

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

1. General Description S175001

A: SPECIFICATIONS S175001E49

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

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MEMO:

GENERAL DESCRIPTION

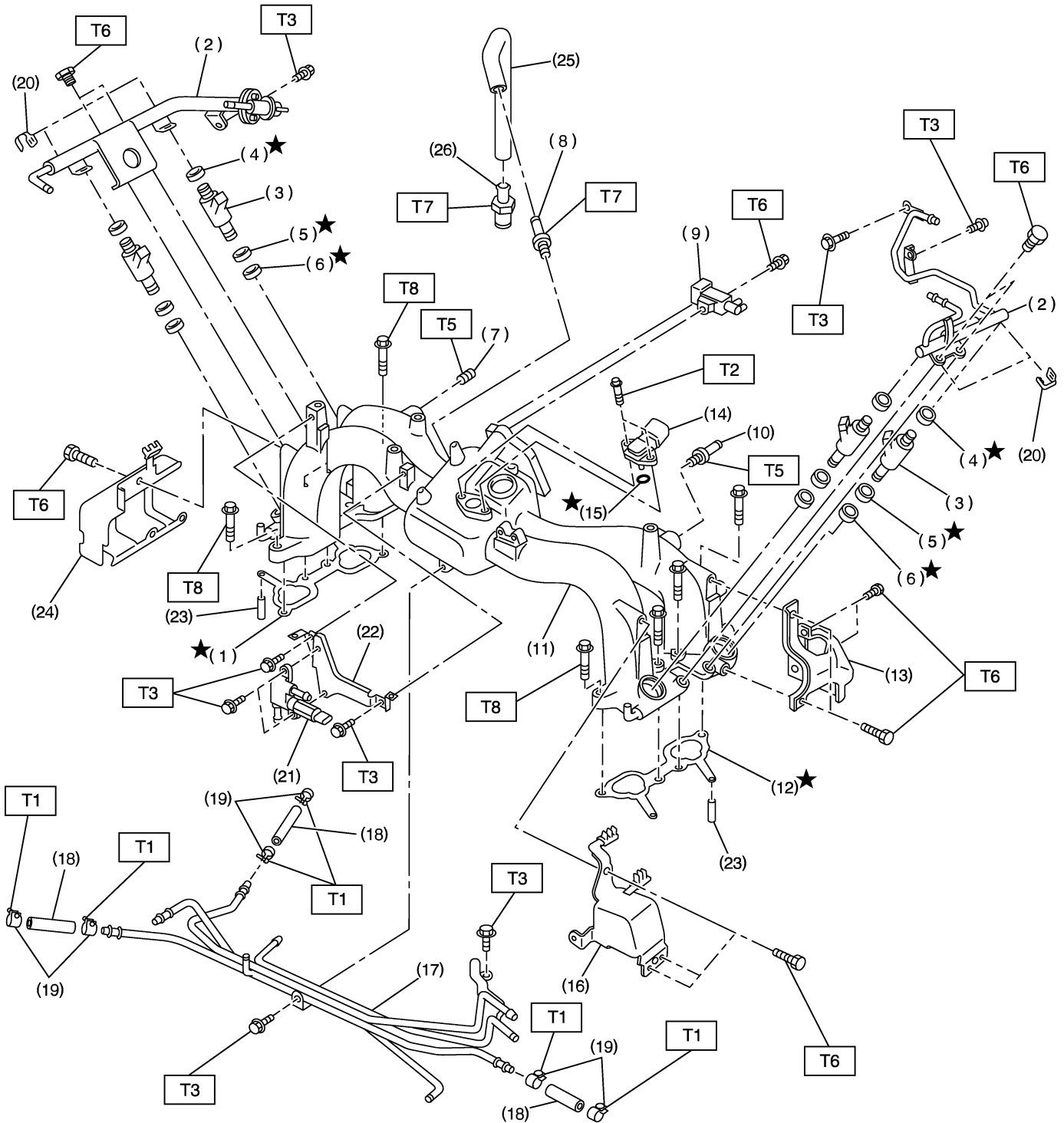
Fuel Injection (Fuel Systems)

B: COMPONENT

S175001A05

1. INTAKE MANIFOLD

S175001A0501



B2M4593A

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

(1) Intake manifold gasket RH	(14) Intake air temperature and pressure sensor
(2) Fuel injector pipe	(15) O-ring
(3) Fuel injector	(16) Fuel pipe protector LH (front)
(4) O-ring	(17) Fuel pipe ASSY
(5) O-ring	(18) Fuel hose
(6) O-ring	(19) Clip
(7) Plug	(20) Clip
(8) Nipple	(21) Air assist injector solenoid valve
(9) Purge control solenoid valve	(22) Air assist injector solenoid valve bracket
(10) Nipple	(23) Guide pin
(11) Intake manifold	(24) Fuel pipe protector RH
(12) Intake manifold gasket LH	
(13) Fuel pipe protector LH (rear)	

- (25) PCV hose
(26) PCV valve

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.5 (0.15, 1.1)

T2: 3.4 (0.35, 2.5)

T3: 5.0 (0.51, 3.7)

T4: 6.4 (0.65, 4.7)

T5: 17 (1.7, 12)

T6: 19 (0.19, 1.4)

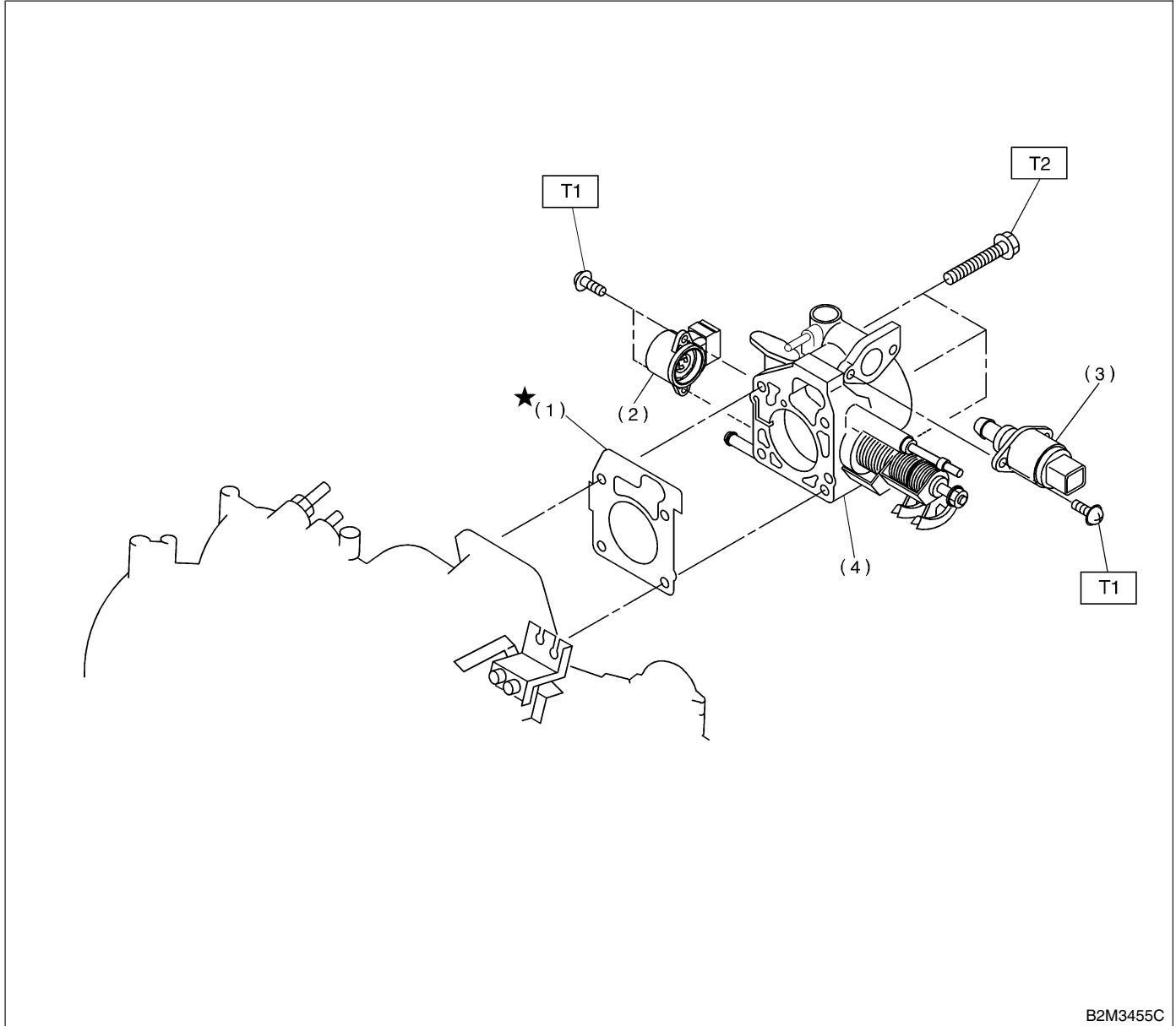
T7: 22.5 (2.29, 16.6)

T8: 25 (2.6, 18.8)

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

2. AIR INTAKE SYSTEM S175001A0502



- (1) Gasket
- (2) Throttle position sensor
- (3) Idle air control solenoid valve

- (4) Throttle body

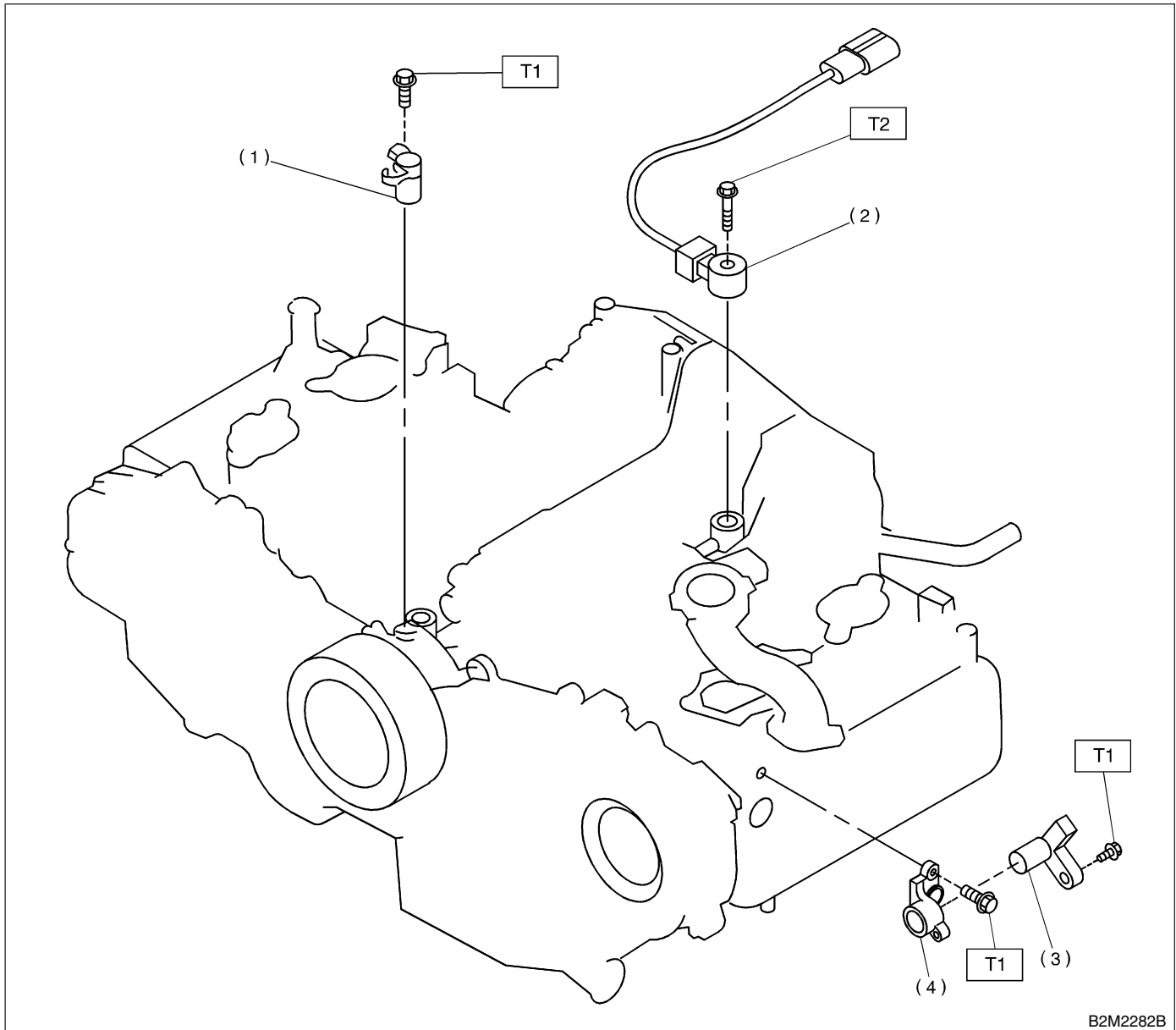
Tightening torque: N·m (kgf-m, ft-lb)

T1: 2.4 (0.24, 1.7)

T2: 22 (2.2, 16)

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS

S175001A0503



B2M2282B

(1) Crankshaft position sensor

(2) Knock sensor

(3) Camshaft position sensor

(4) Camshaft position sensor support

Tightening torque: N·m (kgf-m, ft-lb)

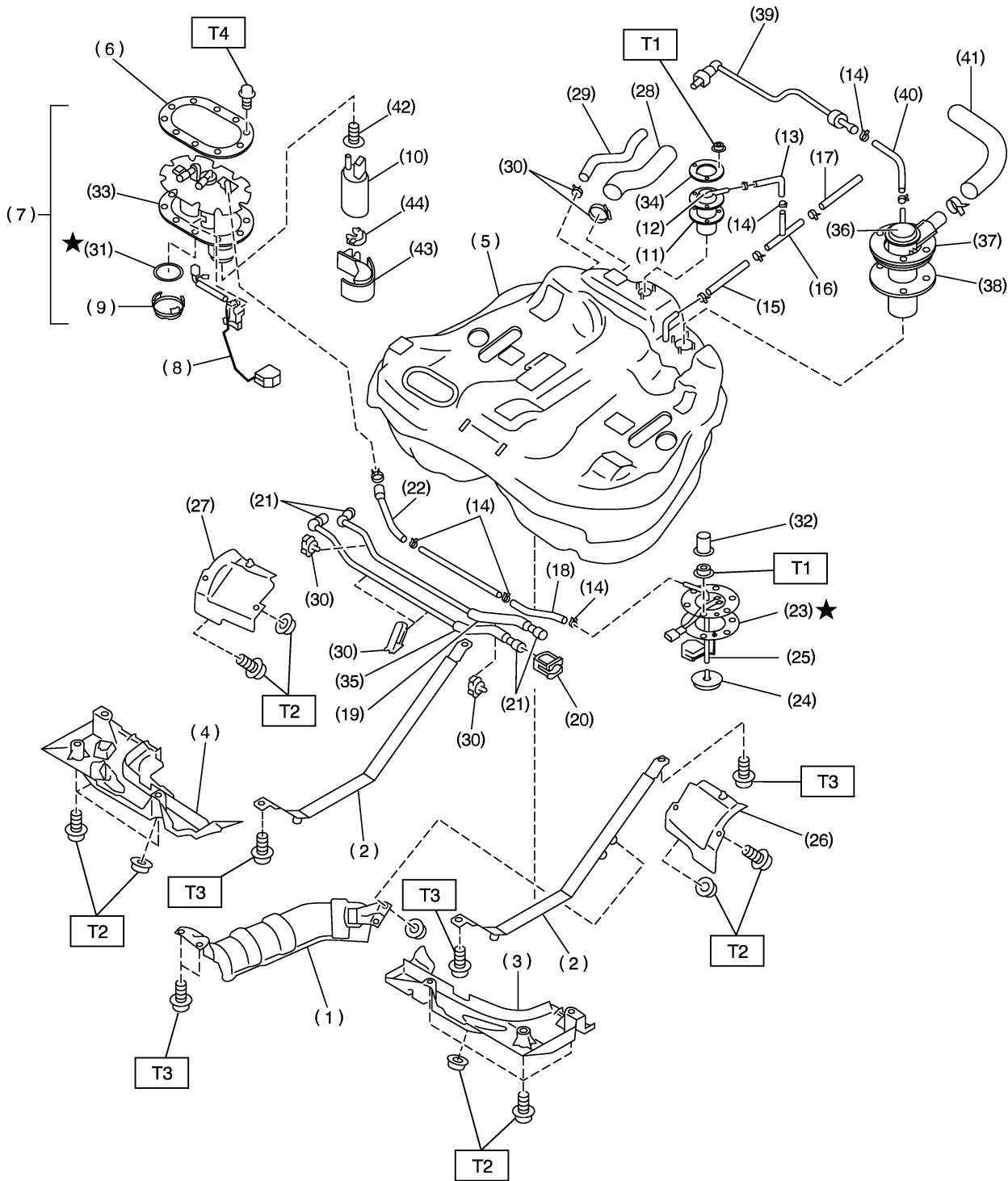
T1: 6.4 (0.65, 4.7)

T2: 24 (2.4, 17.4)

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

4. FUEL TANK S175001A0504



B2M3662A

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

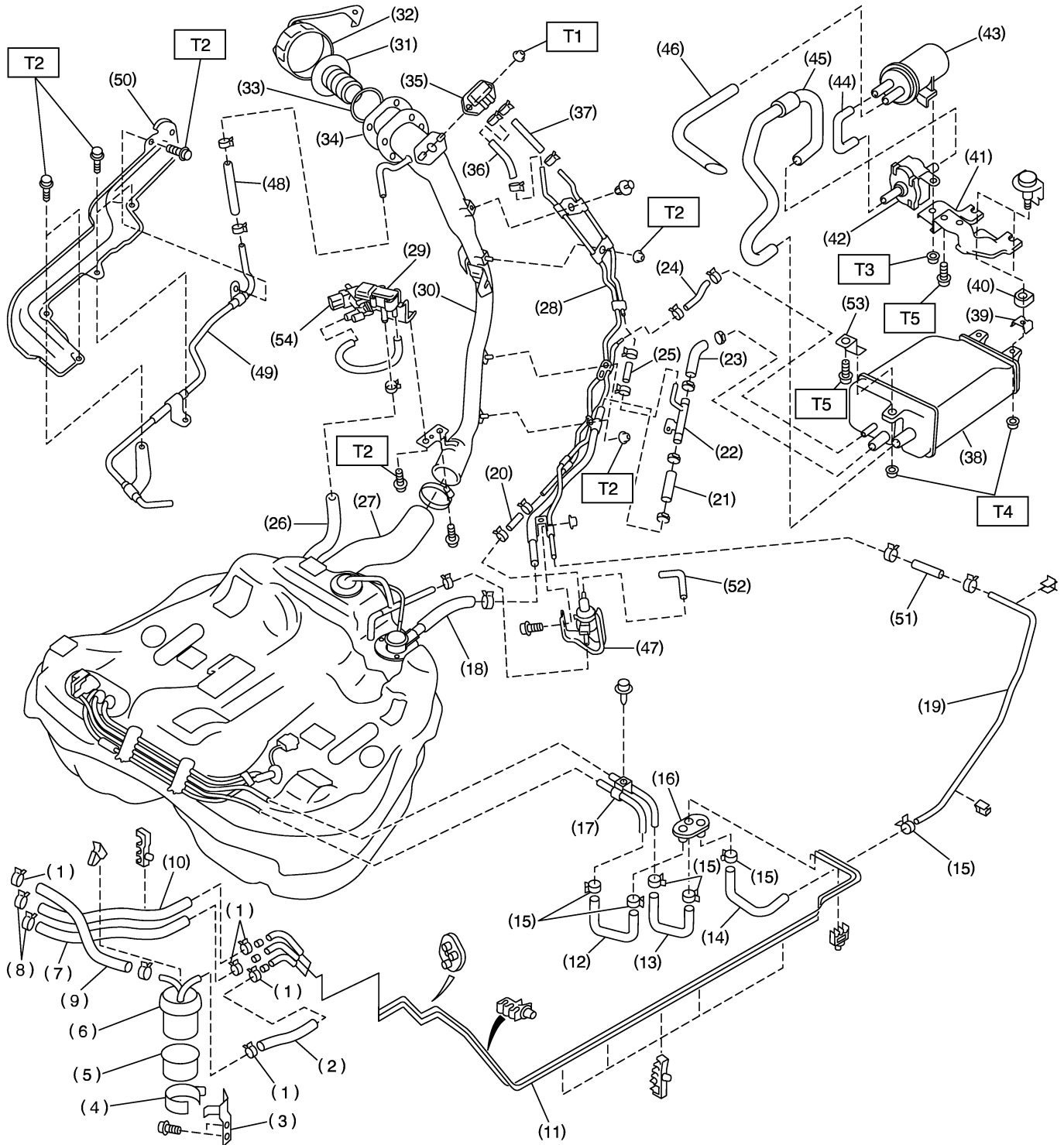
(1) Heat sealed cover	(18) Jet pump hose A	(35) Fuel delivery tube
(2) Fuel tank band	(19) Fuel return tube	(36) Vent valve
(3) Protector LH (Front)	(20) Retainer	(37) Vent valve plate
(4) Protector RH (Front)	(21) Quick connector	(38) Vent valve gasket
(5) Fuel tank	(22) Jet pump hose B	(39) Evaporation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

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)***

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

5. FUEL LINE S175001A0505



B2M4691A

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

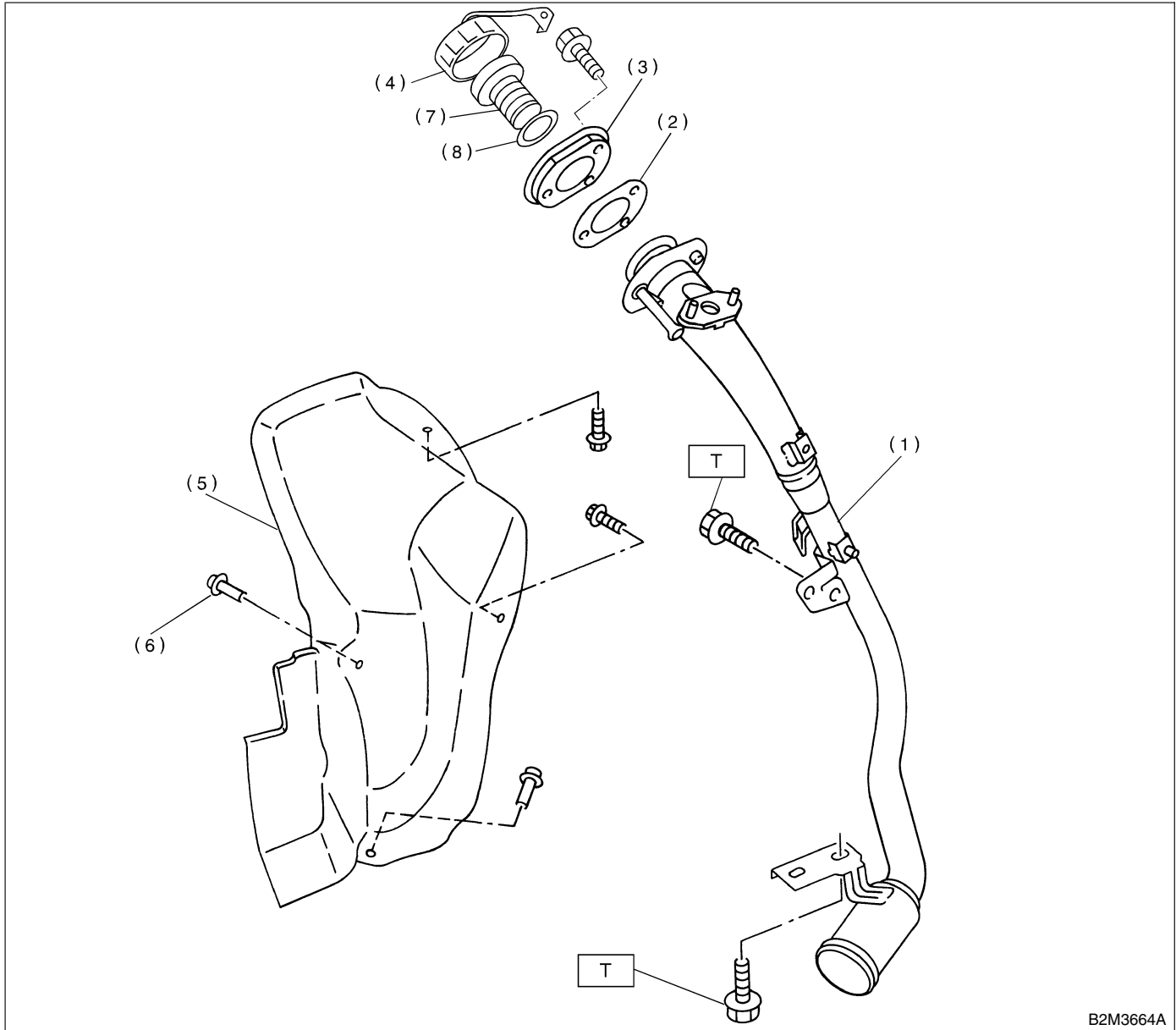
(1) Clamp	(23) Evaporation hose J	(45) Drain valve hose
(2) Fuel delivery hose A	(24) Evaporation hose K	(46) Drain filter hose B
(3) Fuel filter bracket	(25) Evaporation hose L	(47) Pressure control solenoid valve
(4) Fuel filter holder	(26) Fuel tank pressure sensor hose	(48) Evaporation hose O
(5) Fuel filter cup	(27) Fuel filler hose	(49) Evaporation pipe C
(6) Fuel filter	(28) Evaporation pipe B	(50) Pipe protector
(7) Evaporation hose F	(29) Fuel tank pressure sensor	(51) Evaporation hose P
(8) Clip	(30) Fuel filler pipe	(52) Pressure control solenoid valve hose
(9) Fuel delivery hose B	(31) Ring A	(53) Canister front bracket
(10) Fuel return hose	(32) Fuel filler cap	(54) Atmospheric pressure solenoid valve
(11) Fuel pipe ASSY	(33) Ring B	
(12) Fuel delivery hose C	(34) Packing	
(13) Fuel return hose C	(35) Shut valve	
(14) Evaporation hose G	(36) Evaporation hose M	
(15) Clamp	(37) Evaporation hose N	
(16) Grommet	(38) Canister	
(17) Fuel pipe ASSY	(39) Canister lower bracket	
(18) Air vent hose A	(40) Cushion rubber	
(19) Evaporation hose H	(41) Canister upper bracket	
(20) Evaporation hose I	(42) Drain valve	
(21) Air vent hose B	(43) Drain filter	
(22) Air vent pipe	(44) Drain filter hose A	

Tightening torque: N·m (kgf-m, ft-lb)**T1: 4.5 (0.46, 3.3)****T2: 7.5 (0.76, 5.5)****T3: 18 (1.8, 13.0)****T4: 23 (2.3, 16.6)****T5: 33 (3.4, 25)**

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

6. FUEL FILLER PIPE S175001A0506



B2M3664A

(1) Fuel filler pipe ASSY	(5) Filler pipe protector
(2) Filler pipe packing	(6) Clip
(3) Filler ring	(7) Ring A
(4) Filler cap	(8) Ring B

Tightening torque: N·m (kgf-m, ft-lb)

T: 7.5 (0.75, 5.4)

C: CAUTION

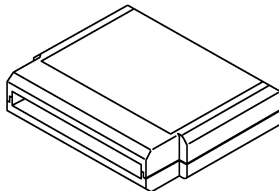
S175001A03

- 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

S175001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3876	24082AA190 (Newly adopted tool)	CARTRIDGE	
 B2M3877	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. ● English: 22771AA030 (Without printer) ● German: 22771AA070 (Without printer) ● French: 22771AA080 (Without printer) ● Spanish: 22771AA090 (Without printer)

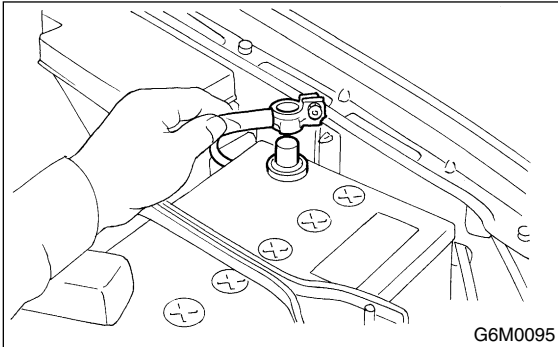
THROTTLE BODY

Fuel Injection (Fuel Systems)

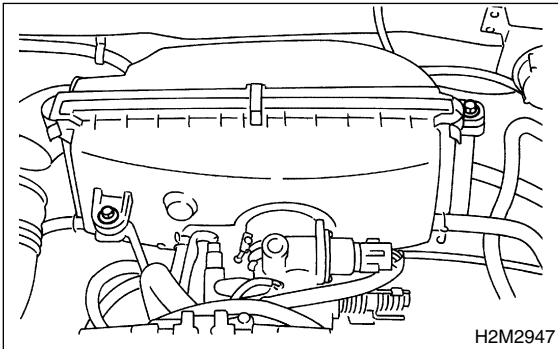
2. Throttle Body S175010

A: REMOVAL S175010A18

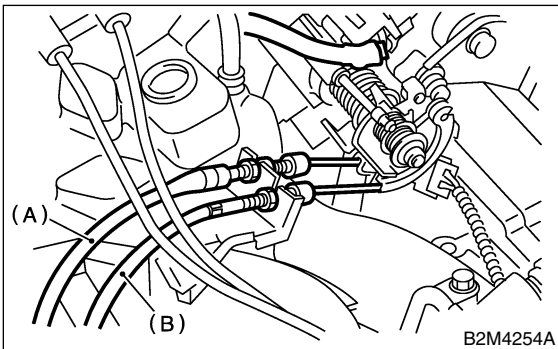
- 1) Disconnect battery ground cable.



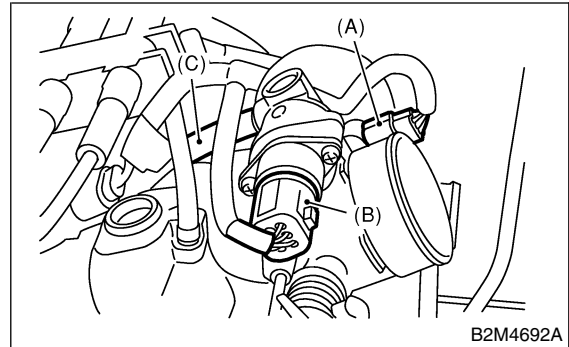
- 2) Remove air cleaner case.



- 3) Disconnect accelerator cable (A).
4) Disconnect cruise control cable (B). (With cruise control model)

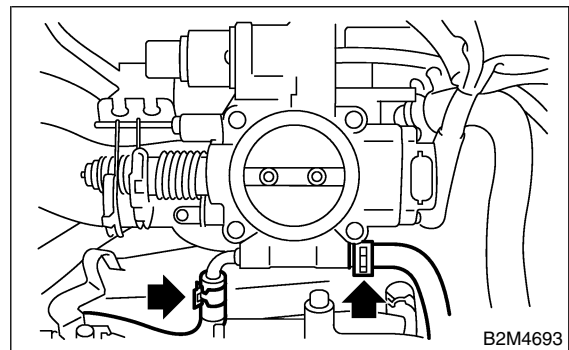


- 5) Disconnect connectors from idle air control solenoid valve, throttle position sensor.
6) Disconnect air by-pass hose from air assist injector solenoid valve.



- (A) Throttle position sensor
(B) Idle air control solenoid valve
(C) Air by-pass hose from air assist injector solenoid valve

- 7) Disconnect engine coolant hoses from throttle body.



- 8) Remove bolts which install throttle body to intake manifold.

B: INSTALLATION S175010A11

Install in the reverse order of removal.

NOTE:

Always use a new gasket.

Tightening torque:

Throttle body;

22 N·m (2.2 kgf·m, 15.9 ft·lb)

Air cleaner case;

6.5 N·m (0.66 kgf·m, 4.8 ft·lb)

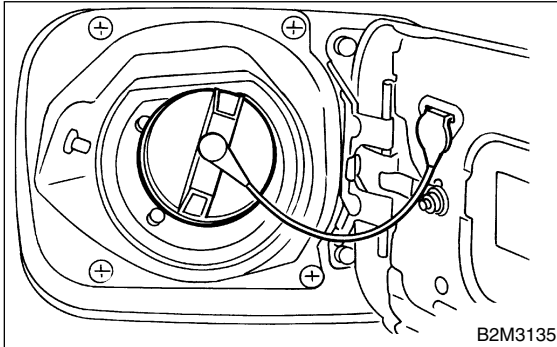
3. Intake Manifold

S175034

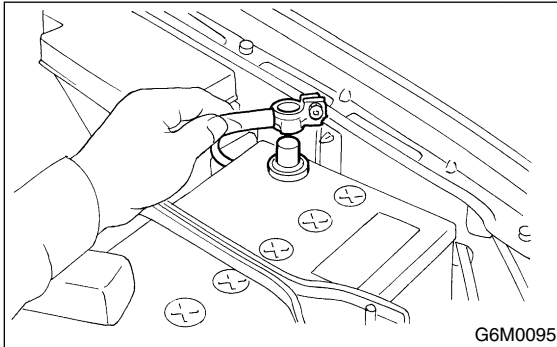
A: REMOVAL

S175034A18

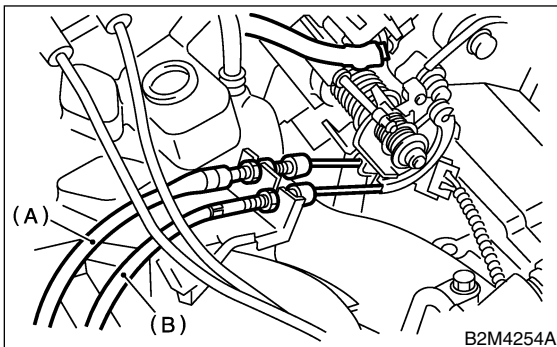
- 1) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open fuel flap lid, and remove fuel filler cap.



- 3) Disconnect battery ground cable.

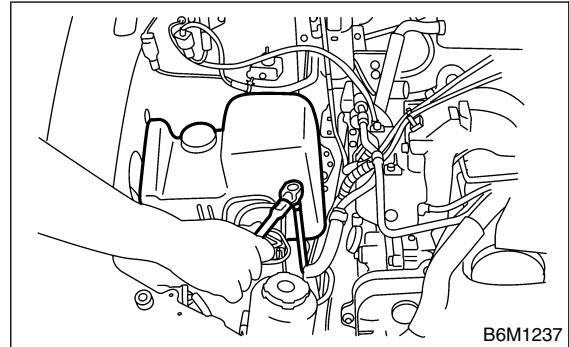


- 4) Remove air intake duct and air cleaner case. <Ref. to IN-7, REMOVAL, Air Intake Duct.> and <Ref. to IN-6, REMOVAL, Air Cleaner Case.>
- 5) Disconnect accelerator cable (A).
- 6) Disconnect cruise control cable (B). (With cruise control model)

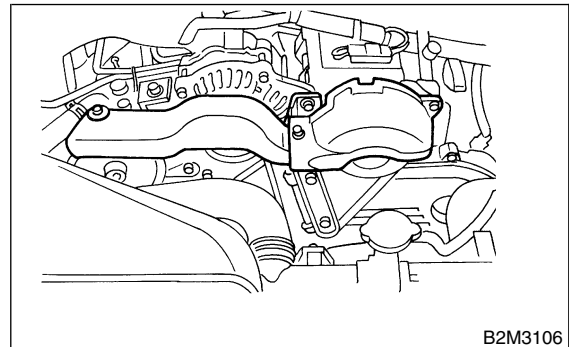


- 7) Remove power steering pump and tank from brackets.

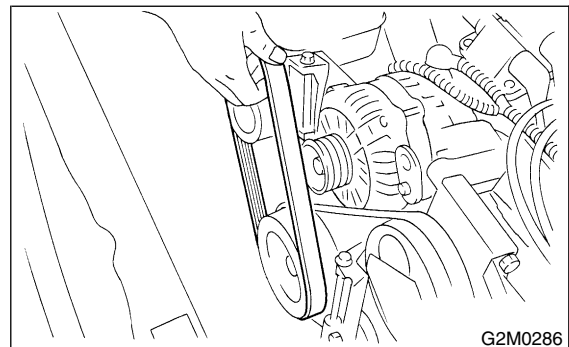
- (1) Remove resonator chamber.



- (2) Remove V-belt covers.



- (3) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.



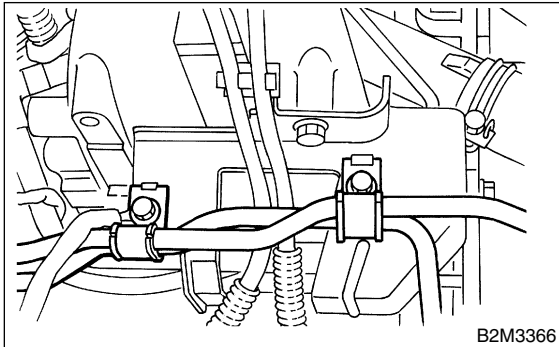
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

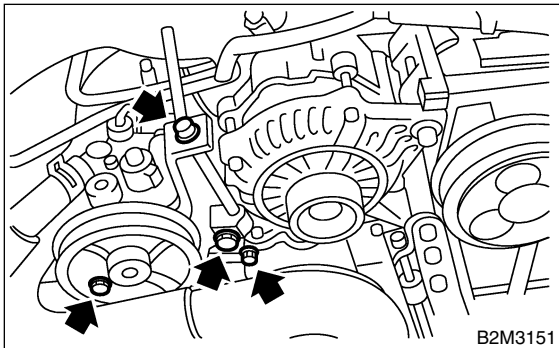
- (4) Remove bolts which hold power steering pipes onto intake manifold protector.

NOTE:

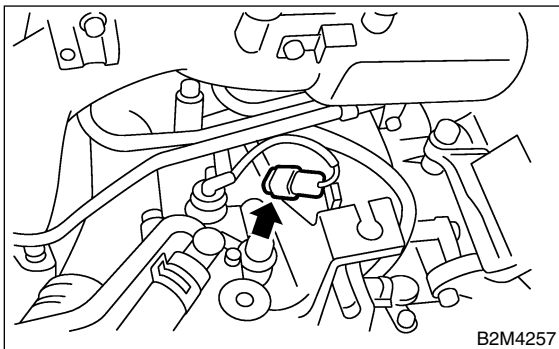
Do not disconnect power steering hose.



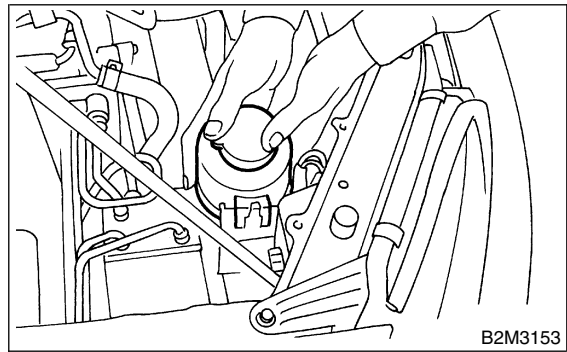
- (5) Remove bolts which install power steering pump bracket.



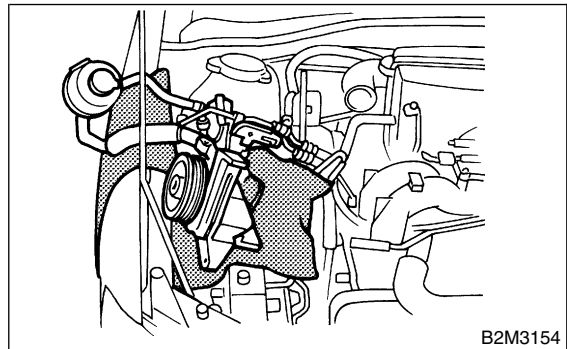
- (6) Disconnect connector from power steering pump switch.



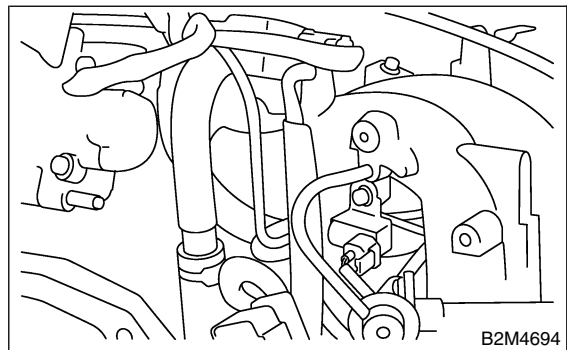
- (7) Remove power steering tank from the bracket by pulling it upwards.



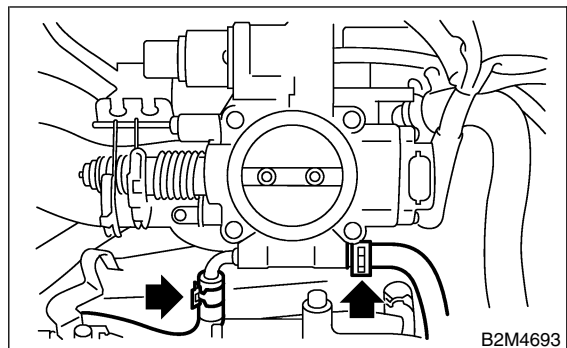
- (8) Place power steering pump and tank on the right side wheel apron.



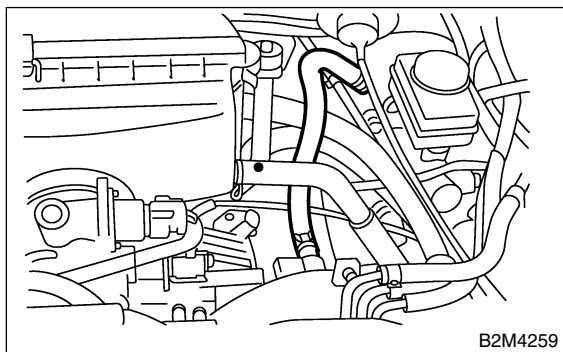
- 8) Disconnect spark plug cords from spark plugs.
9) Disconnect PCV hose from intake manifold.



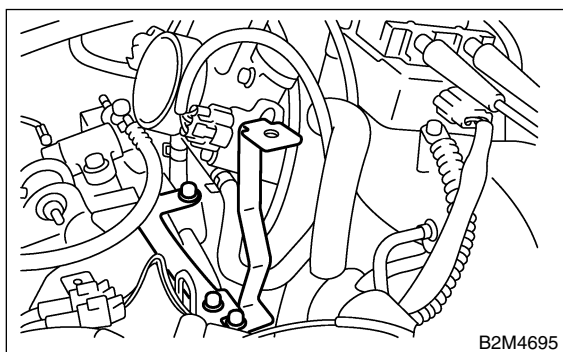
- 10) Disconnect engine coolant hose from throttle body.



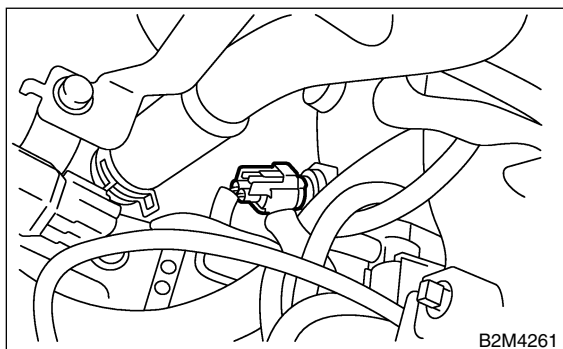
11) Disconnect brake booster hose.



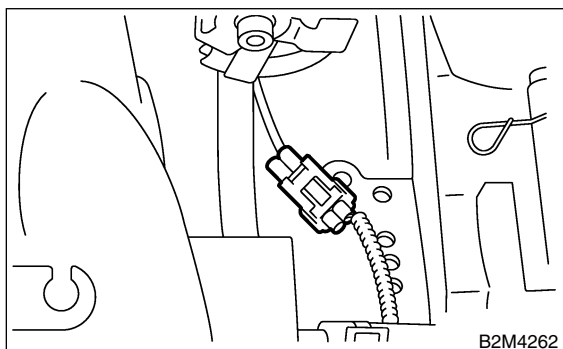
12) Remove air cleaner case stay RH and engine harness bracket, and disconnect engine harness connectors from bulkhead harness connectors.



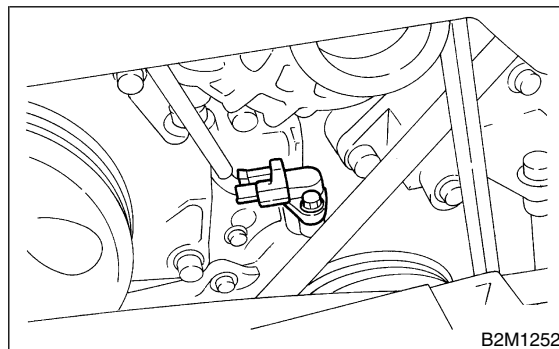
13) Disconnect connectors from engine coolant temperature sensor.



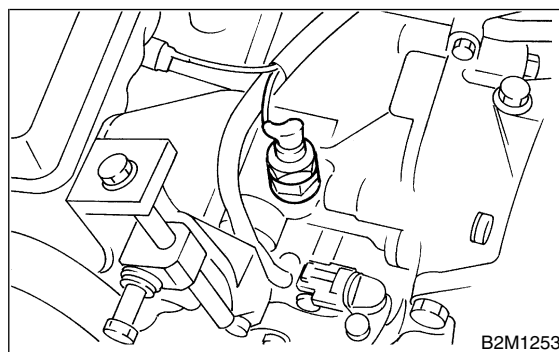
14) Disconnect knock sensor connector.



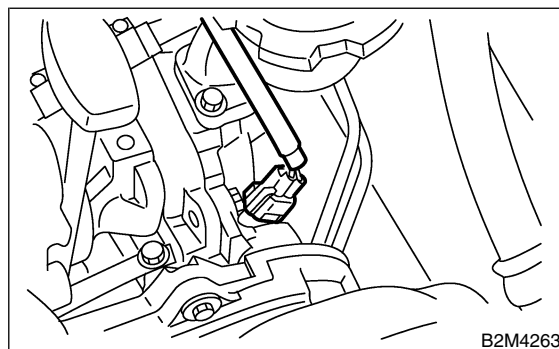
15) Disconnect connector from crankshaft position sensor.



16) Disconnect connector from oil pressure switch.



17) Disconnect connector from camshaft position sensor.



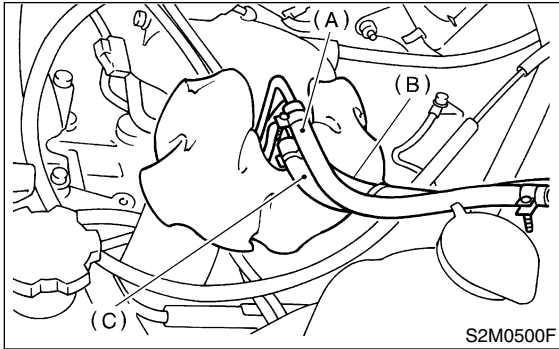
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

18) Disconnect fuel hoses from fuel pipes.

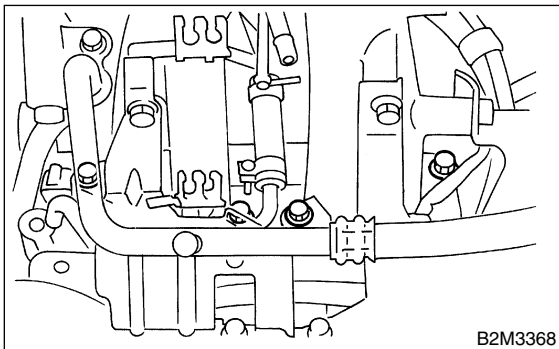
WARNING:

- Do not spill fuel.
- Catch fuel from hoses in a container or cloth.

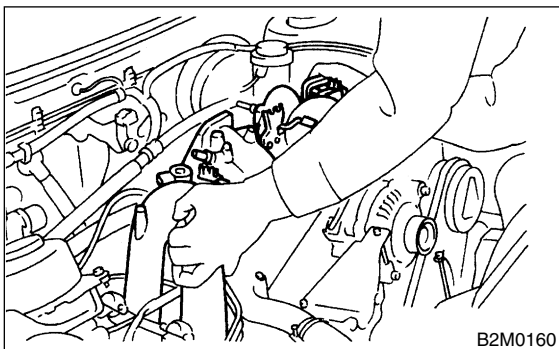


- (A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

19) Remove bolts which hold intake manifold onto cylinder heads.



20) Remove intake manifold.



B: INSTALLATION S175034A11

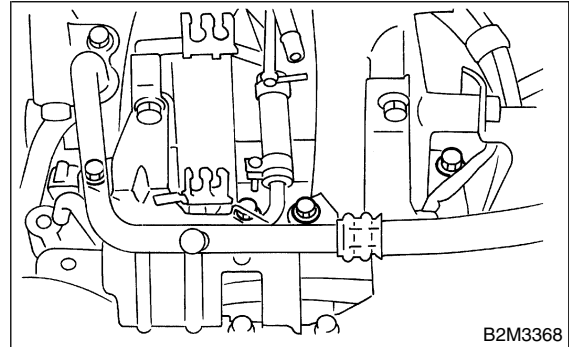
1) Install intake manifold onto cylinder heads.

NOTE:

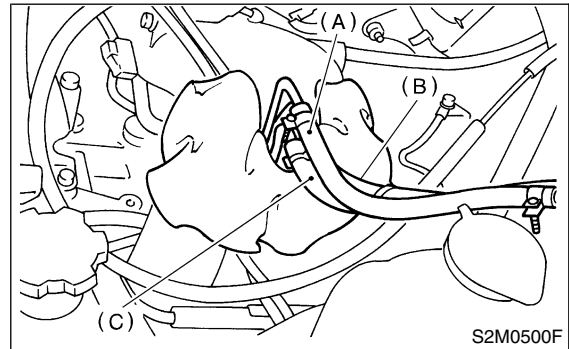
Always use new gaskets.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

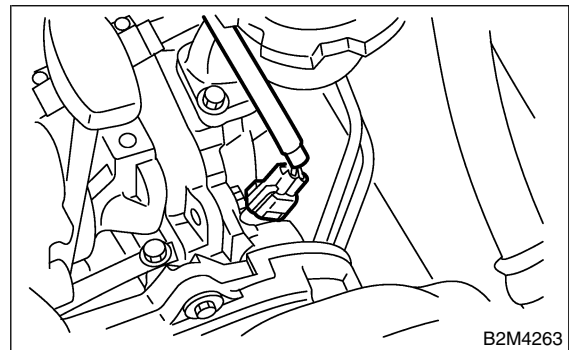


2) Connect fuel hoses.

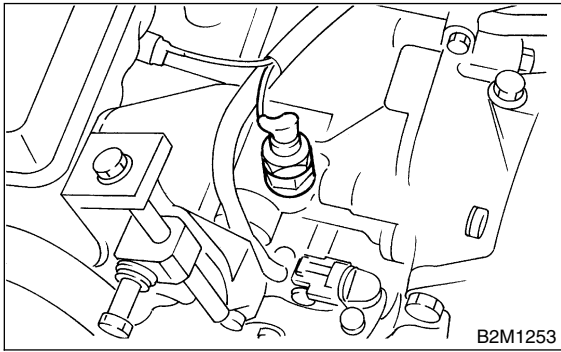


- (A) Fuel delivery hose
(B) Return hose
(C) Evaporation hose

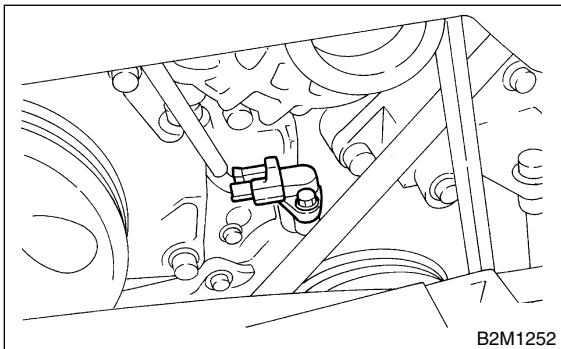
3) Connect connector to camshaft position sensor.



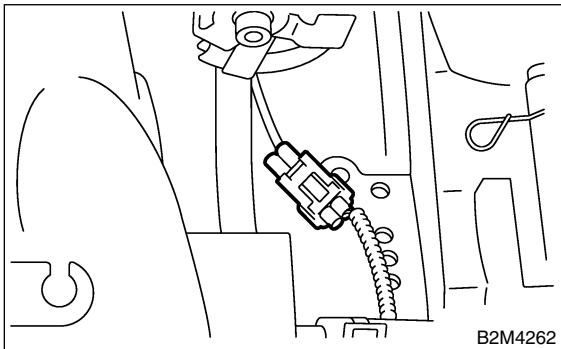
- 4) Connect connector to oil pressure switch.



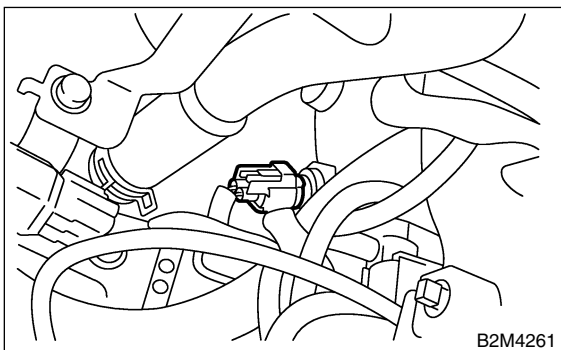
- 5) Connect connector to crankshaft position sensor.



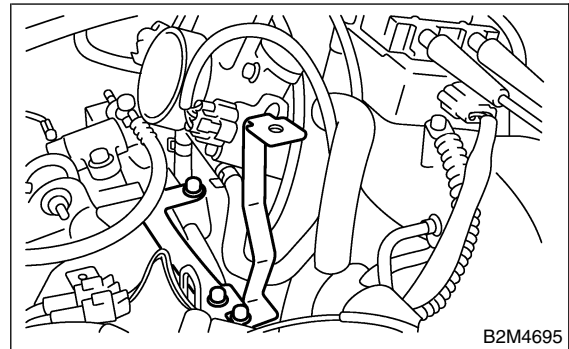
- 6) Connect knock sensor connector.



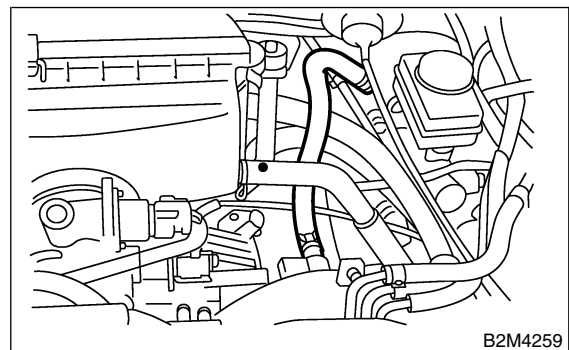
- 7) Connect connectors to engine coolant temperature sensor.



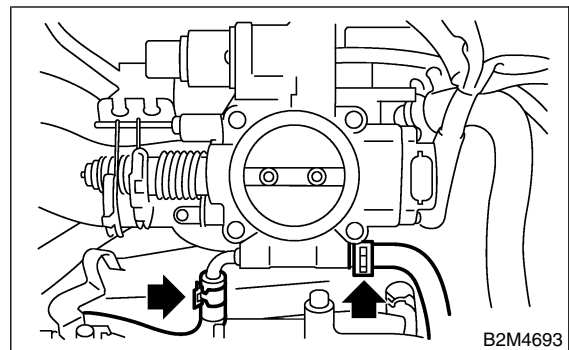
- 8) Install air cleaner case stay RH and engine harness bracket, and connect engine harness connectors to bulkhead connectors.



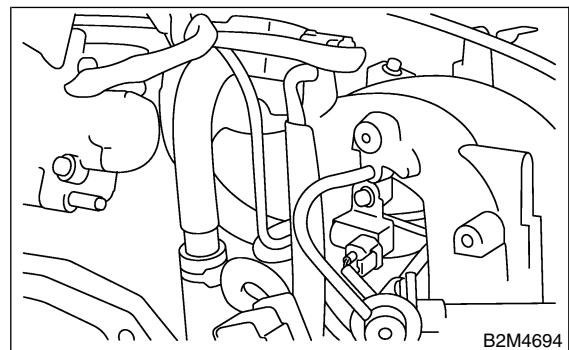
- 9) Connect brake booster hose.



- 10) Connect engine coolant hose to throttle body.



- 11) Connect PCV hose to intake manifold.



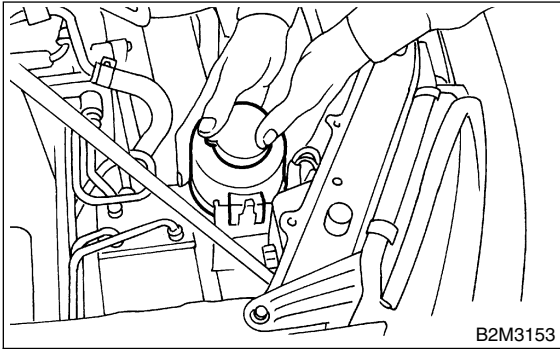
- 12) Connect spark plug cords to spark plugs.

INTAKE MANIFOLD

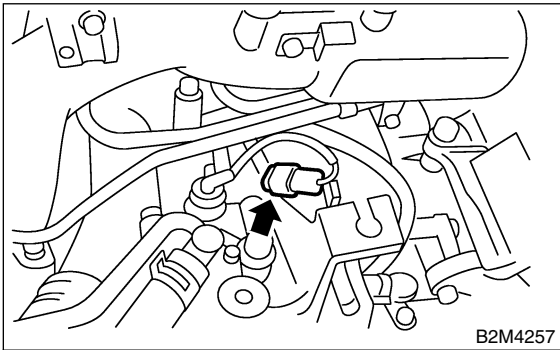
Fuel Injection (Fuel Systems)

13) Install power steering pump and tank on brackets.

(1) Install power steering tank on bracket.

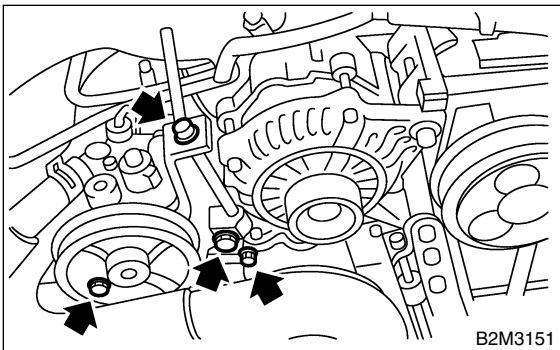


(2) Connect connector to power steering pump switch.

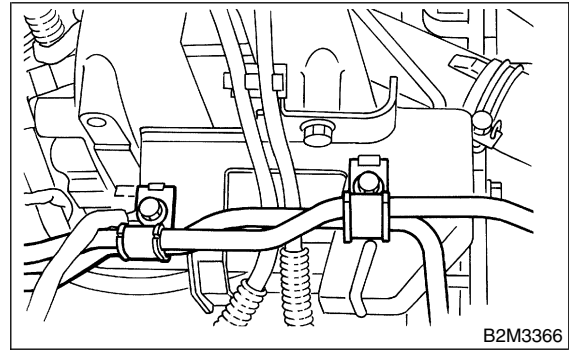


(3) Tighten bolts which install power steering pump on bracket.

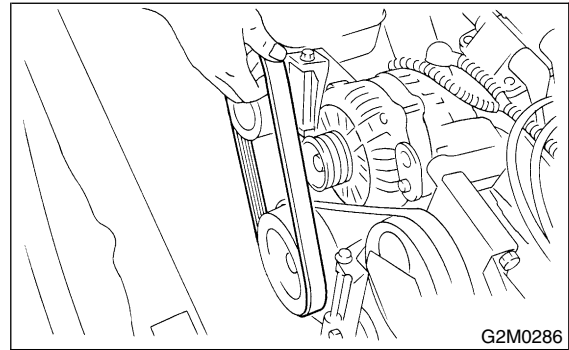
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(4) Install power steering pipes onto right side intake manifold protector.

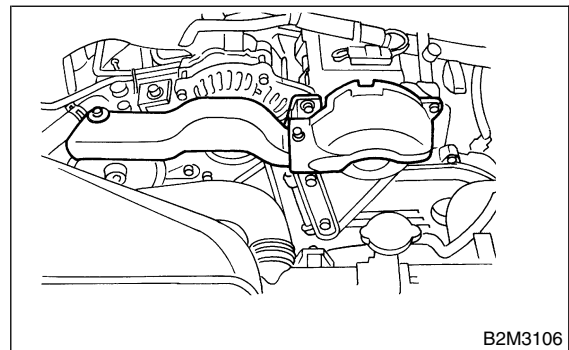


(5) Install power steering pump drive V-belt.



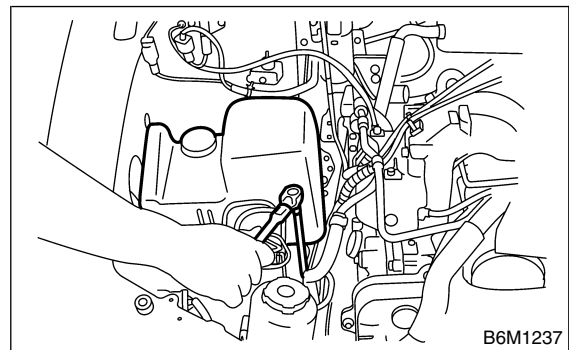
(6) Adjust V-belt. <Ref. to ME-42, REMOVAL, V-belt.>

(7) Install V-belt covers.

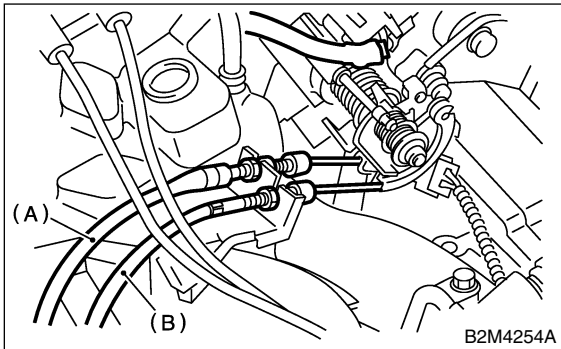


(8) Install resonator chamber.

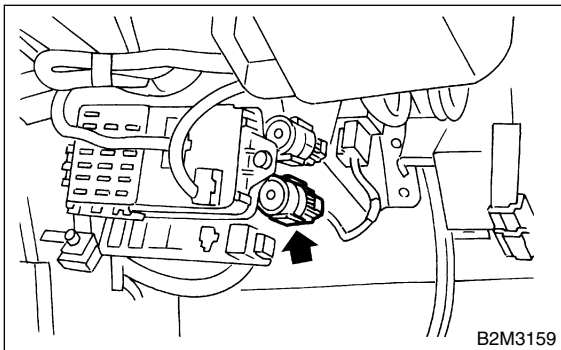
Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



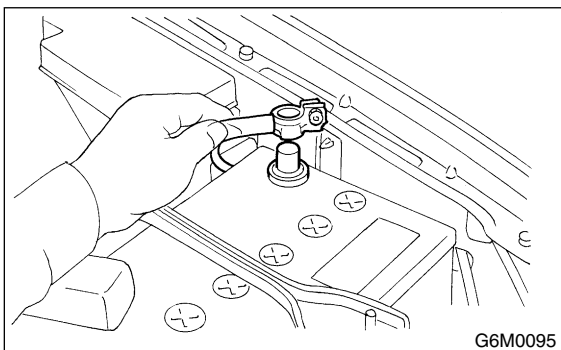
- 14) Connect accelerator cable (A).
- 15) Connect cruise control cable (B). (With cruise control models)



- 16) Install air intake duct and air cleaner case.
<Ref. to IN-7, REMOVAL, Air Intake Duct.> and
<Ref. to IN-6, REMOVAL, Air Cleaner Case.>
- 17) Connect connector to fuel pump relay.

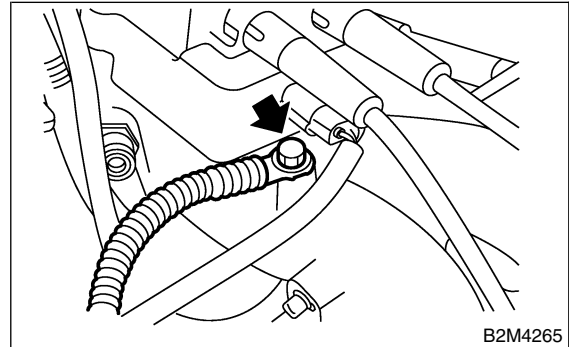


- 18) Connect battery ground cable.

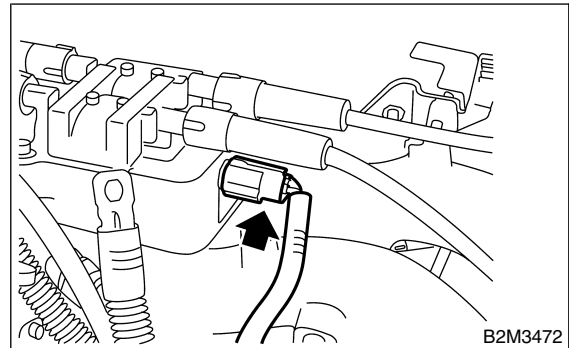


C: DISASSEMBLY S175034A06

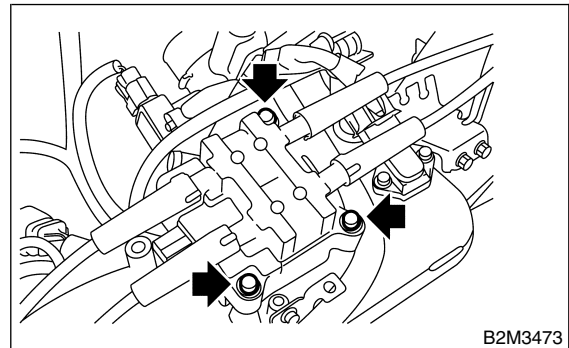
- 1) Disconnect engine ground terminal from intake manifold.



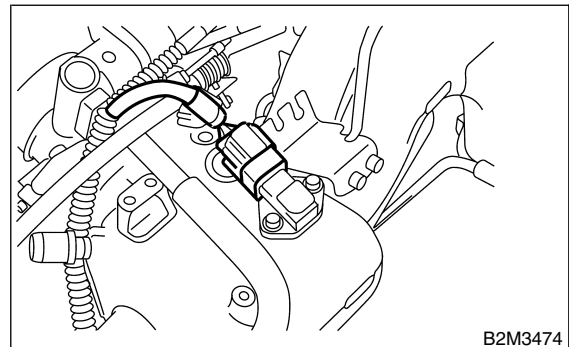
- 2) Disconnect connector from ignition coil and ignitor assembly.



- 3) Remove ignition coil and ignitor assembly.



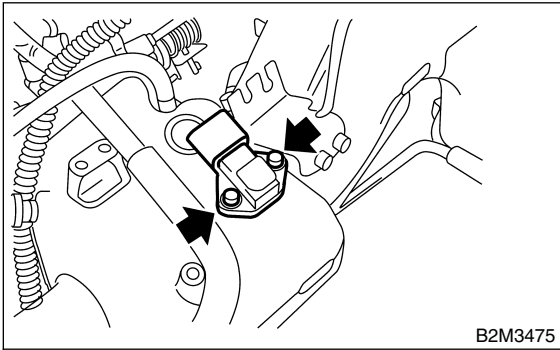
- 4) Disconnect connector from intake air temperature and pressure sensor.



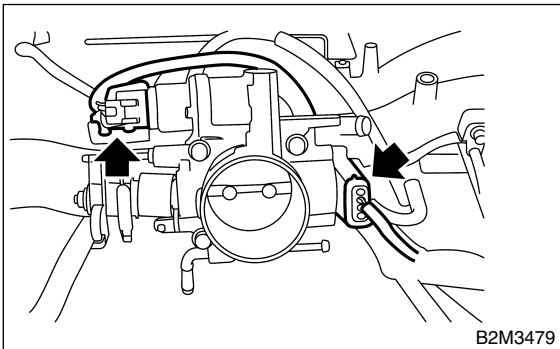
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

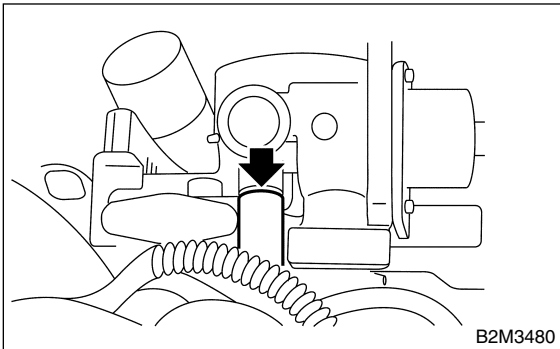
- 5) Remove intake air temperature and pressure sensor from intake manifold.



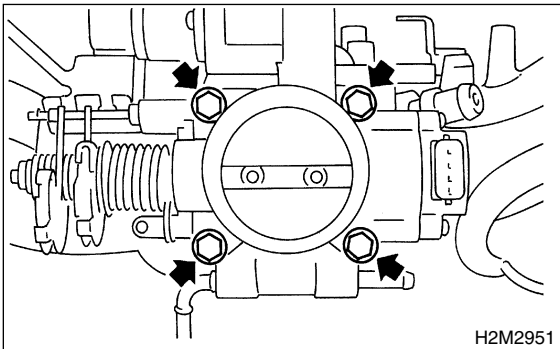
- 6) Disconnect connectors from throttle position sensor and idle air control solenoid valve.



- 7) Disconnect air by-pass hose from throttle body.

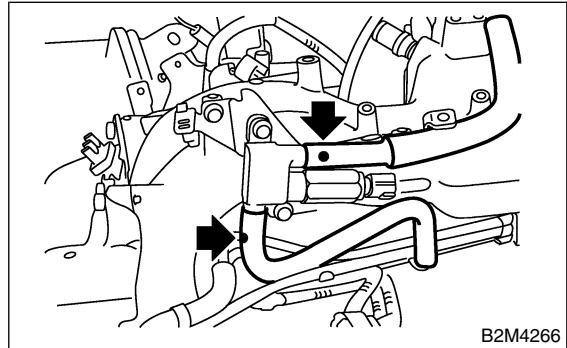


- 8) Remove throttle body.

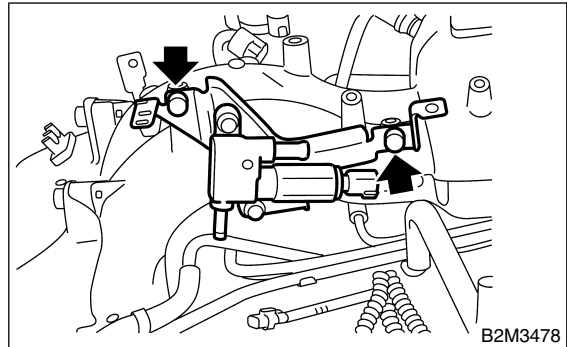


- 9) Disconnect connector from air assist injector solenoid valve.

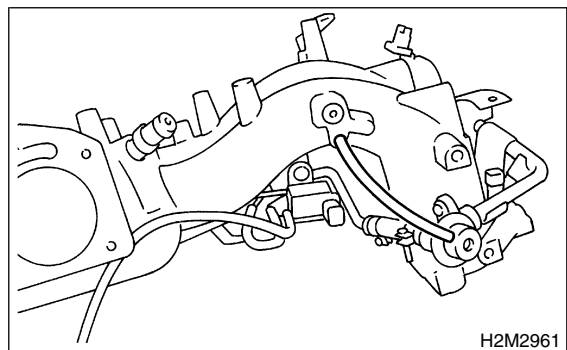
- 10) Disconnect air by-pass hoses from air assist solenoid valve.



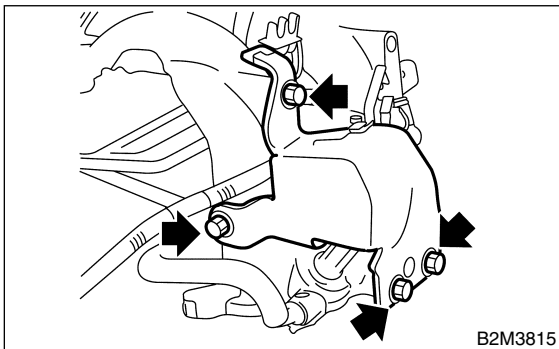
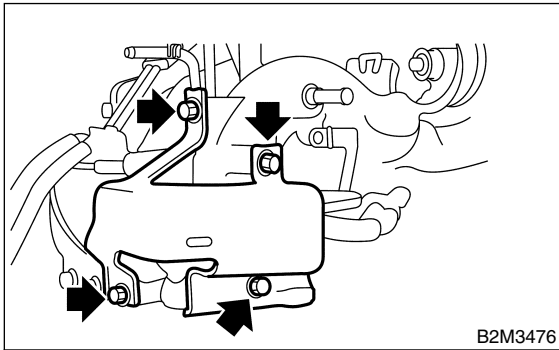
- 11) Remove air assist injector solenoid valve from intake manifold.



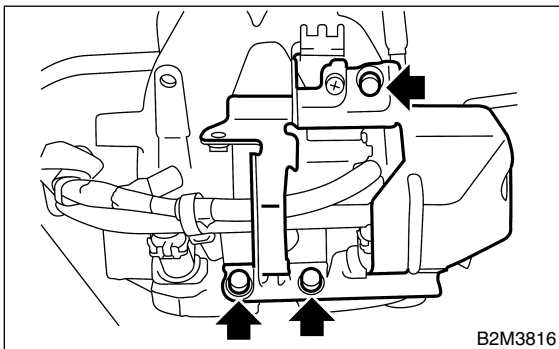
- 12) Disconnect pressure regulator vacuum hose from intake manifold.



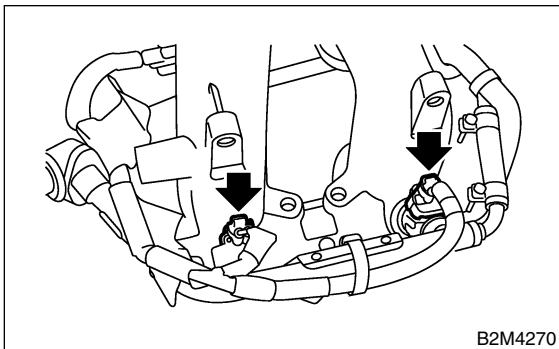
13) Remove fuel pipe protector LH.



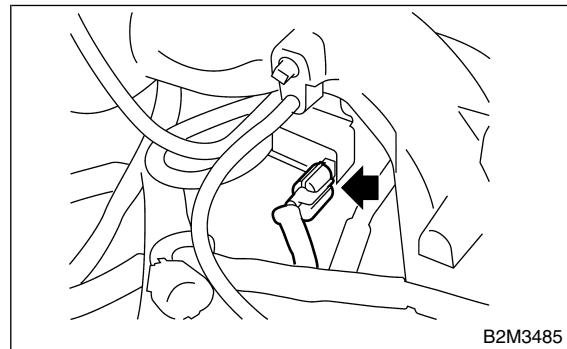
14) Remove fuel pipe protector RH.



15) Disconnect connectors from fuel injectors.

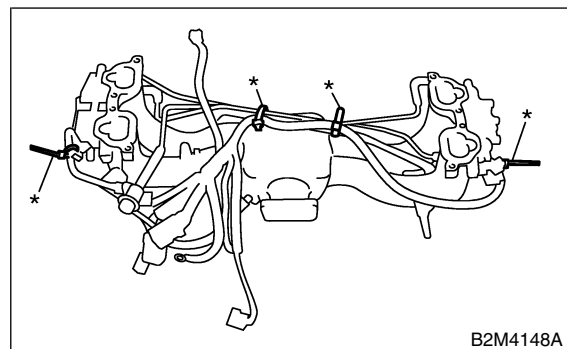


16) Disconnect connector from purge control solenoid valve.



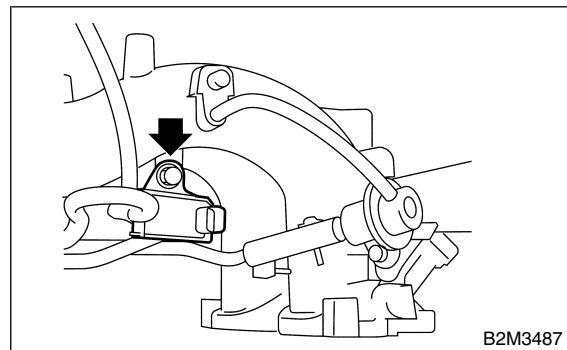
17) Disconnect air by-pass hose from purge control solenoid valve.

18) Remove harness bands (*) which hold engine harness onto intake manifold.

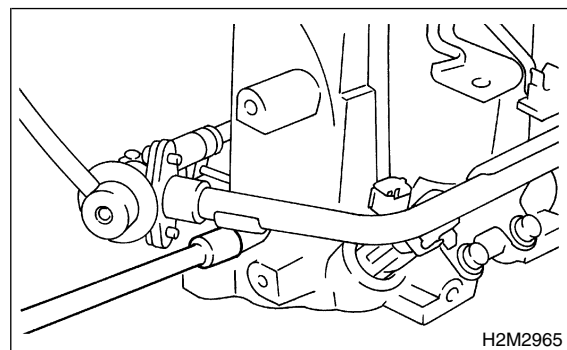


19) Remove engine harness from intake manifold.

20) Remove purge control solenoid valve.



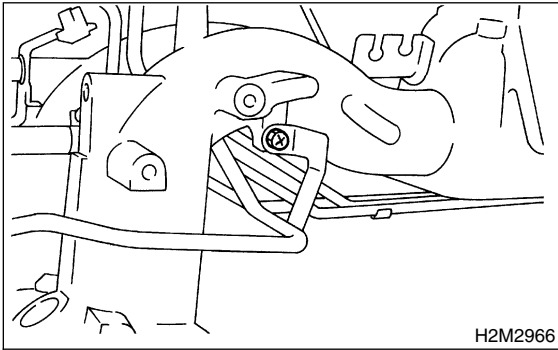
21) Remove bolt which installs injector pipe on intake manifold as shown in figure.



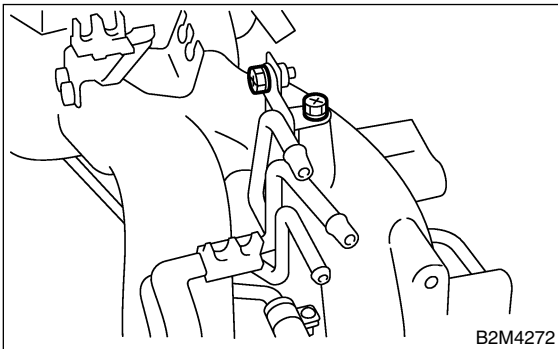
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

22) Remove bolt which installs injector pipe on intake manifold.

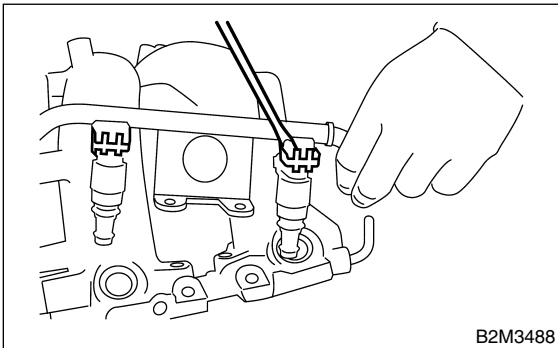


23) Remove two bolts which hold fuel pipes on the left side of intake manifold.

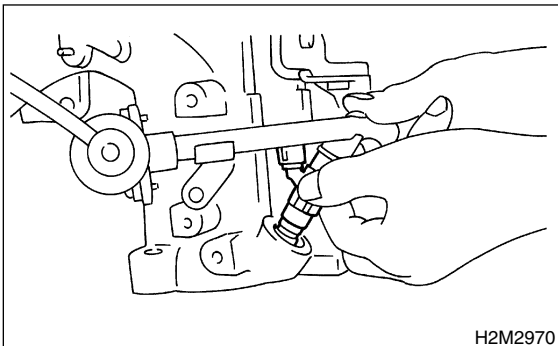


24) Remove fuel injectors.

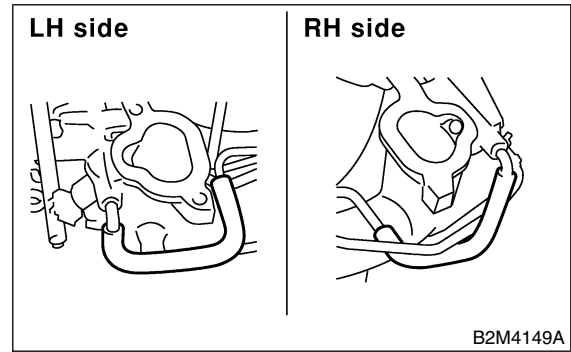
(1) Remove fuel injector securing clip.



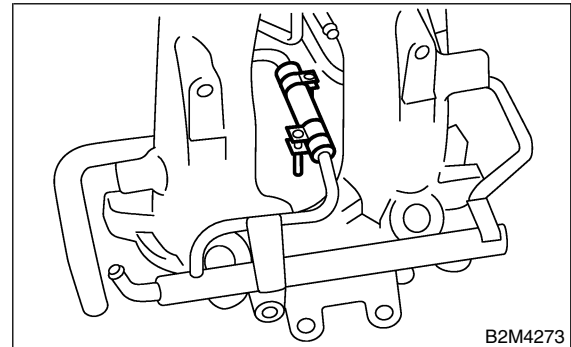
(2) Remove fuel injector while lifting up fuel injector pipe.



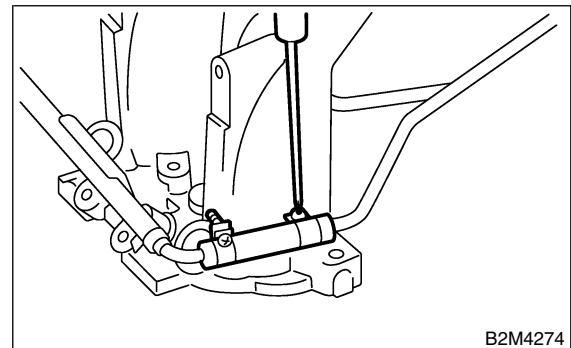
25) Disconnect air by-pass hoses from intake manifold.



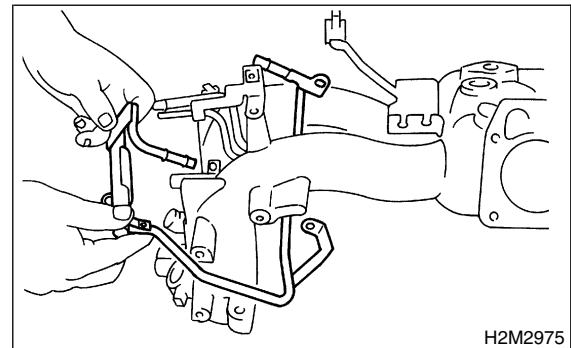
26) Loosen clamp which holds front left side fuel hose to injector pipe and remove the pipe from clamp.



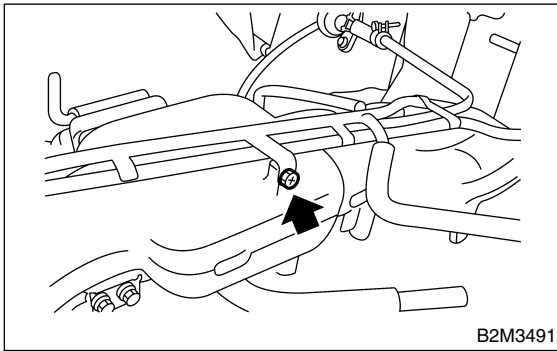
27) Loosen clamp which holds front right side fuel hose to injector pipe and remove the pipe from clamp.



28) Remove fuel injector pipe.



29) Remove bolt which installs fuel pipes on intake manifold.

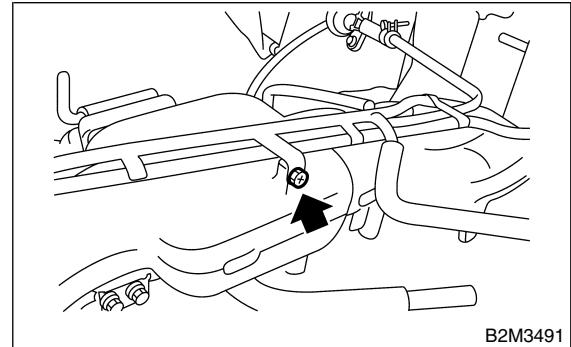


30) Remove fuel pipe assembly and pressure regulator, from intake manifold.

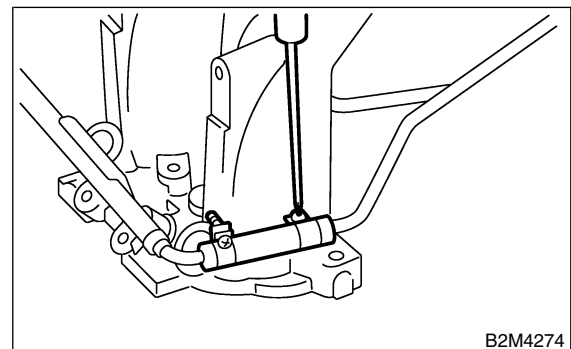
D: ASSEMBLY S175034A02

- 1) Install fuel pipe assembly and pressure regulator, etc. to intake manifold.
- 2) Tighten bolt which installs fuel pipes on intake manifold.

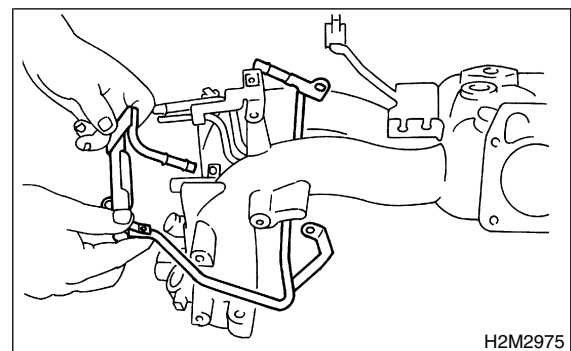
Tightening torque:
4.9 N·m (0.5 kgf-m, 3.6 ft-lb)



- 3) Connect right side fuel hose to injector pipe, and tighten clamp screw.



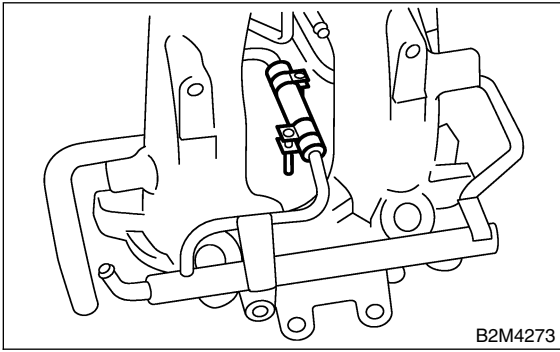
- 4) Install fuel injector pipe.



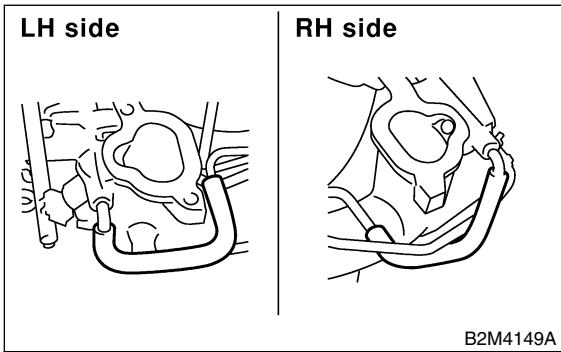
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

- 5) Connect left side fuel hose to injector pipe, and tighten clamp screw.



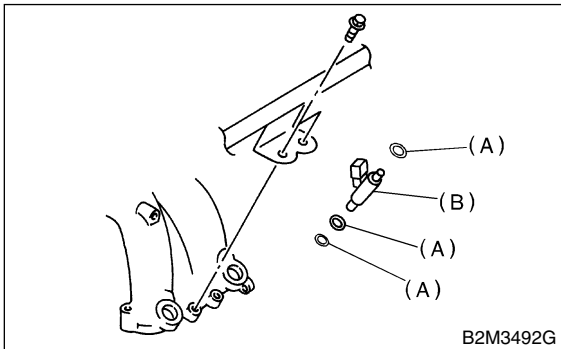
- 6) Connect air assist hoses.



- 7) Install fuel injectors.

NOTE:

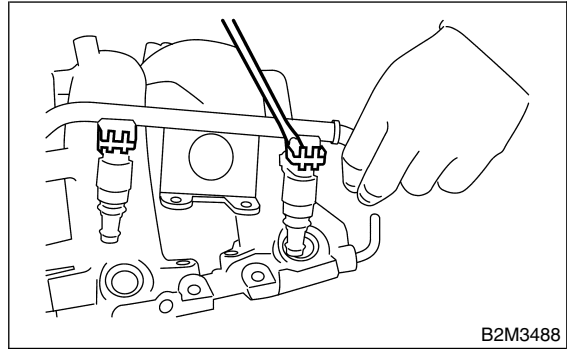
Always use new o-rings.



- (A) O-ring
(B) Fuel injector

NOTE:

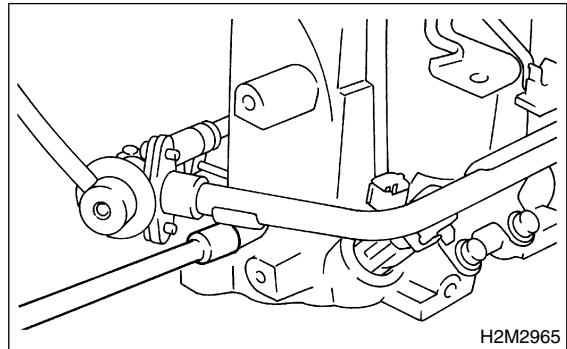
Do not forget to install the fuel injector securing clip.



- 8) Tighten bolt which installs injector pipe on intake manifold.

Tightening torque:

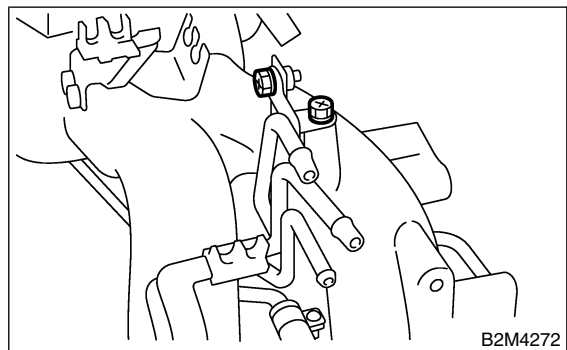
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



- 9) 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)



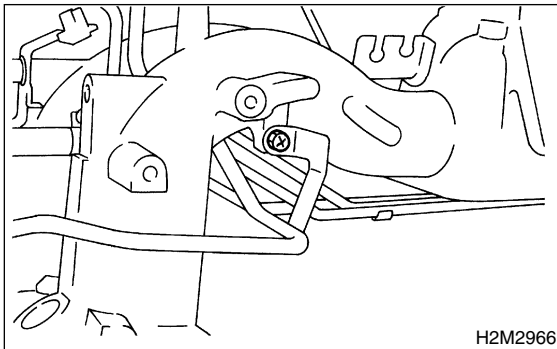
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

10) Tighten bolt which install injector pipe on intake manifold.

Tightening torque:

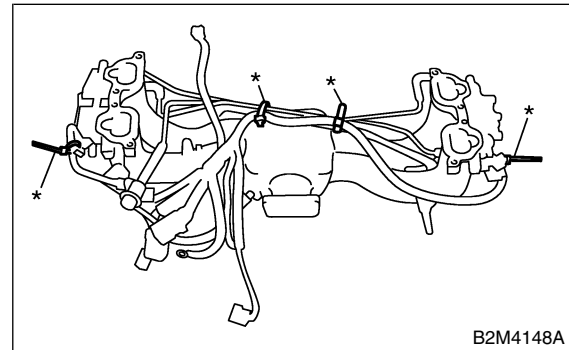
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



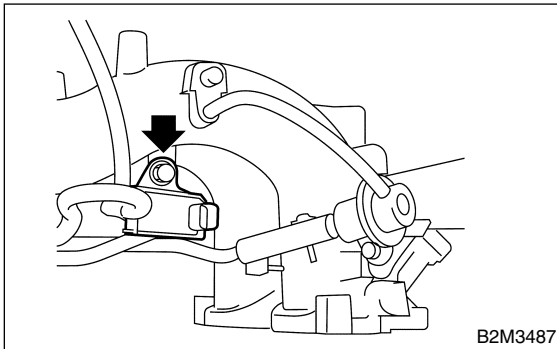
13) Install engine harness onto intake manifold.

14) Connect connectors to fuel injectors and purge control solenoid valve.

15) Hold engine harness by harness bands (*).



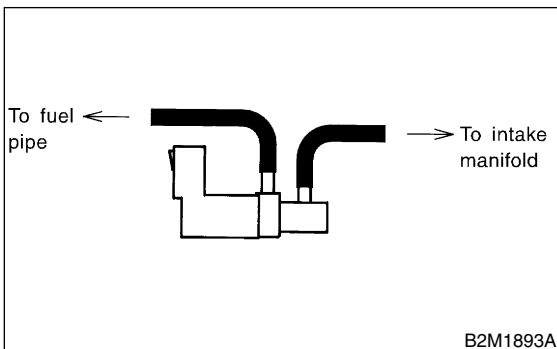
11) Install purge control solenoid valve.



12) Connect hoses to purge control solenoid valve.

CAUTION:

Carefully connect the evaporation hoses.



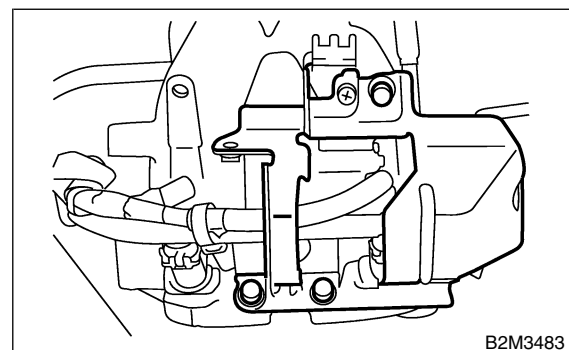
NOTE:

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)



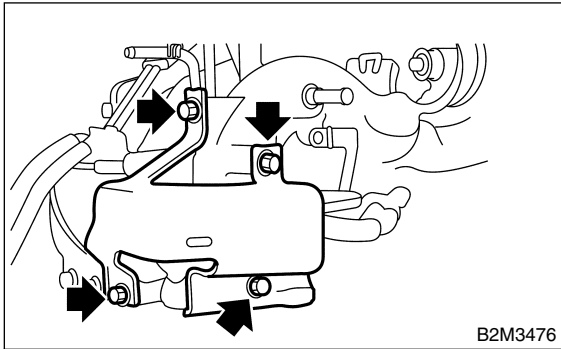
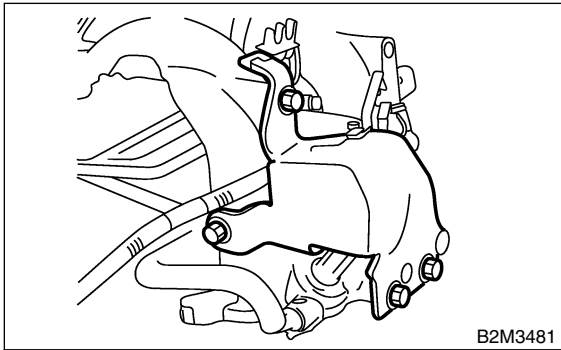
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

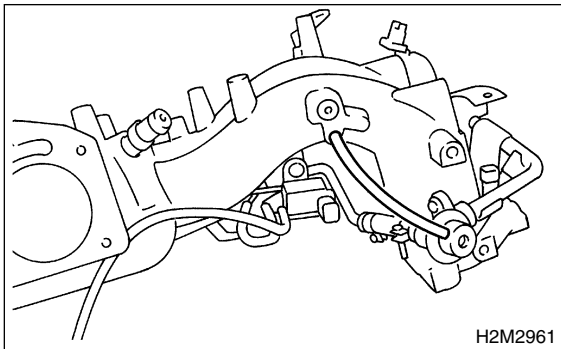
17) Install fuel pipe protector LH.

Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



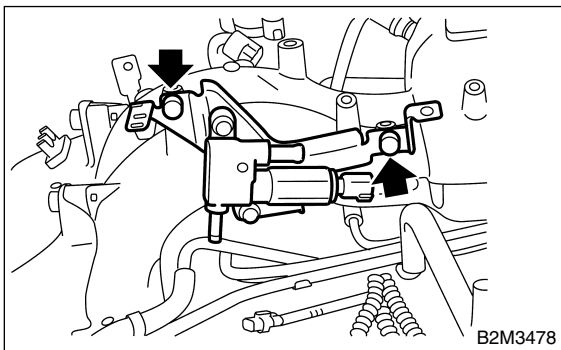
18) Connect pressure regulator vacuum hose to intake manifold.



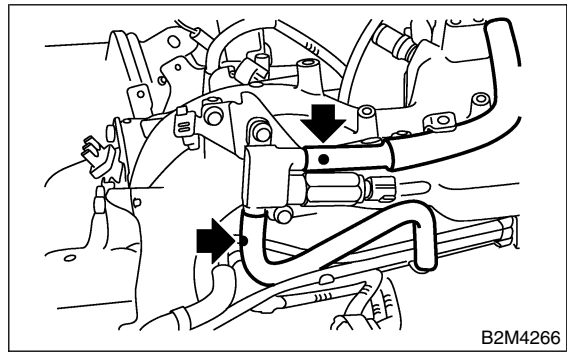
19) Install air assist injector solenoid valve to bracket.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



20) Connect air by-pass hoses to air assist solenoid valve.



21) Connect connector to air assist solenoid valve.

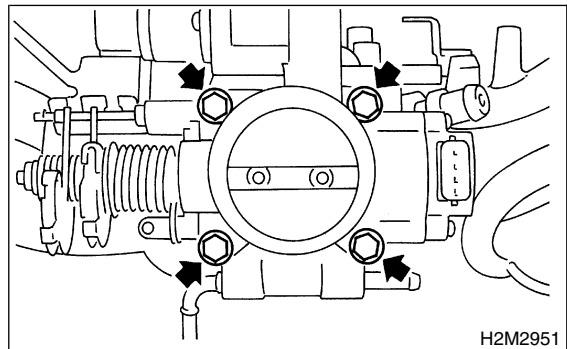
22) Install throttle body to intake manifold.

NOTE:

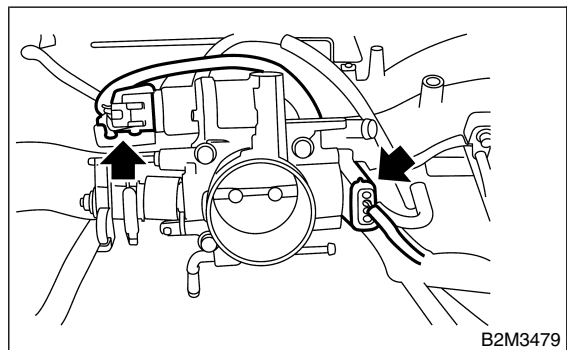
Replace gasket with a new one.

Tightening torque:

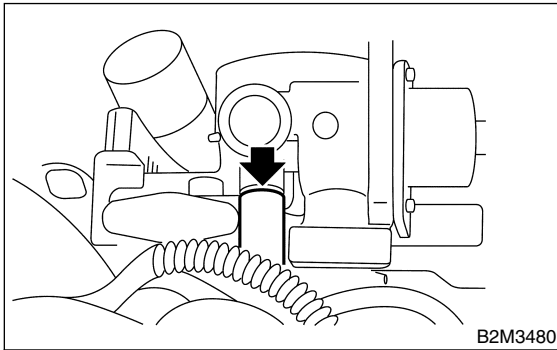
22 N·m (2.2 kgf-m, 15.9 ft-lb)



23) Connect connector to throttle position sensor and idle air control solenoid valve.



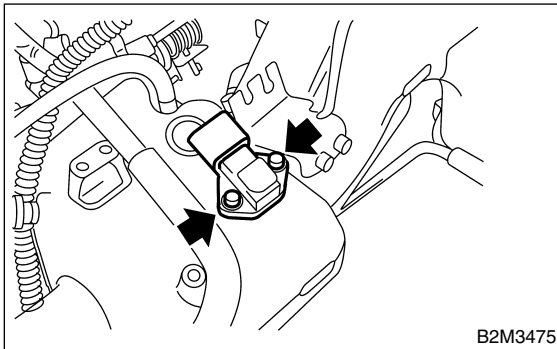
24) Connect air by-pass hose to throttle body.



25) Install intake air temperature and pressure sensor.

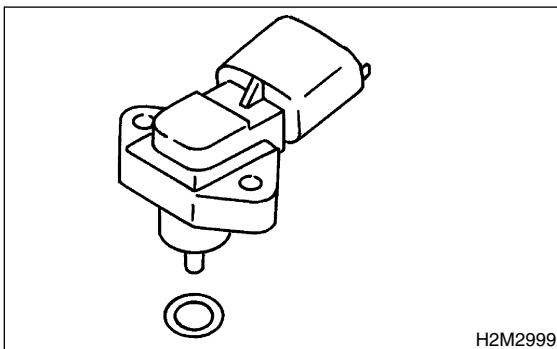
Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



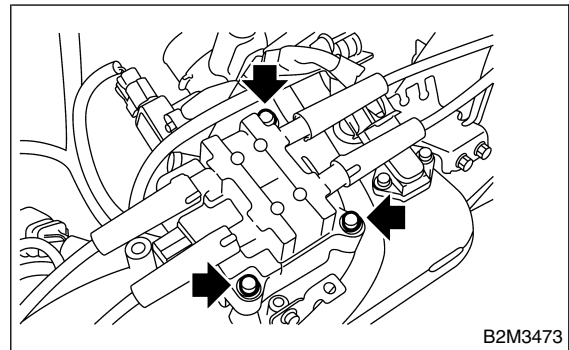
NOTE:

Replace O-ring with a new one.



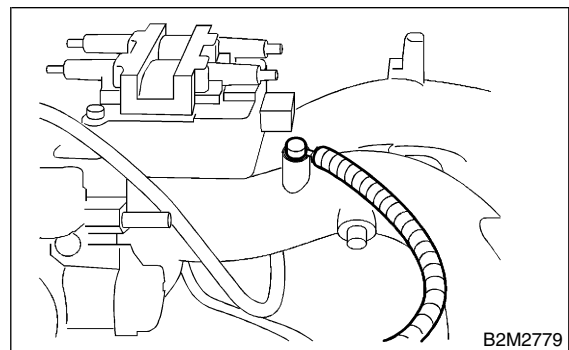
26) Connect connector to intake air temperature and pressure sensor.

27) Install ignition coil and ignitor assembly.



28) Connect connector to ignition coil and ignitor assembly.

29) Install engine ground terminal to intake manifold.



E: INSPECTION S175034A10

Make sure the fuel pipe and fuel hoses are not cracked and that connections are tight.

ENGINE COOLANT TEMPERATURE SENSOR

Fuel Injection (Fuel Systems)

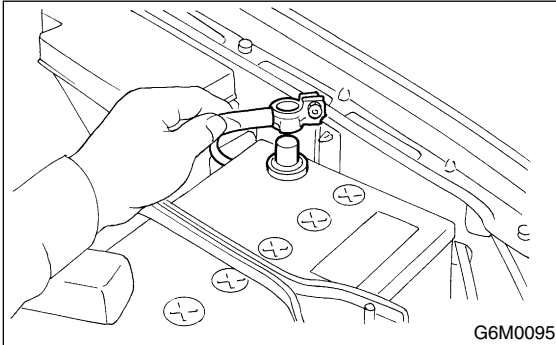
4. Engine Coolant Temperature Sensor

S175047

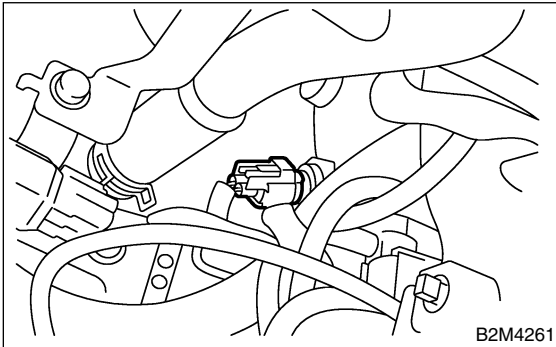
A: REMOVAL

S175047A18

- 1) Disconnect battery ground cable.



- 2) Remove air intake duct and air cleaner case.
<Ref. to IN-7, REMOVAL, Air Intake Duct.> and
<Ref. to IN-6, REMOVAL, Air Cleaner Case.>
- 3) Disconnect connector from engine coolant temperature sensor.



- 4) Remove engine coolant temperature sensor.

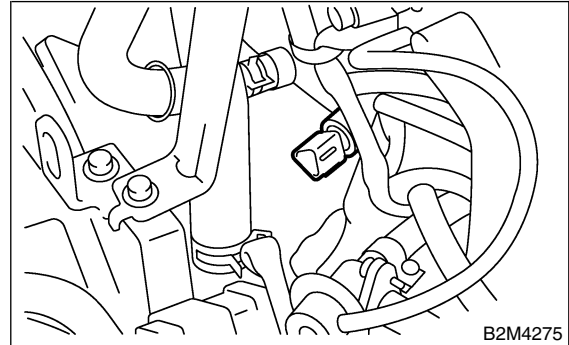
B: INSTALLATION

S175047A11

Install in the reverse order of removal.

Tightening torque:

16 N·m (0.16 kgf-m, 1.2 ft-lb)

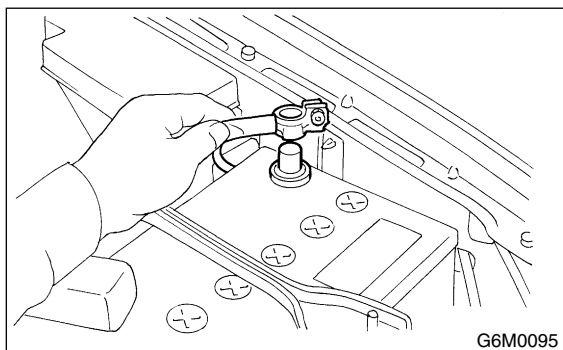


5. Crankshaft Position Sensor

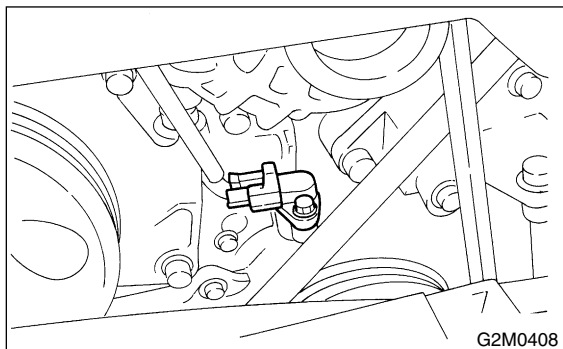
S175043

A: REMOVAL S175043A18

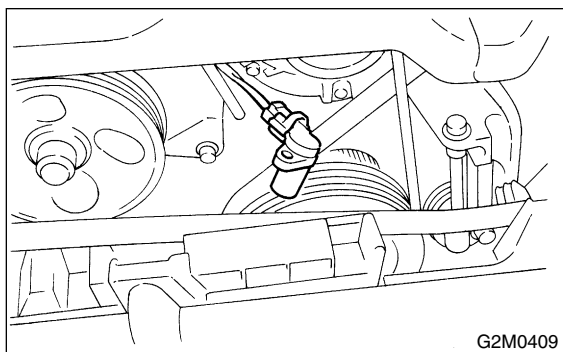
- 1) Disconnect battery ground cable.



- 2) Remove bolt which installs crankshaft position sensor to cylinder block.



- 3) Remove crankshaft position sensor, and disconnect connector from it.

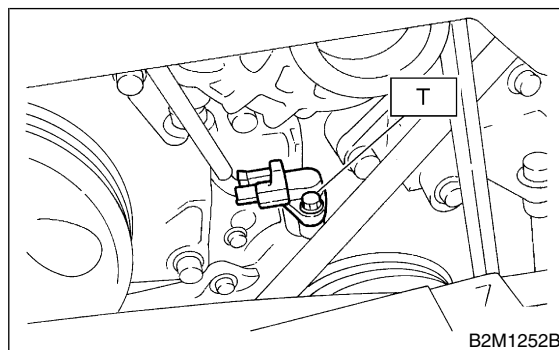


B: INSTALLATION S175043A11

Install in the reverse order of removal.

Tightening torque:

T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



CAMSHAFT POSITION SENSOR

Fuel Injection (Fuel Systems)

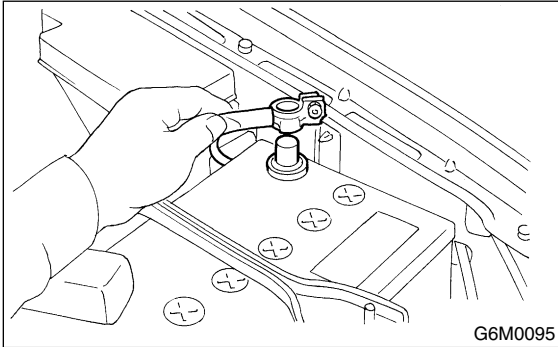
6. Camshaft Position Sensor

S175041

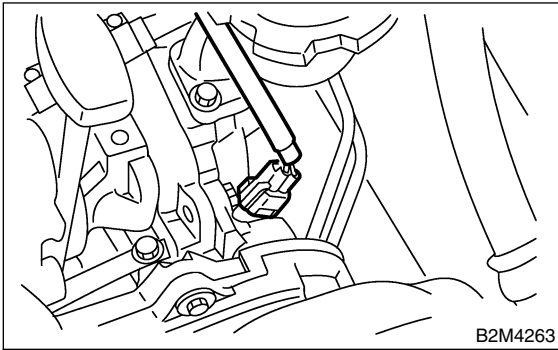
A: REMOVAL

S175041A18

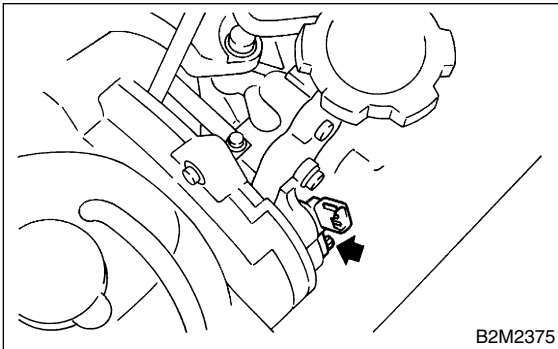
- 1) Disconnect battery ground cable.



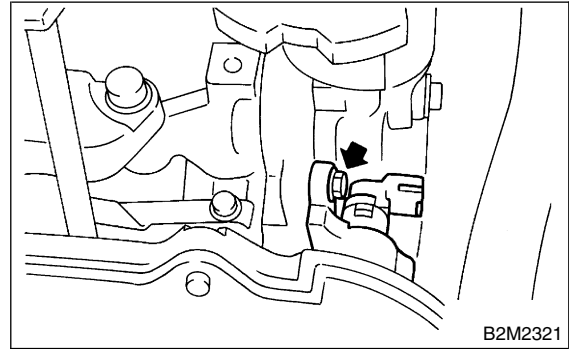
- 2) Disconnect connector from camshaft position sensor.



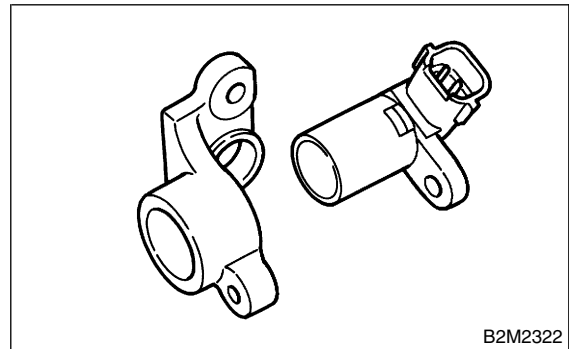
- 3) Remove bolt which installs camshaft position sensor to camshaft position sensor support.



- 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

S175041A11

Install in the reverse order of removal.

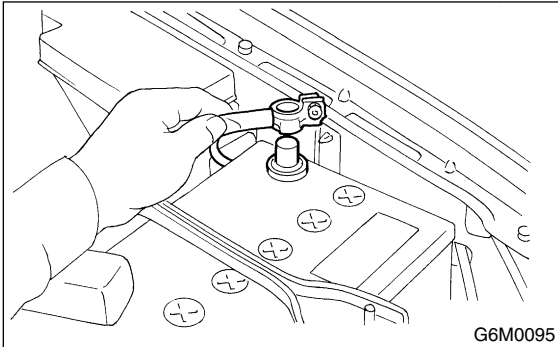
Tightening torque:

- ***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)

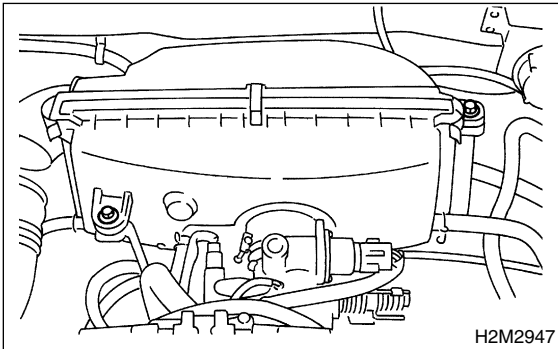
7. Knock Sensor S175042

A: REMOVAL S175042A18

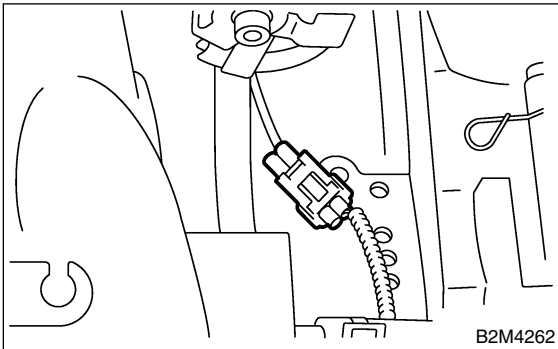
- 1) Disconnect battery ground cable.



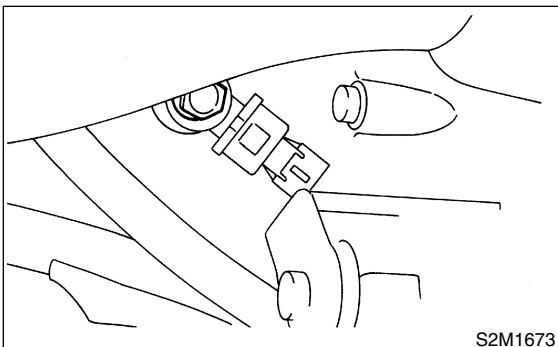
- 2) Remove air cleaner case.



- 3) Disconnect knock sensor connector.



- 4) Remove knock sensor from cylinder block.



B: INSTALLATION S175042A11

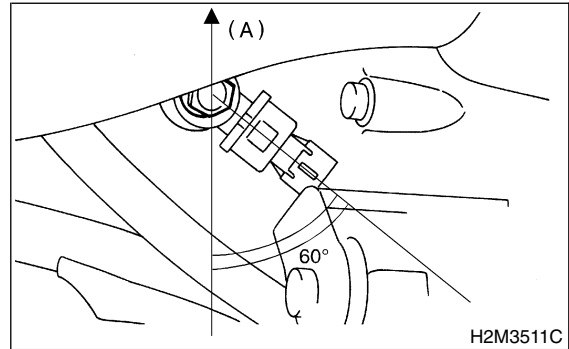
- 1) Install knock sensor to cylinder block.

Tightening torque:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

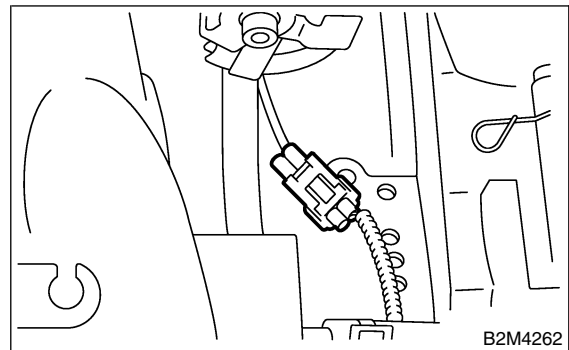
NOTE:

The extraction area of the knock sensor cord must be positioned at a 60° angle relative to the engine rear.

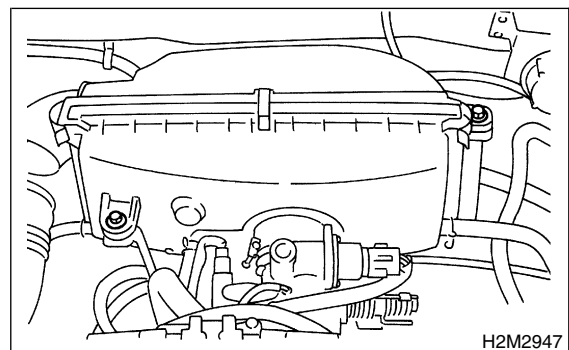


(A) Front side

- 2) Connect knock sensor connector.



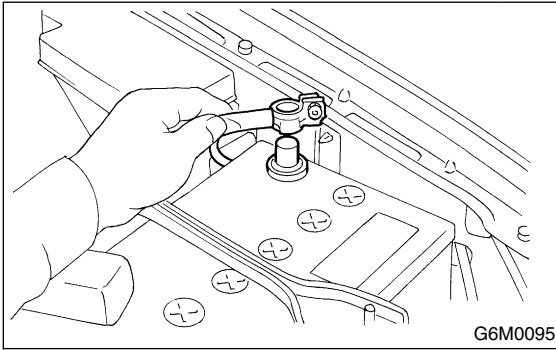
- 3) Install air cleaner case.



KNOCK SENSOR

Fuel Injection (Fuel Systems)

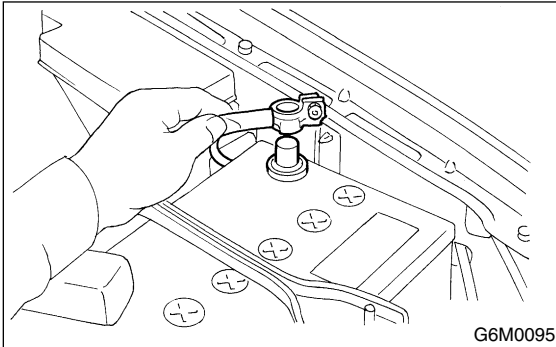
4) Connect battery ground cable.



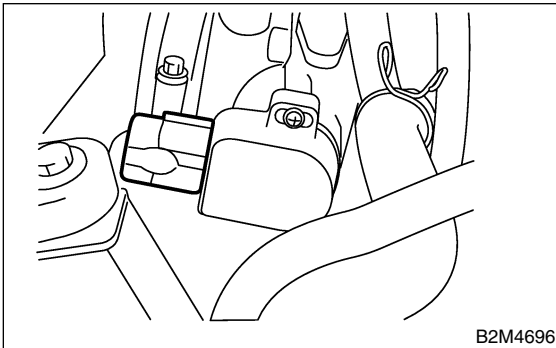
8. Throttle Position Sensor S175039

A: REMOVAL S175039A18

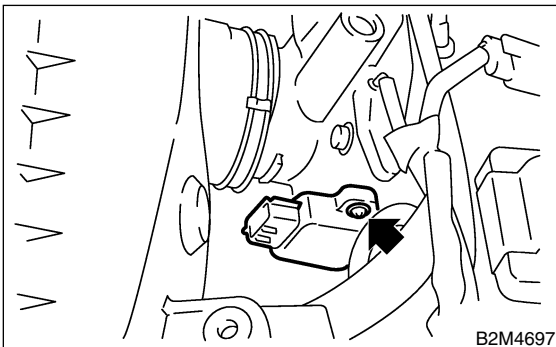
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from throttle position sensor.



- 3) Remove throttle position sensor holding screws, and remove it.



B: INSTALLATION S175039A11

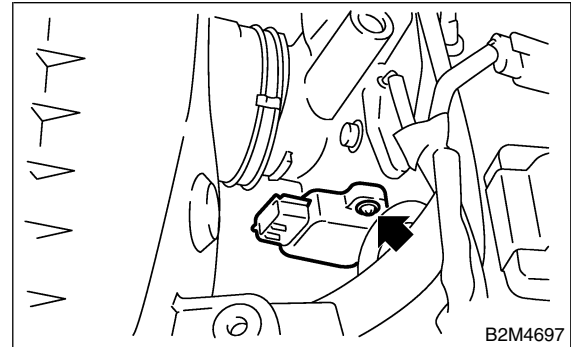
Install in the reverse order of removal.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)

CAUTION:

When installing throttle position sensor, adjust to the specified data.



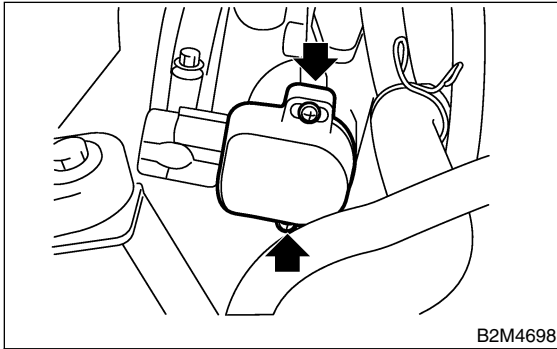
THROTTLE POSITION SENSOR

Fuel Injection (Fuel Systems)

C: ADJUSTMENT

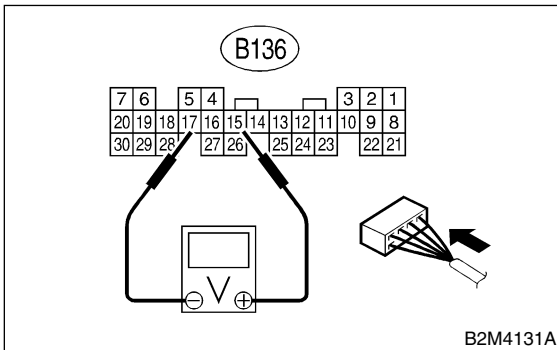
S175039A01

- 1) Turn ignition switch to OFF.
- 2) Loosen throttle position sensor holding screws.



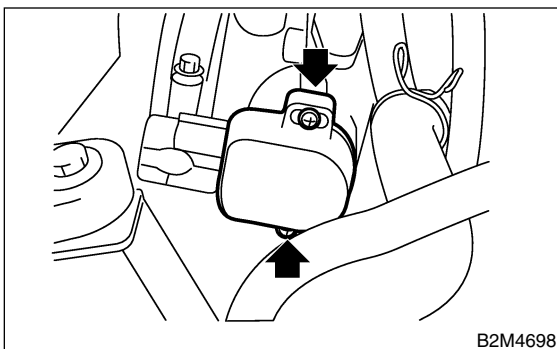
- 3) When using voltage meter;
 - (1) Take out ECM.
 - (2) Turn ignition switch to ON.
 - (3) Adjust throttle position sensor to the proper position to allow the voltage signal to ECM to be in specification.

Connector & terminal / Specified voltage
(B136) No. 15 — (B136) No. 17 / 0.45 — 0.55 V
[Fully closed.]



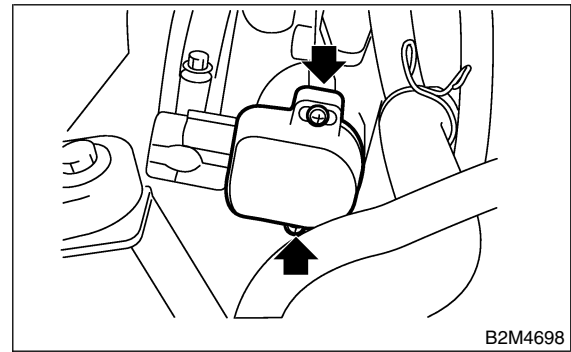
- (4) Tighten throttle position sensor holding screws.

Tightening torque:
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



- 4) When using Subaru Select Monitor;
 - (1) Turn ignition switch to OFF.

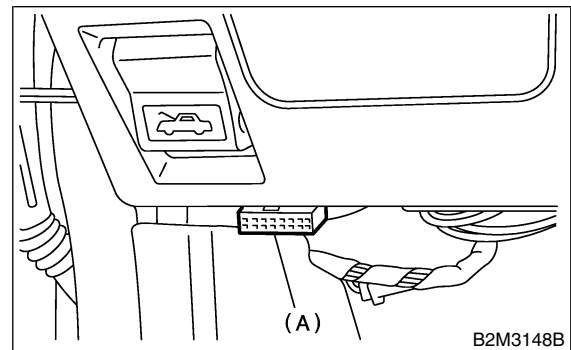
- (2) Loosen throttle position sensor holding screws.



NOTE:

For detailed operation procedures, refer to the Subaru Select Monitor Operation Manual.

- (3) Insert the cartridge to Subaru Select Monitor. <Ref. to FU-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.

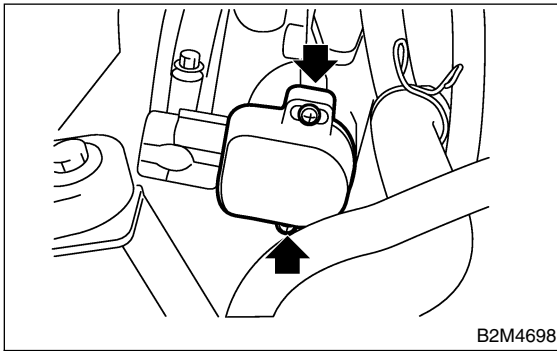
Condition: Throttle fully closed
Throttle opening angle 0.00%
Throttle sensor voltage 0.50 V

- 11) Tighten throttle position sensor holding screws.

THROTTLE POSITION SENSOR

Fuel Injection (Fuel Systems)

Tightening torque:
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



INTAKE AIR TEMPERATURE AND PRESSURE SENSOR

Fuel Injection (Fuel Systems)

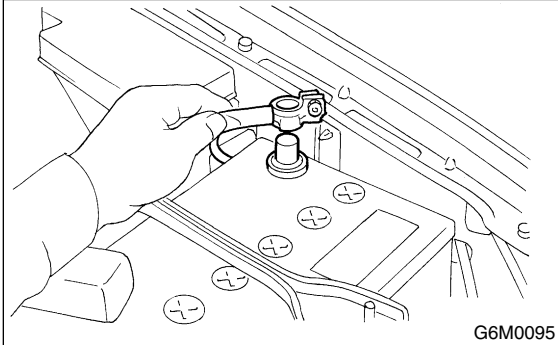
9. Intake Air Temperature and Pressure Sensor

S175044

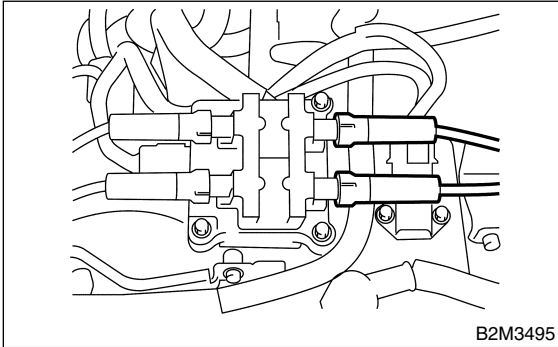
A: REMOVAL

S175044A18

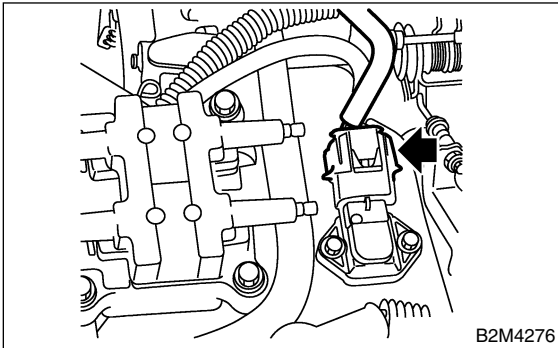
- 1) Disconnect battery ground cable.



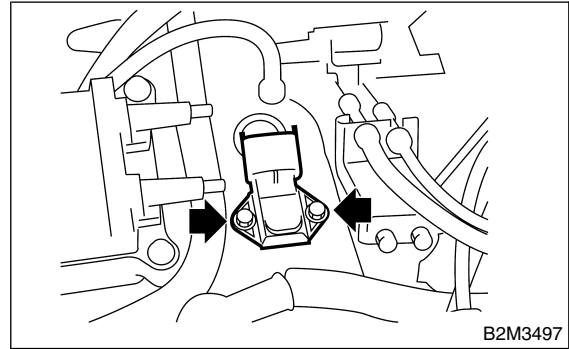
- 2) Disconnect spark plug cord from ignition coil and ignitor assembly.



- 3) Disconnect connector from intake air temperature and pressure sensor.



- 4) Remove intake air temperature and pressure sensor.



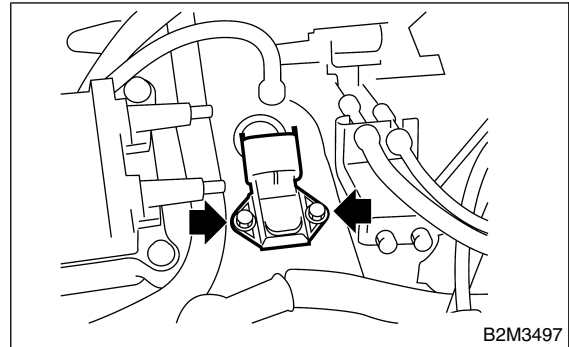
B: INSTALLATION

S175044A11

Install in the reverse order of removal.

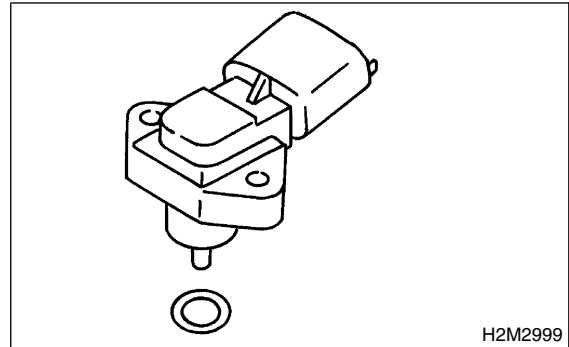
Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



NOTE:

Replace O-ring with a new one.



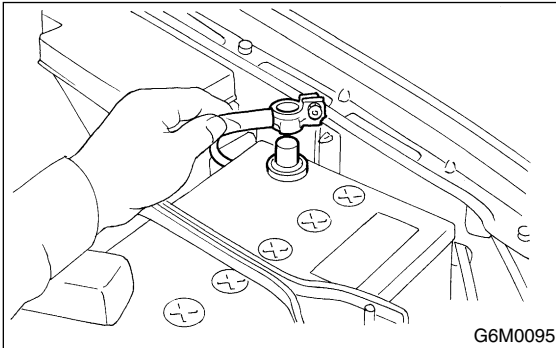
10. Idle Air Control Solenoid Valve

S175056

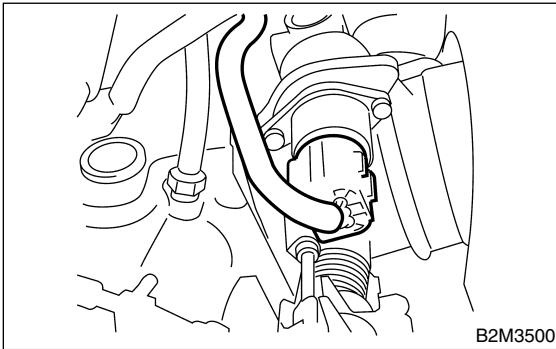
A: REMOVAL

S175056A18

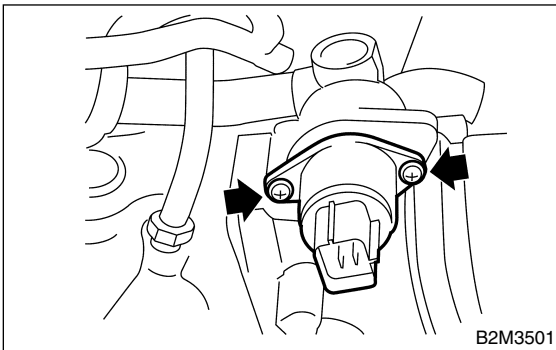
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from idle air control solenoid valve.



- 3) Remove idle air control solenoid valve from throttle body.



B: INSTALLATION

S175056A11

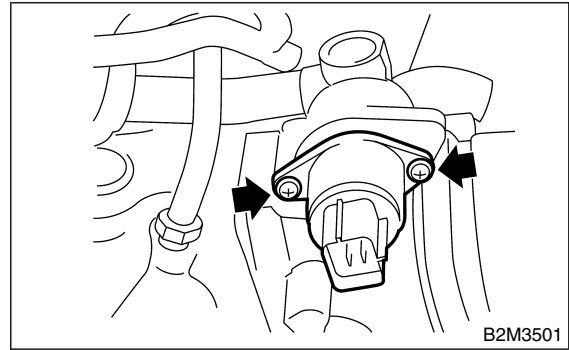
Install in the reverse order of removal.

NOTE:

Always use a new gasket.

Tightening torque:

2.4 N·m (0.24 kgf-m, 1.7 ft-lb)



AIR ASSIST INJECTOR SOLENOID VALVE

Fuel Injection (Fuel Systems)

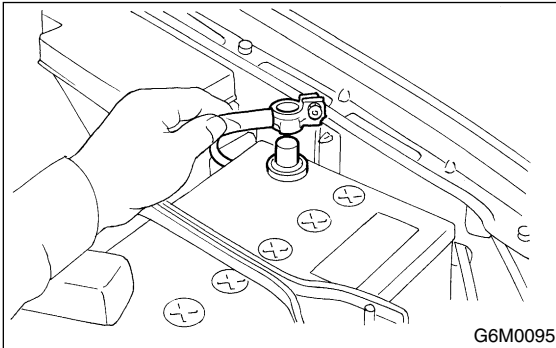
11. Air Assist Injector Solenoid Valve

S175570

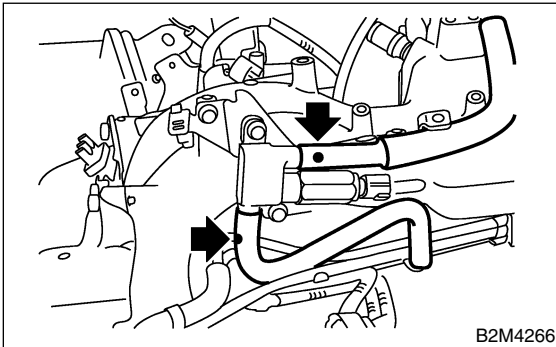
A: REMOVAL

S175570A18

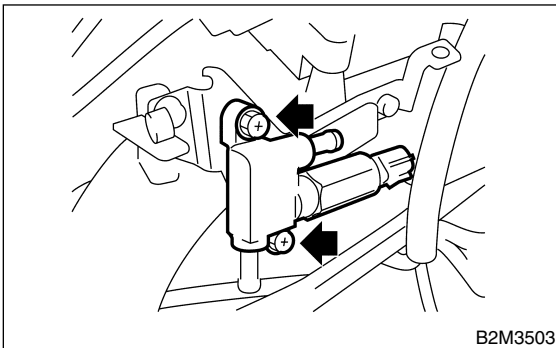
- 1) Disconnect battery ground cable.



- 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.



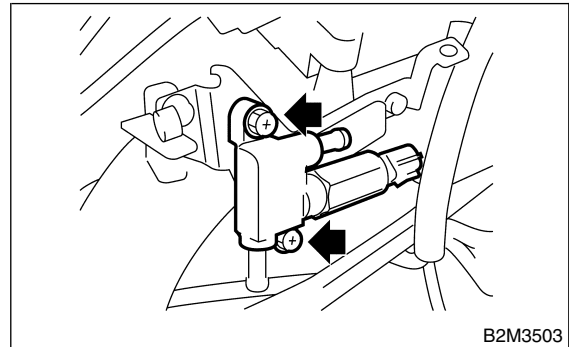
B: INSTALLATION

S175570A11

Install in the reverse order of removal.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



12. Fuel Injector

S175051

A: REMOVAL

S175051A18

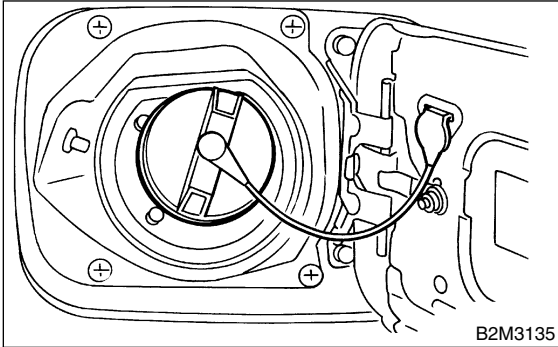
1. RH SIDE

S175051A1801

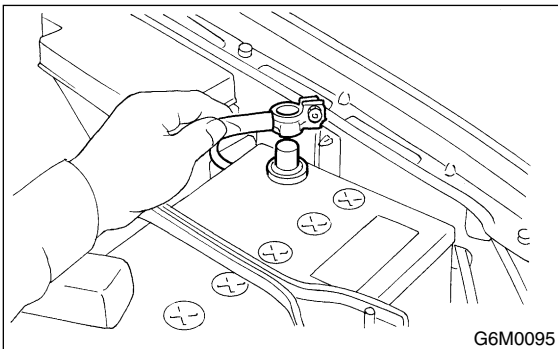
1) Release fuel pressure.

<Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>

2) Open fuel flap lid, and remove fuel filler cap.



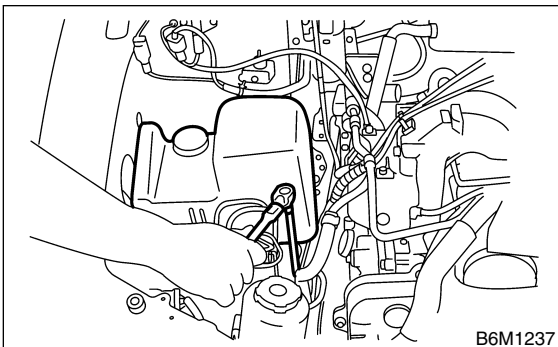
3) Disconnect battery ground cable.



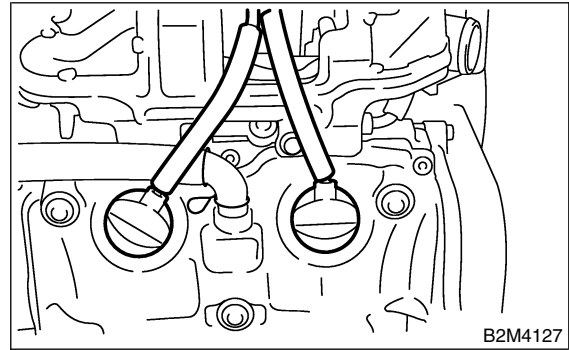
4) Remove air intake duct and air cleaner case.

<Ref. to IN-7, REMOVAL, Air Intake Duct.> and
<Ref. to IN-6, REMOVAL, Air Cleaner Case.>

5) Remove resonator chamber.

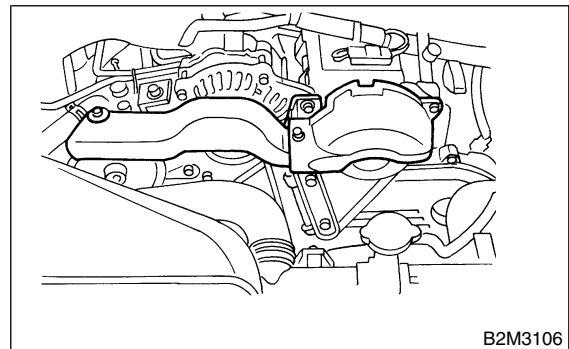


6) Remove spark plug cords from spark plugs (#1 and #3 cylinders).

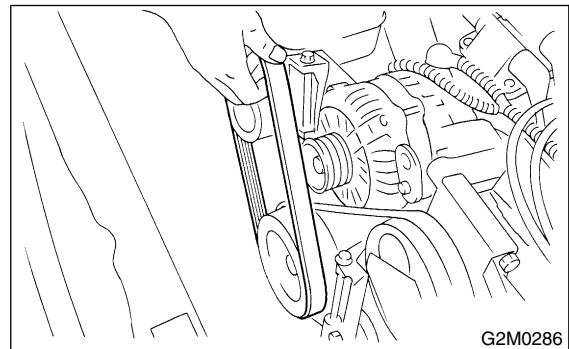


7) Remove power steering pump and tank from brackets.

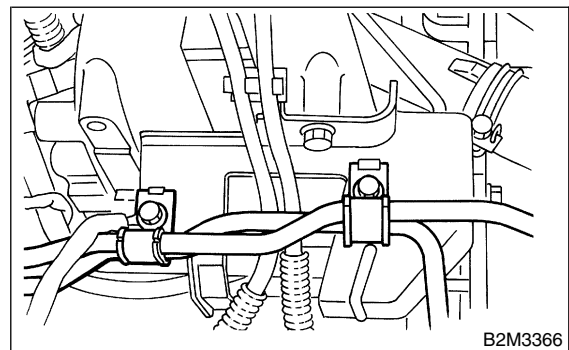
(1) Remove V-belt covers.



(2) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.



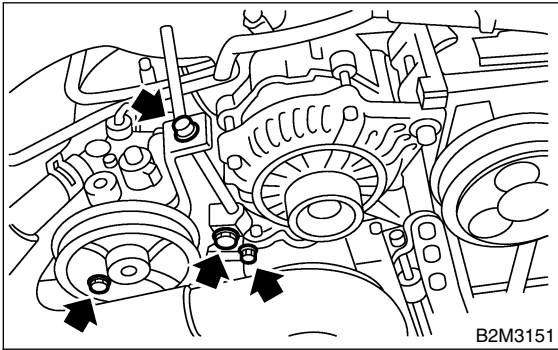
(3) Remove bolts which hold power steering pipes onto intake manifold protector.



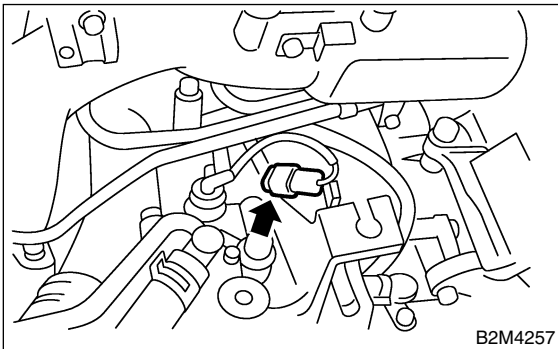
FUEL INJECTOR

Fuel Injection (Fuel Systems)

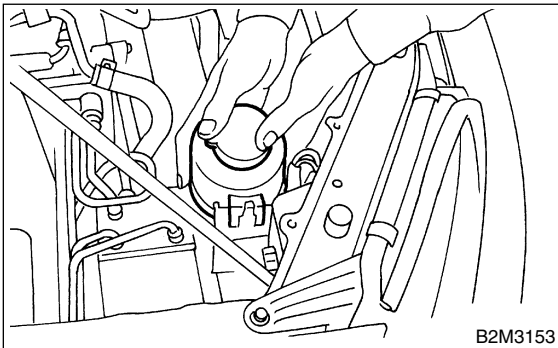
(4) Remove bolts which install power steering pump to bracket.



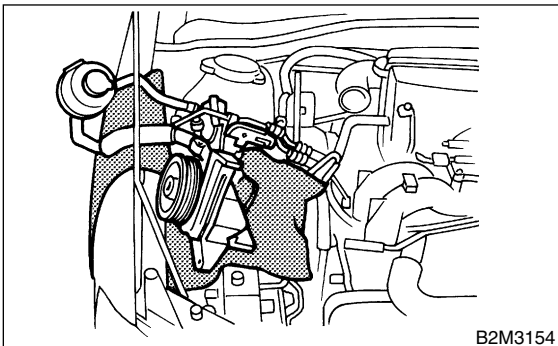
(5) Disconnect connector from power steering pump switch.



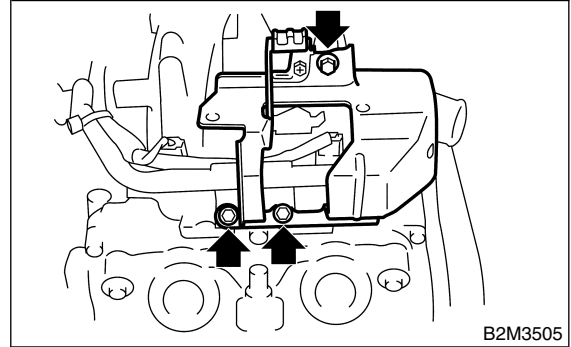
(6) Remove power steering tank from the bracket by pulling it upwards.



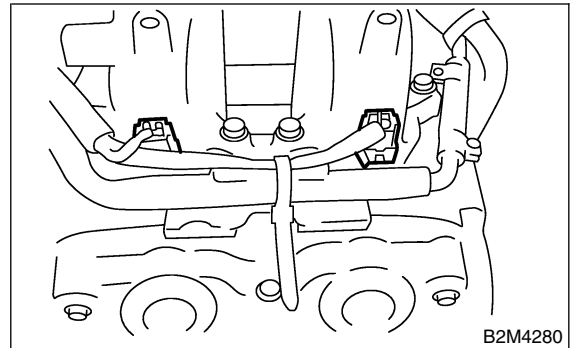
(7) Place power steering pump and tank on the right side wheel apron.



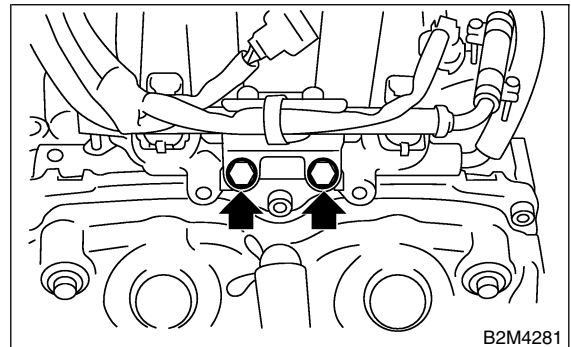
8) Remove fuel pipe protector RH.



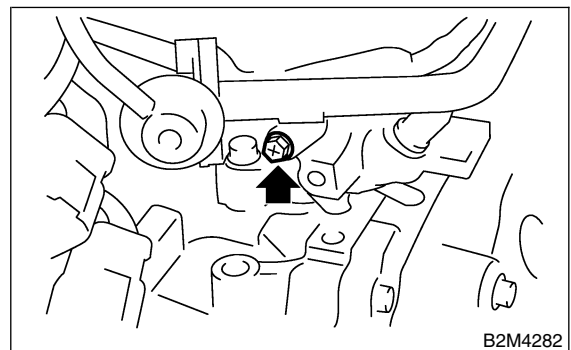
9) Disconnect connector from fuel injector.



10) Remove bolts which hold injector pipe to intake manifold.

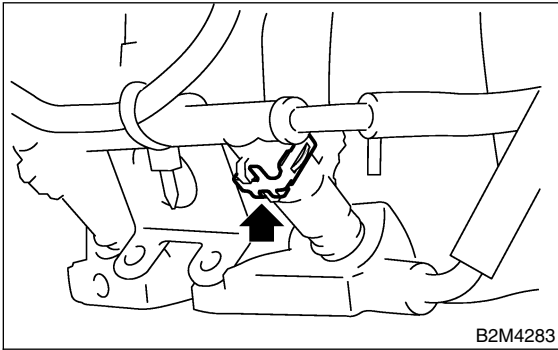


11) Remove bolt which install injector pipe to intake manifold.

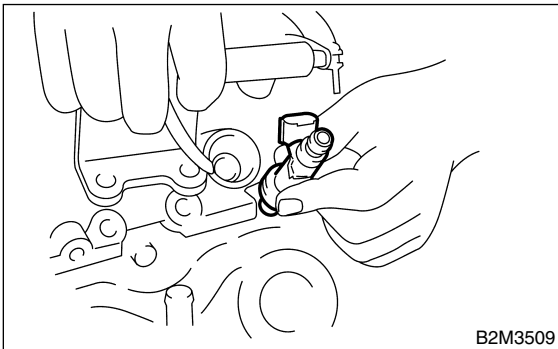


12) Remove fuel injector from intake manifold.

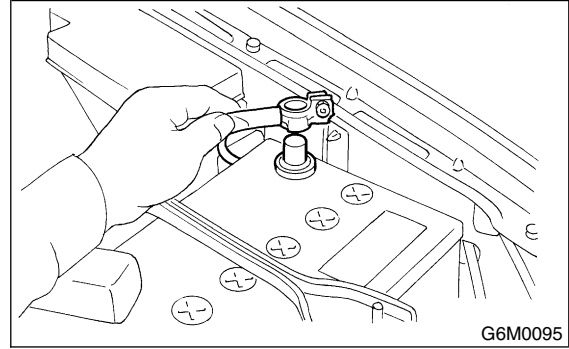
(1) Remove fuel injector securing clip.



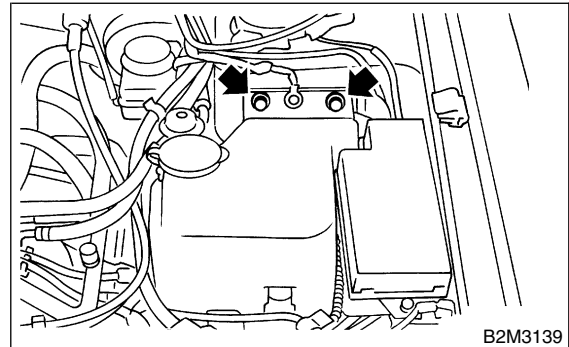
(2) Remove fuel injector while lifting up fuel injector pipe.



3) Disconnect battery ground cable.

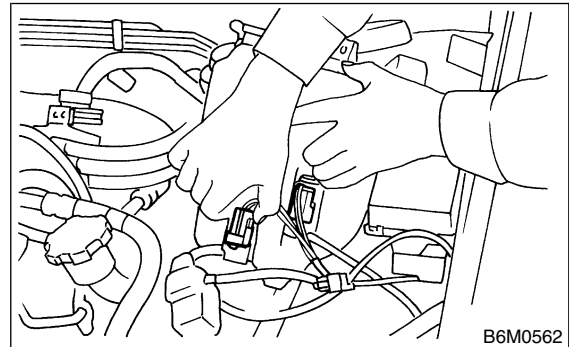


4) Remove two bolts which install washer tank on body.



5) Disconnect connector from front window washer motor.

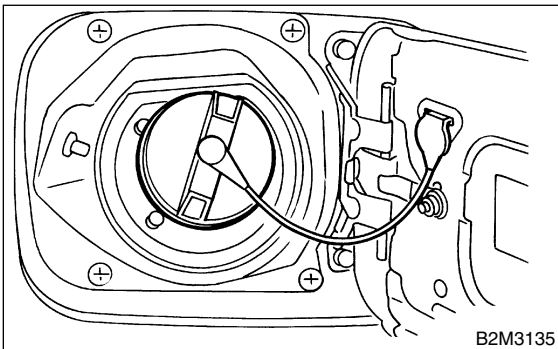
6) Disconnect connector from rear gate glass washer motor.



2. LH SIDE S175051A1802

1) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>

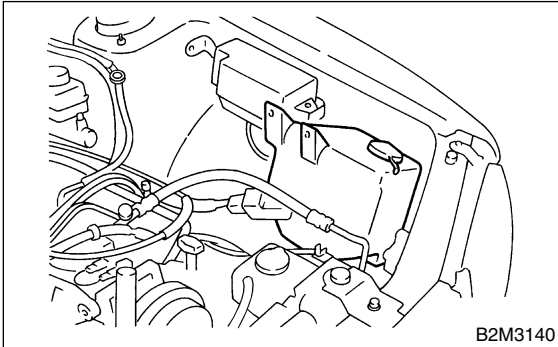
2) Open fuel flap lid, and remove fuel filler cap.



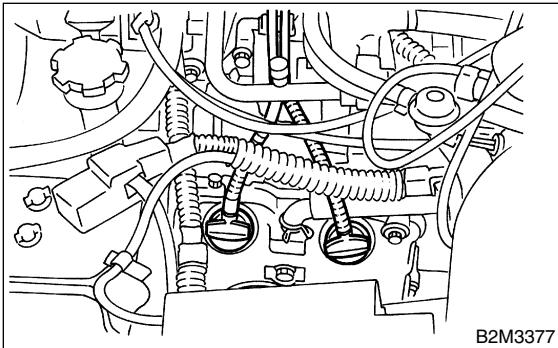
FUEL INJECTOR

Fuel Injection (Fuel Systems)

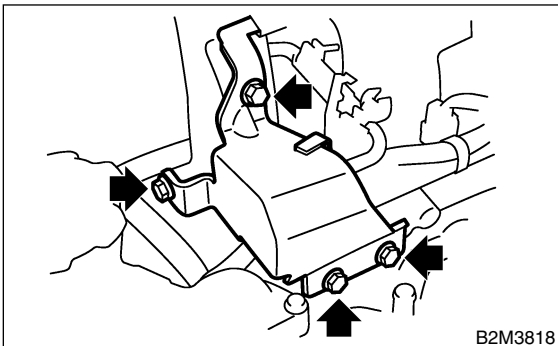
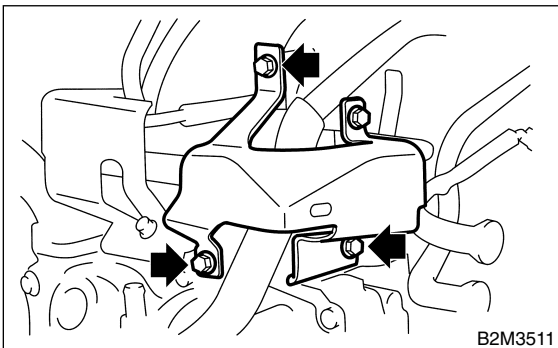
- 7) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.
- 8) Move washer tank, and secure it away from working area.



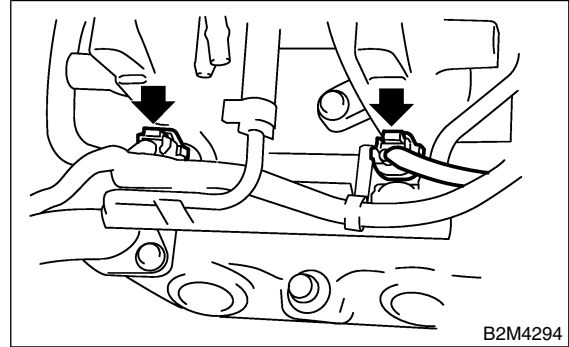
- 9) Remove spark plug cords from spark plugs (#2 and #4 cylinders).



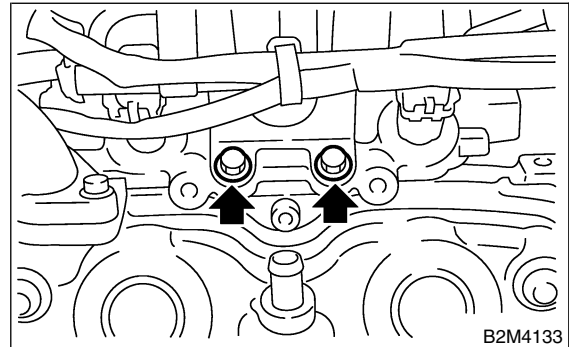
- 10) Remove fuel pipe protector LH.



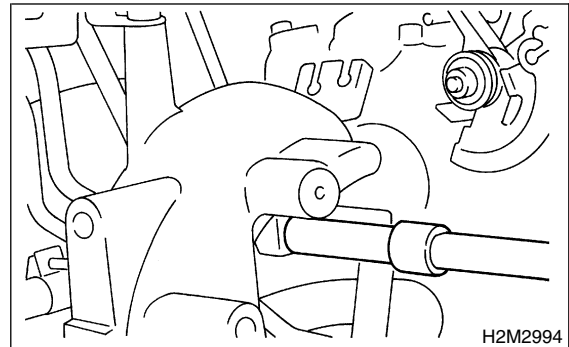
- 11) Disconnect connector from fuel injector.



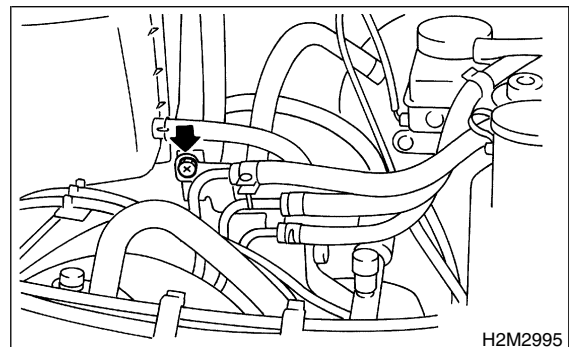
- 12) Remove bolt which holds injector pipe to intake manifold.



- 13) Remove bolt which installs injector pipe to intake manifold.

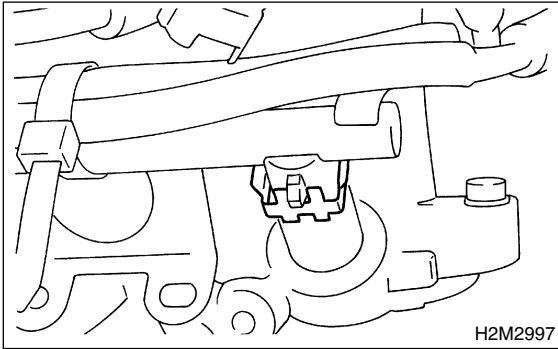


- 14) Remove bolt which holds fuel pipe on the left side intake manifold.

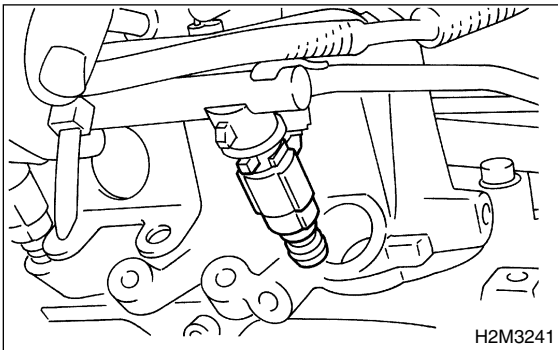


15) Remove fuel injector from intake manifold.

(1) Remove fuel injector securing clip.



(2) Remove fuel injector while lifting up fuel injector pipe.



B: INSTALLATION

S175051A11

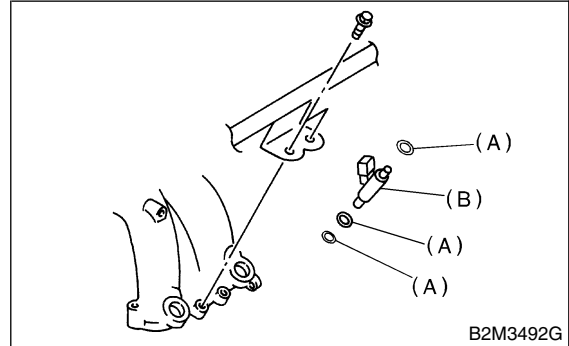
1. RH SIDE

S175051A1101

Install in the reverse order of removal.

NOTE:

Replace O-rings with new ones.

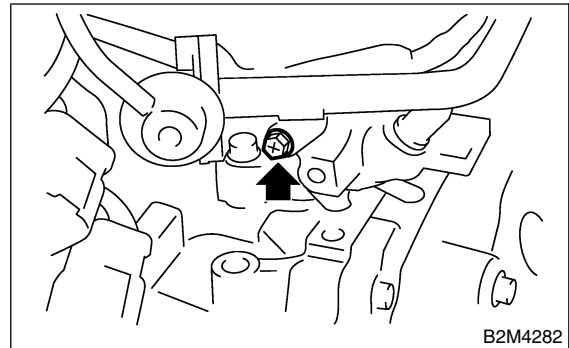


(A) O-ring

(B) Fuel injector

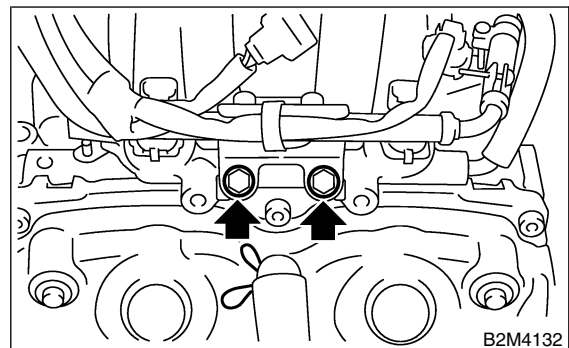
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:

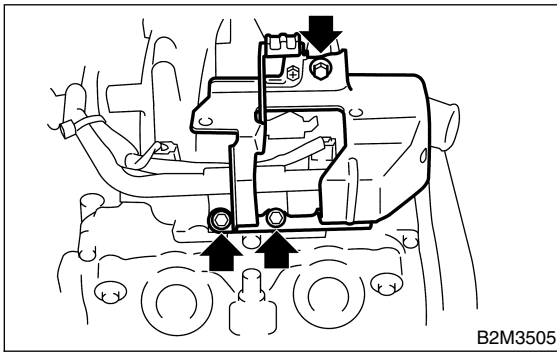
19 N·m (0.19 kgf-m, 1.4 ft-lb)



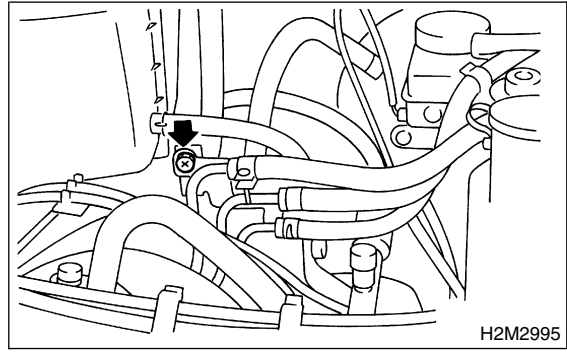
FUEL INJECTOR

Fuel Injection (Fuel Systems)

Tightening torque:
19 N·m (0.19 kgf-m, 1.4 ft-lb)



Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

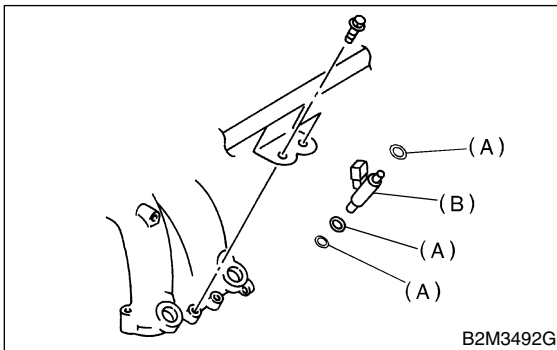


2. LH SIDE S175051A1102

Install in the reverse order of removal.

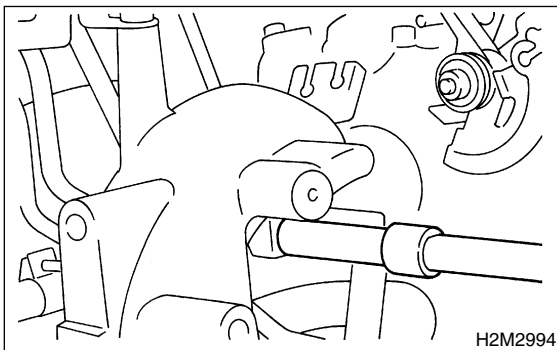
NOTE:

Replace O-rings with new ones.

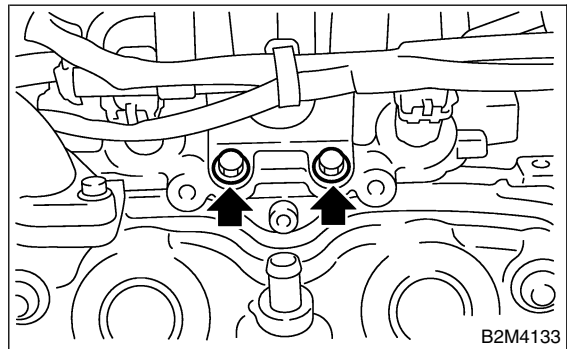


- (A) O-ring
- (B) Fuel injector

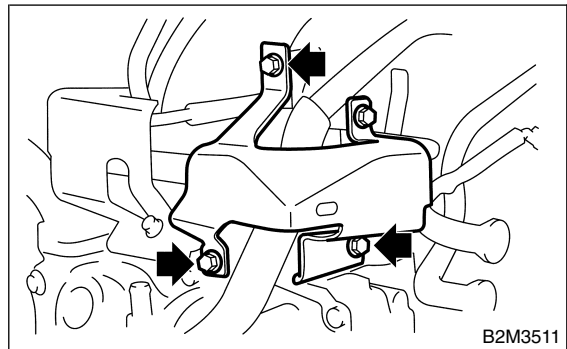
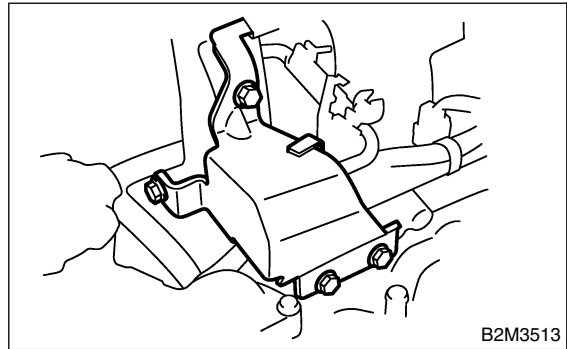
Tightening torque:
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



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)

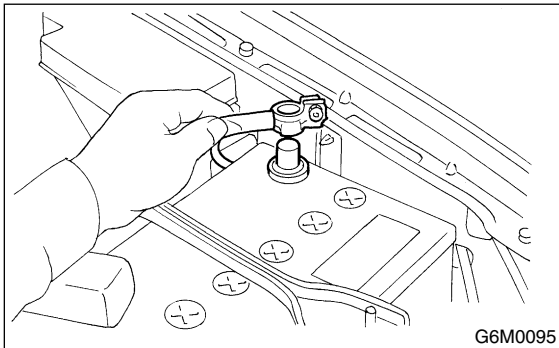


13. Front Oxygen (A/F) Sensor

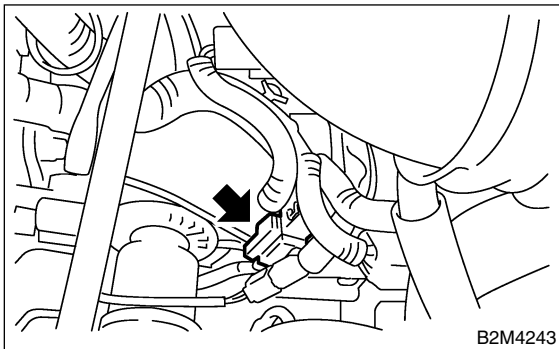
S175642

A: REMOVAL S175642A18

- 1) Disconnect battery ground cable.



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



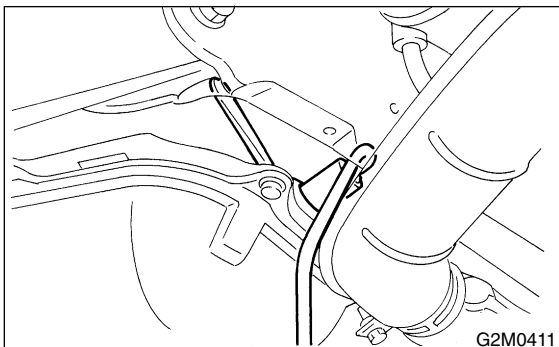
- 3) Lift-up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

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.



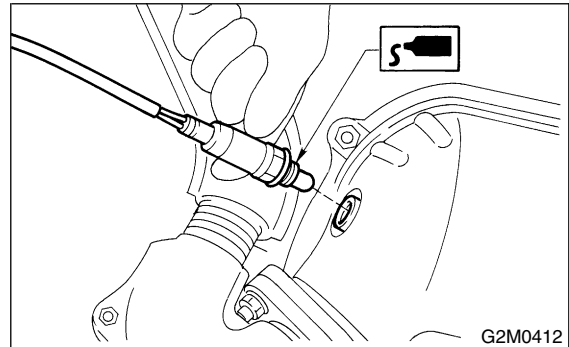
B: INSTALLATION S175642A11

- 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

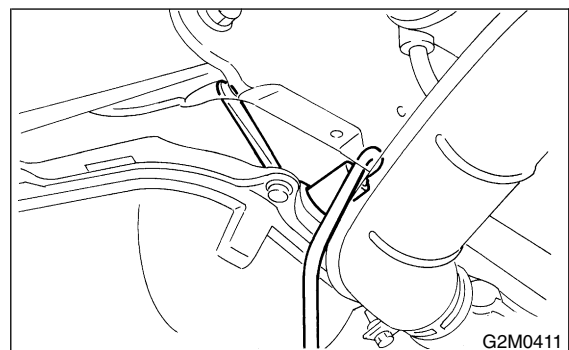
CAUTION:

Never apply anti-seize compound to protector of front oxygen (A/F) sensor.

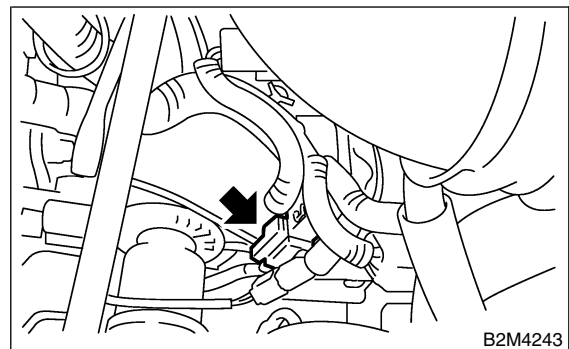


- 2) Install front oxygen (A/F) sensor.

Tightening torque:
21 N·m (2.1 kgf-m, 15.2 ft-lb)



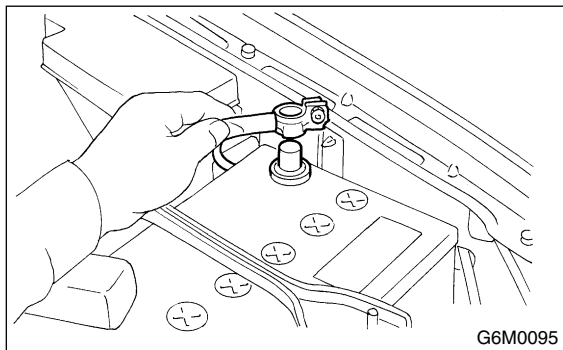
- 3) Lower the vehicle.
- 4) Connect connector of front oxygen (A/F) sensor.



FRONT OXYGEN (A/F) SENSOR

Fuel Injection (Fuel Systems)

5) Connect battery ground cable.



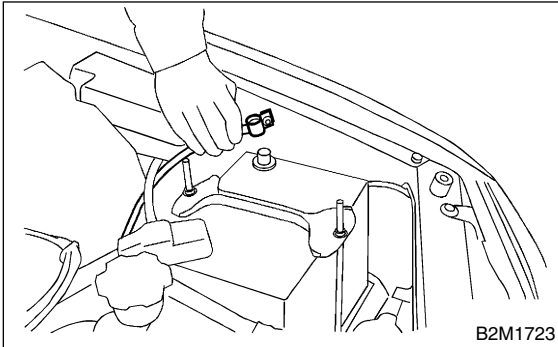
14. Rear Oxygen Sensor

S175657

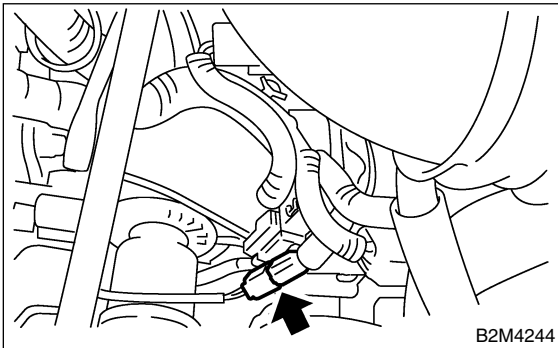
A: REMOVAL

S175657A18

- 1) Disconnect battery ground cable.



- 2) Disconnect connector from rear oxygen sensor.



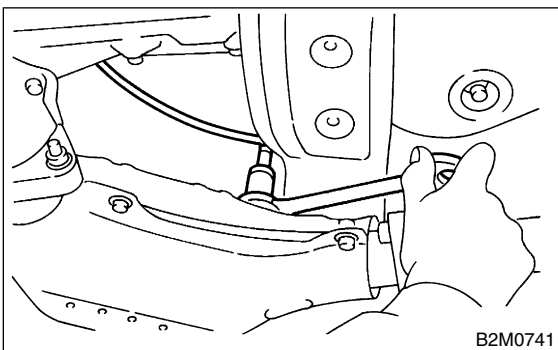
- 3) Lift-up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

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

S175657A11

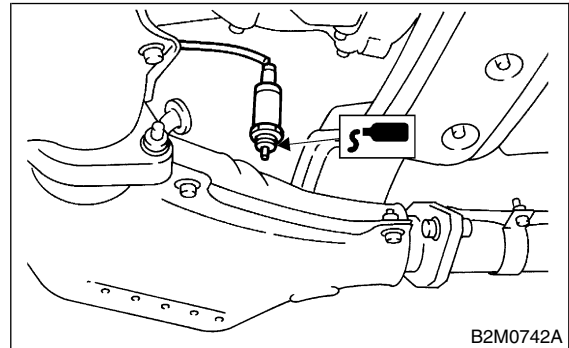
- 1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

CAUTION:

Never apply anti-seize compound to protector of rear oxygen sensor.

Anti-seize compound:

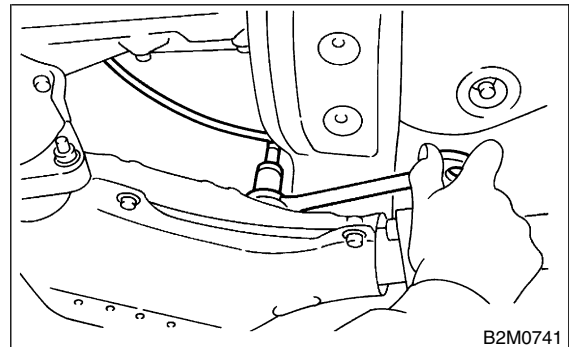
SS-30 by JET LUBE



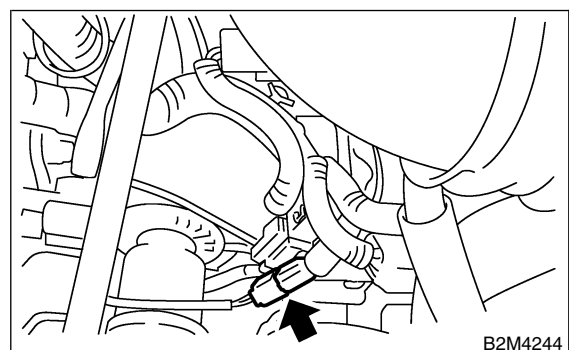
- 2) Install rear oxygen sensor.

Tightening torque:

21 N·m (2.1 kgf·m, 15.2 ft-lb)



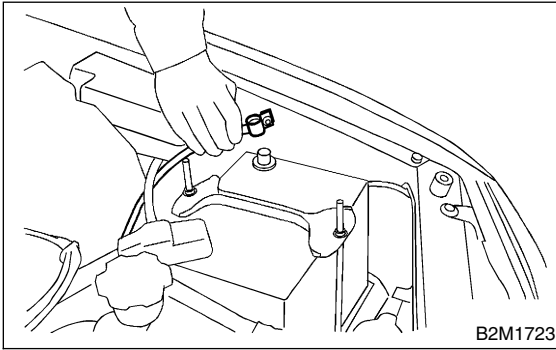
- 3) Lower the vehicle.
- 4) Connect connector to rear oxygen sensor.



REAR OXYGEN SENSOR

Fuel Injection (Fuel Systems)

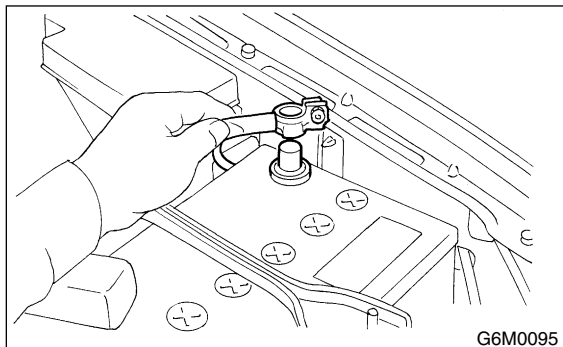
5) Connect battery ground cable.



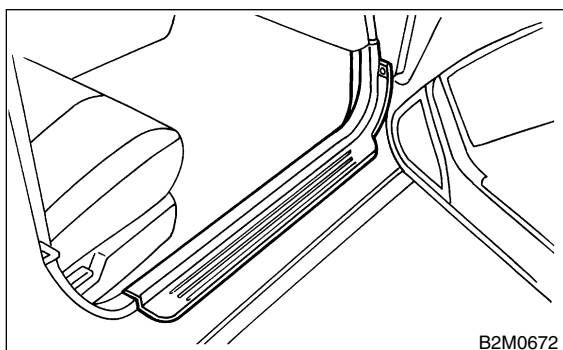
15. Engine Control Module S175049

A: REMOVAL S175049A18

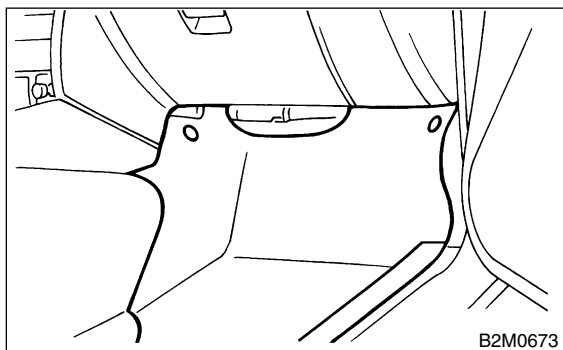
- 1) Disconnect battery ground cable.



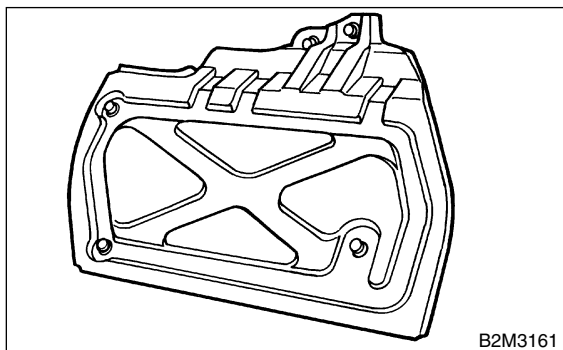
- 2) Remove lower inner trim of passenger side.
<Ref. to EI-43, REMOVAL, Lower Inner Trim.>



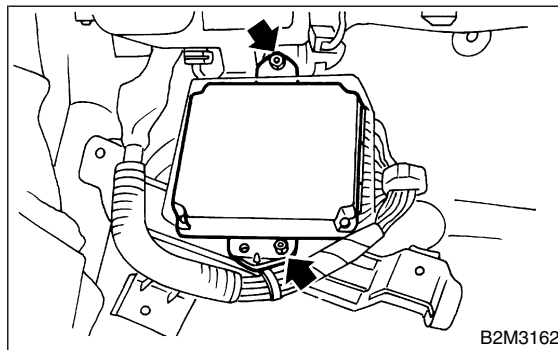
- 3) Detach floor mat of front passenger seat.



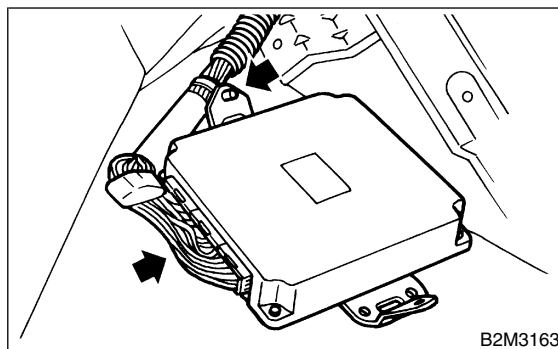
- 4) Remove protect cover.



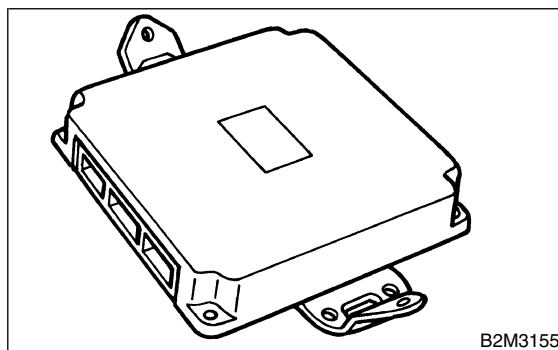
- 5) Remove nuts which hold ECM to bracket.



- 6) Remove clip from bracket.



- 7) Disconnect ECM connectors and take out ECM.



B: INSTALLATION S175049A11

Install in the reverse order of removal.

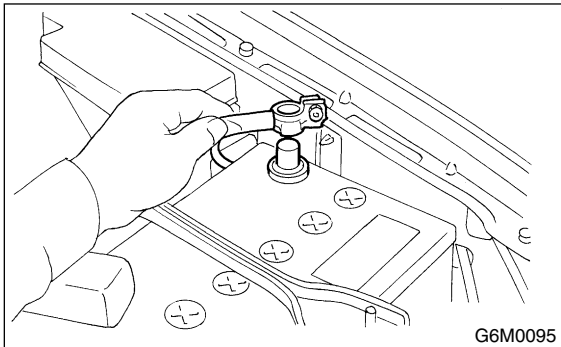
CAUTION:

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

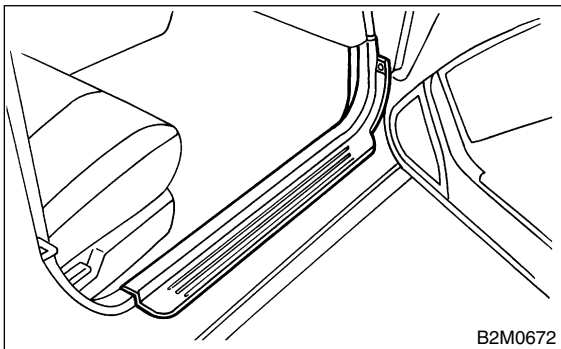
16. Main Relay S175050

A: REMOVAL S175050A18

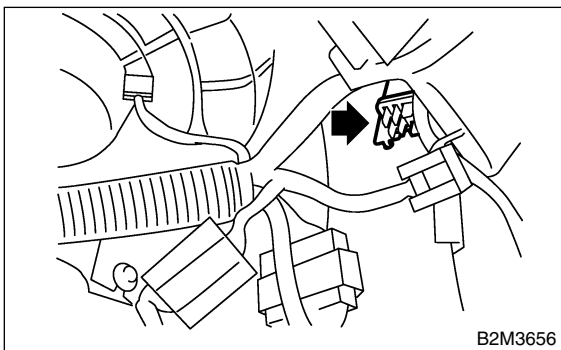
- 1) Disconnect battery ground cable.



- 2) Remove lower inner trim of passenger side.
<Ref. to EI-43, REMOVAL, Lower Inner Trim.>



- 3) Disconnect connectors from main relay.
- 4) Remove bolt which holds main relay bracket on body.



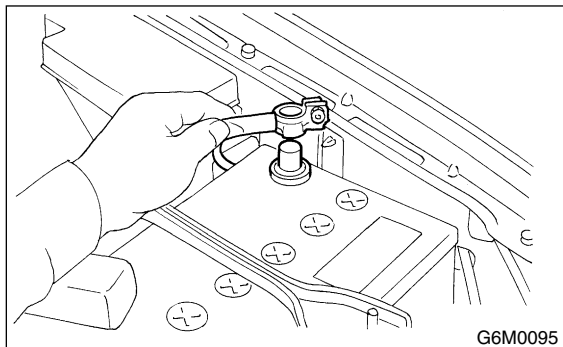
B: INSTALLATION S175050A11

Install in the reverse order of removal.

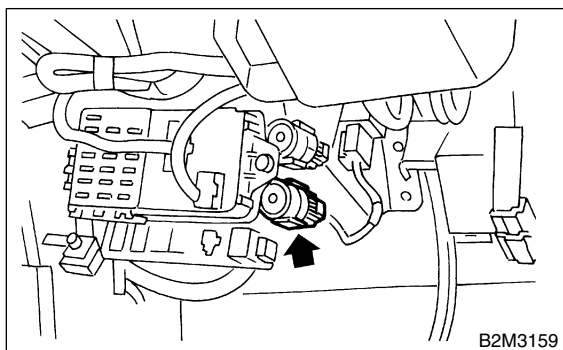
17. Fuel Pump Relay S175048

A: REMOVAL S175048A18

- 1) Disconnect battery ground cable.



- 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 S175048A11

Install in the reverse order of removal.

18. Fuel S175052

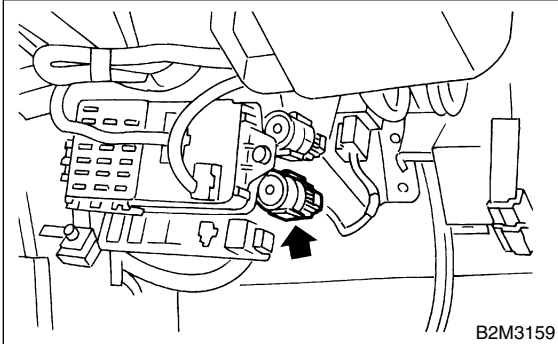
A: OPERATION S175052A16

1. RELEASING OF FUEL PRESSURE S175052A1601

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.



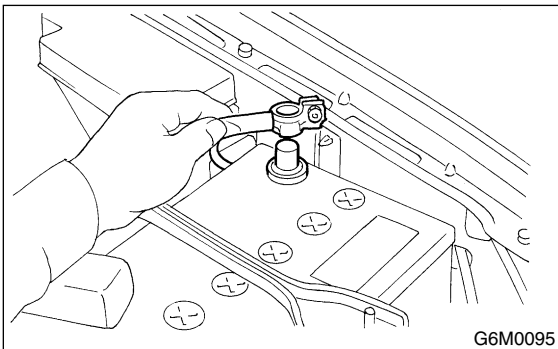
- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn ignition switch to OFF.

2. DRAINING FUEL S175052A1603

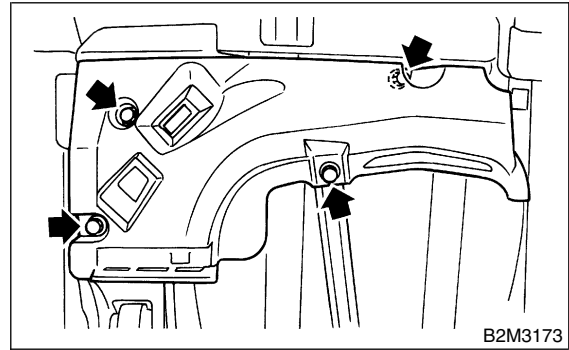
WARNING:

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

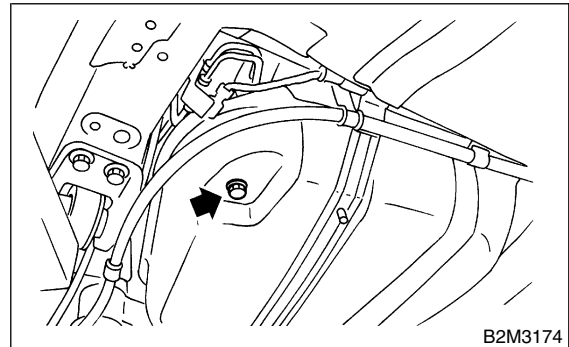
- 1) Set vehicle on the lift.
- 2) Disconnect battery ground cable.



- 3) Lift-up the vehicle.
- 4) Remove front right side fuel tank cover.



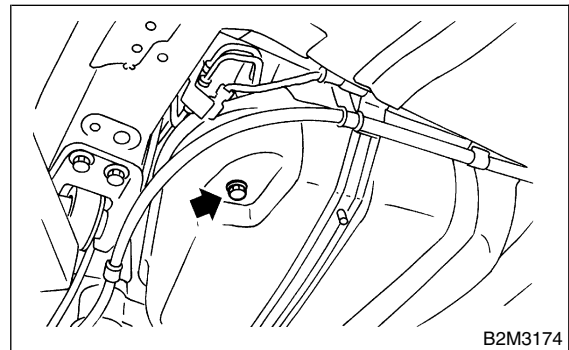
- 5) Drain fuel from fuel tank.
Set a container under the vehicle and remove drain plug from fuel tank.



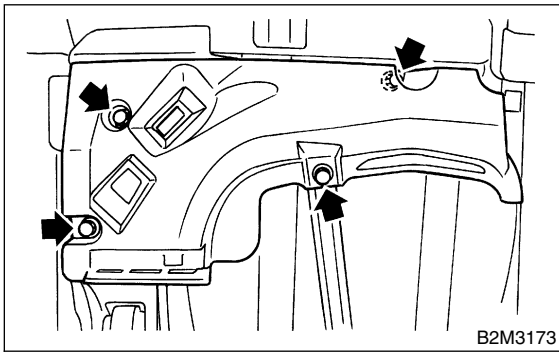
- 6) Tighten fuel drain plug and install front right side tank cover.

Tightening torque:

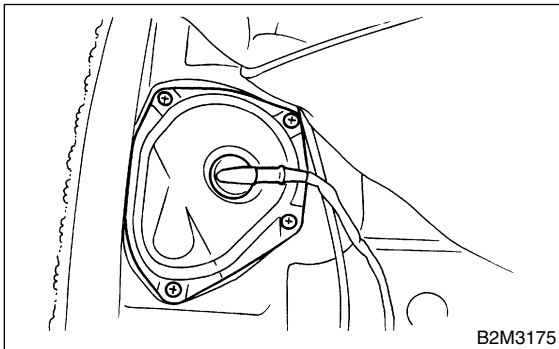
26 N·m (2.65 kgf-m, 19.2 ft-lb)



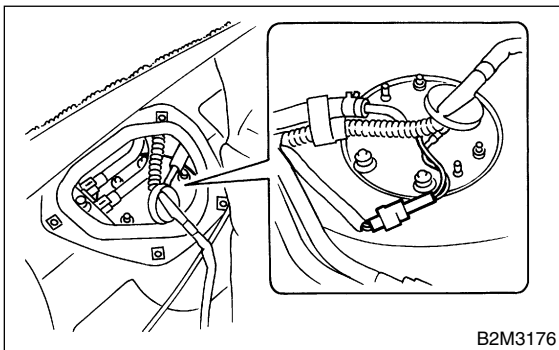
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



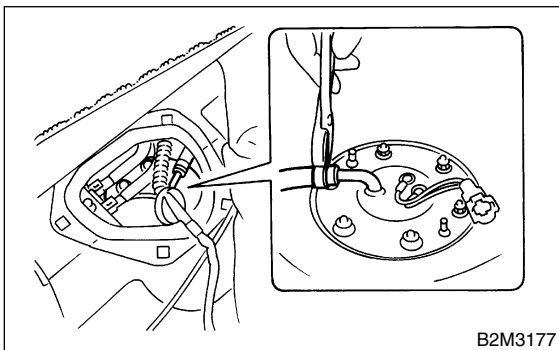
- 7) Lower the vehicle.
- 8) Remove sub service hole cover.



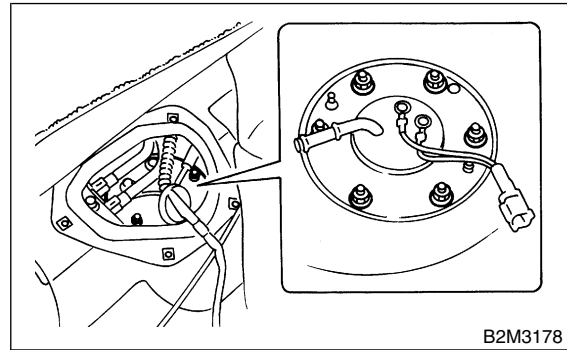
- 9) Disconnect connector from fuel sub level sensor.



- 10) Disconnect fuel jet pump hose.



- 11) Remove fuel sub level sensor.

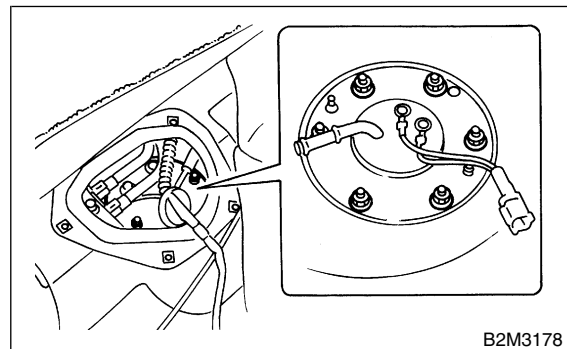


- 12) Drain fuel from fuel tank by using hand pump.

WARNING:
Do not use a motor pump when draining fuel.

- 13) After draining fuel, reinstall fuel sub level sensor.

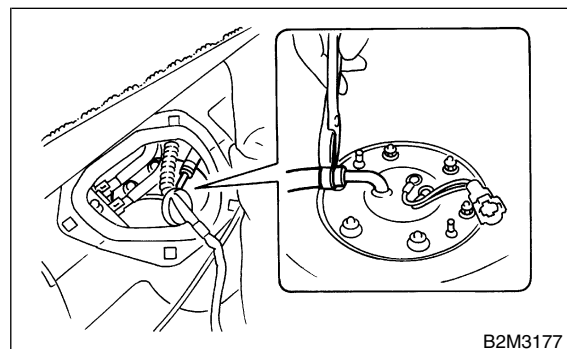
Tightening torque:
T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



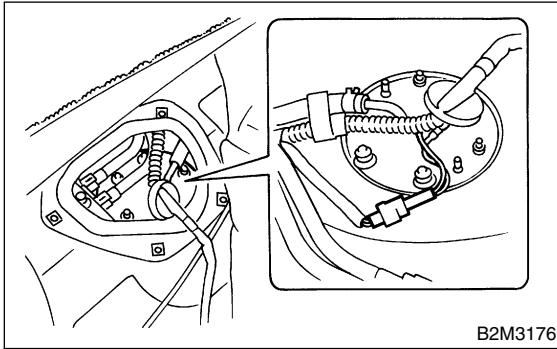
NOTE:

If you have not removed fuel tank yet, proceed with the procedure below for installation.

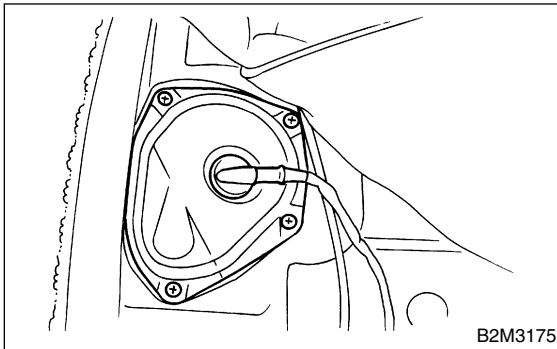
- (1) Connect fuel jet pump hose.



- (2) Connect connector from fuel sub level sensor.



- (3) Install sub service hole cover.

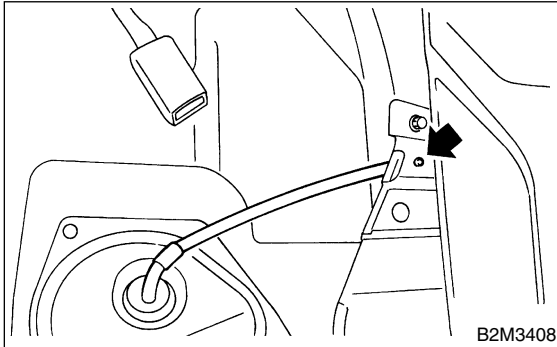


- (4) Set rear seat and floor mat.

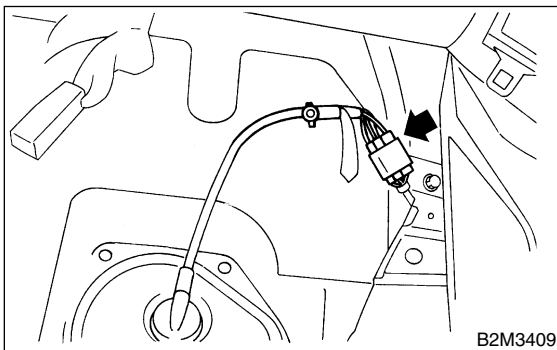
19. Fuel Tank S175053

A: REMOVAL S175053A18

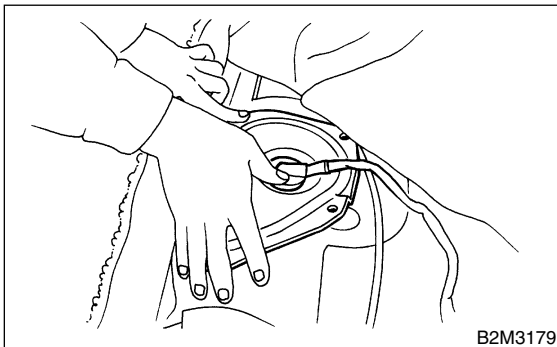
- 1) Set vehicle on the lift.
- 2) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Drain fuel from fuel tank. <Ref. to FU-54, DRAINING FUEL, OPERATION, Fuel.>
- 4) Remove holder clip which secures fuel tank cord on bracket.



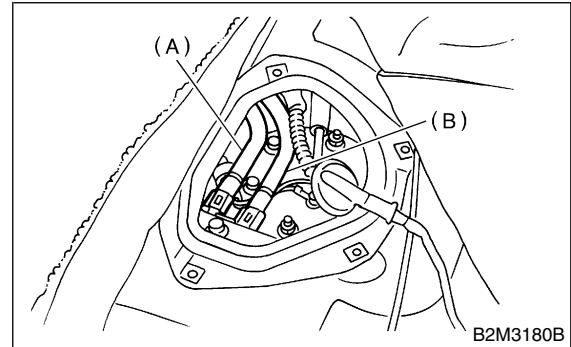
- 5) Disconnect connector of fuel tank cord to rear harness.



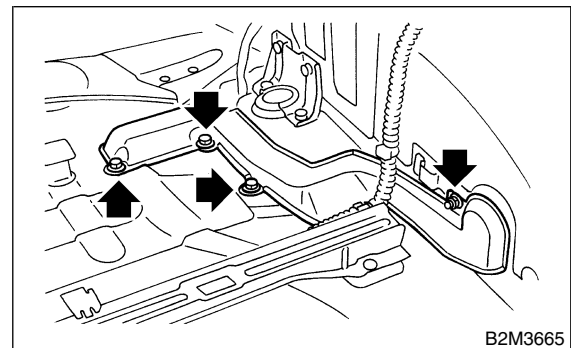
- 6) Push grommet which holds fuel tank cord on service hole cover into body side.



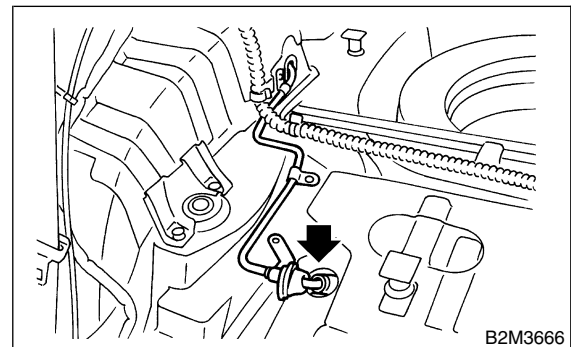
- 7) Separate quick connector of fuel delivery (A) and return hose (B). <Ref. to FU-81, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



- 8) Remove parking brake cable.
 - (1) Remove console box console. <Ref. to EI-36, REMOVAL, Console Box.>
 - (2) Remove parking brake bracket and disconnect parking brake cable from equalizer. <Ref. to PB-5, REMOVAL, Parking Brake Cable.>
- 9) Remove trunk trim. (Sedan model) <Ref. to EI-51, REMOVAL, Trunk Trim.>
- 10) Remove rear quarter lower trim. (Wagon model) <Ref. to EI-44, WAGON, REMOVAL, Rear Quarter Trim.>
- 11) Remove pipe protector.



- 12) Separate quick connector of evaporation pipe (A). <Ref. to FU-81, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

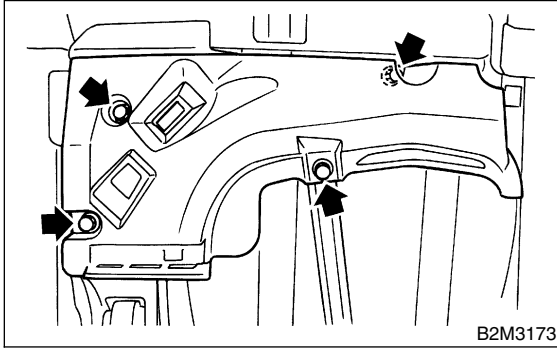


- 13) Remove wheel nuts from rear wheels.
- 14) Lift-up the vehicle.
- 15) Remove rear wheel.

FUEL TANK

Fuel Injection (Fuel Systems)

16) Remove front side fuel tank cover.



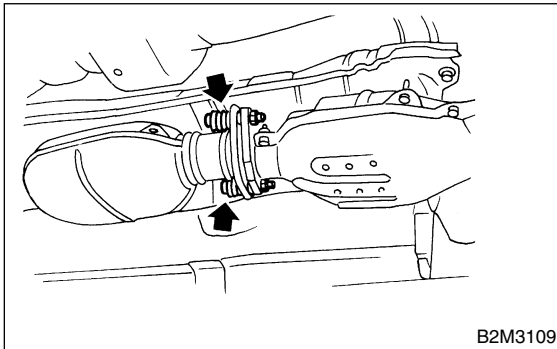
17) Remove rear exhaust pipe and muffler.

NOTE:

To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

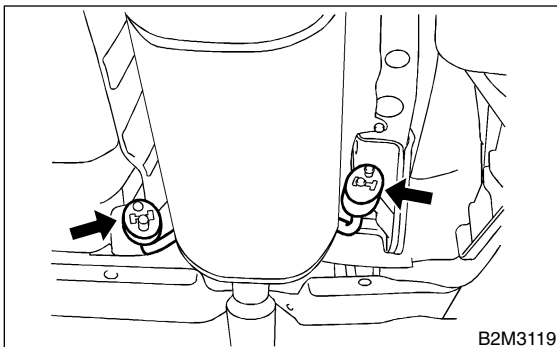
(1) Separate rear exhaust pipe from center exhaust pipe.



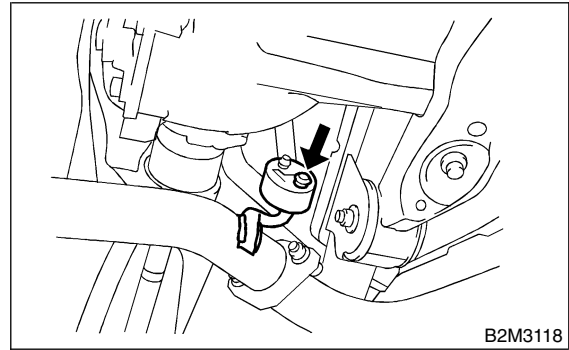
(2) Remove left and right rubber cushions.

CAUTION:

Be careful not to pull down muffler.

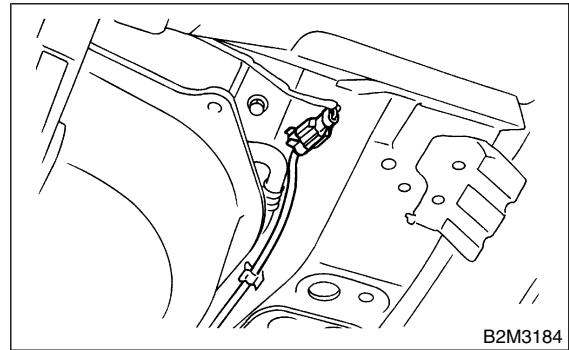


(3) Remove front rubber cushion and detach muffler assembly.



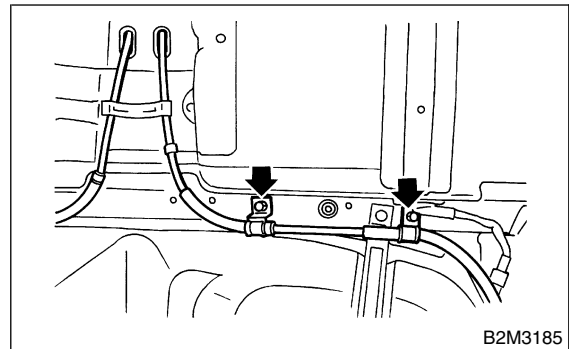
18) Remove propeller shaft. <Ref. to DS-13, REMOVAL, Propeller Shaft.>

19) Disconnect connector from ABS sensor.

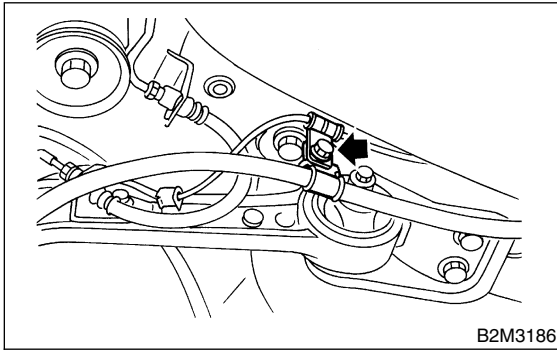


20) Remove bolts which hold parking brake cable holding bracket.

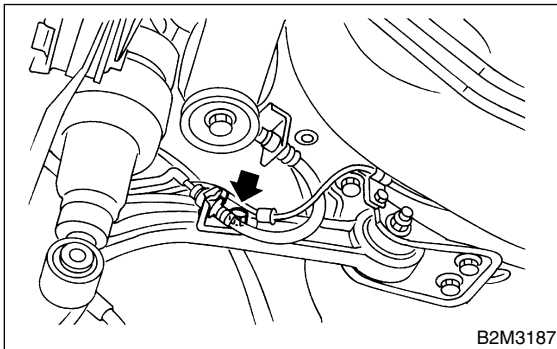
21) Remove parking brake cable from cabin by forcibly pulling it backward.



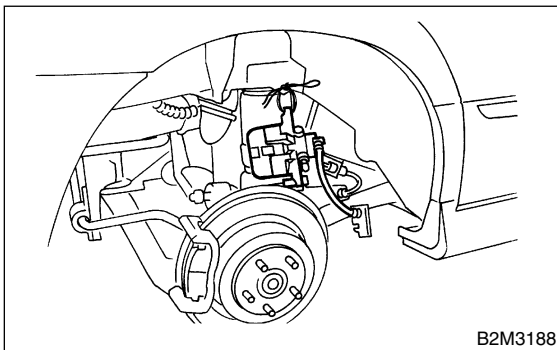
22) Remove bolts which hold parking brake cable holding bracket.



23) Remove bolts which hold rear brake hoses holding bracket.



24) Remove rear brake caliper, then tie it up to the body side of the vehicle as shown in figure.

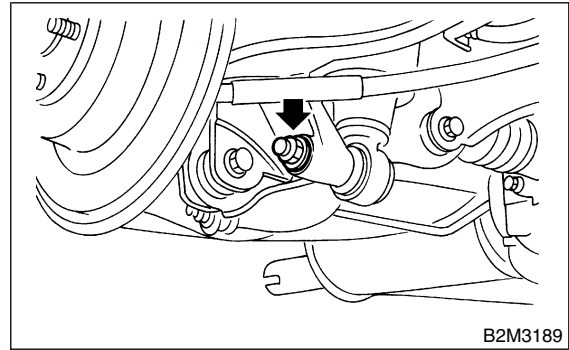


25) Remove rear suspension assembly.

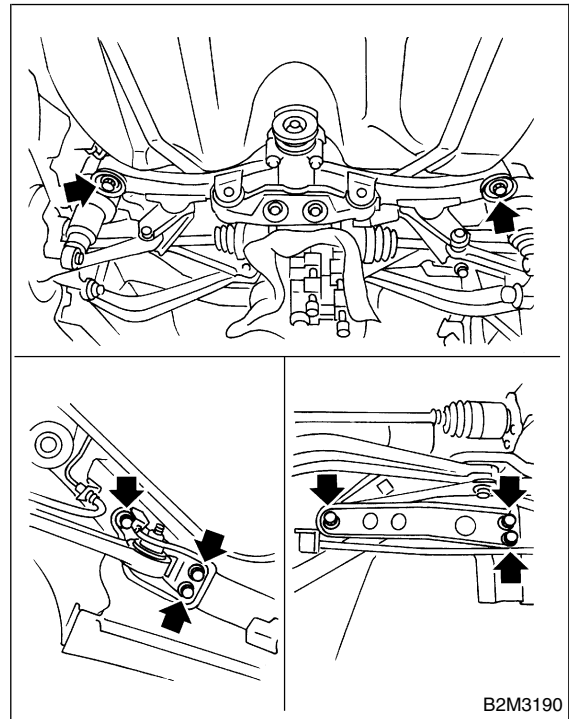
WARNING:
A helper is required to perform this work.

(1) Support rear differential with transmission jack.

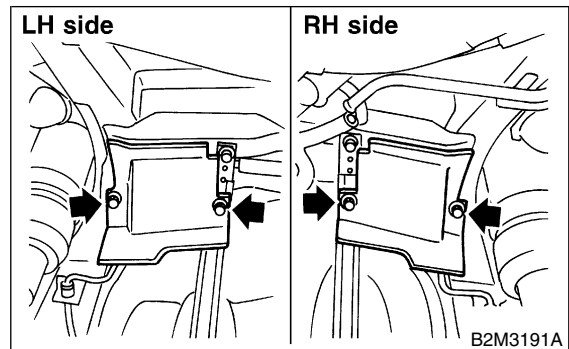
(2) Remove bolt which holds rear shock absorber to rear suspension arm.



(3) Remove bolts which secure rear suspension assembly to body.



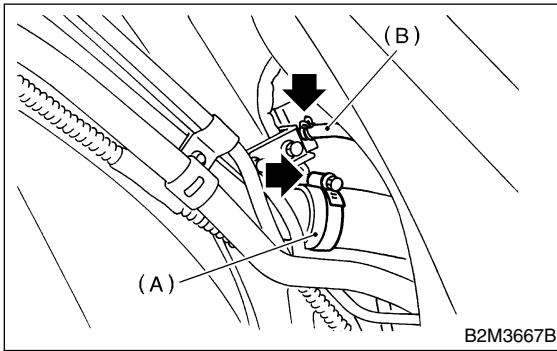
(4) Remove rear suspension assembly.
26) Remove rear side fuel tank cover.



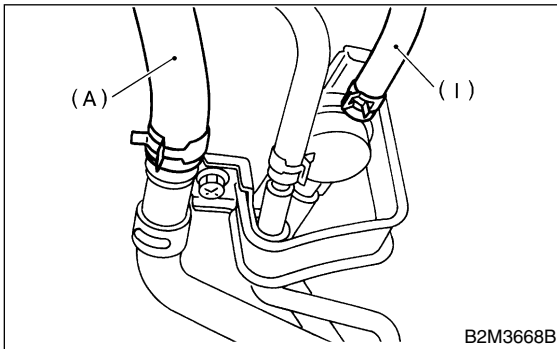
FUEL TANK

Fuel Injection (Fuel Systems)

27) Disconnect fuel filler hose (A) and fuel tank pressure sensor (B) hose.

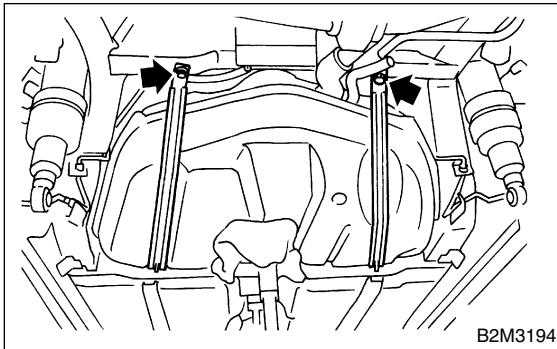


28) Disconnect air vent hose (A) from evaporation pipe assembly and disconnect evaporation hose (I) from pressure control solenoid valve.



29) Support fuel tank with transmission jack, remove bolts from bands and dismount fuel tank from the vehicle.

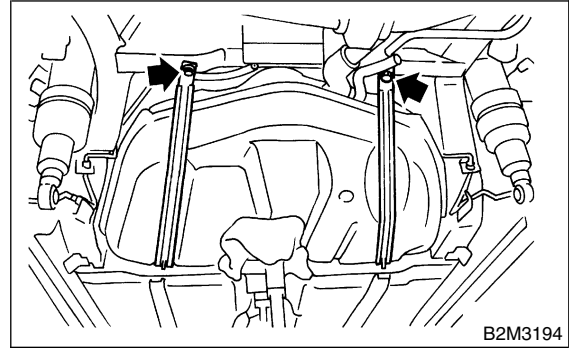
WARNING:
A helper is required to perform this work.



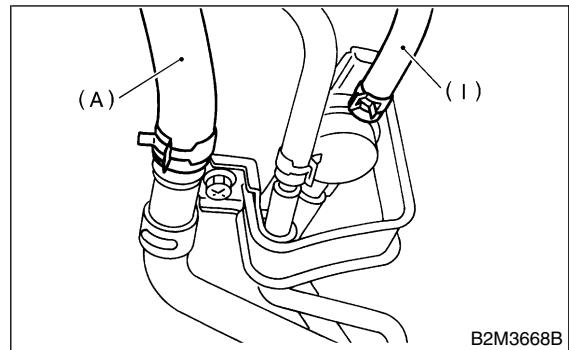
B: INSTALLATION S175053A11

- 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.

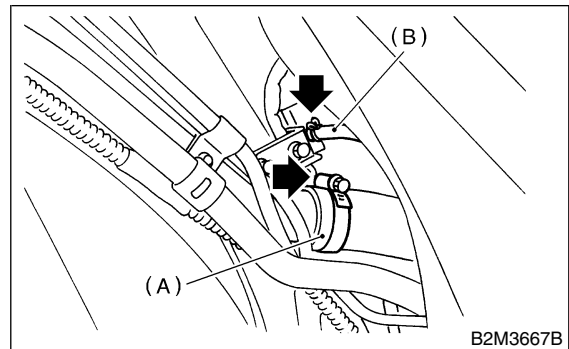
WARNING:
A helper is required to perform this work.



- 3) Connect air vent hose (A) to evaporation pipe assembly and connect evaporation hose (I) to pressure control solenoid valve.



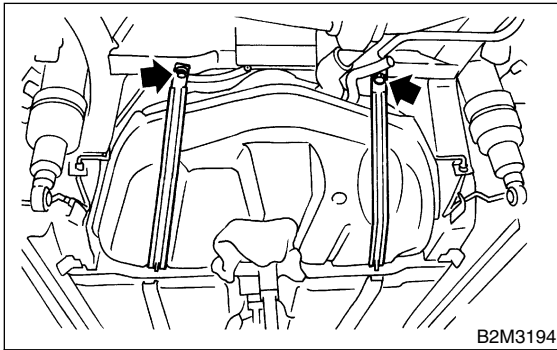
- 4) Connect fuel filler hose (A) and fuel tank pressure sensor hose (B).



5) Tighten band mounting bolts.

Tightening torque:

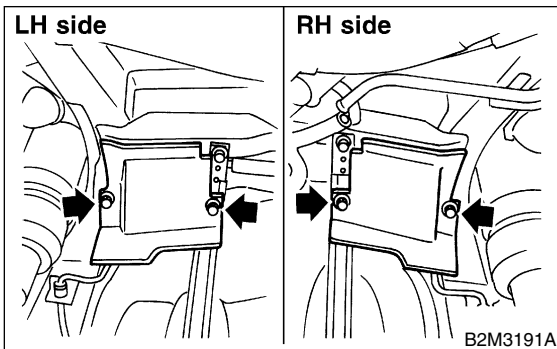
33 N·m (3.4 kgf-m, 25 ft-lb)



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.

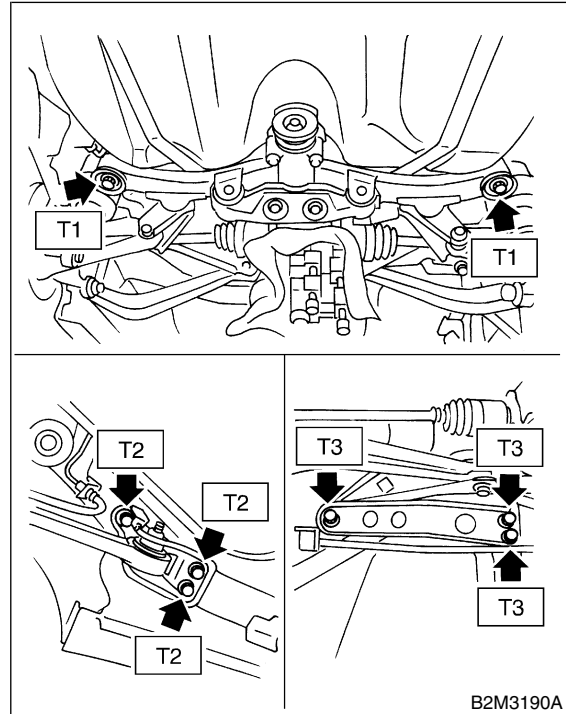
(1) Support rear suspension assembly and then tighten bolts which secure rear suspension assembly.

Tightening torque:

T1: 172 N·m (17.5 kgf-m, 127 ft-lb)

T2: 108 N·m (11.0 kgf-m, 80 ft-lb)

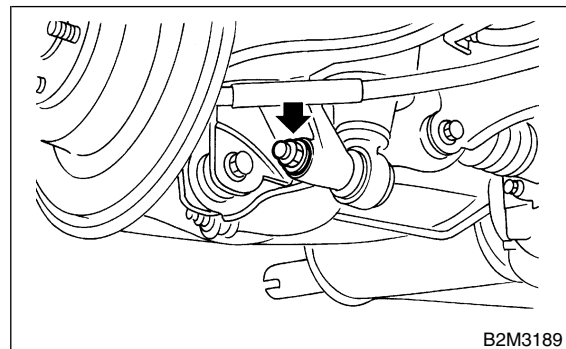
T3: 66 N·m (6.7 kgf-m, 48 ft-lb)



(2) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-14, INSTALLATION, Link Upper.>

Tightening torque:

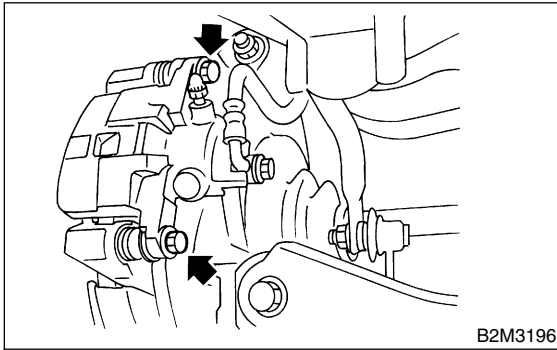
157 N·m (16 kgf-m, 116 ft-lb)



FUEL TANK

Fuel Injection (Fuel Systems)

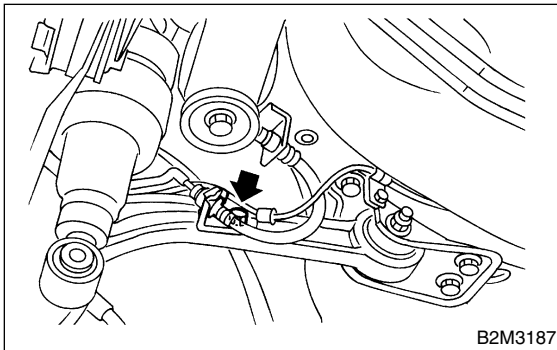
8) Install rear brake caliper. <Ref. to BR-22, INSTALLATION, Rear Disc Brake Assembly.>



9) Tighten bolts which hold rear brake hoses holding bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)

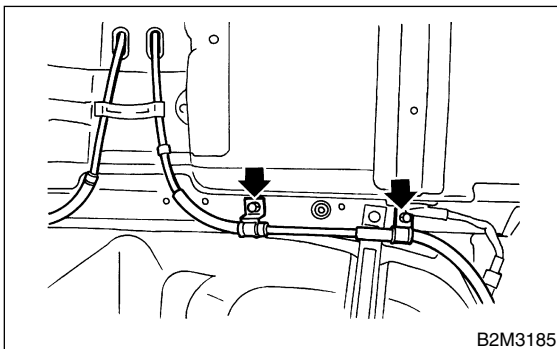


10) Install parking brake cable to cabin by forcibly pushing it forward.

11) Tighten bolts which hold parking brake cable holding bracket.

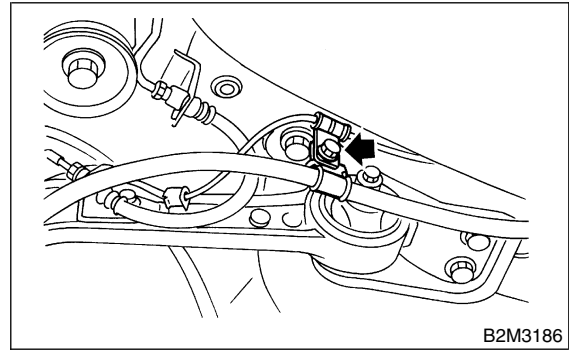
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

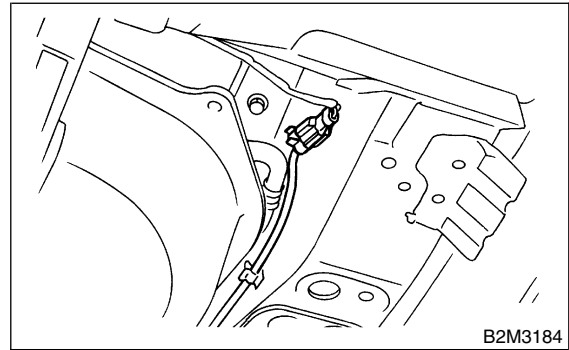


Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)



12) Connect connector to ABS sensor.



13) Install propeller shaft. <Ref. to DS-14, INSTALLATION, Propeller Shaft.>

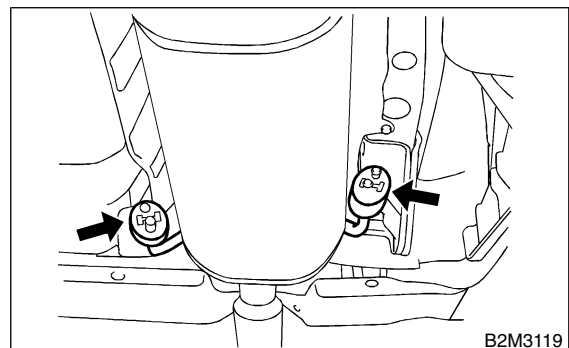
14) Install rear exhaust pipe and muffler.

NOTE:

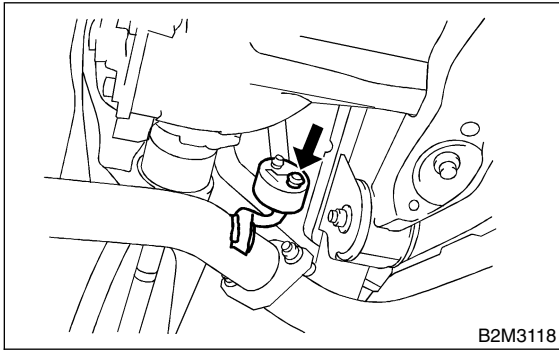
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.



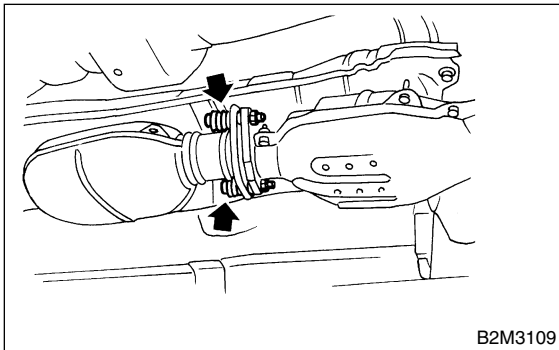
- (2) Install front rubber cushion and attach muffler assembly.



- (3) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:

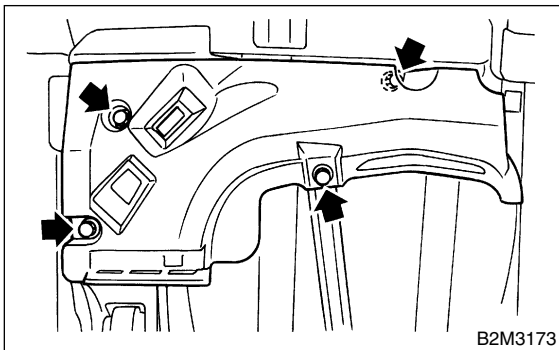
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 15) Install front side fuel tank cover.

Tightening torque:

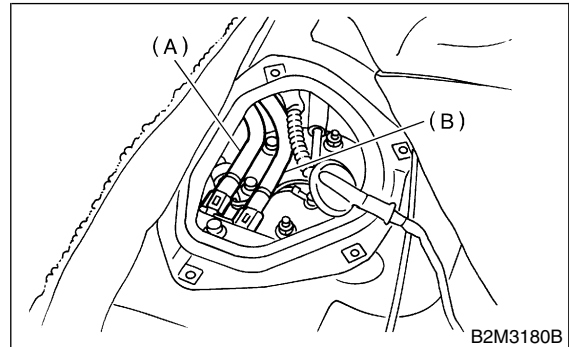
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 16) Install rear wheel.
17) Lower the vehicle.
18) Tighten wheel nuts to rear wheel.
19) Install parking brake cable. <Ref. to PB-4, INSTALLATION, Parking Brake Lever.>

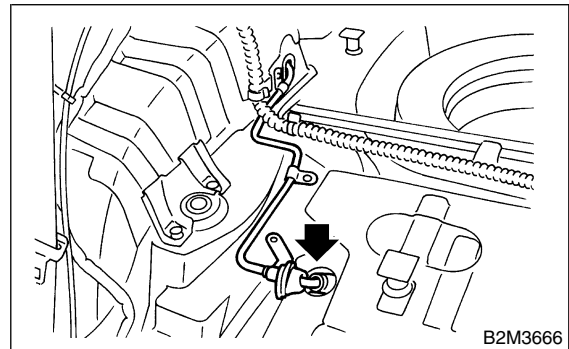
- 20) Install console box. <Ref. to EI-36, INSTALLATION, Console Box.>

- 21) Connect fuel hoses and hold them with quick connector. <Ref. to FU-82, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

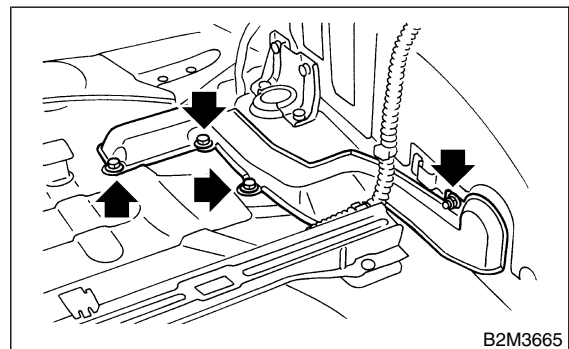


- (A) Delivery hose
(B) Return hose

- 22) Connect evaporation pipe and hold it with quick connector. <Ref. to FU-82, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>



- 23) Install pipe protector.

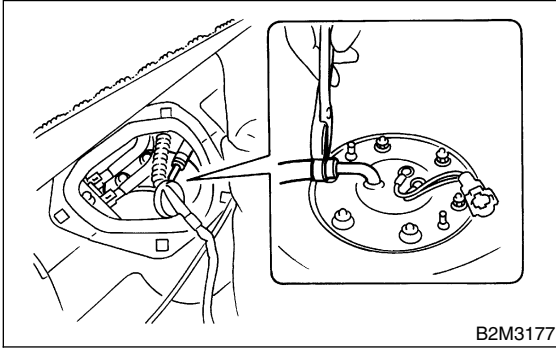


- 24) Install trunk room trim. (Sedan model)
25) Install luggage room trim. (Wagon model)

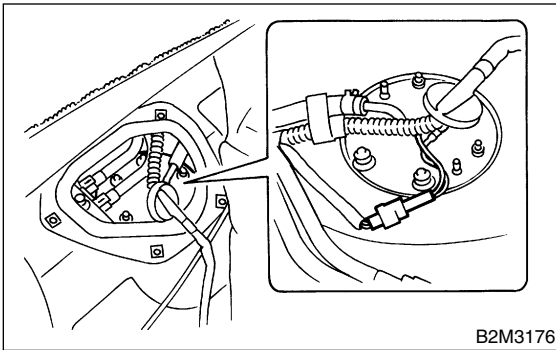
FUEL TANK

Fuel Injection (Fuel Systems)

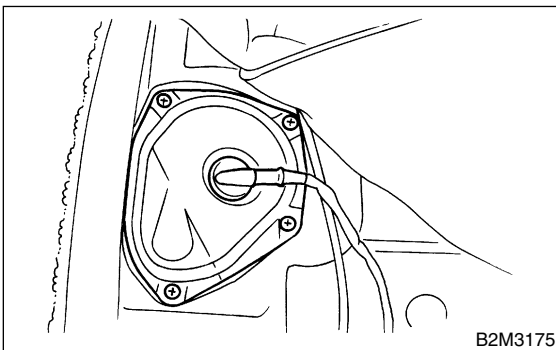
26) Connect fuel jet pump hose.



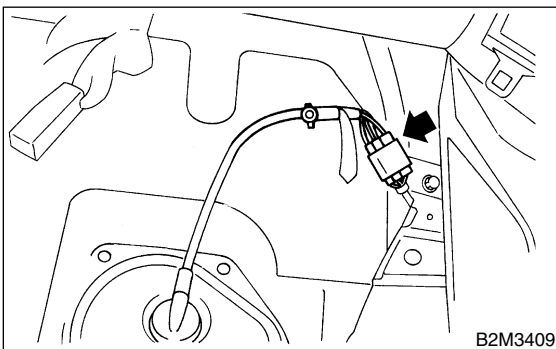
27) Connect connector to fuel sub level sensor.



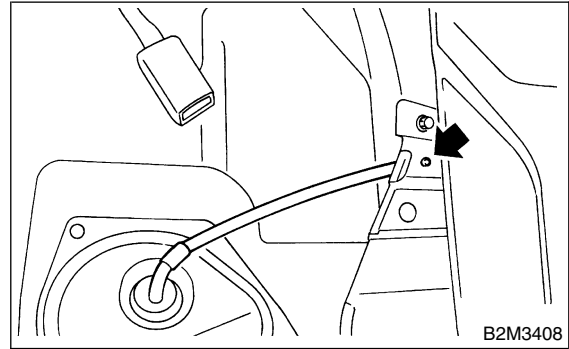
28) Install sub service hole cover.



29) Connect connectors to fuel tank cord and plug service hole with grommet.

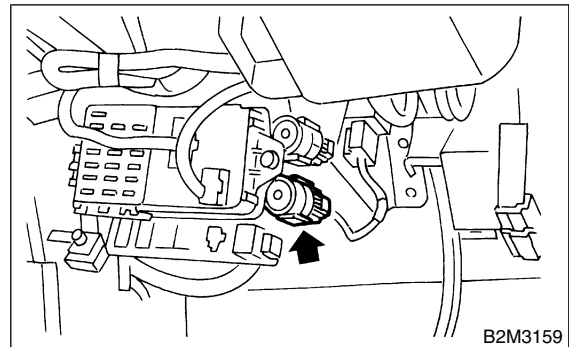


30) Install holder clip which secures fuel tank cord on bracket.



31) Set rear seat and floor mat.

32) Connect connector to fuel pump relay.



33) Bleed air from brake system. (Rear drum brake model only) <Ref. to BR-36, BRAKE LINE, PROCEDURE, Air Bleeding.>

34) Adjust parking brake lever stroke. <Ref. to PB-4, ADJUSTMENT, Parking Brake Lever.>

35) Check wheel alignment and adjust if necessary. <Ref. to FS-6, INSPECTION, Wheel Alignment.>

C: INSPECTION S175053A10

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.

20. Fuel Filler Pipe

S175022

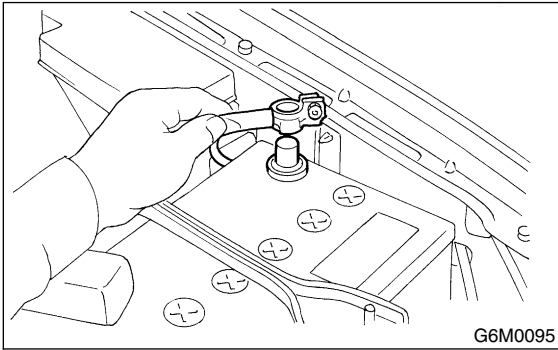
A: REMOVAL

S175022A18

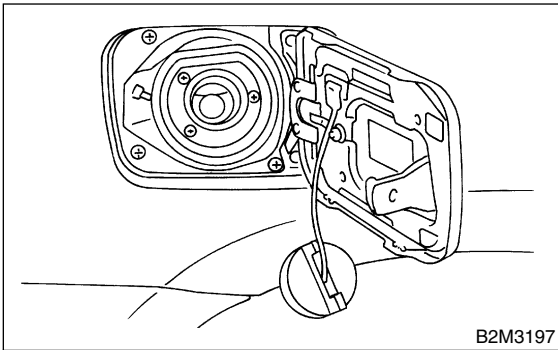
WARNING:

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

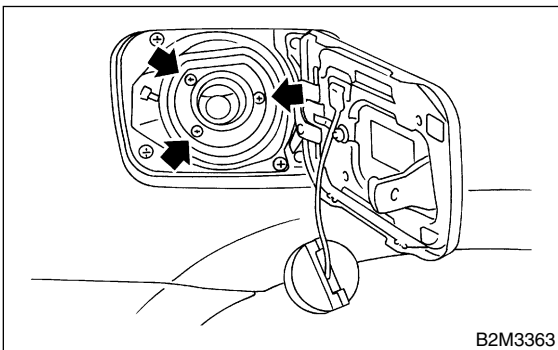
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



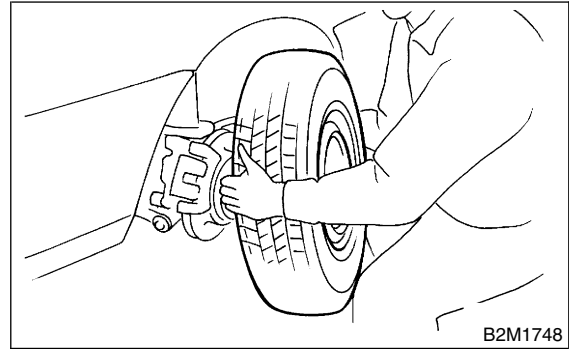
- 3) Open fuel filler flap lid and remove filler cap.



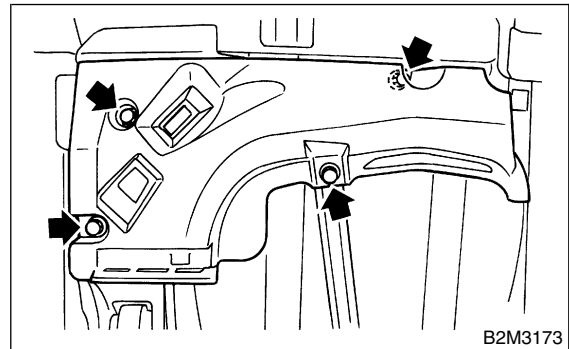
- 4) Remove screws holding packing in place.



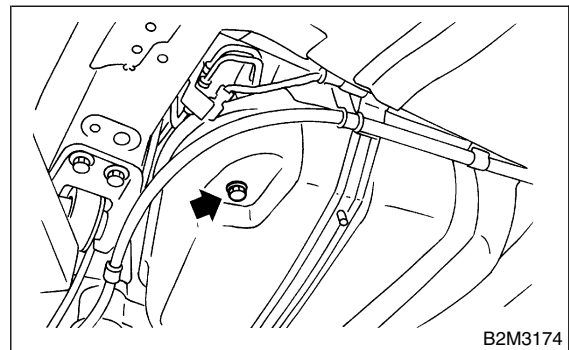
- 5) Lift-up the vehicle.
- 6) Remove rear wheel nuts.
- 7) Remove rear wheel.



- 8) Remove front right side fuel tank cover.



- 9) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



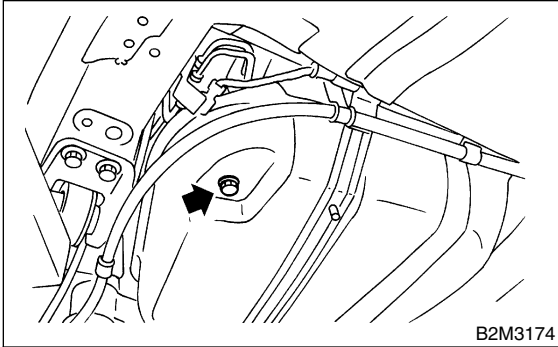
FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

10) Tighten fuel drain plug and then install front right side tank cover.

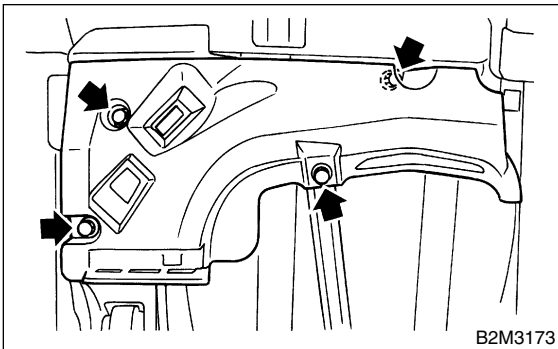
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



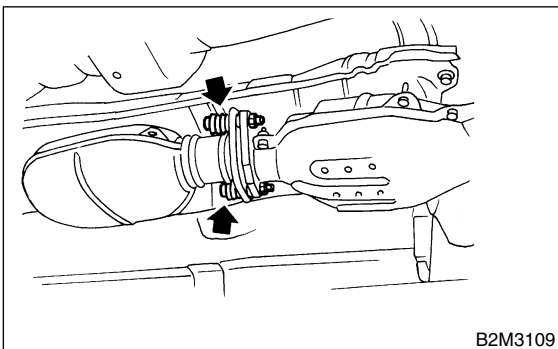
11) Remove rear exhaust pipe and muffler.

NOTE:

To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

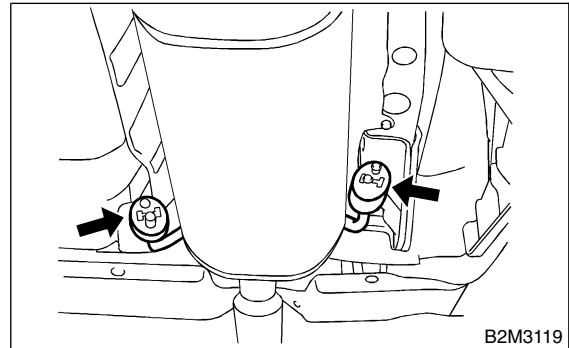
(1) Separate rear exhaust pipe from center exhaust pipe.



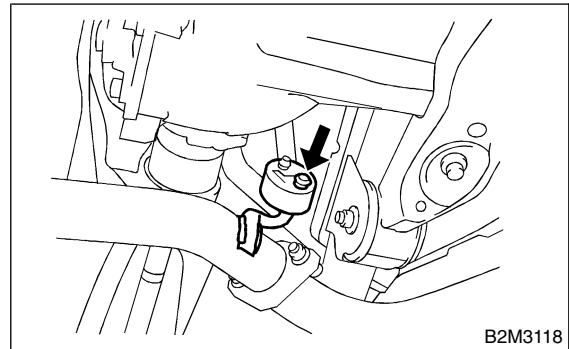
(2) Remove left and right rubber cushions.

CAUTION:

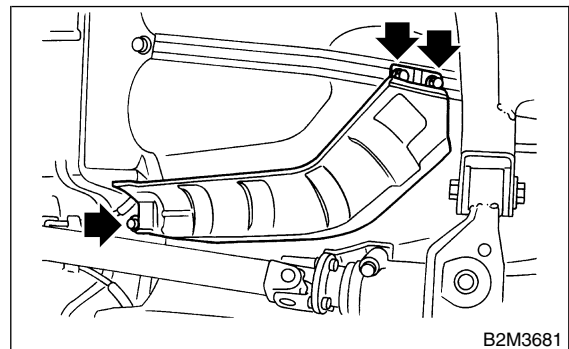
Be careful not to pull down muffler.



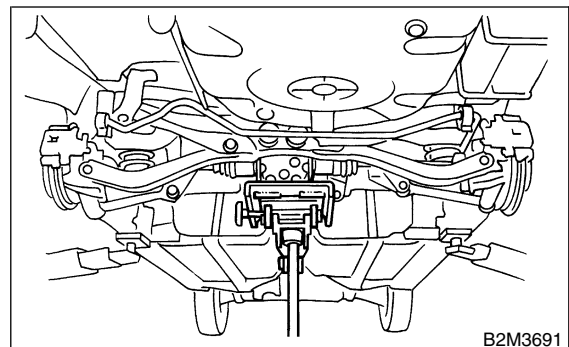
(3) Remove front rubber cushion and detach muffler assembly.



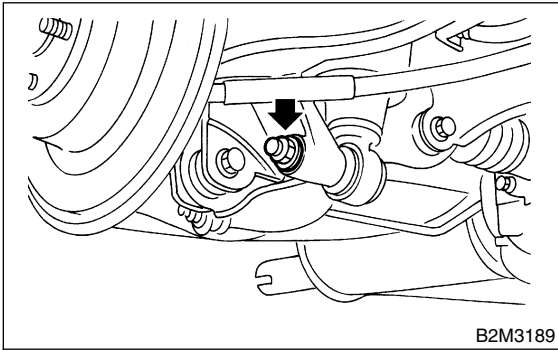
12) Remove heat sealed cover.



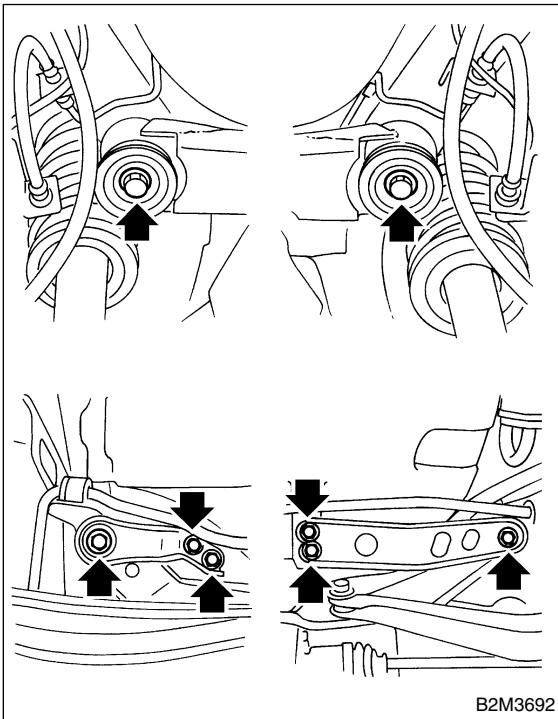
13) Place transmission jack under sub frame.



- 14) Remove bolt which holds rear shock absorber to rear suspension arm.



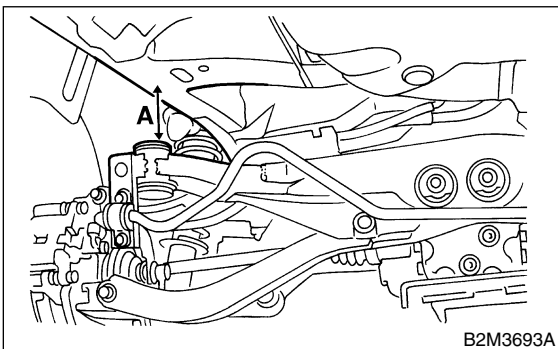
- 15) Remove bolts which hold rear sub frame on body.



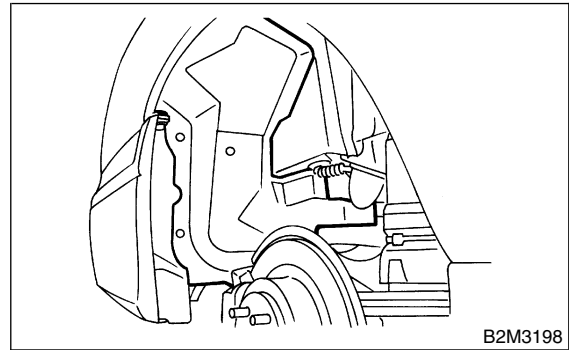
- 16) Lower the rear sub frame.

CAUTION:
Be sure to lower sub frame slowly.

A = 150 mm (5.91 in)

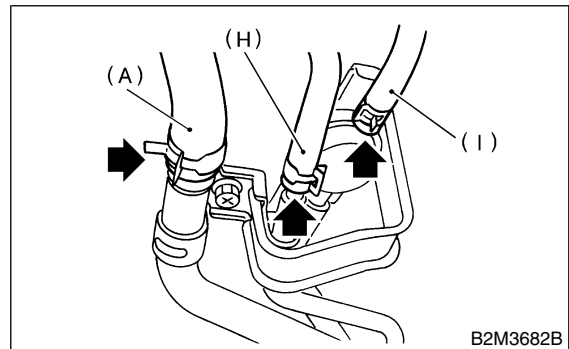


- 17) Remove fuel filler pipe protector.

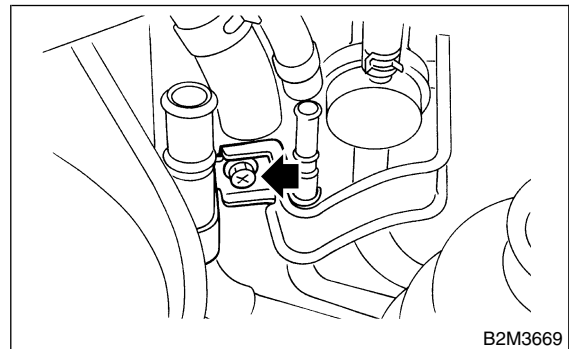


- 18) Disconnect air vent hose (A) and evaporation hose (H) from evaporation pipe assembly.

- 19) Disconnect evaporation hose (I) from pressure control solenoid valve.



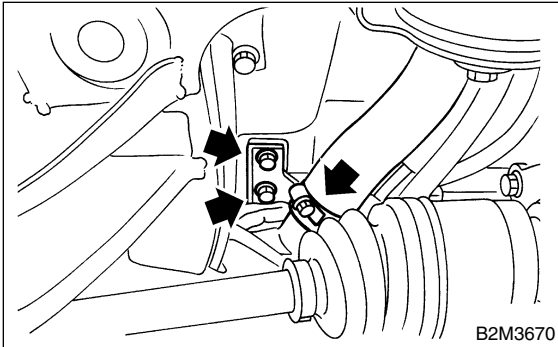
- 20) Remove bolt which holds evaporation pipe assembly on body.



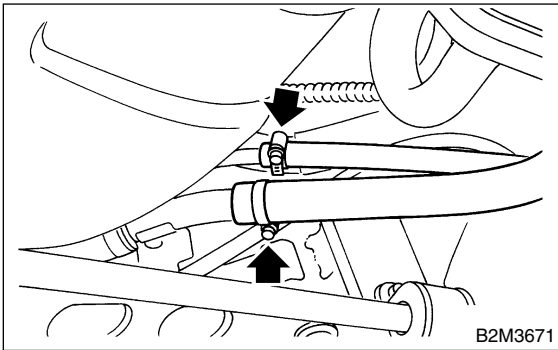
FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

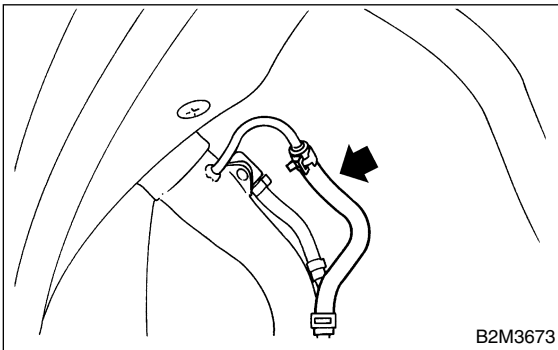
- 21) Disconnect fuel filler hose.
- 22) Remove bolt which holds fuel pressure sensor on fuel filler pipe and remove bolt which holds fuel filler pipe on body.



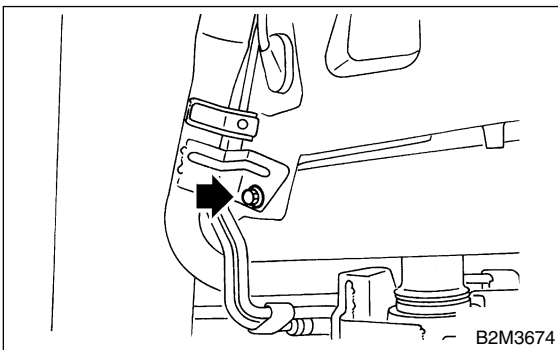
- 23) Disconnect canister hose from evaporation pipe assembly.



- 24) Disconnect evaporation hose (O) from fuel filler pipe.



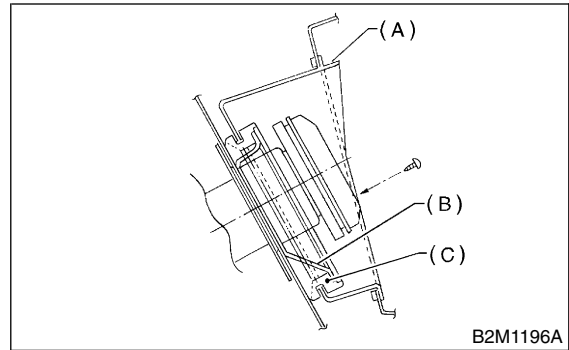
- 25) Remove bolt which holds fuel filler pipe to body.



- 26) Remove fuel filler pipe from under side of the vehicle.

B: INSTALLATION S175022A11

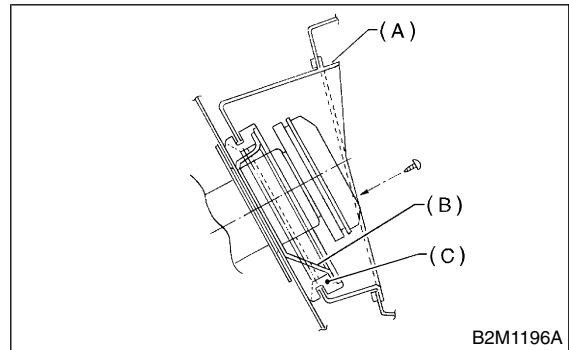
- 1) Hold fuel filler flap open.
- 2) Set fuel saucer (A) with rubber packing (C) and insert fuel filler pipe into hole from the inner side of apron.



- 3) Align holes in fuel filler pipe neck and set cup (B), and tighten screws.

NOTE:

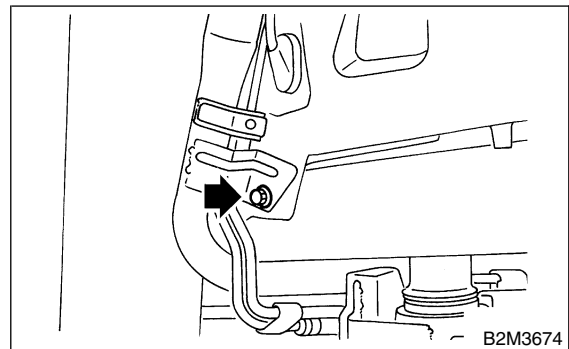
If edges of rubber packing are folded toward the inside, straighten it with a screwdriver.



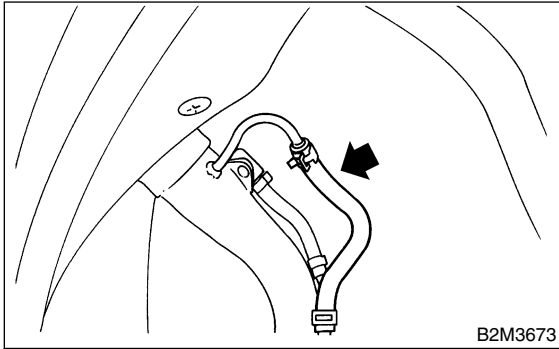
- 4) Tighten bolt which holds fuel filler pipe on body.

Tightening torque:

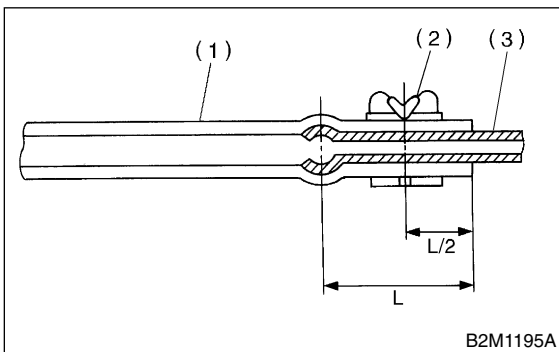
7.5 N·m (0.75 kgf·m, 5.4 ft·lb)



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.

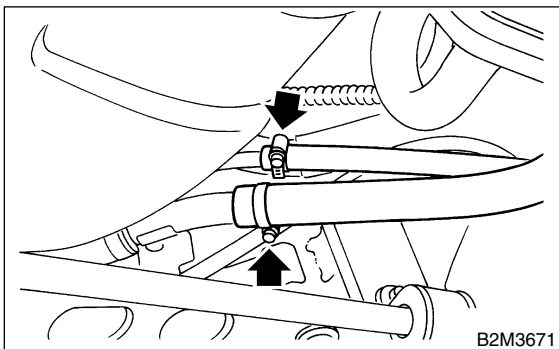


$L = 27.5 \pm 2.5 \text{ mm (1.083 \pm 0.098 in)}$

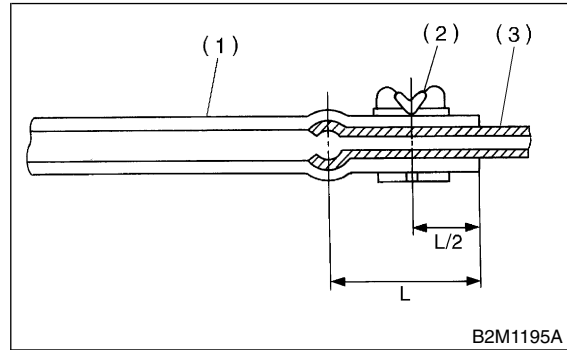


- (1) Hose
- (2) Clip
- (3) Pipe

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.



$L = 27.5 \pm 2.5 \text{ mm (1.083 \pm 0.098 in)}$

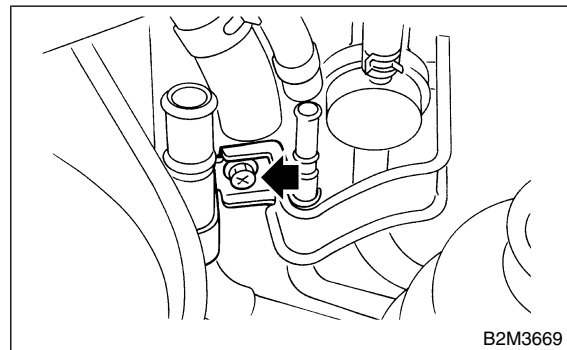


- (1) Hose
- (2) Clip
- (3) Pipe

7) Tighten bolt which holds evaporation pipe assembly on body.

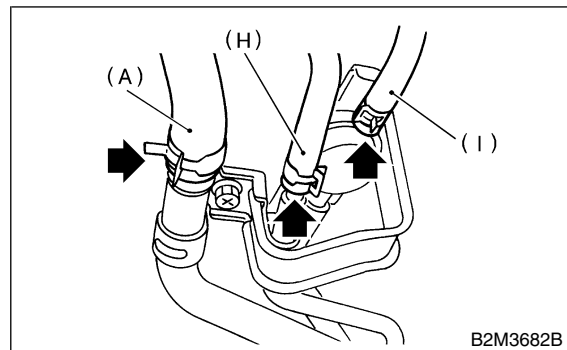
Tightening torque:

7.5 N·m (0.75 kgf·m, 5.4 ft·lb)



8) Insert air vent hose (A), evaporation hose (H) approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe assembly and hold clip.

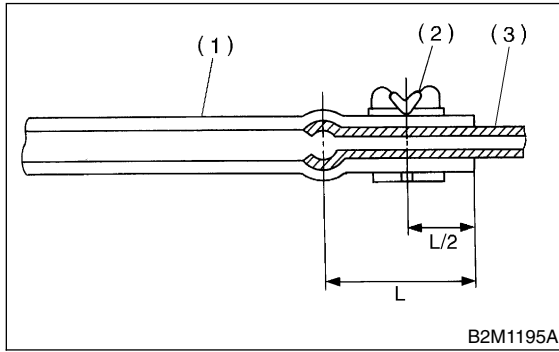
9) Insert evaporation hose (I) to pressure control solenoid valve and hold clip.



FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

$L = 27.5 \pm 2.5 \text{ mm (1.083 \pm 0.098 in)}$



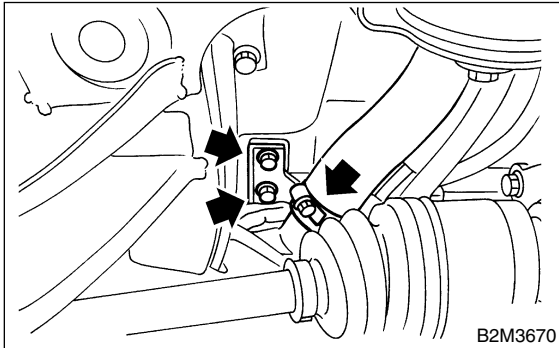
- (1) Hose
- (2) Clip
- (3) Pipe

10) Tighten bolt which holds fuel filler pipe on body and tighten bolt which holds fuel pressure sensor on fuel filler pipe.

Tightening torque:

$7.5 \text{ N}\cdot\text{m (0.75 kgf}\cdot\text{m, 5.4 ft}\cdot\text{lb)}$

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.

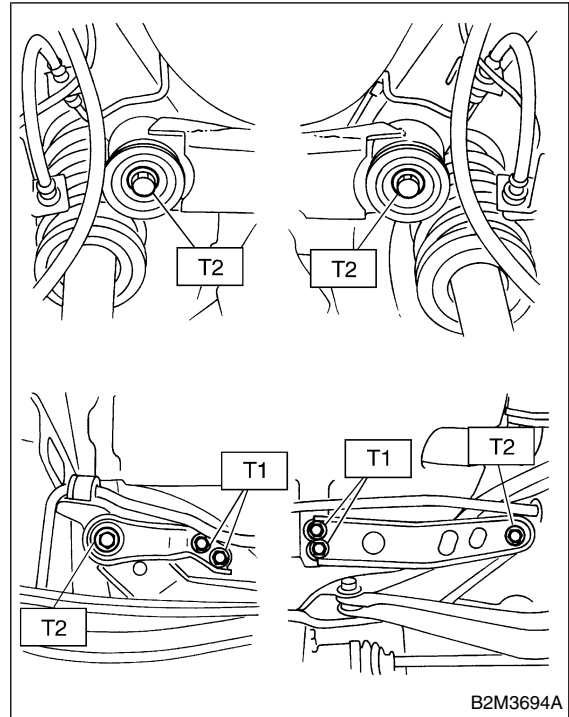


12) Jack-up the rear sub frame and tighten bolts which hold rear sub frame on body.

Tightening torque:

$T1: 66 \text{ N}\cdot\text{m (6.7 kgf}\cdot\text{m, 48.5 ft}\cdot\text{lb)}$

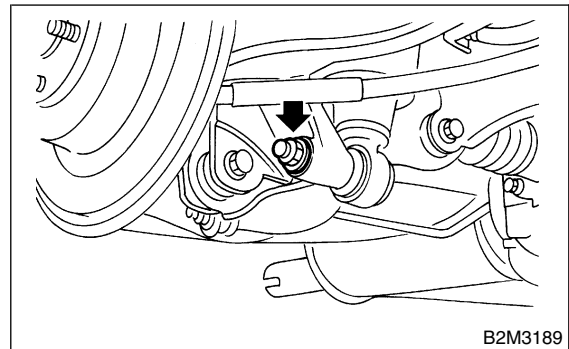
$T2: 172 \text{ N}\cdot\text{m (17.5 kgf}\cdot\text{m, 127 ft}\cdot\text{lb)}$



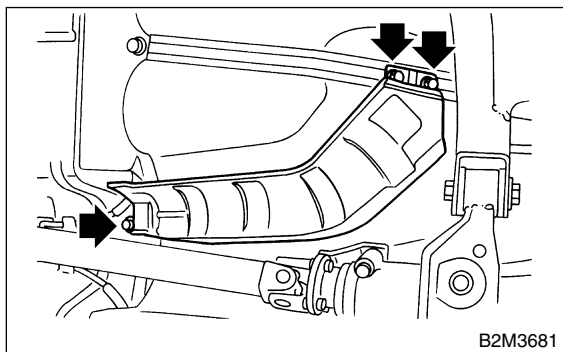
13) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-17, INSTALLATION, Rear Shock Absorber.>

Tightening torque:

$157 \text{ N}\cdot\text{m (16 kgf}\cdot\text{m, 116 ft}\cdot\text{lb)}$



14) Install heat shield cover.



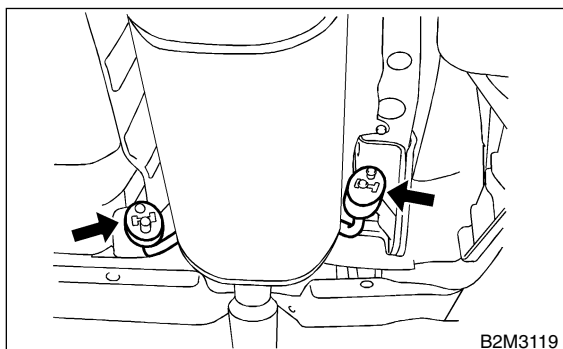
15) Install rear exhaust pipe and muffler.

NOTE:

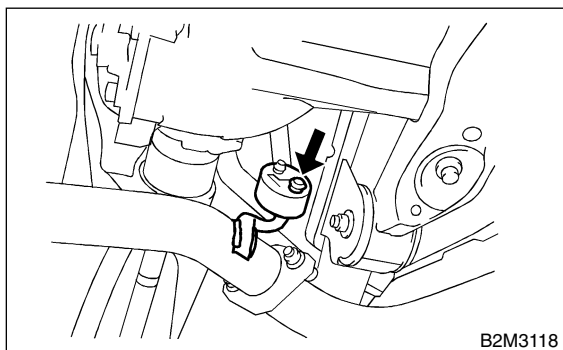
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.



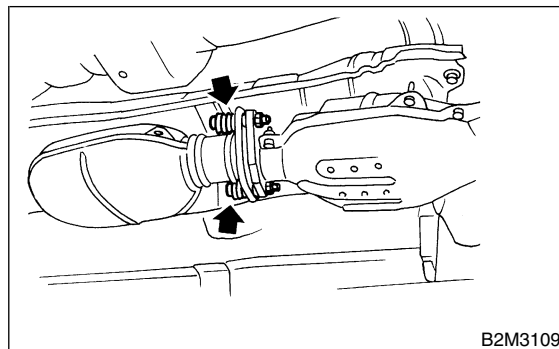
(2) Install front rubber cushion and attach muffler assembly.



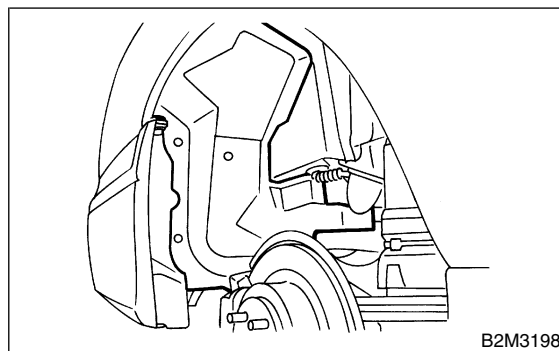
(3) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:

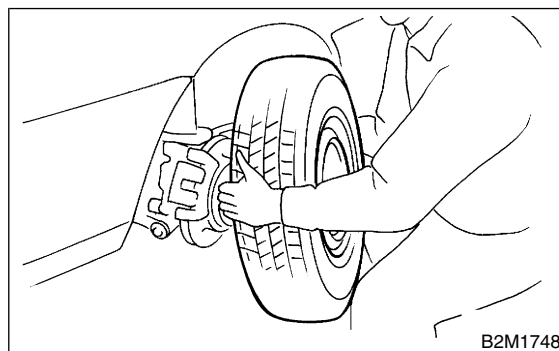
18 N·m (1.8 kgf-m, 13.0 ft-lb)



16) Install fuel filler pipe protector.



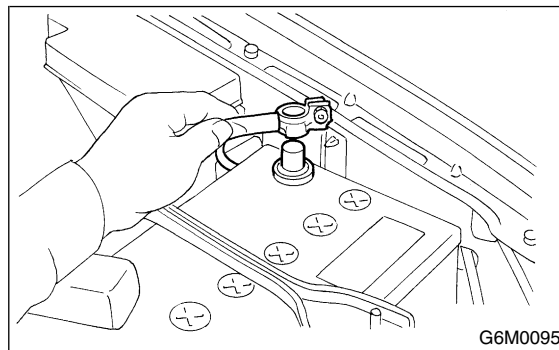
17) Install rear right wheel.



18) Lower the vehicle.

19) Tighten wheel nuts.

20) Connect battery ground terminal.



FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

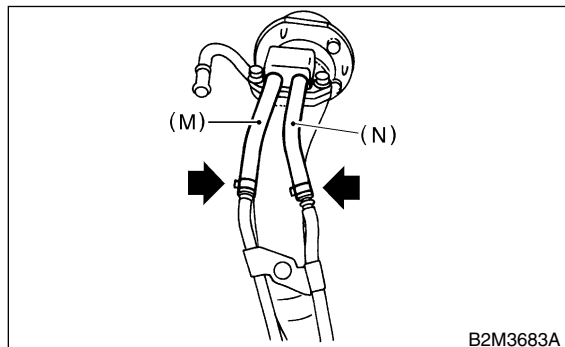
21) Remove fuel filler pipe to under side of the vehicle.

D: ASSEMBLY S175022A02

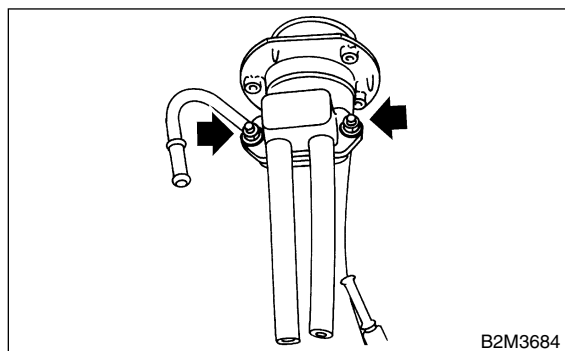
Assemble in the reverse order of disassembly.

C: DISASSEMBLY S175022A06

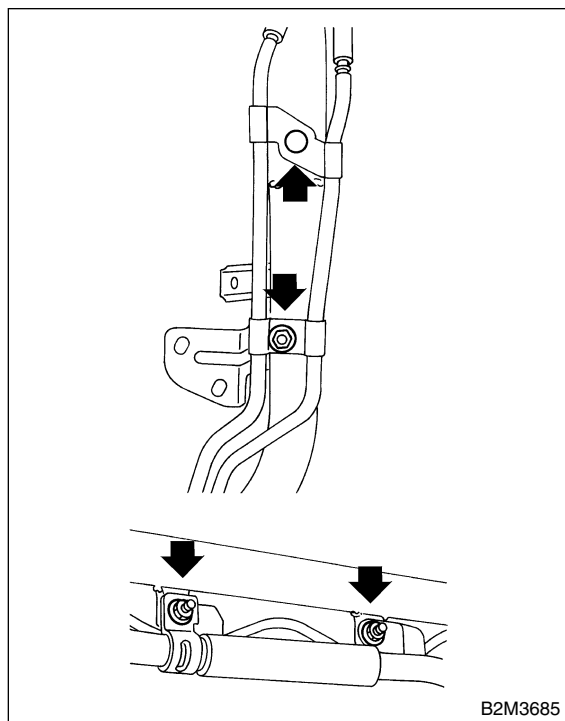
1) Disconnect evaporation hose (M) and (N) from evaporation pipe assembly.



2) Remove shut valve from fuel filler pipe.



3) Remove nut which holds evaporation pipe assembly on fuel filler pipe.



21. Fuel Pump S175025

A: REMOVAL S175025A18

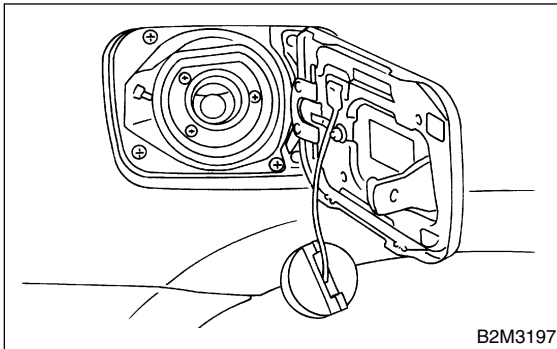
WARNING:

- 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.

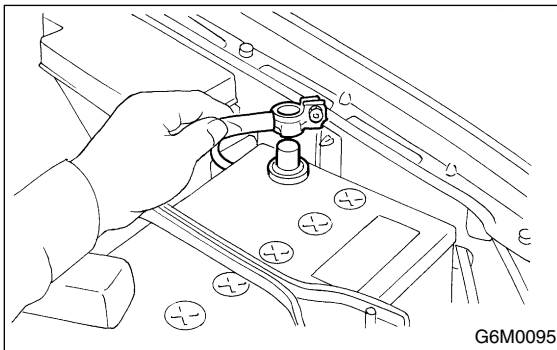
NOTE:

Fuel pump assembly consists of fuel pump and fuel level sensor.

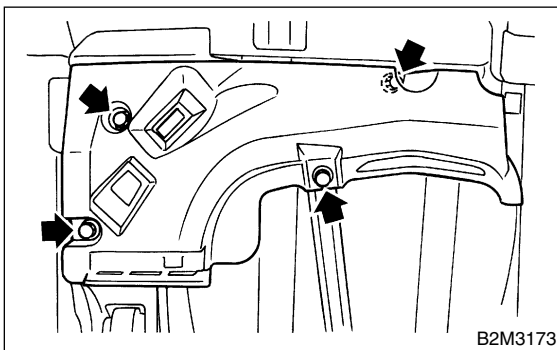
- 1) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open fuel filler flap lid and remove fuel filler cap.



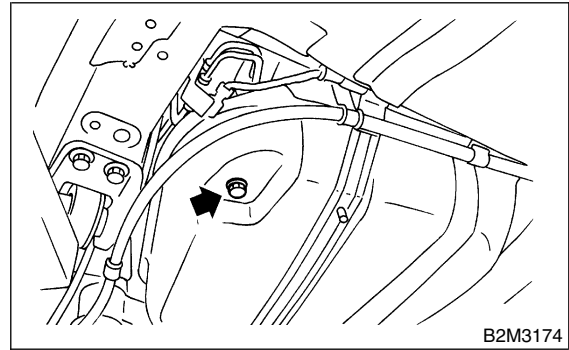
- 3) Disconnect battery ground cable.



- 4) Lift-up the vehicle.
- 5) Remove front side fuel tank cover.



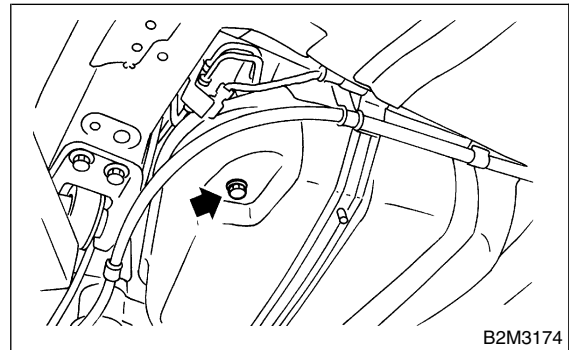
- 6) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



- 7) Tighten fuel drain plug and install front right side fuel tank cover.

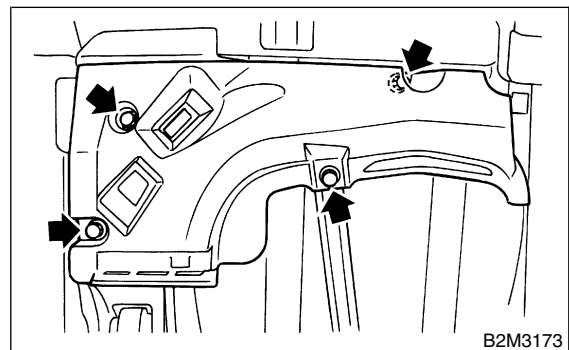
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

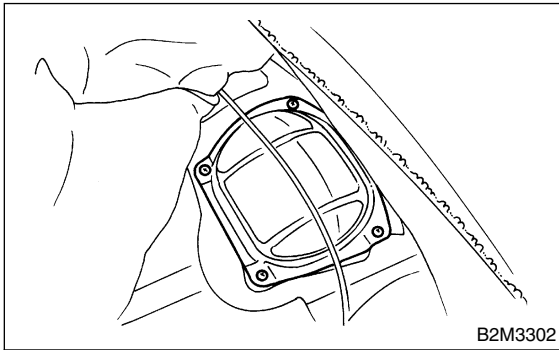


- 8) Raise rear seat and turn floor mat up.

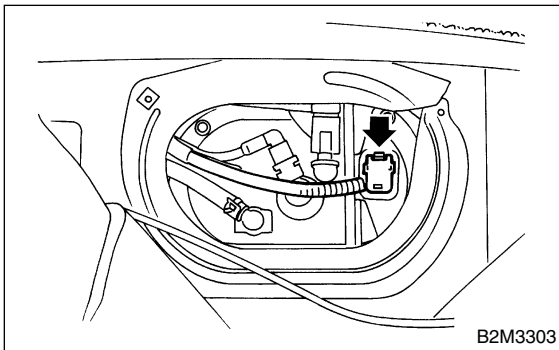
FUEL PUMP

Fuel Injection (Fuel Systems)

9) Remove access hole lid.

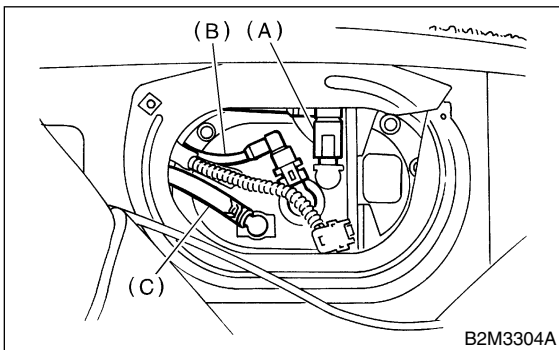


10) Disconnect connector from fuel pump.

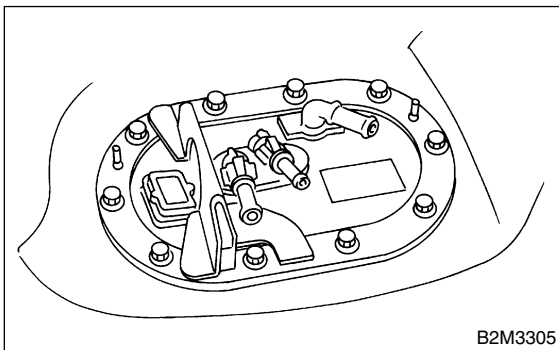


11) Move clips and then disconnect jet pump hose (C).

12) Disconnect quick connector and then disconnect fuel delivery hose (A) and return hose (B). <Ref. to FU-81, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



13) Remove nuts which install fuel pump assembly onto fuel tank.



14) Take off fuel pump assembly from fuel tank.

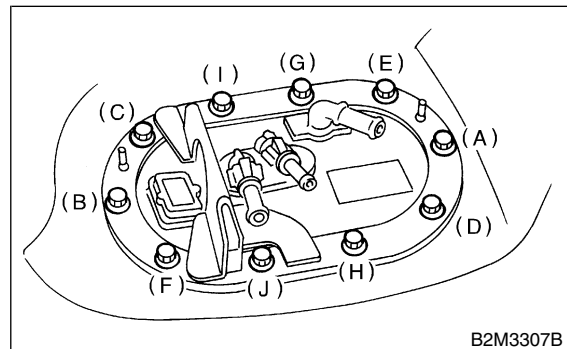
B: INSTALLATION S175025A11

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)

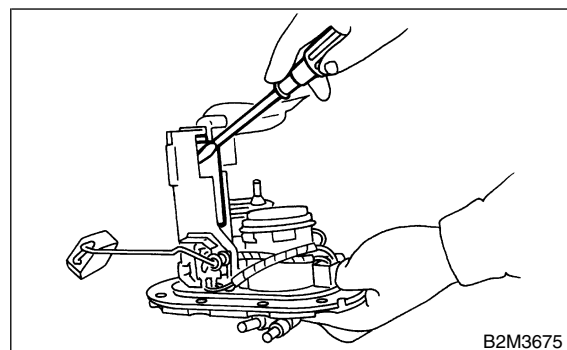


C: DISASSEMBLY S175025A06

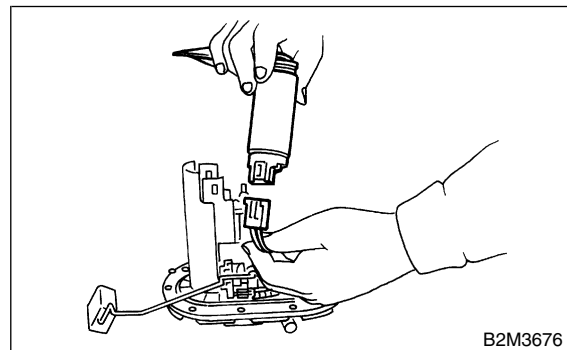
1) Remove fuel pump and pump holder.

NOTE:

When disassembling pump holder, be careful as it is installed with two pawls.



2) Disconnect connector from fuel pump.



D: ASSEMBLY S175025A02

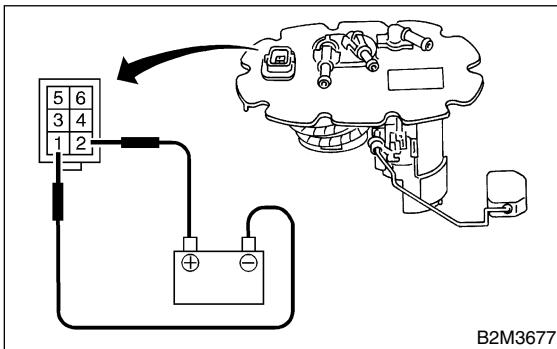
Assemble in the reverse order of disassembly.

E: INSPECTION S175025A10

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.



22. Fuel Level Sensor

S175026

A: REMOVAL

S175026A18

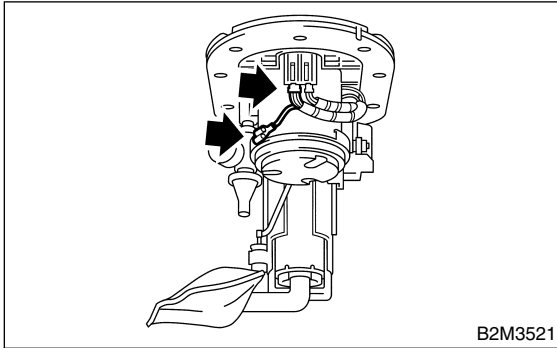
WARNING:

- 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.

NOTE:

Fuel level sensor is built in fuel pump assembly.

- 1) Remove fuel pump assembly. <Ref. to FU-73, REMOVAL, Fuel Pump.>
- 2) Disconnect connector from fuel pump bracket.

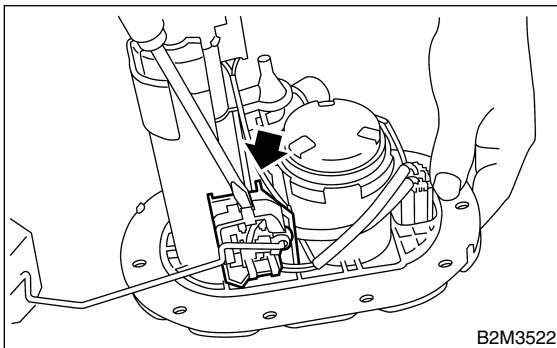


B2M3521

- 3) Pushing the pawls with a screwdriver, remove fuel meter unit by pulling it downwards.

NOTE:

Replace fuel filter pawls with new ones as they might brake when removed.



B2M3522

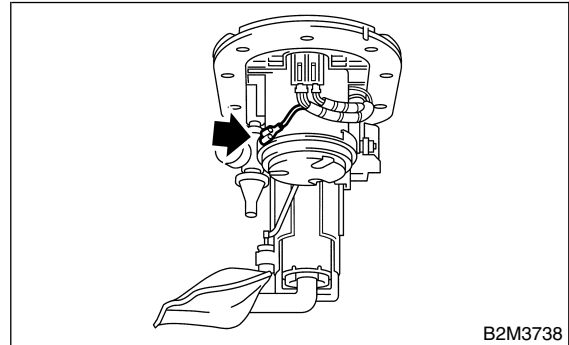
B: INSTALLATION

S175026A11

Install in the reverse order of removal.

WARNING:

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



B2M3738

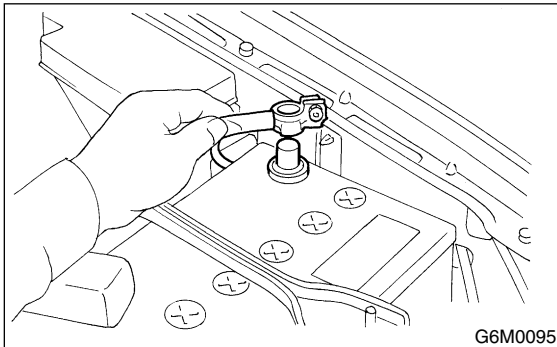
23. Fuel Sub Level Sensor S175023

A: REMOVAL S175023A18

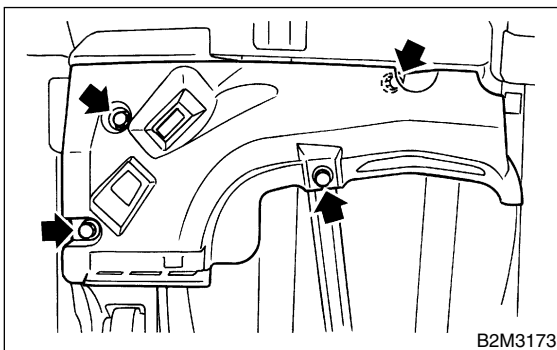
WARNING:

- 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.

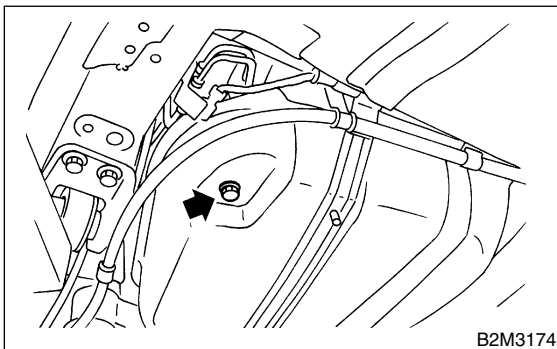
- 1) Disconnect battery ground cable.



- 2) Lift-up the vehicle.
- 3) Remove front side fuel tank cover.



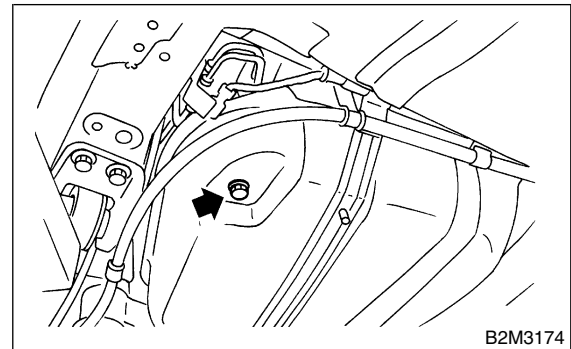
- 4) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



- 5) Tighten fuel drain plug and install front right side fuel tank cover.

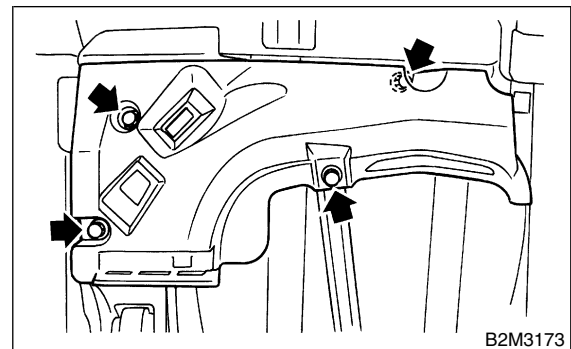
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

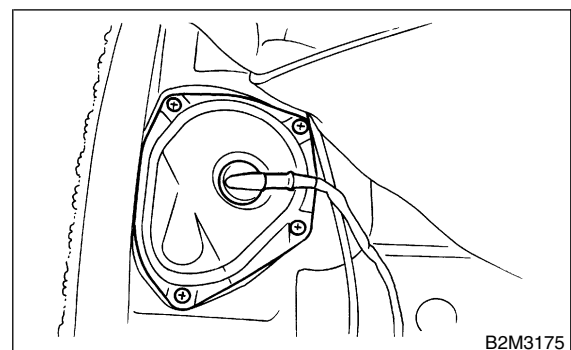


Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



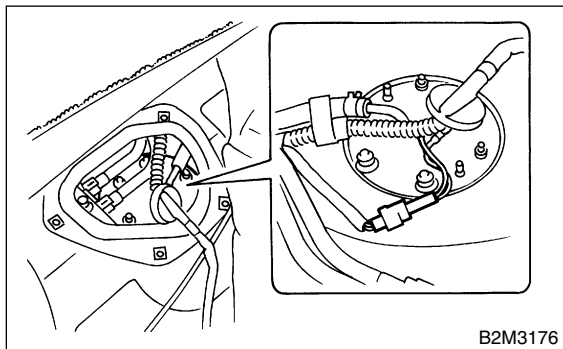
- 6) Raise rear seat and turn floor mat up. (Wagon model)
- 7) Remove rear seat. (Sedan model)
- 8) Remove service hole cover.



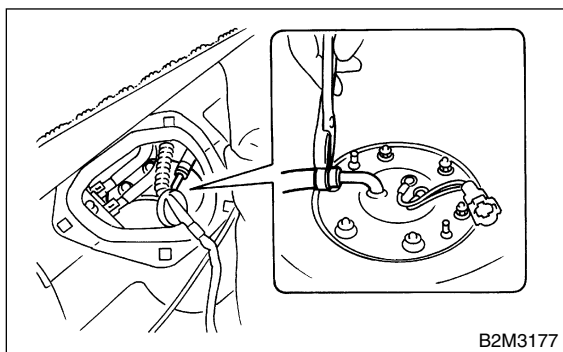
FUEL SUB LEVEL SENSOR

Fuel Injection (Fuel Systems)

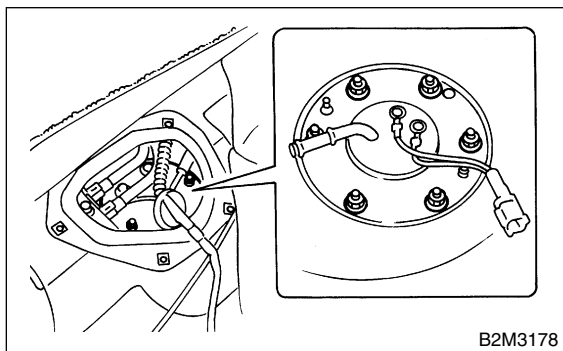
- 9) Disconnect connector from fuel sub level sensor.



- 10) Disconnect fuel jet pump hose.



- 11) Remove bolts which install fuel sub level sensor on fuel tank.



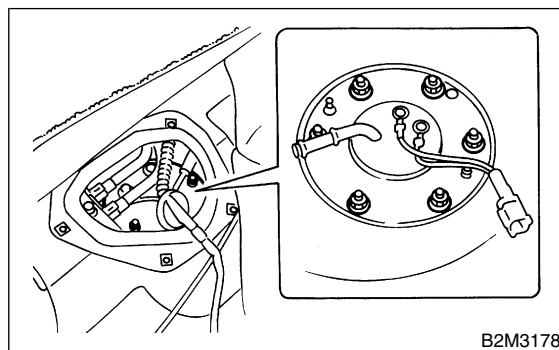
- 12) Remove fuel sub level sensor.

B: INSTALLATION S175023A11

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



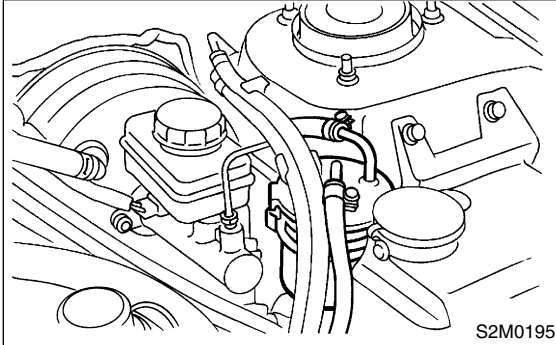
24. Fuel Filter S175027

A: REMOVAL S175027A18

WARNING:

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

- 1) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Disconnect fuel delivery hoses from fuel filter.



- 3) Remove filter from holder.

B: INSTALLATION S175027A11

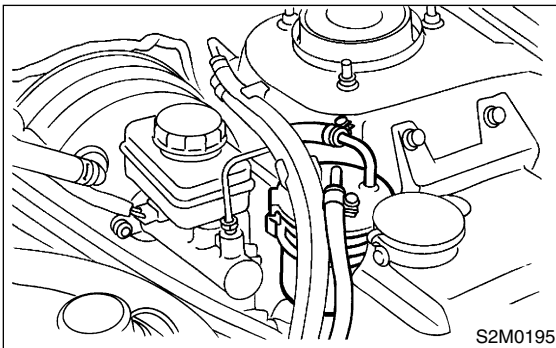
CAUTION:

- If fuel hoses are damaged at the connecting portion, replace it with a new one.
- If clamps are badly damaged, replace with new ones.

- 1) Install in the reverse order of removal.
- 2) Tighten hose clamp screws.

Tightening torque:

1.0 N·m (0.1 kgf-m, 0.7 ft-lb)



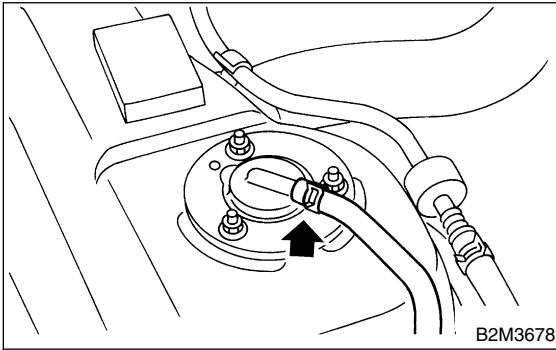
C: INSPECTION S175027A10

- 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.
- 3) If water is found in it, shake and expel the water from inlet port.

25. Fuel Cut Valve S175021

A: REMOVAL S175021A18

- 1) Remove fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 2) Move clip and disconnect evaporation hose from fuel cut valve.



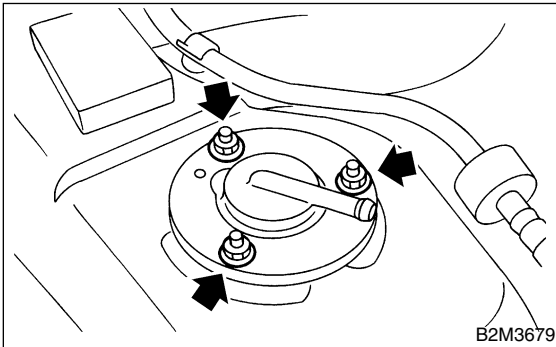
- 3) Remove bolts which install fuel cut valve.

B: INSTALLATION S175021A11

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



26. Fuel Delivery, Return and Evaporation Lines

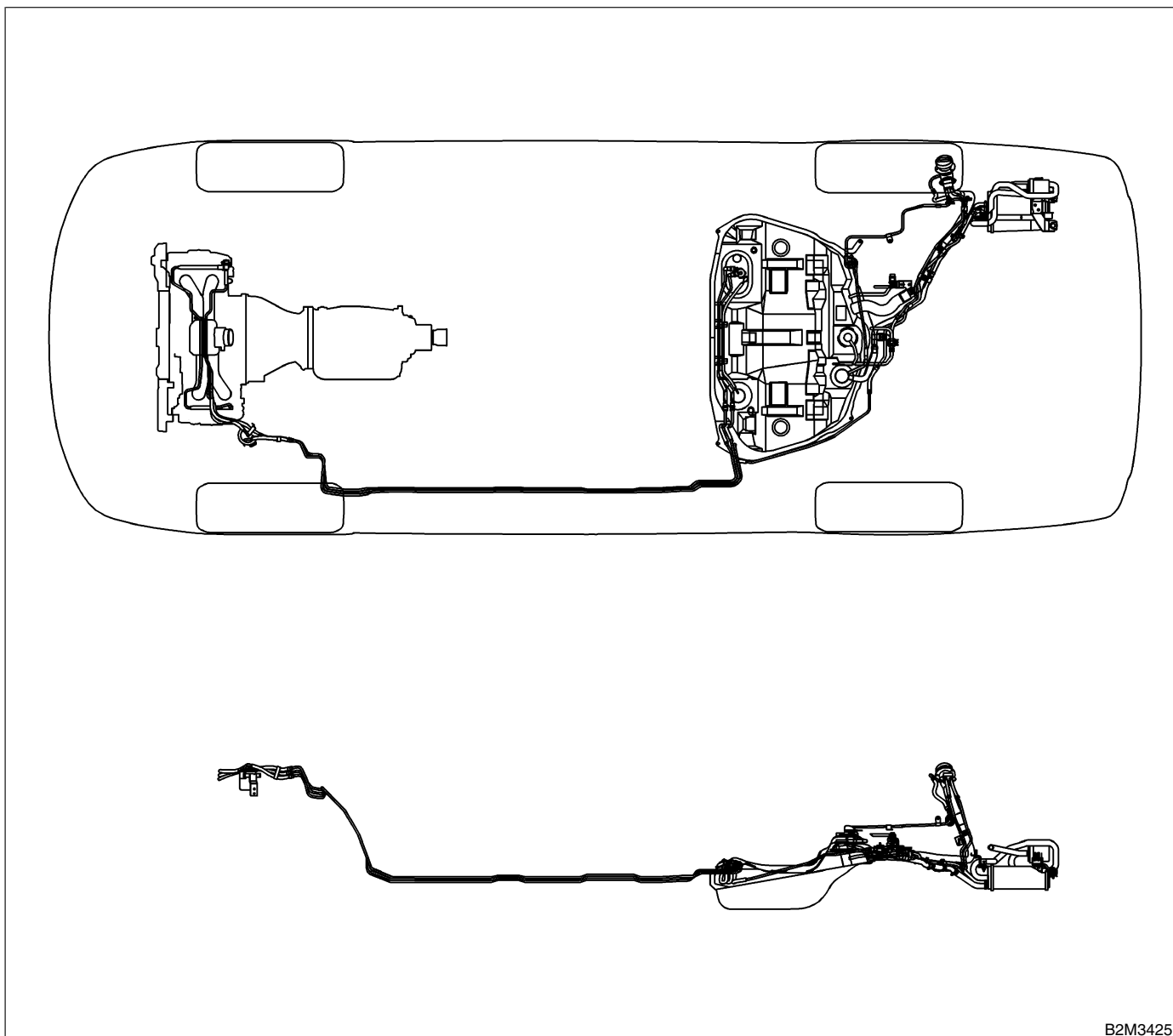
S175019

A: REMOVAL

S175019A18

- 1) Set vehicle on the lift.
- 2) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Open fuel filler flap lid and remove fuel filler cap.

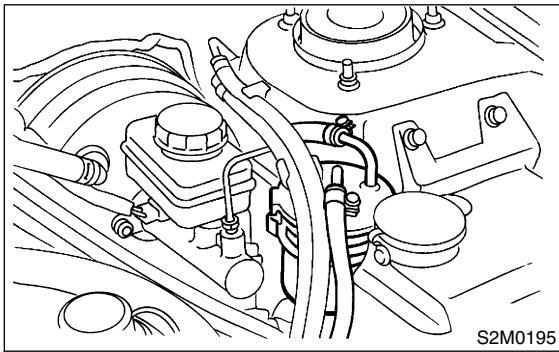
- 4) Remove fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 5) Remove fuel filler pipe. <Ref. to FU-65, REMOVAL, Fuel Filler Pipe.>
- 6) Remove floor mat. <Ref. to EI-52, REMOVAL, Floor Mat.>
- 7) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.



FUEL DELIVERY, RETURN AND EVAPORATION LINES

Fuel Injection (Fuel Systems)

8) In engine compartment, detach fuel delivery hoses, return hoses and evaporation hose.

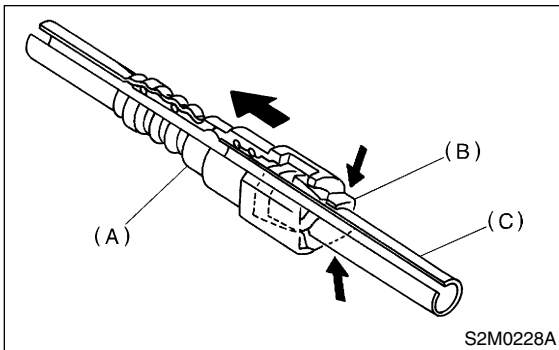


9) Separate quick connector on fuel delivery, return line and evaporation line.

- (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.



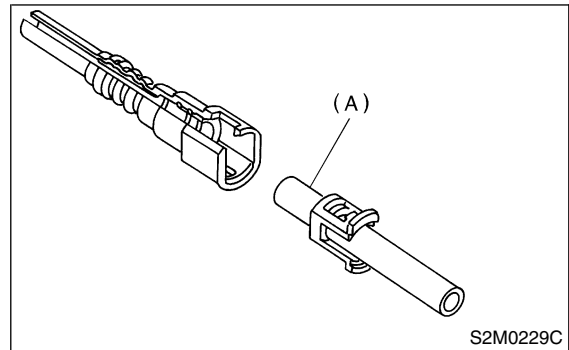
- (A) Connector
(B) Retainer
(C) Pipe

B: INSTALLATION S175019A11

1) Connect quick connector on fuel delivery and return line.

CAUTION:

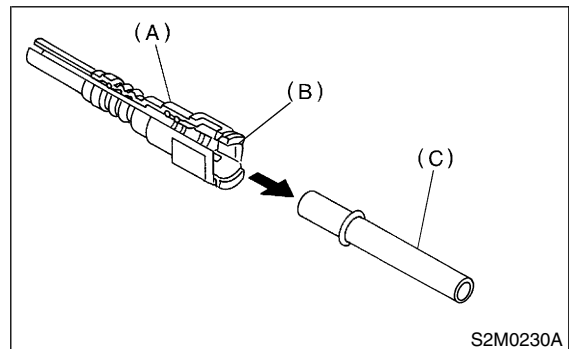
- Always use a new retainer.
- Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface (A) of pipe.



- (1) Set new retainer (B) to connector (A).
- (2) Push pipe into connector completely.

NOTE:

At this time, two clicking sounds are heard.



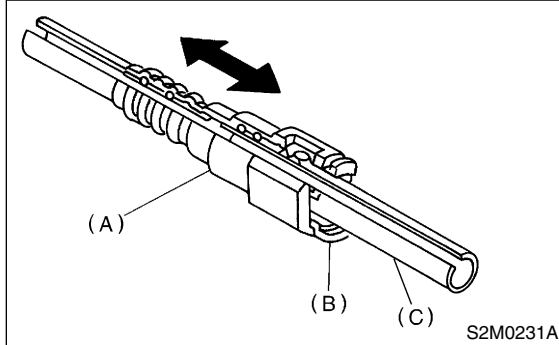
- (A) Connector
(B) Retainer
(C) Pipe

FUEL DELIVERY, RETURN AND EVAPORATION LINES

Fuel Injection (Fuel Systems)

CAUTION:

- Pull the connector to ensure it is connected securely.
- Ensure the two retainer pawls are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
(B) Retainer
(C) Pipe

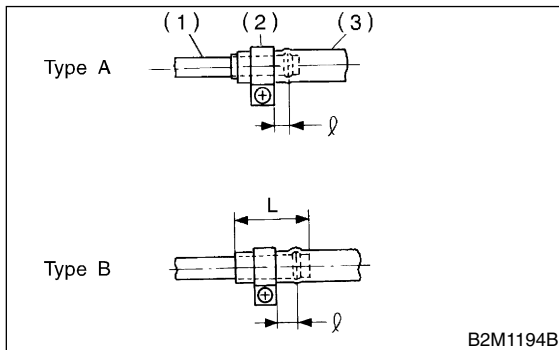
2) Connect fuel delivery hose to pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When fitting length is specified.

Type B: When fitting length is not specified.

$\ell : 2.5 \pm 1.5 \text{ mm } (0.098 \pm 0.059 \text{ in})$

$L: 22.5 \pm 2.5 \text{ mm } (0.886 \pm 0.098 \text{ in})$



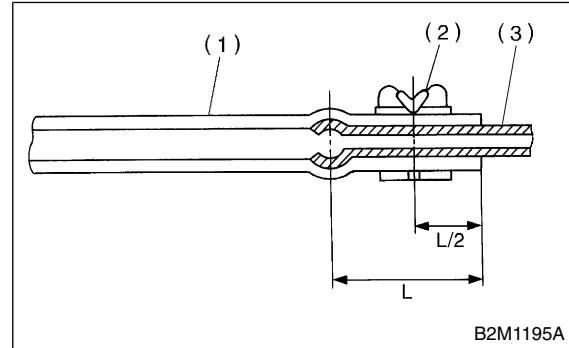
- (1) Fitting
(2) Clamp
(3) Hose

3) Connect evaporation hose to pipe by approx. 15 mm (0.59 in) from hose end.

$L = 17.5 \pm 2.5 \text{ mm } (0.689 \pm 0.098 \text{ in})$

CAUTION:

Be sure to inspect hoses and their connections for any leakage of fuel.



- (1) Hose
(2) Clip
(3) Pipe

C: INSPECTION

S175019A10

1) Make sure that there are no cracks on the fuel pipes and fuel hoses.

2) Make sure that the fuel pipe and fuel hose connections are tight.

FUEL SYSTEM TROUBLE IN GENERAL

Fuel Injection (Fuel Systems)

27. Fuel System Trouble in General S175571

A: INSPECTION S175571A10

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 meter indicator		
1)	Defective operation of fuel meter unit.	Replace.
2)	Defective operation of fuel meter.	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump.	Replace.

NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank.

To prevent water condensation.

- (1) Top off the fuel tank or drain the fuel completely.
- (2) Drain 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 cooling system. Refueling will also complement the effect of anti-freeze solution each time the fuel

level drops to about one-half. After the winter season, drain water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under affected areas below.

- (2) Affected areas

When water condensation is notched 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.

1. General Description S170001

A: CAUTION S170001A03

- 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.

1. General Description S170001

A: CAUTION S170001A03

- 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.

FRONT CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

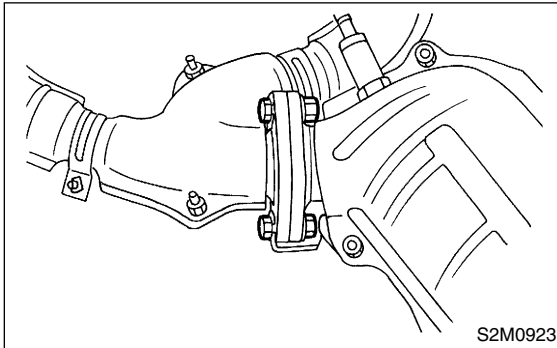
2. Front Catalytic Converter S170017

A: REMOVAL S170017A18

- 1) Remove front and center exhaust pipes. <Ref. to EX-5, REMOVAL, Front Exhaust pipe.>
- 2) Separate front catalytic converter from front exhaust pipe.

NOTE:

The front catalytic converter is intergrated with rear catalytic converter.



B: INSTALLATION S170017A11

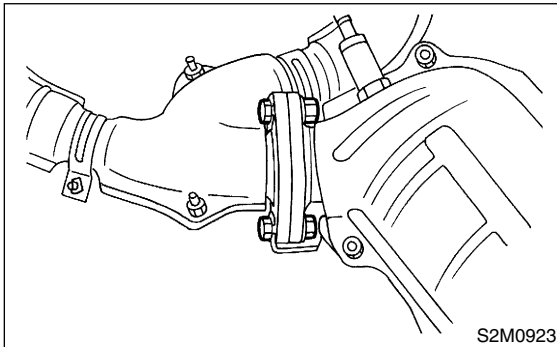
NOTE:

Replace gaskets with new ones.

- 1) Install front catalytic converter to front exhaust pipe.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



- 2) Install front and center exhaust pipes. <Ref. to EX-6, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION S170017A10

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

FRONT CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

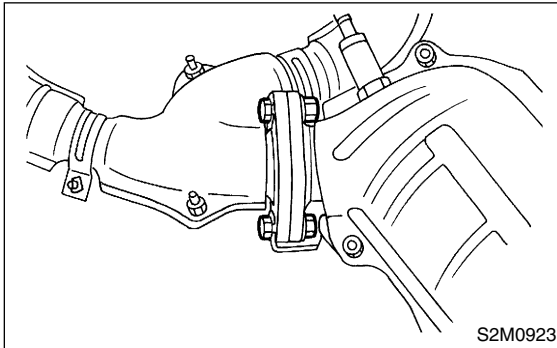
2. Front Catalytic Converter S170017

A: REMOVAL S170017A18

- 1) Remove front and center exhaust pipes. <Ref. to EX-5, REMOVAL, Front Exhaust pipe.>
- 2) Separate front catalytic converter from front exhaust pipe.

NOTE:

The front catalytic converter is intergrated with rear catalytic converter.



B: INSTALLATION S170017A11

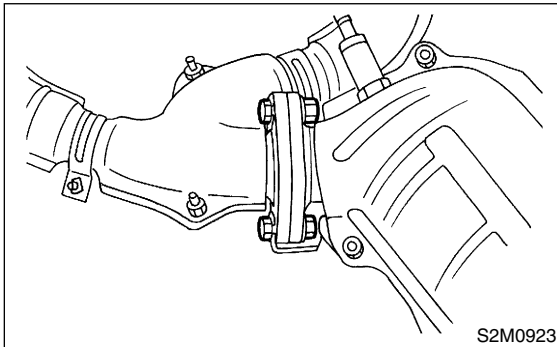
NOTE:

Replace gaskets with new ones.

- 1) Install front catalytic converter to front exhaust pipe.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



- 2) Install front and center exhaust pipes. <Ref. to EX-6, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION S170017A10

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

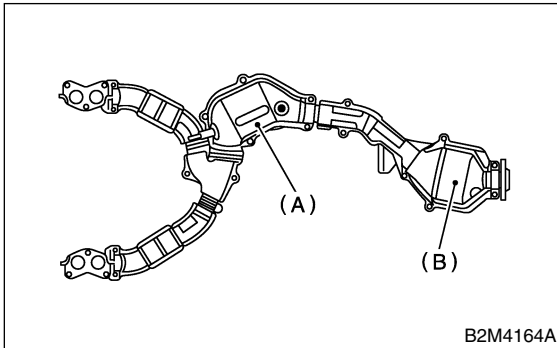
REAR CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

3. Rear Catalytic Converter S170036

A: REMOVAL S170036A18

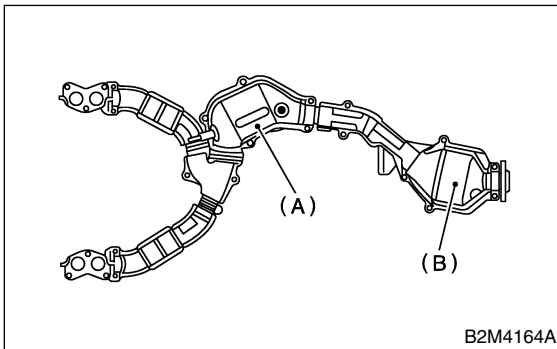
The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the those for the front catalytic converter. <Ref. to EC-3, REMOVAL, Front Catalytic Converter.>



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

B: INSTALLATION S170036A11

The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the ones described under front catalytic converter. <Ref. to EC-3, INSTALLATION, Front Catalytic Converter.>



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

C: INSPECTION S170036A10

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

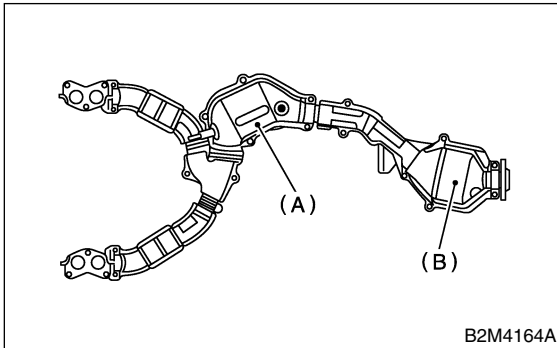
REAR CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

3. Rear Catalytic Converter S170036

A: REMOVAL S170036A18

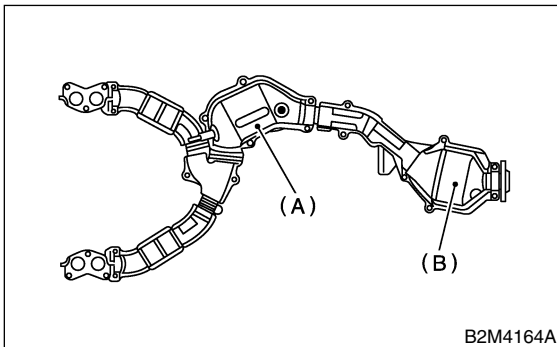
The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the those for the front catalytic converter. <Ref. to EC-3, REMOVAL, Front Catalytic Converter.>



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

B: INSTALLATION S170036A11

The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the ones described under front catalytic converter. <Ref. to EC-3, INSTALLATION, Front Catalytic Converter.>



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

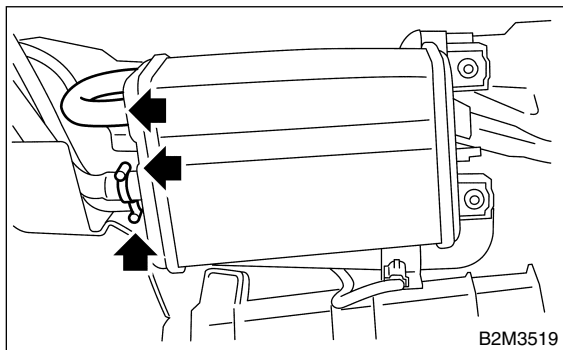
C: INSPECTION S170036A10

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

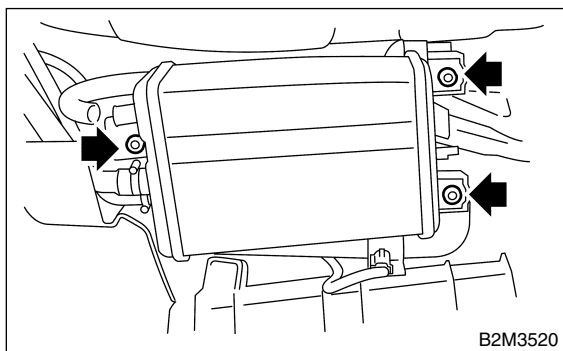
4. Canister S170037

A: REMOVAL S170037A18

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



- 3) Remove canister from body.

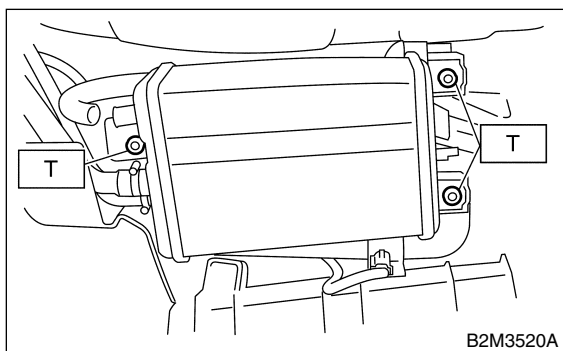


B: INSTALLATION S170037A11

- 1) Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 17 ft-lb)



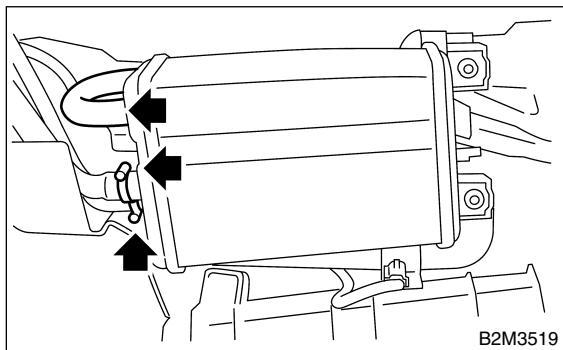
C: INSPECTION S170037A10

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

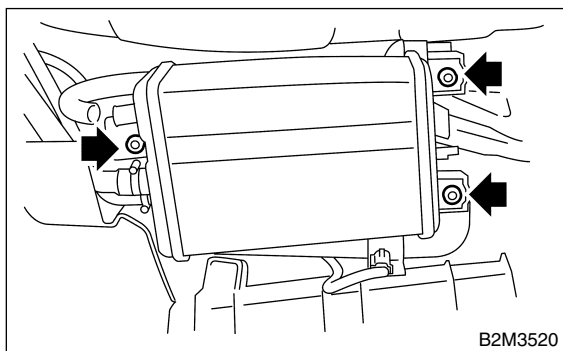
4. Canister S170037

A: REMOVAL S170037A18

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



- 3) Remove canister from body.

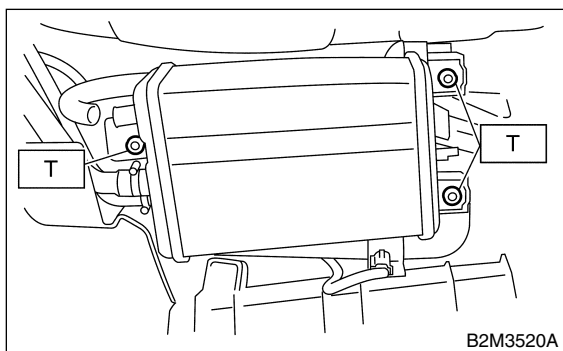


B: INSTALLATION S170037A11

- 1) Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 17 ft-lb)



C: INSPECTION S170037A10

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

PURGE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

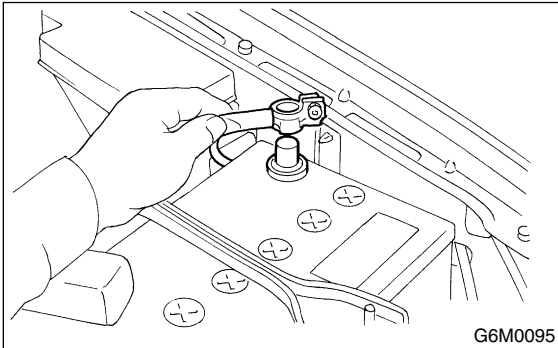
5. Purge Control Solenoid Valve

S170035

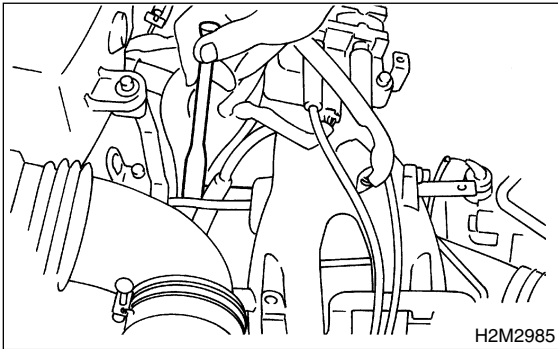
A: REMOVAL

S170035A18

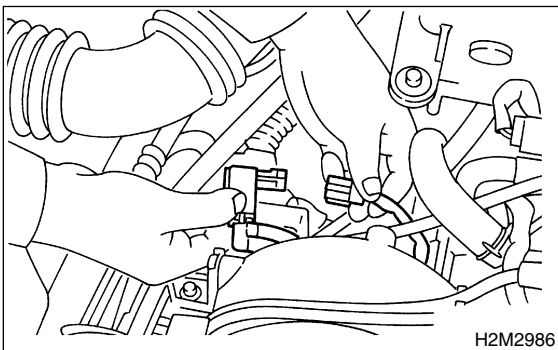
- 1) Disconnect battery ground cable.



- 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.

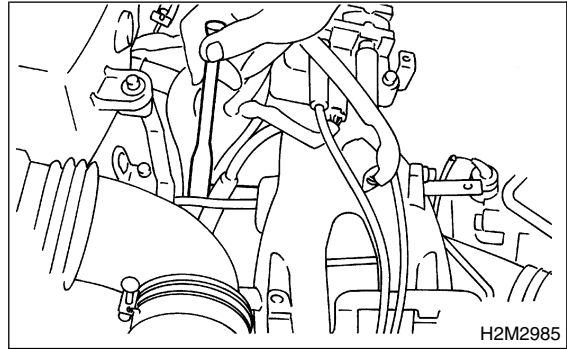


B: INSTALLATION

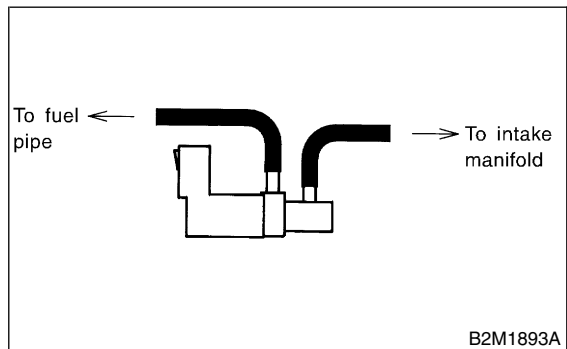
S170035A11

- 1) Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)



CAUTION:
Carefully connect the evaporation hoses.



C: INSPECTION

S170035A10

Make sure hoses are not cracked or loose.

PURGE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

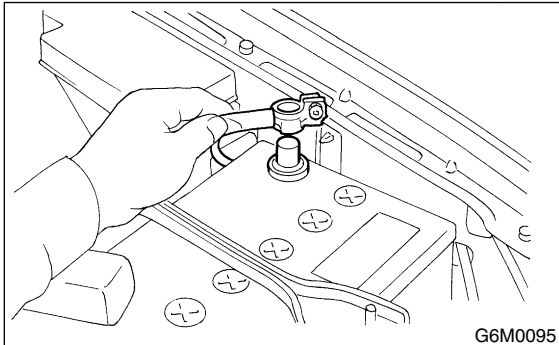
5. Purge Control Solenoid Valve

S170035

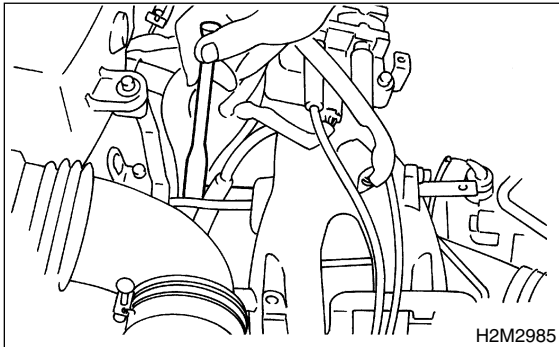
A: REMOVAL

S170035A18

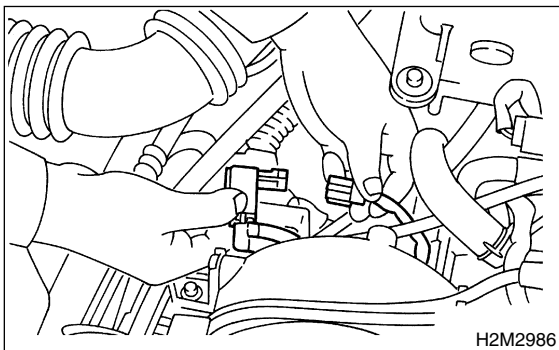
- 1) Disconnect battery ground cable.



- 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.

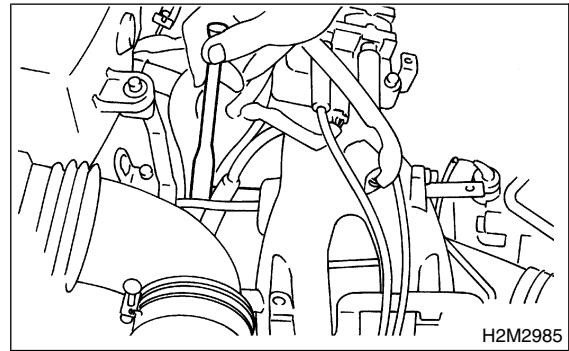


B: INSTALLATION

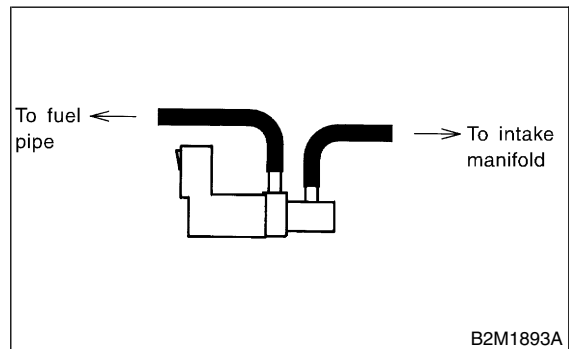
S170035A11

- 1) Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)



CAUTION:
Carefully connect the evaporation hoses.



C: INSPECTION

S170035A10

Make sure hoses are not cracked or loose.

6. Main Fuel Level Sensor S170038

A: REMOVAL S170038A18

For work procedures, refer to “FU” section. <Ref. to FU-76, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION S170038A11

For work procedures, refer to “FU” section. <Ref. to FU-76, INSTALLATION, Fuel Level Sensor.>

6. Main Fuel Level Sensor S170038

A: REMOVAL S170038A18

For work procedures, refer to “FU” section. <Ref. to FU-76, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION S170038A11

For work procedures, refer to “FU” section. <Ref. to FU-76, INSTALLATION, Fuel Level Sensor.>

FUEL TEMPERATURE SENSOR

Emission Control (Aux. Emission Control Devices)

7. Fuel Temperature Sensor S170032

A: REMOVAL S170032A18

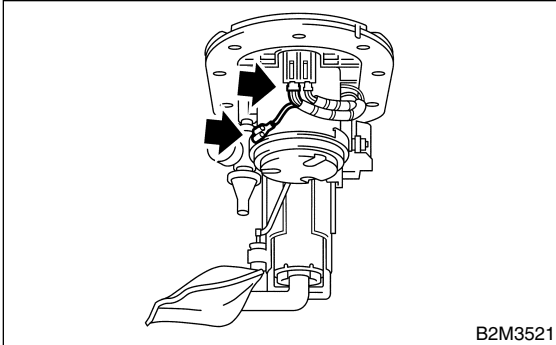
WARNING:

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.

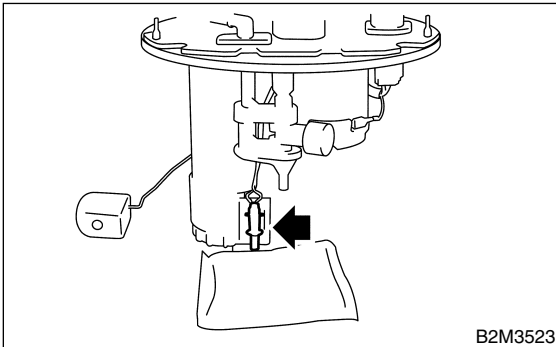
- 1) Remove fuel pump assembly. <Ref. to FU-73, REMOVAL, Fuel Pump.>
- 2) Disconnect connector from fuel pump bracket.



- 3) Remove fuel temperature sensor.

NOTE:

When replacing fuel temperature sensor, also replace fuel level sensor. <Ref. to FU-76, REMOVAL, Fuel Level Sensor.>

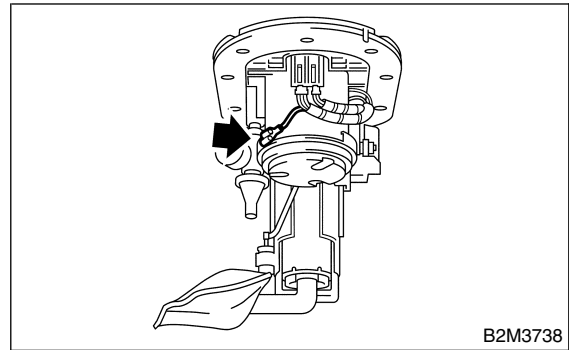


B: INSTALLATION S170032A11

- 1) Install in the reverse order of removal.

WARNING:

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



FUEL TEMPERATURE SENSOR

Emission Control (Aux. Emission Control Devices)

7. Fuel Temperature Sensor S170032

A: REMOVAL S170032A18

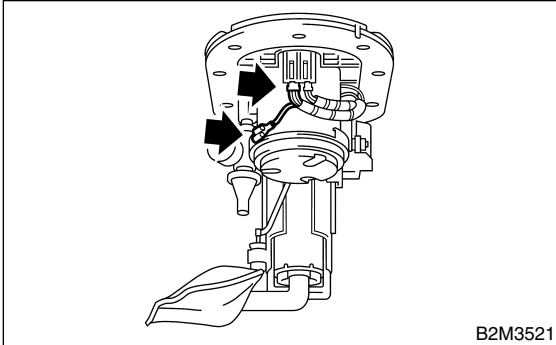
WARNING:

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.

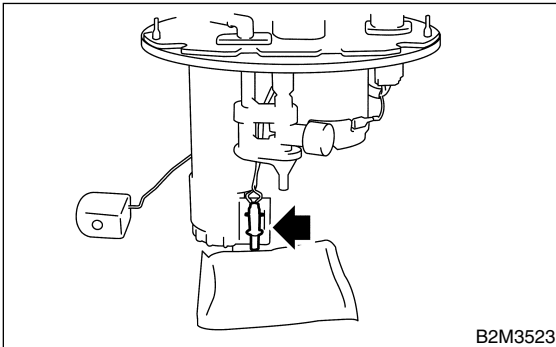
- 1) Remove fuel pump assembly. <Ref. to FU-73, REMOVAL, Fuel Pump.>
- 2) Disconnect connector from fuel pump bracket.



- 3) Remove fuel temperature sensor.

NOTE:

When replacing fuel temperature sensor, also replace fuel level sensor. <Ref. to FU-76, REMOVAL, Fuel Level Sensor.>

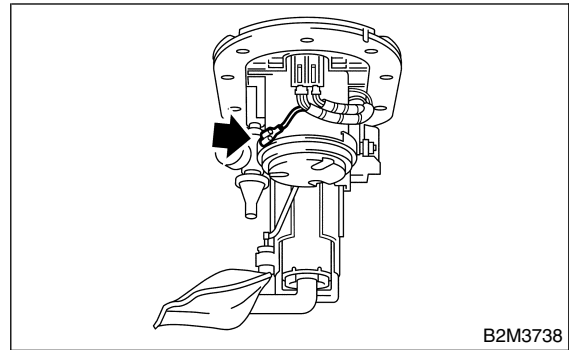


B: INSTALLATION S170032A11

- 1) Install in the reverse order of removal.

WARNING:

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



8. Sub Fuel Level Sensor S170029

A: REMOVAL S170029A18

For work procedures, refer to “FU” section. <Ref. to FU-77, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION S170029A11

For work procedures, refer to “FU” section. <Ref. to FU-78, INSTALLATION, Fuel Sub Level Sensor.>

8. Sub Fuel Level Sensor S170029

A: REMOVAL S170029A18

For work procedures, refer to “FU” section. <Ref. to FU-77, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION S170029A11

For work procedures, refer to “FU” section. <Ref. to FU-78, INSTALLATION, Fuel Sub Level Sensor.>

FUEL TANK PRESSURE SENSOR

Emission Control (Aux. Emission Control Devices)

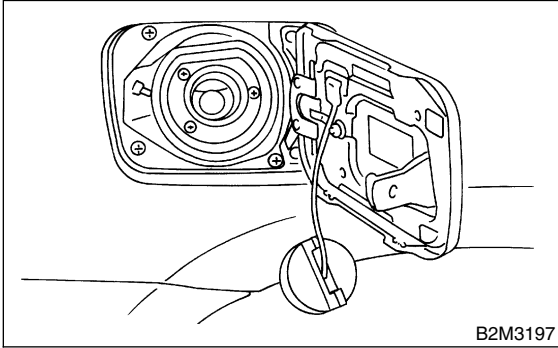
9. Fuel Tank Pressure Sensor

S170030

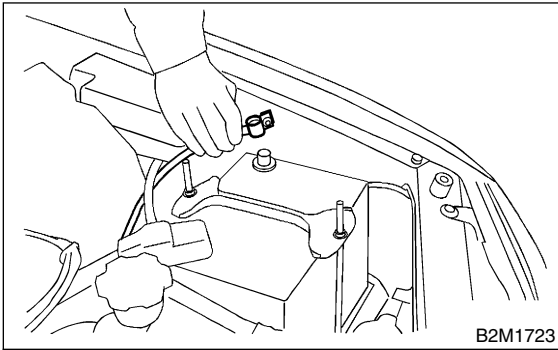
A: REMOVAL

S170030A18

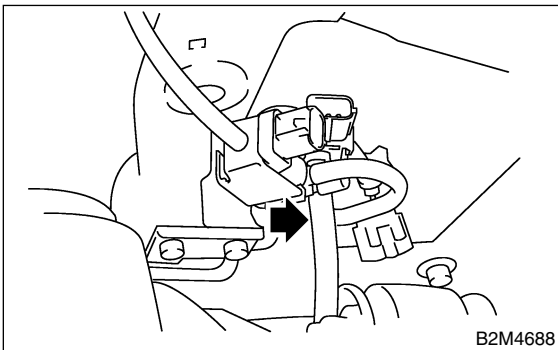
- 1) Set the vehicle on the lift.
- 2) Open fuel flap lid, and remove fuel filler cap.



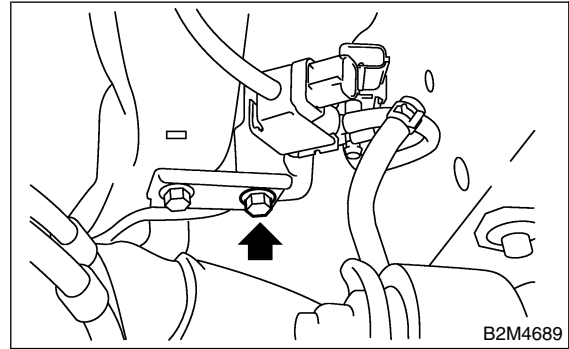
- 3) Disconnect battery ground cable.



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



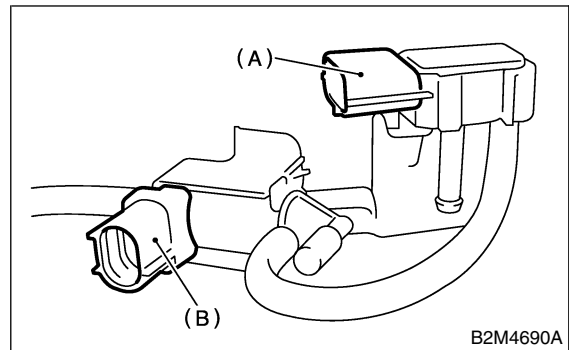
- 7) Remove fuel tank pressure sensor and atmospheric pressure solenoid valve with bracket.



- 8) Remove atmospheric pressure solenoid valve from bracket.

NOTE:

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



- (A) Fuel tank pressure sensor
(B) Atmospheric pressure solenoid valve

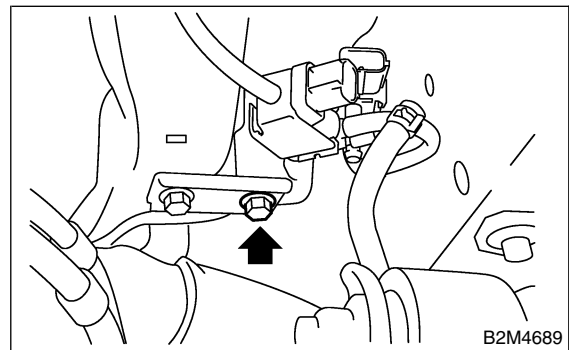
B: INSTALLATION

S170030A11

Install in the reverse order of removal.

Tightening torque:

7.4 N·m (0.75 kgf·m, 5.4 ft·lb)



C: INSPECTION

S170030A10

Make sure that hoses are not cracked or loose.

FUEL TANK PRESSURE SENSOR

Emission Control (Aux. Emission Control Devices)

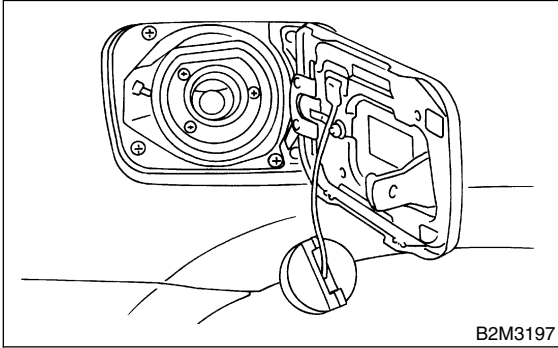
9. Fuel Tank Pressure Sensor

S170030

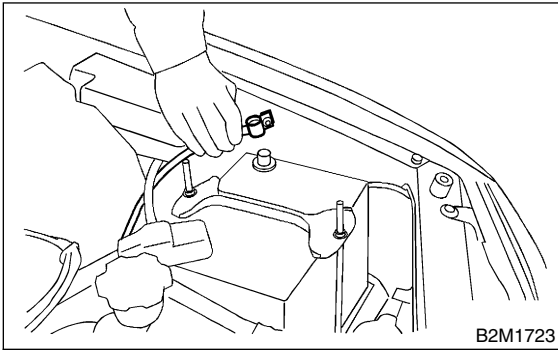
A: REMOVAL

S170030A18

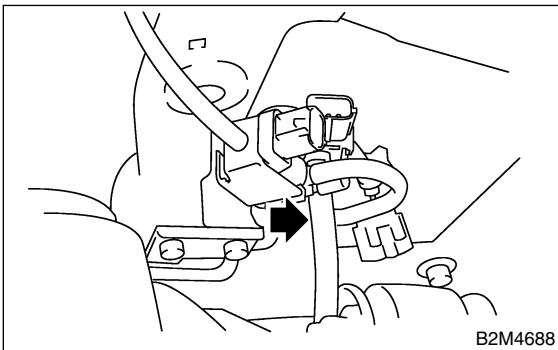
- 1) Set the vehicle on the lift.
- 2) Open fuel flap lid, and remove fuel filler cap.



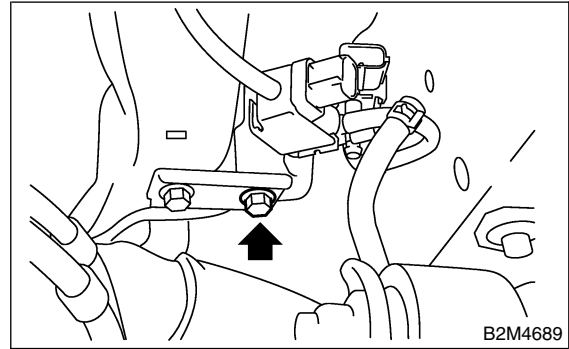
- 3) Disconnect battery ground cable.



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



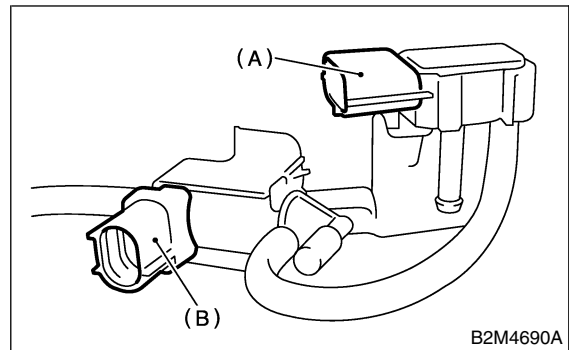
- 7) Remove fuel tank pressure sensor and atmospheric pressure solenoid valve with bracket.



- 8) Remove atmospheric pressure solenoid valve from bracket.

NOTE:

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



- (A) Fuel tank pressure sensor
(B) Atmospheric pressure solenoid valve

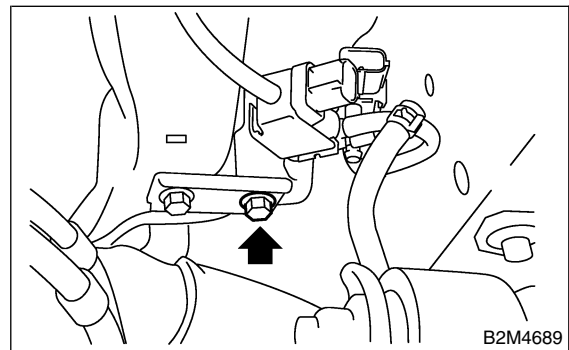
B: INSTALLATION

S170030A11

Install in the reverse order of removal.

Tightening torque:

7.4 N·m (0.75 kgf·m, 5.4 ft·lb)



C: INSPECTION

S170030A10

Make sure that hoses are not cracked or loose.

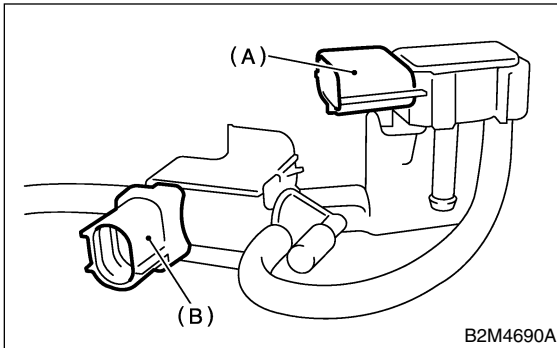
10. Atmospheric Pressure Solenoid Valve

S170804

A: REMOVAL

S170804A18

- 1) Remove fuel tank pressure sensor. <Ref. to EC-10, REMOVAL, Fuel Tank Pressure Sensor.>
- 2) Remove atmospheric pressure solenoid valve from bracket.



- (1) Fuel tank pressure sensor
- (2) Atmospheric pressure solenoid valve

B: INSTALLATION

S170804A11

Install in the reverse order of removal.

C: INSPECTION

S170804A10

Make sure that hoses are not cracked or loose.

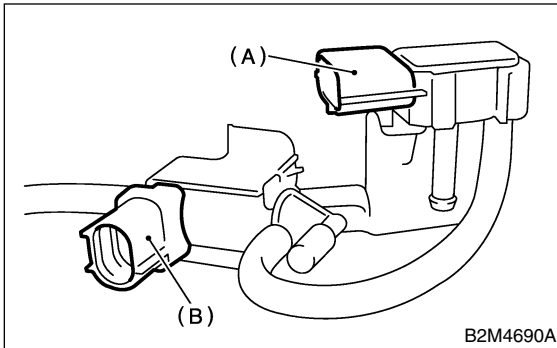
10. Atmospheric Pressure Solenoid Valve

S170804

A: REMOVAL

S170804A18

- 1) Remove fuel tank pressure sensor. <Ref. to EC-10, REMOVAL, Fuel Tank Pressure Sensor.>
- 2) Remove atmospheric pressure solenoid valve from bracket.



- (1) Fuel tank pressure sensor
- (2) Atmospheric pressure solenoid valve

B: INSTALLATION

S170804A11

Install in the reverse order of removal.

C: INSPECTION

S170804A10

Make sure that hoses are not cracked or loose.

PRESSURE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

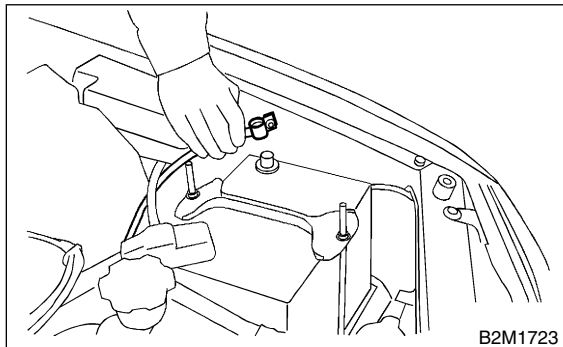
11. Pressure Control Solenoid Valve

S170031

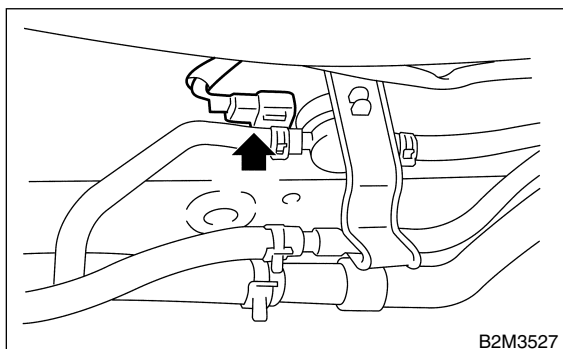
A: REMOVAL

S170031A18

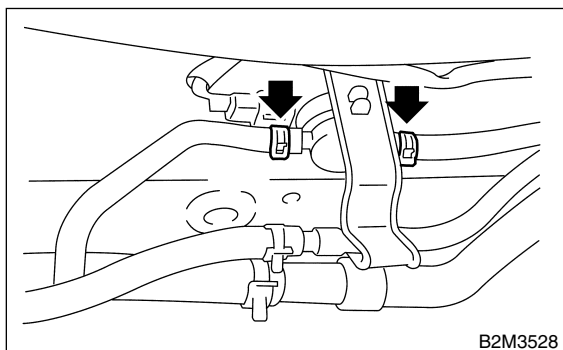
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



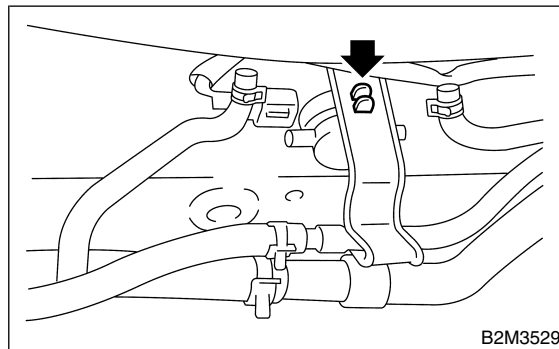
- 3) Lift-up the vehicle.
- 4) Disconnect connector from pressure control solenoid valve.



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



- 6) Remove pressure control solenoid valve from bracket.



B: INSTALLTION

S170031A11

Install in the reverse order of removal.

C: INSPECTION

S170031A10

Make sure that hoses are not cracked or loose.

PRESSURE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

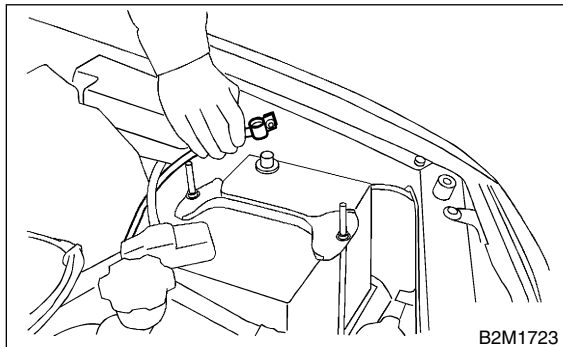
11. Pressure Control Solenoid Valve

S170031

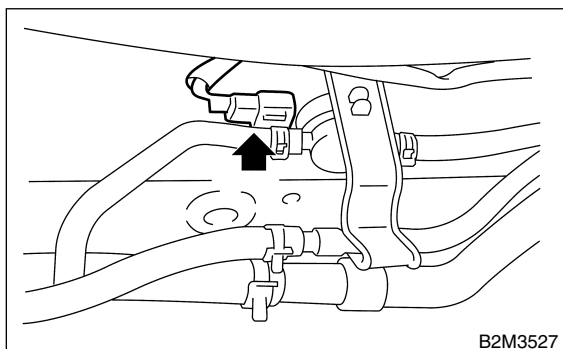
A: REMOVAL

S170031A18

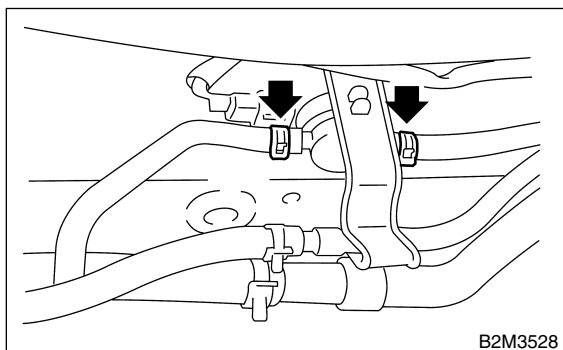
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



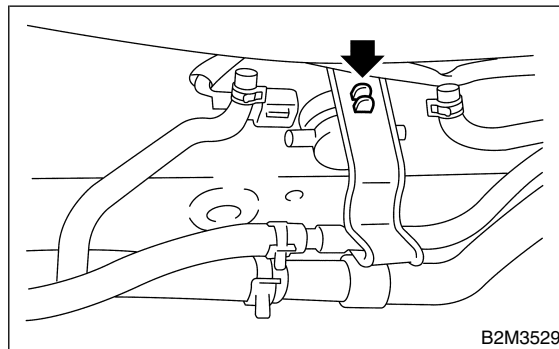
- 3) Lift-up the vehicle.
- 4) Disconnect connector from pressure control solenoid valve.



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



- 6) Remove pressure control solenoid valve from bracket.



B: INSTALLTION

S170031A11

Install in the reverse order of removal.

C: INSPECTION

S170031A10

Make sure that hoses are not cracked or loose.

DRAIN FILTER

Emission Control (Aux. Emission Control Devices)

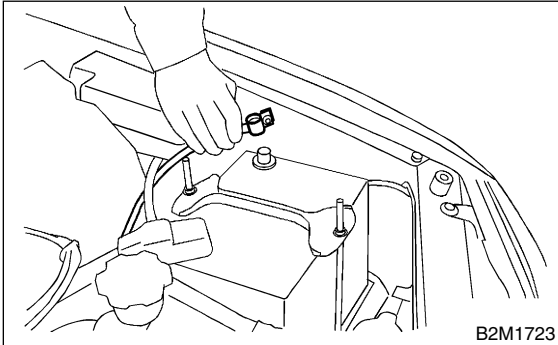
12. Drain Filter

S170567

A: REMOVAL

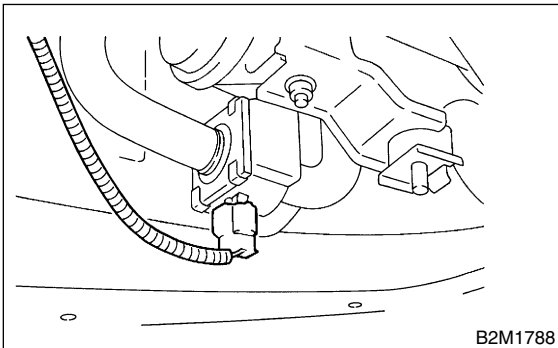
S170567A18

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



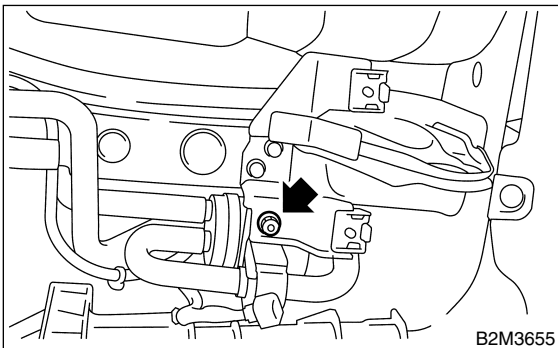
B2M1723

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



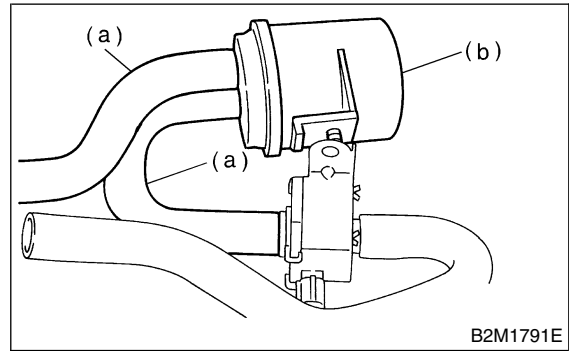
B2M1788

- 6) Remove nut which installs drain filter and drain valve brackets on body, and remove them as a unit.



B2M3655

- 7) Disconnect evaporation hoses, (a) and remove drain filter (b).



B2M1791E

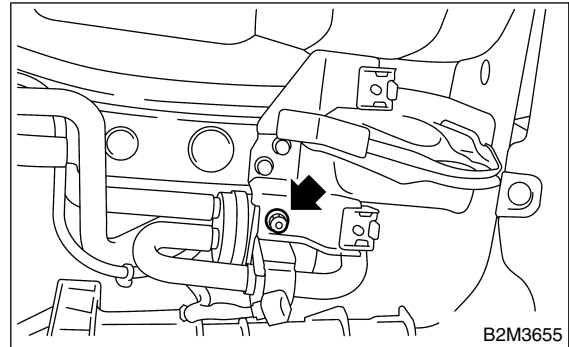
B: INSTALLATION

S170567A11

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



B2M3655

C: INSPECTION

S170567A10

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

DRAIN FILTER

Emission Control (Aux. Emission Control Devices)

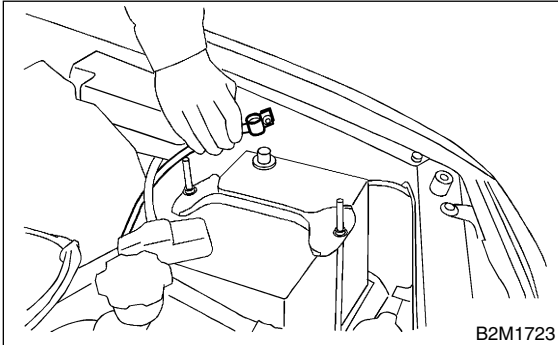
12. Drain Filter

S170567

A: REMOVAL

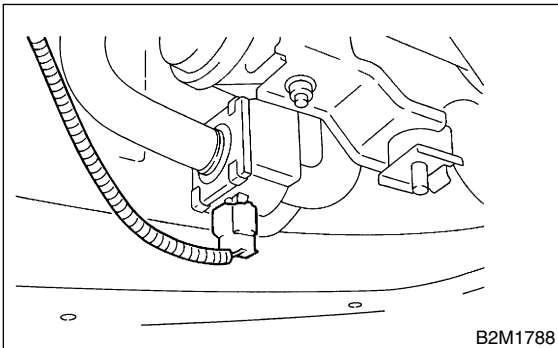
S170567A18

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



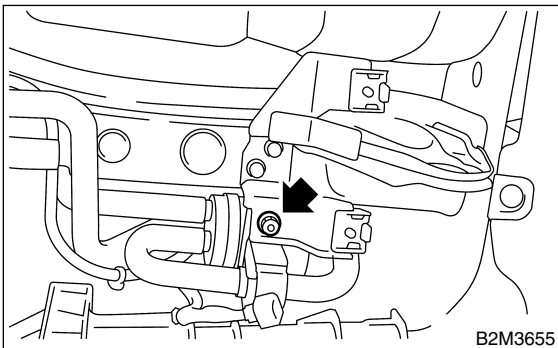
B2M1723

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



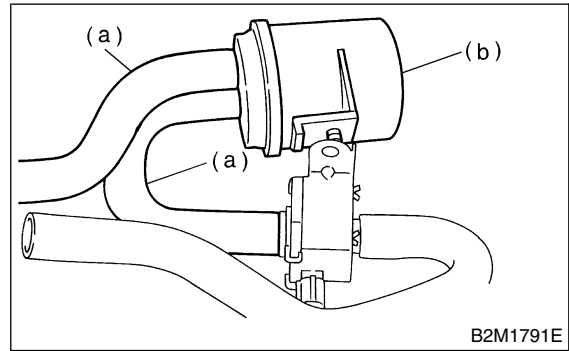
B2M1788

- 6) Remove nut which installs drain filter and drain valve brackets on body, and remove them as a unit.



B2M3655

- 7) Disconnect evaporation hoses, (a) and remove drain filter (b).



B2M1791E

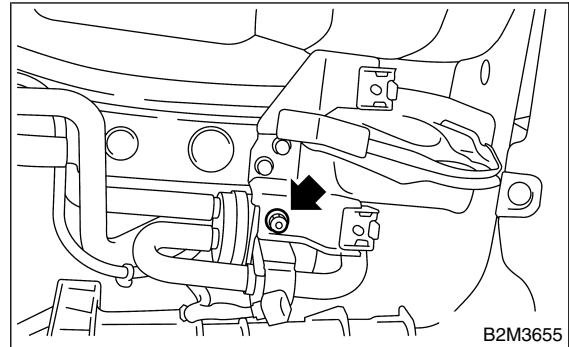
B: INSTALLATION

S170567A11

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



B2M3655

C: INSPECTION

S170567A10

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

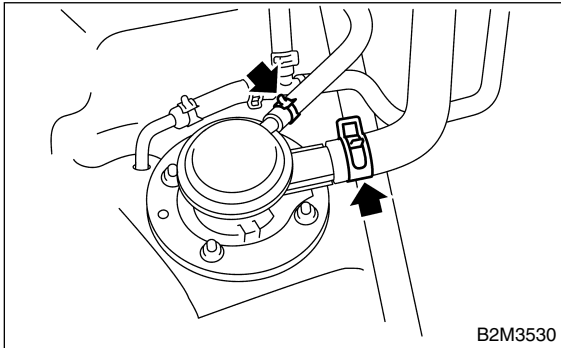
VENT VALVE

Emission Control (Aux. Emission Control Devices)

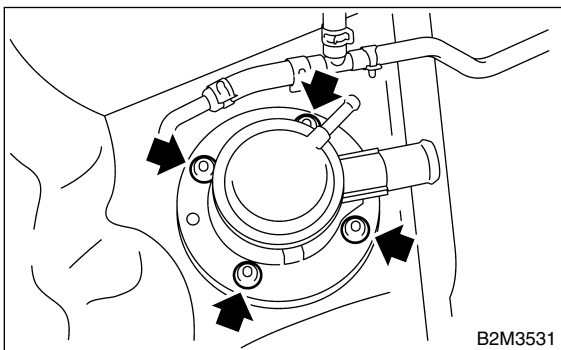
13. Vent Valve S170033

A: REMOVAL S170033A18

- 1) Remove fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 2) Move clips, and disconnect hoses from vent valve.



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



B: INSTALLATION S170033A11

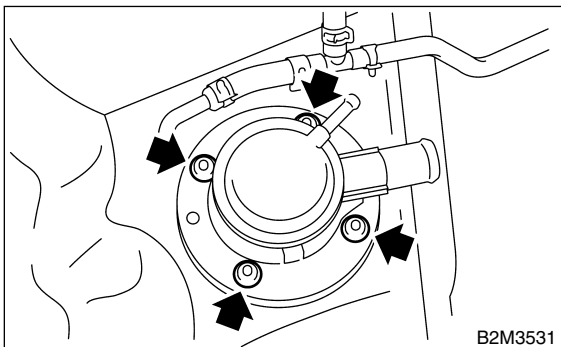
Install in the reverse order of removal.

NOTE:

Replace rubber seat with a new one.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION S170033A10

Make sure that hoses are not cracked or loose.

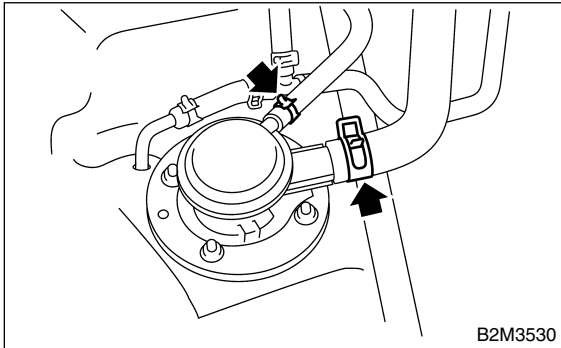
VENT VALVE

Emission Control (Aux. Emission Control Devices)

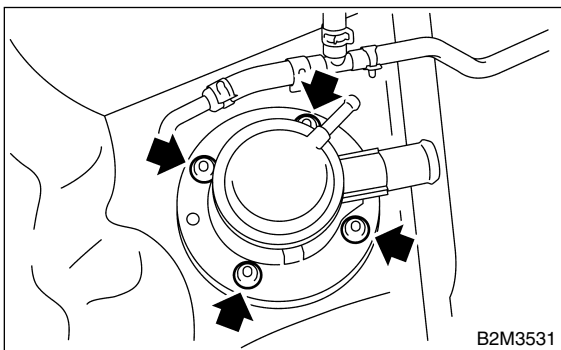
13. Vent Valve S170033

A: REMOVAL S170033A18

- 1) Remove fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 2) Move clips, and disconnect hoses from vent valve.



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



B: INSTALLATION S170033A11

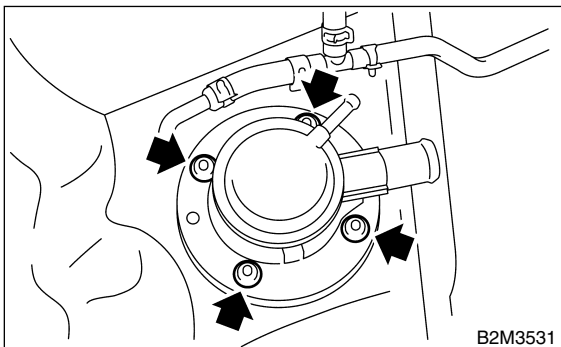
Install in the reverse order of removal.

NOTE:

Replace rubber seat with a new one.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



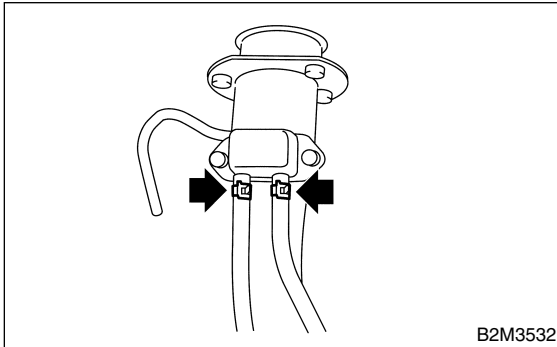
C: INSPECTION S170033A10

Make sure that hoses are not cracked or loose.

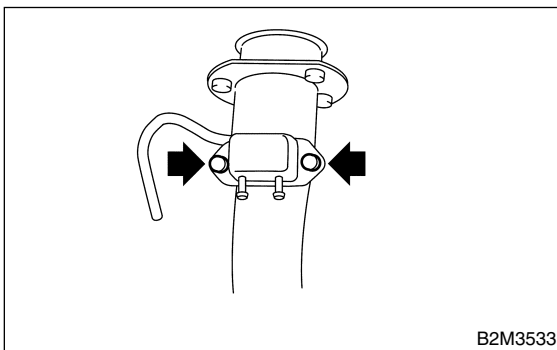
14. Shut Valve S170024

A: REMOVAL S170024A18

- 1) Drain fuel from fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 2) Remove fuel filler pipe. <Ref. to FU-65, REMOVAL, Fuel Filler Pipe.>
- 3) Disconnect evaporation hoses from shut valve.



- 4) Remove shut valve from fuel filler pipe.

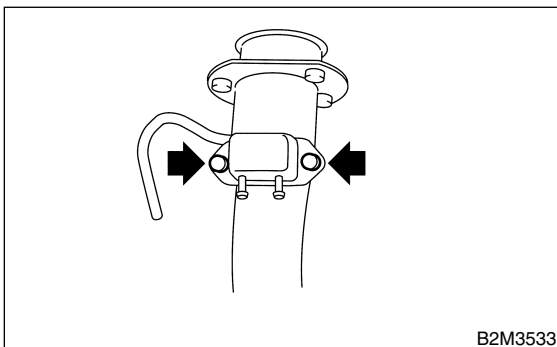


B: INSTALLATION S170024A11

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



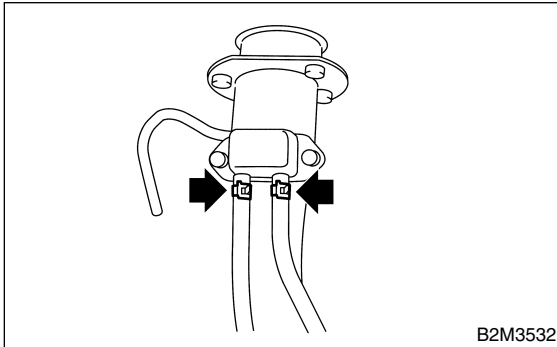
C: INSPECTION S170024A10

Make sure that hoses are not cracked or loose.

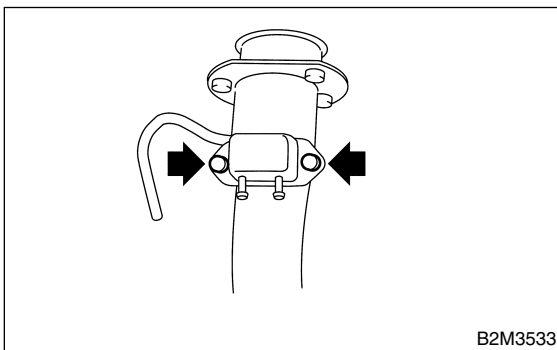
14. Shut Valve S170024

A: REMOVAL S170024A18

- 1) Drain fuel from fuel tank. <Ref. to FU-57, REMOVAL, Fuel Tank.>
- 2) Remove fuel filler pipe. <Ref. to FU-65, REMOVAL, Fuel Filler Pipe.>
- 3) Disconnect evaporation hoses from shut valve.



- 4) Remove shut valve from fuel filler pipe.

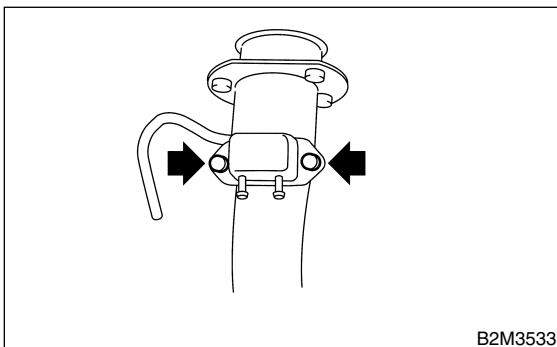


B: INSTALLATION S170024A11

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION S170024A10

Make sure that hoses are not cracked or loose.

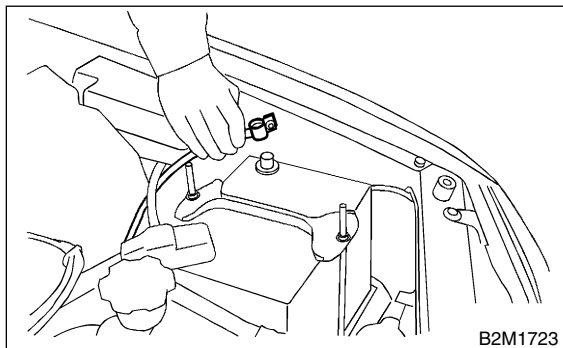
DRAIN VALVE

Emission Control (Aux. Emission Control Devices)

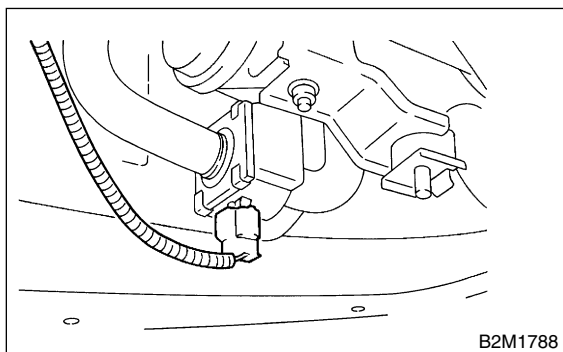
15. Drain Valve S170088

A: REMOVAL S170088A18

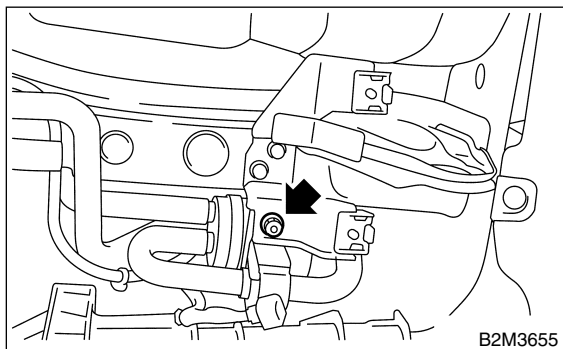
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



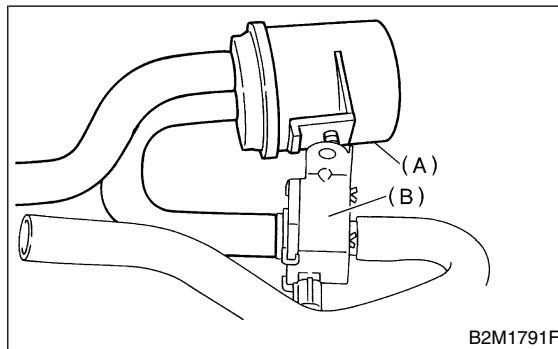
- 3) Lift-up the vehicle.
- 4) Remove canister. <Ref. to EC-5, REMOVAL, Canister.>
- 5) Disconnect connector from drain valve.



- 6) Remove bolt which installs air filter and drain valve brackets on body.



- 7) Disconnect evaporation hose and remove drain valve.



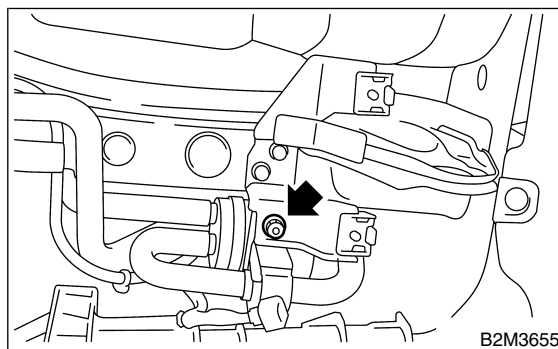
- (1) Drain filter
- (2) Drain valve

B: INSTALLATION S170088A11

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION S170088A10

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

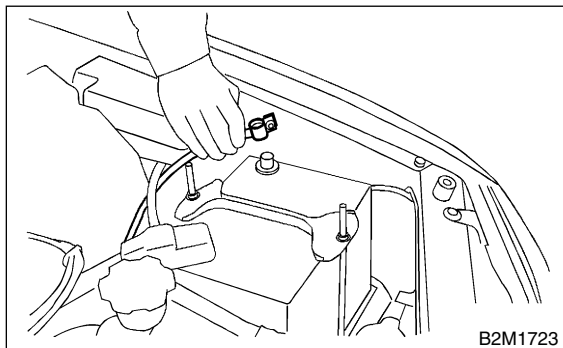
DRAIN VALVE

Emission Control (Aux. Emission Control Devices)

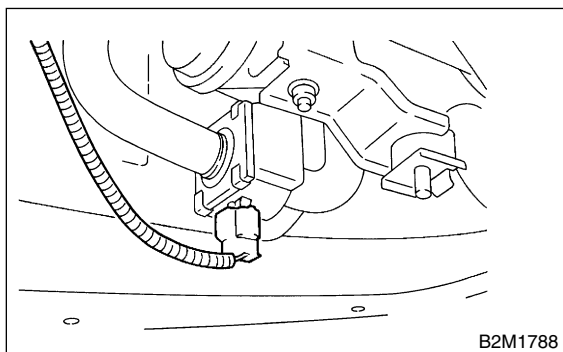
15. Drain Valve S170088

A: REMOVAL S170088A18

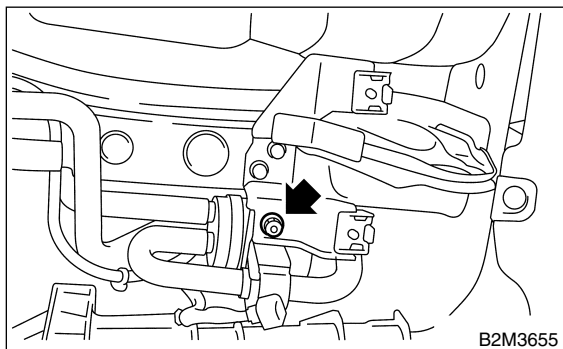
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



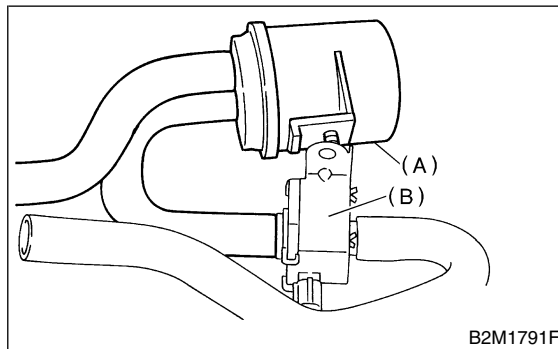
- 3) Lift-up the vehicle.
- 4) Remove canister. <Ref. to EC-5, REMOVAL, Canister.>
- 5) Disconnect connector from drain valve.



- 6) Remove bolt which installs air filter and drain valve brackets on body.



- 7) Disconnect evaporation hose and remove drain valve.



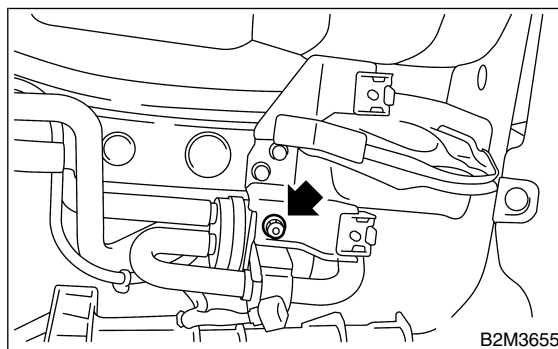
- (1) Drain filter
- (2) Drain valve

B: INSTALLATION S170088A11

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION S170088A10

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

GENERAL DESCRIPTION

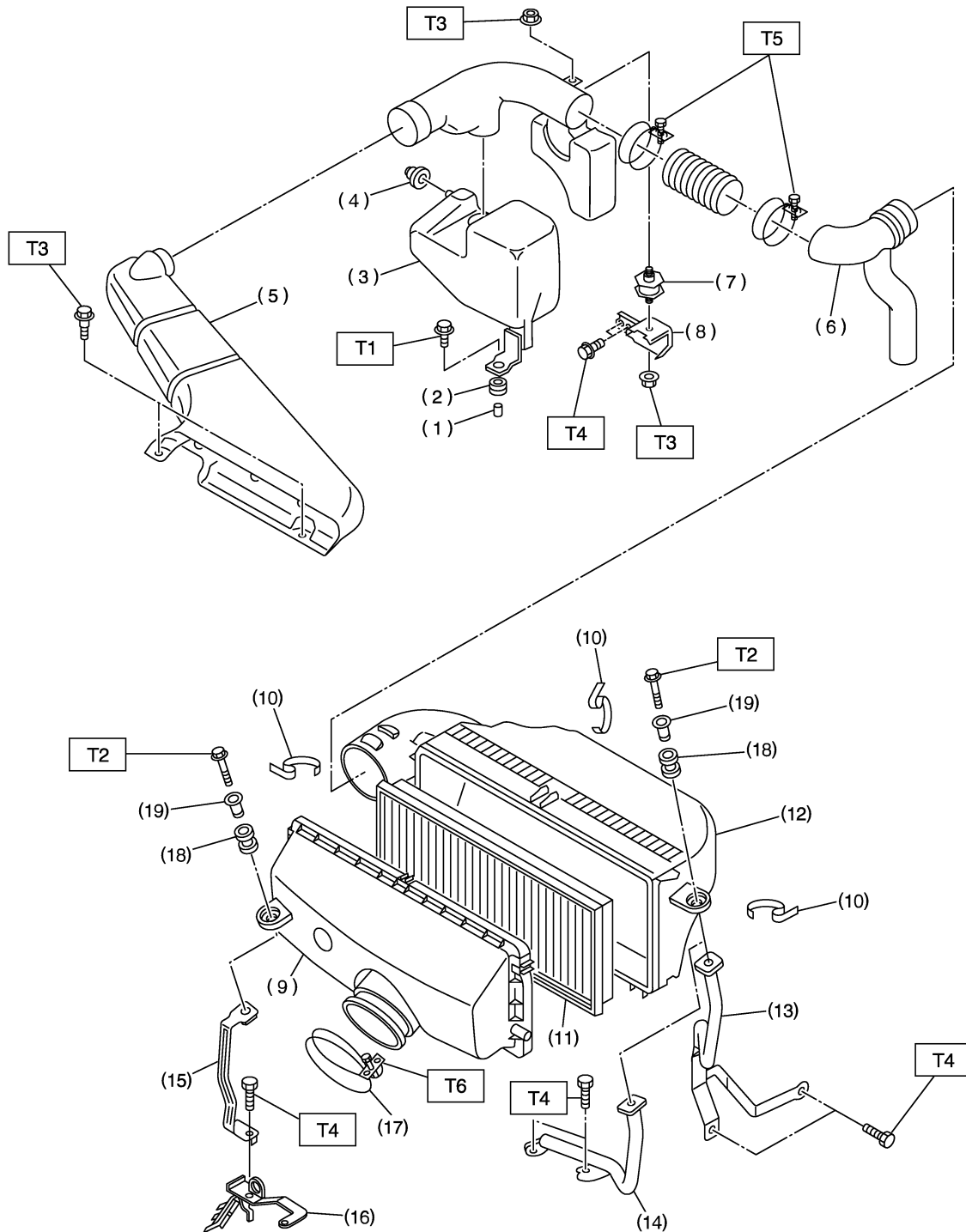
Intake (Induction)

1. General Description

S174001

A: COMPONENT

S174001A05



B2M4592A

GENERAL DESCRIPTION

Intake (Induction)

- (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

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: 2.5 (0.25, 1.8)

T6: 2.9 (0.3, 2.2)

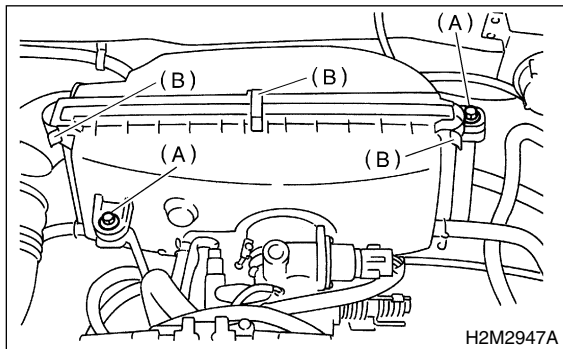
B: CAUTION S174001A03

- 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 S174087

A: REMOVAL S174087A18

- 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 S174087A11

Install in the reverse order of removal.

CAUTION:

Fasten with a clip after inserting the lower tab of the case.

C: INSPECTION S174087A10

Replace if excessively damaged or dirty.

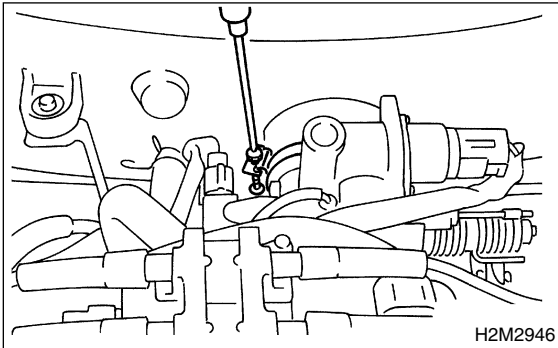
AIR CLEANER CASE

Intake (Induction)

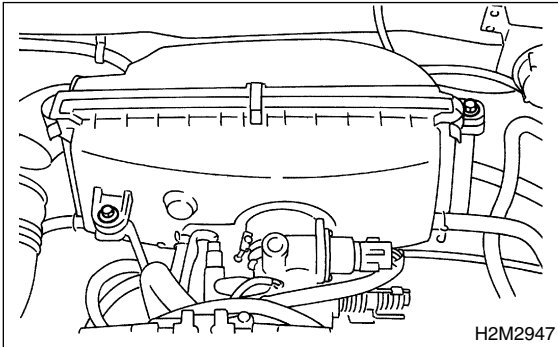
3. Air Cleaner Case S174089

A: REMOVAL S174089A18

- 1) Loosen clamp which connects air cleaner case to throttle body.



- 2) Disconnect hoses from air cleaner case.
- 3) Remove bolts which install air cleaner case to stays.



- 4) Remove air cleaner case.

B: INSTALLATION S174089A11

Install in the reverse order of removal.

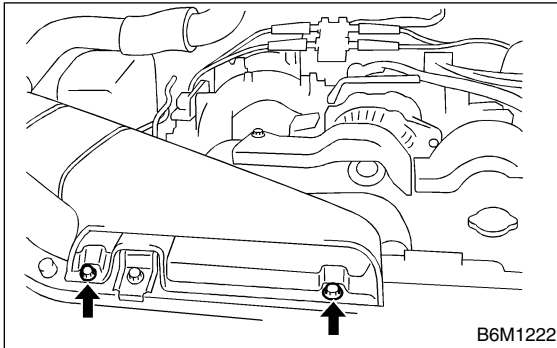
C: INSPECTION S174089A10

Inspect for cracks and loose connections.

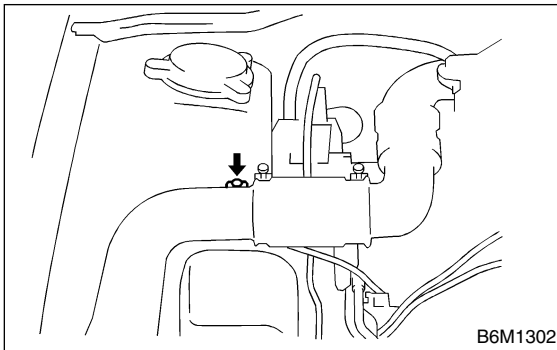
4. Air Intake Duct S174566

A: REMOVAL S174566A18

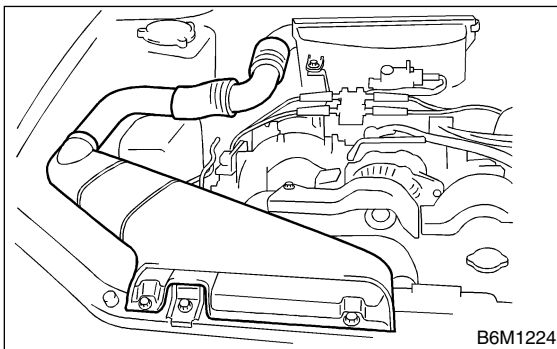
1) Remove bolts which install air intake duct on the front side of body.



2) Remove bolt which installs air intake duct on body.



3) Remove air intake ducts as a unit.



B: INSTALLATION S174566A11

Install in the reverse order of removal.

C: INSPECTION S174566A10

Inspect for cracks and loose connections. Check that no foreign objects are mixed in the air intake duct.

RESONATOR CHAMBER

Intake (Induction)

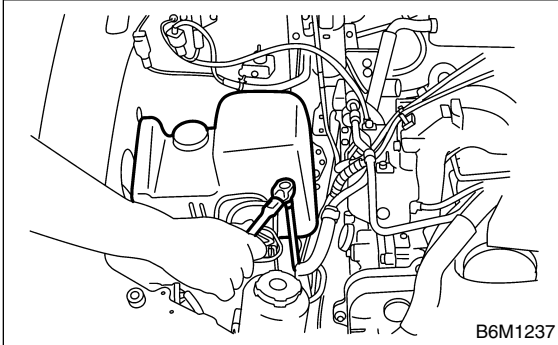
5. Resonator Chamber

S174639

A: REMOVAL

S174639A18

- 1) Remove air intake duct. <Ref. to IN-7, REMOVAL, Air Intake Duct.>
- 2) Remove resonator chamber.



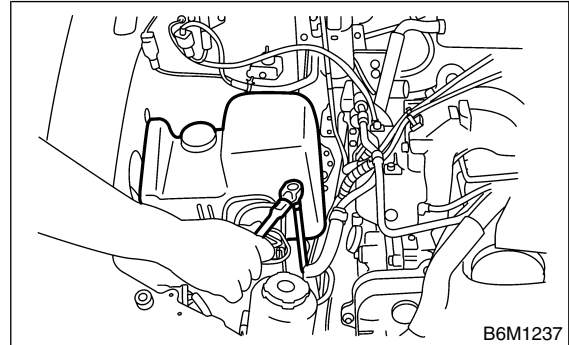
B: INSTALLATION

S174639A11

Install in the reverse order of removal.

Tightening torque:

33 N·m (3.4 kgf-m, 24.6 ft-lb)



C: INSPECTION

S174639A10

Inspect for cracks and loose connections.

GENERAL DESCRIPTION

Mechanical

1. General Description S173001

A: SPECIFICATIONS S173001E49

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)	1,020 — 1,275 (10.4 — 13.0, 148 — 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±0.02 (0.0079±0.0008)
		Exhaust mm (in)	0.25±0.02 (0.0098±0.0008)
	Idling speed [At neutral position on MT, or “P” or “N” position on AT]		MT: 650±100 (No load) AT: 700±100 (No load) 850±100 (A/C switch ON)
	Firing order		1 → 3 → 2 → 4
	Ignition timing		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 bush I.D.		18.00 — 18.08 mm (0.7087 — 0.7118 in)	
	Clearance between spacer and bush	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	39.257 — 39.357 mm (1.5455 — 1.5495 in)
			Limit	39.157 mm (1.5416 in)
	Camshaft journal O.D.		31.928 — 31.945 mm (1.2570 — 1.2577 in)	
	Camshaft journal hole I.D.		32.000 — 32.018 mm (1.2598 — 1.2605 in)	
	Oil clearance	STD	0.055 — 0.090 mm (0.0022 — 0.0035 in)	
Limit		0.10 mm (0.0039 in)		

GENERAL DESCRIPTION

Mechanical

Cylinder head	Surface warpage limit			0.05 mm (0.0020 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	1.0 mm (0.039 in)
			Limit	1.7 mm (0.067 in)
		Exhaust	STD	1.4 mm (0.055 in)
			Limit	2.1 mm (0.083 in)
Valve guide	Inner diameter			6.000 — 6.012 mm (0.2362 — 0.2367 in)
	Protrusion above head		Intake	20.0 — 20.5 mm (0.787 — 0.807 in)
			Exhaust	16.5 — 17.0 mm (0.650 — 0.669 in)
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)
			Limit	0.6 mm (0.024 in)
		Exhaust	STD	1.2 mm (0.047 in)
			Limit	0.6 mm (0.024 in)
	Stem diameter		Intake	5.950 — 5.965 mm (0.2343 — 0.2348 in)
			Exhaust	5.945 — 5.960 mm (0.2341 — 0.2346 in)
	Stem oil clearance	STD	Intake	0.035 — 0.062 mm (0.0014 — 0.0024 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	120.6 mm (4.75 in)
			Exhaust	121.7 mm (4.79 in)
Valve spring	Free length			54.30 mm (2.1378 in)
	Squareness			2.5°, 2.4 mm (0.094 in)
	Tension/spring height			214.8 — 246.2 N (21.9 — 25.1 kgf, 48.3 — 55.3 lb)/ 45.0 mm (1.772 in) 526.6 — 581.6 N (53.7 — 59.3 kgf, 118.4 — 130.8 lb)/34.7 mm (1.366 in)
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	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		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.050 mm (0.0020 in)
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 — 99.735 mm (3.9262 — 3.9266 in)
		0.50 mm (0.0197 in) OS		99.975 — 99.985 mm (3.9360 — 3.9364 in)
	Standard inner diameter of piston pin hole			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).

GENERAL DESCRIPTION

Mechanical

Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.35 — 0.50 mm (0.0138 — 0.0197 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.70 mm (0.0079 — 0.0276 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	0.012 — 0.038 mm (0.0005 — 0.0015 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.490 — 1.502 mm (0.0587 — 0.0591 in)
			0.03 mm (0.0012 in) US	1.504 — 1.512 mm (0.0592 — 0.0595 in)
			0.05 mm (0.0020 in) US	1.514 — 1.522 mm (0.0596 — 0.0599 in)
			0.25 mm (0.0098 in) US	1.614 — 1.622 mm (0.0635 — 0.0639 in)
Connecting rod bushing	Clearance between piston pin and bushing		STD	0 — 0.022 mm (0 — 0.0009 in)
			Limit	0.030 mm (0.0012 in)
Crankshaft	Bend limit			0.035 mm (0.0014 in)
	Crank pin and crank journal	Out-of-roundness		0.020 mm (0.0008 in) or less
		Grinding limit		0.250 mm (0.0098 in)
	Crank pin outer diameter		STD	51.984 — 52.000 mm (2.0466 — 2.0472 in)
			0.03 mm (0.0012 in) US	51.954 — 51.970 mm (2.0454 — 2.0461 in)
			0.05 mm (0.0020 in) US	51.934 — 51.950 mm (2.0446 — 2.0453 in)
			0.25 mm (0.0098 in) US	51.734 — 51.750 mm (2.0368 — 2.0374 in)
	Crank journal outer diameter	#1, #5, #3	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)
		#2, #4	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		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.040 mm (0.0016 in)

GENERAL DESCRIPTION

Mechanical

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)

GENERAL DESCRIPTION

Mechanical

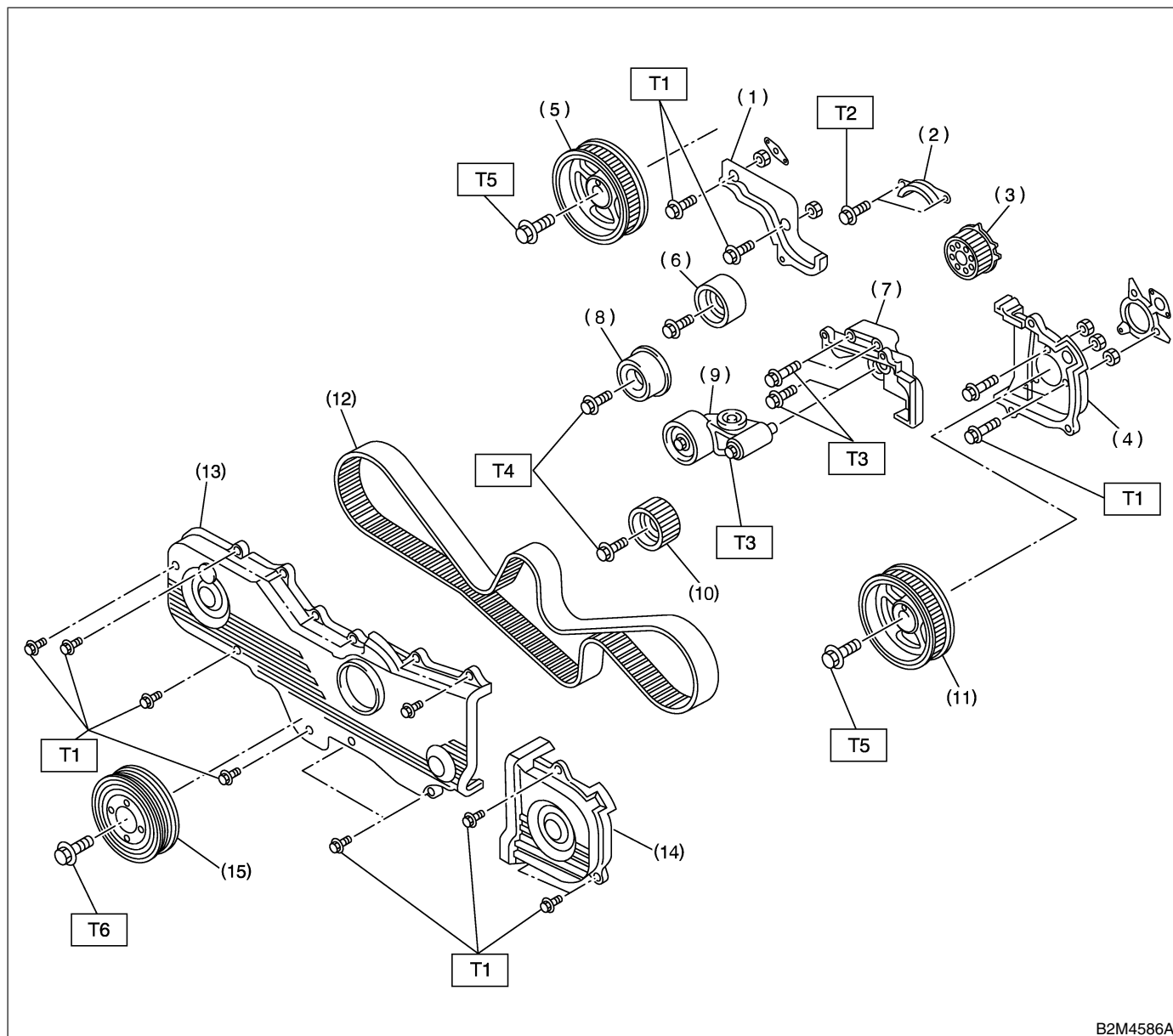
MEMO:

B: COMPONENT

S173001A05

1. TIMING BELT

S173001A0501



B2M4586A

(1) Belt cover No. 2 (RH)	(10) Belt idler No. 2
(2) Timing belt guide (MT vehicles only)	(11) Camshaft sprocket No. 2
(3) Crankshaft sprocket	(12) Timing belt
(4) Belt cover No. 2 (LH)	(13) Front belt cover
(5) Camshaft sprocket No. 1	(14) Belt cover (LH)
(6) Belt idler (No. 1)	(15) Crankshaft pulley
(7) Tensioner bracket	
(8) Belt idler (No. 2)	
(9) Automatic belt tension adjuster ASSY	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 9.8 (1.0, 7.2)

T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

T5: 78 (8.0, 57.9)

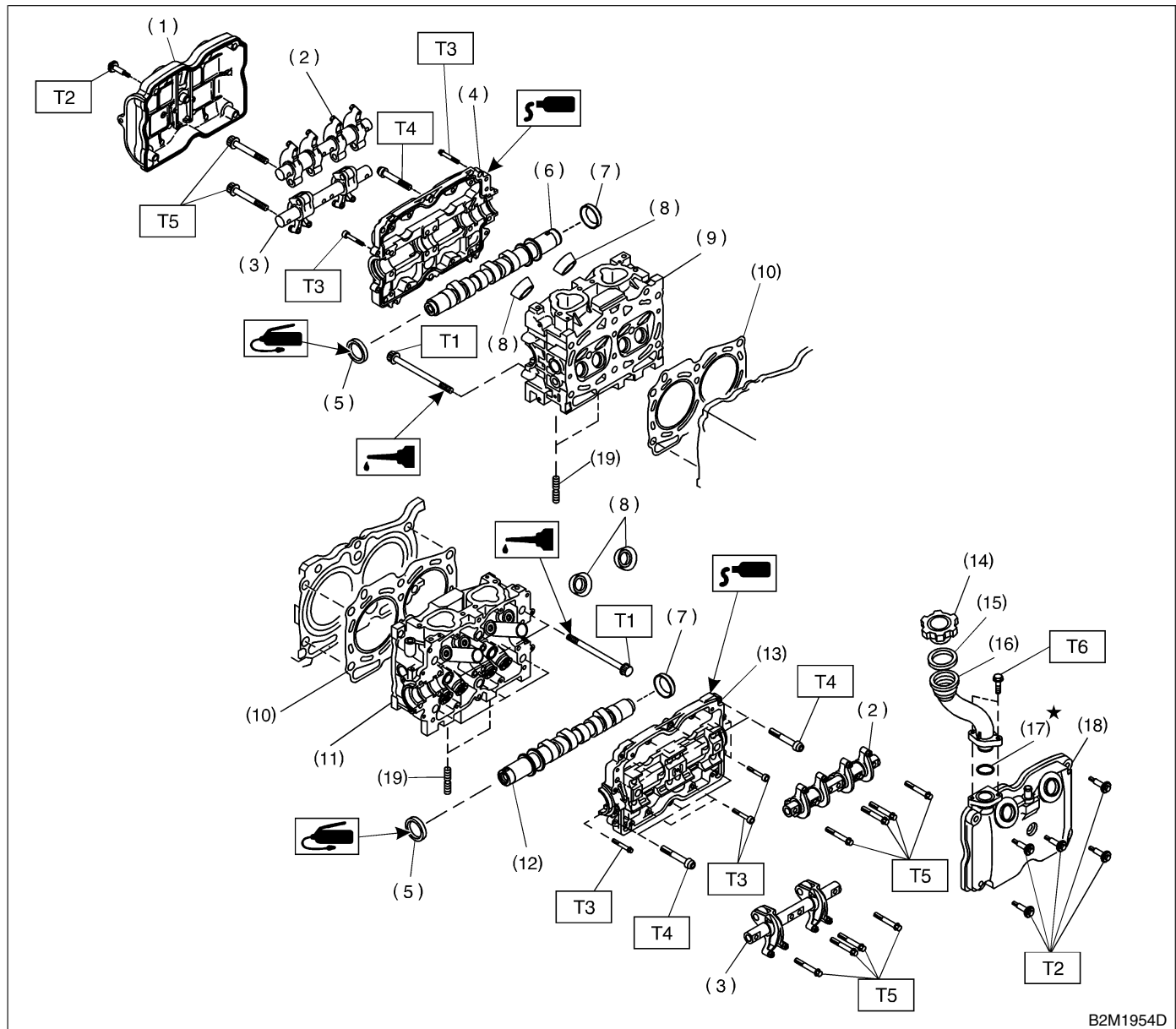
**T6: <Ref. to ME-44,
INSTALLATION, Crankshaft
Pulley.>**

GENERAL DESCRIPTION

Mechanical

2. CYLINDER HEAD AND CAMSHAFT

S173001A0502



B2M1954D

(1) Rocker cover (RH)	(11) Cylinder head (LH)
(2) Intake valve rocker ASSY	(12) Camshaft (LH)
(3) Exhaust valve rocker ASSY	(13) Camshaft cap (LH)
(4) Camshaft cap (RH)	(14) Oil filler cap
(5) Oil seal	(15) Gasket
(6) Camshaft (RH)	(16) Oil filler pipe
(7) Plug	(17) O-ring
(8) Spark plug pipe gasket	(18) Rocker cover (LH)
(9) Cylinder head (RH)	(19) Stud bolt
(10) Cylinder head gasket	

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to ME-59, CYLINDER HEAD, INSTALLATION, Cylinder Head Assembly.>

T2: 5 (0.5, 3.6)

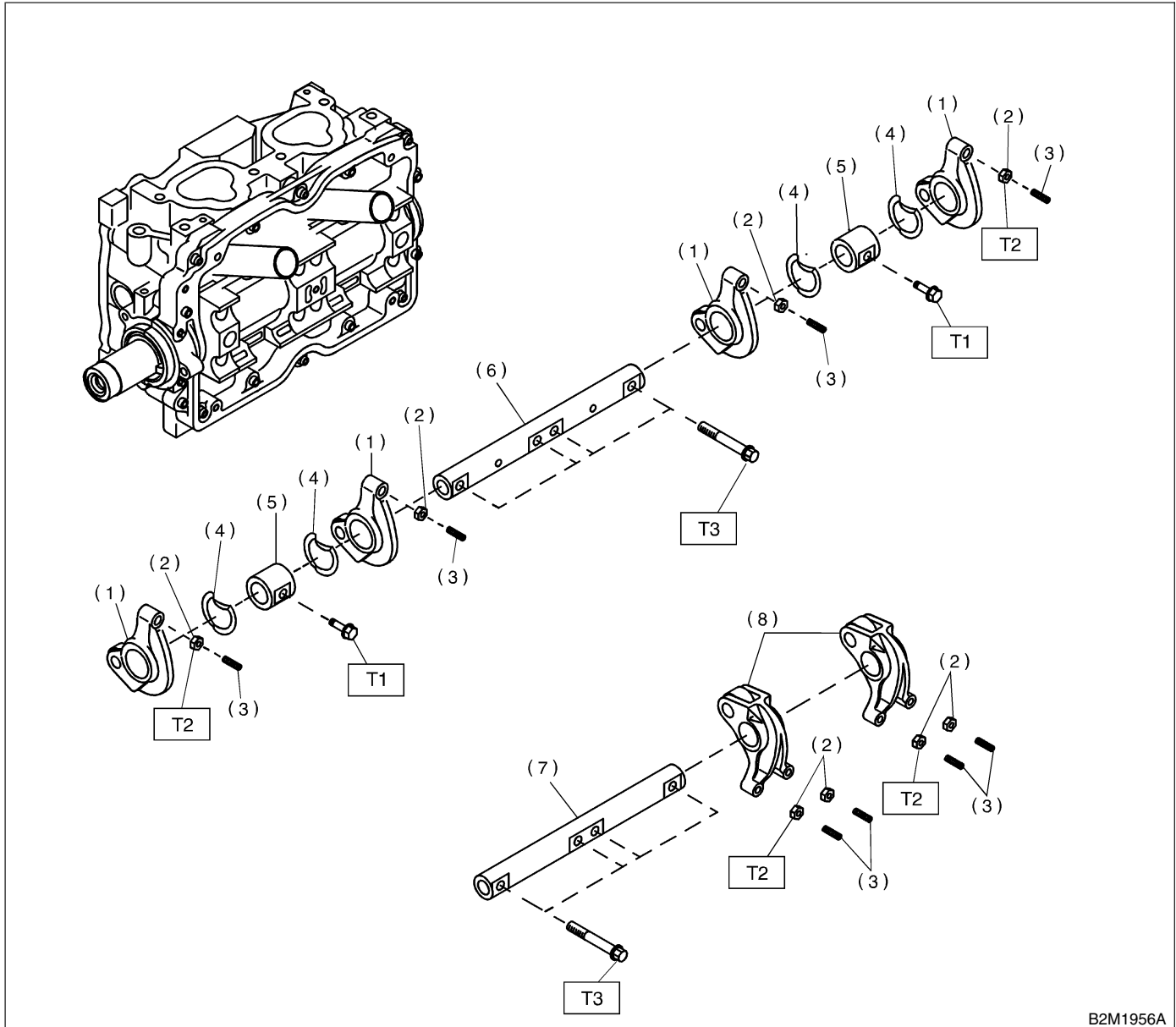
T3: 10 (1.0, 7.2)

T4: 18 (1.8, 13.0)

T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

3. VALVE ROCKER ASSEMBLY S173001A0503



(1) Intake valve rocker arm	(6) Intake rocker shaft
(2) Valve rocker nut	(7) Exhaust rocker shaft
(3) Valve rocker adjust screw	(8) Exhaust valve rocker arm
(4) Spring	
(5) Rocker shaft support	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

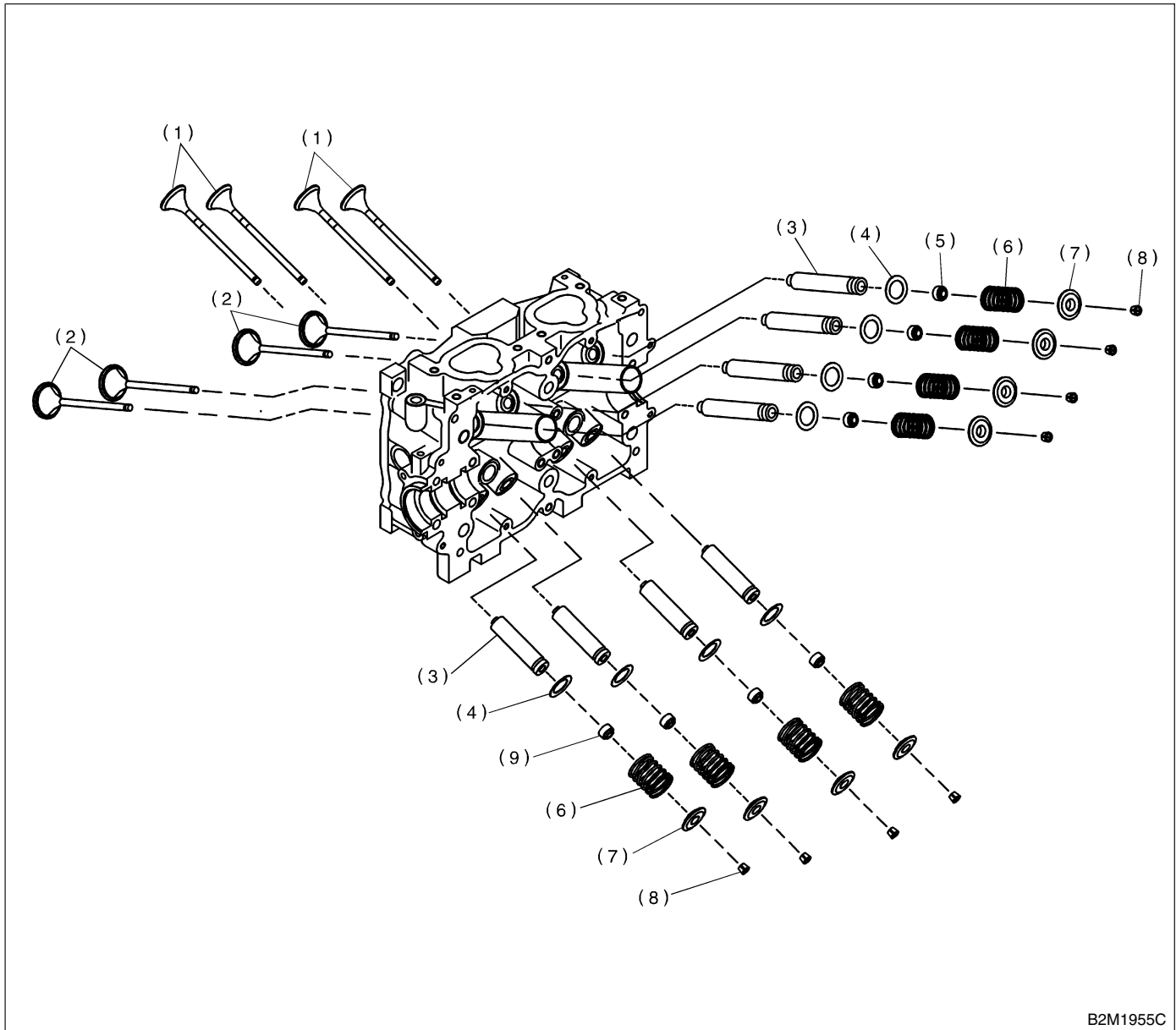
T3: 25 (2.5, 18.1)

GENERAL DESCRIPTION

Mechanical

4. CYLINDER HEAD AND VALVE ASSEMBLY

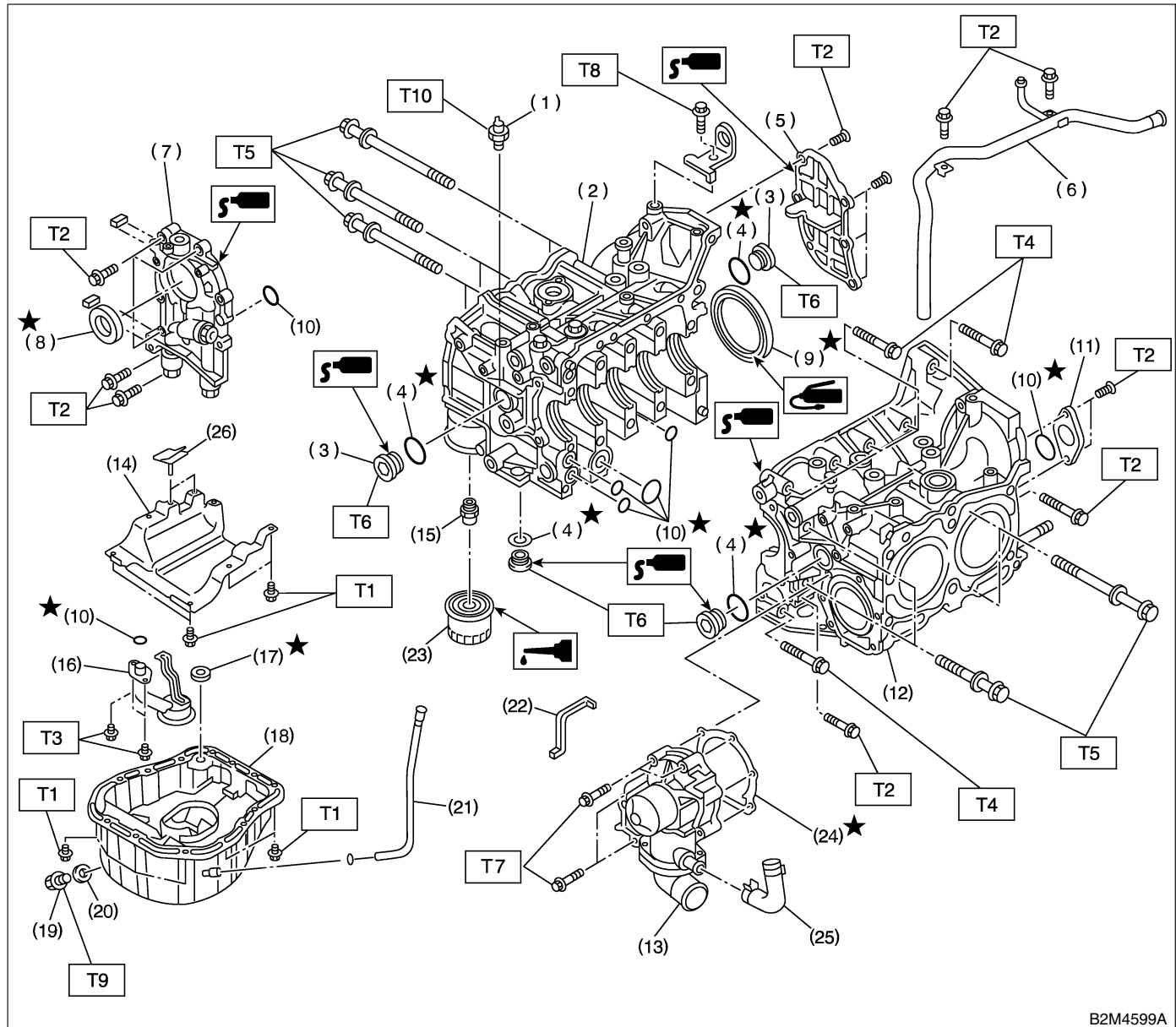
S173001A0504



B2M1955C

(1) Exhaust valve	(4) Valve spring seat	(7) Retainer
(2) Intake valve	(5) Intake valve oil seal	(8) Retainer key
(3) Valve guide	(6) Valve spring	(9) Exhaust valve oil seal

5. CYLINDER BLOCK S173001A0505



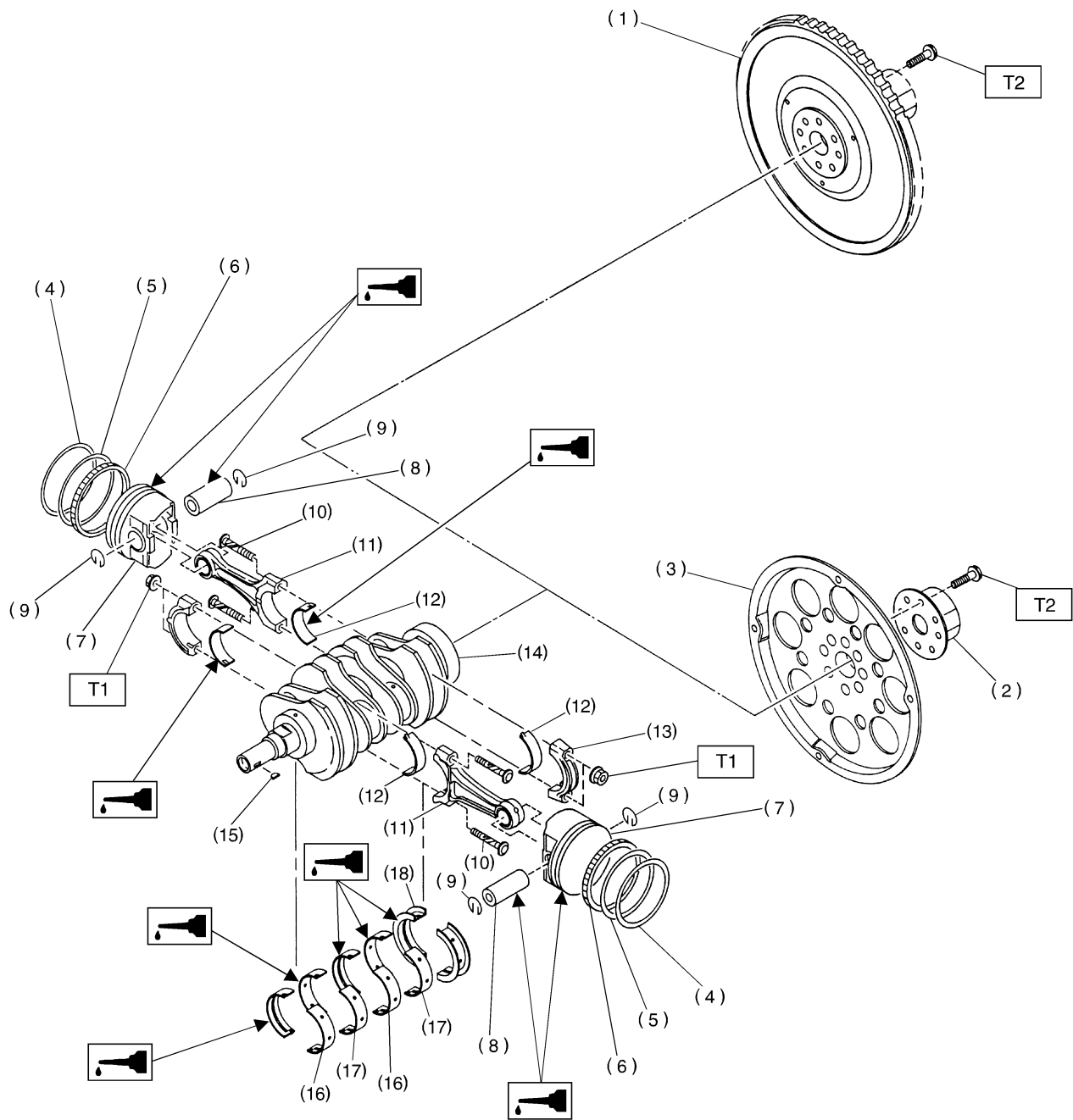
B2M4599A

(1) Oil pressure switch	(15) Oil filter connector
(2) Cylinder block (RH)	(16) Oil strainer
(3) Service hole plug	(17) Gasket
(4) Gasket	(18) Oil pan
(5) Oil separator cover	(19) Drain plug
(6) Water by-pass pipe	(20) Metal gasket
(7) Oil pump	(21) Oil level gauge guide
(8) Front oil seal	(22) Water pump sealing
(9) Rear oil seal	(23) Oil filter
(10) O-ring	(24) Gasket
(11) Service hole cover	(25) Water pump hose
(12) Cylinder block (LH)	(26) Seal
(13) Water pump	
(14) Baffle plate	

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:	47 (4.8, 34.7)
T6:	69 (7.0, 50.6)
T7:	First 12 (1.2, 8.7)
	Second 12 (1.2, 8.7)
T8:	16 (1.6, 11.6)
T9:	44 (4.5, 33)
T10:	25 (2.5, 18.1)

6. CRANKSHAFT AND PISTON S173001A0506



B2M3429A

GENERAL DESCRIPTION

Mechanical

(1) Flywheel (MT)	(9) Circlip
(2) Reinforcement (AT)	(10) Connecting rod bolt
(3) Drive plate (AT)	(11) Connecting rod
(4) Top ring	(12) Connecting rod bearing
(5) Second ring	(13) Connecting rod cap
(6) Oil ring	(14) Crankshaft
(7) Piston	(15) Woodruff key
(8) Piston pin	(16) Crankshaft bearing #1, #3

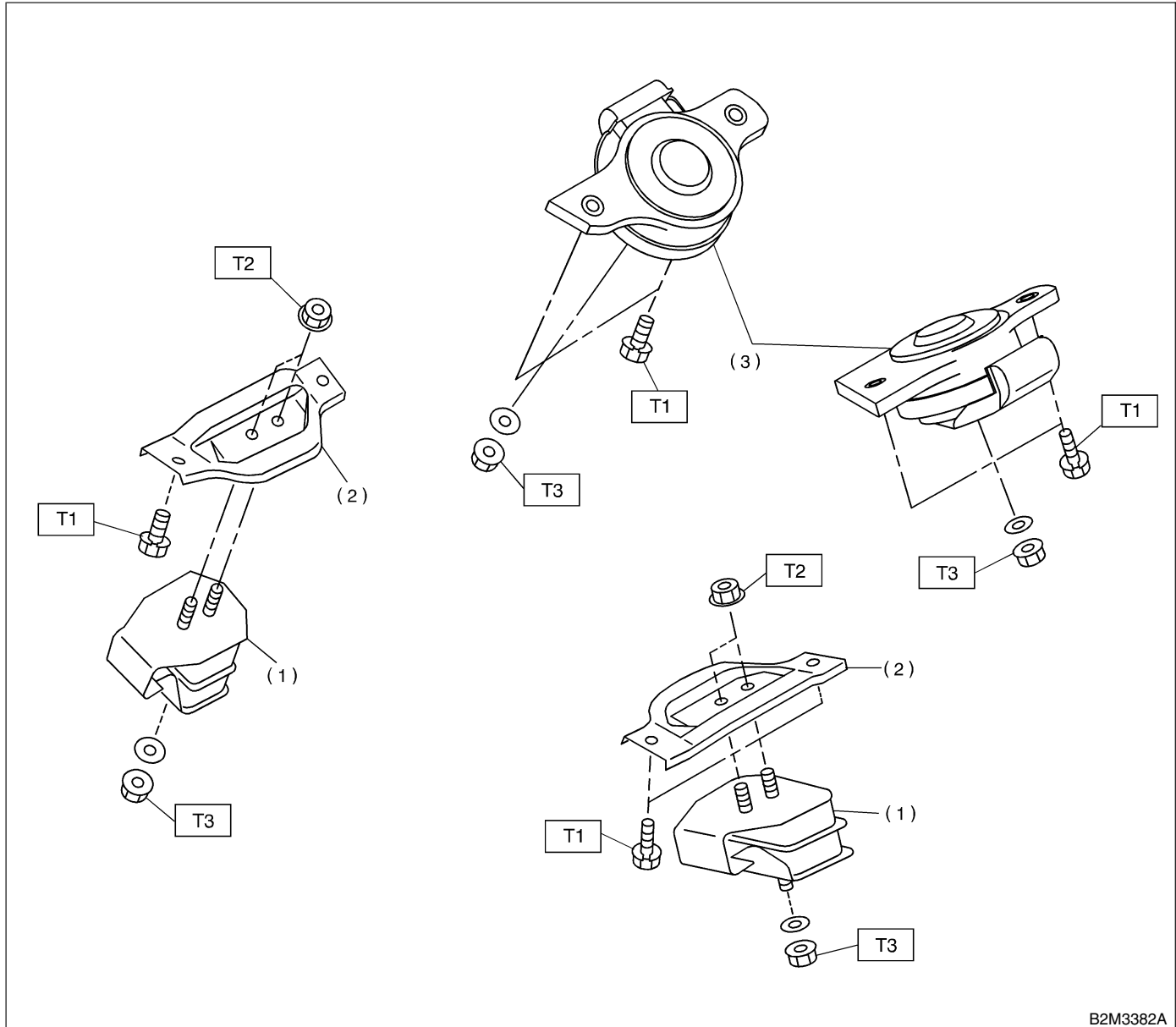
- | |
|--------------------------------|
| (17) Crankshaft bearing #2, #4 |
| (18) Crankshaft bearing #5 |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 44.6 (4.55, 32.9)

T2: 72 (7.3, 52.8)

7. ENGINE MOUNTING S173001A0507



B2M3382A

- (1) Front cushion rubber
(BRIGHTON and L AT vehicles)
- (2) Front engine mounting bracket
(BRIGHTON and L AT vehicles)

- (3) Front cushion rubber (Except
BRIGHTON and L AT vehicles)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 34 (3.5, 25.3)

T2: 41 (4.2, 30)

T3: 74 (7.5, 54)

C: CAUTION S173001A03

- 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.

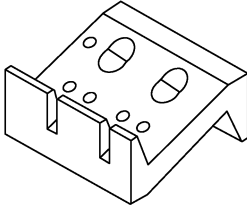
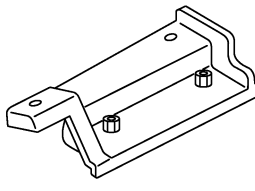
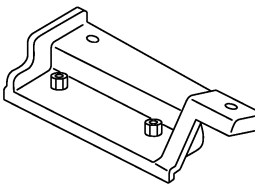
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be 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 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.

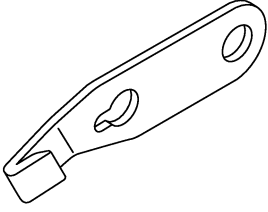
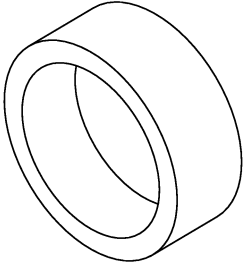
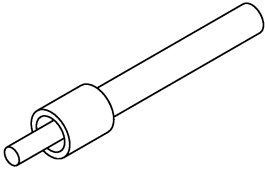
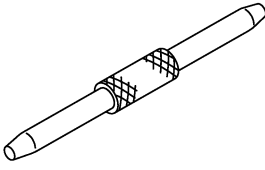
D: PREPARATION TOOL S173001A17

1. SPECIAL TOOLS S173001A1701

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3850	498267800	CYLINDER HEAD TABLE	● Used for replacing valve guides. ● Used for removing and installing valve springs.
 B2M3851	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).
 B2M3852	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).

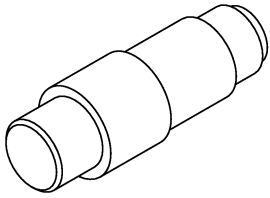
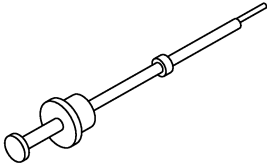
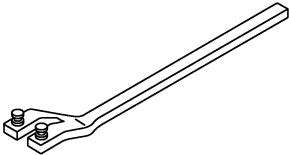
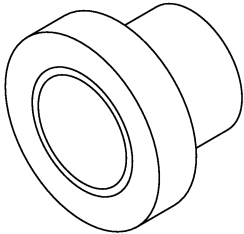
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3853	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 B2M3854	498747300	PISTON GUIDE	Used for installing piston in cylinder.
 B2M3855	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 B2M3856	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.

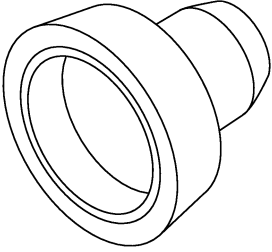
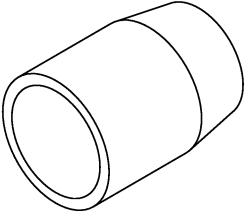
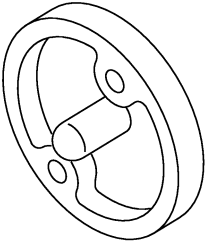
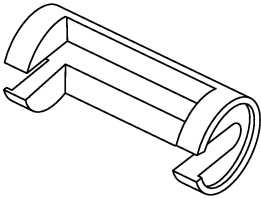
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3857	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 B2M3858	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 B2M3859	499207100	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.
 B2M3860	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.

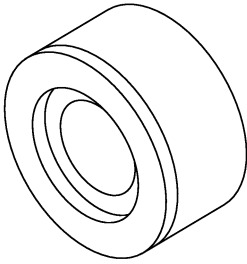
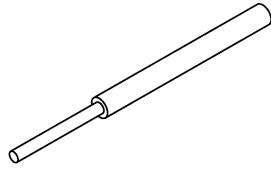
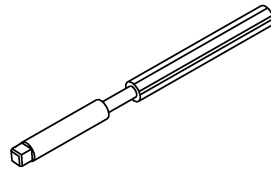
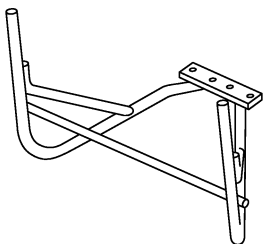
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3861	499587200	CRANKSHAFT OIL SEAL INSTALLER	- Used for installing crankshaft oil seal. - Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 B2M3862	499597000	OIL SEAL GUIDE	- Used for installing camshaft oil seal. - Used with CAMSHAFT OIL SEAL INSTALLER (499587100).
 B2M3863	499597100	CRANKSHAFT OIL SEAL GUIDE	- Used for installing crankshaft oil seal. - Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 B2M3864	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

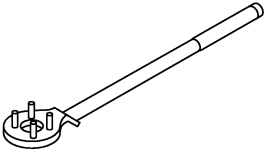
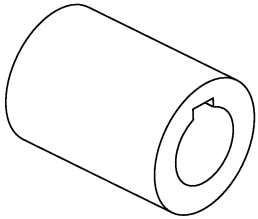
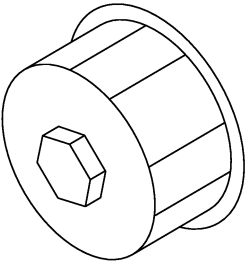
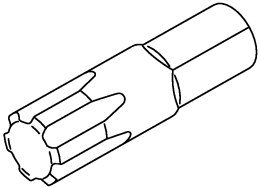
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3865	499767700 (Intake side) 499767800 (Exhaust side)	VALVE GUIDE ADJUSTER	Used for installing valve guides.
 B2M3867	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 B2M3868	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 B2M3869	499817100	ENGINE STAND	- Stand used for engine disassembly and assembly. - Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).

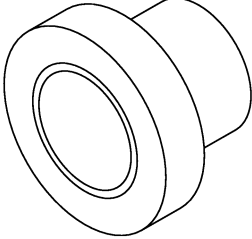
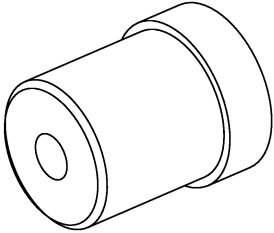
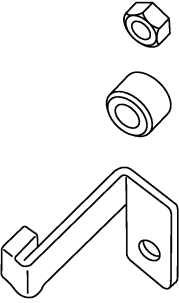
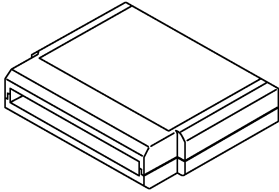
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3870	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 B2M3871	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 B2M3872	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
 B2M3873	499497000	TORX PLUS	Used for removing and installing camshaft cap.

GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3874	499587500	OIL SEAL INSTALLER	Used for installing front camshaft oil seal.
 B2M3875	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 B3M2043	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 B2M3876	24082AA190 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.

GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3877	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)

2. GENERAL PURPOSE TOOLS S173001A1702

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 S173001E45

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.

- Timing Belt
- Valve Rocker Assembly
- Camshaft
- Cylinder Head

2. Compression S173081

A: INSPECTION S173081A10

CAUTION:

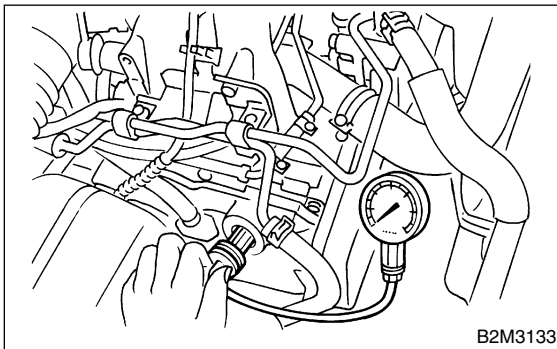
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 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-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG-4, REMOVAL, Spark Plug.>
- 5) Fully open throttle valve.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tight against the spark plug hole.

CAUTION:

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.



B2M3133

- 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/cm², 185 psi)

Limit;

1,020 kPa (10.4 kg/cm², 148 psi)

Difference between cylinders;

49 kPa (0.5 kg/cm², 7 psi), or less

3. Idle Speed

S173082

A: INSPECTION

S173082A10

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.

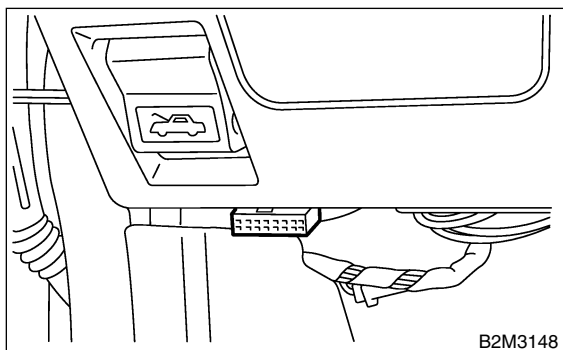
2) Warm-up the engine.

3) Stop the engine, and turn ignition switch to OFF.

4) When using SUBARU SELECT MONITOR <Ref. to ME-15, SPECIAL TOOLS, PREPARATION TOOL, General Description.>

(1) Insert the cartridge to SUBARU SELECT MONITOR.

(2) Connect SUBARU SELECT MONITOR to the data link connector.



(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.

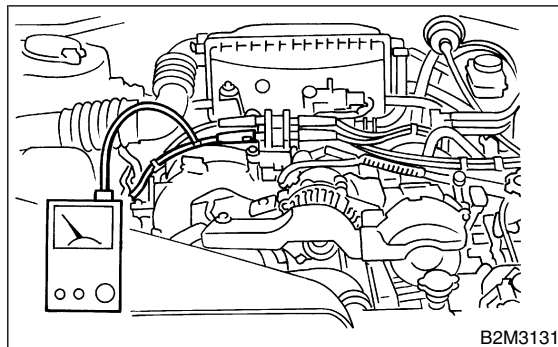
(7) Select {1.12 Data Display} in Data Display Menu.

(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.



NOTE:

● When using the OBD-II general scan tool, carefully read its operation manual.

● This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.

6) Check 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

CAUTION:

Never rotate idle adjusting screw. If idle speed is out of specifications, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN-2, Basic Diagnostic Procedure.>

4. Ignition Timing S173086

A: INSPECTION S173086A10

CAUTION:

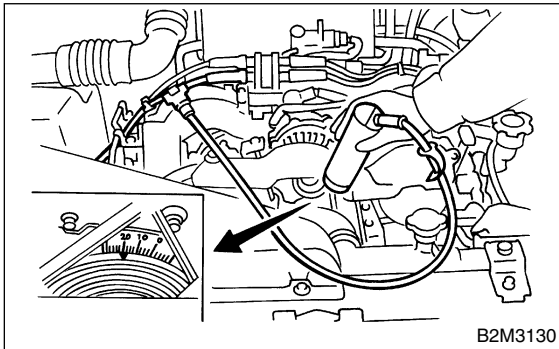
After warming-up, engine becomes very hot.
Be careful not to burn yourself during measurement.

- 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: $10^{\circ} \pm 8^{\circ}/650$

AT vehicle: $15^{\circ} \pm 8^{\circ}/700$



If the timing is not correct, check the ignition control system.

Refer to Engine Control System. <Ref. to EN-2, Basic Diagnostic Procedure.>

INTAKE MANIFOLD VACUUM

Mechanical

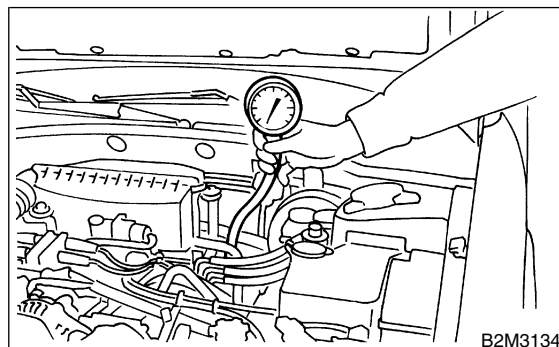
5. Intake Manifold Vacuum S173654

A: INSPECTION S173654A10

- 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.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

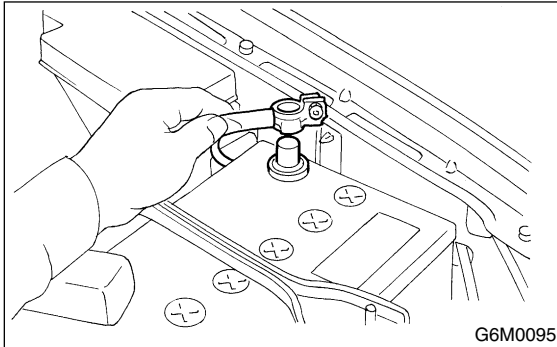
6. Engine Oil Pressure

S173655

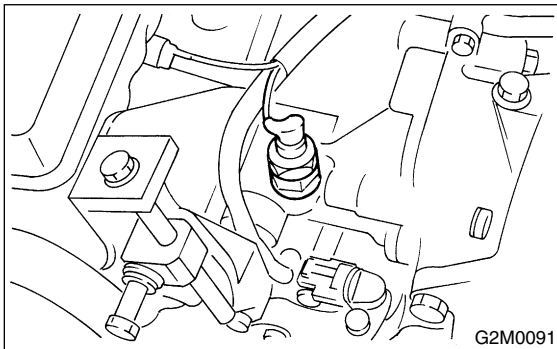
A: INSPECTION

S173655A10

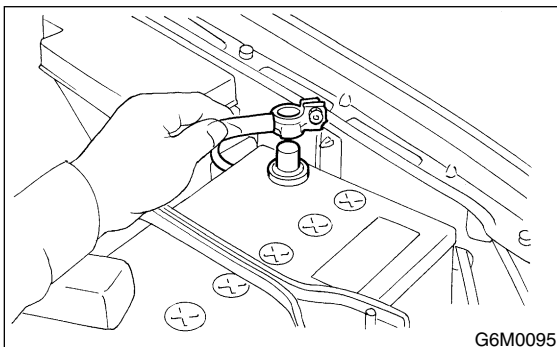
- 1) Disconnect battery ground cable.



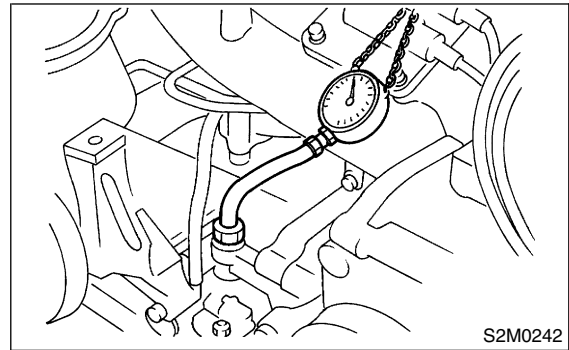
- 2) Remove generator from bracket. <Ref. to SC-15, REMOVAL, Generator.>
- 3) Disconnect connector from oil pressure switch.
- 4) Remove oil pressure switch from engine cylinder block. <Ref. to LU-17, REMOVAL, Oil Pressure Switch.>



- 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/cm², 14 psi) or more at 800 rpm
294 kPa (3.0 kg/cm², 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-19, 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-19, 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-17, 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-42, INSTALLATION, V-belt.>

7. Fuel Pressure S173656

A: INSPECTION S173656A10

WARNING:

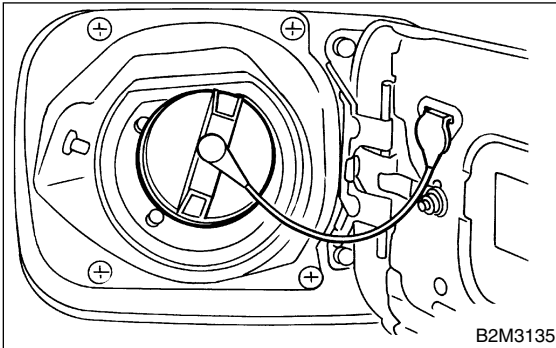
Before removing fuel pressure gauge, release fuel pressure.

NOTE:

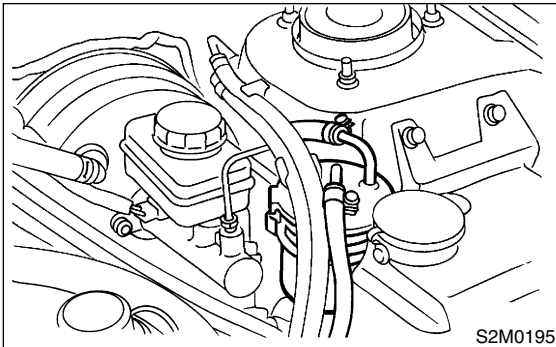
If out of specification, check or replace pressure regulator and pressure regulator vacuum hose.

1) Release fuel pressure. <Ref. to FU-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>

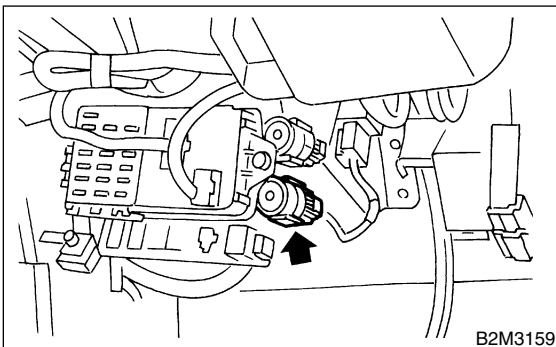
2) Open fuel flap lid, and remove fuel filler cap.



3) Disconnect fuel delivery hoses from fuel filter, and connect fuel pressure gauge.



4) Connect connector of fuel pump relay.

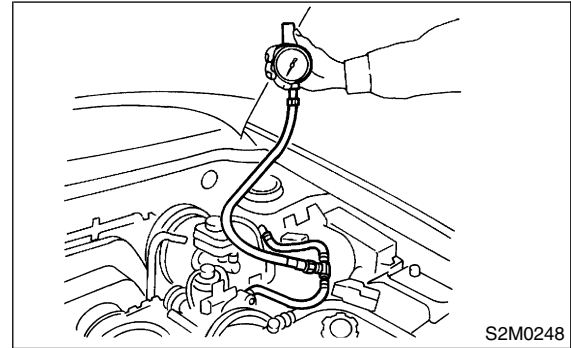


5) Start the engine.

6) Measure fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

Fuel pressure:

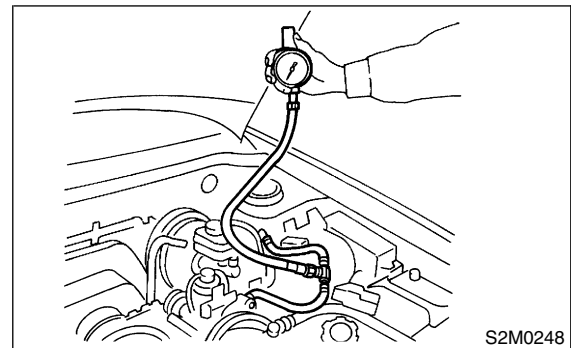
Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm², 41 — 46 psi)



7) After connecting pressure regulator vacuum hose, measure fuel pressure.

Fuel pressure:

Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm², 30 — 34 psi)



NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm², 1 to 3 psi) higher than standard values during high-altitude operations.

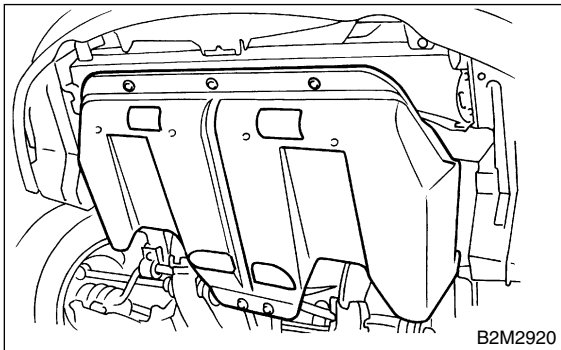
8. Valve Clearance S173083

A: INSPECTION S173083A10

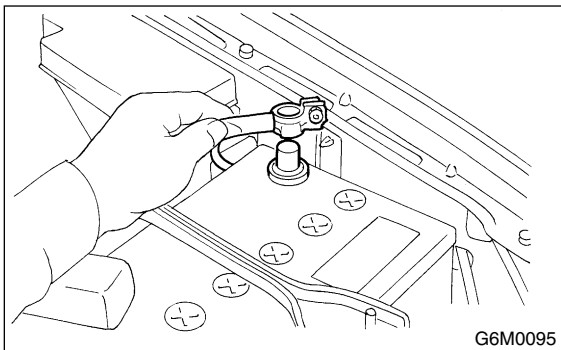
CAUTION:

Inspection and adjustment of valve clearance should be performed while engine is cold.

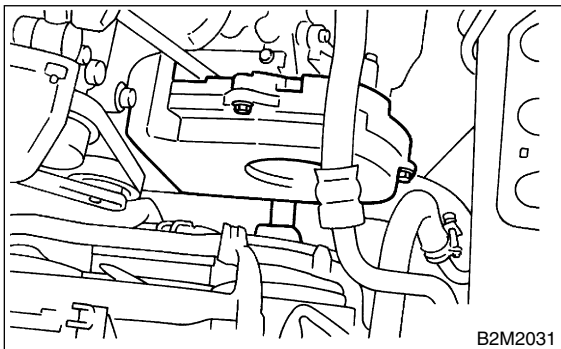
- 1) Set the vehicle onto the lift.
- 2) Lift-up the vehicle.
- 3) Remove under cover.



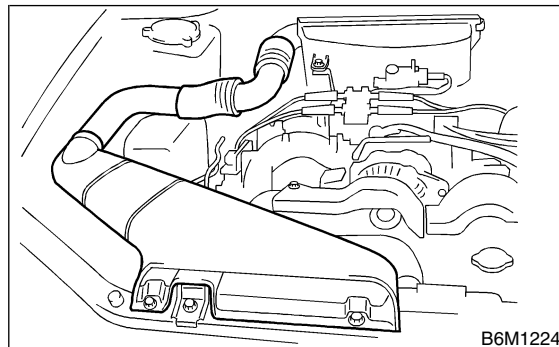
- 4) Disconnect battery ground cable.



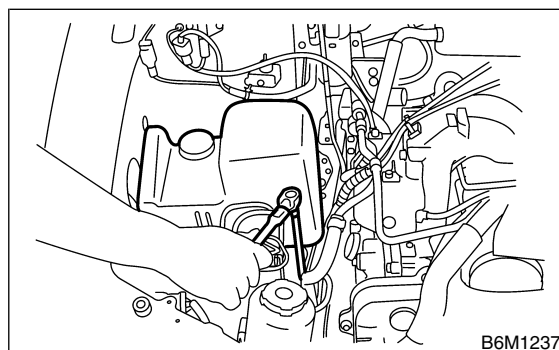
- 5) Lower the vehicle.
- 6) Remove timing belt cover (LH).



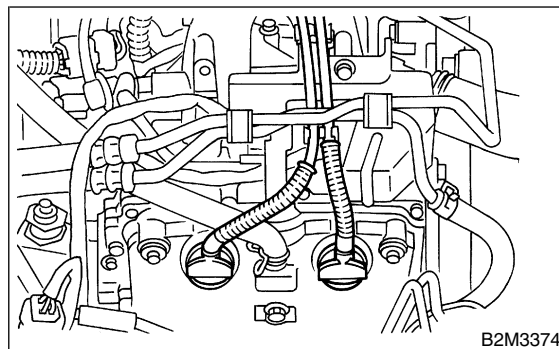
- 7) Remove rocker cover.
- 8) When inspecting #1 and #3 cylinders;
 - (1) Remove bolt which secures air intake duct to radiator panel side.
 - (2) Remove air intake duct as a unit.



- (3) Remove bolt, and then remove resonator chamber.



- (4) Disconnect spark plug cords from spark plugs (#1 and #3 cylinders).

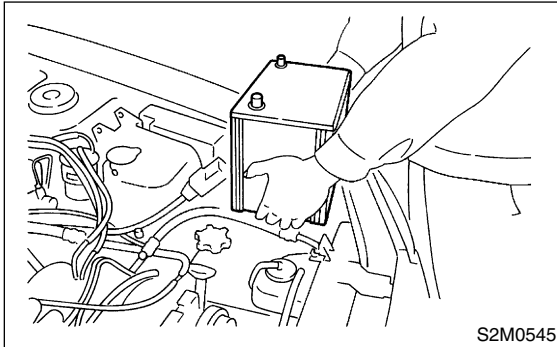


- (5) Disconnect PCV hose from rocker cover (RH).
- (6) Remove bolts, then remove rocker cover (RH).

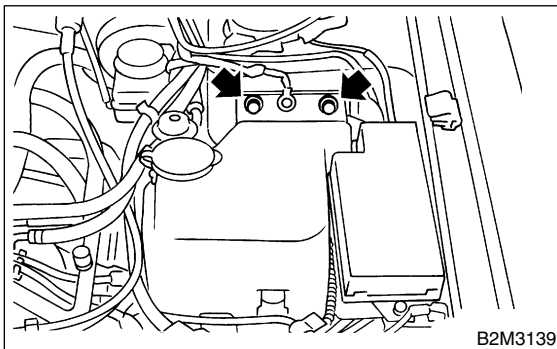
VALVE CLEARANCE

Mechanical

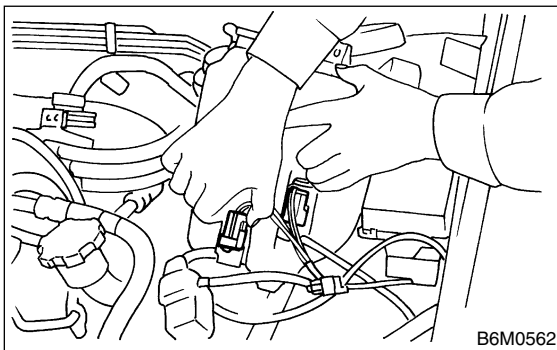
- 9) When inspecting #2 and #4 cylinders;
(1) Disconnect battery cables, and then remove battery and battery carrier.



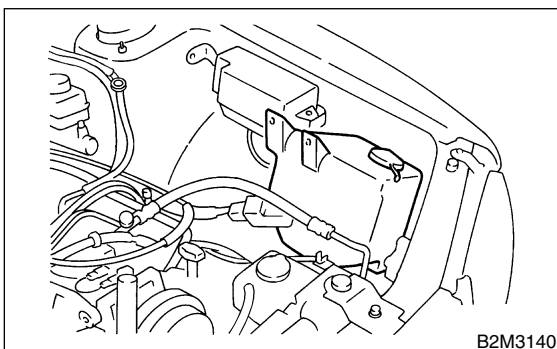
- (2) Remove the two bolts which hold washer tank.



- (3) Disconnect washer motor connectors.



- (4) Move washer tank to forward.



- (5) Disconnect spark plug cords from spark plugs (#2 and #4 cylinders).

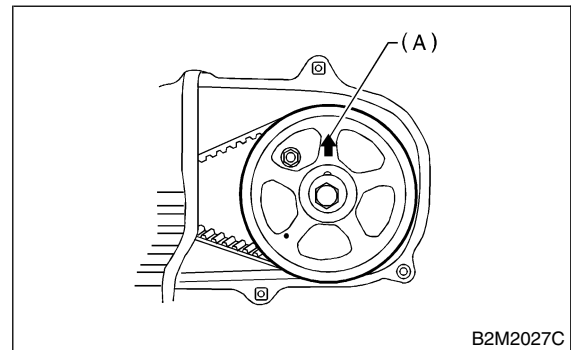
- (6) Disconnect PCV hose from rocker cover (LH).
(7) Remove bolts, then remove rocker cover (LH).

- 10) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using ST.

ST 499977100 CRANKSHAFT PULLEY
WRENCH

NOTE:

When arrow mark (A) on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



- 11) Measure #1 cylinder valve clearance by using thickness gauge.

CAUTION:

- Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.
- Measure exhaust valve clearances while lifting-up the vehicle.

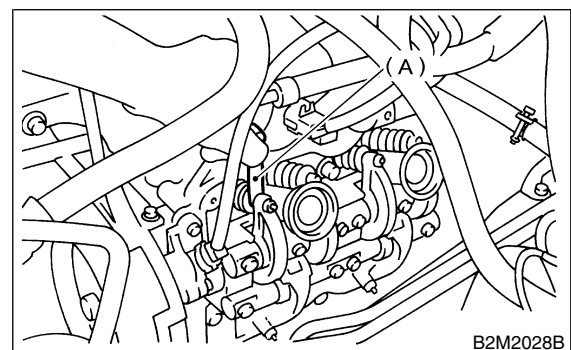
Valve clearance:

Intake;

$0.20 \pm 0.02 \text{ mm } (0.0079 \pm 0.0008 \text{ in})$

Exhaust;

$0.25 \pm 0.02 \text{ mm } (0.0098 \pm 0.0008 \text{ in})$



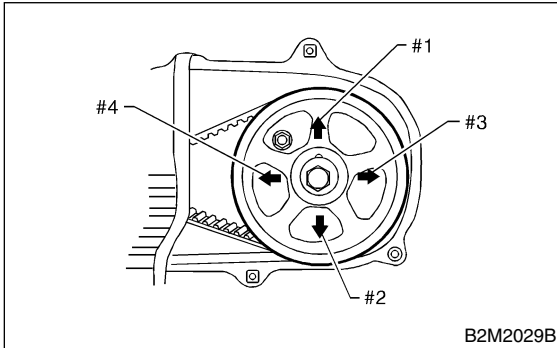
(A) Thickness gauge

- 12) If necessary, adjust the valve clearance. <Ref. to ME-31, ADJUSTMENT, Valve Clearance.>

13) 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.

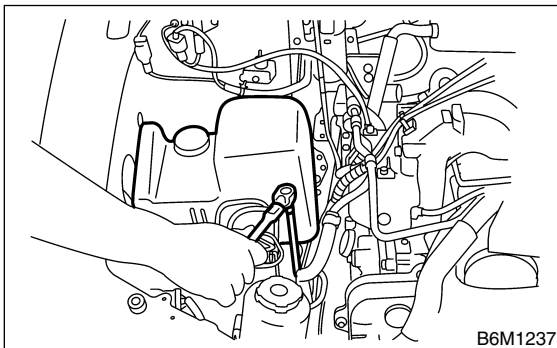


14) After inspection, install the related parts in the reverse order of removal.

Tightening torque:

Resonator chamber;

32 N·m (3.3 kgf·m, 24 ft-lb)



B: ADJUSTMENT

S173083A01

CAUTION:

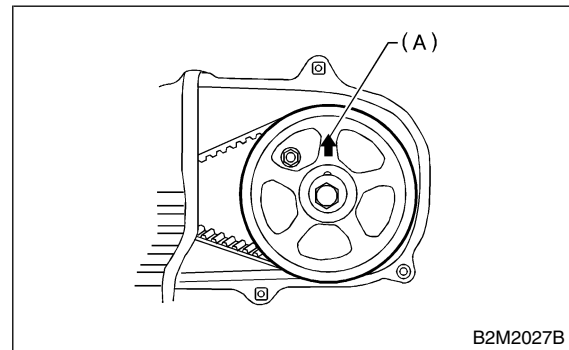
Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using ST.

ST 499977100 CRANKSHAFT PULLEY
WRENCH

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:

10 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.

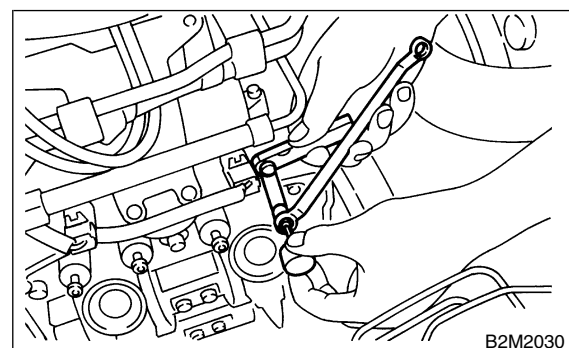
Valve clearance:

Intake;

0.20±0.02 mm (0.0079±0.0008 in)

Exhaust;

0.25±0.02 mm (0.0098±0.0008 in)



3) Ensure that valve clearances are within specifications.

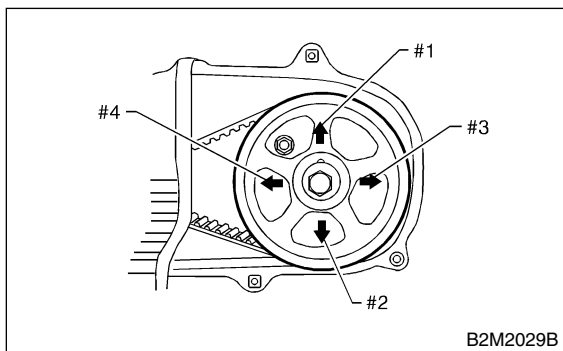
VALVE CLEARANCE

Mechanical

- 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:

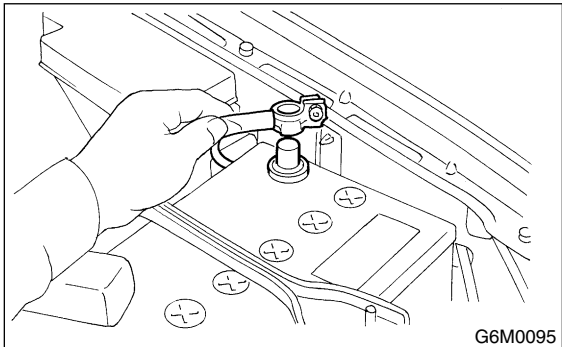
- Be sure to set cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
- To set #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



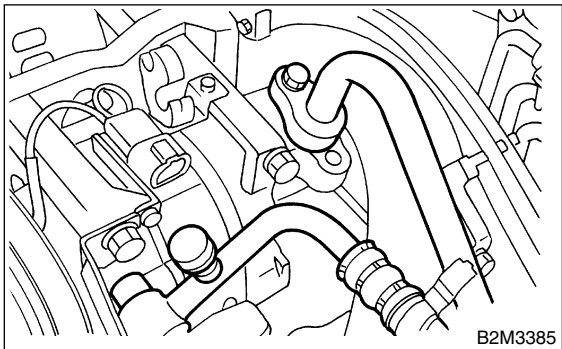
9. Engine Assembly S173079

A: REMOVAL S173079A18

- 1) Set the vehicle on lift arms.
- 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-54, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 5) Remove filler cap.
- 6) Disconnect battery ground cable.

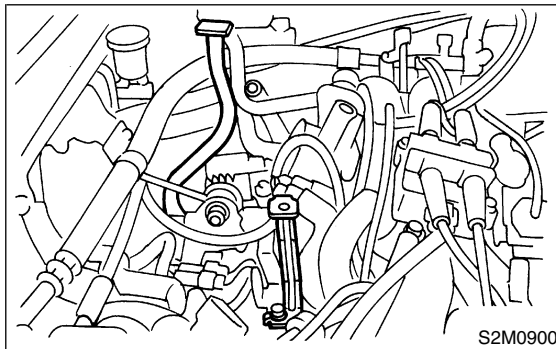


- 7) Remove air intake duct and air cleaner case. <Ref. to IN-7, REMOVAL, Air Intake Duct.> and <Ref. to IN-6, REMOVAL, Air Cleaner Case.>
- 8) Remove under cover.
- 9) Remove radiator from vehicle. <Ref. to CO-21, REMOVAL, Radiator.>
- 10) Remove ATF cooler pipe from body. <Ref. to AT-51, REMOVAL, ATF Cooler Pipe and Hose.>
- 11) Collect refrigerant, and remove pressure hoses. (With A/C)
 - (1) Place and connect the attachment hose to the refrigerant recycle system.
 - (2) Collect refrigerant from A/C system.
 - (3) Disconnect A/C pressure hoses from A/C compressor.

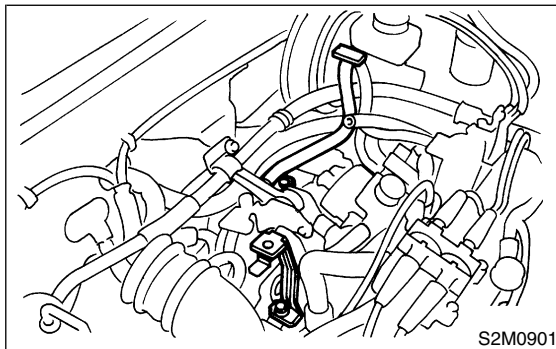


- 12) Remove air cleaner case stay.

• MT model

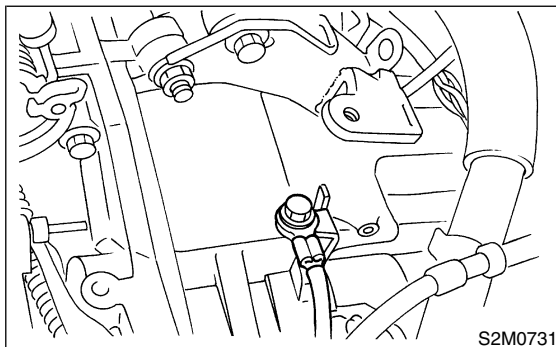


• AT model

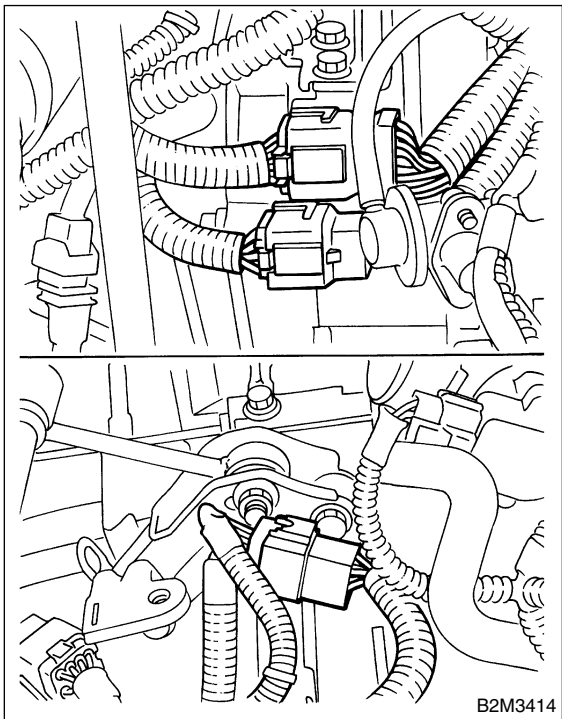


- 13) Disconnect the following connectors and cables.

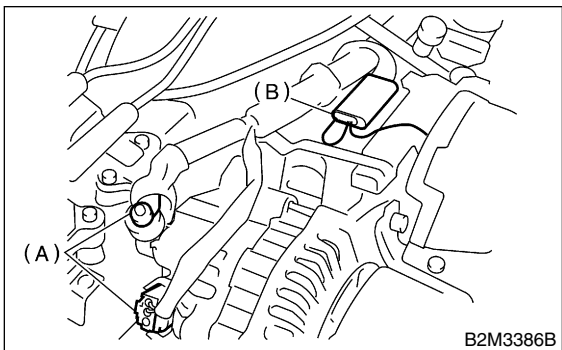
(1) Engine ground terminal



(2) Engine harness connectors

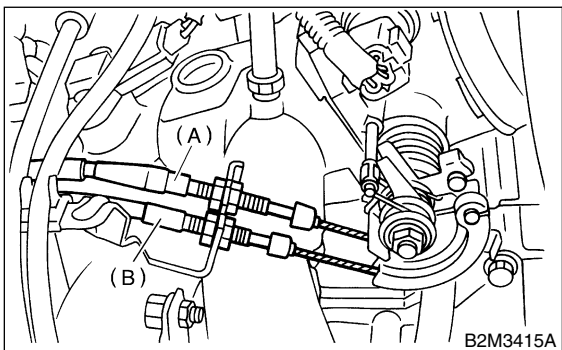


(3) Alternator connector, terminal and A/C compressor connector



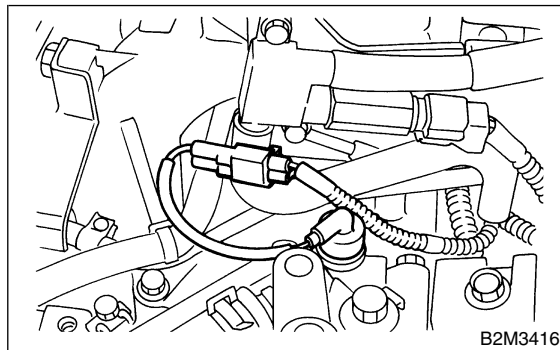
- (A) Alternator connector and terminal
- (B) A/C compressor connector

(4) Accelerator cable and cruise control cable



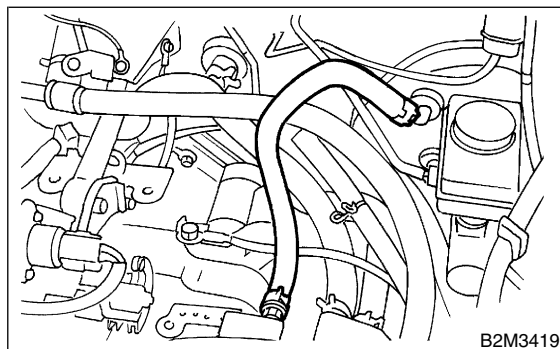
- (A) Accelerator cable
- (B) Cruise control cable

(5) Pressure switch

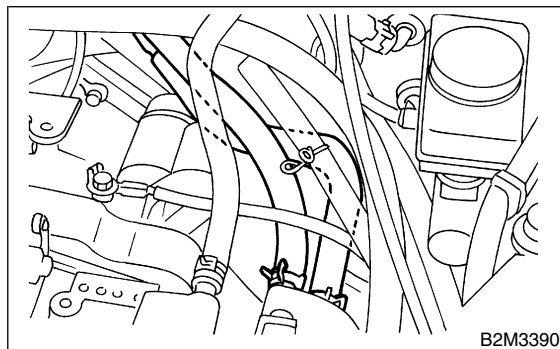


14) Disconnect the following hoses.

(1) Brake booster vacuum hose

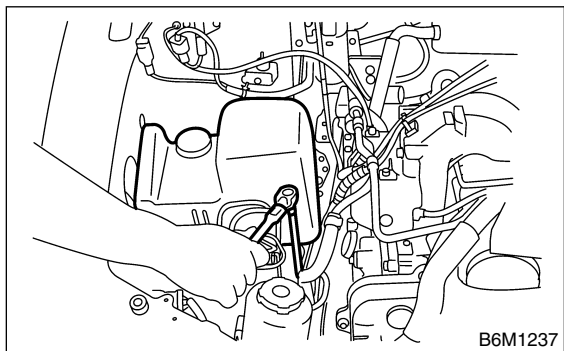


(2) Heater inlet outlet hose

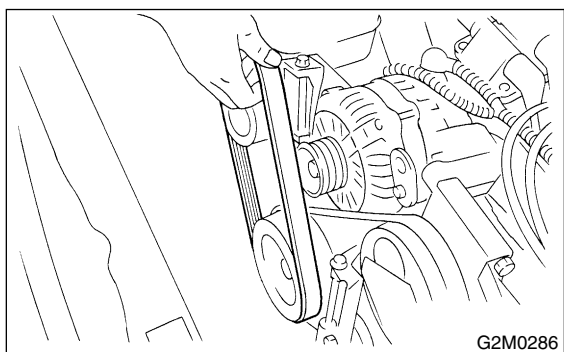


15) Remove power steering pump from bracket.

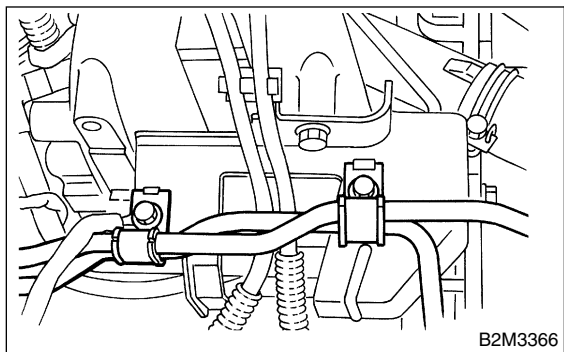
(1) Remove resonator chamber.



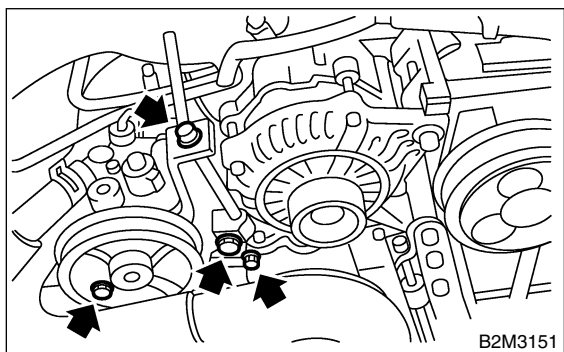
(2) Loosen lock bolt and slider bolt, and remove front side V-belt.



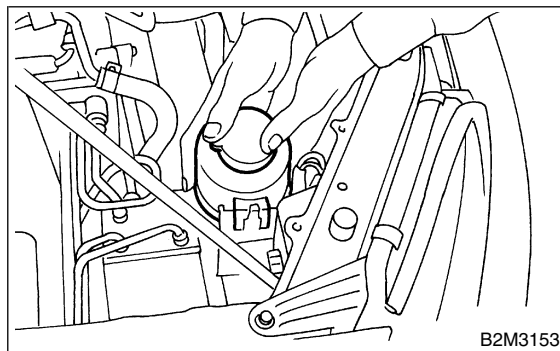
(3) Remove pipe with bracket.



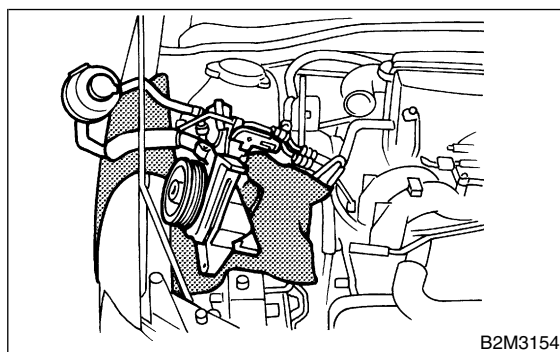
(4) Remove bolts which install power steering pump bracket.



(5) Remove power steering tank from the bracket by pulling it upward.

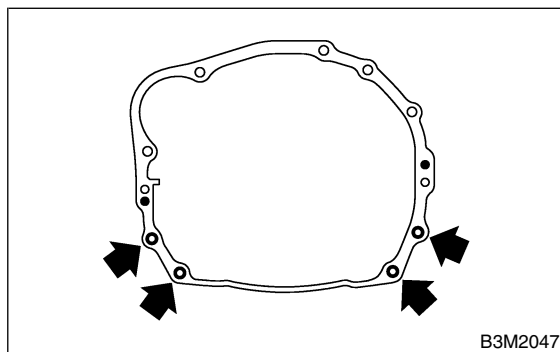


(6) Place power steering pump on the right side wheel apron.



16) Remove front and center exhaust pipe.
<Ref. to EX-5, REMOVAL, Front Exhaust Pipe.>
and <Ref. to EX-8, REMOVAL, Center Exhaust Pipe.>

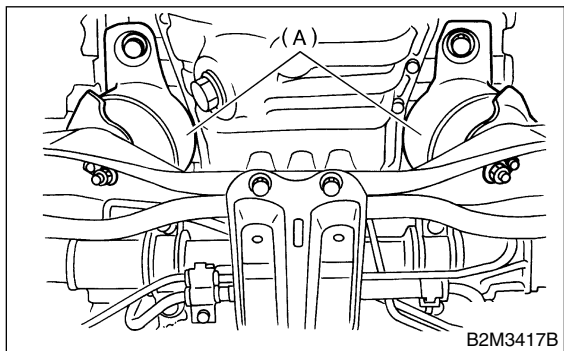
17) Remove nuts which hold lower side of transmission to engine.



ENGINE ASSEMBLY

Mechanical

18) Remove nuts which install front cushion rubber onto front crossmember.

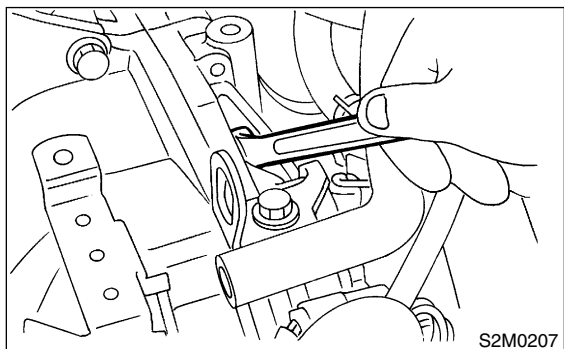


(A) Engine mount

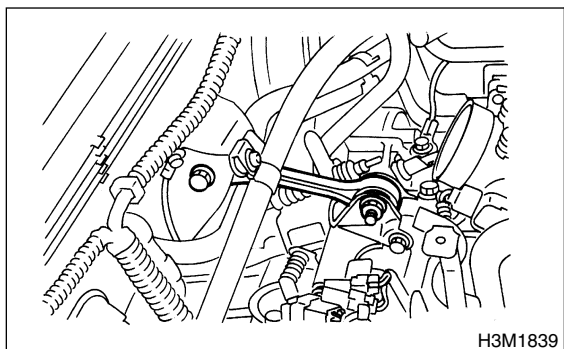
19) Separate torque converter clutch from drive plate. (AT model)

- (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



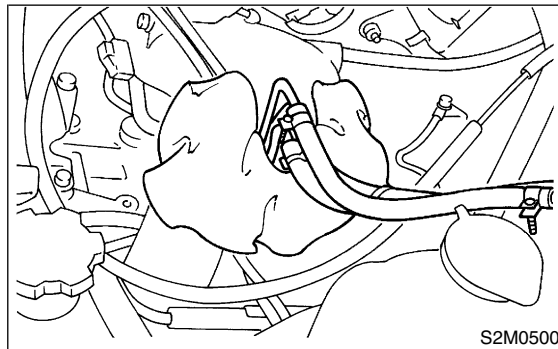
20) Remove pitching stopper.



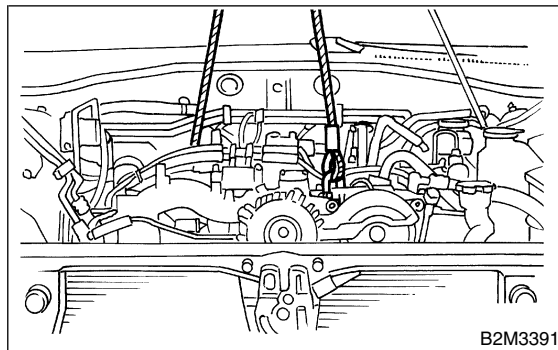
21) Disconnect fuel delivery hose, return hose and evaporation hose.

CAUTION:

- Disconnect hose with its end wrapped with cloth to prevent fuel from splashing.
- Catch fuel from hose into container.



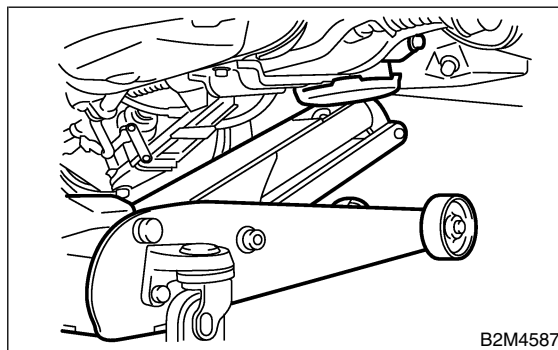
22) Support engine with a lifting device and wire ropes.



23) Support transmission with a garage jack.

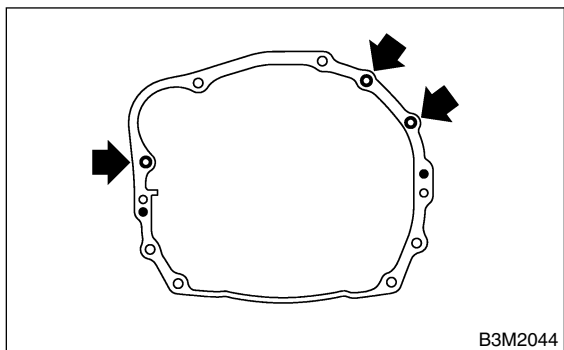
CAUTION:

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.



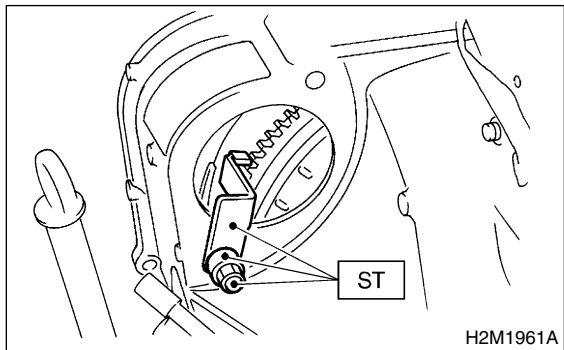
24) Separation of engine and transmission.

- (1) Remove starter. <Ref. to SC-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

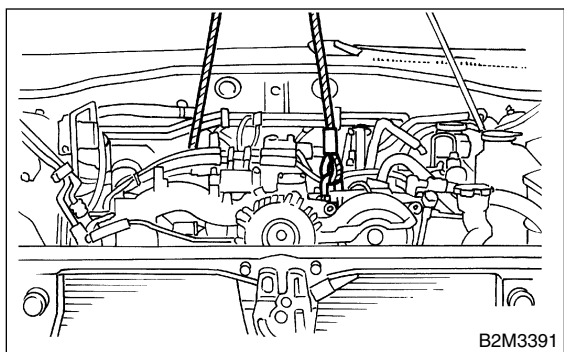


26) Remove engine from vehicle.

- (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 compartment.

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

S173079A11

- 1) Install front cushion rubbers.

Tightening torque:

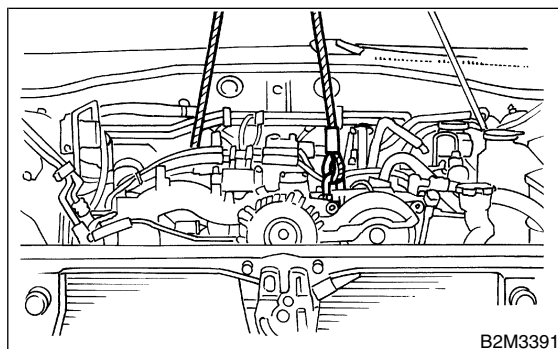
34 N·m (3.5 kgf-m, 25.3 ft-lb)

- 2) Install engine onto transmission.

- (1) Position engine in engine compartment and align it with transmission.

CAUTION:

Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

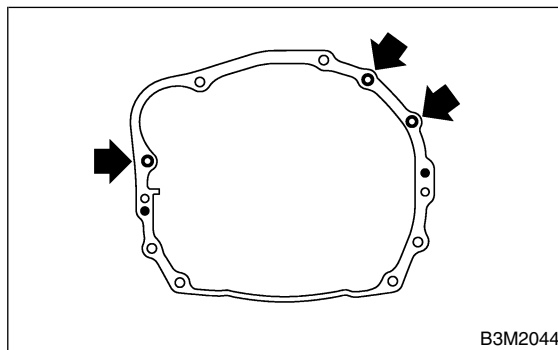


- (2) Apply a small amount of grease to spline of main shaft. (MT model)

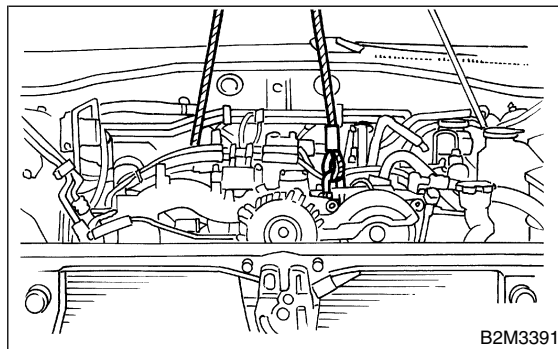
- 3) Tighten bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



- 4) Remove lifting device and wire ropes.



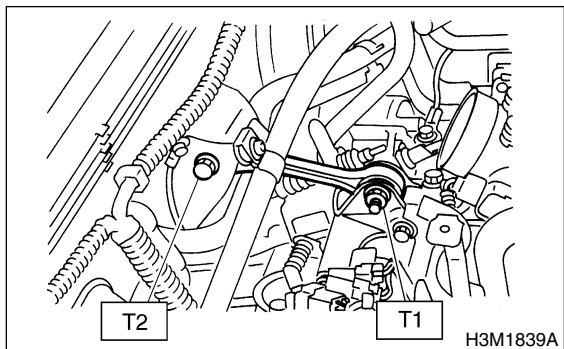
- 5) Remove garage jack.

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-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.

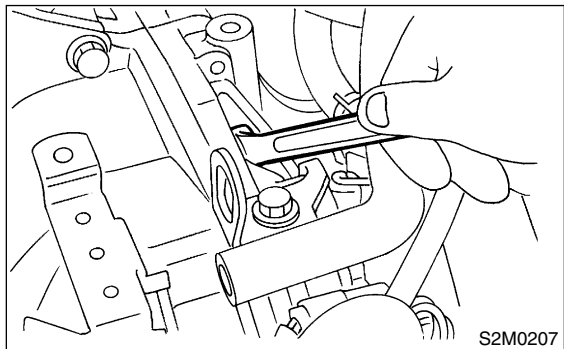
CAUTION:

Be careful not to drop bolts into torque converter clutch housing.

ST 499977100 CRANK PULLEY WRENCH

Tightening torque:

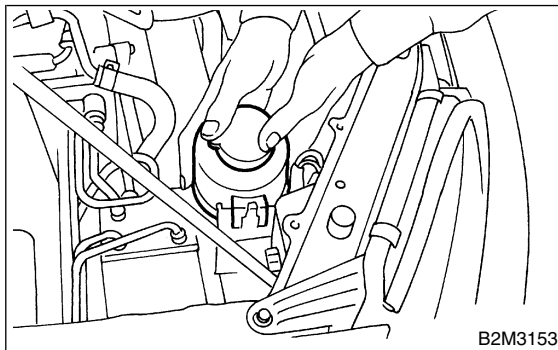
25 N·m (2.5 kgf-m, 18.1 ft-lb)



(3) Clog plug onto service hole.

10) Install power steering pump on bracket.

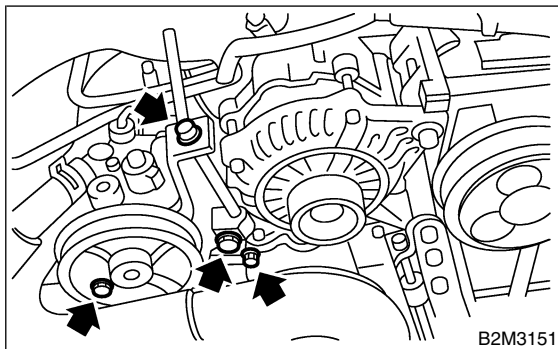
(1) Install power steering tank on bracket.



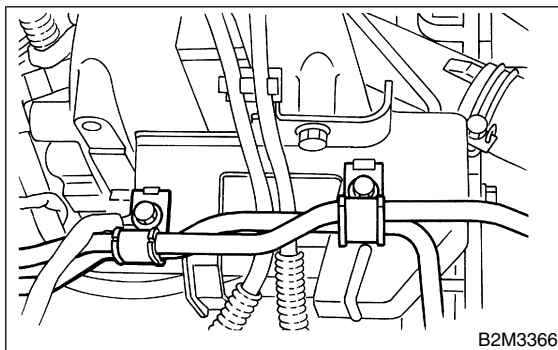
(2) Install power steering pump on bracket, and tighten bolts.

Tightening torque:

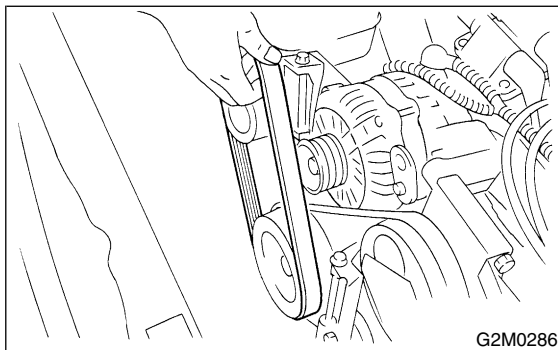
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(3) Tighten bolt which installs power steering pump bracket, and install spark plug codes.



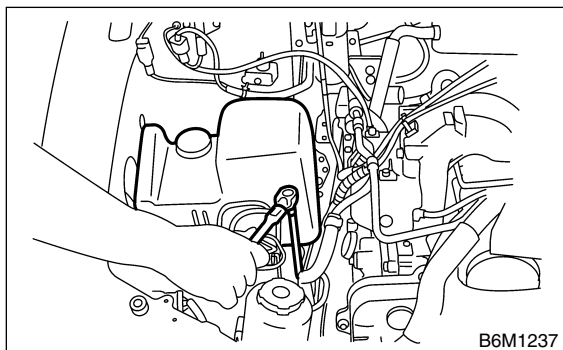
(4) Intake front side V-belt, and adjust it.



- (5) Install resonator chamber.

Tightening torque:

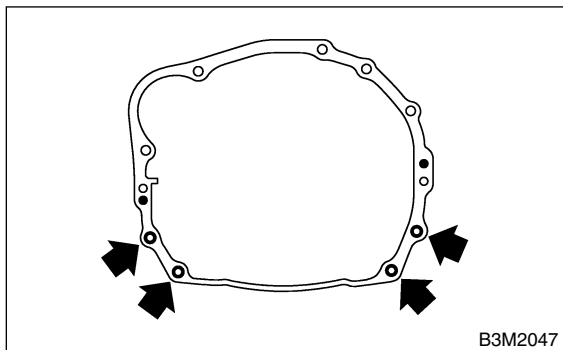
32 N·m (3.3 kgf-m, 24 ft-lb)



- 11) Tighten nuts which hold lower side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



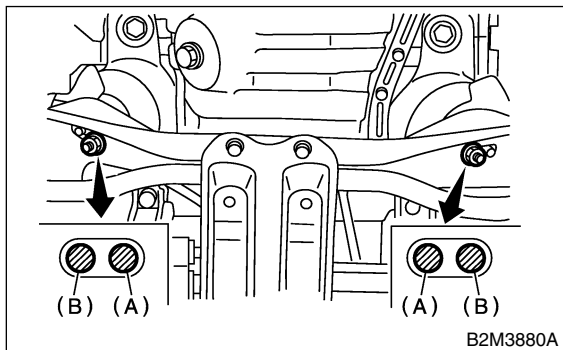
- 12) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:

85 N·m (8.7 kgf-m, 63 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-6, INSTALLATION, Front Exhaust Pipe.> and <Ref. to EX-8, INSTALLATION, Center Exhaust Pipe.>

- 14) Connect the following hoses.

- (1) Fuel delivery hose, return hose and evaporation hose
 - (2) Heater inlet and outlet hoses
 - (3) Brake booster vacuum hose
- 15) Connect the following connectors.
- (1) Engine ground 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)

CAUTION:

After connecting each cable, adjust them.

- 17) Install air cleaner case stay.

Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)

- 18) Install A/C pressure hoses.
<Ref. to AC-38, INSTALLATION, Flexible Hose.>
- 19) Install radiator to vehicle. <Ref. to CO-22, INSTALLATION, Radiator.>
- 20) Install ATF cooler pipe to body. <Ref. to AT-53, INSTALLATION, ATF Cooler Pipe and Hose.>
- 21) Install air intake duct and cleaner case.
<Ref. to IN-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN-6, INSTALLATION, Air Cleaner Case.>
- 22) Install under cover.
- 23) Install battery in the vehicle, and connect cables.
- 24) Fill coolant.
<Ref. to CO-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 25) Check ATF level and correct if necessary. (AT model)
<Ref. to AT-9, Automatic Transmission Fluid.>
- 26) Charge A/C system with refrigerant.
<Ref. to AC-19, OPERATION, Refrigerant Charging Procedure.>
- 27) Remove front hood stay, and close front hood.
- 28) Take off the vehicle from lift arms.

C: INSPECTION

S173079A10

- 1) Make sure pipes and hoses are installed correctly.
- 2) Make sure the engine coolant and ATF are at specified levels.

10. Engine Mounting S173085

A: REMOVAL S173085A18

- 1) Remove engine assembly. <Ref. to ME-33, REMOVAL, Engine Assembly.>
- 2) Remove engine mounting from engine assembly.

B: INSTALLATION S173085A11

Install in the reverse order of removal.

Tightening torque:

Engine mounting;

35 N·m (3.6 kgf-m, 26 ft-lb)

C: INSPECTION S173085A10

Make sure there are no cracks or other damage.

11. Preparation for Overhaul S173091

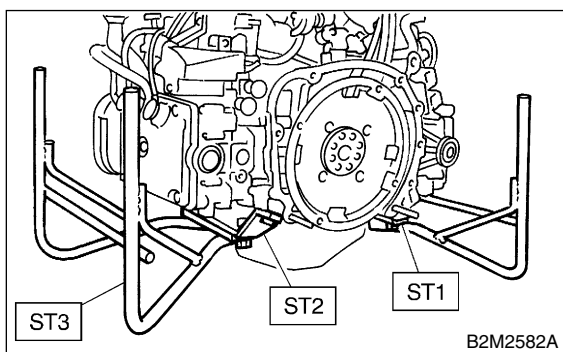
A: PROCEDURE S173091E45

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 S173080

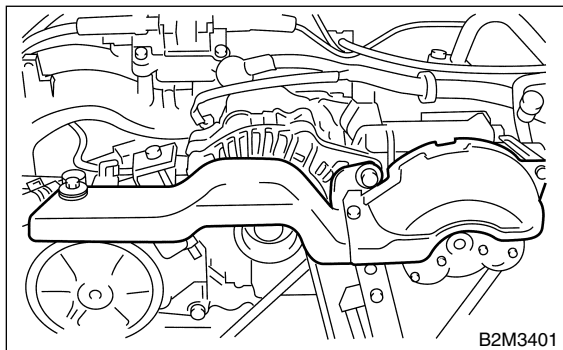
A: REMOVAL S173080A18

1. FRONT SIDE BELT S173080A1801

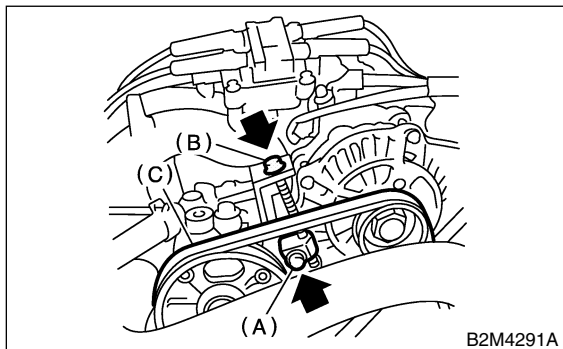
NOTE:

Perform the following procedures 1) to 4) with the engine installed to the body.

- 1) Remove V-belt cover.

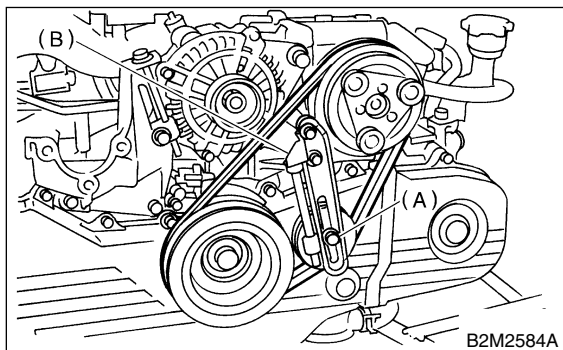


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).

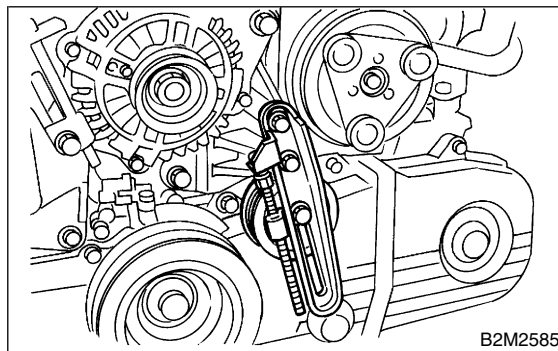


2. REAR SIDE BELT S173080A1802

- 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 S173080A11

1. FRONT SIDE BELT S173080A1101

CAUTION:

Wipe off any oil or water on the belt and pulley.

- 1) Install a belt, and tighten the slider bolt so as to obtain the specified belt tension <Ref. to ME-43, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A)
- 3) Tighten slider bolt (B).

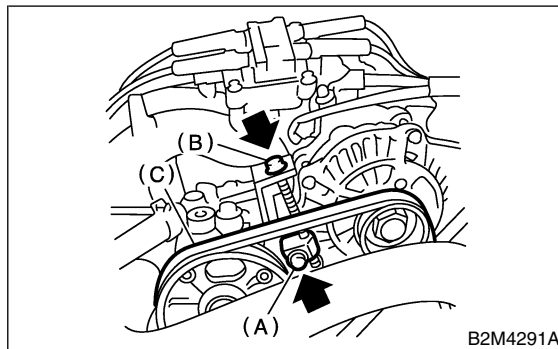
Tightening torque:

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)



- 4) Install V-belt cover.

2. REAR SIDE BELT S173080A1102

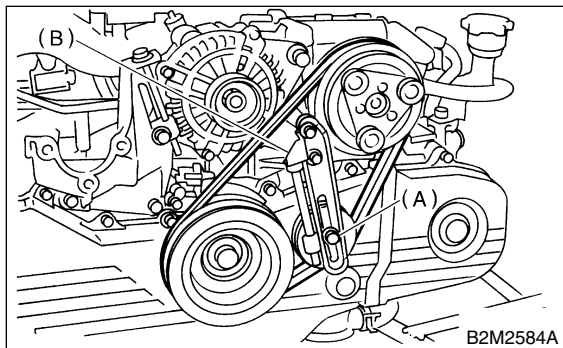
- 1) Install a belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME-43, INSPECTION, V-belt.>

2) Tighten the lock nut (A).

Tightening torque:

Lock nut (A);

22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION

S173080A10

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)

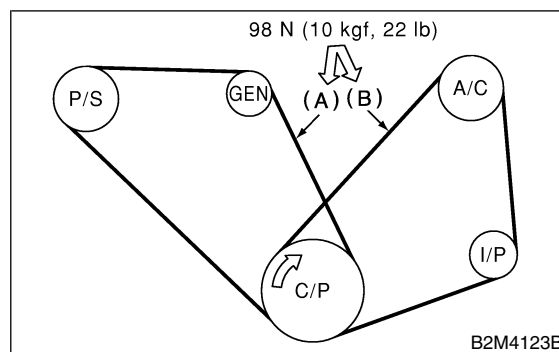
replaced: 7 — 9 mm (0.276 — 0.354 in)

reused: 9 — 11 mm (0.354 — 0.433 in)

(B)*

replaced: 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

CRANKSHAFT PULLEY

13. Crankshaft Pulley S173098

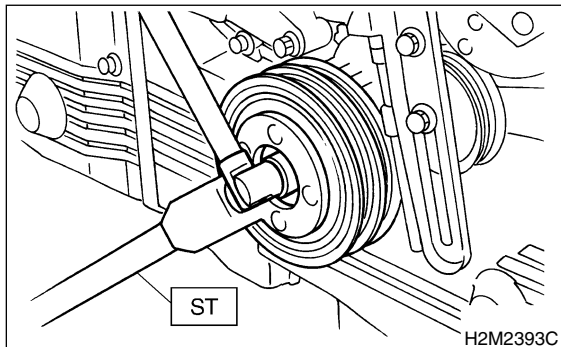
A: REMOVAL S173098A18

1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>

2) Remove crankshaft pulley bolt. To lock crankshaft, use ST.

ST 499977100

CRANKSHAFT PULLEY WRENCH



3) Remove crankshaft pulley.

B: INSTALLATION S173098A11

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 an air gun.

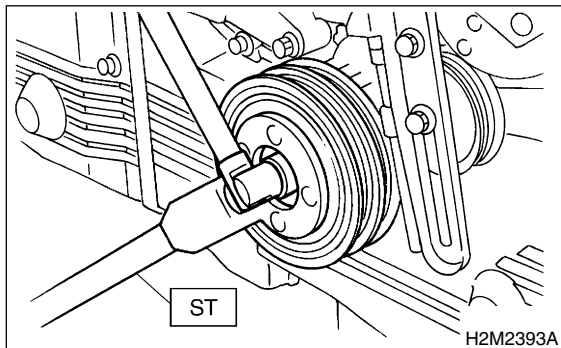
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.

(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:

177 N·m (18.0 kgf-m, 130.2 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 an air gun.

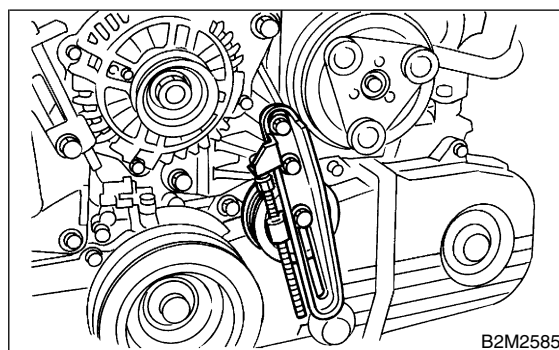
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

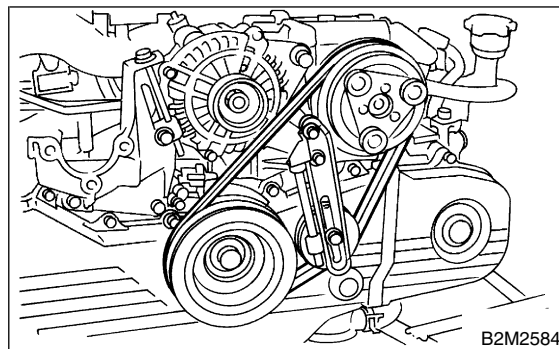
CAUTION:

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 S173098A10

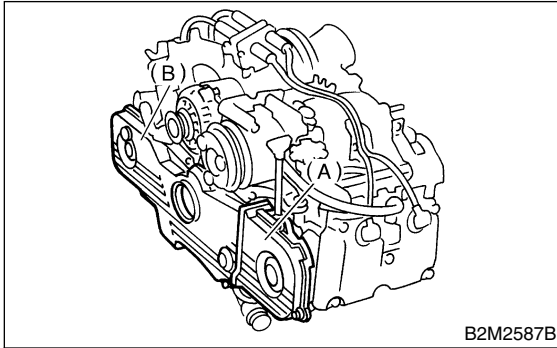
1) Make sure the V-belt is not worn or otherwise damaged.

2) Check the tension of the belt. <Ref. to ME-43, INSPECTION, V-belt.>

14. Belt Cover S173582

A: REMOVAL S173582A18

- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover (LH).
- 4) Remove front belt cover.



- (A) Belt cover (LH)
(B) Front belt cover

B: INSTALLATION S173582A11

- 1) Install front belt cover.

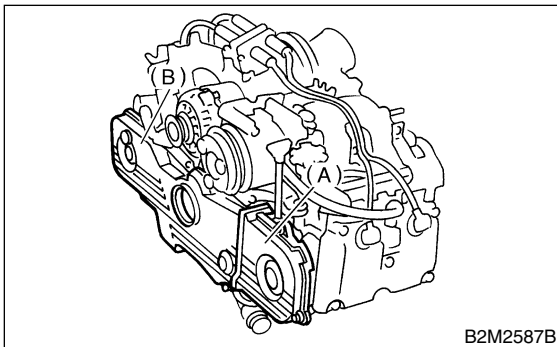
Tightening torque:

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-44, INSTALLATION, Crankshaft Pulley.>
- 4) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: INSPECTION S173582A10

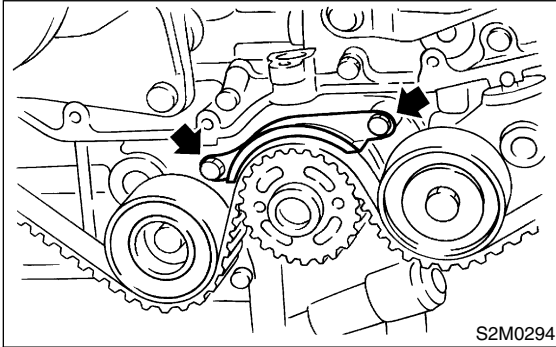
Make sure the cover is not damaged.

15. Timing Belt Assembly S173099

A: REMOVAL S173099A18

1. TIMING BELT S173099A1801

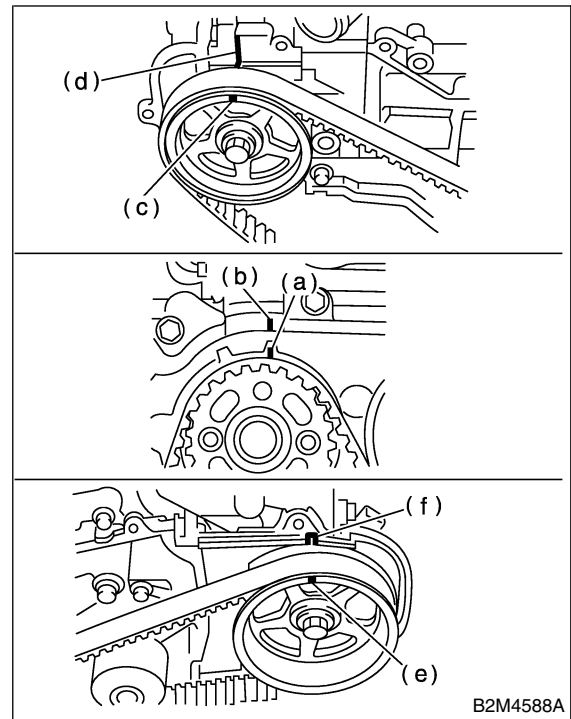
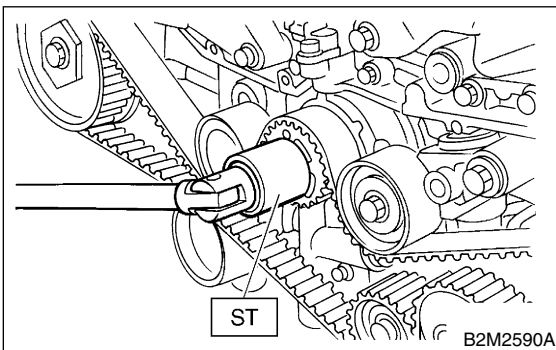
- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt guide. (MT vehicle only)



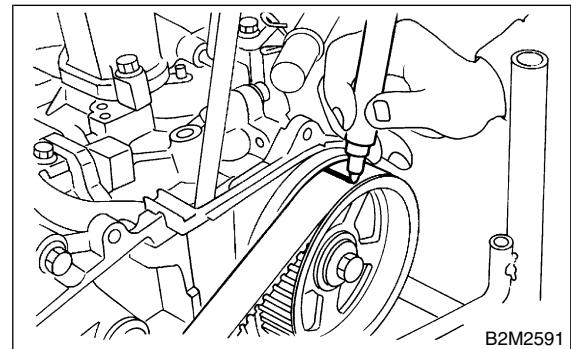
5) If alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as shown in procedures below.

- (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



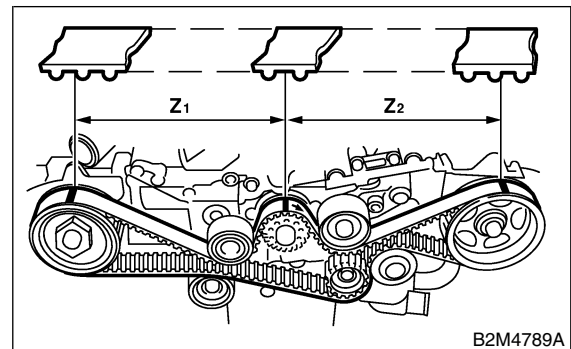
(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the crank sprocket and cam sprockets.



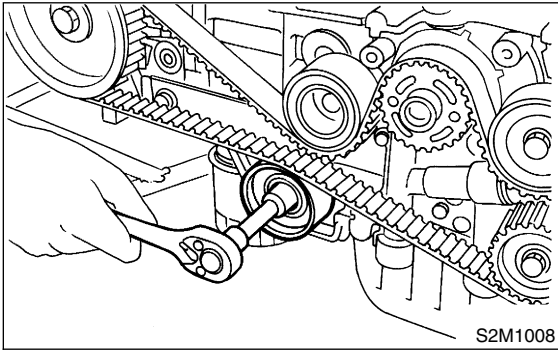
Specified data:

Z_1 : 46.8 tooth length

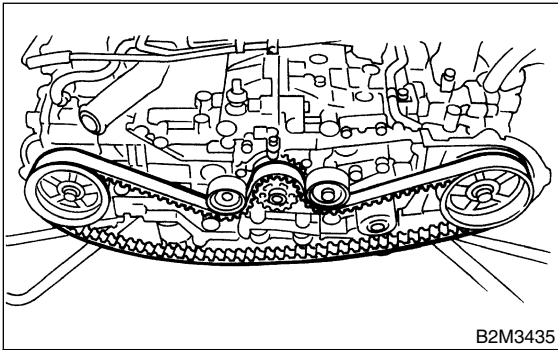
Z_2 : 43.7 tooth



- 6) Remove belt idler (No. 2).
- 7) Remove belt idler No. 2.



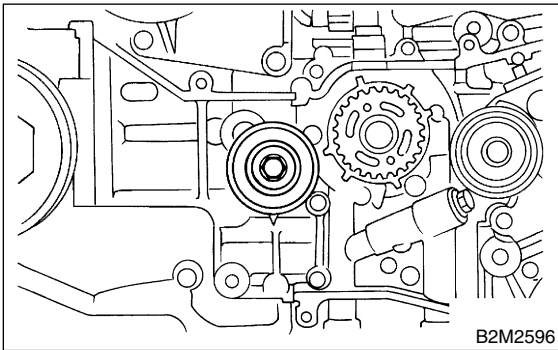
- 8) Remove timing belt.



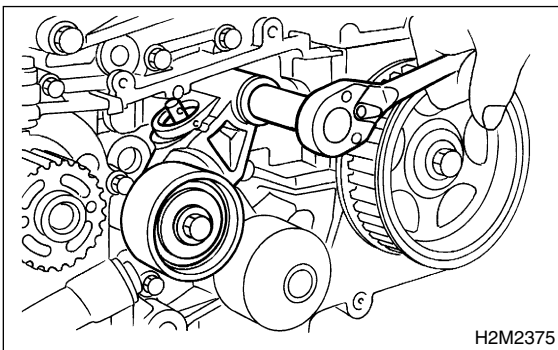
2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

S173099A1802

- 1) Remove belt idler (No. 1).



- 2) Remove automatic belt tension adjuster assembly.



B: INSTALLATION

S173099A11

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

S173099A1101

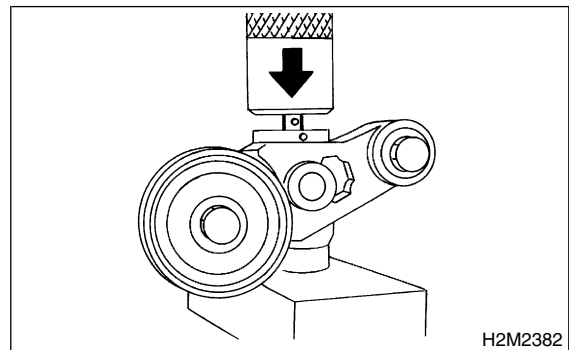
- 1) Preparation for installation of automatic belt tension adjuster assembly;

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.

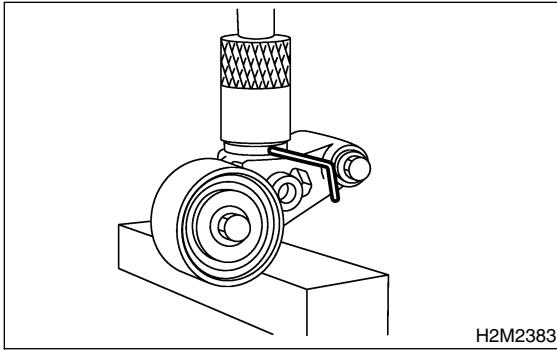
- (2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



TIMING BELT ASSEMBLY

Mechanical

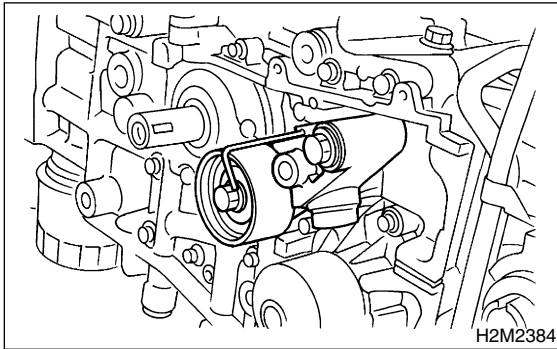
(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



2) Install automatic belt tension adjuster assembly.

Tightening torque:

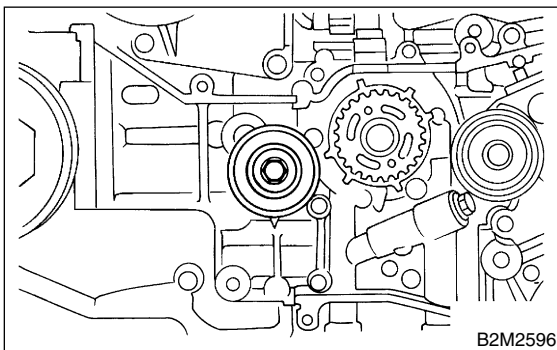
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install belt idler (No. 1).

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



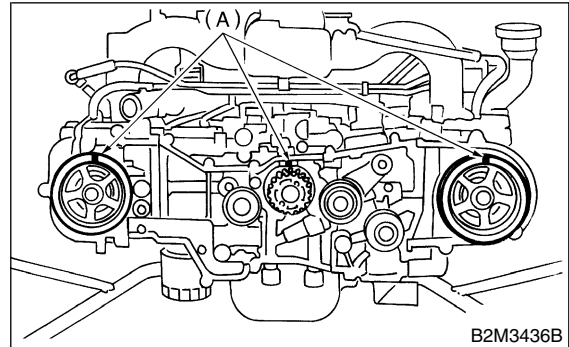
2. TIMING BELT S173099A1102

1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME-47, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

2) Installation of timing belt

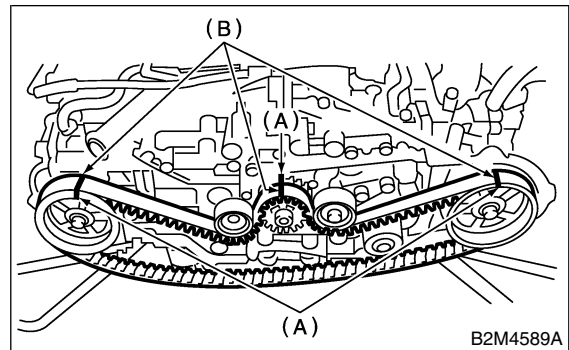
(1) Turn camshaft sprocket No. 2 using ST1, and turn camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

ST1 499207100 CAMSHAFT SPROCKET WRENCH



(2) While aligning alignment mark (B) on timing belt with marks on sprockets (A), position timing belt properly.

CAUTION:
Ensure belt's rotating direction is correct.



3) Install belt idler No. 2.

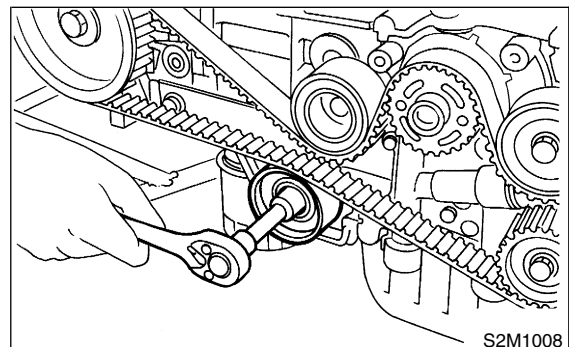
Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

4) Install belt idler (No. 2).

Tightening torque:

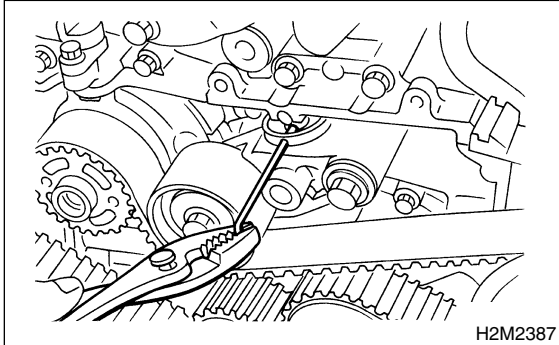
39 N·m (4.0 kgf-m, 28.9 ft-lb)



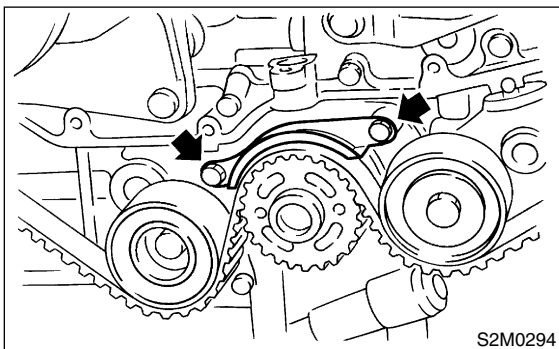
5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove stopper pin from belt tensioner adjuster.

CAUTION:

After properly installing timing belt, remove rocker cover and ensure that the valve lash adjuster contains no air.



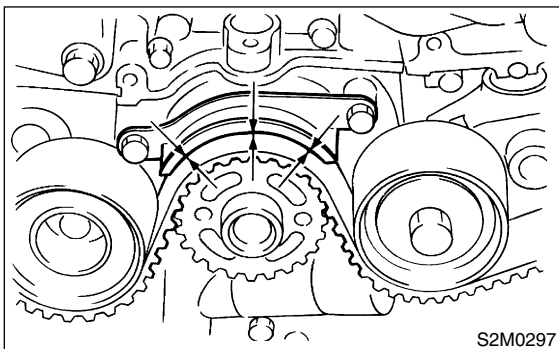
- 6) Install timing belt guide. (MT vehicles only)
(1) Temporarily tighten remaining bolts.



- (2) Check and adjust clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:

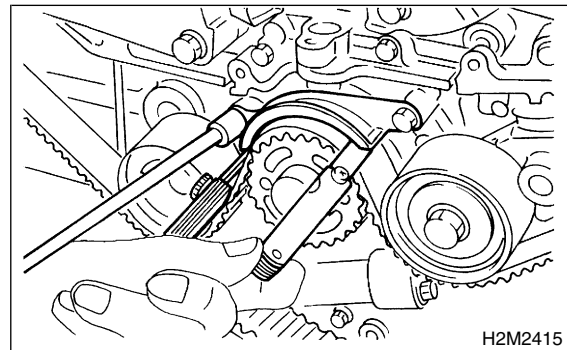
$1.0 \pm 0.5 \text{ mm } (0.039 \pm 0.020 \text{ in})$



- (3) Tighten remaining bolts.

Tightening torque:

$9.8 \text{ N}\cdot\text{m } (1.0 \text{ kgf}\cdot\text{m}, 7.2 \text{ ft}\cdot\text{lb})$



- 7) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>
8) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft Pulley.>
9) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: INSPECTION

S173099A10

1. TIMING BELT

S173099A1001

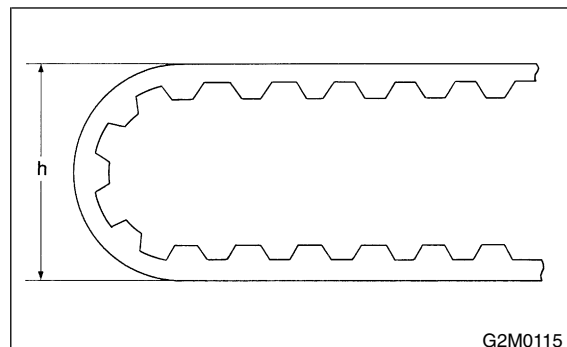
- 1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.
2) Check the condition of back side of belt; if any crack is found, replace belt.

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

$60 \text{ mm } (2.36 \text{ in}) \text{ or more}$



2. AUTOMATIC BELT TENSION ADJUSTER

S173099A1002

- 1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.

CAUTION:

Slight traces of oil at rod's oil seal does not indicate a problem.

2) Check that the adjuster rod does not move when a pressure of 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.

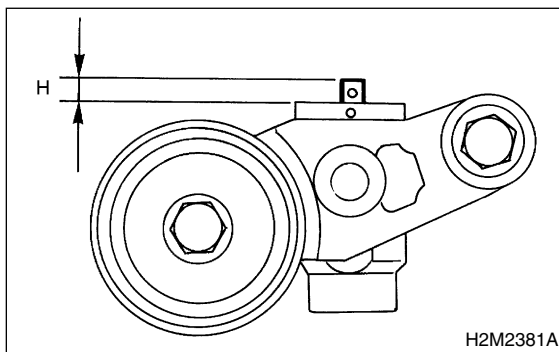
CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- 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*

$5.7 \pm 0.5 \text{ mm } (0.224 \pm 0.020 \text{ in})$



3. BELT TENSION PULLEY S173099A1003

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 S173099A1004

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.

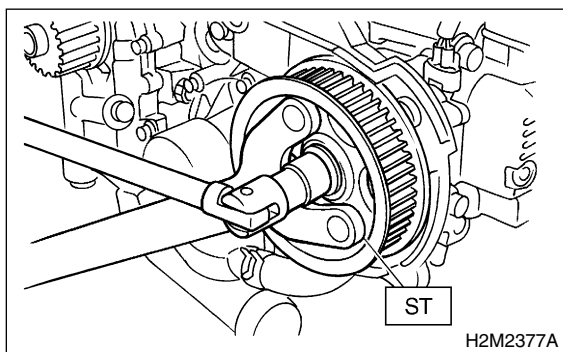
3) Check belt idler for grease leakage.

16. Camshaft Sprocket S173097

A: REMOVAL S173097A18

- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket No. 1 and No. 2. To lock camshaft, use ST.

ST 499207100 CAMSHAFT SPROCKET
WRENCH



- 4) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft Pulley.>
- 5) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: INSPECTION S173097A10

- 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.

B: INSTALLATION S173097A11

- 1) Install camshaft sprocket No. 1 and No. 2. To lock camshaft, use ST.

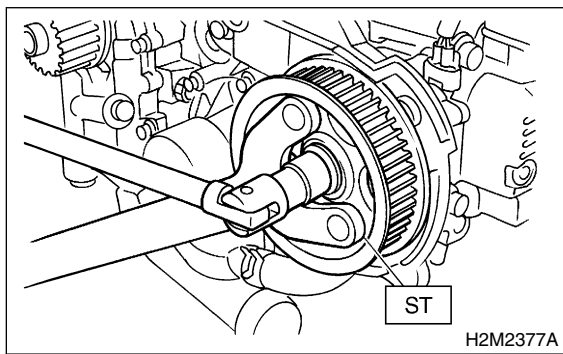
ST 499207100 CAMSHAFT SPROCKET
WRENCH

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.



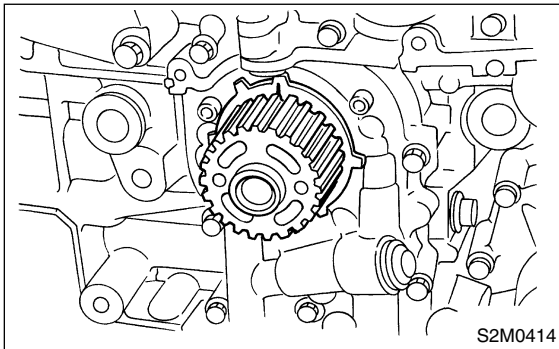
- 2) Install timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>
- 3) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>

CRANKSHAFT SPROCKET

17. Crankshaft Sprocket S173101

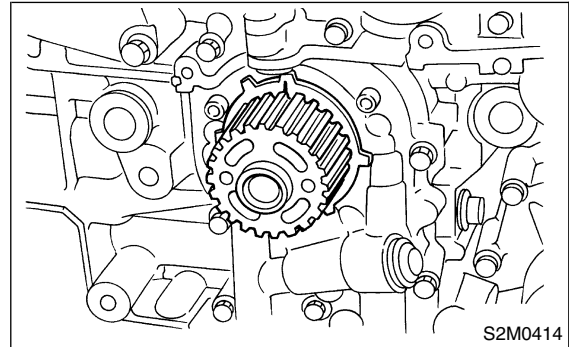
A: REMOVAL S173101A18

- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove crankshaft sprocket.



B: INSTALLATION S173101A11

- 1) Install crankshaft sprocket.



- 2) Install camshaft sprocket. <Ref. to ME-51, INSTALLATION, Camshaft Sprocket.>
- 3) Install timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>
- 4) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>
- 5) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Camshaft Pulley.>
- 6) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: INSPECTION S173101A10

- 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.

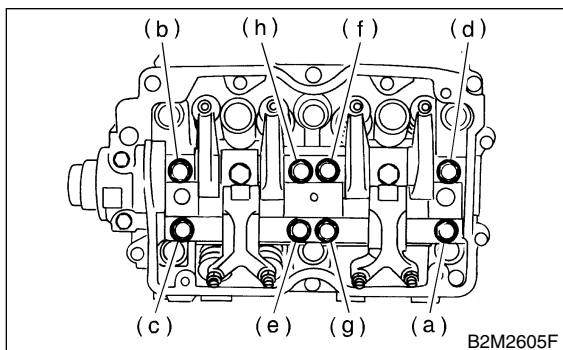
18. Valve Rocker Assembly S173094

A: REMOVAL S173094A18

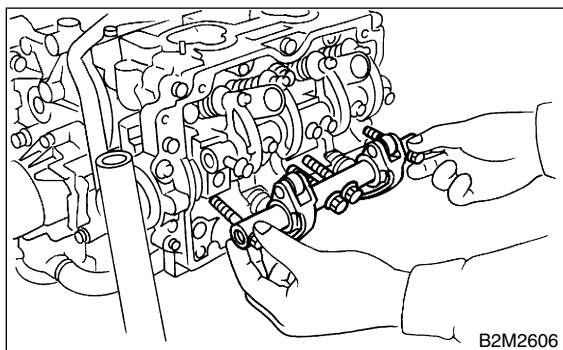
- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME-51, 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.

CAUTION:

Leave two or three threads of bolts (g and h) engaged to retain valve rocker assembly.



- (2) Remove valve rocker assembly.



B: INSTALLATION S173094A11

- 1) Installation of valve rocker assembly
 - (1) Temporarily tighten bolts (a) through (d) equally as shown in figure.

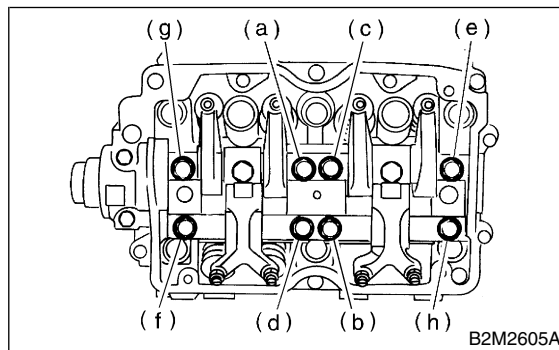
CAUTION:

Do not allow valve rocker assembly to gouge knock pins.

- (2) Tighten bolts (e) through (h) to specified torque.
- (3) Tighten bolts (a) through (d) to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 2) Adjust the valve clearances. <Ref. to ME-31, ADJUSTMENT, Valve Clearance.>
- 3) Install rocker cover and connect PCV hose.
- 4) Install camshaft sprocket. <Ref. to ME-51, INSTALLATION, Camshaft Sprocket.>
- 5) Install timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>
- 6) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>
- 7) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft Pulley.>
- 8) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: DISASSEMBLY S173094A06

- 1) Remove bolts which secure rocker shaft.
- 2) Extract rocker shaft. Remove valve rocker arms, springs, plates and shaft supports from rocker shaft.

CAUTION:

Arrange all removed parts in order so that they can be installed in their original positions.

- 3) Remove nut and adjuster screw from valve rocker.

D: ASSEMBLY S173094A02

- 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)

CAUTION:

Valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure parts with same markings are properly assembled.

VALVE ROCKER ASSEMBLY

Mechanical

3) Install valve rocker shaft securing bolts.

E: INSPECTION S173094A10

1. VALVE ROCKER ARM S173094A1001

1) Measure inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

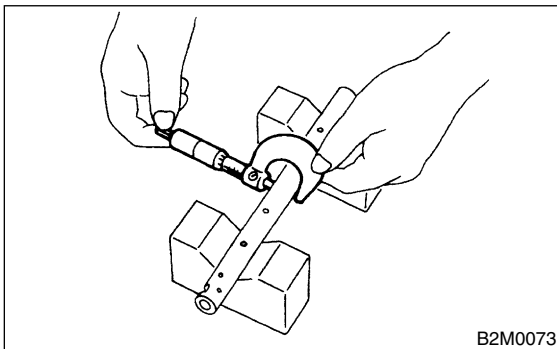
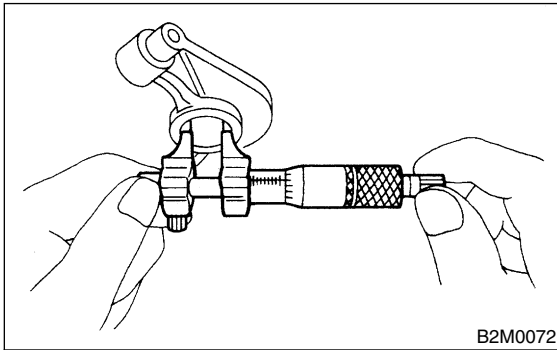
Clearance between arm and shaft:

Standard

0.020 — 0.054 mm (0.0008 — 0.0021 in)

Limit

0.10 mm (0.0039 in)



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) Measure inside diameter of rocker shaft support and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

Clearance between support and shaft:

Standard

0.005 — 0.039 mm (0.0002 — 0.0015 in)

Limit

0.05 mm (0.0020 in)

4) If oil clearance exceeds the limit, replace rocker shaft support or shaft, whichever shows greater amount of wear.

Rocker shaft support inside diameter:

22.005 — 22.026 mm (0.8663 — 0.8672 in)

Rocker shaft diameter:

21.987 — 22.000 mm (0.8656 — 0.8661 in)

5) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace valve rocker arm.

6) Check that valve rocker arm roller rotates smoothly. If not, replace valve rocker arm.

2. INTAKE AND EXHAUST VALVE ROCKER SHAFT S173094A1002

Visually check oil relief valve of shaft end for any of the following abnormalities.

- Breaks in check ball body
- Foreign particles caught in valve spring
- Oil leakage at check ball

CAUTION:

Repair or replace valve rocker shaft as necessary.

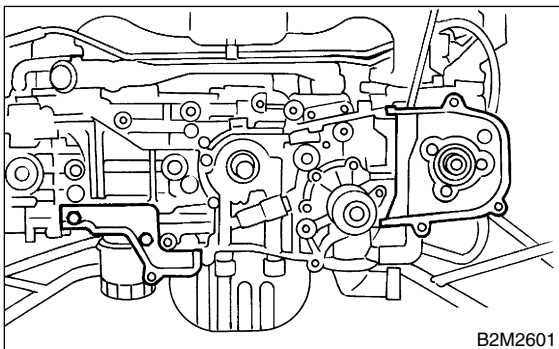
19. Camshaft S173092

A: REMOVAL S173092A18

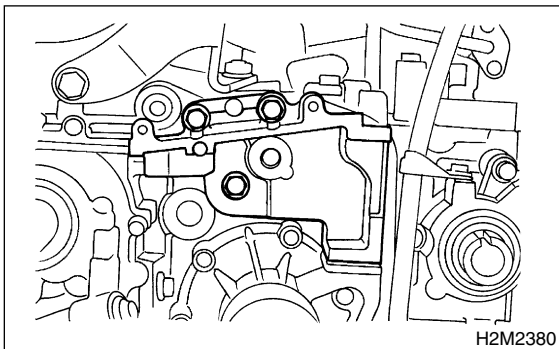
- 1) Remove V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove crankshaft sprocket. <Ref. to ME-52, REMOVAL, Crankshaft Sprocket.>
- 7) Remove belt cover No. 2 (LH).
- 8) Remove belt cover No. 2 (RH).

CAUTION:

Do not damage or lose the seal rubber when removing belt covers.

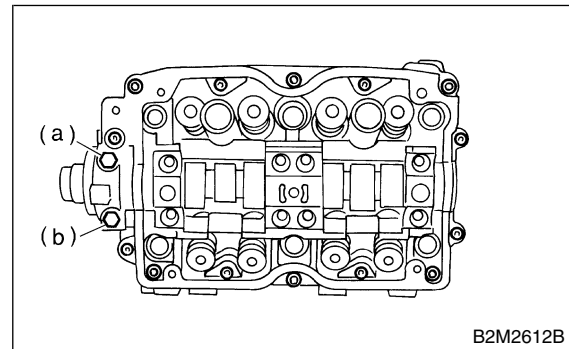


- 9) Remove tensioner bracket.

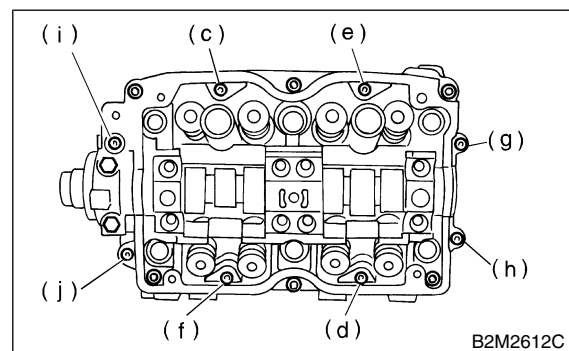


- 10) Remove camshaft position sensor support. (LH side only)
- 11) Remove oil level gauge guide. (LH side only)
- 12) Remove valve rocker assembly. <Ref. to ME-53, REMOVAL, Valve Rocker Assembly.>
- 13) Remove camshaft cap.

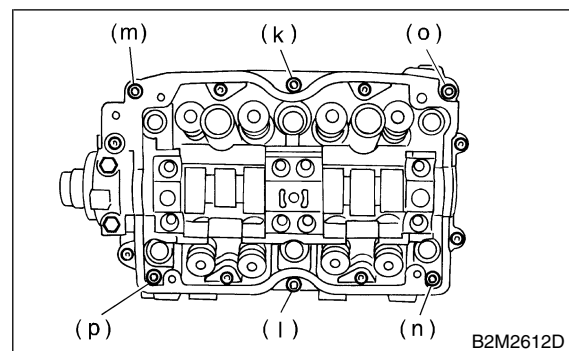
- (1) Remove bolts (a) through (b) in alphabetical sequence.



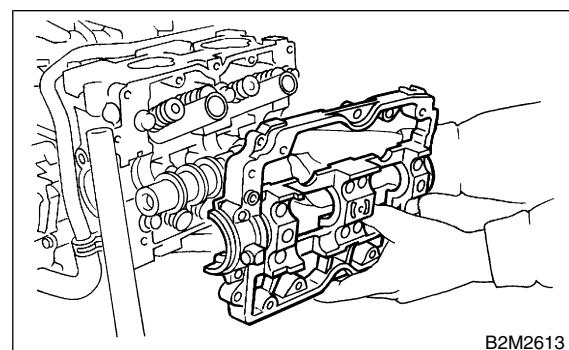
- (2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.



- (3) Remove bolts (k) through (p) in alphabetical sequence using ST.
- ST 499497000 TORX PLUS



- (4) Remove camshaft cap.



- 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

S173092A11

1) Apply a coat of engine oil to camshaft journals and install camshaft.

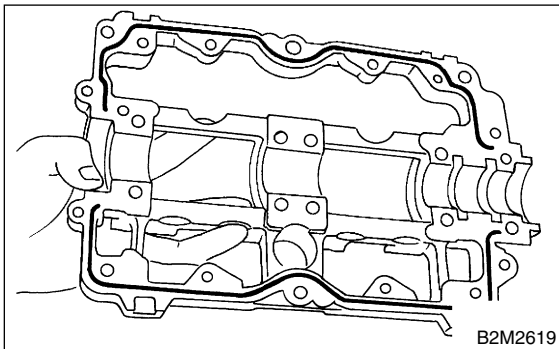
2) Install camshaft cap.

(1) Apply liquid gasket on the around of camshaft cap.

Liquid gasket:

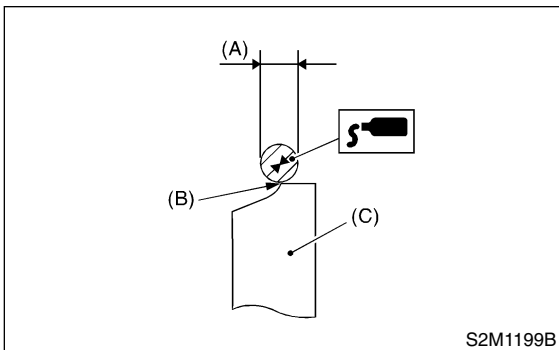
THREE BOND 1280B

P/N K0877YA018

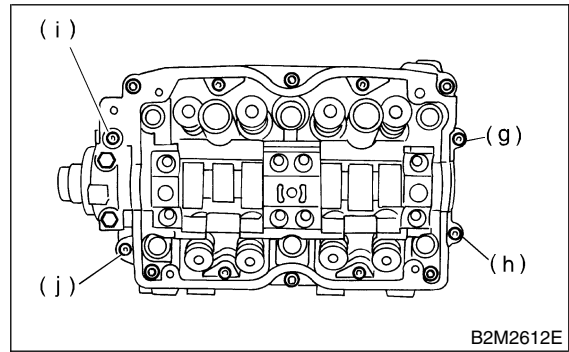


NOTE:

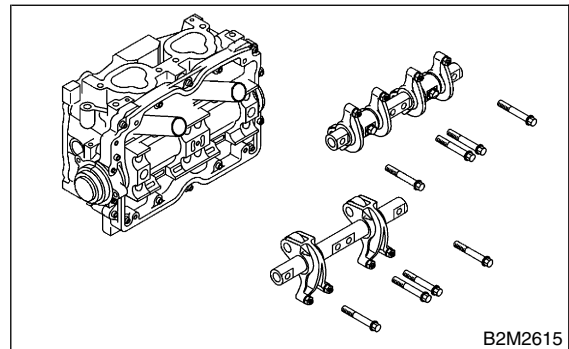
Apply a 3 mm (0.12 in) diameter (A) continuous strip of liquid gasket along edge (B) of camshaft cap (C) mating surface.



(2) Temporarily tighten bolts (g) through (j) in alphabetical sequence.



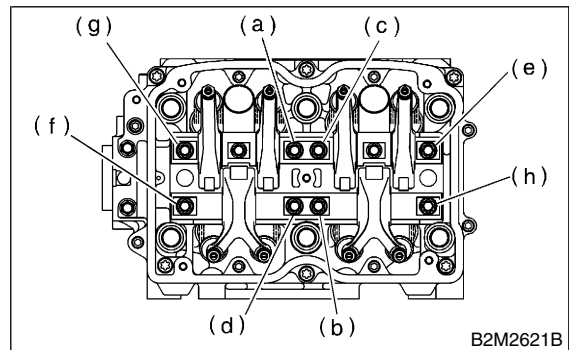
(3) Install valve rocker assembly.



(4) Tighten bolts (a) through (h) in alphabetical sequence.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

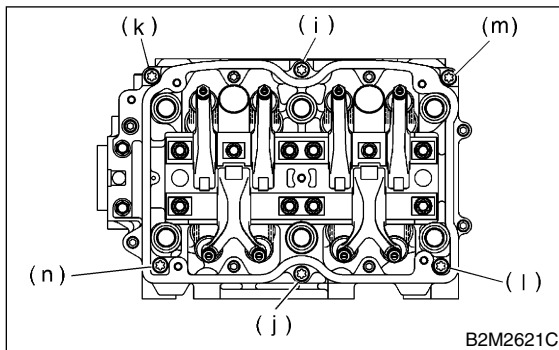


- (5) Tighten TORX bolts (i) through (n) in alphabetical sequence using ST.

ST 499427000 TORX PLUS

Tightening torque:

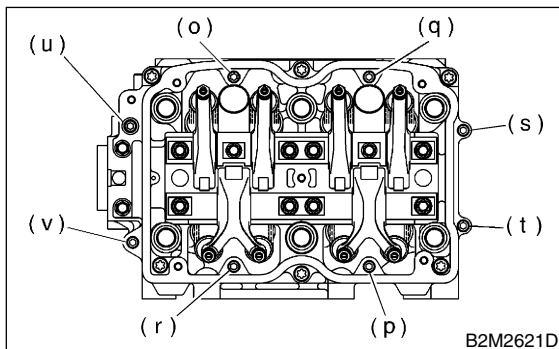
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- (6) Tighten bolts (o) through (v) in alphabetical sequence.

Tightening torque:

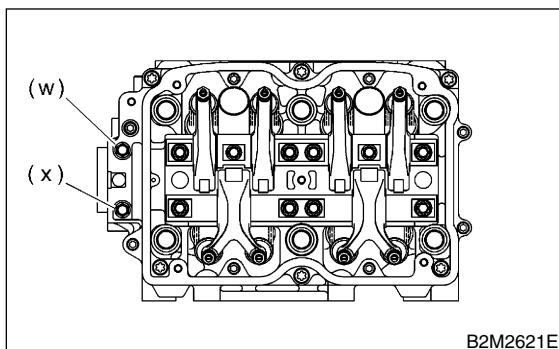
10 N·m (1.0 kgf-m, 7.2 ft-lb)



- (7) Tighten bolts (w) through (x) in alphabetical sequence.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)



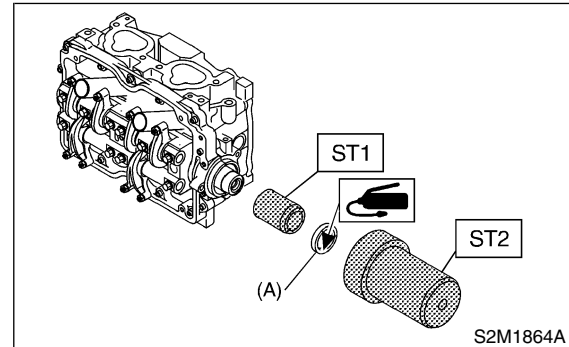
- 3) Apply a coat of grease to oil seal lips and install oil seal (A) on camshaft using ST1 and ST2.

CAUTION:

Use a new oil seal.

ST1 499597000 OIL SEAL GUIDE

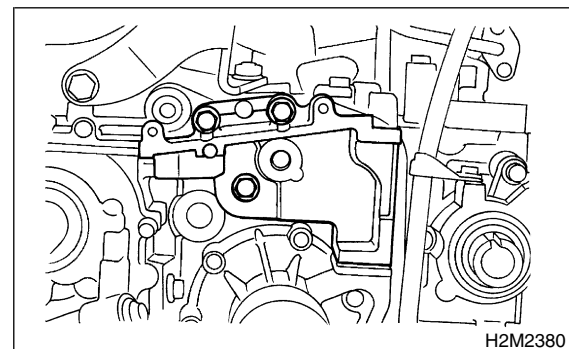
ST2 499587500 OIL SEAL INSTALLER



- 4) Install plug using ST.
ST 499587700 OIL SEAL INSTALLER
5) Adjust the valve clearance. <Ref. to ME-31, 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:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 10) Install belt cover No. 2 (RH).

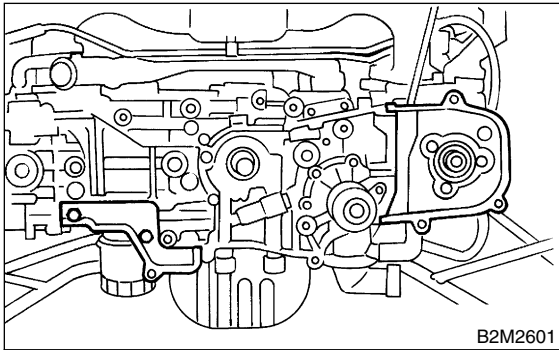
Tightening torque:

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 timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>

13) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>

14) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft Pulley.>

15) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

C: INSPECTION

S173092A10

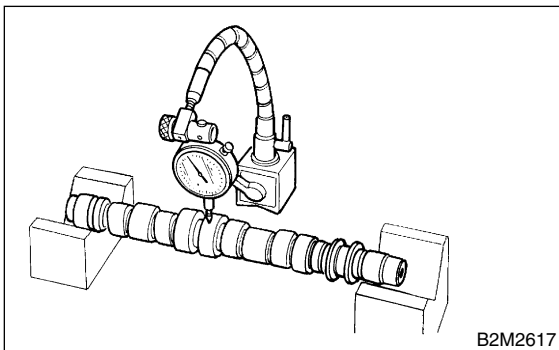
1. CAMSHAFT

S173092A1001

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.

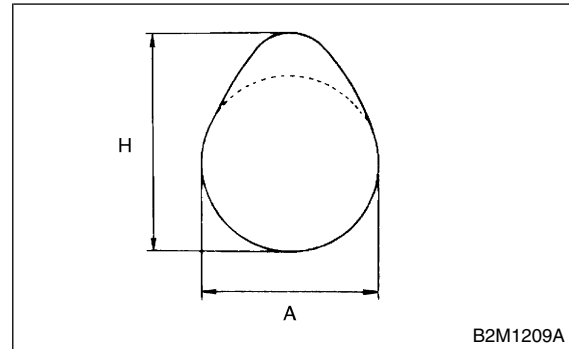
Cam height: H

Unit: mm (in)		
Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
	Limit	39.385 (1.5506)
Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
	Limit	39.157 (1.5416)

Cam base circle diameter A:

IN: 34.00 mm (1.3386 in)

EX: 34.00 mm (1.3386 in)



2. CAMSHAFT SUPPORT

S173092A1002

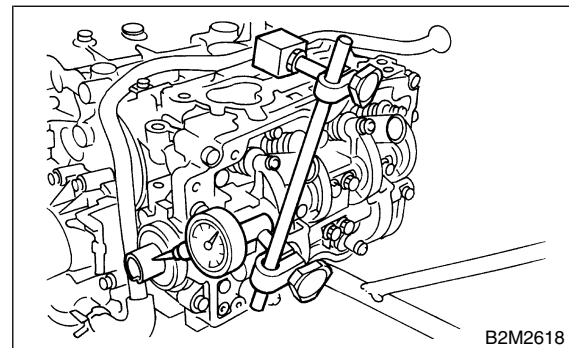
Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace camshaft support.

Standard:

0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:

0.10 mm (0.0039 in)



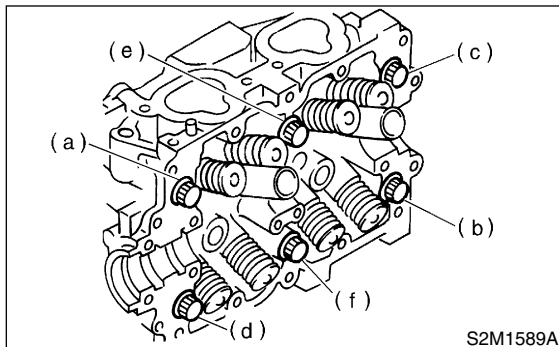
20. Cylinder Head Assembly S173093

A: REMOVAL S173093A18

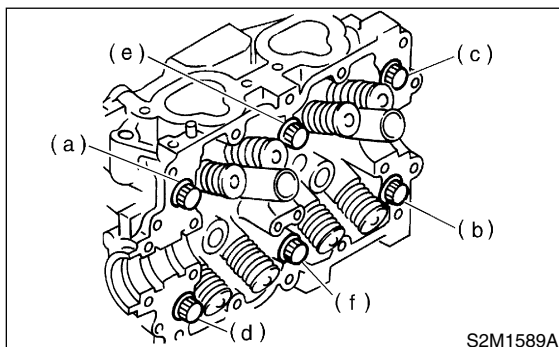
- 1) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME-51, REMOVAL, Camshaft Sprocket.>
- 6) Remove intake manifold. <Ref. to FU-15, REMOVAL, Intake Manifold.>
- 7) Remove bolt which installs A/C compressor bracket on cylinder head.
- 8) Remove valve rocker assembly. <Ref. to ME-53, REMOVAL, Valve Rocker Assembly.>
- 9) Remove camshaft. <Ref. to ME-55, REMOVAL, Camshaft.>
- 10) Remove cylinder head bolts in alphabetical sequence shown in figure.

CAUTION:

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 (b) 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 S173093A11

1. CYLINDER HEAD S173093A1102

- 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 oil pump.

- 2) Tighten cylinder head bolts.
 - (1) Apply a 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° first; back them off by 180° again.
 - (4) Tighten bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb).
 - (5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).
 - (6) Tighten all bolts by 80 to 90° in alphabetical sequence.

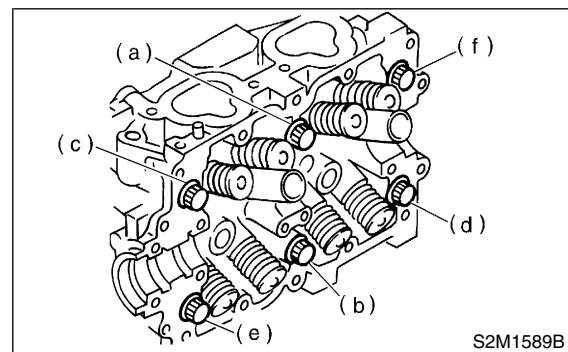
CAUTION:

Do not tighten bolts more than 90°.

- (7) Further tighten all bolts by 80 to 90° in alphabetical sequence shown in figure below.

CAUTION:

Ensure that the total "re-tightening angle" [in the former two steps], do not exceed 180°.



- 3) Install camshaft. <Ref. to ME-56, INSTALLATION, Camshaft.>
- 4) Install valve rocker assembly. <Ref. to ME-53, INSTALLATION, Valve Rocker Assembly.>
- 5) Install A/C compressor bracket on cylinder head.

CYLINDER HEAD ASSEMBLY

Mechanical

- 6) Install intake manifold. <Ref. to FU-18, INSTALLATION, Intake Manifold.>
- 7) Install camshaft sprocket. <Ref. to ME-51, INSTALLATION, Camshaft Sprocket.>
- 8) Install timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>
- 9) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>
- 10) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft Pulley.>
- 11) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>

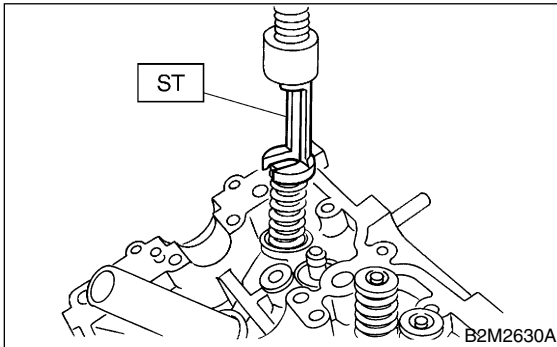
C: DISASSEMBLY

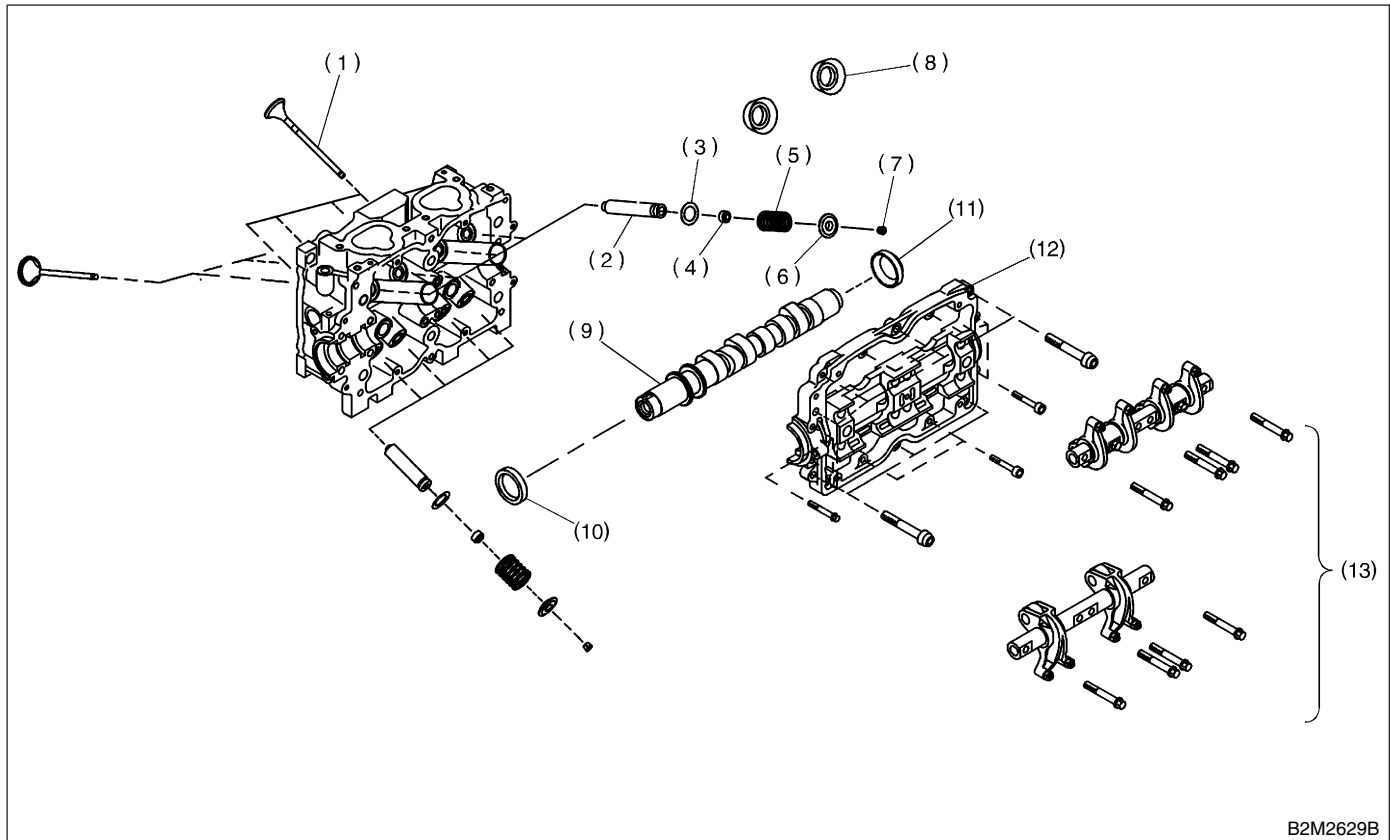
S173093A06

- 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 S173093A02

B2M2629B

(1) Valve	(6) Retainer	(11) Plug
(2) Valve guide	(7) Retainer key	(12) Camshaft cap
(3) Valve spring seat	(8) Spark plug gasket	(13) Valve rocker ASSY
(4) Oil seal	(9) Camshaft	
(5) Valve spring	(10) Oil seal	

- 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.

CAUTION:

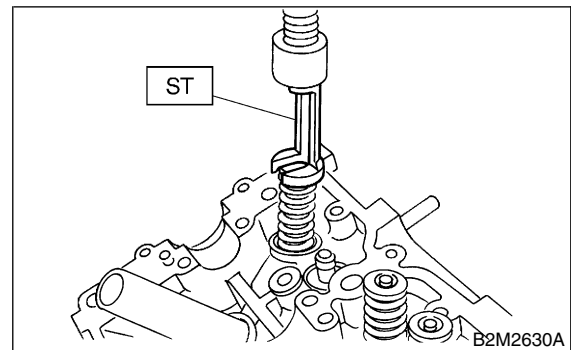
When inserting valve into valve guide, use special care not to damage the oil seal lip.

- (3) Install valve spring and retainer.

CAUTION:

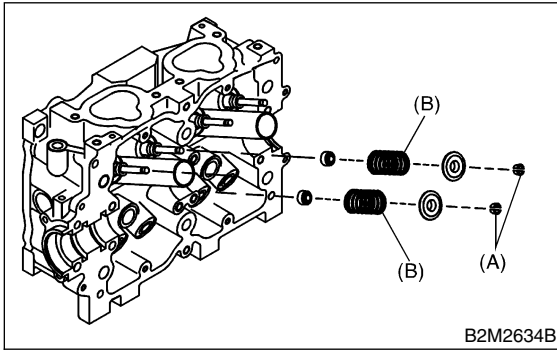
Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

- (4) Set ST on valve spring.
 ST 499718000 VALVE SPRING REMOVER



CYLINDER HEAD ASSEMBLY

- (5) Compress valve spring and fit valve spring retainer key.



- (A) Retainer key
(B) Painted face

- (6) After installing, tap valve spring retainers lightly with wooden hammer for better seating.

E: INSPECTION

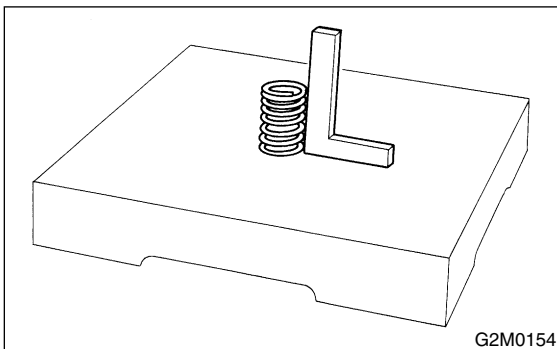
S173093A10

1. VALVE SPRING

S173093A1001

- 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	214.8 — 246.2 N (21.9 — 25.1 kgf, 48.3 — 55.3 lb)/ 45.0 mm (1.772 in)
	526.6 — 581.6 N (53.7 — 59.3 kgf, 118.4 — 130.8 lb)/34.7 mm (1.366 in)



2. INTAKE AND EXHAUST VALVE OIL SEAL

S173093A1002

Replace oil seal with new one, if lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced. Use pliers to pinch and remove oil seal from valve.

- 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:

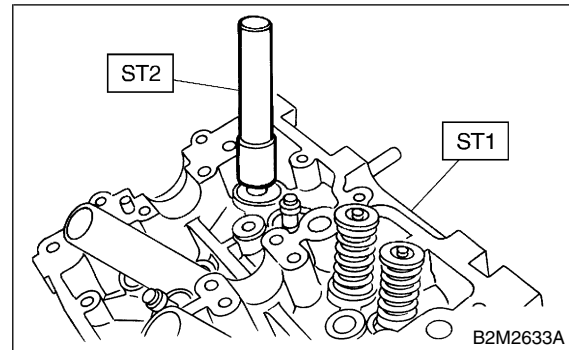
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]



F: ADJUSTMENT

S173093A01

1. CYLINDER HEAD

S173093A0101

- 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.

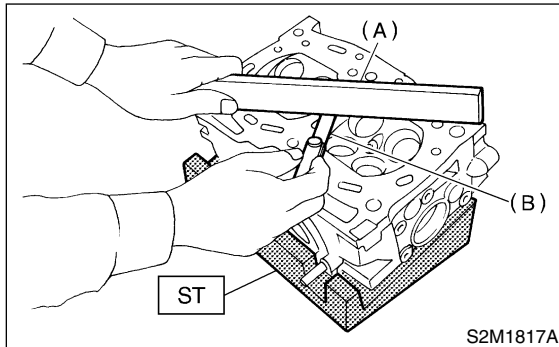
If the warping exceeds 0.05 mm (0.0020 in), regrind the surface with a surface grinder.

Warping limit:
0.05 mm (0.0020 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder head:
97.5 mm (3.839 in)

CAUTION:
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 S173093A0102

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

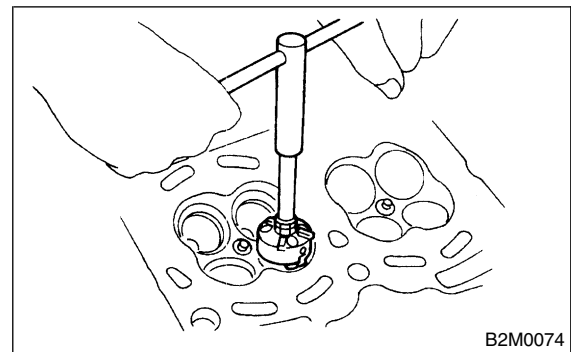
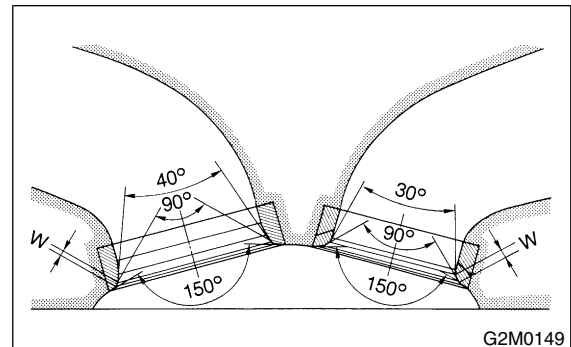
Standard 1.0 mm (0.039 in)

Limit 1.7 mm (0.067 in)

Exhaust

Standard 1.4 mm (0.055 in)

Limit 2.1 mm (0.083 in)



3. VALVE GUIDE S173093A0103

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.

CYLINDER HEAD ASSEMBLY

Mechanical

Clearance between the valve guide and valve stem:

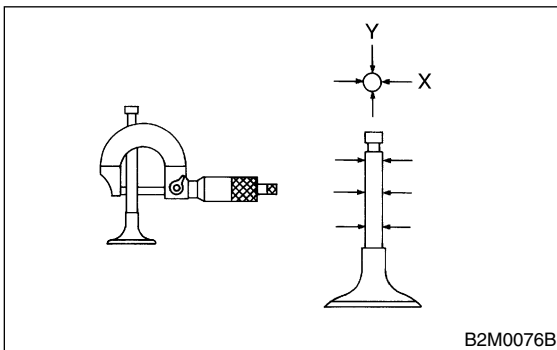
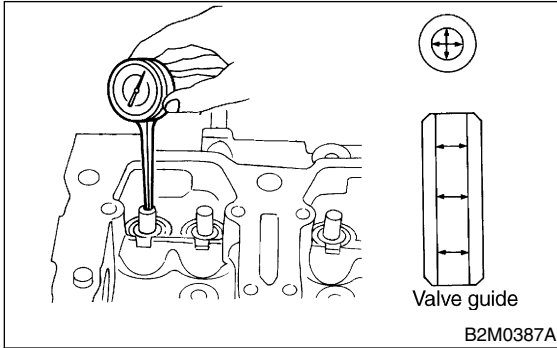
Standard

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)

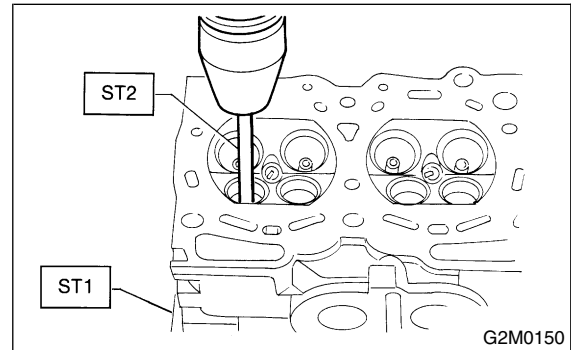
Exhaust

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



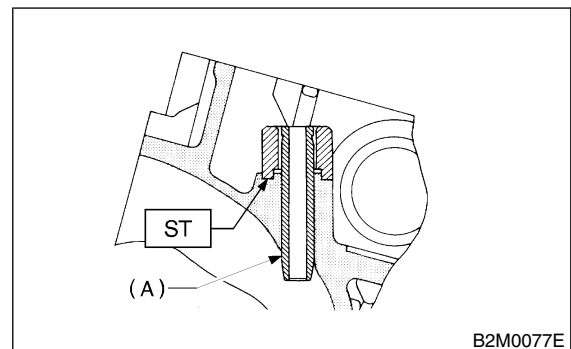
(3) Turn cylinder head upside down and place ST as shown in the figure.

Intake side:

ST 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST 499767800 VALVE GUIDE ADJUSTER

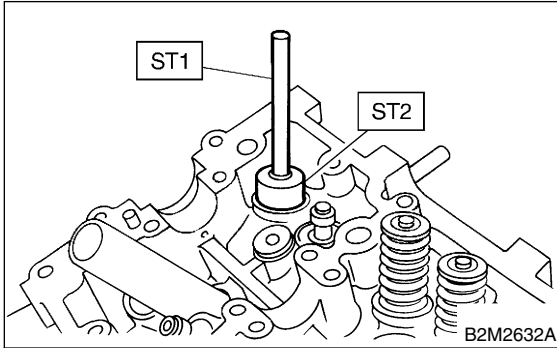


(A) Valve guide

(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.

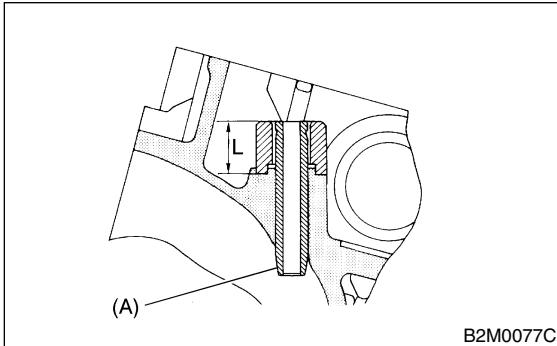
Valve guide protrusion: L

Intake

20.0 — 20.5 mm (0.787 — 0.807 in)

Exhaust

16.5 — 17.0 mm (0.650 — 0.669 in)



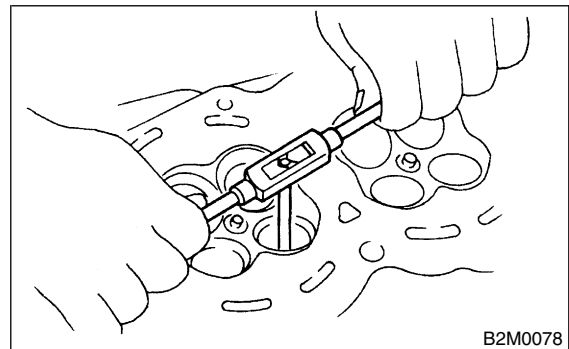
(A) Valve guide

(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into 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.

CYLINDER HEAD ASSEMBLY

Mechanical

4. INTAKE AND EXHAUST VALVE S173093A0104

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 1.0 mm (0.039 in)

Limit 0.6 mm (0.024 in)

Exhaust

Standard 1.2 mm (0.047 in)

Limit 0.6 mm (0.024 in)

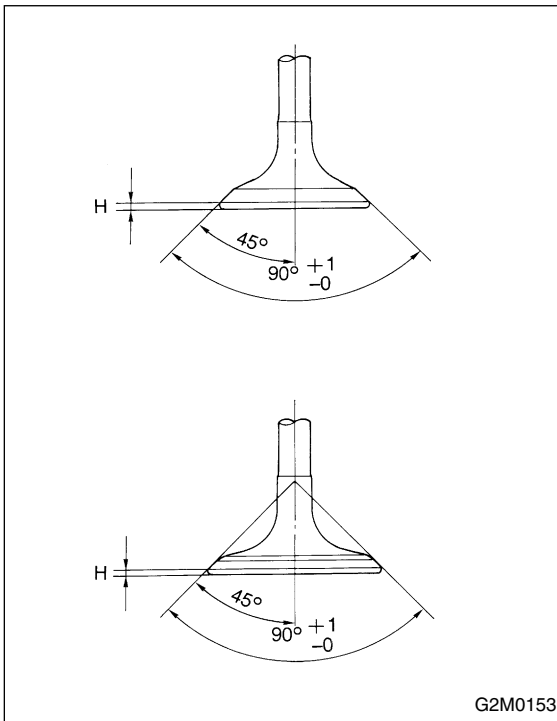
Valve overall length:

Intake

120.6 mm (4.75 in)

Exhaust

121.7 mm (4.79 in)



2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. <Ref. to ME-63, VALVE SEAT, ADJUSTMENT, Cylinder Head Assembly.> Install a new intake valve oil seal after lapping.

21. Cylinder Block S173090

A: REMOVAL S173090A18

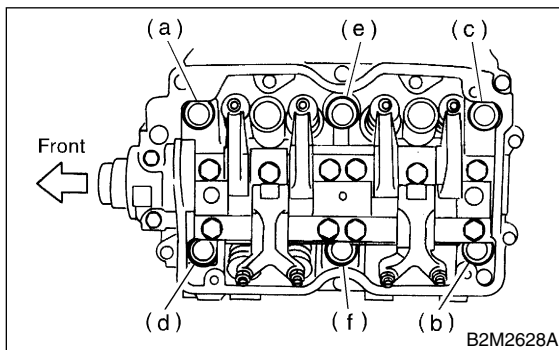
NOTE:

Before conducting this procedure, drain engine oil completely if applicable.

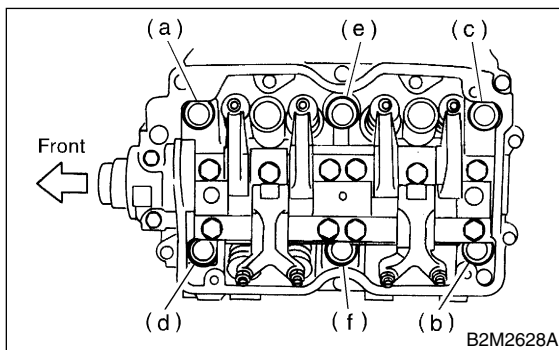
- 1) Remove intake manifold. <Ref. to FU-15, REMOVAL, Intake Manifold.>
- 2) Remove V-belt. <Ref. to ME-42, REMOVAL, V-belt.>
- 3) Remove crankshaft pulley. <Ref. to ME-44, REMOVAL, Crankshaft Pulley.>
- 4) Remove belt cover. <Ref. to ME-45, REMOVAL, Belt Cover.>
- 5) Remove timing belt assembly. <Ref. to ME-46, REMOVAL, Timing Belt Assembly.>
- 6) Remove camshaft sprocket. <Ref. to ME-51, REMOVAL, Camshaft Sprocket.>
- 7) Remove crankshaft sprocket. <Ref. to ME-44, REMOVAL, Crankshaft Sprocket.>
- 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.

CAUTION:

Leave bolts (a) and (b) 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 (b) to remove cylinder head.



- 13) Remove cylinder head gasket.

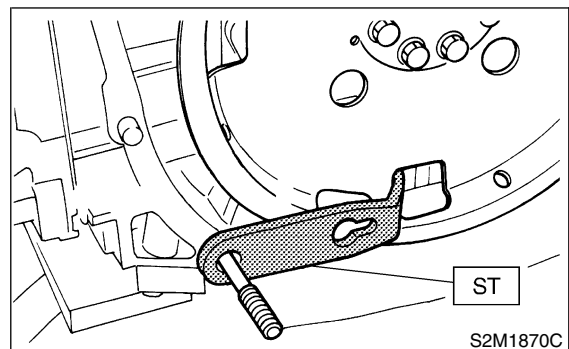
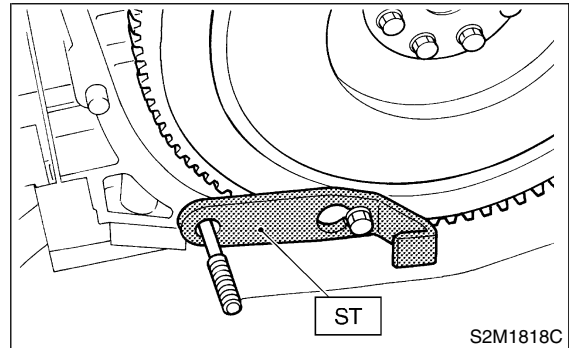
CAUTION:

Do not scratch the mating surface of cylinder head and cylinder block.

- 14) Similarly, remove right side cylinder head.
- 15) Remove clutch housing cover (MT vehicles only).
- 16) Remove flywheel (MT vehicles only) or drive plate (AT vehicles only).

Using ST, lock crankshaft.

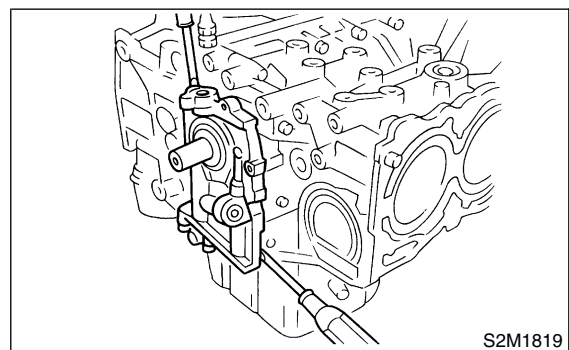
ST 498497100 CRANKSHAFT STOPPER



- 17) Remove oil separator cover.
 - 18) Remove water by-pass pipe for heater.
 - 19) Remove water pump.
 - 20) Remove oil pump from cylinder block.
- Use a flat-bladed screwdriver as shown in figure when removing oil pump.

CAUTION:

Be careful not to scratch the mating surface of cylinder block and oil pump.



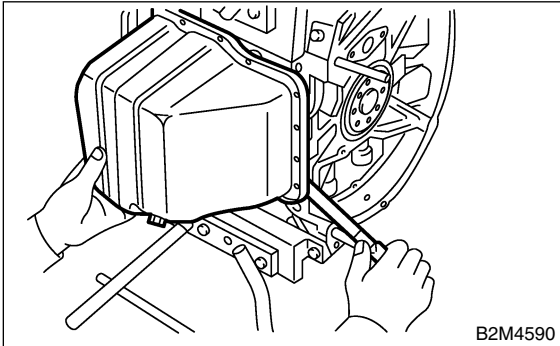
CYLINDER BLOCK

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.

CAUTION:

Do not use a screwdriver or similar tool in place of oil pan cutter.



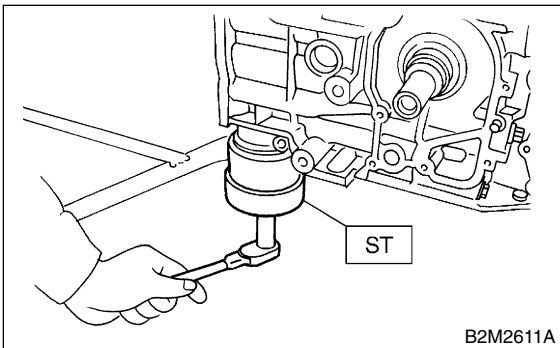
22) Remove oil strainer stay.

23) Remove oil strainer.

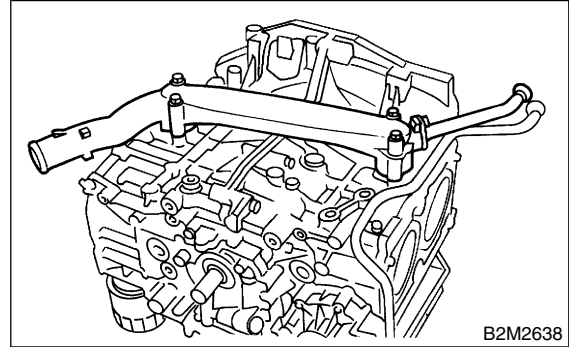
24) Remove baffle plate.

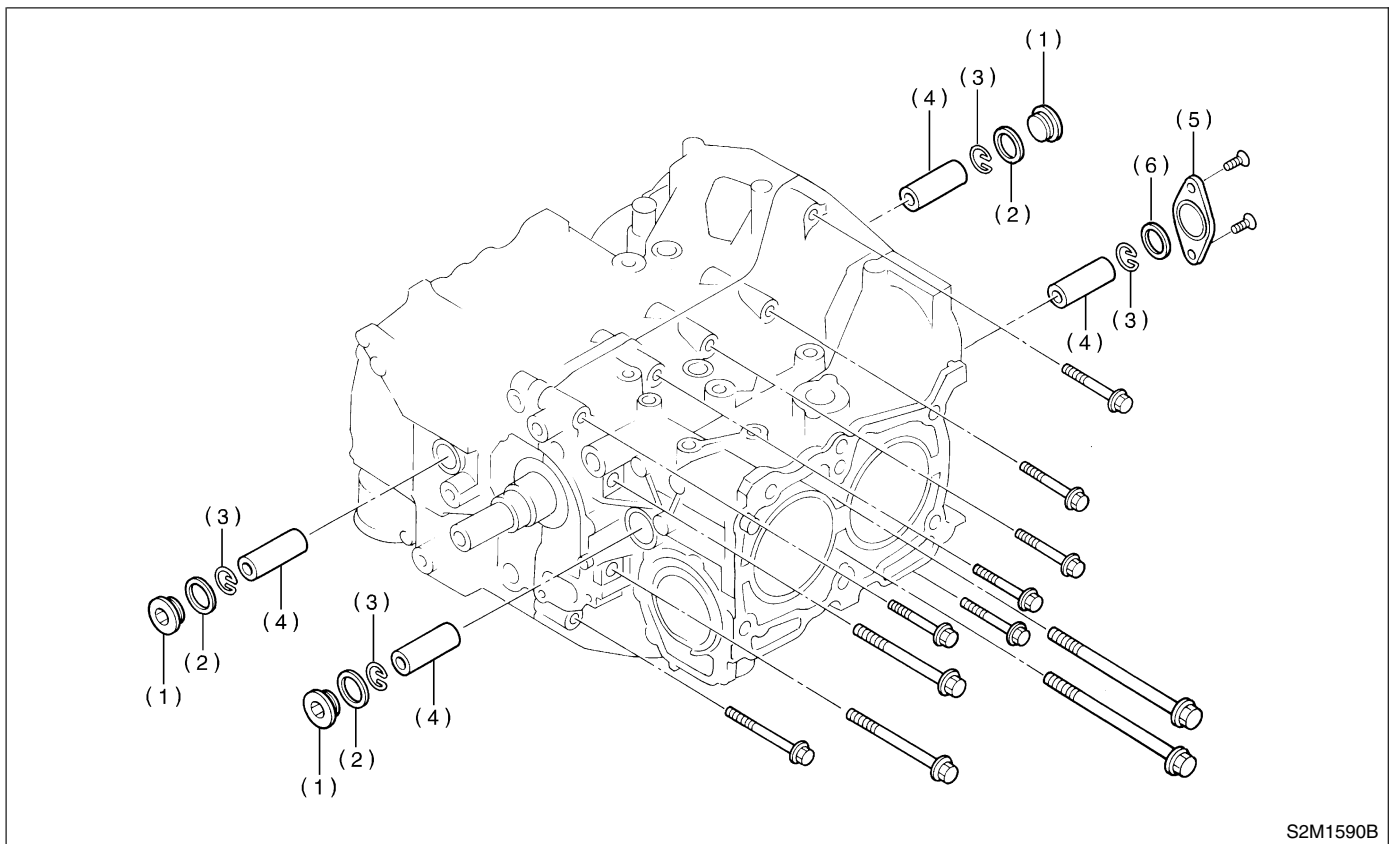
25) Remove oil filter using ST.

ST 498547000 OIL FILTER WRENCH



26) Remove water pipe.





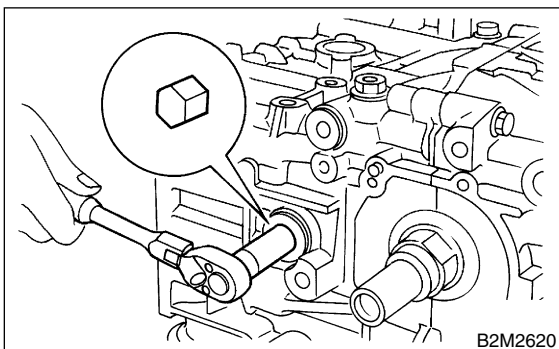
S2M1590B

- (1) Service hole plug
- (2) Gasket

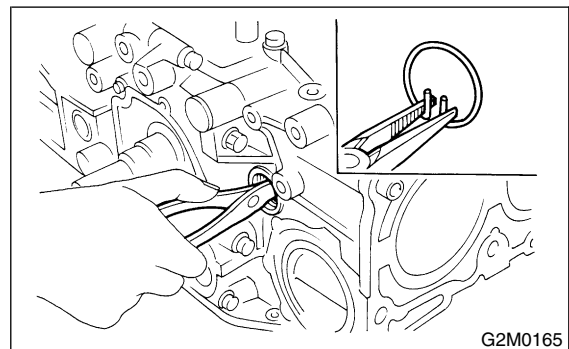
- (3) Circlip
- (4) Piston pin

- (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 circlip through service hole of #1 and #2 cylinders.



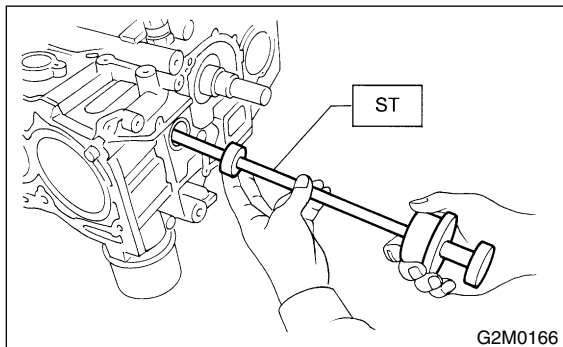
CYLINDER BLOCK

29) Draw out piston pin from #1 and #2 pistons using ST.

ST 499097700 PISTON PIN REMOVER

CAUTION:

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.

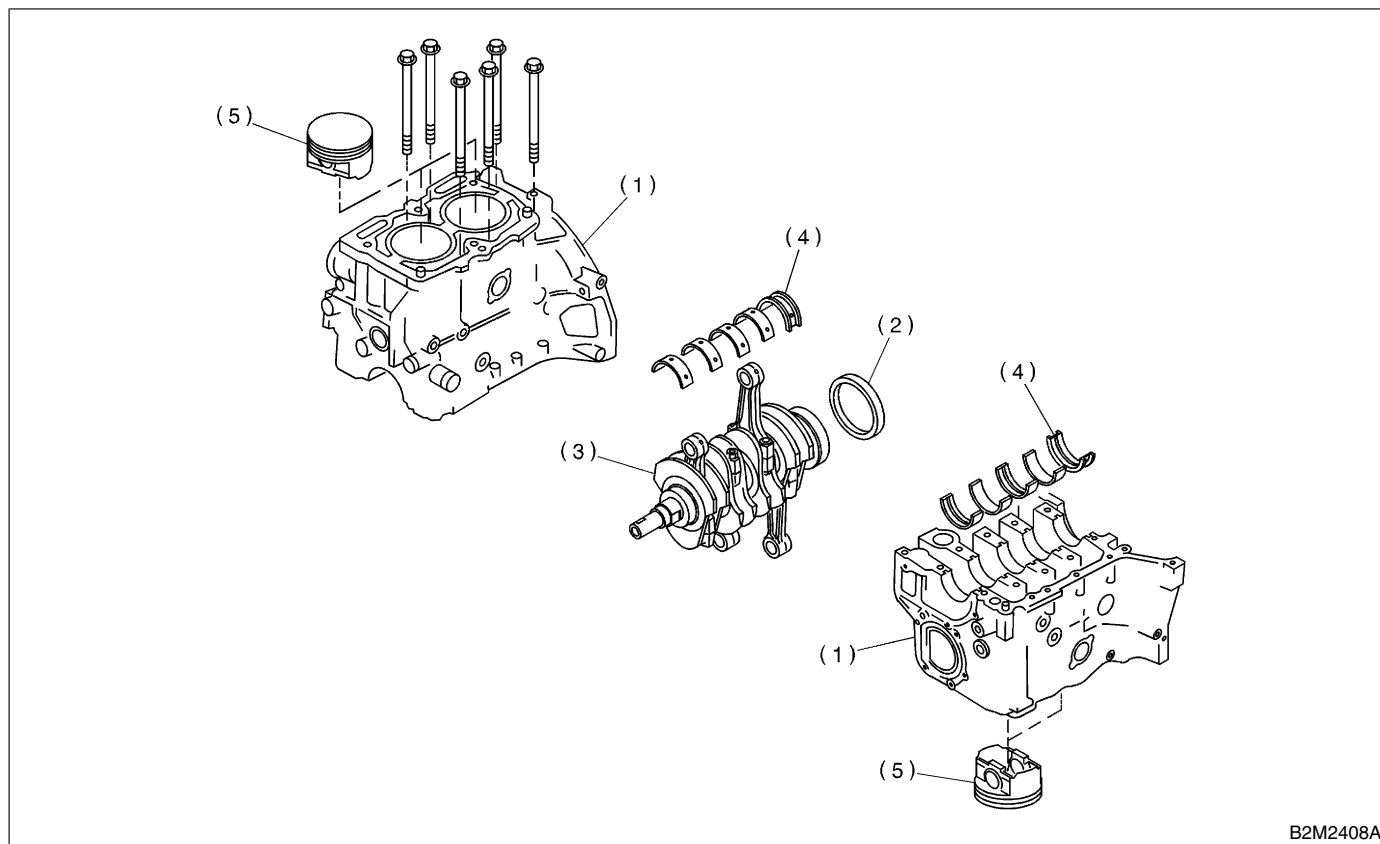
32) Back off bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

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.

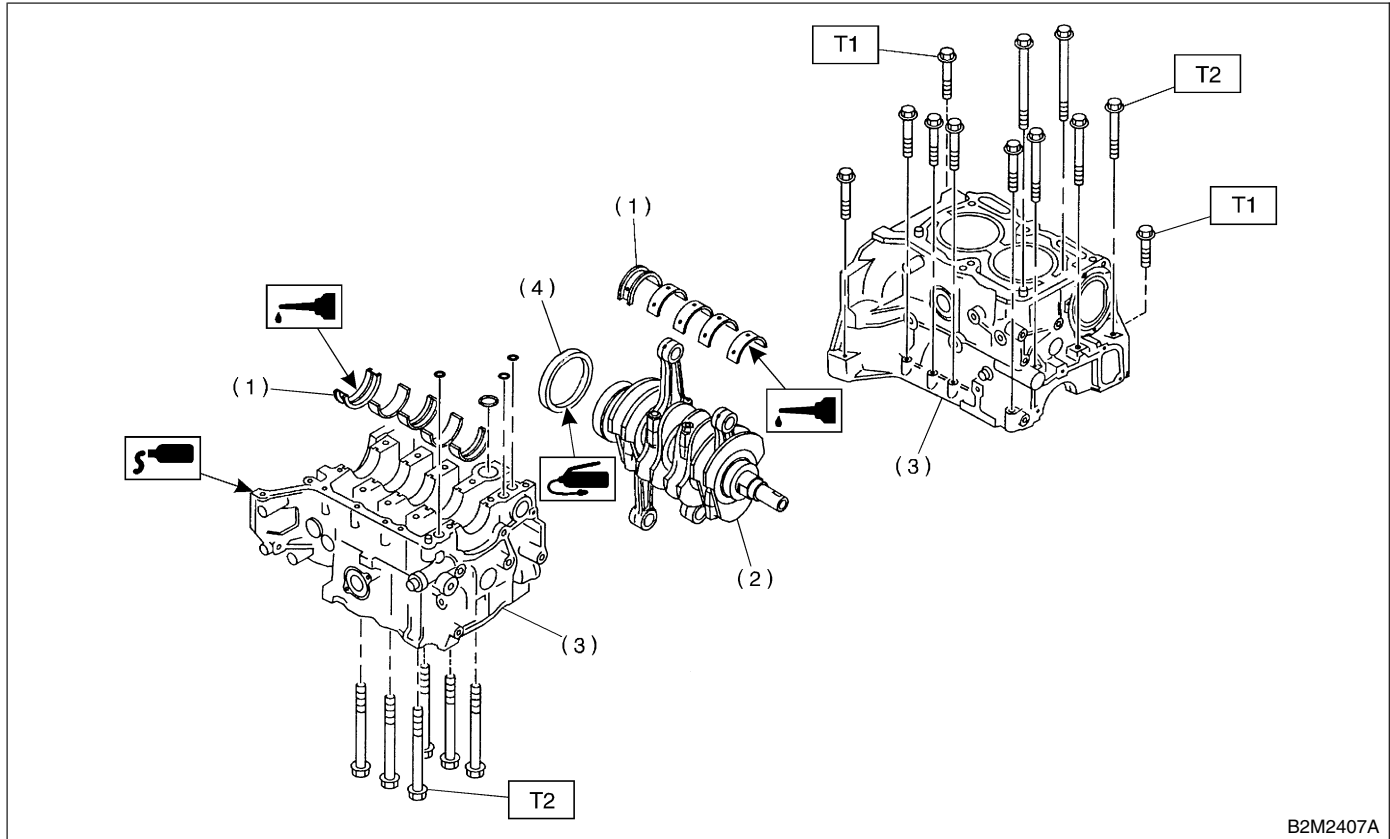
37) Remove crankshaft bearings from cylinder block using hammer handle.

CAUTION:

Do not confuse combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

B: INSTALLATION

S173090A11



- (1) Crankshaft bearing
- (2) Crankshaft
- (3) Cylinder block
- (4) Rear oil seal

Tightening torque: N·m (kgf-m, ft-lb)

T1: 25 (2.5, 18.1)

T2: 47 (4.8, 34.7)

CAUTION:

Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

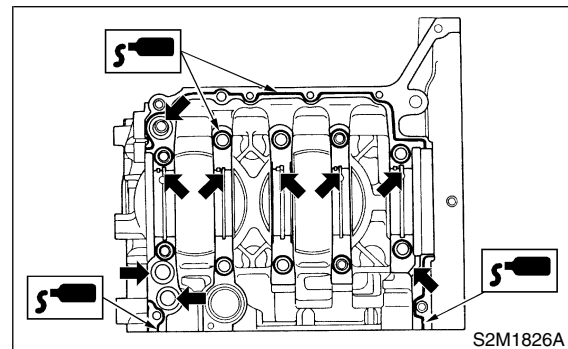
- 1) Position crankshaft on the #2 and #4 cylinder block.
- 2) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

Fluid packing:

THREE BOND 1215 or equivalent

CAUTION:

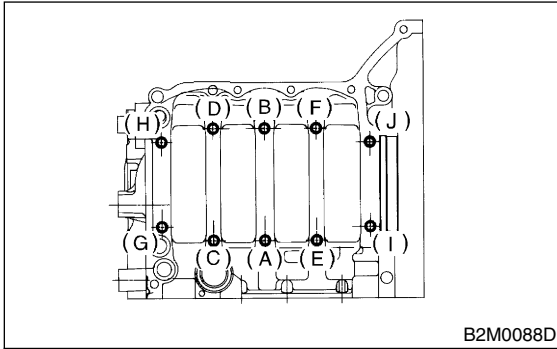
Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.



CYLINDER BLOCK

Mechanical

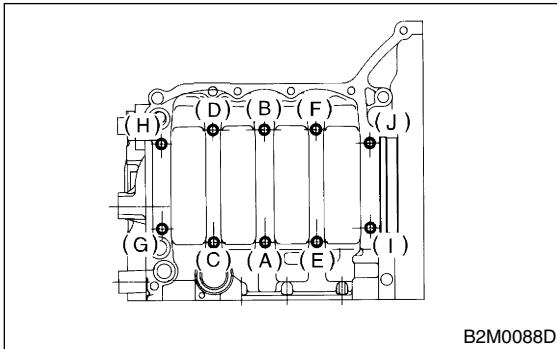
3) Temporarily tighten 10 mm cylinder block connecting bolts in alphabetical sequence shown in figure.



4) Tighten 10 mm cylinder block connecting bolts in alphabetical sequence.

Tightening torque:

$47 \pm 3 \text{ N}\cdot\text{m}$ ($4.8 \pm 0.3 \text{ kgf}\cdot\text{m}$, $34.7 \pm 2.2 \text{ ft}\cdot\text{lb}$)

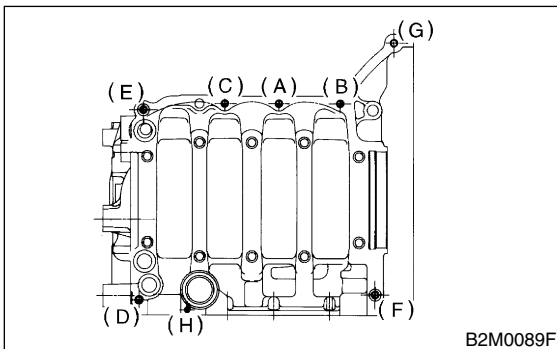


5) Tighten 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in figure.

Tightening torque:

(A) — (G): $25 \text{ N}\cdot\text{m}$ ($2.5 \text{ kgf}\cdot\text{m}$, $18.1 \text{ ft}\cdot\text{lb}$)

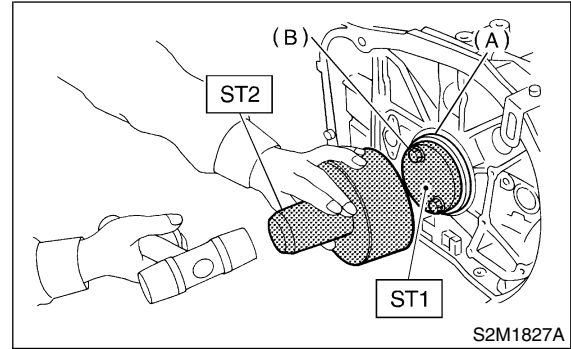
(H): $6.4 \text{ N}\cdot\text{m}$ ($0.65 \text{ kgf}\cdot\text{m}$, $4.7 \text{ ft}\cdot\text{lb}$)



6) Install rear oil seal using ST1 and ST2.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER

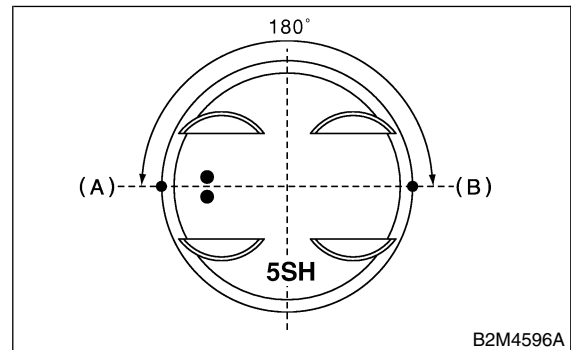


(A) Rear oil seal

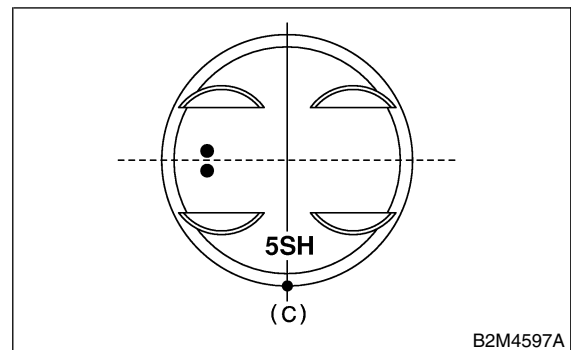
(B) Flywheel attaching bolt

7) Position the top ring gap at (A) or (B) in the figure.

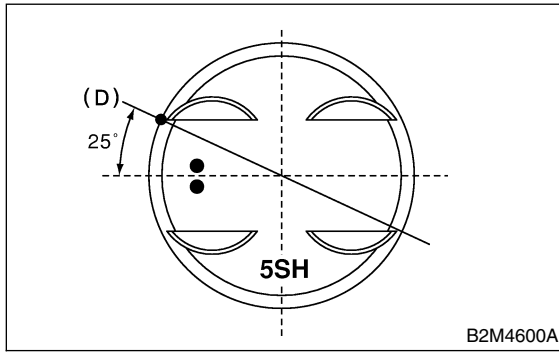
8) Position the second ring gap at 180° on the reverse side for the top ring gap.



9) Position the expander gap at (C) in the figure.

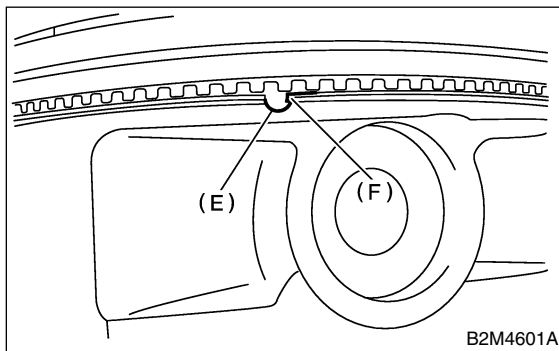


10) Position the lower rail gap at (D) in the figure.

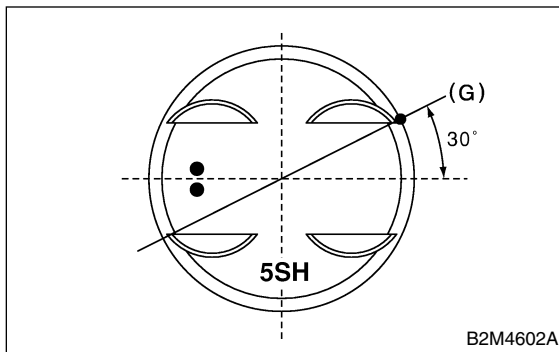


NOTE:

Align lower rail spin stopper (F) with piston side surface hole (E).



11) 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.

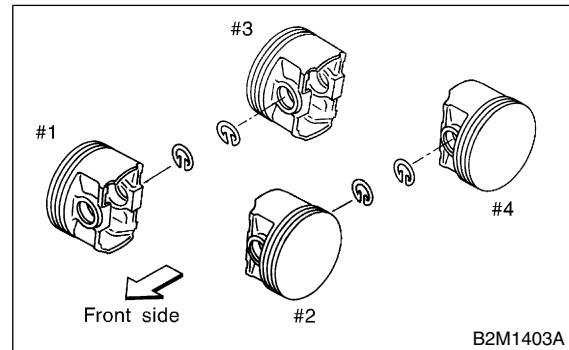
12)

Install circlip.

Install circlips in piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

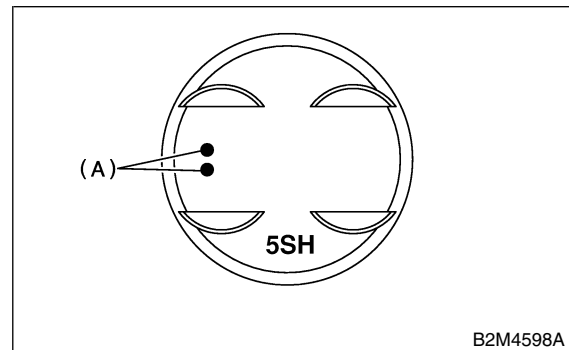
NOTE:

Use new circlips.

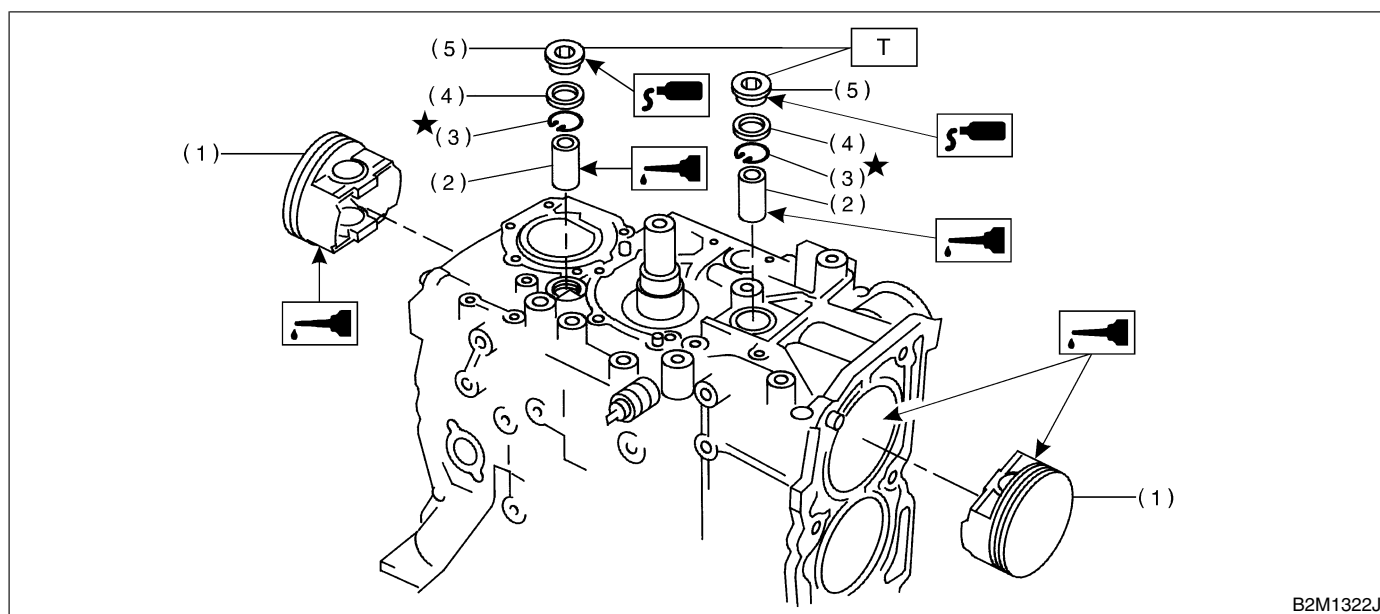


CAUTION:

Piston front mark faces towards the front of the engine.



CYLINDER BLOCK



(1) Piston	(4) Gasket
(2) Piston pin	(5) Service hole plug
(3) Circlip	

Tightening torque: N·m (kgf-m, ft-lb)
T: 69 (7.0, 50.6)

13) Installing piston

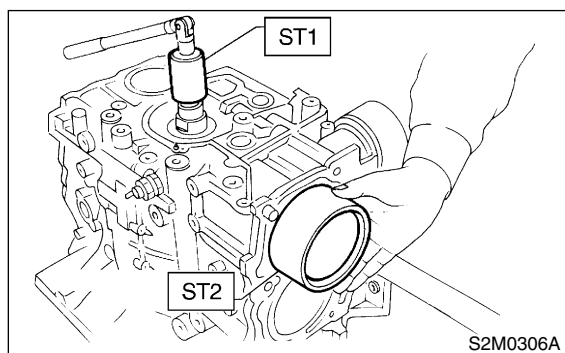
(1) Turn cylinder block so that #1 and #2 cylinders face upward.

(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



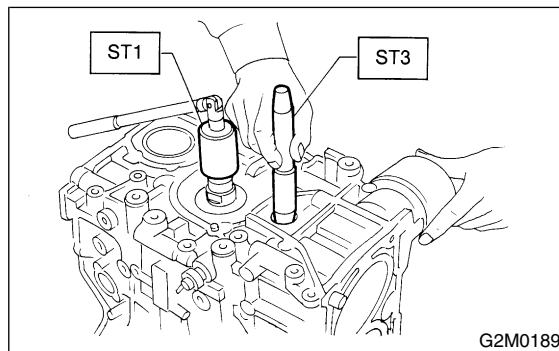
14) Installing piston pin

(1) Insert ST3 into service hole to align piston pin hole with connecting rod small end.

CAUTION:

Apply a coat of engine oil to ST3 before insertion.

ST3 499017100 PISTON PIN GUIDE

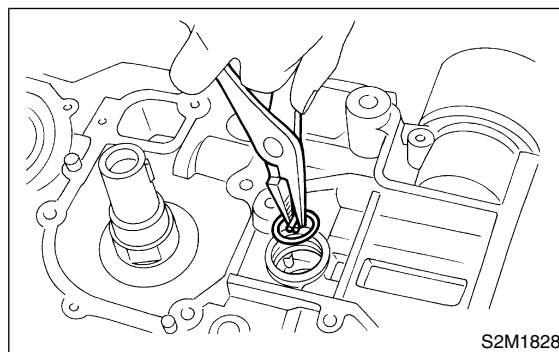


(2) Apply a coat of engine oil to piston pin and insert piston pin into piston and connecting rod through service hole.

(3) Install circlip.

CAUTION:

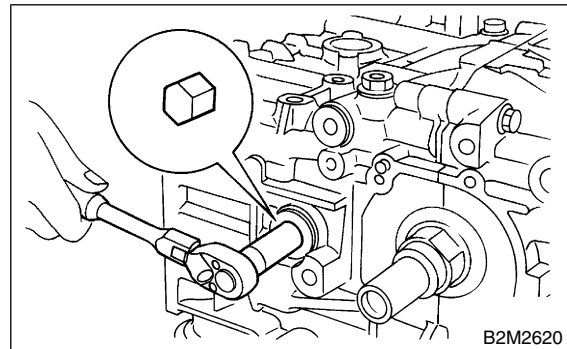
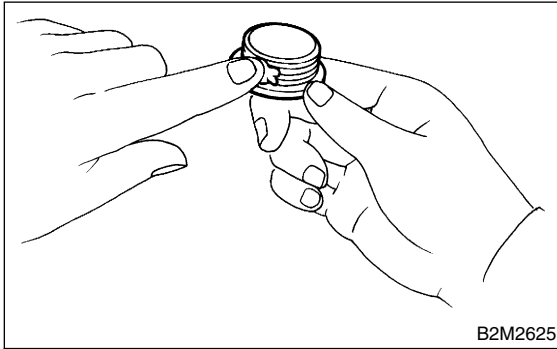
Use new circlips.



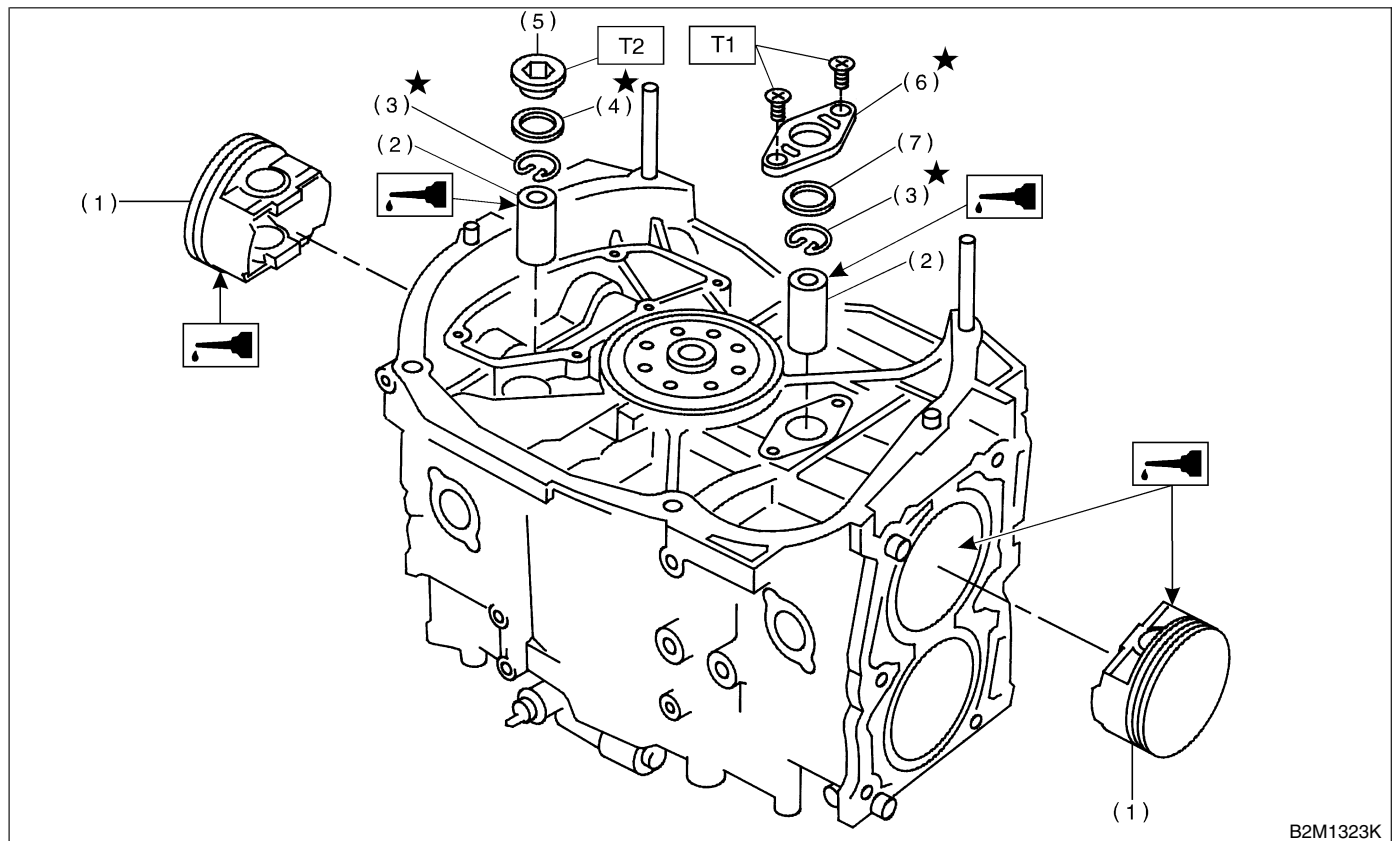
(4) Apply fluid packing around the service hole plug.

Fluid packing:
THREE BOND 1215 or equivalent

CAUTION:
Use a new gasket.



(5) Install service hole plug and gasket.



(1) Piston	(5) Service hole plug
(2) Piston pin	(6) Service hole cover
(3) Circlip	(7) O-ring
(4) Gasket	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

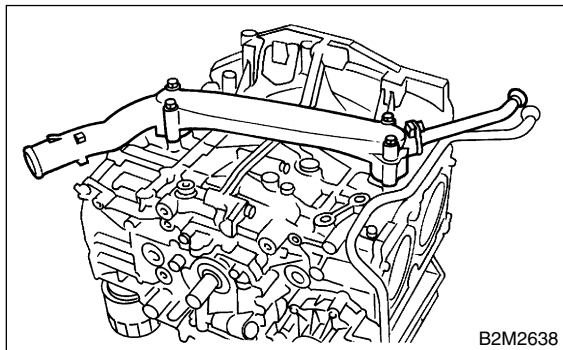
T2: 69 (7.0, 50.6)

(6) 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.

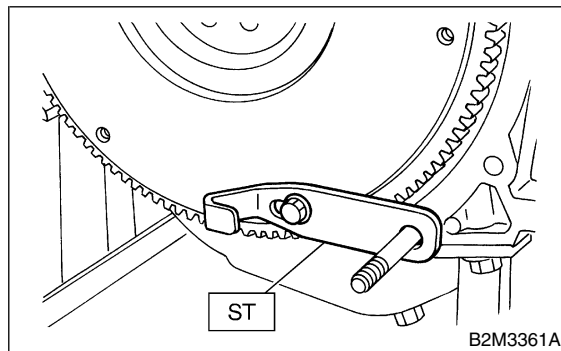
CYLINDER BLOCK

Mechanical

- 15) Install water pipe.



Tightening torque:
72 N·m (7.3 kgf-m, 52.8 ft-lb)



- 16) Install baffle plate.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

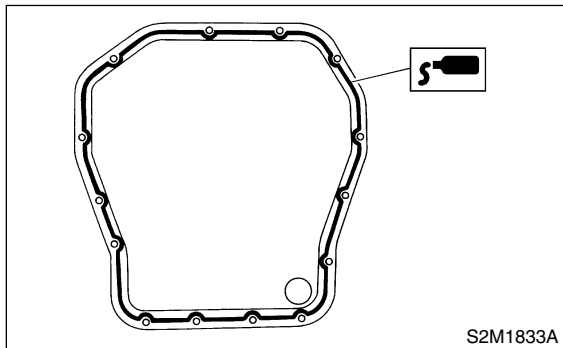
- 17) Install oil strainer and O-ring

Tightening torque:
10 N·m (1.0 kgf-m, 7 ft-lb)

- 18) Install oil strainer stay.

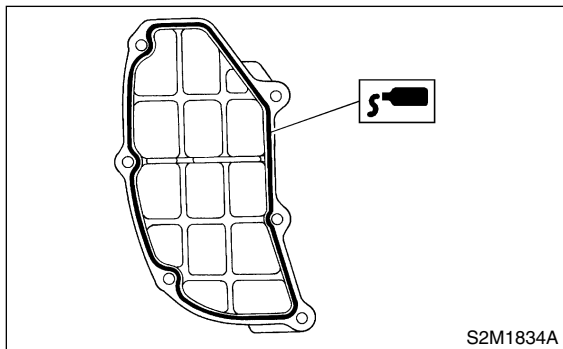
- 19) Apply fluid packing to matching surfaces and install oil pan.

Fluid packing:
THREE BOND 1215 or equivalent



- 20) Apply fluid packing to matching surfaces and install oil separator cover.

Fluid packing:
THREE BOND 1215 or equivalent



- 21) Install flywheel or drive plate.

To lock crankshaft, use ST.

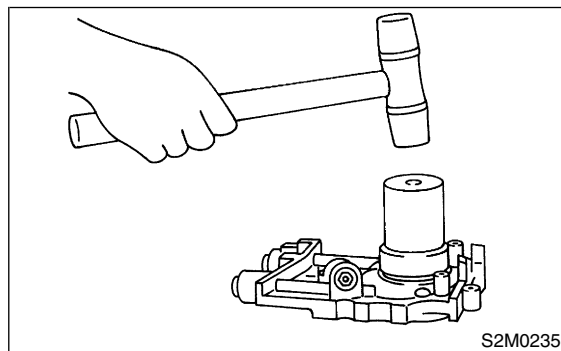
ST 498497100 CRANKSHAFT STOPPER

- 22) Install housing cover.

- 23) Installation of oil pump

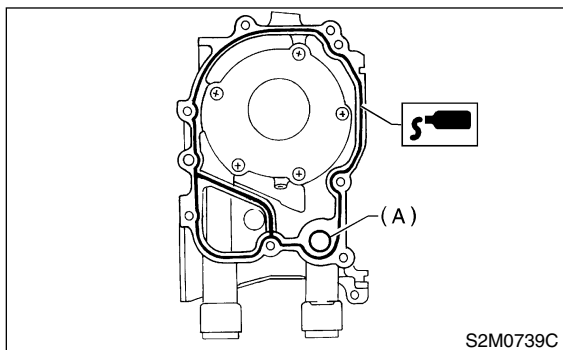
(1) Discard front oil seal after removal. Replace with a new one using ST.

ST 499587100 OIL SEAL INSTALLER



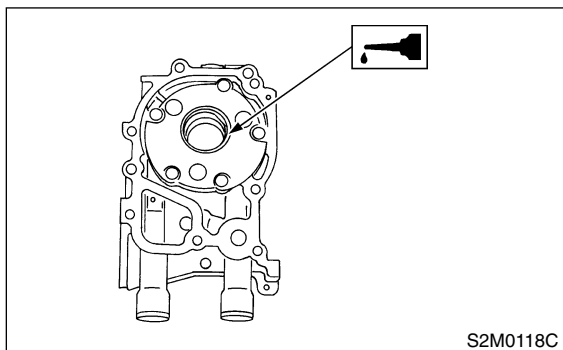
- (2) Apply fluid packing to matching surface of oil pump.

Fluid packing:
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.

24) Install water pump and gasket.

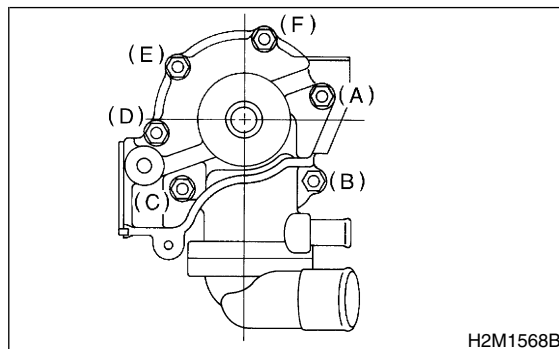
Tightening torque:

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:

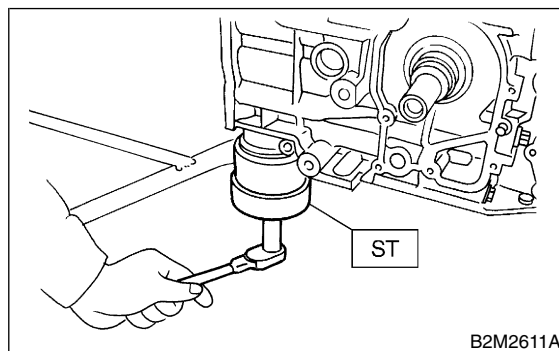
- Be sure to use a new gasket.
- When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.



25) Install water by-pass pipe for heater.

26) Install oil filter using ST.

ST 498547000 OIL FILTER WRENCH



27) Tighten cylinder head bolts.

- (1) Apply a 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° first; back them off by 180° again.
- (4) Tighten bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb).
- (5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).
- (6) Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:

Do not tighten bolts more than 90°.

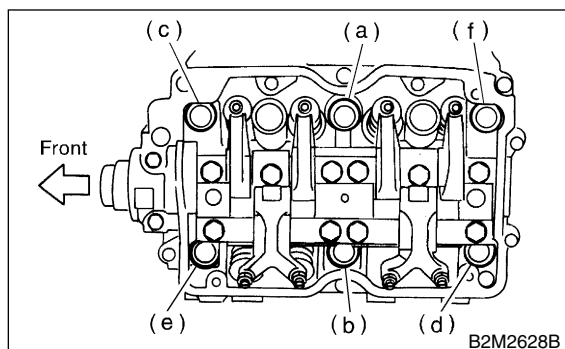
- (7) Further tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:

Ensure that the total "re-tightening angle" [in the former two steps], do not exceed 180°.

CYLINDER BLOCK

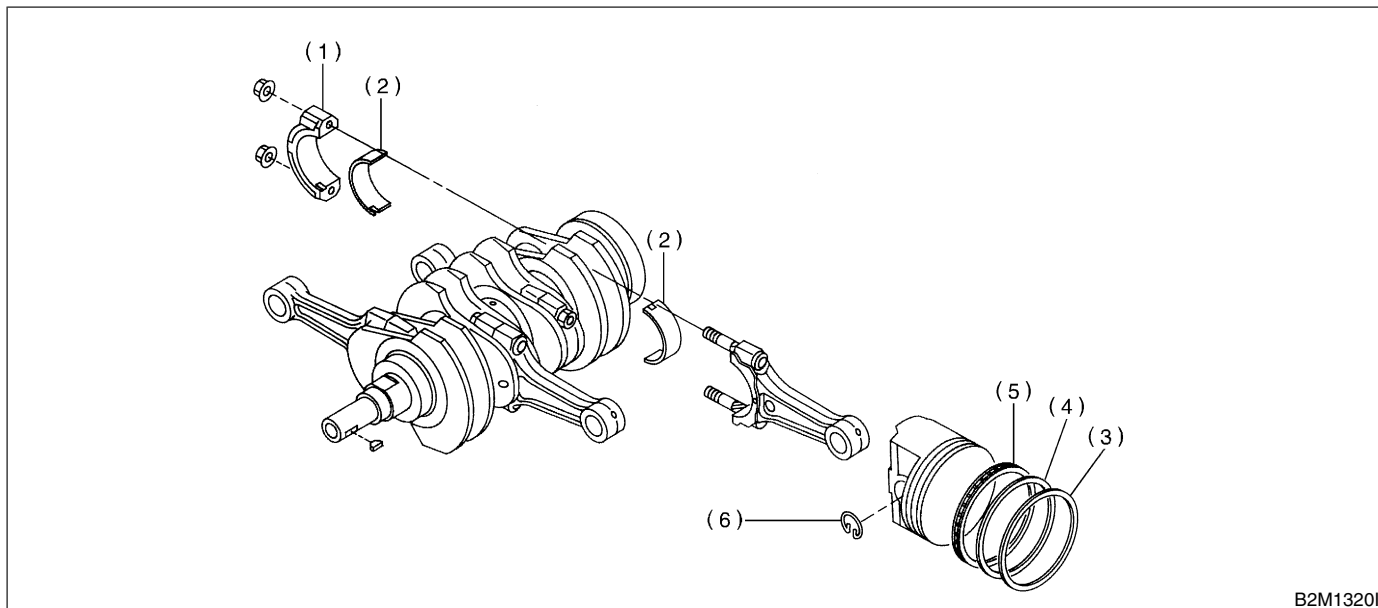
Mechanical



- 28) Install oil level gauge and tighten attaching bolt (left side only).
- 29) Install rocker cover.
- 30) Install crankshaft sprocket. <Ref. to ME-52, INSTALLATION, Crankshaft Sprocket.>
- 31) Install camshaft sprocket. <Ref. to ME-51, INSTALLATION, Camshaft Sprocket.>
- 32) Install timing belt assembly. <Ref. to ME-47, INSTALLATION, Timing Belt Assembly.>
- 33) Install belt cover. <Ref. to ME-45, INSTALLATION, Belt Cover.>
- 34) Install crankshaft pulley. <Ref. to ME-44, INSTALLATION, Crankshaft pulley.>
- 35) Install generator and A/C compressor brackets on cylinder head.
- 36) Install V-belt. <Ref. to ME-42, INSTALLATION, V-belt.>
- 37) Install intake manifold. <Ref. to FU-18, INSTALLATION, Intake Manifold.>

C: DISASSEMBLY

S173090A06



B2M1320I

- (1) Connecting rod cap
(2) Connecting rod bearing

- (3) Top ring
(4) Second ring

- (5) Oil ring
(6) Circlip

- 1) Remove connecting rod cap.
2) Remove connecting rod bearing.

CAUTION:

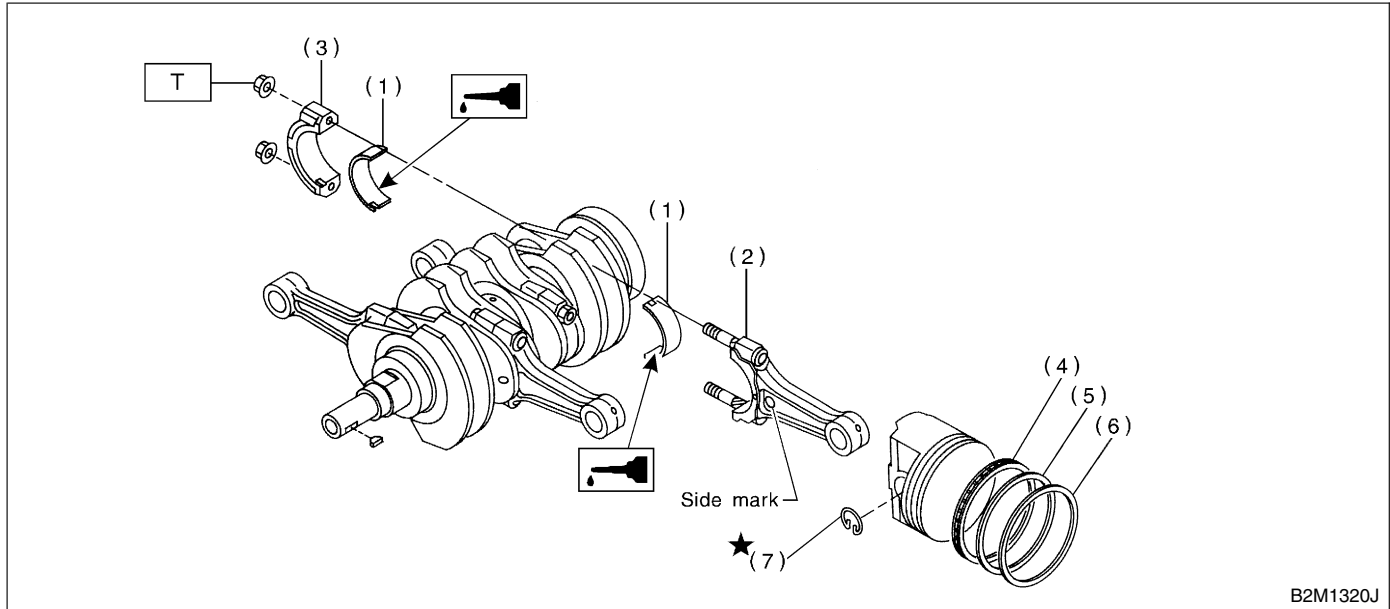
Arrange removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

- 3) Remove piston rings using the piston ring expander.
4) Remove the oil ring by hand.

CAUTION:

Arrange the removed piston rings in good order to prevent confusion.

- 5) Remove circlip.

D: ASSEMBLY S173090A02

B2M1320J

(1) Connecting rod bearing	(5) Second ring
(2) Connecting rod	(6) Top ring
(3) Connecting rod cap	(7) Circlip
(4) Oil ring	

Tightening torque: N·m (kgf-m, ft-lb)
T: 44.6 (4.55, 32.9)

- 1) Install connecting rod bearings on connecting rods and connecting rod caps.

CAUTION:

Apply oil to the surfaces of the connecting rod bearings.

- 2) Install connecting rod on crankshaft.

CAUTION:

Position each connecting rod with the side marked facing forward.

- 3) 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.

- 4) 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 S173090A10**1. CYLINDER BLOCK** S173090A1001

- 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:

0.05 mm (0.0020 in)

Grinding limit:

0.1 mm (0.004 in)

Standard height of cylinder block:

201.0 mm (7.91 in)

2. CYLINDER AND PISTON S173090A1002

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).

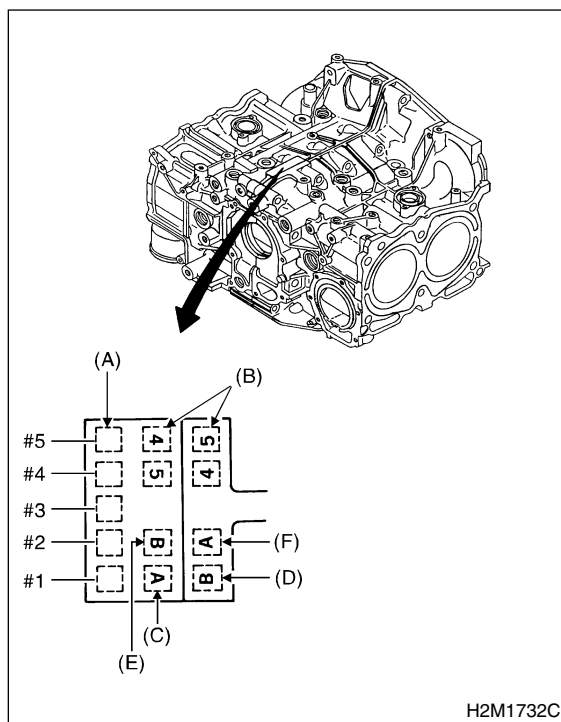
NOTE:

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)

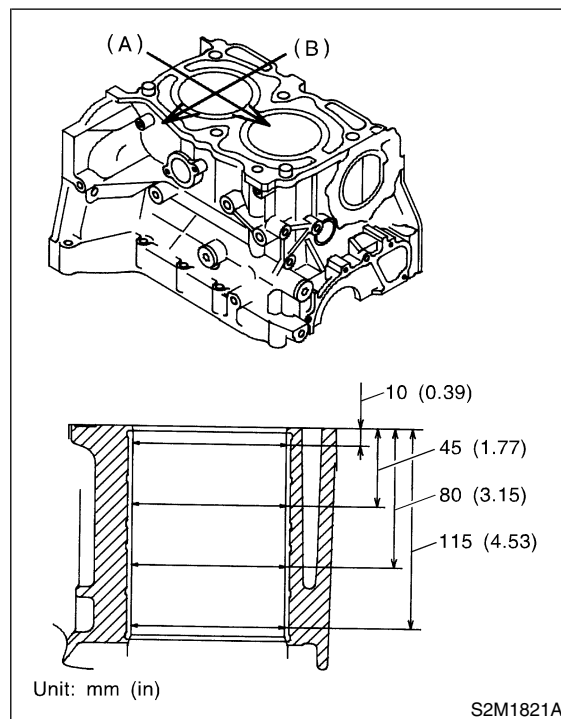
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 in)



- (A) Piston pin direction
- (B) Thrust direction

3) When piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

CYLINDER BLOCK

Mechanical

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

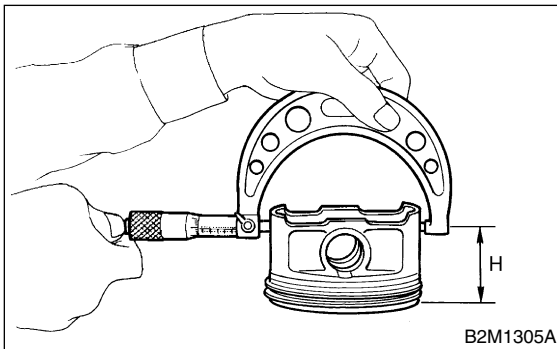
99.725 — 99.735 mm

(3.9262 — 3.9266 in)

0.50 mm (0.0197 in) oversize

99.975 — 99.985 mm

(3.9360 — 3.9364 in)



5) Calculate the clearance between cylinder and piston.

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)

Limit

0.050 mm (0.0020 in)

6) Boring and honing

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, rebores it to use an oversize piston.

CAUTION:

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, 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.

CAUTION:

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

S173090A1003

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-81, 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.

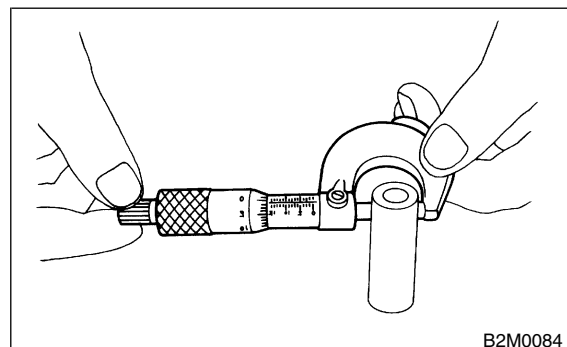
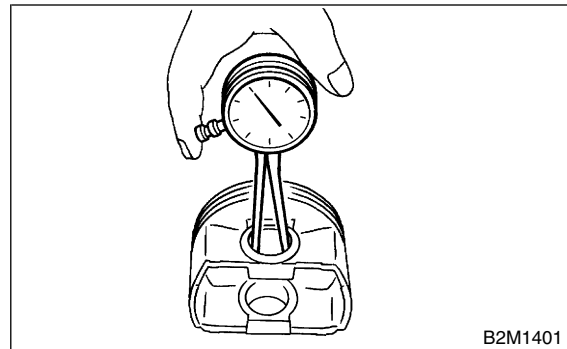
Standard clearance between piston pin and hole in piston:

Standard

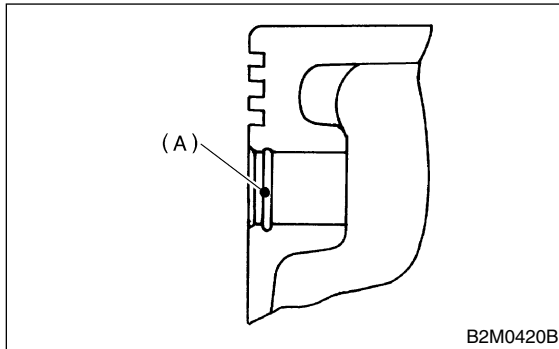
0.004 — 0.008 mm (0.0002 — 0.0003 in)

Limit

0.020 mm (0.0008 in)



4) Check circlip installation groove on the piston for burr. If necessary, remove burr (A) from the groove so that piston pin can lightly move.



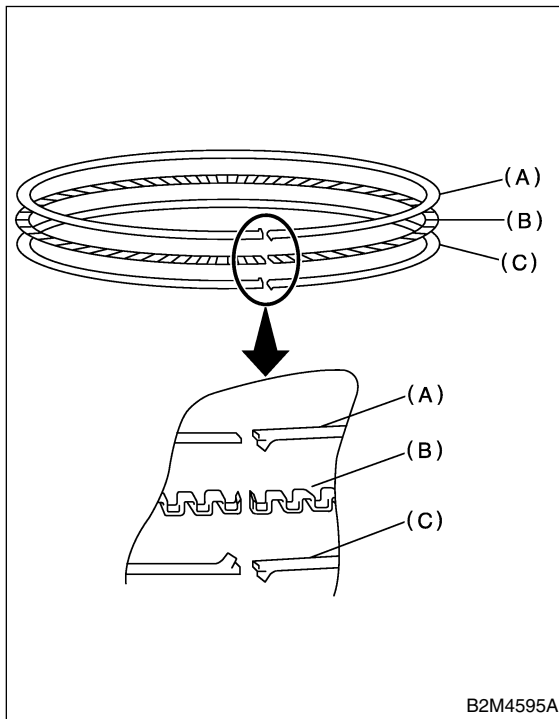
5) Check piston pin circlip for distortion, cracks and wear.

4. PISTON RING S173090A1004

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:

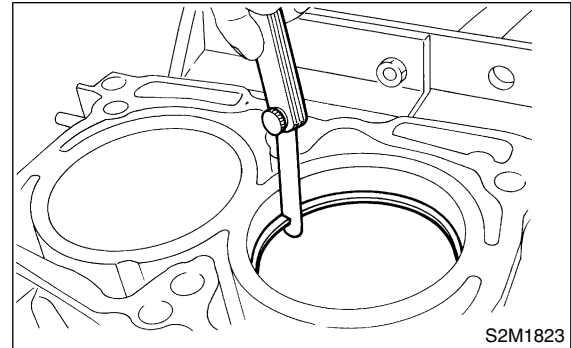
- Marks are shown on the end of the top and second rings. When installing the rings to the piston, face this mark upward.
- Oil ring consists of upper rail, expander and lower rail. When installing on piston, be careful of each rail's direction.



- (A) Upper rail
- (B) Expander
- (C) Lower rail

2) 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	0.35 — 0.50 (0.0138 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.70 (0.0079 — 0.0276)	1.5 (0.059)

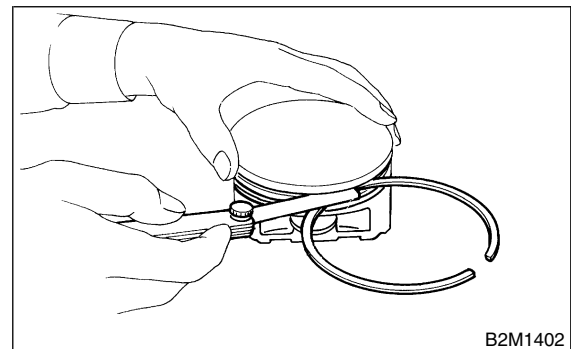


3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

CAUTION:

Before measuring the clearance, clean the piston ring groove and piston ring.

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)



CYLINDER BLOCK

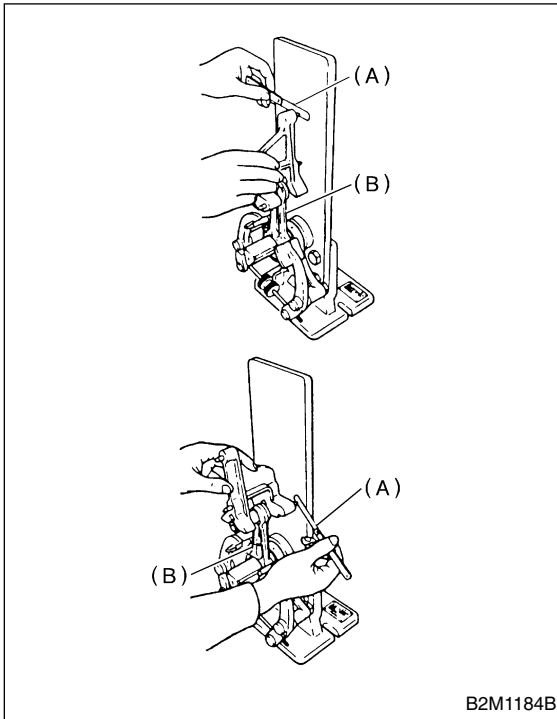
Mechanical

5. CONNECTING ROD S173090A1005

- 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)



- (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.

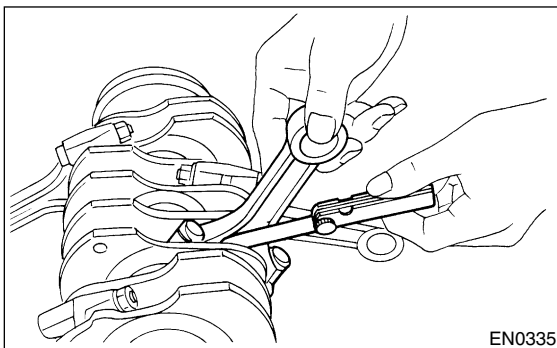
Connecting rod side clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)

Limit

0.4 mm (0.016 in)



- 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

0.012 — 0.038 mm (0.0005 — 0.0015 in)

Limit

0.050 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

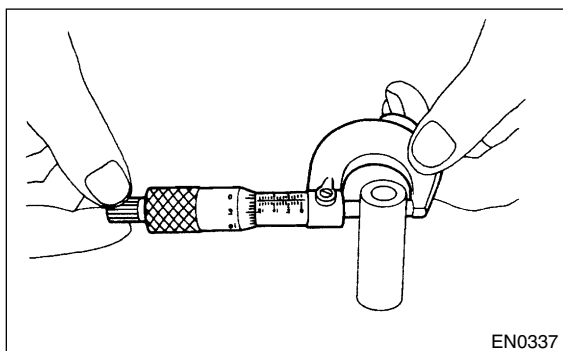
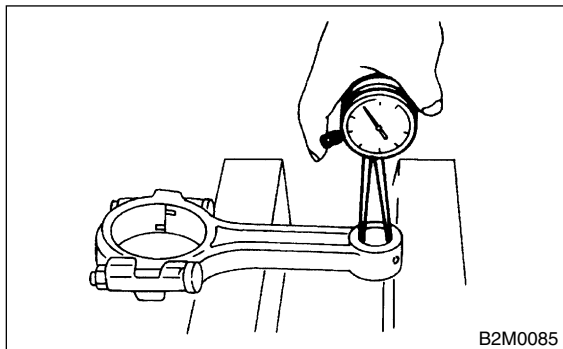
Clearance between piston pin and bushing:

Standard

0 — 0.022 mm (0 — 0.0009 in)

Limit

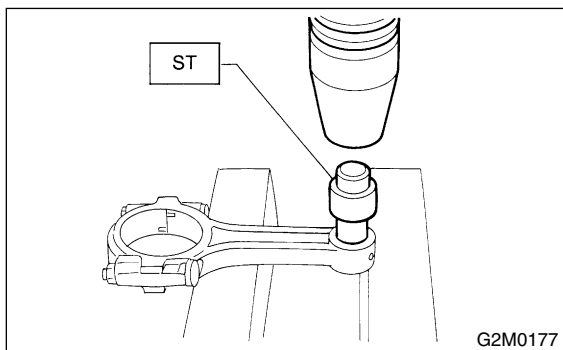
0.030 mm (0.0012 in)



7) Replacement procedure is as follows.

- (1) Remove bushing from connecting rod with ST and press.
- (2) Press bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



- (3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
- (4) After completion of reaming, clean bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

S173090A1006

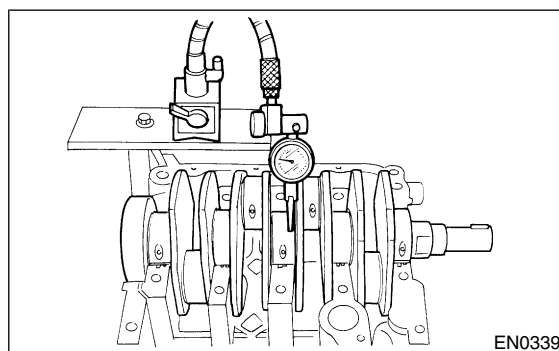
- 1) Clean crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.
- 2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

CAUTION:

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 and crank journal:

Out-of-roundness

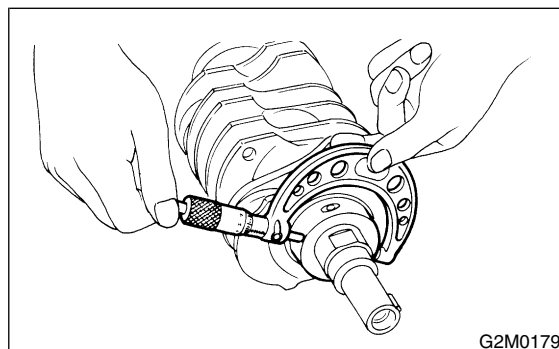
0.020 mm (0.0008 in) or less

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



CYLINDER BLOCK

Mechanical

		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.

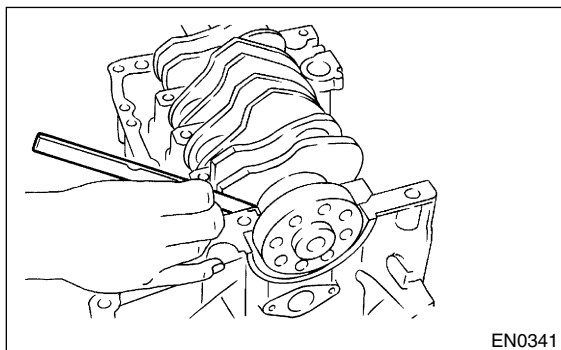
Crankshaft thrust clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)

Limit

0.25 mm (0.0098 in)



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.

Unit: mm (in)	
Crankshaft oil clearance	
Standard	0.010 — 0.030 (0.0004 — 0.0012)
Limit	0.040 (0.0016)

22. Engine Trouble in General

S173095

A: INSPECTION

S173095A10

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-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

ENGINE TROUBLE IN GENERAL

Mechanical

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3) Initial combustion occur.	● Engine control system <Ref. to EN-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
4) Engine stalls after initial combustion.	● Engine control system <Ref. to EN-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

ENGINE TROUBLE IN GENERAL

Mechanical

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
2. Rough idle and engine stall	● Engine control system <Ref. to EN-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

ENGINE TROUBLE IN GENERAL

Mechanical

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	● Engine control system <Ref. to EN-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-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

ENGINE TROUBLE IN GENERAL

Mechanical

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	● Engine control system <Ref. to EN-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-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-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-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

ENGINE TROUBLE IN GENERAL

Mechanical

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	● Engine control system <Ref. to EN-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 S173096

A: INSPECTION S173096A10

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 crankshaft main bearing - Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn cylinder liner and piston ring - Broken or stuck piston ring - Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	- Unusually worn valve lifter - Worn cam gear - Worn camshaft journal bore in crankcase
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Defective generator brush and rotor contact
Gear scream when starting engine	—	- Defective ignition starter switch - Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	- Loose drive belt - Defective water pump shaft
Hissing sound	—	- Loss of compression - Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	- Loose timing belt - Belt contacting case/adjacent part
Valve tappet noise	—	Incorrect valve clearance

NOTE*:

When disconnecting fuel injector connector, 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-55, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN-48, Inspection Mode.> after connecting fuel injector connector.

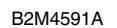
ENGINE NOISE

Mechanical

MEMO:

S172001

S172001A05



GENERAL DESCRIPTION

Exhaust

(1) Upper front exhaust pipe cover CTR	(10) Lower center exhaust pipe cover	(21) Self-locking nut
(2) Lower front exhaust pipe cover CTR	(11) Gasket	(22) Protector
(3) Front exhaust pipe	(12) Upper rear catalytic converter cover	(23) Rear oxygen sensor
(4) Front oxygen (A/F) sensor	(13) Lower rear catalytic converter cover	(24) Gasket
(5) Front catalytic converter	(14) Rear catalytic converter	
(6) Upper front catalytic converter cover	(15) Center exhaust pipe	
(7) Lower front catalytic converter cover	(16) Spring	
(8) Clamp	(17) Rear exhaust pipe	
(9) Upper center exhaust pipe cover	(18) Gasket	
	(19) Cushion rubber	
	(20) Muffler	

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 S172001A03

- 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.

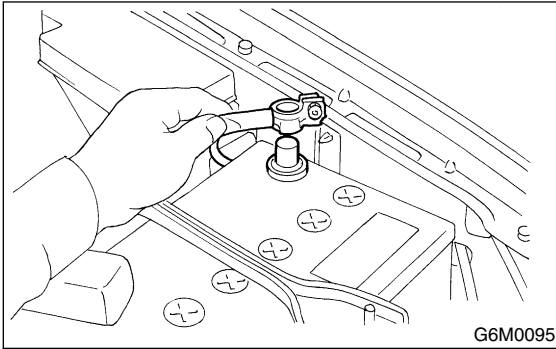
2. Front Exhaust Pipe

S172065

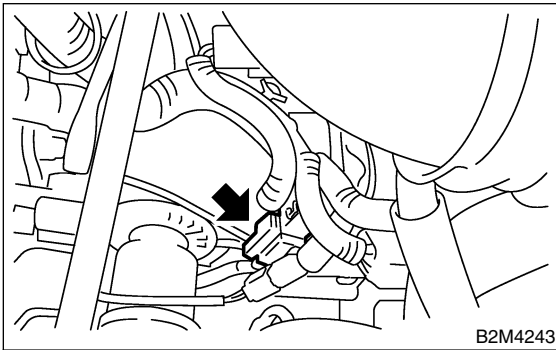
A: REMOVAL

S172065A18

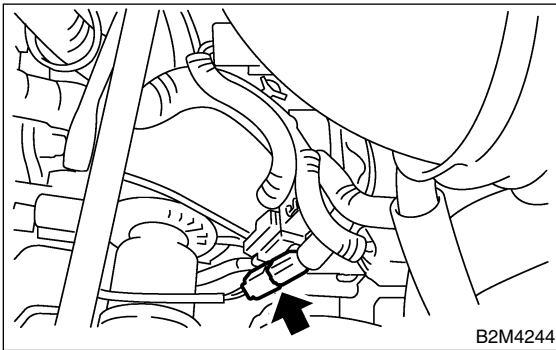
- 1) Disconnect battery ground cable.



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



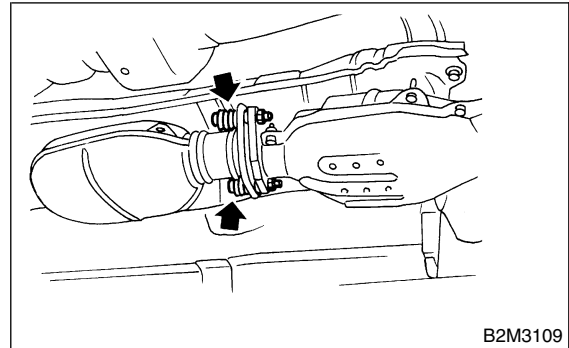
- 3) Disconnect rear oxygen sensor connector.



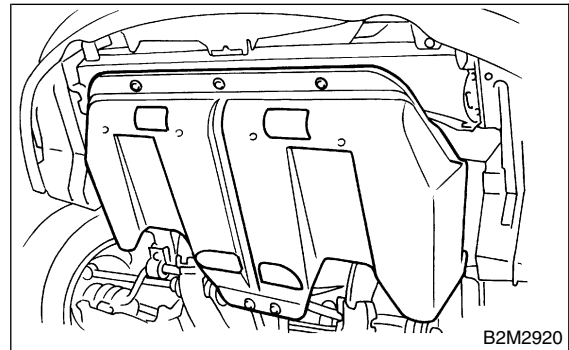
- 4) Lift-up the vehicle.
- 5) Separate front and center exhaust pipe assembly from rear exhaust pipe.

WARNING:

Be careful, exhaust pipe is hot.



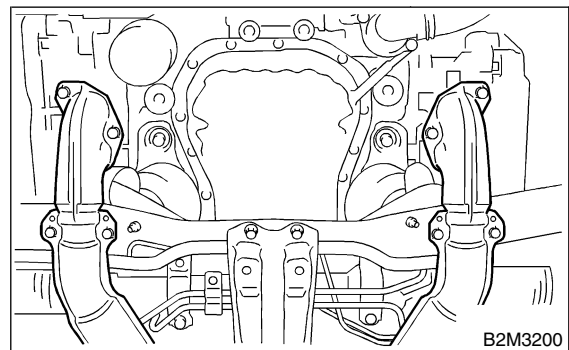
- 6) Remove under cover.



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

CAUTION:

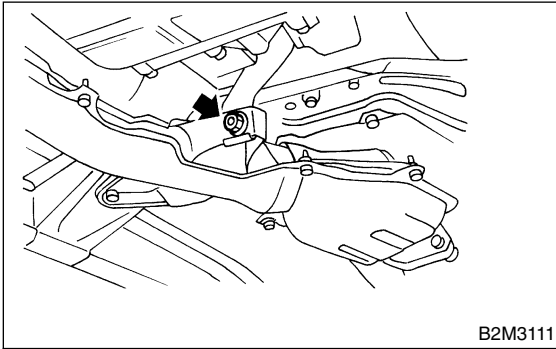
Be careful not to pull down front and center exhaust pipe assembly.



FRONT EXHAUST PIPE

Exhaust

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

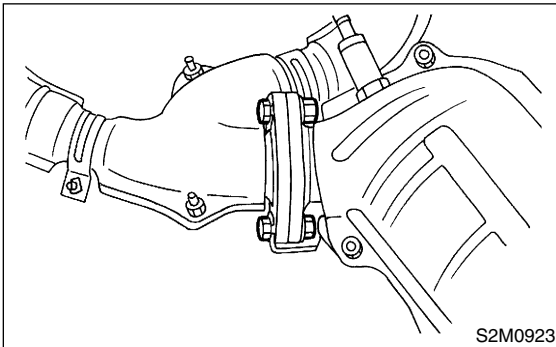


9) Remove front and center exhaust pipe assembly from the vehicle.

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 S172065A11

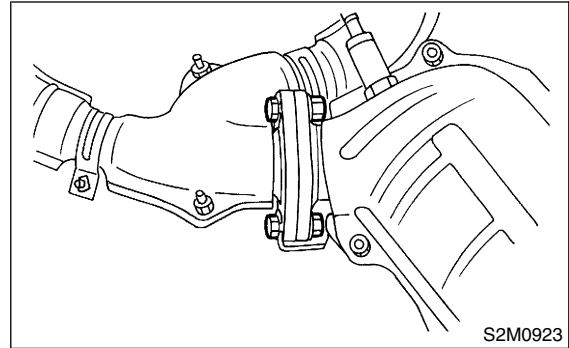
1) Install front exhaust pipe to center exhaust pipe.

NOTE:

Replace gaskets with new ones.

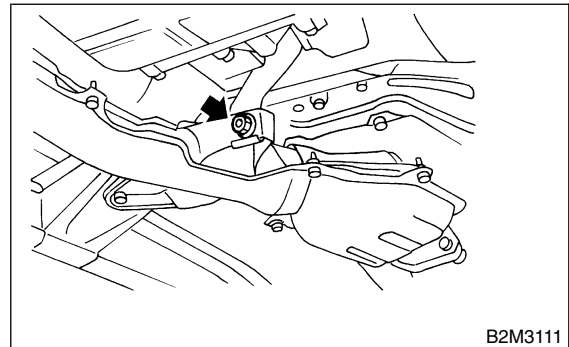
Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



2) Install front and center exhaust pipe assembly to the vehicle.

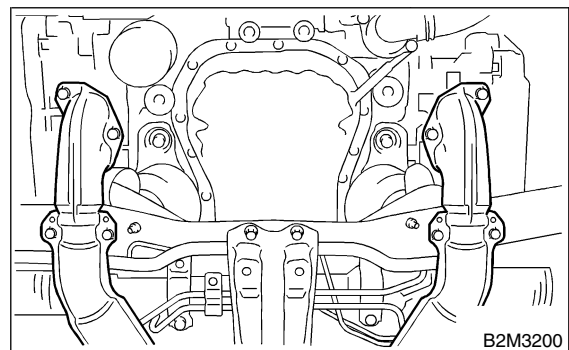
3) Temporarily tighten bolt which installs front and center exhaust pipe assembly to hanger bracket.



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

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)

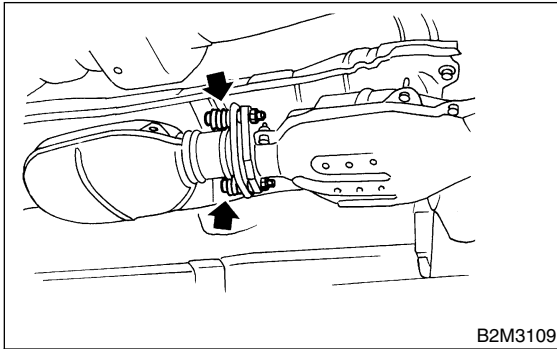


5) Install under cover.

6) Tighten bolts which install front and center exhaust pipe assembly to rear exhaust pipe.

Tightening torque:

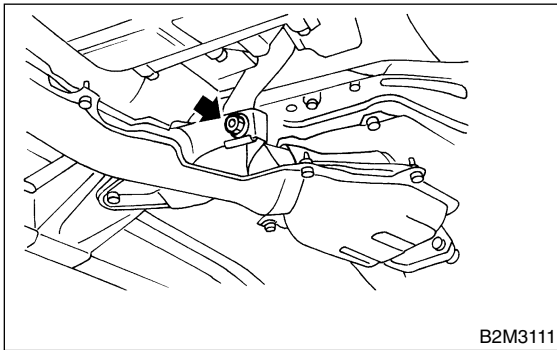
18 N·m (1.8 kgf-m, 13.0 ft-lb)



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

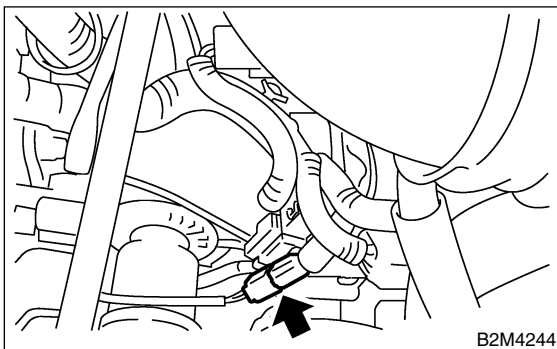
Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)

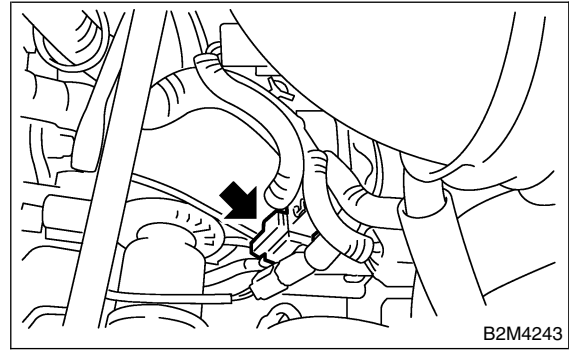


8) Lower the vehicle.

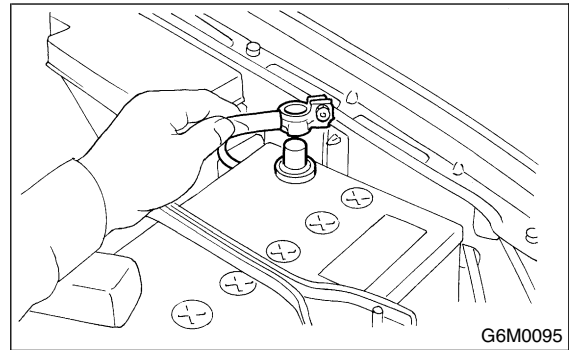
9) Connect rear oxygen sensor connector.



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



11) Connect battery ground cable.



C: INSPECTION

S172065A10

- 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 S172067

A: REMOVAL S172067A18

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-5, REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION S172067A11

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-6, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION S172067A10

- 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

S172068

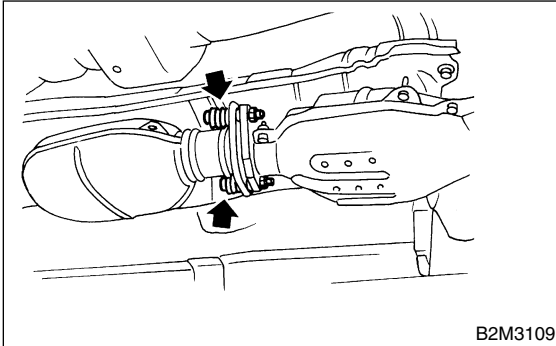
A: REMOVAL

S172068A18

- 1) Separate rear exhaust pipe from center exhaust pipe.

CAUTION:

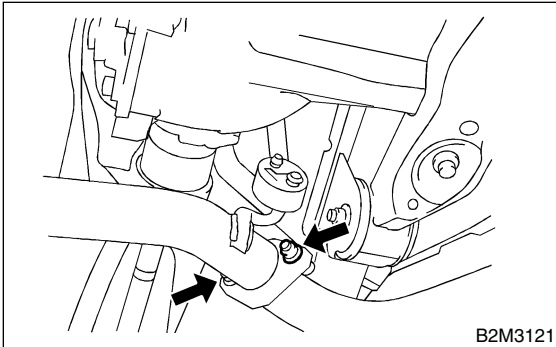
Be careful, exhaust pipe is hot.



- 2) Separate rear exhaust pipe from muffler.

CAUTION:

Be careful not to pull down rear exhaust pipe.



- 3) Remove rear exhaust pipe.

B: INSTALLATION

S172068A11

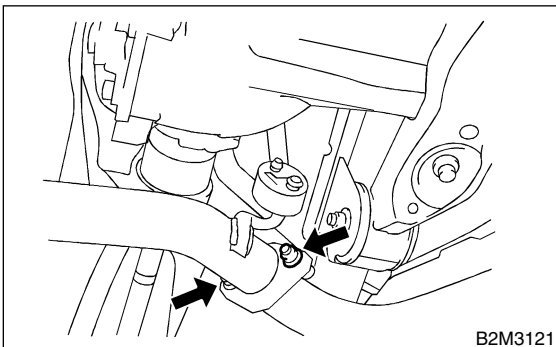
NOTE:

Replace gaskets with new ones.

- 1) Install rear exhaust pipe to muffler.

Tightening torque:

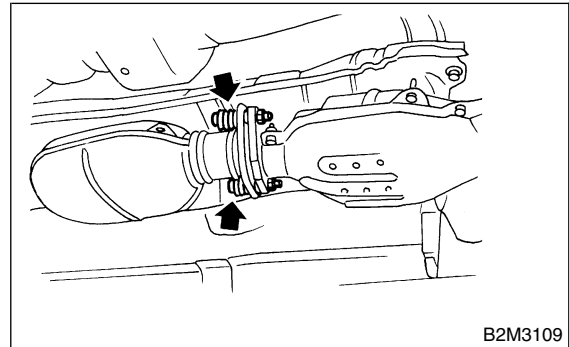
48 N·m (4.9 kgf-m, 35.4 ft-lb)



- 2) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

S172068A10

- 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.

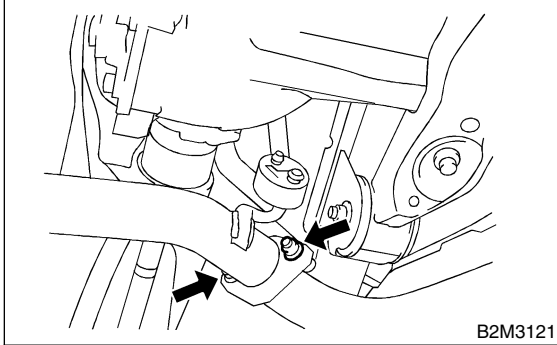
5. Muffler S172066

A: REMOVAL S172066A18

- 1) Separate muffler from rear exhaust pipe.

CAUTION:

Be careful, exhaust pipe is hot.



- 2) Remove left and right rubber cushions.

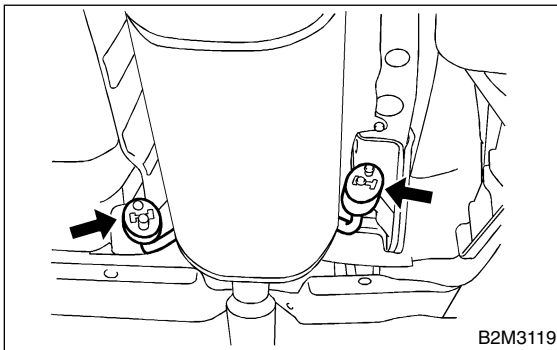
CAUTION:

Be careful not to drop the muffler during removal.

NOTE:

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

SUBARU CRC (Part No. 004301003)

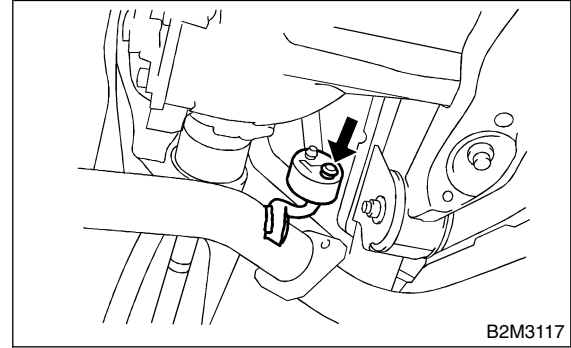


- 3) Remove front rubber cushion, and detach muffler assembly.

NOTE:

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

SUBARU CRC (Part No. 004301003)



B: INSTALLATION S172066A11

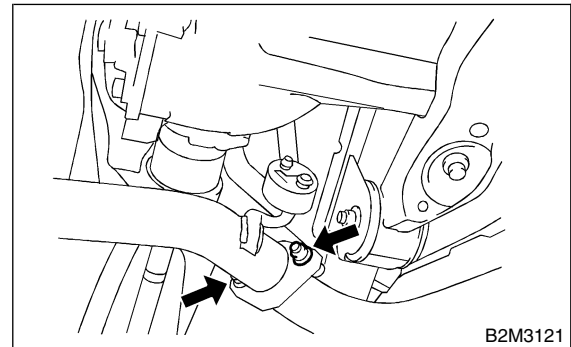
- 1) Install in the reverse order of removal.

NOTE:

Replace gasket with a new one.

Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



C: INSPECTION S172066A10

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

GENERAL DESCRIPTION

Cooling

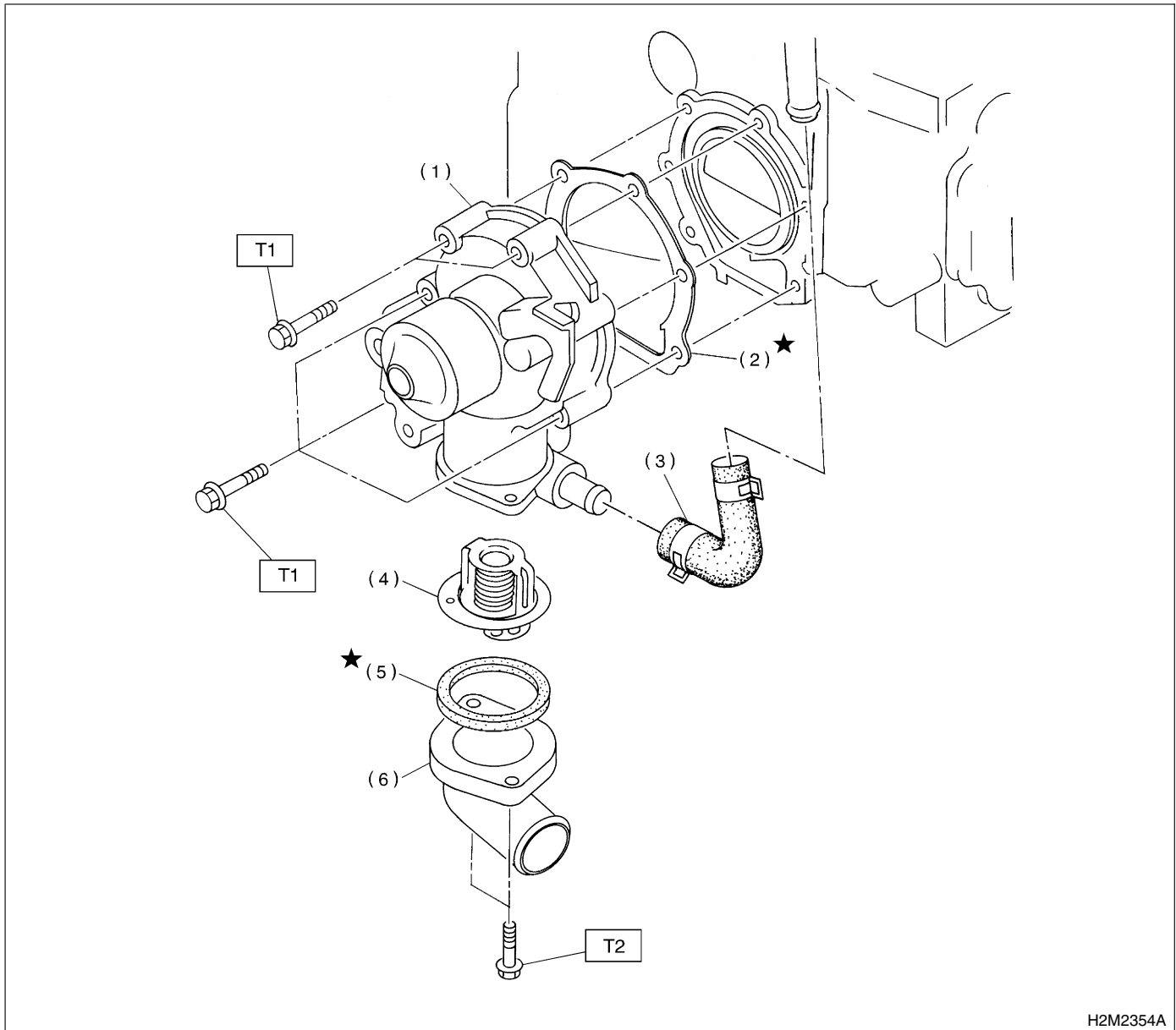
1. General Description S176001

A: SPECIFICATIONS S176001E49

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	20 ℓ (5.3 US gal, 4.4 Imp gal)/min.
		Pump speed—total engine coolant head	760 rpm — 0.3 mAq (1.0 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance II	Discharge	100 ℓ (26.4 US gal, 22.0 Imp gal)/min.
		Pump speed—total engine coolant head	3,000 rpm — 5.0 mAq (16.4 ftAq)
		Engine coolant temperature	85°C (185°F)
	Discharge performance III	Discharge	200 ℓ (52.8 US gal, 44.0 Imp gal)/min.
		Pump speed—total engine coolant head	6,000 rpm — 23.0 mAq (75.5 ftAq)
		Engine coolant temperature	85°C (185°F)
	Impeller diameter		76 mm (2.99 in)
	Number of impeller vanes		8
	Pump pulley diameter		60 mm (2.36 in)
	Clearance between impeller and case	Standard	0.5 — 0.7 mm (0.020 — 0.028 in)
Limit		1.0 mm (0.039 in)	
“Thrust” runout of impeller end		0.5 mm (0.020 in)	
Thermostat	Type		Wax pellet type
	Starts to open		76 — 80°C (169 — 176°F)
	Fully opened		91°C (196°F)
	Valve lift		9.0 mm (0.354 in) or more
	Valve bore		35 mm (1.38 in)
Radiator fan	Motor		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)
	Pressure range in which cap valve is open		Above: 108±15 kPa (1.1±0.15 kg/cm ² , 16±2 psi) Below: −1.0 to −4.9 kPa (−0.01 to −0.05 kg/cm ² , −0.1 to −0.7 psi)
	Fins		Corrugated fin type
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)

B: COMPONENT S176001A05

1. WATER PUMP S176001A0501



H2M2354A

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

Tightening torque: N·m (kgf-m, ft-lb)

T1: First 12 (1.2, 8.7)

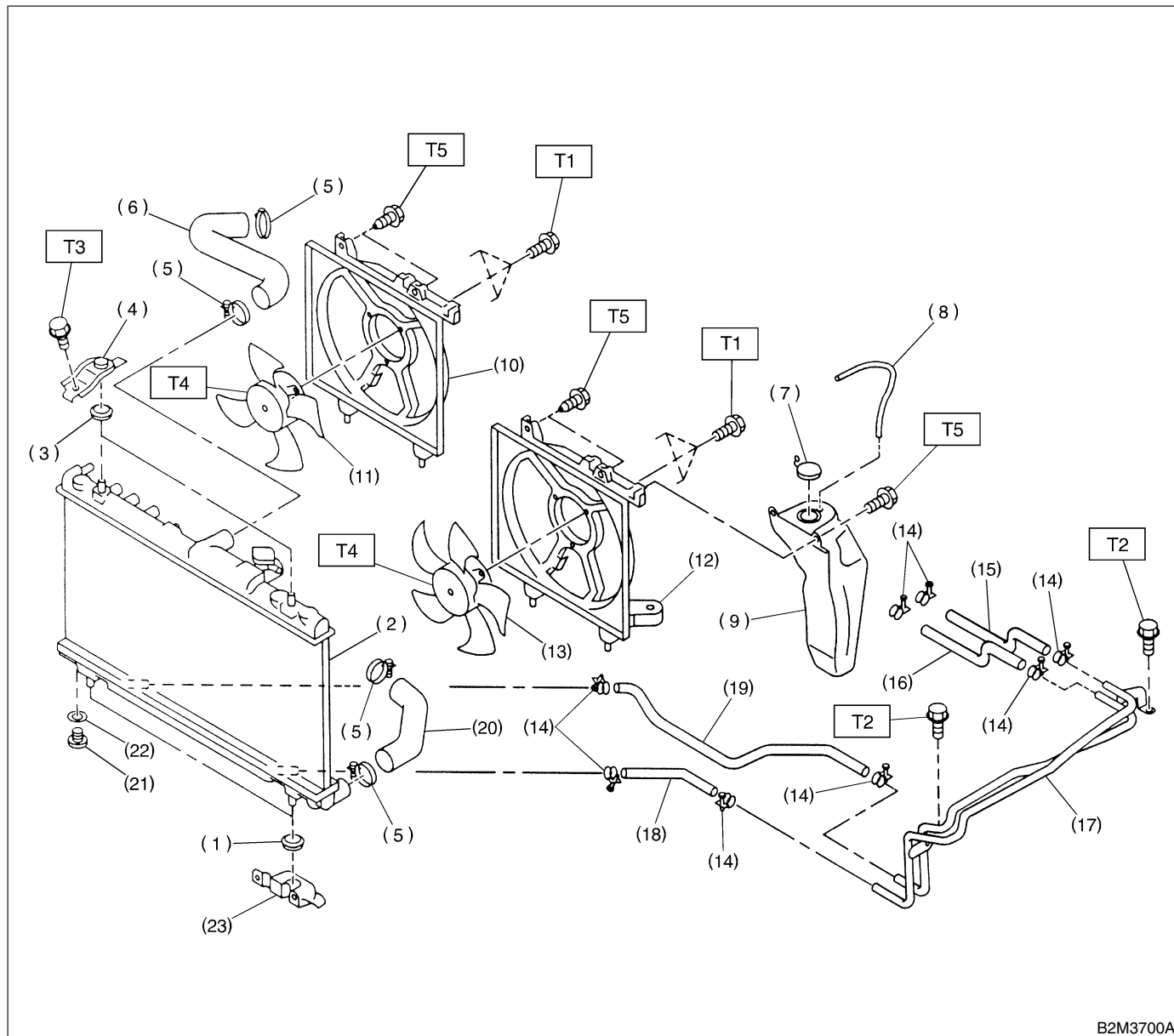
Second 12 (1.2, 8.7)

T2: 6.4 (0.65, 4.7)

GENERAL DESCRIPTION

Cooling

2. RADIATOR AND RADIATOR FAN S176001A0502



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

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 S176001A03

- 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 S176001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
B2M3870	499977100	CRANK PULLEY WRENCH	Used for stopping crankshaft pulley when loosening and tightening crankshaft pulley bolts.
B2M3859	499207100	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.

RADIATOR MAIN FAN SYSTEM

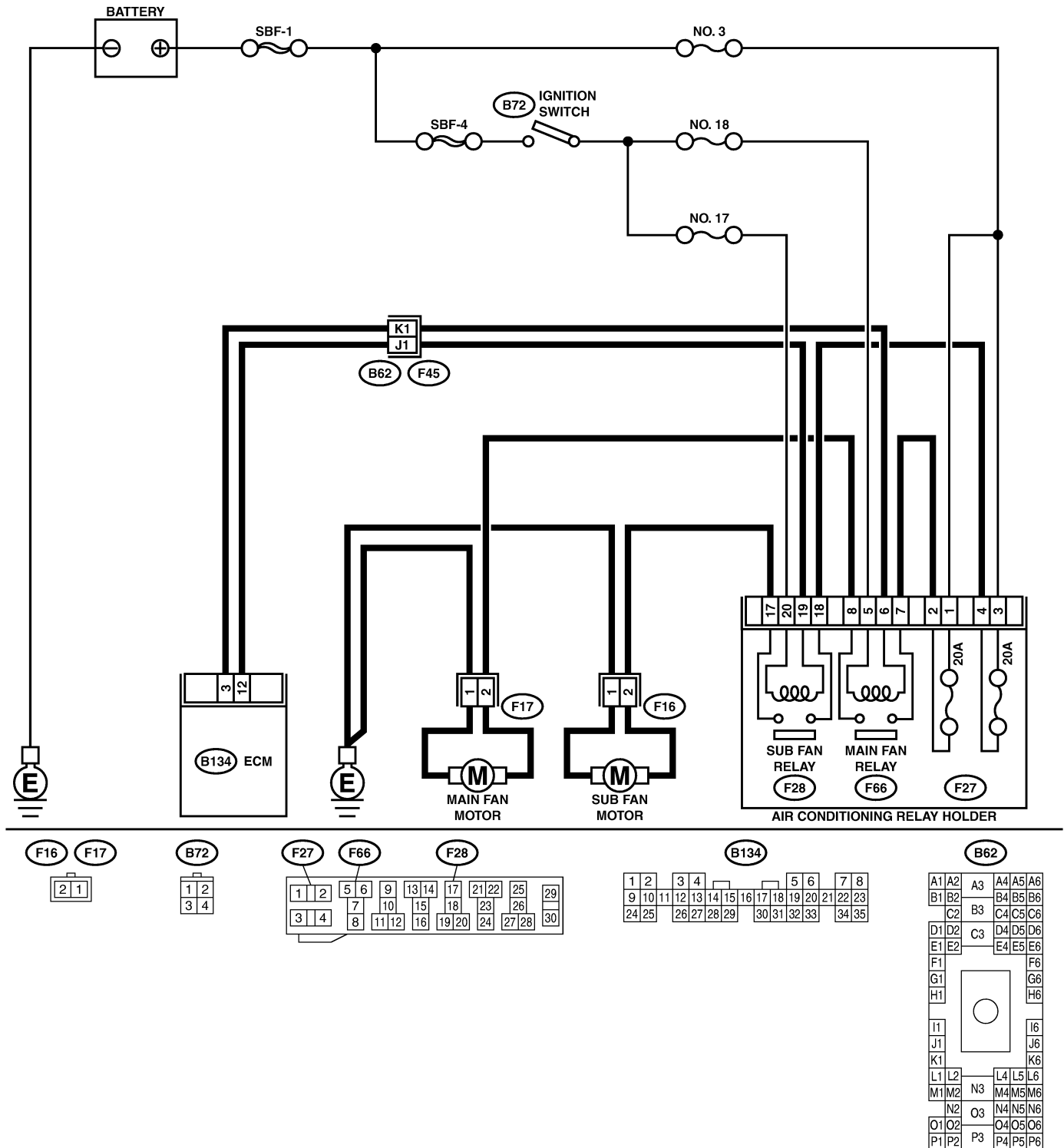
Cooling

2. Radiator Main Fan System

S176732

A: SCHEMATIC

S176732A21



B2M4230

RADIATOR MAIN FAN SYSTEM

Cooling

B: INSPECTION

S176732A10

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.

No.	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 voltage 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 resistance 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 (F66) No. 7 (+) — Chassis ground (-):	Is the voltage 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 (F66) No. 5 (+) — Chassis ground (-):	Is the voltage 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.

RADIATOR MAIN FAN SYSTEM

Cooling

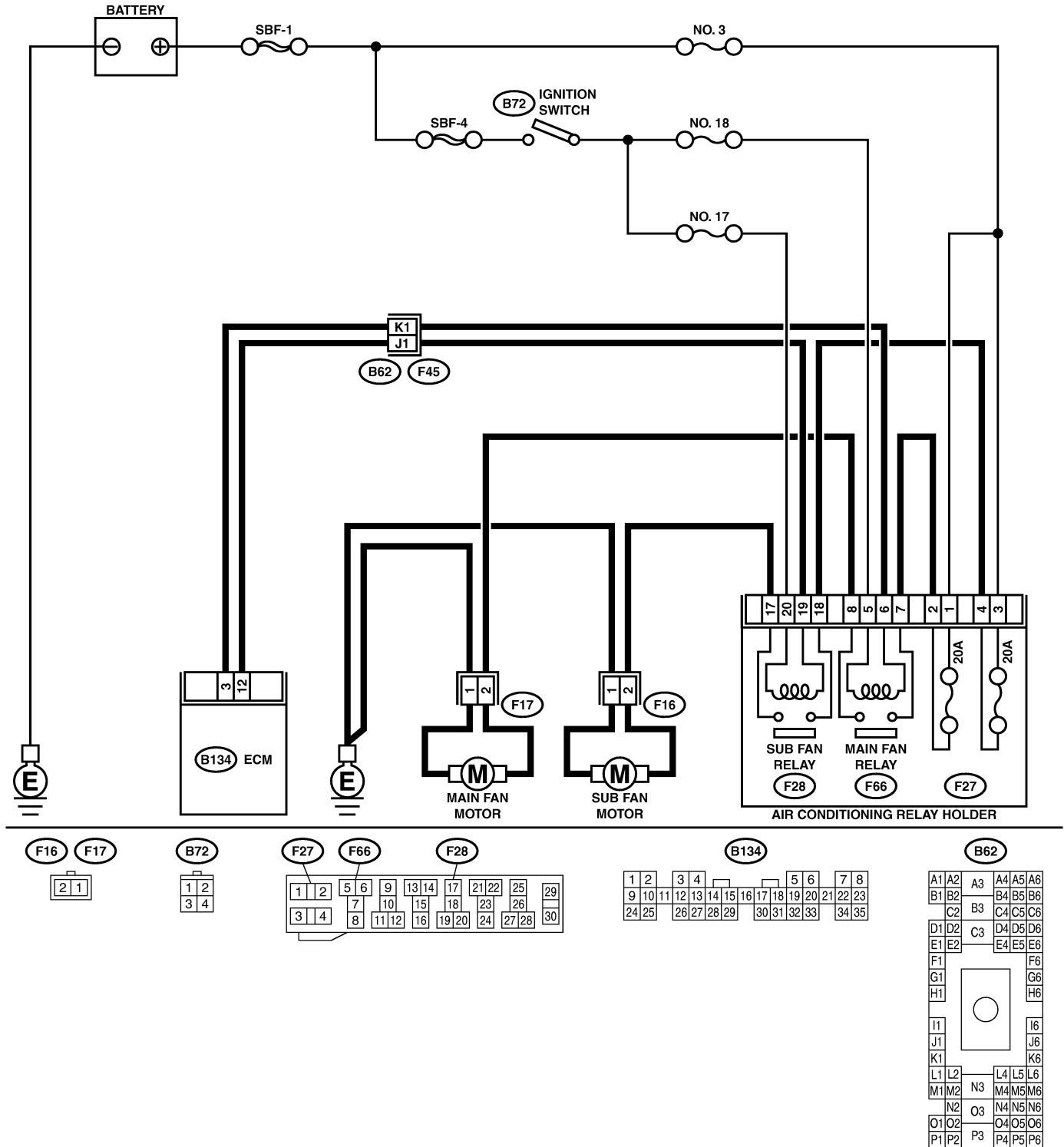
No.	Step	Check	Yes	No
8	CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair open circuit in harness between 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 condition of 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. 7 — No. 8:	Is the resistance more than 1 MΩ?	Go to step 11.	Replace main fan relay.
11	CHECK MAIN FAN RELAY. 1) Connect battery to terminals No. 6 and No. 5 of main fan relay. 2) Measure resistance of main fan relay. Terminal No. 7 — No. 8:	Is the resistance 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 — (F66) No. 8:	Is the resistance 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 (F66) No. 6 — (B134) No. 3:	Is the resistance 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 in connector between main fan motor and ECM?	Repair poor contact connector.	Contact with SOA (distributor) service.

NOTE:

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

3. Radiator Sub Fan System S176733

A: SCHEMATIC S176733A21



RADIATOR SUB FAN SYSTEM

Cooling

B: INSPECTION

S176733A10

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.

No.	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 voltage 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 resistance 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 (F28) No. 18 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 6.	Go to step 7.
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 (F28) No. 20 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 10.	Go to step 9.

RADIATOR SUB FAN SYSTEM

Cooling

No.	Step	Check	Yes	No
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 voltage 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. 17 — No. 18:	Is the resistance more than 1 MΩ?	Go to step 11.	Replace sub fan relay.
11	CHECK SUB FAN RELAY. 1) Connect battery to terminals No. 20 and No. 19 of sub fan relay. 2) Measure resistance of sub fan relay. Terminal No. 17 — No. 18:	Is the resistance 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 — (F28) No. 17:	Is the resistance 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 (F28) No. 19 — (B134) No. 12:	Is the resistance 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.

NOTE:

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

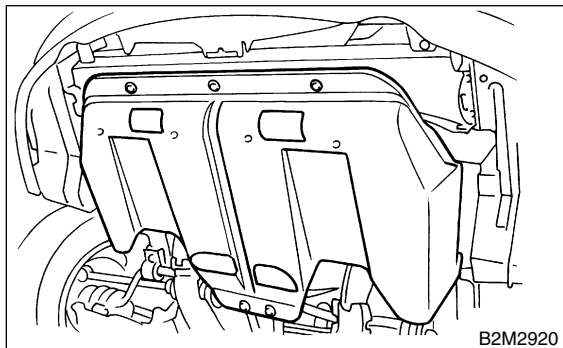
4. Engine Coolant S176060

A: REPLACEMENT S176060A20

1. DRAINING OF ENGINE COOLANT

S176060A2001

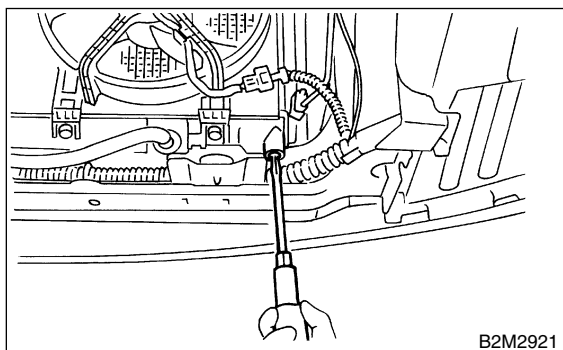
- 1) Lift-up the vehicle.
- 2) Remove under cover.



- 3) Remove drain cock to drain engine coolant into container.

NOTE:

Remove radiator cap so that engine coolant will drain faster.



2. FILLING OF ENGINE COOLANT S176060A2002

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

Engine oil amount for refill:

MT model;

Approx. 6.8 ℓ (7.2 US qt, 6.0 Imp qt)

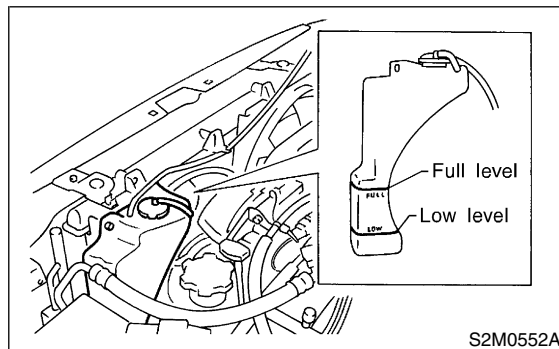
AT model;

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.

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



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

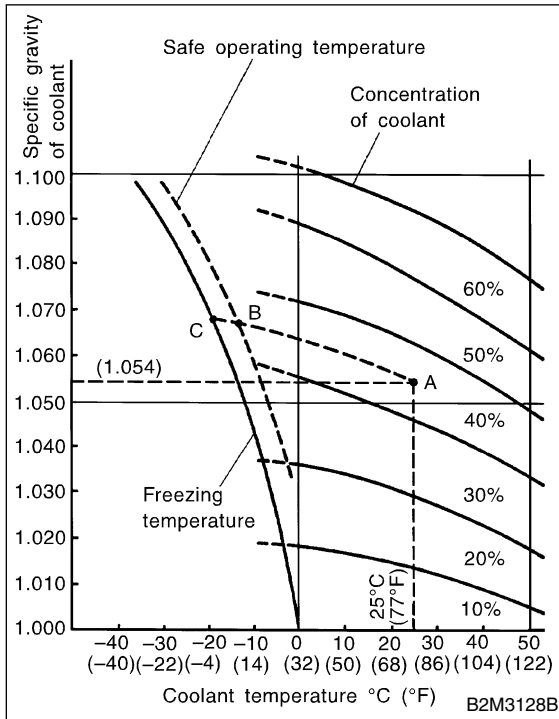
B: INSPECTION S176060A10

1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE S176060A1001

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

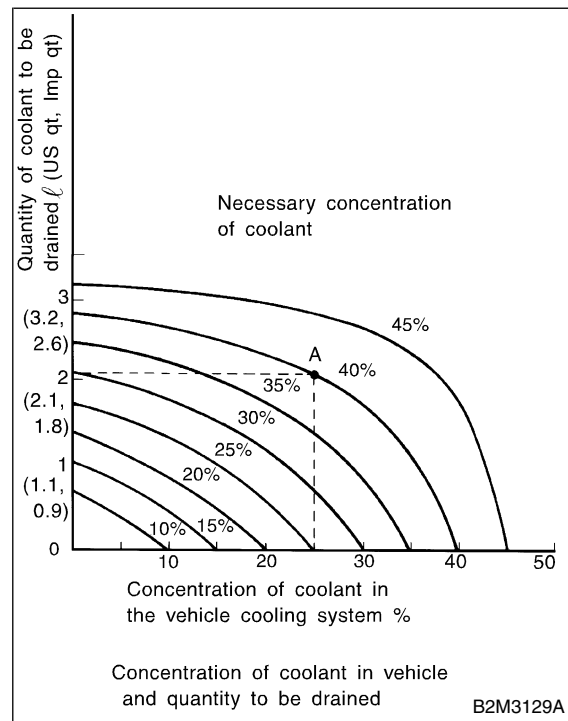
S176060A1002

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.



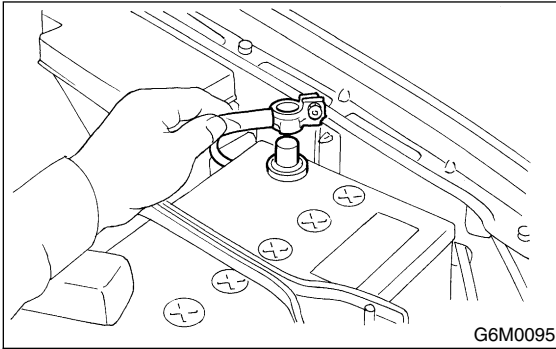
5. Water Pump

S176061

A: REMOVAL

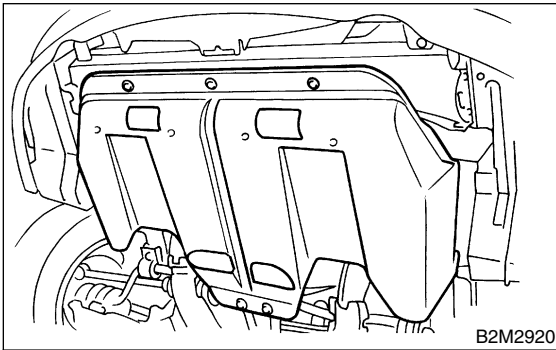
S176061A18

- 1) Disconnect ground cable from battery.



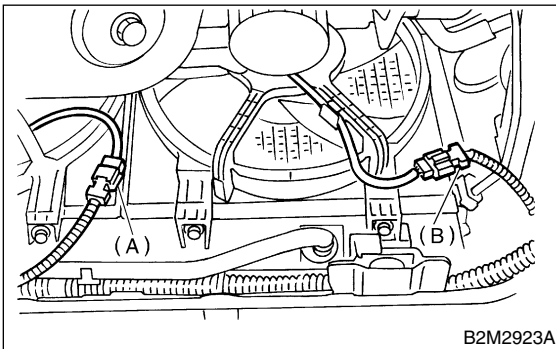
G6M0095

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



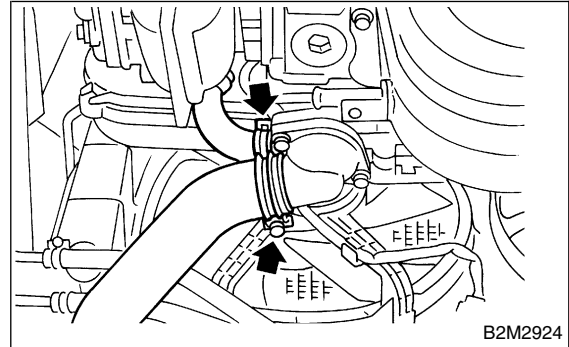
B2M2920

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



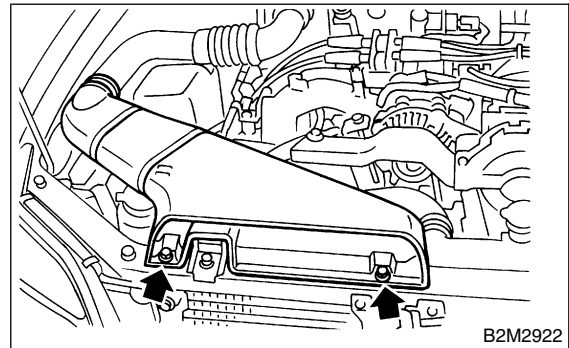
B2M2923A

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



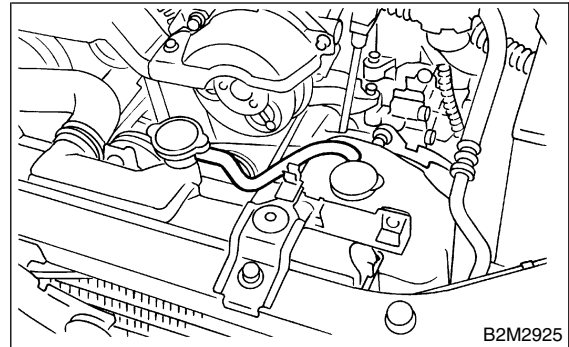
B2M2924

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



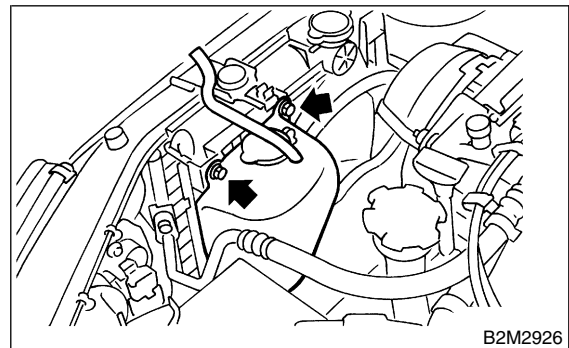
B2M2922

- 9) Disconnect overflow hose.



B2M2925

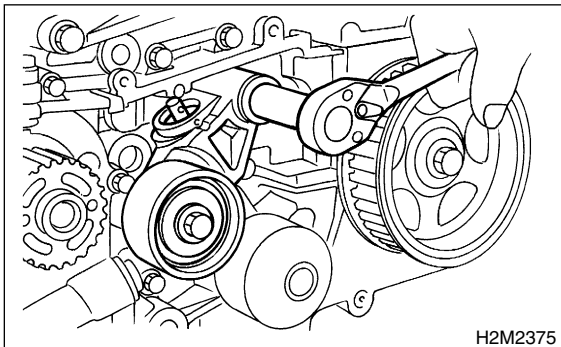
- 10) Remove reservoir tank.



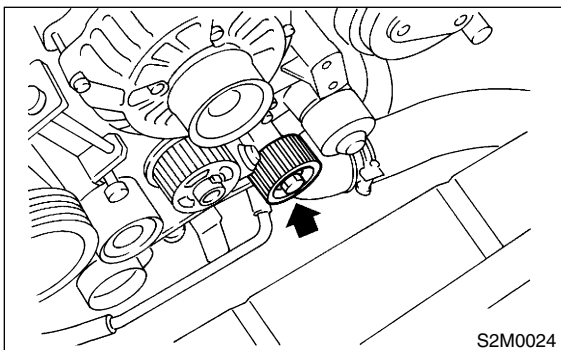
B2M2926

- 11) Remove radiator main fan and sub fan assemblies. <Ref. to CO-26, REMOVAL, Radiator Main Fan and Fan Motor.> and <Ref. to CO-29, REMOVAL, Radiator Sub Fan and Fan Motor.>

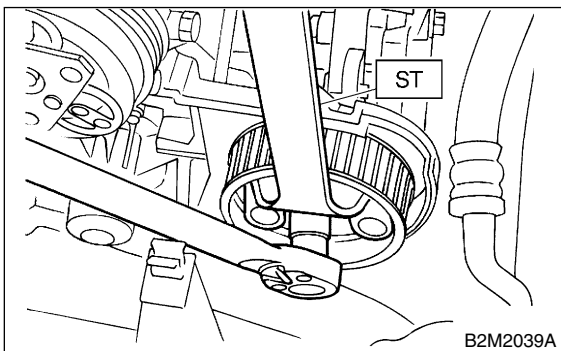
- 12) Remove V-belts.
<Ref. to ME-42, REMOVAL, V-belt.>
- 13) Remove timing belt.
<Ref. to ME-47, TIMING BELT, REMOVAL, Timing Belt Assembly.>
- 14) Remove automatic belt tension adjuster.



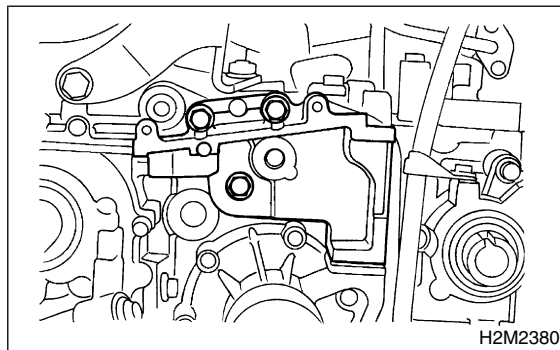
- 15) Remove belt idler No. 2.



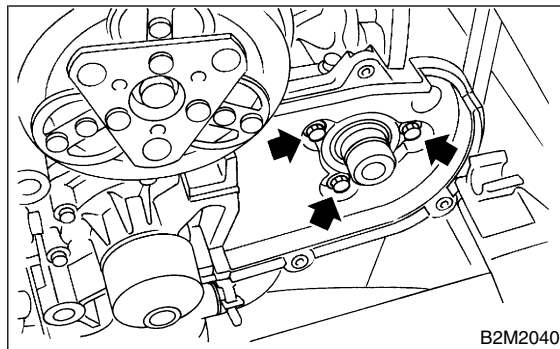
- 16) Remove left-hand camshaft sprocket by using ST.
ST 499207100 CAMSHAFT SPROCKET WRENCH



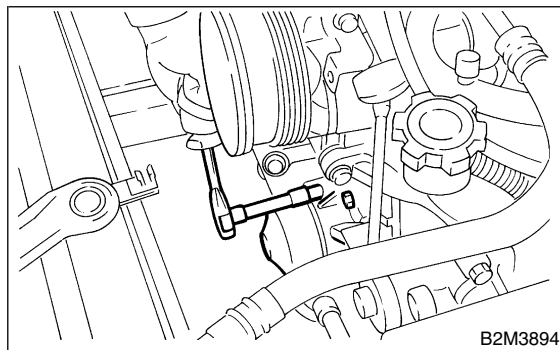
- 17) Remove tensioner bracket.



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



- 19) Disconnect heater hose from water pump.
- 20) Remove water pump.



B: INSTALLATION S176061A11

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

CAUTION:

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

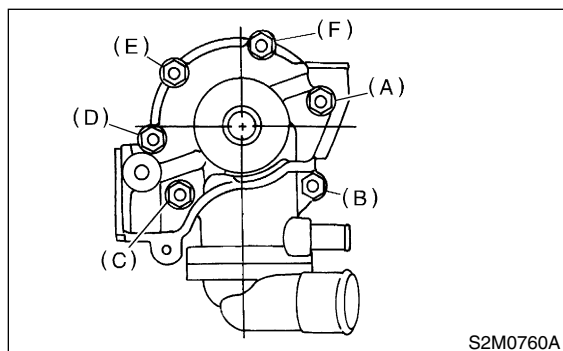
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

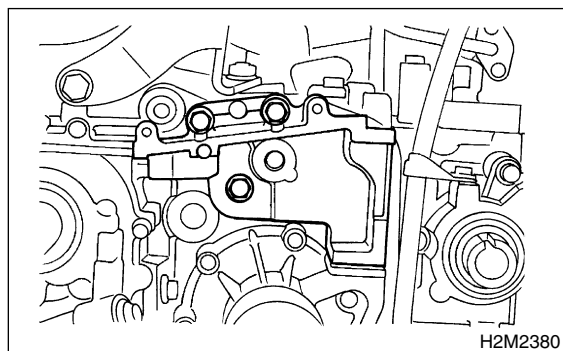
12 N·m (1.2 kgf-m, 8.7 ft-lb)



2) Install tensioner bracket.

Tightening torque:

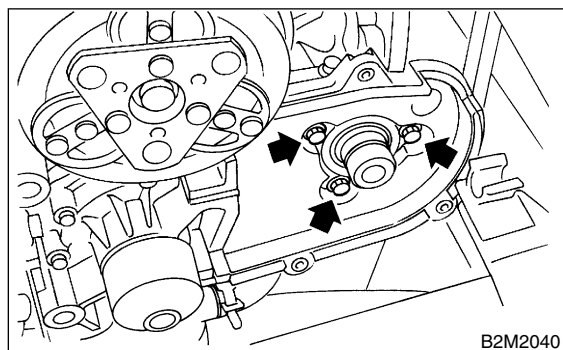
25 N·m (2.5 kgf-m, 18.1 ft-lb)



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

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

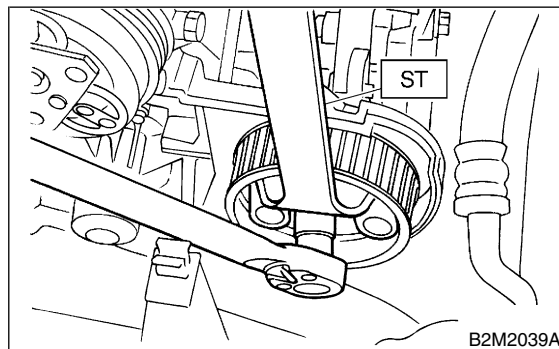


4) Install left-hand camshaft sprockets by using ST.

ST 4992707100 CAMSHAFT SPROCKET WRENCH

Tightening torque:

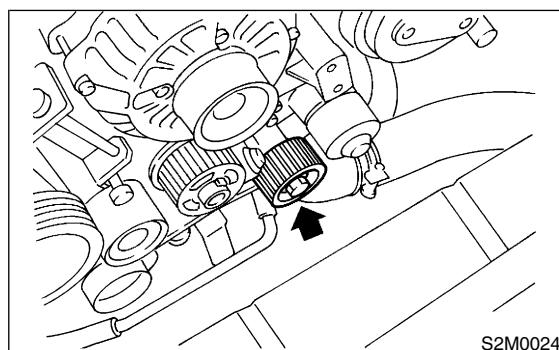
78 N·m (8.0 kgf-m, 57.9 ft-lb)



5) Install belt idler No. 2.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



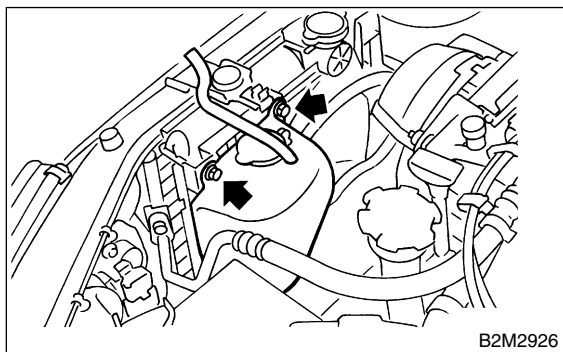
6) Install automatic belt tension adjuster which tension rod is held with pin. <Ref. to ME-48, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

7) Install timing belt. <Ref. to ME-48, TIMING BELT, INSTALLATION, Timing Belt Assembly.>

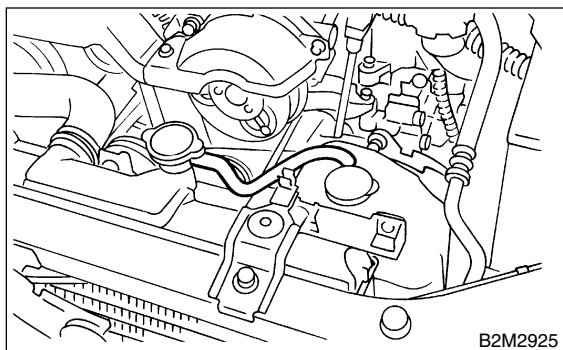
8) Install V-belts. <Ref. to ME-42, INSTALLATION, V-belt.>

9) Install radiator main fan and sub fan motor assemblies. <Ref. to CO-27, INSTALLATION, Radiator Main Fan and Fan Motor.> and <Ref. to CO-29, INSTALLATION, Radiator Sub Fan and Fan Motor.>

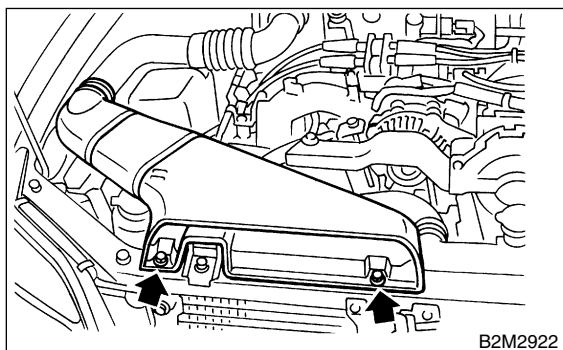
10) Install reservoir tank.



11) Connect overflow hose.

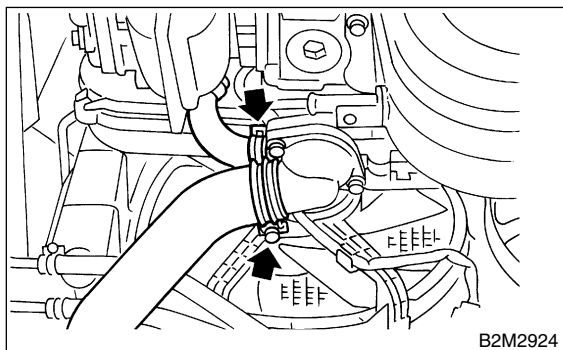


12) Install air intake duct.

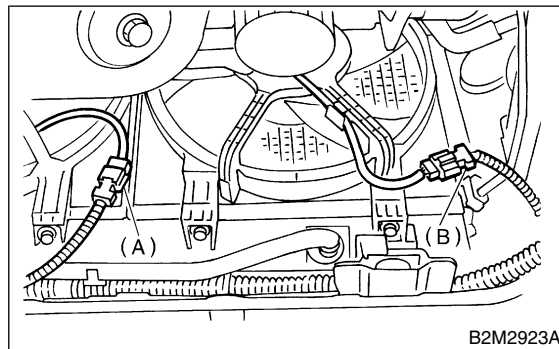


13) Lift-up the vehicle.

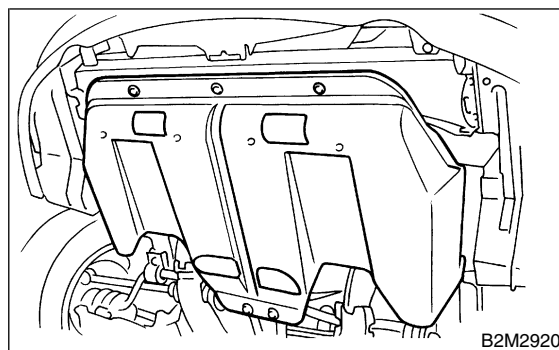
14) Connect radiator outlet hose and heater hose to water pump.



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

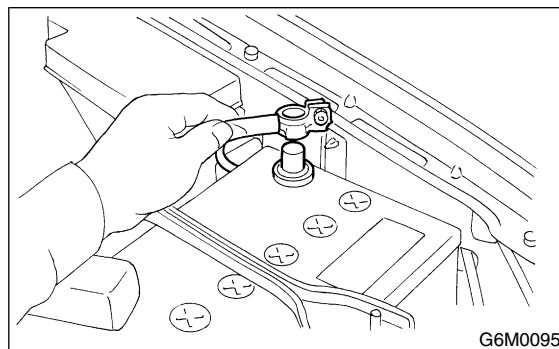


16) Install under cover.



17) Lower the vehicle.

18) Connect battery ground cable.

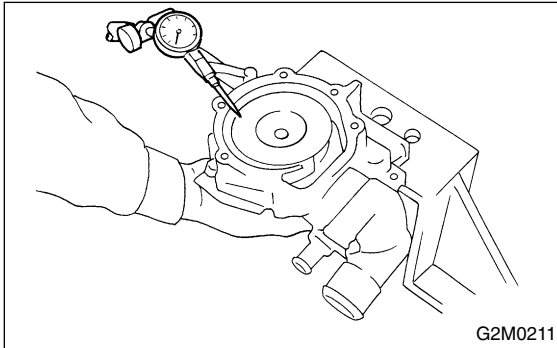


19) Fill coolant. <Ref. to CO-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION S176061A10

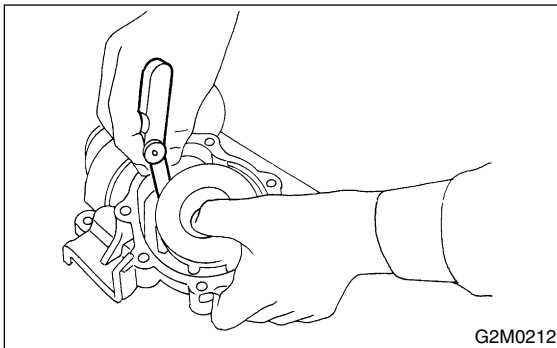
- 1) Check water pump bearing for smooth rotation.
- 2) Check water pump pulley for abnormalities.
- 3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

“Thrust” runout limit:
0.5 mm (0.020 in)



- 4) Check clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 0.7 mm (0.020 — 0.028 in)
Limit
1.0 mm (0.039 in)

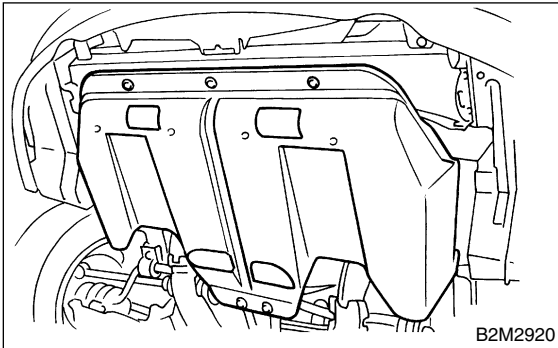


- 5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.

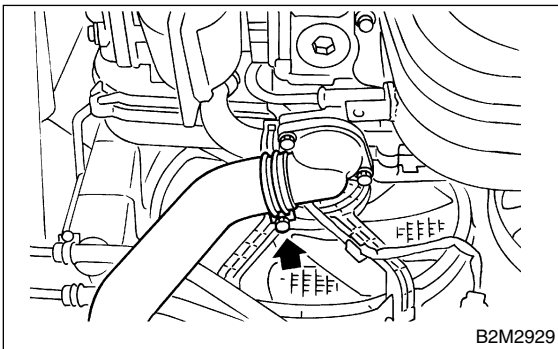
6. Thermostat S176062

A: REMOVAL S176062A18

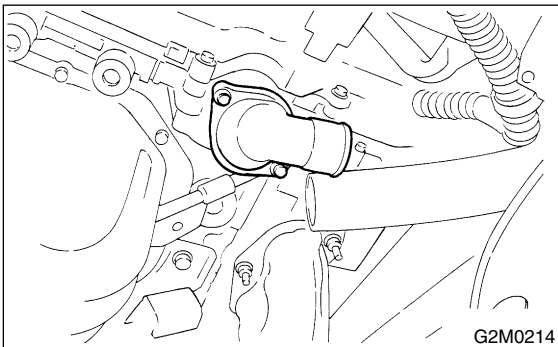
- 1) Lift-up the vehicle.
- 2) Remove under cover.



- 3) Drain engine coolant completely. <Ref. to CO-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 S176062A11

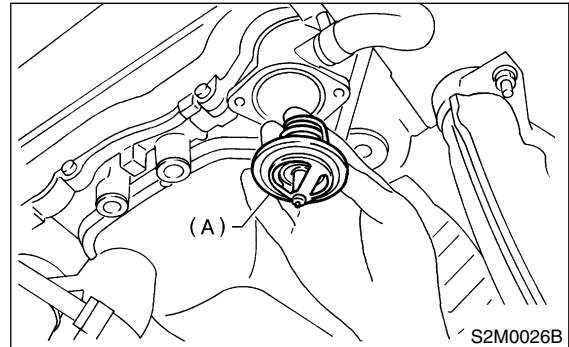
- 1) Install the thermostat in the water pump, and install the thermostat cover together with a gasket.

CAUTION:

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

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



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

C: INSPECTION S176062A10

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

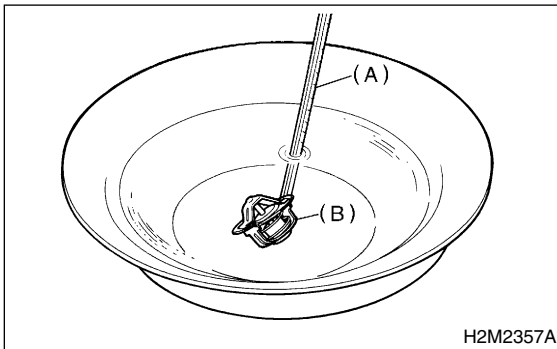
Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be within the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

Starts to open:

76.0 — 80.0°C (169 — 176°F)

Fully opens:

91°C (196°F)

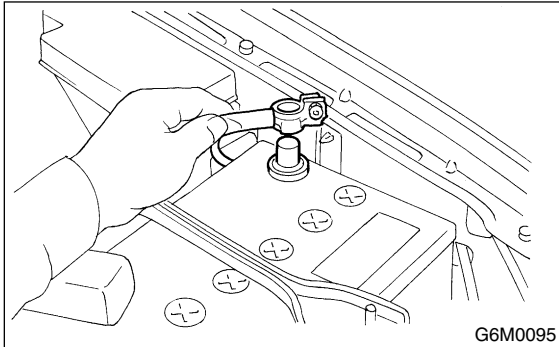


- (A) Thermometer
- (B) Thermostat

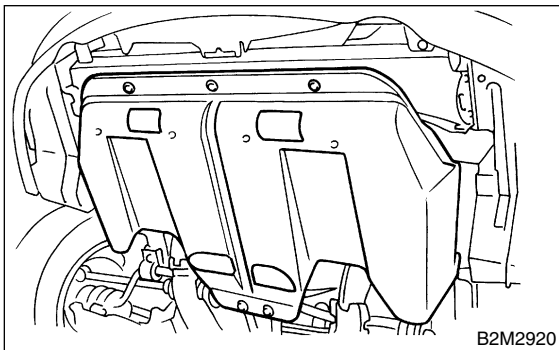
7. Radiator S176058

A: REMOVAL S176058A18

- 1) Disconnect battery ground cable.

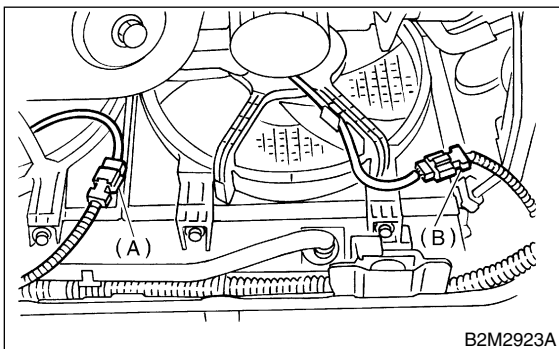


- 2) Lift-up the vehicle.
- 3) Remove under cover.

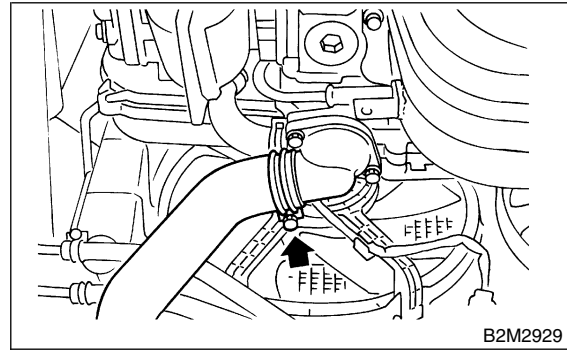


- 4) Drain engine coolant completely. <Ref. to CO-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

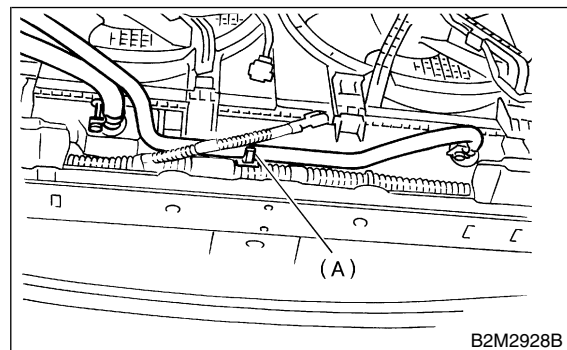
- 5) Disconnect connectors of radiator main fan (A) and sub fan (B) motor.



- 6) Disconnect radiator outlet hose from thermostat cover.

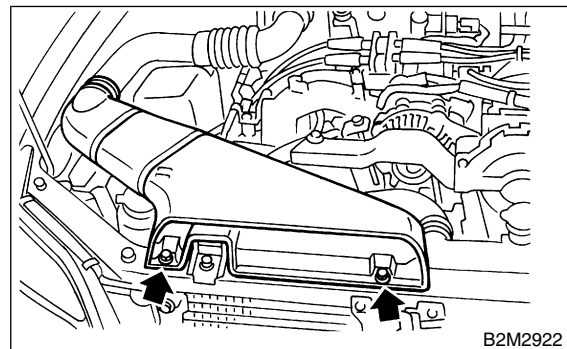


- 7) Disconnect ATF cooler hoses from radiator. (AT vehicles only)

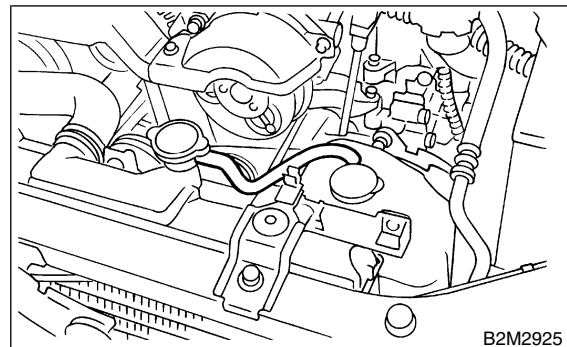


(A) Clip

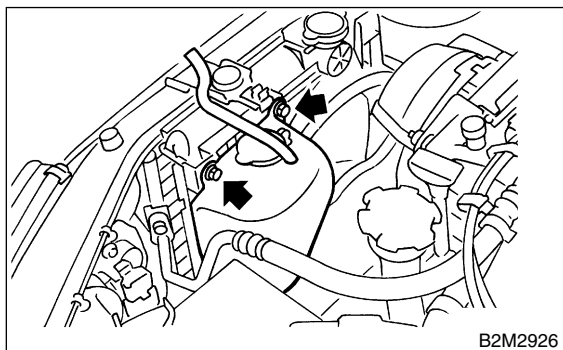
- 8) Lower the vehicle.
- 9) Remove air intake duct.



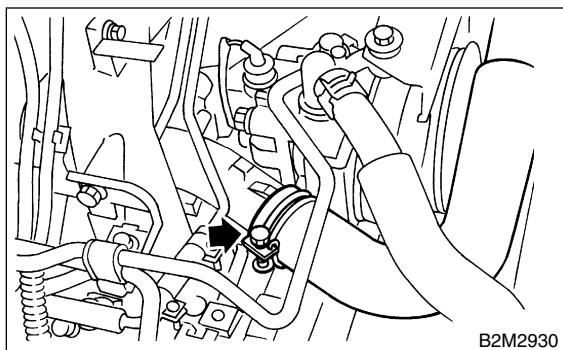
- 10) Disconnect overflow hose.



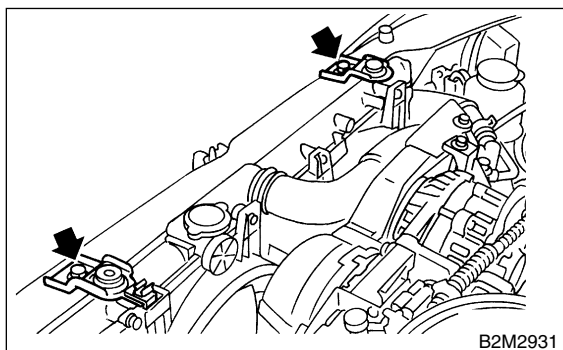
11) Remove reservoir tank.



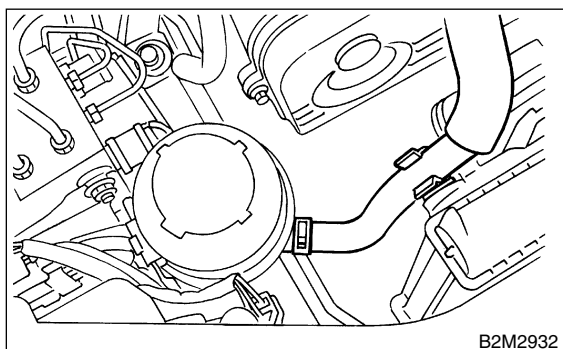
12) Disconnect radiator inlet hose from engine.



13) Remove radiator upper brackets.

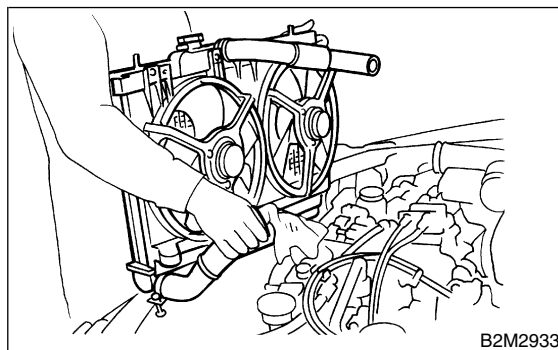


14) Detach power steering hose from the clip on the radiator.



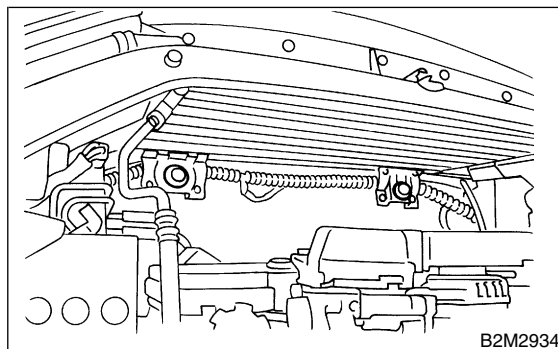
15) While slightly lifting radiator, slide it to left.

16) Lift radiator up and away from vehicle.



B: INSTALLATION S176058A11

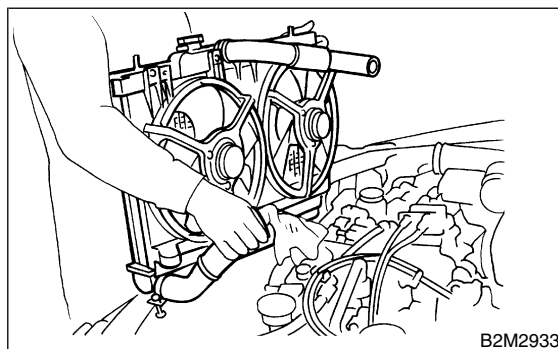
1) Attach radiator mounting cushions to holes on the vehicle.



2) Install radiator while fitting radiator pins to cushions.

NOTE:

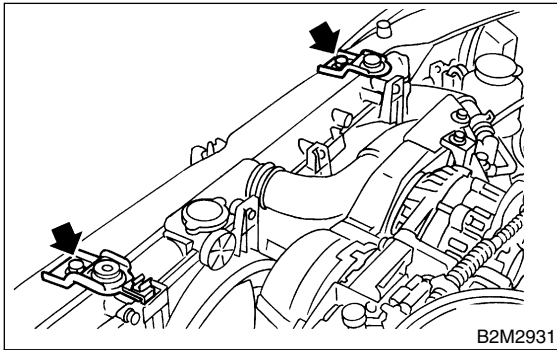
Fit pins on lower side of radiator into cushions on body side.



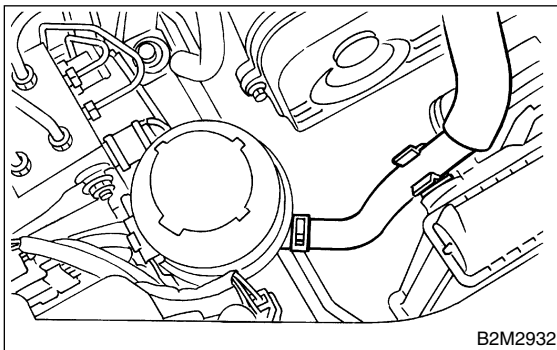
3) Install radiator brackets and tighten bolts.

Tightening torque:

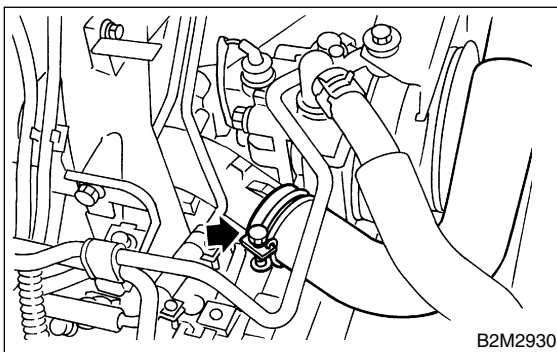
18 N·m (1.8 kgf-m, 13.0 ft-lb)



4) Attach power steering hose to the radiator.



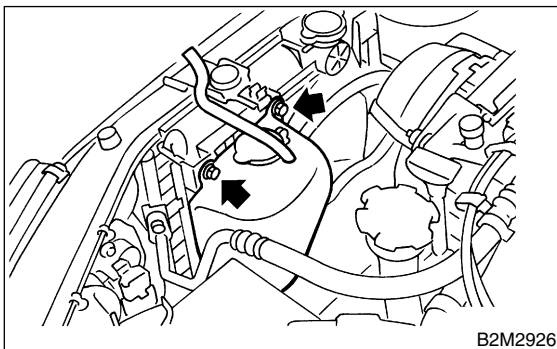
5) Connect radiator inlet hose.



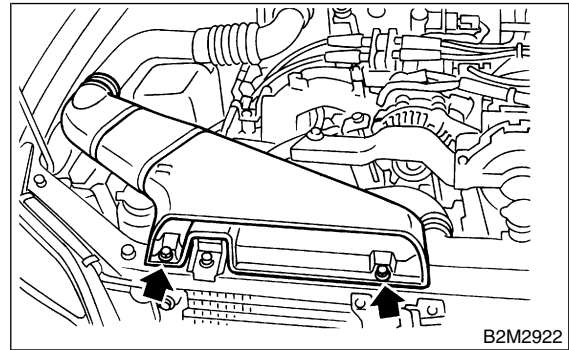
6) Install reservoir tank.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

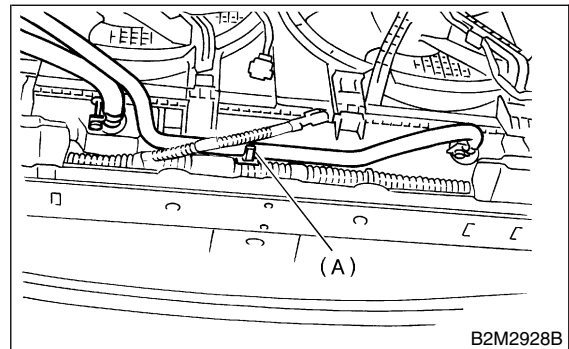


7) Install air intake duct.



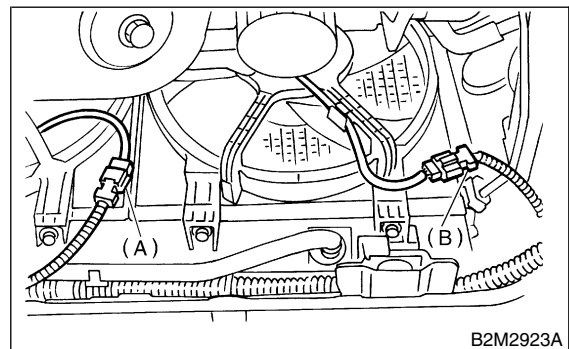
8) Lift-up the vehicle.

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

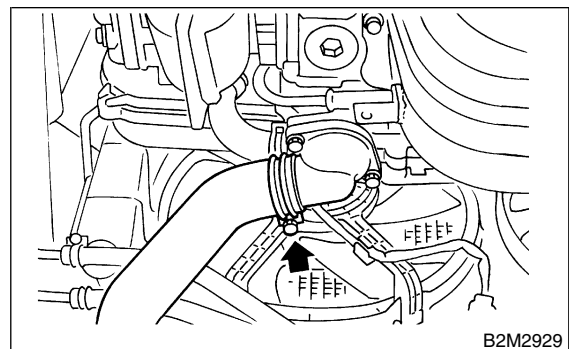


(A) Clip

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



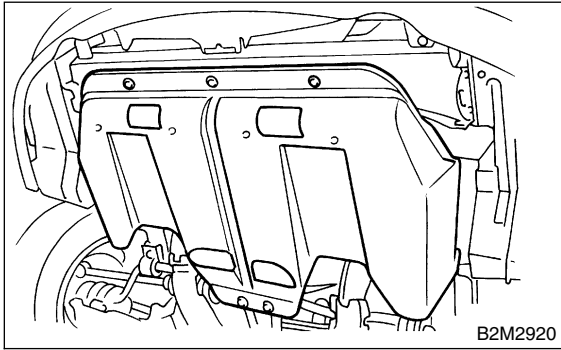
11) Connect radiator outlet hose.



RADIATOR

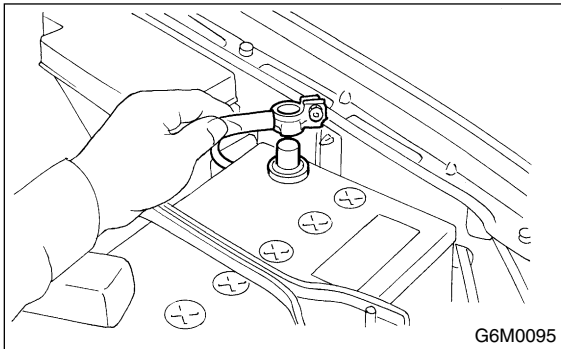
Cooling

12) Install under cover.



13) Lower the vehicle.

14) Connect battery ground cable.

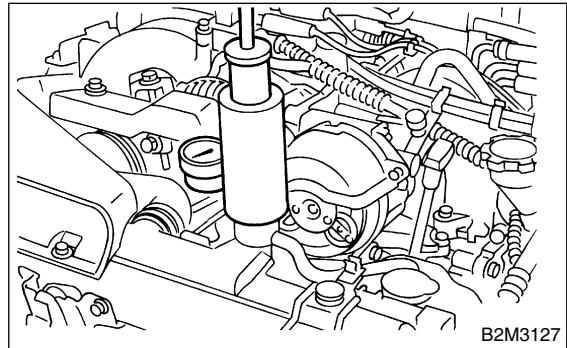


15) Fill coolant. <Ref. to CO-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

16) Check ATF level. <Ref. to AT-9, REPLACEMENT, Automatic Transmission Fluid.>

C: INSPECTION S176058A10

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/cm², 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 also not to deform filler neck of radiator when installing or removing tester.

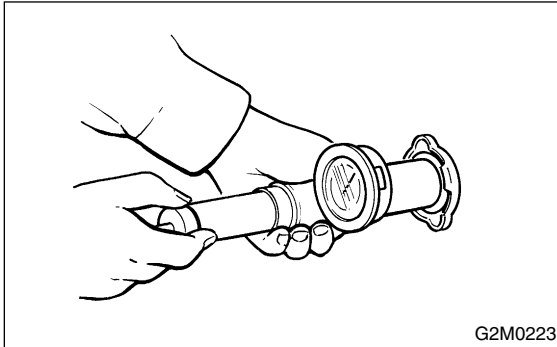
8. Radiator Cap

S176064

A: INSPECTION

S176064A10

- 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/cm², 14 — 18 psi)

Service limit pressure:

83 kPa (0.85 kg/cm², 12 psi)

CAUTION:

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

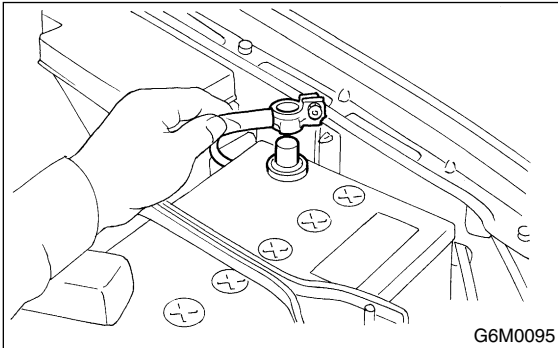
9. Radiator Main Fan and Fan Motor

S176059

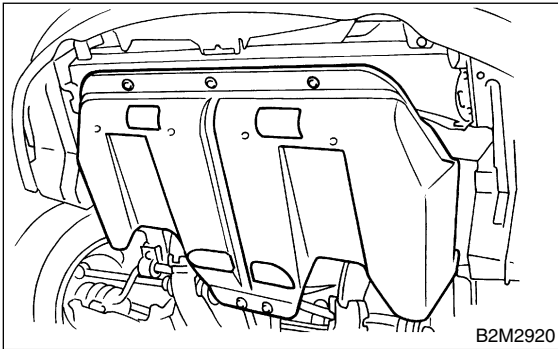
A: REMOVAL

S176059A18

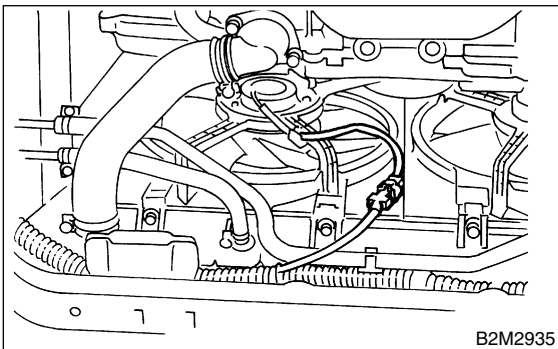
- 1) Disconnect battery ground cable.



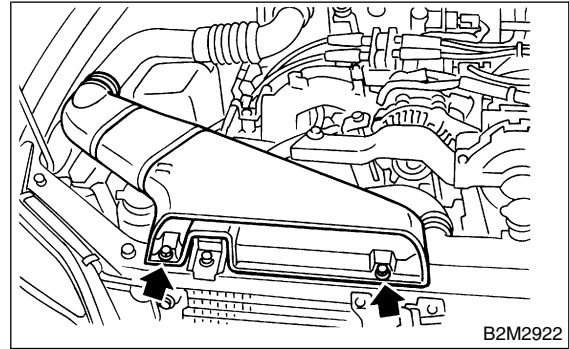
- 2) Lift-up the vehicle.
- 3) Remove under cover.



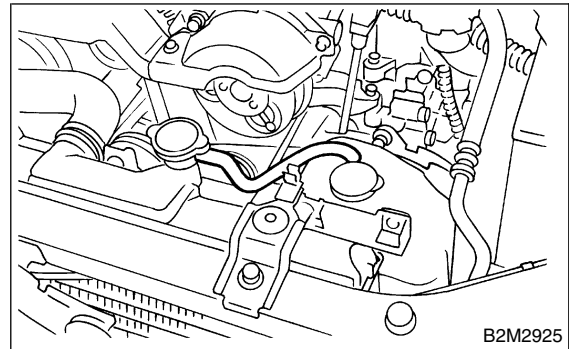
- 4) Disconnect connector of main fan motor.



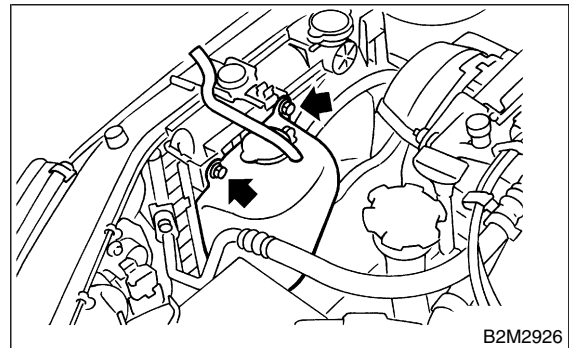
- 5) Lower the vehicle.
- 6) Remove air intake duct.



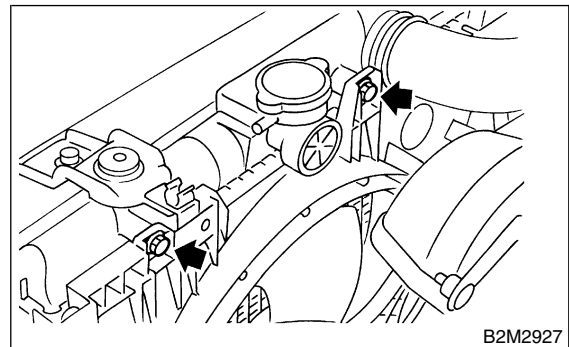
- 7) Disconnect overflow hose.



- 8) Remove reservoir tank.



- 9) Remove radiator main fan motor assembly.



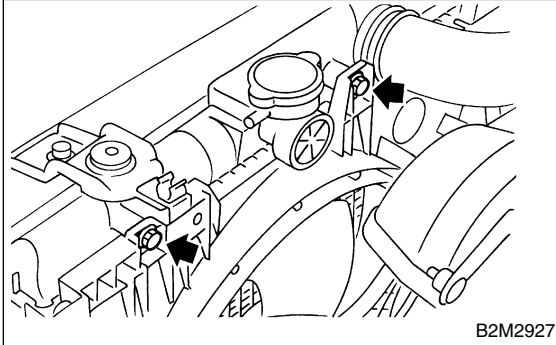
B: INSTALLATION

S176059A11

Install in the reverse order of removal.

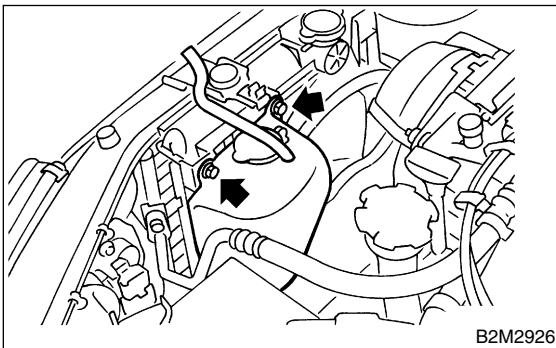
NOTE:

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



Tightening torque:

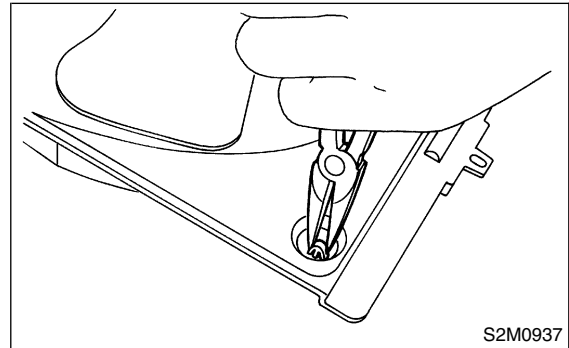
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



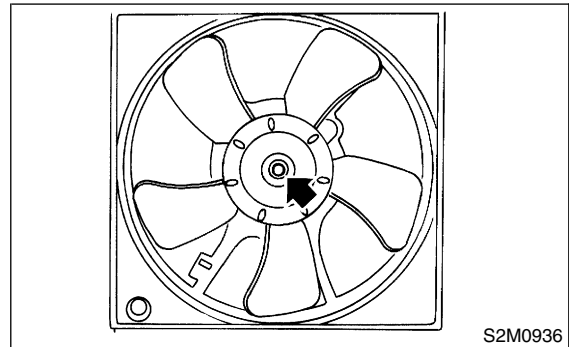
C: DISASSEMBLY

S176059A06

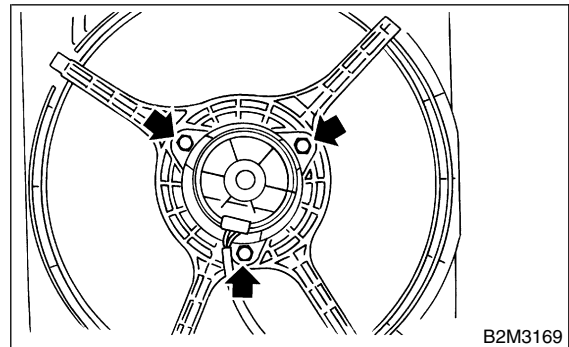
- 1) Remove clip which holds motor connector onto shroud.



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



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



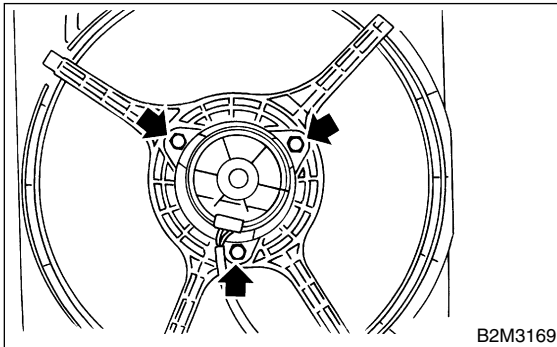
RADIATOR MAIN FAN AND FAN MOTOR

Cooling

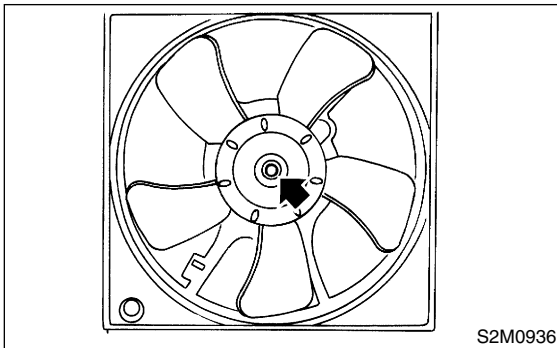
D: ASSEMBLY S176059A02

Assemble in the reverse order of disassembly.

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

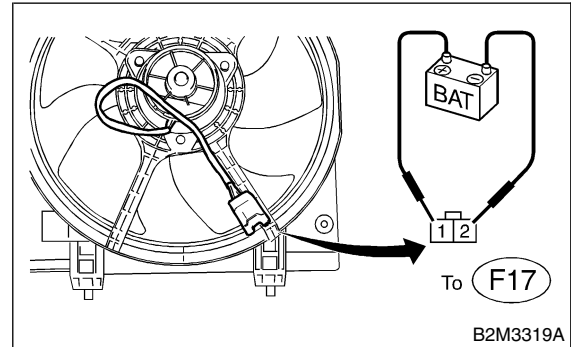


Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



E: INSPECTION S176059A10

- 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.



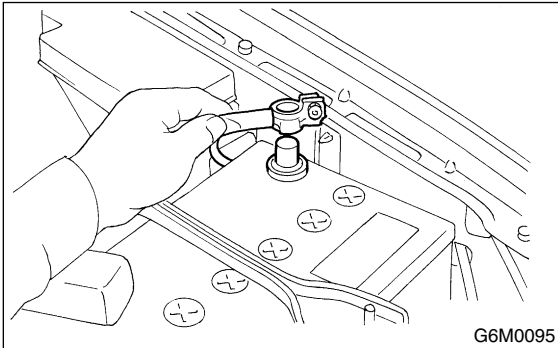
10. Radiator Sub Fan and Fan Motor

S176074

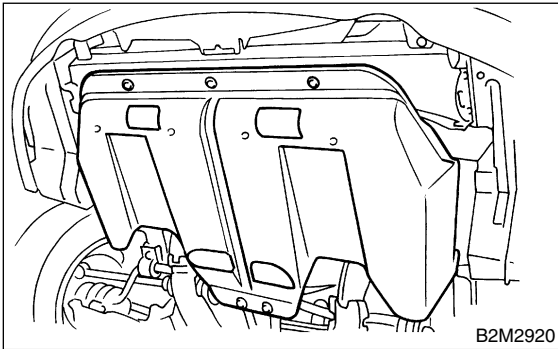
A: REMOVAL

S176074A18

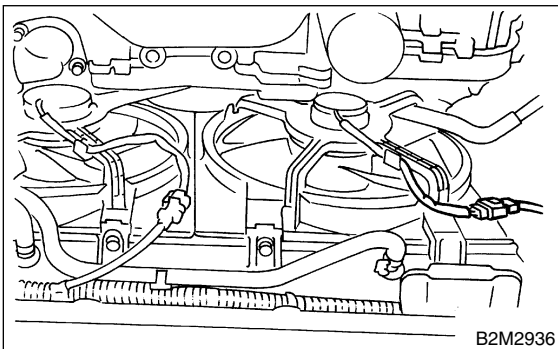
- 1) Disconnect battery ground cable.



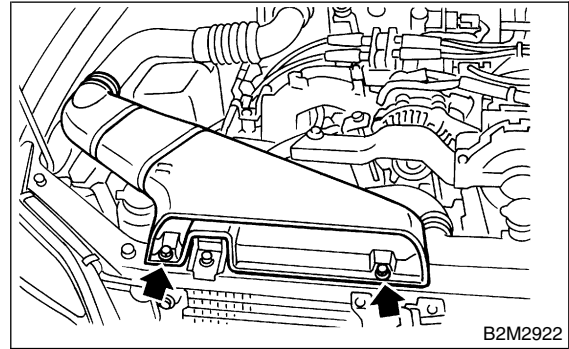
- 2) Lift-up the vehicle.
- 3) Remove under cover.



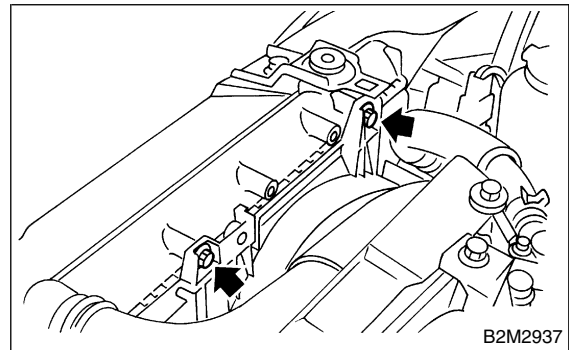
- 4) Disconnect connector of sub fan motor.



- 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.



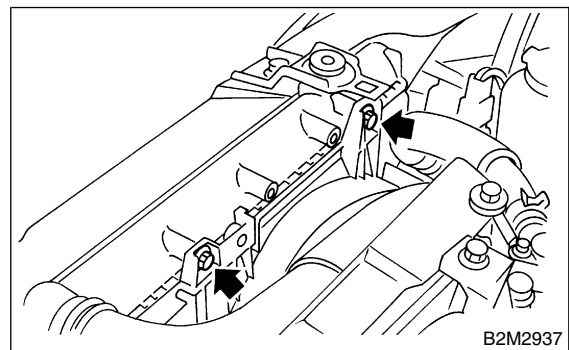
B: INSTALLATION

S176074A11

Install in the reverse order of removal.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



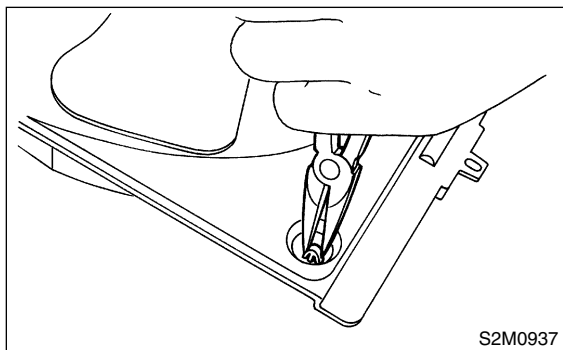
RADIATOR SUB FAN AND FAN MOTOR

Cooling

C: DISASSEMBLY

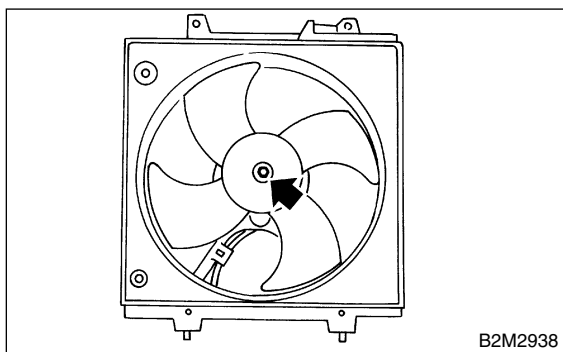
S176074A06

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



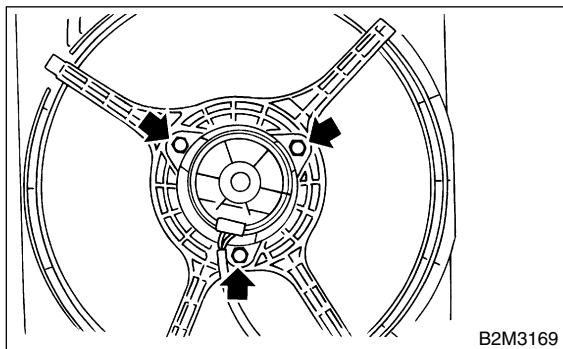
S2M0937

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



B2M2938

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



B2M3169

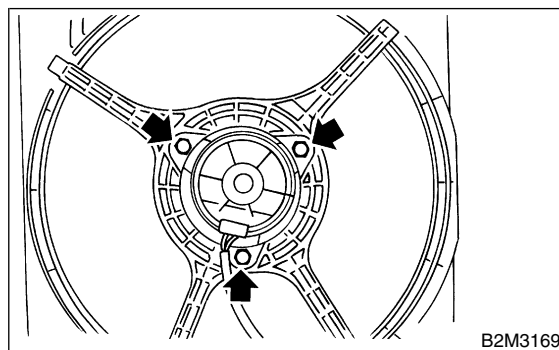
D: ASSEMBLY

S176074A02

Assemble in the reverse order of disassembly.

Tightening torque:

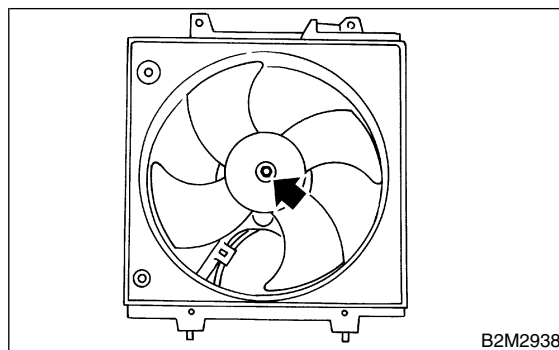
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



B2M3169

Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)

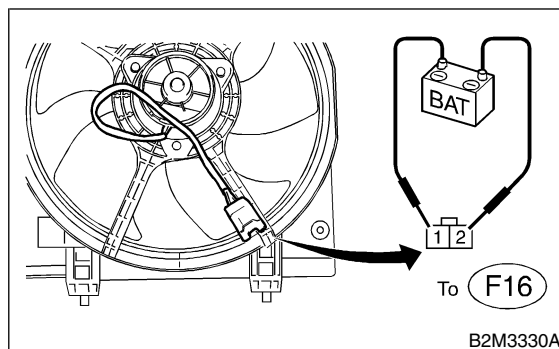


B2M2938

E: INSPECTION

S176074A10

- 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.

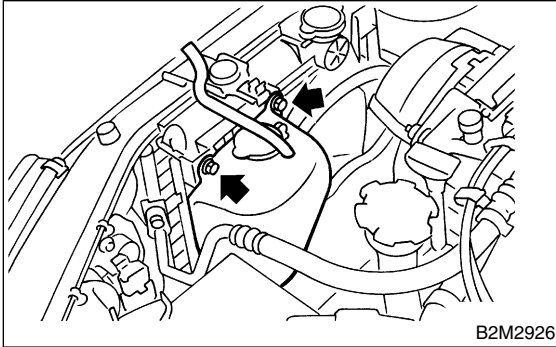


B2M3330A

11. Reservoir Tank S176075

A: REMOVAL S176075A18

- 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.

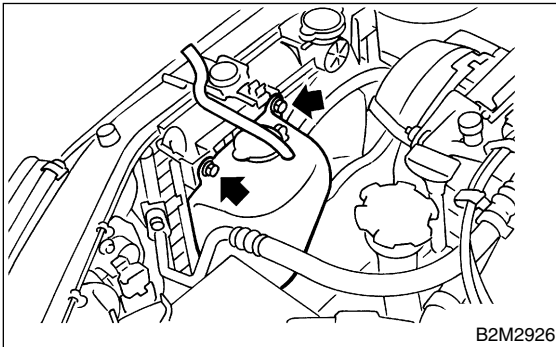


B: INSTALLATION S176075A11

Install in the reverse order of removal.

Tightening torque:

4.9N·m (0.50 kgf-m, 3.6 ft-lb)



C: INSPECTION S176075A10

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

ENGINE COOLING SYSTEM TROUBLE IN GENERAL

Cooling

12. Engine Cooling System Trouble in General

S176078

A: INSPECTION

S176078A10

Trouble		Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN-2, ENGINE, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system. <Ref. to EN-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. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks.	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and crank-case	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.

GENERAL DESCRIPTION

Lubrication

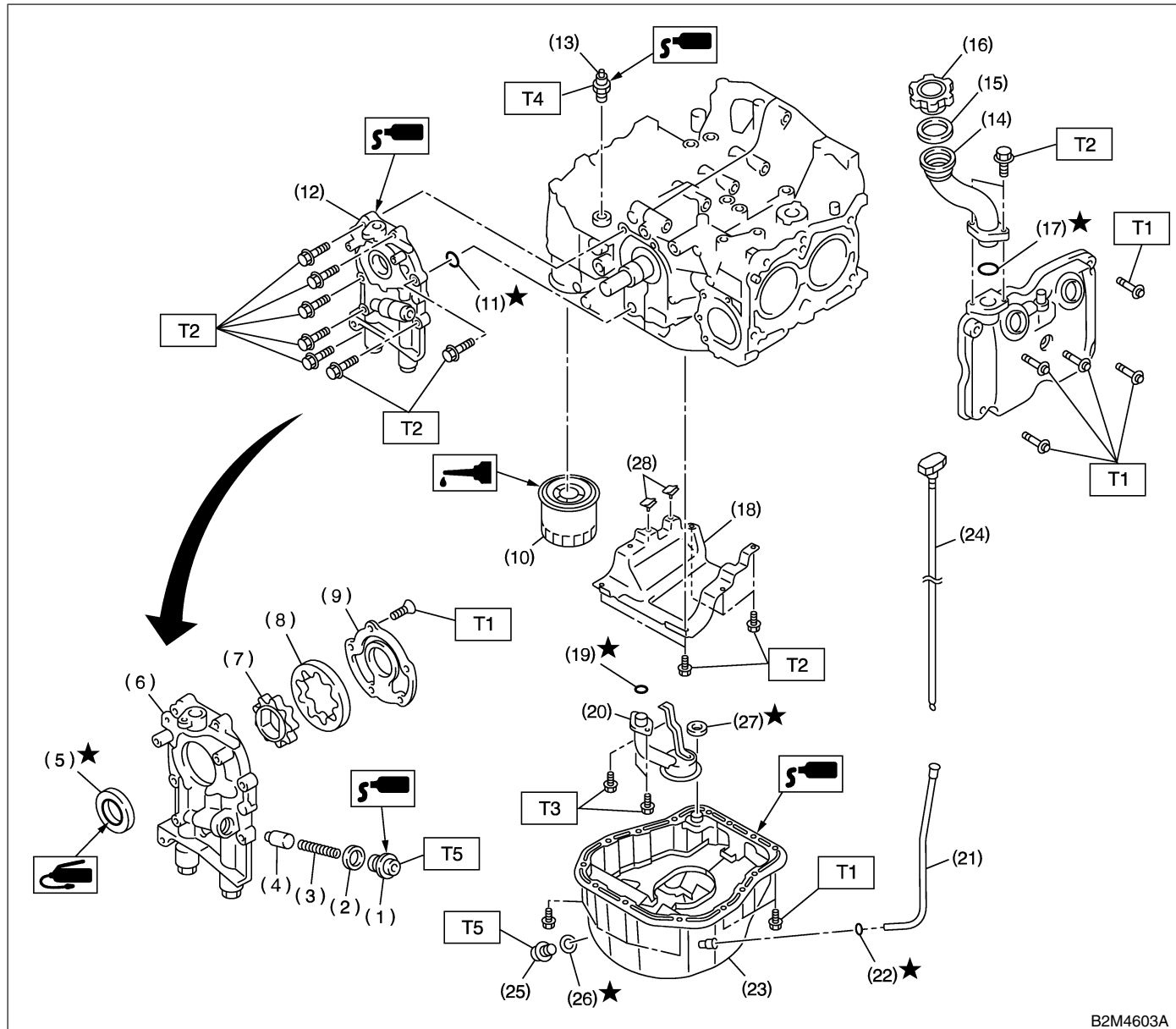
1. General Description S178001

A: SPECIFICATIONS S178001E49

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)	
				- 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)		
			- quantity	32.6 ℓ (8.61 US gal, 7.17 Imp gal)/min.		
Relief valve operation pressure					490 kPa (5.0 kg/cm ² , 71 psi)	
Oil filter	Type				Full-flow filter type	
	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)	
	Oil filter to engine thread size				M 20 × 1.5	
Relief valve (on rocker shaft) operation pressure					69 kPa (0.7kg/cm ² , 10 psi)	
Oil pressure switch	Type				Immersed contact point type	
	Working voltage — wattage				12 V — 3.4 W or less	
	Warning light activation pressure				14.7 kPa (0.15 kg/cm ² , 2.1 psi)	
	Proof pressure				More than 981 kPa (10 kg/cm ² , 142 psi)	
Oil capacity	Upper level				4.0 ℓ (4.2 US qt, 3.5 Imp qt)	
	Lower level				3.0 ℓ (3.2 US qt, 2.6 Imp qt)	

B: COMPONENT

S178001A05



B2M4603A

(1) Plug	(13) Oil pressure switch
(2) Washer	(14) Oil filler duct
(3) Relief valve spring	(15) O-ring
(4) Relief valve	(16) Oil filler cap
(5) Oil seal	(17) O-ring
(6) Oil pump case	(18) Baffle plate
(7) Inner rotor	(19) O-ring
(8) Outer rotor	(20) Oil strainer
(9) Oil pump cover	(21) Oil level gauge guide
(10) Oil filter	(22) O-ring
(11) O-ring	(23) Oil pan
(12) Oil pump ASSY	(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)

GENERAL DESCRIPTION

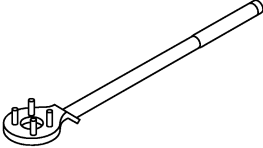
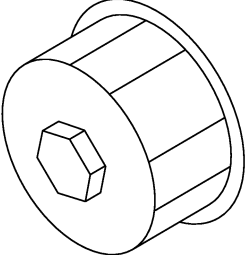
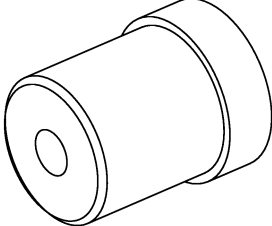
Lubrication

C: CAUTION S178001A03

- 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.

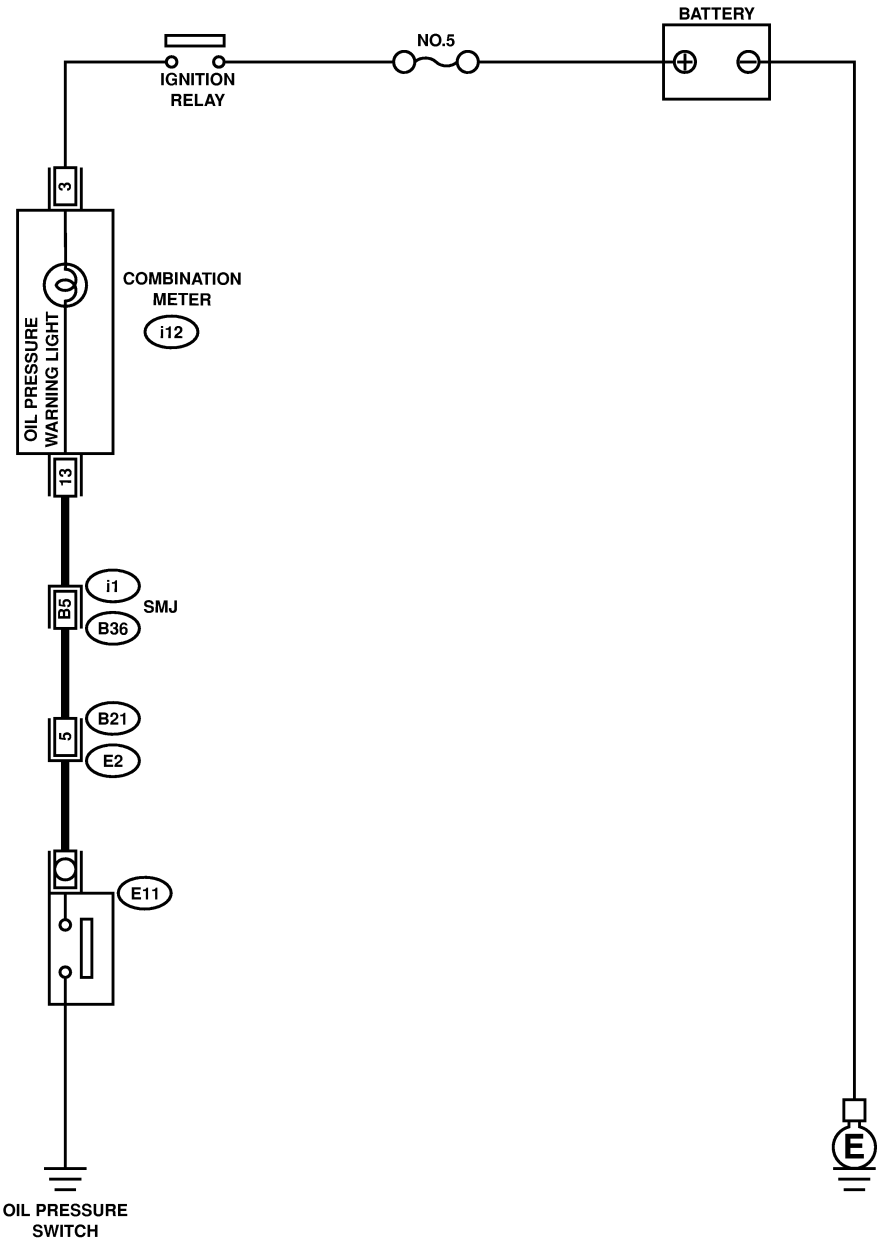
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect ground cable from battery.

D: PREPARATION TOOL S178001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3870	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 B2M3872	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.
 B2M3875	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

2. Oil Pressure System S178076

A: SCHEMATIC S178076A21



i12 (GREEN)

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

B21 (GRAY)

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20

B36

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

OIL PRESSURE SYSTEM

Lubrication

B: INSPECTION

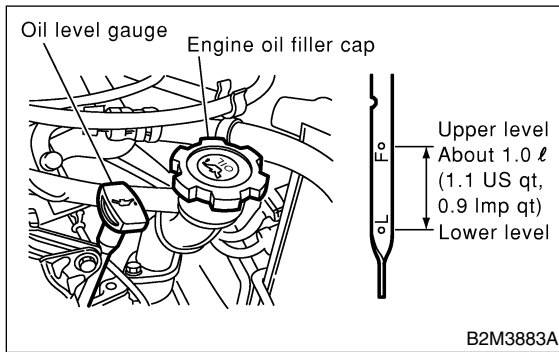
S178076A10

No.	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 voltage 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. C13 — No. C3:	Is the resistance 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 S178077

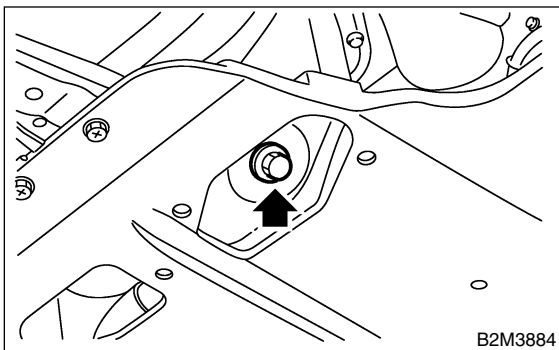
A: INSPECTION S178077A10

- 1) Park vehicle on a level surface.
- 2) Remove oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
- 4) Remove it again and note the reading. If the engine oil level is below the “L” line, add oil to bring the level up to the “F” line.
- 5) After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.
- 6) Just after driving or while the engine is warm, engine oil level may show in the range between the “F” line and the notch mark. This is caused by thermal expansion of the engine oil.
- 7) To prevent overfilling the engine oil, do not add oil above the “F” line when the engine is cold.

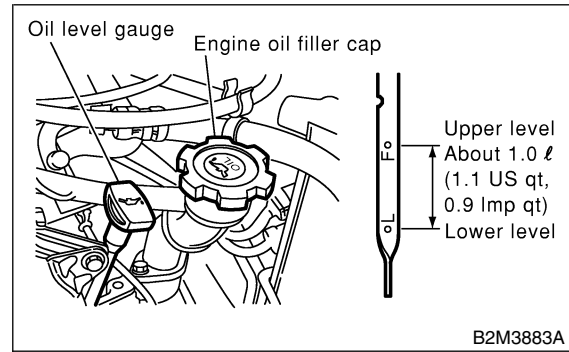


B: REPLACEMENT S178077A20

- 1) Drain engine oil by loosening engine oil drain plug.



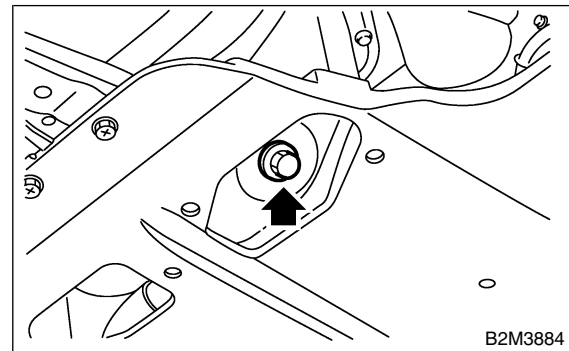
- 2) Open engine oil filler cap for quick draining of the engine oil.



- 3) Replace drain plug gasket.
- 4) Tighten engine oil drain plug after draining engine oil.

Tightening torque:

44 N·m (4.5 kgf-m, 33 ft-lb)



- 5) Fill engine oil through filler pipe up to upper point 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.

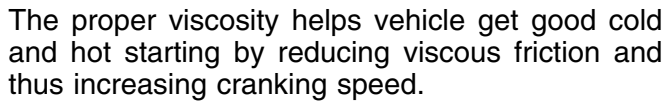
Recommended oil

API classification

SL, SJ or SH with the words “Energy Conserving or Energy conserving II”, CCMC specification G4 or G5, ACEA specification A1, A2 or A3, or New API mark displayed on the container (If it is impossible to get SL, SJ or SH grade, you may use SG grade.)

Oil amount for preparation (when replacing engine oil):

Approx. 4.0 l (4.2 US qt, 3.5 Imp qt)



When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: API classification: SL, SJ or SH
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

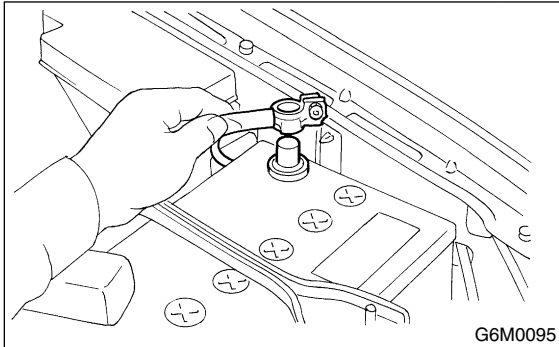
- 6) Close engine oil filler cap.
- 7) Start engine and warm it up for a time.
- 8) After engine stops, recheck the oil level. If necessary, add engine oil up to upper level on level gauge.



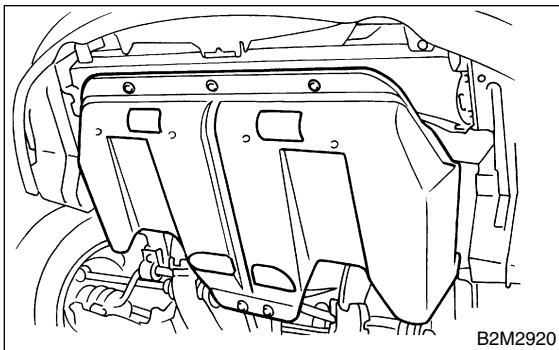
4. Oil Pump S178070

A: REMOVAL S178070A18

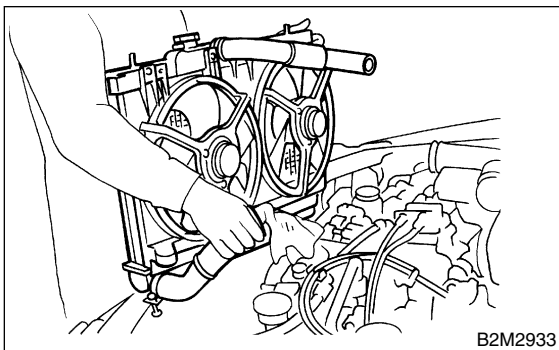
- 1) Disconnect battery ground cable.



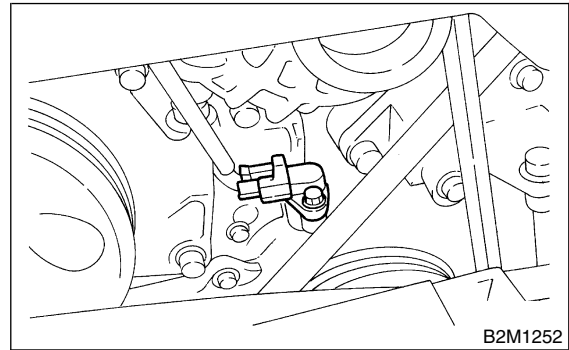
- 2) Lift-up the vehicle.
3) Remove under cover.



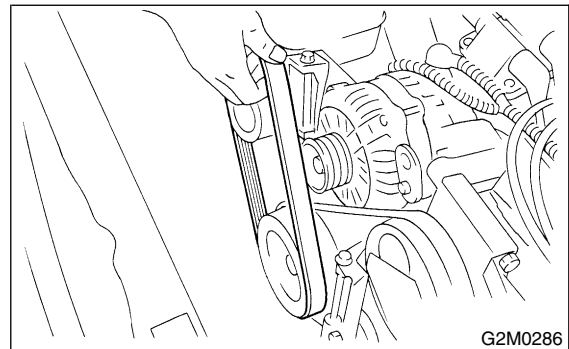
- 4) Lower the vehicle.
5) Remove radiator. <Ref. to CO-21, REMOVAL, Radiator.>



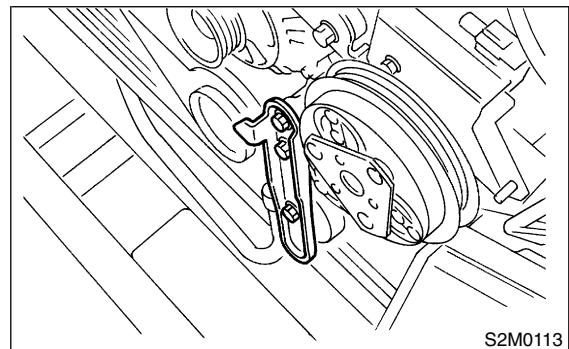
- 6) Remove crankshaft position sensor.



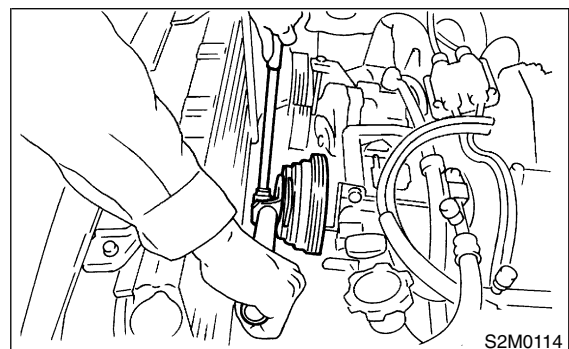
- 7) Remove V-belts. <Ref. to ME-42, REMOVAL, V-belt.>



- 8) Remove rear side V-belt tensioner.

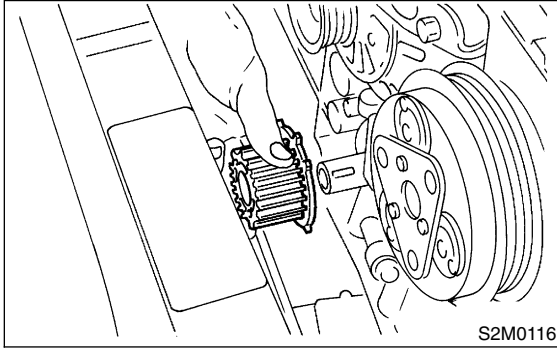


- 9) Remove crankshaft pulley by using ST.
ST 499977100 CRANKSHAFT PULLEY WRENCH

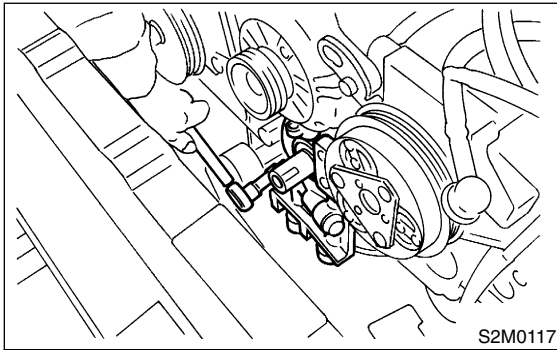


- 10) Remove water pump. <Ref. to CO-14 REMOVAL, Water Pump.>

11) Remove crankshaft sprocket.



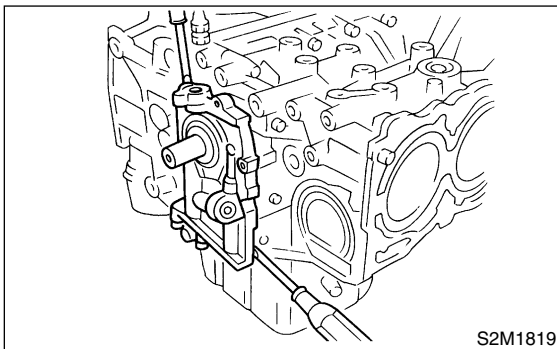
12) Remove bolts which install oil pump onto cylinder block.



13) Remove oil pump by using flat bladed screwdriver.

CAUTION:

Be careful not to scratch mating surfaces of cylinder block and oil pump.



B: INSTALLATION

S178070A11

Install in the reverse order of removal.

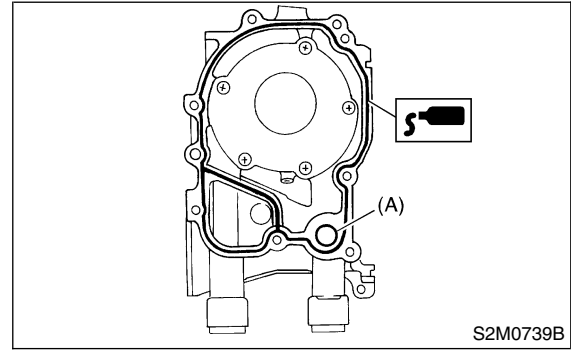
Do the following:

1) Apply fluid packing to matching surfaces of oil pump.

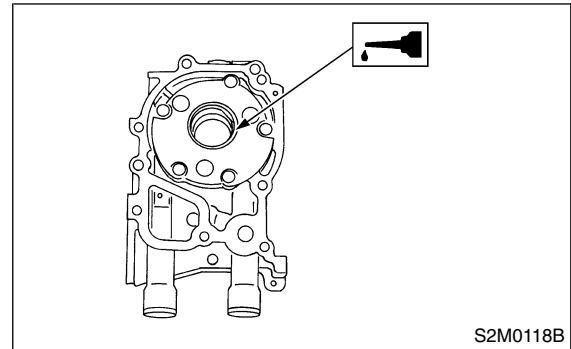
Fluid packing:

THREE BOND 1215 or equivalent

2) Replace O-ring (A) with a new one.



3) Apply a coat of engine oil to the inside of the oil seal.



4) Be careful not to scratch oil seal when installing oil pump on cylinder block.

5) Position the oil pump, aligning the notched area with the crankshaft, and push the oil pump straight.

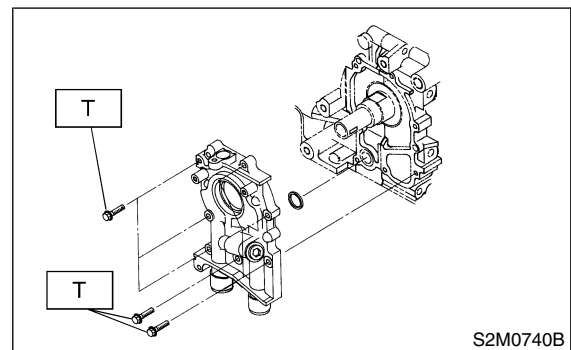
CAUTION:

Make sure the oil seal lip is not folded.

6) Install oil pump.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

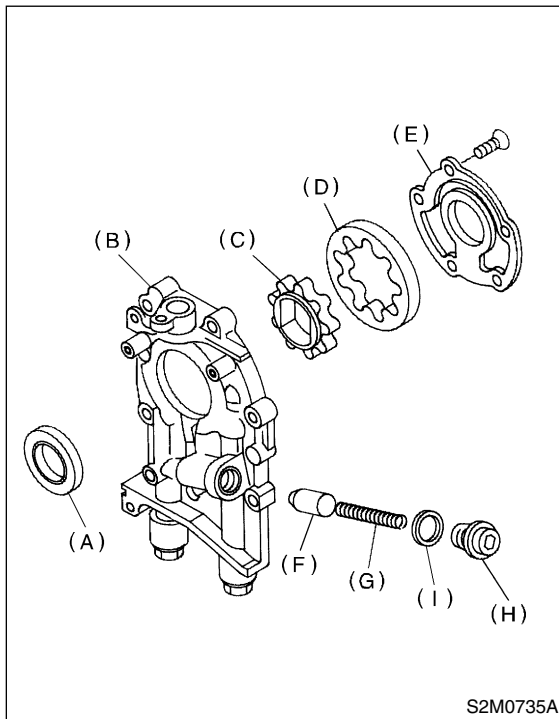


C: DISASSEMBLY S178070A06

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.

CAUTION:

Before removing relief valve, loosen plug when removing oil pump from cylinder block.



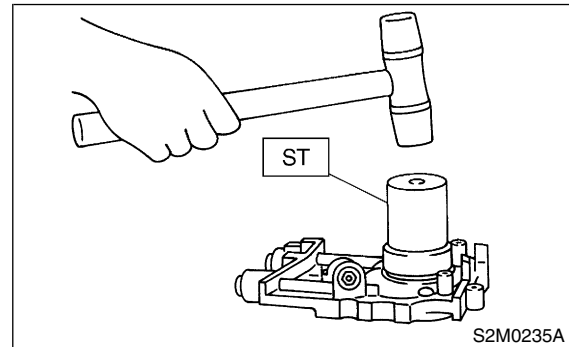
- (A) Oil seal
- (B) Pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Washer

D: ASSEMBLY S178070A02

- 1) Install front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

CAUTION:

Use a new oil seal.

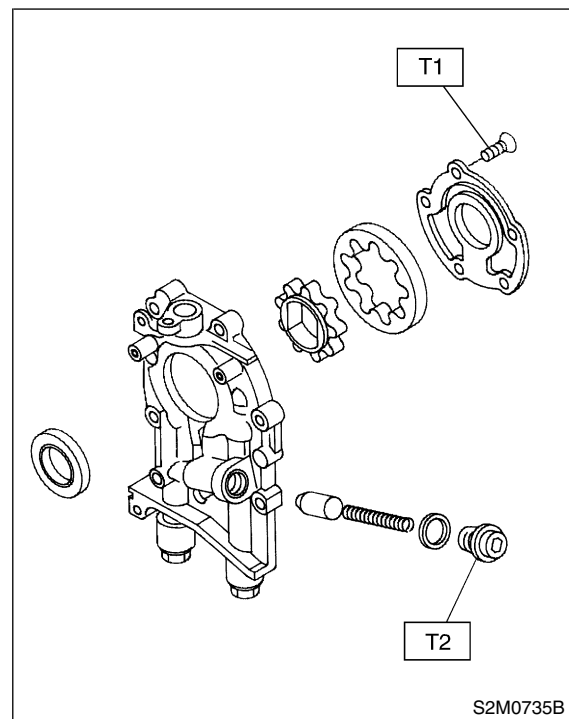


- 2) Apply a coat of engine oil to inner and outer rotors.
- 3) Install inner and outer rotors in their original positions.
- 4) Install oil relief valve and relief valve spring.
- 5) Install oil pump cover.

Tightening torque:

T1: 5 N·m (0.5 kgf-m, 3.6 ft-lb)

T2: 44 N·m (4.5 kgf-m, 33 ft-lb)



E: INSPECTION

S178070A10

1. TIP CLEARANCE

S178070A1001

Measure the tip clearance of rotors. If the clearance exceeds the limit, replace rotors as a matched set.

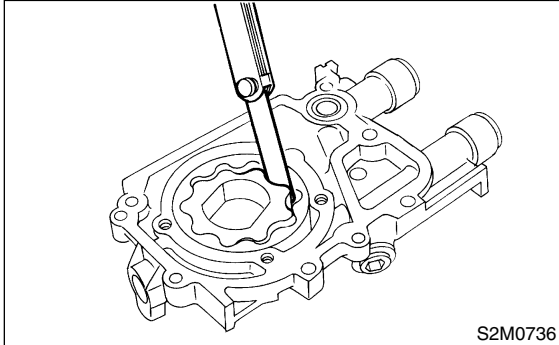
Tip clearance:

Standard

0.04 — 0.14 mm (0.0016 — 0.0055 in)

Limit

0.18 mm (0.0071 in)



2. CASE CLEARANCE

S178070A1002

Measure the clearance between the outer rotor and the cylinder block rotor housing. If the clearance exceeds the limit, replace the rotor.

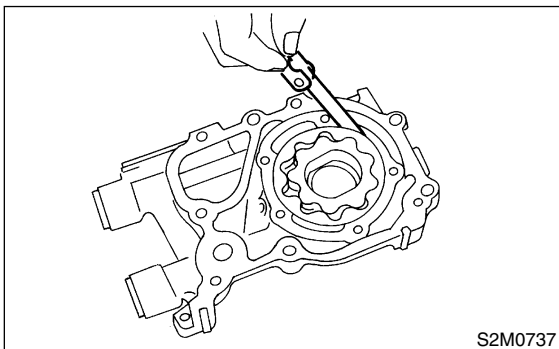
Case clearance:

Standard

0.10 — 0.175 mm (0.0039 — 0.0069 in)

Limit

0.20 mm (0.0079 in)



3. SIDE CLEARANCE

S178070A1003

Measure clearance between oil pump inner rotor and pump cover. If the clearance exceeds the limit, replace rotor or pump body.

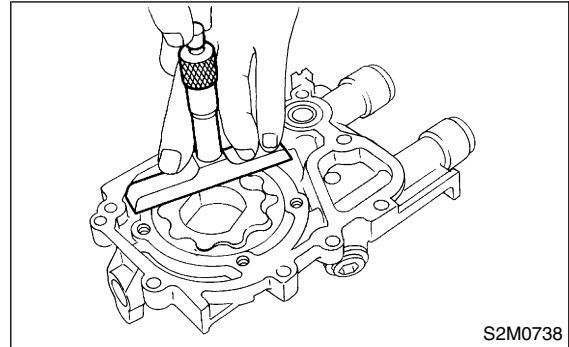
Side clearance:

Standard

0.02 — 0.07 mm (0.0008 — 0.0028 in)

Limit

0.15 mm (0.0059 in)



4. OIL RELIEF VALVE

S178070A1004

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

71.8 mm (2.827 in)

Installed length

54.7 mm (2.154 in)

Load when installed

77.08 N (7.86 kgf, 17.33 lb)

5. OIL PUMP CASE

S178070A1005

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

6. OIL SEAL

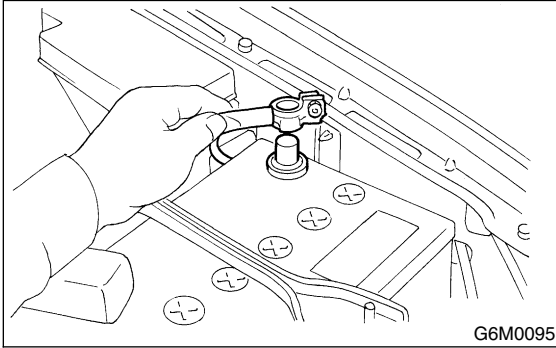
S178070A1006

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

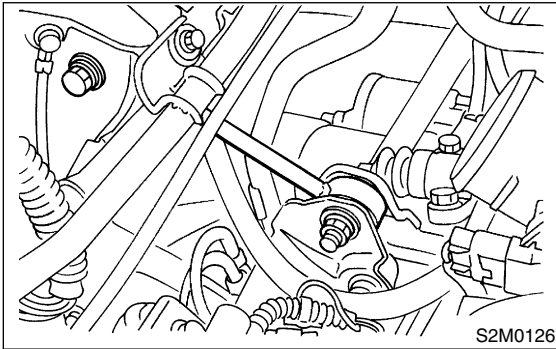
5. Oil Pan and Strainer S178071

A: REMOVAL S178071A18

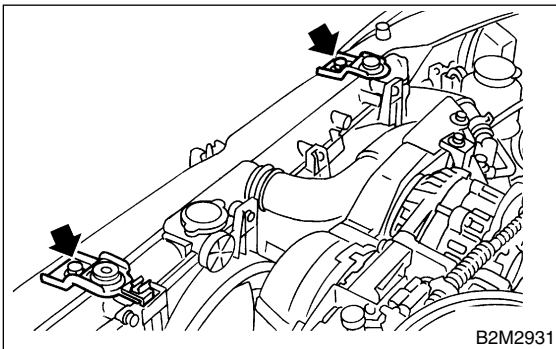
- 1) Set the vehicle on lift arms.
- 2) Remove front wheels.
- 3) Disconnect battery ground cable.



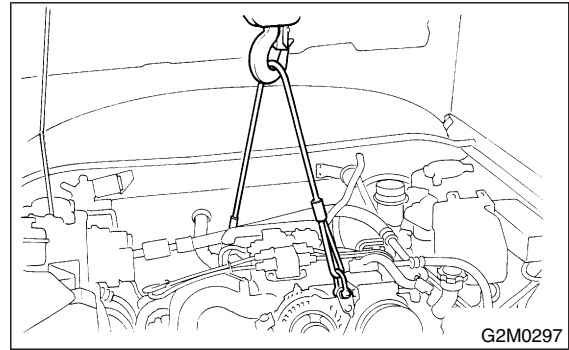
- 4) Remove air intake duct and air cleaner case.
<Ref. to IN-7, REMOVAL, Air Intake Duct.> and
<Ref. to IN-6, REMOVAL, Air Cleaner Case.>
- 5) Remove pitching stopper.



- 6) Remove radiator upper brackets.



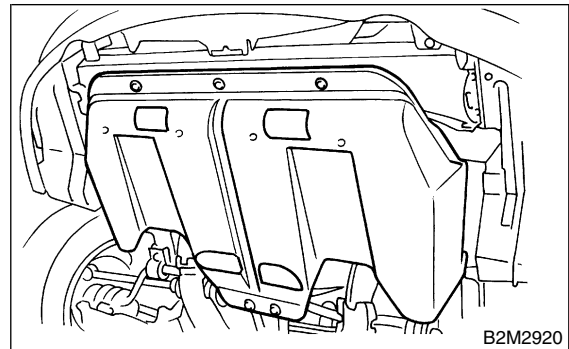
- 7) Support engine with a lifting device and wire ropes.



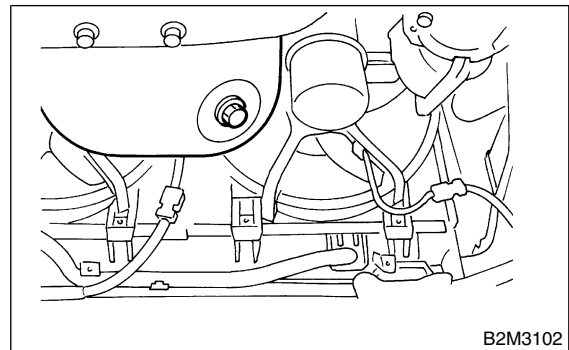
- 8) Lift-up the vehicle.

CAUTION:
At this time, raise up wire ropes.

- 9) Remove under cover.



- 10) Drain engine oil.
Set container under the vehicle, and remove drain plug from oil pan.

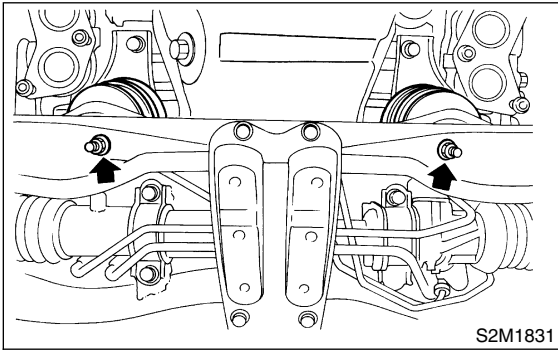


- 11) Remove front and center exhaust pipes. <Ref. to EX-5, REMOVAL, Front Exhaust Pipe.>

OIL PAN AND STRAINER

Lubrication

12) Remove nuts which secure front cushion rubber onto front crossmember.

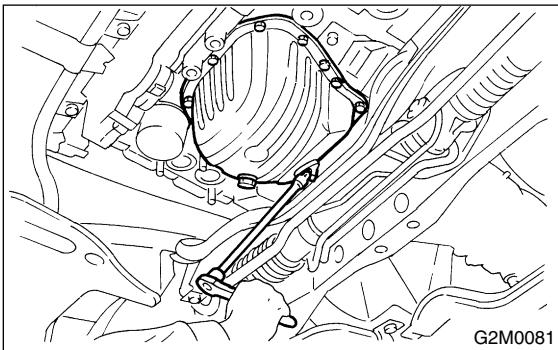


13) Remove bolts which secure oil pan on cylinder block while raising up engine.

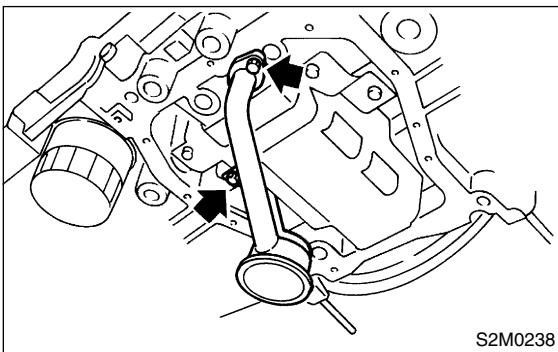
14) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

CAUTION:

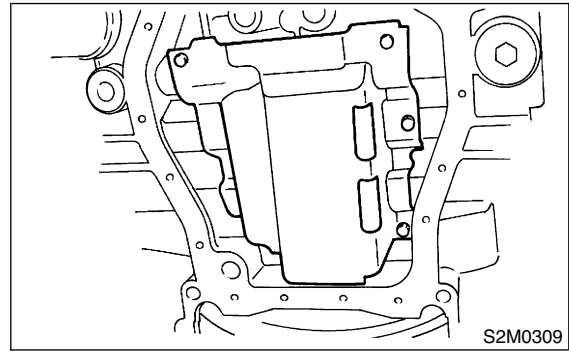
Do not use a screwdriver or similar tool in place of oil pan cutter.



15) Remove oil strainer.



16) Remove baffle plate.



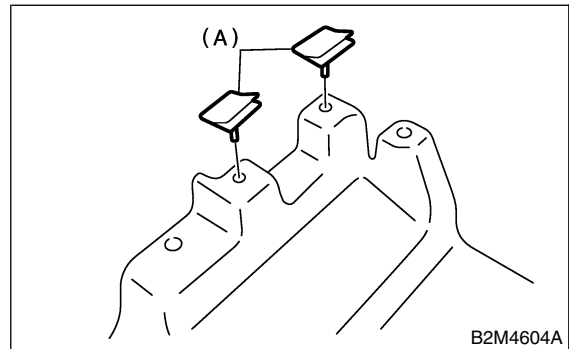
B: INSTALLATION

S178071A11

CAUTION:

Before installing oil pan, clean sealant from oil pan and engine block.

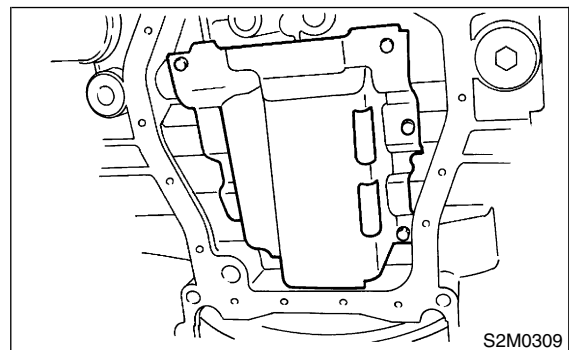
1) Make sure seal (A) is installed on baffle plate.



2) Install baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



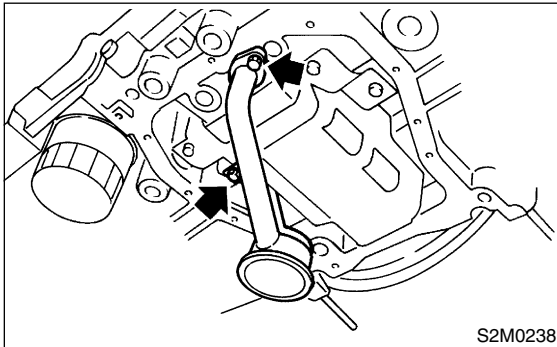
3) Install oil strainer onto baffle plate.

CAUTION:

Replace O-ring with a new one.

Tightening torque:

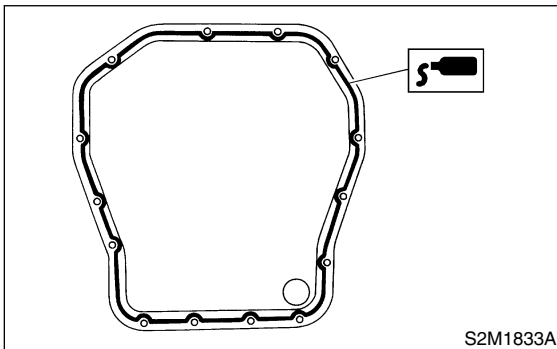
10 N·m (1.0 kgf-m, 7 ft-lb)



4) Apply fluid packing to mating surfaces and install oil pan.

Fluid packing:

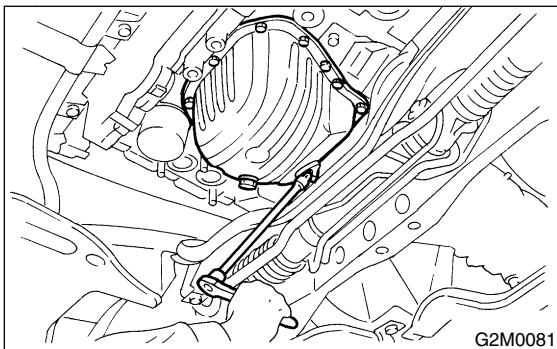
THREE BOND 1215 or equivalent



5) Tighten bolts which install oil pan onto engine block.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

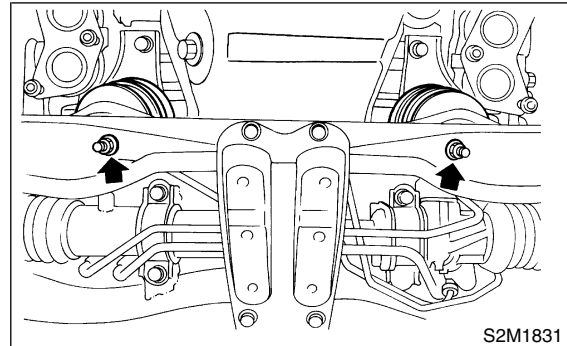


6) Lower engine onto front crossmember.

7) Tighten nuts which secure front cushion rubber onto front crossmember.

Tightening torque:

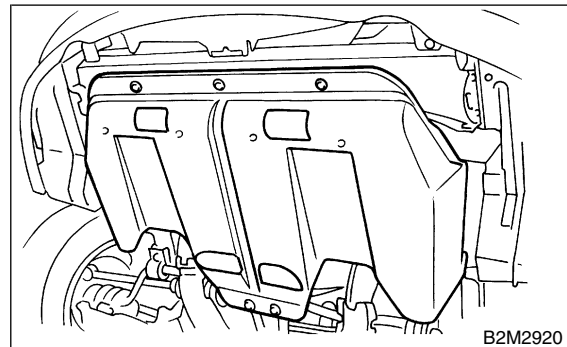
69 N·m (7.0 kgf-m, 51 ft-lb)



8) Install front and center exhaust pipes.

<Ref. to EX-6, INSTALLATION, Front Exhaust Pipe.>

9) Install under cover.

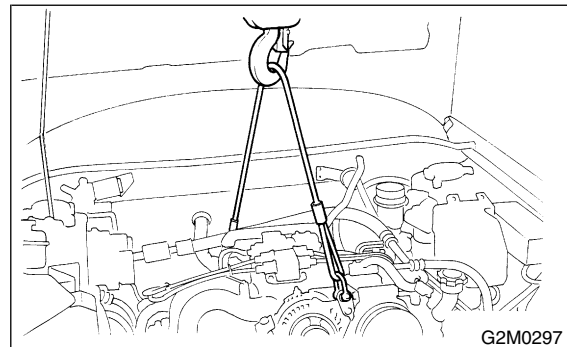


10) Lower the vehicle.

CAUTION:

At this time, lower lifting device and release steel cables.

11) Remove lifting device and steel cables.

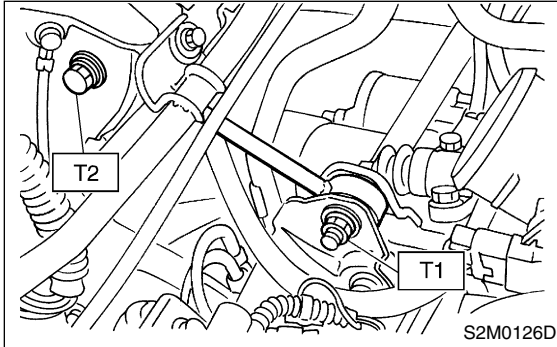


12) Install pitching stopper.

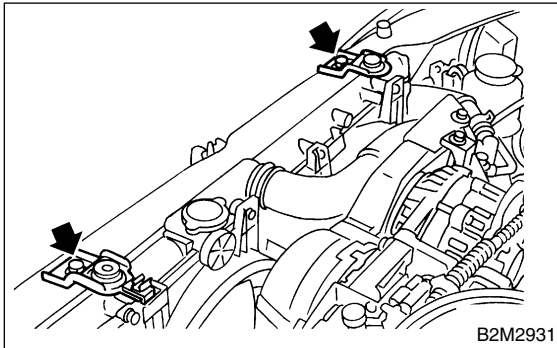
Tightening torque:

T1: 50 N·m (5.1 kgf-m, 37 ft-lb)

T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



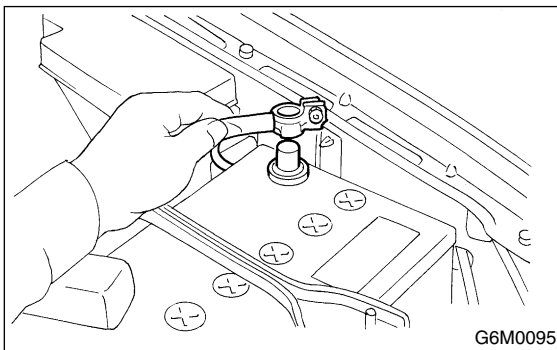
13) Install radiator upper brackets.



14) Install air intake duct and air cleaner case.
<Ref. to IN-7, INSTALLATION, Air Intake Duct.>
and <Ref. to IN-6, INSTALLATION, Air Cleaner Case.>

15) Install front wheels.

16) Connect battery ground cable.



17) Fill engine oil. <Ref. to LU-7, INSPECTION, Engine Oil.>

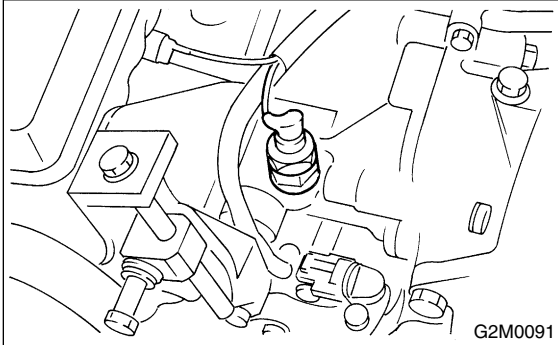
C: INSPECTION S178071A10

By visual check make sure oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

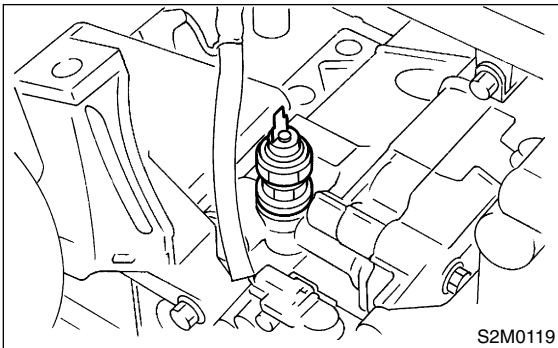
6. Oil Pressure Switch S178069

A: REMOVAL S178069A18

- 1) Remove generator from bracket. <Ref. to SC-15, REMOVAL, Generator.>
- 2) Disconnect terminal from oil pressure switch.



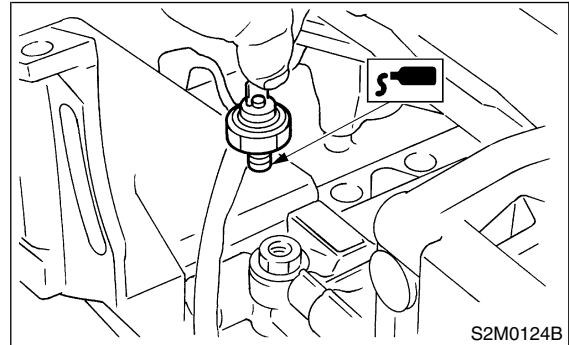
- 3) Remove oil pressure switch.



B: INSTALLATION S178069A11

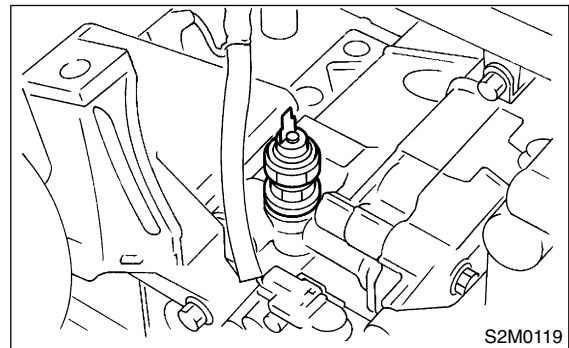
- 1) Apply fluid packing to oil pressure switch threads.

Fluid packing:
THREE BOND 1215 or equivalent

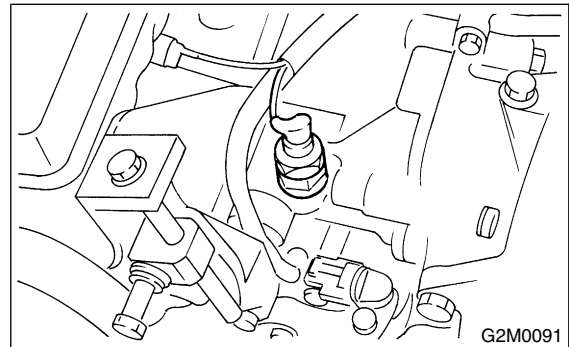


- 2) Install oil pressure switch onto engine block.

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-15, INSTALLATION, Generator.>

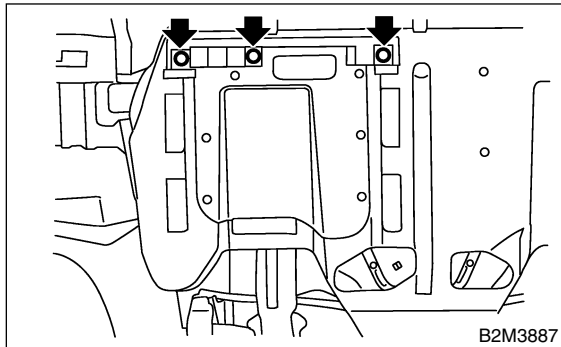
C: INSPECTION S178069A10

Make sure oil does not leak or seep from where the oil pressure switch is installed.

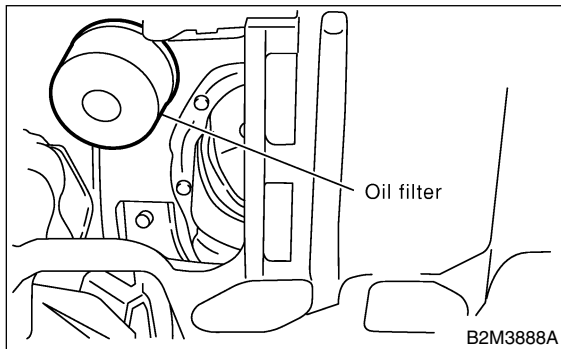
7. Engine Oil Filter S178585

A: REMOVAL S178585A18

- 1) Remove access lid.



- 2) Remove oil filter with ST.
ST 498547000 OIL FILTER WRENCH



B: INSTALLATION S178585A11

- 1) Get a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 2) Install oil filter by turning it by hand, being careful not to damage seal rubber.
- 3) Tighten more (approximately 2/3 to 3/4 turn) after the seal rubber contacts the oil pump case. Do not tighten excessively, or oil may leak.

C: INSPECTION S178585A10

- 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 permanently jointed; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level. <Ref. to LU-7, INSPECTION, Engine Oil.>

8. Engine Lubrication System Trouble in General

S178100

A: INSPECTION

S178100A10

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) Burn-out bulb		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).

MEMO:

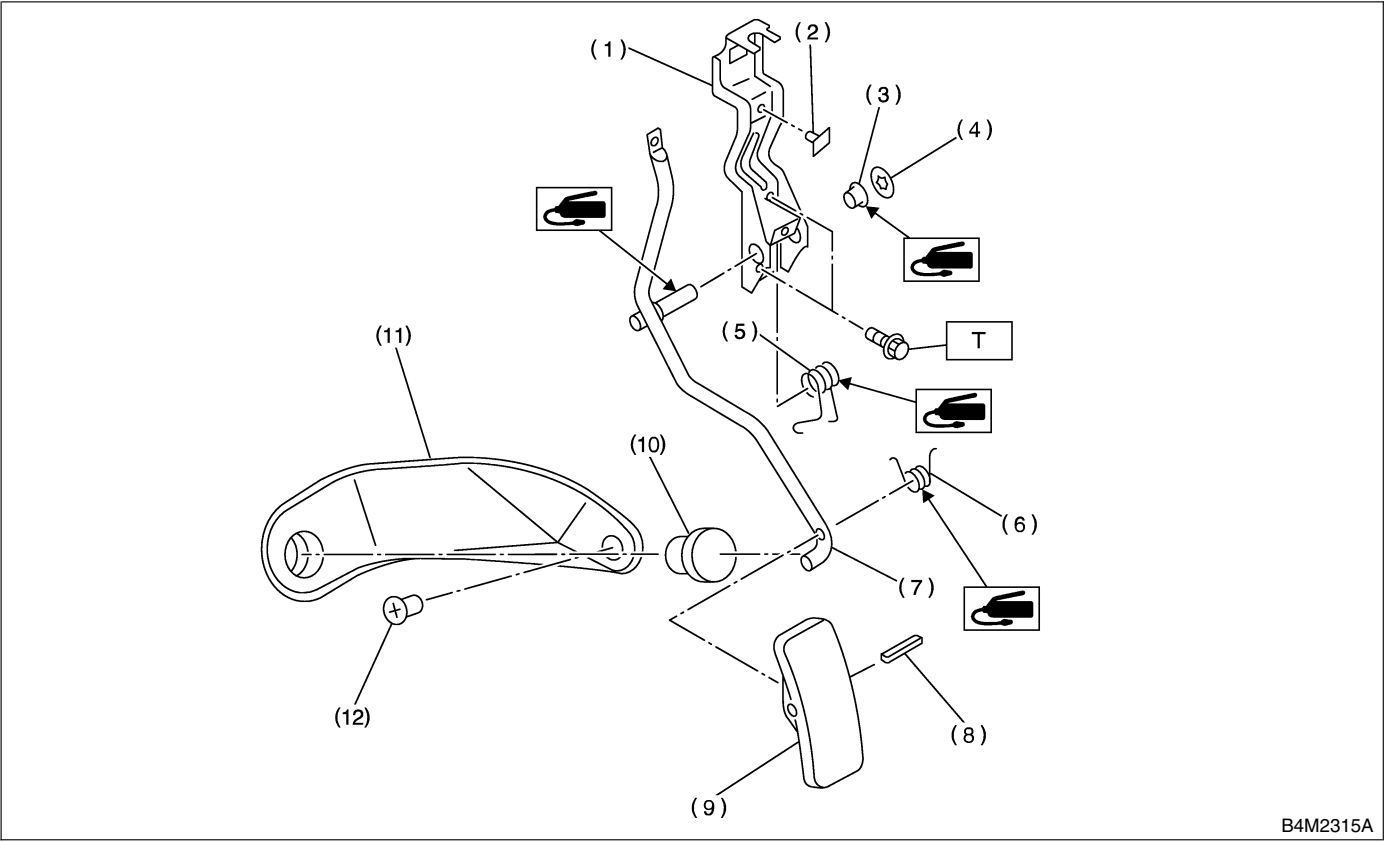
GENERAL DESCRIPTION

1. General Description S177001

A: SPECIFICATION S177001E49

Accelerator pedal	Free play	At pedal pad	1 — 4 mm (0.04 — 0.16 in)
	Stroke	At pedal pad	50 — 55 mm (1.97 — 2.17 in)

B: COMPONENT S177001A05



B4M2315A

(1) Accelerator bracket	(6) Accelerator pedal spring	(11) Accelerator plate
(2) Stopper	(7) Accelerator pedal lever	(12) Clip
(3) Bushing	(8) Spring pin	
(4) Clip	(9) Accelerator pedal	
(5) Accelerator spring	(10) Accelerator stopper	

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

C: CAUTION S177001A03

- 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.

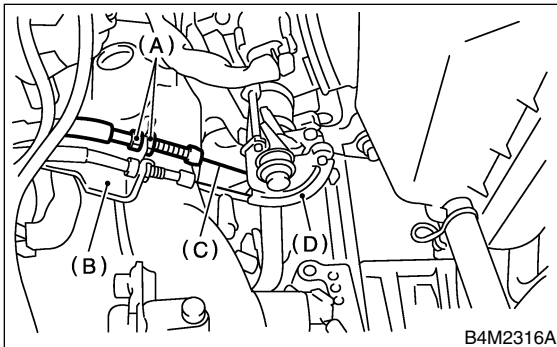
2. Accelerator Pedal S177005

A: REMOVAL S177005A18

- 1) Disconnect ground cable from battery.
- 2) Remove lock nut from accelerator cable bracket.
- 3) Separate accelerator cable from bracket.
- 4) Remove accelerator cable end from throttle cam.
- 5) Disconnect accelerator cable from throttle body.

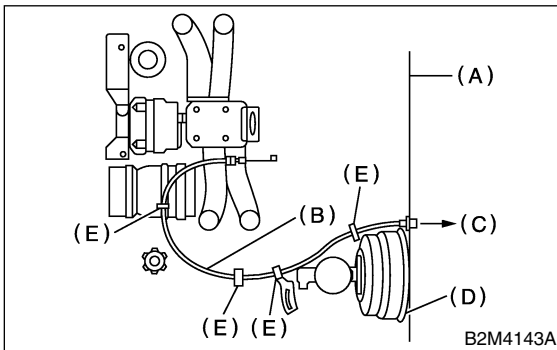
CAUTION:

Be careful not to kink accelerator cable.



- (A) Lock nut
- (B) Accelerator cable bracket
- (C) Accelerator cable
- (D) Throttle cam

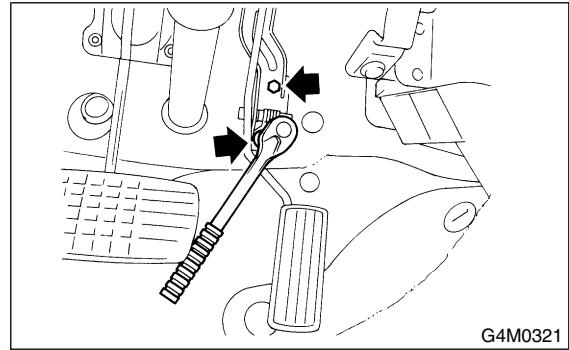
- 6) Remove clip inside engine compartment.



- (A) Toe board
- (B) Accelerator cable
- (C) To accelerator
- (D) Brake booster
- (E) Clip

- 7) Remove instrument panel lower cover from instrument panel, and connector.
- 8) Remove brake and clutch pedal bracket. (MT model) <Ref. to BR-41, REMOVAL, Brake Pedal.>

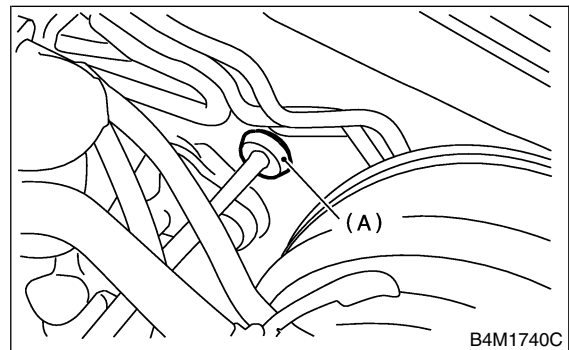
- 9) Remove accelerator pedal connecting bolt from accelerator pedal bracket.



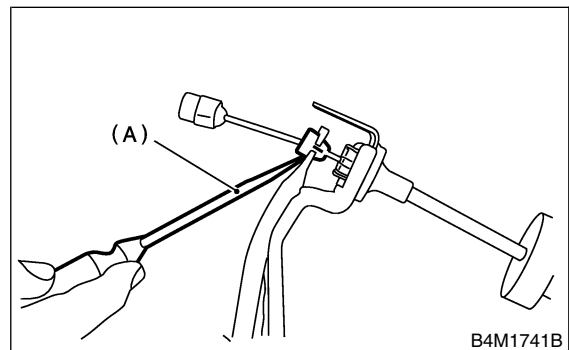
- 10) Disconnect grommet from toe board.

NOTE:

From inside compartment, push grommet (A) into hole.



- 11) Pull out the cable from the toe board hole.
- 12) Disconnect accelerator cable bushing from accelerator pedal lever.

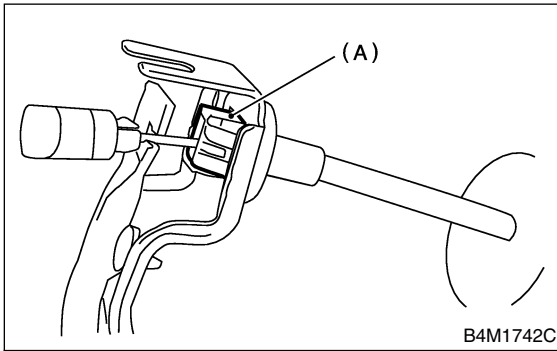


- (A) Slot type screwdriver

ACCELERATOR PEDAL

Speed Control Systems

13) Disconnect accelerator cable stopper (A) from bracket.



14) Separate accelerator cable and bracket.

B: INSTALLATION S177005A11

1) Install in the reverse order of removal.

CAUTION:

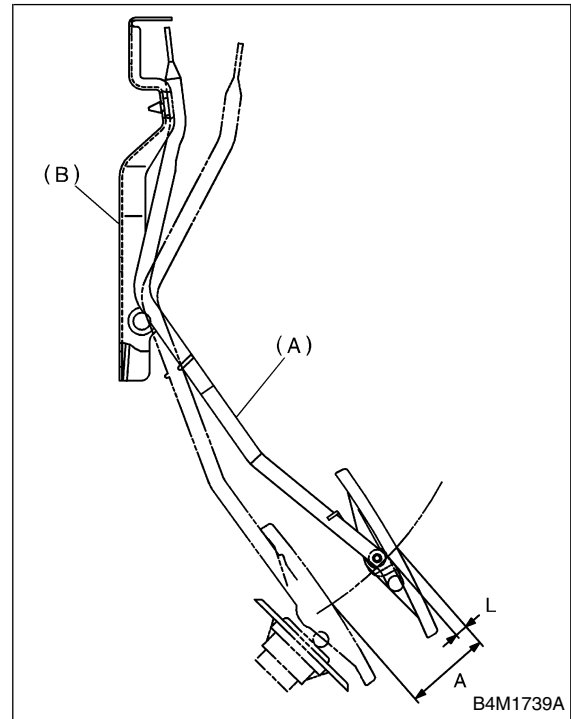
- If cable clamp is damaged, replace it with a new one.
- Never fail to cover outer cable end with boot.
- Be careful not to kink accelerator cable.
- Always use new clevis pins.

2) Check pedal stroke and free play by operating accelerator pedal by hand.

If it is not within specified value, adjust it by turning nut connecting accelerator cable to throttle body.

Free play at pedal pad: L
1 — 4 mm (0.04 — 0.16 in)

Stroke at pedal pad: A
50 — 55 mm (1.97 — 2.17 in)



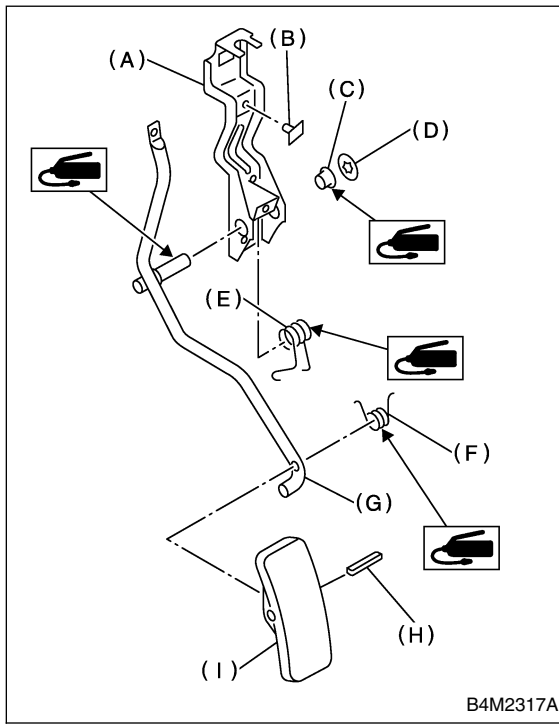
- (A) Accelerator pedal lever
(B) Accelerator pedal bracket

Accelerator cable lock nut tightening torque:
12 N·m (1.2 kgf-m, 9 ft-lb)

C: DISASSEMBLY

S177005A06

- 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

S177005A02

Assemble in the reverse order of disassembly.

CAUTION:

Clean and apply grease to spacer and inside bore of a accelerator pedal.

E: INSPECTION

S177005A10

Lightly move pedal pad in lateral the direction to ensure pedal deflection is in specified range.

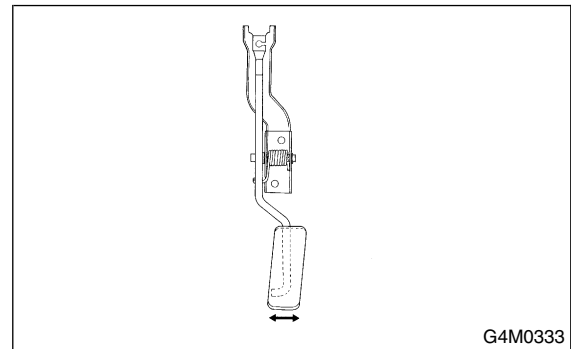
CAUTION:

If excessive deflection is noted, replace bushing and clip with new ones.

Deflection of accelerator pedal:

Service limit

5.0 mm (0.197 in) or less



3. Accelerator Control Cable S177007

A: REMOVAL S177007A18

- 1) Remove accelerator pedal. <Ref to SP-3, REMOVAL, Accelerator Pedal.>
- 2) Separate accelerator cable and accelerator pedal.

B: INSTALLATION S177007A11

- 1) Install in the reverse order of removal.

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 to the throttle cable on the engine side.

- 2) Adjustment after pedal installation <Ref. to SP-4, INSTALLATION, Accelerator Pedal.>

C: INSPECTION S177007A10

- 1) Make sure the inner cable is not twisted or frayed.
- 2) Make sure the outer cable is not cracked.

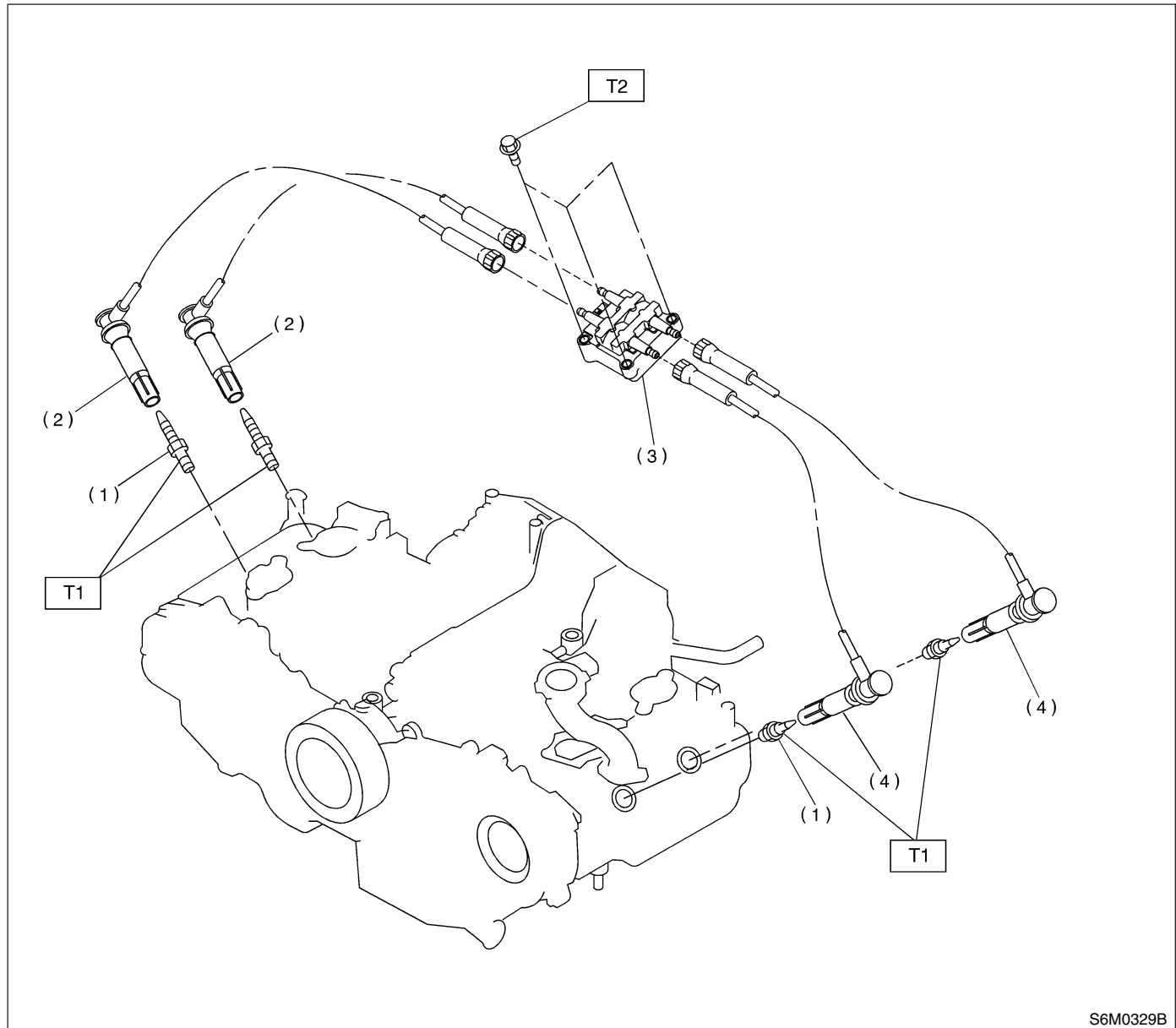
GENERAL DESCRIPTION

Ignition

1. General Description S171001

A: SPECIFICATIONS S171001E49

Item		Designation	
Ignition coil and ignitor assembly	Model	FH0137	
	Manufacturer	DEMCO	
	Primary coil resistance	0.73 $\Omega \pm 10\%$	
	Secondary coil resistance	12.8 k $\Omega \pm 15\%$	
	Insulation resistance between primary terminal and case	More than 10 M Ω	
Spark plug	Type and manufacturer	RC10YC4 CHAMPION	
		Alternate	BKR5E-11 NGK
			BKR6E-11 NGK
	Thread size	mm	14, P = 1.25
	Spark gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)

B: COMPONENT S171001A05

S6M0329B

- (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: 6.4 (0.65, 4.7)****C: CAUTION** S171001A03

- 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 S171003

A: REMOVAL S171003A18

CAUTION:

All spark plugs installed on an engine, must be of the same heat range.

Spark plug:

CHAMPION: RC10YC4

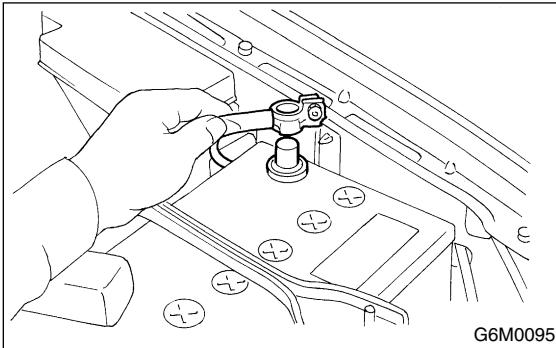
(Alternate)

NGK: BKR5E-11

NGK: BKR6E-11

1. RH SIDE S171003A1805

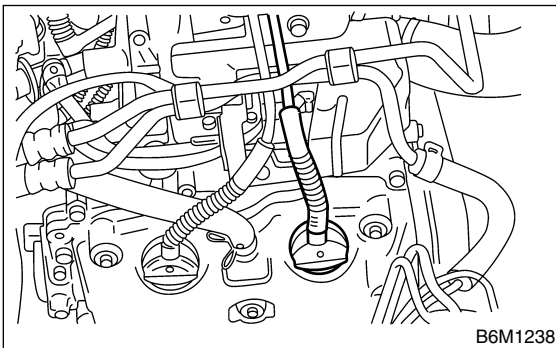
- 1) Disconnect battery ground cable.



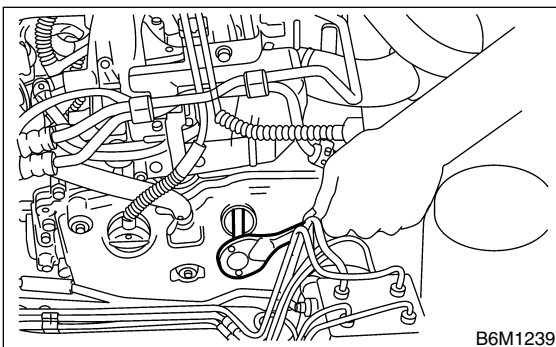
- 2) Remove resonator chamber.

<Ref. to IN-8, REMOVAL, Resonator Chamber.>

- 3) Remove spark plug cords by pulling boot, not cord itself.

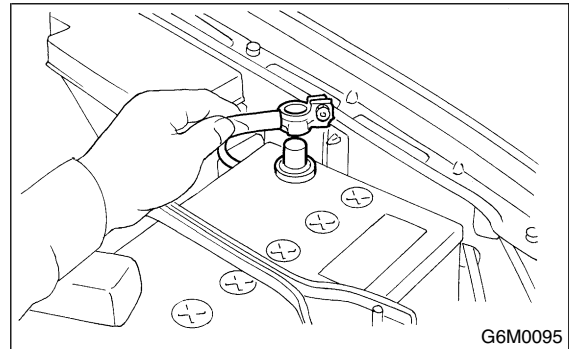


- 4) Remove spark plugs with the spark plug socket.

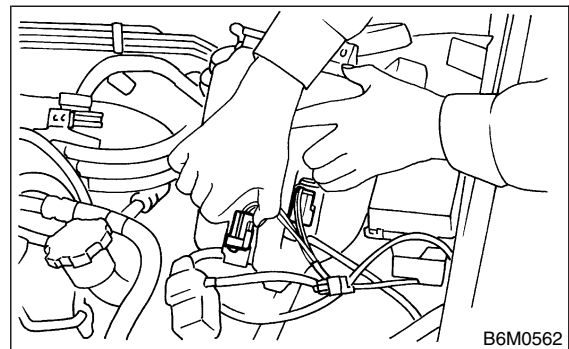


2. LH SIDE S171003A1806

- 1) Disconnect battery ground cable.

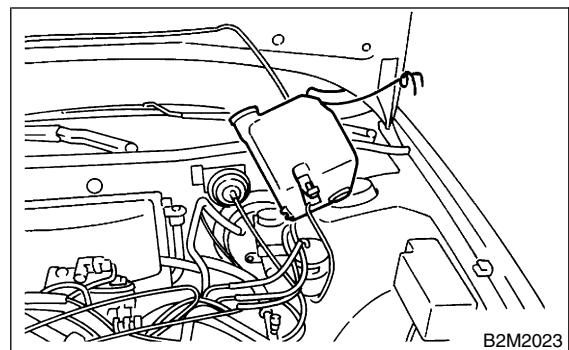


- 2) Disconnect washer motor connector.

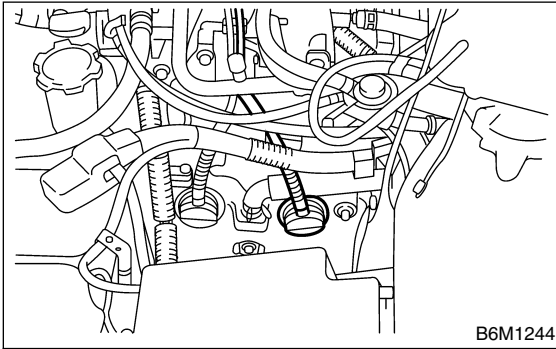


- 3) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.

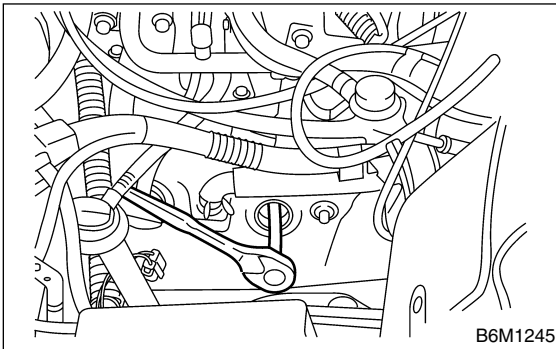
- 4) Remove the two bolts which hold the washer tank, then take the tank away from the working area.



- 5) Remove spark plugs cord by pulling boot, not cord itself.



- 6) Remove spark plug with the spark plugs socket.



B: INSTALLATION

S171003A11

1. RH SIDE

S171003A1105

- 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 (Resonator chamber):

33 N·m (3.4 kgf-m, 24.6 ft-lb)

2. LH SIDE

S171003A1106

- 1) Install in the reverse order of removal.

Tightening torque (Spark plug):

21 N·m (2.1 kgf-m, 15 ft-lb)

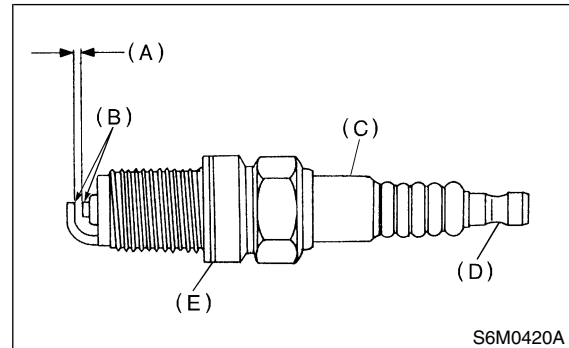
CAUTION:

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

S171003A10

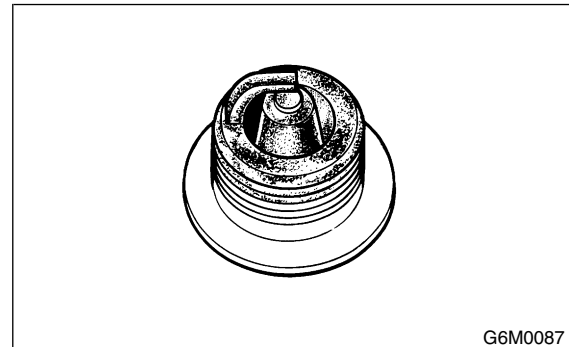
Check electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Electrode gap
- (B) Carbon accumulation or wear
- (C) Cracks
- (D) Damage
- (E) Damaged gasket

1) Normal

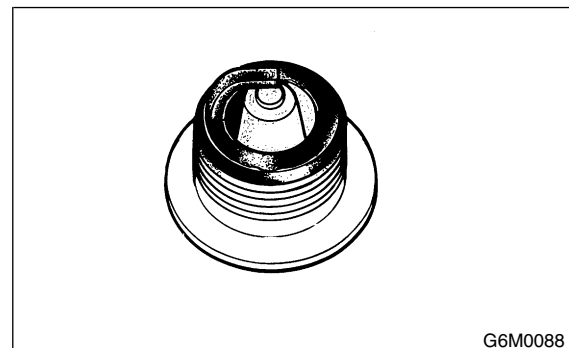
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



2) Carbon fouled

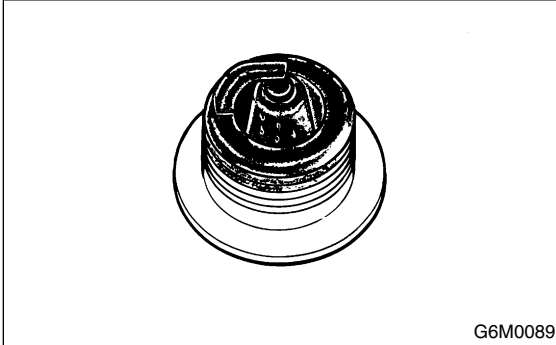
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.

It is advisable to replace with plugs having hotter heat range.



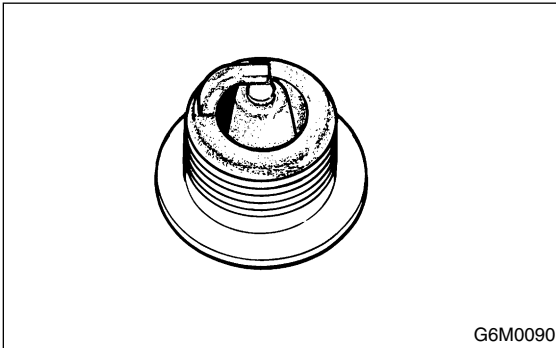
3) Oil fouled

Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If same condition remains after repair, use a hotter plug.



4) Overheating

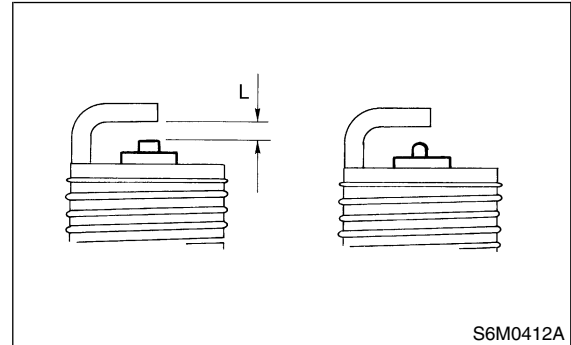
White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.

E: ADJUSTMENT S171003A01

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)



NOTE:

Replace with new spark plug if this area is worn to "ball" shape.

D: CLEANING S171003E56

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.

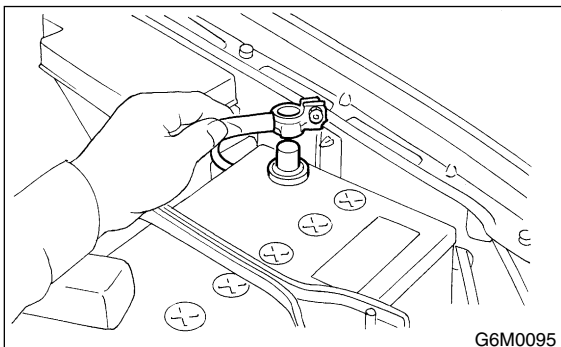
3. Ignition Coil and Ignitor Assembly

S171015

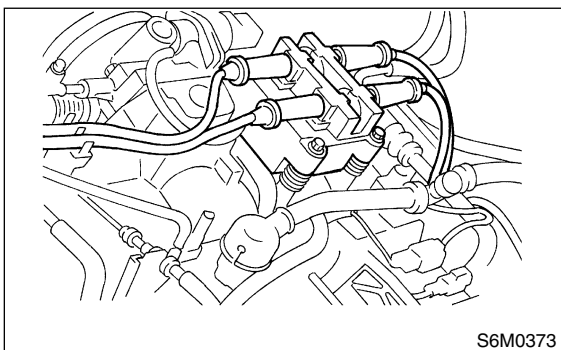
A: REMOVAL

S171015A18

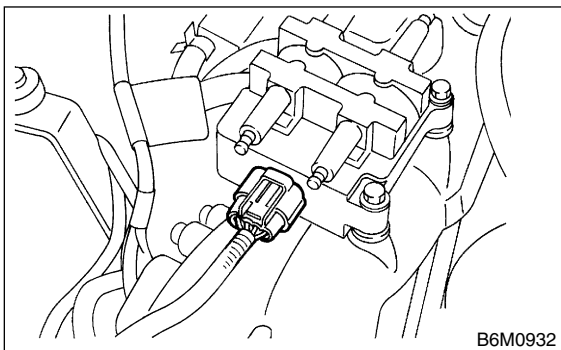
- 1) Disconnect battery ground cable.



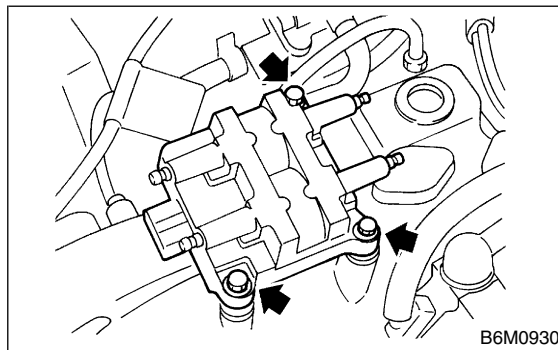
- 2) Disconnect spark plug cords from ignition coil and ignitor assembly.



- 3) Disconnect connector from ignition coil and ignitor assembly.



- 4) Remove ignition coil and ignitor assembly.



B: INSTALLATION

S171015A11

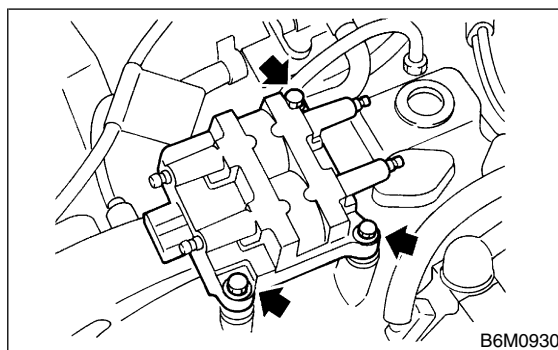
- 1) Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

CAUTION:

Be sure to connect wires to their proper positions. Failure to do so will damage unit.



C: INSPECTION S171015A10

Using accurate tester, inspect the following items, and replace if defective.

- 1) Primary resistance
- 2) Secondary coil resistance

CAUTION:

If the resistance is extremely low, this indicates the presence of a short-circuit.

Specified resistance:

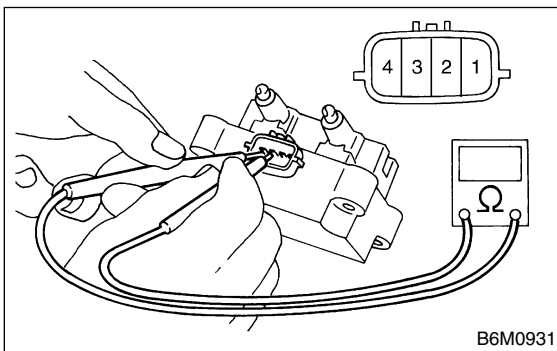
[Primary side]

Between terminal No. 1 and No. 2

$0.73 \Omega \pm 10\%$

Between terminal No. 2 and No. 4

$0.73 \Omega \pm 10\%$



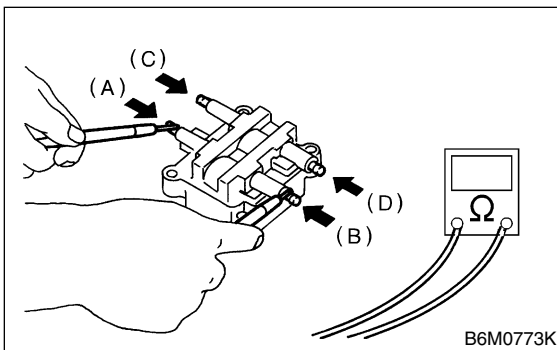
[Secondary side]

Between (A) and (B)

$12.8 \text{ k}\Omega \pm 15\%$

Between (C) and (D)

$12.8 \text{ k}\Omega \pm 15\%$



- 3) Insulation between primary terminal and case:
10 M Ω or more.

4. Spark Plug Cord S171014

A: INSPECTION S171014A10

Check for:

- 1) Damage to cords, deformation, burning or rust formation of terminals
- 2) Resistance values of cords

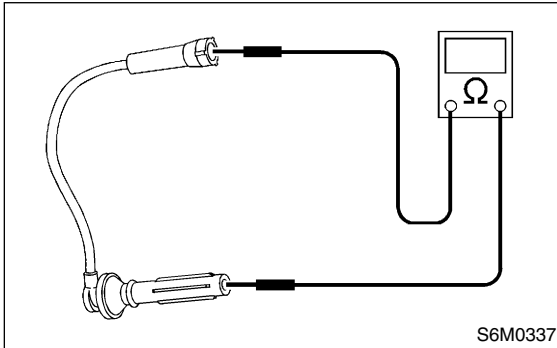
Resistance value:

#1 cord: 5.6 — 10.6

#2 cord: 7.3 — 13.7

#3 cord: 5.9 — 11.1

#4 cord: 7.3 — 13.7



SPARK PLUG CORD

Ignition

MEMO:

GENERAL DESCRIPTION

Starting/Charging Systems

1. General Description S179001

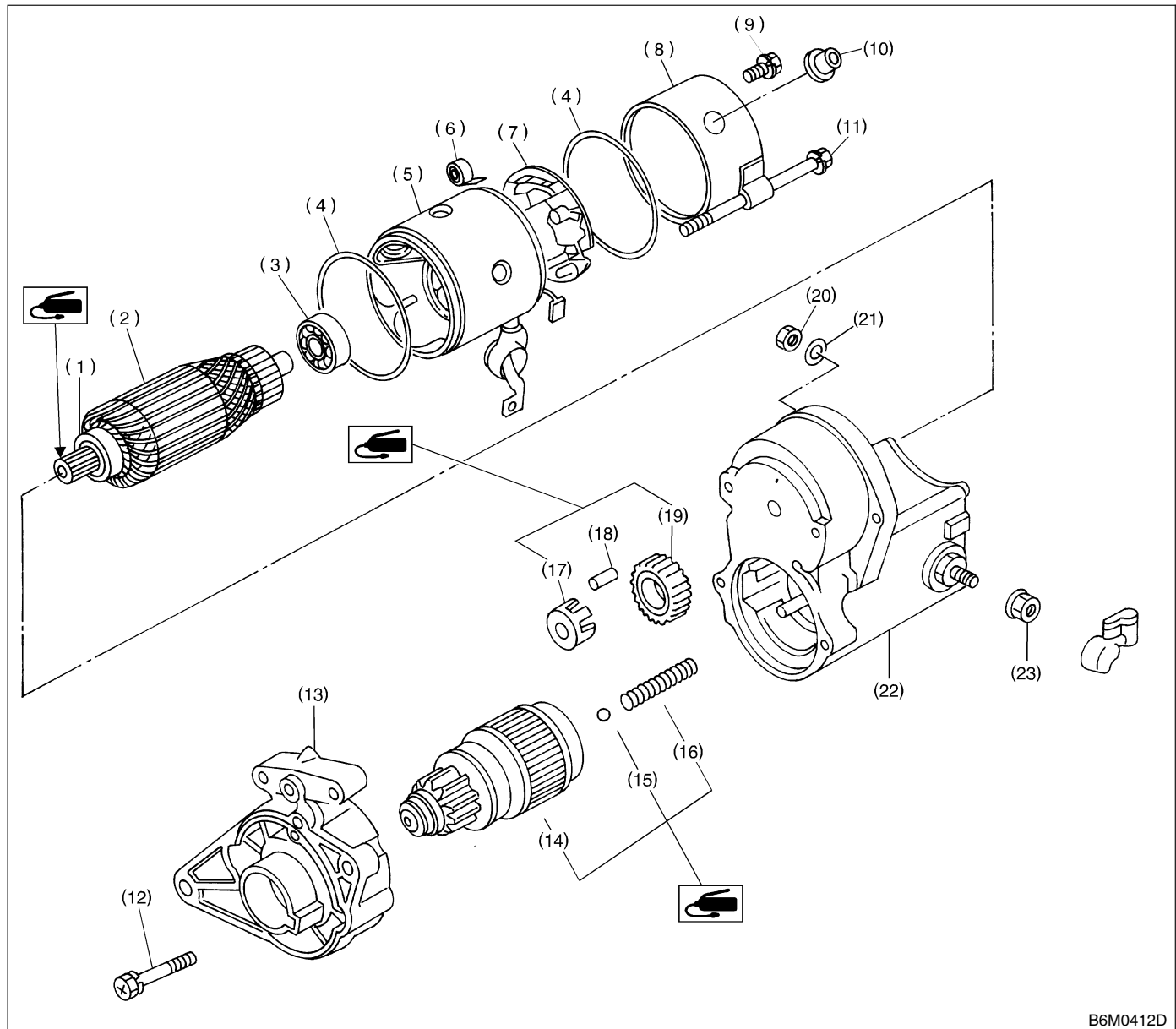
A: SPECIFICATIONS S179001E49

Item			Designation	
			MT	AT
Starter	Type		Reduction type	
	Model		TN128000-8311	TN128000-8321
	Manufacturer		NIPPONDENSO TENNESSEE	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	90 A or less	
		Rotating speed	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		LR190-742	
	Manufacturer		HITACHI AUTOMOTIVE PRODUCTS	
	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 — 39 A or more 2,500 rpm — 66 A or more 5,000 rpm — 85 A or more	
	Regulated voltage		14.5 ^{+0.3} / _{-0.4} V [20°C (68°F)]	
Battery	Reserve capacity	amps min.	90	110
	Cold cranking	amp.	430	490

B: COMPONENT S179001A05

1. STARTER S179001A0501

● MT VEHICLES



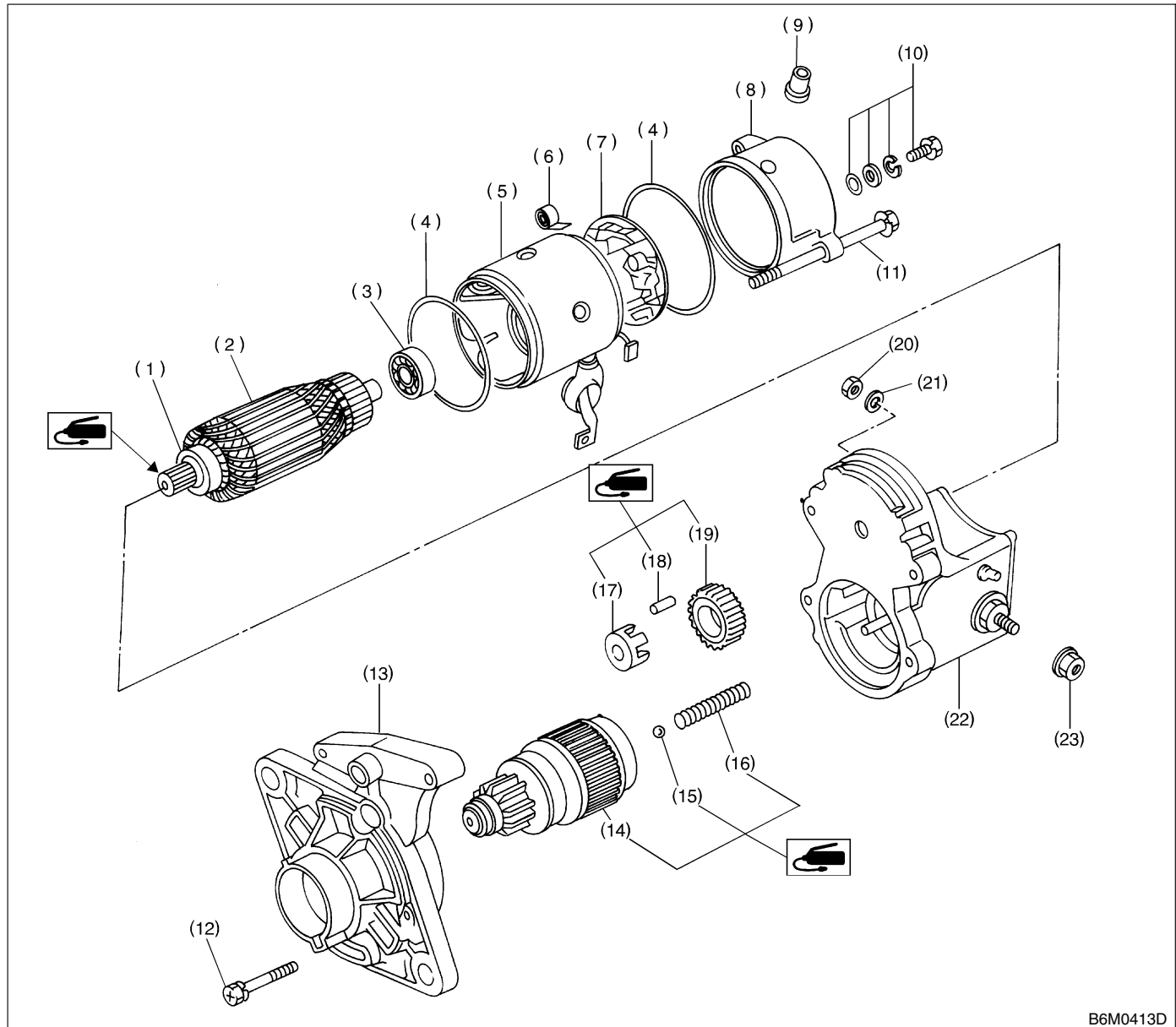
B6M0412D

(1) Front ball bearing	(9) Screw & washer	(17) Retainer
(2) Armature	(10) Cover	(18) Roller
(3) Rear ball bearing	(11) Through bolt	(19) Idle gear
(4) O-ring	(12) Screw & washer	(20) Nut
(5) Yoke	(13) Starter housing	(21) Spring washer
(6) Brush spring	(14) Overrunning clutch	(22) Magnetic switch
(7) Brush holder	(15) Steel ball	(23) Nut
(8) End frame	(16) Spring	

GENERAL DESCRIPTION

Starting/Charging Systems

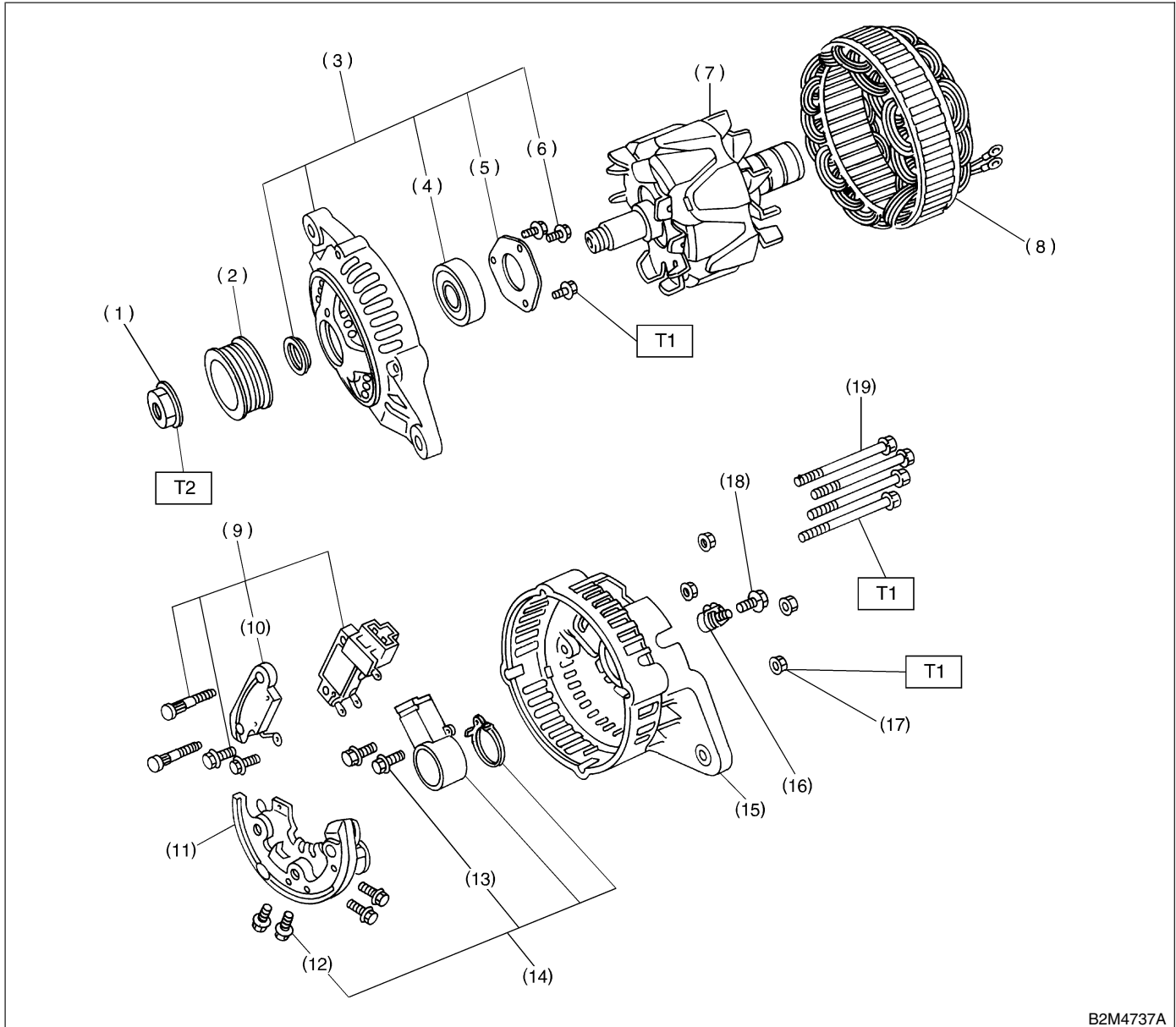
• AT VEHICLES



B6M0413D

(1) Front ball bearing	(9) Cover	(17) Retainer
(2) Armature	(10) Screw & washer	(18) Roller
(3) Rear ball bearing	(11) Through-bolt	(19) Idle gear
(4) O-ring	(12) Screw & washer	(20) Nut
(5) Yoke	(13) Starter housing	(21) Spring washer
(6) Brush spring	(14) Overrunning clutch	(22) Magnetic switch
(7) Brush holder	(15) Steel ball	(23) Nut
(8) End frame	(16) Spring	

2. GENERATOR S179001A0502



- (1) Pulley nut
- (2) Pulley
- (3) Front cover ASSY
- (4) Ball bearing
- (5) Bearing retainer
- (6) Screw
- (7) Rotor
- (8) Stator coil

- (9) IC regulator ASSY
- (10) Condenser
- (11) Diode ASSY
- (12) Bolt
- (13) Bolt
- (14) Brush holder ASSY
- (15) Rear cover
- (16) BAT. terminal

- (17) Nut
- (18) Bolt
- (19) Through-bolt

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3.1 (0.32, 2.3)

T2: 63.7 (6.5, 47.0)

C: CAUTION S179001A03

- 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.

GENERAL DESCRIPTION

Starting/Charging Systems

1. General Description S179001

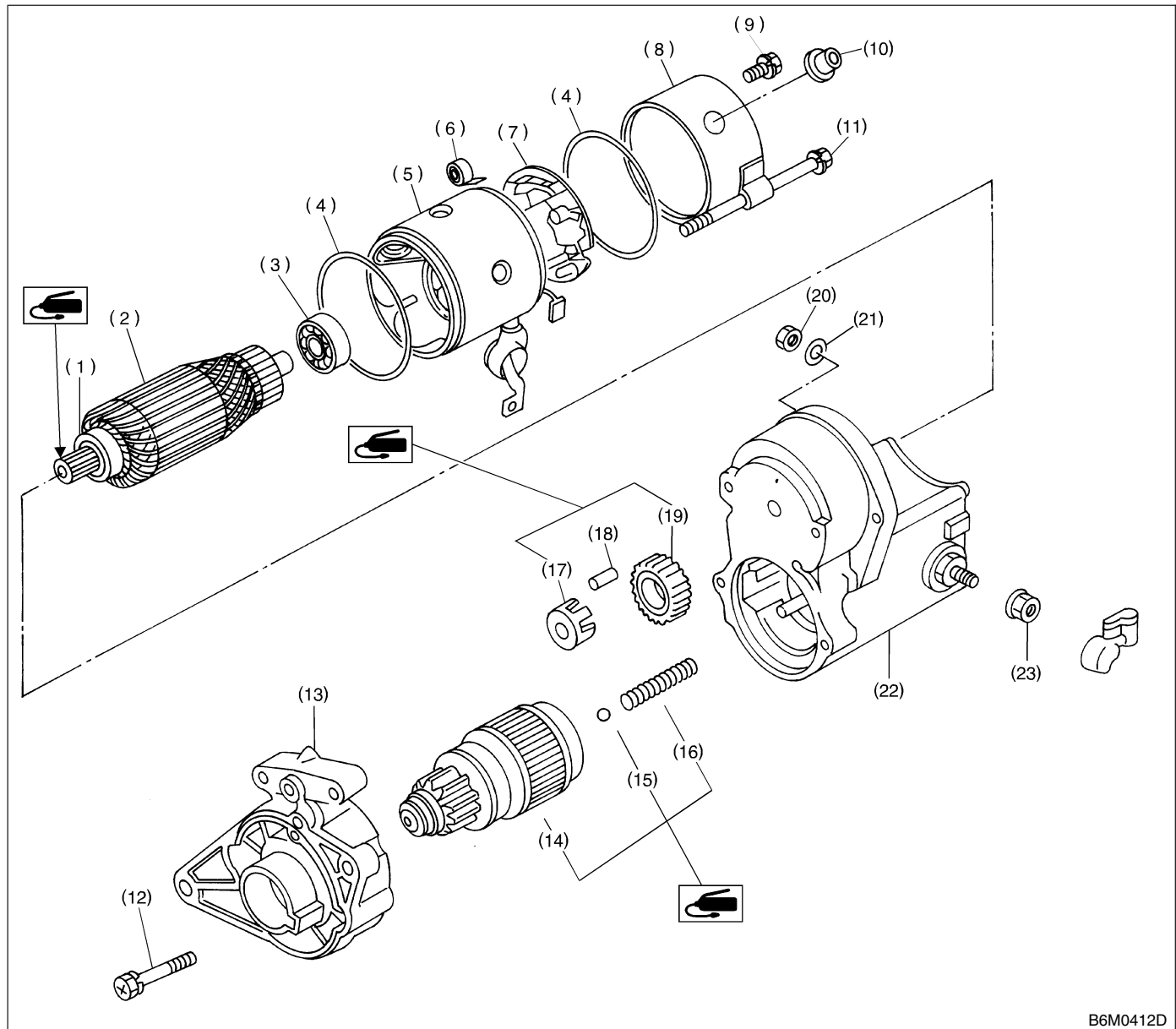
A: SPECIFICATIONS S179001E49

Item			Designation	
			MT	AT
Starter	Type		Reduction type	
	Model		TN128000-8311	TN128000-8321
	Manufacturer		NIPPONDENSO TENNESSEE	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	90 A or less	
		Rotating speed	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		LR190-742	
	Manufacturer		HITACHI AUTOMOTIVE PRODUCTS	
	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 — 39 A or more 2,500 rpm — 66 A or more 5,000 rpm — 85 A or more	
	Regulated voltage		14.5 ^{+0.3} / _{-0.4} V [20°C (68°F)]	
Battery	Reserve capacity	amps min.	90	110
	Cold cranking	amp.	430	490

B: COMPONENT S179001A05

1. STARTER S179001A0501

● MT VEHICLES



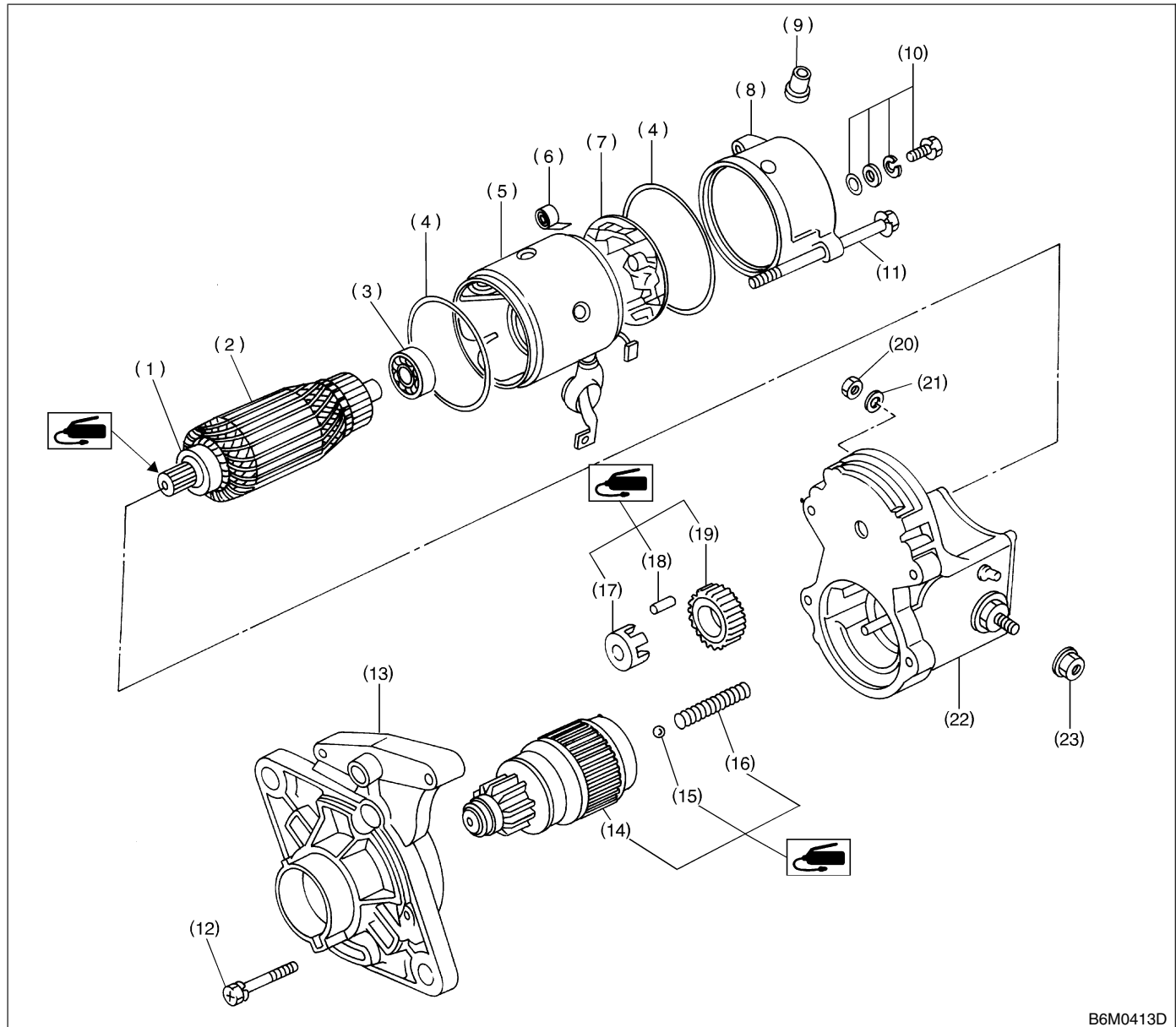
B6M0412D

(1) Front ball bearing	(9) Screw & washer	(17) Retainer
(2) Armature	(10) Cover	(18) Roller
(3) Rear ball bearing	(11) Through bolt	(19) Idle gear
(4) O-ring	(12) Screw & washer	(20) Nut
(5) Yoke	(13) Starter housing	(21) Spring washer
(6) Brush spring	(14) Overrunning clutch	(22) Magnetic switch
(7) Brush holder	(15) Steel ball	(23) Nut
(8) End frame	(16) Spring	

GENERAL DESCRIPTION

Starting/Charging Systems

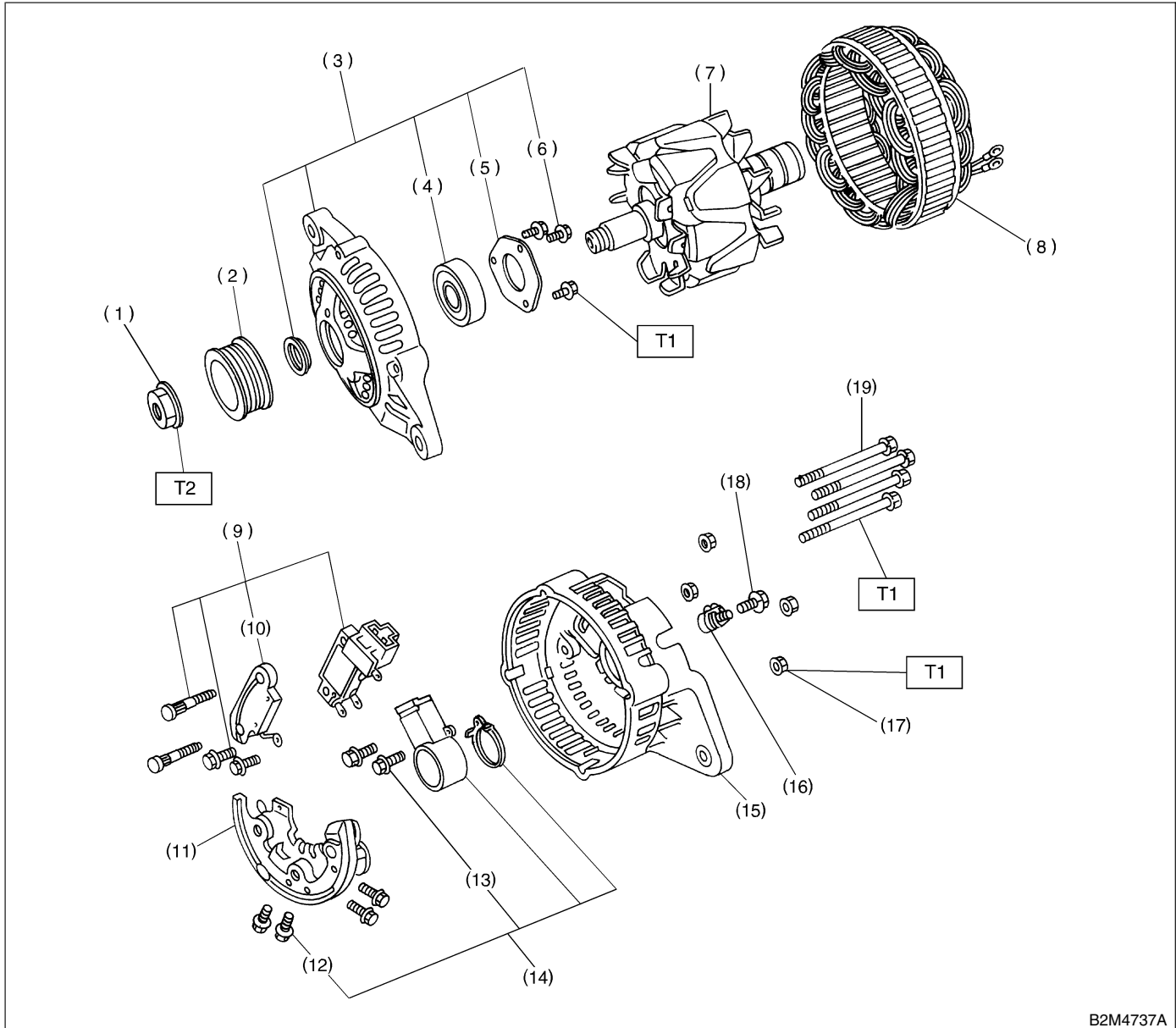
• AT VEHICLES



B6M0413D

(1) Front ball bearing	(9) Cover	(17) Retainer
(2) Armature	(10) Screw & washer	(18) Roller
(3) Rear ball bearing	(11) Through-bolt	(19) Idle gear
(4) O-ring	(12) Screw & washer	(20) Nut
(5) Yoke	(13) Starter housing	(21) Spring washer
(6) Brush spring	(14) Overrunning clutch	(22) Magnetic switch
(7) Brush holder	(15) Steel ball	(23) Nut
(8) End frame	(16) Spring	

2. GENERATOR S179001A0502



- (1) Pulley nut
- (2) Pulley
- (3) Front cover ASSY
- (4) Ball bearing
- (5) Bearing retainer
- (6) Screw
- (7) Rotor
- (8) Stator coil

- (9) IC regulator ASSY
- (10) Condenser
- (11) Diode ASSY
- (12) Bolt
- (13) Bolt
- (14) Brush holder ASSY
- (15) Rear cover
- (16) BAT. terminal

- (17) Nut
- (18) Bolt
- (19) Through-bolt

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3.1 (0.32, 2.3)

T2: 63.7 (6.5, 47.0)

C: CAUTION S179001A03

- 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.

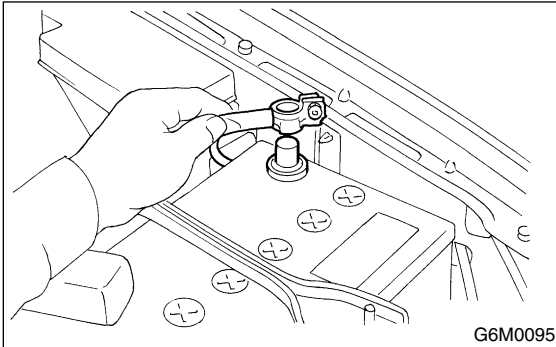
2. Starter

S179012

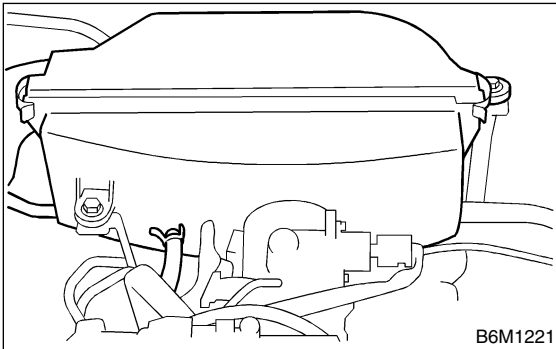
A: REMOVAL

S179012A18

- 1) Disconnect battery ground cable.

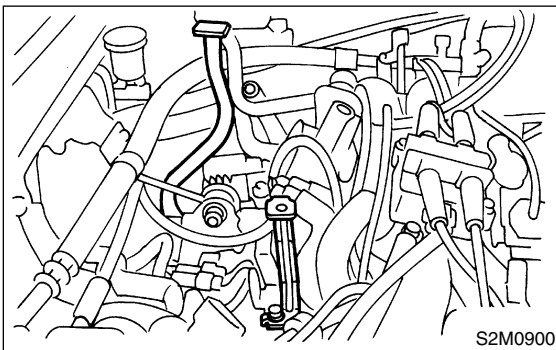


- 2) Remove air cleaner case.

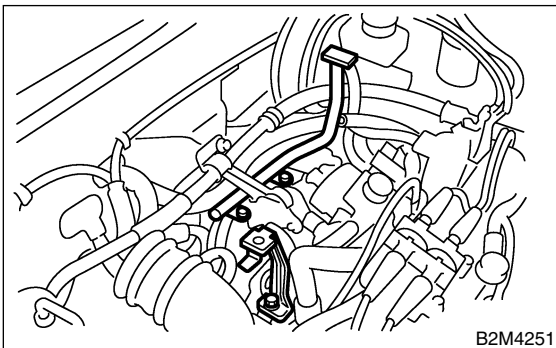


- 3) Remove air cleaner case stay.

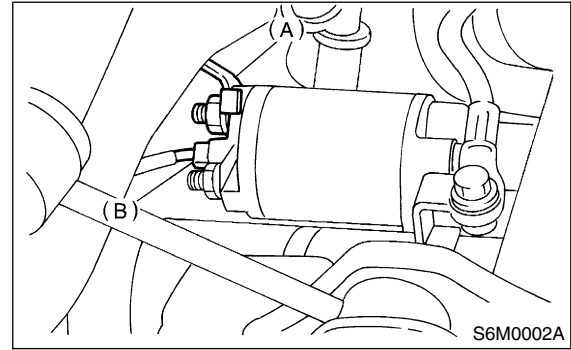
- MT vehicles



- AT vehicles

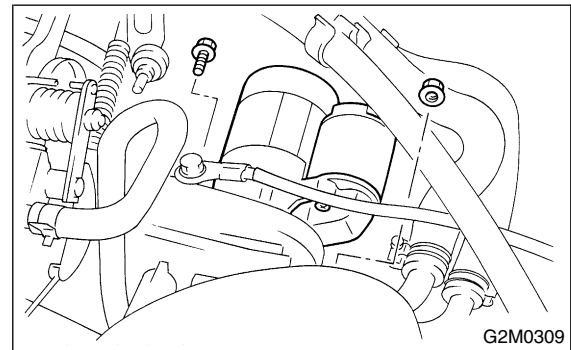


- 4) Disconnect connector and terminal from starter.



- (A) Terminal
- (B) Connector

- 5) Remove starter from transmission.



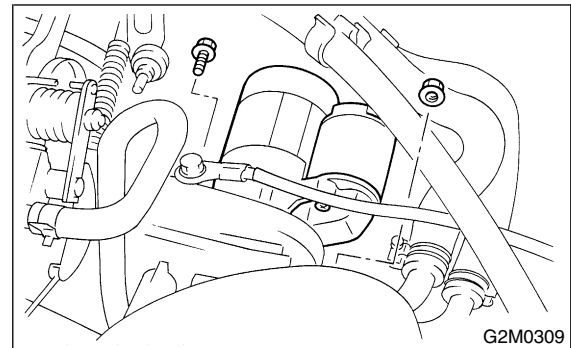
B: INSTALLATION

S179012A11

Install in the reverse order of removal.

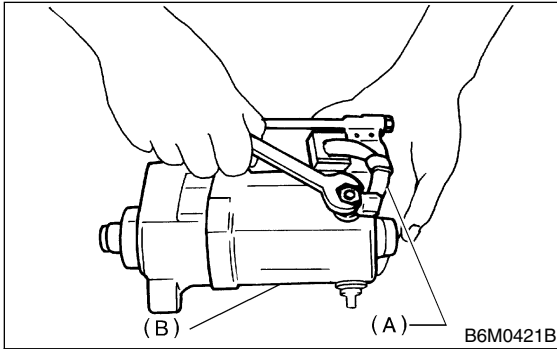
Tightening torque:

50 N·m (5.1 kgf-m, 37 ft-lb)

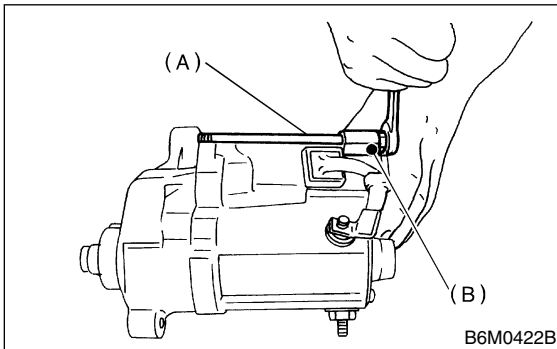


C: DISASSEMBLY S179012A06

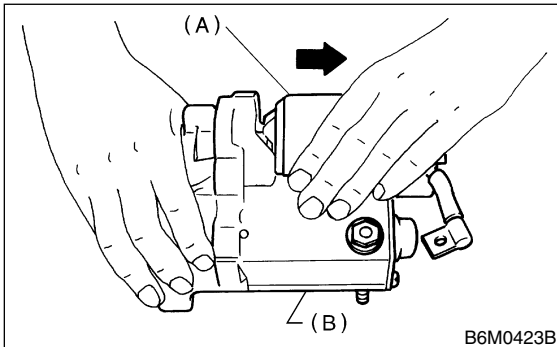
- 1) Disconnect lead wire (A) from magnetic switch (B).



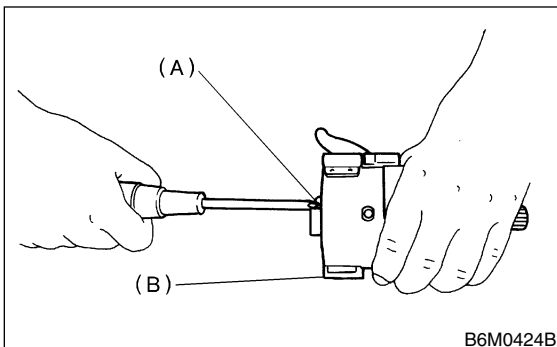
- 2) Remove through-bolts (A) from end frame (B).



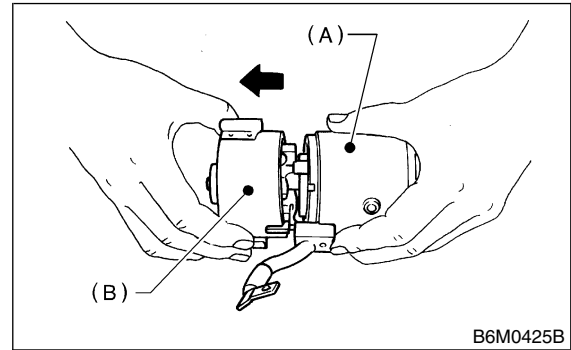
- 3) Remove yoke (A) from magnetic switch (B).



- 4) Remove screws (A) securing end frame (B) to brush holder.

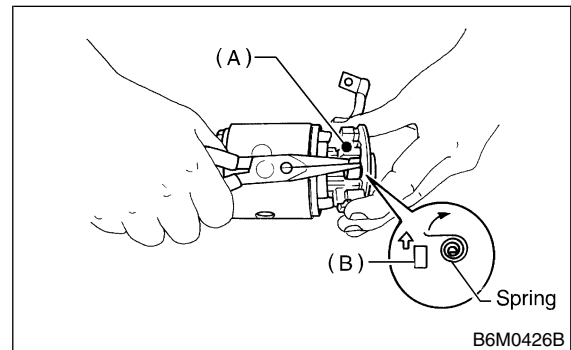


- 5) Separate yoke (A) from end frame (B).



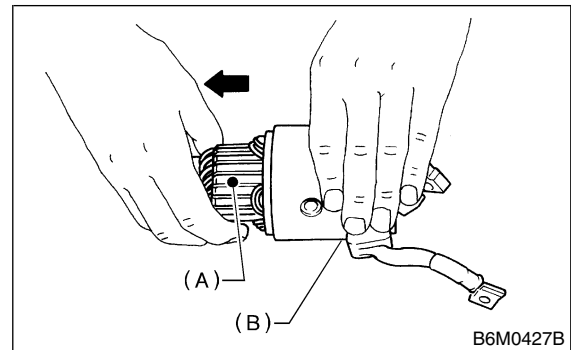
- 6) Remove brush (A) by lifting up positive (+) side brush spring (B) using long-nose pliers.

CAUTION:
Be careful not to damage brush and commutator.

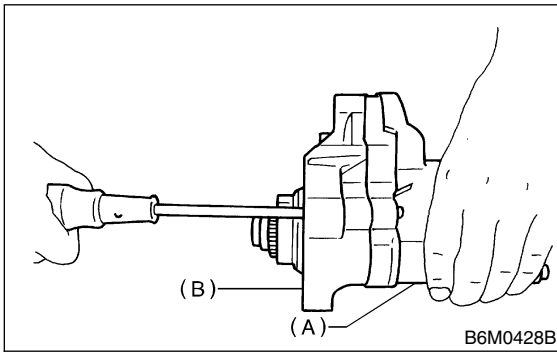


- 7) Remove armature (A) from yoke (B).

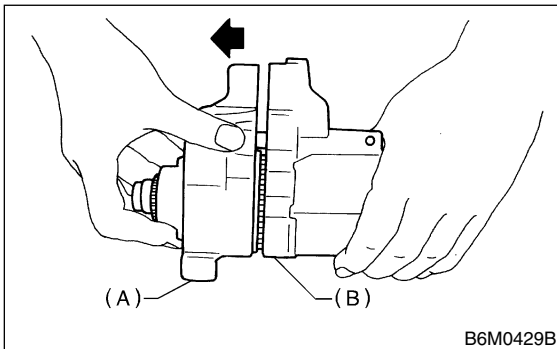
CAUTION:
Be careful not to drop armature.



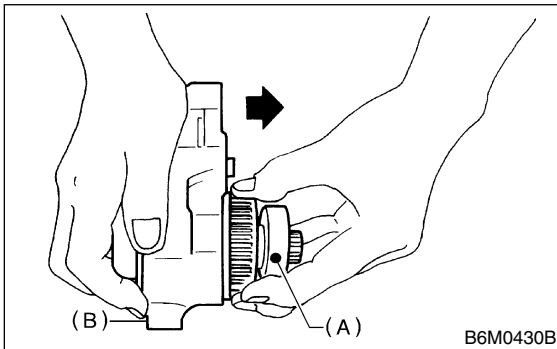
- 8) Remove screws securing magnetic switch (A) to housing (B).



- 9) Remove housing (A) from magnetic switch (B).

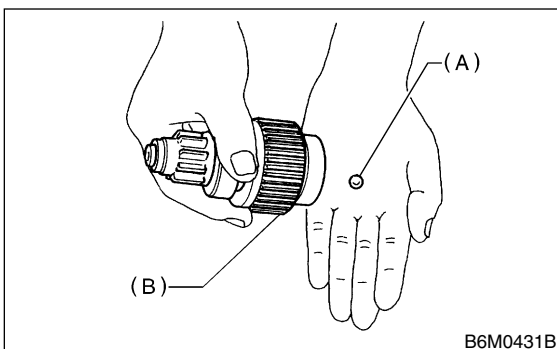


- 10) Remove clutch (A) from housing (B).

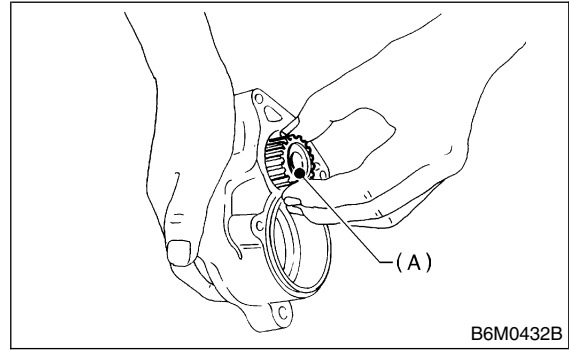


- 11) Take out steel ball (A) from clutch (B).

CAUTION:
Be careful not to lose steel ball.

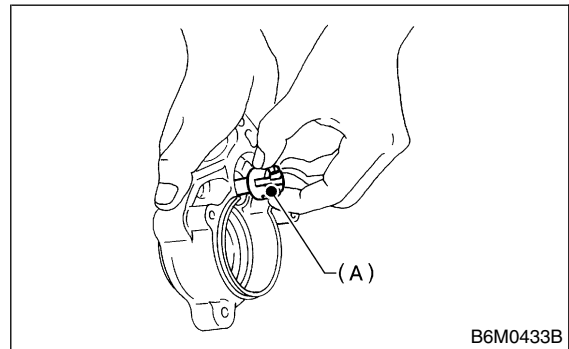


- 12) Remove idle gear (A) from housing.

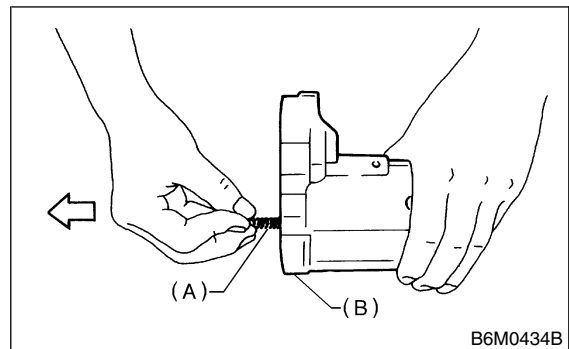


- 13) Remove retainer and roller (A) from housing.

CAUTION:
Be careful not to drop retainer and roller.



- 14) Remove coil spring (A) from magnetic switch (B).



D: ASSEMBLY S179012A02

Assemble in the reverse order of disassembly. Observe the following:

1) Before assembling, lubricate disassembled parts at the points shown in "COMPONENT PARTS". <Ref. to SC-3, COMPONENT, General Description.>

Grease:

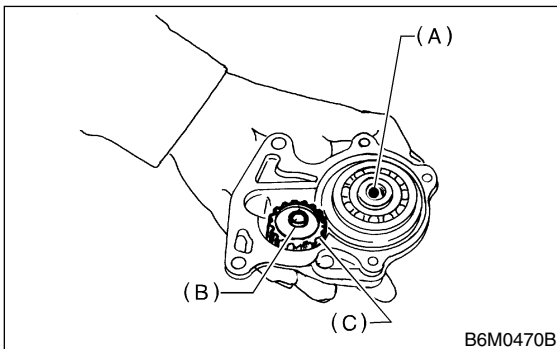
ESSO BEACON 325
SHELL ALVANIA GREASE RA
or equivalent

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.

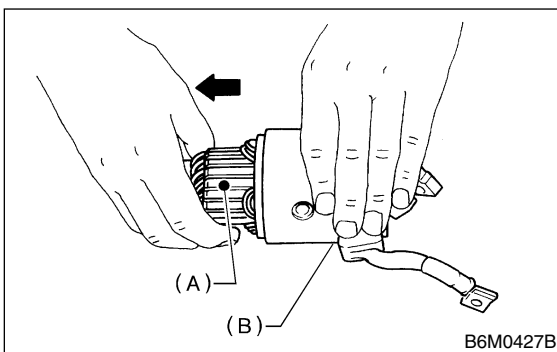


- (A) Steel ball
- (B) Retainer
- (C) Idle gear

3) Installing armature (A) to yoke (B)

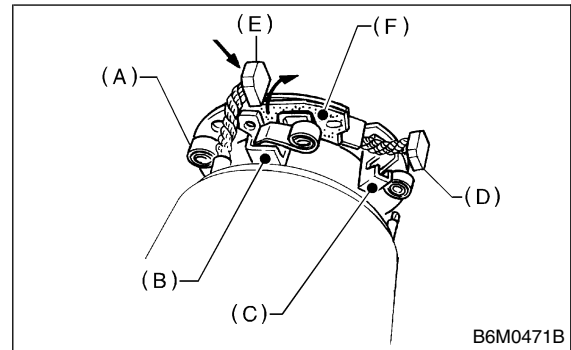
CAUTION:

Do not forget to put felt washer on armature shaft bearing.



4) Installing brushes

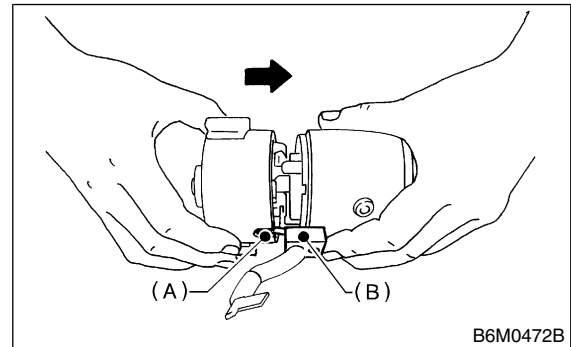
Assemble brush holder to yoke as shown, then assemble two yoke-side brushes to brush holder.



- (A) Brush spring
- (B) Brush holder hole (+)
- (C) Brush holder hole (-)
- (D) Brush (+)
- (E) Brush (-)
- (F) Insulator

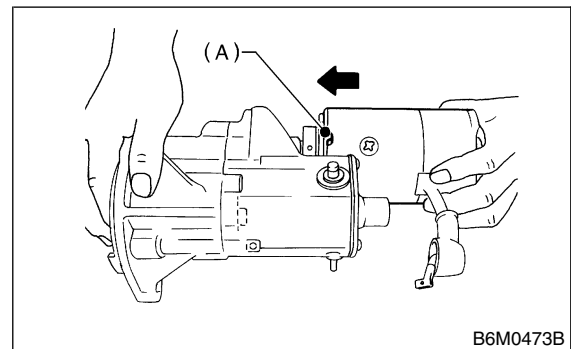
5) Installing end frame

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 protrusion of magnetic switch.



E: INSPECTION S179012A10

1. ARMATURE S179012A1001

1) Check commutator for any sign of burns or rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

2) Run-out test

Check the commutator run-out and replace if it exceeds the limit.

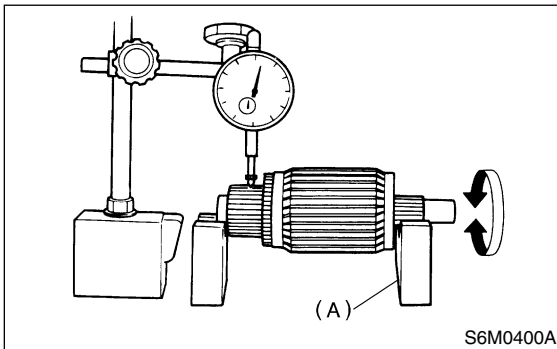
Commutator run-out:

Standard

0.02 mm (0.0008 in), or less

Service limit

Less than 0.05 mm (0.0020 in)



(A) V-block

3) Depth of segment mold

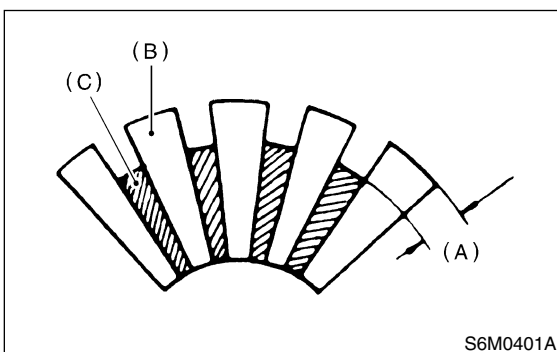
Check the depth of segment mold.

Depth of segment mold:

0.6 mm (0.024 in)

Limit

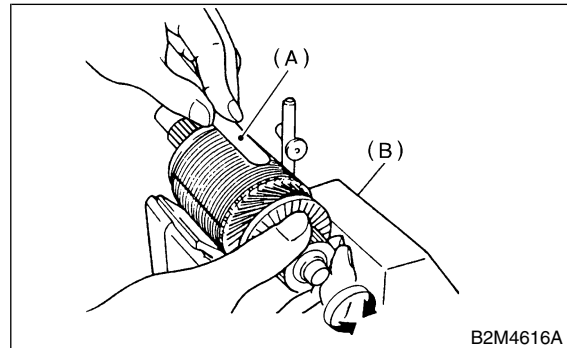
0.2 mm (0.008 in)



- (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 hacksaw blade against armature core while slowly rotating armature. A short-circuited armature will cause the blade to vibrate and to be attracted to core. If the hacksaw blade is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.

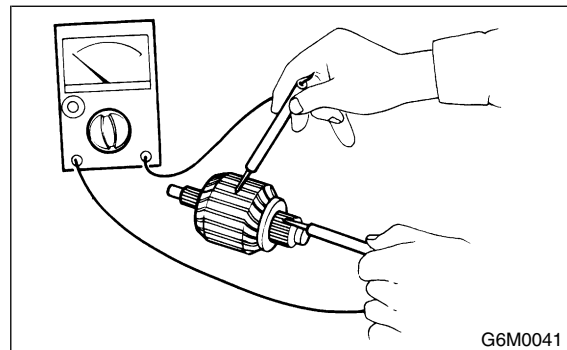


- (A) Iron sheet
- (B) Growler tester

5) Armature ground test

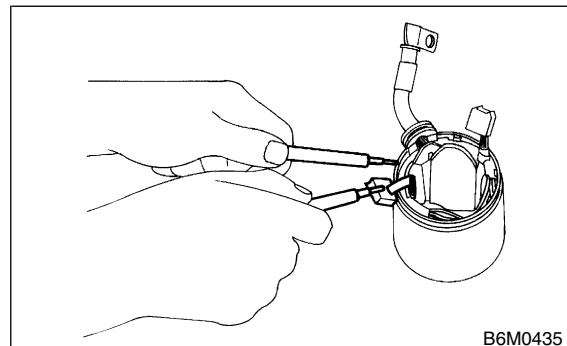
Using circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is a continuity, armature is grounded.

Replace armature if it is grounded.



2. YOKE S179012A1002

Make sure pole is set in position.



STARTER

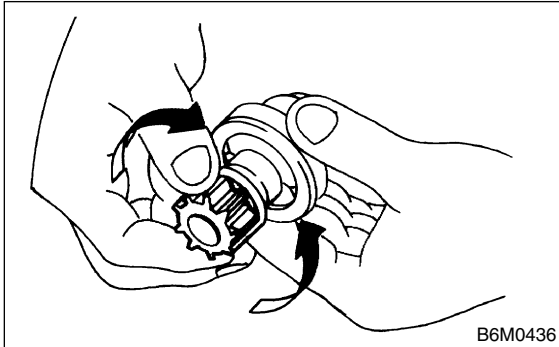
Starting/Charging Systems

3. OVERRUNNING CLUTCH S179012A1003

Inspect teeth of pinion for wear and damage. Replace if it is damaged. Rotate pinion in direction of rotation (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 S179012A1004

1) Brush length

Measure the brush length and replace if it exceeds the service limit.

Replace if abnormal wear or cracks are noticed.

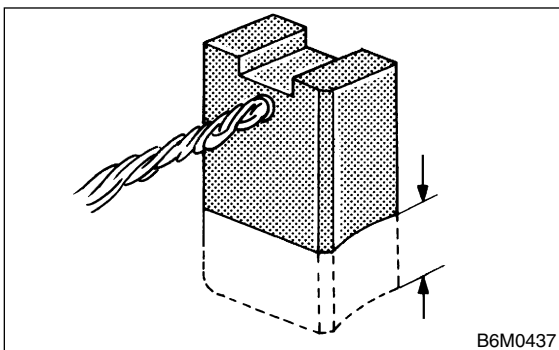
Brush length:

Standard

15 mm (0.59 in)

Service limit

10 mm (0.39 in)

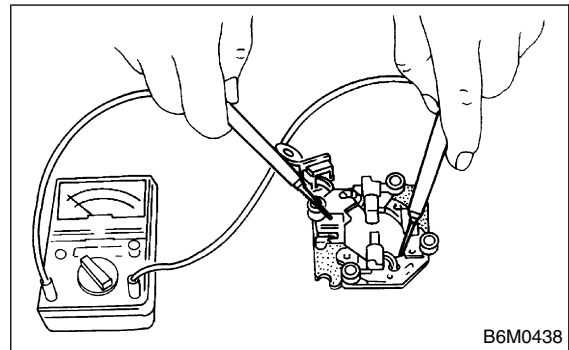


2) Brush movement

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)

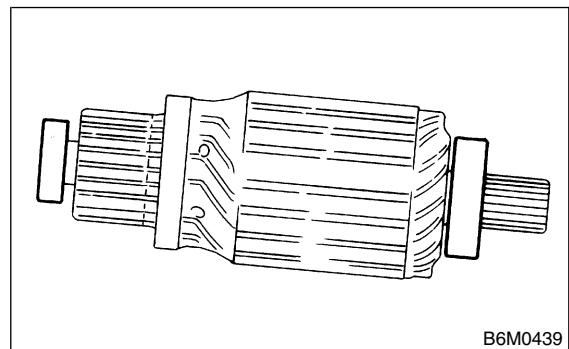
Service limit

6.9 N (0.7 kgf, 1.5 lb)

5. BEARING S179012A1009

1) Rotate bearing by hand; no binding should exist.

2) Rotate bearing rapidly; no abnormal noise should be heard.



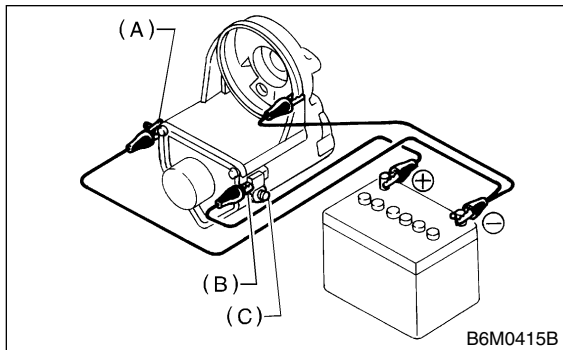
6. MAGNETIC SWITCH S179012A1010

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

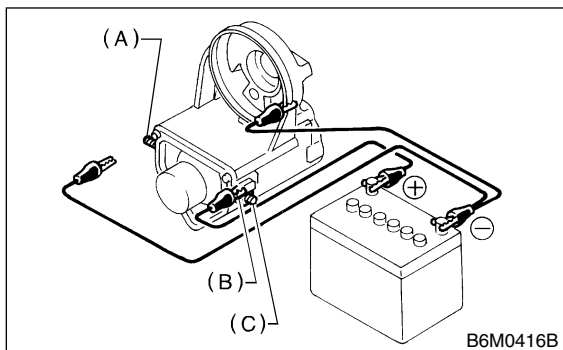
Connect two battery negative leads onto magnetic switch body and terminal C respectively. Then connect battery positive lead onto terminal 50. Pinion should extend when lead connections are made.



- (A) Terminal C
- (B) Terminal 50
- (C) Terminal M

2) Holding-in test

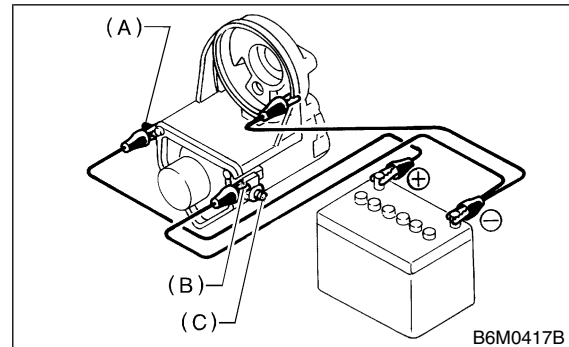
Disconnect lead from terminal C with pinion extended. Pinion should be held in the extended position.



- (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.



- (A) Terminal C
- (B) Terminal 50
- (C) Terminal M

7. PERFORMANCE TEST S179012A1008

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.

STARTER

Starting/Charging Systems

1) No-load test

Run single starter under no-load state, and measure its rotating speed, voltage, and current, using the specified battery. Measured values must meet the following standards:

No-load test (Standard):

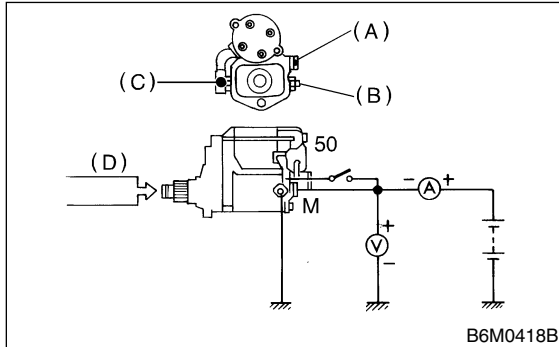
Voltage/Current

11 V/90 A, or more

Rotating speed

TN128000-8311: 3,000 rpm, or more

TN128000-8321: 3,350 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):

TN128000-8311

Voltage/Load

8 V/9.8 N·m (1.0 kgf-m, 7.2 ft-lb)

Current/Speed

280 A max./900 rpm min.

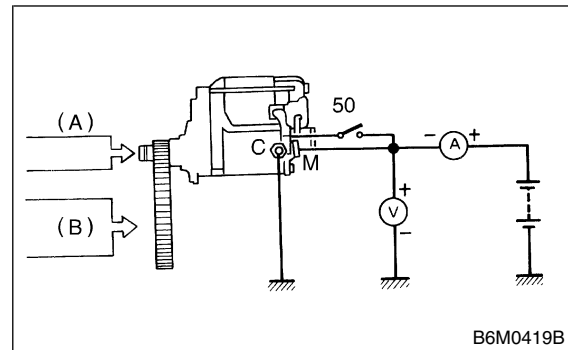
TN128000-8321

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):

TN128000-8311

Voltage/Current

5 V/800 A, or less

Torque

27.5 N·m (2.8 kgf-m, 20.3 ft-lb) min.

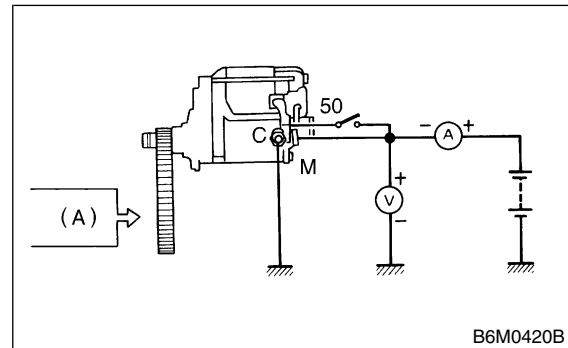
TN128000-8321

Voltage/Current

5 V/1,050 A, or less

Torque

27.5 N·m (2.8 kgf-m, 20.3 ft-lb) min.



- (A) Torque gauge

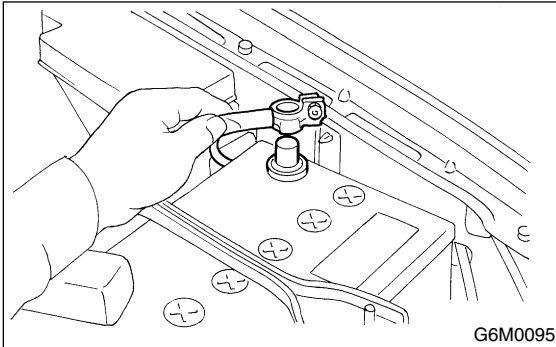
NOTE:

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.

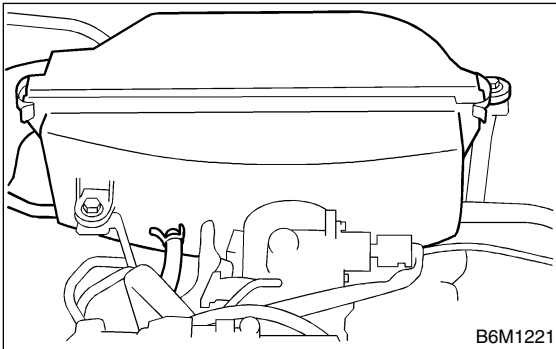
2. Starter S179012

A: REMOVAL S179012A18

- 1) Disconnect battery ground cable.

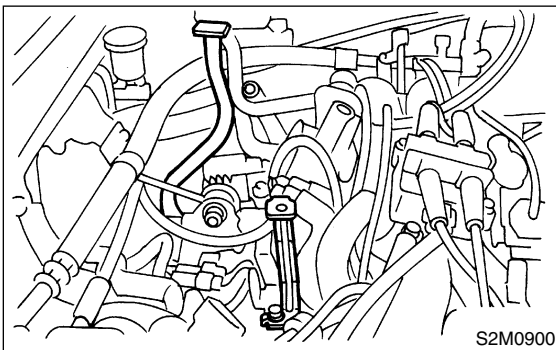


- 2) Remove air cleaner case.

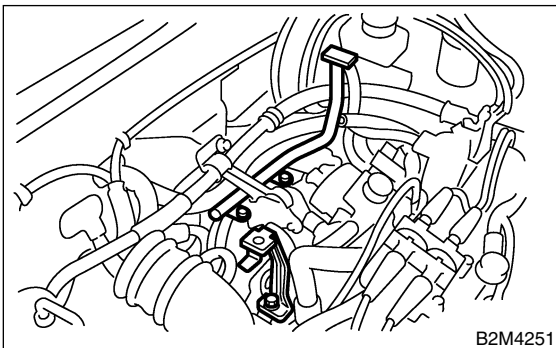


- 3) Remove air cleaner case stay.

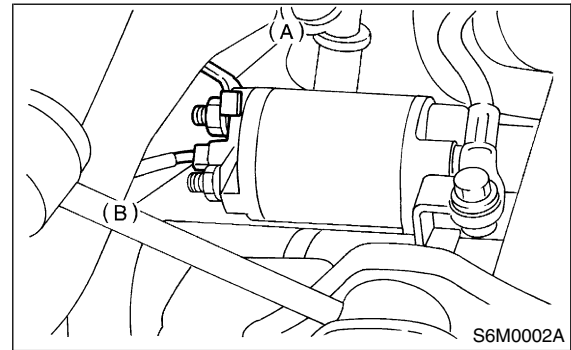
- MT vehicles



- AT vehicles

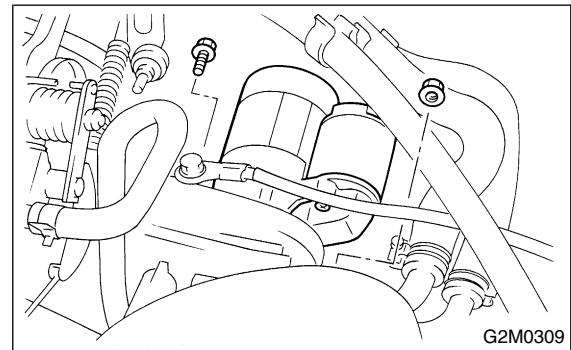


- 4) Disconnect connector and terminal from starter.



- (A) Terminal
(B) Connector

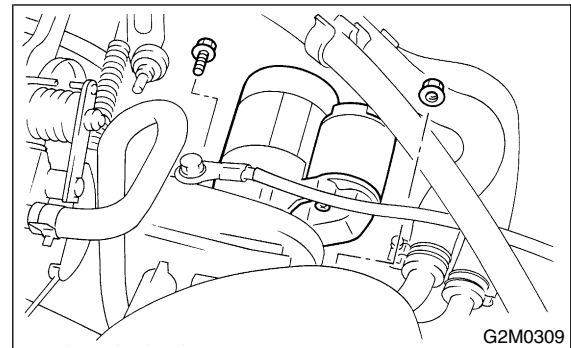
- 5) Remove starter from transmission.



B: INSTALLATION S179012A11

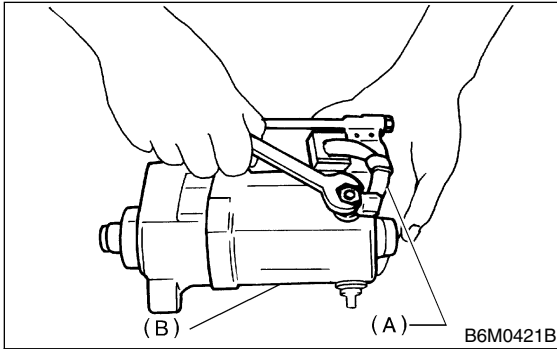
Install in the reverse order of removal.

Tightening torque:
50 N·m (5.1 kgf-m, 37 ft-lb)

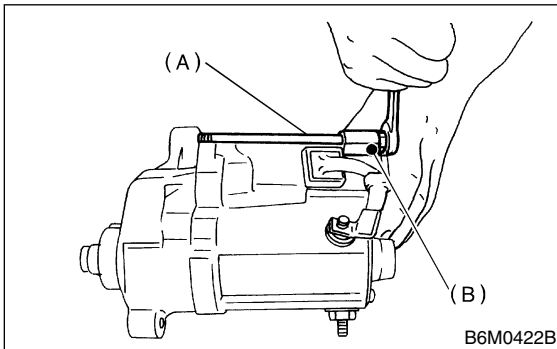


C: DISASSEMBLY S179012A06

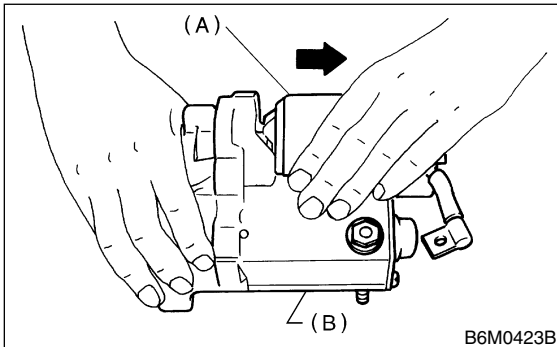
- 1) Disconnect lead wire (A) from magnetic switch (B).



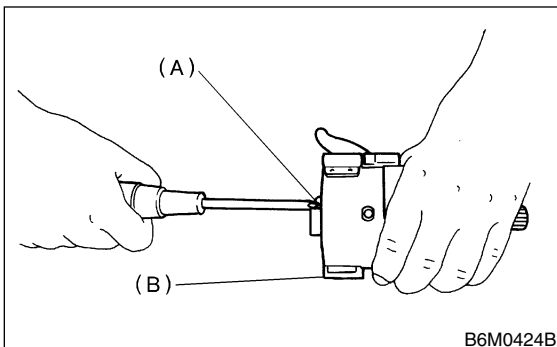
- 2) Remove through-bolts (A) from end frame (B).



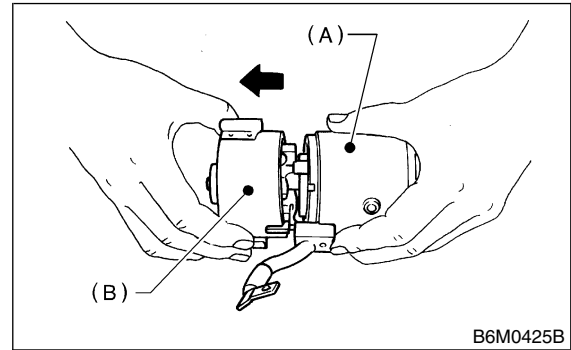
- 3) Remove yoke (A) from magnetic switch (B).



- 4) Remove screws (A) securing end frame (B) to brush holder.

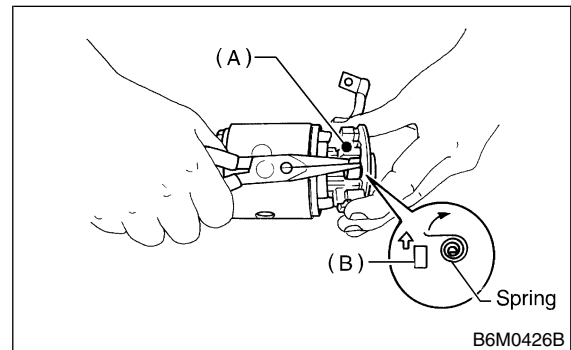


- 5) Separate yoke (A) from end frame (B).



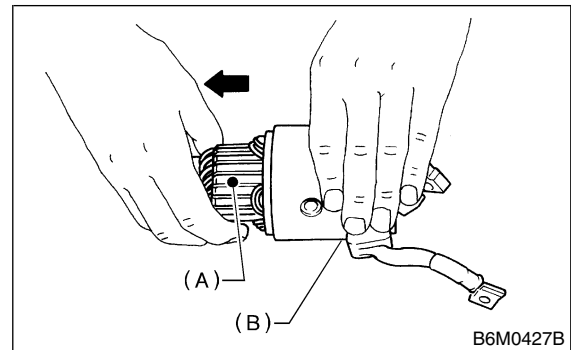
- 6) Remove brush (A) by lifting up positive (+) side brush spring (B) using long-nose pliers.

CAUTION:
Be careful not to damage brush and commutator.

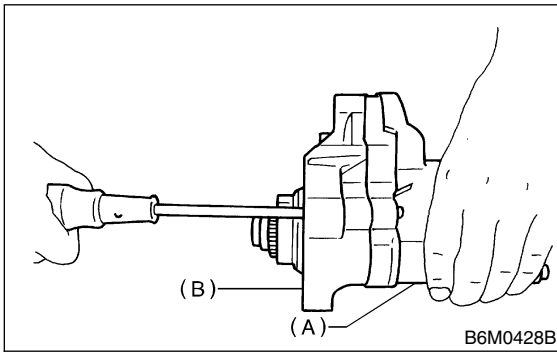


- 7) Remove armature (A) from yoke (B).

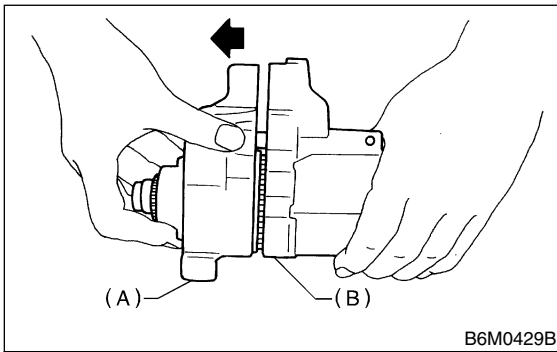
CAUTION:
Be careful not to drop armature.



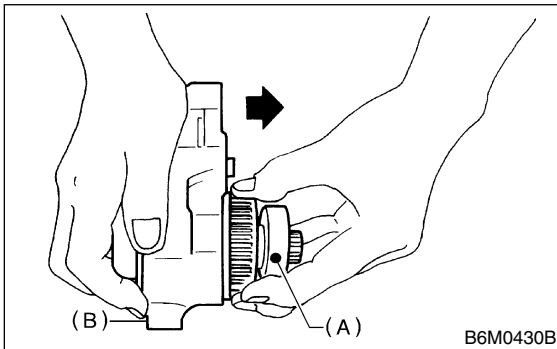
- 8) Remove screws securing magnetic switch (A) to housing (B).



- 9) Remove housing (A) from magnetic switch (B).

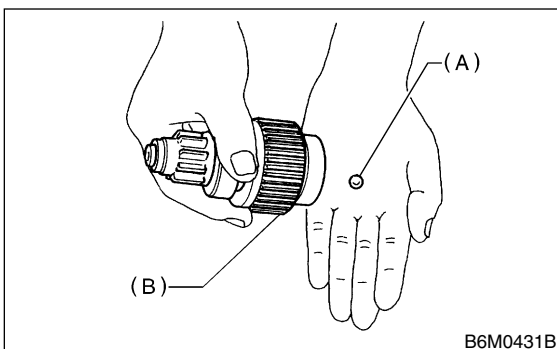


- 10) Remove clutch (A) from housing (B).

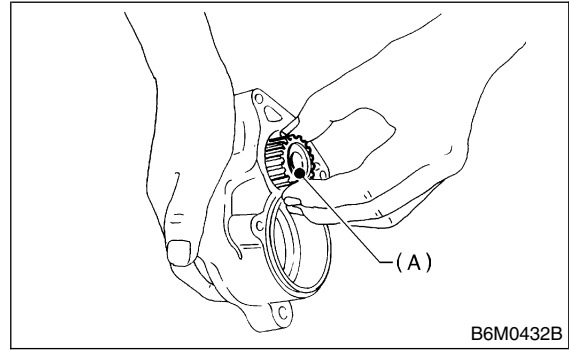


- 11) Take out steel ball (A) from clutch (B).

CAUTION:
Be careful not to lose steel ball.

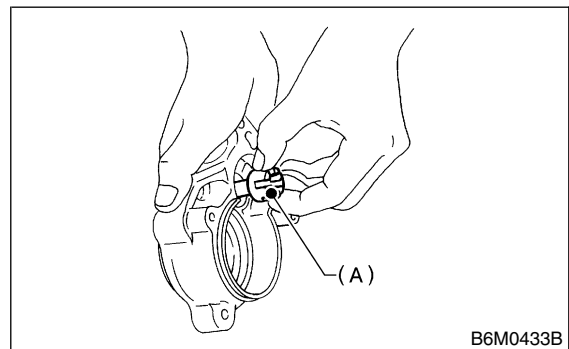


- 12) Remove idle gear (A) from housing.

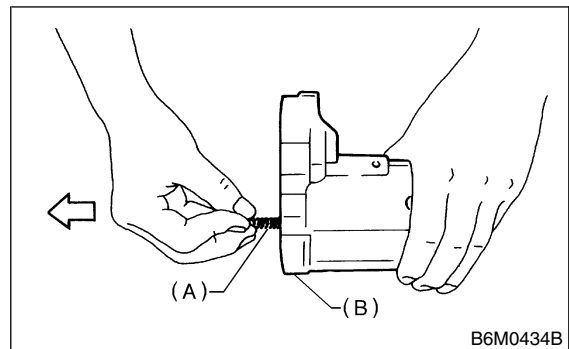


- 13) Remove retainer and roller (A) from housing.

CAUTION:
Be careful not to drop retainer and roller.



- 14) Remove coil spring (A) from magnetic switch (B).



D: ASSEMBLY S179012A02

Assemble in the reverse order of disassembly. Observe the following:

1) Before assembling, lubricate disassembled parts at the points shown in "COMPONENT PARTS". <Ref. to SC-3, COMPONENT, General Description.>

Grease:

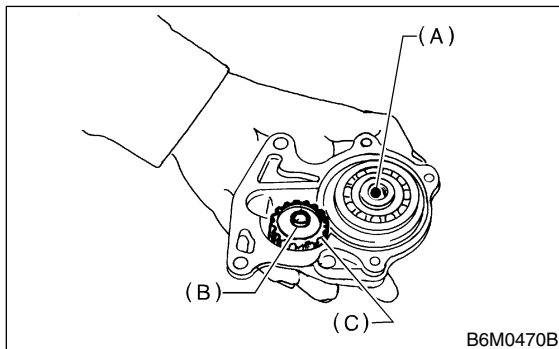
ESSO BEACON 325
SHELL ALVANIA GREASE RA
or equivalent

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.

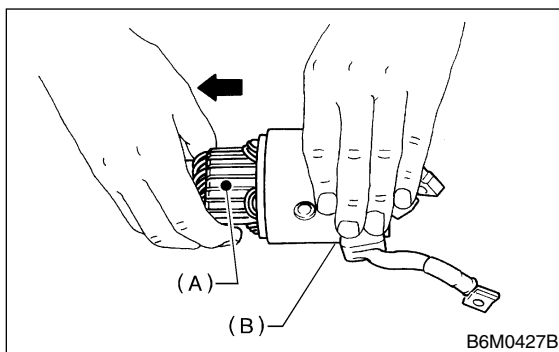


- (A) Steel ball
(B) Retainer
(C) Idle gear

3) Installing armature (A) to yoke (B)

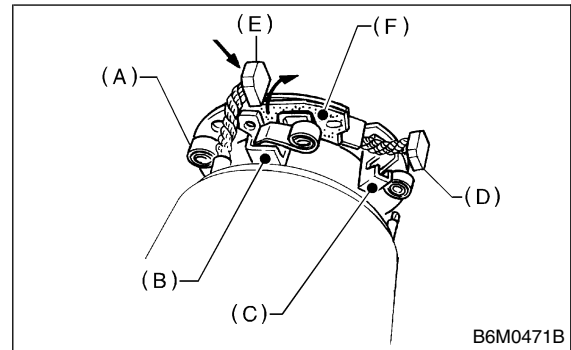
CAUTION:

Do not forget to put felt washer on armature shaft bearing.



4) Installing brushes

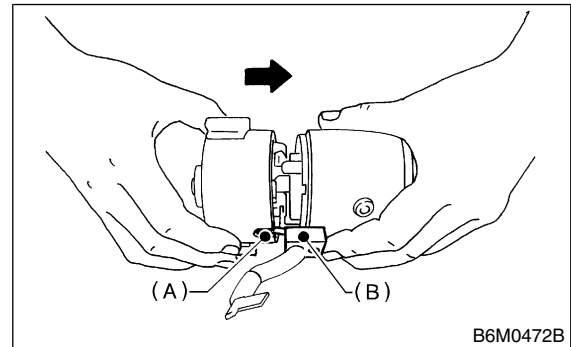
Assemble brush holder to yoke as shown, then assemble two yoke-side brushes to brush holder.



- (A) Brush spring
(B) Brush holder hole (+)
(C) Brush holder hole (-)
(D) Brush (+)
(E) Brush (-)
(F) Insulator

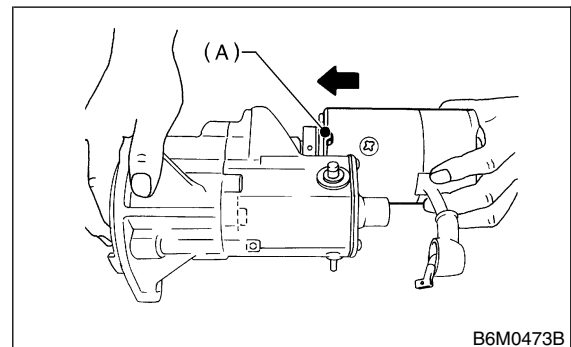
5) Installing end frame

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 protrusion of magnetic switch.



E: INSPECTION S179012A10

1. ARMATURE S179012A1001

1) Check commutator for any sign of burns or rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

2) Run-out test

Check the commutator run-out and replace if it exceeds the limit.

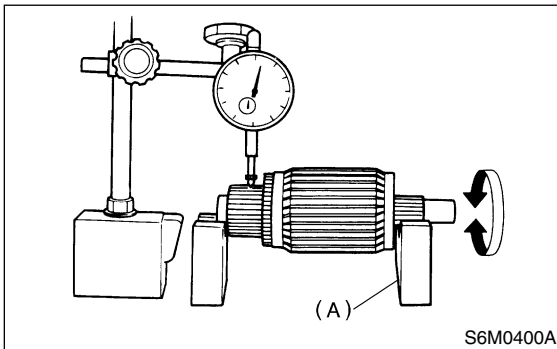
Commutator run-out:

Standard

0.02 mm (0.0008 in), or less

Service limit

Less than 0.05 mm (0.0020 in)



(A) V-block

3) Depth of segment mold

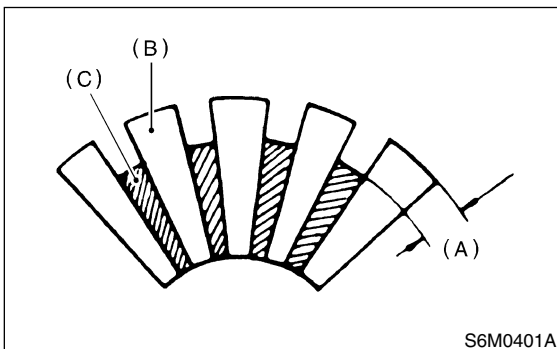
Check the depth of segment mold.

Depth of segment mold:

0.6 mm (0.024 in)

Limit

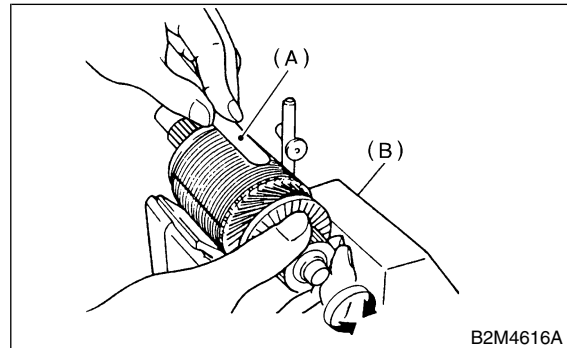
0.2 mm (0.008 in)



- (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 hacksaw blade against armature core while slowly rotating armature. A short-circuited armature will cause the blade to vibrate and to be attracted to core. If the hacksaw blade is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.

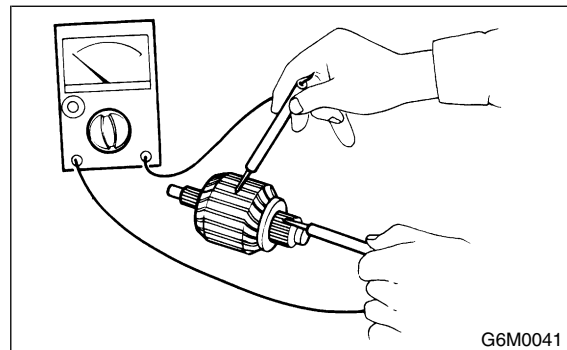


- (A) Iron sheet
- (B) Growler tester

5) Armature ground test

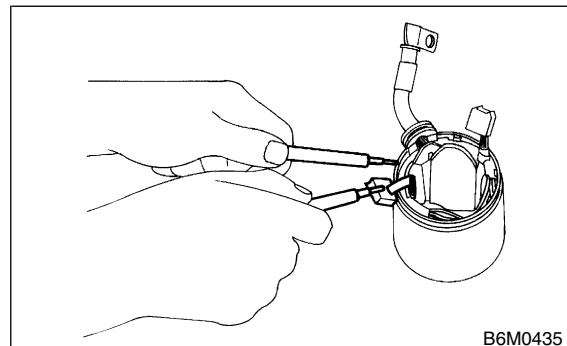
Using circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is a continuity, armature is grounded.

Replace armature if it is grounded.



2. YOKE S179012A1002

Make sure pole is set in position.



STARTER

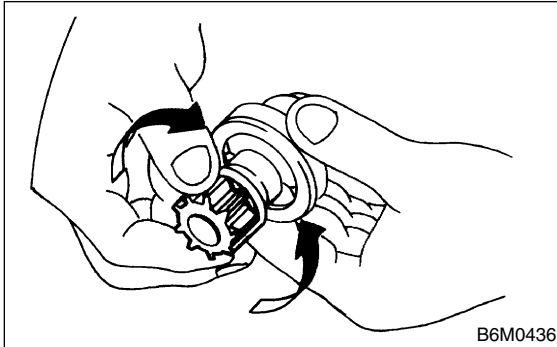
Starting/Charging Systems

3. OVERRUNNING CLUTCH S179012A1003

Inspect teeth of pinion for wear and damage. Replace if it is damaged. Rotate pinion in direction of rotation (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 S179012A1004

1) Brush length

Measure the brush length and replace if it exceeds the service limit.

Replace if abnormal wear or cracks are noticed.

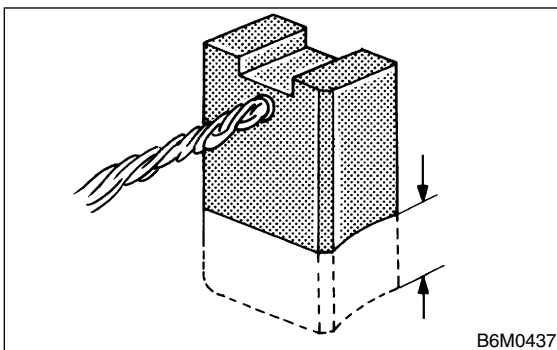
Brush length:

Standard

15 mm (0.59 in)

Service limit

10 mm (0.39 in)

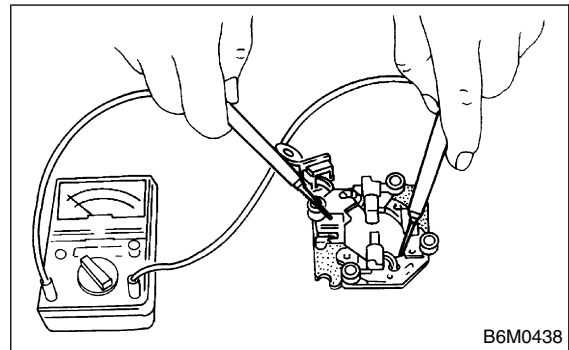


2) Brush movement

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)

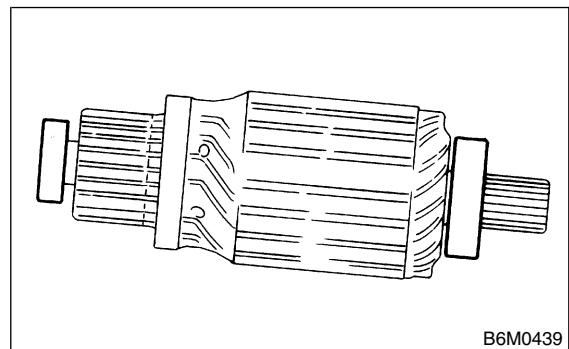
Service limit

6.9 N (0.7 kgf, 1.5 lb)

5. BEARING S179012A1009

1) Rotate bearing by hand; no binding should exist.

2) Rotate bearing rapidly; no abnormal noise should be heard.



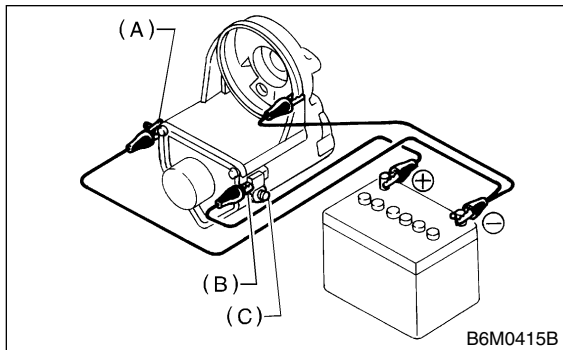
6. MAGNETIC SWITCH S179012A1010

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

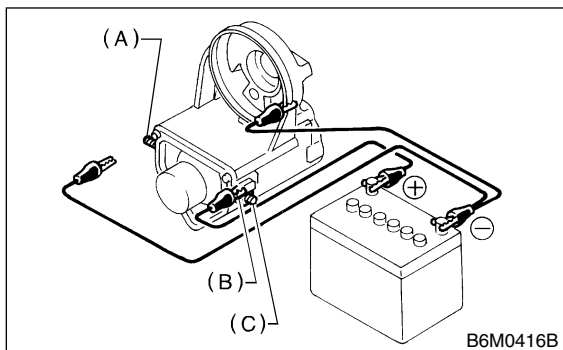
Connect two battery negative leads onto magnetic switch body and terminal C respectively. Then connect battery positive lead onto terminal 50. Pinion should extend when lead connections are made.



- (A) Terminal C
- (B) Terminal 50
- (C) Terminal M

2) Holding-in test

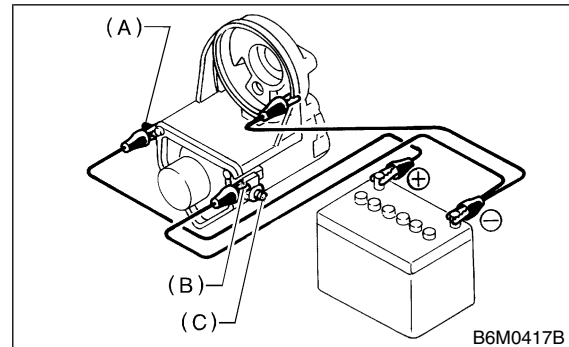
Disconnect lead from terminal C with pinion extended. Pinion should be held in the extended position.



- (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.



- (A) Terminal C
- (B) Terminal 50
- (C) Terminal M

7. PERFORMANCE TEST S179012A1008

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.

STARTER

Starting/Charging Systems

1) No-load test

Run single starter under no-load state, and measure its rotating speed, voltage, and current, using the specified battery. Measured values must meet the following standards:

No-load test (Standard):

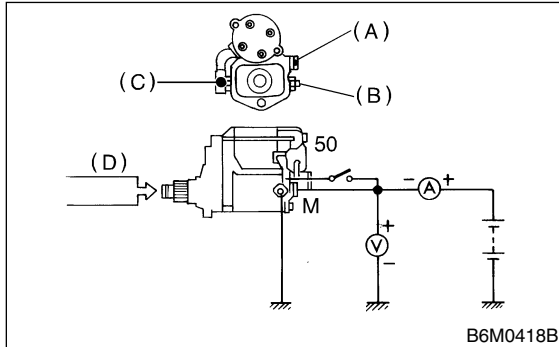
Voltage/Current

11 V/90 A, or more

Rotating speed

TN128000-8311: 3,000 rpm, or more

TN128000-8321: 3,350 rpm, or more



- (A) Tachometer
- (B) Torque gauge
- (C) Terminal 50
- (D) Terminal M

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):

TN128000-8311

Voltage/Load

8 V/9.8 N·m (1.0 kgf-m, 7.2 ft-lb)

Current/Speed

280 A max./900 rpm min.

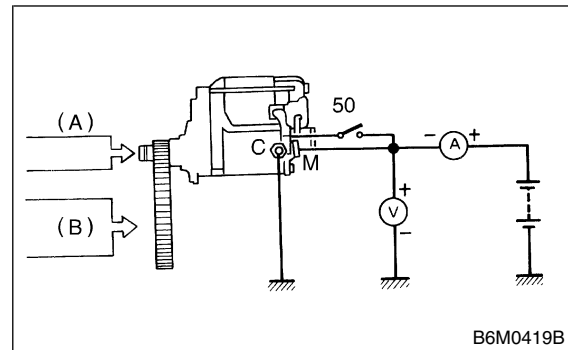
TN128000-8321

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):

TN128000-8311

Voltage/Current

5 V/800 A, or less

Torque

27.5 N·m (2.8 kgf-m, 20.3 ft-lb) min.

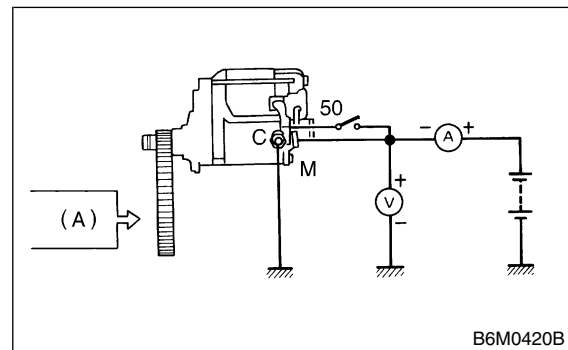
TN128000-8321

Voltage/Current

5 V/1,050 A, or less

Torque

27.5 N·m (2.8 kgf-m, 20.3 ft-lb) min.



- (A) Torque gauge

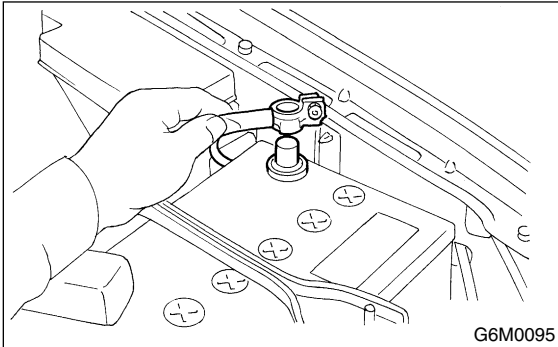
NOTE:

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.

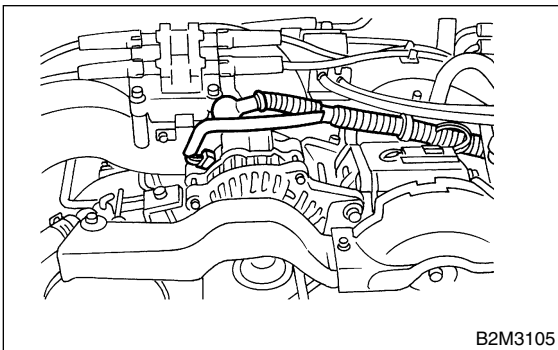
3. Generator S179008

A: REMOVAL S179008A18

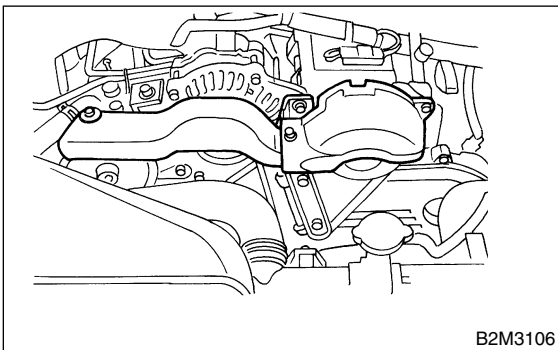
- 1) Disconnect battery ground cable.



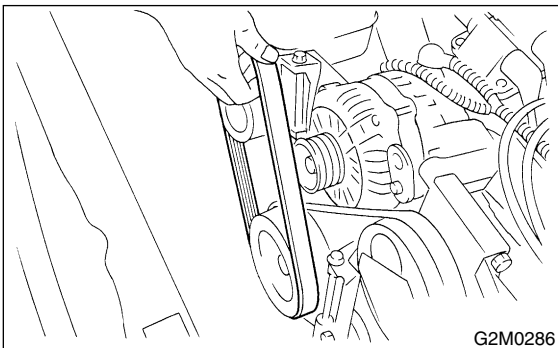
- 2) Disconnect connector and terminal from generator.



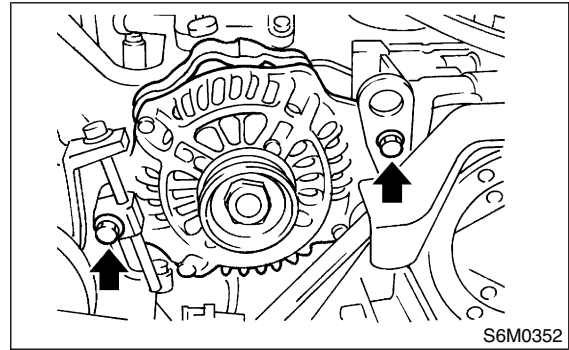
- 3) Remove V-belt cover.



- 4) Remove front side V-belt.



- 5) Remove bolts which install generator onto bracket.



B: INSTALLATION S179008A11

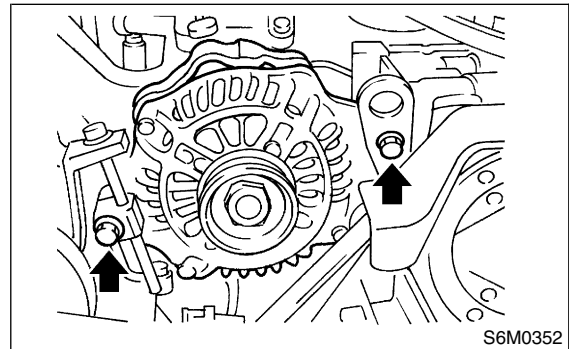
Install in the reverse order of removal.

CAUTION:

Check and adjust V-belt tension. <Ref. to ME-43, INSPECTION, V-belt.>

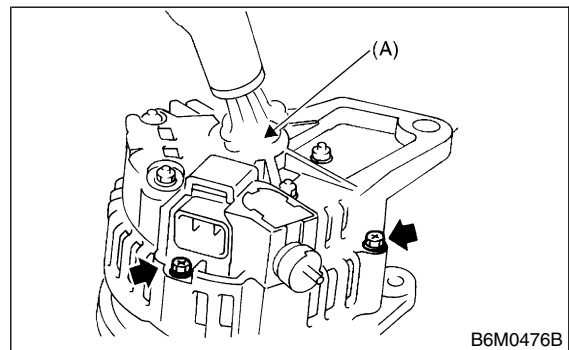
Tightening torque:

25 N·m (2.5 kgf-m, 18 ft-lb)



C: DISASSEMBLY S179008A06

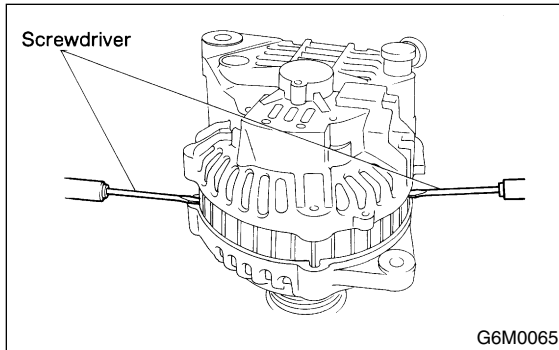
- 1) Heat the portion (A) of rear cover to 50°C (122°F) with heater drier.



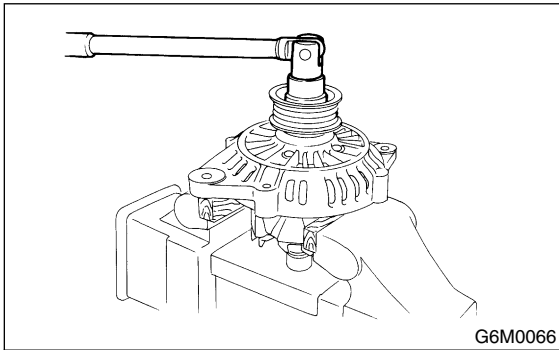
GENERATOR

Starting/Charging Systems

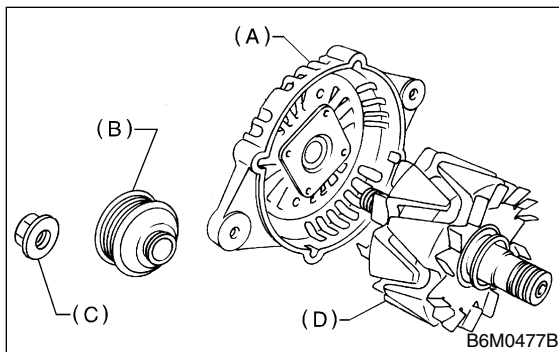
2) Remove the four through-bolts. Then insert the tip of a flat-head screwdriver into the gap between the stator core and front bracket. Pry then apart to disassemble.



3) Hold rotor with a vise and remove pulley nut.



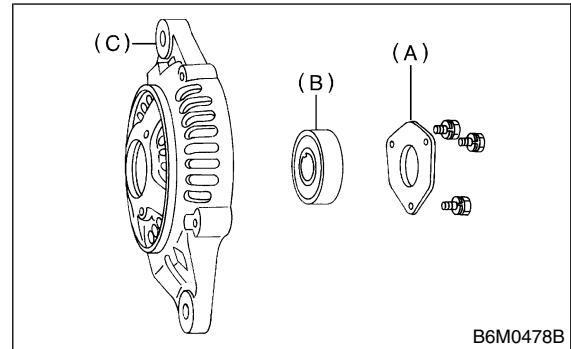
CAUTION:
When holding rotor with vise, insert aluminum plates or wood pieces on the contact surfaces of the vise to prevent rotor from damage.



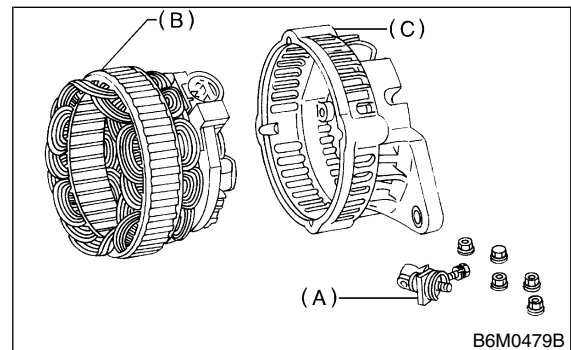
- (A) Front cover
- (B) Pulley
- (C) Nut
- (D) Rotor

4) Remove rotor from front cover.

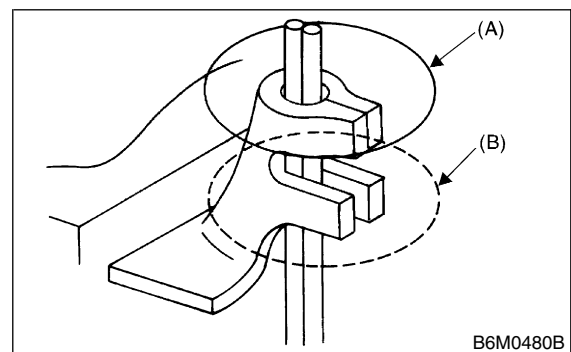
5) Remove three screws from front cover and then bearing retainer (A) and ball bearing (B) from front cover (C).



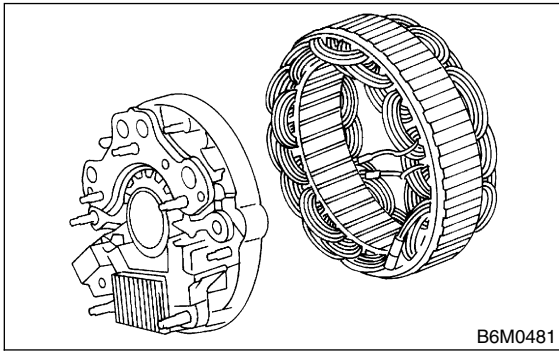
6) Remove bolt which secure battery terminal bolt (A), and remove rear cover. Remove nuts which secure diode plate, and remove stator (B) and rear cover (C).



7) Separate diode plate from stator coil.
(1) Cut the connecting position (A) of stator coil to diode.
(2) Unsolder connection (B) and throughout the lead wire of stator coil.



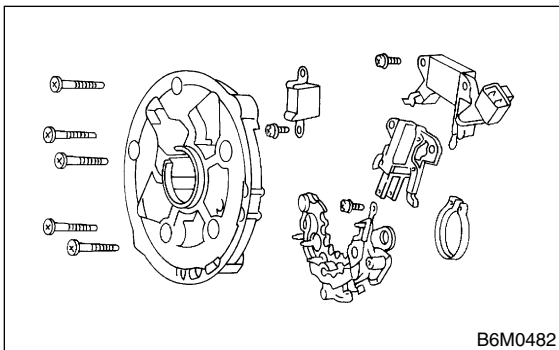
(3) Remove stator coil from diode plate.



8) Remove bolts which secure IC regulator, diode and brush holder.

CAUTION:

Do not apply a shock or load to IC regulator cooling fins.

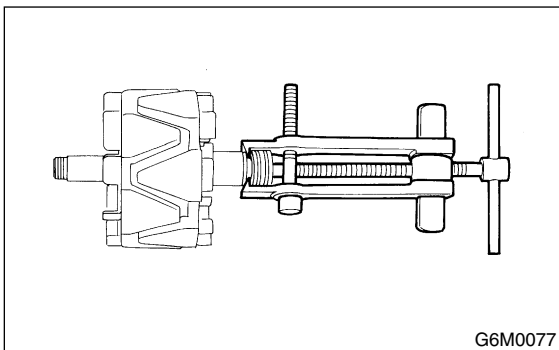


D: ASSEMBLY S179008A02

Assemble in the reverse order of disassembly.

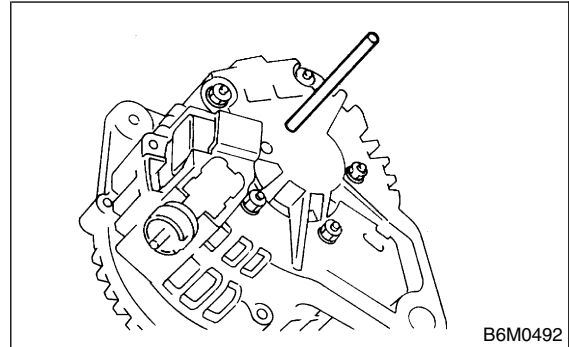
CAUTION:

● When disassembling generator, replace rear ball bearing.

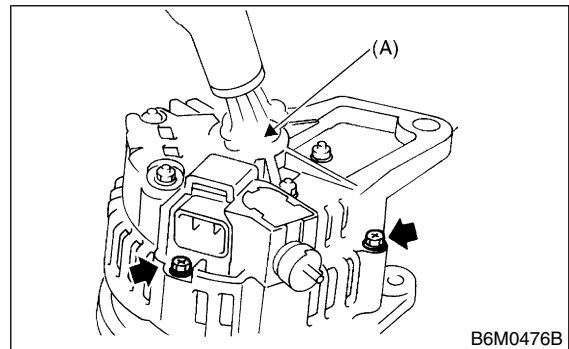


● When soldering starter coil to diode, do not touch lead wire with solder for more than 5 seconds.

● Before installing rear cover, insert pin from outside of rear cover so that holds brush. After installing rear cover, remove pin.



● When installing rear cover, heat portion (A) to 50°C (122°F) with heater drier.

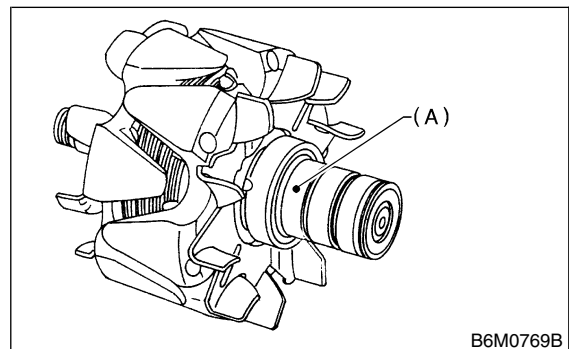


E: INSPECTION S179008A10

1. ROTOR S179008A1002

1) Slip ring surface

Inspect slip rings (A) for contamination or any roughness of the sliding surface. Clean or polish with #500 to #600 emery paper if defective.



GENERATOR

Starting/Charging Systems

2) Slip ring outside diameter

Measure slip ring outside diameter. If slip ring is worn, replace rotor.

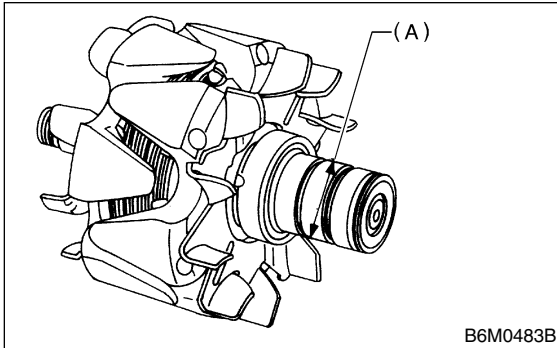
Slip ring outside diameter (A):

Standard

27 mm (1.06 in)

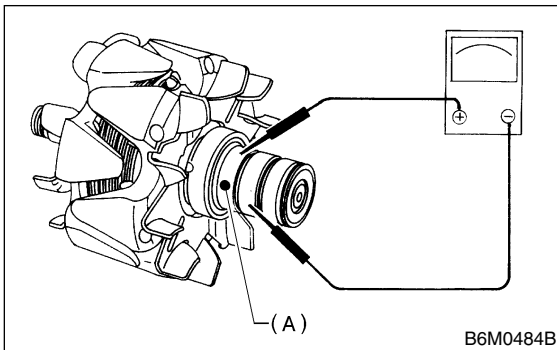
Limit

26 mm (1.02 in)



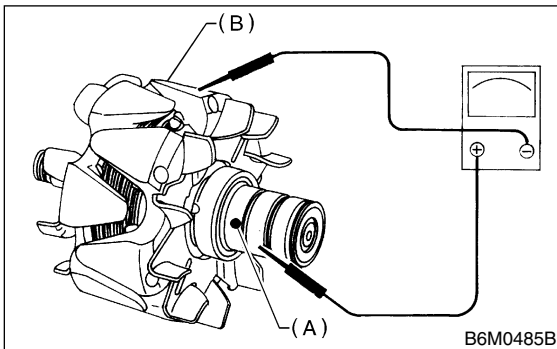
3) Continuity test

Check continuity between slip rings (A). If the measured resistance is 1 M Ω or more, replace rotor.



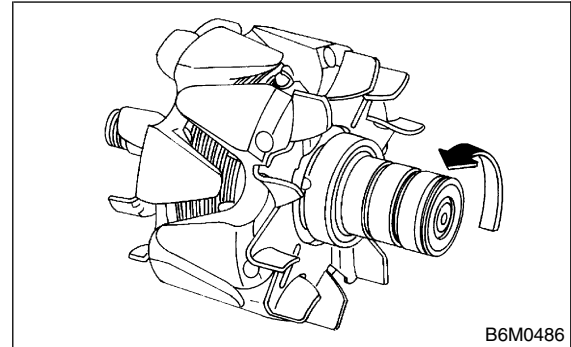
4) Insulation test

Check continuity between slip ring (A) and rotor core (B) or shaft. If the measured resistance is 1 M Ω or less, replace rotor.



5) Ball bearing

Check rear ball bearing. Replace it if it is noisy or if rotor does not turn smoothly.

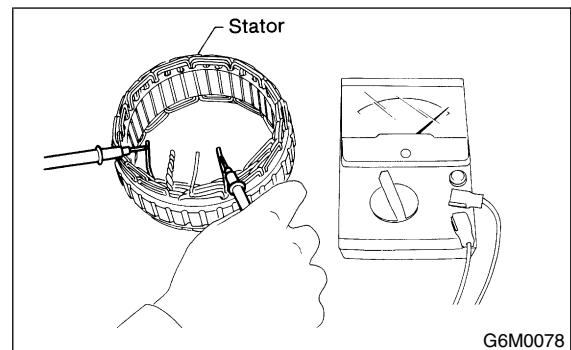


2. STATOR

S179008A1003

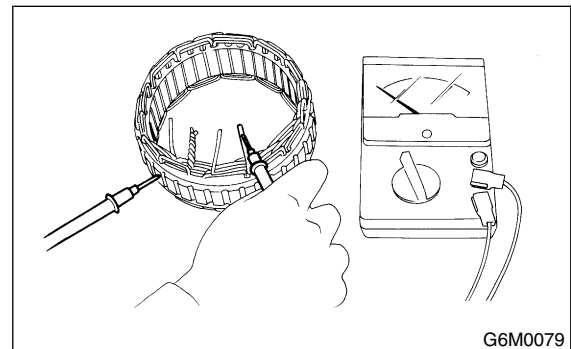
1) Continuity test

Inspect stator coil for continuity between its terminals. When there is no continuity (1 M Ω or more) between individual terminals, cable is broken. Replace stator coil.



2) Insulation test

Inspect stator coil for continuity between stator core and each terminal. If there is continuity (1 Ω or less), replace stator coil.



3. BRUSH S179008A1004

Measure brush length. If brush is worn, replace brush holder assembly.

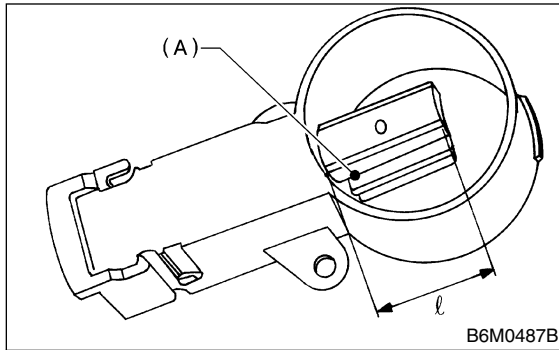
Brush length (ℓ):

Standard

20.5 mm (0.807 in)

Limit

1.5 mm (0.059 in)



- (A) Wear limit
 ℓ : Brush length

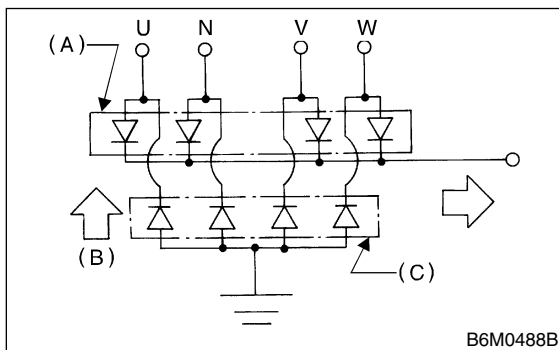
4. DIODE ASSEMBLY S179008A1006

CAUTION:

Never use a high tension insulation tester, such as a meggar as it will damage diodes with its high tension.

The diode consists of eight diodes, four each being located on the positive and negative sides. The diode is necessary to restrict current flow to one direction.

Check all diodes, for continuity. If any diode is faulty, replace diode assembly.

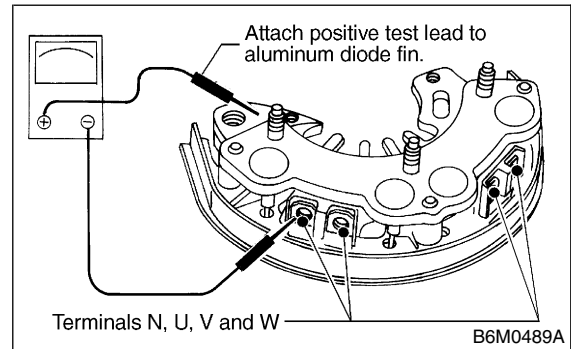


- (A) Diode (positive side)
 (B) Direction of current flow
 (C) Diode (negative side)

1) Diodes on “+” side

Continuity of proper diodes on “+” side

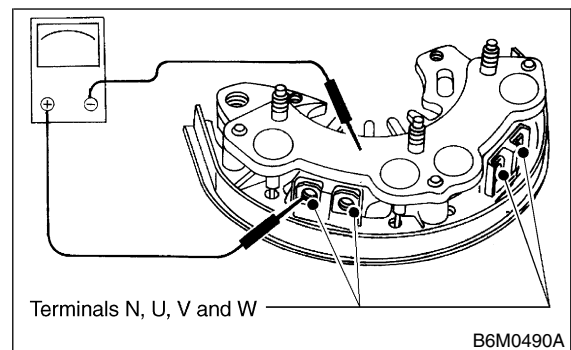
Terminal N, U, V and W	BAT side	
	(+)	(-)
(+)	—	Continuity must not exist.
(-)	Continuity must exist.	—



2) Diodes on “-” side

Continuity of proper diodes on “-” side

Terminal N, U, V and W	“E” side	
	(+)	(-)
(+)	—	Continuity must exist.
(-)	Continuity must not exist.	—

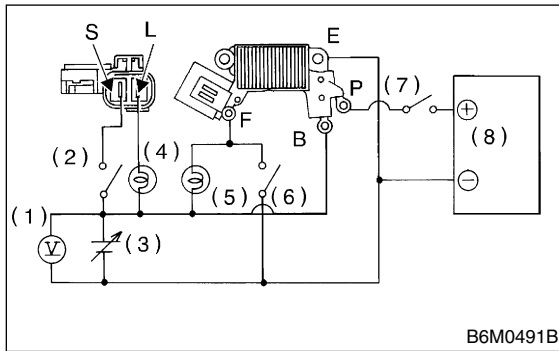


GENERATOR

Starting/Charging Systems

5. IC REGULATOR S179008A1007

1) Compose a circuit diagram as shown in figure.



- (1) Voltage meter: 0 to 30 V
- (2) Switch 1
- (3) Variable DC power supply: Variable 0 to 20 V, 1 A or more
- (4) Lamp 2
- (5) Lamp 1
- (6) Switch 3
- (7) Switch 2
- (8) Plus generator: Power supply 5 to 30 V, 1 kHz

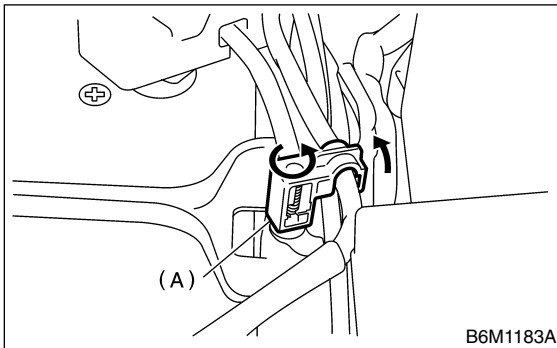
2) Check operation as shown in chart below.

No.	Switch operation			Value of voltage meter	Lamp operation		Remarks
	1	2	3		1	2	
1	ON	OFF	OFF	12 V	DIM	ON	Check initial excitation.
2	ON	ON	OFF	12 V	ON or BLINK	OFF	Check total excitation.
3	ON	ON	OFF	16 V	OFF or DIM-BLINK	OFF	When value of voltage meter is between 12 V and 16 V.
4	OFF	ON	OFF	12 V	ON or BLINK	ON	Check connection for S and B terminals.
5	OFF	ON	ON	18 V	ON	ON	Check for over loading of voltage.

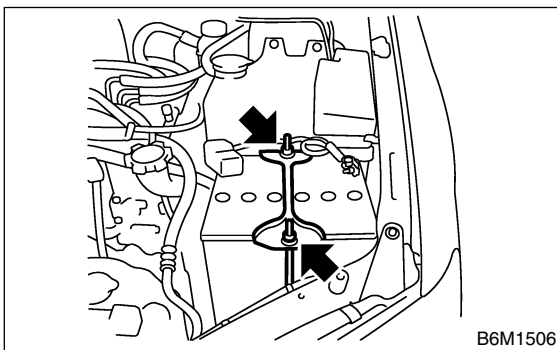
4. Battery S179011

A: REMOVAL S179011A18

- 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 S179011A11

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 retard the formation of corrosion.
- Connect the positive (+) cable of battery and then the negative (-) cable of the battery.

C: INSPECTION S179011A10

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: S179011A1001

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: S179011A1002

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: S179011A1003

- 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:

$$S_{20} = St + 0.0007 \times (t - 20)$$

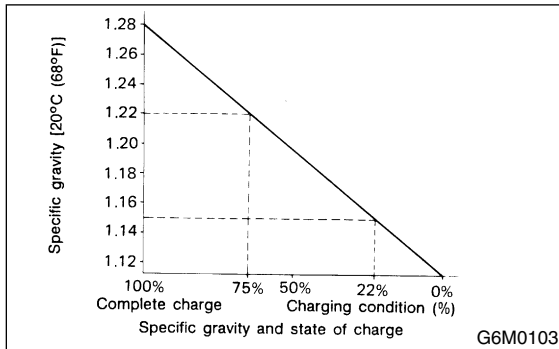
S_{20} : Specific gravity corrected at electrolyte temperature of 20°C

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 S179011A14

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 S179011A1401

- 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 S179011A1402

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 S179011A1403

Charge the battery at current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING S179011A1404

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.

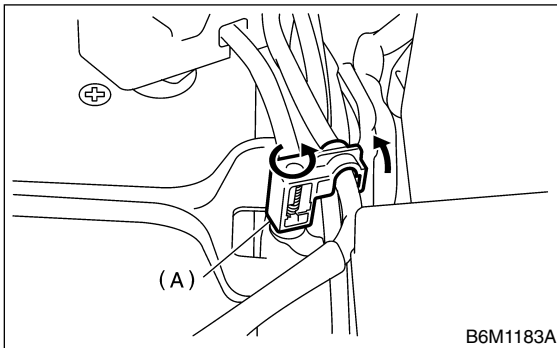
CAUTION:

- Observe the items in 1. NORMAL CHARGING.
- Never use more than 10 amperes when charging the battery because that will shorten battery life.

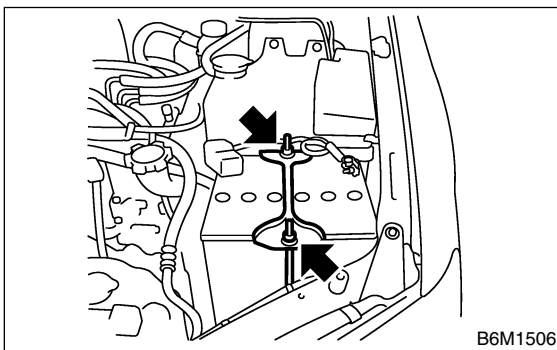
4. Battery S179011

A: REMOVAL S179011A18

- 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 S179011A11

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 retard the formation of corrosion.
- Connect the positive (+) cable of battery and then the negative (–) cable of the battery.

C: INSPECTION S179011A10

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: S179011A1001

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: S179011A1002

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: S179011A1003

- 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:

$$S_{20} = St + 0.0007 \times (t - 20)$$

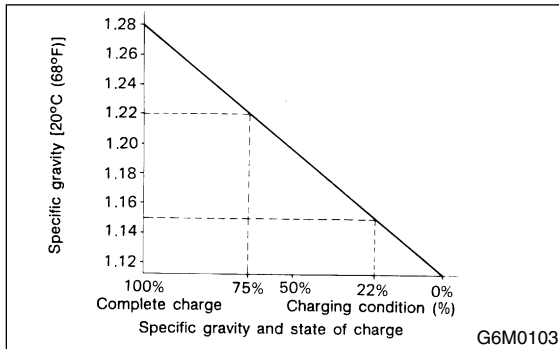
S_{20} : Specific gravity corrected at electrolyte temperature of 20°C

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 S179011A14

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 S179011A1401

- Specific gravity of electrolyte is held at a specific value in a range from 1.250 to 1.290 for more than one hour.
- 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 S179011A1402

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 S179011A1403

Charge the battery at current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING S179011A1404

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:

- Observe the items in 1. NORMAL CHARGING.
- Never use more than 10 amperes when charging the battery because that will shorten battery life.

BASIC DIAGNOSTIC PROCEDURE

Engine (Diagnostics)

1. Basic Diagnostic Procedure

S078501

A: PROCEDURE S078501E45

1. ENGINE S078501E4501

No.	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-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-69, 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-350, INSPECTION, General Diagnostic Table.>
3	CHECK INDICATION OF DTC ON DISPLAY. 1) Turn ignition switch to OFF. 2) Connect the Subaru Select Monitor or the OBD-II general scan tool to data link connector. 3) Turn ignition switch to ON and the Subaru Select Monitor or OBD-II general scan tool switch to ON. 4) Read DTC on the Subaru Select Monitor or OBD-II general scan tool.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	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-58, Engine Malfunction Indicator Lamp (MIL).>
4	PERFORM THE DIAGNOSIS. 1) Inspect using "Diagnostics Procedure with Diagnostic Trouble Code (DTC)". NOTE: <Ref. to EN-96, 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-47, Read Diagnostic Trouble Code.> 2) Repair the trouble cause. 3) Perform the clear memory mode. <Ref. to EN-55, Clear Memory Mode.> 4) Perform the inspection mode. <Ref. to EN-48, Inspection Mode.>	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	Inspect using "Diagnostics Procedure with Diagnostic Trouble Code (DTC)". NOTE: <Ref. to EN-96, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Complete the diagnosis.

2. AUTOMATIC TRANSMISSION S078501E4502

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 AT-9, Automatic Transmission Fluid.>
- 2) Differential gear oil level check <Ref. to AT-11, Differential Gear Oil.>
- 3) ATF leak check <Ref. to AT-9, Automatic Transmission Fluid.>
- 4) Differential gear oil leak check <Ref. to AT-11, Differential Gear Oil.>
- 5) Stall test <Ref. to AT-13, Stall Test.>
- 6) Line pressure test <Ref. to AT-16, Line Pressure Test.>
- 7) Transfer clutch pressure test <Ref. to AT-18, Transfer Clutch Pressure Test.>
- 8) Time lag test <Ref. to AT-15, Time Lag Test.>
- 9) Road test <Ref. to AT-12, Road Test.>
- 10) Shift characteristics <Ref. to AT-18, Transfer Clutch Pressure Test.>

CHECK LIST FOR INTERVIEW

Engine (Diagnostics)

2. Check List for Interview S078502

A: CHECK S078502A04

1. CHECK LIST NO. 1 S078502A0401

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		
Vin no.					
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				

CHECK LIST FOR INTERVIEW

Engine (Diagnostics)

2. CHECK LIST NO. 2 S078502A0402

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:
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 S078001

A: CAUTION S078001A03

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.

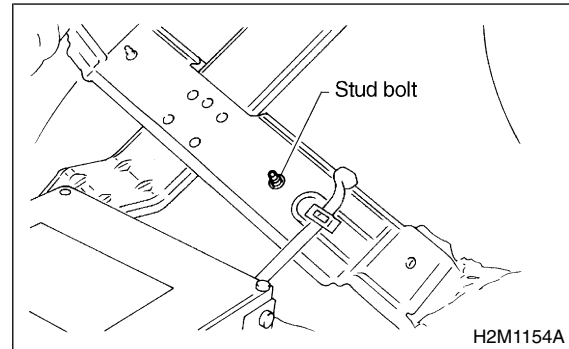
- Otherwise, the ECM may be damaged.

CAUTION:

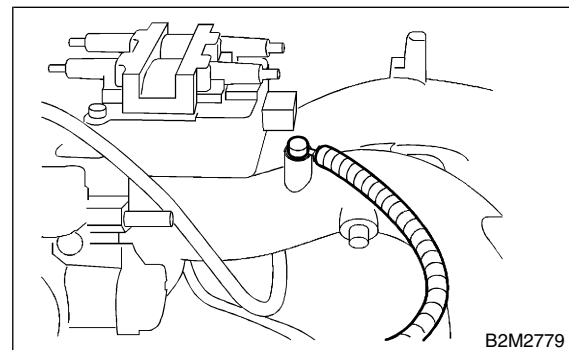
When replacing ECM, be careful not to use the wrong spec. ECM to avoid any damage on fuel injection system.

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.

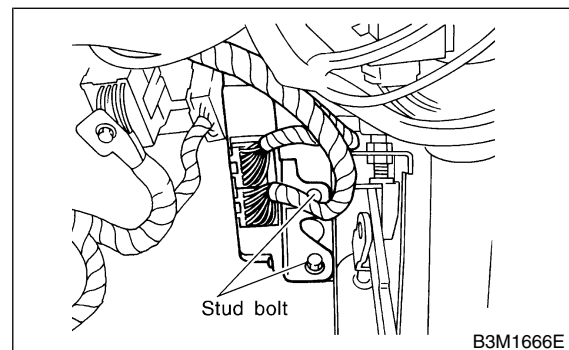
8) Use ECM mounting stud bolts at the body head grounding point when measuring voltage and resistance inside the passenger compartment.



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.



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 S078001A10

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

1. BATTERY S078001A1001

1) Measure battery voltage and specific gravity of electrolyte.

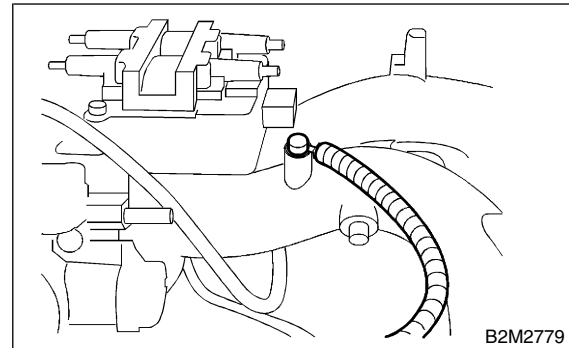
Standard voltage: 12 V

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 S078001A1002

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



C: NOTE S078001A15

1. DESCRIPTION S078001A1501

● The on-board diagnostics (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. CHECK ENGINE malfunction indicator lamp (MIL) in the combination meter indicates occurrence of a fault or trouble.

● Further, against 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 Section 1968.1, California Code of Regulations (OBD-II regulation). The OBD system monitors the components and the system malfunction listed in Engine Section which affects on emissions.

● When the system decides that a malfunction occurs, MIL illuminates. At the same time of the MIL illumination or blinking, a diagnostic trouble code (DTC) and a freeze frame engine conditions are stored into 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, MIL is turned off, but DTC remains at on-board computer.

● The OBD-II system is capable of communication with a general scan tool (OBD-II general scan tool) formed by ISO 9141 CARB.

● The OBD-II diagnostics procedure is different from the usual diagnostics procedure. When troubleshooting OBD-II vehicles, connect Subaru

GENERAL DESCRIPTION

Engine (Diagnostics)

Select Monitor or the OBD-II general scan tool to the vehicle.

2. ENGINE AND EMISSION CONTROL SYSTEM

S078001A1502

- 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.

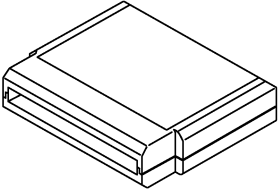
3. AUTOMATIC TRANSMISSION AND ELECTRONIC-HYDRAULIC CONTROL SYSTEM

S078001A1503

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

S078001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3876	24082AA190 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
 B2M3877	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)

MEMO:

4. Electrical Components Location

S078507

A: LOCATION

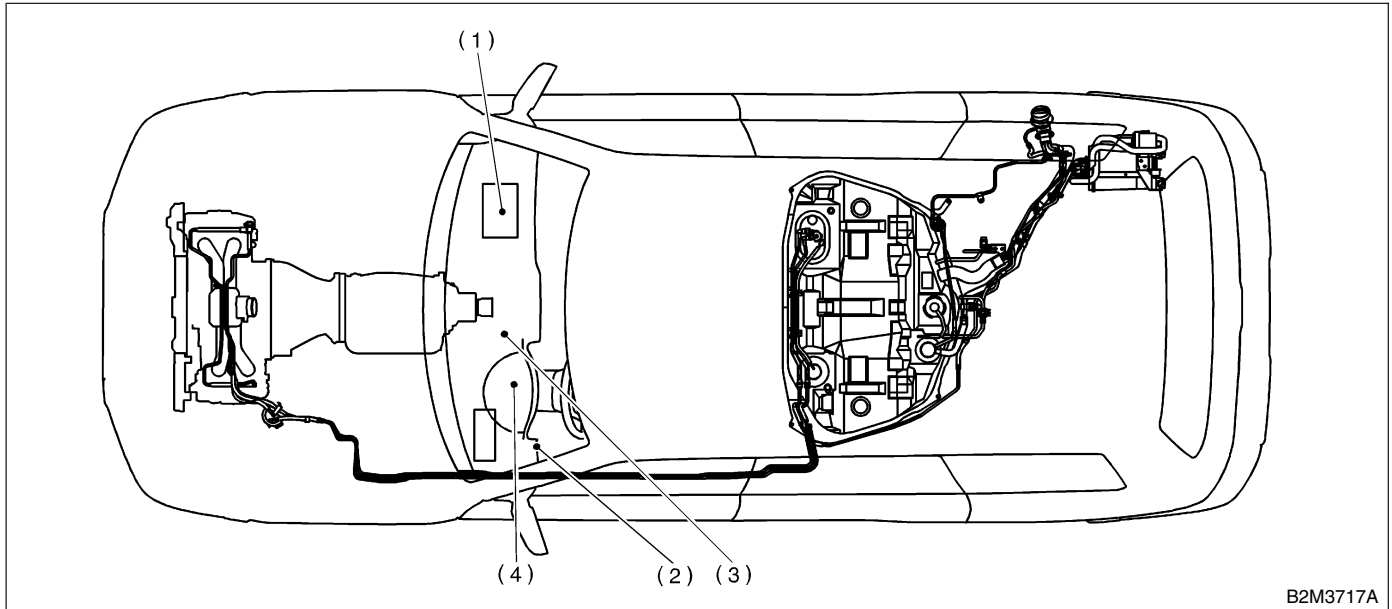
S078507A13

1. ENGINE

S078507A1301

● MODULE

S078507A130101

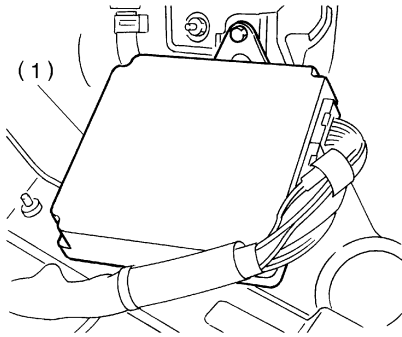


B2M3717A

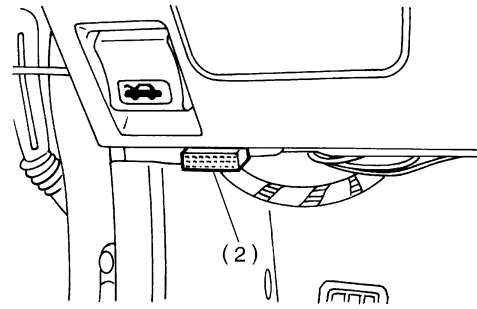
(1) Engine control module (ECM)	(3) Test mode connector
(2) Data link connector (for Subaru Select Monitor and OBD-II general scan tool)	(4) CHECK ENGINE malfunction indicator lamp (MIL)

ELECTRICAL COMPONENTS LOCATION

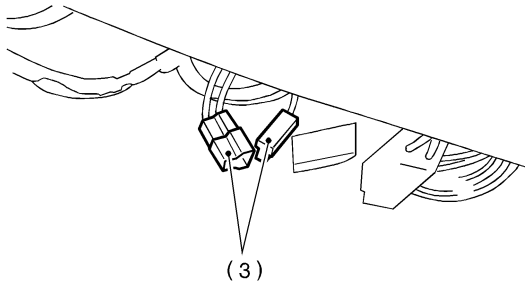
Engine (Diagnostics)



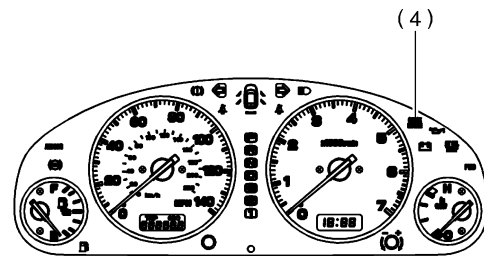
B3M1575A



B2M2960E



B2M2238D

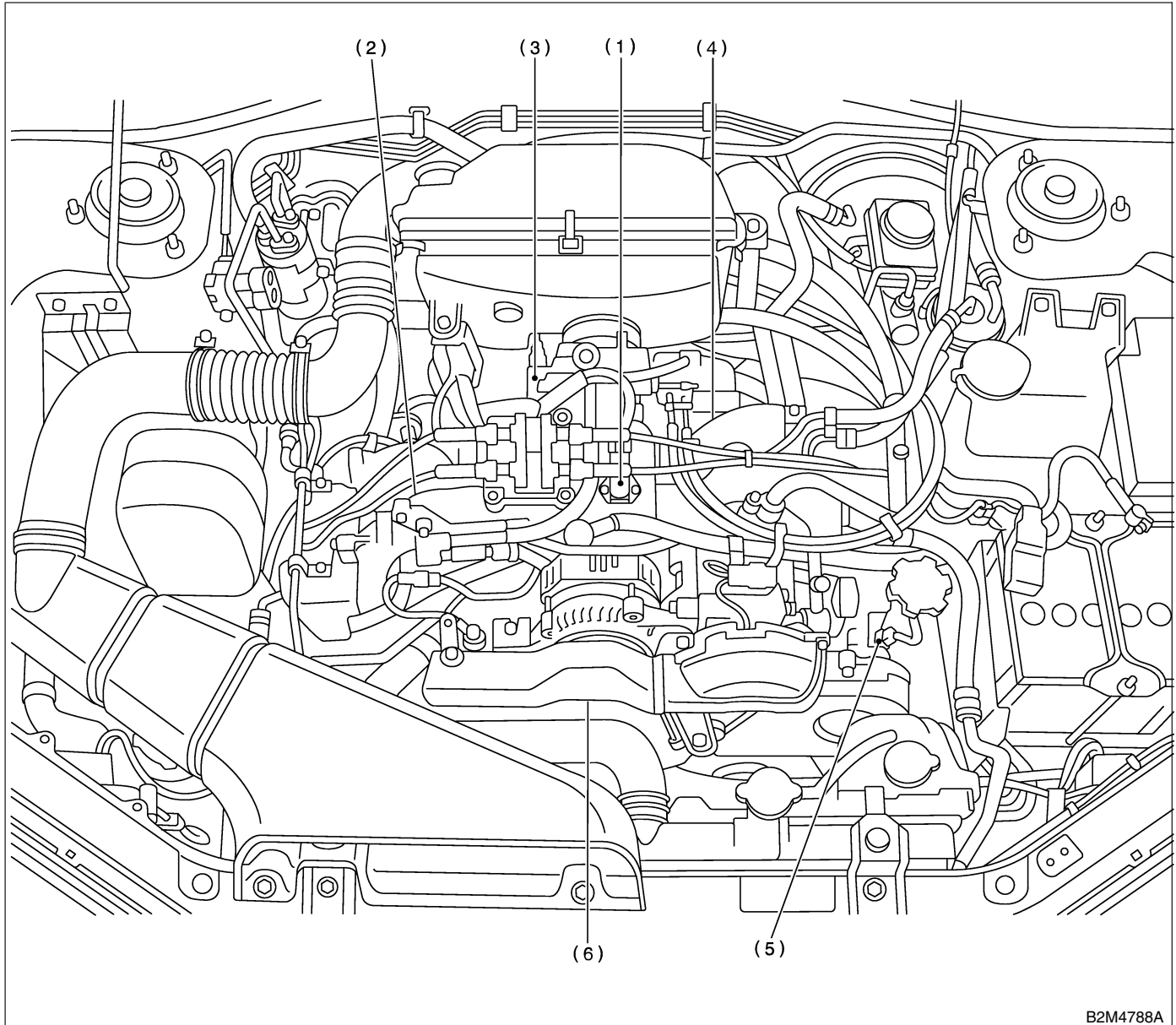


B2M3701A

ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)

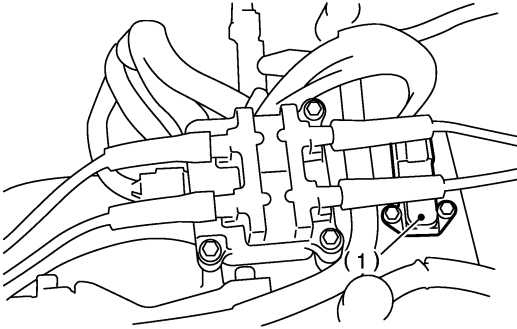
● SENSOR S078507A130102



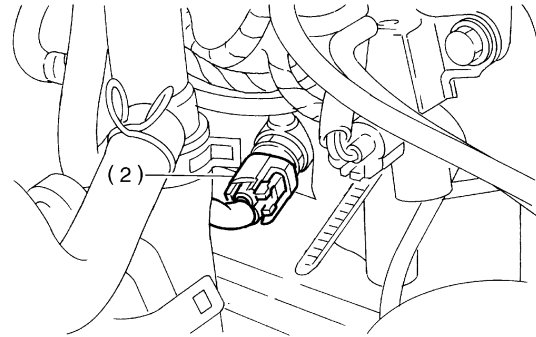
(1) Intake air temperature and pressure sensor	(3) Throttle position sensor
(2) Engine coolant temperature sensor	(4) Knock sensor
	(5) Camshaft position sensor
	(6) Crankshaft position sensor

ELECTRICAL COMPONENTS LOCATION

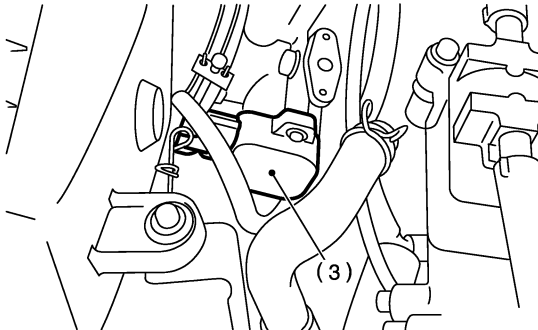
Engine (Diagnostics)



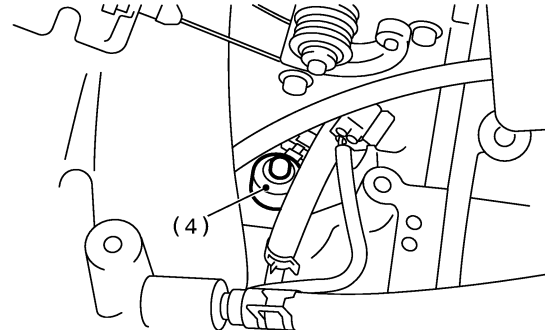
B2M3714B



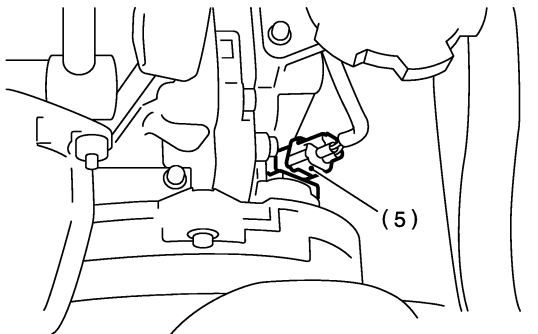
S2M1248C



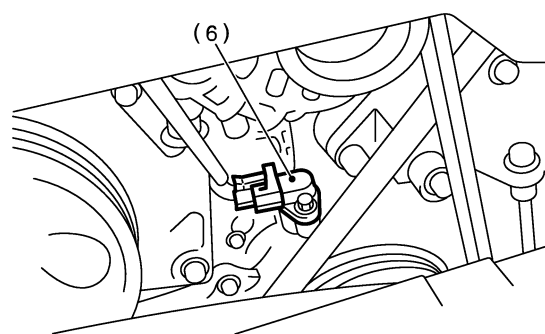
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B2M2241B



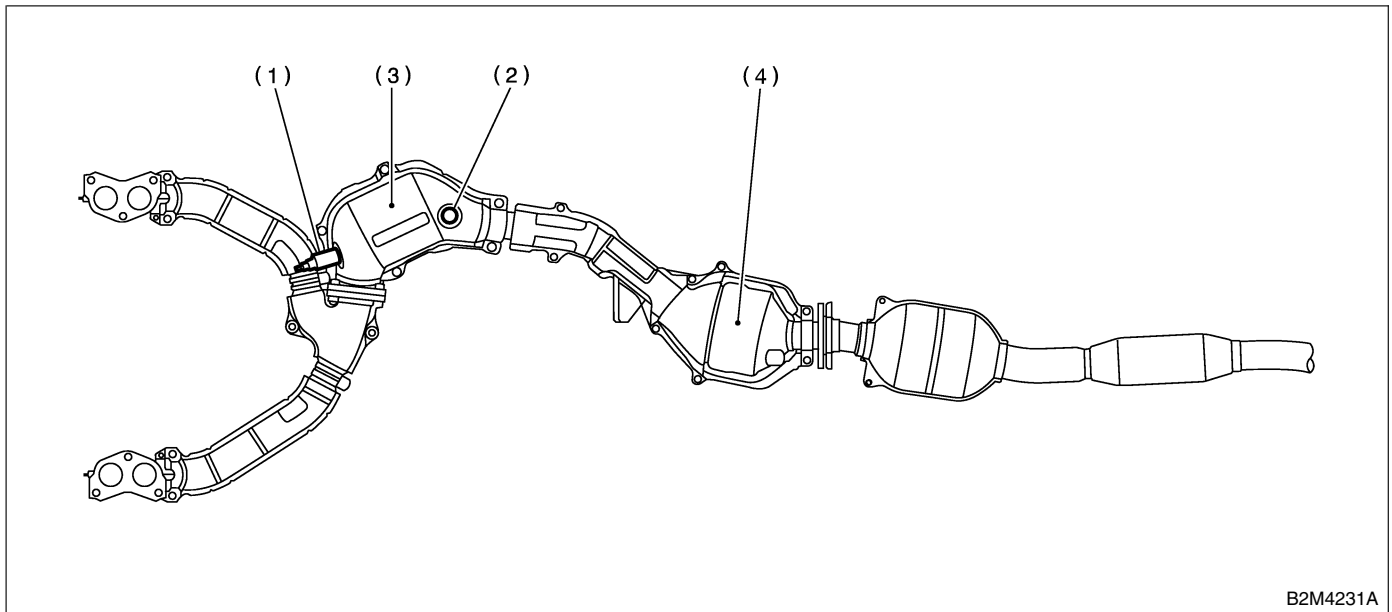
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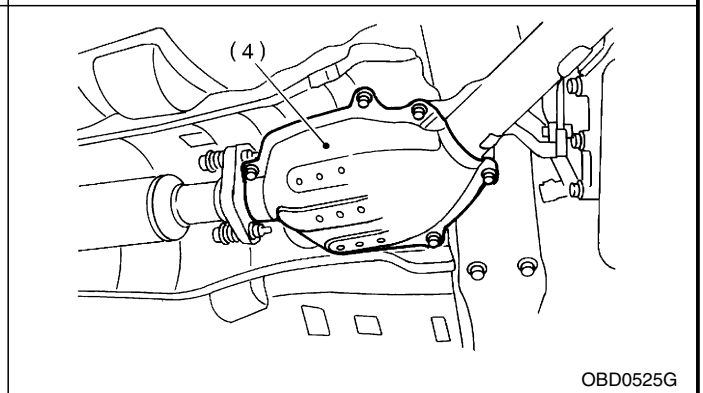
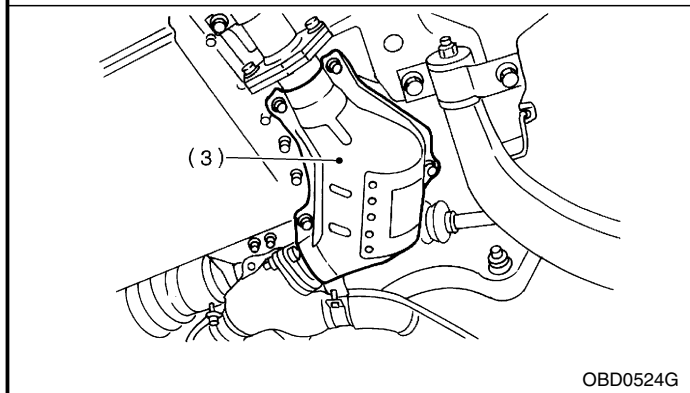
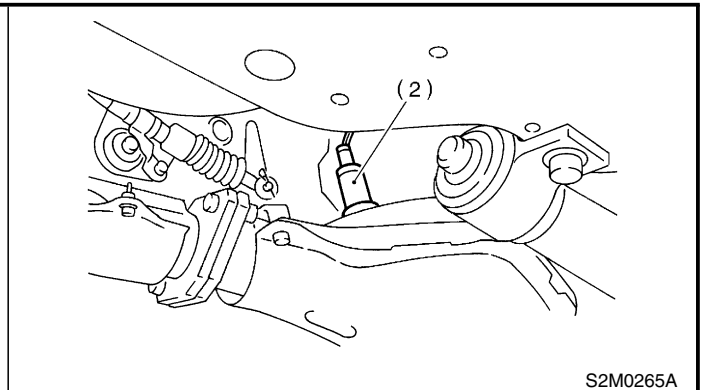
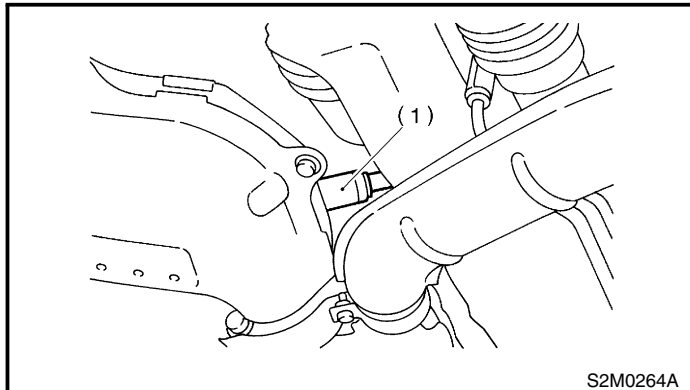
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ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)

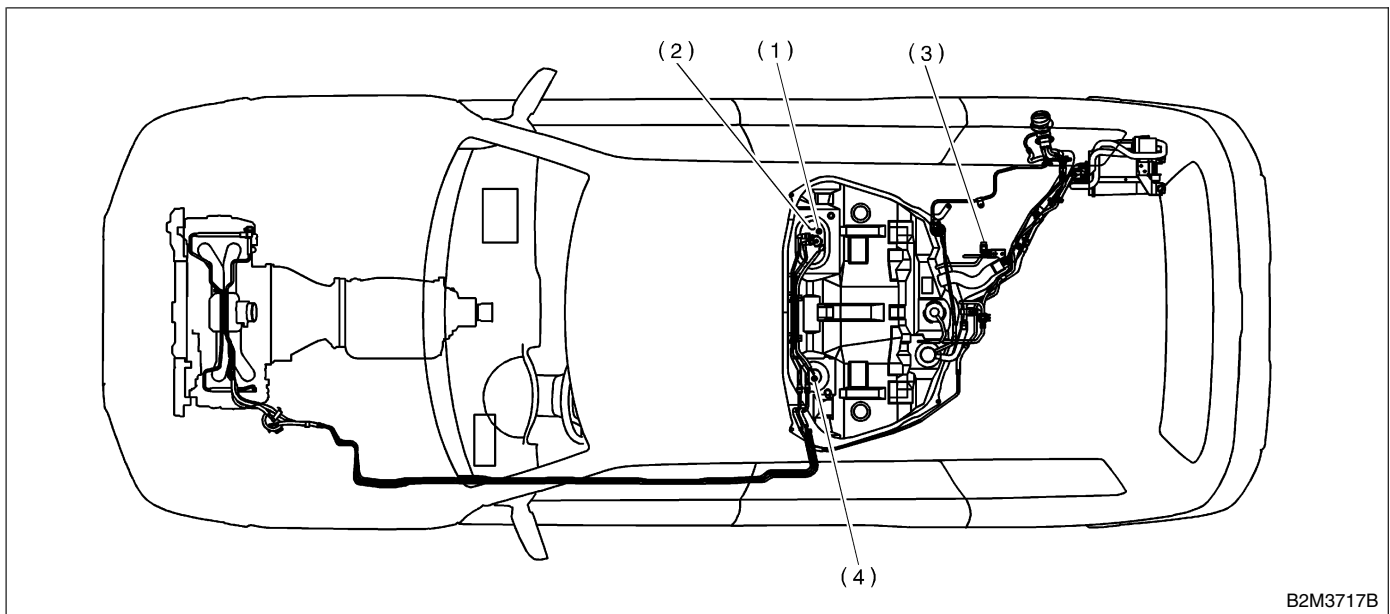


(1) Front oxygen (A/F) sensor	(3) Front catalytic converter
(2) Rear oxygen sensor	(4) Rear catalytic converter

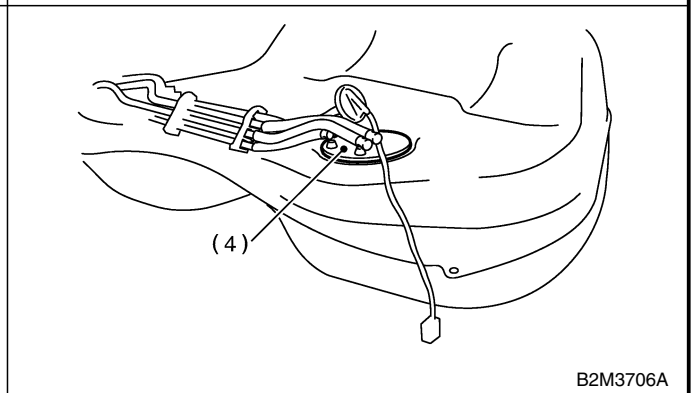
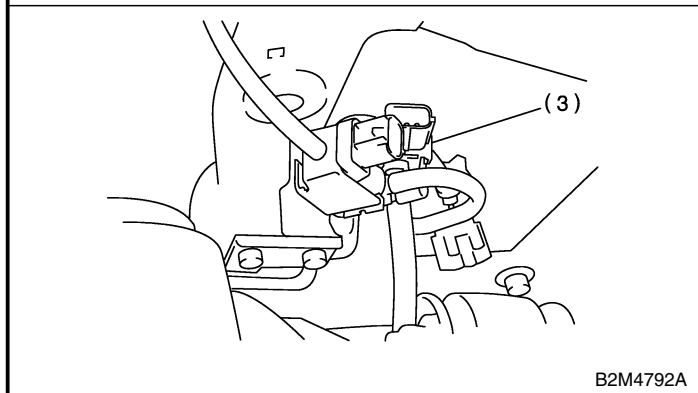
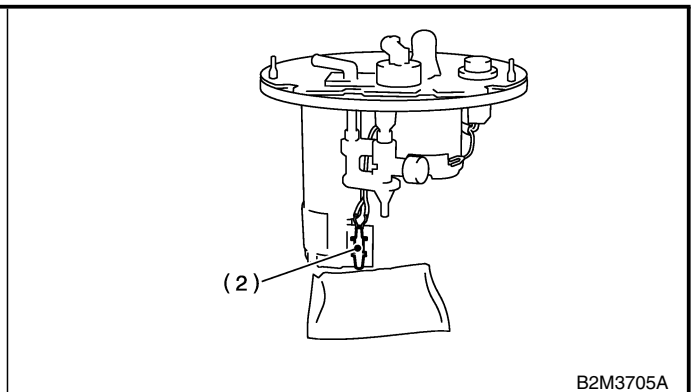
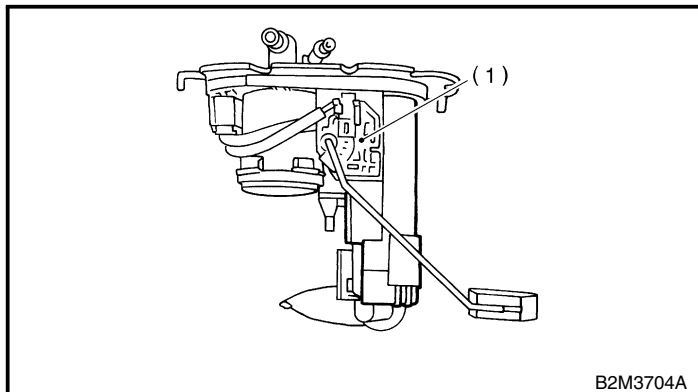


ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)



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

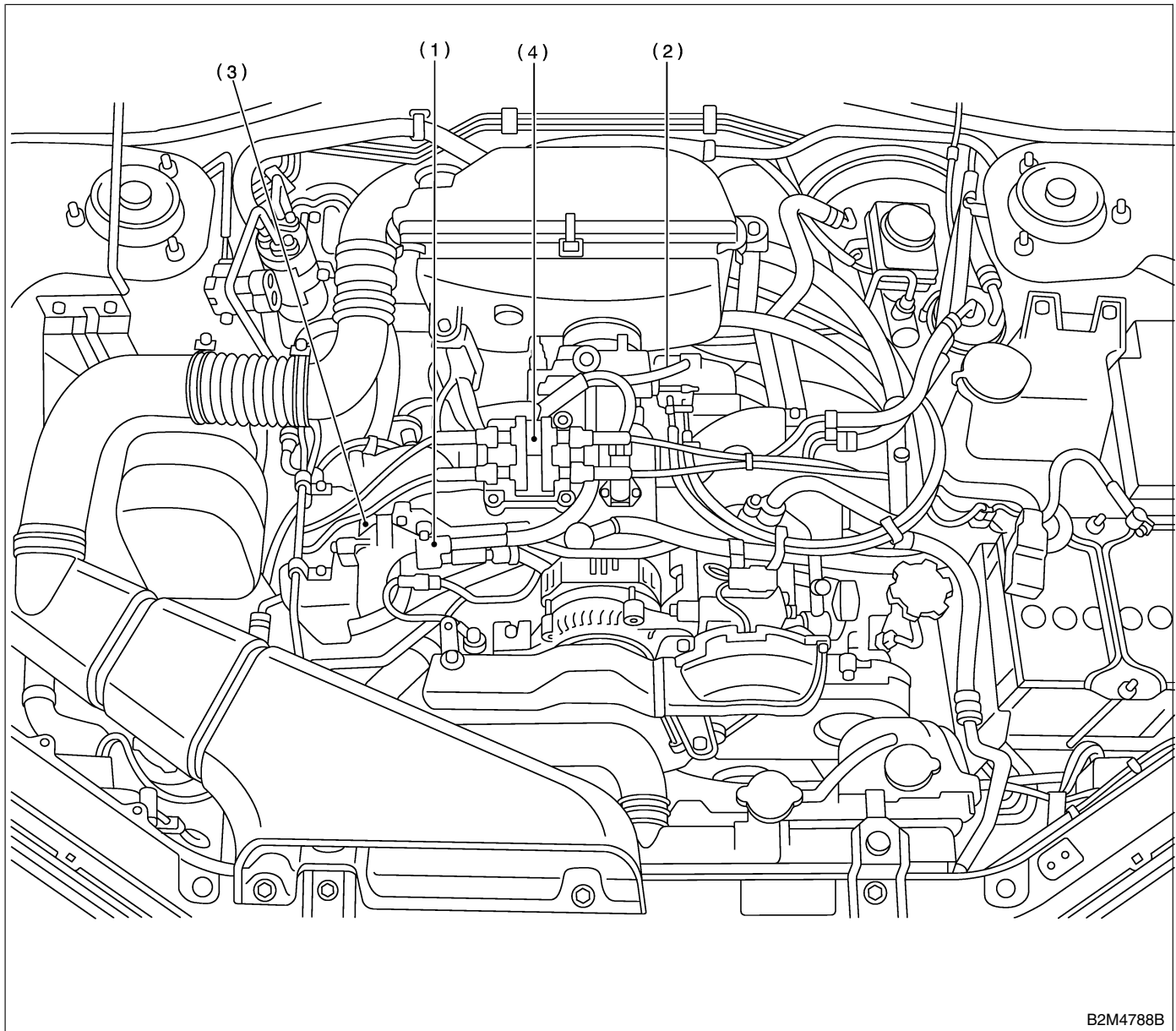


ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)

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

S078507A130103

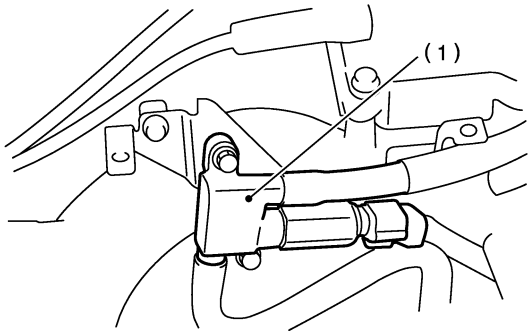


B2M4788B

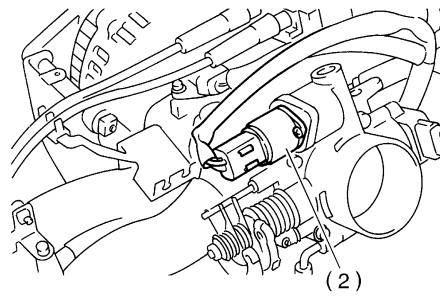
(1) Air assist injector solenoid valve	(3) Purge control solenoid valve
(2) Idle air control solenoid valve	(4) Ignition coil & ignitor ASSY

ELECTRICAL COMPONENTS LOCATION

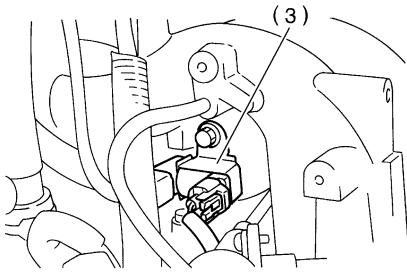
Engine (Diagnostics)



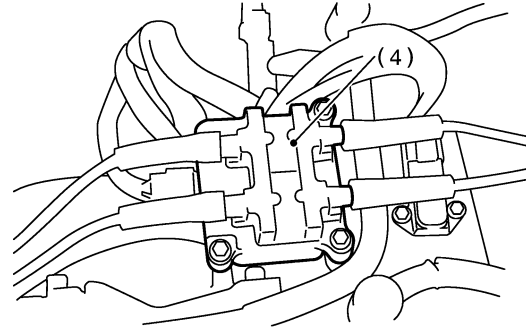
B2M3715A



H2M3259A



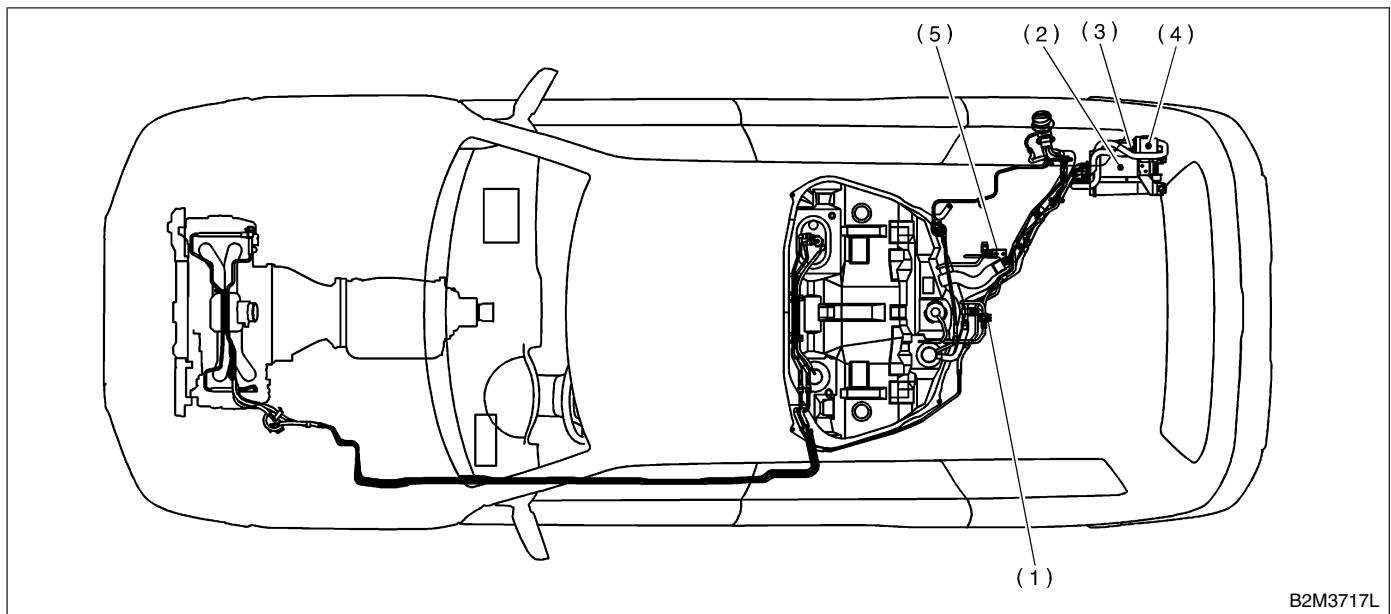
H2M3258B



B2M3720A

ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)



B2M3717L

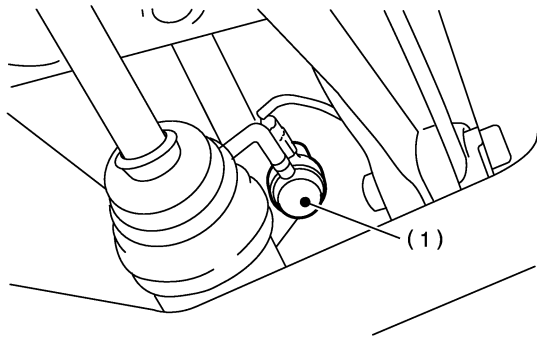
(1) Pressure control solenoid valve
(2) Canister

(3) Drain valve
(4) Drain filter

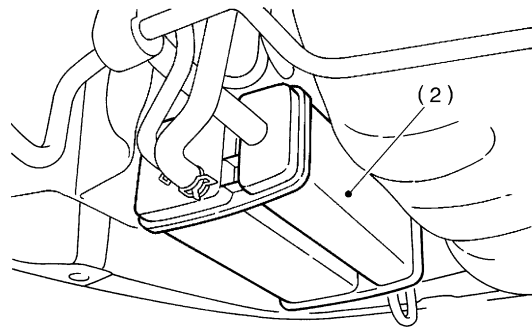
(5) Atmospheric pressure solenoid valve

ELECTRICAL COMPONENTS LOCATION

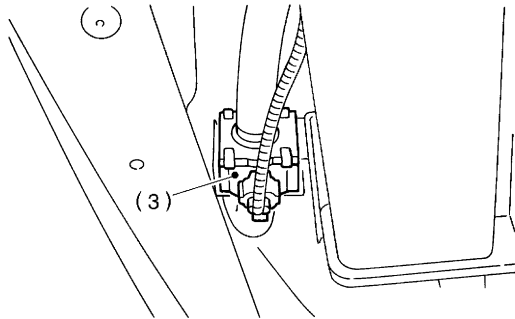
Engine (Diagnostics)



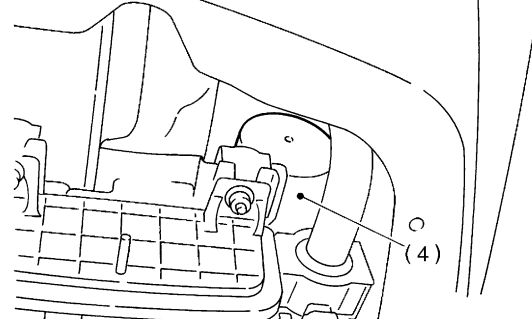
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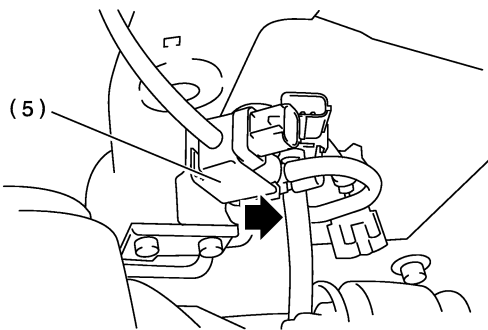
B2M1809A



B2M1810A



B2M1811A

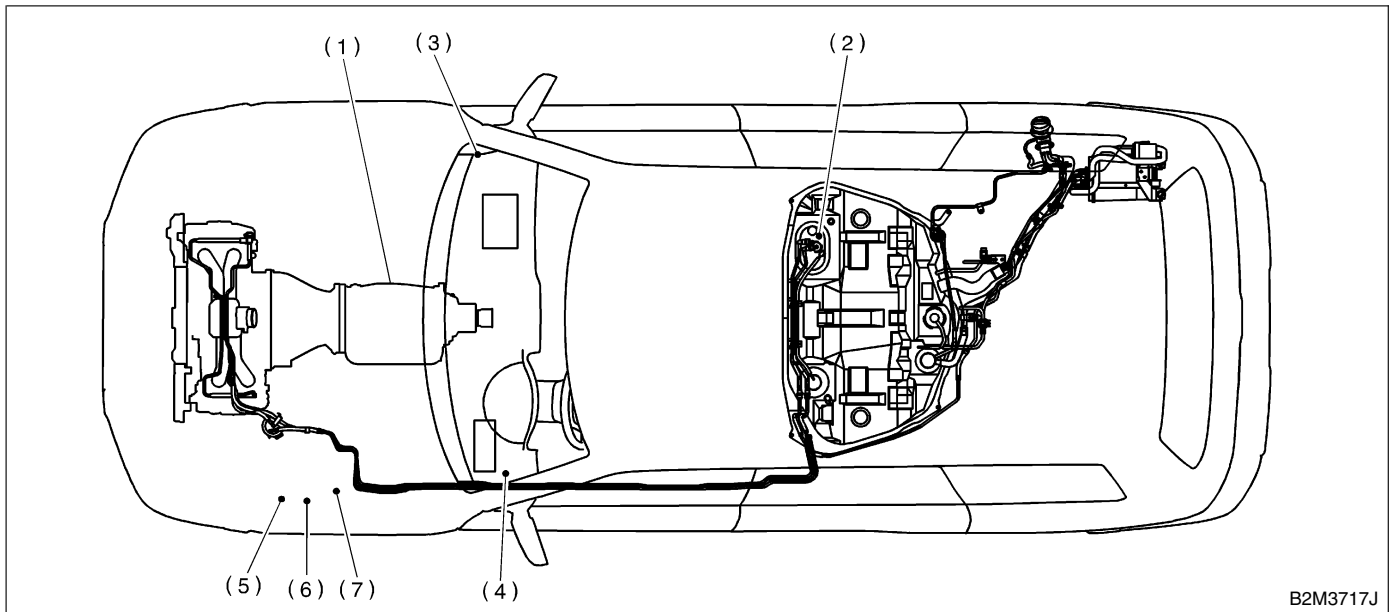


B2M4792B

SUBARU.

ELECTRICAL COMPONENTS LOCATION

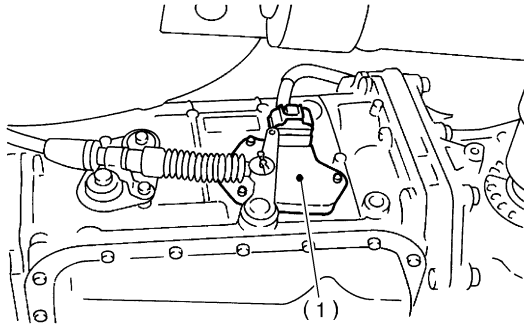
Engine (Diagnostics)



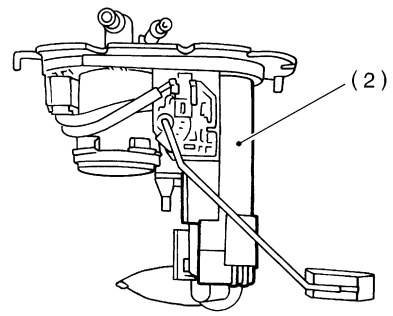
(1) Inhibitor switch	(4) Fuel pump relay	(7) Starter
(2) Fuel pump	(5) Radiator main fan relay	
(3) Main relay	(6) Radiator sub fan relay	

ELECTRICAL COMPONENTS LOCATION

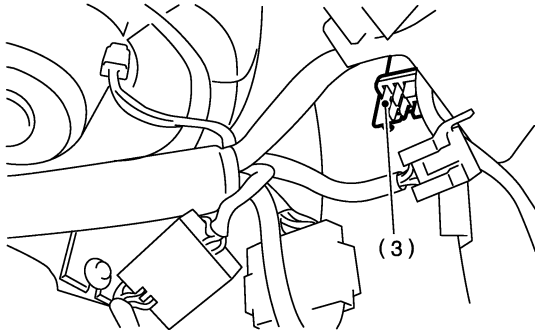
Engine (Diagnostics)



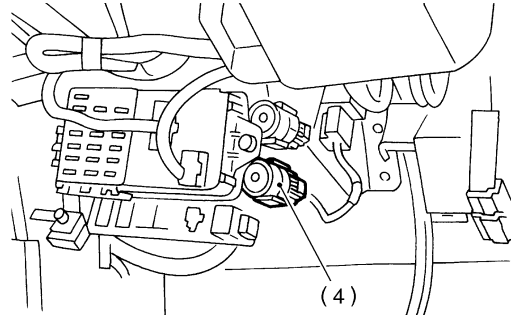
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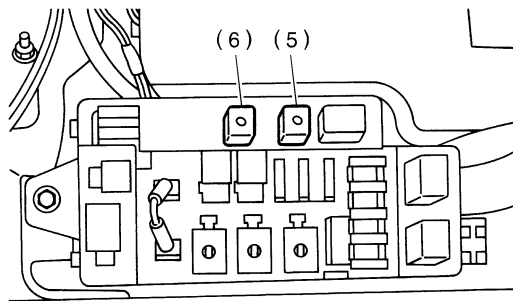
B2M3704C



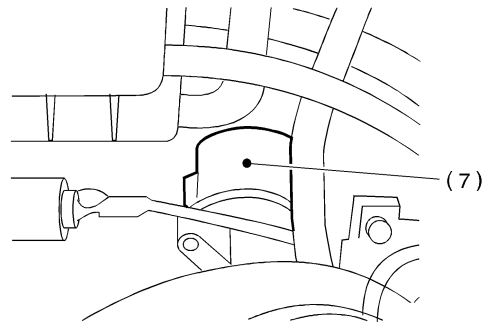
B2M3709B



B2M3710B



B2M3711B



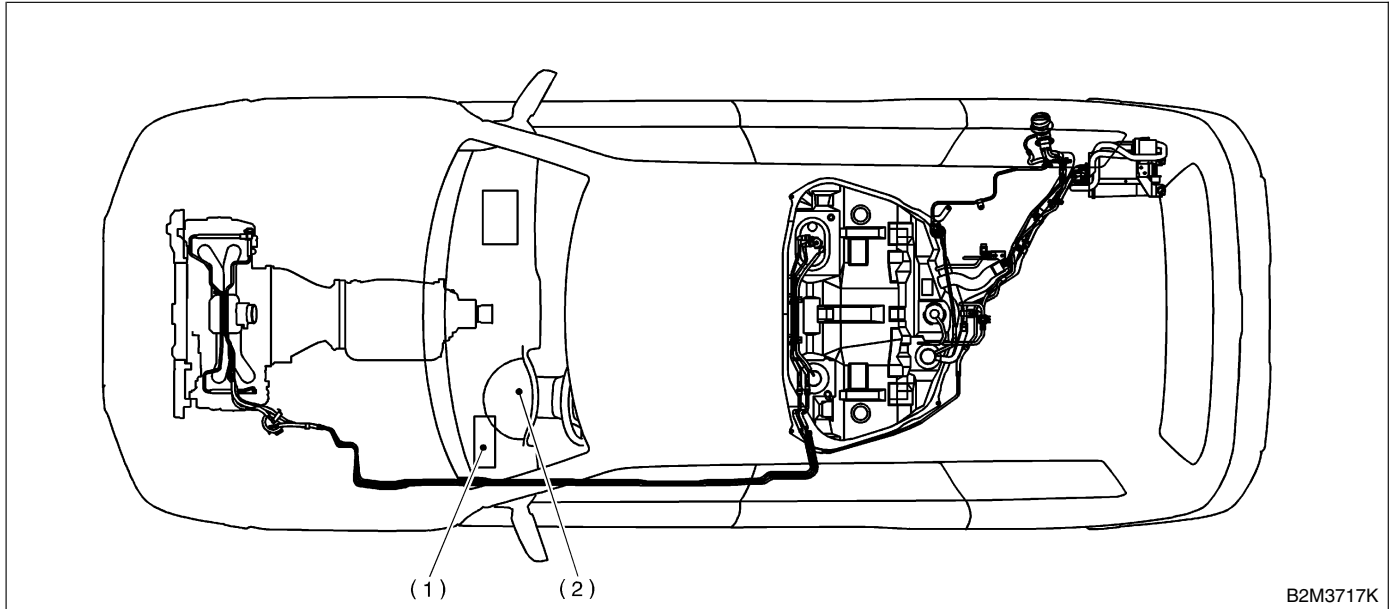
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ELECTRICAL COMPONENTS LOCATION

Engine (Diagnostics)

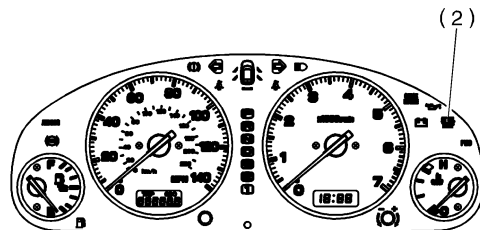
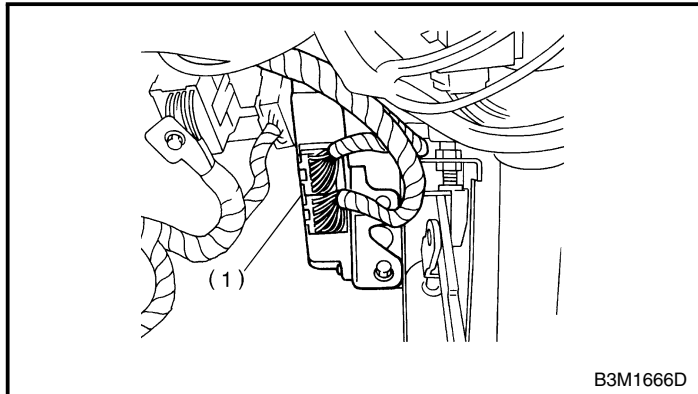
2. TRANSMISSION S078507A1302

● MODULE S078507A130201

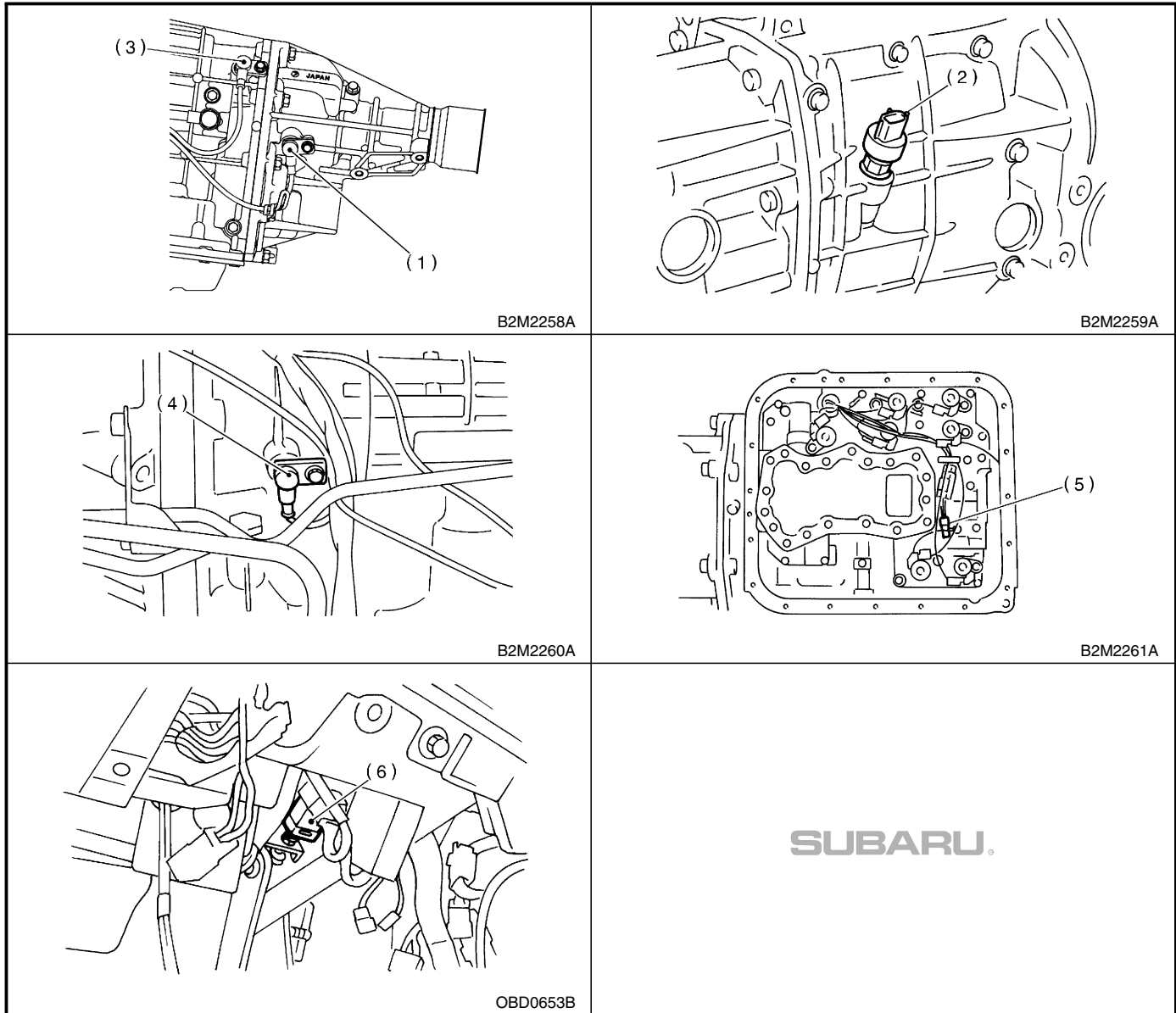


(1) Transmission Control Module
(TCM) (for AT vehicles)

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



● SENSOR S078507A130202

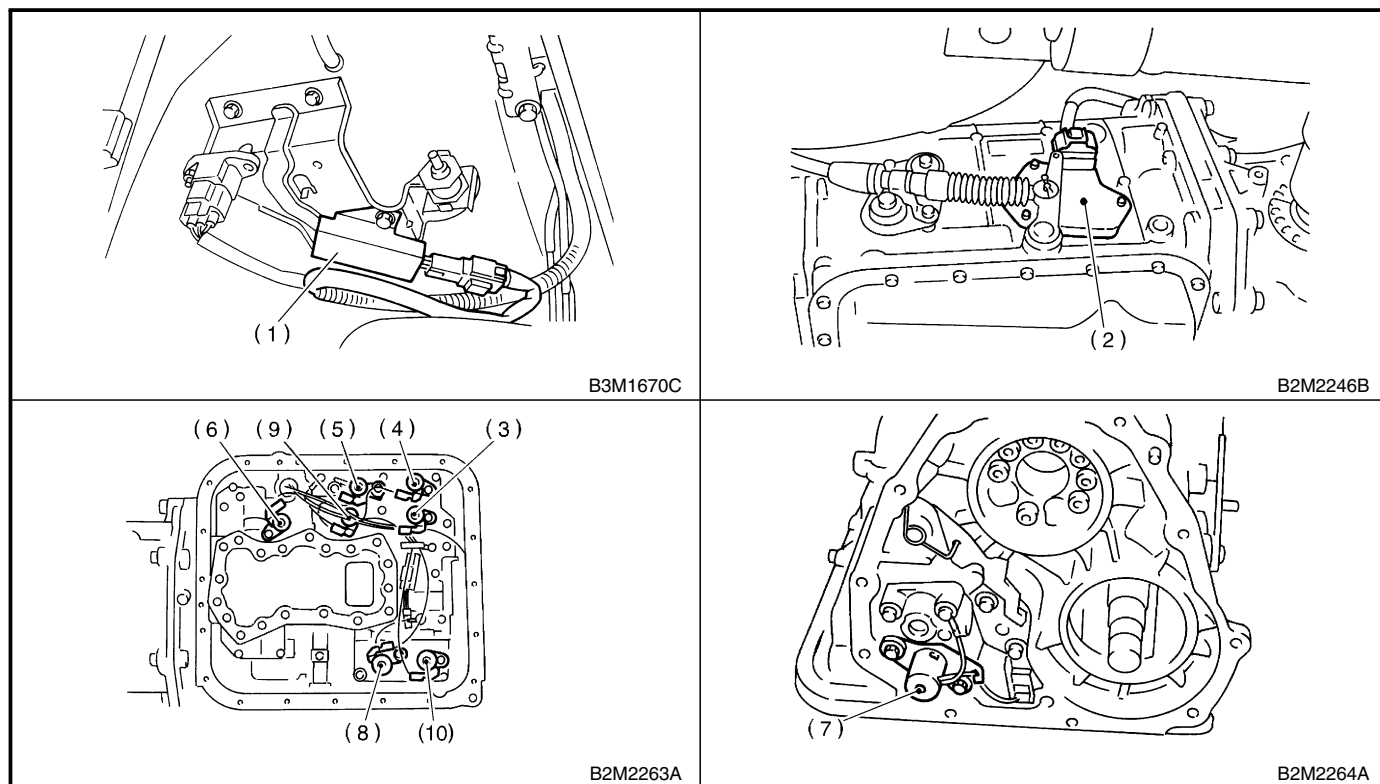


- (1) Rear vehicle speed sensor (for AT vehicles)
- (2) Front vehicle speed sensor (for MT vehicles)
- (3) Front vehicle speed sensor (for AT vehicles)
- (4) Torque converter turbine speed sensor
- (5) ATF temperature sensor (for AT vehicles)
- (6) Brake light switch

ELECTRICAL COMPONENTS LOCATION

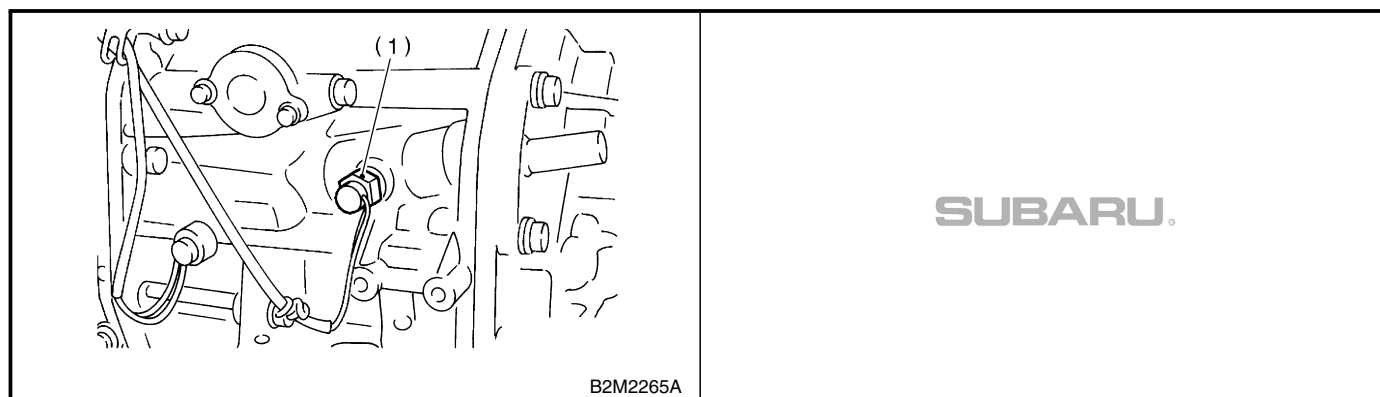
Engine (Diagnostics)

● SOLENOID VALVE AND SWITCH (AT VEHICLES) S078507A130203



- (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) S078507A130204



- (1) Neutral position switch

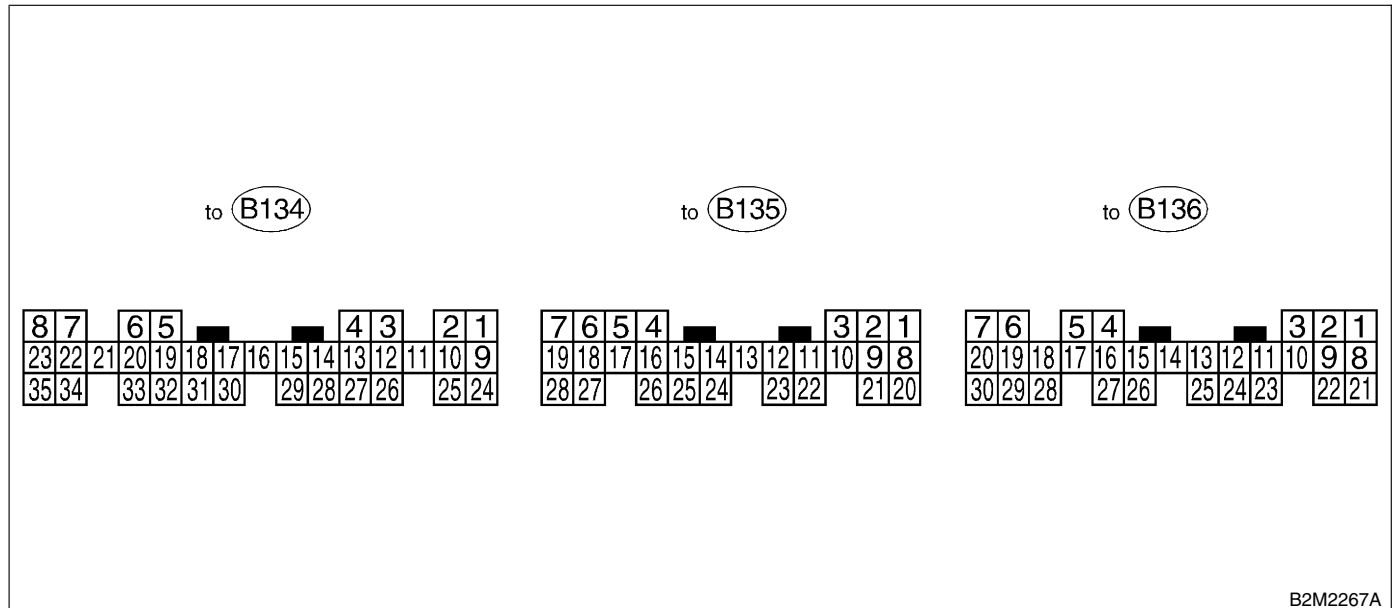
MEMO:

ENGINE CONTROL MODULE (ECM) I/O SIGNAL

Engine (Diagnostics)

5. Engine Control Module (ECM) I/O Signal S078526

A: ELECTRICAL SPECIFICATION S078526A08



B2M2267A

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crankshaft position sensor	Signal (+)	B135	1	0	-7 — +7	Sensor output waveform
	Signal (-)	B135	8	0	0	—
	Shield	B135	10	0	0	—
Camshaft position sensor	Signal (+)	B135	2	0	-7 — +7	Sensor output waveform
	Signal (-)	B135	9	0	0	—
	Shield	B135	10	0	0	—
Throttle position sensor	Signal	B136	17	Fully closed: 0.2 — 1.0 Fully opened: 4.2 — 4.7		—
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	16	0	0	—
Rear oxygen sensor	Signal	B136	18	0	0 — 0.9	—
	Shield	B136	24	0	0	—
	GND (sensor)	B136	16	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B134	22	0 — 1.0	0 — 1.0	—
	Signal 2	B134	23	0 — 1.0	0 — 1.0	—
Rear oxygen sensor heater signal		B134	21	0 — 1.0	0 — 1.0	—
Engine coolant temperature sensor	Signal	B136	14	1.0 — 1.4	1.0 — 1.4	After warm-up the engine.
	GND (sensor)	B136	16	0	0	After warm-up the engine.
Vehicle speed signal		B135	24	0 or 5	0 or 5	"5" and "0" are repeatedly displayed when vehicle is driven.
Starter switch		B135	28	0	0	Cranking: 8 — 14

ENGINE CONTROL MODULE (ECM) I/O SIGNAL

Engine (Diagnostics)

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
A/C switch		B135	27	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Ignition switch		B135	7	10 — 13	13 — 14	—
Neutral position switch (MT)		B135	26	ON: 12±0.5 OFF: 0		Switch is ON when gear is in neutral position.
Neutral position switch (AT)		B135	26	ON: 0 OFF: 12±0.5		Switch is ON when shift is in “N” or “P” position.
Test mode connector		B135	14	5	5	When connected: 0
Knock sensor	Signal	B136	4	2.8	2.8	—
	Shield	B136	25	0	0	—
Back-up power supply		B136	9	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power supply		B136	1	10 — 13	13 — 14	
		B136	2	10 — 13	13 — 14	—
Sensor power supply		B136	15	5	5	—
Line end check 1		B135	20	0	0	—
Ignition control	#1, #2	B134	25	0	1 — 3.4	Waveform
	#3, #4	B134	26	0	1 — 3.4	Waveform
Fuel injector	#1	B134	4	10 — 13	1 — 14	Waveform
	#2	B134	13	10 — 13	1 — 14	Waveform
	#3	B134	14	10 — 13	1 — 14	Waveform
	#4	B134	15	10 — 13	1 — 14	Waveform
Idle air control solenoid valve	Signal 1	B134	5	—	1 — 13	Waveform
	Signal 2	B134	6	—	1 — 13	Waveform
	Signal 3	B134	19	—	1 — 13	Waveform
	Signal 4	B134	20	—	1 — 13	Waveform
	Power supply	B136	2	10 — 13	13 — 14	—
Fuel pump relay control		B134	16	ON: 0.5, or less OFF: 10 — 13	0.5, or less	—
A/C relay control		B134	17	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 1 control		B134	3	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	—
Radiator fan relay 2 control		B134	2	ON: 0.5, or less OFF: 10 — 13	ON: 0.5, or less OFF: 13 — 14	With A/C vehicles only
Self-shutoff control		B135	19	10 — 13	13 — 14	—
Malfunction indicator lamp		B134	11	—	—	Light “ON”: 1, or less Light “OFF”: 10 — 14
Engine speed output		B134	30	—	0 — 13, or more	Waveform
Torque control 1 signal		B135	16	5	5	—
Torque control 2 signal		B135	17	5	5	—
Torque control cut signal		B134	31	8	8	—
Purge control solenoid valve		B134	2	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Fuel temperature sensor		B136	26	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Fuel level sensor		B136	27	0.12 — 4.75	0.12 — 4.75	—

ENGINE CONTROL MODULE (ECM) I/O SIGNAL

Engine (Diagnostics)

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Fuel tank pressure sensor	Signal	B136	12	2.3 — 2.7	2.3 — 2.7	The value obtained after the fuel filler cap was removed once and recapped.
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	16	0	0	—
Fuel tank pressure control solenoid valve		B134	1	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
Drain valve		B134	10	ON: 1, or less OFF: 10 — 13	ON: 1, or less OFF: 13 — 14	—
AT diagnosis input signal		B135	4	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	Waveform
Small light switch		B136	3	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Blower fan switch		B136	30	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Rear defogger switch		B135	21	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sensor signal 1		B136	19	2.8 — 3.2	2.8 — 3.2	—
Front oxygen (A/F) sensor signal 2		B136	6	2.4 — 2.7	2.4 — 2.7	—
Front oxygen (A/F) sensor signal 3		B136	7	0.2 — 4.9	0.2 — 4.9	—
Front oxygen (A/F) sensor signal 4		B136	20	0.2 — 4.9	0.2 — 4.9	—
Pressure sensor		B136	5	2.4 — 4.8	0.4 — 1.8	—
Intake air temperature sensor		B136	13	2.3 — 2.5	1.4 — 1.6	—
SSM/GST communication line		B135	3	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	—
GND (sensors)		B136	16	0	0	—
GND (injectors)		B134	7	0	0	—
GND (ignition system)		B134	27	0	0	—
GND (power supply)		B134	8	0	0	—
GND (control systems)		B136	21	0	0	—
		B136	22	0	0	—
GND (oxygen sensor heater 1)		B134	35	0	0	—
GND (oxygen sensor heater 2)		B134	34	0	0	—

6. Engine Condition Data S078530

A: ELECTRICAL SPECIFICATION

S078530A08

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

Measuring condition:

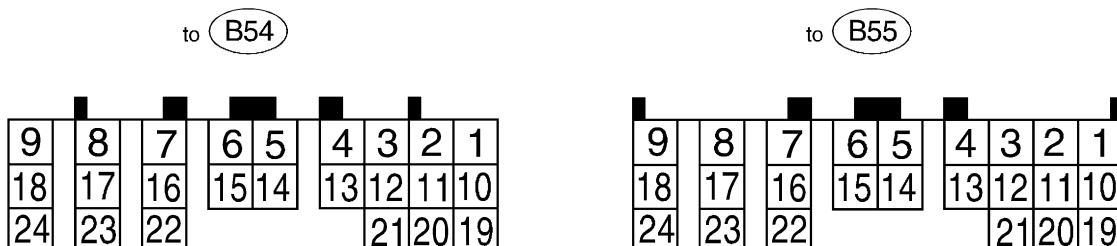
- After warm-up the engine.
- Gear position is in “N” or “P” position.
- A/C is turned OFF.
- All accessory switches are turned OFF.

TRANSMISSION CONTROL MODULE (TCM) I/O SIGNAL

Engine (Diagnostics)

7. Transmission Control Module (TCM) I/O Signal S078506

A: ELECTRICAL SPECIFICATION S078506A08



B2M2269A

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

TRANSMISSION CONTROL MODULE (TCM) I/O SIGNAL

Engine (Diagnostics)

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

Engine (Diagnostics)

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	—

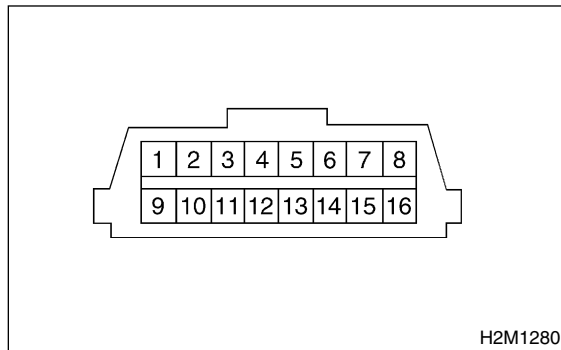
8. Data Link Connector S078505

A: NOTE S078505A15

- 1) This connector is used both for OBD-II 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 OBD-II general scan tools and the Subaru Select Monitor, because the circuit for the Subaru Select Monitor may be damaged.



Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	K line of ISO 9141 CARB
3	Blank	11	Blank
4	Subaru Select Monitor signal (ECM to Subaru Select Monitor)*	12	Ground
5	Subaru Select Monitor signal (Subaru Select Monitor to ECM)*	13	Ground
6	Line end check signal 1	14	Blank
7	Blank	15	Blank
8	Line end check signal 2 (MT vehicles)	16	Blank

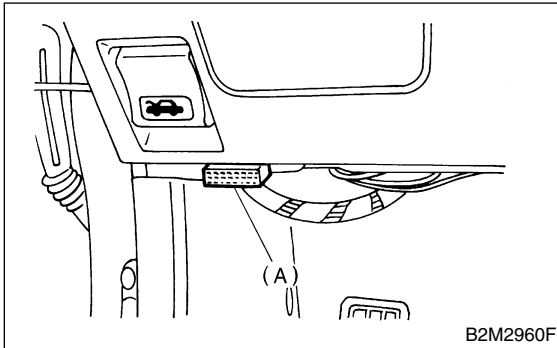
*: Circuit only for Subaru Select Monitor

9. OBD-II General Scan Tool S078527

A: OPERATION S078527A16

1. HOW TO USE OBD-II GENERAL SCAN TOOL S078527A1601

- 1) Prepare a general scan tool (OBD-II general scan tool) required by SAE J1978.
- 2) Open the cover and connect the OBD-II 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 OBD-II general scan tool, call up diagnostic trouble code(s) and freeze frame data. OBD-II general scan tool functions consist of:

- (1) MODE \$01: Current 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 OBD-II General Scan Tool Operation Manual.)

NOTE:

For details concerning diagnostic trouble codes, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>

2. MODE \$01 (CURRENT POWERTRAIN DIAGNOSTIC DATA) S078527A1602

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

3. MODE \$02 (POWERTRAIN FREEZE FRAME DATA) S078527A1603

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

4. MODE \$03 (EMISSION-RELATED POWERTRAIN DIAGNOSTIC TROUBLE CODE) S078527A1604

Refer to Read Diagnostic Trouble Code for information about data denoting emission-related powertrain diagnostic trouble codes. <Ref. to EN-47, Read Diagnostic Trouble Code.>

5. MODE \$04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION) S078527A1605

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

NOTE:

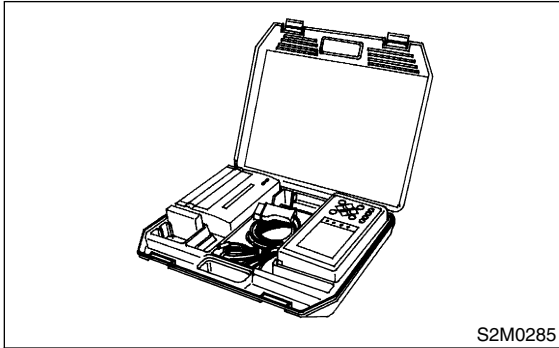
Refer to OBD-II general scan tool manufacturer's instruction manual to clear or reset emission-related diagnostic information (MODE \$04).

10. Subaru Select Monitor S078503

A: OPERATION S078503A16

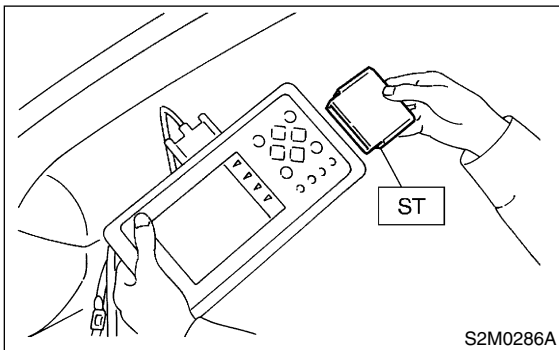
1. HOW TO USE SUBARU SELECT MONITOR S078503A1601

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



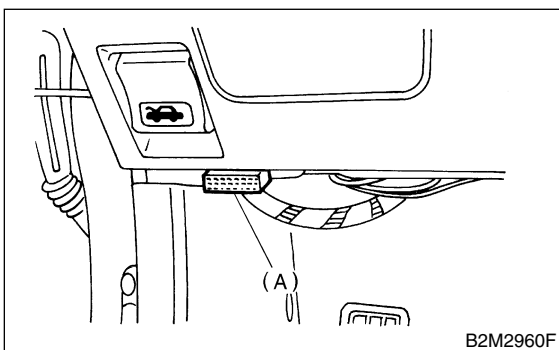
2) Connect diagnosis cable to Subaru Select Monitor.

3) Insert cartridge into Subaru Select Monitor. <Ref. to EN-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).

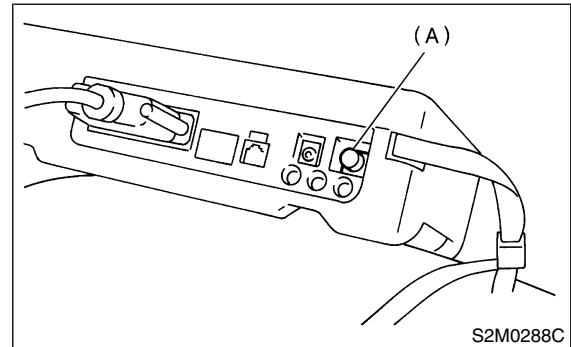


(2) Connect diagnosis cable to data link connector.

CAUTION:

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

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



(A) Power switch

6) Using 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)

S078503A1610

Refer to Read Diagnostic Trouble Code for information about how to indicate DTC. <Ref. to EN-47, Read Diagnostic Trouble Code.>

3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE. (OBD MODE) S078503A1611

Refer to Read Diagnostic Trouble Code for information about how to indicate DTC. <Ref. to EN-47, Read Diagnostic Trouble Code.>

4. READ CURRENT DATA FOR ENGINE. (NORMAL MODE) S078503A1604

- 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 #1 Pulse	ms
Idle air control signal	ISC Valve Step	STEP
Engine load data	Engine Load	%
Front oxygen (A/F) sensor output signal	A/F Sensor #1	—
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	V
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	V
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
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

SUBARU SELECT MONITOR

Engine (Diagnostics)

Contents	Display	Unit of measure
Engine torque control permission signal	Torque Permission Signal	ON or OFF
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF
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
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.

Engine Load

Display: 0 — 100 %

The engine load is displayed. The ECM calculates the engine load via the engine speed and signals from the pressure sensor. The engine load increases when the engine speed and absolute pressure of the intake manifold increase.

Coolant Temp.

Display: -40 to 215°C (-40 to 419°F)

The coolant temperature transmitted from the engine coolant temperature sensor is displayed.

A/F Correction #1

Display: -100 to 99 %

Using the signal from the front oxygen (A/F) sensor, the correction value of the fuel supply amount regulated by the ECM is indicated. When the A/F is lean and when displayed value becomes 0 % or more, ECM increases the fuel. When the A/F is rich and when displayed value becomes 0 % or less, ECM decreases the fuel.

A/F Learning #1

Display: -100 to 99.2 %

The ECM calculates the long-term fuel trim value from the short-term fuel trim value. The long-term fuel trim value means the correction value of long-term fuel supply amount. If the displayed value is less than 0 %, the fuel system is in rich status and the ECM restricts the fuel supply (by shortening the injector pulse). If the displayed value is more than 0 %, the fuel system is in lean status and the ECM increases the fuel supply (by extending the injector pulse).

Mani Absolute Pressure

Display: 0 — 254.9 kPa (0 — 1,912.5 mmHg, 0 — 75.3 inHg)

The pressure in the intake manifold is displayed. The ECM detects the pressure in the intake tube via the signal from the pressure sensor. The ECM calculates the air mass required for the engine.

Engine Speed

Display: 0 — 16,383 rpm

The engine speed transmitted from the crankshaft position sensor is detected.

Vehicle Speed

Display: 0 — 255 km/h (0 — 158 MPH)

The vehicle speed transmitted from the vehicle speed sensor is displayed.

Ignition Timing

Display: -64 to 63.5 deg.

The advanced ignition timing value is displayed. The ECM calculates the advanced ignition timing value using engine coolant temperature, engine speed, and engine load.

Intake Air Temp.

Display: 40 — 215°C (104 — 419°F)

The intake air temperature is displayed. The ECM detects the intake air temperature via the signal from the intake air temperature sensor, and corrects the ignition timing and fuel supply amount.

Rear O2 sensor

Display: 0 — 327.7 Volt

The ECM correct air-fuel ratio by the signal sent from O2 sensor. Also, the signal is used for catalyst degradation diagnosis.

Battery Voltage**Display: 0 — 20.4 V**

The battery voltage is displayed.

Throttle Sensor Voltage**Display: 0 — 5 V**

The throttle angle is displayed in voltage. When the throttle is fully-closed, the displayed voltage value is approx. 0.5 V. When it is fully-open, the voltage is approx. 4 V or more.

Fuel injection #1 Pulse**Display: 0 — 65.3 m/sec (0 — 214.2 ft/sec)**

The injector valve opening time is displayed. The longer the injector valve opening time, the more the fuel is supplied. The higher the engine load, the longer the injector valve opening time becomes.

Knocking Correction**Display: -64 to 63.5 deg.**

The ECM controls the ignition timing via the signal from the knock sensor.

Atmosphere Pressure**Display: 0 — 254.9 kPa (0 — 1,912.5 mmHg, 0 — 75.3 inHg)**

The atmospheric pressure is displayed. The ECM detects the atmospheric pressure via the signal from the atmosphere sensor.

Mani. Relative Pressure**Display: 0 — 126.9 kPa (0 — 952 mmHg, 0 — 37.5 inHg)**

A value calculated by subtracting the absolute pressure in the intake tube from the atmospheric pressure is displayed. A larger load leads to a larger value.

Fuel tank pressure**Display: 0 — 3.2 kPa (0 — 24 mmHg, 0 — 0.94 inHg)**

The pressure in the fuel tank is displayed.

Learned Ignition Timing**Display: -64 to 63.5 deg.**

The advanced ignition timing value is displayed. The ECM calculates the learned ignition timing in each driving range via the signal from the knock sensor. A positive value indicates advanced timing, and a negative value indicates retarded timing.

Fuel Temp.**Display: -40 to 215°C (-40 to 419°F)**

The fuel temperature is displayed. The ECM detects the fuel temperature via the signal from the fuel temperature sensor. This signal is used for the evaporation diagnosis.

Front O2 Heater #1**Display: 0 — 10A**

The heater current of the front oxygen (A/F) sensor is displayed. A larger current value leads to increased heat generation.

Rear O2 Heater Current**Display: 0 — 10 A**

The heater current of the rear O2 sensor is displayed. A larger current value leads to increased heat generation.

Fuel Level**Display: 0 — 5 V**

The float inside the fuel tank is a variable resistor which varies the resistance based on fuel level. The ECM then averages this voltage and the signal voltage from the fuel tank in order to determine fuel level. The scan tool displays close to 0.7 volts for an empty tank, and close to 5 volts for a full tank.

CPC Valve Duty Ratio**Display: 0 — 100 %**

The purge control solenoid valve is regulated by the ECM. The displayed value of 0 % indicates that the purge amount is 0, and 100 % indicates that the purge amount becomes the maximum.

ISC Valve Step**Display: 0 — 255 step**

The idle air control solenoid valve is driven by the stepping motor. The number of steps is regulated by the ECM. A value of 0 step indicates that the air bypass circuit is closed, and the value of 255 steps indicates that it is fully open.

A/F Sensor #1**Display: 0 — 2**

The air surplus ratio output from the front oxygen (A/F) sensor is displayed. Air overflow ratio = 1.0 is regarded as a stoichiometric A/F ratio. A value above 1.0 indicates A/F lean range, and below 1.0 indicates A/F rich range.

A/F Correction #3**Display:**

The correction value of fuel supply amount regulated by the ECM via the signal from the rear oxygen sensor is displayed.

AT Vehicle ID Signal**Display: ON or OFF**

AT and MT vehicles are identified. For AT vehicles, ON is displayed, and for MT ones, OFF is displayed.

Neutral Position Switch
Display: ON or OFF

When the shift lever stays in the neutral position, ON is displayed. When in other positions, OFF is displayed.

Idle Switch Signal
Display: ON or OFF

When the accelerator pedal is released fully, ON is displayed. When depressed fully, OFF is displayed.

P/S Switch
Display: ON or OFF

When the steering wheel is turned fully, ON is displayed. When returned, OFF is displayed. This signal is used for idle control or other controls.

A/C Switch
Display: ON or OFF

When the A/C switch is turned ON, ON is displayed. When turned OFF, OFF is displayed. This signal is used for idle control or other controls.

Starter Switch
Display: ON or OFF

When the vehicle is cranking, ON is displayed. When not cranking, OFF is displayed.

Rear O2 Rich Signal
Display: ON or OFF

When the A/F ratio is rich, ON is displayed. When lean, OFF is displayed.

Knocking Signal
Display: ON or OFF

When knocking occurs and the ignition timing is retarded, ON is displayed. At any other time, OFF is displayed.

Crankshaft Position Sig.
Display: ON or OFF

When a crankshaft signal exists, ON is displayed. At any other time (at engine stall), OFF is displayed.

Camshaft Position Sig.
Display: ON or OFF

When a camshaft signal exists, ON is displayed. At any other time (at engine stall), OFF is displayed.

Rear Defogger SW
Display: ON or OFF

When the rear defogger switch is turned ON, ON is displayed. When turned OFF, OFF is displayed. This signal is used for idle control or other controls.

Blower Fan SW
Display: ON or OFF

When the blower fan switch is turned ON, ON is displayed. When turned OFF, OFF is displayed. This signal is used for idle control or other controls.

Light Switch
Display: ON or OFF

When the light switch is turned ON, ON is displayed. When turned OFF, OFF is displayed. This signal is used for idle control or other controls.

A/C Compressor Signal
Display: ON or OFF

When the A/C clutch is engaged, ON is displayed. When disengaged, OFF is displayed.

Radiator Fan Relay #1, #2
Display: ON or OFF

When the radiator fan relay is ON (radiator operates), ON is displayed. When OFF (radiator stops), OFF is displayed.

Fuel Pump Relay
Display: ON or OFF

When the radiator fan relay is ON (fuel pump operates), ON is displayed. When OFF (fuel pump stops), OFF is displayed.

PCV Solenoid Valve
Display: ON or OFF

The status of the pressure control solenoid valve is displayed. When the pressure control solenoid valve is closed, OFF is displayed. When open, ON is displayed. During an evaporation leak diagnosis, the pressure control solenoid valve is only open when vacuum in the intake tube is taken into the fuel tank.

Vent Solenoid Valve
Display: ON or OFF

The status of the drain valve is displayed. When the drain valve is closed, ON is displayed. When open, OFF is displayed. Except during an evaporation leak diagnosis, the drain valve is always open.

Assist Air Sol. Valve
Display: ON or OFF

When the air assist injector solenoid valve is open, ON is displayed. When closed, OFF is displayed. The air assist injector solenoid valve opens to increase mass air flow at cold start, improving the mixture formation.

Tank Sensor Cont. Valve***Display: ON or OFF***

When the atmospheric pressure solenoid valve is open, ON is displayed. When closed, OFF is displayed. The valve is only activated during a 0.02-inch evaporation leak diagnosis.

Torque Control Signal #1, #2***Display: ON or OFF***

When a torque down signal exists, ON is displayed. When it doesn't, OFF is displayed.

Torque Permission Signal***Display: ON or OFF***

The signal which notifies whether or not torque down is possible is displayed. This signal is transmitted from the ECU in response to a torque down signal from the TCU. When torque down is prohibited, ON is displayed. When permitted, OFF is displayed.

SUBARU SELECT MONITOR

Engine (Diagnostics)

5. READ CURRENT DATA FOR ENGINE. (OBD MODE) S078503A1605

- 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	%
A/F sensor equipment	A/F sensor	ON or OFF
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) S078503A1606

- 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. READ OXYGEN SENSOR MONITORING TEST RESULTS DATA FOR ENGINE. (OBD MODE) S078503A1607

- 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 {O2 Sensor Monitor} and press the [YES] key.
- 6) On the «O2 Sensor Select» display screen, select the {Bank 1-Sensor1} or {Bank 1-Sensor2} and press the [YES] key.

- Bank 1-Sensor1 indicates the front oxygen or A/F sensor, and Bank 1-Sensor2 indicates the rear oxygen sensor.

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

Contents	Display	Unit of measure
Oxygen sensor for monitoring test	<O2 Sensor Monitor (-----)>	—
Rich to lean oxygen sensor threshold voltage	Rich to lean sensor volt	V
Lean to rich oxygen sensor threshold voltage	Lean to rich sensor volt	V
Low oxygen sensor voltage for switch time calculation	Low sensor voltage	V
High oxygen sensor voltage for switch time calculation	High sensor voltage	V
Rich to lean oxygen sensor switch time	Rich to lean switch time	sec
Lean to rich oxygen sensor switch time	Lean to rich switch time	sec
Maximum oxygen sensor voltage for test cycle	Maximum sensor Voltage	V
Minimum oxygen sensor voltage for test cycle	Minimum sensor Voltage	V

NOTE:

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

8. LED OPERATION MODE FOR ENGINE S078503A1608

- 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.

SUBARU SELECT MONITOR

Engine (Diagnostics)

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.

9. READ CURRENT DATA FOR AT. S078503A1612

- 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.

Front Wheel Speed

Display: 0 — 255 km/h (0 — 158 MPH)

The front wheel speed is displayed. This signal is used for the shift control, lock-up control, line pressure control, and transfer control.

ATF Temp.

Display: -40 to 215°C (-40 to 419°F)

The ATF temperature via the signal from the ATF temperature sensor is displayed.

Gear Position

Display:

The present gear position is displayed. The gear position is calculated from the engine speed and torque converter turbine speed.

Line Pressure Duty Ratio

Display: 0 — 123%

The duty value of the line pressure duty solenoid is displayed. The line pressure duty solenoid is regulated by the TCM, adjusting the line pressure to the optimum value depending on driving conditions.

Lock Up Duty Ratio

Display: 0 — 123%

The duty value of the lock-up duty solenoid is displayed. The lock-up duty solenoid is regulated by the TCM. Because the lock-up duty solenoid controls the lock-up control valve, the lock-up clutch engages and disengages smoothly.

SUBARU SELECT MONITOR

Engine (Diagnostics)

Transfer Duty Ratio

Display: 0 — 123%

The duty value of the transfer duty solenoid is displayed. The transfer duty solenoid is regulated by the TCM, adjusting the transfer clutch oil pressure and controlling the driving force of the rear wheels.

Turbine Revolution Speed

Display: 0 — 8,160 rpm

The input shaft speed detected by the torque converter speed sensor is displayed. This signal is used to control the line pressure and 2 - 4 brake pressure control timing during shifting.

Throttle Sensor Power

Display: 0 — 256 V

The supply voltage to the throttle sensor is displayed. This signal is used for the throttle sensor output correction.

Brake Clutch Duty Ratio

Display: 0 — 123%

The duty value of the 2 - 4 brake duty solenoid. The 2 - 4 brake duty solenoid is regulated by the TCM, adjusting the 2 - 4 brake pressure during shifting and relieving from harsh shifting.

Rear Wheel Speed

Display: 0 — 255 km/h (0 — 158 MPH)

The rear wheel speed is displayed. This signal is used to control the transfer. If the front vehicle speed sensor is malfunctioning, this signal is used as a substitute.

Cruise Control Signal

Display: ON or OFF

When the cruise control switch is ON, ON is displayed. When OFF, OFF is displayed.

ABS Signal

Display: ON or OFF

When the ABS function is active, ON is displayed. When inactive, OFF is displayed.

Stop Light Signal

Display: ON or OFF

When the brake pedal is depressed, ON is displayed. When released, OFF is displayed.

1st, 2nd, 3rd, D, R, Range Signal

Display: ON or OFF

When the switch for each range is ON, ON is displayed.

2-4 Brake Timing Sol.

Display: ON or OFF

When the 2 - 4 brake timing solenoid is ON, ON is displayed. When OFF, OFF is displayed. The 2 - 4 brake timing solenoid is regulated by the TCM, controlling the release timing of the 2 - 4 brake.

Low Clutch Timing Sol.

Display: ON or OFF

When the low clutch timing solenoid is ON, ON is displayed. When OFF, OFF is displayed. The low clutch timing solenoid is regulated by the TCM, controlling the release timing of the low clutch.

Shift Solenoid #1, #2

Display: ON or OFF

When the solenoid valve is ON, ON is displayed. When OFF, OFF is displayed. By combining No. 1 and No. 2 solenoids, the shifting mechanism is controlled.

P Range

Display: ON or OFF

When the shift lever stays in P range, ON is displayed. When not in P range, OFF is displayed.

N Range

Display: ON or OFF

When the shift lever stays in N range, ON is displayed. When not in N range, OFF is displayed.

11. Read Diagnostic Trouble Code S078508

A: OPERATION S078508A16

1. SUBARU SELECT MONITOR (NORMAL MODE) S078508A1601

- 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-88, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE) S078508A1602

- 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-88, List of Diagnostic Trouble Code (DTC).>

3. OBD-II GENERAL SCAN TOOL S078508A1603

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-88, List of Diagnostic Trouble Code (DTC).>

NOTE:

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

INSPECTION MODE

Engine (Diagnostics)

12. Inspection Mode S078510

A: OPERATION S078510A16

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-53, Drive Cycle.>

DTC No.	Item
P0031	Front oxygen (A/F) sensor heater circuit low input
P0032	Front oxygen (A/F) sensor heater circuit high input
P0037	Rear oxygen sensor heater circuit low input
P0038	Rear oxygen sensor heater circuit high input
P0066	Air assist injector solenoid valve circuit low input
P0067	Air assist injector solenoid valve circuit high input
P0106	Pressure sensor circuit range/performance problem (low input)
P0107	Pressure sensor circuit low input
P0108	Pressure sensor circuit high input
P0112	Intake air temperature sensor circuit low input
P0113	Intake air temperature sensor circuit high input
P0117	Engine coolant temperature sensor circuit low input
P0118	Engine coolant temperature sensor circuit high input
P0122	Throttle position sensor circuit low input
P0123	Throttle position sensor circuit high input
P0131	Front oxygen (A/F) sensor circuit malfunction (open circuit)
P0132	Front oxygen (A/F) sensor circuit malfunction (short circuit)
P0137	Rear oxygen sensor circuit low input
P0138	Rear oxygen sensor circuit high input
P0182	Fuel temperature sensor A circuit low input
P0183	Fuel temperature sensor A circuit high input
P0327	Knock sensor circuit low input
P0328	Knock sensor circuit high input
P0335	Crankshaft position sensor circuit malfunction
P0336	Crankshaft position sensor circuit range/performance problem
P0340	Camshaft position sensor circuit malfunction
P0341	Camshaft position sensor circuit range/performance problem
P0447	Evaporative emission control system vent control low input
P0448	Evaporative emission control system vent control high input
P0452	Evaporative emission control system pressure sensor low input
P0458	Evaporative emission control system purge control valve circuit low input
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0500	Vehicle speed sensor malfunction
P0512	Starter switch circuit high input
P0604	Internal control module memory check sum error
P0691	Cooling fan relay 1 circuit low input
P0692	Cooling fan relay 1 circuit high input
P0703	Brake switch input malfunction
P0705	Transmission range sensor circuit malfunction
P0710	Transmission fluid temperature sensor circuit malfunction
P0715	Torque converter turbine speed sensor circuit malfunction
P0720	Output speed sensor (vehicle speed sensor 2) circuit malfunction
P0725	Engine speed input circuit malfunction
P0731	Gear 1 incorrect ratio

DTC No.	Item
P0732	Gear 2 incorrect ratio
P0733	Gear 3 incorrect ratio
P0734	Gear 4 incorrect ratio
P0741	Torque converter clutch system malfunction
P0743	Torque converter clutch system (Lock-up duty solenoid) electrical
P0748	Pressure control solenoid (Line pressure duty solenoid) electrical
P0753	Shift solenoid A (Shift solenoid 1) electrical
P0758	Shift solenoid B (Shift solenoid 2) electrical
P0778	2-4 brake pressure control solenoid valve circuit malfunction
P0785	2-4 brake timing control solenoid valve circuit malfunction
P0851	Neutral position switch circuit low input
P0852	Neutral position switch circuit high input
P0864	Automatic transmission diagnosis input signal circuit malfunction
P0865	Automatic transmission diagnosis input signal circuit low input
P0866	Automatic transmission diagnosis input signal circuit high input
P1110	Atmospheric pressure sensor low input
P1111	Atmospheric pressure sensor high input
P1112	Atmospheric pressure sensor range/performance problem
P1146	Pressure sensor circuit range/performance problem (high input)
P1400	Fuel tank pressure control solenoid valve circuit low input
P1420	Fuel tank pressure control solenoid valve circuit high input
P1446	Evaporative emission control system atmospheric pressure solenoid valve circuit low input
P1447	Evaporative emission control system atmospheric pressure solenoid valve circuit high input
P1507	Idle control system malfunction (fail-safe)
P1510	Idle air control solenoid valve signal 1 circuit low input
P1511	Idle air control solenoid valve signal 1 circuit high input
P1512	Idle air control solenoid valve signal 2 circuit low input
P1513	Idle air control solenoid valve signal 2 circuit high input
P1514	Idle air control solenoid valve signal 3 circuit low input
P1515	Idle air control solenoid valve signal 3 circuit high input
P1516	Idle air control solenoid valve signal 4 circuit low input
P1517	Idle air control solenoid valve signal 4 circuit high input
P1518	Starter switch circuit low input
P1540	Vehicle speed sensor malfunction 2
P1560	Back-up voltage circuit malfunction
P1698	Engine torque control cut signal circuit low input
P1699	Engine torque control cut signal circuit high input
P1700	Throttle position sensor circuit malfunction for automatic transmission
P1701	Cruise control set signal circuit malfunction for automatic transmission
P1703	Low clutch timing control solenoid valve circuit malfunction
P1711	Engine torque control signal 1 circuit malfunction
P1712	Engine torque control signal 2 circuit malfunction

1. PREPARATION FOR THE INSPECTION MODE

S078510A1601

- 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.

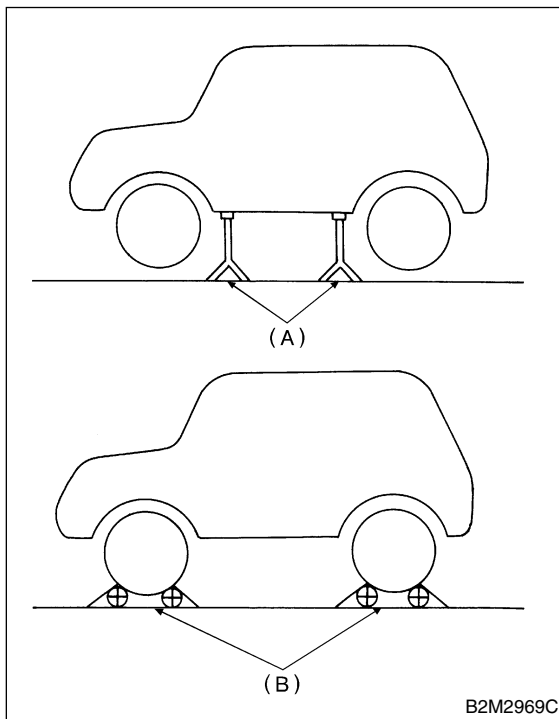
WARNING:

- 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 runoff of front wheels.

INSPECTION MODE

Engine (Diagnostics)

- 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.

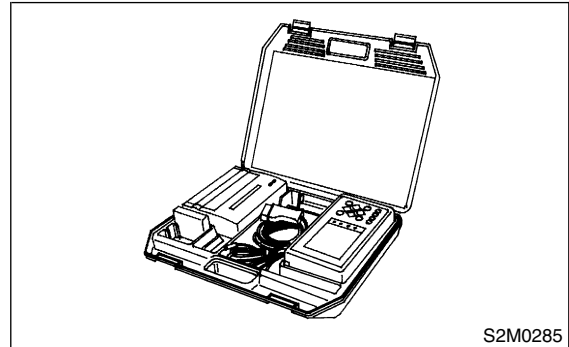


B2M2969C

- (A) Safety stand
(B) Free rollers

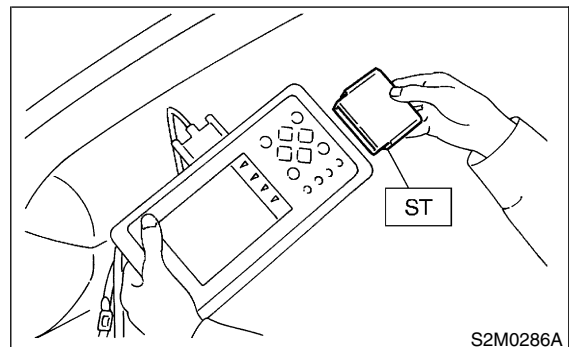
2. SUBARU SELECT MONITOR S078510A1602

- 1) After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN-55, Clear Memory Mode.>
- 2) Warm up engine.
- 3) Prepare Subaru Select Monitor kit. <Ref. to EN-8, PREPARATION TOOL, General Description.>



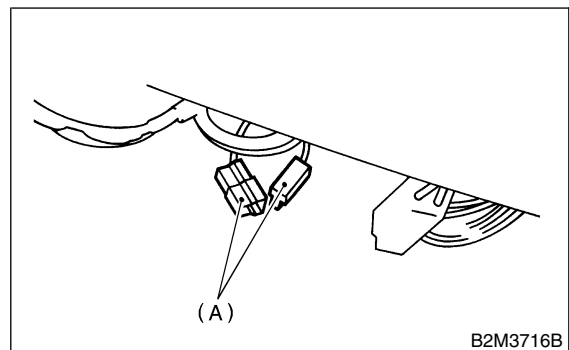
S2M0285

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



S2M0286A

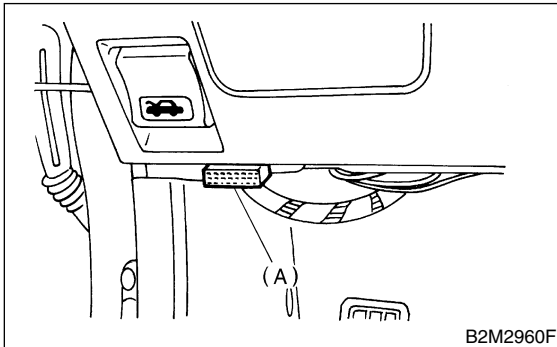
- 6) Connect test mode connector (A) at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



B2M3716B

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).

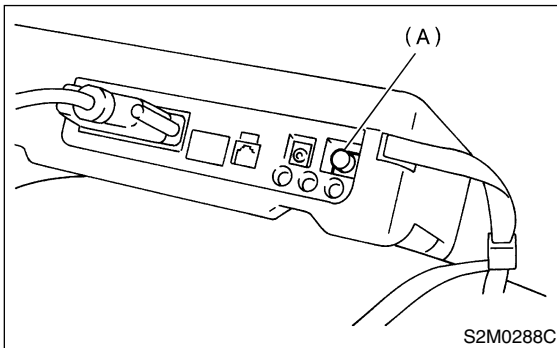


- (2) Connect diagnosis cable to data link connector.

CAUTION:

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

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



(A) Power switch

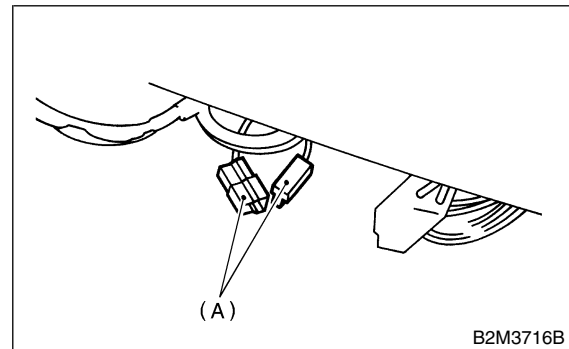
- 9) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
- 10) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 11) Press the [YES] key after displayed the information of engine type.
- 12) On the «Engine 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-88, 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. OBD-II GENERAL SCAN TOOL S078510A1603

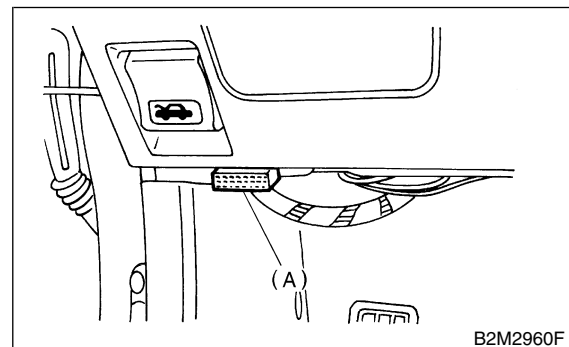
- 1) After performing diagnostics and clearing the memory, check for any remaining unresolved trouble data: <Ref. to EN-55, Clear Memory Mode.>
- 2) Warm up engine.
- 3) Connect test mode connector (A) at the lower side of the instrument panel (on the driver's side), to the side of the center console box.



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

NOTE:

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

<Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>

13. Drive Cycle S078812

A: OPERATION S078812A16

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 S078812A1601

- 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-55, 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.

S078812A1602

DTC No.	Item	Condition
*P0111	Intake air temperature sensor circuit range/performance problem	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	Thermostat malfunction	Coolant temperature at start is less than 55°C (131°F).
*P0130	Front oxygen (A/F) sensor circuit range/performance problem (Lean)	—
*P0133	Front oxygen (A/F) sensor circuit slow response	—
*P0181	Fuel temperature sensor A circuit range/performance problem	—
*P0420	Catalyst system efficiency below threshold	—
*P0442	Evaporative emission control system malfunction	—
*P0451	Evaporative emission control system pressure sensor range/performance problem	—
P0453	Evaporative emission control system pressure sensor high input	—
*P0456	Evaporative emission control system malfunction	—
*P0457	Evaporative emission control system malfunction	—
P0459	Evaporative emission control system purge control valve circuit high input	—
*P0464	Fuel level sensor intermittent input	—
*P1137	Front oxygen (A/F) sensor circuit range/performance problem	—
*P1442	Fuel level sensor circuit range/performance problem 2	—
P1443	Evaporative emission control system vent control function problem	—
*P1448	Atmospheric pressure solenoid valve circuit range/performance problem	—

DRIVE CYCLE

Engine (Diagnostics)

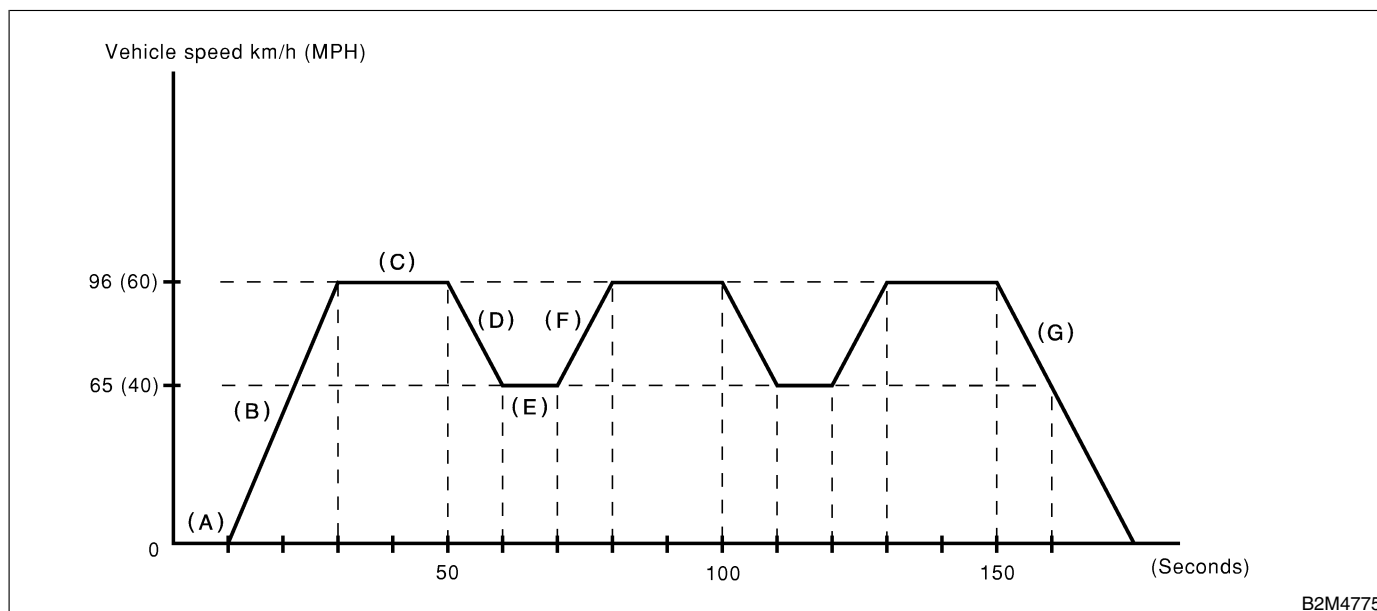
3. IDLE FOR 10 MINUTES S078812A1603

NOTE:

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

DTC No.	Item	Condition
*P0483	Cooling fan function problem	—
*P0506	Idle control system RPM lower than expected	—
*P0507	Idle control system RPM higher than expected	—

4. DRIVE ACCORDING TO THE FOLLOWING DRIVE PATTERN S078812A1604



(A) Idle engine for 1 minute.	(D) Decelerate with fully closed throttle to 64 km/h (40 MPH).	(F) Accelerate to 97 km/h (60 MPH) within 10 seconds.
(B) Accelerate to 97 km/h (60 MPH) within 20 seconds.	(E) Drive vehicle at 64 km/h (40 MPH) for 10 seconds.	(G) Stop vehicle with throttle fully closed.
(C) Drive vehicle at 97 km/h (60 MPH) for 20 seconds.		

DTC No.	Item	Condition
*P0065	Air assist injector solenoid valve malfunction	—
*P0121	Throttle position sensor circuit range/performance problem (high input)	—
*P0139	Rear oxygen sensor circuit slow response	—
*P0171	Fuel trim malfunction (Lean)	—
*P0172	Fuel trim malfunction (Rich)	—
*P0301	Cylinder 1 misfire detected	—
*P0302	Cylinder 2 misfire detected	—
*P0303	Cylinder 3 misfire detected	—
*P0304	Cylinder 4 misfire detected	—
*P1142	Throttle position sensor circuit range/performance problem (low input)	—

14. Clear Memory Mode S078513

A: OPERATION S078513A16

1. SUBARU SELECT MONITOR (NORMAL MODE) S078513A1601

- 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) S078513A1602

- 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. OBD-II GENERAL SCAN TOOL S078513A1603

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

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

COMPULSORY VALVE OPERATION CHECK MODE

Engine (Diagnostics)

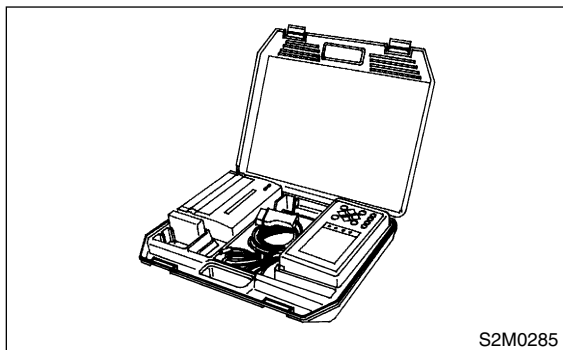
15. Compulsory Valve Operation Check Mode

S078528

A: OPERATION

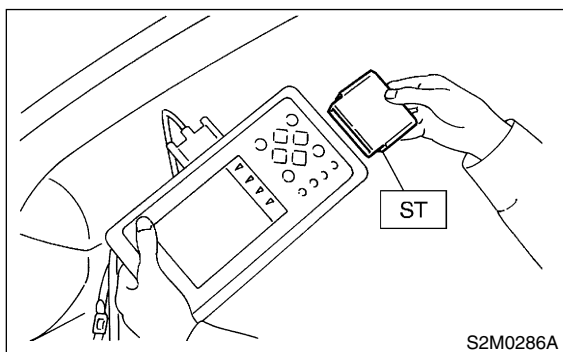
S078528A16

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

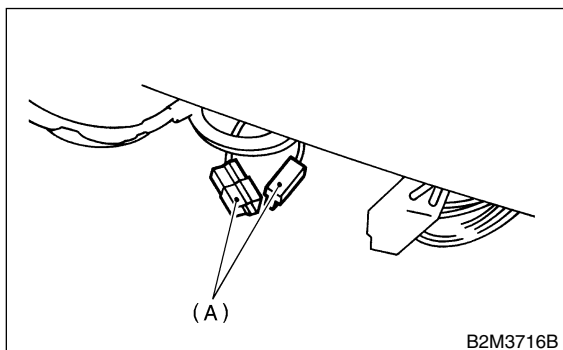


2) Connect diagnosis cable to Subaru Select Monitor.

3) Insert cartridge into Subaru Select Monitor. <Ref. to EN-8, PREPARATION TOOL, General Description.>

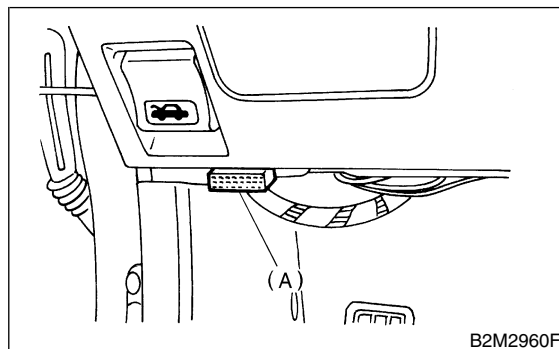


4) Connect test mode connector (A) at the lower portion of instrument panel (on the driver's side), to the side of the center console box.



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).

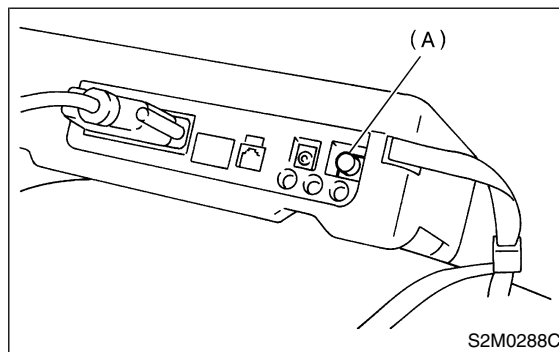


(2) Connect diagnosis cable to data link connector.

CAUTION:

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

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



(A) Power switch

7) On the «Main Menu» display screen, select 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.

COMPULSORY VALVE OPERATION CHECK MODE

Engine (Diagnostics)

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 pressure sensor operation check	Fuel Tank Sensor Control Valve

NOTE:

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

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

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

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

16. Engine Malfunction Indicator Lamp (MIL) S078653

A: PROCEDURE S078653E45

1. Activation of check engine malfunction indicator lamp (MIL). <Ref. to EN-59, 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-60, 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-63, 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-64, 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-66, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 HZ., Engine Malfunction Indicator Lamp (MIL).>

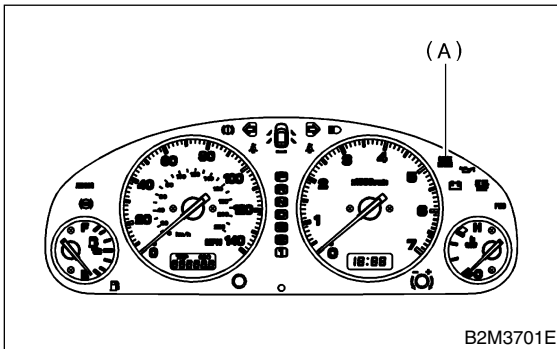
B: ACTIVATION OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL)

S078653E89

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

NOTE:

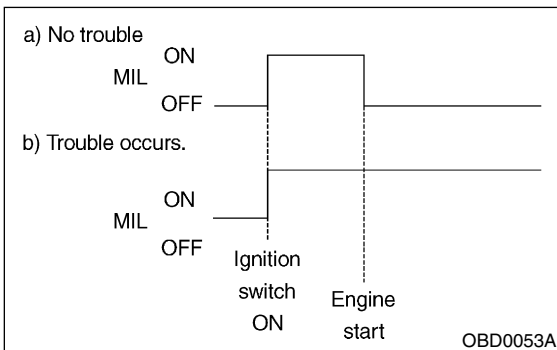
If the MIL does not illuminate, perform diagnostics of the CHECK ENGINE light circuit or the combination meter circuit. <Ref. to EN-60, CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT COME ON., Engine Malfunction Indicator Lamp (MIL).>



B2M3701E

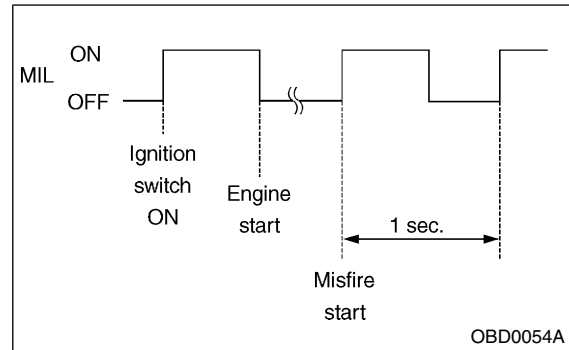
(A) Malfunction indicator lamp (MIL)

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



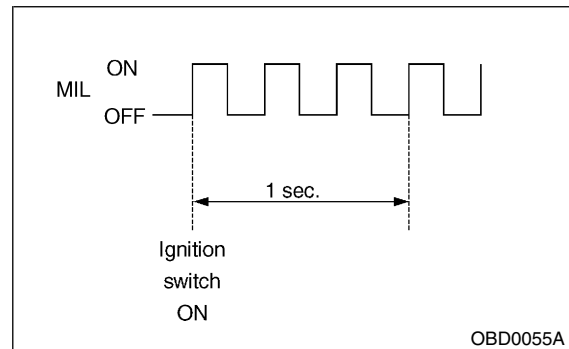
OBD0053A

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



OBD0054A

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.



OBD0055A

Engine (Diagnostics)

S078653E90

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

- When ignition switch is turned ON (engine OFF), MIL does not come on.

IGNITION RELAY

IGNITION SWITCH (B72)

IGNITION SWITCH SOLENOID (SBF-4)

IGNITION SWITCH SOLENOID (SBF-1)

IGNITION SWITCH SOLENOID (No. 5)

BATTERY

COMBINATION METER (i12)

ECM (B134)

Wiring Diagram Details:

- The Ignition Relay is connected to the Ignition Switch (B72) and the Ignition Switch Solenoid (SBF-4).
- The Ignition Switch (B72) is connected to the Ignition Switch Solenoid (SBF-4) and the Ignition Switch Solenoid (SBF-1).
- The Ignition Switch Solenoid (SBF-4) is connected to the Ignition Switch Solenoid (SBF-1).
- The Ignition Switch Solenoid (SBF-1) is connected to the Ignition Switch Solenoid (No. 5).
- The Ignition Switch Solenoid (No. 5) is connected to the Battery.
- The Battery is connected to the Ignition Switch Solenoid (No. 5).
- The Combination Meter (i12) is connected to the Ignition Switch Solenoid (No. 5).
- The ECM (B134) is connected to the Ignition Switch Solenoid (No. 5).

Pinout Tables:

B72

1	2
3	4

i12

1	2	3	4	5	6
7	8	9	10	11	12

B134

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

B157

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38

B36

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

B2M4633

No.	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. 11 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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.
3	CHECK ECM CONNECTOR.	Is ECM connector correctly connected?	Replace ECM. <Ref. to FU-51, 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-11, 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. 11 — (i12) No. 12:	Is resistance 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. Measure voltage between combination meter connector and chassis ground. Connector & terminal (i12) No. 3 (+) — Chassis ground (-):	Is voltage 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

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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.

S078653E91

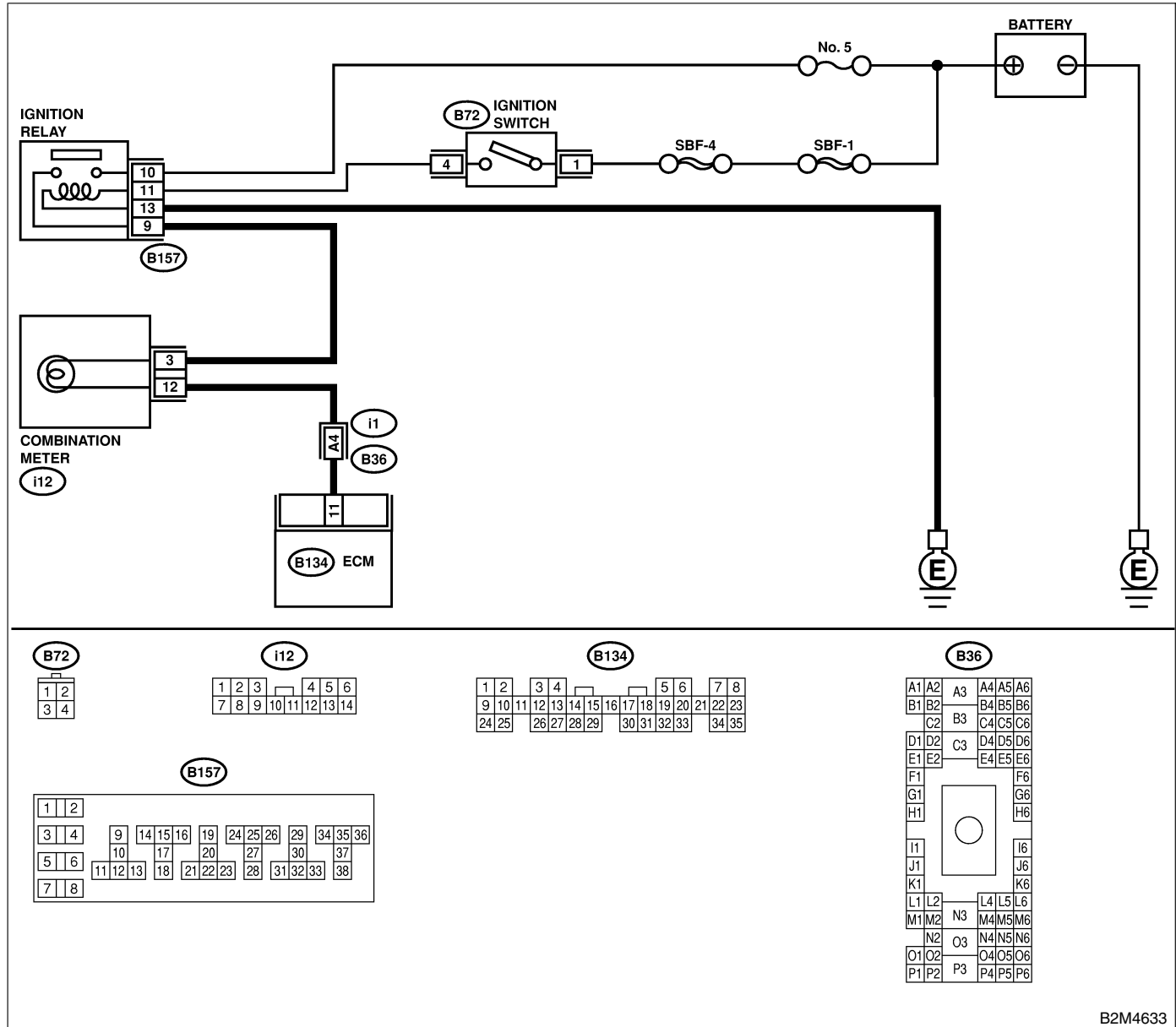
• DIAGNOSIS:

- 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 OBD-II general scan tool display.

• WIRING DIAGRAM:



B2M4633

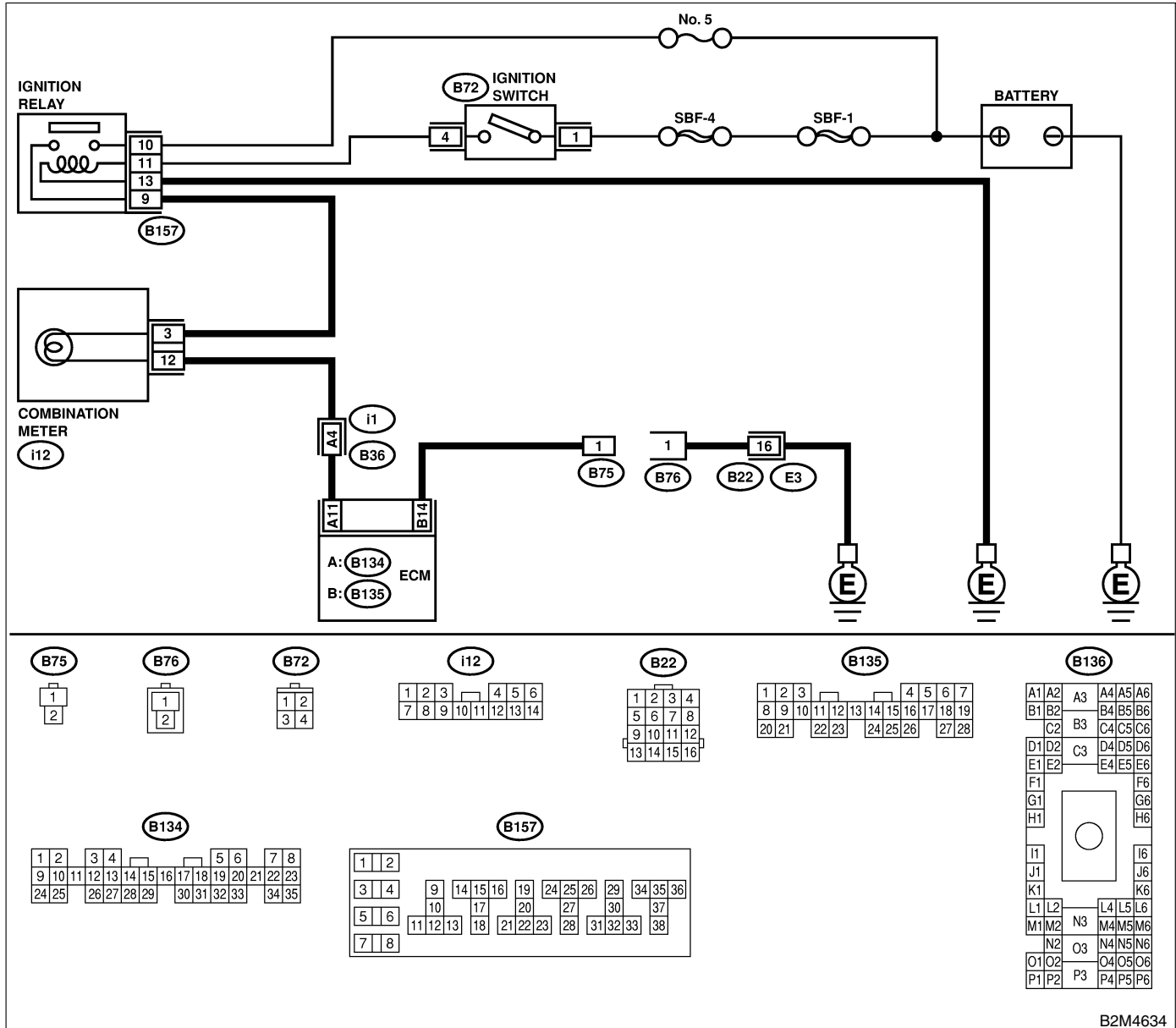
No.	Step	Check	Yes	No
1	CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Turn ignition switch to ON.	Does the MIL come on?	Repair short circuit in harness between combination meter and ECM connector.	Replace ECM. <Ref. to FU-51, Engine Control Module.>

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

E: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) DOES NOT BLINK AT A CYCLE OF 3 Hz. S078653E92

- **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:**



B2M4634

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

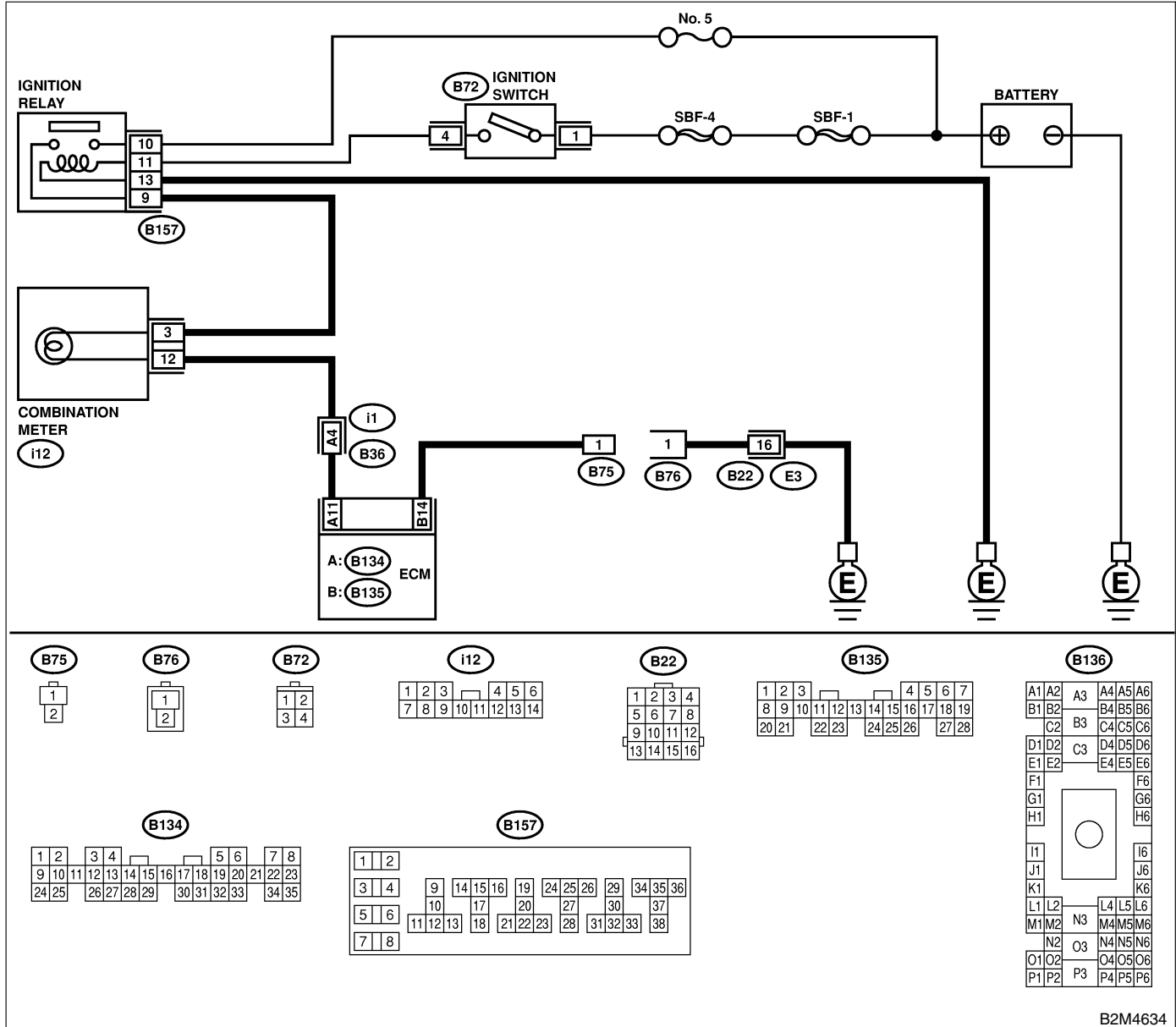
No.	Step	Check	Yes	No
1	CHECK STATUS OF CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL). 1) Turn ignition switch to OFF. 2) Disconnect test mode connector. 3) Turn ignition switch to ON. (engine OFF)	Does the MIL come on?	Go to step 2.	Repair the MIL circuit. <Ref. to EN-60, CHECK ENGINE MALFUNCTION INDICATOR 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 resistance 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 (B135) No. 14 — Chassis ground:	Is resistance 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-51, Engine Control Module.>

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

F: CHECK ENGINE MALFUNCTION INDICATOR LAMP (MIL) REMAINS BLINKING AT A CYCLE OF 3 Hz. S078653E93

- **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:**



B2M4634

No.	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.

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

No.	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 (B135) No. 14 — Chassis ground:	Is resistance less than 5 Ω ?	Repair short circuit in harness between ECM and test mode connector.	Replace ECM. <Ref. to FU-51, Engine Control Module.>

ENGINE MALFUNCTION INDICATOR LAMP (MIL)

Engine (Diagnostics)

MEMO:

17. Diagnostics for Engine Starting Failure

S078533

A: PROCEDURE

S078533E45

1. Inspection of starter motor circuit. <Ref. to EN-70, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
2. Inspection of ECM power supply and ground line. <Ref. to EN-74, CONTROL MODULE POWER SUPPLY AND GROUND LINE, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ignition control system. <Ref. to EN-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
4. Inspection of fuel pump circuit. <Ref. to EN-82, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel injector circuit. <Ref. to EN-86, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

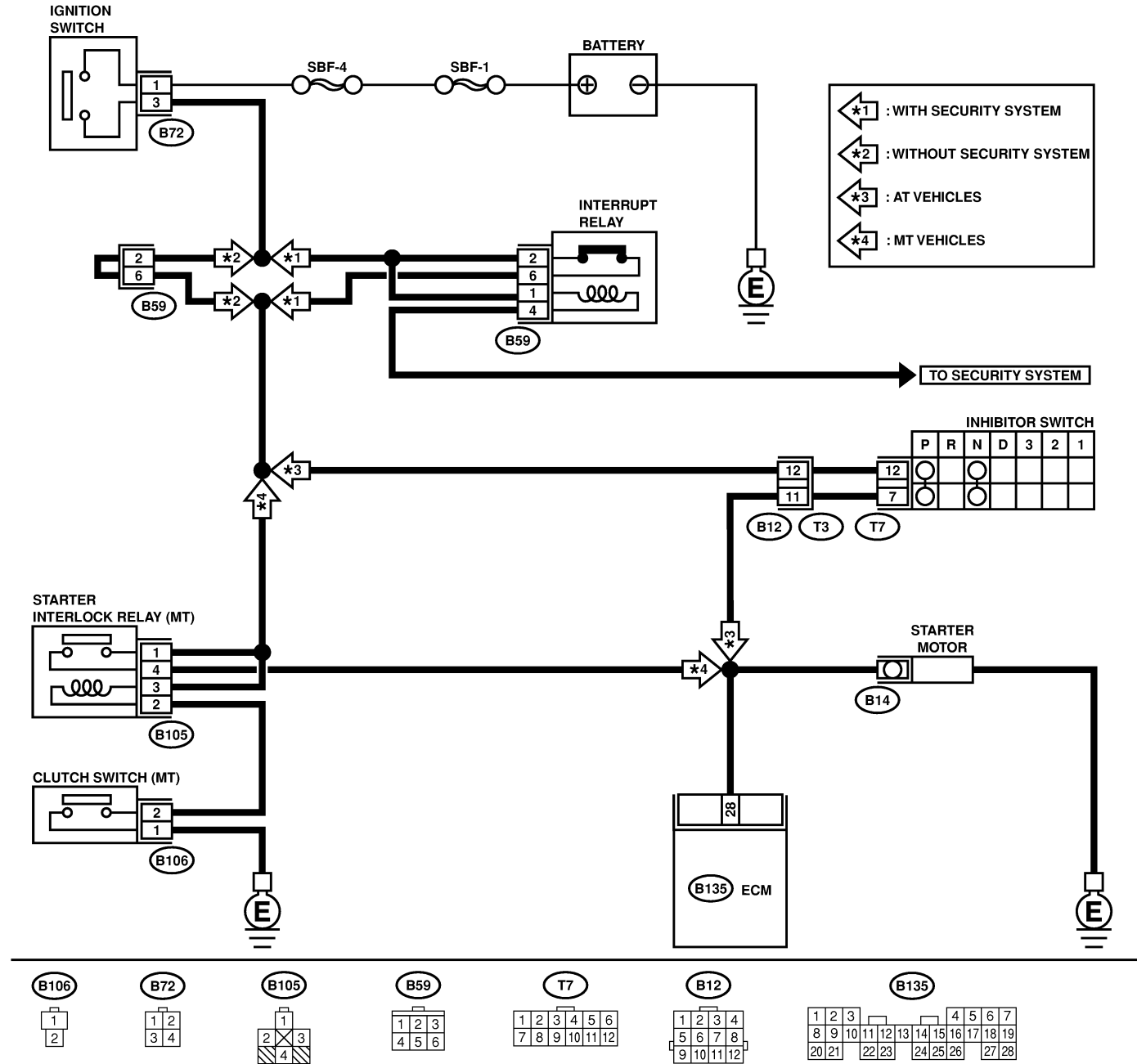
B: STARTER MOTOR CIRCUIT

S078533E94

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN-55, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN-48, Inspection Mode.>.

● WIRING DIAGRAM:



B2M4635

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR.	Does starter motor operate when the switch starts?	Go to step 2.	Go to step 3.
2	CHECK DTC. <Ref. to EN-47, OPERATION, Read Diagnostic Trouble Code.>	Is the trouble code stored in memory? <Ref. to EN-88, LIST, List of Diagnostic Trouble Code (DTC).>	Record DTC. Repair the trouble case. <Ref. to EN-26, Engine Control Module (ECM) I/O Signal.>	Go to step 3.
3	CHECK INPUT SIGNAL FOR STARTER MOTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from starter motor. 3) Turn ignition switch to ST. 4) Measure 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.	Is the voltage more than 10 V?	Go to step 4.	Go to step 5.
4	CHECK GROUND CIRCUIT OF STARTER MOTOR. 1) Turn ignition switch to OFF. 2) Disconnect starter motor ground cable. 3) Measure resistance of ground cable between ground cable terminal and engine ground.	Is resistance less than 5 Ω ?	Check starter motor. <Ref. to SC-7, Starter.>	Repair open circuit of ground cable.
5	CHECK HARNESS BETWEEN ECM AND STARTER MOTOR CIRCUIT. 1) Turn ignition switch to OFF. 2) Measure resistance between starter motor and ECM. Connector & terminal (B14) No. 1 — Engine ground:	Is resistance less than 1 Ω ?	Repair ground short circuit.	Go to step 6.
6	CHECK HARNESS BETWEEN ECM AND STARTER MOTOR CIRCUIT. 1) Turn ignition switch to START. 2) Measure resistance of fuse. Connector & terminal (B14) No. 1 — Engine ground:	Is resistance less than 1 Ω ?	Go to step 7.	Repair ground short circuit.
7	CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR. 1) Ignition switch to OFF. 2) Disconnect connector from ignition switch. 3) Measure power supply voltage between ignition switch connector and chassis ground. Connector & terminal (B72) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 8.	Repair open circuit in harness between ignition switch and battery.
8	CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR. 1) Connect connector to ignition switch. 2) Turn ignition switch to START. 3) Measure voltage between ignition switch and chassis ground. Connector & terminal (B72) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 9.	Replace ignition switch.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
9	CHECK TRANSMISSION TYPE.	Is the vehicle AT?	Go to step 10.	Repair open circuit between ignition switch and starter motor circuit.
10	CHECK INHIBITOR SWITCH CIRCUIT. 1) Turn ignition switch to OFF. 2) Place the selector lever in the "P" or "N" position. 3) Separate transmission harness connector. 4) Measure resistance between transmission harness connector receptacle's terminals. Connector & terminal (T3) No. 11 — No. 12:	Is the resistance less than 1 Ω ?	Repair open circuit in harness between starter motor and ignition switch connector.	Go to step 11.
11	CHECK TRANSMISSION HARNESS. 1) Disconnect connector from inhibitor switch. 2) Measure resistance of harness between transmission harness and inhibitor switch connector. Connector & terminal (T3) No. 11 — (T7) No. 7:	Is the resistance less than 1 Ω ?	Go to step 12.	Repair open circuit in harness between transmission harness and inhibitor switch connector.
12	CHECK POOR CONTACT. Check poor contact in inhibitor switch connector.	Is there poor contact in inhibitor switch connector?	Repair poor contact in inhibitor switch connector.	Replace inhibitor switch.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

MEMO:

Engine (Diagnostics)

CAUTION:

- **WIRING DIAGRAM:**



No.	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 resistance less than 10 Ω?	Go to step 2.	Replace main relay.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
2	CHECK GROUND CIRCUIT OF ECM. 1) Disconnect connector from ECM. 2) Measure resistance of harness between ECM and chassis ground. Connector & terminal <i>(B135) No. 25 — Chassis ground:</i> <i>(B136) No. 21 — Chassis ground:</i> <i>(B136) No. 22 — Chassis ground:</i> <i>(B134) No. 27 — Chassis ground:</i> <i>(B134) No. 8 — Chassis ground:</i> <i>(B134) No. 7 — Chassis ground:</i> <i>(B134) No. 34 — Chassis ground:</i> <i>(B134) No. 35 — Chassis ground:</i>	Is the resistance 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 <i>(B136) No. 9 (+) — Chassis ground (-):</i>	Is the voltage more than 10 V?	Go to step 4.	Repair open or 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 <i>(B135) No. 7 (+) — Chassis ground (-):</i>	Is the voltage 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 <i>(B135) No. 19 — Chassis ground:</i>	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair ground short circuit in harness between ECM connector and main relay connector, then replace ECM.
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 <i>(B135) No. 19 (+) — Chassis ground (-):</i>	Is the voltage 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 <i>(B47) No. 2 (+) — Chassis ground (-):</i>	Is the voltage more than 10 V?	Go to step 8.	Repair open circuit in harness between ECM connector and main relay connector.
8	CHECK GROUND CIRCUIT OF MAIN RELAY. 1) Turn ignition switch to OFF. 2) Measure resistance between main relay connector and chassis ground. Connector & terminal <i>(B47) No. 1 — Chassis ground:</i>	Is the resistance 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 <i>(B47) No. 5 (+) — Chassis ground (-):</i> <i>(B47) No. 6 (+) — Chassis ground (-):</i>	Is the voltage more than 10 V?	Go to step 10.	Repair open or ground short circuit in harness of power supply circuit.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 (B136) No. 1 (+) — Chassis ground (-): (B136) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Check ignition control system. <Ref. to EN-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair open or ground short circuit in harness between ECM connector and main relay connector.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

MEMO:

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

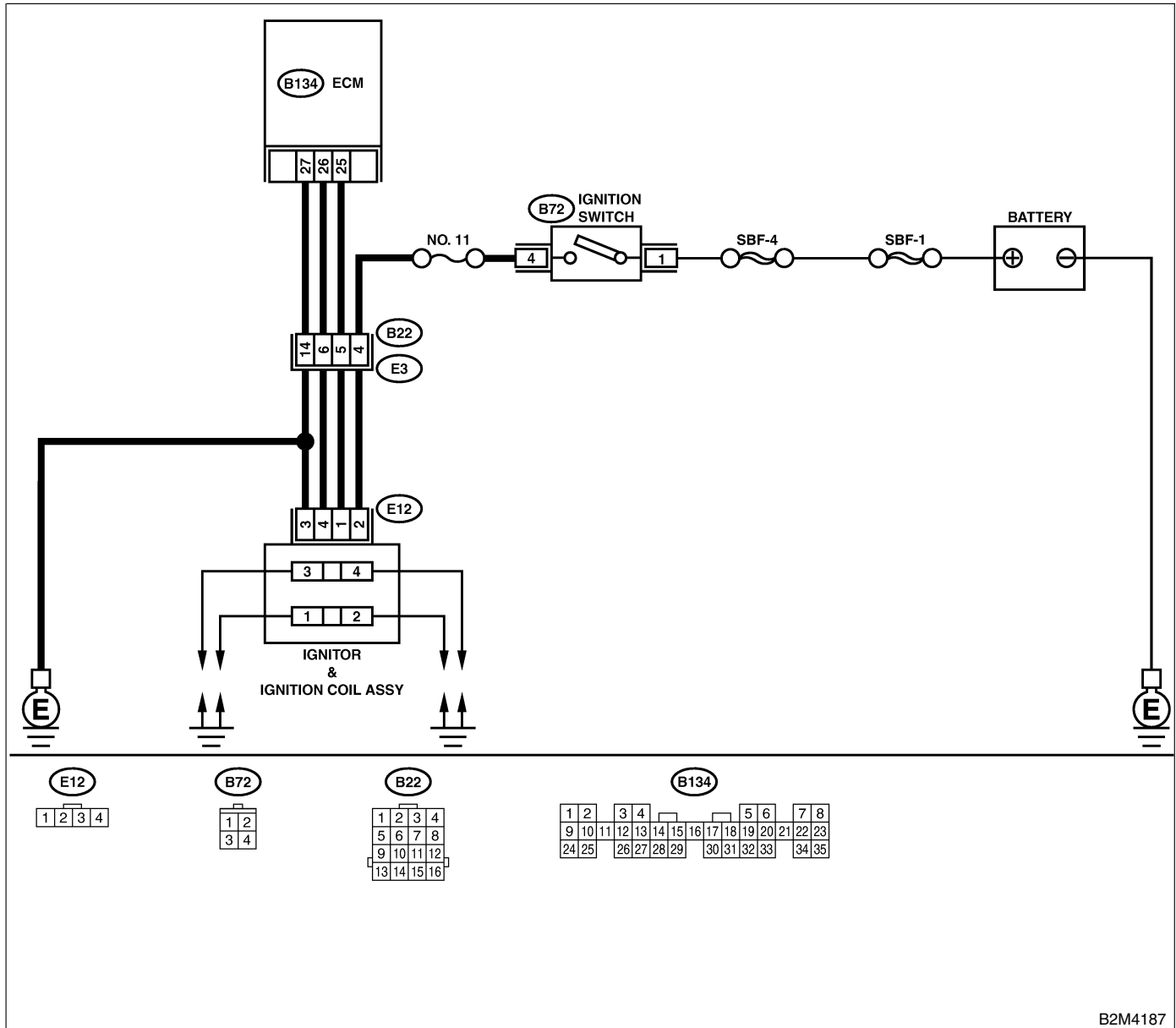
D: IGNITION CONTROL SYSTEM

S078533E95

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● WIRING DIAGRAM:



B2M4187

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK SPARK PLUG CONDITION. 1) Remove the spark plug. <Ref. to IG-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG-5, INSPECTION, Spark Plug.>	Is the spark plug's status OK?	Go to step 2.	Replace the spark plug.
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-82, 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 voltage 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 resistance between 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 resistance between 10 and 15 k Ω ?	Go to step 6.	Replace ignition coil & ignitor assembly. <Ref. to IG-7, Ignition Coil and Ignitor Assembly.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 voltage more than 10 V?	Go to step 7.	Replace ignition coil & ignitor assembly. <Ref. to IG-7, Ignition Coil and Ignitor Assembly.>
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. 25 — (E12) No. 1: (B134) No. 26 — (E12) No. 4:	Is the resistance 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. 25 — Engine ground: (B134) No. 26 — Engine ground:	Is the resistance more than 1 M Ω ?	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-82, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>

MEMO:

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

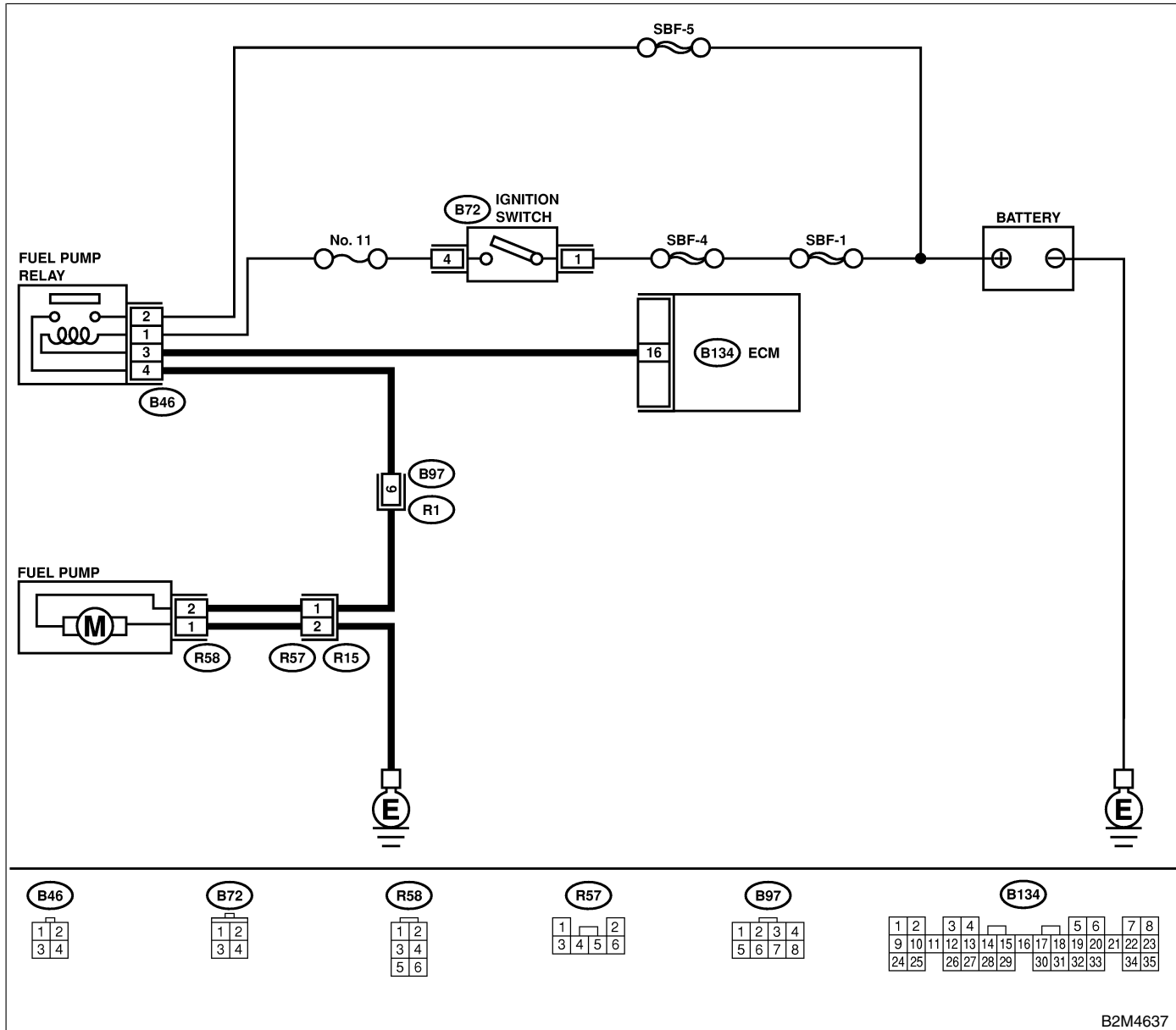
E: FUEL PUMP CIRCUIT

S078533E96

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● WIRING DIAGRAM:



B2M4637

No.	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-56, Compulsory Valve Operation Check Mode.>	Does fuel pump produce operating sound?	Check fuel injector circuit. <Ref. to EN-86, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
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. 4 — Chassis ground:	Is the resistance 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. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace fuel pump. <Ref. to FU-73, 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. 1 — (B46) No. 4:	Is the resistance 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. 1 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair short circuit in harness between fuel pump and fuel pump relay connector.
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 resistance less than 10 Ω ?	Go to step 7.	Replace fuel pump relay. <Ref. to FU-53, Fuel Pump Relay.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	Step	Check	Yes	No
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. 16 — (B46) No. 3:	Is the resistance 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-86, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

MEMO:

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

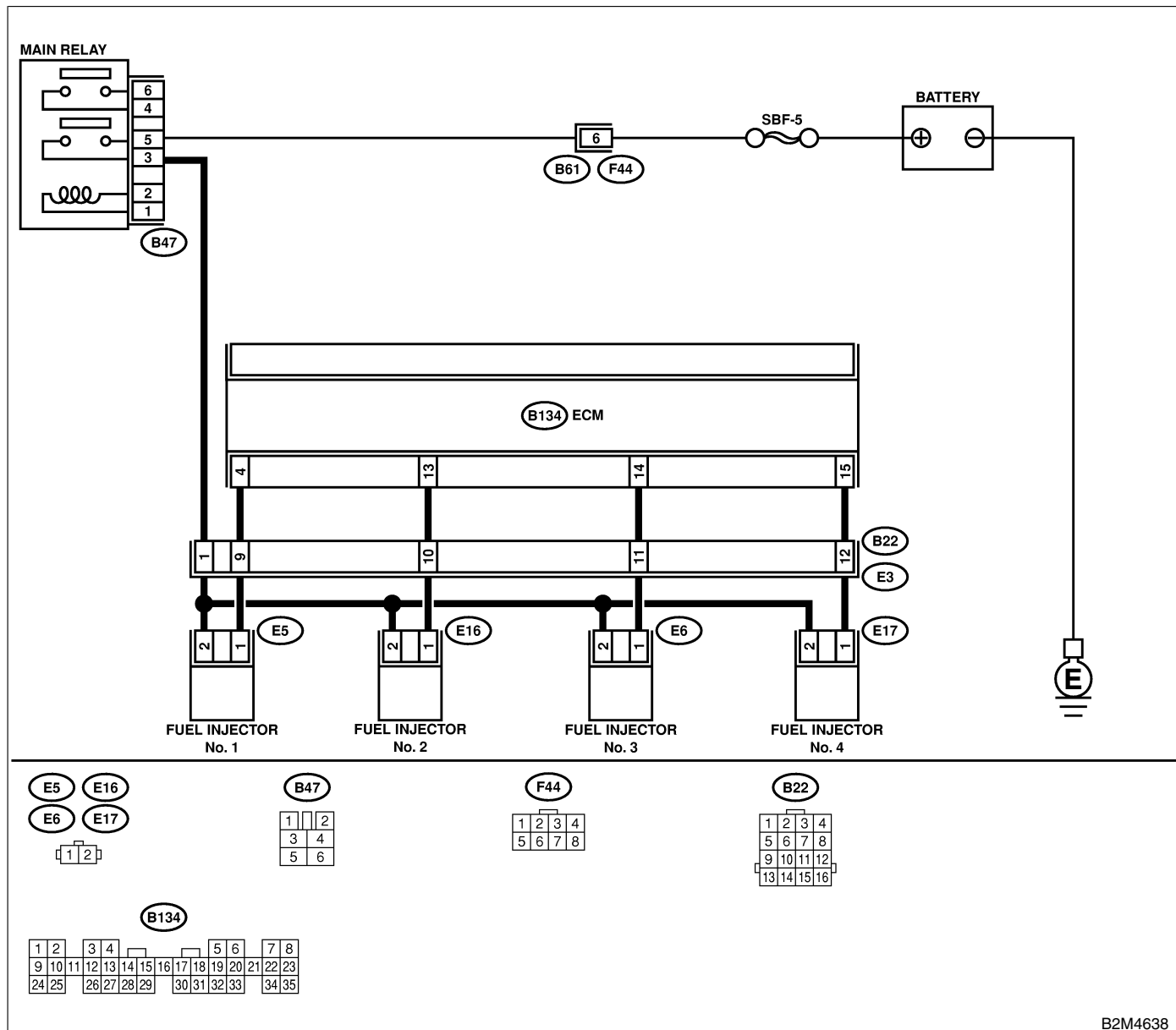
F: FUEL INJECTOR CIRCUIT

S078533E97

CAUTION:

- Check or repair only faulty parts.
- After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode. <Ref. to EN-48, OPERATION, Inspection Mode.>

• WIRING DIAGRAM:



B2M4638

No.	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.	Is the fuel injector emits "operating" sound?	Check fuel pressure. <Ref. to ME-28, INSPECTION, Fuel Pressure.>	Go to step 2.

DIAGNOSTICS FOR ENGINE STARTING FAILURE

Engine (Diagnostics)

No.	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 voltage 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. 4 — (E5) No. 1: (B134) No. 13 — (E16) No. 1: (B134) No. 14 — (E6) No. 1: (B134) No. 15 — (E17) No. 1:	Is the resistance 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. 4 — Chassis ground: (B134) No. 13 — Chassis ground: (B134) No. 14 — Chassis ground: (B134) No. 15 — Chassis ground:	Is the resistance more than 1 M Ω ?	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 resistance between 5 and 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-350, INSPECTION, General Diagnostic Table.>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

18. List of Diagnostic Trouble Code (DTC)

S078525

A: LIST

S078525A12

DTC No.	Item	Index
P0031	Front oxygen (A/F) sensor heater circuit low input	<Ref. to EN-96, DTC P0031 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	Front oxygen (A/F) sensor heater circuit high input	<Ref. to EN-100, DTC P0032 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	Rear oxygen sensor heater circuit low input	<Ref. to EN-102, DTC P0037 — REAR OXYGEN SENSOR HEATER CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	Rear oxygen sensor heater circuit high input	<Ref. to EN-106, DTC P0038 — REAR OXYGEN SENSOR HEATER CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0065	Air assist injector solenoid valve malfunction	<Ref. to EN-108, DTC P0065 — AIR ASSIST INJECTOR SOLENOID VALVE MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0066	Air assist injector solenoid valve circuit low input	<Ref. to EN-110, DTC P0066 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0067	Air assist injector solenoid valve circuit high input	<Ref. to EN-112, DTC P0067 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0106	Pressure sensor circuit range/performance problem (low input)	<Ref. to EN-114, DTC P0106 — PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Pressure sensor circuit low input	<Ref. to EN-116, DTC P0107 — PRESSURE SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Pressure sensor circuit high input	<Ref. to EN-120, DTC P0108 — PRESSURE SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake air temperature sensor circuit range/performance problem	<Ref. to EN-124, DTC P0111 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake air temperature sensor circuit low input	<Ref. to EN-126, DTC P0112 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake air temperature sensor circuit high input	<Ref. to EN-128, DTC P0113 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine coolant temperature sensor circuit low input	<Ref. to EN-132, DTC P0117 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine coolant temperature sensor circuit high input	<Ref. to EN-134, DTC P0118 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0121	Throttle position sensor circuit range/performance problem (high input)	<Ref. to EN-138, DTC P0121 — THROTTLE POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P0122	Throttle position sensor circuit low input	<Ref. to EN-140, DTC P0122 — THROTTLE POSITION SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle position sensor circuit high input	<Ref. to EN-144, DTC P0123 — THROTTLE POSITION SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient coolant temperature for closed loop fuel control	<Ref. to EN-146, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Thermostat malfunction	<Ref. to EN-148, DTC P0128 — THERMOSTAT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0130	Front oxygen (A/F) sensor circuit range/performance problem (Lean)	<Ref. to EN-150, DTC P0130 — FRONT OXYGEN (A/F) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	Front oxygen (A/F) sensor circuit malfunction (open circuit)	<Ref. to EN-154, DTC P0131 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (OPEN CIRCUIT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	Front oxygen (A/F) sensor circuit malfunction (short circuit)	<Ref. to EN-156, DTC P0132 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (SHORT CIRCUIT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	Front oxygen (A/F) sensor circuit slow response	<Ref. to EN-158, DTC P0133 — FRONT OXYGEN (A/F) SENSOR CIRCUIT SLOW RESPONSE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	Rear oxygen sensor circuit low input	<Ref. to EN-160, DTC P0137 — REAR OXYGEN SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	Rear oxygen sensor circuit high input	<Ref. to EN-164, DTC P0138 — REAR OXYGEN SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	Rear oxygen sensor circuit slow response	<Ref. to EN-168, DTC P0139 — REAR OXYGEN SENSOR CIRCUIT SLOW RESPONSE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	Fuel trim malfunction (Lean)	<Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	Fuel trim malfunction (Rich)	<Ref. to EN-170, DTC P0172 — FUEL TRIM #1 (RH) MALFUNCTION (A/F TOO RICH) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel temperature sensor A circuit range/performance problem	<Ref. to EN-172, DTC P0181 — FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel temperature sensor A circuit low input	<Ref. to EN-174, DTC P0182 — FUEL TEMPERATURE SENSOR A CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel temperature sensor A circuit high input	<Ref. to EN-176, DTC P0183 — FUEL TEMPERATURE SENSOR A CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 misfire detected	<Ref. to EN-179, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 misfire detected	<Ref. to EN-179, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P0303	Cylinder 3 misfire detected	<Ref. to EN-179, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 misfire detected	<Ref. to EN-180, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock sensor circuit low input	<Ref. to EN-188, DTC P0327 — KNOCK SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock sensor circuit high input	<Ref. to EN-190, DTC P0328 — KNOCK SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft position sensor circuit malfunction	<Ref. to EN-192, DTC P0335 — CRANKSHAFT POSITION SENSOR CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft position sensor circuit range/performance problem	<Ref. to EN-194, DTC P0336 — CRANKSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft position sensor circuit malfunction	<Ref. to EN-196, DTC P0340 — CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft position sensor circuit range/performance problem	<Ref. to EN-198, DTC P0341 — CAMSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst system efficiency below threshold	<Ref. to EN-202, DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0442	Evaporative emission control system malfunction	<Ref. to EN-204, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative emission control system vent control low input	<Ref. to EN-208, DTC P0447 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative emission control system vent control high input	<Ref. to EN-212, DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative emission control system pressure sensor range/performance problem	<Ref. to EN-214, DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative emission control system pressure sensor low input	<Ref. to EN-216, 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-220, DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative emission control system malfunction	<Ref. to EN-224, DTC P0456 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative emission control system malfunction	<Ref. to EN-228, DTC P0457 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative emission control system purge control valve circuit low input	<Ref. to EN-232, DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P0459	Evaporative emission control system purge control valve circuit high input	<Ref. to EN-236, DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel level sensor circuit low input	<Ref. to EN-238, 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-242, DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel level sensor intermittent input	<Ref. to EN-246, DTC P0464 — FUEL LEVEL SENSOR INTERMITTENT INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0483	Cooling fan function problem	<Ref. to EN-248, DTC P0483 — COOLING FAN FUNCTION PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle speed sensor malfunction	<Ref. to EN-252, DTC P0500 — VEHICLE SPEED SENSOR MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle control system RPM lower than expected	<Ref. to EN-254, 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-256, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter switch circuit high input	<Ref. to EN-258, DTC P0512 — STARTER SWITCH CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal control module memory check sum error	<Ref. to EN-261, DTC P0604 — INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0691	Cooling fan relay 1 circuit low input	<Ref. to EN-262, DTC P0691 — COOLING FAN RELAY 1 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0692	Cooling fan relay 1 circuit high input	<Ref. to EN-266, DTC P0692 — COOLING FAN RELAY 1 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0703	Brake switch input malfunction	<Ref. to EN-270, DTC P0703 — BRAKE SWITCH INPUT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0705	Transmission range sensor circuit malfunction	<Ref. to AT-122, CHECK INHIBITOR SWITCH, Diagnostic Procedure for No-Trouble Code (DTC).>
P0710	Transmission fluid temperature sensor circuit malfunction	<Ref. to AT-48, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0715	Torque converter turbine speed sensor circuit malfunction	<Ref. to AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output speed sensor (vehicle speed sensor 2) circuit malfunction	<Ref. to AT-60, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0725	Engine speed input circuit malfunction	<Ref. to AT-44, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	Gear 1 incorrect ratio	<Ref. to EN-272, DTC P0731 — GEAR 1 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P0732	Gear 2 incorrect ratio	<Ref. to EN-272, DTC P0732 — GEAR 2 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	Gear 3 incorrect ratio	<Ref. to EN-272, DTC P0733 — GEAR 3 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0734	Gear 4 incorrect ratio	<Ref. to EN-273, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0741	Torque converter clutch system malfunction	<Ref. to EN-274, DTC P0741 — TORQUE CONVERTER CLUTCH SYSTEM MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque converter clutch system (Lock-up duty solenoid) electrical	<Ref. to AT-100, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0748	Pressure control solenoid (Line pressure duty solenoid) electrical	<Ref. to AT-90, DTC 75 LINE PRESSURE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0753	Shift solenoid A (Shift solenoid 1) electrical	<Ref. to AT-74, DTC 71 SHIFT SOLENOID 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift solenoid B (Shift solenoid 2) electrical	<Ref. to AT-78, DTC 72 SHIFT SOLENOID 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0778	2-4 brake pressure control solenoid valve circuit malfunction	<Ref. to AT-94, DTC 76 2-4 BRAKE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0785	2-4 brake timing control solenoid valve circuit malfunction	<Ref. to AT-86, DTC 74 2-4 BRAKE TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral position switch circuit low input	<Ref. to EN-276, DTC P0851 — NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> and <Ref. to EN-278, DTC P0851 — NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT (MT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral position switch circuit high input	<Ref. to EN-280, DTC P0852 — NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> and <Ref. to EN-284, DTC P0852 — NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT (MT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0864	Automatic transmission diagnosis input signal circuit malfunction	<Ref. to EN-288, DTC P0864 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0865	Automatic transmission diagnosis input signal circuit low input	<Ref. to EN-290, DTC P0865 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0866	Automatic transmission diagnosis input signal circuit high input	<Ref. to EN-292, DTC P0866 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1110	Atmospheric pressure sensor low input	<Ref. to EN-294, DTC P1110 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1111	Atmospheric pressure sensor high input	<Ref. to EN-294, DTC P1111 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P1112	Atmospheric pressure sensor range/performance problem	<Ref. to EN-295, DTC P1112 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1137	Front oxygen (A/F) sensor circuit range/performance problem	<Ref. to EN-296, DTC P1137 — FRONT OXYGEN (A/F) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1142	Throttle position sensor circuit range/performance problem (low input)	<Ref. to EN-300, DTC P1142 — THROTTLE POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1146	Pressure sensor circuit range/performance problem (high input)	<Ref. to EN-302, DTC P1146 — PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel tank pressure control solenoid valve circuit low input	<Ref. to EN-304, DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel tank pressure control solenoid valve circuit high input	<Ref. to EN-308, DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1442	Fuel level sensor circuit range/performance problem 2	<Ref. to EN-310, DTC P1442 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM 2 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Evaporative emission control system vent control function problem	<Ref. to EN-312, DTC P1443 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL FUNCTION PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1446	Evaporative emission control system atmospheric pressure solenoid valve circuit low input	<Ref. to EN-314, DTC P1446 — EVAPORATIVE EMISSION CONTROL SYSTEM ATMOSPHERIC PRESSURE SOLENOID VALVE LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1447	Evaporative emission control system atmospheric pressure solenoid valve circuit high input	<Ref. to EN-318, DTC P1447 — EVAPORATIVE EMISSION CONTROL SYSTEM ATMOSPHERIC PRESSURE SOLENOID VALVE HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1448	Evaporative emission control system atmospheric pressure solenoid valve circuit range/performance problem	<Ref. to EN-320, DTC P1448 — EVAPORATIVE EMISSION CONTROL SYSTEM ATMOSPHERIC PRESSURE SOLENOID VALVE RANGE/PERFORMANCE PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1507	Idle control system malfunction (fail-safe)	<Ref. to EN-322, DTC P1507 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1510	Idle air control solenoid valve signal 1 circuit low input	<Ref. to EN-324, DTC P1510 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1511	Idle air control solenoid valve signal 1 circuit high input	<Ref. to EN-324, DTC P1511 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1512	Idle air control solenoid valve signal 2 circuit low input	<Ref. to EN-324, DTC P1512 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1513	Idle air control solenoid valve signal 2 circuit high input	<Ref. to EN-324, DTC P1513 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

DTC No.	Item	Index
P1514	Idle air control solenoid valve signal 3 circuit low input	<Ref. to EN-324, DTC P1514 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1515	Idle air control solenoid valve signal 3 circuit high input	<Ref. to EN-324, DTC P1515 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1516	Idle air control solenoid valve signal 4 circuit low input	<Ref. to EN-326, DTC P1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1517	Idle air control solenoid valve signal 4 circuit high input	<Ref. to EN-330, DTC P1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1518	Starter switch circuit low input	<Ref. to EN-332, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1540	Vehicle speed sensor malfunction 2	<Ref. to EN-336, DTC P1540 — VEHICLE SPEED SENSOR MALFUNCTION 2 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up voltage circuit malfunction	<Ref. to EN-338, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1698	Engine torque control cut signal circuit low input	<Ref. to EN-340, DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1699	Engine torque control cut signal circuit high input	<Ref. to EN-342, DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1700	Throttle position sensor circuit malfunction for automatic transmission	<Ref. to AT-52, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1701	Cruise control set signal circuit malfunction for automatic transmission	<Ref. to EN-344, DTC P1701 — CRUISE CONTROL SET SIGNAL CIRCUIT MALFUNCTION FOR AUTOMATIC TRANSMISSION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1703	Low clutch timing control solenoid valve circuit malfunction	<Ref. to AT-82, DTC 73 LOW CLUTCH TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1711	Engine torque control signal 1 circuit malfunction	<Ref. to EN-346, 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-348, DTC P1712 — ENGINE TORQUE CONTROL SIGNAL 2 CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

LIST OF DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

19. Diagnostic Procedure with Diagnostic Trouble Code (DTC) S078521

A: DTC P0031 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT LOW INPUT — S078521F83

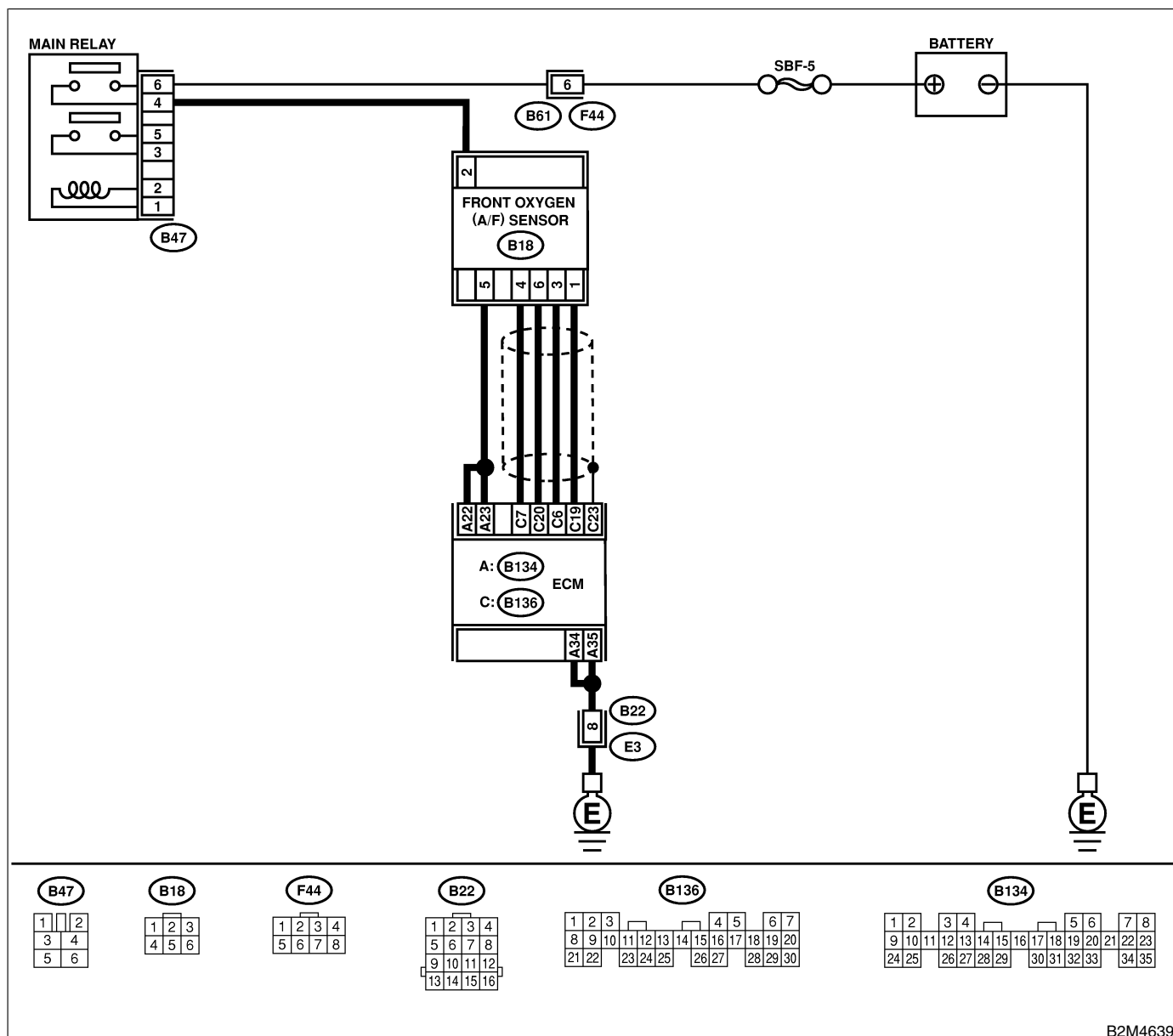
- DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

- WIRING DIAGRAM:



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1132 and P0141 at the same time?	Go to step 2.	Go to step 5.
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. 2 (+) — Engine ground (-):	Is the voltage 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 (B134) No. 35 — Chassis ground:	Is the resistance 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 GROUND CIRCUIT OF ECM. 1) Measure resistance of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 34 — Chassis ground:	Is there resistance less than 5 Ω ?	Go to step 5.	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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
5	CHECK CURRENT DATA. 1) Start engine 2) Read data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value more 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.
6	CHECK OUTPUT SIGNAL FROM ECM. 1) Start and idle the engine. 2) Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 22 (+) — Chassis ground (-):	Is the voltage less than 1.0 V?	Go to step 8.	Go to step 7.
7	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 22 (+) — Chassis ground (-):	Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair poor contact in ECM connector.	Go to step 8.
8	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 23 (+) — Chassis ground (-):	Is the voltage less than 1.0 V?	Go to step 10.	Go to step 9.
9	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 23 (+) — Chassis ground (-):	Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair poor contact in ECM connector.	Go to step 10.
10	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. 2 — No. 5:	Is the resistance 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 EC-47, Front Oxygen (A/F) Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

B: DTC P0032 — FRONT OXYGEN (A/F) SENSOR HEATER CIRCUIT HIGH INPUT — S078521F84

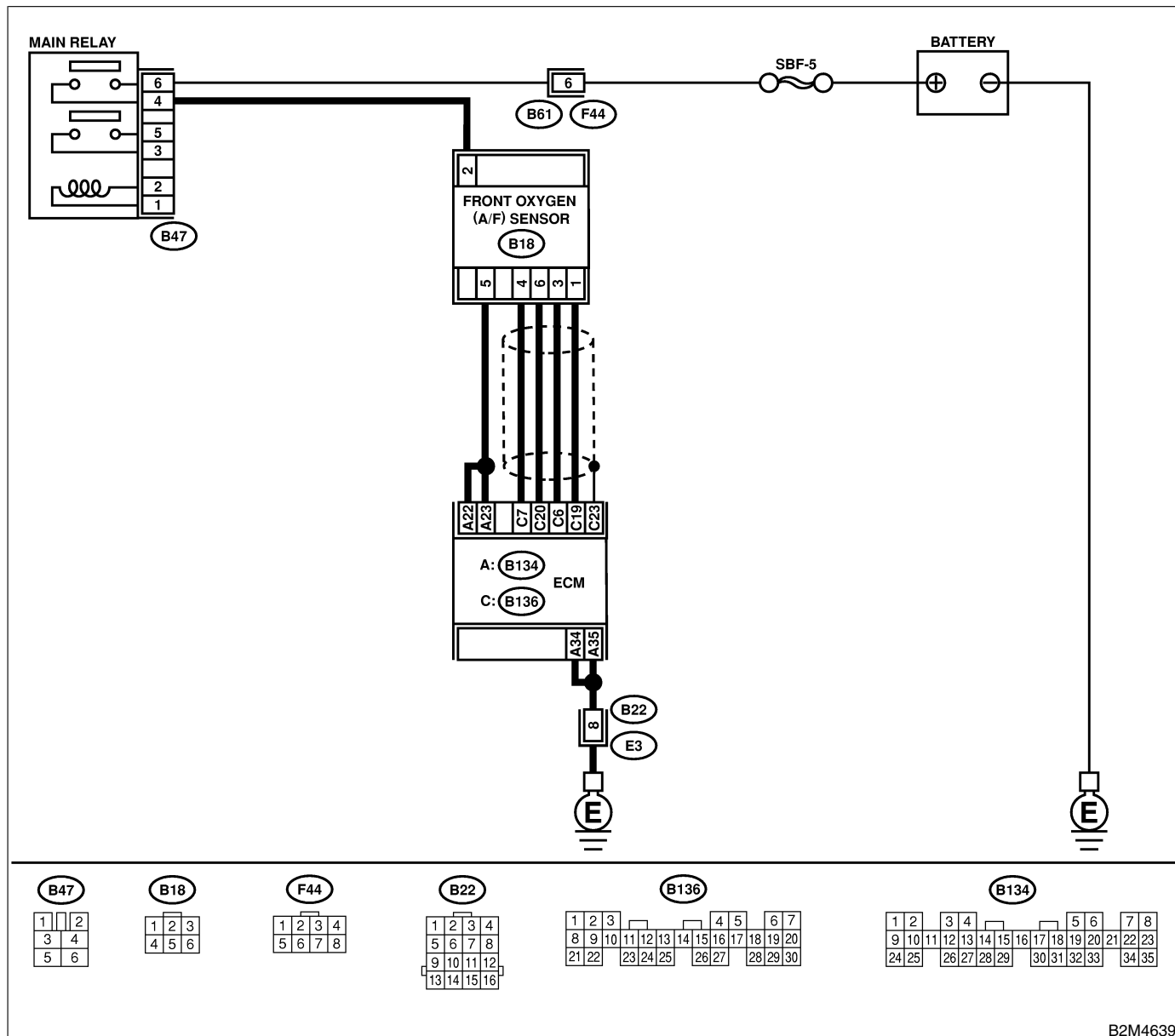
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. 23 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Go to step 3.	Go to step 2.
2	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 22 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Go to step 3.	Go to step 4.
3	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value more than 2.3 A?	Replace ECM. <Ref. to FU-51, Engine Control Module.>	END
4	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 23 (+) — Chassis ground (-):	Does the voltage change more than 8 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	Go to step 5.
5	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 22 (+) — Chassis ground (-):	Does the voltage change more than 8 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	END

C: DTC P0037 — REAR OXYGEN SENSOR HEATER CIRCUIT LOW INPUT —

S078521G89

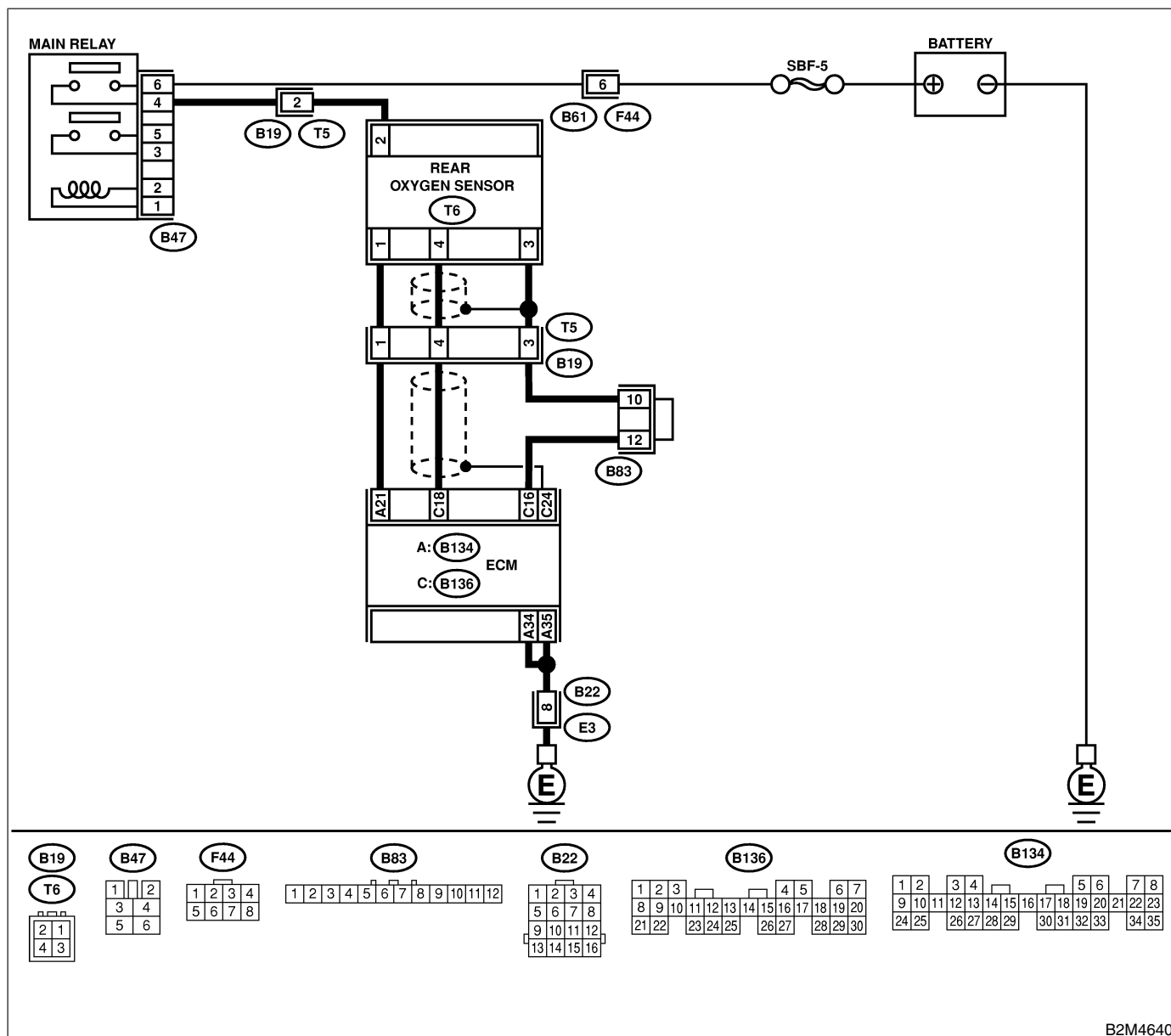
• DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



B2M4640

No.	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 (B134) No. 35 — Chassis ground:	Is the resistance less than 5 Ω?	Go to step 3.	Go to step 2.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
2	CHECK GROUND CIRCUIT OF ECM. 1) 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 (B22) 2) Measure resistance of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 34 — Chassis ground:	Is the resistance 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 and engine ground terminal ● Poor contact in ECM connector ● Poor contact in coupling connector
3	CHECK CURRENT DATA. 1) Start engine. 2) Read data of rear oxygen sensor heater current using Subaru Select Monitor or OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 4.
4	CHECK OUTPUT SIGNAL FROM ECM. 1) Start and idle the engine. 2) Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 21 (+) — Chassis ground (-):	Is the voltage less than 1.0 V?	Go to step 7.	Go to step 5.
5	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 21 (+) — Chassis ground (-):	Does the voltage change less than 1.0 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair poor contact in ECM connector.	Go to step 6.
6	CHECK OUTPUT SIGNAL FROM ECM. 1) Disconnect connector from rear oxygen sensor. 2) Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 21 (+) — Chassis ground (-):	Is the voltage 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-51, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
7	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 voltage more than 10 V?	Go to step 8.	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
8	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 resistance 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-49, Rear Oxygen Sensor.>

MEMO:

D: DTC P0038 — REAR OXYGEN SENSOR HEATER CIRCUIT HIGH INPUT —

S078521F86

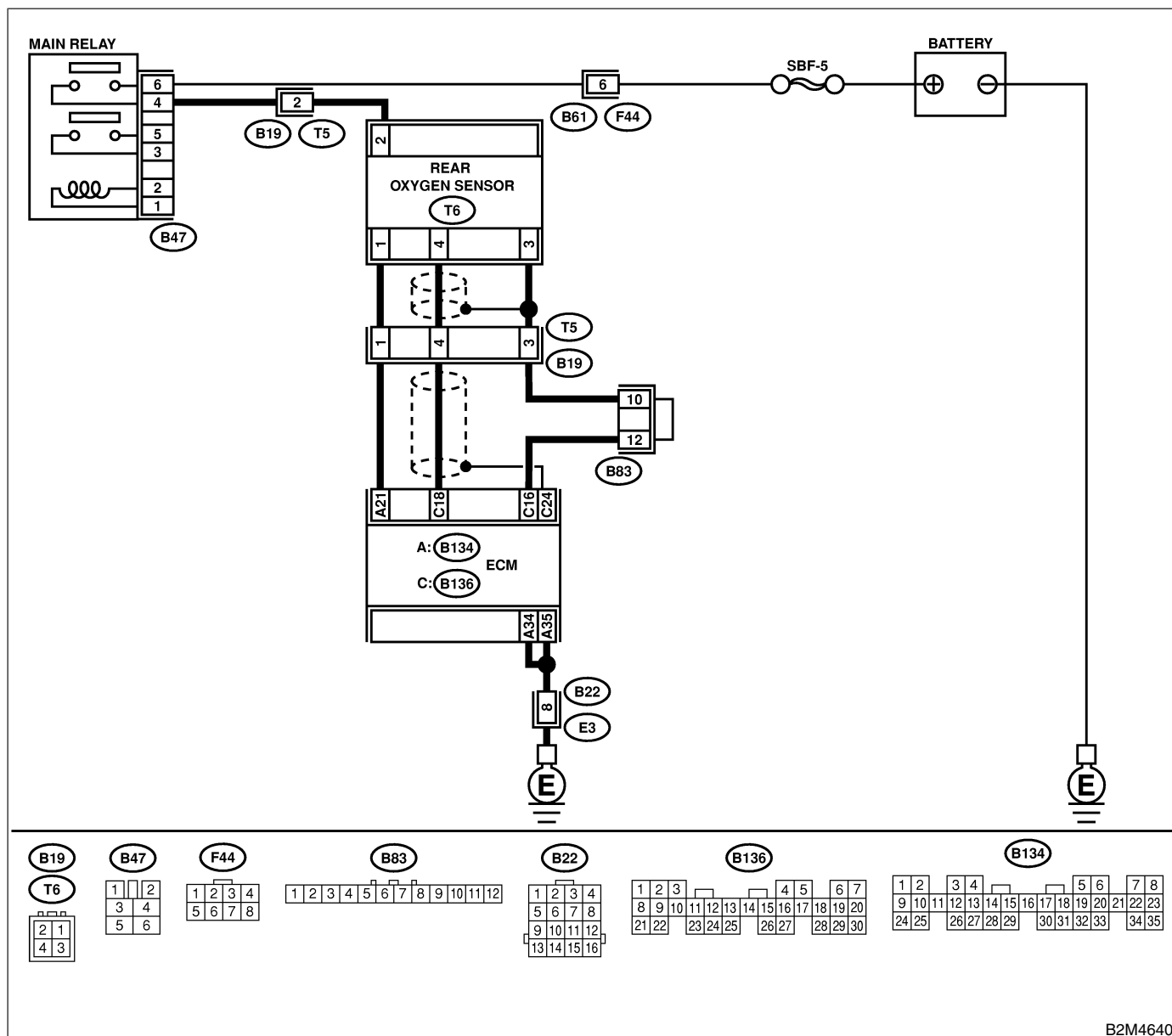
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4640

No.	Step	Check	Yes	No
1	CHECK INPUT SIGNAL FOR ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 21 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value more than 7 A?	Replace ECM. <Ref. to FU-51, 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

Engine (Diagnostics)

— S078521F87

- Two consecutive driving cycles with fault

- Erroneous idling
- Engine stalls.

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

MAIN RELAY

AIR ASSIST INJECTOR SOLENOID VALVE

BATTERY

SBF-5

F44

B61

B47

E42

E3

B22

B134 ECM

E

E42

B47

F44

B22

B134

B2M464

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-56, Compulsory Valve Operation Check Mode.>	Does air assist injector solenoid valve operating sound?	Go to step 3.	Replace air assist injector solenoid valve. <Ref. to FU-40, 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 damaged?	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-41, REMOVAL, Fuel Injector.> 3) Check for clogged fuel injectors.	Is fuel injector clogged?	Replace fuel injector. <Ref. to FU-41, INSTALLATION, Fuel Injector.>	Replace air assist injector solenoid valve. <Ref. to FU-40, Air Assist Injector Solenoid Valve.>

F: DTC P0066 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT LOW INPUT — S078521F88

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

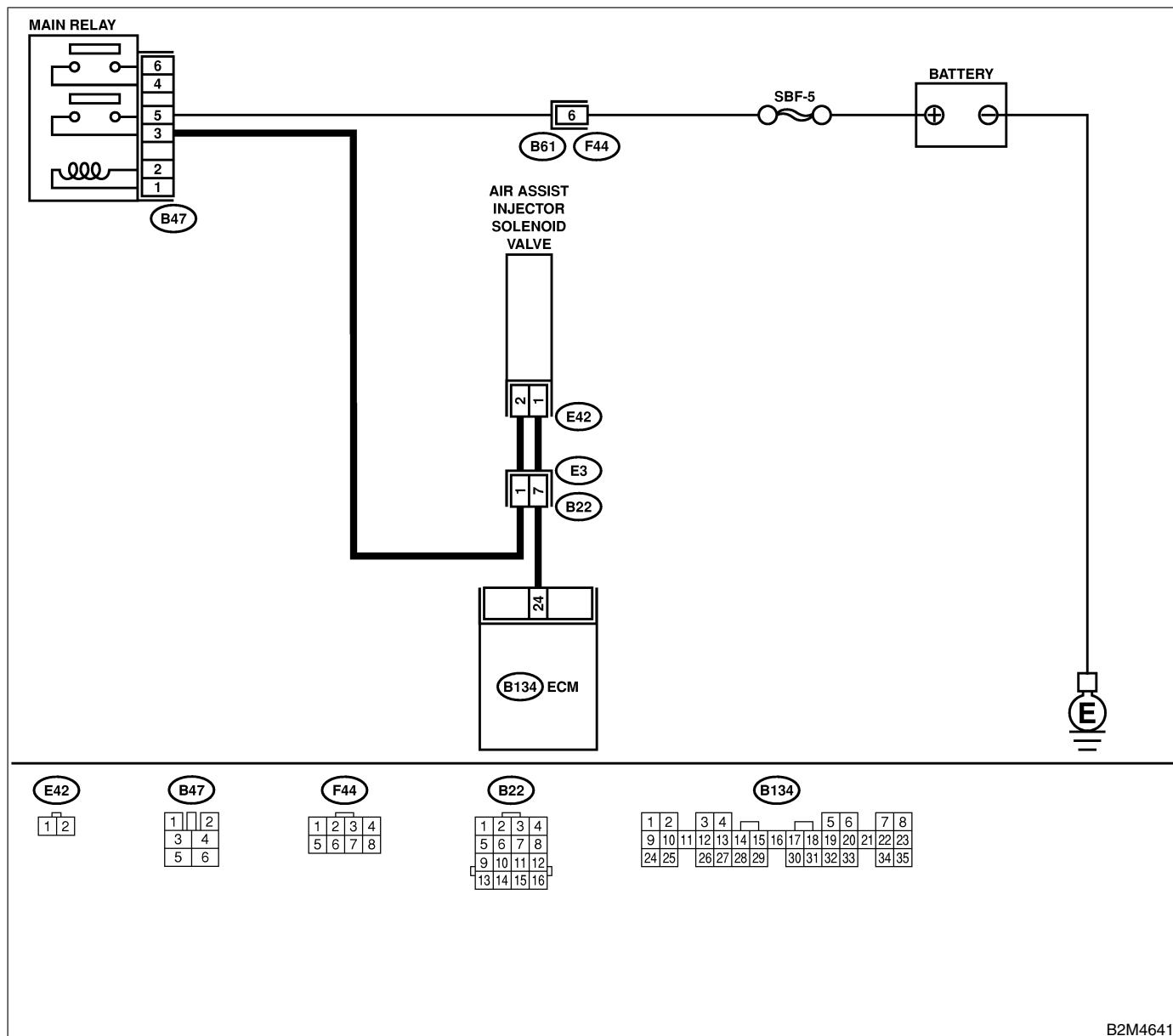
● **TROUBLE SYMPTOM:**

- Erroneous idling
- Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4641

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. 24 (+) — Chassis ground (-):	Is the voltage 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 voltage 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. 24 — (E42) No. 1:	Is the resistance 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. 24 — Chassis ground:	Is the resistance more than 1 M Ω ?	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-40, Air Assist Injector Solenoid Valve.>

G: DTC P0067 — AIR ASSIST INJECTOR SOLENOID VALVE CIRCUIT HIGH INPUT — S078521G72

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

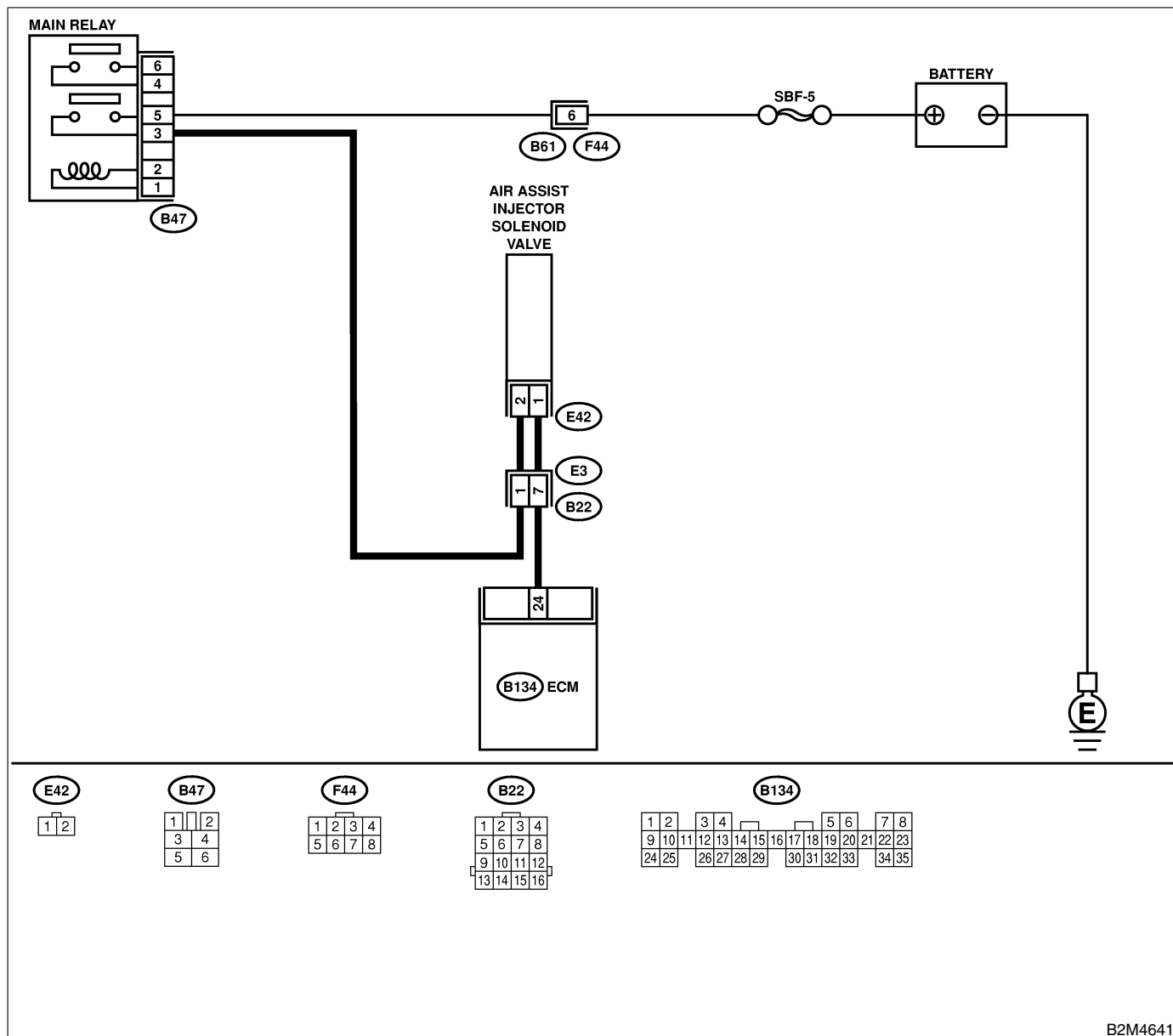
● **TROUBLE SYMPTOM:**

- Erroneous idling
- Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4641

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. 24 (+) — Chassis ground (-):	Is the voltage 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. 24 (+) — Chassis ground (-):	Is the voltage 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-51, Engine Control Module.>	Replace air assist injector solenoid valve <Ref. to FU-40, Air Assist Injector Solenoid Valve.> and ECM <Ref. to FU-51, Engine Control Module.>
3	CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 24 (+) — Chassis ground (-):	Does the voltage change more than 10 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to FU-51, Engine Control Module.>	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

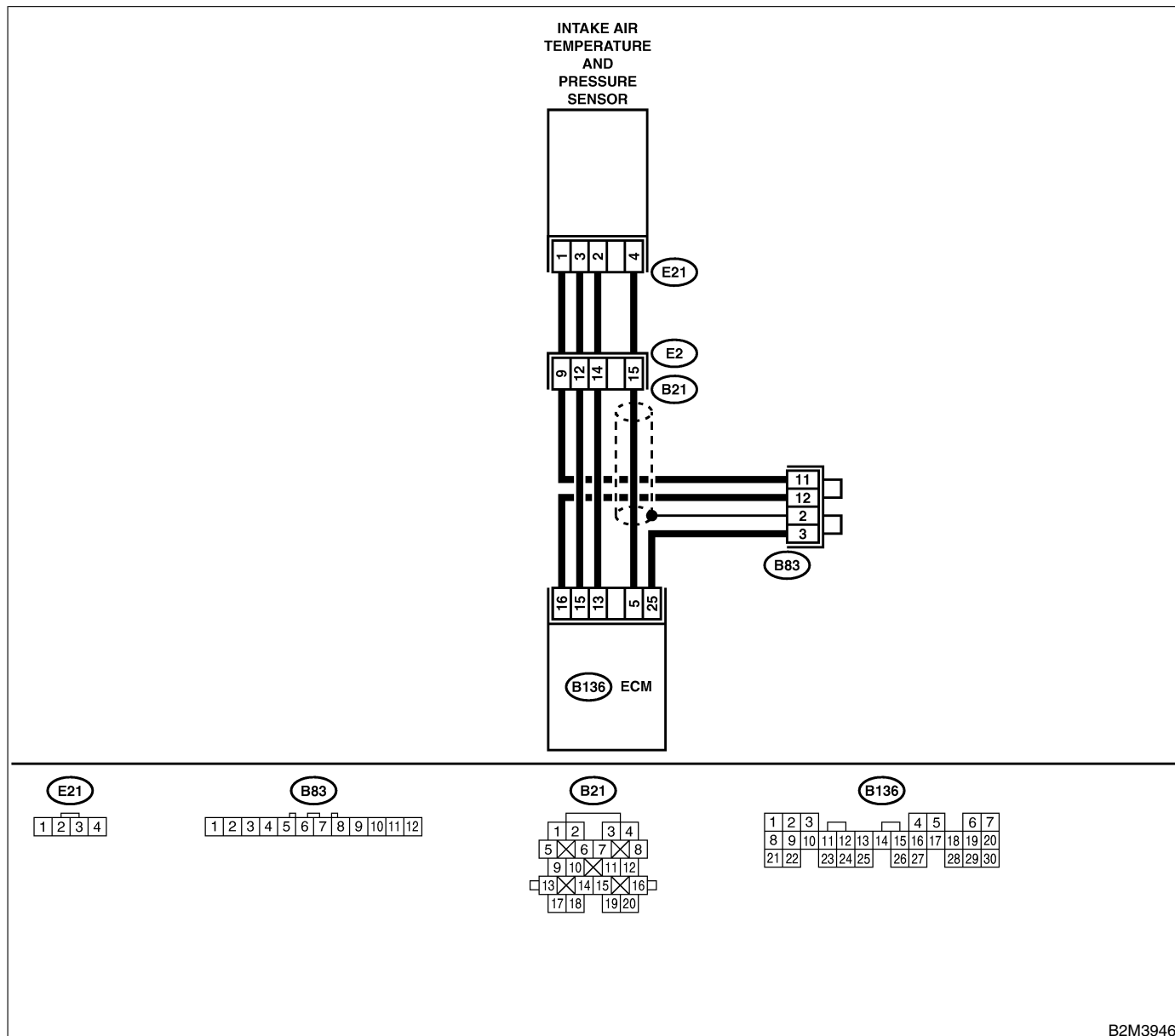
H: DTC P0106 — PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (LOW INPUT) — S078521F90

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY. NOTE: In this case, it is not necessary to inspect DTC P0106.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual. Specification: ● Intake manifold absolute pressure Ignition ON 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) Idling 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg)	Is the value within the specifications?	Go to step 4.	Replace intake air temperature sensor and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>
4	CHECK THROTTLE POSITION. Read data of throttle position signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is throttle positioning ratio equal to or less than 5% when throttle is fully closed?	Go to step 5.	Adjust or replace throttle position sensor. <Ref. to FU-35, Throttle Position Sensor.>
5	CHECK THROTTLE POSITION.	Is throttle positioning ratio equal to or more than 85% when throttle is fully open?	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>	Replace throttle position sensor. <Ref. to FU-35, Throttle Position Sensor.>

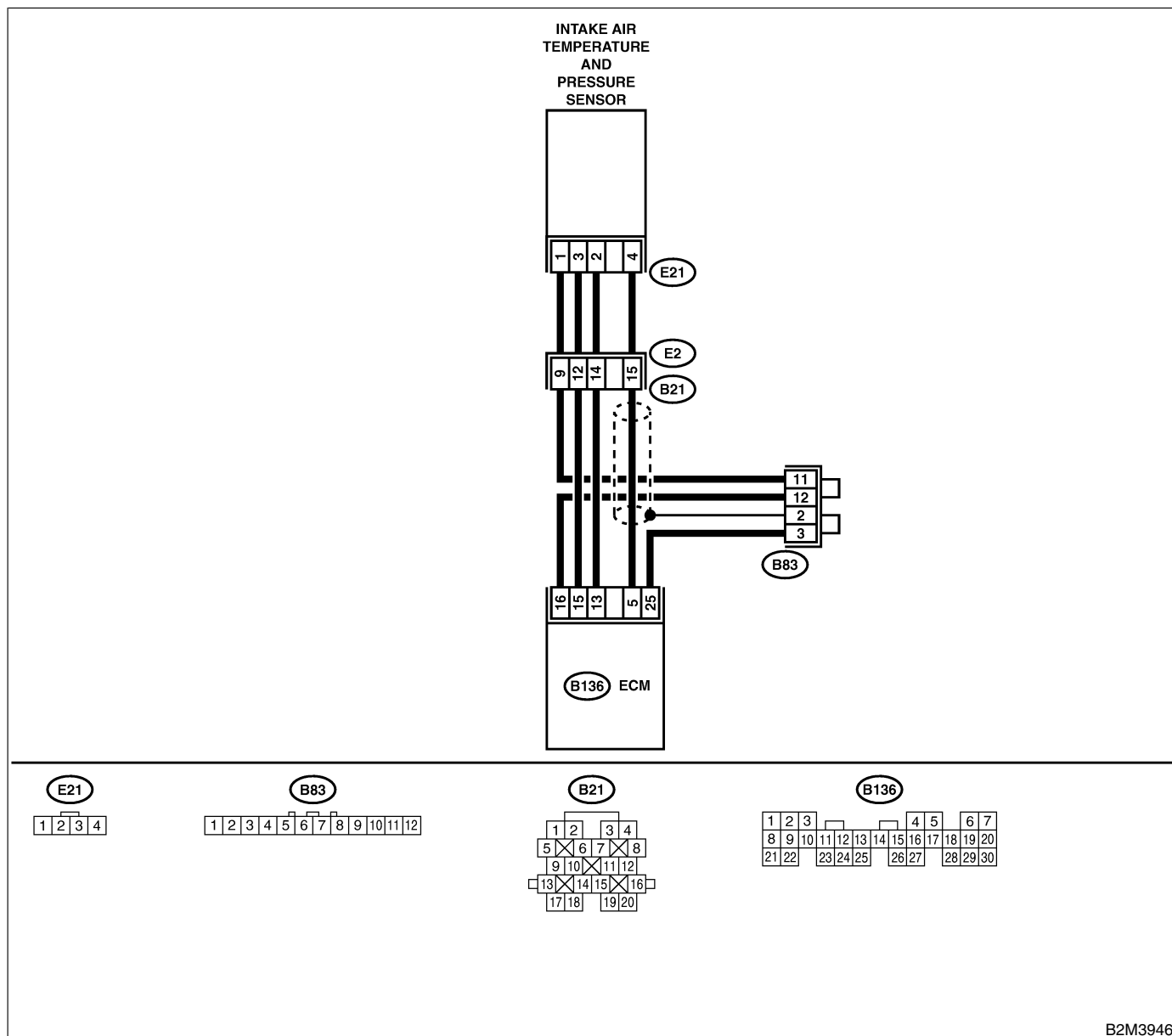
I: DTC P0107 — PRESSURE SENSOR CIRCUIT LOW INPUT — S078521B12

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 (B136) No. 15 (+) — Chassis ground (-):	Is the voltage 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 (B136) No. 15 (+) — Chassis ground (-):	Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	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 (B136) No. 5 (+) — Chassis ground (-):	Is the voltage 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-36, Subaru Select Monitor.>	Does the value change more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	Repair poor contact in ECM connector.	Go to step 7.
7	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from intake air temperature and 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 voltage more than 4.5 V?	Go to step 8.	Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
8	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and intake air temperature and pressure sensor connector. Connector & terminal (B136) No. 16 — (E21) No. 1:	Is the resistance less than 1 Ω ?	Go to step 9.	Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.
9	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. Measure resistance of harness between intake air temperature and pressure sensor connector and engine ground. Connector & terminal (E21) No. 4 — Engine ground:	Is the resistance more than 500 k Ω ?	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 intake air temperature and pressure sensor connector.	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>

MEMO:

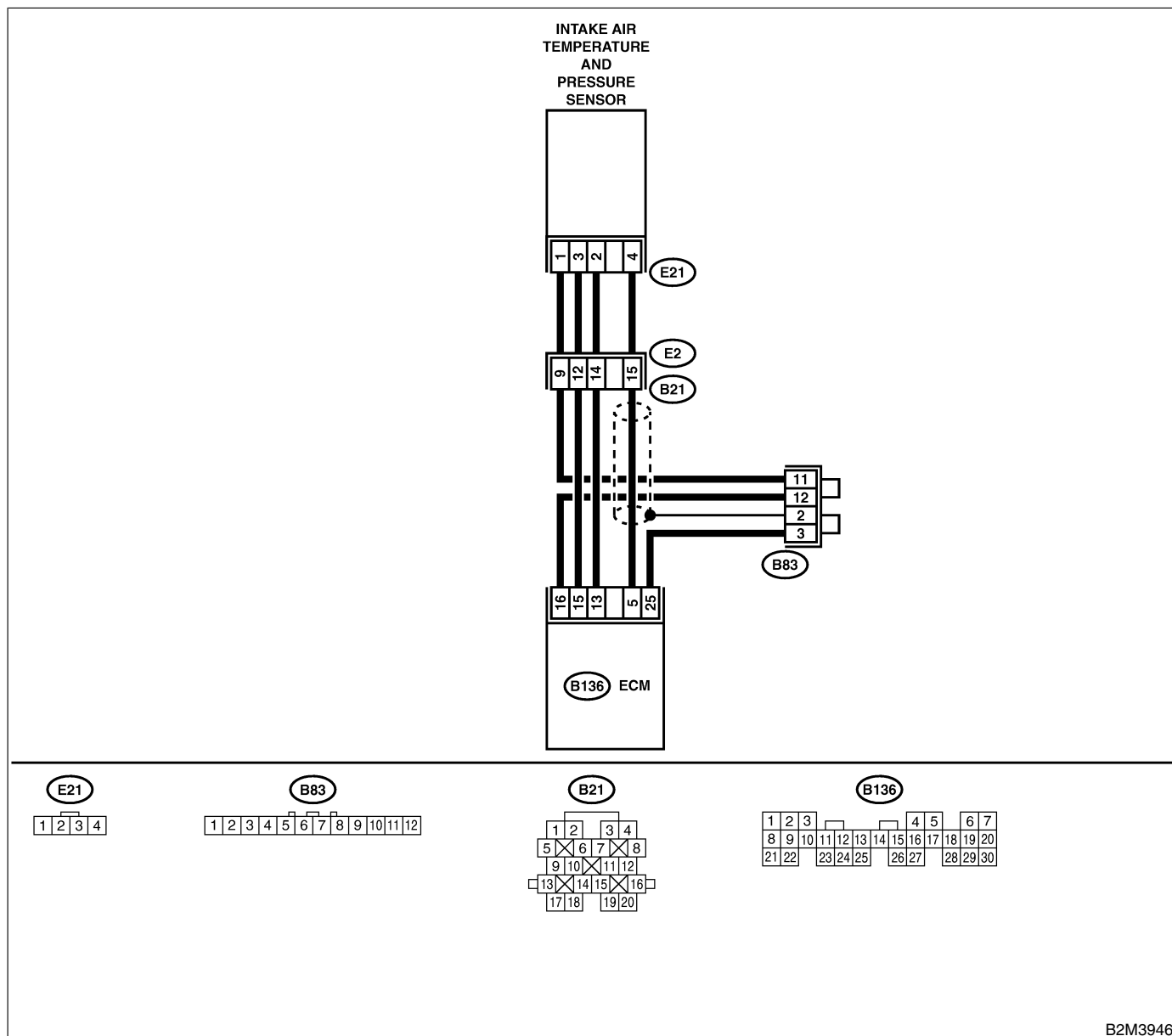
J: DTC P0108 — PRESSURE SENSOR CIRCUIT HIGH INPUT — S078521B13

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Go to step 10.	Go to step 2.
2	CHECK INPUT SIGNAL FOR ECM. Measure voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 15 (+) — Chassis ground (-):	Is the voltage 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. 15 (+) — Chassis ground (-):	Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	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 (B136) No. 5 (+) — Chassis ground (-):	Is the voltage 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-36, Subaru Select Monitor.>	Does the value change more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	Repair poor contact in ECM connector.	Go to step 6.
6	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from intake air temperature and pressure sensor. 3) Turn ignition switch to ON. 4) Measure voltage between intake air temperature and pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 7.	Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
7	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and intake air temperature and pressure sensor connector. Connector & terminal (B136) No. 5 — (E21) No. 4:	Is the resistance less than 1 Ω?	Go to step 8.	Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.
8	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. Measure resistance of harness between ECM and intake air temperature and pressure sensor connector. Connector & terminal (B136) No. 16 — (E21) No. 1:	Is the resistance less than 1 Ω?	Go to step 9.	Repair open circuit in harness between ECM and intake air temperature and pressure sensor connector.
9	CHECK POOR CONTACT. Check poor contact in intake air temperature and pressure sensor connector.	Is there poor contact in intake manifold pressure sensor connector?	Repair poor contact in intake air temperature and pressure sensor connector.	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>
10	CHECK HARNESS BETWEEN ECM AND INTAKE AIR TEMPERATURE AND PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF and Subaru Select Monitor or the OBD-II general scan tool switch to OFF. 2) Disconnect connector from intake air temperature and pressure sensor. 3) Turn ignition switch to ON and Subaru Select Monitor or the OBD-II general scan tool switch to ON. 4) Read data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Repair battery short circuit in harness between ECM and intake air temperature and pressure sensor connector.	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

K: DTC P0111 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM — S078521B14

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

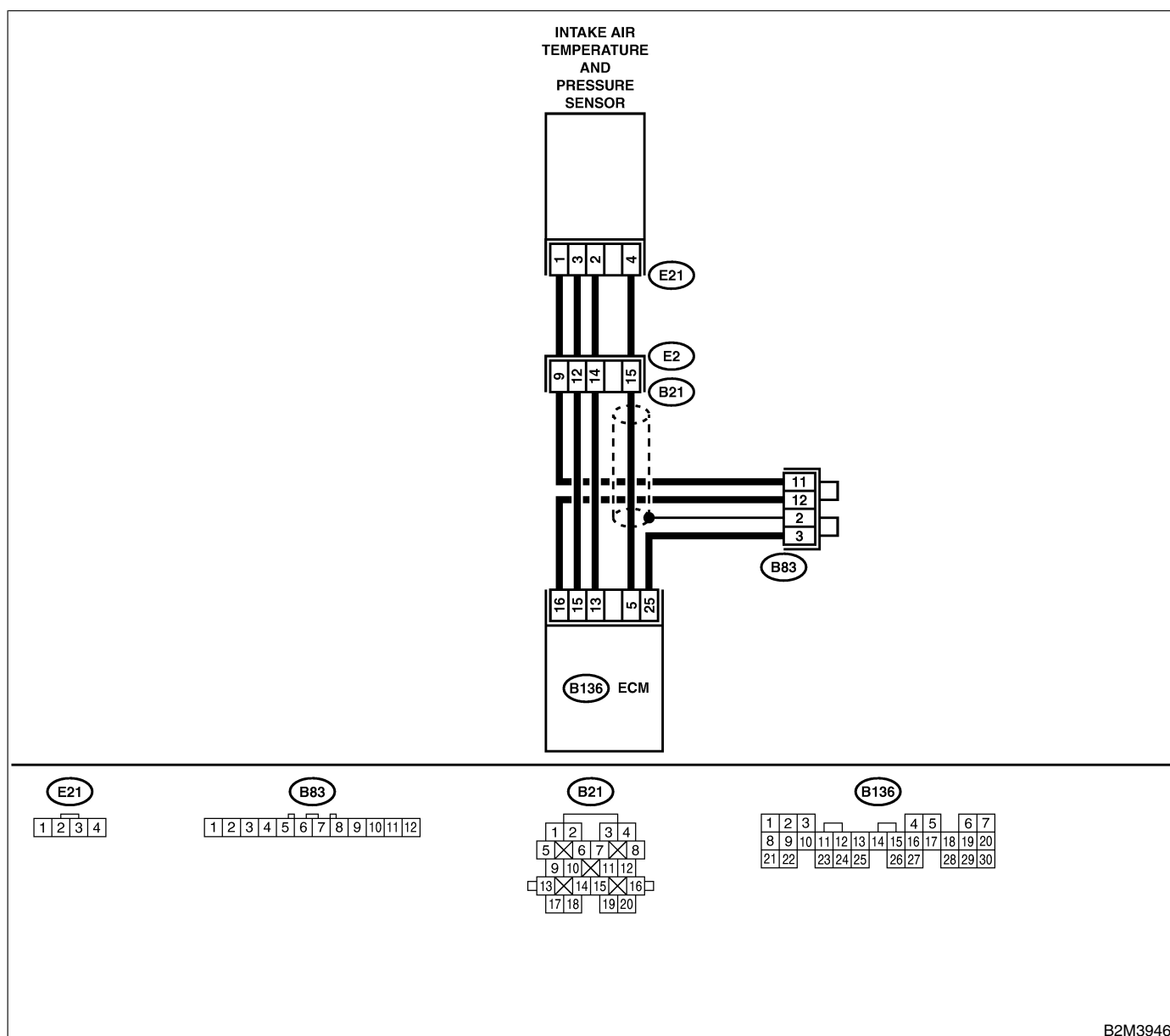
● **TROUBLE SYMPTOM:**

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3946

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature between 75°C (167°F) and 95°C (203°F)?	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>	Inspect DTC P0125 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>

L: DTC P0112 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW INPUT

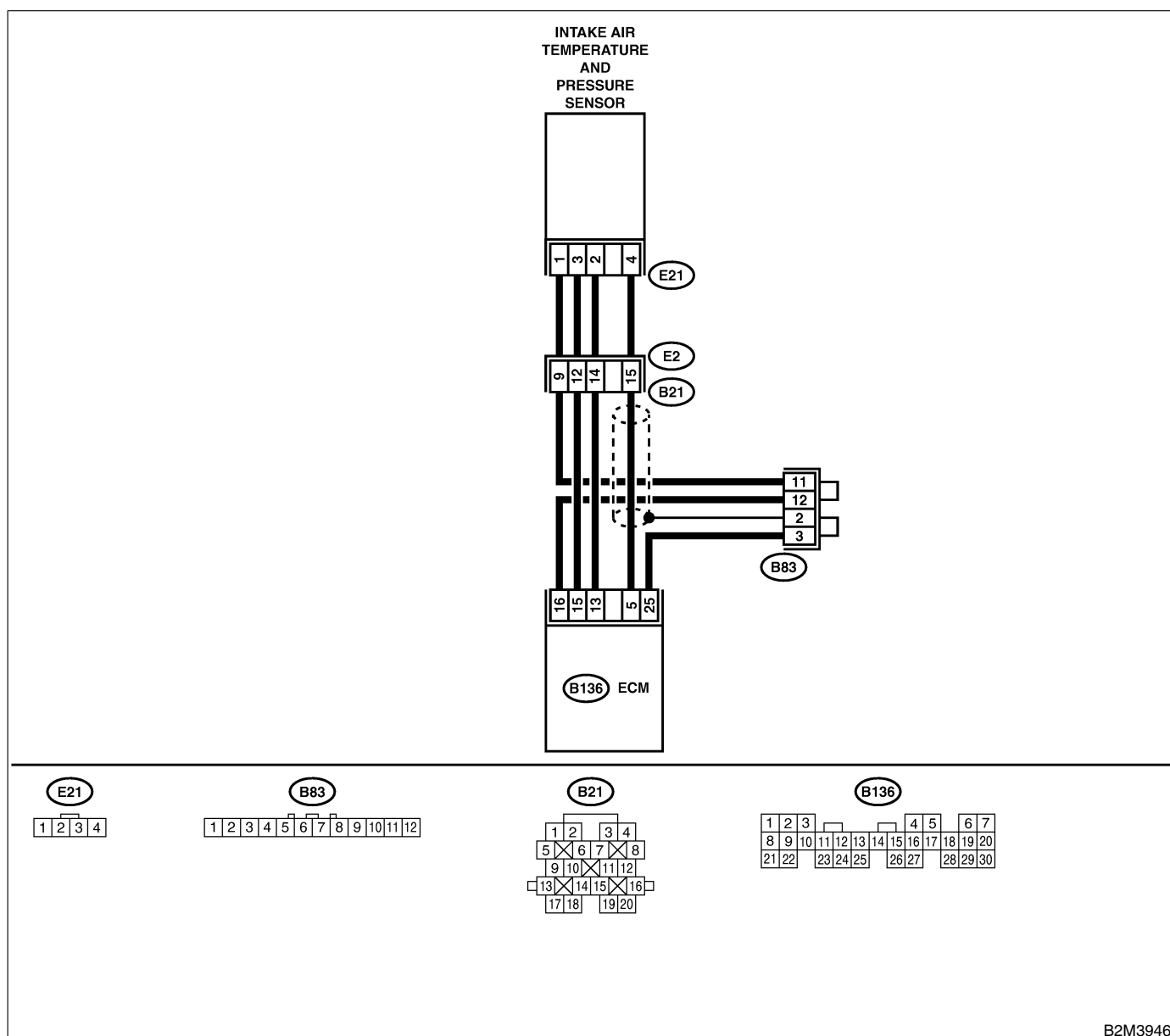
S078521B15

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● WIRING DIAGRAM:



B2M3946

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value greater 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 and pressure sensor - Poor contact in ECM - Poor contact in coupling connector - Poor contact in joint connector
2	CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE 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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value less than -40°C (-40°F)?	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>	Repair ground short circuit in harness between intake air temperature sensor and ECM connector.

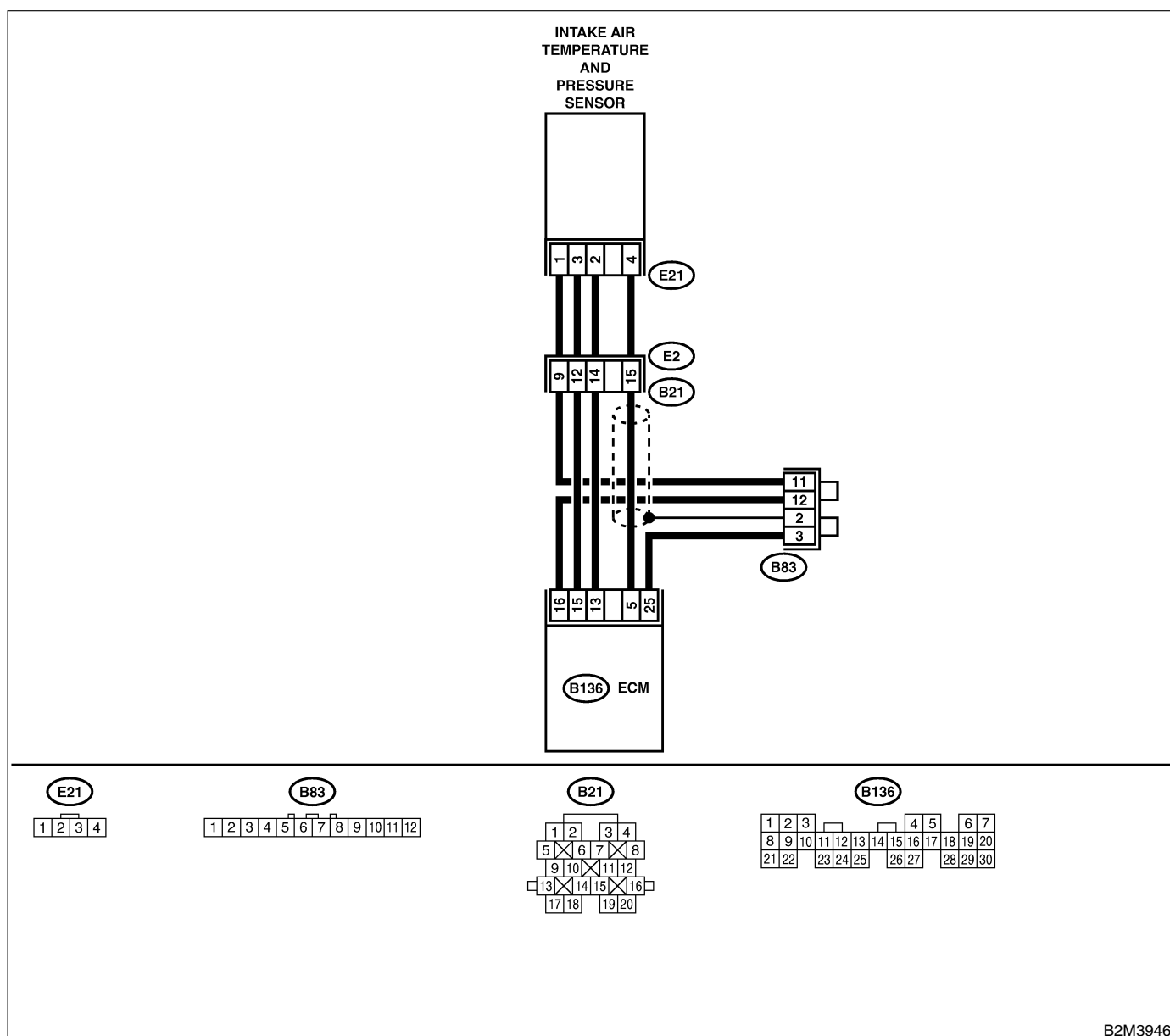
M: DTC P0113 — INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH INPUT — S078521B16

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3946

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 and pressure sensor - Poor contact in ECM - Poor contact in coupling connector - Poor contact in joint connector
2	CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from intake air temperature and pressure sensor. 3) Measure voltage between intake air temperature and pressure sensor connector and engine ground. Connector & terminal (E21) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between intake air temperature and pressure sensor and ECM connector.	Go to step 3.
3	CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure voltage between intake air temperature and pressure sensor connector and engine ground. Connector & terminal (E21) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between intake air temperature and pressure sensor and ECM connector.	Go to step 4.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
4	CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE SENSOR AND ECM CONNECTOR. Measure voltage between intake air temperature and pressure sensor connector and engine ground. Connector & terminal (E21) No. 2 (+) — Engine ground (-):	Is the voltage 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 and pressure sensor and ECM connector ● Poor contact in intake air temperature and pressure sensor ● Poor contact in ECM ● Poor contact in coupling connector ● Poor contact in joint connector
5	CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE AND PRESSURE 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 (E21) No. 1 — Engine ground:	Is the resistance less than 5 Ω ?	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: ● Open circuit in harness between intake air temperature and pressure sensor and ECM connector ● Poor contact in intake air temperature and pressure sensor ● Poor contact in ECM ● Poor contact in coupling connector ● Poor contact in joint connector

MEMO:

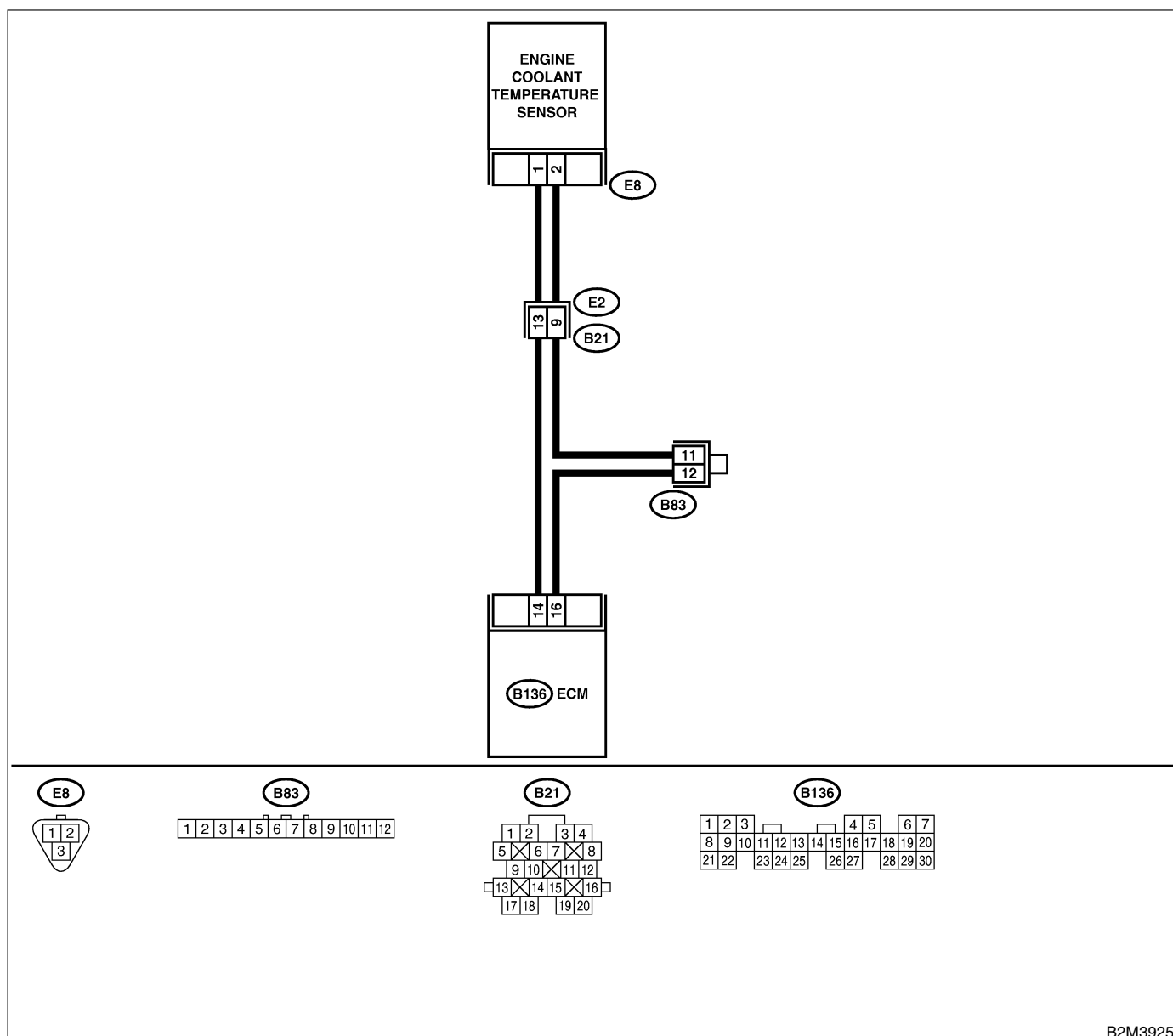
N: DTC P0117 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW INPUT — S078521F91

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3925

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value greater 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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value less than -40°C (-40°F)?	Replace engine coolant temperature sensor. <Ref. to FU-30, Engine Coolant Temperature Sensor.>	Repair ground short circuit in harness between engine coolant temperature sensor and ECM connector.

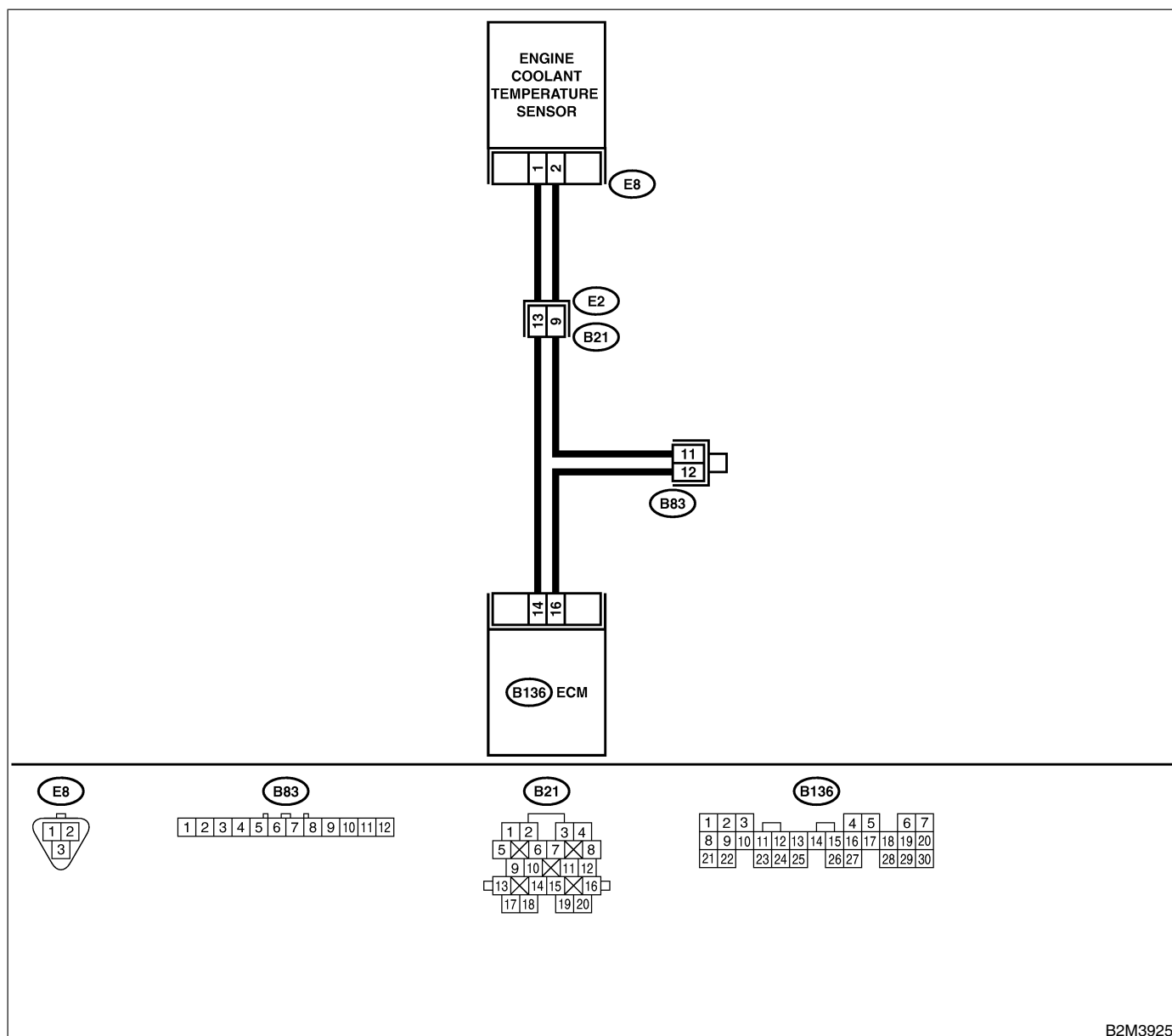
O: DTC P0118 — ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH INPUT — S078521F92

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3925

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 voltage 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 voltage 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 voltage 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance less than 5 Ω?	Replace engine coolant temperature sensor. <Ref. to FU-30, 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:

**P: DTC P0121 — THROTTLE POSITION SENSOR CIRCUIT
RANGE/PERFORMANCE PROBLEM (HIGH INPUT) —** S078521B19

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

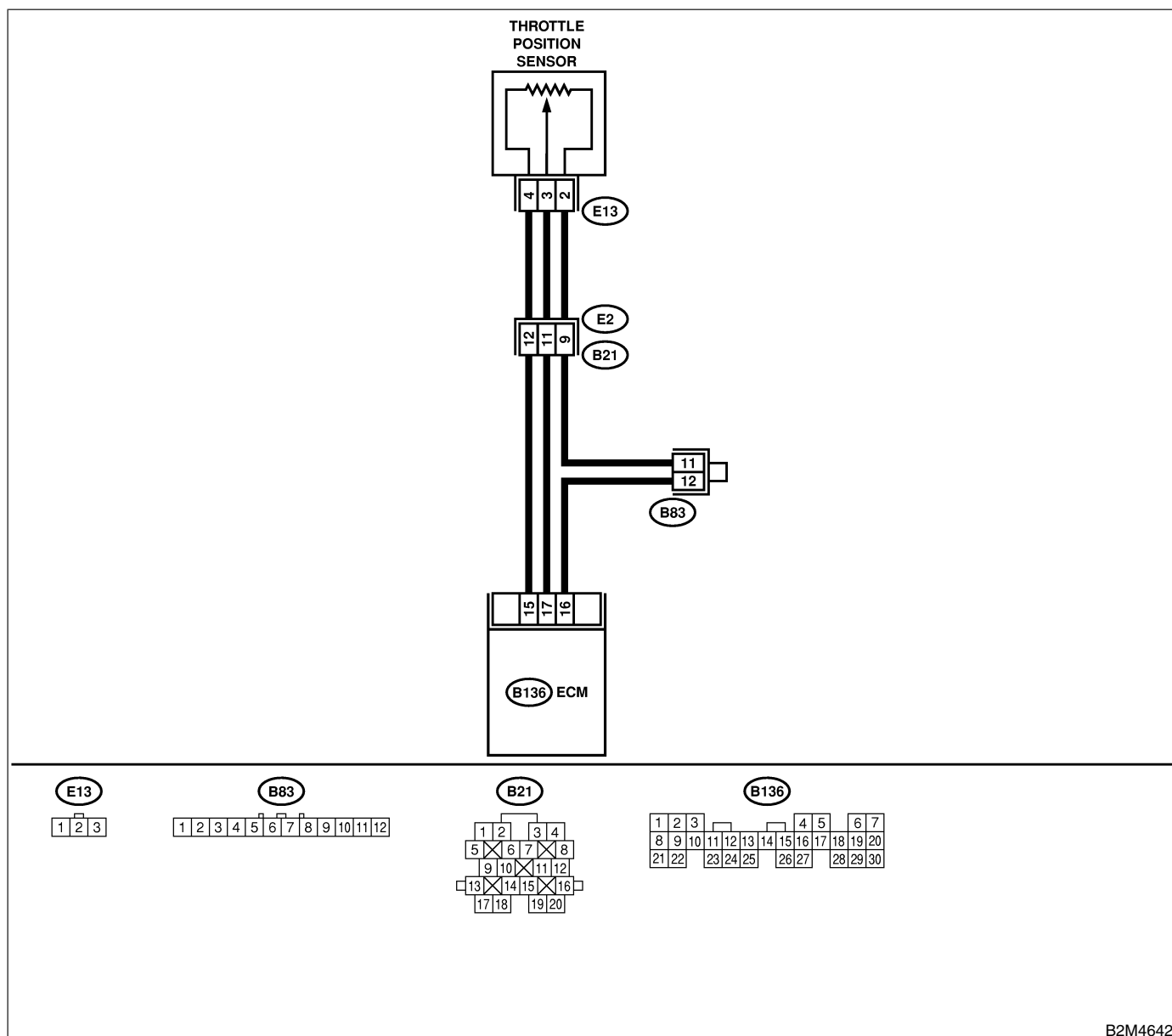
● **TROUBLE SYMPTOM:**

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-35, Throttle Position Sensor.>

Engine (Diagnostics)

S078521B20

- Immediately at fault recognition

- Erroneous idling
- Engine stalls.
- Poor driving performance

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

THROTTLE
POSITION
SENSOR

E13

E2
B21

B83

B136 ECM

E13

B83

B21

B136

1 2 3

1 2 3 4 5 6 7 8 9 10 11 12

1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20

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

B2M4642

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK CURRENT DATA. 1) Start engine. 2) Read data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 (B136) No. 15 (+) — Chassis ground (-):	Is the voltage 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. 15 (+) — Chassis ground (-):	Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	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 (B136) No. 17 (+) — Chassis ground (-):	Is the voltage 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.	Does the voltage change more than 0.1 V by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 voltage 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 (B136) No. 17 — (E13) No. 3:	Is the resistance 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 resistance more than 1 M Ω ?	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-35, Throttle Position Sensor.>

MEMO:

R: DTC P0123 — THROTTLE POSITION SENSOR CIRCUIT HIGH INPUT —

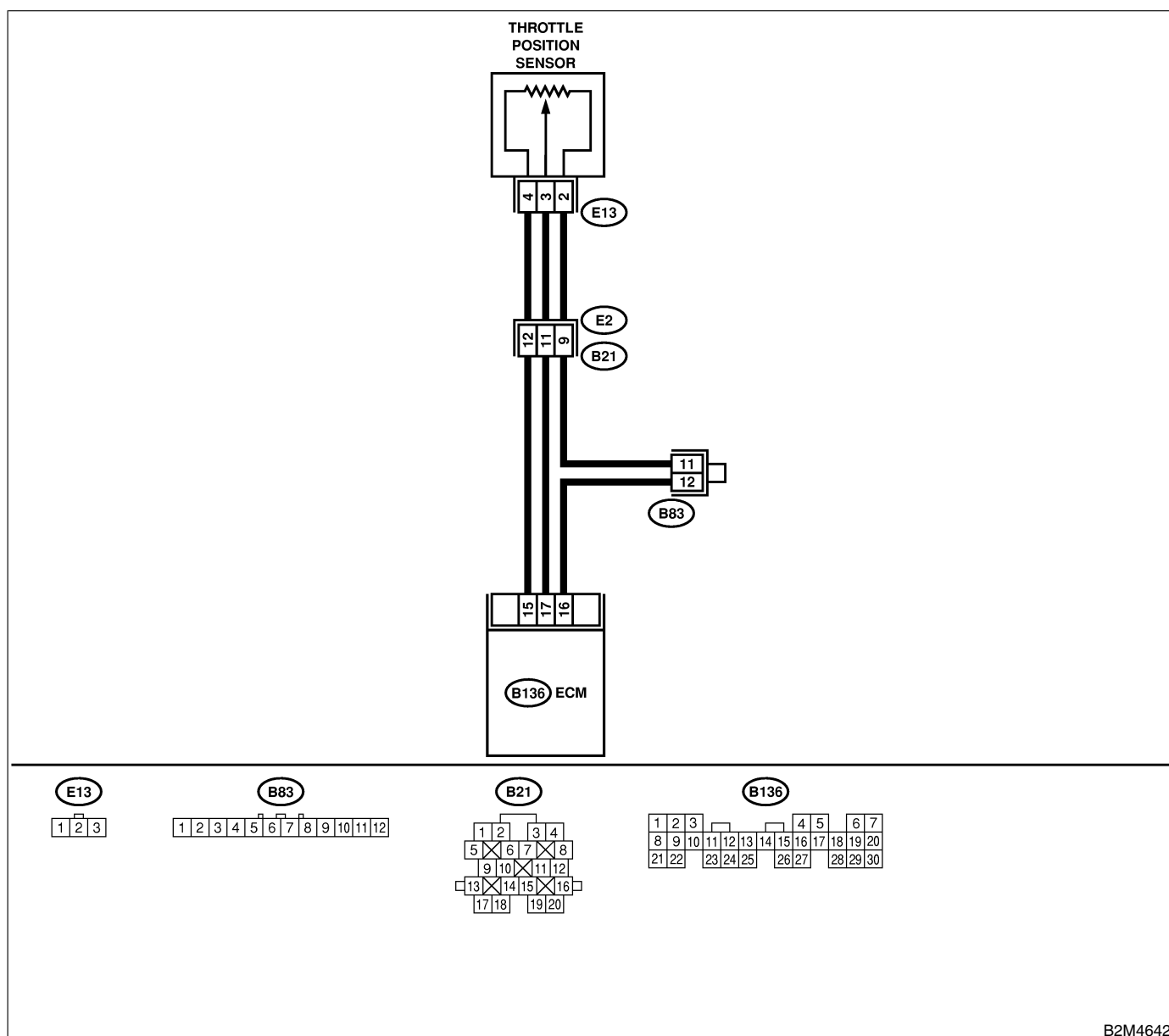
S078521B21

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4642

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK CURRENT DATA. 1) Start engine. 2) Read data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 resistance 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 voltage 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-51, Engine Control Module.>	Replace throttle position sensor. <Ref. to FU-35, Throttle Position Sensor.>

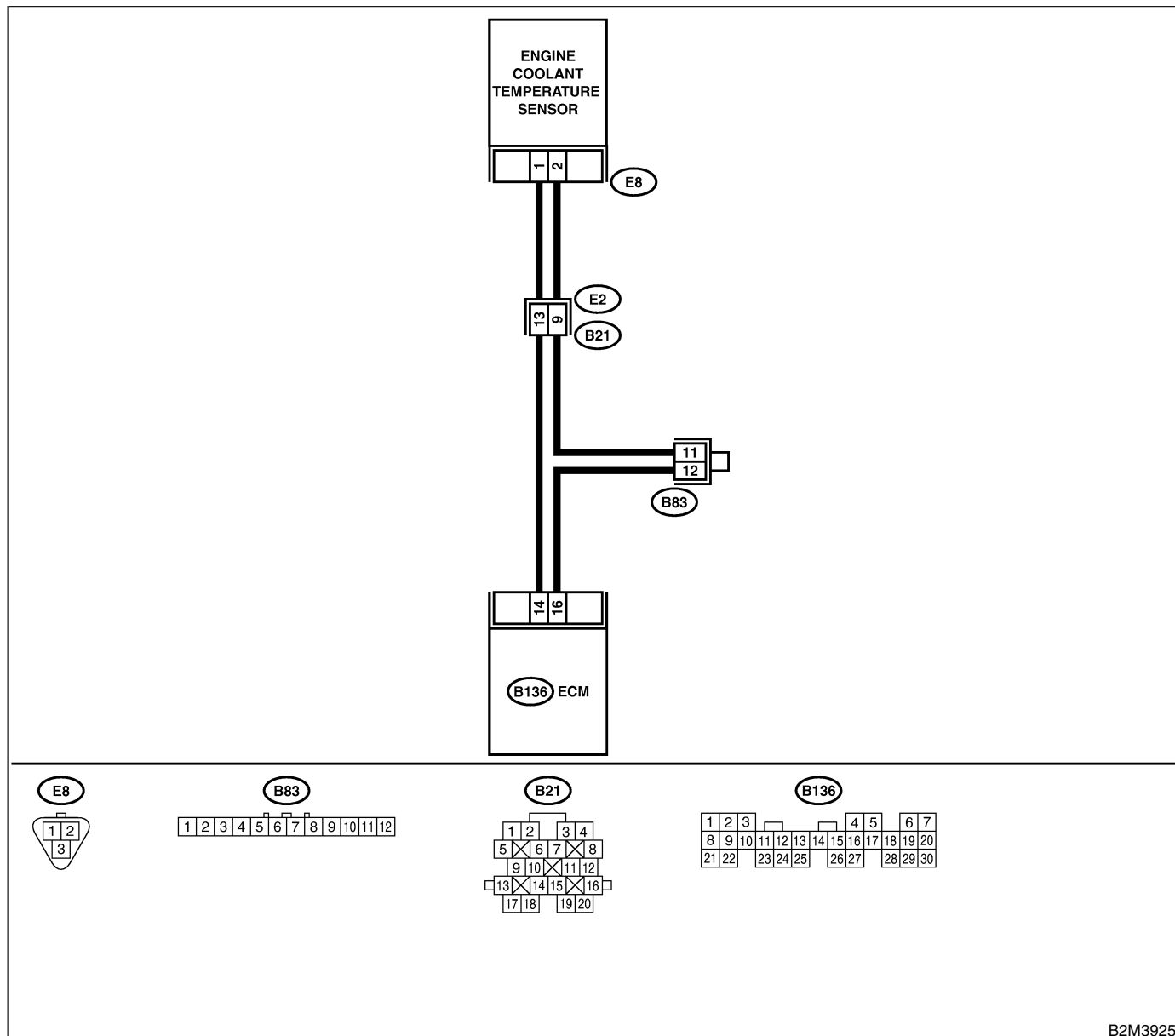
S: DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL — S078521B22

- **DTC DETECTING CONDITION:**
 - Two consecutive driving cycles with fault
- **TROUBLE SYMPTOM:**
 - Engine would not return to idling.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3925

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-19, Thermostat.>	Replace engine coolant temperature sensor. <Ref. to EN-30, Engine Coolant Temperature Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

T: DTC P0128 — THERMOSTAT MALFUNCTION — S078521F93

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	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 P1490.	Go to step 2.
2	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Go to step 3.	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>
3	CHECK TIRE SIZE.	Is the tire size the same as designated tire and four wheel tire?	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-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-26, Radiator Main Fan and Fan Motor.> and <Ref. to CO-29, Radiator Sub Fan and Fan Motor.>	Replace thermostat. <Ref. to CO-19, Thermostat.>

MEMO:

**U: DTC P0130 — FRONT OXYGEN (A/F) SENSOR CIRCUIT
RANGE/PERFORMANCE PROBLEM (LEAN) —** S078521G44

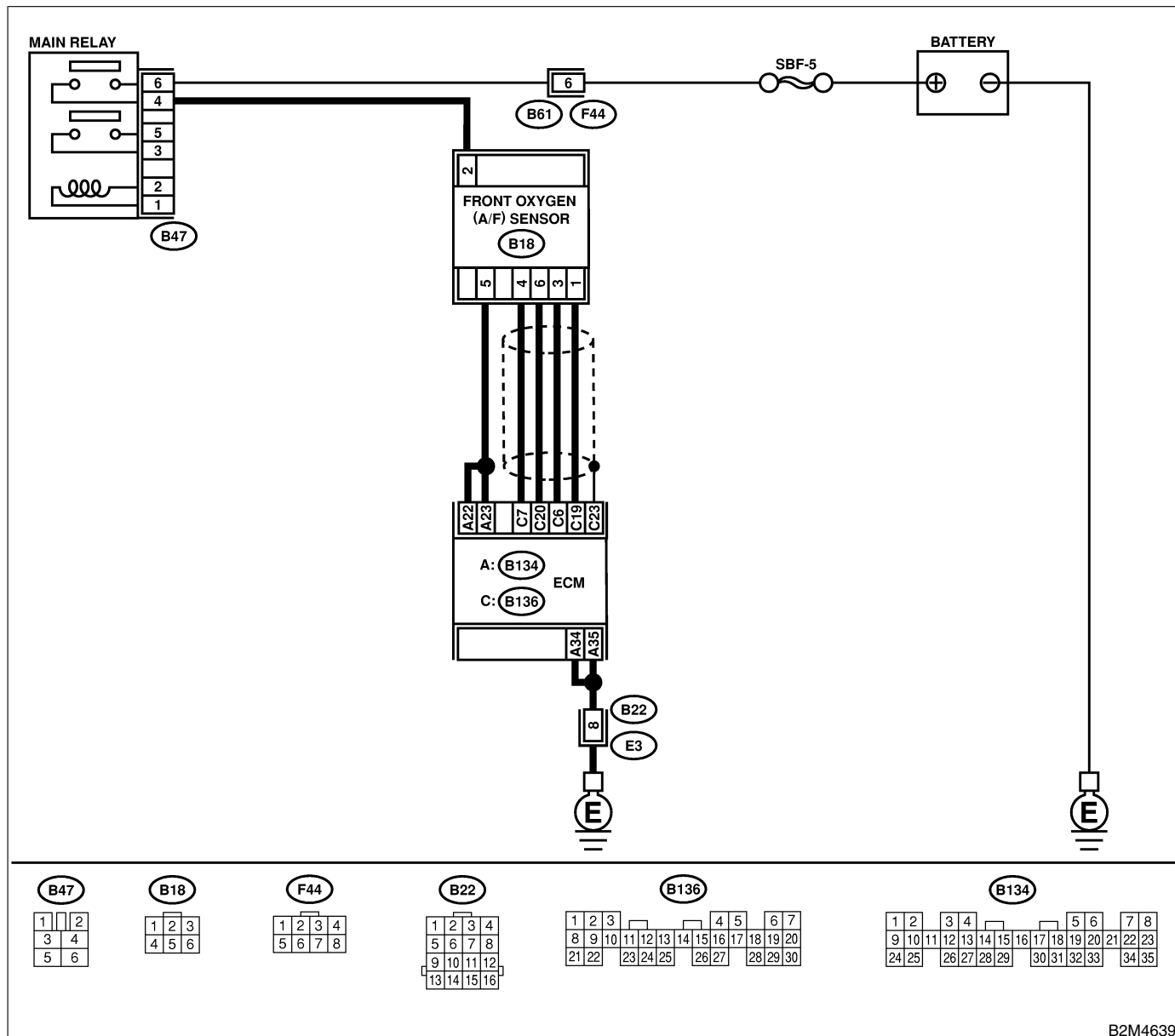
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 OBD-II 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value equal to or more than 0.85 and equal to less than 1.15 in idling?	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: 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 value more than 1.1 for a moment?	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. 6 — (B18) No. 1: (B136) No. 7 — (B18) No. 6: (B136) No. 19 — (B18) No. 3: (B136) No. 20 — (B18) No. 4:	Is the resistance 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. 6 — Chassis ground: (B136) No. 7 — Chassis ground: (B136) No. 19 — Chassis ground: (B136) No. 20 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 6.	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 a fault in exhaust system?	Repair or replace faulty parts.	Replace front oxygen (A/F) sensor. <Ref. to FU-47, Front Oxygen (A/F) Sensor.>

MEMO:

V: DTC P0131 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (OPEN CIRCUIT) — S078521G45

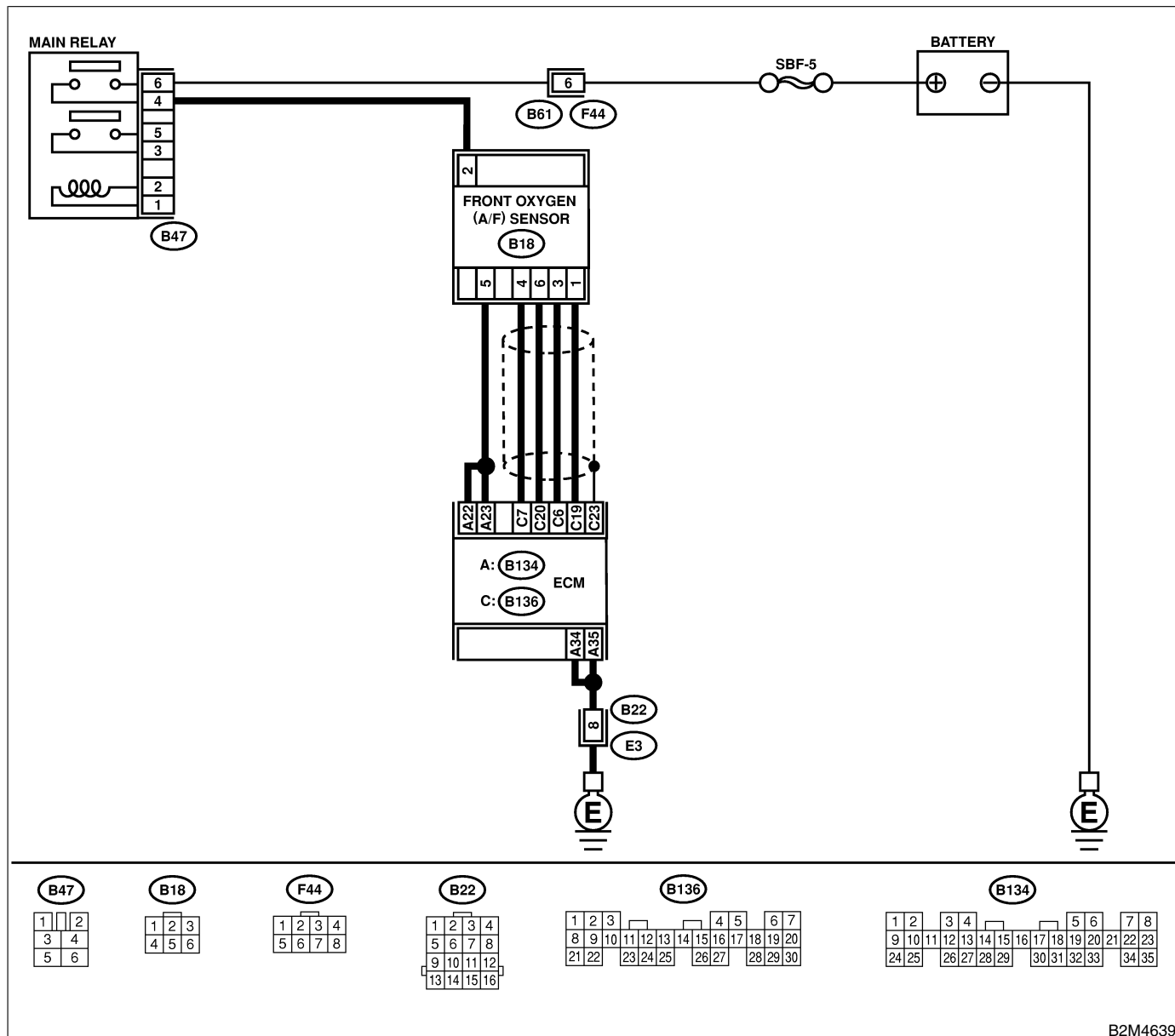
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. 6 — (E18) No. 1: (B136) No. 7 — (B18) No. 6: (B136) No. 19 — (B18) No. 3: (B136) No. 20 — (B18) No. 4:	Is the resistance 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 front oxygen (A/F) sensor connector ● Poor contact in front oxygen (A/F) sensor connector ● Poor contact in ECM connector
2	CHECK POOR CONTACT. Check 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-47, Front Oxygen (A/F) Sensor.>

W: DTC P0132 — FRONT OXYGEN (A/F) SENSOR CIRCUIT MALFUNCTION (SHORT CIRCUIT) — S078521G46

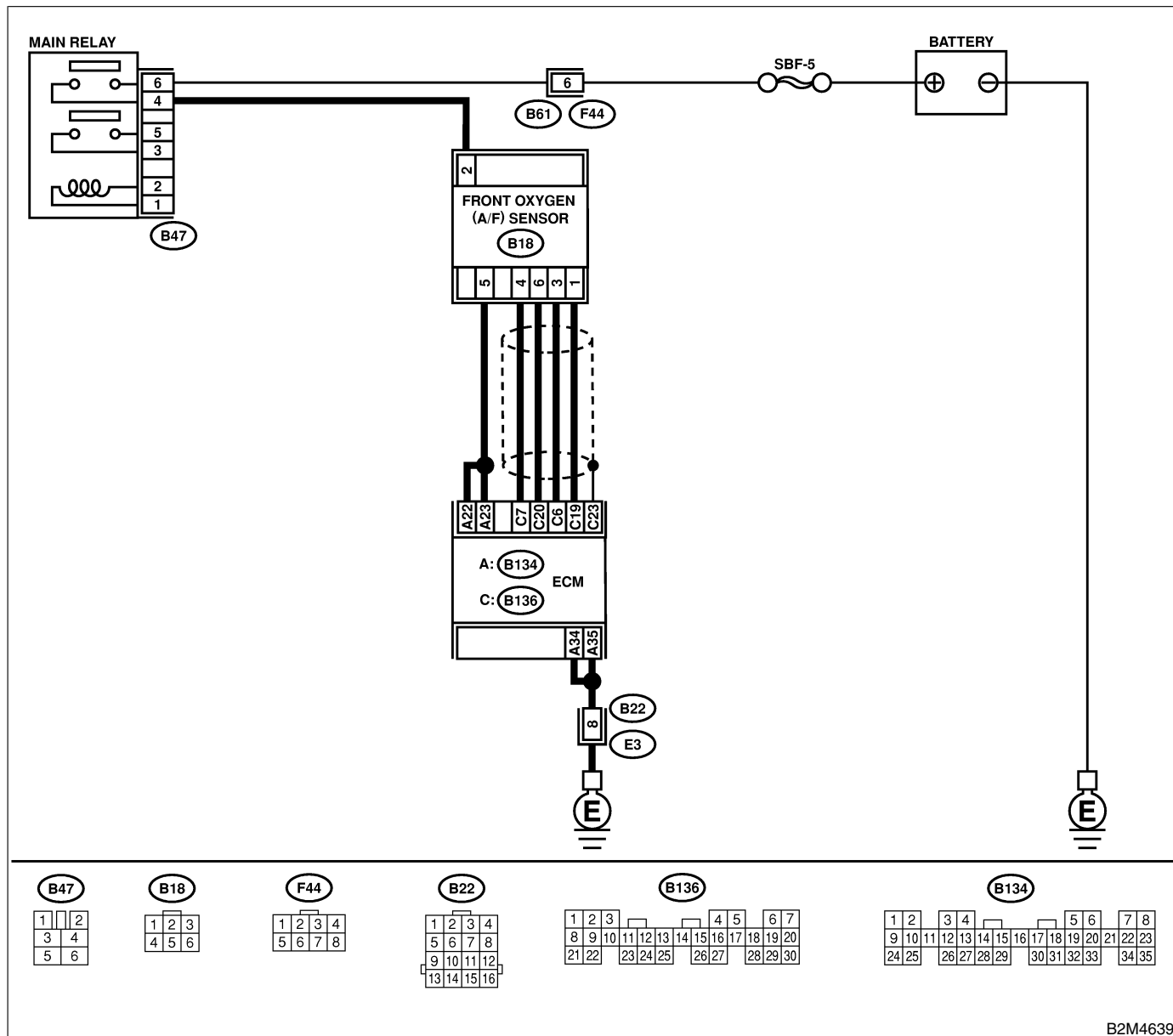
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 6 — Chassis ground: (B136) No. 7 — Chassis ground: (B136) No. 19 — Chassis ground: (B136) No. 20 — Chassis ground:	Is the resistance more than 10 Ω ?	Replace front oxygen (A/F) sensor. <Ref. to FU-47, Front Oxygen (A/F) Sensor.>	Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

X: DTC P0133 — FRONT OXYGEN (A/F) SENSOR CIRCUIT SLOW RESPONSE — S078521B26

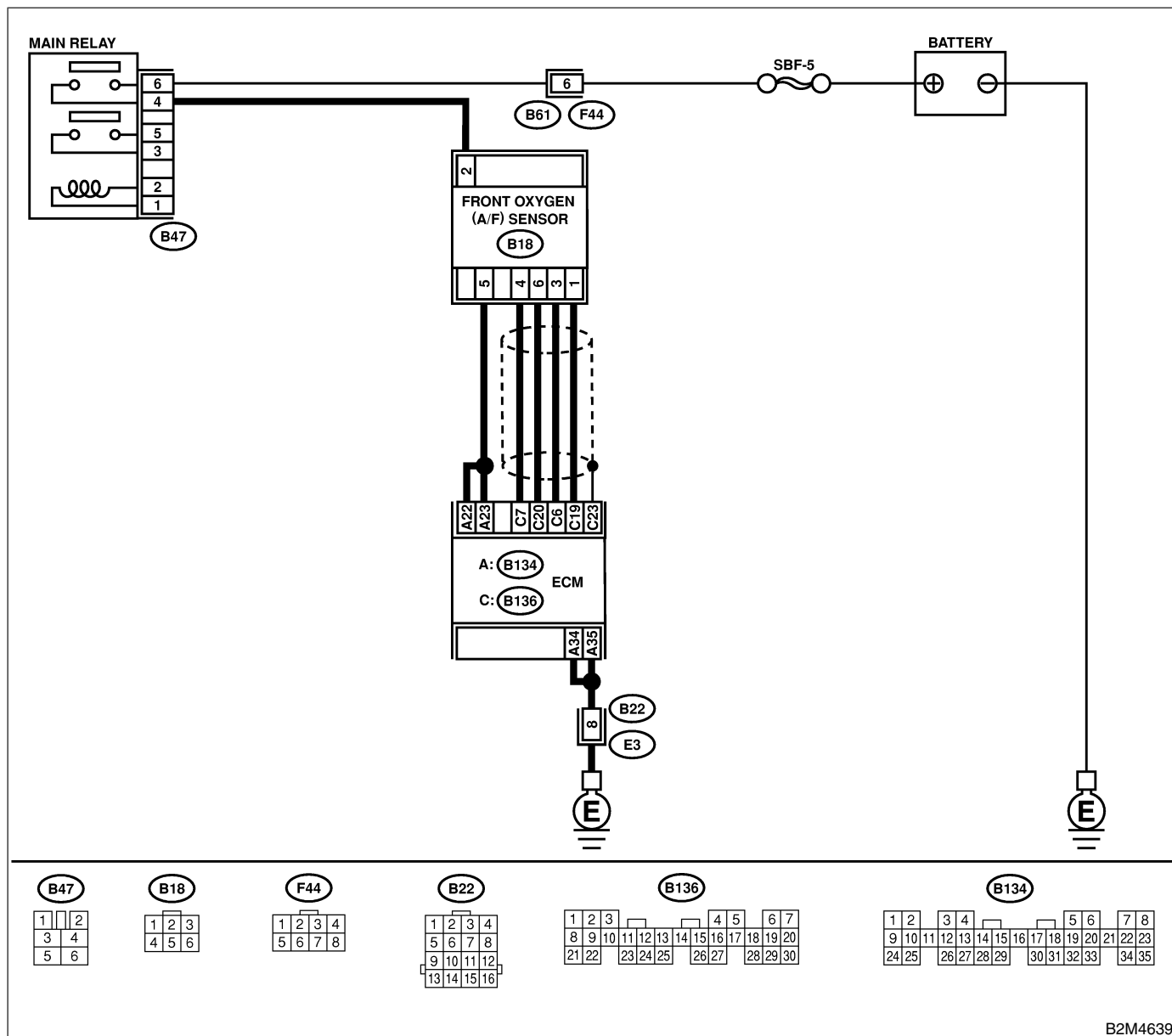
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 a fault in exhaust system?	Repair exhaust system.	Replace front oxygen (A/F) sensor. <Ref. to FU-47, Front Oxygen (A/F) Sensor.>

Y: DTC P0137 — REAR OXYGEN SENSOR CIRCUIT LOW INPUT — S078521K17

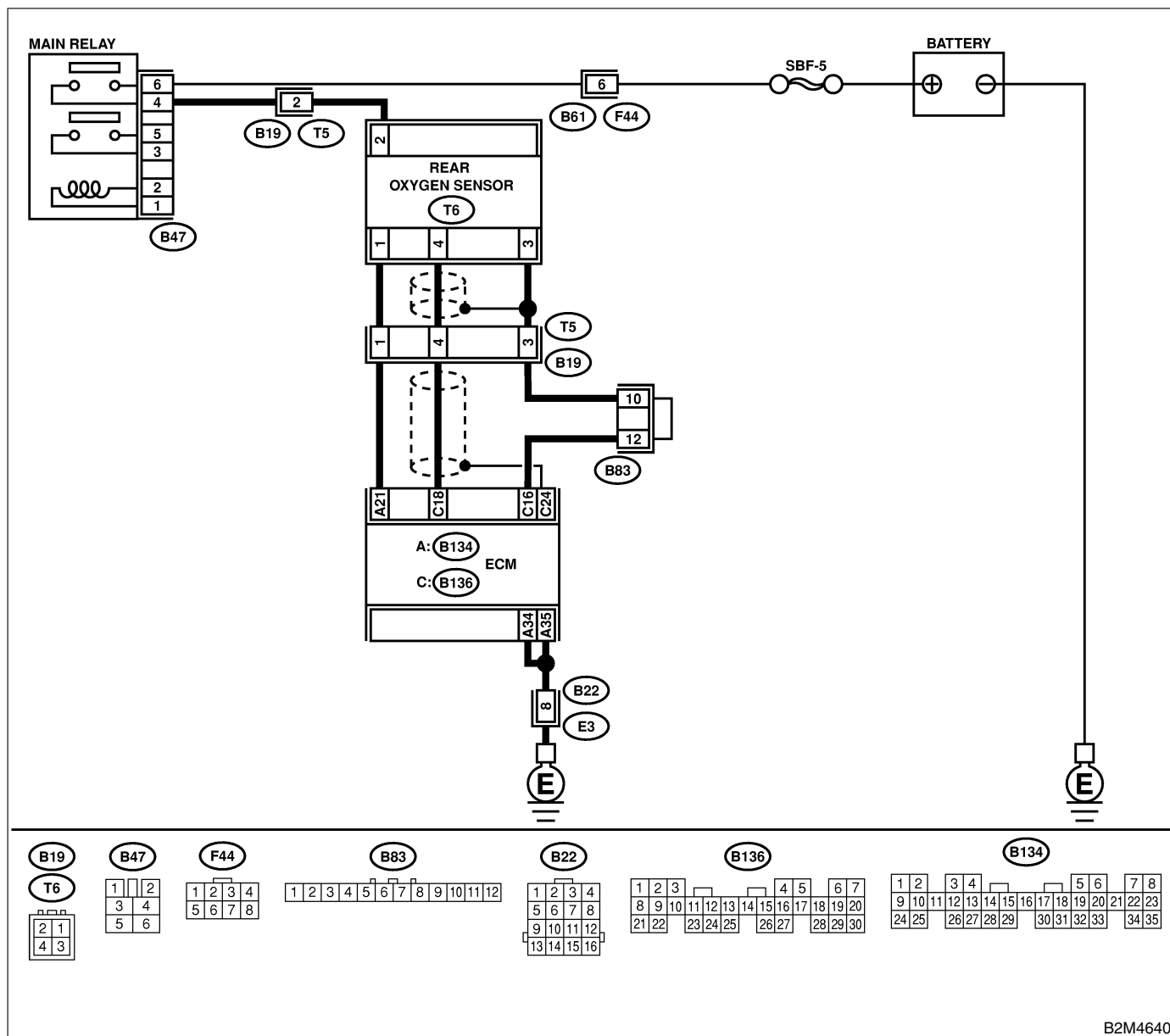
• **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0131 or P0132?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
2	CHECK FAILURE CAUSE OF P0131 or P0132. Inspect DTC P0131 or P0132 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>	Is the failure cause of P0131 or P0132 in the fuel system?	Check fuel system. NOTE: In this case, it is not necessary to inspect DTC P0137.	Go to step 3.
3	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 2,000 rpm to 3,000 rpm for two minutes. 2) Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II 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-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Does the value fluctuate?	Go to step 7.	Go to step 4.
4	CHECK REAR OXYGEN SENSOR DATA. Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II General Scan Tool.	Is the value fixed between 0.2 and 0.4 V?	Go to step 5.	Replace rear oxygen sensor. <Ref. to FU-49, Rear Oxygen Sensor.>
5	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 (B136) No. 16 — (T6) No. 3:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 6.
6	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 voltage more than 0.2 V?	Replace rear oxygen sensor. <Ref. to FU-49, 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
7	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 a fault in exhaust system?	Repair or replace faulty parts.	Replace rear oxygen sensor. <Ref. to FU-49, Rear Oxygen Sensor.>

MEMO:

Z: DTC P0138 — REAR OXYGEN SENSOR CIRCUIT HIGH INPUT — S078521K18

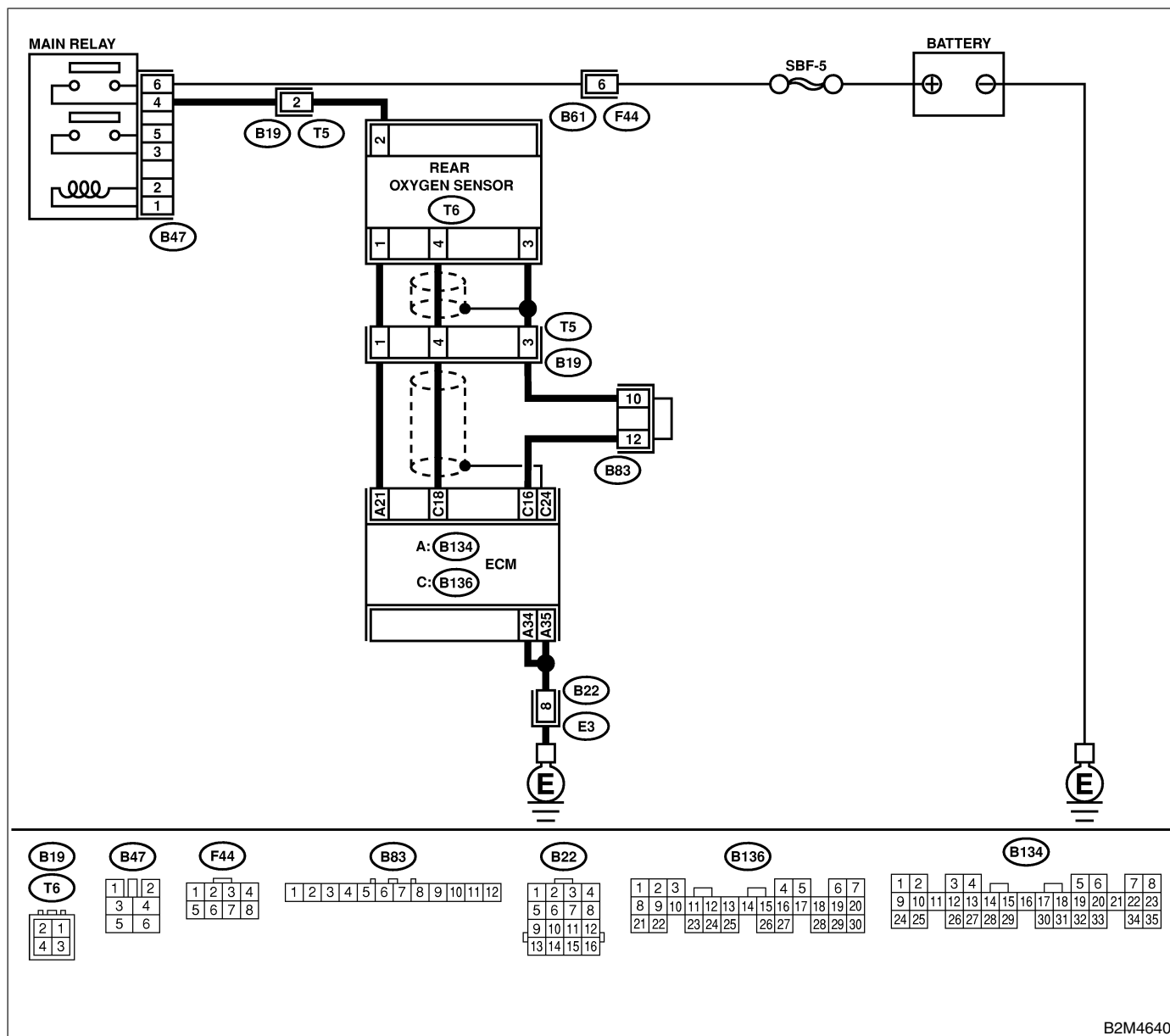
• **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



B2M4640

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0131 or P0132?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
2	CHECK FAILURE CAUSE OF P0131 or P0132. Inspect DTC P0131 or P0132 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>	Is the failure cause of P0131 or P0132 in the fuel system?	Check fuel system. NOTE: In this case, it is not necessary to inspect DTC P0138.	Go to step 3.
3	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 2,000 rpm to 3,000 rpm for two minutes. 2) Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II 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-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Does the value fluctuate?	Go to step 7.	Go to step 4.
4	CHECK REAR OXYGEN SENSOR DATA. Read data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II General Scan Tool.	Is the value fixed between 0.2 and 0.4 V?	Go to step 5.	Replace rear oxygen sensor. <Ref. to FU-49, Rear Oxygen Sensor.>
5	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 (B136) No. 16 — (T6) No. 3:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 6.
6	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 voltage more than 0.2 V?	Replace rear oxygen sensor. <Ref. to FU-49, 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
7	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 a fault in exhaust system?	Repair or replace faulty parts.	Replace rear oxygen sensor. <Ref. to FU-49, Rear Oxygen Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

AA: DTC P0139 — REAR OXYGEN SENSOR CIRCUIT SLOW RESPONSE —

S078521B29

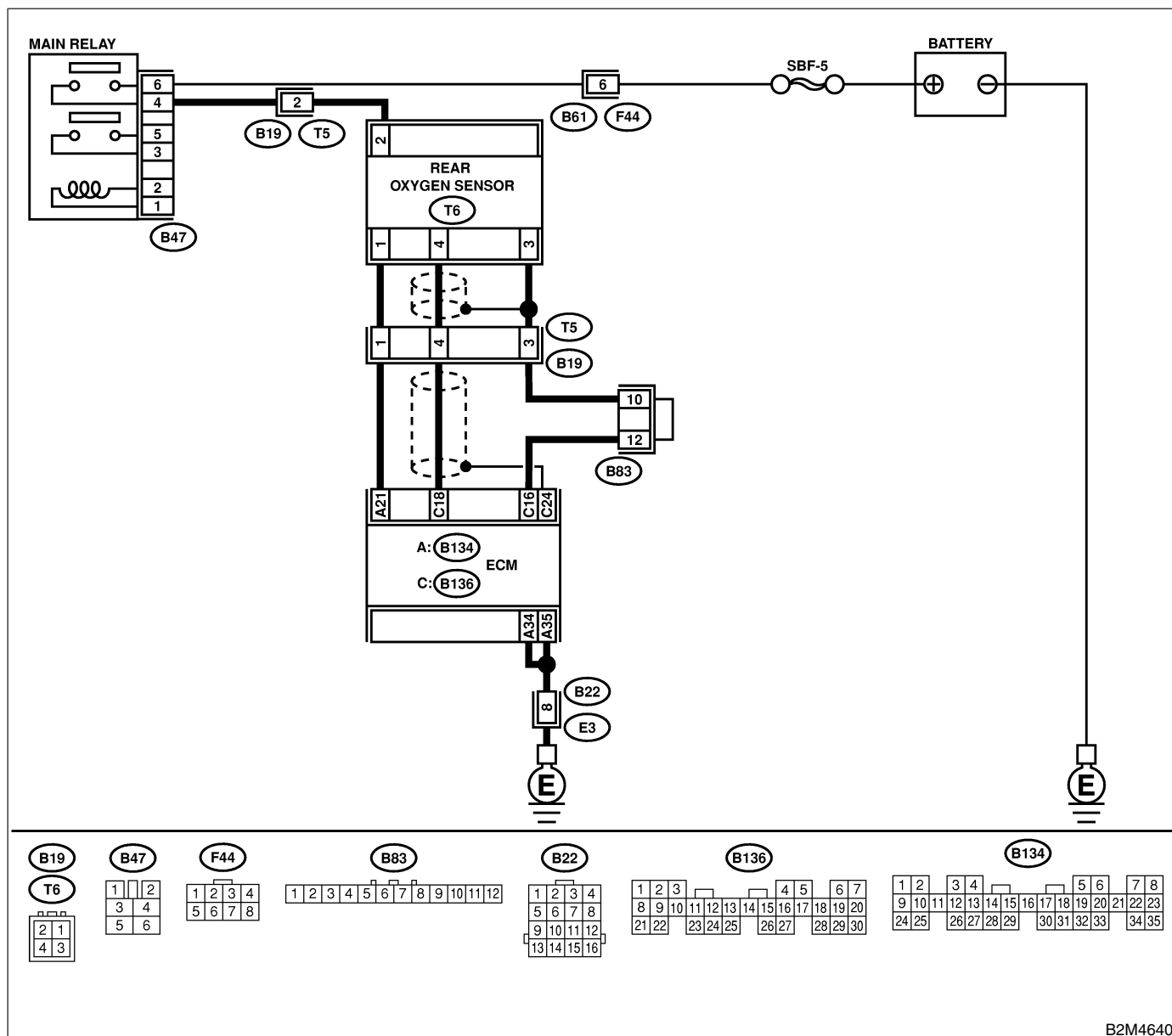
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-49, Rear Oxygen Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

AB: DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN)— S078521B33

NOTE:

For the diagnostic procedure, refer to DTC P0172. <Ref. to EN-170, DTC P0172 — FUEL TRIM #1 (RH) MALFUNCTION (A/F TOO RICH) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AC: DTC P0172 — FUEL TRIM #1 (RH) MALFUNCTION (A/F TOO RICH) — S078521H36

• DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

• TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	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(H6)-96, 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 AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step 4.
4	CHECK FUEL PRESSURE. WARNING: • Place "NO FIRE" signs near the working area. • Be careful not to spill fuel on the floor. 1) Release 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 fuel pressure between 284 and 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)?	Go to step 5.	Repair the following items. Fuel pressure too high • Clogged fuel return line or bent hose Fuel pressure too low • Improper fuel pump discharge • Clogged fuel supply line

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
5	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 fuel pressure between 206 and 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)?	Go to step 6.	Repair the following items. Fuel pressure too high ● Faulty pressure regulator ● Clogged fuel return line or bent hose Fuel pressure too low ● Faulty pressure regulator ● Improper fuel pump discharge ● Clogged fuel supply line
6	CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1) Start the engine and warm-up completely. 2) Read data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is temperature between 70°C (158°F) and 100°C (212°F)?	Go to step 7.	Replace engine coolant temperature sensor. <Ref. to FU-30, Engine Coolant Temperature Sensor.>
7	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual. Specification: Idling 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg) Ignition ON 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)	Is the voltage within the specifications?	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>

AD: DTC P0181 — FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE PROBLEM —

S078521B34

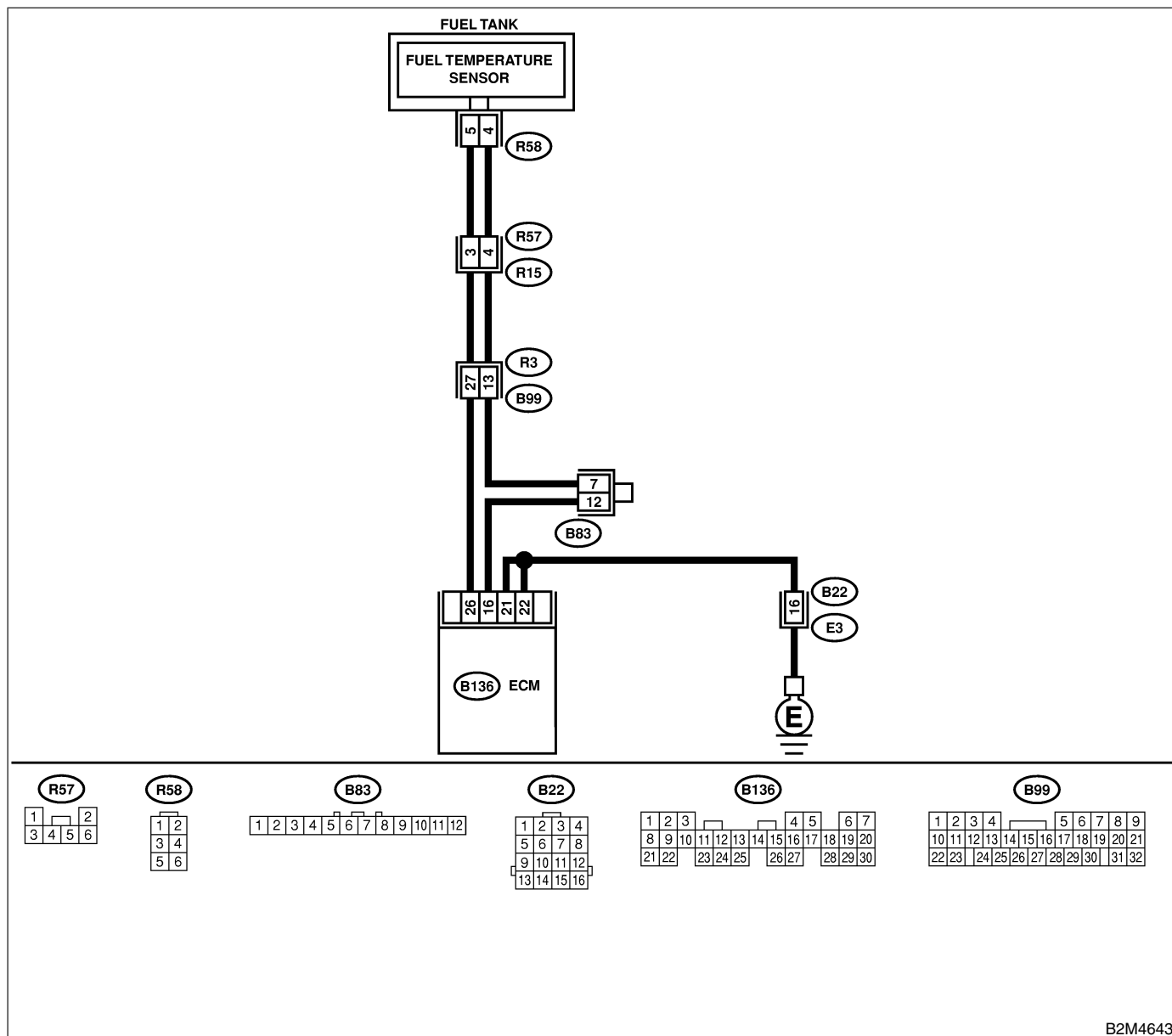
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4643

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-8, Fuel Temperature Sensor.>

AE: DTC P0182 — FUEL TEMPERATURE SENSOR A CIRCUIT LOW INPUT —

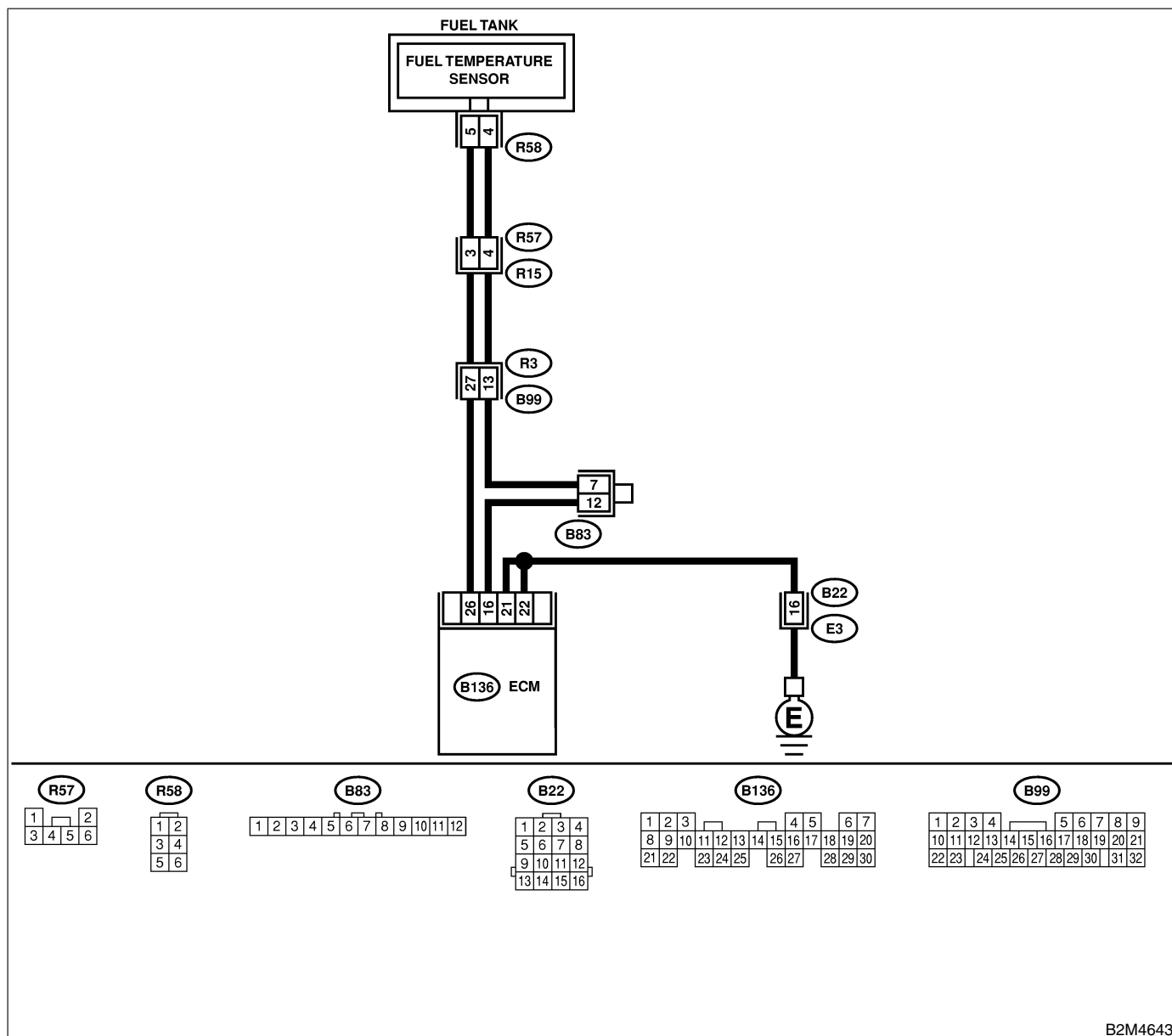
S078521B35

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



B2M4643

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK CURRENT DATA. 1) Start engine. 2) Read data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value greater 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 OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value less than -40°C (-40°F)?	Replace fuel temperature sensor. <Ref. to EC-8, Fuel Temperature Sensor.>	Repair ground short circuit in harness between fuel pump and ECM connector.

AF: DTC P0183 — FUEL TEMPERATURE SENSOR A CIRCUIT HIGH INPUT —

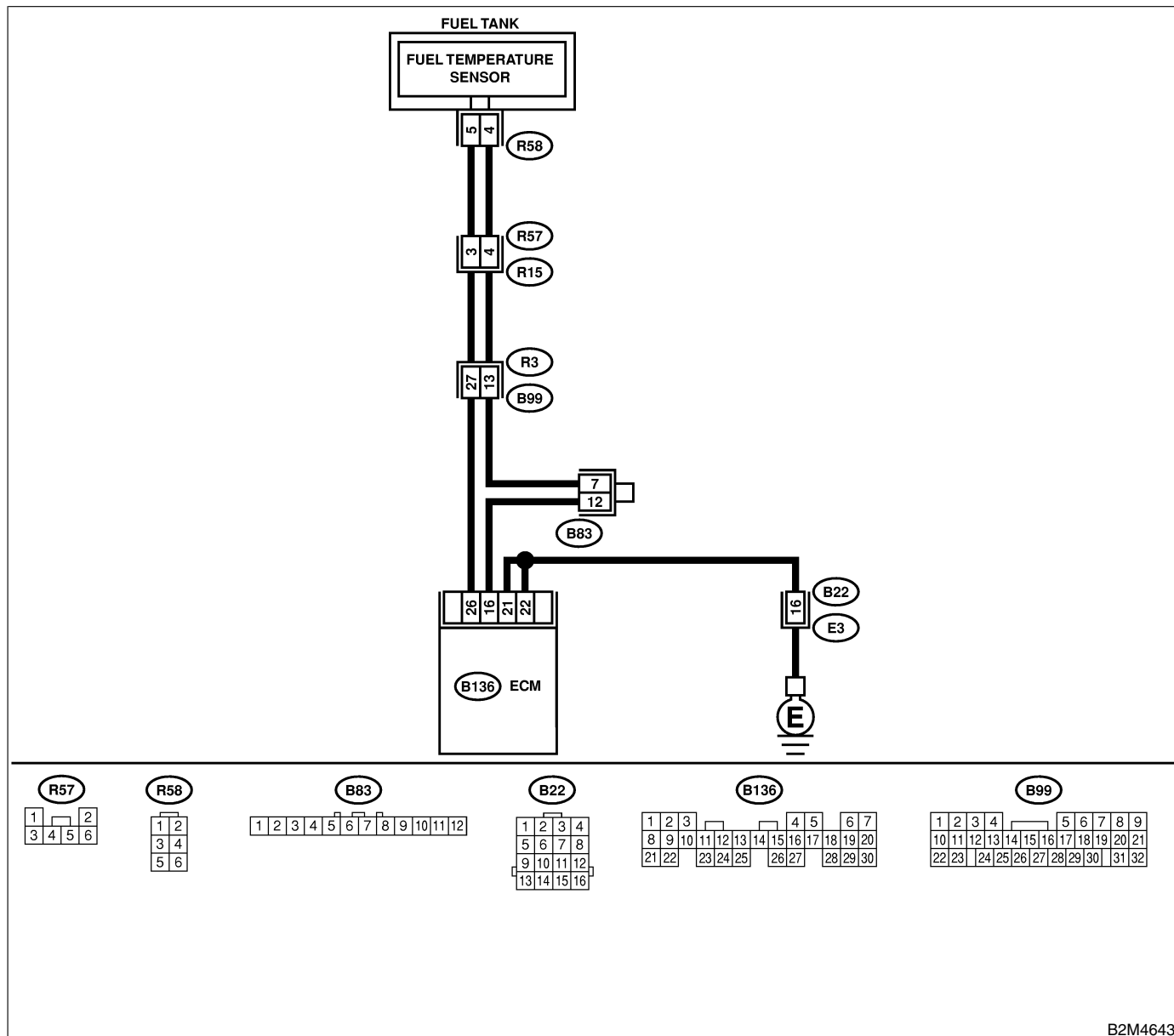
S078521B36

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK CURRENT DATA. 1) Start engine. 2) Read data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 voltage 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 voltage 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 voltage 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance less than 5 Ω ?	Replace fuel temperature sensor. <Ref. to EC-8, Fuel Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: ● Open circuit in harness between ECM and fuel pump connector ● Poor contact in fuel pump connector ● Poor contact in ECM connector ● Poor contact in coupling connectors ● Poor contact in joint connector

AG: DTC P0301 — CYLINDER 1 MISFIRE DETECTED — S078521B37

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN-180, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AH: DTC P0302 — CYLINDER 2 MISFIRE DETECTED — S078521B38

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN-180, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AI: DTC P0303 — CYLINDER 3 MISFIRE DETECTED — S078521B39

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN-180, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

AJ: DTC P0304 — CYLINDER 4 MISFIRE DETECTED — S078521B40

- **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)

- **TROUBLE SYMPTOM:**

- Engine stalls.
- Erroneous idling
- Rough driving

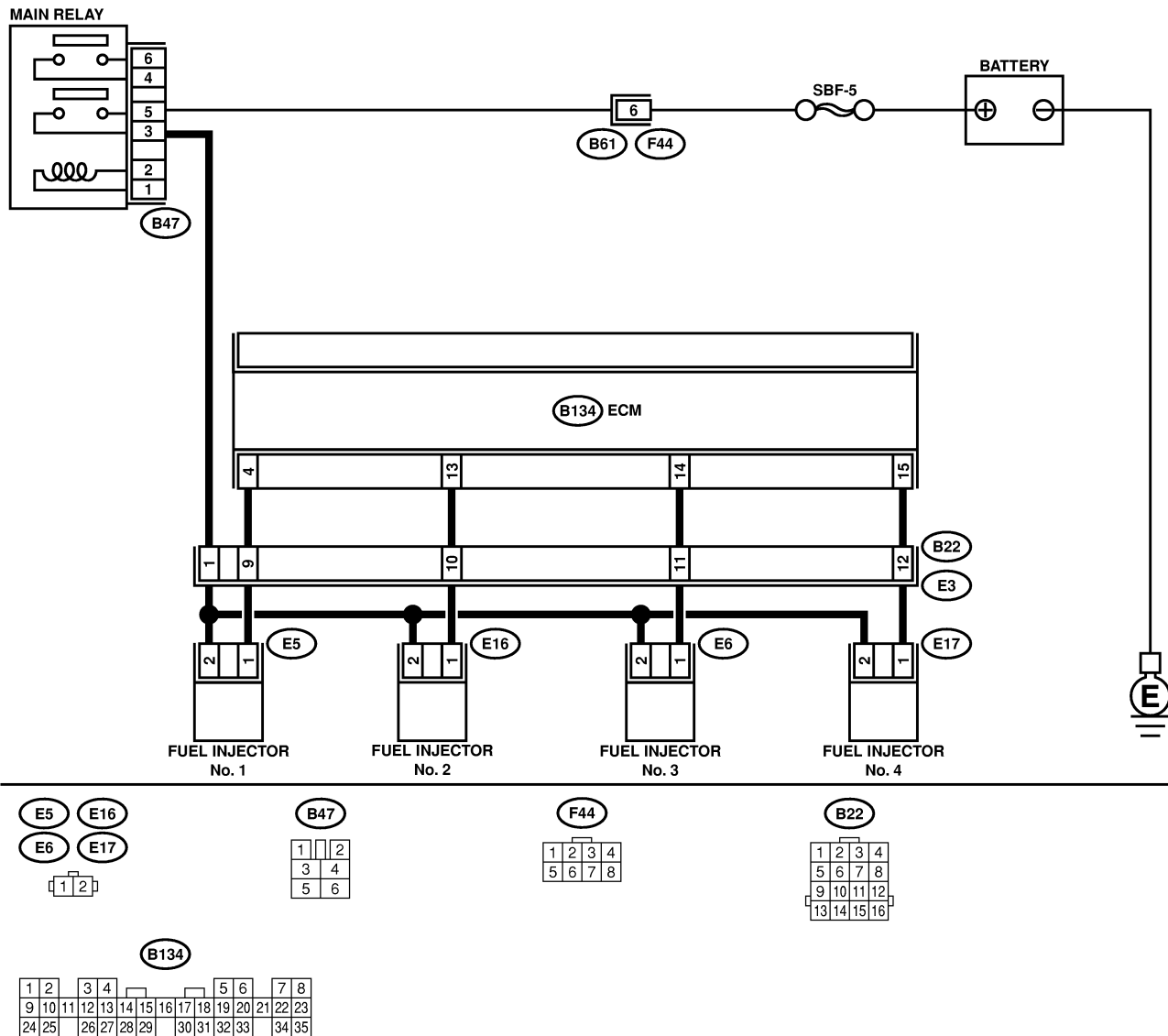
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4638

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 faulty cylinders. Connector & terminal #1 (B134) No. 4 (+) — Chassis ground (-): #2 (B134) No. 13 (+) — Chassis ground (-): #3 (B134) No. 14 (+) — Chassis ground (-): #4 (B134) No. 15 (+) — Chassis ground (-):	Is the voltage 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 faulty cylinders. 3) Measure voltage between ECM connector and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 1 — Engine ground: #2 (E16) No. 1 — Engine ground: #3 (E6) No. 1 — Engine ground: #4 (E17) No. 1 — Engine ground:	Is the resistance 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 faulty cylinders. Connector & terminal #1 (B134) No. 4 — (E5) No. 1: #2 (B134) No. 13 — (E16) No. 1: #3 (B134) No. 14 — (E6) No. 1: #4 (B134) No. 15 — (E17) No. 1:	Is the resistance 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 faulty cylinder. Terminals No. 1 — No. 2:	Is the resistance between 5 and 20 Ω?	Go to step 6.	Replace faulty fuel injector. <Ref. to FU-41, Fuel Injector.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 faulty cylinders. Connector & terminal <i>#1 (E5) No. 2 (+) — Engine ground (-):</i> <i>#2 (E16) No. 2 (+) — Engine ground (-):</i> <i>#3 (E6) No. 2 (+) — Engine ground (-):</i> <i>#4 (E17) No. 2 (+) — Engine ground (-):</i>	Is the voltage 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 faulty cylinders ● Poor contact in coupling connector ● Poor contact in main relay connector ● Poor contact in fuel injector connector on faulty cylinders
7	CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel injector on faulty cylinder. 3) Turn ignition switch to ON. 4) Measure voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal <i>#1 (B134) No. 4 (+) — Chassis ground (-):</i> <i>#2 (B134) No. 13 (+) — Chassis ground (-):</i> <i>#3 (B134) No. 14 (+) — Chassis ground (-):</i> <i>#4 (B134) No. 15 (+) — Chassis ground (-):</i>	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and fuel injector. After repair, replace ECM. <Ref. to FU-51, 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 faulty cylinder. Terminals <i>No. 1 — No. 2:</i>	Is the resistance less than 1 Ω ?	Replace faulty fuel injector <Ref. to FU-41, Fuel Injector.> and ECM <Ref. to FU-51, 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-52, Crankshaft Sprocket.>	Go to step 11.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. ST 499987500 CRANKSHAFT SOCKET	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME-46, Timing Belt Assembly.>	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-55, 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.	Was the cause of misfire diagnosed when the engine is running?	Finish diagnostics operation, if the engine has no abnormality. NOTE: Ex. Remove spark plug cord, etc.	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 faulty cylinders ● Poor contact in ECM connector ● Poor contact in coupling connector
15	CHECK AIR INTAKE SYSTEM.	Is there a fault 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.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
16	CHECK MISFIRE SYMPTOM. 1) Turn ignition switch to ON. 2) Read diagnostic trouble code (DTC). ● Subaru Select Monitor <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual. NOTE: Perform diagnosis according to the items listed below.	Does the Subaru Select Monitor or OBD-II 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 OBD-II 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 OBD-II 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 OBD-II 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 OBD-II general scan tool indicate DTC P0302 and P0304?	Go to step 25.	Go to step 26.
21	ONLY ONE CYLINDER	Is there a fault in that cylinder?	Repair or replace faulty parts. NOTE: Check the following items. ● Spark plug ● Spark plug cord ● Fuel injector ● Compression ratio	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	GROUP OF #1 AND #2 CYLINDERS	Are there faults in #1 and #2 cylinders?	Repair or replace faulty 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-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
23	GROUP OF #3 AND #4 CYLINDERS	Are there faults in #3 and #4 cylinders?	Repair or replace faulty 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-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	GROUP OF #1 AND #3 CYLINDERS	Are there faults in #1 and #3 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. ● Spark plugs ● Fuel injectors ● Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	GROUP OF #2 AND #4 CYLINDERS	Are there faults in #2 and #4 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. ● Spark plugs ● Fuel injectors ● Compression ratio ● Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
26	CYLINDER AT RANDOM	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN-170, DTC P0171 — FUEL TRIM MALFUNCTION (A/F TOO LEAN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. ● Spark plugs ● Fuel injectors ● Compression ratio

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

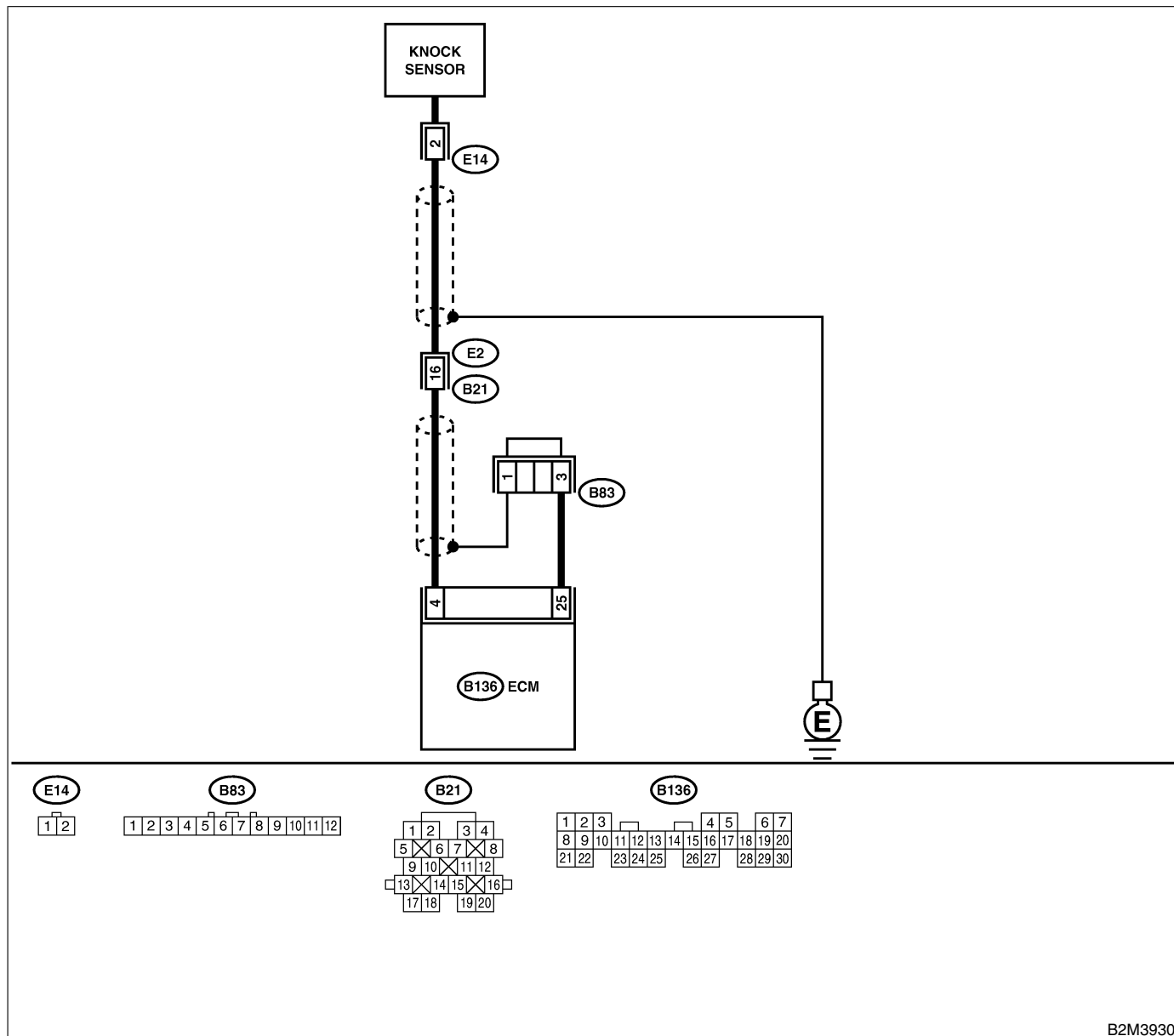
AK: DTC P0327 — KNOCK SENSOR CIRCUIT LOW INPUT — S078521F94

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B136) No. 4 — Chassis ground:	Is the resistance more than 700 k Ω ?	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: ● Open circuit in harness between knock sensor and ECM connector ● Poor contact in knock sensor connector ● Poor contact in coupling connector
2	CHECK KNOCK SENSOR. 1) Disconnect connector from knock sensor. 2) Measure resistance between knock sensor connector terminal and engine ground. Terminal No. 2 — Engine ground:	Is the resistance more than 700 k Ω ?	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-33, Knock Sensor.>	Tighten knock sensor installation bolt securely.

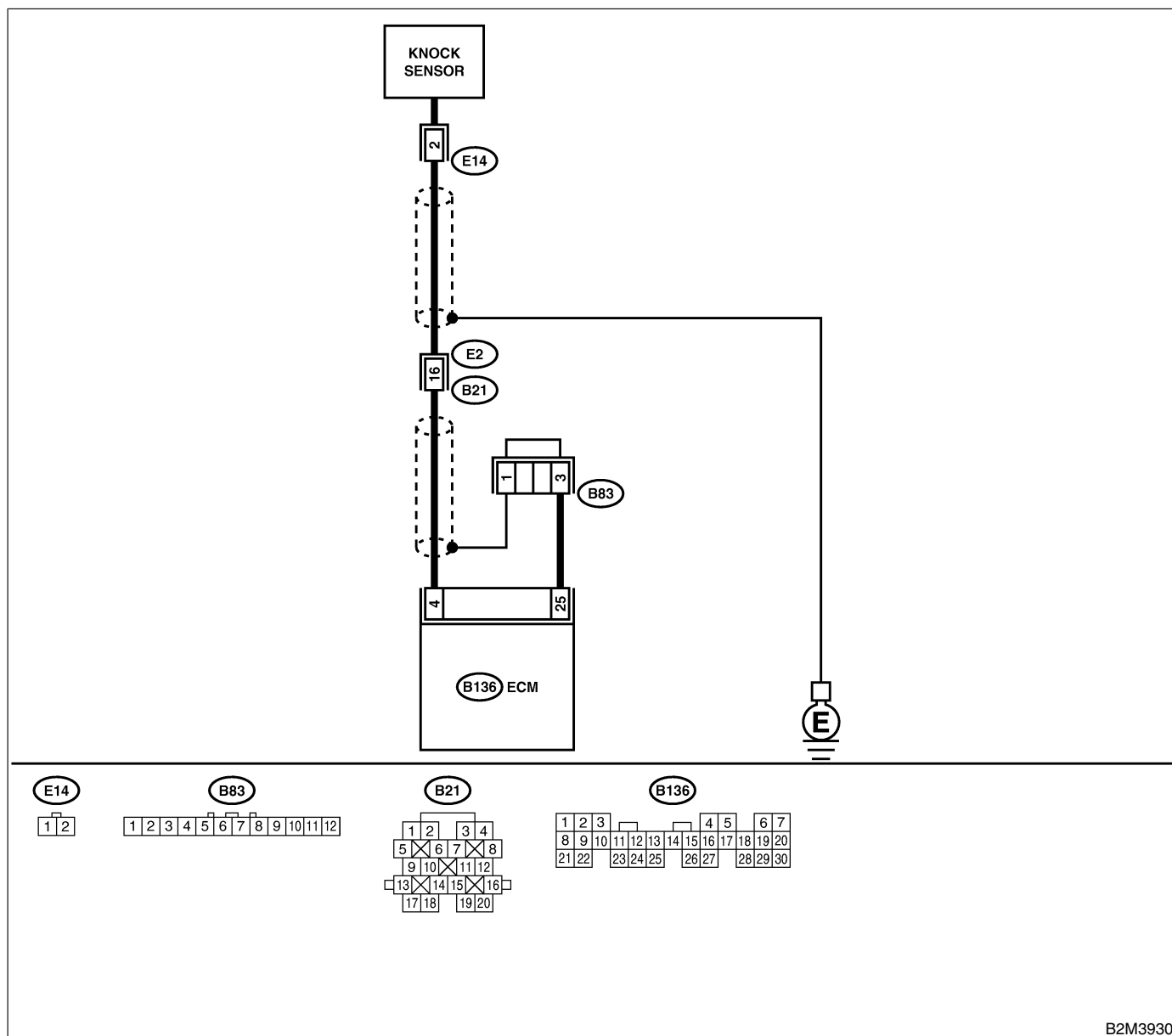
AL: DTC P0328 — KNOCK SENSOR CIRCUIT HIGH INPUT — S078521F95

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B136) No. 4 — Chassis ground:	Is the resistance less than 400 k Ω ?	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 resistance less than 400 k Ω ?	Replace knock sensor. <Ref. to FU-33, 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 (B136) No. 4 (+) — Chassis ground (-):	Is the voltage 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.

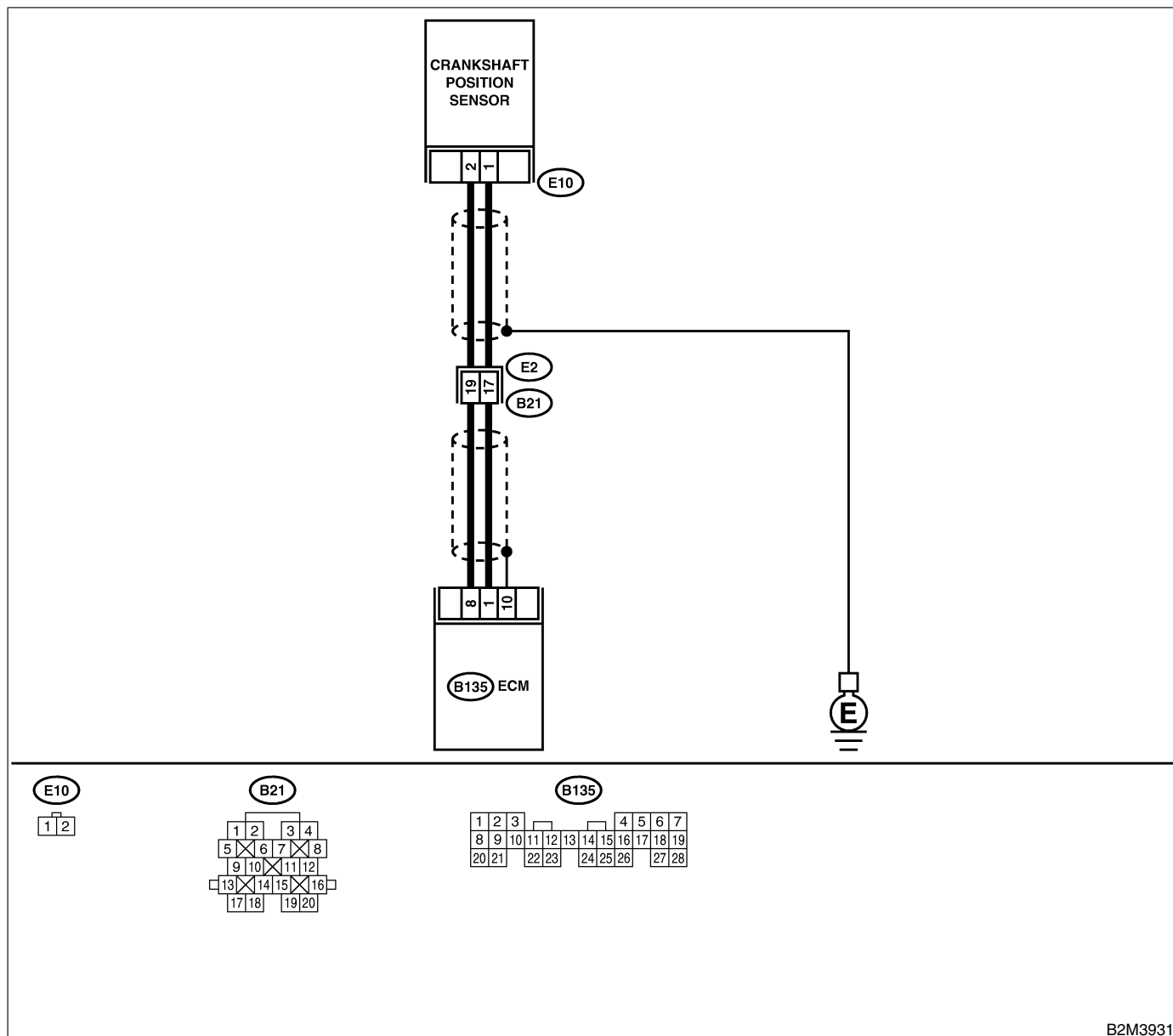
**AM: DTC P0335 — CRANKSHAFT POSITION SENSOR CIRCUIT
MALFUNCTION —** S078521B42

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3931

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance more than 100 k Ω ?	Repair harness and connector. NOTE: In this case, repair the following: ● Open circuit in harness between crankshaft position sensor and ECM connector ● Poor contact in ECM connector ● Poor contact in coupling connector	Go to step 2.
2	CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground:	Is the resistance 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 resistance 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 resistance between 1 and 4 k Ω ?	Repair poor contact in crankshaft position sensor connector.	Replace crankshaft position sensor. <Ref. to FU-31, Crankshaft Position Sensor.>

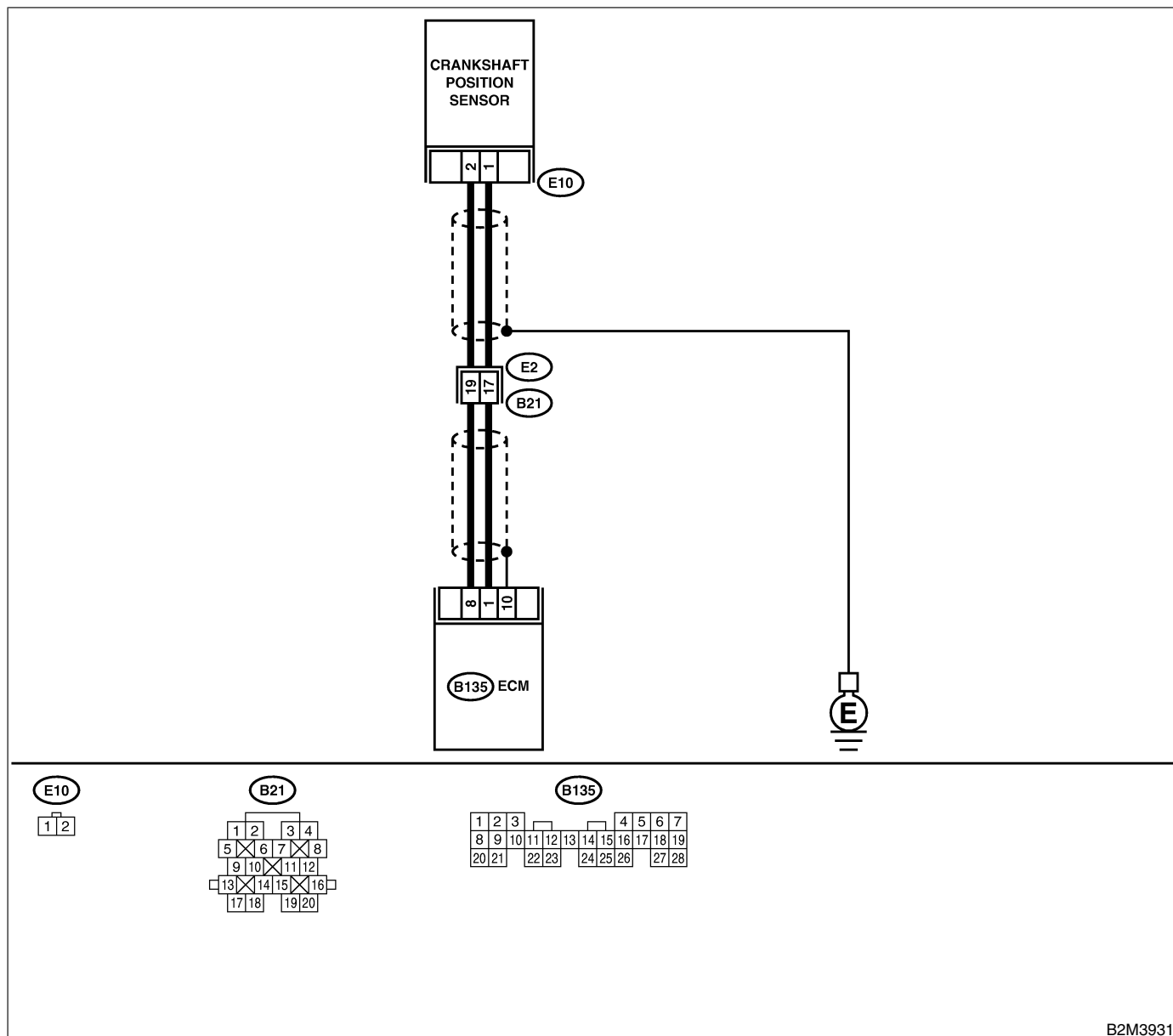
**AN: DTC P0336 — CRANKSHAFT POSITION SENSOR CIRCUIT
RANGE/PERFORMANCE PROBLEM —** S078521B43

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0335?	Inspect DTC P0335 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, 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-52, 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. ST 499987500 CRANKSHAFT SOCKET	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME-46, Timing Belt Assembly.>	Replace crankshaft position sensor. <Ref. to FU-52, Crankshaft Position Sensor.>

AO: DTC P0340 — CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

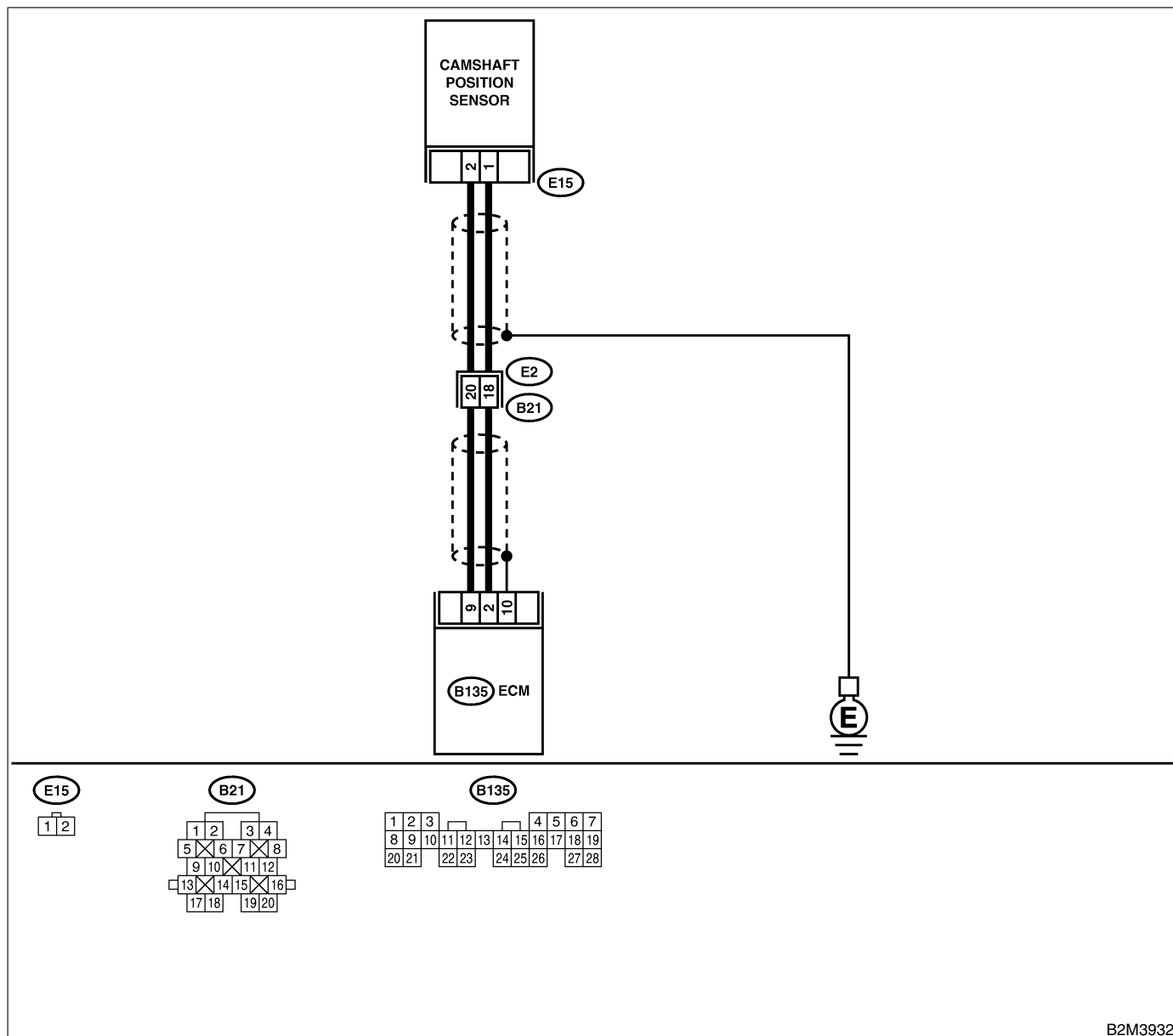
S078521B44

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3932

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance more than 100 k Ω ?	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 resistance 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 resistance 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 resistance between 1 and 4 k Ω ?	Repair poor contact in camshaft position sensor connector.	Replace camshaft position sensor. <Ref. to FU-32, Camshaft Position Sensor.>

**AP: DTC P0341 — CAMSHAFT POSITION SENSOR CIRCUIT
RANGE/PERFORMANCE PROBLEM —**

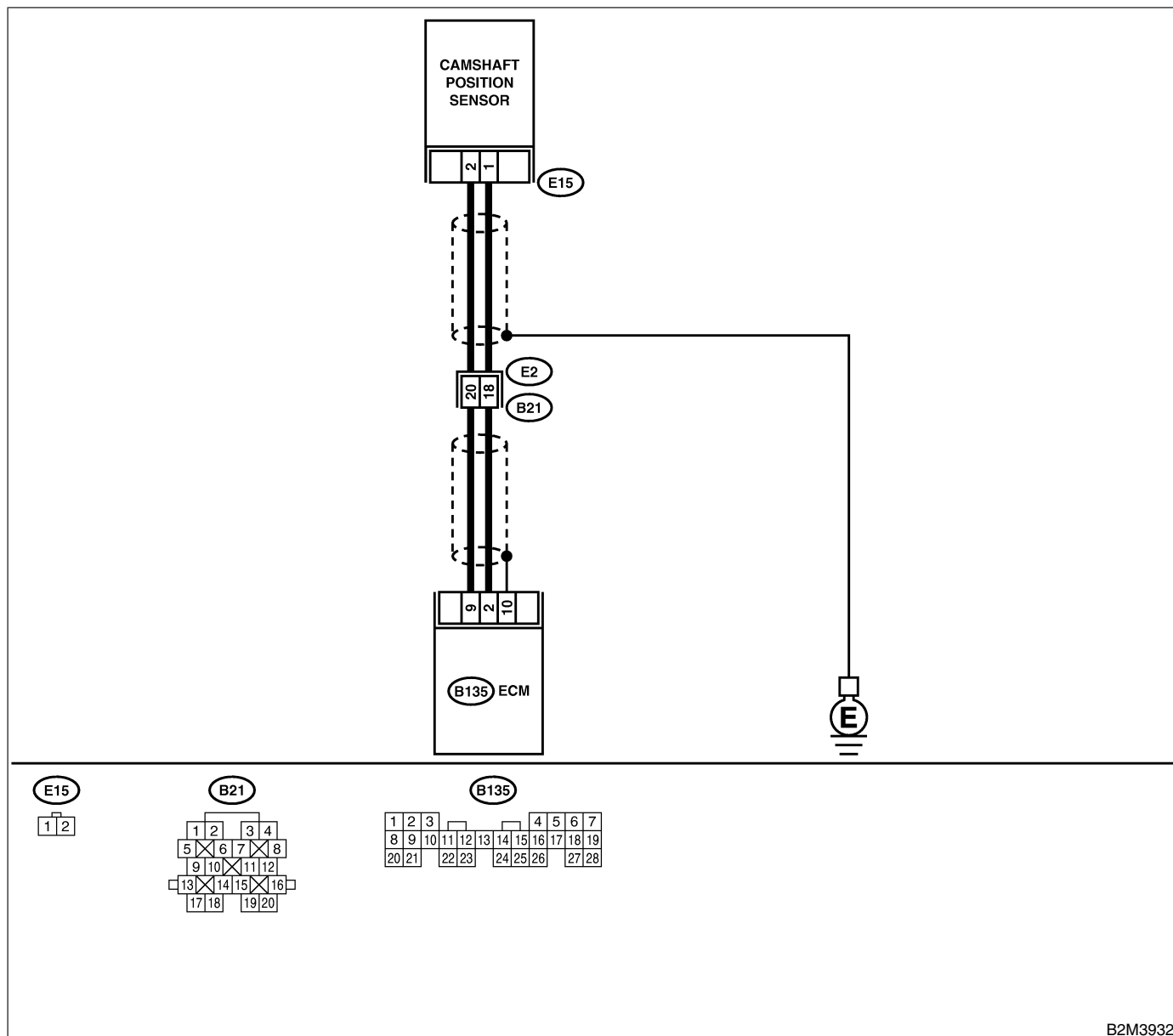
S078521B45

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3932

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0340?	Inspect DTC P0340 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, 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 resistance more than 100 k Ω ?	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 resistance 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 resistance 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.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 resistance between 1 and 4 kΩ?	Go to step 7.	Replace camshaft position sensor. <Ref. to FU-32, Camshaft Position Sensor.>
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. <Ref. to ME-45, Belt Cover.>	Are camshaft sprocket teeth cracked or damaged?	Replace camshaft sprocket. <Ref. to ME-51, 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. ST 499207100 CAMSHAFT SPROCKET WRENCH	Is timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME-46, Timing Belt Assembly.>	Replace camshaft position sensor. <Ref. to FU-32, Camshaft Position Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

AQ: DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

S078521B46

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

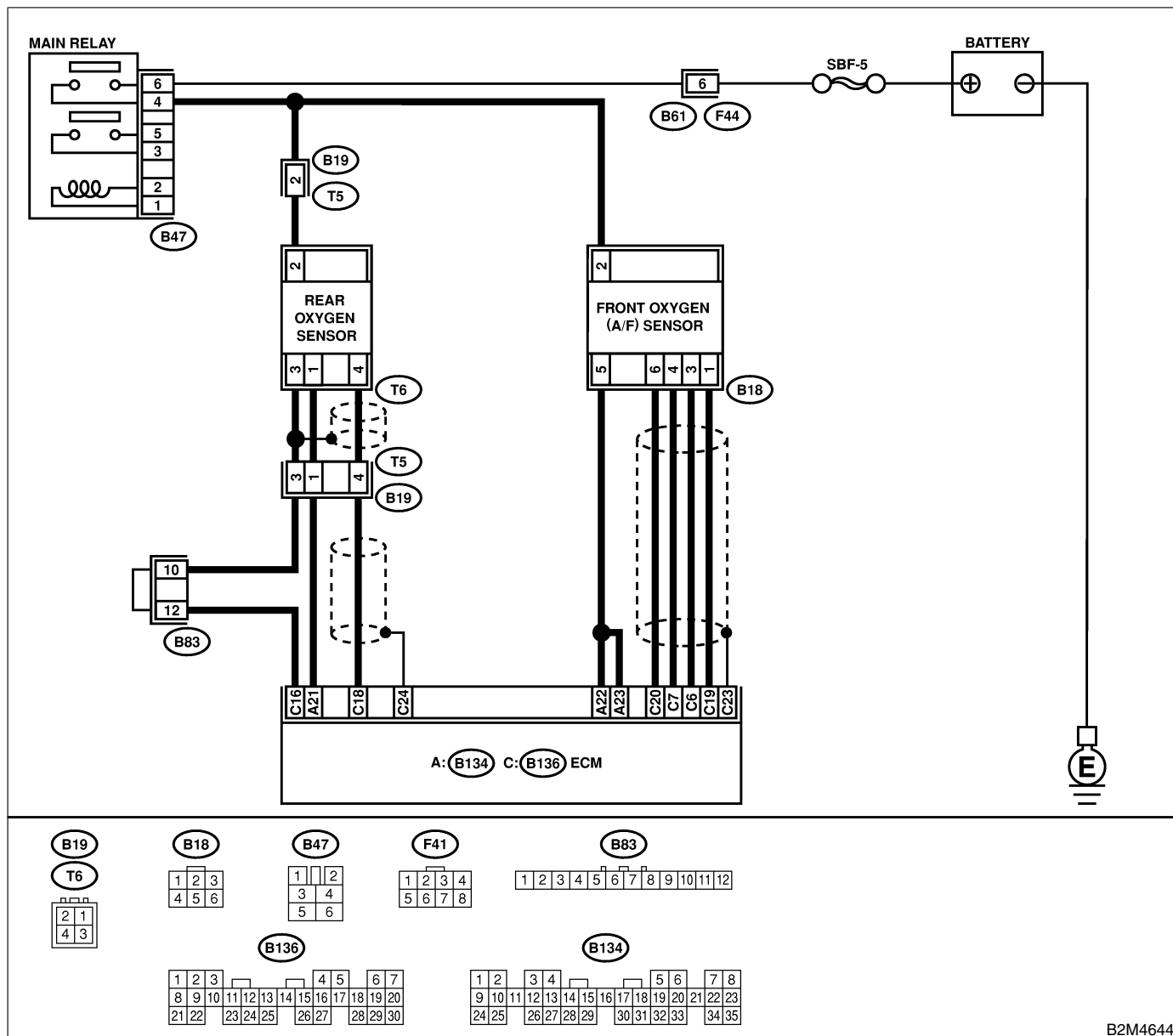
● **TROUBLE SYMPTOM:**

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4644

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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	Is there a fault in exhaust system?	Repair or replace exhaust system. <Ref. to EX-2, General Description.>	Go to step 3.
3	CHECK REAR CATALYTIC CONVERTER. Separate rear catalytic converter from rear exhaust pipe.	Is there damage at rear face of rear catalyst?	Replace front catalytic converter <Ref. to EC-3, Front Catalytic Converter.> and rear catalytic converter <Ref. to EC-4, Rear Catalytic Converter.>.	Go to step 4.
4	CHECK FRONT CATALYTIC CONVERTER. Remove front catalytic converter.	Is there damage at rear face or front face of front catalyst?	Replace front catalytic converter. <Ref. to EC-3, Front Catalytic Converter.>	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

AR: DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION — S078521B48

- **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

- **TROUBLE SYMPTOM:**

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

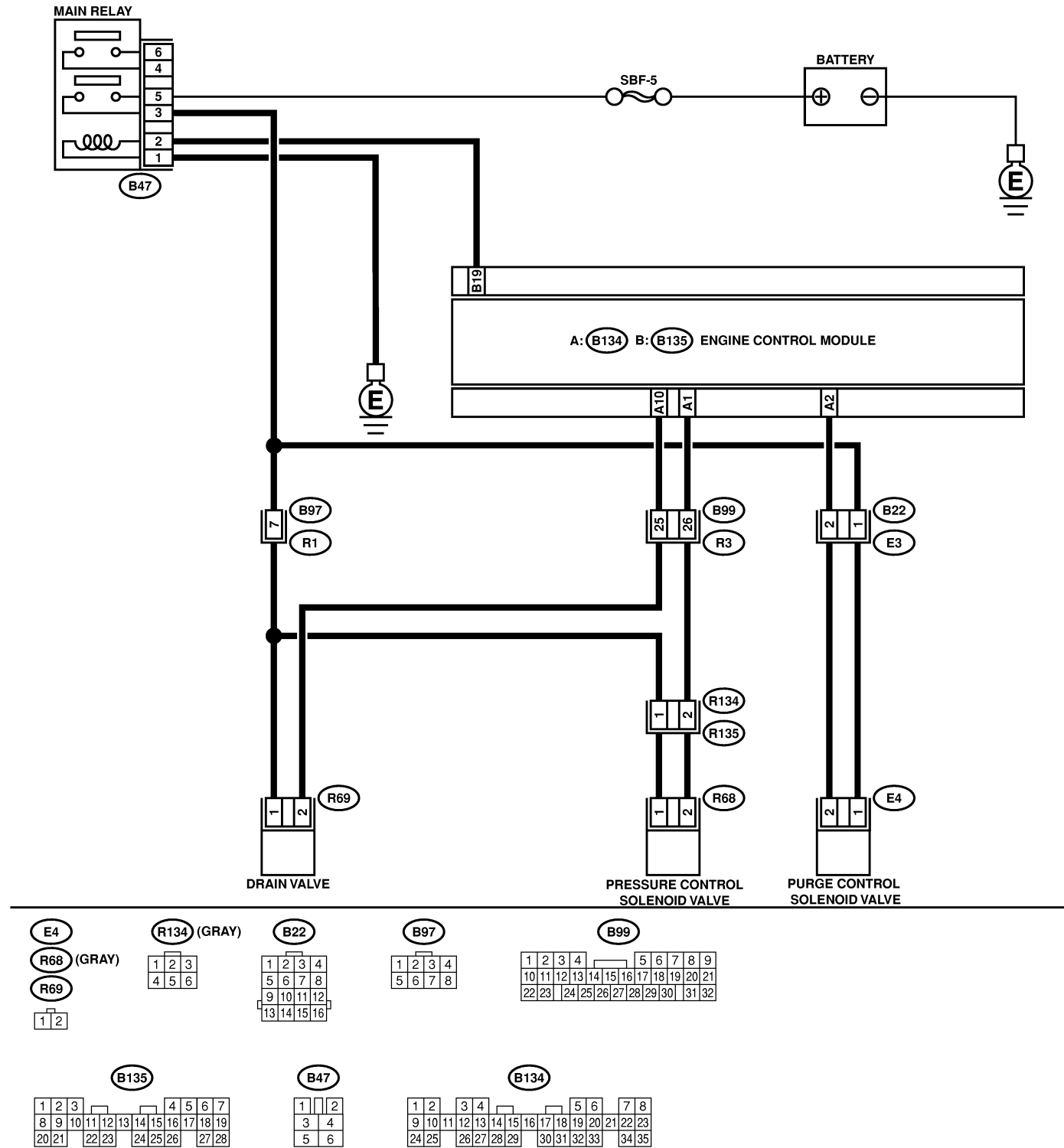
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4645

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 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-65, Fuel Filler Pipe.>	Go to step 4.
4	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-56, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step 5.	Replace drain valve. <Ref. to EC-16, Drain Valve.>
5	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-56, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step 6.	Replace purge control solenoid valve. <Ref. to EC-6, Purge Control Solenoid Valve.>
6	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-56, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step 7.	Replace pressure control solenoid valve. <Ref. to EC-12, Pressure Control Solenoid Valve.>
7	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 fuel line?	Repair or replace fuel line. <Ref. to FU-81, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.
8	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-5, Canister.>	Go to step 9.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
9	CHECK FUEL TANK. Remove fuel tank. <Ref. to FU-57, 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-57, Fuel Tank.>	Go to step 10.
10	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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AS: DTC P0447 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL LOW INPUT — S078521F98

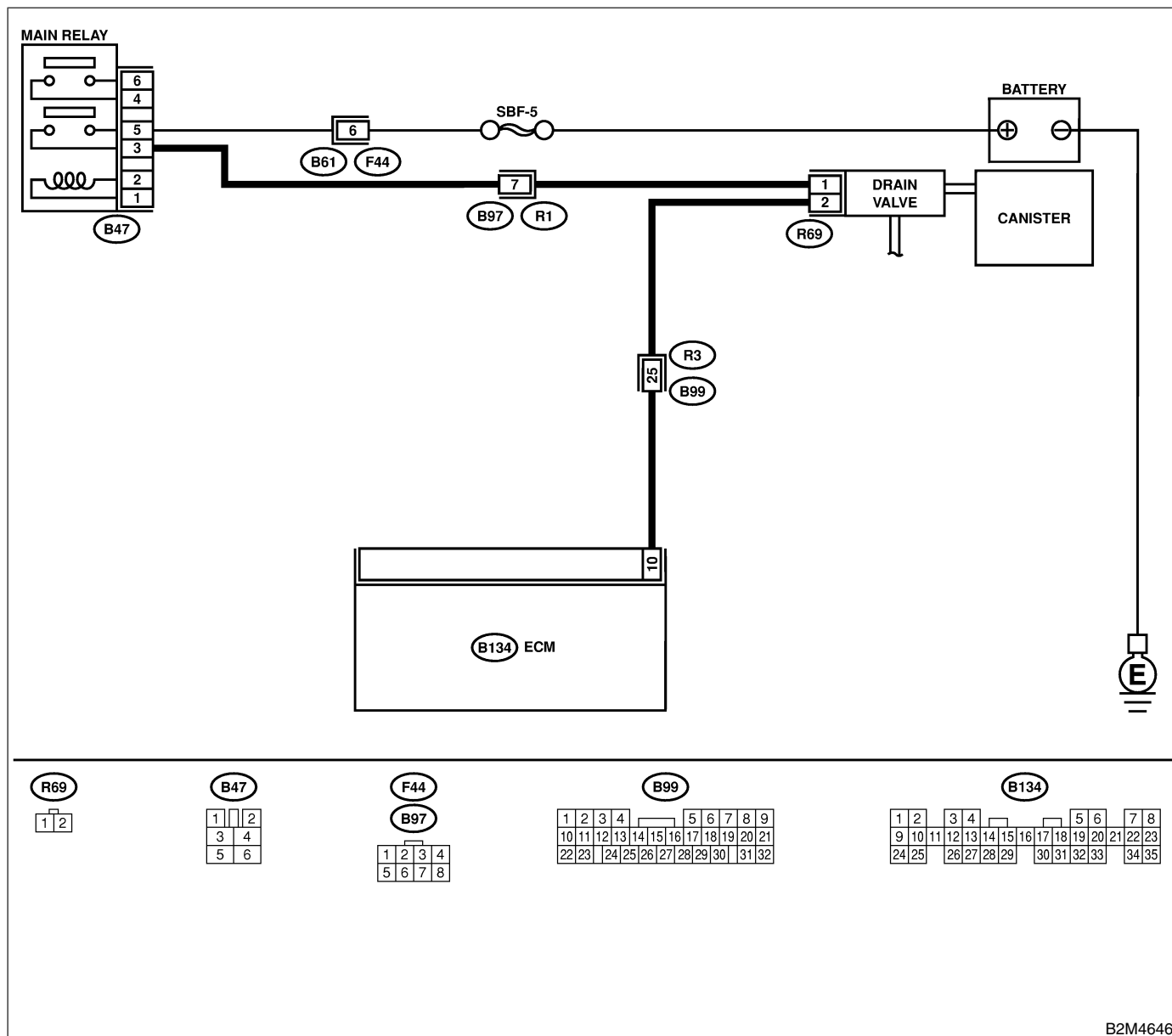
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4646

No.	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. 10 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 (R69) No. 2 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and drain valve connector.	Go to step 4.
4	CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. Measure resistance of harness between ECM and drain valve connector. Connector & terminal (B134) No. 10 — (R69) No. 2:	Is the voltage 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 resistance between 10 and 100 Ω ?	Go to step 6.	Replace drain valve. <Ref. to EC-16, Drain Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (R69) No. 1 (+) — Chassis ground (-):	Is the voltage 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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

MEMO:

AT: DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL HIGH INPUT — S078521F99

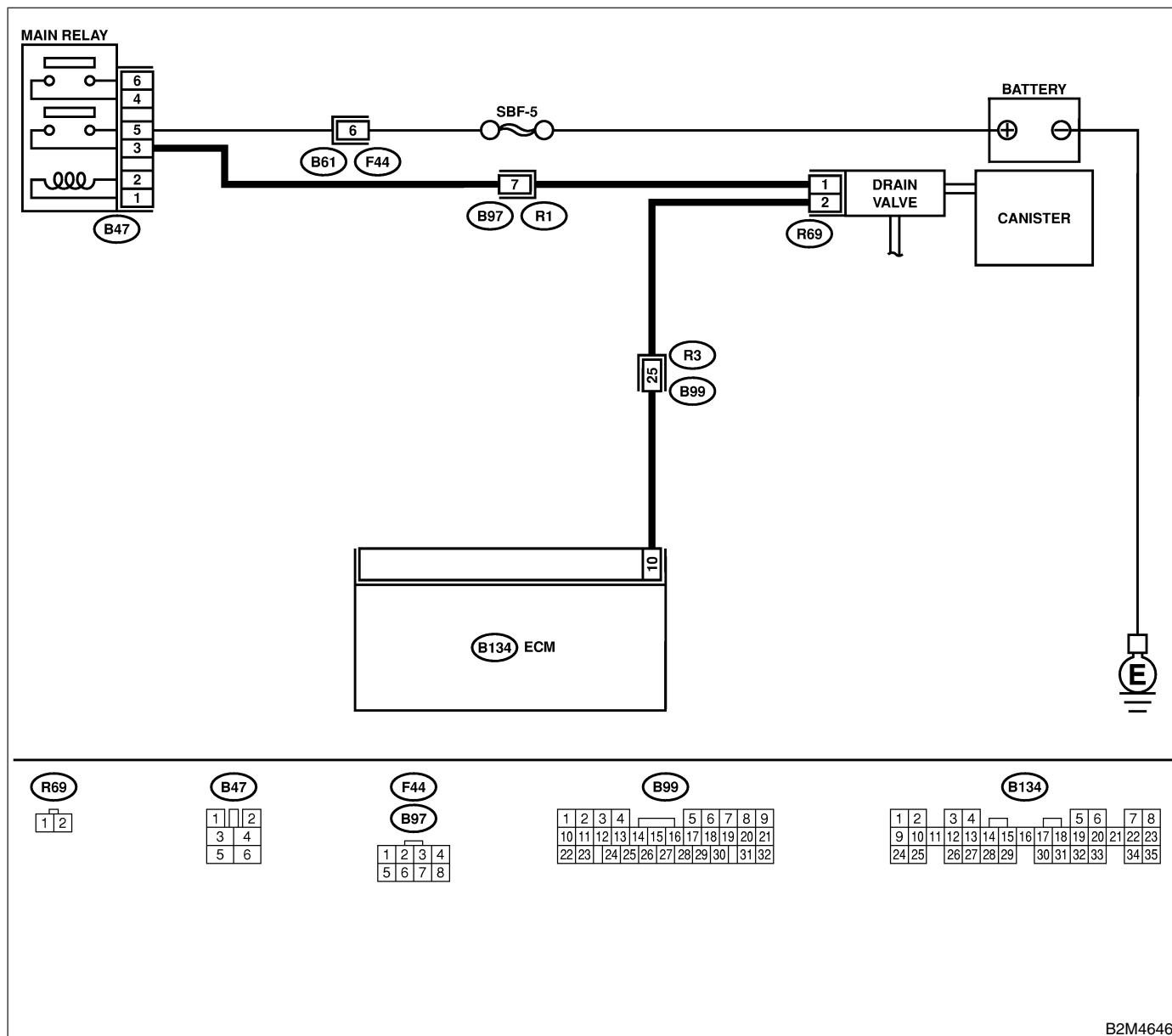
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4646

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 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-56, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 10 (+) — Chassis ground (-):	Does voltage change between 0 and 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. 10 (+) — Chassis ground (-):	Is the voltage 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-51, 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. 10 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and drain valve connector. After repair, replace ECM. <Ref. to FU-51, 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 resistance less than 1 Ω ?	Replace drain valve <Ref. to EC-16, Drain Valve.> and ECM <Ref. to FU-51, 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-51, Engine Control Module.>

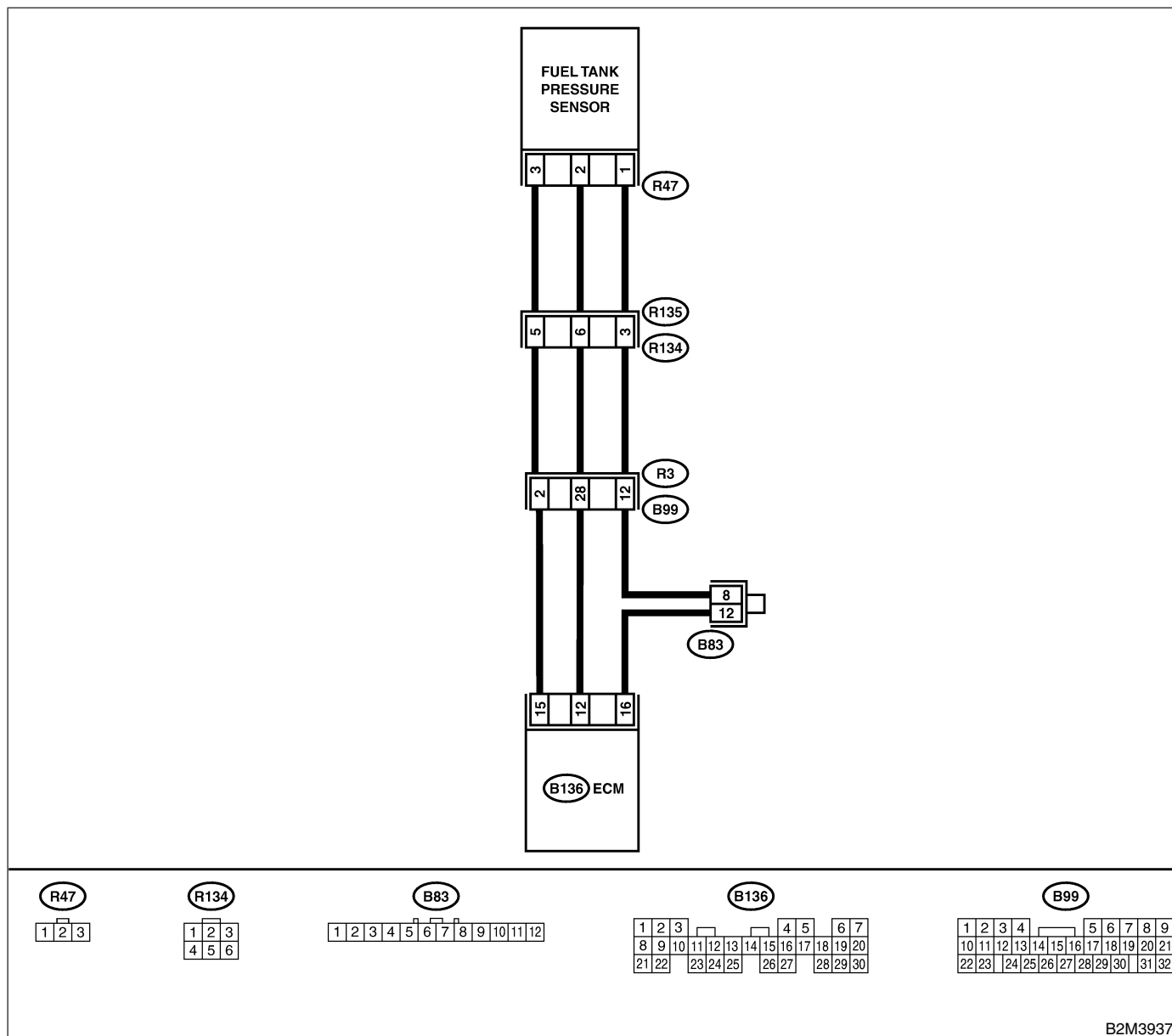
**AU: DTC P0451 — EVAPORATIVE EMISSION CONTROL SYSTEM
PRESSURE SENSOR RANGE/PERFORMANCE PROBLEM —** S078521B51

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 a fault in pressure/vacuum line?	Repair or replace hoses and pipes.	Replace fuel tank pressure sensor. <Ref. to EC-10, Fuel Tank Pressure Sensor.>

AV: DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT — S078521B52

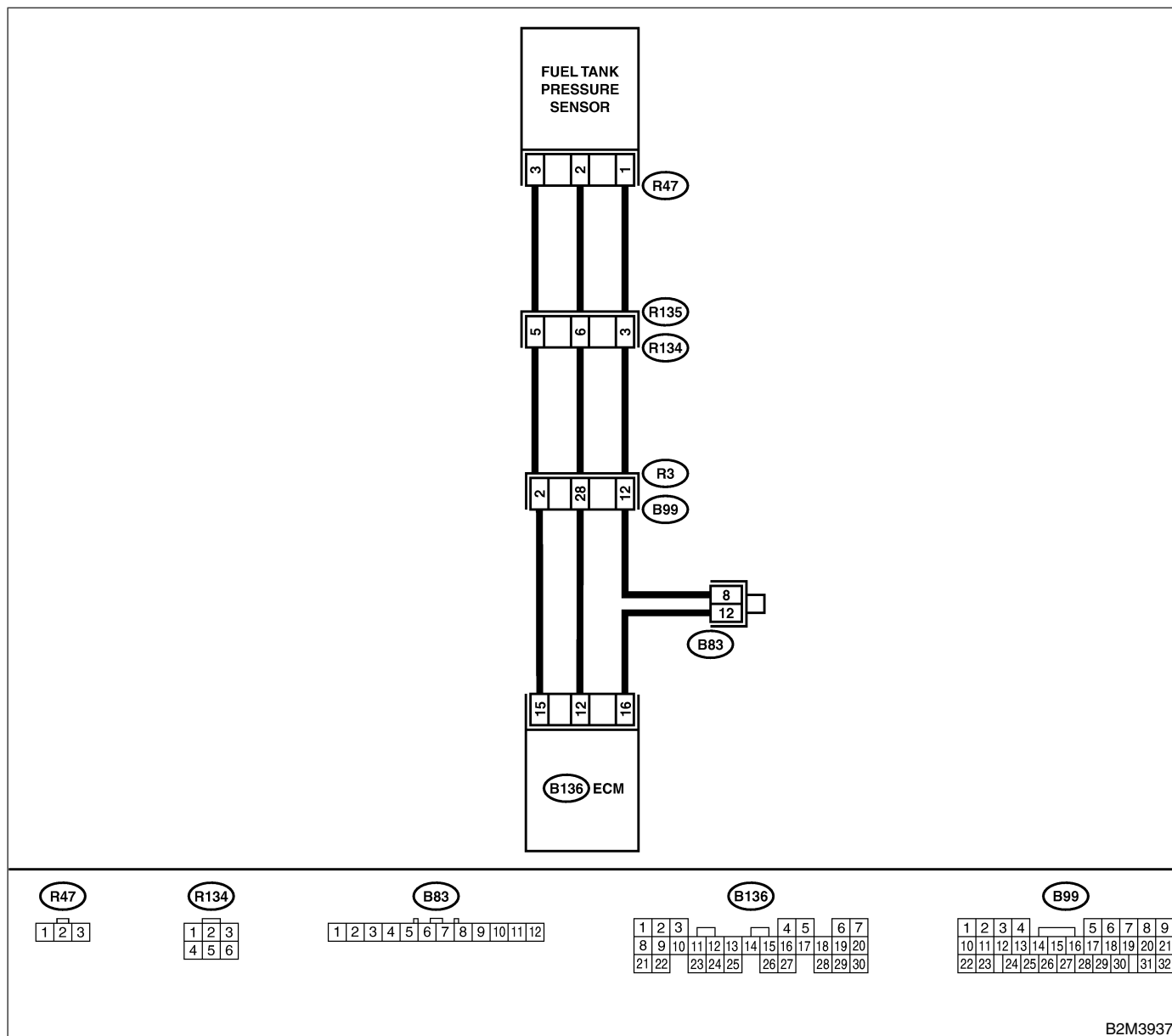
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 (B136) No. 15 (+) — Chassis ground (-):	Is the voltage 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 (B136) No. 15 (+) — Chassis ground (-):	Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	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 (B136) No. 12 (+) — Chassis ground (-):	Is the voltage 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-36, Subaru Select Monitor.>	Does the value change more than -2.8 kPa (-21.0 mmHg, -0.827 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	Repair poor contact in ECM connector.	Go to step 6.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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. 5 (+) — Chassis ground (-):	Is the voltage 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
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 (B136) No. 16 — (R134) No. 3:	Is the resistance 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. 3 — Chassis ground:	Is the resistance more than 500 k 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. 5 — (R47) No. 3:	Is the resistance 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. 3 — (R47) No. 1:	Is the resistance 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 resistance more than 500 k Ω ?	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-10, Fuel Tank Pressure Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

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

S078521B53

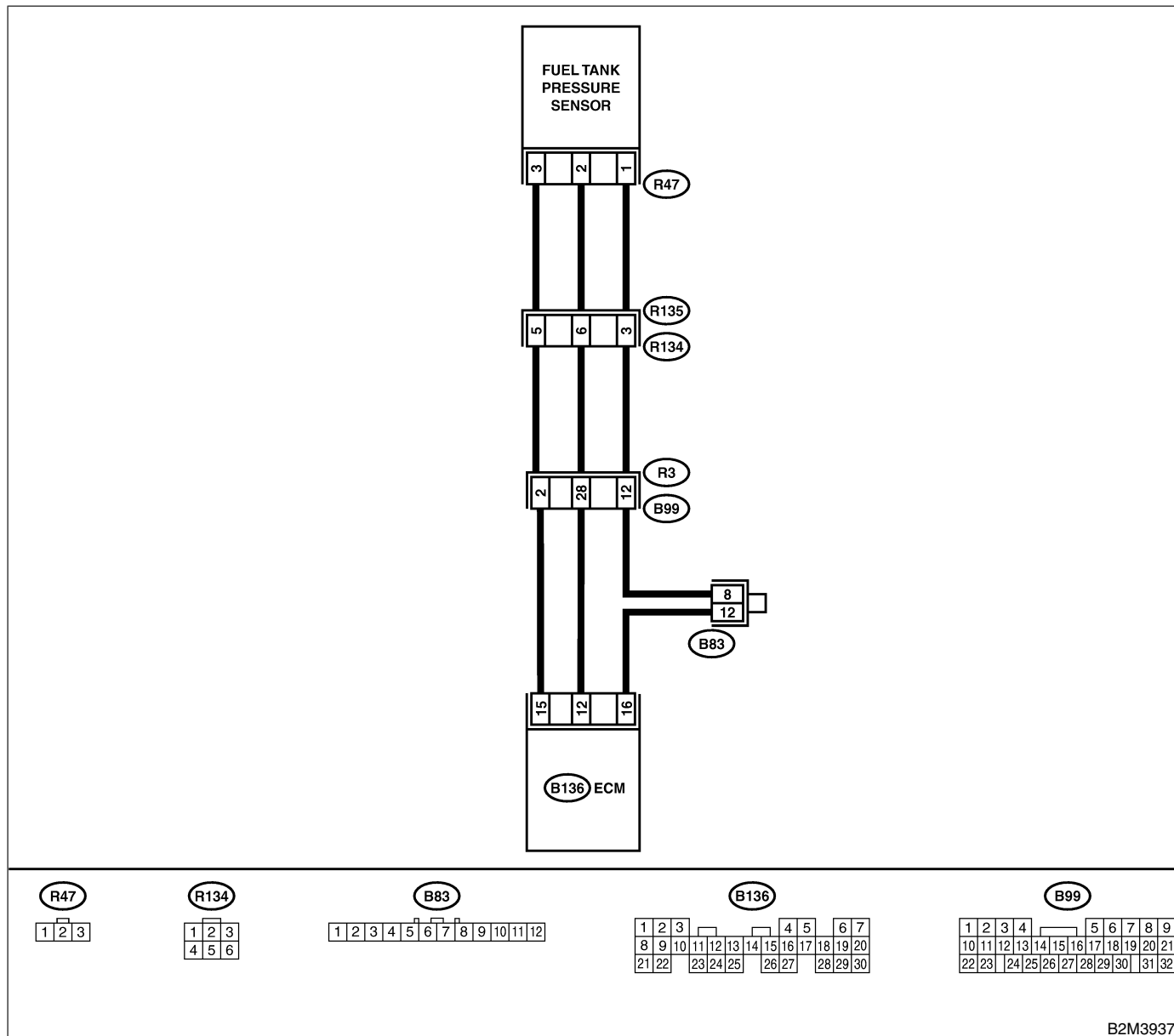
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3937

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 (B136) No. 15 (+) — Chassis ground (-):	Is the voltage 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 (B136) No. 15 (+) — Chassis ground (-):	Does the voltage change more than 4.5 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair poor contact in ECM connector.	Replace ECM. <Ref. to FU-51, Engine Control Module.>
4	CHECK INPUT SIGNAL FOR ECM. Measure voltage between ECM and chassis ground. Connector & terminal (B136) No. 12 (+) — Chassis ground (-):	Is the voltage 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-36, Subaru Select Monitor.>	Does the value change more than -2.8 kPa (-21.0 mmHg, -0.827 inHg) by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	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. 5 (+) — Chassis ground (-):	Is the voltage 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B136) No. 12 — (R134) No. 6:	Is the resistance 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 (B136) No. 16 — (R134) No. 3:	Is the resistance 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 resistance 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. 3 — (R47) No. 1:	Is the resistance 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 FU-10, 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the 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 FU-10, Fuel Tank Pressure Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

AX: DTC P0456 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION — S078521G00

- **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

- **TROUBLE SYMPTOM:**

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

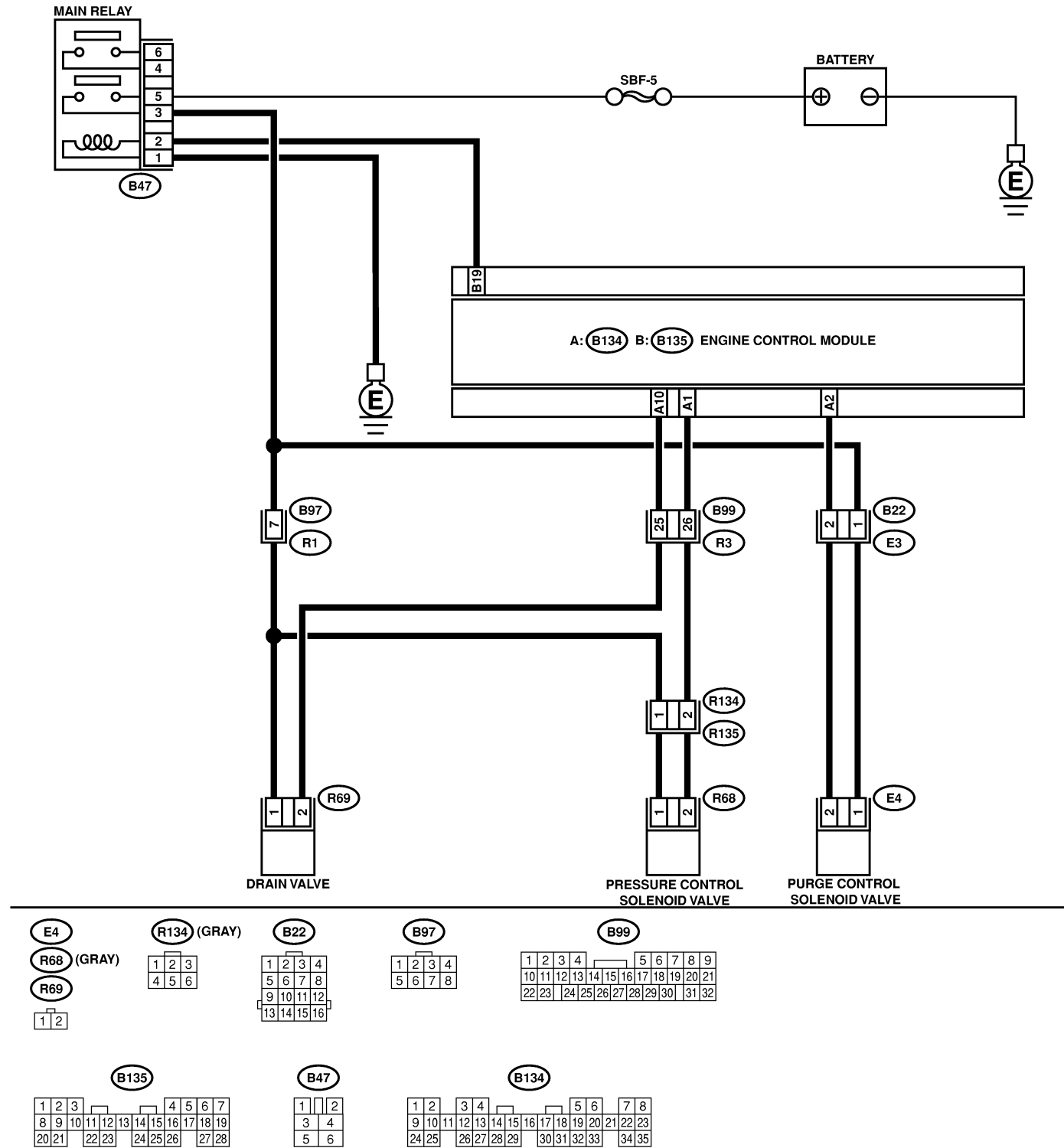
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4645

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 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-65, Fuel Filler Pipe.>	Go to step 4.
4	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-56, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step 5.	Replace drain valve. <Ref. to EC-16, Drain Valve.>
5	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-56, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step 6.	Replace purge control solenoid valve. <Ref. to EC-6, Purge Control Solenoid Valve.>
6	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-56, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step 7.	Replace pressure control solenoid valve. <Ref. to EC-12, Pressure Control Solenoid Valve.>
7	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 fuel line?	Repair or replace fuel line. <Ref. to FU-81, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.
8	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-5, Canister.>	Go to step 9.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
9	CHECK FUEL TANK. Remove fuel tank. <Ref. to FU-57, 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-57, 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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

AY: DTC P0457 — EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION — S078521K05

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

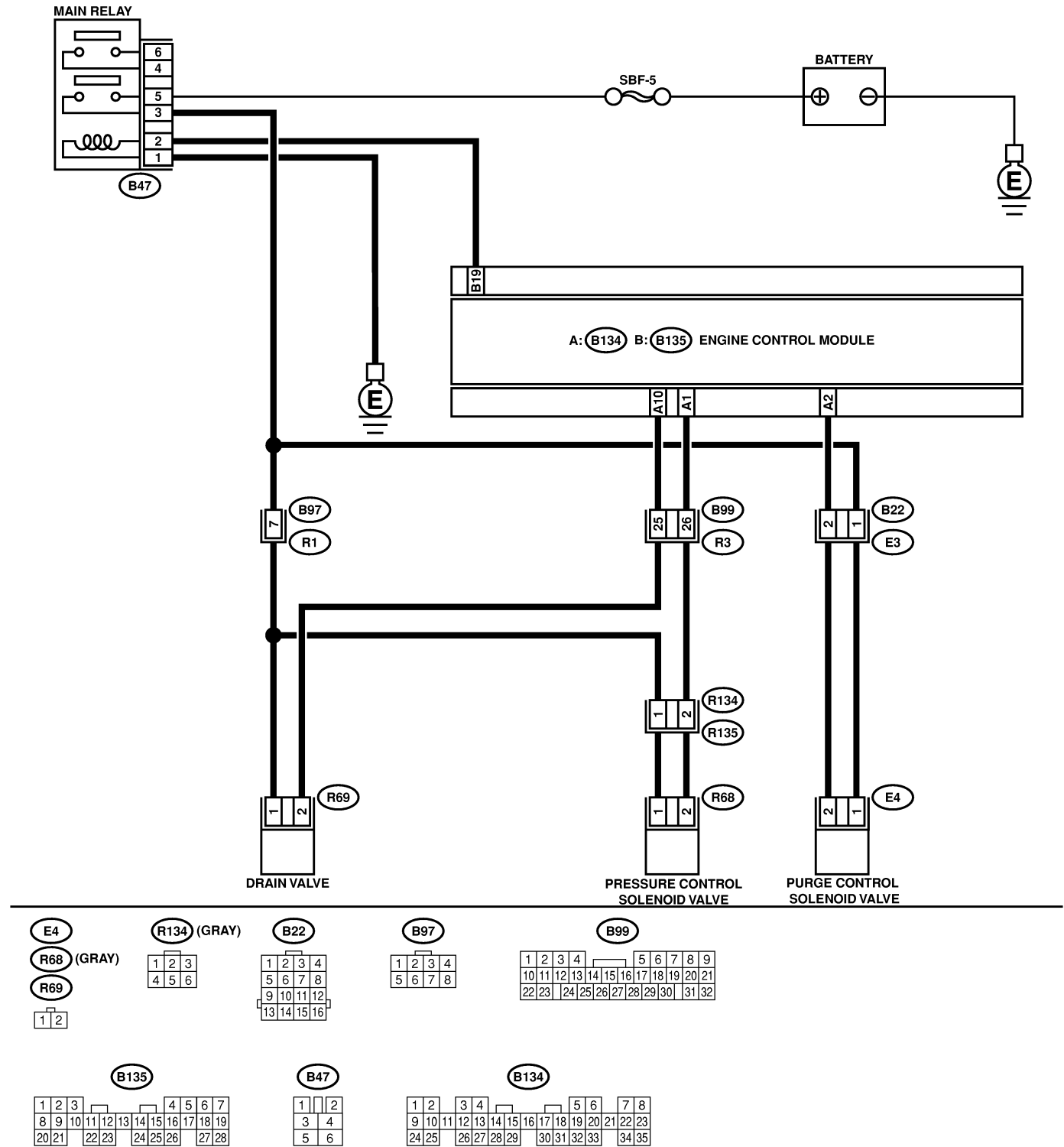
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4645

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 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-65, Fuel Filler Pipe.>	Go to step 4.
4	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-56, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Go to step 5.	Replace drain valve. <Ref. to EC-16, Drain Valve.>
5	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-56, Compulsory Valve Operation Check Mode.>	Does purge control solenoid valve produce operating sound?	Go to step 6.	Replace purge control solenoid valve. <Ref. to EC-6, Purge Control Solenoid Valve.>
6	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-56, Compulsory Valve Operation Check Mode.>	Does pressure control solenoid valve produce operating sound?	Go to step 7.	Replace pressure control solenoid valve. <Ref. to EC-12, Pressure Control Solenoid Valve.>
7	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 fuel line?	Repair or replace fuel line. <Ref. to FU-81, Fuel Delivery, Return and Evaporation Lines.>	Go to step 8.
8	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-5, Canister.>	Go to step 9.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
9	CHECK FUEL TANK. Remove fuel tank. <Ref. to FU-57, 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-57, 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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

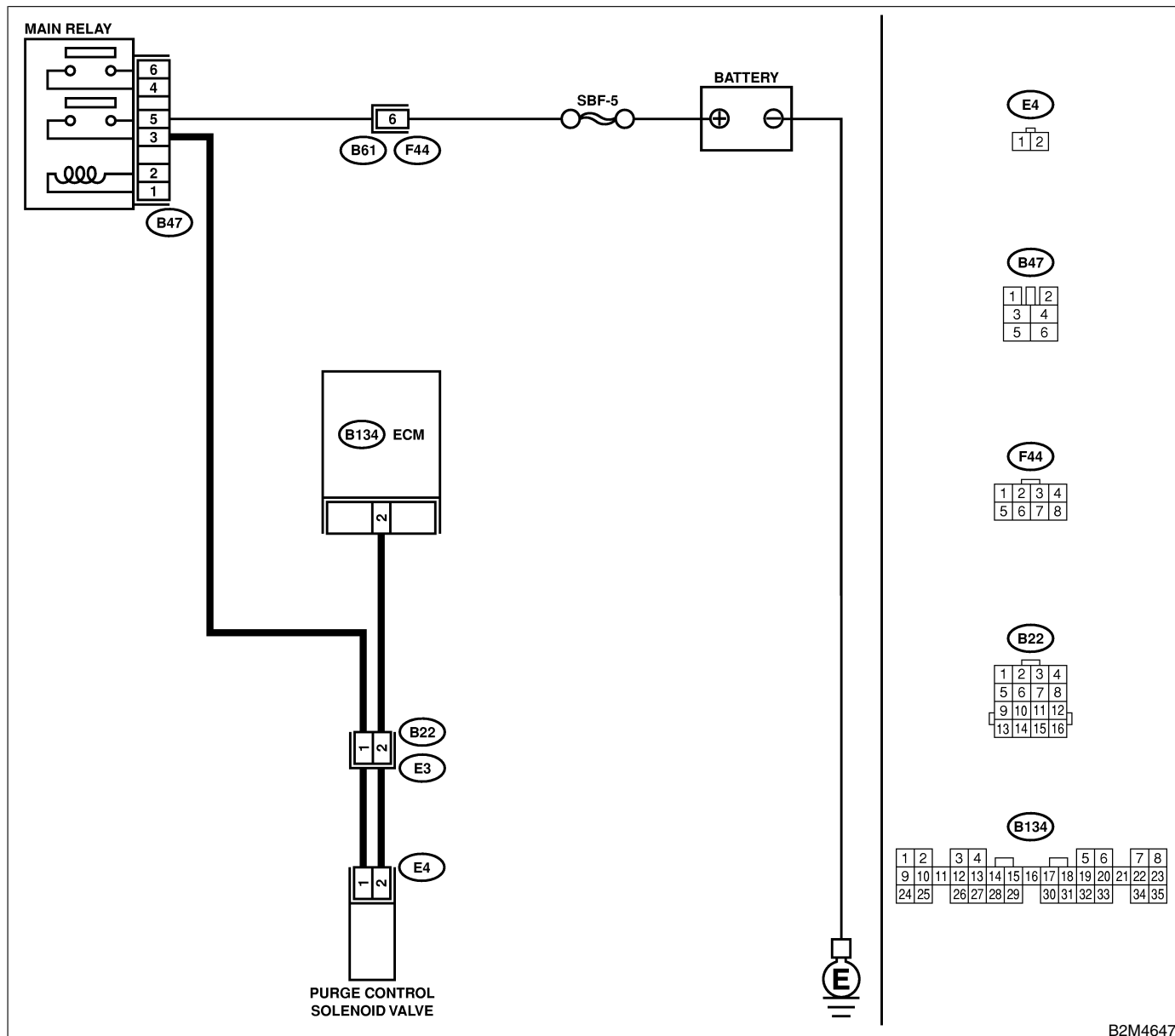
AZ: DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW INPUT — S078521K06

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4647

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Even if MIL lights up, the circuit has returned to a normal condition at this time. Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Go to step 2.
2	CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect 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 resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and purge control solenoid valve connector.	Go to step 3.
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. 2 — (E4) No. 2:	Is the resistance 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 resistance between 10 and 100 Ω ?	Go to step 5.	Replace purge control solenoid valve. <Ref. to EC-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 voltage more than 10 V?	Go to step 6.	Repair open circuit in harness between main relay and purge control solenoid valve connector.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

BA: DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH INPUT — S078521K07

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

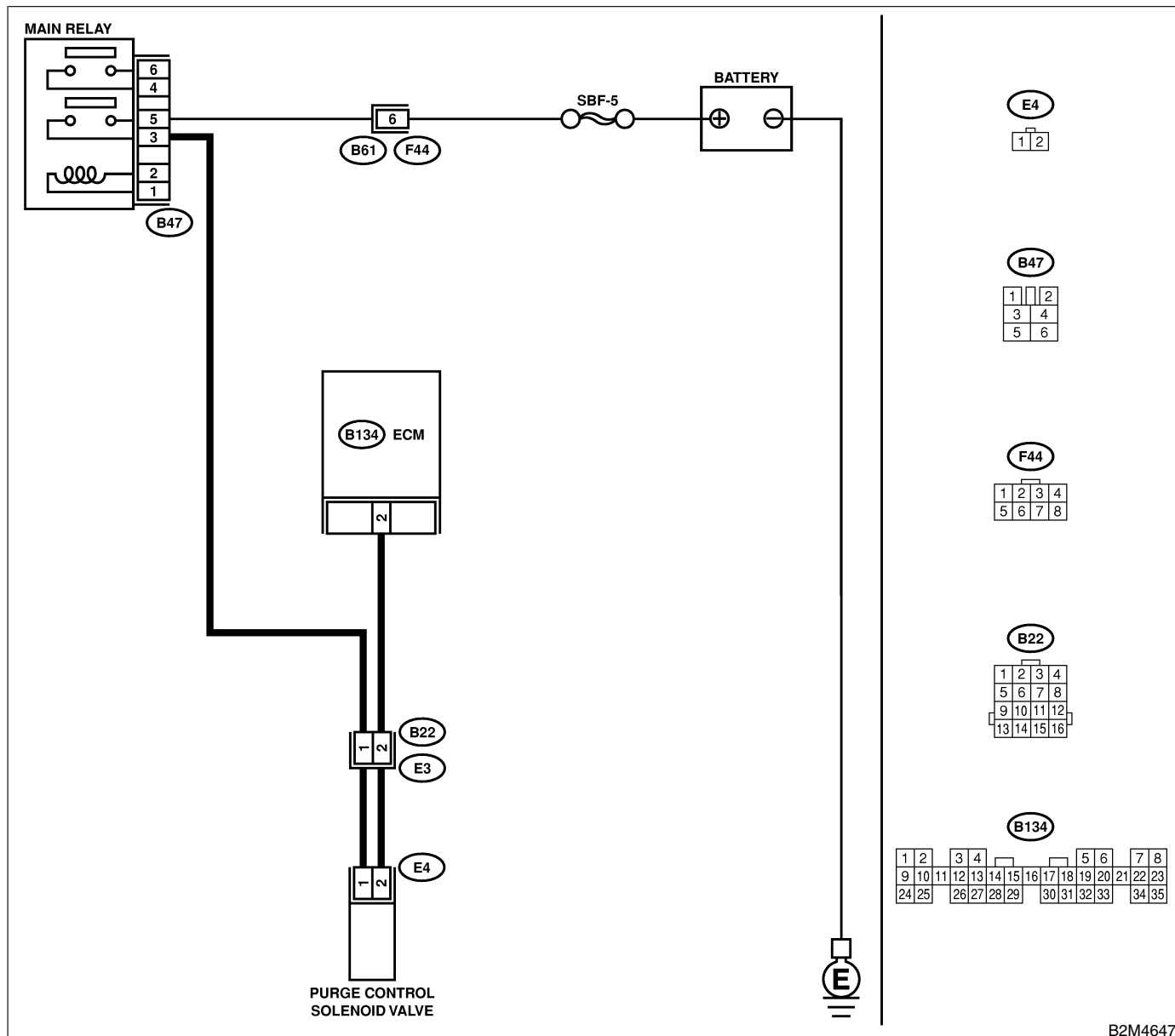
● **TROUBLE SYMPTOM:**

- Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-56, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 2 (+) — Chassis ground (-):	Does voltage change between 0 and 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. 2 (+) — Chassis ground (-):	Is the voltage 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-51, 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. 2 (+) — Chassis ground (-):	Is the voltage 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-51, 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 resistance less than 1 Ω ?	Replace purge control solenoid valve <Ref. to EC-6, Purge Control Solenoid Valve.> and ECM <Ref. to FU-51, 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-51, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BB: DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT — S078521B55

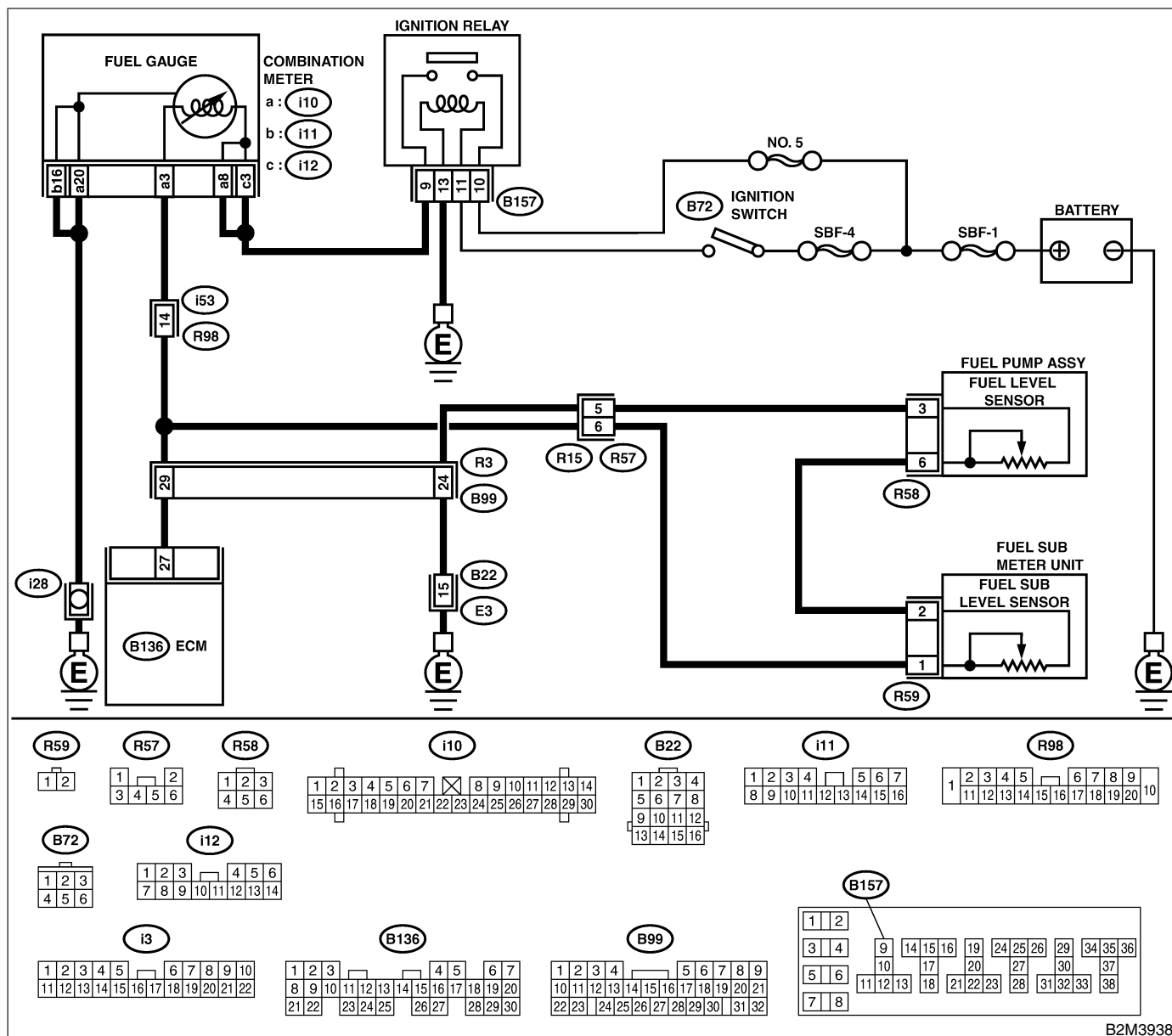
• DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



B2M3938

No.	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.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B136) No. 27 (+) — Chassis ground (-):	Is the voltage 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-36, Subaru Select Monitor.>	Does the value change less than 0.12 V by shaking harness and connector of ECM while monitoring the value with Subaru Select Monitor?	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 (B136) No. 27 (+) — Chassis ground (-):	Is the voltage 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 (B136) No. 27 — Chassis ground:	Is the resistance 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 (B136) No. 27 — (i10) No. 3:	Is the resistance 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 resistance more than 1 MΩ?	Go to step 8.	Repair ground short circuit in fuel tank cord.
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 resistance 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-73, 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 resistance between 0.5 and 2.5 Ω?	Go to step 10.	Replace fuel level sensor.
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-77, 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 resistance between 0.5 and 2.5 Ω?	Repair poor contact in harness between ECM and combination meter connector.	Replace fuel sub level sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BC: DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT — S078521B56

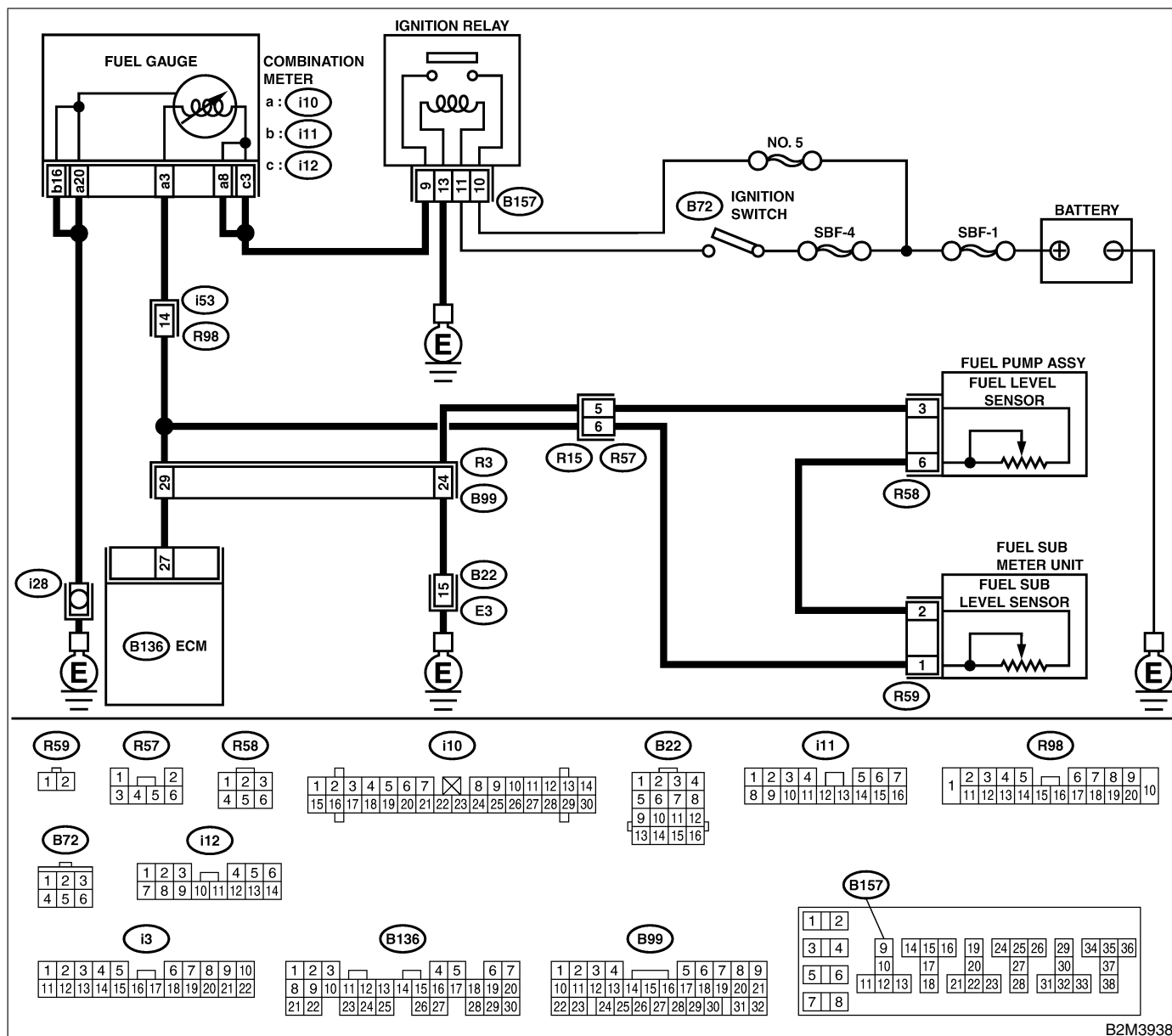
• DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



B2M3938

No.	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.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B136) No. 27 (+) — Chassis ground (-):	Is the voltage 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 (B136) No. 27 (+) — Chassis ground (-):	Is the voltage more than 4.75 V?	Go to step 4.	Repair battery short circuit between ECM and combination meter connector.
4	CHECK HARNESS BETWEEN ECM AND FUEL TANK CORD. 1) Turn ignition switch to OFF. 2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15). 3) Measure resistance between ECM and fuel tank cord. Connector & terminal (B136) No. 27 — (R15) No. 6:	Is the resistance 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 resistance 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 resistance less than 10 Ω ?	Go to step 7.	Repair open circuit between coupling connector and fuel level sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 resistance less than 10 Ω ?	Go to step 8.	Repair open circuit between fuel level sensor and fuel sub level sensor.
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 resistance less than 10 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-73, 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 resistance more than 54.5 Ω ?	Replace fuel level sensor. <Ref. to FU-76, 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-77, 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 resistance more than 41.5 Ω ?	Replace fuel sub level sensor. <Ref. to FU-77, Fuel Sub Level Sensor.>	Replace combination meter. <Ref. to IDI-11, Combination Meter Assembly.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

BD: DTC P0464 — FUEL LEVEL SENSOR INTERMITTENT INPUT— S078521G01

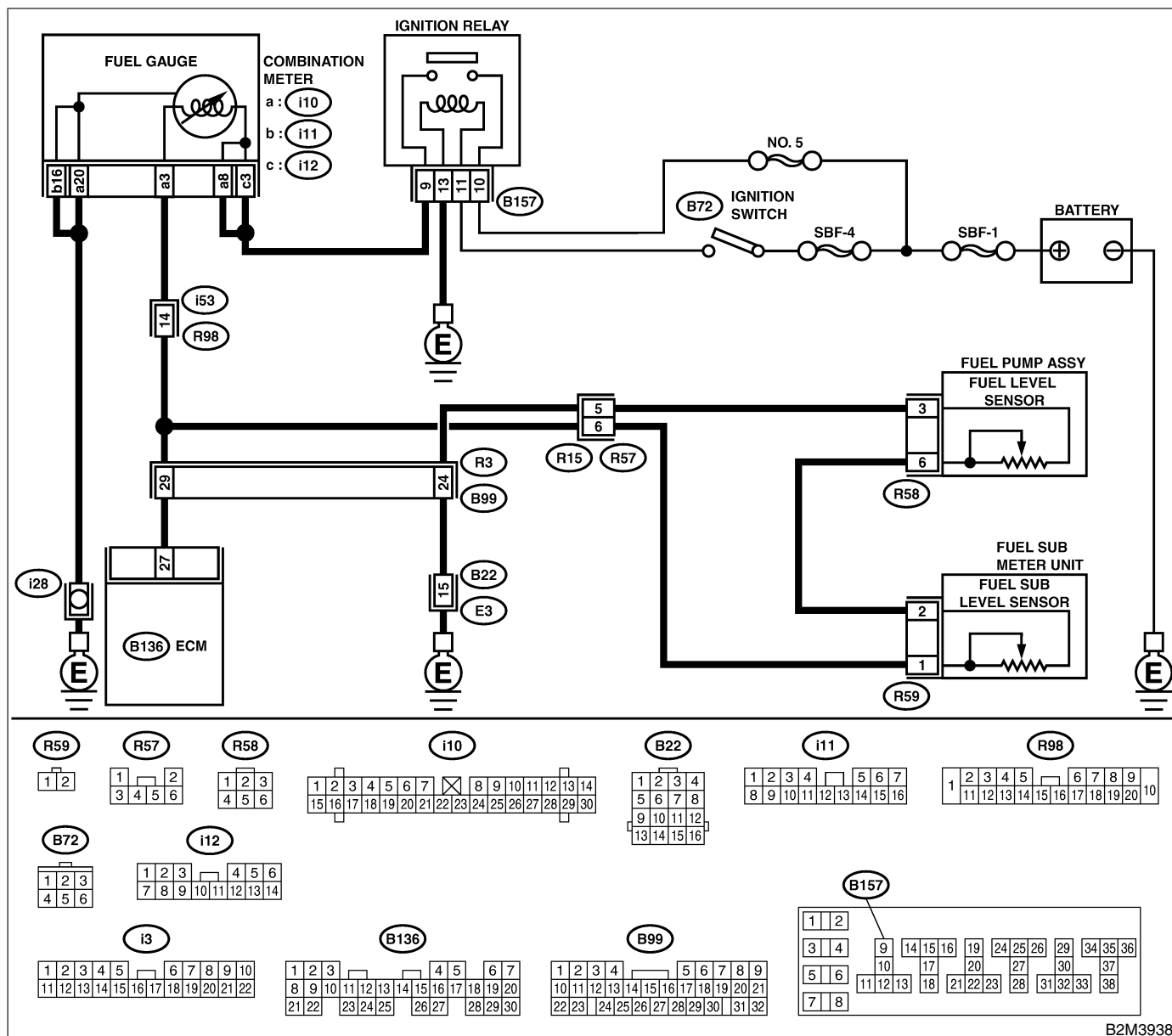
• DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• WIRING DIAGRAM:



B2M3938

No.	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-88, List of Diagnostic Trouble Code (DTC).>	Go to step 2.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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-73, 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-76, 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-77, 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-77, Fuel Sub Level Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BE: DTC P0483 — COOLING FAN FUNCTION PROBLEM — S078521B58

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

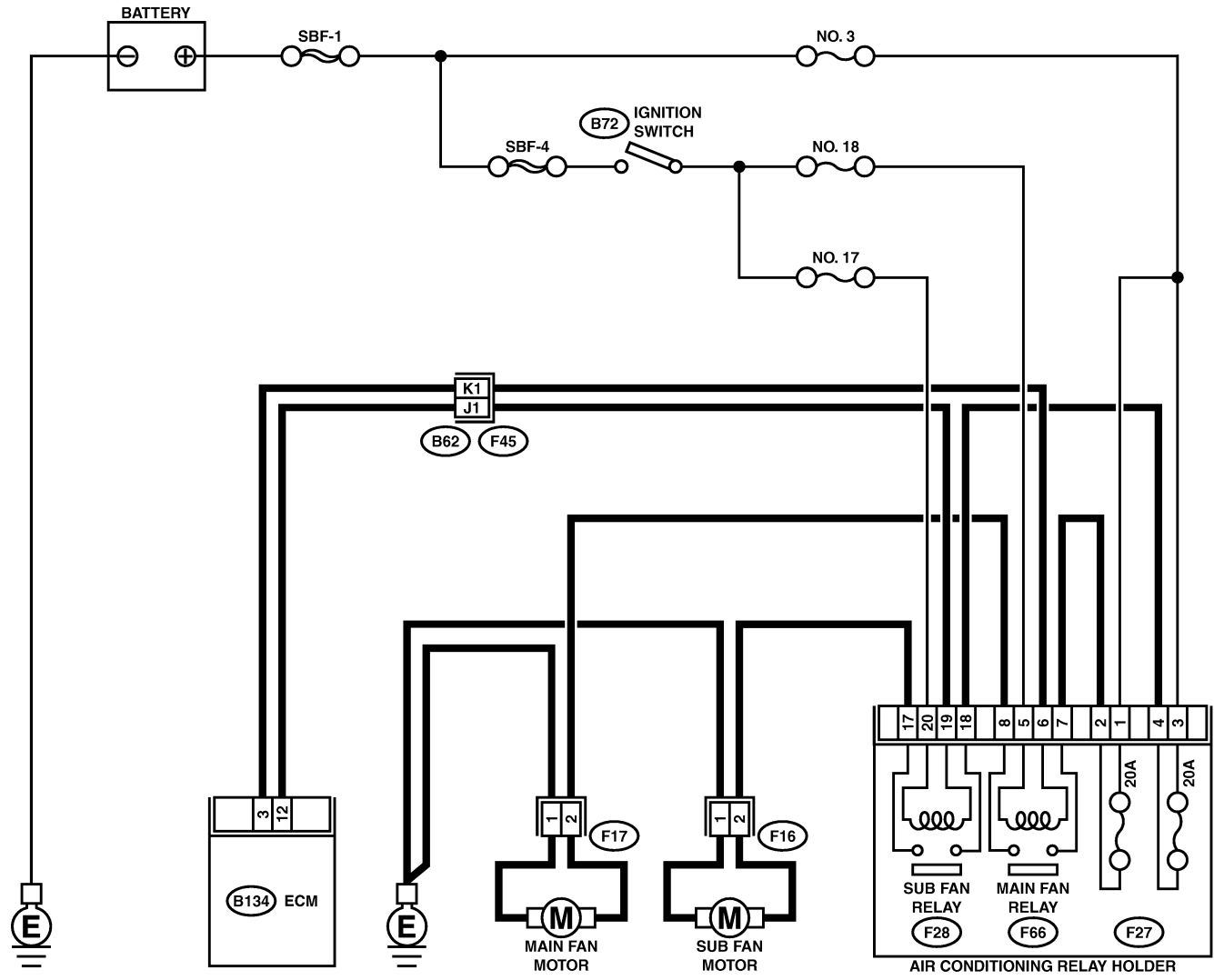
NOTE:

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.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



(B72) (BLUE)

1	2
3	4

(F27) (F66)

1	2	5	6	9	13	14	17	21	22	25	29
3	4	7	10	15	18	23	26	27	28	30	

(B134)

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

(B62)

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

B2M3939

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, List of Diagnostic Trouble Code (DTC).>	Check radiator fan and fan motor. <Ref. to CO-26, INSPECTION, Radiator Main Fan and Fan Motor.> and <Ref. to CO-29, INSPECTION, Radiator Sub Fan and Fan Motor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

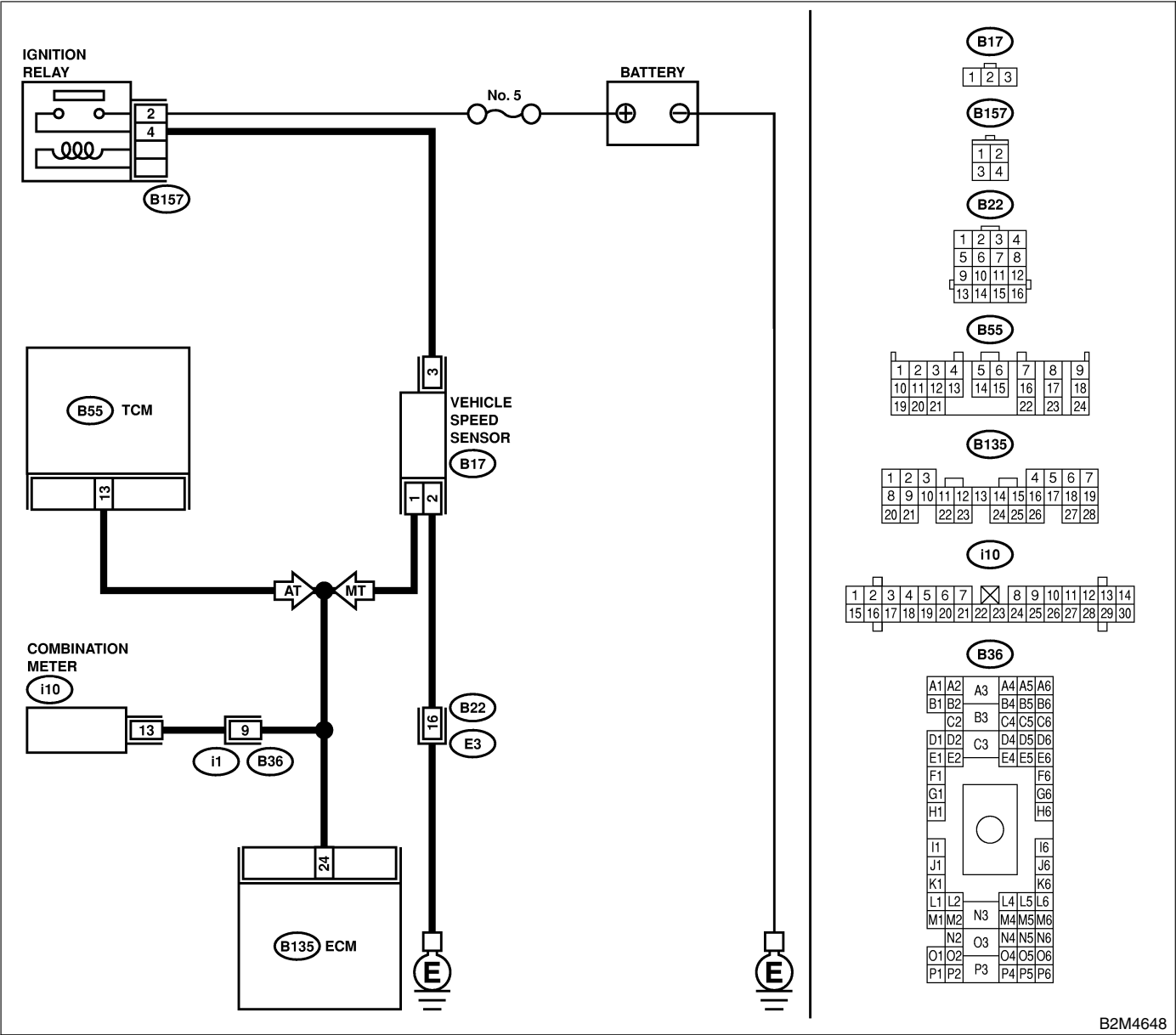
MEMO:

BF: DTC P0500 — VEHICLE SPEED SENSOR MALFUNCTION — S078521B59

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

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4648

No.	Step	Check	Yes	No
1	CHECK TRANSMISSION TYPE.	Is the transmission type AT?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
2	CHECK DTC P0720 ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?	Check front vehicle speed sensor signal circuit. <Ref. to AT-60, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with 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-13, Speedometer.> and <Ref. to AT-33, Front Vehicle Speed Sensor.> and <Ref. to AT-37, Rear Vehicle Speed Sensor.> and <Ref. to AT-38, 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 (B135) No. 24 — (i10) No. 7:	Is the resistance 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

Engine (Diagnostics)

— S078521B61

- Two consecutive driving cycles with fault

- Engine is difficult to start.
- Engine does not start.
- Erroneous idling
- Engine stalls.

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

MAIN RELAY

IDLE AIR CONTROL SOLENOID VALVE

BATTERY

SBF-5

B61 **F44**

B22 **E3**

E7

B21 **E2**

B134 ECM

E

E7

B47

F44

B22

B21

B134

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-39, REMOVAL, Idle Air Control Solenoid Valve.> 3) Remove throttle body from intake manifold. <Ref. to FU-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-39, INSTALLATION, Idle Air Control Solenoid Valve.>	Replace throttle body. <Ref. to FU-14, INSTALLATION, Throttle Body.>

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

S078521B62

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

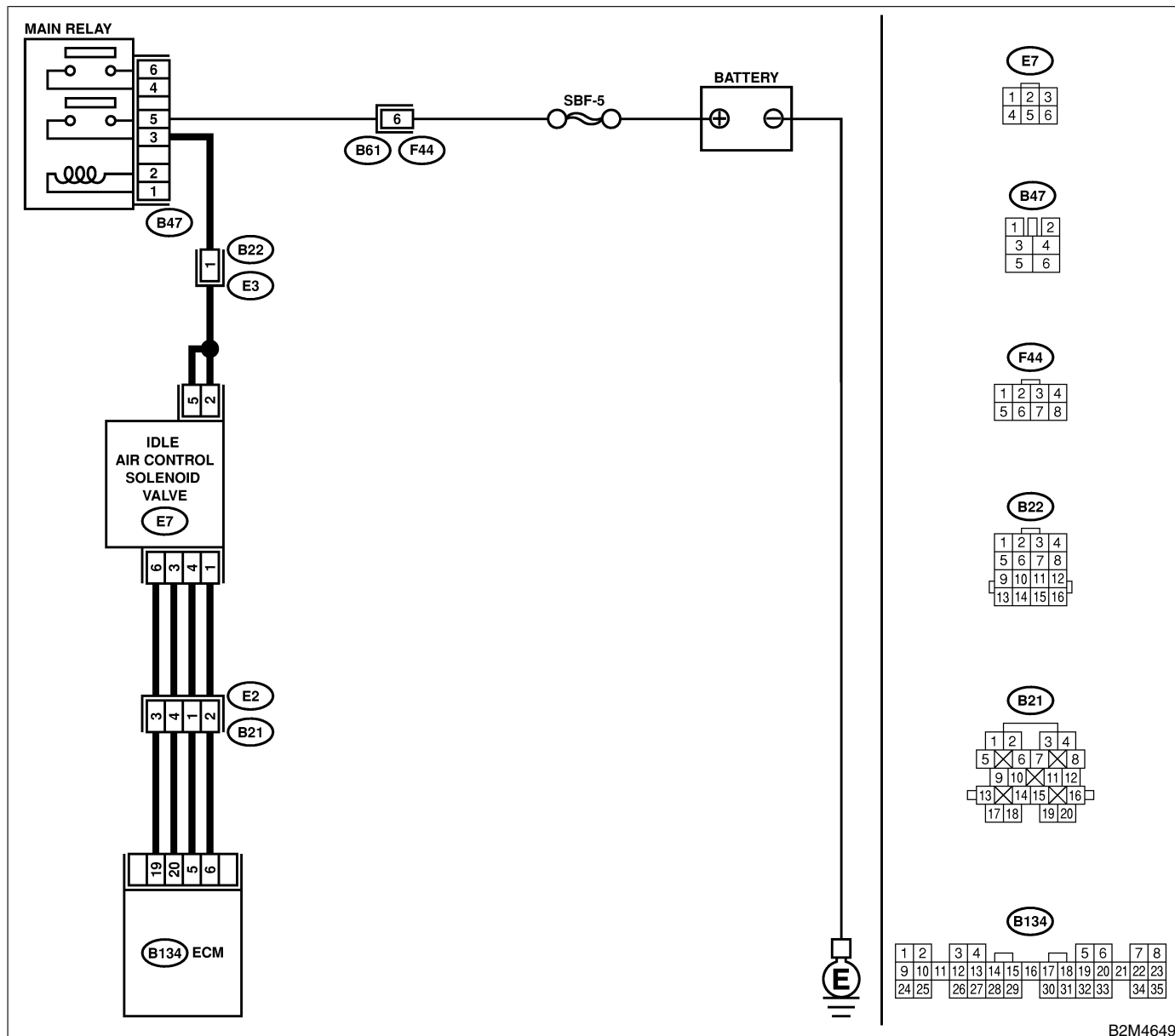
● **TROUBLE SYMPTOM:**

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 a 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-6, INSTALLATION, 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-39, 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-39, Idle Air Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BI: DTC P0512 — STARTER SWITCH CIRCUIT HIGH INPUT — S078521G02

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

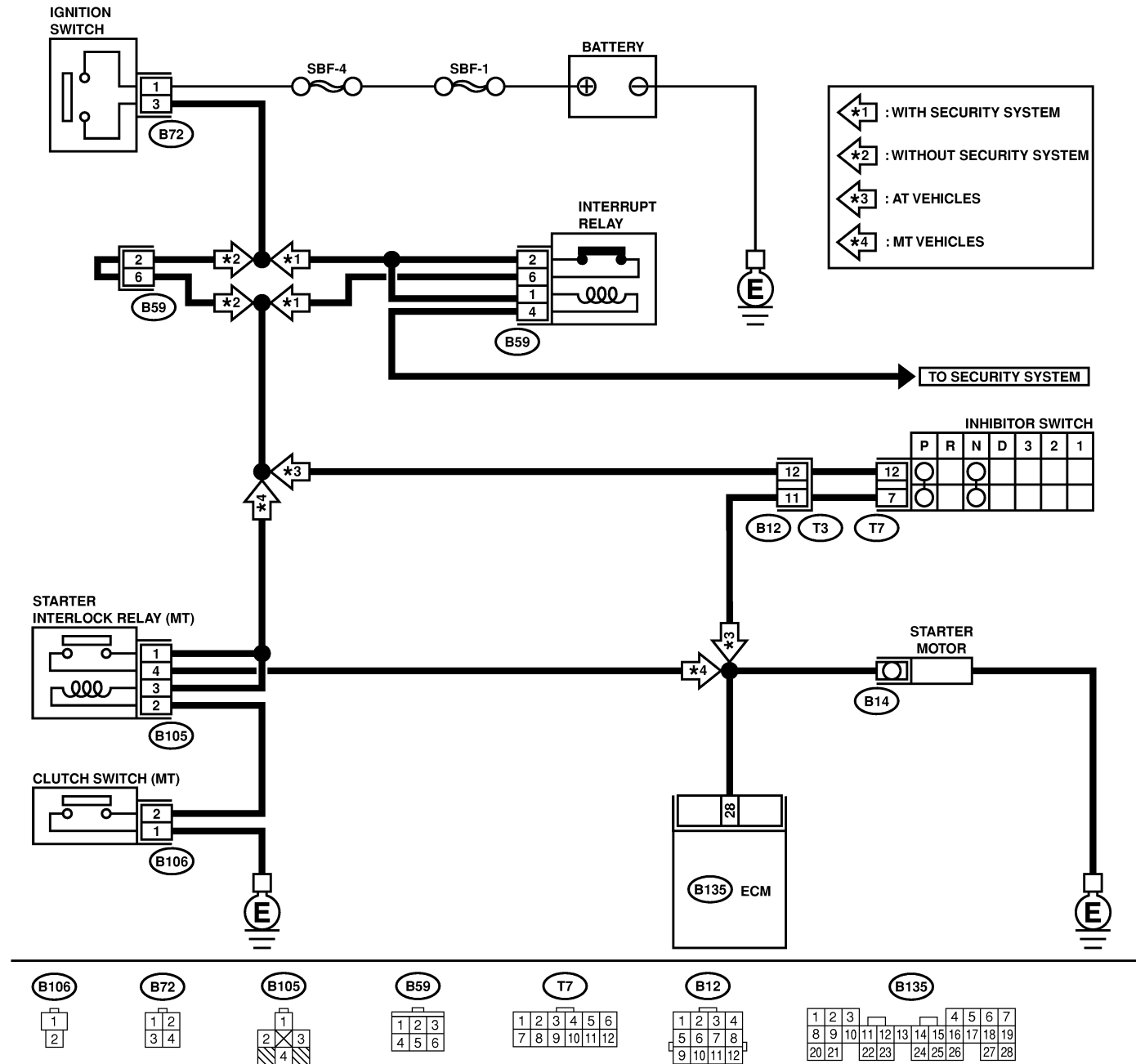
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4635

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR. NOTE: Place the inhibitor switch in each position.	Does starter motor operate when ignition switch to "ON"?	Repair battery short circuit in starter motor circuit.	Check starter motor circuit. <Ref. to EC-69, Diagnostics for Engine Starting Failure.>

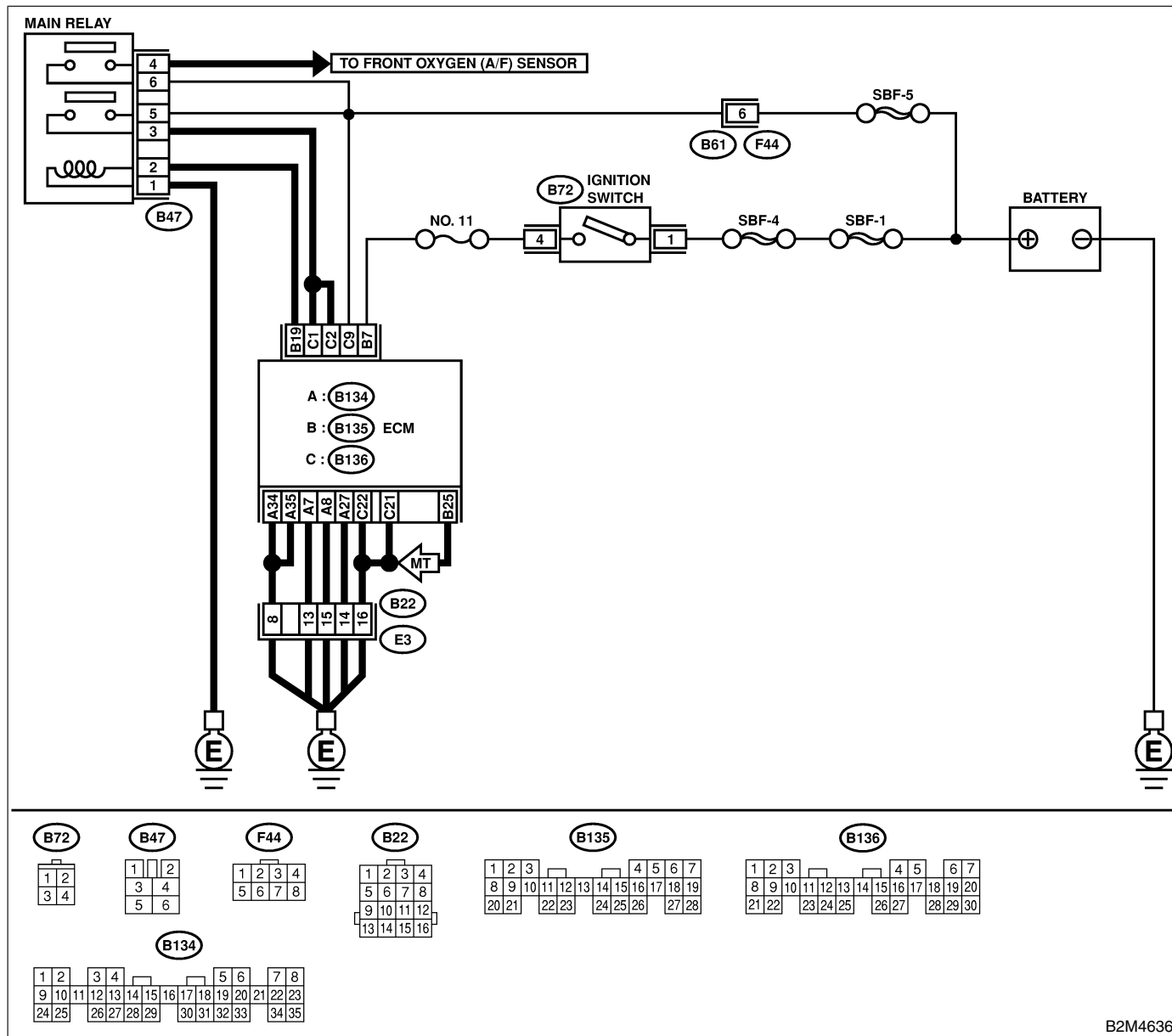
BJ: DTC P0604 — INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR — S078521G03

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4636

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0601?	Replace ECM. <Ref. to FU-51, Engine Control Module.>	It is not necessary to inspect DTC P0601.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BK: DTC P0691 — COOLING FAN RELAY 1 CIRCUIT LOW INPUT — S078521K19

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

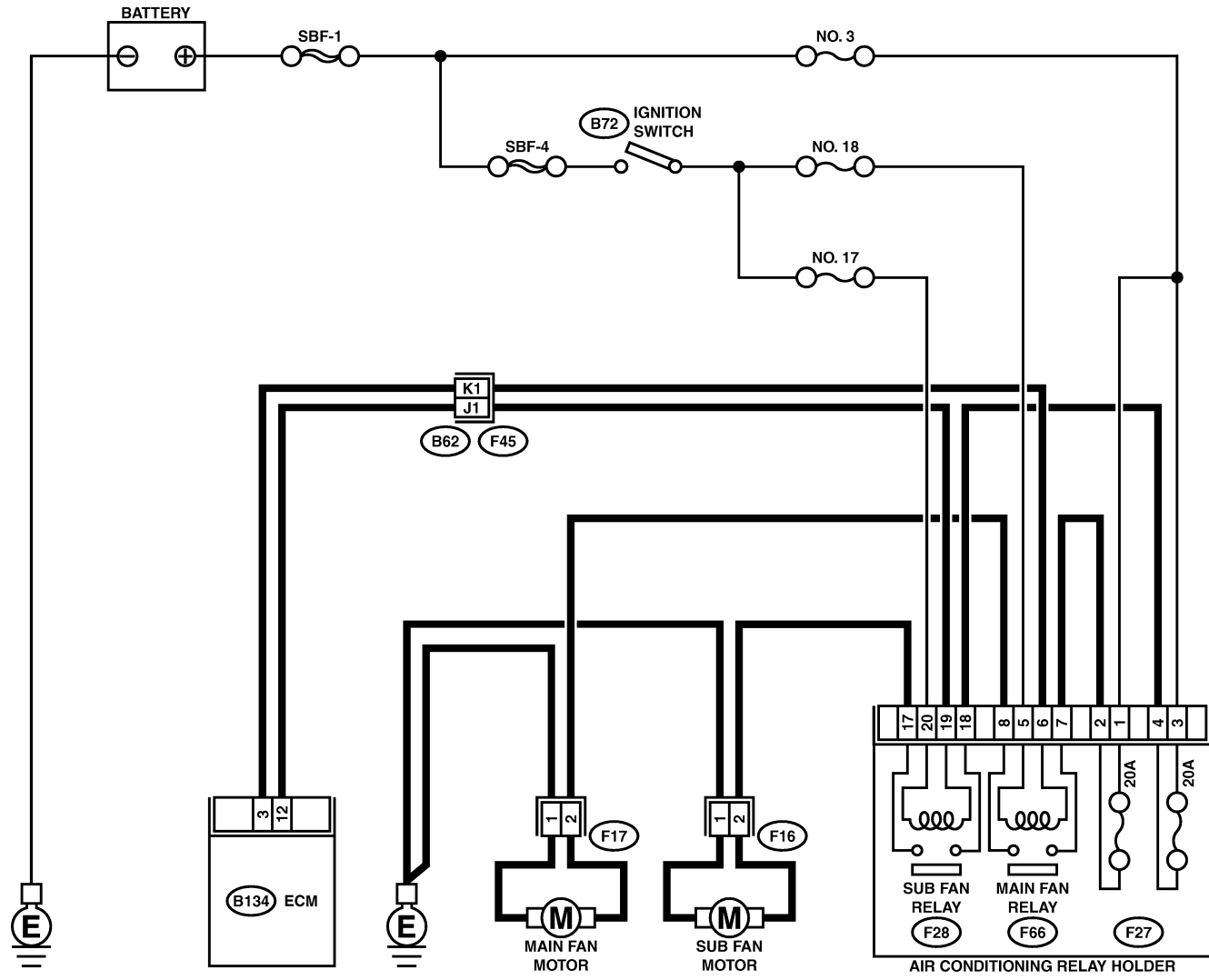
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



(B72) (BLUE)

1	2
3	4

(F27) (F66)

1	2	5	6	9	13	14	17	21	22	25	29
3	4	7	10	15	18	23	26	27	28	30	

(B134)

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

(B62)

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

B2M3939

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 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-36, Subaru Select Monitor.> Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Does voltage change between 0 and 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. 3) Measure resistance of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 3 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in radiator fan relay 1 control circuit.	Go to step 3.
3	CHECK POWER SUPPLY FOR RELAY. 1) Remove main fan relay from A/C relay holder. 2) Turn ignition switch to ON. 3) Measure voltage between fuse and relay box (F/B) connector and chassis ground. Connector & terminal (F66) No. 5 (+) — Chassis ground (-):	Is the voltage 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. 6:	Is the resistance between 87 and 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. 3 — (F66) No. 6:	Is the resistance 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 (distributor) service.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BL: DTC P0692 — COOLING FAN RELAY 1 CIRCUIT HIGH INPUT — S078521K20

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

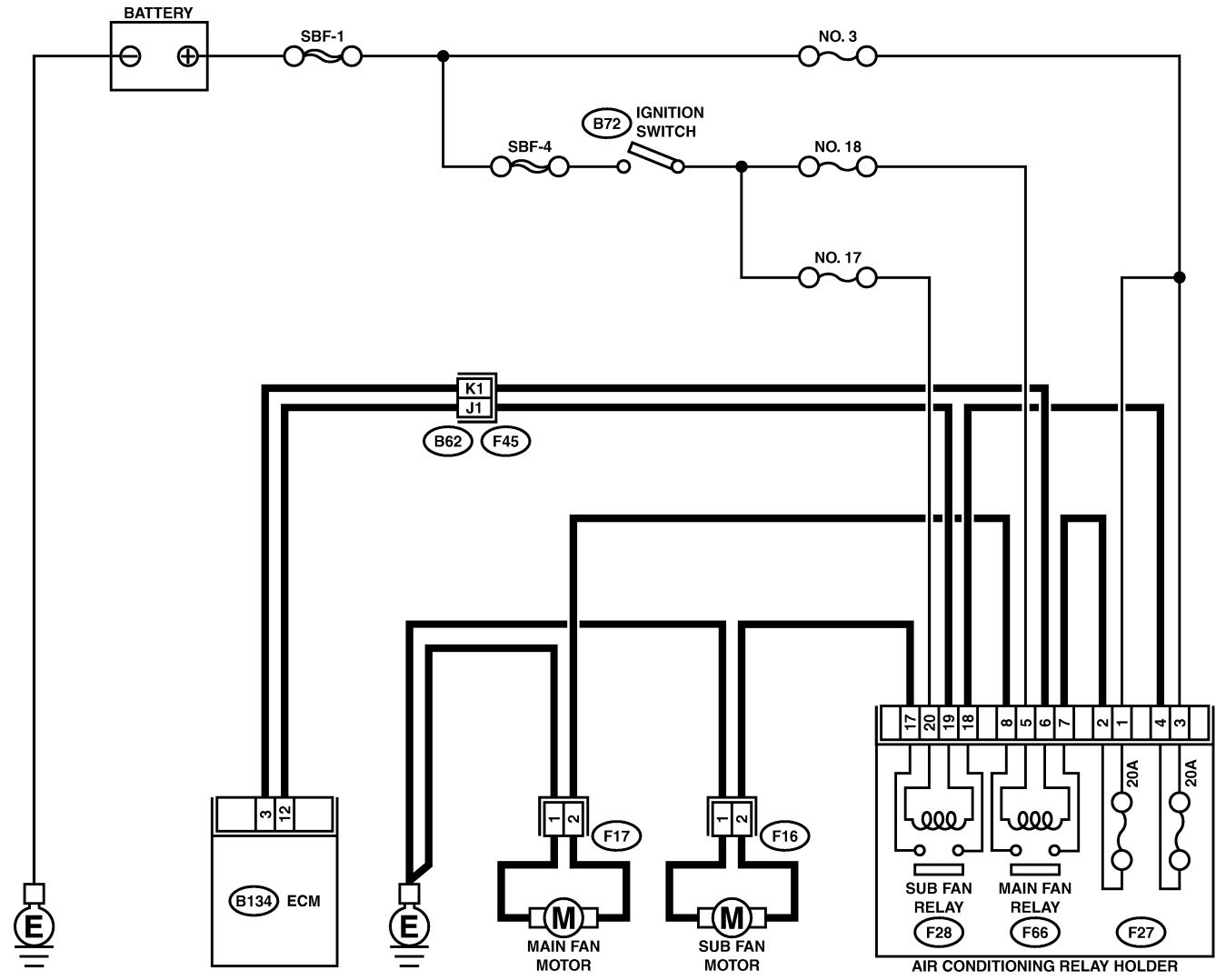
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



(B72) (BLUE)

1	2
3	4

(F27) (F66)

1	2	5	6	9	13	14	17	21	22	25	29
3	4	7	10	15	18	23	26	27	28	30	

(B134)

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

(B62)

A1	A2	A3	A4	A5	A6
B1	B2	B3	B4	B5	B6
C1	C2	C3	C4	C5	C6
D1	D2	D3	D4	D5	D6
E1	E2	E3	E4	E5	E6
F1	F2	F3	F4	F5	F6
G1	G2	G3	G4	G5	G6
H1	H2	H3	H4	H5	H6
I1	I2	I3	I4	I5	I6
J1	J2	J3	J4	J5	J6
K1	K2	K3	K4	K5	K6
L1	L2	L3	L4	L5	L6
M1	M2	M3	M4	M5	M6
N1	N2	N3	N4	N5	N6
O1	O2	O3	O4	O5	O6
P1	P2	P3	P4	P5	P6

B2M3939

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-56, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Does voltage change between 0 and 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. 3 (+) — Chassis ground (-):	Is the voltage 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. 1 — No. 3:	Is the resistance 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. 1 — No. 3	Is the resistance 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-51, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

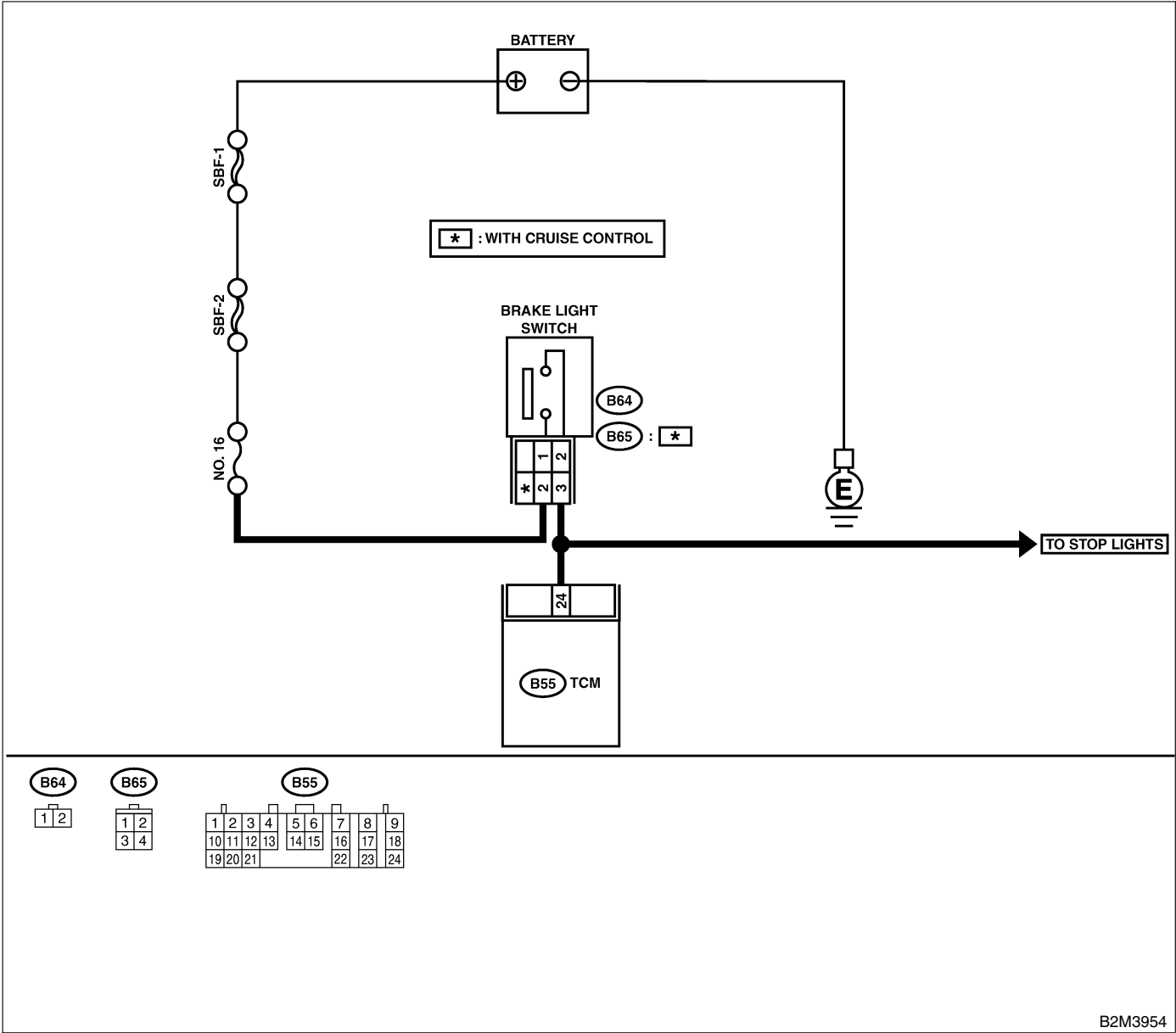
MEMO:

BM: DTC P0703 — BRAKE SWITCH INPUT MALFUNCTION — S078521B64

- DTC DETECTING CONDITION:
 - Two consecutive driving cycles with fault

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● WIRING DIAGRAM:



No.	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.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 — (B64) No. 2: (B55) No. 24 — (B65) No. 3 (With cruise control):	Is the resistance 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 resistance more than 1 M Ω ?	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 voltage less than 1 V when releasing the brake pedal?	Go to step 5.	Adjust or replace brake light switch. <Ref. to LI-7, 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 voltage more than 10 V when depressing the brake pedal?	Go to step 6.	Adjust or replace brake light switch. <Ref. to LI-7, 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 AT-49, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

BN: DTC P0731 — GEAR 1 INCORRECT RATIO — S078521B70

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN-273, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BO: DTC P0732 — GEAR 2 INCORRECT RATIO — S078521B71

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN-273, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BP: DTC P0733 — GEAR 3 INCORRECT RATIO — S078521B72

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN-273, DTC P0734 — GEAR 4 INCORRECT RATIO —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BQ: DTC P0734 — GEAR 4 INCORRECT RATIO — S078521B73

● DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

● TROUBLE SYMPTOM:

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● WIRING DIAGRAM:

No.	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-88, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK THROTTLE POSITION SENSOR CIRCUIT. Check throttle position sensor circuit. <Ref. to AT-52, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-60, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-12, INSPECTION, Road Test.>	Replace TCM. <Ref. to AT-49, Transmission Control Module (TCM).>

BR: DTC P0741 — TORQUE CONVERTER CLUTCH SYSTEM MALFUNCTION

S078521G04

● DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault

● TROUBLE SYMPTOM:

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	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-88, 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 AT-100, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-52, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-66, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-44, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 AT-122, CHECK INHIBITOR SWITCH., Diagnostic Procedure for No-diagnostic Trouble Code (DTC).>	Is there any trouble 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 AT-120, CHECK BRAKE SWITCH., Diagnostic Procedure for No-diagnostic Trouble Code (DTC).>	Is there any trouble in brake light switch circuit?	Repair or replace brake light switch circuit.	Go to step 8.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
8	CHECK ATF TEMPERATURE SENSOR CIRCUIT. Check ATF temperature sensor circuit. <Ref. to AT-48, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Is there any trouble 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 trouble in automatic transmission?	Repair or replace automatic transmission. <Ref. to AT-12, INSPECTION, Road Test.>	Replace TCM. <Ref. to AT-49, Transmission Control Module (TCM).>

BS: DTC P0851 — NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT (AT MODEL) — S078521K43

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

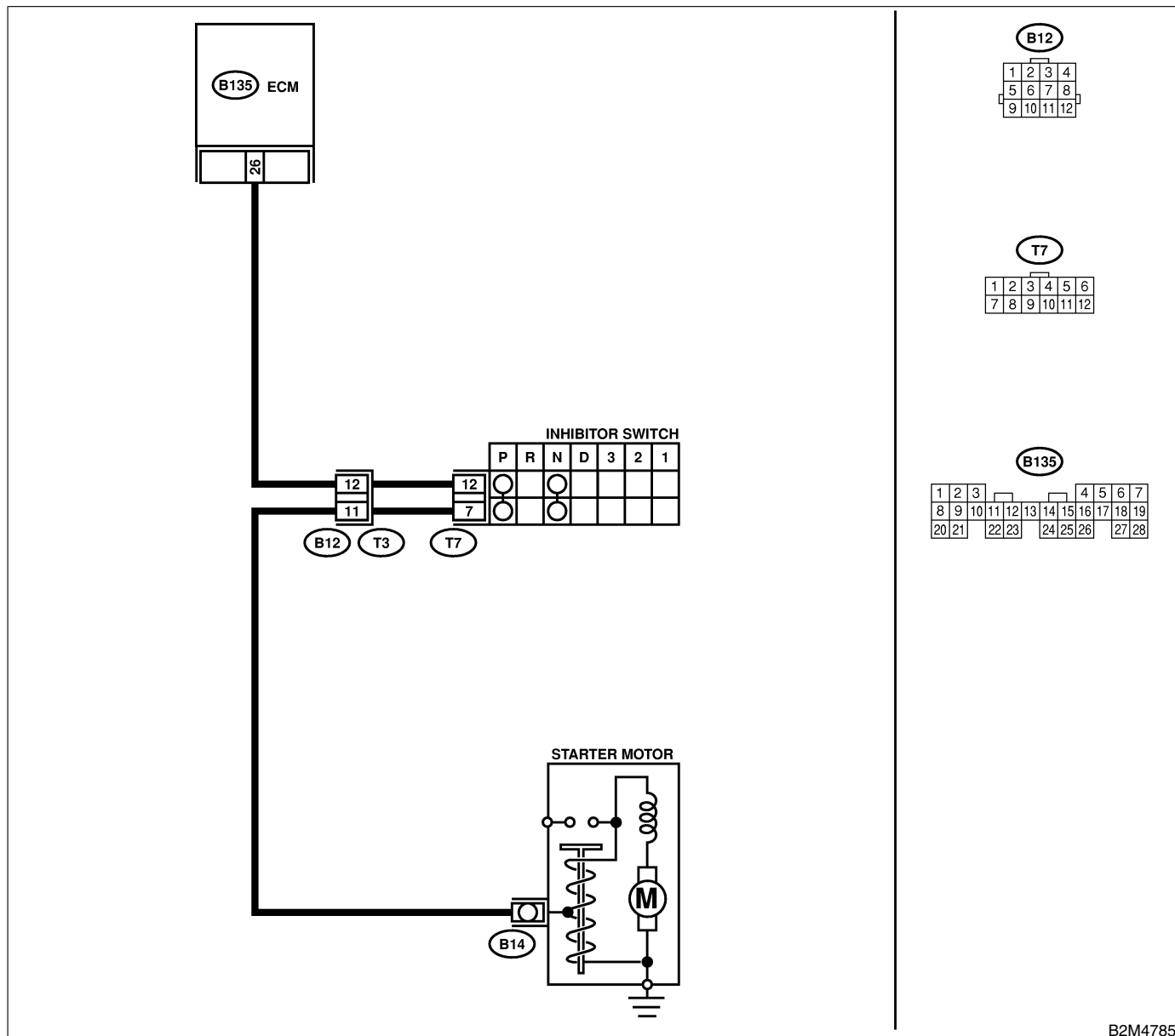
● **TROUBLE SYMPTOM:**

- Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4785

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostics Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage between 4.5 and 5.5 V at except "N" and "P" positions?	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 (B135) No. 26 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and transmission harness connector.	Go to step 4.
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 resistance less than 10 Ω ?	Repair ground short circuit in harness between transmission harness and inhibitor switch connector.	Go to step 5.
5	CHECK INHIBITOR SWITCH. Measure resistance between inhibitor switch connector receptacle's terminals in select lever except for "N" position. Terminals No. 7 — No. 12:	Is the resistance more than 1 M Ω at except "N" and "P" positions?	Go to step 6.	Replace inhibitor switch. <Ref. to AT-29, Inhibitor switch.>
6	CHECK SELECTOR CABLE CONNECTION.	Is there any fault in selector cable connection to inhibitor switch?	Repair selector cable connection. <Ref. to CS-26, Select Cable.>	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

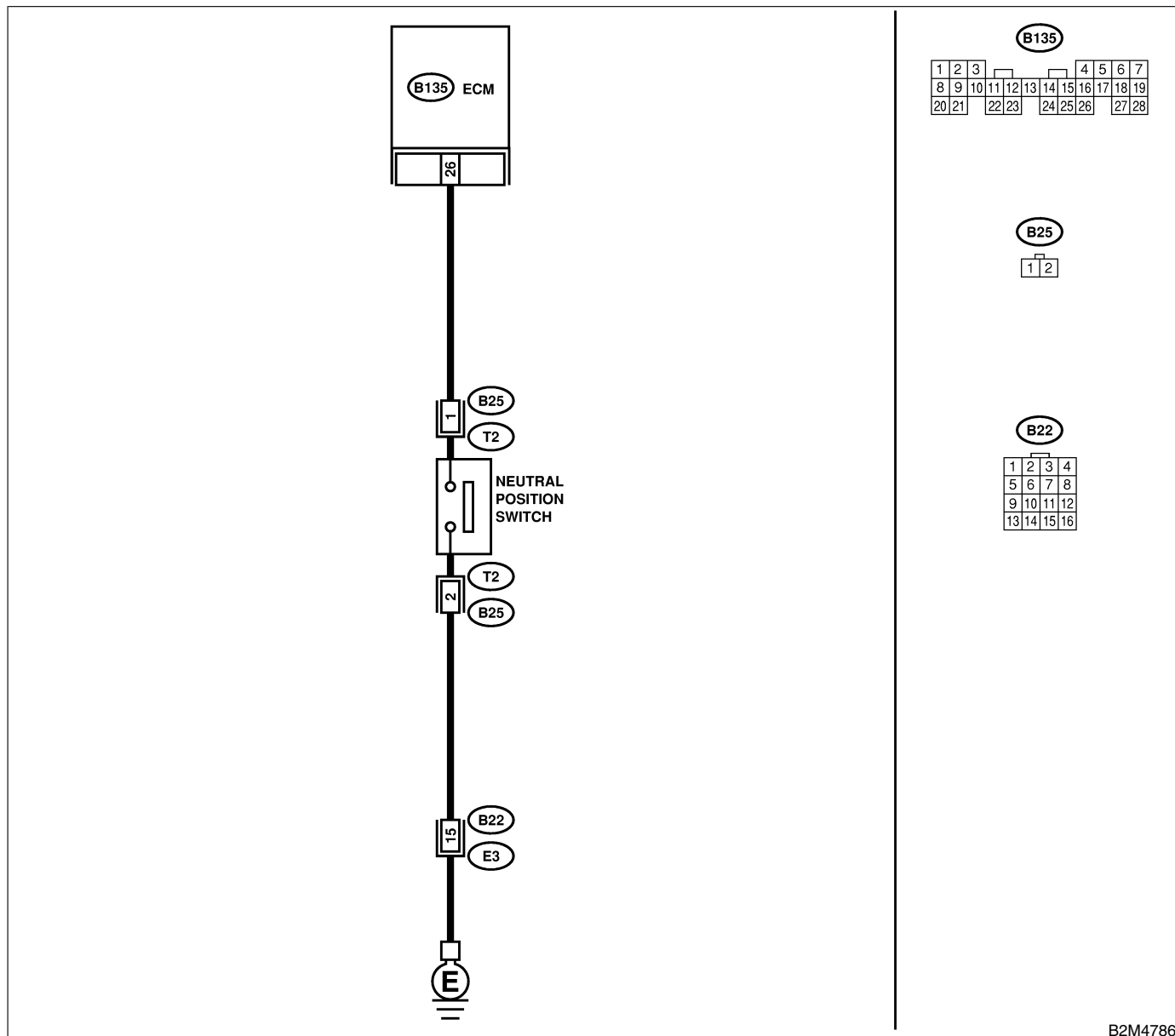
BT: DTC P0851 — NEUTRAL POSITION SWITCH CIRCUIT LOW INPUT (MT MODEL) — S078521K44

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4786

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 26 (+) — Chassis ground (-):	Is the voltage more than 10 V in neutral position?	Go to step 2.	Go to step 4.
2	CHECK INPUT SIGNAL FOR ECM. Measure voltage between ECM and chassis ground. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage less than 1 V in other positions?	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 (distributor) service. 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) Measure resistance between transmission harness and connector terminals. Connector & terminal (T2) No. 1 — No. 2:	Is the resistance more than 1 M Ω in neutral position?	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. Measure resistance between ECM and chassis ground. Connector & terminal (B135) No. 26 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and transmission harness connector.	Go to step 6.
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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

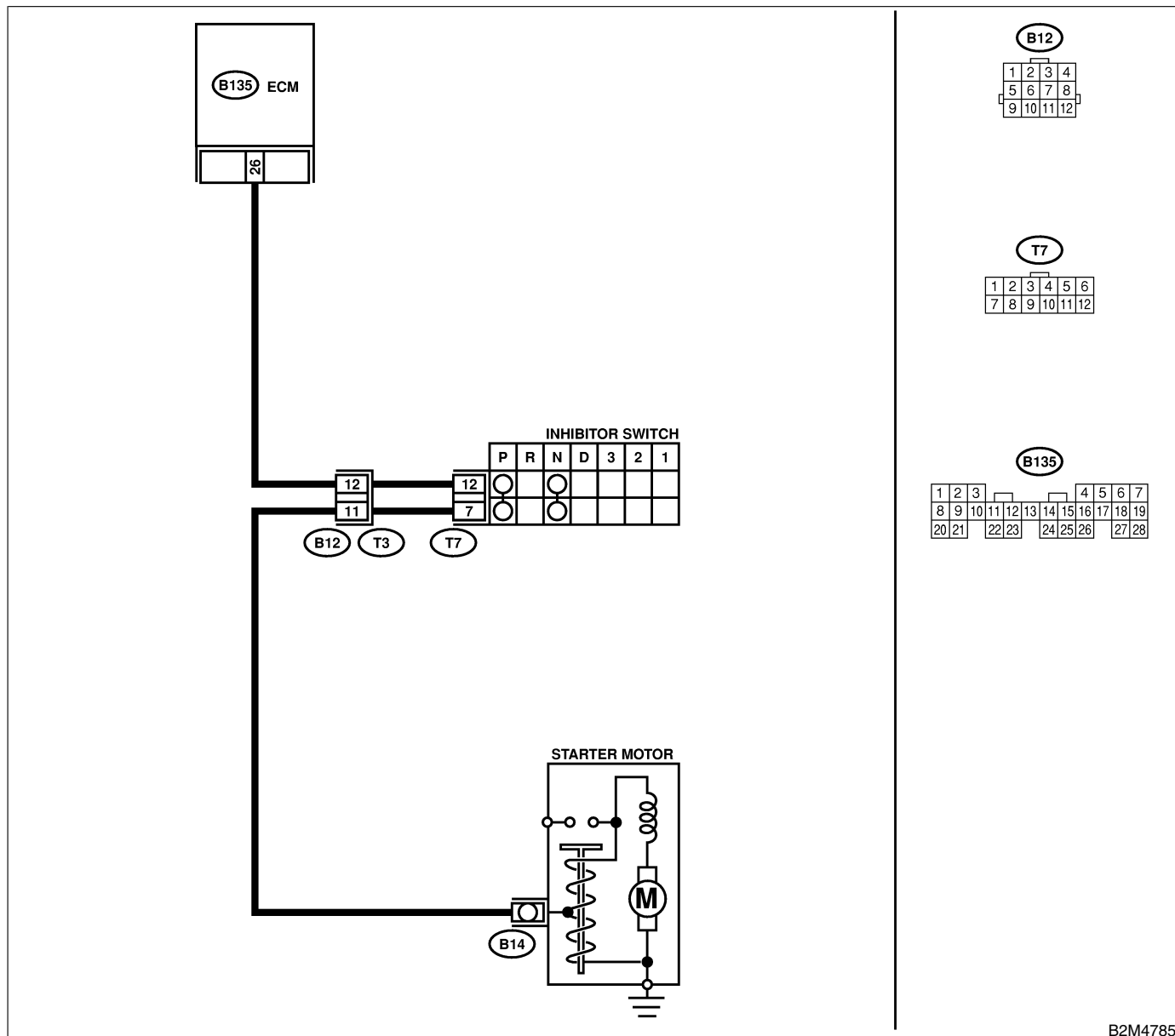
BU: DTC P0852 — NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT (AT MODEL) — S078521K45

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4785

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostics Trouble Code (DTC)". <Ref. to EN-88, List of Diagnostic Trouble Code (DTC).	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 lever "N" and "P" positions. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage 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 lever except for "N" and "P" positions. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage between 4.5 and 5.5 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 (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. 26 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit 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 connectors from ECM and inhibitor switch. 3) Measure resistance of harness between ECM and inhibitor switch connector. Connector & terminal (B135) No. 26 — (T7) No. 12:	Is the resistance 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance 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 ground line ● Poor contact in starter motor connector ● Poor contact in starter motor ground ● Starter motor
8	CHECK INHIBITOR SWITCH. Measure resistance between inhibitor switch connector receptacle's terminals in select lever "N" and "P" positions. Terminals No. 7 — No. 12:	Is the resistance less than 1 Ω ?	Go to step 9.	Replace inhibitor switch. <Ref. to AT-29, Inhibitor Switch.>
9	CHECK SELECTOR CABLE CONNECTION.	Is there any fault in selector cable connection to inhibitor switch?	Repair selector cable connection. <Ref. to CS-26, Select Cable.>	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

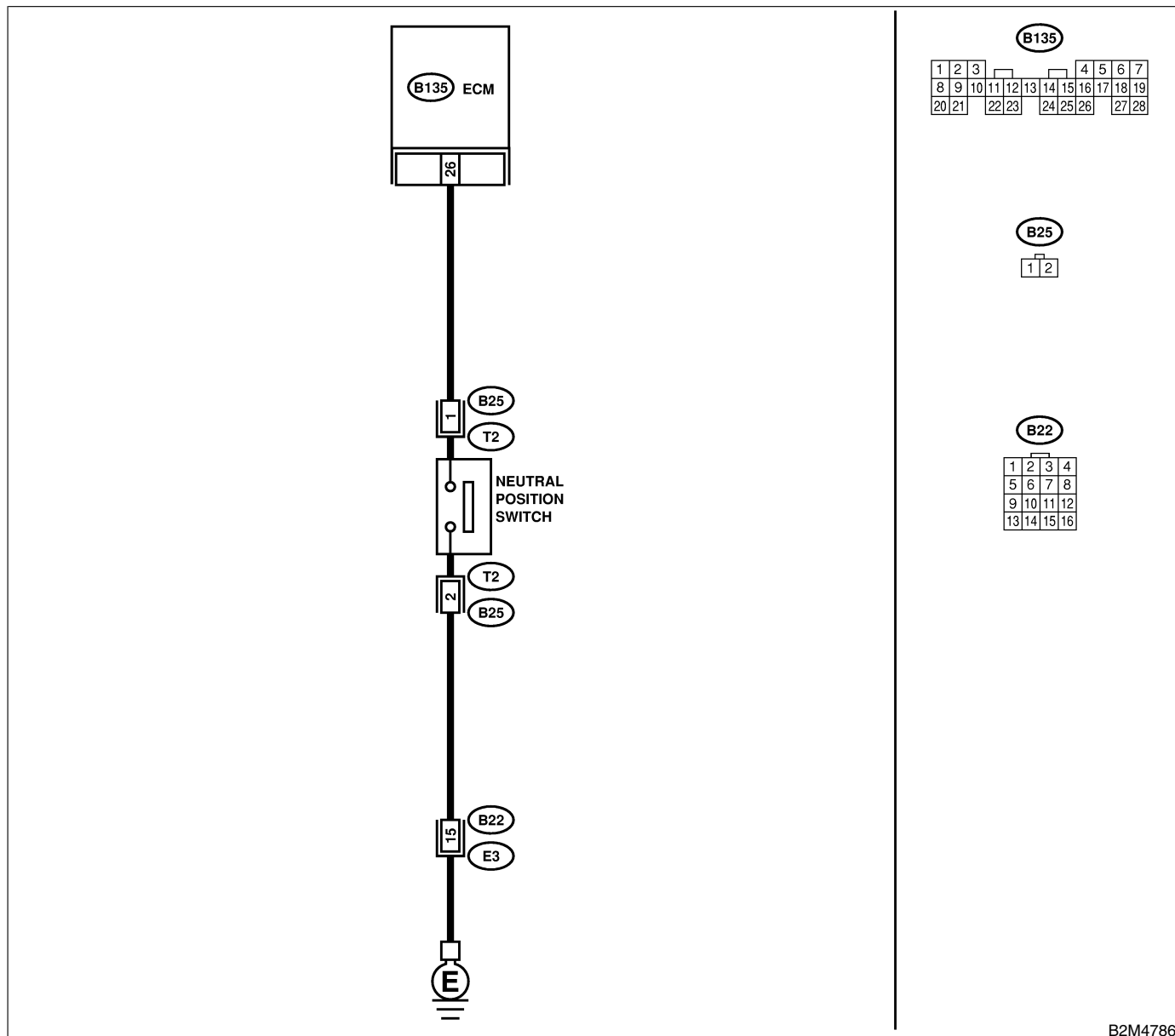
BV: DTC P0852 — NEUTRAL POSITION SWITCH CIRCUIT HIGH INPUT (MT MODEL) — S078521K46

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4786

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 26 (+) — Chassis ground (-):	Is the voltage more than 10 V in neutral position?	Go to step 2.	Go to step 4.
2	CHECK INPUT SIGNAL FOR ECM. Measure voltage between ECM and chassis ground. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage less than 1 V in other positions?	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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	CHECK NEUTRAL POSITION SWITCH. Measure resistance between transmission harness connector terminals. Connector & terminal (T2) No. 1 — No. 2:	Is the resistance less than 1 Ω in other positions?	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 of harness between ECM and transmission harness connector. Connector & terminal (B135) No. 26 — (B25) No. 1:	Is the resistance 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 resistance 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

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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:

BW: DTC P0864 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT MALFUNCTION — S078521K10

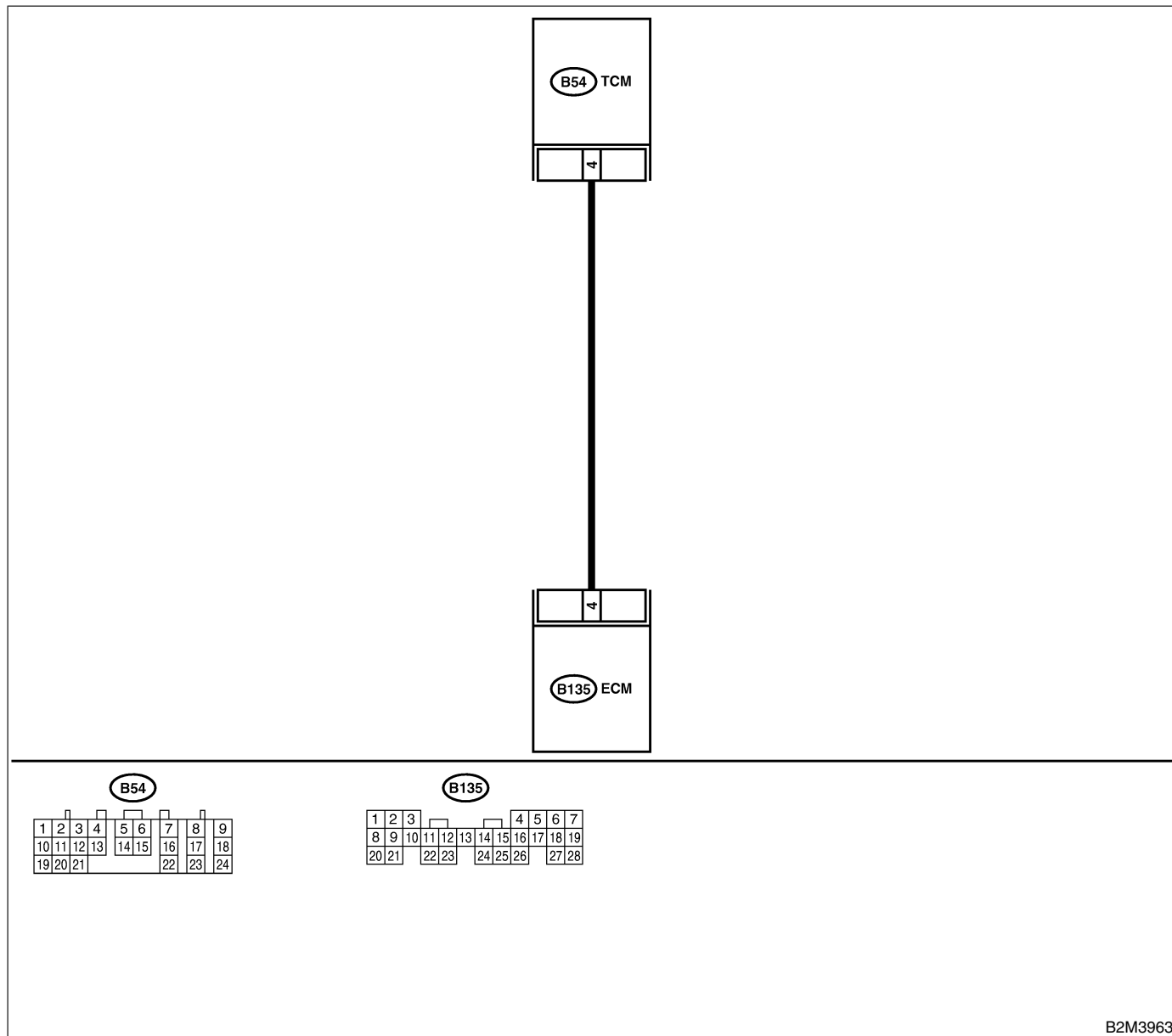
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



No.	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 AT-49, Transmission Control Module (TCM).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 AT-49, Transmission Control Module (TCM).>

BX: DTC P0865 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL CIRCUIT LOW INPUT — S078521K11

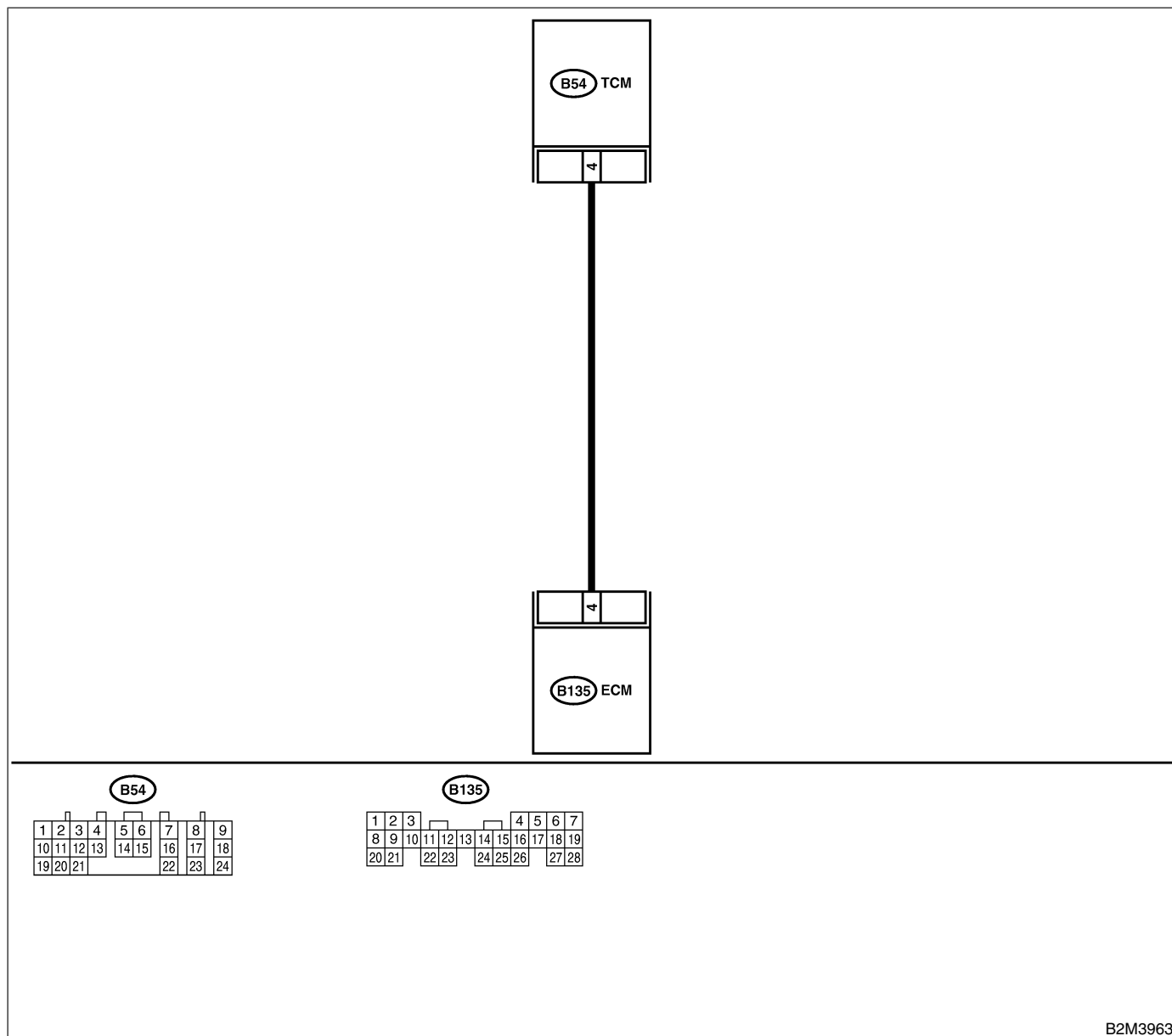
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 4 (+) — Chassis ground (-):	Is the voltage 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 (B135) No. 4 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and TCM connector.	Go to step 3.
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 (B135) No. 4 (+) — Chassis ground (-):	Is the voltage 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 AT-25, Read Diagnostic Trouble Code (DTC).>	Does trouble code appear for automatic transmission?	Inspect trouble code for automatic transmission. <Ref. to AT-44, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Replace TCM. <Ref. to AT-49, Transmission Control Module (TCM).>

**BY: DTC P0866 — AUTOMATIC TRANSMISSION DIAGNOSIS INPUT SIGNAL
CIRCUIT HIGH INPUT —** S078521K12

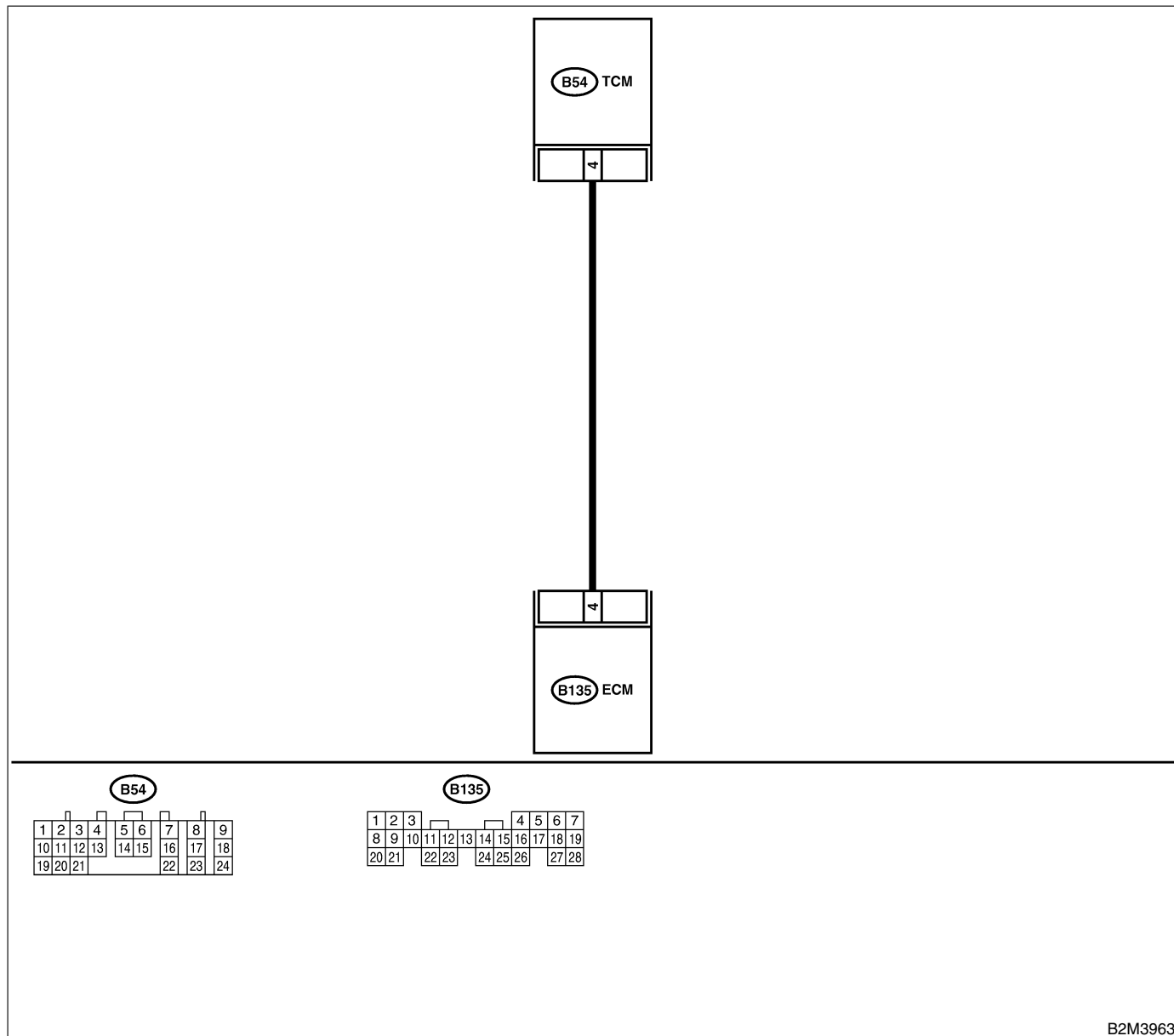
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 4 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to FU-51, Control Module.>	Go to step 2.
2	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 4 (+) — Chassis ground (-):	Is the voltage 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 (B135) No. 4 (+) — Chassis ground (-):	Is the voltage 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 (B135) No. 4 (+) — Chassis ground (-):	Does the voltage change from 1 V to 4 V while monitoring the value with voltage meter?	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 (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure voltage between TCM and chassis ground. Connector & terminal (B54) No. 4 (+) — Chassis ground (-):	Is the voltage 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.

BZ: DTC P1110 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT LOW INPUT — S078521B84

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1110?	Replace ECM. <Ref. to FU-51, Engine Control Module.> NOTE: Atmospheric pressure sensor is built into ECM.	It is not necessary to inspect DTC P1110.

CA: DTC P1111 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT HIGH INPUT — S078521B85

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1111?	Replace ECM. <Ref. to FU-51, Engine Control Module.> NOTE: Atmospheric pressure sensor is built into ECM.	It is not necessary to inspect DTC P1111.

**CB: DTC P1112 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/
PERFORMANCE PROBLEM —** S078521B86**• DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

No.	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-88, List of Diagnostic Trouble Code (DTC).>	Replace ECM. <Ref. to FU-51, Engine Control Module.> NOTE: Atmospheric pressure sensor is built into ECM.

CC: DTC P1137 — FRONT OXYGEN (A/F) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM — S078521G49

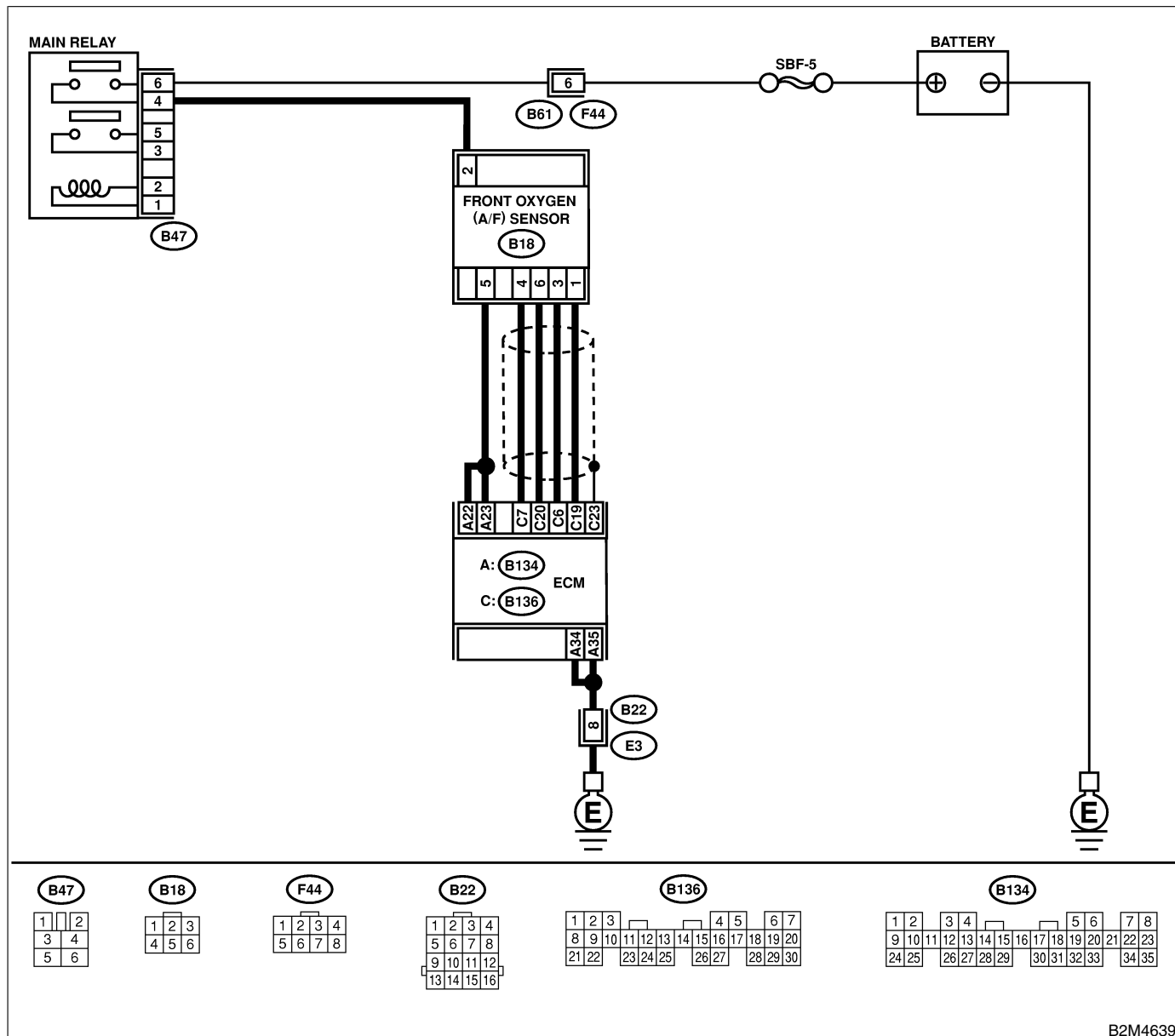
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4639

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 OBD-II 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the value equal to or more than 0.85 and equal to less than 1.15 in idling?	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: 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 value more than 1.1 for a moment?	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. 6 — (B18) No. 1: (B136) No. 7 — (B18) No. 6: (B136) No. 19 — (B18) No. 3: (B136) No. 20 — (B18) No. 4:	Is the resistance 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. 6 — Chassis ground: (B136) No. 7 — Chassis ground: (B136) No. 19 — Chassis ground: (B136) No. 20 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 6.	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 a fault in exhaust system?	Repair or replace faulty parts.	Replace front oxygen (A/F) sensor. <Ref. to FU-47, Front Oxygen (A/F) Sensor.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

**CD: DTC P1142 — THROTTLE POSITION SENSOR CIRCUIT
RANGE/PERFORMANCE PROBLEM (LOW INPUT) —** S078521B99

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

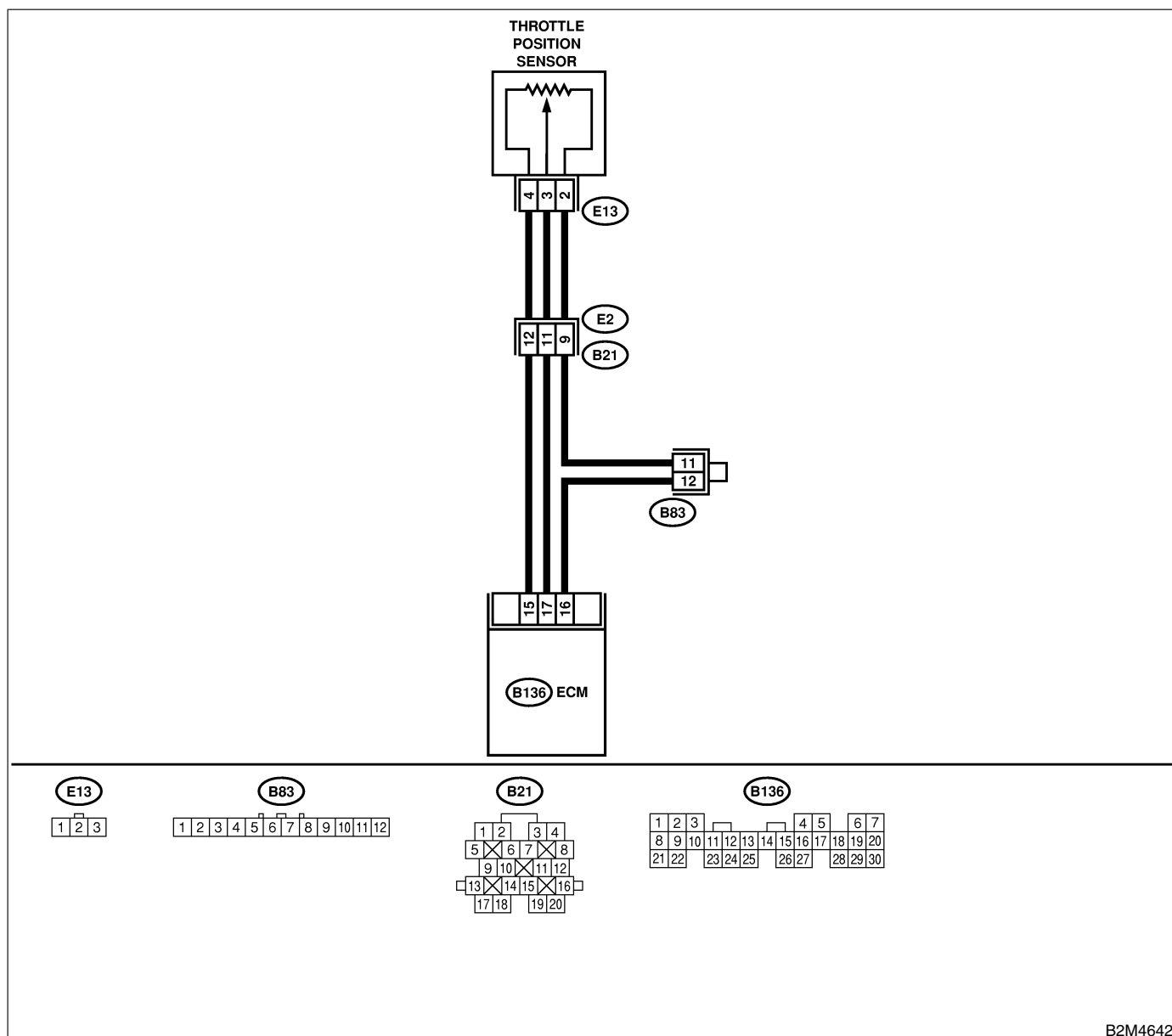
● **TROUBLE SYMPTOM:**

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P1142.	Replace throttle position sensor. <Ref. to FU-35, INSTALLATION, Throttle Position Sensor.>

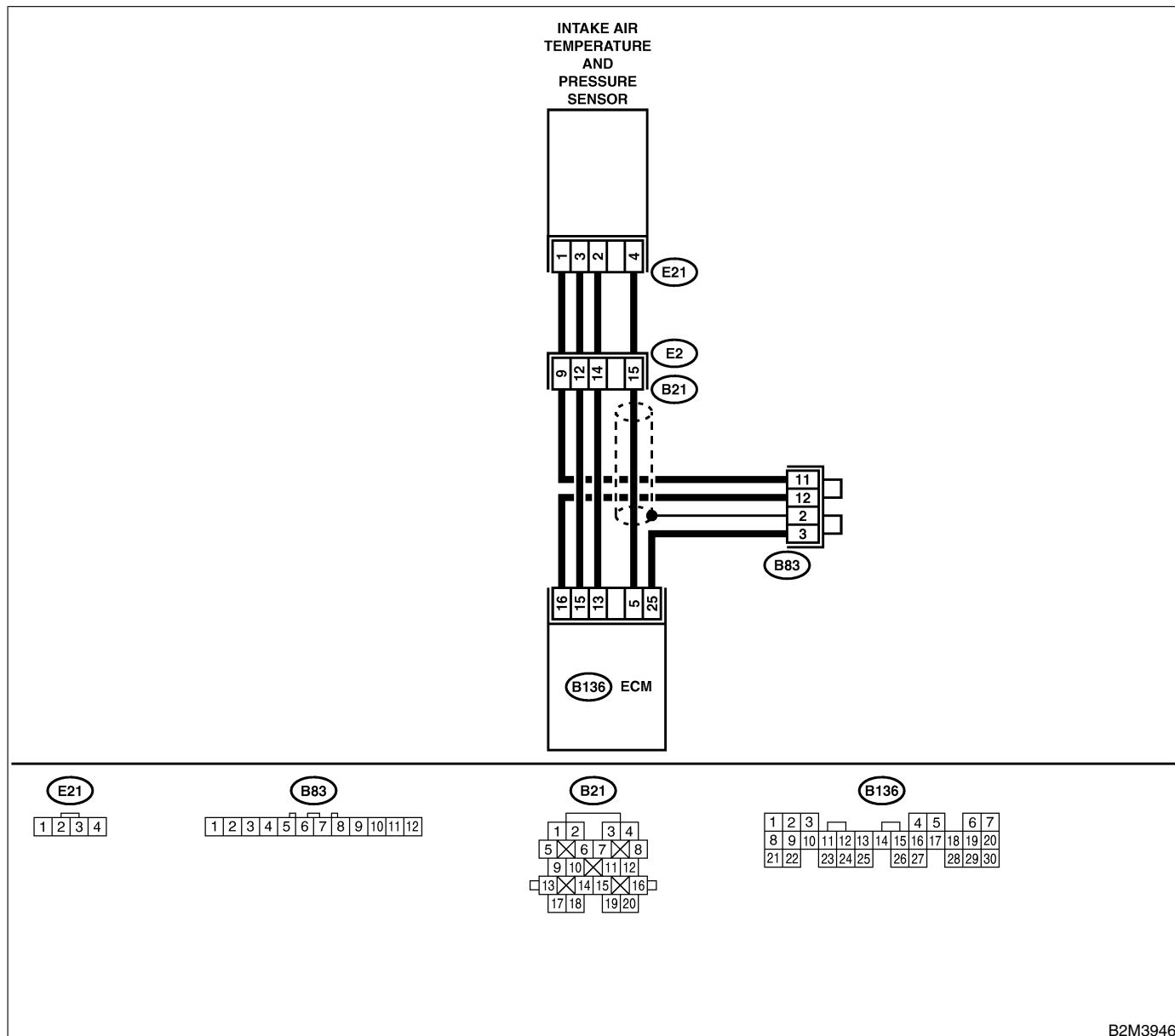
CE: DTC P1146 — PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM (HIGH INPUT) — S078521G07

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3946

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY. NOTE: In this case, it is not necessary to inspect DTC P0106.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN-88, 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 OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual. Specification: ● Intake manifold absolute pressure Ignition ON 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) Idling 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg)	Is the value within the specifications?	Go to step 4.	Replace intake air temperature sensor and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>
4	CHECK THROTTLE POSITION. Read data of throttle position signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: ● Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN-36, Subaru Select Monitor.> ● OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is throttle positioning ratio equal to or less than 5% when throttle is fully closed?	Go to step 5.	Adjust or replace throttle position sensor. <Ref. to FU-35, Throttle Position Sensor.>
5	CHECK THROTTLE POSITION.	Is throttle positioning ratio equal to or more than 85% when throttle is fully open?	Replace intake air temperature and pressure sensor. <Ref. to FU-38, Intake Air Temperature and Pressure Sensor.>	Replace throttle position sensor. <Ref. to FU-35, Throttle Position Sensor.>

CF: DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW INPUT — S078521C07

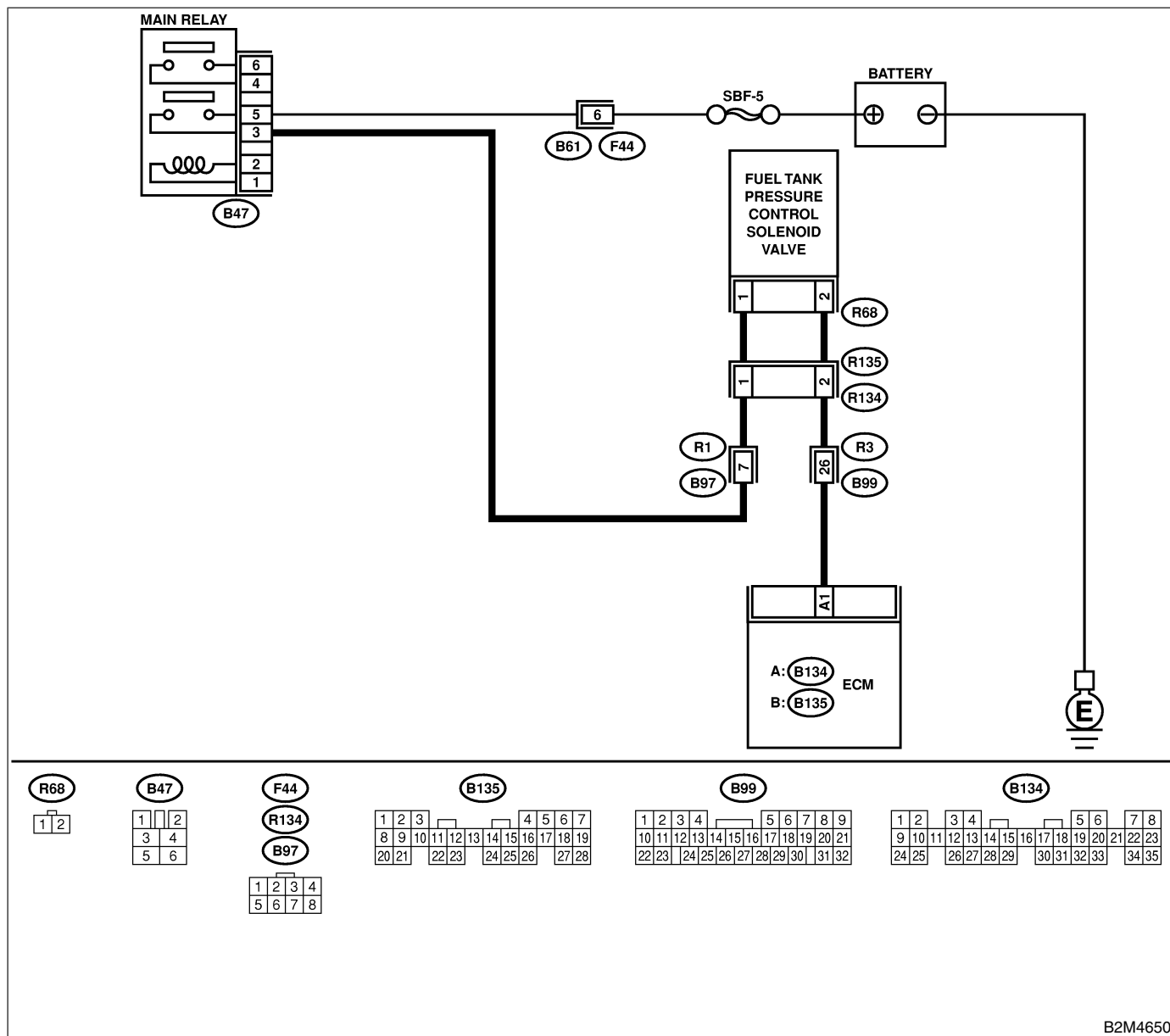
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4650

No.	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. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connectors from fuel tank pressure control solenoid valve and ECM. 3) Measure resistance of harness between fuel tank pressure control solenoid valve connector and chassis ground. Connector & terminal (R68) No. 2 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and fuel tank pressure control solenoid valve connector.	Go to step 4.
4	CHECK HARNESS BETWEEN FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure resistance of harness between ECM and fuel tank pressure control solenoid valve connector. Connector & terminal (B134) No. 1 — (R68) No. 2:	Is the voltage less than 1 V?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: ● Open circuit in harness between ECM and fuel tank pressure control solenoid valve connector ● Poor contact in coupling connectors
5	CHECK FUEL TANK PRESSURE CONTROL SOLENOID VALVE. Measure resistance between fuel tank pressure control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance between 10 and 100 Ω ?	Go to step 6.	Replace fuel tank pressure control solenoid valve. <Ref. to EC-12, Pressure Control Solenoid Valve.>
6	CHECK POWER SUPPLY TO FUEL TANK PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to ON. 2) Measure voltage between fuel tank pressure control solenoid valve and chassis ground. Connector & terminal (R68) No. 1 (+) — Chassis ground (-):	Is the voltage 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 pressure control solenoid valve connector ● Poor contact in coupling connectors ● Poor contact in main relay connector

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

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

MEMO:

**CG: P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE
CIRCUIT HIGH INPUT —** S078521C08

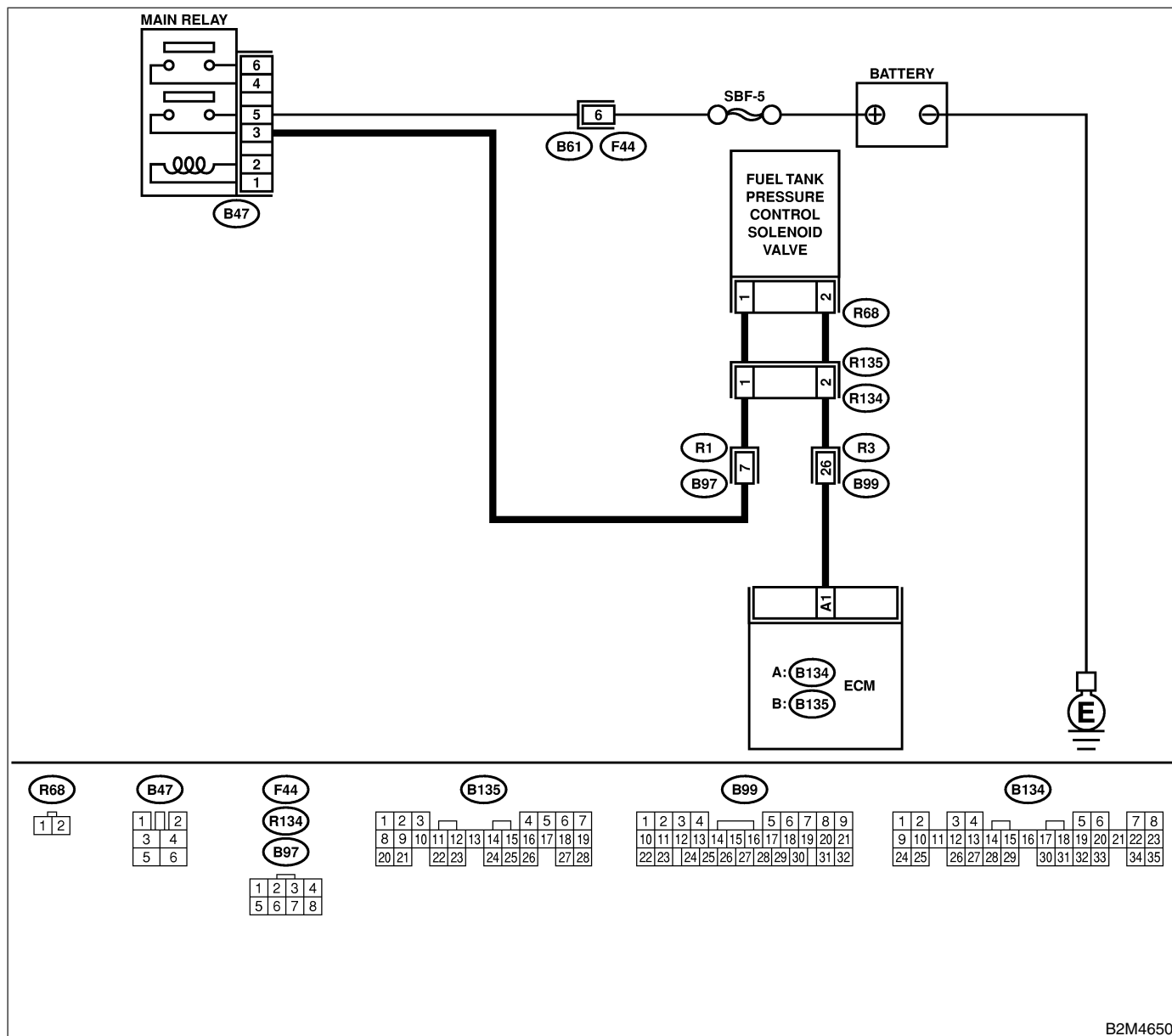
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 fuel tank pressure control solenoid valve, measure voltage between ECM and chassis ground. NOTE: Fuel tank pressure control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN-56, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 1 (+) — Chassis ground (-):	Does voltage change between 0 and 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. 1 (+) — Chassis ground (-):	Is the voltage 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-51, Engine Control Module.>
4	CHECK HARNESS BETWEEN FUEL TANK PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from fuel tank pressure control solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and fuel tank pressure control solenoid valve connector. After repair, replace ECM. <Ref. to FU-51, Engine Control Module.>	Go to step 5.
5	CHECK FUEL TANK PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Measure resistance between fuel tank pressure control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace fuel tank pressure control solenoid valve <Ref. to EC-6, Pressure Control Solenoid Valve.> and ECM <Ref. to FU-51, 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-51, Engine Control Module.>

**CH: DTC P1442 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE
PROBLEM 2 —** S078521C11

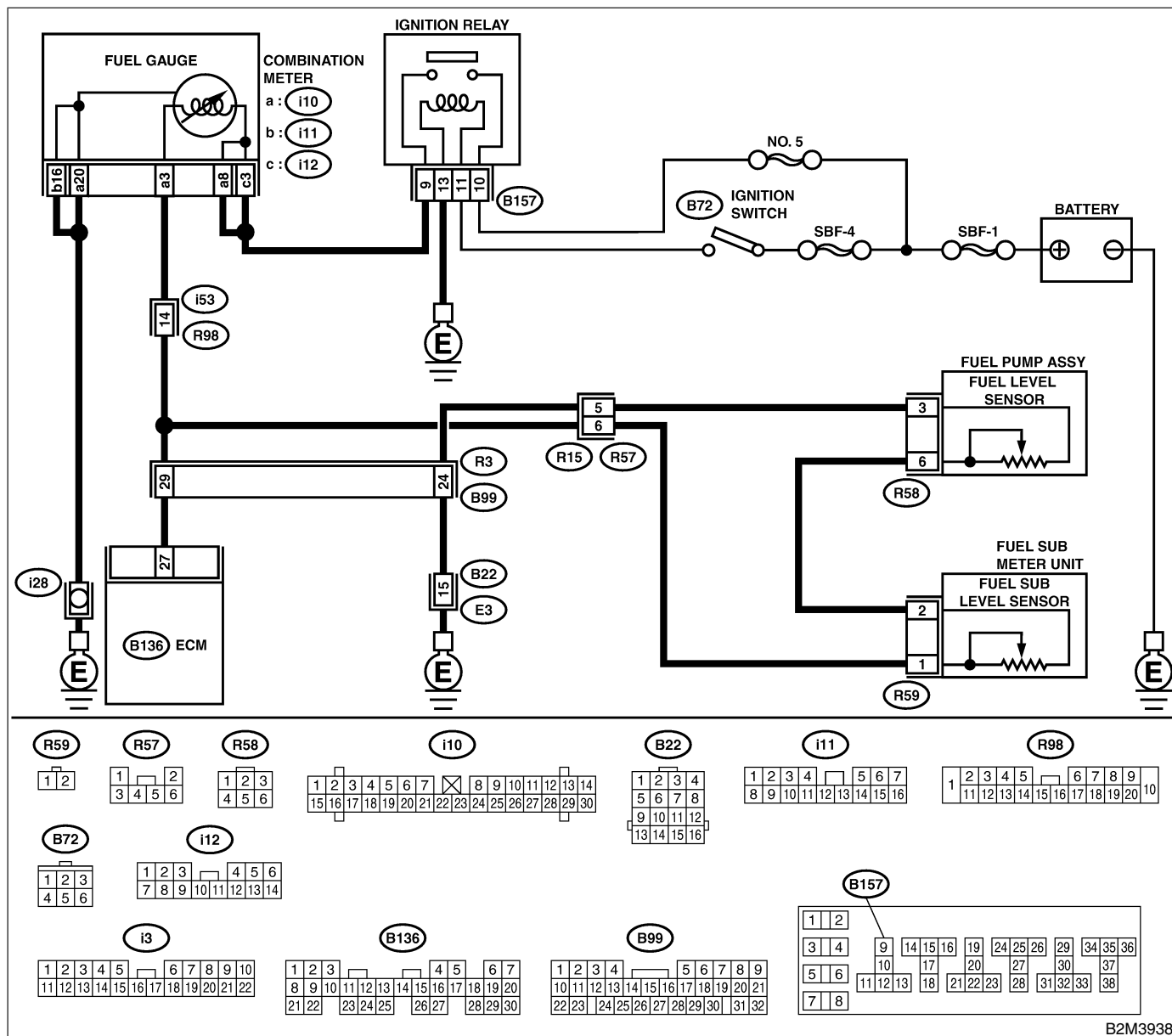
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3938

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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-76, Fuel Level Sensor.> and fuel sub level sensor. <Ref. to FU-77, Fuel Sub Level Sensor.>

Engine (Diagnostics)

S078521C12

- Immediately after fault occurrence

- Improper fuel supply

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

MAIN RELAY

BATTERY

DRAIN VALVE

CANISTER

ECM (B134)

Sensors and Components: B61, F44, B97, R1, R3, B99, R69, B47, SBF-5

Legend:

- R69:** 1 2
- B47:** 1 2, 3 4, 5 6
- F44:** 1 2 3 4, 5 6 7 8
- B99:** 1 2 3 4, 5 6 7 8, 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
- B134:** 1 2, 3 4, 5 6, 7 8, 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK VENT LINE HOSES. Check the following items. ● Clogging of vent hoses between canister and drain valve ● Clogging of vent hose between drain valve and air filter ● Clogging of drain filter	Is there a fault in vent line?	Repair or replace the faulty 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), to the side of the center console box. 3) Turn ignition switch to ON. 4) Operate drain valve. 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-56, Compulsory Valve Operation Check Mode.>	Does drain valve produce operating sound?	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace drain valve. <Ref. to EC-16, Drain Valve.>

**CJ: DTC P1446 — EVAPORATIVE EMISSION CONTROL SYSTEM
ATMOSPHERIC PRESSURE SOLENOID VALVE LOW INPUT —**

S078521K47

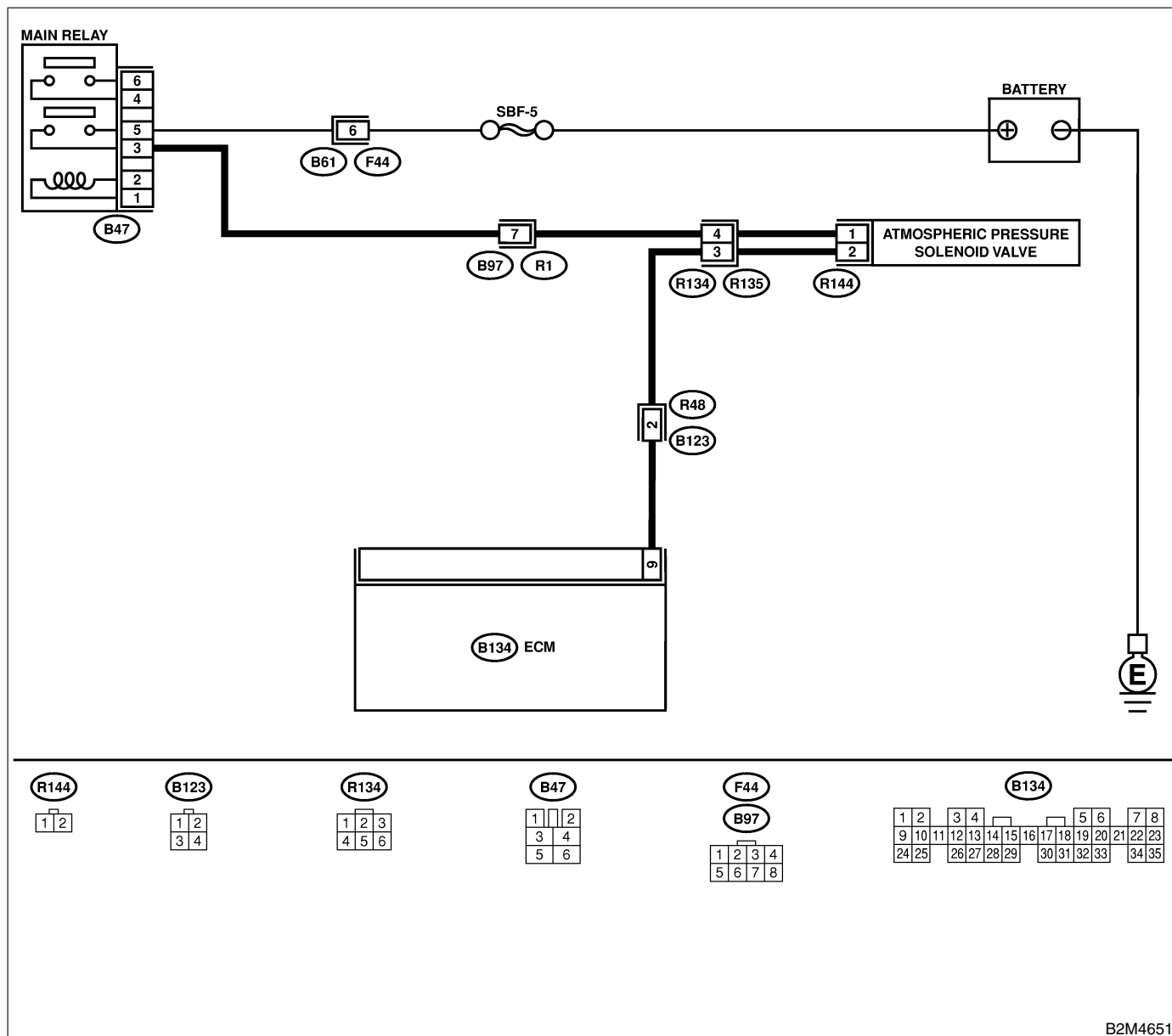
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4651

No.	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. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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 ATMOSPHERIC PRESSURE SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connectors from atmospheric pressure solenoid valve and ECM. 3) Measure resistance of harness between drain valve connector and chassis ground. Connector & terminal (R144) No. 2 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 4.	Repair ground short circuit in harness between ECM and atmospheric pressure solenoid valve connector.
4	CHECK HARNESS BETWEEN ATMOSPHERIC PRESSURE SOLENOID VALVE AND ECM CONNECTOR. Measure resistance of harness between ECM and atmospheric pressure solenoid valve connector. Connector & terminal (B134) No. 9 — (R144) No. 2:	Is the voltage 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 ATMOSPHERIC PRESSURE SOLENOID VALVE. Measure resistance between atmospheric pressure solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance between 10 and 100 Ω?	Go to step 6.	Replace atmospheric pressure solenoid valve. <Ref. to EC-11, Atmospheric Pressure Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
6	CHECK POWER SUPPLY TO ATMOSPHERIC PRESSURE SOLENOID VALVE. 1) Turn ignition switch to ON. 2) Measure voltage between atmospheric pressure solenoid valve and chassis ground. Connector & terminal (R144) No. 1 (+) — Chassis ground (–):	Is the voltage 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 atmospheric pressure solenoid valve ● Poor contact in coupling connectors ● Poor contact in main relay connector
7	CHECK POOR CONTACT. Check poor contact in atmospheric pressure solenoid valve connector.	Is there poor contact in atmospheric pressure solenoid valve connector?	Repair poor contact in atmospheric pressure solenoid valve connector.	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

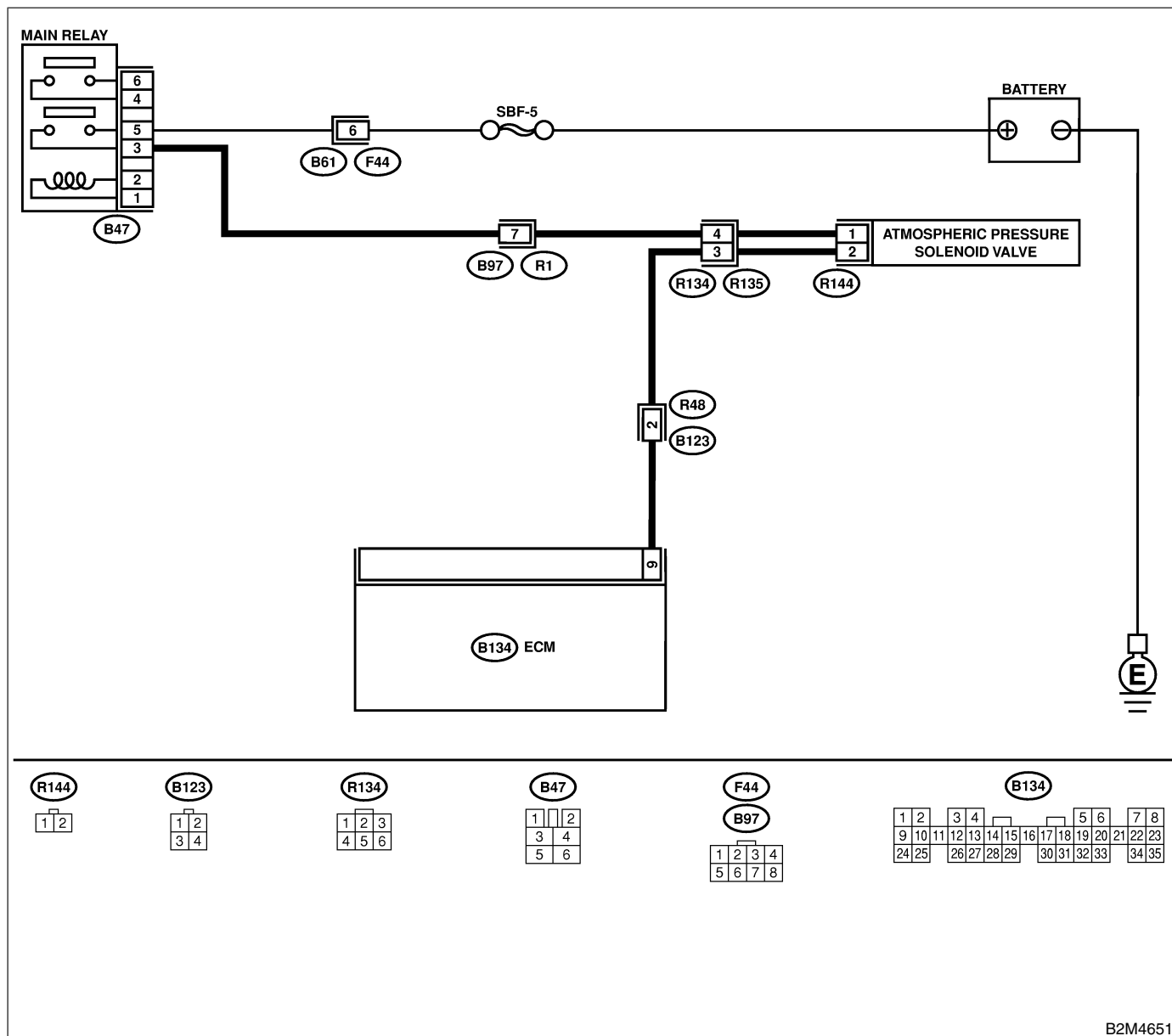
**CK: DTC P1447 — EVAPORATIVE EMISSION CONTROL SYSTEM
 ATMOSPHERIC PRESSURE SOLENOID VALVE HIGH INPUT —** S078521K48

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

• **WIRING DIAGRAM:**



B2M4651

No.	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. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 3.	Go to step 2.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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-51, Engine Control Module.>
3	CHECK HARNESS BETWEEN ATMOSPHERIC PRESSURE SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from atmospheric pressure solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and atmospheric pressure solenoid valve connector. After repair, replace ECM. <Ref. to FU-51, Engine Control Module.>	Go to step 4.
4	CHECK DRAIN VALVE. 1) Turn ignition switch to OFF. 2) Measure resistance between atmospheric pressure solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace atmospheric pressure solenoid valve <Ref. to EC-11, Atmospheric Pressure Solenoid Valve.> and ECM <Ref. to FU-51, 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-51, Engine Control Module.>

**CL: DTC P1448 — EVAPORATIVE EMISSION CONTROL SYSTEM
ATMOSPHERIC PRESSURE SOLENOID VALVE RANGE/PERFORMANCE
PROBLEM —** S078521K49

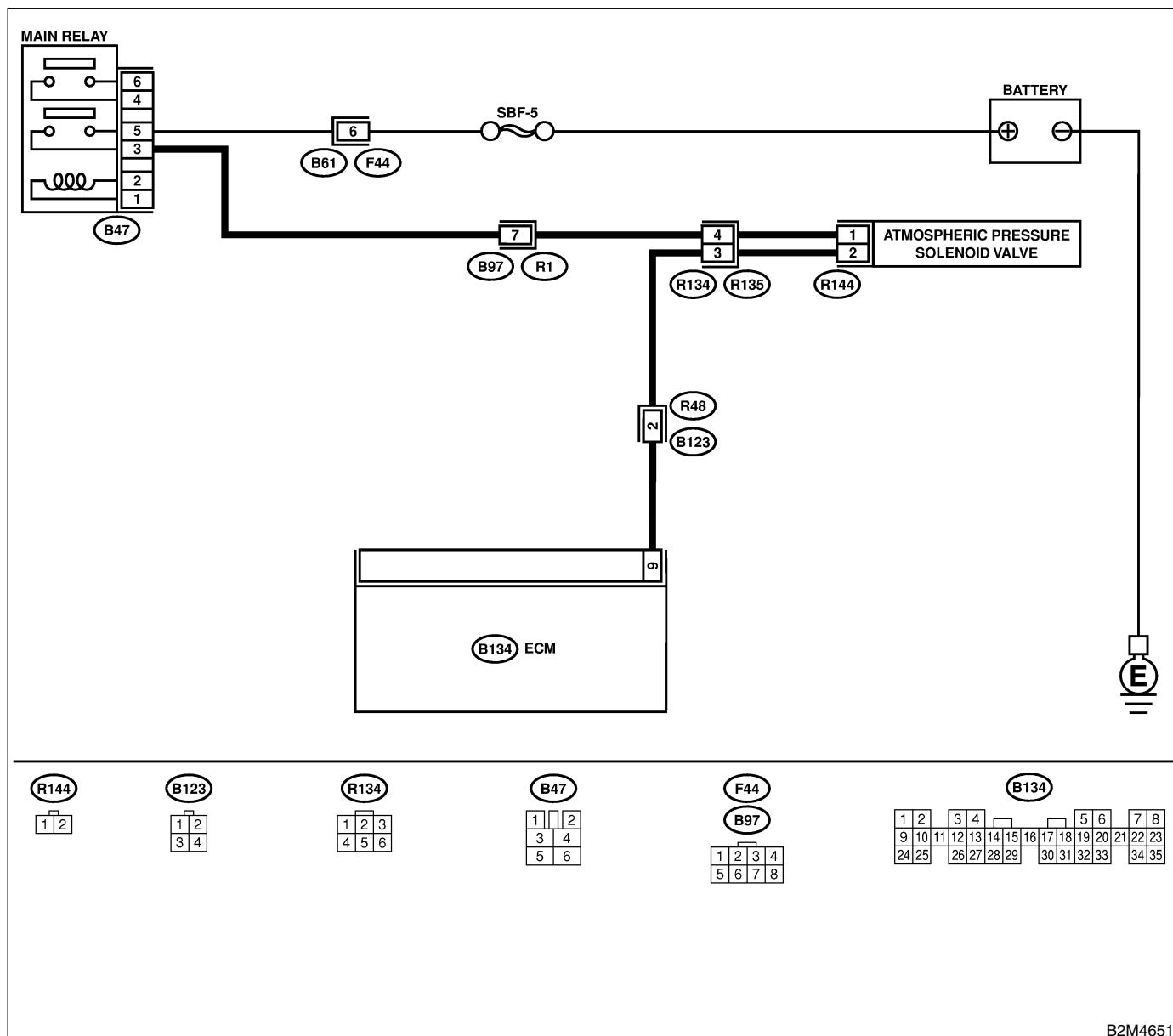
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 a fault in pressure/vacuum line?	Repair or replace hoses and pipes.	Replace fuel tank pressure sensor. <Ref. to EC-10, Fuel Tank Pressure Sensor.>

CM: DTC P1507 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —

S078521C16

● **DTC DETECTING CONDITION:**

- Immediately at fault recognition

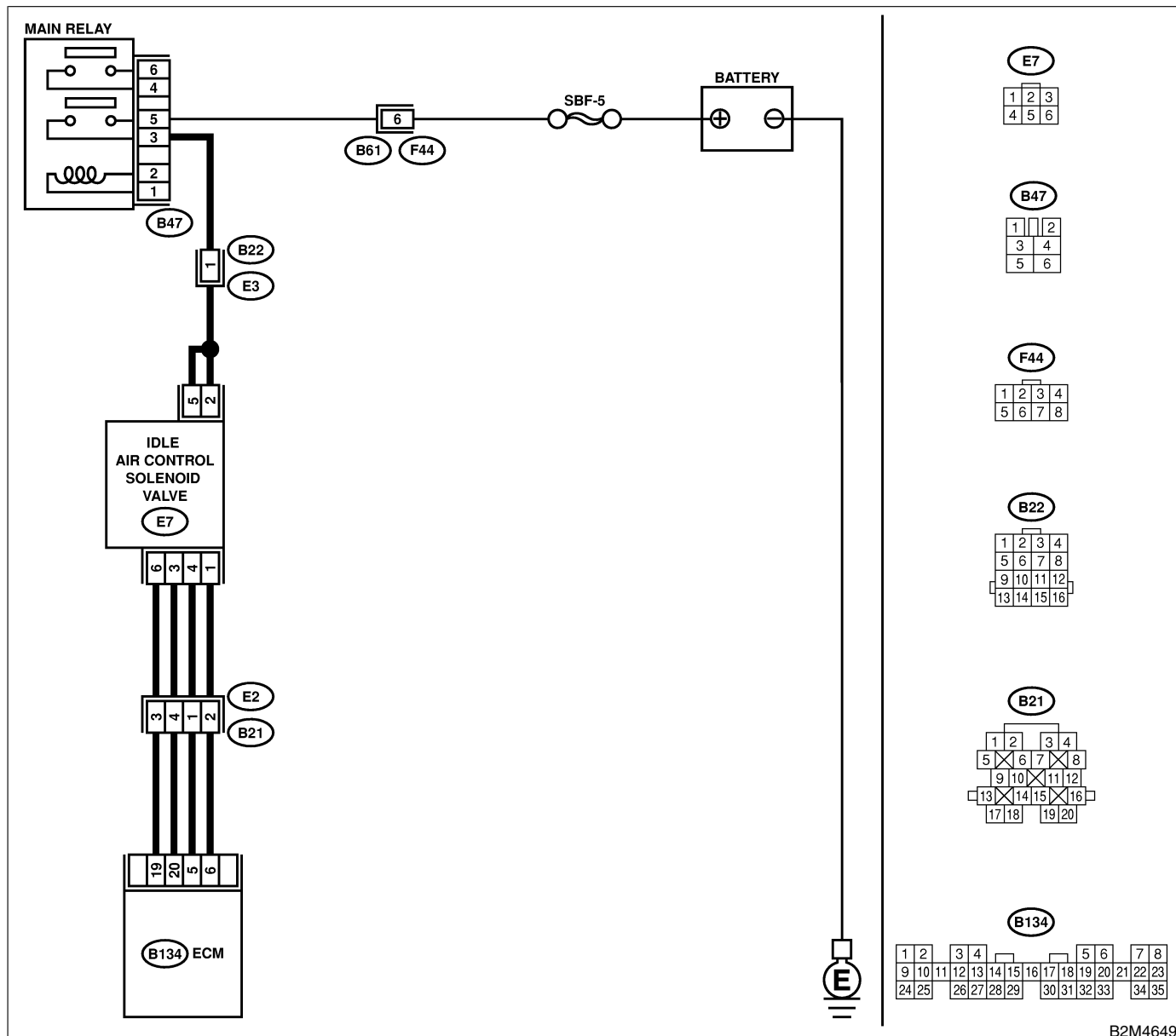
● **TROUBLE SYMPTOM:**

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4649

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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-88, 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 a 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-6, INSTALLATION, 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-39, 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-39, Idle Air Control Solenoid Valve.>

**CN: DTC P1510 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1
CIRCUIT LOW INPUT —** S078521C17

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN-326, DTC 1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**CO: DTC P1511 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 1
CIRCUIT HIGH INPUT —** S078521C18

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN-330, DTC 1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**CP: DTC P1512 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2
CIRCUIT LOW INPUT —** S078521C19

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN-326, DTC 1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**CQ: DTC P1513 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 2
CIRCUIT HIGH INPUT —** S078521C20

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN-330, DTC 1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**CR: DTC P1514 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3
CIRCUIT LOW INPUT —** S078521C21

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN-326, DTC 1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**CS: DTC P1515 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 3
CIRCUIT HIGH INPUT —** S078521C22

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN-330, DTC 1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4 CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

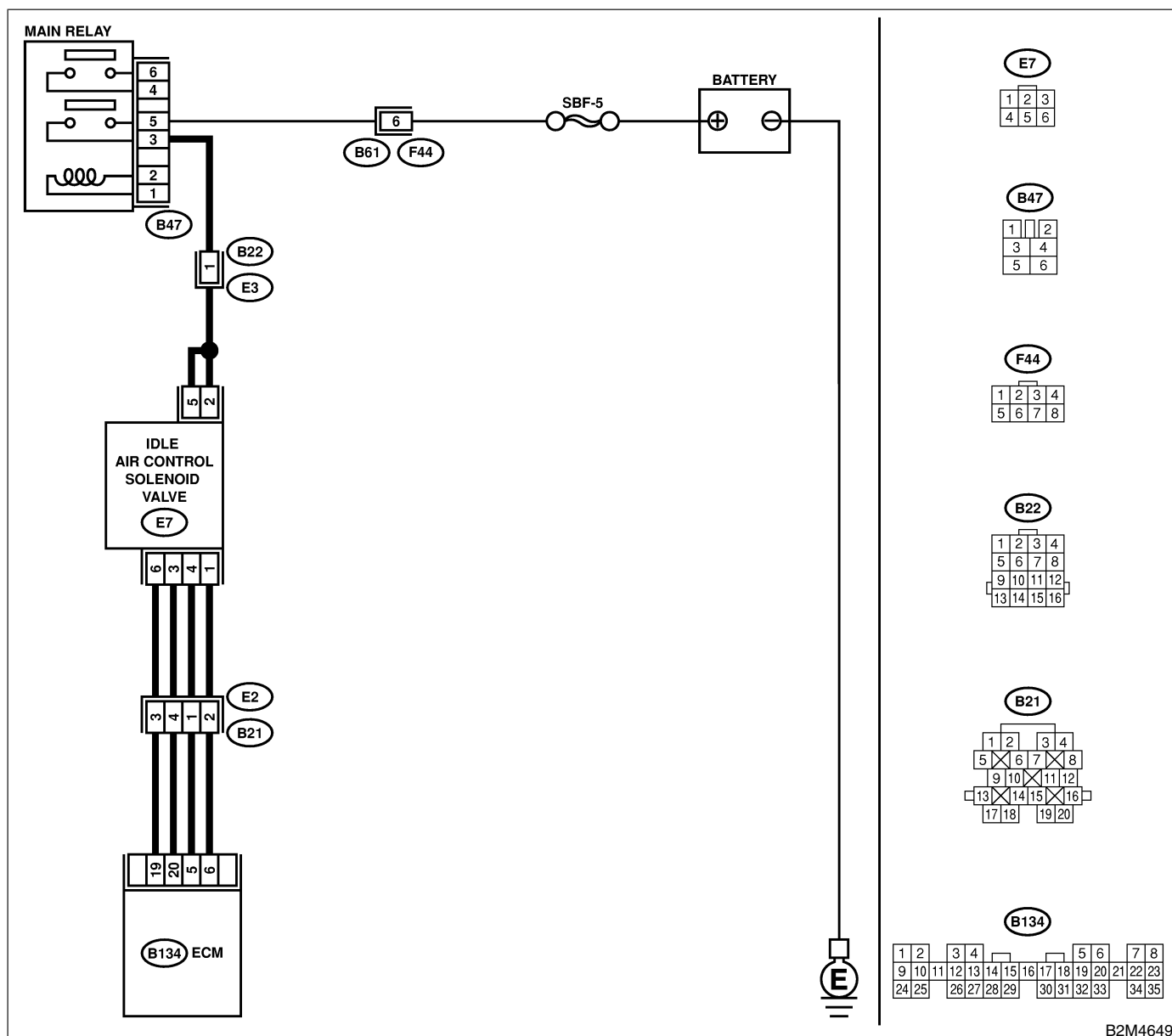
**CT: DTC P1516 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4
CIRCUIT LOW INPUT —** S078521C23

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (-):	Is the voltage 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. Connector & terminal (E7) No. 5 (+) — Engine ground (-):	Is the voltage 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. 5 — (E7) No. 3: DTC P1512; (B134) No. 6 — (E7) No. 1: DTC P1514; (B134) No. 19 — (E7) No. 6: DTC P1516; (B134) No. 20 — (E7) No. 4:	Is the resistance 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. 5 — Chassis ground: DTC P1512; (B134) No. 6 — Chassis ground: DTC P1514; (B134) No. 19 — Chassis ground: DTC P1516; (B134) No. 20 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and idle air control solenoid valve connector.	Go to step 5.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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-39, Idle Air Control Solenoid Valve.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

MEMO:

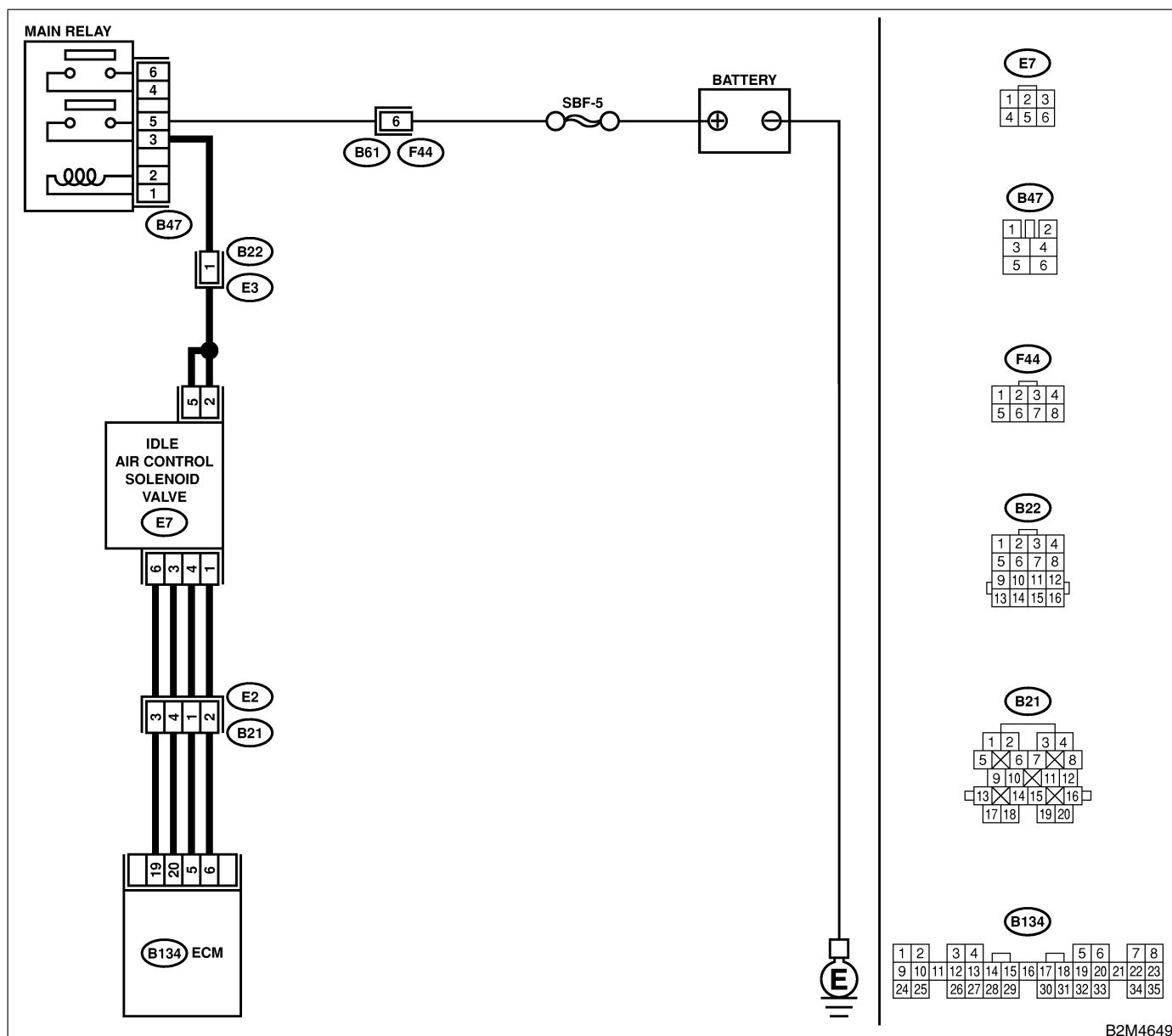
**CU: DTC P1517 — IDLE AIR CONTROL SOLENOID VALVE SIGNAL 4
CIRCUIT HIGH INPUT —** S078521C24

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M4649

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P1511, P1513, P1515 and P1517 at same time?	Go to step 2.	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 resistance 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. 5 (+) — Chassis ground (-): DTC P1513; (B134) No. 6 (+) — Chassis ground (-): DTC P1515; (B134) No. 19 (+) — Chassis ground (-): DTC P1517; (B134) No. 20 (+) — Chassis ground (-):	Is the voltage 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-51, Engine Control Module.>	Replace ECM. <Ref. to FU-51, Engine Control Module.>

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

CV: DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT — S078521G09

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

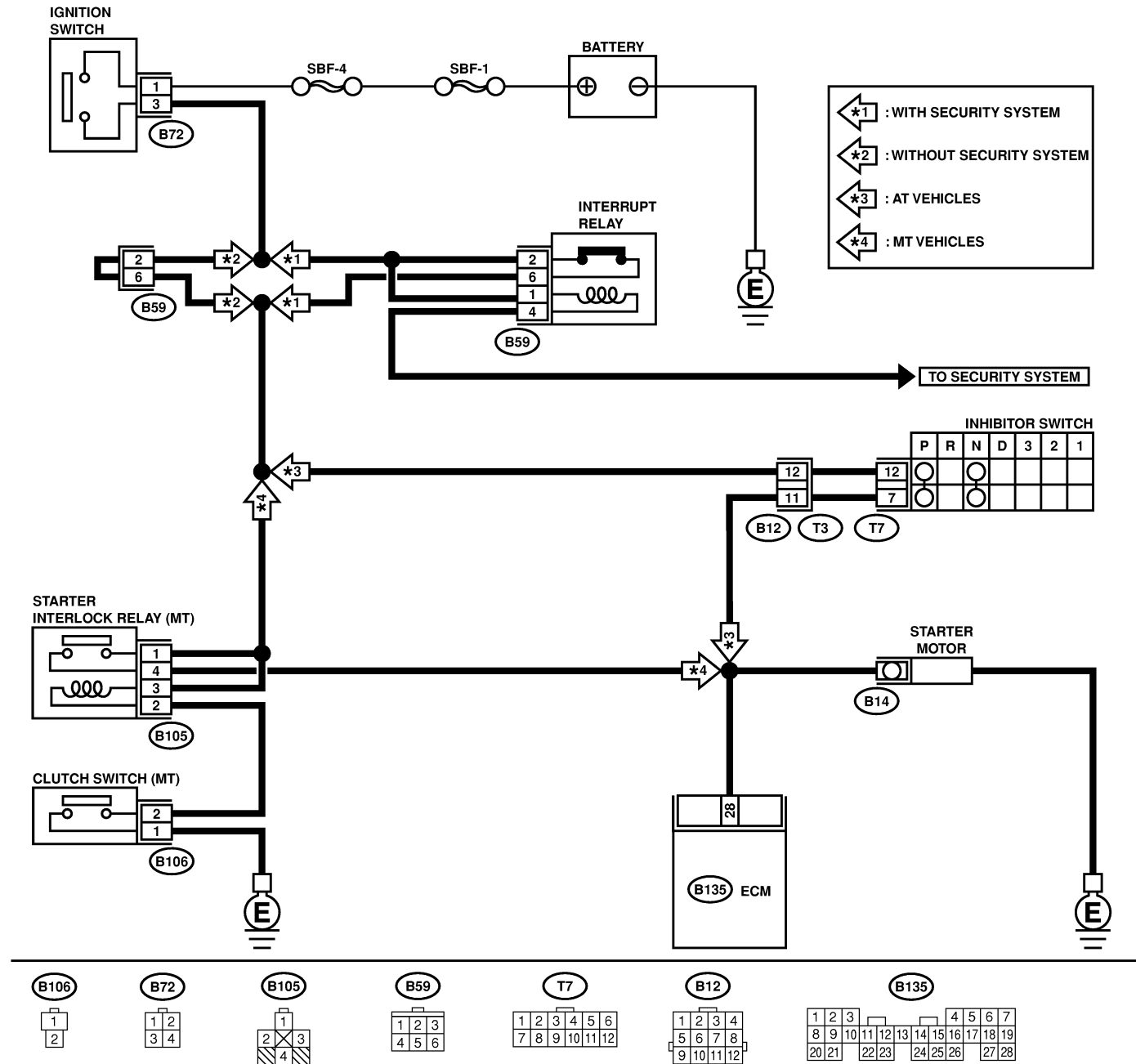
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

● WIRING DIAGRAM:



B2M4635

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR. NOTE: Place the inhibitor switch in the "P" or "N" position.	Does starter motor operate when 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-70, STARTER MOTOR CIRCUIT, Diagnostic for Engine Starting Failure.>

MEMO:

Engine (Diagnostics)

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

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

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DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
1	CHECK DTC P0720 ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?	Check front vehicle speed sensor signal circuit. <Ref. to AT-60, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Trouble Code (DTC).>	Go to step 2.
2	CHECK SPEEDOMETER OPERATION IN COMBINATION METER.	Does speedometer operate normally?	Go to step 3.	Check speedometer and vehicle speed sensor. <Ref. to IDI-13, Speedometer.>
3	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 (B135) No. 24 — (i10) No. 13:	Is the resistance 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

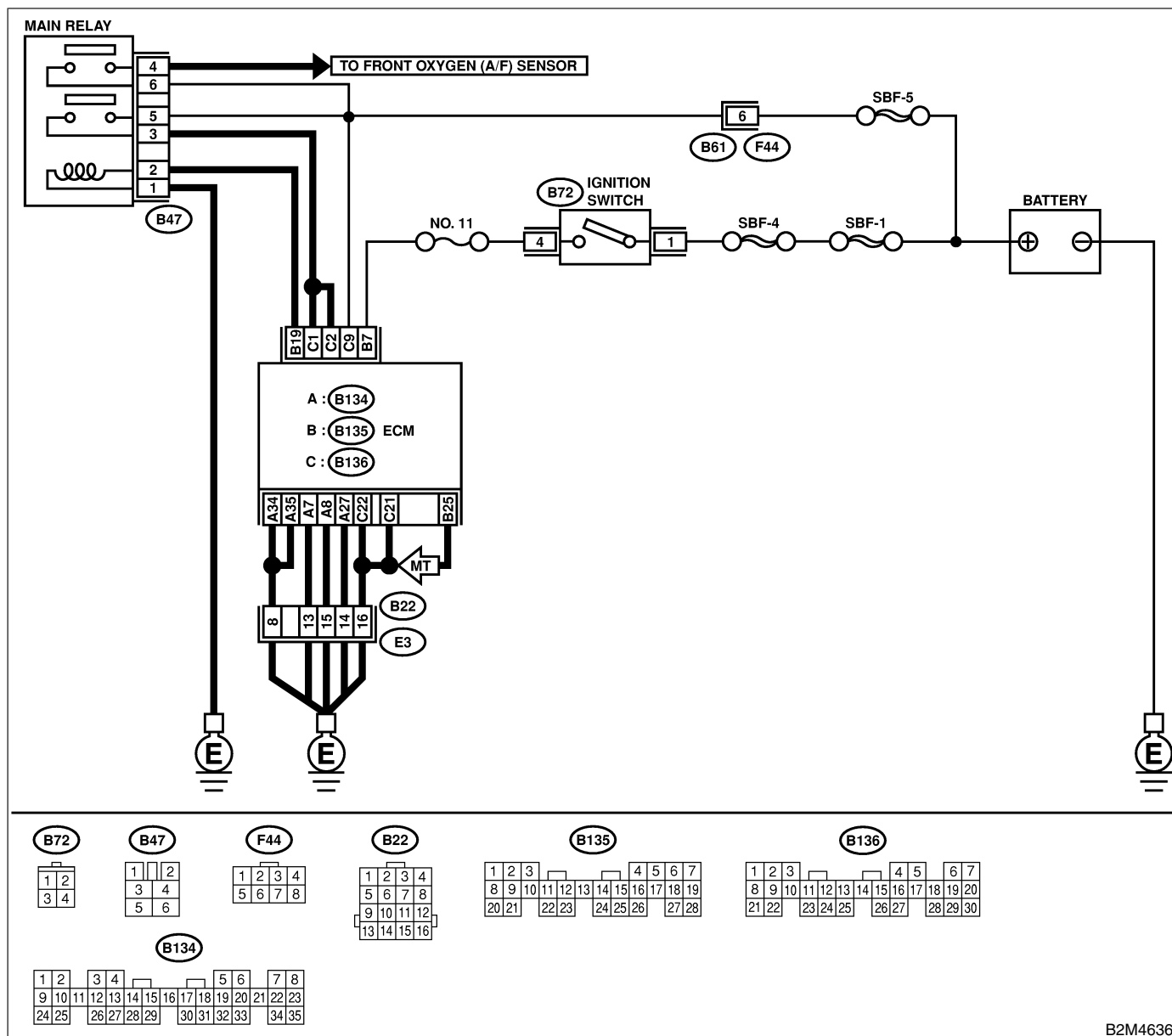
CX: DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION — S078521C27

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

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



B2M4636

No.	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 (B136) No. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair poor contact in ECM connector.	Go to step 2.

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	Step	Check	Yes	No
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. <i>Connector & terminal (B136) No. 9 — Chassis ground:</i>	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM connector and battery terminal.	Go to step 3.
3	CHECK FUSE SBF-5.	Is fuse blown?	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

CY: DTC P1698 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT LOW INPUT — S078521G15

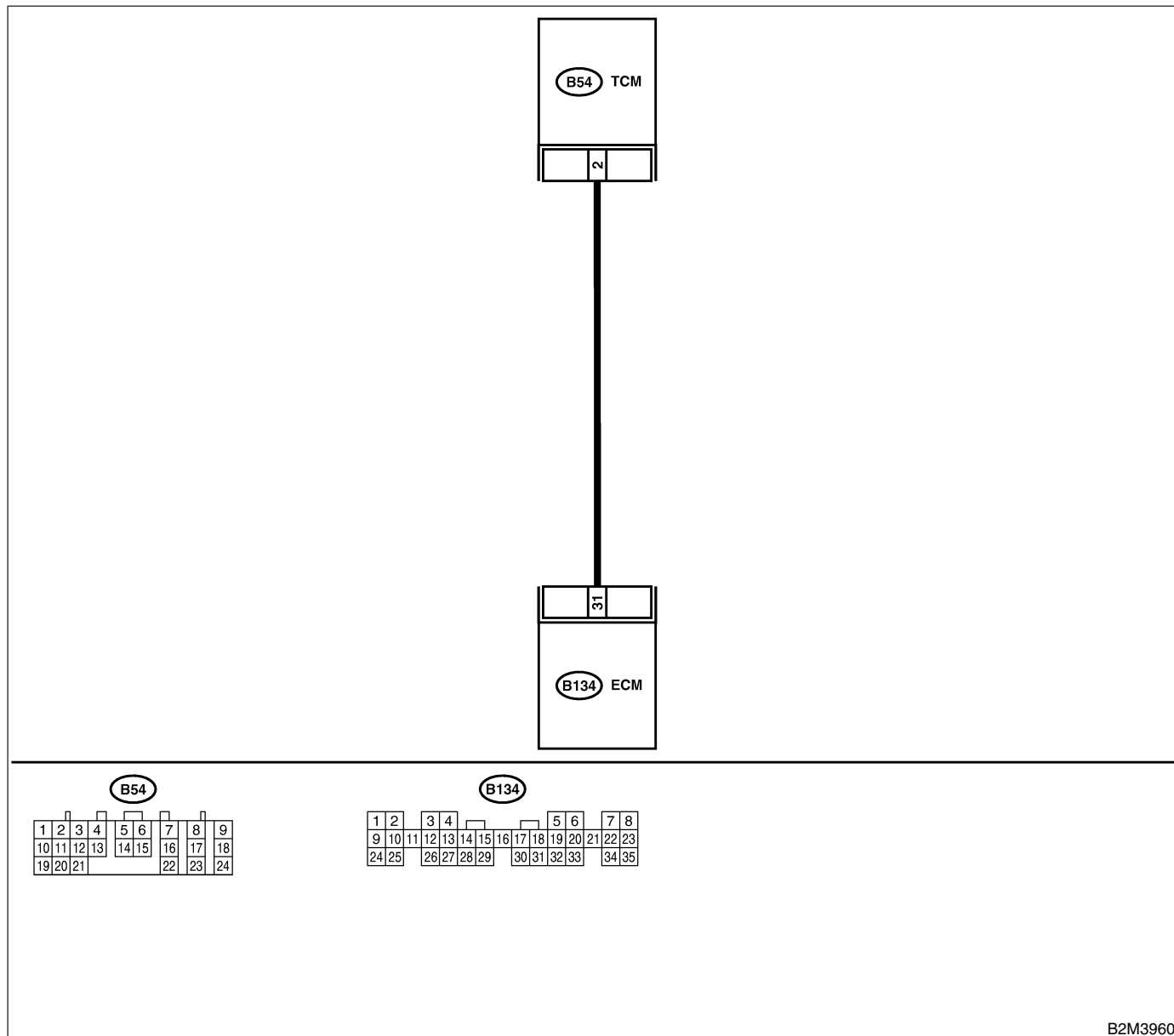
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B134) No. 31 (+) — Chassis ground (-):	Is the voltage 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 (B134) No. 31 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and TCM connector.	Go to step 3.
3	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure resistance of harness between ECM and TCM connector. Connector & terminal (B134) No. 31 — (B54) No. 2:	Is the resistance less than 1 Ω ?	Repair poor contact in ECM or TCM connector.	Repair open circuit in harness between ECM and TCM connector.

CZ: DTC P1699 — ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT HIGH INPUT — S078521G16

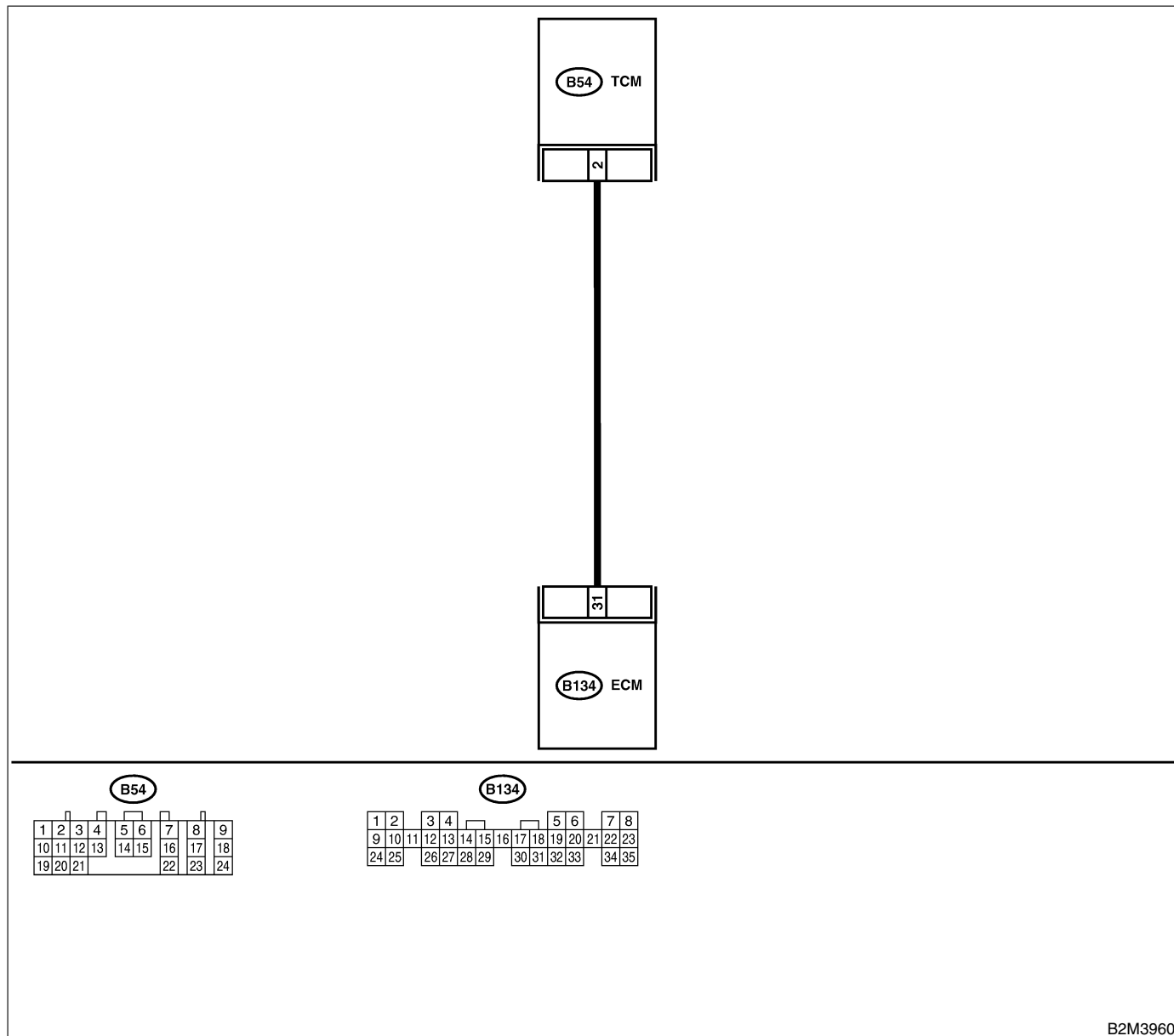
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B134) No. 31 (+) — Chassis ground (-):	Is the voltage 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-51, 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 (B134) No. 31 (+) — Chassis ground (-):	Does the voltage change more than 10 V by shaking harness and connector of ECM while monitoring the value with voltage meter?	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace ECM. <Ref. to FU-51, Engine Control Module.>	Contact with SOA (distributor) service. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

**DA: DTC P1701 — CRUISE CONTROL SET SIGNAL CIRCUIT MALFUNCTION
FOR AUTOMATIC TRANSMISSION —** S078521C29

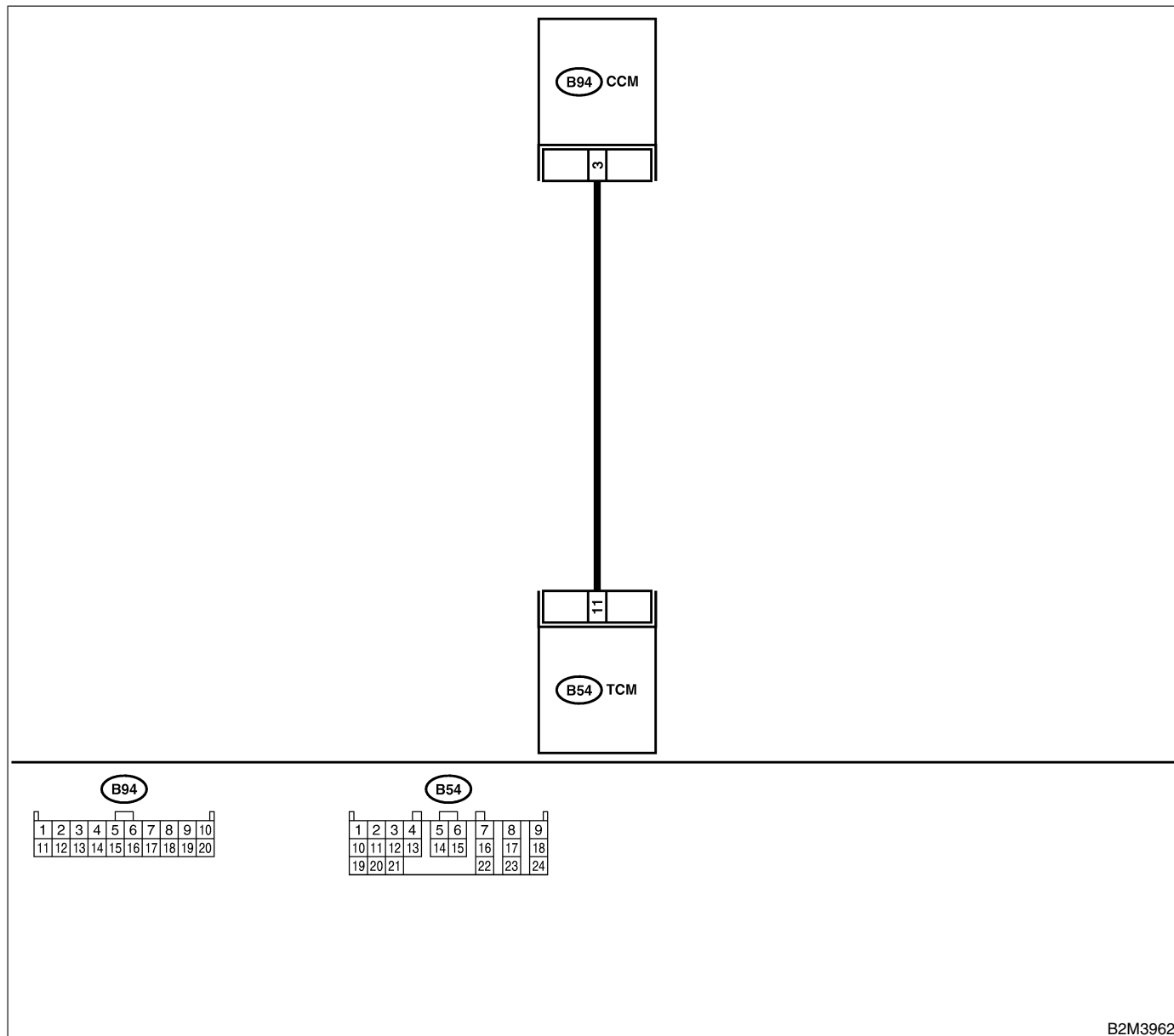
● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



B2M3962

DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 resistance 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 (B54) No. 11 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair short circuit in harness between TCM and CCM connector.	Go to step 3.
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 resistance less than 1 V?	Go to step 4.	Check cruise control command switch circuit. <Ref. to CC-6, 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 AT-49, Transmission Control Module (TCM).>

**DB: DTC P1711 — ENGINE TORQUE CONTROL SIGNAL 1 CIRCUIT
MALFUNCTION —** S078521G17

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

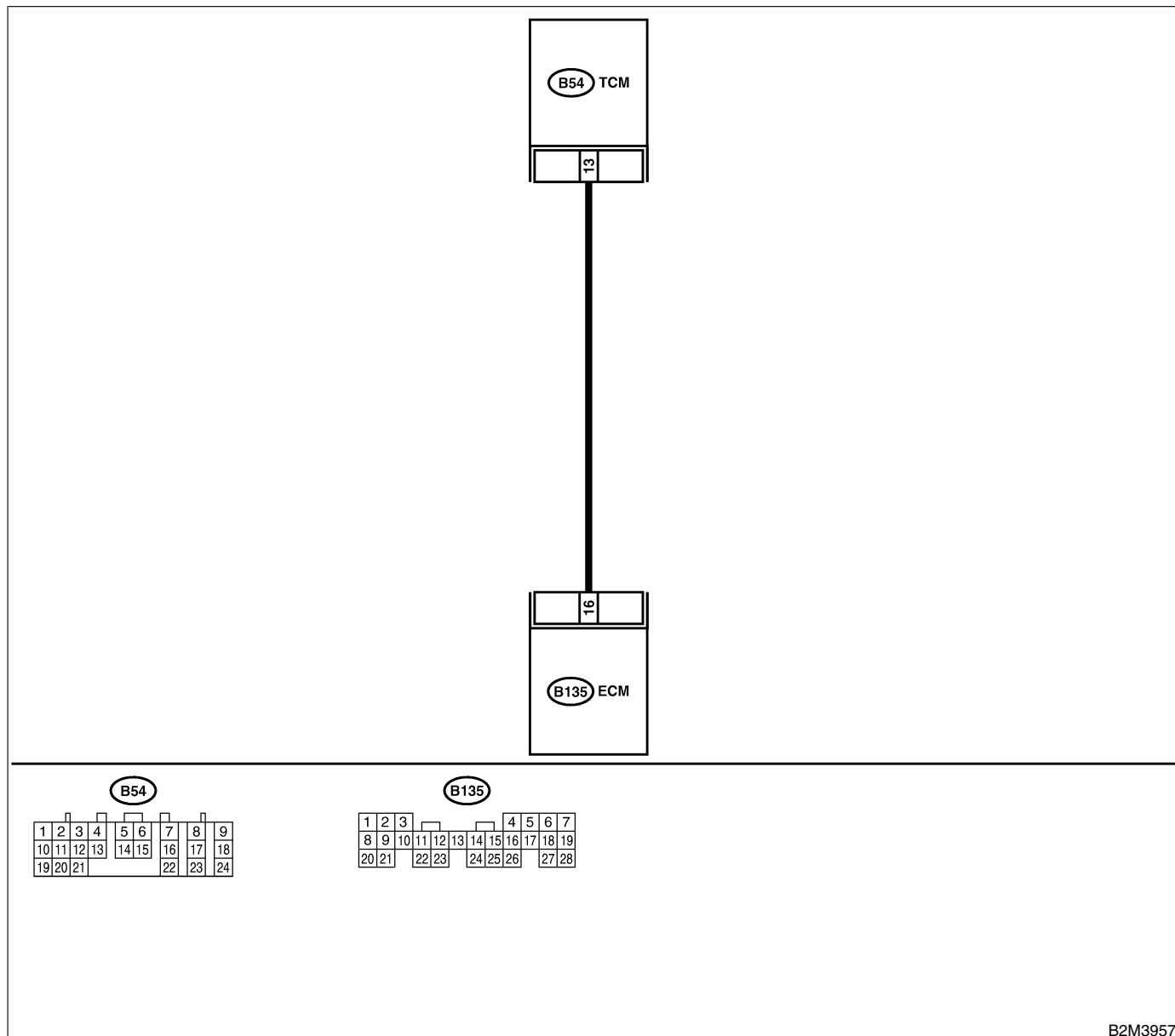
● **TROUBLE SYMPTOM:**

- Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 16 (+) — Chassis ground (-):	Is the voltage 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 (B135) No. 16 (+) — Chassis ground (-):	Is the voltage 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 (distributor) service. 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 (B135) No. 16 — (B54) No. 13:	Is the resistance 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 (B135) No. 16 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and TCM connector.	Go to step 6.
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 AT-49, Transmission Control Module (TCM).>

**DC: DTC P1712 — ENGINE TORQUE CONTROL SIGNAL 2 CIRCUIT
MALFUNCTION —** S078521G18

● **DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault

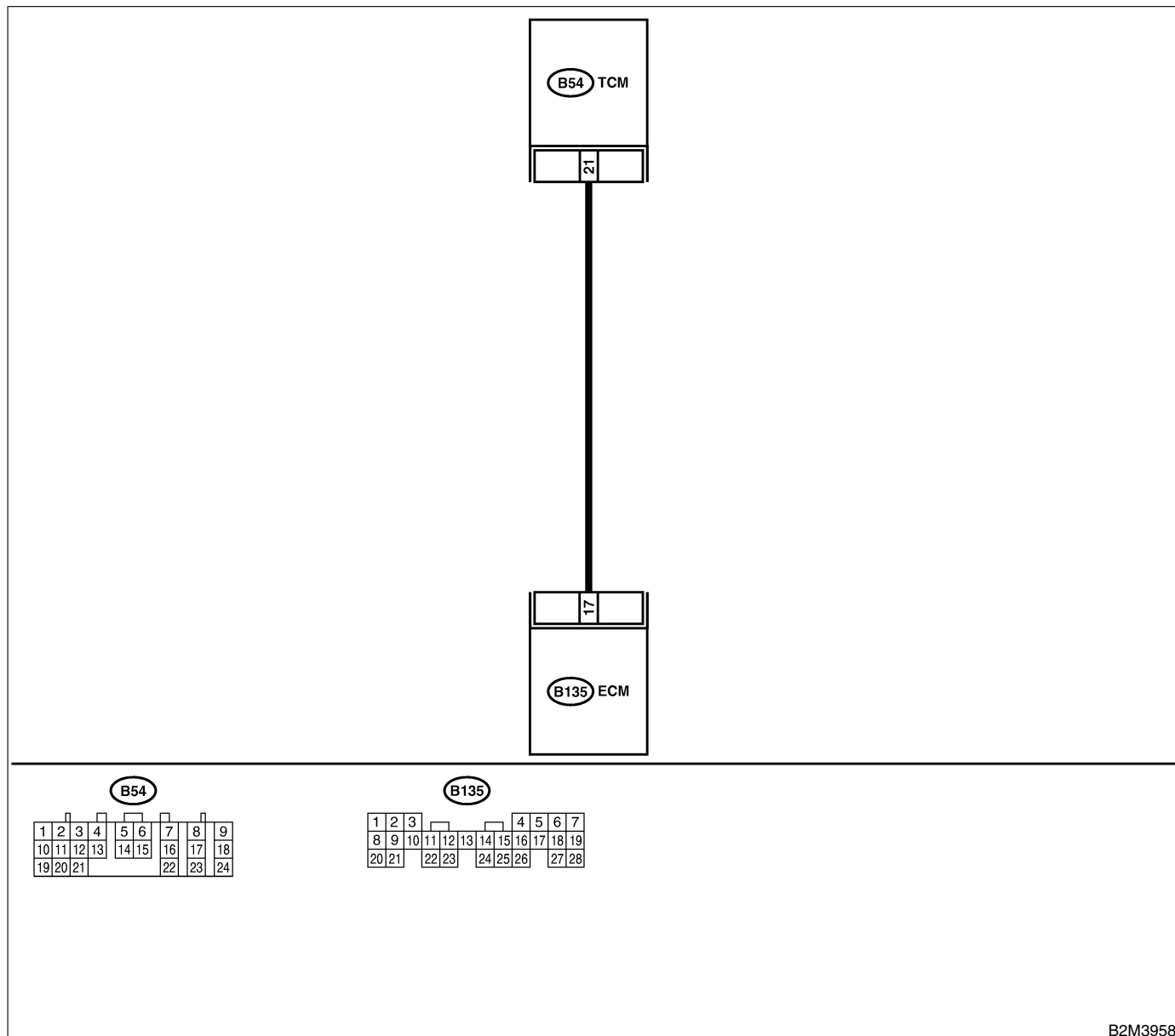
● **TROUBLE SYMPTOM:**

- Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN-55, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN-48, OPERATION, Inspection Mode.>.

● **WIRING DIAGRAM:**



DIAGNOSTIC PROCEDURE WITH DIAGNOSTIC TROUBLE CODE (DTC)

Engine (Diagnostics)

No.	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 (B135) No. 17 (+) — Chassis ground (-):	Is the voltage 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 (B135) No. 17 (+) — Chassis ground (-):	Is the voltage 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 (distributor) service. 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 (B135) No. 17 — (B54) No. 21:	Is the resistance 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 (B135) No. 17 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM and TCM connector.	Go to step 6.
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 AT-49, Transmission Control Module (TCM).>

GENERAL DIAGNOSTIC TABLE

Engine (Diagnostics)

20. General Diagnostic Table

S078257

A: INSPECTION

S078257A10

1. ENGINE

S078257A1001

NOTE:

Malfunction of parts other than those listed is also possible. <Ref. to ME-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 sags 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

GENERAL DIAGNOSTIC TABLE

Engine (Diagnostics)

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 S078257A1002

NOTE:

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

GENERAL DIAGNOSTIC TABLE

Engine (Diagnostics)

MEMO: