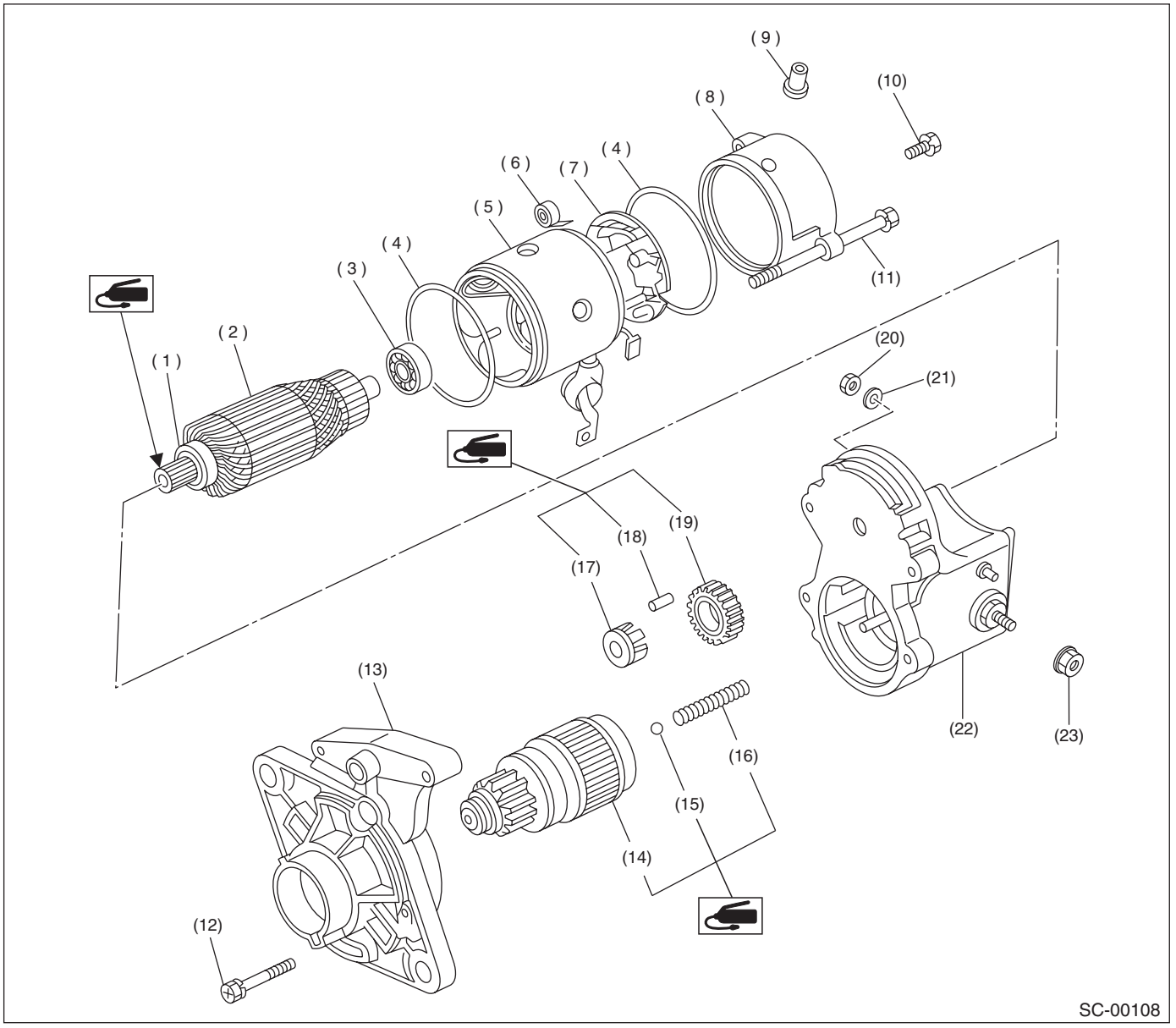
1. STARTER

- MT MODELS



(1) Front ball bearing
(2) Armature
(3) Rear ball bearing
(4) O-ring
(5) Yoke
(6) Brush spring
(7) Brush holder
(8) End frame
(9) Screw
(10) Cover
(11) Through bolt
(12) Screw & washer
(13) Starter housing
(14) Overrunning clutch
(15) Steel ball
(16) Spring
(17) Retainer
(18) Roller
(19) Idle gear
(20) Nut
(21) Spring washer
(22) Magnetic switch
(23) Nut

- AT MODELS



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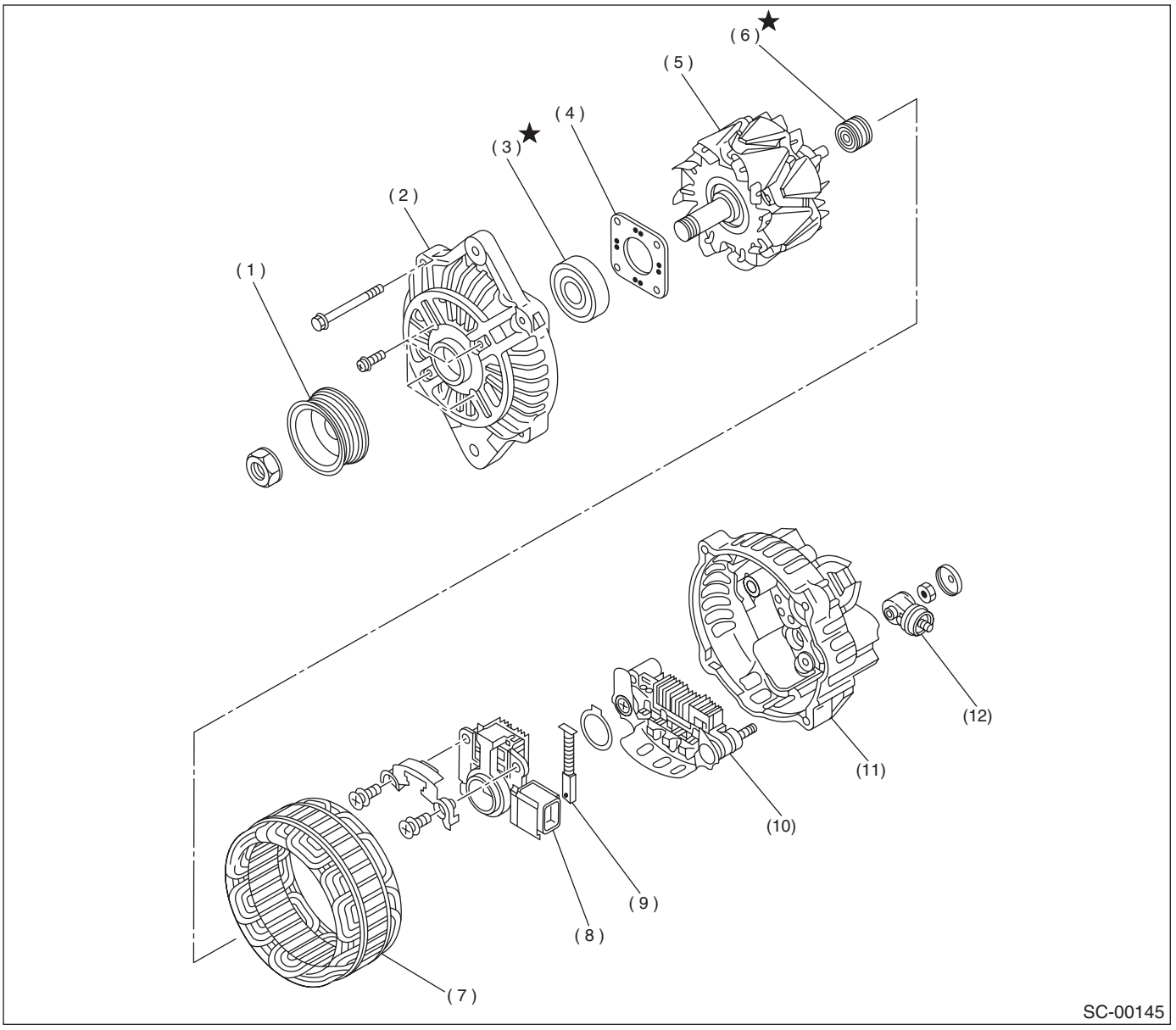
(22) Magnetic switch
(23) Nut

2. GENERATOR



(1) Pulley
(2) Front cover
(3) Ball bearing
(4) Bearing retainer
(5) Rotor
(6) Bearing
(7) Stator coil
(8) IC regulator with brush
(9) Brush
(10) Rectifier
(11) Rear cover
(12) Terminal

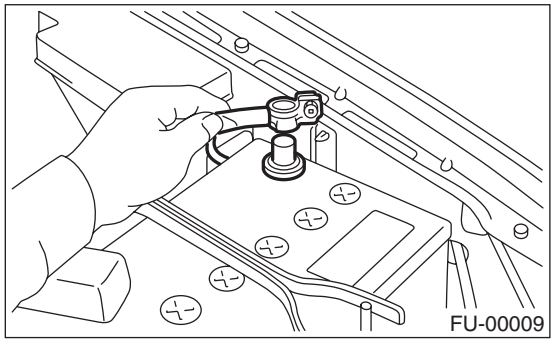
C: CAUTION

• 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 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 ground cable from battery.

2. Starter

A: REMOVAL

1) Disconnect ground cable from battery.

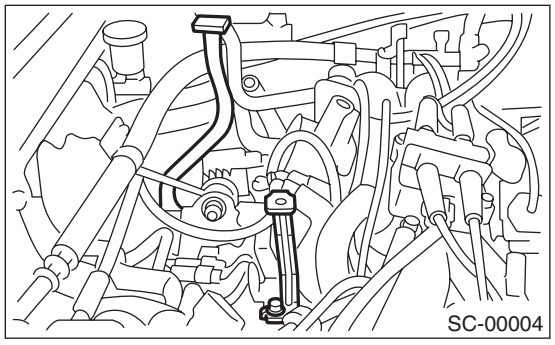


2) Remove air cleaner case. (Non-Turbo model) <Ref. to IN(H4SO)-6, REMOVAL, Air Cleaner Case.>

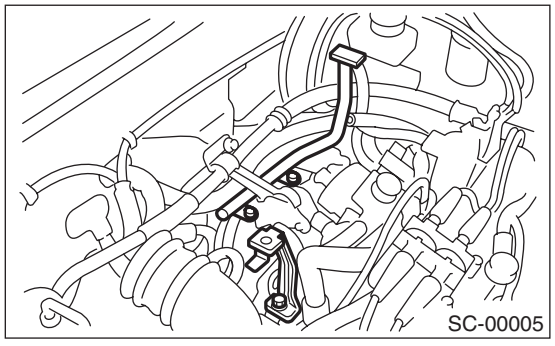
3) Remove intercooler. (Turbo model) <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>

4) Remove air cleaner case stay.

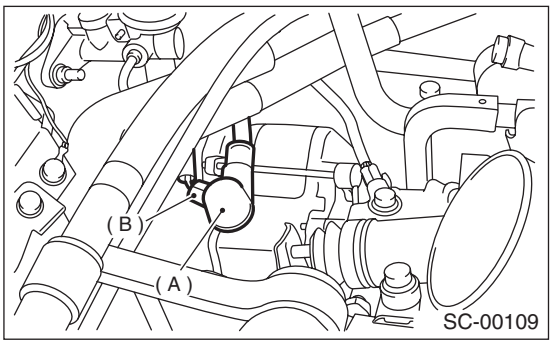
- MT vehicles



- AT vehicles



5) Disconnect connector and terminal from starter.



(A) Terminal
(B) Connector

6) Remove starter from transmission.

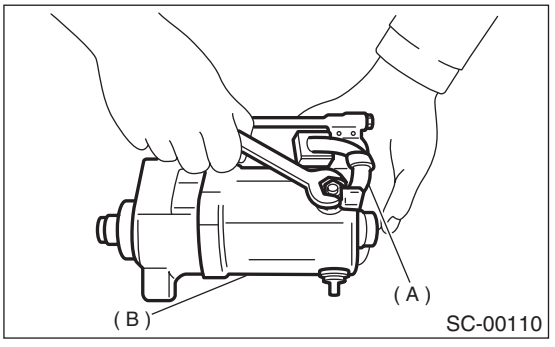
B: INSTALLATION

Install in the reverse order of removal.

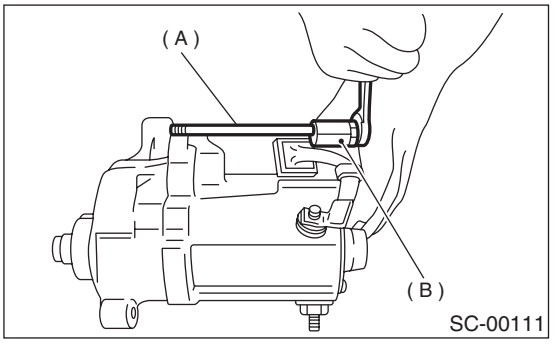
Tightening torque:
50 N·m (5.1 kgf-m, 37 ft-lb)

C: DISASSEMBLY

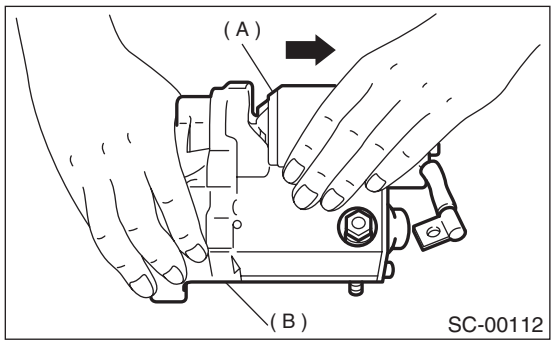
1) Disconnect lead wire (A) from magnetic switch (B).



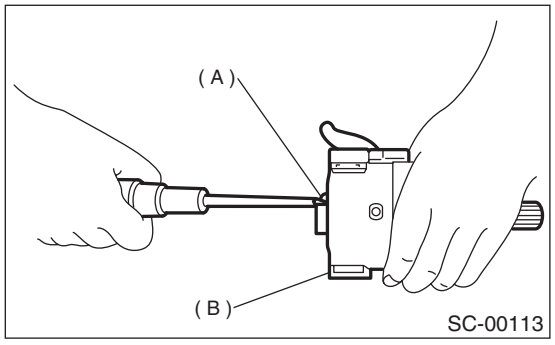
2) Remove through-bolts (A) from end frame (B).



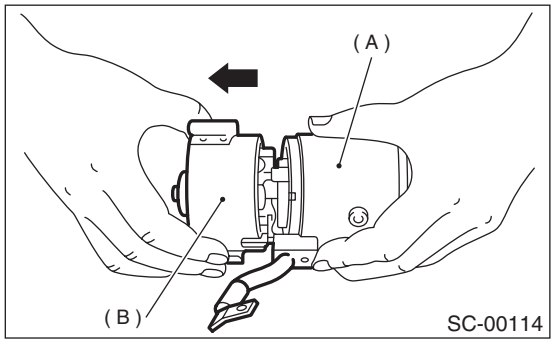
3) Remove yoke (A) from magnetic switch (B).



4) Remove screws (A) securing brush holder to end frame (B).

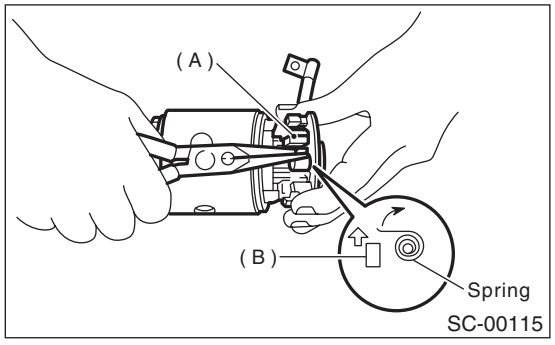


5) Separate yoke (A) from end frame (B).

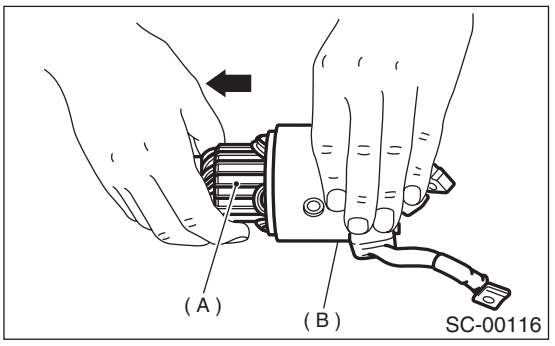


6) Remove brush (A) by lifting up positive (+) side brush spring (B) using long-nose pliers.

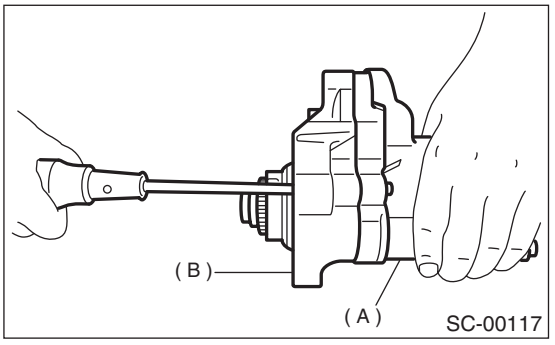
CAUTION:
Be careful not to damage brush and commutator.



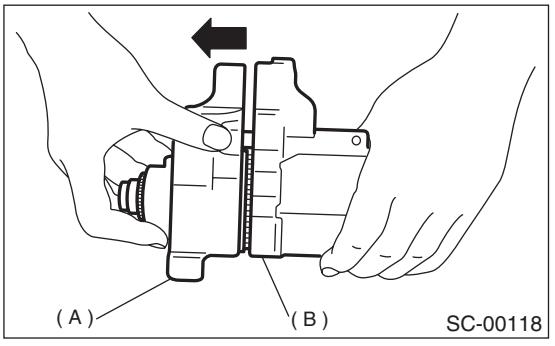
7) Remove armature (A) from yoke (B).



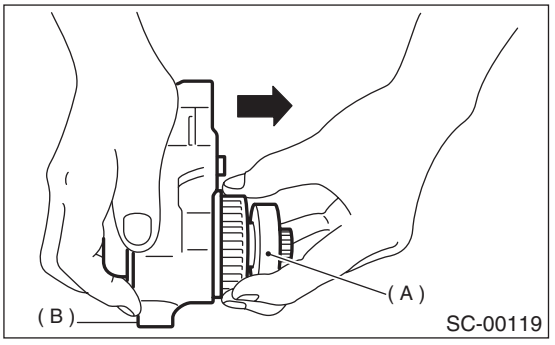
8) Remove screws securing magnetic switch (A) to housing (B).



9) Remove housing (A) from magnetic switch (B).

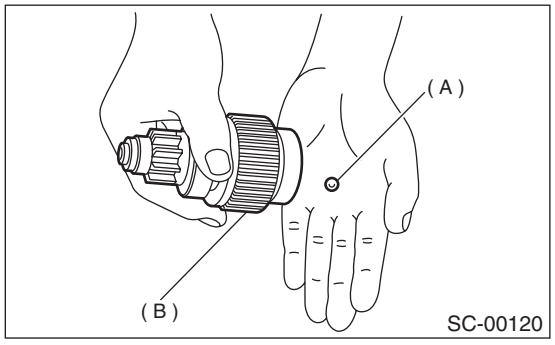


10) Remove clutch (A) from housing (B).

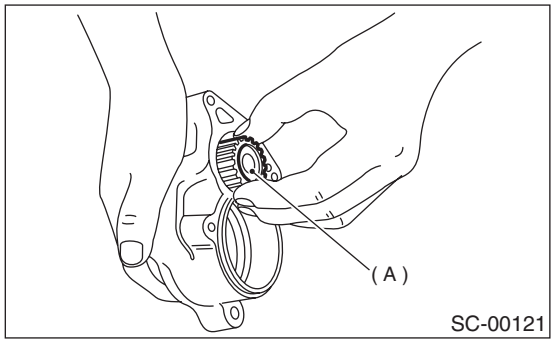


11) Take out steel ball (A) from clutch (B).

CAUTION:
Be careful not to lose steel ball.

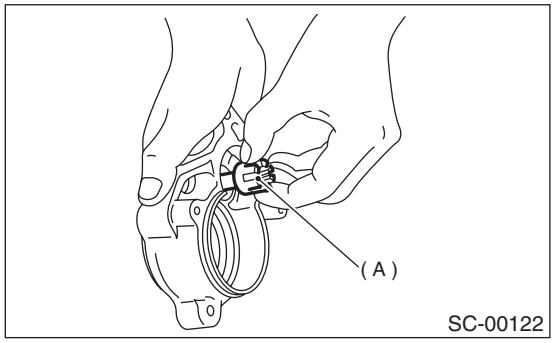


12) Remove idle gear (A) from housing.

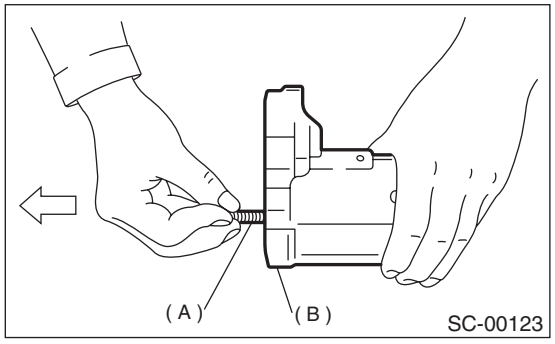


13) Remove retainer and roller (A) from housing.

CAUTION:
Be careful not to drop retainer and roller.



14) Remove coil spring (A) from magnetic switch (B).



D: ASSEMBLY

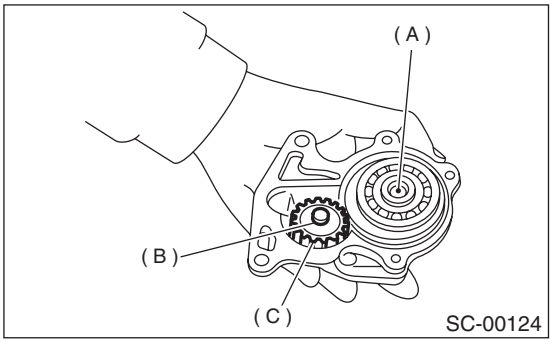
Assemble in the reverse order of disassembly. Observe the following:

1) Before assembling, apply grease to the points shown in “COMPONENT PARTS”. <Ref. to SC(H4SO)-3, COMPONENT, General Description.>

2) Assembling magnetic switch, clutch, and housing

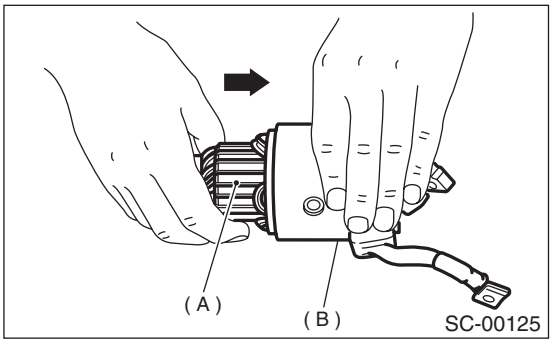
To assemble, first install clutch to magnetic switch, then install idle gear, and finally install clutch.

CAUTION:
• Do not forget to install steel ball and coil spring to clutch.
• Attach bearing to idle gear beforehand.

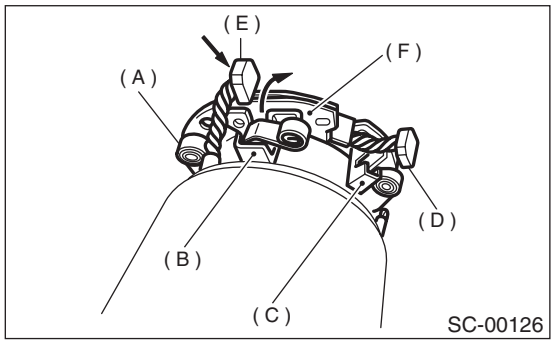


(A) Steel ball
(B) Retainer
(C) Idle gear

3) Installing armature (A) to yoke (B)

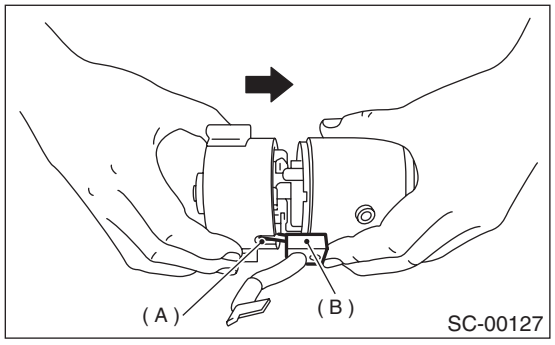


4) Installing brushes
Assemble brush holder to yoke as shown, then assemble two yoke-side brushes to brush holder.

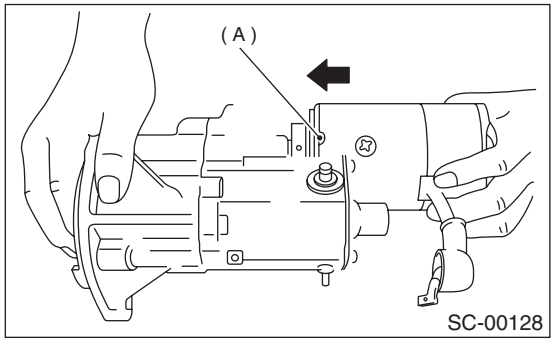


(A) Brush spring
(B) Brush holder hole (+)
(C) Brush holder hole (–)
(D) Brush (–)
(E) Brush (+)
(F) Insulator

5) Installing end frame
When assembling end frame to yoke, align notched portion (A) of end frame with lead wire grommet (B).



6) Installing yoke
When installing yoke to magnetic switch, align notch (A) of yoke with groove of magnetic switch.

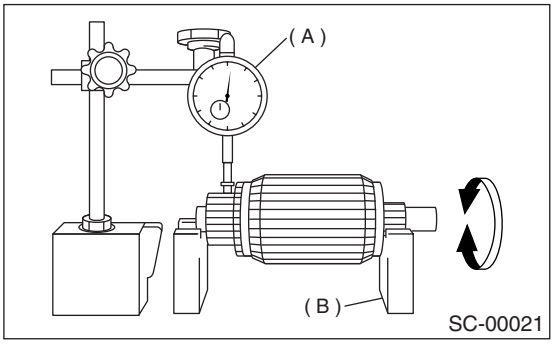


E: INSPECTION

1. ARMATURE

1) Check commutator for any sign of burns of 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 replace if it exceeds the limit.

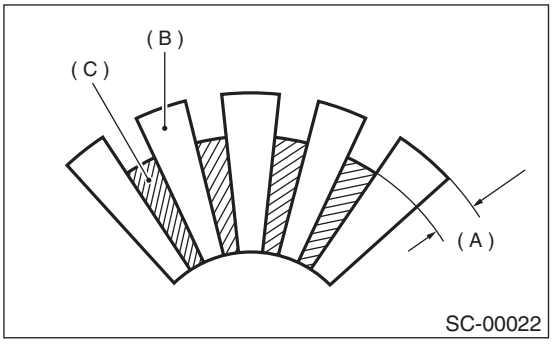
Commutator run-out:
Standard
0.02 mm (0.0008 in), or less
Service limit
Less than 0.05 mm (0.0020 in)



(A) Dial gauge
(B) V-block

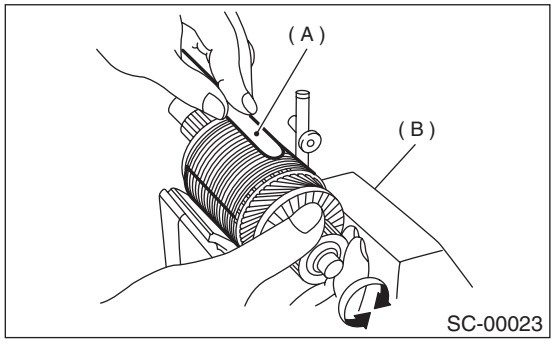
3) Depth of segment mold
Check the depth of segment mold.

Depth of segment mold:
0.6 mm (0.024 in)
Limit
0.2 mm (0.008 in)



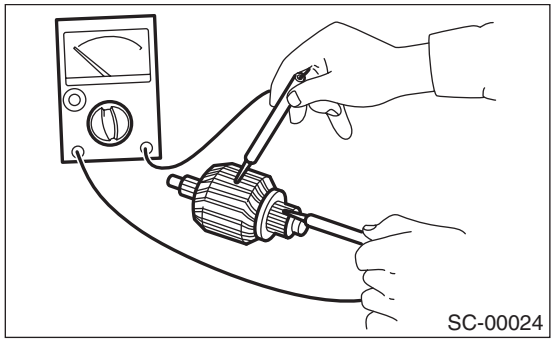
(A) Depth of mold
(B) Segment
(C) Mold

4) Armature short-circuit test
Check armature for short-circuit by placing it on growler tester. Hold a iron sheet against 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 circuit tester, touch one probe to the commutator segment and the other to shaft. If there is no continuity, it is normal. If there is a continuity armature is grounded. Replace armature if it is grounded.



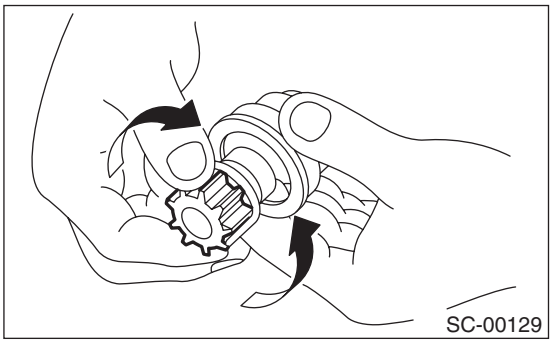
2. YOKE

Make sure pole is set in position.

3. OVERRUNNING CLUTCH

Inspect teeth of pinion for wear and damage. Replace if it is damaged. Rotate pinion in correct direction of rotation (counter clockwise). It should rotate smoothly. But in opposite direction, it should be locked.

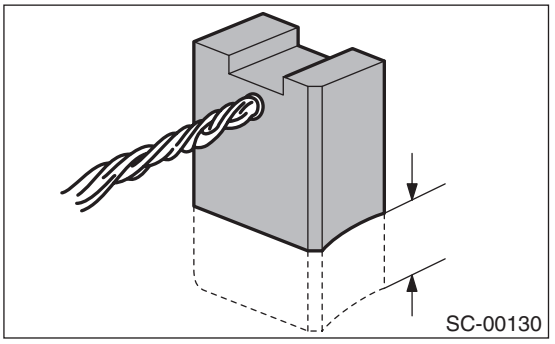
CAUTION:
Do not clean overrunning clutch with oil to prevent grease from flowing out.



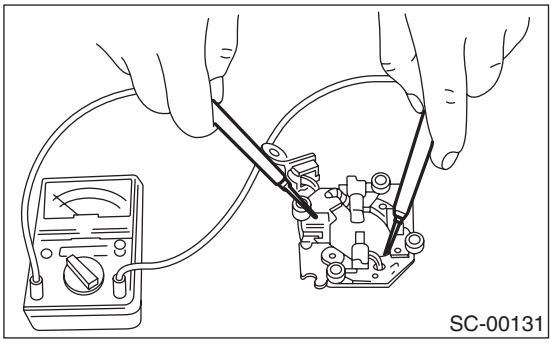
4. BRUSH AND BRUSH HOLDER

1) Brush length
Measure the brush length and replace if it exceeds the service limit.
Replace if abnormal wear or cracks are noticed.

Brush length:
Standard
15 mm (0.59 in)
Service limit
10 mm (0.39 in)



2) Brush movement
Be sure brush moves smoothly inside brush holder.
3) Insulation resistance of brush holder
Be sure there is no continuity between brush holder and its plate.

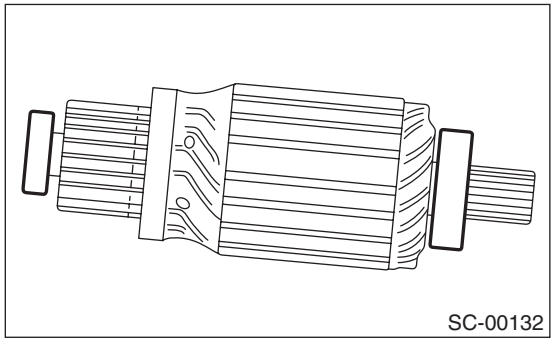


4) Brush spring force
Measure brush spring force with a spring scale. If it is less than the service limit, replace brush spring.

Brush spring force:
Standard
18.6 N (1.9 kgf, 4.2 lb) (when new)
Service limit
6.9 N (0.7 kgf, 1.5 lb)

5. BEARING

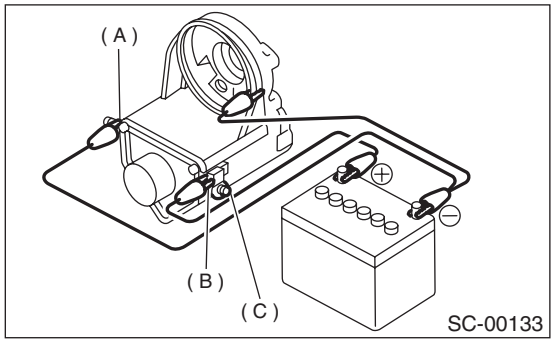
1) Rotate bearing by hand; no binding should exist.
2) Rotate bearing rapidly; no abnormal noise should be heard.


SC-00132

6. MAGNETIC SWITCH

CAUTION:
• The following magnetic switch tests should be performed with specified voltage applied.
• Each test should be conducted within 3 to 5 seconds. Power to be furnished should be one-half the rated voltage.

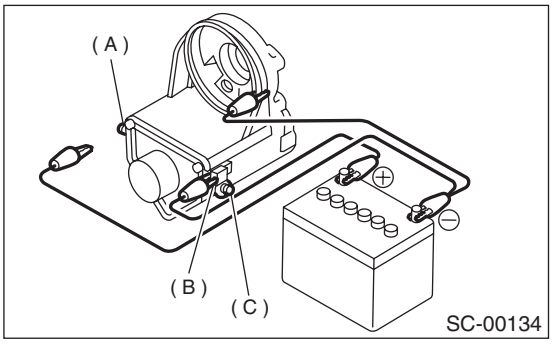
1) Pull-in test
Connect two battery negative leads onto magnetic switch body and terminal C respectively. Then connect battery positive lead onto terminal 50. Pinion should extend when lead connections are made.



SC-00133

(A) Terminal C
(B) Terminal 50
(C) Terminal M

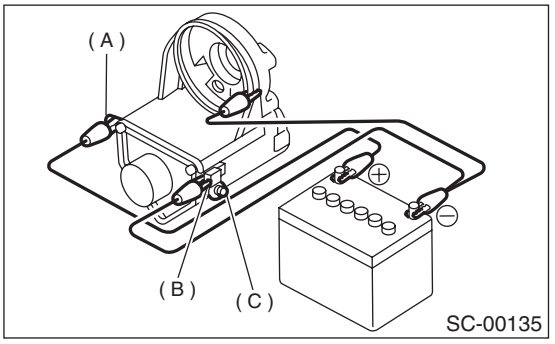
2) Holding-in test
Disconnect lead from terminal C with pinion extended. Pinion should be held in the extended position.



SC-00134

(A) Terminal C
(B) Terminal 50
(C) Terminal M

3) Return test
Connect two battery negative leads onto terminal 50 and onto switch body respectively. Then connect battery positive lead onto terminal C. Next, disconnect lead from terminal 50. Pinion should return immediately.



SC-00135

(A) Terminal C
(B) Terminal 50
(C) Terminal M

7. PERFORMANCE TEST

The starter is required to produce a large torque and high rotating speed, but these starter characteristics vary with the capacity of the battery. It is therefore important to use a battery with the specified capacity whenever testing the starter.
The starter should be checked for the following three items:
• No-load test
Measure the maximum rotating speed and current under a no-load state.
• Load test
Measure the magnitude of current needed to generate the specified torque and rotating speed.

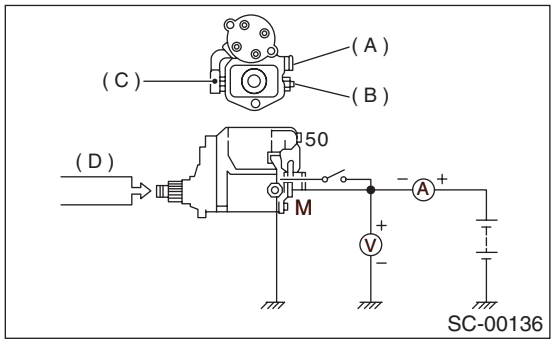
- Stall test

Measure the torque and current when the armature is locked.

1) No-load test

Under no-load state, measure its rotating speed and current, using the specified battery. Measured values must meet the following standards:

No-load test (Standard):
Voltage/Current
11 V/90 A, or more
Rotating speed
228000-7131: 3,000 rpm, or more
228000-7141: 2,900 rpm, or more



(A) Terminal 50
(B) Terminal M
(C) Terminal C
(D) Tachometer

2) Load test (For reference)

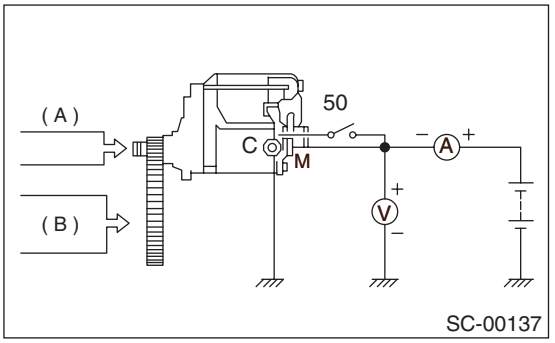
Perform this test to check maximum output of starter. Use test bench which is able to apply load (brake) to starter. Measure torque value and rotating speed under the specified voltage and current conditions while controlling braking force applied to starter.

CAUTION:
Change engagement position of overrunning clutch and make sure it is not slipping.

Load test (Standard):

228000-7131
Voltage/Load
8 V/9.8 N·m (1.0 kgf-m, 7.2 ft-lb)
Current/Speed
280 A, or less/900 rpm , or more

228000-7141
Voltage/Load
8 V/13.7 N·m (1.4 kgf-m, 10.1 ft-lb)
Current/Speed
370 A, or less/880 rpm, or more



(A) Tachometer
(B) Torque gauge

3) Stall test

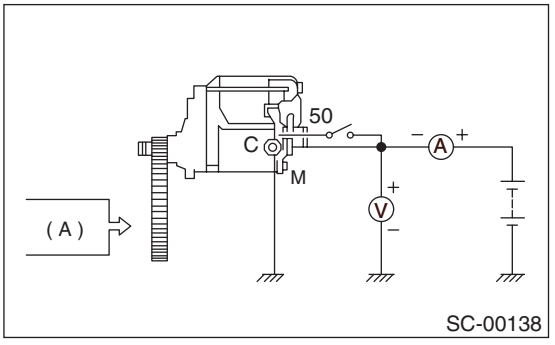
Using the same test equipment used for load test, apply brake to lock starter armature. Then measure voltage, current, and torque values.

Measured values must meet the following standard.

Stall test (Standard):

228000-7131
Voltage/Current
5 V/800 A, or less
Torque
27.5 N·m (2.8 kgf-m, 20.3 ft-lb), or more

228000-7141
Voltage/Current
5 V/1,050 A, or less
Torque
27.5 N·m (2.8 kgf-m, 20.3 ft-lb), or more



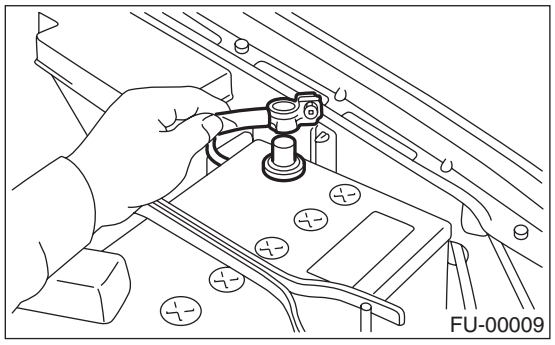
(A) Torque gauge

NOTE:
Low rotating speed or excessive current during no-load test may be attributable to high rotating resistance of starter due to improper assembling.
Small current and no torque during stall test may be attributable to excessive contact resistance between brush and commutator; whereas, normal current and insufficient torque may be attributable to shorted commutator or poor insulation.
Starter can be considered normal if it passes no-load and stall tests; therefore, load test may be omitted.

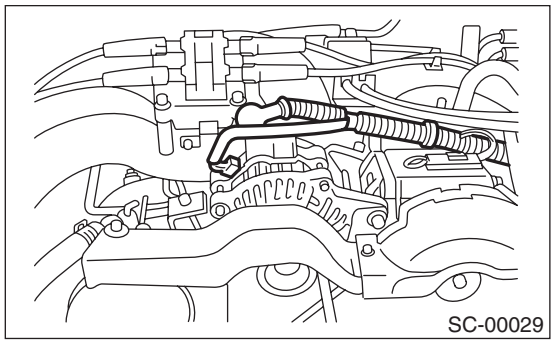
3. Generator

A: REMOVAL

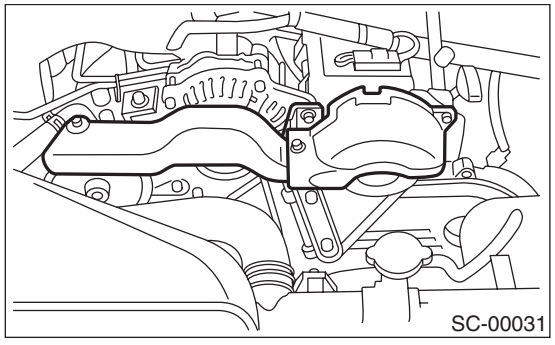
1) Disconnect ground cable from battery.



2) Disconnect the connector and terminal from generator.

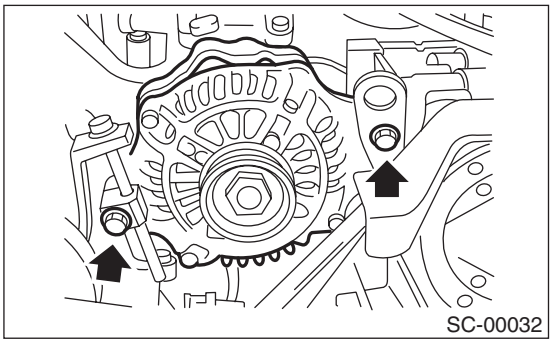


3) Remove the V-belt cover.



4) Remove the front side V-belt.
<Ref. to ME(H4SO)-40, FRONT SIDE BELT, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-45, FRONT SIDE BELT, REMOVAL, V-belt.>

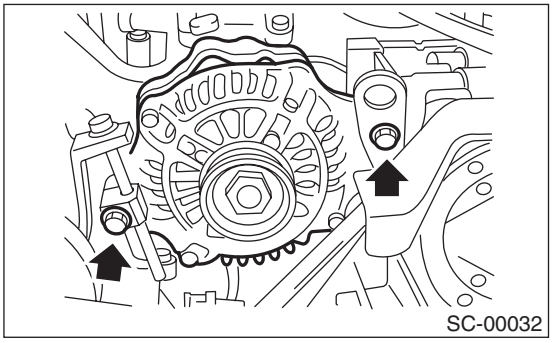
5) Remove the bolts which install generator onto bracket.



B: INSTALLATION

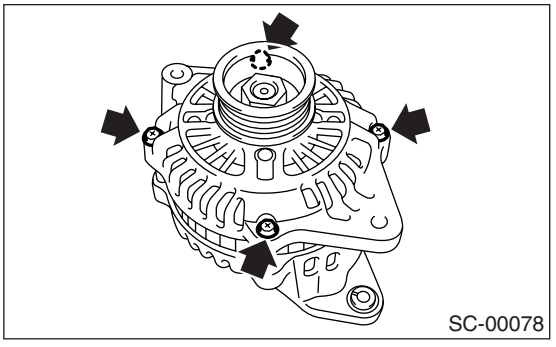
Install in the reverse order of removal.

CAUTION:
Check and adjust the V-belt tension. <Ref. to ME(H4SO)-41, INSPECTION, V-belt.> or <Ref. to ME(H4DOTC)-46, INSPECTION, V-belt.>

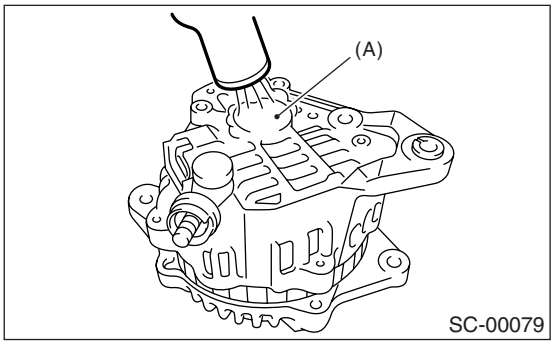


C: DISASSEMBLY

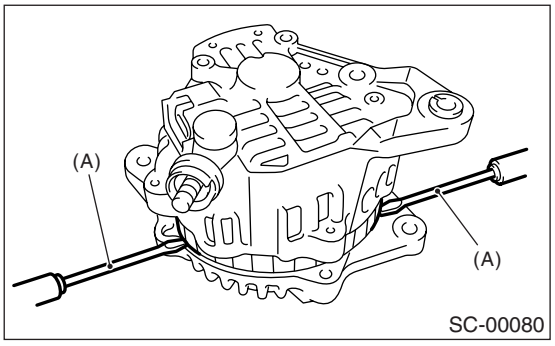
1) Remove the four through-bolts.



2) Heat the portion (A) of rear cover to 50°C (122°F) with heater drier.

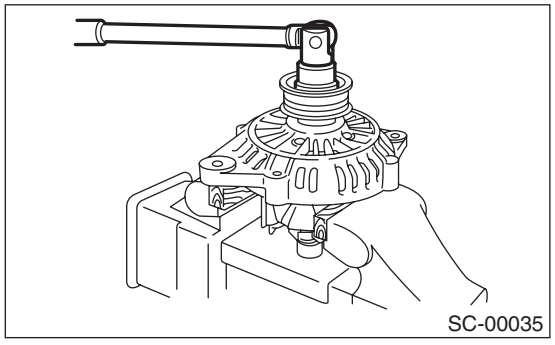


3) Then insert the tip of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

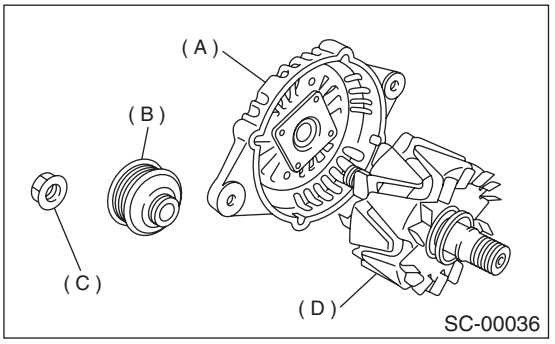


(A) Screwdriver

4) Hold the rotor with a vise and remove pulley nut.

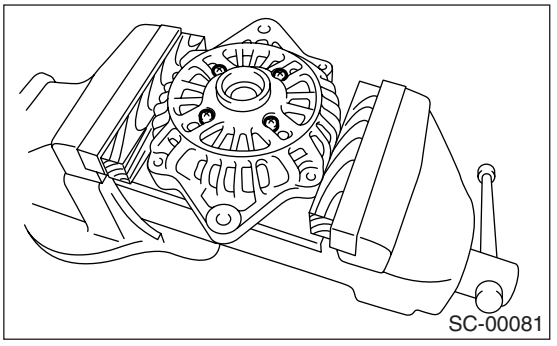


CAUTION:
When holding the rotor with vise, insert aluminum plates or wood pieces on the contact surfaces of vise to prevent rotor from damage.

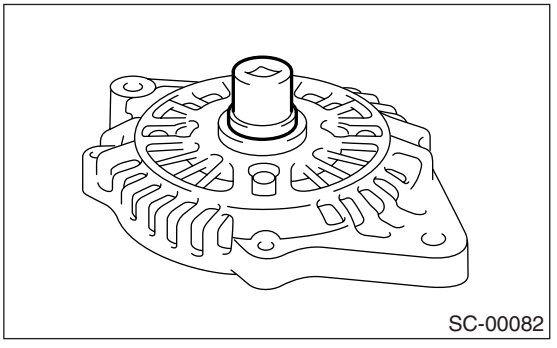


(A) Front cover
(B) Pulley
(C) Nut
(D) Rotor

5) Remove the ball bearing as follows.
(1) Remove the bolt, and then remove the bearing retainer.

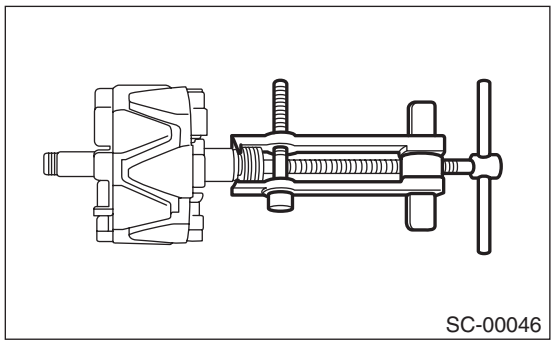


(2) Firmly install an appropriate tool (such as a fit socket wrench) to bearing inner race.



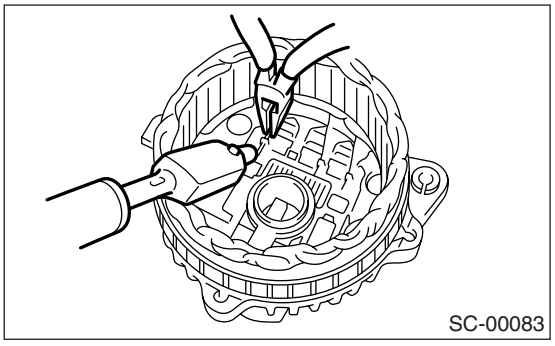
(3) Push the ball bearing off the front cover using a press.

6) Remove the bearing from rotor using a bearing puller.

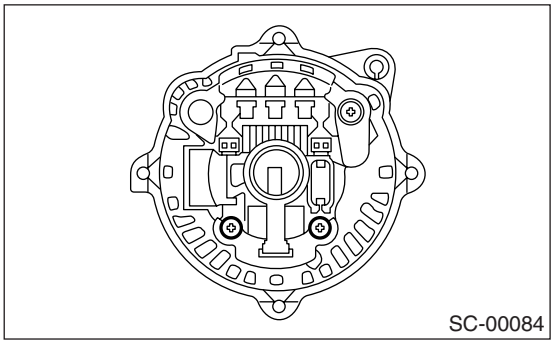

SC-00046

7) Unsolder connection between rectifier and stator coil to remove the stator coil.

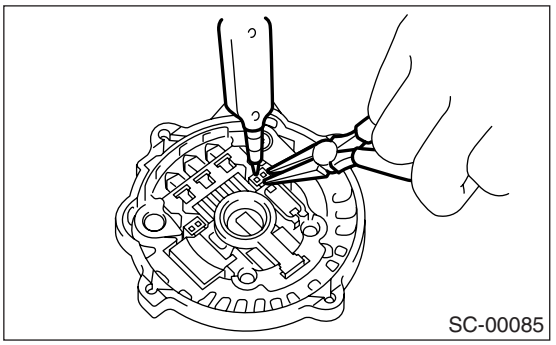
CAUTION:
Do not allow the 180 — 270 W solding bit to contact the terminals for more than 5 seconds at a time because the rectifier cannot withstand heat very well.


SC-00083

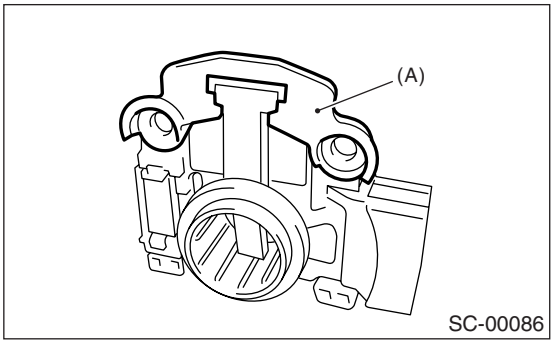
8) Remove the IC regulator as follows.
(1) Remove the screws which secure IC regulator to rear cover.


SC-00084

(2) Unsolder the connection between IC regulator and rectifier to remove the IC regulator.


SC-00085

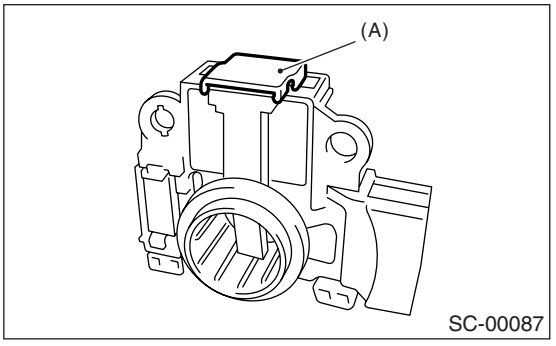
9) Remove the brush as follows.
(1) Remove cover A.



SC-00086

(A) Cover A

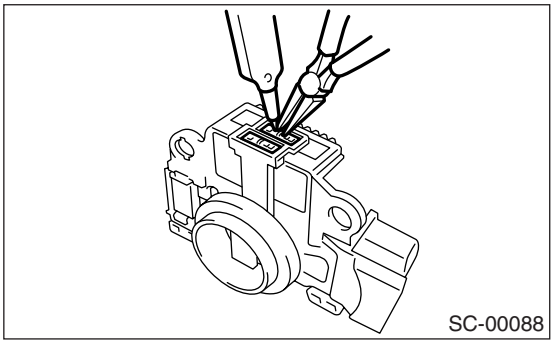
(2) Remove the cover B.



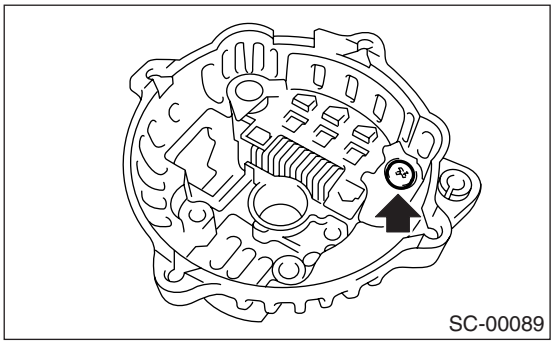
SC-00087

(A) Cover B

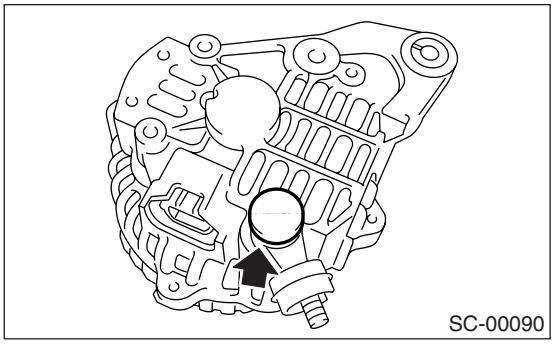
(3) Separate the brush from connection to remove.


SC-00088

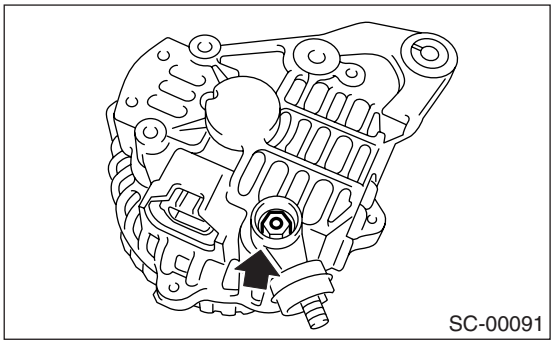
10) Remove the rectifier as follows.
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover of terminal B.



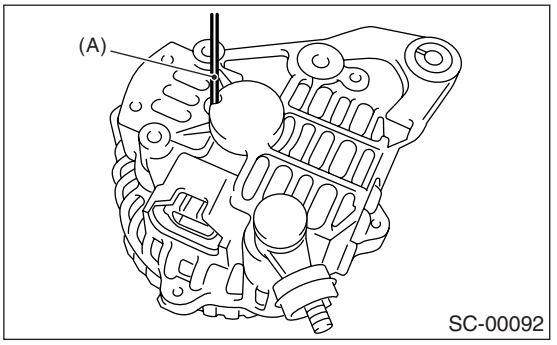
(3) Remove the nut of terminal B, and then remove the rectifier.



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. length 4 to 5 cm (1.6 to 2.0 in)] wire through the hole 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.

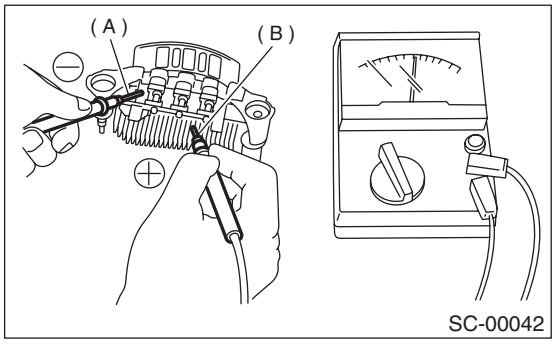
5) After reassembly, turn the pulley by hand to check that rotor turns smoothly.

E: INSPECTION

1. DIODE

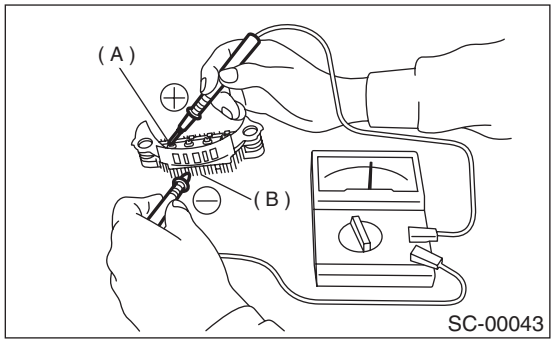
CAUTION:
Never use a mega tester (measuring use for high voltage) or any other similar measure for this test; otherwise, the diodes may be damaged.

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 Ω 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 Ω or less only in the direction from the heat sink to diode lead.



(A) Diode lead
(B) Heat sink (Negative side)

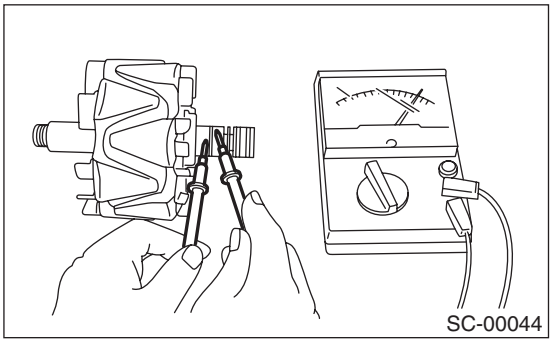
2. ROTOR

1) Slip ring surface
Inspect the slip rings for contamination or any roughness of 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 rotor assembly.

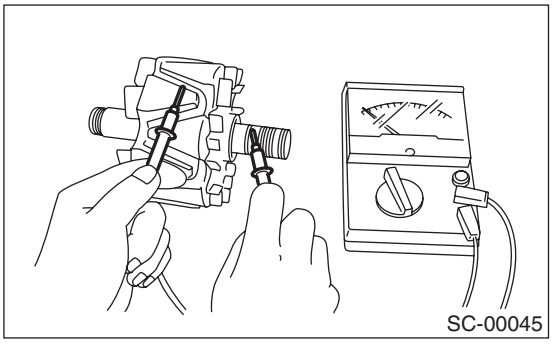
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Continuity test
Check the resistance between slip rings using circuit tester.
If the resistance is not within specification, replace the rotor assembly.

Specified resistance:
Approx. 1.8 — 2.2 Ω



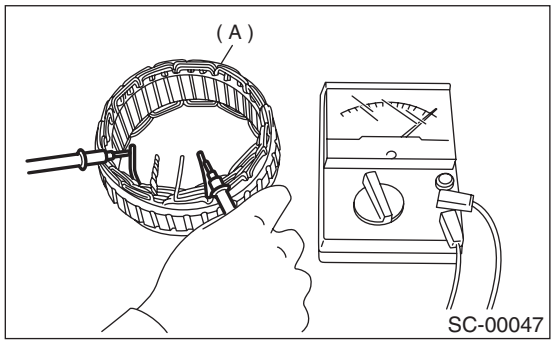
4) Insulation test
Check the continuity between slip ring and rotor core or shaft. If resistance is 1 Ω or less, the rotor coil is grounded, and so replace the rotor assembly.



5) Ball bearing (rear side)
Check the rear ball bearing. Replace if it is noisy or if the rotor does not turn smoothly.

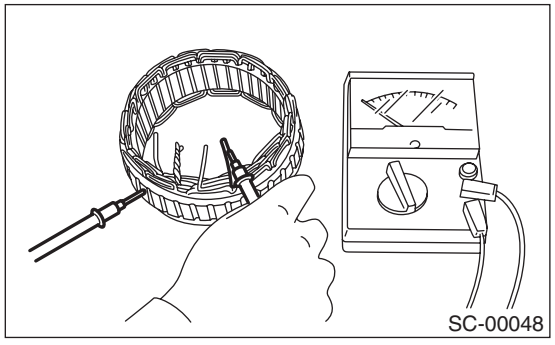
3. STATOR

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

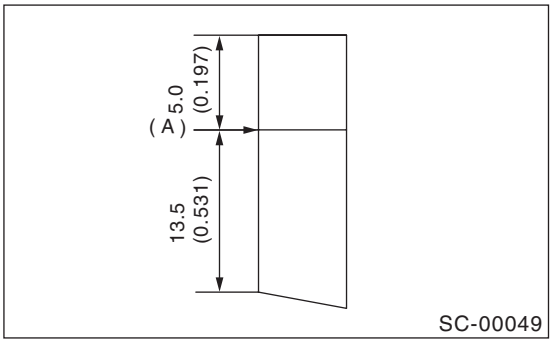
2) Insulation test
Inspect the stator coil for continuity between stator core and each end of lead wire. If resistance is 1 Ω or less, the stator coil is grounded, and so replace the stator assembly.



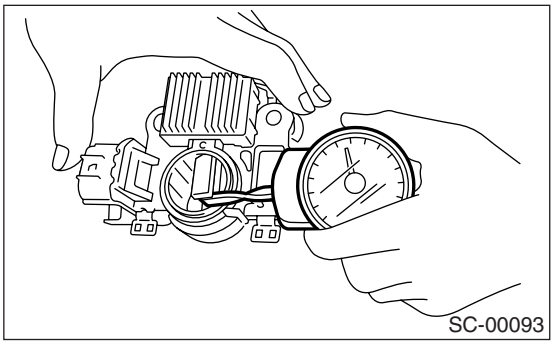
4. BRUSH

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 2.2 N (224 g, 7.91 oz), replace the brush spring with a new one. The new spring must have a pressure of 4.8 to 6.0 N (489 to 612 g, 17.26 to 21.60 oz).



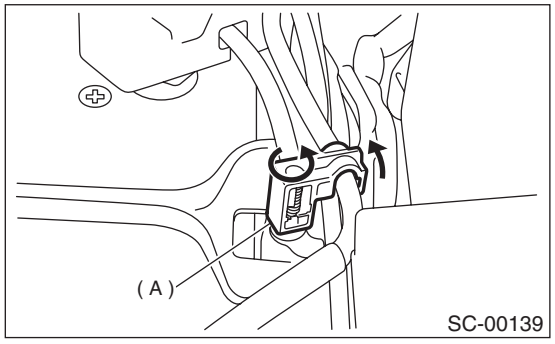
5. BEARING (FRONT SIDE)

Check the front ball bearing. If the resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

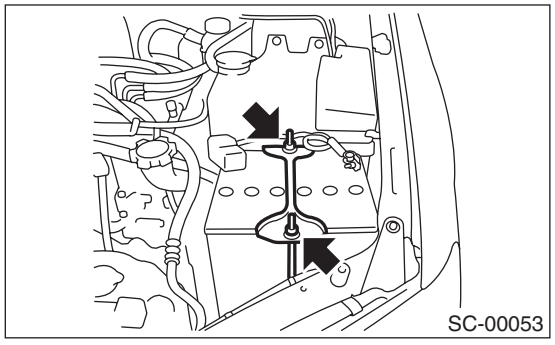
4. Battery

A: REMOVAL

1) Remove battery cable holder (A) from battery rod.



2) Disconnect the positive (+) cable after disconnecting the negative (–) cable of battery.
3) Remove flange nuts from battery rods and take off battery holder.



4) Remove 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 battery cable terminals and apply grease to prevent corrosion.
• Connect the positive (+) cable of battery and then the negative (–) cable of the 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 water for 15 minutes and get prompt medical attention.
• Batteries produce explosive gases. 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 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 because a short circuit will be caused.

1. EXTERNAL PARTS

Check for the existence of dirt or cracks on the 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

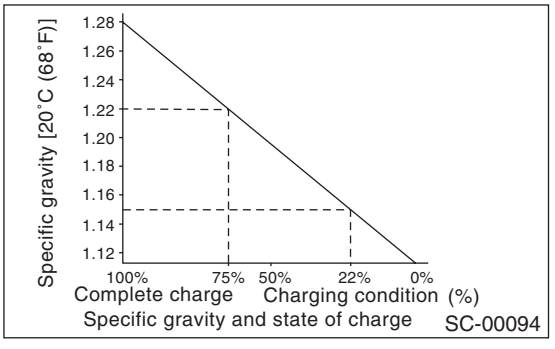
Check the electrolyte level in each cell. If the level is below MIN LEVEL, bring the level to MAX LEVEL by pouring distilled water into the battery cell. Do not fill beyond MAX LEVEL.

3. SPECIFIC GRAVITY OF ELECTROLYTE

1) Measure 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:

$$S_{20} = St + 0.0007 \times (t - 20)$$

S_{20}: Specific gravity corrected at electrolyte temperature of 20°C
St : 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 the battery will disclose the state of charge of the battery. The relation between the specific gravity and the state of charge is as shown in 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.
• Be careful since battery electrolyte overflows while charging the battery.
• Observe instructions when handling battery charger.
• Before charging the battery on vehicle, disconnect battery ground terminal. Failure to follow this rule may damage alternator's diodes or other electrical units.

1. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte is held at a specific value in a range from 1.250 to 1.290 for more than one hour.
2) Voltage per battery cell is held at a specific value in a range from 2.5 to 2.8 volts for more than one hour.

2. CHECK HYDROMETER FOR STATE OF CHARGE

Hydrometer indicator	State of charge	Required action
Green dot	Above 65%	Load test
Dark dot	Below 65%	Charge battery
Clear dot	Low electrolyte	Replace battery* (If cranking complaint)
*: Check electrical system before replacement.		

3. NORMAL CHARGING

Charge the battery at current value specified by manufacturer or at approximately 1/10 of 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 the 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:
Never use more than 10 amperes when charging the battery because that will shorten battery life.