

GENERAL DESCRIPTION

Cooling

1. General Description

S106001

A: SPECIFICATIONS

S106001E49

Cooling system			Electric fan + Forced engine coolant circulation system
Total engine coolant capacity ℓ (US qt, Imp qt)			MT: Approx. 6.0 (6.3, 5.3) AT: Approx. 6.2 (6.6, 5.5)
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)
Thermostat	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		0.45 ℓ (0.5 US qt, 0.4 Imp qt)

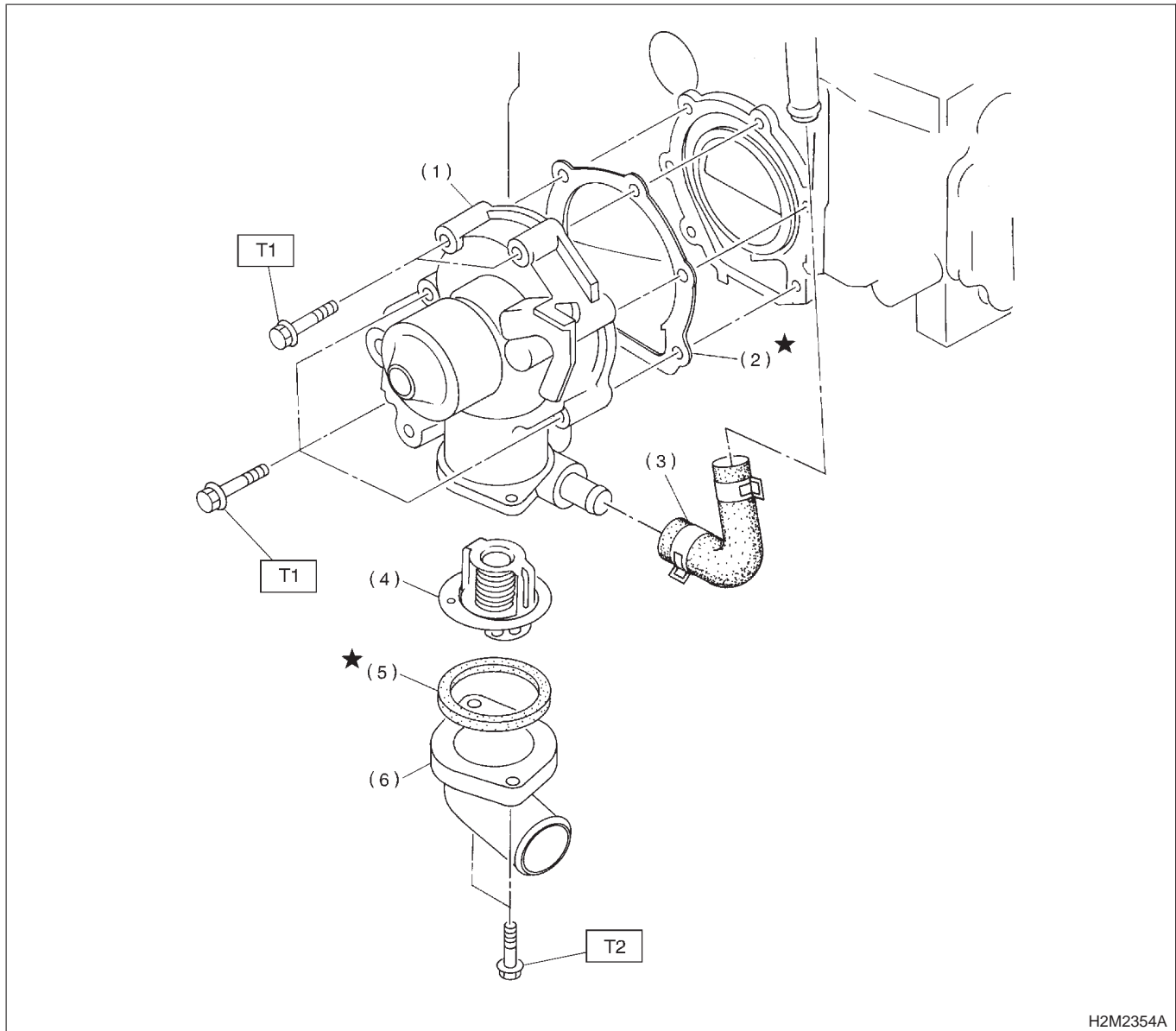
CO(H4)-2

B: COMPONENT

S106001A05

1. WATER PUMP

S106001A0501

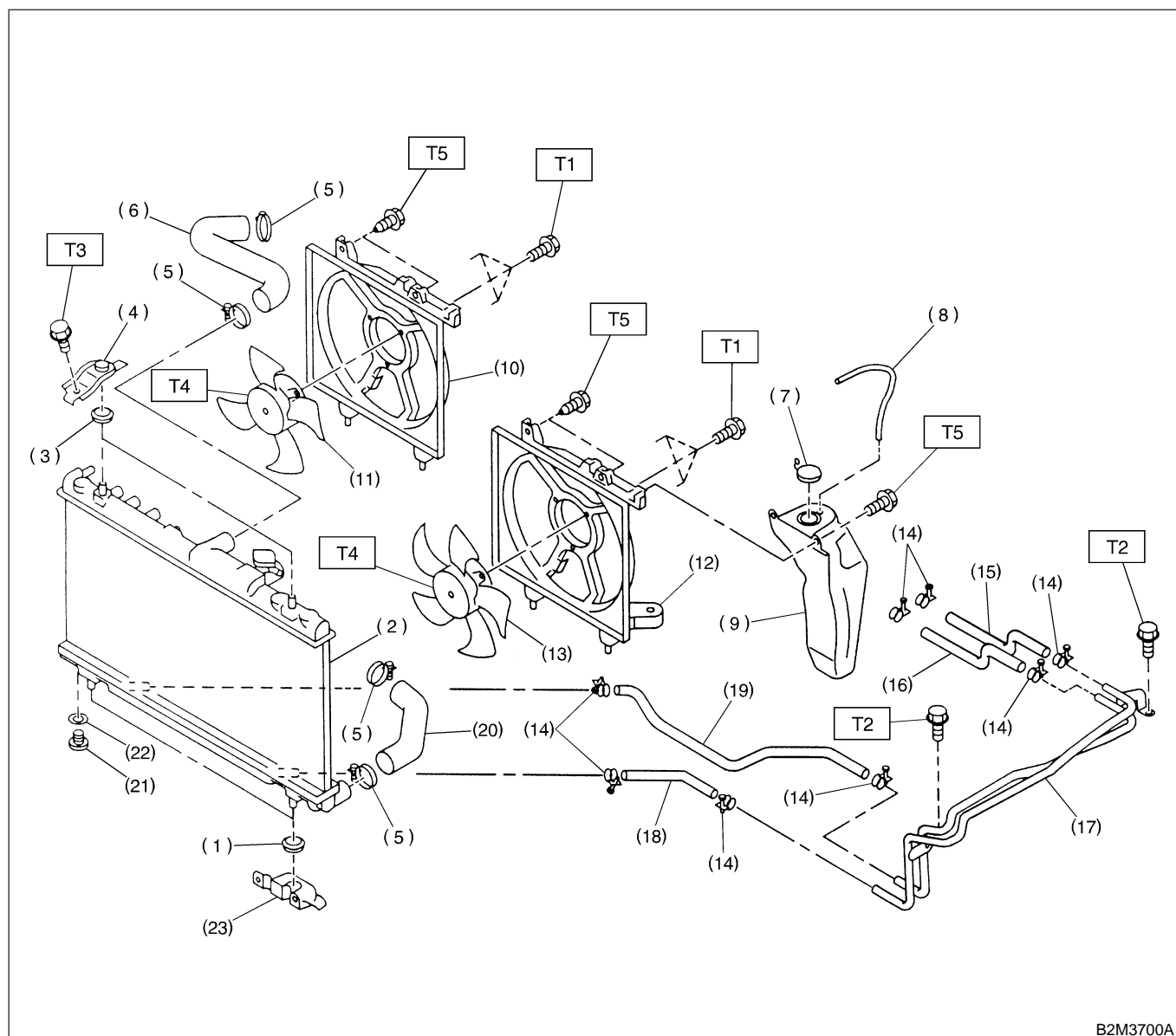


H2M2354A

- | | |
|-------------------------|----------------------|
| (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)**

2. RADIATOR AND RADIATOR FAN S106001A0502



- | | | |
|--|--|--|
| (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) Over flow 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)

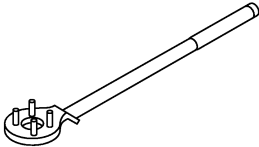
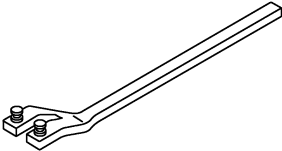
T5: 4.9 (0.50, 3.6)

C: CAUTION S106001A03

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

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

D: PREPARATION TOOL S106001A17

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.

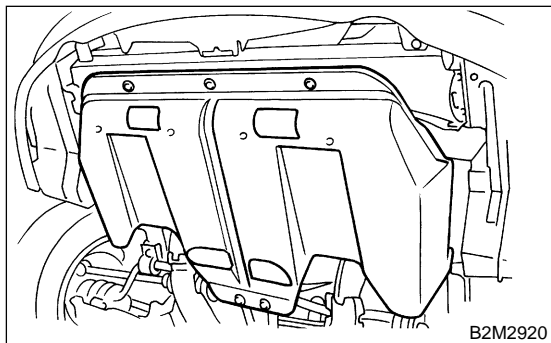
2. Engine Coolant S106060

A: REPLACEMENT S106060A20

1. DRAINING OF ENGINE COOLANT

S106060A2001

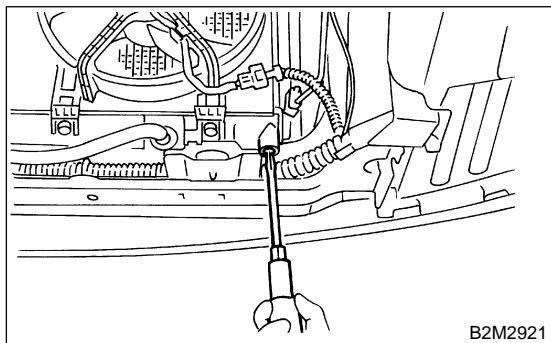
- 1) Lift-up the vehicle.
- 2) Remove under cover.



- 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 S106060A2002

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

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

MT model;

Approx. 6.4 ℓ (6.8 US qt, 5.6 Imp qt)

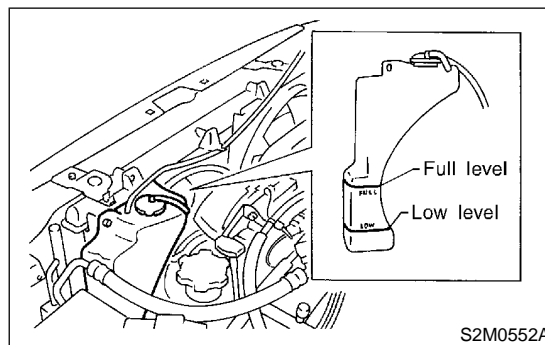
AT model;

Approx. 6.3 ℓ (6.7 US qt, 5.5 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.

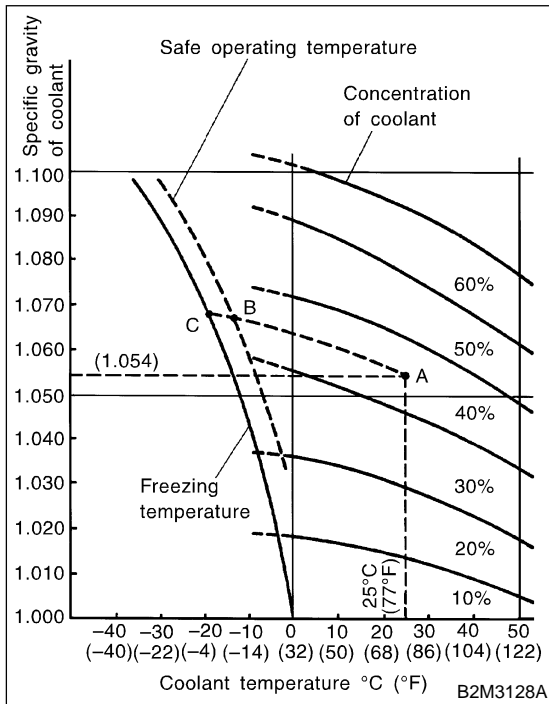
B: INSPECTION S106060A10

1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE S106060A1001

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

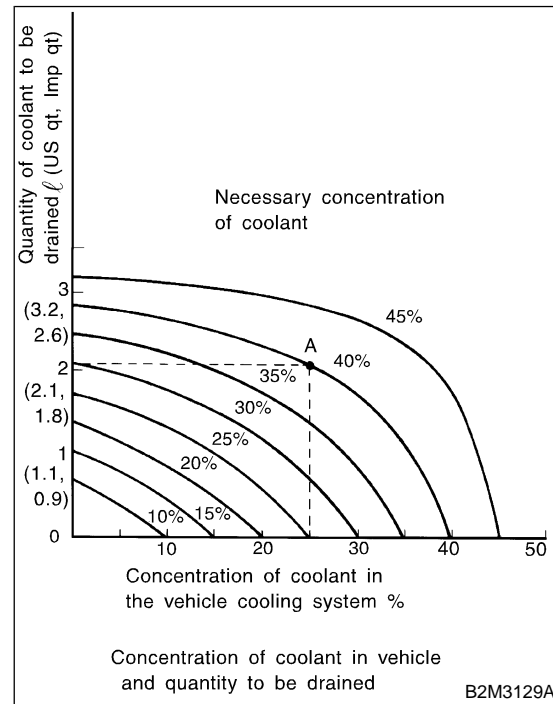
S106060A1002

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.

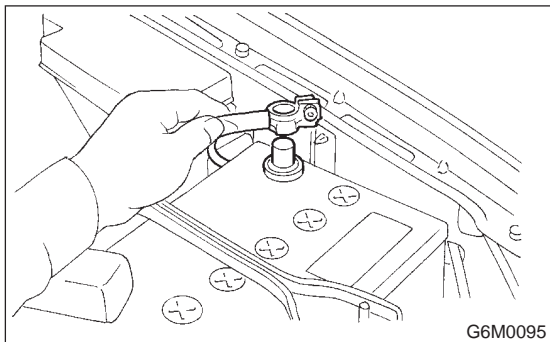
If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.



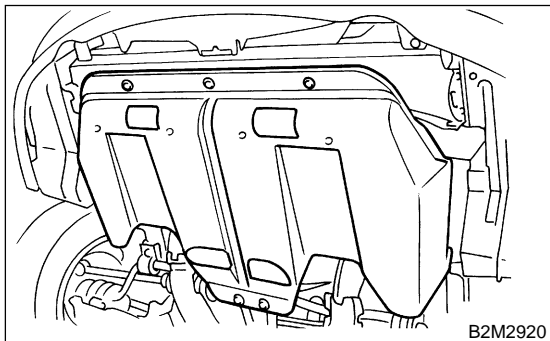
3. Water Pump S106061

A: REMOVAL S106061A18

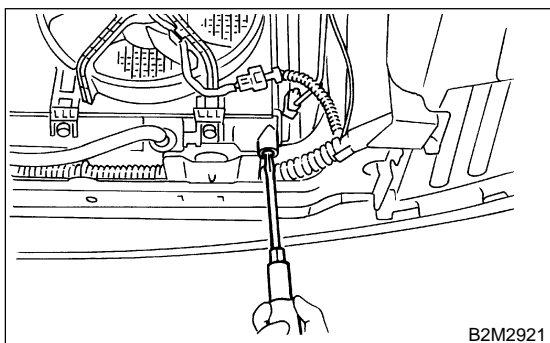
- 1) Disconnect ground cable from the battery.



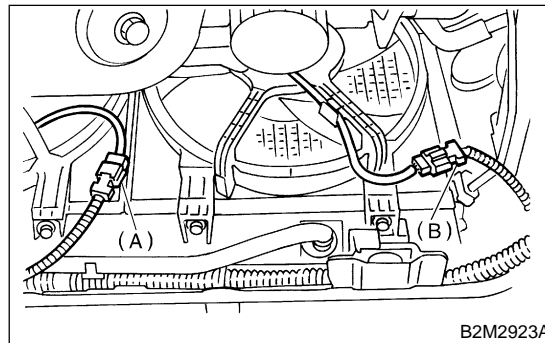
- 2) Lift-up the vehicle.
- 3) Remove under cover.



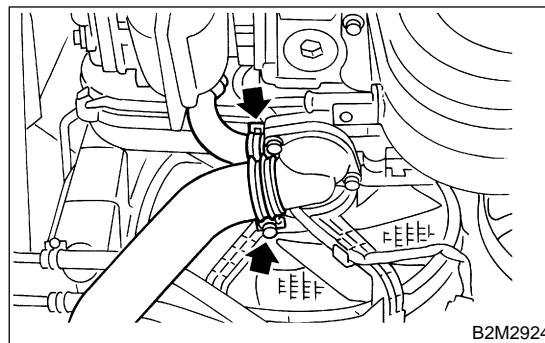
- 4) Drain engine coolant completely.
<Ref. to CO(H4)-6 DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



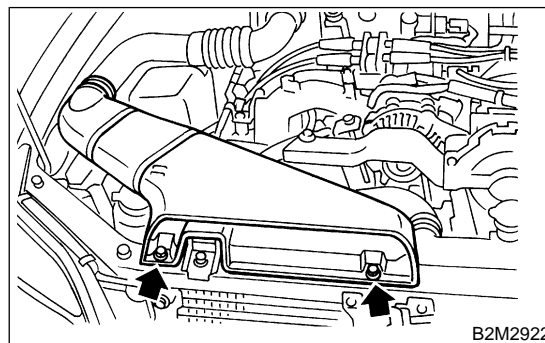
- 5) Disconnect connectors from radiator main fan (A) and sub fan (B) motors.



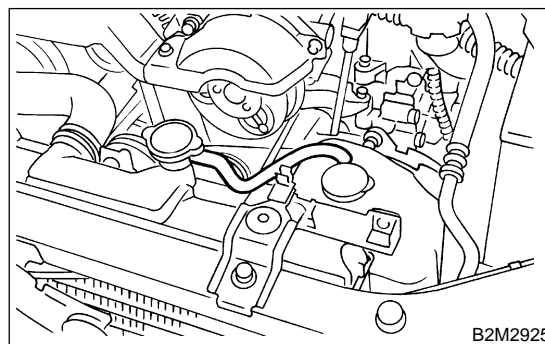
- 6) Disconnect radiator outlet hose and heater hose from water pump.



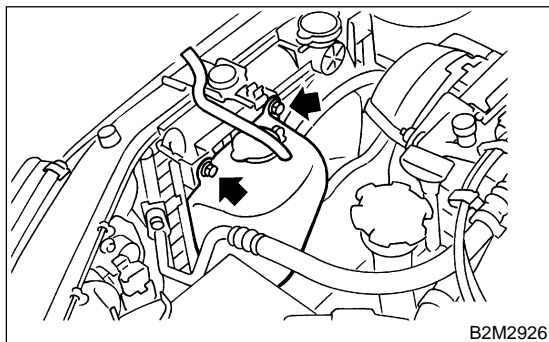
- 7) Lower the vehicle.
- 8) Remove air intake duct.



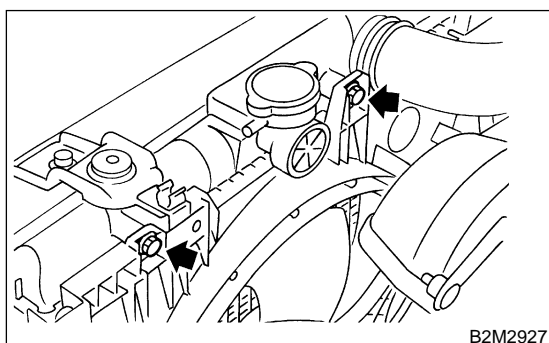
- 9) Disconnect over flow hose.



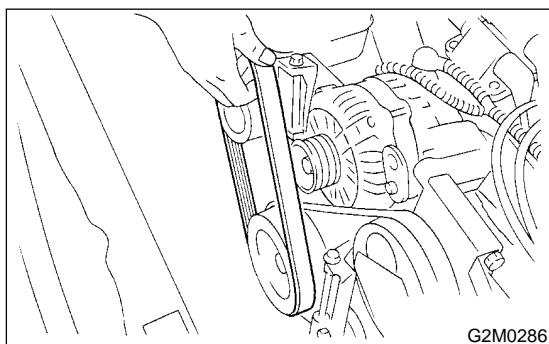
10) Remove reservoir tank.



11) Remove radiator main fan and sub fan assemblies. <Ref. to CO(H4)-20 REMOVAL, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4)-23 REMOVAL, Radiator Sub Fan and Fan Motor.>

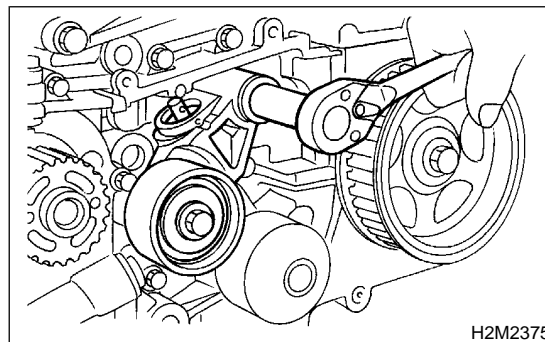


12) Remove V-belts.
<Ref. to ME(H4)-43 REMOVAL, V-belt.>

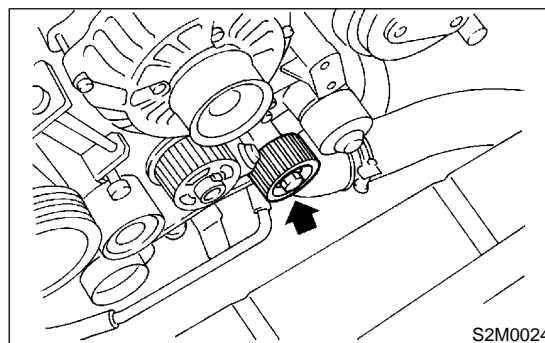


13) Remove timing belt.
<Ref. to ME(H4)-46 TIMING BELT, REMOVAL, Timing Belt Assembly.>

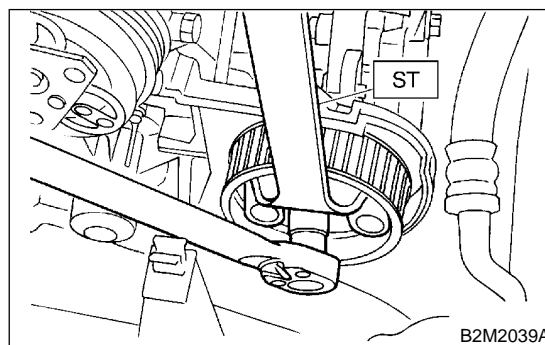
14) Remove automatic belt tension adjuster.



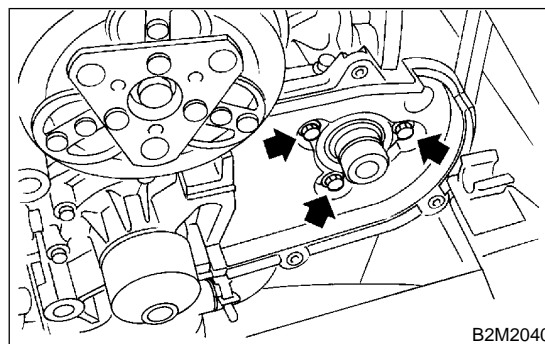
15) Remove belt idler No. 2.



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



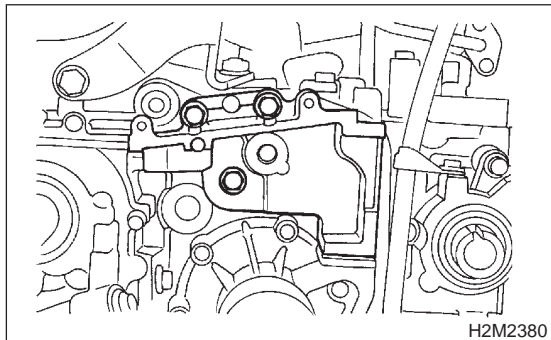
17) Remove left-hand belt cover No. 2.



WATER PUMP

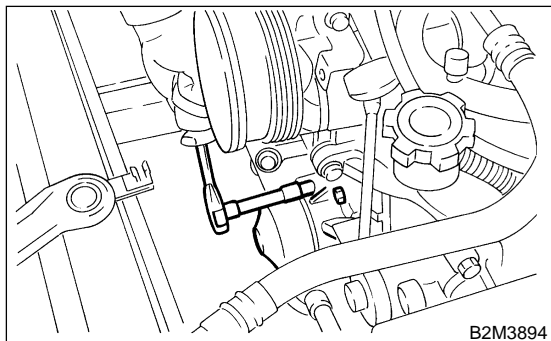
Cooling

18) Remove tensioner bracket.



19) Disconnect heater hose from water pump.

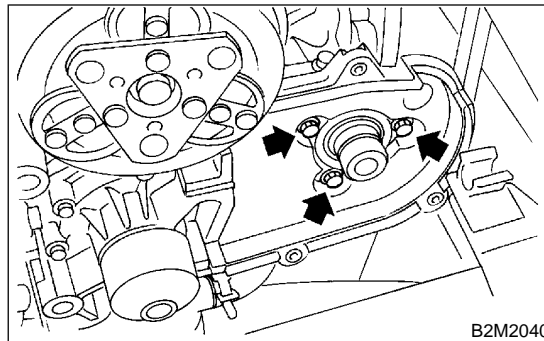
20) Remove water pump.



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

Tightening torque:

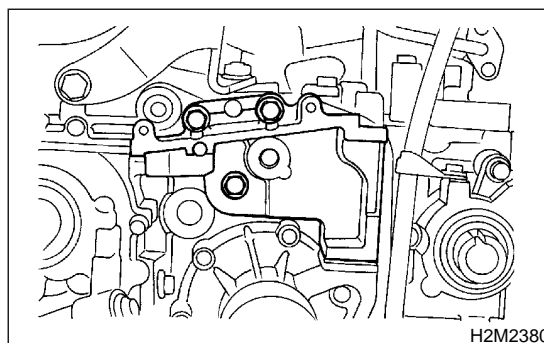
5 N·m (0.5 kgf-m, 3.6 ft-lb)



3) Install tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



B: INSTALLATION

S106061A11

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.

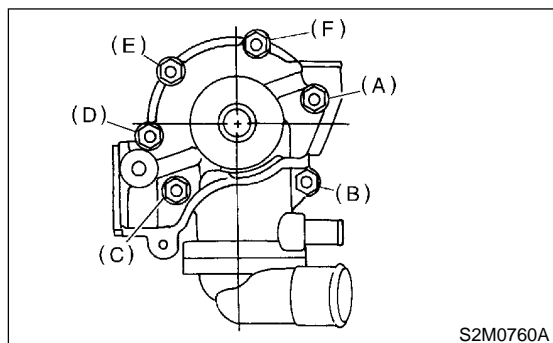
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

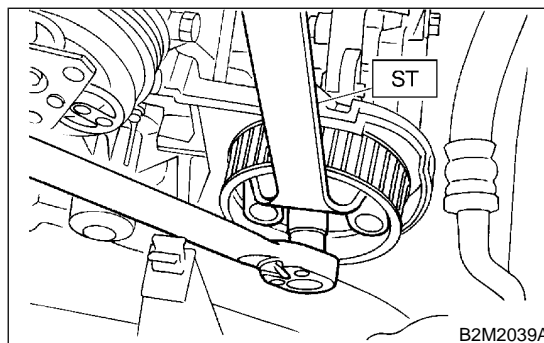


4) Install left-hand camshaft sprockets by using ST.

ST 4992707100 CAMSHAFT SPROCKET WRENCH

Tightening torque:

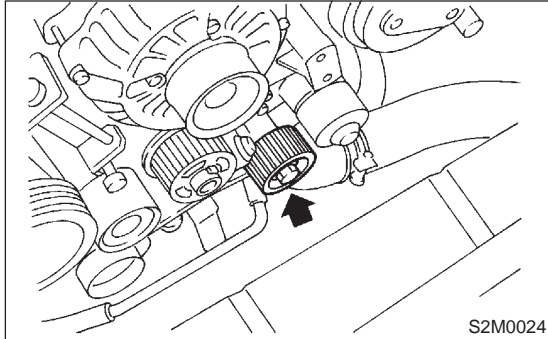
78 N·m (8.0 kgf-m, 57.9 ft-lb)



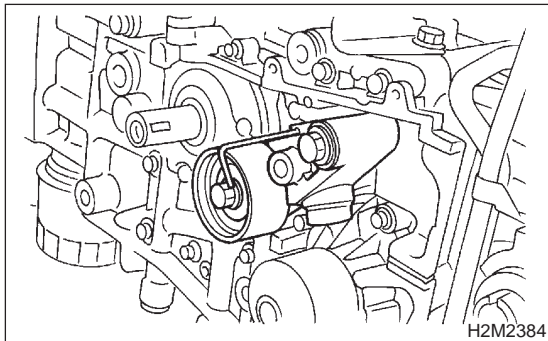
5) Install belt idler No. 2.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

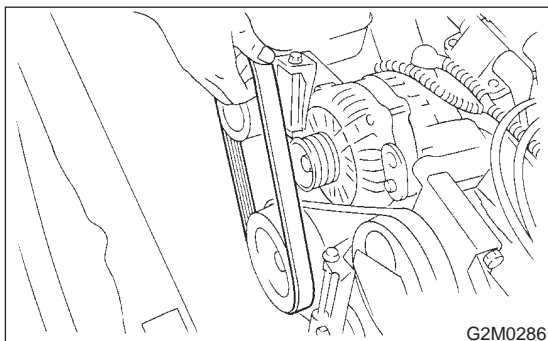


6) Install automatic belt tension adjuster which tension rod is held with pin. <Ref. to ME(H4)-47 AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

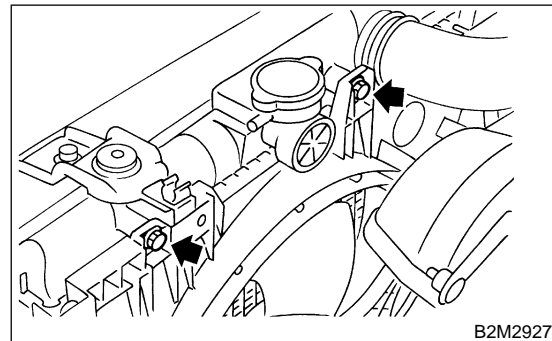


7) Install timing belt. <Ref. to ME(H4)-48 TIMING BELT, INSTALLATION, Timing Belt Assembly.>

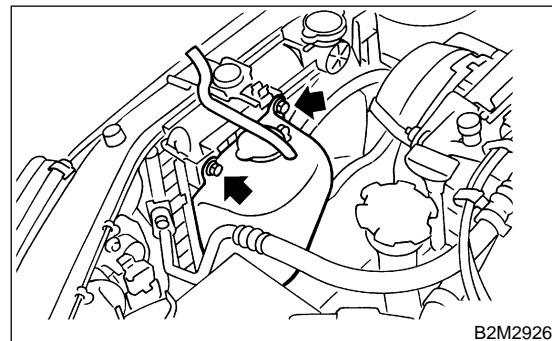
8) Install V-belts. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>



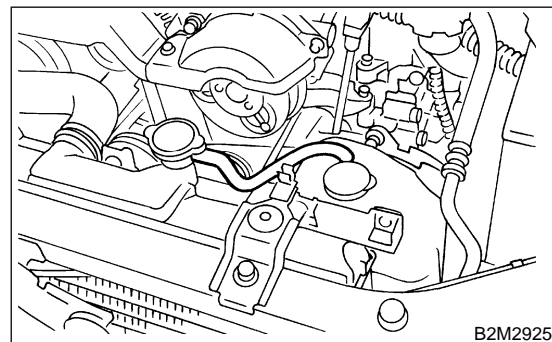
9) Install radiator main fan and sub fan motor assemblies. <Ref. to CO(H4)-21 INSTALLATION, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4)-23 INSTALLATION, Radiator Sub Fan and Fan Motor.>



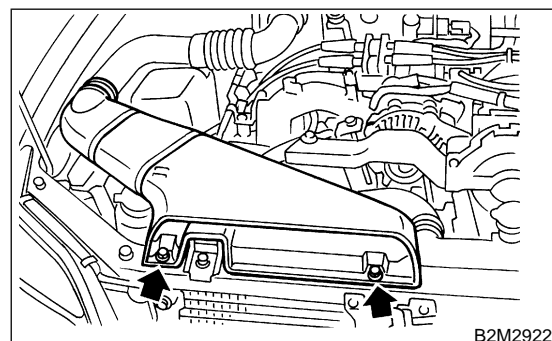
10) Install reservoir tank.



11) Connect over flow hose.

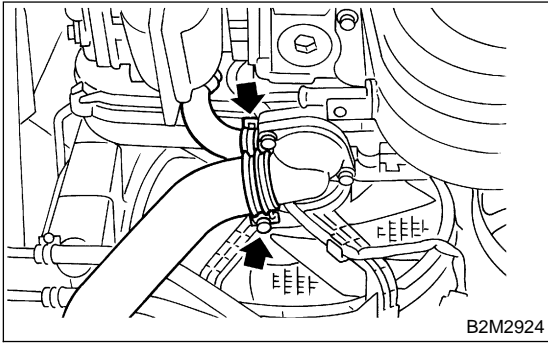


12) Install air intake duct.

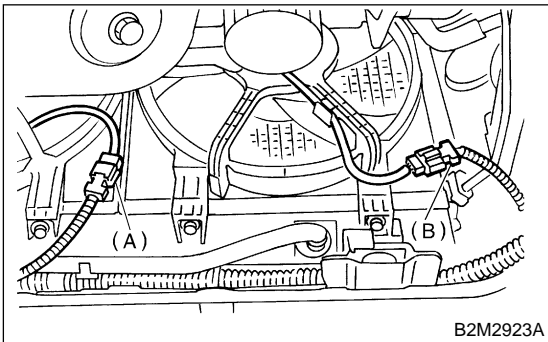


13) Lift-up the vehicle.

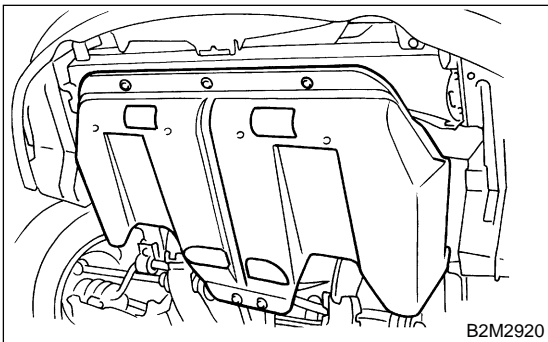
- 14) Connect radiator outlet hose and heater hose to water pump.



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

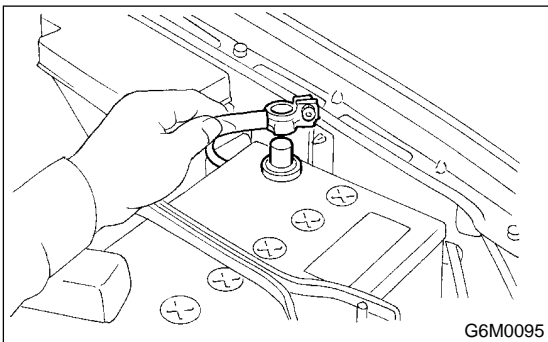


- 16) Install under cover.



- 17) Lower the vehicle.

- 18) Connect battery ground cable.

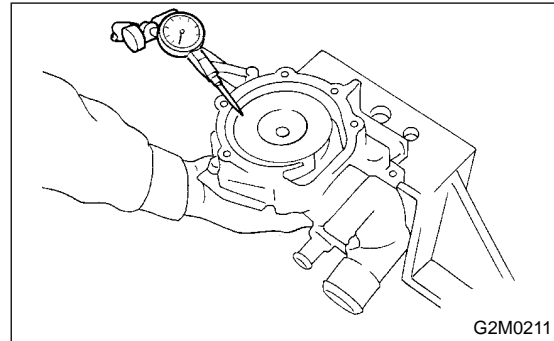


- 19) Fill coolant. <Ref. to CO(H4)-6 FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION S106061A10

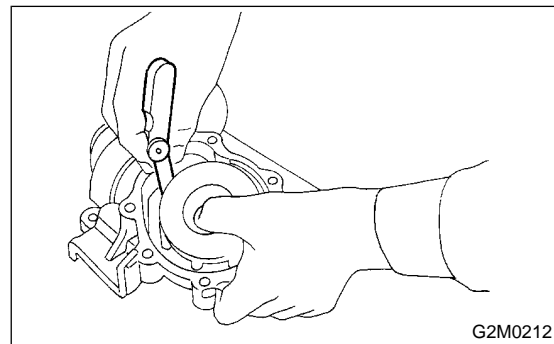
- 1) Check water pump bearing for smooth rotation.
- 2) Check water pump pulley for abnormalities.
- 3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

"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)

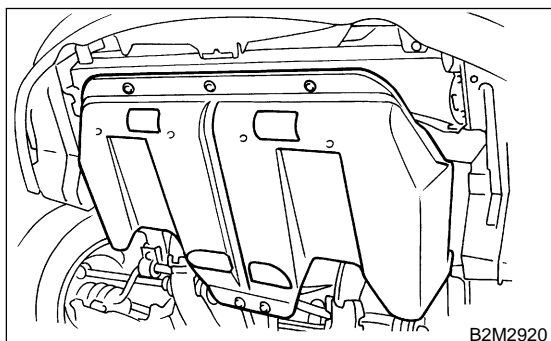


- 5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.

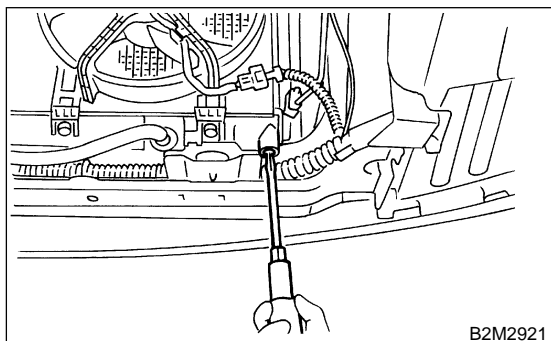
4. Thermostat S106062

A: REMOVAL S106062A18

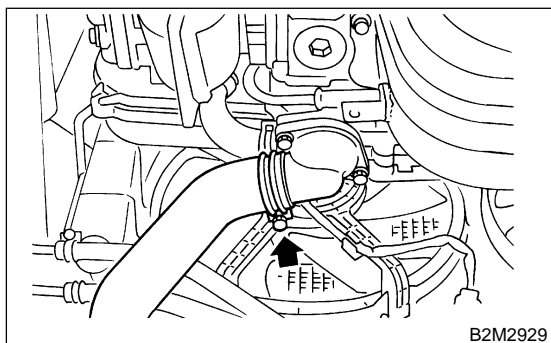
- 1) Lift-up the vehicle.
- 2) Remove under cover.



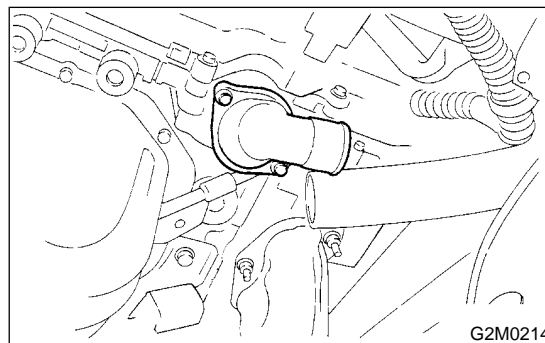
- 3) Drain engine coolant completely. <Ref. to CO(H4)-6 DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



- 4) Disconnect radiator outlet hose from thermostat cover.



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



B: INSTALLATION S106062A11

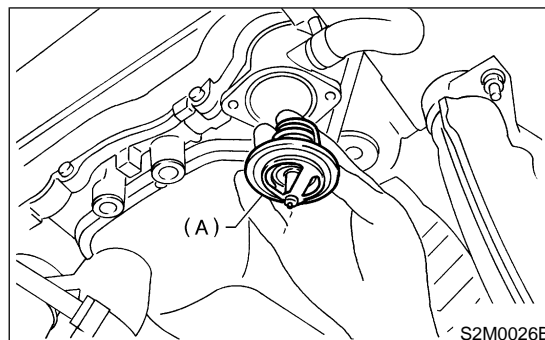
- 1) Install the thermostat in the water pump, and install the thermostat cover together with a gasket.

CAUTION:

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

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



- 2) Fill coolant. <Ref. to CO(H4)-6 FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION S106062A10

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

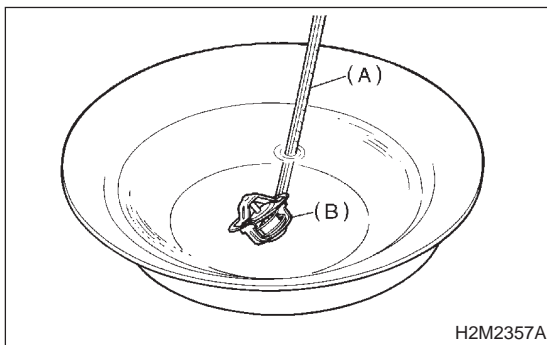
Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be to the specification.

Starts to open:

76.0 — 80.0°C (169 — 176°F)

Fully opens:

91°C (196°F)

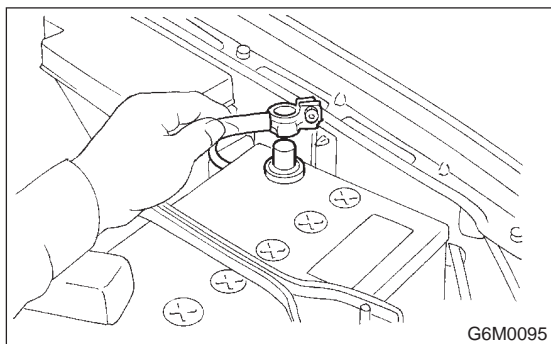


- (A) Thermometer
- (B) Thermostat

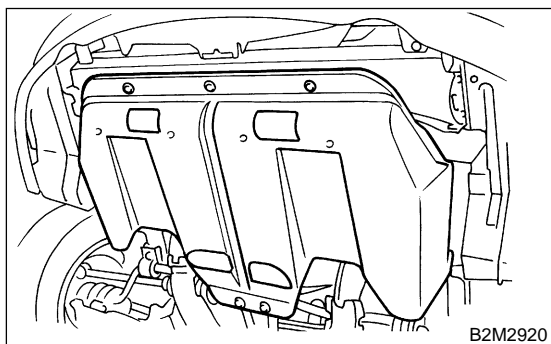
5. Radiator S106058

A: REMOVAL S106058A18

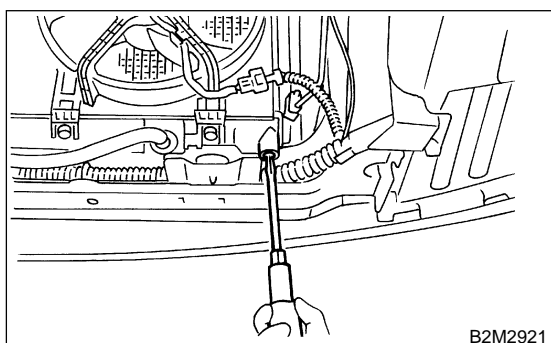
- 1) Disconnect battery ground cable.



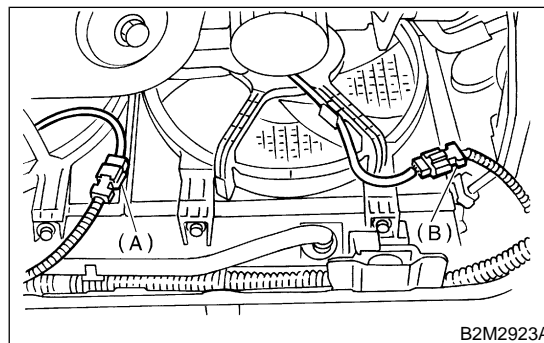
- 2) Lift-up the vehicle.
- 3) Remove under cover.



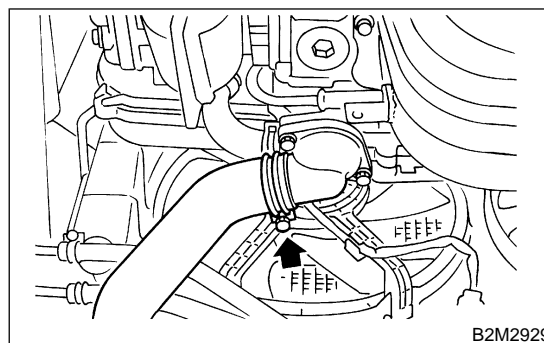
- 4) Drain engine coolant completely. <Ref. to CO(H4)-6 DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



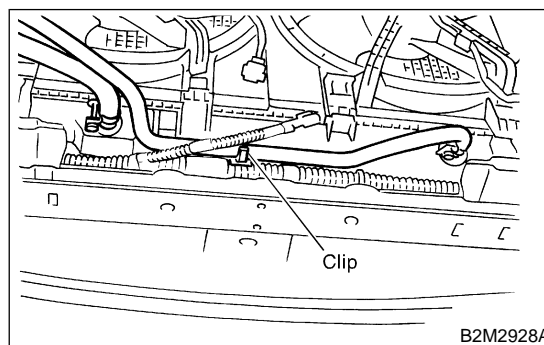
- 5) Disconnect connectors of radiator main fan (A) and sub fan (B) motor.



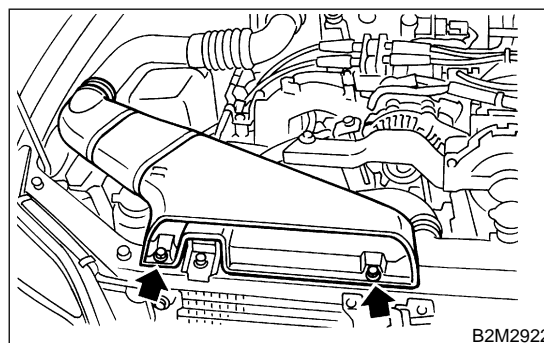
- 6) Disconnect radiator outlet hose from thermostat cover.



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



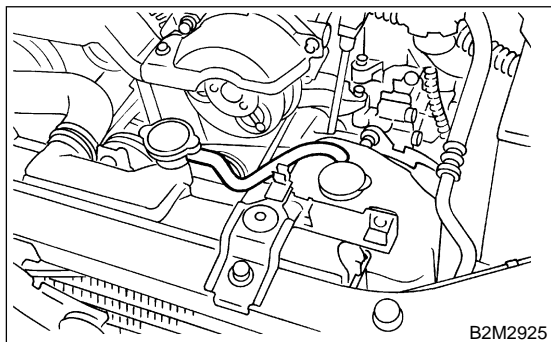
- 8) Lower the vehicle.
- 9) Remove air intake duct.



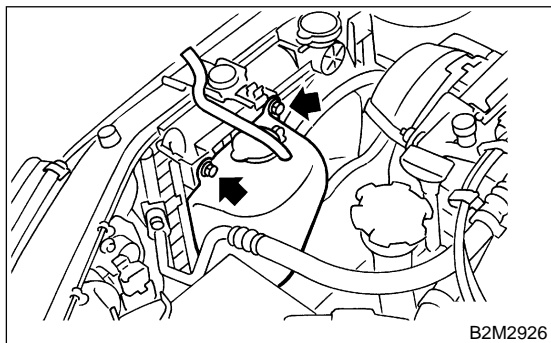
RADIATOR

Cooling

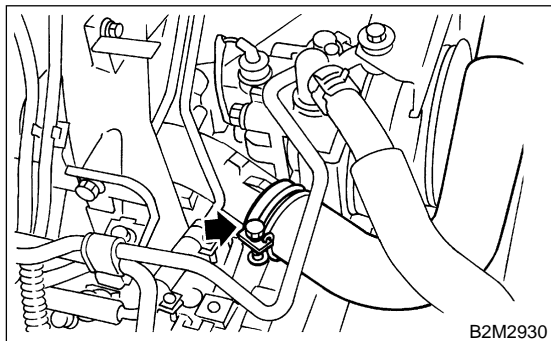
10) Disconnect over flow hose.



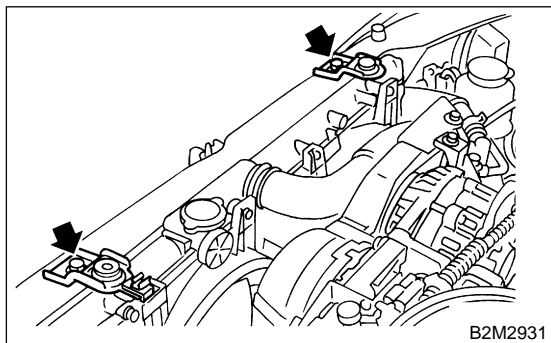
11) Remove reservoir tank.



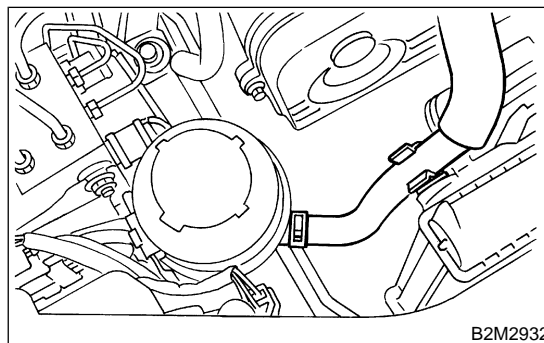
12) Disconnect radiator inlet hose from engine.



13) Remove radiator upper brackets.

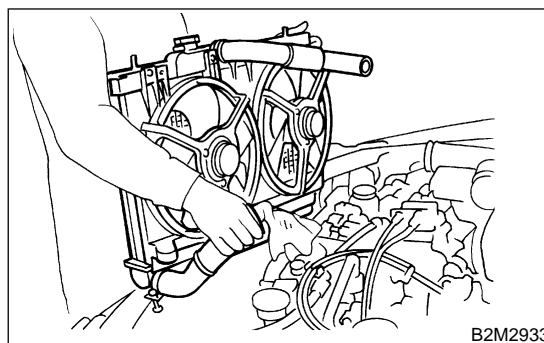


14) Detach power steering hose from the clip on the radiator.



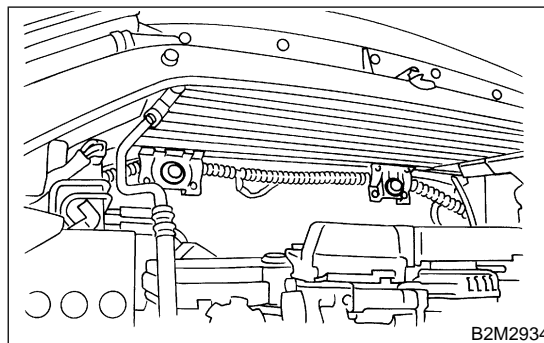
15) While slightly lifting radiator, slide it to left.

16) Lift radiator up and away from vehicle.



B: INSTALLATION S106058A11

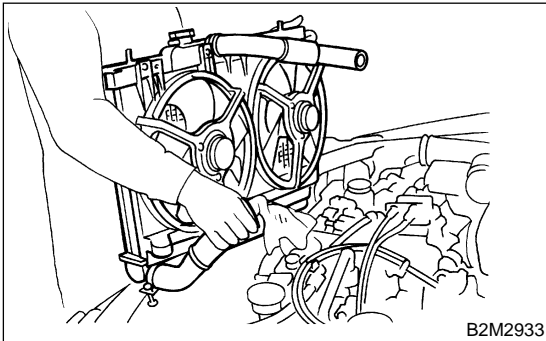
1) Attach radiator mounting cushions to holes on the vehicle.



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

NOTE:

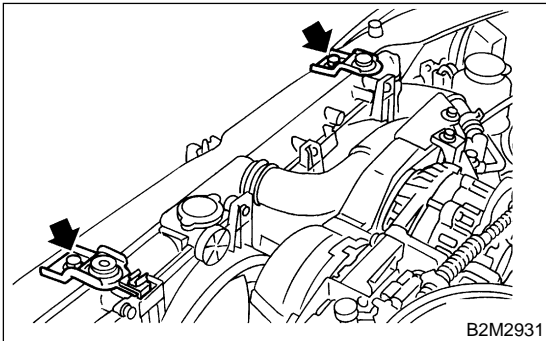
Fit pins on lower side of radiator into cushions on body side.



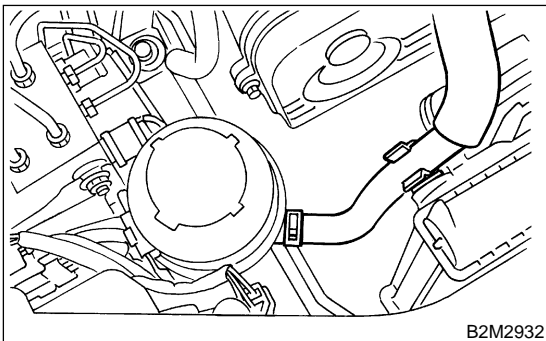
- 3) Install radiator brackets and tighten bolts.

Tightening torque:

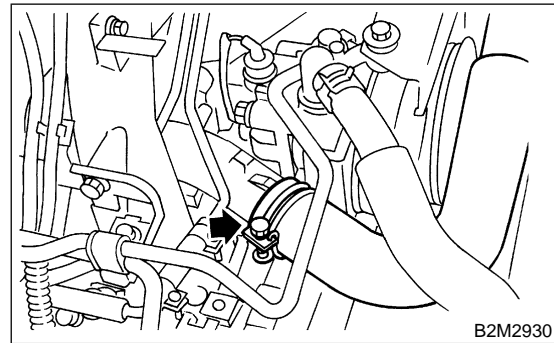
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 4) Attach power steering hose to the radiator.



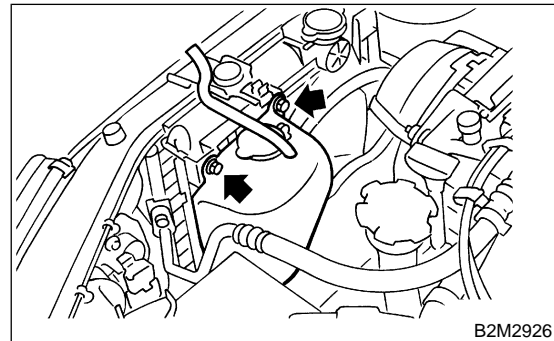
- 5) Connect radiator inlet hose.



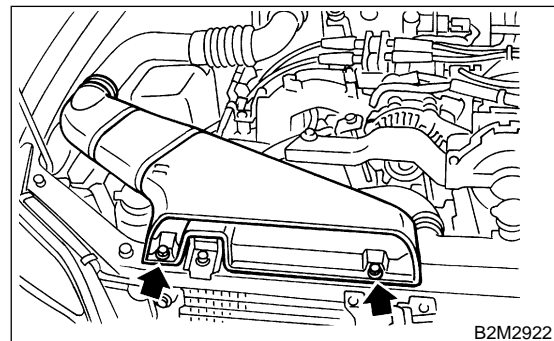
- 6) Install reservoir tank.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

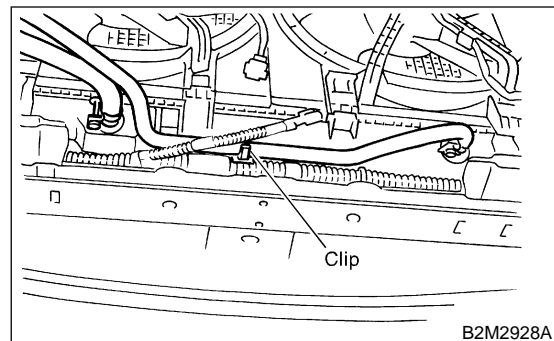


- 7) Install air intake duct.

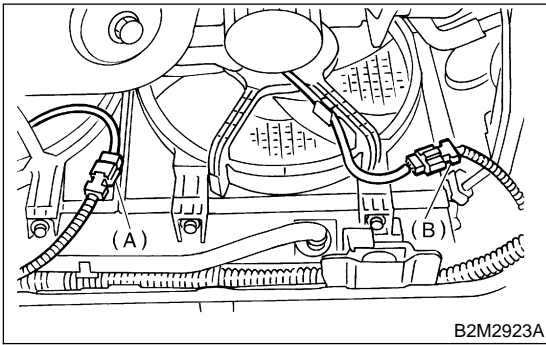


- 8) Lift-up the vehicle.

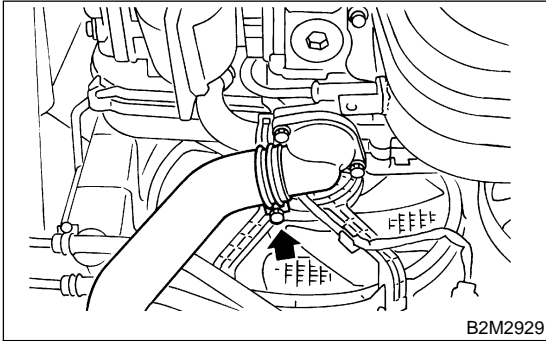
- 9) Connect ATF cooler hoses. (AT vehicles only)



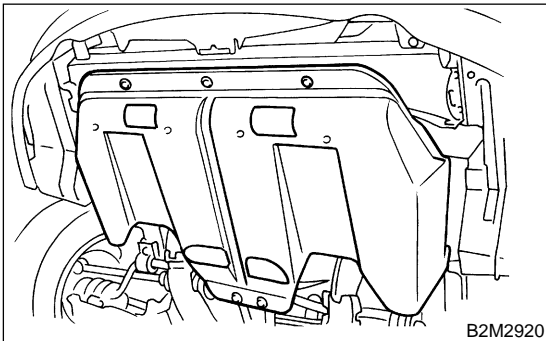
- 10) Connect connectors to radiator main fan motor and sub fan motor.



11) Connect radiator outlet hose.

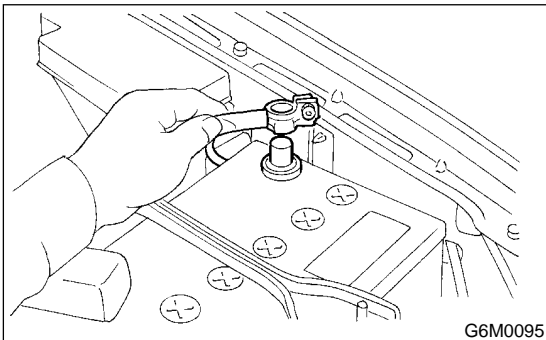


12) Install under cover.



13) Lower the vehicle.

14) Connect battery ground cable.

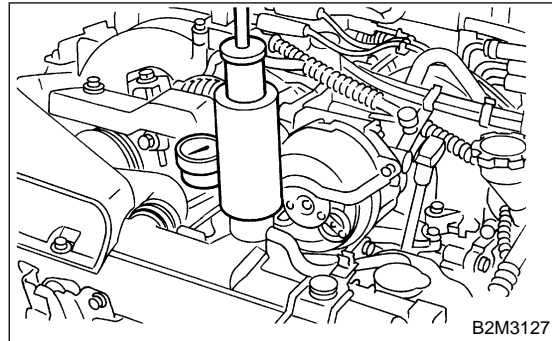


15) Fill coolant. <Ref. to CO(H4)-6 FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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

C: INSPECTION S106058A10

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.

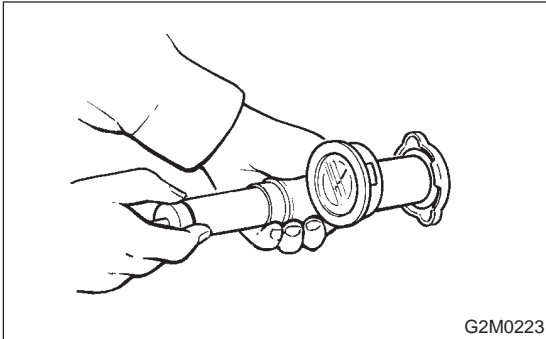
CAUTION:

- 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.

6. Radiator Cap S106064

A: INSPECTION S106064A10

- 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.

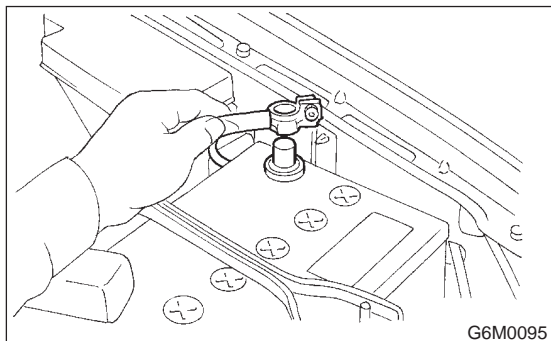
7. Radiator Main Fan and Fan Motor

S106059

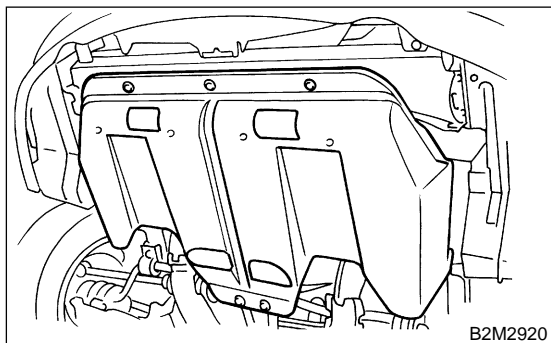
A: REMOVAL

S106059A18

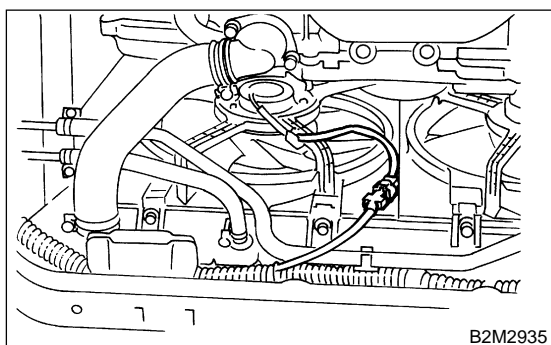
- 1) Disconnect battery ground cable.



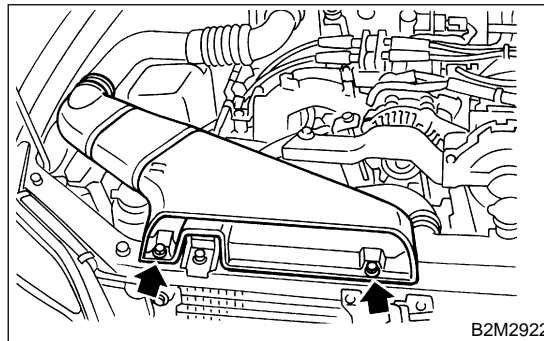
- 2) Lift-up the vehicle.
- 3) Remove under cover.



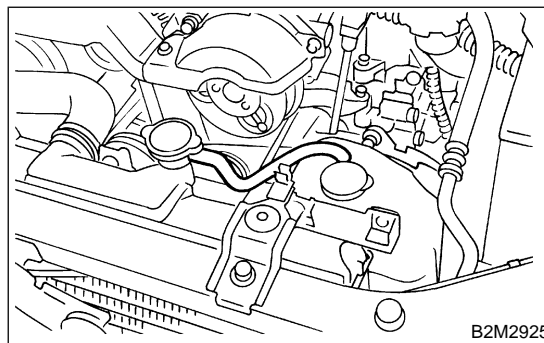
- 4) Disconnect connector of main fan motor.



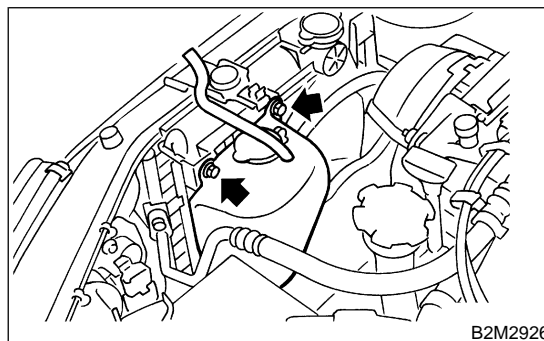
- 5) Lower the vehicle.
- 6) Remove air intake duct.



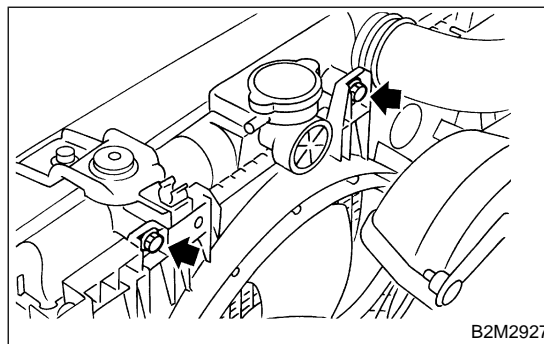
- 7) Disconnect over flow hose.



- 8) Remove reservoir tank.



- 9) Remove radiator main fan motor assembly.

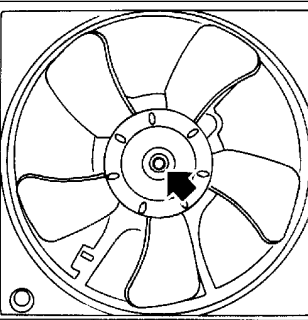
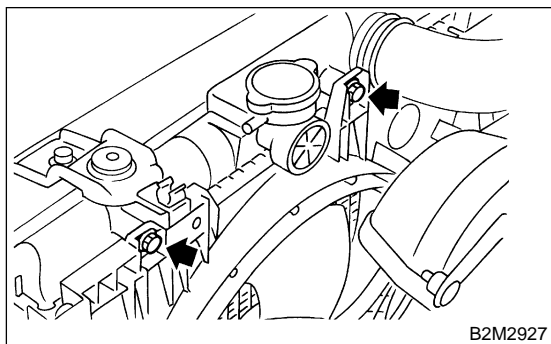


B: INSTALLATION S106059A11

Install in the reverse order of removal.

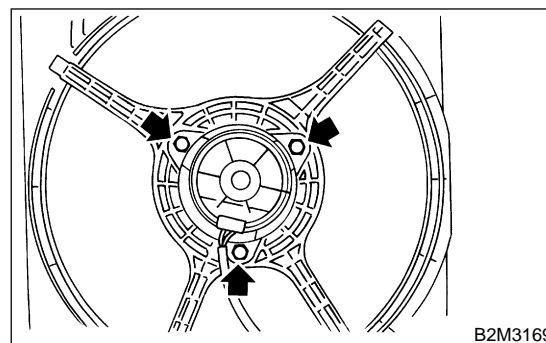
NOTE:

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



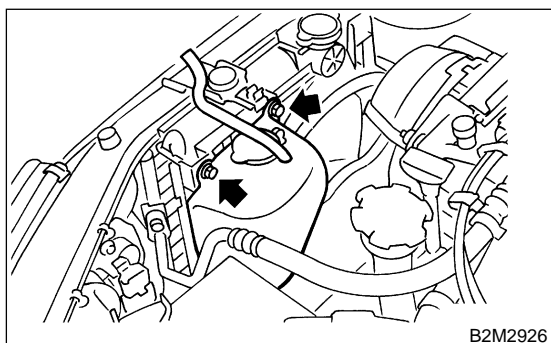
2) Remove nut which holds fan itself onto fan motor and shroud assembly.

3) Remove bolts which install fan motor onto shroud.



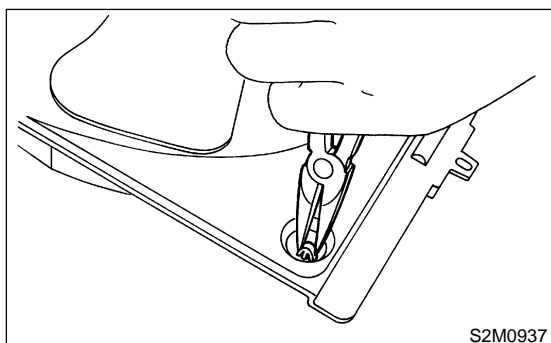
Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



C: DISASSEMBLY S106059A06

1) Remove clip which holds motor connector onto shroud.

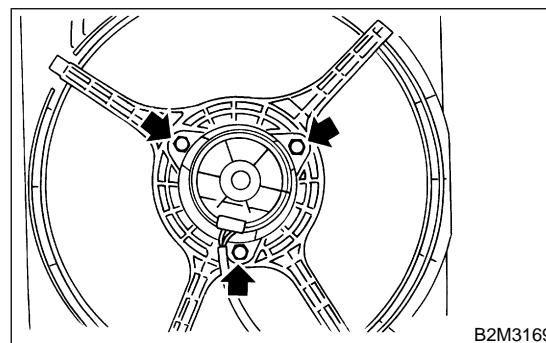


D: ASSEMBLY S106059A02

Assemble in the reverse order of disassembly.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

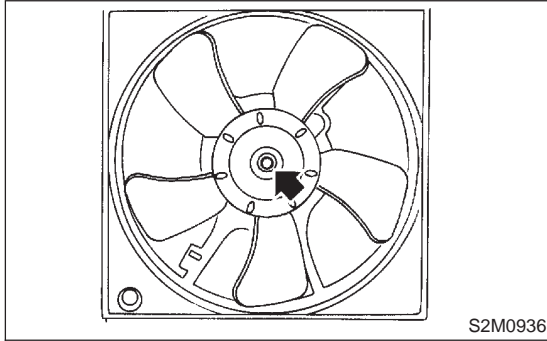


RADIATOR MAIN FAN AND FAN MOTOR

Cooling

Tightening torque:

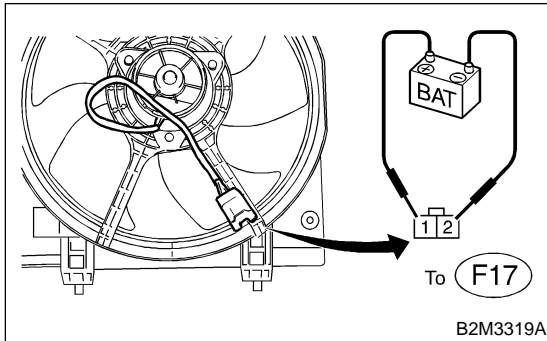
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



E: INSPECTION

S106059A10

- 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.



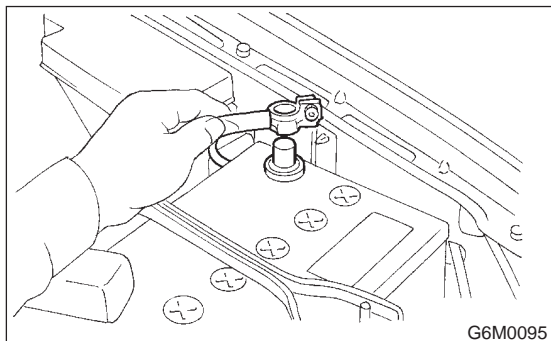
8. Radiator Sub Fan and Fan Motor

S106074

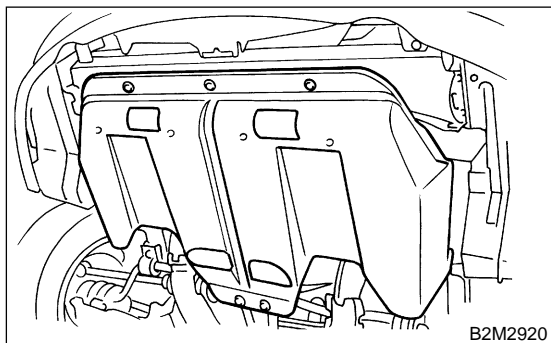
A: REMOVAL

S106074A18

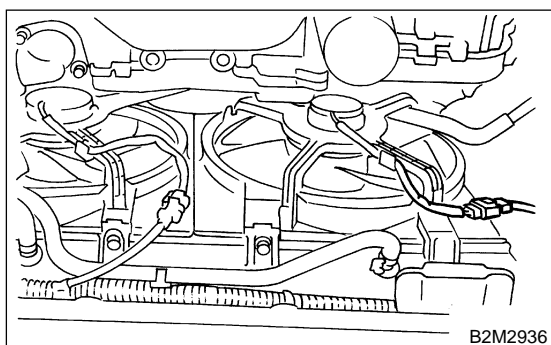
- 1) Disconnect battery ground cable.



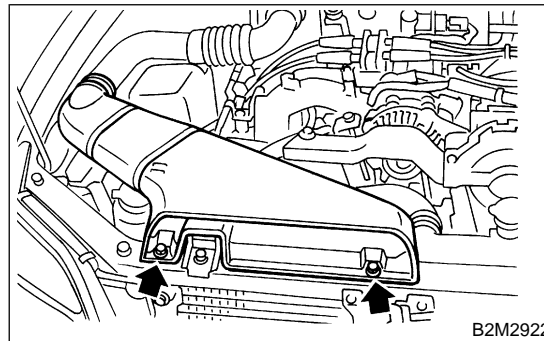
- 2) Lift-up the vehicle.
- 3) Remove under cover.



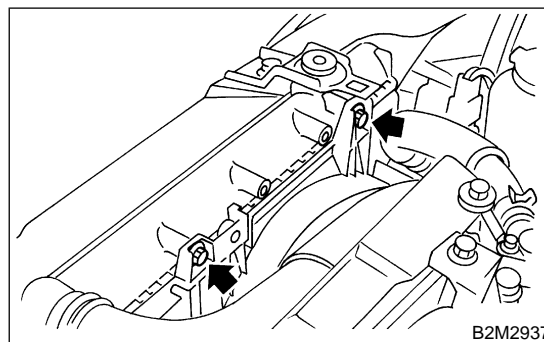
- 4) Disconnect connector of sub fan motor.



- 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.



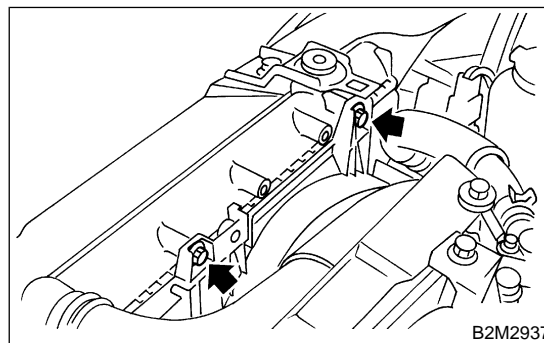
B: INSTALLATION

S106074A11

Install in the reverse order of removal.

Tightening torque:

4.9 N·m (0.50 kgf-m, 3.6 ft-lb)



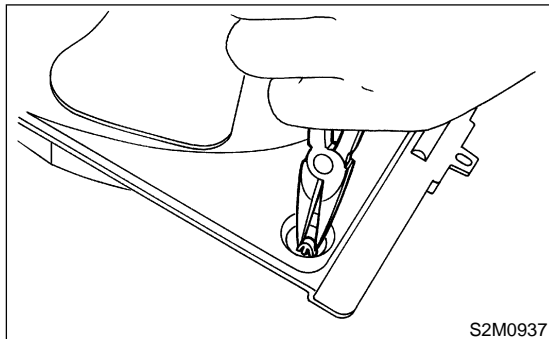
RADIATOR SUB FAN AND FAN MOTOR

Cooling

C: DISASSEMBLY

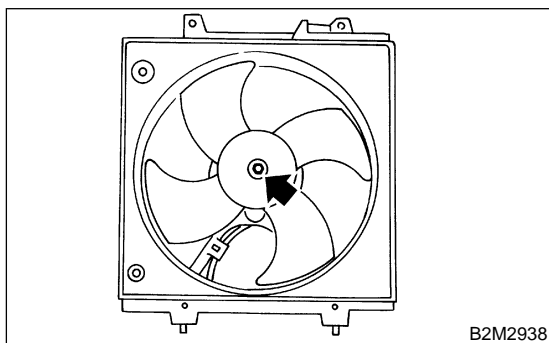
S106074A06

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



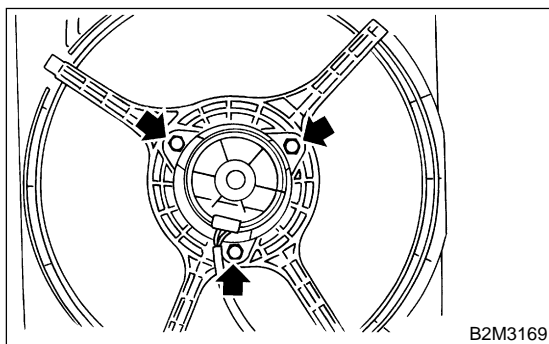
S2M0937

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



B2M2938

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



B2M3169

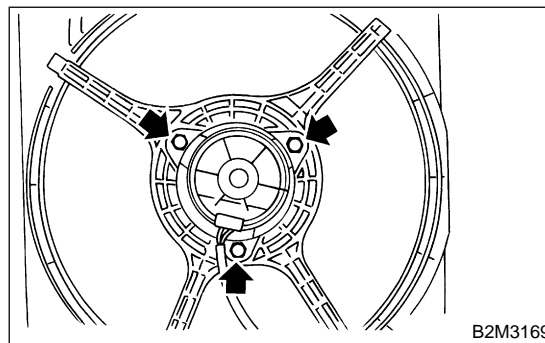
D: ASSEMBLY

S106074A02

Assemble in the reverse order of disassembly.

Tightening torque:

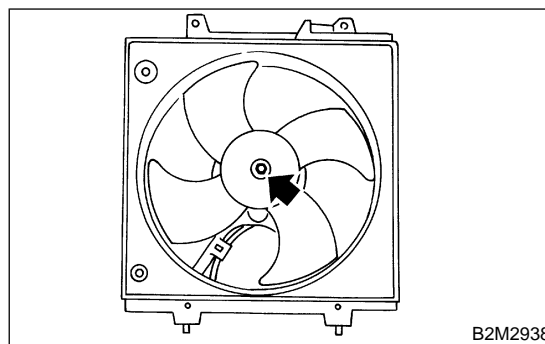
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



B2M3169

Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)

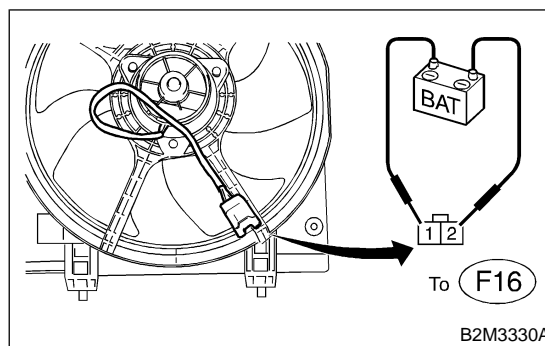


B2M2938

E: INSPECTION

S106074A10

- 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.

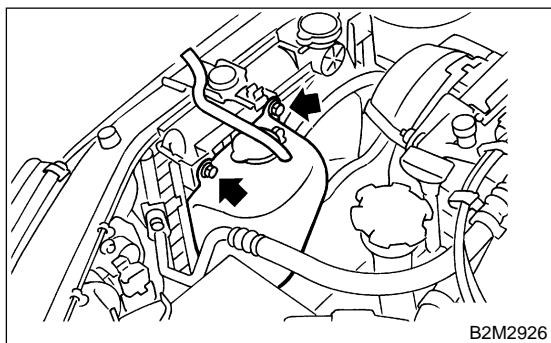


B2M3330A

9. Reservoir Tank S106075

A: REMOVAL S106075A18

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

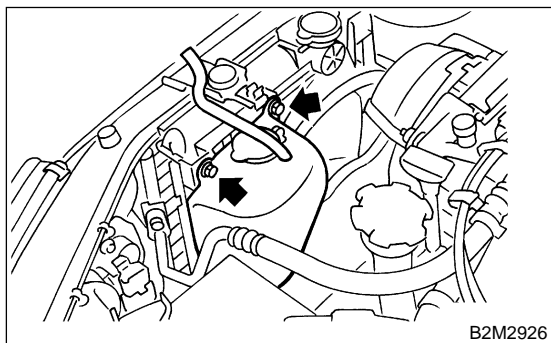


B: INSTALLATION S106075A11

Install in the reverse order of removal.

Tightening torque:

4.9N·m (0.50 kgf-m, 3.6 ft-lb)



C: INSPECTION S106075A10

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

ENGINE COOLING SYSTEM TROUBLE IN GENERAL

Cooling

10. Engine Cooling System Trouble in General

S106078

A: INSPECTION

S106078A10

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(H4)-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(H4)-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.
Over-cooling	p. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Engine coolant leaks.	a. Atmospheric temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
	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.
Noise	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

1. General Description S110001

A: CAUTION S110001A03

- 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 negative terminal from battery.

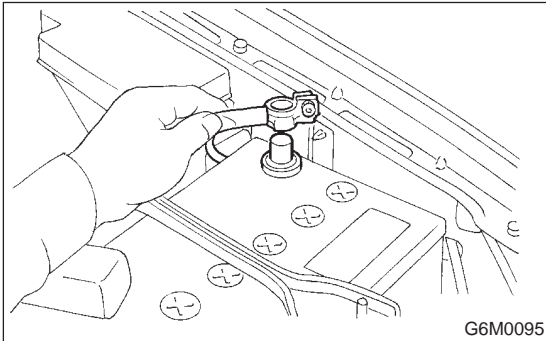
FRONT CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

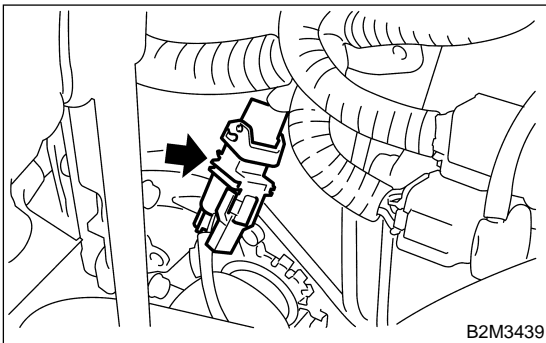
2. Front Catalytic Converter S110017

A: REMOVAL S110017A18

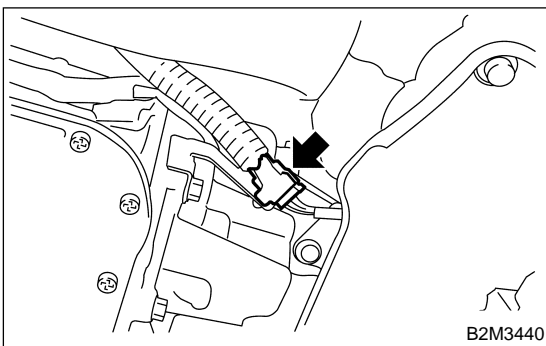
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



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



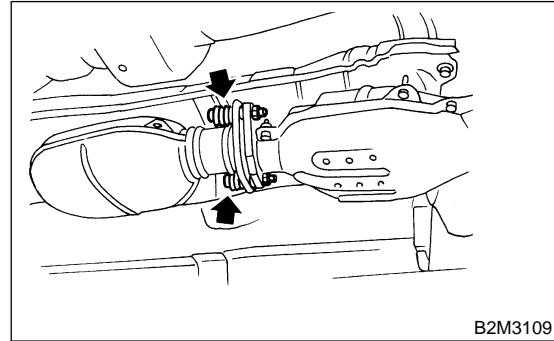
- 4) Lift-up the vehicle.
- 5) Remove under cover.
- 6) Disconnect connector from rear oxygen sensor connector.



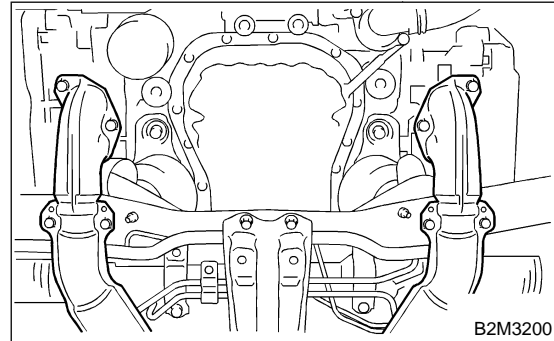
- 7) Separate center exhaust pipe from rear exhaust pipe.

CAUTION:

Be careful, exhaust pipe is hot.



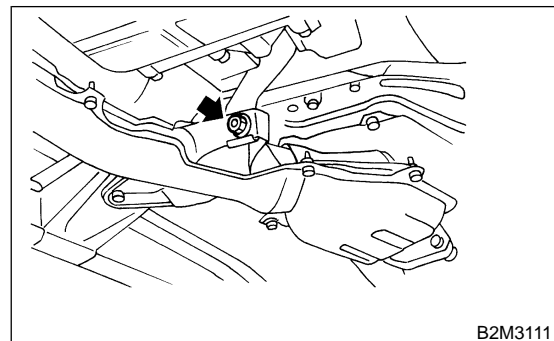
- 8) Remove bolts which hold front exhaust pipe onto cylinder heads.



- 9) Remove front exhaust pipe and center exhaust pipe from hanger bracket.

CAUTION:

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



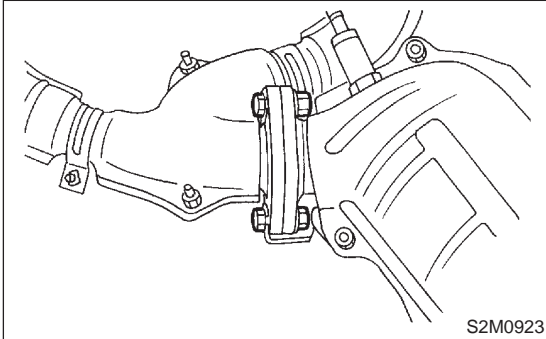
FRONT CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

10) Separate front catalytic converter from front exhaust pipe.

NOTE:

The rear catalytic converter is integrated with front catalytic converter. Therefore, the procedure for removing rear catalytic converter is the same as the description above.



B: INSTALLATION

S110017A11

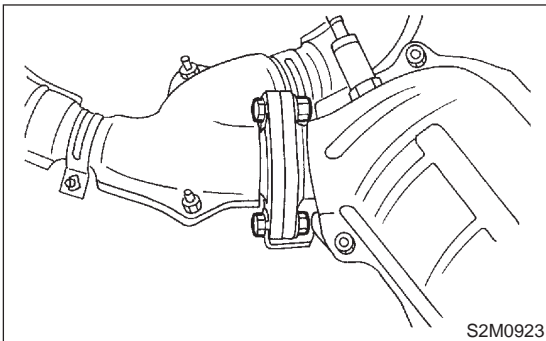
CAUTION:

Replace gaskets with new ones.

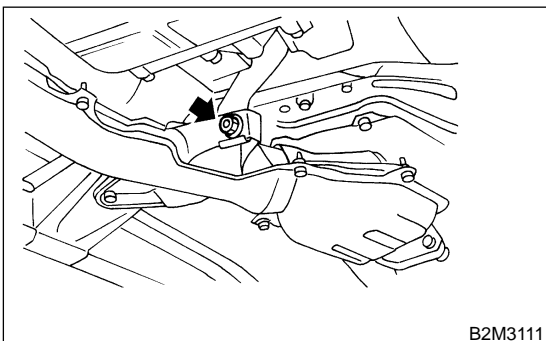
1) Install front catalytic converter to front exhaust pipe.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



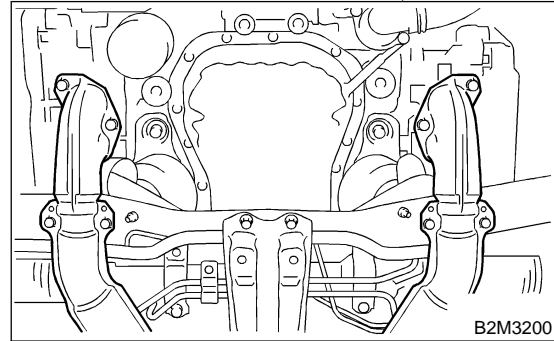
2) Install front exhaust pipe and center exhaust pipe. And temporarily tighten bolt which installs center exhaust pipe to hanger bracket.



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

Tightening torque:

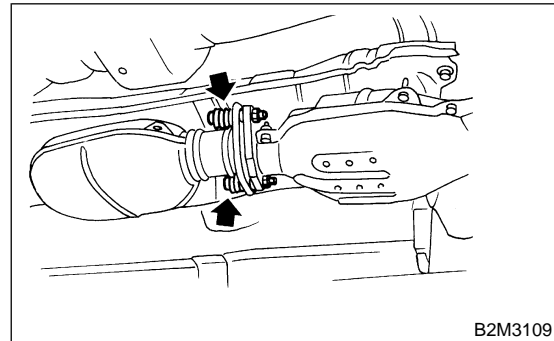
30 N·m (3.1 kgf-m, 22.4 ft-lb)



4) Install center exhaust pipe to rear exhaust pipe.

Tightening torque:

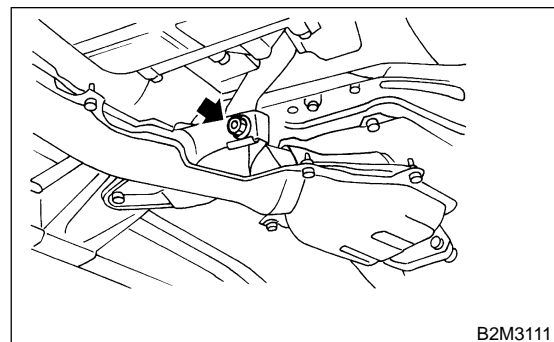
18 N·m (1.8 kgf-m, 13.0 ft-lb)



5) Tighten bolt which holds center exhaust pipe to hanger bracket.

Tightening torque:

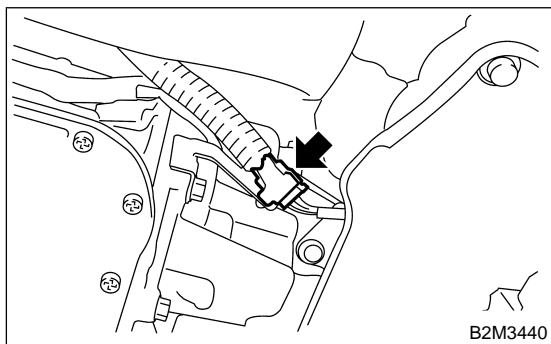
35 N·m (3.6 kgf-m, 26.0 ft-lb)



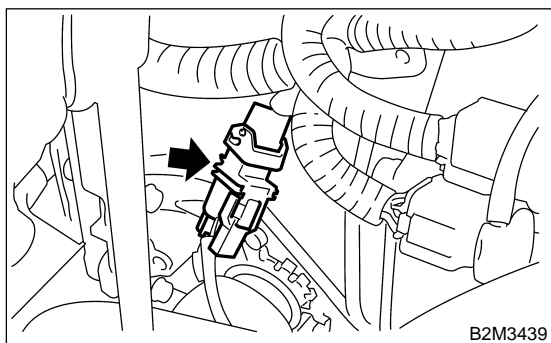
FRONT CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

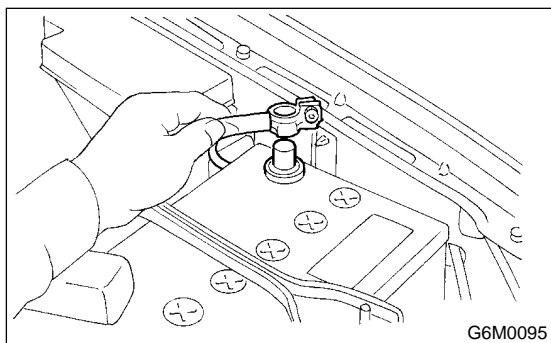
- 6) Connect connector to rear oxygen sensor connector.



- 7) Install under cover.
- 8) Lower the vehicle.
- 9) Connect front oxygen (A/F) sensor connector.



- 10) Connect battery ground cable.



NOTE:

The rear catalytic converter is integrated with front catalytic converter. Therefore, the procedure for installing rear catalytic converter is the same as the description above.

C: INSPECTION S110017A10

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

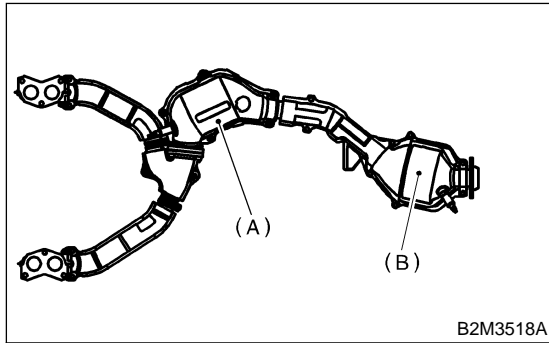
REAR CATALYTIC CONVERTER

Emission Control (Aux. Emission Control Devices)

3. Rear Catalytic Converter S110036

A: REMOVAL S110036A18

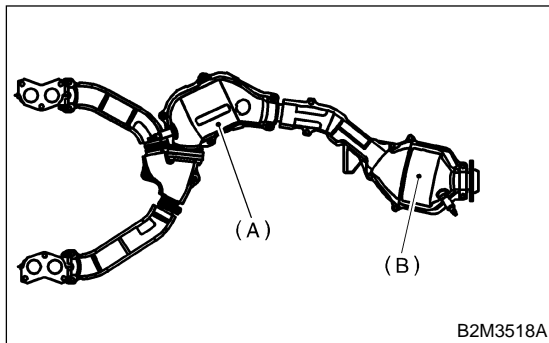
The front and rear catalytic converter and center exhaust pipe are integrated into one unit. Therefore, the removal and installation procedures are the same as the those for the front catalytic converter. <Ref. to EC(H4)-3 REMOVAL, Front Catalytic Converter.>



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

B: INSTALLATION S110036A11

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(H4)-4 INSTALLATION, Front Catalytic Converter.>



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

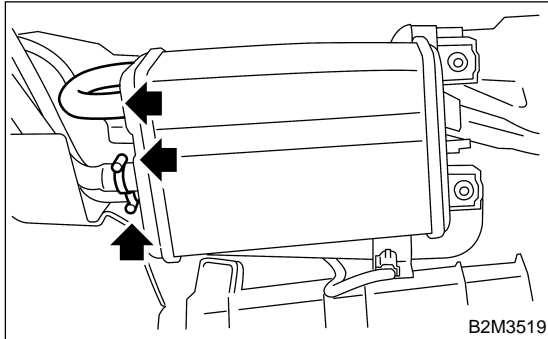
C: INSPECTION S110036A10

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

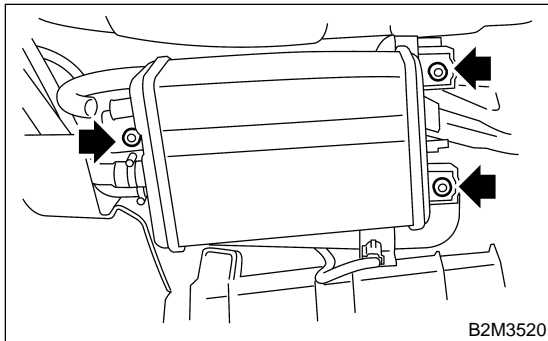
4. Canister S110037

A: REMOVAL S110037A18

- 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.

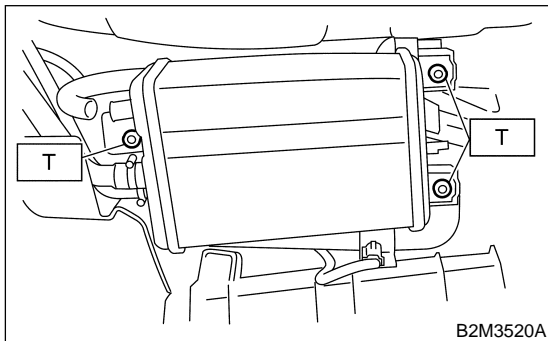


B: INSTALLATION S110037A11

- 1) Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 17 ft-lb)



C: INSPECTION S110037A10

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

PURGE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

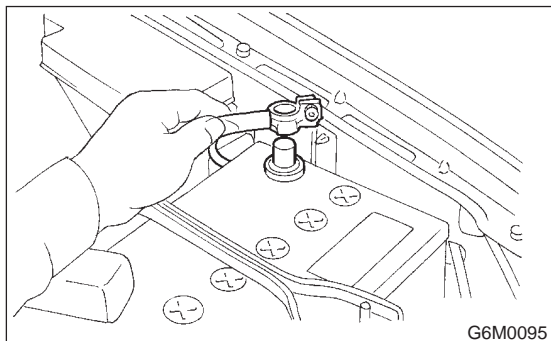
5. Purge Control Solenoid Valve

S110035

A: REMOVAL

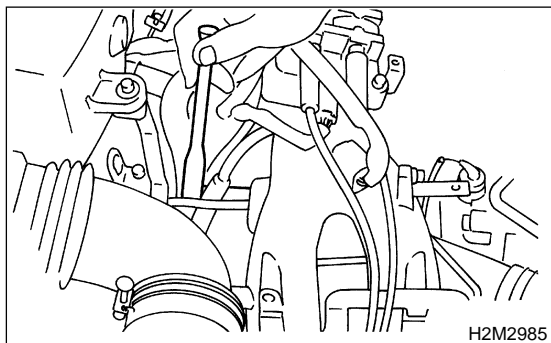
S110035A18

- 1) Disconnect battery ground cable.



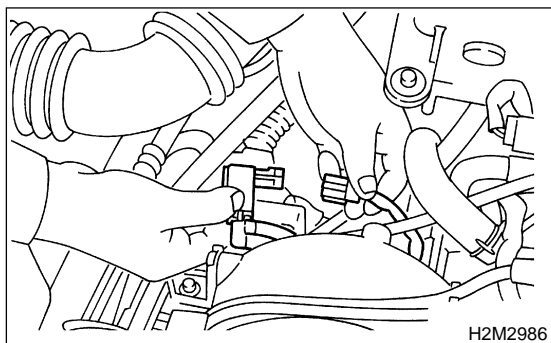
G6M0095

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

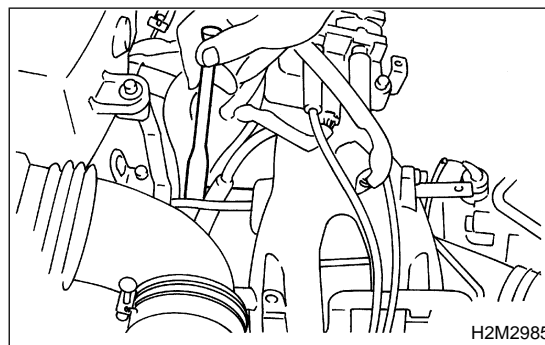


H2M2985

- 3) Take out purge control solenoid valve through the bottom of the intake manifold.
- 4) Disconnect connector and hoses from purge control solenoid valve.



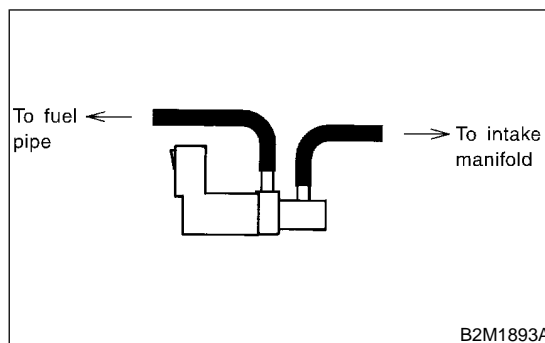
H2M2986



H2M2985

CAUTION:

Carefully connect the evaporation hoses.



B2M1893A

C: INSPECTION

S110035A10

Make sure hoses are not cracked or loose.

B: INSTALLATION

S110035A11

- 1) Install in the reverse order of removal.

Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)

MAIN FUEL LEVEL SENSOR

Emission Control (Aux. Emission Control Devices)

6. Main Fuel Level Sensor S110038

A: REMOVAL S110038A18

For work procedures, refer to “FU” section. <Ref. to FU(H4)-93 REMOVAL, Fuel Lever Sensor.>

B: INSTALLATION S110038A11

For work procedures, refer to “FU” section. <Ref. to FU(H4)-93 INSTALLATION, Fuel Lever Sensor.>

FUEL TEMPERATURE SENSOR

Emission Control (Aux. Emission Control Devices)

7. Fuel Temperature Sensor S110032

A: REMOVAL S110032A18

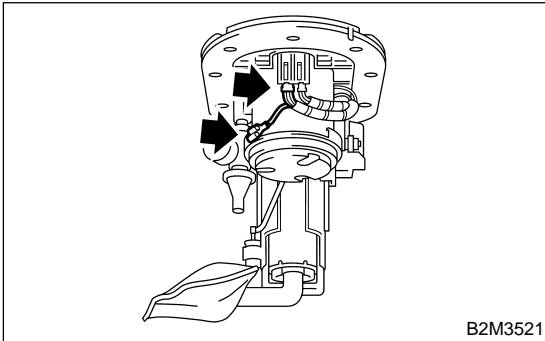
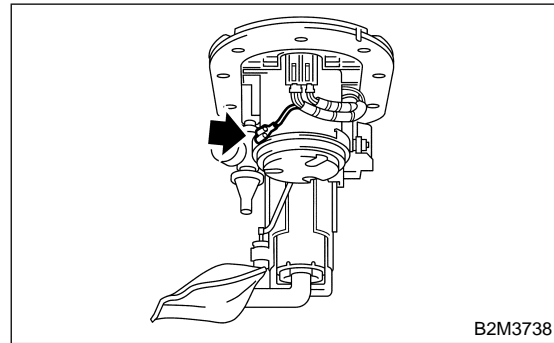
WARNING:

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.

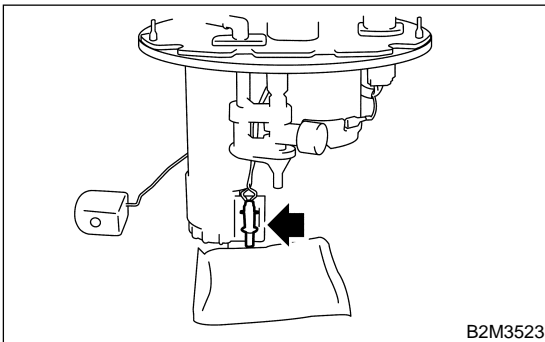
- 1) Remove fuel pump assembly. <Ref. to FU(H4)-90 REMOVAL, Fuel Pump.>
- 2) Disconnect connector from fuel pump bracket.



- 3) Remove fuel temperature sensor.

NOTE:

When replacing fuel temperature sensor, also replace fuel level sensor. <Ref. to FU(H4)-93 REMOVAL, Fuel Level Sensor.>



B: INSTALLATION S110032A11

- 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 S110029

A: REMOVAL S110029A18

For work procedures, refer to “FU(H4)” section.
<Ref. to FU(H4)-94 REMOVAL, Fuel Sub Lever Sensor.>

B: INSTALLATION S110029A11

For work procedures, refer to “FU(H4)” section.
<Ref. to FU(H4)-95 INSTALLATION, Fuel Sub Lever Sensor.>

FUEL TANK PRESSURE SENSOR

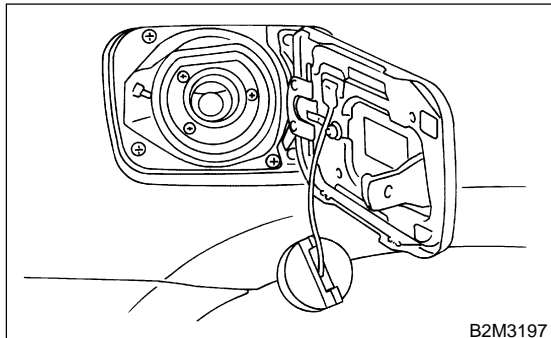
Emission Control (Aux. Emission Control Devices)

9. Fuel Tank Pressure Sensor

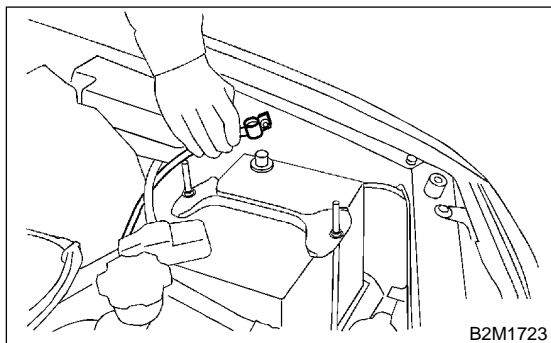
S110030

A: REMOVAL S110030A18

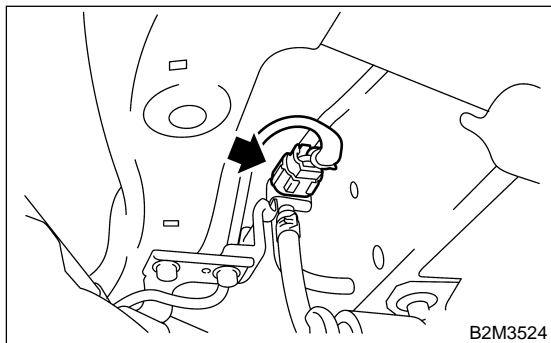
- 1) Set the vehicle on the lift.
- 2) Open fuel flap lid, and remove fuel filler cap.



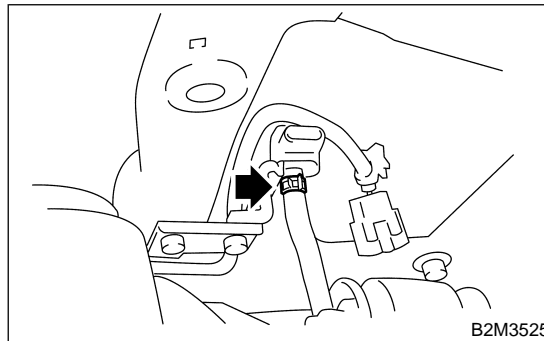
- 3) Disconnect battery ground cable.



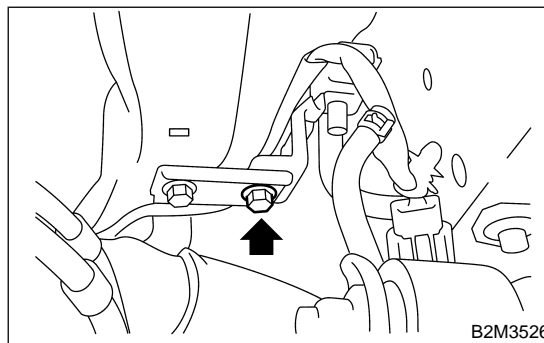
- 4) Lift-up the vehicle.
- 5) Disconnect connector from fuel tank pressure sensor.



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



- 7) Remove fuel tank pressure sensor.

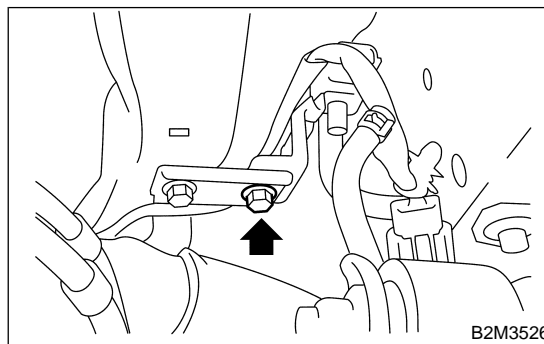


B: INSTALLATION S110030A11

- 1) Install in the reverse order of removal.

Tightening torque:

7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



C: INSPECTION S110030A10

- 1) Make sure that hoses are not cracked or loose.

PRESSURE CONTROL SOLENOID VALVE

Emission Control (Aux. Emission Control Devices)

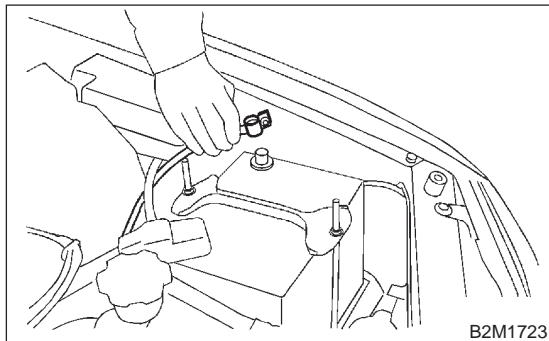
10. Pressure Control Solenoid Valve

S110031

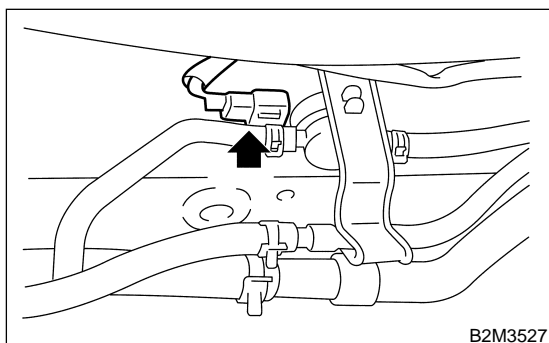
A: REMOVAL

S110031A18

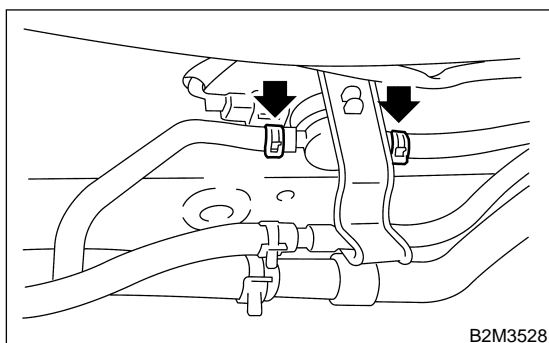
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



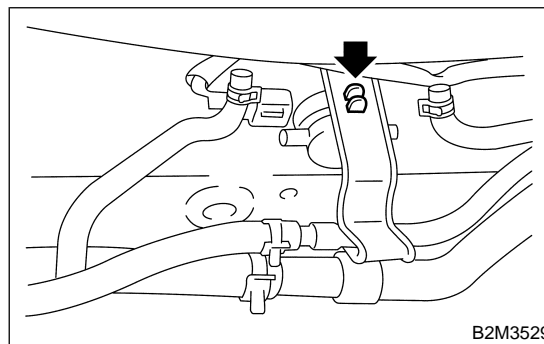
- 3) Lift-up the vehicle.
- 4) Disconnect connector from pressure control solenoid valve.



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



- 6) Remove pressure control solenoid valve from bracket.



B: INSTALLTION

S110031A11

- 1) Install in the reverse order of removal.

C: INSPECTION

S110031A10

- 1) Make sure that hoses are not cracked or loose.

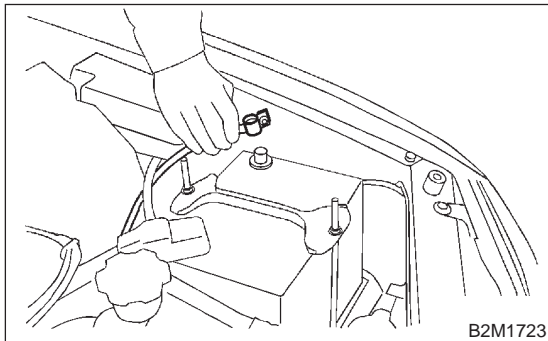
DRAIN FILTER

Emission Control (Aux. Emission Control Devices)

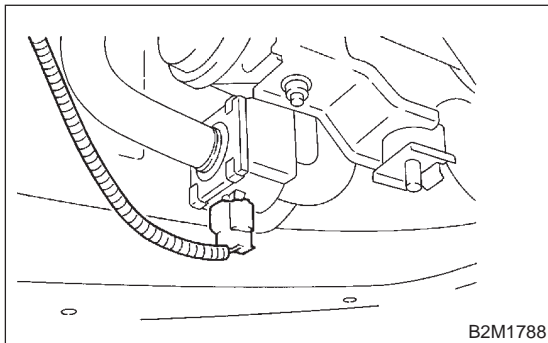
11. Drain Filter S110567

A: REMOVAL S110567A18

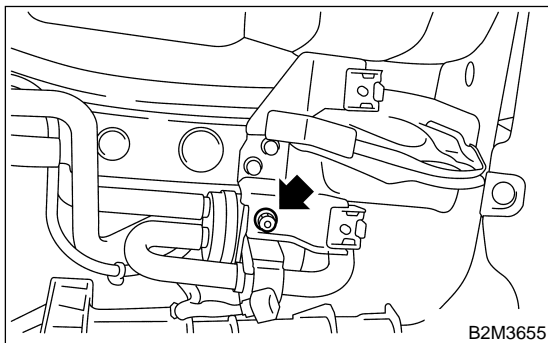
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



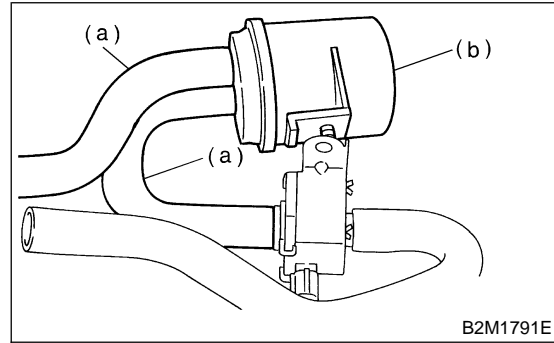
- 3) Lift-up the vehicle.
- 4) Remove canister. <Ref. to EC(H4)-7 REMOVAL, Canister.>
- 5) Disconnect connector from drain valve.



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



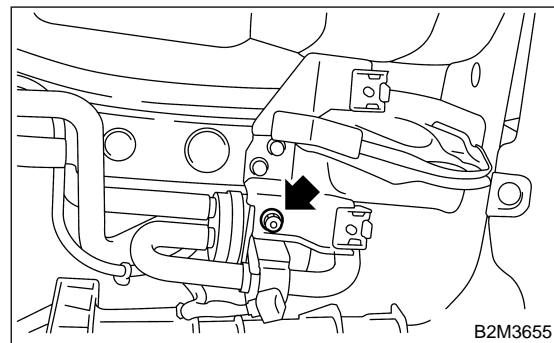
- 7) Disconnect evaporation hoses, (a) and remove drain filter (b).



B: INSTALLATION S110567A11

- 1) Install in the reverse order of removal.

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



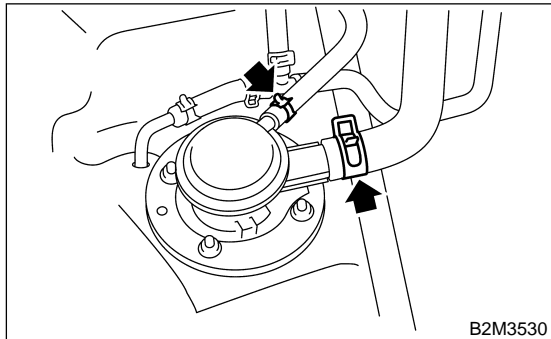
C: INSPECTION S110567A10

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

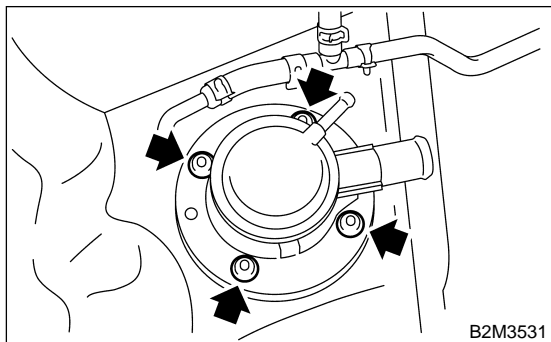
12. Vent Valve S110033

A: REMOVAL S110033A18

- 1) Remove fuel tank. <Ref. to FU(H4)-73 REMOVAL, Fuel Tank.>
- 2) Move clips, and disconnect hoses from vent valve.



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



B: INSTALLATION S110033A11

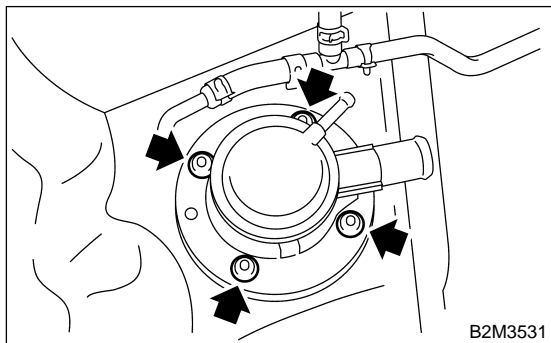
- 1) Install in the reverse order of removal.

CAUTION:

Replace rubber seat with a new one.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION S110033A10

- 1) Make sure that hoses are not cracked or loose.

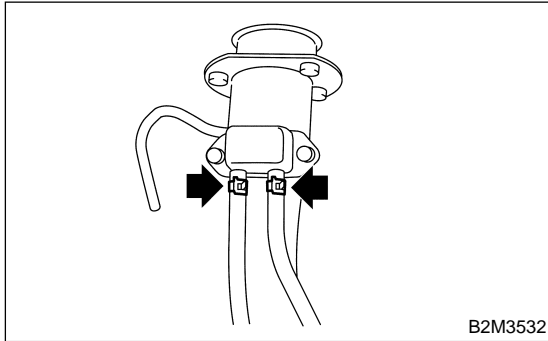
SHUT VALVE

Emission Control (Aux. Emission Control Devices)

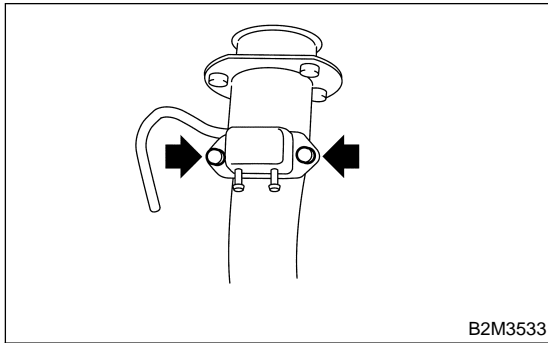
13. Shut Valve S110024

A: REMOVAL S110024A18

- 1) Drain fuel from fuel tank. <Ref. to FU(H4)-73 REMOVAL, Fuel Tank.>
- 2) Remove fuel filler pipe. <Ref. to FU(H4)-82 REMOVAL, Fuel Filler Pipe.>
- 3) Disconnect evaporation hoses from shut valve.



- 4) Remove shut valve from fuel filler pipe.

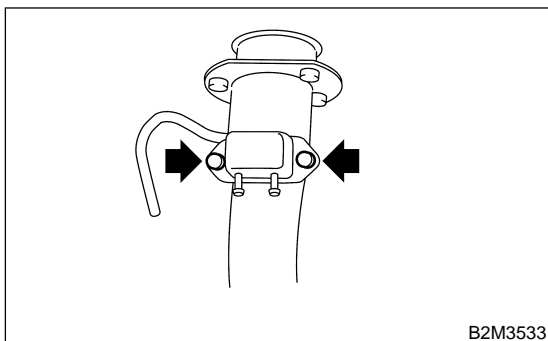


B: INSTALLATION S110024A11

- 1) Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION S110024A10

- 1) Make sure that hoses are not cracked or loose.

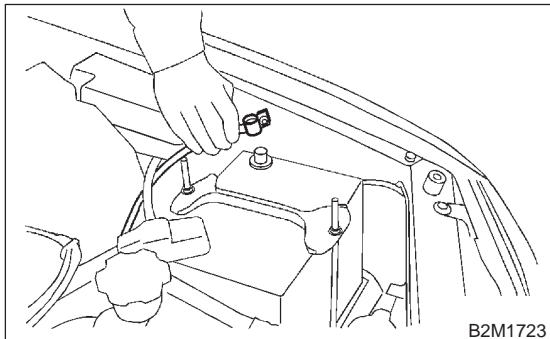
DRAIN VALVE

Emission Control (Aux. Emission Control Devices)

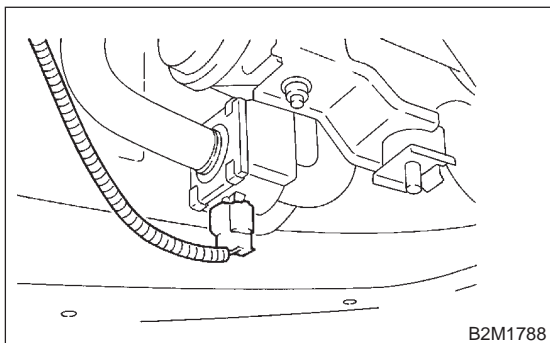
14. Drain Valve S110088

A: REMOVAL S110088A18

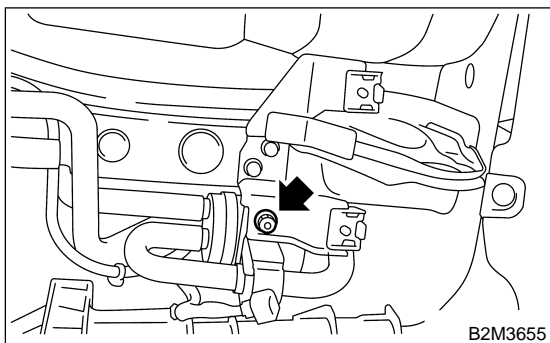
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



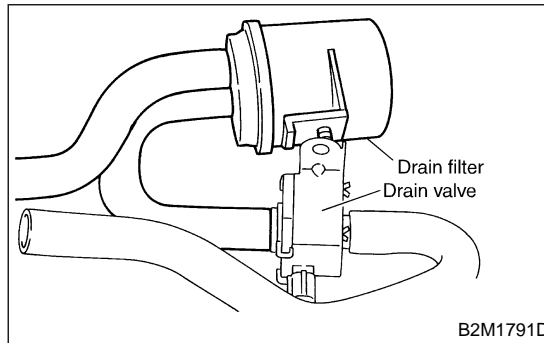
- 3) Lift-up the vehicle.
- 4) Remove canister. <Ref. to EC(H4)-7 REMOVAL, Canister.>
- 5) Disconnect connector from drain valve.



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



- 7) Disconnect evaporation hose and remove drain valve.

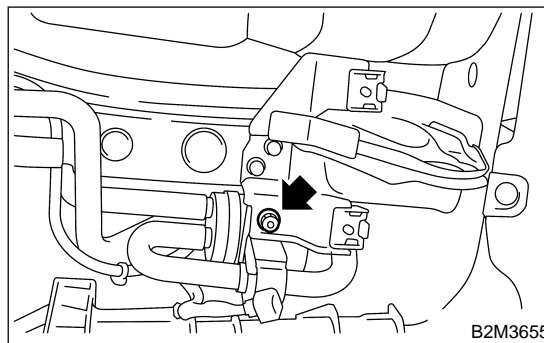


B: INSTALLATION S110088A11

- 1) Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION S110088A10

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

DRAIN VALVE

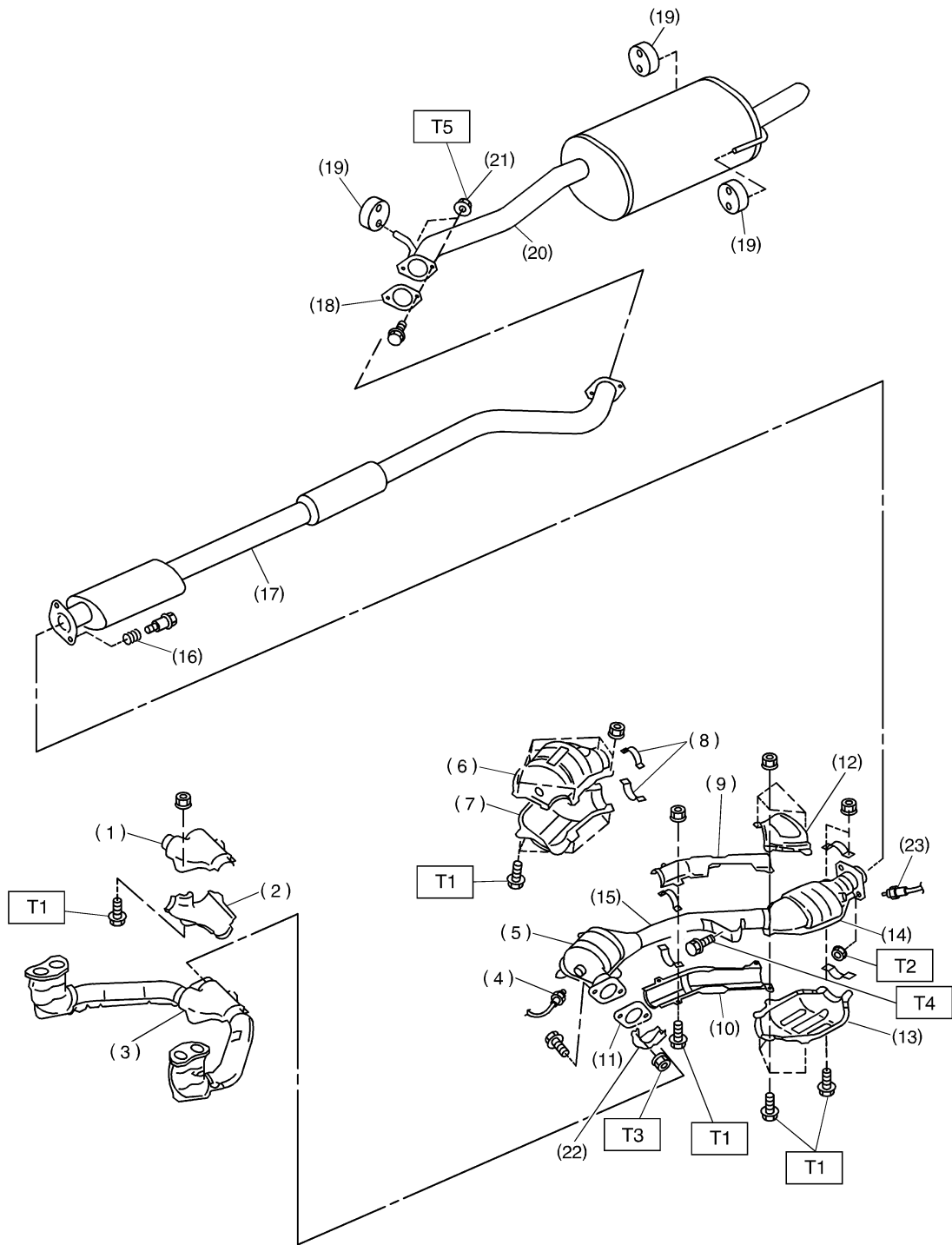
Emission Control (Aux. Emission Control Devices)

MEMO:

EC(H4)-18

1. General Description S102001

A: COMPONENT S102001A05



B2M3438A

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	<hr/> Tightening torque: N·m (kgf-m, ft-lb) T1: 13 (1.3, 9.4) T2: 18 (1.8, 13.0) T3: 30 (3.1, 22.4) T4: 35 (3.6, 26.0) T5: 48 (4.9, 35.4) <hr/>
(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	

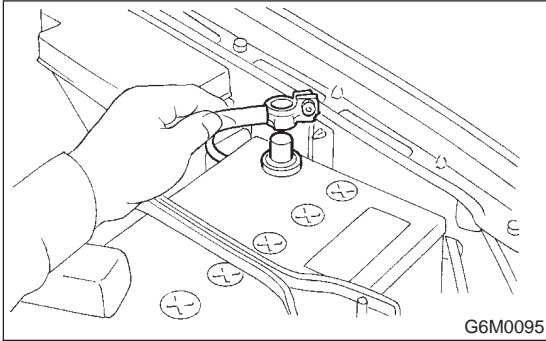
B: CAUTION S102001A03

- 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 negative terminal from battery.

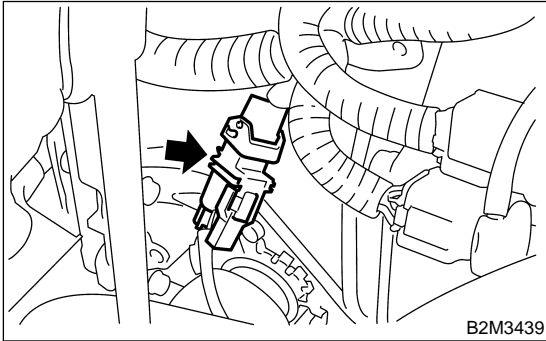
2. Front Exhaust Pipe S102065

A: REMOVAL S102065A18

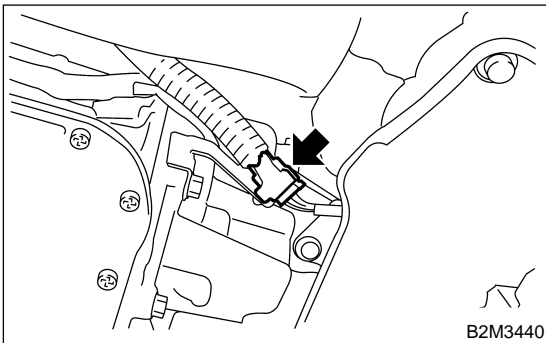
- 1) Disconnect battery ground cable.



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



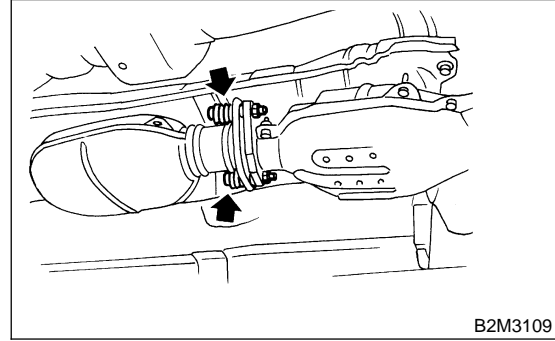
- 3) Lift-up the vehicle.
- 4) Disconnect rear oxygen sensor connector.



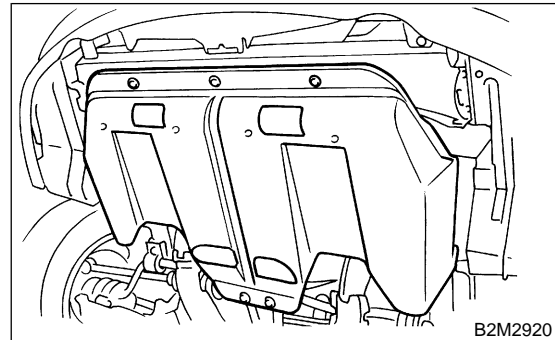
- 5) Separate front and center exhaust pipe assembly from rear exhaust pipe.

WARNING:

Be careful, exhaust pipe is hot.



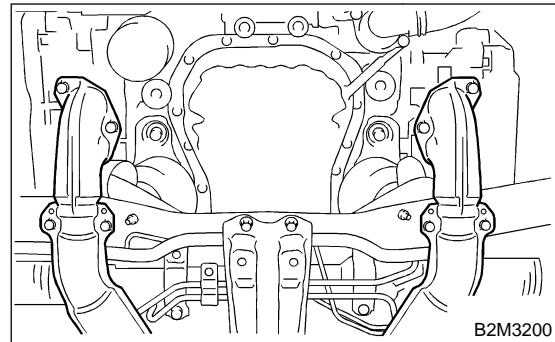
- 6) Remove under cover.



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

CAUTION:

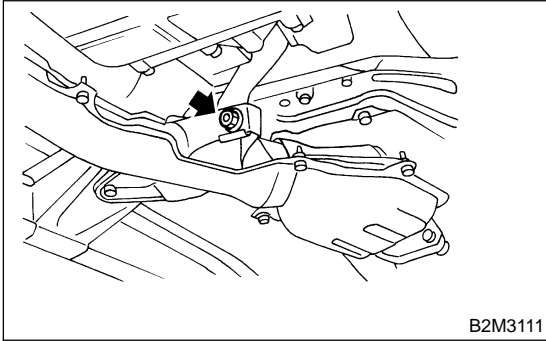
Be careful not to pull down front and center exhaust pipe assembly.



FRONT EXHAUST PIPE

Exhaust

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

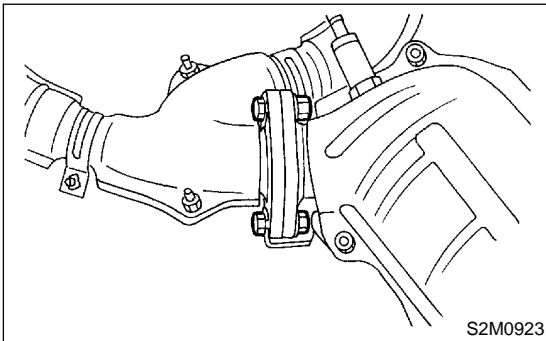


- 9) Remove front and center exhaust pipe assembly from the vehicle.

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 S102065A11

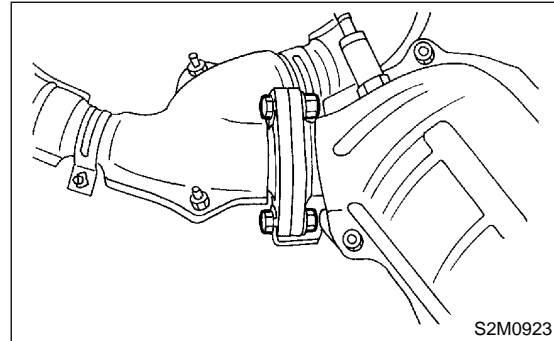
- 1) Install front exhaust pipe to center exhaust pipe.

CAUTION:

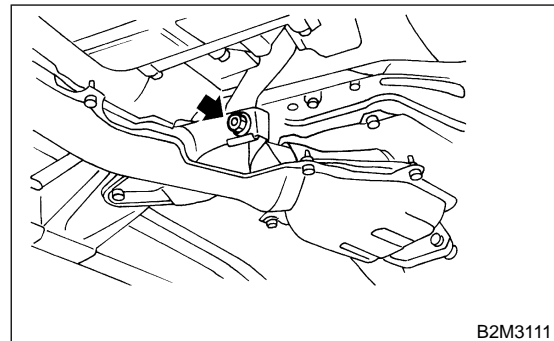
Replace gaskets with new ones.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



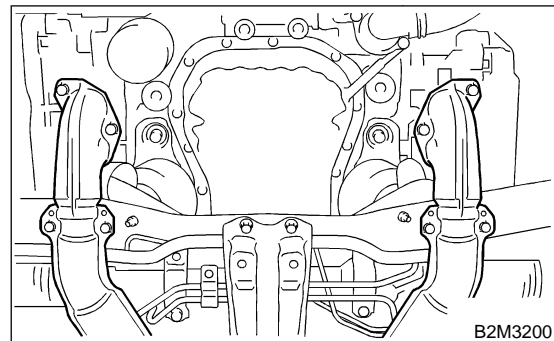
- 2) Install front and center exhaust pipe assembly to the vehicle.
3) Temporarily tighten bolt which installs front and center exhaust pipe assembly to hanger bracket.



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

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)

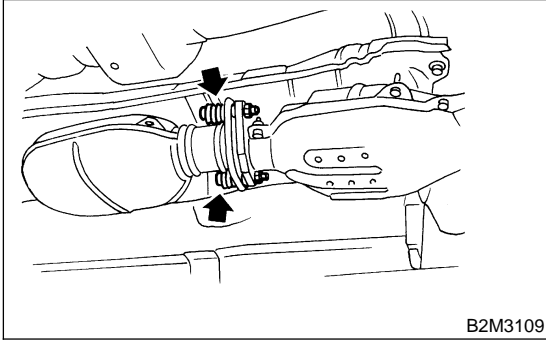


- 5) Install under cover.

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

Tightening torque:

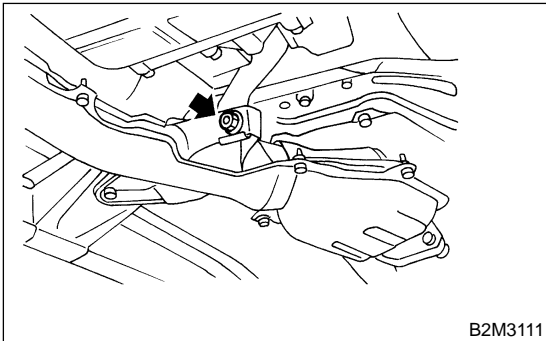
18 N·m (1.8 kgf-m, 13.0 ft-lb)



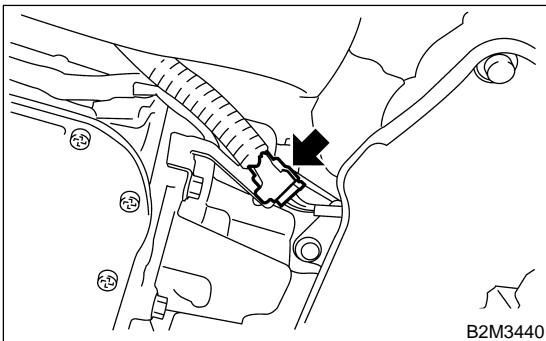
7) Tighten bolt which holds front and center exhaust pipe assembly to hanger bracket.

Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)

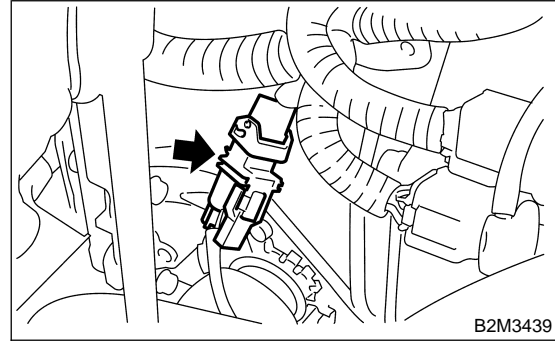


8) Connect rear oxygen sensor connector.

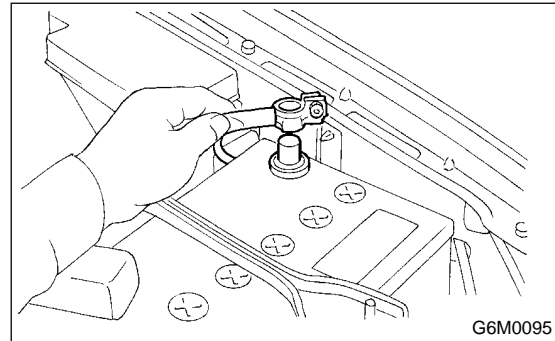


9) Lower the vehicle.

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



11) Connect battery ground cable.



C: INSPECTION

S102065A10

- 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 S102067

A: REMOVAL S102067A18

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(H4)-5 REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION S102067A11

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(H4)-6 INSTALLTION, Front Exhaust Pipe.>

C: INSPECTION S102067A10

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

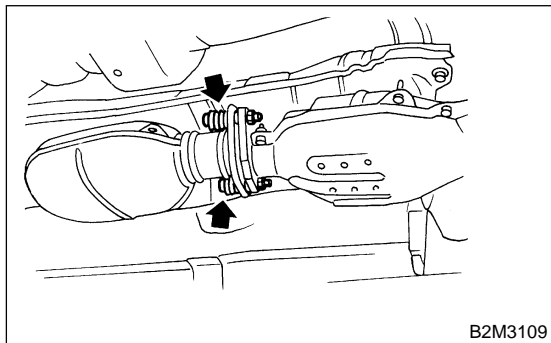
4. Rear Exhaust Pipe S102068

A: REMOVAL S102068A18

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

CAUTION:

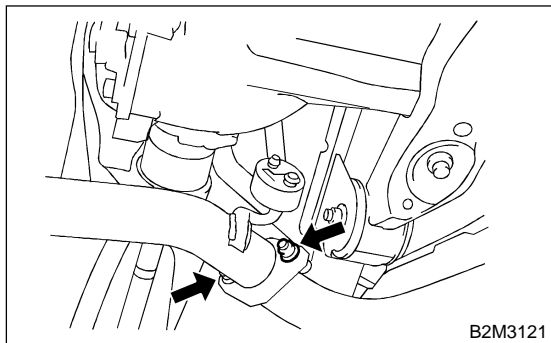
Be careful, exhaust pipe is hot.



- 2) Separate rear exhaust pipe from muffler.

CAUTION:

Be careful not to pull down rear exhaust pipe.



- 3) Remove rear exhaust pipe.

B: INSTALLATION S102068A11

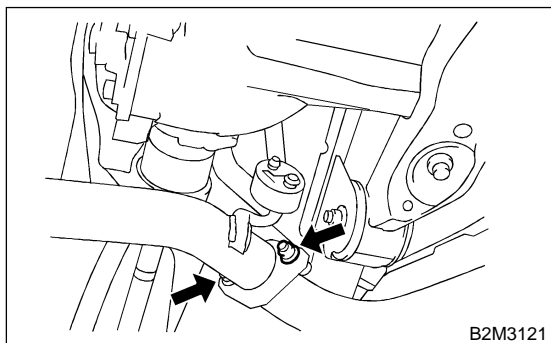
CAUTION:

Replace gaskets with new ones.

- 1) Install rear exhaust pipe to muffler.

Tightening torque:

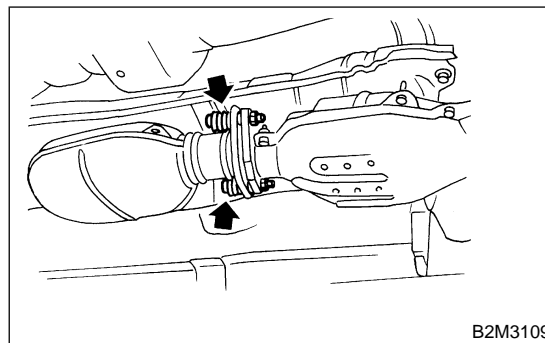
48 N·m (4.9 kgf-m, 35.4 ft-lb)



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

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION S102068A10

- 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.

MUFFLER

Exhaust

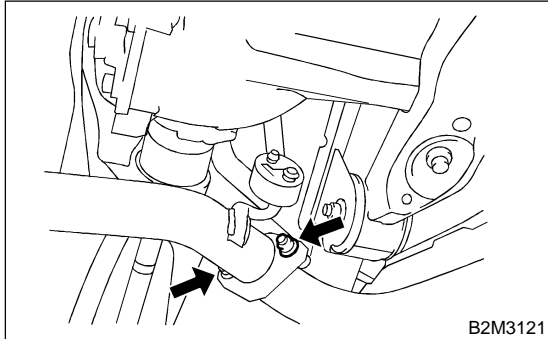
5. Muffler S102066

A: REMOVAL S102066A18

- 1) Separate muffler from rear exhaust pipe.

CAUTION:

Be careful, exhaust pipe is hot.



- 2) Remove left and right rubber cushions.

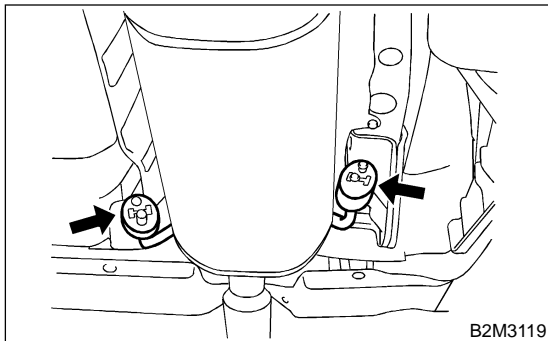
CAUTION:

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)

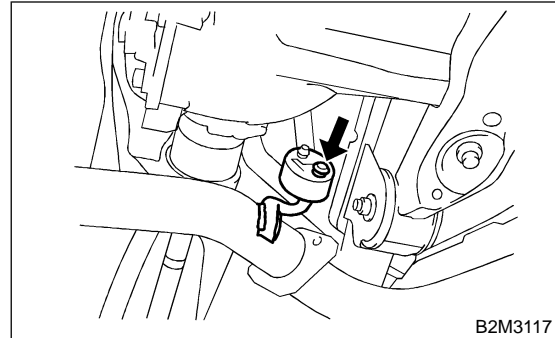


- 3) Remove front rubber cushion, and detach muffler assembly.

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 S102066A11

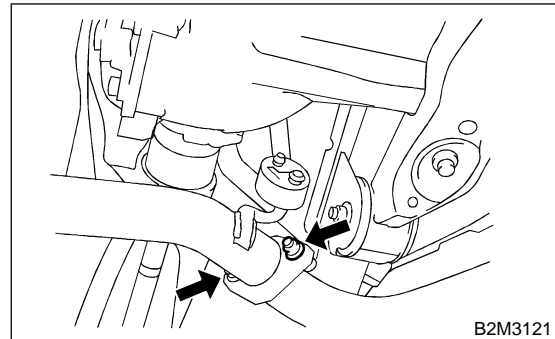
- 1) Install in the reverse order of removal.

CAUTION:

Replace gasket with a new one.

Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



C: INSPECTION S102066A10

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

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

1. General Description S105001

A: SPECIFICATIONS S105001E49

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

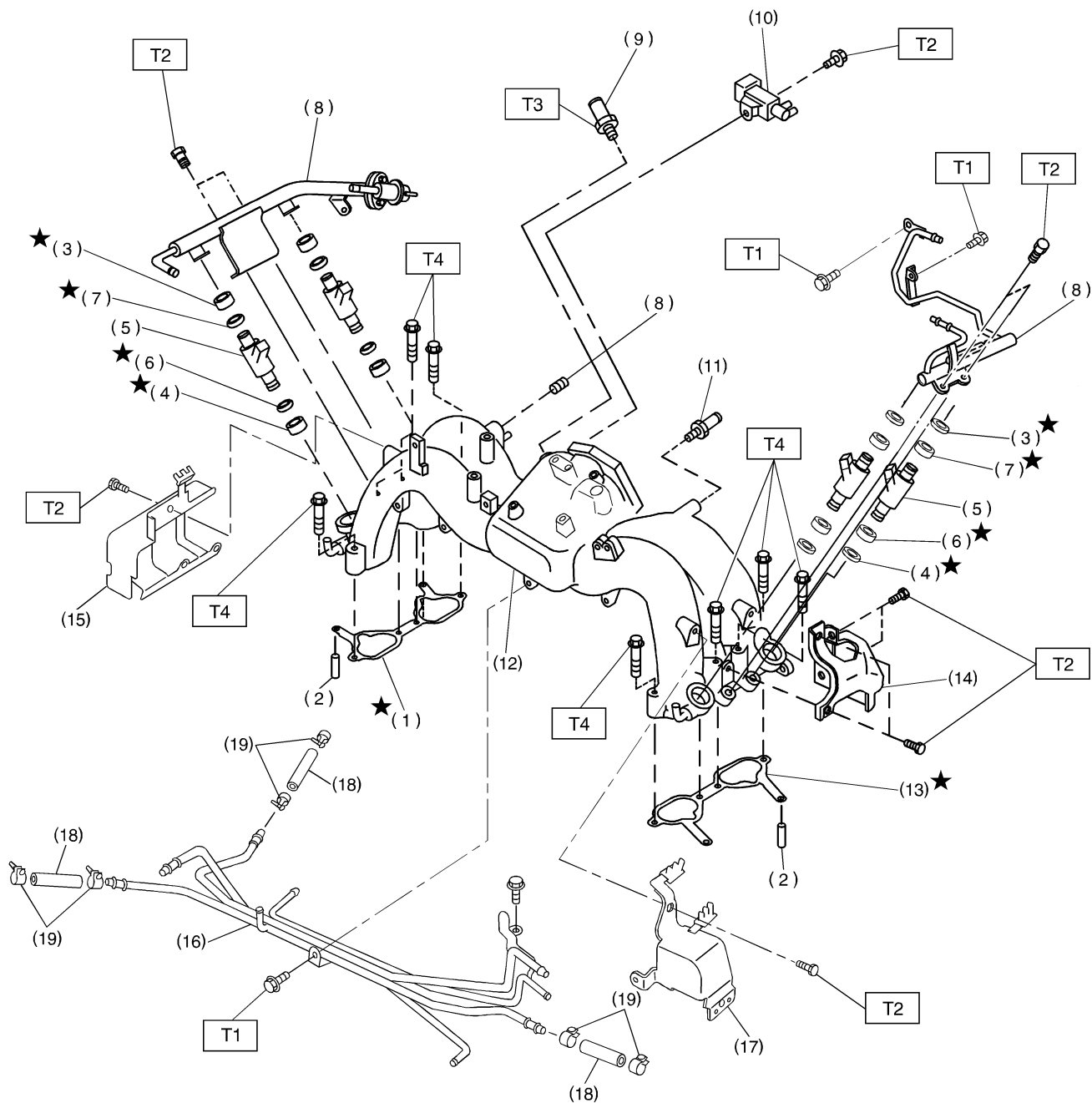
B: COMPONENT

S105001A05

1. INTAKE MANIFOLD

S105001A0501

MT VEHICLES



B2M4151A

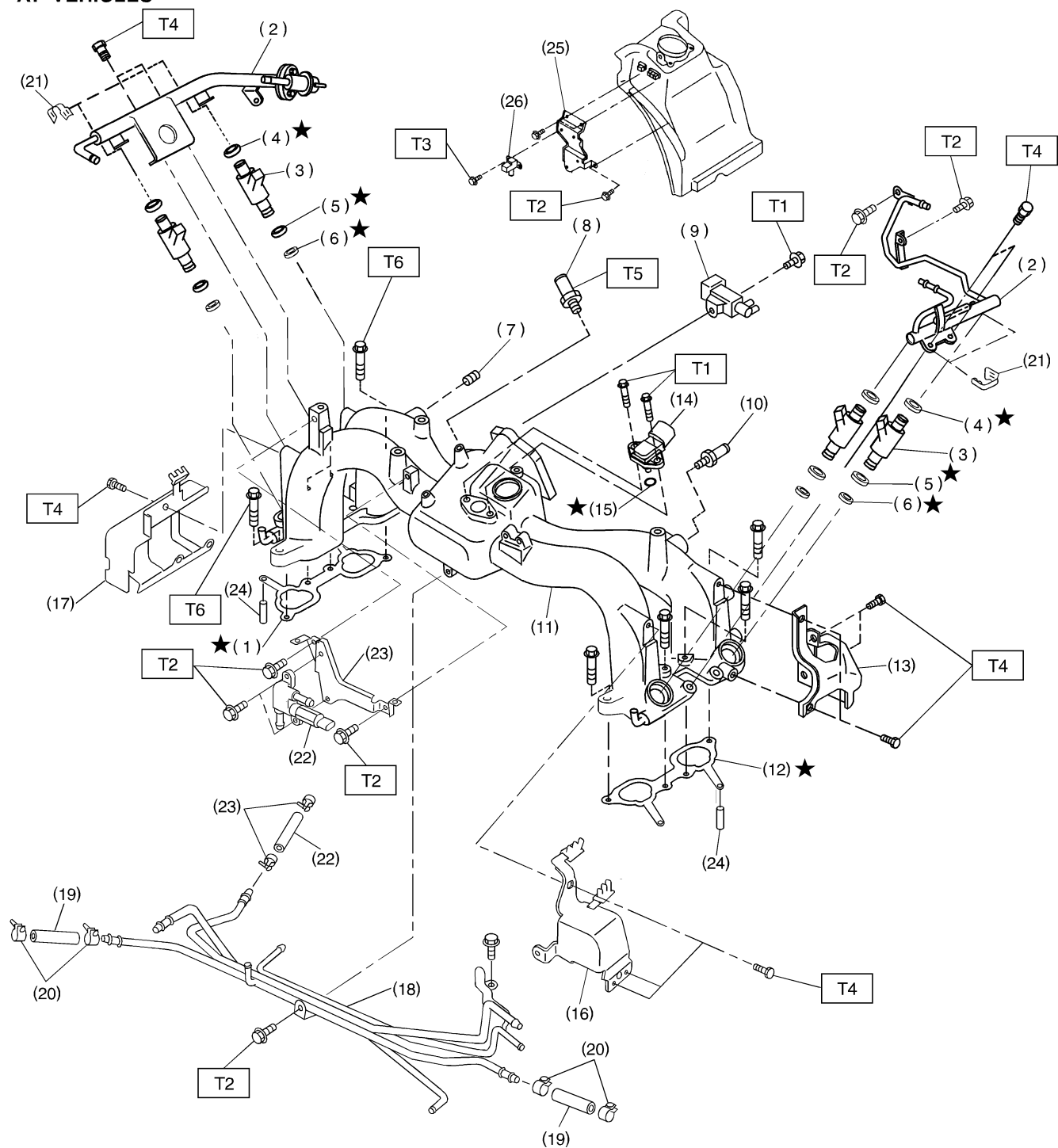
FU(H4)-3

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

(1) Intake manifold gasket RH	(10) Purge control solenoid valve	(19) Clip
(2) Guide pin	(11) Nipple	
(3) Insulator A	(12) Intake manifold	Tightening torque: N·m (kgf-m, ft-lb)
(4) Insulator B	(13) Intake manifold gasket LH	T1: 5.0 (0.51, 3.7)
(5) Fuel injector	(14) Fuel pipe protector LH	T2: 19 (1.9, 14)
(6) O-ring B	(15) Fuel pipe protector RH	T3: 22.5 (2.29, 16.6)
(7) O-ring A	(16) Fuel pipe ASSY	T4: 25 (2.5, 18.1)
(8) Plug	(17) Fuel pipe protector LH	
(9) PCV valve	(18) Fuel hose	

AT VEHICLES



B2M3454B

FU(H4)-5

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

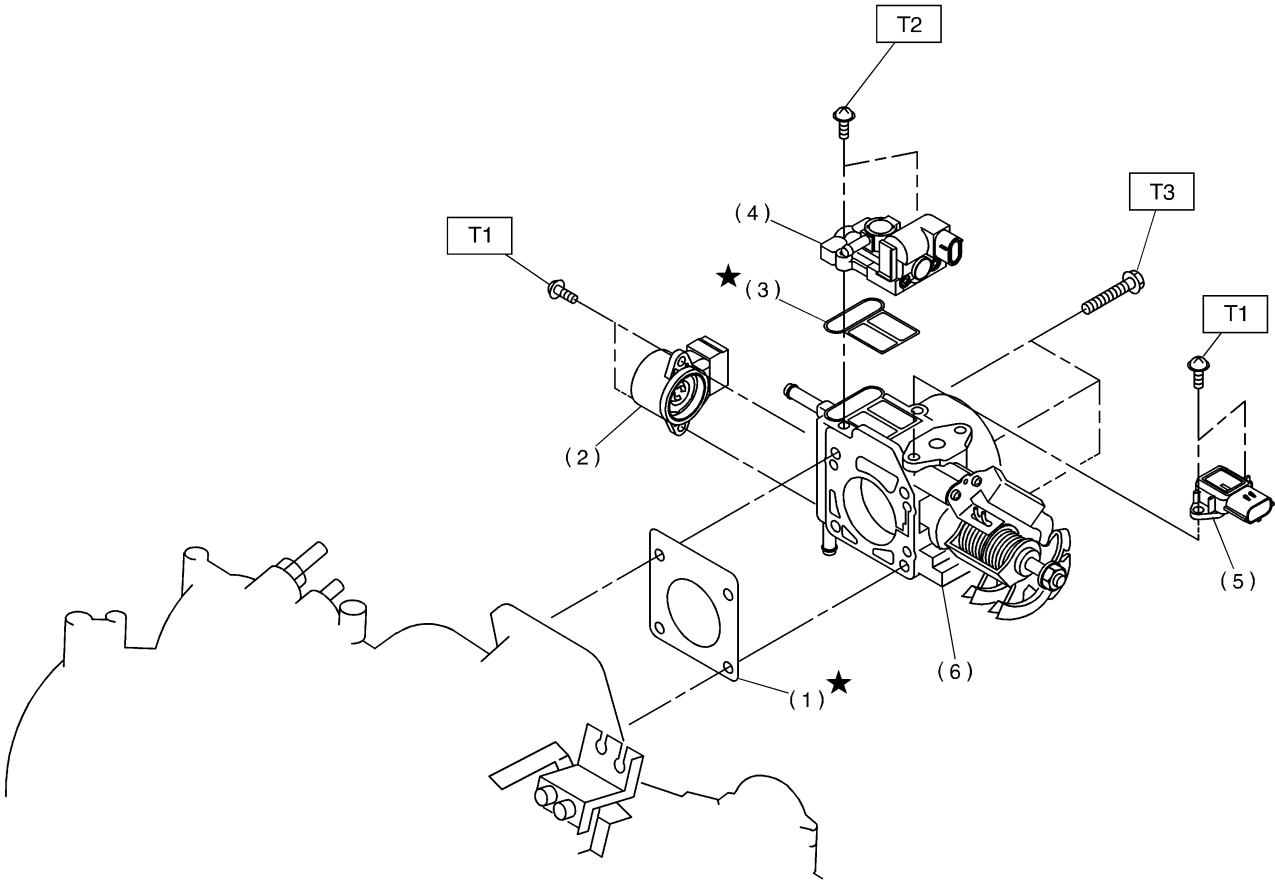
(1) Intake manifold gasket RH	(14) Intake air temperature and pressure sensor	(25) Atmospheric pressure sensor bracket
(2) Fuel injector pipe	(15) O-ring	(26) Atmospheric pressure sensor
(3) Fuel injector	(16) Fuel pipe protector LH	
(4) O-ring	(17) Fuel pipe protector RH	
(5) O-ring	(18) Fuel pipe ASSY	
(6) O-ring	(19) Fuel hose	
(7) Plug	(20) Clip	
(8) PCV valve	(21) Clip	
(9) Purge control solenoid valve	(22) Air assist injector solenoid valve	
(10) Nipple	(23) Air assist injector solenoid valve bracket	
(11) Intake manifold	(24) Guide pin	
(12) Intake manifold gasket LH		
(13) Fuel pipe protector LH		

Tightening torque: N·m (kgf-m, ft-lb)

- T1: 3.4 (0.35, 2.5)**
- T2: 5.0 (0.51, 3.7)**
- T3: 6.4 (0.65, 4.7)**
- T4: 19 (0.19, 1.4)**
- T5: 22.5 (2.29, 16.6)**
- T6: 25 (2.6, 18.8)**

2. AIR INTAKE SYSTEM S105001A0502

MT VEHICLES



B2M2278B

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

- (5) Intake manifold pressure sensor
- (6) Throttle body

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.6 (0.16, 1.2)

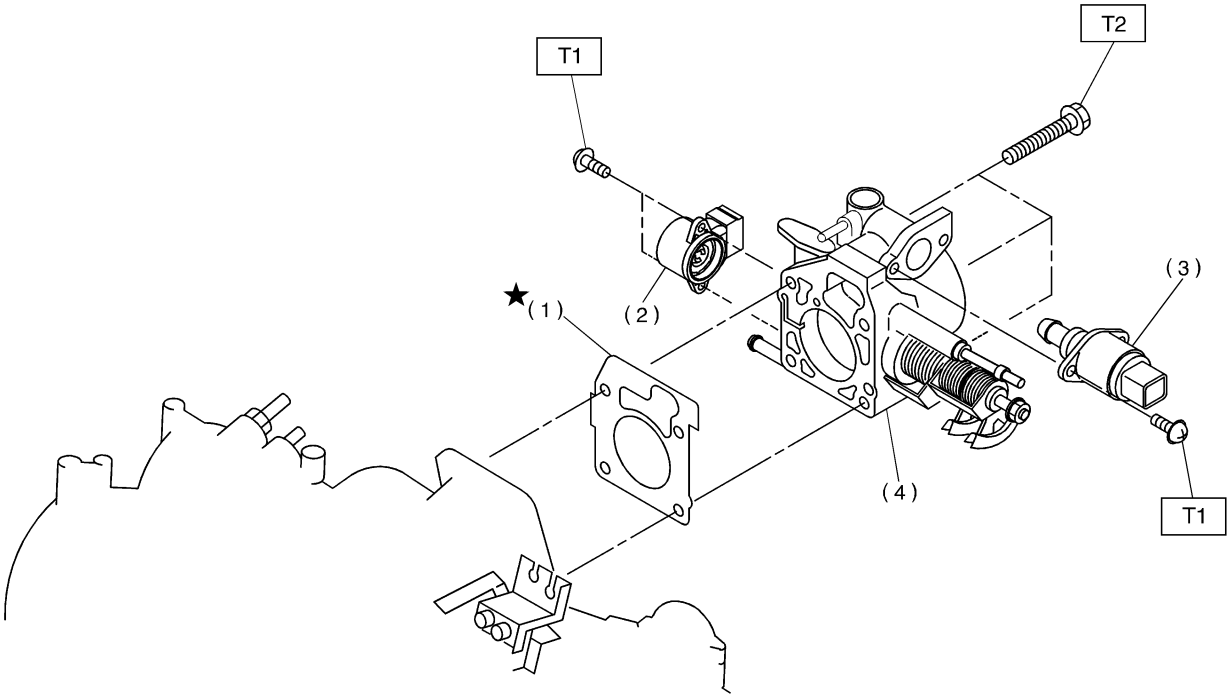
T2: 2.8 (0.29, 2.1)

T3: 22 (2.2, 15.9)

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

AT VEHICLES



B2M3455B

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

- (4) Throttle body

Tightening torque: N·m (kgf-m, ft-lb)

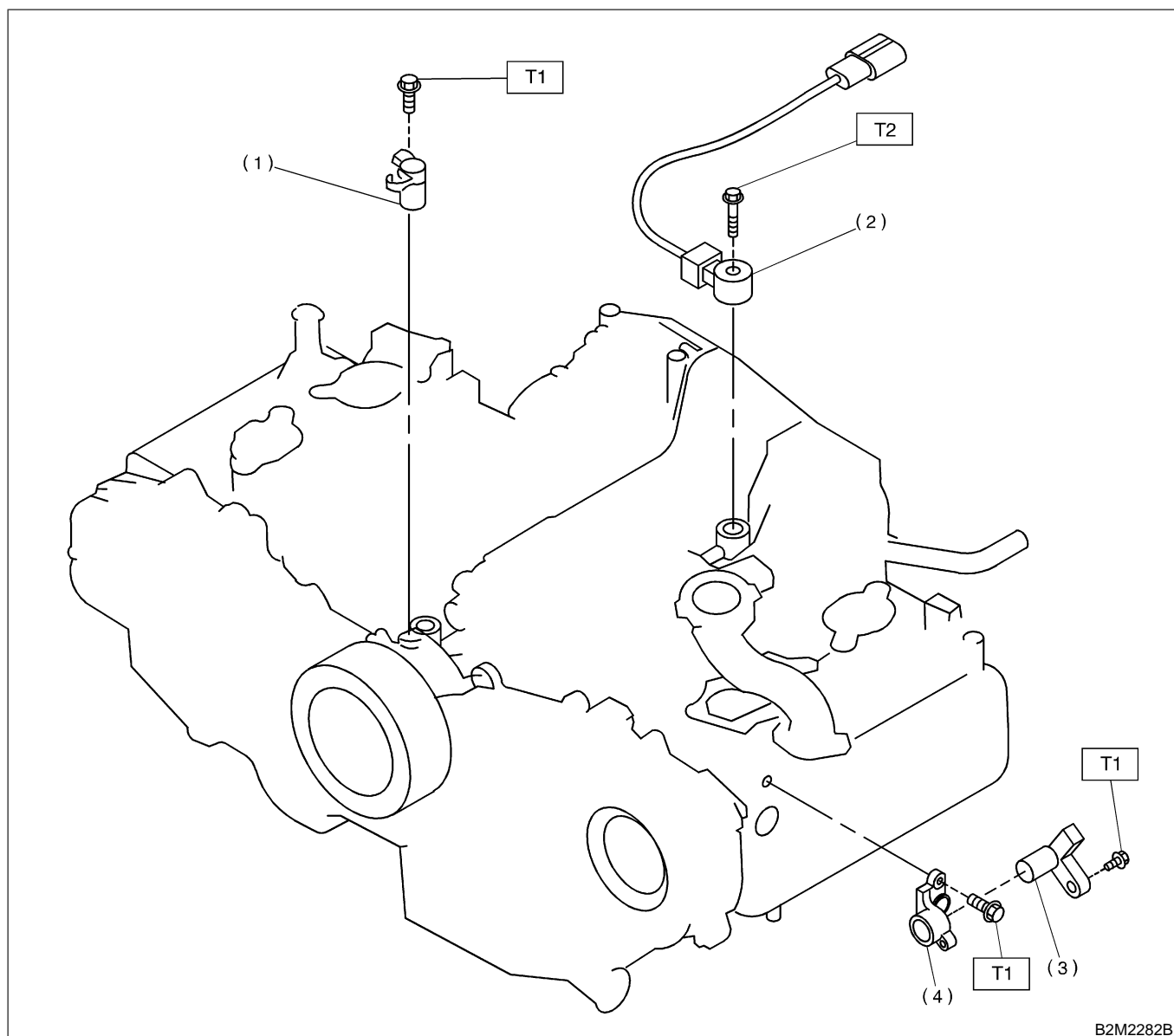
T1: 1.6 (0.16, 1.2)

T2: 22 (2.2, 16)

FU(H4)-8

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS

S105001A0503



B2M2282B

- (1) Crankangle 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)

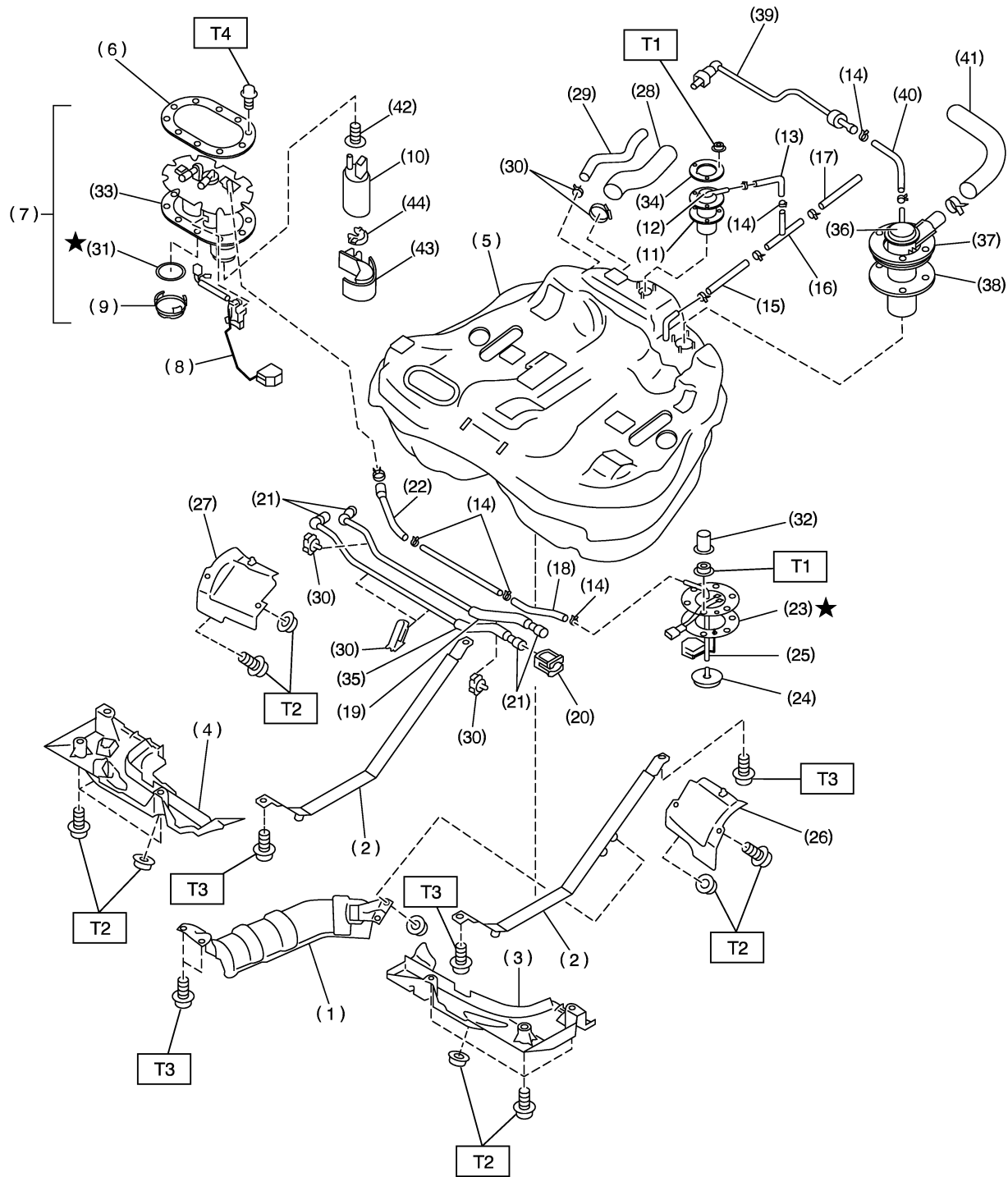
T2: 23.5 (2.4, 17.4)

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

4. FUEL TANK

S105001A0504



B2M3662A

FU(H4)-10

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	

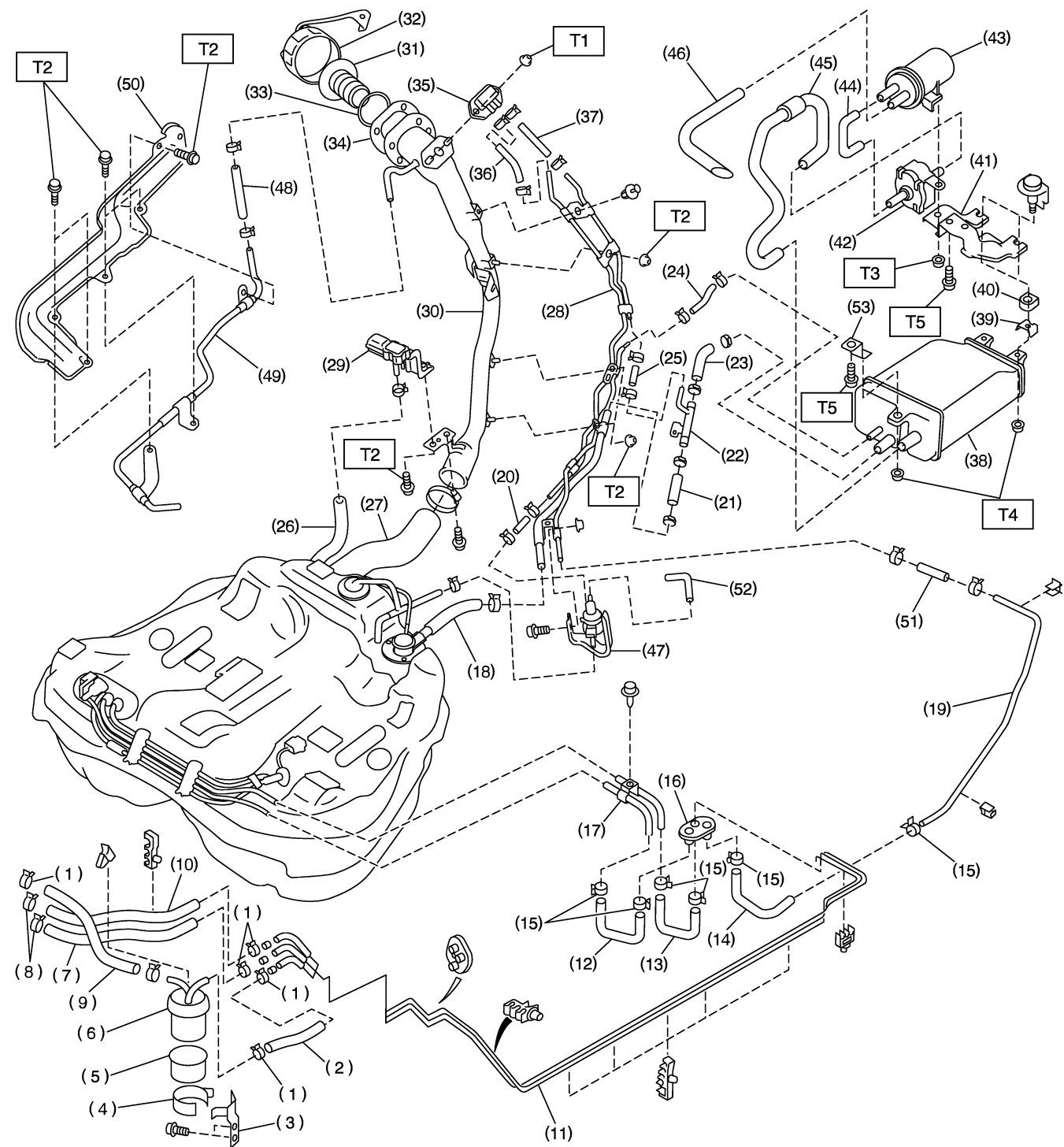
Tightening torque: N·m (kgf-m, ft-lb)**T1: 4.4 (0.45, 3.3)****T2: 18 (1.8, 13.0)****T3: 33 (3.4, 25)****T4: 5.9 (0.6, 4.3)**

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

5. FUEL LINE

S105001A0505



B2M4150A

FU(H4)-12

GENERAL DESCRIPTION

Fuel Injection (Fuel Systems)

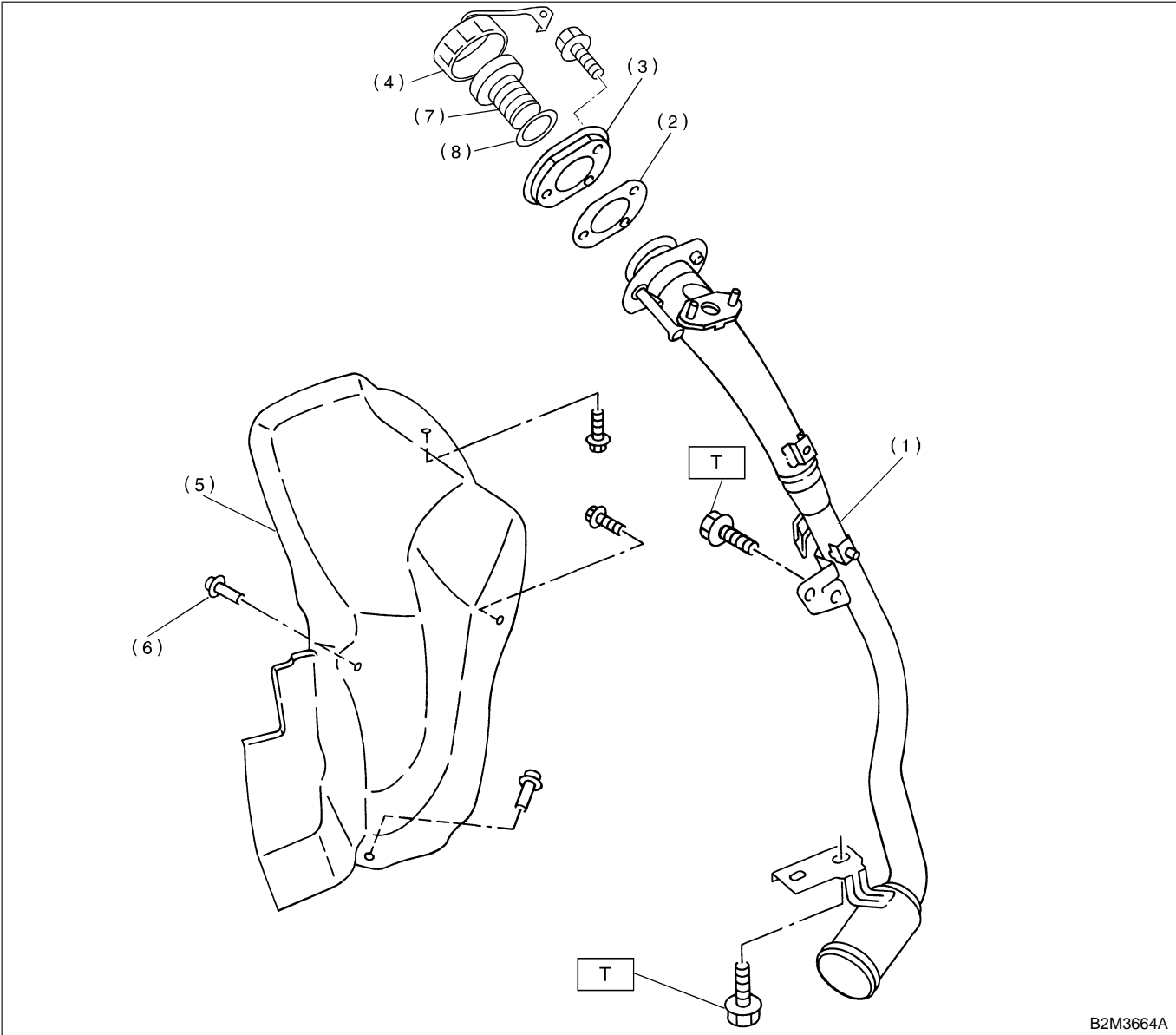
(1) Clamp	(22) Air vent pipe	(43) Drain filter
(2) Fuel delivery hose A	(23) Evaporation hose J	(44) Drain filter hose A
(3) Fuel filter bracket	(24) Evaporation hose K	(45) Drain valve hose
(4) Fuel filter holder	(25) Evaporation hose L	(46) Drain filter hose B
(5) Fuel filter cup	(26) Fuel tank pressure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

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 S105001A0506



- | | |
|---------------------------|---------------------------|
| (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 |

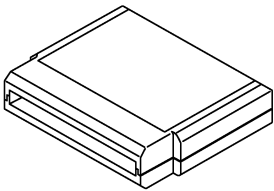

Tightening torque: N·m (kgf·m, ft·lb)
T: 7.5 (0.75, 5.4)

C: CAUTION S105001A03

- 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 negative terminal from battery.
- Place "NO FIRE" signs near the working area.
- Be careful not to spill fuel on the floor.

D: PREPARATION TOOL S105001A17

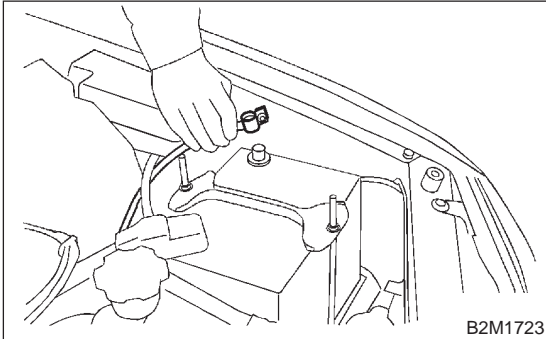
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3876	24082AA150	CARTRIDGE	
 B2M3877	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems. <ul style="list-style-type: none">● English: 22771AA030 (Without printer)● German: 22771AA070 (Without printer)● French: 22771AA080 (Without printer)● Spanish: 22771AA090 (Without printer)

2. Throttle Body S105010

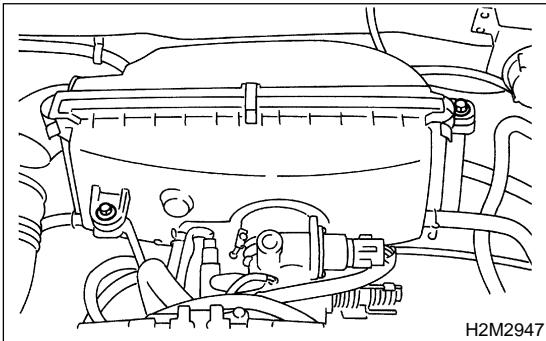
A: REMOVAL S105010A18

1. MT VEHICLES S105010A1801

1) Disconnect battery ground cable.

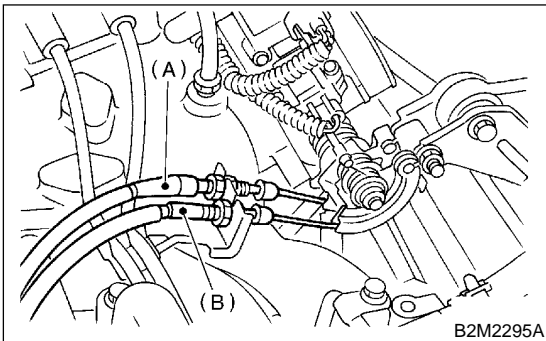


2) Remove air cleaner case. <Ref. to IN(H4)-6 REMOVAL, Air Cleaner Case.>



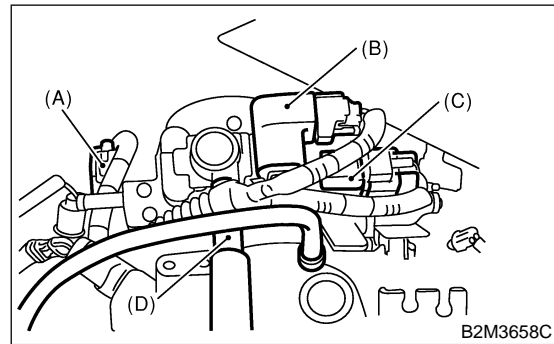
3) Disconnect accelerator cable (A).

4) Disconnect cruise control cable (B). (With cruise control model)

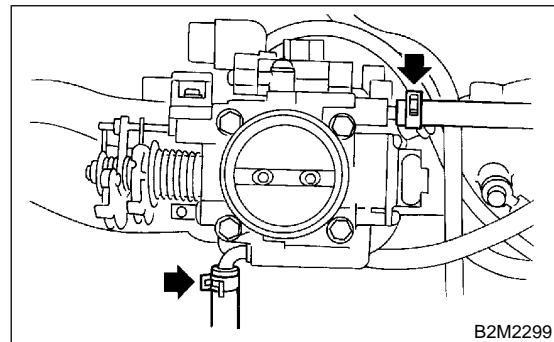


5) Disconnect connectors from throttle position sensor (A), idle air control solenoid valve (B) and intake manifold pressure sensor (C).

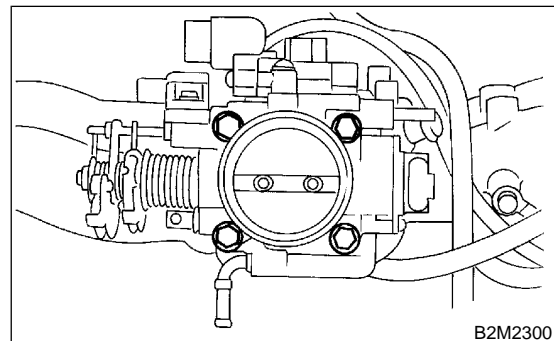
6) Disconnect air by-pass hose (D) from idle air control solenoid valve.



7) Disconnect engine coolant hoses from throttle body.

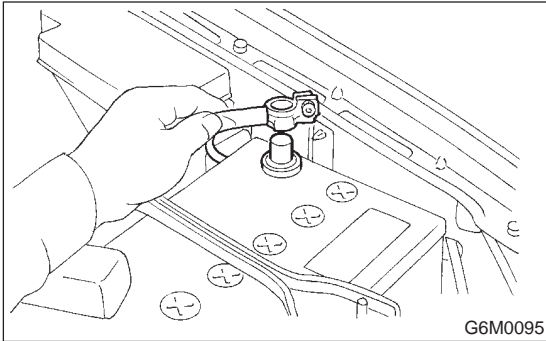


8) Remove bolts which install throttle body to intake manifold.

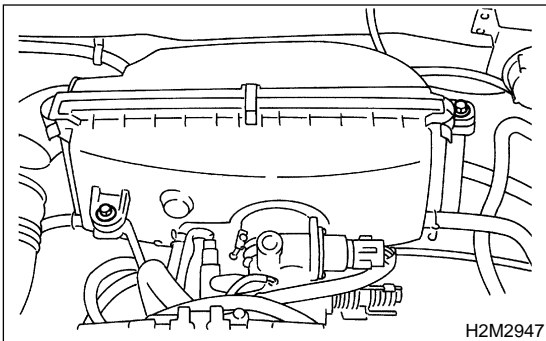


2. AT VEHICLES S105010A1802

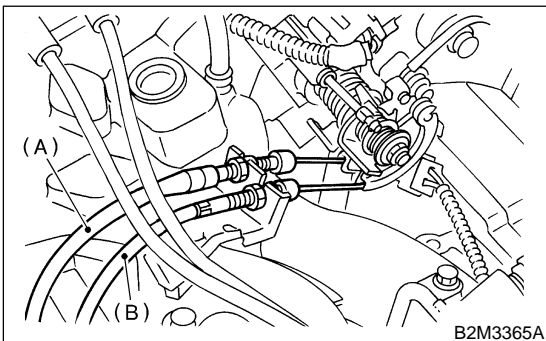
- 1) Disconnect battery ground cable.



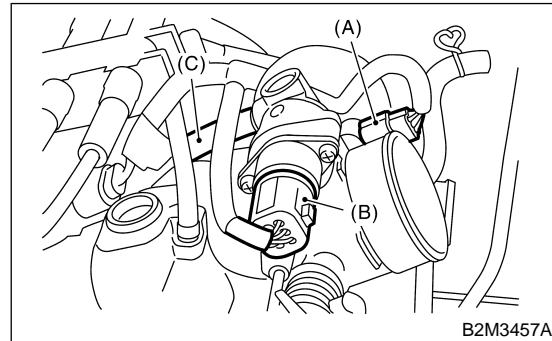
- 2) Remove air cleaner case.



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

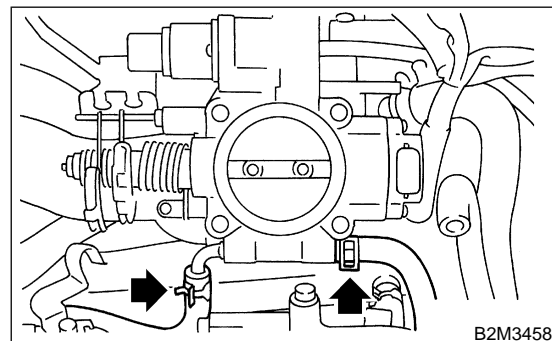


- 5) Disconnect connectors from idle air control solenoid valve, throttle position sensor.
- 6) Disconnect air by-pass hose from air assist injector solenoid valve.



- (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 S105010A11

1. MT VEHICLES S105010A1101

Install in the reverse order of removal.

CAUTION:

Always use a new gasket.

Tightening torque:

Throttle body;

22 N·m (2.2 kgf-m, 15.9 ft-lb)

Air cleaner case;

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

2. AT VEHICLES S105010A1102

Install in the reverse order of removal.

CAUTION:

Always use a new gasket.

THROTTLE BODY

Fuel Injection (Fuel Systems)

Tightening torque:

Throttle body;

22 N·m (2.2 kgf-m, 15.9 ft-lb)

Air cleaner case;

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

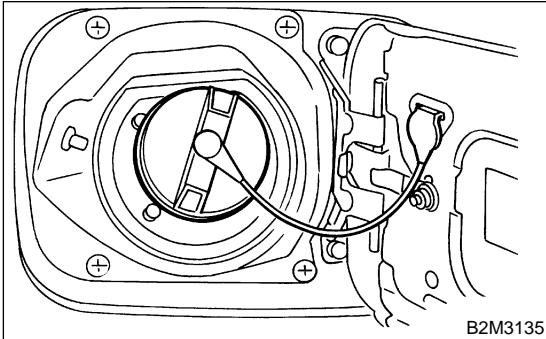
3. Intake Manifold

S105034

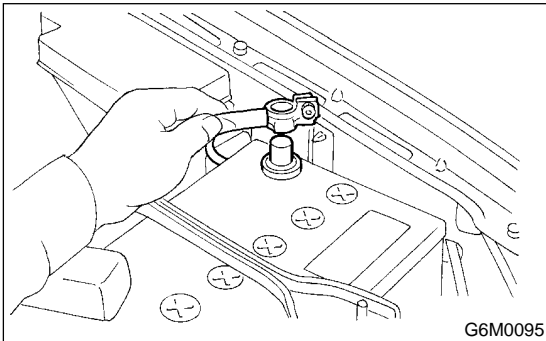
A: REMOVAL

S105034A18

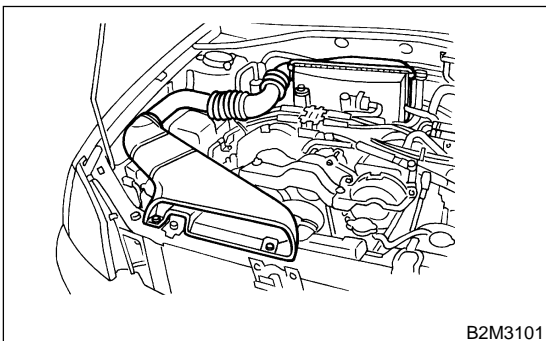
- 1) Release fuel pressure. <Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open fuel flap lid, and remove fuel filler cap.



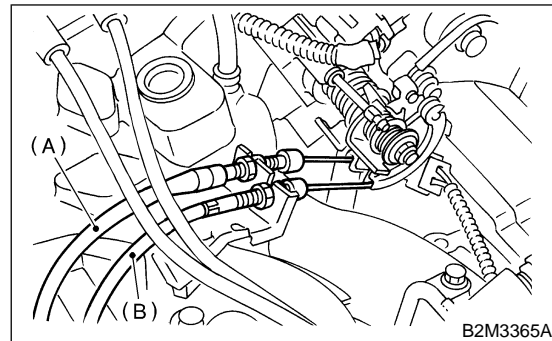
- 3) Disconnect battery ground cable.



- 4) Remove air intake duct and air cleaner assembly. <Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.> and <Ref. to IN(H4)-6 REMOVAL, Air Cleaner Case.>

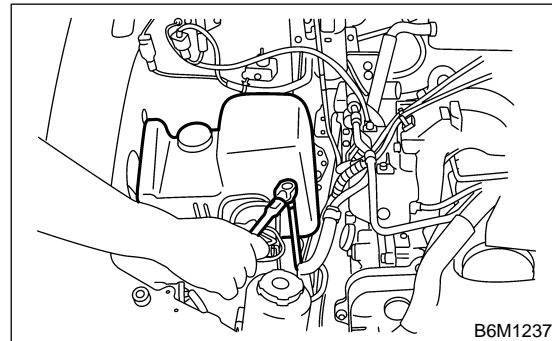


- 5) Disconnect accelerator cable (A).
- 6) Disconnect cruise control cable (B). (With cruise control model)

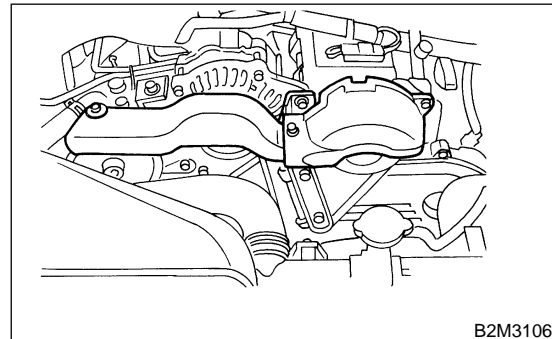


- 7) Remove power steering pump and tank from brackets.

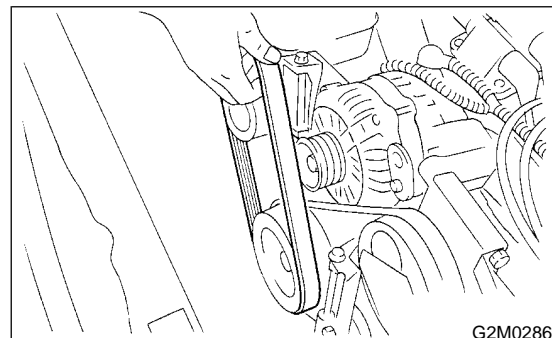
- (1) Remove resonator chamber.



- (2) Remove V-belt covers.



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



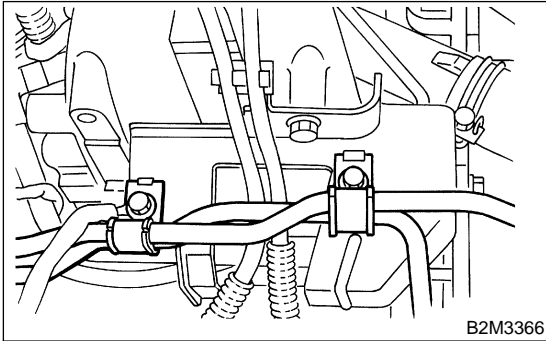
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

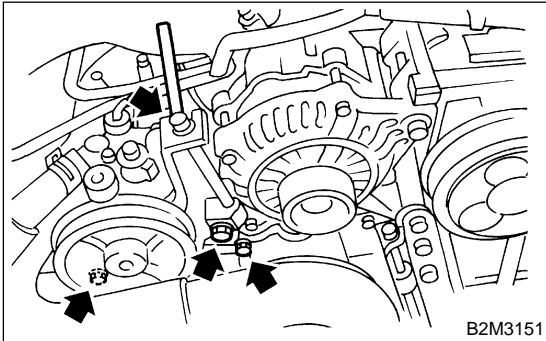
- (4) Remove bolts which hold power steering pipes onto intake manifold protector.

NOTE:

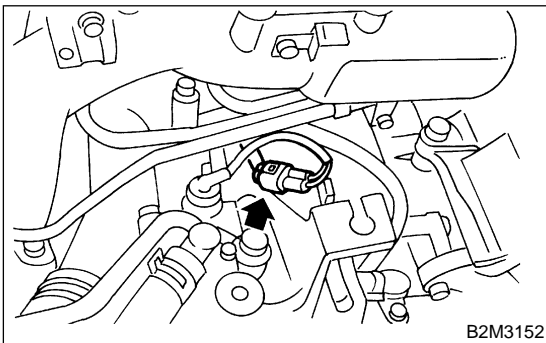
Do not disconnect power steering hose.



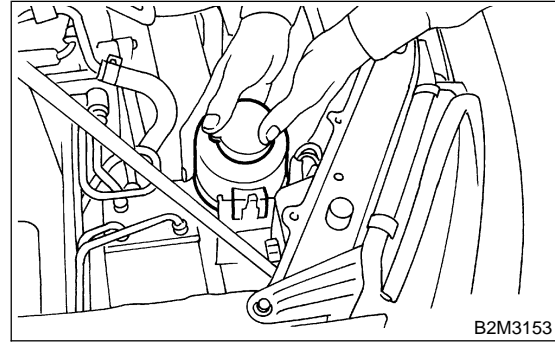
- (5) Remove bolts which install power steering pump bracket.



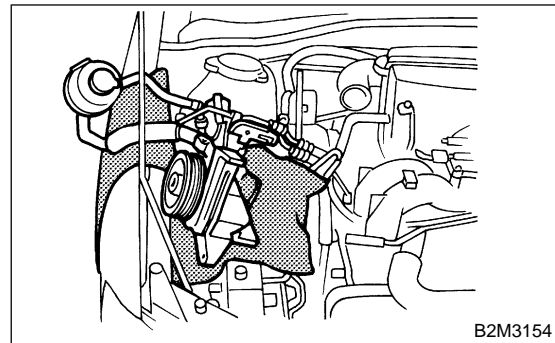
- (6) Disconnect connector from power steering pump switch.



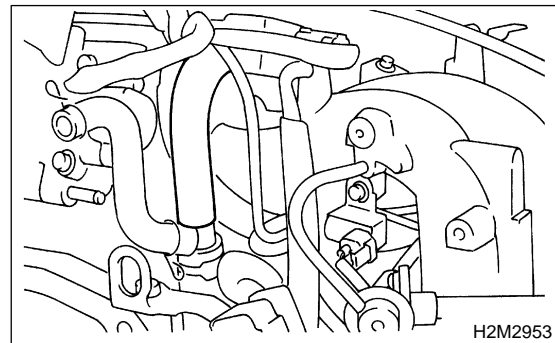
- (7) Remove power steering tank from the bracket by pulling it upwards.



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



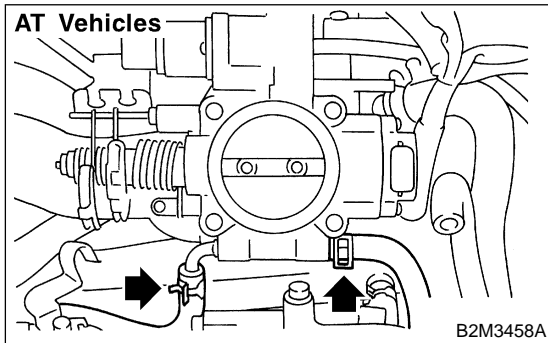
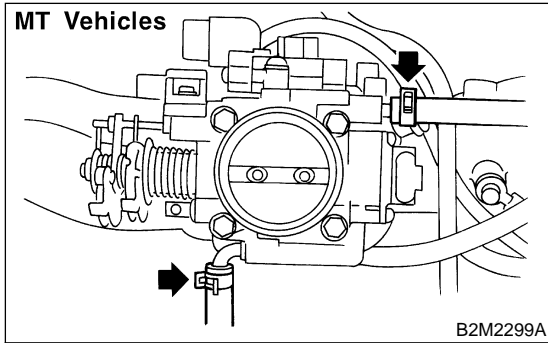
- 8) Disconnect spark plug cords from spark plugs.
9) Disconnect PCV hose from intake manifold.



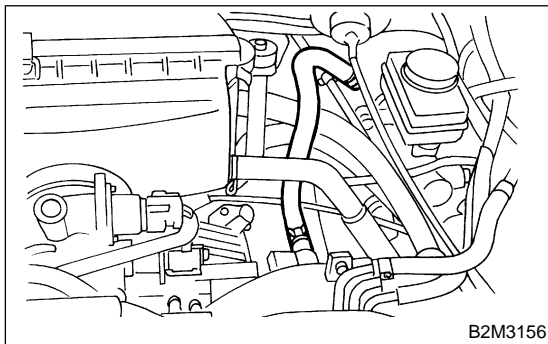
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

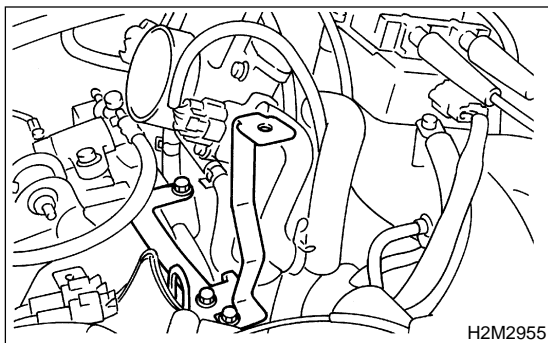
10) Disconnect engine coolant hose from throttle body.



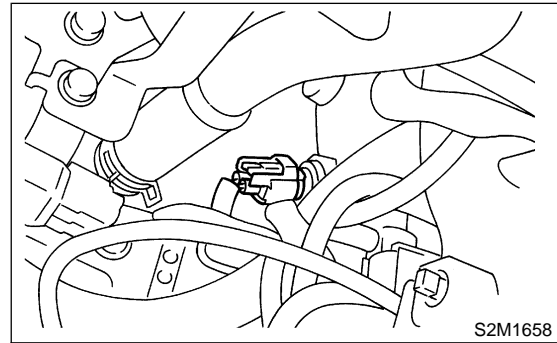
11) Disconnect brake booster hose.



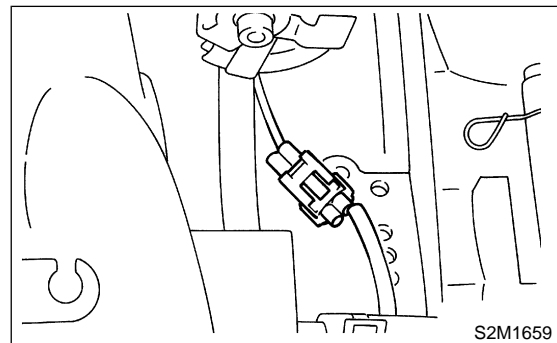
12) Remove air cleaner case stay RH and engine harness bracket, and disconnect engine harness connectors from bulkhead harness connectors.



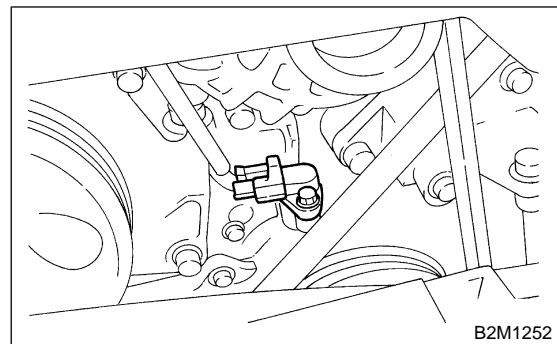
13) Disconnect connectors from engine coolant temperature sensor.



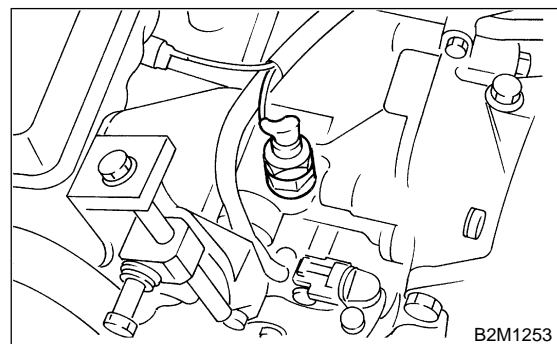
14) Disconnect knock sensor connector.



15) Disconnect connector from crankshaft position sensor.



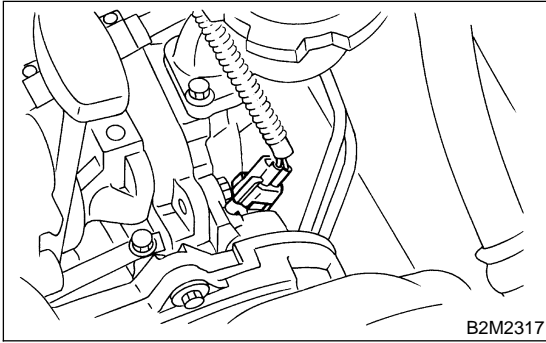
16) Disconnect connector from oil pressure switch.



INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

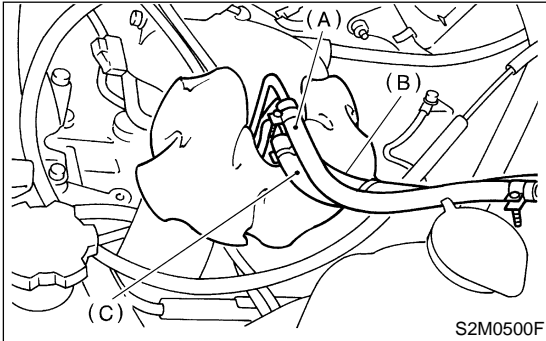
17) Disconnect connector from camshaft position sensor.



18) Disconnect fuel hoses from fuel pipes.

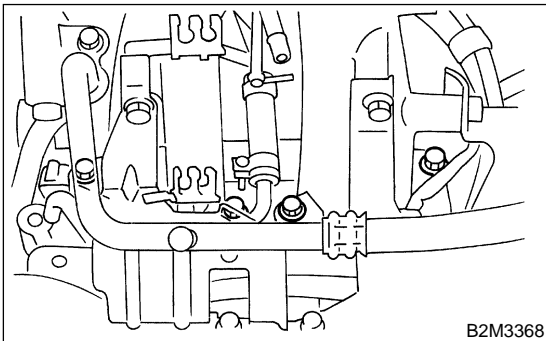
WARNING:

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

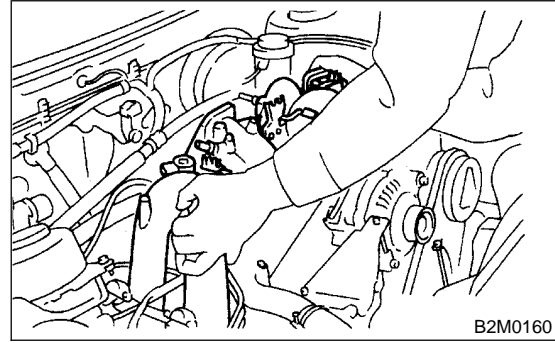


- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

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



20) Remove intake manifold.



B: INSTALLATION

S105034A11

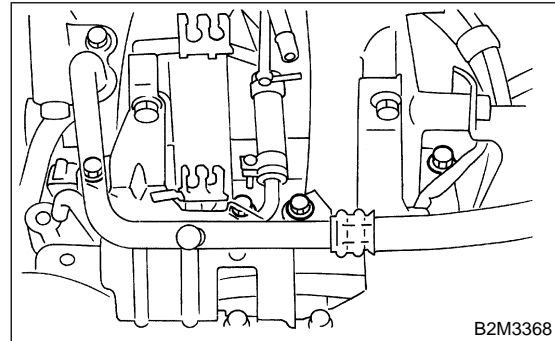
1) Install intake manifold onto cylinder heads.

CAUTION:

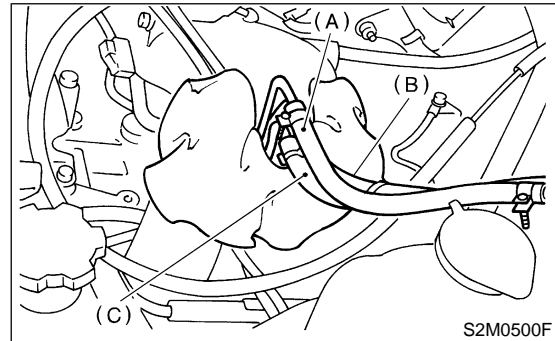
Always use new gaskets.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



2) Connect fuel hoses.

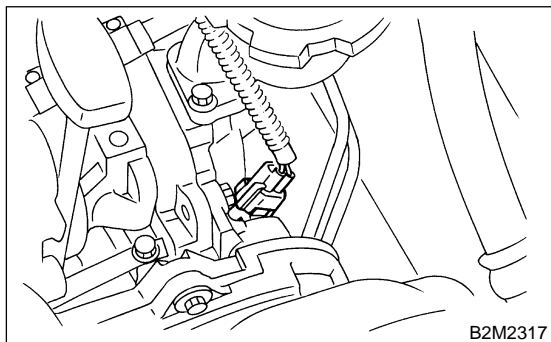


- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

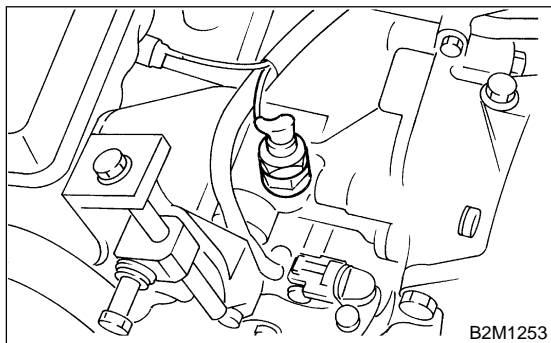
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

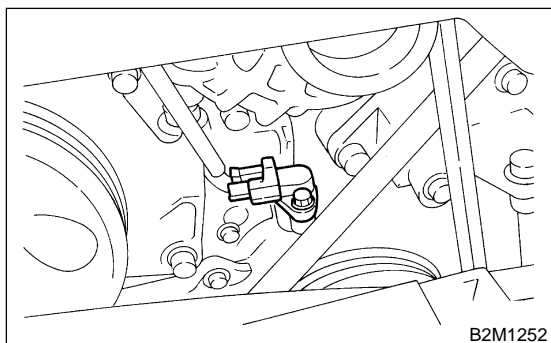
- 3) Connect connector to camshaft position sensor.



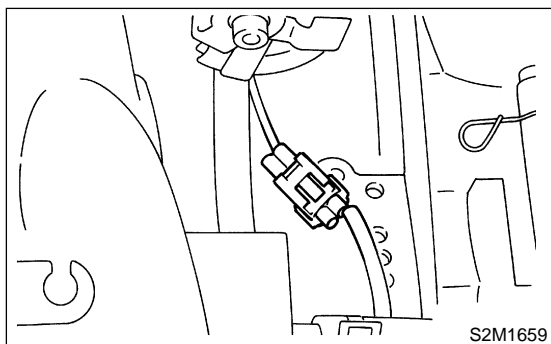
- 4) Connect connector to oil pressure switch.



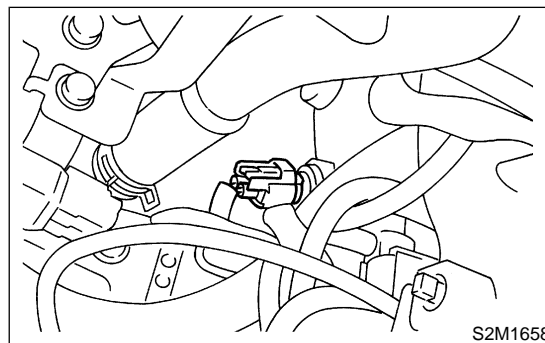
- 5) Connect connector to crankshaft position sensor.



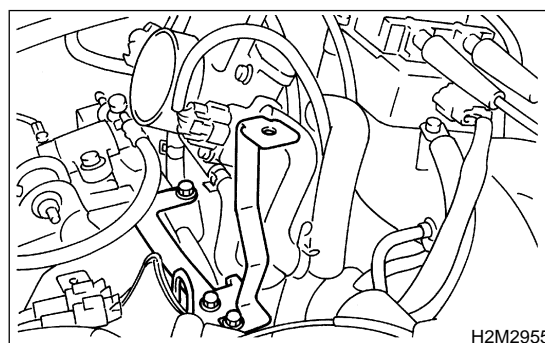
- 6) Connect knock sensor connector.



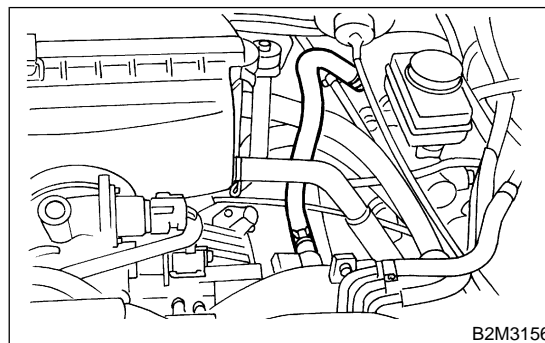
- 7) Connect connectors to engine coolant temperature sensor.



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



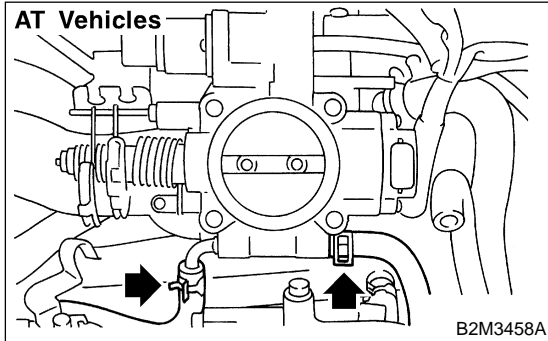
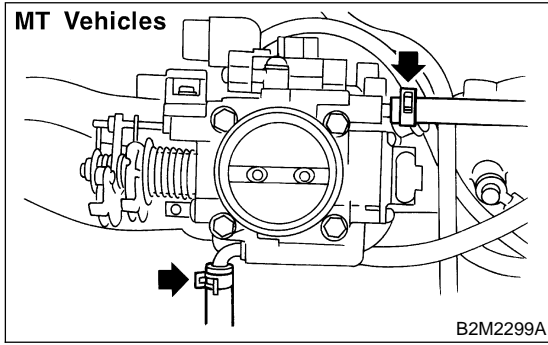
- 9) Connect brake booster hose.



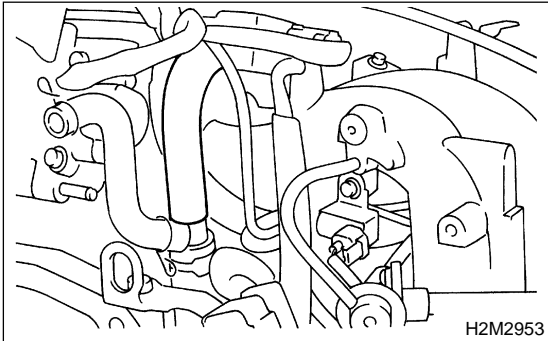
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

10) Connect engine coolant hose to throttle body.



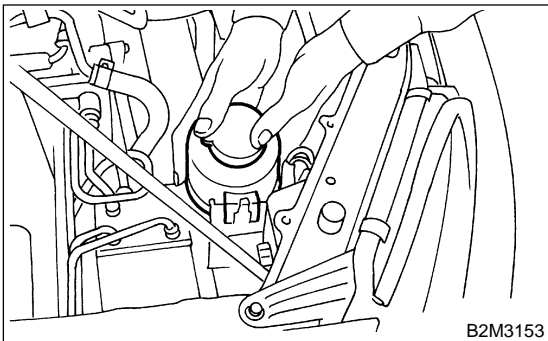
11) Connect PCV hose to intake manifold.



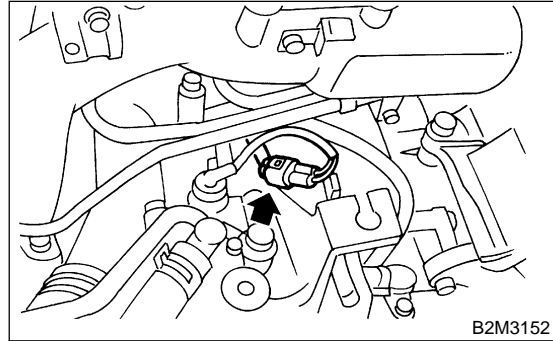
12) Connect spark plug cords to spark plugs.

13) Install power steering pump and tank on brackets.

(1) Install power steering tank on bracket.



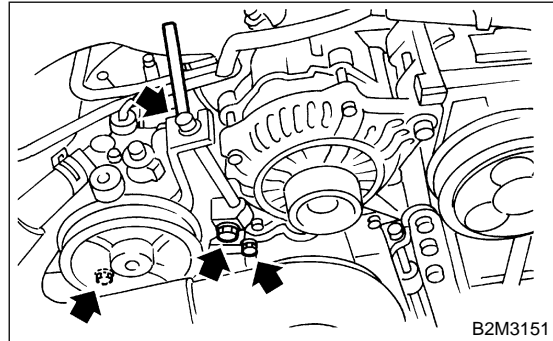
(2) Connect connector to power steering pump switch.



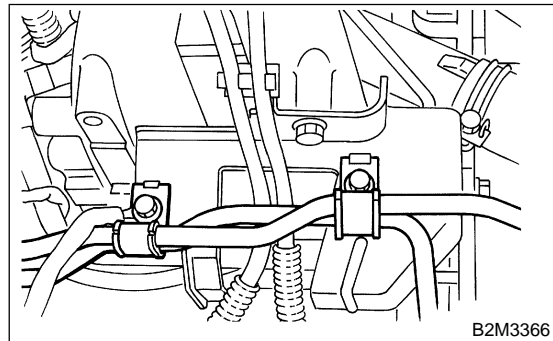
(3) Tighten bolts which install power steering pump on bracket.

Tightening torque:

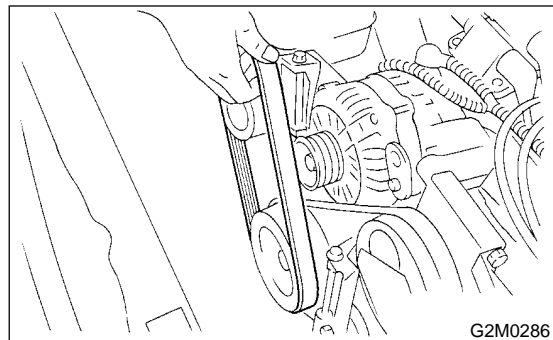
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



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

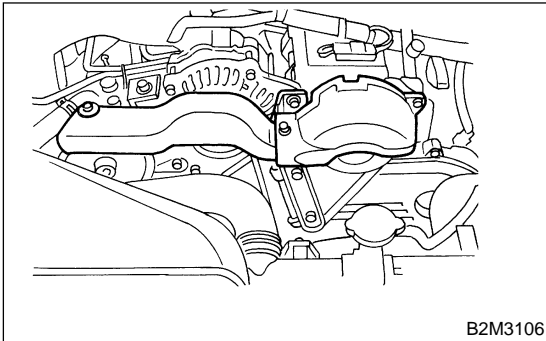


(5) Install power steering pump drive V-belt.



(6) Adjust V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>

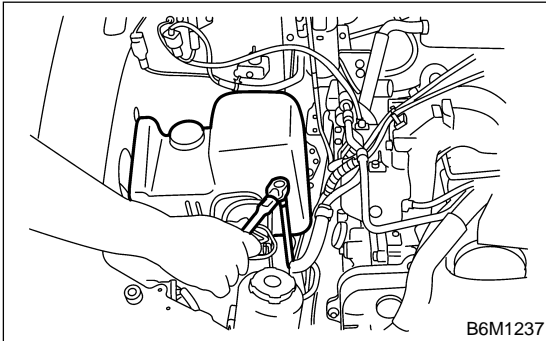
(7) Install V-belt covers.



(8) Install resonator chamber.

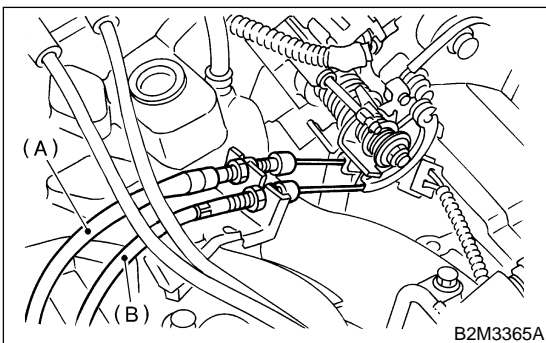
Tightening torque:

33 N·m (3.4 kgf-m, 24.6 ft-lb)

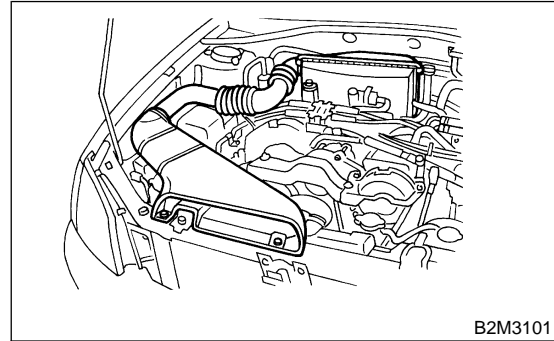


14) Connect accelerator cable (A).

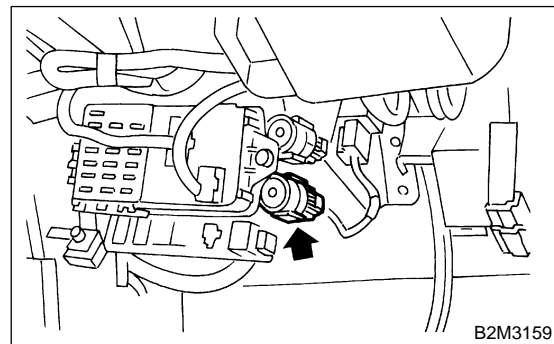
15) Connect cruise control cable (B). (With cruise control models)



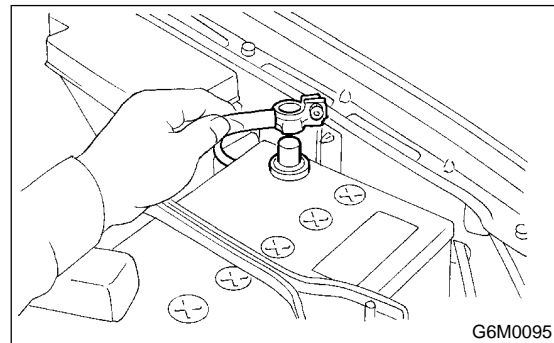
16) Install air intake duct and air cleaner assembly. <Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.> and <Ref. to IN(H4)-6 REMOVAL, Air Cleaner Case.>



17) Connect connector to fuel pump relay.



18) Connect battery ground cable.



INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

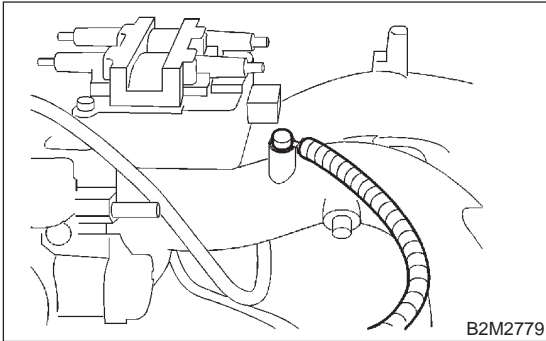
C: DISASSEMBLY

S105034A06

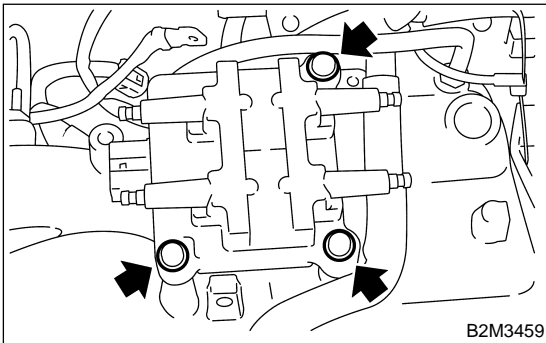
1. MT VEHICLES

S105034A0601

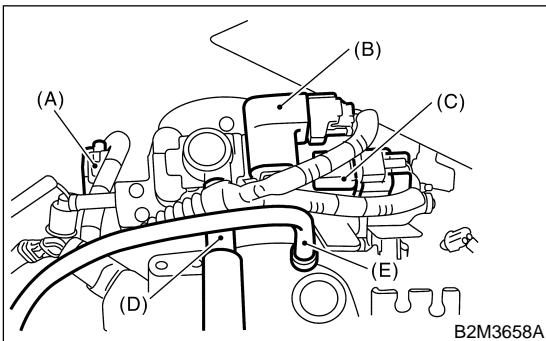
- 1) Disconnect engine ground terminal from intake manifold.



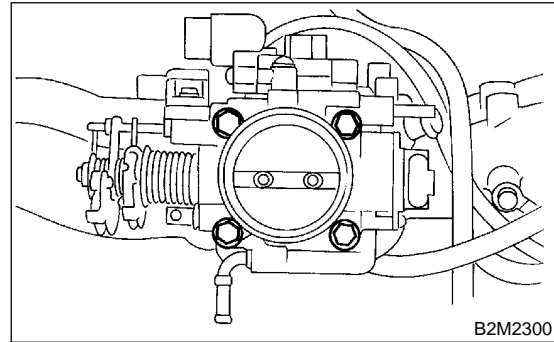
- 2) Disconnect connector from ignition coil and ignitor assembly.
- 3) Remove ignition coil and ignitor assembly.



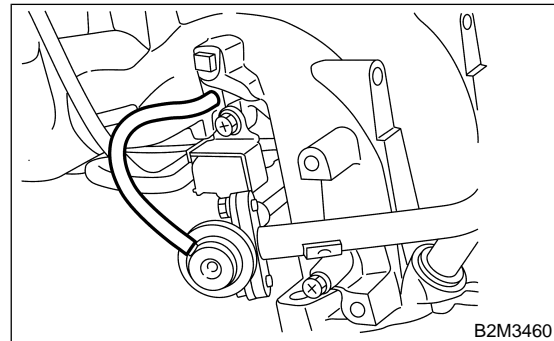
- 4) Disconnect connectors from throttle position sensor (A), idle air control solenoid valve (B) and intake manifold pressure sensor (C).
- 5) Disconnect air by-pass hose (D) from idle air control solenoid valve.
- 6) Disconnect air by-pass hose (E) from intake manifold.



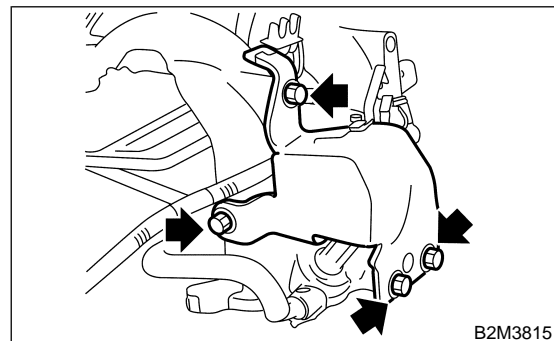
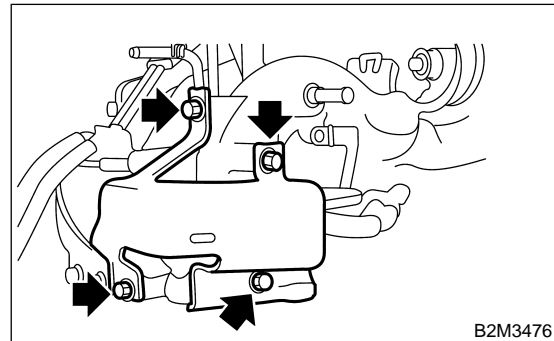
- 7) Remove throttle body.



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



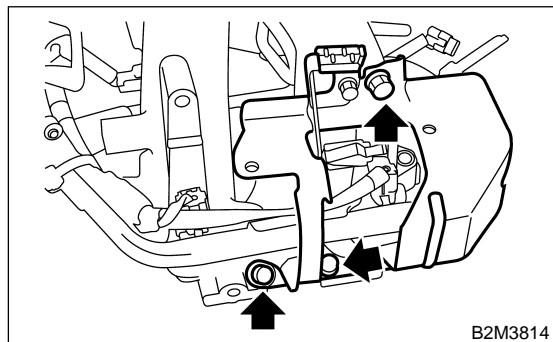
- 9) Remove fuel pipe protector LH.



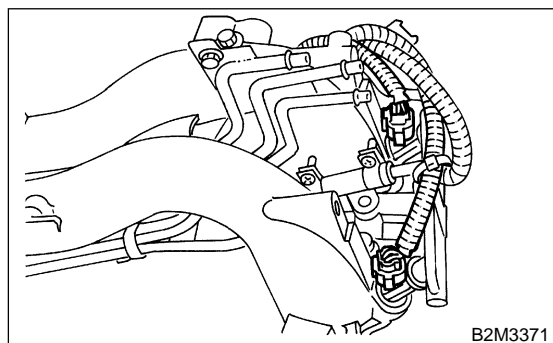
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

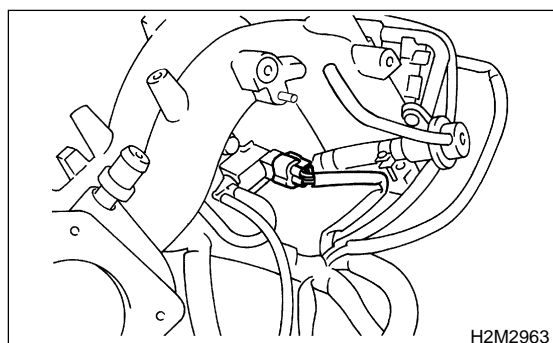
- 10) Remove fuel pipe protector RH.



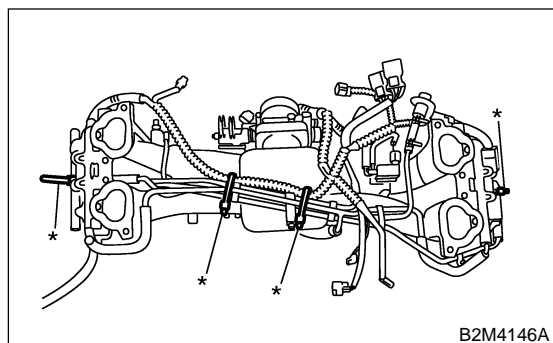
- 11) Disconnect connectors from fuel injectors.



- 12) Disconnect connector from purge control solenoid valve.

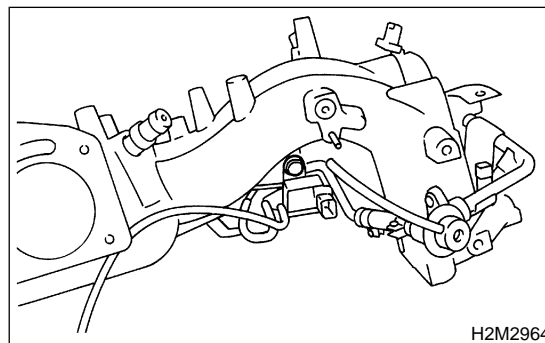


- 13) Remove harness bands (*) which hold engine harness onto intake manifold.

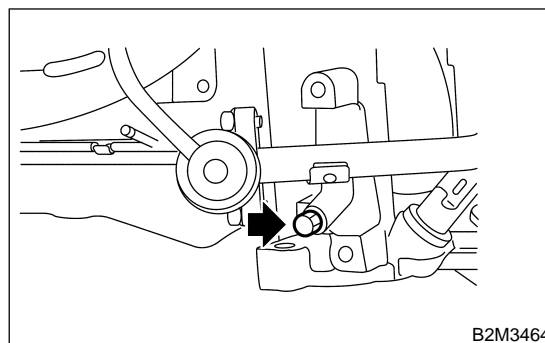


- 14) Remove engine harness from intake manifold.

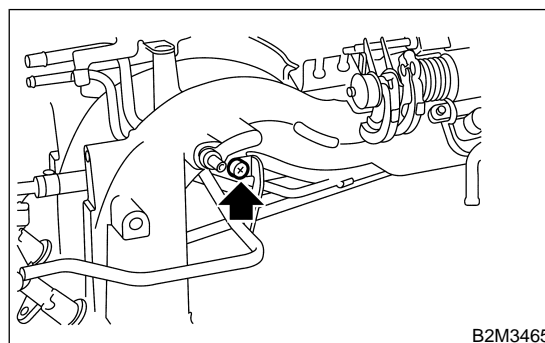
- 15) Remove purge control solenoid valve.



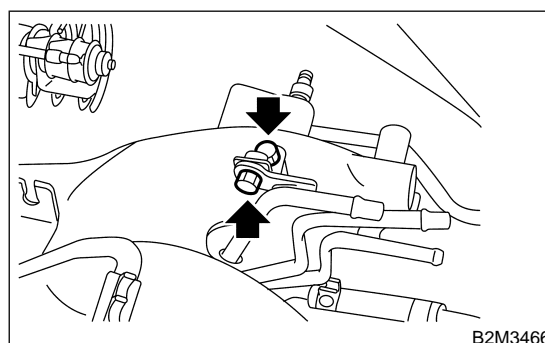
- 16) Remove bolt which installs injector pipe on intake manifold as shown in figure.



- 17) Remove bolt which installs injector pipe on intake manifold.



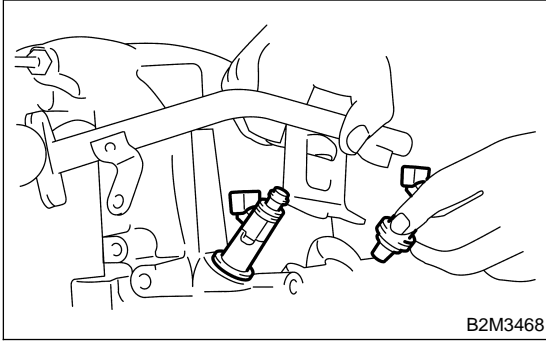
- 18) Remove two bolts which hold fuel pipes on the left side of intake manifold.



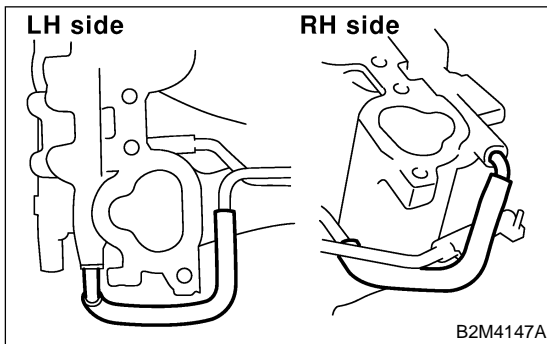
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

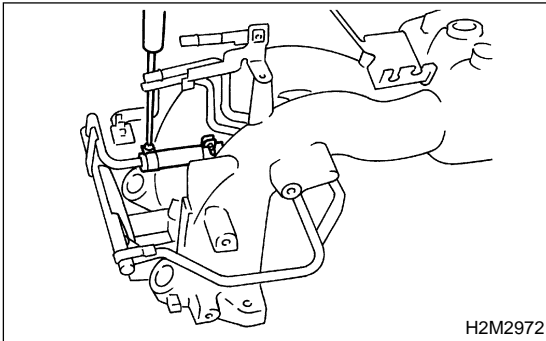
19) Remove fuel injector while lifting up fuel injector pipe.



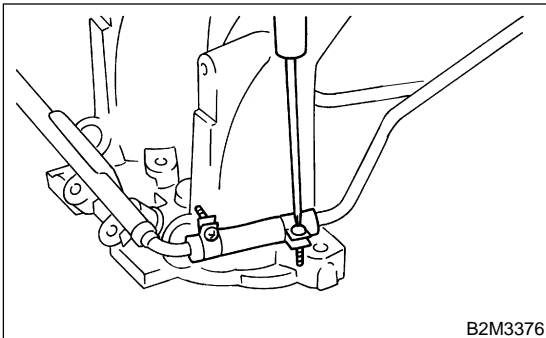
20) Disconnect air by-pass hoses from intake manifold.



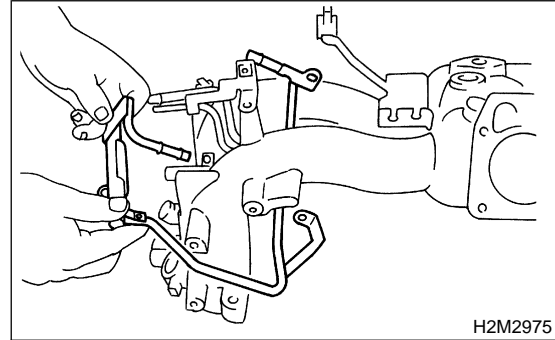
21) Loosen clamp which holds front left side fuel hose to injector pipe and remove the pipe from clamp.



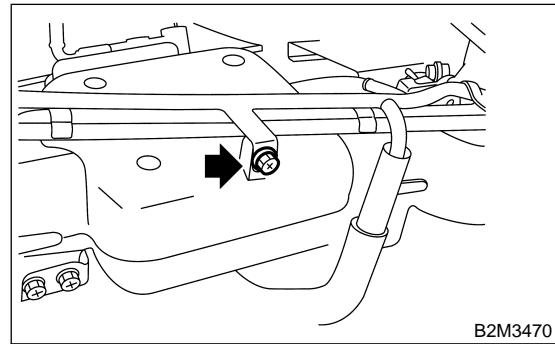
22) Loosen clamp which holds front right side fuel hose to injector pipe and remove the pipe from clamp.



23) Remove fuel injector pipe.



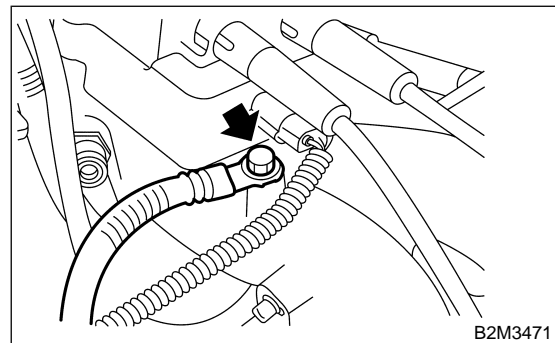
24) Remove bolt which installs fuel pipes on intake manifold.



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

2. AT VEHICLES S105034A0602

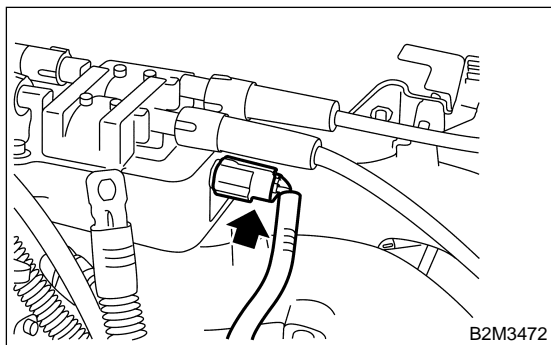
1) Disconnect engine ground terminal from intake manifold.



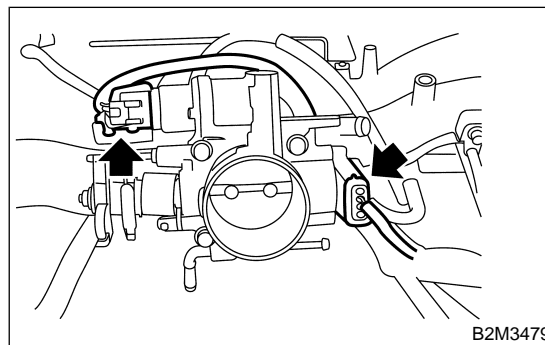
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

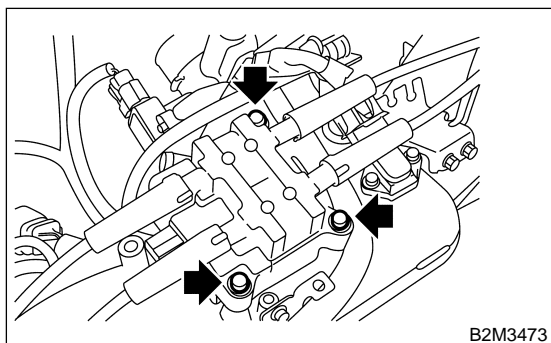
2) Disconnect connector from ignition coil and ignitor assembly.



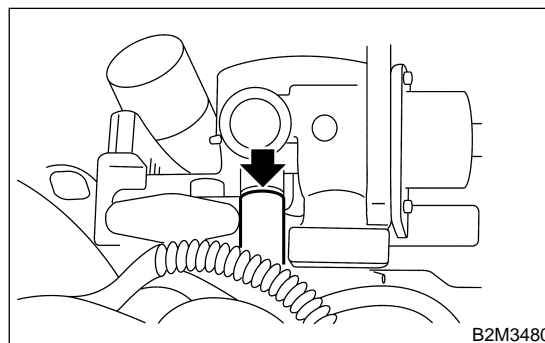
6) Disconnect connectors from throttle position sensor and idle air control solenoid valve.



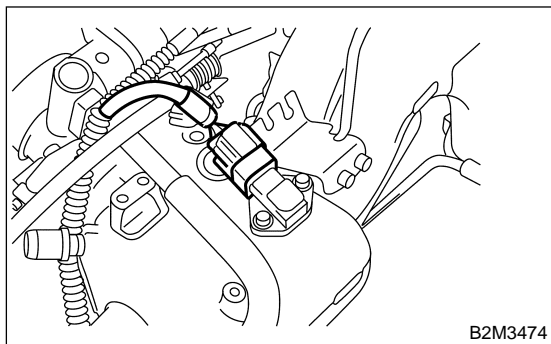
3) Remove ignition coil and ignitor assembly.



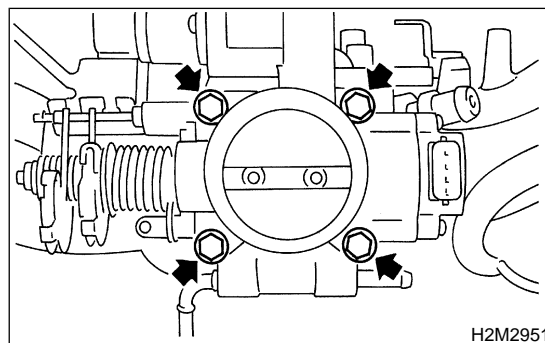
7) Disconnect air by-pass hose from throttle body.



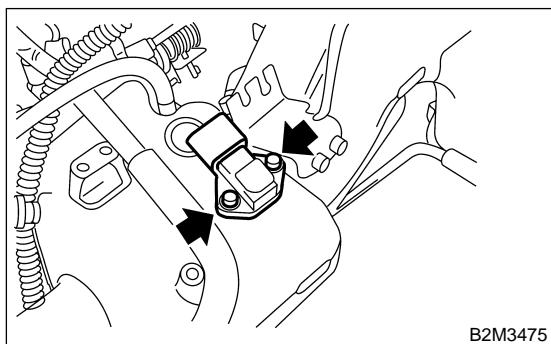
4) Disconnect connector from intake air temperature and pressure sensor.



8) Remove throttle body.

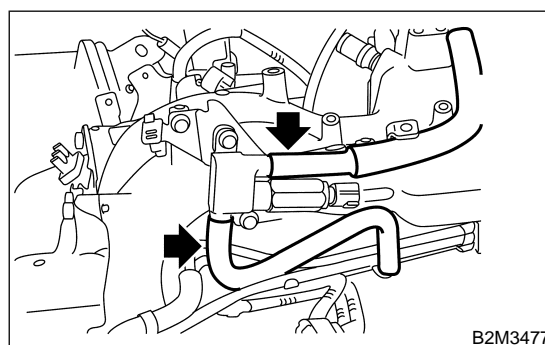


5) Remove intake air temperature and pressure sensor from intake manifold.



9) Disconnect connector from air assist injector solenoid valve.

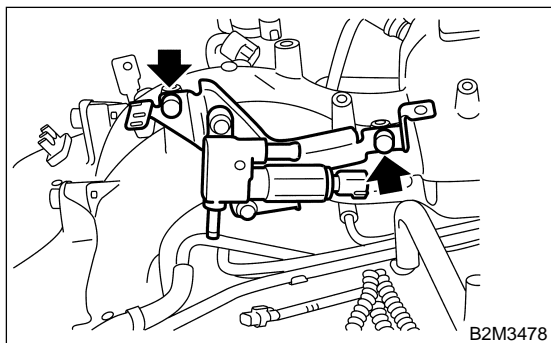
10) Disconnect air by-pass hoses from air assist solenoid valve.



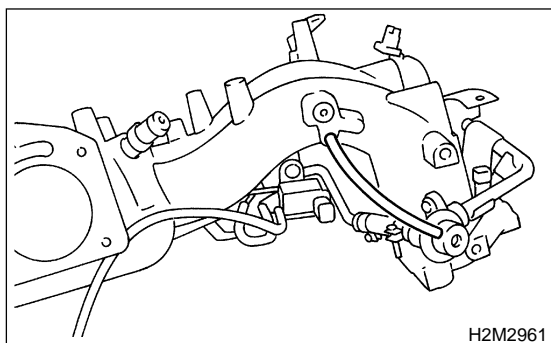
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

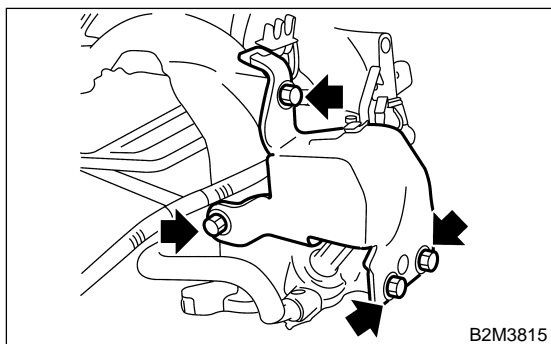
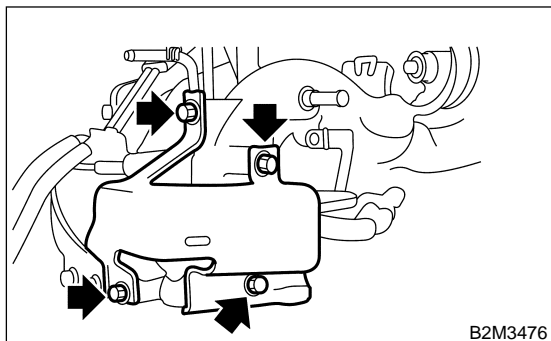
11) Remove air assist injector solenoid valve from intake manifold.



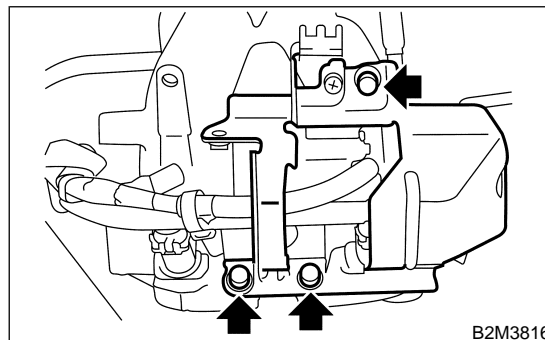
12) Disconnect pressure regulator vacuum hose from intake manifold.



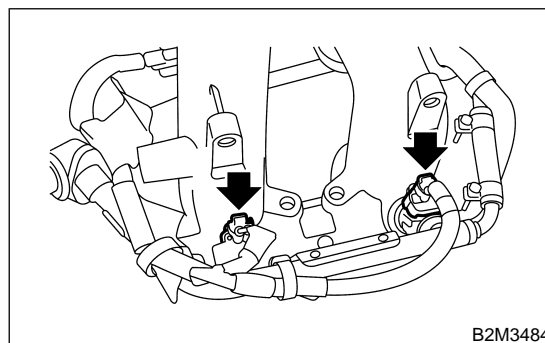
13) Remove fuel pipe protector LH.



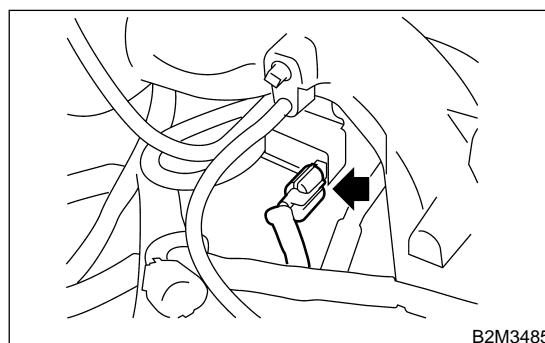
14) Remove fuel pipe protector RH.



15) Disconnect connectors from fuel injectors.

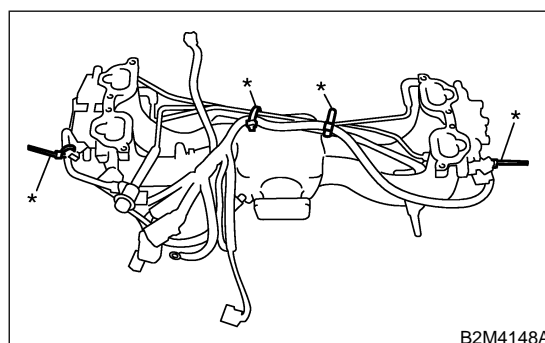


16) Disconnect connector from purge control solenoid valve.



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

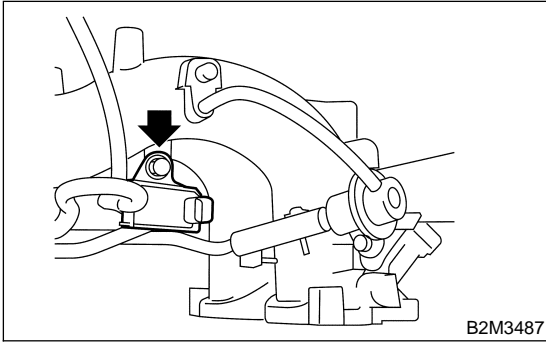
18) Remove harness bands (*) which hold engine harness onto intake manifold.



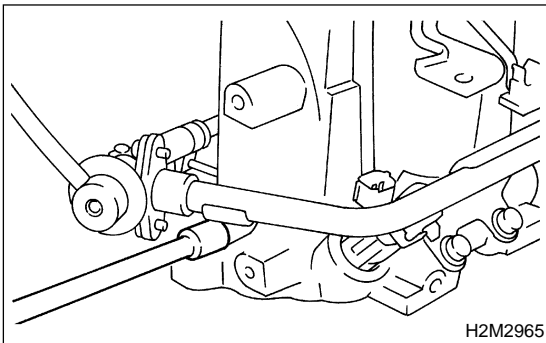
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

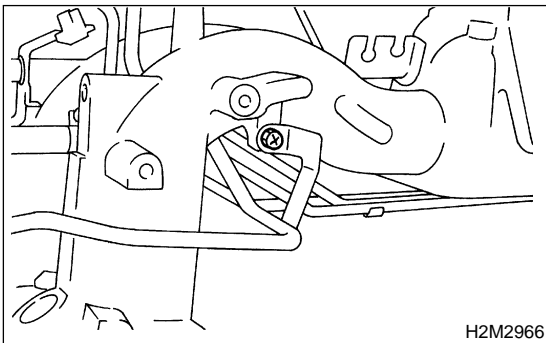
- 19) Remove engine harness from intake manifold.
20) Remove purge control solenoid valve.



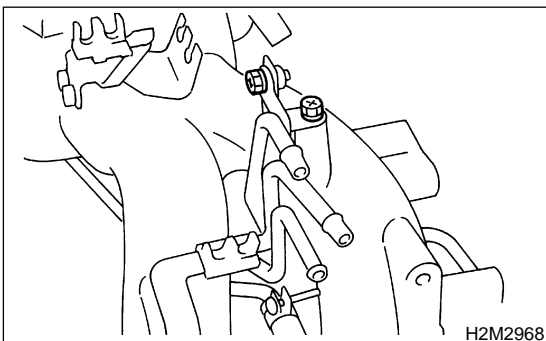
- 21) Remove bolt which installs injector pipe on intake manifold as shown in figure.



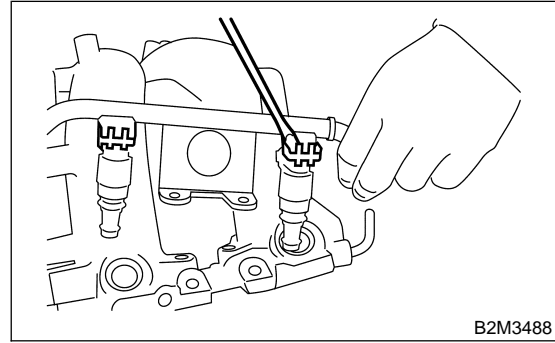
- 22) Remove bolt which installs injector pipe on intake manifold.



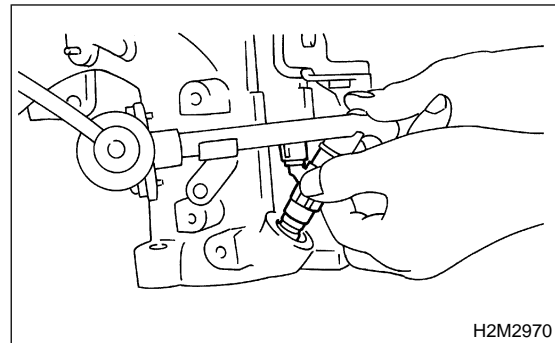
- 23) Remove two bolts which hold fuel pipes on the left side of intake manifold.



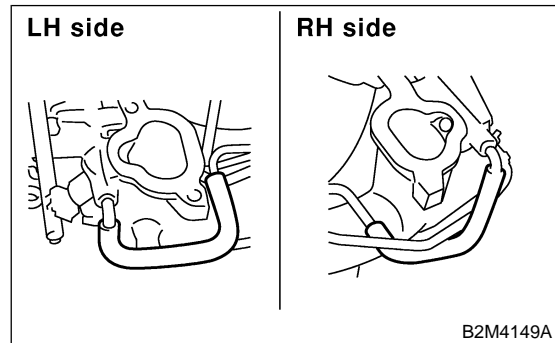
- 24) Remove fuel injectors.
(1) Remove fuel injector securing clip.



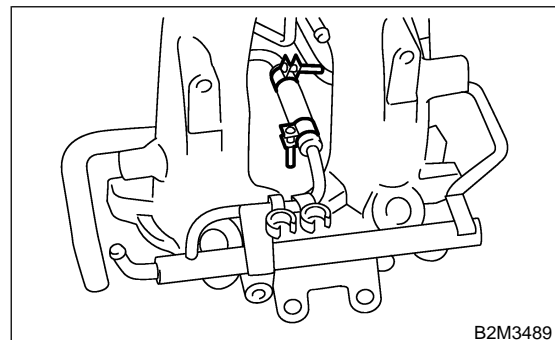
- (2) Remove fuel injector while lifting up fuel injector pipe.



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



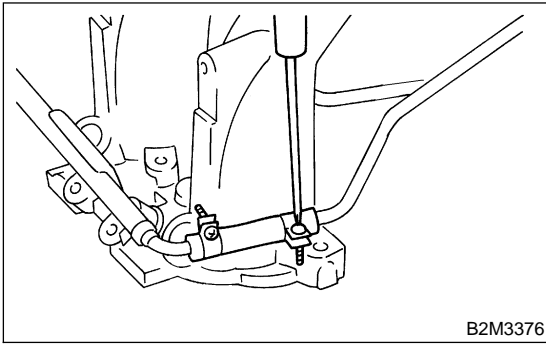
- 26) Loosen clamp which holds front left side fuel hose to injector pipe and remove the pipe from clamp.



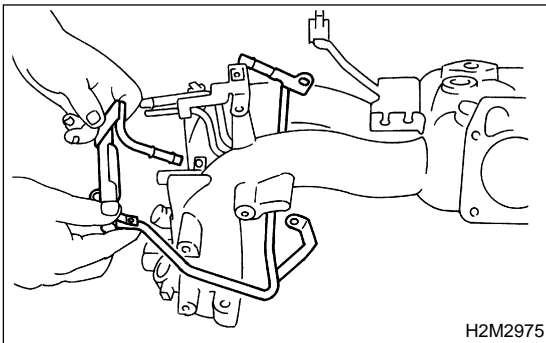
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

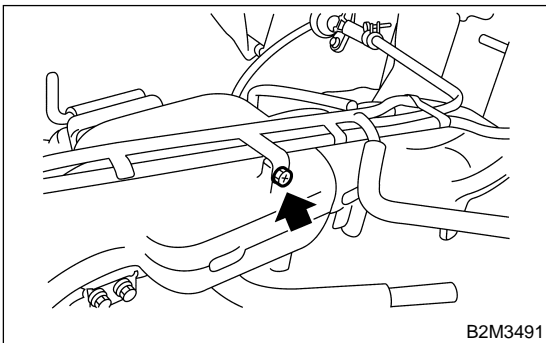
27) Loosen clamp which holds front right side fuel hose to injector pipe and remove the pipe from clamp.



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 S105034A02

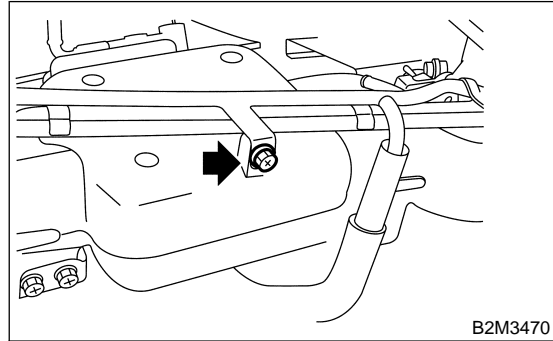
1. MT VEHICLES S105034A0201

1) Install fuel pipe assembly and pressure regulator, etc. to intake manifold.

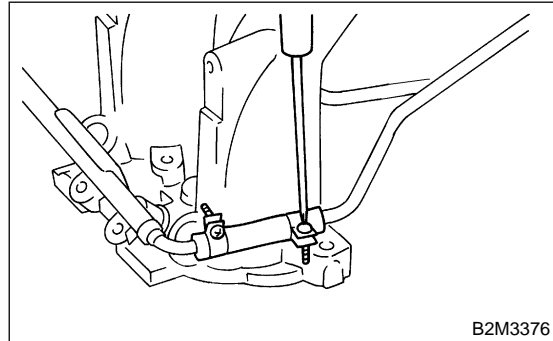
2) Tighten bolt which installs fuel pipes on intake manifold.

Tightening torque:

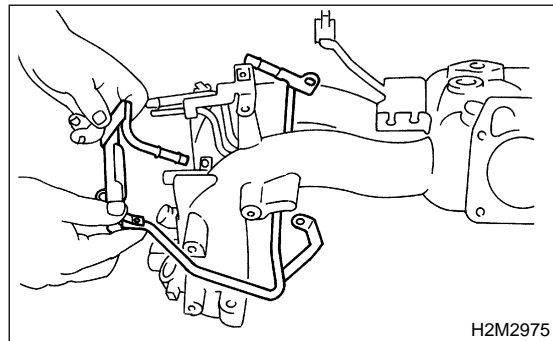
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



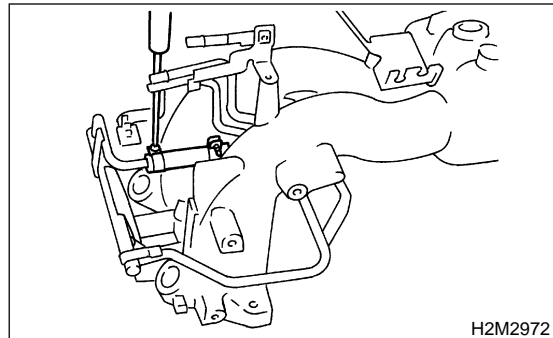
3) Connect right side fuel hose to injector pipe, and tighten clamp screw.



4) Install fuel injector pipe.



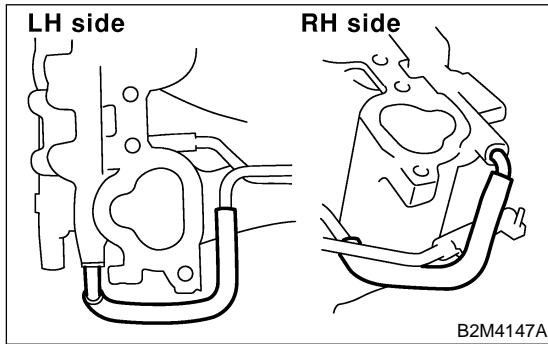
5) Connect left side fuel hose to injector pipe, and tighten clamp screw.



INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

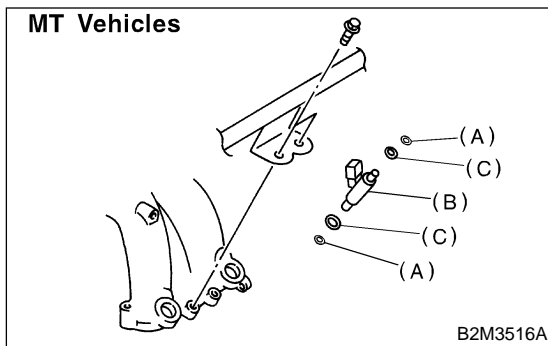
- 6) Connect air by-pass hoses.



- 7) Install fuel injectors.

CAUTION:

Always use new o-rings and insulators.

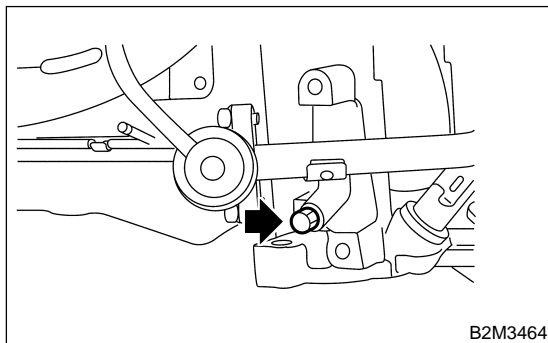


- (A) O-ring
- (B) Fuel injector
- (C) Insulator

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

Tightening torque:

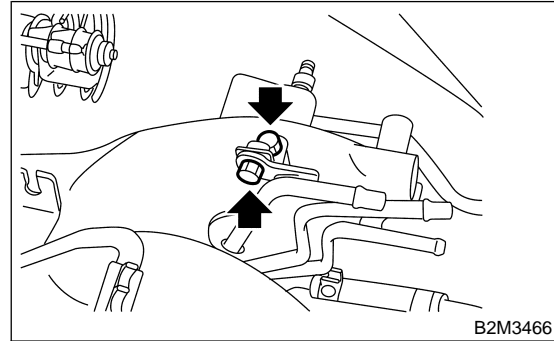
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



- 9) Tighten two bolts which install fuel pipes on the left side of intake manifold.

Tightening torque:

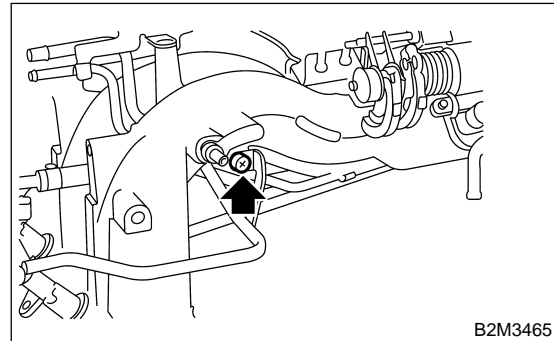
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



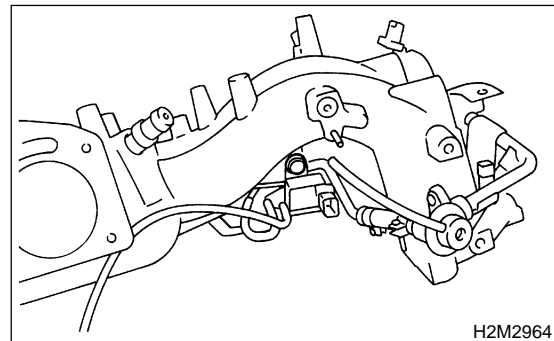
- 10) Tighten bolt which install injector pipe on intake manifold.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



- 11) Install purge control solenoid valve.



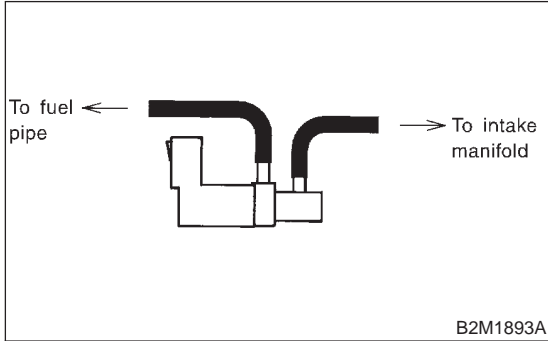
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

12) Connect hoses to purge control solenoid valve.

CAUTION:

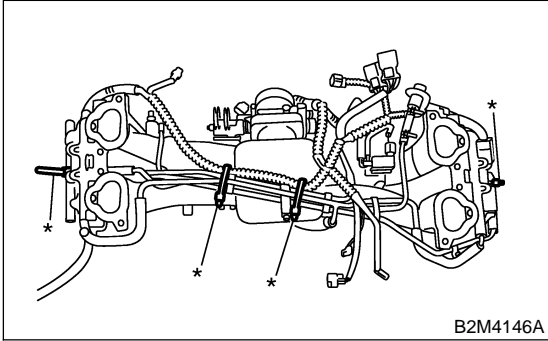
Carefully connect the evaporation hoses.



13) Install engine harness onto intake manifold.

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

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



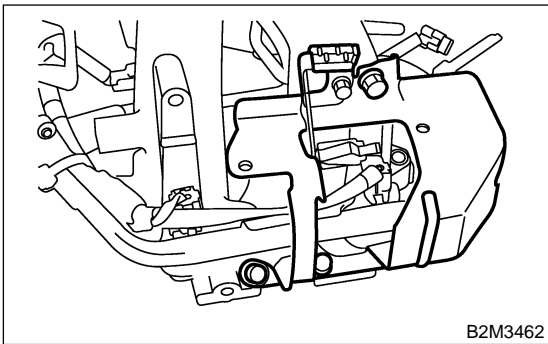
NOTE:

Do not use harness band on harnesses where they are supposed to be protected by the fuel pipe protector.

16) Install fuel pipe protector RH.

Tightening torque:

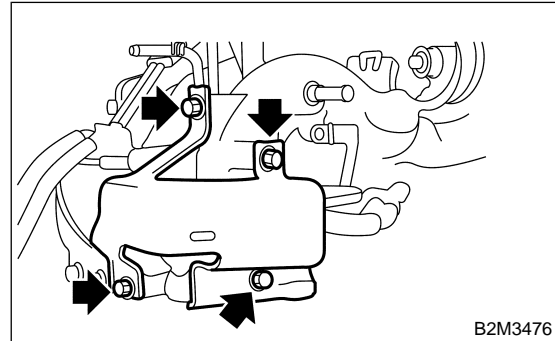
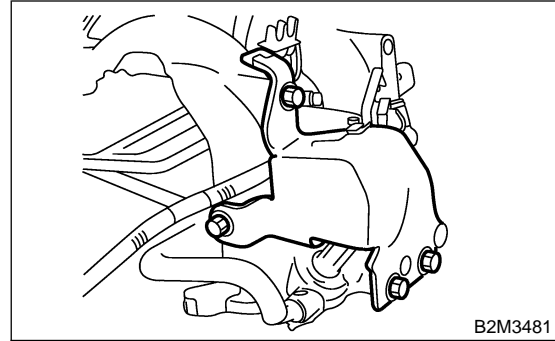
19 N·m (1.9 kgf-m, 13.7 ft-lb)



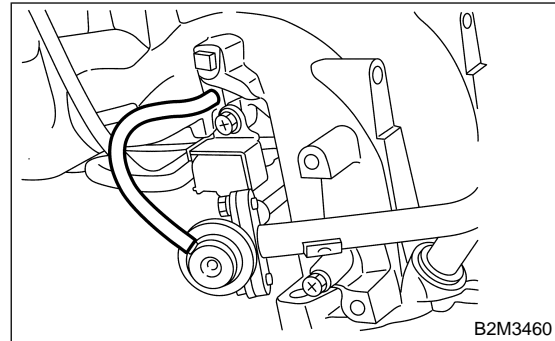
17) Install fuel pipe protector LH.

Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



18) Connect pressure regulator vacuum hose to intake manifold.



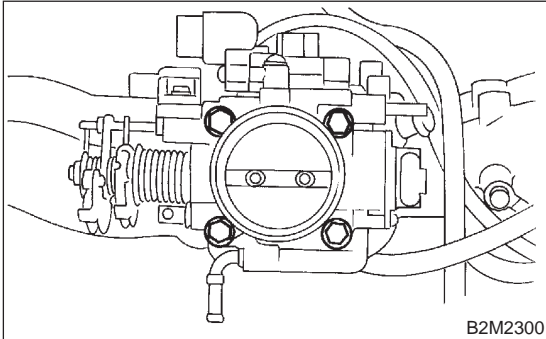
19) Install throttle body to intake manifold.

CAUTION:

Replace gasket with a new one.

Tightening torque:

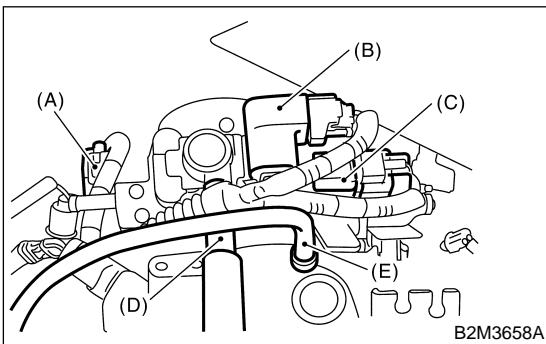
22 N·m (2.2 kgf-m, 15.9 ft-lb)



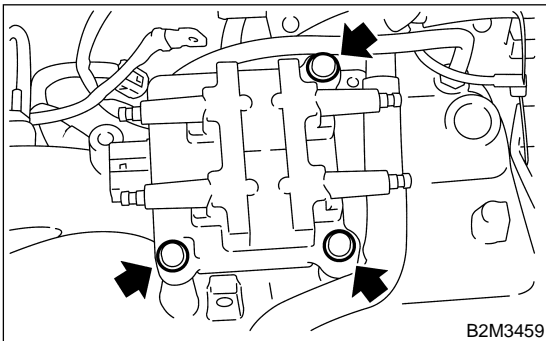
20) Connect connectors to throttle position sensor (A), idle air control solenoid valve (B) and intake manifold pressure sensor (C).

21) Connect air by-pass hose (D) to idle air control solenoid valve.

22) Connect air by-pass hose (E) to intake manifold.

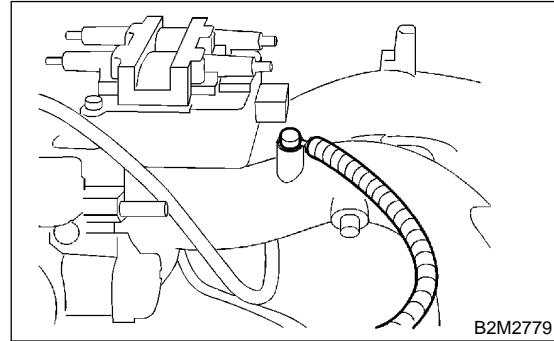


23) Install ignition coil and ignitor assembly.



24) Connect connector to ignition coil and ignitor assembly.

25) Install engine ground terminal to intake manifold.



2. AT VEHICLES

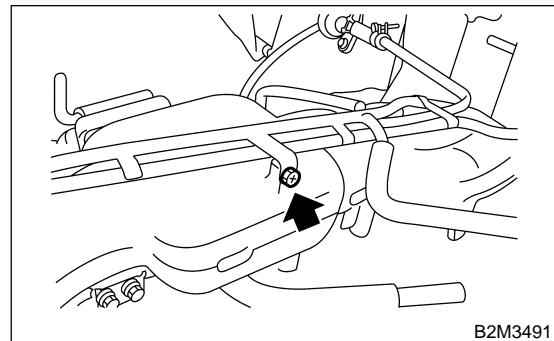
S105034A0202

1) Install fuel pipe assembly and pressure regulator, etc. to intake manifold.

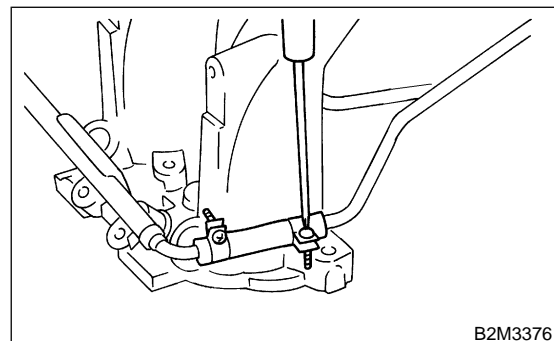
2) Tighten bolt which installs fuel pipes on intake manifold.

Tightening torque:

4.9 N·m (0.5 kgf-m, 3.6 ft-lb)



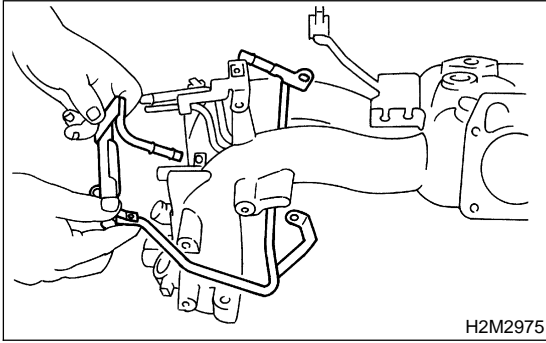
3) Connect right side fuel hose to injector pipe, and tighten clamp screw.



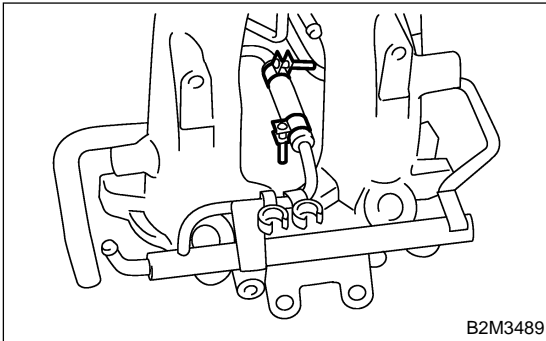
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

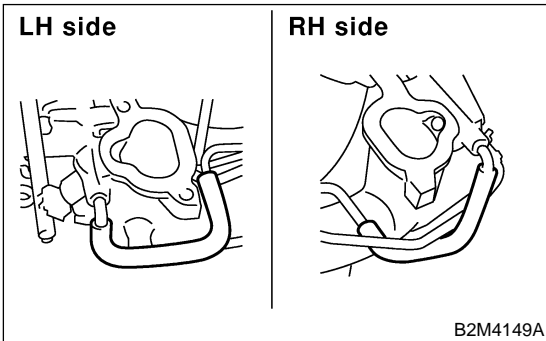
- 4) Install fuel injector pipe.



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

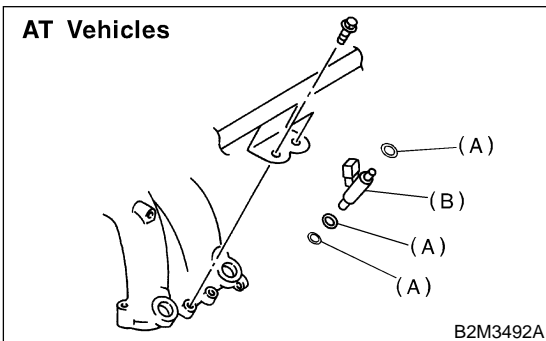


- 6) Connect air assist hoses.



- 7) Install fuel injectors.

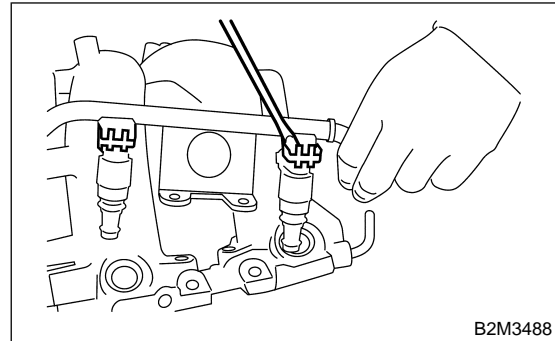
CAUTION:
Always use new o-rings.



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

NOTE:

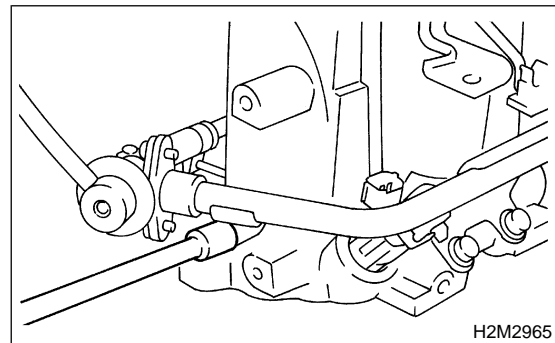
Do not forget to install the fuel injector securing clip.



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

Tightening torque:

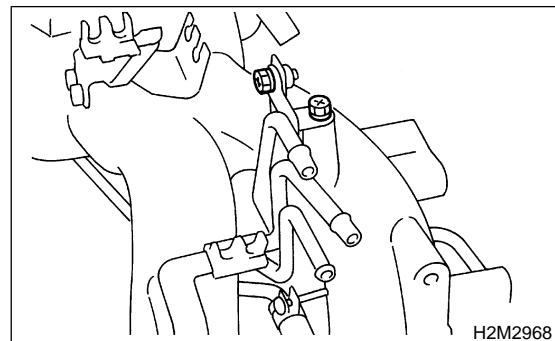
5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



- 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)



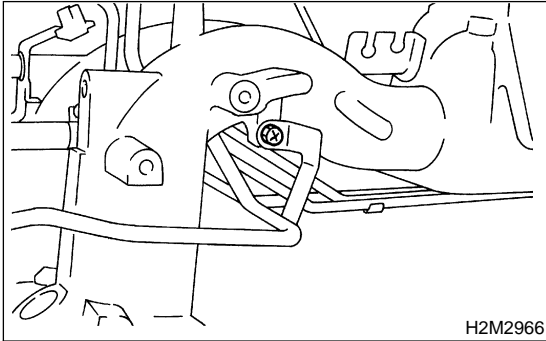
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

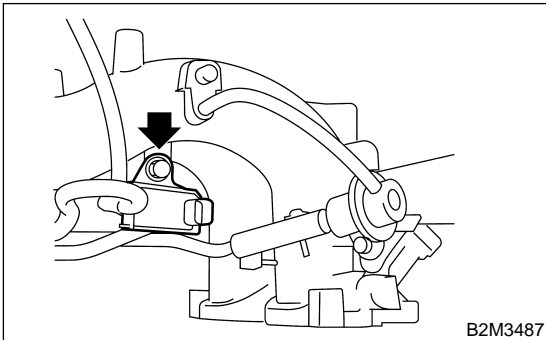
10) Tighten bolt which install injector pipe on intake manifold.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



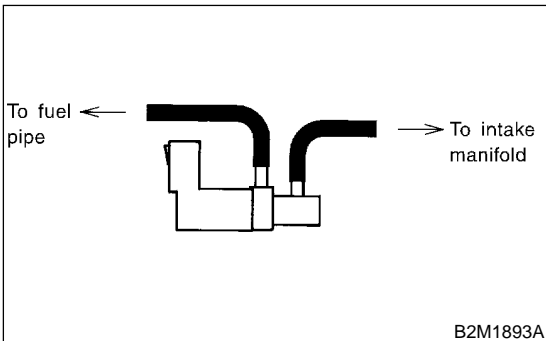
11) Install purge control solenoid valve.



12) Connect hoses to purge control solenoid valve.

CAUTION:

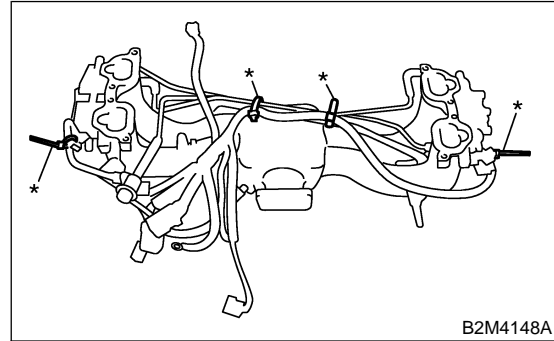
Carefully connect the evaporation hoses.



13) Install engine harness onto intake manifold.

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

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



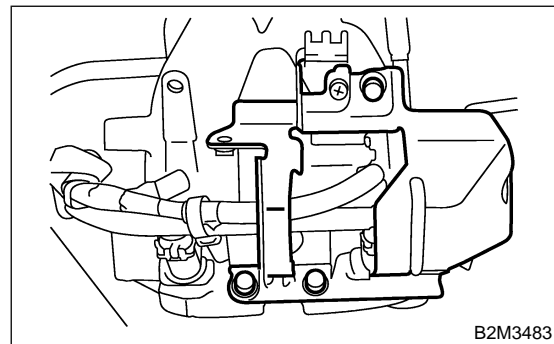
NOTE:

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)



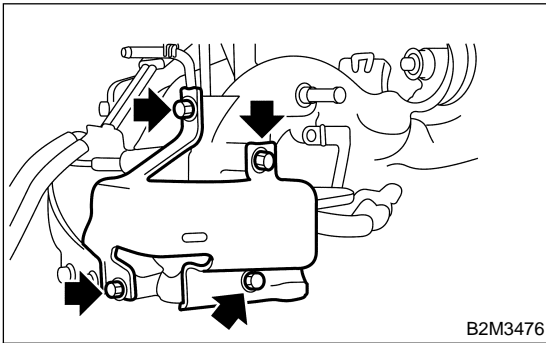
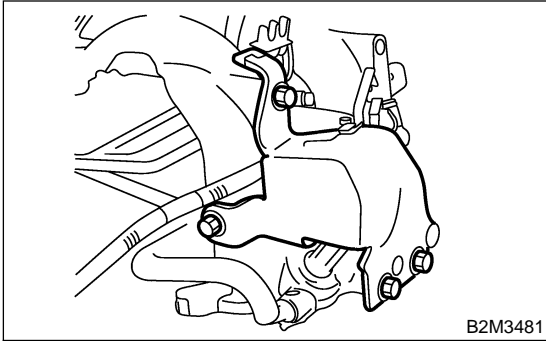
INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

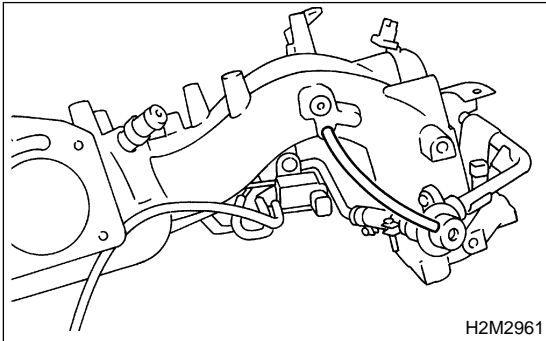
17) Install fuel pipe protector LH.

Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



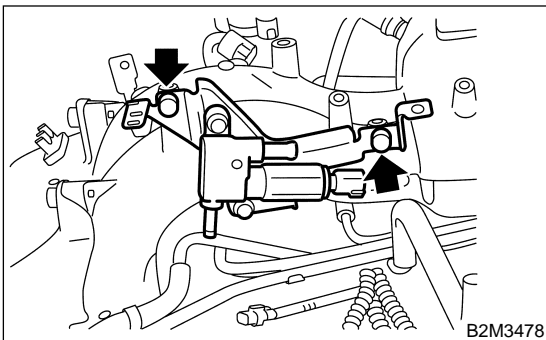
18) Connect pressure regulator vacuum hose to intake manifold.



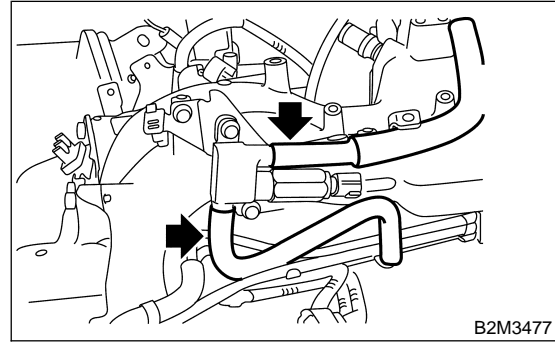
19) Install air assist injector solenoid valve to bracket.

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.

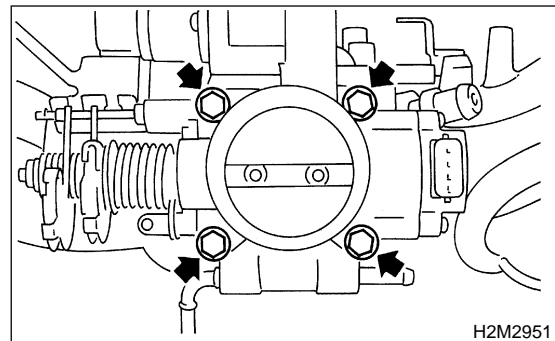
22) Install throttle body to intake manifold.

CAUTION:

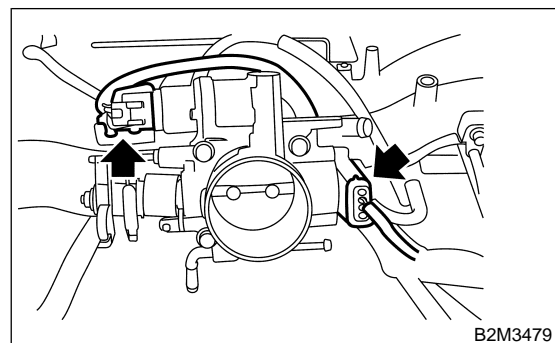
Replace gasket with a new one.

Tightening torque:

22 N·m (2.2 kgf-m, 15.9 ft-lb)



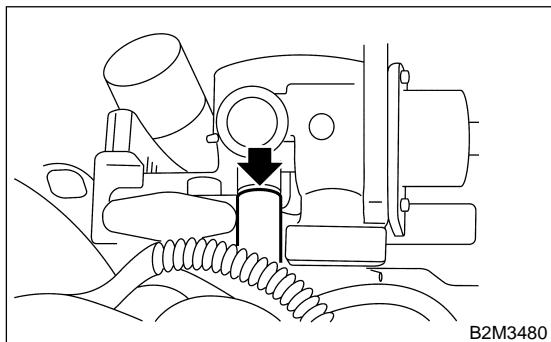
23) Connect connector to throttle position sensor and idle air control solenoid valve.



INTAKE MANIFOLD

Fuel Injection (Fuel Systems)

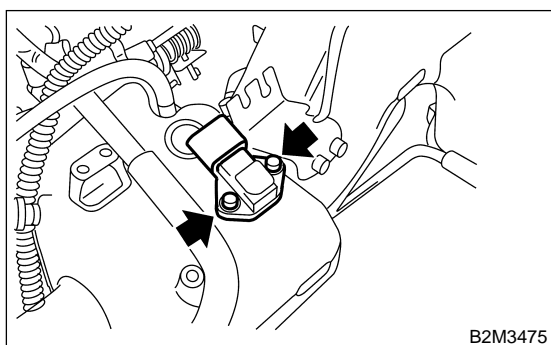
24) Connect air by-pass hose to throttle body.



25) Install intake air temperature and pressure sensor.

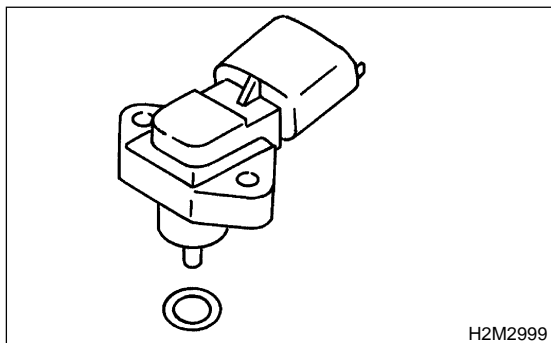
Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



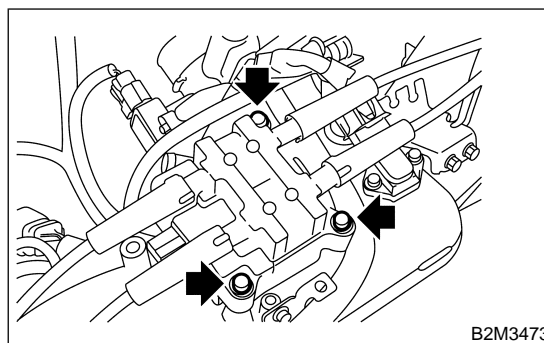
CAUTION:

Replace O-ring with new one.



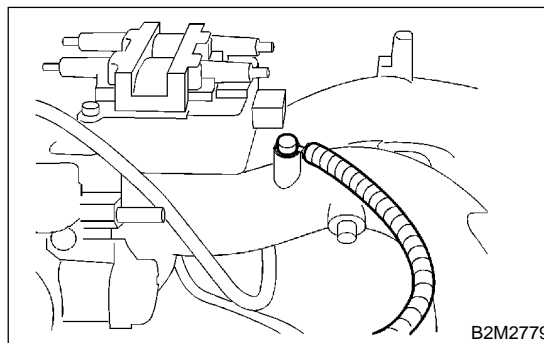
26) Connect connector to intake air temperature and pressure sensor.

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

S105034A10

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

ENGINE COOLANT TEMPERATURE SENSOR

Fuel Injection (Fuel Systems)

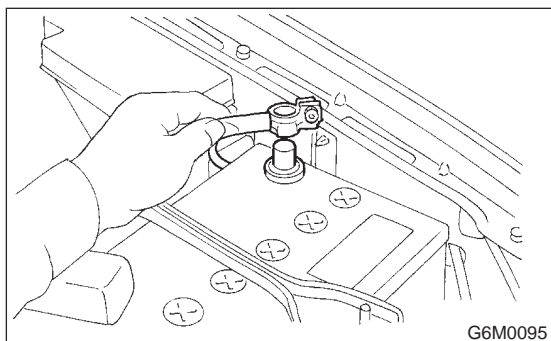
4. Engine Coolant Temperature Sensor

S105047

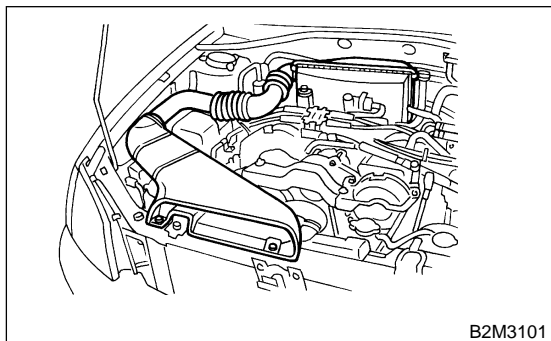
A: REMOVAL

S105047A18

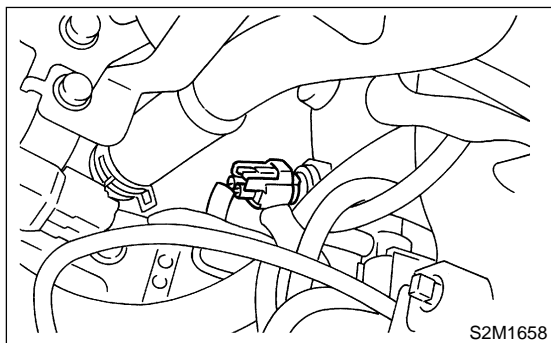
- 1) Disconnect battery ground cable.



- 2) Remove air intake duct and air cleaner assembly. <Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.> and <Ref. to IN(H4)-6 REMOVAL, Air Cleaner Case.>



- 3) Disconnect connector from engine coolant temperature sensor.



- 4) Remove engine coolant temperature sensor.

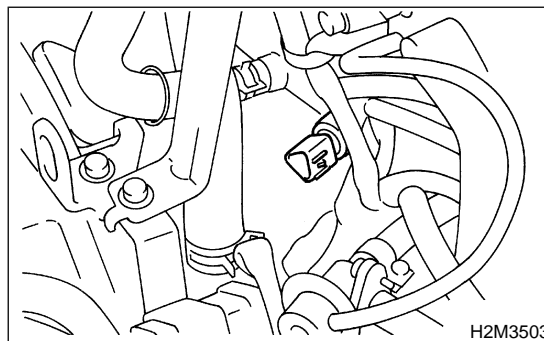
B: INSTALLATION

S105047A11

Install in the reverse order of removal.

Tightening torque:

16 N·m (0.16 kgf-m, 1.2 ft-lb)

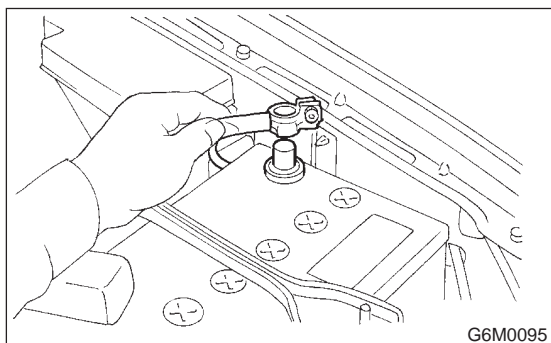


5. Crankshaft Position Sensor

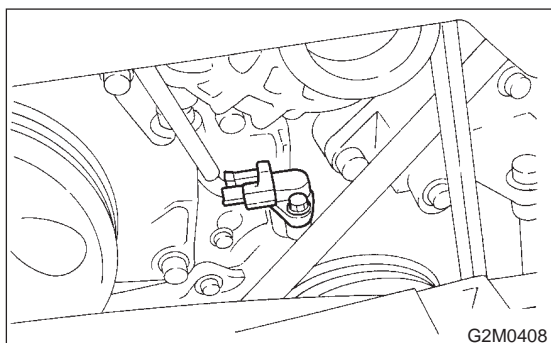
S105043

A: REMOVAL S105043A18

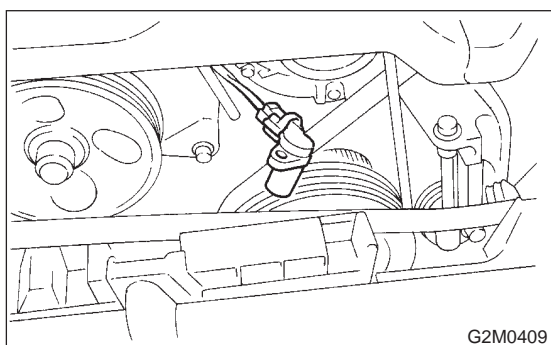
- 1) Disconnect battery ground cable.



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



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

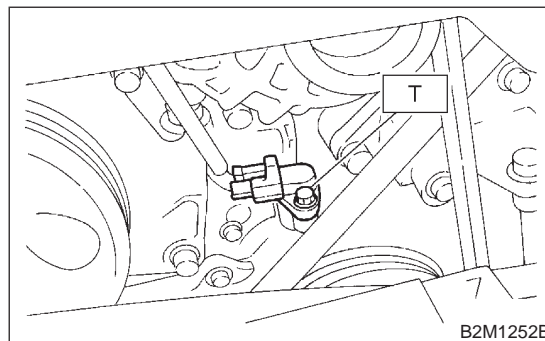


B: INSTALLATION S105043A11

Install in the reverse order of removal.

Tightening torque:

T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



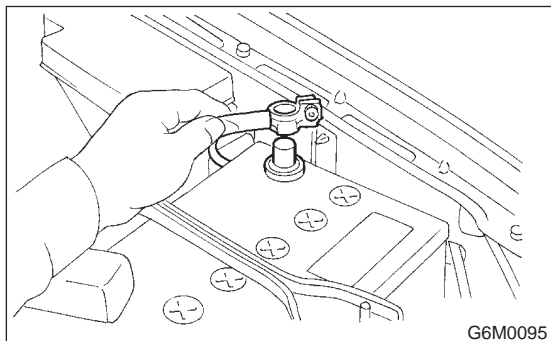
6. Camshaft Position Sensor

S105041

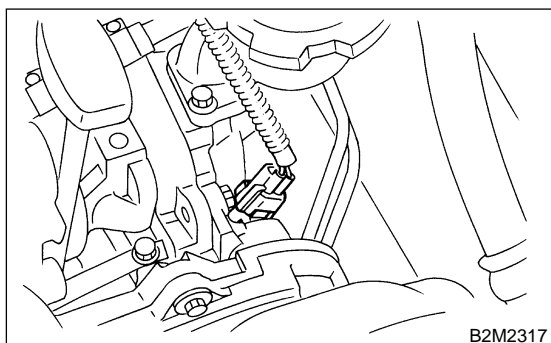
A: REMOVAL

S105041A18

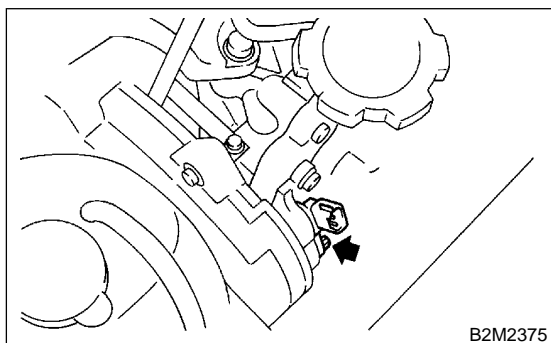
- 1) Disconnect battery ground cable.



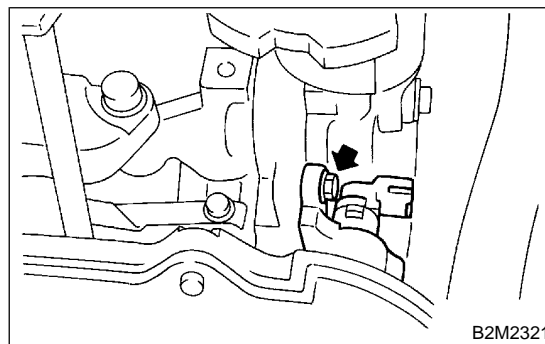
- 2) Disconnect connector from camshaft position sensor.



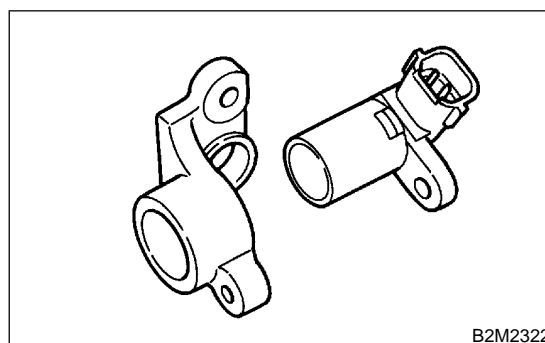
- 3) Remove bolt which installs camshaft position sensor to camshaft position sensor support.



- 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

S105041A11

Install in the reverse order of removal.

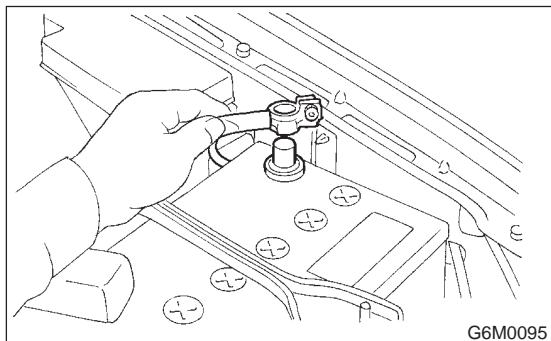
Tightening torque:

- 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)

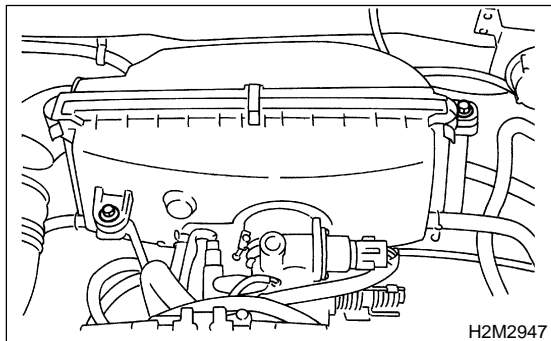
7. Knock Sensor S105042

A: REMOVAL S105042A18

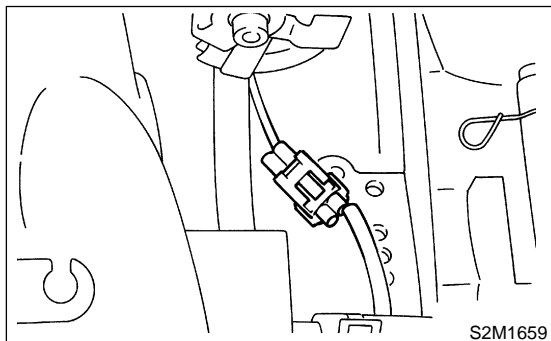
- 1) Disconnect battery ground cable from battery ground terminal.



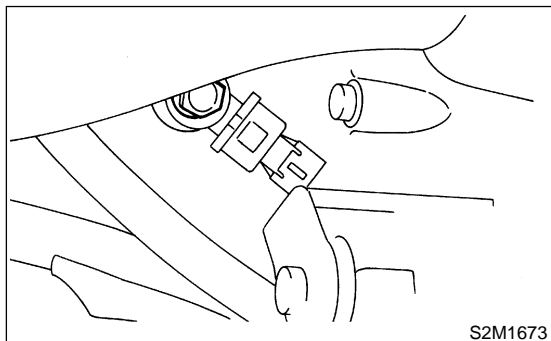
- 2) Remove air cleaner case.



- 3) Disconnect knock sensor connector.



- 4) Remove knock sensor from cylinder block.



B: INSTALLATION S105042A11

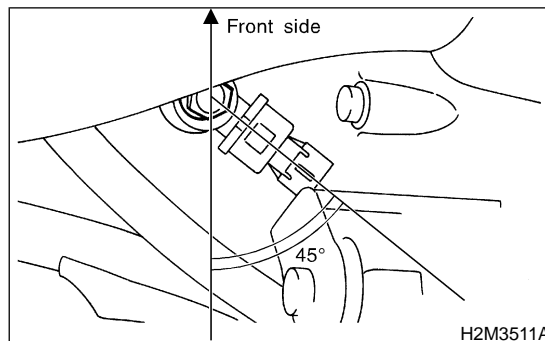
- 1) Install knock sensor to cylinder block.

Tightening torque:

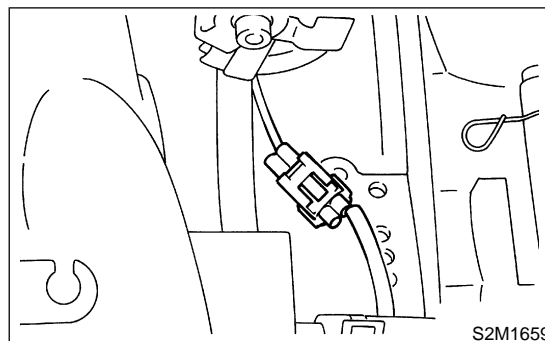
24 N·m (2.4 kgf-m, 17.4 ft-lb)

NOTE:

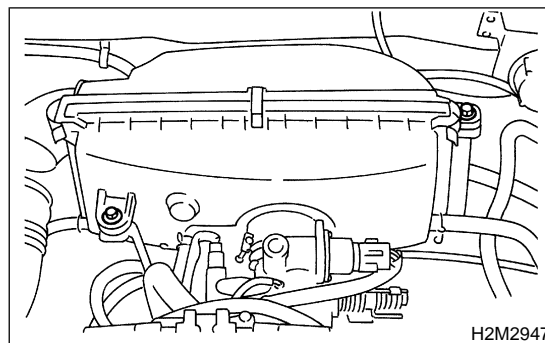
The extraction area of the knock sensor cord must be positioned at a 45° angle relative to the engine rear.



- 2) Connect knock sensor connector.



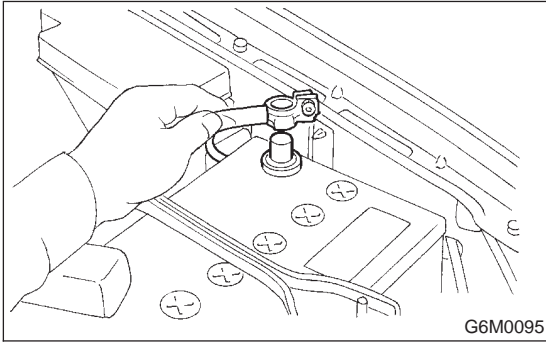
- 3) Install air cleaner case.



KNOCK SENSOR

Fuel Injection (Fuel Systems)

4) Connect battery ground cable.

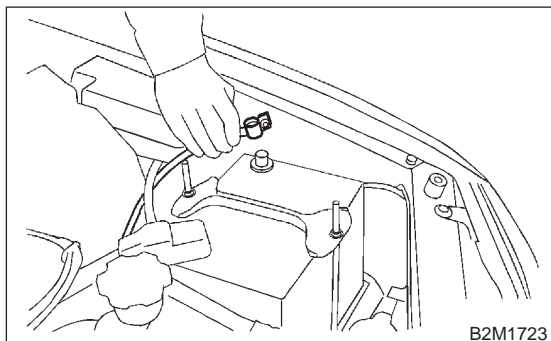


8. Throttle Position Sensor S105039

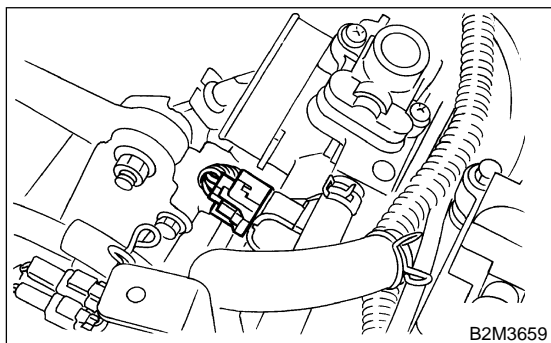
A: REMOVAL S105039A18

1. MT VEHICLES S105039A1801

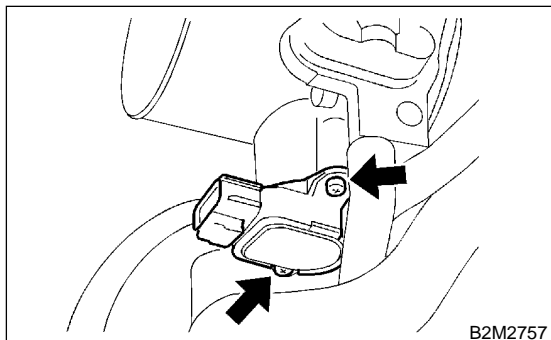
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from throttle position sensor.

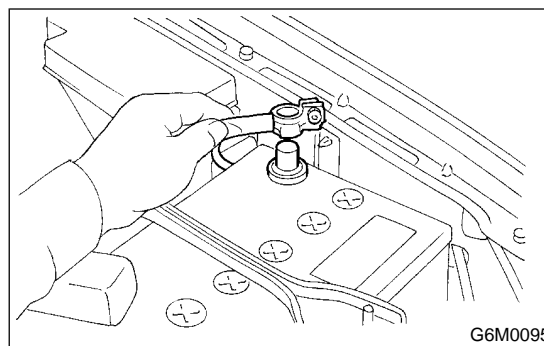


- 3) Remove throttle position sensor holding screws, and remove throttle position sensor itself.

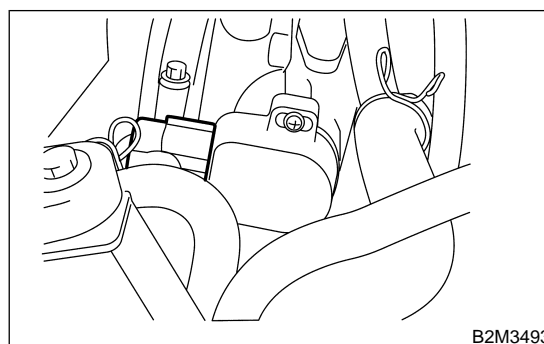


2. AT VEHICLES S105039A1802

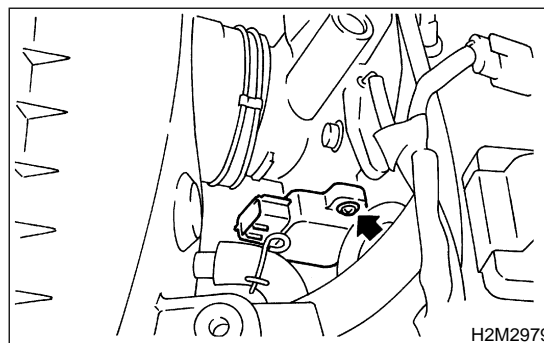
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from throttle position sensor.



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



THROTTLE POSITION SENSOR

Fuel Injection (Fuel Systems)

B: INSTALLATION

S105039A11

1. MT VEHICLES

S105039A1101

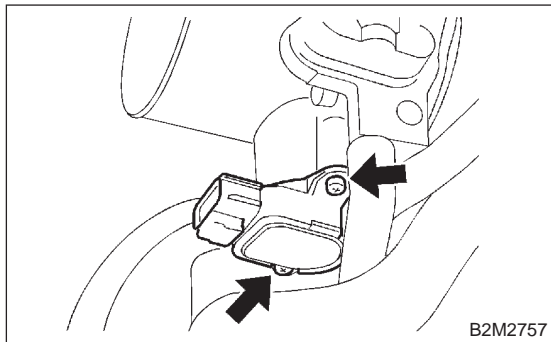
Install in the reverse order of removal.

CAUTION:

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

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



2. AT VEHICLES

S105039A1102

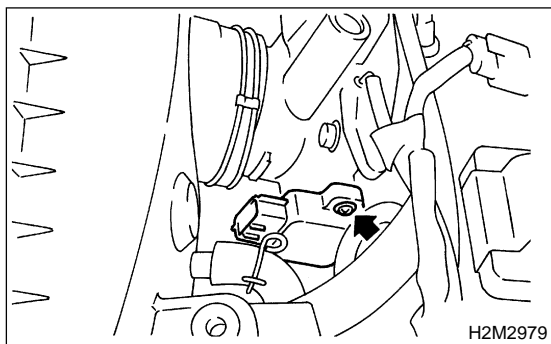
Install in the reverse order of removal.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)

CAUTION:

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



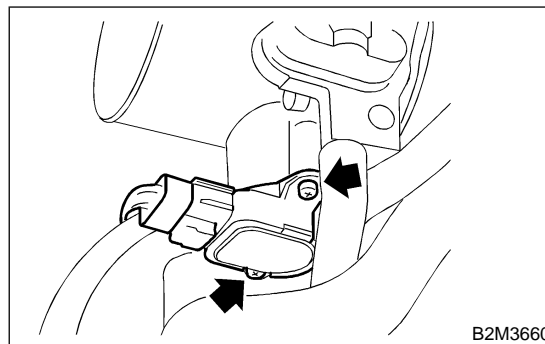
C: ADJUSTMENT

S105039A01

1. MT VEHICLES

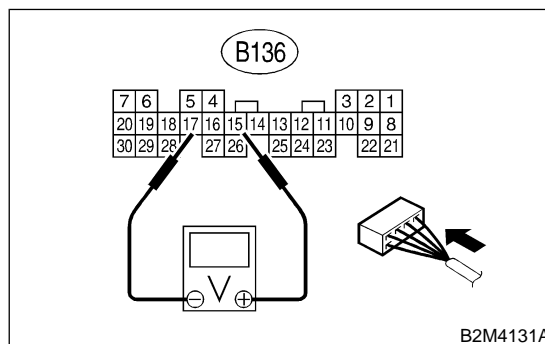
S105039A0101

- 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.

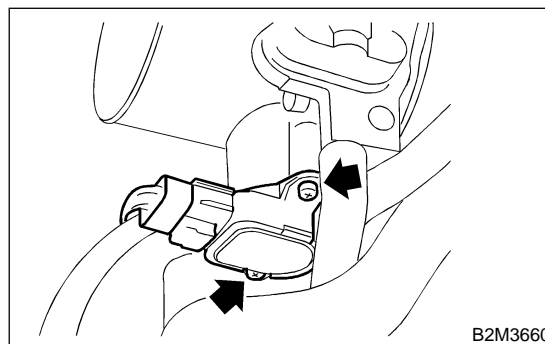
Connector & terminal / Specified voltage
(B136) No. 15 — (B136) No. 17 / 0.45 —
0.55 V
[Fully closed.]



- (4) Tighten throttle position sensor holding screws.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



THROTTLE POSITION SENSOR

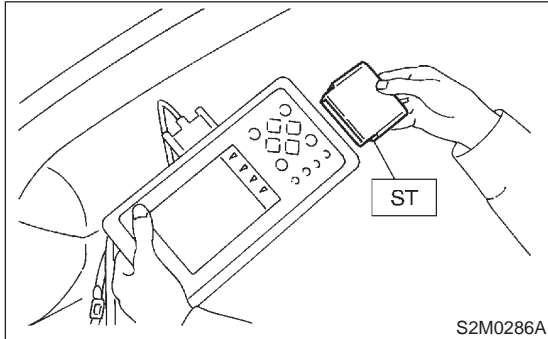
Fuel Injection (Fuel Systems)

4) When using Subaru Select Monitor;

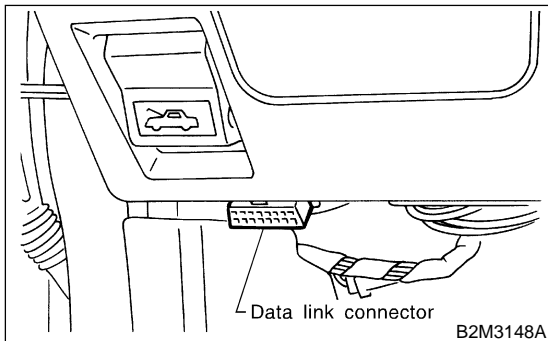
NOTE:

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

- (1) Insert the cartridge to Subaru Select Monitor.



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



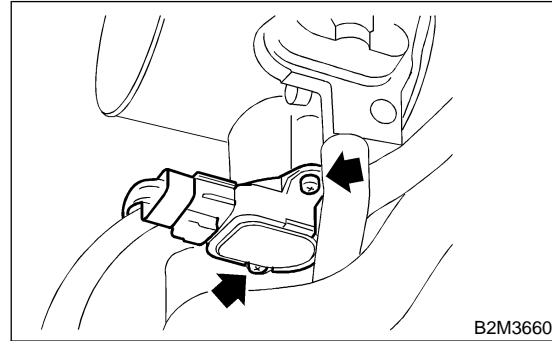
- (3) Turn ignition switch to ON, and Subaru Select Monitor switch to ON.
- (4) Select {2. Each System Check} in Main Menu.
- (5) Select {Engine Control System} in Selection Menu.
- (6) Select {1. Current Data Display & Save} in EGI/EMPI Diagnosis.
- (7) Select {1.12 Data Display} in Data Display Menu.
- (8) 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

- (9) Tighten throttle position sensor holding screws.

Tightening torque:

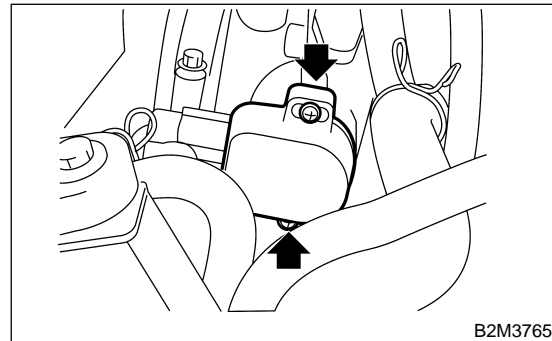
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



2. AT VEHICLES

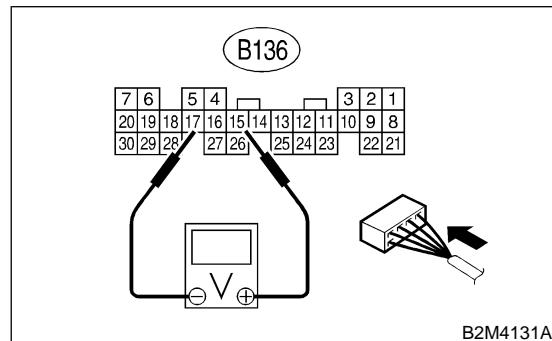
S105039A0102

- 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.]



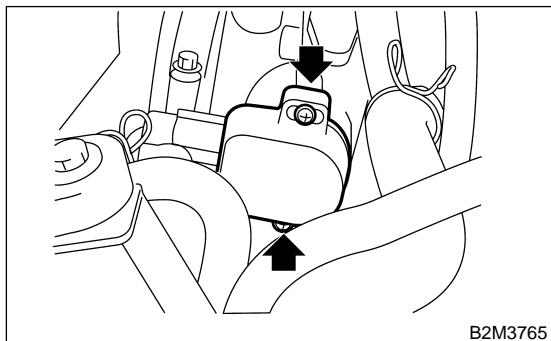
THROTTLE POSITION SENSOR

Fuel Injection (Fuel Systems)

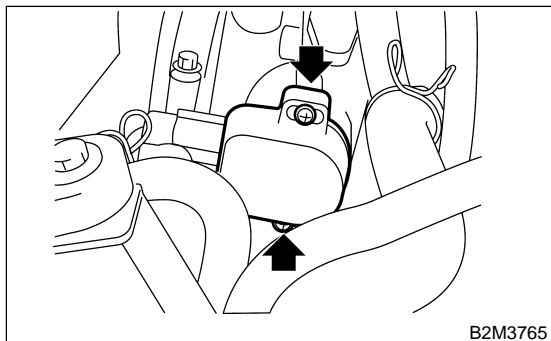
- (4) Tighten throttle position sensor holding screws.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



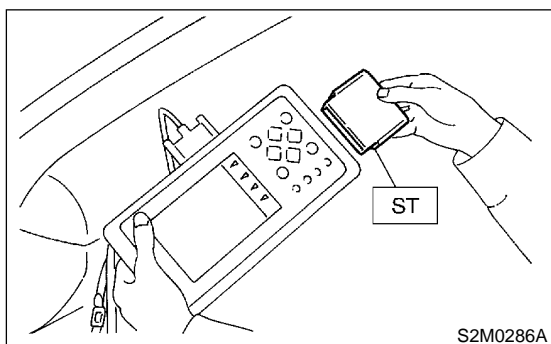
- 4) When using Subaru Select Monitor;
- (1) Turn ignition switch to OFF.
 - (2) Loosen throttle position sensor holding screws.



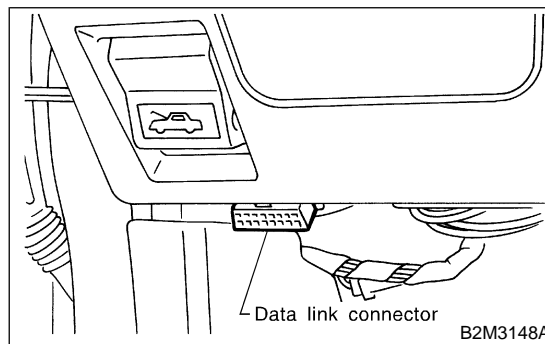
NOTE:

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

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



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



- 5) Turn ignition switch to ON, and Subaru Select Monitor switch to ON.
- 6) Select {2. Each System Check} in Main Menu.
- 7) Select {Engine Control System} in Selection Menu.
- 8) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
- 9) Select {1.12 Data Display} in Data Display Menu.
- 10) Adjust throttle position sensor to the proper position to match with the following specifications.

Condition: Throttle fully closed

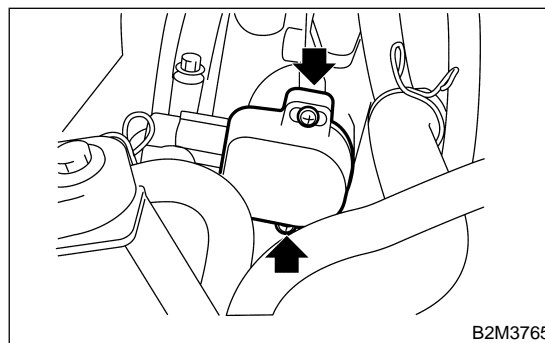
Throttle opening angle 0.00%

Throttle sensor voltage 0.50 V

- 11) Tighten throttle position sensor holding screws.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



9. Intake Manifold Pressure Sensor

S105568

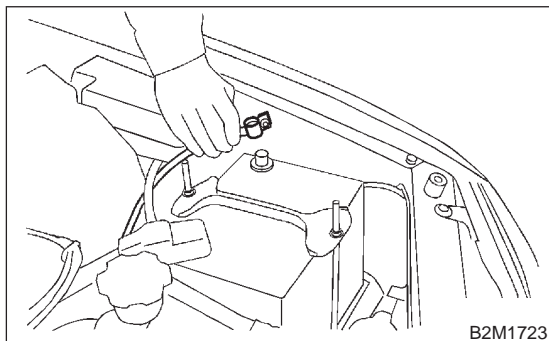
A: REMOVAL

S105568A18

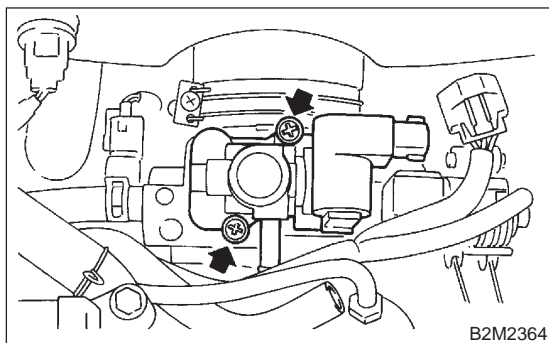
NOTE:

This sensor is installed on MT vehicles only.

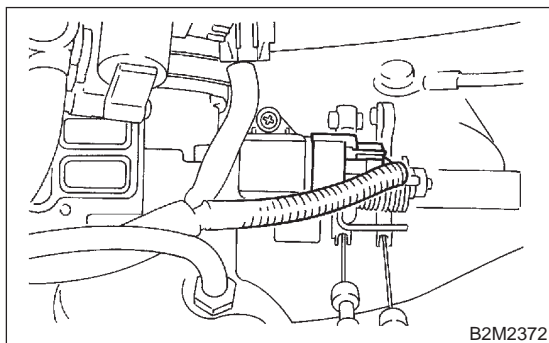
- 1) Disconnect battery ground cable.



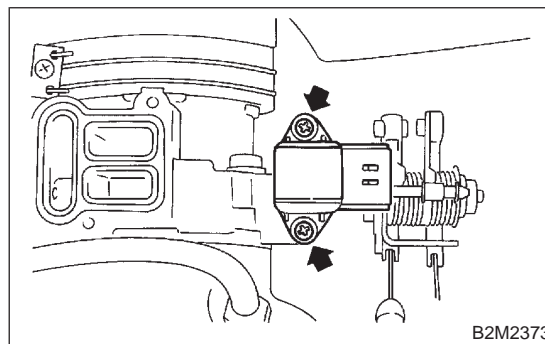
- 2) Remove idle air control solenoid valve. <Ref. to FU(H4)-53 MT VEHICLES, REMOVAL, Idle Air Control Solenoid Valve.>



- 3) Disconnect connector from intake manifold pressure sensor.



- 4) Remove intake manifold pressure sensor from throttle body.



B: INSTALLATION

S105568A11

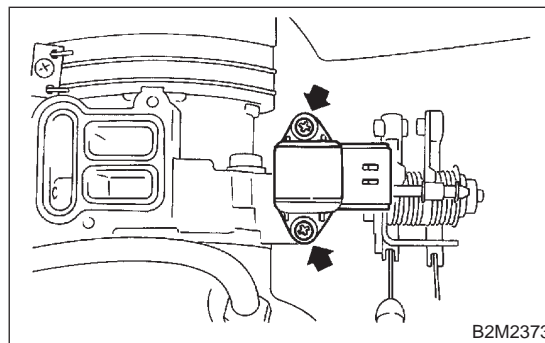
Install in the reverse order of removal.

CAUTION:

Replace gaskets for intake air pressure sensor and idle air control solenoid valve with new ones.

Tightening torque:

2.8 N·m (0.29 kgf-m, 2.1 ft-lb)



INTAKE AIR TEMPERATURE SENSOR

Fuel Injection (Fuel Systems)

10. Intake Air Temperature Sensor

S105569

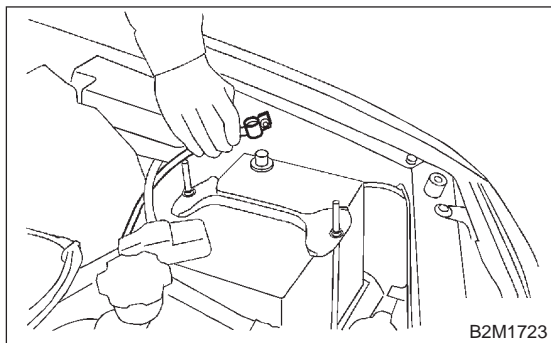
A: REMOVAL

S105569A18

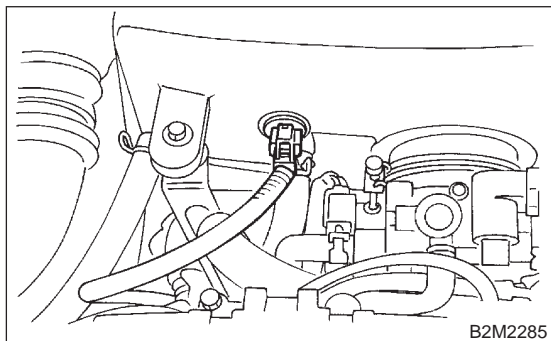
NOTE:

This sensor is installed on MT vehicles only.

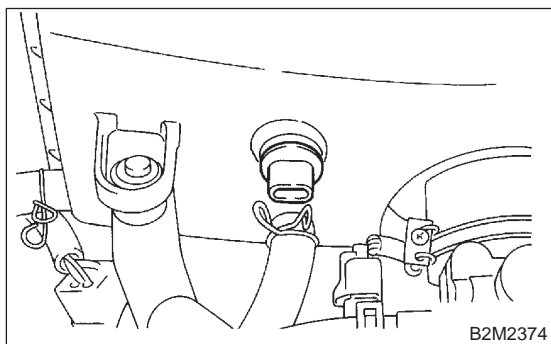
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from intake air temperature sensor.



- 3) Remove intake air temperature sensor from air cleaner case.



B: INSTALLATION

S105569A11

Install in the reverse order of removal.

11. Intake Air Temperature and Pressure Sensor

S105044

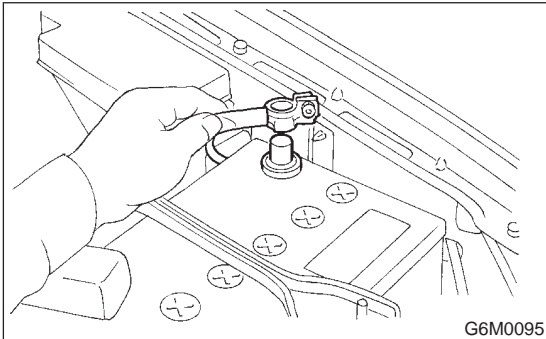
A: REMOVAL

S105044A18

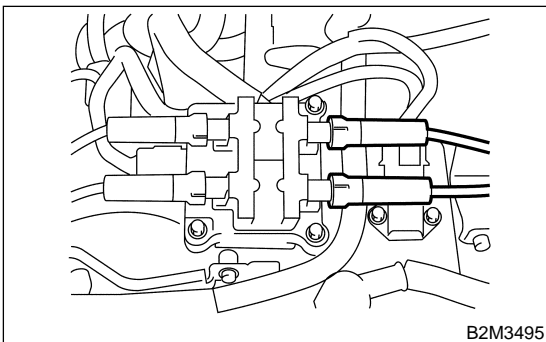
NOTE:

This sensor is installed on AT vehicles only.

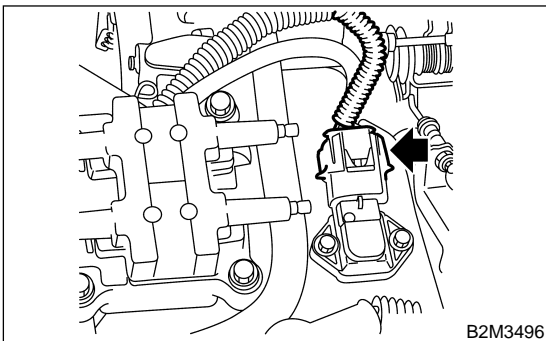
- 1) Disconnect battery ground cable.



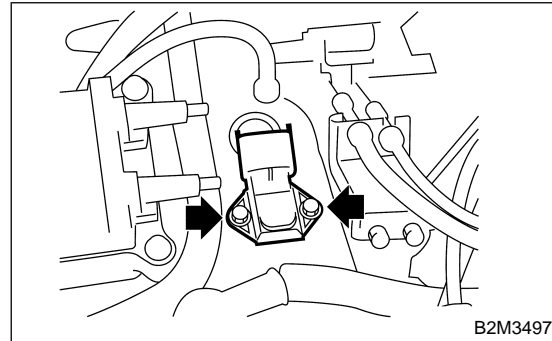
- 2) Disconnect spark plug cord from ignition coil and ignitor assembly.



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



- 4) Remove intake air temperature and pressure sensor.



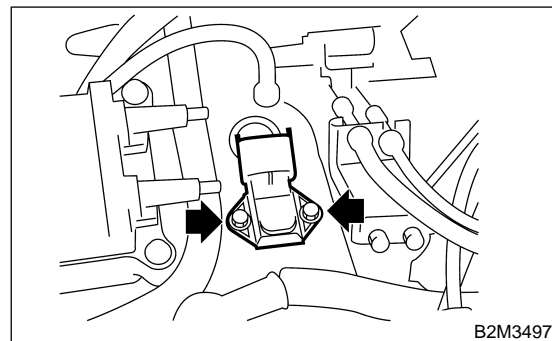
B: INSTALLATION

S105044A11

Install in the reverse order of removal.

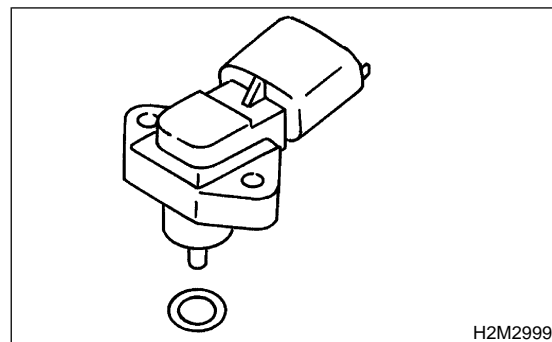
Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



CAUTION:

Replace O-ring with new one.



ATMOSPHERIC PRESSURE SENSOR

Fuel Injection (Fuel Systems)

12. Atmospheric Pressure Sensor

S105045

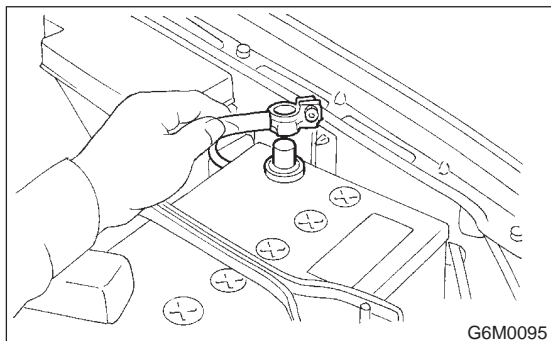
A: REMOVAL

S105045A18

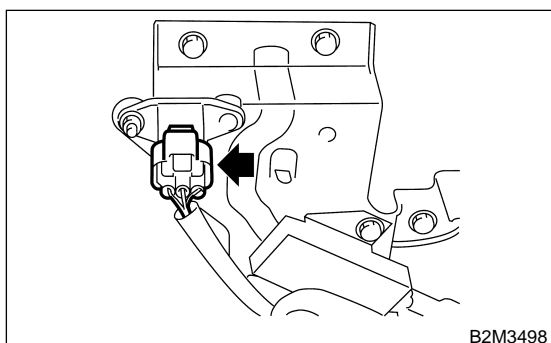
NOTE:

This sensor is installed on AT vehicles only.

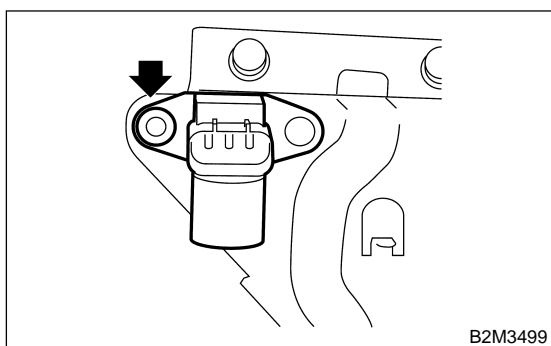
- 1) Disconnect battery ground cable.



- 2) Disconnect connector from atmospheric pressure sensor.



- 3) Remove atmospheric pressure sensor from bracket.



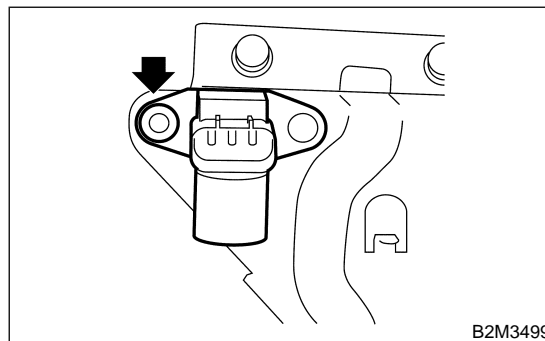
B: INSTALLATION

S105045A11

Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



13. Idle Air Control Solenoid Valve

S105056

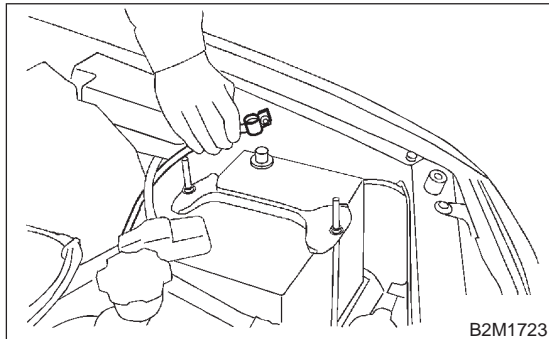
A: REMOVAL

S105056A18

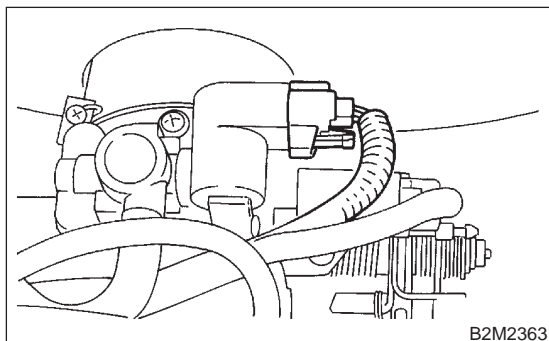
1. MT VEHICLES

S105056A1801

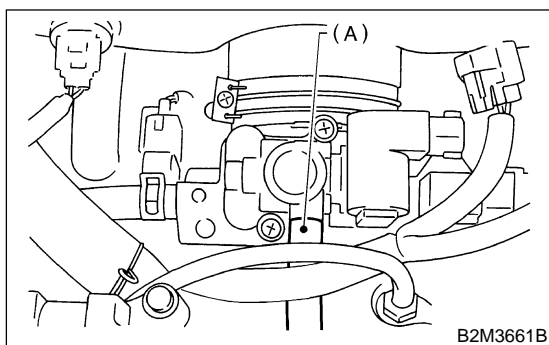
- 1) Disconnect battery ground cable.



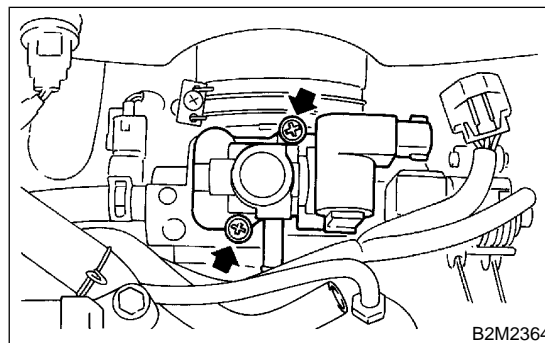
- 2) Disconnect connector from idle air control solenoid valve.



- 3) Disconnect air by-pass hose (A) from idle air control solenoid valve.



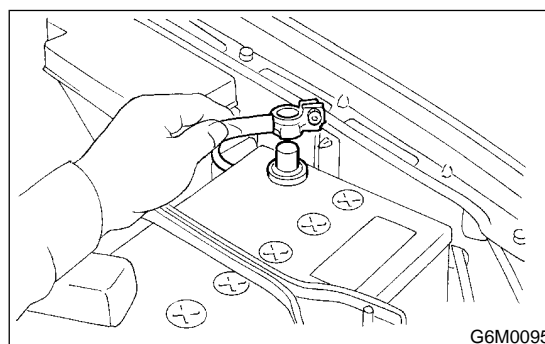
- 4) Remove idle air control solenoid valve from throttle body.



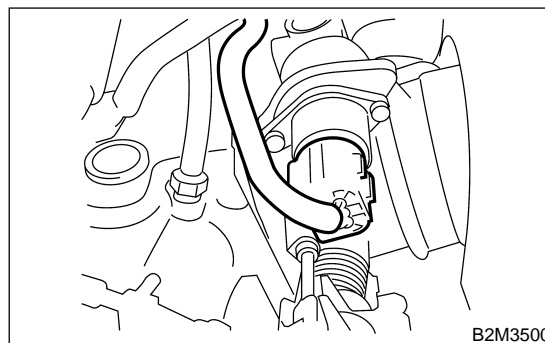
2. AT VEHICLES

S105056A1802

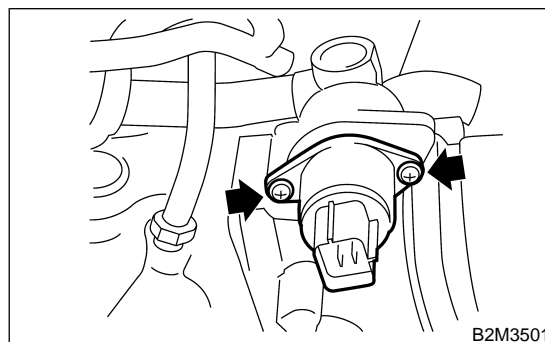
- 1) Disconnect battery ground cable.



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



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



IDLE AIR CONTROL SOLENOID VALVE

Fuel Injection (Fuel Systems)

B: INSTALLATION

S105056A11

1. MT VEHICLES

S105056A1101

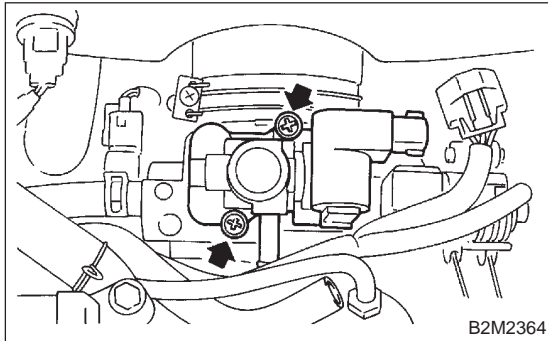
Install in the reverse order of removal.

CAUTION:

Replace gasket with a new one.

Tightening torque:

2.8 N·m (0.29 kgf-m, 2.1 ft-lb)



2. AT VEHICLES

S105056A1102

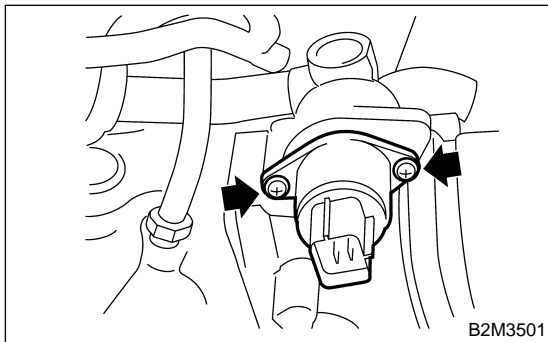
Install in the reverse order of removal.

CAUTION:

Always use new gasket.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



14. Air Assist Injector Solenoid Valve

S105570

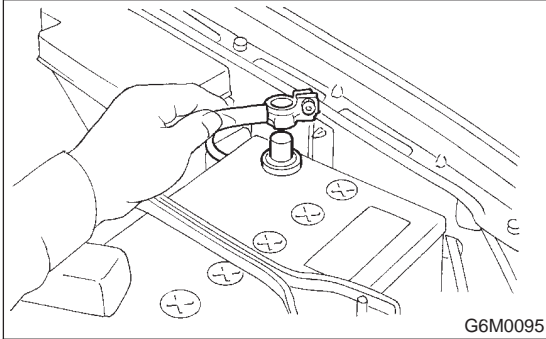
A: REMOVAL

S105570A18

NOTE:

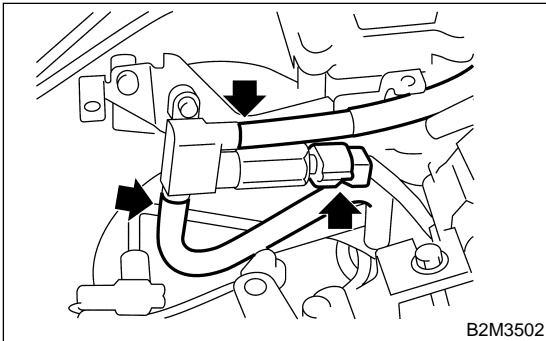
This solenoid valve is used on AT vehicles only.

- 1) Disconnect battery ground cable.



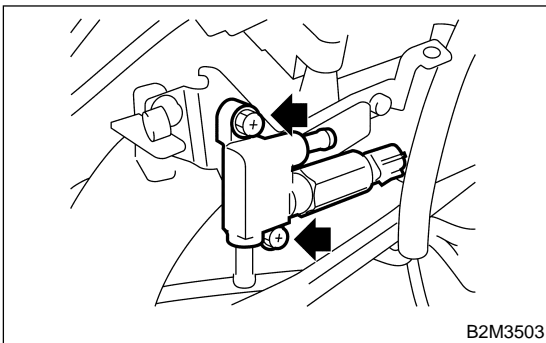
G6M0095

- 2) Disconnect connector from air assist injector solenoid valve and disconnect air by-pass hoses.



B2M3502

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



B2M3503

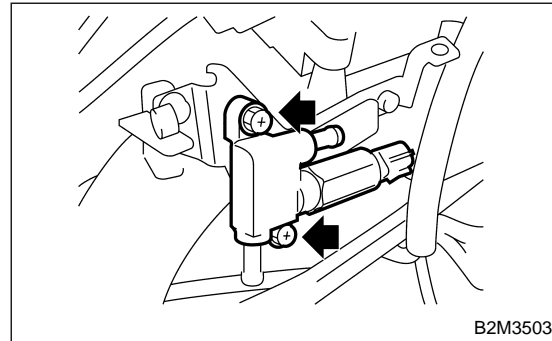
B: INSTALLATION

S105570A11

Install in the reverse order of removal.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



B2M3503

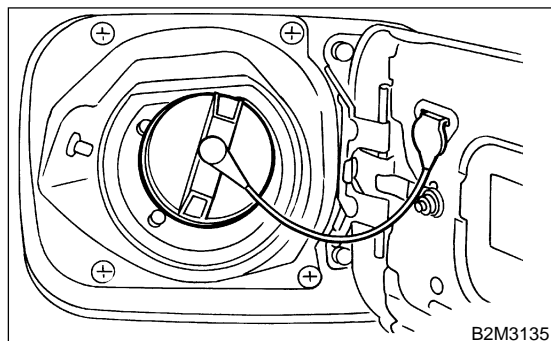
15. Fuel Injector S105051

A: REMOVAL S105051A18

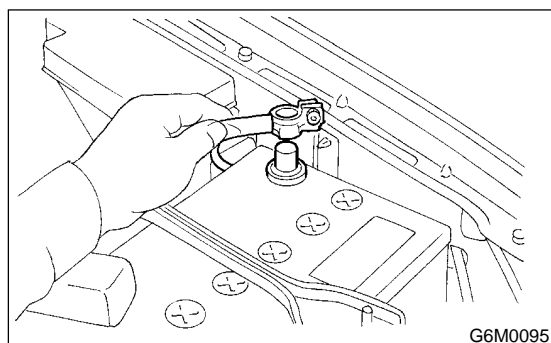
1. RH SIDE S105051A1801

1) Release fuel pressure.
<Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, Fuel.>

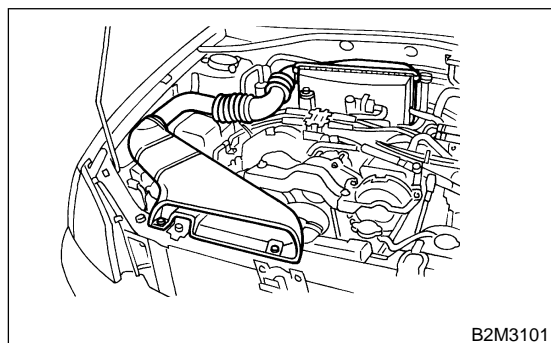
2) Open fuel flap lid, and remove fuel filler cap.



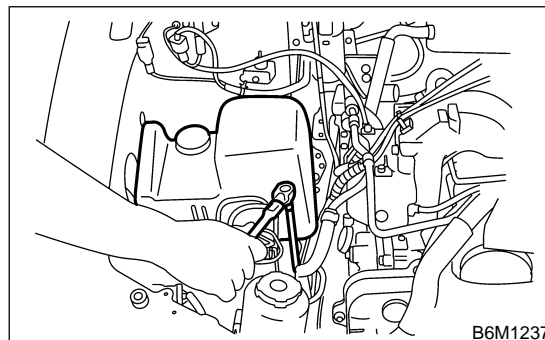
3) Disconnect battery ground cable.



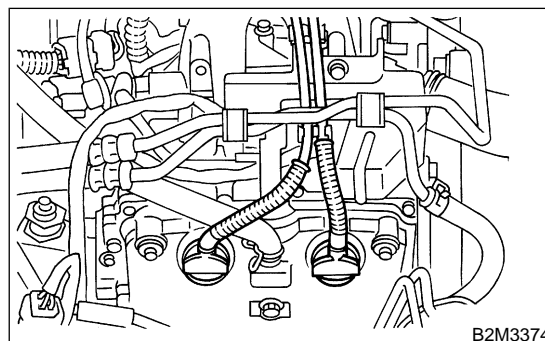
4) Remove air intake duct and air cleaner assembly. <Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.> and <Ref. to IN(H4)-6 REMOVAL, Air Cleaner Case.>



5) Remove resonator chamber.

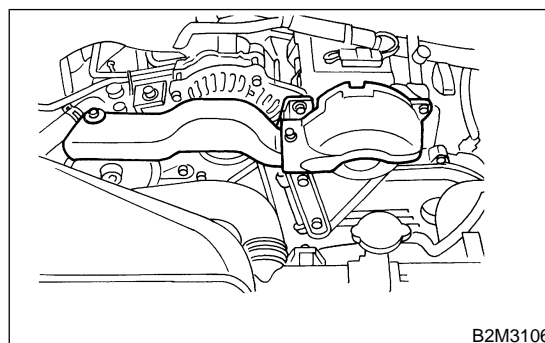


6) Remove spark plug cords from spark plugs (#1 and #3 cylinders).

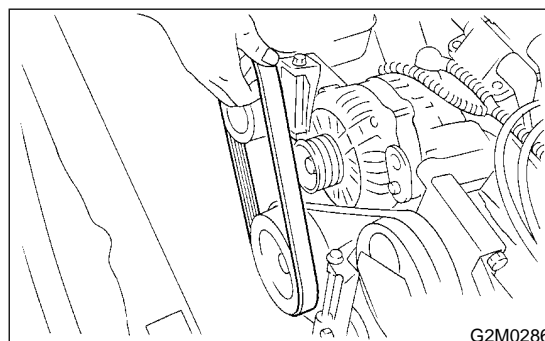


7) Remove power steering pump and tank from brackets.

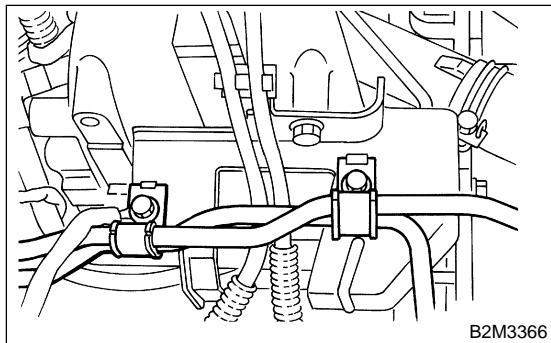
(1) Remove V-belt covers.



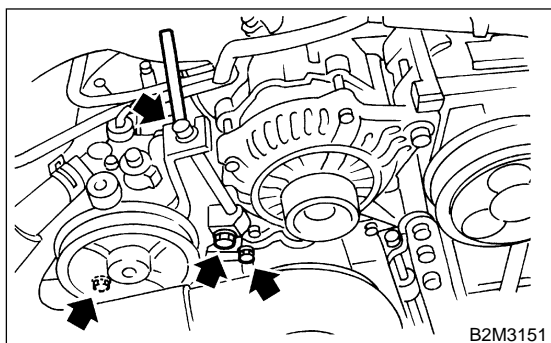
(2) Loosen lock bolt and slider bolt, and remove power steering pump drive V-belt.



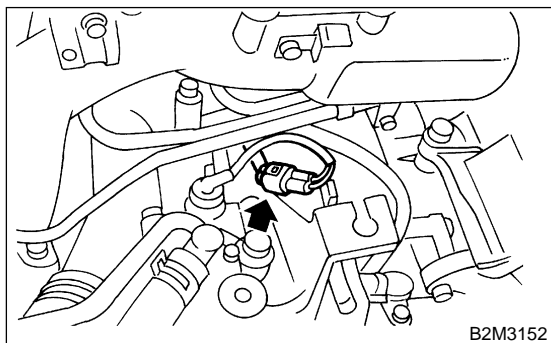
(3) Remove bolts which hold power steering pipes onto intake manifold protector.



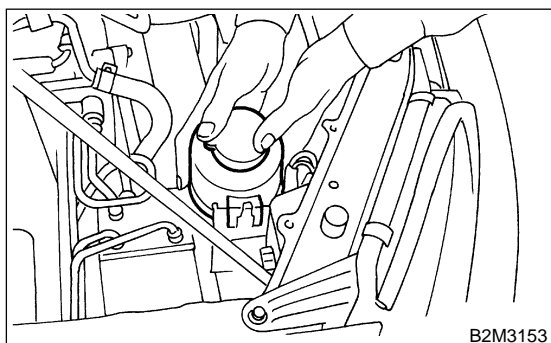
(4) Remove bolts which install power steering pump to bracket.



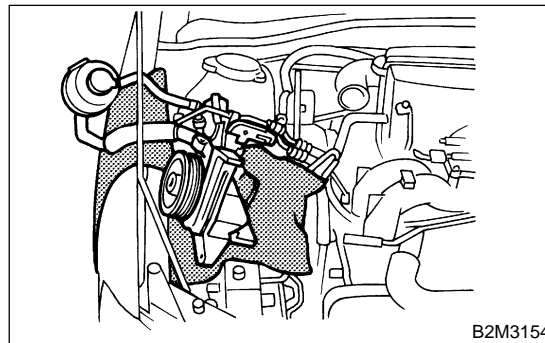
(5) Disconnect connector from power steering pump switch.



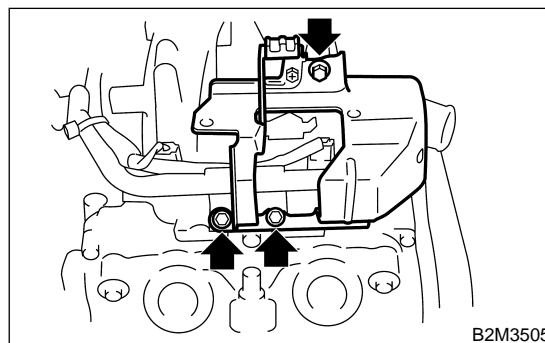
(6) Remove power steering tank from the bracket by pulling it upwards.



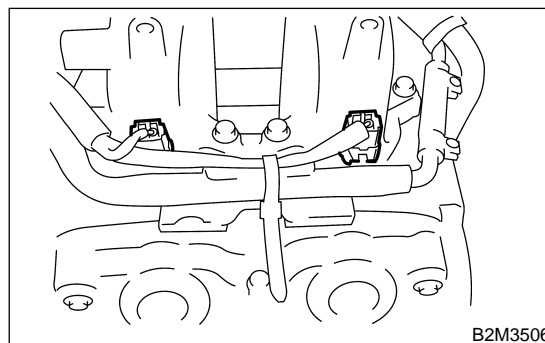
(7) Place power steering pump and tank on the right side wheel apron.



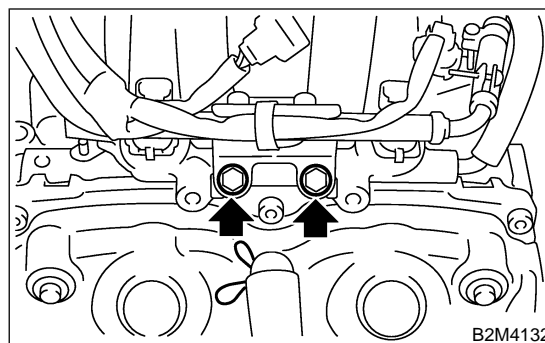
8) Remove fuel pipe protector RH.



9) Disconnect connector from fuel injector.



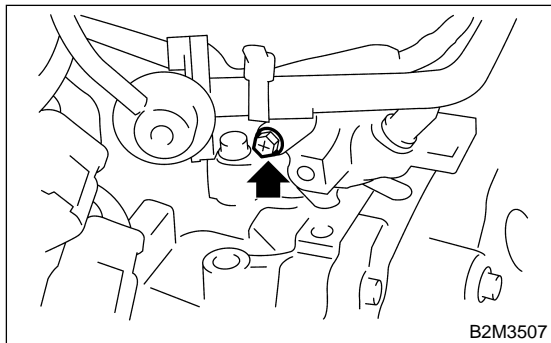
10) Remove bolt which holds injector pipe to intake manifold.



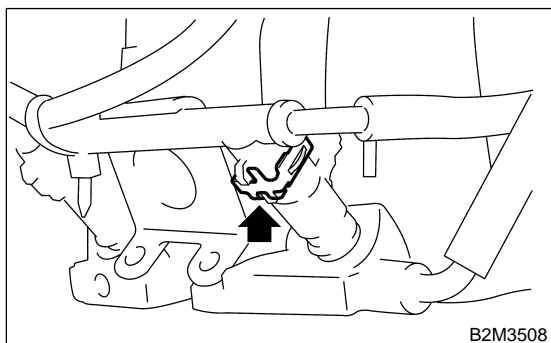
FUEL INJECTOR

Fuel Injection (Fuel Systems)

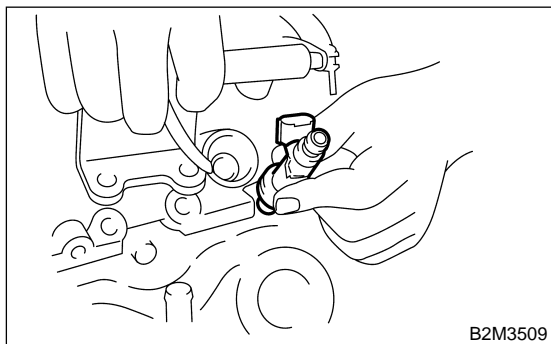
11) Remove bolt which install injector pipe to intake manifold.



12) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip. (AT vehicle)

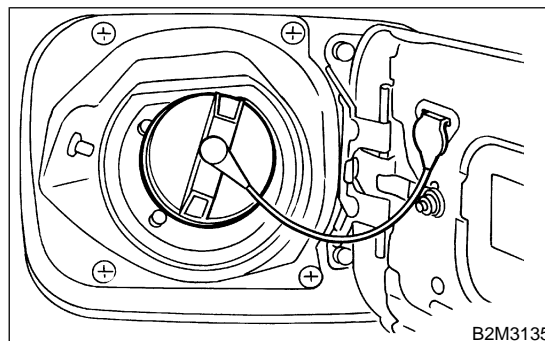


(2) Remove fuel injector while lifting up fuel injector pipe.

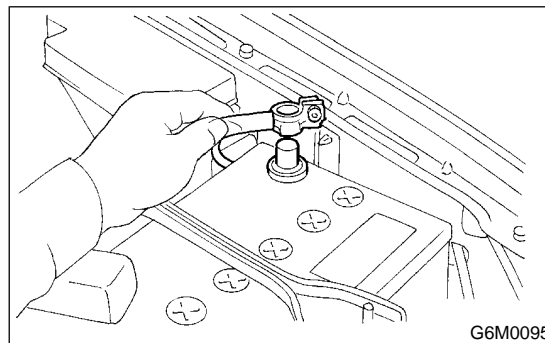


2. LH SIDE S105051A1802

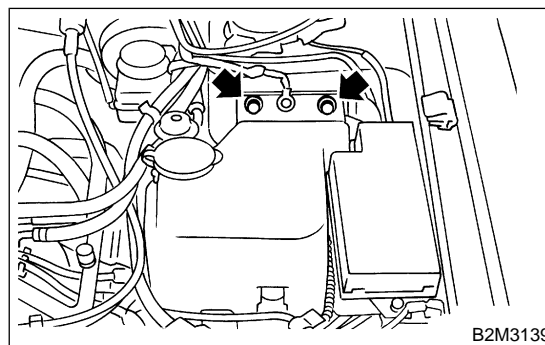
- 1) Release fuel pressure. <Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open fuel flap lid, and remove fuel filler cap.



3) Disconnect battery ground cable.

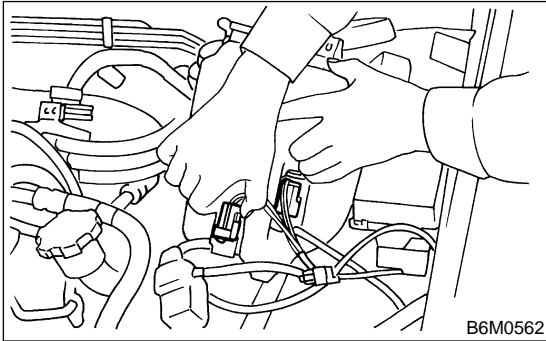


4) Remove two bolts which install washer tank on body.



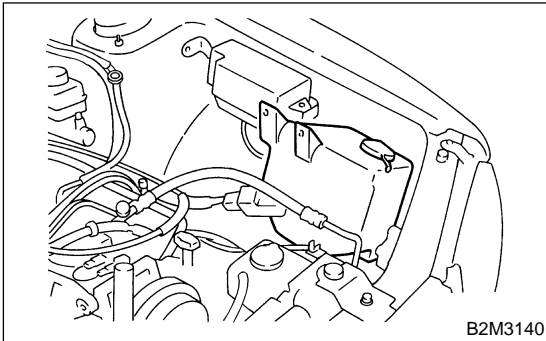
5) Disconnect connector from front window washer motor.

6) Disconnect connector from rear gate glass washer motor.

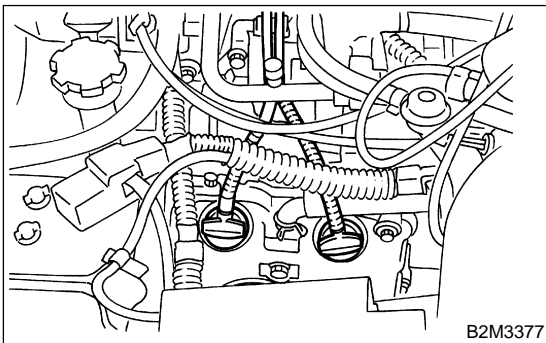


7) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.

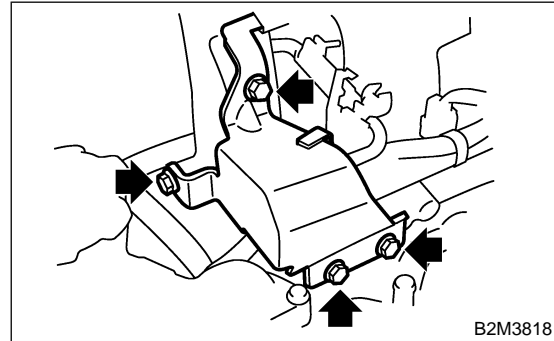
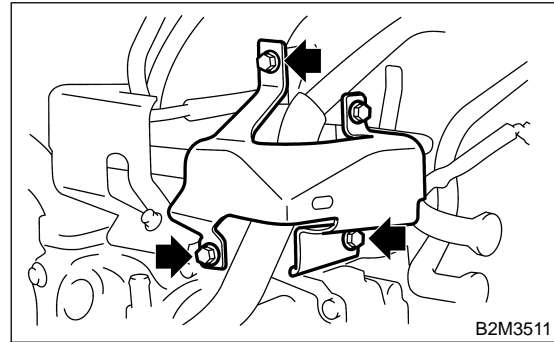
8) Move washer tank, and secure it away from working area.



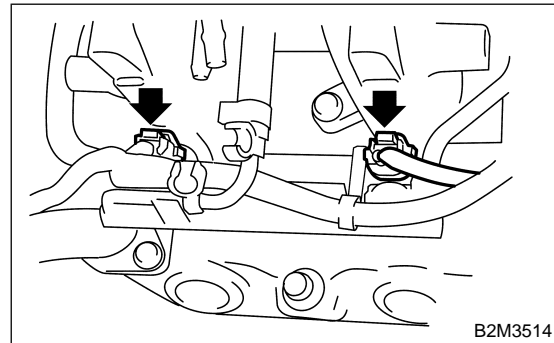
9) Remove spark plug cords from spark plugs (#2 and #4 cylinders).



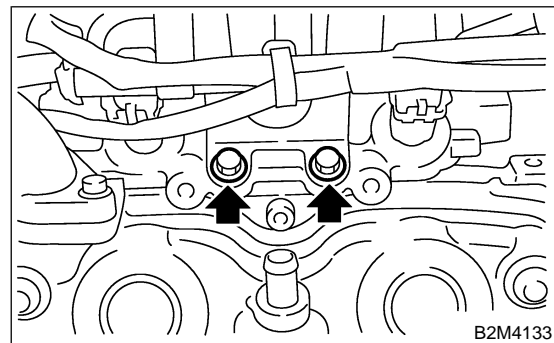
10) Remove fuel pipe protector LH.



11) Disconnect connector from fuel injector.



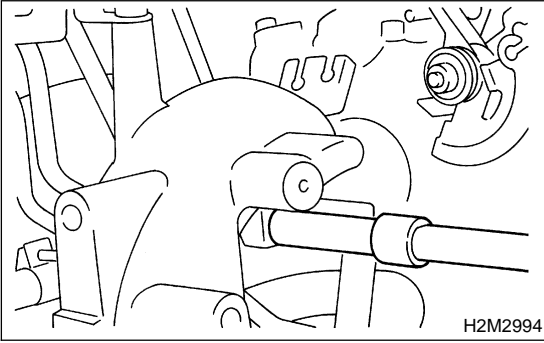
12) Remove bolt which holds injector pipe to intake manifold.



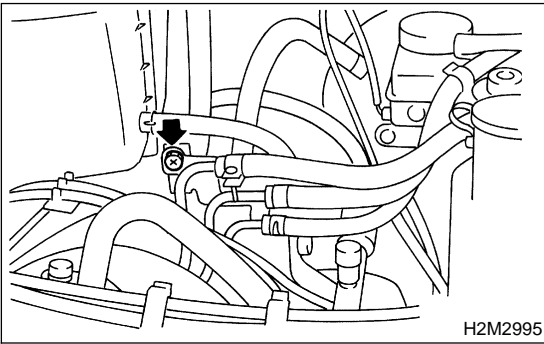
FUEL INJECTOR

Fuel Injection (Fuel Systems)

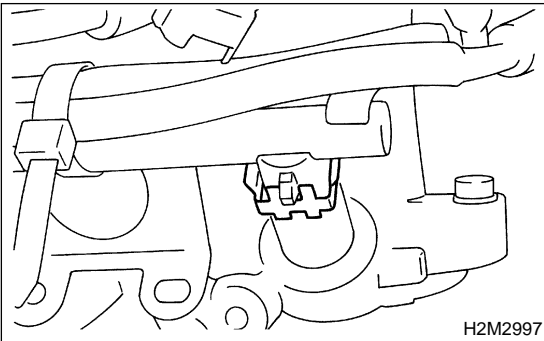
13) Remove bolt which installs injector pipe to intake manifold.



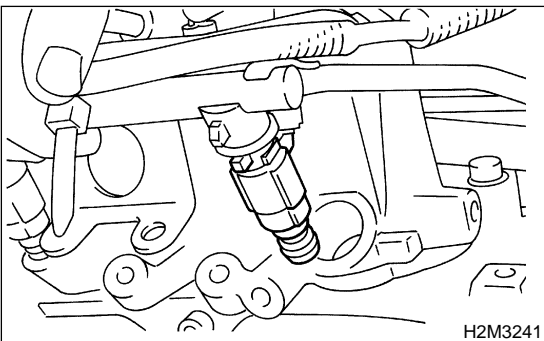
14) Remove bolt which holds fuel pipe on the left side intake manifold.



15) Remove fuel injector from intake manifold.
(1) Remove fuel injector securing clip. (AT vehicles)



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



B: INSTALLATION

S105051A11

1. RH SIDE

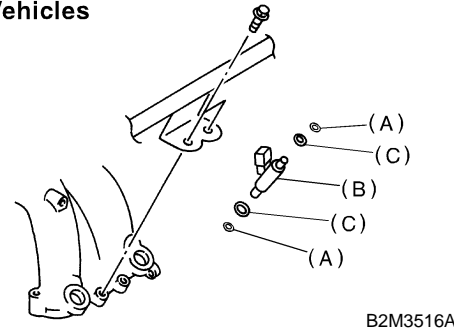
S105051A1101

Install in the reverse order of removal.

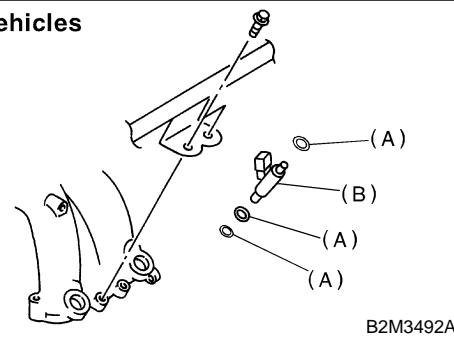
CAUTION:

Replace O-rings and insulators with new ones.

MT Vehicles



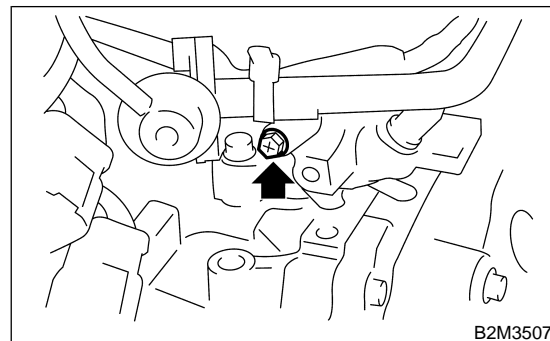
AT Vehicles



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

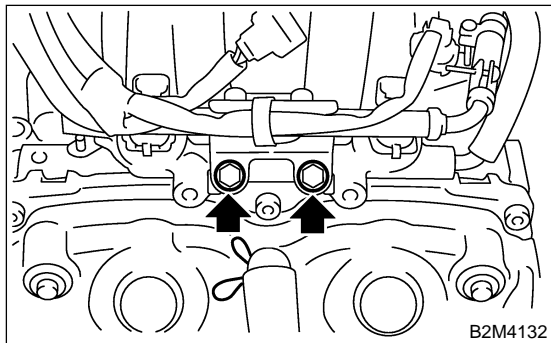
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



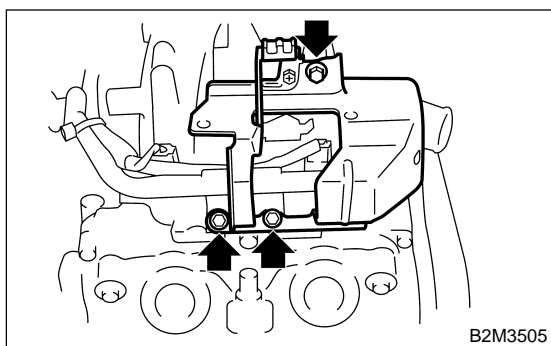
Tightening torque:

19 N·m (0.19 kgf-m, 1.4 ft-lb)



Tightening torque:

19 N·m (0.19 kgf-m, 1.4 ft-lb)



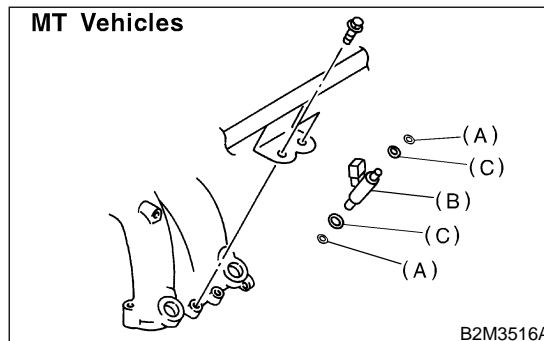
2. LH SIDE S105051A1102

Install in the reverse order of removal.

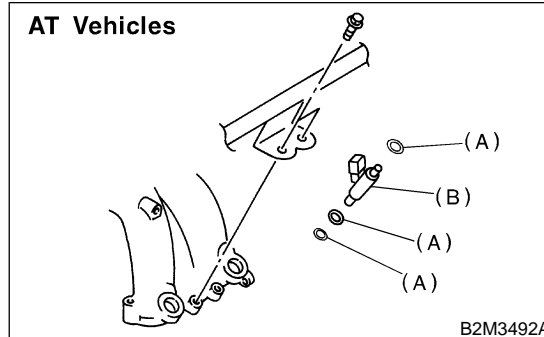
CAUTION:

Replace O-rings and insulators with new ones.

MT Vehicles



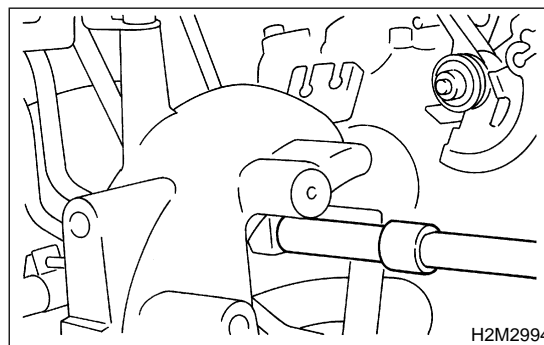
AT Vehicles



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

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

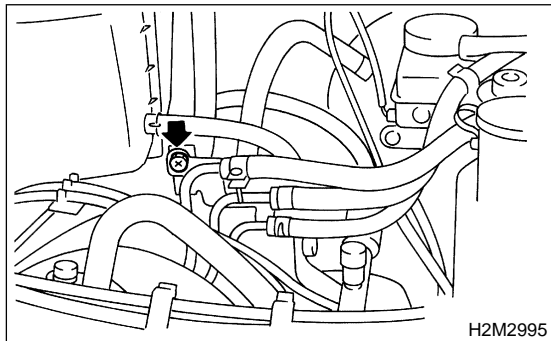


FUEL INJECTOR

Fuel Injection (Fuel Systems)

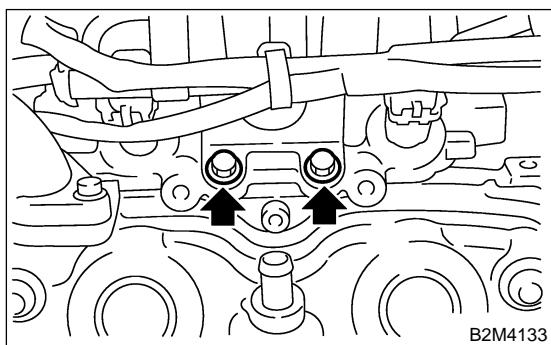
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



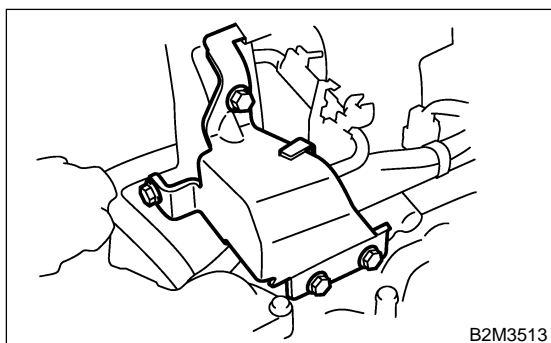
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



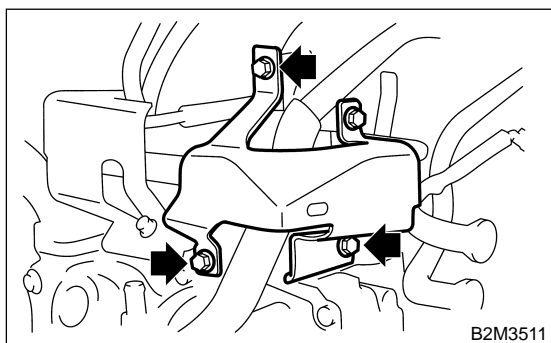
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



FU(H4)-62

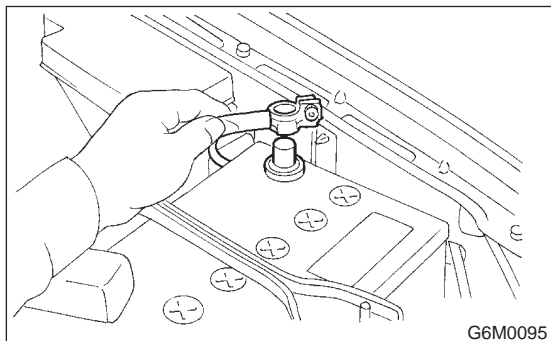
16. Front Oxygen (A/F) Sensor

S105642

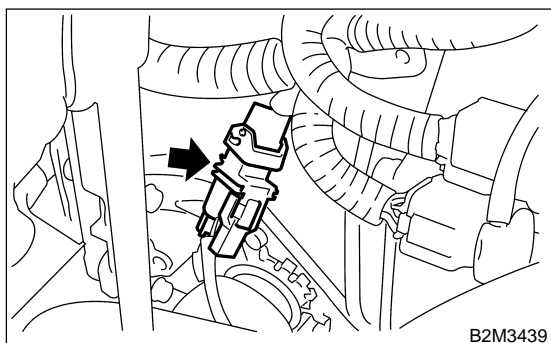
A: REMOVAL

S105642A18

- 1) Disconnect battery ground cable.



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



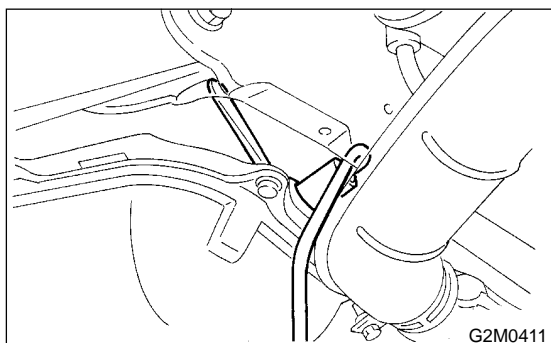
- 3) Lift-up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove front oxygen (A/F) sensor.

CAUTION:

When removing front oxygen (A/F) sensor, do not force front oxygen (A/F) sensor especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.



B: INSTALLATION

S105642A11

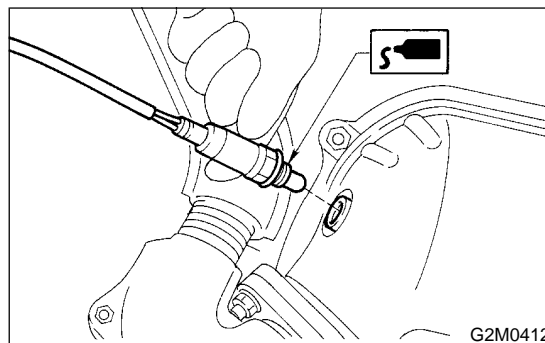
- 1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to threaded portion of front oxygen (A/F) sensor to make the next removal easier.

Anti-seize compound:

SS-30 by JET LUBE

CAUTION:

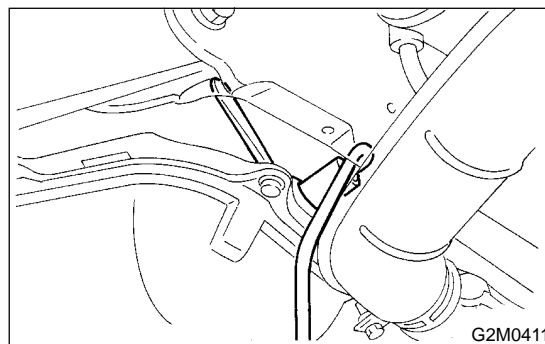
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.



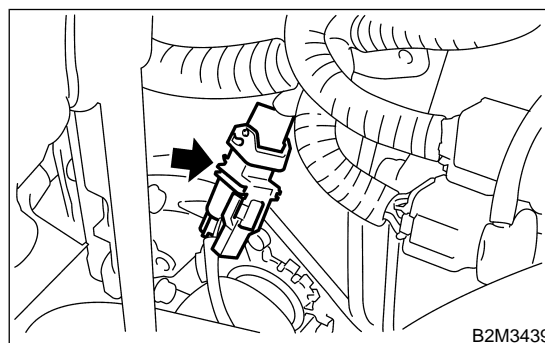
- 2) Install front oxygen (A/F) sensor.

Tightening torque:

21±3 N·m (2.1±0.3 kg·m, 15.2±2.2 ft·lb)



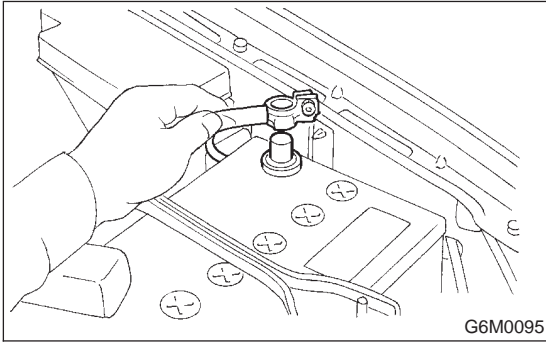
- 3) Lower the vehicle.
- 4) Connect connector of front oxygen (A/F) sensor.



FRONT OXYGEN (A/F) SENSOR

Fuel Injection (Fuel Systems)

5) Connect battery ground cable.



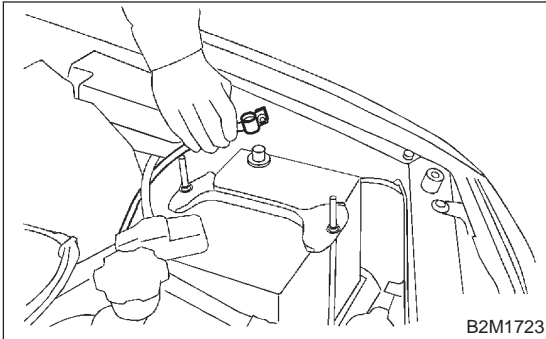
17. Rear Oxygen Sensor

S105657

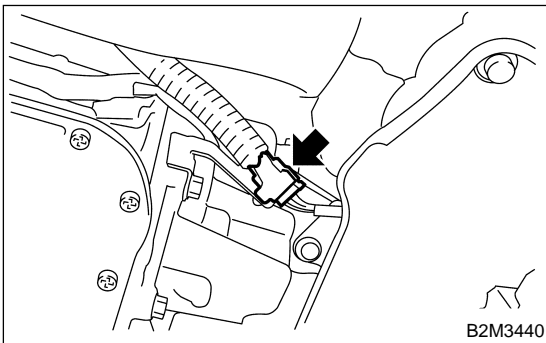
A: REMOVAL

S105657A18

- 1) Disconnect battery ground cable.



- 2) Disconnect connector from rear oxygen sensor.



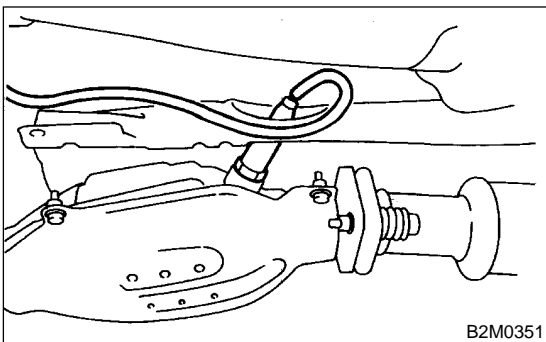
- 3) Lift-up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove rear oxygen sensor.

CAUTION:

When removing, do not force rear oxygen sensor in an unnatural way especially when exhaust pipe is cold, otherwise it will damage exhaust pipe.



B: INSTALLATION

S105657A11

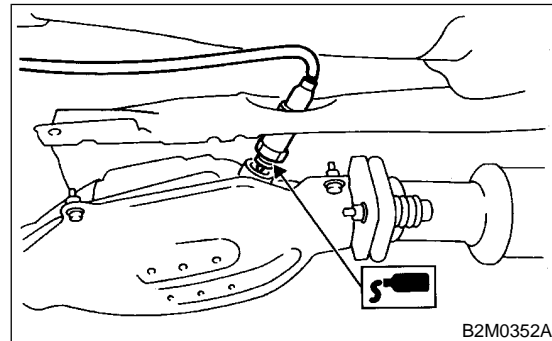
- 1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion of rear oxygen sensor to make the next removal easier.

CAUTION:

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

Anti-seize compound:

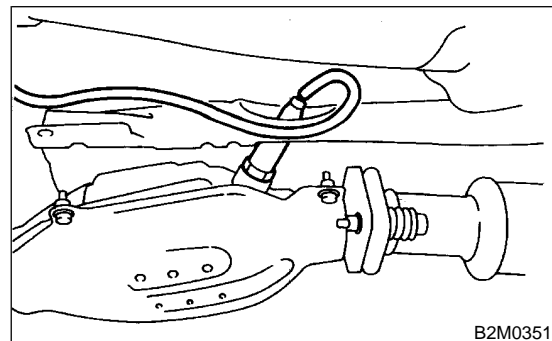
SS-30 by JET LUBE



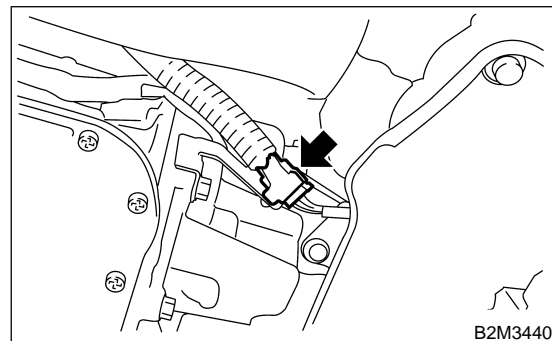
- 2) Install rear oxygen sensor.

Tightening torque:

21±3 N·m (2.1±0.3 kg-m, 15.2±2.2 ft-lb)



- 3) Connect connector to rear oxygen sensor.

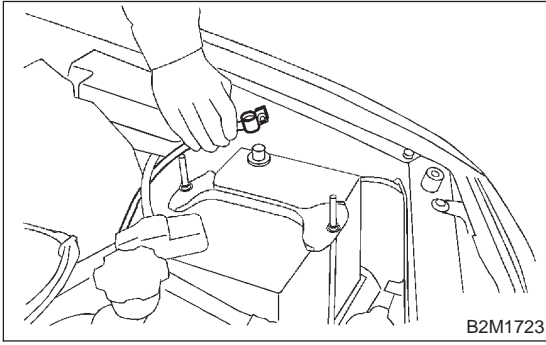


- 4) Lower the vehicle.

REAR OXYGEN SENSOR

Fuel Injection (Fuel Systems)

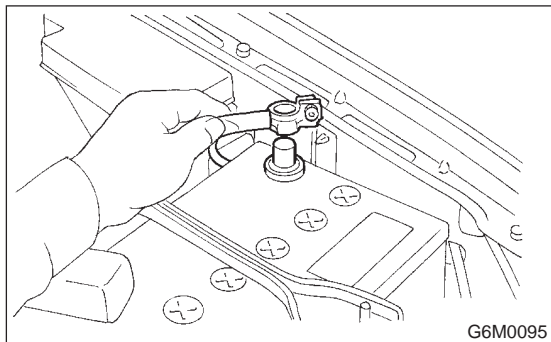
5) Connect battery ground cable.



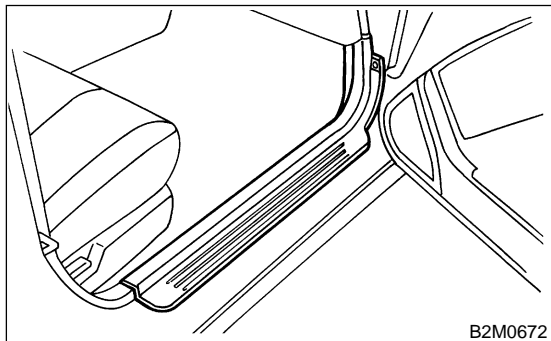
18. Engine Control Module S105049

A: REMOVAL S105049A18

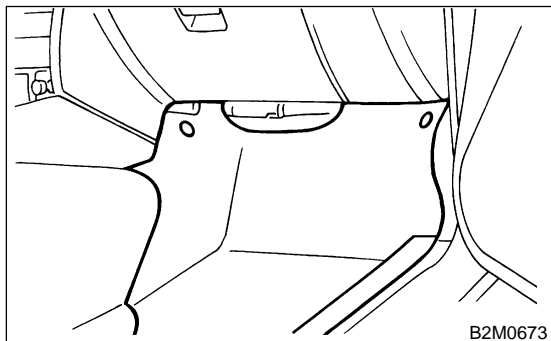
- 1) Disconnect battery ground cable.



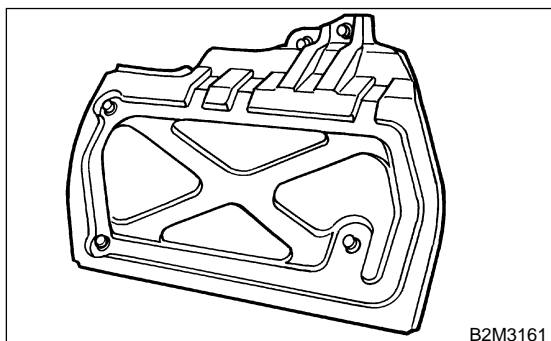
- 2) Remove lower inner trim of passenger side.
<Ref. to EI-43 REMOVAL, Lower Inner Trim.>



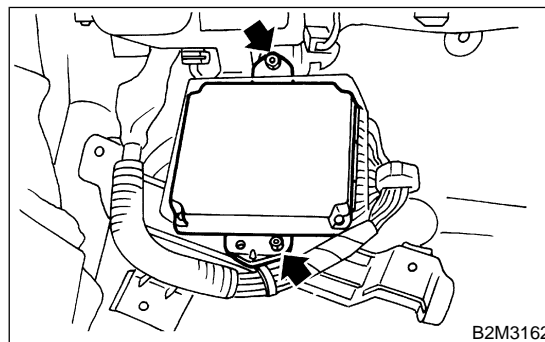
- 3) Detach floor mat of front passenger seat.



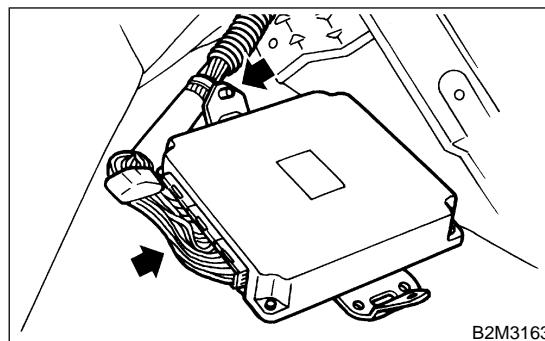
- 4) Remove protect cover.



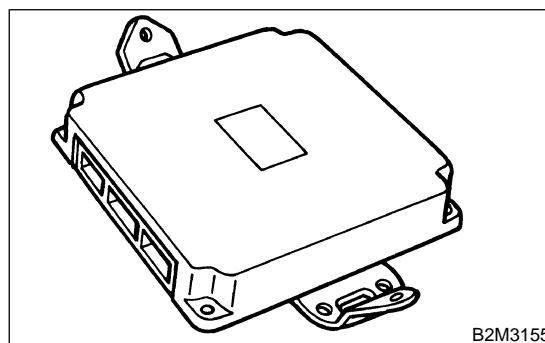
- 5) Remove nuts which hold ECM to bracket.



- 6) Remove clip from bracket.



- 7) Disconnect ECM connectors and take out ECM.



B: INSTALLATION S105049A11

Install in the reverse order of removal.

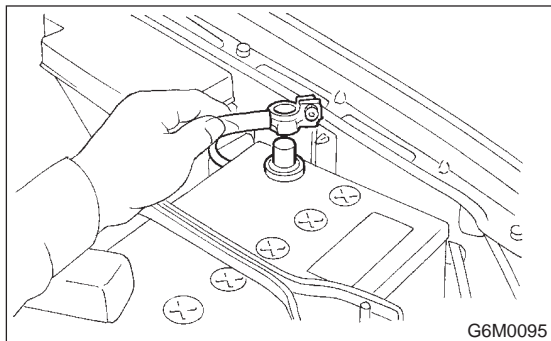
CAUTION:

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

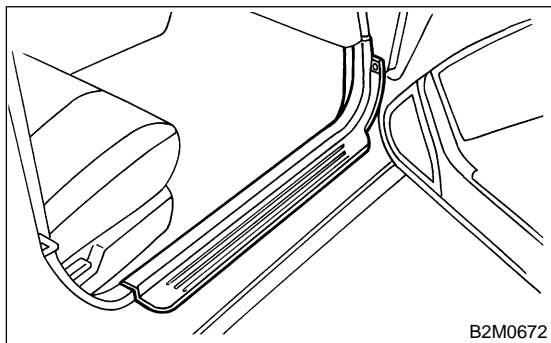
19. Main Relay S105050

A: REMOVAL S105050A18

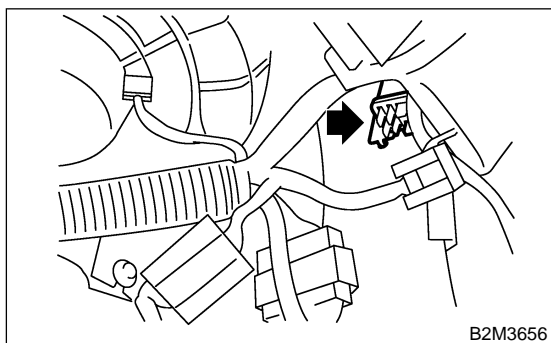
- 1) Disconnect battery ground cable.



- 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.



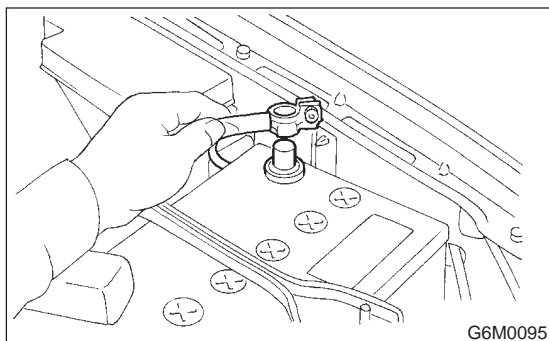
B: INSTALLATION S105050A11

Install in the reverse order of removal.

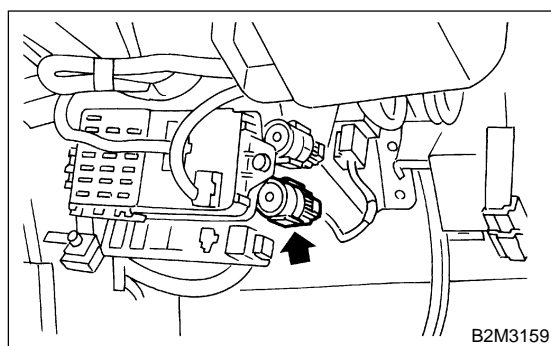
20. Fuel Pump Relay S105048

A: REMOVAL S105048A18

- 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 S105048A11

Install in the reverse order of removal.

21. Fuel S105052

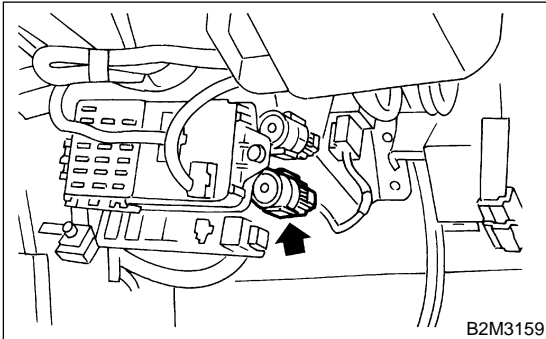
A: OPERATION S105052A16

1. RELEASING OF FUEL PRESSURE S105052A1601

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.



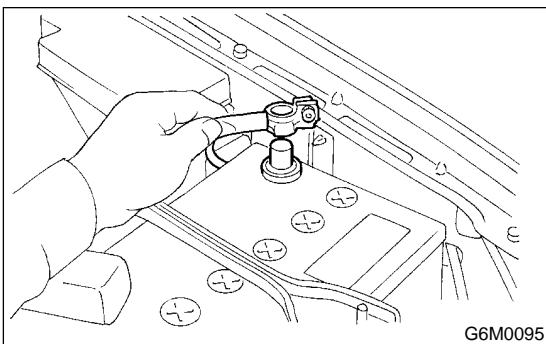
- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn ignition switch to OFF.

2. DRAINING FUEL S105052A1602

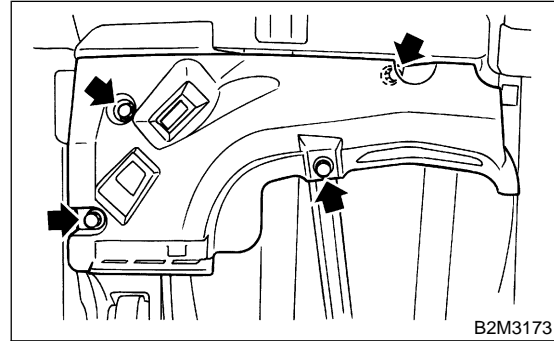
WARNING:

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

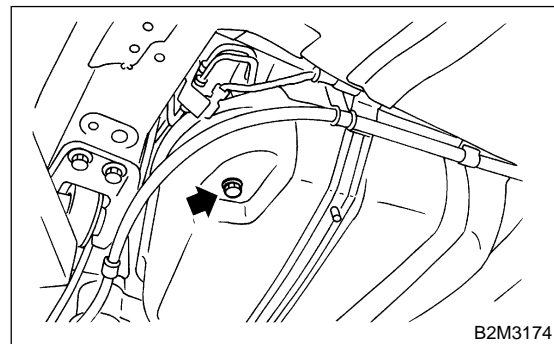
- 1) Set vehicle on the lift.
- 2) Disconnect battery ground cable.



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



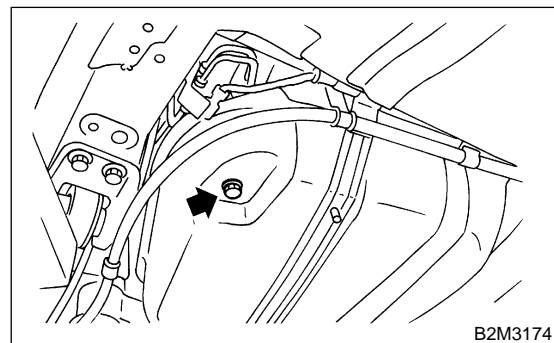
- 5) Drain fuel from fuel tank.
Set a container under the vehicle and remove drain plug from fuel tank.



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

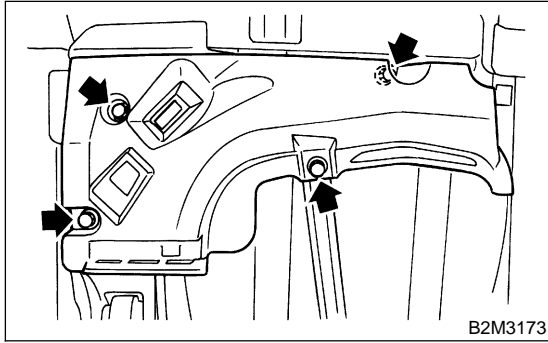
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



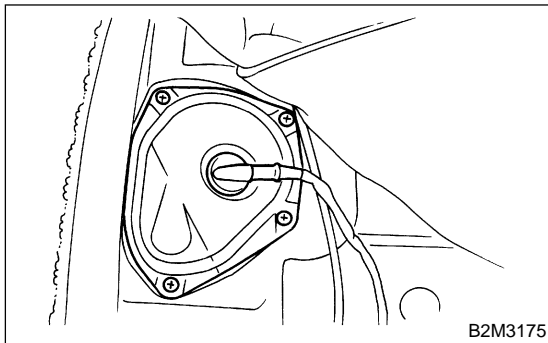
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

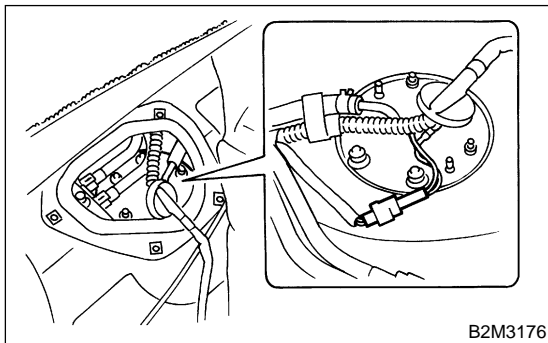


7) Lower the vehicle.

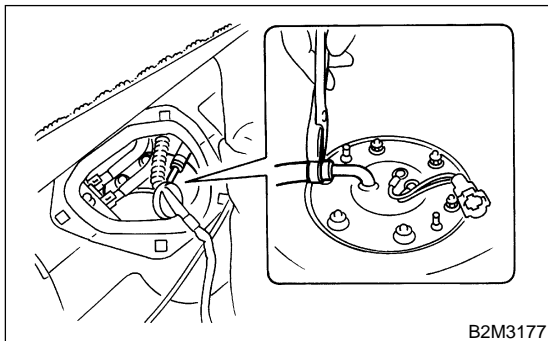
8) Remove sub service hole cover.



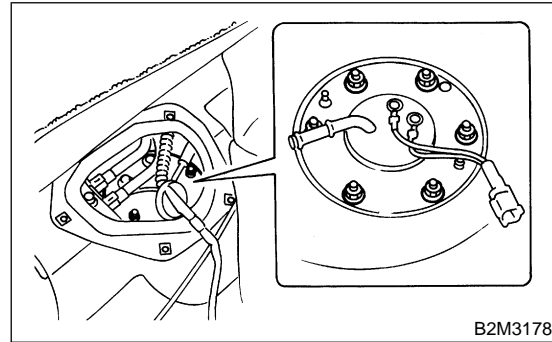
9) Disconnect connector from fuel sub level sensor.



10) Disconnect fuel jet pump hose.



11) Remove fuel sub level sensor.



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

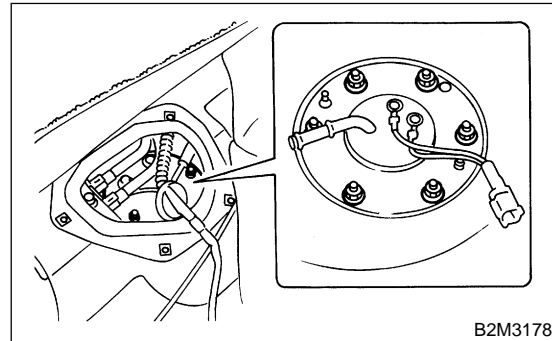
WARNING:

Do not use a motor pump when draining fuel.

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

Tightening torque:

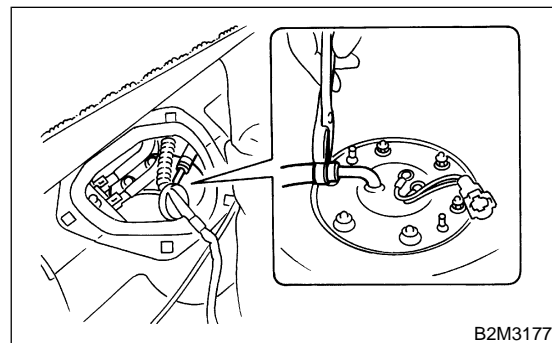
T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



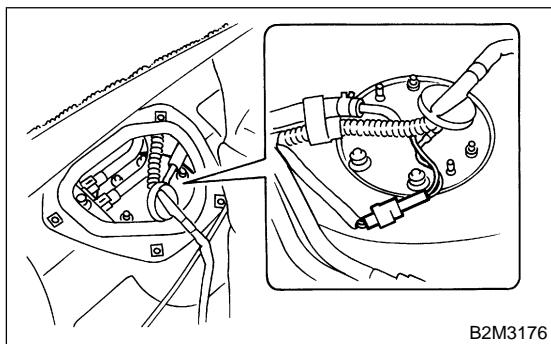
NOTE:

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

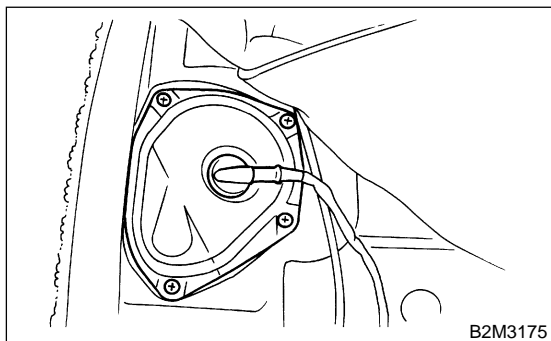
(1) Connect fuel jet pump hose.



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



- (3) Install sub service hole cover.

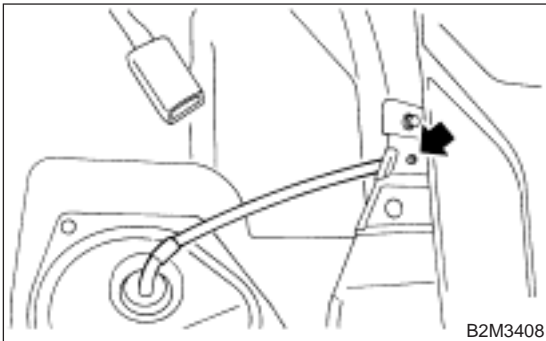


- (4) Set rear seat and floor mat.

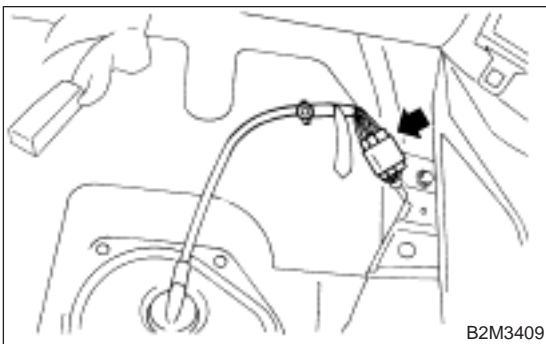
22. Fuel Tank S105053

A: REMOVAL S105053A18

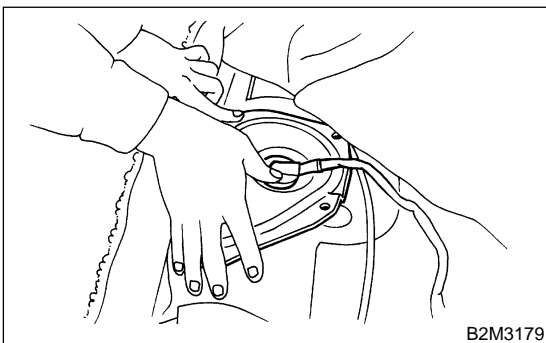
- 1) Set vehicle on the lift.
- 2) Release fuel pressure. <Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Drain fuel from fuel tank. <Ref. to FU(H4)-70 DRAINING FUEL, OPERATION, Fuel.>
- 4) Remove holder clip which secures fuel tank cord on bracket.



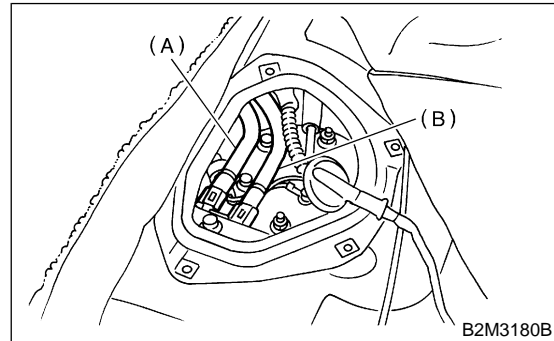
- 5) Disconnect connector of fuel tank cord to rear harness.



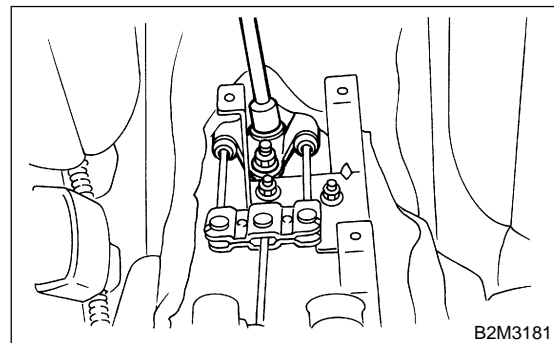
- 6) Push grommet which holds fuel tank cord on service hole cover into body side.



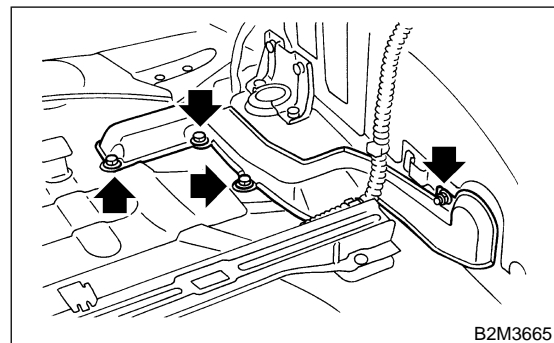
- 7) Separate quick connector of fuel delivery (A) and return hose (B). <Ref. to FU(H4)-98 REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



- 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.>



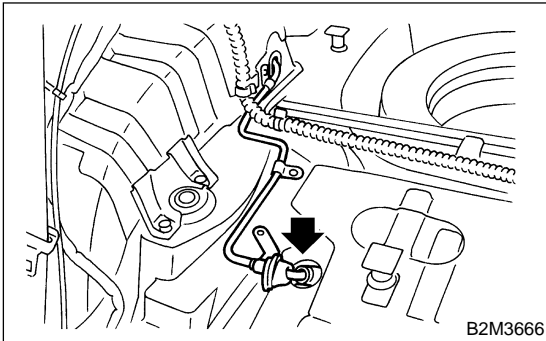
- 9) Remove trunk trim. (Sedan model)
<Ref. to EI-51 REMOVAL, Trunk Trim.>
- 10) Remove rear quarter lower trim. (Wagon model)
<Ref. to EI-44 WAGON, REMOVAL, Rear Quarter Trim.>
- 11) Remove pipe protector.



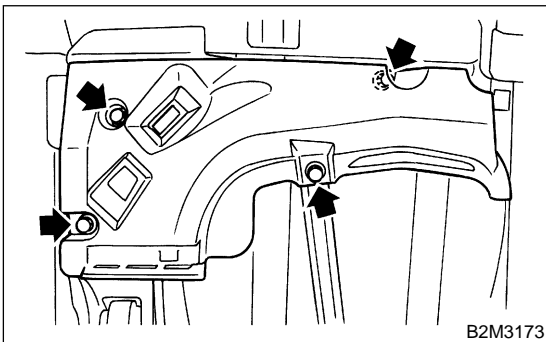
FUEL TANK

Fuel Injection (Fuel Systems)

12) Separate quick connector of evaporation pipe
(A). <Ref. to FU(H4)-98 REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



- 13) Remove wheel nuts from rear wheels.
- 14) Lift-up the vehicle.
- 15) Remove rear wheel.
- 16) Remove front side fuel tank cover.



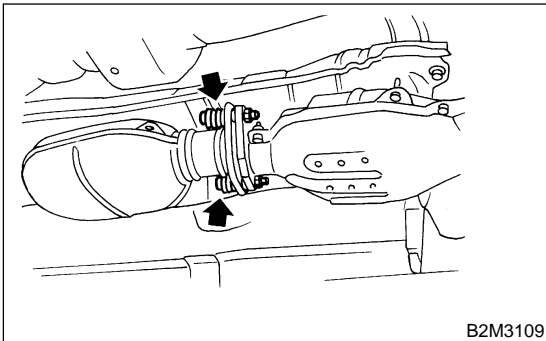
17) Remove rear exhaust pipe and muffler.

NOTE:

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

SUBARU CRC (Part No. 004301003)

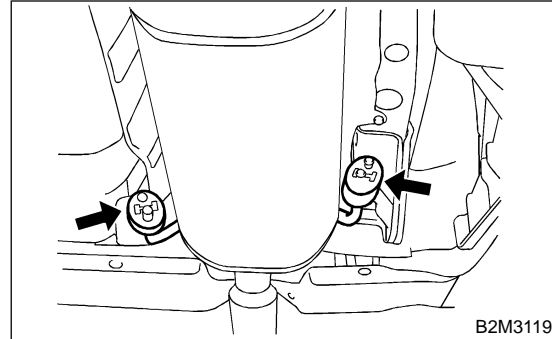
(1) Separate rear exhaust pipe from center exhaust pipe.



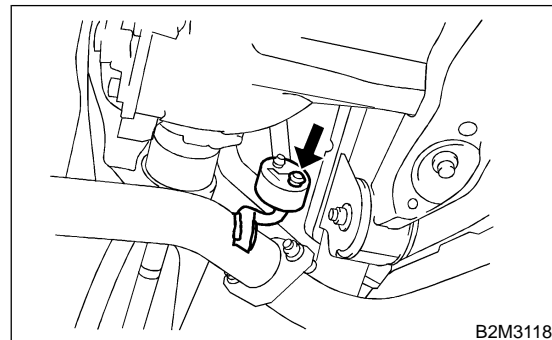
(2) Remove left and right rubber cushions.

CAUTION:

Be careful not to pull down muffler.

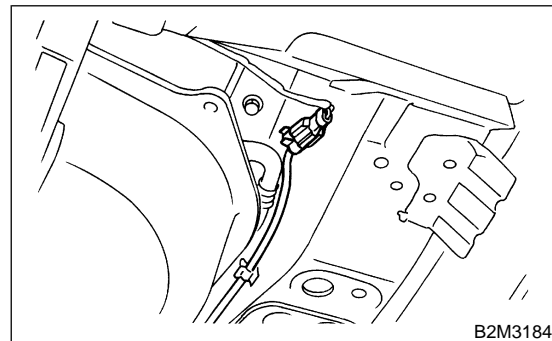


(3) Remove front rubber cushion and detach muffler assembly.



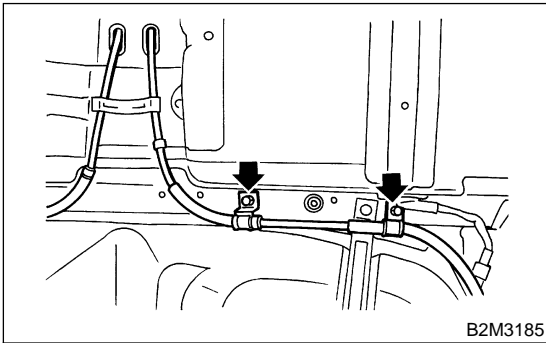
18) Remove propeller shaft. <Ref. to DS-13 REMOVAL, Propeller Shaft.>

19) Disconnect connector from ABS sensor.

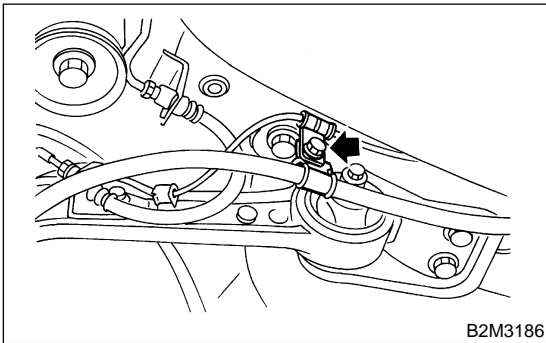


20) Remove bolts which hold parking brake cable holding bracket.

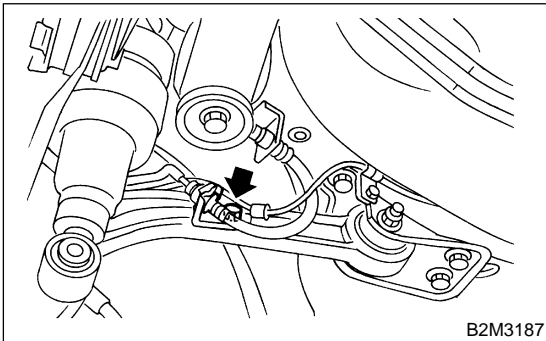
21) Remove parking brake cable from cabin by forcibly pulling it backward.



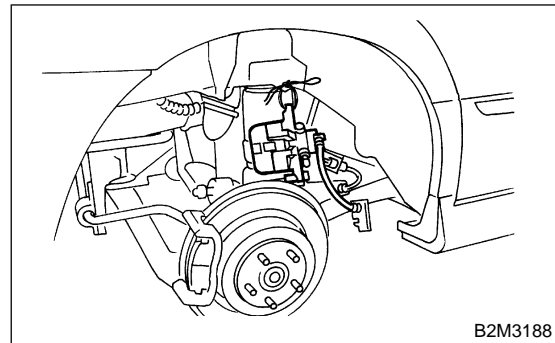
22) Remove bolts which hold parking brake cable holding bracket.



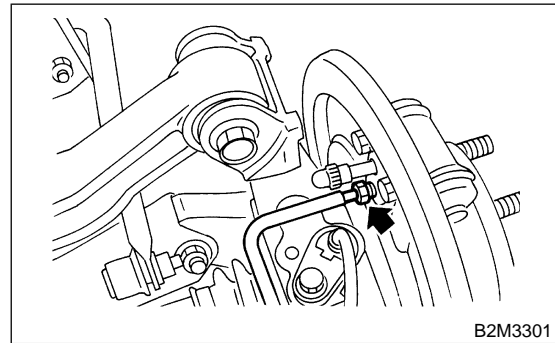
23) Remove bolts which hold rear brake hoses holding bracket.



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



25) Disconnect brake pipes from wheel cylinder. (Rear drum brake model) <Ref. to BR-30 REMOVAL, Rear Drum Brake Shoe.>

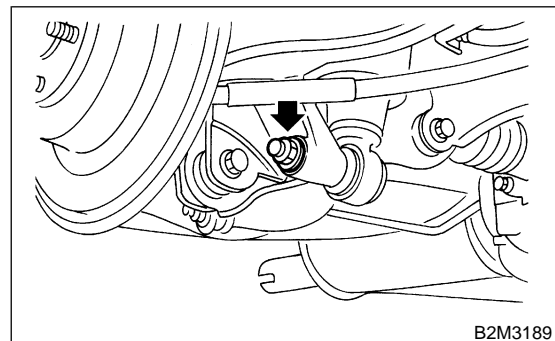


26) Remove rear suspension assembly.

WARNING:

A helper is required to perform this work.

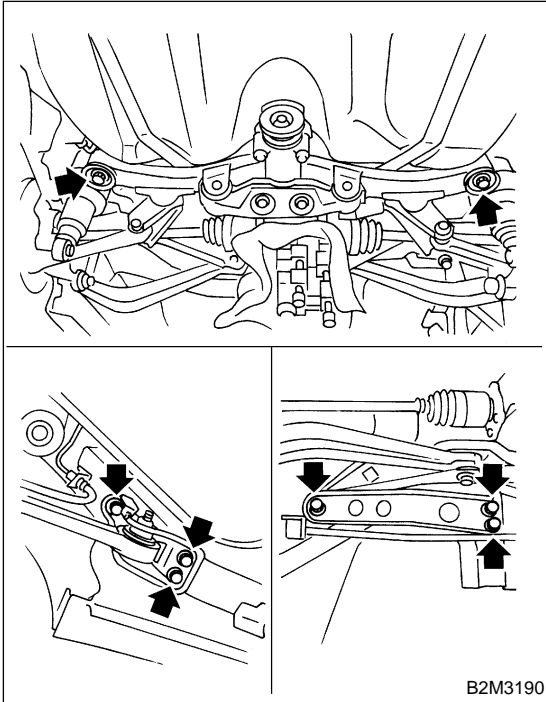
- (1) Support rear differential with transmission jack.
- (2) Remove bolt which holds rear shock absorber to rear suspension arm.



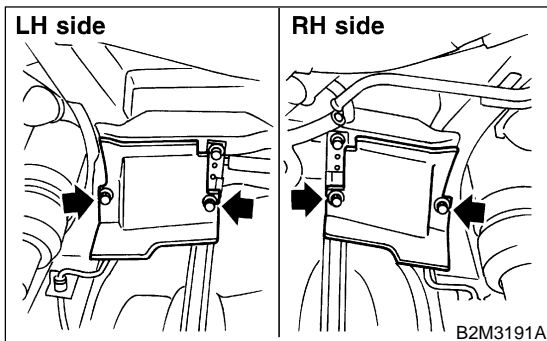
FUEL TANK

Fuel Injection (Fuel Systems)

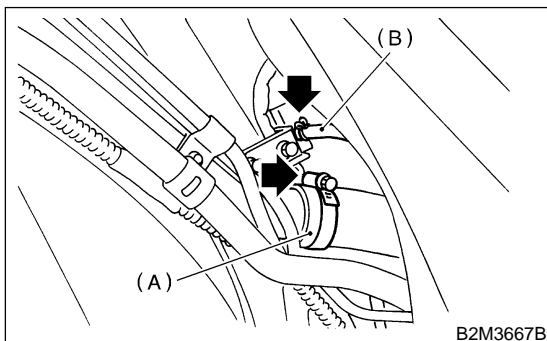
- (3) Remove bolt which secure rear suspension assembly to body.



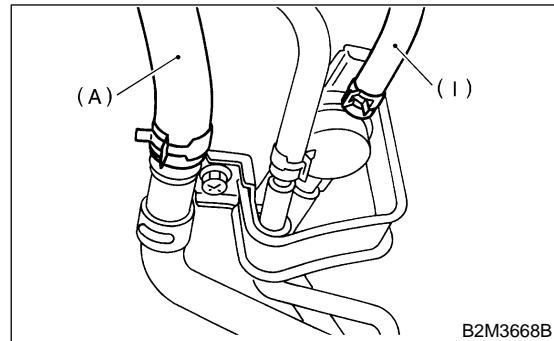
- (4) Remove rear suspension assembly.
27) Remove rear side fuel tank cover.



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



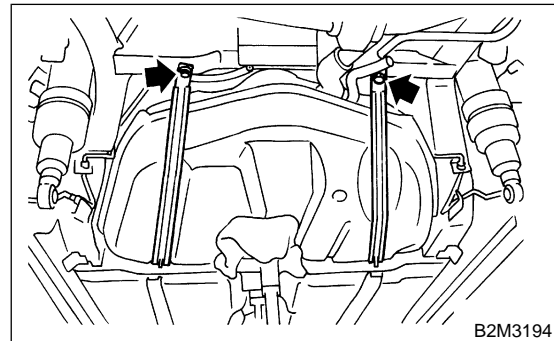
- 29) Disconnect air vent hose (A) from evaporation pipe assembly and disconnect evaporation hose (I) from pressure control solenoid valve.



- 30) 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.

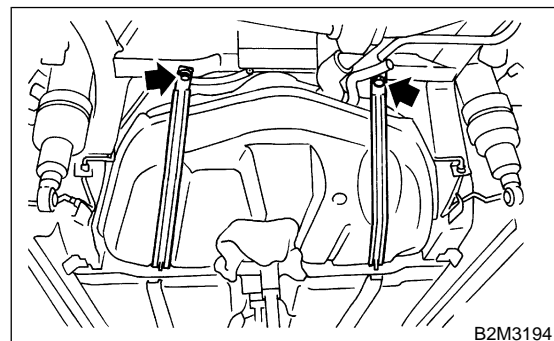


B: INSTALLATION S105053A11

- 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:

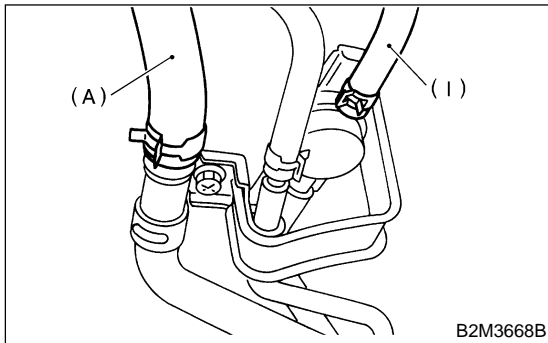
A helper is required to perform this work.



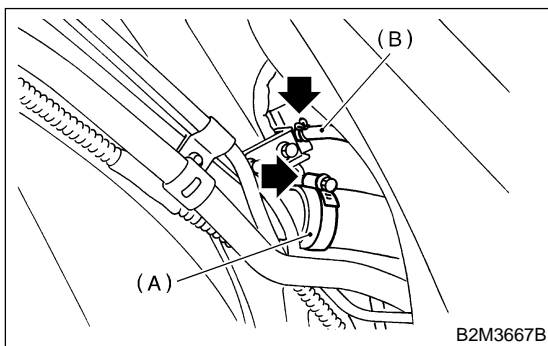
FUEL TANK

Fuel Injection (Fuel Systems)

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



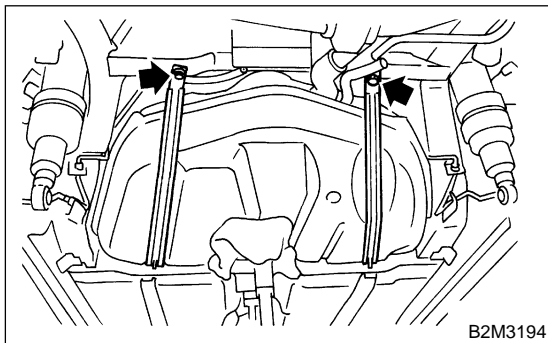
- 4) Connect fuel filler hose (A) and fuel tank pressure sensor hose (B).



- 5) Tighten band mounting bolts.

Tightening torque:

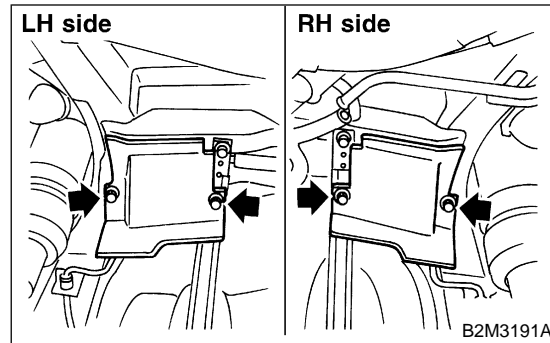
33 N·m (3.4 kgf-m, 25 ft-lb)



- 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.

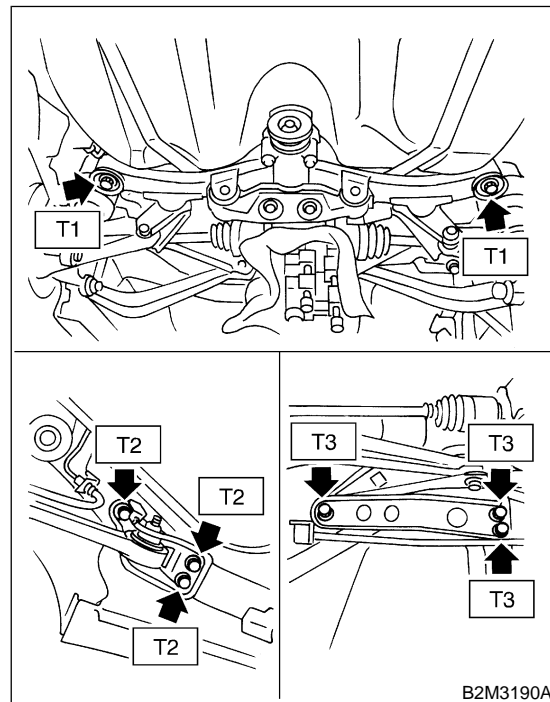
- (1) Support rear suspension assembly and then tighten bolts which secure rear suspension assembly.

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)



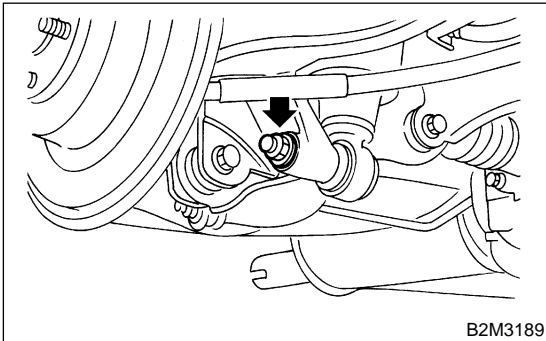
FUEL TANK

Fuel Injection (Fuel Systems)

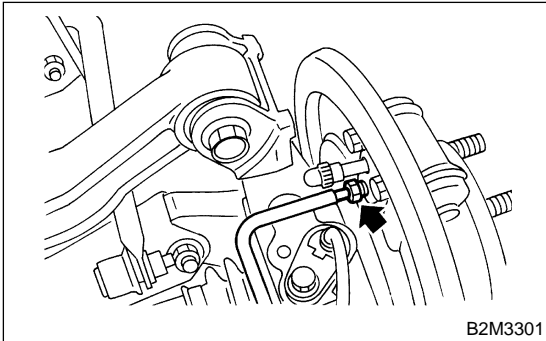
(2) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-19 INSTALLATION, Link Upper.>

Tightening torque:

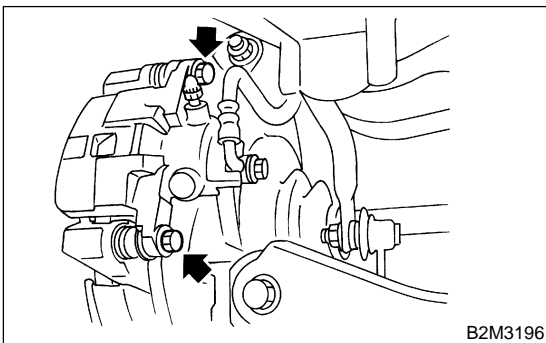
157 N·m (16 kgf-m, 116 ft-lb)



8) Connect brake pipes to wheel cylinder. (Rear drum brake model) <Ref. to BR-36 INSTALLATION, Rear Drum Brake Assembly.>



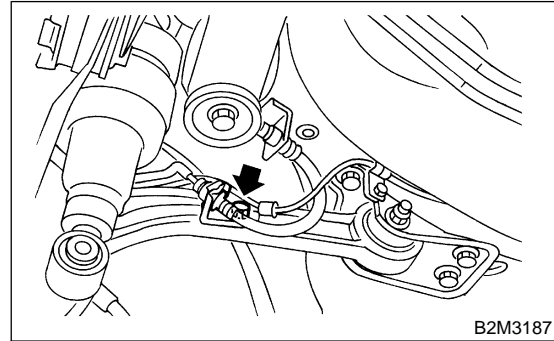
9) Install rear brake caliper. (Rear disk brake model) <Ref. to BR-27 INSTALLATION, Rear Disc Brake Assembly.>



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

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)

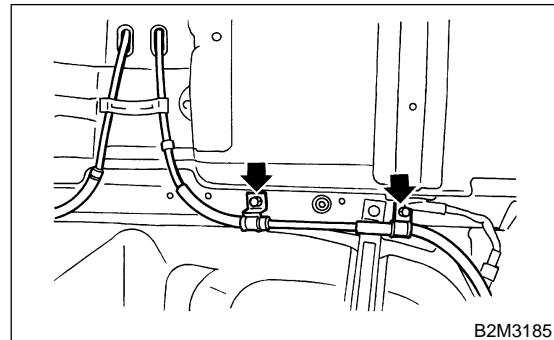


11) Install parking brake cable to cabin by forcibly pushing it forward.

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

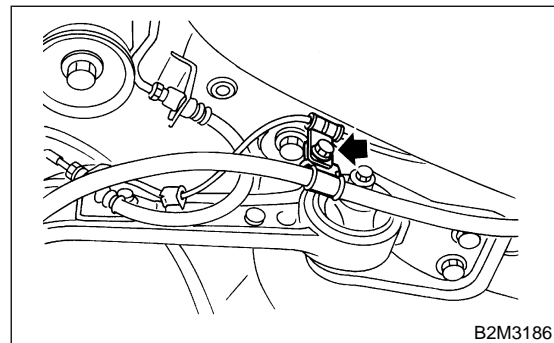
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

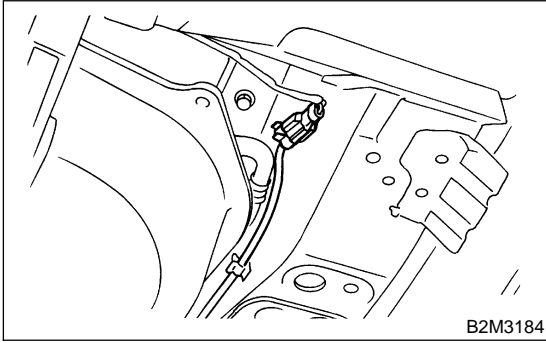


Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)



- 13) Connect connector to ABS sensor.



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

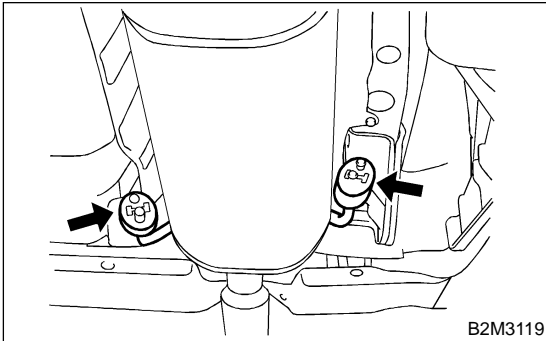
- 15) Install rear exhaust pipe and muffler.

NOTE:

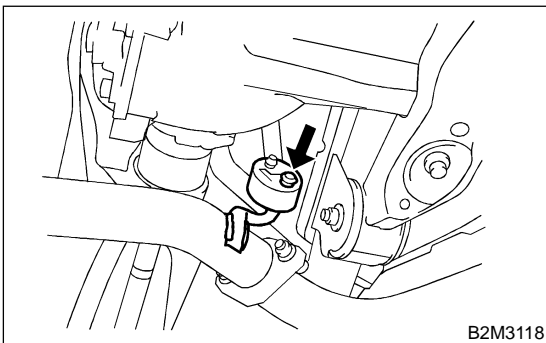
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

- (1) Install left and right rubber cushions.



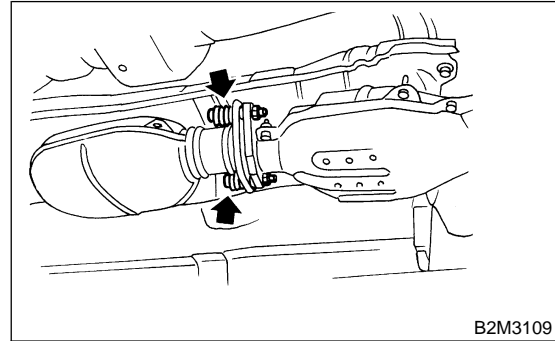
- (2) Install front rubber cushion and attach muffler assembly.



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

Tightening torque:

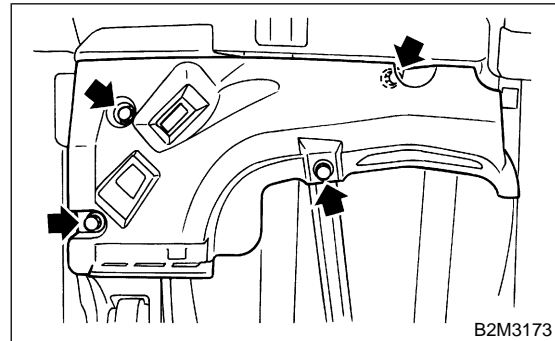
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 16) Install front side fuel tank cover.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

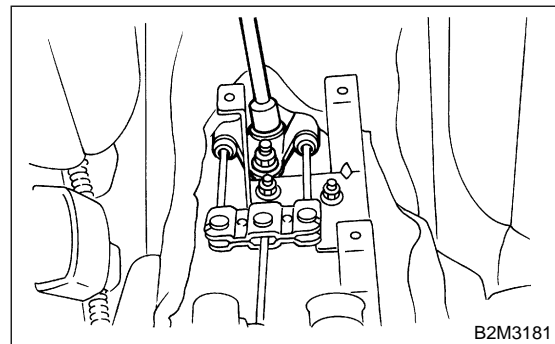


- 17) Install rear wheel.

- 18) Lower the vehicle.

- 19) Tighten wheel nuts to rear wheel.

- 20) Install parking brake cable. <Ref. to PB-6 INSTALLATION, Parking Brake Lever.>

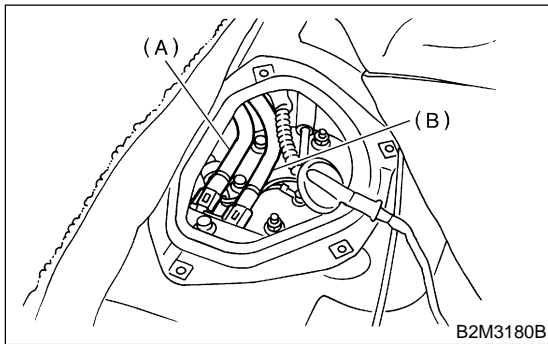


FUEL TANK

Fuel Injection (Fuel Systems)

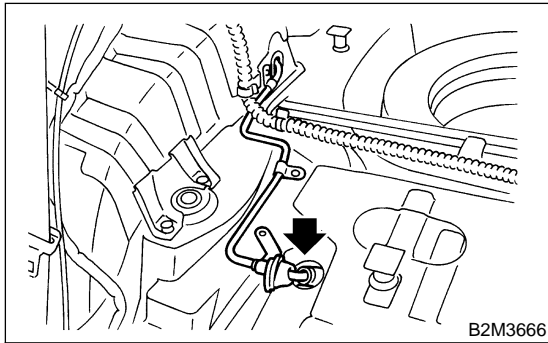
21) Install console box. <Ref. to EI-36 INSTALLATION, Console Box.>

22) Connect fuel hoses and hold them with quick connector. <Ref. to FU(H4)-99 INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

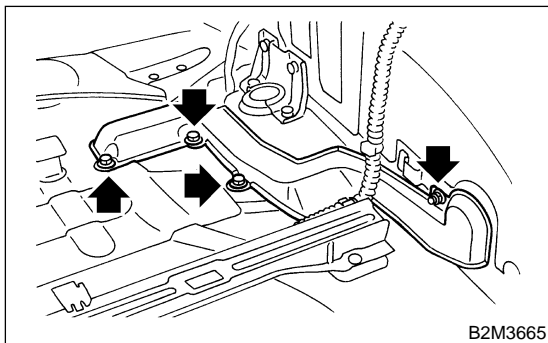


- (A) Delivery hose
- (B) Return hose

23) Connect evaporation pipe (A) and hold it with quick connector. <Ref. to FU(H4)-99 INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>



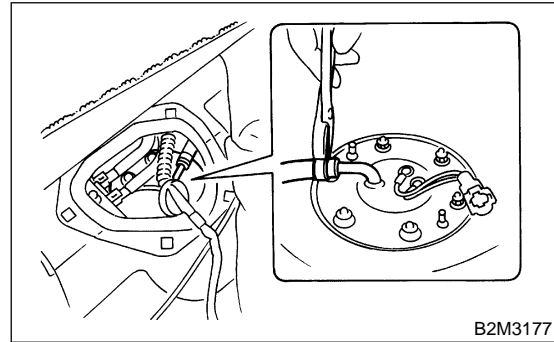
24) Install pipe protector.



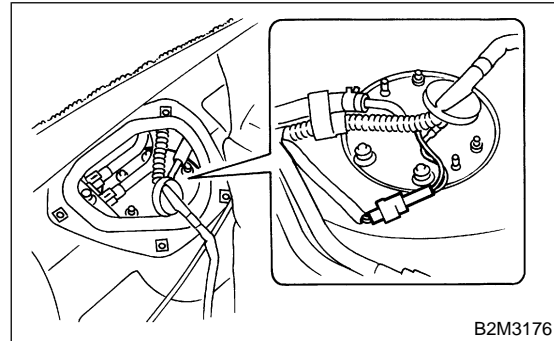
25) Install trunk room trim. (Sedan model)

26) Install luggage room trim. (Wagon model)

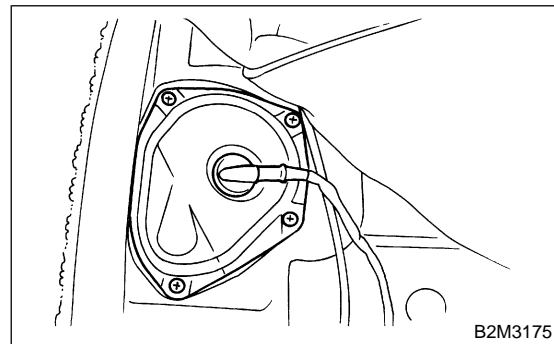
27) Connect fuel jet pump hose.



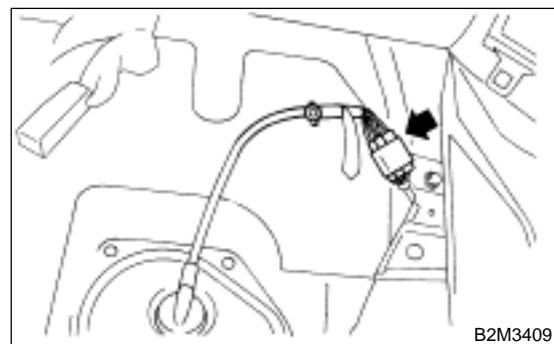
28) Connect connector to fuel sub level sensor.



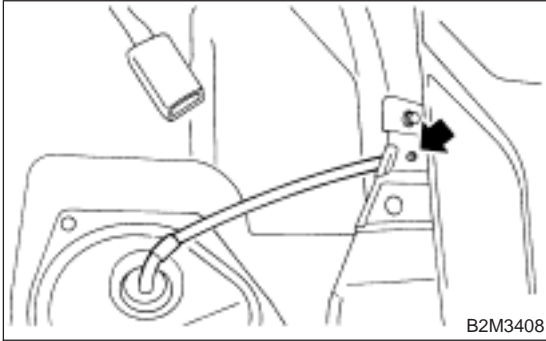
29) Install sub service hole cover.



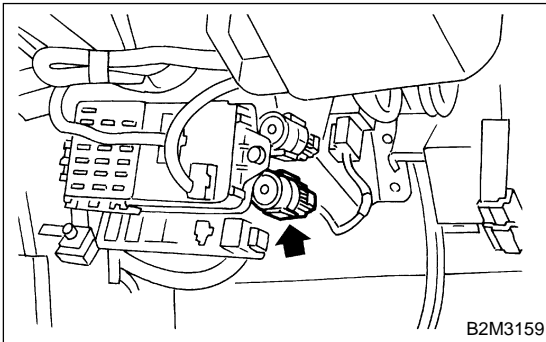
30) Connect connectors to fuel tank cord and plug service hole with grommet.



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



- 32) Set rear seat and floor mat.
33) Connect connector to fuel pump relay.



- 34) Bleed air from brake system. (Rear drum brake model only) <Ref. to BR-53 BRAKE LINE, PROCEDURE, Air Bleeding.>
35) Adjust parking brake lever stroke. <Ref. to.>
36) Check wheel alignment and adjust if necessary. <Ref. to FS-6 INSPECTION, Wheel Alignment.>

C: INSPECTION S105053A10

- 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.

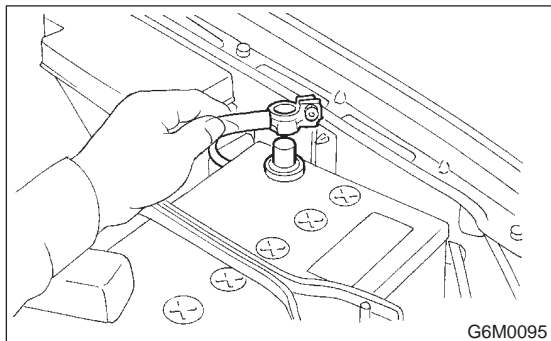
23. Fuel Filler Pipe S105022

A: REMOVAL S105022A18

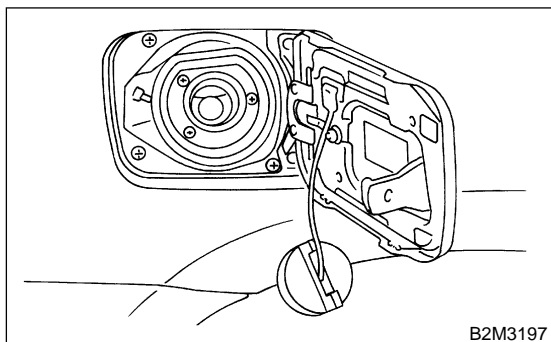
WARNING:

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

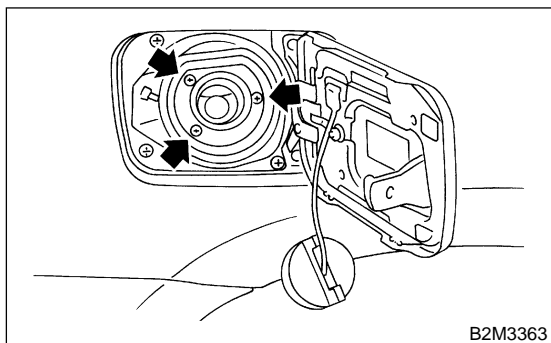
- 1) Set the vehicle on the lift.
- 2) Disconnect battery ground cable.



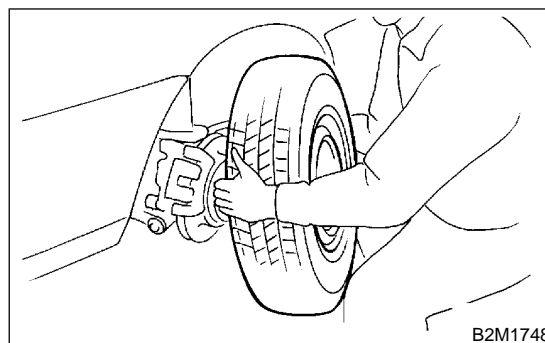
- 3) Open fuel filler flap lid and remove filler cap.



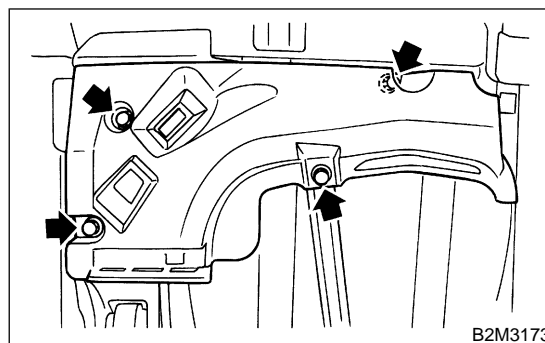
- 4) Remove screws holding packing in place.



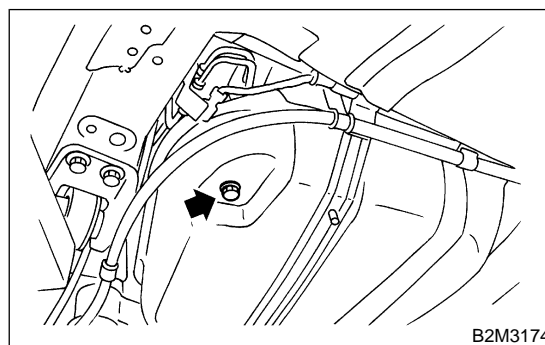
- 5) Lift-up the vehicle.
- 6) Remove rear wheel nuts.
- 7) Remove rear wheel.



- 8) Remove front right side fuel tank cover.



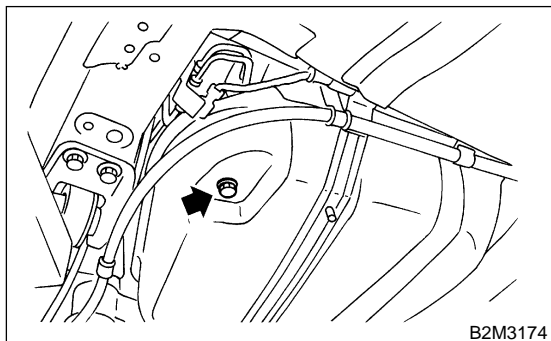
- 9) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



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

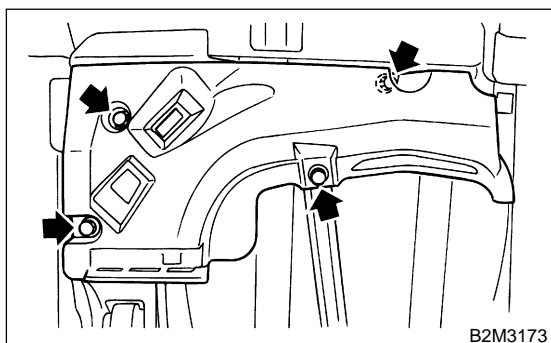
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



Tightening torque:

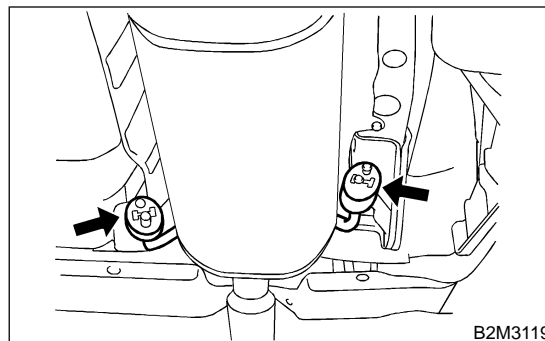
18 N·m (1.8 kgf-m, 13.0 ft-lb)



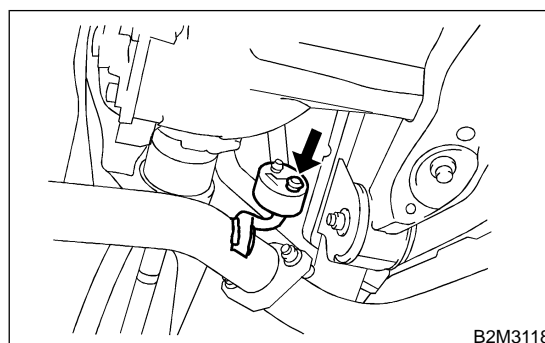
(2) Remove left and right rubber cushions.

CAUTION:

Be careful not to pull down muffler.



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



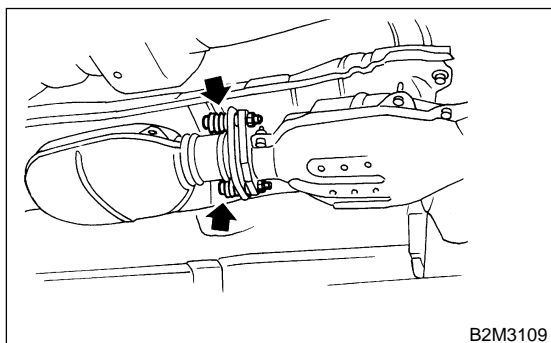
11) Remove rear exhaust pipe and muffler.

NOTE:

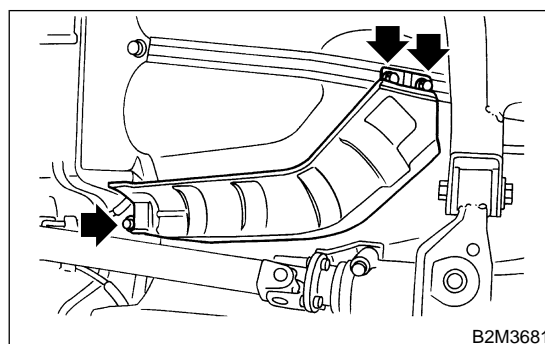
To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

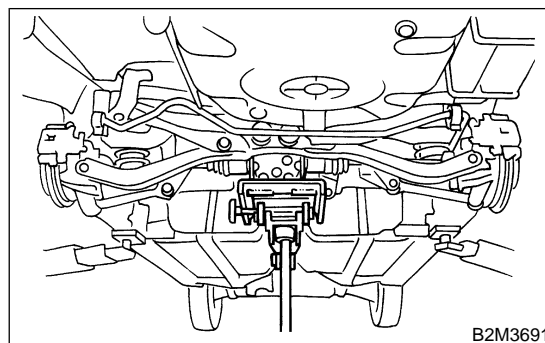
(1) Separate rear exhaust pipe from center exhaust pipe.



12) Remove heat sealed cover.



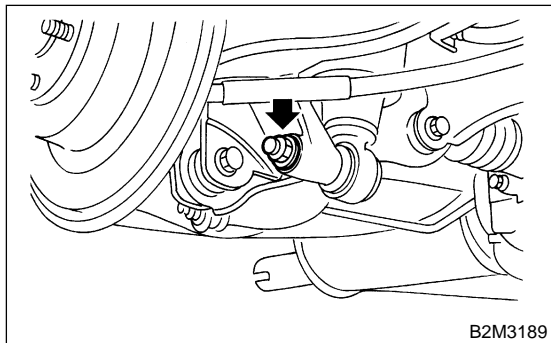
13) Place transmission jack under sub frame.



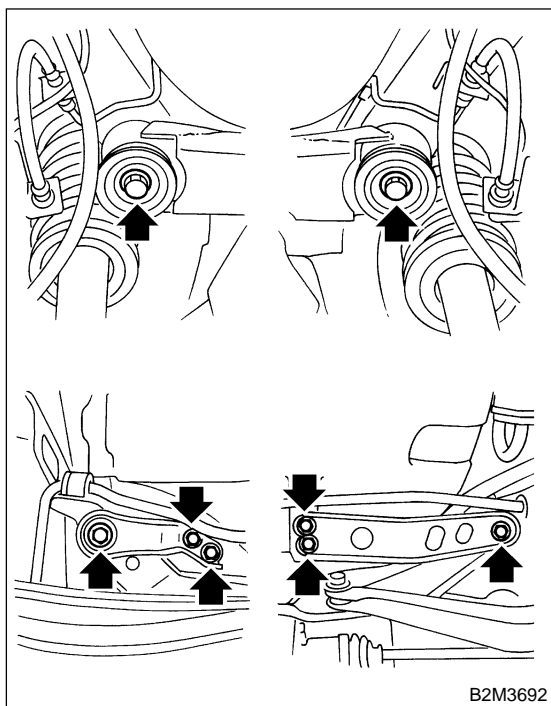
FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

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



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

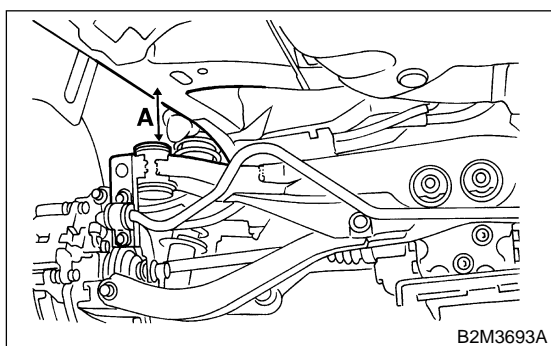


16) Lower the rear sub frame.

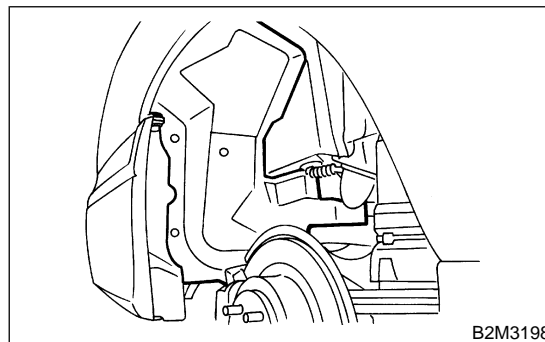
CAUTION:

Be sure to lower sub frame slowly.

$A = 150 \text{ mm (5.91 in)}$

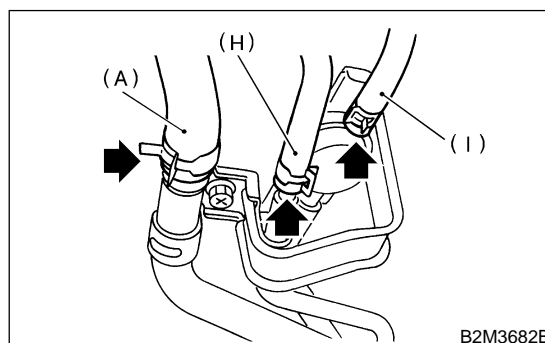


17) Remove fuel filler pipe protector.

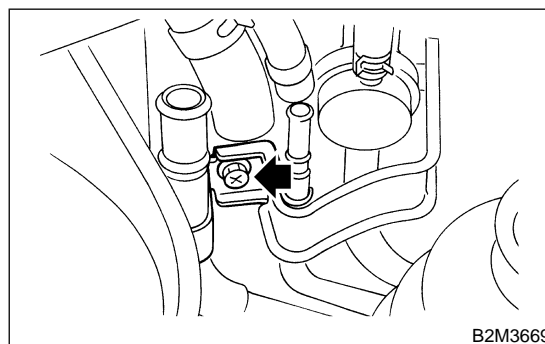


18) Disconnect air vent hose (A) and evaporation hose (H) from evaporation pipe assembly.

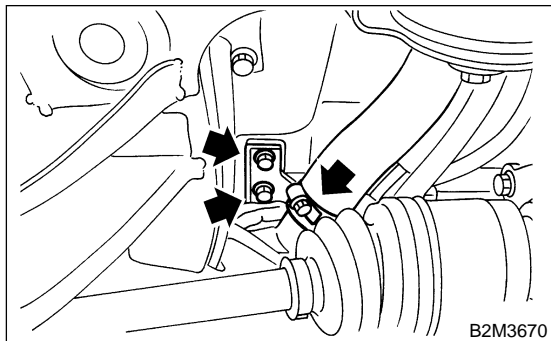
19) Disconnect evaporation hose (I) from pressure control solenoid valve.



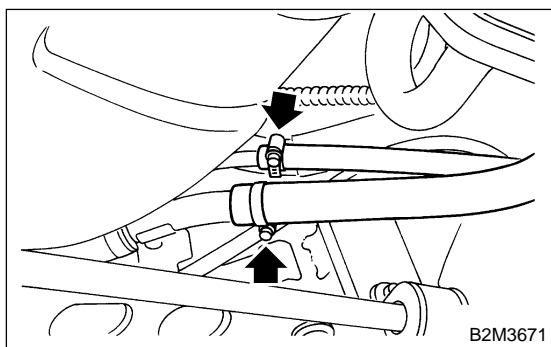
20) Remove bolt which holds evaporation pipe assembly on body.



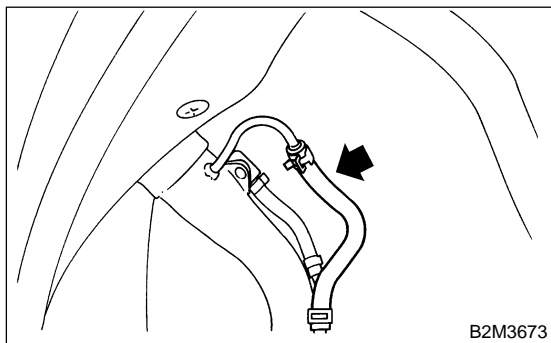
- 21) Disconnect fuel filler hose.
- 22) Remove bolt which holds fuel pressure sensor on fuel filler pipe and remove bolt which holds fuel filler pipe on body.



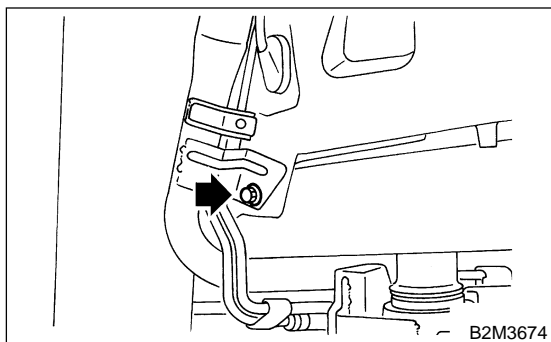
- 23) Disconnect canister hose from evaporation pipe assembly.



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



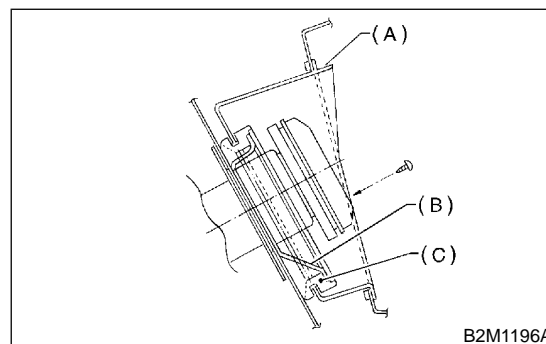
- 25) Remove bolt which holds fuel filler pipe to body.



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

B: INSTALLATION S105022A11

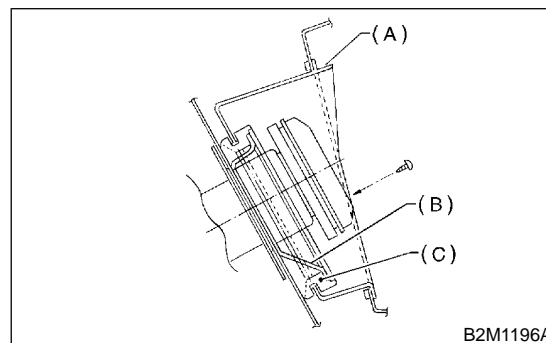
- 1) Hold fuel filler flap open.
- 2) Set fuel saucer (A) with rubber packing (C) and insert fuel filler pipe into hole from the inner side of apron.



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

NOTE:

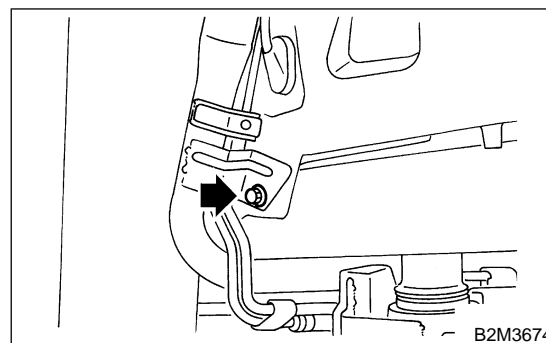
If edges of rubber packing are folded toward the inside, straighten it with a screwdriver.



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

Tightening torque:

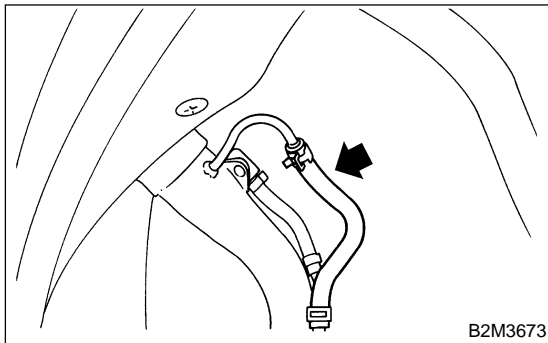
7.5 N·m (0.75 kgf·m, 5.4 ft-lb)



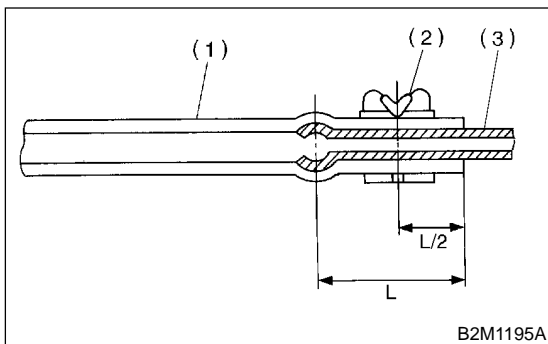
FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

5) Insert evaporation hose (O) approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe and hold clip.

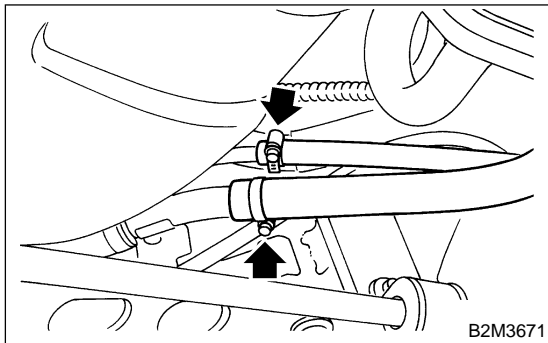


$L = 27.5 \pm 2.5 \text{ mm (1.083} \pm 0.098 \text{ in)}$

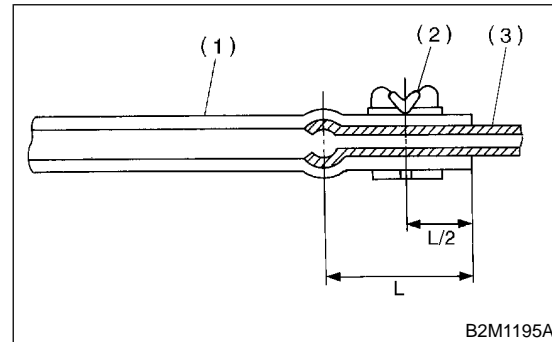


- (1) Hose
- (2) Clip
- (3) Pipe

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.



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

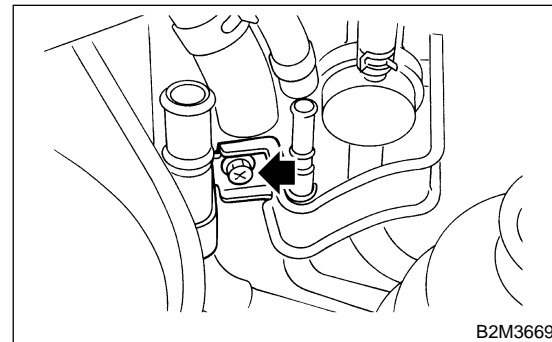


- (1) Hose
- (2) Clip
- (3) Pipe

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

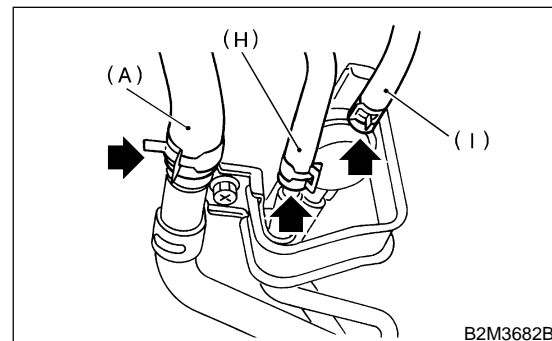
Tightening torque:

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.

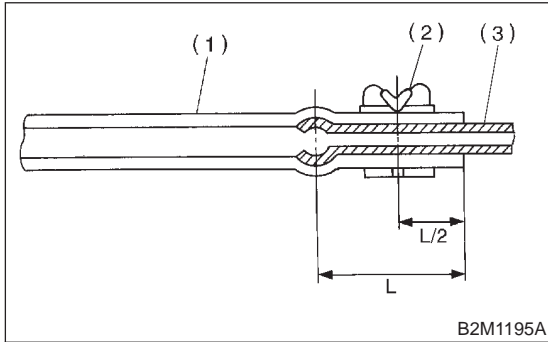
9) Insert evaporation hose (I) to pressure control solenoid valve and hold clip.



FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

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



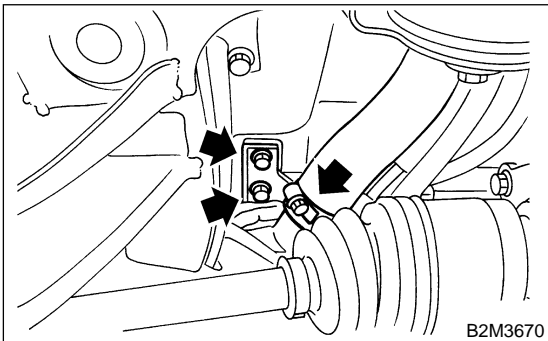
- (1) Hose
- (2) Clip
- (3) Pipe

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

Tightening torque:

7.5 N·m (0.75 kgf-m, 5.4 ft-lb)

11) Insert fuel filler hose approximately 35 to 40 mm (1.38 to 1.57 in) over the lower end of fuel filler pipe and tighten clamp.

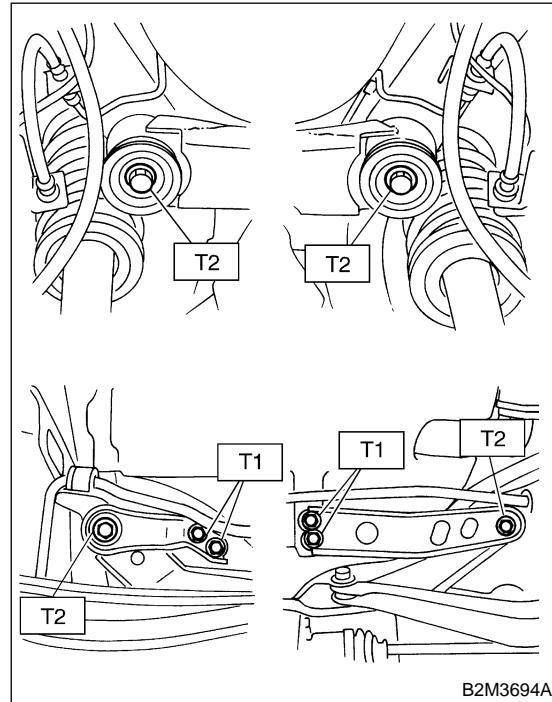


12) Jack-up the rear sub frame and tighten bolts which hold rear sub frame on body.

Tightening torque:

T1: 66 N·m (6.7 kgf-m, 48.5 ft-lb)

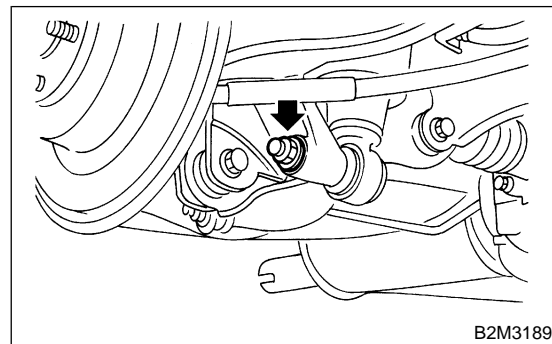
T2: 172 N·m (17.5 kgf-m, 127 ft-lb)



13) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-22 INSTALLATION, Rear Shock Absorber.>

Tightening torque:

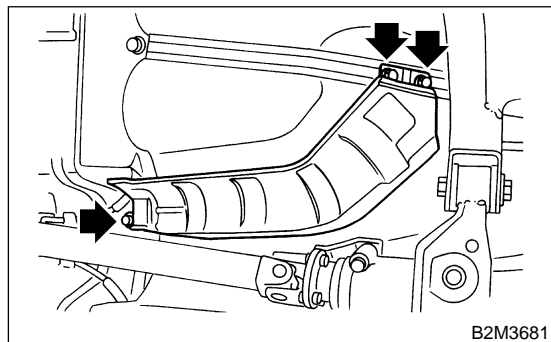
157 N·m (16 kgf-m, 116 ft-lb)



FUEL FILLER PIPE

Fuel Injection (Fuel Systems)

- 14) Install heat shield cover.



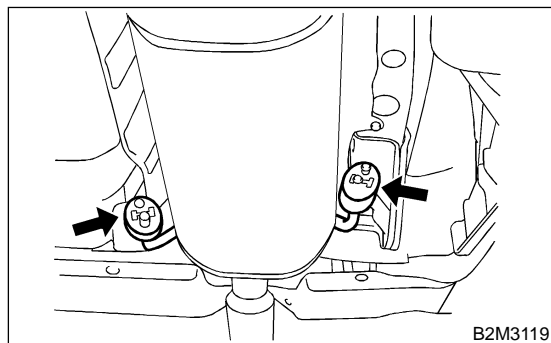
- 15) Install rear exhaust pipe and muffler.

NOTE:

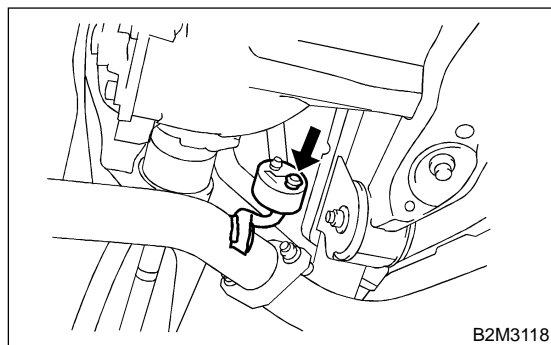
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

- (1) Install left and right rubber cushions.



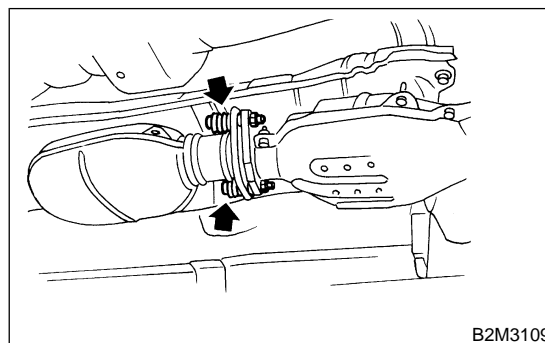
- (2) Install front rubber cushion and attach muffler assembly.



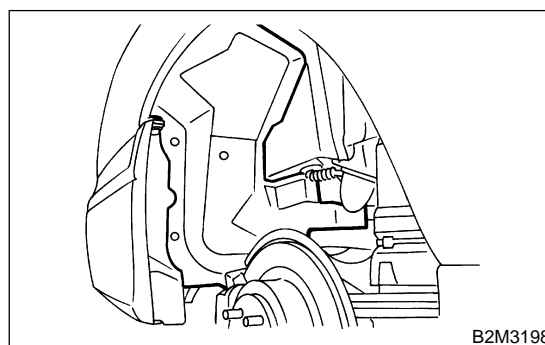
- (3) Install rear exhaust pipe to center exhaust pipe.

Tightening torque:

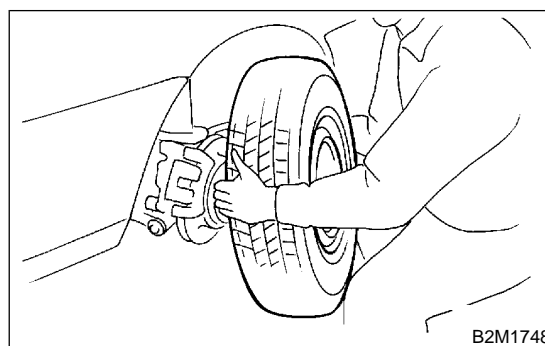
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 16) Install fuel filler pipe protector.



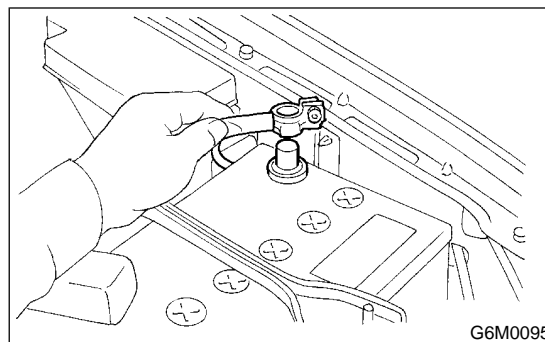
- 17) Install rear right wheel.



- 18) Lower the vehicle.

- 19) Tighten wheel nuts.

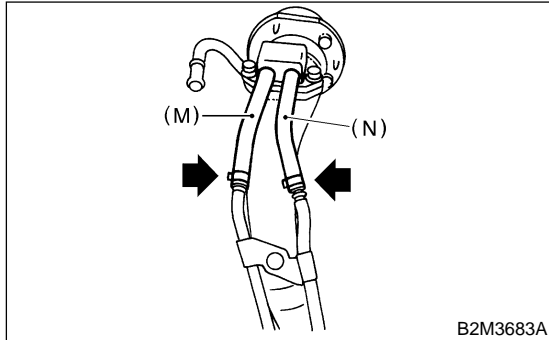
- 20) Connect battery ground terminal.



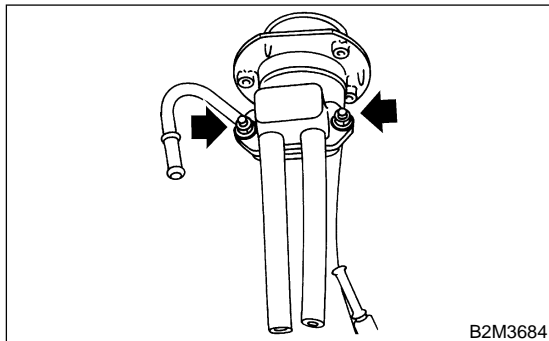
21) Remove fuel filler pipe to under side of the vehicle.

C: DISASSEMBLY S105022A06

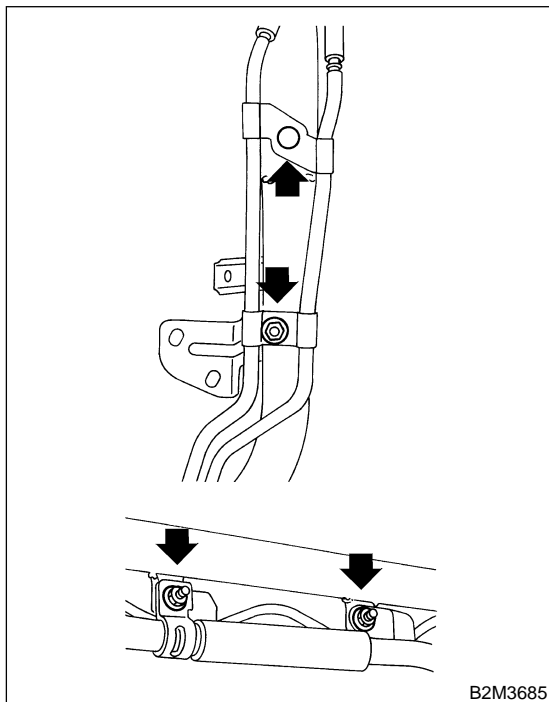
1) Disconnect evaporation hose (M) and (N) from evaporation pipe assembly.



2) Remove shut valve from fuel filler pipe.



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



D: ASSEMBLY S105022A02

Assemble in the reverse order of disassembly.

24. Fuel Pump S105025

A: REMOVAL S105025A18

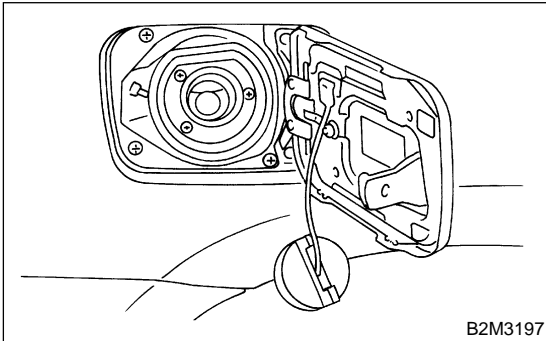
WARNING:

- 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.

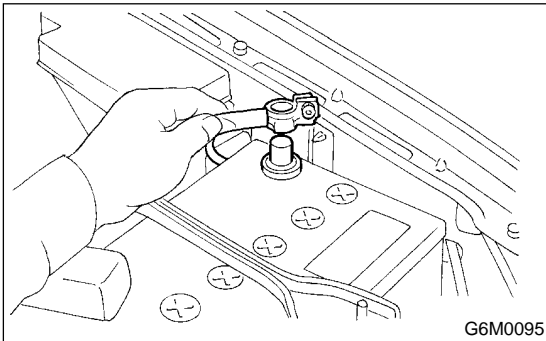
NOTE:

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

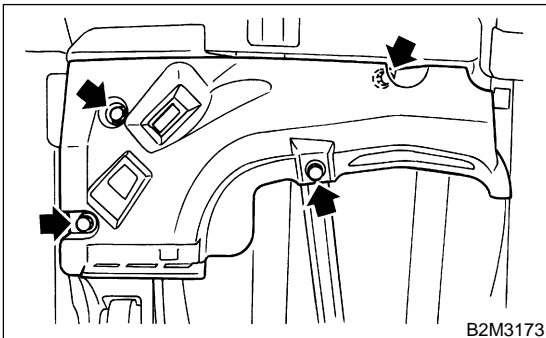
- 1) Release fuel pressure. <Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Open fuel filler flap lid and remove fuel filler cap.



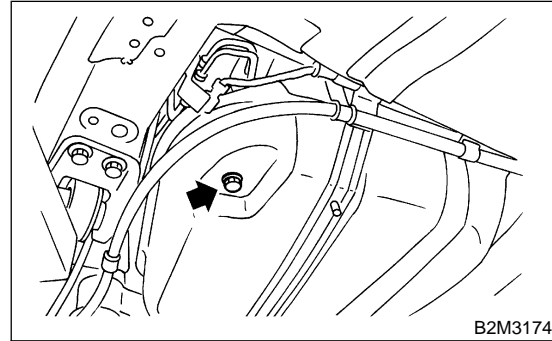
- 3) Disconnect battery ground cable.



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



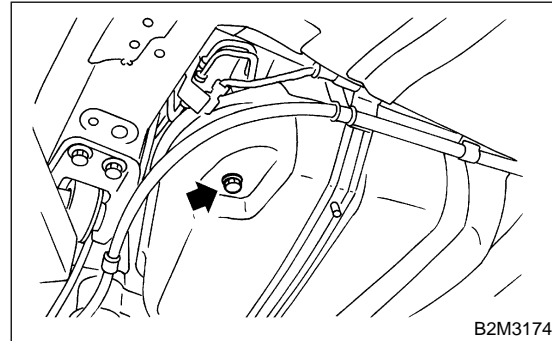
- 6) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



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

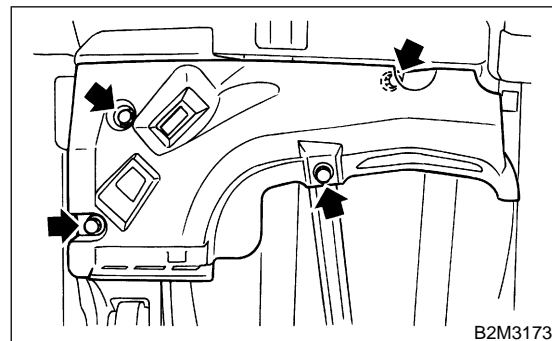
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)



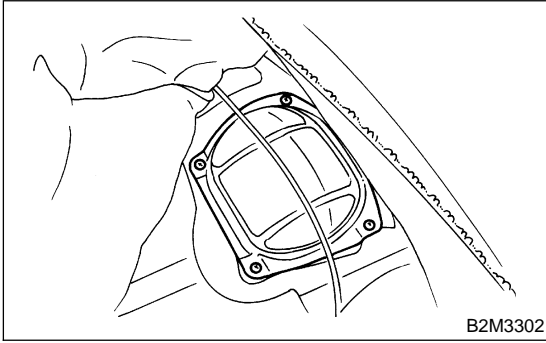
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

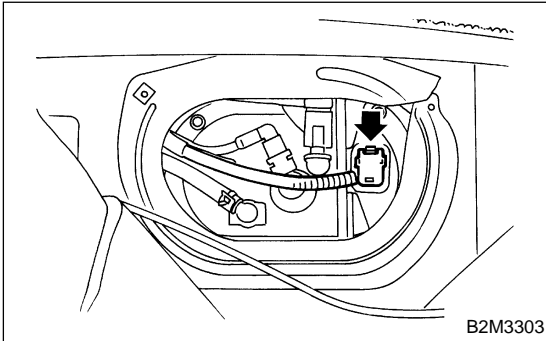


- 8) Raise rear seat and turn floor mat up.

- 9) Remove access hole lid.

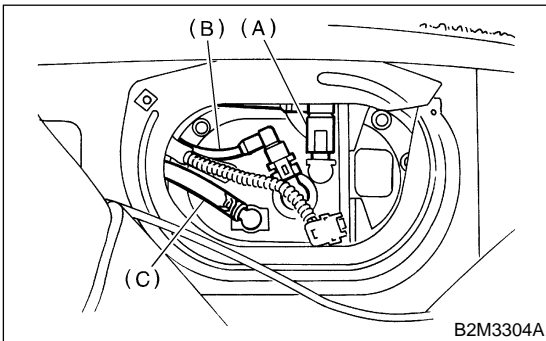


- 10) Disconnect connector from fuel pump.

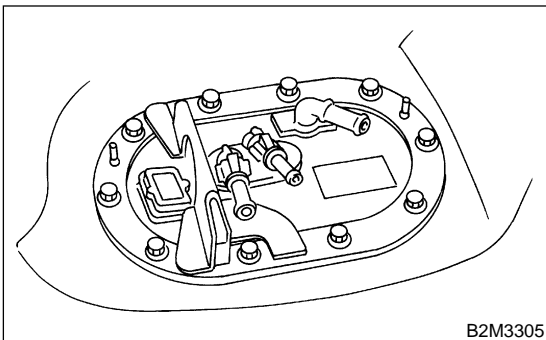


- 11) Move clips and then disconnect jet pump hose (C).

- 12) Disconnect quick connector and then disconnect fuel delivery hose (A) and return hose (B).
<Ref. to FU(H4)-98 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

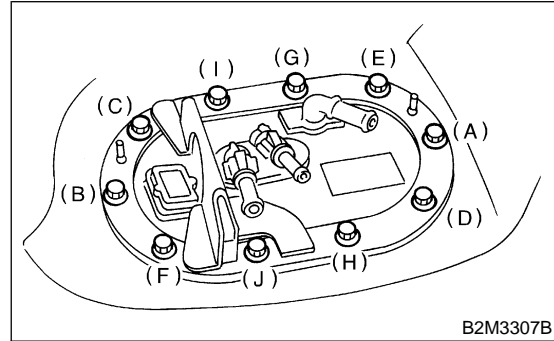
S105025A11

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)



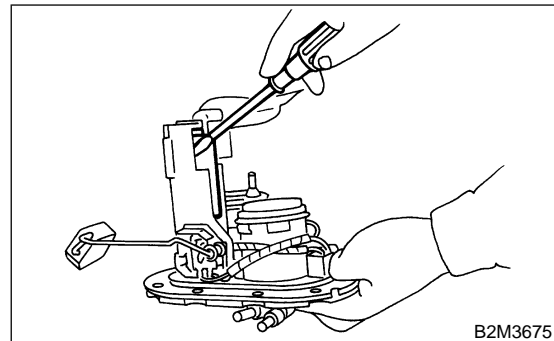
C: DISASSEMBLY

S105025A06

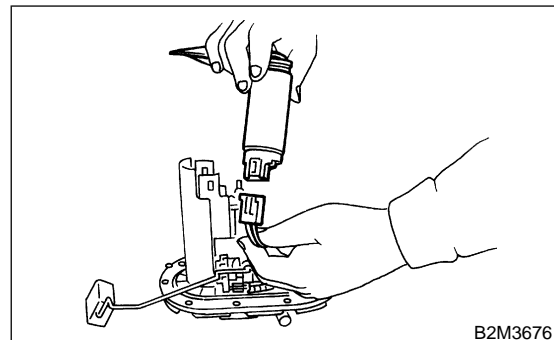
- 1) Remove fuel pump and pump holder.

NOTE:

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



- 2) Disconnect connector from fuel pump.



D: ASSEMBLY S105025A02

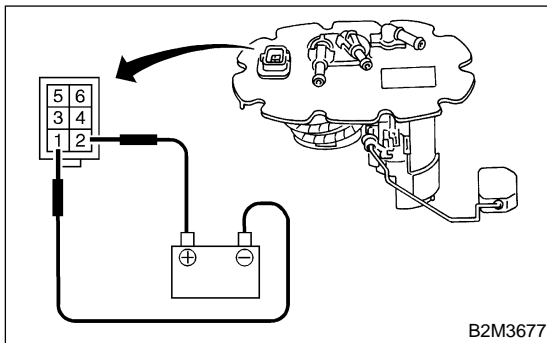
Assemble in the reverse order of disassembly.

E: INSPECTION S105025A10

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.



25. Fuel Level Sensor

S105026

A: REMOVAL

S105026A18

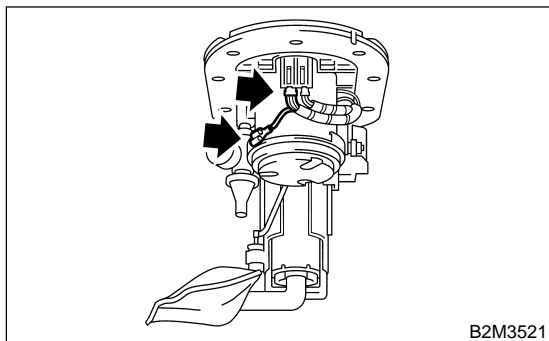
WARNING:

- 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(H4)-90 REMOVAL, Fuel Pump.>
- 2) Disconnect connector from fuel pump bracket.

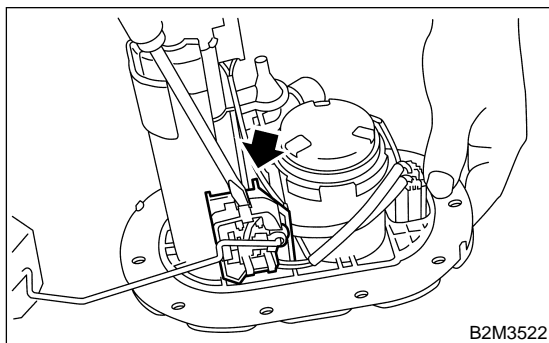


B2M3521

- 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

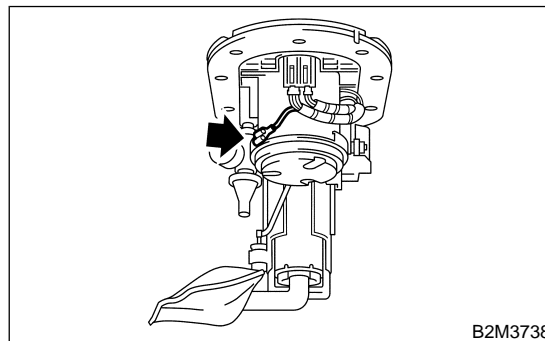
B: INSTALLATION

S105026A11

Install in the reverse order of removal.

WARNING:

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



B2M3738

FUEL SUB LEVEL SENSOR

Fuel Injection (Fuel Systems)

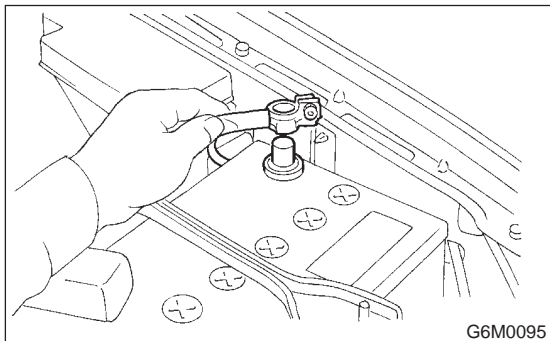
26. Fuel Sub Level Sensor S105023

A: REMOVAL S105023A18

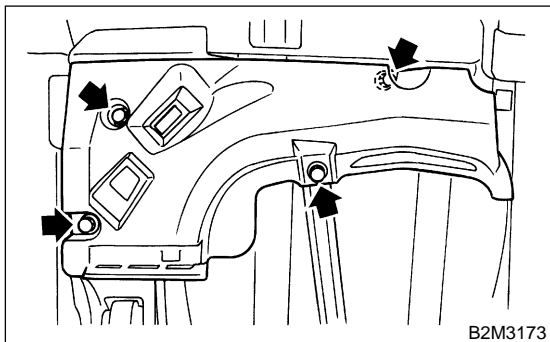
WARNING:

- 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.

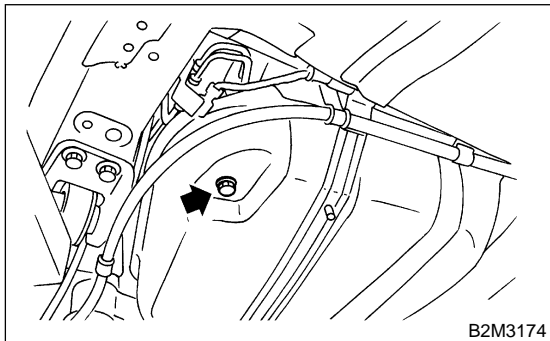
- 1) Disconnect battery ground cable.



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



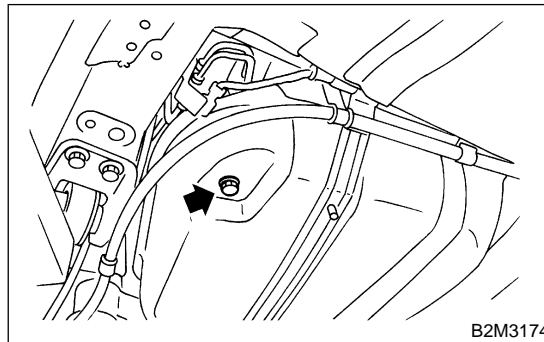
- 4) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



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

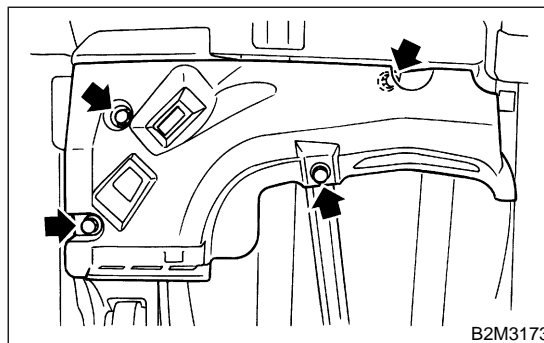
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

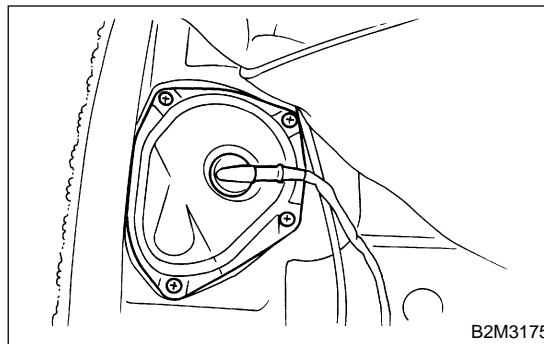


Tightening torque:

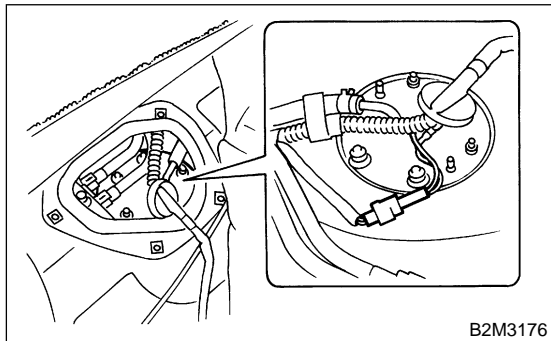
18 N·m (1.8 kgf-m, 13.0 ft-lb)



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



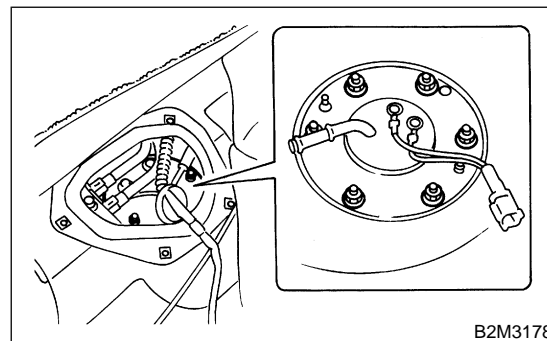
- 9) Disconnect connector from fuel sub level sensor.



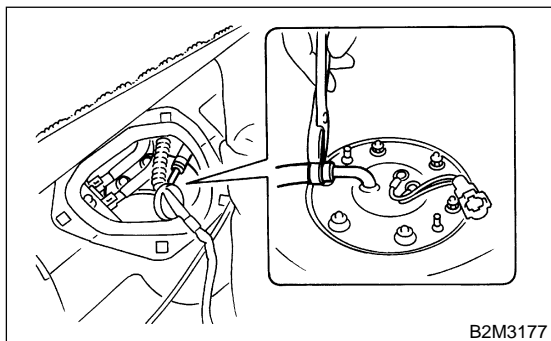
B: INSTALLATION S105023A11

Install in the reverse order of removal.

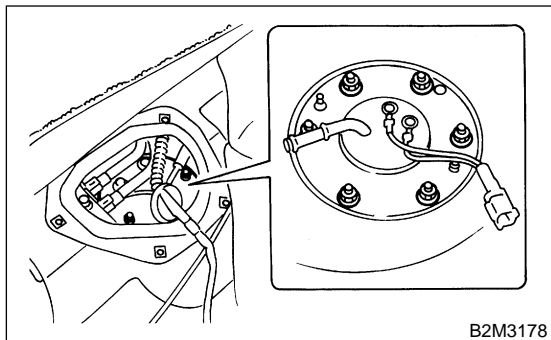
Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



- 10) Disconnect fuel jet pump hose.



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



- 12) Remove fuel sub level sensor.

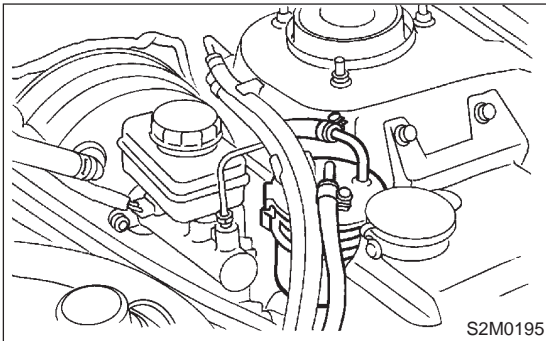
27. Fuel Filter S105027

A: REMOVAL S105027A18

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(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 2) Disconnect fuel delivery hoses from fuel filter.



- 3) Remove filter from holder.

B: INSTALLATION S105027A11

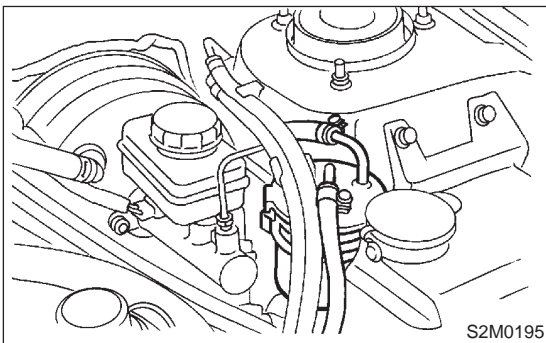
CAUTION:

- 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)



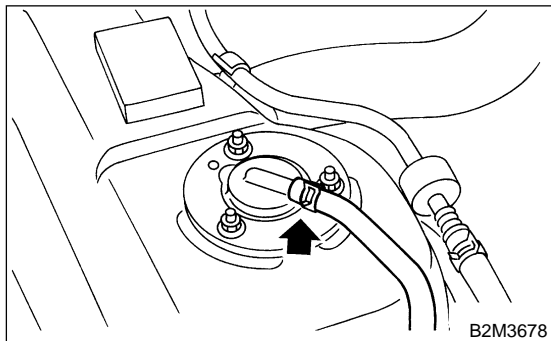
C: INSPECTION S105027A10

- 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.

28. Fuel Cut Valve S105021

A: REMOVAL S105021A18

- 1) Remove fuel tank. <Ref. to FU(H4)-73 REMOVAL, Fuel Tank.>
- 2) Move clip and disconnect evaporation hose from fuel cut valve.



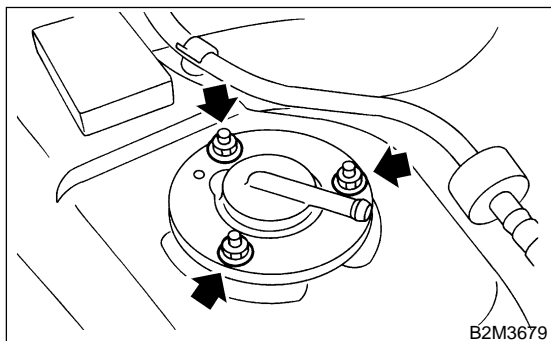
- 3) Remove bolts which install fuel cut valve.

B: INSTALLATION S105021A11

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



FUEL DELIVERY, RETURN AND EVAPORATION LINES

Fuel Injection (Fuel Systems)

29. Fuel Delivery, Return and Evaporation Lines

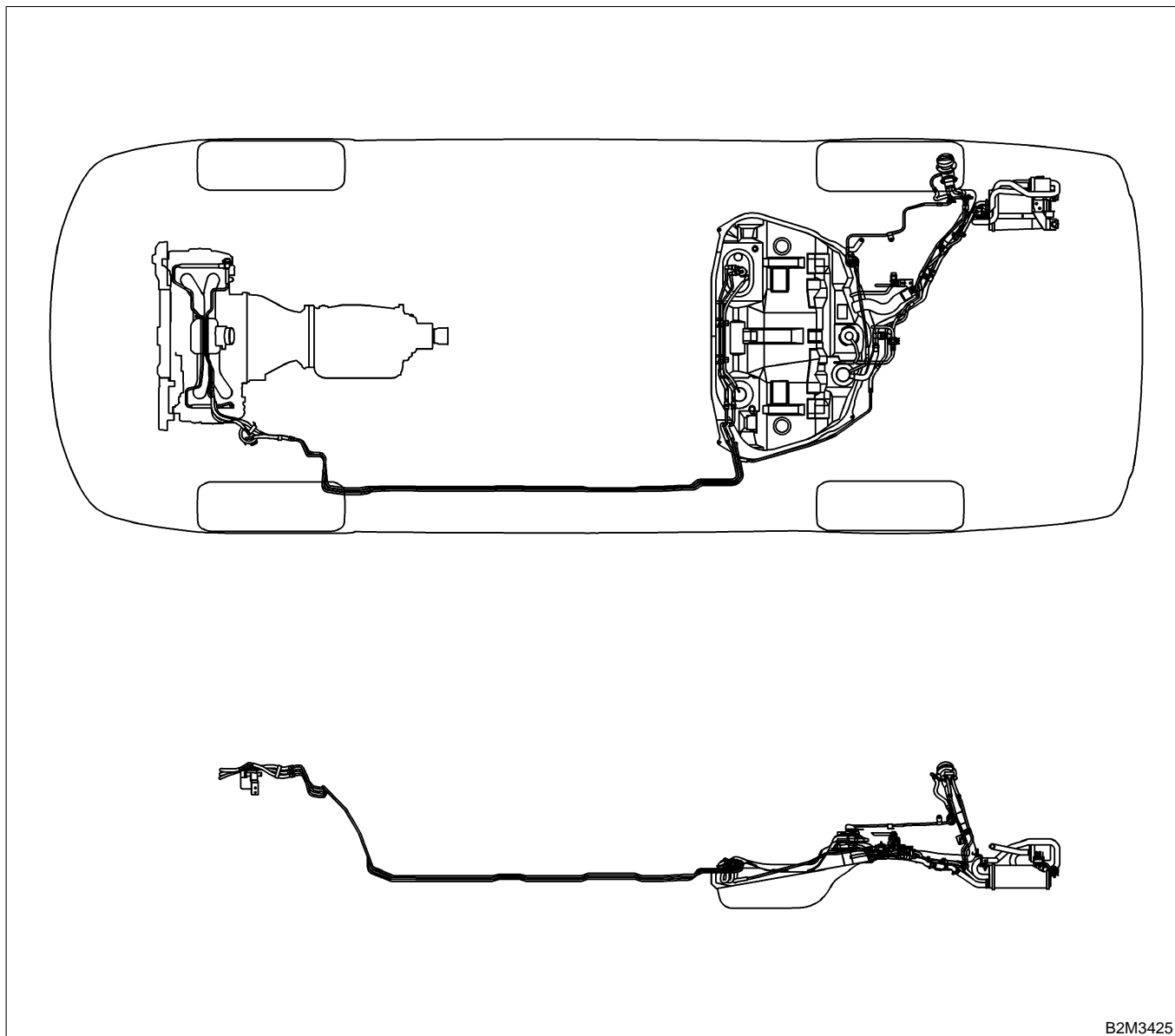
S105019

A: REMOVAL

S105019A18

- 1) Set vehicle on the lift.
- 2) Release fuel pressure. <Ref. to FU(H4)-70 RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
- 3) Open fuel filler flap lid and remove fuel filler cap.

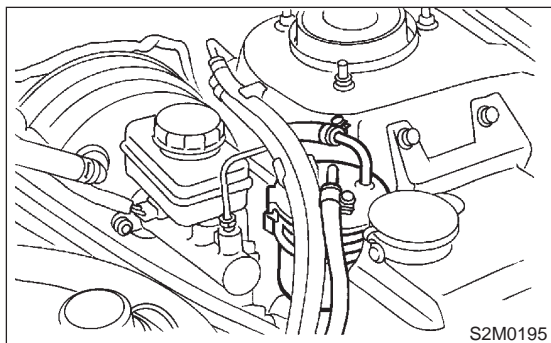
- 4) Remove fuel tank. <Ref. to FU(H4)-73 REMOVAL, Fuel Tank.>
- 5) Remove fuel filler pipe. <Ref. to FU(H4)-82 REMOVAL, Fuel Filler Pipe.>
- 6) Remove floor mat. <Ref. to EI-53 REMOVAL, Floor Mat.>
- 7) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.



B2M3425

FU(H4)-98

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

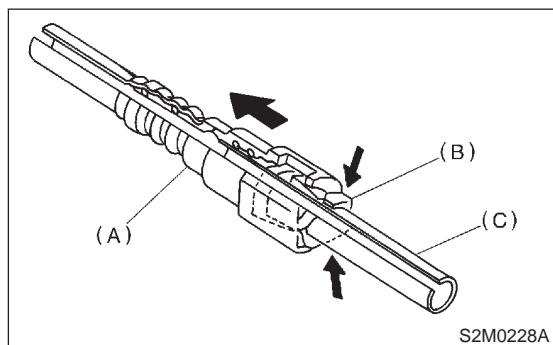


9) Separate quick connector on fuel delivery, return line and evaporation line.

- (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

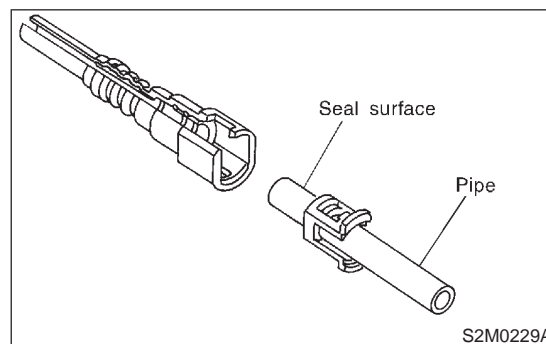
B: INSTALLATION

S105019A11

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

CAUTION:

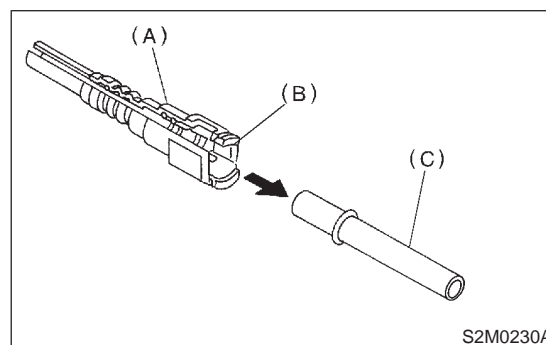
- Always use a new retainer.
- Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface of pipe.



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

NOTE:

At this time, two clicking sounds are heard.



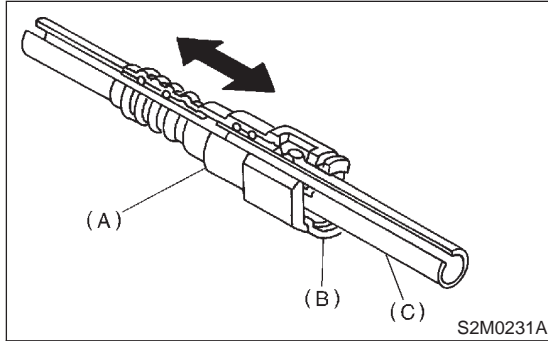
- (A) Connector
- (B) Retainer
- (C) Pipe

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

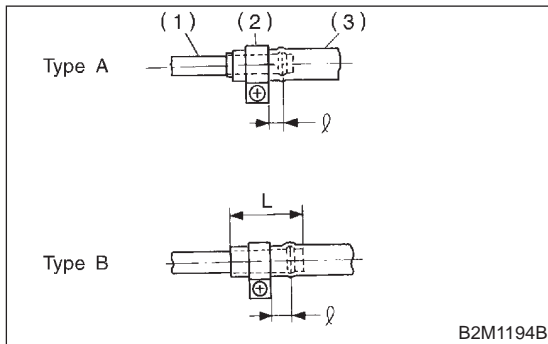
2) Connect fuel delivery hose to pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When fitting length is specified.

Type B: When fitting length is not specified.

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

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



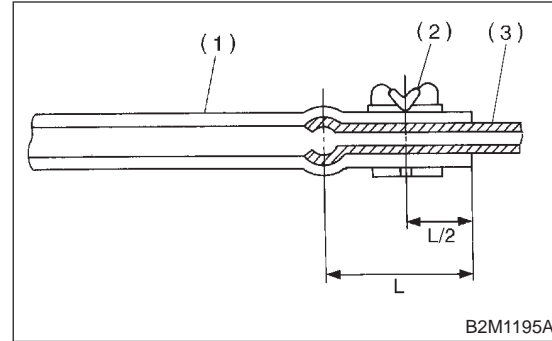
- (1) Fitting
(2) Clamp
(3) Hose

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

S105019A10

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.

30. Fuel System Trouble in General

S105571

A: INSPECTION

S105571A10

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 cool-

ing 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.

FUEL SYSTEM TROUBLE IN GENERAL

Fuel Injection (Fuel Systems)

MEMO:

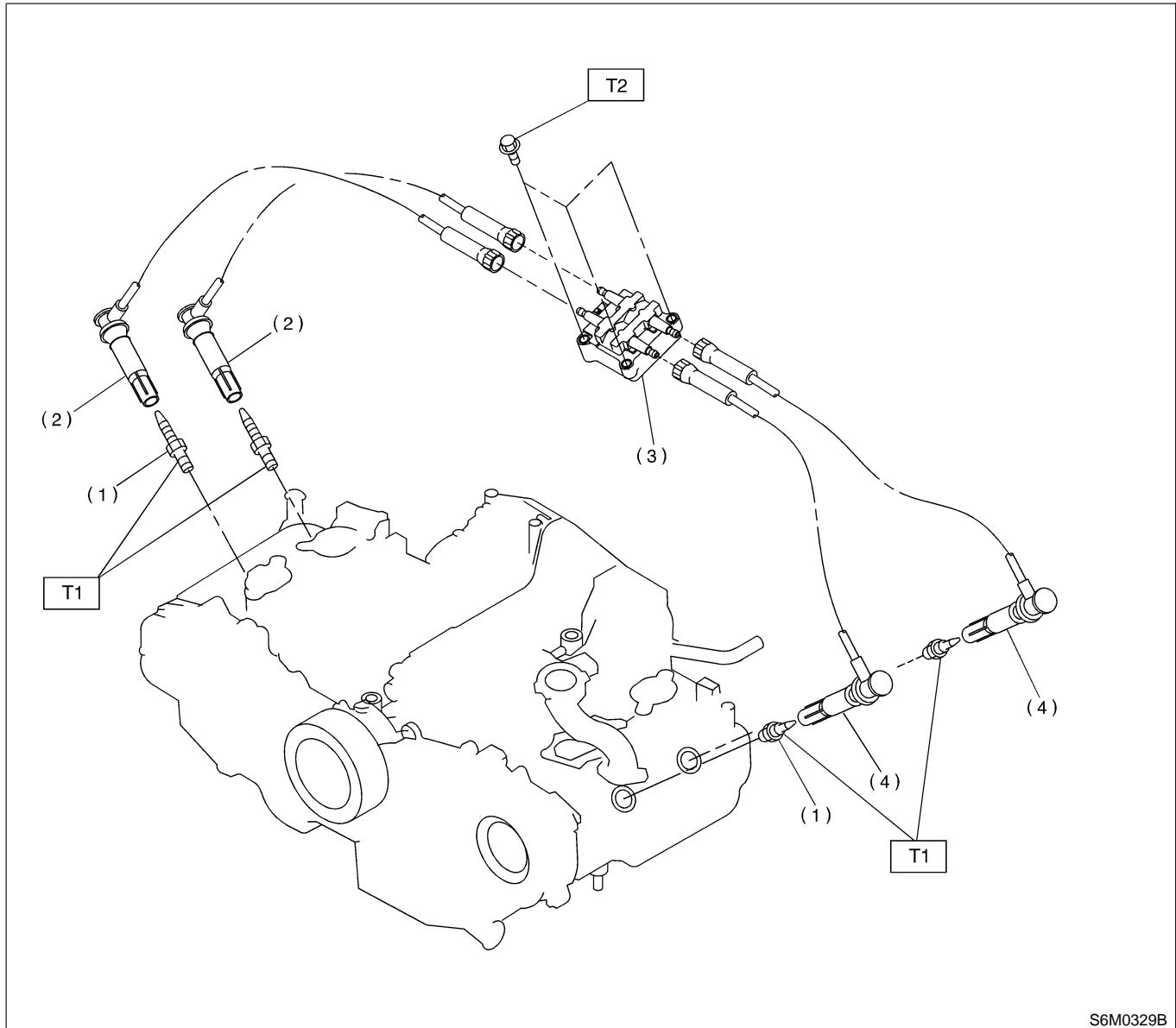
1. General Description S101001

A: SPECIFICATIONS S101001E49

Item		Designation	
Ignition coil and ignitor assembly	Model	FH0137	
	Manufacturer	DEMCO	
	Primary coil resistance	0.73 Ω ±10%	
	Secondary coil resistance	12.8 k Ω ±15%	
	Insulation resistance between primary terminal and case	More than 10 M Ω	
Spark plug	Type and manufacturer	RC10YC4 CHAMPION	
		Alternate	RC8YC4 CHAMPION BKR6E-11 NGK K20PR-U11 NIPPONDENSO
	Thread size	mm	14, P = 1.25
	Spark gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)

B: COMPONENT

S101001A05



- (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: 20.6 (2.10, 15.2)

T2: 6.4 (0.65, 4.7)

C: CAUTION

S101001A03

- 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 negative terminal from battery.

2. Spark Plug S101003

A: REMOVAL S101003A18

CAUTION:

All spark plugs installed on an engine, must be of the same heat range.

Spark plug:

CHAMPION: RC10YC4

(Alternate)

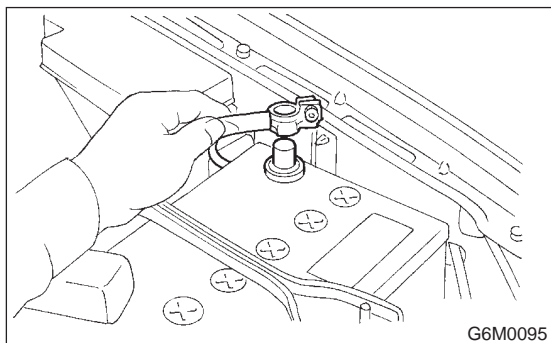
CHAMPION: RC8YC4

NGK: BKR6E-11

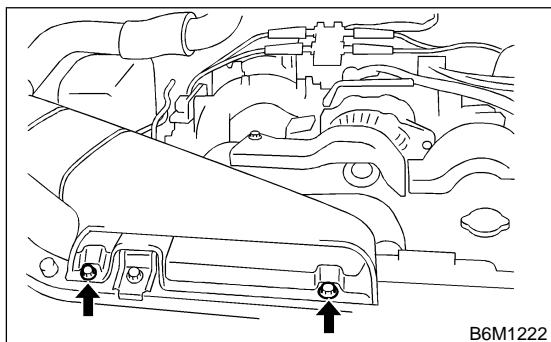
NIPPONDENSO: K20PR-U11

1. RH SIDE S101003A1805

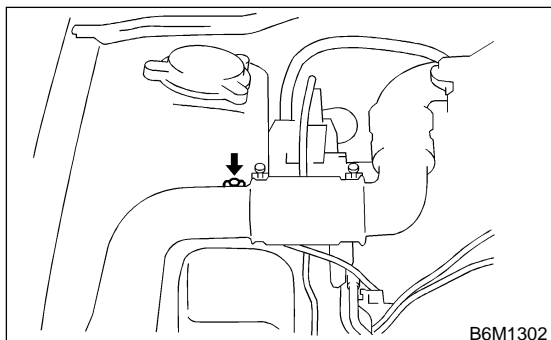
- 1) Disconnect battery ground cable.



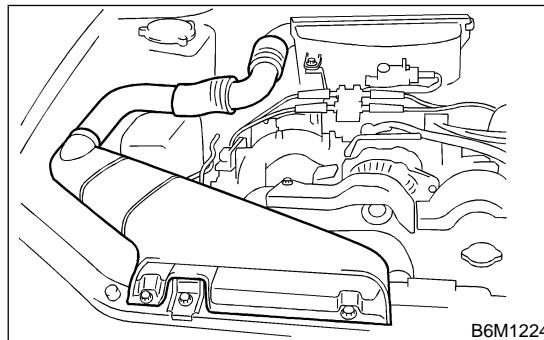
- 2) Remove air intake duct and resonator chamber.
 - (1) Remove bolt which installs air intake duct on the front side of body.



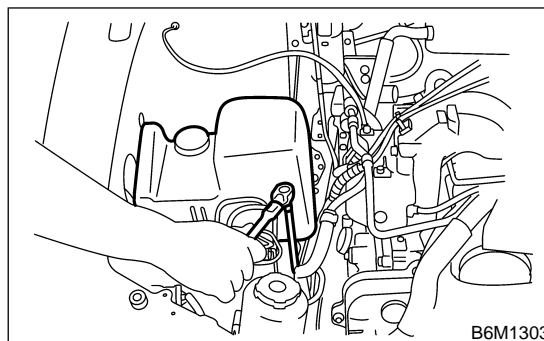
- (2) Remove bolt which installs air intake duct on body.



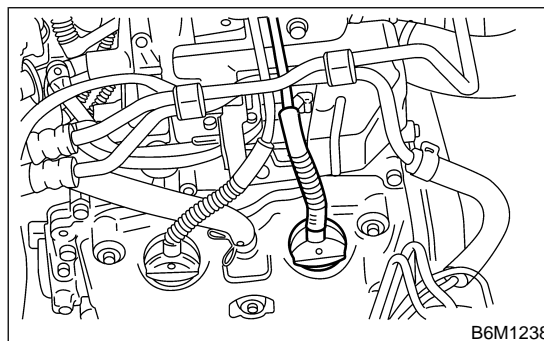
- (3) Remove air intake duct as a unit.



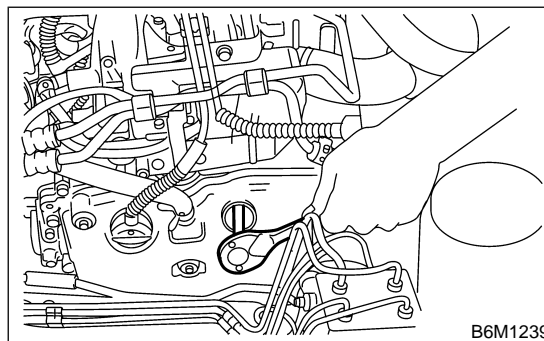
- (4) Remove resonator chamber.



- 3) Remove spark plug cords by pulling boot, not cord itself.

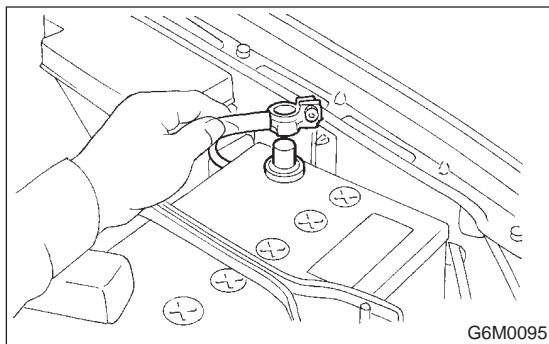


- 4) Remove spark plugs with the spark plug socket.

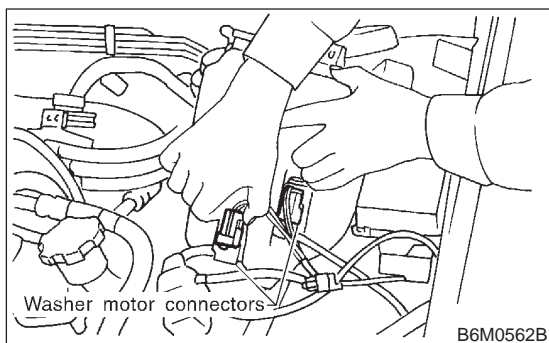


2. LH SIDE S101003A1806

- 1) Disconnect battery ground cable.

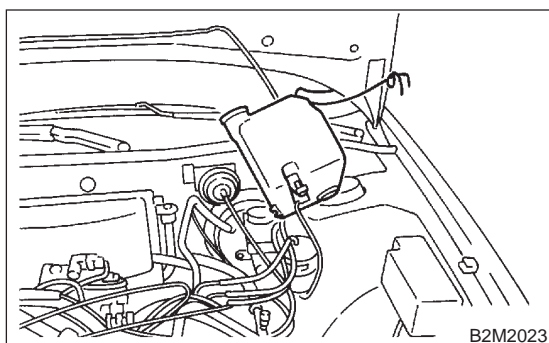


- 2) Disconnect washer motor connector.

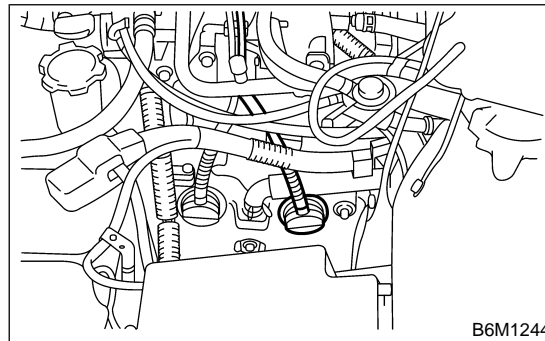


- 3) Disconnect rear window glass washer hose from washer motor, then plug connection with a suitable cap.

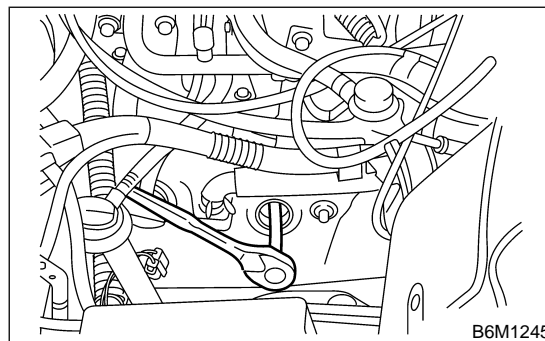
- 4) Remove the two bolts which hold the washer tank, then take the tank away from the working area.



- 5) Remove spark plugs cord by pulling boot, not cord itself.



- 6) Remove spark plug with the spark plug socket.



B: INSTALLATION S101003A11

1. RH SIDE S101003A1105

- 1) Install in the reverse order of removal.

Tightening torque (Spark plug):
20.6 N·m (2.10 kgf-m, 15.2 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.

2. LH SIDE S101003A1106

- 1) Install in the reverse order of removal.

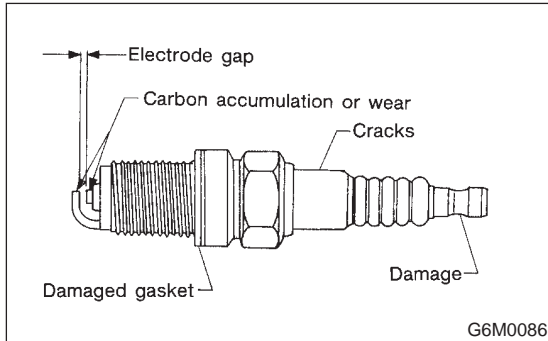
Tightening torque (Spark plug):
20.6 N·m (2.10 kgf-m, 15.2 ft-lb)

CAUTION:

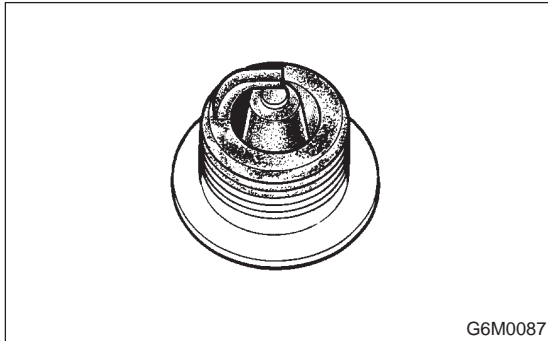
The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

C: INSPECTION S101003A10

Check electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.

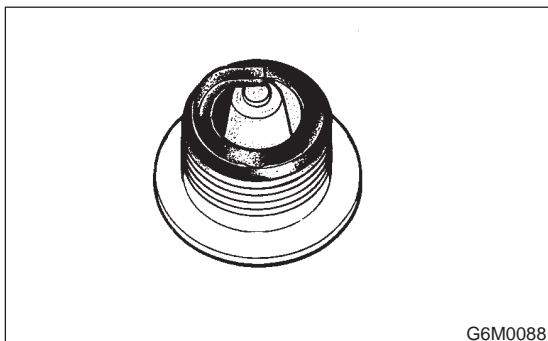
**1) Normal**

Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

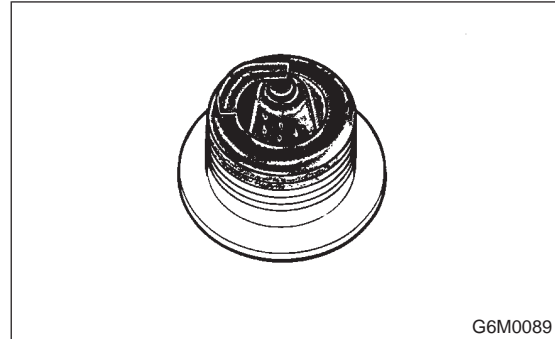
**2) Carbon fouled**

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.

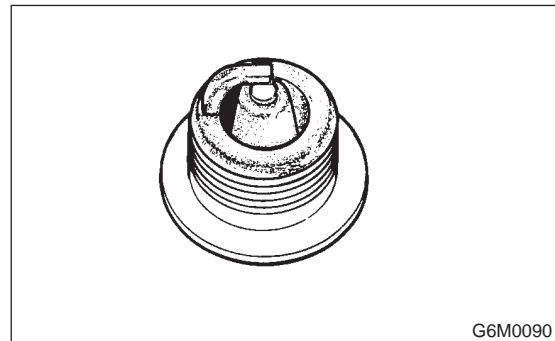
It is advisable to replace with plugs having hotter heat range.

**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.

**D: CLEANING** S101003E56

Clean spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain.

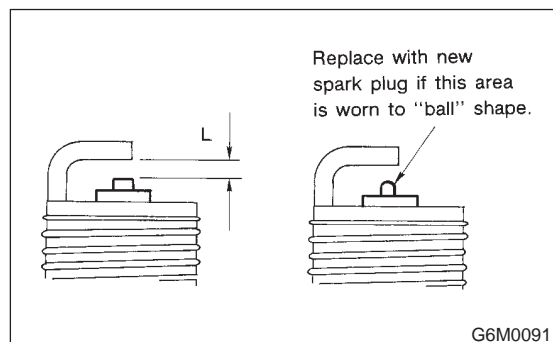
If deposits are too stubborn, replace plugs.

E: ADJUSTMENT S101003A01

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)



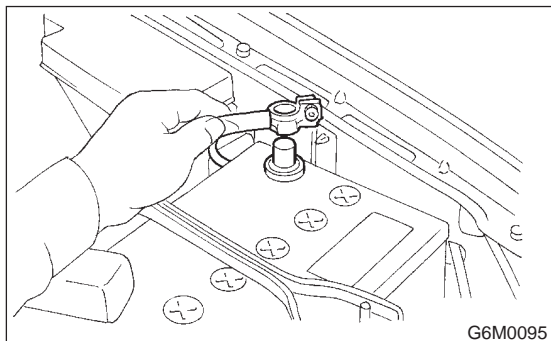
IGNITION COIL AND IGNITOR ASSEMBLY

Ignition

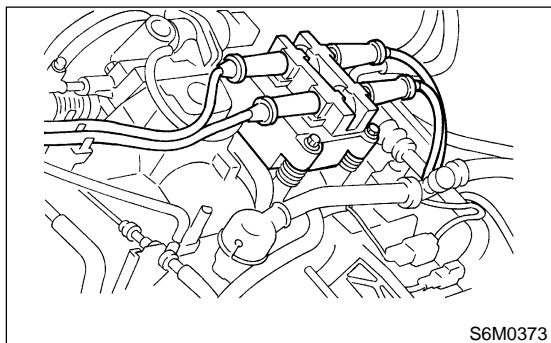
3. Ignition Coil and Ignitor Assembly S101015

A: REMOVAL S101015A18

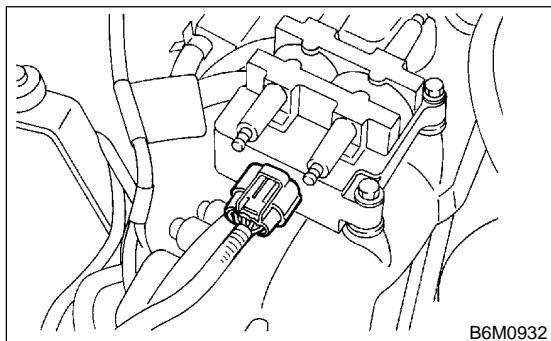
- 1) Disconnect battery ground cable.



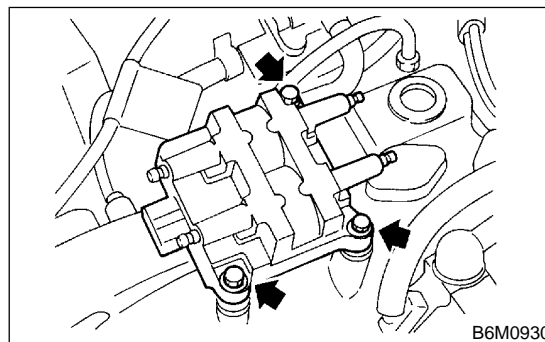
- 2) Disconnect spark plug cords from ignition coil and ignitor assembly.



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



- 4) Remove ignition coil and ignitor assembly.



B: INSTALLATION S101015A11

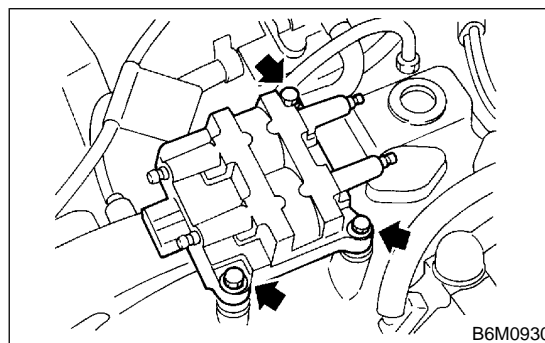
- 1) Install in the reverse order of removal.

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 S101015A10

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:

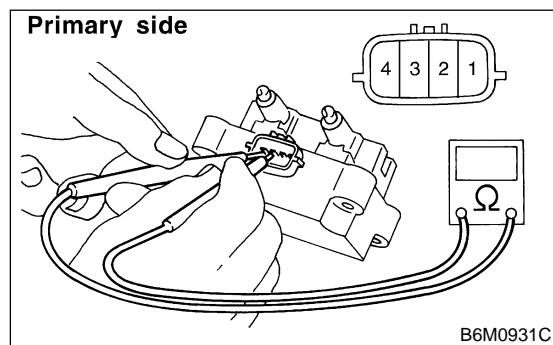
[Primary side]

Between terminal No. 1 and No. 2

$0.73 \Omega \pm 10\%$

Between terminal No. 2 and No. 4

$0.73 \Omega \pm 10\%$



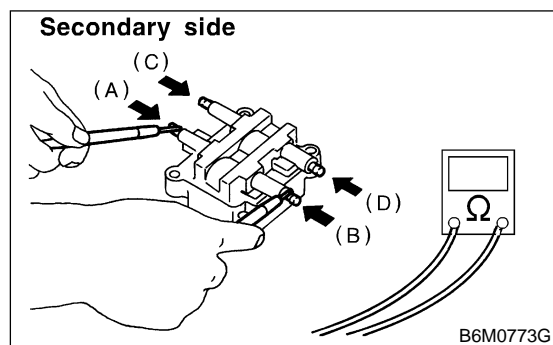
[Secondary side]

Between (A) and (B)

$12.8 k\Omega \pm 15\%$

Between (C) and (D)

$12.8 k\Omega \pm 15\%$



- 3) Insulation between primary terminal and case:
10 M Ω or more.

4. Spark Plug Cord S101014

A: INSPECTION S101014A10

Check for:

- 1) Damage to cords, deformation, burning or rust formation of terminals
- 2) Resistance values of cords

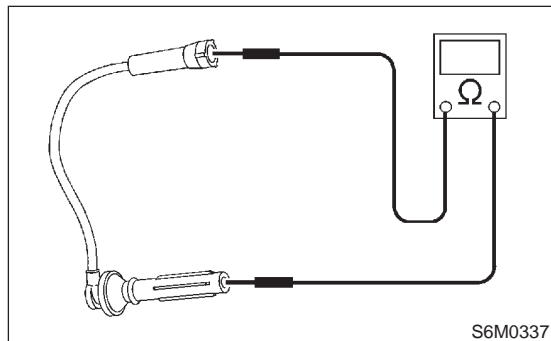
Resistance value:

#1 cord: 5.6 — 10.6

#2 cord: 7.3 — 13.7

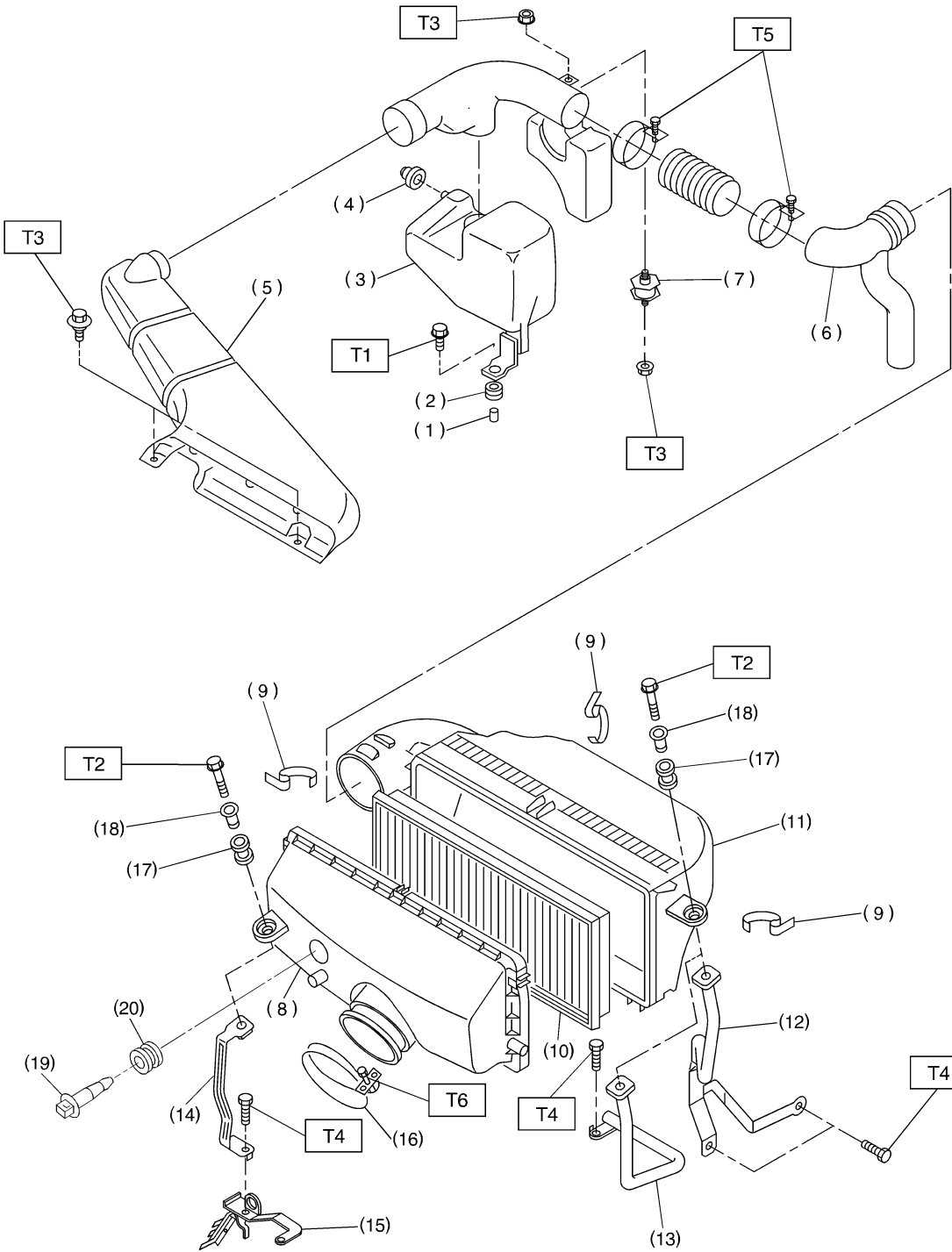
#3 cord: 5.9 — 11.1

#4 cord: 7.3 — 13.7



1. General Description S104001

A: COMPONENT S104001A05



B2M3456A

GENERAL DESCRIPTION

Intake (Induction)

- | | |
|--------------------------|---|
| (1) Spacer | (12) Air cleaner case stay LH (MT vehicles) |
| (2) Bush | (13) Air cleaner case stay LH (AT vehicles) |
| (3) Resonator chamber | (14) Air cleaner case stay RH |
| (4) Cushion rubber | (15) Engine harness bracket |
| (5) Air intake duct A | (16) Clamp |
| (6) Air intake duct B | (17) Bush |
| (7) Cushion | (18) Spacer |
| (8) Air cleaner case A | (19) Intake air temperature sensor |
| (9) Clip | (20) Rubber bush |
| (10) Air cleaner element | |
| (11) Air cleaner case B | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 32.3 (3.3, 23.9)

T2: 6.4 (0.65 4.7)

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)

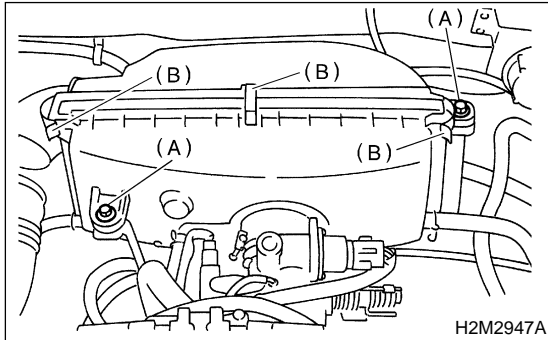
B: CAUTION S104001A03

- 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 negative terminal from battery.

2. Air Cleaner S104087

A: REMOVAL S104087A18

- 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.

B: INSTALLATION S10487A11

Install in the reverse order of removal.

CAUTION:

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

C: INSPECTION S104087A10

Replace if excessively damaged or dirty.

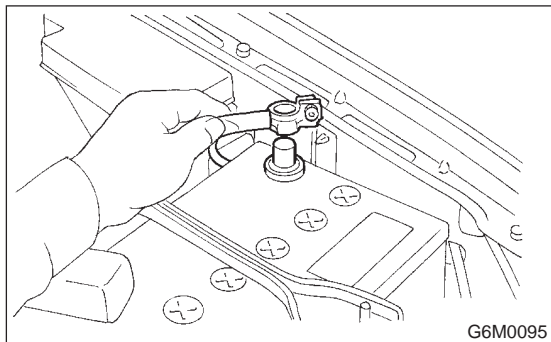
AIR CLEANER CASE

Intake (Induction)

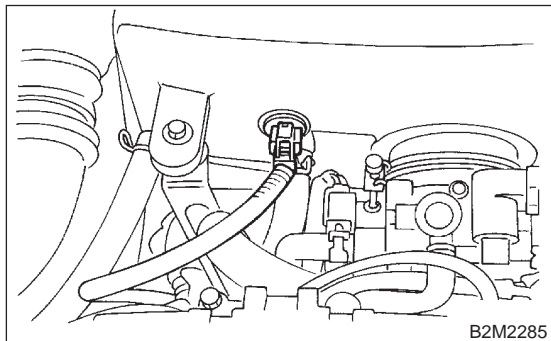
3. Air Cleaner Case S104089

A: REMOVAL S104089A18

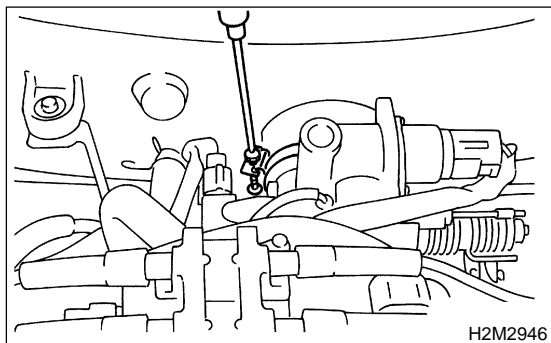
- 1) Disconnect battery ground cable.



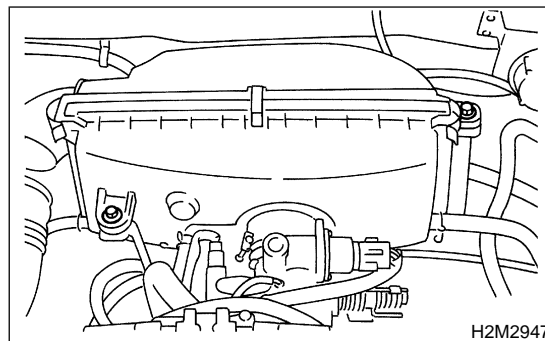
- 2) Disconnect connector from intake air temperature sensor. (MT vehicles)



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



- 4) Disconnect hoses from air cleaner case.
- 5) Remove bolts which install air cleaner case to stays.



- 6) Remove air cleaner case.

B: INSTALLATION S10489A11

Install in the reverse order of removal.

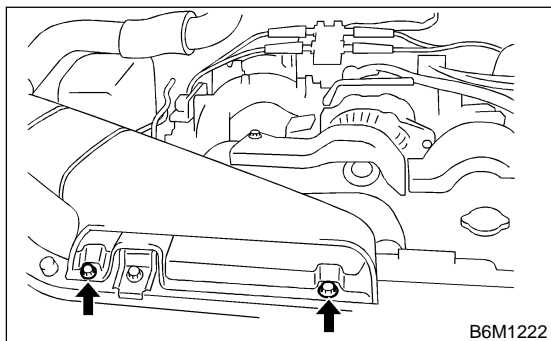
C: INSPECTION S104089A10

Inspect for cracks and loose connections.

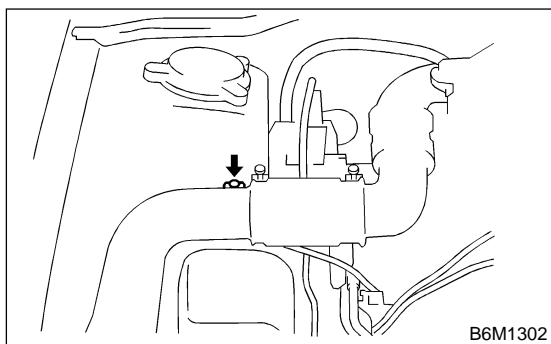
4. Air Intake Duct S104566

A: REMOVAL S104566A18

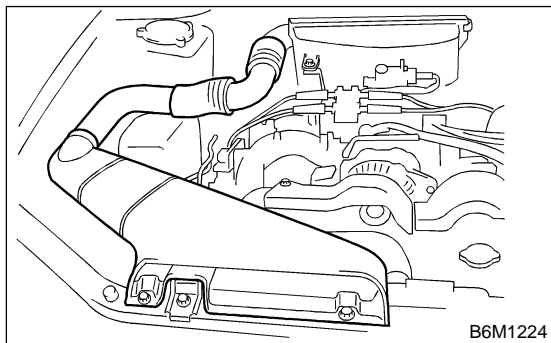
1) Remove bolts which install air intake duct on the front side of body.



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



3) Remove air intake ducts as a unit.



B: INSTALLATION S104566A11

Install in the reverse order of removal.

C: INSPECTION S104566A10

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

RESONATOR CHAMBER

Intake (Induction)

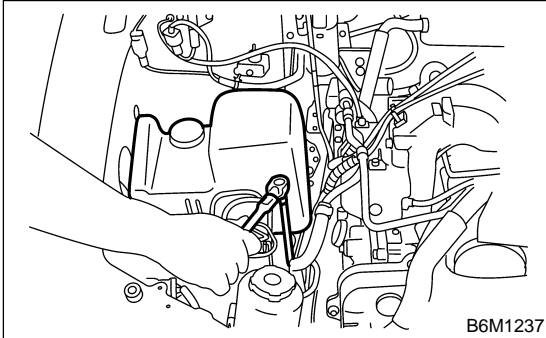
5. Resonator Chamber

S104639

A: REMOVAL

S104639A18

- 1) Remove air intake duct. <Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.>
- 2) Remove resonator chamber.



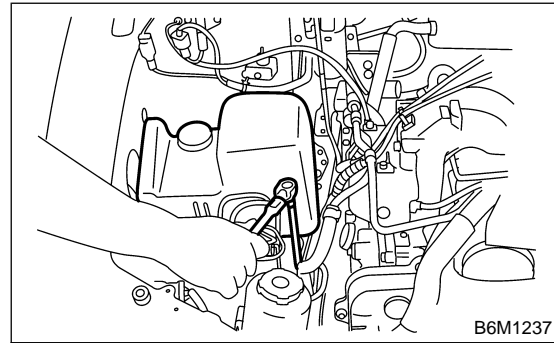
B: INSTALLATION

S104639A11

Install in the reverse order of removal.

Tightening torque:

33 N·m (3.4 kgf-m, 24.6 ft-lb)



C: INSPECTION

S104639A10

Inspect for cracks and loose connections.

GENERAL DESCRIPTION

Lubrication

1. General Description S108001

A: SPECIFICATIONS S108001E49

Lubrication method					Forced lubrication	
Oil pump	Pump type			Trochoid type		
	Number of teeth		Inner rotor	9		
			Outer rotor	10		
	Outer rotor diameter × thickness				78 × 9 mm (3.07 × 0.35 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)	700 rpm	Discharge	- pressure	98 kPa (1.0 kg/cm ² , 14 psi)	
				- quantity	4.2 ℓ (4.4 US qt, 3.7 Imp qt)/min.	
		5,000 rpm	Discharge	- pressure	294 kPa (3.0 kg/cm ² , 43 psi)	
				- quantity	42.0 ℓ (11.10 US gal, 9.24 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			1,000 cm ² (155 sq in)		
	By-pass valve opening pressure			157 kPa (1.6 kg/cm ² , 23 psi)		
	Outer diameter × width			80 × 70 mm (3.15 × 2.76 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 (at replacement)					4.0 ℓ (4.2 US qt, 3.5 Imp qt)	

LU(H4)-2

S108001A05



-

👉 00.5.31/68j/1lu4 👈

GENERAL DESCRIPTION

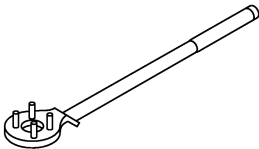
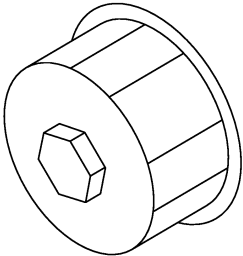
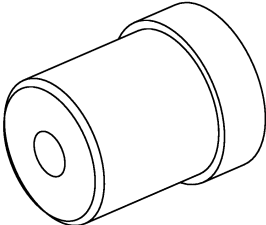
Lubrication

C: CAUTION S108001A03

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

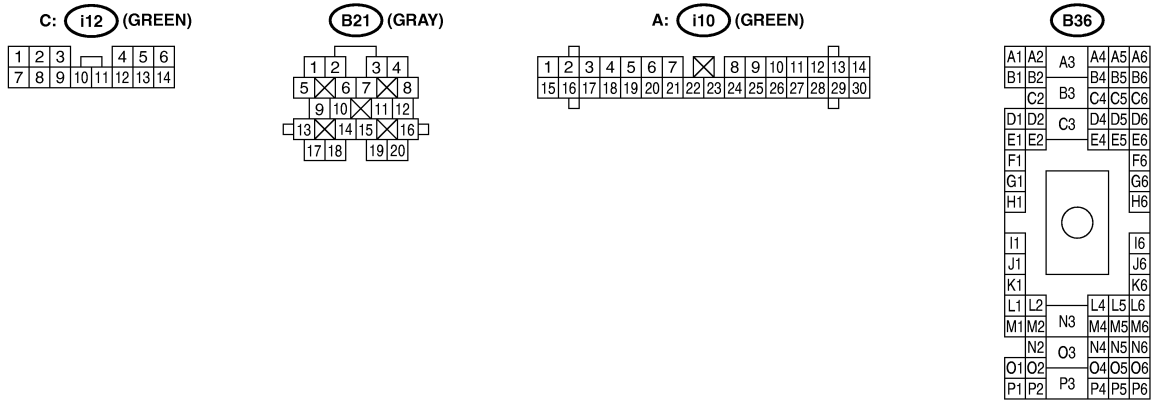
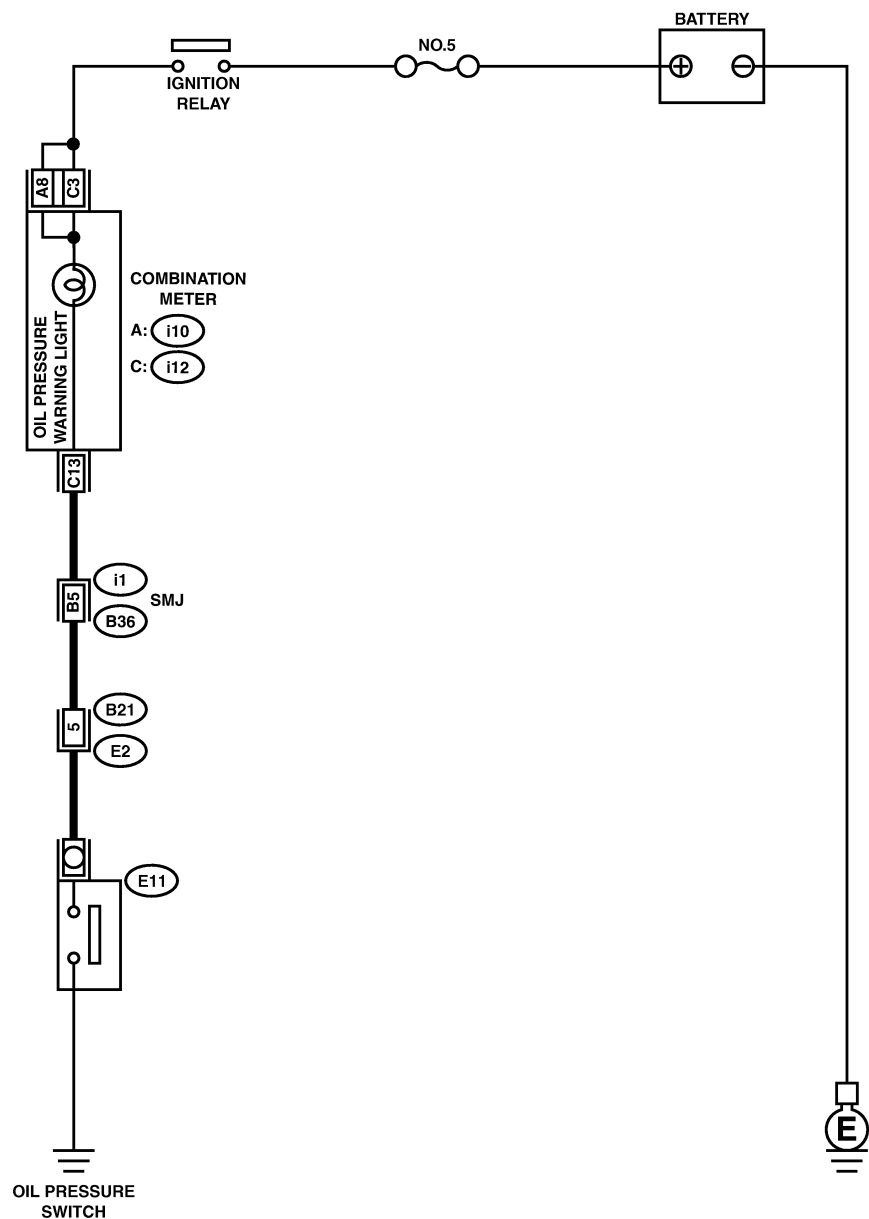
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be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

D: PREPARATION TOOL S108001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3870	499977100	CRANK 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 S108076

A: SCHEMATIC S108076A21



OIL PRESSURE SYSTEM

Lubrication

B: INSPECTION

S108076A10

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-10 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.

LU(H4)-6

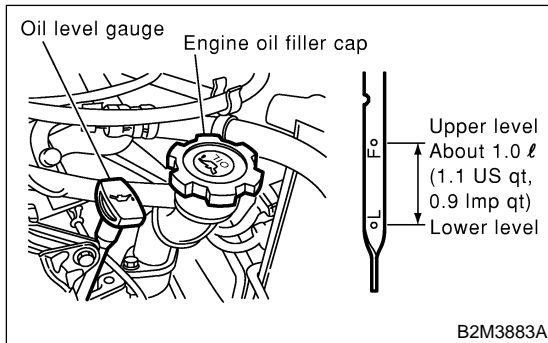
3. Engine Oil

S108077

A: INSPECTION

S108077A10

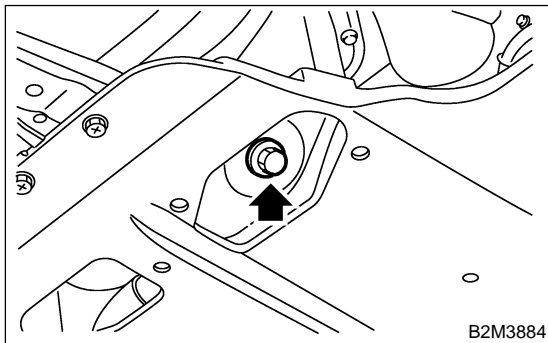
- 1) Park vehicle on a level surface.
- 2) Remove oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
- 4) Remove it again and note the reading. If the engine oil level is below the "L" line, add 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.



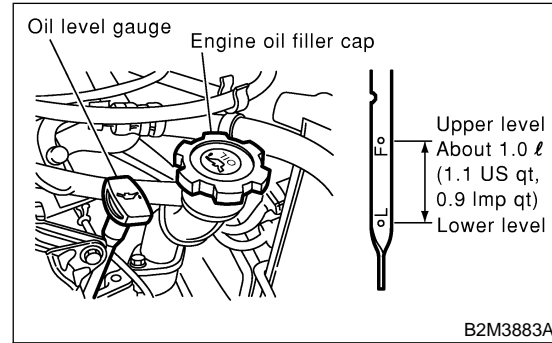
B: REPLACEMENT

S108077A20

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



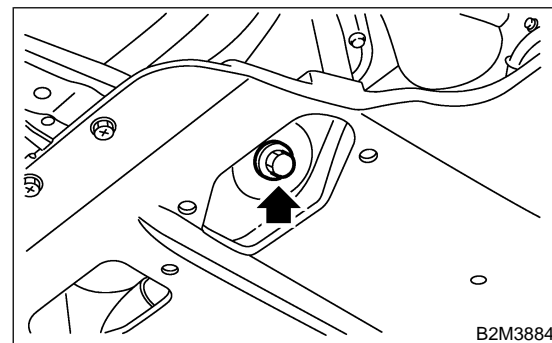
- 2) Open engine oil filler cap for quick draining of the engine oil.



- 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

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 SJ or SH grade, you may use SG grade.)

Engine 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)

SAE Viscosity No. and Applicable Temperature							
(°C)	-30	-20	-15	0	15	30	40
(°F)	-22	-4	5	32	59	86	104

10W-30, 10W-40

5W-30 PREFERRED

B2M3885A

The proper viscosity helps vehicle get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

CAUTION:

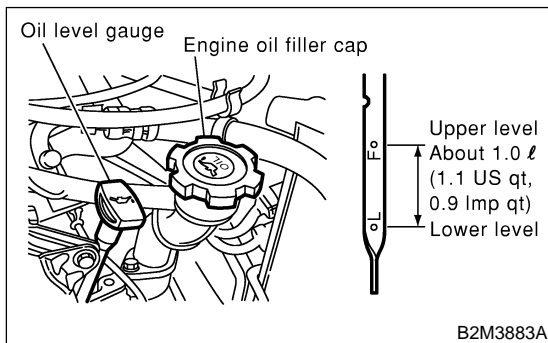
When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:

If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: API classification: SJ or SH

SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

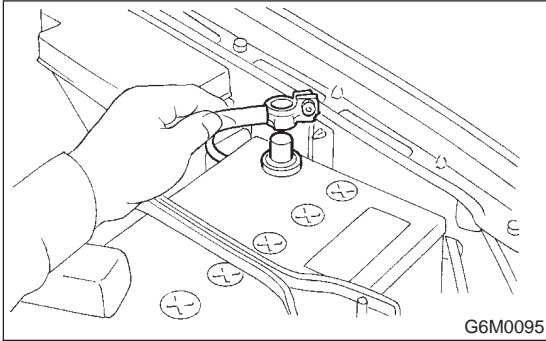
- 6) Close engine oil filler cap.
- 7) Start engine and warm it up for a time.
- 8) After engine stops, recheck the oil level. If necessary, add engine oil up to upper level on level gauge.



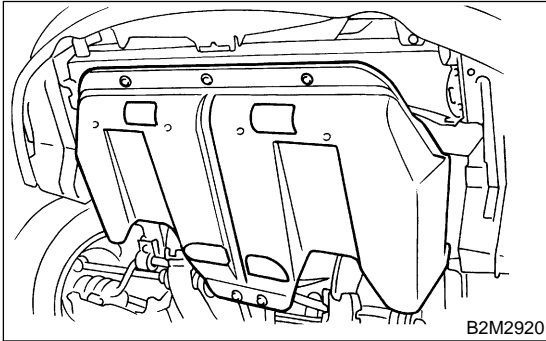
4. Oil Pump S108070

A: REMOVAL S108070A18

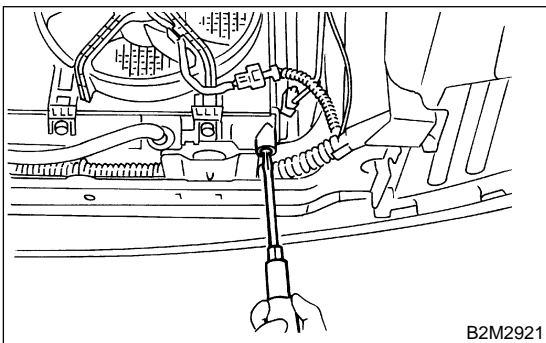
- 1) Disconnect battery ground cable.



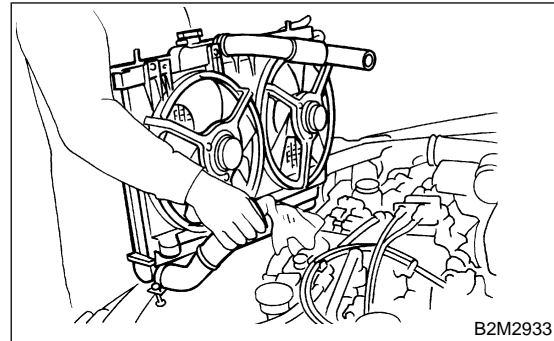
- 2) Lift-up the vehicle.
3) Remove under cover.



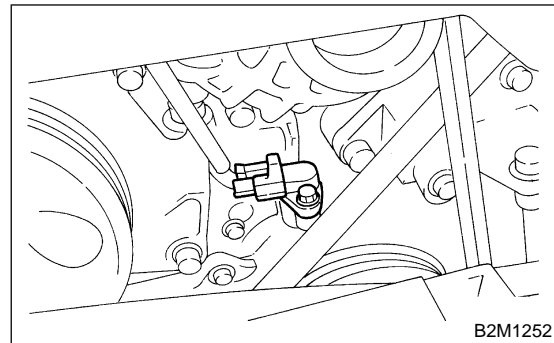
- 4) Drain coolant. <Ref. to CO(H4)-6 DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



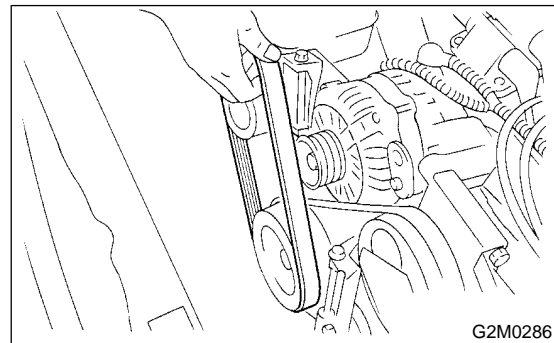
- 5) Lower the vehicle.
6) Remove radiator. <Ref. to CO(H4)-15 REMOVAL, Radiator.>



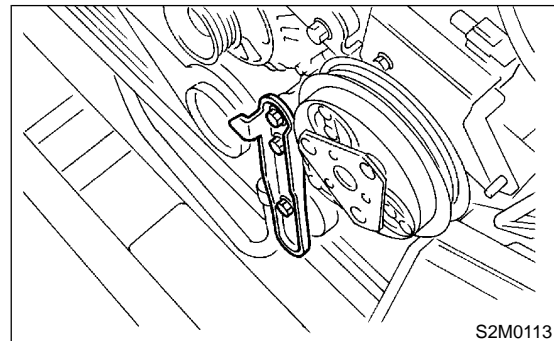
- 7) Remove crankshaft position sensor.



- 8) Remove V-belts. <Ref. to ME(H4)-43 REMOVAL, V-belt.>



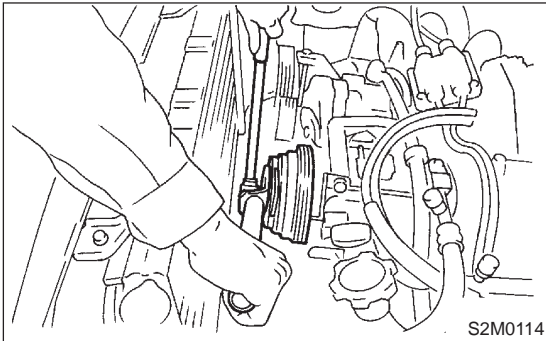
- 9) Remove rear side V-belt tensioner.



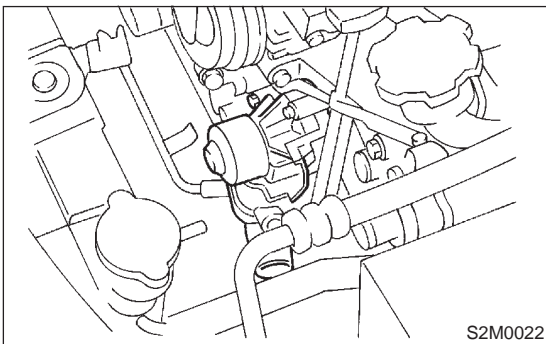
OIL PUMP

Lubrication

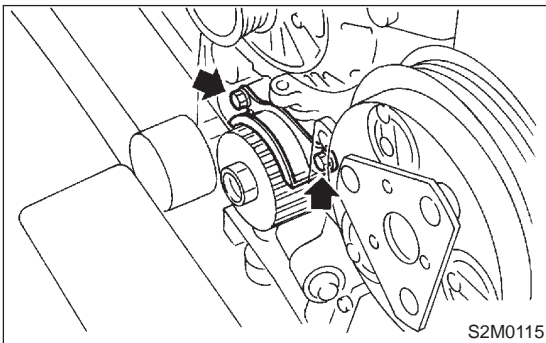
- 10) Remove crankshaft pulley by using ST.
ST 499977100 CRANKSHAFT PULLEY
WRENCH



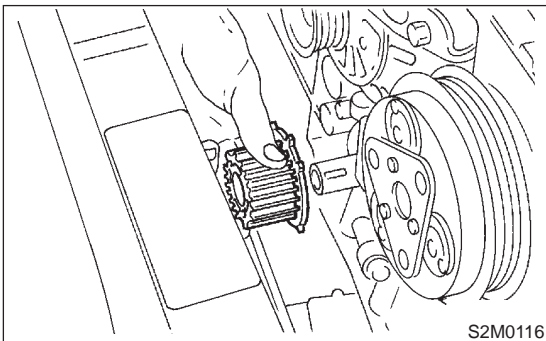
- 11) Remove water pump. <Ref. to CO(H4)-8
REMOVAL, Water Pump.>



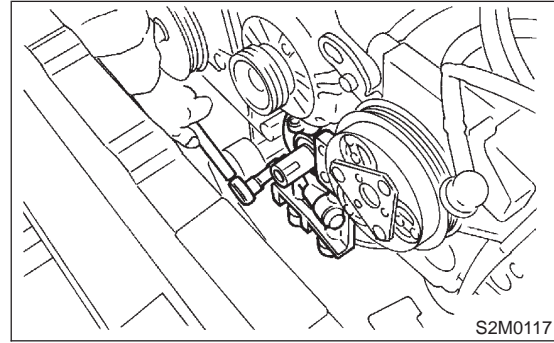
- 12) Remove timing belt guide. (MT vehicles only)



- 13) Remove crankshaft sprocket.



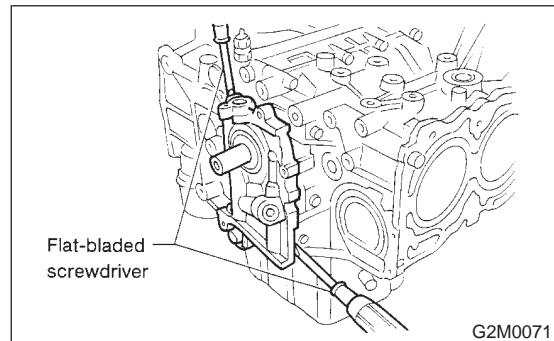
- 14) Remove bolts which install oil pump onto cylinder block.



- 15) Remove oil pump by using flat bladed screwdriver.

CAUTION:

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



B: INSTALLATION

S108070A11

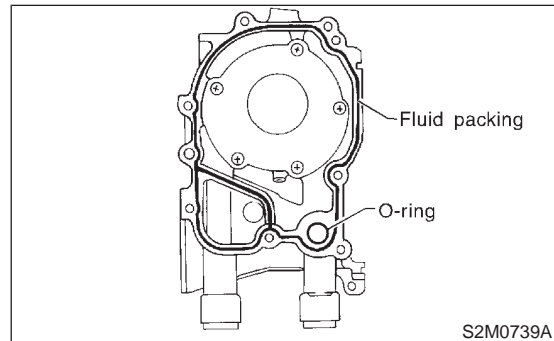
Install in the reverse order of removal.

Do the following:

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

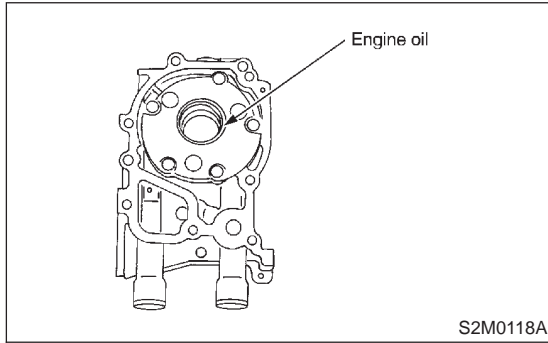
Fluid packing:

THREE BOND 1215 or equivalent



- 2) Replace O-ring 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.

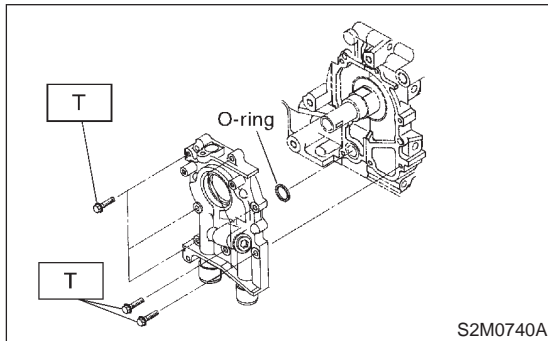
CAUTION:

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)

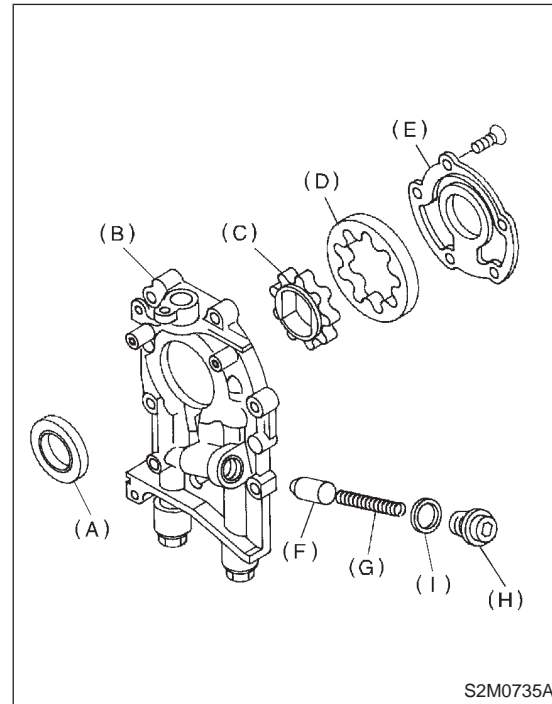


C: DISASSEMBLY S108070A06

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.

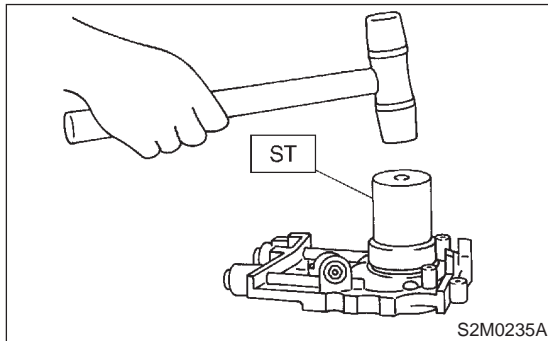


- (A) Oil seal
- (B) Pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Pump cover
- (F) Relief valve
- (G) Relief spring
- (H) Plug
- (I) Washer

D: ASSEMBLY S108070A02

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

CAUTION:
Use a new oil seal.

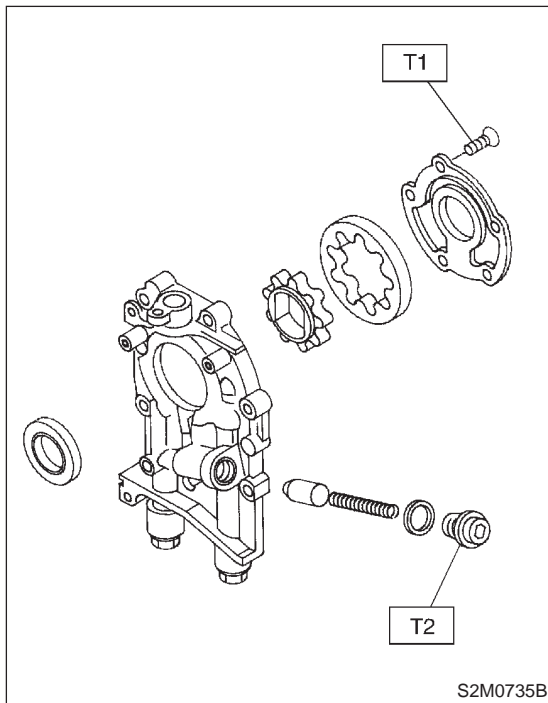


- 2) Apply a coat of engine oil to inner and outer rotors.
- 3) Install inner and outer rotors in their original positions.
- 4) Install oil relief valve and relief spring.
- 5) Install oil pump cover.

Tightening torque:

T1: 5 N·m (0.5 kgf-m, 3.6 ft-lb)

T2: 44.1 N·m (4.5 kgf-m, 32.5 ft-lb)



E: INSPECTION S108070A10

1. TIP CLEARANCE S108070A1001

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

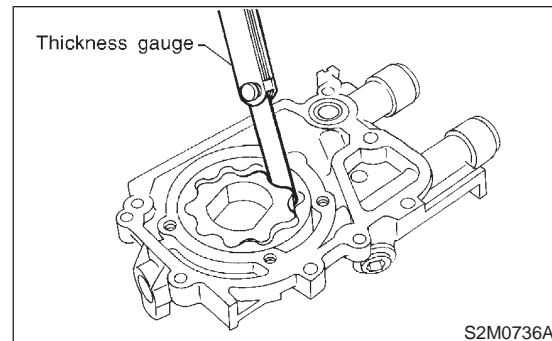
Tip clearance:

Standard

0.04 — 0.14 mm (0.0016 — 0.0055 in)

Limit

0.18 mm (0.0071 in)



2. CASE CLEARANCE S108070A1002

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

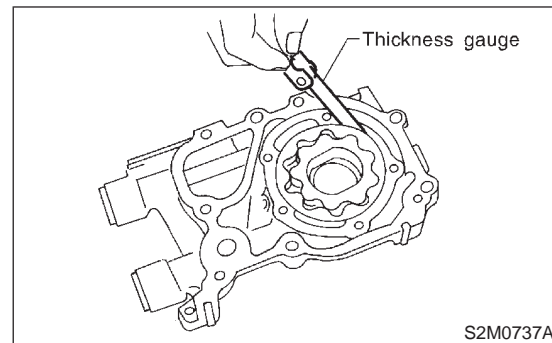
Case clearance:

Standard

0.10 — 0.175 mm (0.0039 — 0.0069 in)

Limit

0.20 mm (0.0079 in)



3. SIDE CLEARANCE S108070A1003

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

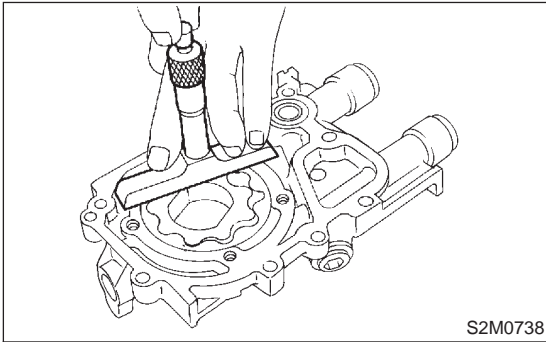
Side clearance:

Standard

0.02 — 0.07 mm (0.0008 — 0.0028 in)

Limit

0.15 mm (0.0059 in)



4. OIL RELIEF VALVE S108070A1004

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 kg, 17.33 lb)

5. OIL PUMP CASE S108070A1005

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

6. OIL SEAL S108070A1006

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

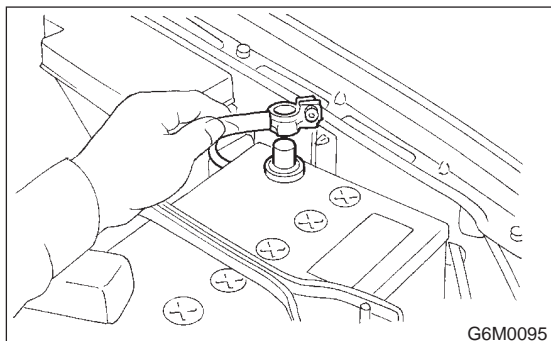
5. Oil Pan and Strainer

S108071

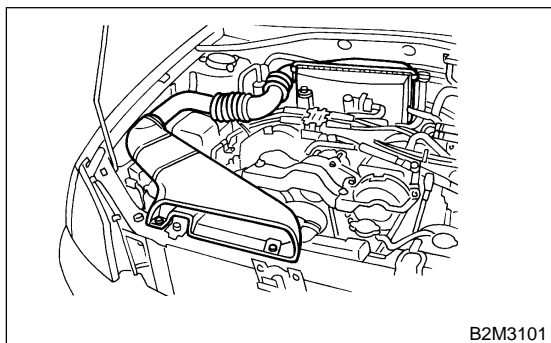
A: REMOVAL

S108071A18

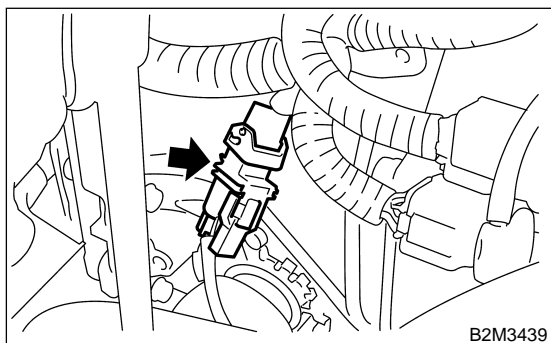
- 1) Set the vehicle on lift arms.
- 2) Remove front wheels.
- 3) Disconnect battery ground cable.



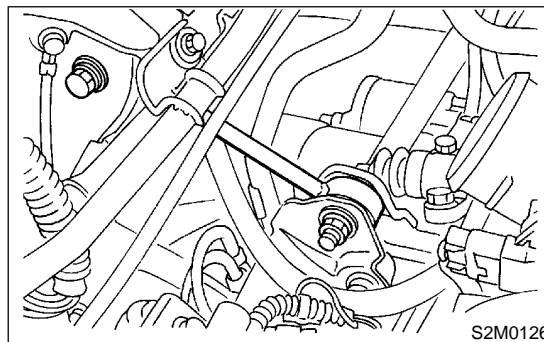
- 4) Remove air intake duct and air cleaner case.
<Ref. to IN(H4)-7 REMOVAL, Air Intake Duct.>



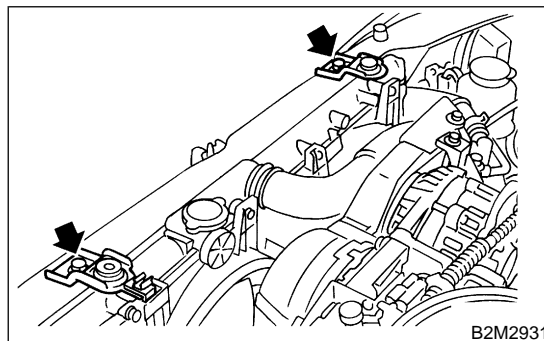
- 5) Disconnect connector from front oxygen (A/F) sensor.



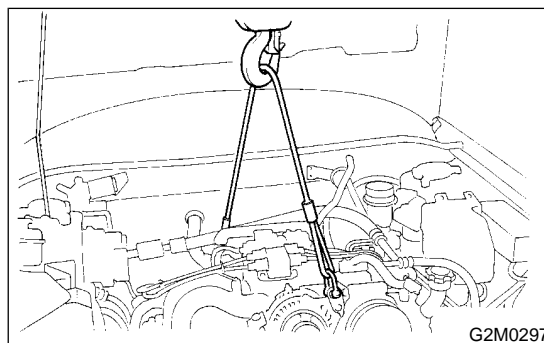
- 6) Remove pitching stopper.



- 7) Remove radiator upper brackets.



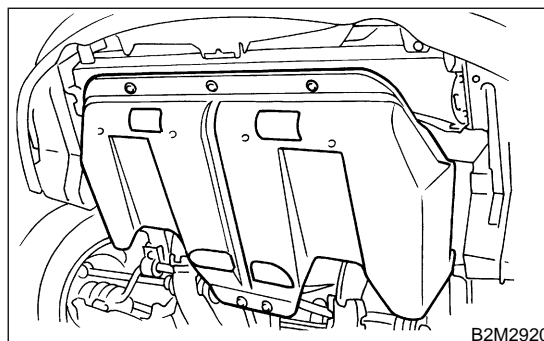
- 8) Support engine with a lifting device and wire ropes.



- 9) Lift-up the vehicle.

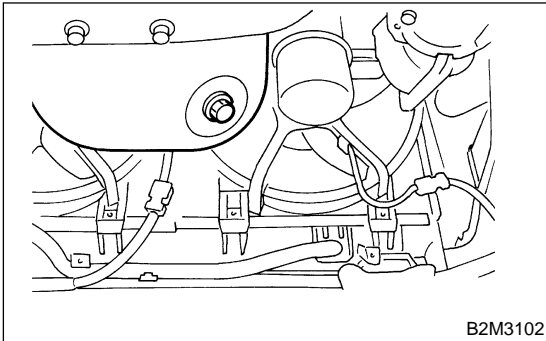
CAUTION:
At this time, raise up wire ropes.

- 10) Remove under cover.

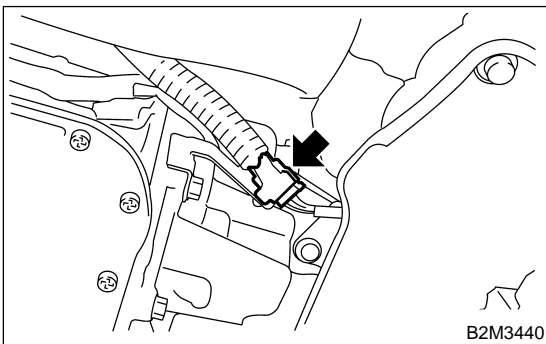


11) Drain engine oil.

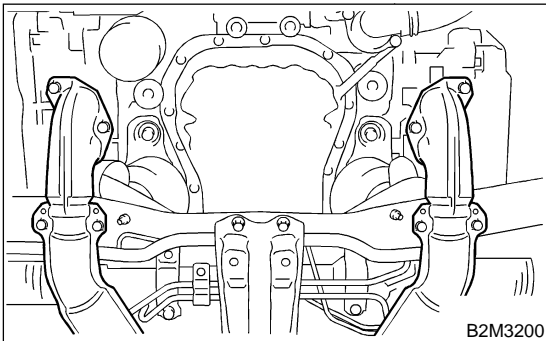
Set container under the vehicle, and remove drain plug from oil pan.



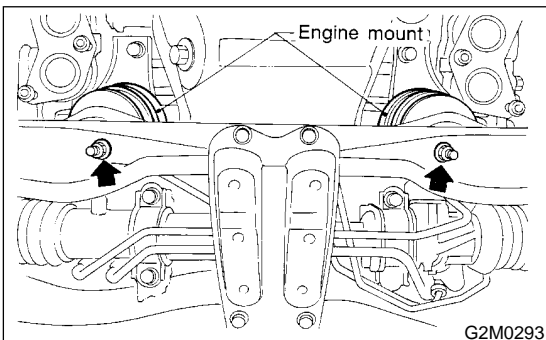
12) Disconnect connector from rear oxygen sensor.



13) Remove front and center exhaust pipes. <Ref. to EX(H4)-5 REMOVAL, Front Exhaust Pipe.>



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

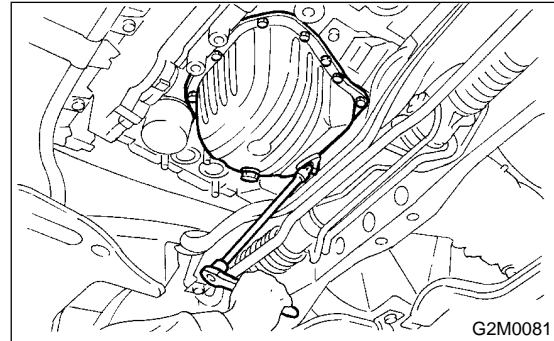


15) Remove bolts which install oil pan on cylinder block while raising up engine.

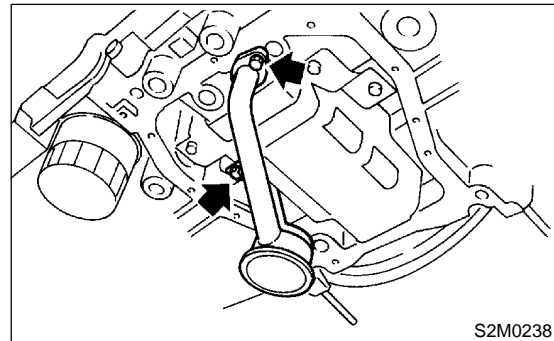
16) Insert oil pan cutter blade between cylinder block-to-oil pan clearance.

CAUTION:

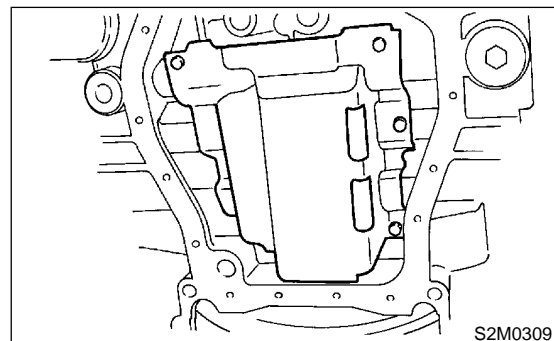
Do not use a screwdriver or similar tool in place of oil pan cutter.



17) Remove oil strainer.



18) Remove baffle plate.



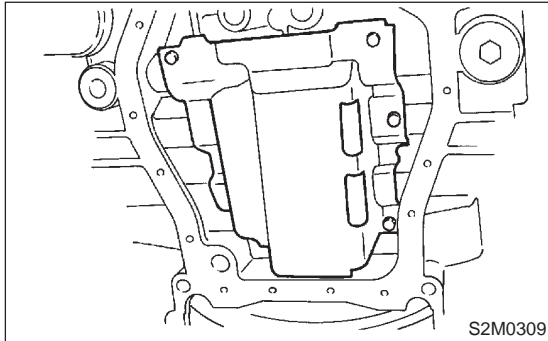
B: INSTALLATION S108071A11**CAUTION:**

Before installing oil pan, clean sealant from oil pan and engine block.

1) Install baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



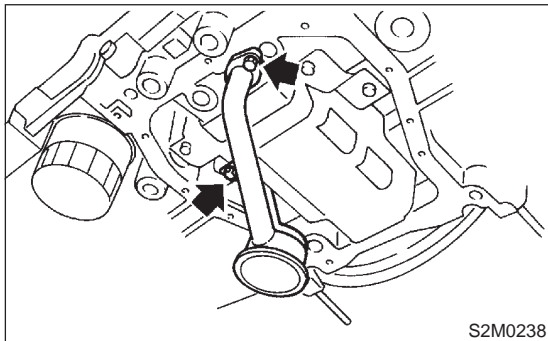
2) Install oil strainer onto baffle plate.

CAUTION:

Replace O-ring with a new one.

Tightening torque:

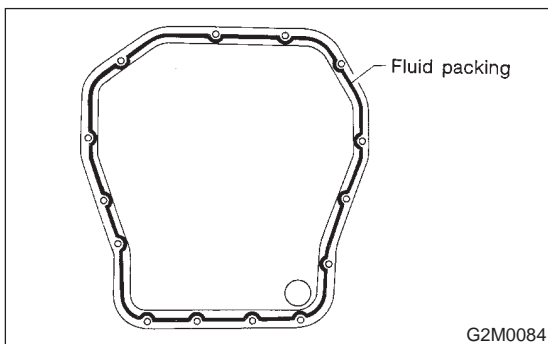
10 N·m (1.0 kgf-m, 7 ft-lb)



3) Apply fluid packing to mating surfaces and install oil pan.

Fluid packing:

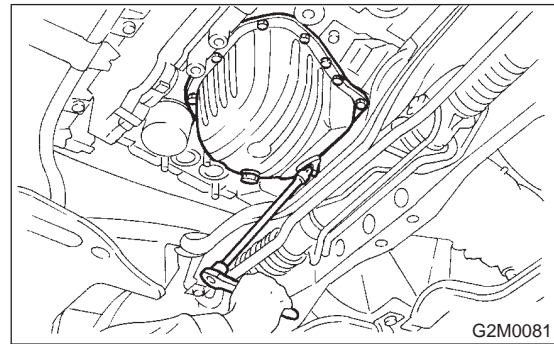
THREE BOND 1215 or equivalent



4) Tighten bolts which install oil pan onto engine block.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

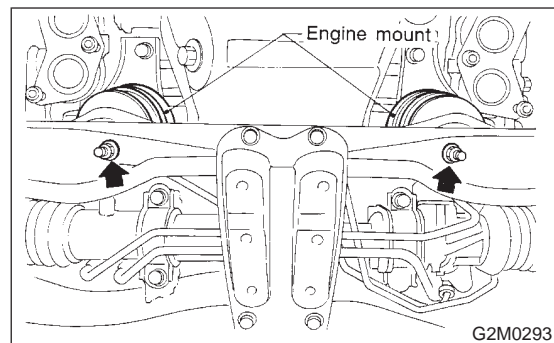


5) Lower engine onto front crossmember.

6) Tighten nuts which install front cushion rubber onto front crossmember.

Tightening torque:

69 N·m (7.0 kgf-m, 51 ft-lb)

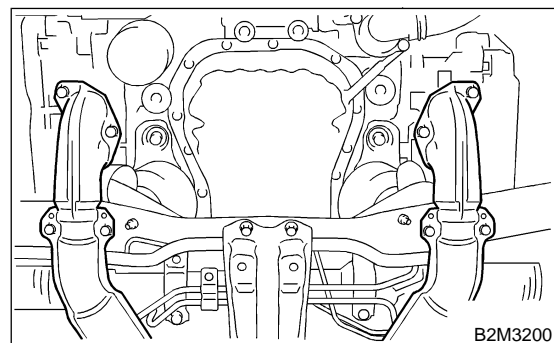


7) Install front and center exhaust pipes.

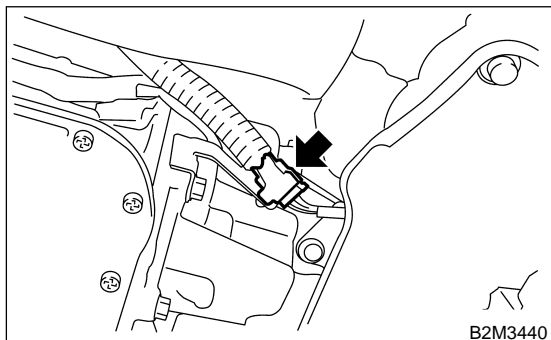
<Ref. to EX(H4)-6 INSTALLATION, Front Exhaust Pipe.>

CAUTION:

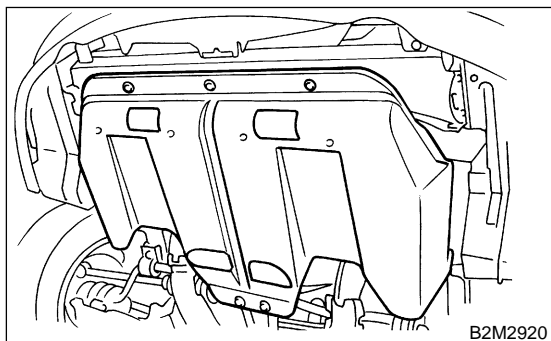
Always use the new gaskets.



- 8) Connect connector to rear oxygen sensor.



- 9) Install under cover.

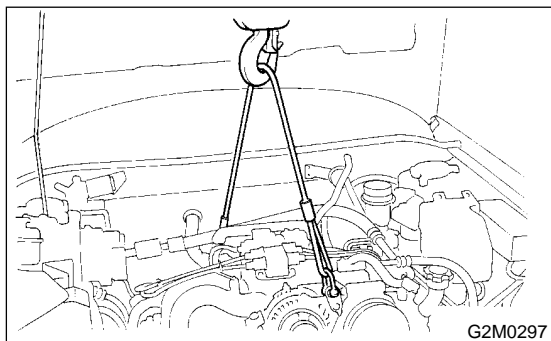


- 10) Lower the vehicle.

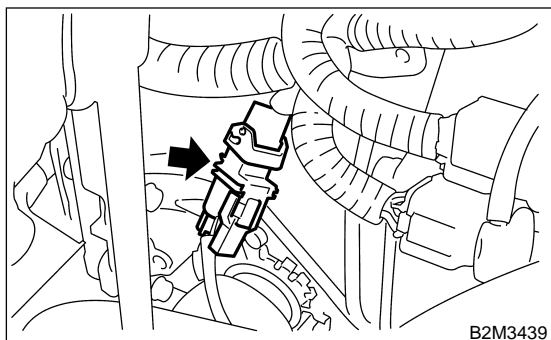
CAUTION:

At this time, lower lifting device and release steel cables.

- 11) Remove lifting device and steel cables.



- 12) Connect connector to front oxygen (A/F) sensor.

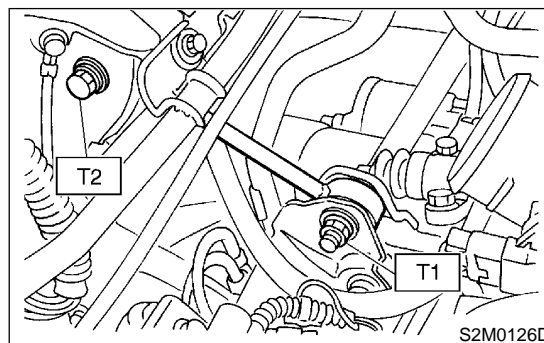


- 13) Install pitching stopper.

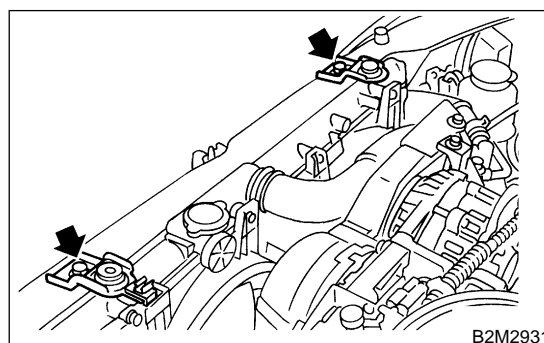
Tightening torque:

T1: 49 N·m (5.0 kgf-m, 36.2 ft-lb)

T2: 57 N·m (5.8 kgf-m, 42 ft-lb)

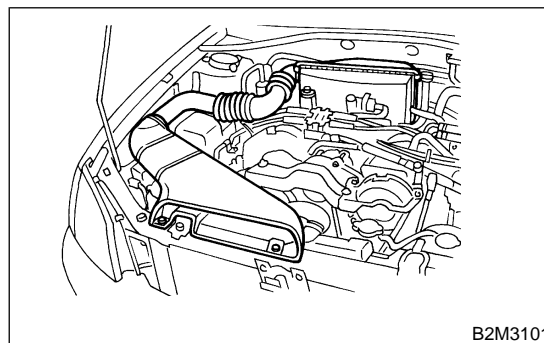


- 14) Install radiator upper brackets.



- 15) Install air intake duct.

<Ref. to IN(H4)-7 INSTALLATION, Air Intake Duct.>

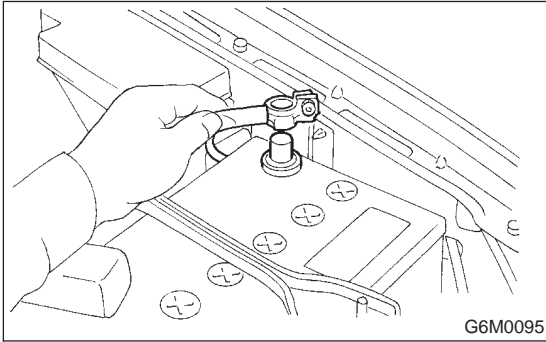


- 16) Install front wheels.

OIL PAN AND STRAINER

Lubrication

17) Connect battery ground cable.



18) Fill engine oil. <Ref. to LU(H4)-7 INSPECTION, Engine Oil.>

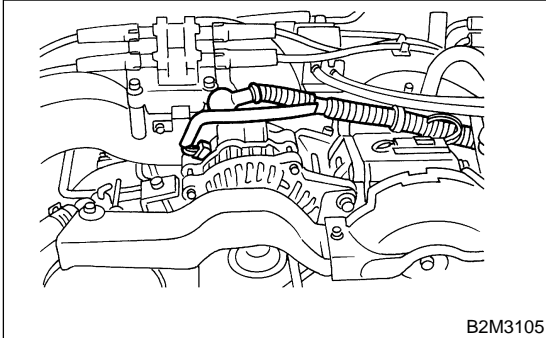
C: INSPECTION S108071A10

By visual check make sure oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

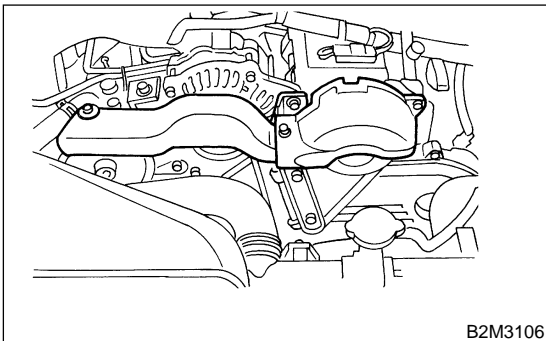
6. Oil Pressure Switch S108069

A: REMOVAL S108069A18

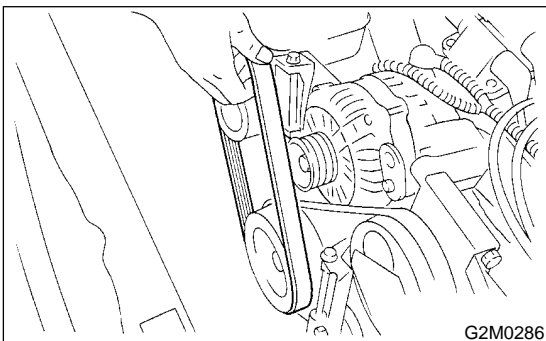
- 1) Remove generator from bracket.
 - (1) Disconnect connector and terminal from generator.



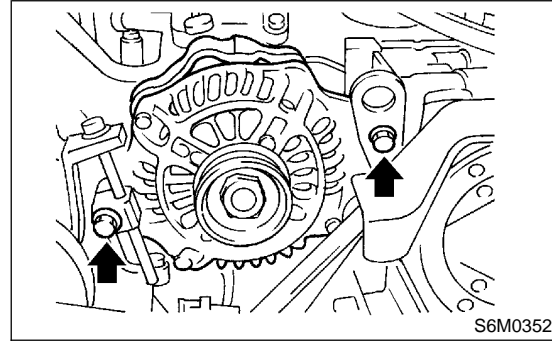
- (2) Remove V-belt cover.



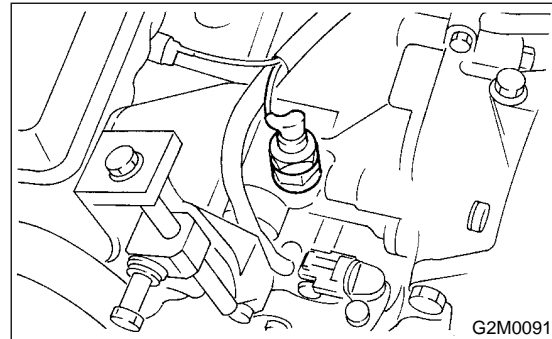
- (3) Loosen lock bolt and slider bolt, and remove front side V-belt.



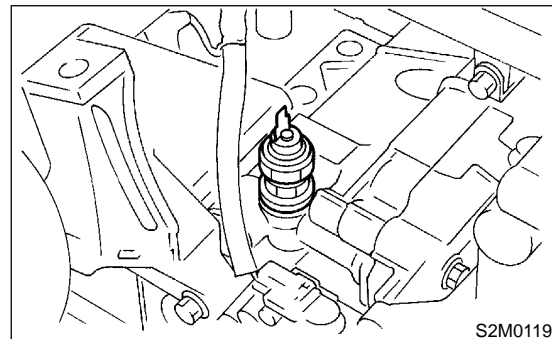
- (4) Remove bolts which install generator on bracket.



- (2) Disconnect terminal from oil pressure switch.



- (3) Remove oil pressure switch.



OIL PRESSURE SWITCH

Lubrication

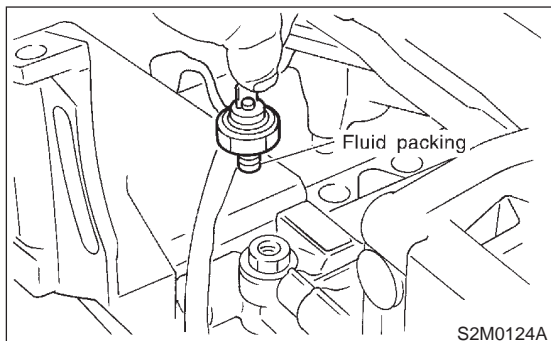
B: INSTALLATION

S108069A11

1) Apply fluid packing to oil pressure switch threads.

Fluid packing:

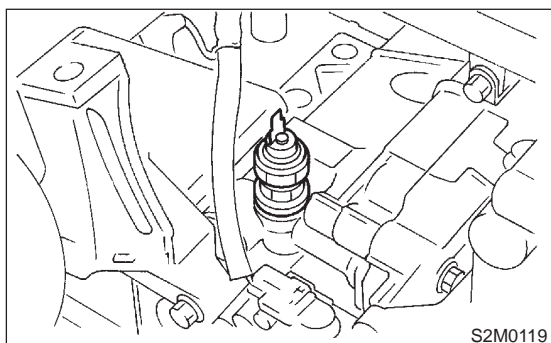
THREE BOND 1215 or equivalent



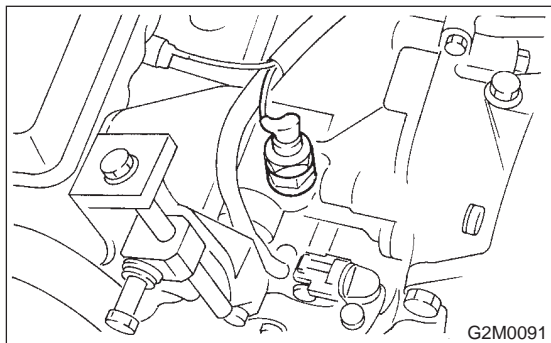
2) Install oil pressure switch onto engine block.

Tightening torque:

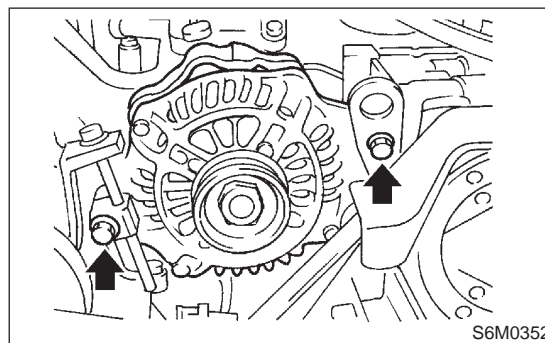
25 N·m (2.5 kgf-m, 18.1 ft-lb)



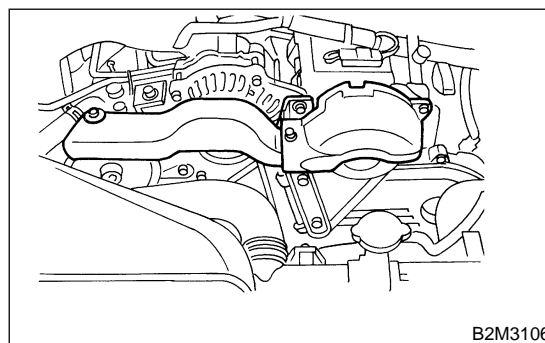
3) Connect terminal of oil pressure switch.



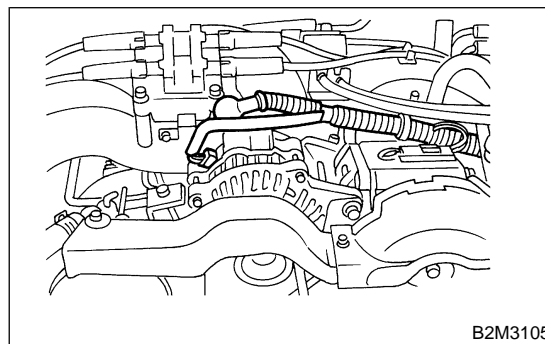
4) Install generator on bracket and temporarily tighten installing bolts.



5) Install front side V-belt and adjust it.
<Ref. to ME(H4)-43 INSTALLATION, V-belt.>
6) Install V-belt cover.



7) Connect connector and terminal to generator.



C: INSPECTION

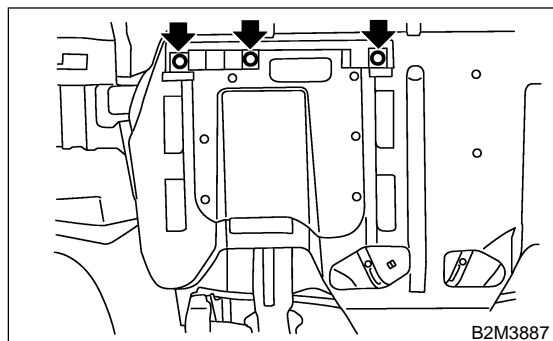
S108069A10

Make sure oil does not leak or seep from where the oil pressure switch is installed.

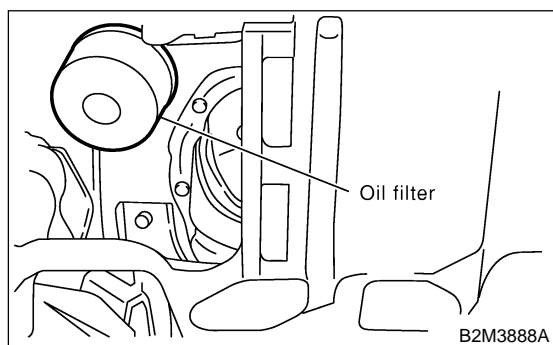
7. Engine Oil Filter S108585

A: REMOVAL S108585A18

- 1) Remove access lid.



- 2) Remove oil filter with ST.
ST 498547000 OIL FILTER WRENCH



B: INSTALLATION S108585A11

- 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 S108585A10

- 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(H4)-7 INSPECTION, Engine Oil.>

ENGINE LUBRICATION SYSTEM TROUBLE IN GENERAL

Lubrication

8. Engine Lubrication System Trouble in General

S108100

A: INSPECTION

S108100A10

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).

GENERAL DESCRIPTION

Mechanical

1. General Description

S103001

A: SPECIFICATIONS

S103001E49

Engine	Type		Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve arrangement		Belt driven, single over-head camshaft, 4-valve/cylinder
	Bore x Stroke mm (in)		99.5 x 79.0 (3.917 x 3.110)
	Displacement cm ³ (cu in)		2,457 (150)
	Compression ratio		10.0
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm ² , psi)		1,079 — 1,275 (11.0 — 13.0, 156 — 185)
	Number of piston rings		Pressure ring: 2, Oil ring: 1
	Intake valve timing	Opening	1° BTDC
		Closing	51° ABDC
	Exhaust valve timing	Opening	50° BBDC
		Closing	6° ATDC
	Valve clearance	Intake mm (in)	0.20±0.02 (0.0079±0.0008)
		Exhaust mm (in)	0.25±0.02 (0.0098±0.0008)
	Idling speed [At neutral position on MT, or “P” or “N” position on AT] rpm		MT: 650±100 (No load) AT: 700±100 (No load) 850±100 (A/C switch ON)

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		0.020 mm (0.0008 in)		
	Thrust clearance	STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)		
		Limit	0.11 mm (0.0043 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)		

ME(H4)-2

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			98.3 mm (3.870 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 kg, 48.3 — 55.3 lb)/ 45.0 mm (1.772 in) 526.6 — 581.6 N (53.7 — 59.3 kg, 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).

ME(H4)-3

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	0.020 — 0.046 mm (0.0008 — 0.0018 in)
			Limit	0.05 mm (0.0020 in)
	Thickness at center portion		STD	1.486 — 1.498 mm (0.0585 — 0.0590 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)

ME(H4)-4

GENERAL DESCRIPTION

Mechanical

Crankshaft bearing	Crankshaft bearing thickness	#1, #5	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, #3, #4	STD	2.000 — 2.013 mm (0.0787 — 0.0793 in)
			0.03 mm (0.0012 in) US	2.019 — 2.022 mm (0.0795 — 0.0796 in)
			0.05 mm (0.0020 in) US	2.029 — 2.032 mm (0.0799 — 0.0800 in)
			0.25 mm (0.0098 in) US	2.129 — 2.132 mm (0.0838 — 0.0839 in)

GENERAL DESCRIPTION

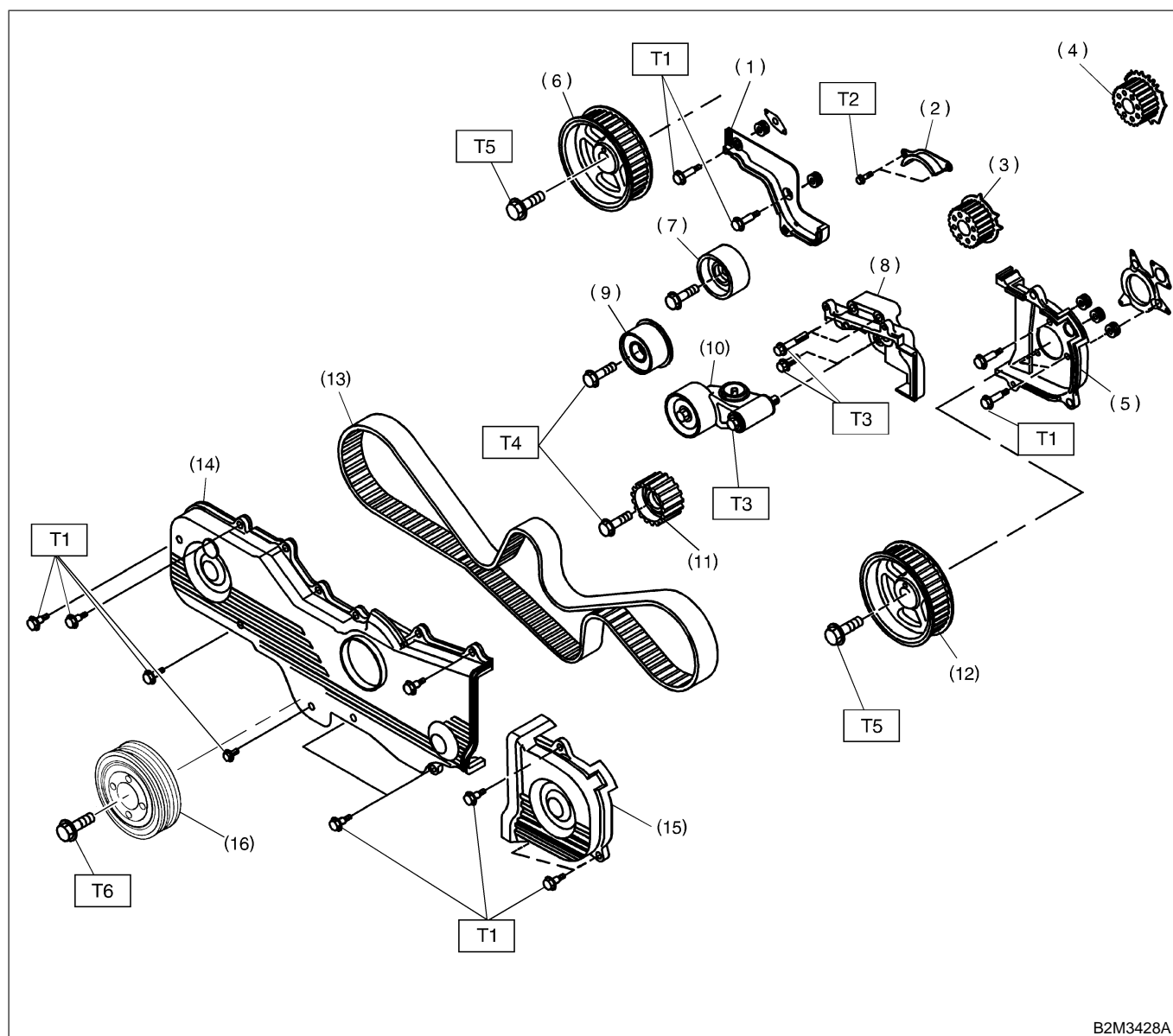
Mechanical

B: COMPONENT

S103001A05

1. TIMINGBELT

S103001A0501



B2M3428A

- | | |
|--|---|
| (1) Belt cover No. 2 (RH) | (8) Tensioner bracket |
| (2) Timing belt guide (MT vehicles only) | (9) Belt idler (No. 2) |
| (3) Crankshaft sprocket (AT vehicles) | (10) Automatic belt tension adjuster ASSY |
| (4) Crankshaft sprocket (MT vehicles) | (11) Belt idler No. 2 |
| (5) Belt cover No. 2 (LH) | (12) Camshaft sprocket No. 2 |
| (6) Camshaft sprocket No. 1 | (13) Timing belt |
| (7) Belt idler (No. 1) | (14) Front belt cover |
| | (15) Belt cover (LH) |
| | (16) Crankshaft pulley |

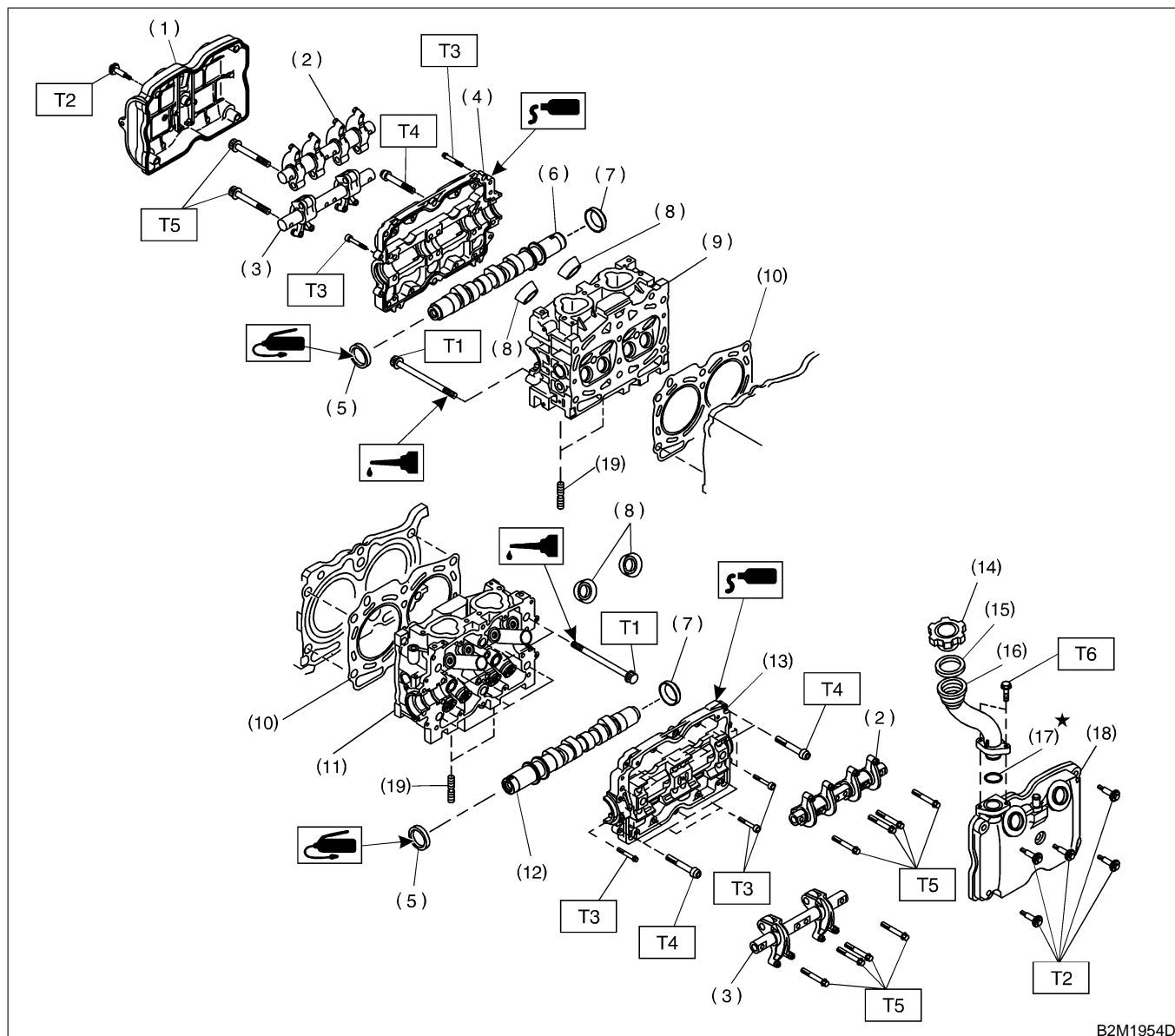
Tightening torque: N-m (kgf-m, ft-lb)

- 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: 177 (18.0, 130.2)

ME(H4)-6

2. CYLINDER HEAD AND CAMSHAFT

S103001A0502



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(H4)-59 CYLINDER HEAD, INSTALLATION, Cylinder Head Assembly.>

T2: 5 (0.5, 3.6)

T3: 10 (1.0, 7.2)

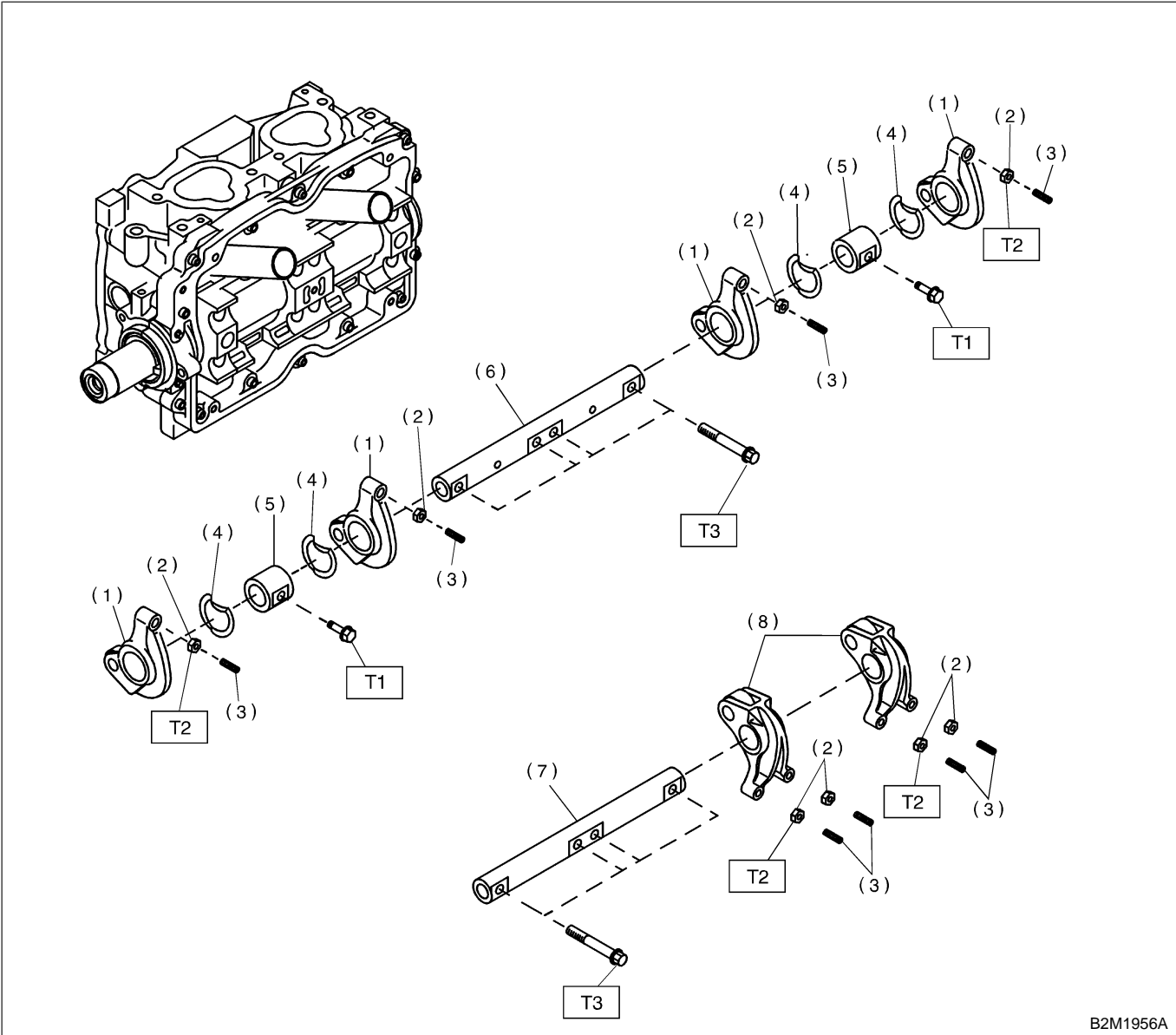
T4: 18 (1.8, 13.0)

T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

ME(H4)-7

3. VALVE ROCKER ASSEMBLY S103001A0503



B2M1956A

- | | |
|-------------------------------|------------------------------|
| (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)

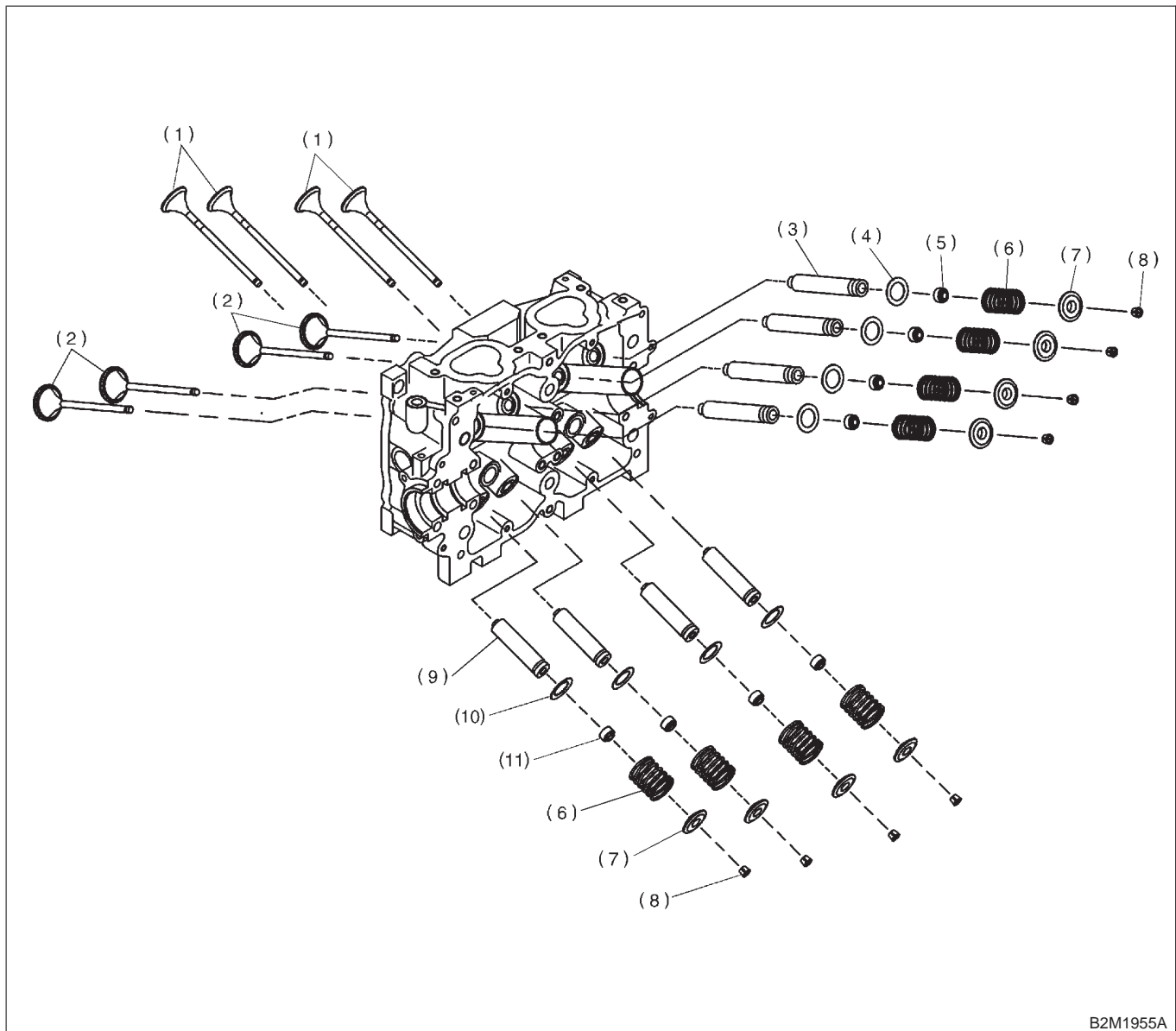
T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY

S103001A0504



B2M1955A

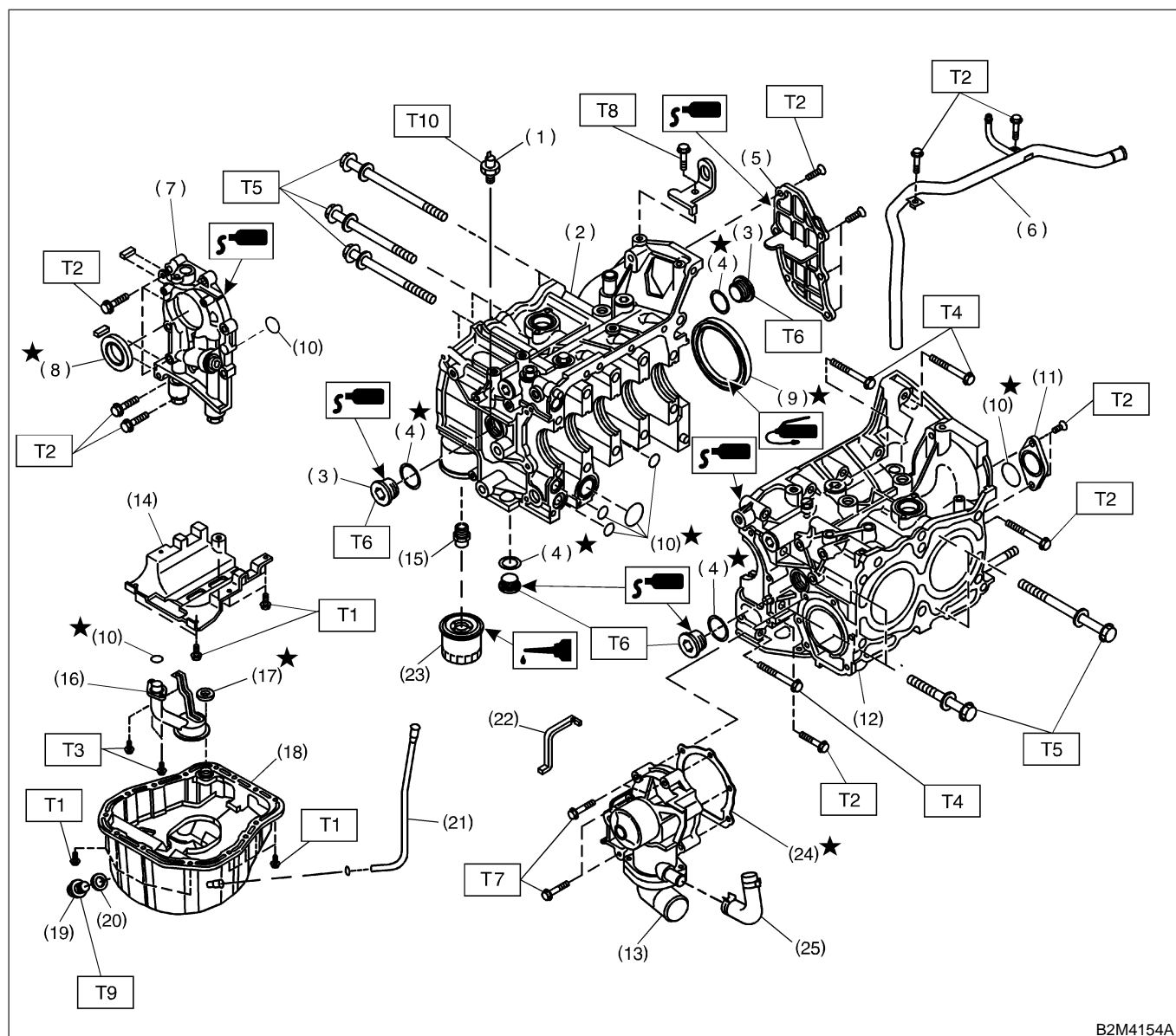
- | | | |
|------------------------------|---------------------------|--------------------------------|
| (1) Exhaust valve | (5) Intake valve oil seal | (9) Exhaust valve guide |
| (2) Intake valve | (6) Valve spring | (10) Exhaust valve spring seat |
| (3) Intake valve guide | (7) Retainer | (11) Exhaust valve oil seal |
| (4) Intake valve spring seat | (8) Retainer key | |

ME(H4)-9

GENERAL DESCRIPTION

Mechanical

5. CYLINDER BLOCK S103001A0505



B2M4154A

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

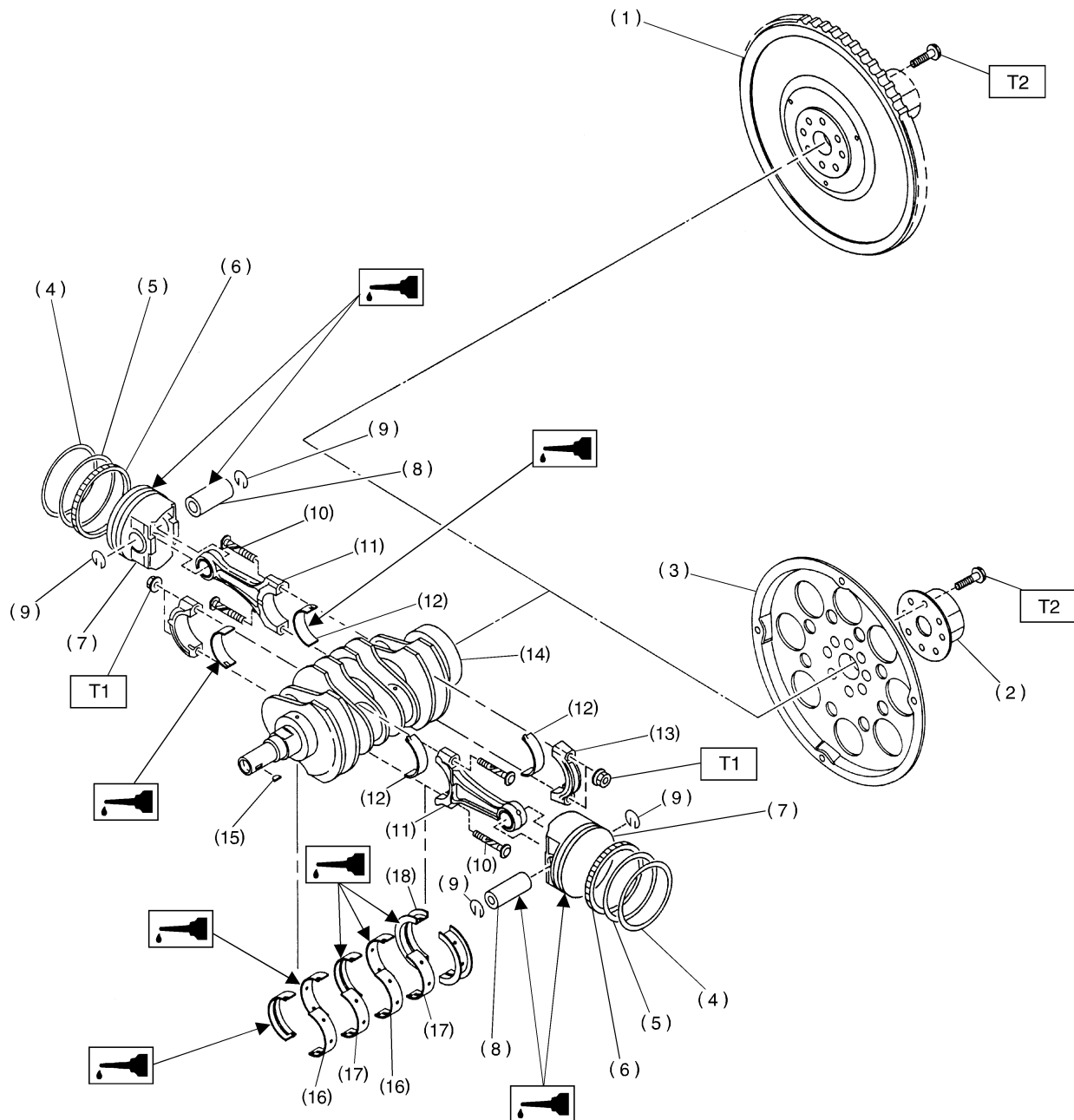
Tightening torque: N-m (kgf-m, ft-lb)

- 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)

ME(H4)-10

6. CRANKSHAFT AND PISTON

S103001A0506



B2M3429A

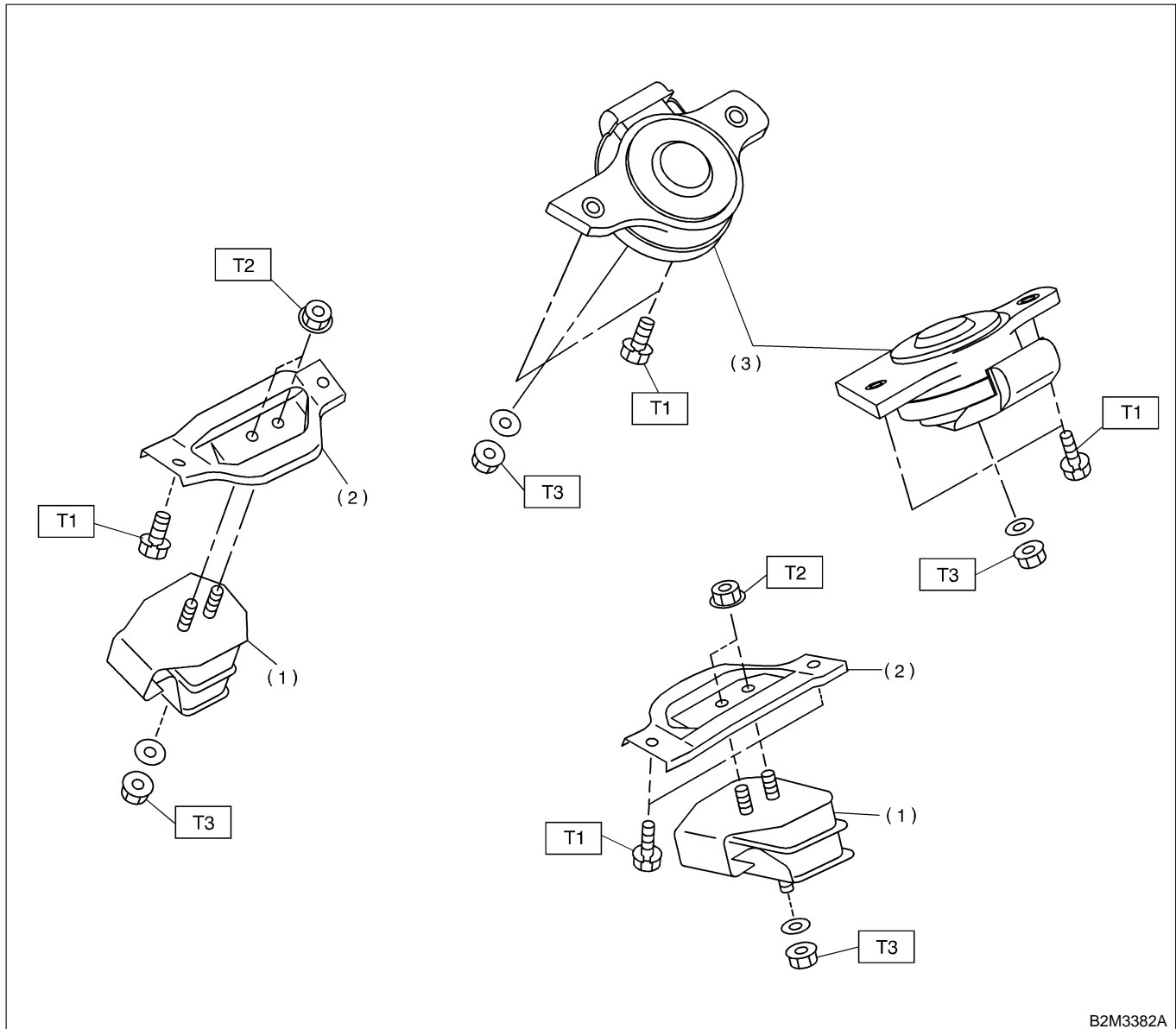
ME(H4)-11

GENERAL DESCRIPTION

Mechanical

(1) Flywheel (MT)	(9) Circlip	(17) Crankshaft bearing #2, #4
(2) Reinforcement (AT)	(10) Connecting rod bolt	(18) Crankshaft bearing #5
(3) Drive plate (AT)	(11) Connecting rod	
(4) Top ring	(12) Connecting rod bearing	Tightening torque: N·m (kgf-m, ft-lb)
(5) Second ring	(13) Connecting rod cap	T1: 44.6 (4.55, 32.9)
(6) Oil ring	(14) Crankshaft	T2: 72 (7.3, 52.8)
(7) Piston	(15) Woodruff key	
(8) Piston pin	(16) Crankshaft bearing #1, #3	

7. ENGINE MOUNTING S103001A0507



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** S103001A03

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary

removal, installation, disassembly, and replacement.

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

GENERAL DESCRIPTION

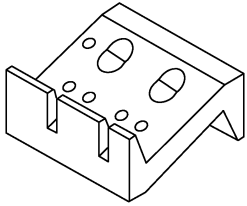
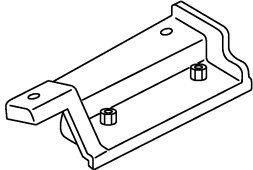
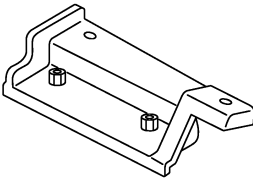
Mechanical

- 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.

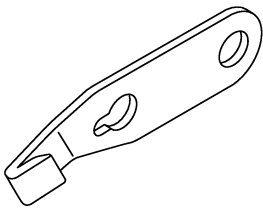
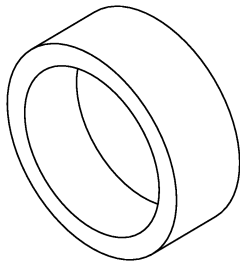
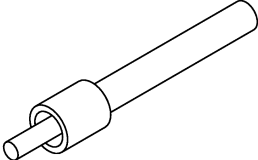
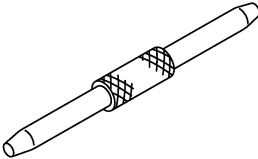
D: PREPARATION TOOL S103001A17

1. SPECIAL TOOLS S103001A1701

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3850	498267800	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> ● 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).

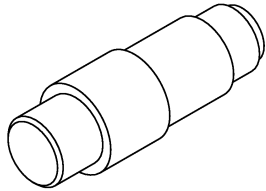
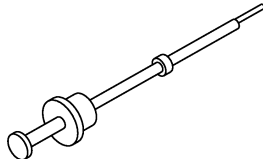
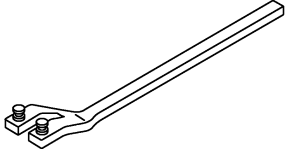
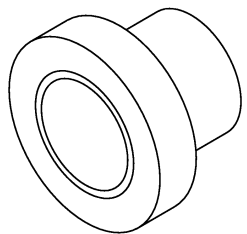
GENERAL DESCRIPTION

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.

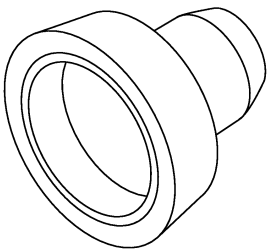
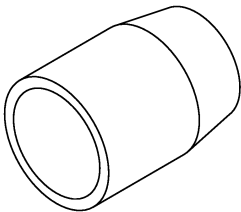
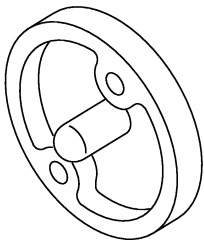
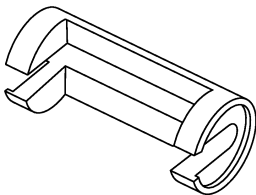
GENERAL DESCRIPTION

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.

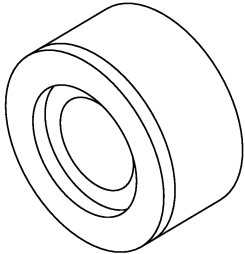
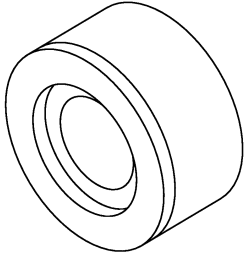
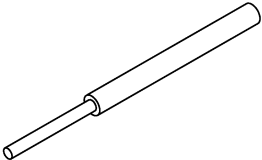
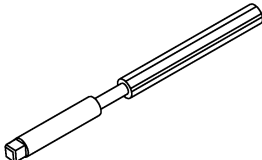
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>B2M3861</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> Used for installing crankshaft oil seal. Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 <p>B2M3862</p>	499597000	OIL SEAL GUIDE	<ul style="list-style-type: none"> Used for installing camshaft oil seal. Used with CAMSHAFT OIL SEAL INSTALLER (499587100).
 <p>B2M3863</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> Used for installing crankshaft oil seal. Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 <p>B2M3864</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

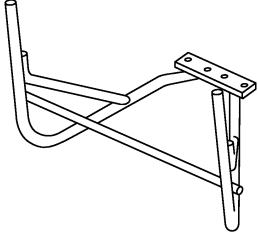
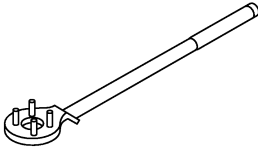
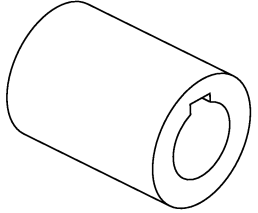
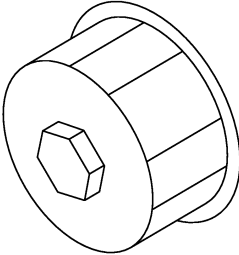
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3865	499767700	VALVE GUIDE ADJUSTER	Used for installing intake valve guides.
 B2M3865	499767800	VALVE GUIDE ADJUSTER	Used for installing exhaust valve guide.
 B2M3867	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 B2M3868	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.

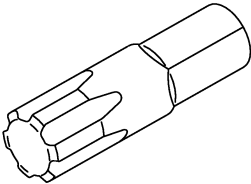
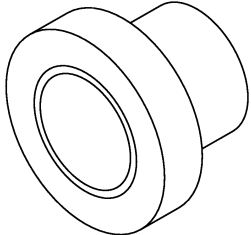
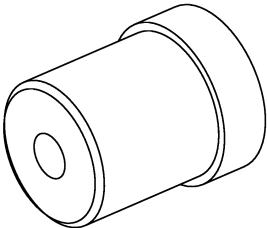
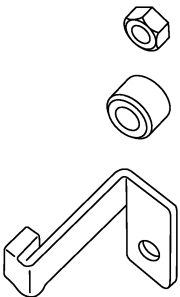
GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>B2M3869</p>	499817100	ENGINE STAND	<ul style="list-style-type: none"> Stand used for engine disassembly and assembly. Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 <p>B2M3870</p>	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 <p>B2M3871</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p>B2M3872</p>	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.

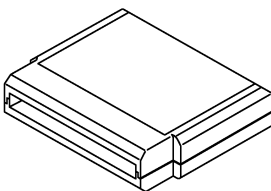

GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3873	499497000	TORX PLUS	Used for removing and installing camshaft cap.
 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.

GENERAL DESCRIPTION

Mechanical

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3876	24082AA150	CARTRIDGE	Troubleshooting for electrical systems.
 B2M3877	22771AA030	SELECT MONI-TOR KIT	Troubleshooting for electrical systems. <ul style="list-style-type: none"> English: 22771AA030 (Without printer) German: 22771AA070 (Without printer) French: 22771AA080 (Without printer) Spanish: 22771AA090 (Without printer)

2. GENERAL PURPOSE TOOLS S103001A1702

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 S103001E45

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 S103081

A: INSPECTION S103081A10

CAUTION:

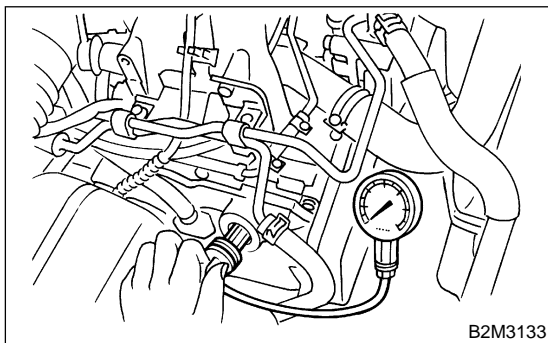
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 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(H4)-70 RELEASING OF FUEL PRESSURE, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG(H4)-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;

1,216 kPa (12.4 kg/cm², 176 psi)

Limit;

941 kPa (9.6 kg/cm², 137 psi)

Difference between cylinders;

49 kPa (0.5 kg/cm², 7 psi), or less

3. Idle Speed

S103082

A: INSPECTION

S103082A10

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.

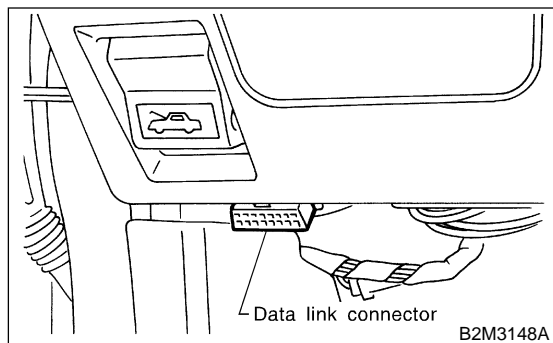
2) Warm-up the engine.

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

4) When using SUBARU SELECT MONITOR <Ref. to ME(H4)-14 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.

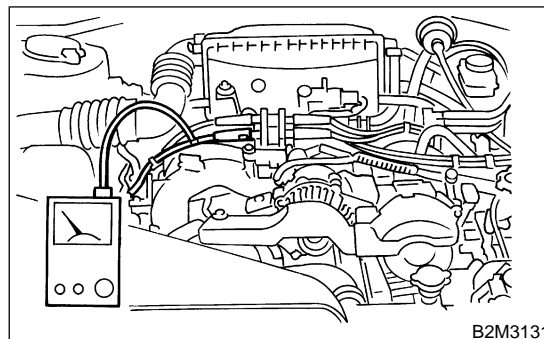
(7) Select {1.12 Data Display} in Data Display Menu.

(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.



B2M3131

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(H4)-2, Basic Diagnostic Procedure.>

4. Ignition Timing S103086

A: INSPECTION S103086A10

CAUTION:

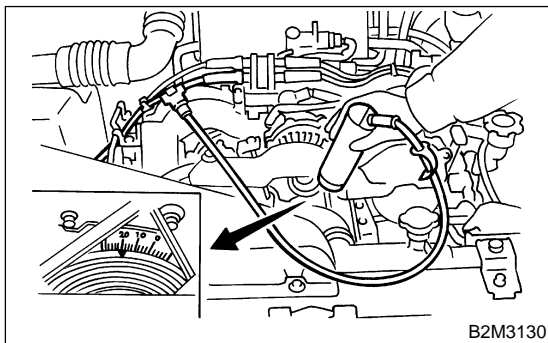
After warming-up, engine becomes very hot.
Be careful not to burn yourself during measurement.

- 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(H4)-2, Basic Diagnostic Procedure.>

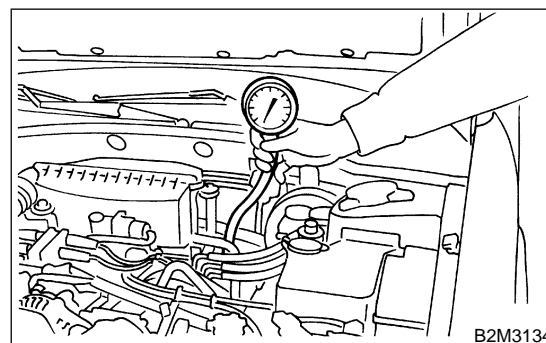
5. Intake Manifold Vacuum S103654

A: INSPECTION S103654A10

- 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

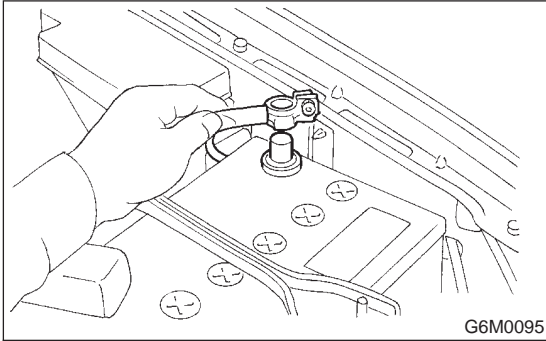
6. Engine Oil Pressure

S103655

A: INSPECTION

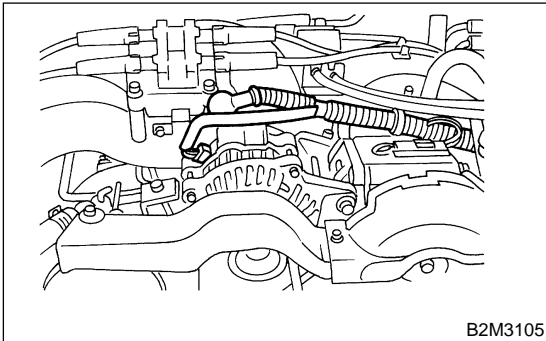
S103655A10

- 1) Disconnect battery ground cable.

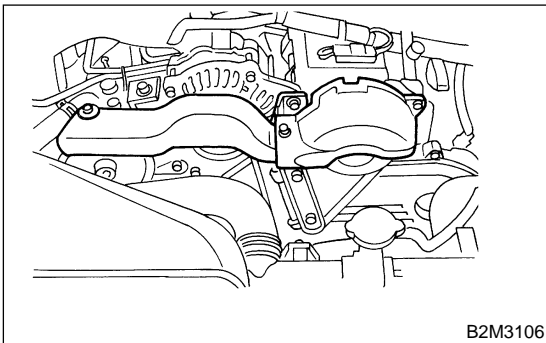


- 2) Remove generator from bracket.

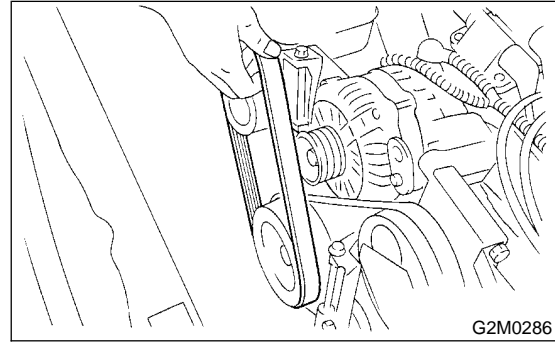
- (1) Disconnect connector and terminal from generator.



- (2) Remove V-belt cover.

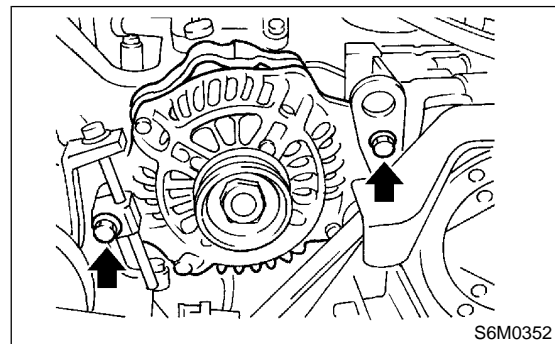


- (3) Loosen lock bolt and slider bolt, and remove front side V-belt.

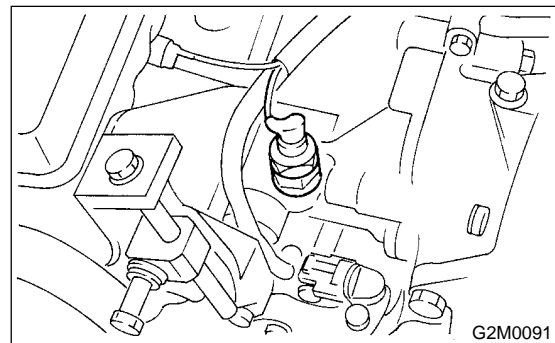


- (4) Remove generator lock bolt.

- (5) Remove bolt which install generator on bracket.

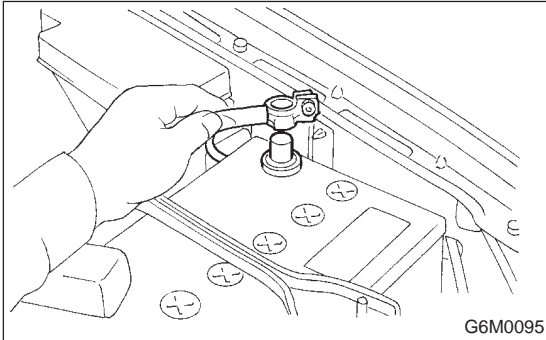


- 3) Disconnect connector from oil pressure switch.
- 4) Remove oil pressure switch from engine cylinder block. <Ref. to LU(H4)-19 REMOVAL, Oil Pressure Switch.>

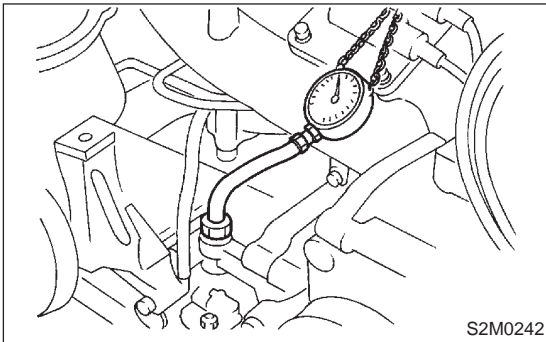


- 5) Connect oil pressure gauge hose to cylinder block.

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(H4)-22 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(H4)-22 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(H4)-20 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(H4)-43 INSTALLATION, V-belt.>

7. Fuel Pressure S103656

A: INSPECTION S103656A10

WARNING:

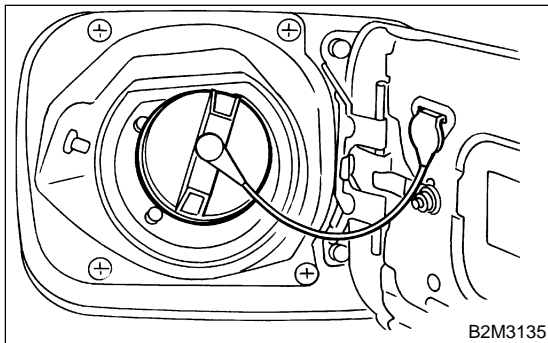
Before removing fuel pressure gauge, release fuel pressure.

NOTE:

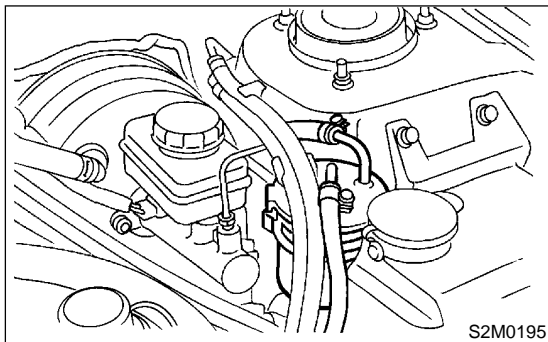
If out of specification, check or replace pressure regulator and pressure regulator vacuum hose.

1) Release fuel pressure. <Ref. to FU(H4)-xx
RELEASING OF FUEL PRESSURE OPERATION,
Fuel.>

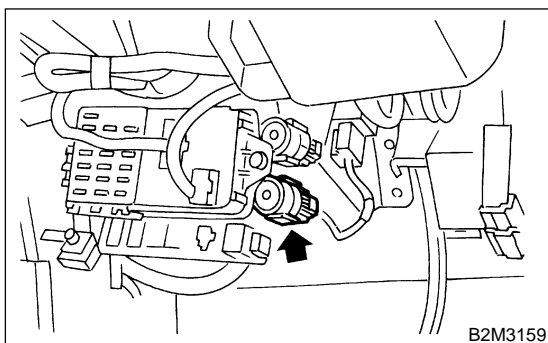
2) Open fuel flap lid, and remove fuel filler cap.



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



4) Connect connector of fuel pump relay.

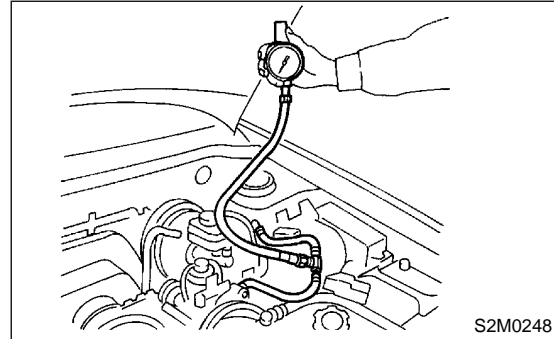


5) Start the engine.

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

Fuel pressure:

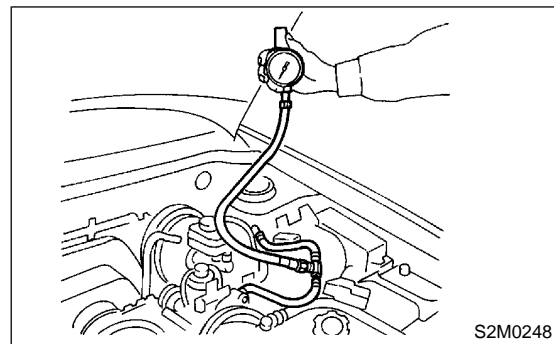
Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm², 41 — 46 psi)



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.

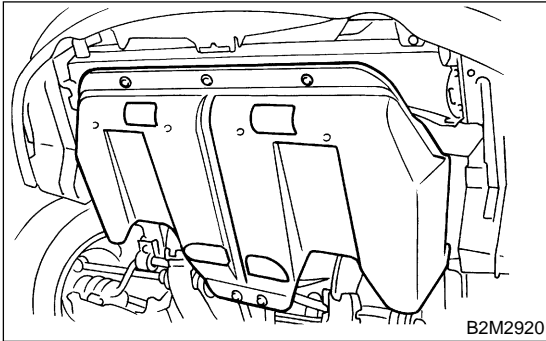
8. Valve Clearance S103083

A: INSPECTION S103083A10

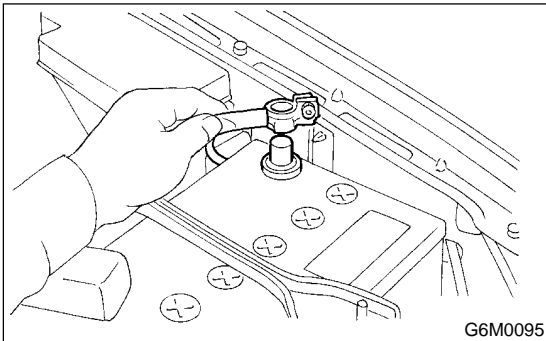
CAUTION:

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

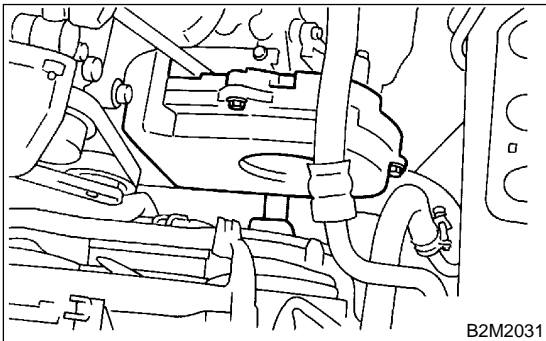
- 1) Set the vehicle onto the lift.
- 2) Lift-up the vehicle.
- 3) Remove under cover.



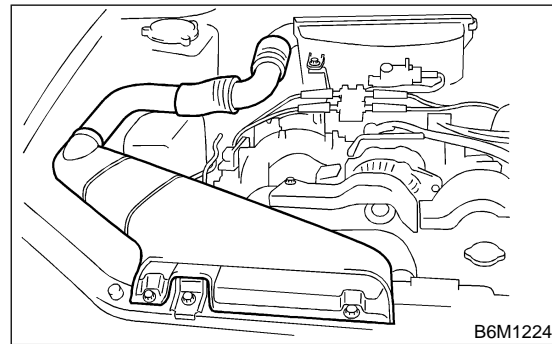
- 4) Disconnect battery ground cable.



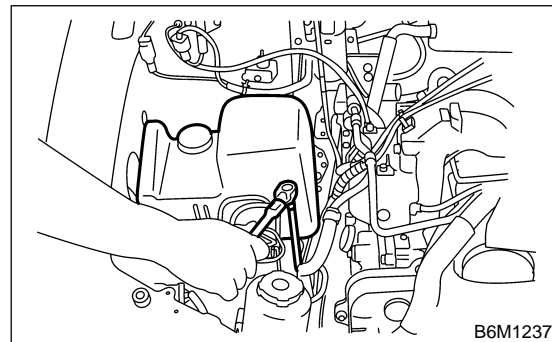
- 5) Lower the vehicle.
- 6) Remove timing belt cover (LH).



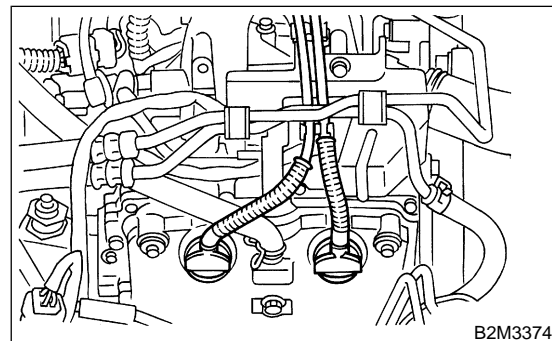
- 7) Remove rocker cover.
- 8) When inspecting #1 and #3 cylinders;
 - (1) Remove bolt which secures air intake duct to radiator panel side.
 - (2) Remove air intake duct as a unit.



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



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

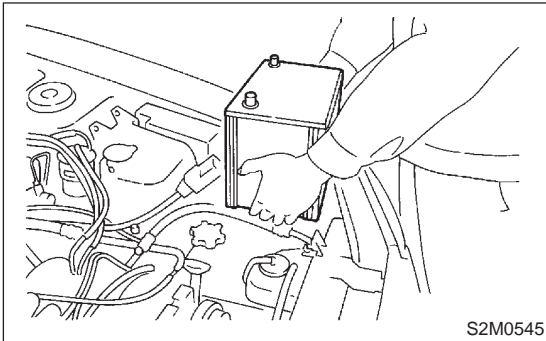


- (5) Disconnect PCV hose from rocker cover (RH).
- (6) Remove bolts, then remove rocker cover (RH).

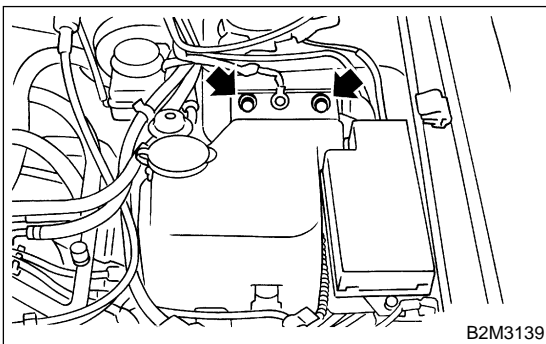
VALVE CLEARANCE

Mechanical

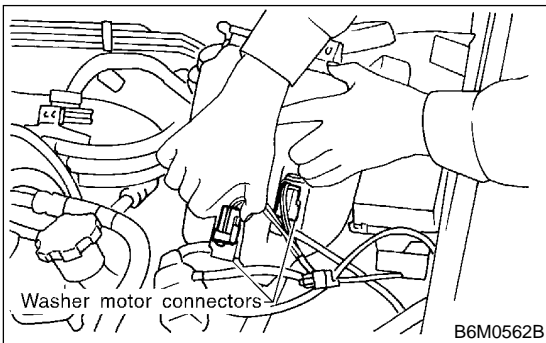
- 9) When inspecting #2 and #4 cylinders;
(1) Disconnect battery cables, and then remove battery and battery carrier.



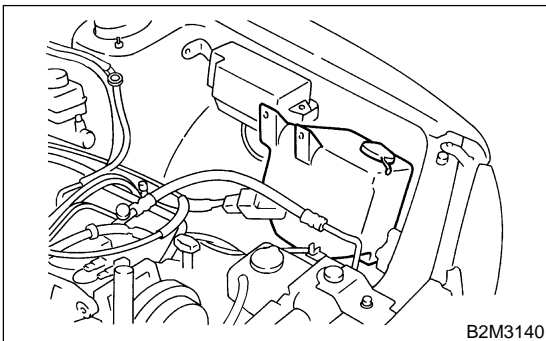
- (2) Remove the two bolts which hold washer tank.



- (3) Disconnect washer motor connectors.



- (4) Move washer tank to forward.



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

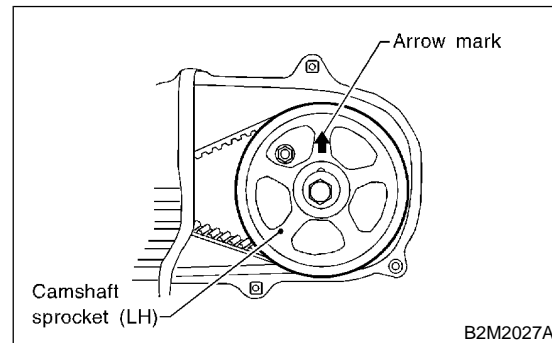
- (6) Disconnect PCV hose from rocker cover (LH).
(7) Remove bolts, then remove rocker cover (LH).

- 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 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.

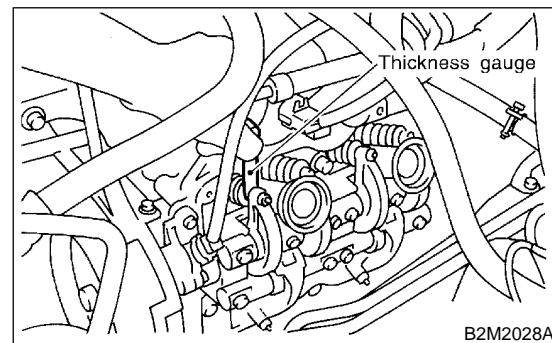
Valve clearance:

Intake;

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

Exhaust;

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

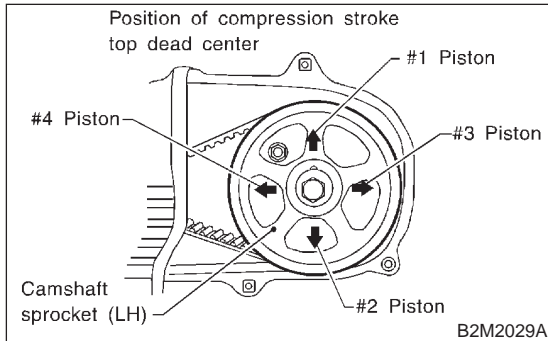


- 12) If necessary, adjust the valve clearance. <Ref. to ME(H4)-31 ADJUSTMENT, Valve Clearance.>

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.

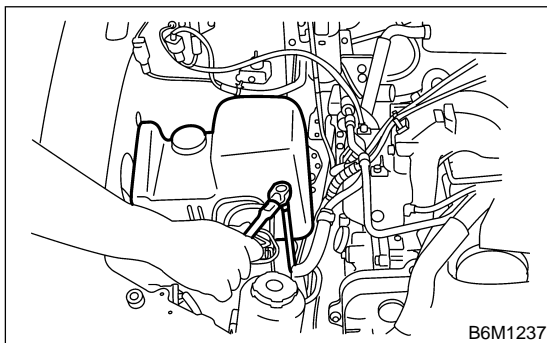


14) After inspection, install the related parts in the reverse order of removal.

Tightening torque:

Resonator chamber;

32 N·m (3.3 kgf-m, 24 ft-lb)



B: ADJUSTMENT

S103083A01

CAUTION:

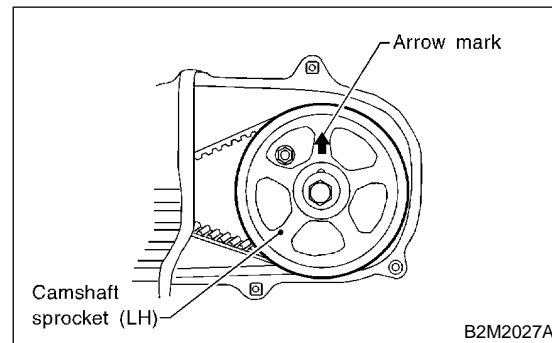
Adjustment of valve clearance should be performed while engine is cold.

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 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 lift-up the vehicle.

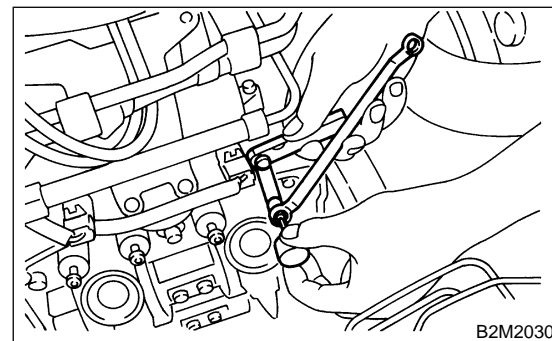
Valve clearance:

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.

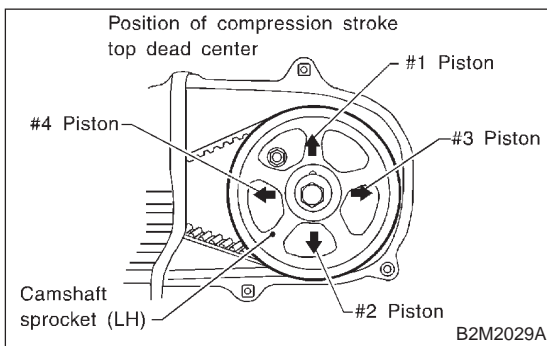
VALVE CLEARANCE

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:

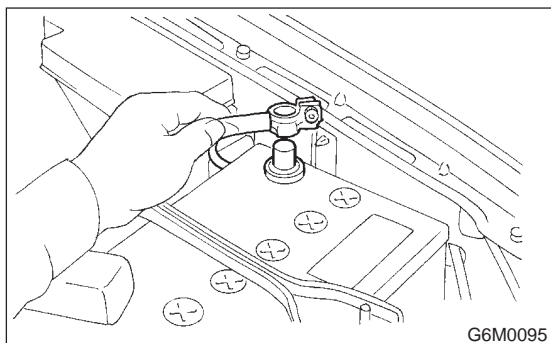
- Be sure to set cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
- To set #3, #2 and #4 cylinder pistons to their top dead centers on compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand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



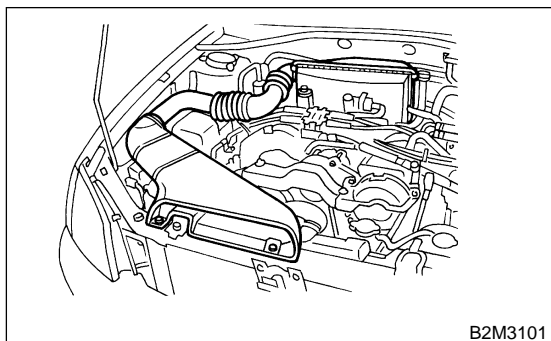
9. Engine Assembly S103079

A: REMOVAL S103079A18

- 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(H4)-70
RELEASING OF FUEL PRESSURE,
OPERATION, Fuel.>
- 5) Remove filler cap.
- 6) Disconnect battery ground terminal.

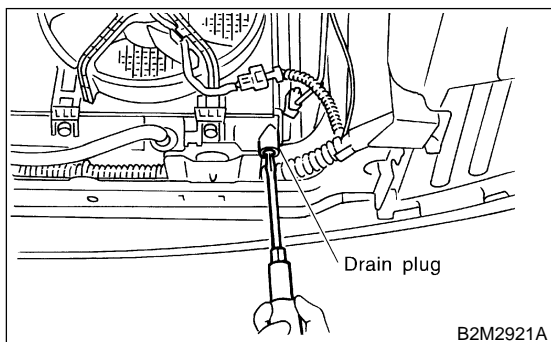


- 7) Remove air intake duct and air cleaner case.
<Ref. to IN(H4)-7, REMOVAL, Air Intake Duct.>
and <Ref. to IN(H4)-6 REMOVAL, Air Cleaner
Case.>

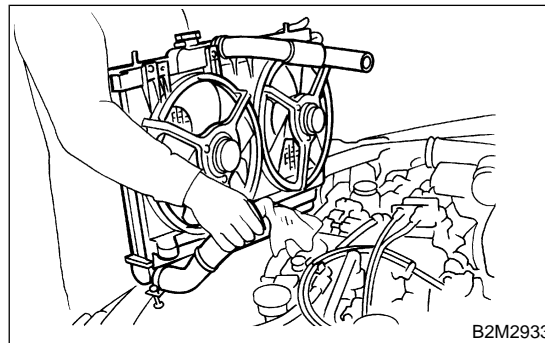


- 8) Remove under cover.
- 9) Drain coolant.

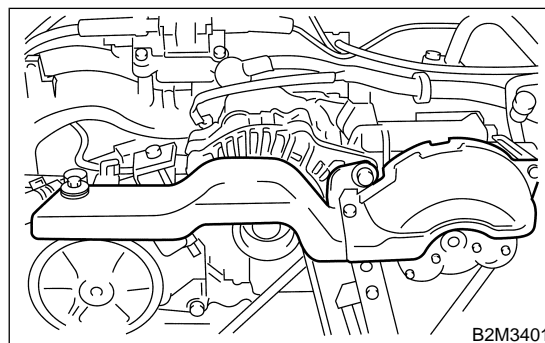
Set container under the vehicle, and loose drain
cock from radiator. <Ref. to CO(H4)-6 DRAINING
OF ENGINE COOLANT, REPLACEMENT, Engine
Coolant.>



- 10) Remove radiator from vehicle. <Ref. to
CO(H4)-15 REMOVAL, Radiator.>

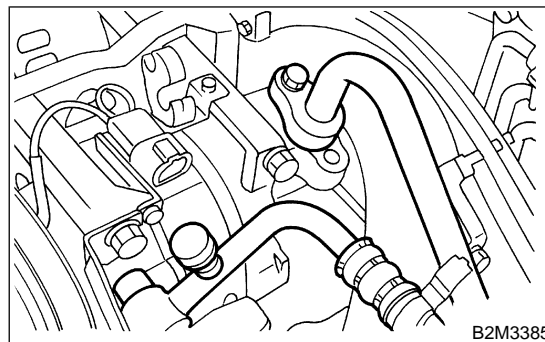


- 11) Remove V-belt cover.



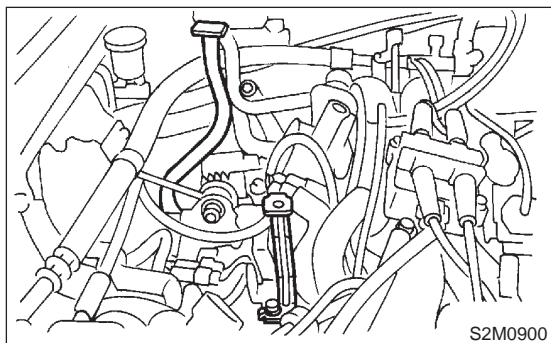
- 12) Collect refrigerant, and remove pressure
hoses. (With A/C)

- (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.

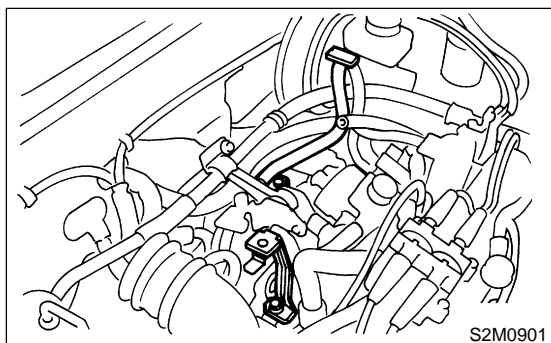


13) Remove air cleaner case stay.

● **MT model**

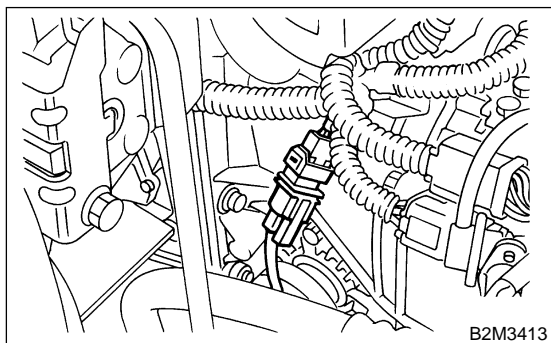


● **AT model**

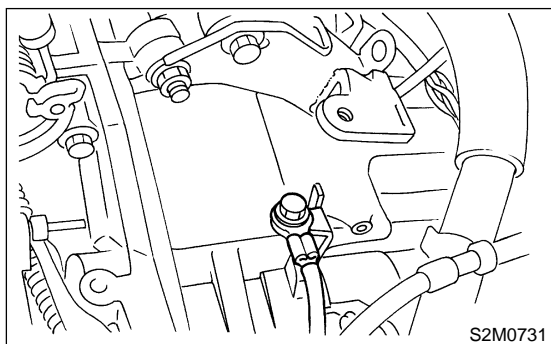


14) Disconnect the following connectors and cables.

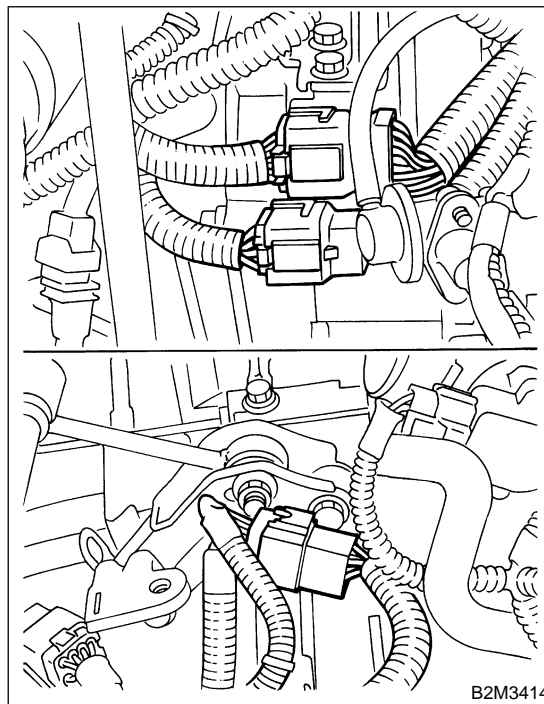
(1) Front oxygen sensor connector



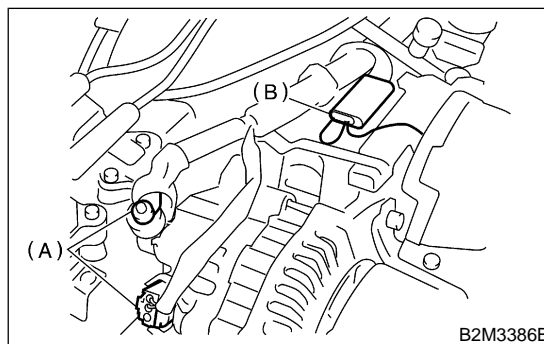
(2) Engine ground terminal



(3) Engine harness connectors



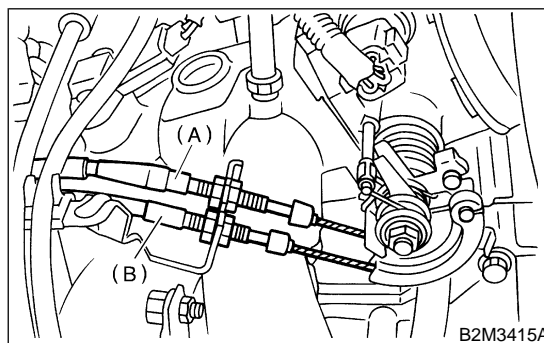
(4) Alternator connector, terminal and A/C compressor connector



(A) A/C compressor connector

(B) Alternator connector and terminal

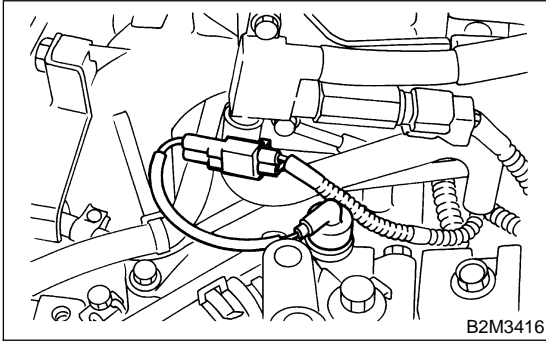
(5) Accelerator cable and cruise control cable



(A) Accelerator cable

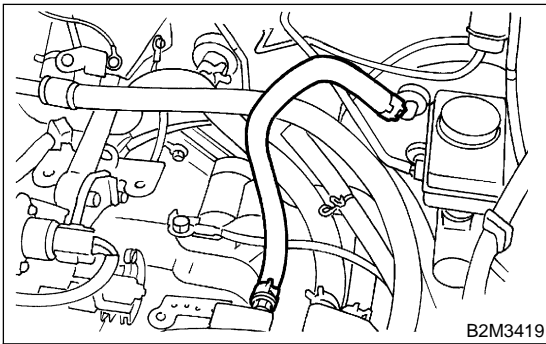
(B) Cruise control cable

(6) Pressure switch

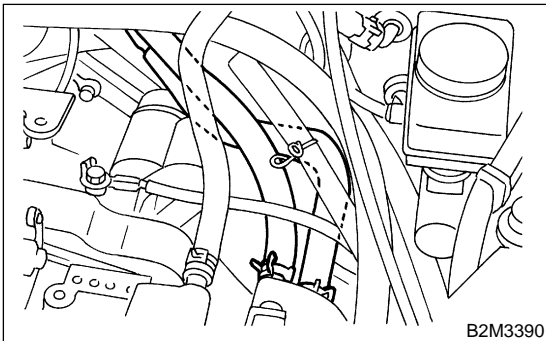


15) Disconnect the following hoses.

(1) Brake booster vacuum hose

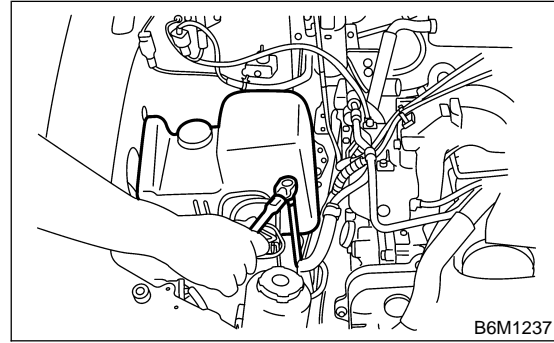


(2) Heater inlet outlet hose

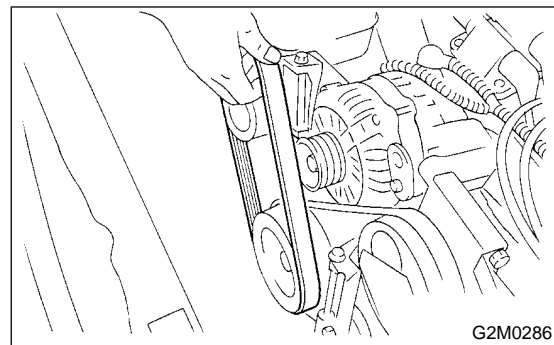


16) Remove power steering pump from bracket.

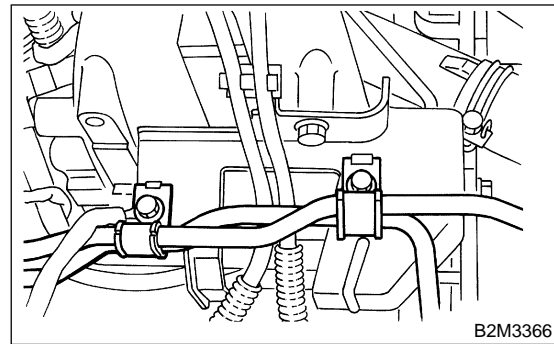
(1) Remove resonator chamber.



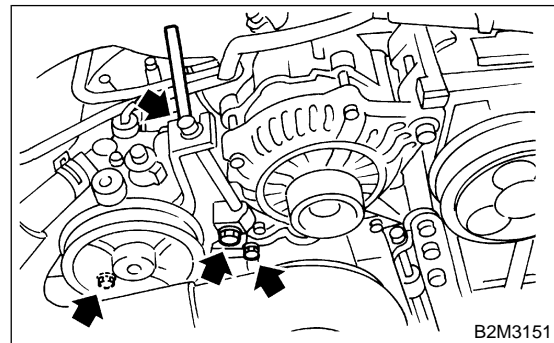
(2) Loosen lock bolt and slider bolt, and remove front side V-belt.



(3) Remove pipe with bracket.



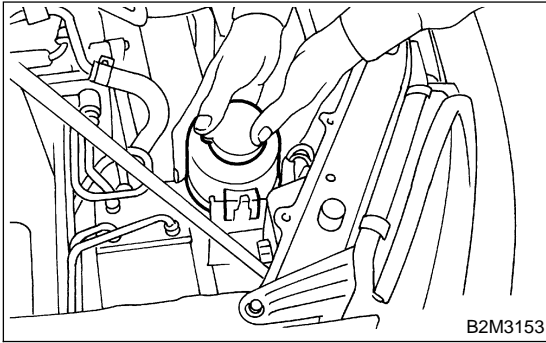
(4) Remove bolts which install power steering pump bracket.



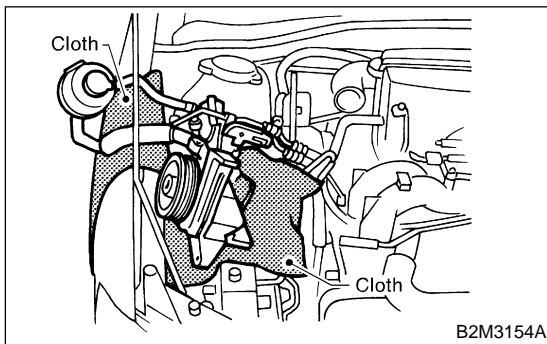
ENGINE ASSEMBLY

Mechanical

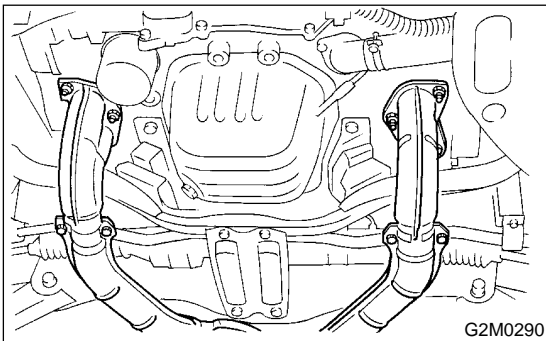
(5) Remove power steering tank from the bracket by pulling it upward.



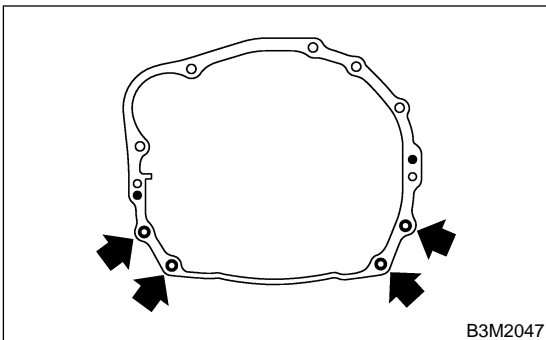
(6) Place power steering pump on the right side wheel apron.



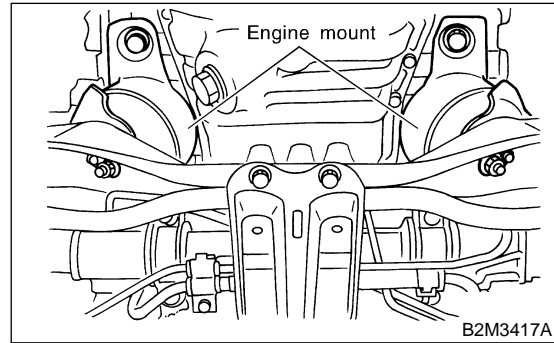
17) Remove front and center exhaust pipe.
<Ref. to EX(H4)-5 REMOVAL, Front Exhaust Pipe.> and <Ref. to EX(H4)-8 REMOVAL, Center Exhaust Pipe.>



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



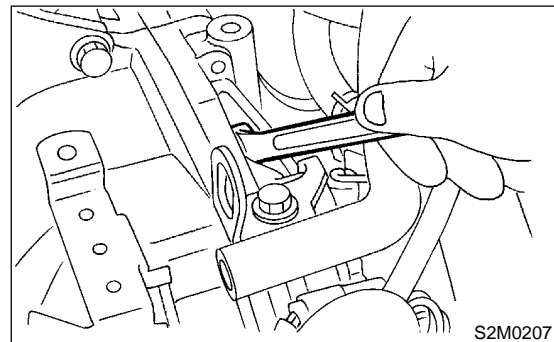
19) Remove nuts which install front cushion rubber onto front crossmember.



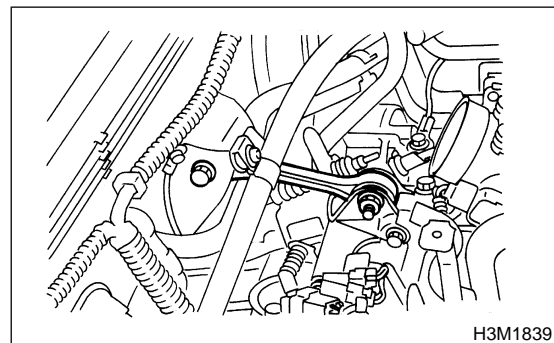
20) Separate torque converter clutch from drive plate. (AT model)

- (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 engine using ST.

ST 499977100 CRANK PULLEY WRENCH



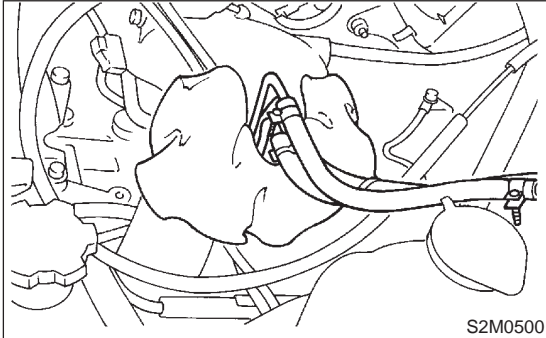
21) Remove pitching stopper.



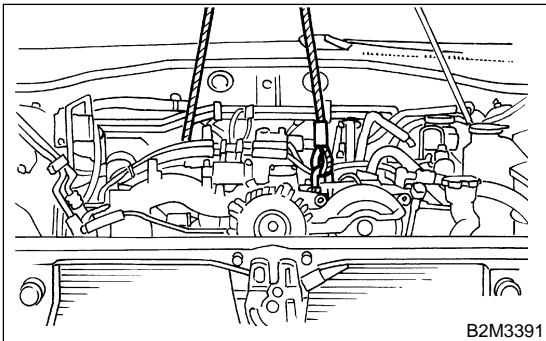
22) Disconnect fuel delivery hose, return hose and evaporation hose.

CAUTION:

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



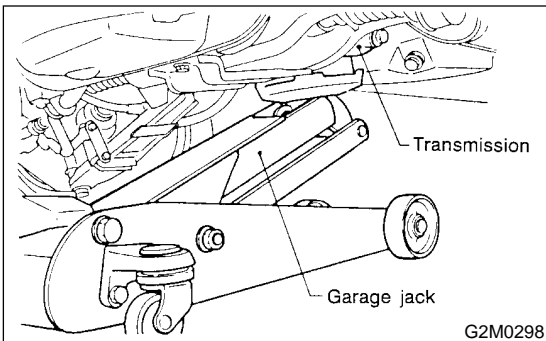
23) Support engine with a lifting device and wire ropes.



24) Support transmission with a garage jack.

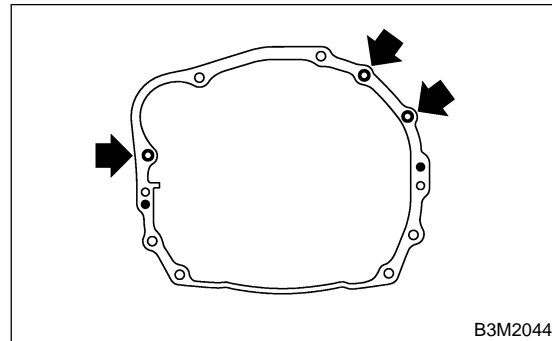
CAUTION:

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.



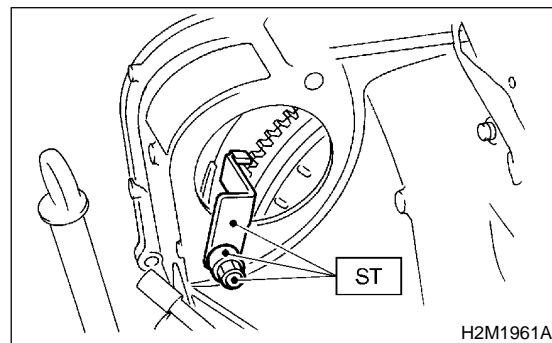
25) Separation of engine and transmission.

- (1) Remove starter. <Ref. to SC(H4)-7 REMOVAL, Starter.>
- (2) Remove bolts which hold upper side of transmission to engine.



26) Install ST to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

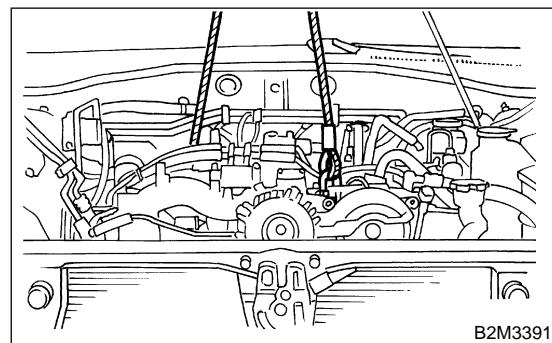


27) Remove engine from vehicle.

- (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.



28) Remove front cushion rubbers.

B: INSTALLATION S103079A11

- 1) Install front cushion rubbers.

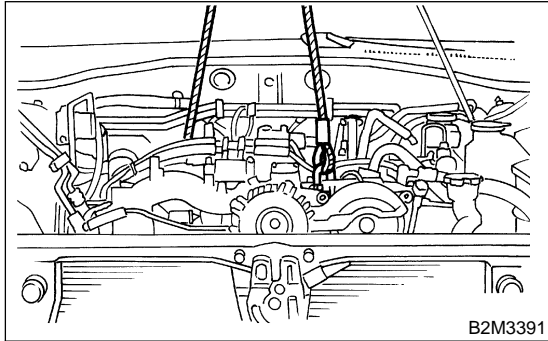
Tightening torque:

34±5 N·m (3.5±0.5 kgf-m, 25.3±3.6 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.

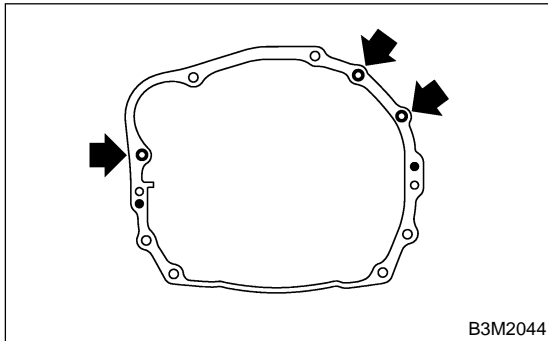


- (2) Apply a small amount of grease to spline of main shaft. (MT model)

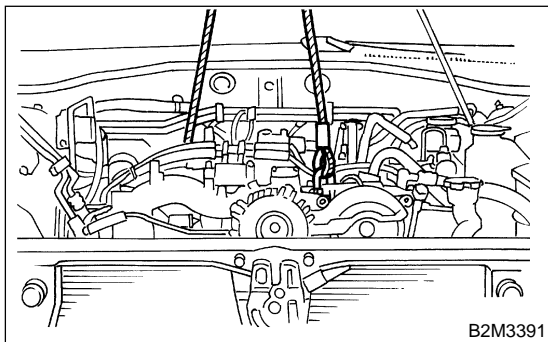
- 3) Tighten bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



- 4) Remove lifting device and wire ropes.



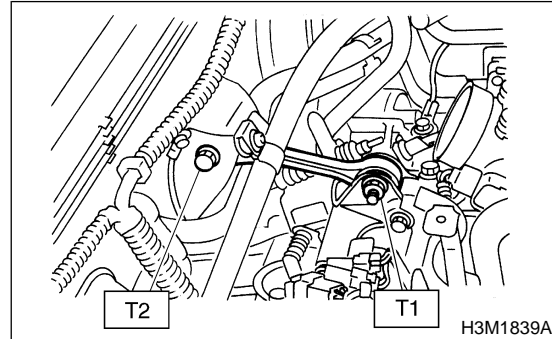
- 5) Remove garage jack.

- 6) Install pitching stopper.

Tightening torque:

T1: 49 N·m (5.0 kgf-m, 36.2 ft-lb)

T2: 57 N·m (5.8 kgf-m, 42 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(H4)-8 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 engine by using ST.

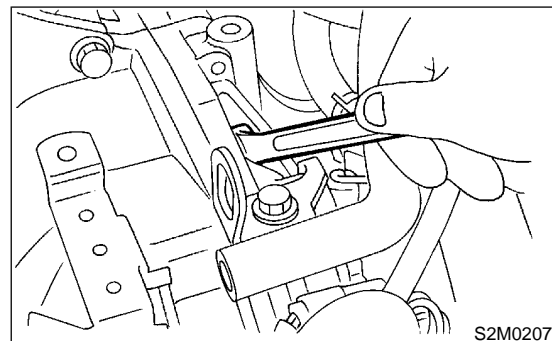
CAUTION:

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

ST 499977100 CRANK PULLEY WRENCH

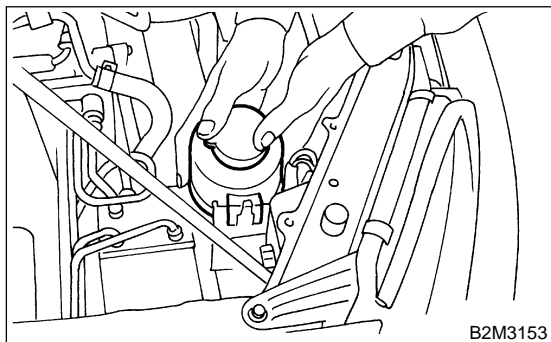
Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- (3) Clog plug onto service hole.
- 10) Install power steering pump on bracket.

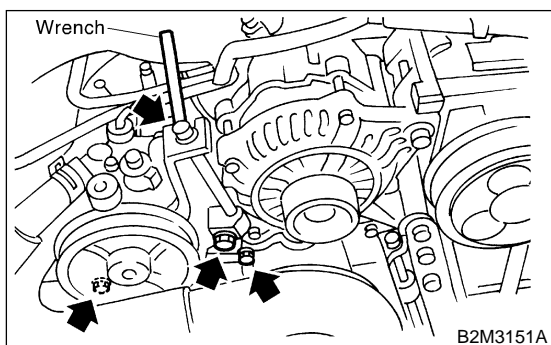
- (1) Install power steering tank on bracket.



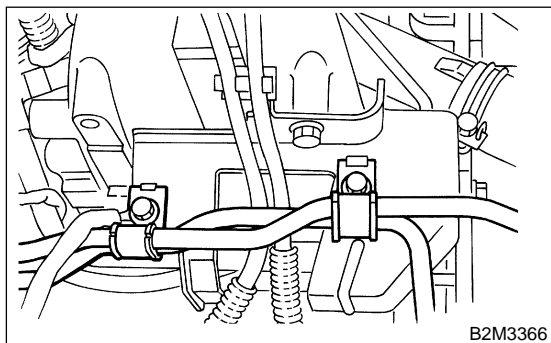
- (2) Install power steering pump on bracket, and tighten bolts.

Tightening torque:

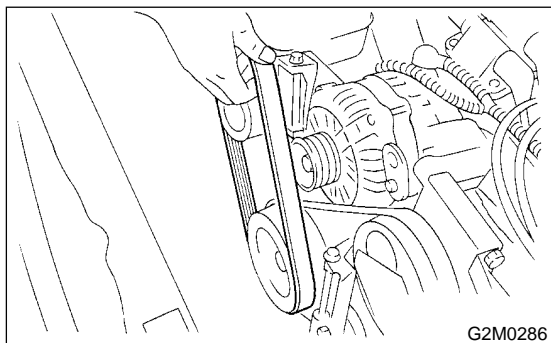
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



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



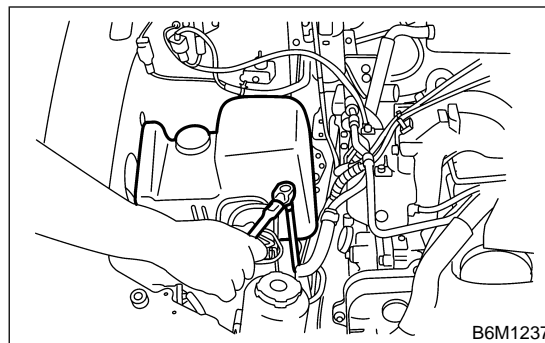
- (4) Intake front side V-belt, and adjust it.



- (5) Install resonator chamber.

Tightening torque:

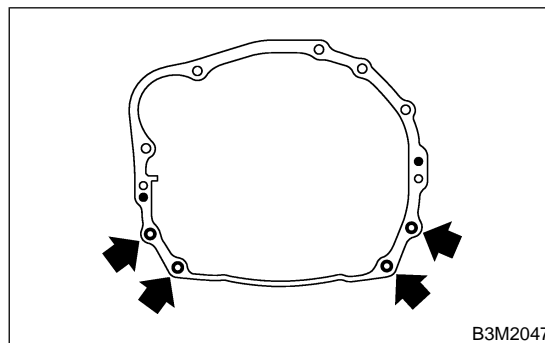
33 N·m (3.4 kgf-m, 24.6 ft-lb)



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

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



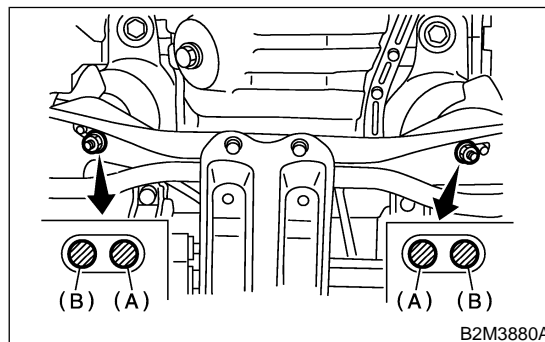
- 12) Tighten nuts which install front cushion rubber onto crossmember.

Tightening torque:

83 N·m (8.5 kgf-m, 61 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(H4)-6 INSTALLATION, Front Exhaust Pipe.> and <Ref. to EX(H4)-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) Oxygen sensor connector (Except general model)
- (4) Alternator connector and terminal
- (5) A/C compressor connectors
- (6) 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)

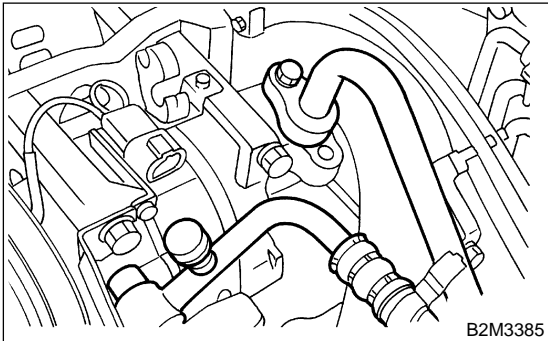
- 18) Install A/C pressure hoses.
<Ref. to AC-37 INSTALLATION, Flexible Hose.>

CAUTION:

Use new O-rings.

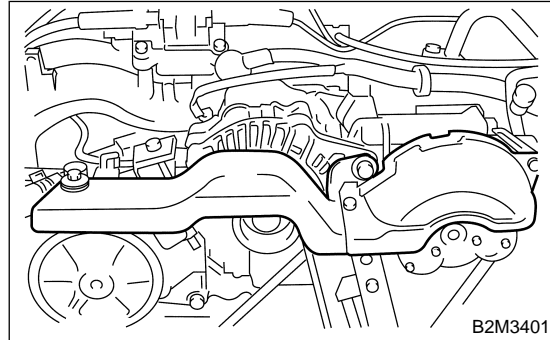
Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

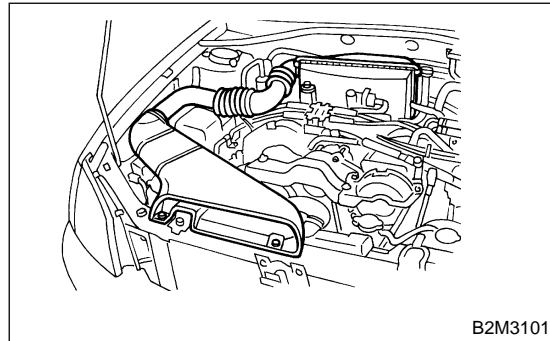


- 19) Install radiator to vehicle. <Ref. to CO(H4)-16 INSTALLATION, Radiator.>

- 20) Install V-belt cover.



- 21) Install air intake duct and cleaner case.
<Ref. to IN(H4)-2 General Description.>



- 22) Install under cover.
- 23) Install battery in the vehicle, and connect cables.
- 24) Fill coolant.
<Ref. to CO(H4)-6 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 S103079A10

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

10. Engine Mounting S103085

A: REMOVAL S103085A18

- 1) Remove engine assembly. <Ref. to ME(H4)-33 REMOVAL, Engine Assembly.>
- 2) Remove engine mounting from engine assembly.

B: INSTALLATION S103085A11

Install in the reverse order of removal.

Tightening torque:

Engine mounting;

34 N·m (3.5 kgf-m, 25.3 ft-lb)

C: INSPECTION S103085A10

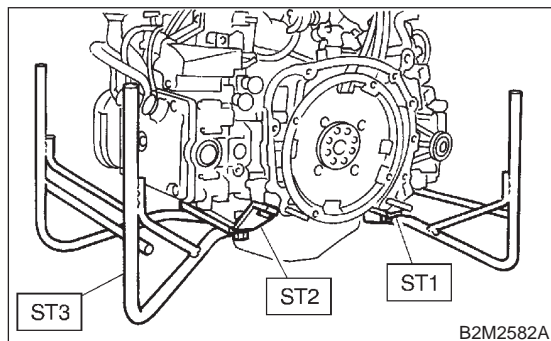
Make sure there are no cracks or other damage.

11. Preparation for Overhaul S103091

A: PROCEDURE S103091E45

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



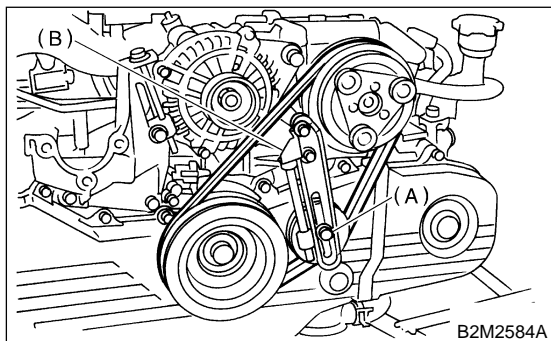
2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.

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.

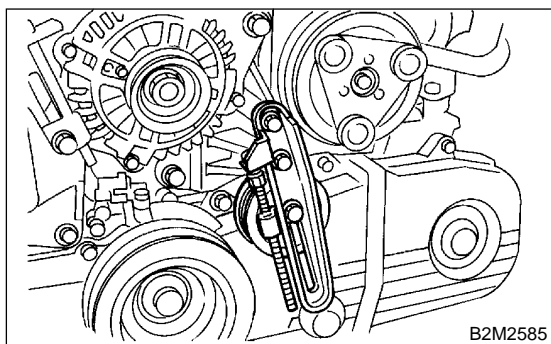
12. V-belt S103080

A: REMOVAL S103080A18

- 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.



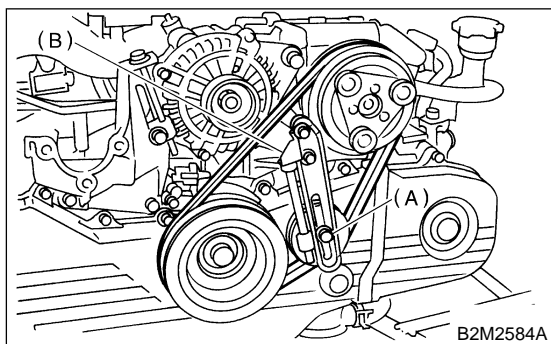
B: INSTALLATION S103080A11

- 1) Install a new belt, and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4)-43 INSPECTION, V-belt.>
- 2) Tighten the slider bolt (B).
- 3) Tighten the lock nut (A).

Tightening torque:

Lock nut (A);

22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION S103080A10

- 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)

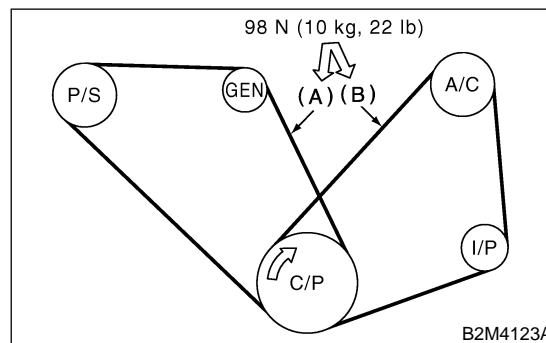
replaced: 7 — 9 mm (0.276 — 0.354 in)

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

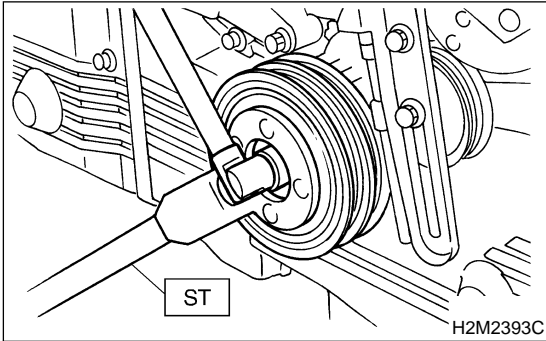
CRANKSHAFT PULLEY

Mechanical

13. Crankshaft Pulley S103098

A: REMOVAL S103098A18

- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley bolt. To lock crankshaft, use ST.
ST 499977100
CRANKSHAFT PULLEY WRENCH

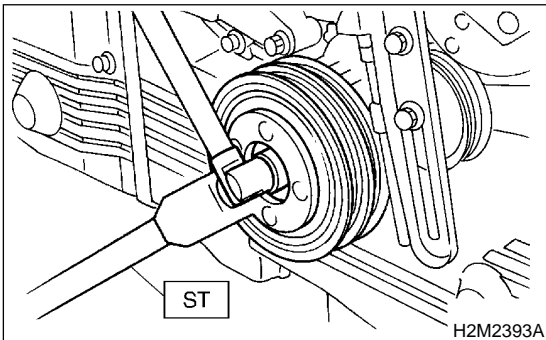


- 3) Remove crankshaft pulley.

B: INSTALLATION S103098A11

- 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.

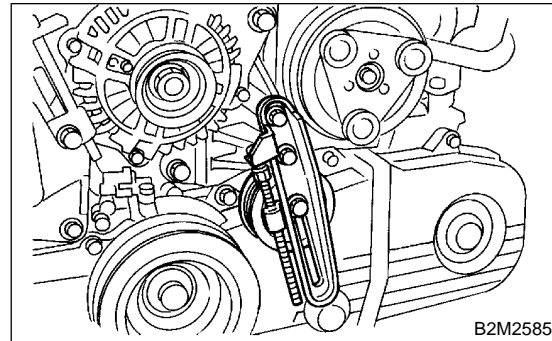
Crankshaft pulley bolt: 12369AA011

- (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.

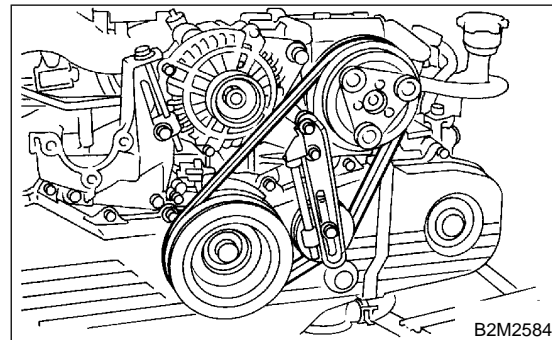
CAUTION:

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.



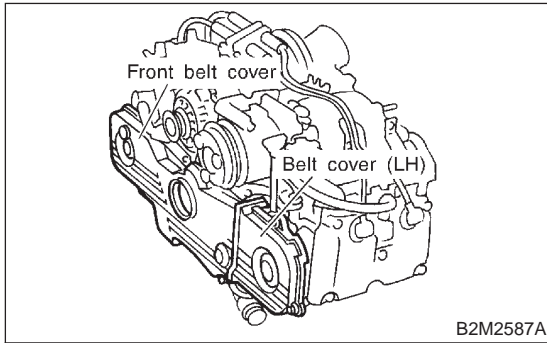
C: INSPECTION S103098A10

- 1) Make sure the V-belt is not worn or otherwise damaged.
- 2) Check the tension of the belt. <Ref. to ME(H4)-43 INSPECTION, V-belt.>

14. Belt Cover S103582

A: REMOVAL S103582A18

- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover (LH).
- 4) Remove front belt cover.



B: INSTALLATION S103582A11

- 1) Install front belt cover.

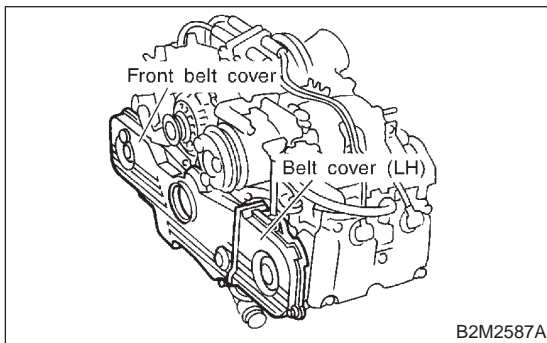
Tightening torque:

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)



- 3) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Crankshaft Pulley.>
- 4) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: INSPECTION S103582A10

Make sure the cover is not damaged.

15. Timing Belt Assembly

S103099

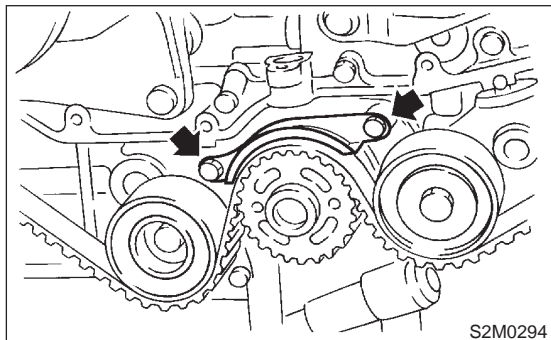
A: REMOVAL

S103099A18

1. TIMING BELT

S103099A1802

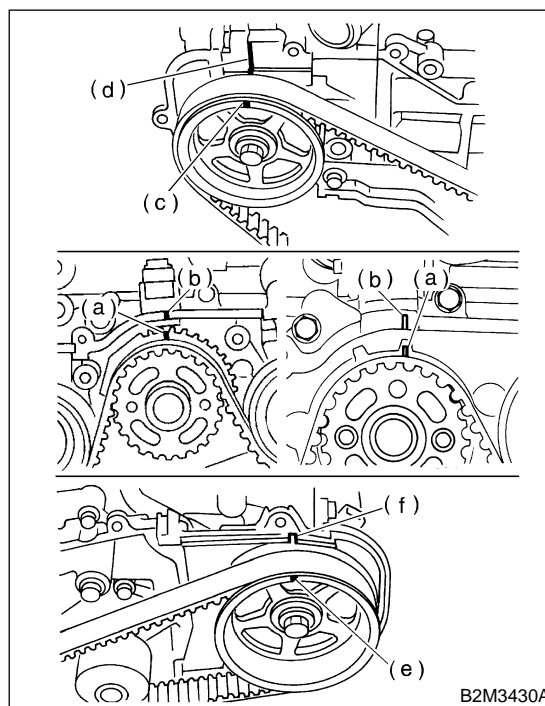
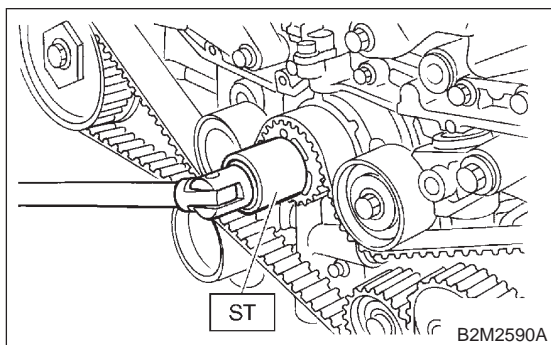
- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt guide. (MT vehicle only)



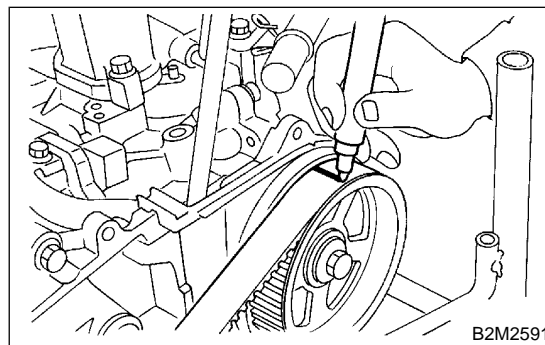
5) If alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing timing belt as shown in procedures below.

- (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



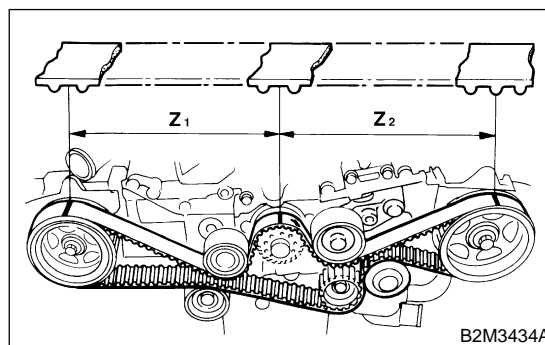
(2) Using white paint, put alignment and/or arrow marks on timing belts in relation to the crank sprocket and cam sprockets.



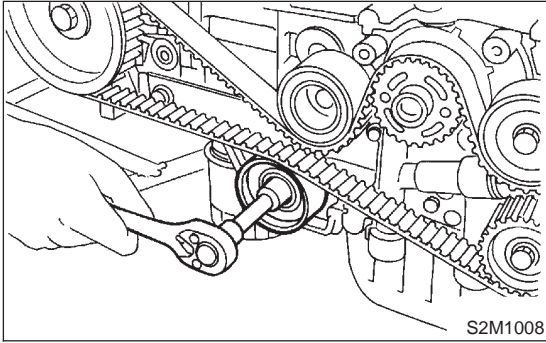
Specified data:

Z₁: 44 tooth length

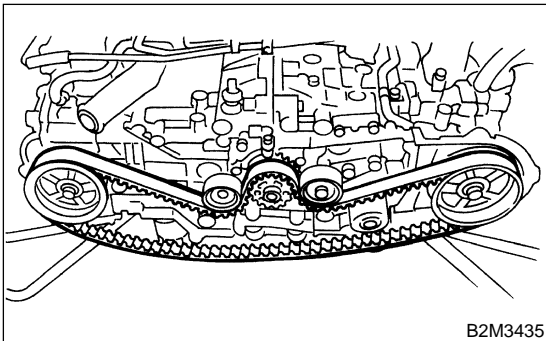
Z₂: 40.5 tooth



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



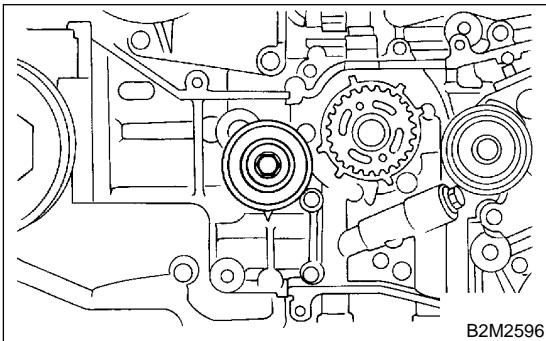
- 8) Remove timing belt.



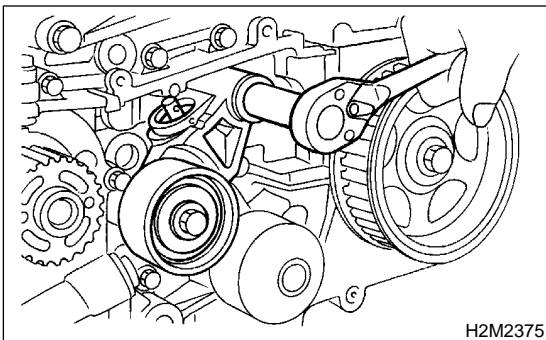
2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

S103099A1803

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



- 2) Remove automatic belt tension adjuster assembly.



B: INSTALLATION

S103099A11

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

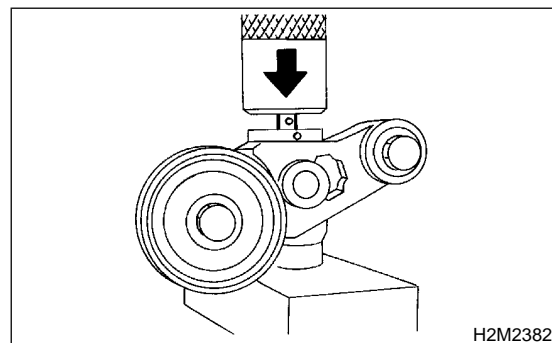
S103099A1102

- 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 kg, 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 kg, 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.

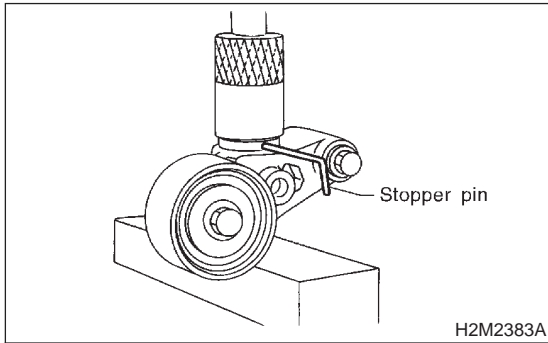
- (1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.
- (2) Slowly move the adjuster rod down with a pressure of 294 N (30 kg, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



TIMING BELT ASSEMBLY

Mechanical

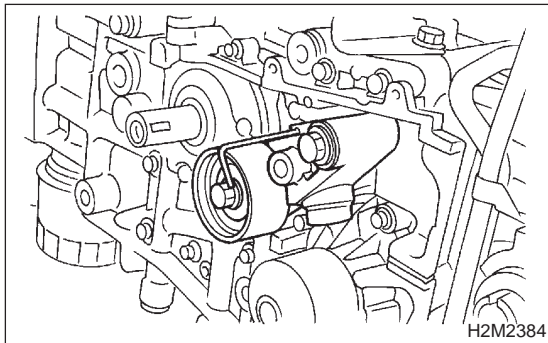
(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



2) Install automatic belt tension adjuster assembly.

Tightening torque:

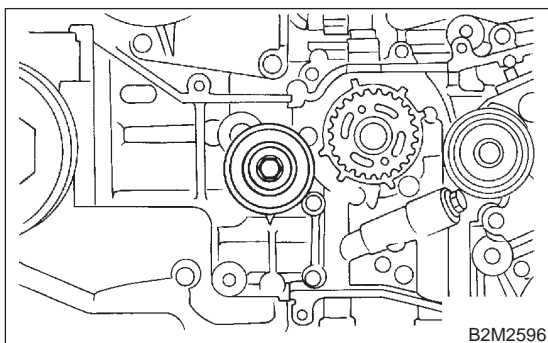
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install belt idler (No. 1).

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



2. TIMING BELT

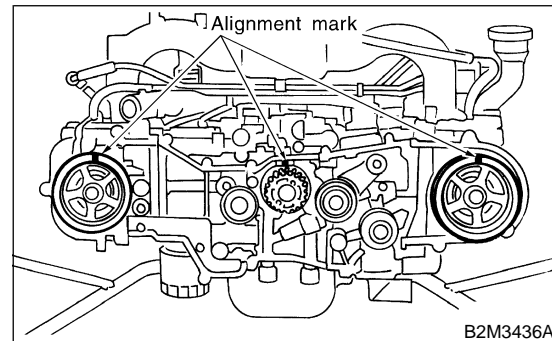
S103099A1103

1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4)-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 come to top positions.

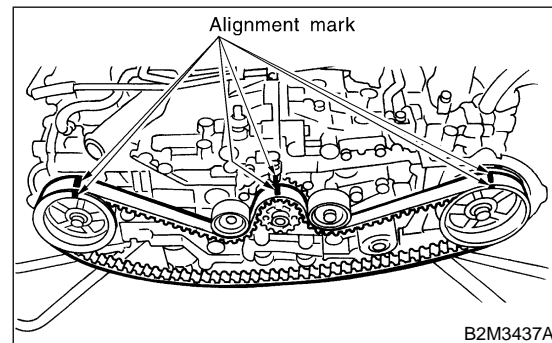
ST1 499207100 CAMSHAFT SPROCKET WRENCH



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

CAUTION:

Ensure belt's rotating direction is correct.



3) Install belt idler No. 2.

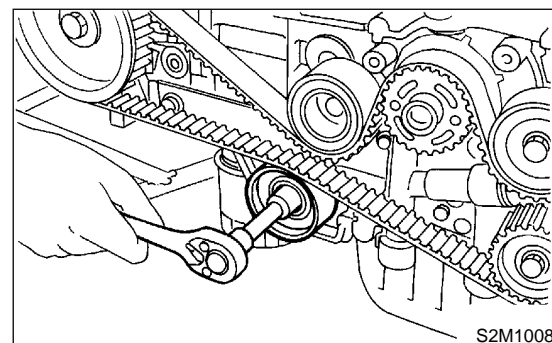
Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

4) Install belt idler (No. 2).

Tightening torque:

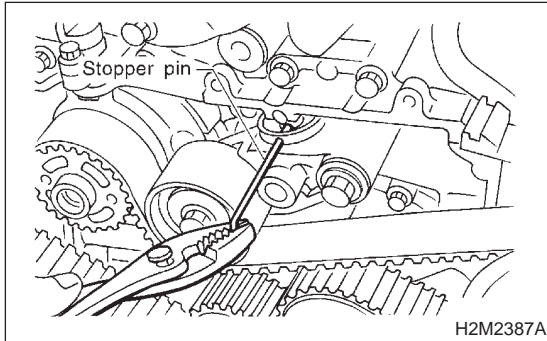
39 N·m (4.0 kgf-m, 28.9 ft-lb)



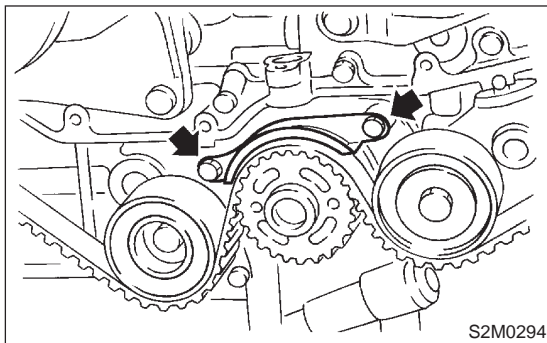
5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove stopper pin from belt tensioner adjuster.

CAUTION:

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



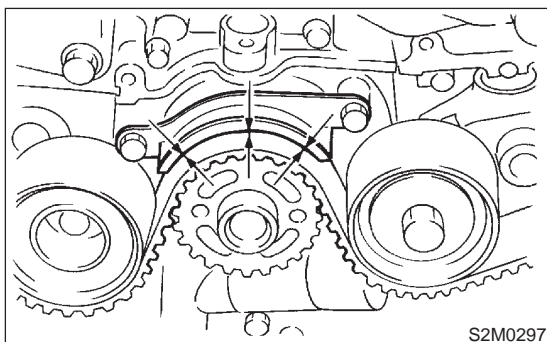
6) Install timing belt guide. (MT vehicles only)
(1) Temporarily tighten remaining bolts.



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

Clearance:

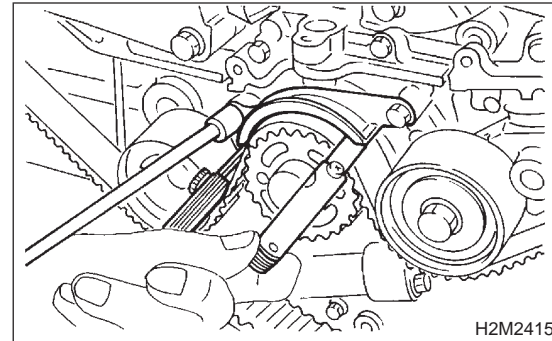
$1.0 \pm 0.5 \text{ mm (0.039} \pm 0.020 \text{ in)}$



(3) Tighten remaining bolts.

Tightening torque:

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



7) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>

8) Install crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>

9) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: INSPECTION

S103099A10

1. TIMING BELT

S103099A1001

1) Check timing belt teeth for breaks, cracks, and wear. If any fault is found, replace belt.

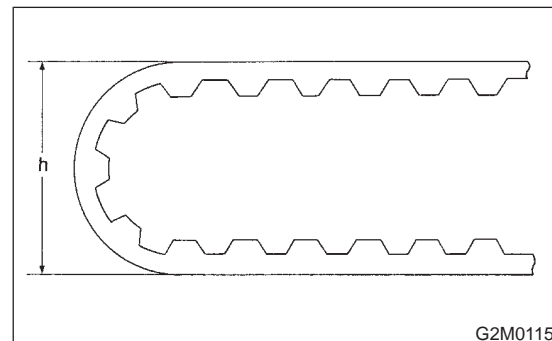
2) Check the condition of back side of belt; if any crack is found, replace belt.

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

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



2. AUTOMATIC BELT TENSION ADJUSTER

S103099A1002

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 kg, 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 kg, 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 kg, 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.

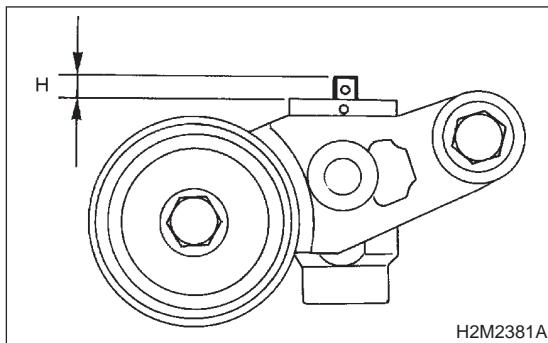
CAUTION:

- 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 kg, 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 S103099A1003

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 S103099A1004

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.

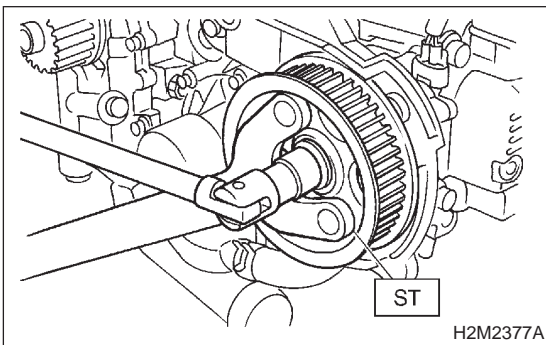
16. Camshaft Sprocket S103097

A: REMOVAL S103097A18

1. REMOVAL S103097A1804

- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket No. 1 and No. 2. To lock camshaft, use ST.

ST 499207100 CAMSHAFT SPROCKET
WRENCH



- 3) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>
- 4) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Crankshaft Pulley.>
- 5) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: INSPECTION S103097A10

- 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 S103097A11

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

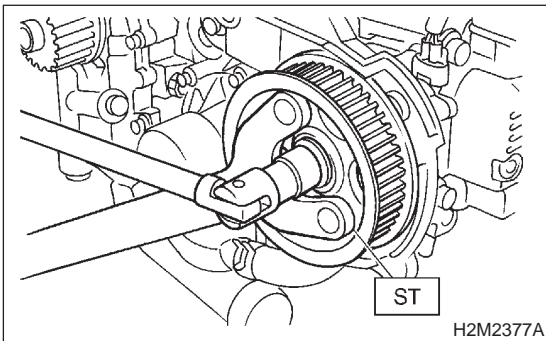
ST 499207100 CAMSHAFT SPROCKET
WRENCH

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(H4)-47 INSTALLATION, Timing Belt Assembly.>

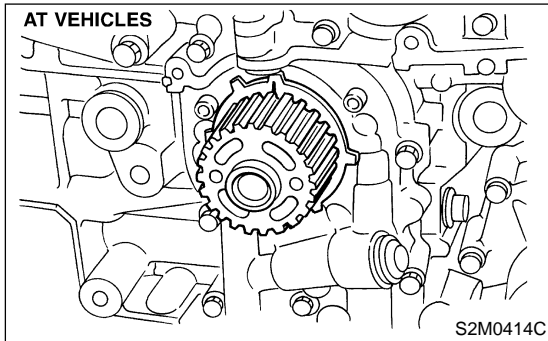
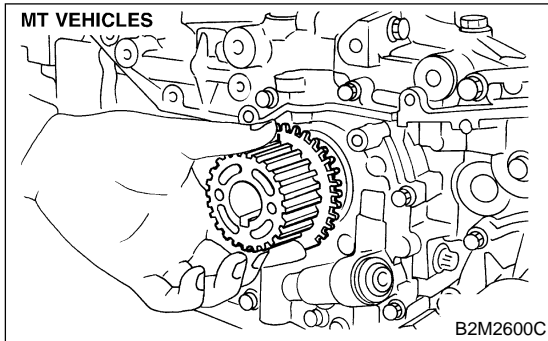
17. Crankshaft Sprocket

S103101

A: REMOVAL

S103101A18

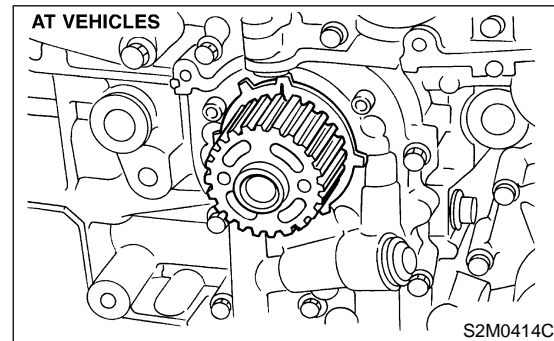
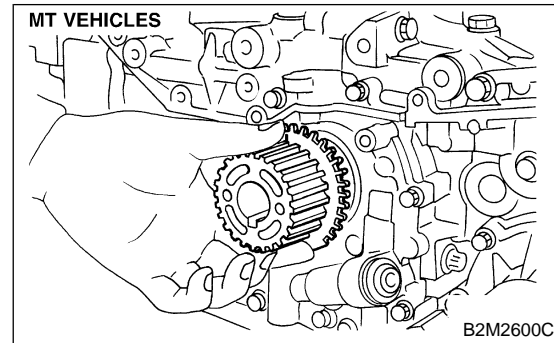
- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME(H4)-51 REMOVAL, Camshaft Sprocket.>
- 6) Remove crankshaft sprocket.



B: INSTALLATION

S103101A11

- 1) Install crankshaft sprocket.



- 2) Install camshaft sprocket. <Ref. to ME(H4)-51 INSTALLATION, Camshaft Sprocket.>
- 3) Install timing belt assembly. <Ref. to ME(H4)-47 INSTALLATION, Timing Belt Assembly.>
- 4) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>
- 5) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Camshaft Pulley.>
- 6) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: INSPECTION

S103101A10

- 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.

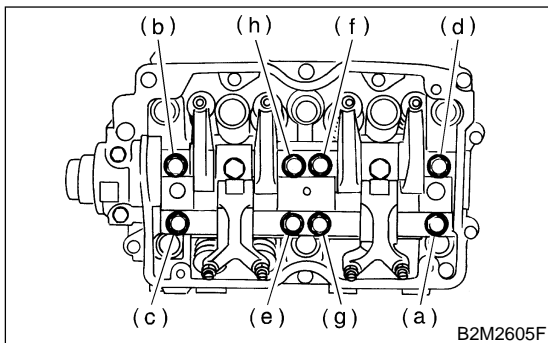
18. Valve Rocker Assembly S103094

A: REMOVAL S103094A18

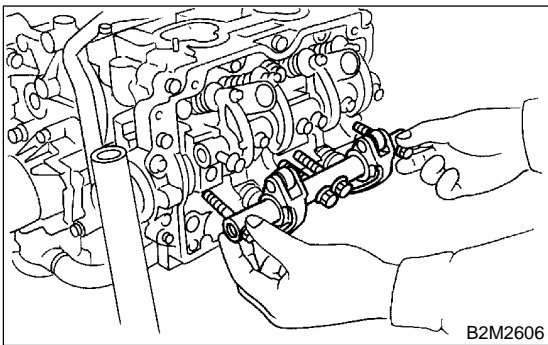
- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME(H4)-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 S103094A11

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

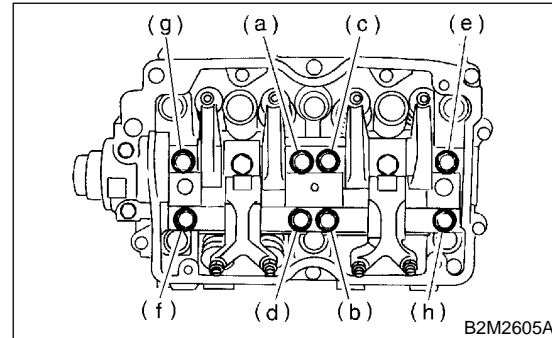
CAUTION:

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(H4)-31 ADJUSTMENT, Valve Clearance.>
- 3) Install rocker cover and connect PCV hose.
- 4) Install camshaft sprocket. <Ref. to ME(H4)-51 INSTALLATION, Camshaft Sprocket.>
- 5) Install timing belt assembly. <Ref. to ME(H4)-47 INSTALLATION, Timing Belt Assembly.>
- 6) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>
- 7) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Crankshaft Pulley.>
- 8) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: DISASSEMBLY S103094A06

- 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 S103094A02

- 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±1 N·m (0.5±0.1 kgf-m, 3.6±0.7 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

S103094A10

1. VALVE ROCKER ARM

S103094A1002

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

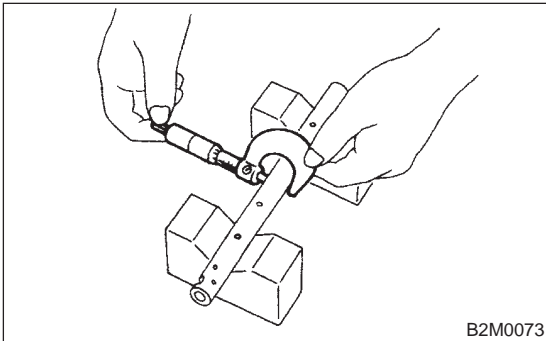
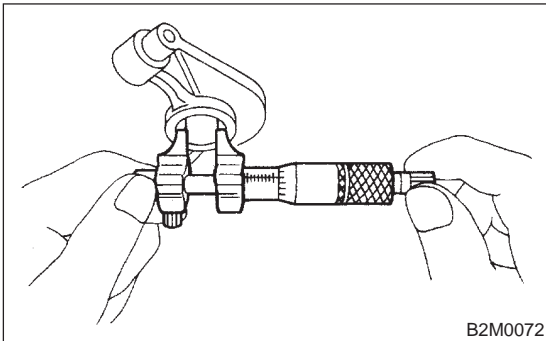
Clearance between arm and shaft:

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

S103094A1003

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.

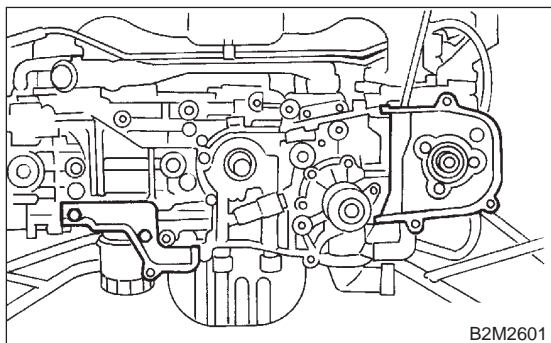
19. Camshaft S103092

A: REMOVAL S103092A18

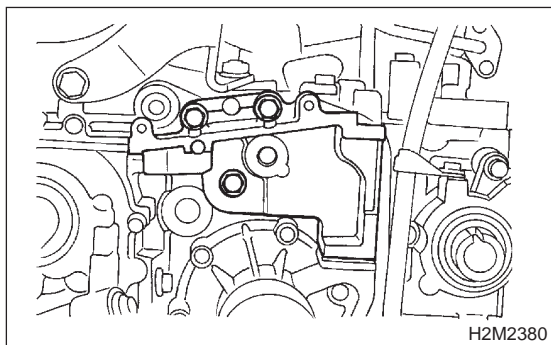
- 1) Remove V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME(H4)-51 REMOVAL, Camshaft Sprocket.>
- 6) Remove crankshaft sprocket. <Ref. to ME(H4)-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.

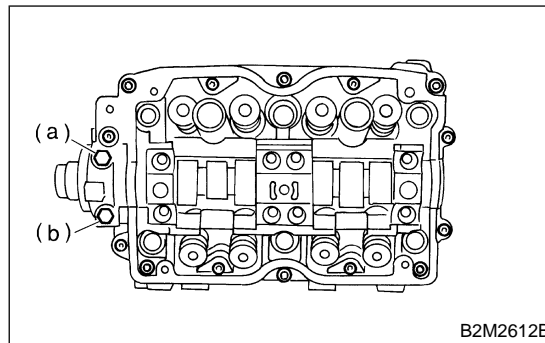


- 9) Remove tensioner bracket.

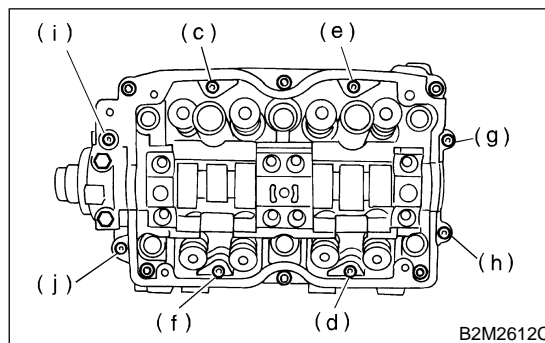


- 10) Remove camshaft position sensor support. (LH side only)
- 11) Remove oil level gauge guide. (LH side only)
- 12) Remove valve rocker assembly. <Ref. to ME(H4)-53 REMOVAL, Valve Rocker Assembly.>
- 13) Remove camshaft cap.

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

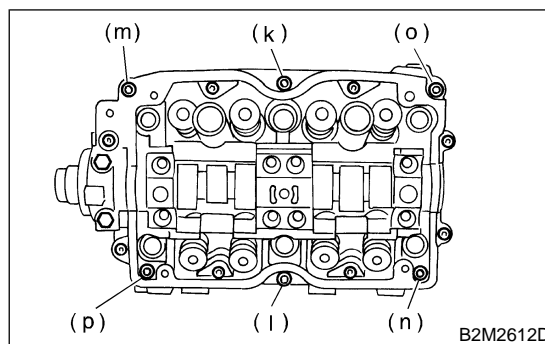


- (2) Equally loosen bolts (c) through (j) all the way in alphabetical sequence.

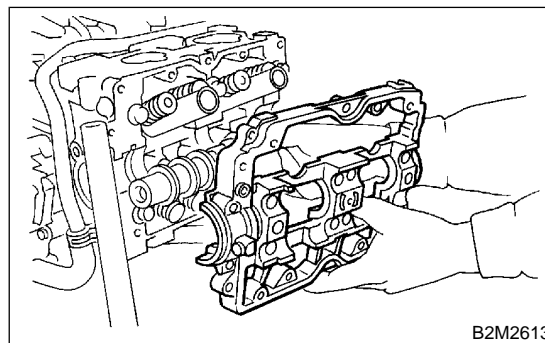


- (3) Remove bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX PLUS



- (4) Remove camshaft cap.



- 14) Remove camshaft.
- 15) Remove oil seal.

CAMSHAFT

Mechanical

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.

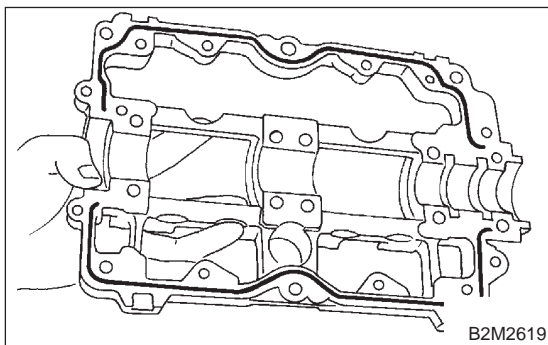
B: INSTALLATION

S103092A11

- 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.

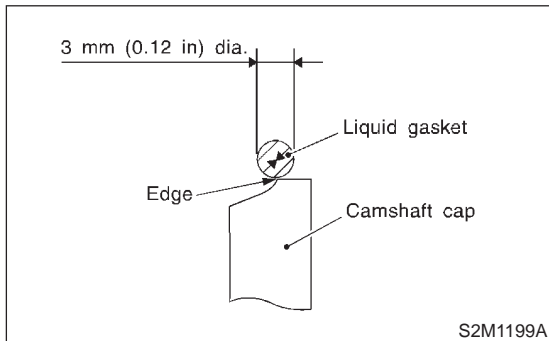
Liquid gasket:

THREE BOND 1280B
P/N K0877YA018

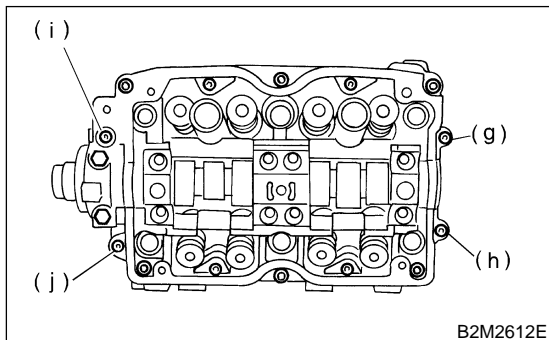


NOTE:

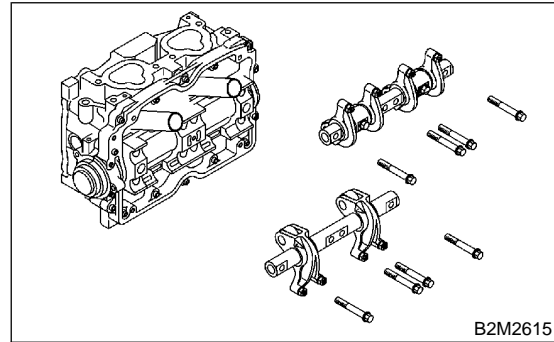
Apply a coat of 3 mm (0.12 in) dia. liquid gasket along edge of cam cap mating surface.



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



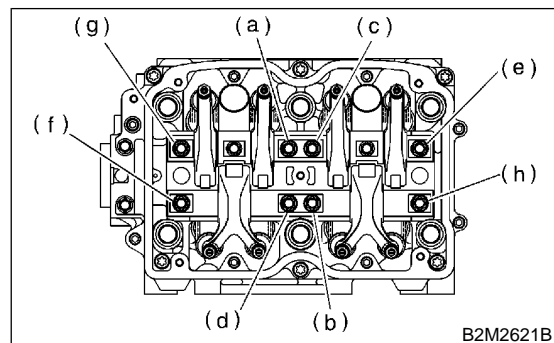
- (3) Install valve rocker assembly.



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

Tightening torque:

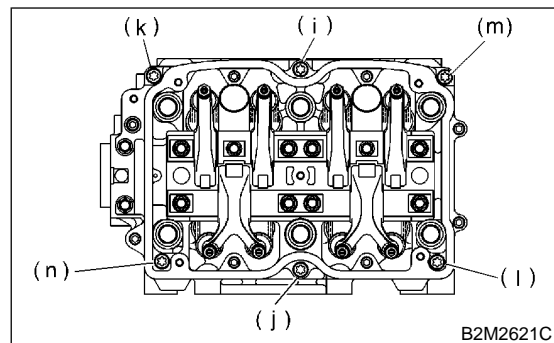
25 N·m (2.5 kgf-m, 18.1 ft-lb)



- (5) Tighten TORX bolts (i) through (n) in alphabetical sequence using ST.
ST 499427000 TORX PLUS

Tightening torque:

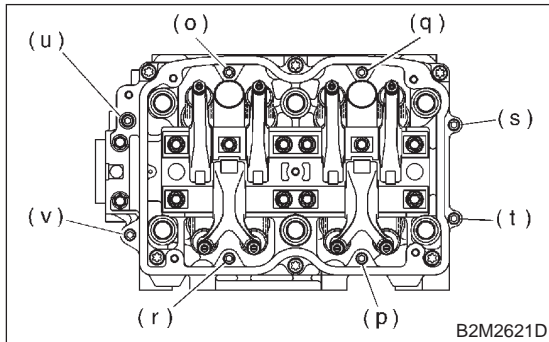
18 N·m (1.8 kgf-m, 13.0 ft-lb)



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

Tightening torque:

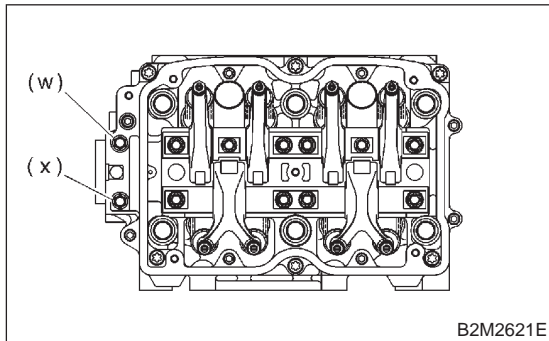
10 N·m (1.0 kgf-m, 7.2 ft-lb)



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

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

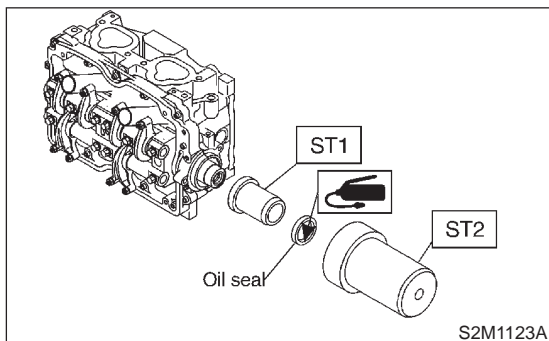


3) Apply a coat of grease to oil seal lips and install oil seal (A) on camshaft using ST1 and ST2.

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(H4)-31 ADJUSTMENT, Valve Clearance.>

6) Install rocker cover and connect PCV hose.

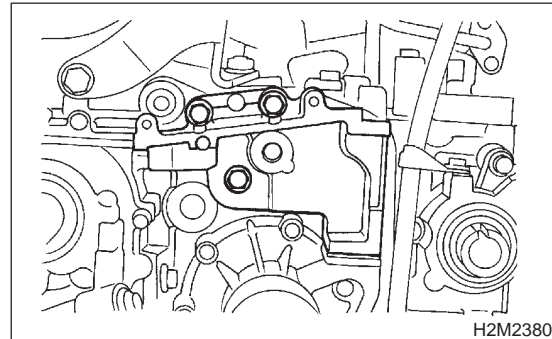
7) Install oil level gauge guide. (LH side only)

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).

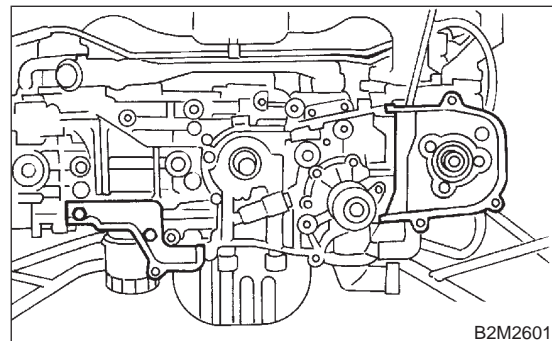
Tightening torque:

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(H4)-47 INSTALLATION, Timing Belt Assembly.>

13) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>

14) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Crankshaft Pulley.>

15) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

C: INSPECTION

S103092A10

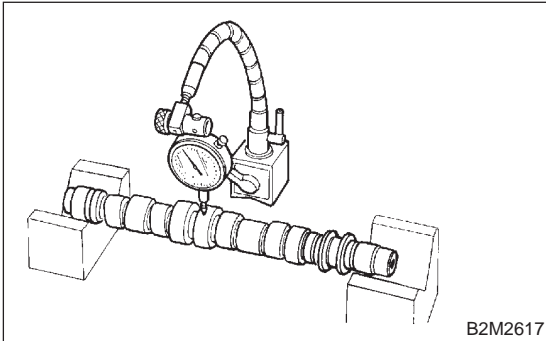
1. CAMSHAFT

S103092A1001

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.

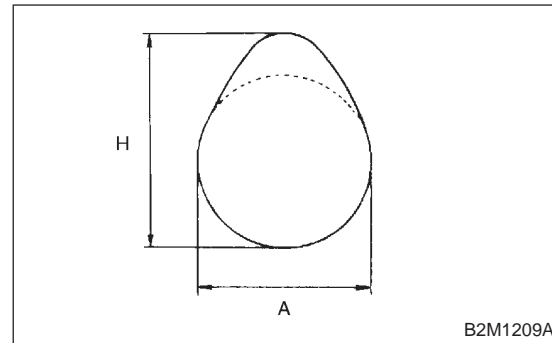
Cam height: H

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

S103092A1002

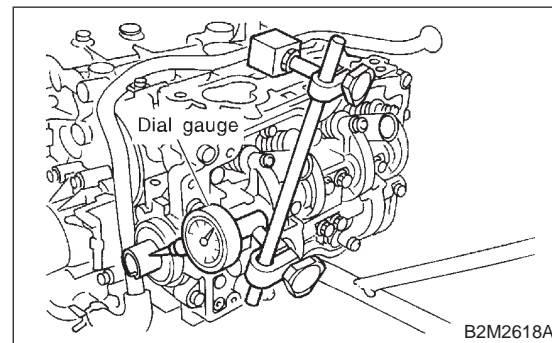
Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace camshaft support.

Standard:

0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:

0.10 mm (0.0039 in)



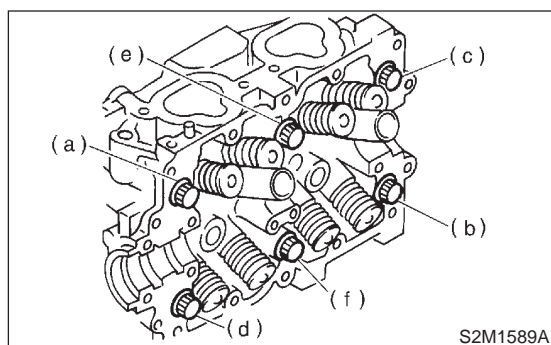
20. Cylinder Head Assembly S103093

A: REMOVAL S103093A18

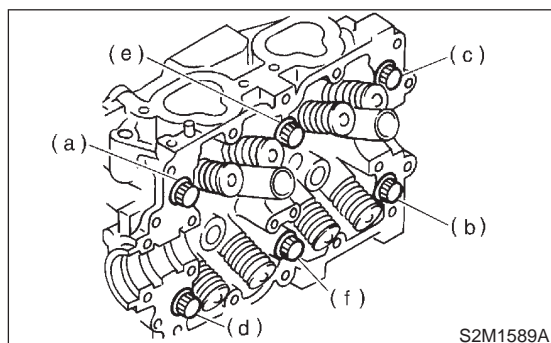
- 1) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 2) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 3) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 4) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 5) Remove camshaft sprocket. <Ref. to ME(H4)-51 REMOVAL, Camshaft Sprocket.>
- 6) Remove intake manifold. <Ref. to FU(H4)-19 REMOVAL, Intake Manifold.>
- 7) Remove bolt which installs A/C compressor bracket on cylinder head.
- 8) Remove valve rocker assembly. <Ref. to ME(H4)-53 REMOVAL, Valve Rocker Assembly.>
- 9) Remove camshaft. <Ref. to ME(H4)-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 S103093A11

1. CYLINDER HEAD S103093A1102

- 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.

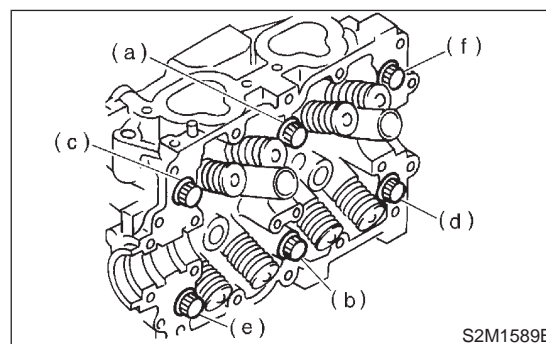
CAUTION:

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(H4)-56 INSTALLATION, Camshaft.>

- 4) Install valve rocker assembly. <Ref. to ME(H4)-53 INSTALLATION, Valve Rocker Assembly.>

- 5) Install A/C compressor bracket on cylinder head.

CYLINDER HEAD ASSEMBLY

Mechanical

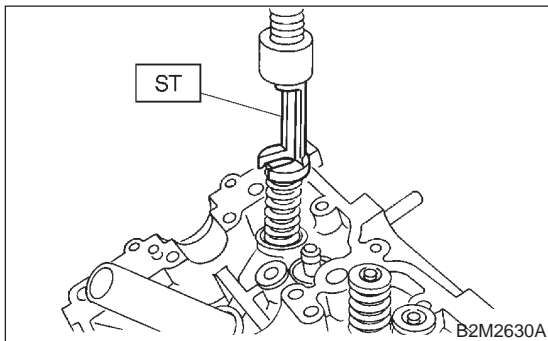
- 6) Install intake manifold. <Ref. to FU(H4)-22 INSTALLATION, Intake Manifold.>
- 7) Install camshaft sprocket. <Ref. to ME(H4)-51 INSTALLATION, Camshaft Sprocket.>
- 8) Install timing belt assembly. <Ref. to ME(H4)-47 INSTALLATION, Timing Belt Assembly.>
- 9) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>
- 10) Install crankshaft pulley. <Ref. to ME(H4)-44 INSTALLATION, Crankshaft Pulley.>
- 11) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

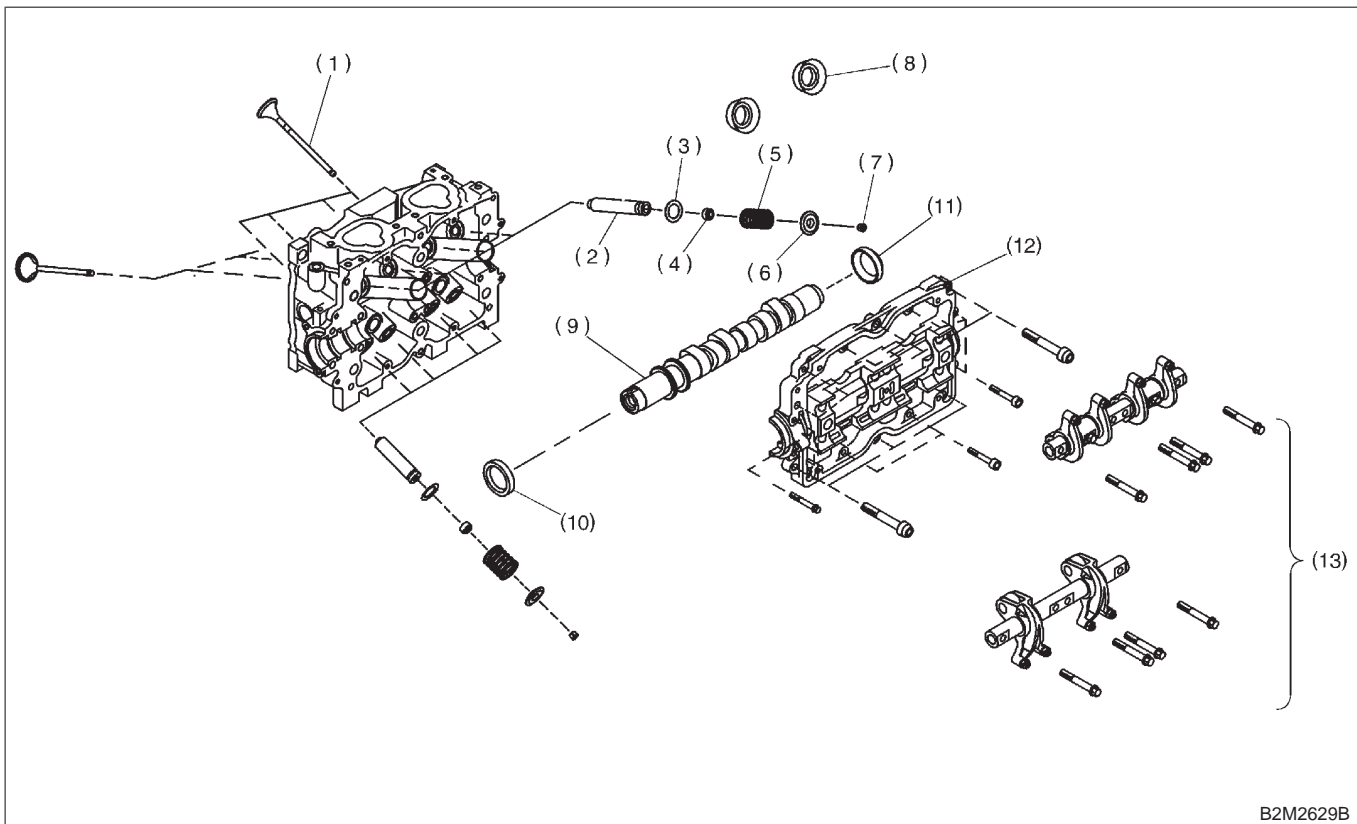
C: DISASSEMBLY S103093A06

- 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 S103093A02

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

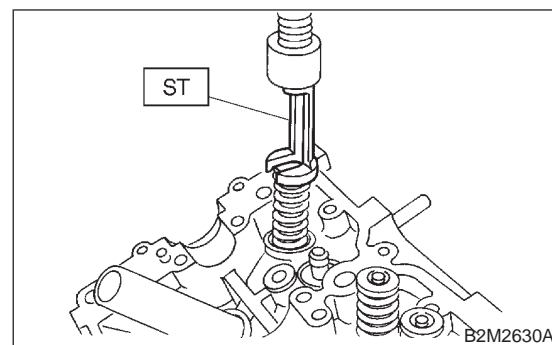
(2) Coat stem of each valve with engine oil and insert valve into valve guide.

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.**

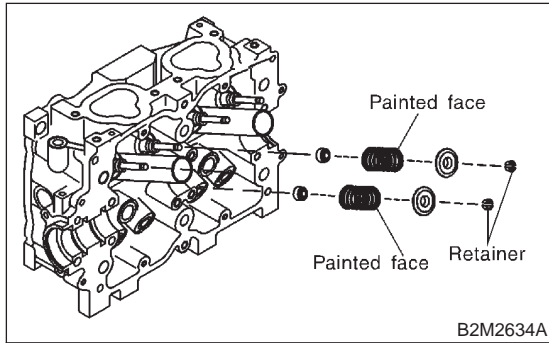
ST 499718000 VALVE SPRING REMOVER



CYLINDER HEAD ASSEMBLY

Mechanical

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



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

E: INSPECTION

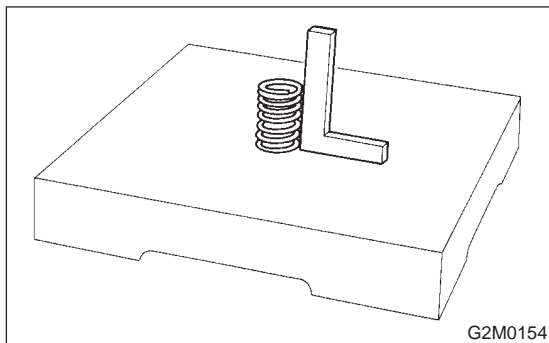
S103093A10

1. VALVE SPRING

S103093A1002

- 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 kg, 48.3 — 55.3 lb)/ 45.0 mm (1.772 in)
	526.6 — 581.6 N (53.7 — 59.3 kg, 118.4 — 130.8 lb)/34.7 mm (1.366 in)



2. INTAKE AND EXHAUST VALVE OIL SEAL

S103093A1003

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:

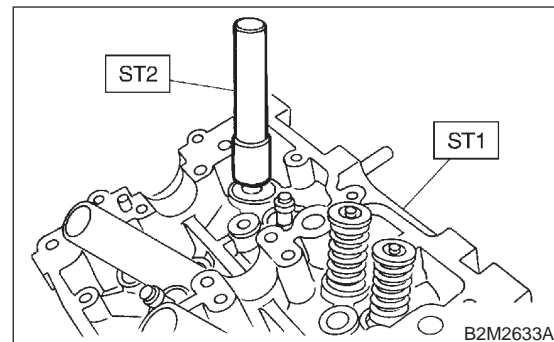
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]



F: ADJUSTMENT

S103093A01

1. CYLINDER HEAD

S103093A0101

- 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.

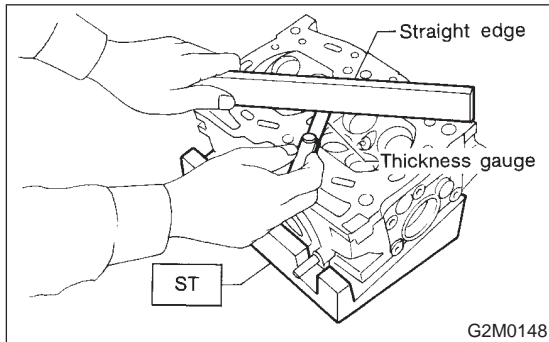
ST 498267800 CYLINDER HEAD TABLE

- 3) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge and thickness gauge.

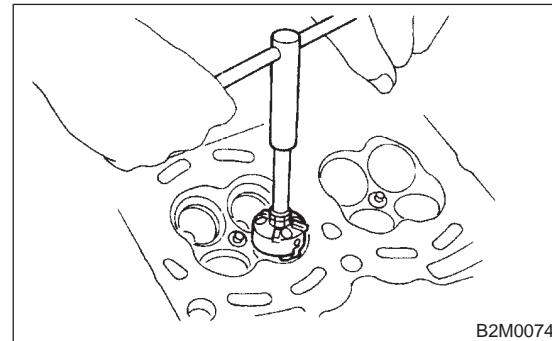
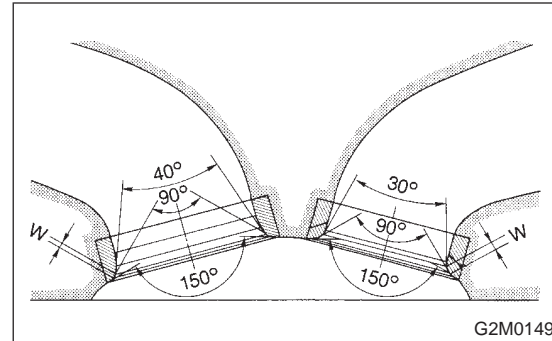
If the warping exceeds 0.05 mm (0.0020 in), regrind the surface with a surface grinder.

Warping limit:**0.05 mm (0.0020 in)****Grinding limit:****0.3 mm (0.012 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.

**2. VALVE SEAT** S103093A0102

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** S103093A0103

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:

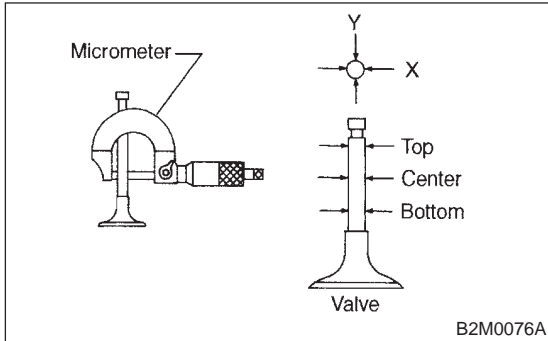
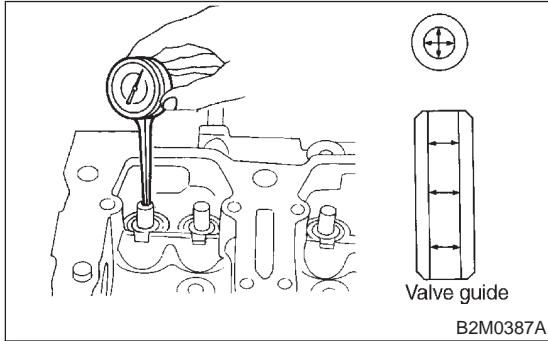
Standard

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

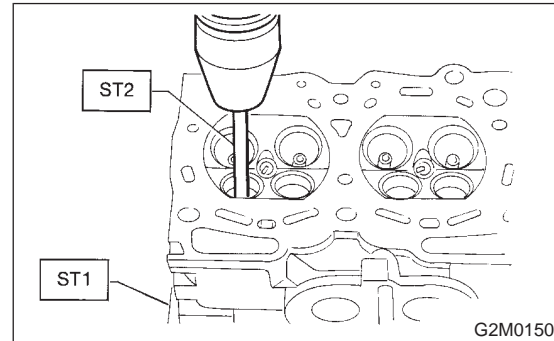
5.945 — 5.960 mm (0.2341 — 0.2346 in)

(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



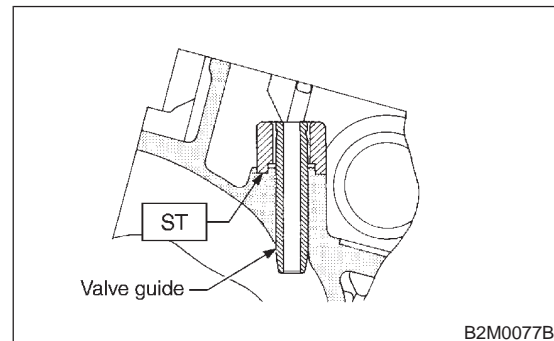
(3) Turn cylinder head upside down and place ST as shown in the figure.

Intake side:

ST 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST 499767800 VALVE GUIDE ADJUSTER



(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.

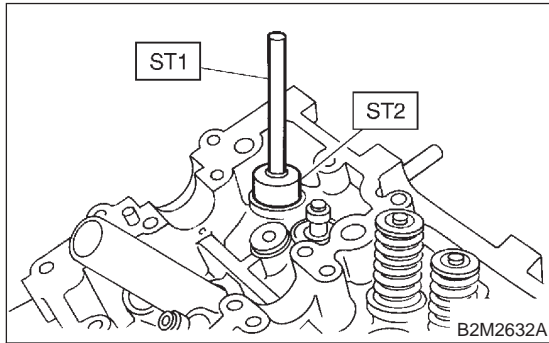
ST1 499767200 VALVE GUIDE REMOVER

Intake side:

ST2 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

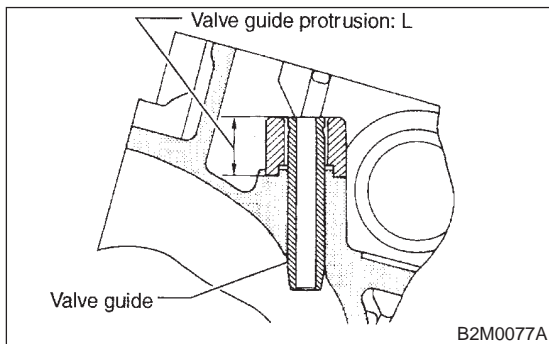
Valve guide protrusion: L

Intake

20.0 — 20.5 mm (0.787 — 0.807 in)

Exhaust

16.5 — 17.0 mm (0.650 — 0.669 in)

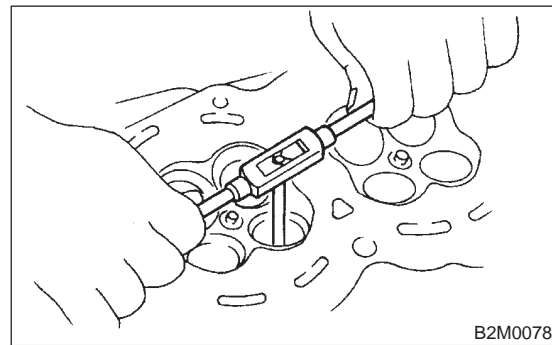


(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean valve guide to remove chips.

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 S103093A0104

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)

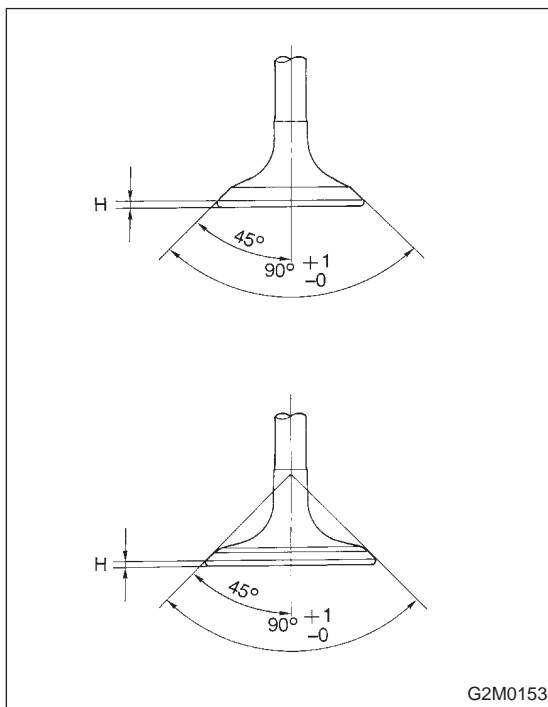
Valve overall length:

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(H4)-63 VALVE SEAT, ADJUSTMENT, Cylinder Head Assembly.> Install a new intake valve oil seal after lapping.

21. Cylinder Block S103090

A: REMOVAL S103090A18

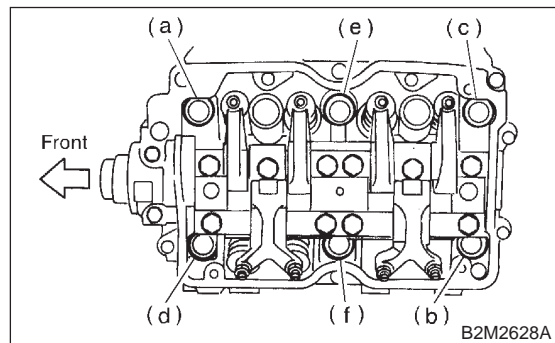
NOTE:

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

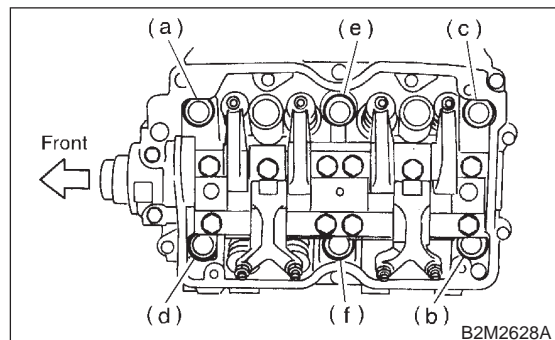
- 1) Remove intake manifold. <Ref. to FU(H4)-19 REMOVAL, Intake Manifold.>
- 2) Remove V-belt. <Ref. to ME(H4)-43 REMOVAL, V-belt.>
- 3) Remove crankshaft pulley. <Ref. to ME(H4)-44 REMOVAL, Crankshaft Pulley.>
- 4) Remove belt cover. <Ref. to ME(H4)-45 REMOVAL, Belt Cover.>
- 5) Remove timing belt assembly. <Ref. to ME(H4)-46 REMOVAL, Timing Belt Assembly.>
- 6) Remove camshaft sprocket. <Ref. to ME(H4)-51 REMOVAL, Camshaft Sprocket.>
- 7) Remove crankshaft sprocket. <Ref. to ME(H4)-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.

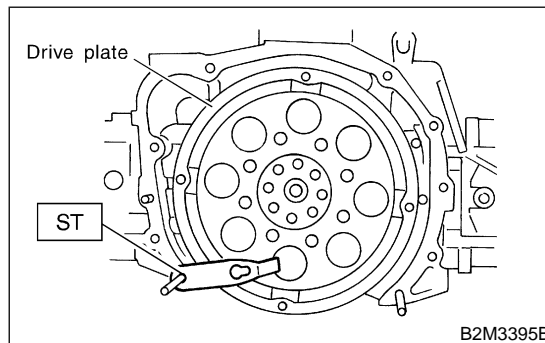
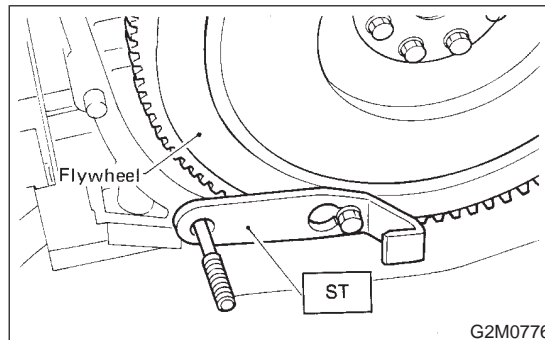


- 13) Remove cylinder head gasket.

CAUTION:

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

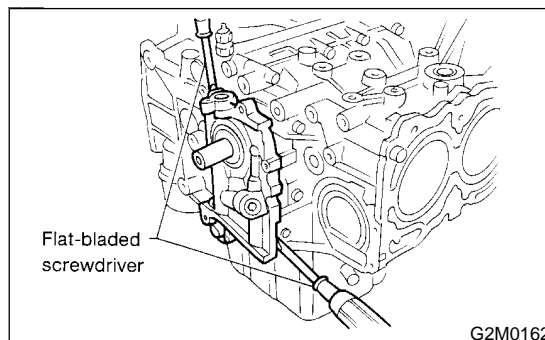
- 14) Similarly, remove right side cylinder head.
 - 15) Remove clutch housing cover (MT vehicles only).
 - 16) Remove flywheel (MT vehicles only) or drive plate (AT vehicles only).
- Using ST, lock crankshaft.
ST 498497100 CRANKSHAFT STOPPER



- 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

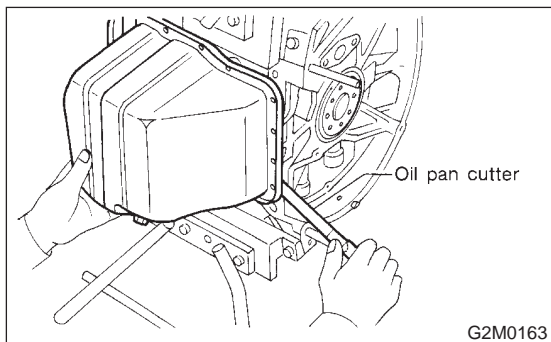
Mechanical

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.



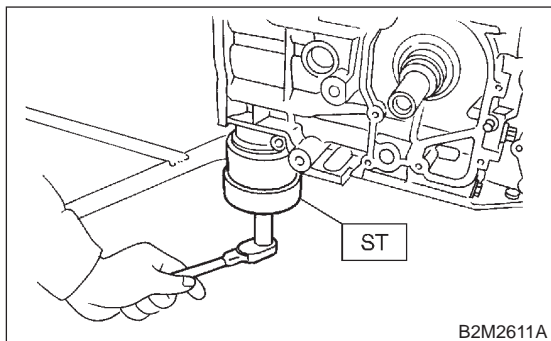
22) Remove oil strainer stay.

23) Remove oil strainer.

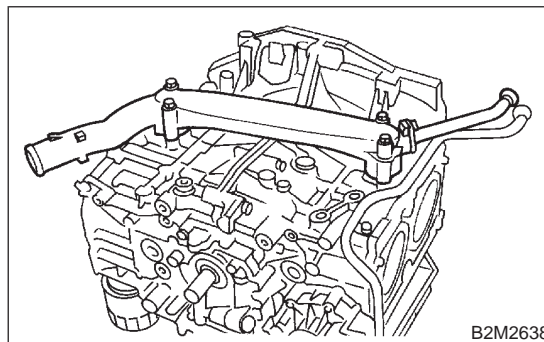
24) Remove baffle plate.

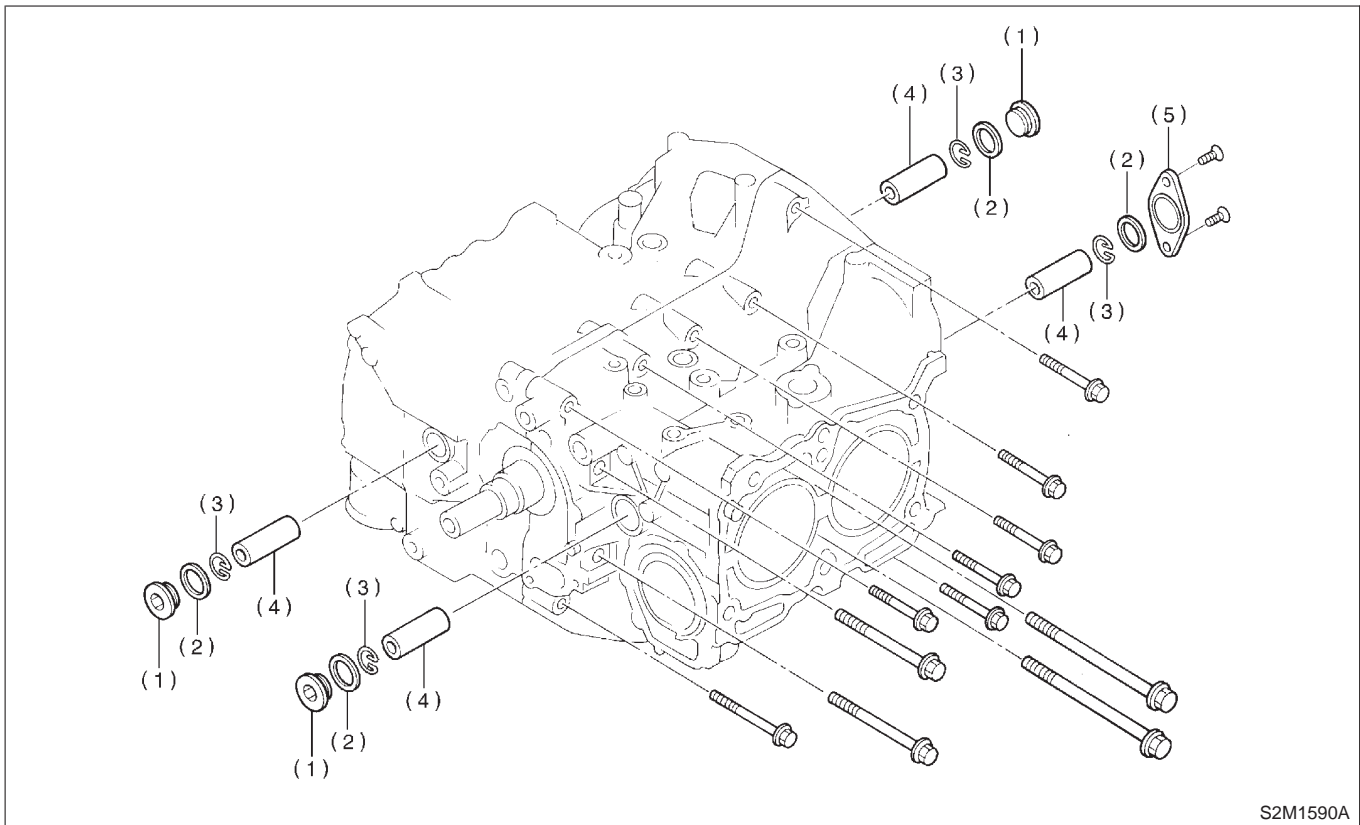
25) Remove oil filter using ST.

ST 498547000 OIL FILTER WRENCH



26) Remove water pipe.





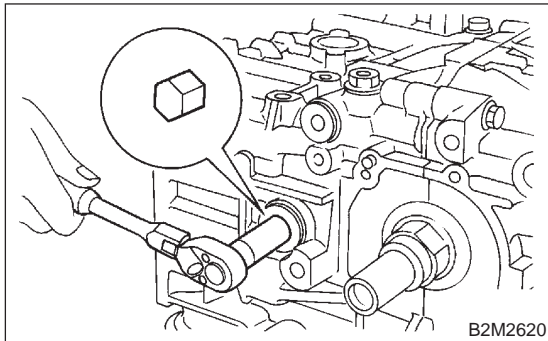
S2M1590A

(1) Service hole plug
(2) Gasket

(3) Circlip
(4) Piston pin

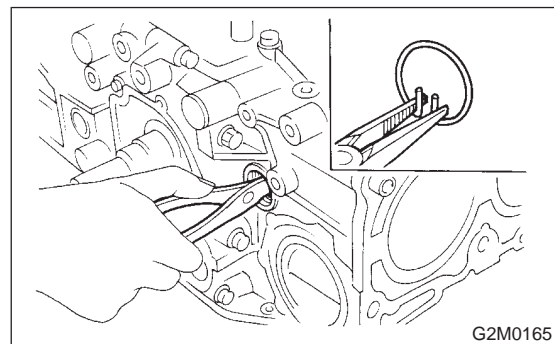
(5) Service hole cover

27) Remove service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].



B2M2620

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.



G2M0165

CYLINDER BLOCK

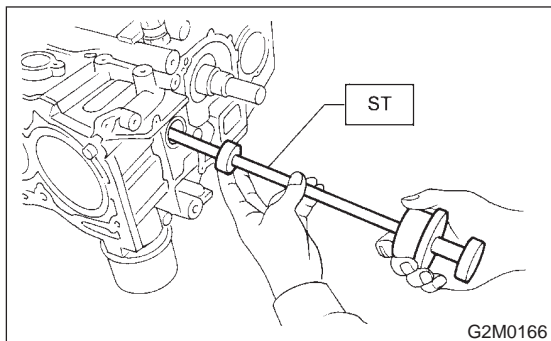
Mechanical

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.

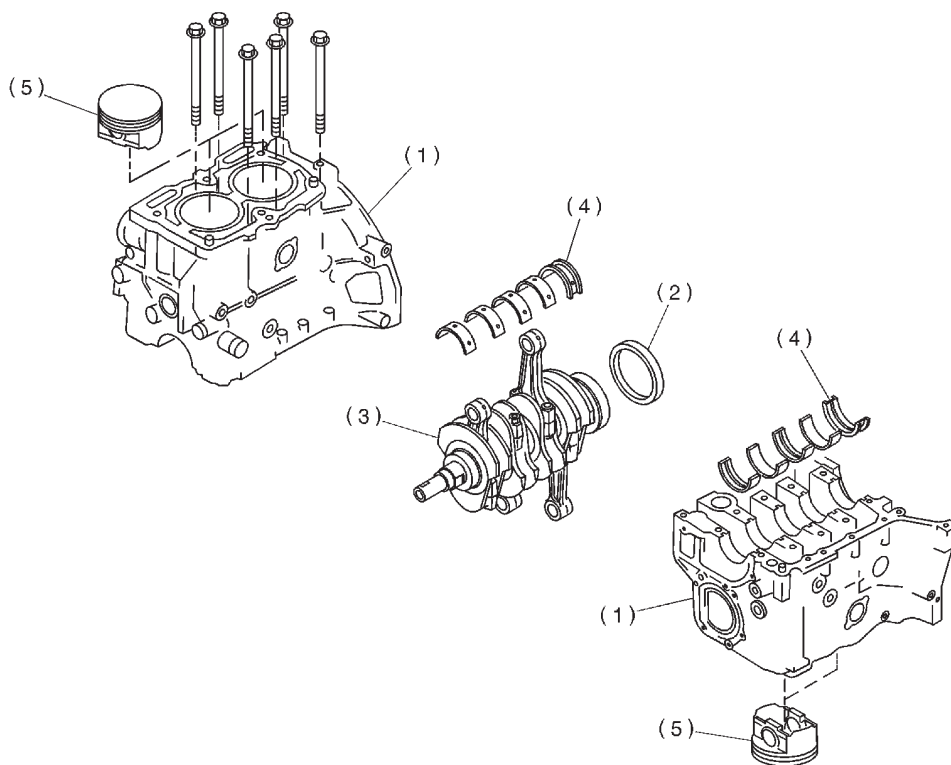
32) Back off bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

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.

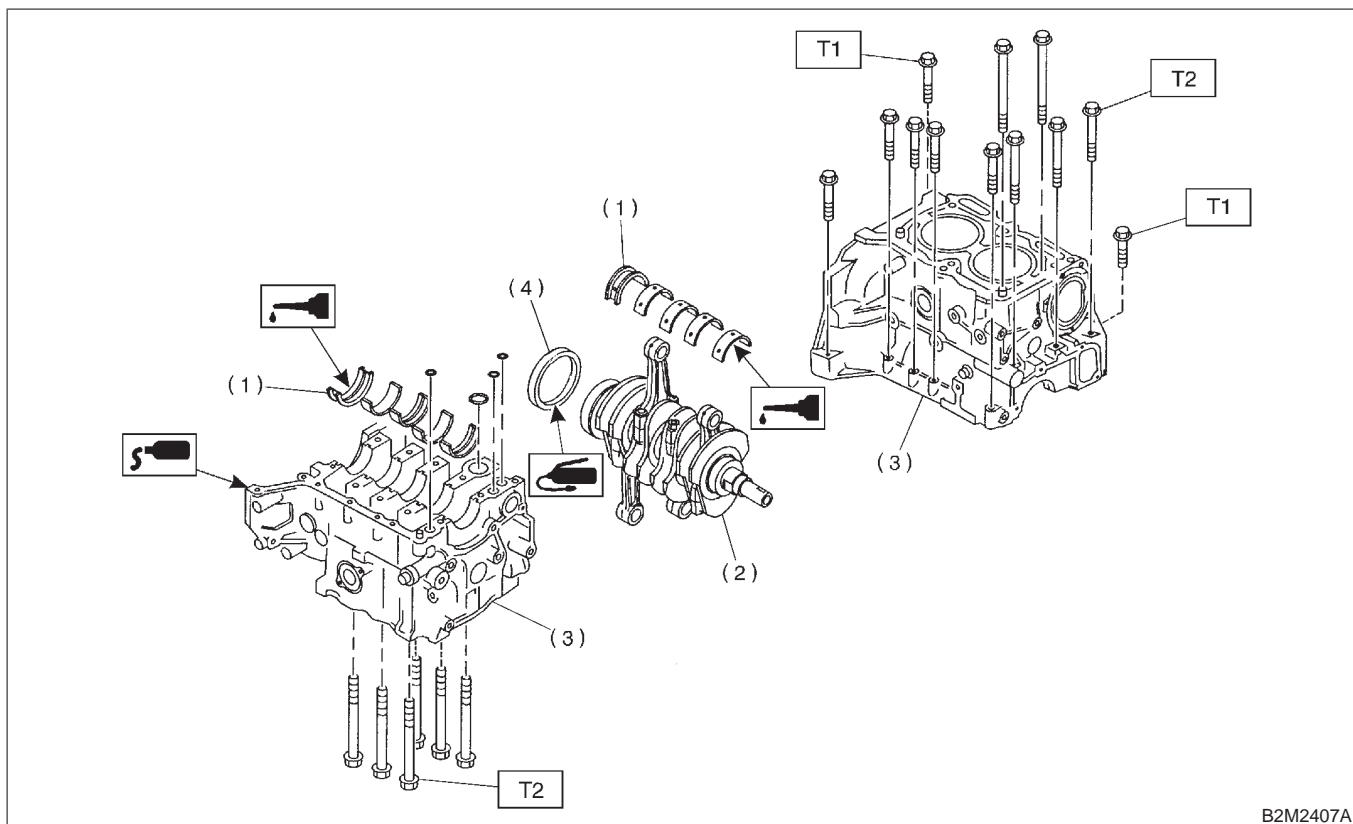
CAUTION:

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

ME(H4)-70

B: INSTALLATION

S103090A11



B2M2407A

- (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.

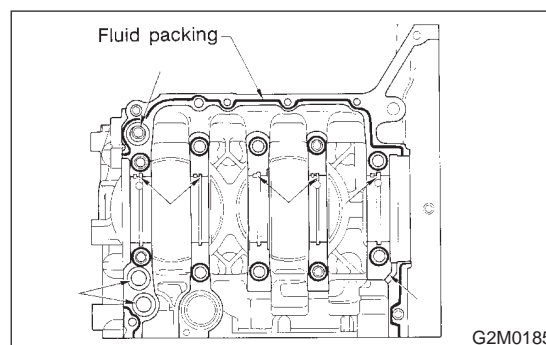
- 1) Position crankshaft on the #2 and #4 cylinder block.
- 2) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

Fluid packing:

THREE BOND 1215 or equivalent

CAUTION:

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

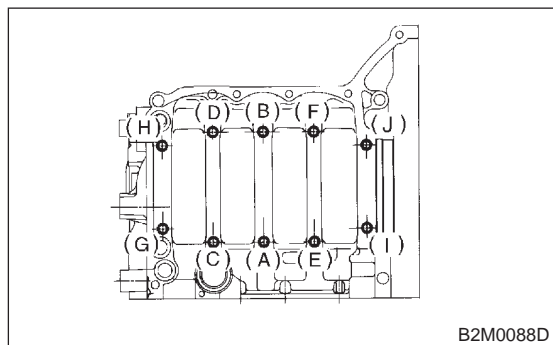


G2M0185

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

CYLINDER BLOCK

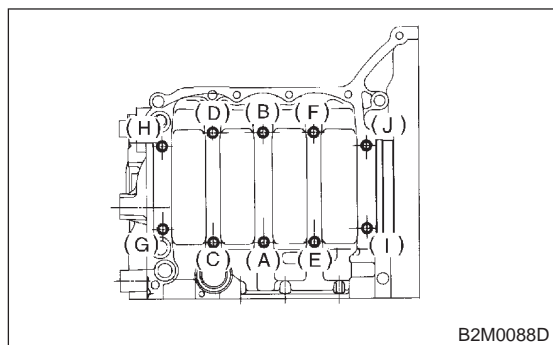
Mechanical



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

Tightening torque:

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

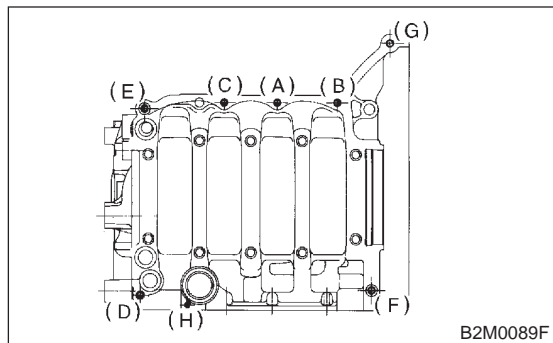


5) Tighten 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in figure.

Tightening torque:

(A) — (G): $25 \pm 2 \text{ N}\cdot\text{m}$ ($2.5 \pm 0.2 \text{ kgf}\cdot\text{m}$, $18.1 \pm 1.4 \text{ ft}\cdot\text{lb}$)

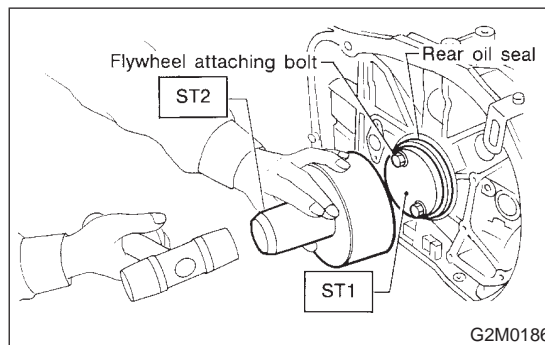
(H): $6.4 \text{ N}\cdot\text{m}$ ($0.65 \text{ kgf}\cdot\text{m}$, $4.7 \text{ ft}\cdot\text{lb}$)



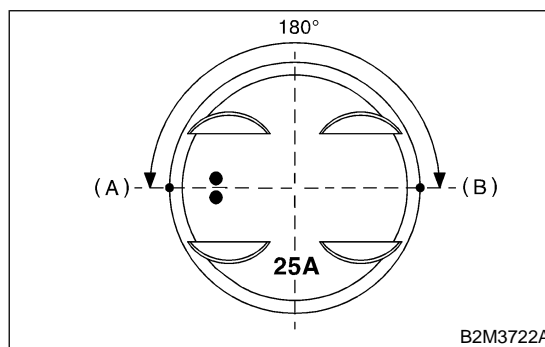
6) Install rear oil seal using ST1 and ST2.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER

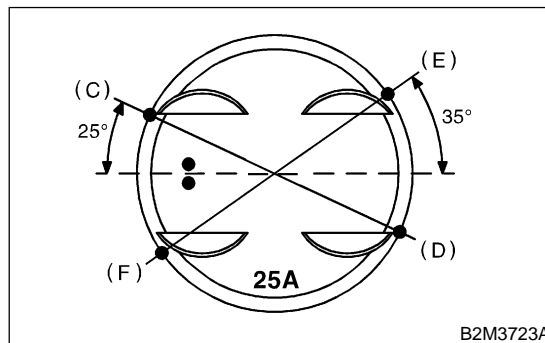


7) Position the top ring gap at (A) or (B) in the figure.



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

9) Position the upper rail gap at (C) or (D) in the figure.

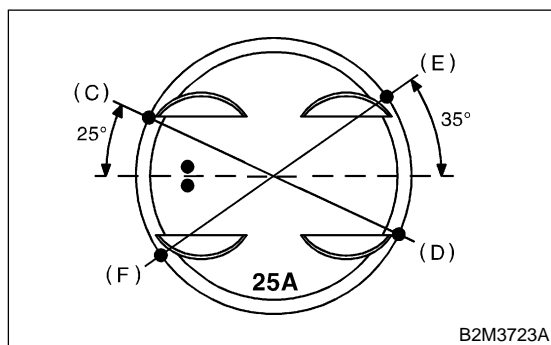


10) Position the expander gap at 180° of the reverse side for the upper rail gap.

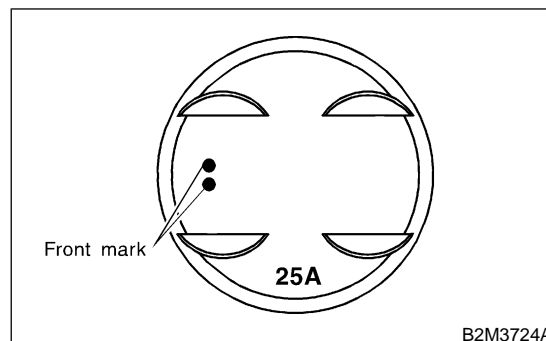
11) Position the lower rail gap at (E) or (F) in the figure.

CAUTION:

- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.

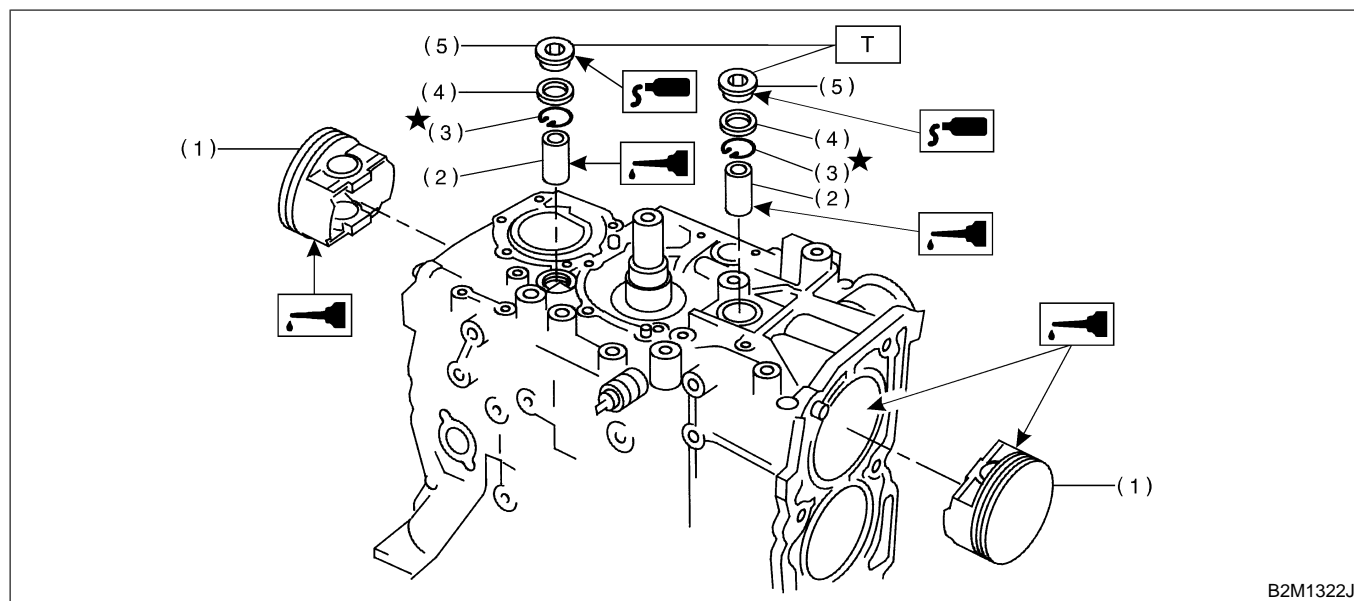
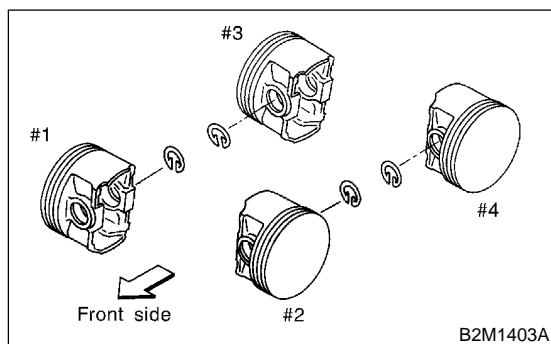


CAUTION:
Piston front mark faces towards the front of the engine.



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

CAUTION:
Use new circlips.



- | | |
|----------------|-----------------------|
| (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)

CYLINDER BLOCK

Mechanical

13) Installing piston

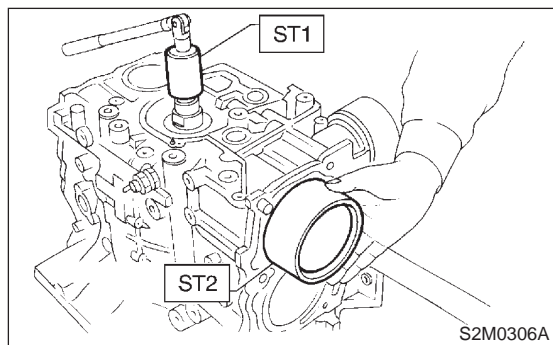
(1) Turn cylinder block so that #1 and #2 cylinders face upward.

(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



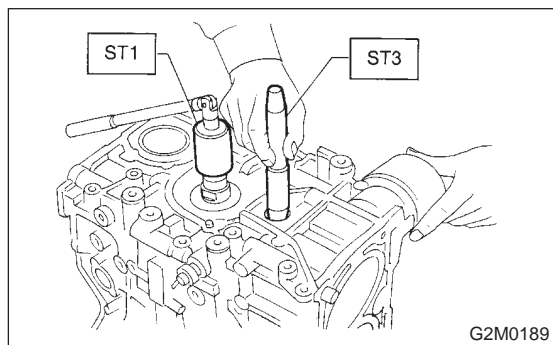
14) Installing piston pin

(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

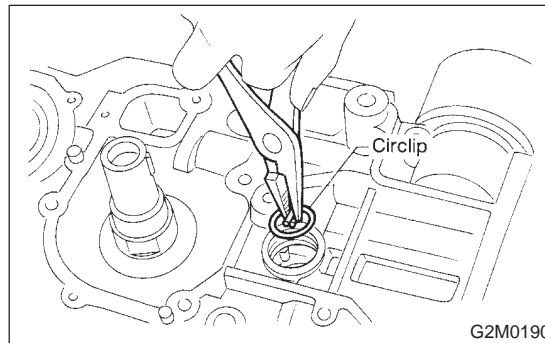


(2) Apply a coat of engine oil to piston pin and insert piston pin into piston and connecting rod through service hole.

(3) Install circlip.

CAUTION:

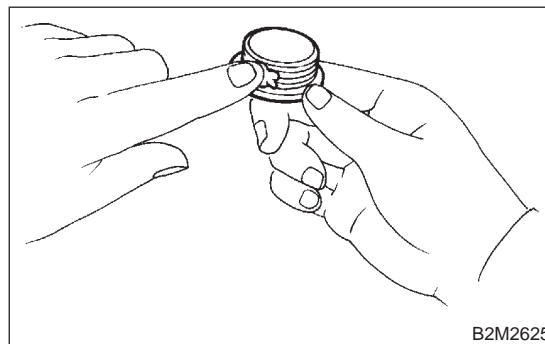
Use new circlips.



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

Fluid packing:

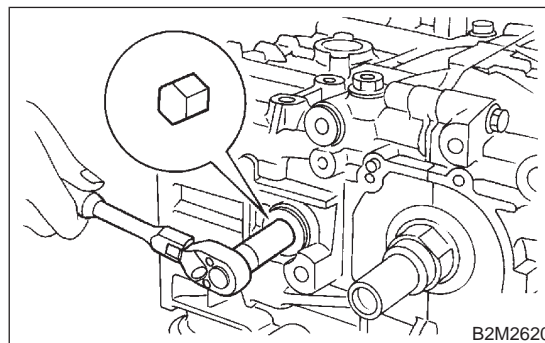
THREE BOND 1215 or equivalent

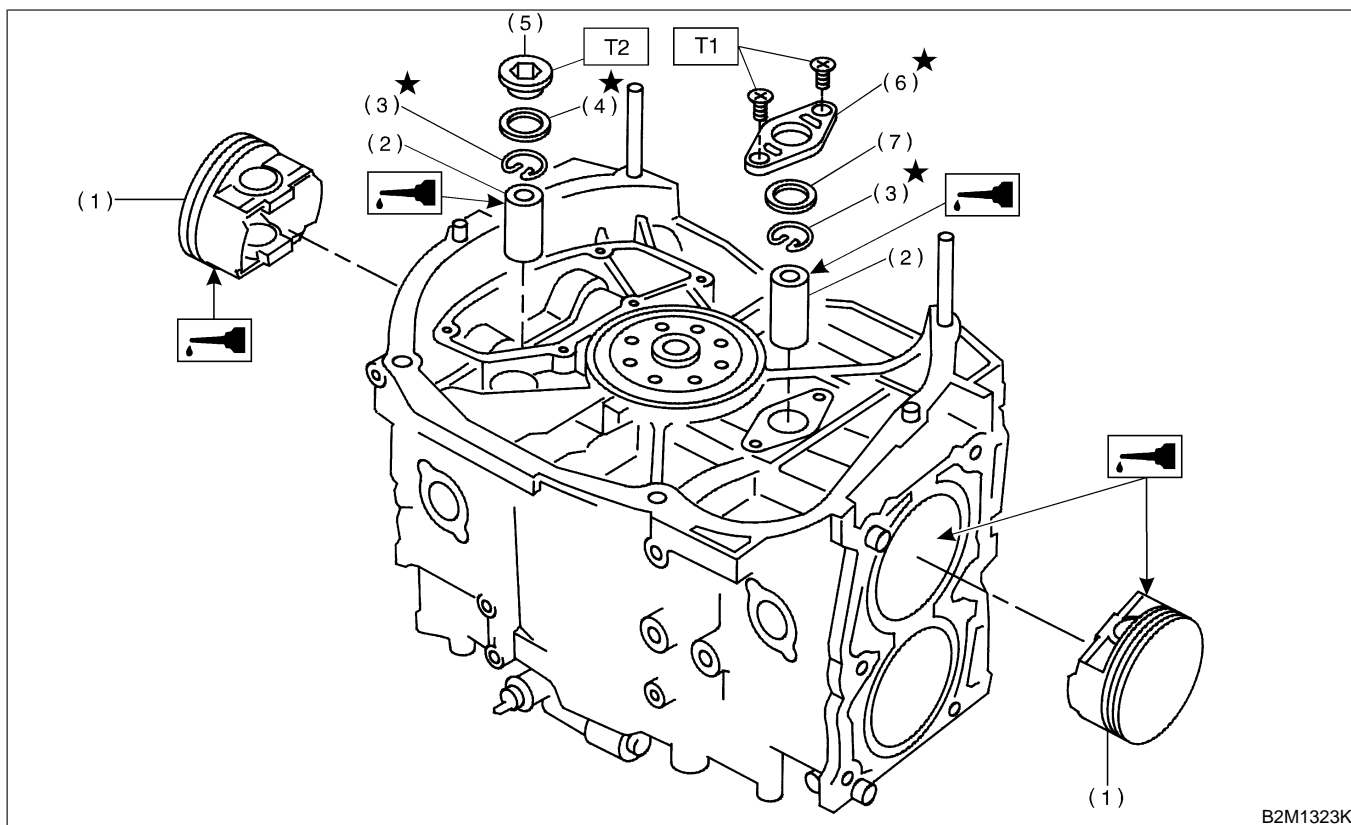


(5) Install service hole plug and gasket.

CAUTION:

Use a new 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)

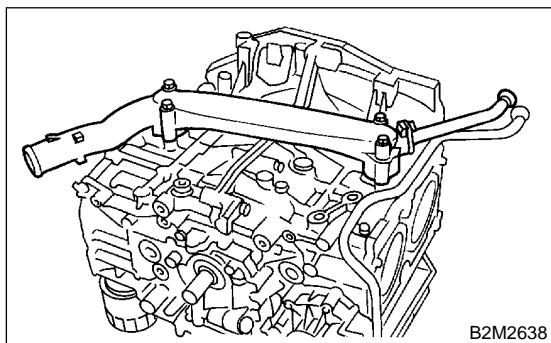
T2: 69 (7.0, 50.6)

(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.

15) Install water pipe.

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

Fluid packing:
THREE BOND 1215 or equivalent



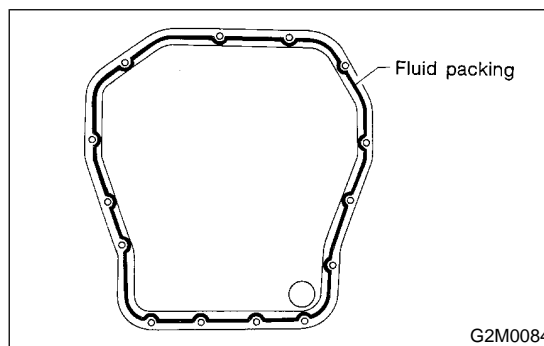
16) Install baffle plate.

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.

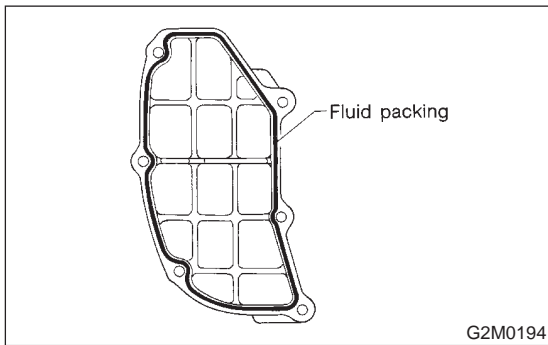


20) Apply fluid packing to matching surfaces and install oil separator cover.

Fluid packing:
THREE BOND 1215 or equivalent

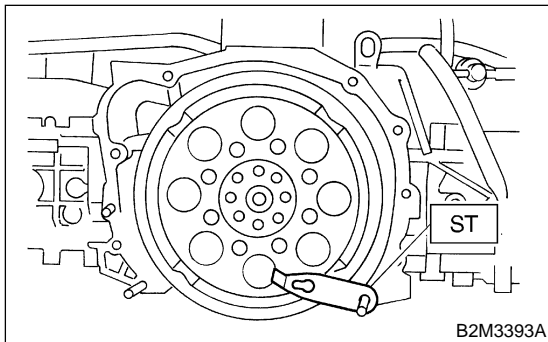
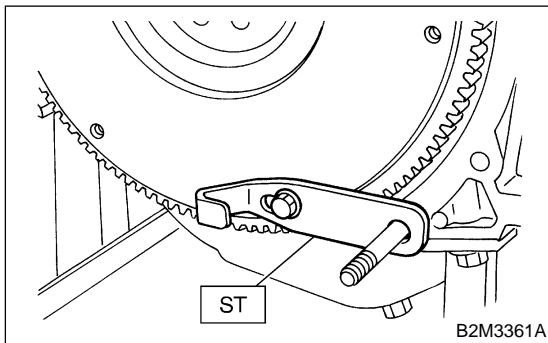
CYLINDER BLOCK

Mechanical

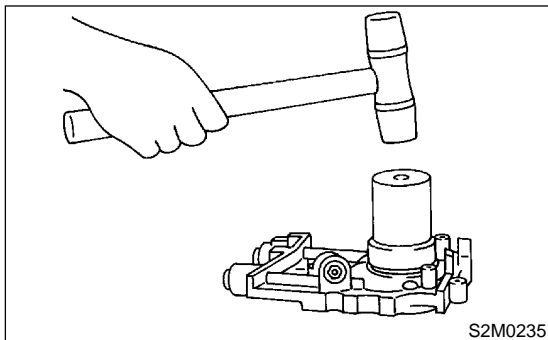


- 21) Install flywheel or drive plate.
To lock crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

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

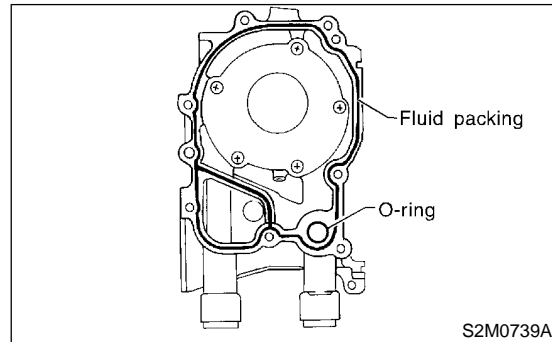


- 22) Install housing cover.
23) Installation of oil pump
(1) Discard front oil seal after removal. Replace
with a new one using ST.
ST 499587100 OIL SEAL INSTALLER

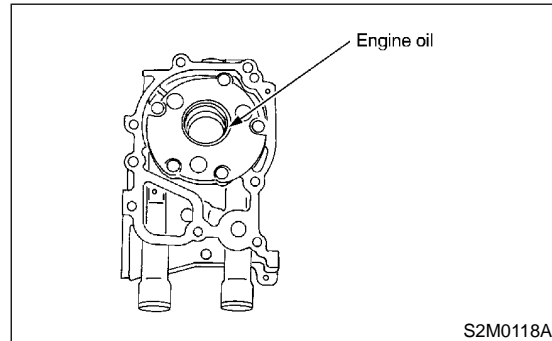


- (2) Apply fluid packing to matching surface of oil pump.

Fluid packing:
THREE BOND 1215 or equivalent



- (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:

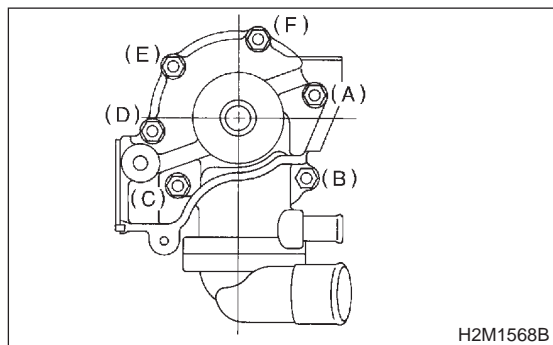
- Do not forget to install O-ring and seal when installing oil pump.
- Align flat surface of oil pump's inner rotor with crankshaft before installation.

- 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:

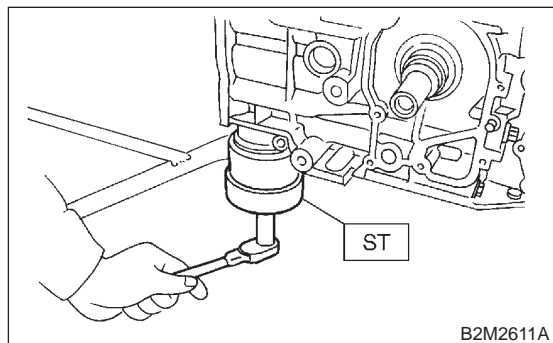
- Be sure to use a new gasket.
- When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.



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 kg-m, 22 ft-lb) in alphabetical sequence.

Then tighten all bolts to 69 N·m (7.0 kg-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 kg-m, 25 ft-lb).

(5) Tighten bolts (c), (d), (e) and (f) to 15 N·m (1.5 kg-m, 11 ft-lb).

(6) Tighten all bolts by 80 to 90° in alphabetical sequence.

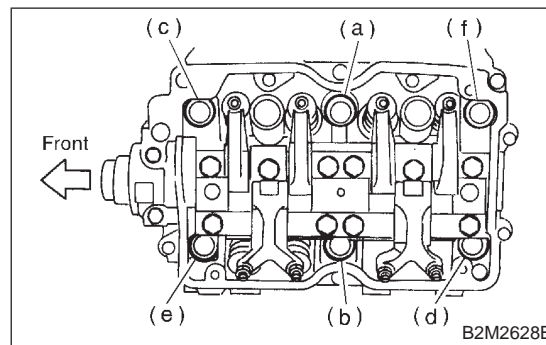
CAUTION:

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°.



28) Install oil level gauge guide and tighten attaching bolt (left side only).

29) Install rocker cover.

30) Install crankshaft sprocket. <Ref. to ME(H4)-52 INSTALLATION, Crankshaft Sprocket.>

31) Install camshaft sprocket. <Ref. to ME(H4)-51 INSTALLATION, Camshaft Sprocket.>

32) Install timing belt assembly. <Ref. to ME(H4)-47 INSTALLATION, Timing Belt Assembly.>

33) Install belt cover. <Ref. to ME(H4)-45 INSTALLATION, Belt Cover.>

34) Install crankshaft pulley. <Ref. to ME(H4)-44, INSTALLATION, Crankshaft pulley.>

35) Install generator and A/C compressor brackets on cylinder head.

36) Install V-belt. <Ref. to ME(H4)-43 INSTALLATION, V-belt.>

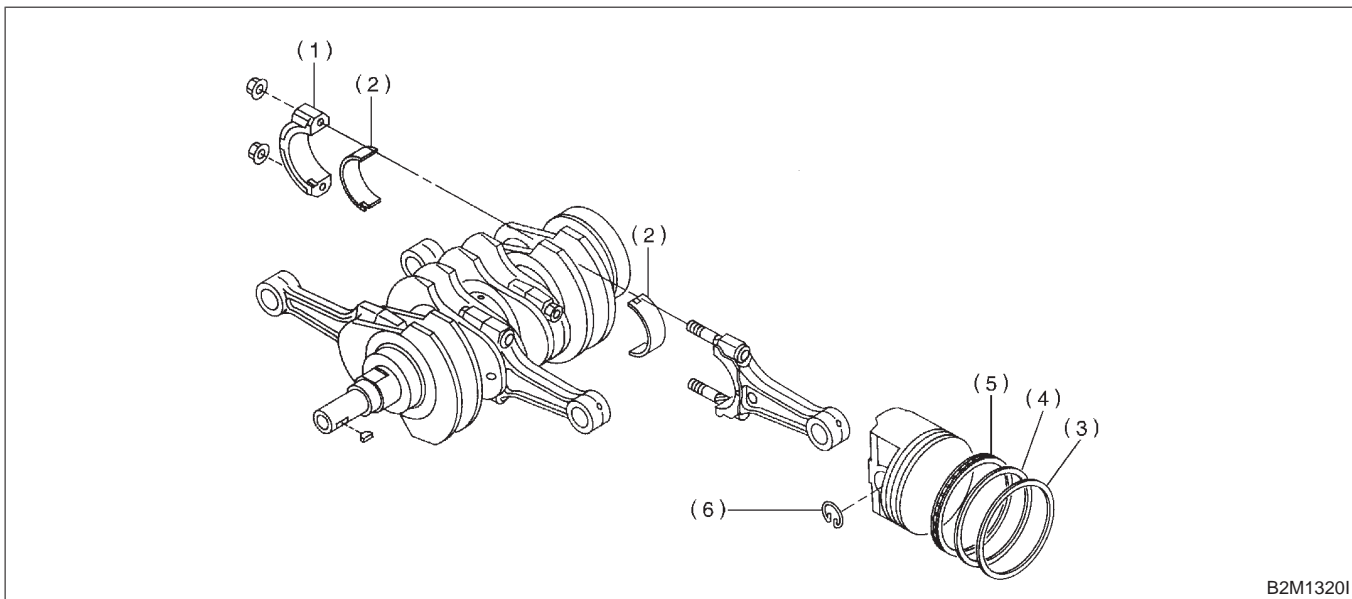
37) Install intake manifold. <Ref. to FU(H4)-22 INSTALLATION, Intake Manifold.>

CYLINDER BLOCK

Mechanical

C: DISASSEMBLY

S103090A06



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:

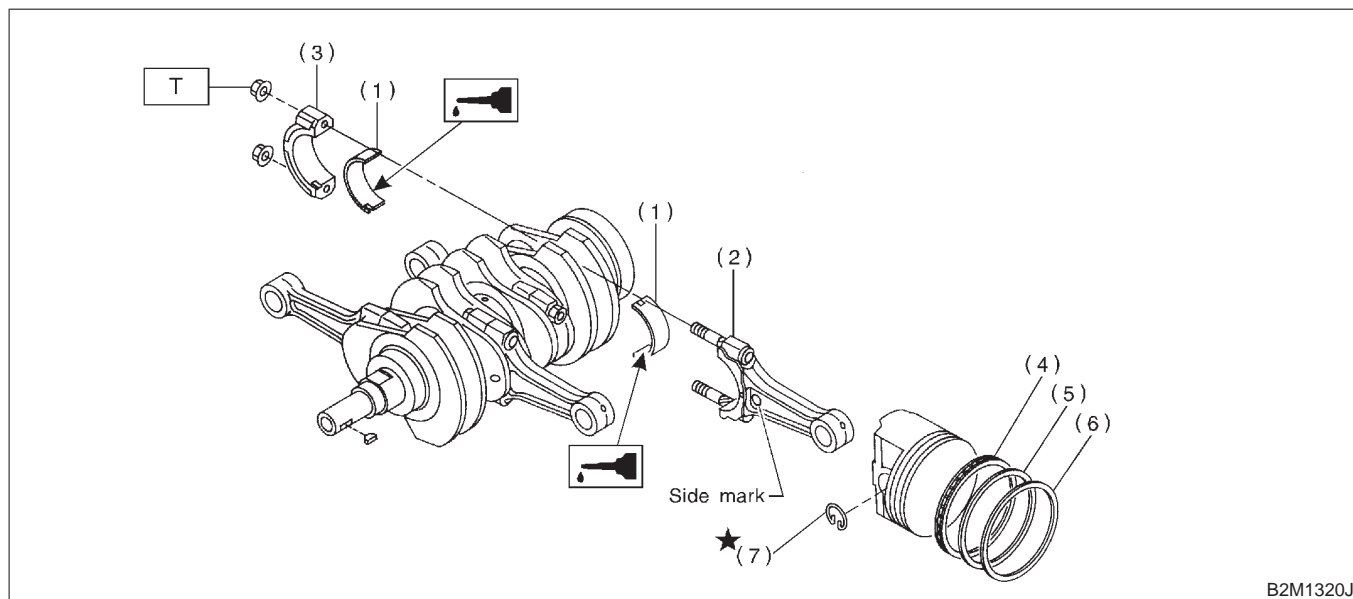
Arrange the removed piston rings in good order to prevent confusion.

- 5) Remove circlip.

ME(H4)-78

D: ASSEMBLY

S103090A02



- | | |
|----------------------------|-----------------|
| (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, upper rail and lower rail in this order by hand. Then install second ring and top ring with a piston ring expander.

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)

E: INSPECTION

S103090A10

1. CYLINDER BLOCK

S103090A1002

CYLINDER BLOCK

Mechanical

2. CYLINDER AND PISTON S103090A1003

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).

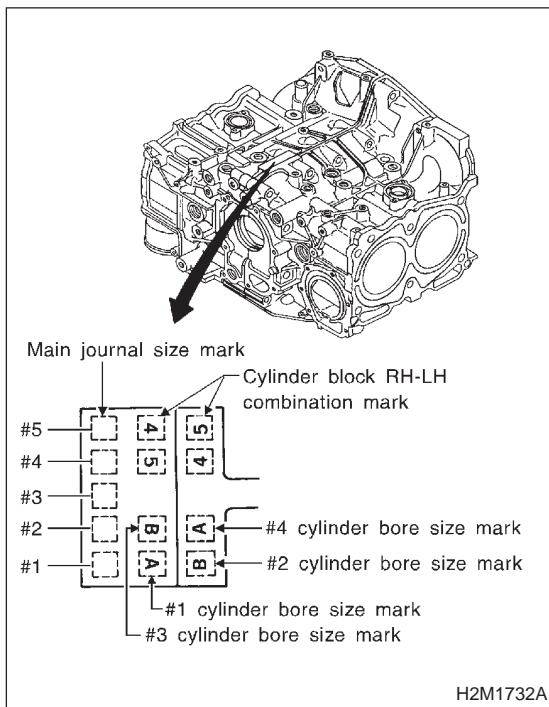
NOTE:

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)



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)

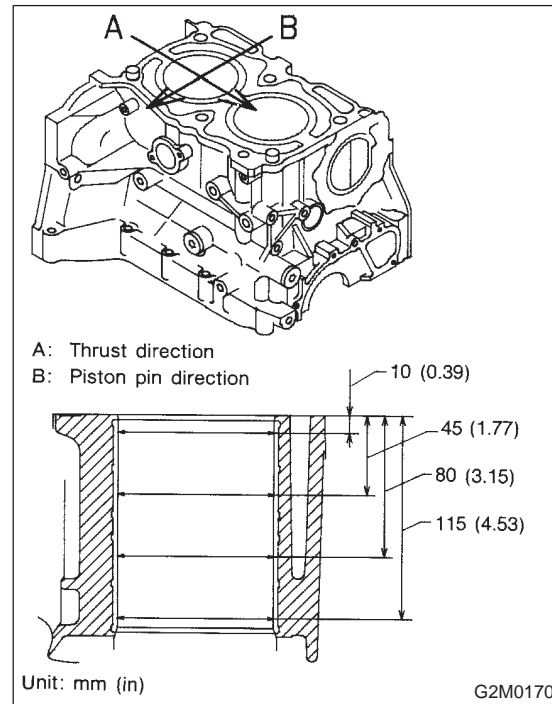
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 in)



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

4) How to measure the outer diameter of each piston

Measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

CAUTION:

Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:

37.0 mm (1.457 in)

Piston outer diameter:

Standard

A: 99.485 — 99.495 mm
(3.9167 — 3.9171 in)

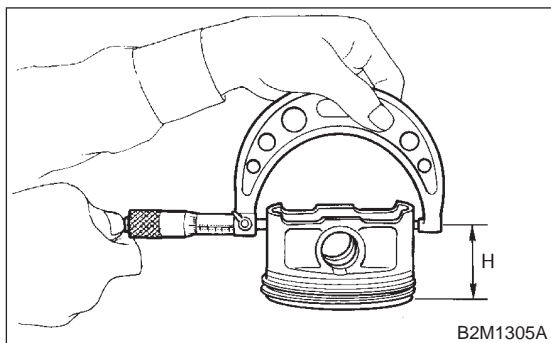
B: 99.475 — 99.485 mm
(3.9163 — 3.9167 in)

0.25 mm (0.0098 in) oversize

99.725 — 99.735 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, rebore it to use an oversize piston.

CAUTION:

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the crankcase.

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

S103090A1004

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-80 CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.

3) Make sure that piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

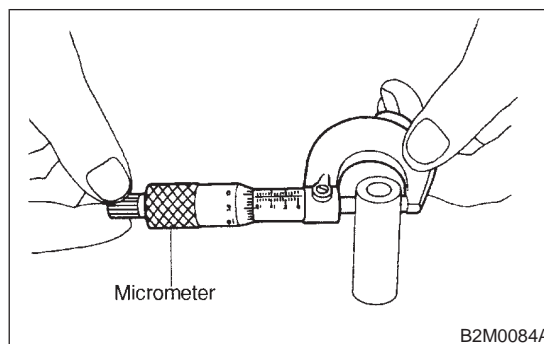
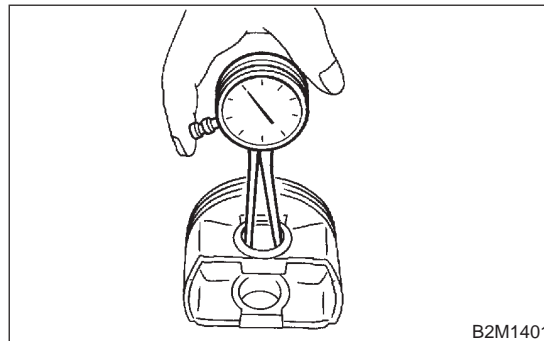
Standard clearance between piston pin and hole in piston:

Standard

0.004 — 0.008 mm (0.0002 — 0.0003 in)

Limit

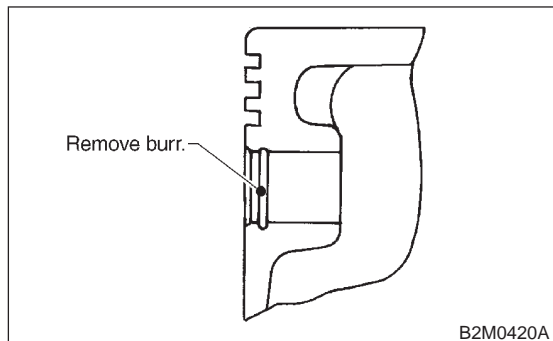
0.020 mm (0.0008 in)



CYLINDER BLOCK

Mechanical

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



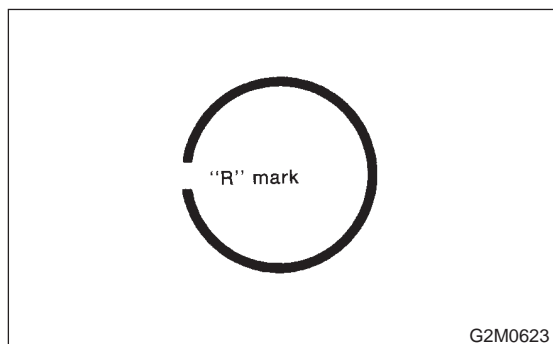
5) Check piston pin circlip for distortion, cracks and wear.

4. PISTON RING S103090A1005

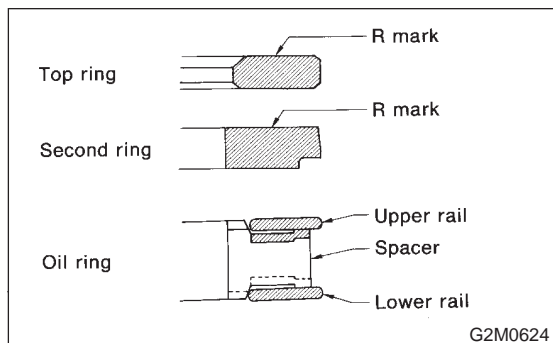
1) If piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace piston ring with a new one of the same size as the piston.

CAUTION:

● “R” is marked on the end of the top and second rings. When installing the rings to the piston, face this mark upward.

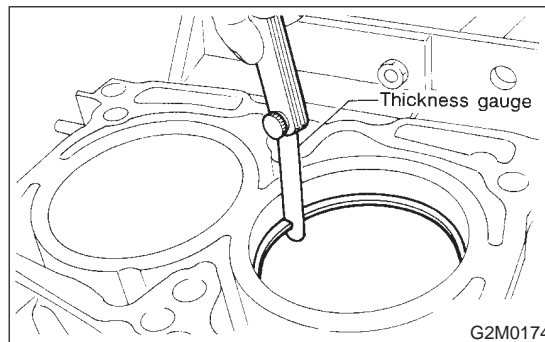


● The oil ring is a combined ring consisting of two rails and a spacer in between. When installing, be careful to assemble correctly.



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)

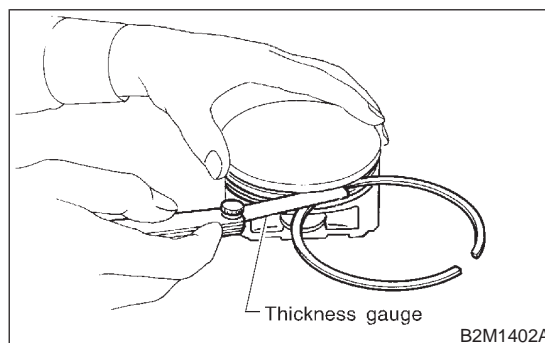


3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

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)

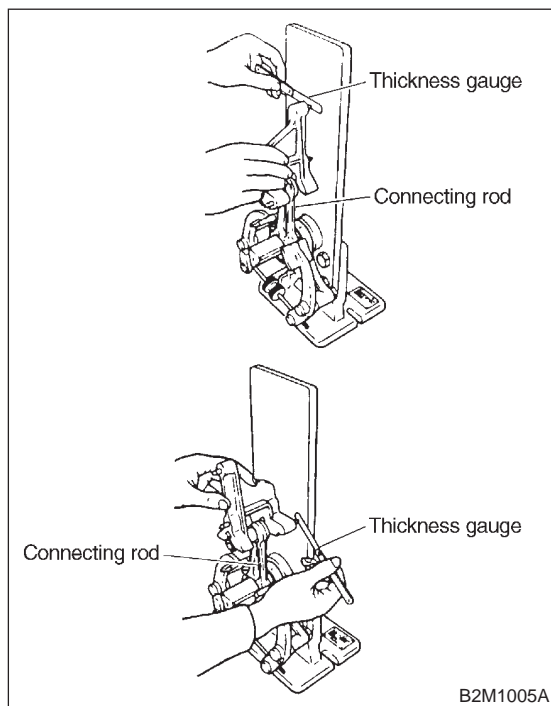


5. CONNECTING ROD S103090A1006

- 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)



- 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.

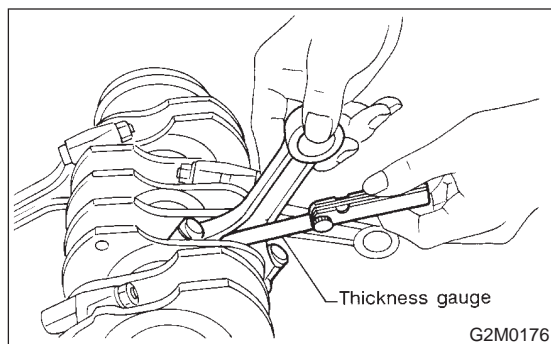
Connecting rod side clearance:

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

0.020 — 0.046 mm (0.0008 — 0.0018 in)

Limit

0.050 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.486 — 1.498 (0.0585 — 0.0590)	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)

CYLINDER BLOCK

Mechanical

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.

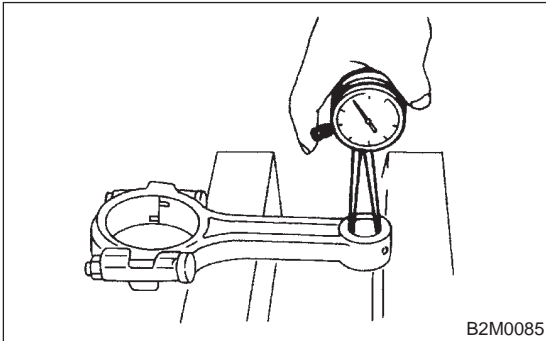
Clearance between piston pin and bushing:

Standard

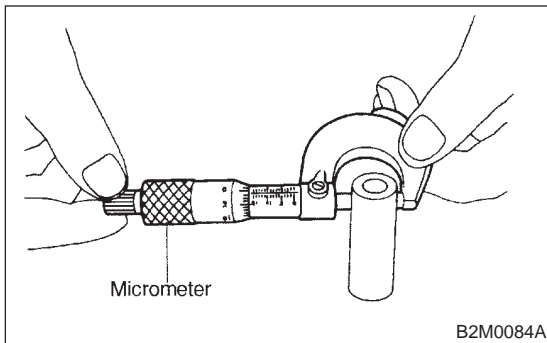
0 — 0.022 mm (0 — 0.0009 in)

Limit

0.030 mm (0.0012 in)



B2M0085

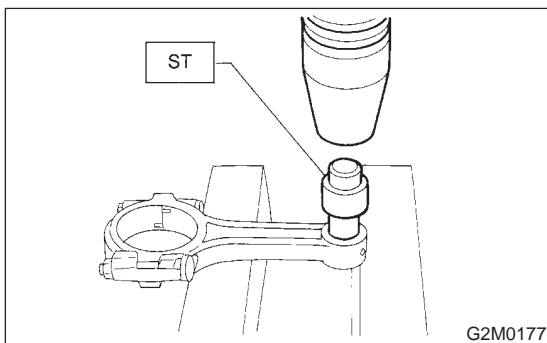


B2M0084A

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



G2M0177

- (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

S103090A1007

1) Clean crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.

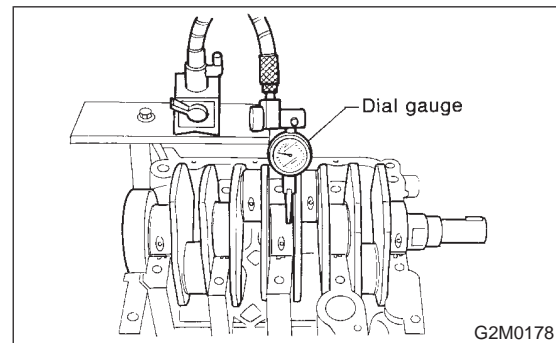
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

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)



G2M0178

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

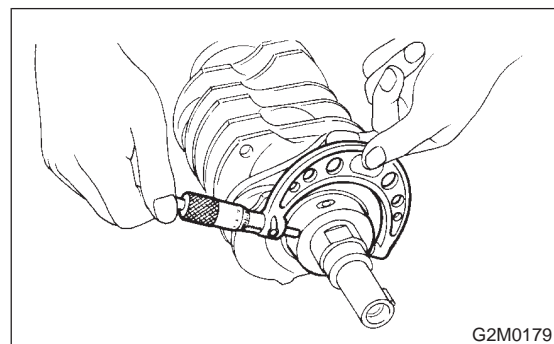
0.020 mm (0.0008 in) or less

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



G2M0179

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.

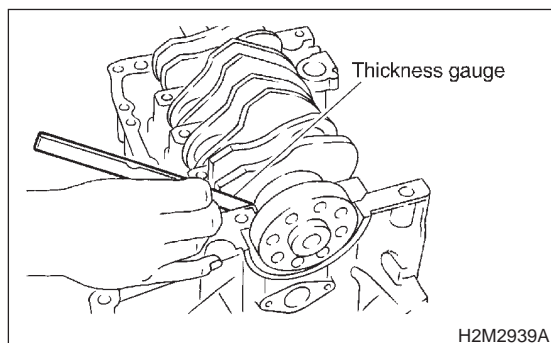
Crankshaft thrust clearance:

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

S103095

A: INSPECTION S103095A10

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(H4)-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(H4)-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(H4)-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(H4)-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 filter 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(H4)-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 filter 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(H4)-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 filter 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(H4)-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(H4)-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(H4)-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(H4)-2 Basic Diagnostic Procedure.>		A
	● Intake system	● Loosened oil filter 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 filter cap	C
	● Compression	● Defective valve stem	A
		● Worn or stuck piston rings, cylinder and piston	A
	● Lubrication system	● Loosened oil pump attaching bolts and defective gasket	B
		● Defective oil filter 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(H4)-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 S103096

A: INSPECTION S103096A10

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> Valve mechanism is defective. Incorrect valve clearance Worn valve rocker Worn camshaft Broken valve spring
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn connecting rod bearing (big end)
	Oil pressure is normal.	<ul style="list-style-type: none"> Loose flywheel mounting bolts Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	<ul style="list-style-type: none"> 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*)	<ul style="list-style-type: none"> 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*)	<ul style="list-style-type: none"> 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*)	<ul style="list-style-type: none"> Unusually worn valve lifter Worn cam gear Worn camshaft journal bore in crankcase
Squeaky sound	—	<ul style="list-style-type: none"> Insufficient generator lubrication
Rubbing sound	—	<ul style="list-style-type: none"> Defective generator brush and rotor contact
Gear scream when starting engine	—	<ul style="list-style-type: none"> Defective ignition starter switch Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> Loose drive belt Defective water pump shaft
Hissing sound	—	<ul style="list-style-type: none"> Loss of compression Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	<ul style="list-style-type: none"> Loose timing belt Belt contacting case/adjacent part
Valve tappet noise	—	<ul style="list-style-type: none"> 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(H4)-63 Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4)-60 Inspection Mode.> after connecting fuel injector connector.

GENERAL DESCRIPTION

Starting/Charging Systems

1. General Description S109001

A: SPECIFICATIONS S109001E49

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		A2TB2891ZC	LR190-742
	Manufacturer		MITUBISHI ELECTRIC CORPORATION	HITACHI AUTOMOTIVE PRODUCTS
	Voltage and output		12 V — 90 A	12 V — 90 A
	Polarity on ground side		Negative	
	Rotating direction		Clockwise (when observed from pulley side.)	
	Armature connection		3-phase Y-type	
	Output current		1,500 rpm — 36 A or more	1,500 rpm — 39 A or more
			2,500 rpm — 65 A or more	2,500 rpm — 66 A or more
			5,000 rpm — 86 A or more	5,000 rpm — 85 A or more
	Regulated voltage		14.5 ^{+0.3} / _{-0.4} V [20°C (68°F)]	

SC(H4)-2

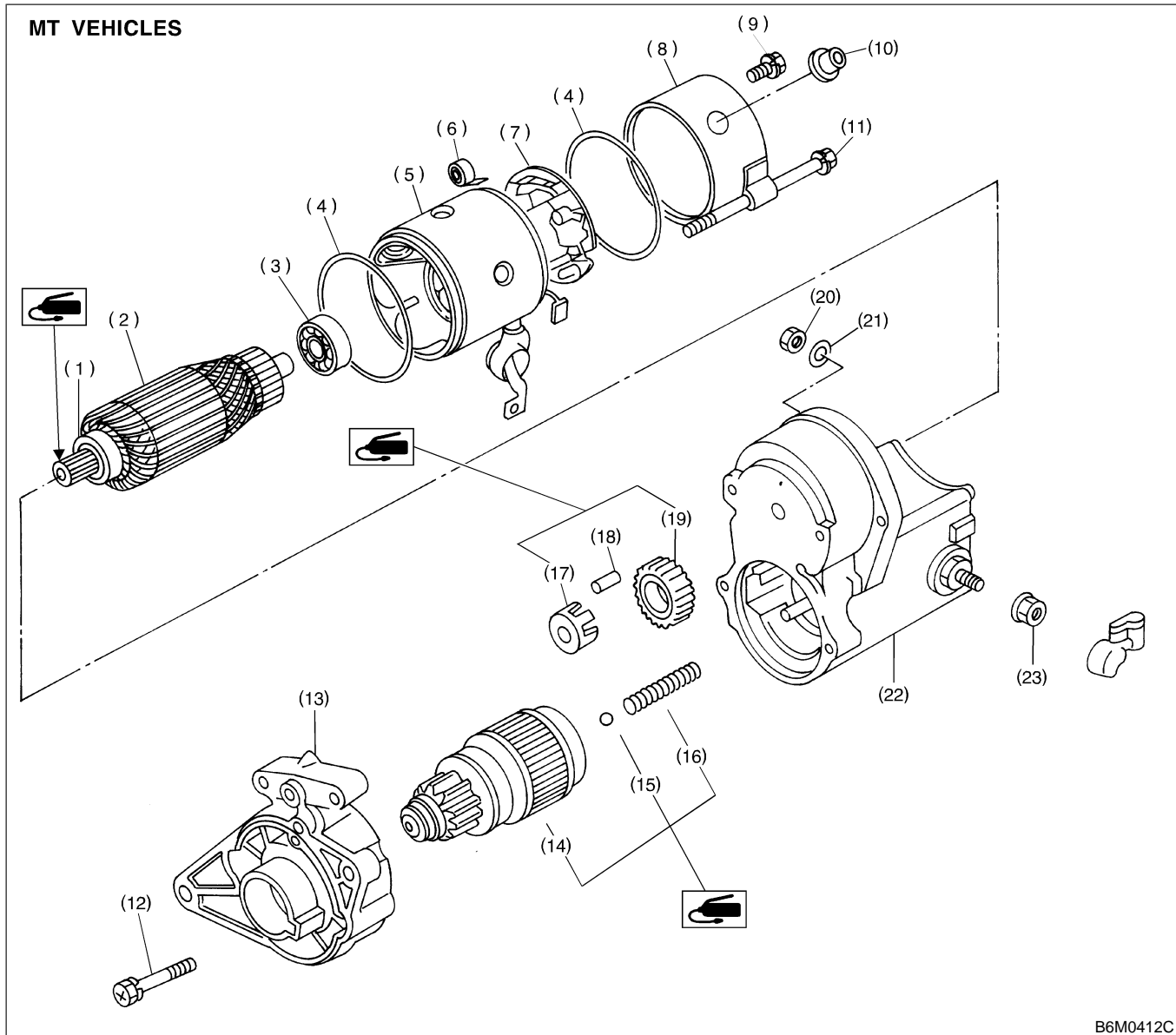
B: COMPONENT

S109001A05

1. STARTER

S109001A0501

MT VEHICLES



B6M0412C

- (1) Front ball bearing
- (2) Armature
- (3) Rear ball bearing
- (4) O-ring
- (5) Yoke
- (6) Brush spring
- (7) Brush holder
- (8) End frame

- (9) Screw & washer
- (10) Cover
- (11) Through bolt
- (12) Screw & washer
- (13) Starter housing
- (14) Overrunning clutch
- (15) Steel ball
- (16) Spring

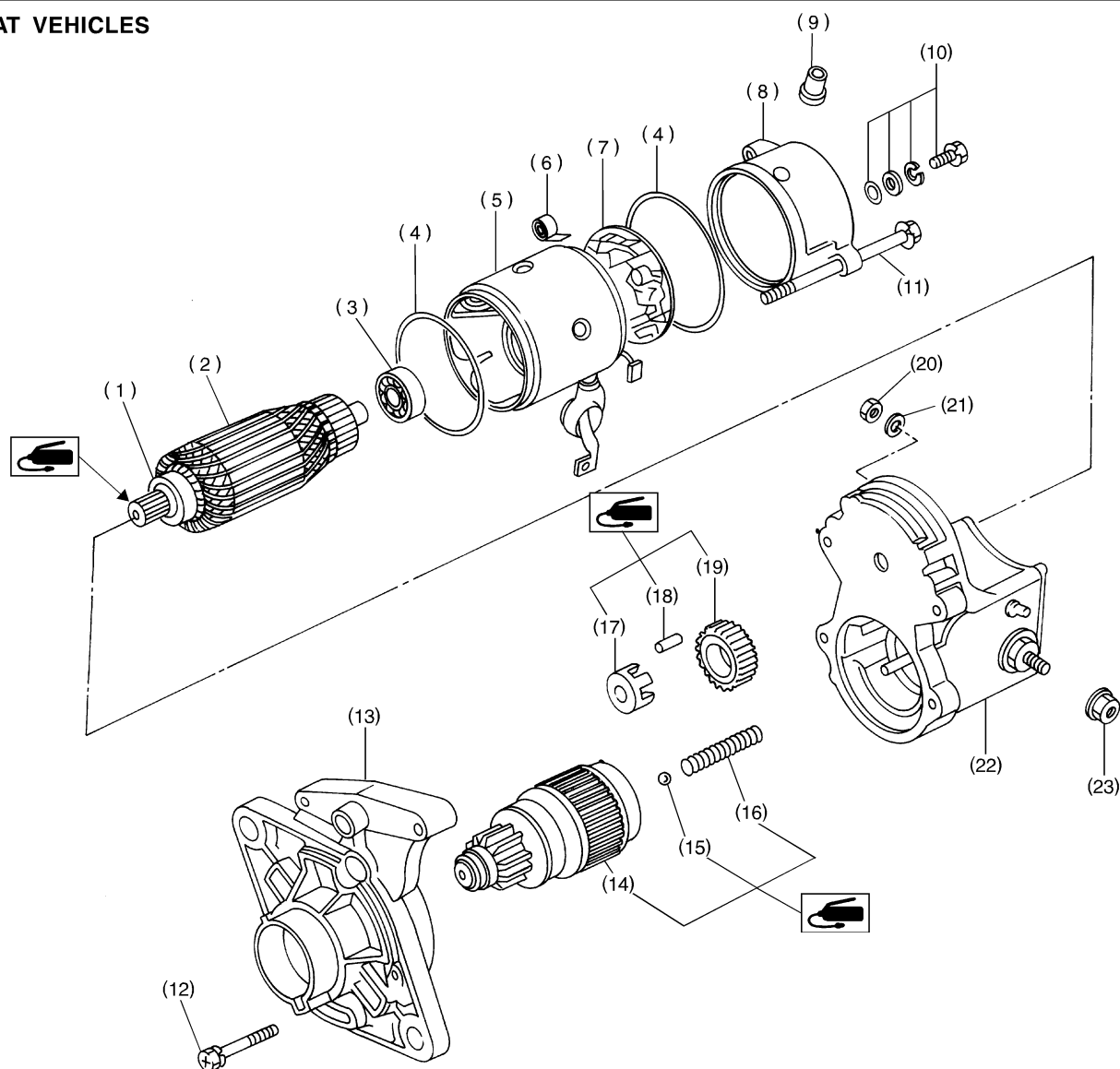
- (17) Retainer
- (18) Roller
- (19) Idle gear
- (20) Nut
- (21) Spring washer
- (22) Magnet switch
- (23) Nut

SC(H4)-3

GENERAL DESCRIPTION

Starting/Charging Systems

AT VEHICLES

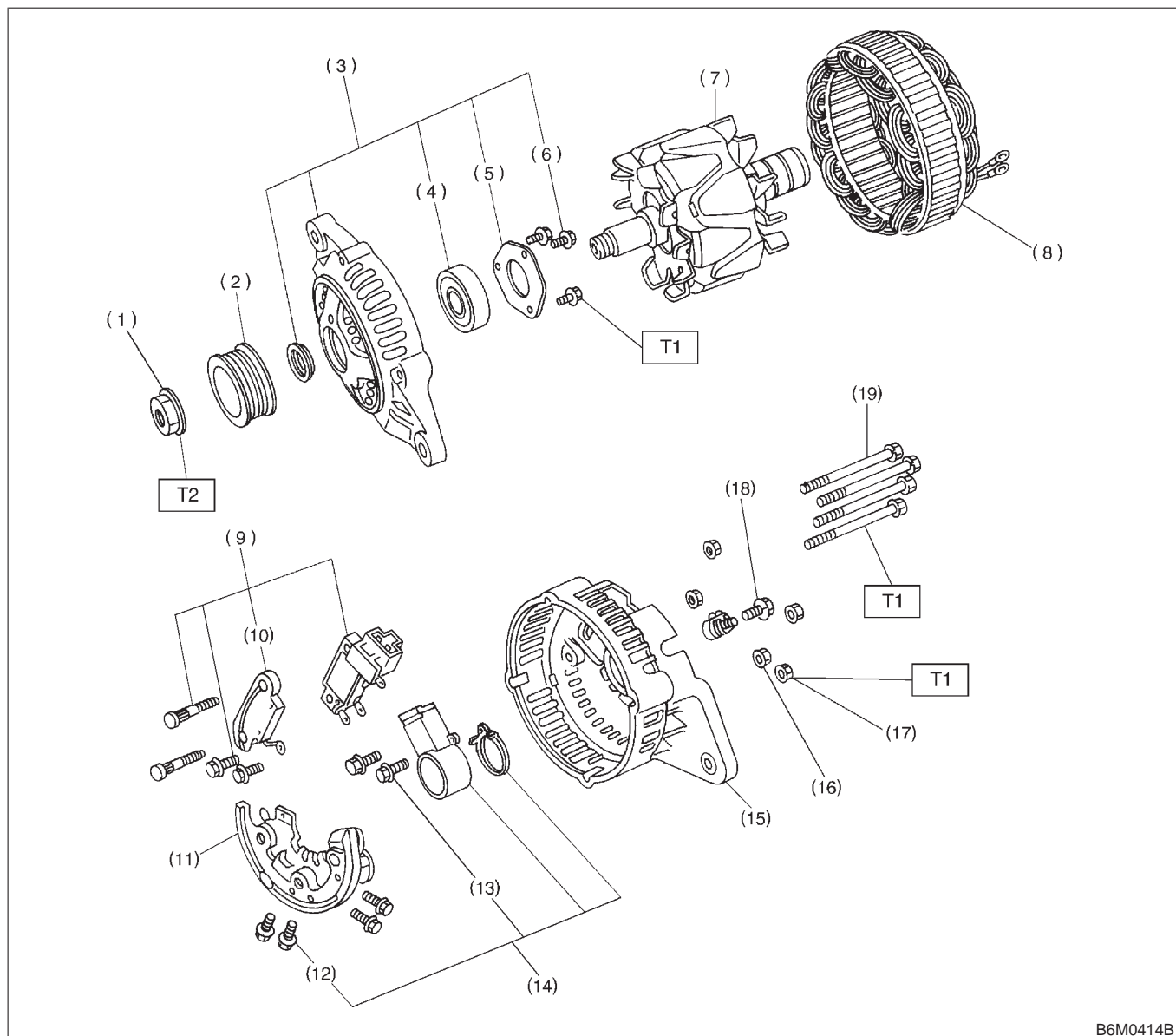


B6M0413C

- | | | |
|------------------------|-------------------------|--------------------|
| (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) Magnet switch |
| (7) Brush holder | (15) Steel ball | (23) Nut |
| (8) End frame | (16) Spring | |

SC(H4)-4

2. GENERATOR S109001A0502



- (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)

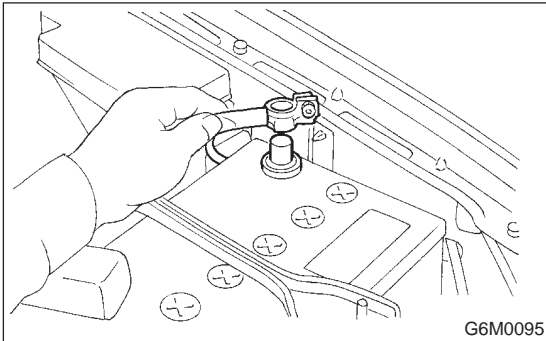
C: CAUTION S109001A03

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

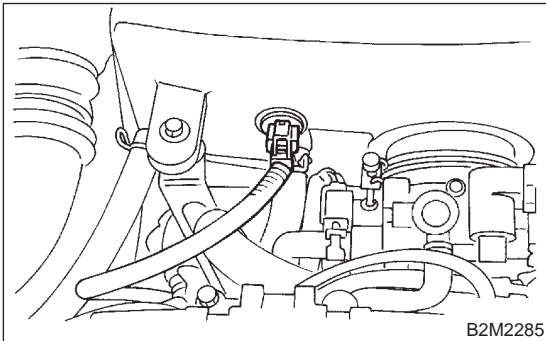
2. Starter S109012

A: REMOVAL S109012A18

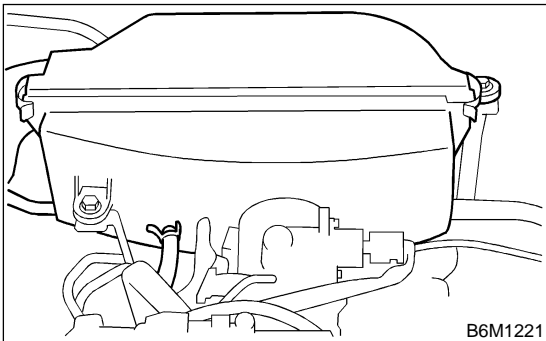
- 1) Disconnect battery ground cable.



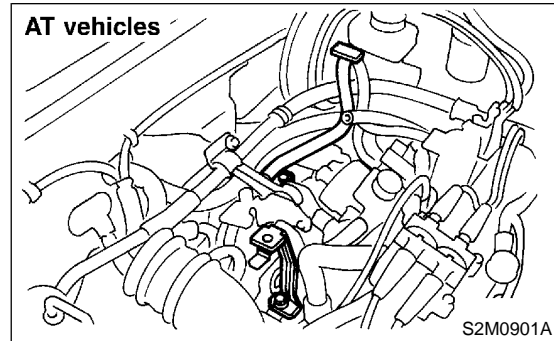
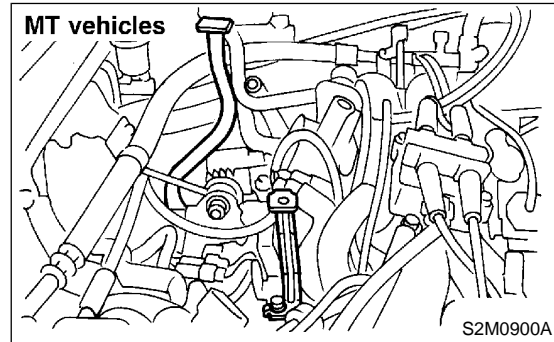
- 2) Disconnect connector from intake air temperature sensor. (MT vehicles)



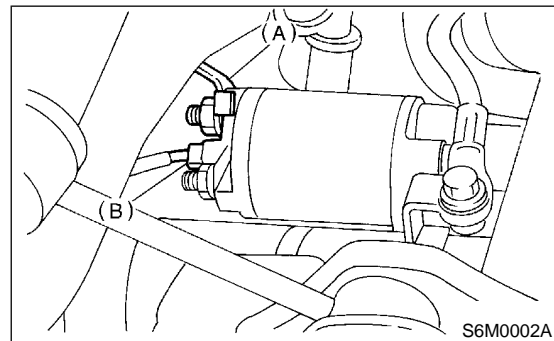
- 3) Remove air cleaner case.



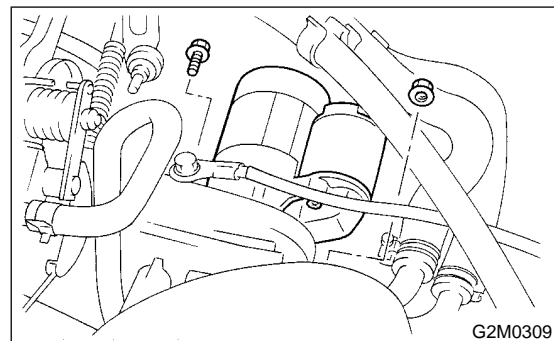
- 4) Remove air cleaner case stay.



- 5) Disconnect connector and terminal from starter.



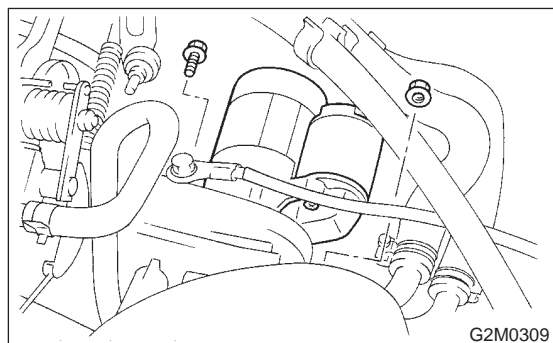
- 6) Remove starter from transmission.



B: INSTALLATION S109012A11

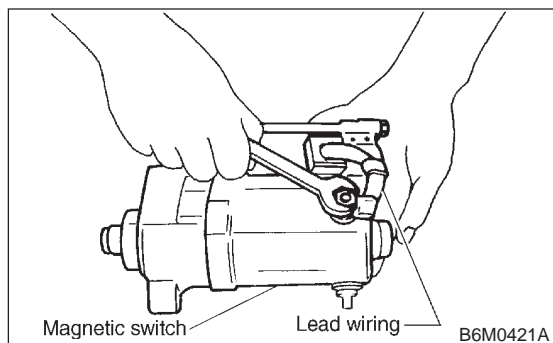
Install in the reverse order of removal.

Tightening torque:
50 N·m (5.1 kgf-m, 37 ft-lb)

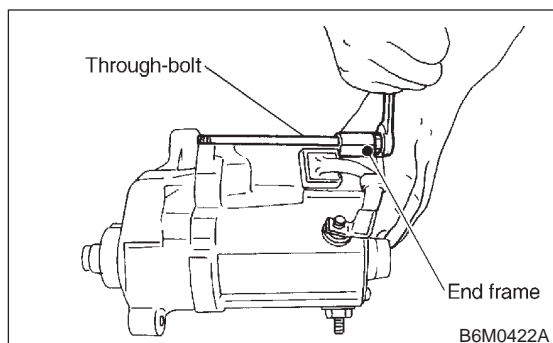


C: DISASSEMBLY S109012A06

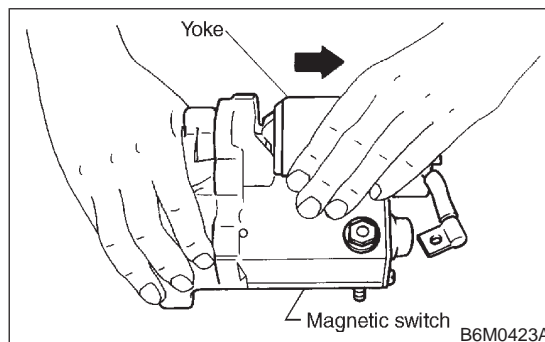
- 1) Disconnect lead wire from magnetic switch.



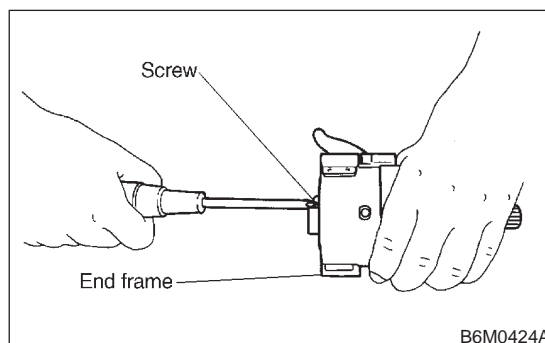
- 2) Remove through-bolts from end frame.



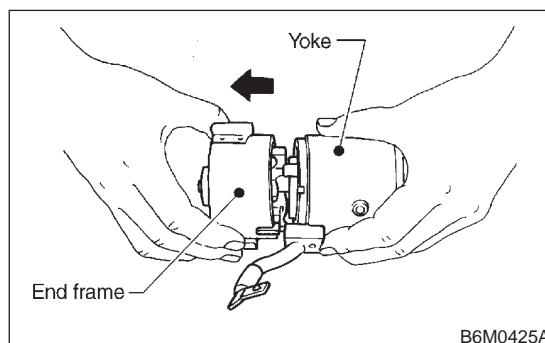
- 3) Remove yoke from magnetic switch.



- 4) Remove screws securing end frame to brush holder.

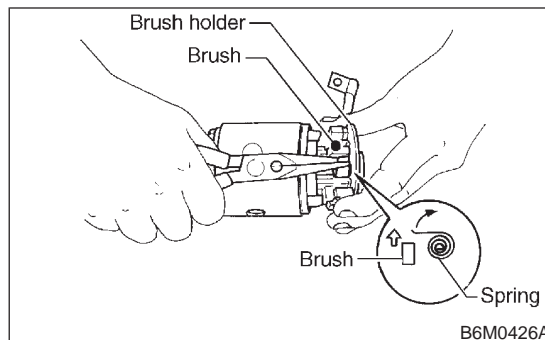


- 5) Separate yoke from end frame.



- 6) Remove brush by lifting up positive (+) side brush spring using long-nose pliers.

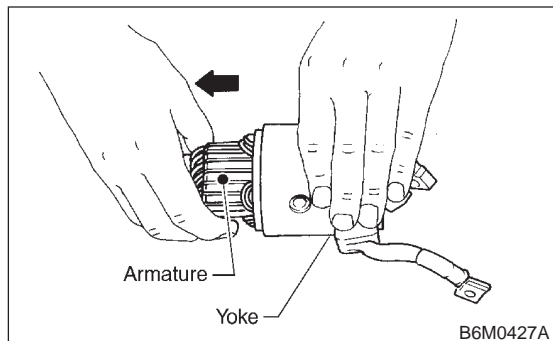
CAUTION:
Be careful not to damage brush and commutator.



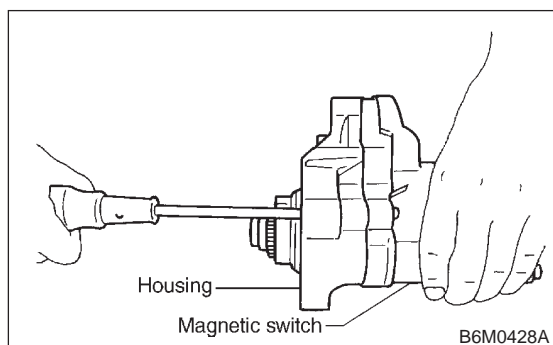
7) Remove armature from yoke.

CAUTION:

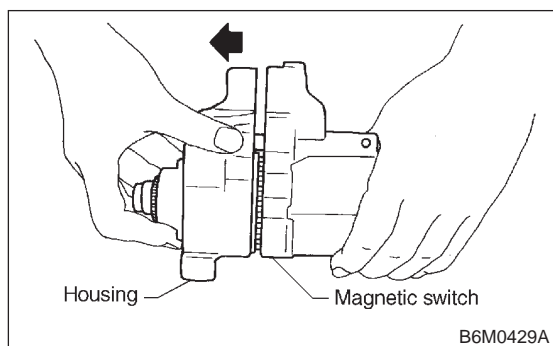
Be careful not to drop armature.



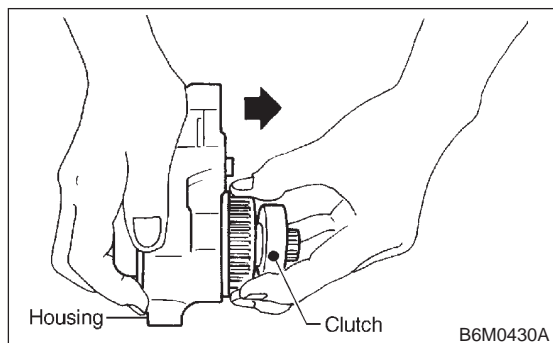
8) Remove screws securing magnetic switch to housing.



9) Remove housing from magnetic switch.



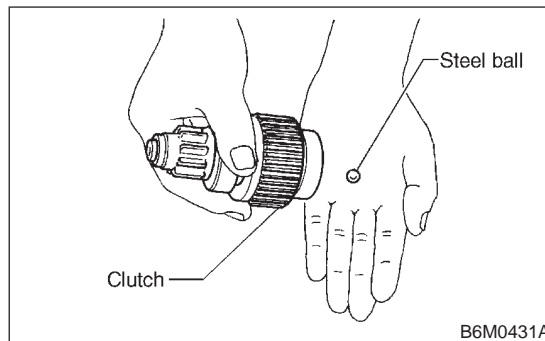
10) Remove clutch from housing.



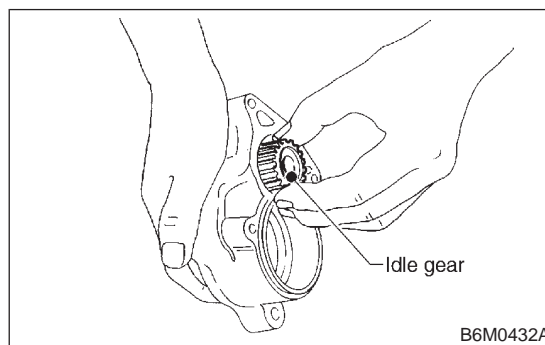
11) Take out steel ball from clutch.

CAUTION:

Be careful not to lose steel ball.



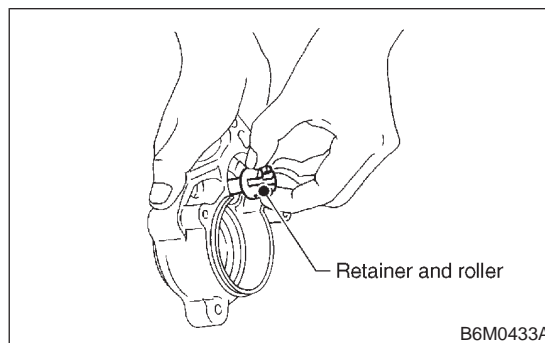
12) Remove idle gear from housing.



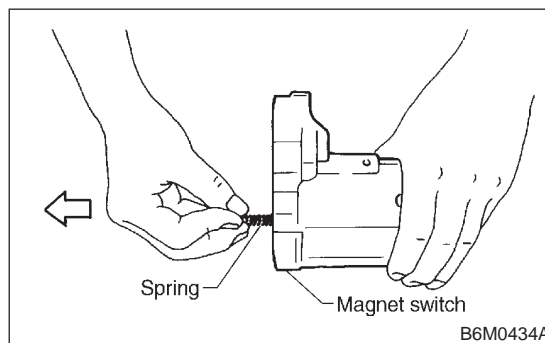
13) Remove retainer and roller from housing.

CAUTION:

Be careful not to drop retainer and roller.



14) Remove coil spring from magnetic switch.



D: ASSEMBLY S109012A02

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(H4)-3 STARTER, COMPONENT, General Description.>

Grease:

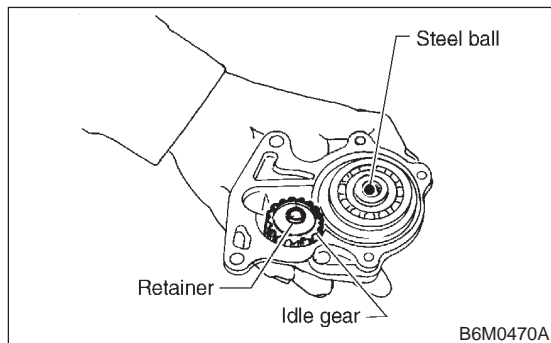
ESSO BEACON 325
SHELL ALVANIA GREASE RA
or equivalent

2) Assembling magnetic switch, clutch, and housing

To assemble, first install clutch to magnetic switch, then install idle gear, and finally install clutch.

CAUTION:

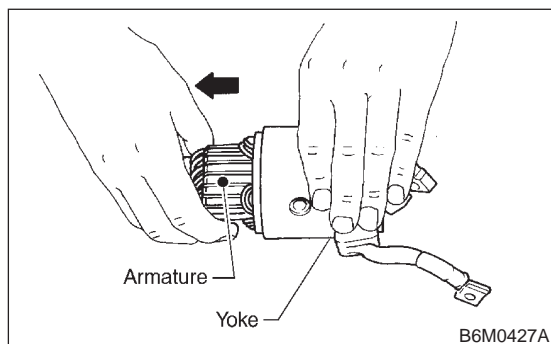
- Do not forget to install steel ball and coil spring to clutch.
- Attach bearing to idle gear beforehand.



3) Installing armature to yoke

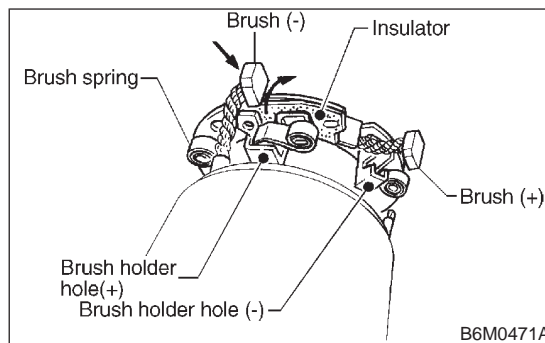
CAUTION:

Do not forget to put felt washer on armature shaft bearing.



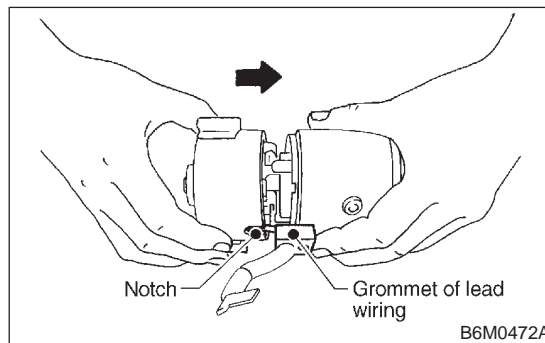
4) Installing brushes

Assemble brush holder to yoke as shown, then assemble two yoke-side brushes to brush holder.



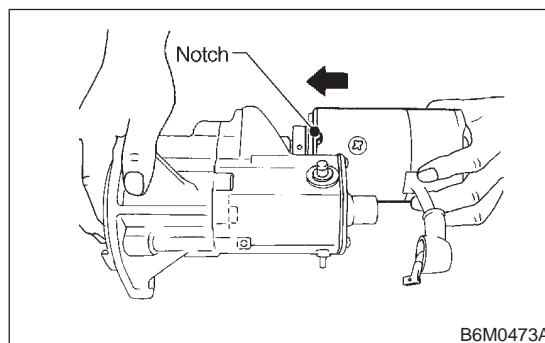
5) Installing end frame

When assembling end frame to yoke, align notched portion of end frame with lead wire grommet.



6) Installing yoke

When installing yoke to magnetic switch, align notch of yoke with protrusion of magnetic switch.



E: INSPECTION S109012A10

1. ARMATURE S109012A1001

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.

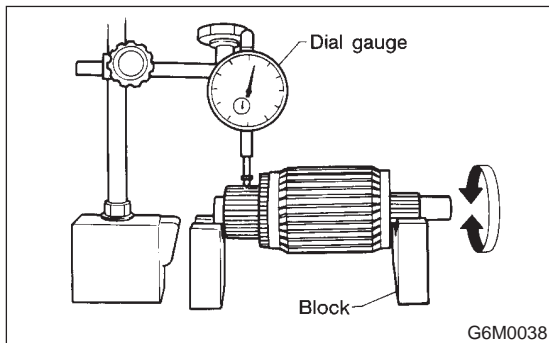
Commutator run-out:

Standard

0.02 mm (0.0008 in), or less

Service limit

Less than 0.05 mm (0.0020 in)



3) Depth of segment mold

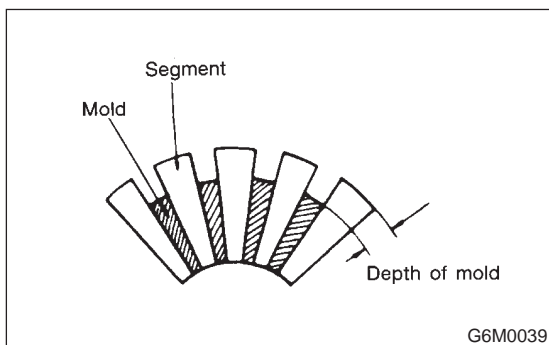
Check the depth of segment mold.

Depth of segment mold:

0.6 mm (0.024 in)

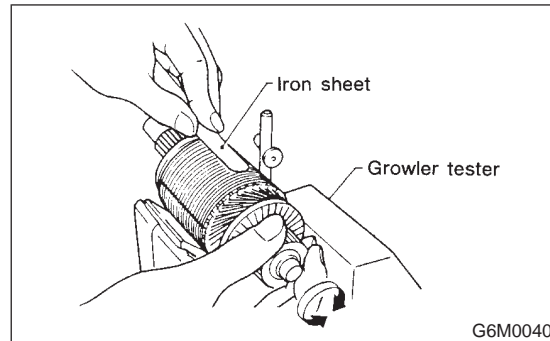
Limit

0.2 mm (0.008 in)



4) Armature short-circuit test

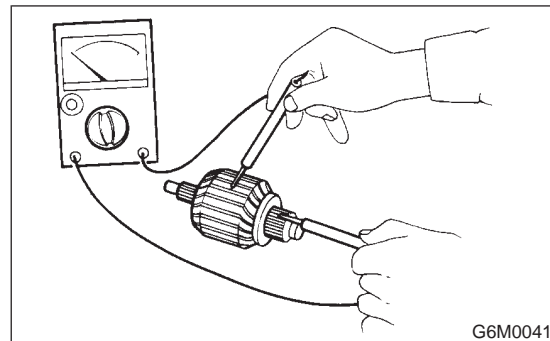
Check armature for short-circuit by placing it on growler tester. Hold a hacksaw blade against armature core while slowly rotating armature. A short-circuited armature will cause the blade to vibrate and to be attracted to core. If the hacksaw blade is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.



5) Armature ground test

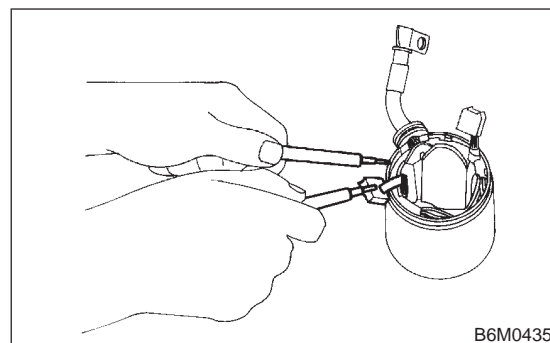
Using circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is a continuity, armature is grounded.

Replace armature if it is grounded.



2. YOKE S109012A1002

Make sure pole is set in position.



STARTER

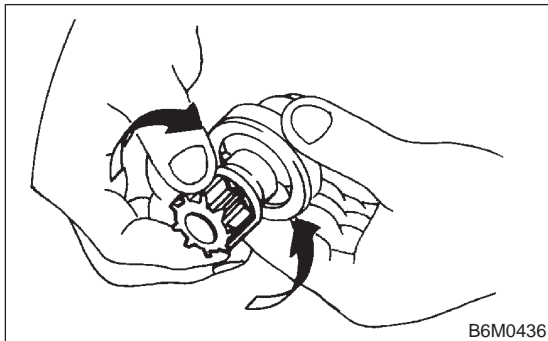
Starting/Charging Systems

3. OVERRUNNING CLUTCH S109012A1003

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 S109012A1004

1) Brush length

Measure the brush length and replace if it exceeds the service limit.

Replace if abnormal wear or cracks are noticed.

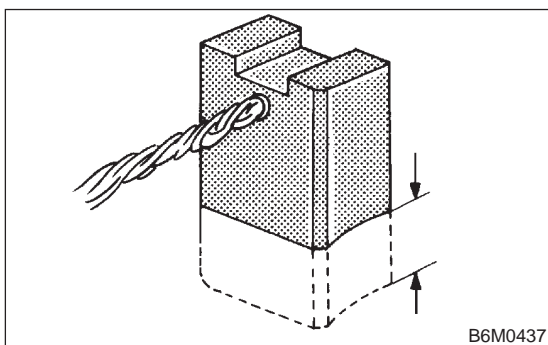
Brush length:

Standard

15 mm (0.59 in)

Service limit

10 mm (0.39 in)

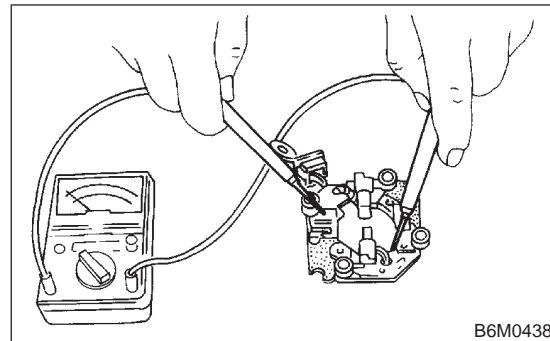


2) Brush movement

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 kg, 4.2 lb) (when new)

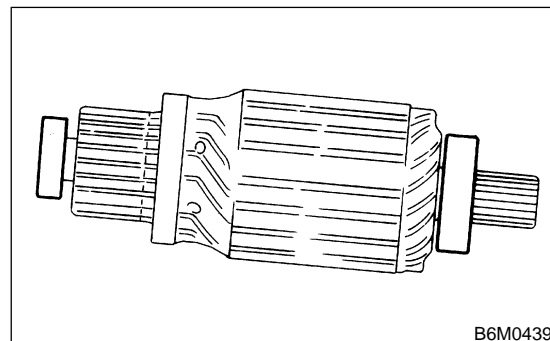
Service limit

6.9 N (0.7 kg, 1.5 lb)

5. BEARING S109012A1005

1) Rotate bearing by hand; no binding should exist.

2) Rotate bearing rapidly; no abnormal noise should be heard.



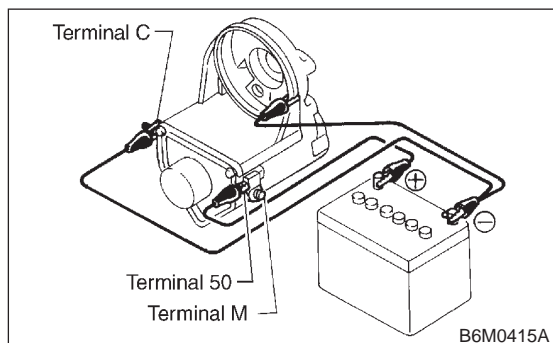
6. MAGNETIC SWITCH S109012A1006

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.

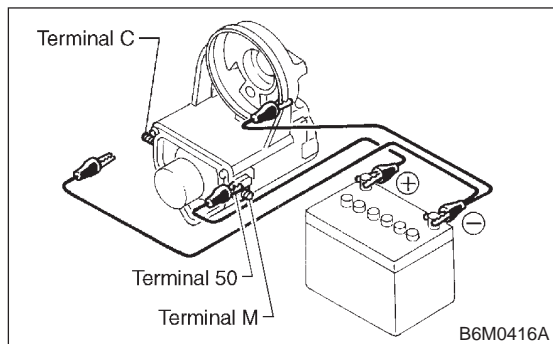
1) Pull-in test

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.



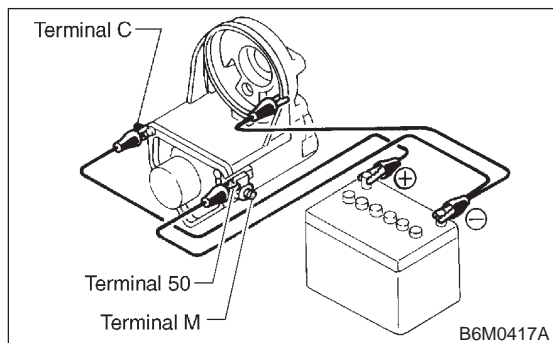
2) Holding-in test

Disconnect lead from terminal C with pinion extended. Pinion should be held in the extended position.



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.



fied capacity whenever testing the starter.

The starter should be checked for the following three items:

• No-load test

Measure the maximum rotating speed and current under a no-load state.

• Load test

Measure the magnitude of current needed to generate the specified torque and rotating speed.

• Stall test

Measure the torque and current when the armature is locked.

1) No-load test

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):

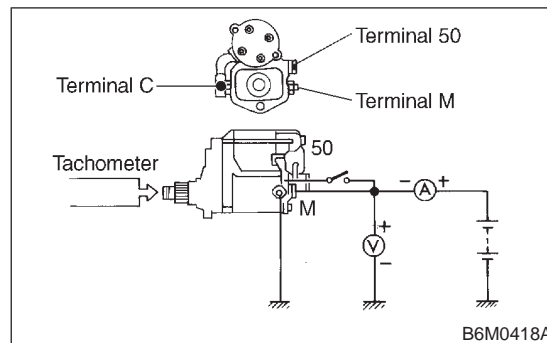
Voltage/Current

11 V/90 A, or more

Rotating speed

TN128000-8311: 3,000 rpm, or more

TN128000-8321: 3,350 rpm, or more



7. PERFORMANCE TEST S109012A1007

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 speci-

STARTER

Starting/Charging Systems

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.

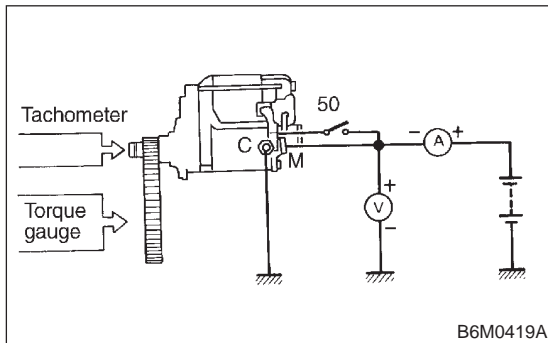
TN128000-8321

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



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.

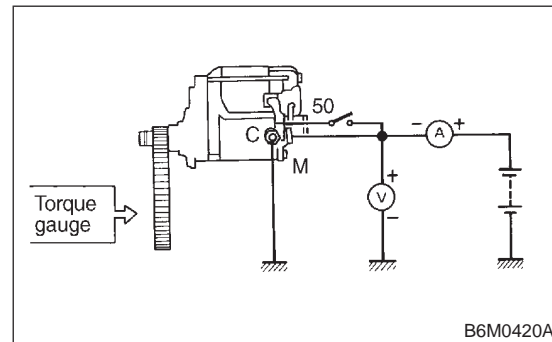
TN128000-8321

Voltage/Current

5 V/1,050 A, or less

Torque

27.5 N·m (2.8 kgf-m, 20.3 ft-lb) min.



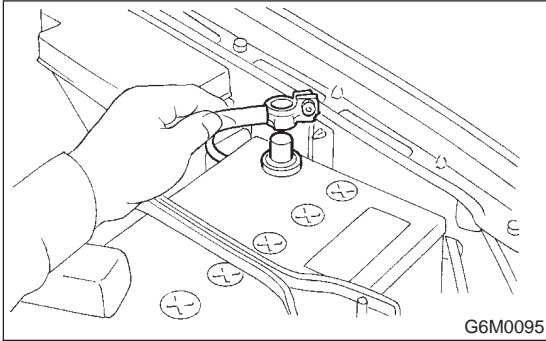
NOTE:

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.

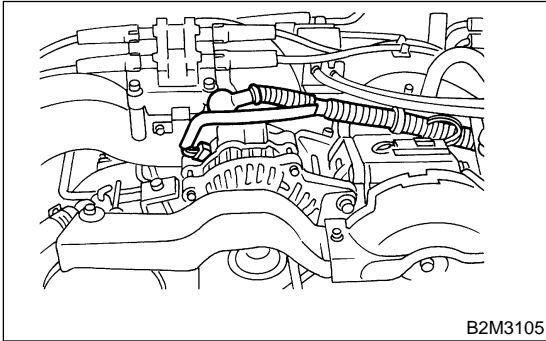
3. Generator S109008

A: REMOVAL S109008A18

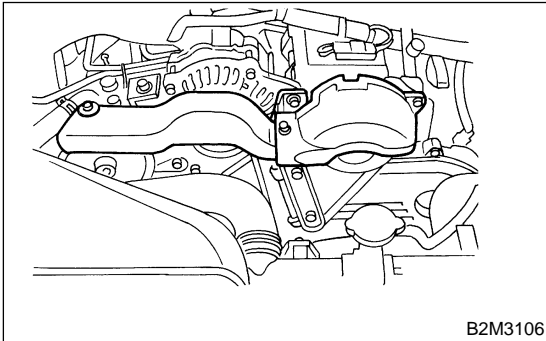
- 1) Disconnect battery ground cable.



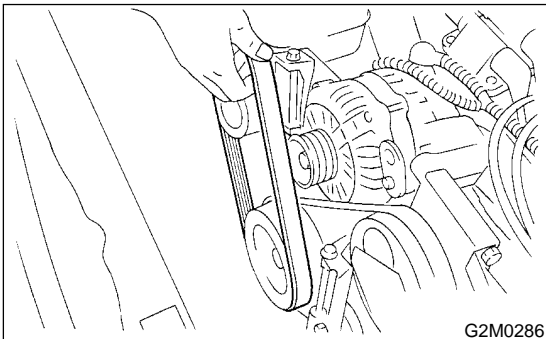
- 2) Disconnect connector and terminal from generator.



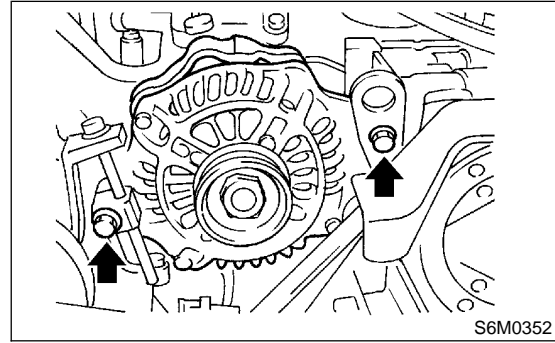
- 3) Remove V-belt cover.



- 4) Remove front side V-belt.



- 5) Remove bolts which install generator onto bracket.

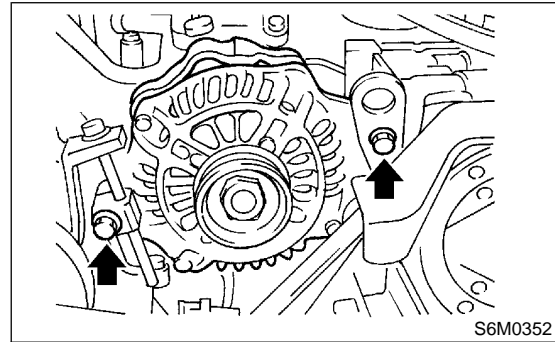


B: INSTALLATION S109008A11

Install in the reverse order of removal.

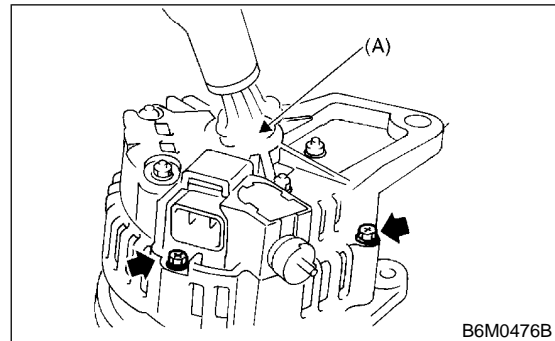
CAUTION:

Check and adjust V-belt tension. <Ref. to ME(H4)-43 INSPECTION, V-belt.>



C: DISASSEMBLY S109008A06

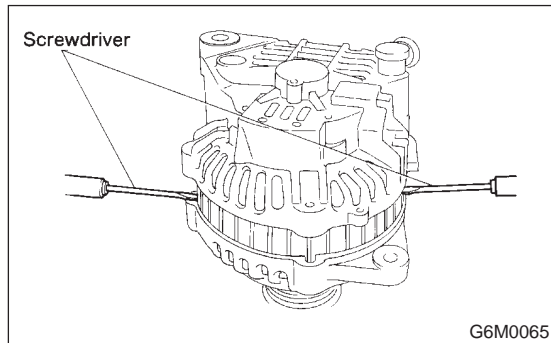
- 1) Heat the portion (A) of rear cover to 50°C (122°F) with heater drier.



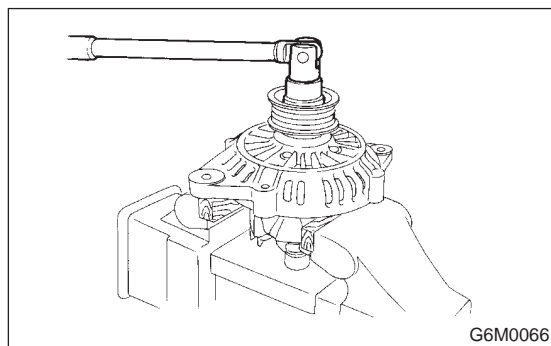
GENERATOR

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.

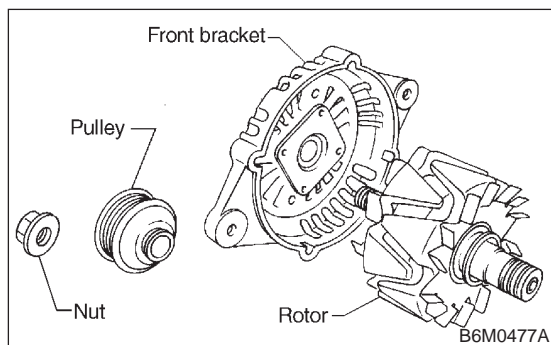


3) Hold rotor with a vise and remove pulley nut.



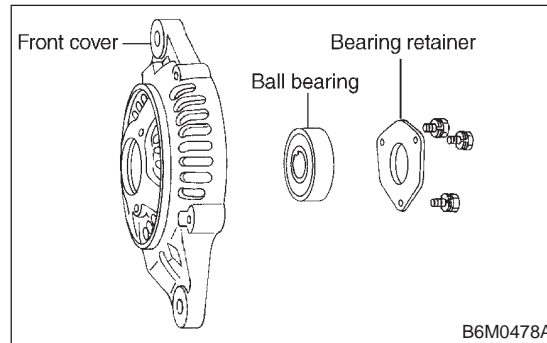
CAUTION:

When holding rotor with vise, insert aluminum plates or wood pieces on the contact surfaces of the vise to prevent rotor from damage.

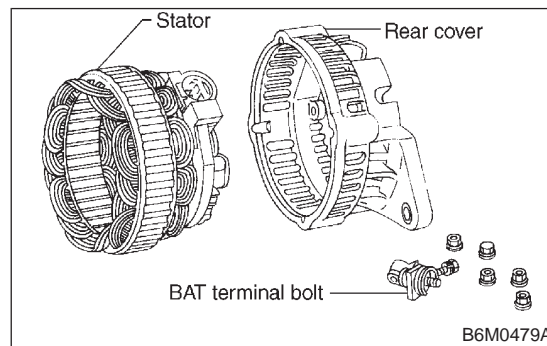


4) Remove rotor from front cover.

5) Remove three screws from front cover and then bearing retainer and ball bearing.



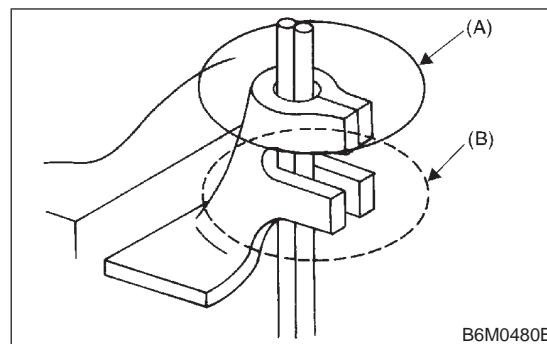
6) Remove bolt which secure battery terminal bolt, and remove rear cover. Remove nuts which secure diode plate, and remove stator and rear cover.



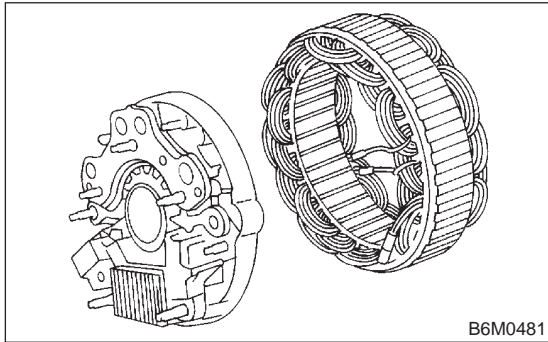
7) Separate diode plate from stator coil.

(1) Cut the connecting position (A) of stator coil to diode.

(2) Unsolder connection (B) and throughout the lead wire of stator coil.



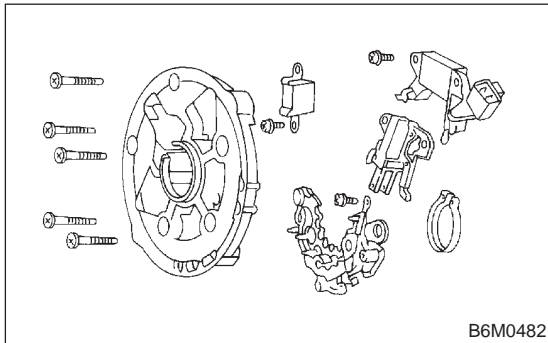
- (3) Remove stator coil from diode plate.



- 8) Remove bolts which secure IC regulator, diode and brush holder.

CAUTION:

Do not apply a shock or load to IC regulator cooling fins.



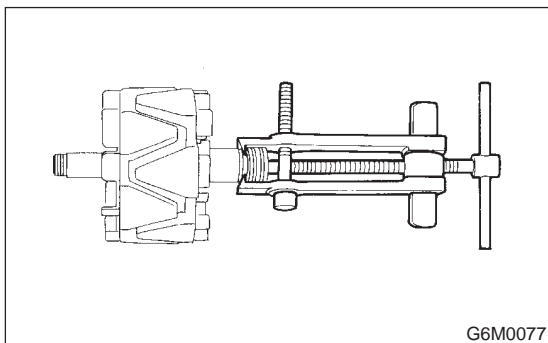
D: ASSEMBLY

S109008A02

Assemble in the reverse order of disassembly.

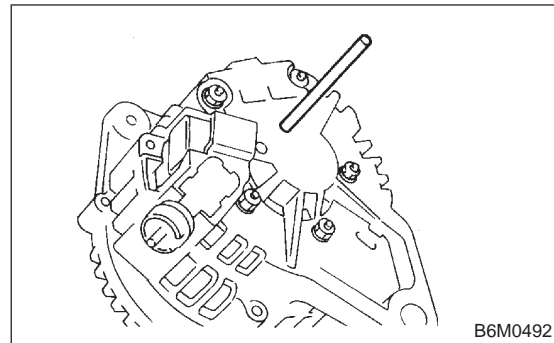
CAUTION:

- When disassembling generator, replace rear ball bearing.

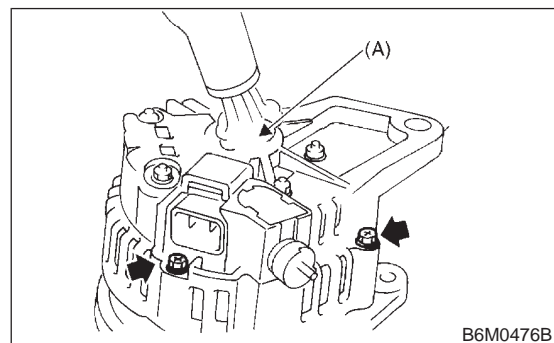


- When soldering starter coil to diode, do not touch lead wire with solder for more than 5 seconds.

- 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

S109008A10

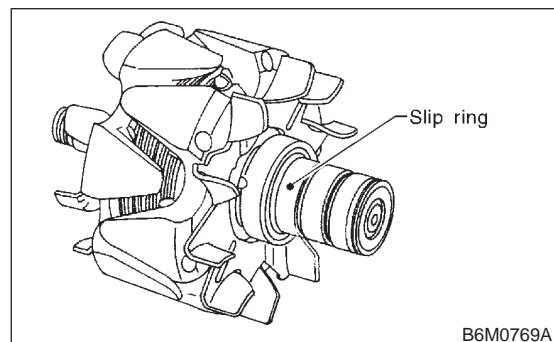
1. ROTOR

S109008A1001

- 1) Slip ring surface

Inspect slip rings 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.

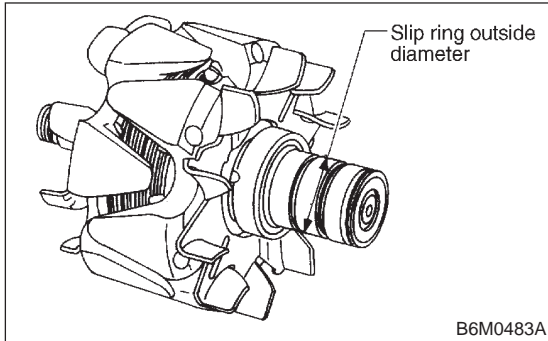
Slip ring outside diameter:

Standard

27 mm (1.06 in)

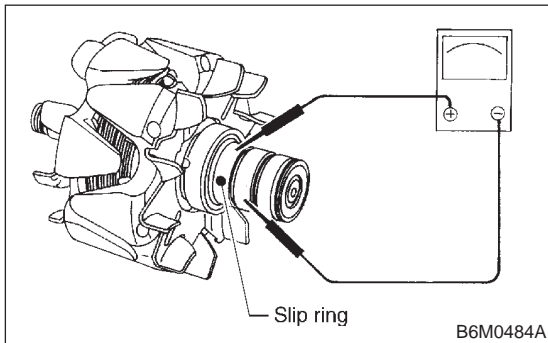
Limit

26 mm (1.02 in)



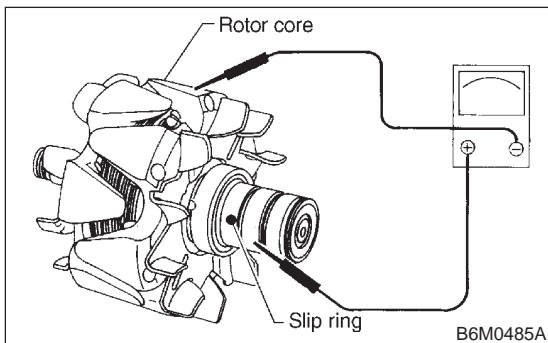
3) Continuity test

Check continuity between slip rings. If continuity does not exist, replace rotor.



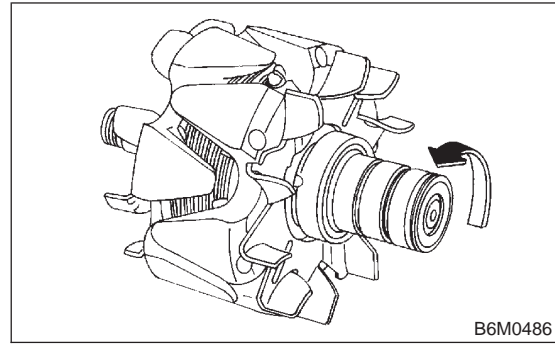
4) Insulation test

Check continuity between slip ring and rotor core or shaft. If continuity exists, replace rotor.



5) Ball bearing

Check rear ball bearing. Replace it if it is noisy or if rotor does not turn smoothly.

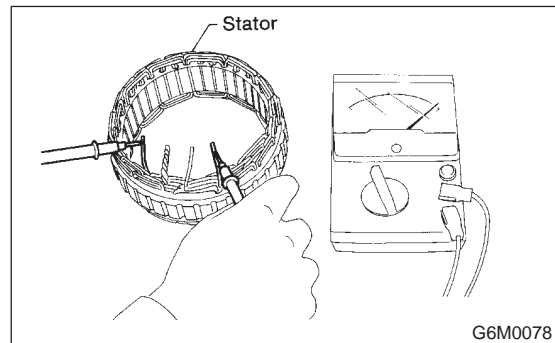


2. STATOR

S109008A1002

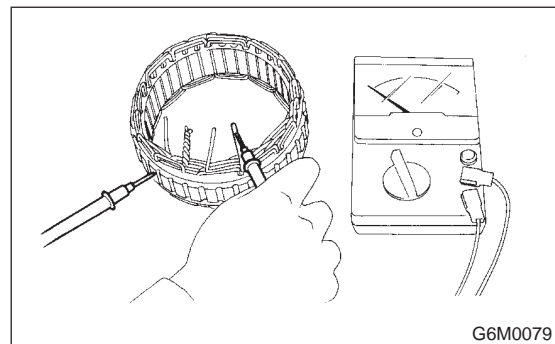
1) Continuity test

Inspect stator coil for continuity between its terminals. When there is no continuity 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, replace stator coil.



3. BRUSH S109008A1003

Measure brush length. If brush is worn, replace brush holder assembly.

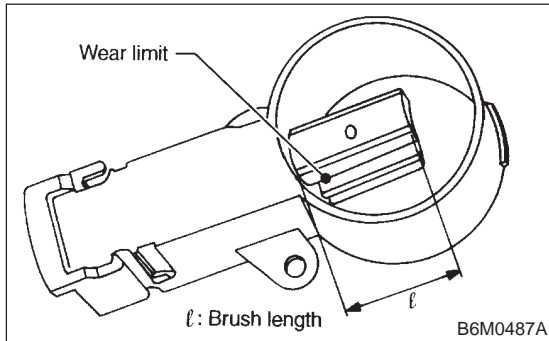
Brush length (ℓ):

Standard

20.5 mm (0.807 in)

Limit

1.5 mm (0.059 in)



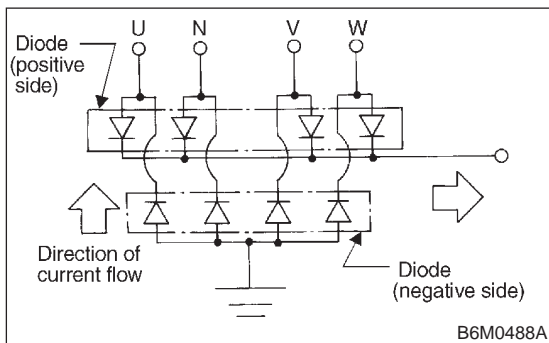
4. DIODE ASSEMBLY S109008A1004

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.

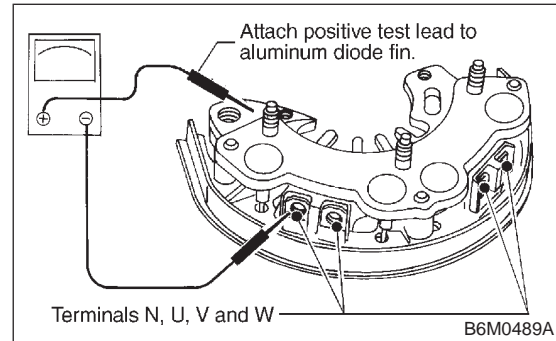
Check all diodes, for continuity. If any diode is faulty, replace diode assembly.



1) Diodes on “+” side

Continuity of proper diodes on “+” side

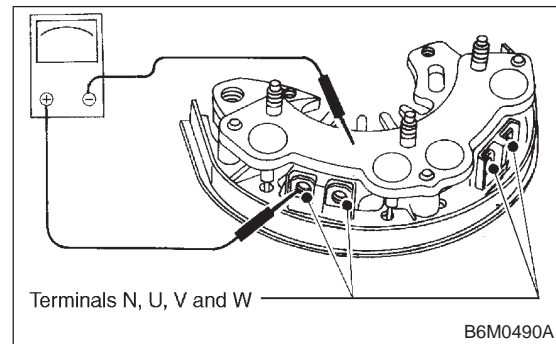
Terminal N, U, V and W	BAT side	
	(+)	(-)
(+)	—	Continuity must not exist.
(-)	Continuity must exist.	—



2) Diodes on “-” side

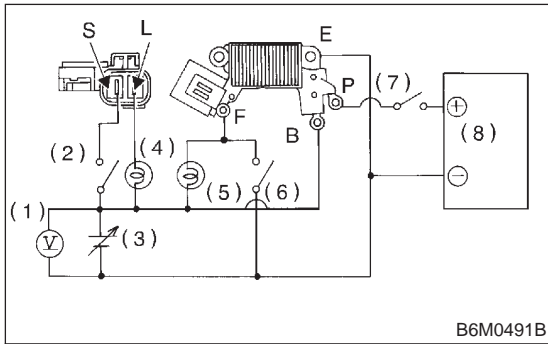
Continuity of proper diodes on “-” side

Terminal N, U, V and W	“E” side	
	(+)	(-)
(+)	—	Continuity must exist.
(-)	Continuity must not exist.	—



5. IC REGULATOR S109008A1005

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

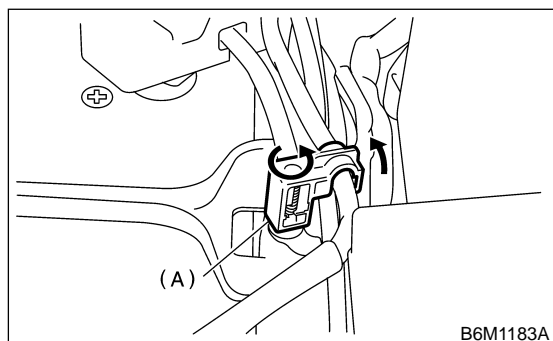
2) Check operation as shown in chart below.

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.

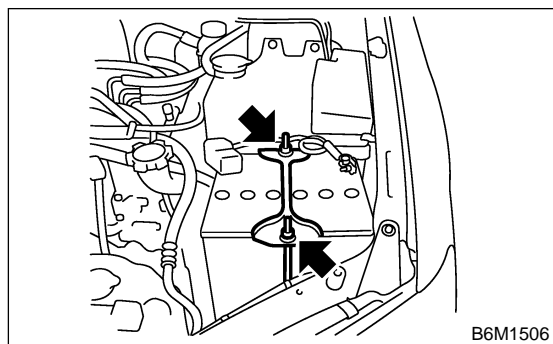
4. Battery S109011

A: REMOVAL S109011A18

- 1) Remove battery cable holder (A) from battery rod.



- 2) Disconnect the positive (+) terminal after disconnecting the negative (-) terminal of battery.
- 3) Remove flange nuts from battery rods and take off battery holder.



- 4) Remove battery.

B: INSTALLATION S109011A11

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 (+) terminal of battery and then the negative (-) terminal of the battery.

C: INSPECTION S109011A10

WARNING:

- Electrolyte has toxicity; be careful handling the fluid.
- Avoid contact with skin, eyes or clothing. Especially at contact with eyes, blush with water for 15 minutes and get prompt medical attention.
- Batteries produce explosive gasses. Keep sparks, flame, cigarettes away.
- Ventilate when charging or using in enclosed space.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. Never lean over a battery.
- Do not let 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: S109011A1001

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: S109011A1002

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: S109011A1003

- 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:

$$S_{20} = S_t + 0.0007 \times (t - 20)$$

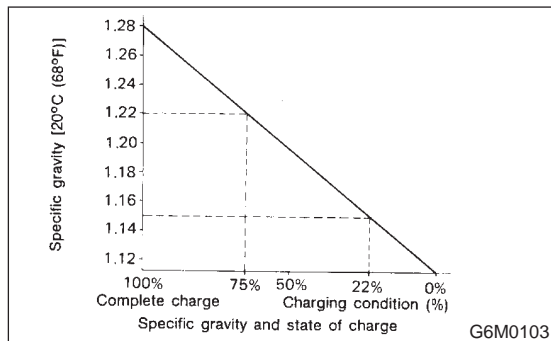
S_{20} : Specific gravity corrected at electrolyte temperature of 20°C

S_t : Measured specific gravity

t : Measured temperature (°C)

Determine whether or not battery must be charged, according to corrected specific gravity.

Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]



2) Measuring the specific gravity of the electrolyte in 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

S109011A14

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

S109011A1401

- 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

S109011A1402

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

S109011A1403

Charge the battery at current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING

S109011A1404

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:

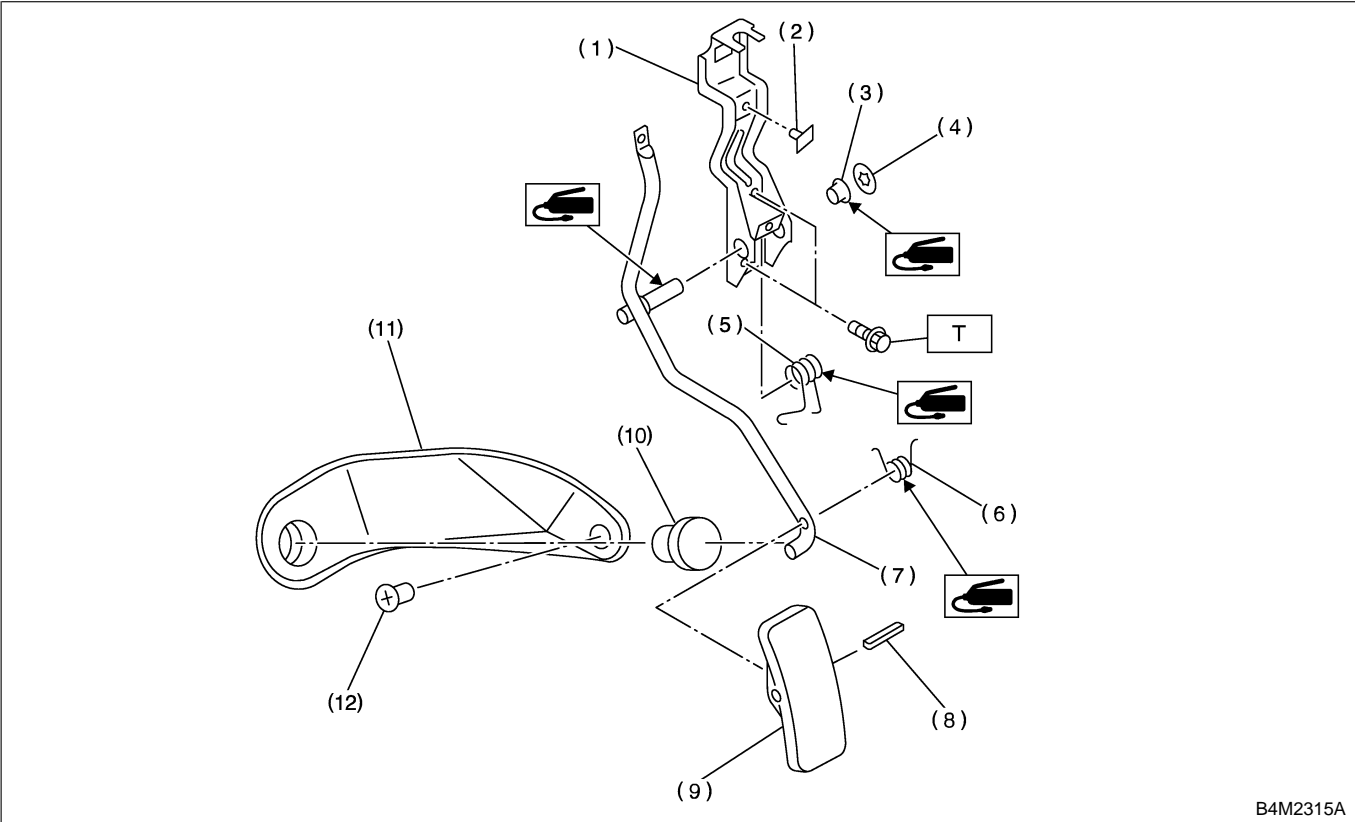
- Observe the items in 1. NORMAL CHARGING.
- Never use more than 10 amperes when charging the battery because that will shorten battery life.

1. General Description S107001

A: SPECIFICATION S107001E49

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 S107001A05



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 S107001A03

- 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 negative terminal from battery.

2. Accelerator Pedal

S107005

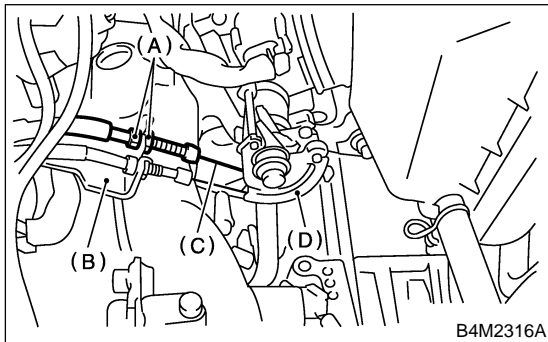
A: REMOVAL

S107005A18

- 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.

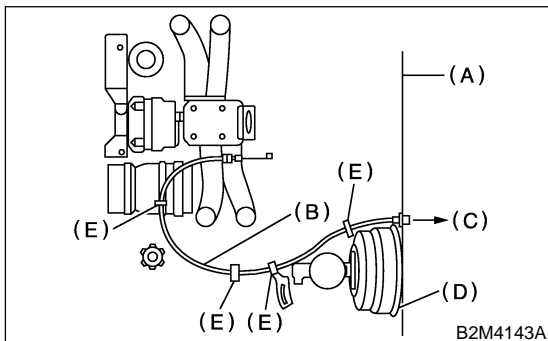
CAUTION:

Be careful not to kink accelerator cable.



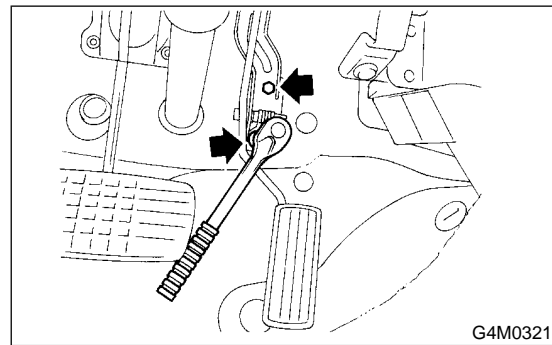
- (A) Lock nut
- (B) Accelerator cable bracket
- (C) Accelerator cable
- (D) Throttle cam

- 6) Remove clip inside engine compartment.



- (A) Toe board
- (B) Accelerator cable pedal
- (C) To accelerator
- (D) Brake booster
- (E) Clip

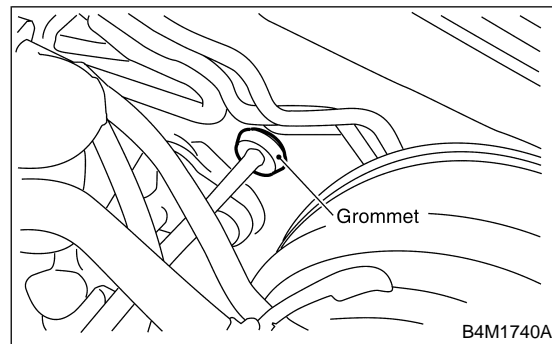
- 7) Remove instrument panel lower cover from instrument panel, and connector.
- 8) Remove brake and clutch pedal bracket. (MT model) <Ref. to BR-60 REMOVAL, Brake Pedal.>
- 9) Remove accelerator pedal connecting bolt from accelerator pedal bracket.



- 10) Disconnect grommet from toe board.

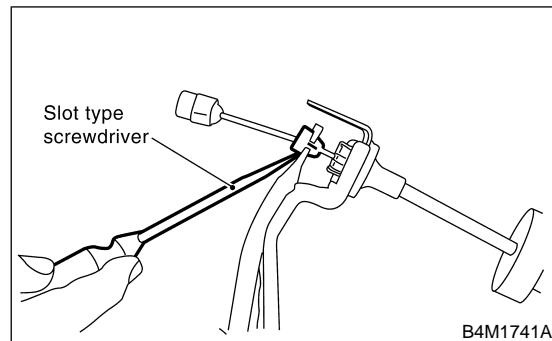
NOTE:

From inside compartment, push grommet into hole.

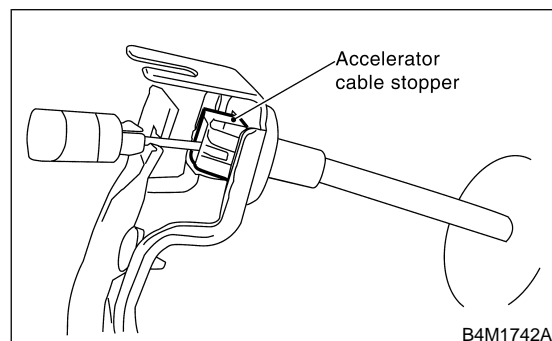


- 11) Pull out the cable from the toe board hole.

- 12) Disconnect accelerator cable bushing from accelerator pedal lever.



- 13) Disconnect accelerator cable stopper from bracket.



- 14) Separate accelerator cable and bracket.

ACCELERATOR PEDAL

Speed Control Systems

B: INSTALLATION

S107005A11

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.

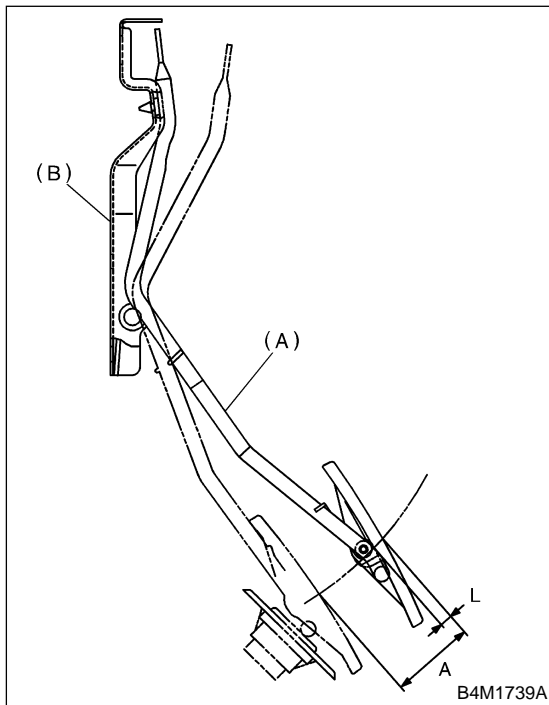
If it is not within specified value, adjust it by turning nut connecting accelerator cable to throttle body.

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
(B) Accelerator pedal bracket

Accelerator cable lock nut tightening torque:

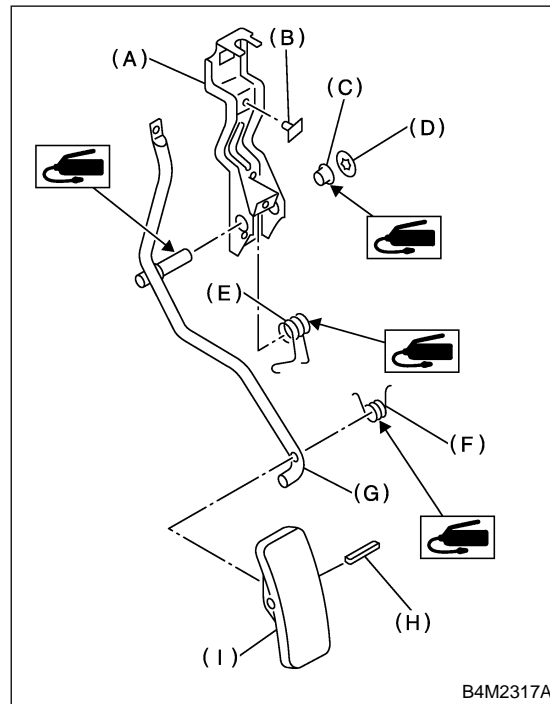
12 N·m (1.2 kgf-m, 9 ft-lb)

C: DISASSEMBLY

S107005A06

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

S107005A02

Assemble in the reverse order of disassembly.

CAUTION:

Clean and apply grease to spacer and inside bore of a accelerator pedal.

E: INSPECTION

S107005A10

Lightly move pedal pad in lateral the direction to ensure pedal deflection is in specified range.

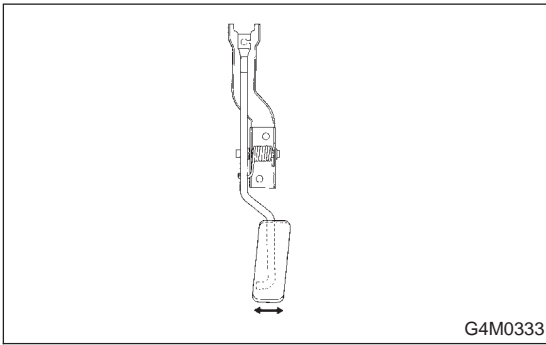
CAUTION:

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 S107007

A: REMOVAL S107007A18

- 1) Remove accelerator pedal. <Ref to SP(H4)-3 REMOVAL, Accelerator Pedal.>
- 2) Separate accelerator cable and accelerator pedal.

B: INSTALLATION S107007A11

- 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(H4)-4 INSTALLATION, Accelerator Pedal.>

C: INSPECTION S107007A10

- 1) Make sure the inner cable is not twisted or frayed.
- 2) Make sure the outer cable is not cracked.