1. General Description

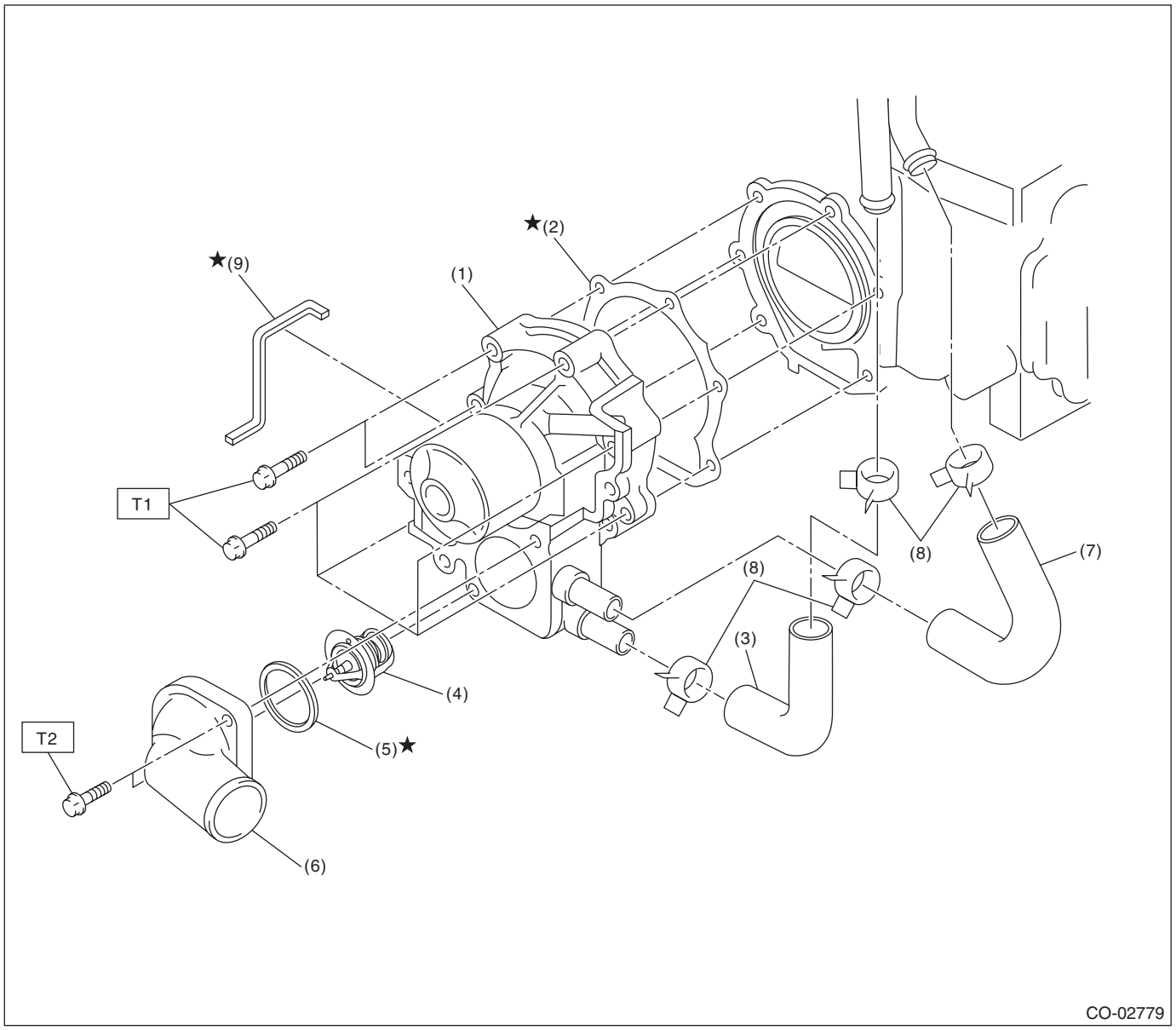
A: SPECIFICATION

Cooling system					Electric fan + Forced engine coolant circulation system
Total engine coolant capacity				L (US qt, Imp qt)	Approx. 7.7 (8.1, 6.8)
Water pump	Type				Centrifugal impeller type
	Discharge performance	Discharge rate		L (US gal, Imp gal)/min.	200 (52.8, 44.0)
		Pump speed — Discharge pressure			6,000 rpm — 225.4 kPa (23.0 mAq)
		Engine coolant temperature			80°C (176°F)
	Impeller diameter			mm (in)	76 (2.99)
	Number of impeller vanes				8
	Pump pulley diameter			mm (in)	60 (2.36)
	Clearance between impeller and pump case			mm (in) Standard	0.5 — 1.5 (0.020 — 0.059)
Thermostat	Type				Wax pellet type
	Starting temperature to open				76 — 80°C (169 — 176°F)
	Fully opens				91°C (196°F)
	Valve lift			mm (in)	9.0 (0.354) or more
	Valve bore			mm (in)	35 (1.38)
Radiator fan	Motor input	Main fan		W	120
		Sub fan		W	120
	Fan diameter / Blade	Main fan			318.5 mm (12.54 in)/9
		Sub fan			318.5 mm (12.54 in)/11
Radiator	Type				Down flow
	Core dimensions	Width × Height × Thickness		mm (in)	687.4 × 340 × 16 (27.06 × 13.39 × 0.63)
	Pressure range in which cap valve is open	Coolant filler tank side	Positive pressure side	Standard	93 — 123 (0.95 — 1.25, 14 — 18)
		kPa (kg/cm^2, psi)		Limit	83 (0.85, 12)
			Negative pressure side	Standard	–1.0 — –4.9 (–0.01 — –0.05, –0.1 — –0.7)
		Radiator side	Positive pressure side only	Standard	122 — 152 (1.24 — 1.55, 18 — 22)
		kPa (kg/cm^2, psi)		Limit	112 (1.14, 16)
	Fins				Corrugated fin type
Reservoir tank	Capacity			L (US qt, Imp qt)	0.45 (0.48, 0.40)

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

B: COMPONENT

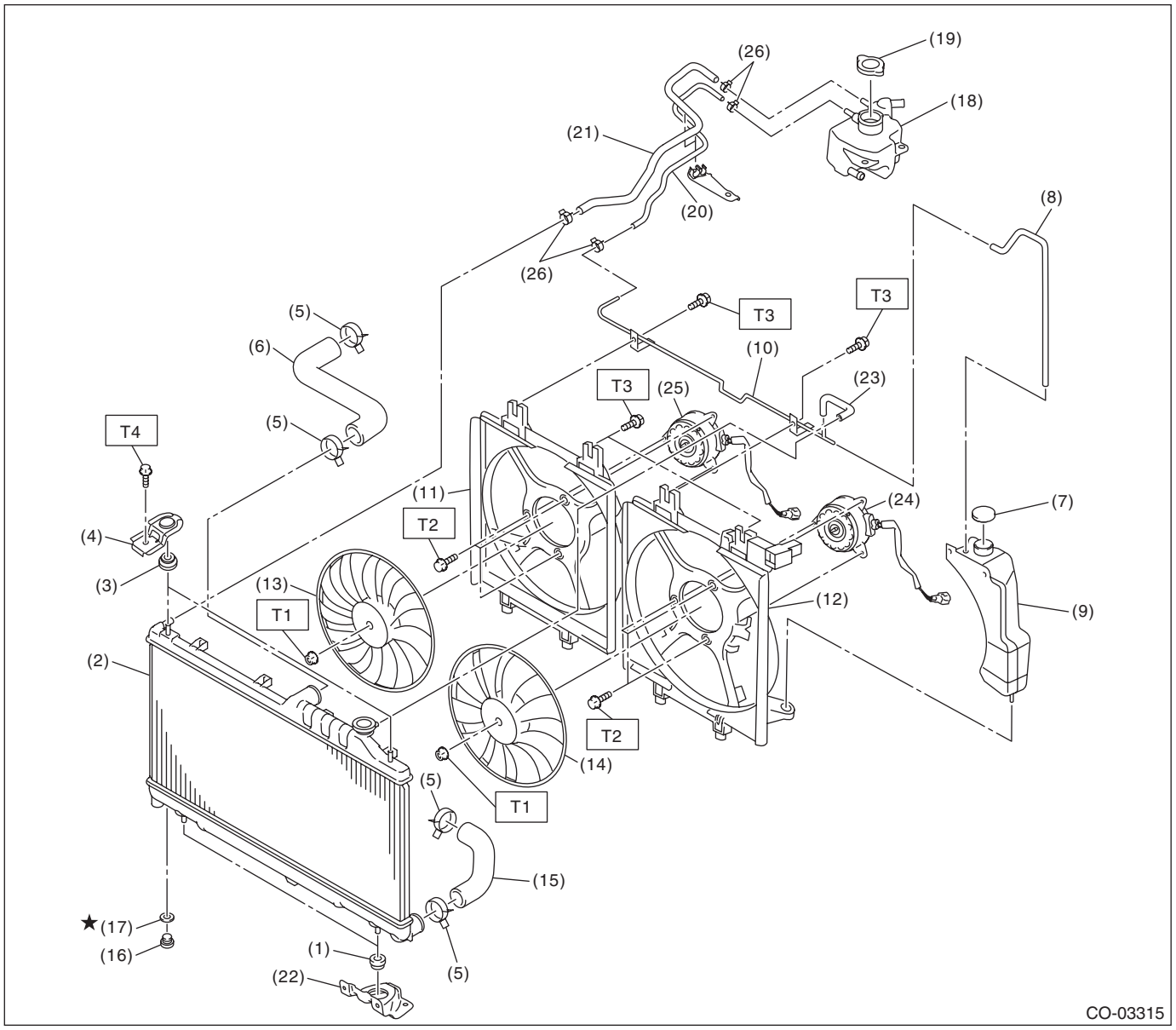
1. WATER PUMP



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

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

2. RADIATOR AND RADIATOR FAN



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

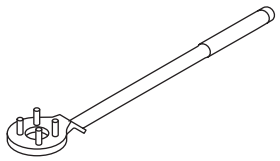
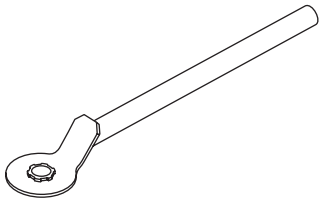
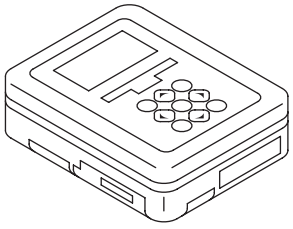
Tightening torque: N·m (kgf-m, ft-lb)
T1: 3.4 (0.3, 2.5)
T2: 4.41 (0.45, 3.25)
T3: 7.5 (0.8, 5.5)
T4: 12 (1.2, 8.9)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- Follow all government and local regulations concerning disposal of refuse when disposing engine coolant.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for removing and installing the crank pulley.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket and exhaust cam sprocket.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

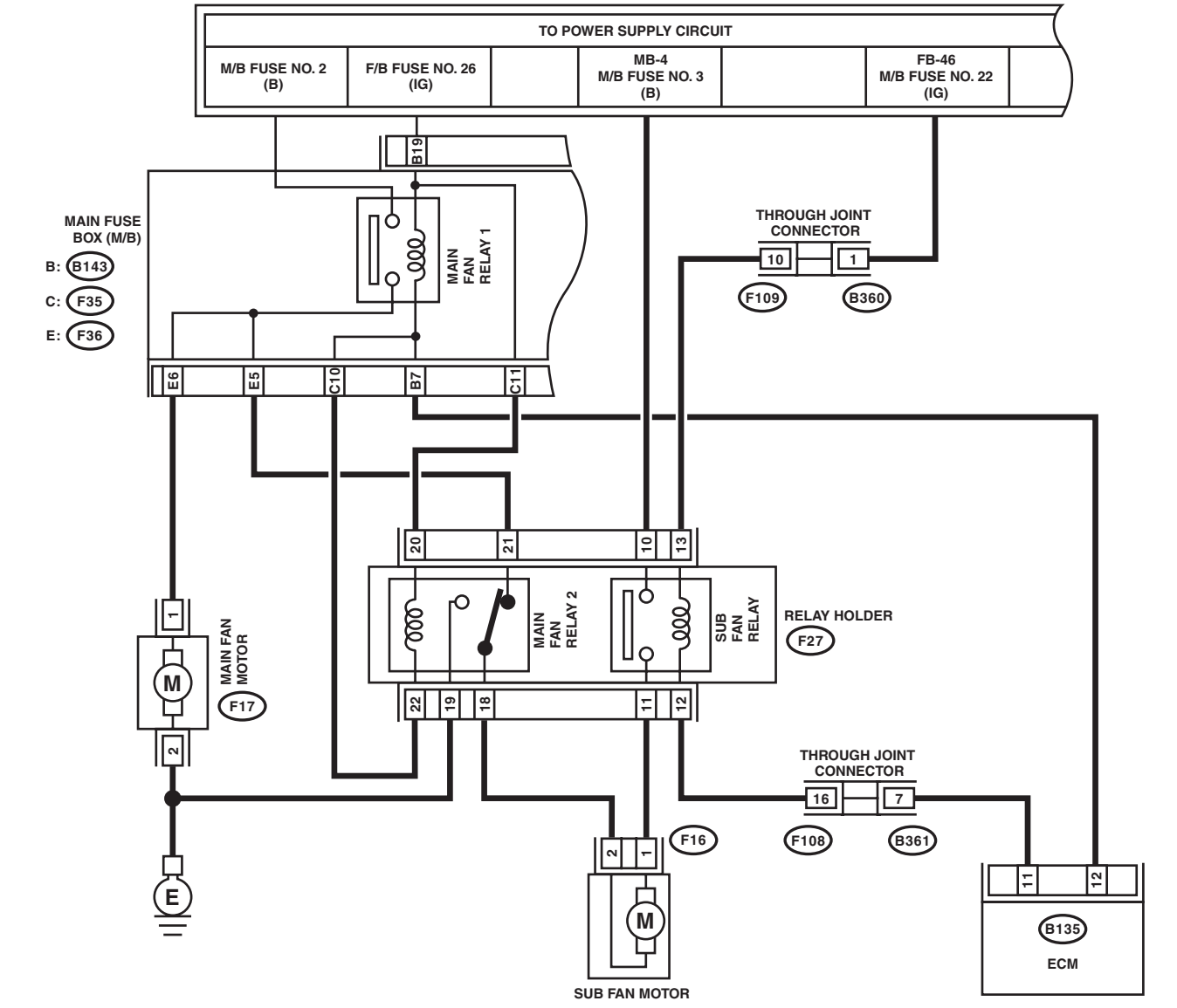
2. GENERAL TOOL

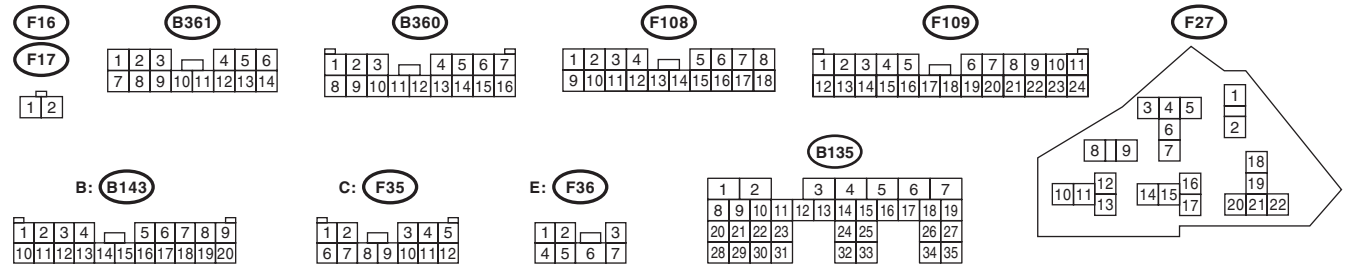
TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Radiator cap tester	Used for checking radiator and radiator cap.

2. Radiator Fan System

A: WIRING DIAGRAM

Radiator Fan System <Ref. to WI-64, WIRING DIAGRAM, Radiator Fan System.>





CO-02773

B: INSPECTION

OPERATING CONDITION:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 89°C (192°F) or less Decrease: 87°C (189°F) or less	Increase: 90 — 95°C (194 — 203°F) Decrease: 88 — 90°C (190 — 194°F)	Increase: 96°C (205°F) or more Decrease: 91°C (196°F) or more
		Radiator fan operation	Radiator fan operation	Radiator fan operation
During acceleration: 19 km/h (12 MPH) or less During deceleration: 10 km/h (6 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 20 — 69 km/h (12 — 43 MPH) During deceleration: 11 — 64 km/h (7 — 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 70 — 105 km/h (43 — 65 MPH) During deceleration: 65 — 100 km/h (40 — 62 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 106 km/h (66 MPH) or more During deceleration: 101 km/h (63 MPH) or more	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed

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

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to "Compulsory Valve Operation Check Mode" for detailed procedures. <Ref. to EN(H4DOTC)(diag)-64, Compulsory Valve Operation Check Mode.>	Do the radiator main fans and radiator sub fans rotate at low speed?	Go to step **2**.	Go to step **3**.
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to "Compulsory Valve Operation Check Mode" for detailed procedures. <Ref. to EN(H4DOTC)(diag)-64, Compulsory Valve Operation Check Mode.>	Do the radiator main fans and radiator sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step **27**.
3	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from the relay holder. 3) Measure the voltage between sub fan relay connector and chassis ground. ***Connector & terminal*** ***(F27) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Go to step **5**.
4	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between sub fan relay connector and chassis ground. ***Connector & terminal*** ***(F27) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **7**.	Go to step **6**.
5	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.

	Step	Check	Yes	No
6	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
7	**CHECK SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 10 — No. 11:***	Is the resistance 1 MΩ or more?	Go to step **8**.	Replace the sub fan relay.
8	**CHECK SUB FAN RELAY.** 1) Connect the battery to terminals No. 13 and No. 12 of the sub fan relay. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 10 — No. 11:***	Is the resistance less than 1 Ω?	Go to step **9**.	Replace the sub fan relay.
9	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between sub fan relay connector and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 11:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between sub fan relay connector and sub fan motor connector.
10	**CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.** 1) Remove main fan relay 2 from the relay holder. 2) Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 18:***	Is the resistance less than 1 Ω?	Go to step **11**.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
11	**CHECK FOR POOR CONTACT.** Check poor contact of sub fan motor connector.	Is there poor contact of the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step **12**.
12	**CHECK SUB FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator sub fan rotate?	Go to step **13**.	Replace the sub fan motor.
13	**CHECK MAIN FAN RELAY 2.** Measure the resistance between main fan relay 2 terminals. ***Terminals*** ***No. 21 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **14**.	Replace the main fan relay 2.
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F27) No. 21:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit of the harness between main fan relay 2 connector and main fan motor connector.

	Step	Check	Yes	No
15	**CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.** Measure the resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **16**.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
16	**CHECK FOR POOR CONTACT.** Check poor contact of main fan motor connector.	Is there poor contact of the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step **17**.
17	**CHECK MAIN FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator main fan rotate?	Go to step **18**.	Replace the main fan motor.
18	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the sub fan relay connector and ECM connector. ***Connector & terminal*** ***(B135) No. 11 — (F27) No. 12:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the open circuit of harness between sub fan relay connector and ECM.
19	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-48, Read Diagnostic Trouble Code (DTC).>
20	**CHECK MAIN FAN RELAY 1.** 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step **21**.	Replace the main fan relay 1.
21	**CHECK MAIN FAN RELAY 1.** 1) Connect the main fan relay 1 coil side terminal to the battery. 2) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the main fan relay 1.
22	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F36) No. 6:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of the harness between main fan relay 1 connector and main fan motor connector.
23	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the main fan relay 1 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (B143) No. 7:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit of the harness between main fan relay 1 connector and ECM.

	Step	Check	Yes	No
24	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND ECM.** Measure the resistance between the main fan relay 2 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (F27) No. 22:***	Is the resistance less than 1 Ω?	Go to step **25**.	Repair the open circuit of the harness between main fan relay 2 connector and ECM.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and No. 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **26**.
26	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Repair the power supply circuit to the main fuse box.
27	**CHECK OPERATION OF RADIATOR FAN.** If the both fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating.	Does the radiator sub fan rotate?	Go to step **20**.	Go to step **28**.
28	**CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.** 1) Remove main fan relay 2 from the relay holder. 2) Measure the resistance between main fan relay 2 connector and chassis ground. ***Connector & terminal*** ***(F27) No. 19 — Chassis ground:***	Is the resistance less than 1 Ω?	Go to step **29**.	Repair the open circuit of harness between main fan relay 2 connector and chassis ground.
29	**CHECK POWER SUPPLY TO MAIN FAN RELAY 2.** 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 connector and chassis ground. ***Connector & terminal*** ***(F27) No. 20 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **30**.	Repair the power supply line.
30	**CHECK MAIN FAN RELAY 2.** 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance 1 MΩ or more?	Go to step **31**.	Replace the main fan relay 2.
31	**CHECK MAIN FAN RELAY 2.** 1) Connect the battery to terminals No. 20 and No. 22 of the main fan relay 2. 2) Measure the resistance between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance less than 1 Ω?	Go to step **23**.	Replace the main fan relay 2.

3. Engine Coolant

A: INSPECTION

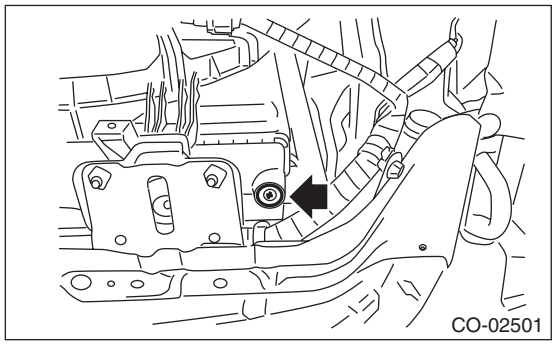
NOTE:
When adding the engine coolant, always use SUBARU Super Coolant.
1) Park the vehicle on a level surface.
2) Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
(1) Make sure the engine coolant level in the reservoir tank is between “FULL” and “LOW” with the engine in a cold condition.
(2) Open the cap of coolant filler tank, and check that the engine coolant is filled up to the filler neck position.

B: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Remove the drain plug to drain engine coolant into container.

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



4) Install the drain plug.

NOTE:
Use new O-rings.
5) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>

2. FILLING OF ENGINE COOLANT

1) Pour cooling system conditioner through the filler neck of coolant filler tank.

Cooling system protective agent:
Refer to “SPECIFICATION” for cooling system protective agent. <Ref. to CO(STI)-2, SPECIFICATION, General Description.>
2) Fill the engine coolant into coolant filler tank up to the filler neck position.

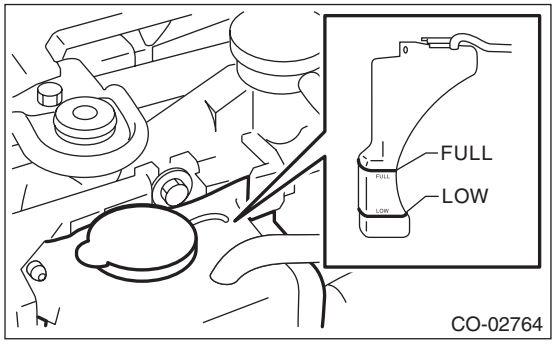
Recommended engine coolant:
Refer to “SPECIFICATION” for recommended engine coolant. <Ref. to CO(STI)-2, SPECIFICATION, General Description.>

Engine coolant level:
Refer to “SPECIFICATION” for engine coolant level. <Ref. to CO(STI)-2, SPECIFICATION, General Description.>

Engine coolant concentration:
Refer to “ADJUSTMENT” for the recommended engine coolant concentration. <Ref. to CO(STI)-14, ADJUSTMENT, Engine Coolant.>

CAUTION:
Do not confuse the cap of coolant filler tank and cap of radiator.

NOTE:
• When pouring the engine coolant, the radiator side cap must not be removed.
• The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to use SUBARU Super Coolant, since other coolant may cause corrosion.
3) Fill engine coolant into the reservoir tank up to “FULL” level.



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

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

C: ADJUSTMENT

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

CAUTION:
Use the Subaru Super Coolant with a 50 — 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.
To adjust the concentration of Subaru Super Coolant according to temperature, select the proper Subaru Super Coolant concentration from the table, and add the amount of diluting water corresponding to the required concentration to the Subaru Super Coolant (concentrated type).

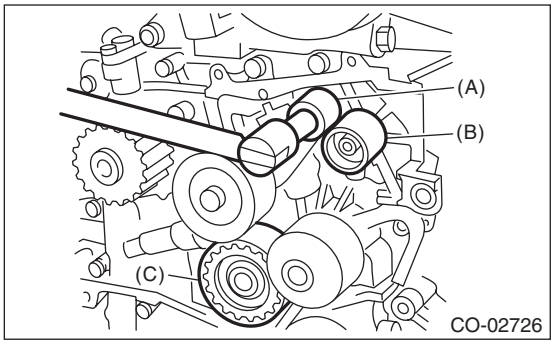
Relationship of Subaru Super Coolant concentration and freezing temperature			
Subaru Super Coolant concentration	50%	55%	60%
Freezing temp.	–36°C (–33°F)	–41°C (–42°F)	–50°C (–58°F)

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

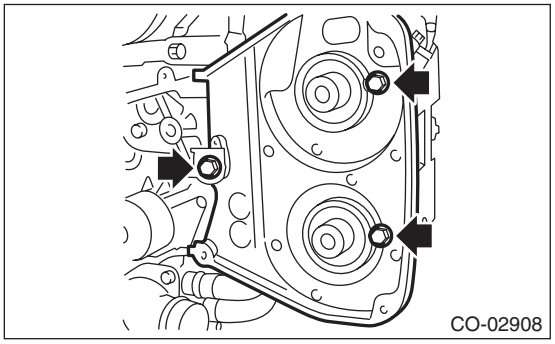
4. Water Pump

A: REMOVAL

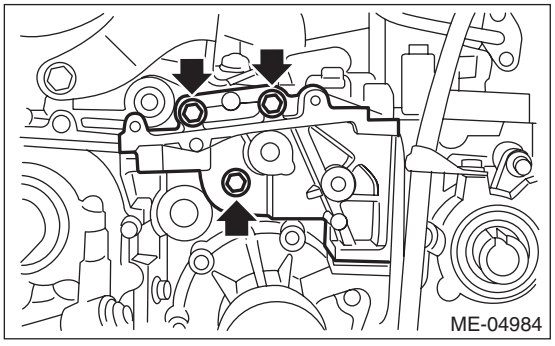
1) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.>
2) Remove the V-belts. <Ref. to ME(STI)-40, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
6) Remove the automatic belt tension adjuster (A).
7) Remove the belt idler (B).
8) Remove the belt idler No. 2 (C).



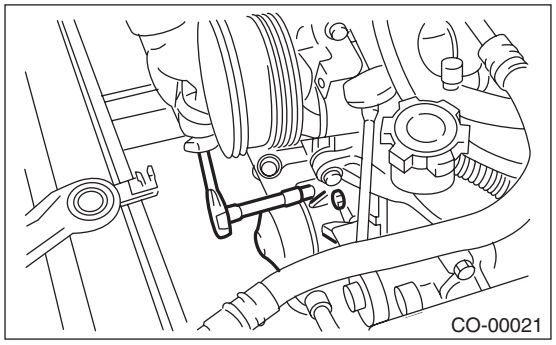
9) Remove the cam sprocket LH. <Ref. to ME(STI)-59, REMOVAL, Cam Sprocket.>
10) Remove the belt cover No. 2 LH.



11) Remove the tensioner bracket.



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

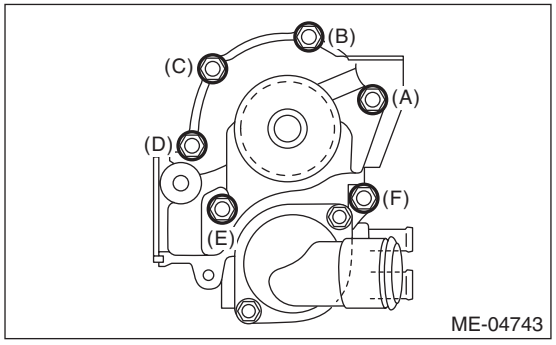


B: INSTALLATION

1) Install the water pump onto cylinder block LH.

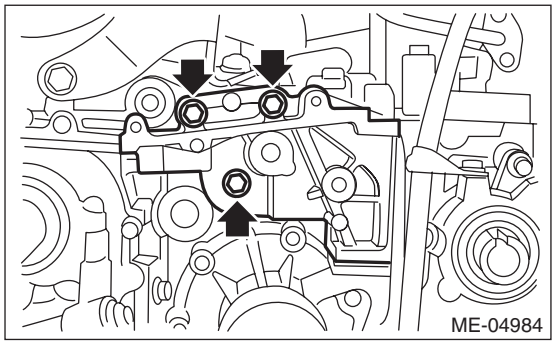
NOTE:
- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

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



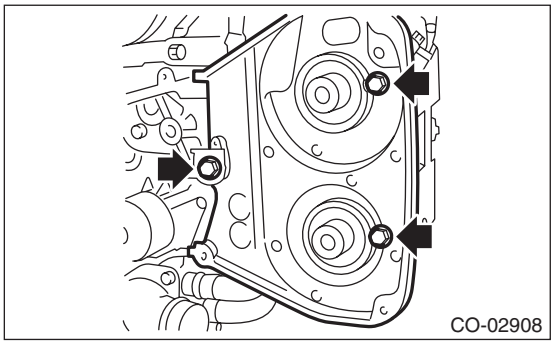
2) Install the hose to water pump.
3) Install the tensioner bracket.

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



4) Install the belt cover No. 2 LH.

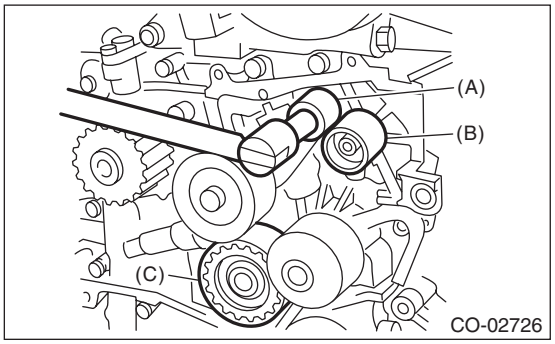
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



5) Install the cam sprocket LH. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>
6) Install the belt idler No. 2 (C).

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)
7) Install the belt idler (B).

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)
8) Install the automatic belt tension adjuster (A) with the tension rod held by a pin. <Ref. to ME(STI)-52, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

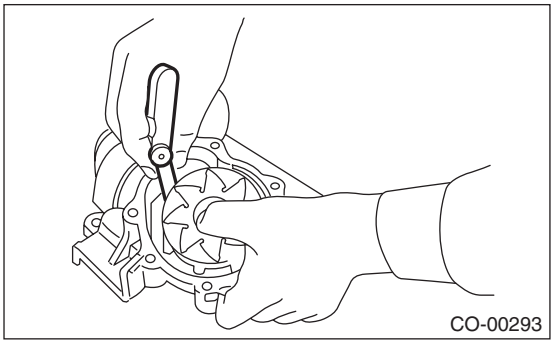


9) Install the timing belt. <Ref. to ME(STI)-53, TIMING BELT, INSTALLATION, Timing Belt.>
10) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
11) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>
12) Install the V-belts. <Ref. to ME(STI)-40, INSTALLATION, V-belt.>
13) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.>

C: INSPECTION

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

Clearance between impeller and pump case:
Standard
0.5 — 1.5 mm (0.020 — 0.059 in)

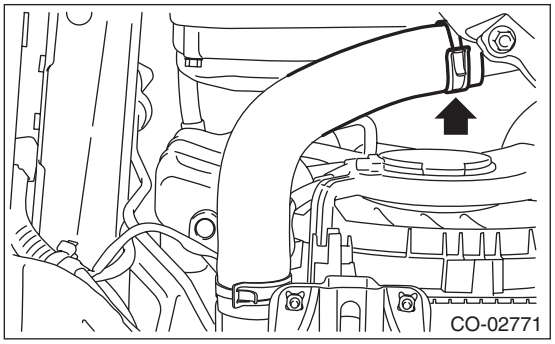


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

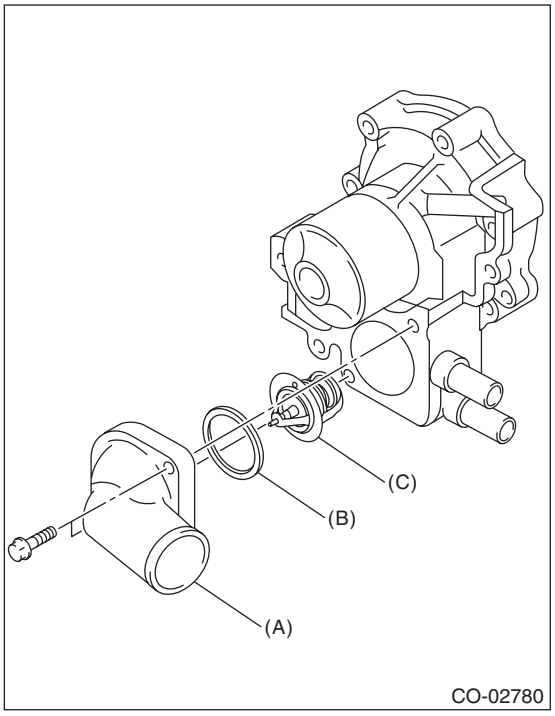
5. Thermostat

A: REMOVAL

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the radiator outlet hose from thermostat cover.



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



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

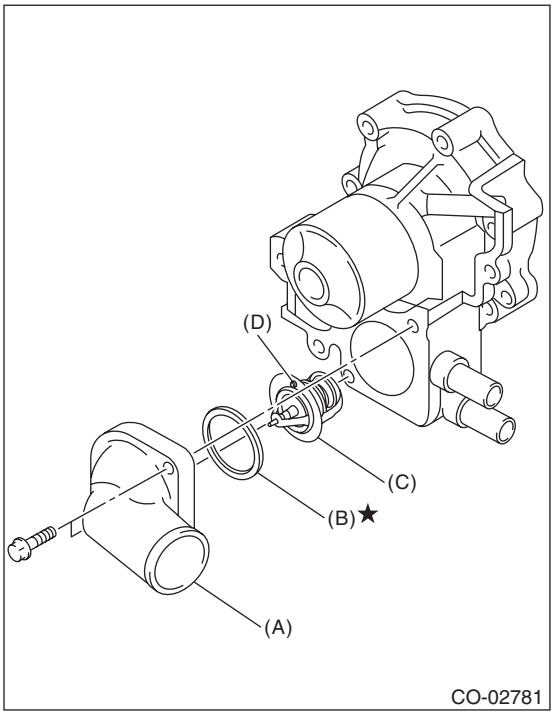
B: INSTALLATION

1) Install a gasket to thermostat.

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

NOTE:
Install the parts with the jiggle pin facing upward.

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



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

3) Connect the radiator outlet hose to thermostat cover.
4) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

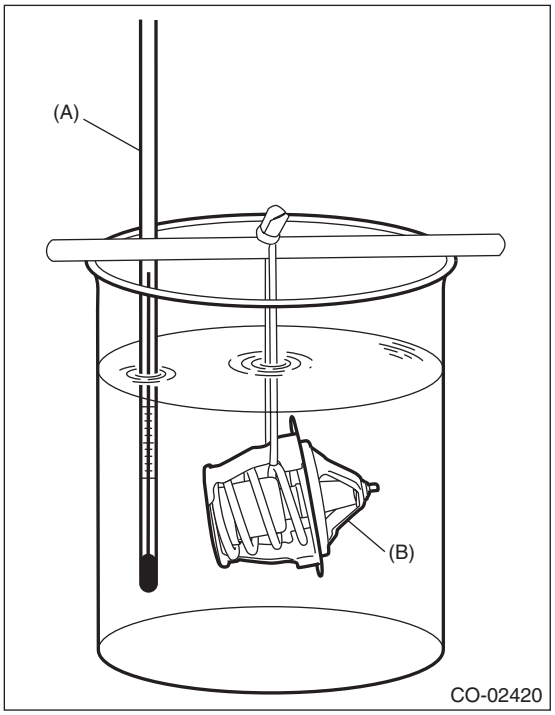
1) Check that the thermostat does not have deformation, cracks or damage.
2) Check that the thermostat valve closes completely at an ambient temperature.
3) Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins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

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

Starting temperature to open:
76 — 80°C (169 — 176°F)

Full open temperature:
91°C (196°F)

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



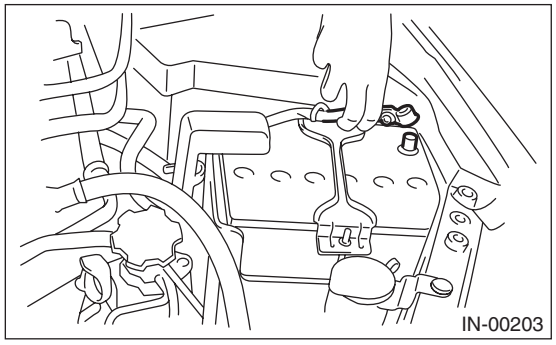
(A) Thermometer
(B) Thermostat

6. Radiator

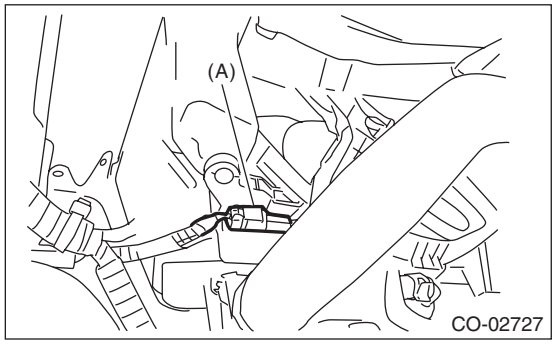
A: REMOVAL

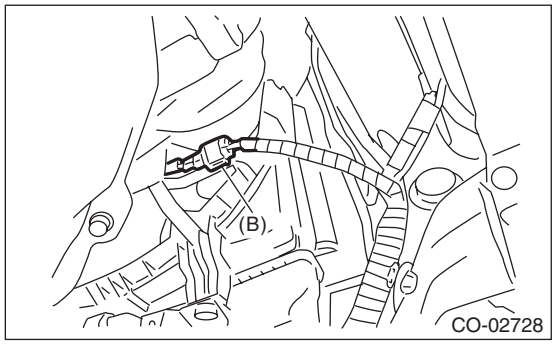
CAUTION:
The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.

1) Disconnect the ground cable from battery.

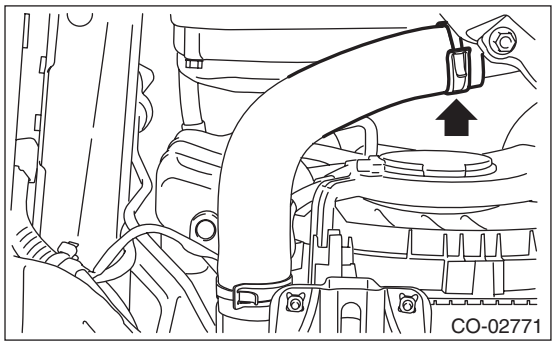


2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect the connector (A) from the main fan motor and the connector (B) from the sub fan motor.

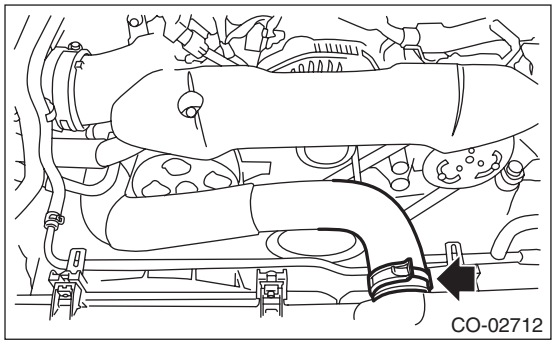




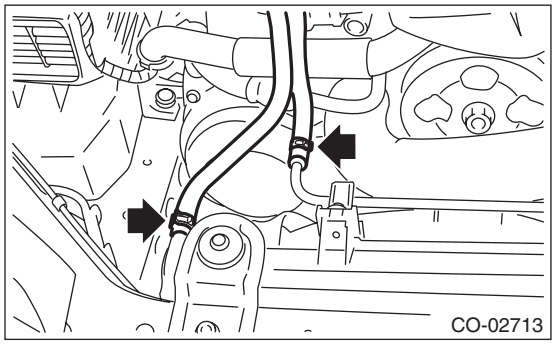
6) Disconnect the radiator outlet hose from thermostat cover.



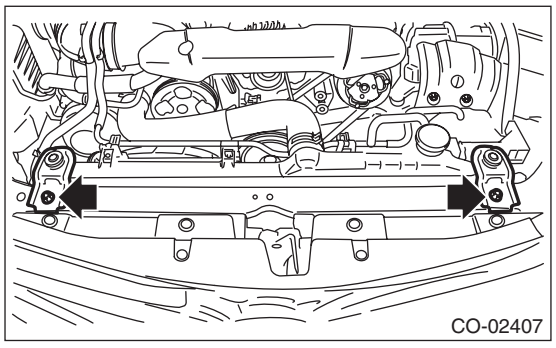
7) Lower the vehicle.
8) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
9) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
10) Disconnect the radiator inlet hose from the radiator.



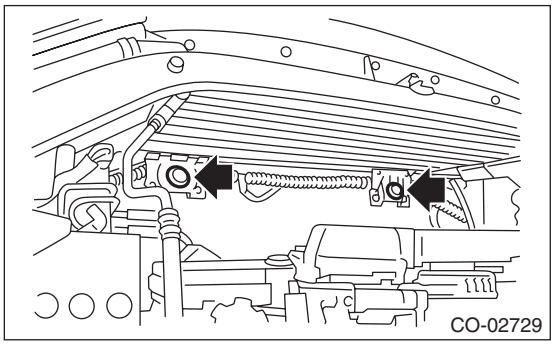
11) Disconnect the two engine coolant hoses from the radiator and over flow pipe.



12) Remove the radiator upper brackets.

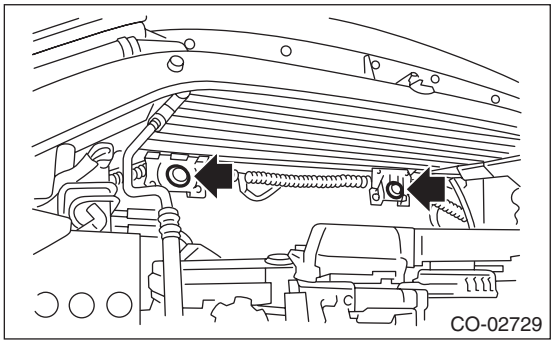


13) Move the radiator to the left while lifting it upward.
14) Lift the radiator up and remove the radiator from vehicle.
15) Remove the radiator lower cushion from the radiator lower bracket.



B: INSTALLATION

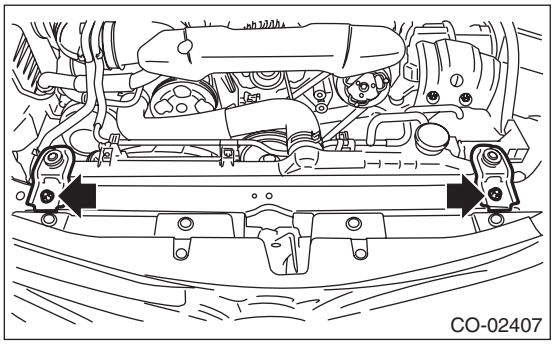
1) Attach the radiator lower cushion to the radiator lower bracket.



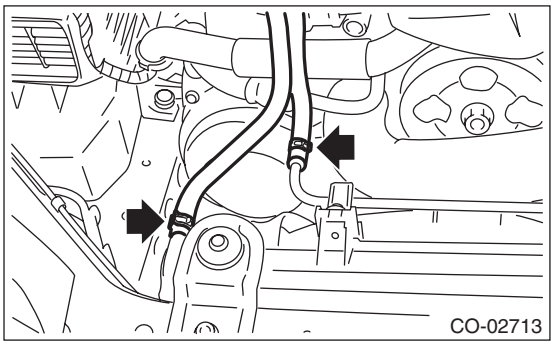
2) Install the radiator to vehicle.

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

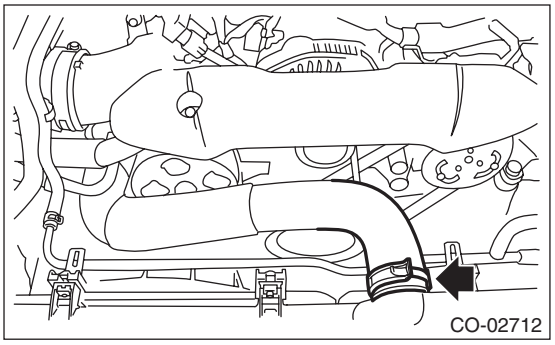
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



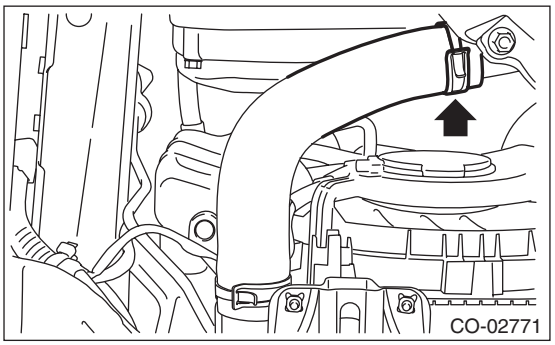
4) Connect the two engine coolant hoses to the radiator and over flow pipe.



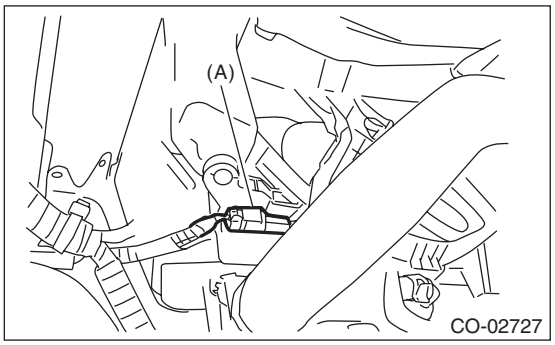
5) Connect the radiator inlet hose.

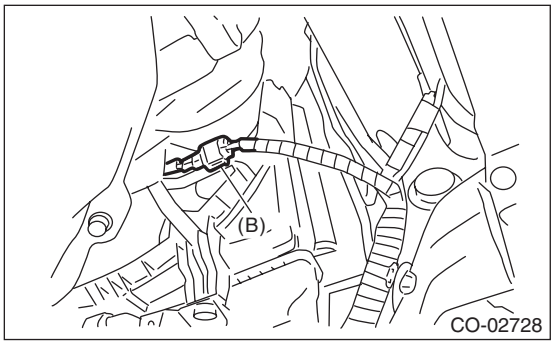


6) Install the reservoir tank. <Ref. to CO(STI)-27, INSTALLATION, Reservoir Tank.>
7) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
8) Lift up the vehicle.
9) Connect the radiator outlet hose.

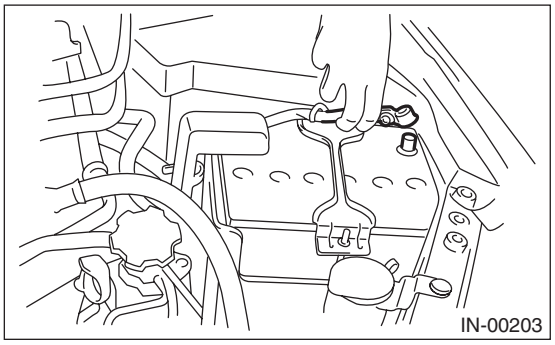


10) Connect the connector (A) to the main fan motor and the connector (B) to the sub fan motor.





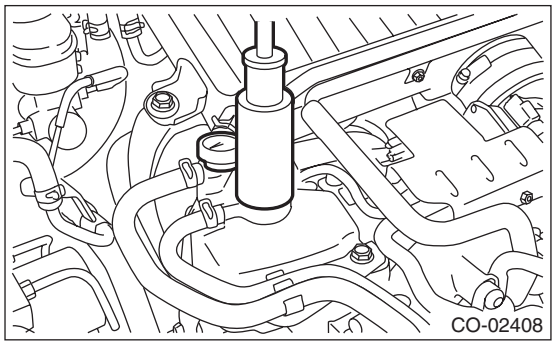
11) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
12) Lower the vehicle.
13) Connect the battery ground terminal.



14) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

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



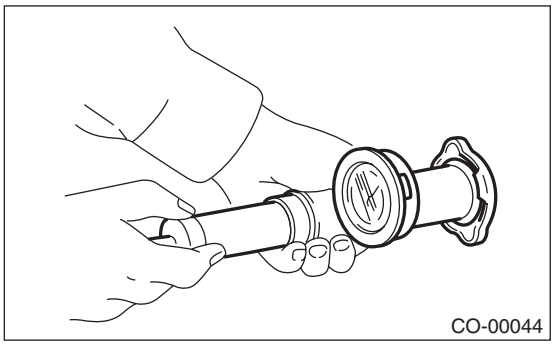
4) Apply a pressure of 122 kPa (1.2 kg/cm^2, 18 psi) to the radiator and check the following points:
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

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

7. Radiator Cap

A: INSPECTION

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



3) Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

Coolant filler tank side:
Standard
93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)
Limit
83 kPa (0.85 kg/cm^2, 12 psi)

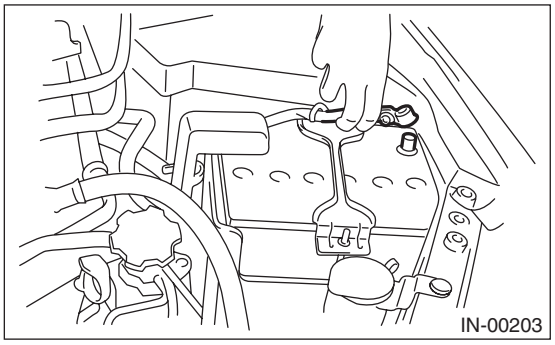
Radiator side:
Standard
122 — 152 kPa (1.24 — 1.55 kg/cm^2, 18 — 22 psi)
Limit
112 kPa (1.14 kg/cm^2, 16 psi)

CAUTION:
• Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.
• Do not confuse the cap of coolant filler tank and cap of radiator.

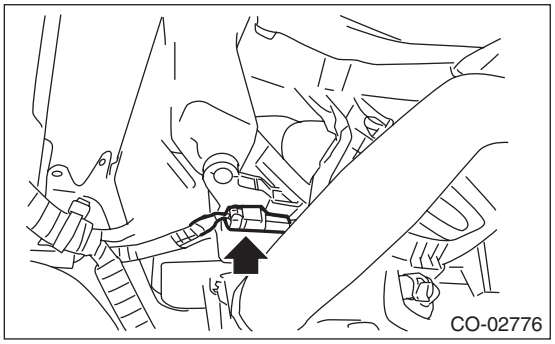
8. Radiator Main Fan and Fan Motor

A: REMOVAL

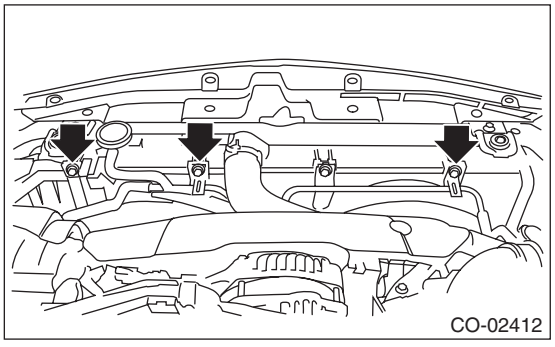
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the main fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
8) Remove the bolts which secure the radiator main fan motor assembly and the over flow pipe.



9) Remove the radiator main fan motor assembly from the upper side of the vehicle.

B: INSTALLATION

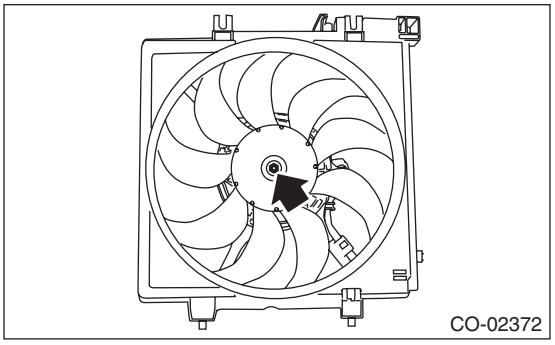
Install in the reverse order of removal.

CAUTION:
Check if the radiator hose and the over flow hose are properly connected.

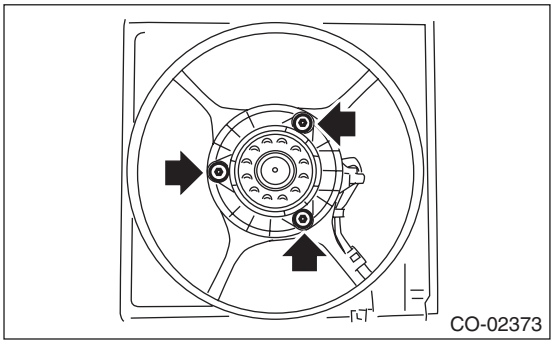
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
2) Disconnect the radiator main fan from the main fan motor.



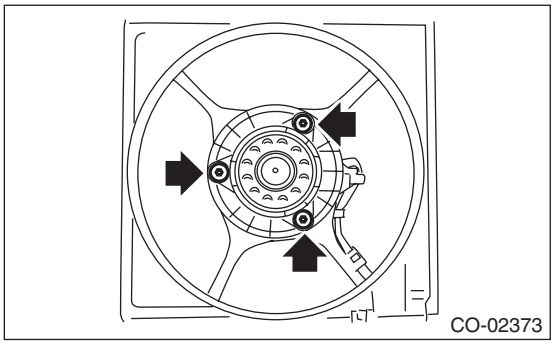
3) Disconnect the main fan motor from the radiator main fan shroud.



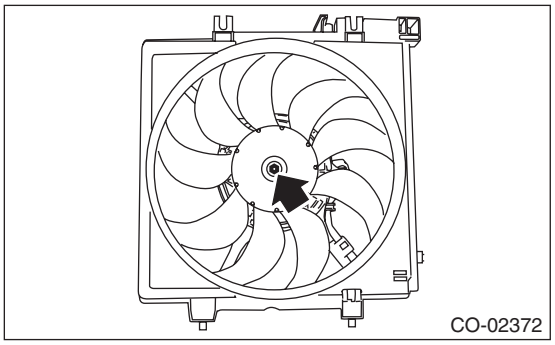
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



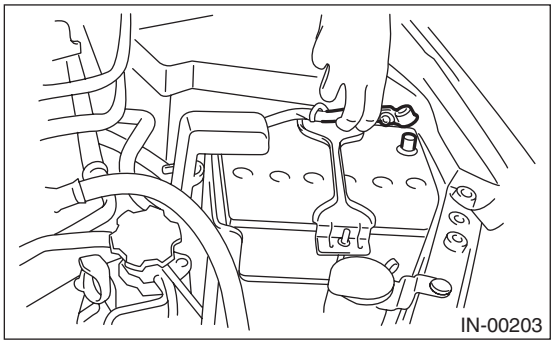
E: INSPECTION

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

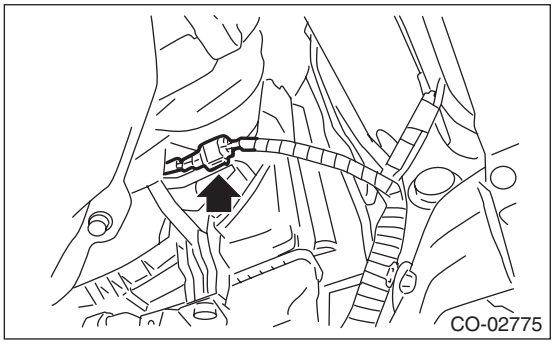
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

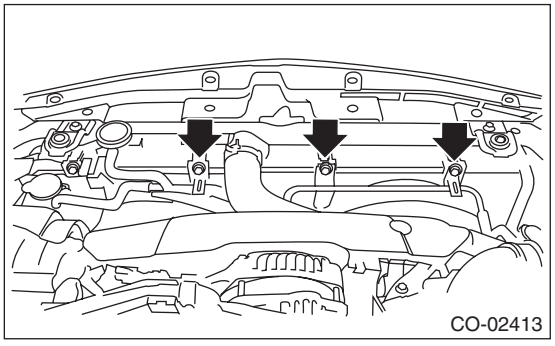
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the sub fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the bolts which secure the radiator sub fan motor assembly and the over flow pipe.



8) Raise the radiator sub fan motor assembly slightly, remove the pin at the lower part of the radiator sub fan motor assembly from the radiator hole, and remove the radiator sub fan motor assembly from the lower side of the vehicle.

B: INSTALLATION

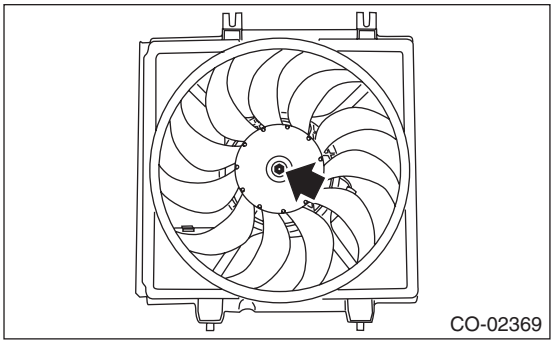
Install in the reverse order of removal.

CAUTION:
Check if the radiator hose and the over flow hose are properly connected.

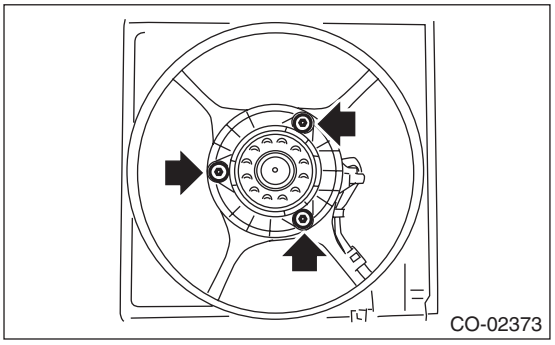
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2) Disconnect the radiator sub fan from the sub fan motor.



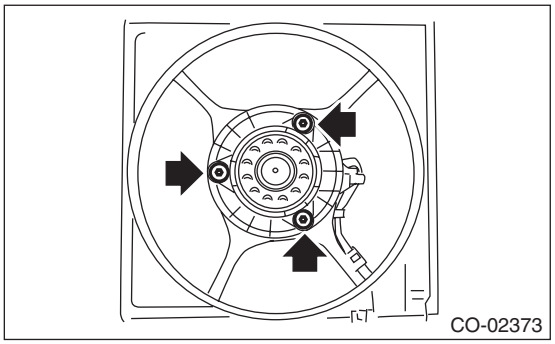
3) Disconnect the sub fan motor from the radiator sub fan shroud.



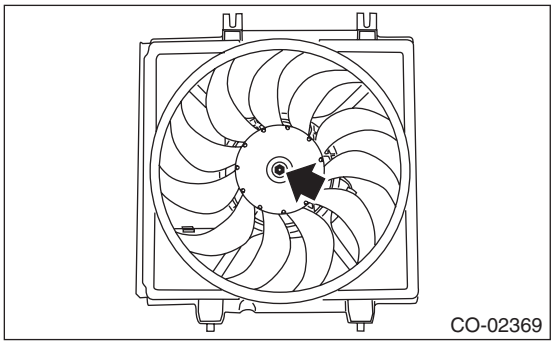
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



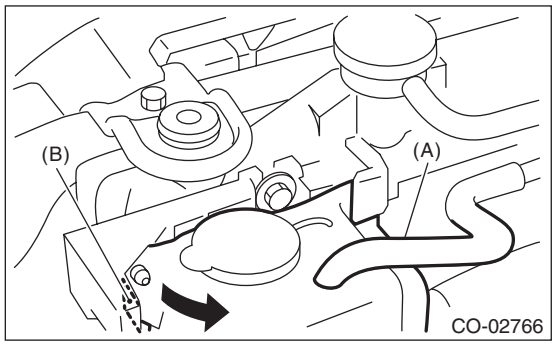
E: INSPECTION

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

10.Reservoir Tank

A: REMOVAL

1) Pull out the over flow hose (A).
2) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

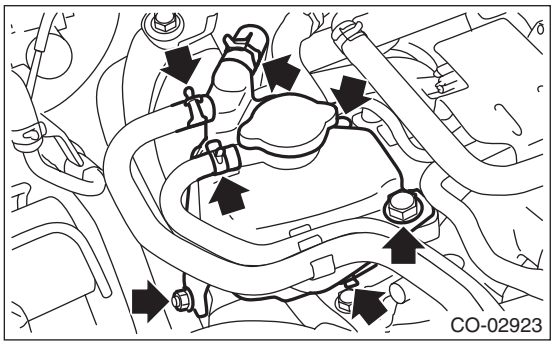
1) Check that the reservoir tank does not have deformation, cracks or damage.
2) Make sure the over flow hoses are not cracked, damaged or loose.
3) Make sure the engine coolant level is between “FULL” and “LOW”.

11.Coolant Filler Tank

A: REMOVAL

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

1) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Disconnect the engine coolant hoses from coolant filler tank.
3) Remove the bolt and nut which secure the coolant filler tank.
4) Remove the coolant filler tank.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

1) Check that the coolant filler tank does not have deformation, cracks or damage.
2) Check that the engine coolant hose has no cracks, damage or loose part.

12.Engine Cooling System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on timing belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Defective radiator fan	Replace.
	j. Improper engine oil in engine coolant	Replace the engine coolant. If ineffective, check, repair or replace engine components.
	k. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	l. Excessive back pressure in exhaust system	Clean or replace.
	m. Insufficient clearance between piston and cylinder	Adjust or replace.
	n. Slipping clutch	Repair or replace.
	o. Dragging brake	Adjust.
	p. Defective radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them.
Over-cooling	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace cylinder head gasket.
	e. Damaged or cracked cylinder head and cylinder block	Repair or replace.
	f. Damaged or cracked thermostat cover	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Timing belt problem	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

LUBRICATION

LU(STI)

		Page
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3.	Engine Oil	11
4.	Oil Pump	13
5.	Oil Pan and Strainer	18
6.	Oil Pressure Switch	22
7.	Engine Oil Cooler	24
8.	Oil Pipe	25
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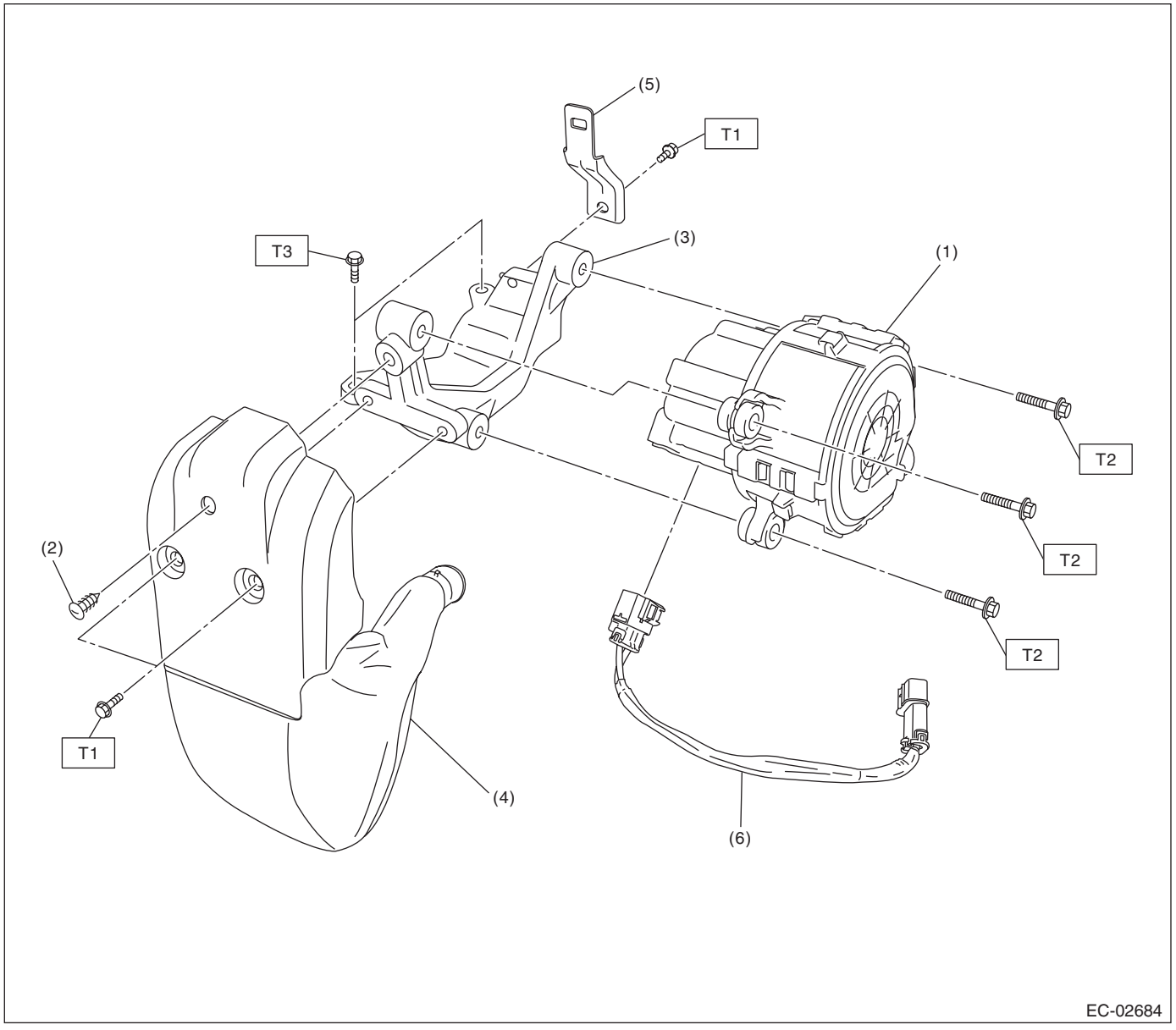
1. General Description

A: COMPONENT

1. CANISTER, PURGE CONTROL SOLENOID VALVE, PRESSURE CONTROL SOLENOID VALVE ASSEMBLY, SHUT VALVE, LEAK CHECK VALVE, AND DRAIN SEPARATOR

For components of canister, purge control solenoid valve, pressure control solenoid valve assembly, shut valve, leak check valve, and drain separator, refer to FU (STI). <Ref. to FU(STI)-3, COMPONENT, General Description.>

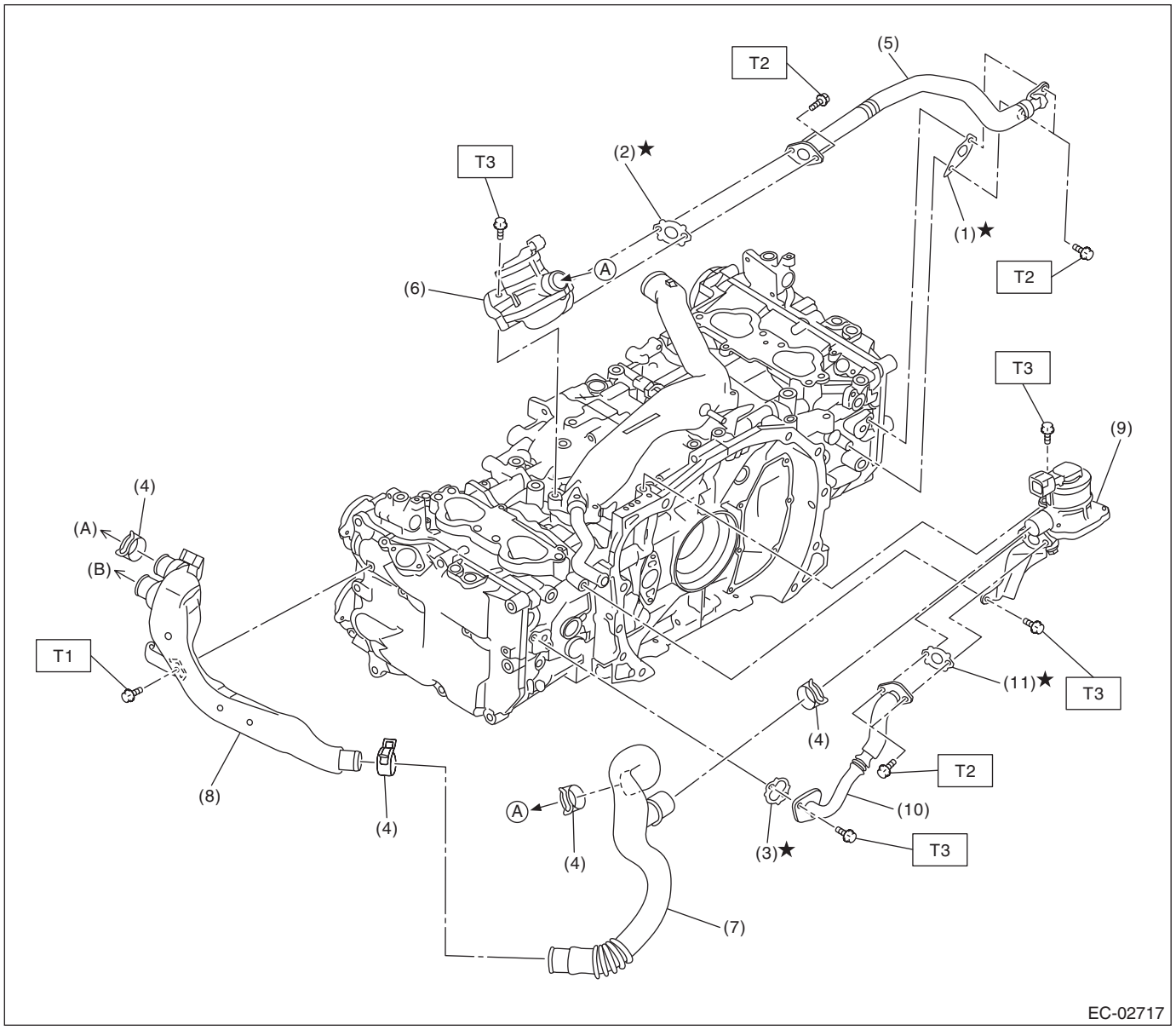
2. SECONDARY AIR PUMP



(1)	Secondary air pump	(4)	Resonator	
(2)	Clip	(5)	Harness stay	
(3)	Secondary air pump bracket	(6)	Secondary air pump harness	

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 9 (0.9, 6.6)
T3: 19 (1.9, 14.0)

3. SECONDARY AIR COMBINATION VALVE



(A) To secondary air pump
(B) To resonator

(1) Gasket
(2) Gasket
(3) Gasket
(4) Clip
(5) Secondary air pipe RH
(6) Secondary air combination valve RH
(7) Air duct A
(8) Air duct B
(9) Secondary air combination valve LH
(10) Secondary air pipe LH
(11) Gasket

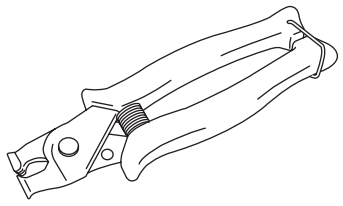
Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 9 (0.9, 6.6)
T3: 19 (1.9, 14.0)

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: PREPARATION TOOL

1. SPECIAL TOOL

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

2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance.
Mighty Vac	Used for inspecting the fuel tank pressure sensor.

2. Front Catalytic Converter

A: REMOVAL

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

C: INSPECTION

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

3. Rear Catalytic Converter

A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

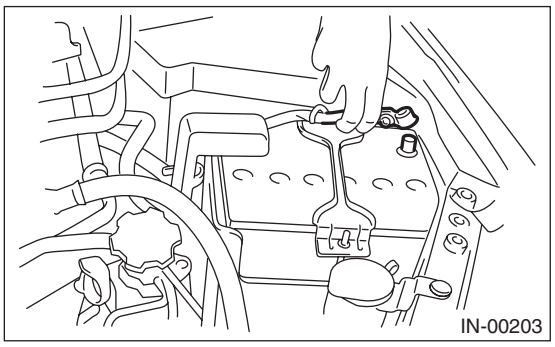
C: INSPECTION

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

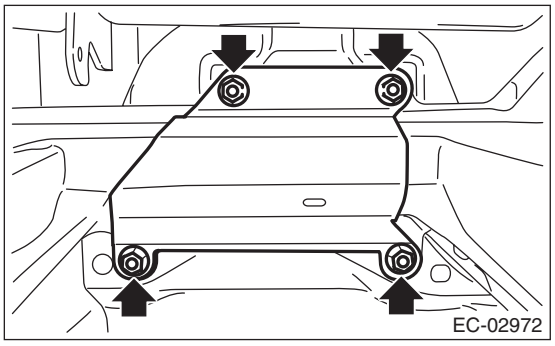
4. Canister

A: REMOVAL

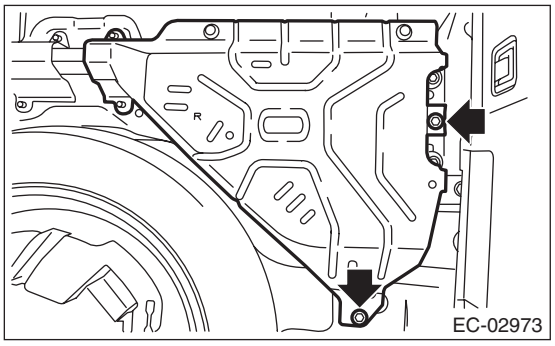
1) Disconnect the ground cable from battery.



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

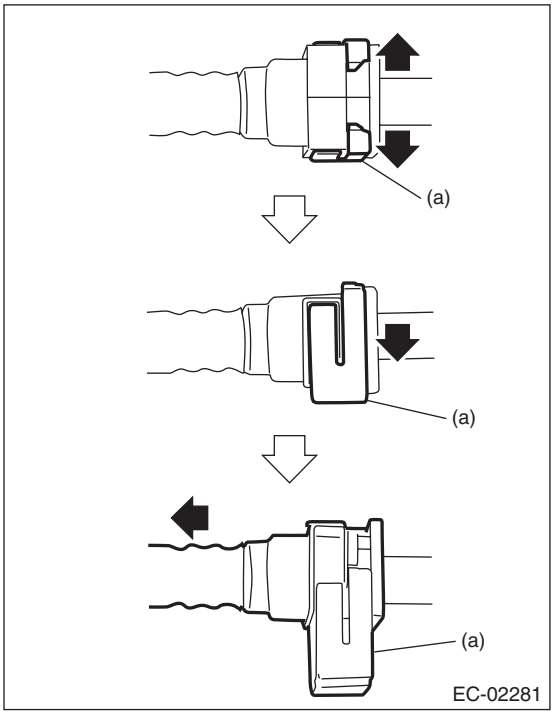


8) Remove the canister cover RH.

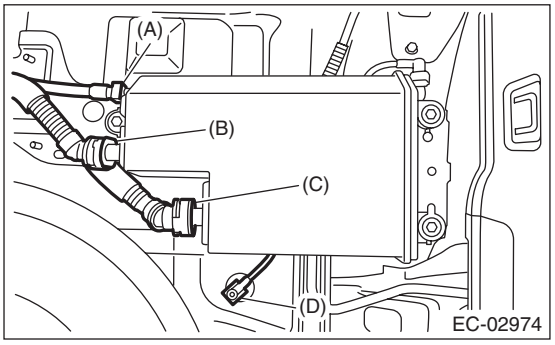


9) Disconnect the purge tube (A), vent tube (B), drain tube A (C) and PCV drain tube (D).

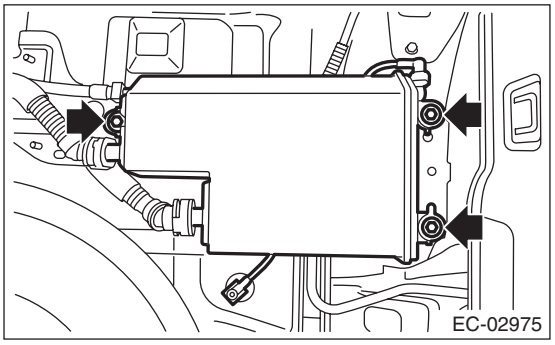
NOTE:
Disconnect the quick connector as shown in the figure.



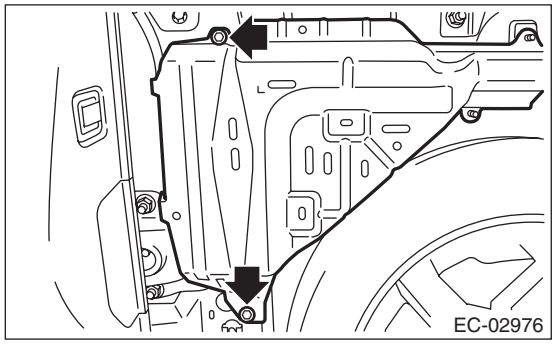
(a) Retainer



10) Remove the canister.

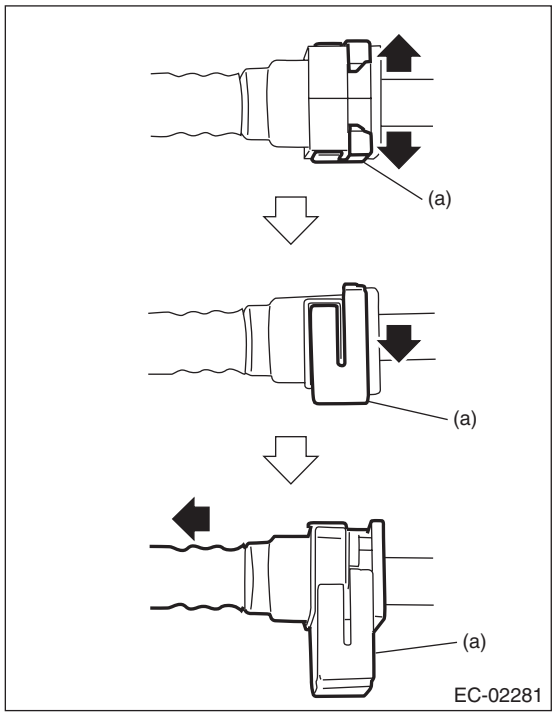


11) Remove the canister cover LH.

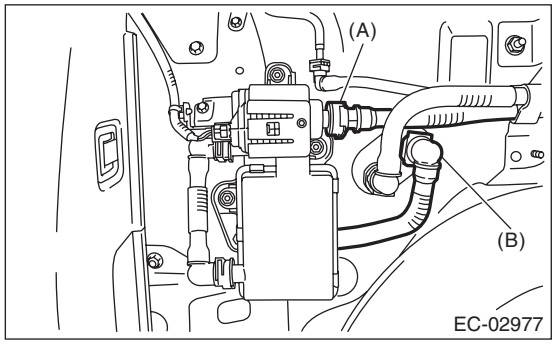


12) Disconnect drain tube A (A) and drain tube B (B).

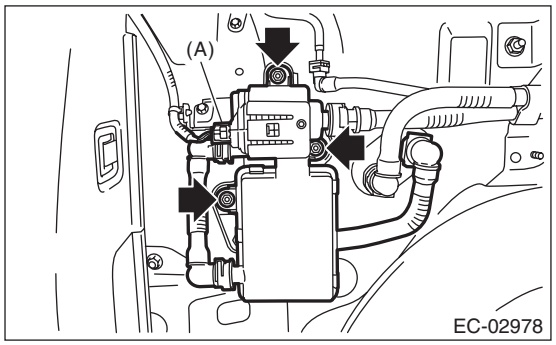
NOTE:
Disconnect the quick connector as shown in the figure.



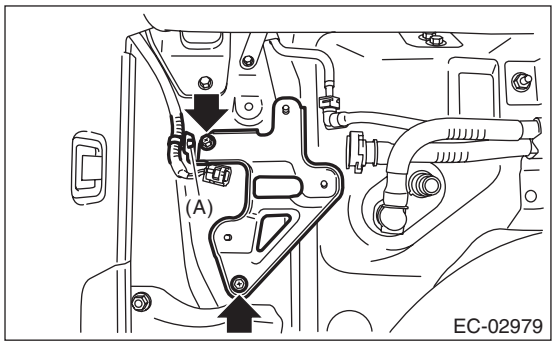
(a) Retainer



13) Disconnect the connector (A) from leak check valve assembly, and remove the leak check valve assembly.

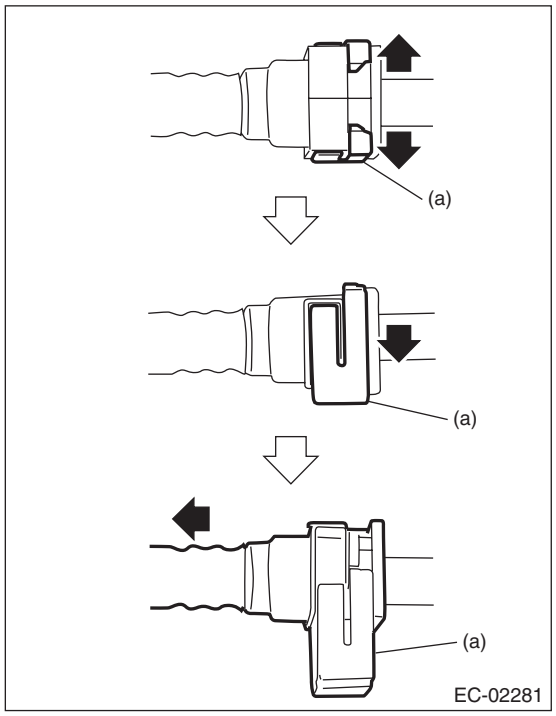


14) Remove the clip (A), which secures the leak check valve assembly harness, from the valve bracket, and remove the valve bracket.

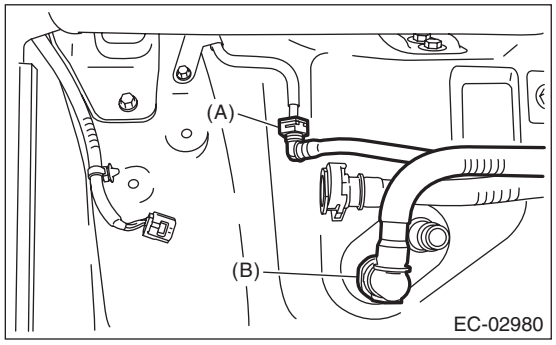


15) Disconnect purge tube (A) and vent tube (B).

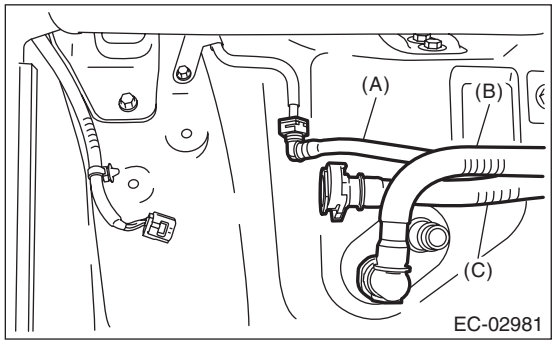
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer



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



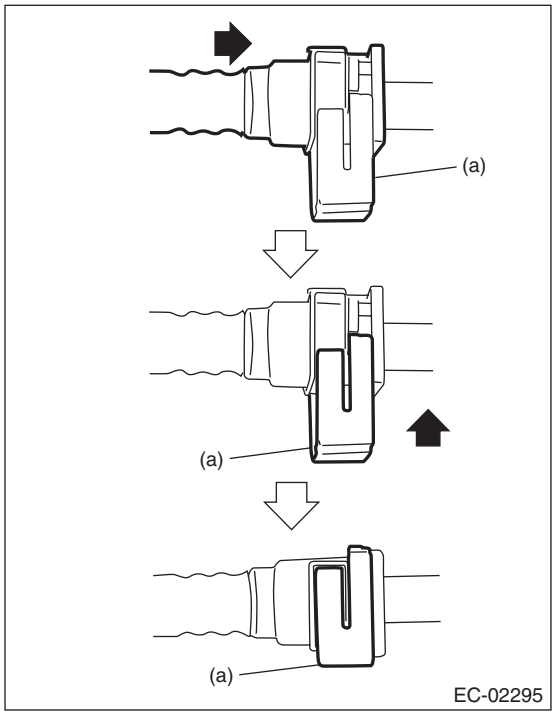
B: INSTALLATION

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

- Connect the quick connector as shown in the figure.

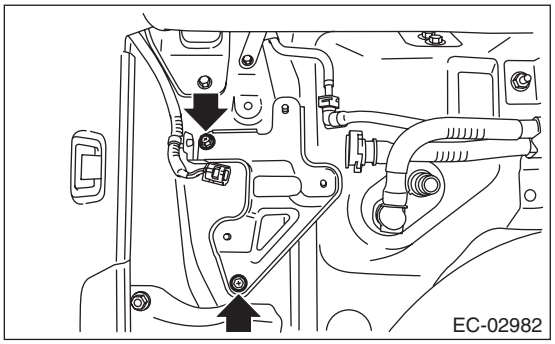
CAUTION:

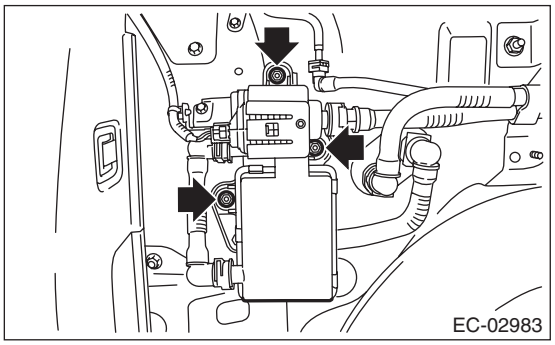
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, securely insert the pipe all the way before locking the retainer.**
- **When it is difficult to lock the retainer, make sure that the pipe is securely inserted.**
- **Make sure that the quick connector is securely connected.**



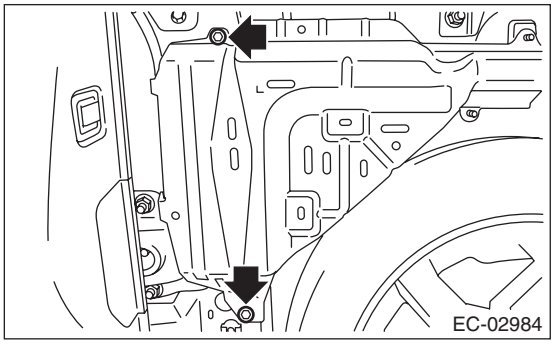
(a) Retainer

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

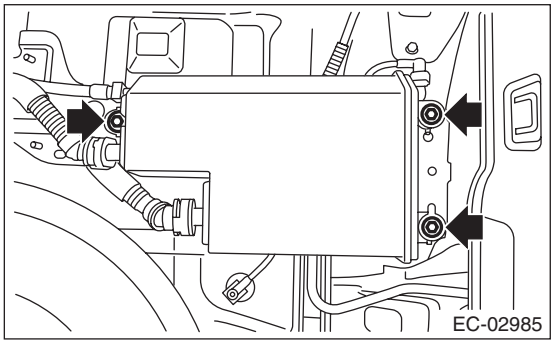




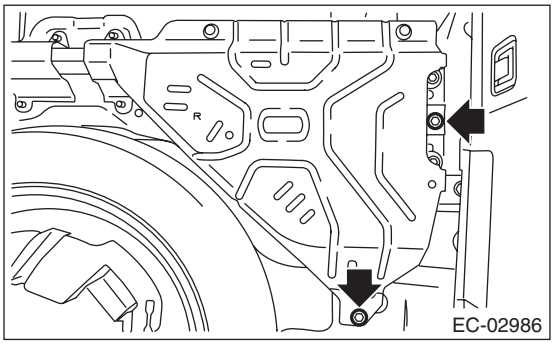
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

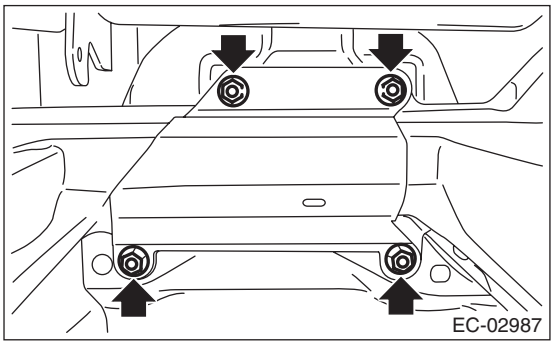


Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



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





C: INSPECTION

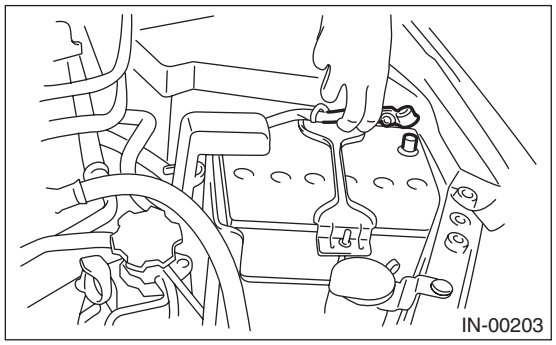
1) Check that the canister and leak check valve assembly have no deformation, cracks or other damages.
2) Check that the tube has no cracks, damage or loose part.

5. Purge Control Solenoid Valve

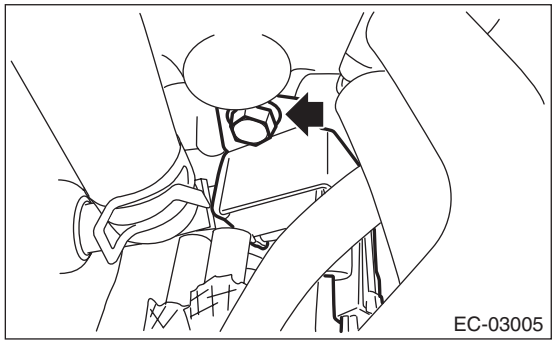
A: REMOVAL

1. PURGE CONTROL SOLENOID VALVE 1

1) Disconnect the ground cable from battery.



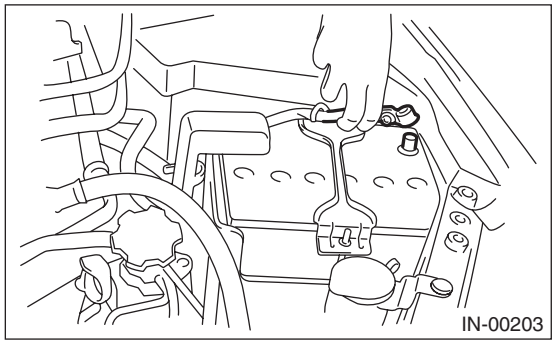
2) Remove the bolts which secure purge control solenoid valve 1 to the intake manifold, and disconnect the connector from the purge control solenoid valve 1.



3) Disconnect the vacuum hose and the vacuum control hose from purge control solenoid valve 1.

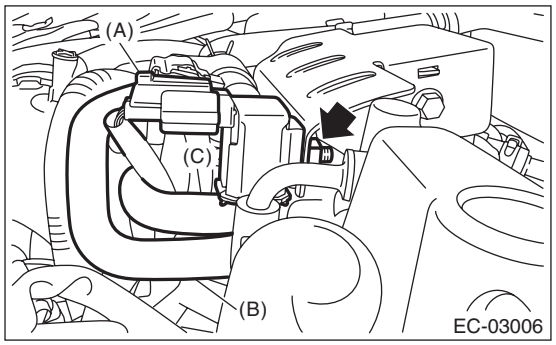
2. PURGE CONTROL SOLENOID VALVE 2

1) Disconnect the ground cable from battery.



2) Disconnect connector (A), vacuum hose (B), and vacuum control hose (C) from purge control solenoid valve 2.

3) Remove purge control solenoid valve 2 from the solenoid valve bracket.

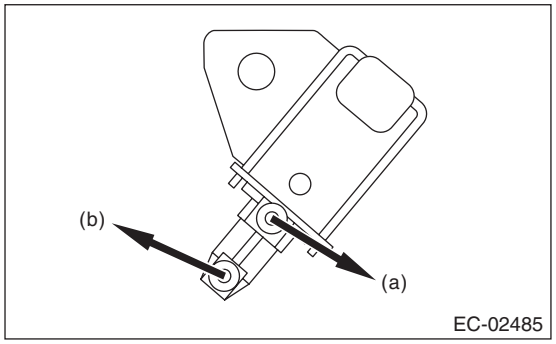


B: INSTALLATION

1. PURGE CONTROL SOLENOID VALVE 1

Install in the reverse order of removal.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.



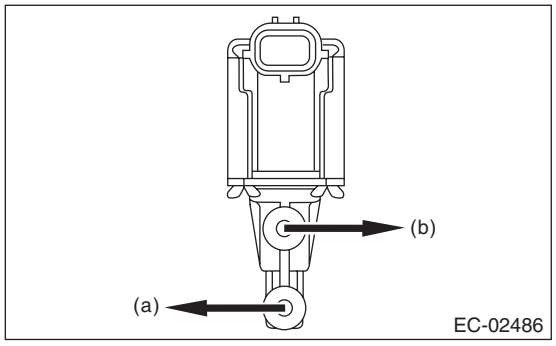
(a) To intake manifold
(b) To branching pipe → fuel pipe

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

2. PURGE CONTROL SOLENOID VALVE 2

Install in the reverse order of removal.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.



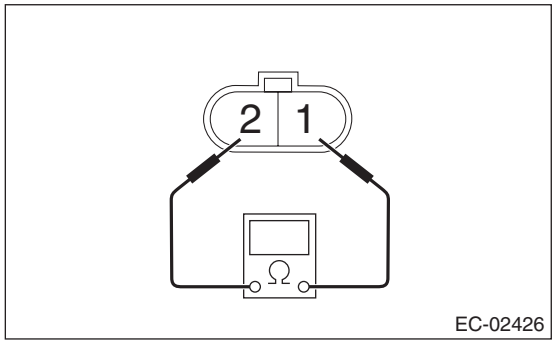
(a) To intake duct
(b) To branching pipe → fuel pipe

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

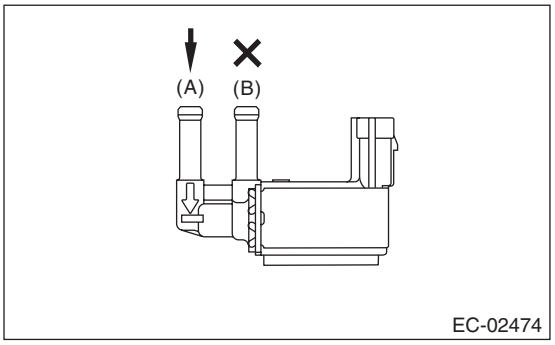
1. PURGE CONTROL SOLENOID VALVE

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

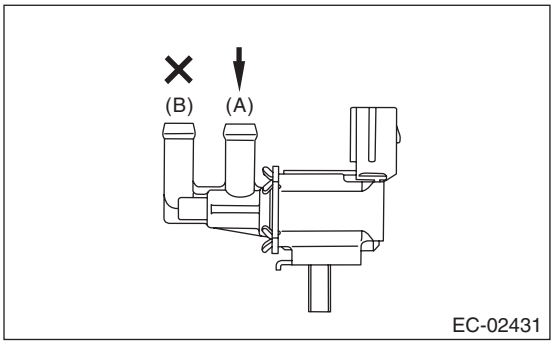


	Terminal No.	Standard
Purge control solenoid valve 1	1 and 2	32±2 Ω (when 20°C (68°F))
Purge control solenoid valve 2		24±3 Ω (when 20°C (68°F))

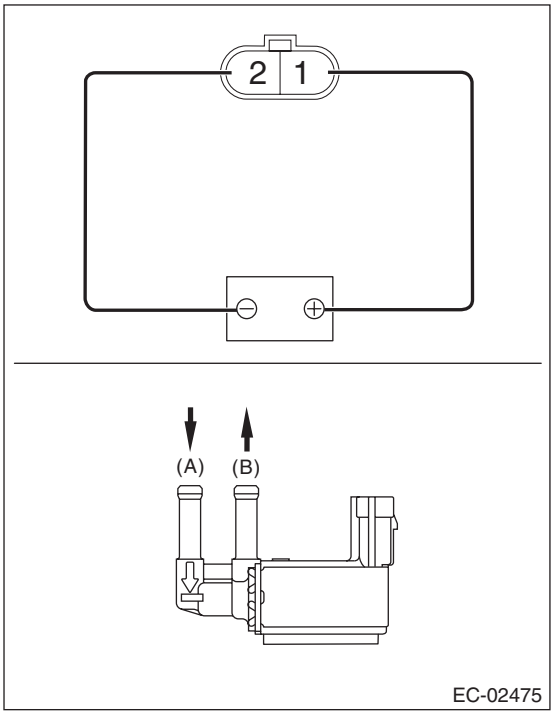
3) Check that air does not come out from (B) when air is blown into (A).
- Purge control solenoid valve 1



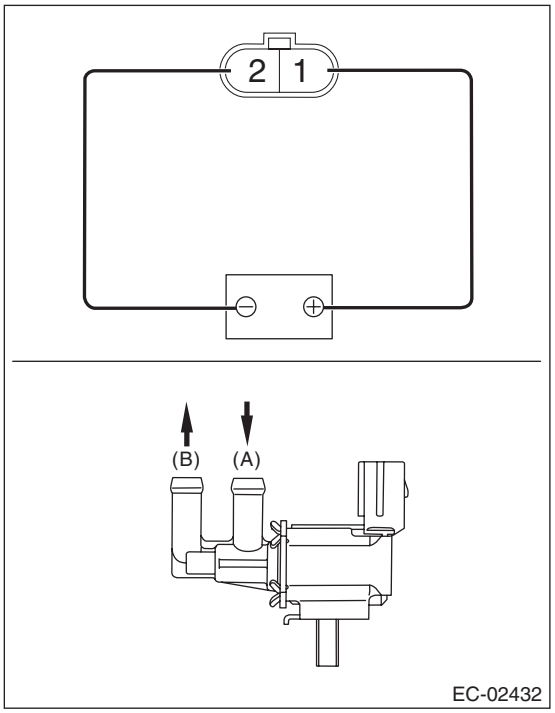
- Purge control solenoid valve 2



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



- Purge control solenoid valve 2



2. OTHER INSPECTIONS

Make sure the vacuum hoses and vacuum control hoses are not cracked or loose.

6. Fuel Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-82, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-82, INSTALLATION, Fuel Level Sensor.>

C: INSPECTION

For inspection procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-82, INSPECTION, Fuel Level Sensor.>

7. Fuel Sub Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-83, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-84, INSTALLATION, Fuel Sub Level Sensor.>

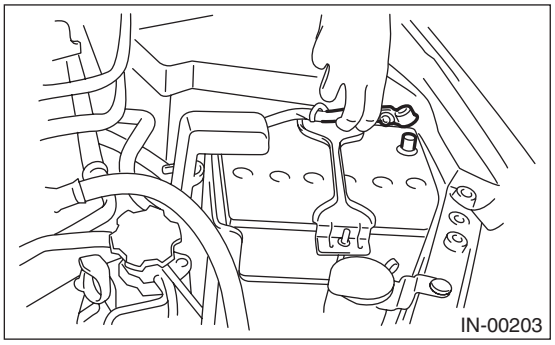
C: INSPECTION

For inspection procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-84, INSPECTION, Fuel Sub Level Sensor.>

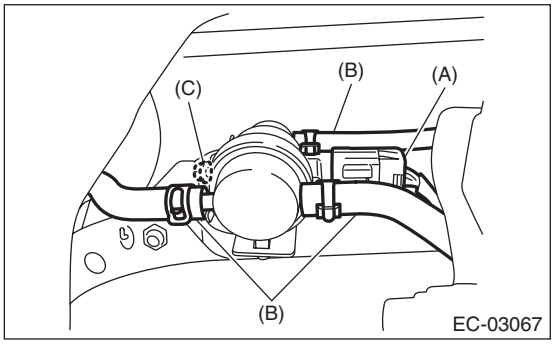
8. Pressure Control Solenoid Valve Assembly

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Disconnect the connector (A) and evaporation hose (B) from the pressure control solenoid valve assembly.
4) Remove the nut (C) securing the bracket to the fuel tank and remove the pressure control solenoid valve assembly.



B: INSTALLATION

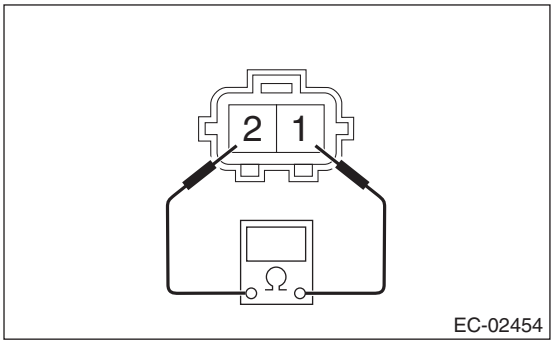
Install in the reverse order of removal.

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

C: INSPECTION

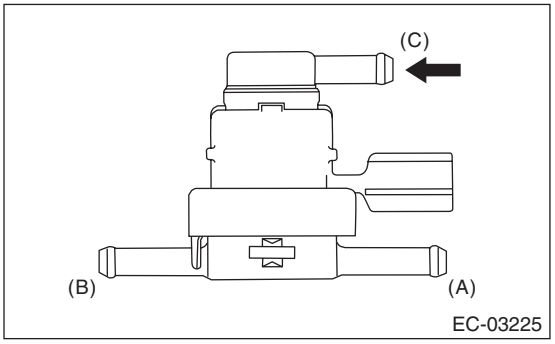
1. PRESSURE CONTROL SOLENOID VALVE ASSEMBLY

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



Terminal No.	Standard
1 and 2	20 — 30 Ω

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



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

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

2. OTHER INSPECTIONS

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

9. Drain Filter

A: SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to “Canister” for removal and installation procedures. <Ref. to EC(STI)-7, REMOVAL, Canister.> <Ref. to EC(STI)-9, INSTALLATION, Canister.>

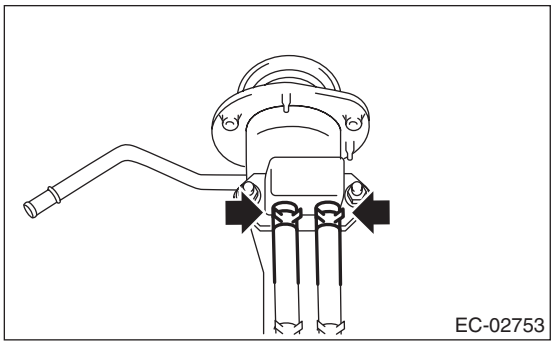
10.Shut Valve

A: REMOVAL

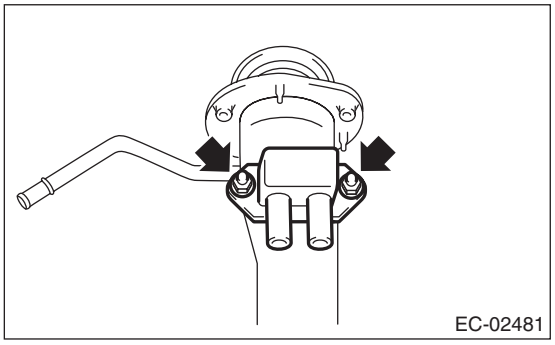
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Remove the fuel filler pipe. <Ref. to FU(STI)-77, REMOVAL, Fuel Filler Pipe.>
2) Disconnect the evaporation hose from the shut valve.



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



B: INSTALLATION

Install in the reverse order of removal.

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

C: INSPECTION

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

11.Leak Check Valve Assembly

A: REMOVAL

Refer to “Canister” for removal procedures. <Ref. to EC(STI)-7, REMOVAL, Canister.>

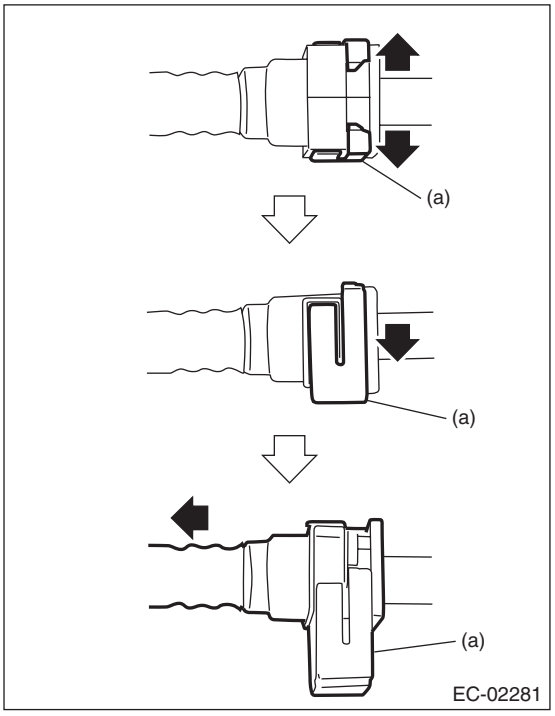
B: INSTALLATION

Refer to “Canister” for installation procedures. <Ref. to EC(STI)-9, INSTALLATION, Canister.>

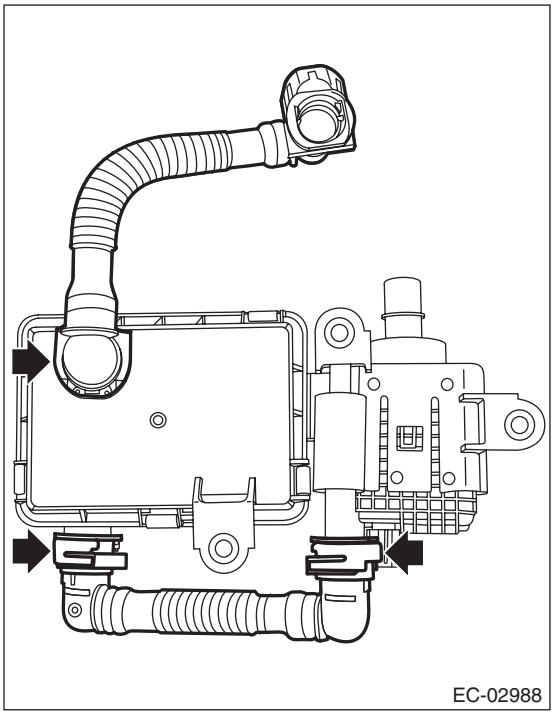
C: DISASSEMBLY

Disconnect the drain tube from the leak check valve assembly.

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



(a) Retainer



D: ASSEMBLY

Assemble the parts in the reverse order of disassembly while being careful of the following.

• Connect the quick connector as shown in the figure.

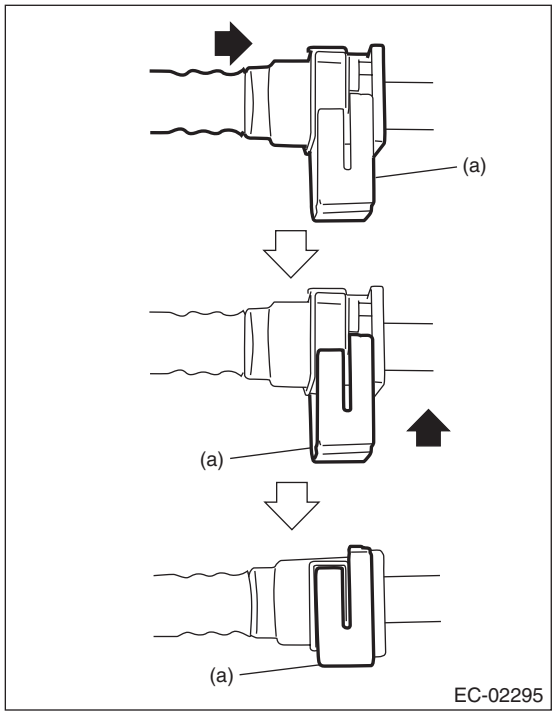
CAUTION:

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

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

• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.

• Make sure that the quick connector is securely connected.

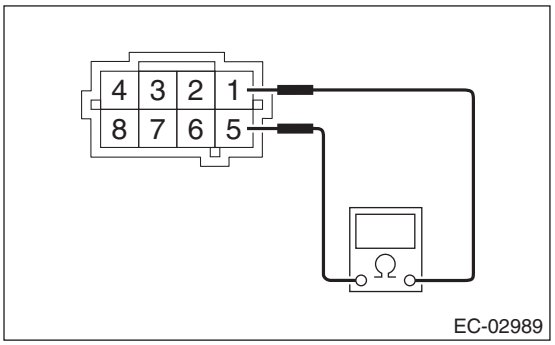


(a) Retainer

E: INSPECTION

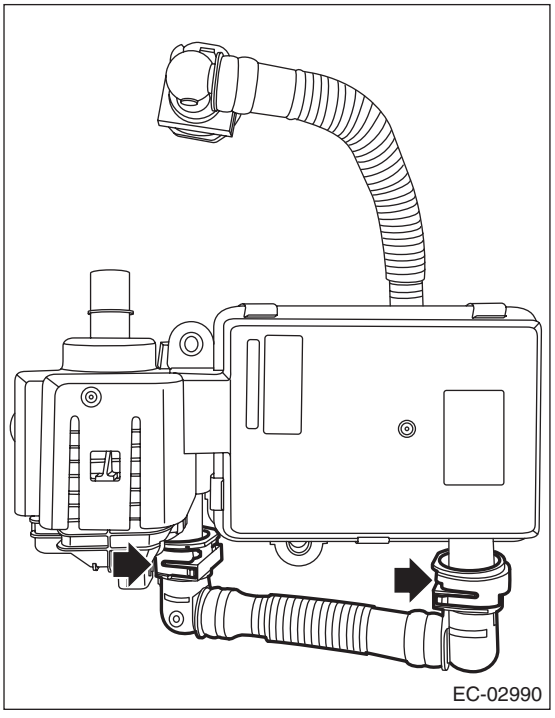
1. CHECK SWITCHING VALVE

1) Check the resistance between switching valve terminals.

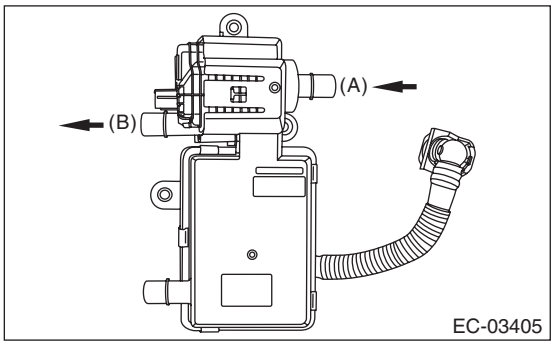


Terminal No.	Standard
1 and 5	27^{+3}_{-2} Ω (when 20°C (68°F))
	31±4 Ω (when 60°C (140°F))

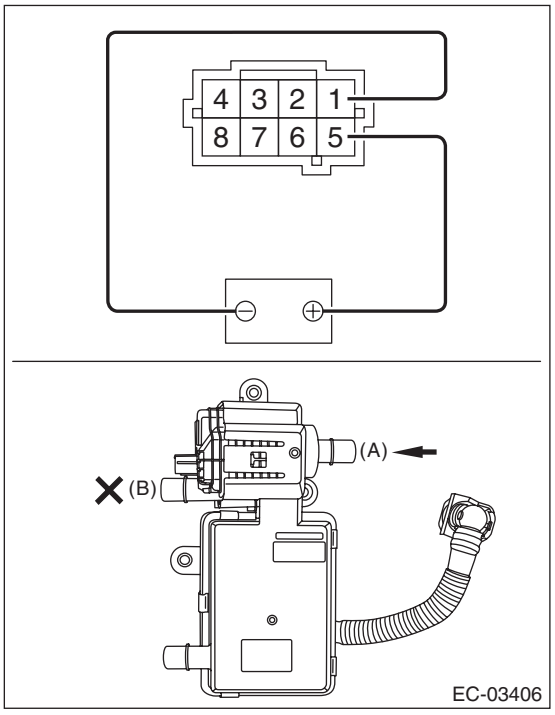
2) Disconnect the drain tube from the leak check valve assembly.



3) Check that air is discharged from (B) when air is blown into (A).



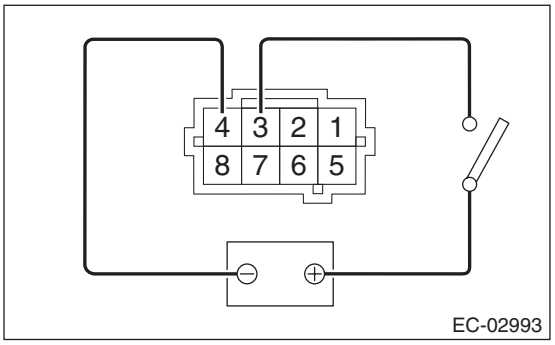
4) Connect the battery positive terminal to the terminal No. 5 and the battery negative terminal to the terminal No. 1. Check that air does not come out from (B) when air is blown into (A).



2. CHECK VACUUM PUMP

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and inspect the vacuum pump operation.

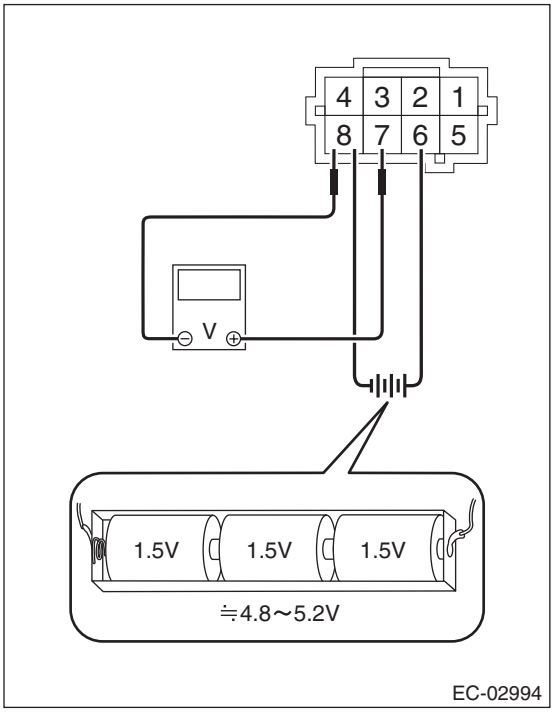
CAUTION:
Do not operate the vacuum pump for 5 minutes or more.



3. CHECK PRESSURE SENSOR

1) Connect dry-cell battery positive terminal to terminal No. 6 and dry-cell battery ground terminal to terminal No. 8, circuit tester positive terminal to terminal No. 7 and the circuit tester negative terminal to terminal No. 8.

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

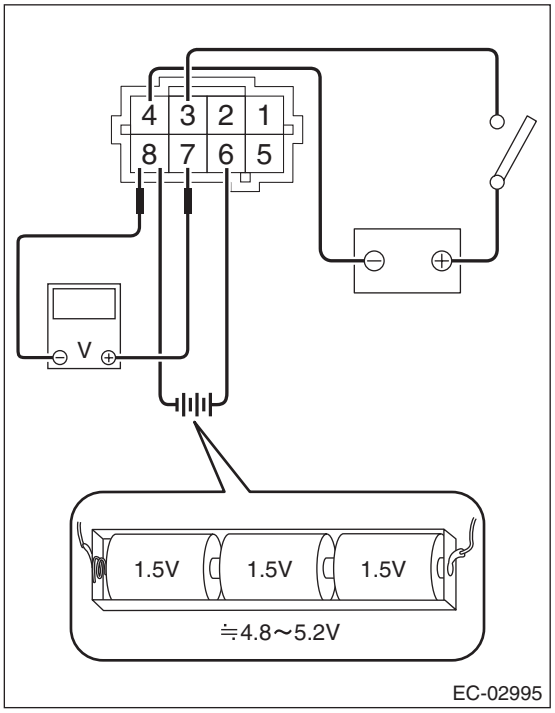


2) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
7 (+) and 8 (–)	Approx. 3.5 V (when 25°C (77°F))

3) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and check that there is a voltage drop from the voltage measured in step 2) when the vacuum pump is operated.



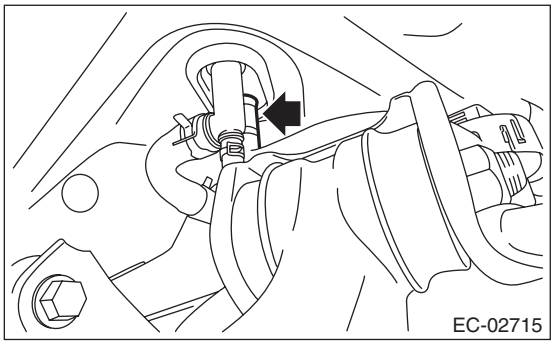
4. OTHER INSPECTIONS

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

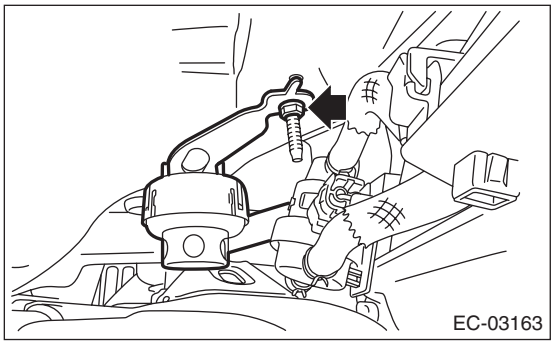
12.Drain Separator

A: REMOVAL

1) Lift up the vehicle.
2) Remove the rear differential. <Ref. to DI-22, REMOVAL, Rear Differential (T-type).>
3) Disconnect the drain hose from the connector.



4) Remove the drain separator from the vehicle.



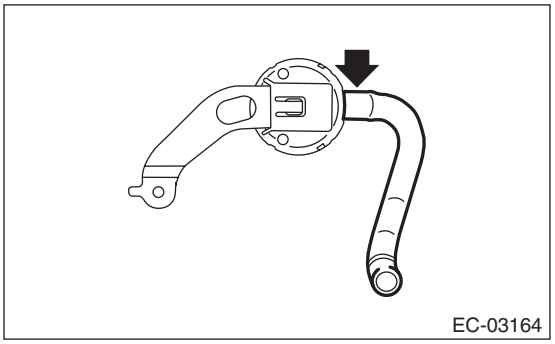
B: INSTALLATION

Install in the reverse order of removal.

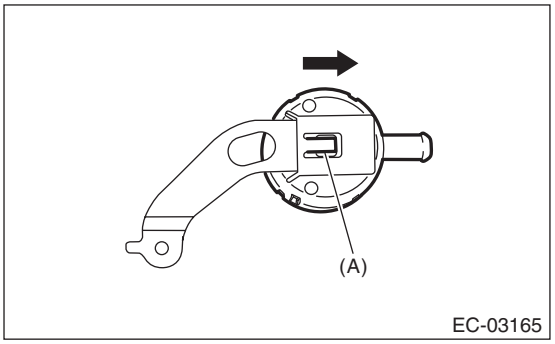
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the drain hose from the drain separator.



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



D: ASSEMBLY

Assemble in the reverse order of disassembly.

E: INSPECTION

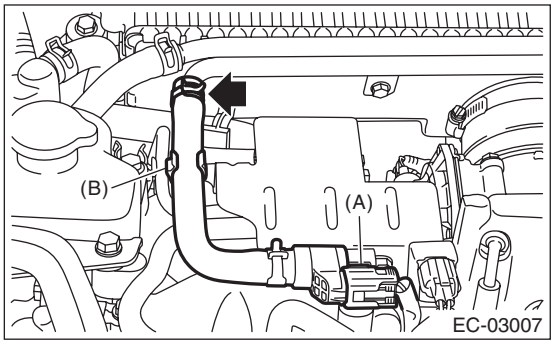
1) Check that the drain separator and drain separator bracket have no deformation, crack, or other damage.
2) Check that the drain hose has no crack, damage, or looseness.
3) Check that no foreign substances are clogged in the drain separator.

13.PCV Hose Assembly

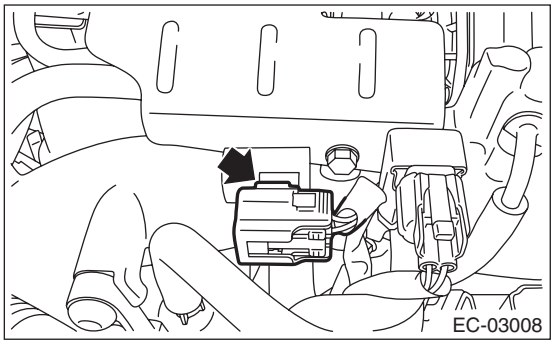
A: REMOVAL

CAUTION:
Do not remove unless the hose and the diagnostics connector are broken.

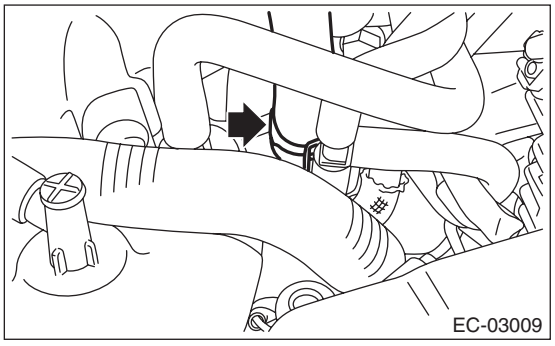
1) Disconnect the connector (A) from the PCV hose assembly A.
2) Remove the PCV hose assembly A from the clip (B), and remove the PCV hose assembly A from the PCV pipe.



3) Remove the connector from the PCV hose assembly B.

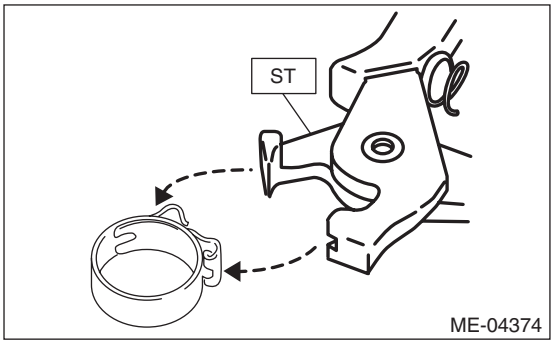


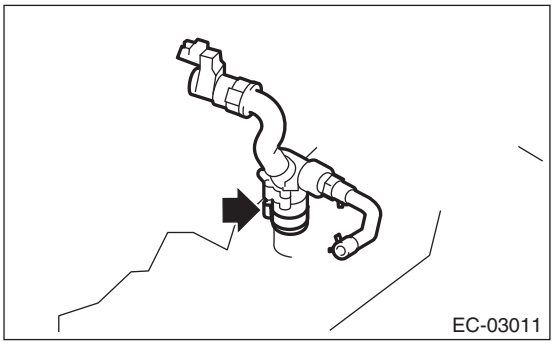
4) Remove the PCV hose assembly B from the intake duct.



5) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
6) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.>
7) Remove the PCV hose assembly C from the cylinder block RH.

NOTE:
Pinch the clamp of the PCV hose assembly C by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

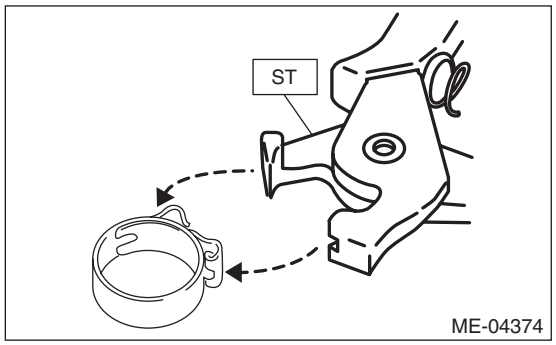


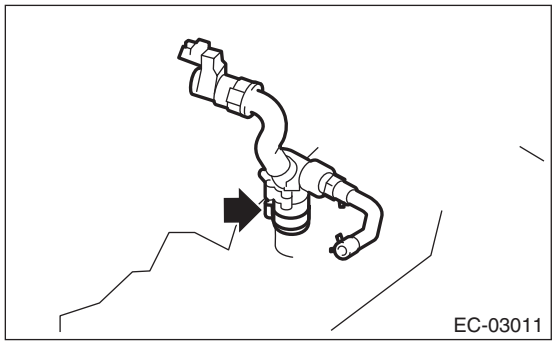


B: INSTALLATION

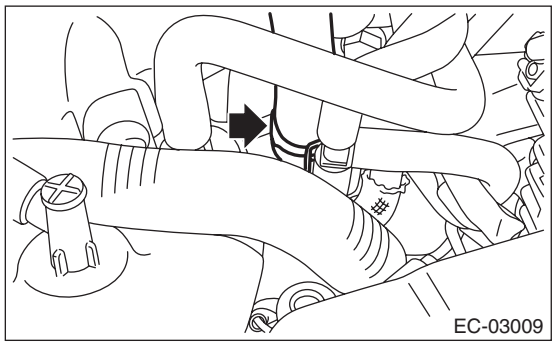
1) Install the PCV hose assembly C onto the cylinder block RH.

NOTE:
Use a new clamp for the PCV hose assembly C, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS

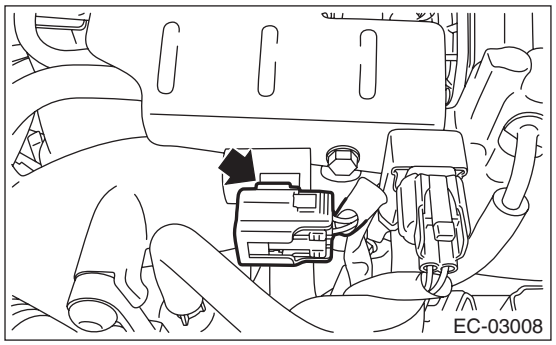




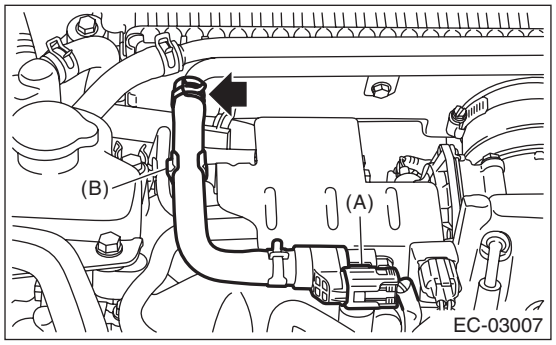
2) Install the turbocharger. <Ref. to IN(STI)-16, INSTALLATION, Turbocharger.>
3) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
4) Install the PCV hose assembly B onto the intake duct.



5) Connect the connector to the PCV hose assembly B.



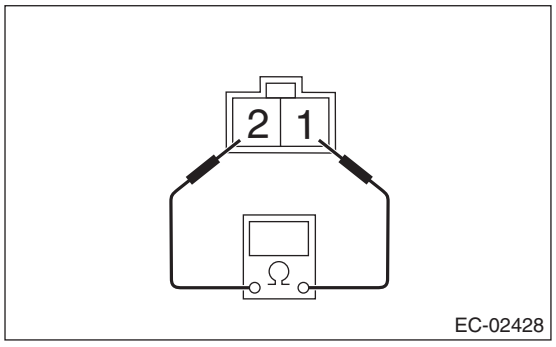
6) Install the PCV hose assembly A to the PCV pipe, and install the PCV hose assembly A to the clip (B).
7) Connect the connector (A) to the PCV hose assembly A.



C: INSPECTION

1. DIAGNOSIS CONNECTOR

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



Terminal No.	Standard
1 and 2	Less than 1 Ω

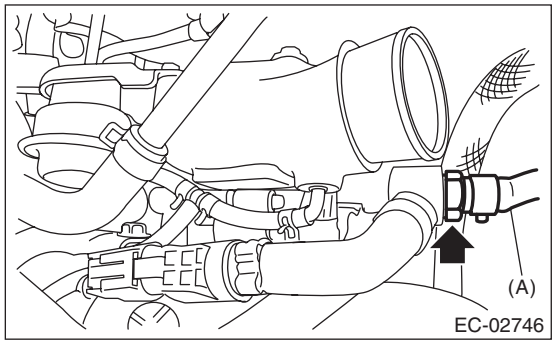
2. OTHER INSPECTIONS

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

14.PCV Valve

A: REMOVAL

CAUTION:
Do not remove unless the PCV valve is broken.
1) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
2) Disconnect the vacuum hose (A) from the PCV valve and remove the PCV valve from the PCV connector.



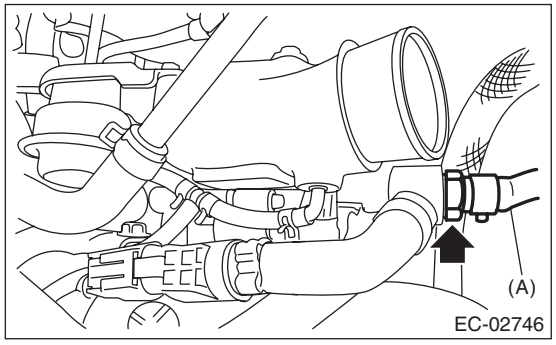
B: INSTALLATION

1) Install the PCV valve to the PCV connector and connect the vacuum hose (A) to the PCV valve.

NOTE:
Apply liquid gasket to the bolt threads of PCV valve.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
22.5 N·m (2.3 kgf-m, 16.6 ft-lb)

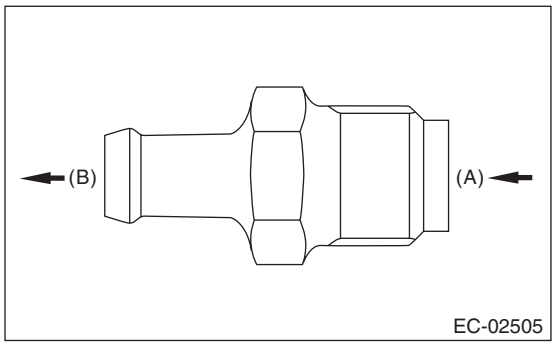


2) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>

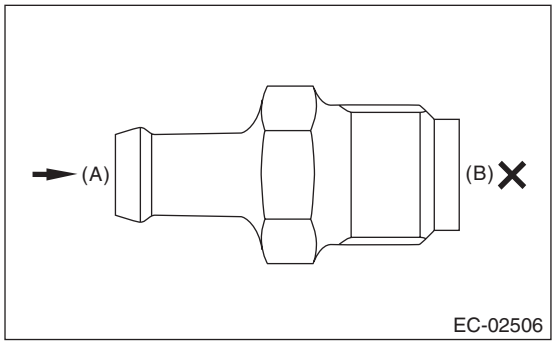
C: INSPECTION

1. PCV VALVE

1) Check that the PCV valve has no deformation, cracks or other damages.
2) Check that air is discharged from (B) when air is blown into (A).



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



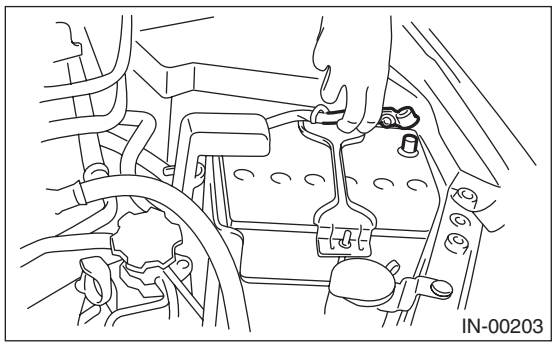
2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

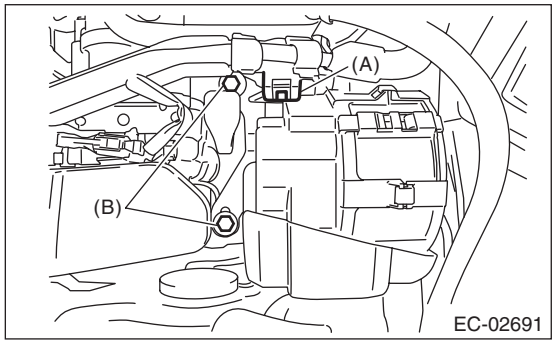
15.Secondary Air Pump

A: REMOVAL

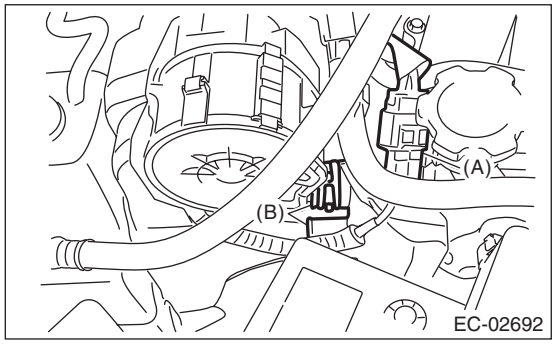
1) Disconnect the ground cable from battery.



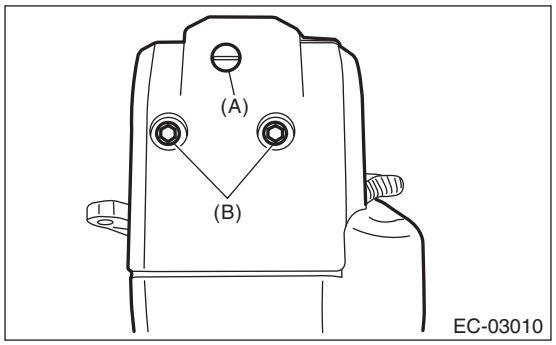
2) Remove the clip (A) which holds the harness on the harness stay and remove the bolt (B) which holds the secondary air pump on the vehicle.



3) Disconnect the connector (A) and air duct (B) from secondary air pump.



4) Remove the secondary air pump from the vehicle and the resonator from the secondary air pump.

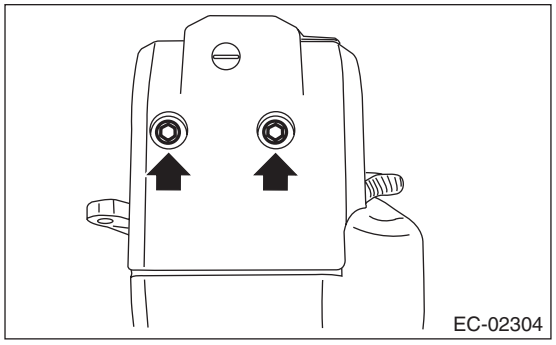


(A) Clip
(B) Bolt

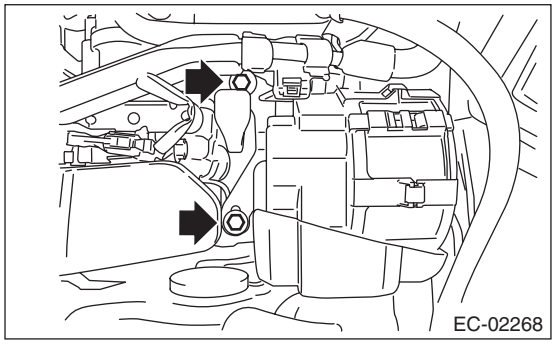
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



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

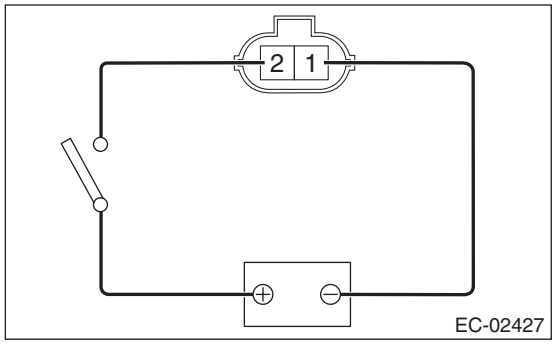


C: INSPECTION

1. SECONDARY AIR PUMP

1) Check that the secondary air pump has no deformation, cracks or other damages.
2) Connect battery positive terminal to the terminal No. 2 and battery negative terminal to the terminal No. 1, and inspect the secondary air pump operation.

CAUTION:
Do not operate the secondary air pump continuously for 80 seconds or more.



2. OTHER INSPECTIONS

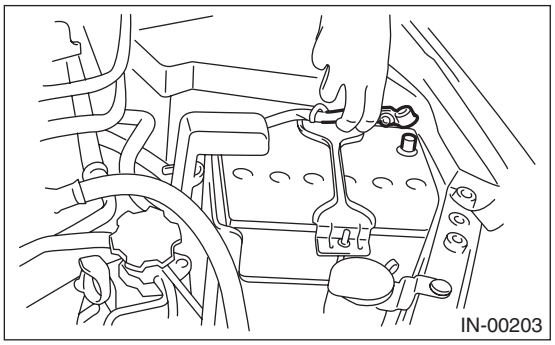
Check that the air duct or resonator has no cracks, damage or loose part.

16.Secondary Air Combination Valve

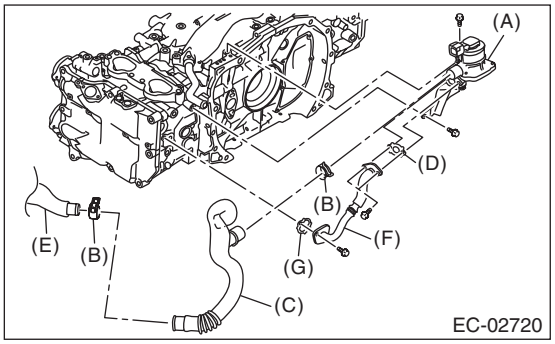
A: REMOVAL

1. SECONDARY AIR COMBINATION VALVE LH

1) Disconnect the ground cable from battery.



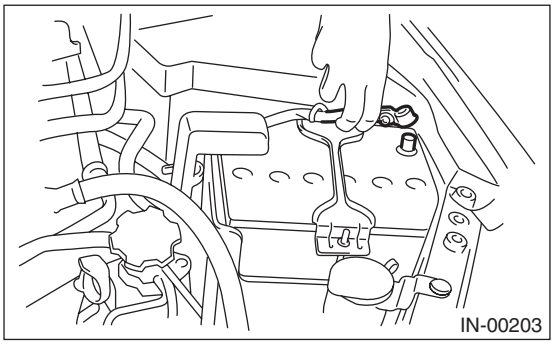
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Disconnect the connector from the secondary air combination valve LH.
4) Disconnect the air duct A.
5) Remove the secondary air pipe LH.
6) Remove the secondary air combination valve LH.



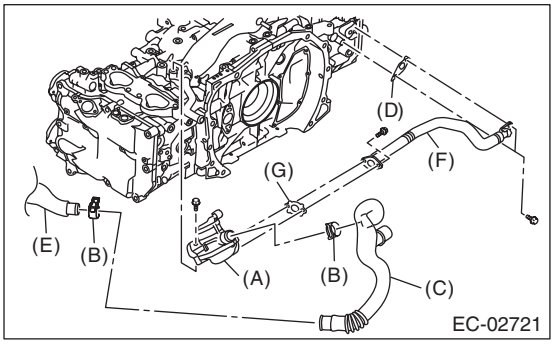
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Disconnect the air duct A.
5) Disconnect the secondary air pipe RH.
6) Remove the secondary air combination valve RH.



(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe RH
(G) Gasket

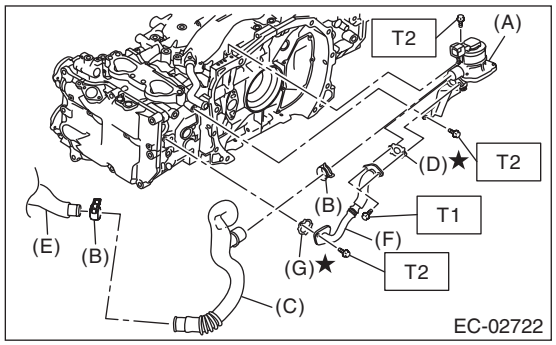
B: INSTALLATION

1. SECONDARY AIR COMBINATION VALVE LH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



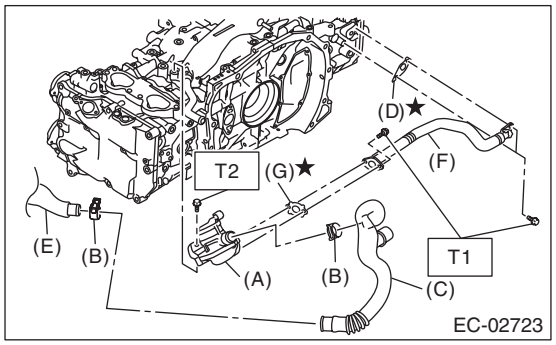
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

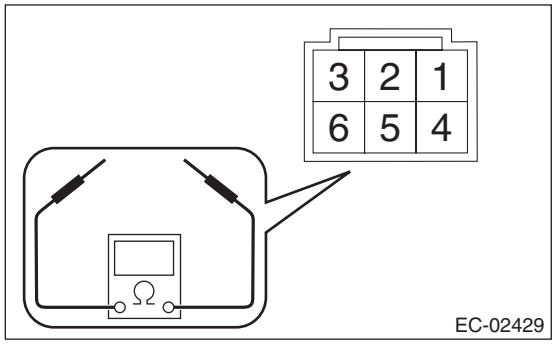


(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe RH
(G) Gasket

C: INSPECTION

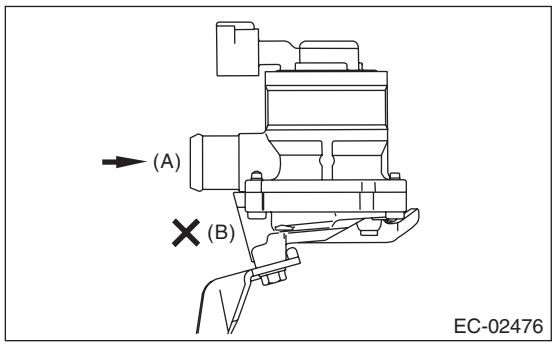
1. SECONDARY AIR COMBINATION VALVE LH

1) Check that the secondary air combination valve LH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve LH.

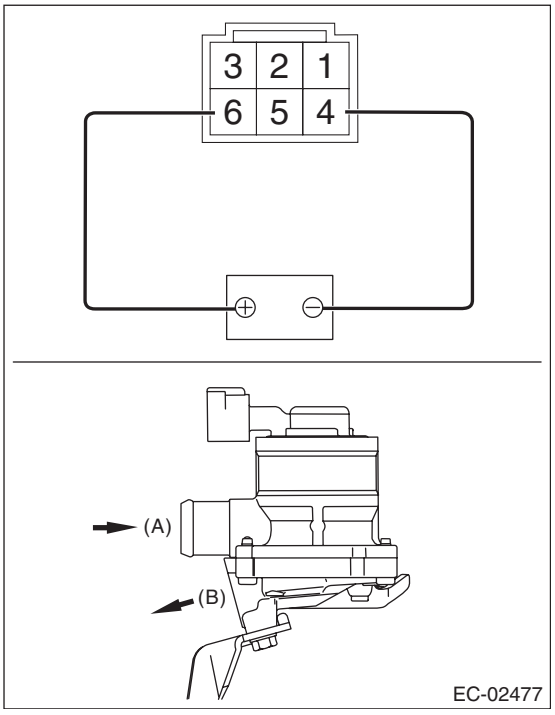


Terminal No.	Standard
4 and 6	5.0±0.5 Ω (when 20°C (68°F))
2 and 3	15 kΩ or less
1 and 2	4.5 kΩ or less

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

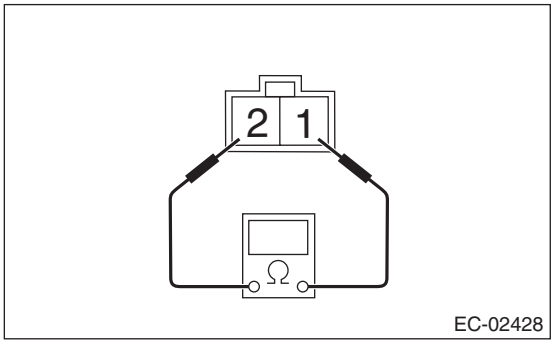


4) Connect the battery positive terminal to the terminal No. 6 and the battery negative terminal to the terminal No. 4. Check that air is discharged from (B), when supplying air to (A).



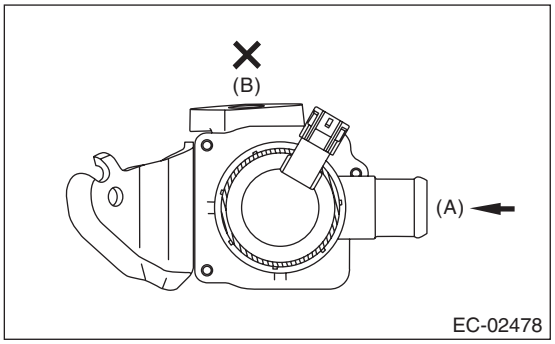
2. SECONDARY AIR COMBINATION VALVE RH

1) Check that the secondary air combination valve RH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve RH.

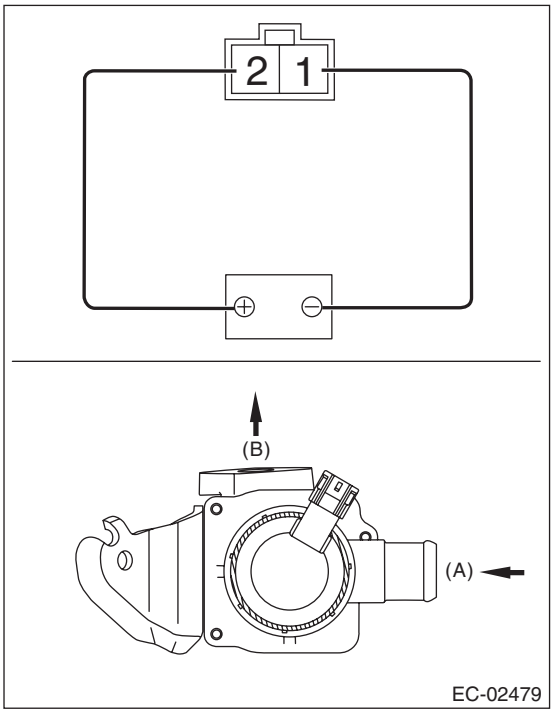


Terminal No.	Standard
1 and 2	5.0±0.5 Ω (when 20°C (68°F))

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



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



3. OTHER INSPECTIONS

1) Check that the secondary air pipe has no deformation, cracks or other damages.
2) Check that the air duct has no cracks, damage or loose part.

INTAKE (INDUCTION)

IN(STI)

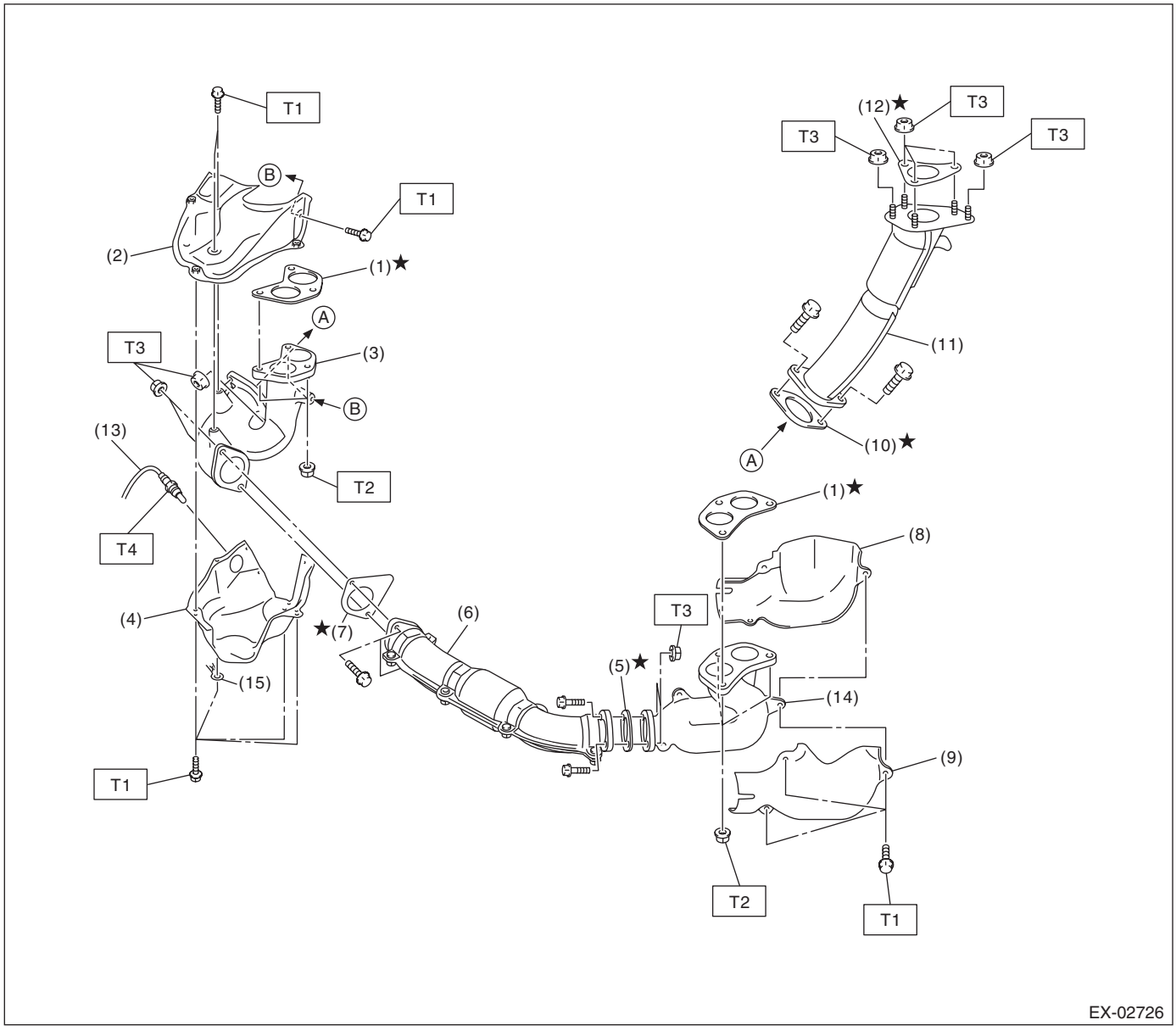
Page

1. General Description 2
2. Air Cleaner Element 7
3. Air Cleaner Case 8
4. Air Intake Duct 10
5. Intake Duct 11
6. Intercooler 12
7. Turbocharger 15
8. Air By-pass Valve 19
9. Resonator Chamber 20

1. General Description

A: COMPONENT

1. FRONT EXHAUST PIPE



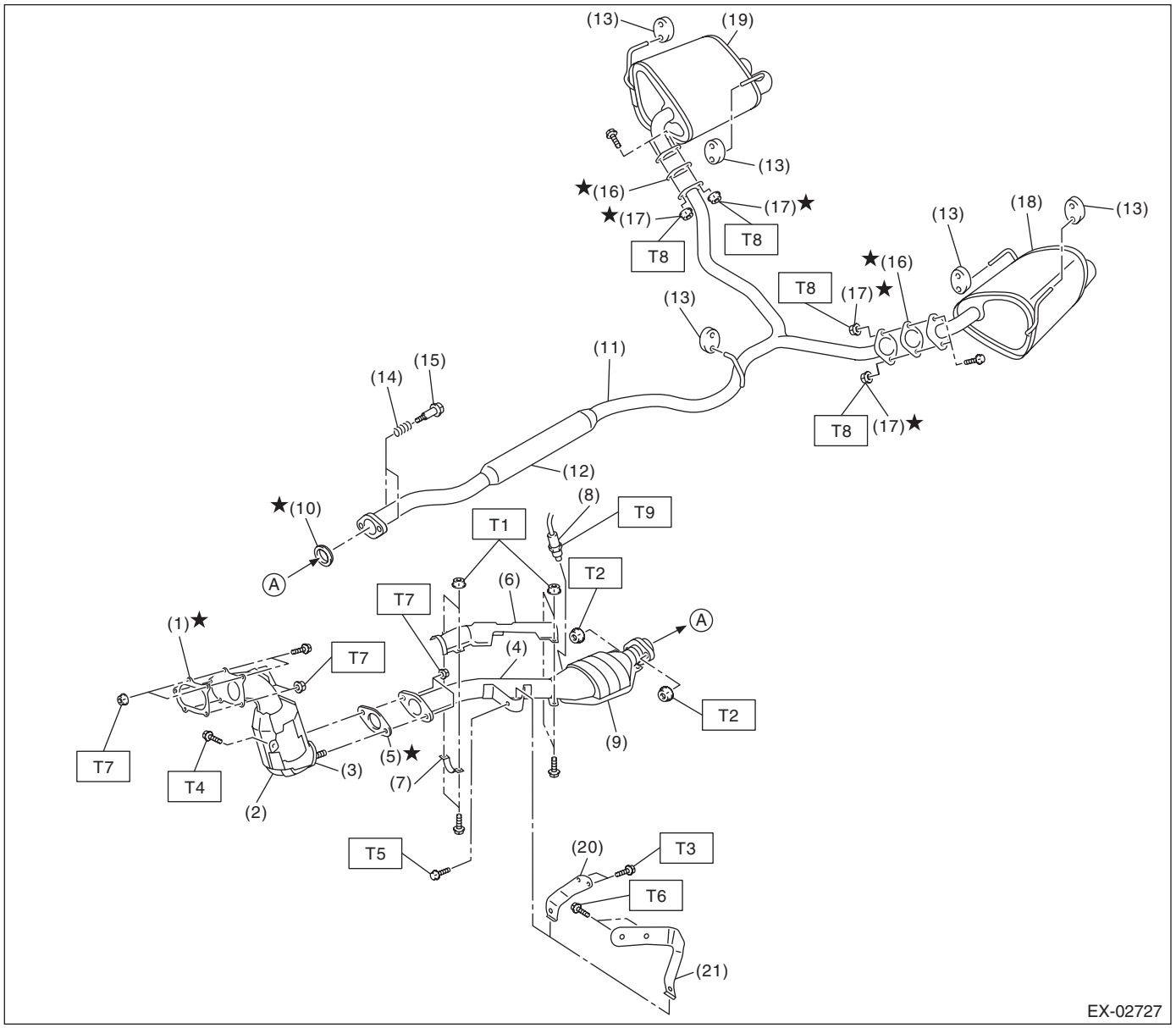
(1) Gasket
(2) Exhaust manifold RH upper cover
(3) Exhaust manifold RH
(4) Exhaust manifold RH lower cover
(5) Gasket
(6) Front exhaust pipe
(7) Gasket
(8) Exhaust manifold LH inner cover
(9) Exhaust manifold LH outer cover
(10) Gasket
(11) Joint pipe
(12) Gasket
(13) Front oxygen (A/F) sensor
(14) Exhaust manifold LH
(15) Ground cable

Tightening torque: N·m (kgf-m, ft-lb)

T1: 19 (1.9, 14.0)
T2: 40 (4.1, 29.5)
T3: 42.5 (4.3, 31.3)
T4: <Ref. to FU(STI)-54, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, INSTALLATION, Front Oxygen (A/F) Sensor.>

2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER

- 4 door model

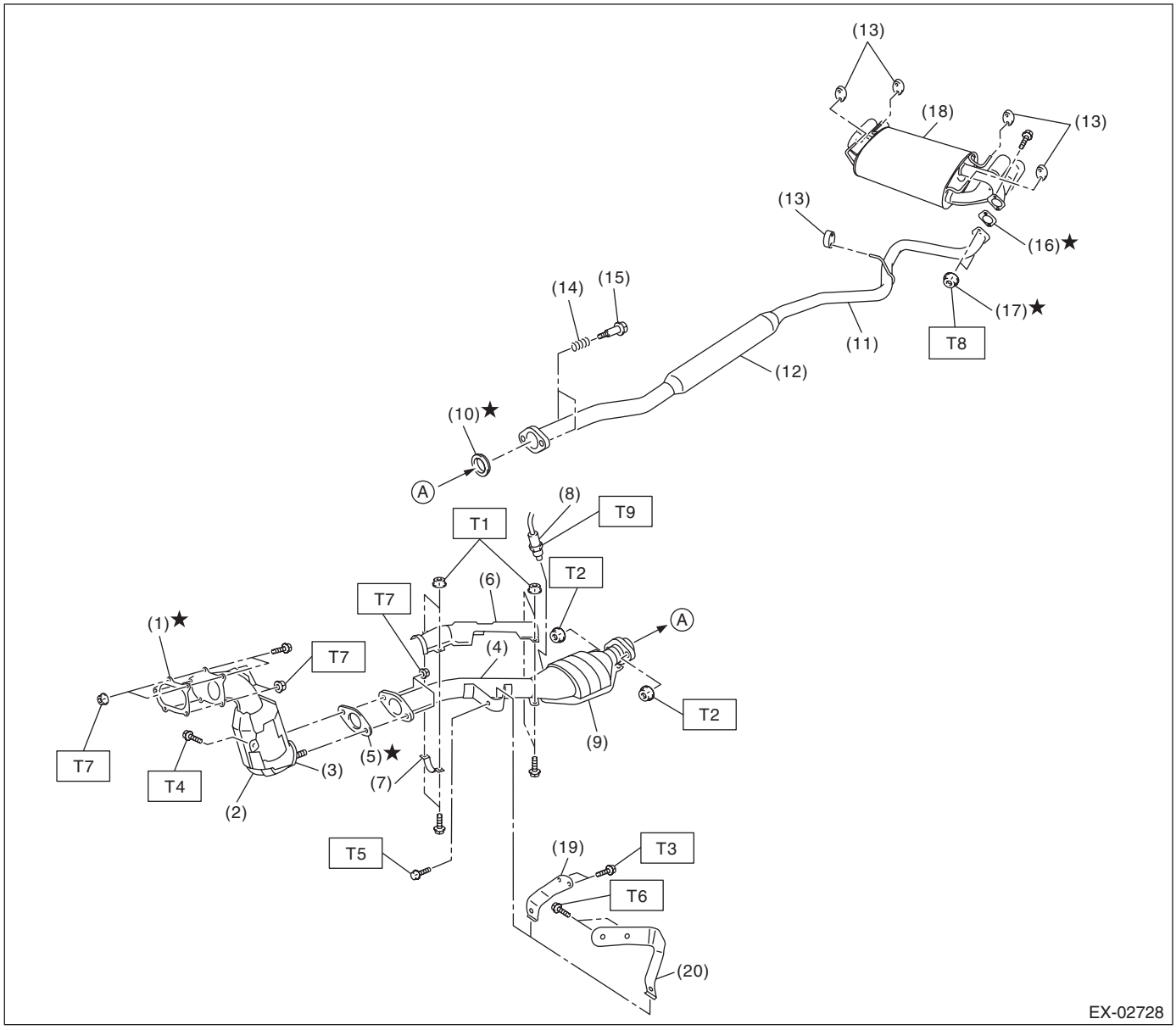


(1)	Gasket	(12)	Chamber
(2)	Front catalytic converter	(13)	Cushion rubber
(3)	Center exhaust pipe (front)	(14)	Spring
(4)	Center exhaust pipe (rear)	(15)	Bolt
(5)	Gasket	(16)	Gasket
(6)	Center exhaust pipe upper cover	(17)	Self-locking nut
(7)	Clamp	(18)	Muffler LH
(8)	Rear oxygen sensor	(19)	Muffler RH
(9)	Rear catalytic converter	(20)	Hanger bracket (5MT model)
(10)	Gasket	(21)	Hanger bracket (6MT model)
(11)	Rear exhaust pipe		

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 13 (1.3, 9.6)***
- ***T2: 18 (1.8, 13.3)***
- ***T3: 23 (2.3, 17.0)***
- ***T4: 30 (3.1, 22.1)***
- ***T5: 35 (3.6, 25.8)***
- ***T6: 40 (4.1, 29.5)***
- ***T7: 42.5 (4.3, 31.3)***
- ***T8: 48 (4.9, 35.4)***
- ***T9: <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>***

- 5 door model



(1)	Gasket	(11)	Rear exhaust pipe
(2)	Front catalytic converter	(12)	Chamber
(3)	Center exhaust pipe (front)	(13)	Cushion rubber
(4)	Center exhaust pipe (rear)	(14)	Spring
(5)	Gasket	(15)	Bolt
(6)	Center exhaust pipe upper cover	(16)	Gasket
(7)	Clamp	(17)	Self-locking nut
(8)	Rear oxygen sensor	(18)	Muffler
(9)	Rear catalytic converter	(19)	Hanger bracket (5MT model)
(10)	Gasket	(20)	Hanger bracket (6MT model)

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 13 (1.3, 9.6)***
- ***T2: 18 (1.8, 13.3)***
- ***T3: 23 (2.3, 17.0)***
- ***T4: 30 (3.1, 22.1)***
- ***T5: 35 (3.6, 25.8)***
- ***T6: 40 (4.1, 29.5)***
- ***T7: 42.5 (4.3, 31.3)***
- ***T8: 48 (4.9, 35.4)***
- ***T9: <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>***

B: CAUTION

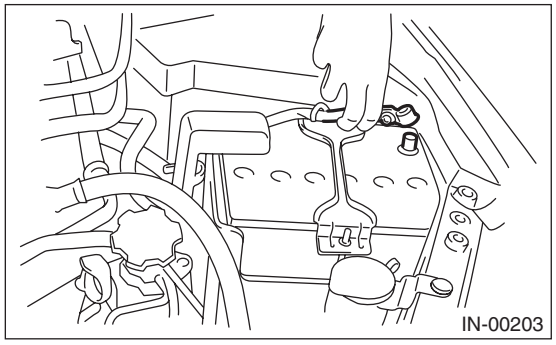
- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If any grease adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

2. Front Exhaust Pipe

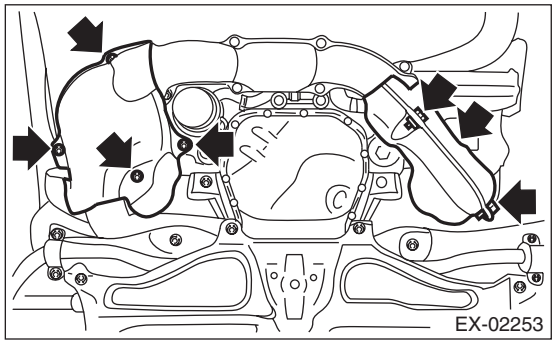
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

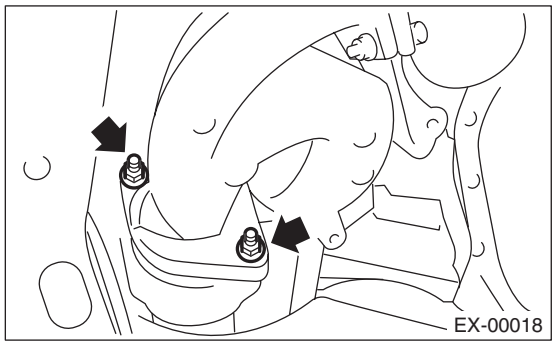
1) Disconnect the ground cable from battery.



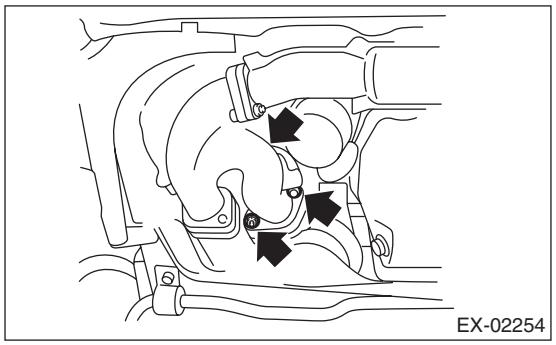
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, REMOVAL, Front Oxygen (A/F) Sensor.>
5) Remove the exhaust manifold RH lower cover and exhaust manifold LH cover.

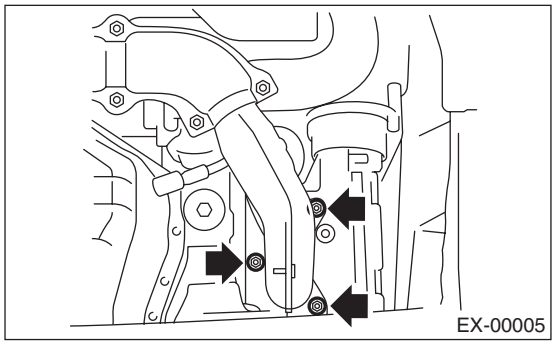


6) Remove the bolts and nuts which hold joint pipe onto exhaust manifold RH.



7) While holding the front exhaust pipe with one hand, remove the nuts which hold the exhaust manifold to the cylinder head exhaust port and remove the front exhaust pipe.



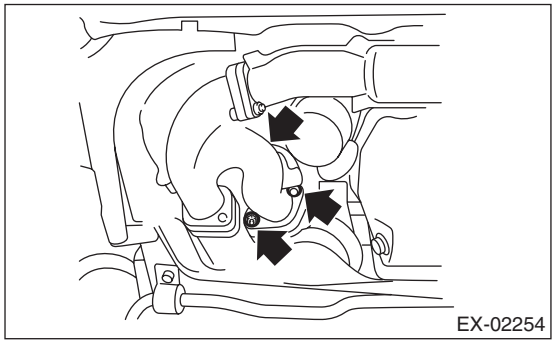


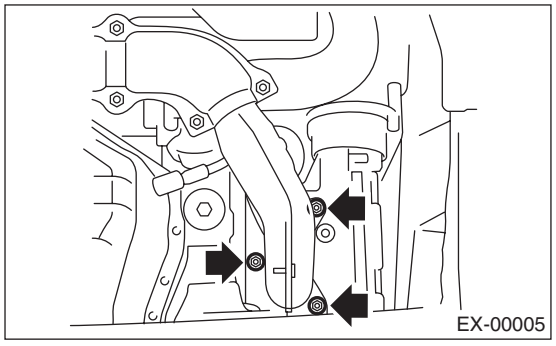
B: INSTALLATION

1) Install the front exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)

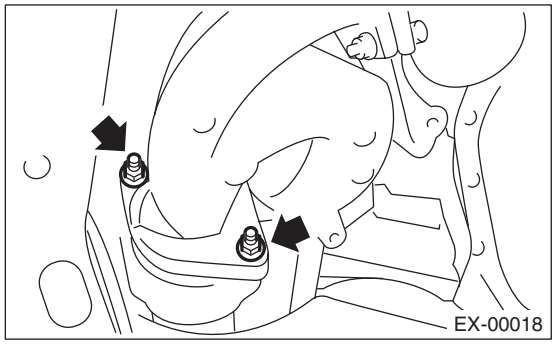




2) Install the joint pipe to the exhaust manifold RH.

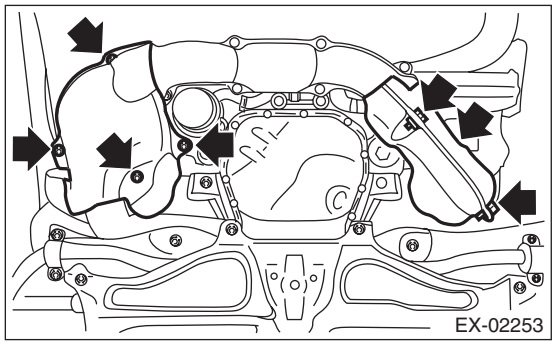
NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

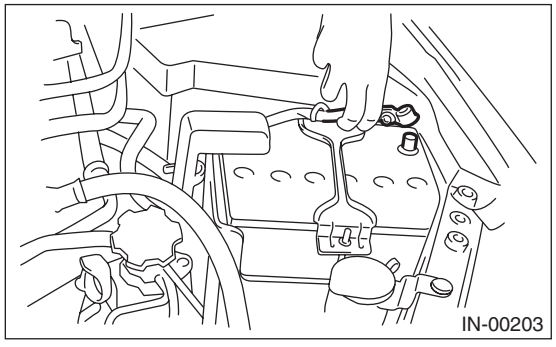


3) Install the exhaust manifold RH lower cover and exhaust manifold LH cover.

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

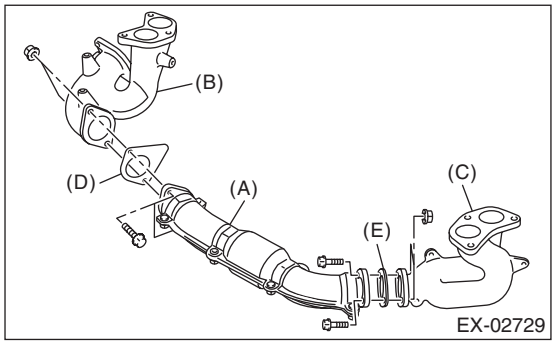


4) Install the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, INSTALLATION, Front Oxygen (A/F) Sensor.>
5) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
6) Lower the vehicle.
7) Connect the battery ground terminal.



C: DISASSEMBLY

1) Remove the exhaust manifold RH upper cover.
2) Remove the exhaust manifold RH and the exhaust manifold LH from the front exhaust pipe.



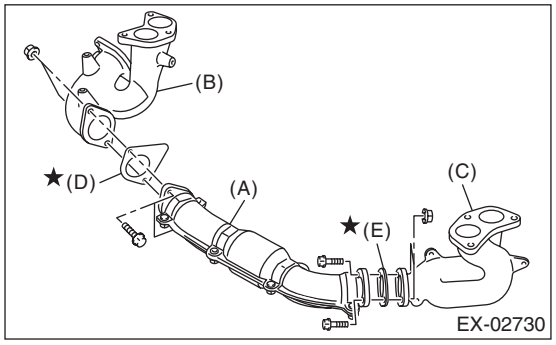
(A) Front exhaust pipe
(B) Exhaust manifold RH
(C) Exhaust manifold LH
(D) Gasket
(E) Gasket

D: ASSEMBLY

1) Install the exhaust manifold RH and the exhaust manifold LH to the front exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



(A) Front exhaust pipe
(B) Exhaust manifold RH
(C) Exhaust manifold LH
(D) Gasket
(E) Gasket

2) Install the exhaust manifold RH upper cover.

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

E: INSPECTION

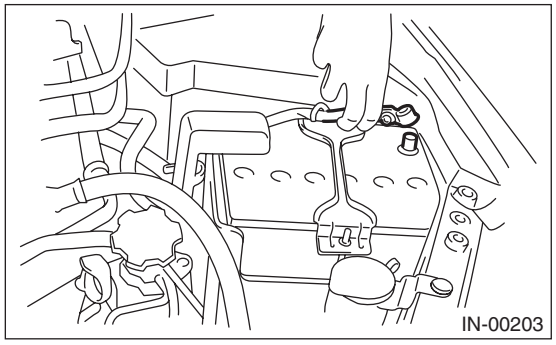
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

3. Center Exhaust Pipe

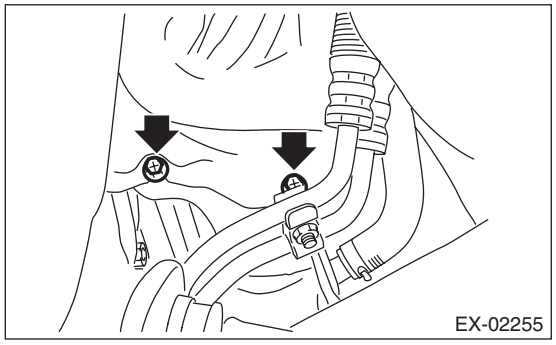
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

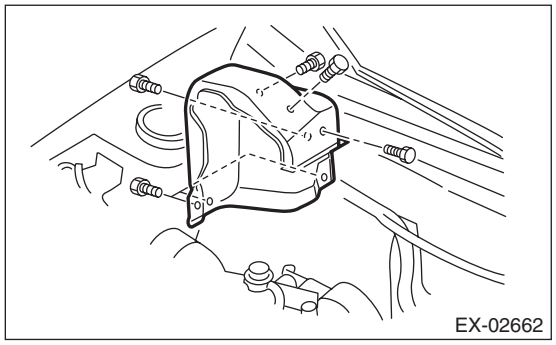
1) Disconnect the ground cable from battery.



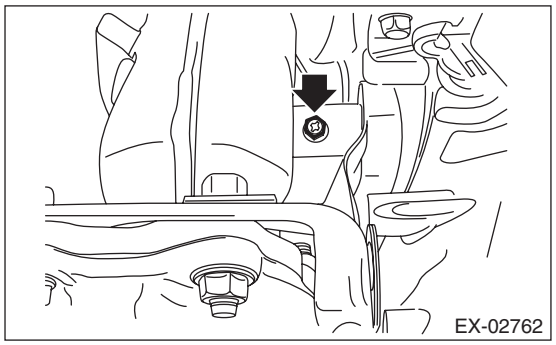
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Lift up the vehicle.
4) Remove the transmission under cover. (6MT model)
5) Remove the bolts which secure the lower side of the turbocharger lower cover.



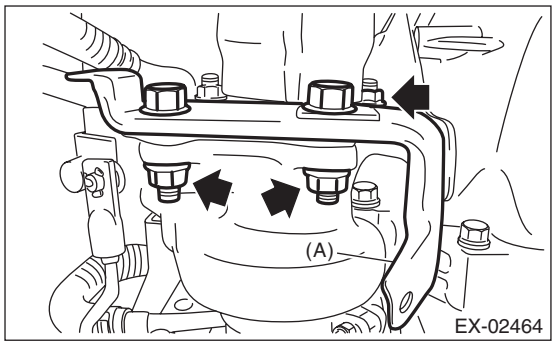
6) Lower the vehicle.
7) Remove the turbocharger upper cover.



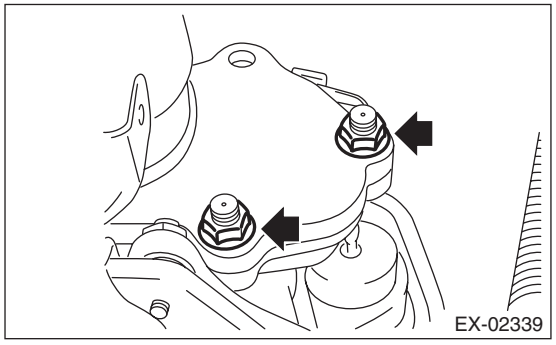
8) Remove the bolts which hold the upper side of the turbocharger lower cover.



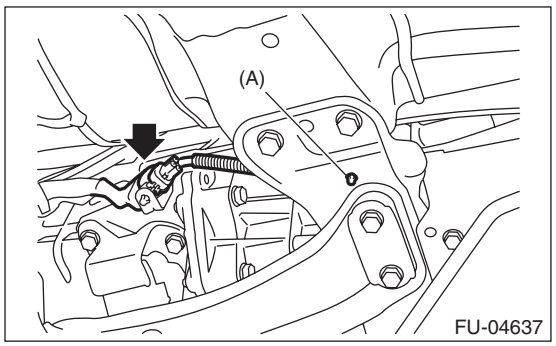
9) Remove the upper side bolts and nuts that hold the center exhaust pipe on the turbocharger, and remove the turbocharger cover stay (A).



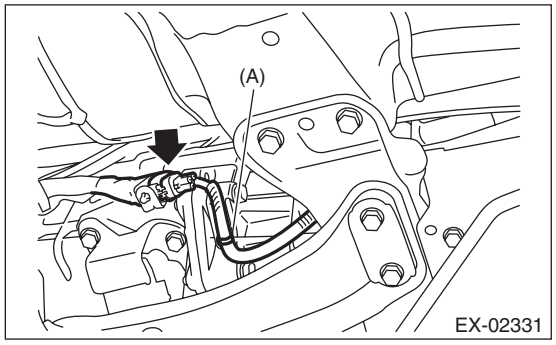
10) Lift up the vehicle.
11) Remove the lower side nuts (two places) that hold the center exhaust pipe on the turbocharger.



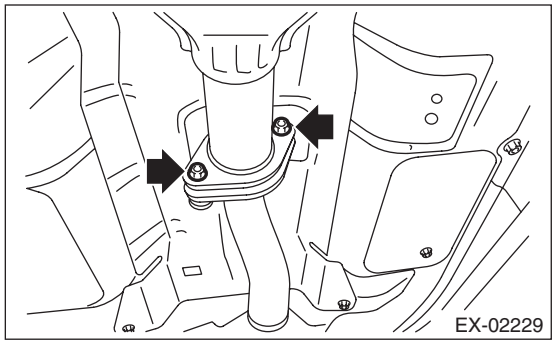
12) Disconnect the connector from the rear oxygen sensor, and remove the clip (A) holding the rear oxygen sensor harness.
- 5MT model



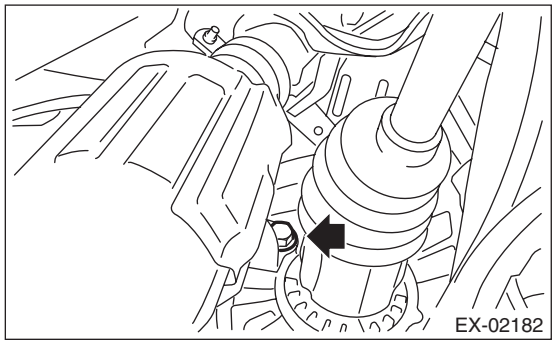
• 6MT model



13) Remove the rear exhaust pipe from center exhaust pipe.

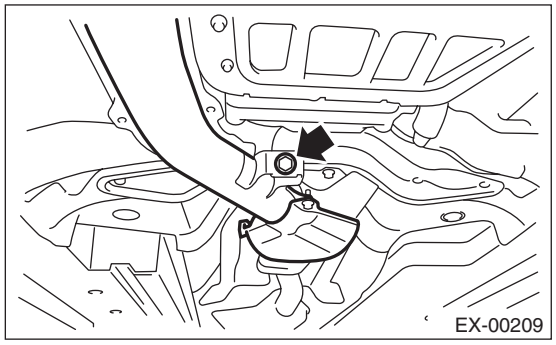


14) Remove the bolt which holds center exhaust pipe to transmission.



15) Remove the bolt which holds center exhaust pipe to hanger bracket, and remove the center exhaust pipe.

CAUTION:
Be careful not to drop the center exhaust pipe.



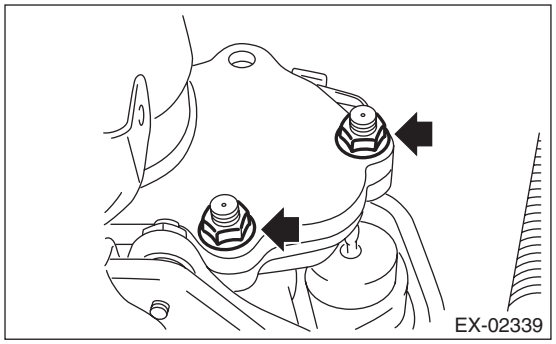
16) Remove the turbocharger lower cover.

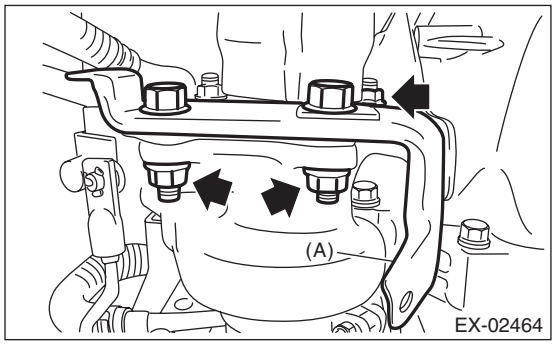
B: INSTALLATION

1) Set the turbocharger lower cover, and temporarily tighten the bolts that hold the lower side of the turbocharger lower cover.
2) Install the center exhaust pipe and temporarily tighten the bolt which holds center exhaust pipe to hanger bracket.
3) Temporarily tighten the bolt which holds the center exhaust pipe to the transmission.
4) Install the center exhaust pipe along with the turbocharger cover stay (A) to the turbocharger.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

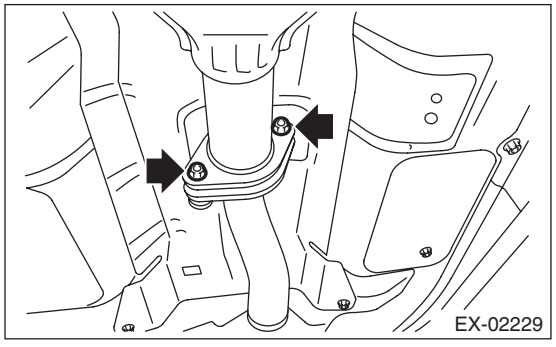




5) Install the rear exhaust pipe to center exhaust pipe.

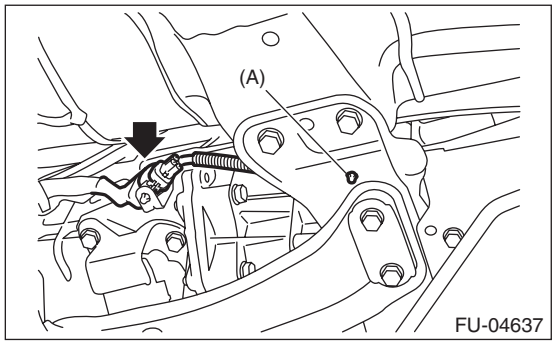
NOTE:
Use a new gasket.

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

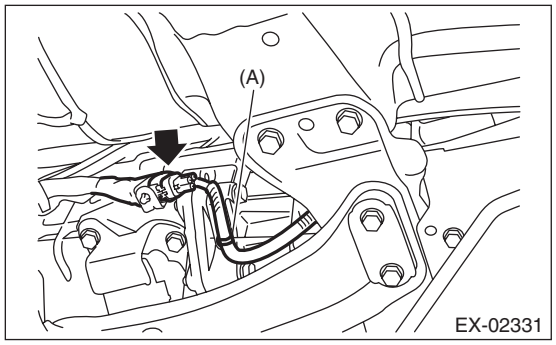


6) Connect the connector to the rear oxygen sensor, and hold the rear oxygen sensor harness with the clip (A).

- 5MT model

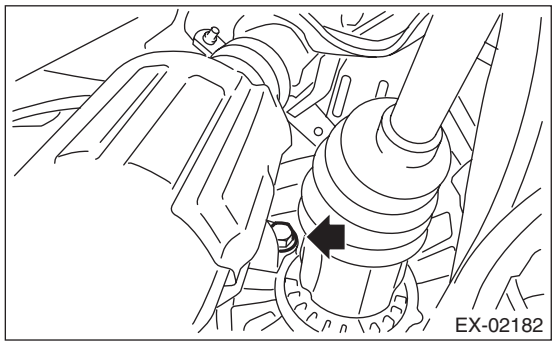


- 6MT model



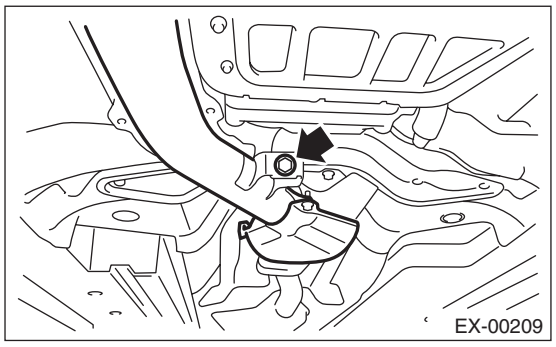
7) Tighten the bolt which holds center exhaust pipe to transmission.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)



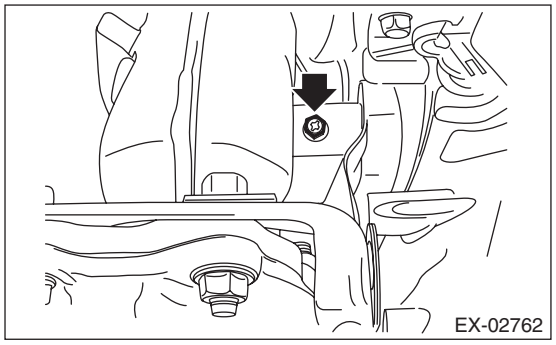
8) Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



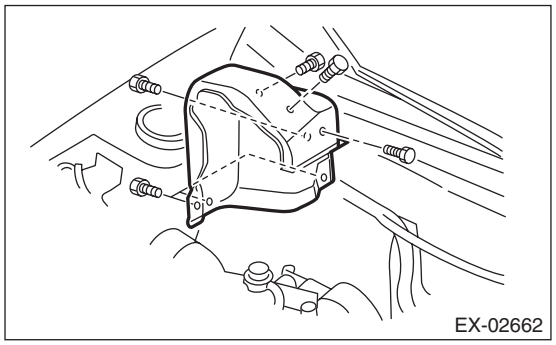
9) Lower the vehicle.
10) Attach the bolt which holds the upper side of the turbocharger lower cover.

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



11) Attach the turbocharger upper cover.

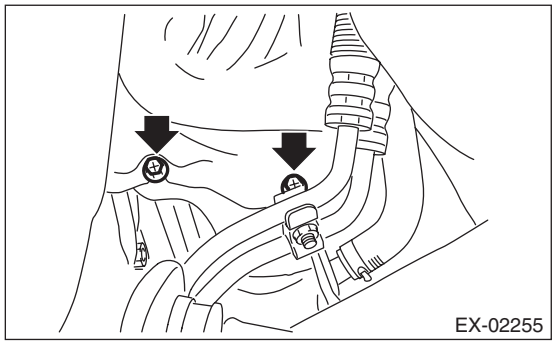
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



12) Lift up the vehicle.

13) Tighten the bolts that secure the lower side of the turbocharger lower cover.

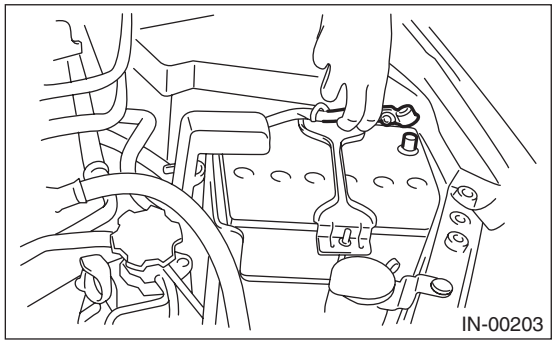
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



14) Install the transmission under cover. (6MT model)

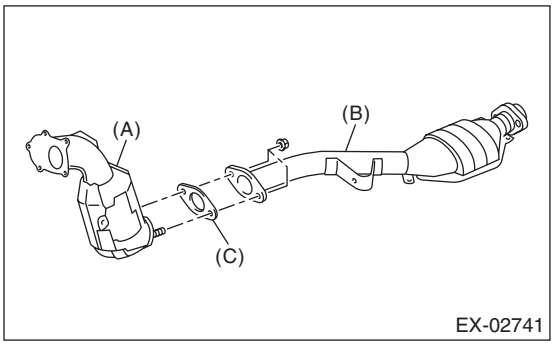
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

15) Lower the vehicle.
16) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
17) Connect the battery ground terminal.



C: DISASSEMBLY

1) Remove the rear O_2 sensor from the center exhaust pipe (rear). <Ref. to FU(STI)-56, REMOVAL, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, REMOVAL, Rear Oxygen Sensor.>
2) Remove the center exhaust pipe upper cover.
3) Remove the center exhaust pipe (rear) from the center exhaust pipe (front).



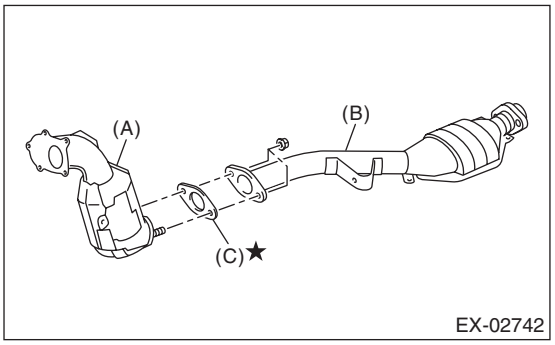
(A) Center exhaust pipe (front)
(B) Center exhaust pipe (rear)
(C) Gasket

D: ASSEMBLY

1) Assemble the center exhaust pipe (rear) to the center exhaust pipe (front).

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



(A) Center exhaust pipe (front)
(B) Center exhaust pipe (rear)
(C) Gasket

2) Install the center exhaust pipe upper cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

3) Install the rear O_2 sensor to the center exhaust pipe (rear). <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>

E: INSPECTION

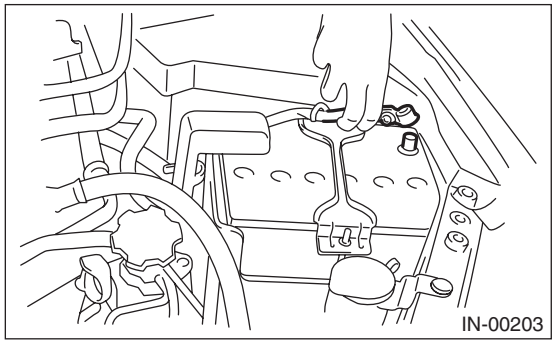
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

4. Joint Pipe

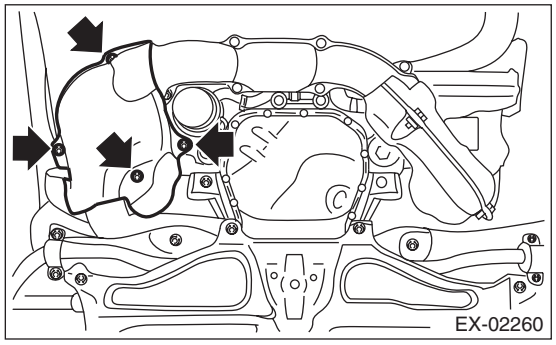
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

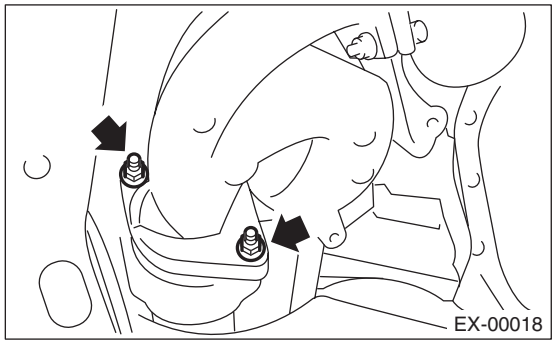
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, REMOVAL, Front Oxygen (A/F) Sensor.>
5) Remove the exhaust manifold RH lower cover.



6) Remove the bolts and nuts which hold exhaust manifold RH onto joint pipe.



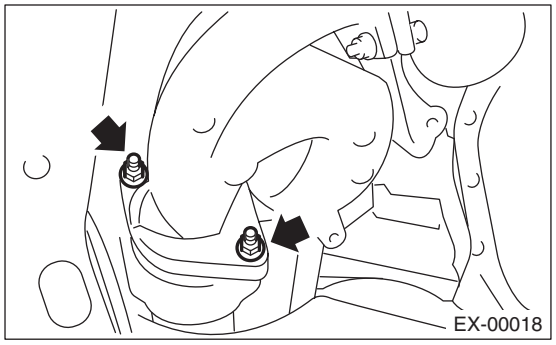
7) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
8) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.> <Ref. to IN(w/o STI)-14, REMOVAL, Turbocharger.>
9) Take off the joint pipe in the upward direction.

B: INSTALLATION

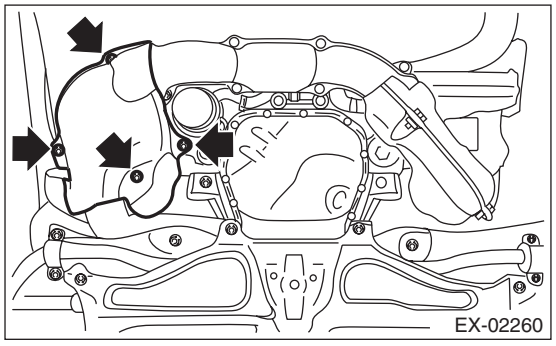
Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



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



C: INSPECTION

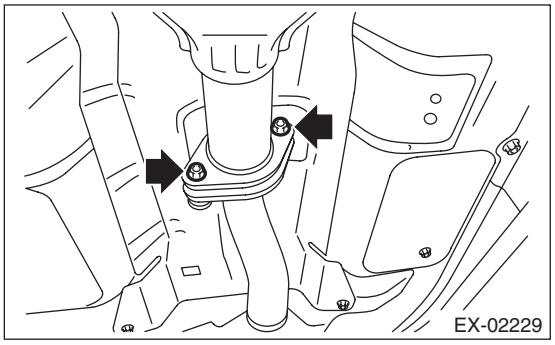
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

5. Rear Exhaust Pipe

A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

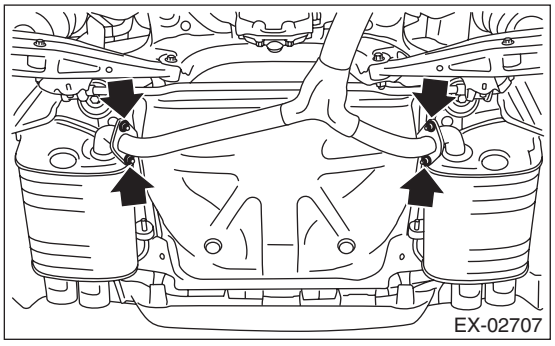
1) Lift up the vehicle.
2) Remove the center exhaust pipe from rear exhaust pipe.



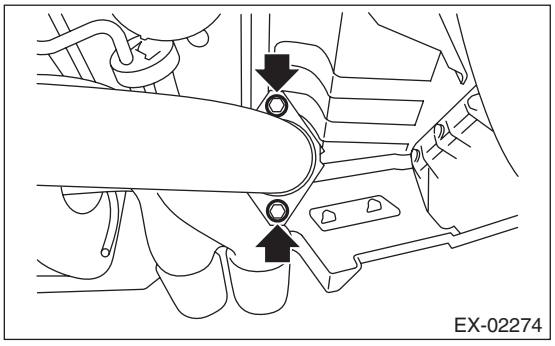
3) Remove the muffler from rear exhaust pipe.

CAUTION:
Be careful not to drop the rear exhaust pipe.

- 4 door model

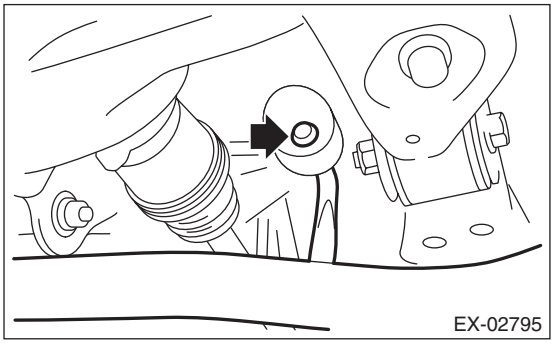


- 5 door model



4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
5) Remove the rear exhaust pipe from the cushion rubber.

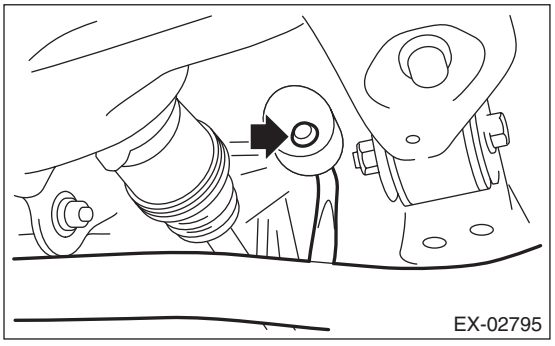
CAUTION:
Be careful not to let the muffler contact the rear bumper.



B: INSTALLATION

1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
2) Install the rear exhaust pipe to cushion rubber.

NOTE:
After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

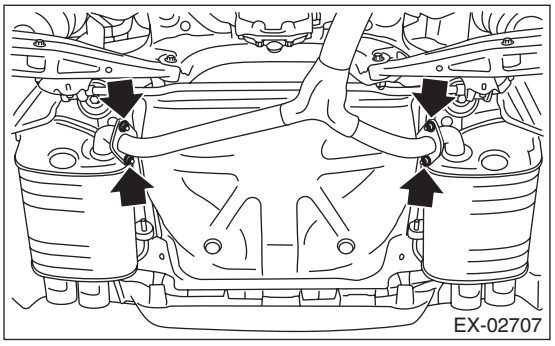


3) Install the rear exhaust pipe to the muffler.

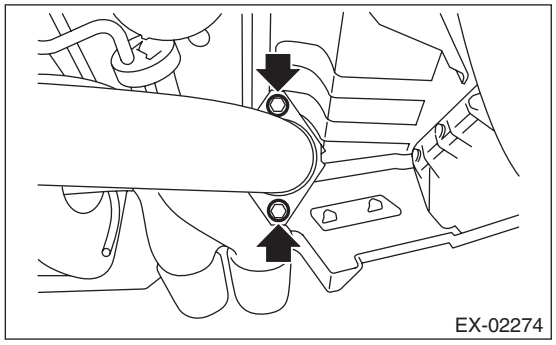
NOTE:
Use a new gasket and self-locking nut.

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

- 4 door model



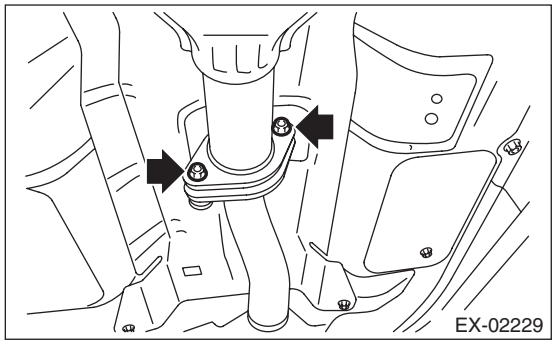
- 5 door model



4) Install the center exhaust pipe to rear exhaust pipe.

NOTE:
Use a new gasket.

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



5) Lower the vehicle.

C: INSPECTION

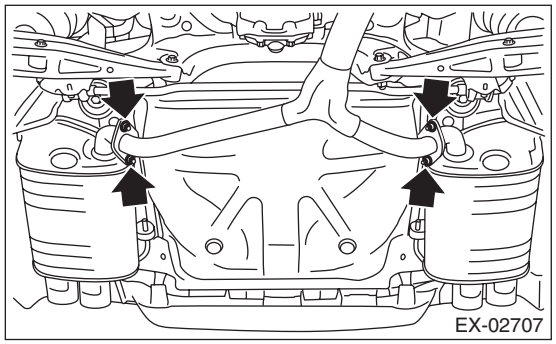
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

6. Muffler

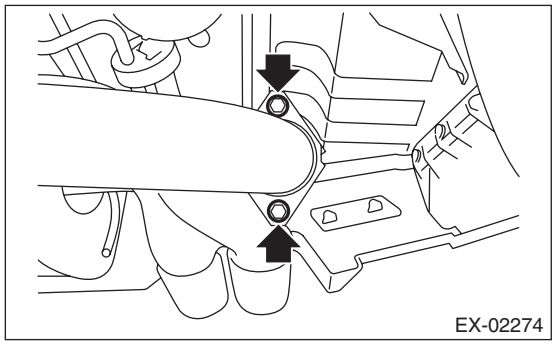
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

1) Lift up the vehicle.
2) Remove the rear exhaust pipe from the muffler.
- 4 door model



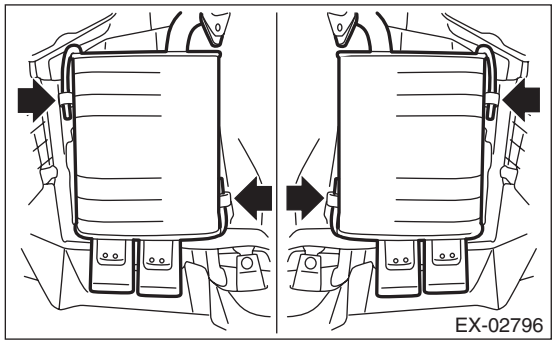
- 5 door model



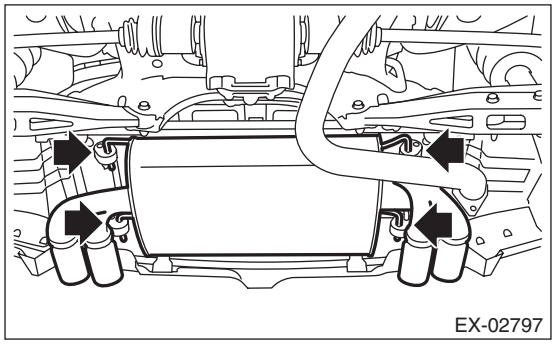
3) Apply a coat of spray type lubricant to the mating area of cushion rubber.
4) Remove the muffler from the cushion rubber.

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

- 4 door model



- 5 door model



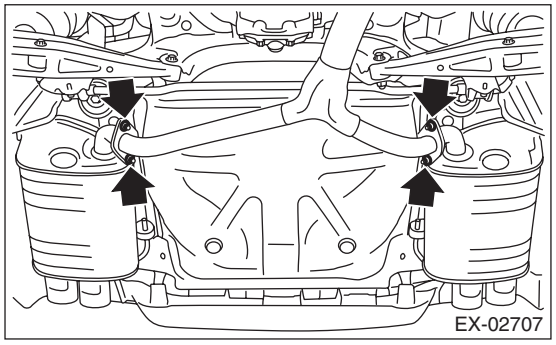
B: INSTALLATION

Install in the reverse order of removal.

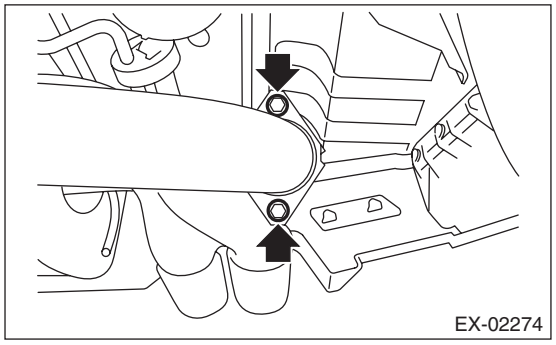
NOTE:
- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

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

- 4 door model



- 5 door model



C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

COOLING

CO(STI)

Page

1. General Description 2
2. Radiator Fan System 7
3. Engine Coolant 13
4. Water Pump 15
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6. Radiator 19
7. Radiator Cap 22
8. Radiator Main Fan and Fan Motor 23
9. Radiator Sub Fan and Fan Motor 25
10. Reservoir Tank 27
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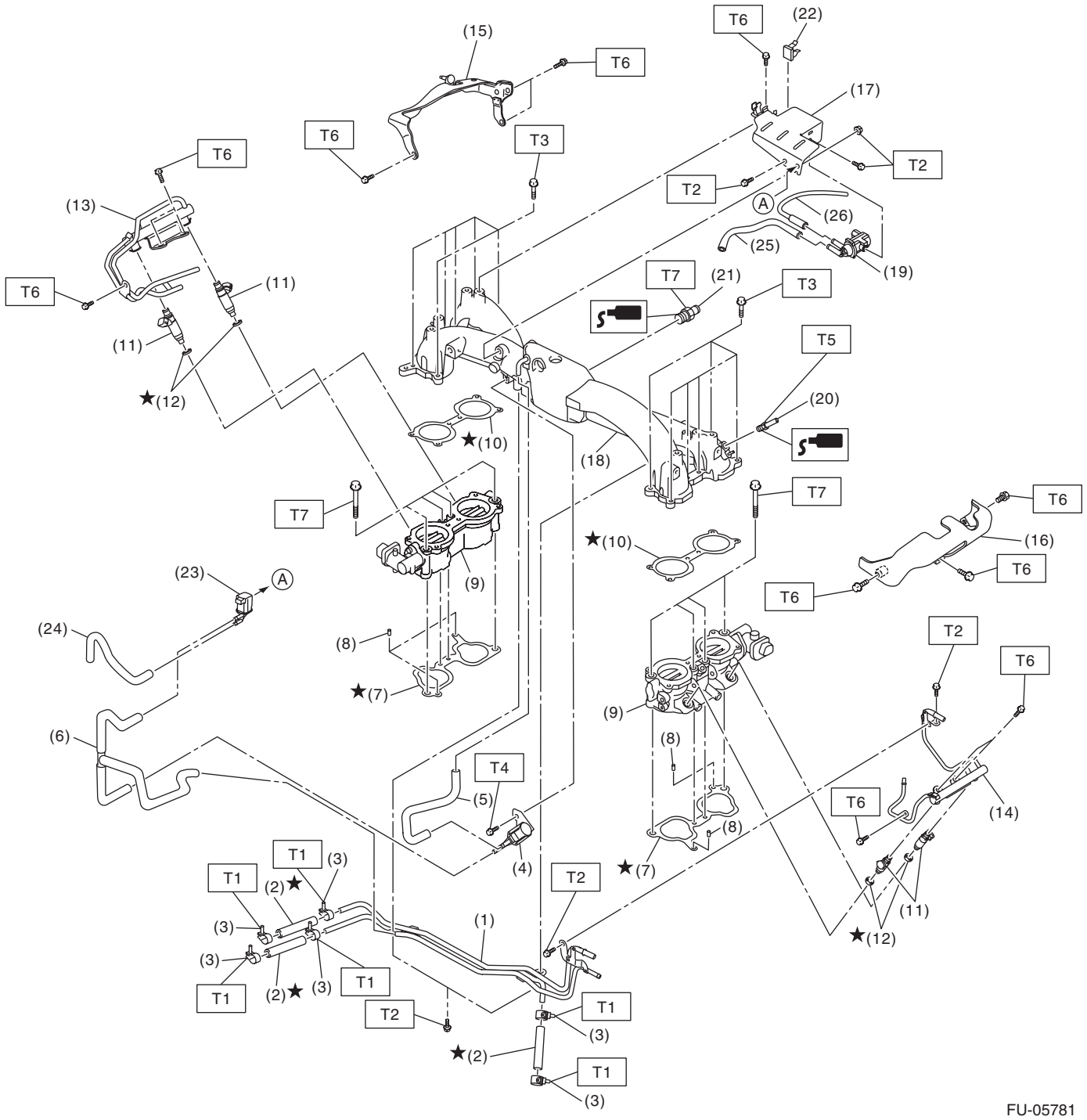
1. General Description

A: SPECIFICATION

Fuel tank	Capacity	64 L (16.9 US gal, 14.1 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	900 kPa (9.18 kg/cm^2, 130.5 psi), or less
	Discharge rate	175 L (46.2 US gal, 38.5 Imp gal)/h or more [12 V at 300 kPa (3.06 kg/cm^2, 43.5 psi)]
Fuel filter		In-tank type

B: COMPONENT

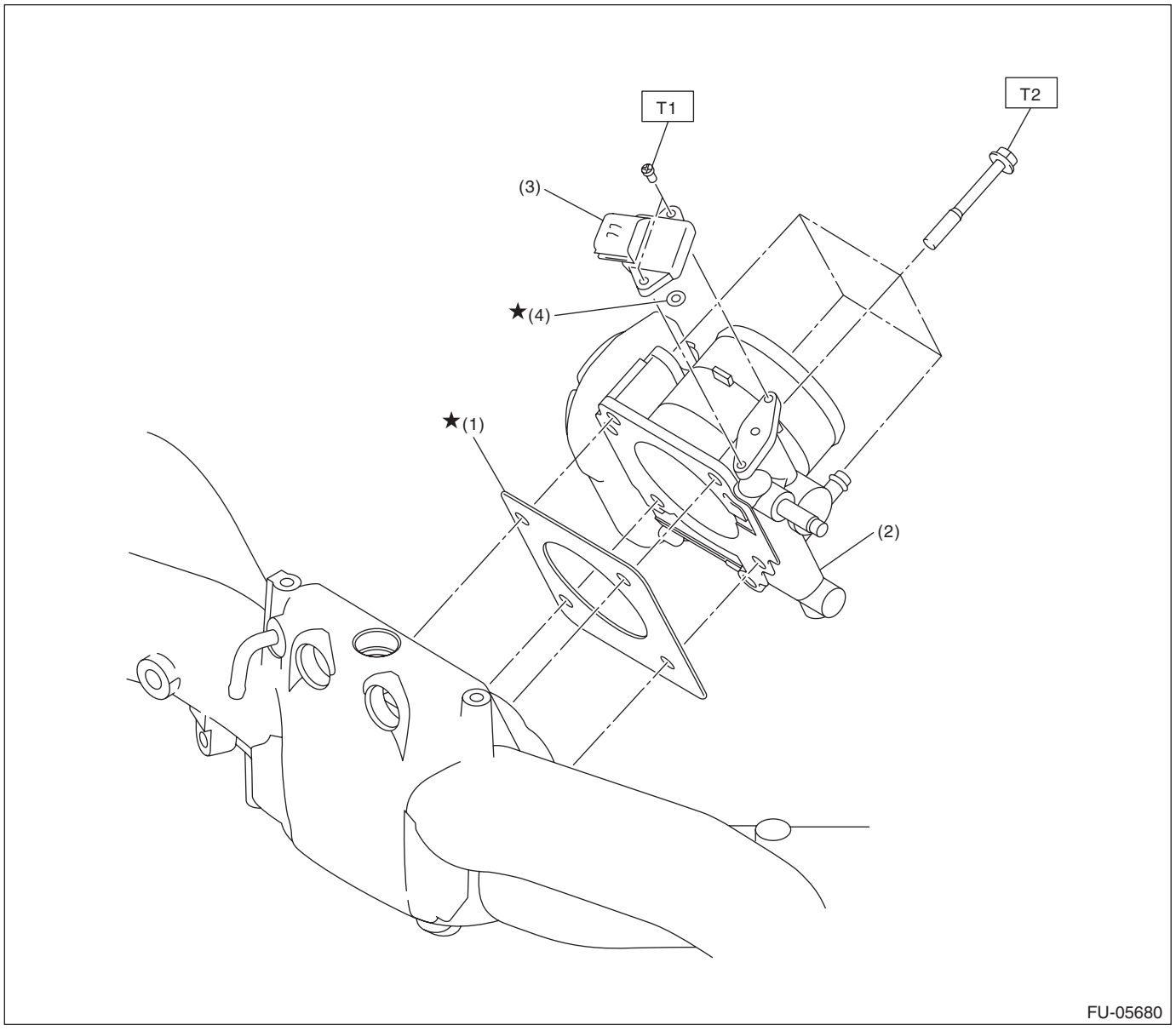
1. INTAKE MANIFOLD



(1) Fuel pipe ASSY
(2) Fuel hose
(3) Clamp
(4) Purge control solenoid valve 1
(5) Vacuum hose A
(6) Vacuum control hose
(7) Intake manifold gasket
(8) Guide pin
(9) Tumble generator valve ASSY
(10) Tumble generator valve gasket
(11) Fuel injector
(12) O-ring
(13) Fuel injector pipe RH
(14) Fuel injector pipe LH
(15) Fuel pipe protector RH
(16) Fuel pipe protector LH
(17) Solenoid valve bracket
(18) Intake manifold
(19) Wastegate control solenoid valve
(20) Nipple
(21) Nipple
(22) Clip
(23) Purge control solenoid valve 2
(24) Vacuum hose
(25) Vacuum hose
(26) Air control hose

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.25 (0.1, 0.9)
T2: 6.4 (0.7, 4.7)
T3: 8.3 (0.8, 6.1)
T4: 16 (1.6, 11.8)
T5: 17 (1.7, 12.5)
T6: 19 (1.9, 14.0)
T7: 25 (2.5, 18.4)

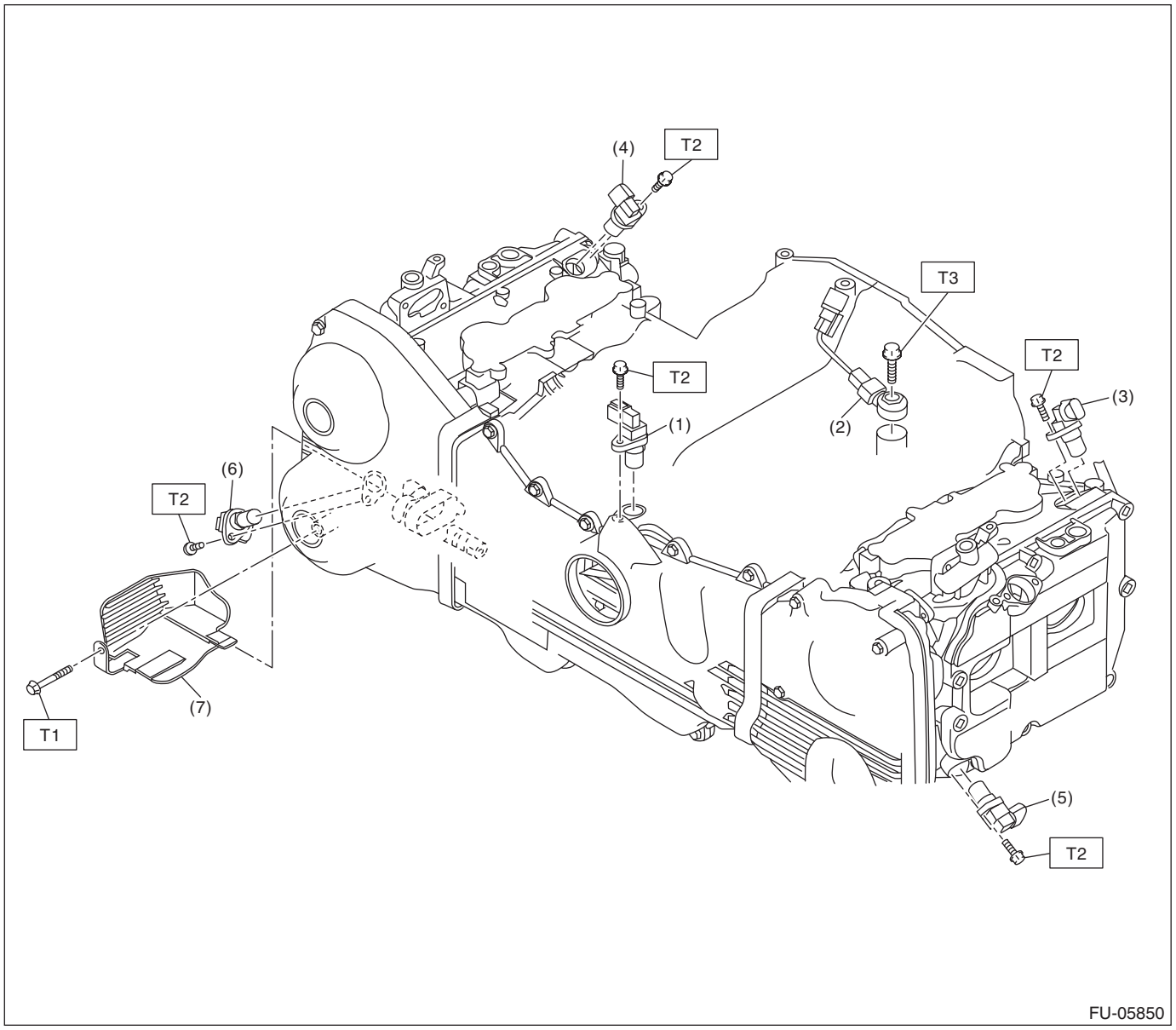
2. AIR INTAKE SYSTEM



(1) Gasket
(2) Throttle body
(3) Manifold absolute pressure sensor
(4) O-ring

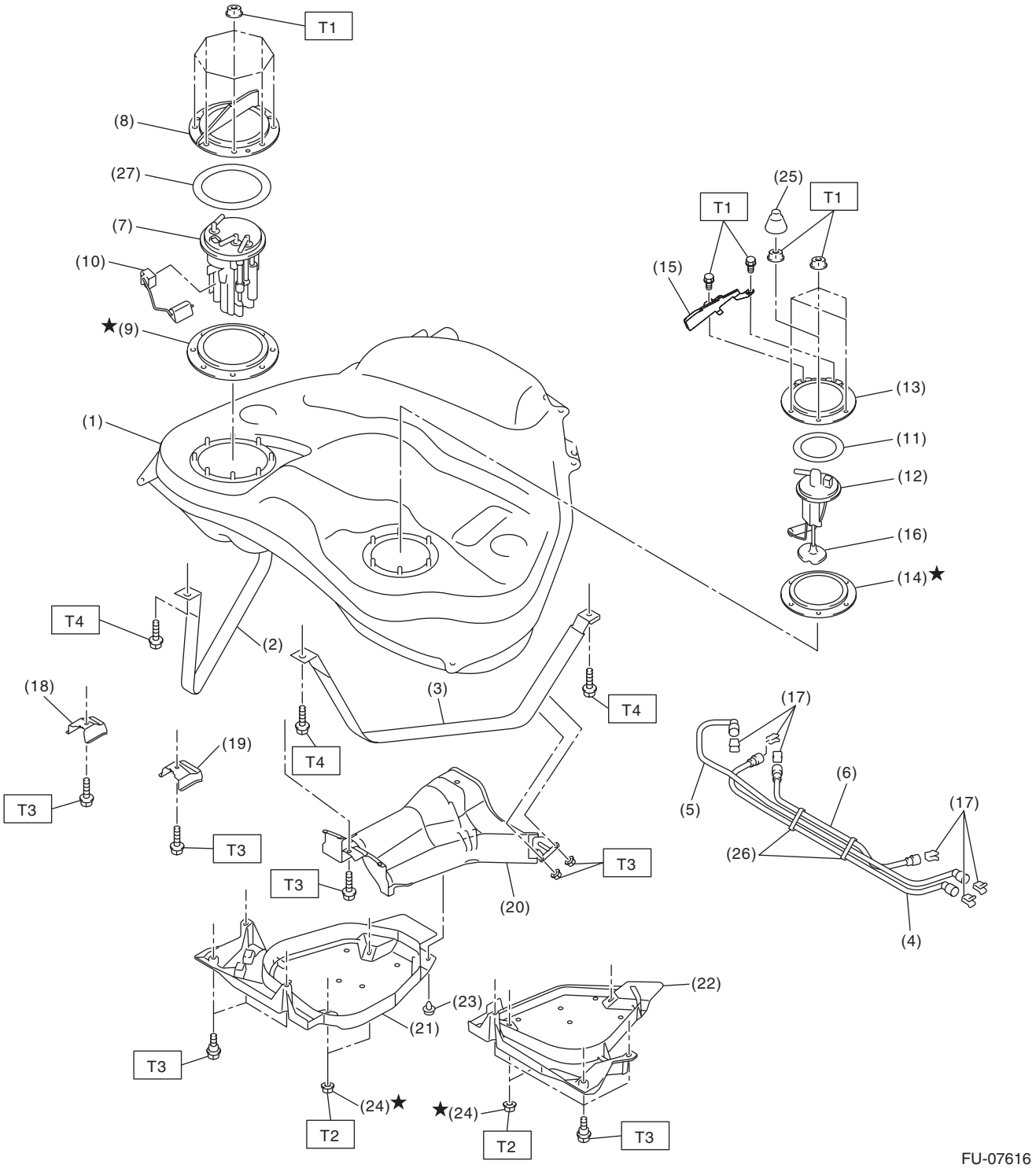
Tightening torque: N·m (kgf-m, ft-lb)
T1: 2 (0.2, 1.5)
T2: 8 (0.8, 5.9)

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(1)	Crankshaft position sensor	(5)	Exhaust camshaft position sensor LH	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Knock sensor	(6)	Exhaust camshaft position sensor RH	***T1: 5 (0.5, 3.7)***
(3)	Intake camshaft position sensor LH	(7)	Engine harness cover	***T2: 6.4 (0.7, 4.7)***
(4)	Intake camshaft position sensor RH			***T3: 24 (2.4, 17.7)***

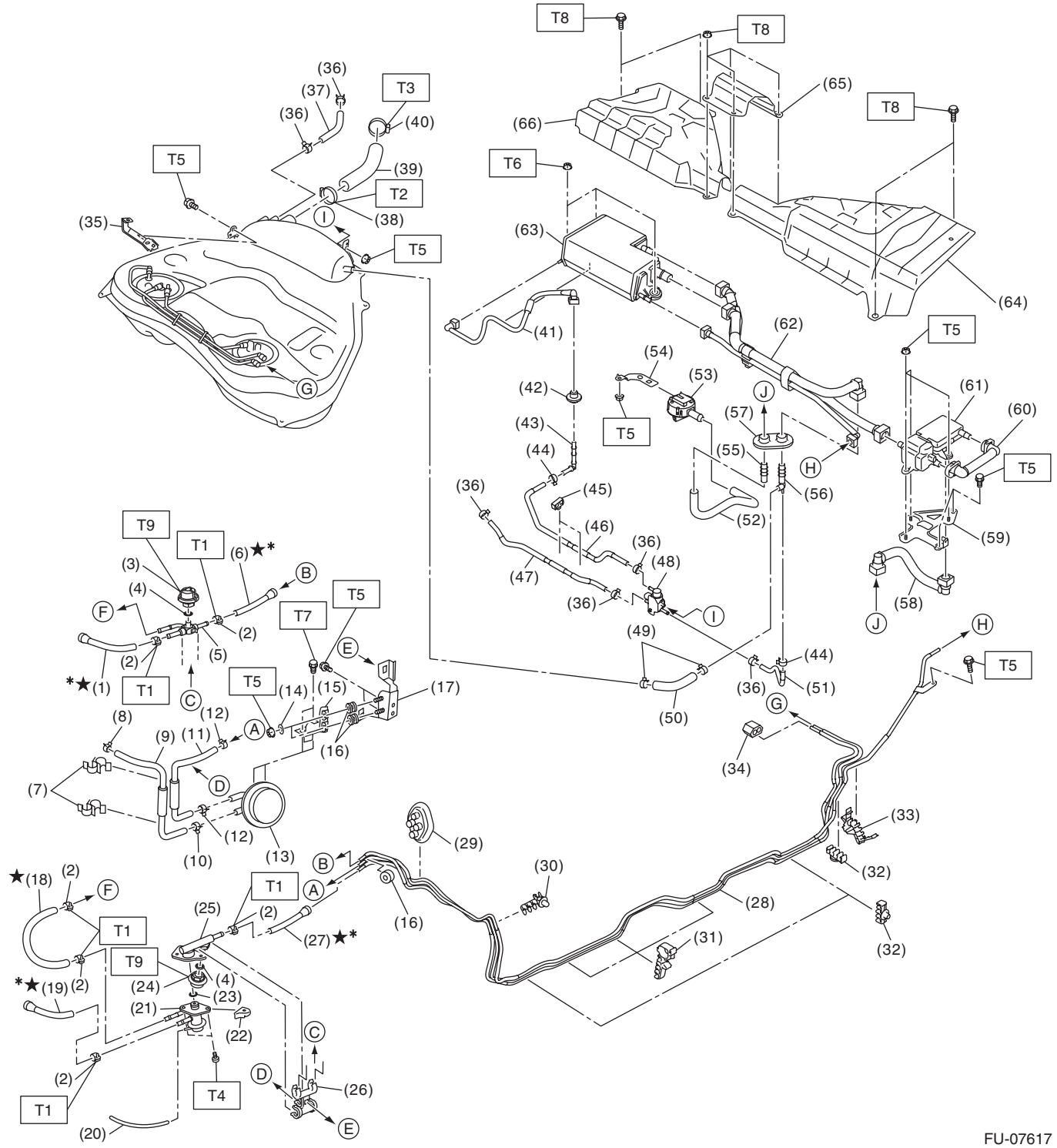
4. FUEL TANK


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T3
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T2
★(24)
T2
T3
FU-07616

(1) Fuel tank
(2) Fuel tank band RH
(3) Fuel tank band LH
(4) Fuel delivery tube
(5) Fuel return tube
(6) Jet pump tube
(7) Fuel pump ASSY
(8) Fuel pump upper plate
(9) Fuel pump gasket
(10) Fuel level sensor
(11) Fuel sub level sensor upper plate cushion
(12) Fuel sub level sensor
(13) Fuel sub level sensor upper plate
(14) Fuel sub level sensor gasket
(15) Fuel sub level sensor protector
(16) Fuel sub level sensor filter
(17) Retainer
(18) Stopper RH
(19) Stopper LH
(20) Heat shield cover
(21) Fuel tank protector RH
(22) Fuel tank protector LH
(23) Clip
(24) Self-locking nut
(25) Rubber cap
(26) Tube clamp
(27) Fuel pump upper plate cushion

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.4, 3.2)
T2: 9 (0.9, 6.6)
T3: 18 (1.8, 13.3)
T4: 33 (3.4, 24.3)

5. FUEL LINE

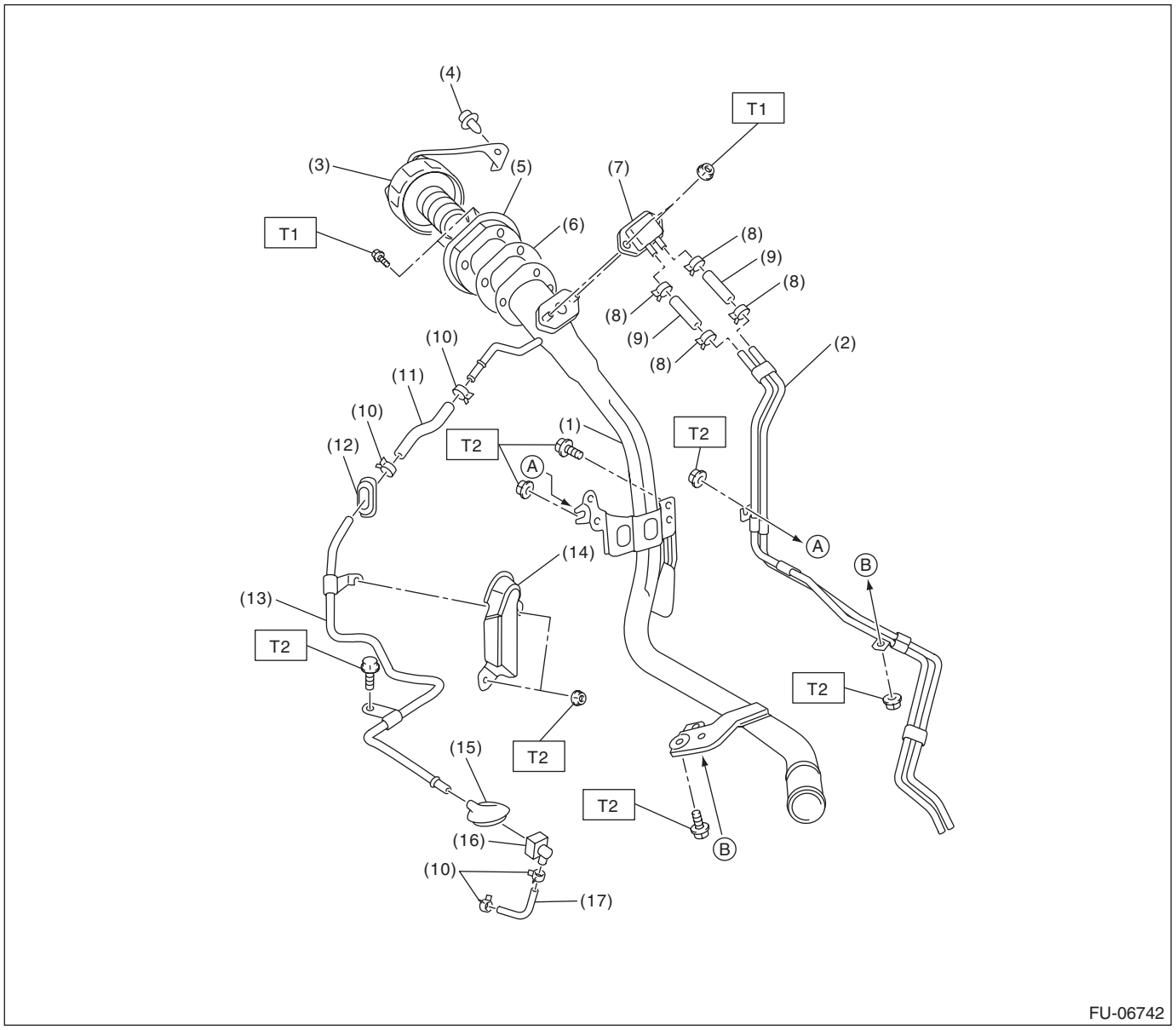

T8
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(51)
(34)
(33)
FU-07617

(1) Fuel delivery hose A
(2) Clamp
(3) Pulsation damper A
(4) Fuel pipe gasket
(5) Fuel by-pass pipe
(6) Fuel delivery hose B
(7) Hose clamp
(8) Clip
(9) Evaporation hose A
(10) Clip
(11) Evaporation hose B
(12) Clip
(13) Purge damper
(14) Collar
(15) Purge damper bracket
(16) Bushing
(17) Damper bracket
(18) Fuel hose
(19) Fuel return hose A
(20) Vacuum hose
(21) Pressure regulator
(22) Fuel pipe protector
(23) O-ring
(24) Pulsation damper B
(25) Fuel holder ASSY
(26) Damper holder
(27) Fuel return hose B
(28) Fuel pipe ASSY
(29) Fuel pipe front grommet
(30) Pipe clamp
(31) Pipe clamp
(32) Pipe clamp
(33) Pipe clamp
(34) Fuel pipe rear grommet
(35) Bracket
(36) Clip
(37) Evaporation hose C
(38) Clamp
(39) Fuel filler hose
(40) Clamp
(41) PCV drain tube
(42) Grommet
(43) Hose connector
(44) Clip
(45) Hose clamp
(46) Evaporation hose D
(47) Evaporation hose E
(48) Pressure control solenoid valve ASSY
(49) Clip
(50) Evaporation hose F
(51) Evaporation hose G
(52) Drain hose
(53) Drain separator
(54) Drain separator bracket
(55) Hose connector
(56) Hose connector
(57) Grommet
(58) Drain tube A
(59) Leak check valve ASSY bracket
(60) Drain tube B
(61) Leak check valve ASSY
(62) Canister tube ASSY
(63) Canister
(64) Canister cover LH
(65) Center canister cover
(66) Canister cover RH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.25 (0.1, 0.9)
T2: 2 (0.2, 1.5)
T3: 2.5 (0.3, 1.8)
T4: 6.4 (0.7, 4.7)
T5: 7.5 (0.8, 5.5)
T6: 8 (0.8, 5.9)
T7: 13 (1.3, 9.6)
T8: 18 (1.8, 13.3)
T9: 21.6 (2.2, 15.9)

* It can be reused if the quick connector side is disconnected.

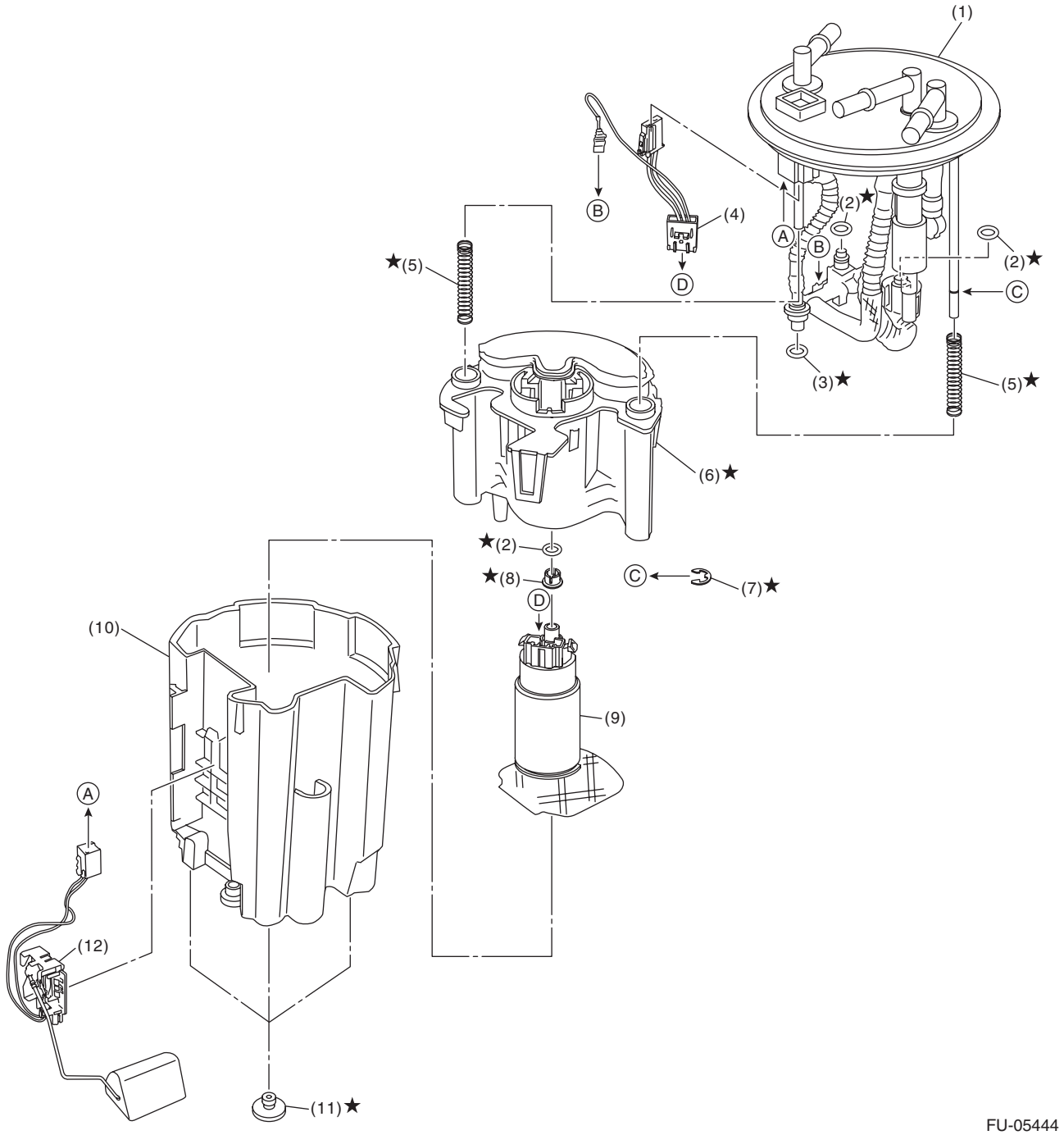
6. FUEL FILLER PIPE



(1) Fuel filler pipe
(2) Evaporation pipe A
(3) Fuel filler cap
(4) Clip
(5) Filler ring
(6) Filler pipe gasket
(7) Shut valve
(8) Clip
(9) Evaporation hose A
(10) Clip
(11) Evaporation hose B
(12) Grommet
(13) Evaporation pipe B
(14) Evaporation pipe protector
(15) Grommet
(16) Quick connector
(17) Evaporation hose C

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.4, 3.2)
T2: 7.5 (0.8, 5.5)

7. FUEL PUMP



FU-05444

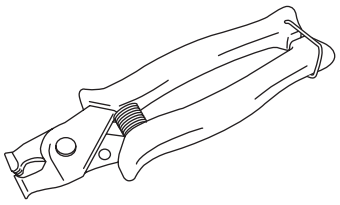
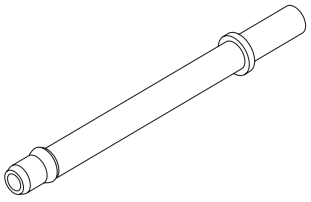
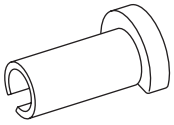
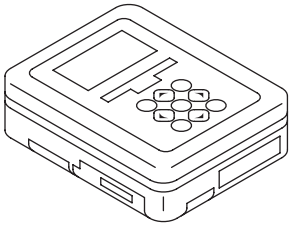
(1) Sub tank bracket ASSY
(2) O-ring
(3) O-ring
(4) Fuel pump harness
(5) Spring
(6) Fuel filter
(7) Clip
(8) Spacer
(9) Pump ASSY
(10) Sub tank
(11) Cushion
(12) Fuel level sensor

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.
- When the suspension-related components have been removed and installed, be sure to adjust the steering angle sensor. <Ref. to VDC-13, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U).>

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing the PCV hose. • This tool is made by the French company CAILLAU. (code) 54.0.000.205 To make it easier to obtain, it has been provided with a tool number.
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for draining fuel.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for draining fuel and each inspection.

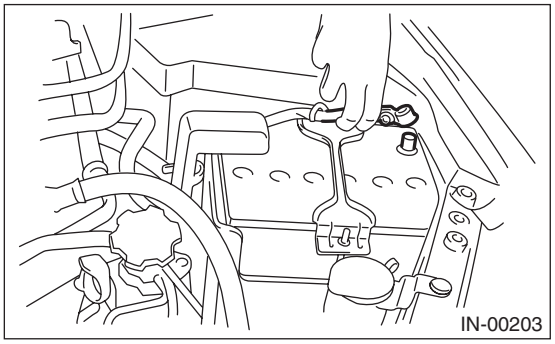
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Oscilloscope	Used for inspecting the waveform of each sensor.

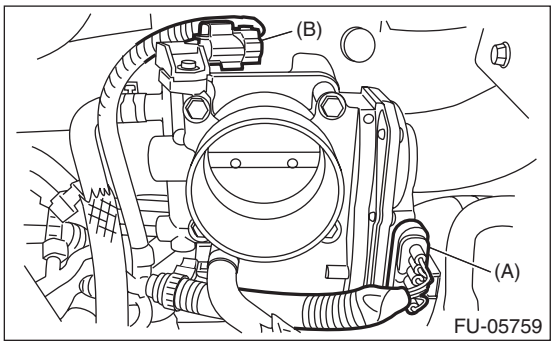
2. Throttle Body

A: REMOVAL

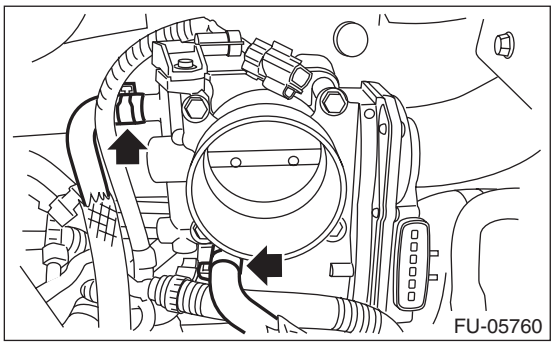
1) Disconnect the ground cable from battery.



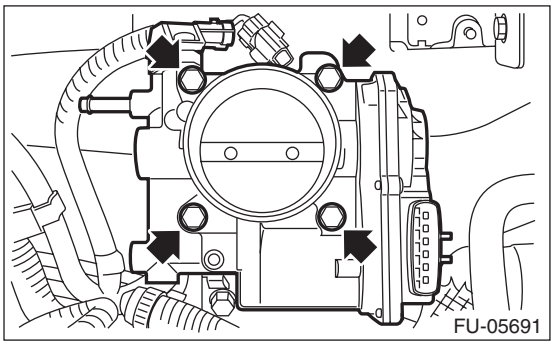
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
6) Disconnect the connector (A) from the throttle position sensor, and the connector (B) from the manifold pressure sensor.



7) Disconnect the engine coolant hose from throttle body.



8) Remove the throttle body from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

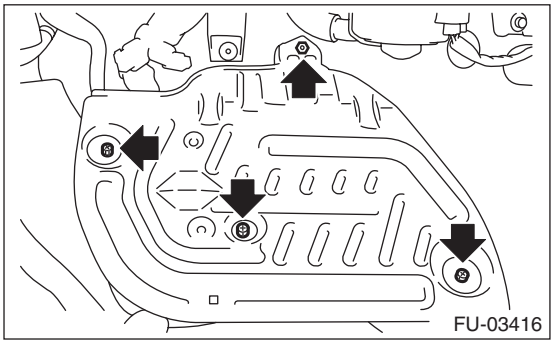
NOTE:
Use a new gasket.

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

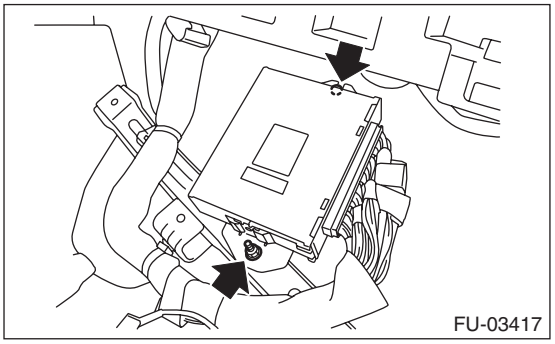
C: INSPECTION

1. THROTTLE SENSOR INSPECTION (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

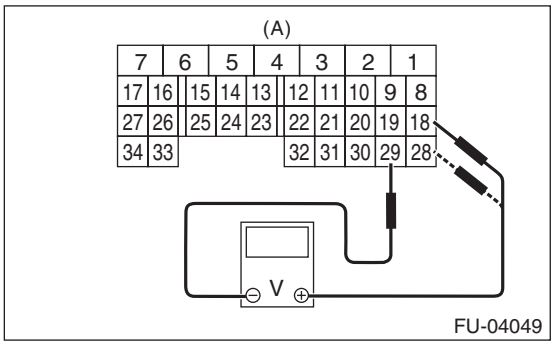


4) Remove the nuts and bolts which hold the ECM to the bracket.



5) Turn the ignition switch to ON. (engine OFF)

6) Measure the voltage between ECM connector terminals.



(A) To ECM connector

Throttle sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (Full closed)	18 (+) and 29 (–)	Approx. 0.6 V
	Depressed (Full opened)		Approx. 3.96 V
Sub	Not depressed (Full closed)	28 (+) and 29 (–)	Approx. 1.48 V
	Depressed (Full opened)		Approx. 4.17 V

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

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

2. THROTTLE SENSOR INSPECTION (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the throttle opening angle signal and voltage of throttle sensor using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-41, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

Throttle sensor	Throttle opening angle signal	Standard
Main	0.0%	Approx. 0.6 V
	100.0%	Approx. 3.96 V
Sub	0.0%	Approx. 1.48 V
	100.0%	Approx. 4.17 V

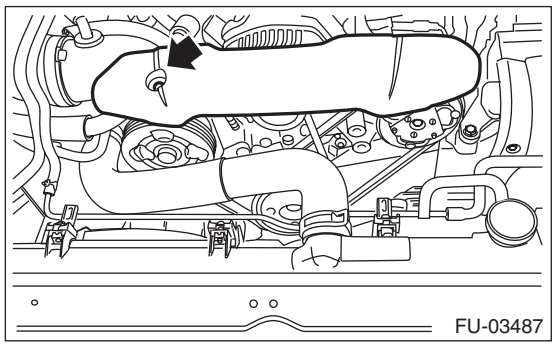
3. OTHER INSPECTIONS

1) Check that the throttle body has no deformation, cracks or other damages.
2) Check that the engine coolant hose has no cracks, damage or loose part.

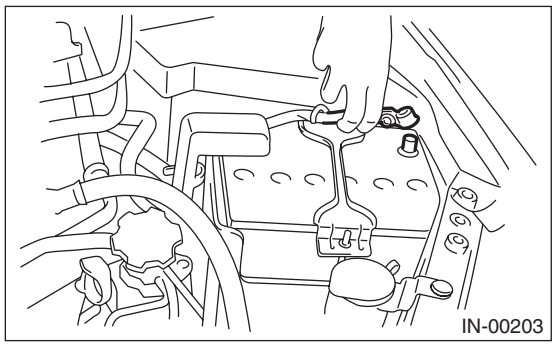
3. Intake Manifold

A: REMOVAL

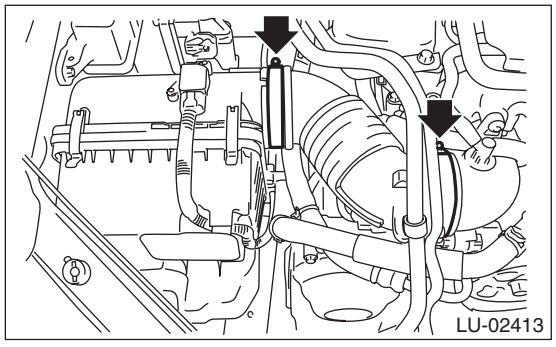
1) Remove the V-belt covers.



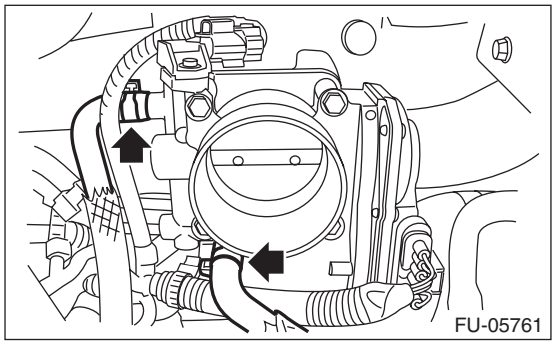
2) Collect the refrigerant from A/C system. <Ref. to AC-19, PROCEDURE, Refrigerant Recovery Procedure.>
3) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
4) Disconnect the ground cable from battery.



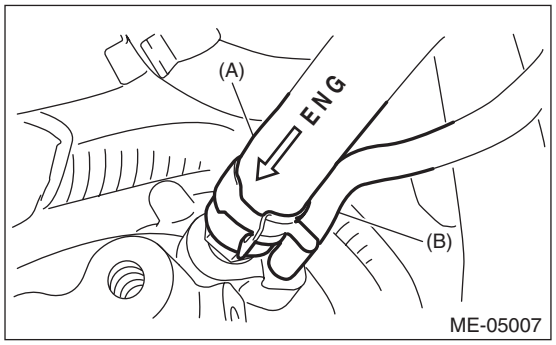
5) Open the fuel filler lid and remove the fuel filler cap.
6) Lift up the vehicle.
7) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
8) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
9) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
10) Remove the air intake boot.



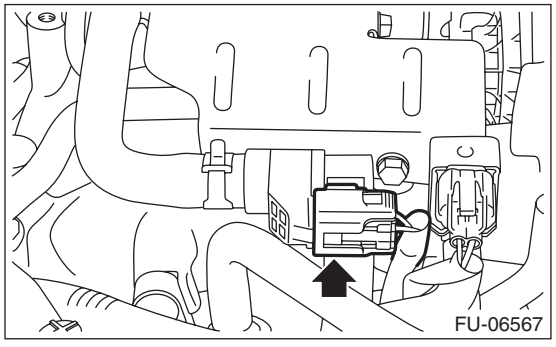
11) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
12) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
13) Remove the coolant filler tank. <Ref. to CO(STI)-28, REMOVAL, Coolant Filler Tank.>
14) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-41, REMOVAL, Hose and Pipe.>
15) Disconnect the engine coolant hose from throttle body.



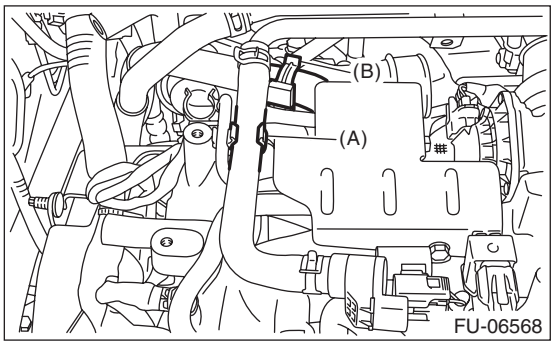
16) Disconnect the brake booster vacuum hose (A) and pressure regulator vacuum hose (B) from the intake manifold.



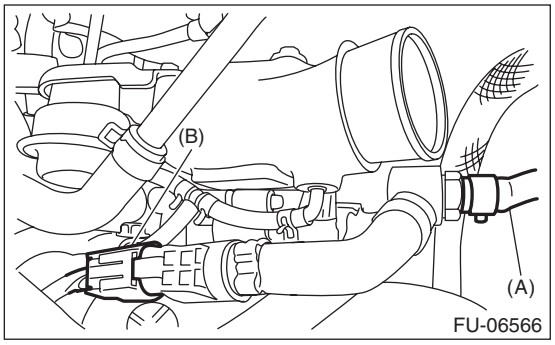
17) Disconnect the connector from the PCV hose assembly A.



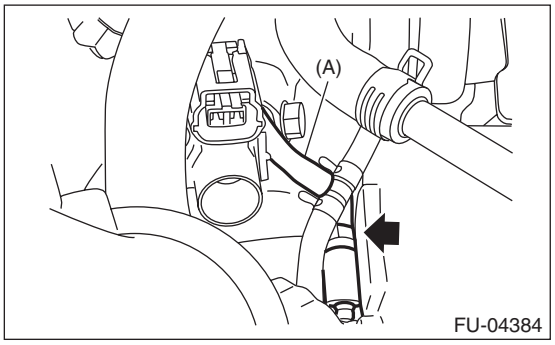
18) Remove the PCV hose assembly A from clip (A), and remove the vacuum hose from clip (B).



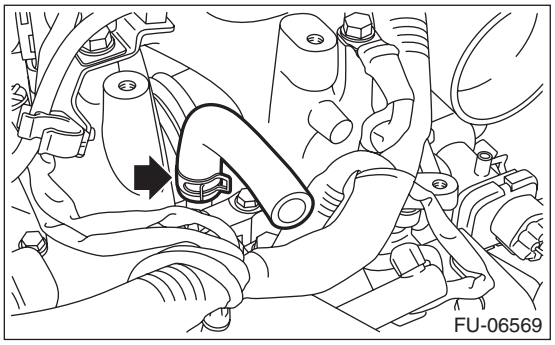
19) Disconnect the vacuum hose (A) and the connector (B) from the PCV hose assembly B.



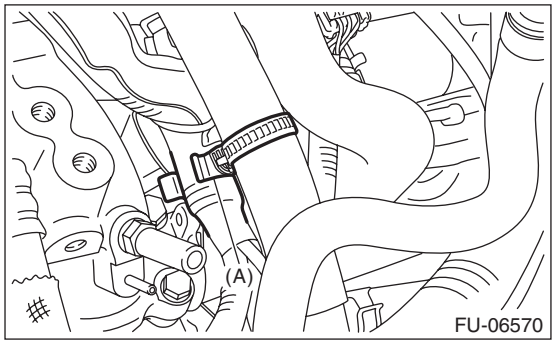
20) Disconnect the air control hose (A) from the waste gate actuator, and loosen the clamp which holds the intake duct to the turbocharger.



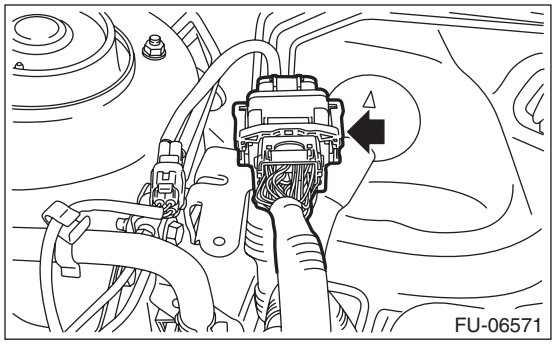
21) Remove the engine coolant hose from the water tank pipe.



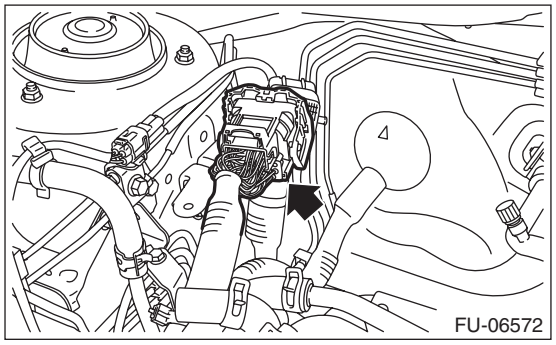
22) Remove the engine harness from clip (A).



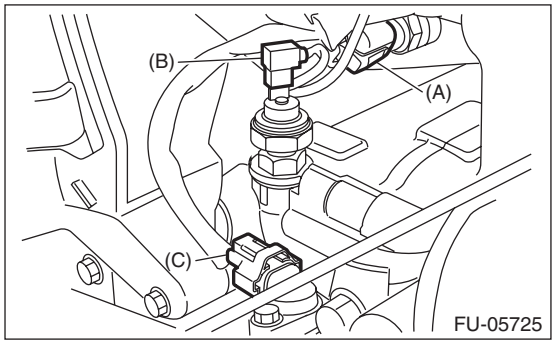
23) Disconnect the bulkhead harness connectors from the engine harness connectors.



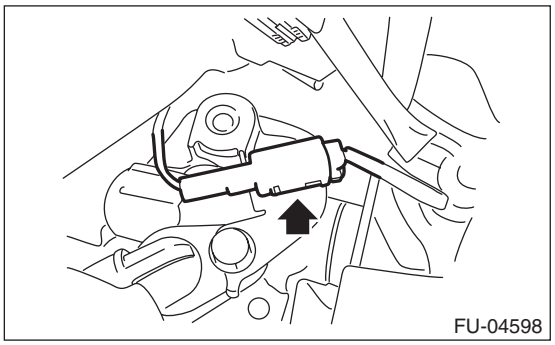
24) Remove the engine harness connector from the engine harness bracket.



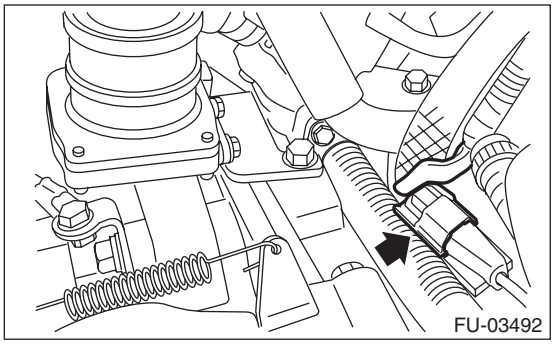
25) Disconnect the connector (A) from the engine coolant temperature sensor, connector (B) from the oil pressure switch, and connector (C) from the crankshaft position sensor.



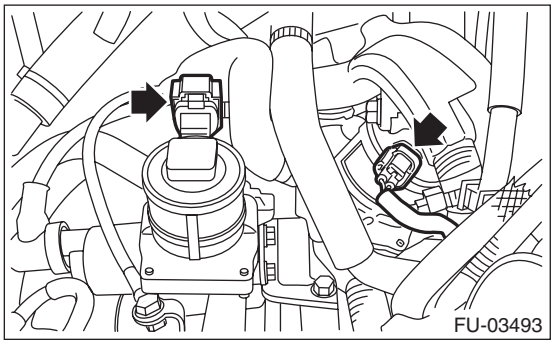
26) Disconnect the connector from power steering pump switch.



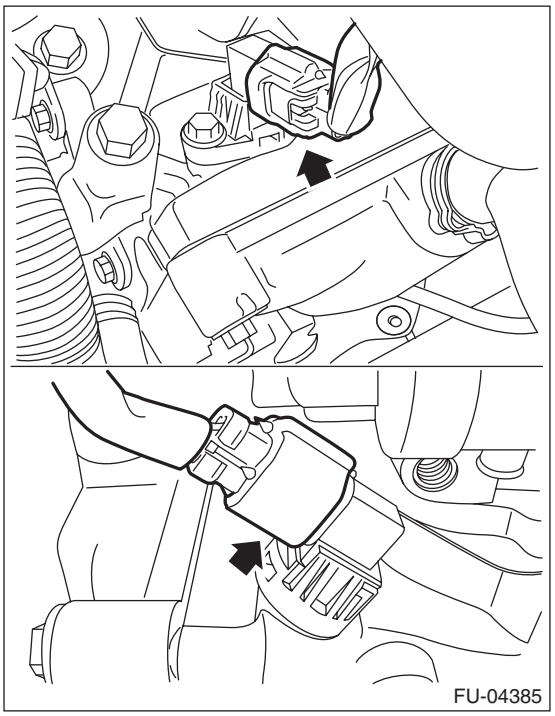
27) Disconnect the connector from the knock sensor.



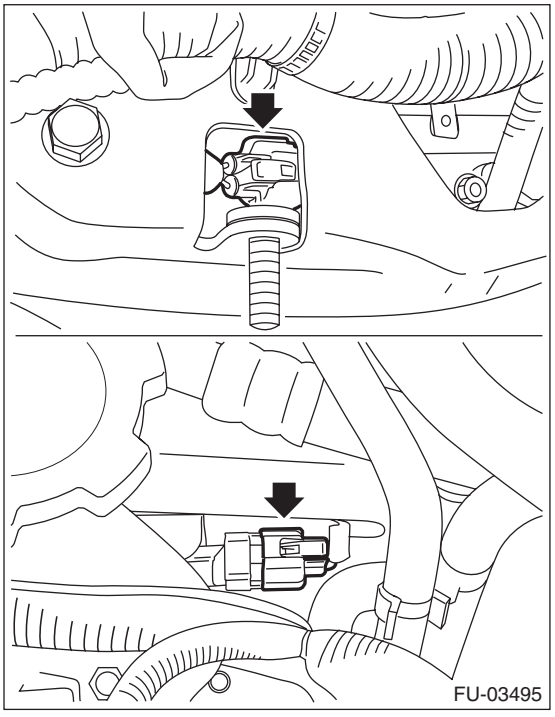
28) Disconnect the connector from the secondary air combination valve.



29) Disconnect the connector from the intake camshaft position sensor.

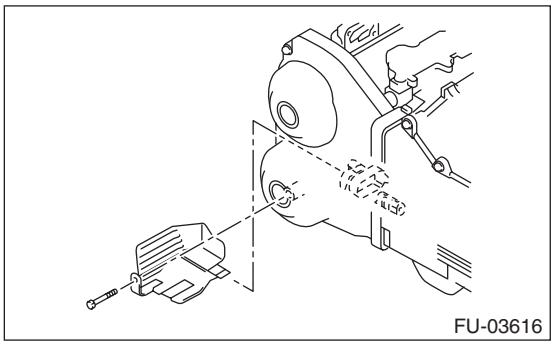


30) Disconnect the connector from the intake oil flow control solenoid valve.

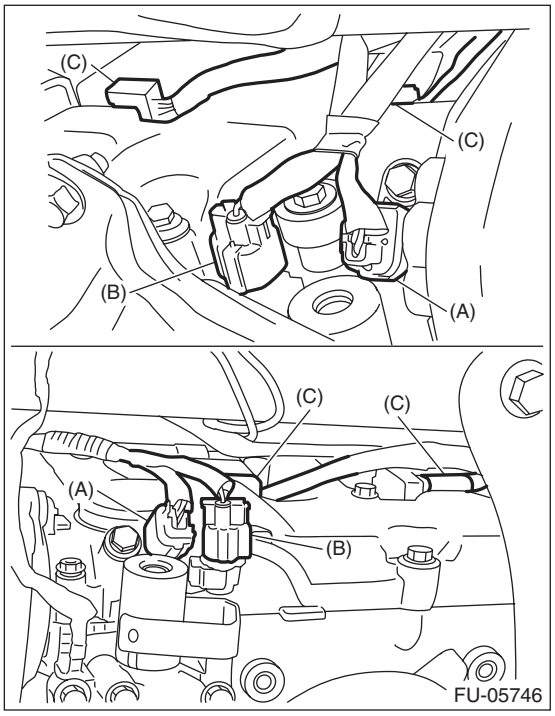


31) Lift up the vehicle.

32) Remove the engine harness cover. (right side only.)

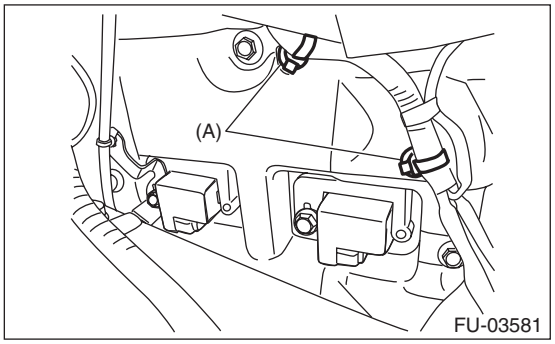


33) Disconnect connector (A) from the exhaust camshaft position sensor, connector (B) from the exhaust oil flow control solenoid valve, and connector (C) from the ignition coil.

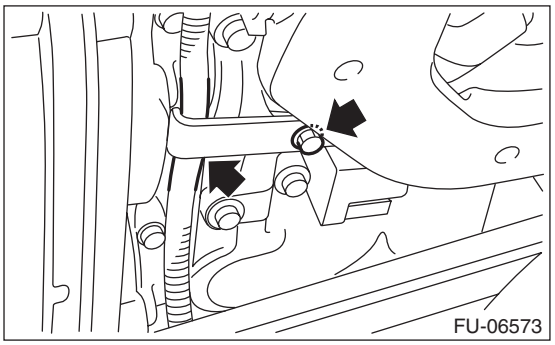


34) Lower the vehicle.

35) Remove the clip (A) which hold the engine harness to the rocker cover RH.



36) Remove the bolts that secure the air duct to the rocker cover LH, and remove the engine harness.



37) Disconnect the fuel delivery hose, fuel return hose and evaporation hose.

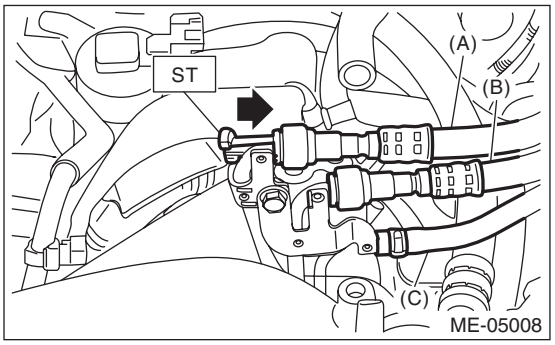
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

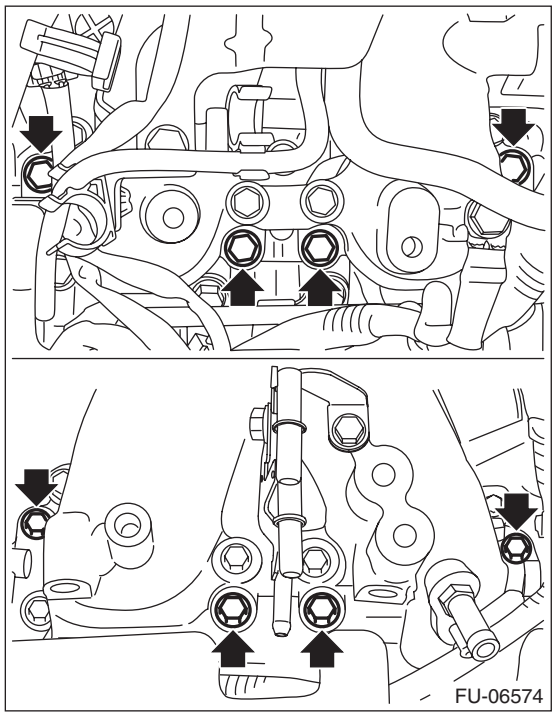
(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

38) Remove the intake manifold from cylinder head.

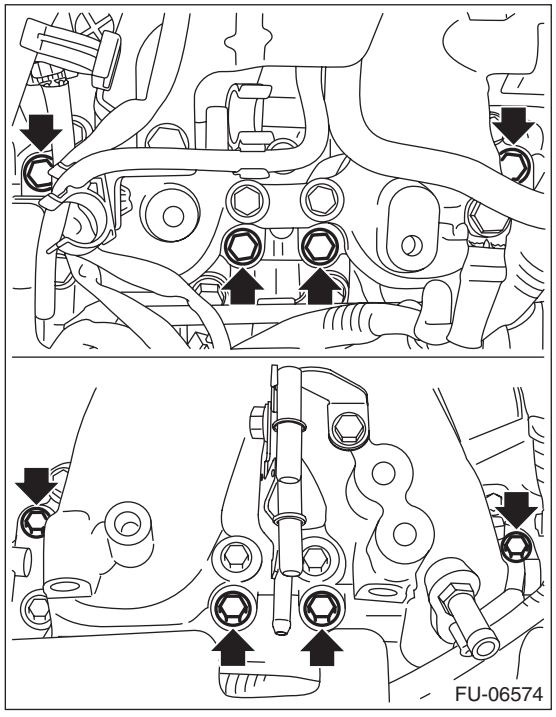


B: INSTALLATION

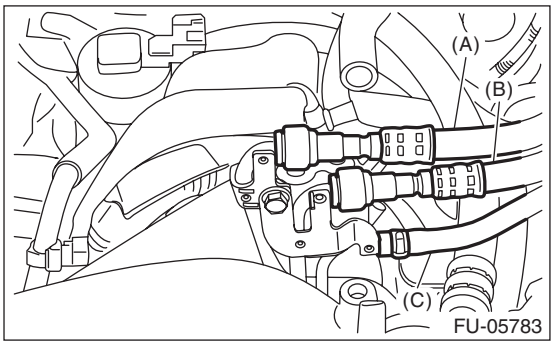
1) Install the intake manifold onto cylinder heads.

NOTE:
Use a new gasket.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



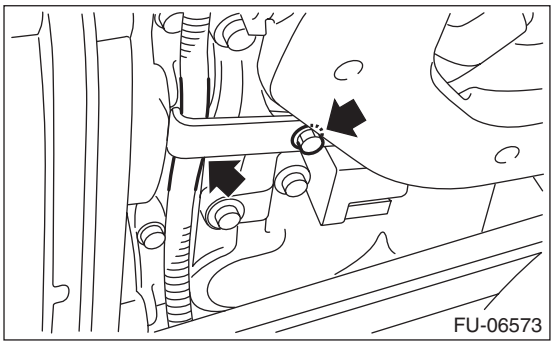
2) Connect the fuel delivery hose, fuel return hose, and evaporation hose.



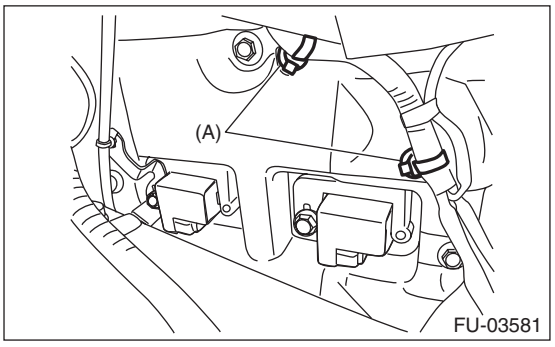
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

3) Fix the engine harness to the rocker cover LH with the air duct.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

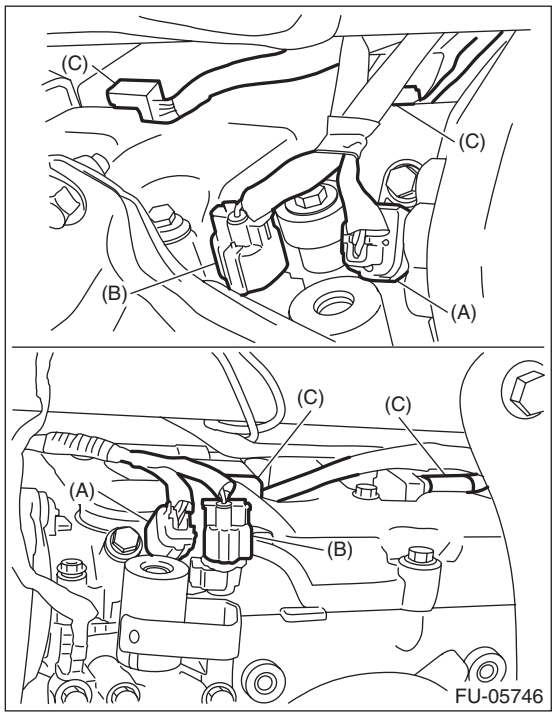


4) Fix the engine harness to the rocker cover RH with clips (A).



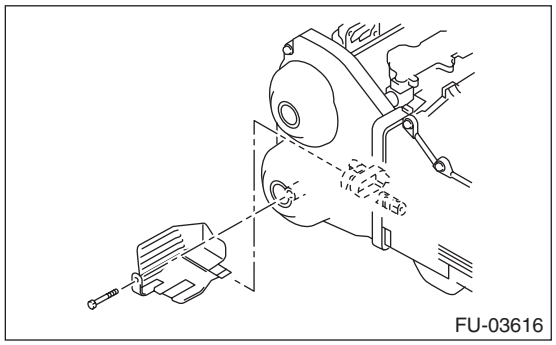
5) Lift up the vehicle.

6) Connect connector (A) to the exhaust camshaft position sensor, connector (B) to the exhaust oil flow control solenoid valve, connector (C) to the ignition coil.



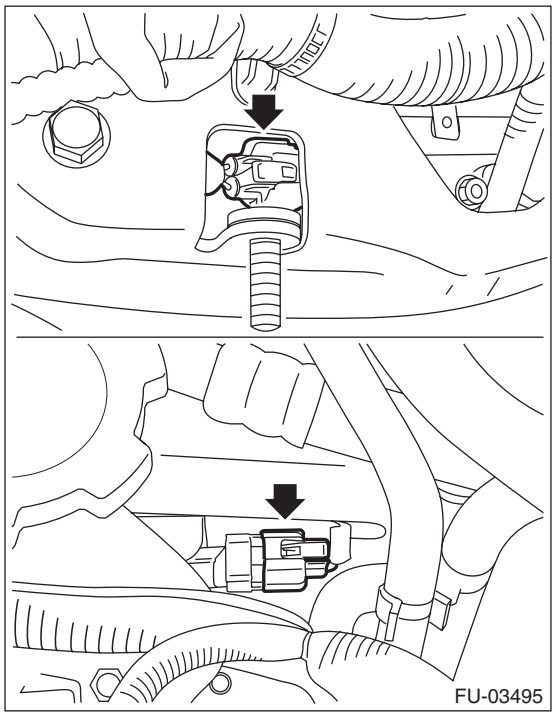
7) Install the engine harness cover. (right side only.)

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

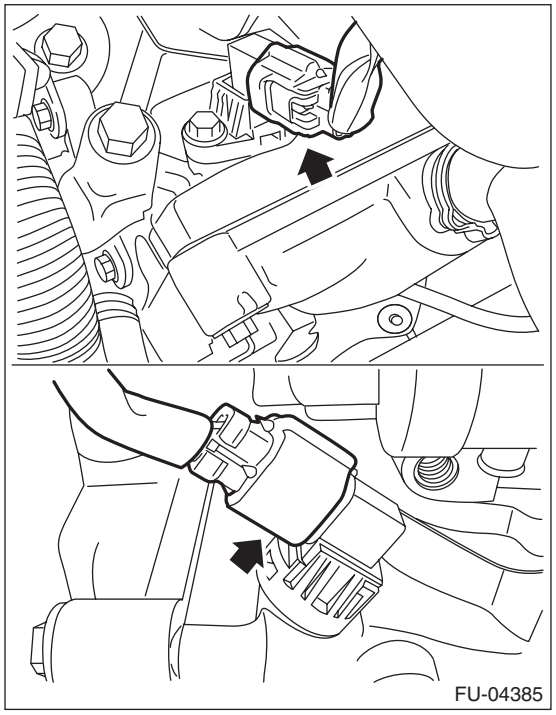


8) Lower the vehicle.

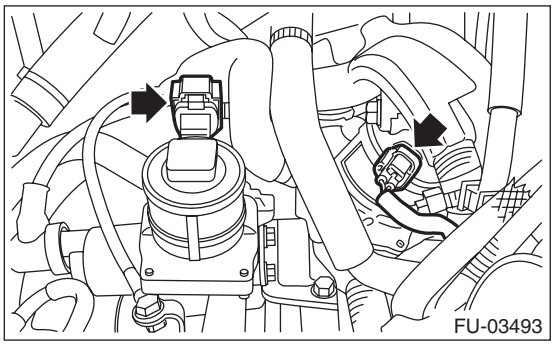
9) Connect the connector to the intake oil flow control solenoid valve.



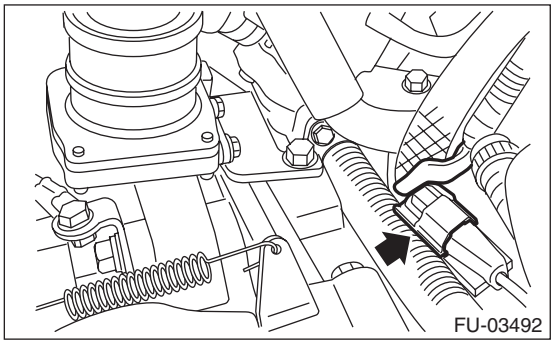
10) Connect the connector to the intake camshaft position sensor.



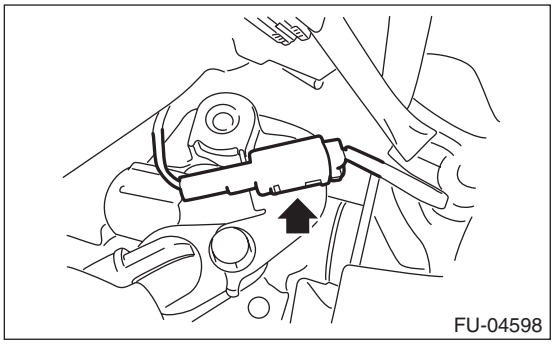
11) Connect the connector to the secondary air combination valve.



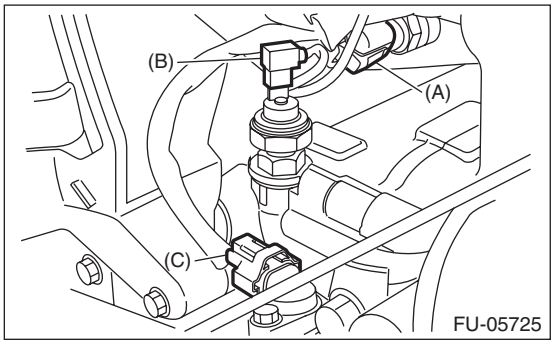
12) Connect the connector to the knock sensor.



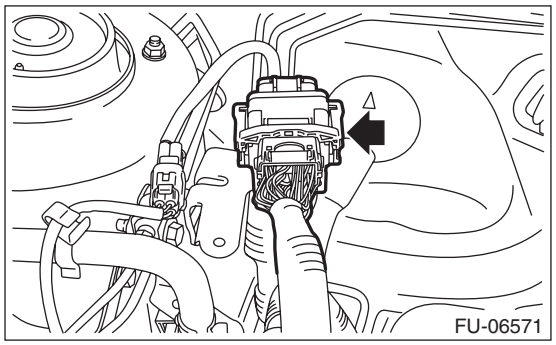
13) Connect the connector to the power steering pump switch.



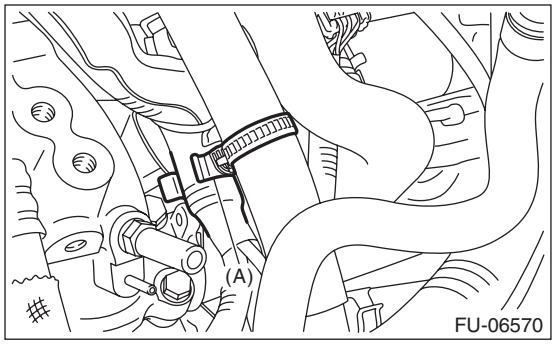
14) Connect the connector (A) to the engine coolant temperature sensor, connector (B) to the oil pressure switch, and the connector (C) to the crankshaft position sensor.



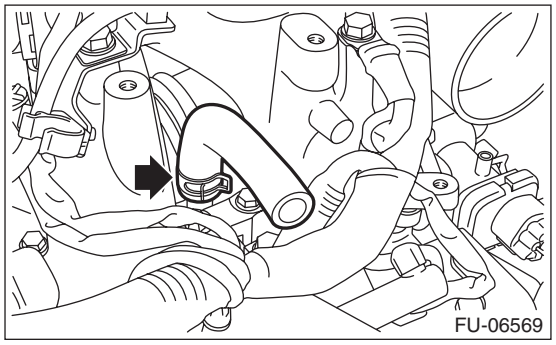
15) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



16) Install the engine harness to clip (A).

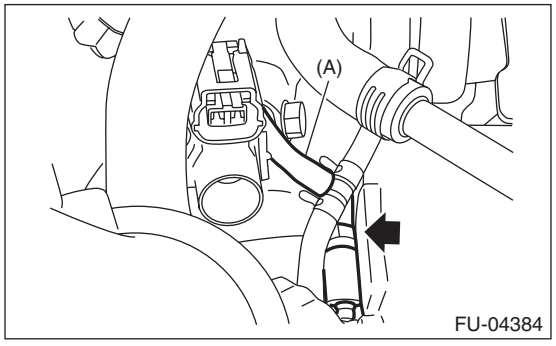


17) Install the engine coolant hose to the water tank pipe.

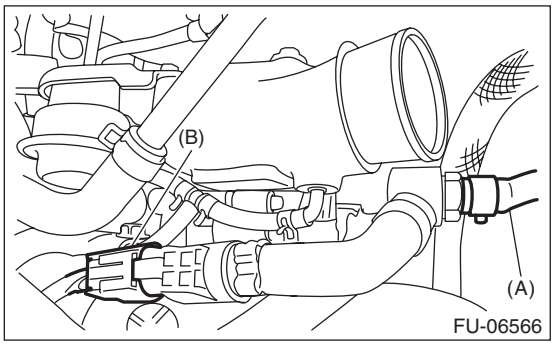


18) Connect the air control hose (A) to the wastegate actuator, and install the turbocharger to the intake duct.

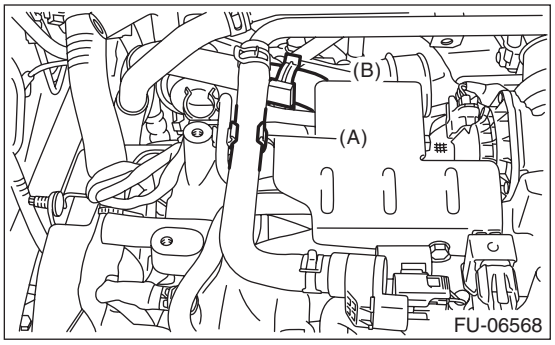
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



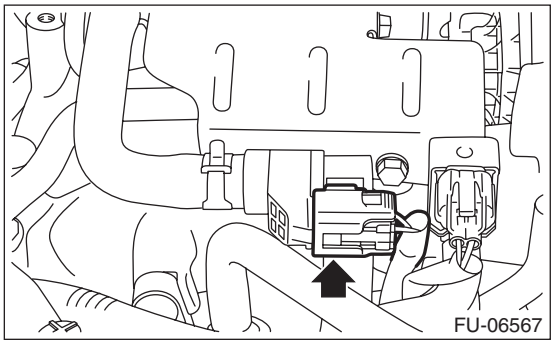
19) Connect the vacuum hose (A) and connector (B) to the PCV hose assembly B.



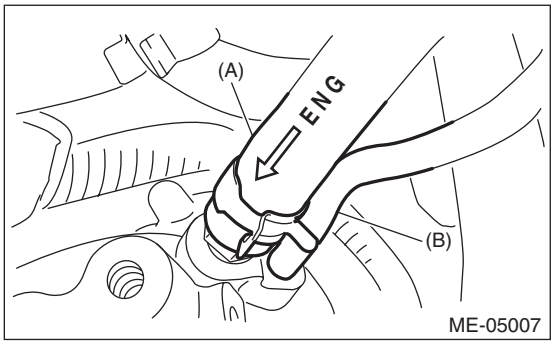
20) Install the vacuum hose to clip (B), and install the PCV hose assembly A to clip (A).



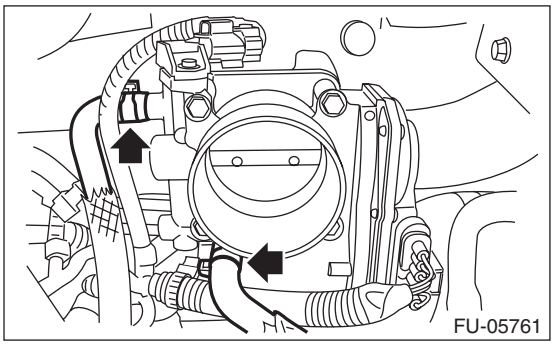
21) Connect the connector to the PCV hose assembly A.



22) Connect the brake booster vacuum hose (A) and pressure regulator vacuum hose (B) to the intake manifold.

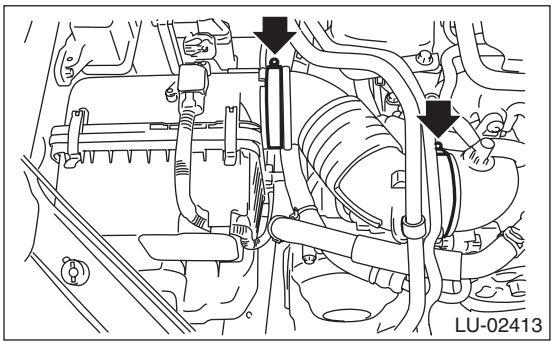


23) Connect the engine coolant hoses to throttle body.

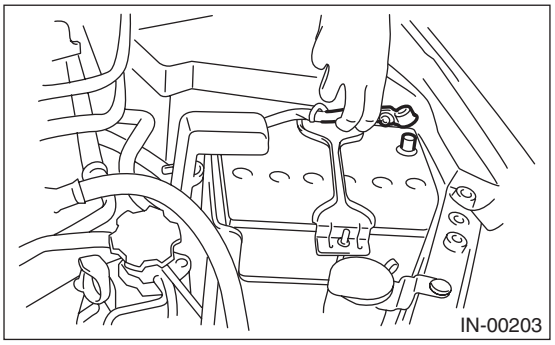


24) Install the A/C pressure hoses to A/C compressor. <Ref. to AC-41, INSTALLATION, Hose and Pipe.>
25) Install the coolant filler tank. <Ref. to CO(STI)-28, INSTALLATION, Coolant Filler Tank.>
26) Install the generator. <Ref. to SC(STI)-21, INSTALLATION, Generator.>
27) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
28) Install the air intake boot.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



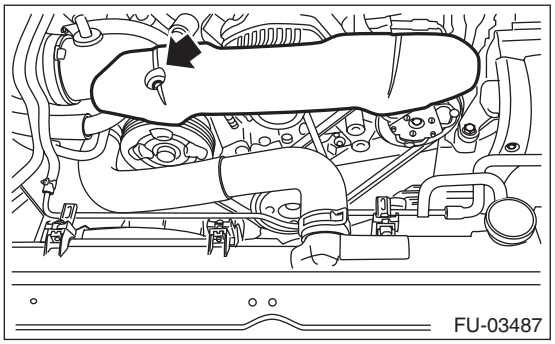
29) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
30) Connect the battery ground terminal.



31) Lift up the vehicle.
32) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
33) Lower the vehicle.

34) Install the V-belt cover.

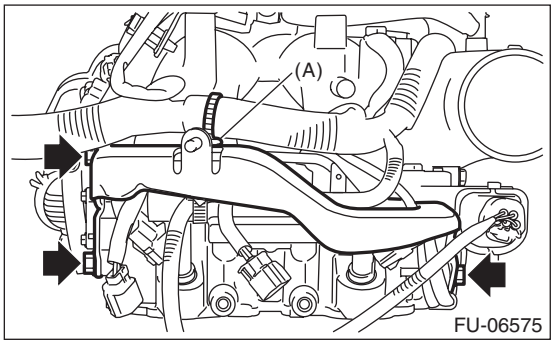
Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



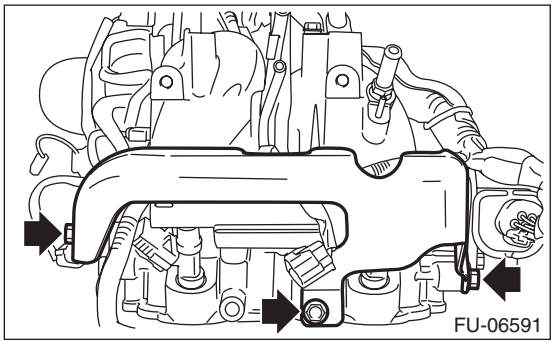
35) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
36) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>

C: DISASSEMBLY

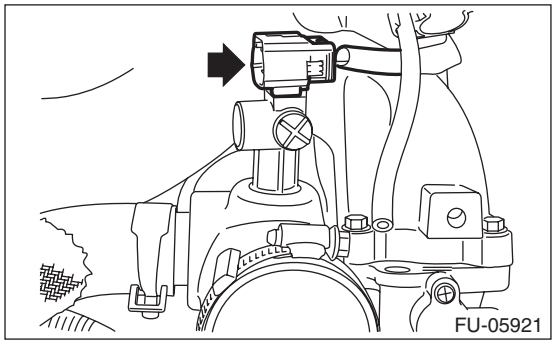
1) Remove clamp (A) holding the fuel pipe protector RH to the engine harness, and remove the fuel pipe protector RH.



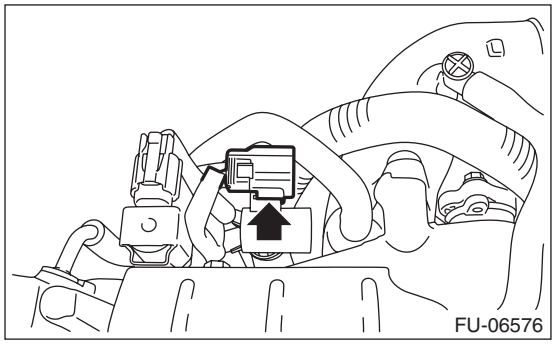
2) Remove the fuel pipe protector LH.



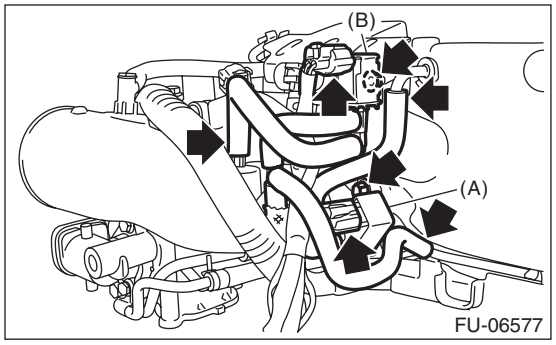
3) Remove the connector from the intake duct.



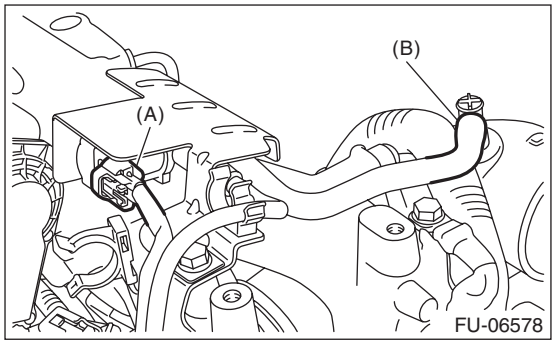
4) Remove the connector from the PCV hose assembly.



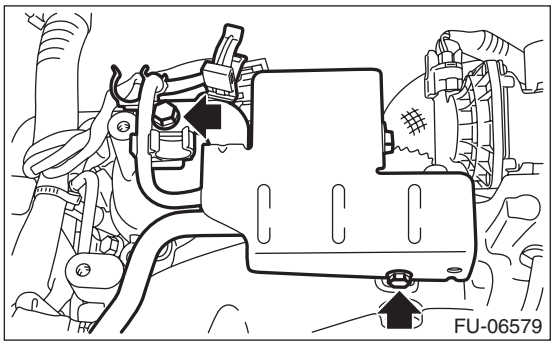
5) Remove purge control solenoid valve 1 (A) and purge control solenoid valve 2 (B).



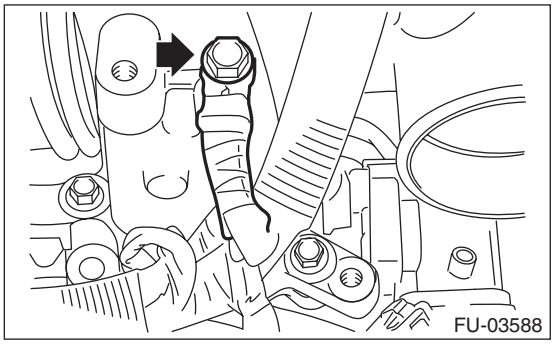
6) Disconnect the connector (A) from the wastegate control solenoid valve, and disconnect the vacuum hose (B) from the intake duct.



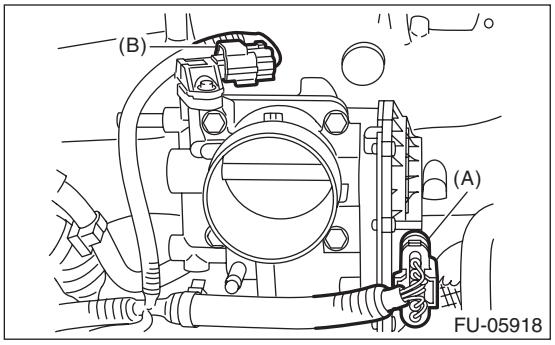
7) Remove the solenoid valve bracket together with the wastegate control solenoid valve.



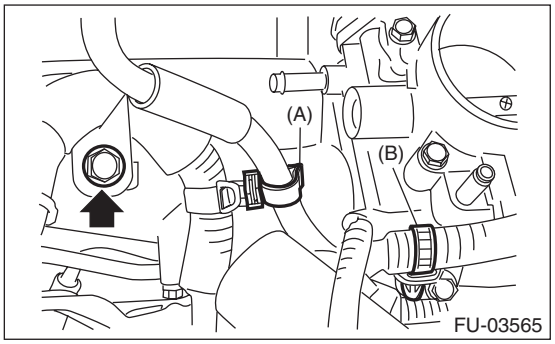
8) Remove the engine ground terminals from the intake manifold.



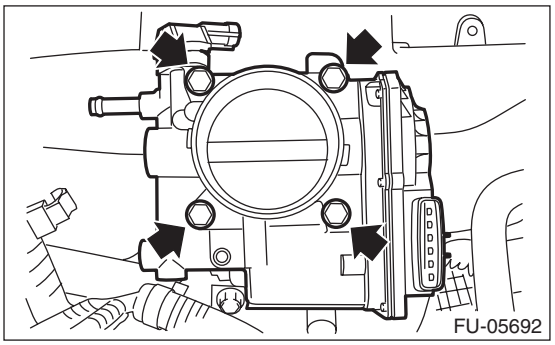
9) Disconnect the connector (A) from the throttle position sensor, and the connector (B) from the manifold pressure sensor.



10) Remove clip (A) holding the engine harness and vacuum hose, clip (B) holding the engine harness to the engine harness stay, and the bolt holding the engine harness to the intake manifold.

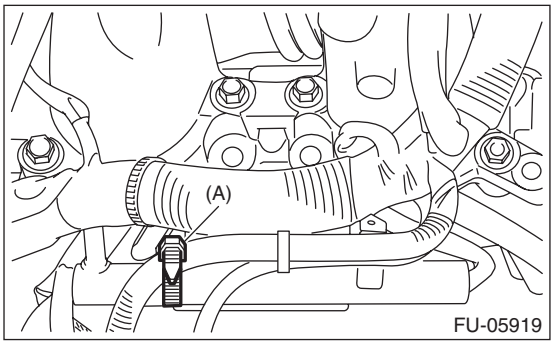


11) Remove the throttle body from the intake manifold.

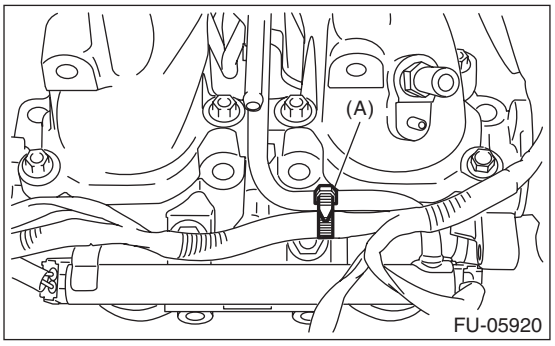


12) Remove the harness band (A) which holds the engine harness to the fuel injector pipe.

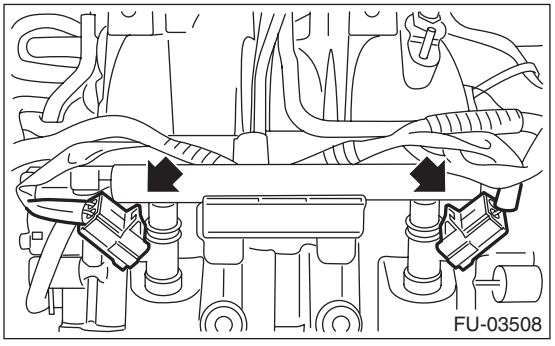
- RH side



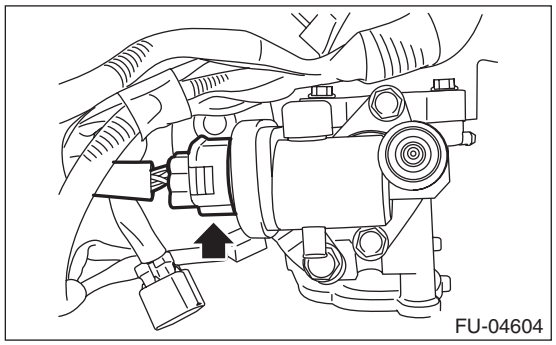
- LH side



13) Disconnect the connector from fuel injector.

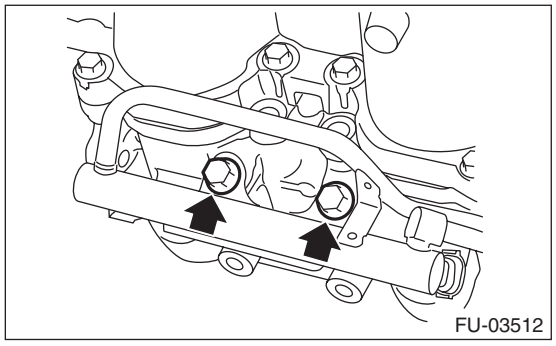


14) Disconnect the connector from the tumble generator valve assembly.

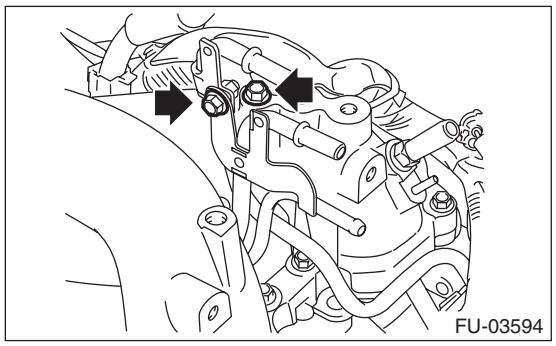

FU-04604

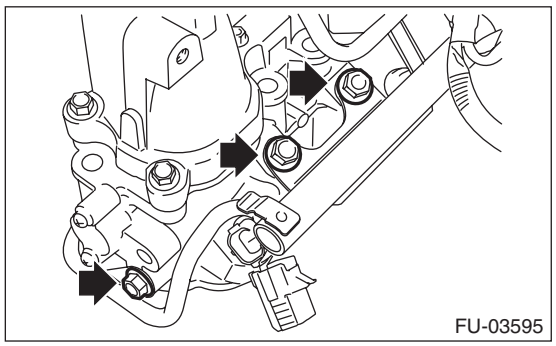
15) Remove the bolts which hold fuel injector pipe.

- RH side

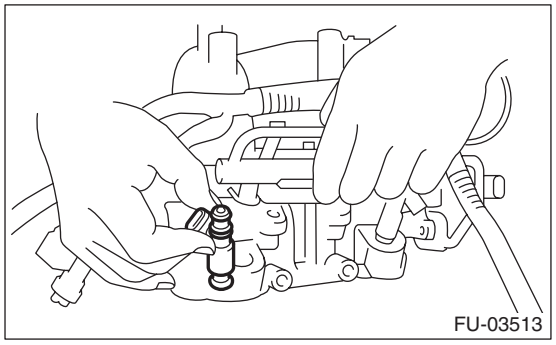

FU-03512

- LH side

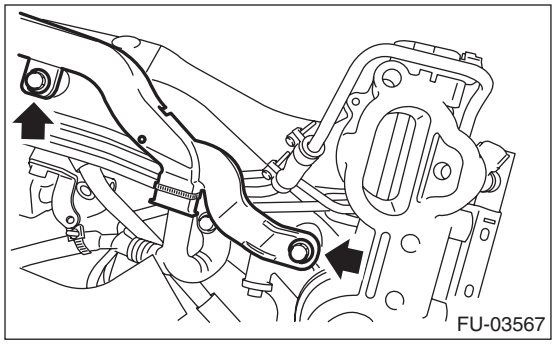

FU-03594


FU-03595

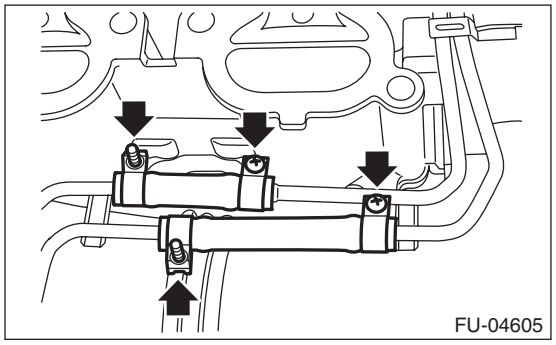
16) Remove the fuel injector.


FU-03513

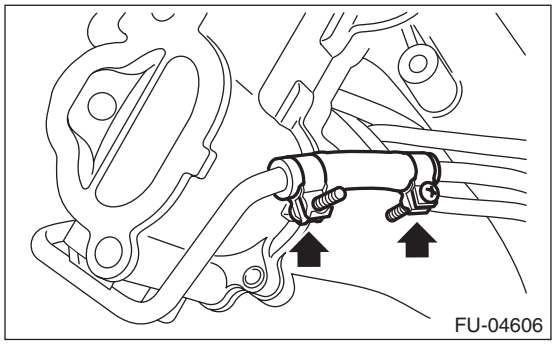
17) Remove the harness brackets holding the engine harness to the intake manifold, and remove the engine harness.


FU-03567

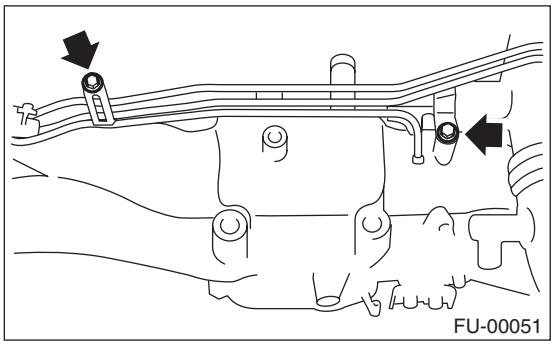
18) Loosen the clamp holding the RH side fuel hose to the fuel injector pipe RH, and remove the fuel injector pipe RH.


FU-04605

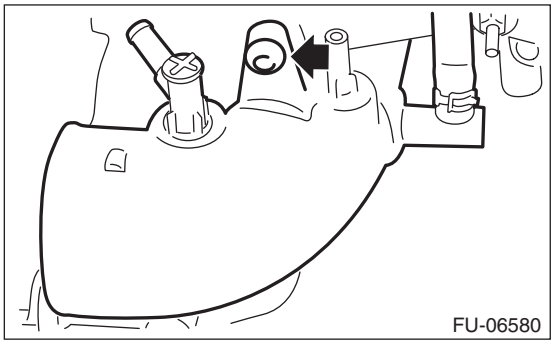
19) Loosen the clamp holding the LH side fuel hose to the fuel injector pipe LH, and remove the fuel injector pipe LH.


FU-04606

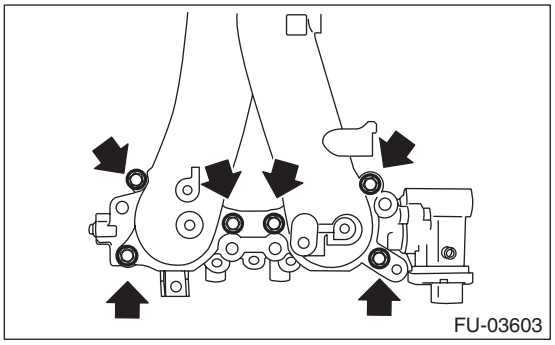
20) Remove the bolts holding the fuel pipe assembly to the intake manifold, and remove the fuel pipe assembly.



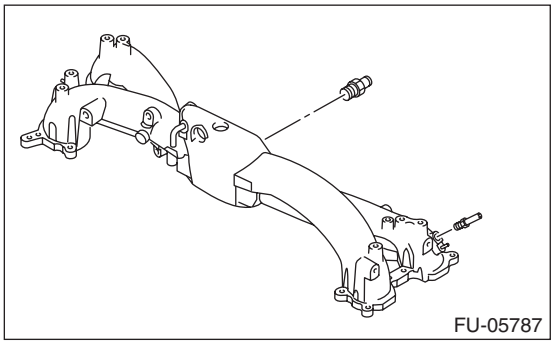
21) Remove the intake duct from intake manifold.



22) Remove the tumble generator valve assembly from the intake manifold.



23) Remove the nipple from the intake manifold.

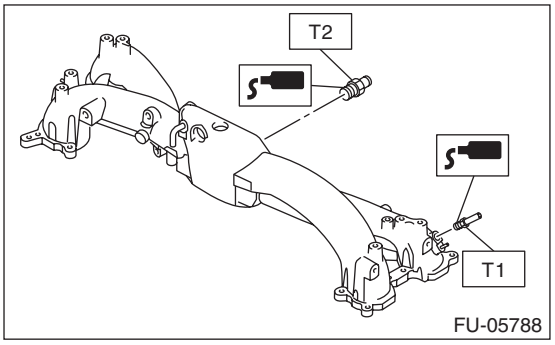


D: ASSEMBLY

1) Apply liquid gasket to the nipple threads, and install the nipple to the intake manifold.

Liquid gasket:
THREE BOND 1105 (Part No. 004403010)

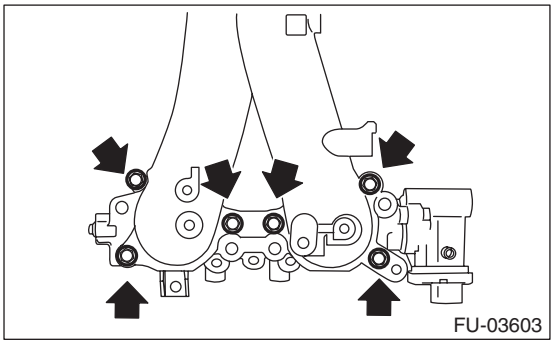
Tightening torque:
T1: 17 N·m (1.7 kgf-m, 12.5 ft-lb)
T2: 25 N·m (2.5 kgf-m, 18.4 ft-lb)



2) Install the tumble generator valve assembly onto intake manifold.

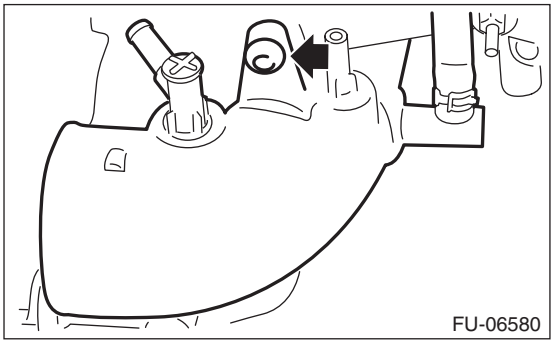
NOTE:
Use a new gasket.

Tightening torque:
8.3 N·m (0.8 kgf-m, 6.1 ft-lb)



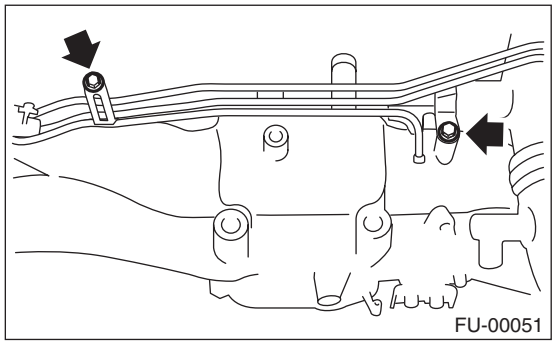
3) Install the air intake duct to the intake manifold.

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

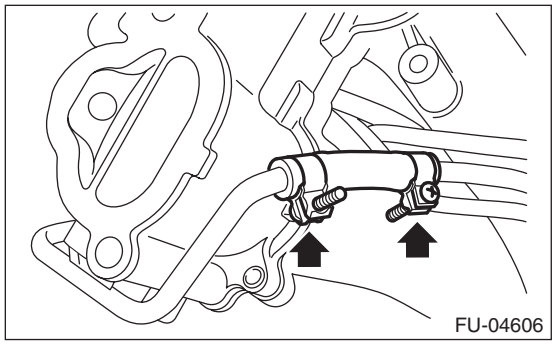


4) Install the fuel pipe assembly to the intake manifold.

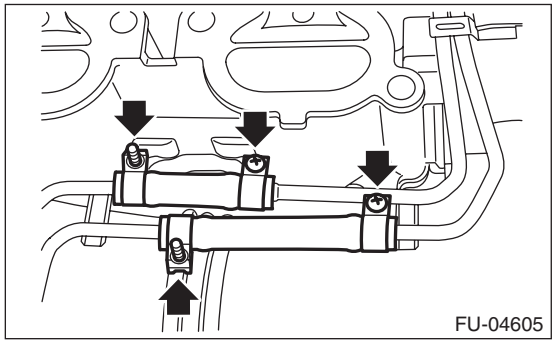
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-00051

5) Install the fuel injector pipe LH and connect the LH side fuel hose to the fuel injector pipe LH. <Ref. to FU(STI)-97, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

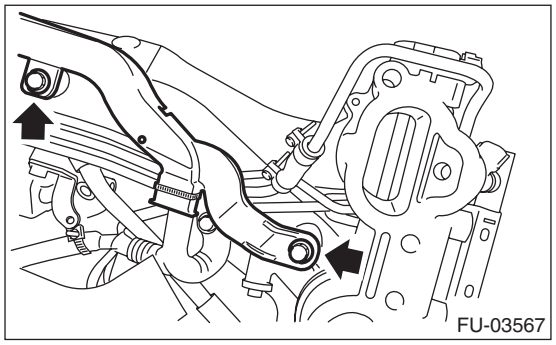

FU-04606

6) Install the fuel injector pipe RH and connect the RH side fuel hose to the fuel injector pipe RH. <Ref. to FU(STI)-97, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>


FU-04605

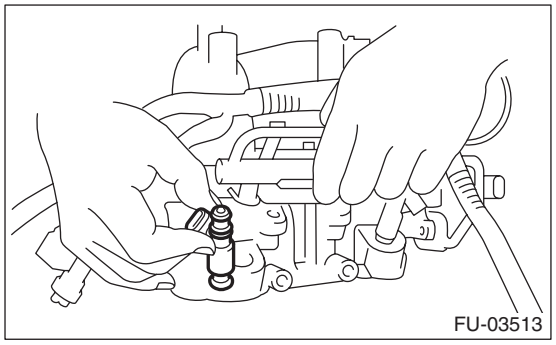
7) Install the engine harness to the intake manifold and attach the harness brackets holding the engine harness.

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


FU-03567

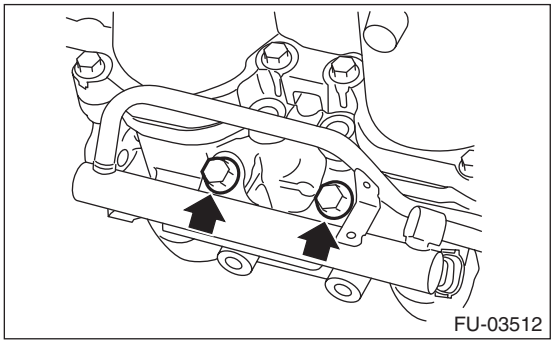
8) Install the fuel injector.

NOTE:
Use new O-rings.


FU-03513

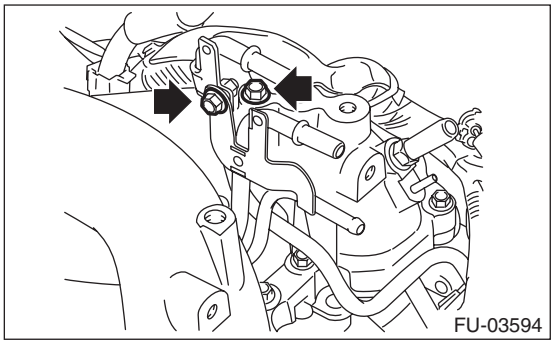
9) Install the bolts which hold fuel injector pipe.
- RH side

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

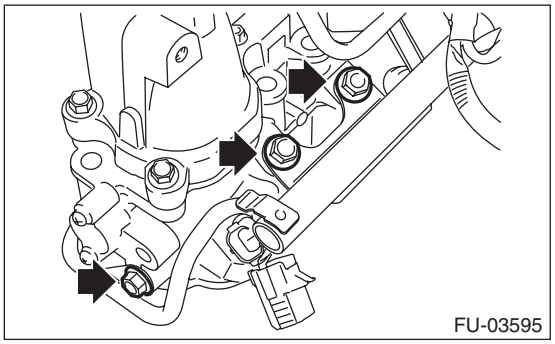

FU-03512

- LH side

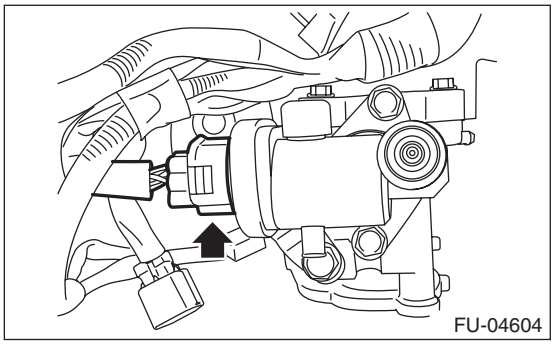
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-03594

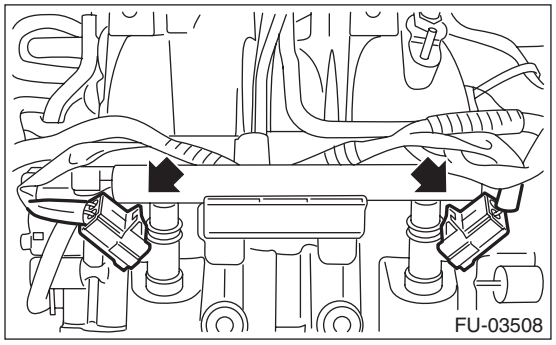
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)


FU-03595

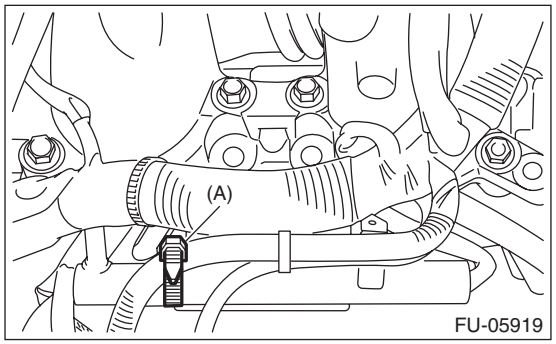
10) Connect the connector to the tumble generator valve assembly.


FU-04604

11) Connect the connectors to the fuel injector.

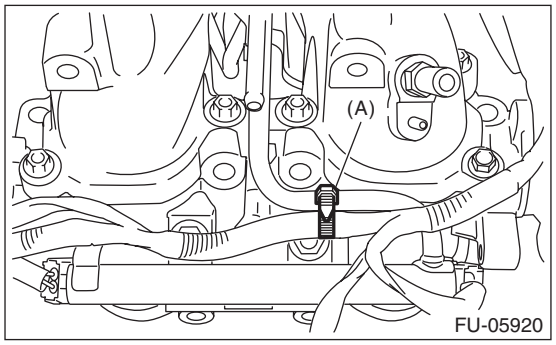

FU-03508

12) Secure the engine harness to the fuel injector pipe with the harness band (A).
- RH side



FU-05919

- LH side

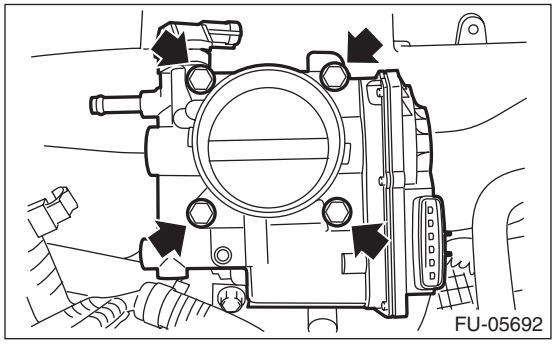


FU-05920

13) Install the throttle body to the intake manifold.

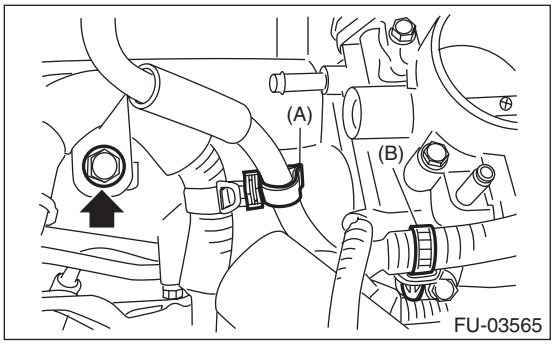
NOTE:
Use a new gasket.

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

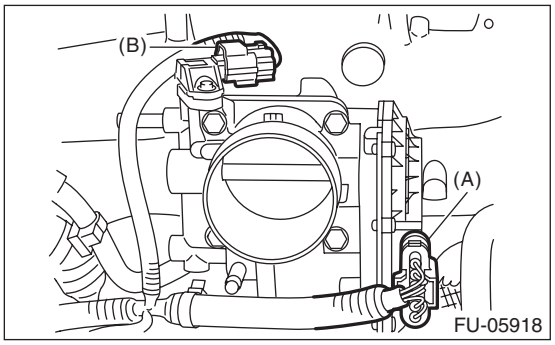

FU-05692

14) Secure the engine harness and vacuum hose using the clip (A), and secure the engine harness to the engine harness stay using the clip (B), and install the bolt which holds the engine harness to the intake manifold.

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

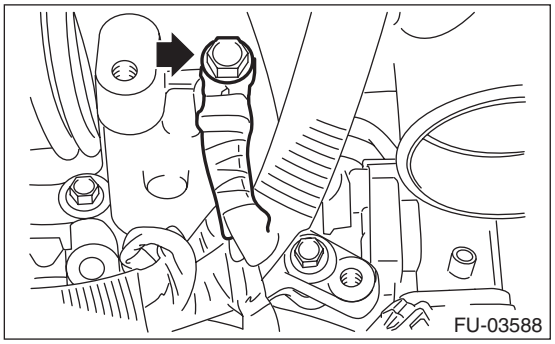


15) Connect connector (A) to the throttle position sensor and connector (B) to the manifold pressure sensor.



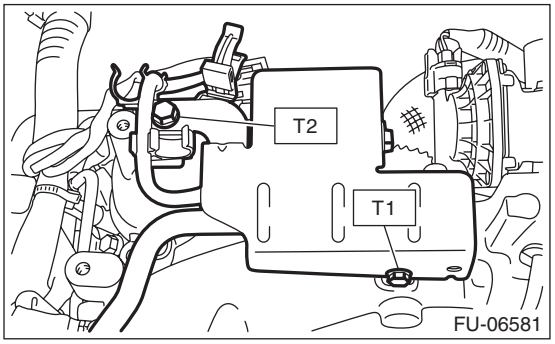
16) Install the engine ground terminal to intake manifold.

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

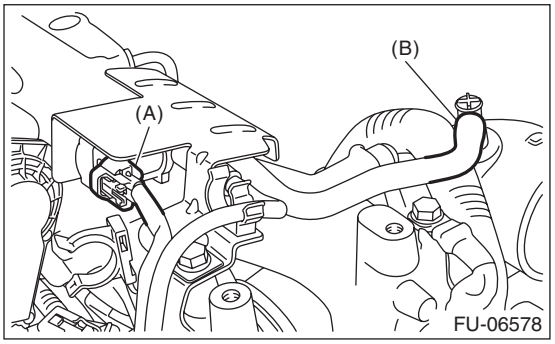


17) Install the solenoid valve bracket together with the wastegate control solenoid valve.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

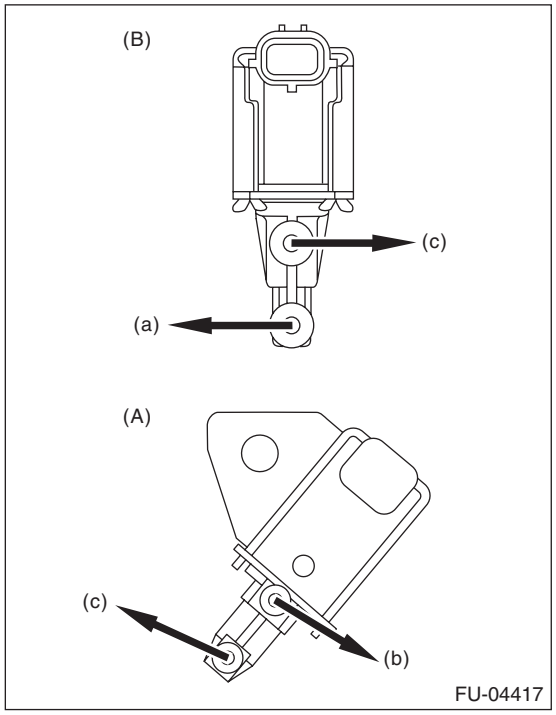


18) Connect the vacuum hose (B) to the intake duct, then connect the connector (A) to the wastegate control solenoid valve.



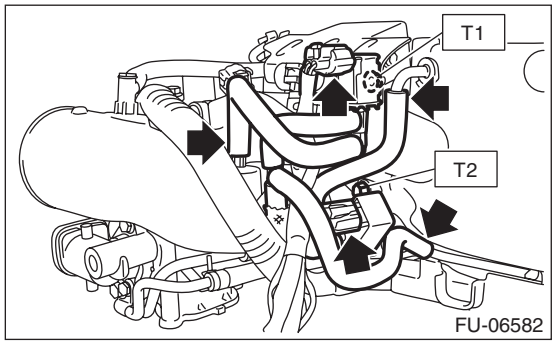
19) Install purge control solenoid valve 1 and purge control solenoid valve 2.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.

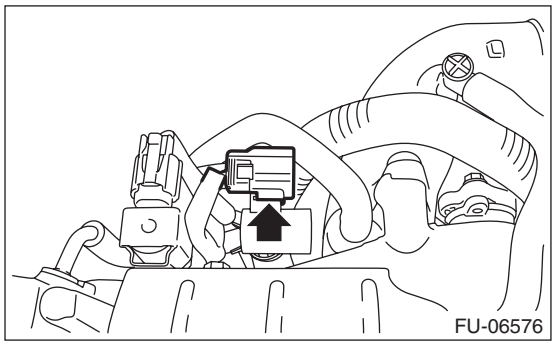


(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake duct
(b) To intake manifold
(c) To branching pipe → fuel pipe

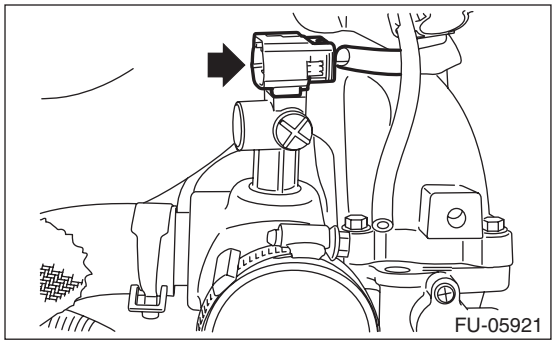
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 16 N·m (1.6 kgf-m, 11.8 ft-lb)



20) Attach the connector to the PCV hose assembly.

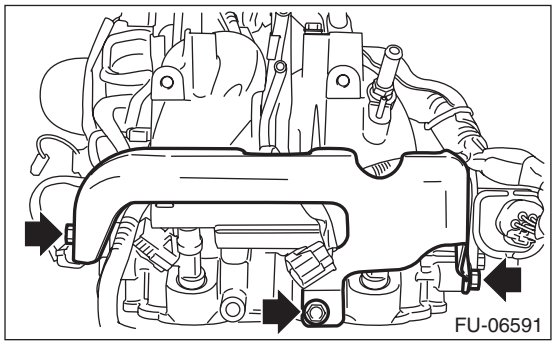


21) Install the connector to the intake duct.



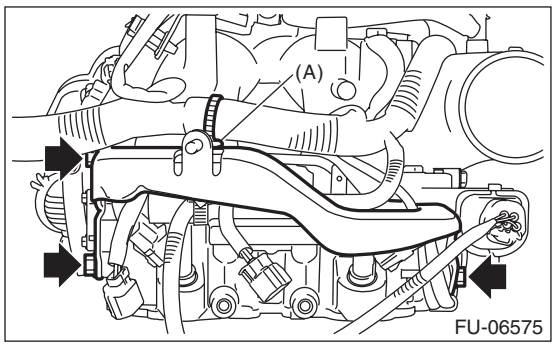
22) Install the fuel pipe protector LH.

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



23) Install the fuel pipe protector RH, and secure the engine harness to the fuel pipe protector RH using the clip (A).

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



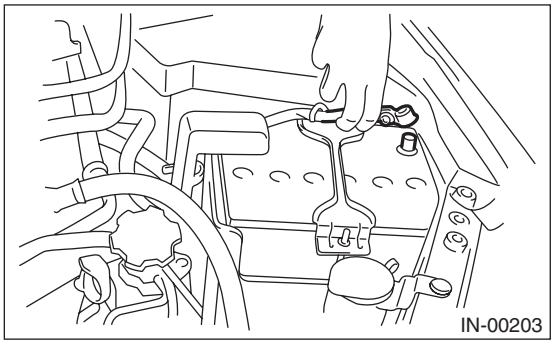
E: INSPECTION

1) Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
2) Check that the hose has no cracks, damage or loose part.

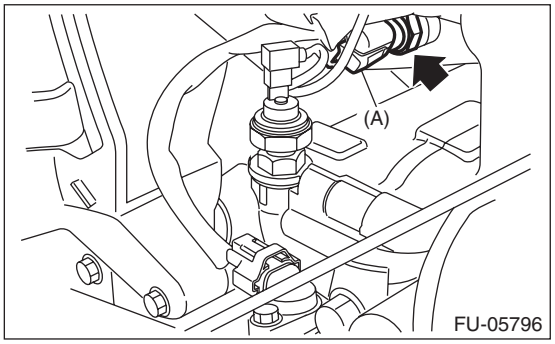
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

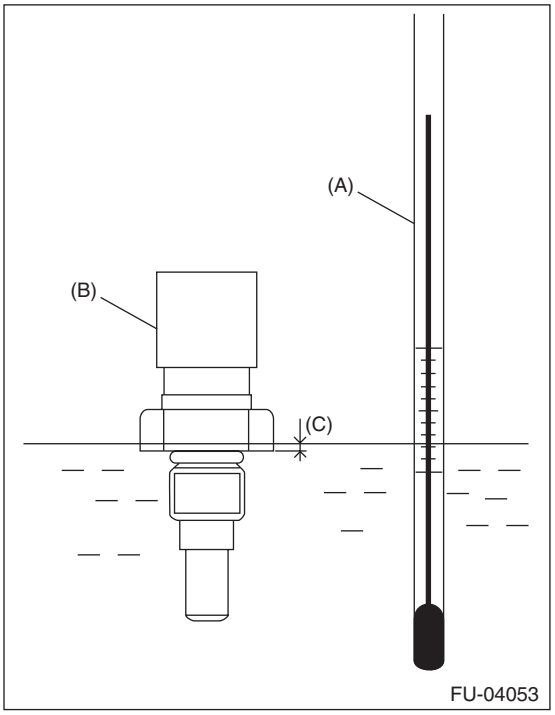
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

C: INSPECTION

1) Check that the engine coolant temperature sensor has no deformation, cracks or other damages.

2) Immerse the engine coolant temperature sensor and a thermometer in water.

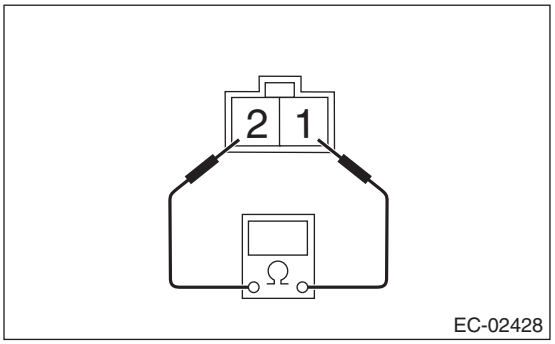
CAUTION:
Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: To approx. $^{1}/_{3}$

3) Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

NOTE:
Agitate the water for even temperature distribution.

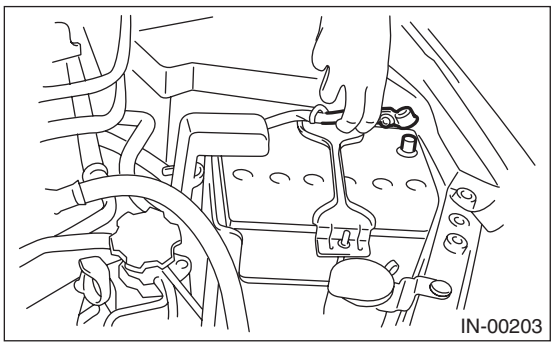


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	2.45±0.2 kΩ
80°C (176°F)		0.318±0.013 kΩ

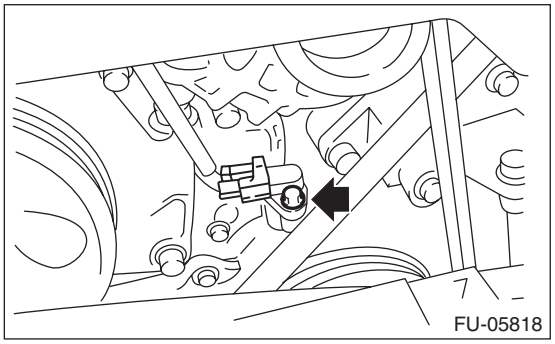
5. Crankshaft Position Sensor

A: REMOVAL

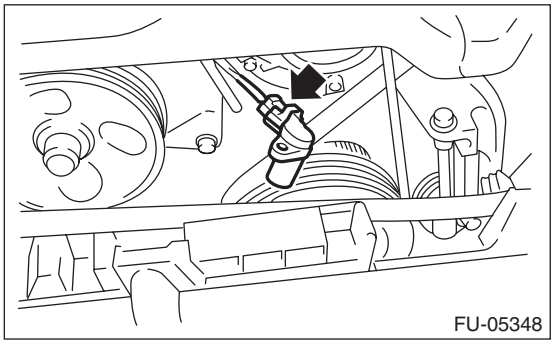
1) Disconnect the ground cable from battery.



2) Remove the bolt which secures crankshaft position sensor to oil pump.



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



B: INSTALLATION

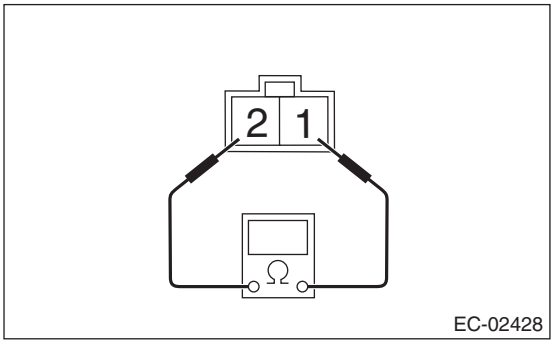
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1. CRANKSHAFT POSITION SENSOR (METHOD WITH CIRCUIT TESTER)

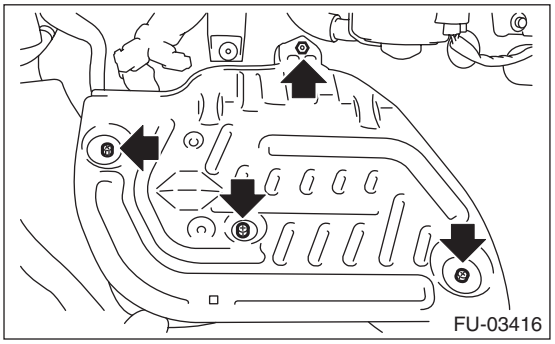
Measure the resistance between crankshaft position sensor terminals.



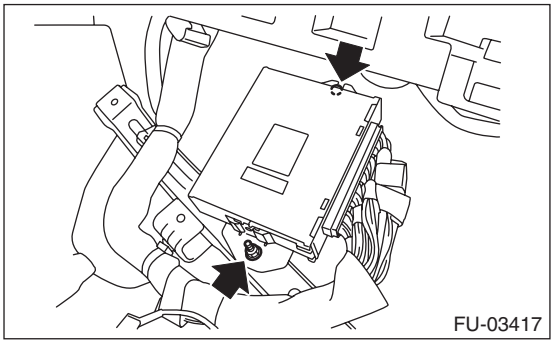
Terminal No.	Standard
1 and 2	2.04±0.204 kΩ

2. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

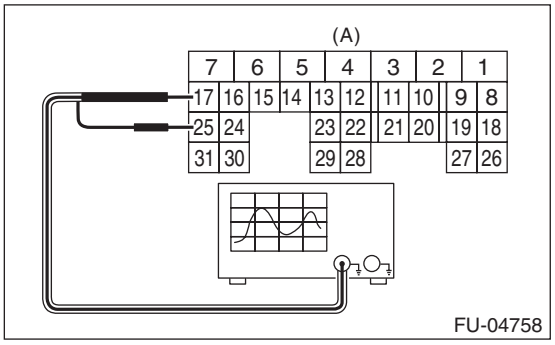
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



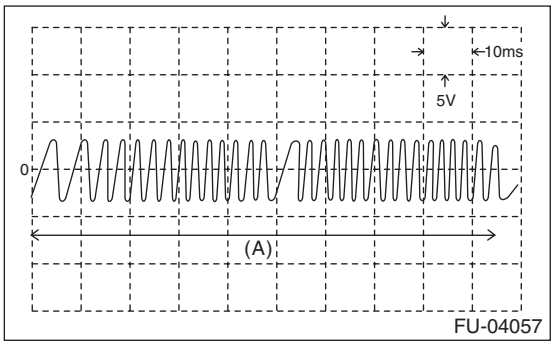
6) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
17	+
25	–

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.



(A) One crankshaft rotation

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

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

3. OTHER INSPECTIONS

Check that the crankshaft position sensor has no deformation, cracks or other damages.

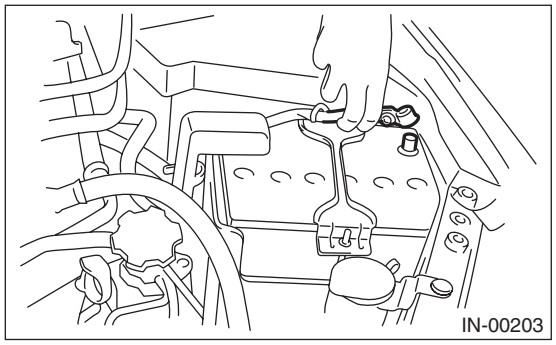
6. Camshaft Position Sensor

A: REMOVAL

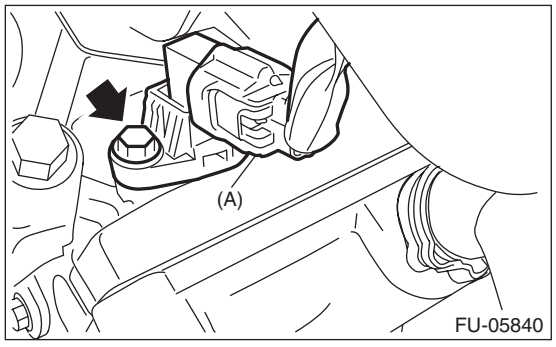
1. INTAKE SIDE

• Camshaft position sensor RH

1) Disconnect the ground cable from battery.

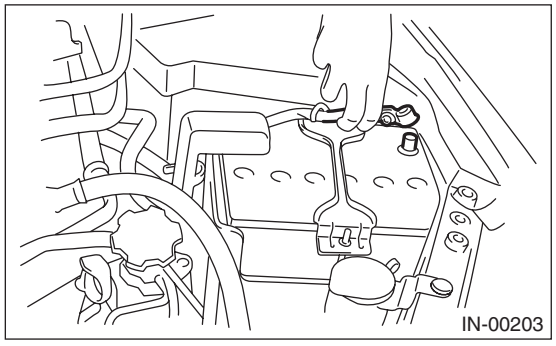


2) Disconnect the connector (A) from the camshaft position sensor RH, and remove the camshaft position sensor RH from the rear side of the cylinder head.



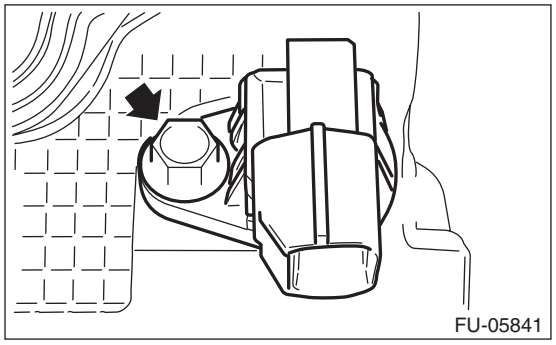
• Camshaft position sensor LH

1) Disconnect the ground cable from battery.



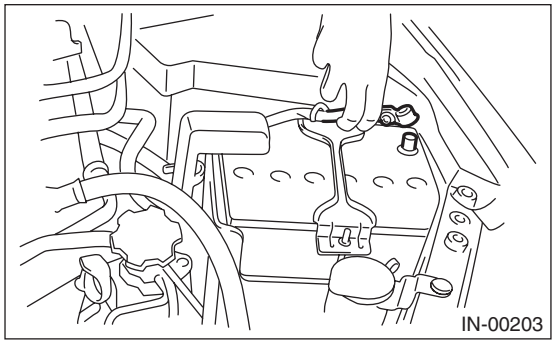
2) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>

3) Remove the camshaft position sensor LH.



2. EXHAUST SIDE

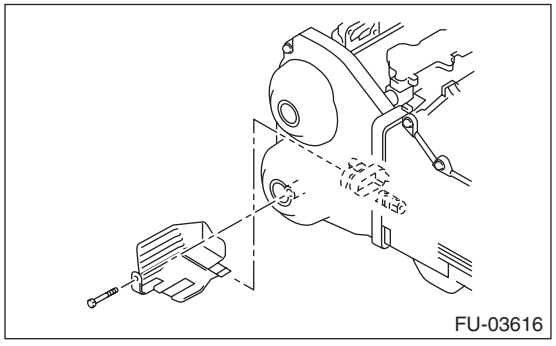
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.

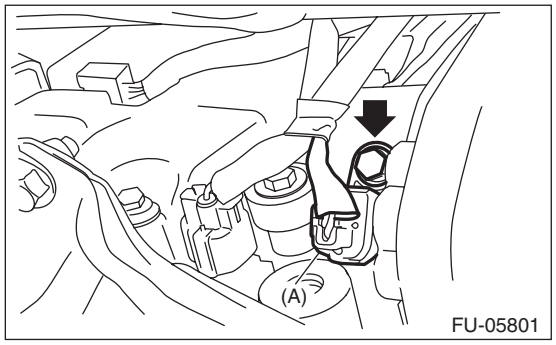
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>

4) Remove the engine harness cover. (right side only.)

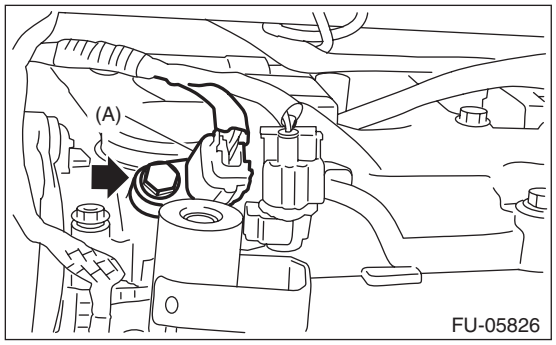


5) Disconnect connector (A) from the camshaft position sensor, and remove the camshaft position sensor from under the cylinder head.

- RH side



- LH side



B: INSTALLATION

1. INTAKE SIDE

Install in the reverse order of removal.

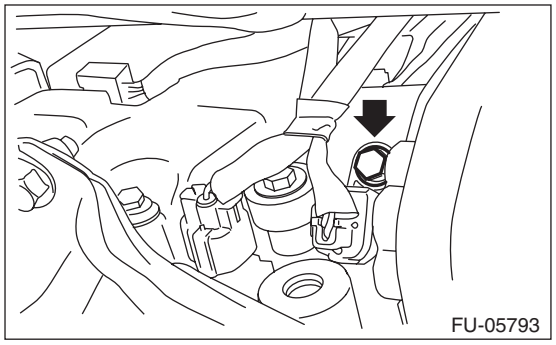
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. EXHAUST SIDE

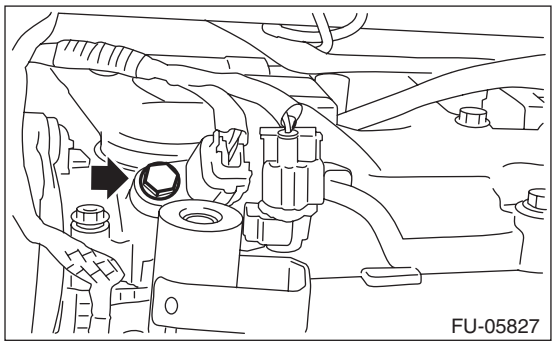
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

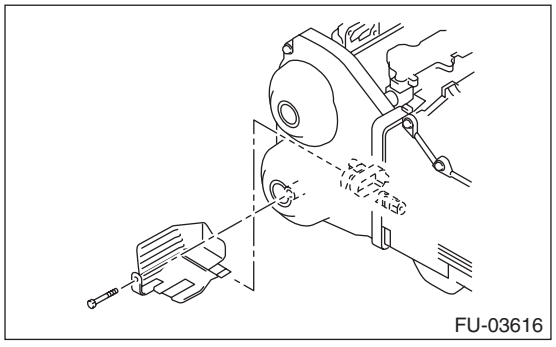
- RH side



- LH side



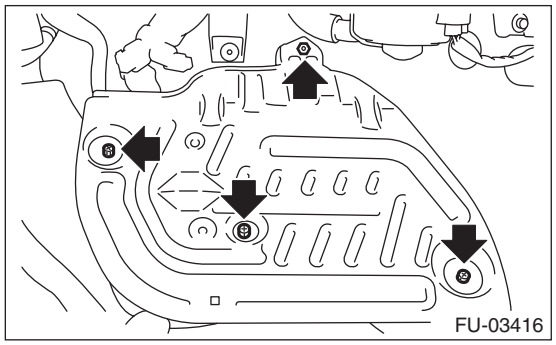
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



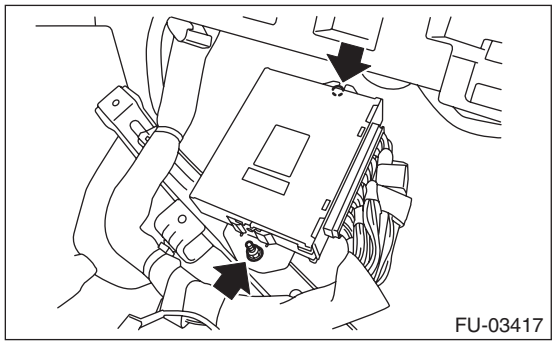
C: INSPECTION

1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

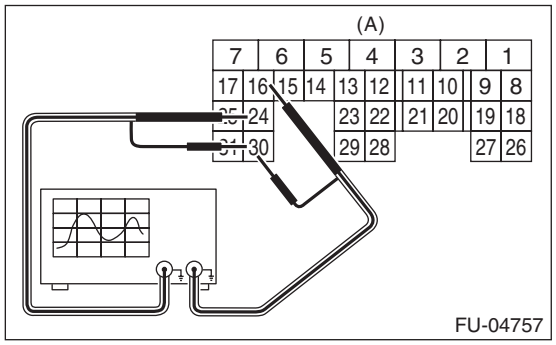
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.

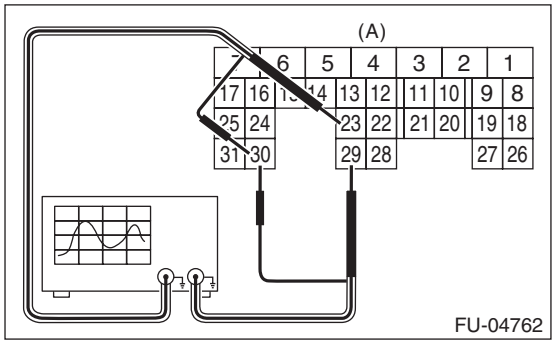


6) Connect the probe to ECM connector.
- Intake camshaft position sensor



(A) To ECM connector

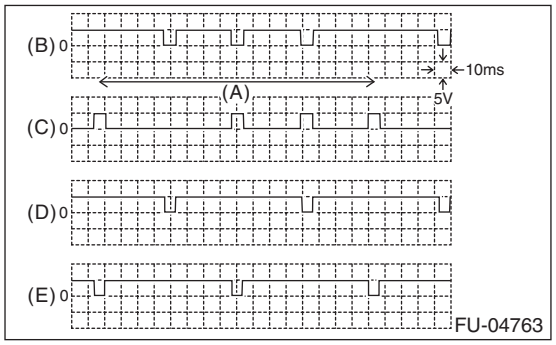
- Exhaust camshaft position sensor



(A) To ECM connector

Camshaft position sensor		Terminal No.	Probe
Intake	RH	24	+
	LH	16	+
Exhaust	RH	23	+
	LH	29	+
RH and LH		30	–

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.



(A) One camshaft rotation
(B) Intake camshaft position sensor RH
(C) Intake camshaft position sensor LH
(D) Exhaust camshaft position sensor RH
(E) Exhaust camshaft position sensor LH

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

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

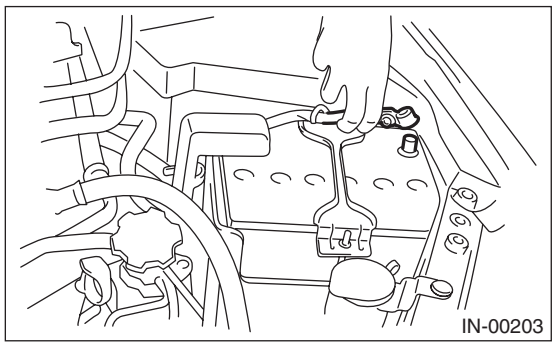
2. OTHER INSPECTIONS

Check that the camshaft position sensor has no deformation, cracks or other damages.

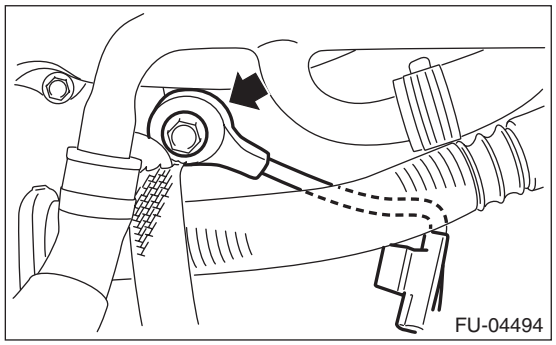
7. Knock Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the secondary air combination valve RH. <Ref. to EC(STI)-29, REMOVAL, Secondary Air Combination Valve.>
5) Remove the knock sensor from cylinder block.

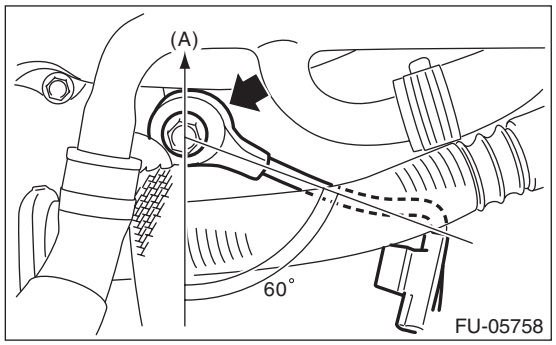


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

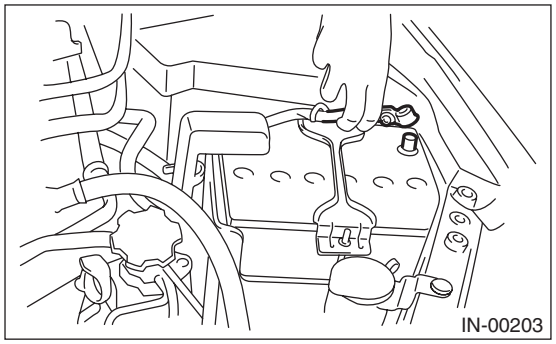
NOTE:
The portion of the knock sensor cord that is pulled out must be positioned at a 60° angle relative to the engine rear.

Tightening torque:
24 N·m (2.4 kgf-m, 17.7 ft-lb)



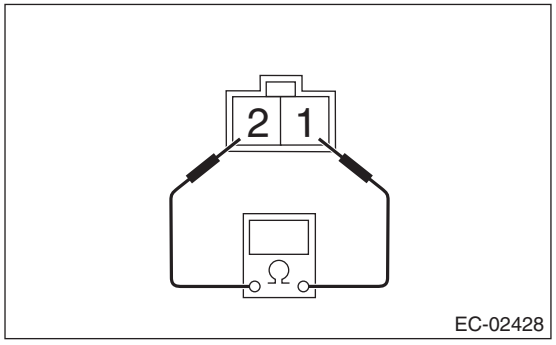
(A) Front side of vehicle

2) Install the secondary air combination valve RH. <Ref. to EC(STI)-30, SECONDARY AIR COMBINATION VALVE RH, INSTALLATION, Secondary Air Combination Valve.>
3) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
4) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
5) Connect the battery ground terminal.



C: INSPECTION

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



Terminal No.	Standard
1 and 2	560±28 kΩ

8. Throttle Position Sensor

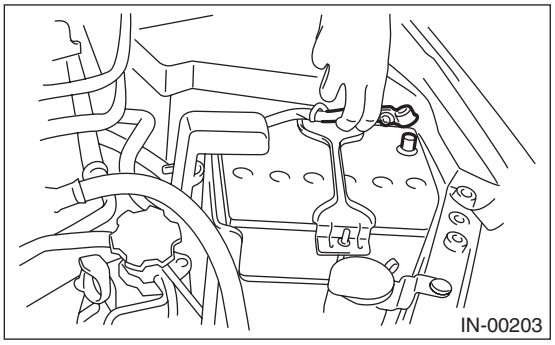
A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.
Refer to “Throttle Body” for removal and installation procedure. <Ref. to FU(STI)-15, REMOVAL, Throttle Body.> <Ref. to FU(STI)-15, INSTALLATION, Throttle Body.>

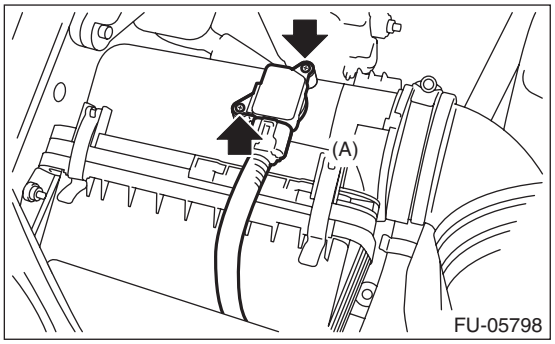
9. Mass Air Flow and Intake Air Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.



B: INSTALLATION

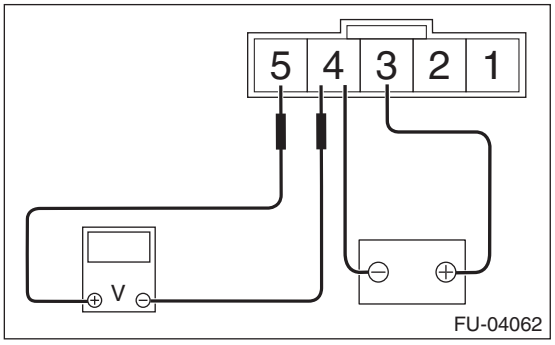
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.1 kgf-m, 0.7 ft-lb)

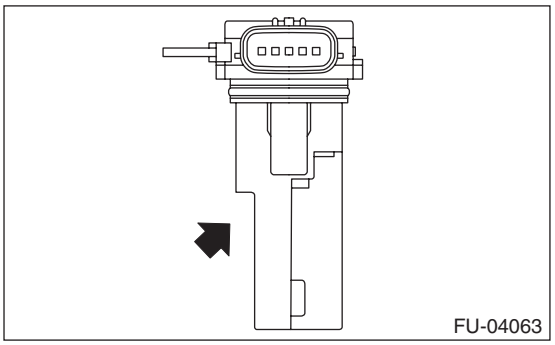
C: INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, the circuit tester positive terminal to terminal No. 5 and the circuit tester ground terminal to terminal No. 4.

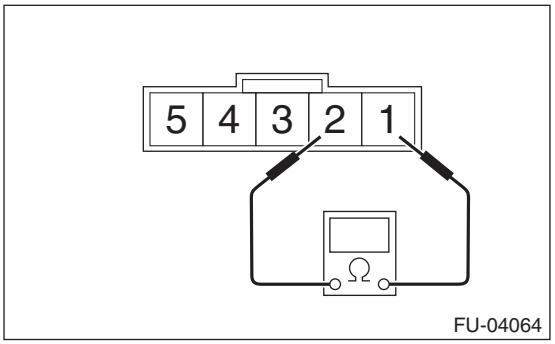


2) Check the voltage changes when air is blown to the mass air flow sensor unit in arrow direction.



2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.



Temperature	Terminal No.	Standard
–20°C (–4°F)	1 and 2	16.0±2.4 kΩ
20°C (68°F)		2.45±0.24 kΩ
60°C (140°F)		0.580±0.087 kΩ

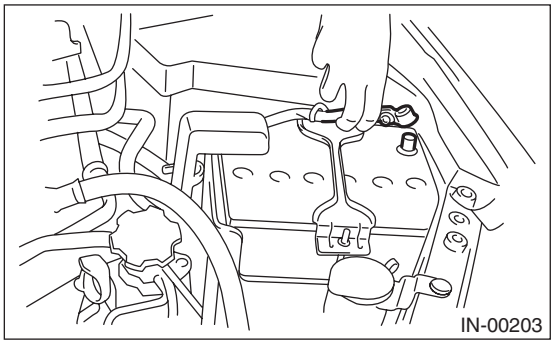
3. OTHER INSPECTIONS

1) Check that the mass air flow and intake air temperature sensor has no deformation, cracks or other damages.
2) Check that the mass air flow and intake air temperature sensor has no dirt.

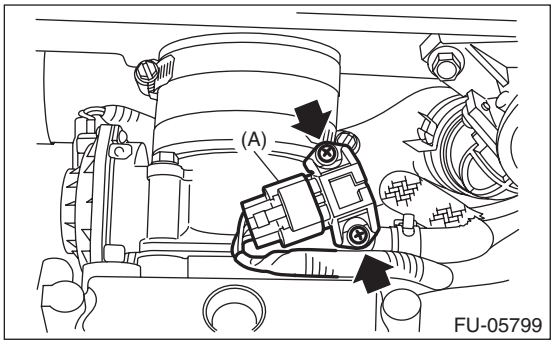
10.Manifold Absolute Pressure Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) from the manifold absolute pressure sensor, and remove the manifold absolute pressure sensor from throttle body.



B: INSTALLATION

Install in the reverse order of removal.

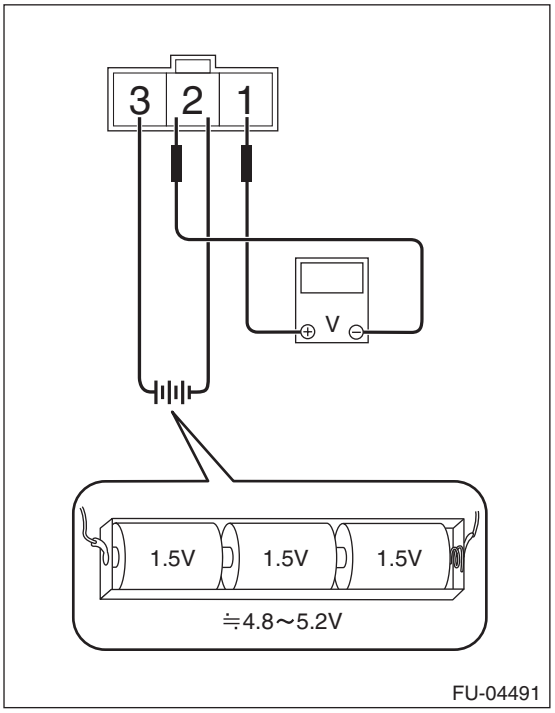
NOTE:
Use new O-rings.

Tightening torque:
2 N·m (0.2 kgf-m, 1.5 ft-lb)

C: INSPECTION

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

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

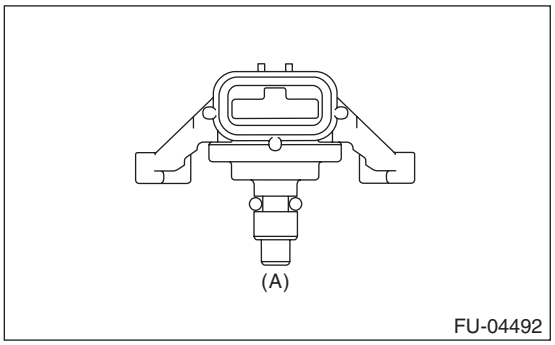


3) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
1 (+) and 2 (–)	Approx. 2.0 V (when 25°C (77°F))

4) Connect the Mighty Vac to the pressure port (A) of manifold absolute pressure sensor.



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

CAUTION:
Do not apply vacuum of less than –88 — 200 kPa (–0.9 — 2.04 kgf/cm^2, –12.8 — 29.0 psi). Doing so may damage the manifold absolute pressure sensor.

NOTE:
When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3). When positive pressure occurs, on the other hand, the voltage will rise.

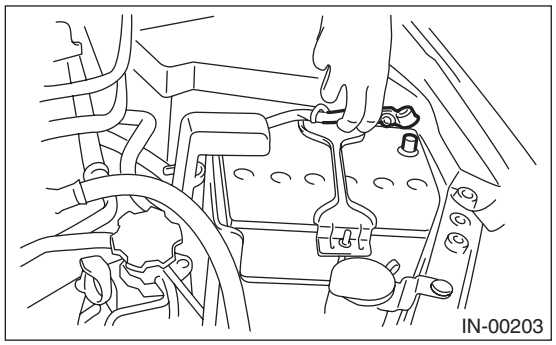
Pressure	Terminal No.	Standard
–88 kPa (–0.9 kgf/cm^2, –12.8 psi)	1 (+) and 2 (–)	Approx. 0.8 V (when 25°C (77°F))
181 kPa (1.85 kgf/cm^2, 26.2 psi)		Approx. 4.7 V (when 25°C (77°F))

11.Fuel Injector

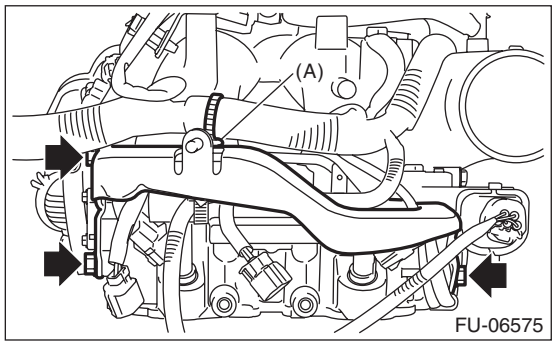
A: REMOVAL

1. RH SIDE

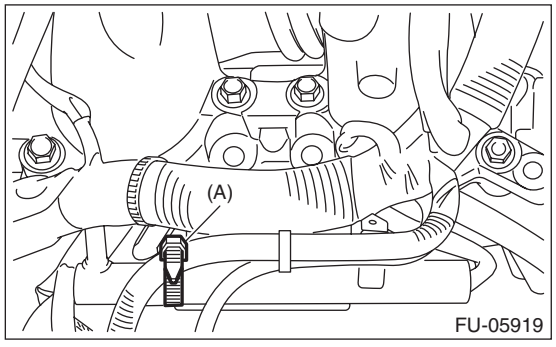
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



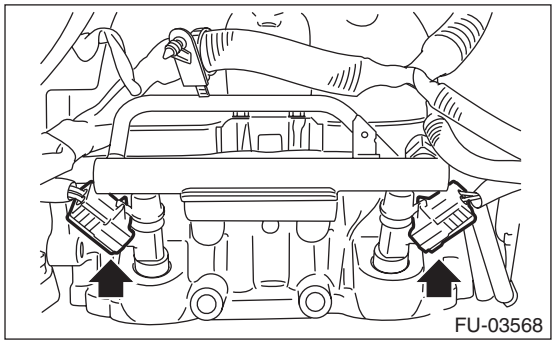
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Remove clip (A) holding the engine harness to the fuel pipe protector RH, and remove the fuel pipe protector RH from the intake manifold.



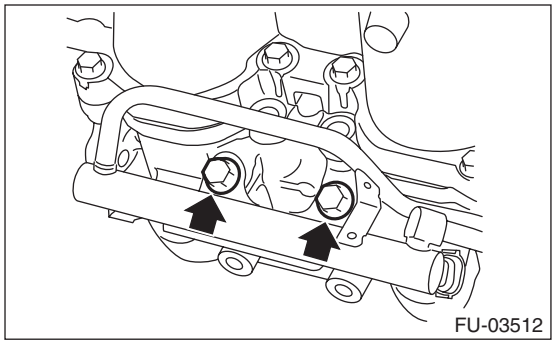
6) Remove the harness band (A) which holds the engine harness to the fuel injector pipe RH.



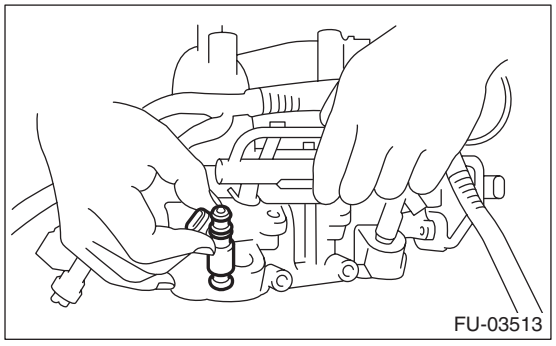
7) Disconnect the connector from fuel injector.



8) Remove the bolts which hold fuel injector pipe RH.

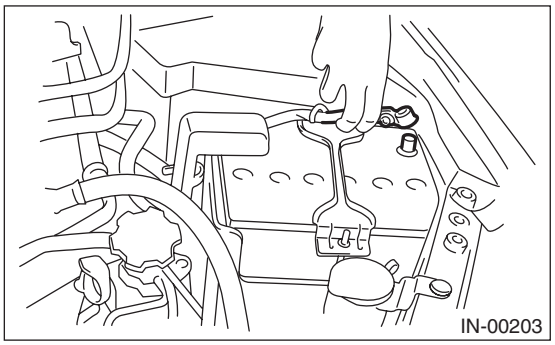


9) Remove the fuel injector.

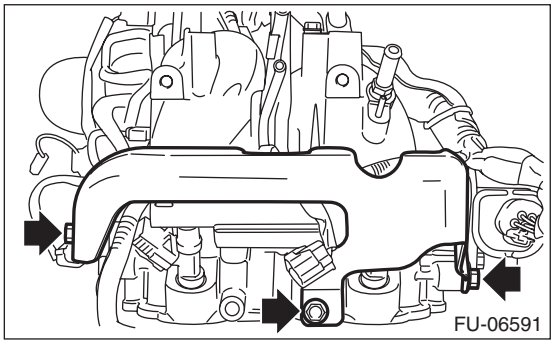


2. LH SIDE

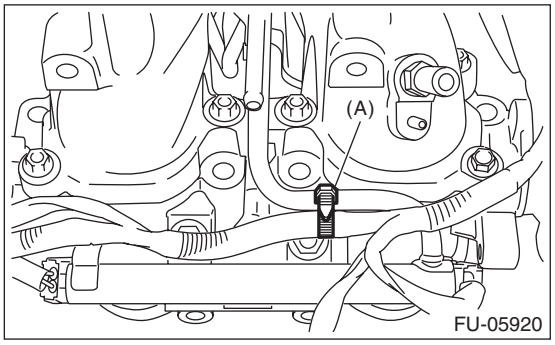
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



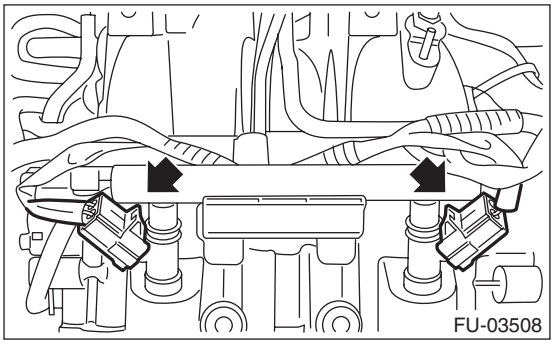
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Remove the fuel pipe protector LH from the intake manifold.



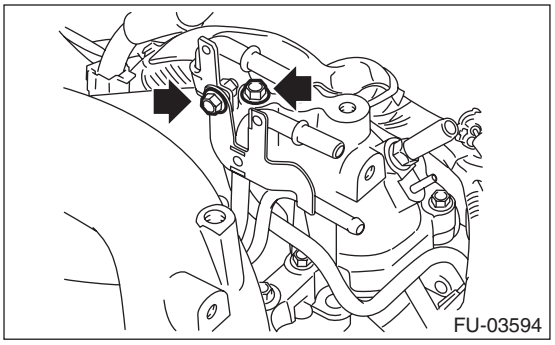
6) Remove the harness band (A) which holds the engine harness to the fuel injector pipe LH.

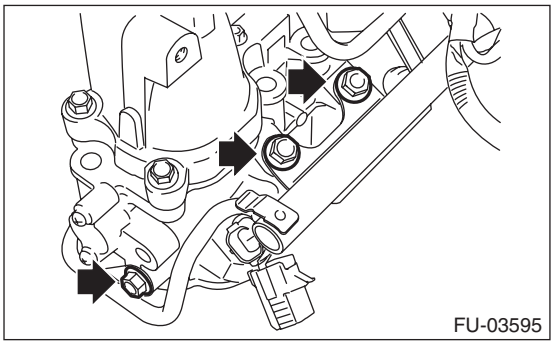


7) Disconnect the connector from fuel injector.

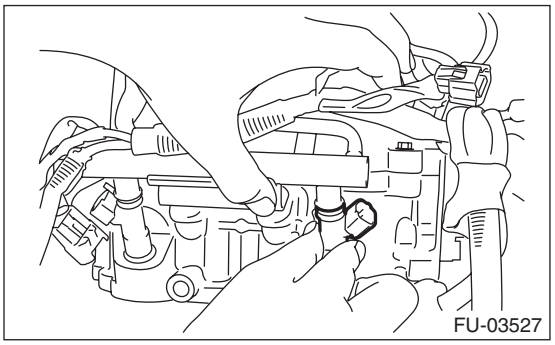


8) Remove the bolts which hold fuel injector pipe LH.





9) Remove the fuel injector.



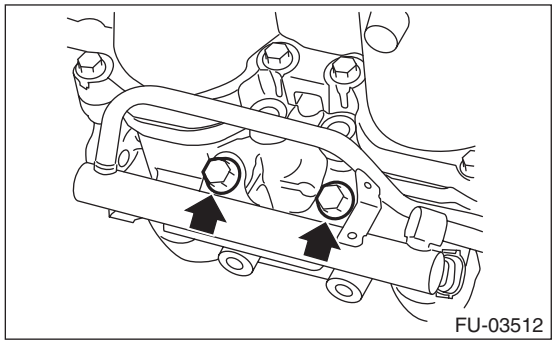
B: INSTALLATION

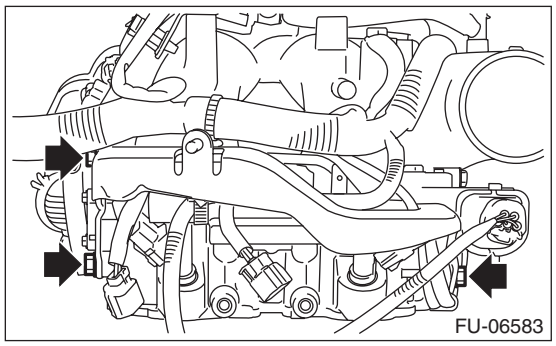
1. RH SIDE

Install in the reverse order of removal.

NOTE:
Use new O-rings.

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


FU-03512

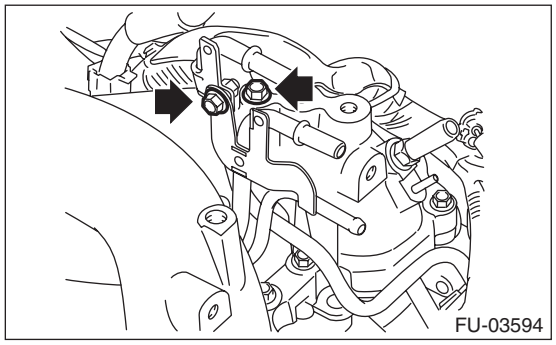

FU-06583

2. LH SIDE

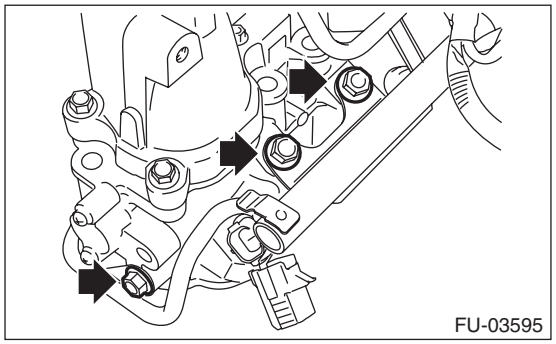
Install in the reverse order of removal.

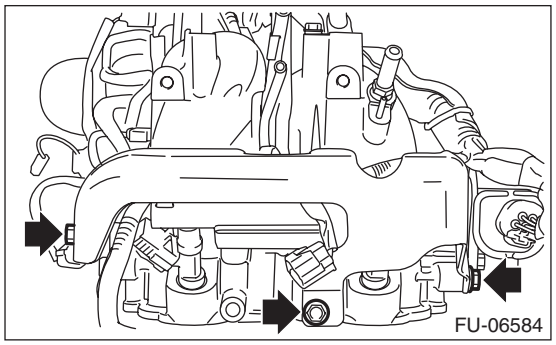
NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-03594

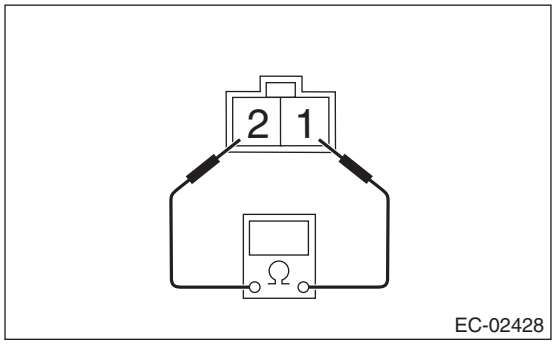
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)


FU-03595


FU-06584

C: INSPECTION

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



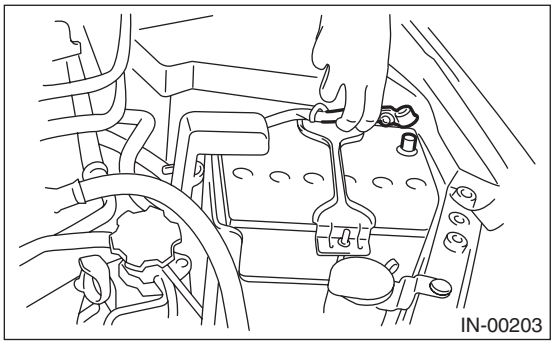
EC-02428

Terminal No.	Standard
1 and 2	Approx. 12.0 Ω (when 20°C (68°F))

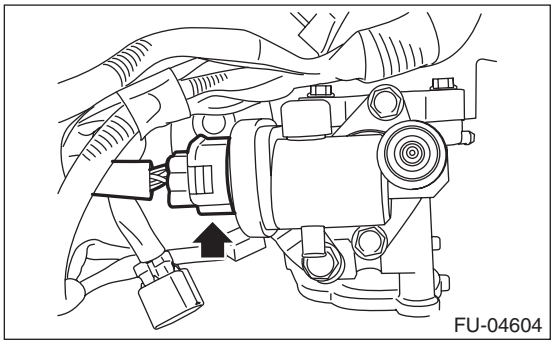
12.Tumble Generator Valve Assembly

A: REMOVAL

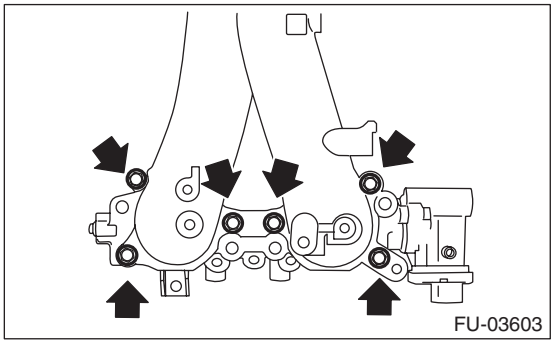
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Disconnect the connector from the tumble generator valve assembly.



6) Remove the fuel injector. <Ref. to FU(STI)-45, REMOVAL, Fuel Injector.>
7) Remove the tumble generator valve assembly from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
8.3 N·m (0.8 kgf-m, 6.1 ft-lb)

C: INSPECTION

1) Check that the tumble generator valve assembly has no deformation, cracks or other damages.
2) Check tumble generator valve for contamination or clogging.

13. Tumble Generator Valve Actuator

A: SPECIFICATION

The tumble generator valve assembly cannot be disassembled.
Refer to “Tumble Generator Valve Assembly” for removal and installation procedures. <Ref. to FU(STI)-48, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(STI)-48, INSTALLATION, Tumble Generator Valve Assembly.>

14. Oil Flow Control Solenoid Valve

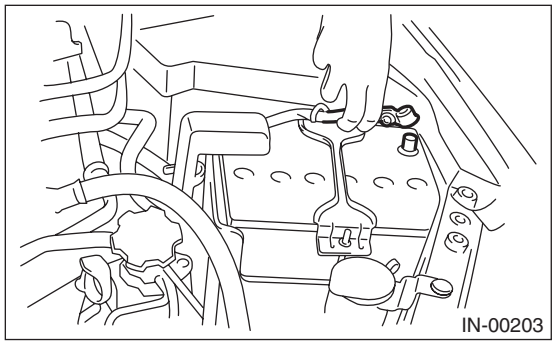
A: REMOVAL

1. INTAKE SIDE

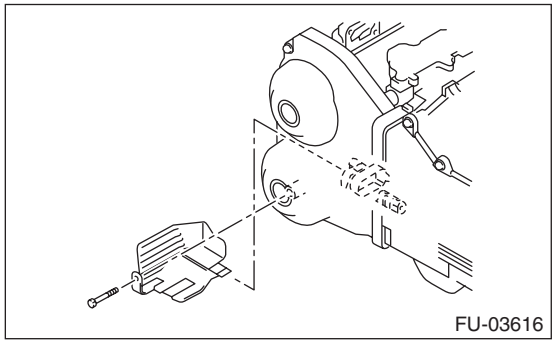
Oil flow control solenoid valve is a unit with front camshaft cap.
Refer to “Camshaft” for removal procedures. <Ref. to ME(STI)-61, REMOVAL, Camshaft.>

2. EXHAUST SIDE

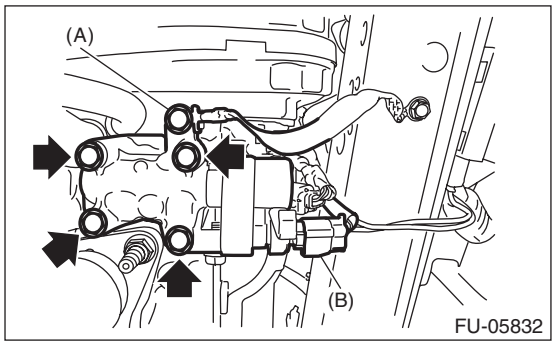
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front exhaust pipe. (right side only.) <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
5) Remove the engine harness cover. (right side only.)



6) Disconnect the ground cable (A). (left side only)
7) Disconnect the connector (B) from the oil flow control solenoid valve, and remove the oil flow control solenoid valve from the cylinder head.



B: INSTALLATION

1. INTAKE SIDE

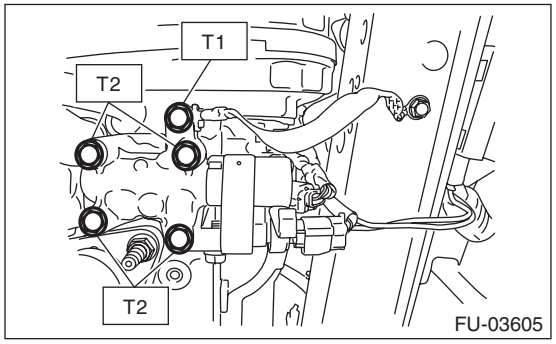
Refer to “Camshaft” for installation procedure. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>

2. EXHAUST SIDE

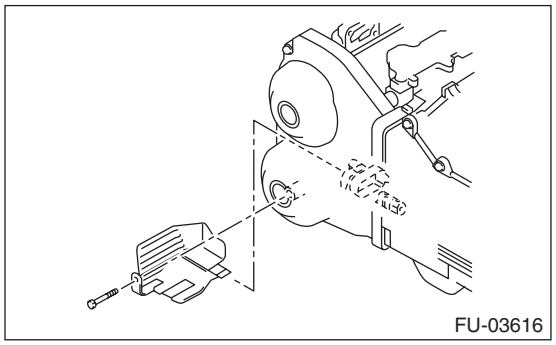
Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)
T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



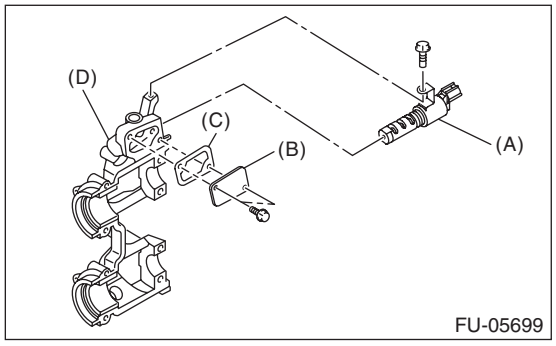
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



C: DISASSEMBLY

1. INTAKE SIDE

1) Remove the two mounting bolts securing oil return cover, and remove the oil return cover and gasket.
2) Remove the bolt securing oil flow control solenoid valve, and remove the oil flow control solenoid valve.



(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

2. EXHAUST SIDE

The oil flow control solenoid valve on the exhaust side cannot be disassembled.

D: ASSEMBLY

1. INTAKE SIDE

1) Install the oil flow control solenoid valve.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

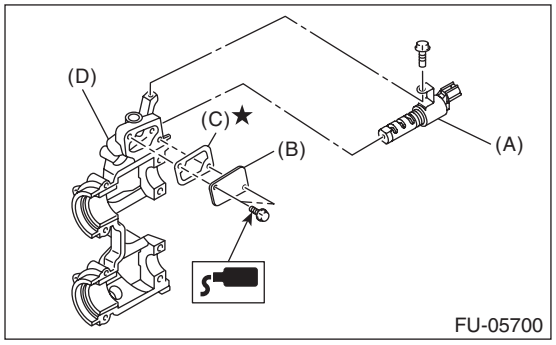
2) Apply liquid gasket to the two bolts securing oil return cover.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042)

3) Attach the oil return cover and gasket.

Tightening torque:
9 N·m (0.9 kgf-m, 6.6 ft-lb)

NOTE:
Use a new gasket.



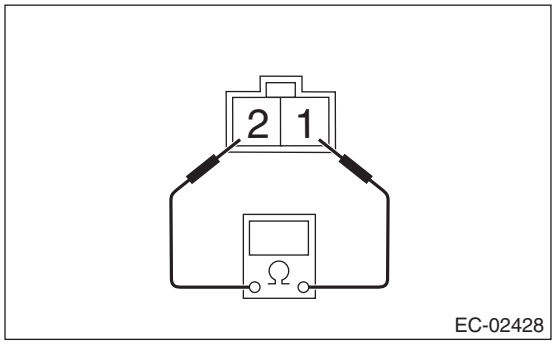
(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

2. EXHAUST SIDE

The oil flow control solenoid valve on the exhaust side cannot be disassembled.

E: INSPECTION

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

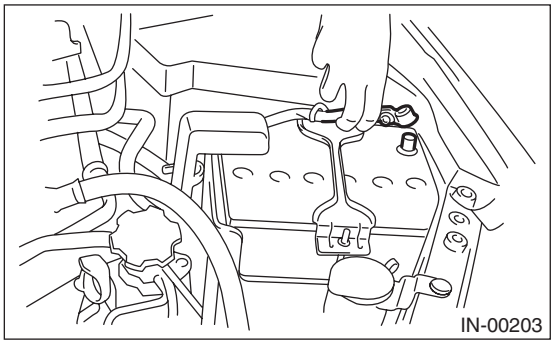


Terminal No.	Standard
1 and 2	7.4±0.5 Ω (when 20°C (68°F))

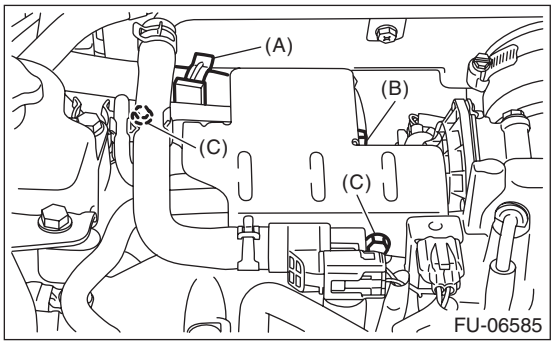
15. Wastegate Control Solenoid Valve

A: REMOVAL

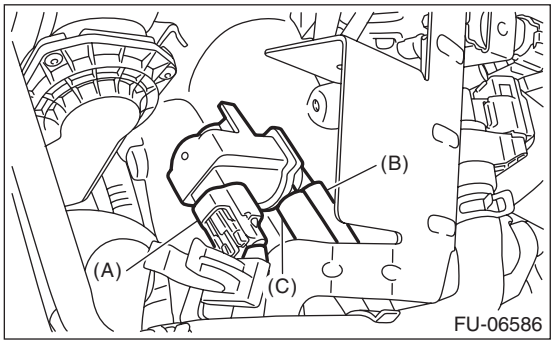
1) Disconnect the ground cable from battery.



2) Remove the vacuum hose from clip (A), and remove the bolt (B) which secures the wastegate control solenoid valve.
3) Remove the bolts (C) which secure solenoid valve bracket onto intake manifold.



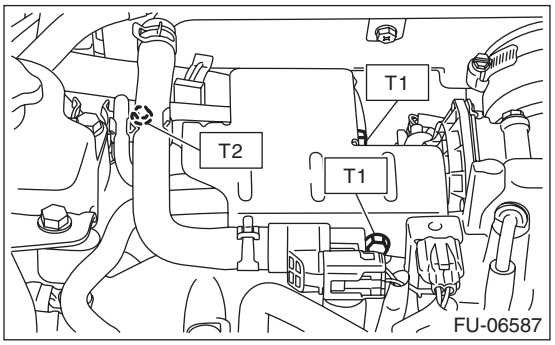
4) Disconnect the connector (A) from the wastegate control solenoid valve.
5) Disconnect the vacuum hose (B) and air control hose (C) from the wastegate control solenoid valve, and remove the wastegate control solenoid valve.



B: INSTALLATION

Install in the reverse order of removal.

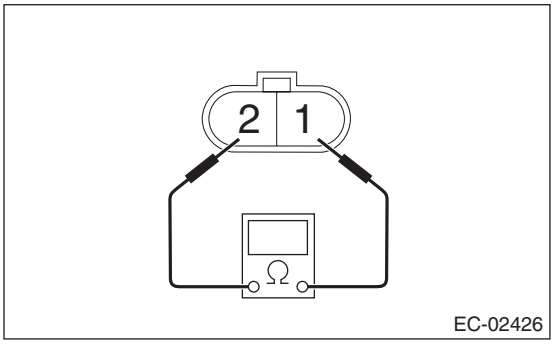
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



C: INSPECTION

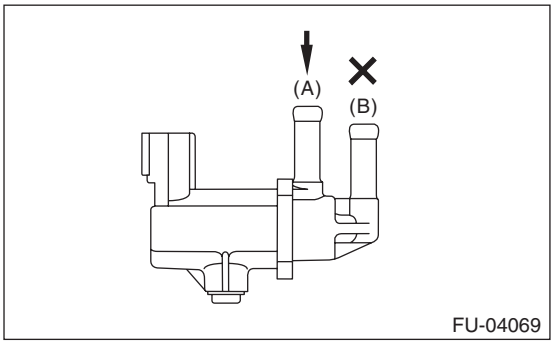
1. WASTEGATE CONTROL SOLENOID VALVE

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

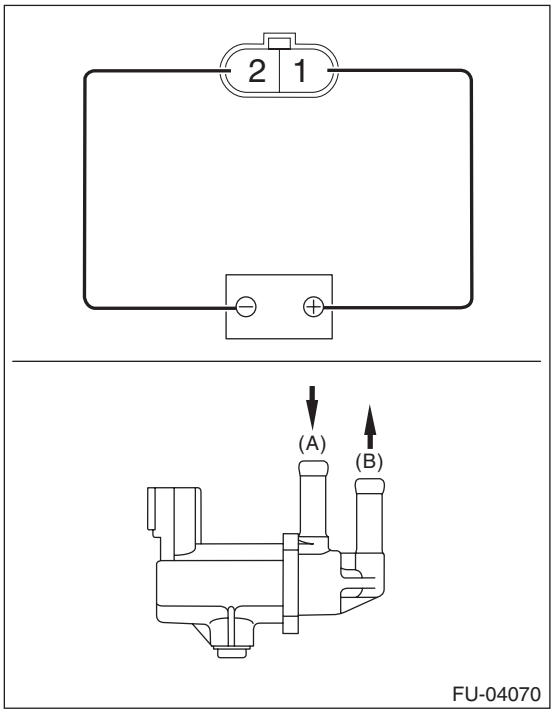


Terminal No.	Standard
1 and 2	28±2 Ω (when 20°C (68°F))

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



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



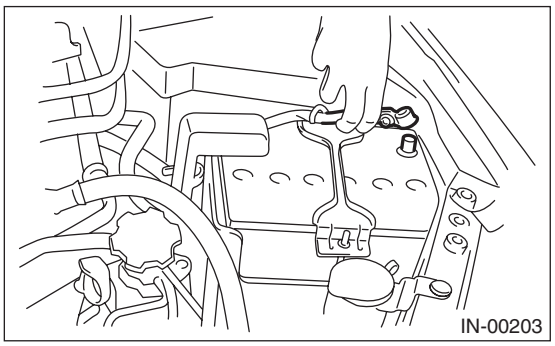
2. OTHER INSPECTIONS

Check that the vacuum hose and air control hose have no cracks, damage or loose part.

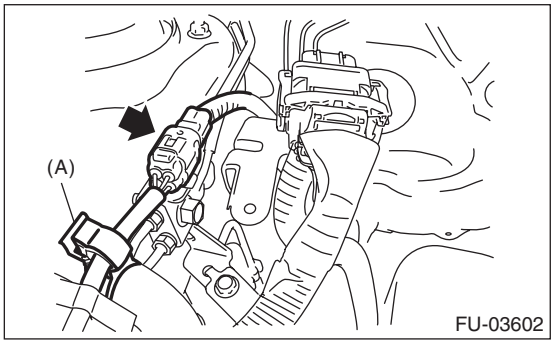
16.Front Oxygen (A/F) Sensor

A: REMOVAL

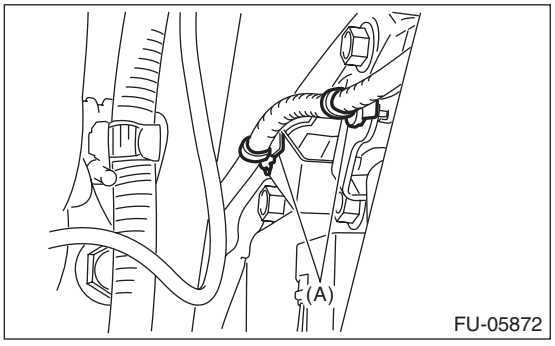
1) Disconnect the ground cable from battery.



2) Disconnect the connector from the front oxygen (A/F) sensor, and remove the clip (A) holding the return hose and front oxygen (A/F) sensor harness.

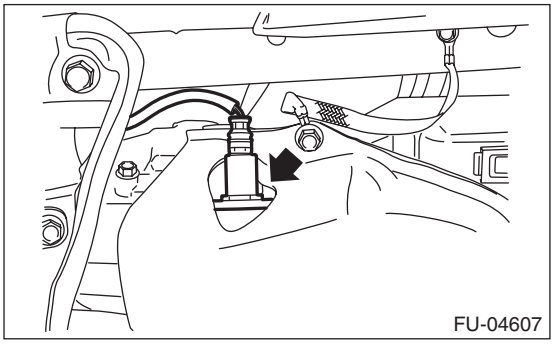


3) Remove the clips (A) holding the front oxygen (A/F) sensor harness to the engine harness stay.



4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
6) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
7) Remove the front oxygen (A/F) sensor.

CAUTION:
When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



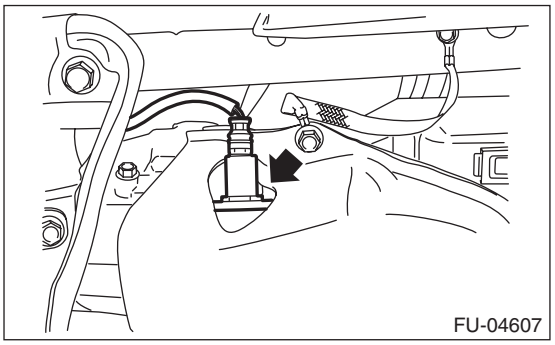
B: INSTALLATION

CAUTION:
If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.
1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

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

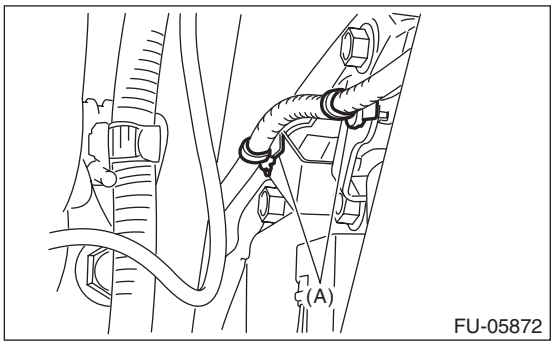
Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent
2) Install the front oxygen (A/F) sensor.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)

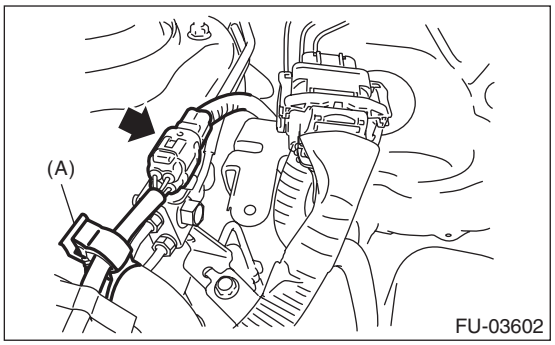


3) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
4) Lower the vehicle.

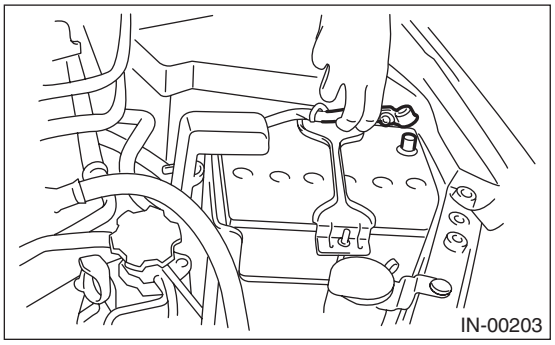
5) Secure the front oxygen (A/F) sensor harness to the engine harness stay using the clips (A).



6) Connect the connector to the front oxygen (A/F) sensor, and secure the return hose and front oxygen (A/F) sensor harness using the clip (A).

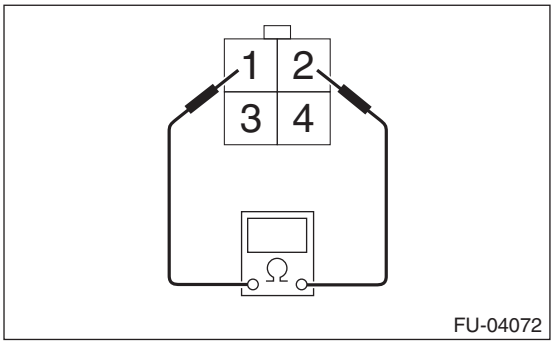


7) Connect the battery ground terminal.



C: INSPECTION

1) Check that the front oxygen (A/F) sensor has no deformation, cracks or other damages.
2) Measure the resistance between front oxygen (A/F) sensor terminals.

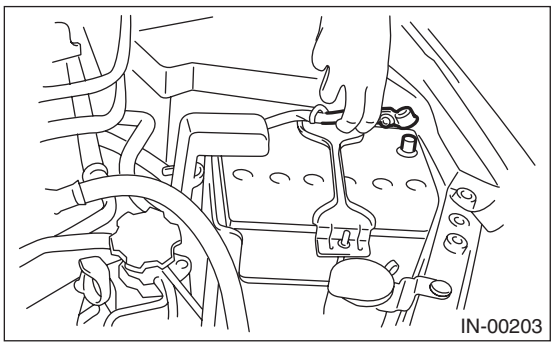


Terminal No.	Standard
1 and 2	2.4±0.24 Ω (when 20°C (68°F))

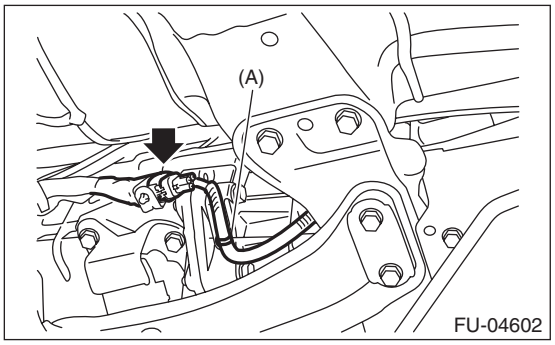
17.Rear Oxygen Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.

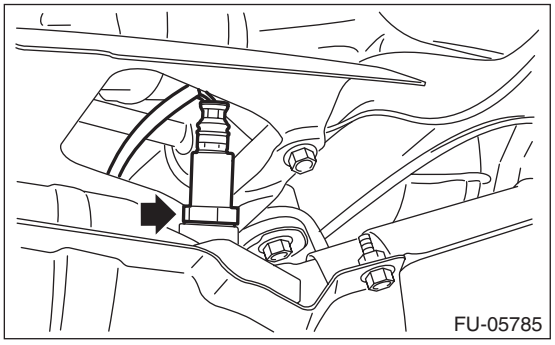


2) Lift up the vehicle.
3) Remove the transmission under cover.
4) Disconnect the connector from the rear oxygen sensor, and remove the clip (A) holding the rear oxygen sensor harness.



5) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
6) Remove the rear oxygen sensor.

CAUTION:
When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



B: INSTALLATION

CAUTION:
If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.

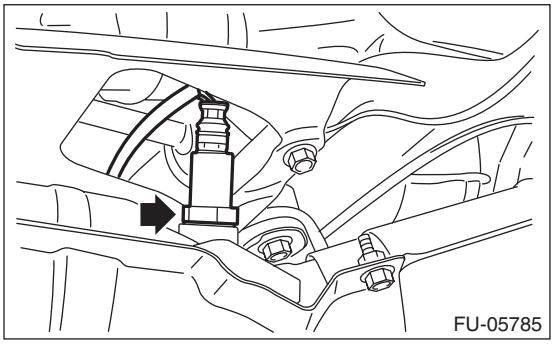
1) Before installing rear oxygen sensor, apply the anti-seize compound only to the threaded portion of rear oxygen sensor to make the next removal easier.

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

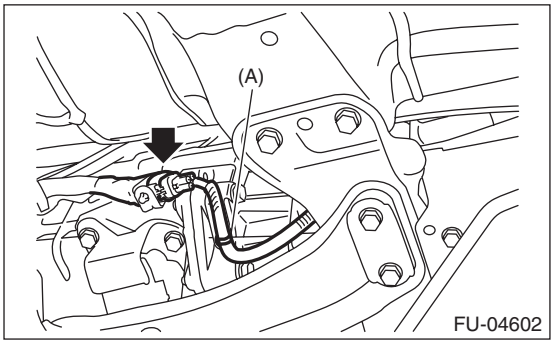
Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

2) Install the rear oxygen sensor.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



3) Connect the connector to the rear oxygen sensor, and hold the rear oxygen sensor harness with the clip (A).

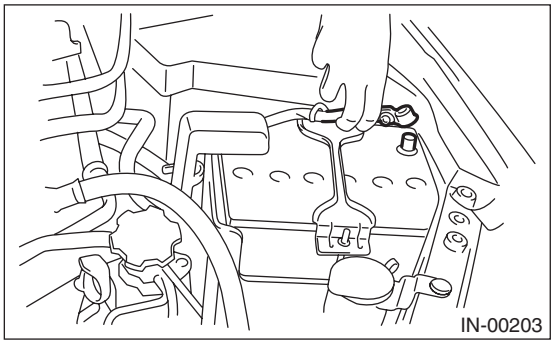


4) Install the transmission under cover.

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

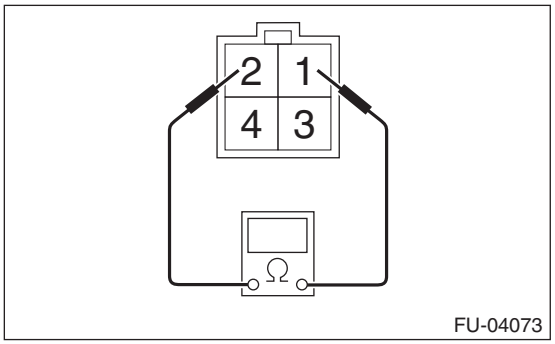
5) Lower the vehicle.

6) Connect the battery ground terminal.



C: INSPECTION

1) Check that the rear oxygen sensor has no deformation, cracks or other damages.
2) Measure the resistance between rear oxygen sensor terminals.

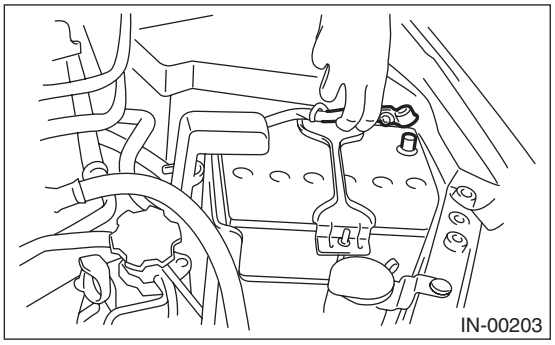


Terminal No.	Standard
1 and 2	$5.6^{+0.8}_{-0.6}$ Ω (when 20°C (68°F))

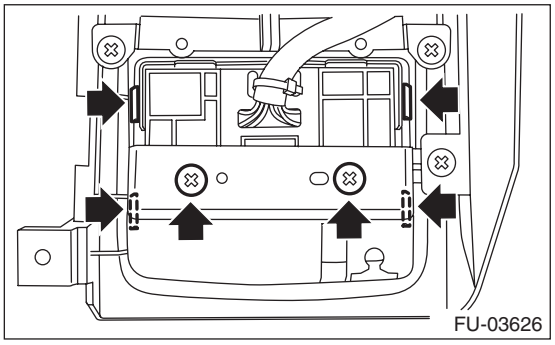
18.SI-DRIVE (SUBARU Intelligent Drive) Selector

A: REMOVAL

1) Disconnect the ground cable from the battery.



2) Remove the console box. <Ref. to EI-51, REMOVAL, Console Box.>
3) Remove the multi-selector switch connector from the console box.
4) Remove the screws and tabs holding the multi-selector switch to the console box and the multi-selector switch.



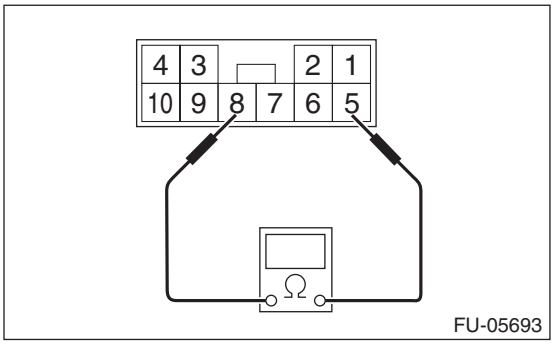
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
1.5 N·m (0.2 kgf-m, 1.1 ft-lb)

C: INSPECTION

1) Check that the multi select switch does not have deformation, cracks, or damage.
2) Check the resistance between the terminals at the SI-DRIVE selector.

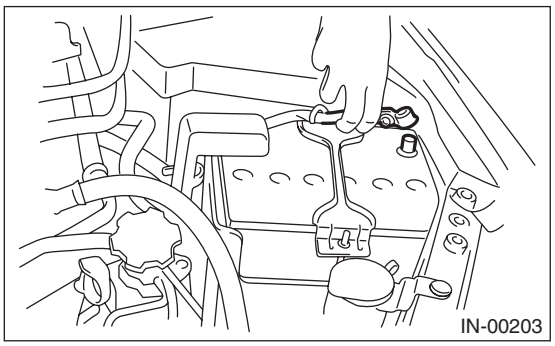


Switch position	Terminal No.	Standard
Sport (When turning the SI-DRIVE selector to the left)	5 and 8	Less than 1 Ω
Intelligent (When pressing the SI-DRIVE selector)		1±0.05 kΩ
Sport Sharp (When turning the SI-DRIVE selector to the right)		3.67±0.1835 kΩ

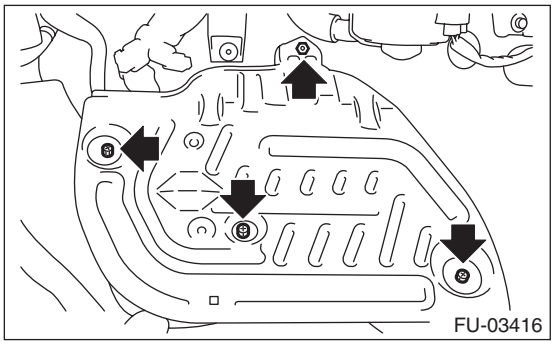
19.Engine Control Module (ECM)

A: REMOVAL

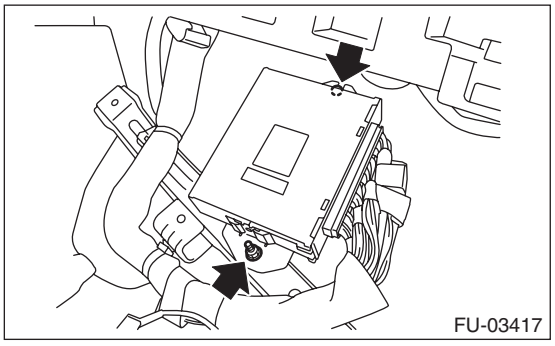
1) Disconnect the ground cable from battery.



2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



6) Disconnect the ECM connectors, and take out the ECM.

B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
• When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system. (Refer to "PC application help for Subaru Select Monitor".)
• When replacing the ECM or bracket, replace both parts with new parts.
• After installing the bracket to the ECM, do not separate the bracket.
• If the bracket has been installed to the ECM in the wrong direction, replace both parts with new parts.

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

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

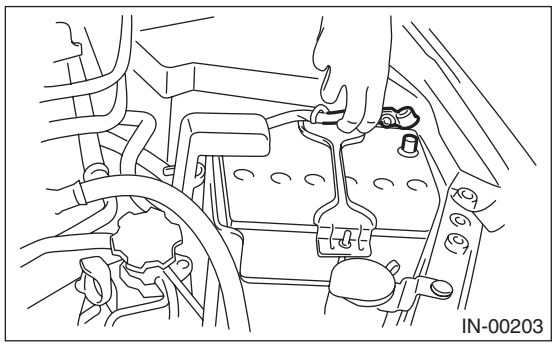
C: INSPECTION

Check that the ECM has no deformation, cracks or other damages.

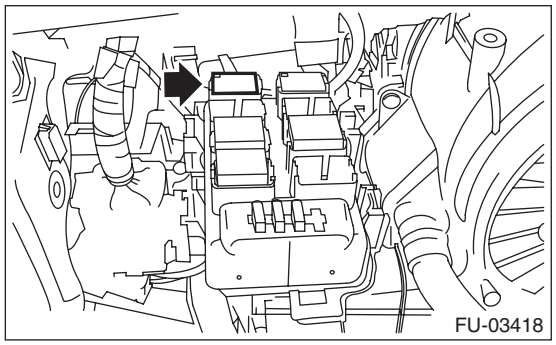
20.Main Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the main relay from the relay block on the back side of the glove box.

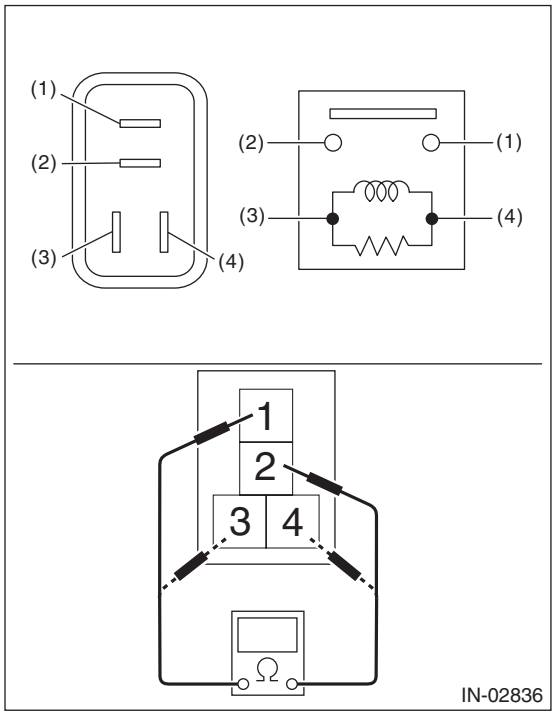


B: INSTALLATION

Install in the reverse order of removal.

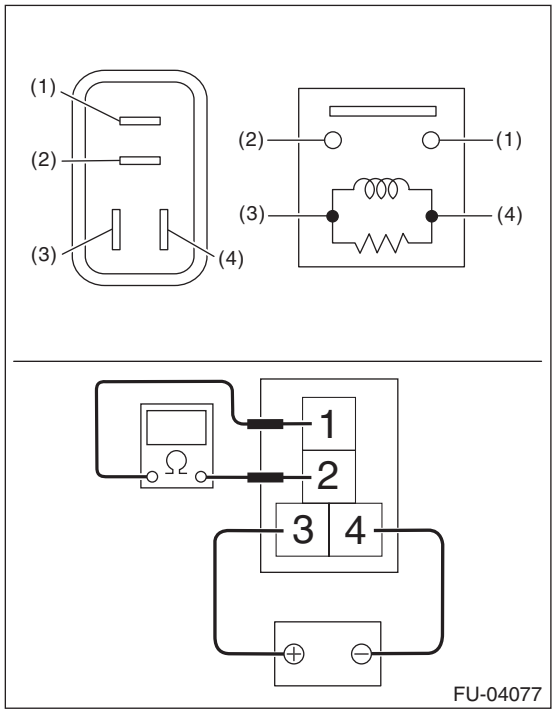
C: INSPECTION

1) Check that the main relay has no deformation, cracks or other damages.
2) Measure the resistance between main relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	130.4 — 230.8 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the main relay terminals.

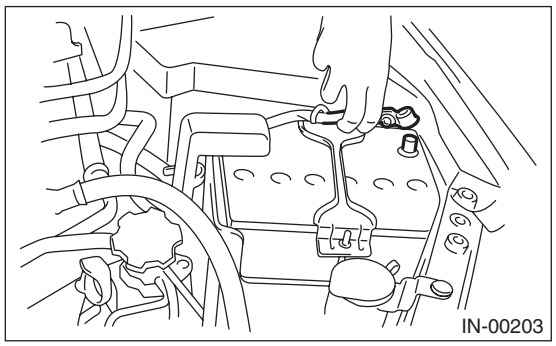


Terminal No.	Standard
1 and 2	Less than 1 Ω

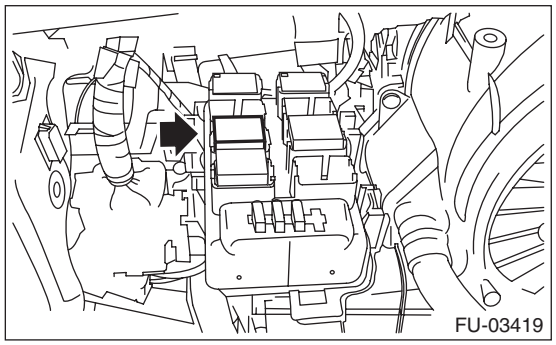
21.Fuel Pump Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the fuel pump relay from the relay block on the back side of the glove box.

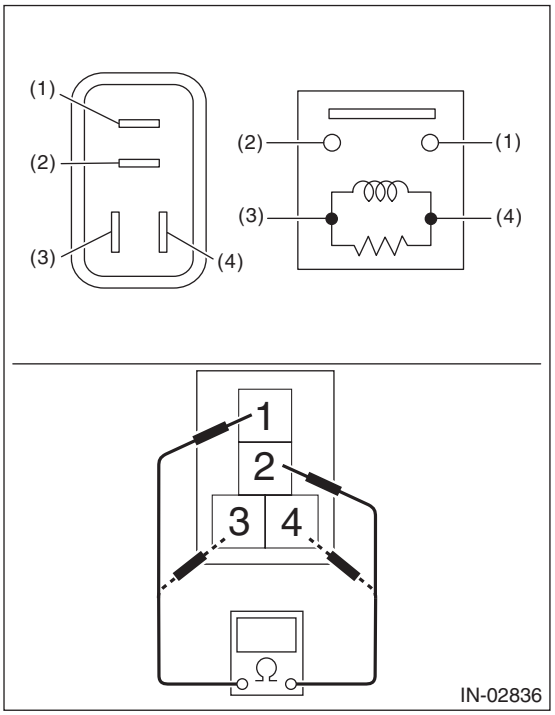


B: INSTALLATION

Install in the reverse order of removal.

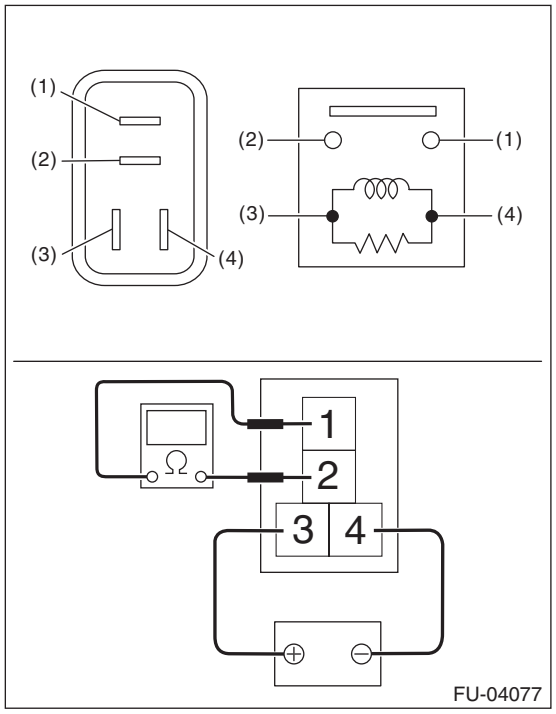
C: INSPECTION

1) Check that the fuel pump relay has no deformation, cracks or other damages.
2) Measure the resistance between fuel pump relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the fuel pump relay terminals.

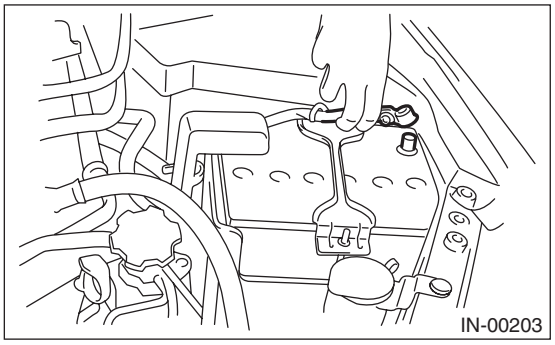


Terminal No.	Standard
1 and 2	Less than 1 Ω

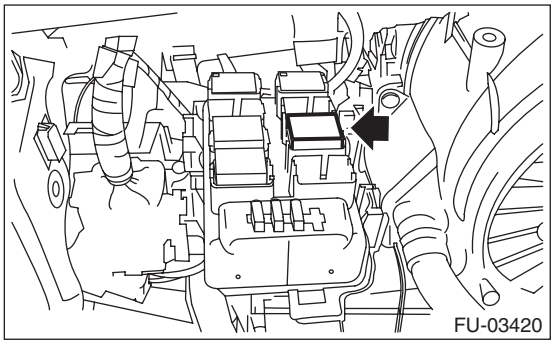
22. Electronic Throttle Control Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the electronic throttle control relay from the relay block on the back side of the glove box.

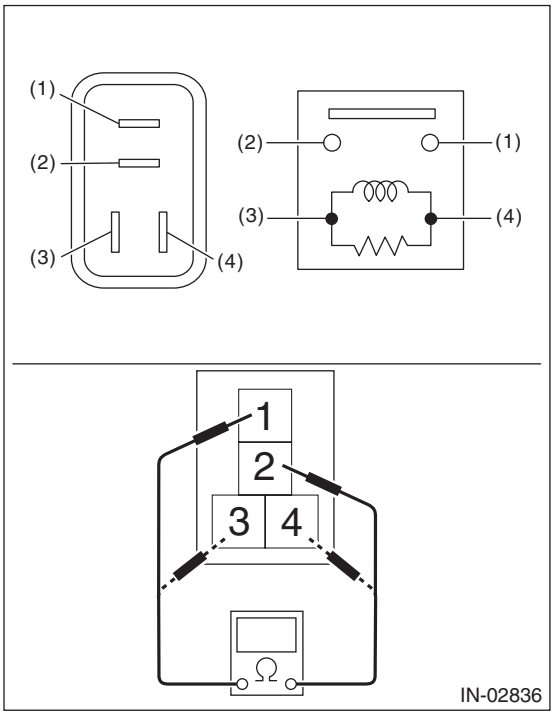


B: INSTALLATION

Install in the reverse order of removal.

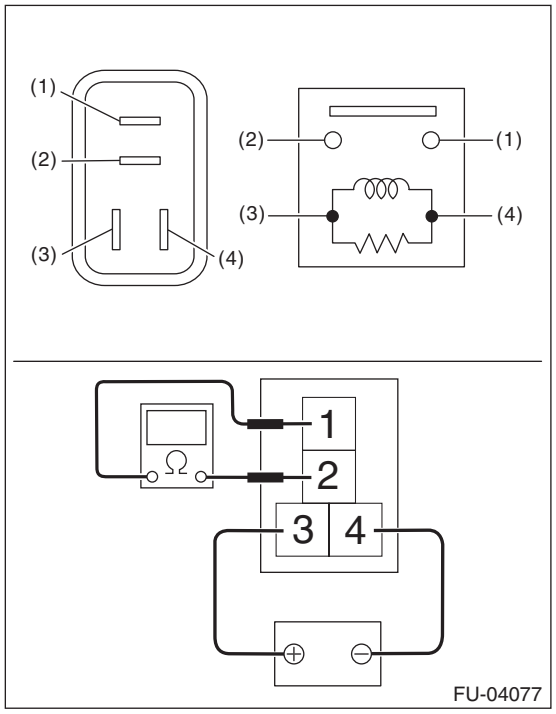
C: INSPECTION

1) Check that the electronic throttle control relay has no deformation, cracks or other damages.
2) Measure the resistance between electronic throttle control relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the electronic throttle control relay terminals.

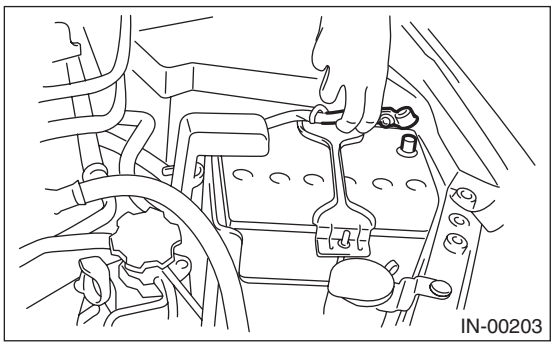


Terminal No.	Standard
1 and 2	Less than 1 Ω

23.Fuel Pump Control Unit

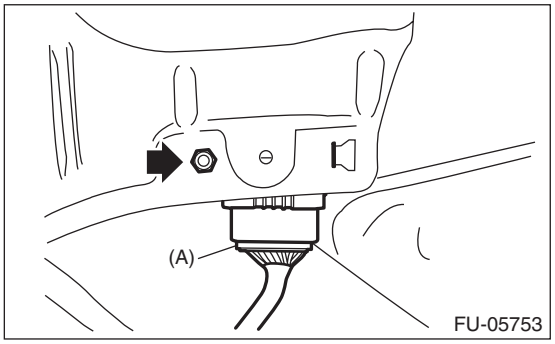
A: REMOVAL

1) Disconnect the ground cable from battery.

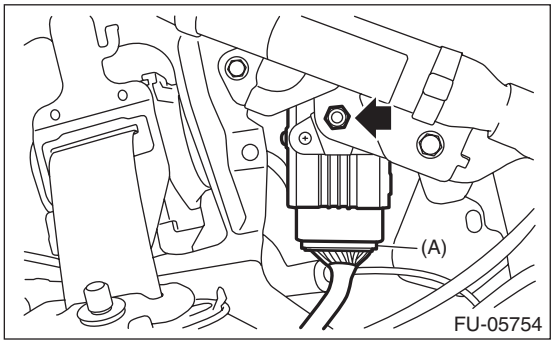


2) Remove the right side trunk side trim. (4 door model) <Ref. to EI-63, REMOVAL, Trunk Room Trim.>
3) Remove the right side rear quarter trim. (5 door model) <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
4) Disconnect the connector (A) from the fuel pump control unit, and remove the fuel pump control unit.

- 4 door model



- 5 door model



B: INSTALLATION

Install in the reverse order of removal.

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

C: INSPECTION

Check that the fuel pump control unit has no deformation, cracks or other damages.

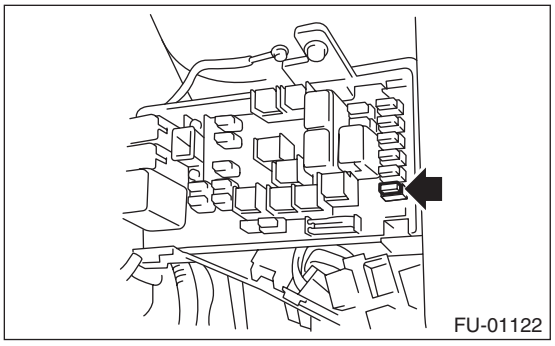
24.Fuel

A: PROCEDURE

1. RELEASING OF FUEL PRESSURE

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

CAUTION:
Be careful not to spill fuel.
1) Remove the fuse of fuel pump from main fuse box.



2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn the ignition switch to OFF.
5) Install the fuse of fuel pump to the main fuse box.

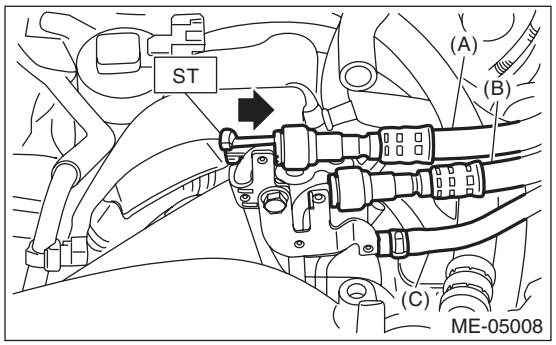
2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

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

CAUTION:
Be careful not to spill fuel.

NOTE:
• If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose. <Ref. to FU(STI)-68, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
• Be careful not to let the battery run-out.
• Be aware that the fuel may remain in the fuel tank after draining the fuel.
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.
ST 42099AE000 QUICK CONNECTOR RELEASE

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

3) Connect ST to the fuel delivery hose.
ST 18471AA000 FUEL PIPE ADAPTER
4) Connect the gasoline proof hose to ST and put the end of the hose in the container.
5) Drive the fuel pump and drain the fuel using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-65, FUEL PUMP CONTROL (ON/OFF DRIVE), OPERATION, System Operation Check Mode.>

CAUTION:
Be careful not to spill fuel.
6) Install the related parts in the reverse order after draining the fuel.

3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

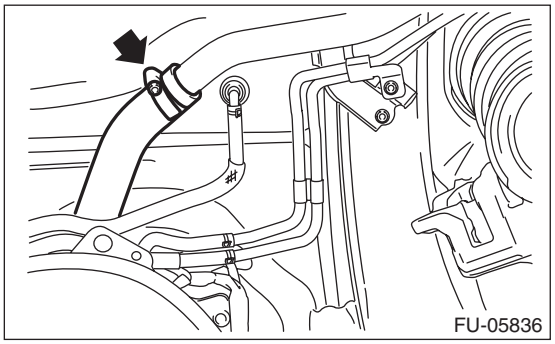
• 4 door model

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

CAUTION:
• Be careful not to spill fuel.
• Fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.

NOTE:
Be aware that the fuel may remain in the fuel tank after draining the fuel.
1) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
4) Open the fuel filler lid and remove the fuel filler cap.
5) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
6) Disconnect the fuel filler hose from the fuel filler pipe assembly.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.



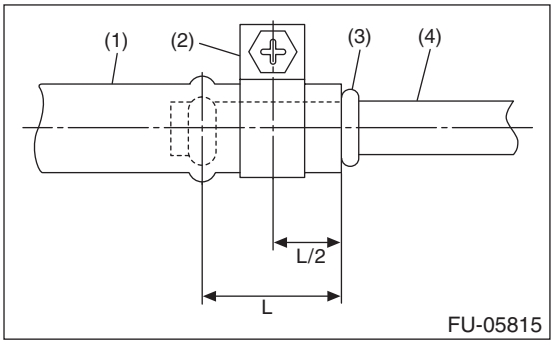
7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.

8) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to the spool, and then install the clamp as shown.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

• 5 door model

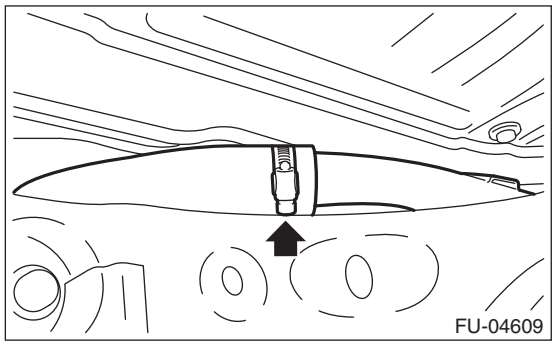
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
• Be careful not to spill fuel.
• Fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.

NOTE:
Be aware that the fuel may remain in the fuel tank after draining the fuel.
1) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).

5) Disconnect the fuel filler hose from the fuel filler pipe assembly.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



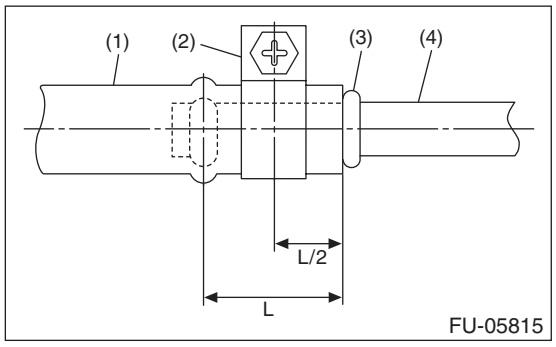
6) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.

7) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to the spool, and then install the clamp as shown.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

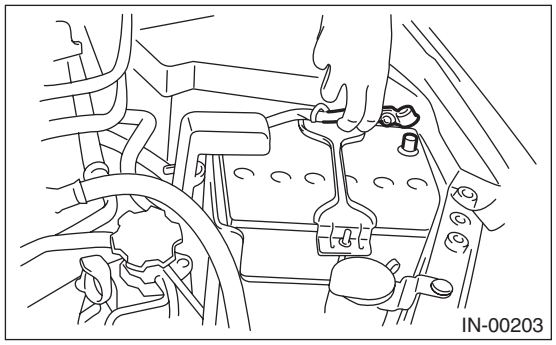
25.Fuel Tank

A: REMOVAL

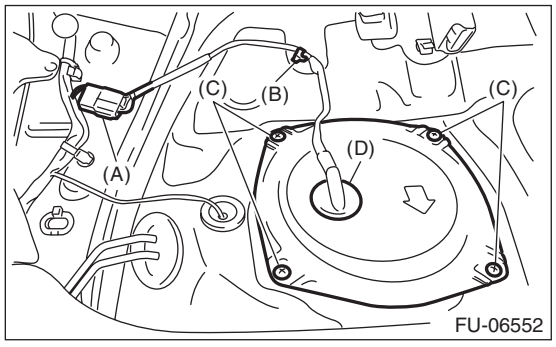
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

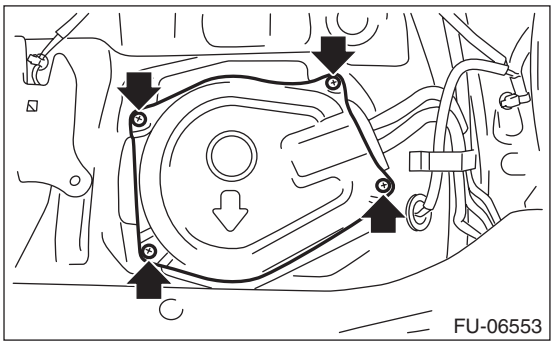
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



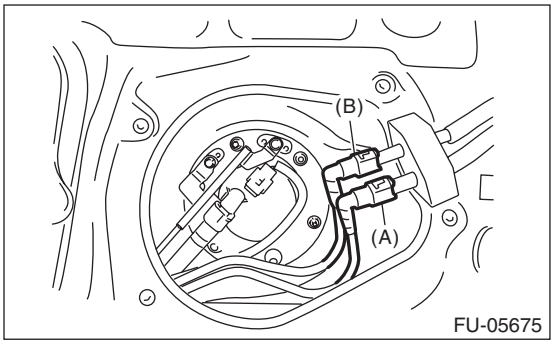
4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover of fuel pump.
   (1) Disconnect fuel pump connector (A), and remove clip (B).
   (2) Remove the screw (C).
   (3) Push the grommet (D) down and remove the service hole cover.



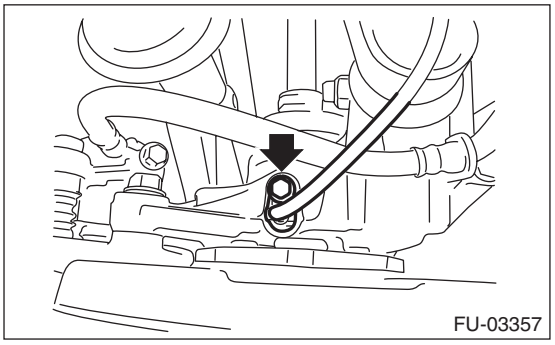
6) Remove the service hole cover of fuel sub level sensor.



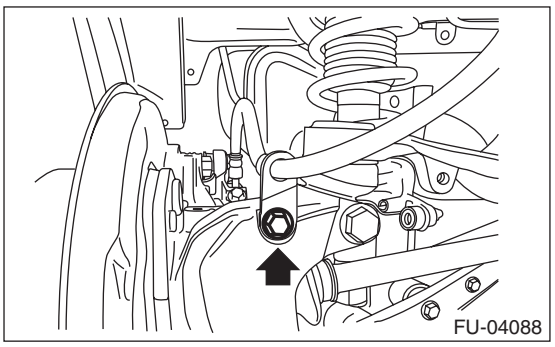
7) Disconnect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



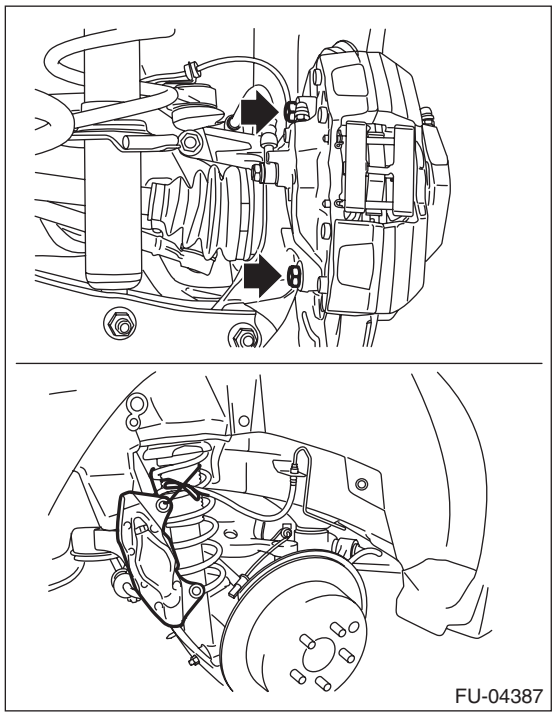
8) Remove the rear wheels.
9) Lift up the vehicle.
10) Remove the rear ABS wheel speed sensor from the rear housing.



11) Remove the rear brake hose bracket from rear housing.



12) Remove the rear disc brake assembly and tie it to the body side of the vehicle.



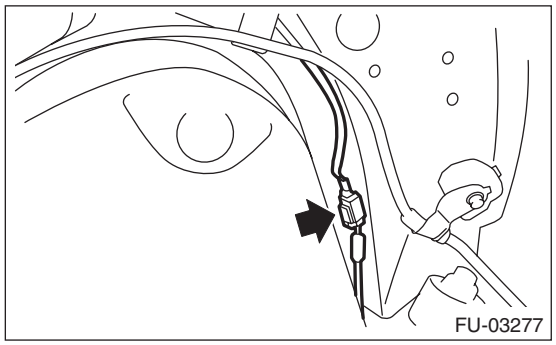
13) Remove the parking brake cable from parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

14) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>

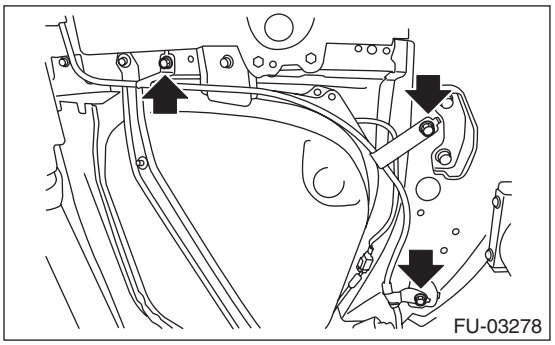
15) Remove the propeller shaft. <Ref. to DS-11, REMOVAL, Propeller Shaft.>

16) Remove the heat shield cover and fuel tank protector.

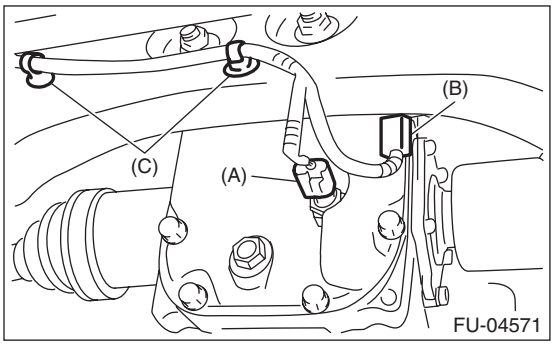
17) Disconnect the connector from the rear ABS wheel speed sensor.



18) Remove the parking brake cable clamp from the body.



19) Disconnect the connectors from oil temperature switch (A) and ground (B), and remove the clips (C) which secure the harness.

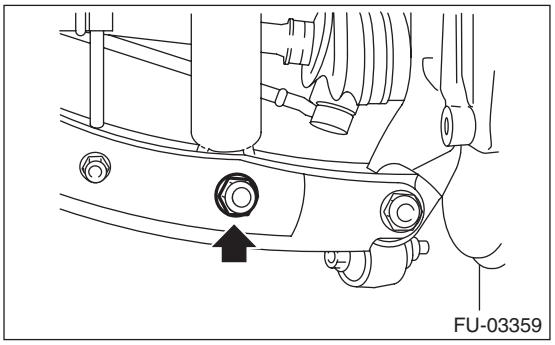


20) Remove the rear suspension assembly.

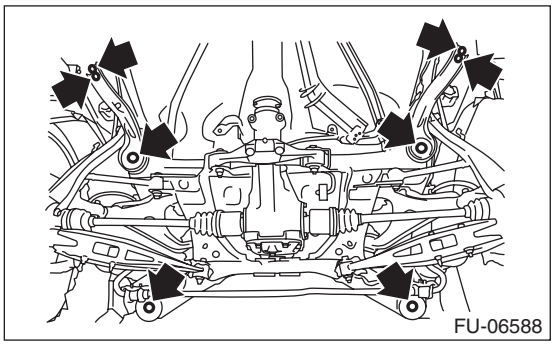
WARNING:
A helper is required to perform this work.

(1) Support the rear differential with the transmission jack.

(2) Remove the bolt and nut which secure rear shock absorber to rear suspension arm.

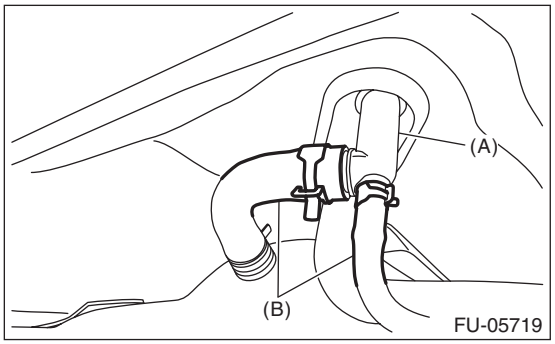


(3) Remove the bolts which secure the rear suspension assembly to the body.



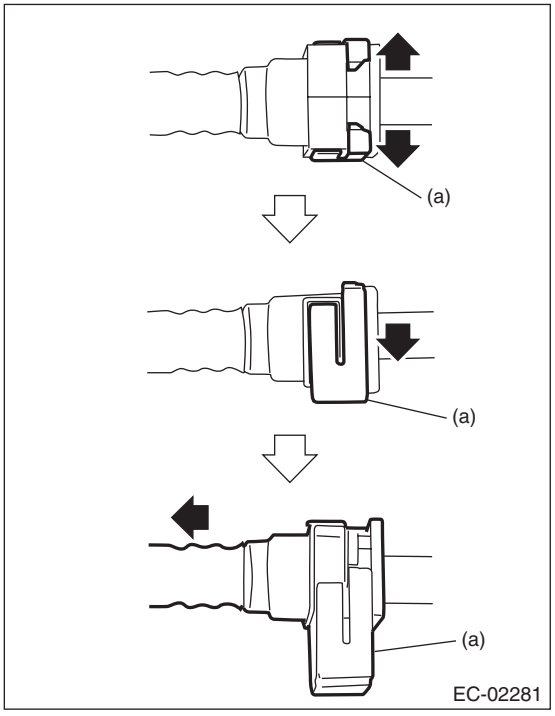
(4) Remove the rear suspension assembly.

21) Disconnect the evaporation hose (B) from hose connector (A).

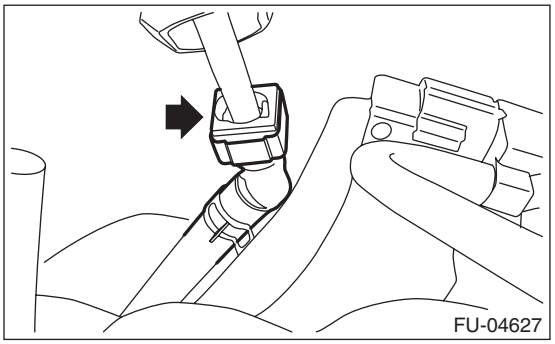


22) Disconnect the quick connector of the evaporation hose from the evaporation pipe.

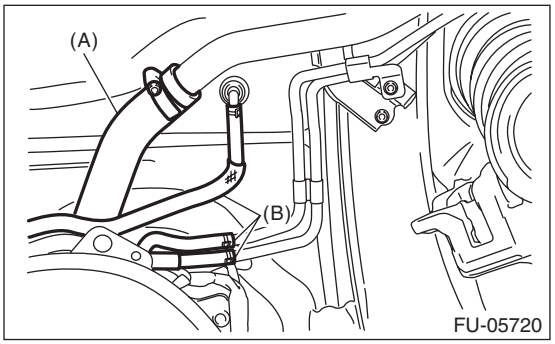
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer

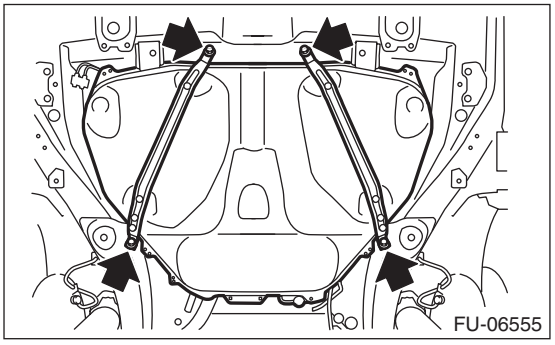


23) Disconnect the fuel filler hose (A) and evaporation hose (B).



24) Support the fuel tank with a transmission jack, remove the fuel tank band, and remove the fuel tank from the vehicle.

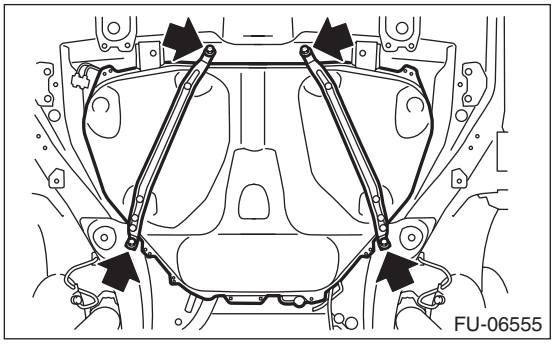
WARNING:
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank.**



B: INSTALLATION

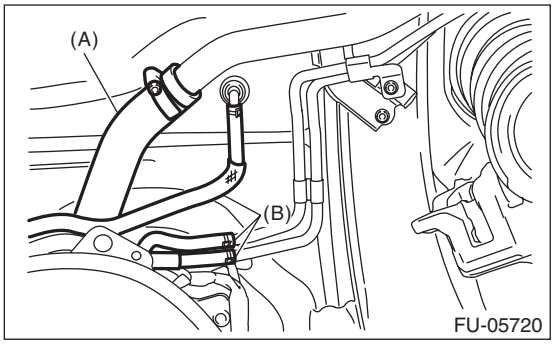
1) Support the fuel tank with a transmission jack, set the fuel tank and the fuel tank band in place, and temporarily tighten the bolts of the fuel tank band.

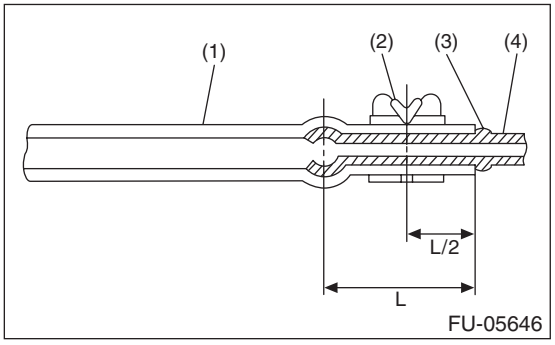
WARNING:
A helper is required to perform this work.



2) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

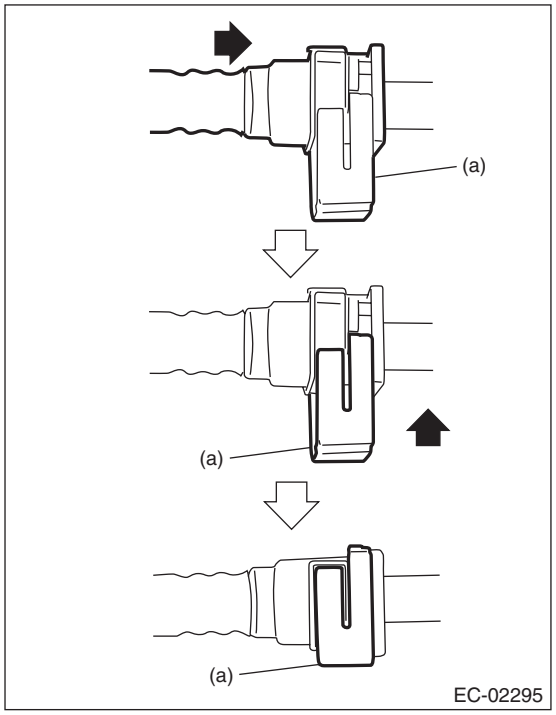




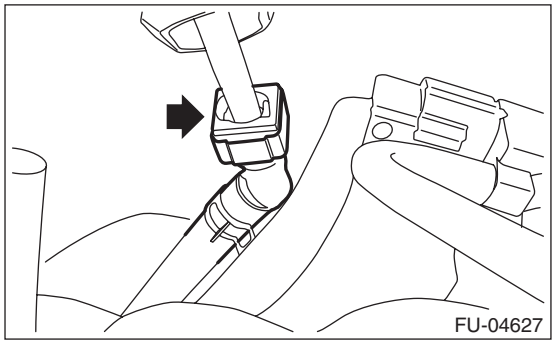
(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

3) Connect the quick connector of the evaporation hose to the evaporation pipe.

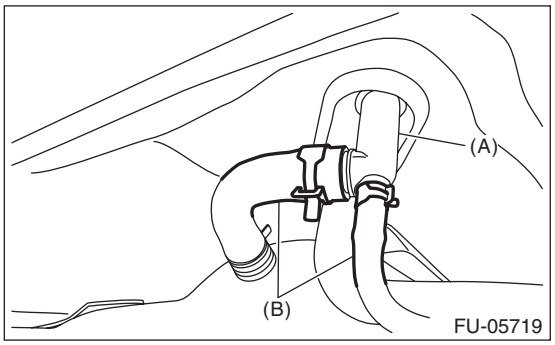
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.
• Make sure that the quick connector is securely connected.



(a) Retainer

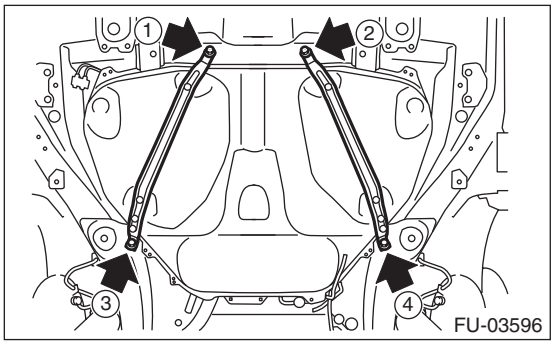


4) Connect the evaporation hose (B) to hose connector (A).



5) Tighten the bolts of the fuel tank band in the order shown in the figure.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)

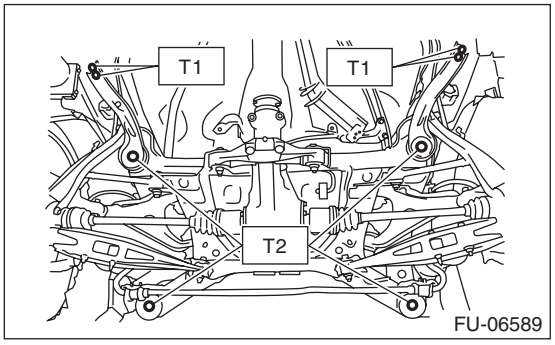


6) Install the rear suspension assembly.

WARNING:
A helper is required to perform this work.

(1) Support the rear differential with the transmission jack.
(2) Support the rear suspension assembly and install the rear suspension assembly to the body.

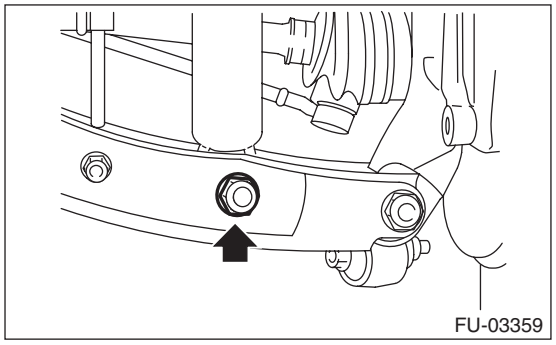
Tightening torque:
T1: 70 N·m (7.1 kgf-m, 51.6 ft-lb)
T2: 145 N·m (14.8 kgf-m, 106.9 ft-lb)



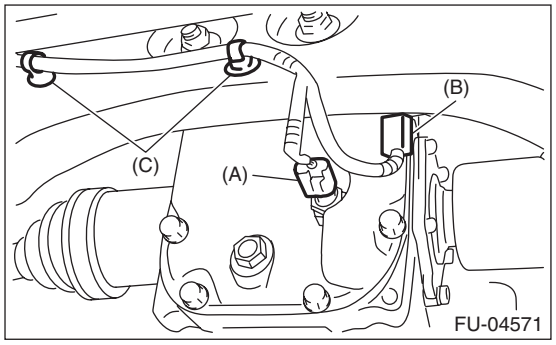
(3) Install the rear shock absorber to the rear suspension arm.

NOTE:
Use a new self-locking nut.

Tightening torque:
80 N·m (8.2 kgf-m, 59.0 ft-lb)

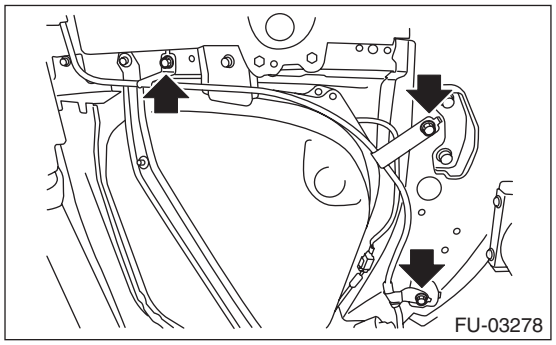


7) Connect the connectors to oil temperature switch (A) and ground (B), and secure the harness with clips (C).



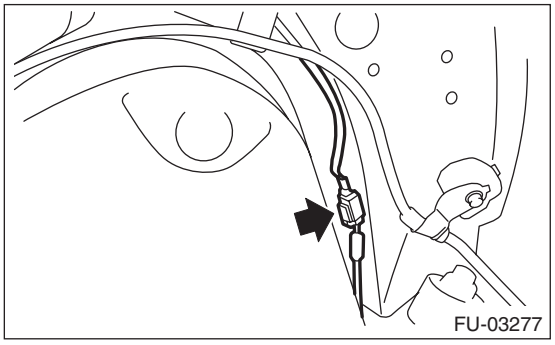
8) Install the parking brake cable clamp to the body.

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



9) Connect the connector to the rear ABS wheel speed sensor.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)


FU-03277

10) Install the heat shield cover.

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

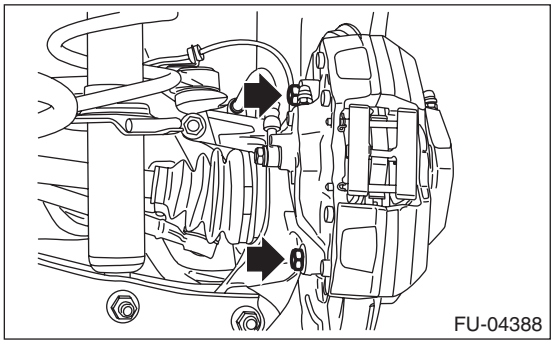
11) Install the fuel tank protector.

NOTE:
Use a new self-locking nut.

Tightening torque:
Nut: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
Bolt: 18 N·m (1.8 kgf-m, 13.3 ft-lb)

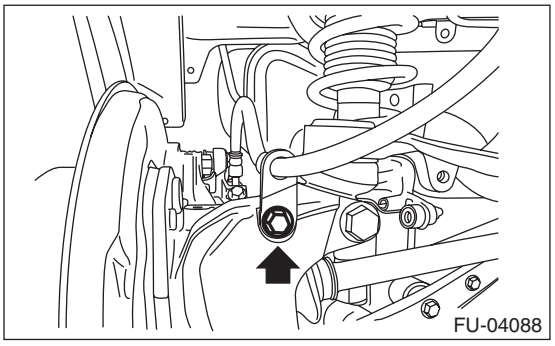
12) Install the propeller shaft. <Ref. to DS-12, INSTALLATION, Propeller Shaft.>
13) Install the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, INSTALLATION, Muffler.>
14) Lower the vehicle.
15) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>
16) Install the rear disc brake assembly.

Tightening torque:
65 N·m (6.6 kgf-m, 47.9 ft-lb)


FU-04388

17) Install the rear brake hose bracket to the rear housing.

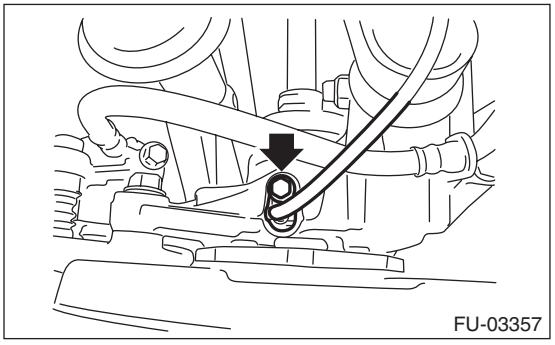
Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)


FU-04088

18) Attach the rear ABS wheel speed sensor to the rear housing.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)

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

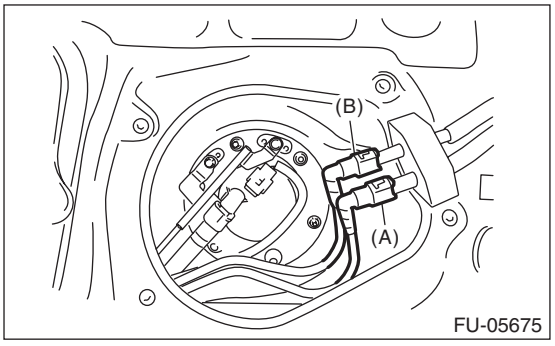

FU-03357

19) Install the rear wheels.

Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)

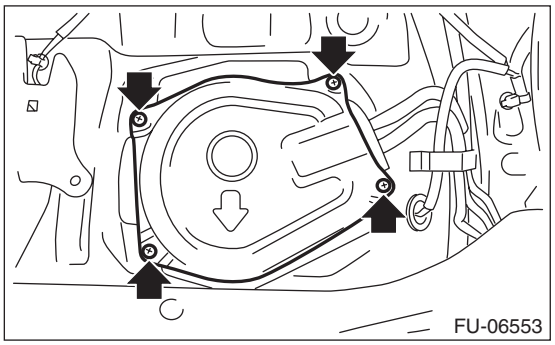
20) Connect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(STI)-96, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

NOTE:
When connecting, be careful not to reverse the delivery side and return side.

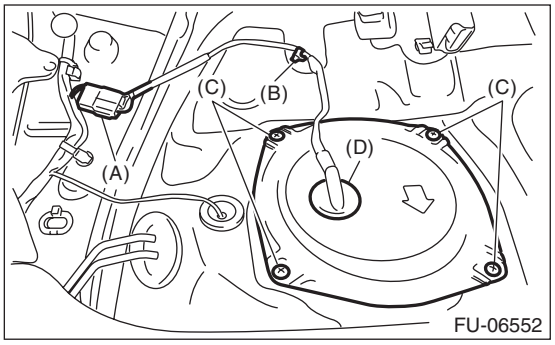


FU-05675

21) Install the service hole cover of fuel sub level sensor.

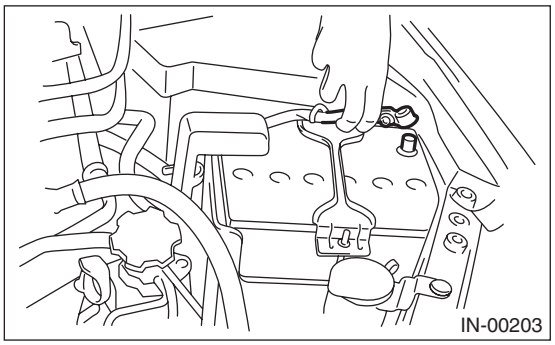


22) Attach the service hole cover of the fuel pump, and attach the connector and clip.



(A) Connector
(B) Clip
(C) Screw
(D) Grommet

23) Install the rear seat cushion. <Ref. to SE-14, INSTALLATION, Rear Seat.>
24) Connect the battery ground terminal.



25) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

1) Check that the fuel tank and fuel pipe have no deformation, cracks and other damages.
2) Check that the fuel hose and tube have no cracks, damage or loose part.

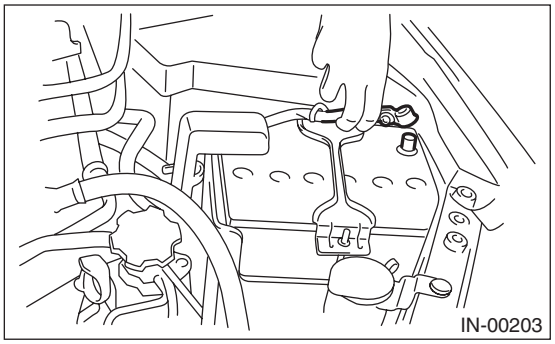
26.Fuel Filler Pipe

A: REMOVAL

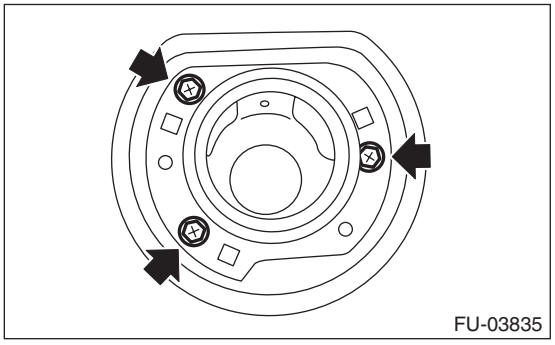
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

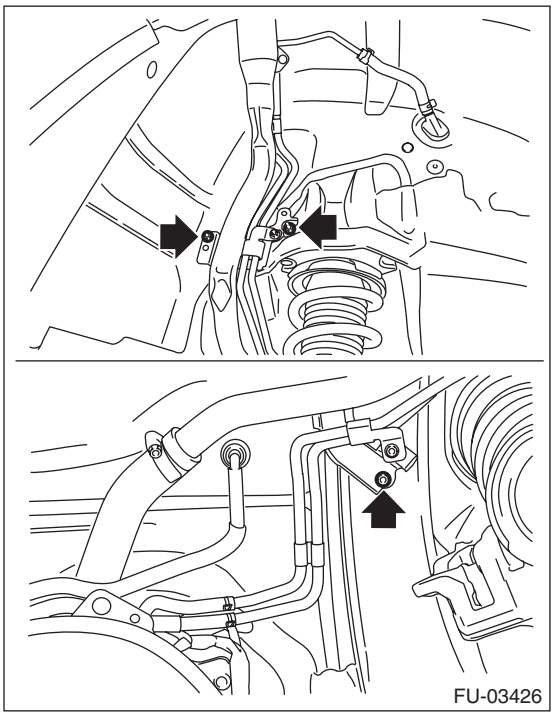
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



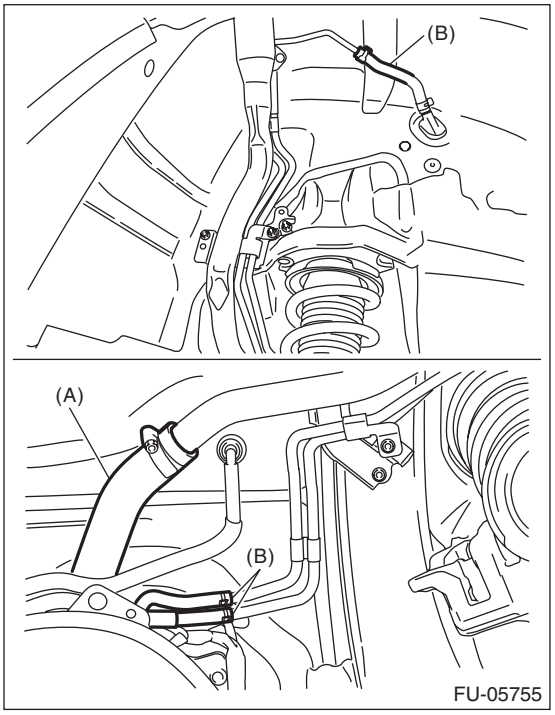
4) Open the fuel filler lid, and remove the filler cap.
5) Remove the screws which secure the fuel filler ring, and then remove the fuel filler ring.



6) Remove the rear wheel RH.
7) Lift up the vehicle.
8) Remove the rear mud guard RH. <Ref. to EI-30, REAR MUD GUARD, REMOVAL, Mud Guard.>
9) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
10) Remove the bolts and nuts which secure fuel filler pipe assembly onto the vehicle body.



11) Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.

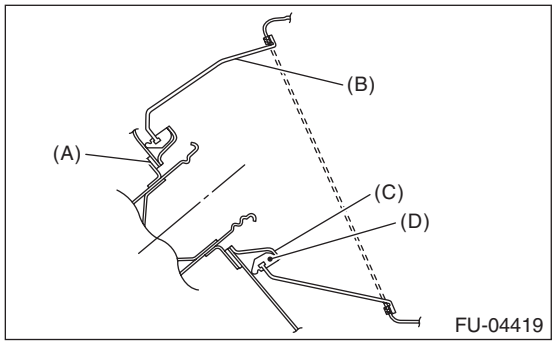


12) Remove the fuel filler pipe assembly from the underside of the vehicle.

B: INSTALLATION

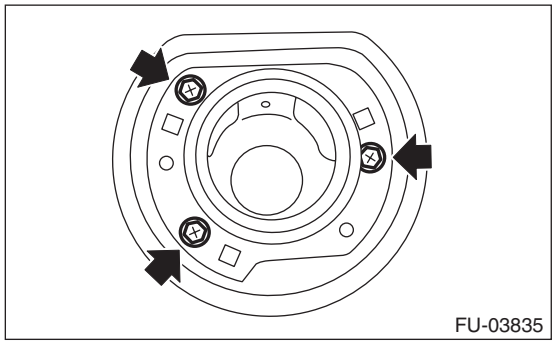
1) Open the fuel filler lid.
2) Attach the fuel filler pipe gasket to the fuel filler pipe assembly, and insert the fuel filler pipe assembly from inside of the rear fender.
3) Install the fuel filler ring to the fuel filler pipe assembly.

NOTE:
If the edges of rubber gasket are folded toward inside, straighten it with a flat tip screwdriver.



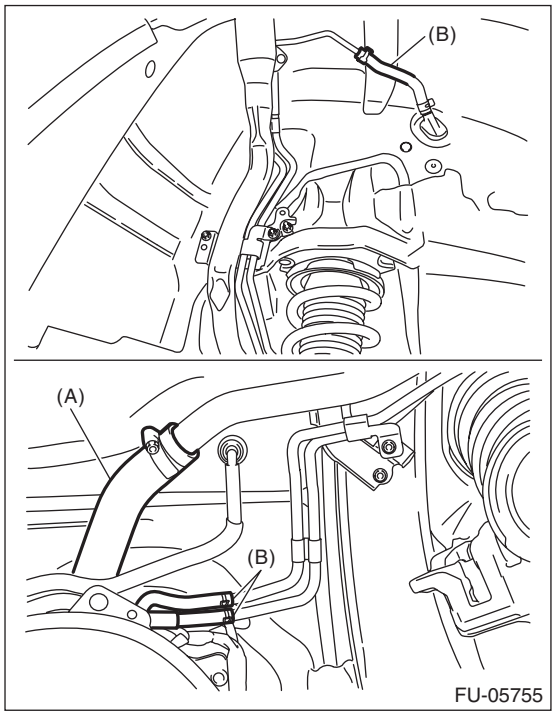
(A) Fuel filler pipe gasket
(B) Fuel saucer
(C) Fuel filler ring
(D) Rubber gasket

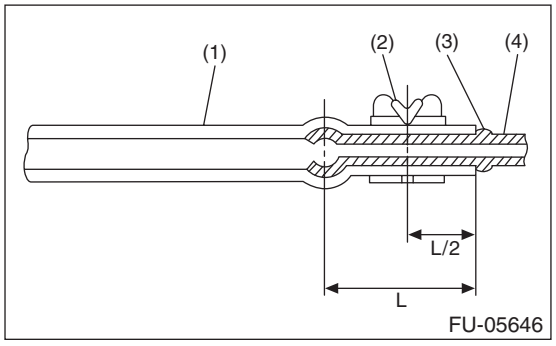
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

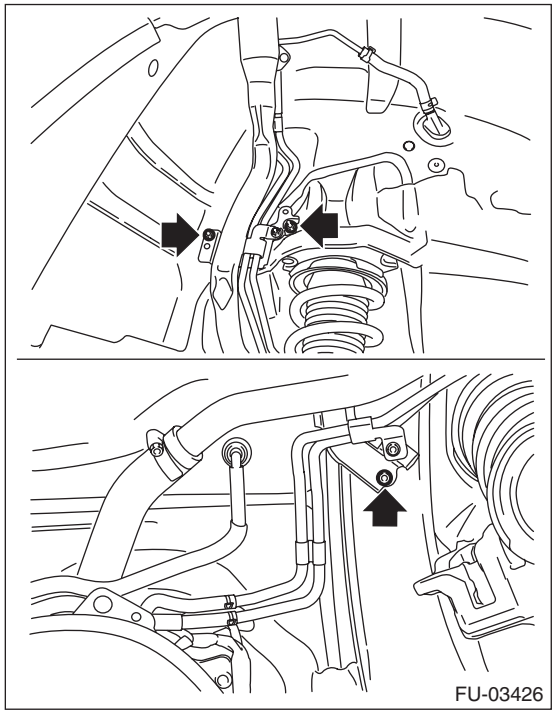




(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

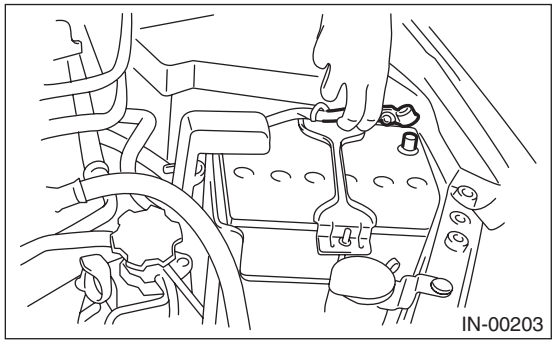
5) Install the fuel filler pipe assembly to vehicle body.

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



6) Install the rear sub frame. <Ref. to RS-18, INSTALLATION, Rear Sub Frame.>
7) Install the rear mud guard RH. <Ref. to EI-30, INSTALLATION, Mud Guard.>
8) Lower the vehicle.
9) Install the rear wheel RH.

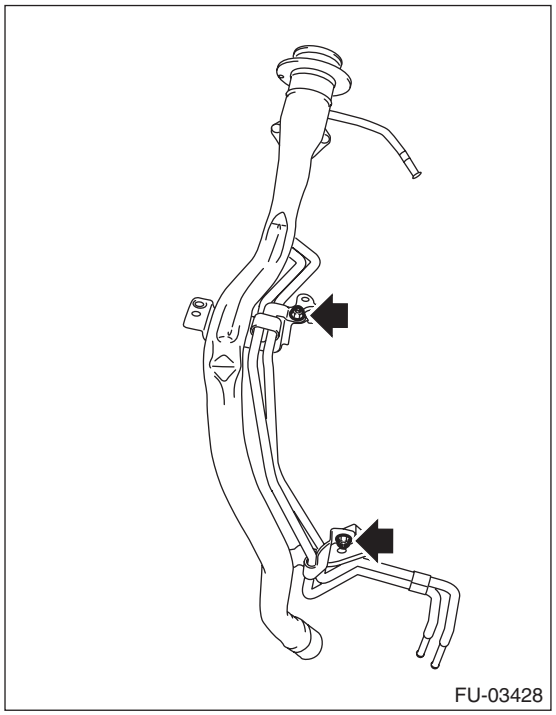
Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)
10) Connect the battery ground terminal.



11) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

1) Remove the shut valve from the fuel filler pipe. <Ref. to EC(STI)-18, REMOVAL, Shut Valve.>
2) Remove the evaporation pipe from the fuel filler pipe.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

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

E: INSPECTION

1) Check that the fuel filler pipe and evaporation pipe have no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

27.Fuel Pump

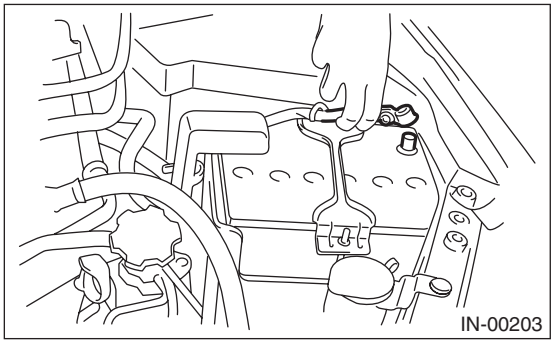
A: REMOVAL

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

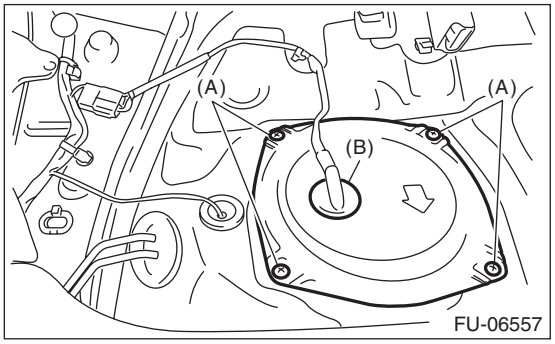
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

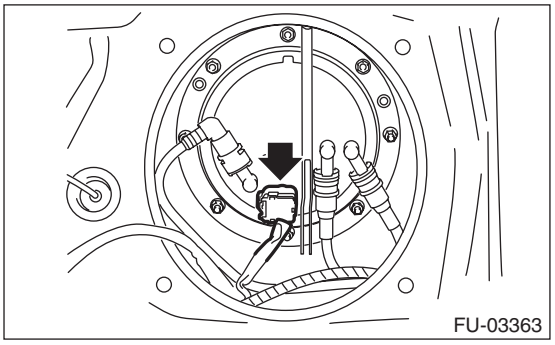

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover.
   (1) Remove the screws (A).
   (2) Push the grommet (B) down and remove service hole cover.

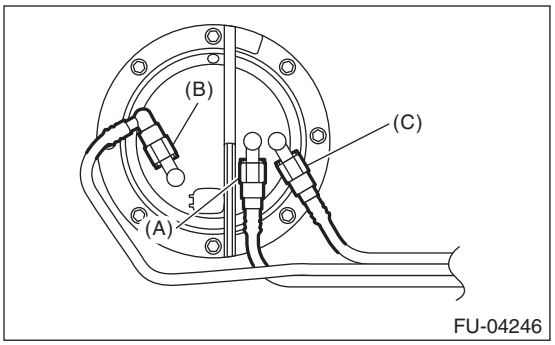


FU-06557

6) Disconnect the connector from fuel pump.

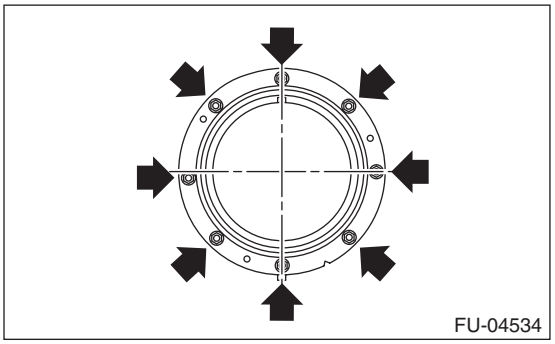

FU-03363

7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



FU-04246

8) Remove the nuts which hold the fuel pump upper plate to the fuel tank.


FU-04534

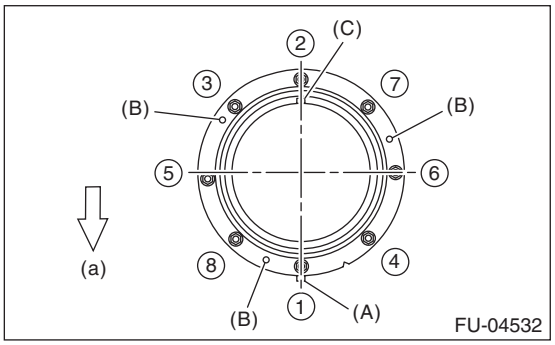
9) Remove the fuel pump assembly from the fuel tank.

B: INSTALLATION

Install in the reverse order of removal while being careful of the following.
• Make sure the sealing portion is free from fuel or foreign matter before installation.
• Align protrusion (A) of the gasket to the position shown in the figure.
• Insert the protrusion (B) of gasket to the fuel pump upper plate. (3 places)
• Align the protrusion (C) of fuel pump assembly with the cutout on the fuel pump upper plate.
• Tighten the nuts to the specified torque in the order as shown in the figure.

NOTE:
Use a new gasket.

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

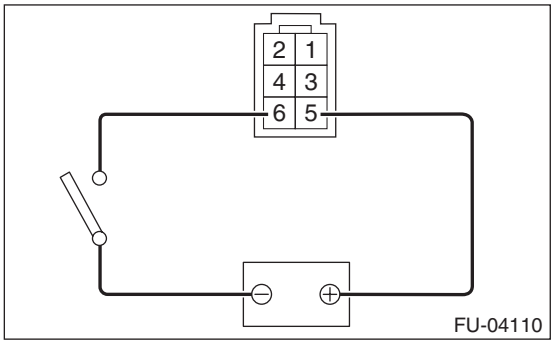


(a) Front side of vehicle

C: INSPECTION

1) Check that the fuel pump has no deformation, cracks or other damages.
2) Connect the battery positive terminal to terminal No. 5 and the battery ground terminal to terminal No. 6, and inspect the fuel pump operation.

WARNING:
• Wipe off fuel completely.
• Keep the battery as far apart from fuel pump as possible.
• Do not run the fuel pump for a long time under non-load condition.



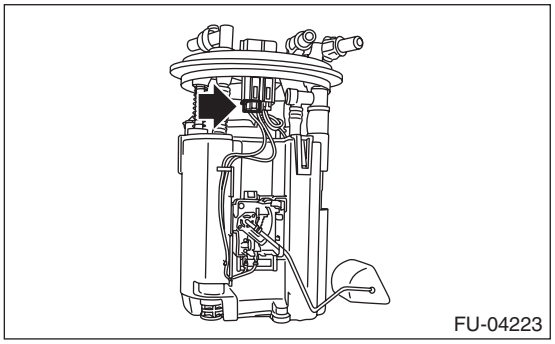
28.Fuel Level Sensor

A: REMOVAL

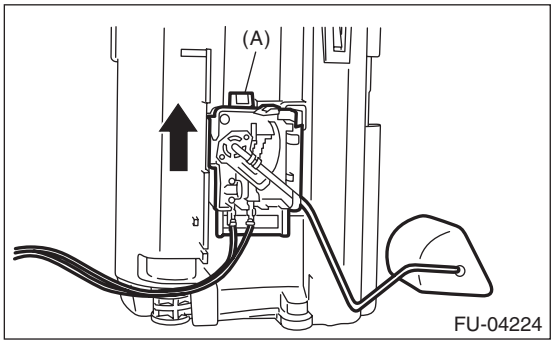
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
The fuel level sensor is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(STI)-80, REMOVAL, Fuel Pump.>
2) Disconnect the fuel level sensor connector.


FU-04223

3) Slide the fuel level sensor in the direction of the arrow and remove the fuel level sensor by pressing the claw (A) of the fuel level sensor.



FU-04224

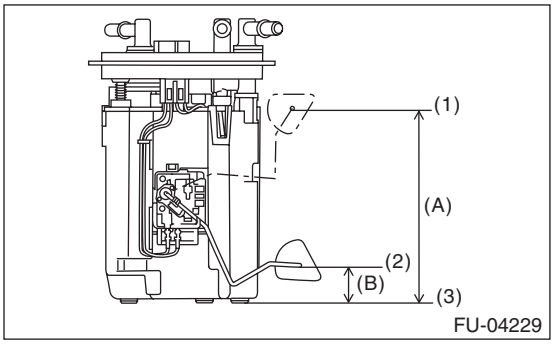
B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check that the fuel level sensor has no damage.
2) Measure the fuel level sensor float position.

NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.

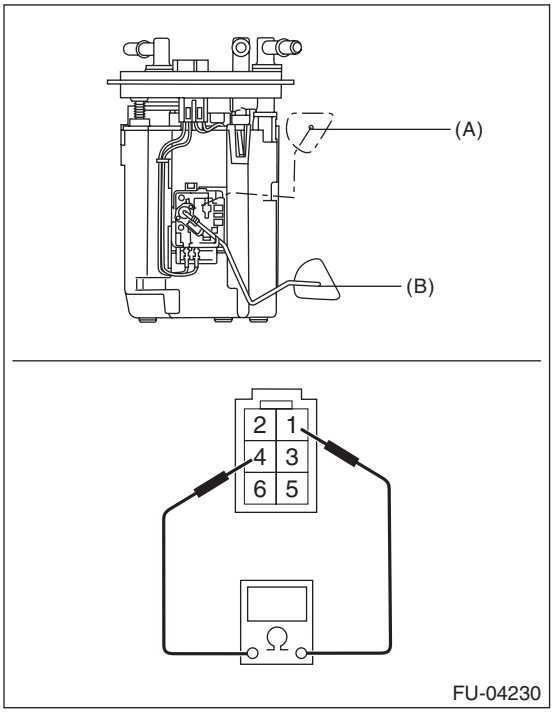


FU-04229

(1) FULL
(2) EMPTY
(3) Fuel tank seating surface

Float position	Standard
FULL to Fuel tank seating surface (A)	135±4 mm (5.315±0.157 in)
EMPTY to Fuel tank seating surface (B)	23.7±4 mm (0.933±0.157 in)

3) Measure the resistance between fuel level sensor terminals.



FU-04230

Float position	Terminal No.	Standard
FULL (A)	1 and 4	2.0±1.0 Ω
EMPTY (B)		31.9±1.0 Ω

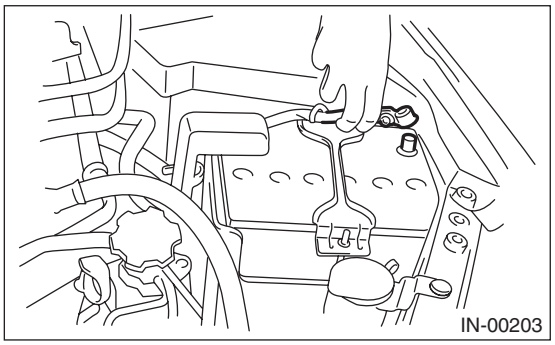
29.Fuel Sub Level Sensor

A: REMOVAL

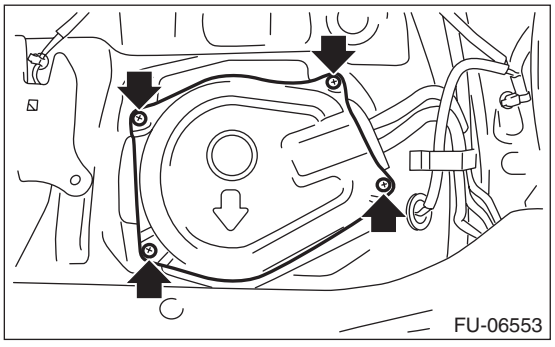
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

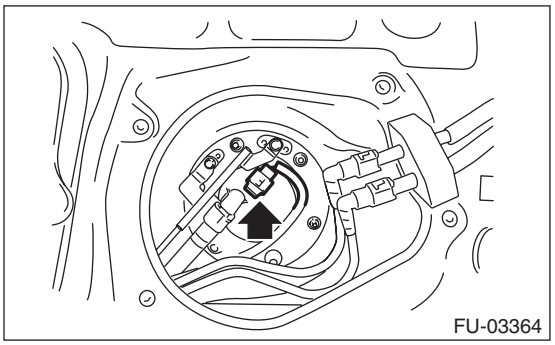
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.


IN-00203

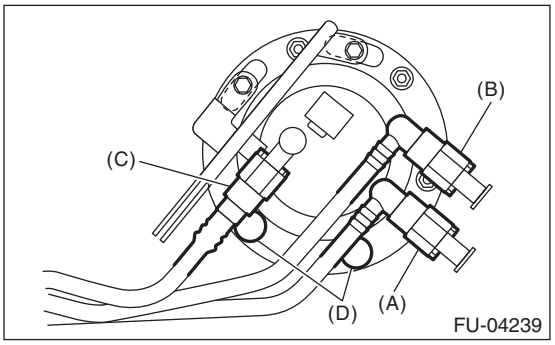
4) Remove the rear seat cushion. <Ref. to SE-13, REMOVAL, Rear Seat.>
5) Remove the service hole cover.


FU-06553

6) Disconnect the connector from the fuel sub level sensor.

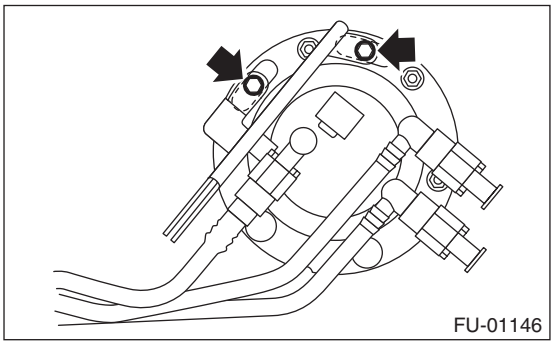

FU-03364

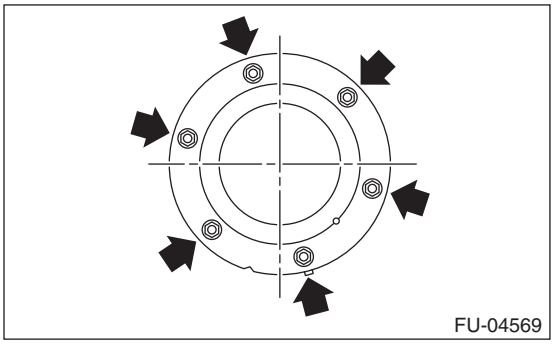
7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
8) Remove the rubber cap (D) from the nut.



FU-04239

9) Remove the bolts and nuts which hold fuel sub level sensor protector and fuel sub level sensor upper plate to the fuel tank.


FU-01146


FU-04569

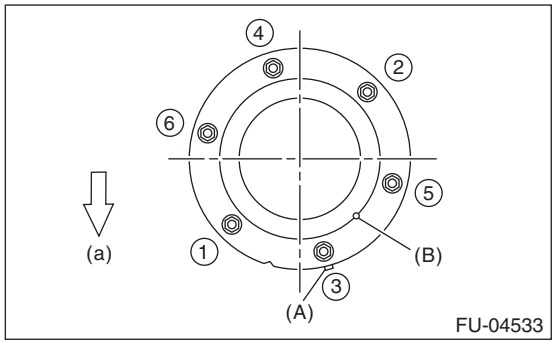
10) Remove the fuel sub level sensor from the fuel tank.

B: INSTALLATION

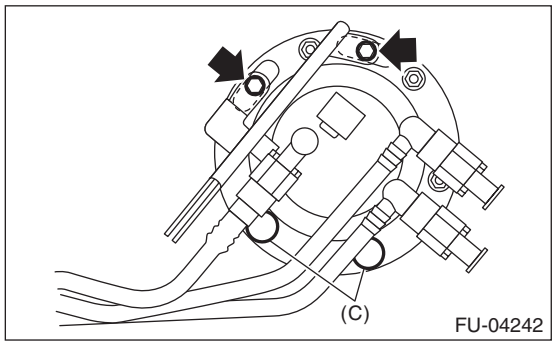
Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the figure.
- Align protrusion (B) of the fuel sub level sensor to the cutout in the fuel sub level sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.
- After tightening, install the rubber cap (C) at the position shown in the figure.

NOTE:
- Use a new gasket.
- Do not forget to install rubber cap (C).

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

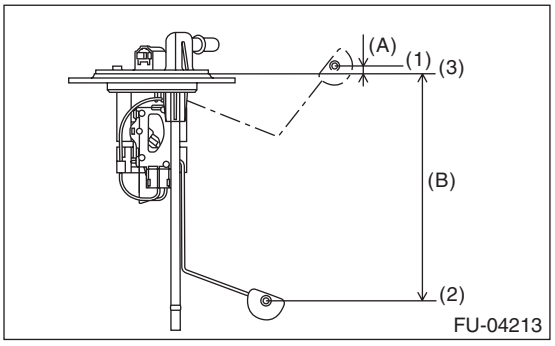


(a) Front side of vehicle



C: INSPECTION

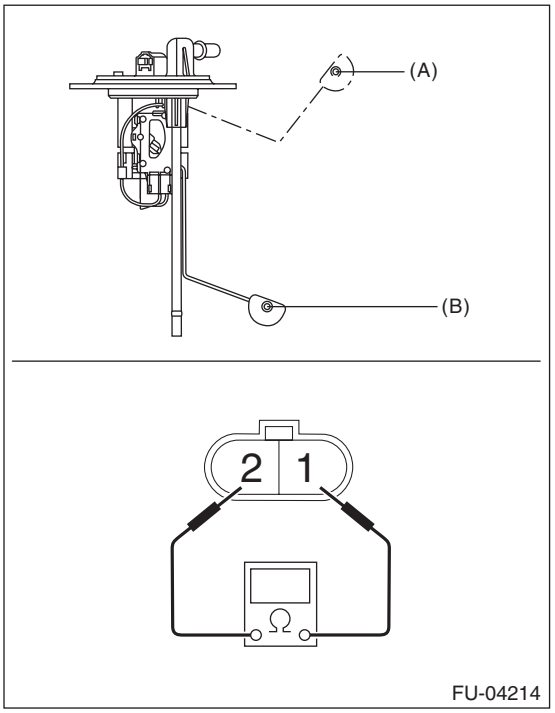
1) Check that the fuel sub level sensor has no damage.
2) Measure the fuel sub level sensor float position.



(1) FULL
(2) EMPTY
(3) Datum points

Float position	Standard
FULL to Datum point (A)	5.31±3.5 mm (0.209±0.138 in)
EMPTY to Datum point (B)	160.6±3.5 mm (6.323±0.138 in)

3) Measure the resistance between fuel sub level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	$2.0^{+0.5}_{-1.0}$ Ω
EMPTY (B)		62.1±1.0 Ω

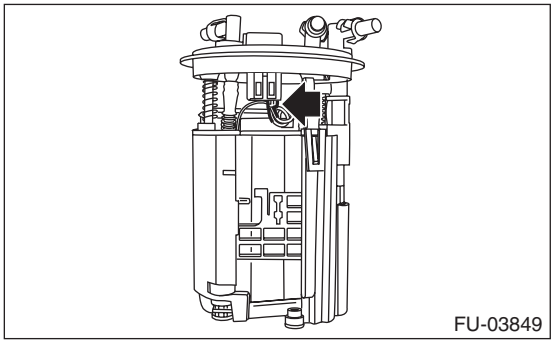
30.Fuel Filter

A: REMOVAL

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

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**
- **Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.**

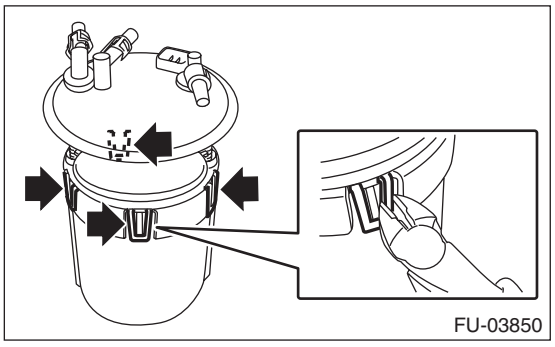
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(STI)-80, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor. <Ref. to FU(STI)-82, REMOVAL, Fuel Level Sensor.>
3) Disconnect the pump assembly connector from sub tank bracket assembly.


FU-03849

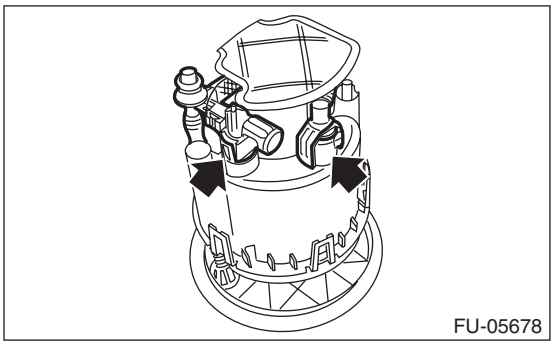
4) Cut off the tab holders connecting the sub tank bracket assembly and the sub tank in four locations, and separate the sub tank bracket assembly and the sub tank.

CAUTION:
Be careful not to damage the sub tank.

NOTE:
If the O-ring is remaining on the sub tank, remove.

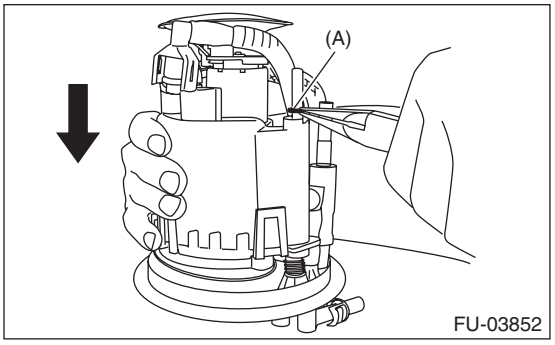

FU-03850

5) Disconnect two connectors of fuel delivery pipe from fuel filter assembly.


FU-05678

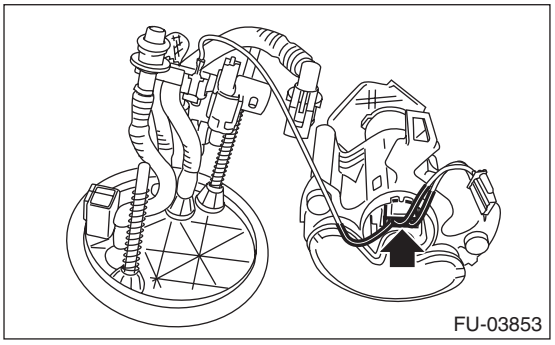
6) Push to compress the fuel filter assembly in the direction of the arrow, remove clip (A), and separate the sub tank bracket assembly and the fuel filter assembly.

CAUTION:
When separating the sub tank bracket assembly and the fuel filter assembly, be careful not to damage the ground wire.



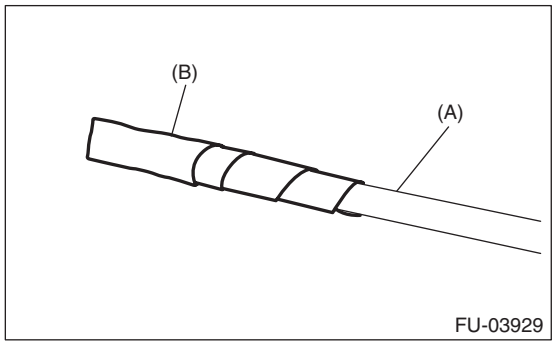
FU-03852

7) Disconnect the connector from the pump assembly.


FU-03853

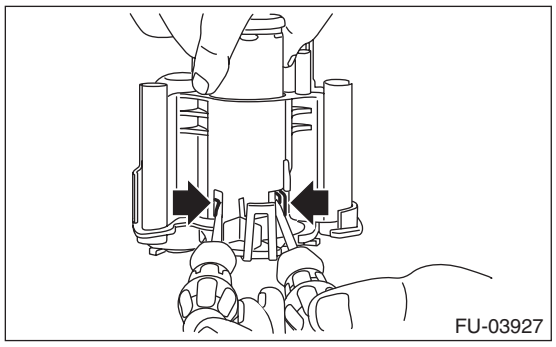
8) Lift the two tab holders connecting the pump assembly to the fuel filter using a flat tip screwdriver (with a shaft diameter of approx. 3 mm (0.12 in)), etc., and separate the fuel filter and pump assembly.

CAUTION:
• To prevent damaging the tabs of the pump assembly, wrap the tip of flat tip screwdriver (A), etc. with tape (B).



• Be careful not to drop or apply any impact to the pump assembly.

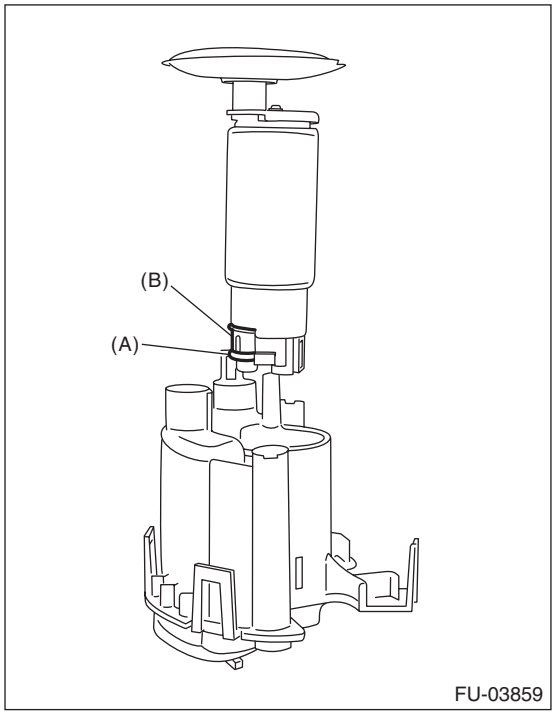
NOTE:
If the spacer and O-ring are remaining on the pump assembly, remove them.



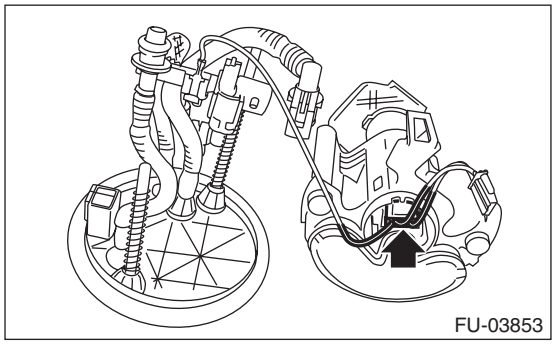
B: INSTALLATION

1) Assemble O-ring (A) and spacer (B) to the pump assembly and attach the pump assembly to the fuel filter.

NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Use a new spacer.
- Apply gasoline to the O-ring.
- Insert the pump assembly until a click is heard.

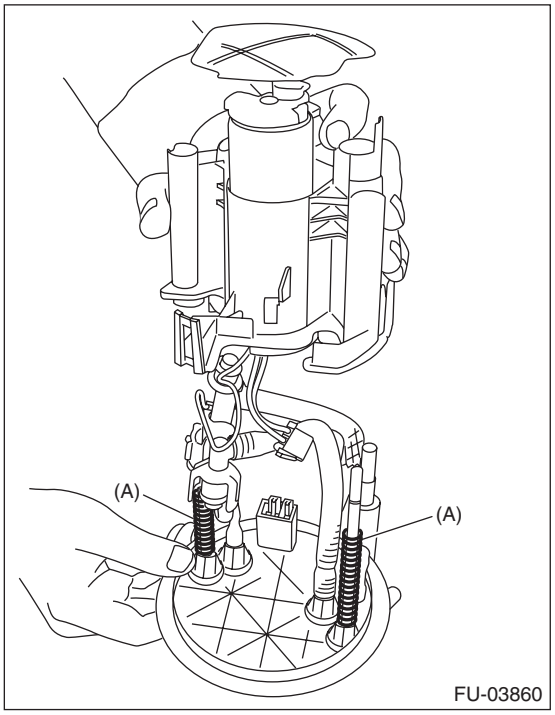


2) Connect the connector to the pump assembly.



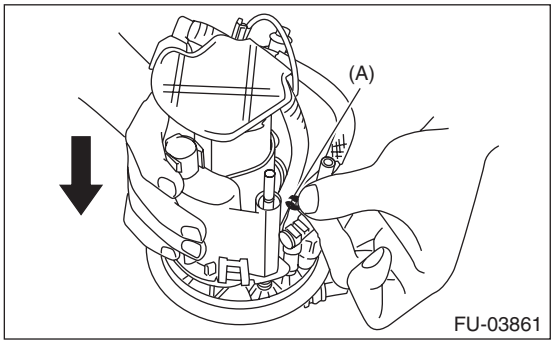
3) Attach spring (A) to the metal rod of the sub tank bracket assembly, and assemble the fuel filter assembly.

NOTE:
Use a new spring.



4) Push the fuel filter assembly in the direction of the arrow to compress, and attach clip (A).

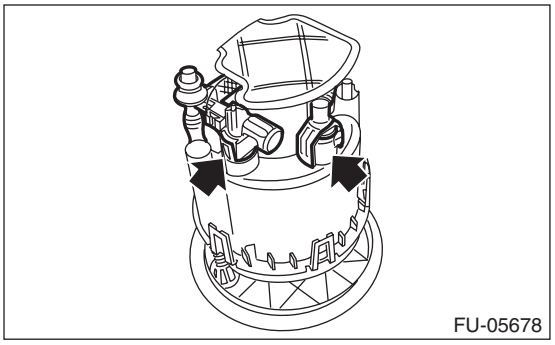
NOTE:
Use a new clip.



5) Connect the fuel piping connector to the fuel filter assembly.

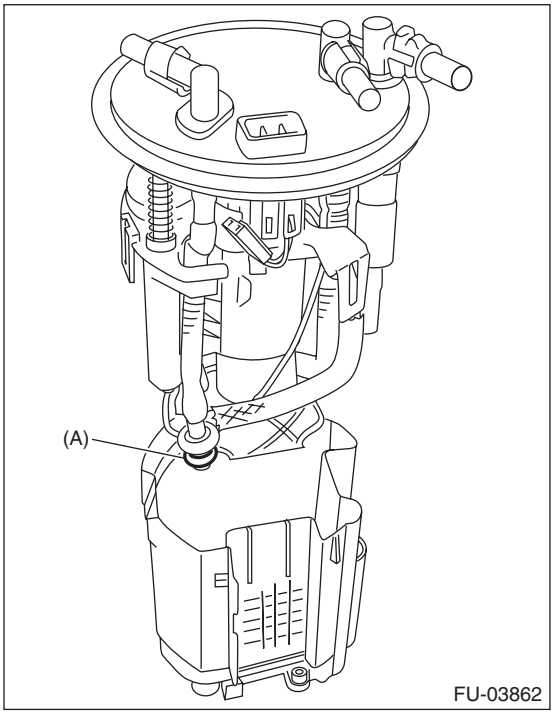
NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring.
- The O-rings of the black and white connectors are identified by a difference in diameter. Be careful not to confuse the two during assembly.

O-ring inner diameter:
Black connector O-ring [Approx. 7 mm (0.28 in)]
White connector O-ring [Approx. 8 mm (0.31 in)]

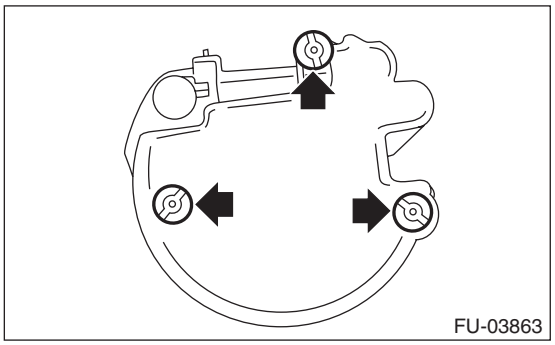


6) Attach the O-ring (A) to the fuel filter assembly, and attach the sub tank to the sub tank bracket assembly.

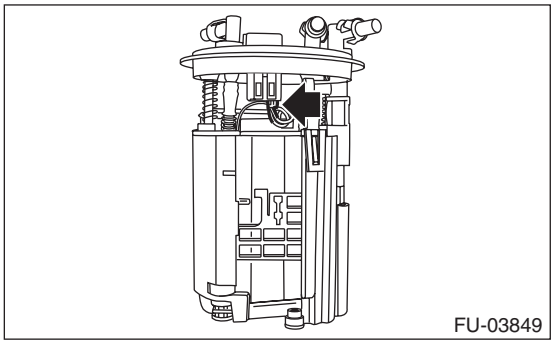
NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.



7) Replace the cushion on the rear face of the sub tank with a new cushion.



8) Connect the pump assembly connector to the sub tank bracket assembly.



9) Install the fuel level sensor. <Ref. to FU(STI)-82, INSTALLATION, Fuel Level Sensor.>
10) Inspect the fuel level sensor. <Ref. to FU(STI)-82, INSPECTION, Fuel Level Sensor.>
11) Install the fuel pump assembly. <Ref. to FU(STI)-81, INSTALLATION, Fuel Pump.>

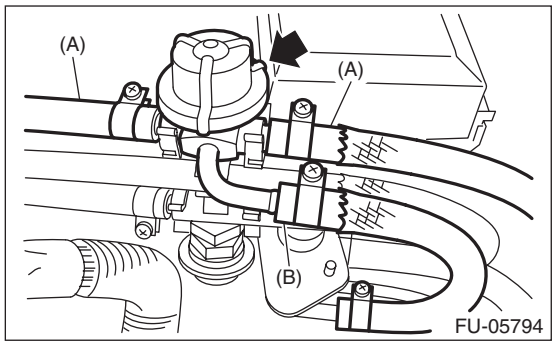
31.Pulsation Damper Assembly

A: REMOVAL

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

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the fuel delivery hose (A) and fuel hose (B) from the pulsation damper assembly, and remove the pulsation damper assembly.



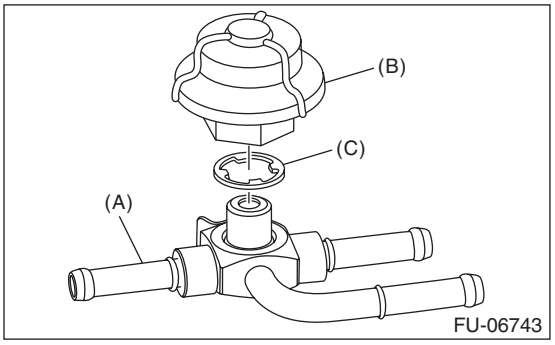
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
For the information about connecting the fuel delivery hose and fuel hose, refer to "Fuel Delivery, Return & Evaporation Lines". <Ref. to FU(STI)-97, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

C: DISASSEMBLY

Remove the pulsation damper and fuel pipe gasket from the fuel by-pass pipe.



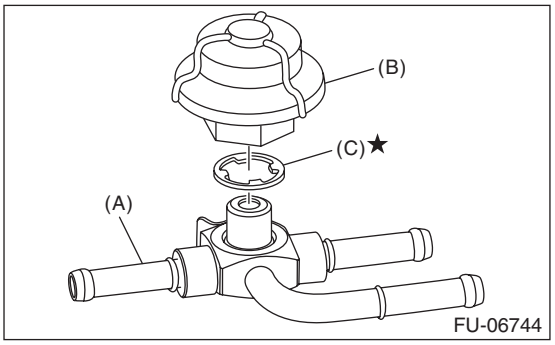
(A) Fuel by-pass pipe
(B) Pulsation damper
(C) Fuel pipe gasket

D: ASSEMBLY

Install the fuel pipe gasket and pulsation damper to the fuel by-pass pipe.

NOTE:
Use a new fuel pipe gasket.

Tightening torque:
21.6 N·m (2.2 kgf-m, 15.9 ft-lb)



(A) Fuel by-pass pipe
(B) Pulsation damper
(C) Fuel pipe gasket

E: INSPECTION

1) Check that the pulsation damper assembly has no deformation, cracks or other damages.
2) Check that the fuel delivery hose and fuel hose have no cracks, damage or loose part.

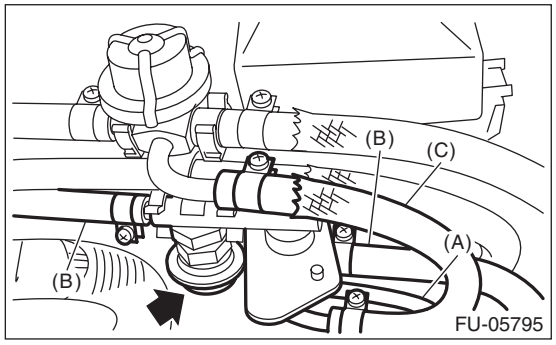
32.Pressure Regulator & Damper Assembly

A: REMOVAL

WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the vacuum hose (A) from the pressure regulator and damper assembly.
3) Disconnect the fuel return hose (B) and fuel hose (C) from the pressure regulator & damper assembly, and remove the fuel regulator & damper assembly.



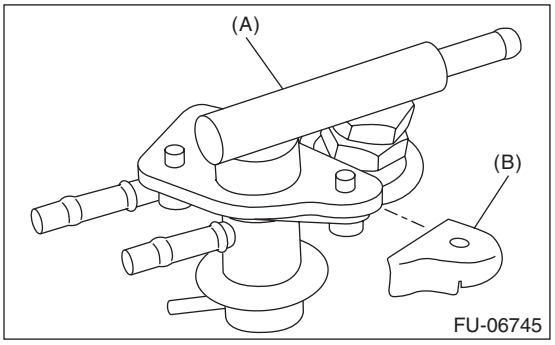
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
For the information about connecting the fuel return hose and fuel hose, refer to “Fuel Delivery, Return & Evaporation Lines”. <Ref. to FU(STI)-97, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

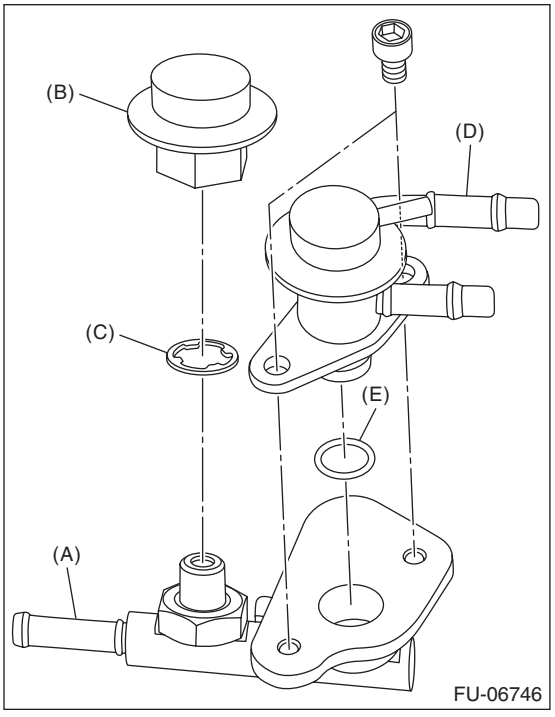
C: DISASSEMBLY

1) Remove the fuel pipe protector from the pressure regulator and damper assembly.



(A) Pressure regulator & damper ASSY
(B) Fuel pipe protector

2) Remove the pulsation damper and fuel pipe gasket from the fuel holder assembly, and remove the pressure regulator from the fuel holder assembly.



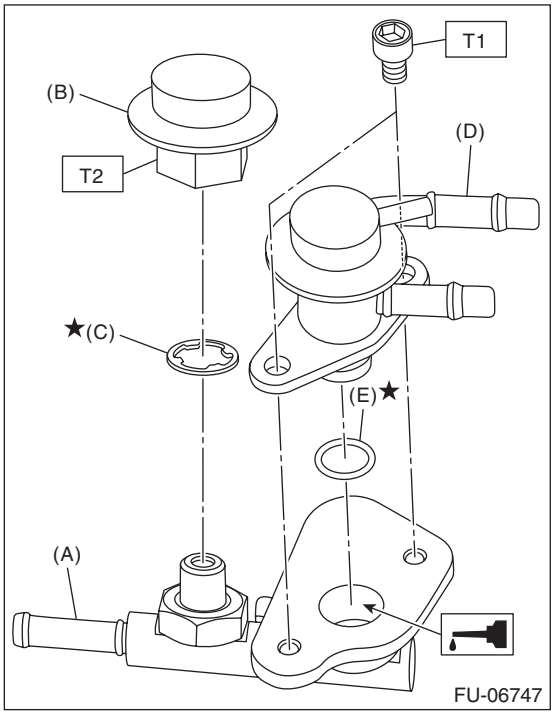
(A) Fuel holder ASSY
(B) Pulsation damper
(C) Fuel pipe gasket
(D) Pressure regulator
(E) O-ring

D: ASSEMBLY

1) Install the pressure regulator to the fuel holder assembly, and install the fuel pipe gasket and pulsation damper to the fuel holder assembly.

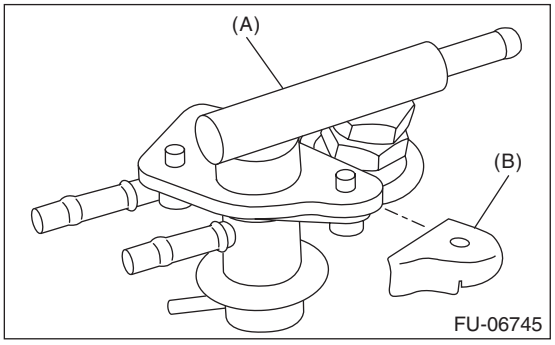
NOTE:
- Use new O-rings and fuel pipe gaskets.
- Apply a thin coat of engine oil to the pressure regulator installation hole of fuel holder assembly.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 21.6 N·m (2.2 kgf-m, 15.9 ft-lb)



(A) Fuel holder ASSY
(B) Pulsation damper
(C) Fuel pipe gasket
(D) Pressure regulator
(E) O-ring

2) Install the fuel pipe protector to the pressure regulator and damper assembly.



(A) Pressure regulator & damper ASSY
(B) Fuel pipe protector

E: INSPECTION

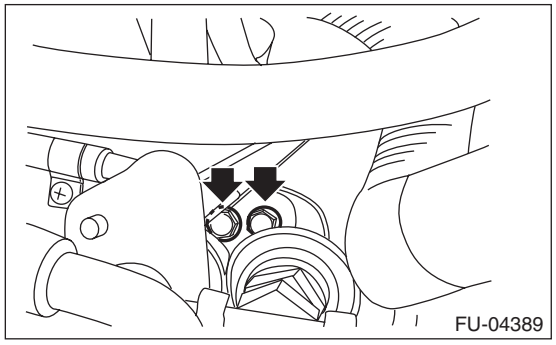
1) Check that the pressure regulator and damper assembly has no deformation, cracks or other damages.
2) Check that the vacuum hose, fuel return hose and fuel hose have no cracks, damage or loose part.

33.Purge Damper

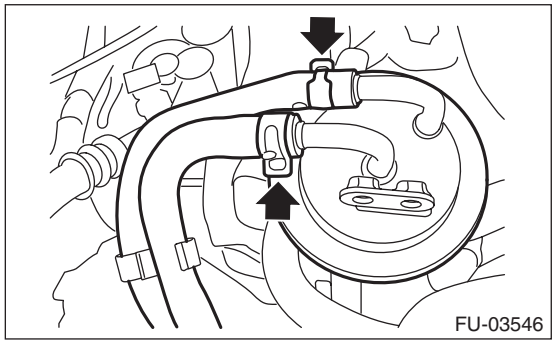
A: REMOVAL

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

1) Remove the bolts which secure the purge damper to the purge damper bracket.



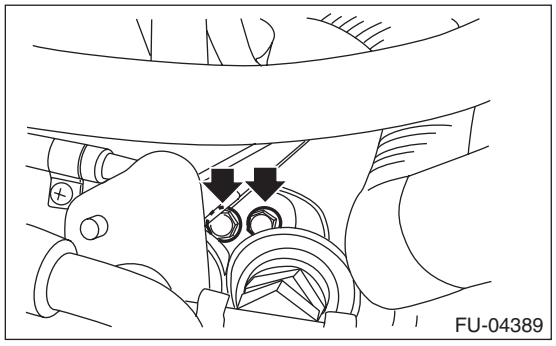
2) Disconnect the evaporation hose from the purge damper and remove the purge damper.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

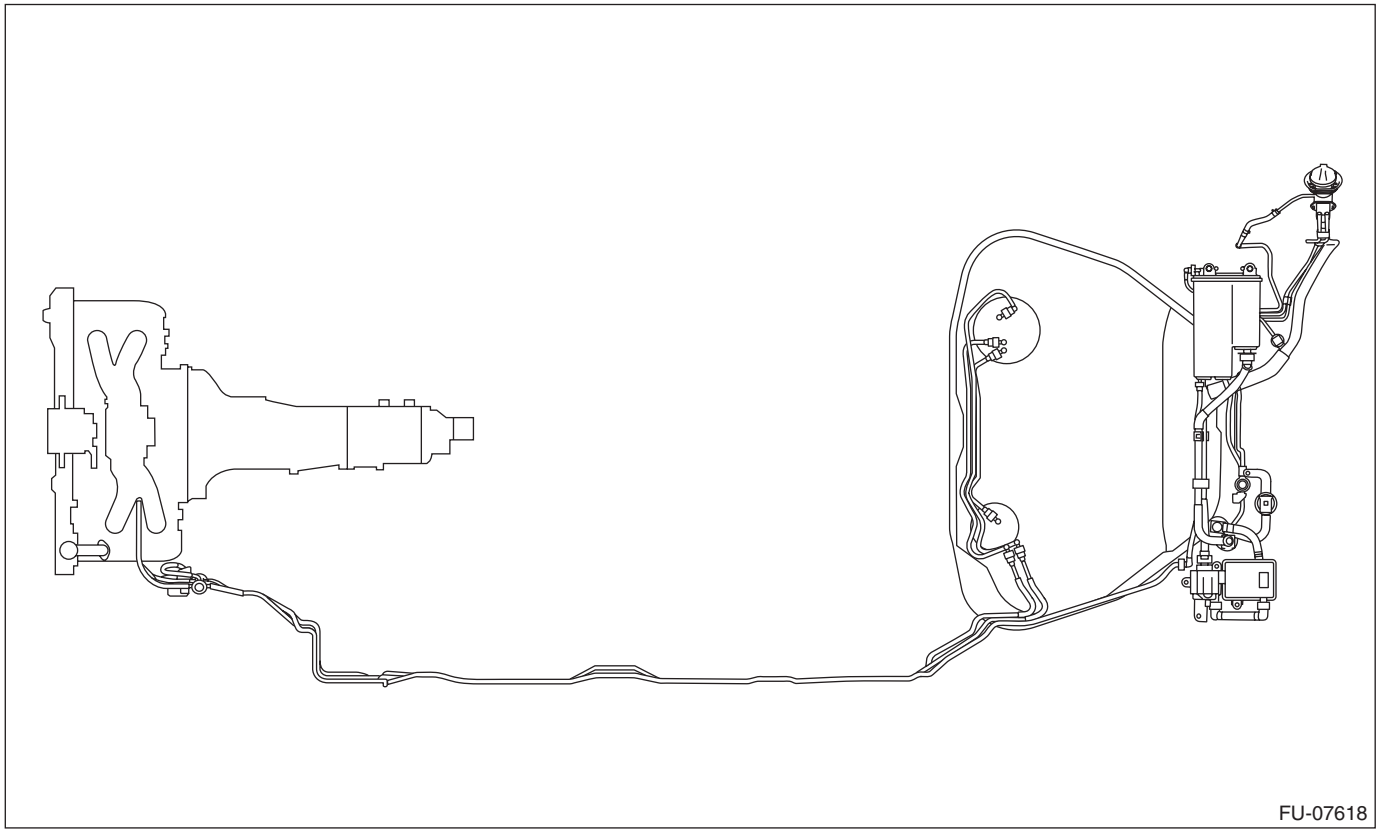


C: INSPECTION

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

34.Fuel Delivery, Return and Evaporation Lines

A: REMOVAL



WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

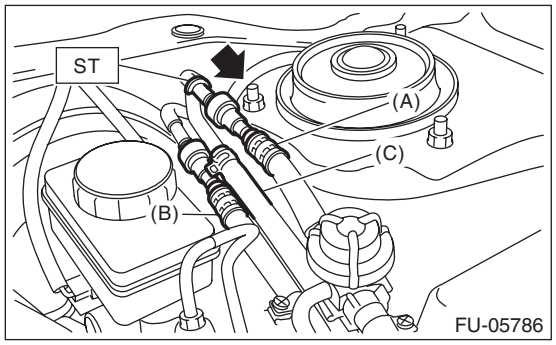
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Remove the floor mat. <Ref. to EI-71, REMOVAL, Floor Mat.>
4) In the engine compartment, disconnect the fuel delivery hoses, fuel return hoses and evaporation hoses.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.
(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

5) Remove the canister. <Ref. to EC(STI)-7, REMOVAL, Canister.>
6) Remove the fuel tank. <Ref. to FU(STI)-70, REMOVAL, Fuel Tank.>
7) Remove the fuel pipe assembly from vehicle.
8) Disconnect the quick connector, then disconnect the fuel delivery tube, fuel return tube and jet pump tube from the fuel tank.

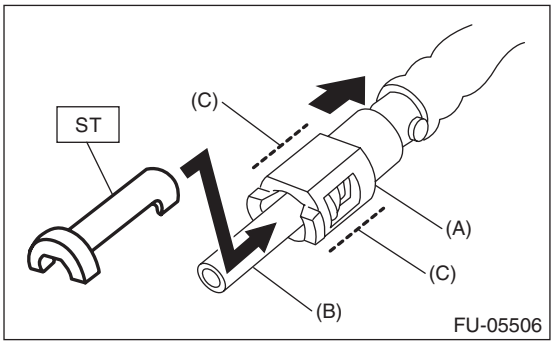
• When using ST

1. Attach ST to the pipe and push ST in the direction of arrow mark to disconnect the quick connector.

ST 42099AE000 QUICK CONNECTOR RELEASE

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.
• To disconnect the connector, hold (C) shown in the figure and pull in axial direction.
• If the connector and pipe are sticking to each other, push and pull the connector with ST pushed, and then pull the connector after it starts moving freely.
• When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.

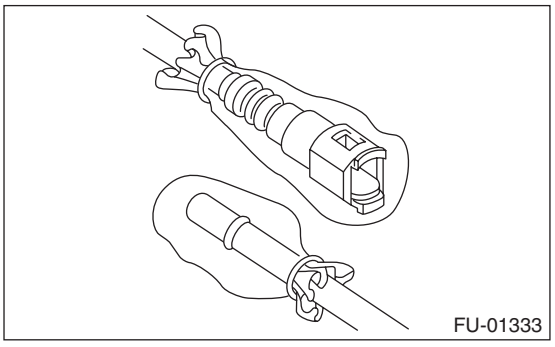
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



(A) Quick connector
(B) Pipe
(C) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

CAUTION:
When reusing the retainer, do not disconnect the retainer from the connector.

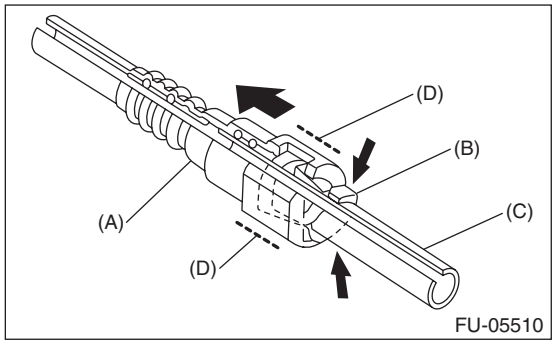


• When not using ST

1. Push the retainer in the direction of the arrow, disconnect the quick connector from pipe.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (D) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with the retainer pushed in the direction of the arrow, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

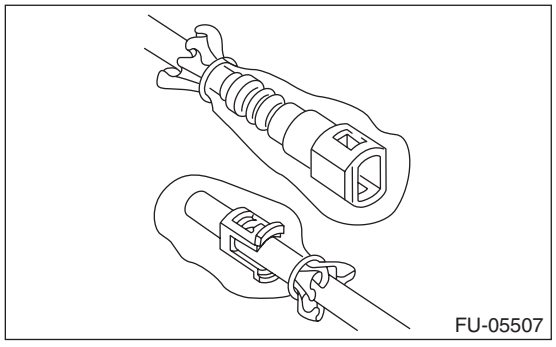
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



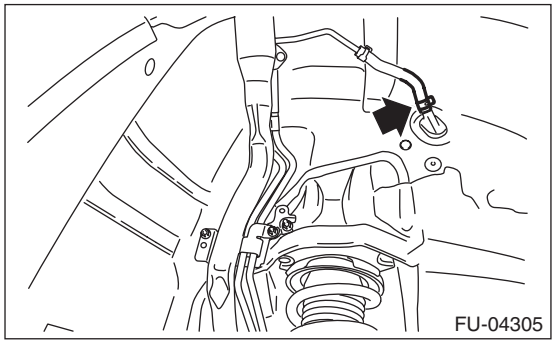
(A) Quick connector
(B) Retainer
(C) Pipe
(D) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

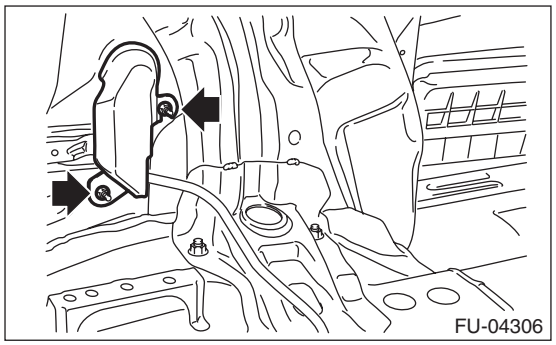
CAUTION:
When reusing the retainer, do not disconnect the retainer from the pipe.



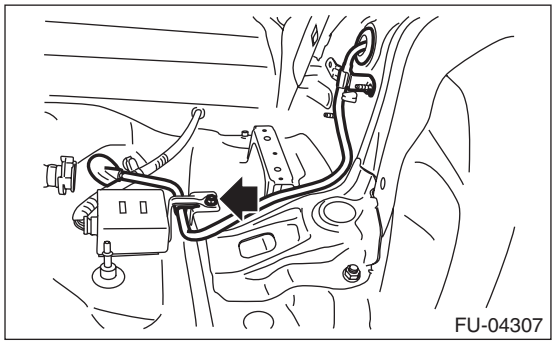
9) Remove the evaporation pipe.
(1) Remove the rear mud guard RH. <Ref. to EI-30, REMOVAL, Mud Guard.>
(2) Disconnect the evaporation hose.



(3) Remove the right side rear quarter trim. <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
(4) Remove the evaporation pipe protector.



(5) Remove the evaporation pipe from vehicle.

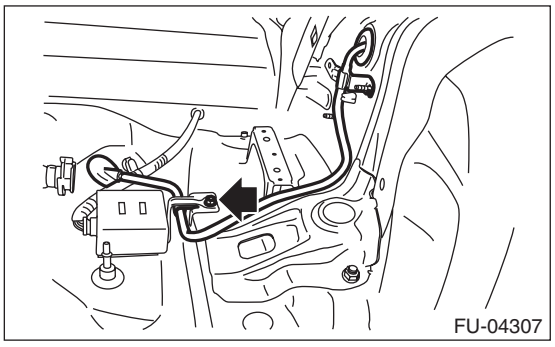


B: INSTALLATION

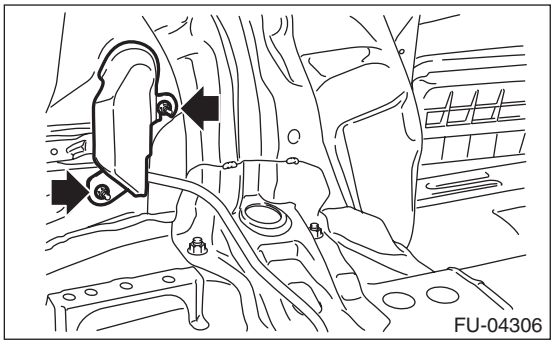
Install in the reverse order of removal while being careful of the following.

1. EVAPORATION PIPE INSTALLATION

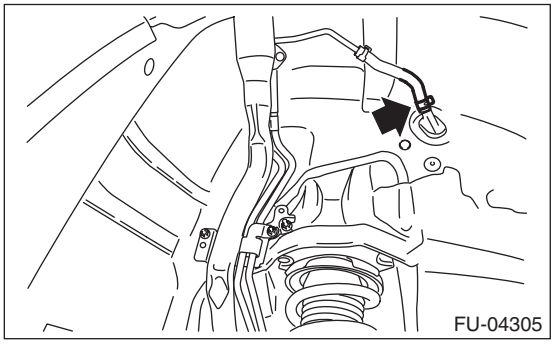
1) Install the evaporation pipe to the vehicle.



2) Install the evaporation pipe protector.



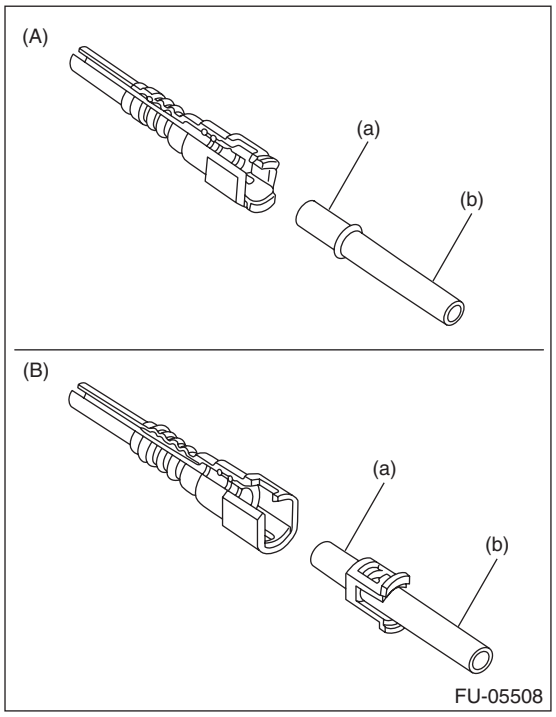
3) Install the right side rear quarter trim. <Ref. to EI-61, INSTALLATION, Rear Quarter Trim.>
4) Connect the evaporation hose.



5) Install the rear mud guard RH. <Ref. to EI-30, INSTALLATION, Mud Guard.>

2. CONNECTING THE FUEL LINE QUICK CONNECTOR

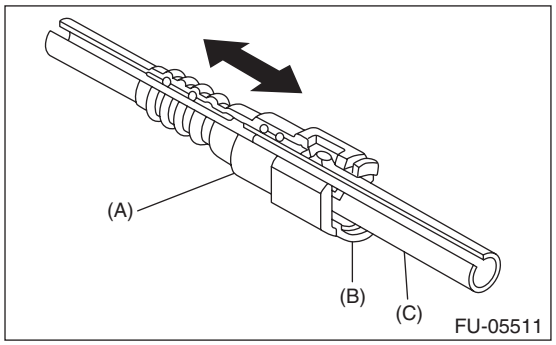
CAUTION:
• Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.



(A) When removed using the ST
(B) When removed without using the ST
(a) Seal surface
(b) Pipe

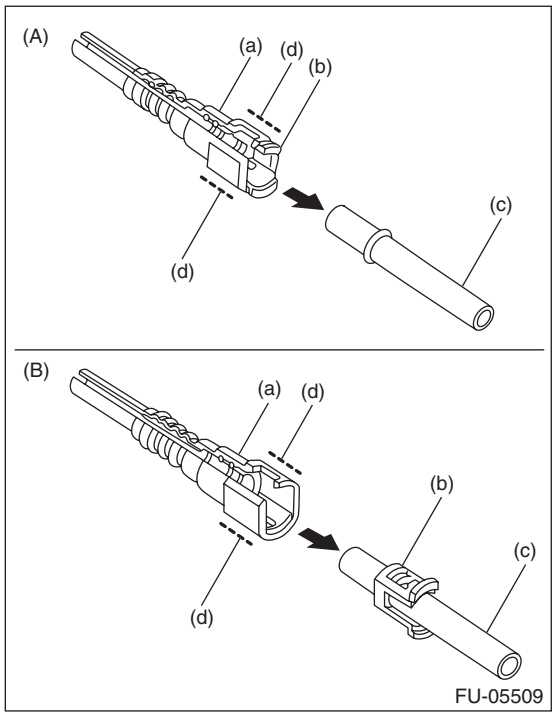
• When reusing the retainer, make sure that neither scratches nor deformation exist on the retainer. If it is faulty, use a new part.
1) Connect the quick connector to pipe.

CAUTION:
• Make sure that the quick connector is securely connected.



(A) Quick connector
(B) Retainer
(C) Pipe

• Make sure the two retainer pawls are engaged in their mating positions in the quick connector.
• Be sure to inspect tubes and their connections for any leakage of fuel.
• To connect the connector, hold (d) shown in the figure and push in axial direction.
• When connecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.



(A) When removed using the ST
(B) When removed without using the ST
(a) Quick connector
(b) Retainer
(c) Pipe
(d) Connector holding position

3. CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE

Connect the fuel delivery hose, fuel return hose, and fuel hose as shown in the figure.

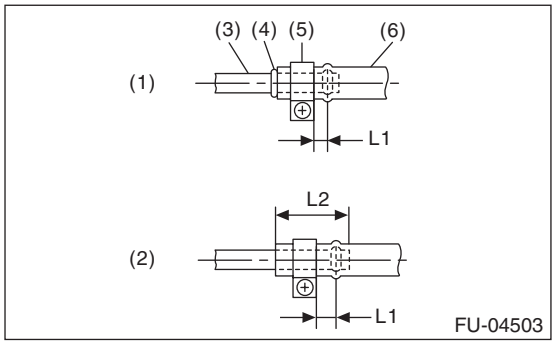
CAUTION:
• If the connection portion has a spool or stopper, do not allow the end of the hose to bend or ride over by inserting the hose too deep.
• Be sure to inspect hoses and their connections for any leakage of fuel.

NOTE:
Use new fuel delivery hose, fuel return hose, and fuel hose.

Tightening torque:
1.25 N·m (0.1 kgf-m, 0.9 ft-lb)

L1: 2.5±1.5 mm (0.098±0.059 in)

L2: 22.5±2.5 mm (0.886±0.098 in)

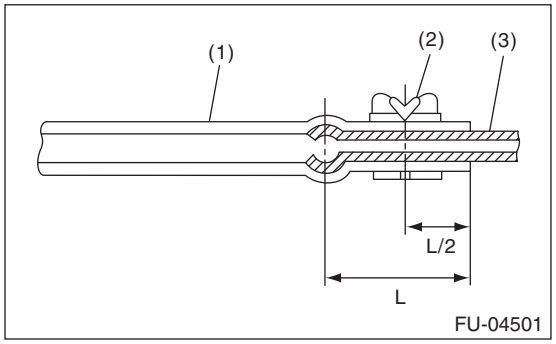


(1) When there is a spool or bump
(2) When there is no spool or bump
(3) Pipe
(4) Spool or bump
(5) Clamp
(6) Hose

4. EVAPORATION HOSE CONNECTION

Connect the evaporation hose to the pipe with an overlap of 15 to 20 mm (0.59 to 0.79 in).

L = 17.5±2.5 mm (0.689±0.098 in)



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

C: INSPECTION

1) Check that the fuel pipe has no deformation, cracks or other damages.
2) Check that the hose and tube have no cracks, damage or loose part.

35.Fuel System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Insufficient fuel supply to fuel injector	a. Fuel pump does not operate.	
	❍ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	❍ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
	b. Decline of fuel pump function	Replace the fuel pump.
	c. Clogged fuel filter	Replace the fuel filter. Clean or replace the fuel tank if necessary.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
	e. Air is mixed in fuel system.	Check the fuel line connections, correct or replace the defective part.
	f. Damaged diaphragm of pressure regulator	Replace the pressure regulator.
Leakage or blow out of fuel	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Cracked fuel line pipe, hose or tube	Replace the fuel line pipe, hose or tube.
	c. Cracked fuel tank or defective welding part	Replace the fuel tank.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
Gasoline smell inside of compartment	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Defective gasket of fuel saucer or fuel filler pipe assembly	Correct or replace the gasket.
	c. Defective canister	Replace the canister.
Defective fuel gauge	a. Defective operation of fuel level sensor	Replace the fuel level sensor.
	b. Defective operation of combination meter	Replace the combination meter.
	c. Defective operation of integrated unit	Replace the integrated unit.
Noise	a. Large operation noise or vibration of fuel pump	Replace the fuel pump.

NOTE:
• When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
• In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
• When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
• Before using water removing agent, follow the cautions noted on the bottle.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

EC(STI)

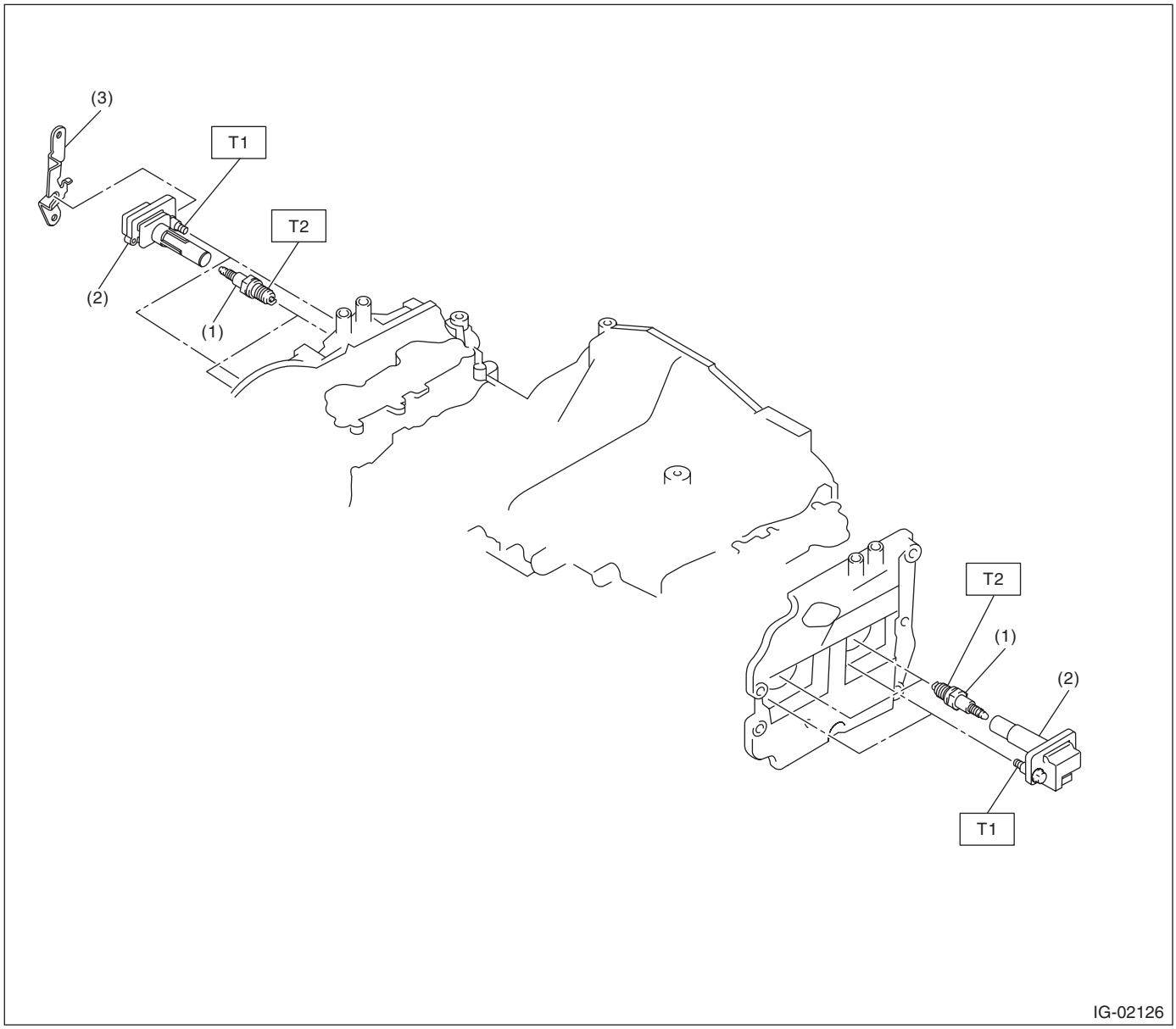
		Page
1.	General Description	2
2.	Front Catalytic Converter	5
3.	Rear Catalytic Converter	6
4.	Canister	7
5.	Purge Control Solenoid Valve	11
6.	Fuel Level Sensor	14
7.	Fuel Sub Level Sensor	15
8.	Pressure Control Solenoid Valve Assembly	16
9.	Drain Filter	17
10.	Shut Valve	18
11.	Leak Check Valve Assembly	19
12.	Drain Separator	23
13.	PCV Hose Assembly	24
14.	PCV Valve	26
15.	Secondary Air Pump	27
16.	Secondary Air Combination Valve	29

1. General Description

A: SPECIFICATION

Item			Specifications
Ignition coil	Type		FK0368
	Ignition system		Independent ignition coil
	Manufacturer		Diamond Electric
Spark plug	Manufacturer and type		NGK: SILFR6A
	Thread size (diameter, pitch, length) mm		14, 1.25, 26.5
	Spark plug gap mm (in)	Standard	0.7 — 0.8 (0.028 — 0.031)
	Electrode		Iridium

B: COMPONENT



(1) Spark plug
(2) Ignition coil
(3) Engine harness stay (#3 ignition coil side only)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 16 (1.6, 11.8)
T2: 21 (2.1, 15.5)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

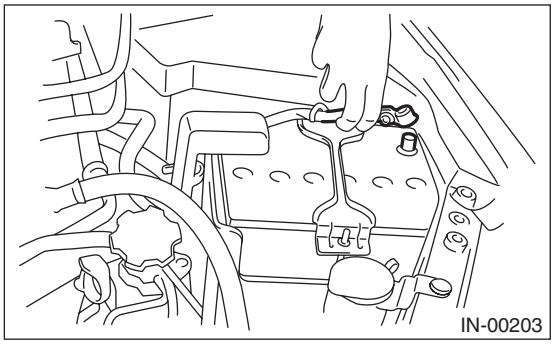
2. Spark Plug

A: REMOVAL

Spark plug:
Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(STI)-2, SPECIFICATION, General Description.>

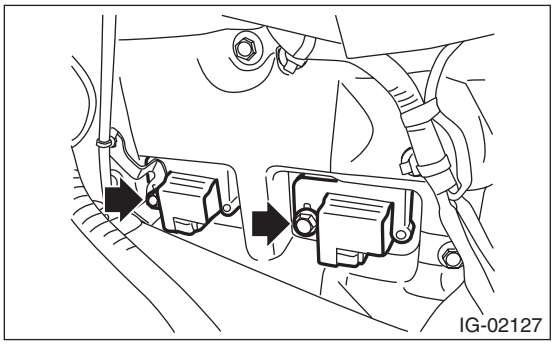
1. RH SIDE

1) Disconnect the ground cable from battery.



2) Remove the air cleaner case. <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
3) Disconnect the connector from ignition coil.
4) Remove the ignition coil.

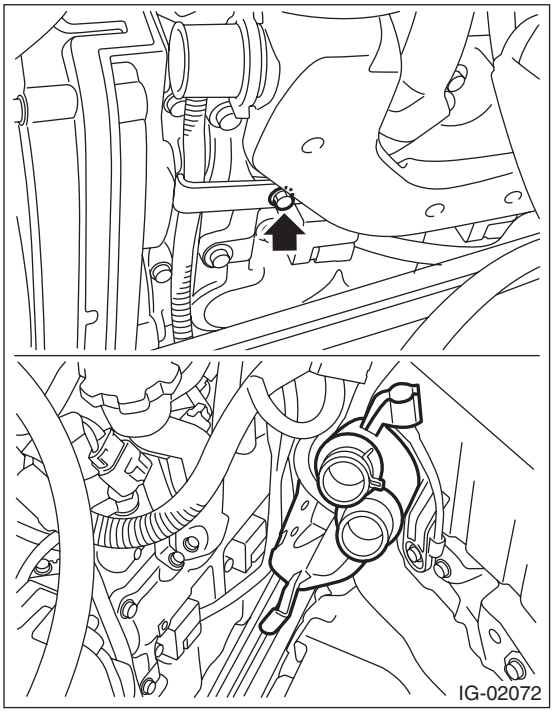
NOTE:
Turn #3 ignition coil by 180 degrees to remove it.



5) Remove the spark plug with a spark plug socket.

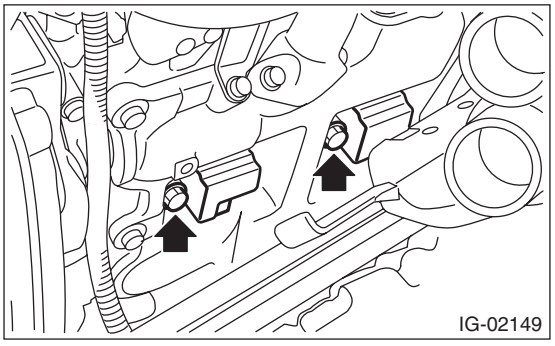
2. LH SIDE

1) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
2) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
3) Remove the bolts that secure the air duct to the rocker cover LH, and lift the air duct.



4) Disconnect the connector from ignition coil.
5) Remove the ignition coil.

NOTE:
Turn #4 ignition coil by 180° to remove it.



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

B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

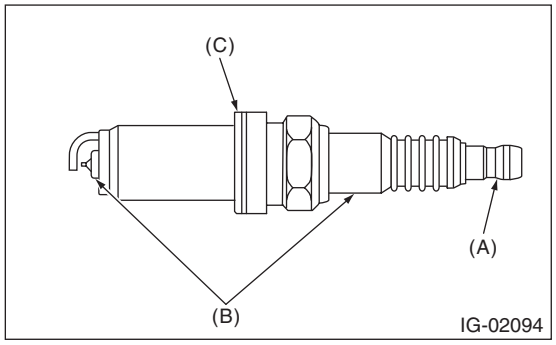
Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

Tightening torque (Air duct):
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

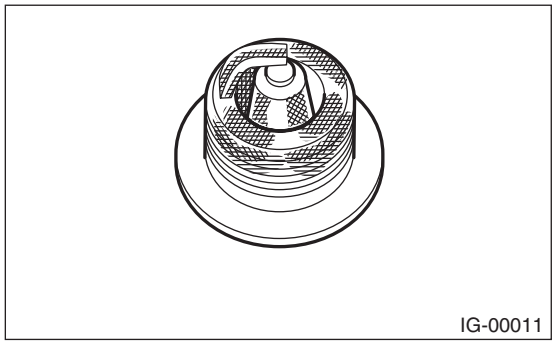
1) Check the spark plug for abnormalities. If defective, replace the spark plug.



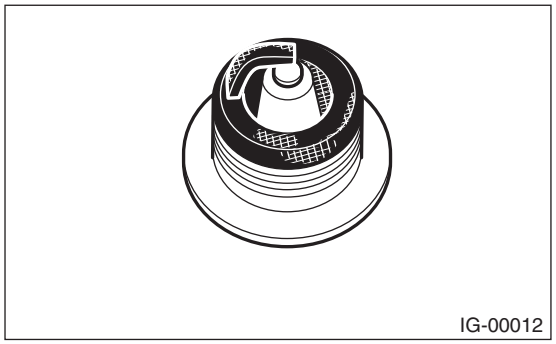
(A) Terminal damage
(B) Crack or damage in insulator
(C) Damaged gasket

2) Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

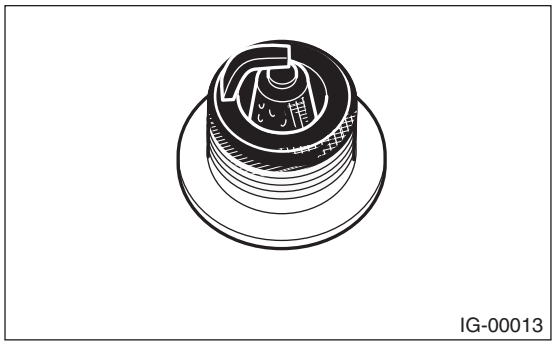
(1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



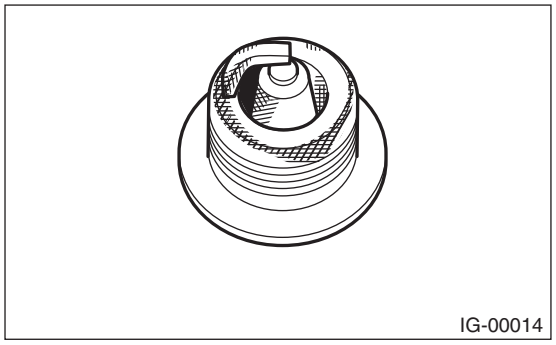
(2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture, etc.



(3) Oil fouled:
Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



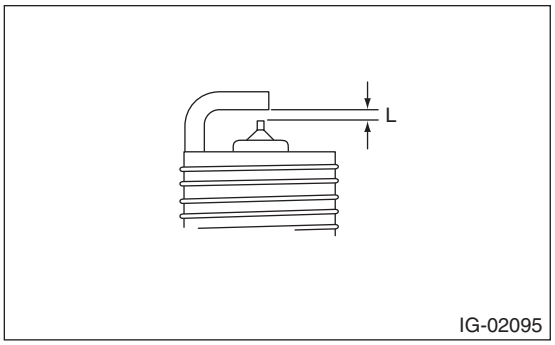
(4) Overheating:
A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.



3) Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap “L” using a gap gauge. If it is not within the standard, replace the spark plug.

NOTE:
- Never use a plug cleaner.
- Do not use a metal brush as it may damage the electrode area.

Spark plug gap L:
Standard
0.7 — 0.8 mm (0.028 — 0.031 in)



3. Ignition Coil

A: REMOVAL

Direct ignition type is adopted. Refer to “Spark Plug” for removal procedure. <Ref. to IG(STI)-4, REMOVAL, Spark Plug.>

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H4DOTC)(diag)-80, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

STARTING/CHARGING SYSTEMS

SC(STI)

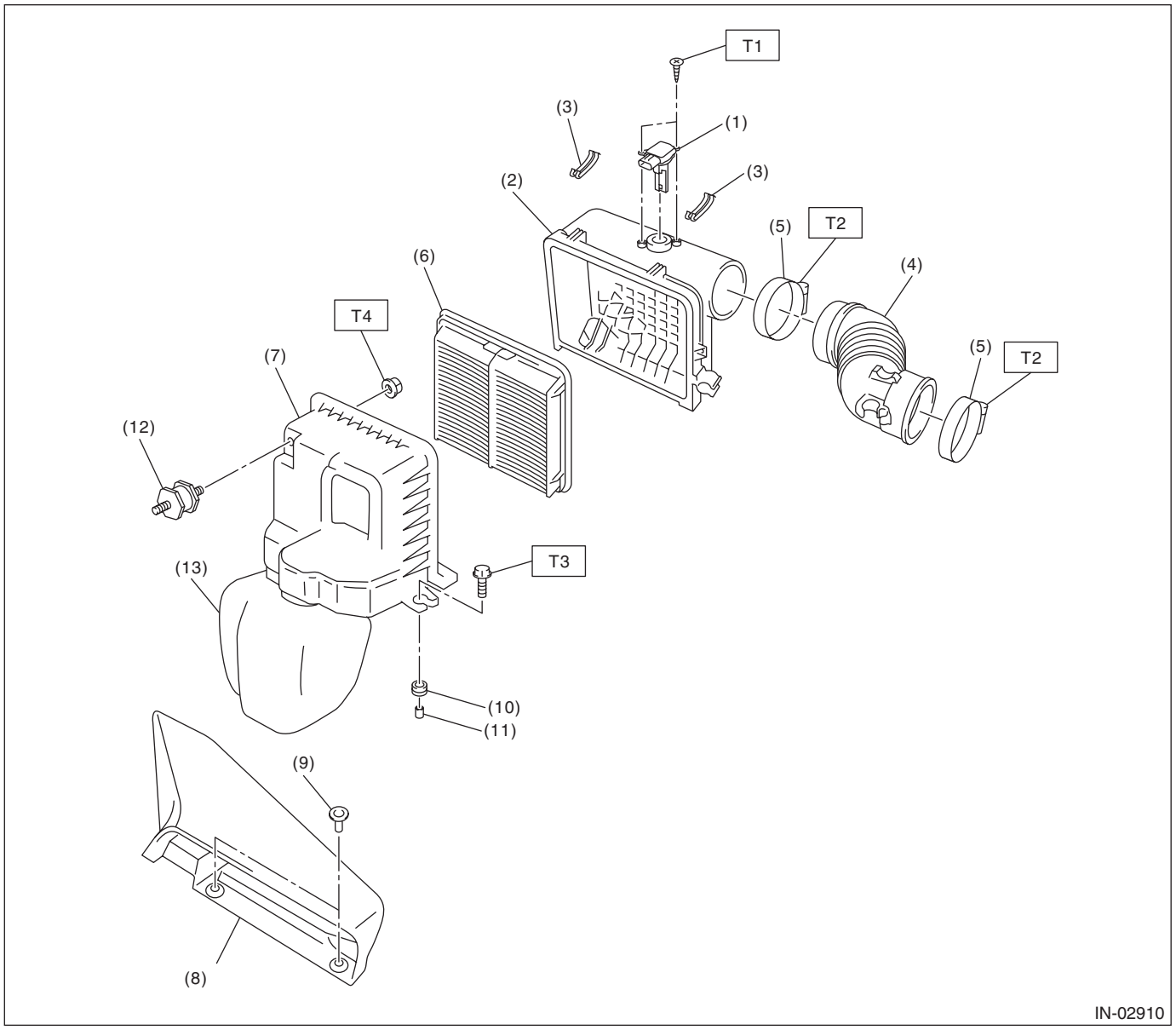
Page

1. General Description 2
2. Starter 8
3. Generator 21
4. Battery 27

1. General Description

A: COMPONENT

1. AIR CLEANER

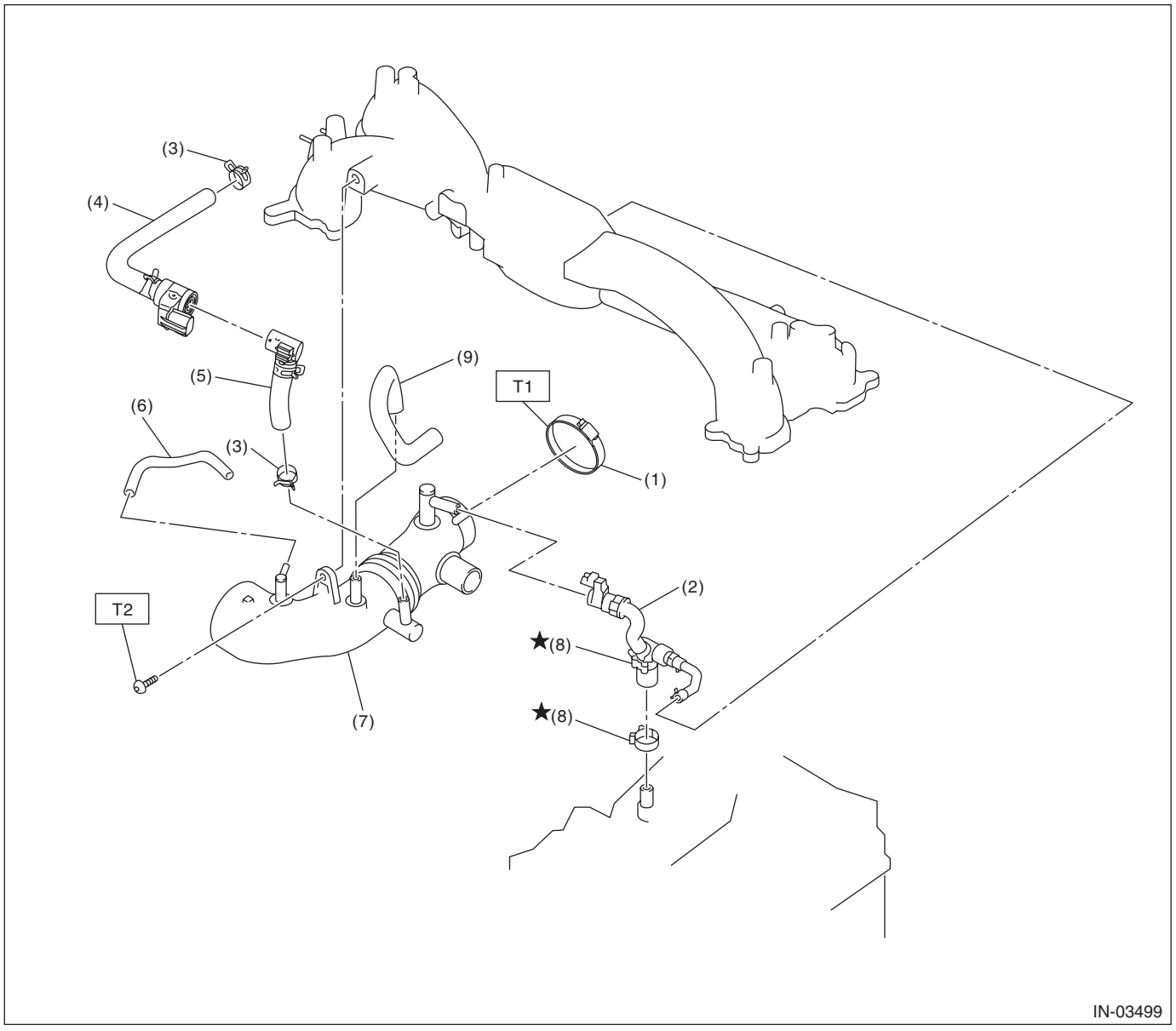


(1)	Mass air flow and intake air temperature sensor	(8)	Air intake duct
(2)	Air cleaner case (rear)	(9)	Clip
(3)	Clip	(10)	Cushion
(4)	Air intake boot	(11)	Spacer
(5)	Clamp	(12)	Cushion
(6)	Air cleaner element	(13)	Resonator chamber
(7)	Air cleaner case (front)		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1 (0.1, 0.7)
T2: 2.5 (0.3, 1.8)
T3: 6 (0.6, 4.4)
T4: 7.5 (0.8, 5.5)

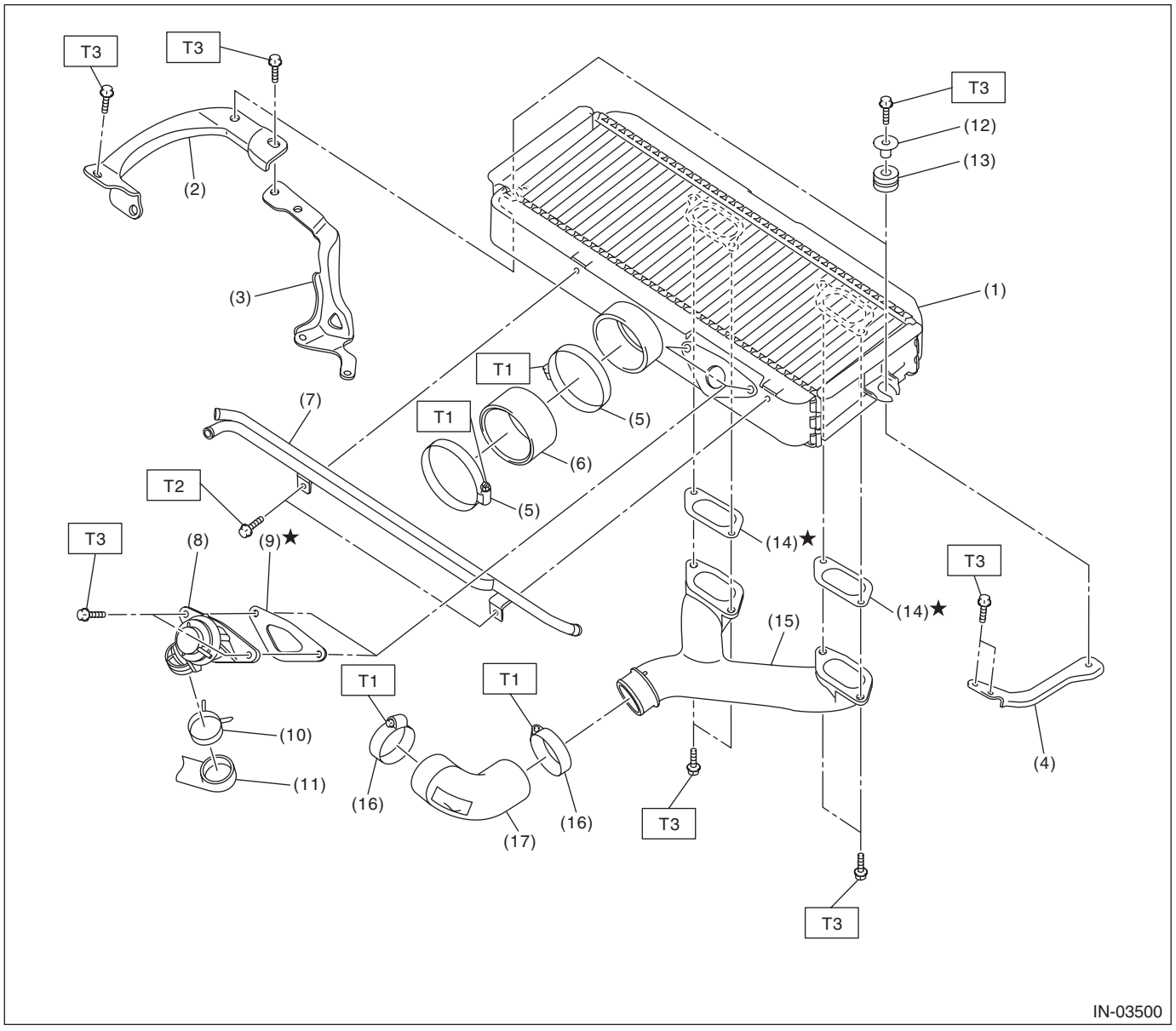
2. INTAKE DUCT



(1) Clamp
(2) PCV hose ASSY A
(3) Clip
(4) PCV hose ASSY B
(5) PCV hose ASSY C
(6) Vacuum hose A
(7) Intake duct
(8) Clamp
(9) Vacuum hose B

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3 (0.3, 2.2)
T2: 17 (1.7, 12.5)

3. INTERCOOLER

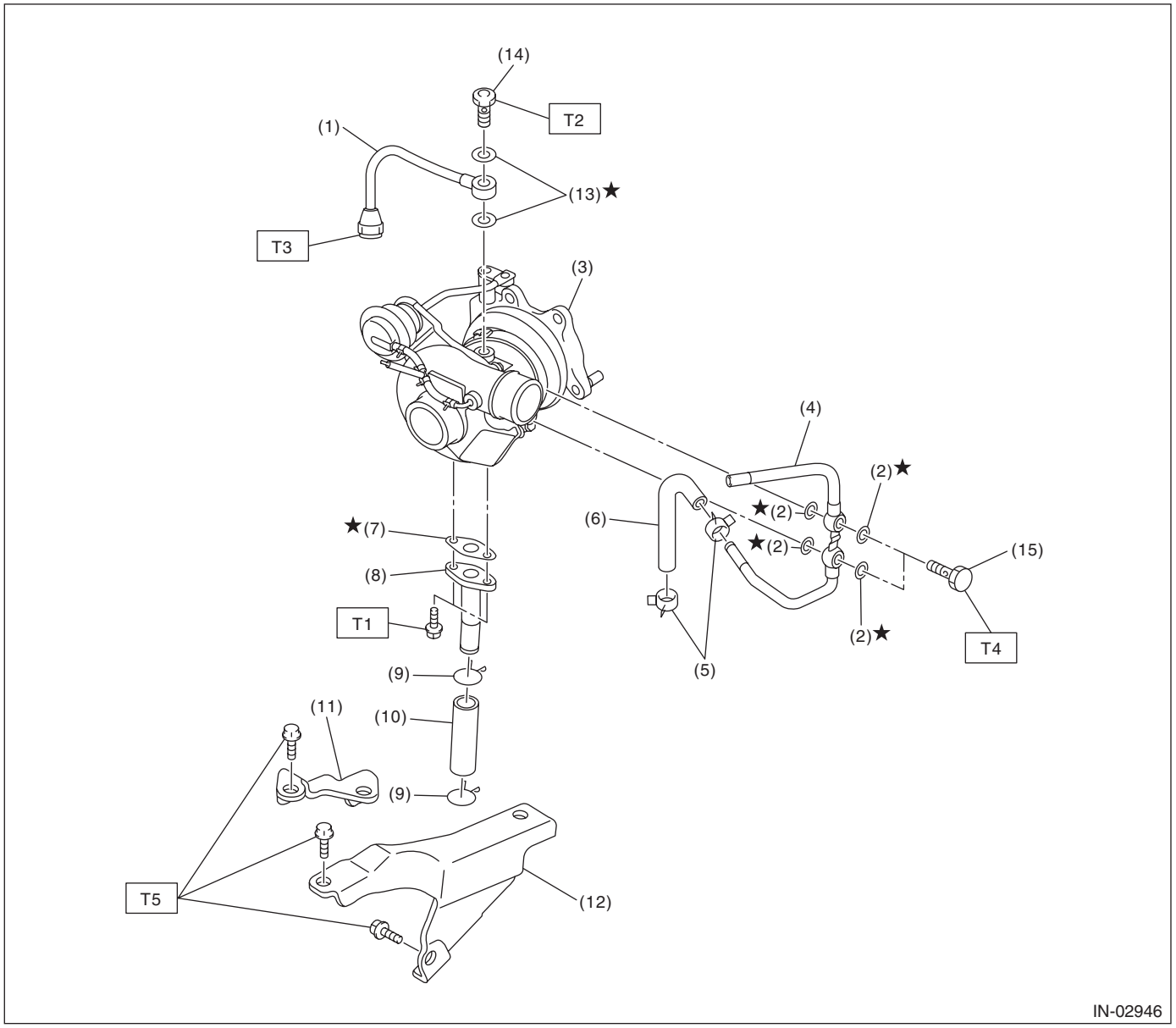


IN-03500

(1) Intercooler
(2) Intercooler stay A
(3) Intercooler stay B
(4) Intercooler stay C
(5) Clamp
(6) Air duct hose
(7) PCV pipe
(8) Air by-pass valve
(9) Gasket
(10) Clip
(11) Air by-pass hose
(12) Spacer
(13) Cushion
(14) Gasket
(15) Intercooler duct
(16) Clamp
(17) Intake duct

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3 (0.3, 2.2)
T2: 5.5 (0.6, 4.1)
T3: 16 (1.6, 11.8)

4. TURBOCHARGER



(1) Oil inlet pipe
(2) Gasket
(3) Turbocharger
(4) Water pipe
(5) Clip
(6) Engine coolant hose
(7) Gasket
(8) Oil outlet pipe
(9) Clip
(10) Oil outlet hose
(11) Turbocharger stay RH
(12) Turbocharger stay LH
(13) Gasket
(14) Union bolt A
(15) Union bolt B

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.9 (0.5, 3.6)
T2: 16 (1.6, 11.8)
T3: 20 (2.0, 14.8)
T4: 23 (2.3, 17.0)
T5: 33 (3.4, 24.3)

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: PREPARATION TOOL

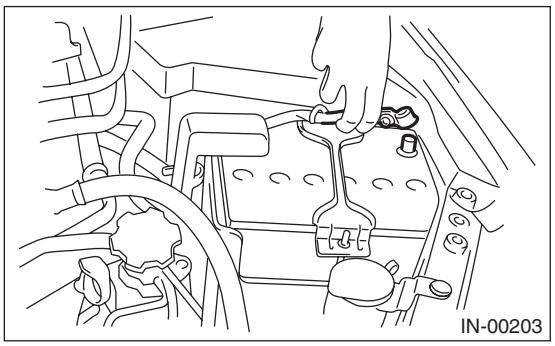
1. GENERAL TOOL

TOOL NAME	REMARKS
Mighty Vac	Used for checking waste gate actuator and air by-pass valve.

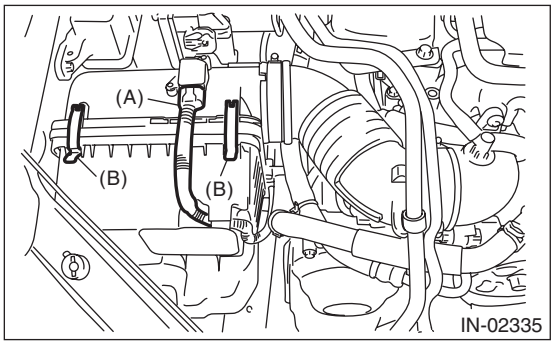
2. Air Cleaner Element

A: REMOVAL

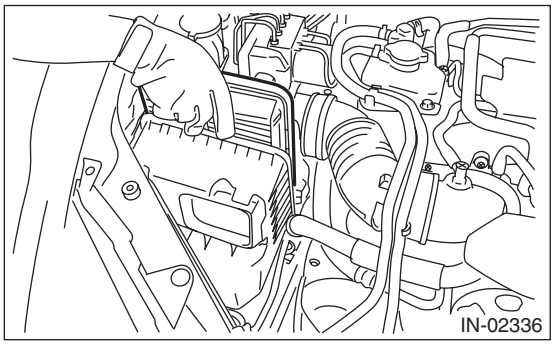
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Remove the clips (B) from the air cleaner case (front).



5) Open the air cleaner case, and remove the air cleaner element.

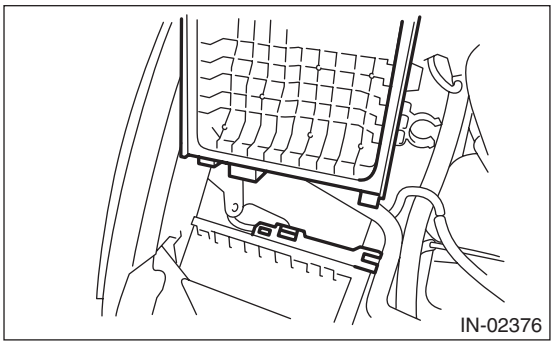


B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.

NOTE:
• Check that there are no foreign objects in the air cleaner case.
• If the protrusion of the air cleaner case (rear) is removed when removing the air cleaner element, align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



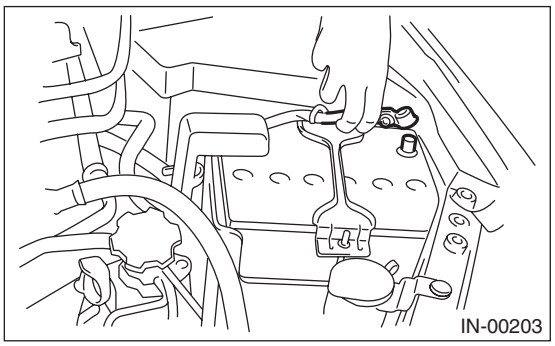
C: INSPECTION

1) Check that the air cleaner element has no deformation, cracks or other damages.
2) Check the air cleaner element for excessive dirt.

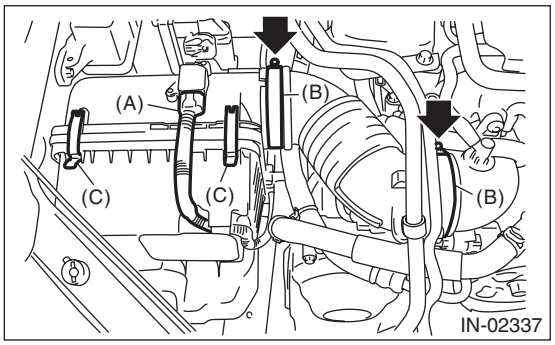
3. Air Cleaner Case

A: REMOVAL

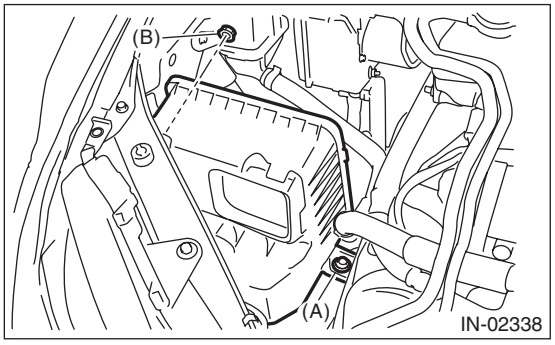
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Loosen the clamp (B) which holds the air intake boot.
5) Remove the clip (C) from the air cleaner case (front).



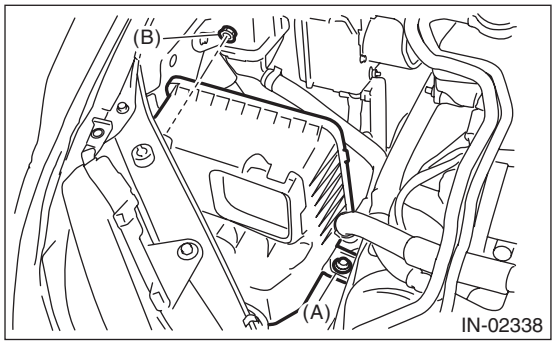
6) Remove the air cleaner case (rear) and air intake boot.
7) Remove the air cleaner element.
8) Remove bolts (A) and nuts (B) which secure the air cleaner case (front) to the body, and remove the air cleaner case (front).



B: INSTALLATION

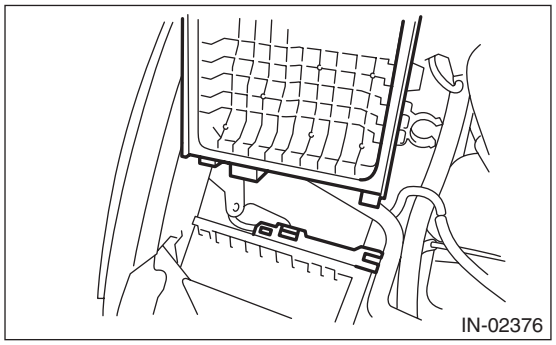
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

Tightening torque:
Bolt (A)
6 N·m (0.6 kgf-m, 4.4 ft-lb)
Nut (B)
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

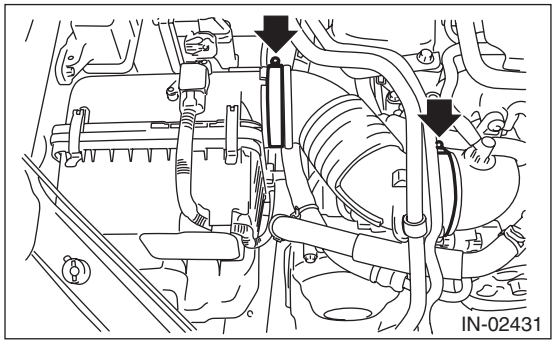


2) Install the air cleaner element.
3) Install the air cleaner case (rear) and air intake boot.

NOTE:
When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.

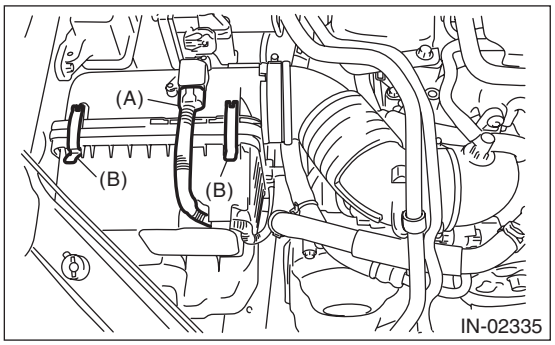


Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

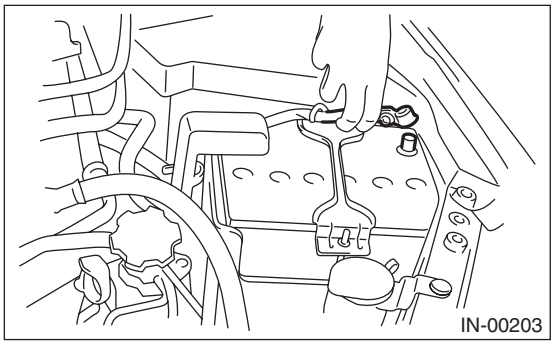


4) Install the clip (B) to the air cleaner case (front).

5) Connect the connector (A) to the mass air flow and intake air temperature sensor.



6) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
7) Connect the ground cable to battery.



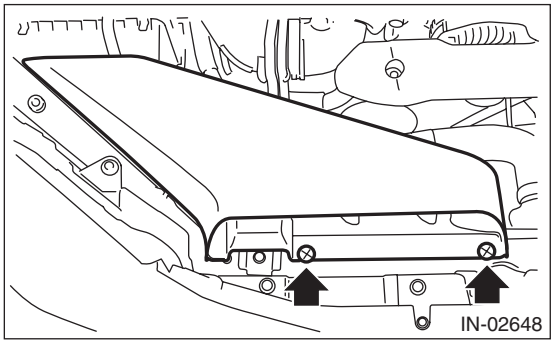
C: INSPECTION

1) Check that the air cleaner case has no deformation, cracks or other damages.
2) Check that the air intake boot has no cracks, damage or loose part.

4. Air Intake Duct

A: REMOVAL

Remove the clip which secures the air intake duct, and remove the air intake duct.



B: INSTALLATION

Install in the reverse order of removal.

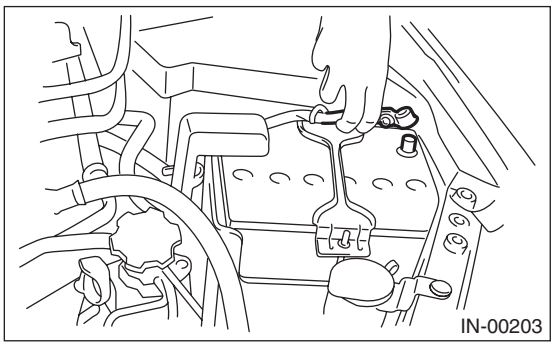
C: INSPECTION

1) Check that the air intake duct has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake duct.

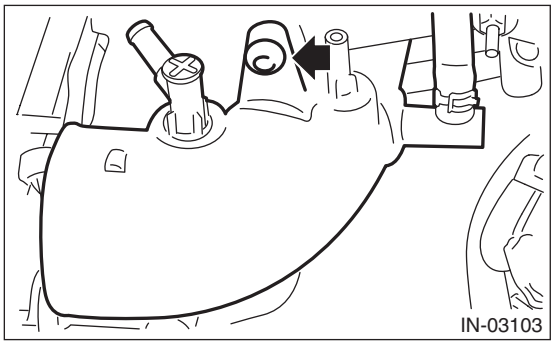
5. Intake Duct

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
3) Remove the sensor, engine harness and fuel pipe from the intake manifold. <Ref. to FU(STI)-25, DISASSEMBLY, Intake Manifold.>
4) Remove the intake duct from intake manifold.



5) Remove the PCV hose assembly and air by-pass hose from the intake duct.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

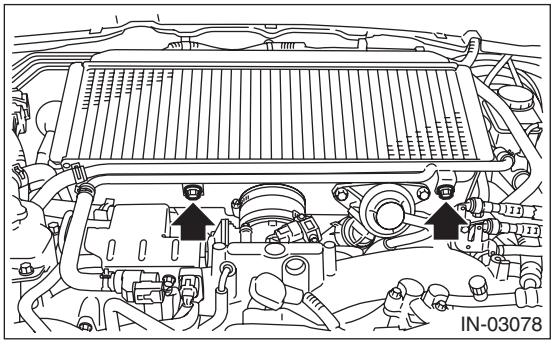
C: INSPECTION

Check that the intake duct has no deformation, cracks or other damages.

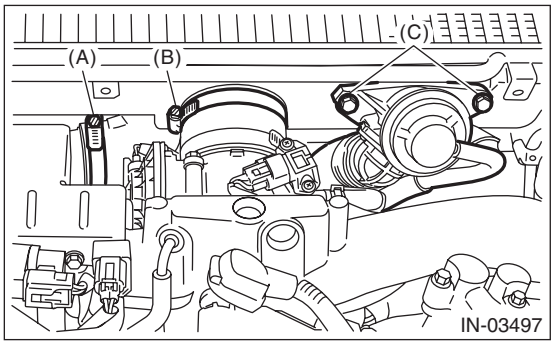
6. Intercooler

A: REMOVAL

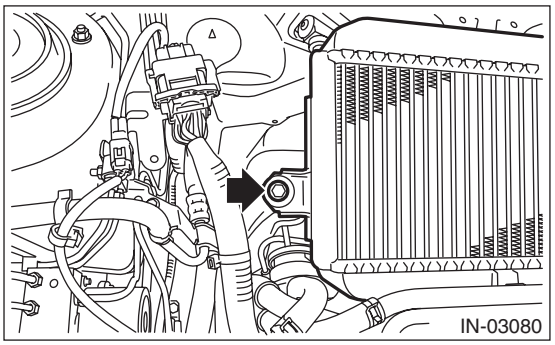
1) Remove the bolts holding the PCV pipe to the intercooler.

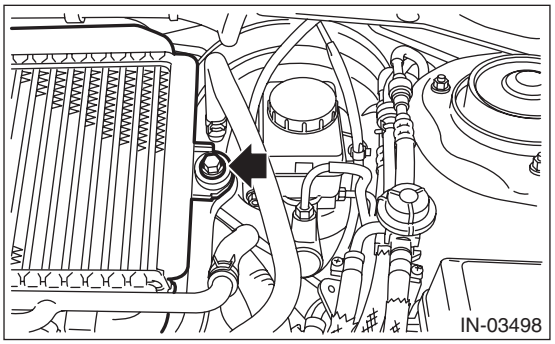


2) Loosen the clamp (A) holding the intake duct to the turbocharger.
3) Loosen the clamp (B) holding the air duct hose to the intercooler.
4) Remove the bolts (C) securing the air by-pass valve to the intercooler, and disconnect the air by-pass valve.

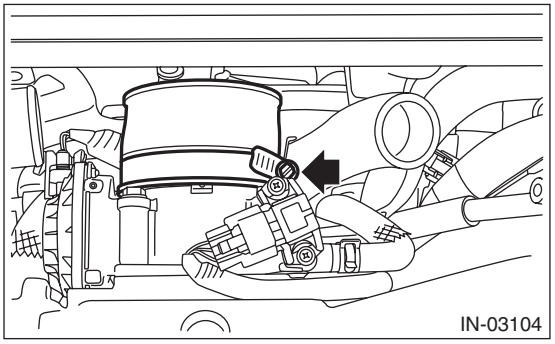


5) Remove the bolts which secure the intercooler to the intercooler stay, and remove the intercooler.

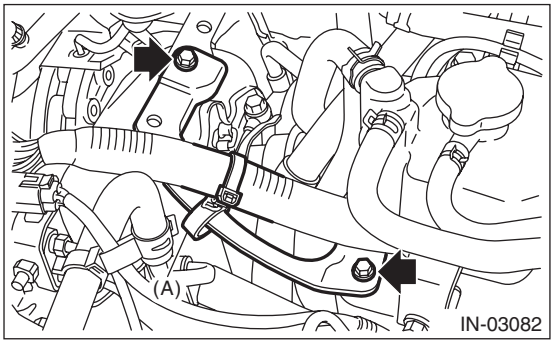




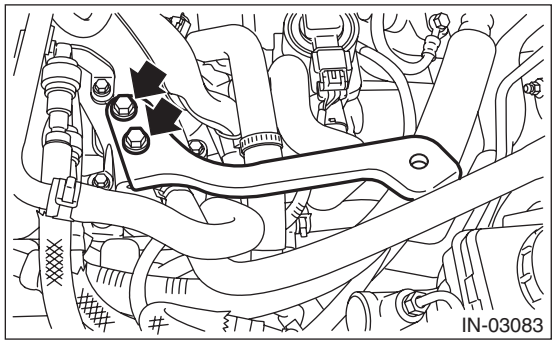
6) Remove the air duct hose from the throttle body.



7) Remove clip (A) holding the engine harness to the intercooler stay RH, and remove the intercooler stay RH.



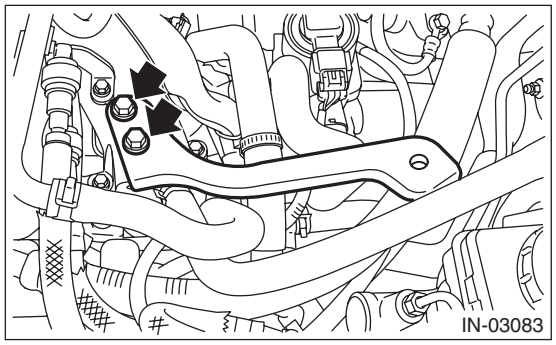
8) Remove the intercooler stay LH.



B: INSTALLATION

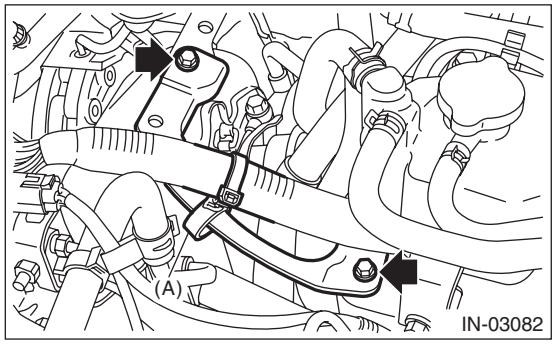
1) Install the intercooler stay LH.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



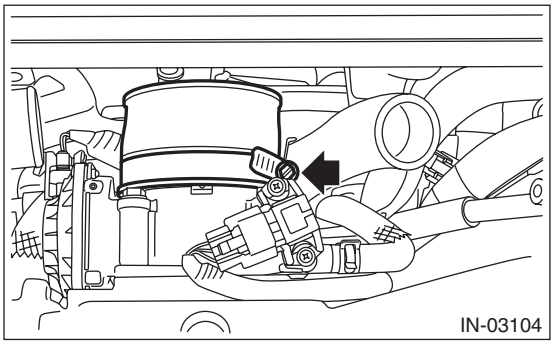
2) Install the intercooler stay RH, and install the clip (A) which secures the engine harness to the intercooler stay RH.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



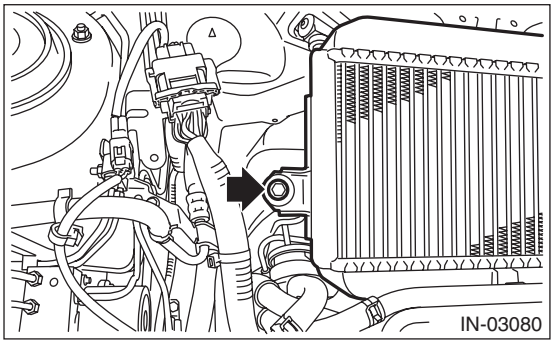
3) Attach the air duct hose to the throttle body.

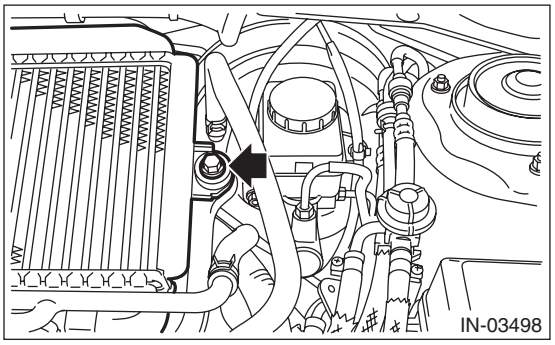
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



4) Install the intercooler to the intercooler stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



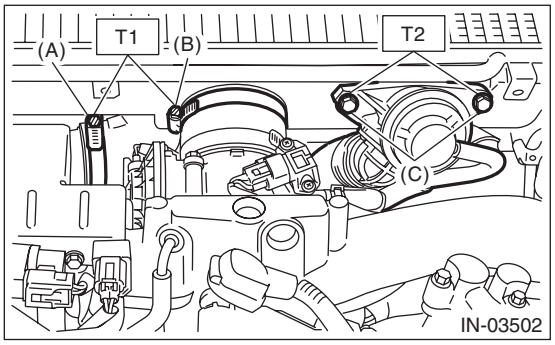


5) Tighten the clamp (A) which secures the intake duct to the turbocharger.
6) Tighten the clamp (B) which secures the air duct hose to the intercooler.

7) Install the bolts (C) which secures the air by-pass valve to the intercooler, and install the air by-pass valve.

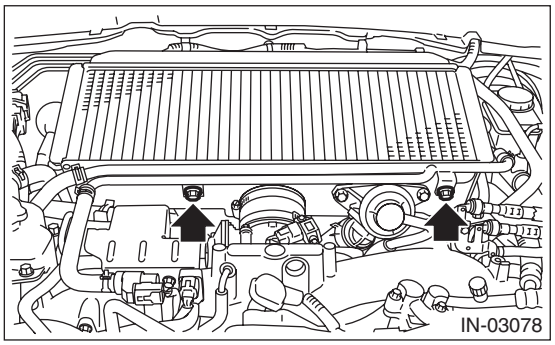
NOTE:
Use a new gasket.

Tightening torque:
T1: 3 N·m (0.3 kgf-m, 2.2 ft-lb)
T2: 16 N·m (1.6 kgf-m, 11.8 ft-lb)



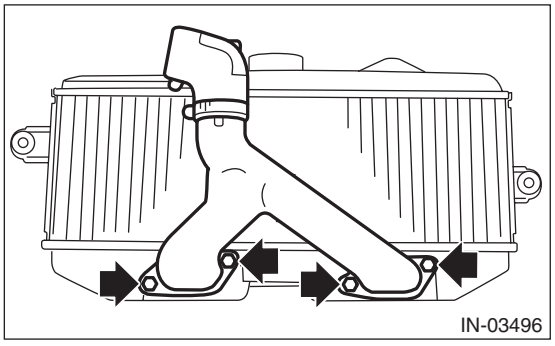
8) Install the PCV pipe to the intercooler.

Tightening torque:
5.5 N·m (0.6 kgf-m, 4.1 ft-lb)

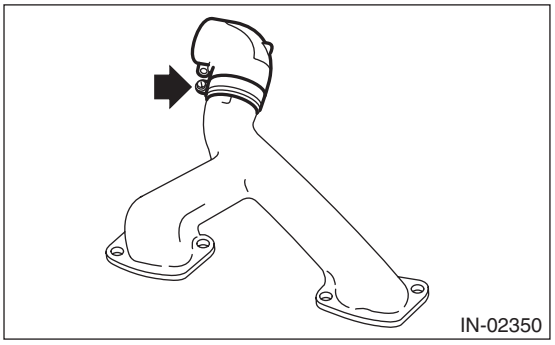


C: DISASSEMBLY

1) Remove the intercooler duct from the intercooler.



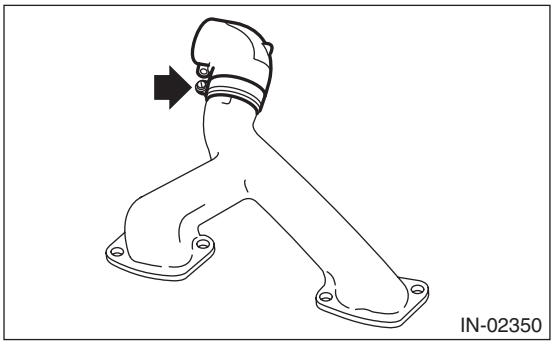
2) Remove the intake duct from intercooler duct.



D: ASSEMBLY

1) Install the intake duct to the intercooler duct.

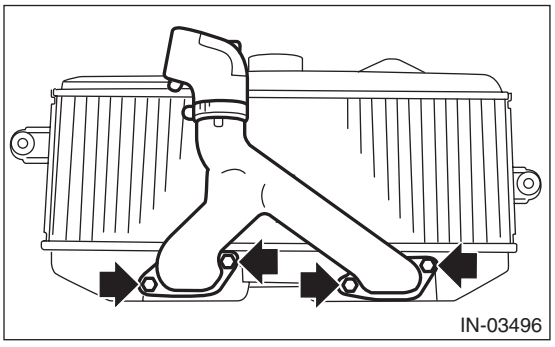
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



2) Install the intercooler duct to the intercooler.

NOTE:
Use a new gasket.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



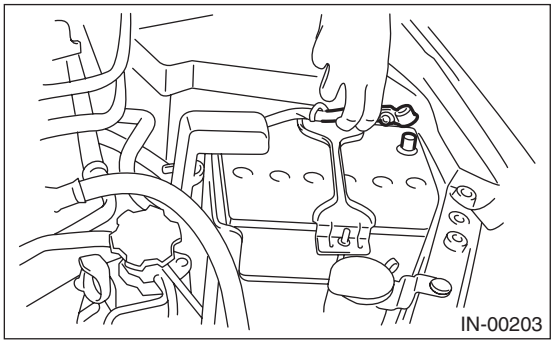
E: INSPECTION

1) Check that the intercooler and intercooler duct have no deformation, cracks or other damages.
2) Check that the hose and intake duct have no cracks, damage or loose part.

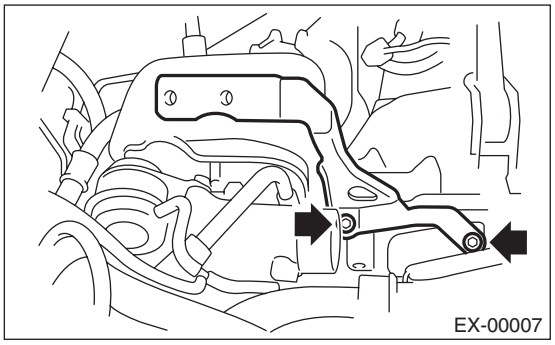
7. Turbocharger

A: REMOVAL

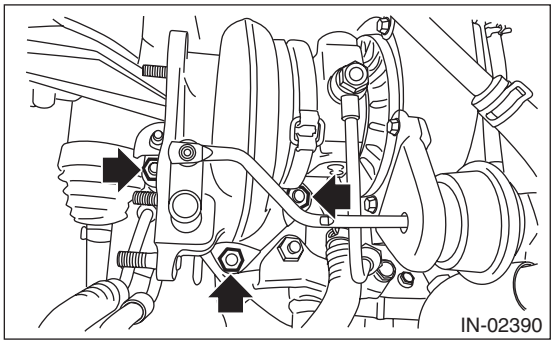
1) Disconnect the ground cable from battery.


IN-00203

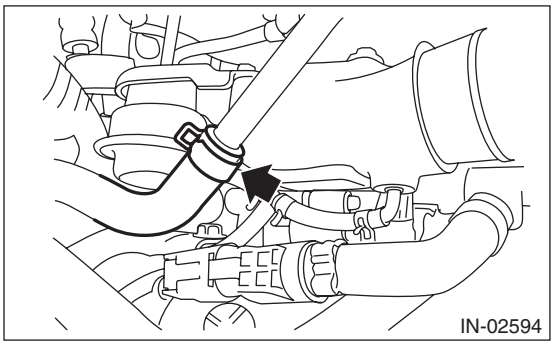
2) Lift up the vehicle.
3) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Lower the vehicle.
5) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
6) Remove the intercooler stay.


EX-00007

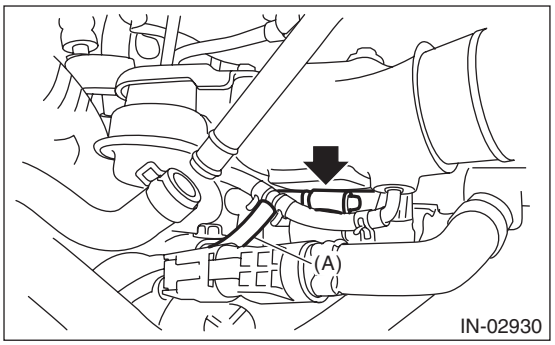
7) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
8) Lower the vehicle.
9) Remove the joint pipe from the turbocharger.


IN-02390

10) Disconnect the engine coolant hose from the upper side of the water pipe.


IN-02594

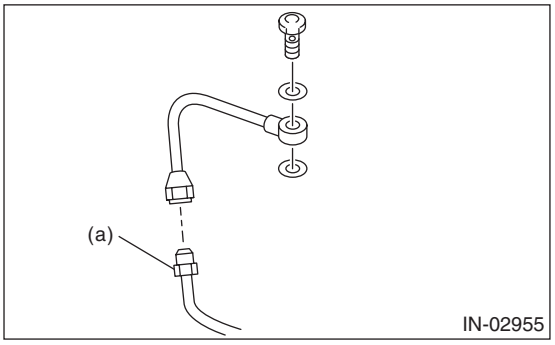
11) Disconnect the air control hose (A), and loosen the clamp holding the intake duct to the turbocharger.



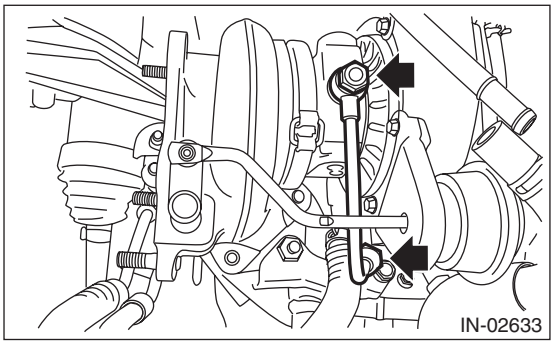
IN-02930

12) Remove the oil inlet pipe from the turbocharger.

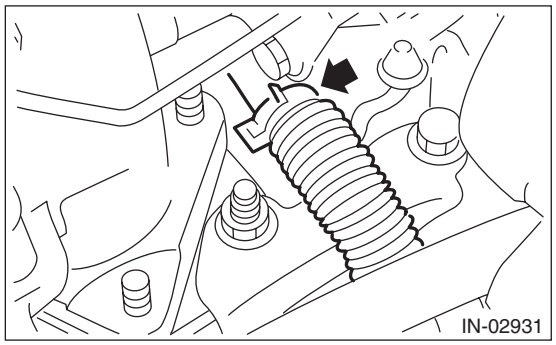
CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when loosing the oil inlet pipe flare nut, and avoid the part from rotating together while loosening the nut.



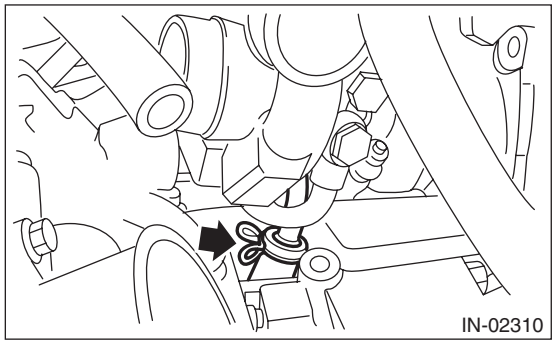
IN-02955


IN-02633

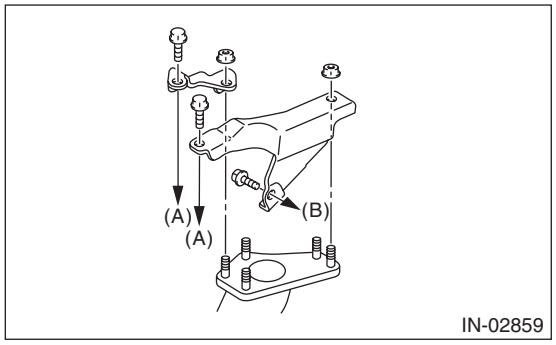
13) Disconnect the engine coolant hose from the lower side of the water pipe.



14) Disconnect the oil outlet hose from the oil outlet pipe, and remove the turbocharger.



15) Remove the turbocharger stay.

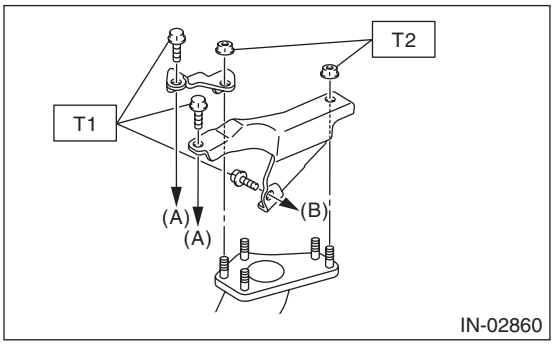


(A) To cylinder head RH
(B) To cylinder block RH

B: INSTALLATION

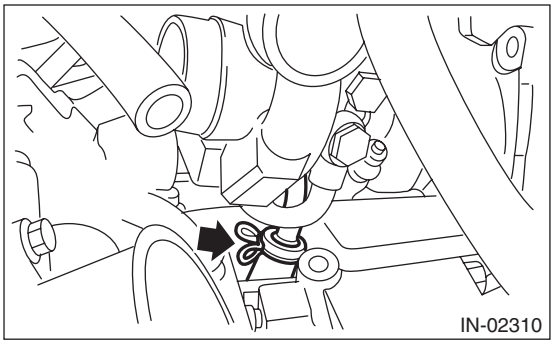
1) Install the turbocharger stay.

Tightening torque:
T1: 33 N·m (3.4 kgf-m, 24.3 ft-lb)
T2: 42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

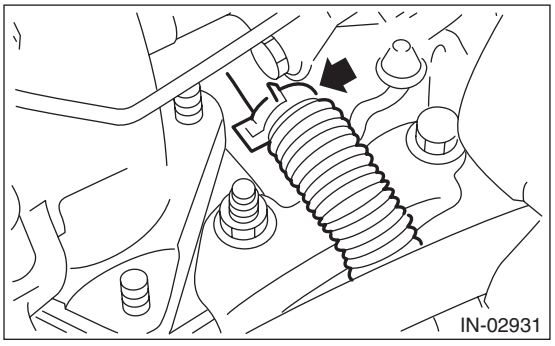


(A) To cylinder head RH
(B) To cylinder block RH

2) Connect the oil outlet hose to the oil outlet pipe.

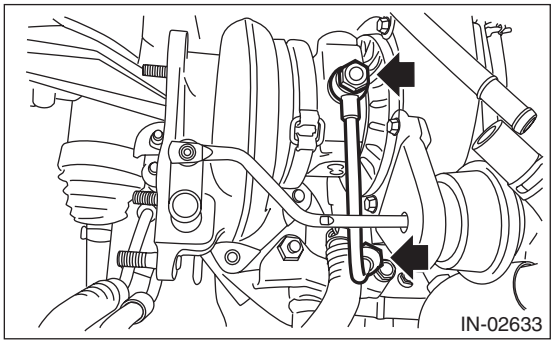


3) Connect the engine coolant hose to the lower side of the water pipe.



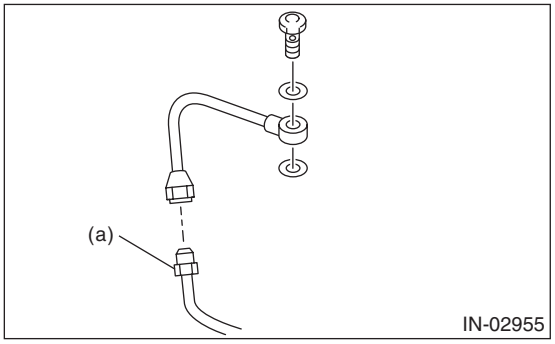
4) Temporarily tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

NOTE:
Use a new gasket.

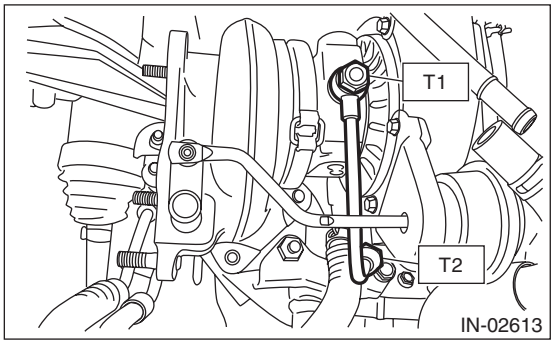


5) Tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when tightening the oil inlet pipe flare nut, and avoid the part from rotating together while tightening the nut.

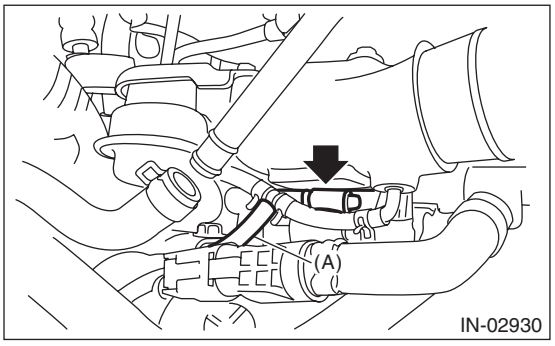


Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)

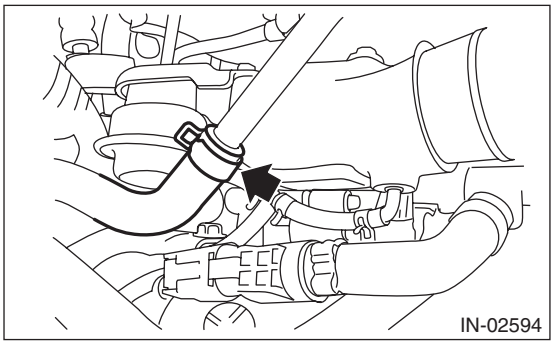


6) Connect the air control hose (A), and install the intake duct to the turbocharger.

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



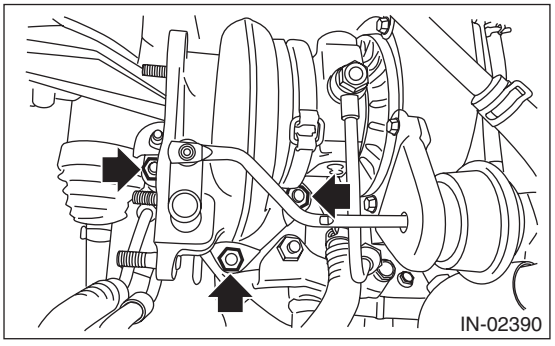
7) Connect the engine coolant hoses to the upper side of the water pipe.



8) Install the joint pipe to turbocharger.

NOTE:
Use a new gasket.

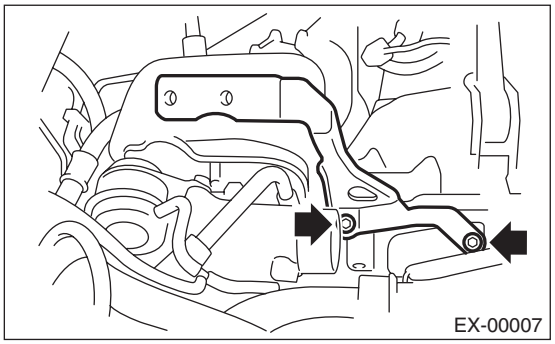
Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



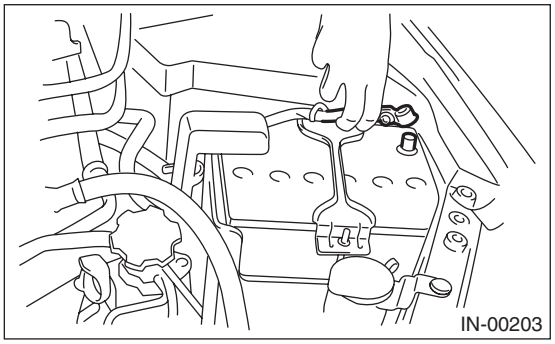
9) Lift up the vehicle.
10) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
11) Lower the vehicle.

12) Install the intercooler stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



13) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
14) Connect the battery ground terminal.

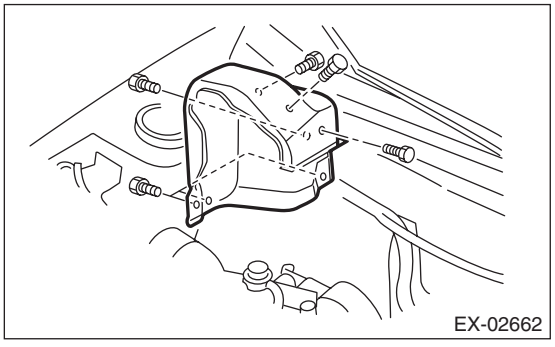


15) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

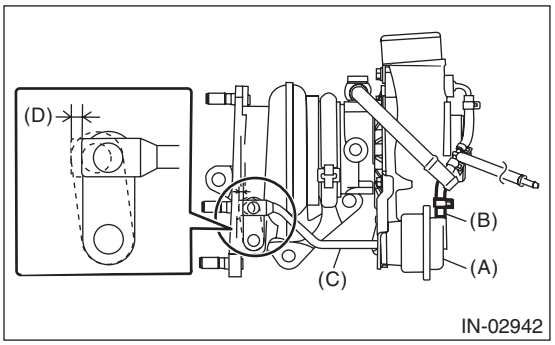
C: INSPECTION

1. WASTE GATE ACTUATOR

1) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
2) Remove the turbocharger upper cover.



3) Remove the boost hose (B) from the waste gate actuator (A) of the turbocharger, and connect the Mighty Vac to the waste gate actuator (A).



(A) Waste gate actuator
(B) Boost hose
(C) Control rod
(D) Control rod stroke

4) Pressurize slowly with the Mighty Vac, and measure the pressure when the control rod stroke (D) becomes 2 mm (0.08 in). If it is not within the standard, replace the turbocharger assembly.

CAUTION:
Do not pressurize over 89.9 kPa (0.92 kgf/cm^2, 13.0 psi) to prevent damaging the waste gate actuator.

Operating pressure (control rod stroke 2 mm (0.08 in)):
Standard
74.7 — 80.8 kPa
(0.76 — 0.82 kgf/cm^2, 10.8 — 11.7 psi)

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

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

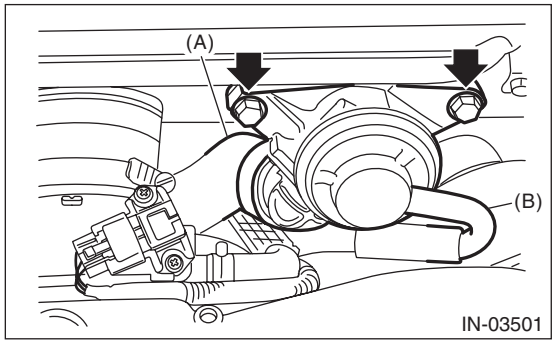
2. OTHER INSPECTIONS

1) Check that the turbocharger, turbocharger stay and pipe have no deformation, cracks or other damages.
2) Check that the hose and intake duct have no cracks, damage or loose part.
3) Check that there are no oil leakage or water leakage from the pipe attachment section.

8. Air By-pass Valve

A: REMOVAL

Remove the air by-pass valve from the intercooler, and then disconnect air by-pass hose (A) and vacuum hose (B) from the air by-pass valve.



B: INSTALLATION

Install in the reverse order of removal.

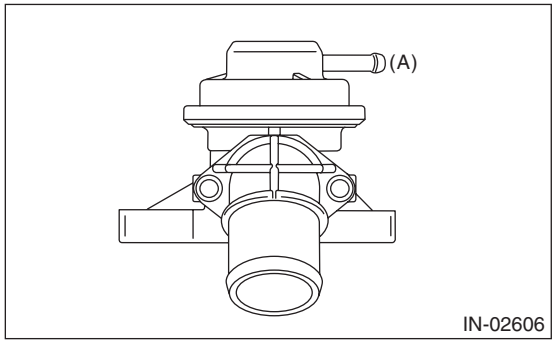
NOTE:
Use a new gasket.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

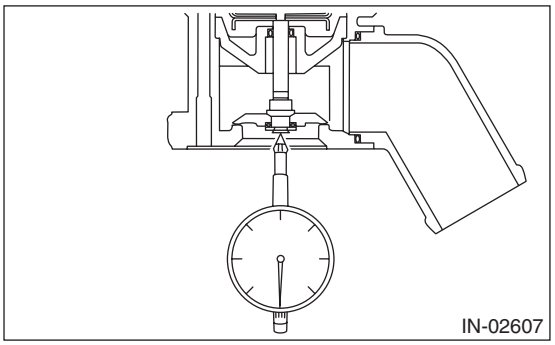
1. AIR BY-PASS VALVE

1) Check that the air by-pass valve has no deformation, cracks or other damages.
2) Connect the Mighty Vac to the nipple (A) of the air by-pass valve.



3) Using the Mighty Vac, generate the vacuum pressure to –93.3 kPa (–0.95 kgf/cm^2, –13.5 psi). Check that the Mighty Vac gauge needle holds 10 seconds without falling by –92.6 kPa (–0.94 kgf/cm^2, –13.4 psi).

4) Set a dial gauge to the end of valve rod of the air by-pass valve.



5) Slowly generate vacuum pressure with the Mighty Vac and check the pressure when the needle of the dial gauge (valve stroke) becomes 0.5 mm (0.02 in). If it is not within the standard, replace the air by-pass valve.

Opening pressure (valve stroke 0.5 mm (0.02 in)):
Standard
–62.7 — –70.7 kPa
(–0.64 — –0.72 kgf/cm^2, –9.09 — –10.3 psi)

6) Increase vacuum pressure more than 5) and check the pressure when the needle of the dial gauge (valve stroke) becomes 7.5 mm (0.3 in). If it is not within the standard, replace the air by-pass valve.

Full open pressure (valve stroke 7.5 mm (0.3 in)):
Standard
–102.7 — –117.3 kPa
(–1.05 — –1.20 kgf/cm^2, –14.9 — –17.0 psi)

2. OTHER INSPECTIONS

Check that the vacuum hose and air by-pass pipe have no cracks, damage or loose part.

9. Resonator Chamber

A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for removal procedure. <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>

B: INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for installation procedure. <Ref. to IN(STI)-8, INSTALLATION, Air Cleaner Case.>

C: INSPECTION

Check that the resonator chamber has no deformation, cracks or other damages.

MECHANICAL

ME(STI)

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1. General Description

A: SPECIFICATION

1. STI MODEL

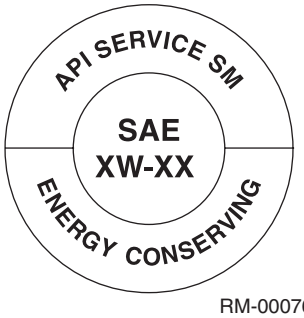
Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth	Inner rotor			9
		Outer rotor			10
	Outer rotor diameter × thickness mm (in)				78 × 11 (3.07 × 0.43)
	Tip clearance between inner and outer rotors mm (in)			Standard	0.04 — 0.14 (0.0016 — 0.0055)
	Case clearance between outer rotor and pump case mm (in)			Standard	0.10 — 0.175 (0.0039 — 0.0069)
	Side clearance between inner rotor and pump case mm (in)			Standard	0.02 — 0.07 (0.0008 — 0.0028)
	Relief valve spring	Free length mm (in)			73.7 (2.902)
		Installed length mm (in)			54.7 (2.154)
		Load when installed N (kgf, lbf)			93.1 (9.49, 20.93)
	Performance (Oil temperature 80°C (176°F))	600 rpm	Discharge pressure kPa (kg/cm^2, psi)		98 (1.0, 14)
			Discharge rate L (US qt, Imp qt)/min.		6.4 (6.8, 5.6) or more
		6,000 rpm	Discharge pressure kPa (kg/cm^2, psi)		392 (4.0, 56.8)
			Discharge rate L (US qt, Imp qt)/min.		63.0 (66.6, 55.4) or more
	Relief valve working pressure kPa (kg/cm^2, psi)				538 (5.5, 78)
Oil filter	Filter type				Full-flow filter type
	Filtration area cm^2 (sq in)	Outer diameter: 68 mm (2.68 in) (Black)			800 (124)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			555 (86)
	By-pass valve opening pressure kPa (kg/cm^2, psi)				160 (1.63, 23.2)
	Outer diameter × width mm (in)	Outer diameter: 68 mm (2.68 in) (Black)			68 × 65 (2.68 × 2.56)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			67.4 × 65.3 (2.65 × 2.57)
	Installation screw specifications				M 20 × 1.5
Oil pressure switch	Type				Immersed contact point type
	Operating voltage — power consumption				12 V — 3.4 W or less
	Warning light operating pressure kPa (kg/cm^2, psi)				14.7 (0.15, 2.1)
	Proof pressure kPa (kg/cm^2, psi)				981 (10, 142) or more
Engine oil	Total capacity (at overhaul) L (US qt, Imp qt)				5.0 (5.3, 4.4)
	When replacing engine oil and oil filter L (US qt, Imp qt)				4.3 (4.5, 3.8)
	When replacing engine oil only L (US qt, Imp qt)				4.0 (4.2, 3.5)

2. EXCEPT FOR STI MODEL

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth	Inner rotor			9
		Outer rotor			10
	Outer rotor diameter × thickness			mm (in)	76 × 10 (2.99 × 0.39)
	Tip clearance between inner and outer rotors		mm (in)	Standard	0.04 — 0.14 (0.0016 — 0.0055)
	Case clearance between outer rotor and pump case		mm (in)	Standard	0.10 — 0.175 (0.0039 — 0.0069)
	Side clearance between inner rotor and pump case		mm (in)	Standard	0.02 — 0.07 (0.0008 — 0.0028)
	Relief valve spring	Free length		mm (in)	73.7 (2.902)
		Installed length		mm (in)	54.7 (2.154)
		Load when installed		N (kgf, lbf)	93.1 (9.49, 20.93)
	Performance (Oil temperature 80°C (176°F))	600 rpm	Discharge pressure	kPa (kg/cm^2, psi)	98 (1.0, 14)
			Discharge rate	L (US qt, Imp qt)/min.	4.6 (4.9, 4.0) or more
		5,000 rpm	Discharge pressure	kPa (kg/cm^2, psi)	294 (3.0, 43)
			Discharge rate	L (US qt, Imp qt)/min.	47.0 (49.7, 41.4) or more
	Relief valve working pressure			kPa (kg/cm^2, psi)	588 (6.0, 85)
Oil filter	Filter type				Full-flow filter type
	Filtration area cm^2 (sq in)	Outer diameter: 68 mm (2.68 in) (Black)			800 (124)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			555 (86)
	By-pass valve opening pressure			kPa (kg/cm^2, psi)	160 (1.63, 23.2)
	Outer diameter × width mm (in)	Outer diameter: 68 mm (2.68 in) (Black)			68 × 65 (2.68 × 2.56)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			67.4 × 65.3 (2.65 × 2.57)
	Installation screw specifications				M 20 × 1.5
Oil pressure switch	Type				Immersed contact point type
	Operating voltage — power consumption				12 V — 3.4 W or less
	Warning light operating pressure			kPa (kg/cm^2, psi)	14.7 (0.15, 2.1)
	Proof pressure			kPa (kg/cm^2, psi)	981 (10, 142) or more
Engine oil	Total capacity (at overhaul)			L (US qt, Imp qt)	5.0 (5.3, 4.4)
	When replacing engine oil and oil filter			L (US qt, Imp qt)	4.2 (4.4, 3.7)
	When replacing engine oil only			L (US qt, Imp qt)	4.0 (4.2, 3.5)

Specified oil:

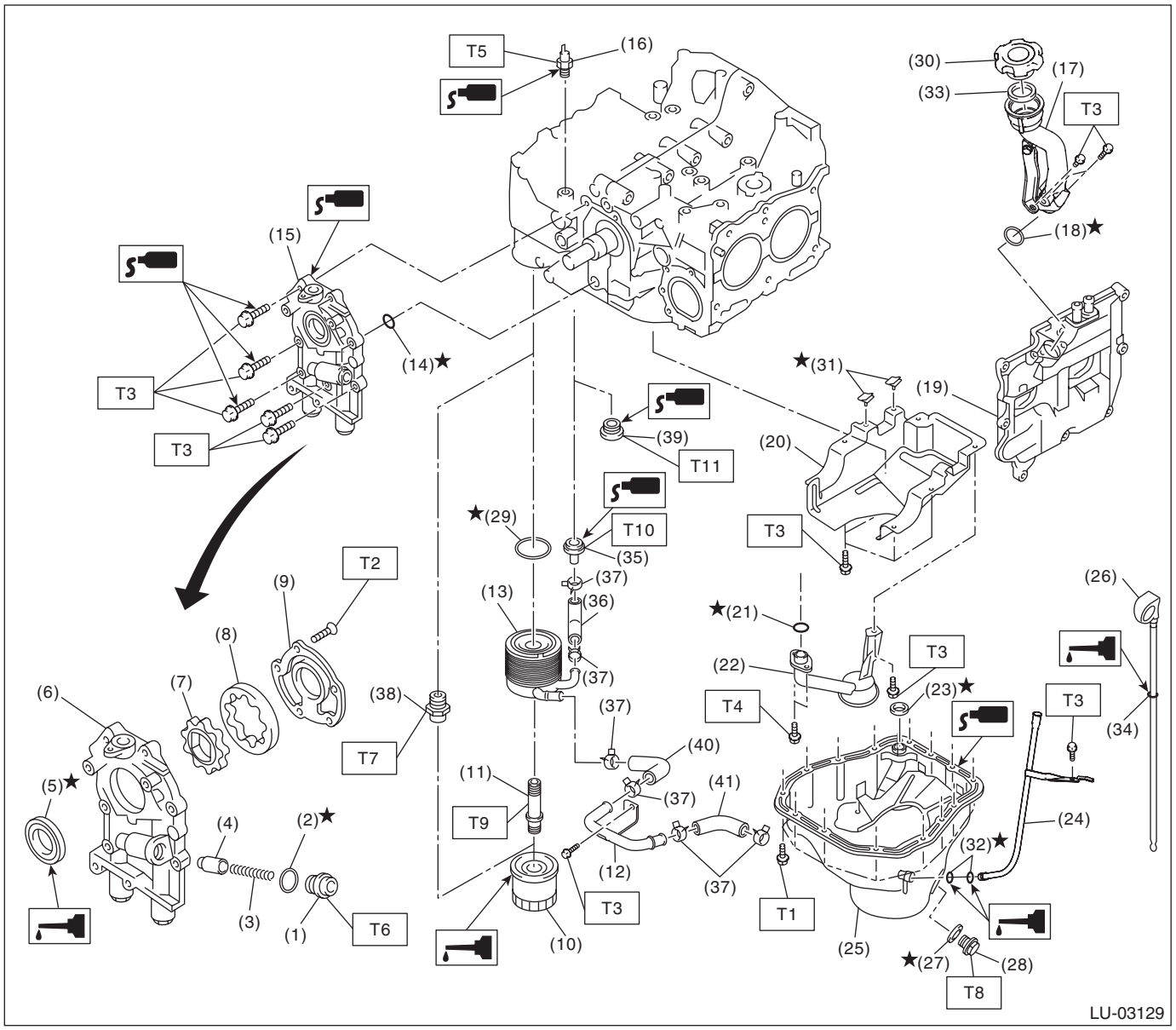
CAUTION:
- **Use 5W-30 (synthetic oil).**
- **It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use the following engine oil specified by Subaru.**

Engine oil standard		SAE viscosity No.
 RM-00076 Those with the API standard SM "Energy Conserving" or SN "Resource Conserving" logo.	or	 RM-00002 Those with the ILSAC standard GF-4 or GF-5 "starburst mark" displayed on top of the container.	5W-30 (synthetic oil)

NOTE:
The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

B: COMPONENT

1. OIL PUMP AND OIL PAN

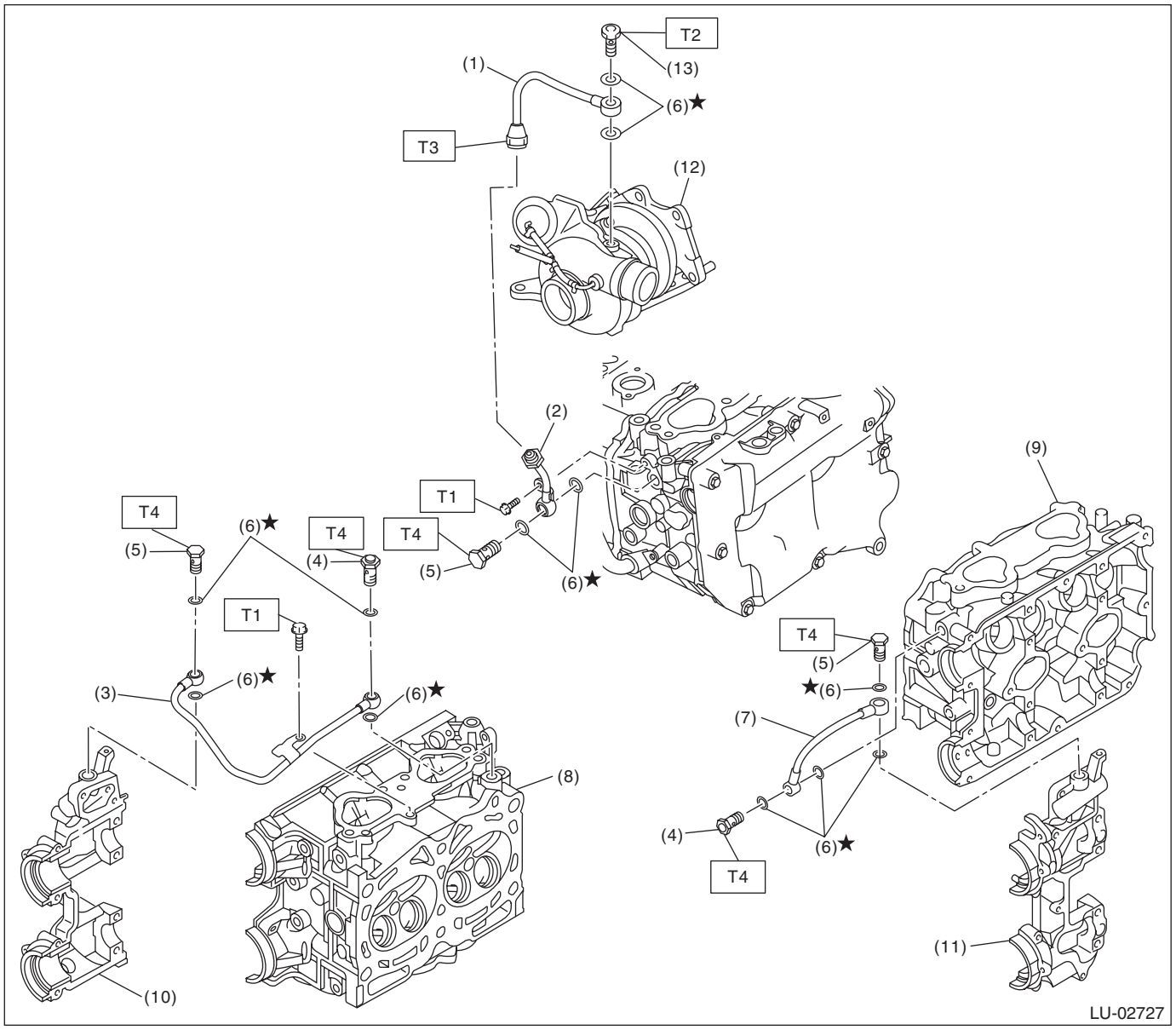


(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Front oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) Oil cooler connector (model with oil cooler)
(12) Oil cooler pipe (model with oil cooler)
(13) Oil cooler (model with oil cooler)
(14) O-ring
(15) Oil pump ASSY
(16) Oil pressure switch
(17) Oil filler duct
(18) O-ring
(19) Rocker cover
(20) Baffle plate
(21) O-ring
(22) Oil strainer
(23) Gasket
(24) Oil level gauge guide
(25) Oil pan
(26) Oil level gauge
(27) Drain plug gasket
(28) Drain plug
(29) Gasket (model with oil cooler)
(30) Oil filler cap
(31) Seal
(32) O-ring
(33) Gasket
(34) O-ring
(35) Nipple (model with oil cooler)
(36) Oil cooler hose A (model with oil cooler)
(37) Clip (model with oil cooler)
(38) Oil filter connector (model without oil cooler)
(39) Plug (model without oil cooler)
(40) Oil cooler hose B (model with oil cooler)
(41) Oil cooler hose C (model with oil cooler)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.7)
T2: 5.4 (0.6, 4.0)
T3: 6.4 (0.7, 4.7)
T4: 10 (1.0, 7.0)
T5: 25 (2.5, 18.4)
T6: 44 (4.5, 32.5)
T7: 45 (4.6, 33.2)
T8: 46.5 (4.7, 34.3)
T9: 54 (5.5, 39.8)
T10: 69 (7.0, 50.9)
T11: 70 (7.1, 51.6)

2. OIL PIPE



(1)	Oil inlet pipe	(8)	Cylinder head RH
(2)	Turbocharger oil pipe	(9)	Cylinder head LH
(3)	Oil pipe RH	(10)	Front camshaft cap RH
(4)	Union bolt with filter (with protrusion)	(11)	Front camshaft cap LH
(5)	Union bolt without filter (without protrusion)	(12)	Turbocharger
(6)	Gasket	(13)	Union bolt without filter (with protrusion)
(7)	Oil pipe LH		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)

T2: 16 (1.6, 11.8)

T3: 20 (2.0, 14.8)

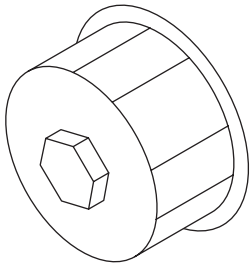
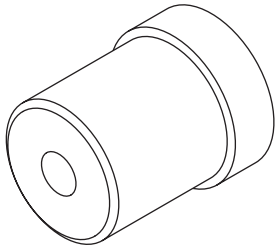
T4: 29 (3.0, 21.4)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
- Follow all government and local regulations concerning disposal of refuse when disposing of oil.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter (black). (Outer diameter: 68 mm (2.68 in))
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil seal into oil pump.

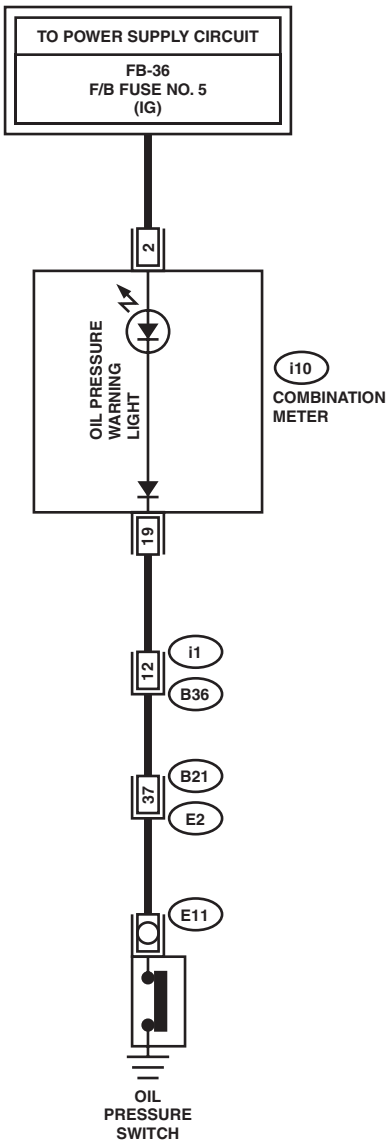
2. GENERAL TOOL

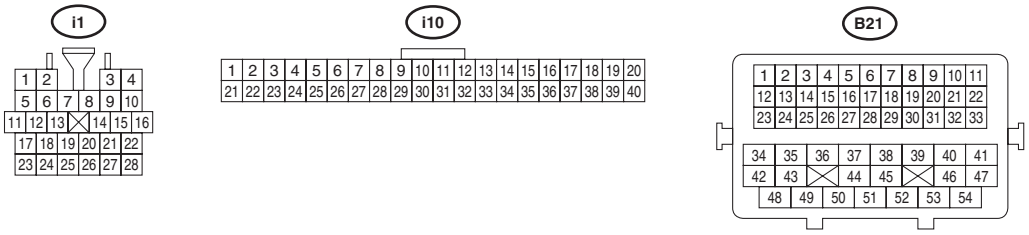
TOOL NAME	REMARKS
Oil filter wrench (65/67 mm 14 Flutes)	Used for removing and installing oil filter (blue). (Outer diameter: 67.4 mm (2.65 in))
Circuit tester	Used for measuring resistance and voltage.

2. Oil Pressure System

A: WIRING DIAGRAM

Oil pressure warning system <Ref. to WI-150, WIRING DIAGRAM, Oil Pressure Warning Light System.>





LU-03150

B: INSPECTION

Step		Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON (engine OFF). 2) Check other warning lights.	Does the warning light illuminate?	Go to step **2**.	Repair or replace the combination meter. <Ref. to IDI-5, INSPECTION, Combination Meter System.>
2	**CHECK POWER SUPPLY TO OIL PRESSURE SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage between oil pressure switch harness connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(STI)-22, Oil Pressure Switch.>	Go to step **3**.
3	**CHECK COMBINATION METER.** 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. ***Terminals*** ***No. 2 — No. 19:***	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between combination meter and oil pressure switch • Poor contact of combination meter connector • Poor contact of oil pressure switch connector • Poor contact of coupling connector	Repair or replace the combination meter. <Ref. to IDI-5, INSPECTION, Combination Meter System.>

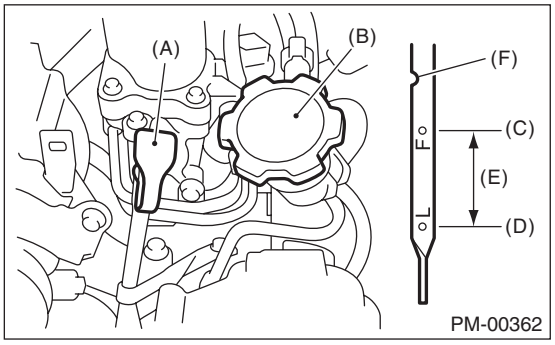
3. Engine Oil

A: INSPECTION

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Park the vehicle on a level surface.
2) Remove the oil level gauge and wipe away the oil.
3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
4) Pull out the oil level gauge again, and check the oil level. If the engine oil level is below "L" line, make sure that there is no oil leakage from the engine, then add oil to raise the level up to the "F" line.
5) Start the engine, and spread the oil in engine room.
6) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.

NOTE:
• Just after driving or while the engine is warm, engine oil level shows in the range between the "F" line and the notch mark. This is caused by thermal expansion of engine oil.
• To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
• As the oil level gauge is used for daily maintenance, "F" line and "L" line is set assuming that the engine is cold.



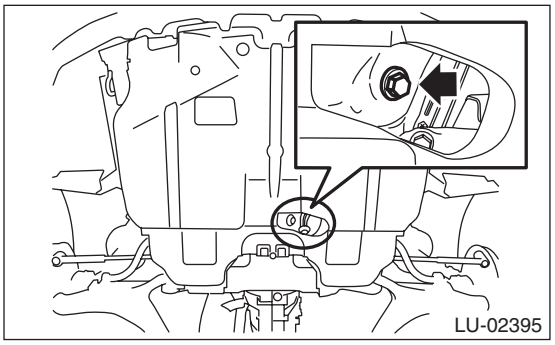
(A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

B: REPLACEMENT

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Open the engine oil filler cap for quick draining of engine oil.
2) Lift up the vehicle.
3) Drain engine oil by loosening the engine oil drain plug.

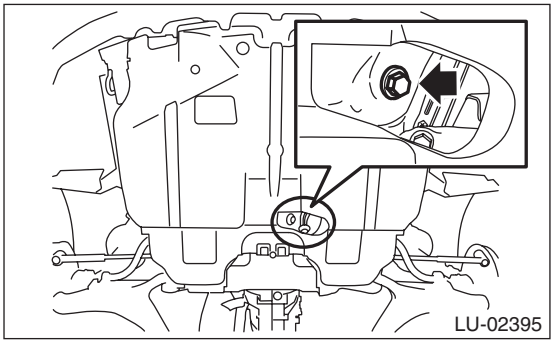
NOTE:
Prepare the container for draining of engine oil.



4) Tighten the engine oil drain plug after draining engine oil.

NOTE:
Use a new drain plug gasket.

Tightening torque:
46.5 N·m (4.7 kgf-m, 34.3 ft-lb)

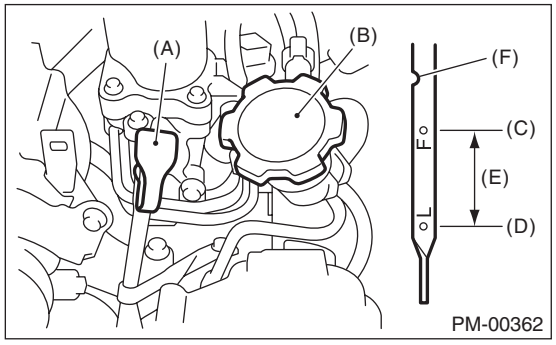


5) Lower the vehicle.
6) Using engine oil of proper quality and viscosity, fill engine oil through the filler duct to the "F" line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

Recommended oil:
Refer to "SPECIFICATION" for recommended oil. <Ref. to LU(STI)-2, SPECIFICATION, General Description.>

Engine oil capacity:
Refer to "SPECIFICATION" for engine oil capacity. <Ref. to LU(STI)-2, SPECIFICATION, General Description.>

7) Close the engine oil filler cap.
8) Start the engine to circulate the oil in engine.
9) After stopping the engine, recheck the oil level. If necessary, add engine oil up to the “F” line on oil level gauge.

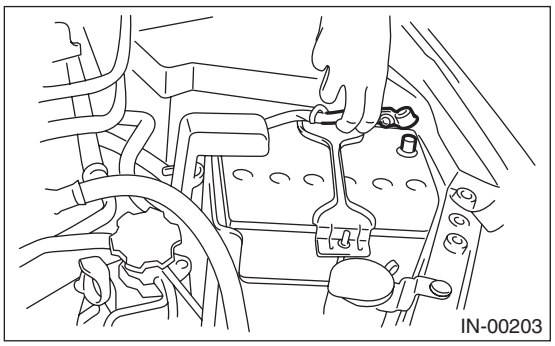


(A) Oil level gauge
(B) Engine oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

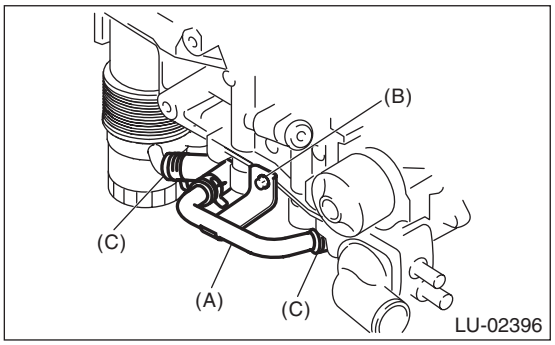
4. Oil Pump

A: REMOVAL

1) Disconnect the ground cable from battery.

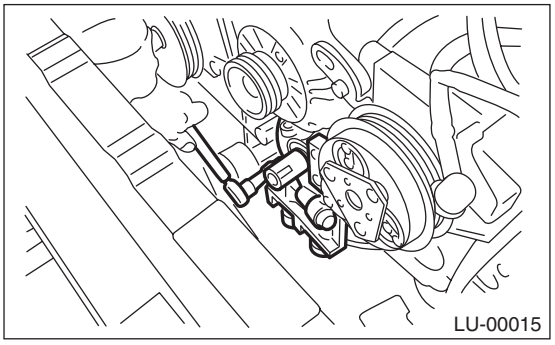


2) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.> <Ref. to CO(w/o STI)-19, REMOVAL, Radiator.>
3) Lift up the vehicle.
4) Remove the bolt (B) which secures oil cooler pipe (A) to oil pump. (Model with oil cooler)
5) Remove the oil cooler pipe (A) and hose (C). (Model with oil cooler)



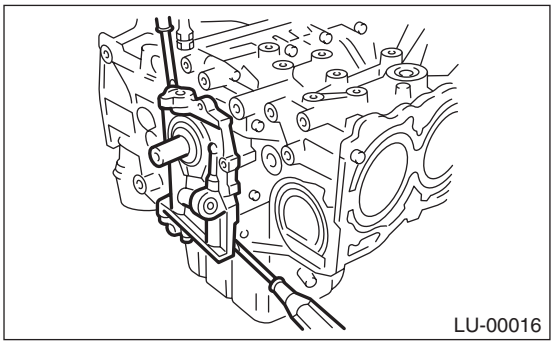
6) Lower the vehicle.
7) Remove the crankshaft position sensor.
<Ref. to FU(STI)-35, REMOVAL, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, REMOVAL, Crankshaft Position Sensor.>
8) Remove the water pump. <Ref. to CO(STI)-15, REMOVAL, Water Pump.> <Ref. to CO(w/o STI)-15, REMOVAL, Water Pump.>
9) Remove the crank sprocket. <Ref. to ME(STI)-60, REMOVAL, Crank Sprocket.> <Ref. to ME(w/o STI)-58, REMOVAL, Crank Sprocket.>
10) Remove the bolts which install oil pump onto cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



11) Remove the oil pump by using flat tip screwdriver.

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

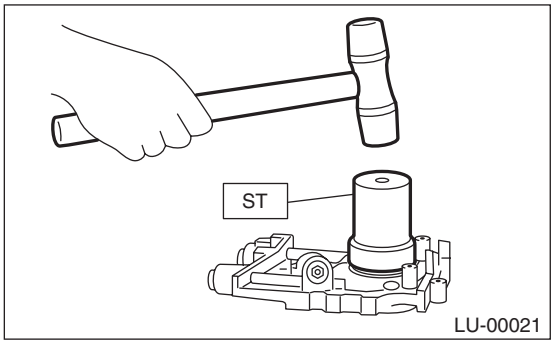


12) Remove the front oil seal from the oil pump.

B: INSTALLATION

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

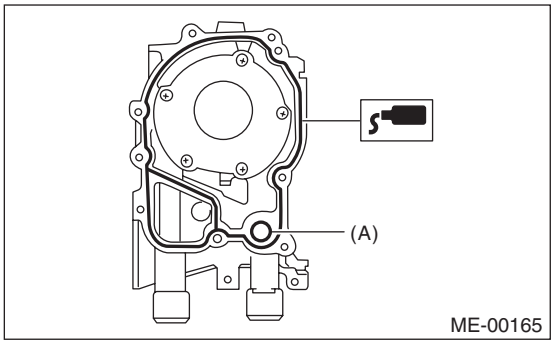
NOTE:
Use a new front oil seal.



2) Apply liquid gasket to the mating surfaces of oil pump.

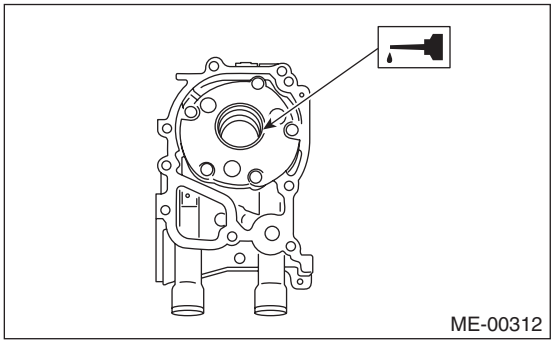
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

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



4) Install the oil pump to cylinder block.

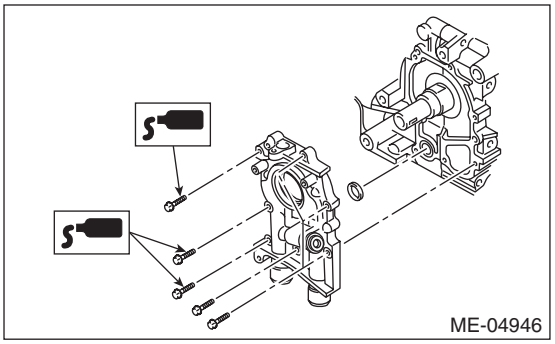
CAUTION:
• Be careful not to damage the front oil seal during installation.
• Make sure the front oil seal lip is not folded.

NOTE:
• Align the flat surface of oil pump's inner rotor with that of crankshaft before installation.
• Use new O-rings.
• Do not forget to install O-rings.

5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

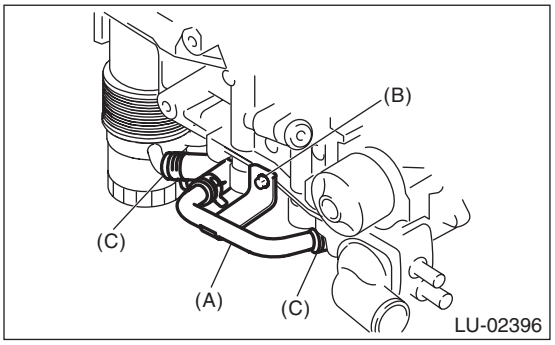
Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



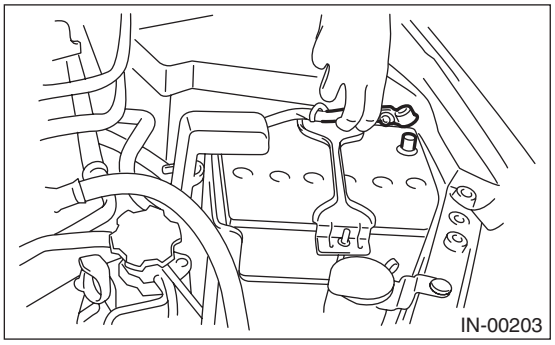
6) Install the crank sprocket. <Ref. to ME(STI)-60, INSTALLATION, Crank Sprocket.> <Ref. to ME(w/o STI)-58, INSTALLATION, Crank Sprocket.>
7) Install the water pump. <Ref. to CO(STI)-15, INSTALLATION, Water Pump.> <Ref. to CO(w/o STI)-15, INSTALLATION, Water Pump.>
8) Install the crankshaft position sensor. <Ref. to FU(STI)-35, INSTALLATION, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, INSTALLATION, Crankshaft Position Sensor.>
9) Lift up the vehicle.
10) Install oil cooler pipe (A) and hose (C). (Model with oil cooler)
11) Install the oil cooler pipe (A) to oil pump using the bolts (B). (Model with oil cooler)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Lower the vehicle.
13) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.> <Ref. to CO(w/o STI)-20, INSTALLATION, Radiator.>

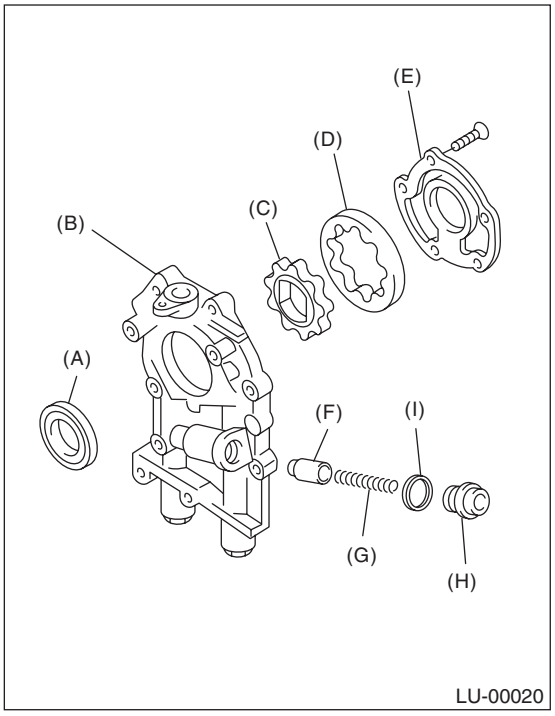
14) Connect the battery ground terminal.



C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner rotor and outer rotor so that they can be replaced in their original positions during reassembly.

NOTE:
Before disassembling the oil pump, remove the relief valve.

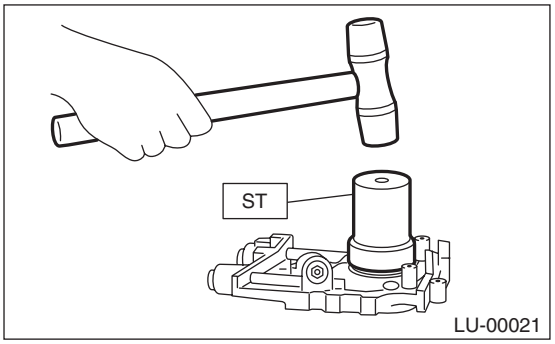


(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

NOTE:
Use a new front oil seal.

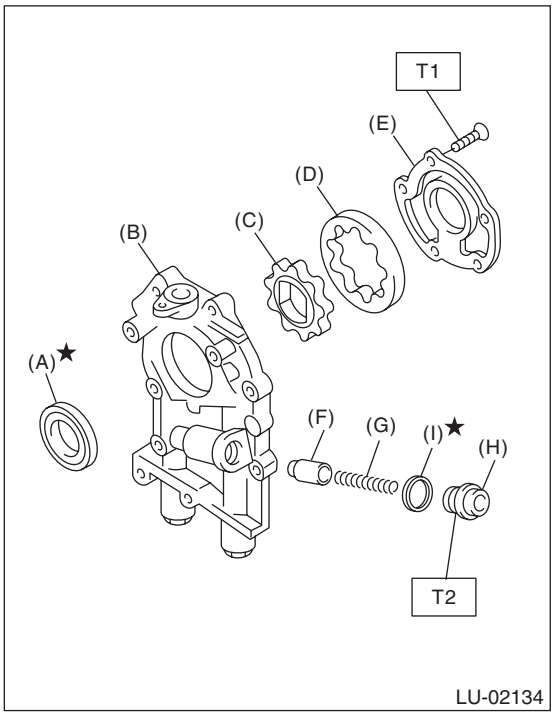


2) Apply a coat of engine oil to the inner rotor and outer rotor.
3) Install the inner rotor and outer rotor.
4) Assemble the oil relief valve and install relief valve spring and plug.

NOTE:
Use a new gasket.

5) Install the oil pump cover.

Tightening torque:
T1: 5.4 N·m (0.6 kgf-m, 4.0 ft-lb)
T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)



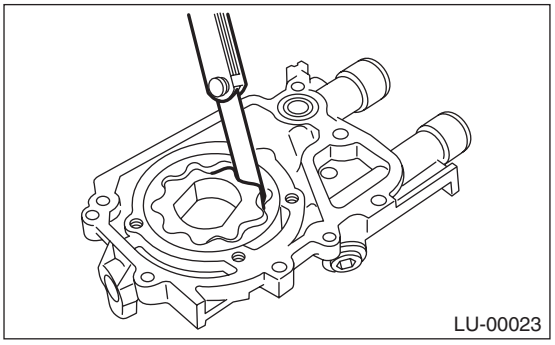
(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

E: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance is out of standard, replace the rotors as a set.

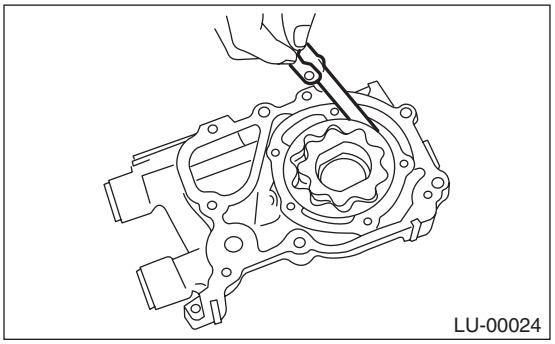
Tip clearance between inner and outer rotors:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)



2. CASE CLEARANCE

Measure the clearance between outer rotor and oil pump case. If clearance exceeds the standard, replace the oil pump case.

Case clearance between outer rotor and pump case:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)



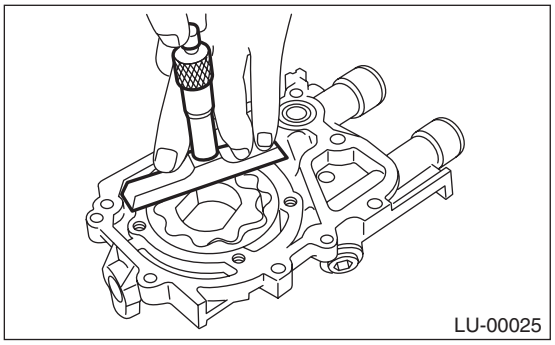
3. SIDE CLEARANCE

Measure the gap between the inner rotor and the oil pump case to measure the clearance between the inner rotor and the oil pump cover as shown in the figure. If clearance is out of standard, replace the rotor or the oil pump case.

Side clearance between inner rotor and pump case:

Standard

0.02 — 0.07 mm (0.0008 — 0.0028 in)



4. OIL RELIEF VALVE

Check the valve for assembly condition and damage, and the relief valve spring for damage and deterioration.
Replace the parts if defective.

Relief valve spring:

Free length

73.7 mm (2.902 in)

Installed length

54.7 mm (2.154 in)

Load when installed

93.1 N (9.49 kgf, 20.93 lbf)

5. OIL PUMP CASE

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

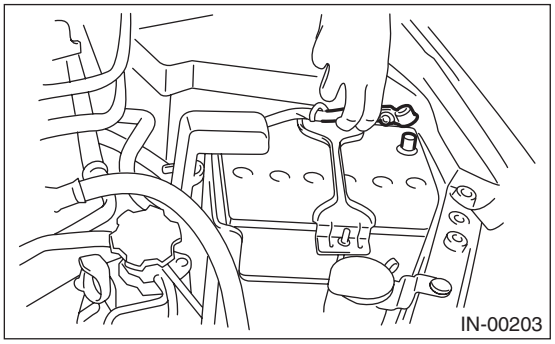
6. FRONT OIL SEAL

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

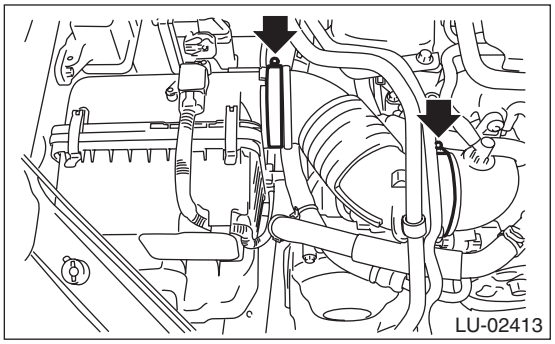
5. Oil Pan and Strainer

A: REMOVAL

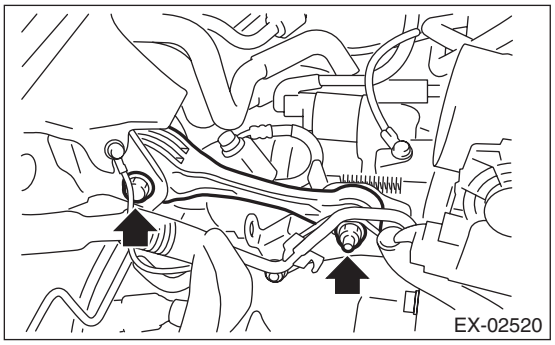
1) Disconnect the ground cable from battery.



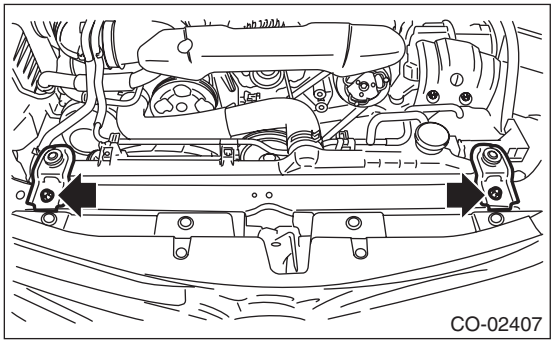
2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
3) Remove the air intake boot.



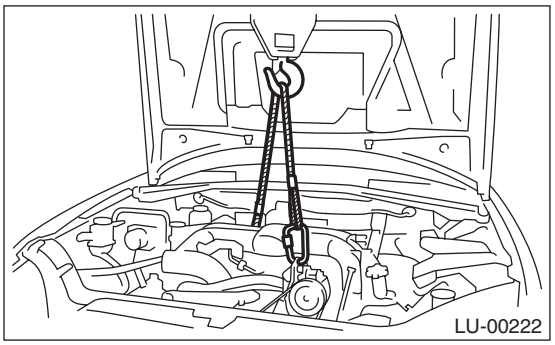
4) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
5) Remove the pitching stopper.



6) Remove the radiator upper brackets.



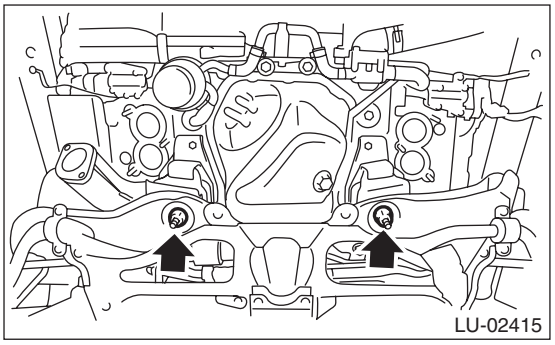
7) Support the engine with a lifting device and wire ropes.



8) Lift up the vehicle.

CAUTION:
When lifting up the vehicle, raise up wire ropes at the same time.

9) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
10) Drain the engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.>
11) Remove the front exhaust pipe. <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
12) Remove the nuts which secure the engine mounting to the front crossmember.

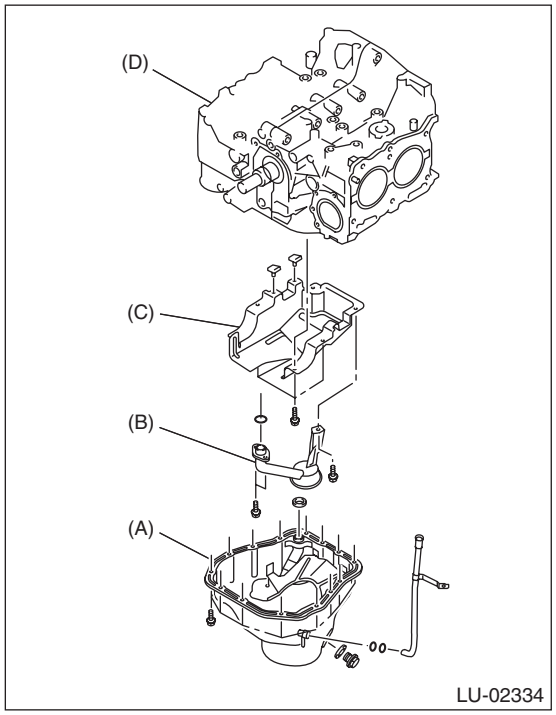


13) Remove the bolts which secure oil pan on cylinder block with the engine raised up.
14) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

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

15) Remove the oil strainer.

16) Remove the baffle plate.

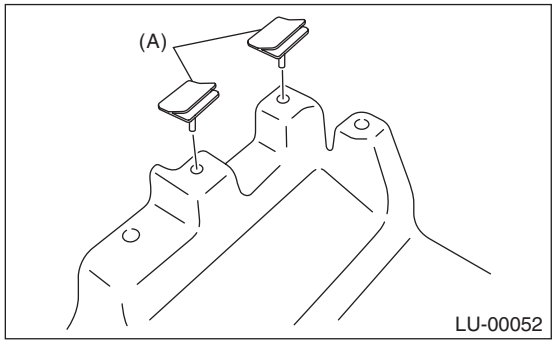


(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

B: INSTALLATION

NOTE:
Before installing the oil pan, clean the mating surface of oil pan and engine block.
1) Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.

NOTE:
Use a new seal.



2) Install the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

3) Install the oil strainer to cylinder block.

NOTE:
Use new O-rings.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

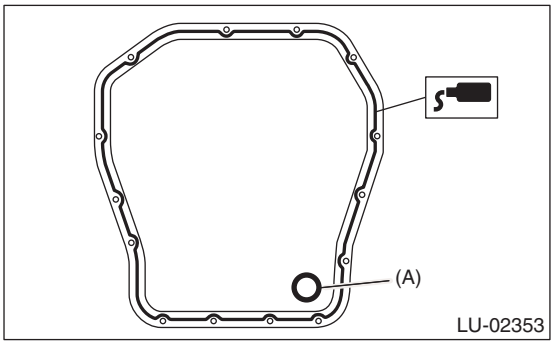
4) Tighten the oil strainer stay together with the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

5) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
- Use a new gasket.
- Install within 5 min. after applying liquid gasket.

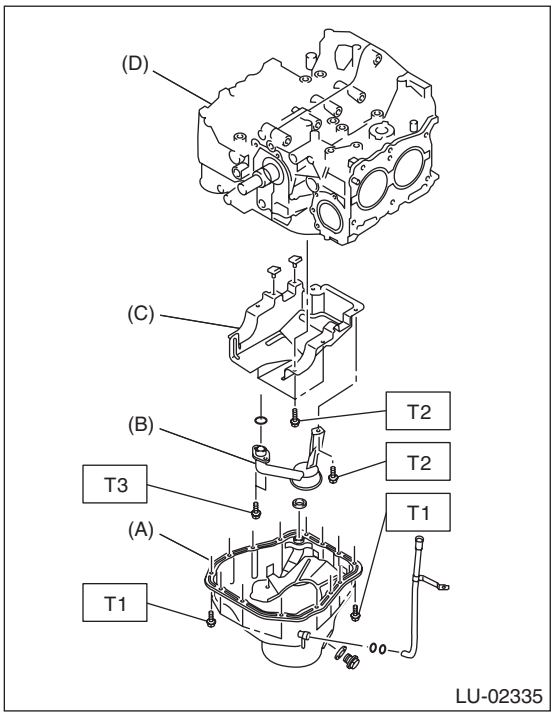
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) Gasket

6) Tighten the bolts which install oil pan to cylinder block.

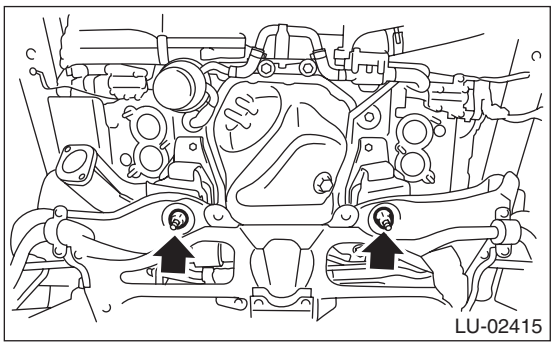
Tightening torque:
T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T3: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

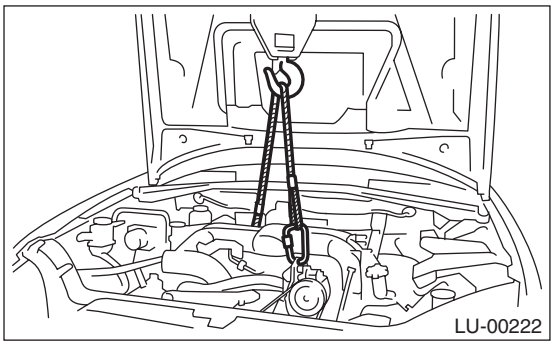
7) Lower the engine onto front crossmember.
8) Install the nuts which hold the engine mounting to the front crossmember.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)



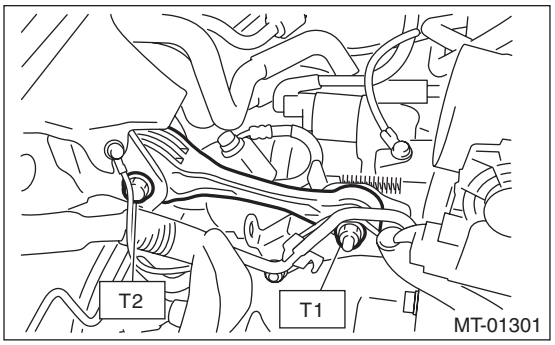
9) Install the front exhaust pipe. <Ref. to EX(STI)-6, INSTALLATION, Front Exhaust Pipe.>
10) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
11) Lower the vehicle.

CAUTION:
When lowering the vehicle, lower the lift up device and wire ropes at the same time.
12) Remove the lifting device and wire ropes.



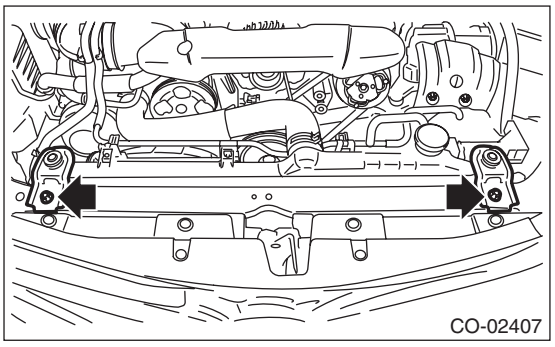
13) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



14) Install the radiator upper brackets.

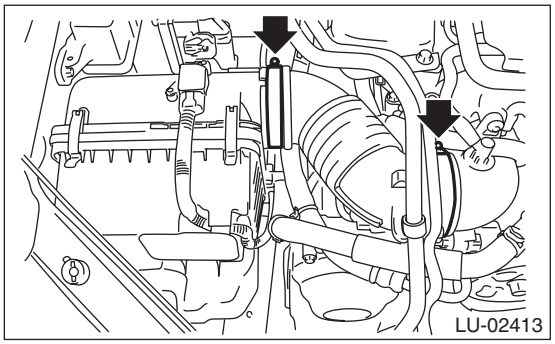
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



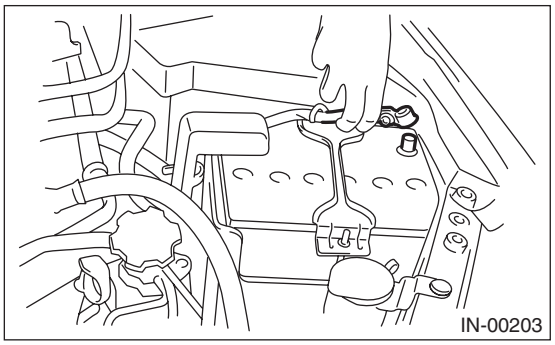
15) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>

16) Install the air intake boot.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



17) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.> <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
18) Connect the battery ground terminal.



19) Refill the engine oil. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

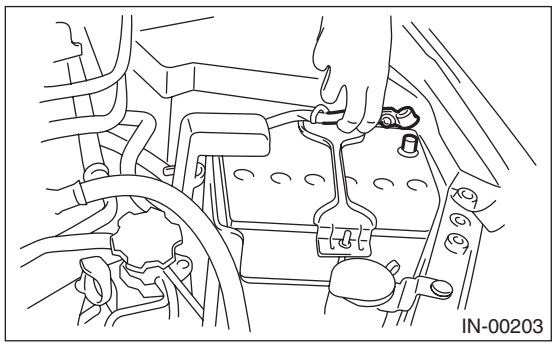
C: INSPECTION

Check that the oil pan, oil strainer and baffle plate do not have deformation, cracks or damage.

6. Oil Pressure Switch

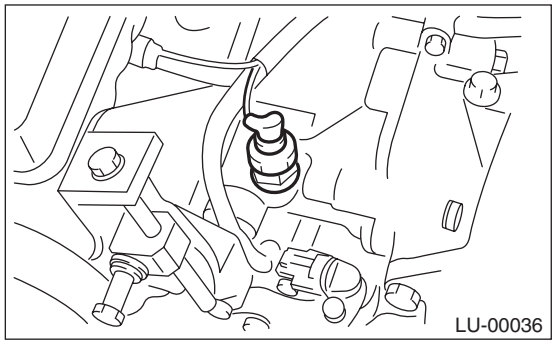
A: REMOVAL

1) Disconnect the ground cable from battery.

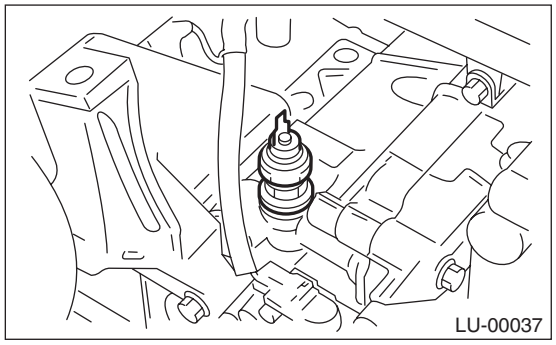


2) Remove the generator from the bracket. <Ref. to SC(STI)-21, REMOVAL, Generator.>

3) Disconnect the terminal from oil pressure switch.



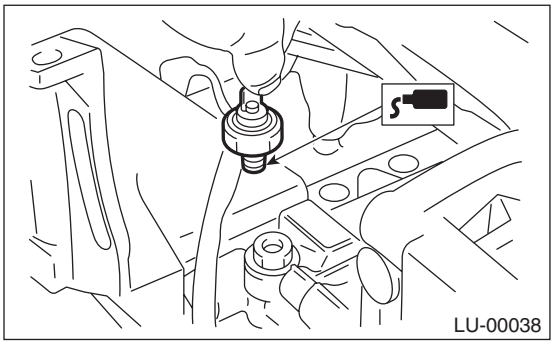
4) Remove the oil pressure switch.



B: INSTALLATION

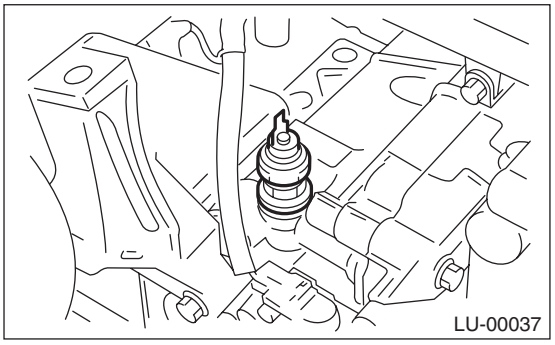
1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

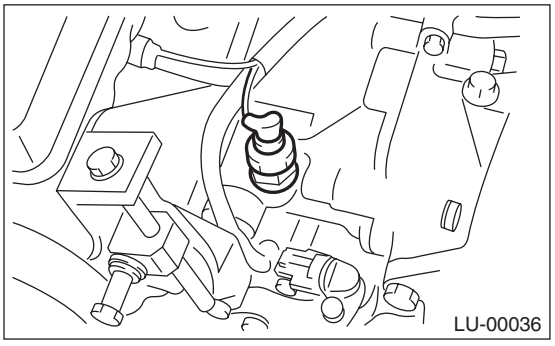


2) Install the oil pressure switch to cylinder block.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

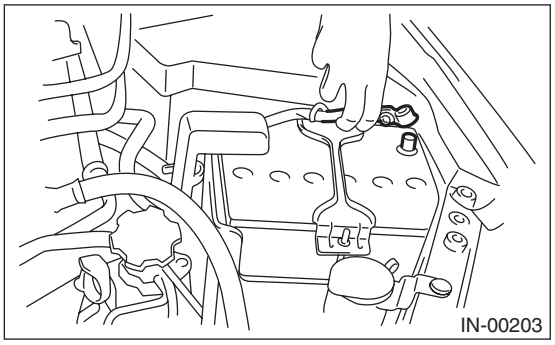


3) Connect the terminal to the oil pressure switch.



4) Install the generator to the bracket. <Ref. to SC(STI)-21, INSTALLATION, Generator.>

5) Connect the ground cable to battery.



C: INSPECTION

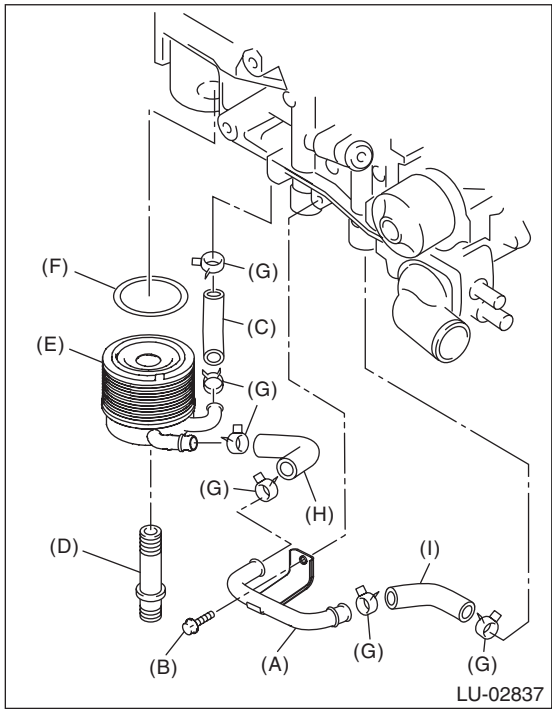
1) Check that the oil pressure switch does not have deformation, cracks or damage.
2) Check that there are no oil leaks or oil oozing from the oil pressure switch installation portion.

7. Engine Oil Cooler

A: REMOVAL

CAUTION:
If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

NOTE:
STI model is equipped with engine oil cooler.
1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Remove the engine oil filter. <Ref. to LU(STI)-31, REMOVAL, Engine Oil Filter.>
5) Remove the bolt (B) holding the oil cooler pipe (A) to the oil pump.
6) Remove the oil cooler pipe (A), oil cooler hose A (C), oil cooler hose B (H), and oil cooler hose C (I).
7) Remove the oil cooler connector (D) and oil cooler (E).



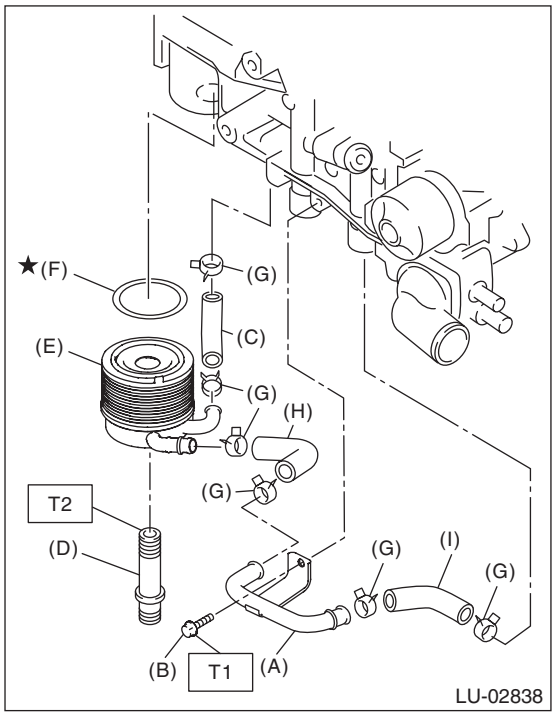
(A) Oil cooler pipe
(B) Bolt
(C) Oil cooler hose A
(D) Oil cooler connector
(E) Oil cooler
(F) Gasket
(G) Clip
(H) Oil cooler hose B
(I) Oil cooler hose C

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
- Use a new gasket.
- After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 54 N·m (5.5 kgf-m, 39.8 ft-lb)



(A) Oil cooler pipe
(B) Bolt
(C) Oil cooler hose A
(D) Oil cooler connector
(E) Oil cooler
(F) Gasket
(G) Clip
(H) Oil cooler hose B
(I) Oil cooler hose C

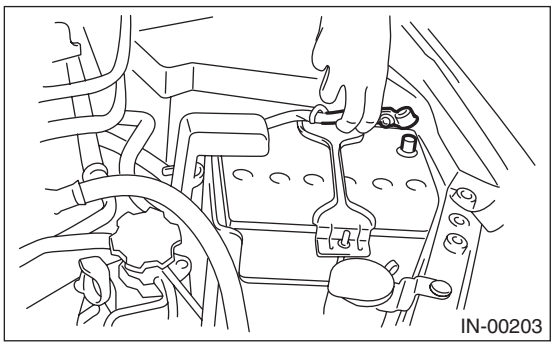
C: INSPECTION

1) Check that the engine oil cooler, oil cooler pipe and oil cooler connector do not have deformation, cracks or damage.
2) Make sure the oil cooler hoses are not cracked, damaged or loose.
3) Blow with compressed air to make sure the coolant passages are not clogged.
4) Make sure the mating surfaces of the cylinder block do not have damage.

8. Oil Pipe

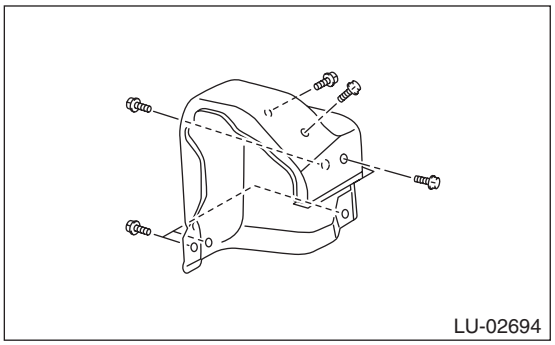
A: REMOVAL

1) Disconnect the ground cable from battery.



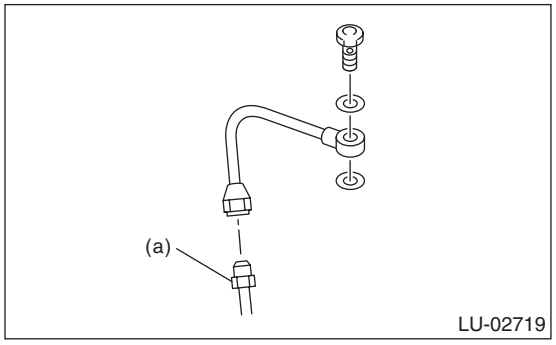
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>

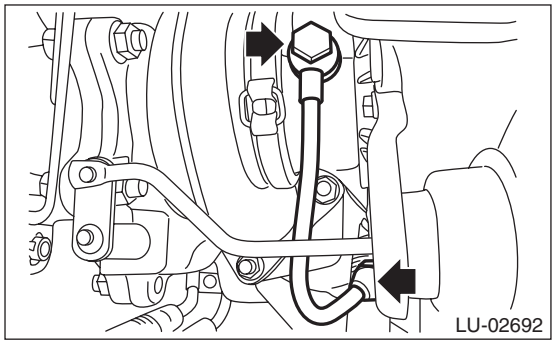
3) Remove the turbocharger upper cover.



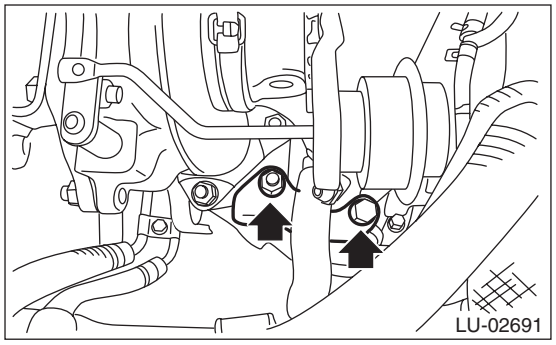
4) Remove the oil inlet pipe from the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when loosing the oil inlet pipe flare nut, and avoid the part from rotating together while loosening the nut.

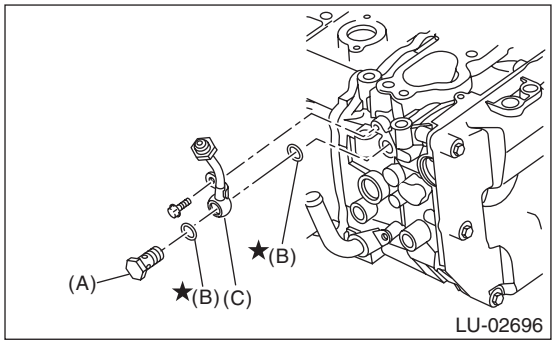




5) Remove the turbocharger stay.



6) Remove the turbocharger oil pipe.

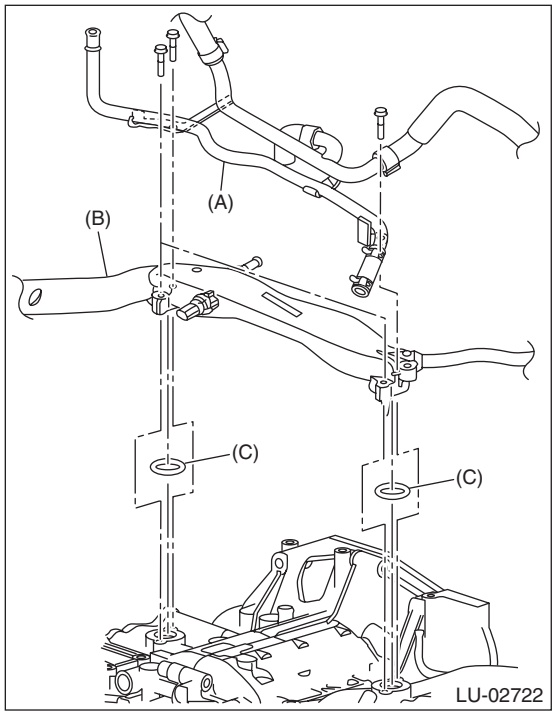


(A) Union bolt without filter (without protrusion)
(B) Gasket
(C) Turbocharger oil pipe

7) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.> <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
8) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.> <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
9) Remove the secondary air pump. (Oil pipe LH only) <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.> <Ref. to EC(w/o STI)-29, REMOVAL, Secondary Air Pump.>
10) Remove the blow-by pipe and water pipe assembly. (Oil pipe RH only)

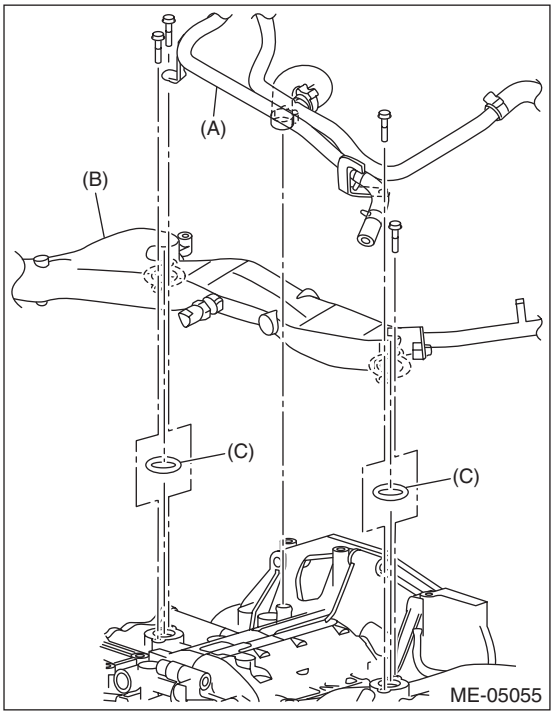
NOTE:
Do not remove the vacuum hose, radiator inlet hose, and heater outlet hose.

- STI model



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

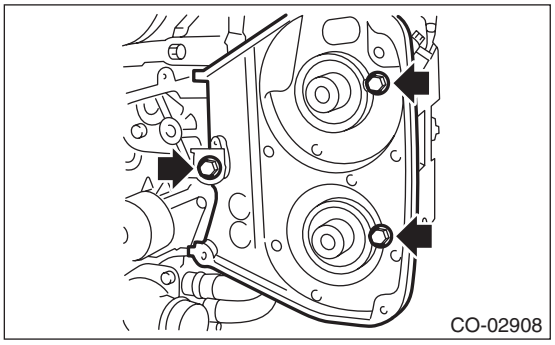
- Except for STI model



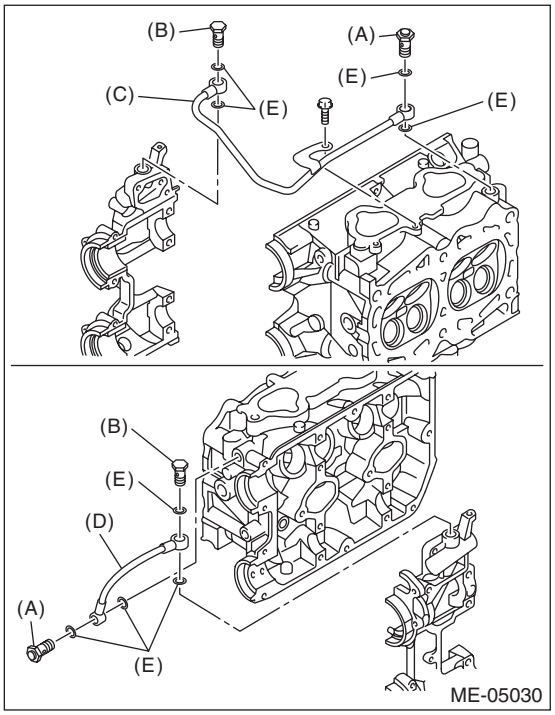
(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

11) Remove the radiator main fan and radiator sub fan. <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
12) Remove the V-belts. <Ref. to ME(STI)-40, REMOVAL, V-belt.> <Ref. to ME(w/o STI)-38, REMOVAL, V-belt.>
13) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.> <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
14) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
15) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.> <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
16) Remove the cam sprocket LH. <Ref. to ME(STI)-59, REMOVAL, Cam Sprocket.> <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>

17) Remove the timing belt cover No. 2 LH.



18) Remove the oil pipe.



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

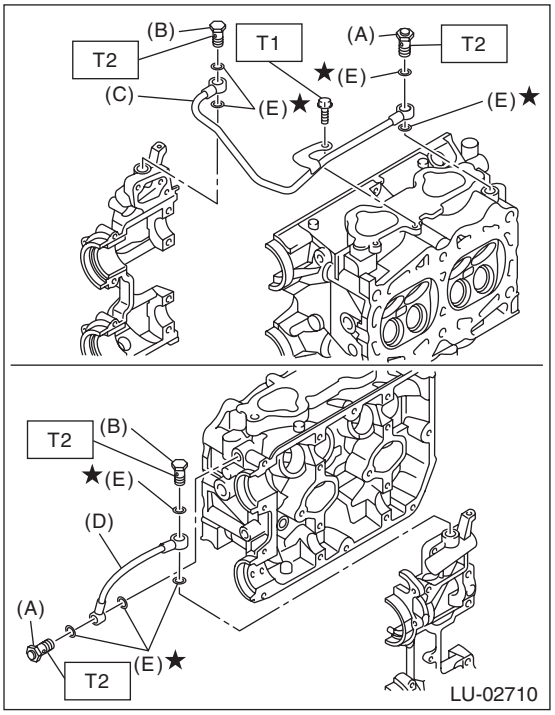
B: INSTALLATION

1) Inspect the union bolt with filter. <Ref. to LU(STI)-30, INSPECTING UNION BOLT WITH FILTER, INSPECTION, Oil Pipe.>

2) Install the oil pipe.

NOTE:
- Be careful of the install location of the union bolt; the location will differ depending on the presence of filter.
- Use a new gasket.

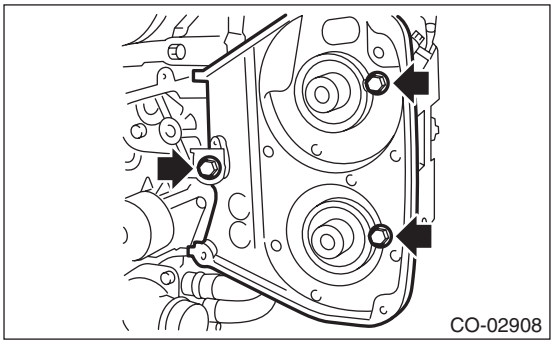
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

3) Install the timing belt cover No. 2 LH.

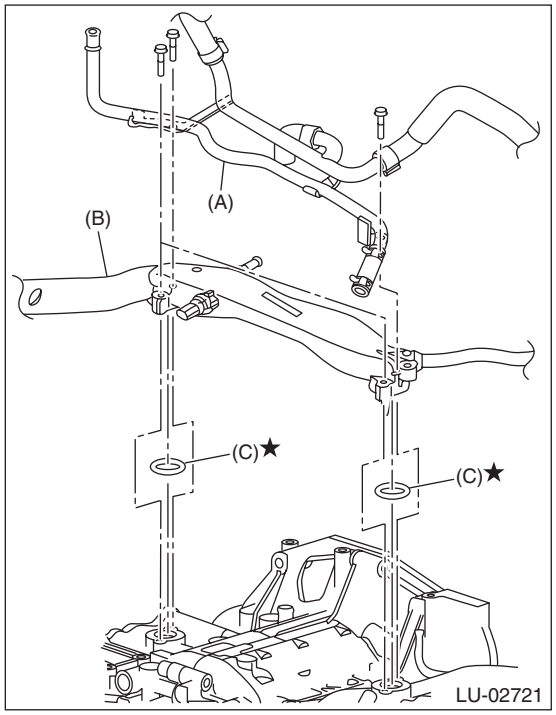
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



4) Install the cam sprocket LH. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.> <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
5) Install the timing belt. <Ref. to ME(STI)-53, TIMING BELT, INSTALLATION, Timing Belt.> <Ref. to ME(w/o STI)-51, TIMING BELT, INSTALLATION, Timing Belt.>
6) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
7) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.> <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
8) Install the V-belts. <Ref. to ME(STI)-40, INSTALLATION, V-belt.> <Ref. to ME(w/o STI)-38, INSTALLATION, V-belt.>
9) Install the radiator main fan and the radiator sub fan. <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
10) Install the blow-by pipe and water pipe assembly. (Oil pipe RH only)

- STI model

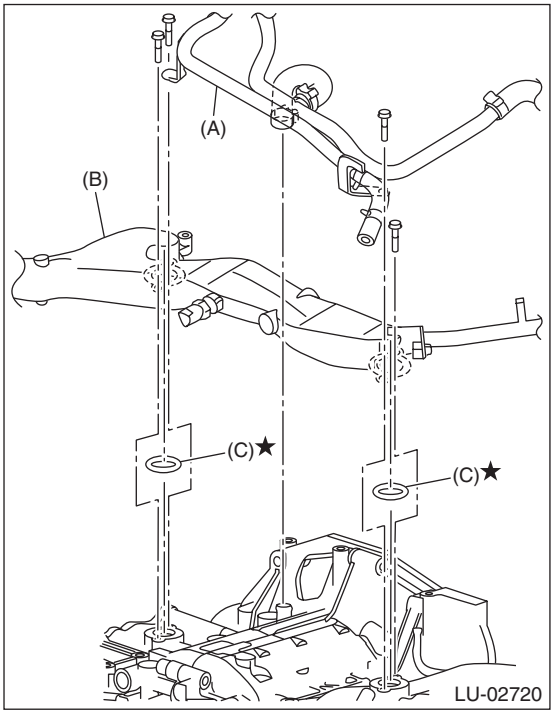
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

- Except for STI model

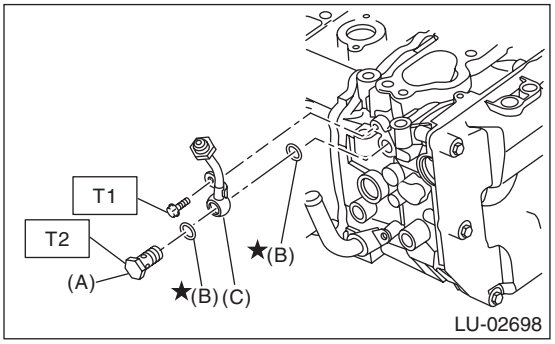
Tightening torque:
6.5 N·m (0.7 kgf-m, 4.8 ft-lb)



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

11) Install the secondary air pump. (Oil pipe LH only) <Ref. to EC(STI)-27, INSTALLATION, Secondary Air Pump.> <Ref. to EC(w/o STI)-29, INSTALLATION, Secondary Air Pump.>
12) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.> <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
13) Install the turbocharger oil pipe.

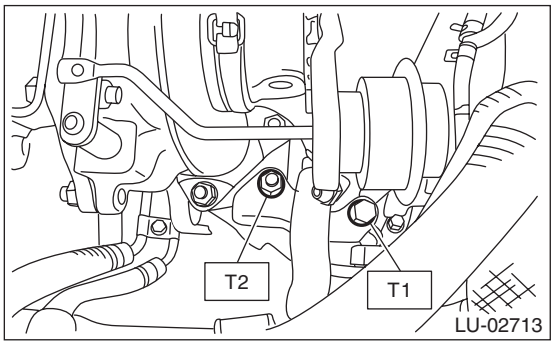
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt without filter (without protrusion)
(B) Gasket
(C) Turbocharger oil pipe

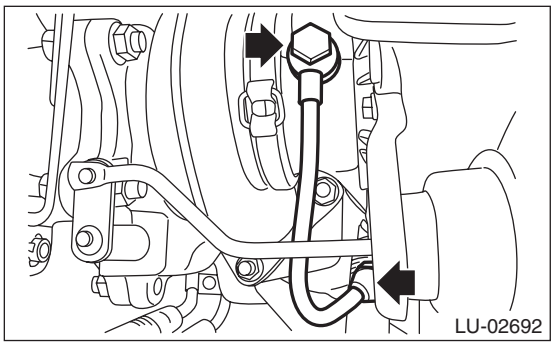
14) Install the turbocharger stay.

Tightening torque:
T1: 33 N·m (3.4 kgf-m, 24.3 ft-lb)
T2: 42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



15) Temporarily tighten the bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

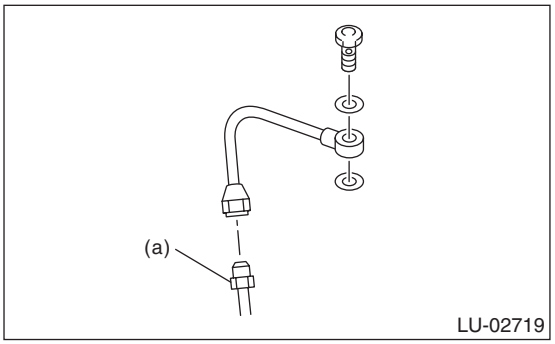
NOTE:
Use a new gasket.

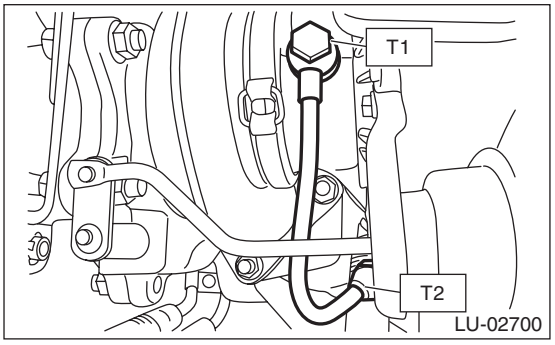


16) Tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when tightening the oil inlet pipe flare nut, and avoid the part from rotating together while tightening the nut.

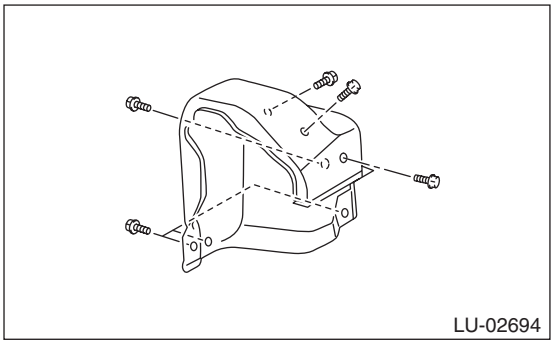
Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)





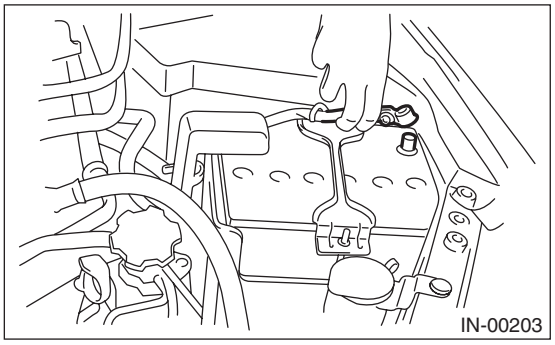
17) Attach the turbocharger upper cover.

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



18) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>

19) Connect the battery ground terminal.

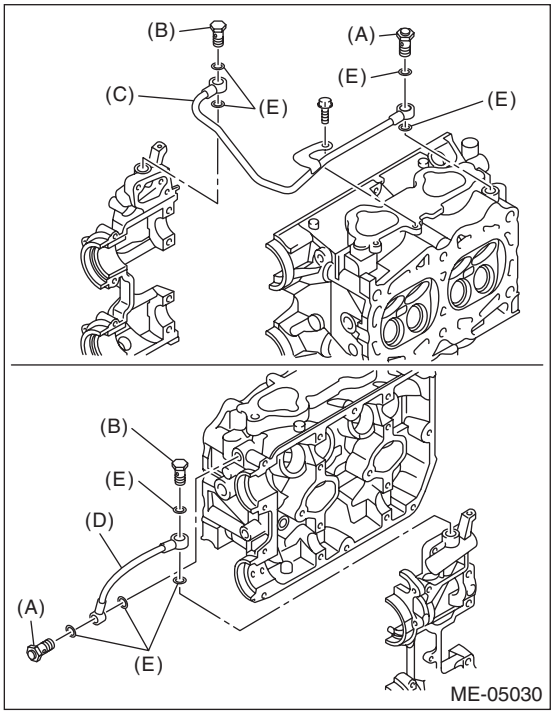


20) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.> <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1. INSPECTING UNION BOLT WITH FILTER

Check the filter part of union bolt for clogging or damage, and if defective, replace the union bolt with filter with the new part.



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

2. OTHER INSPECTIONS

1) Check that the oil pipe and union bolt have no deformation, cracks and other damages.
2) Check that there are no oil leaks or oil oozing from the oil pipe attachment section.

9. Engine Oil Filter

A: REMOVAL

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Remove the oil filter.

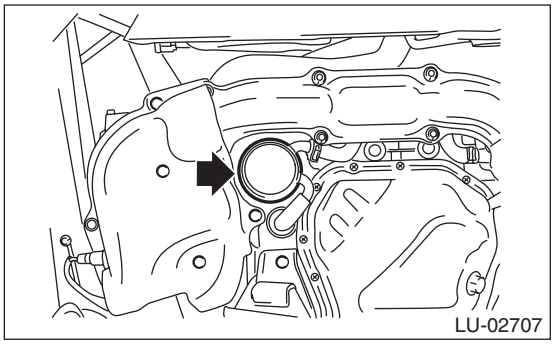
- Oil filter (Black)

Remove using the ST.

ST 18332AA000 OIL FILTER WRENCH (OUTER DIAMETER: 68 MM (2.68 IN) FOR OIL FILTER)

- Oil filter (Blue)

Remove using a general tool (65/67 mm 14 Flutes).


LU-02707

B: INSTALLATION

CAUTION:
Do not tighten excessively, or oil may leak.

1) Clean the oil filter installation surface on cylinder block or oil cooler.
2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
3) Install the oil filter turning it by hand, being careful not to damage the seal rubber of the oil filter.

- Tighten the oil filter (Black) with an outer diameter of 68 mm (2.68 in) (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with the cylinder block or oil cooler. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
- Tighten the oil filter (Blue) with an outer diameter of 67.4 mm (2.65 in) (approx. 7/8 rotation) after the seal rubber of the oil filter comes in contact with cylinder block or oil cooler. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.9 ft-lb).

4) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

C: INSPECTION

1) After installing the oil filter, run the engine and check for oil leakage around seal rubber.

NOTE:
The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

2) Check the engine oil level. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

10.Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause	Corrective action
Warning light remains ON.	a. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	b. Low oil pressure	
	❍ Clogging of oil filter	Replace.
	❍ Malfunction of oil by-pass valve in oil filter	Replace.
	❍ Malfunction of oil relief valve in oil pump	Clean or replace.
	❍ Clogged oil passage	Clean.
	❍ Excessive tip clearance and side clearance of oil pump rotor	Replace.
	❍ Clogged oil strainer or broken pipe	Clean or replace.
	c. No oil pressure	
	❍ Insufficient engine oil (degradation, etc.)	Replace.
	❍ Broken pipe of oil strainer	Replace.
	❍ Stuck oil pump rotor	Replace.
Warning light does not illuminate.	a. Malfunction of combination meter	Replace.
	b. Poor contact of switch contact points	Replace.
	c. Disconnection of wiring	Repair.
Warning light flickers momentarily.	a. Defective terminal contact	Repair.
	b. Defective wiring harness	Repair.
	c. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	d. Low oil pressure	
	❍ Clogging of oil filter	Replace.
	❍ Malfunction of oil by-pass valve in oil filter	Replace.
	❍ Malfunction of oil relief valve in oil pump	Clean or replace.
	❍ Clogged oil passage	Clean.
	❍ Excessive tip clearance and side clearance of oil pump rotor	Replace.
	❍ Clogged oil strainer or broken pipe	Clean or replace.

SPEED CONTROL SYSTEMS

SP(STI)

Page

1. General Description 2
2. Accelerator Pedal 4

1. General Description

A: SPECIFICATION

Engine	Model				2.5 L
	Cylinder arrangement				Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve system mechanism				Belt driven, double overhead camshaft, 4-valve/cylinder
	Bore × Stroke			mm (in)	99.5 × 79.0 (3.92 × 3.11)
	Displacement			cm^3 (cu in)	2,457 (149.94)
	Compression ratio				8.2
	Compression pressure (at 200 — 300 rpm)			kPa (kg/cm^2, psi) Standard	981 — 1,177 (10 — 12, 142 — 171)
	Number of piston rings				Pressure ring: 2, Oil ring: 1
	Intake valve timing		Open	Max. retard	ATDC 5°
				Min. advance	BTDC 25°
			Close	Max. retard	ABDC 65°
				Min. advance	ABDC 35°
	Exhaust valve timing		Open	Max. retard	BBDC 32°
				Min. advance	BBDC 72°
			Close	Max. retard	ATDC 28°
				Min. advance	BTDC 12°
	Valve clearance mm (in)	Inspection value	Intake		$0.20^{+0.04}_{-0.06}$ ($0.0079^{+0.0016}_{-0.0024}$)
			Exhaust		0.35±0.05 (0.0138±0.0020)
		Adjustment value	Intake		$0.20^{+0.01}_{-0.03}$ ($0.0079^{+0.0004}_{-0.0012}$)
			Exhaust		0.35±0.02 (0.0138±0.0008)
	Idle speed (Gear shift lever is in neutral) rpm		No load	Standard	700±100
			A/C ON	Standard	750±100
	Ignition order				1 → 3 → 2 → 4
	Ignition timing			BTDC/rpm Standard	15°±10°/700

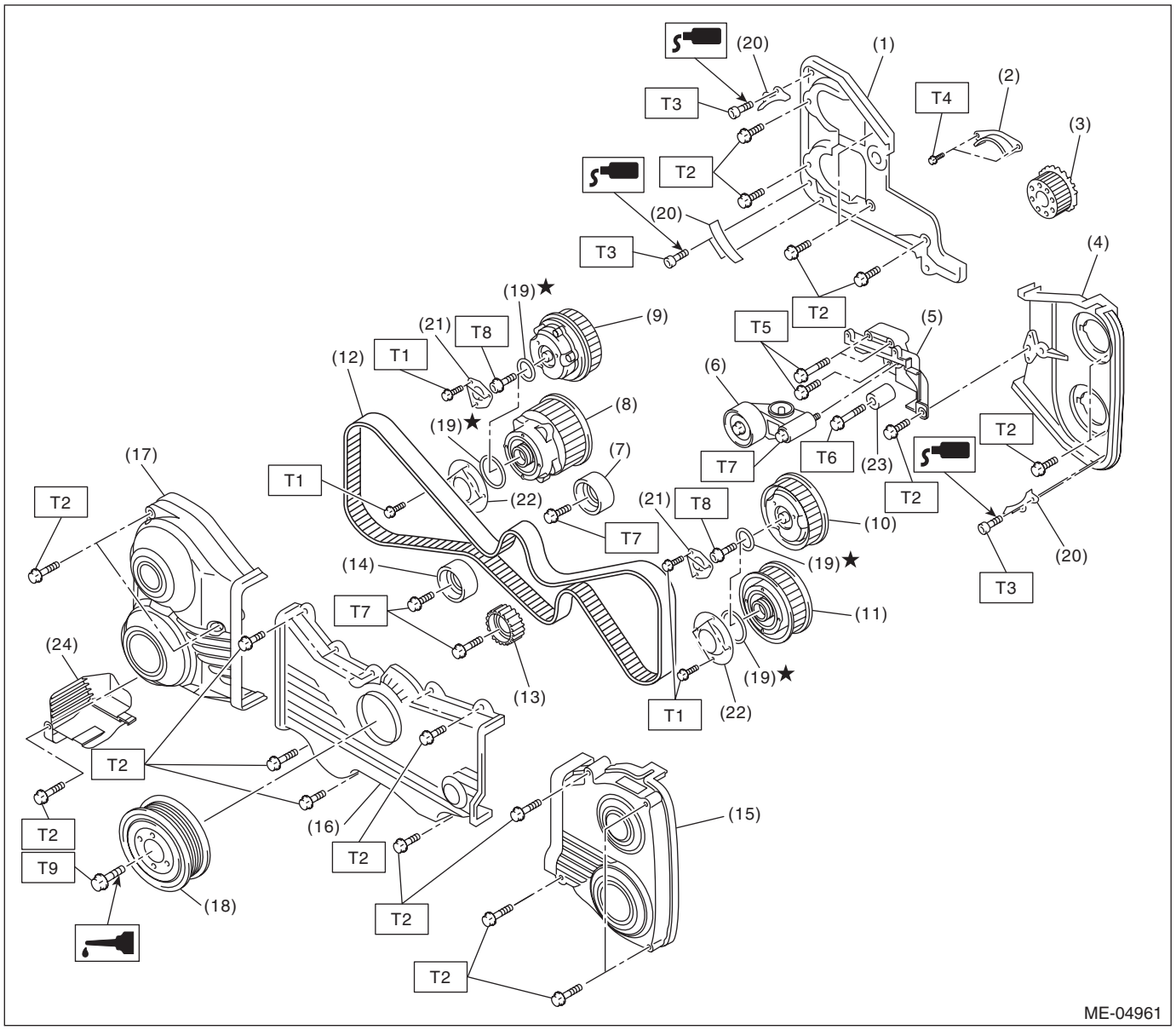
NOTE:
OS: Oversize US: Undersize

Belt tension adjuster	Adjuster rod protrusion amount		mm (in)	5.2 — 6.2 (0.205 — 0.244)
Camshaft	Bending limit		mm (in)	0.020 (0.00079)
	Cam lobe height mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
		Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
	Cam base circle diameter mm (in)		Standard	37.0 (1.457)
	Journal O.D. mm (in)	Front	Standard	37.946 — 37.963 (1.4939 — 1.4946)
		Center, rear	Standard	29.946 — 29.963 (1.1790 — 1.1796)
	Oil clearance mm (in)		Standard	0.037 — 0.072 (0.0015 — 0.0028)
	Thrust clearance mm (in)		Standard	0.068 — 0.116 (0.0027 — 0.0047)
Cylinder head	Warping limit (Mating surface with cylinder block)		mm (in)	0.035 (0.0014)
	Grinding limit		mm (in)	0.3 (0.012)
	Standard height		mm (in)	127.5 (5.02)
Valve seat	Seating angle between valve and valve seat			90°
	Contacting width between valve and valve seat mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
		Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Clearance between the valve guide and valve stem mm (in)	Intake	Standard	0.030 — 0.057 (0.0012 — 0.0022)
		Exhaust	Standard	0.040 — 0.067 (0.0016 — 0.0026)
	Inside diameter		mm (in)	6.000 — 6.012 (0.2362 — 0.2367)
	Valve stem outer diameters mm (in)	Intake		5.955 — 5.970 (0.2344 — 0.2350)
		Exhaust		5.945 — 5.960 (0.2341 — 0.2346)
	Valve guide protrusion amount		mm (in)	15.8 — 16.2 (0.622 — 0.638)
Valve	Head edge thickness mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
		Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
	Overall length mm (in)	Intake		104.4 (4.110)
		Exhaust		104.65 (4.1201)
Valve spring	Free length		mm (in)	53.48 (2.106)
	Tension/spring height N (kgf, lb)/mm (in)		Set	204.6 — 235.4 (20.86 — 24.00, 46.00 — 52.93)/36.0 (1.417)
			Lift	363.5 — 401.7 (37.07 — 40.96, 81.73 — 90.32)/26.7 (1.051)
	Squareness			2.5°, 2.3 mm (0.091 in) or less
Valve lifter	Outer diameter		mm (in) Standard	34.959 — 34.975 (1.3763 — 1.3770)
	Valve lifter mating surface inner diameter		mm (in) Standard	34.994 — 35.016 (1.3777 — 1.3786)
	Valve lifter and valve lifter mating surface clearance		mm (in) Standard	0.019 — 0.057 (0.0007 — 0.0022)
Cylinder block	Warping limit (Mating surface with cylinder head)		mm (in)	0.025 (0.0098)
	Grinding limit		mm (in)	0.1 (0.004)
	Standard height		mm (in)	201.0 (7.91)
	Cylindricality		mm (in) Limit	0.015 (0.0006)
	Out-of-roundness		mm (in) Limit	0.010 (0.0004)
	Clearance between cylinder and piston at 20°C (68°F)		mm (in) Standard	–0.010 — 0.010 (–0.00039 — 0.00039)
	Cylinder inner diameter boring limit (diameter)		mm (in)	To 100.005 (3.9372)

Piston	Piston grade point			mm (in)	38.2 (1.50)
	Outer diameter mm (in)	Standard	A		99.505 — 99.515 (3.9175 — 3.9179)
			B		99.495 — 99.505 (3.9171 — 3.9175)
		0.25 (0.0098) OS			99.745 — 99.765 (3.9270 — 3.9278)
		0.50 (0.0197) OS			99.995 — 100.015 (3.9368 — 3.9376)
Piston pin	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).
	Clearance between piston pin hole and piston pin			mm (in) Standard	0.004 — 0.008 (0.0002 — 0.0003)
Piston ring	Piston ring gap mm (in)	Top ring		Standard	0.23 — 0.28 (0.0091 — 0.0110)
		Second ring		Standard	0.37 — 0.52 (0.015 — 0.0203)
		Oil ring		Standard	0.20 — 0.50 (0.0079 — 0.0197)
	Clearance between piston ring and piston ring groove mm (in)	Top ring		Standard	0.040 — 0.080 (0.0016 — 0.0031)
		Second ring		Standard	0.030 — 0.070 (0.0012 — 0.0028)
Connecting rod and connecting rod bearing	Bend or twist per 100 mm (3.94 in) in length			mm (in) Limit	0.1 (0.0039)
	Thrust clearance			mm (in) Standard	0.070 — 0.330 (0.0028 — 0.0130)
	Oil clearance			mm (in) Standard	0.017 — 0.045 (0.0007 — 0.0018)
	Bearing size (Thickness at center) mm (in)	Standard			1.490 — 1.506 (0.0587 — 0.0593)
		0.03 (0.0012) US			1.504 — 1.512 (0.0592 — 0.0595)
		0.05 (0.0020) US			1.514 — 1.522 (0.0596 — 0.0599)
		0.25 (0.0098) US			1.614 — 1.622 (0.0635 — 0.0639)
Bushing of small end	Clearance between piston pin and bushing			mm (in) Standard	0 — 0.022 (0 — 0.0009)
Crankshaft and crankshaft bearing	Bending limit				mm (in) 0.035 (0.0014)
	Crank pin	Cylindricality		mm (in) Limit	0.006 (0.0002)
		Out-of-roundness		mm (in) Limit	0.005 (0.0002)
		Grinding limit (dia.)			mm (in) To 51.750 (2.0374)
	Crank journal	Cylindricality		mm (in) Limit	0.006 (0.0002)
		Out-of-roundness		mm (in) Limit	0.005 (0.0002)
		Grinding limit (dia.)			mm (in) To 59.758 (2.3527)
	Crank pin outer diameter mm (in)	Standard			51.976 — 52.000 (2.0463 — 2.0472)
		0.03 (0.0012) US			51.954 — 51.970 (2.0454 — 2.0461)
		0.05 (0.0020) US			51.934 — 51.950 (2.0447 — 2.0453)
		0.25 (0.0098) US			51.734 — 51.750 (2.0368 — 2.0374)
	Crank journal outer diameter mm (in)	Standard			59.984 — 60.008 (2.3616 — 2.3625)
		0.03 (0.0012) US			59.962 — 59.978 (2.3607 — 2.3613)
		0.05 (0.0020) US			59.942 — 59.958 (2.3599 — 2.3605)
		0.25 (0.0098) US			59.742 — 59.758 (2.3520 — 2.3527)
	Bearing size (Thickness at center) mm (in)	#1, #3	Standard		1.998 — 2.015 (0.0787 — 0.0793)
			0.03 (0.0012) US		2.017 — 2.020 (0.0794 — 0.0795)
			0.05 (0.0020) US		2.027 — 2.030 (0.0798 — 0.0799)
			0.25 (0.0098) US		2.127 — 2.130 (0.0837 — 0.0839)
		#2, #4, #5	Standard		2.000 — 2.017 (0.0787 — 0.0794)
			0.03 (0.0012) US		2.019 — 2.022 (0.0795 — 0.0796)
			0.05 (0.0020) US		2.029 — 2.032 (0.0799 — 0.0800)
			0.25 (0.0098) US		2.129 — 2.132 (0.0838 — 0.0839)
	Thrust clearance			mm (in) Standard	0.030 — 0.115 (0.0012 — 0.0045)
	Oil clearance			mm (in) Standard	0.010 — 0.030 (0.00039 — 0.0012)

B: COMPONENT

1. TIMING BELT



(1)	Timing belt cover No. 2 RH	(13)	Belt idler No. 2	
(2)	Timing belt guide	(14)	Belt idler	
(3)	Crank sprocket	(15)	Timing belt cover LH	
(4)	Timing belt cover No. 2 LH	(16)	Front belt cover	
(5)	Tensioner bracket	(17)	Timing belt cover RH	
(6)	Automatic belt tension adjuster ASSY	(18)	Crank pulley	
(7)	Belt idler	(19)	O-ring	
(8)	Exhaust cam sprocket RH	(20)	Timing belt guide	
(9)	Intake cam sprocket RH	(21)	Intake actuator cover	
(10)	Intake cam sprocket LH	(22)	Exhaust actuator cover	
(11)	Exhaust cam sprocket LH	(23)	Belt idler	
(12)	Timing belt	(24)	Engine harness cover	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3.4 (0.3, 2.5)

T2: 5 (0.5, 3.7)

T3: 6.4 (0.7, 4.7)

T4: 9.75 (1.0, 7.2)

T5: 24.5 (2.5, 18.1)

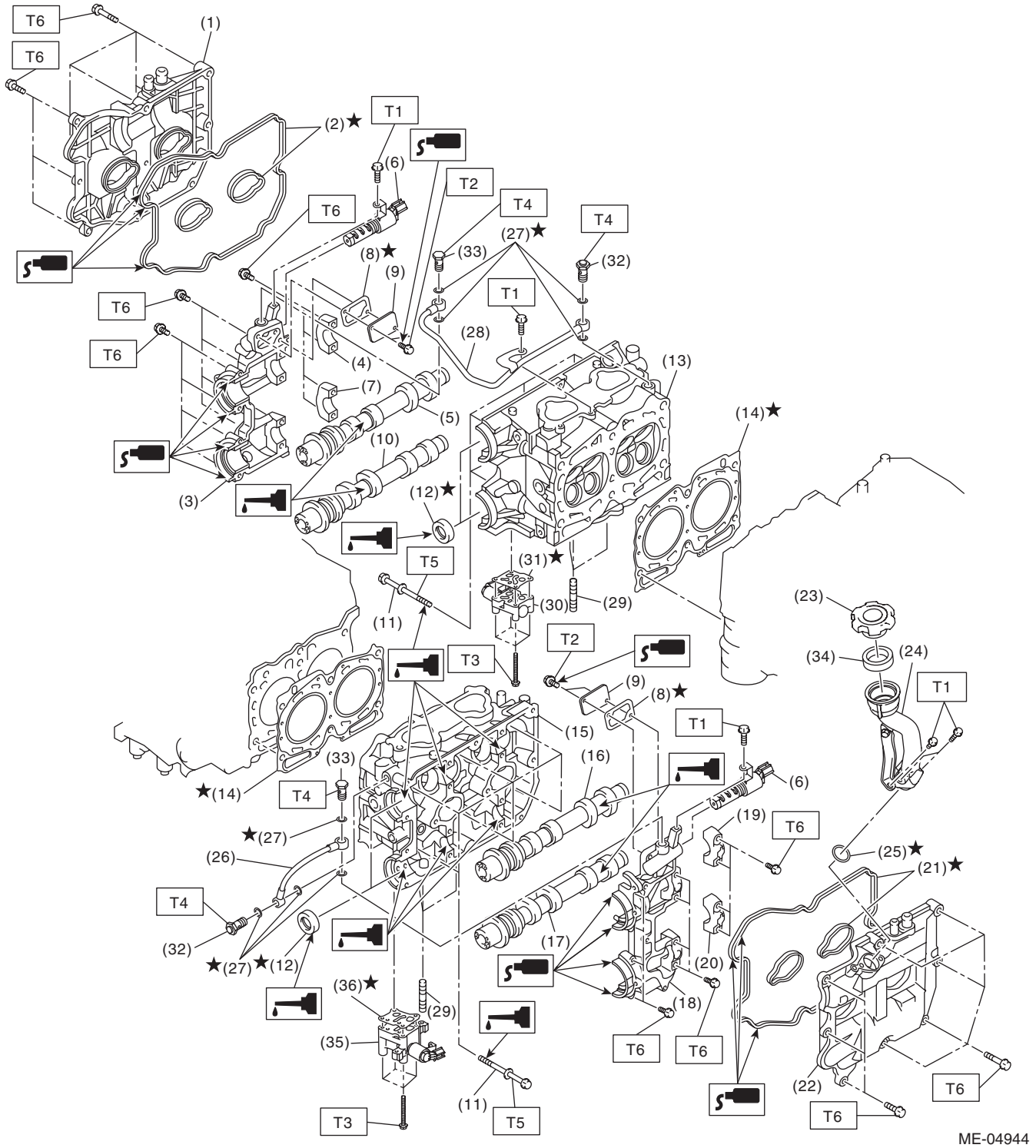
T6: 25 (2.5, 18.4)

T7: 39 (4.0, 28.8)

T8: <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>

T9: <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>

2. CYLINDER HEAD AND CAMSHAFT

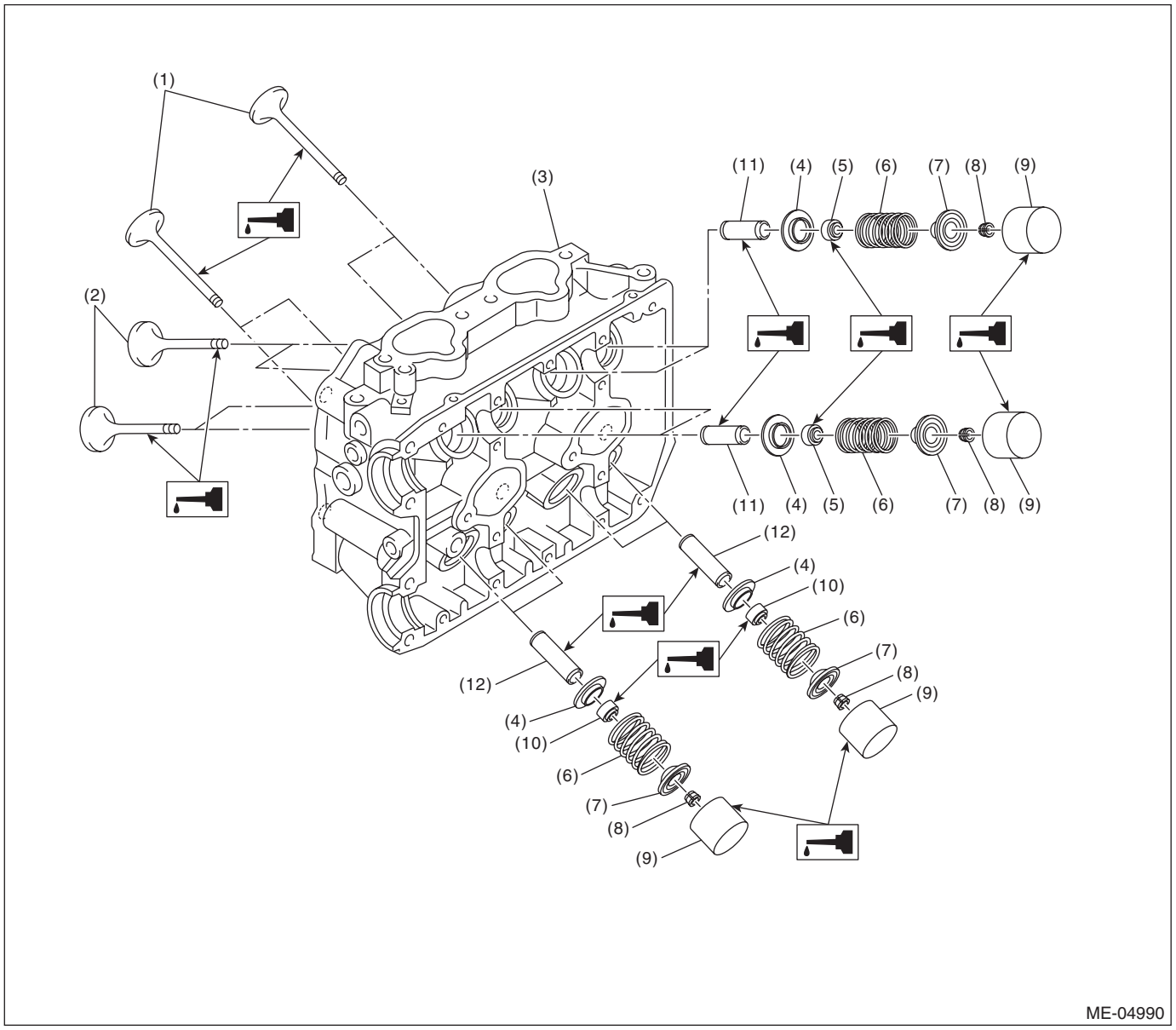


(1) Rocker cover RH
(2) Rocker cover gasket RH
(3) Front camshaft cap RH
(4) Intake camshaft cap RH
(5) Intake camshaft RH
(6) Intake oil flow control solenoid valve
(7) Exhaust camshaft cap RH
(8) Gasket
(9) Oil return cover
(10) Exhaust camshaft RH
(11) Cylinder head bolt
(12) Oil seal
(13) Cylinder head RH
(14) Cylinder head gasket
(15) Cylinder head LH
(16) Intake camshaft LH
(17) Exhaust camshaft LH
(18) Front camshaft cap LH
(19) Intake camshaft cap LH
(20) Exhaust camshaft cap LH
(21) Rocker cover gasket LH
(22) Rocker cover LH
(23) Oil filler cap
(24) Oil filler duct
(25) O-ring
(26) Oil pipe LH
(27) Gasket
(28) Oil pipe RH
(29) Stud bolt
(30) Exhaust oil flow control solenoid valve RH
(31) Gasket RH
(32) Union bolt with filter (with protrusion)
(33) Union bolt without filter (without protrusion)
(34) Gasket
(35) Exhaust oil flow control solenoid valve LH
(36) Gasket LH

Tightening torque: N·m (kgf-m, ft-lb)

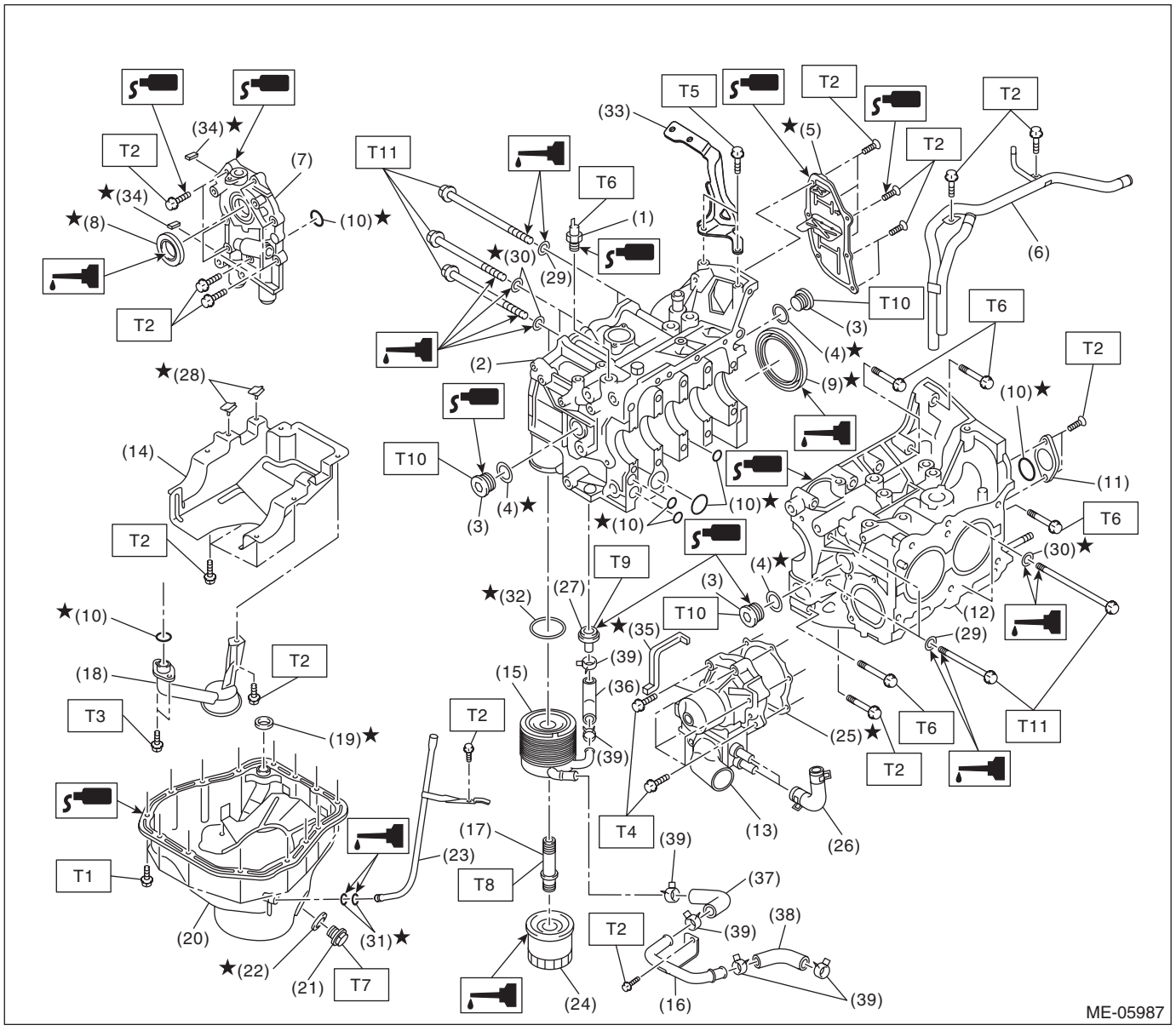
T1: 6.4 (0.7, 4.7)
T2: 9 (0.9, 6.6)
T3: 10 (1.0, 7.4)
T4: 29 (3.0, 21.4)
T5: <Ref. to ME(STI)-70, INSTALLATION, Cylinder Head.>
T6: <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>

3. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve spring retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

4. CYLINDER BLOCK

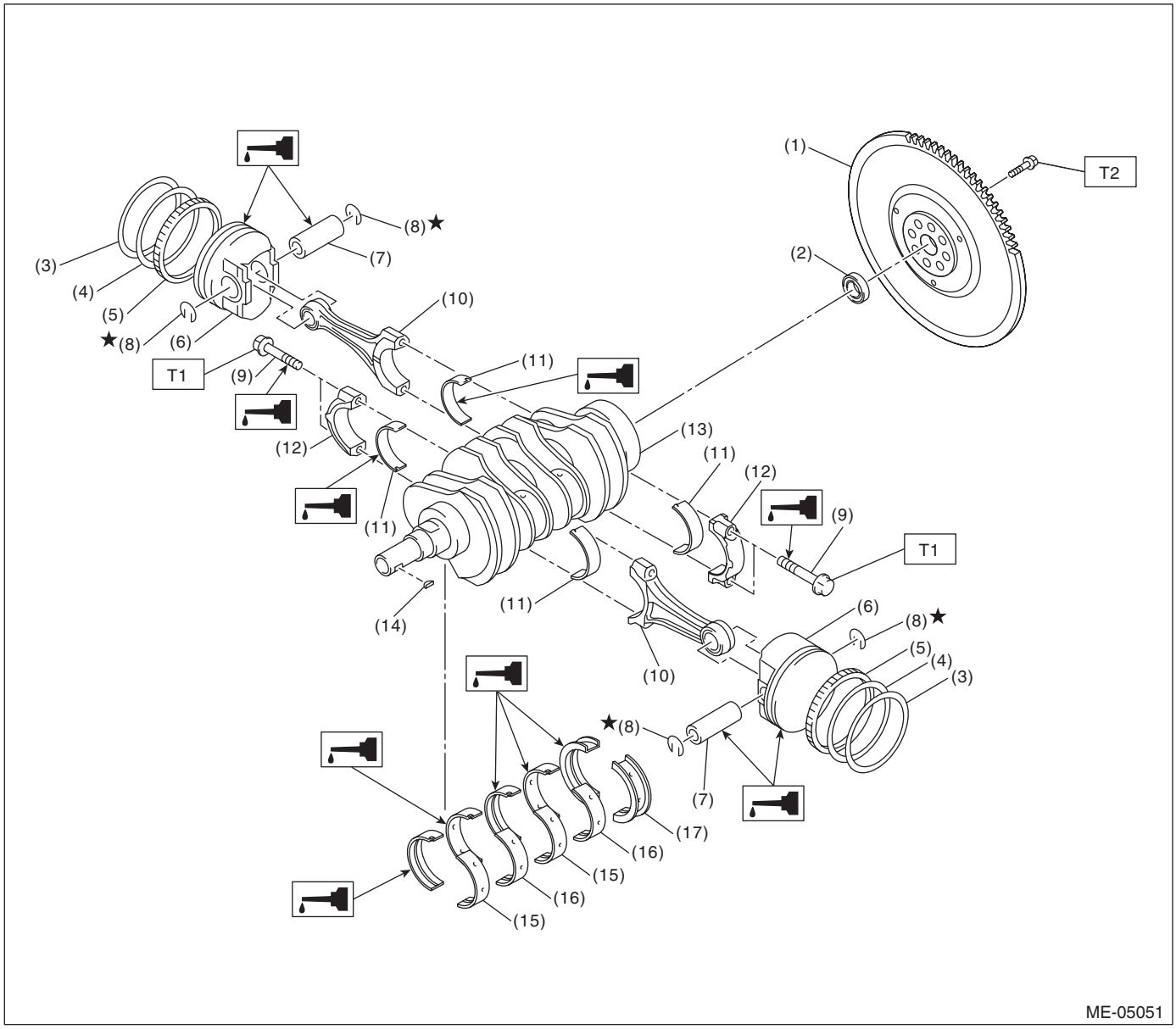


(1) Oil pressure switch
(2) Cylinder block RH
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block LH
(13) Water pump
(14) Baffle plate
(15) Oil cooler
(16) Oil cooler pipe
(17) Connector
(18) Oil strainer
(19) Gasket
(20) Oil pan
(21) Drain plug
(22) Drain plug gasket
(23) Oil level gauge guide
(24) Oil filter
(25) Gasket
(26) Water pump hose
(27) Nipple
(28) Seal
(29) Washer
(30) Seal washer
(31) O-ring
(32) Gasket
(33) Intercooler stay (engine rear hanger)
(34) Oil pump seal
(35) Water pump sealing
(36) Oil cooler hose A
(37) Oil cooler hose B
(38) Oil cooler hose C
(39) Clip

Tightening torque: N·m (kgf-m, ft-lb)

T1:	***5 (0.5, 3.7)***
T2:	***6.4 (0.7, 4.7)***
T3:	***10 (1.0, 7.4)***
T4:	***First 12 (1.2, 8.9)***
	Second 12 (1.2, 8.9)
T5:	***16 (1.6, 11.8)***
T6:	***25 (2.5, 18.4)***
T7:	***44 (4.5, 32.5)***
T8:	***54 (5.5, 39.8)***
T9:	***69 (7.0, 50.9)***
T10:	***70 (7.1, 51.6)***
T11:	***<Ref. to ME(STI)-84, INSTALLATION, Cylinder Block.>***

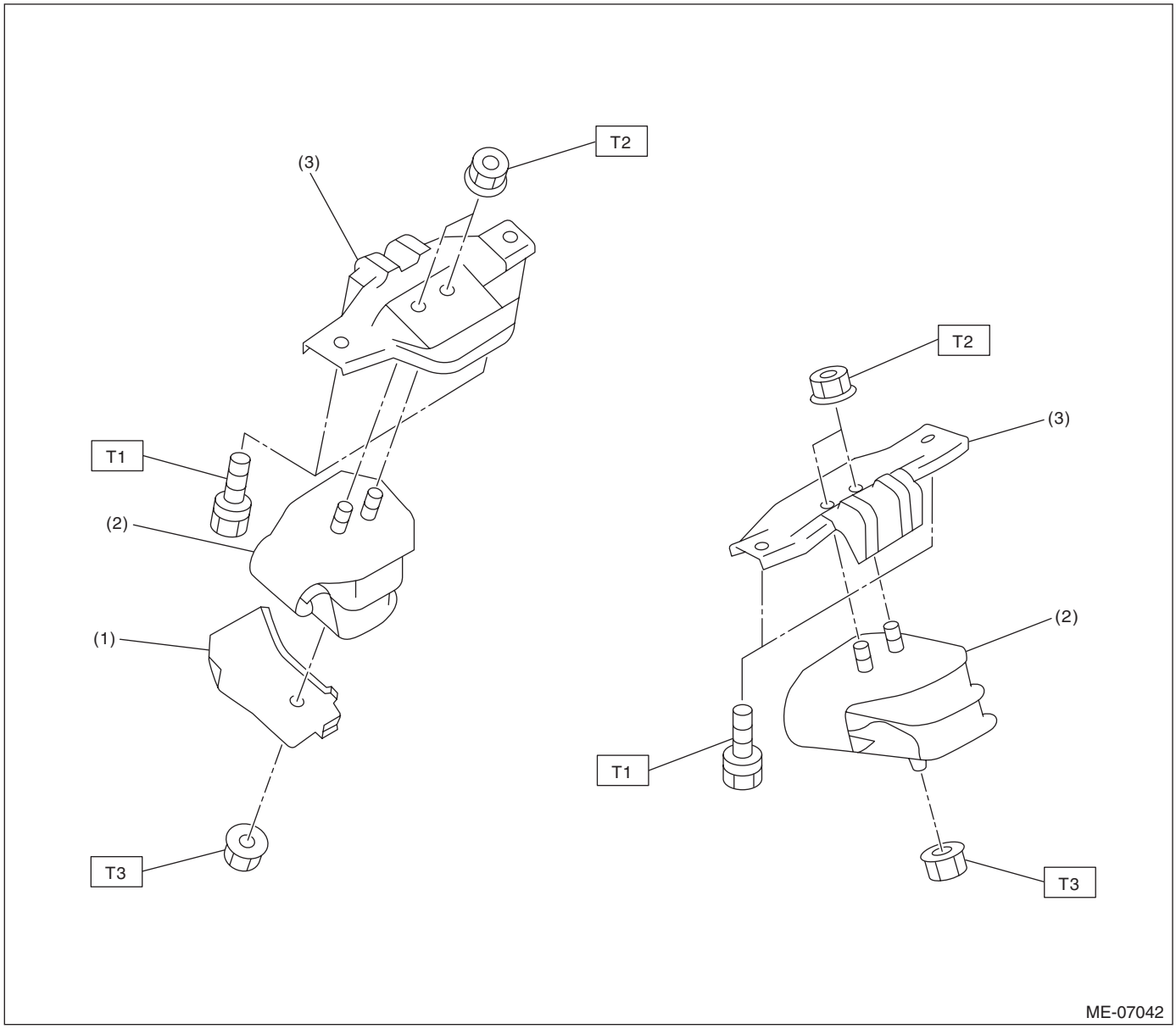
5. CRANKSHAFT AND PISTON



(1) Flywheel
(2) Ball bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Piston
(7) Piston pin
(8) Snap ring
(9) Connecting rod bolt
(10) Connecting rod
(11) Connecting rod bearing
(12) Connecting rod cap
(13) Crankshaft
(14) Woodruff key
(15) Crankshaft bearing #1, #3
(16) Crankshaft bearing #2, #4
(17) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)
T1: 52 (5.3, 38.4)
T2: <Ref. to CL-14, INSTALLATION, Flywheel.>

6. ENGINE MOUNTING



(1) Heat shield cover
(2) Front cushion rubber
(3) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 31.0)
T3: 45 (4.6, 33.2)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use. When lifting up the vehicle, make sure to support the vehicle at the jack-up points.
- Be careful not to let any oil or grease contact the clutch disc, flywheel or timing belt.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil when being assembled.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

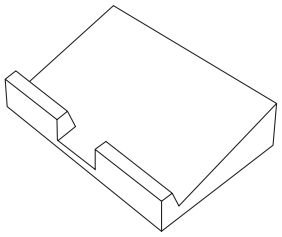
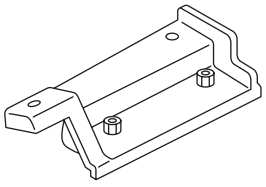
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve spring.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).

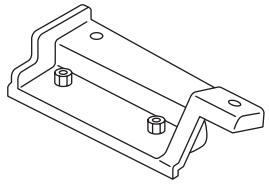
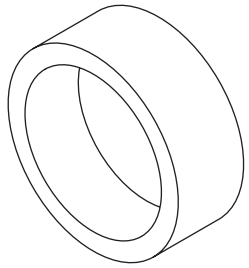
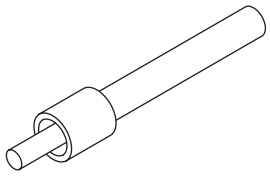
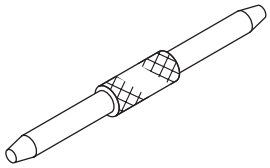
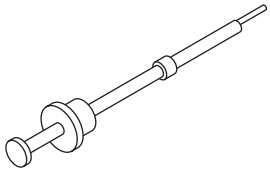
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 ST-498747300	498747300	PISTON GUIDE	Used for installing the piston into the cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake valve guide oil seals and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.

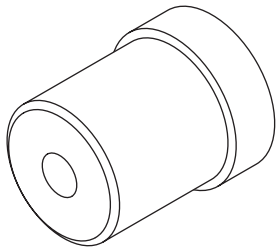
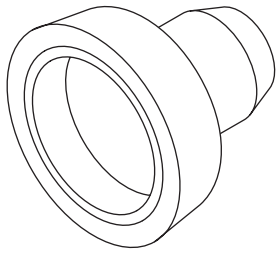
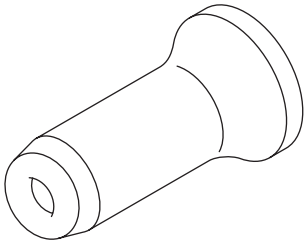
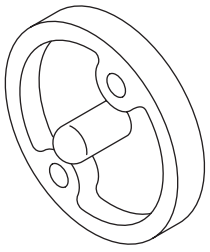
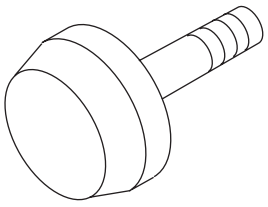
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing the camshaft oil seal.
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499597200	499597200	OIL SEAL GUIDE	• Used for installing the camshaft oil seal. • Used together with OIL SEAL INSTALLER (499587600).

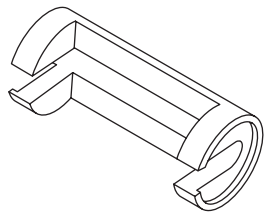
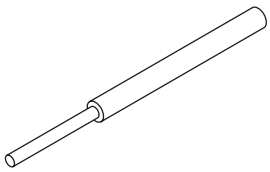
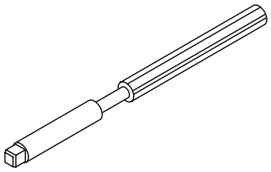
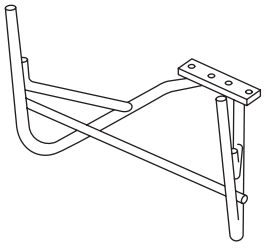
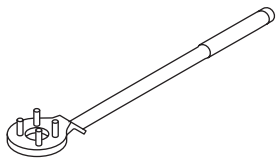
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	• Used for disassembling and assembling engine. • Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for removing and installing the crank pulley.

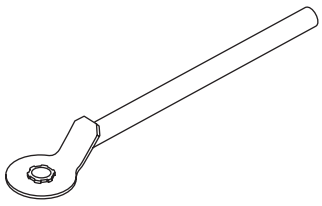
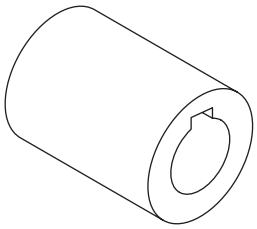
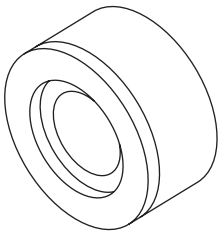
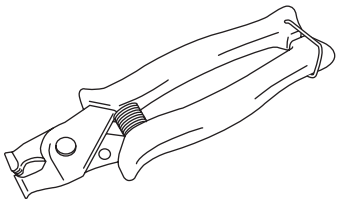
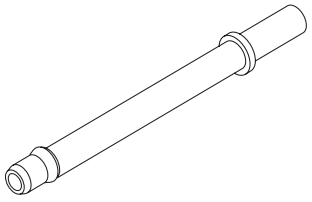
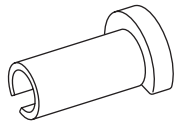
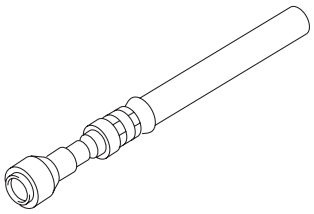
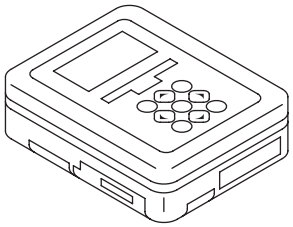
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket and exhaust cam sprocket.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake valve guides and exhaust valve guides.
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing the PCV hose. • This tool is made by the French company CAILLAU. (code) 54.0.000.205 To make it easier to obtain, it has been provided with a tool number.
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for inspecting the fuel pressure.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST42075AG690	42075AG690	FUEL HOSE	Used for inspecting the fuel pressure. NOTE: This is the SUBARU genuine part.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.

2. GENERAL TOOL

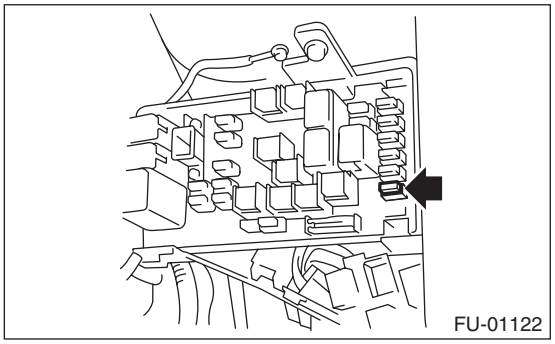
TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.
Angle gauge	Used for installing the crank pulley.

2. Compression

A: INSPECTION

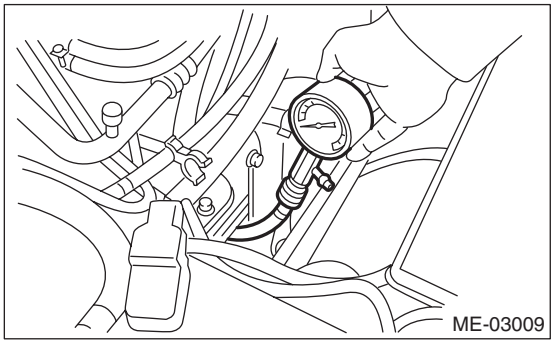
CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) After warming-up the engine, turn the ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Remove the fuse of fuel pump from main fuse box.



4) Start the engine and run it until it stalls.
5) After the engine stalls, crank it for five more seconds.
6) Turn the ignition switch to OFF.
7) Remove all spark plugs. <Ref. to IG(STI)-4, REMOVAL, Spark Plug.>
8) Fully open the throttle valve.
9) Check the starter motor for satisfactory performance and operation.
10) Install the compression gauge to the spark plug hole.

NOTE:
When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.



11) Crank the engine by starter motor and read the value when the needle of the compression gauge becomes stable.

NOTE:
• Perform at least two measurements per cylinder, and make sure that the values are correct.
• If the compression pressure is out of standard, check or adjust the pistons, valves and cylinders.

Compression (fully open throttle):
Standard
981 — 1,177 kPa
(10 — 12 kgf/cm^2, 142 — 171 psi)
Difference between cylinders
49 kPa (0.5 kgf/cm^2, 7 psi) or less

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

3. Idle Speed

A: INSPECTION

1) Before checking the idle speed, check the following item:
   (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-41, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
• Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.
• If idle speed is out of standard, refer to the General Diagnosis Table under “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>
   (1) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

Idle speed (no load and gear shift lever in neutral position):
Standard
700±100 rpm
   (2) Check the idle speed when loaded. (Turn the A/C switch to “ON” and operate the compressor for at least one minute before measurement.)

Idle speed (A/C ON and gear shift lever in neutral position):
Standard
750±100 rpm

4. Ignition Timing

A: INSPECTION

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

1. METHOD WITH SUBARU SELECT MONITOR

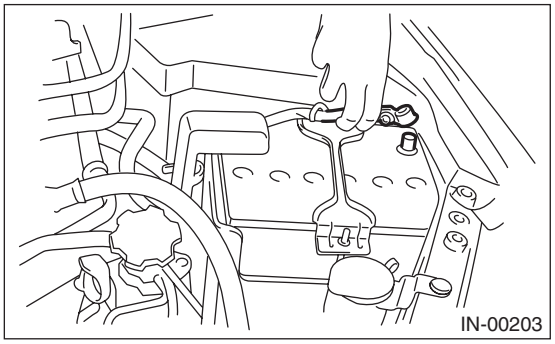
1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-41, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

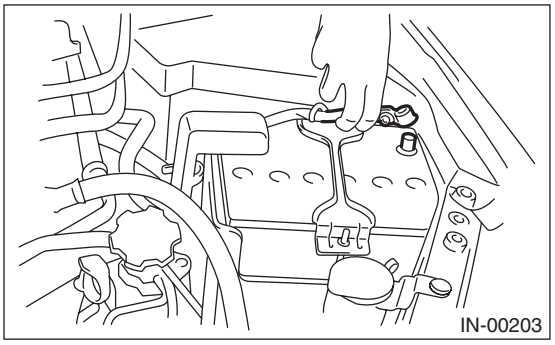
Ignition timing [BTDC/rpm]:
Standard
15°±10°/700

2. METHOD WITH TIMING LIGHT

1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Stop the engine, and turn the ignition switch to OFF.
4) Disconnect the ground cable from battery.



5) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
6) Remove the air cleaner case. <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
7) Connect the timing light to the power wire of #1 ignition coil.
8) Install the air cleaner case. <Ref. to IN(STI)-8, INSTALLATION, Air Cleaner Case.>
9) Connect the battery ground terminal.



10) Start the engine, turn the timing light to the crank pulley, and check the ignition timing through the timing belt cover gauge.

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

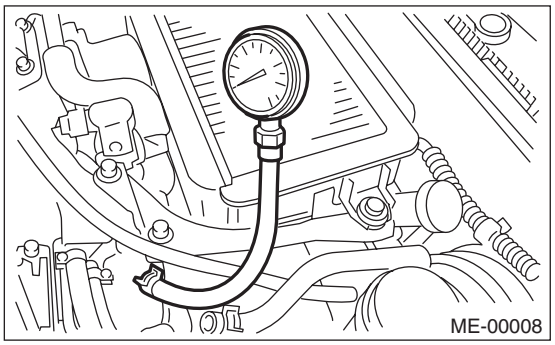
Ignition timing [BTDC/rpm]:
Standard
15°±10°/700

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

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm up the engine.
2) Disconnect the brake booster vacuum hose from the intake manifold, and attach the vacuum gauge.



3) Keep the engine at idle speed and read the vacuum gauge indication.

NOTE:
Condition of engine inside can be diagnosed by observing the behavior of the vacuum gauge needle as described in table below.

Intake manifold vacuum (at idling, A/C OFF):
Standard
–65.3 kPa (–490 mmHg, –19.29 inHg) or more

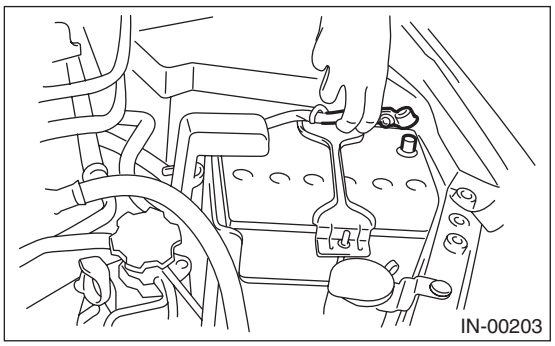
4) After inspection, install the related parts in the reverse order of removal.

Diagnosis of engine condition by inspection of intake manifold vacuum	
Vacuum gauge needle behavior	Possible engine condition
1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than standard value.	Leakage around cylinder
3. Needle drops suddenly and intermittently from standard value.	Sticky valve
4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
5. Needle vibrates above and below standard value in narrow range.	Defective ignition system

6. Engine Oil Pressure

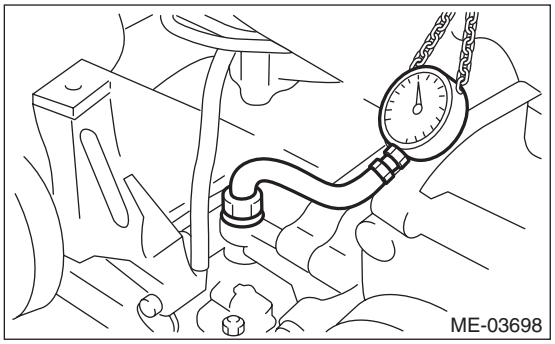
A: INSPECTION

1) Disconnect the ground cable from battery.

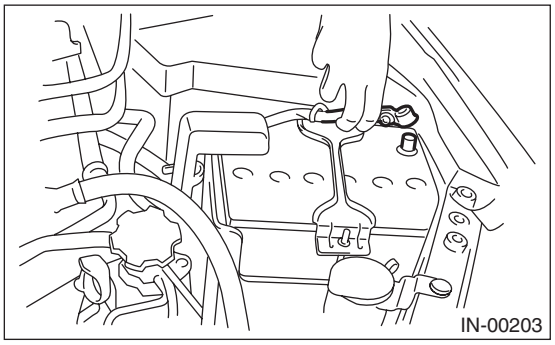


2) Remove the oil pressure switch. <Ref. to LU(STI)-22, REMOVAL, Oil Pressure Switch.>

3) Install the oil pressure gauge to cylinder block.



4) Connect the battery ground terminal.



5) Start the engine, and check the oil pressure.

NOTE:
• Standard value is based on an engine oil temperature of 80°C (176°F).
• If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(STI)-32, INSPECTION, Engine Lubrication System Trouble in General.>
• If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(STI)-32, INSPECTION, Engine Lubrication System Trouble in General.>

Engine oil pressure:
Standard
98 kPa (1.0 kgf/cm^2, 14 psi) or more (at 600 rpm)
392 kPa (4.0 kgf/cm^2, 57 psi) or more (at 6,000 rpm)

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

7. Fuel Pressure

A: INSPECTION

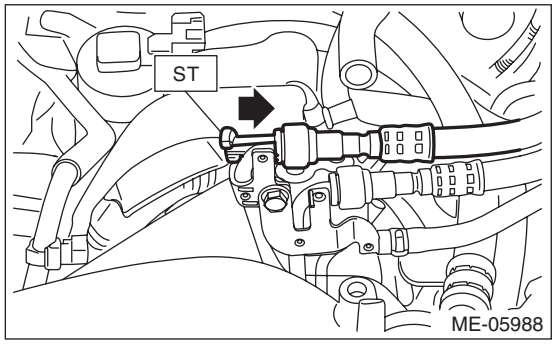
CAUTION:
• Before removing the fuel pressure gauge, release the fuel pressure.
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the fuel delivery hose from the fuel delivery pipe, and connect the fuel pressure gauge.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

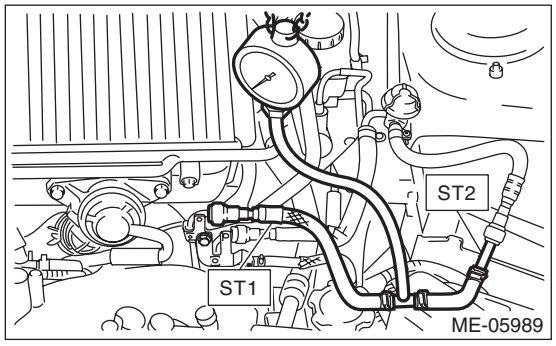
(1) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the quick connector of the fuel delivery hose.

ST 42099AE000 QUICK CONNECTOR RELEASE



(2) Connect the fuel pressure gauge with ST1 and ST2.

NOTE:
ST1 is a SUBARU genuine part.
ST1 42075AG690 FUEL HOSE
ST2 18471AA000 FUEL PIPE ADAPTER



4) Start the engine.
5) Check the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator & damper assembly, and pressure regulator vacuum hose.

Fuel pressure:
Standard
284 — 314 kPa
(2.9 — 3.2 kgf/cm^2, 41 — 46 psi)

6) After connecting the vacuum hose to the pressure regulator, check the fuel pressure again.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator & damper assembly, and pressure regulator vacuum hose.

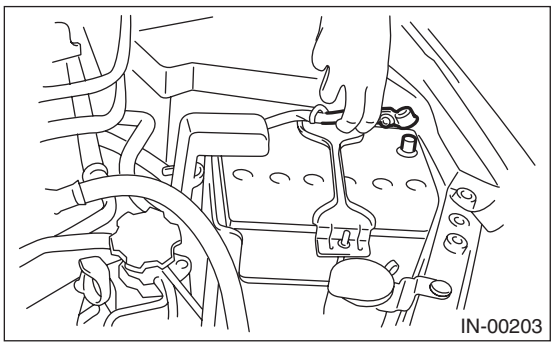
Fuel pressure:
Standard
230 — 260 kPa
(2.4 — 2.7 kgf/cm^2, 33 — 38 psi)

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

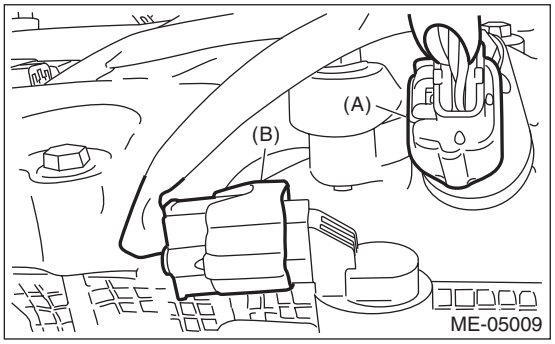
8. Valve Clearance

A: INSPECTION

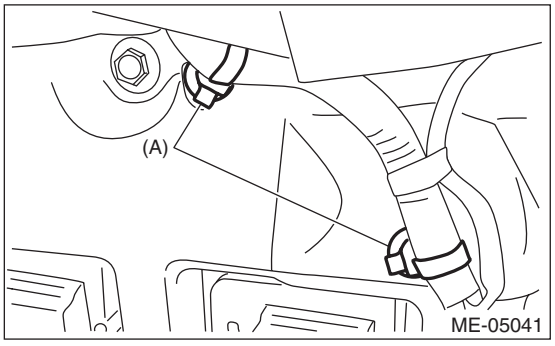
1) Disconnect the ground cable from battery.



2) Remove the engine from vehicle. <Ref. to ME(STI)-30, REMOVAL, Engine Assembly.>
3) Remove the timing belt cover RH. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
4) When inspecting #1 and #3 cylinders
(1) Disconnect the connector (A) from the exhaust camshaft position sensor RH and the connector (B) form the exhaust oil flow control solenoid valve RH.

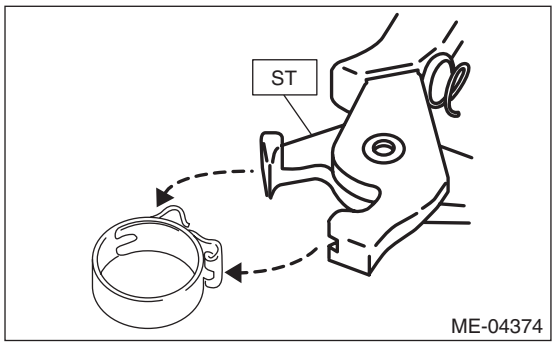


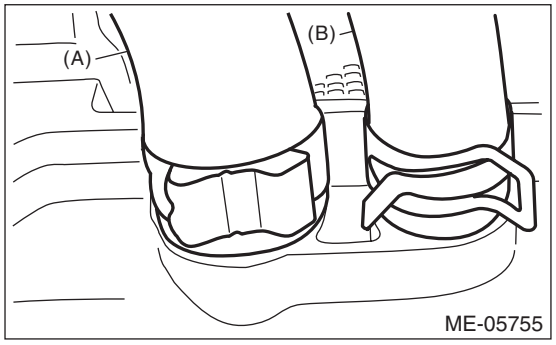
(2) Remove the clip (A) which hold the engine harness to the rocker cover RH.



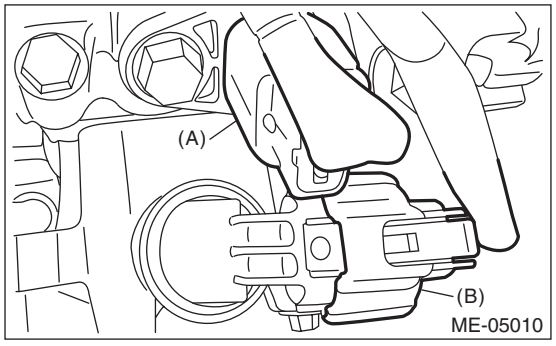
(3) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>
(4) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover RH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

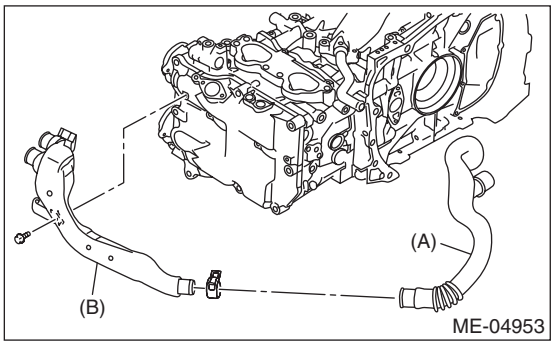




(5) Remove the rocker cover RH.
5) When inspecting #2 and #4 cylinders
(1) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
(2) Disconnect the connector (A) from the exhaust camshaft position sensor LH and the connector (B) form the exhaust oil flow control solenoid valve LH.

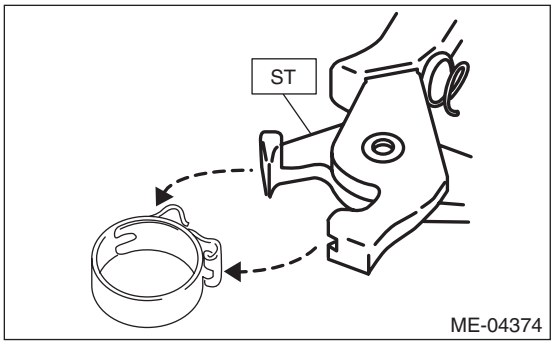


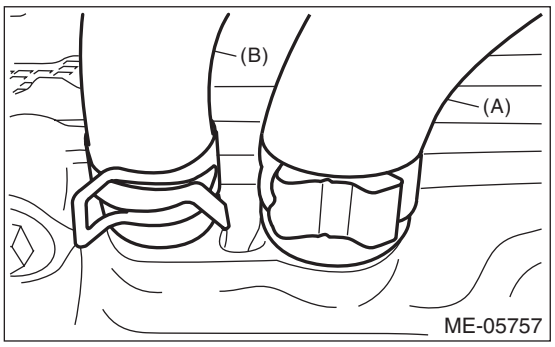
(3) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).



(4) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>
(5) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover LH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



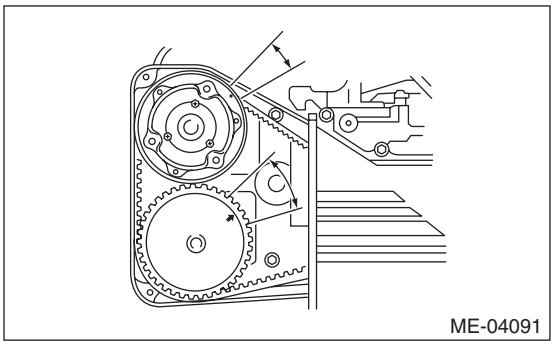


(6) Remove the rocker cover LH.

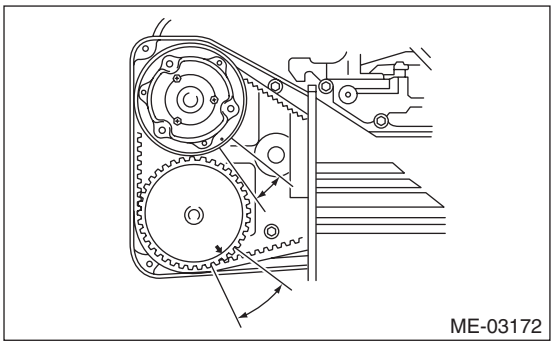
6) Turn the crank pulley clockwise until the round mark and arrow mark on the cam sprocket are set to position shown in the figure.

NOTE:
Turn the crank pulley using a socket wrench.

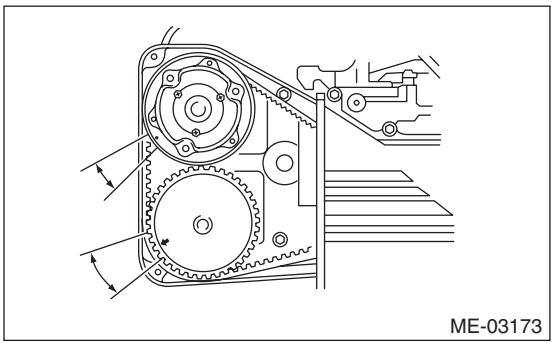
• Measurement of clearance of #1 cylinder intake valve and #3 cylinder exhaust valve



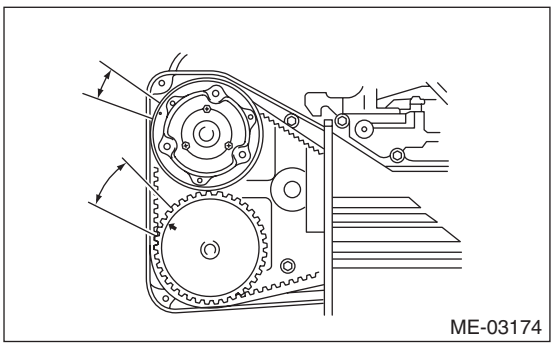
• Measurement of clearance of #2 cylinder exhaust valve and #3 cylinder intake valve



• Measurement of clearance of #2 cylinder intake valve and #4 cylinder exhaust valve



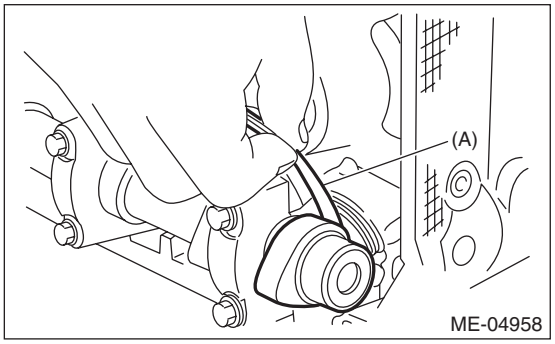
• Measurement of clearance of #1 cylinder exhaust valve and #4 cylinder intake valve



7) Measure the clearance of intake valve and exhaust valve using thickness gauge (A).

NOTE:
• Insert a thickness gauge in a direction as horizontal as possible with respect to the valve lifter.
• Lift up the vehicle, and then measure the exhaust valve clearances.
• If the measured value is not within the inspection value, take notes of the value in order to adjust the valve clearance later on.

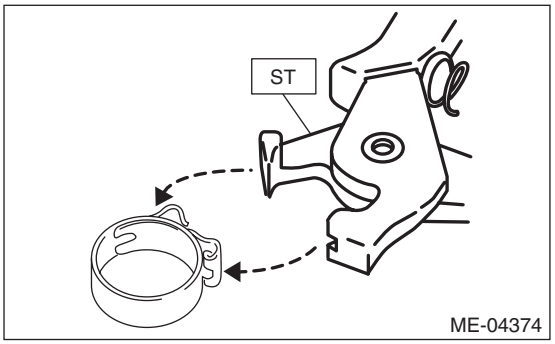
Valve clearance (inspection value):
Intake
$0.20^{+0.04}_{-0.06}$ mm ($0.0079^{+0.0016}_{-0.0024}$ in)
Exhaust
0.35±0.05 mm (0.0138±0.0020 in)

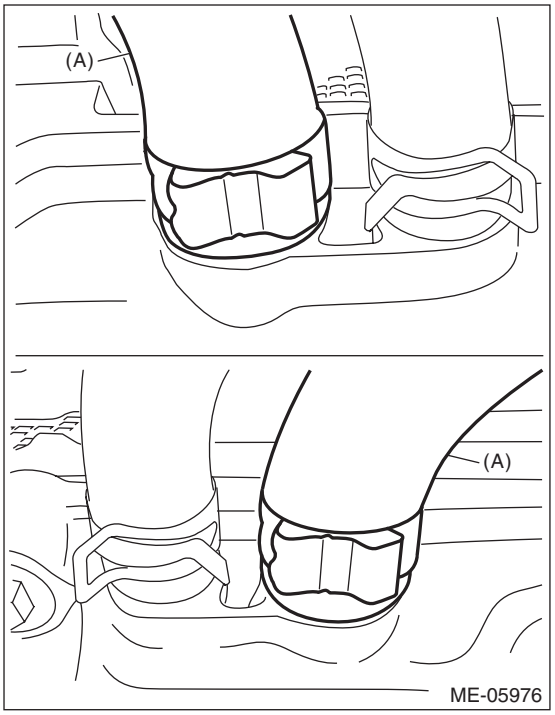


8) If necessary, adjust the valve clearance. <Ref. to ME(STI)-29, ADJUSTMENT, Valve Clearance.>

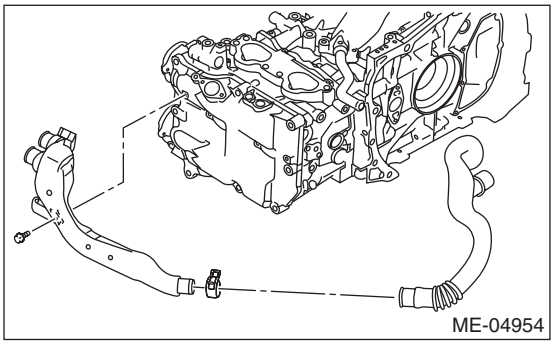
9) After inspection, install the related parts in the reverse order of removal.

NOTE:
• Refer to “Camshaft” when installing the rocker cover. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>
• Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





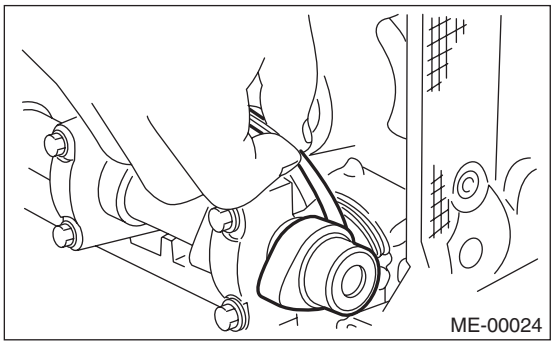
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



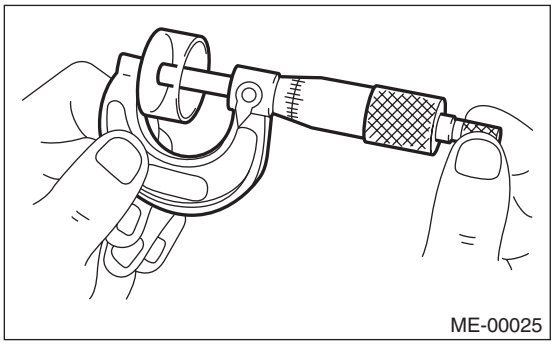
B: ADJUSTMENT

1) Measure all the valve clearances. <Ref. to ME(STI)-26, INSPECTION, Valve Clearance.>

NOTE:
Record the measured value of each valve clearance.


ME-00024

2) Remove the camshaft. <Ref. to ME(STI)-61, REMOVAL, Camshaft.>
3) Remove the valve lifter.
4) Measure the thickness of valve lifter using micrometer.


ME-00025

5) Select a valve lifter of suitable thickness using the measured valve clearance and valve lifter thickness, and install it.

NOTE:
Use a new valve lifter.

Unit: mm (in)
Intake valve: S = (V + T) – 0.19 (0.0075) Exhaust valve: S = (V + T) – 0.35 (0.0138)
S: Valve lifter thickness required V: Measured valve clearance T: Valve lifter thickness to be used

6) Install the camshaft. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>
7) Install the cam sprocket. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(STI)-53, TIMING BELT, INSTALLATION, Timing Belt.>
9) Measure all valves for valve clearance again at this time. If the valve clearance is not within the adjustment value, repeat the procedure over again from step 2).

Valve clearance (adjustment value):
Intake
$0.20^{+0.01}_{-0.03}$ ***mm*** $(0.0079^{+0.0004}_{-0.0012}$ ***in)***
Exhaust
0.35±0.02 mm (0.0138±0.0008 in)

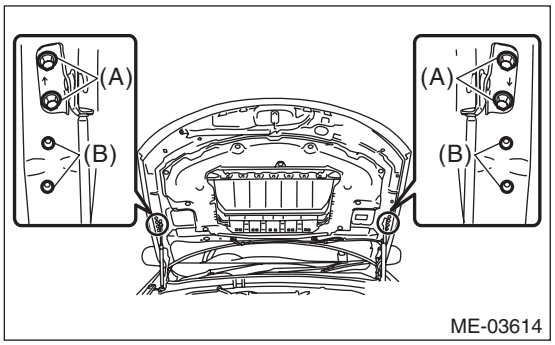
10) After adjustment, install the related parts in the reverse order of removal.

9. Engine Assembly

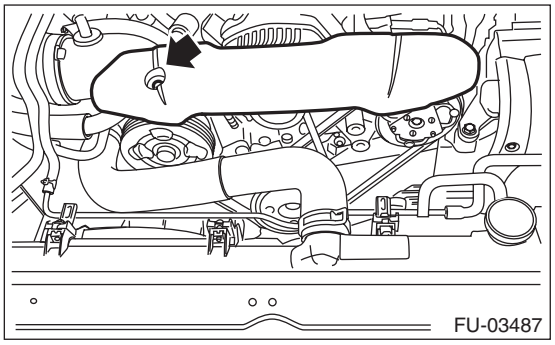
A: REMOVAL

1) Change the bolt installation position from (A) to (B), then open the front hood completely.

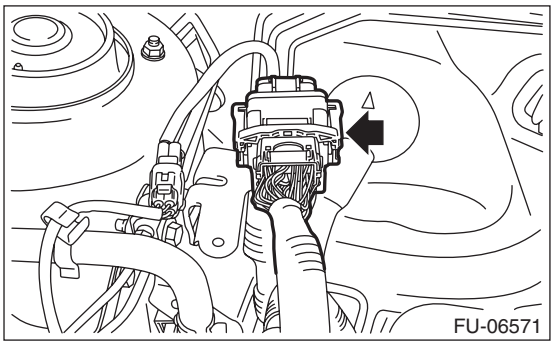
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



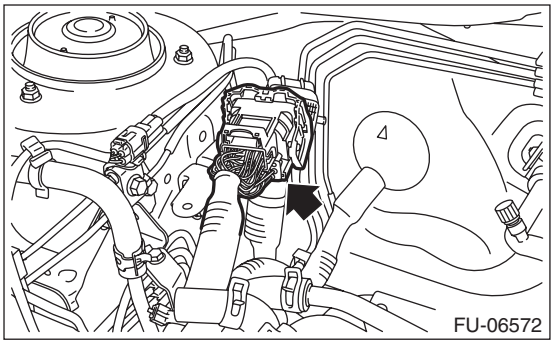
2) Remove the V-belt covers.



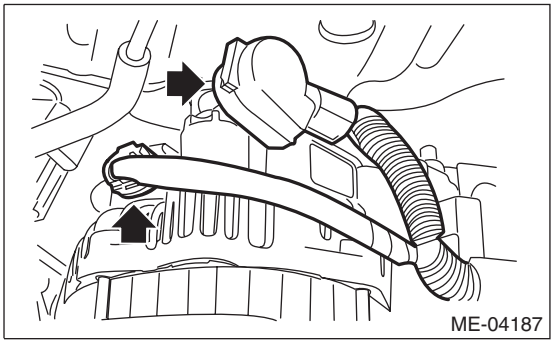
3) Collect the refrigerant from A/C system. <Ref. to AC-19, Refrigerant Recovery Procedure.>
4) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
5) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
6) Open the fuel filler lid and remove the fuel filler cap.
7) Remove the air intake duct and air cleaner case. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
8) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
9) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.>
10) Remove the coolant filler tank. <Ref. to CO(STI)-28, REMOVAL, Coolant Filler Tank.>
11) Disconnect the bulkhead harness connectors from the engine harness connectors.



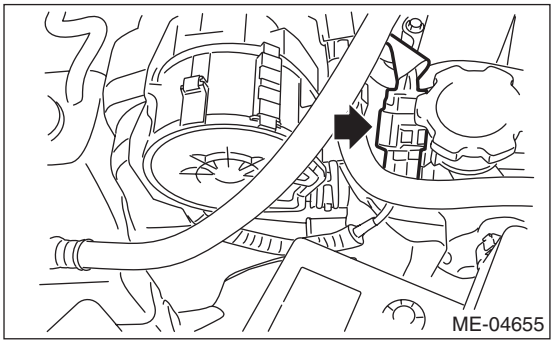
12) Remove the engine harness connector from the engine harness bracket.



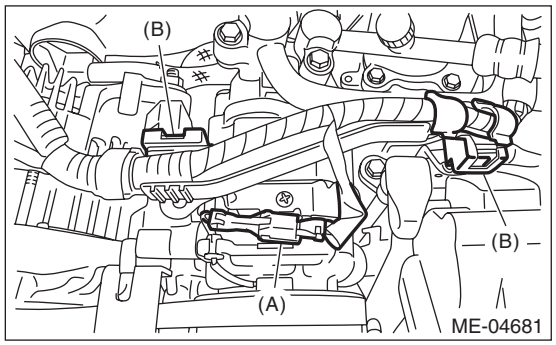
13) Disconnect the following connectors and terminals.
(1) Generator connector and terminal



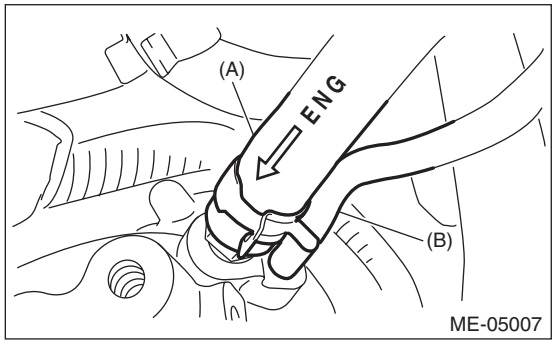
(2) Secondary air pump connector



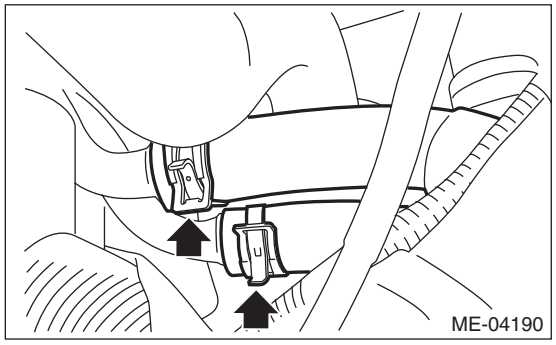
14) Disconnect the connector (A) from the A/C compressor, and remove the clip (B) securing the generator cord.



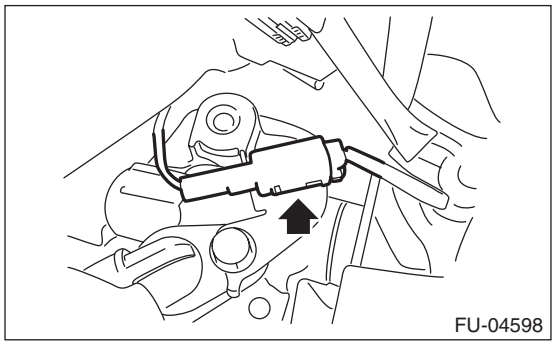
15) Disconnect the following hoses.
(1) A/C pressure hose <Ref. to AC-41, REMOVAL, Hose and Pipe.>
(2) Brake booster vacuum hose (A) and pressure regulator vacuum hose (B)



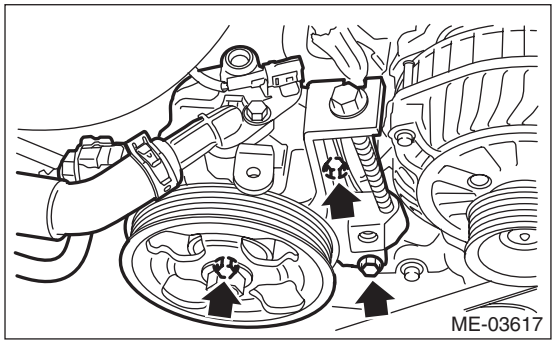
(3) Heater inlet hose and heater outlet hose



16) Remove the power steering pump.
(1) Remove the front side belts. <Ref. to ME(STI)-40, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Disconnect the connector from power steering pump switch.

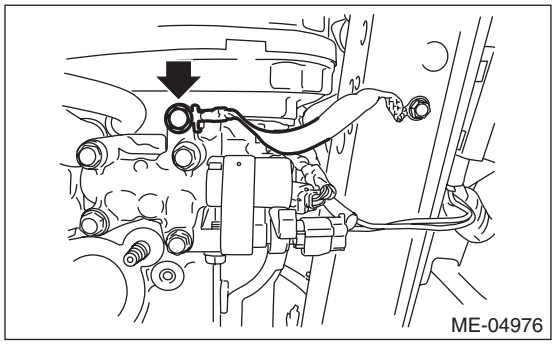


(3) Remove the power steering pump from the engine.

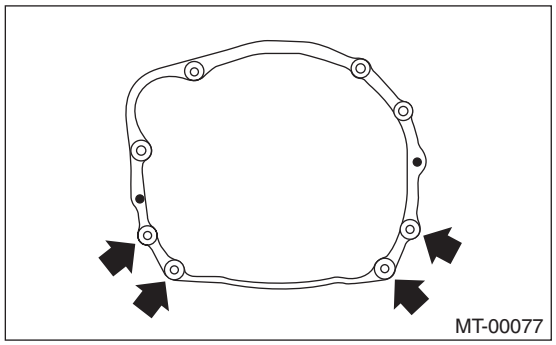


(4) Place the power steering pump on the right side wheel apron.

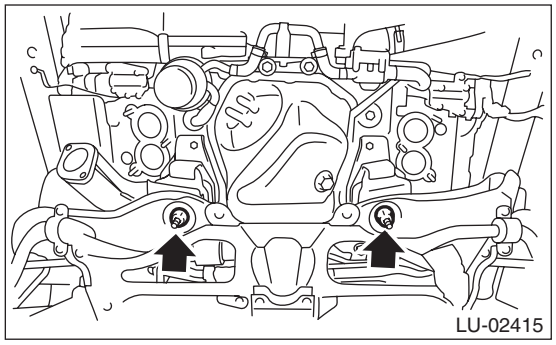
17) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
18) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.>
19) Remove the joint pipe and front exhaust pipe. <Ref. to EX(STI)-12, REMOVAL, Joint Pipe.> <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
20) Disconnect the ground cable on the engine side.



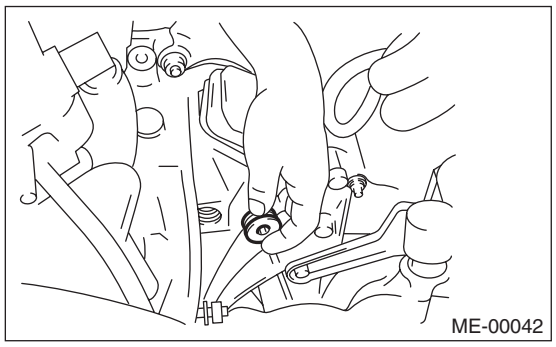
21) Remove the bolts and nuts which hold the lower side of transmission to the engine.



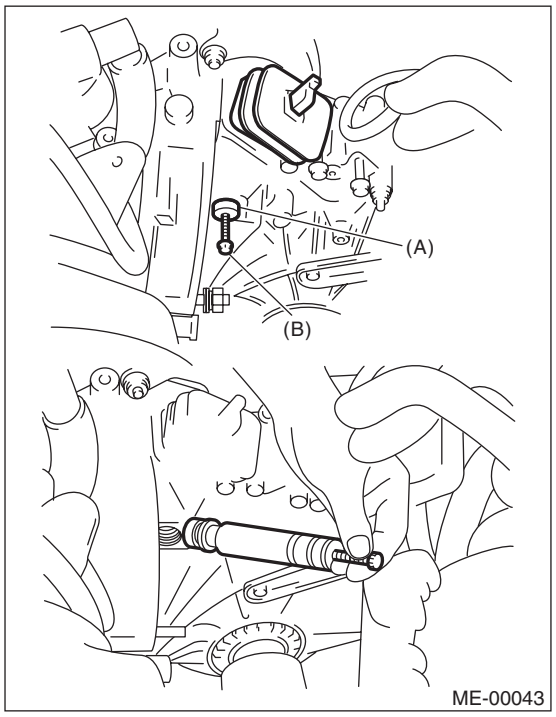
22) Remove the nuts which secure the engine mounting to the front crossmember.



23) Lower the vehicle.
24) Remove the starter. <Ref. to SC(STI)-8, REMOVAL, Starter.>
25) Separate the clutch release fork from the release bearing.
(1) Remove the clutch operating cylinder from the transmission.
(2) Remove the service hole plug using a hexagon wrench (10 mm).



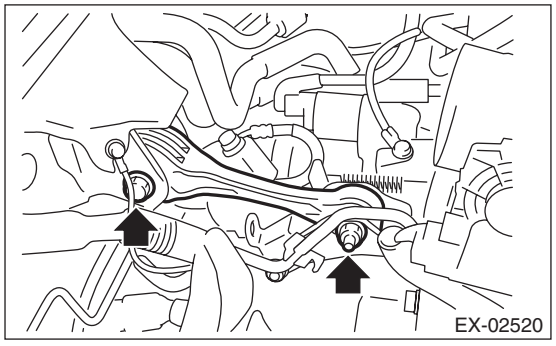
(3) Screw-in the 6 mm dia. bolt into the release fork shaft to remove.



(A) Release fork shaft
(B) Bolt

(4) Raise the release fork, unlock the release bearing tab, then remove the release fork.

NOTE:
Step (4) is required to avoid interference with the engine when removing the engine from the transmission.
26) Remove the pitching stopper.



27) Disconnect the fuel delivery hose, fuel return hose and evaporation hose.

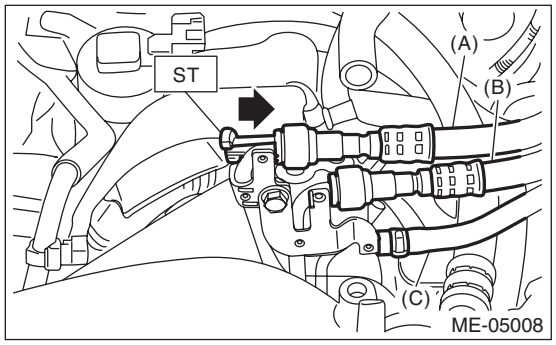
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

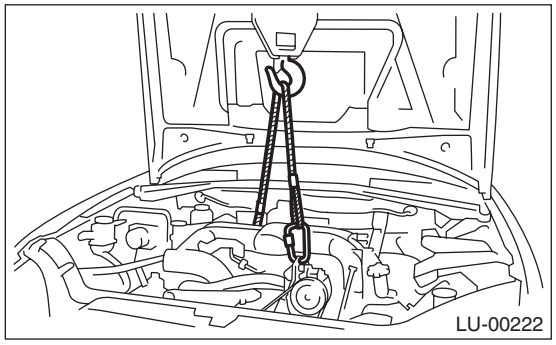
(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



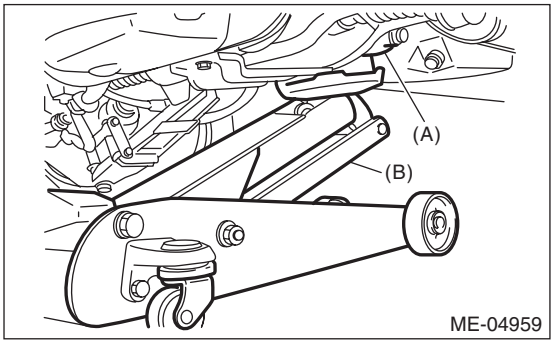
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

28) Support the engine with a lifting device and wire ropes.



29) Support the transmission with a garage jack.

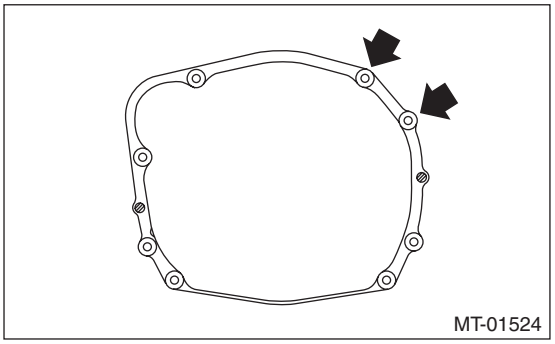
CAUTION:
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.



(A) Transmission
(B) Garage jack

30) Remove the bolts which hold the upper side of the transmission to the engine.

CAUTION:
Before removing the engine away from transmission, check to be sure no work has been overlooked.



31) Remove the engine from the vehicle.

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

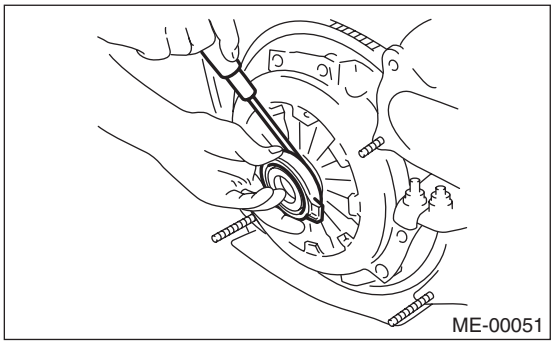
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
(4) Slowly move the engine away from engine compartment.

32) Remove the engine mounting from the engine.

B: INSTALLATION

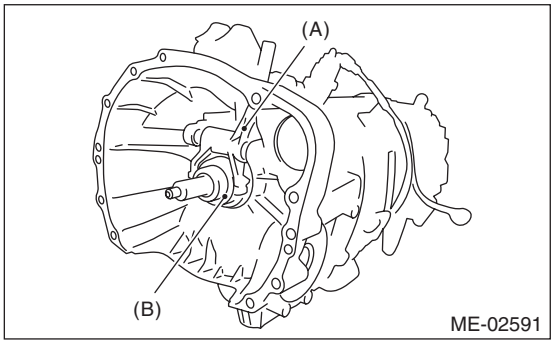
1) Install the clutch release fork and bearing to the transmission.

(1) Using a flat tip screwdriver, remove the release bearing from the clutch cover.



(2) Attach the release bearing to the transmission.

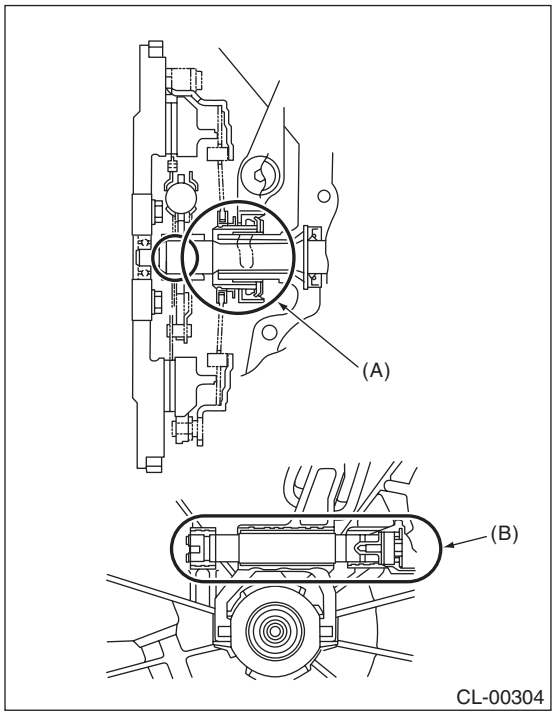
(3) Install the release fork into the release bearing tab.



(A) Release fork
(B) Release bearing

(4) Apply grease to the specified areas.

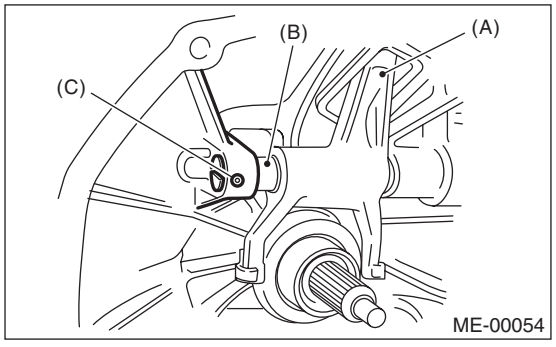
Grease:
Spline part
NICHIMOLY N-130 or equivalent
Shaft part
KOPR-KOTE or equivalent



(A) Spline
(B) Shaft

(5) Insert the release shaft to release fork.

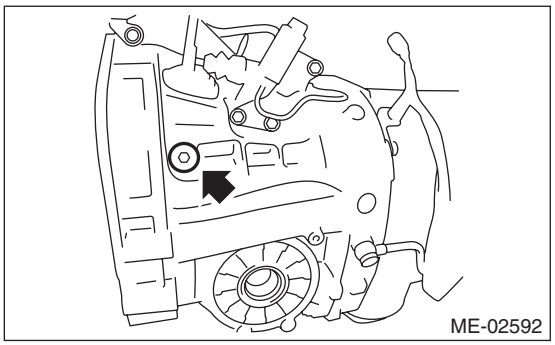
NOTE:
Allow the cutout portion of release shaft to come into contact with the spring pin.



(A) Release fork
(B) Release shaft
(C) Spring pin

(6) Install the service hole plug.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)



2) Install the engine mounting onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

3) Apply a small amount of grease to splines of main shaft.

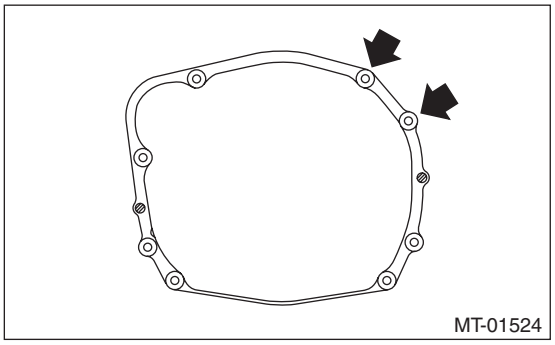
Grease:
NICHIMOLY N-130 or equivalent

4) Position the engine in engine compartment and align it with transmission.

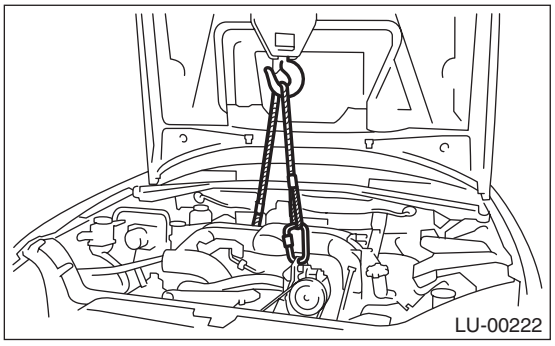
NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

5) Install the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



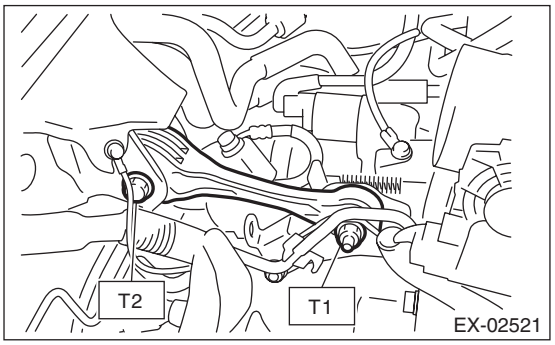
6) Remove the lifting device and wire ropes.



7) Remove the garage jack.

8) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)

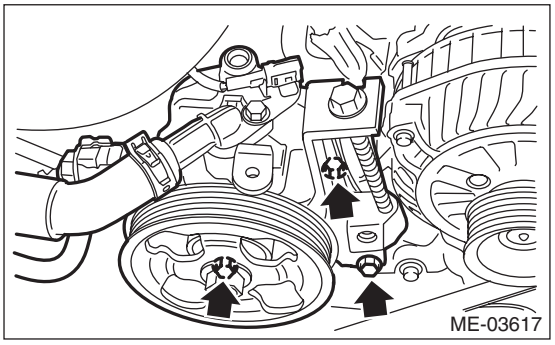


9) Install the starter. <Ref. to SC(STI)-8, INSTALLATION, Starter.>

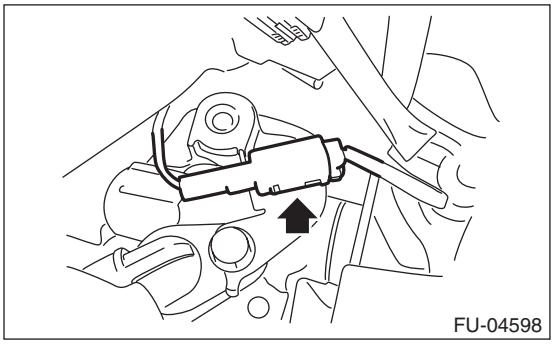
10) Install the power steering pump.

(1) Install the power steering pump onto the engine.

Tightening torque:
Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-4, COMPONENT, General Description.>



(2) Connect the connector to the power steering pump switch.

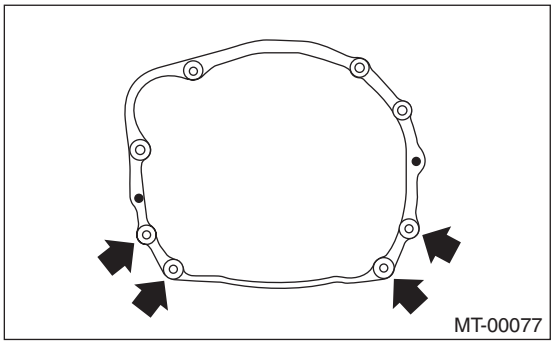


(3) Install the front side belt. <Ref. to ME(STI)-40, FRONT SIDE BELT, INSTALLATION, V-belt.>

11) Lift up the vehicle.

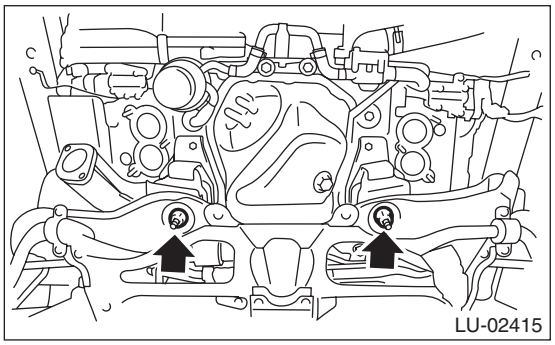
12) Install the bolts and nuts which hold lower side of the transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



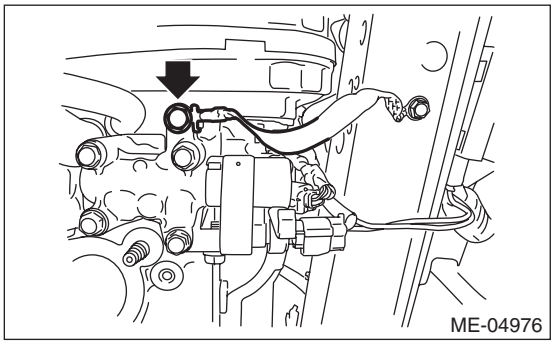
13) Install the nuts which hold the engine mounting to the crossmember.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)

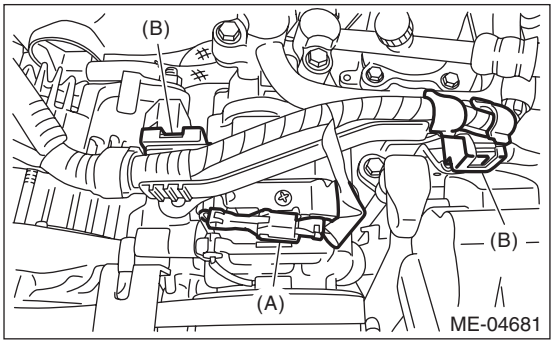


14) Connect the ground cable.

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



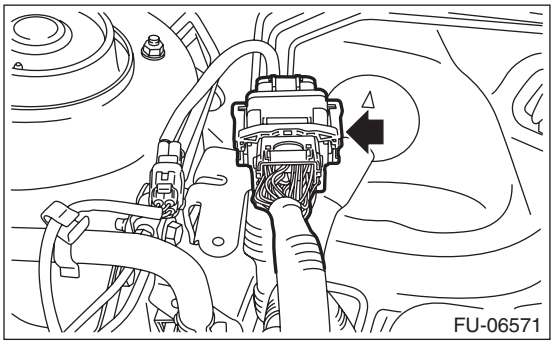
15) Install the joint pipe and front exhaust pipe. <Ref. to EX(STI)-6, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(STI)-12, INSTALLATION, Joint Pipe.>
16) Install the turbocharger. <Ref. to IN(STI)-16, INSTALLATION, Turbocharger.>
17) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
18) Connect the following hoses.
(1) Fuel delivery hose, fuel return hose and evaporation hose
(2) Heater inlet hose and heater outlet hose
(3) Brake booster vacuum hose and pressure regulator vacuum hose
(4) A/C pressure hose <Ref. to AC-41, INSTALLATION, Hose and Pipe.>
19) Secure the generator cord using the clip (B) and connect the connector (A) to A/C compressor.



20) Connect the following connectors and terminals.
(1) Generator connector and terminal

Tightening torque:
15 N·m (1.5 kgf-m, 11.1 ft-lb)
(2) Secondary air pump connector

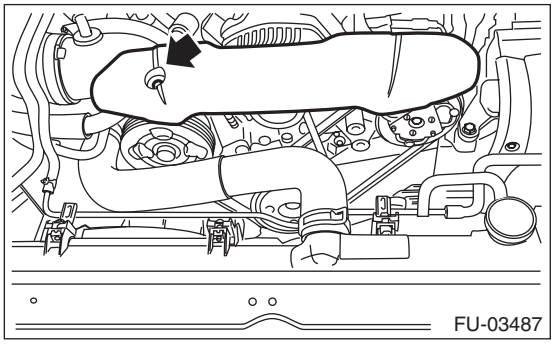
21) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



22) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
23) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.>
24) Install the coolant filler tank. <Ref. to CO(STI)-28, INSTALLATION, Coolant Filler Tank.>
25) Install the air cleaner case and air intake duct. <Ref. to IN(STI)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
26) Install the battery. <Ref. to SC(STI)-27, INSTALLATION, Battery.>
27) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

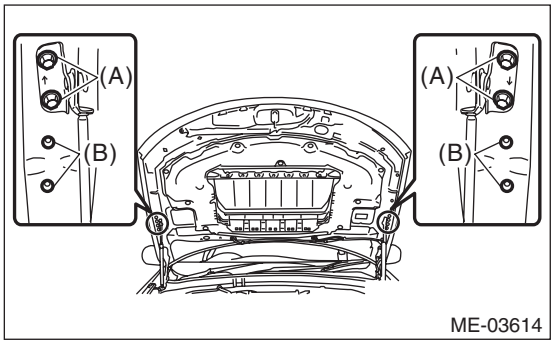
28) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>
29) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



30) Change the bolt installation position from (B) to (A), then close the front hood.

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



C: INSPECTION

1) Check that pipes, hoses, connectors and clamps are installed firmly.
2) Check the engine coolant is at specified level.
3) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

10.Engine Mounting

A: REMOVAL

1) Remove the front crossmember. <Ref. to FS-27, REMOVAL, Front Crossmember.>
2) Remove the engine mounting from the engine.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

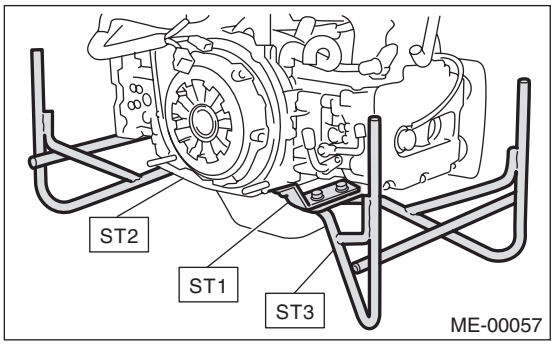
Make sure that no crack or other damages do not exist.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from vehicle body, attach the ST to the engine as shown in the figure.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817100	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

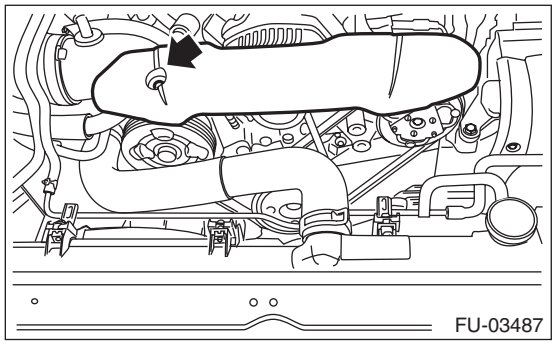
12.V-belt

A: REMOVAL

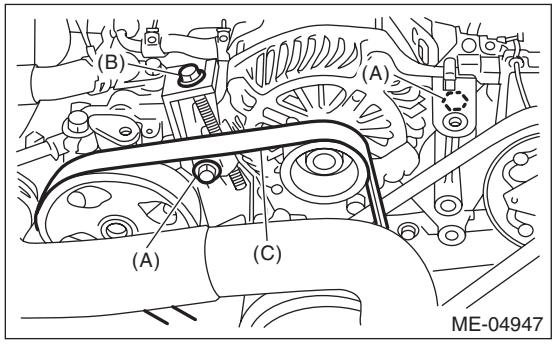
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

1. FRONT SIDE BELT

1) Remove the V-belt covers.

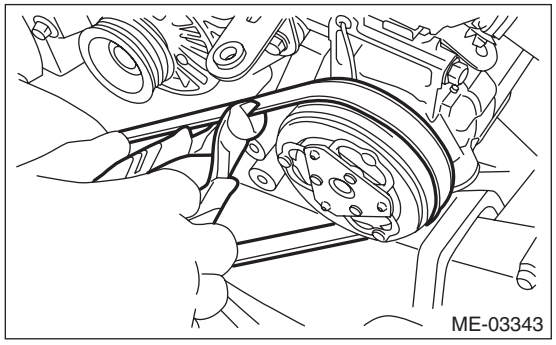


2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Loosen the bolt (A).
4) Loosen the slider bolt (B).
5) Remove the front side belt (C).



2. REAR SIDE BELT

1) Remove the front side belts. <Ref. to ME(STI)-40, FRONT SIDE BELT, REMOVAL, V-belt.>
2) Cut the rear side belt with a wire cutter, etc., and discard.

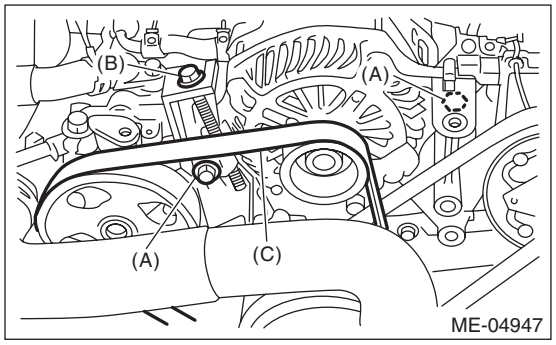


B: INSTALLATION

1. FRONT SIDE BELT

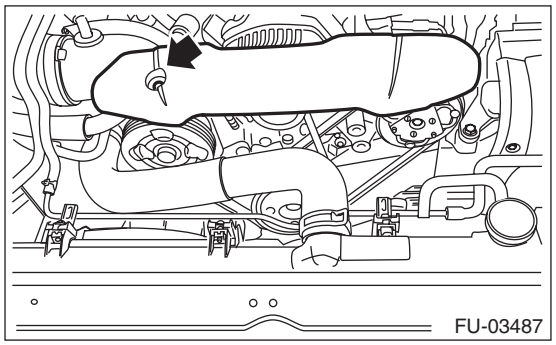
CAUTION:
• When reusing the front side belt, wipe off dust and water with cloth.
• Do not use the front side belt if there is any oil, grease or coolant on the belt.
• Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.
1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Install the front side belt (C), and adjust the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(STI)-46, INSPECTION, V-belt.>
3) Tighten the bolt (A).
4) Tighten the slider bolt (B).

Tightening torque:
Bolt (A)
25 N·m (2.5 kgf-m, 18.4 ft-lb)
Slider bolt (B)
8 N·m (0.8 kgf-m, 5.9 ft-lb)



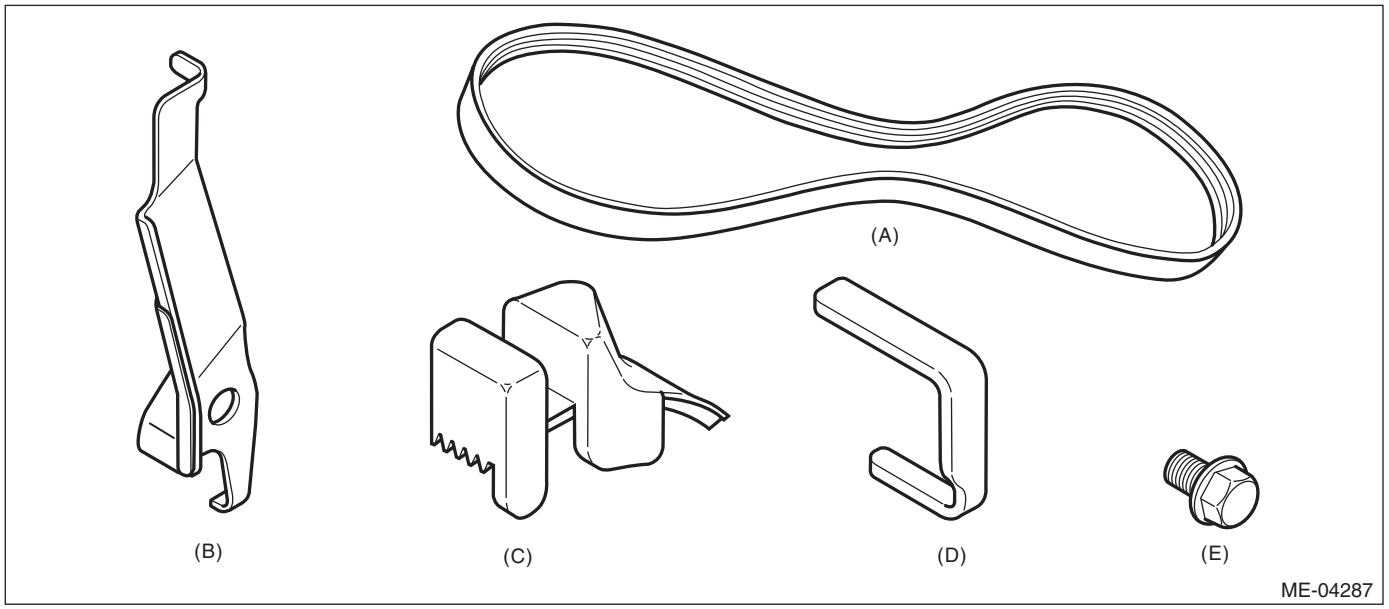
5) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
6) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



2. REAR SIDE BELT

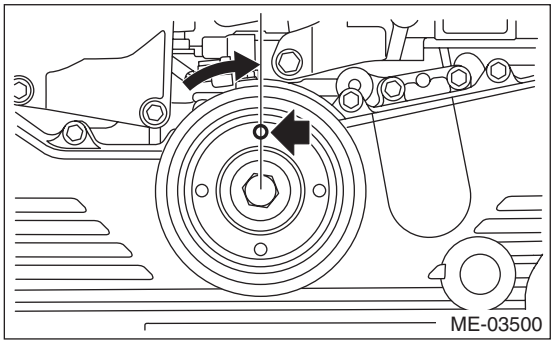
CAUTION:
- **Do not re-use the rear side belt.**
- **Be careful not to let oil, grease or coolant contact a new rear side belt.**
- **Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
- **To install the rear side belt, always use the provided tools (belt stopper, belt guide, belt guide holder, and bolt).**



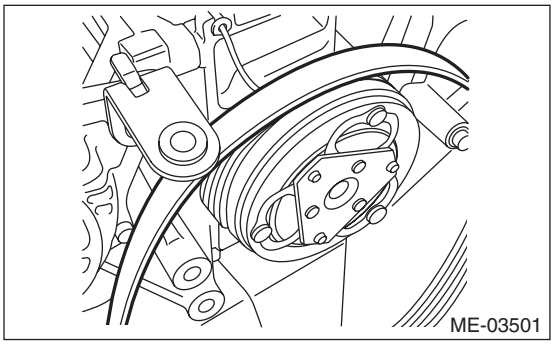
(A) Rear side belt
(B) Belt stopper
(C) Belt guide
(D) Belt guide holder
(E) Bolt

1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Wipe off any oil, water, dirt, and rust on the front of the crank pulley with cloth.
3) Slowly turn the crank pulley clockwise so that the service hole of the crank pulley comes around the top.

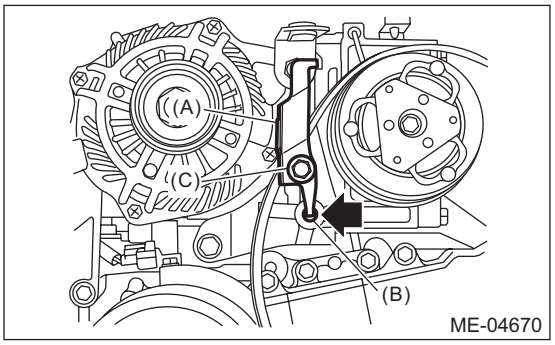
CAUTION:
Do not turn the crank pulley counterclockwise.



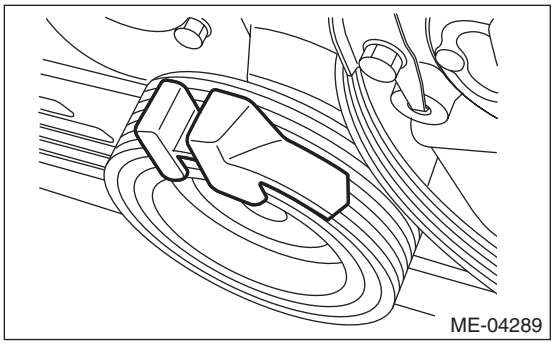
4) Hook a new rear side belt on the A/C compressor pulley.



5) As shown in the figure, insert the claw of the belt stopper (A) to the lower hole (B) of the compressor bracket, then attach with bolt (C).

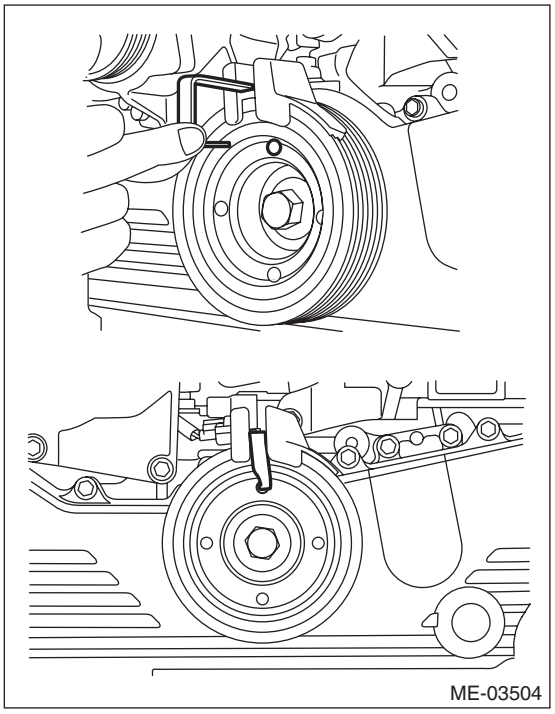


6) Place the belt guide while aligning it with the belt line of the crank pulley on the front side belt side.

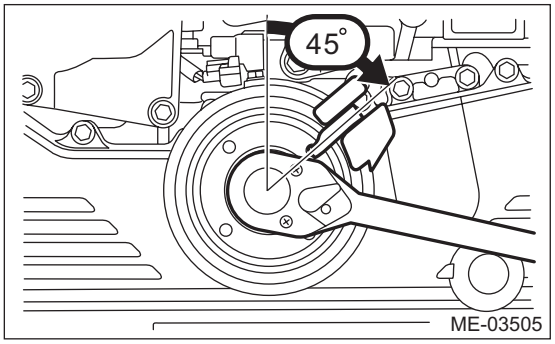


7) Insert the belt guide holder into the service hole of the crank pulley so that the belt guide comes in between.

NOTE:
Place the belt guide holder with the longer side up.

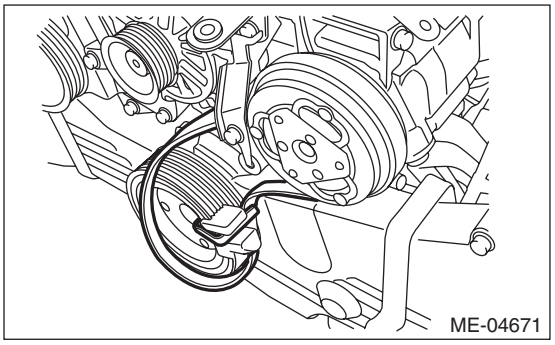


8) Slowly turn the crank pulley clockwise until the belt guide comes to approximately 45°.

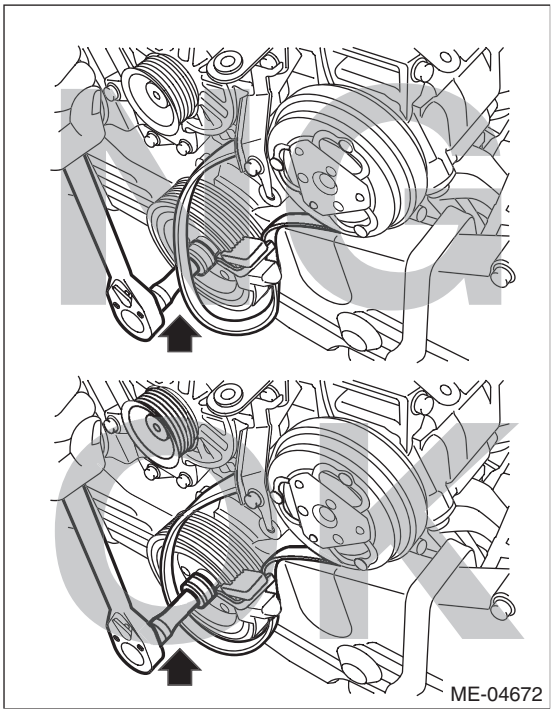


9) Place the rib surface of the rear side belt into the crank pulley groove, so that the rear side belt comes in between the belt guide holder.

CAUTION:
When it is difficult to place the rear side belt to the crank pulley groove, pull out the belt guide holder half way, then place the rear side belt into the groove so that it comes in between the belt guide holder.

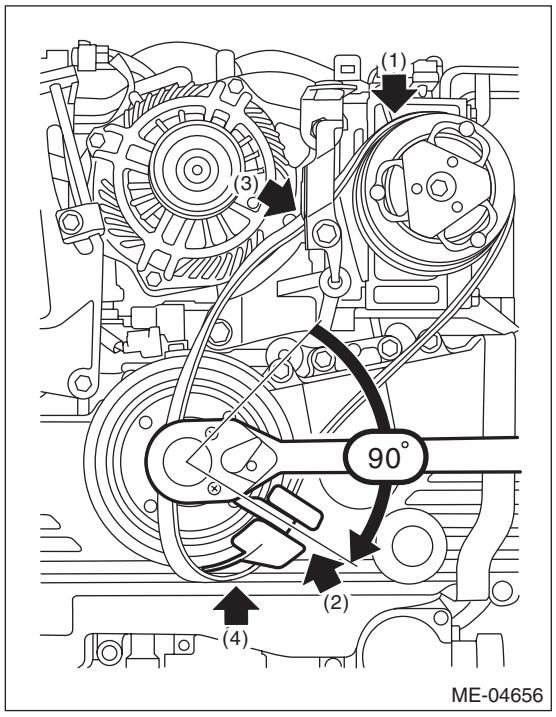


10) Place the tool through the loop of the rear side belt, and set on the crank pulley bolt.



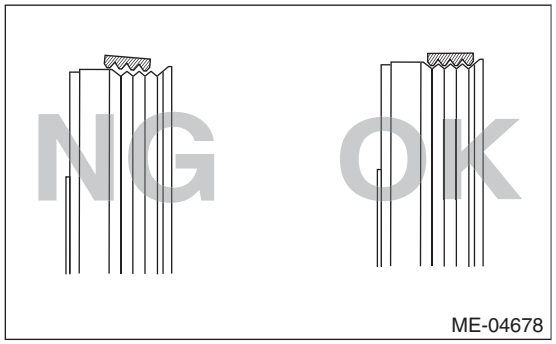
11) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.

CAUTION:
When turning the crank pulley, always make sure that the belt guide is not off from the crank pulley groove.



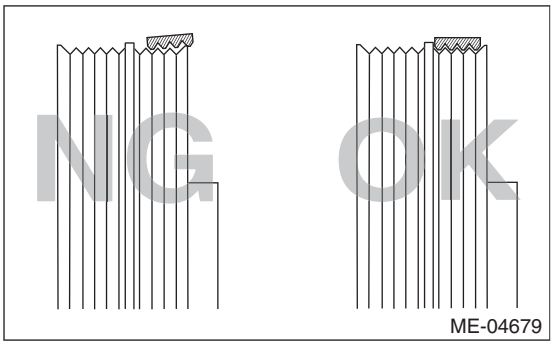
ME-04656

(1) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



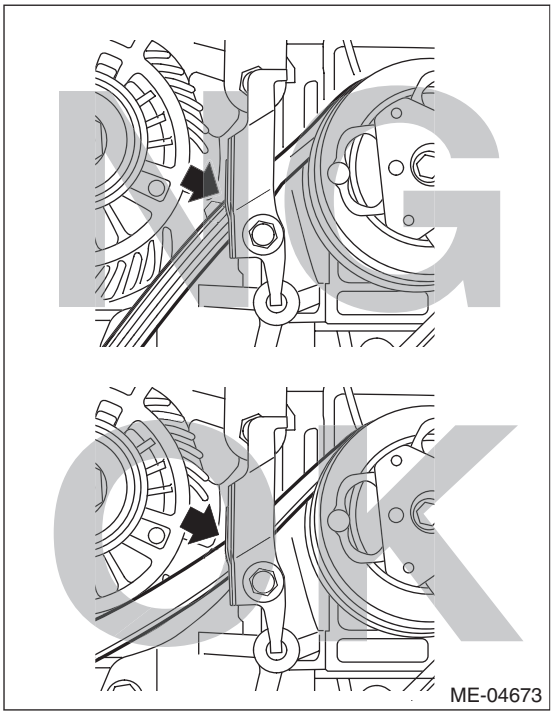
ME-04678

(2) The rib of the rear side belt is securely placed on the groove of the crank pulley.



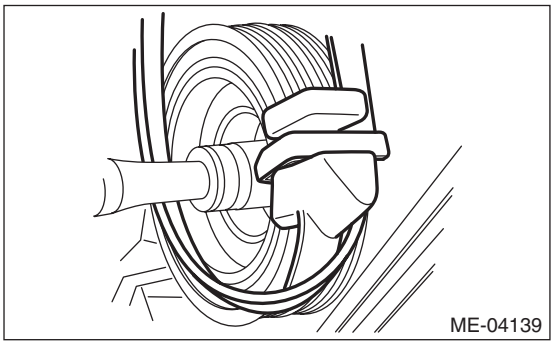
ME-04679

(3) The surface of the rear side belt is held by the belt stopper.

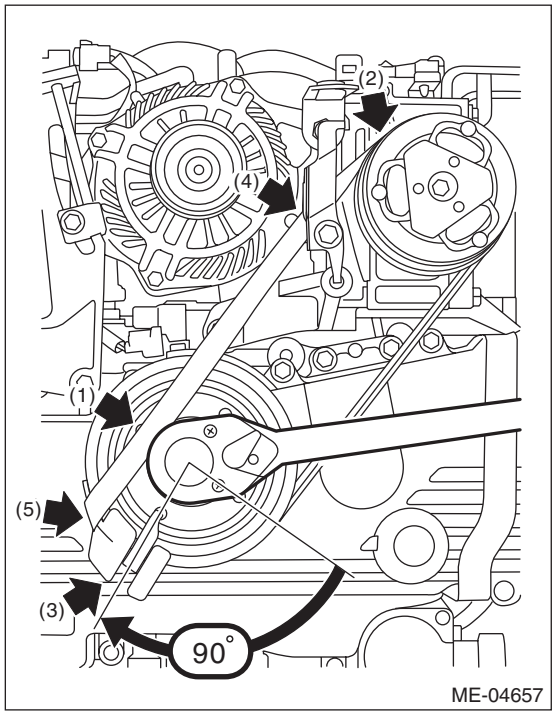


ME-04673

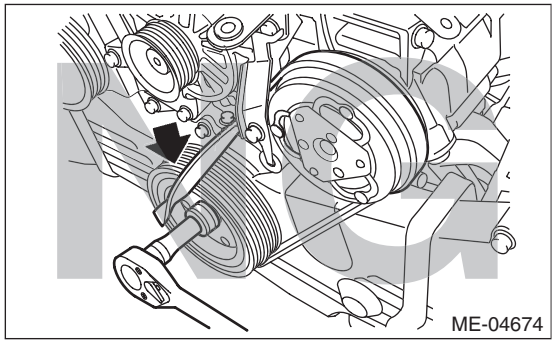
(4) The rear side belt is securely placed on the belt guide.


ME-04139

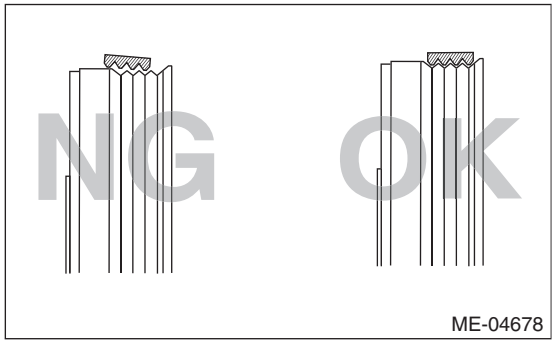
12) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.



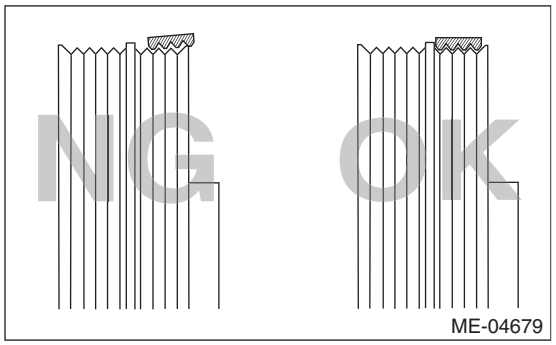
(1) The rear side belt is not twisted.



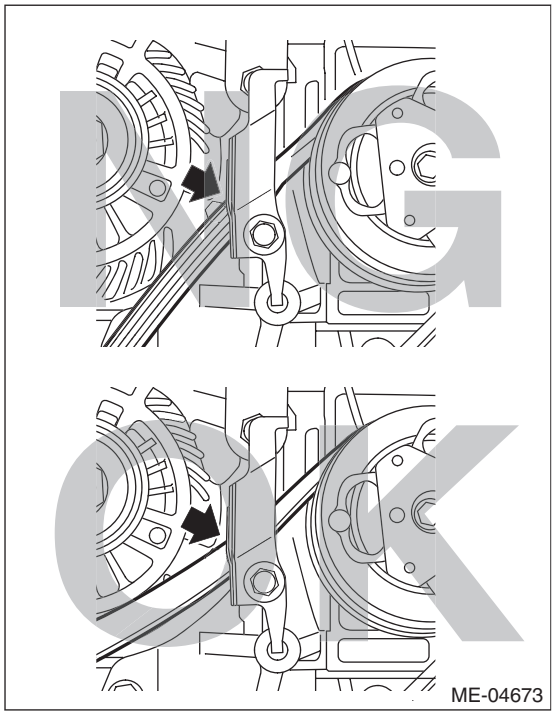
(2) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



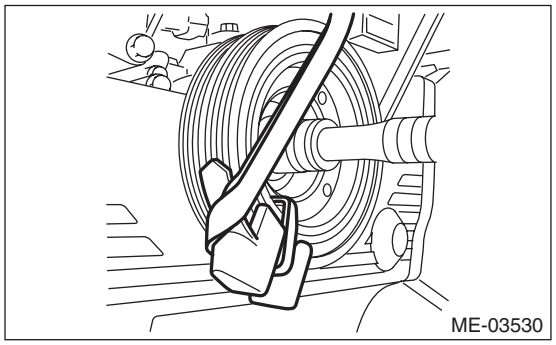
(3) The rib of the rear side belt is securely placed on the groove of the crank pulley.



(4) The surface of the rear side belt is held by the belt stopper.

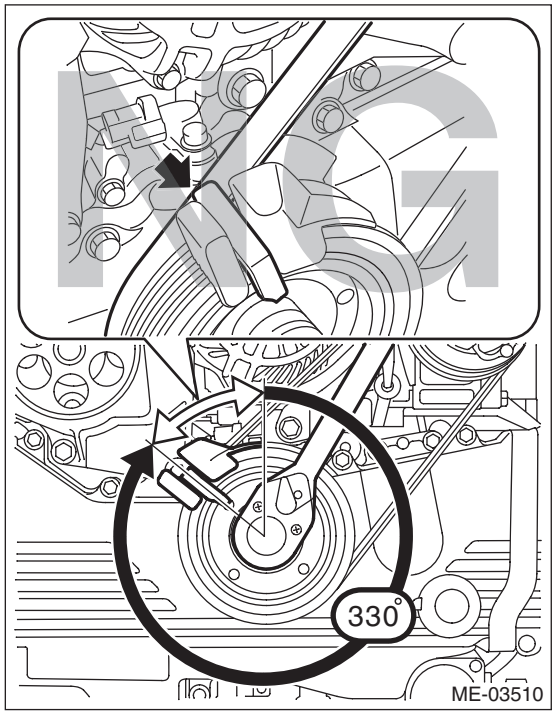


(5) The rear side belt is securely placed on the belt guide.

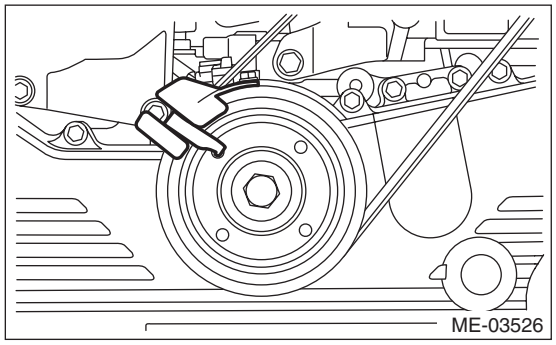


13) Slowly turn the crank pulley clockwise, and install the rear side belt.

CAUTION:
Be careful that the total of procedures 8), 11), 12) and 13) does not exceed 330°; failure to do so may cause damage to the rear side belt and fall of the belt guide holder.

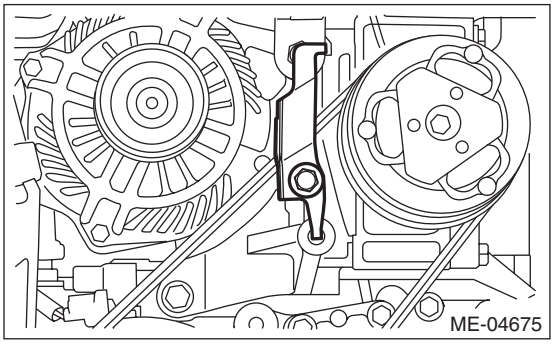


14) Remove the belt guide and belt guide holder from the crank pulley.

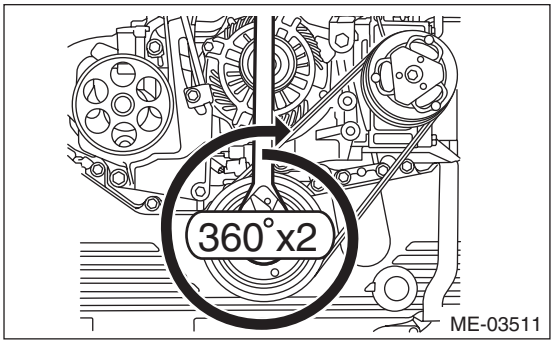


15) Remove the belt stopper from the compressor bracket.

CAUTION:
Always remove the belt stopper; failure to do so may cause smoke, fire, or belt cutting.



16) Make sure that the belt rib is securely installed on the groove of each pulley, then turn the crank pulley slowly, twice in the clockwise direction, to seat the rear side belt properly.



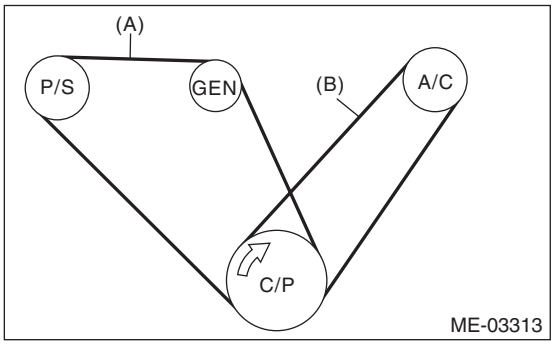
17) Discard the provided tools (belt stopper, belt guide, belt guide holder, and bolt) that are used.
18) Install the front side belt. <Ref. to ME(STI)-40, FRONT SIDE BELT, INSTALLATION, V-belt.>

C: INSPECTION

1. FRONT SIDE BELT

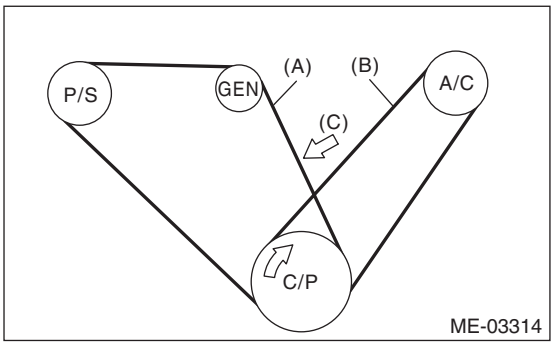
CAUTION:
Check and adjust the front side belt tension so that it is within the specified range. Using the belt with a tension out of the specified range may result in a fault such as the following:
• If the front side belt tension is higher, unexpected force is generated at the power steering oil pump, generator and crankshaft bearing, causing abnormal noise due to abnormal wear of the bearing.
• If the front side belt tension is lower, the front side belt and crank pulley slip, causing abnormally high temperature on the crank pulley due to frictional heat. If this condition repeatedly occurs, the front side belt may abnormally wear, causing abnormal noise, front side belt damage or crank pulley damage.
1) Replace the front side belt, if crack, fraying or wear is found.
2) Check the front side belt tension and adjust it if necessary by changing the generator installing position.

Front side belt tension (with belt tension gauge):
When installing new parts
640 — 780 N (65 — 80 kgf, 144 — 175 lbf)
At inspection
490 — 640 N (50 — 65 kgf, 110 — 144 lbf)



(A) Front side belt
(B) Rear side belt
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

Front side belt tension (without belt tension gauge):
When installing new parts
7 — 9 mm (0.276 — 0.354 in)
At inspection
9 — 11 mm (0.354 — 0.433 in)



(A) Front side belt
(B) Rear side belt
(C) 98 N (10 kgf, 22 lbf)
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

2. REAR SIDE BELT

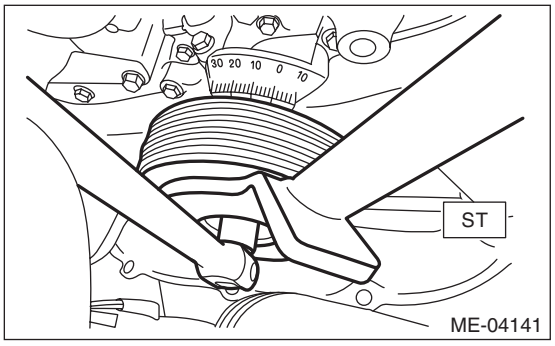
Replace the rear side belt, if crack, fraying or wear is found, or noise is emitted.

NOTE:
For the rear side belt, a stretch type belt is used, and therefore, it is not necessary to check deflection nor tension.

13.Crank Pulley

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the V-belts. <Ref. to ME(STI)-40, REMOVAL, V-belt.>
2) Use the ST to lock the crank pulley, and remove the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH



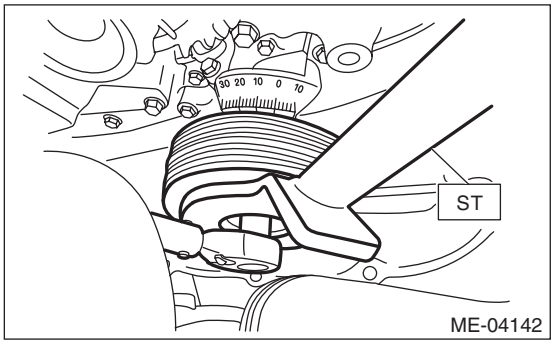
3) Remove the crank pulley.

B: INSTALLATION

1. METHOD WITHOUT ANGLE GAUGE

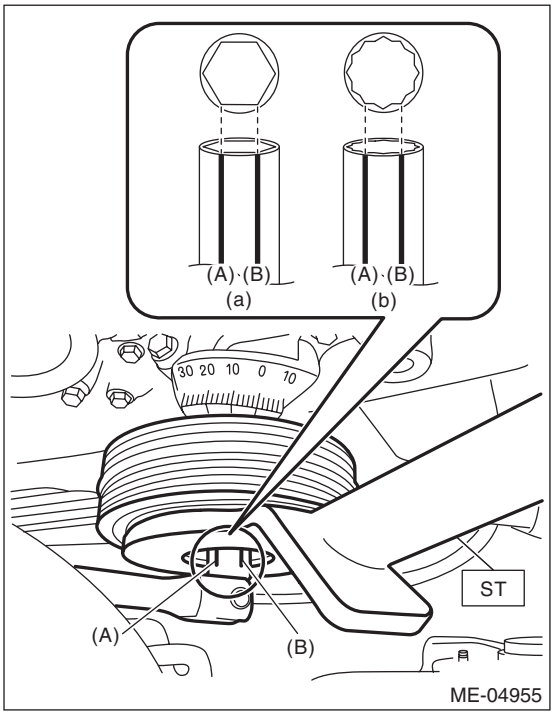
1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH

Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



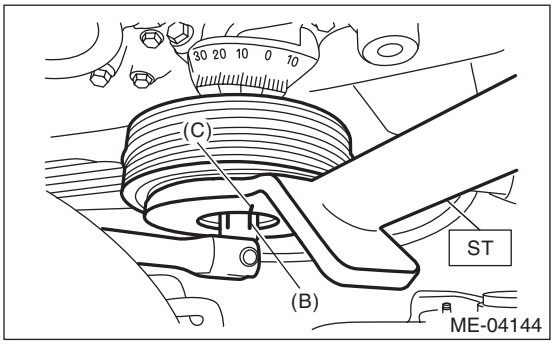
(2) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

NOTE:
Set the socket onto the crank pulley bolt so that reference lines (A) and (B) is visible.
ST 499977100 CRANK PULLEY WRENCH



(a) When using 6-point socket
(b) When using 12-point socket

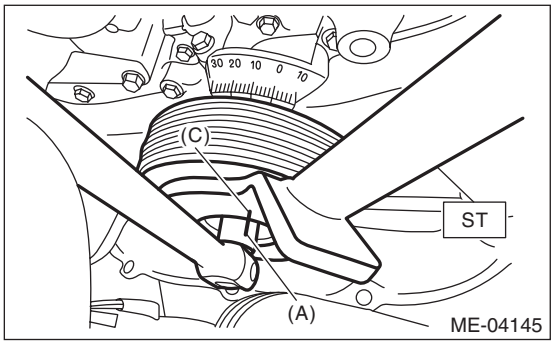
(3) Draw end line (C) on ST using a marker at the same position as reference line (B) drawn on the socket in step (2).
ST 499977100 CRANK PULLEY WRENCH



(4) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (C) are aligned.

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.
ST 499977100 CRANK PULLEY WRENCH

Tightening angle:
60°±5°

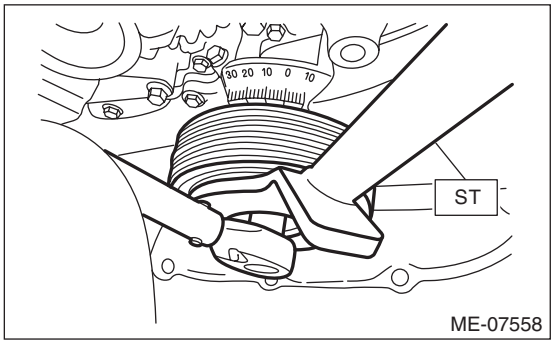


5) Install the V-belts. <Ref. to ME(STI)-40, INSTALLATION, V-belt.>

2. METHOD WITH ANGLE GAUGE

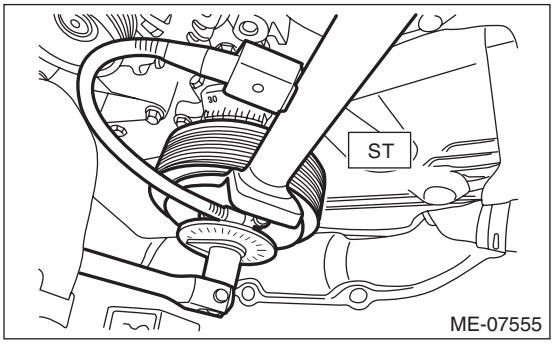
1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Remove the radiator main fan motor assembly and radiator sub fan motor assembly. <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
(2) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH

Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



(3) Set the angle gauge, use the ST to lock the crank pulley, and tighten the crank pulley bolt to the specified angle.
ST 499977100 CRANK PULLEY WRENCH

Tightening angle:
60°±5°



(4) Install the radiator main fan motor assembly and radiator sub fan motor assembly. <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>

5) Install the V-belts. <Ref. to ME(STI)-40, INSTALLATION, V-belt.>

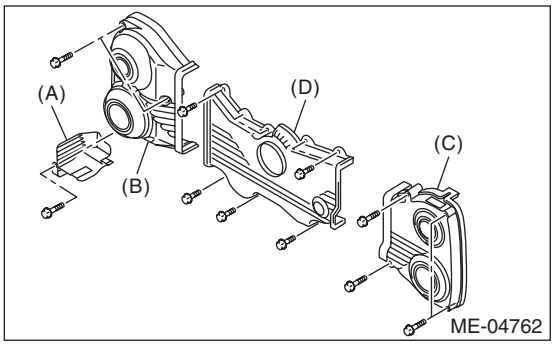
C: INSPECTION

1) Check that the crank pulley has no deformation, cracks or other damages.

14.Timing Belt Cover

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
2) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover RH (B) together with the engine harness cover (A).
4) Remove the timing belt cover LH (C).
5) Remove the front timing belt cover (D).

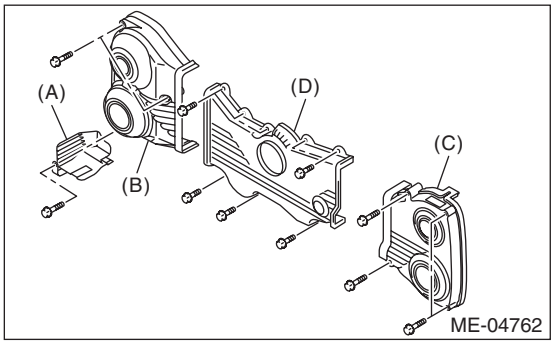


B: INSTALLATION

1) Install the front timing belt cover (D).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
2) Install the timing belt cover LH (C).

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



3) Install the timing belt cover RH (B) together with the engine harness cover (A).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
4) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>
5) Install the secondary air pump. <Ref. to EC(STI)-27, INSTALLATION, Secondary Air Pump.>

C: INSPECTION

Check the timing belt cover for damage.

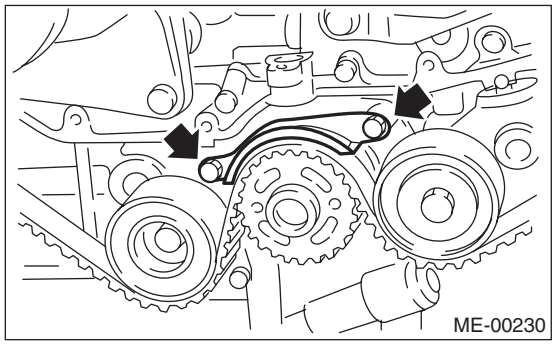
15.Timing Belt

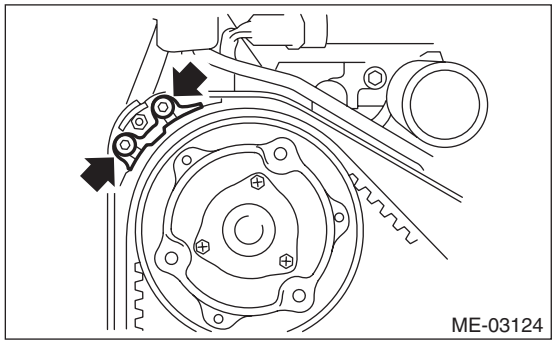
A: REMOVAL

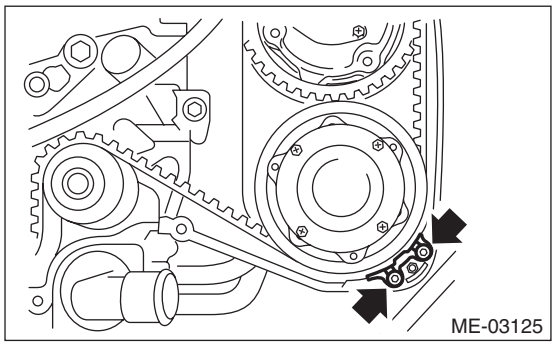
NOTE:
• When replacing a single part, perform the work with the engine assembly installed to body.
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
  • Radiator main fan motor assembly <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.>
  • Radiator sub fan motor assembly <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
• When performing the work with the engine installed to body, protect the radiator with cardboards or blankets.

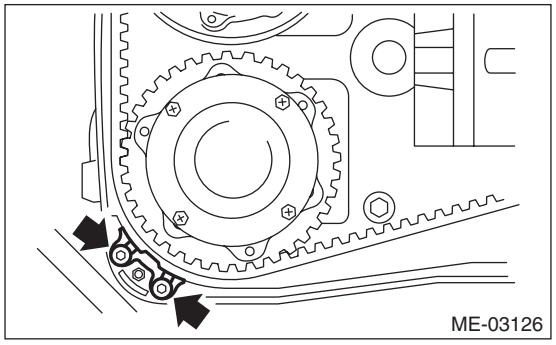
1. TIMING BELT

1) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt guide.


ME-00230

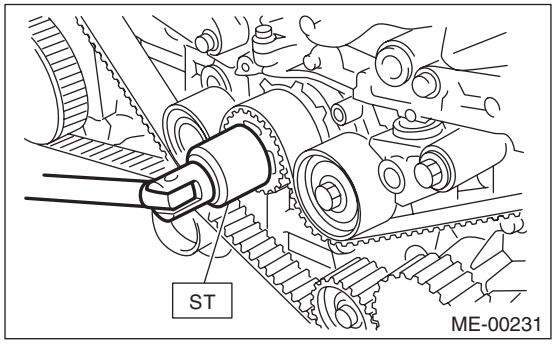

ME-03124


ME-03125


ME-03126

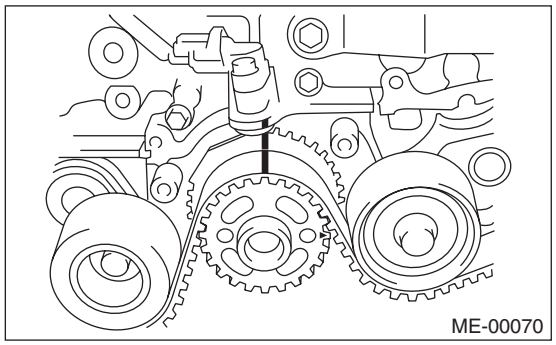
4) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
  (1) Turn the crankshaft using ST, and align the alignment marks on crank sprocket, intake cam sprocket LH, exhaust cam sprocket LH, intake cam sprocket RH and exhaust cam sprocket RH with marks on oil pump and notches of timing belt cover.

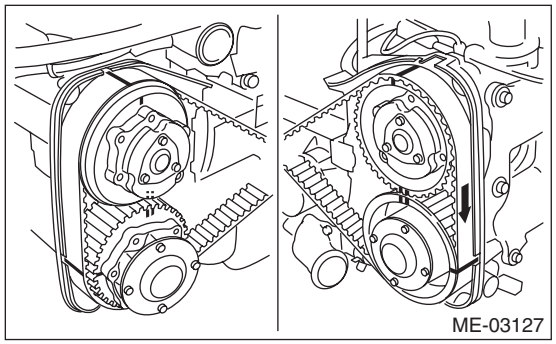
ST 499987500 CRANKSHAFT SOCKET



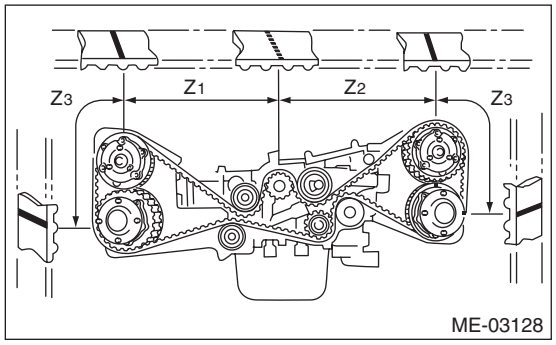
ME-00231

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


ME-00070

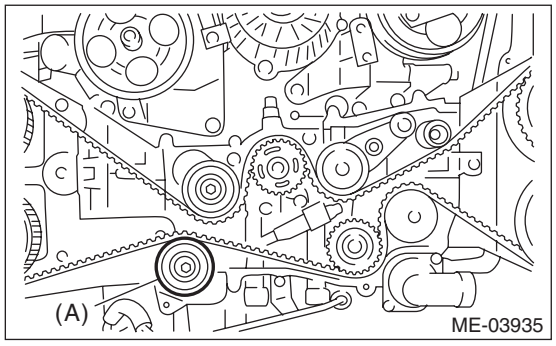

ME-03127

Z_1: 54.5 teeth
Z_2: 51 teeth
Z_3: 28 teeth



ME-03128

5) Remove the belt idler (A).



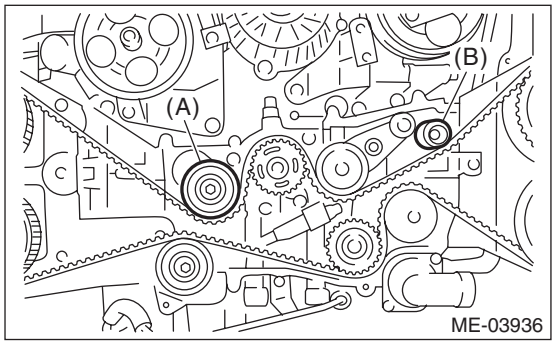
ME-03935

6) Remove the timing belt.

CAUTION:
After the timing belt has been removed, never rotate the intake and exhaust sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

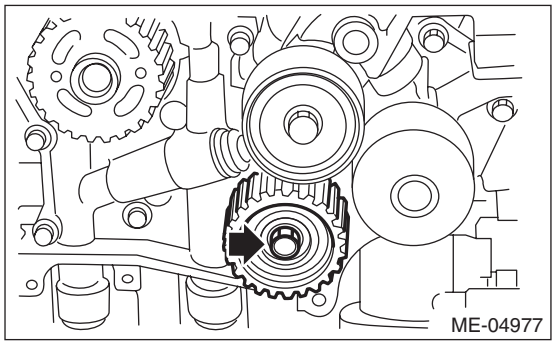
2. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Remove the belt idler (A) and (B).

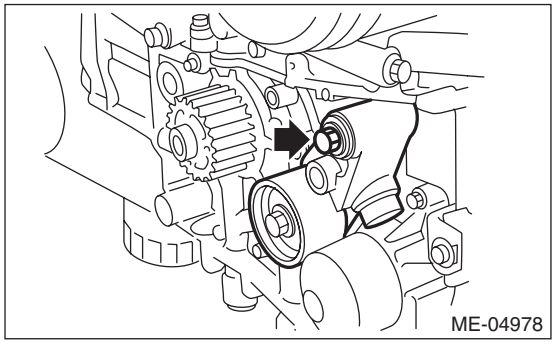


ME-03936

2) Remove the belt idler No. 2.


ME-04977

3) Remove the automatic belt tension adjuster assembly.


ME-04978

B: INSTALLATION

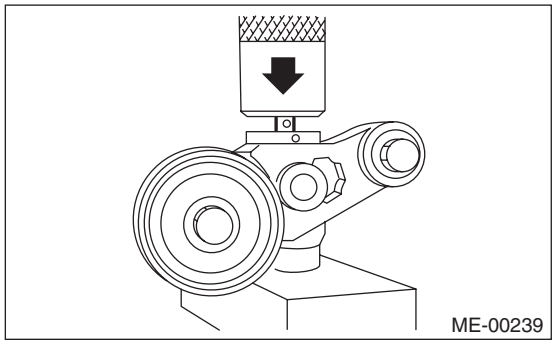
1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Prepare for installation of the automatic belt tension adjuster assembly.

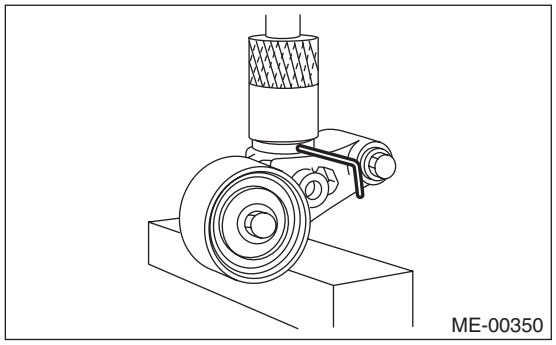
CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the push adjuster rod gradually taking three minutes or more.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
• Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
• Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to vertical pressing tool.

(2) Slowly push in the adjuster rod with a pressure of 165 N (16.8 kgf, 37.1 lbf) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

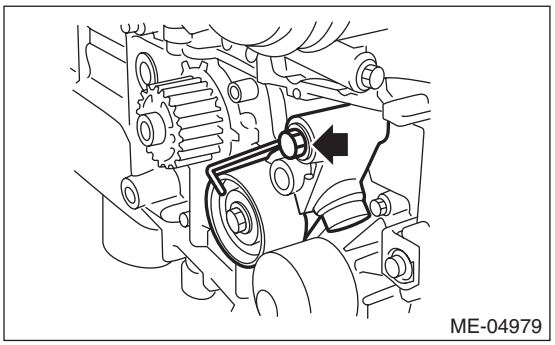

ME-00239

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


ME-00350

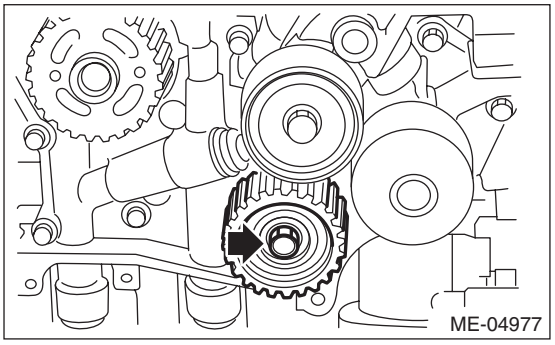
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)


ME-04979

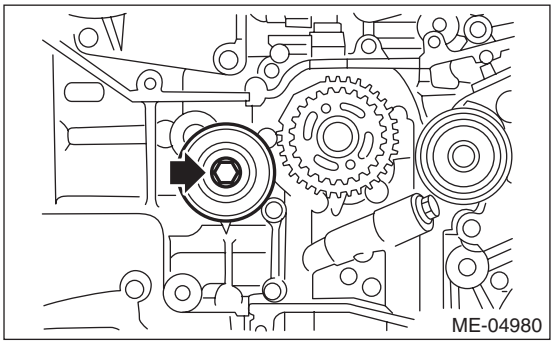
3) Install the belt idler No. 2.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

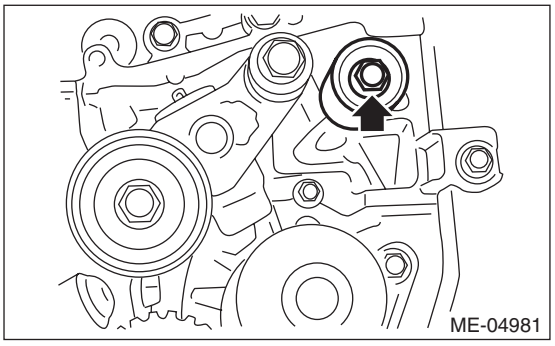

ME-04977

4) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)


ME-04980

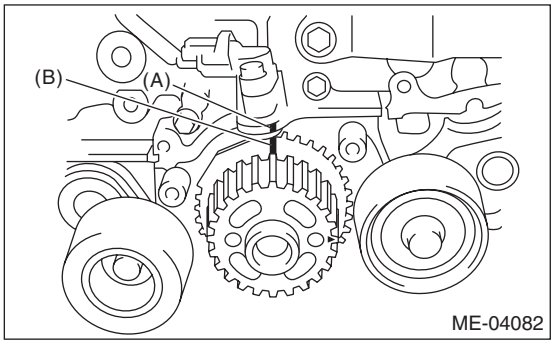
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)


ME-04981

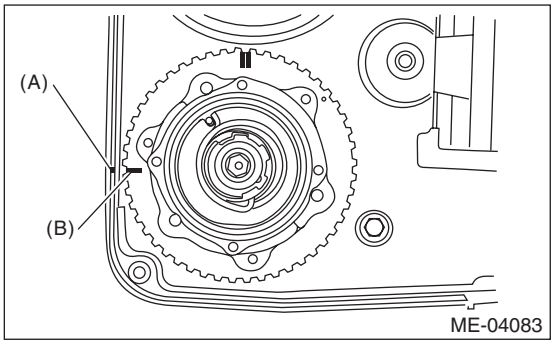
2. TIMING BELT

1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(STI)-52, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

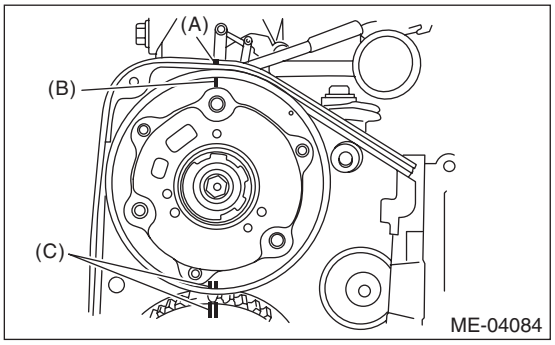
2) Align the mark (B) on crank sprocket with the mark (A) on oil pump.



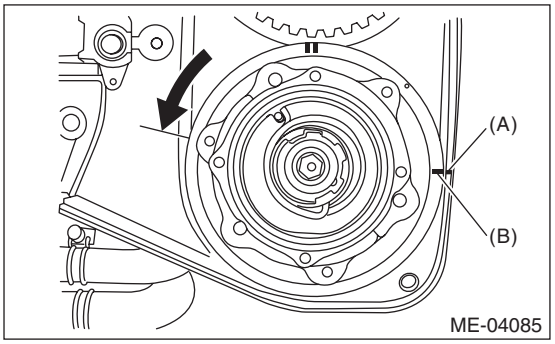
3) Align the single line mark (B) on the exhaust cam sprocket RH with notch (A) on the timing belt cover.



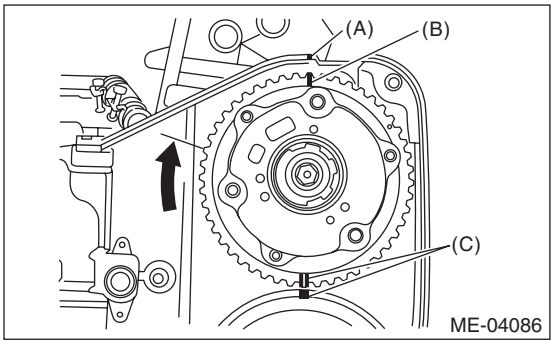
4) Align the single line mark (B) on the intake cam sprocket RH with notch (A) on the timing belt cover. Make sure that the double line marks (C) on intake and exhaust cam sprockets are aligned.



5) Align the single line mark (B) on exhaust cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).



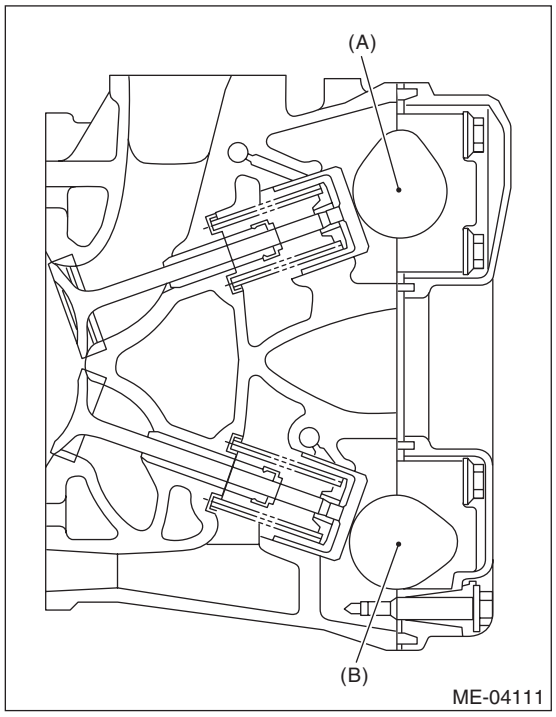
6) Align the single line mark (B) on intake cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket clockwise (as viewed from front of engine). Make sure the double line marks (C) on the intake and exhaust cam sprockets are aligned.



7) Make sure that the cam and crank sprockets are positioned properly.

CAUTION:

• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, heads will interfere with each other, resulting in bent valves.



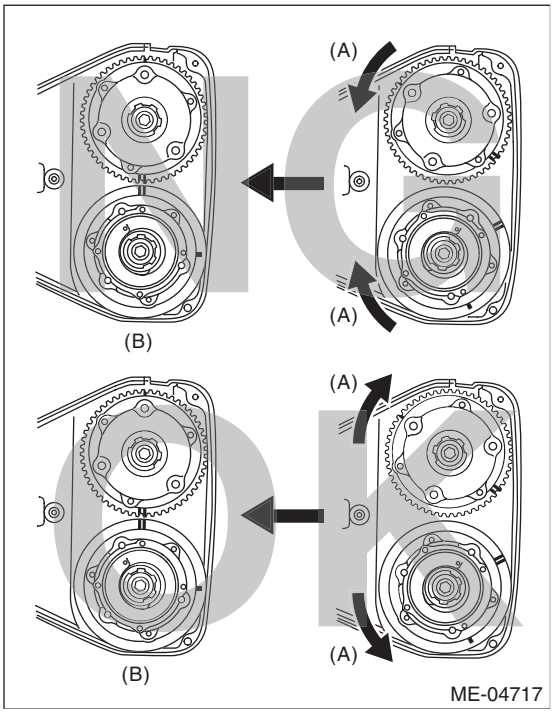
(A) Intake camshaft
(B) Exhaust camshaft

• When the timing belts are not installed, four camshafts are held at the "zero-lift" position, where all cams on camshafts are not pushing down on the intake and exhaust valves. (Under this condition, all valves remain unlifted.)

• When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshaft LH are held, pushing their corresponding valves down. (Under this condition, these valves are held lifted.) Camshaft RH are held so that their cams do not push the valves down.

• Camshafts LH must be rotated from the zero-lift position to the position where the timing belt is to be installed with the smallest possible angle, in order to prevent mutual interference of intake and exhaust valve heads.

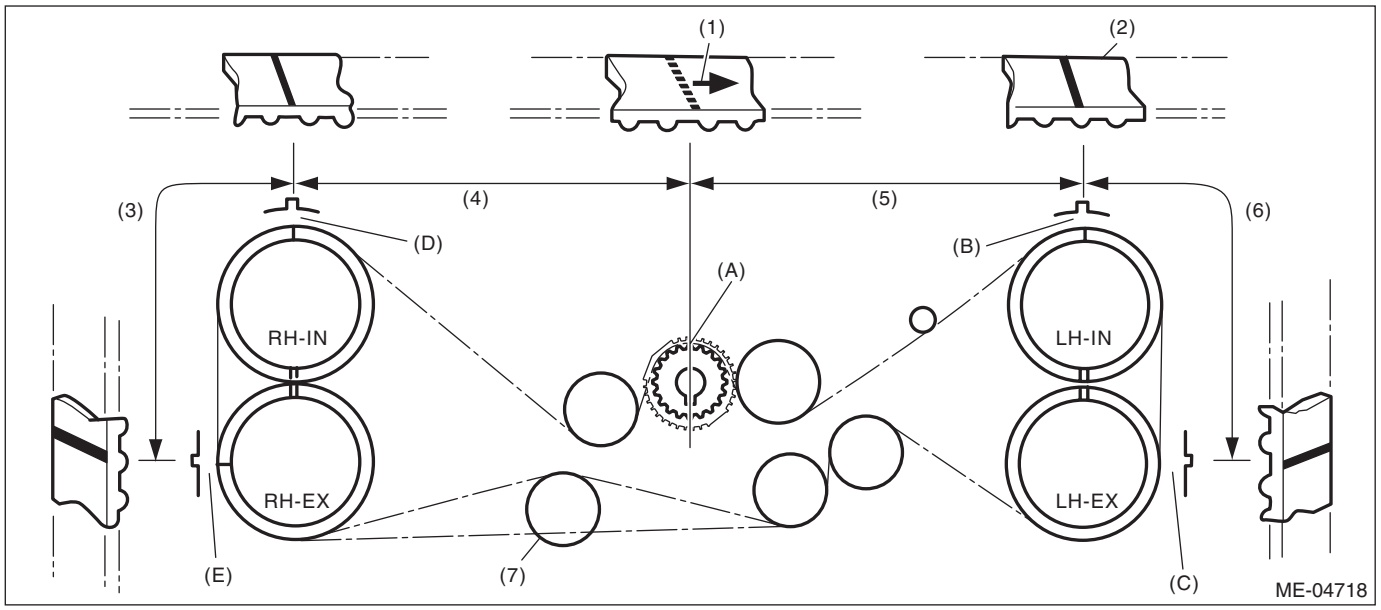
• Do not allow the camshafts to rotate in the direction shown in the upper figure. Doing this may cause both the intake and exhaust valves to lift simultaneously, resulting in mutual interference of valve heads.



(A) Direction of rotation
(B) Timing belt installation position

8) Align the alignment mark on the timing belt with marks on the sprockets in the alphabetical order shown in the figure. While aligning marks, position the timing belt properly, and install the timing belt.

CAUTION:
- **If the timing belt slips by 1 or more teeth, the valve and piston may hit each other.**
- **Make sure that the direction of belt rotation is correct.**

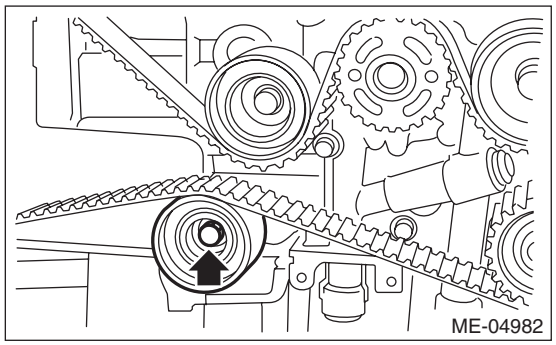


(1) Arrow mark
(2) Timing belt
(3) 28 teeth
(4) 54.5 teeth
(5) 51 teeth
(6) 28 teeth
(7) Install it in the end

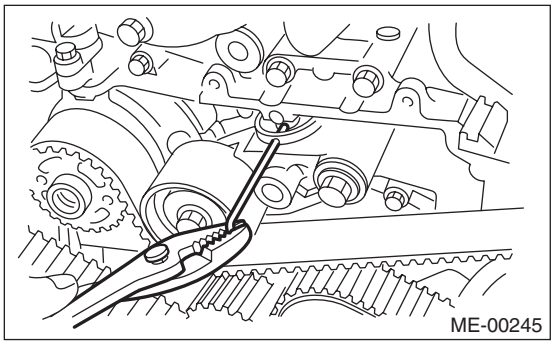
9) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

NOTE:
Make sure that the marks on the timing belt and sprockets are aligned.



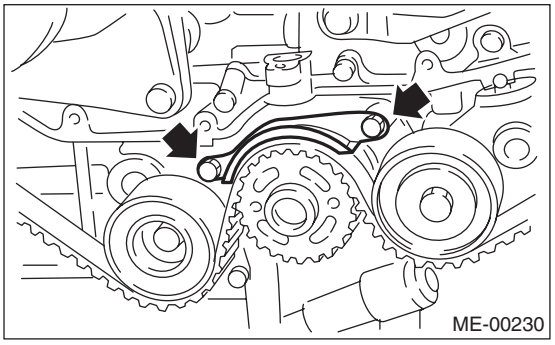
10) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.

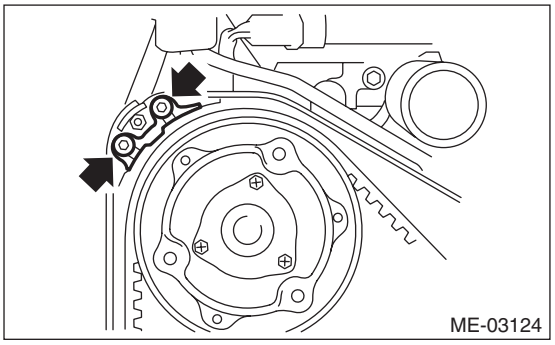

ME-00245

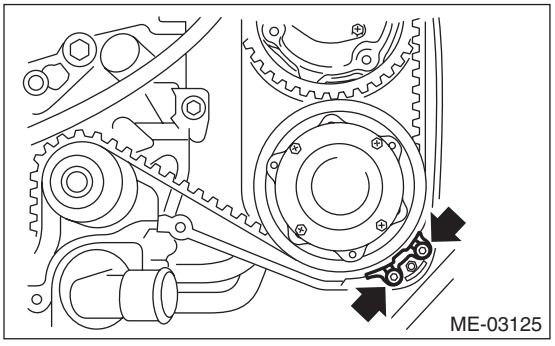
11) Install the timing belt guide.
(1) Temporarily tighten the bolts mounting the timing belt guide.

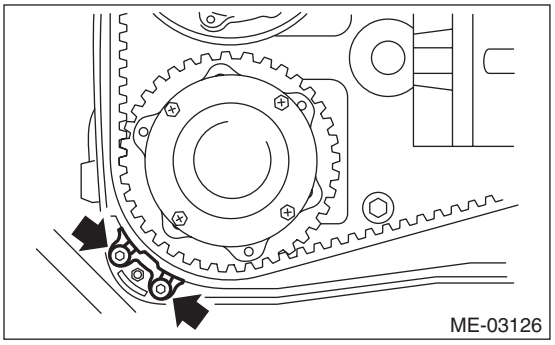
NOTE:
• Before installing the timing belt guide, clean the timing belt guide mounting bolt holes of the timing belt cover No. 2.
• Apply liquid gasket to the thread of the timing belt guide mounting bolt on the cam sprocket section. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent


ME-00230

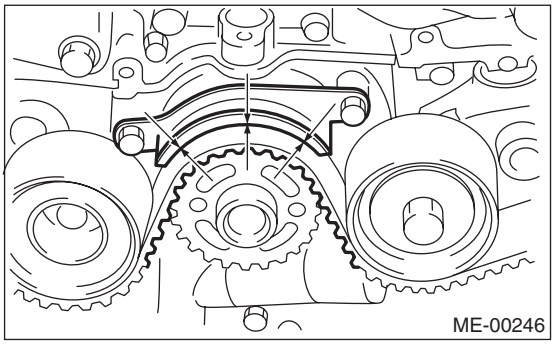

ME-03124

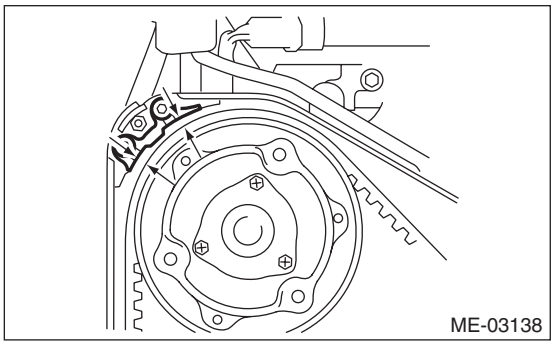

ME-03125

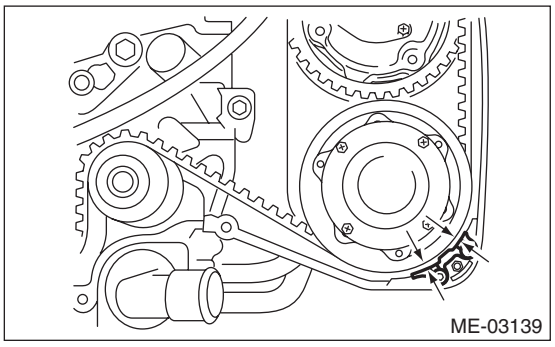

ME-03126

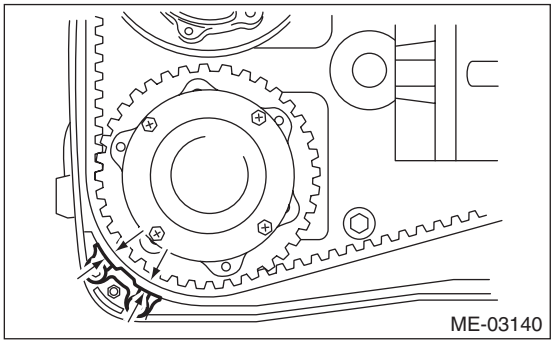
(2) Adjust the clearance between timing belt and timing belt guide using a thickness gauge and tighten.

Clearance:
1.0±0.5 mm (0.039±0.020 in)

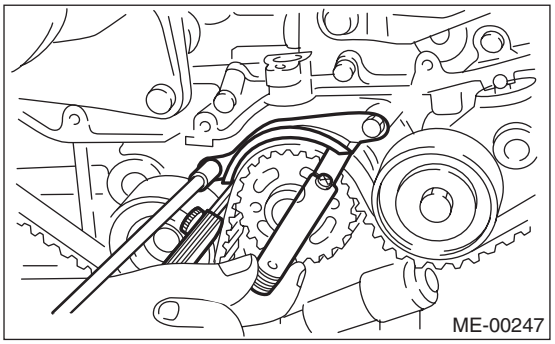

ME-00246


ME-03138

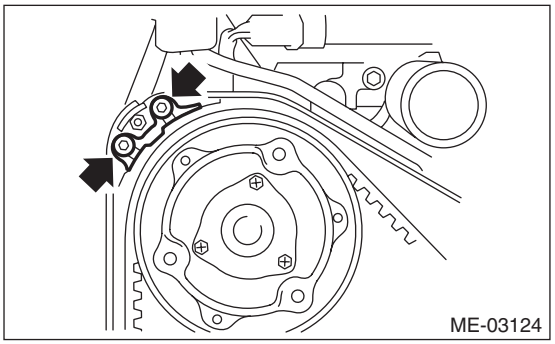

ME-03139

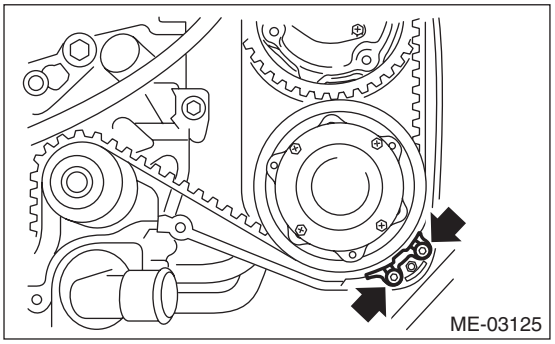

ME-03140

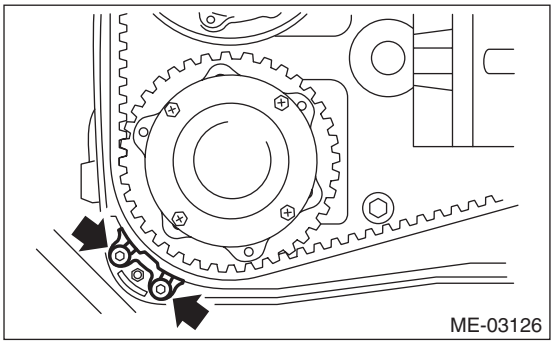
Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)


ME-00247

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


ME-03124


ME-03125


ME-03126

12) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>

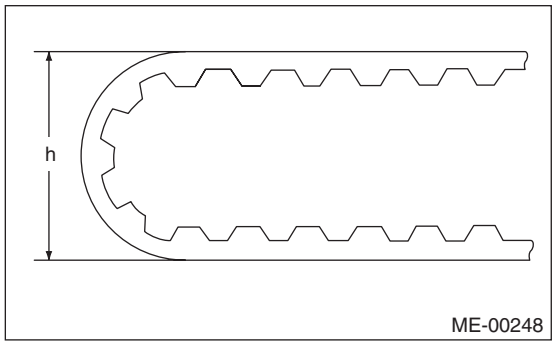
C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.
2) Check the condition on the back surface of the timing belt. If cracks are found, replace the timing belt.

CAUTION:
• Be careful not to let oil, grease or coolant contact the timing belt. Remove quickly and thoroughly if this happens.
• Do not bend the timing belt sharply.

In radial diameter h:
60 mm (2.36 in) or more



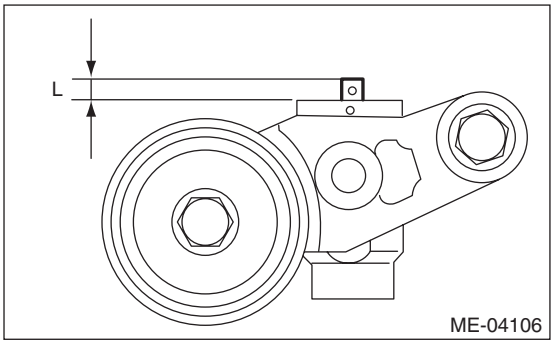
2. AUTOMATIC BELT TENSION ADJUSTER

1) Visually check the oil seals for leaks, and rod ends for abnormal wear and scratches. If necessary, replace the automatic belt tension adjuster assembly.

NOTE:
Slight traces of oil at the rod oil seal does not indicate a problem.
2) Check that the adjuster rod does not move when a pressure of 165 N (16.8 kgf, 37.1 lbf) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff enough and moves freely when applying 165 N (16.8 kgf, 37.1 lbf), check it using the following procedures:
(1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.
(2) With the adjuster rod moved all the way up, apply a pressure of 165 N (16.8 kgf, 37.1 lbf) to it, and check the adjuster rod stiffness.
(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new part.

CAUTION:
• Always use a vertical type pressing tool to move the adjuster rod down.
• Do not use a lateral type vise.
• Push the adjuster rod vertically.
• Press-in the push adjuster rod gradually taking three minutes or more.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lbf).
• Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
4) Measure the amount of adjuster rod protrusion "L" from the end surface of the cylinder. If it is not within specifications, replace the automatic belt tension adjuster assembly with a new part.

Protrusion amount of adjuster rod L:
5.2 — 6.2 mm (0.205 — 0.244 in)



3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly with a new part if faulty.
2) Check the belt tension pulley for smooth rotation. Replace the automatic belt tension adjuster assembly with a new part if abnormal noise or excessive play occurs.
3) Check the belt tension pulley for grease leakage.

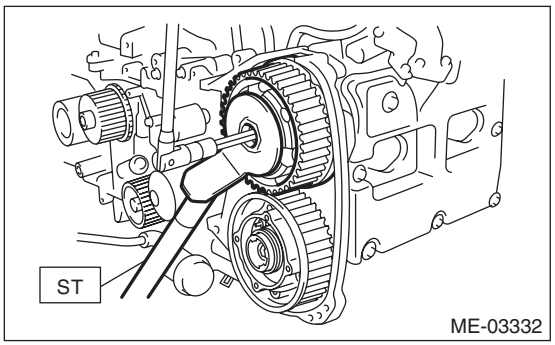
4. BELT IDLER

1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.
2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.

16.Cam Sprocket

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
4) Remove the actuator covers of the intake and exhaust cam sprockets.
5) Use the ST to lock the cam sprocket, and remove the cam sprocket bolt.
ST 499977500 CAM SPROCKET WRENCH



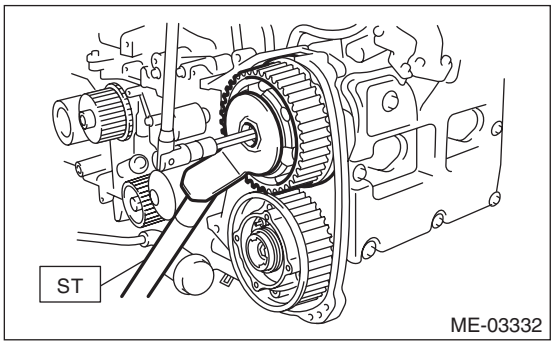
6) Remove the cam sprocket.

B: INSTALLATION

1) Install the cam sprocket.
2) Use the ST to lock the cam sprocket, and install the cam sprocket bolt.

NOTE:
Do not confuse cam sprockets (LH) and (RH), and (INT) and (EXH) during installation.
ST 499977500 CAM SPROCKET WRENCH

Tightening torque:
Tighten to 30 N·m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.



3) Attach the actuator covers of the intake and exhaust cam sprockets.

NOTE:
Use new O-rings.

Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)
4) Install the timing belt. <Ref. to ME(STI)-52, INSTALLATION, Timing Belt.>
5) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
6) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>

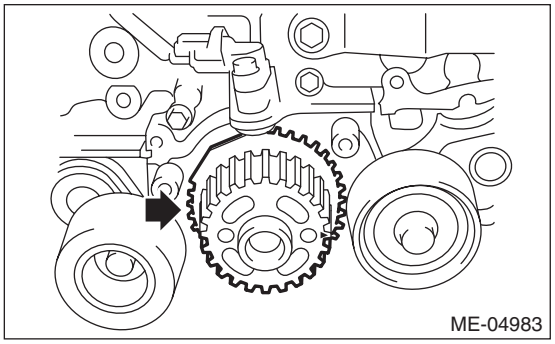
C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between cam sprocket and key.

17.Crank Sprocket

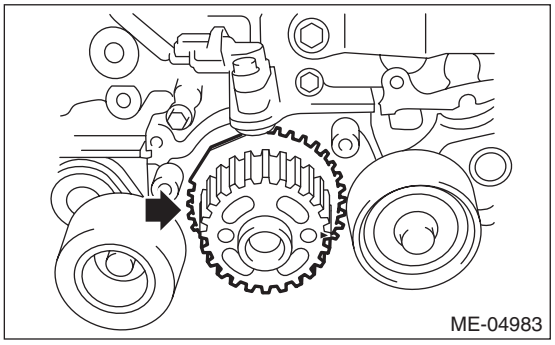
A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
4) Remove the crank sprocket.



B: INSTALLATION

1) Install the crank sprocket.



2) Install the timing belt. <Ref. to ME(STI)-52, INSTALLATION, Timing Belt.>
3) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
4) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>

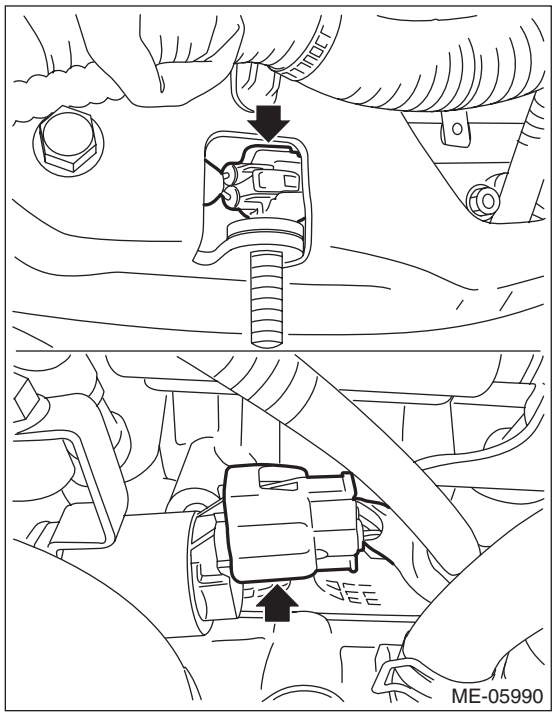
C: INSPECTION

1) Check the crank sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between crank sprocket and key.
3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

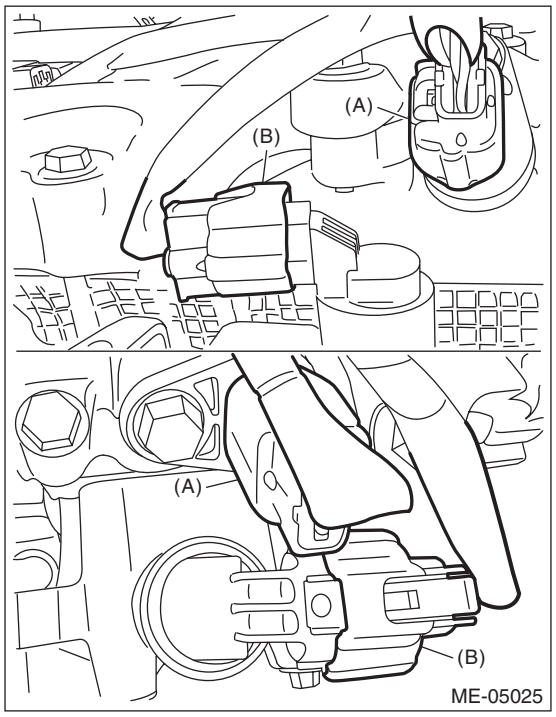
18.Camshaft

A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(STI)-30, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
6) Remove the cam sprocket. <Ref. to ME(STI)-59, REMOVAL, Cam Sprocket.>
7) Disconnect the connector from the intake oil flow control solenoid valve.


ME-05990

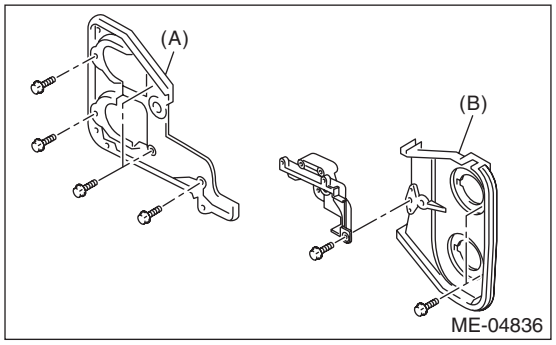
8) Disconnect the connector (A) from the exhaust camshaft position sensor and the connector (B) form the exhaust oil flow control solenoid valve.



ME-05025

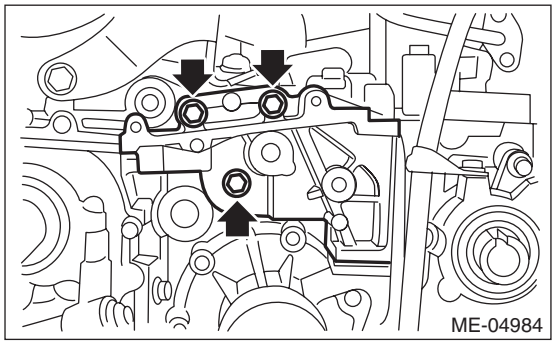
9) Remove the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

NOTE:
When removing the timing belt cover, be careful not to damage the seal rubber.

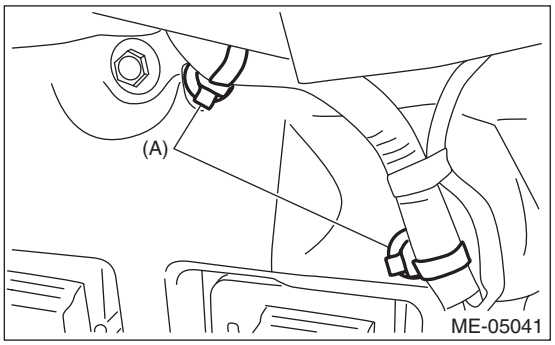


ME-04836

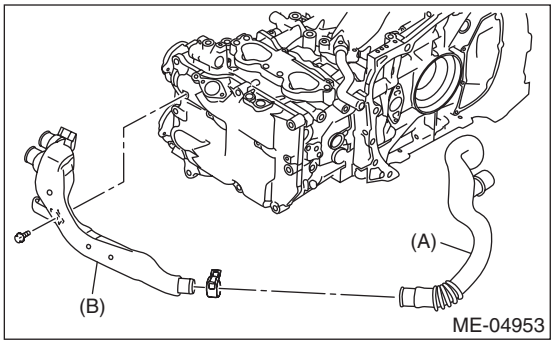
10) Remove the tensioner bracket.


ME-04984

11) Remove the clip (A) which hold the engine harness to the rocker cover RH.



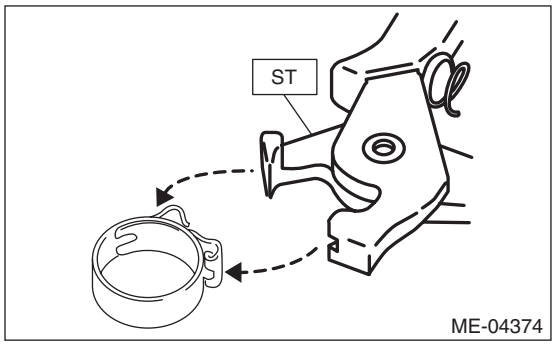
12) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).

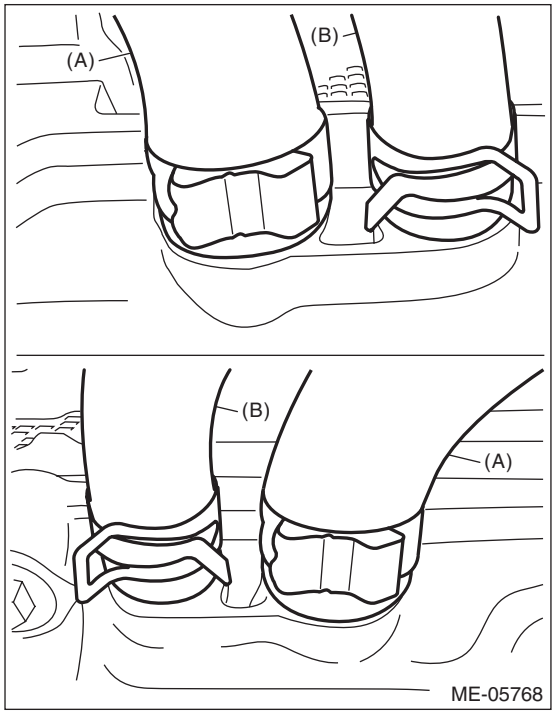


13) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>

14) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover.

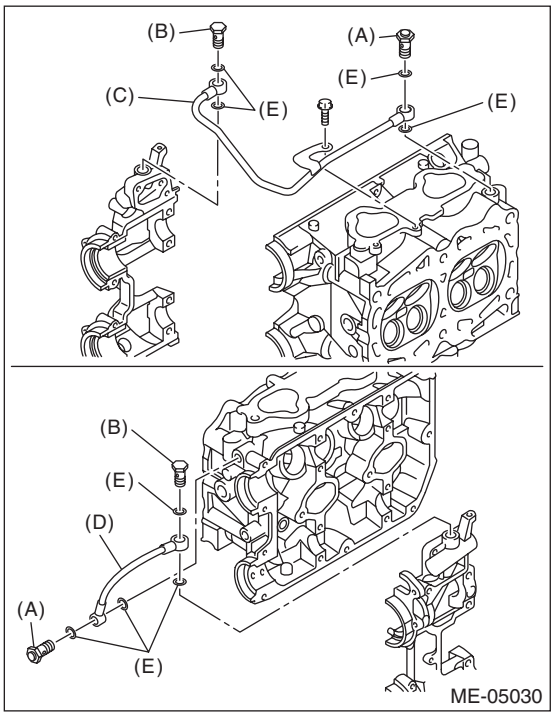
NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS





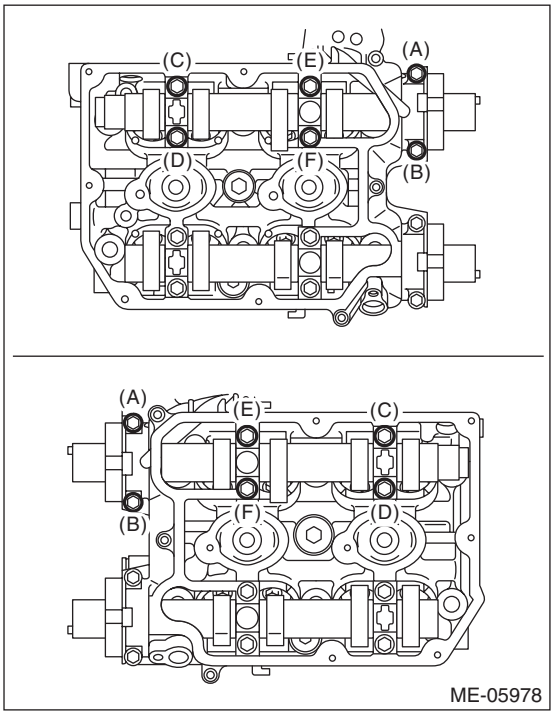
15) Remove the rocker cover.

16) Remove the union bolt without filter (without protrusion) which secures the oil pipe to the front camshaft cap.

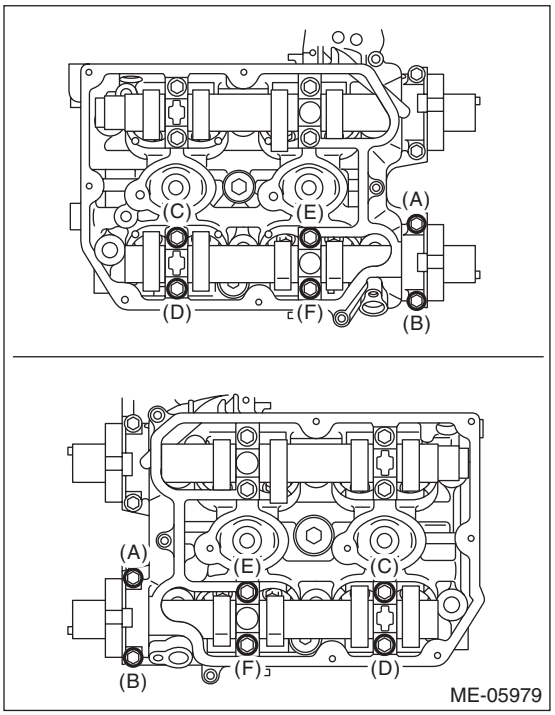


(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

17) Loosen the upper side of the front camshaft cap and the intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



18) Loosen the lower side of the front camshaft cap and the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



19) Remove the front camshaft cap.
20) Remove the intake camshaft caps and intake camshaft.

21) Remove the exhaust camshaft caps and exhaust camshaft.

NOTE:
Arrange camshaft caps in order so that they can be installed in their original positions.

22) Remove the oil seal.

CAUTION:
Do not scratch the journal surface when removing the oil seal.

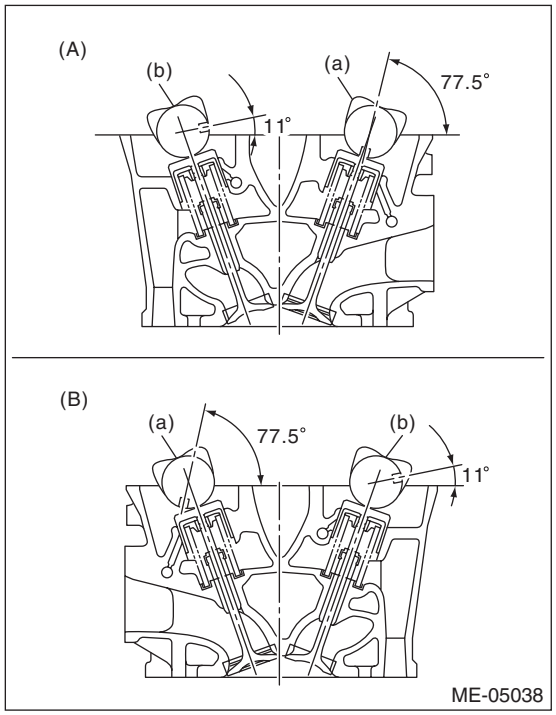
B: INSTALLATION

1) Install the camshaft.
Apply engine oil to the cylinder head at camshaft journal installation location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with base circle of the cam lobe.

NOTE:
- Set the camshaft to the position shown in the figure.
- When set at the position shown in the figure, it is not necessary to rotate the camshaft RH when installing the timing belt, but it is necessary to rotate the camshaft LH slightly.

Intake camshaft LH:
Rotate 80° clockwise.

Exhaust camshaft LH:
Rotate 45° counterclockwise.



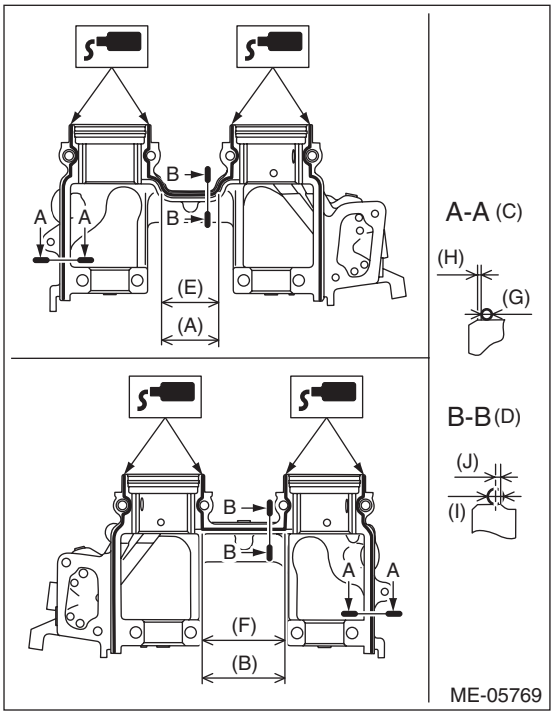
(A) Cylinder head RH
(B) Cylinder head LH
(a) Intake camshaft
(b) Exhaust camshaft

2) Install the camshaft cap.
(1) Apply small amount of liquid gasket to the mating surface of cap.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to come out and flow toward oil seal, resulting in oil leak.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Liquid gasket applying diameter:
Mating surfaces other than ranges A and B
2±0.5 mm (0.0787±0.0197 in)
Mating surfaces of ranges A and B
3±1 mm (0.1181±0.0394 in)

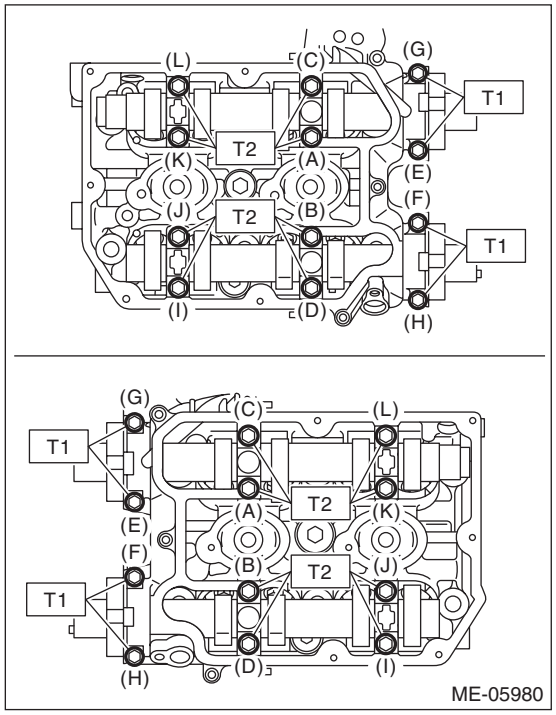


(A) Range A
(B) Range B
(C) Liquid gasket applying position of mating surfaces of ranges other than A and B
(D) Liquid gasket applying position of mating surfaces of ranges A and B
(E) 44.8 mm (1.7638 in)
(F) 65 mm (2.5591 in)
(G) ϕ2±0.5 mm (0.0787±0.0197 in)
(H) 0.5±0.5 mm (0.0197±0.0197 in)
(I) ϕ3±1 mm (0.1181±0.0394 in)
(J) 1 mm (0.0394 in) or less

(2) Apply a thin coat of engine oil to the cap journal surface, and install the camshaft cap to the camshaft.

(3) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque.

Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)

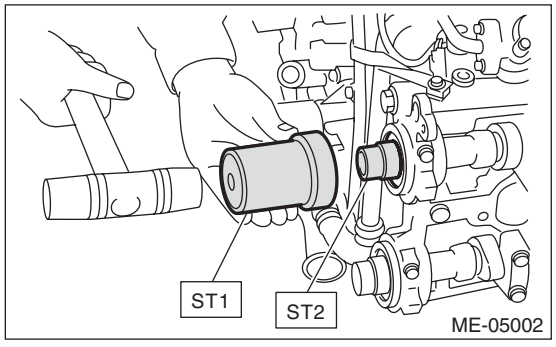


(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at base circle.

3) Apply a thin coat of engine oil to the periphery of the camshaft oil seal and oil seal lip, and install the oil seal on the camshaft using ST1 and ST2.

NOTE:
Use a new oil seal.

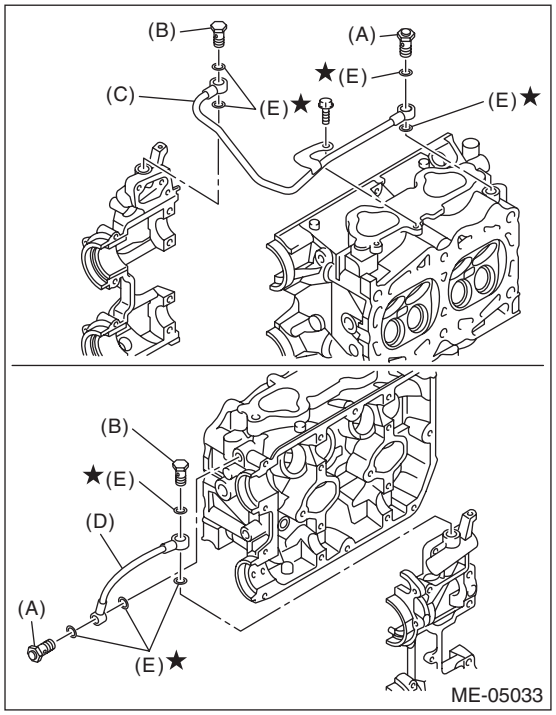
ST1	499587600	OIL SEAL INSTALLER
ST2	499597200	OIL SEAL GUIDE



4) Install the oil pipe to the front camshaft cap using the union bolt without filter (without protrusion).

NOTE:
Use a new gasket.

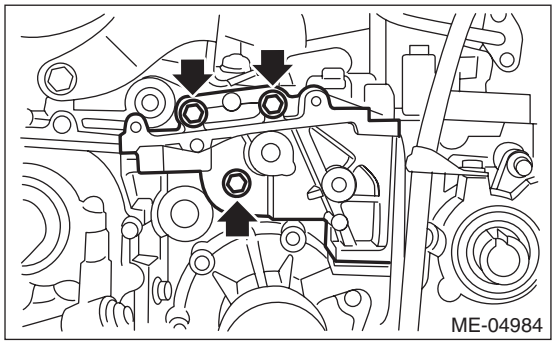
Tightening torque:
29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

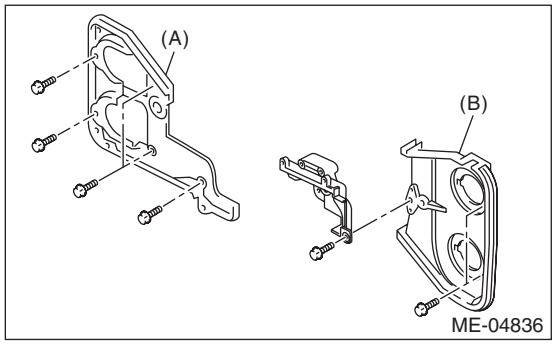
5) Install the tensioner bracket.

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



6) Install the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

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



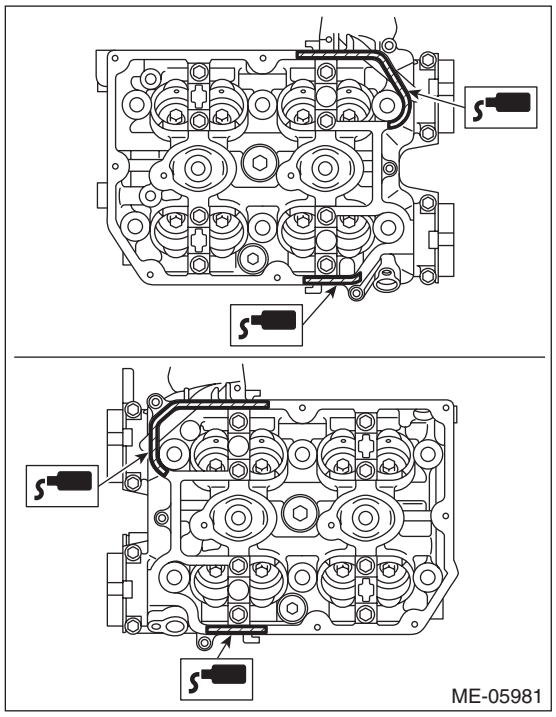
7) Install the cam sprocket. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(STI)-52, INSTALLATION, Timing Belt.>
9) Adjust the valve clearance. <Ref. to ME(STI)-29, ADJUSTMENT, Valve Clearance.>
10) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

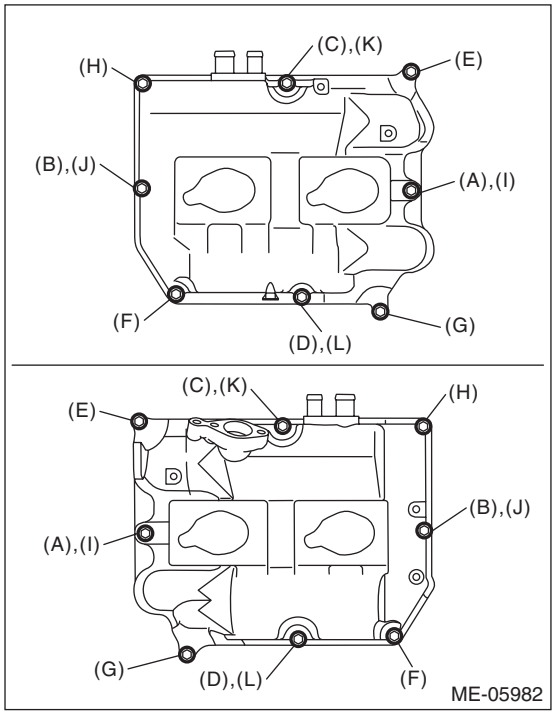
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



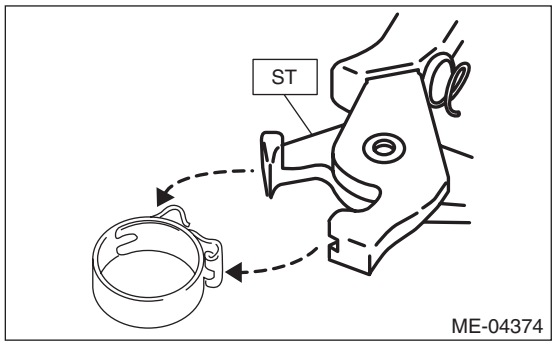
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

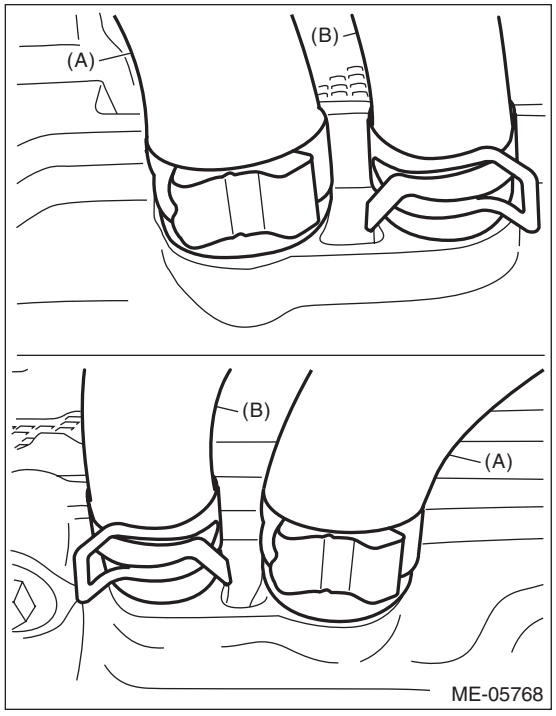
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



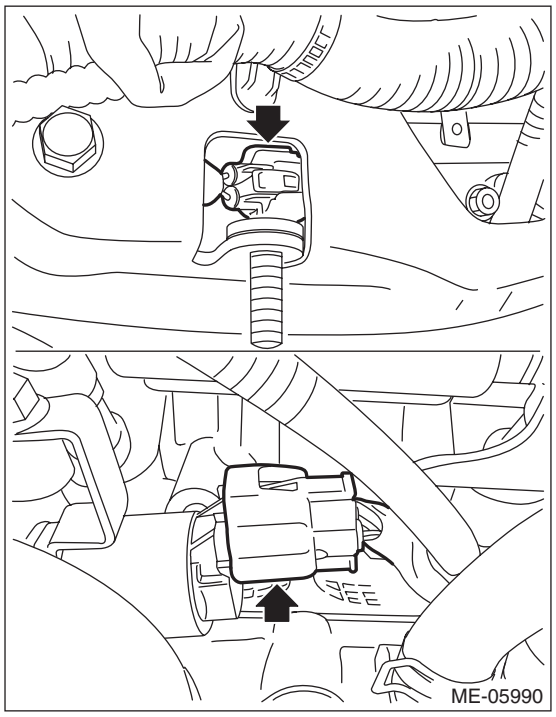
11) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS

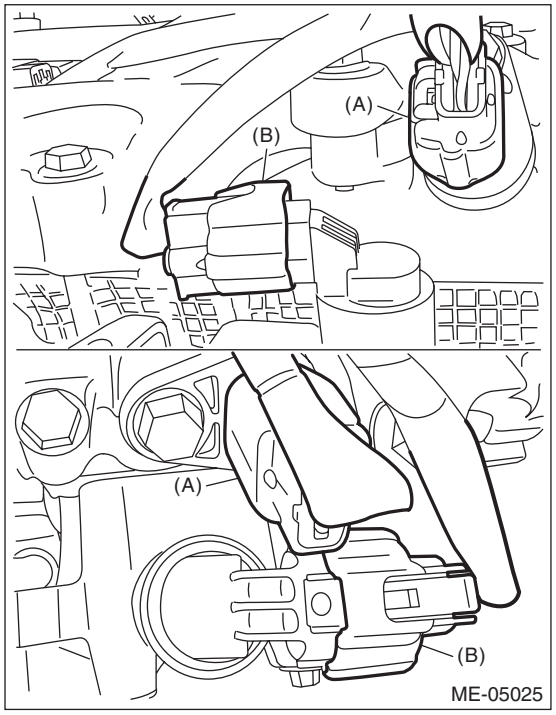




12) Connect the connector to the intake oil flow control solenoid valve.



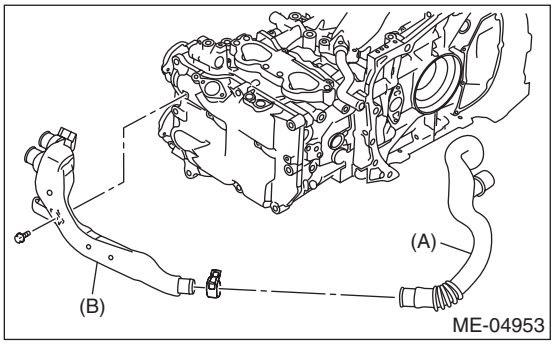
13) Connect the connector (A) to the exhaust camshaft position sensor and the connector (B) to the exhaust oil flow control solenoid valve.



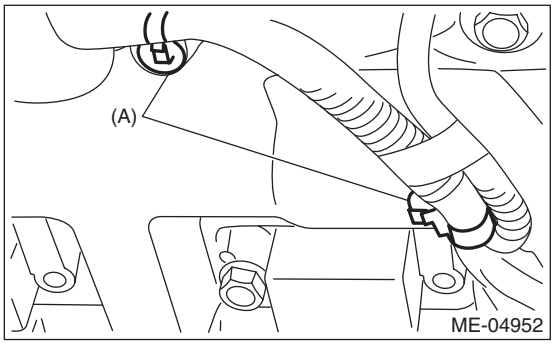
14) Install the ignition coil. <Ref. to IG(STI)-7, INSTALLATION, Ignition Coil.>

15) Install the air duct B (B) to the rocker cover LH and the air duct A (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



16) Fix the engine harness to the rocker cover RH with clips (A).

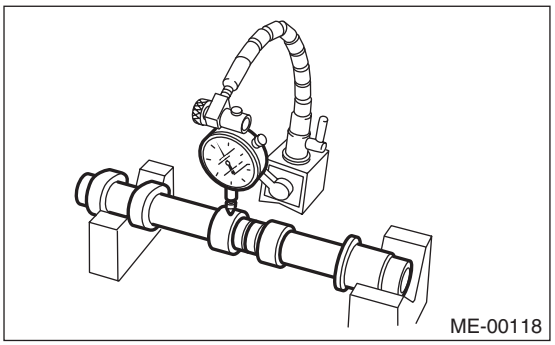


17) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
18) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>
19) Install the rear side belt. <Ref. to ME(STI)-41, REAR SIDE BELT, INSTALLATION, V-belt.>
20) Install the engine to the vehicle. <Ref. to ME(STI)-34, INSTALLATION, Engine Assembly.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Camshaft bend limit:
0.020 mm (0.00079 in)

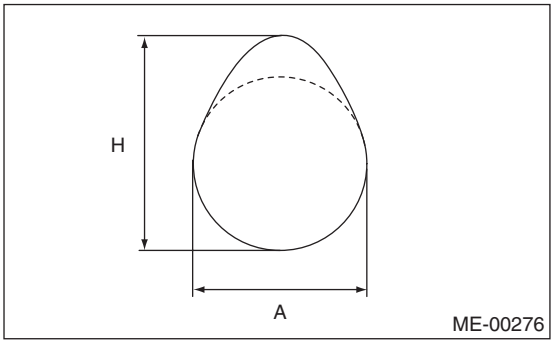


2) Check the journal for damage and wear. Replace if faulty.
3) Check the cutout portion used for camshaft sensor for damage. Replace if faulty.
4) Check the cam face condition, and remove the minor faults by grinding with oil stone. If offset wear occurs, replace it.
5) Measure the cam lobe height “H” and cam base circle diameter “A”. If it exceeds the standard or offset wear occurs, replace it.

Cam lobe height H:

Standard
Intake
46.55 — 46.65 mm (1.833 — 1.837 in)
Exhaust
46.75 — 46.85 mm (1.841 — 1.844 in)

Cam base circle diameter A:
Standard
37.0 mm (1.457 in)

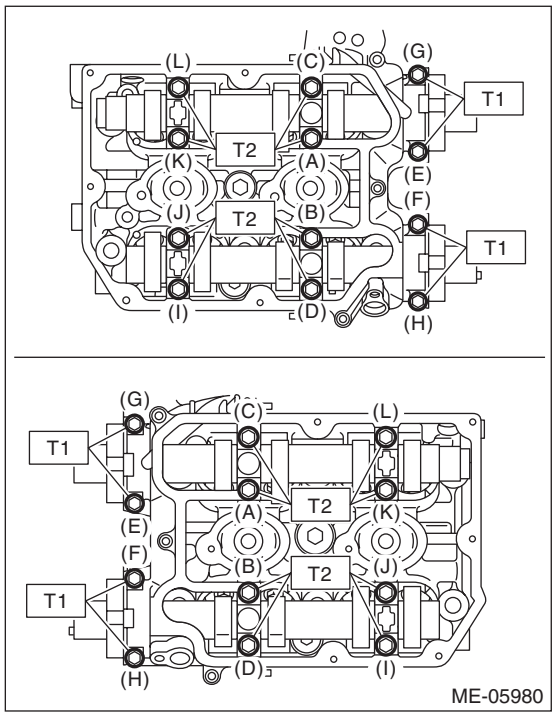


6) Measure the outside diameter of camshaft journal. If the journal diameter is not within specification, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard mm (in)	37.946 — 37.963 (1.4939 — 1.4946)	29.946 — 29.963 (1.1790 — 1.1796)

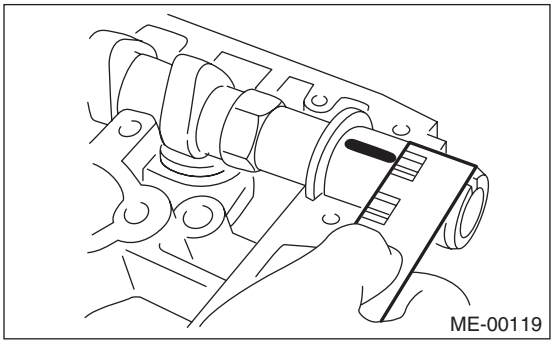
7) Measure the oil clearance of camshaft journal.
(1) Clean the camshaft cap and cylinder head camshaft journal.
(2) Place the camshaft on cylinder head. (Without installing the valve lifter)
(3) Place a plastigauge across each camshaft journals.
(4) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque. Do not turn the camshaft.

Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



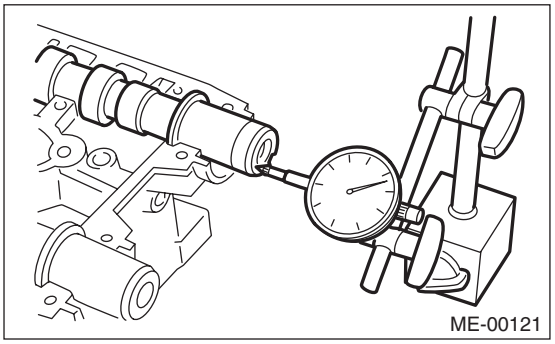
(5) Remove the camshaft cap.
(6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the standard, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

Camshaft oil clearance:
Standard
0.037 — 0.072 mm (0.0015 — 0.0028 in)



(7) Completely remove the plastigauge.
8) Measure the thrust clearance with setting the dial gauge at end surface of camshaft. If the thrust clearance is not within the standard or there is offset wear, replace the camshaft caps and cylinder head as a set. If necessary replace the camshaft.

Camshaft thrust clearance:
Standard
0.068 — 0.116 mm (0.0027 — 0.0047 in)

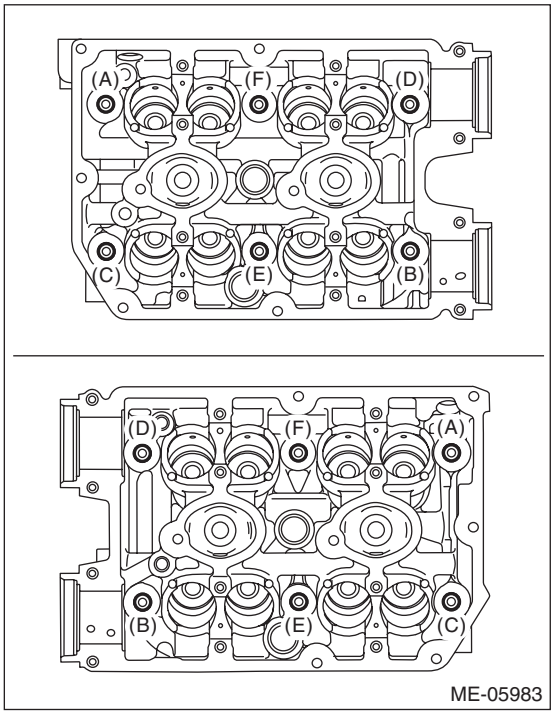


19.Cylinder Head

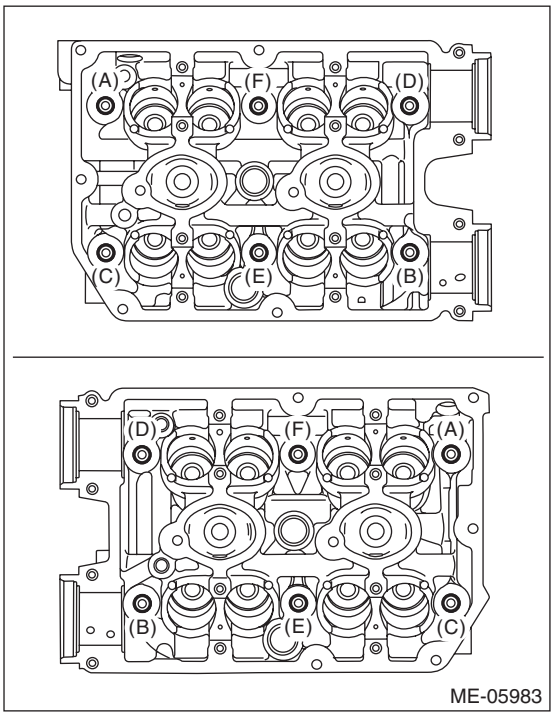
A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(STI)-30, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(STI)-59, REMOVAL, Cam Sprocket.>
8) Remove the secondary air combination valve. <Ref. to EC(STI)-29, REMOVAL, Secondary Air Combination Valve.>
9) Remove the bolts which secure A/C compressor bracket to cylinder head.
10) Remove the oil pipe. <Ref. to LU(STI)-25, REMOVAL, Oil Pipe.>
11) Remove the camshaft. <Ref. to ME(STI)-61, REMOVAL, Camshaft.>
12) Remove the oil level gauge guide. (LH side only)
13) Remove the cylinder head bolts in alphabetical order shown in the figure.

NOTE:
Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



14) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.



15) Remove the cylinder head gasket.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.

B: INSTALLATION

1) Install the cylinder head to the cylinder block.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.

NOTE:
Use a new cylinder head gasket.

(1) Clean the bolt threads and the bolt holes in the cylinder block

CAUTION:
To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

(2) Apply a sufficient coat of engine oil to the washer and bolt thread.
(3) Tighten all bolts to 40 N·m (4.1 kgf-m, 29.5 ft-lb) in alphabetical order.

(4) Retighten all bolts to 95 N·m (9.7 kgf-m, 70.1 ft-lb) in alphabetical order.

CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be reused.

(5) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.

(6) Tighten all bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in alphabetical order.

(7) Retighten all bolts to 30 N·m (3.1 kgf-m, 22.1 ft-lb) in alphabetical order.

(8) Retighten all bolts to 70 N·m (7.1 kgf-m, 51.6 ft-lb) in alphabetical order.

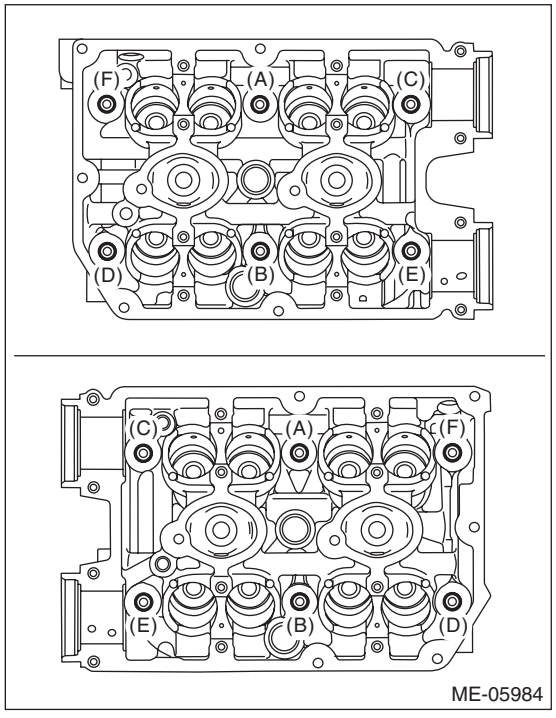
(9) Retighten all bolts by 80 — 90° in alphabetical order.

(10) Retighten all bolts by 40 — 45° in alphabetical order.

CAUTION:
The tightening angle of the bolt should not exceed 45°.

(11) Retighten bolts (A) and (B) by 40 — 45°.

CAUTION:
Make sure the total "tightening angle" of steps (10) and (11) does not exceed 90°.



2) Install the oil level gauge guide. (LH side only)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

3) Install the camshaft. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>

4) Install the oil pipe. <Ref. to LU(STI)-27, INSTALLATION, Oil Pipe.>

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

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

6) Install the secondary air combination valve. <Ref. to EC(STI)-30, INSTALLATION, Secondary Air Combination Valve.>

7) Install the cam sprocket. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>

8) Install the timing belt. <Ref. to ME(STI)-52, INSTALLATION, Timing Belt.>

9) Adjust the valve clearance. <Ref. to ME(STI)-29, ADJUSTMENT, Valve Clearance.>

10) Install the rocker cover.

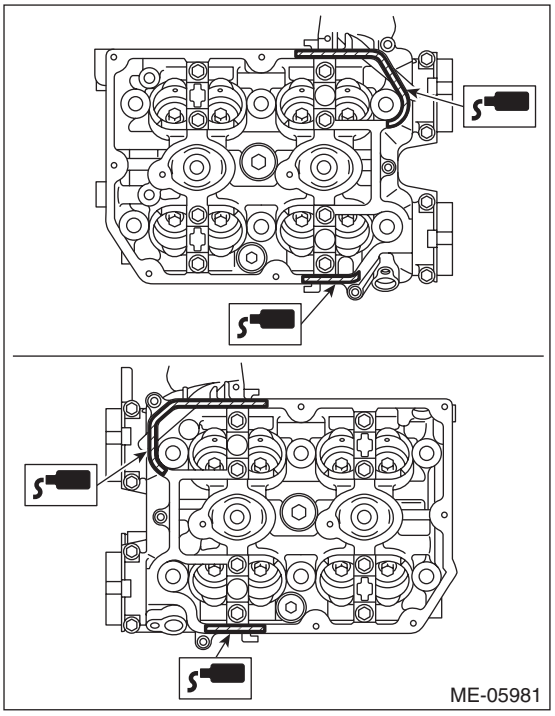
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

NOTE:
Install within 5 min. after applying liquid gasket.

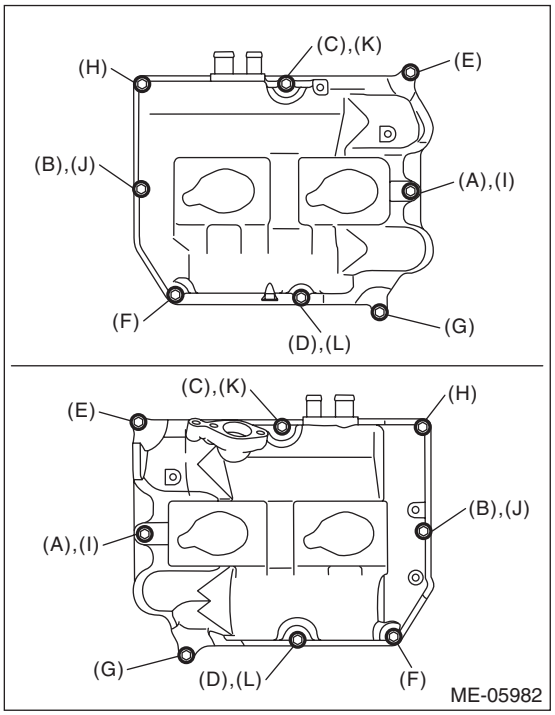
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.

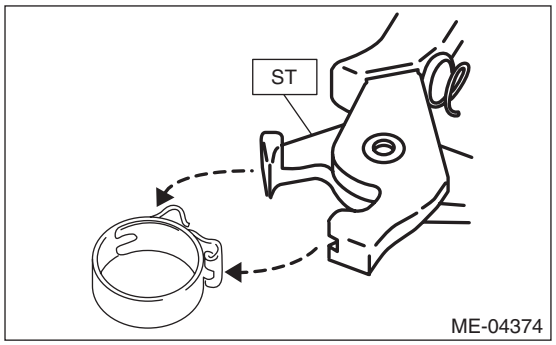
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

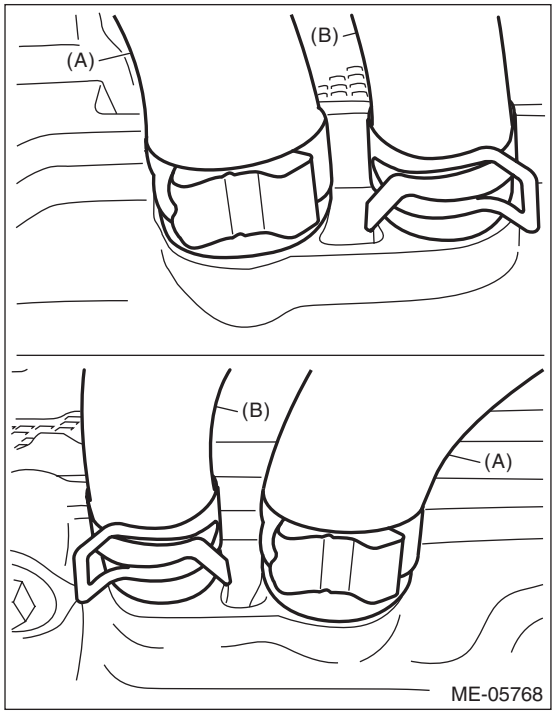
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



11) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



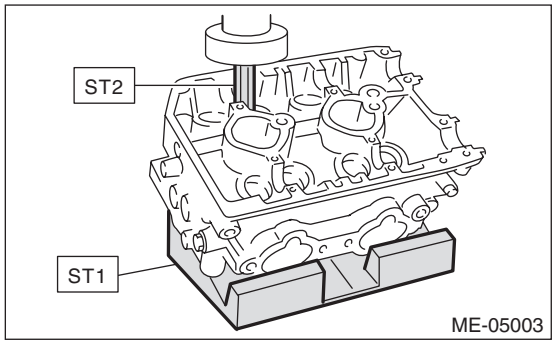


12) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>
14) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
15) Install the rear side belt. <Ref. to ME(STI)-41, REAR SIDE BELT, INSTALLATION, V-belt.>
16) Install the engine to the vehicle. <Ref. to ME(STI)-34, INSTALLATION, Engine Assembly.>

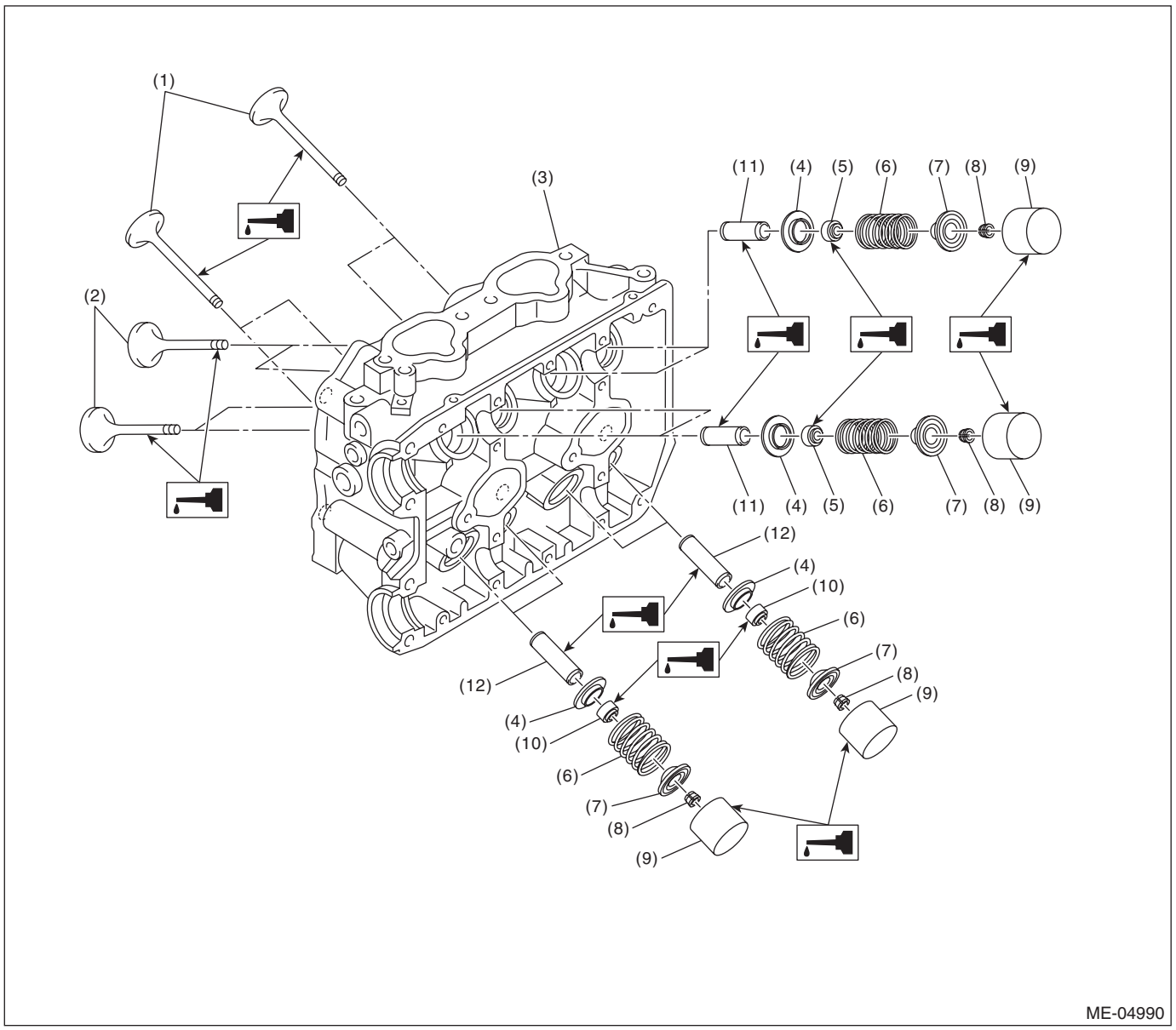
C: DISASSEMBLY

1) Remove the valve lifter.
2) Place the cylinder head on ST1.
ST1 498267600 CYLINDER HEAD TABLE
3) Using ST2, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST2 499718000 VALVE SPRING REMOVER

NOTE:
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.
- For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to “INSPECTION”. <Ref. to ME(STI)-76, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(STI)-78, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



D: ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve spring retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

1) Install the valve spring and valve.
(1) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

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

(2) Set the cylinder head on ST1.

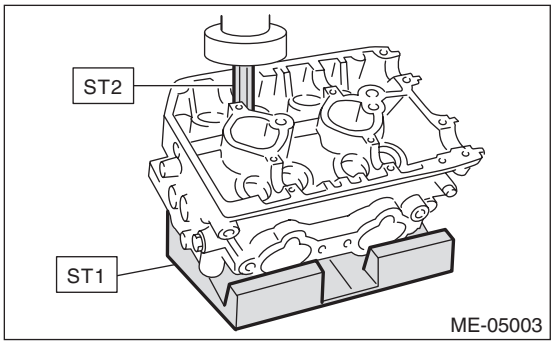
ST1 498267600 CYLINDER HEAD TABLE

(3) Install the valve spring and valve spring retainer.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(4) Set the ST2 on valve spring.

ST2 499718000 VALVE SPRING REMOVER



(5) Compress the valve spring and fit the valve spring retainer key.
(6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

2) Apply oil to the surface of valve lifter.
3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

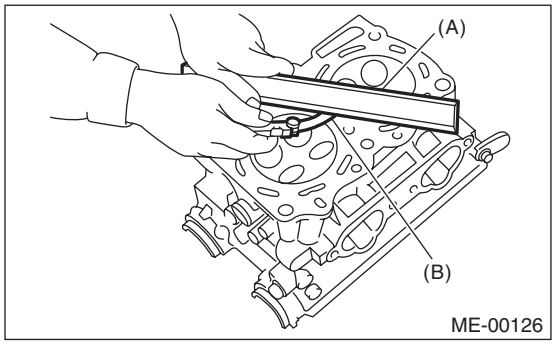
1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B).
If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

Warping limit:
0.035 mm (0.0014 in)

Grinding limit:
0.3 mm (0.012 in)

Standard height of cylinder head:
127.5 mm (5.02 in)

NOTE:
Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.

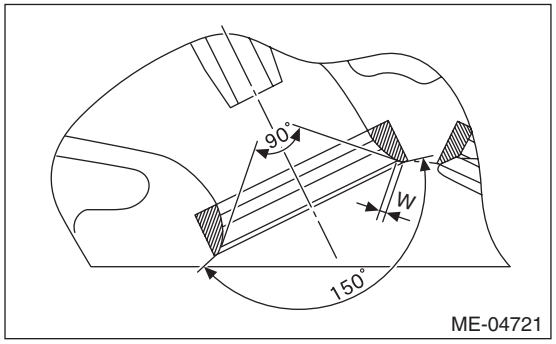


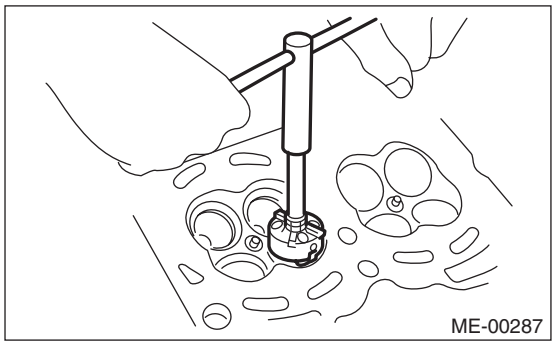
2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

Contacting width W between valve and valve seat:

Standard
Intake
0.6 — 1.4 mm (0.024 — 0.055 in)
Exhaust
1.2 — 1.8 mm (0.047 — 0.071 in)





3. VALVE GUIDE

1) Check the clearance between valve guide and valve stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

Clearance between the valve guide and valve stem:

Standard
Intake
0.030 — 0.057 mm (0.0012 — 0.0022 in)
Exhaust
0.040 — 0.067 mm (0.0016 — 0.0026 in)

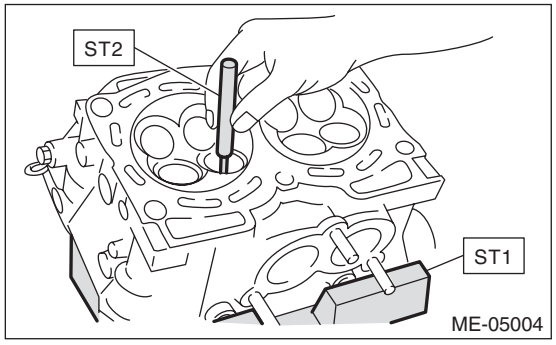
2) If the clearance between valve guide and valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows the greater amount of wear or damage. See the following procedure for valve guide replacement.

Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:
Intake
5.955 — 5.970 mm (0.2344 — 0.2350 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

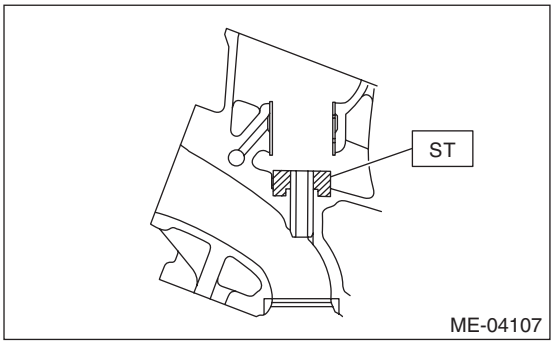
(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



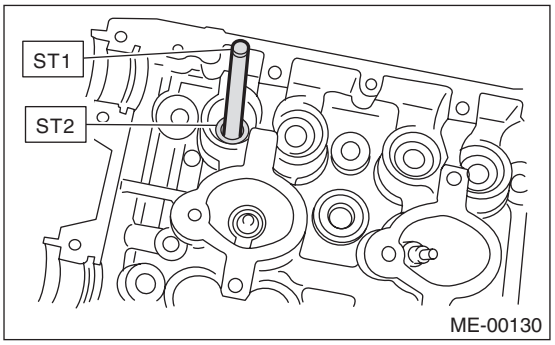
(3) Turn the cylinder head upside down and place the ST as shown in the figure.

ST 18251AA020 VALVE GUIDE ADJUSTER



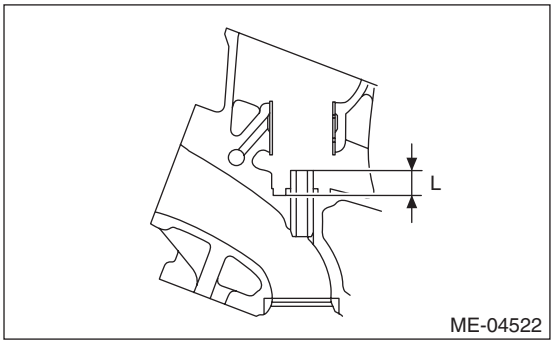
(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.
(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion amount "L".

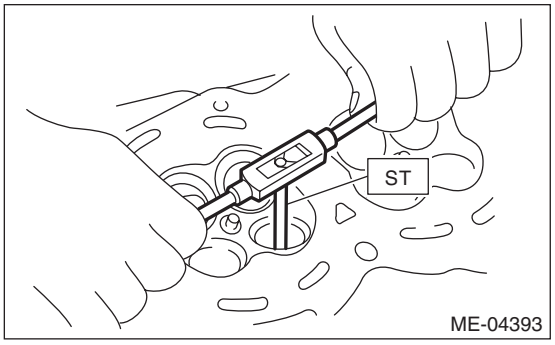
Valve guide protrusion amount L:
15.8 — 16.2 mm (0.622 — 0.638 in)



(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

NOTE:
• Apply engine oil to the ST when reaming.
• If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.
• If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.

ST 499767400 VALVE GUIDE REAMER



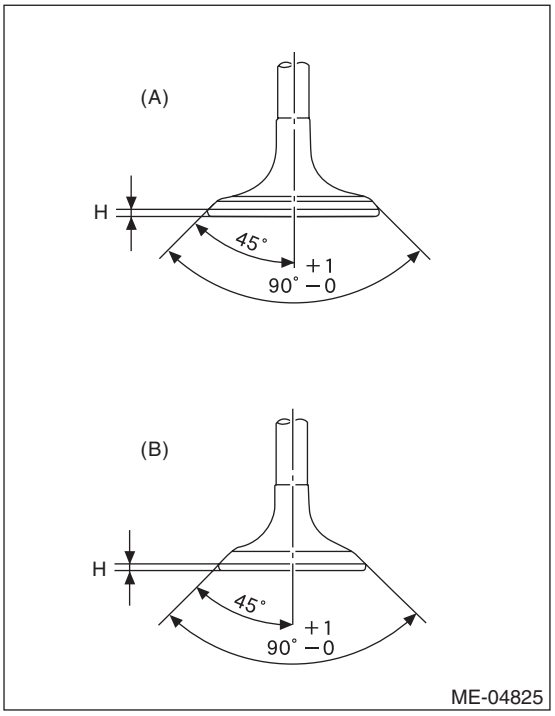
(8) After reaming, clean the valve guide to remove chips.
(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange of valve and valve stem, and replace the valve with a new part if damaged, worn, deformed, or if dimension "H" in the figure is outside of the specified limit.

Head edge thickness H:

Standard
Intake (A)
1.0 — 1.4 mm (0.039 — 0.055 in)
Exhaust (B)
1.3 — 1.7 mm (0.051 — 0.067 in)



2) Put a small amount of grinding compound on the valve seat surface, and lap the valve and valve seat surface. Replace with a new valve oil seal after lapping.

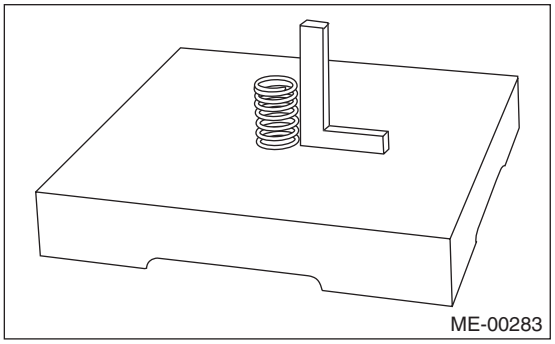
NOTE:
It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:
Intake
104.4 mm (4.110 in)
Exhaust
104.65 mm (4.1201 in)

5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.
2) To measure the squareness of the valve spring, stand the valve spring on a surface plate and measure its deflection at the top of the valve spring using a try square.

Free length mm (in)		53.48 (2.106)
Tension/spring height N (kgf, lbf)/mm (in)	Set	204.6 — 235.4 (20.86 — 24.00, 46.00 — 52.93)/36.0 (1.417)
	Lift	363.5 — 401.7 (37.07 — 40.96, 81.73 — 90.32)/26.7 (1.051)
Squareness		2.5°, 2.3 mm (0.091 in) or less


ME-00283

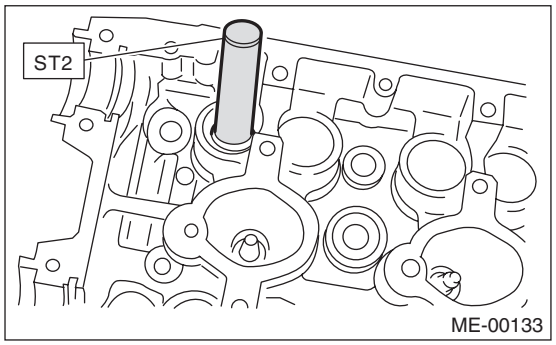
6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part. See the procedure 2) and subsequent for replacement procedures.
- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.
ST1 498267600 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

NOTE:
- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

Color of rubber part:
Intake [Gray]
Exhaust [Green]

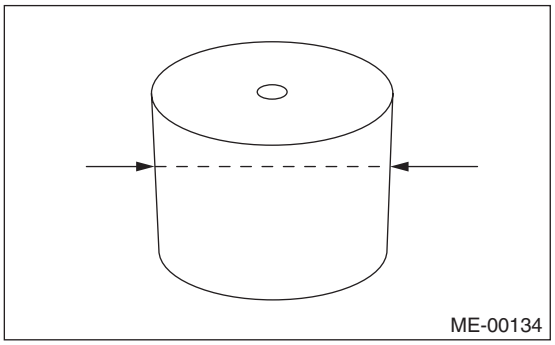


ME-00133

7. VALVE LIFTER

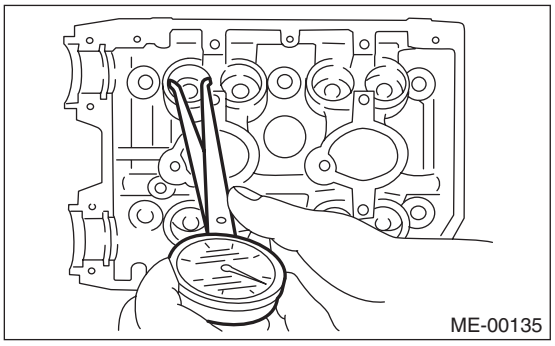
1) Check the valve lifter visually.
2) Measure the outer diameter of valve lifter.

Outer diameter of valve lifter:
Standard
34.959 — 34.975 mm (1.3763 — 1.3770 in)



3) Measure the inner diameter of valve lifter mating surface on cylinder head.

Valve lifter mating surface inner diameter:
Standard
34.994 — 35.016 mm (1.3777 — 1.3786 in)



4) Check the clearance between valve lifter and valve lifter mating surface. The clearance can be checked by measuring the outer diameter of valve lifter and the inner diameter of valve lifter. If it exceeds the standard or offset wear occurs, replace the cylinder head.

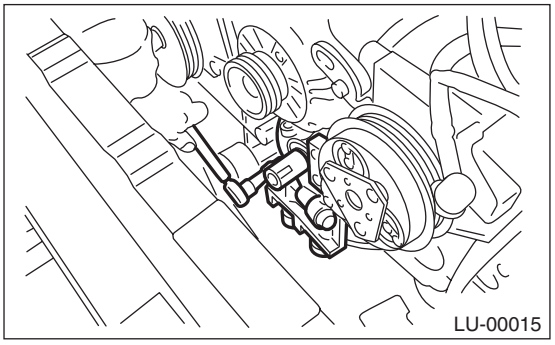
Valve lifter and valve lifter mating surface clearance:
Standard
0.019 — 0.057 mm (0.0007 — 0.0022 in)

20.Cylinder Block

A: REMOVAL

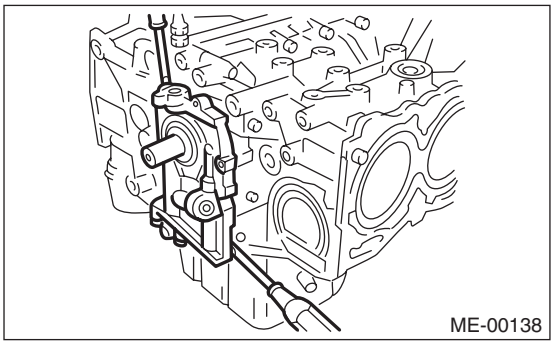
NOTE:
Before conducting this procedure, drain the engine oil completely.
1) Remove the engine from the vehicle. <Ref. to ME(STI)-30, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(STI)-47, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(STI)-49, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(STI)-50, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(STI)-59, REMOVAL, Cam Sprocket.>
8) Remove the crank sprocket. <Ref. to ME(STI)-60, REMOVAL, Crank Sprocket.>
9) Remove the generator and A/C compressor with their brackets.
10) Remove the camshaft. <Ref. to ME(STI)-61, REMOVAL, Camshaft.>
11) Remove the cylinder head. <Ref. to ME(STI)-70, REMOVAL, Cylinder Head.>
12) Remove the clutch disc and cover. <Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
13) Remove the flywheel. <Ref. to CL-14, REMOVAL, Flywheel.>
14) Remove the oil separator cover.
15) Remove the water by-pass pipe for heater.
16) Remove the oil filter. <Ref. to LU(STI)-31, REMOVAL, Engine Oil Filter.>
17) Remove the oil cooler. <Ref. to LU(STI)-24, REMOVAL, Engine Oil Cooler.>
18) Remove the water pump. <Ref. to CO(STI)-15, REMOVAL, Water Pump.>
19) Remove the bolts which secure oil pump to cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



20) Remove the oil pump from cylinder block using a flat tip screwdriver.

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

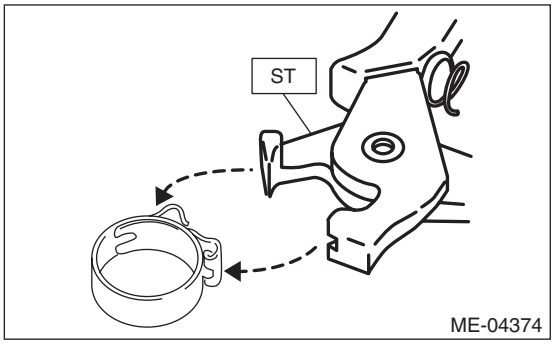


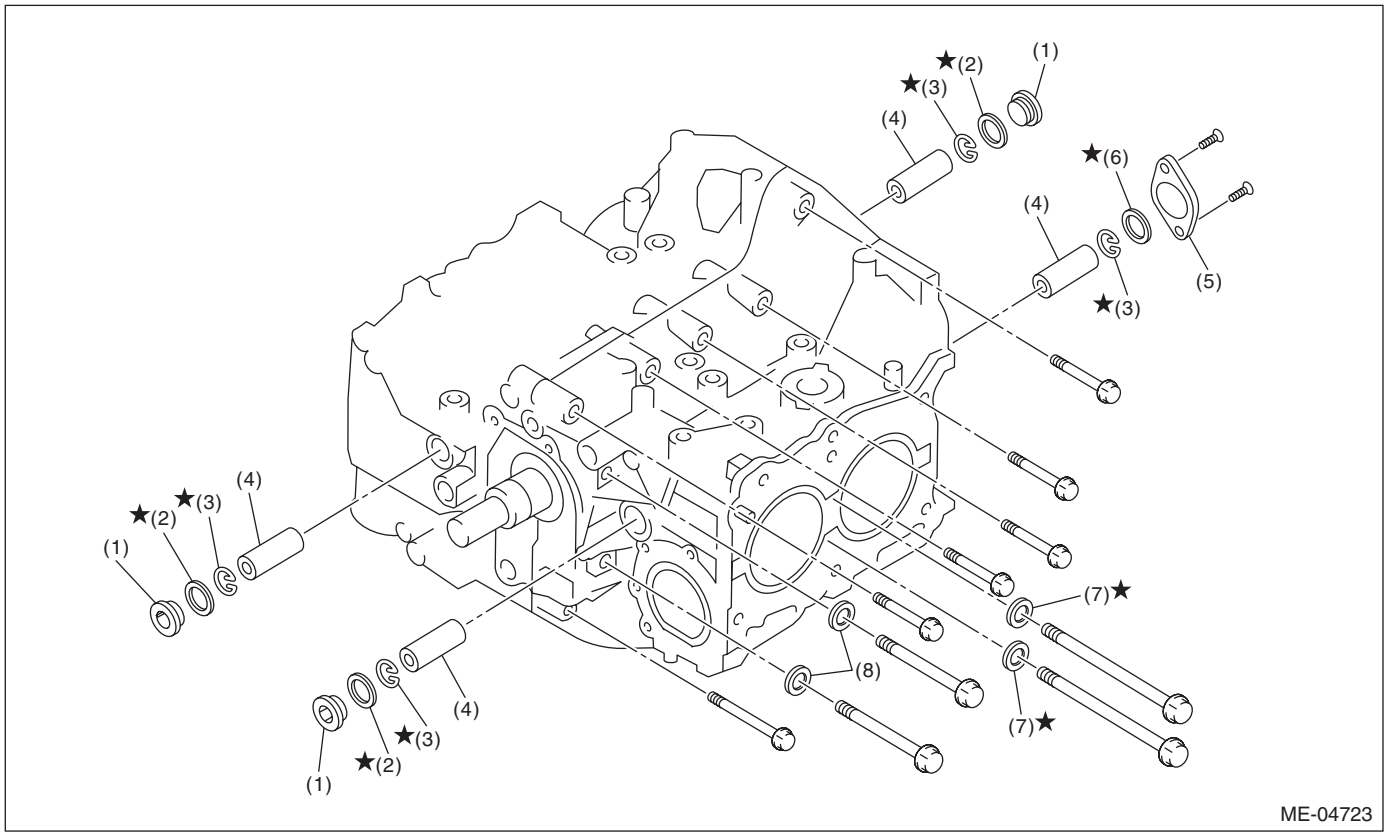
21) Remove the front oil seal from the oil pump.
22) Remove the oil pan.
(1) Set the part so that the cylinder block LH is on the upper side.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tools in place of oil pan cutter.
23) Remove the oil strainer.
24) Remove the baffle plate.

25) Remove the water tank pipe assembly from the cylinder block RH.

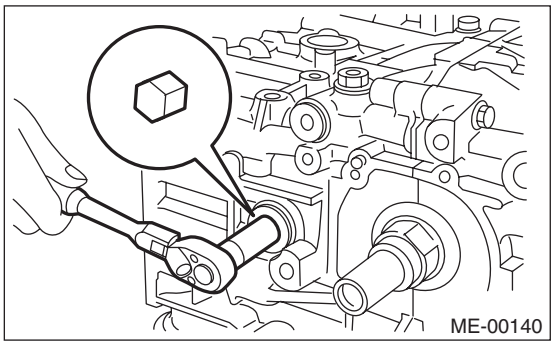
NOTE:
Pinch the clamp of the water tank pipe assembly by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



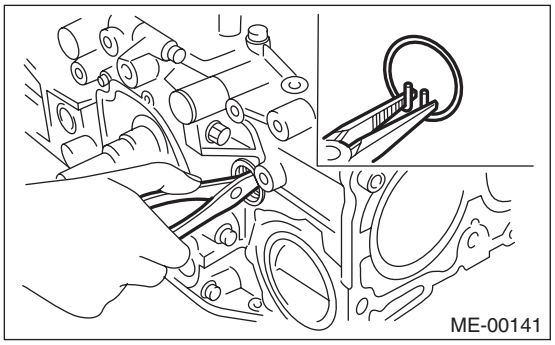


(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring
(7) Seal washer
(8) Washer

26) Remove the service hole plugs using a hexagon wrench [14 mm].



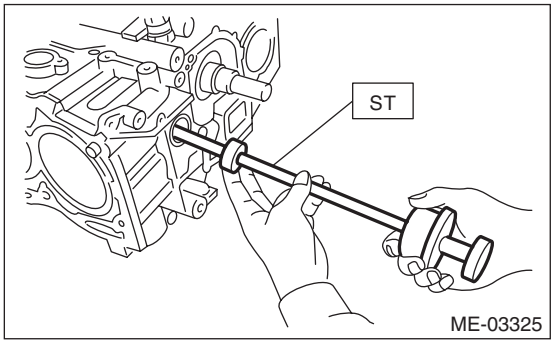
27) Remove the service hole cover.
28) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



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

ST	499097700	PISTON PIN REMOVER ASSY

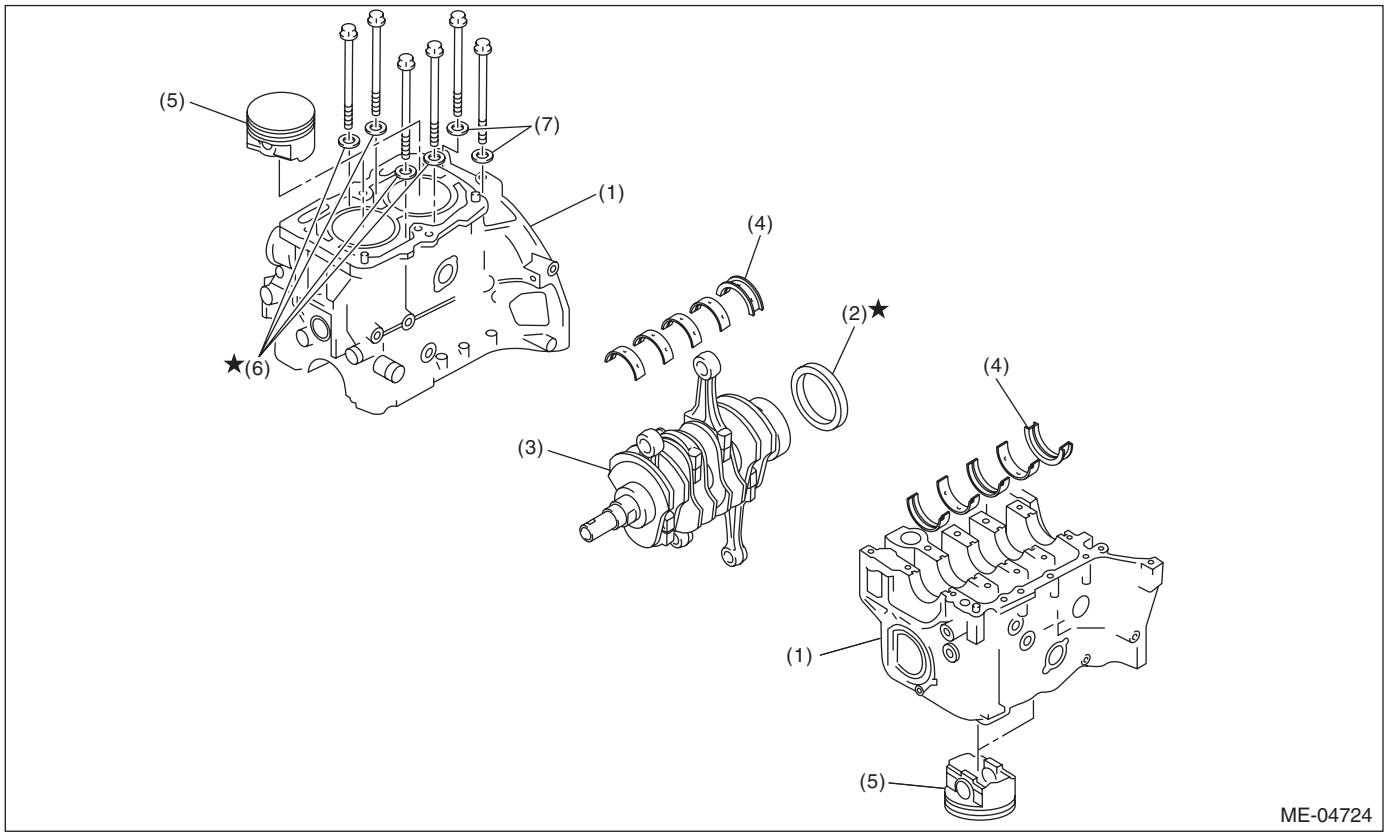
NOTE:
Be careful not to confuse the original combination of piston, piston pin and cylinder.



30) Similarly draw out the piston pins from #3 and #4 pistons.
31) Remove the cylinder block connecting bolt on the RH side.
32) Loosen the cylinder block connecting bolt on the LH side by 2 to 3 turns.
33) Set the part so that the cylinder block LH is on the upper side, and remove the cylinder block connecting bolt.

34) Separate the cylinder block LH and RH.

NOTE:
When separating the cylinder block, do not allow the connecting rod to fall or damage the cylinder block.



(1) Cylinder block
(2) Rear oil seal
(3) Crankshaft
(4) Crankshaft bearing
(5) Piston
(6) Seal washer
(7) Washer

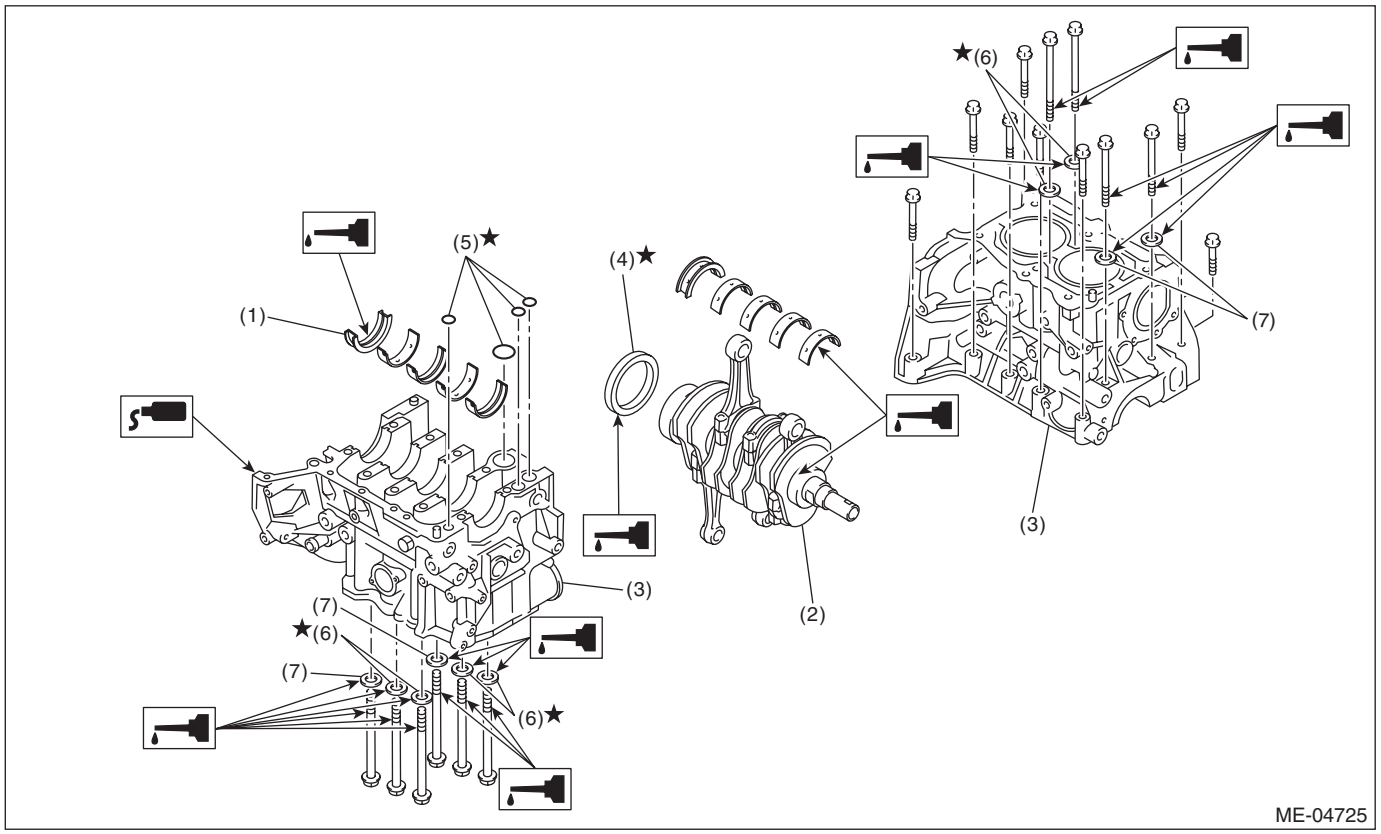
35) Remove the rear oil seal.
36) Remove the crankshaft together with connecting rod.
37) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:
• Press the crankshaft bearing at the end opposite to locking lip to remove.
• Be careful not to confuse the crankshaft bearing combination.

38) Remove each piston from the cylinder block using a wooden bar or hammer handle.

NOTE:
Be careful not to confuse the original combination of piston and cylinder.

B: INSTALLATION



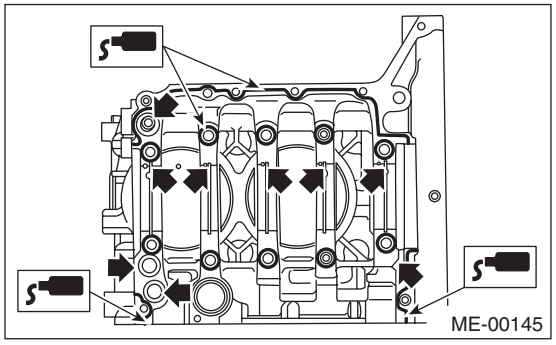
(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal
(5) O-ring
(6) Seal washer
(7) Washer

1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
2) Position the crankshaft and O-ring on cylinder block RH.

NOTE:
Use new O-rings.
3) Apply liquid gasket to the mating surfaces of cylinder block RH, and position cylinder block LH.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

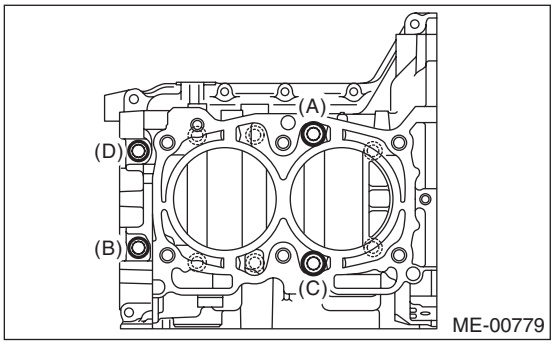


4) Apply a coat of engine oil to the washer and bolt thread.

NOTE:
Use a new seal washer.

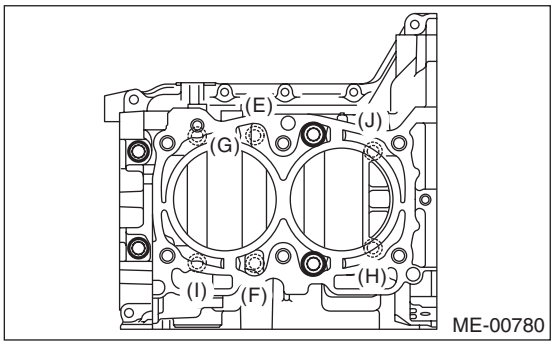
5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



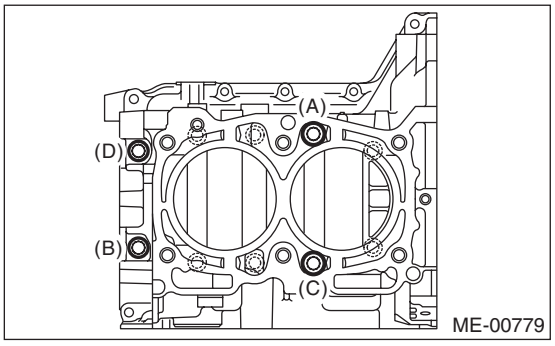
6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



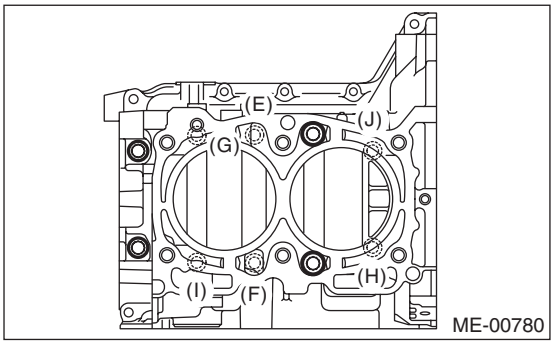
7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

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



8) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

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



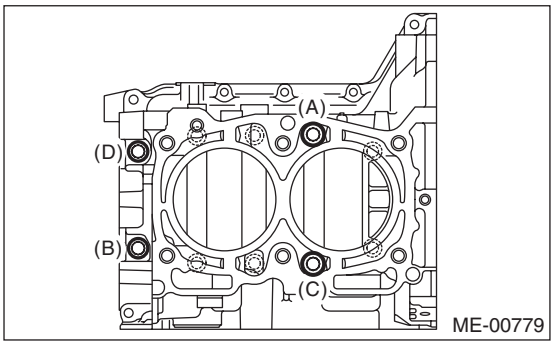
9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

Tightening angle:
90°

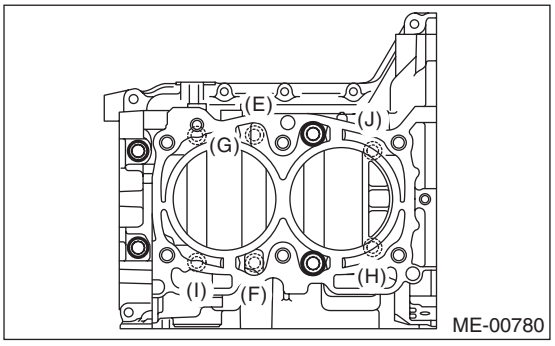
- (B), (D): Torque tightening

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



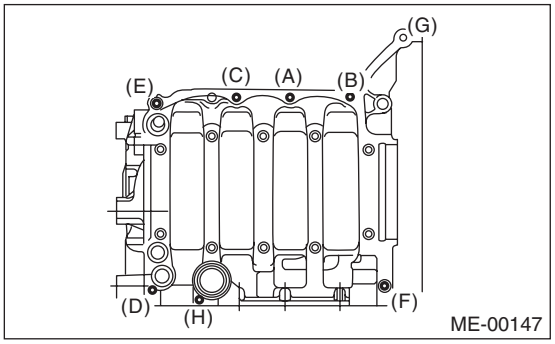
10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

Tightening angle:
90°



11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

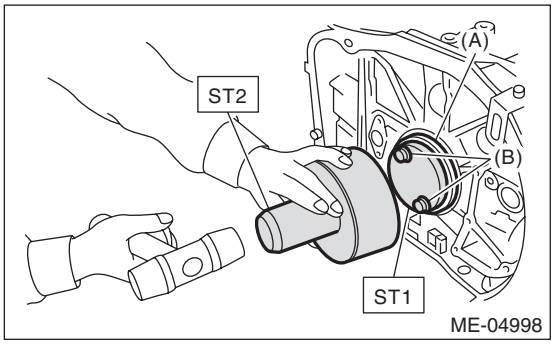
Tightening torque:
(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)
(H): 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

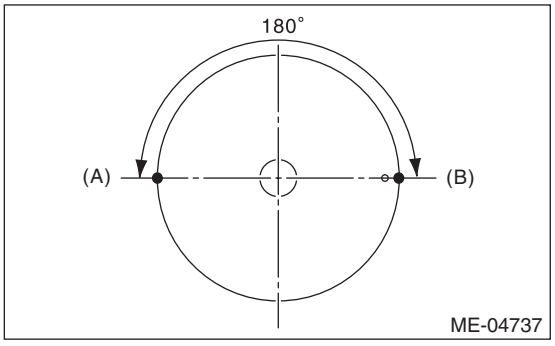
NOTE:
Use a new rear oil seal.

ST1	499597100	CRANKSHAFT OIL SEAL GUIDE
ST2	499587200	CRANKSHAFT OIL SEAL INSTALLER

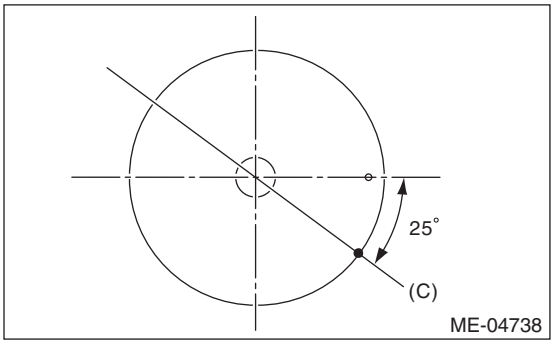


(A) Rear oil seal
(B) Flywheel attachment bolt

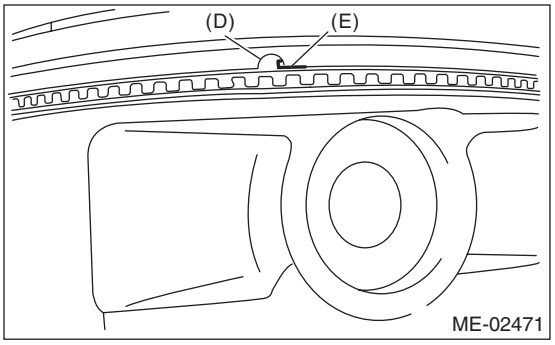
13) Position the top ring gap at (A) or (B) in the figure.
14) Position the second ring gap at 180° on the reverse side the top ring gap.



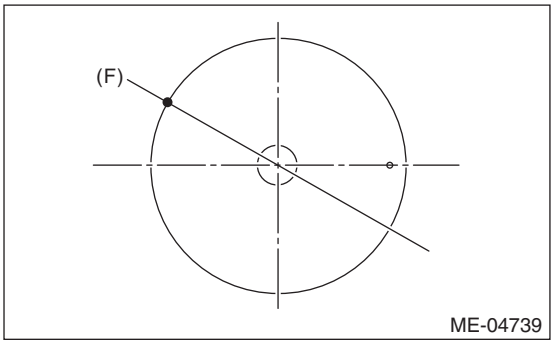
15) Position the upper rail gap at (C) in the figure.



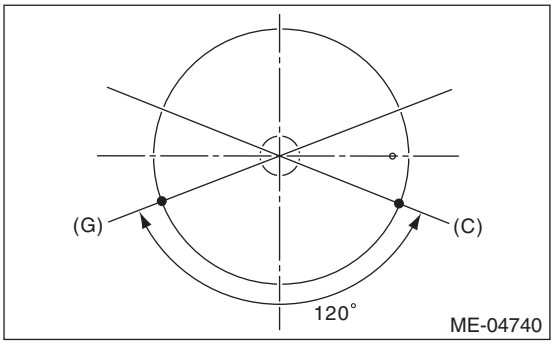
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure on the 180° opposite direction of (C).



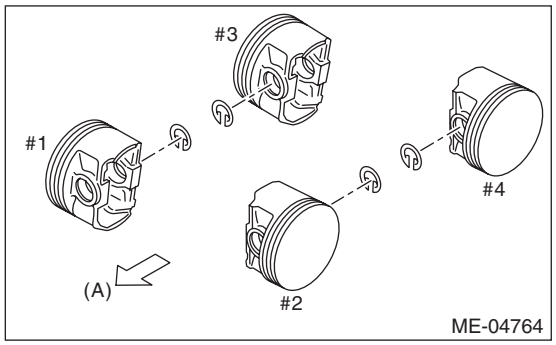
18) Set the lower rail gap at position (G), located 120° clockwise from (C) in the figure.



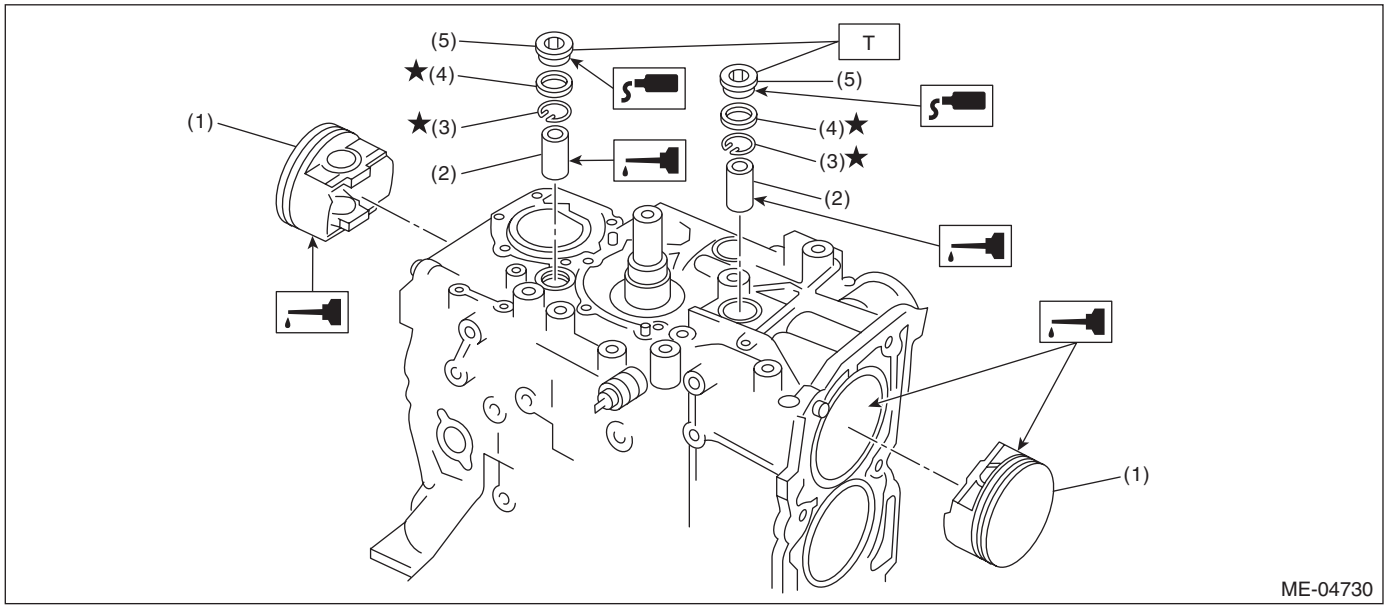
NOTE:
• Make sure ring gaps do not face the same direction.
• Make sure ring gaps are not within the piston skirt area.

19) Install the snap ring.
Before positioning the piston on the cylinder block, attach the snap ring in the service hole of the cylinder block, and the piston hole on the opposite side.

NOTE:
Use new snap rings.



(A) Front side



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

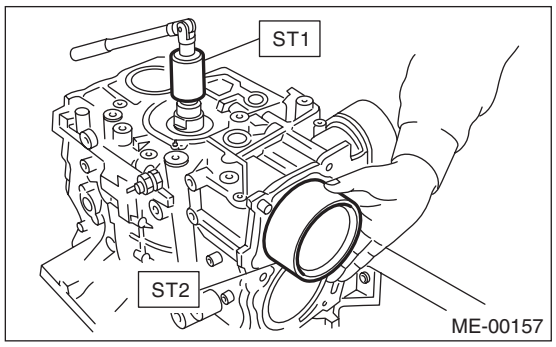
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.6)

20) Install the piston.
(1) Set the parts so that the #1 and #2 cylinders are on the upper side.
(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

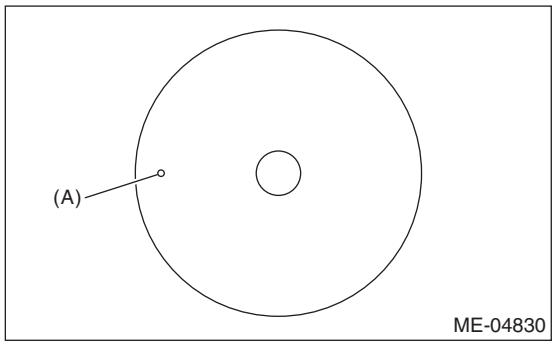
ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



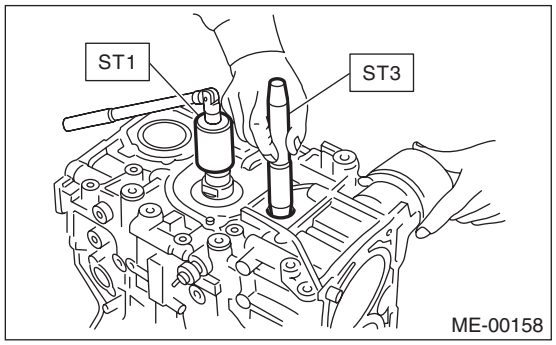
NOTE:
Face the piston front mark towards the front of the engine.



(A) Front mark

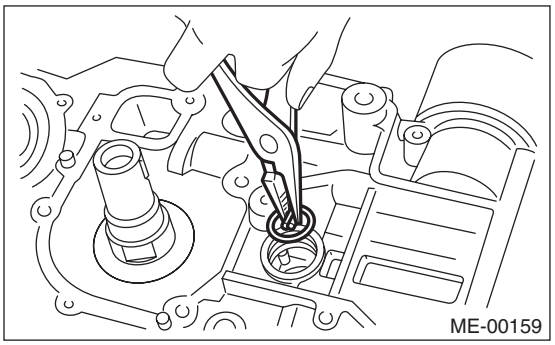
21) Install the piston pin.
(1) Apply a coat of engine oil to ST3.
(2) Insert ST3 into the service hole to align the piston pin hole and the connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



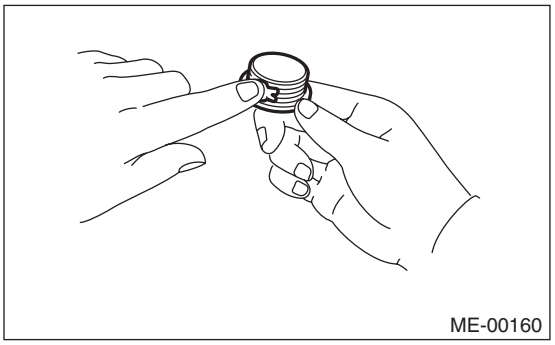
(3) Apply a thin coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
(4) Install the snap ring.

NOTE:
Use new snap rings.



(5) Apply liquid gasket to the threaded portion of the service hole plug.

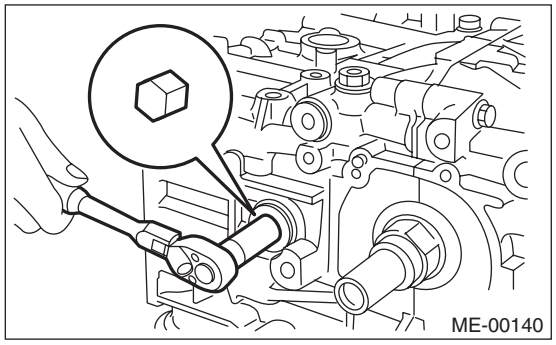
Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

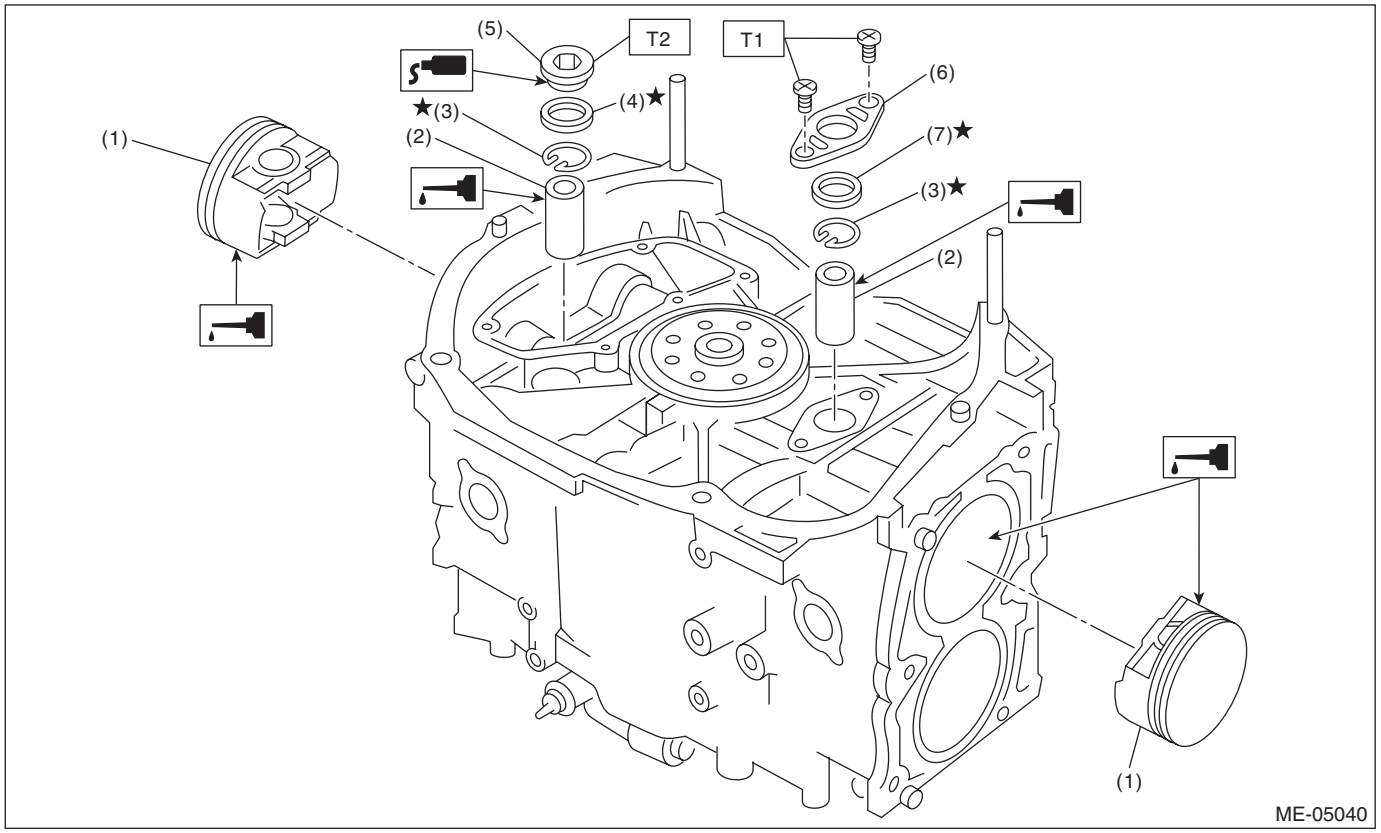


(6) Install the service hole plug and gasket.

NOTE:
Use a new gasket.

Tightening torque:
70 N·m (7.1 kgf-m, 51.6 ft-lb)





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

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 70 (7.1, 51.6)

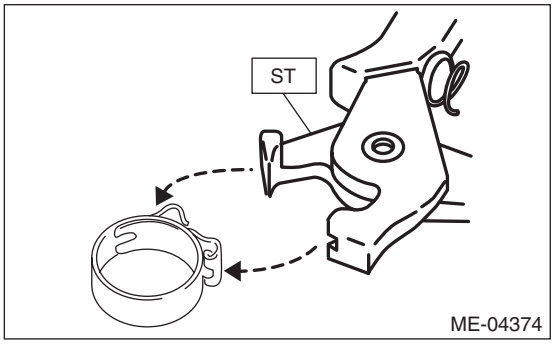
(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
(8) Install the service hole cover.

NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

22) Install the water tank pipe assembly onto the cylinder block RH.

NOTE:
Use a new clamp for the water tank pipe assembly clamp, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



23) Install the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

24) Install the oil strainer.

NOTE:
Use new O-rings.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

25) Tighten the oil strainer stay together with the baffle plate.

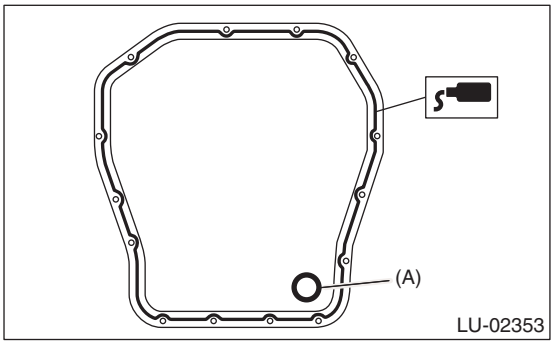
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

26) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

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



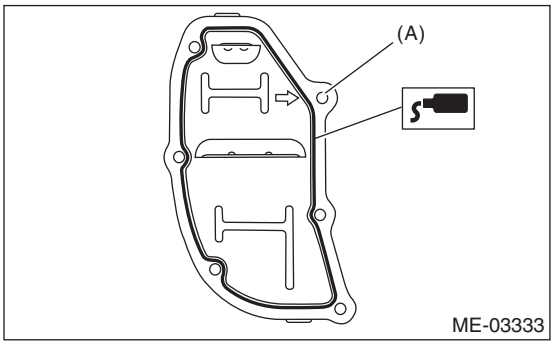
(A) Gasket

27) Apply liquid gasket to the mating surface of oil separator cover and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Use new oil separator cover.

Liquid gasket:
Mating surface
THREE BOND 1217G (Part No. K0877Y0100) or equivalent
Bolt thread (A) (when reusing the bolt)
THREE BOND 1324 (Part No. 004403042) or equivalent

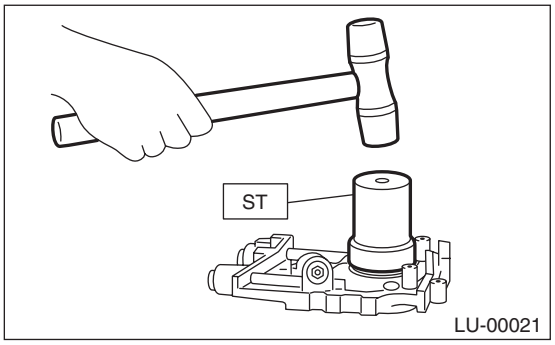
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



28) Install the flywheel. <Ref. to CL-14, INSTALLATION, Flywheel.>
29) Install the clutch disc and cover. <Ref. to CL-11, INSTALLATION, Clutch Disc and Cover.>

30) Install the oil pump.
(1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

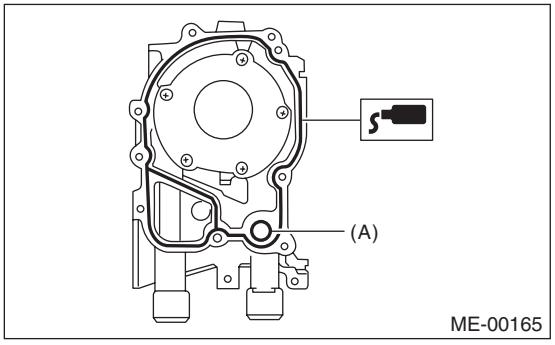
NOTE:
Use a new front oil seal.



(2) Apply liquid gasket to the mating surfaces of oil pump.

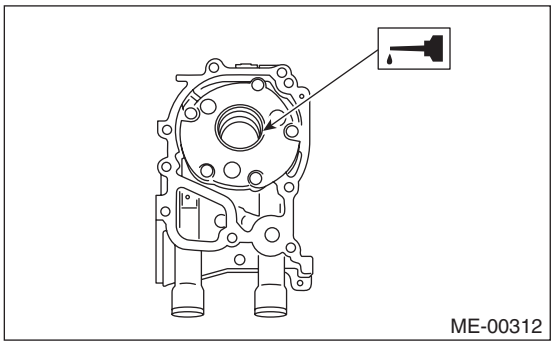
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

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



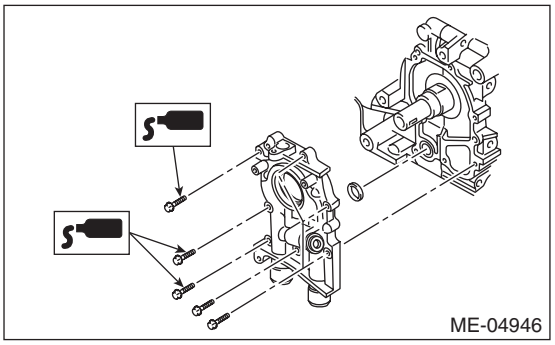
(4) Install the oil pump to cylinder block.

CAUTION:
• Be careful not to damage the front oil seal during installation.
• Make sure the front oil seal lip is not folded.

NOTE:
• Align the flat surface of oil pump's inner rotor with that of crankshaft before installation.
• Use new O-rings.
• Do not forget to assemble O-rings.
(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

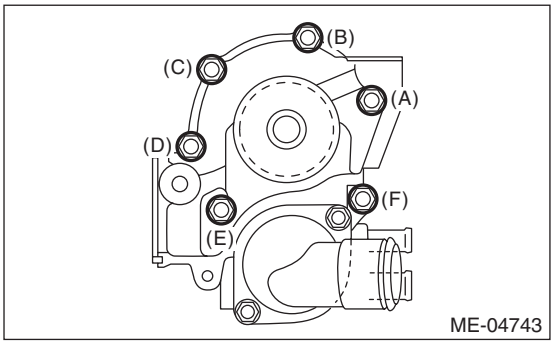
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



31) Install the water pump and gasket.

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

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



32) Install the water by-pass pipe for heater.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

33) Install the oil cooler. <Ref. to LU(STI)-24, INSTALLATION, Engine Oil Cooler.>

34) Install the oil filter. <Ref. to LU(STI)-31, INSTALLATION, Engine Oil Filter.>
35) Install the cylinder head. <Ref. to ME(STI)-70, INSTALLATION, Cylinder Head.>
36) Install the camshaft. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>
37) Install the generator and A/C compressor with their brackets.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

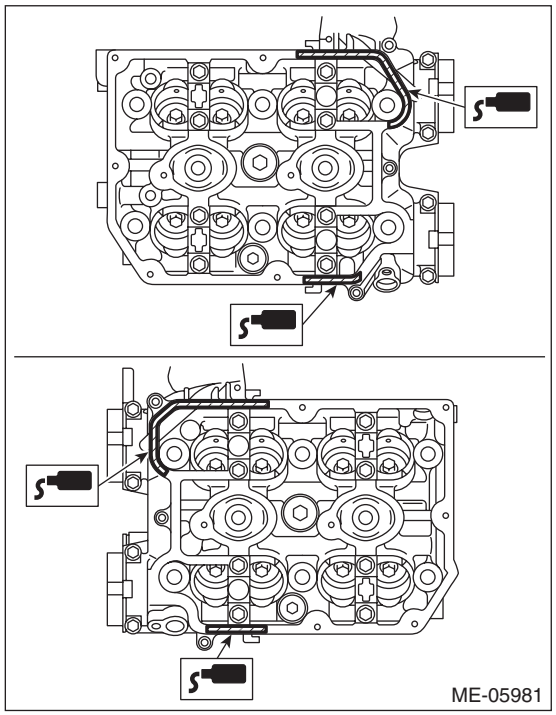
38) Install the crank sprocket. <Ref. to ME(STI)-60, INSTALLATION, Crank Sprocket.>
39) Install the cam sprocket. <Ref. to ME(STI)-59, INSTALLATION, Cam Sprocket.>
40) Install the timing belt. <Ref. to ME(STI)-52, INSTALLATION, Timing Belt.>
41) Adjust the valve clearance. <Ref. to ME(STI)-29, ADJUSTMENT, Valve Clearance.>
42) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

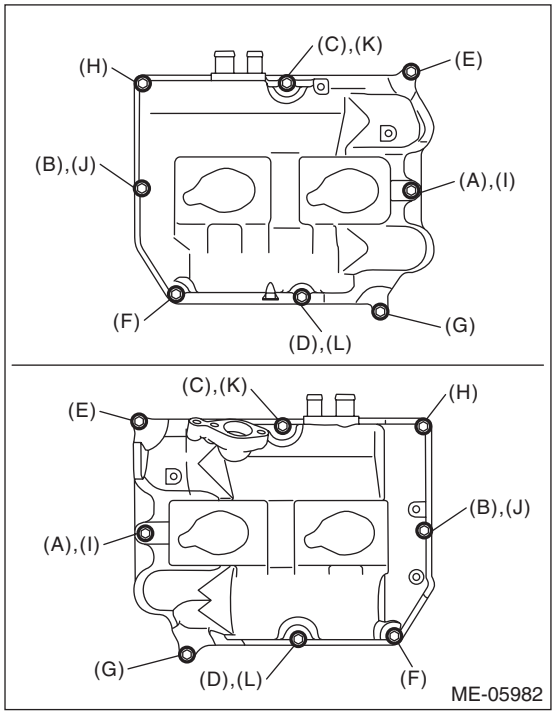
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



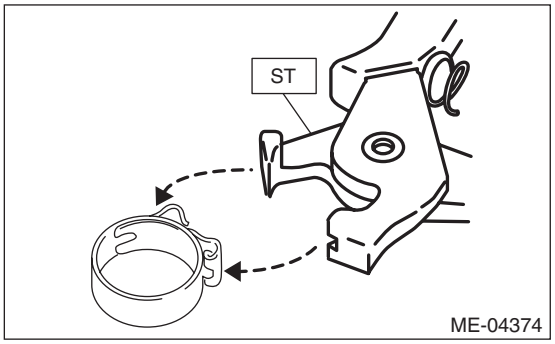
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

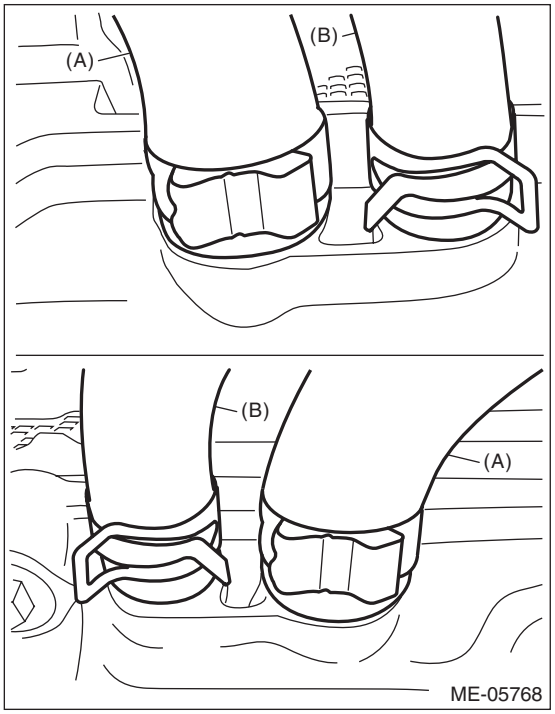
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



43) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

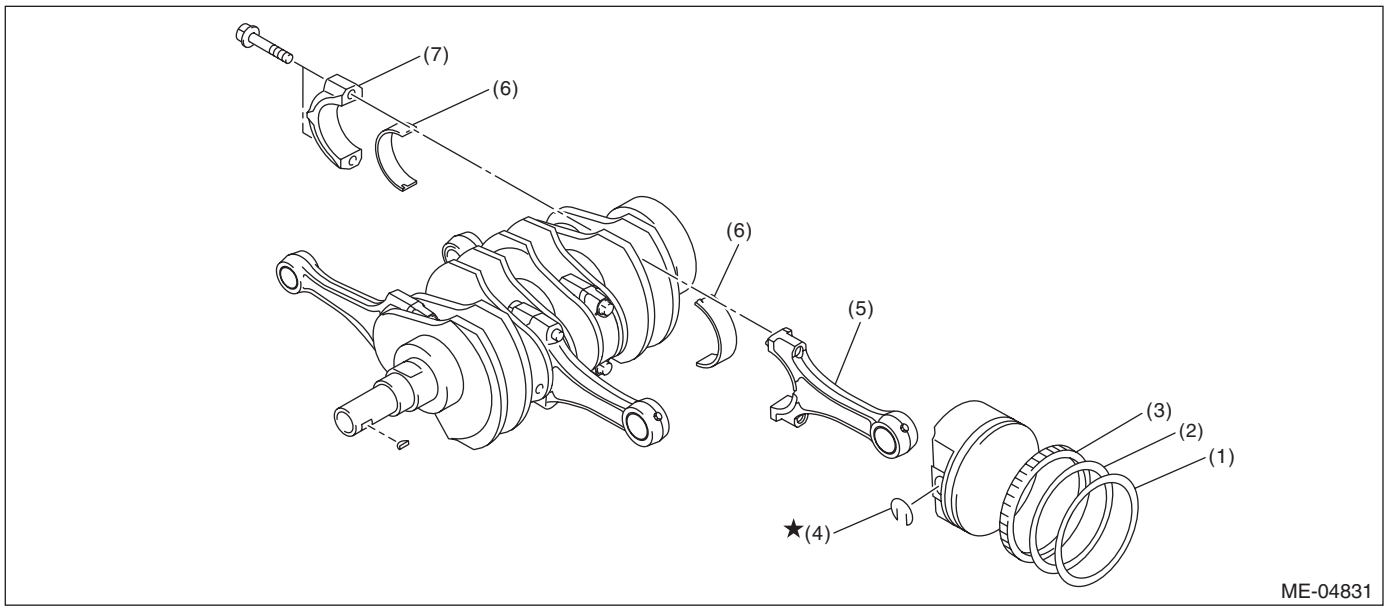
NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





44) Install the timing belt cover. <Ref. to ME(STI)-49, INSTALLATION, Timing Belt Cover.>
45) Install the crank pulley. <Ref. to ME(STI)-47, INSTALLATION, Crank Pulley.>
46) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
47) Install the rear side belt. <Ref. to ME(STI)-41, REAR SIDE BELT, INSTALLATION, V-belt.>
48) Install the engine to the vehicle. <Ref. to ME(STI)-34, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY



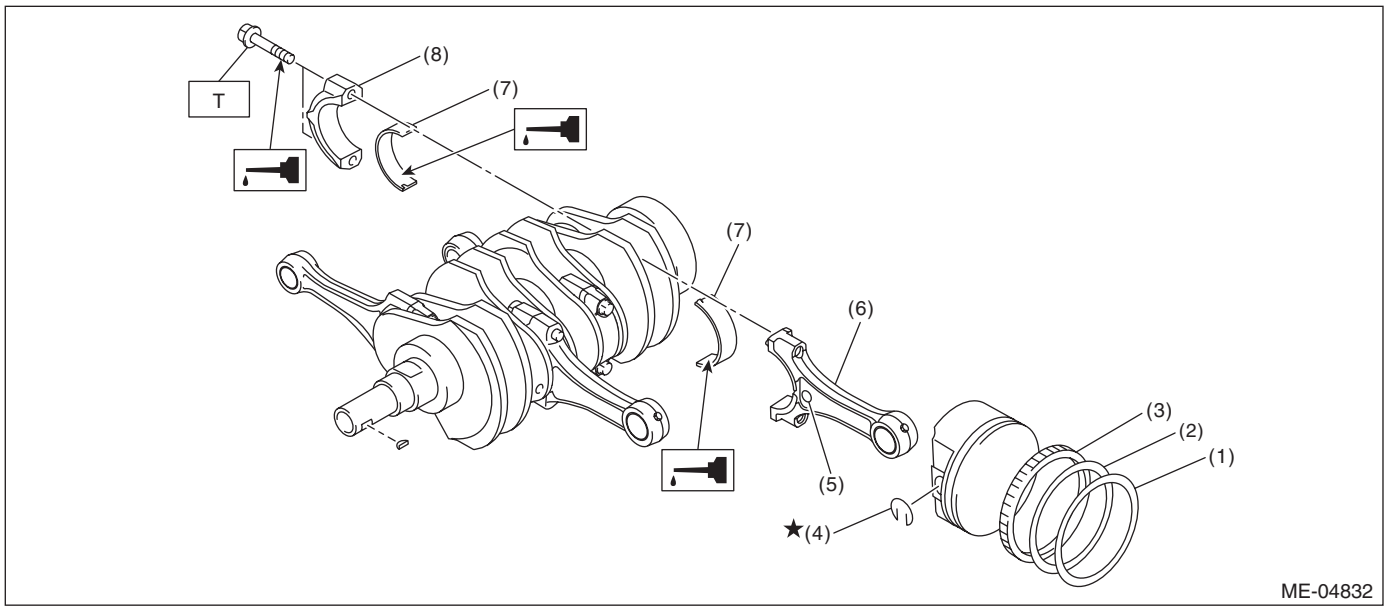
(1) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Connecting rod
(6) Connecting rod bearing
(7) Connecting rod cap

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

NOTE:
Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.
3) Remove the piston rings using piston ring expander.
4) Remove the oil ring by hand.

NOTE:
Arrange the removed piston rings in proper order, to prevent confusion.
5) Remove the snap ring.

D: ASSEMBLY



(1)	Top ring	(5)	Side mark
(2)	Second ring	(6)	Connecting rod
(3)	Oil ring	(7)	Connecting rod bearing
(4)	Snap ring	(8)	Connecting rod cap

Tightening torque: N·m (kgf-m, ft-lb)
T: 52 (5.3, 38.4)

1) Apply engine oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
2) Position each connecting rod with the side with a side mark facing forward, and install it.
3) Attach the connecting rod cap and tighten it with connecting rod bolt. Make sure the arrow on connecting rod cap faces the front during installation.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
• When tightening the connecting rod bolts, apply oil on the threads.

Tightening torque:
52 N·m (5.3 kgf-m, 38.4 ft-lb)
4) Install the oil ring upper rail, expander and lower rail by hand.
5) Install the second ring and top ring using piston ring expander.

NOTE:
Assemble so that the piston ring mark “R” faces the top side of the piston.

E: INSPECTION

1. CYLINDER BLOCK

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Check the oil passages for clogging.
3) Inspect the cylinder block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.025 mm (0.00098 in)

Grinding limit:
0.1 mm (0.004 in)

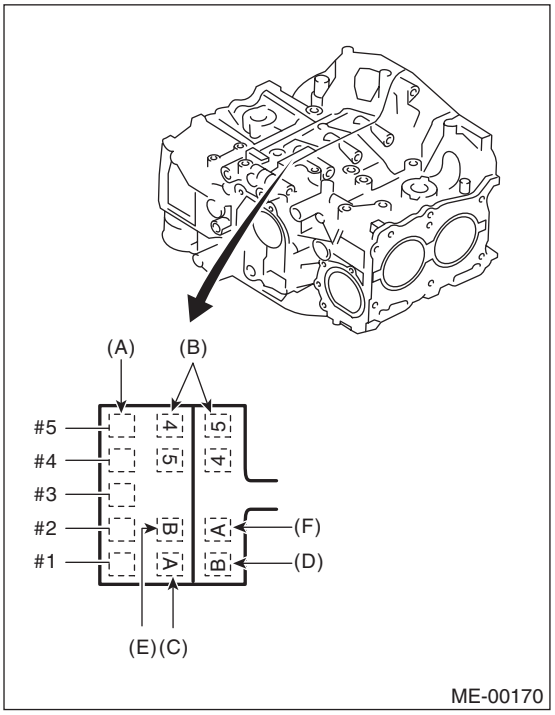
Standard height of cylinder block:
201.0 mm (7.91 in)

2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the front upper face of the cylinder block.

NOTE:
• Measurement should be performed at a temperature of 20°C (68°F).
• Standard sized pistons are classified into two grades, “A” and “B”. These grades should be used as guide lines in selecting a standard piston.

Standard diameter:
A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)



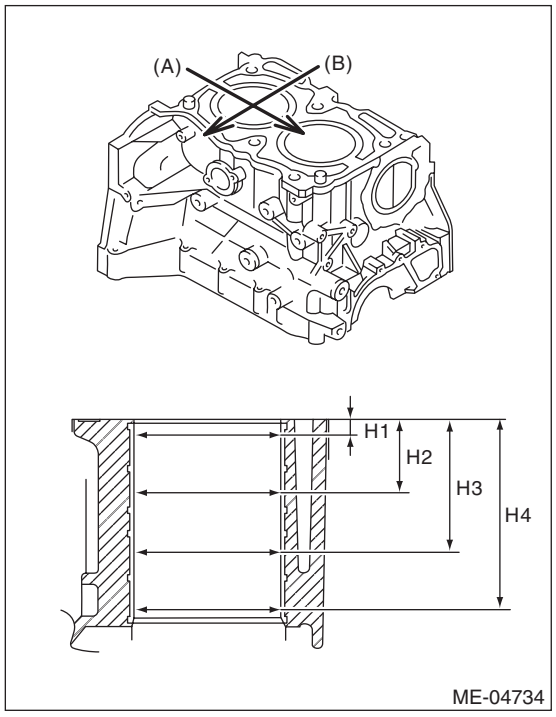
(A) Main journal size mark
(B) Cylinder block (RH) – (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

2) Measure inner diameter of each cylinder.
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

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

Cylindricality:
Limit
0.015 mm (0.0006 in)

Out-of-roundness:
Limit
0.010 mm (0.0004 in)



(A) Piston pin direction
(B) Thrust direction
H1: 10 mm (0.39 in)
H2: 45 mm (1.77 in)
H3: 80 mm (3.15 in)
H4: 115 mm (4.53 in)

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

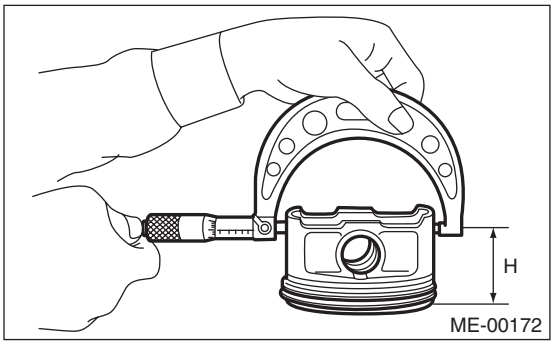
4) Measure outer diameter of each piston.
Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

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

Piston grade point H:
38.2 mm (1.50 in)

Piston outer diameter:

Standard
A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)
0.25 mm (0.0098 in) oversize
99.745 — 99.765 mm (3.9270 — 3.9278 in)
0.50 mm (0.0197 in) oversize
99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

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

Clearance between cylinder and piston at 20°C (68°F):
Standard
–0.010 — 0.010 mm (–0.00039 — 0.00039 in)

6) Boring and honing
(1) If any of the measured value of cylindricality, out-of-roundness or cylinder-to-piston clearance is out of standard or if there is any damage on the cylinder wall, rebore it to replace with an oversize piston.

CAUTION:
When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and replaced with oversize pistons.

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

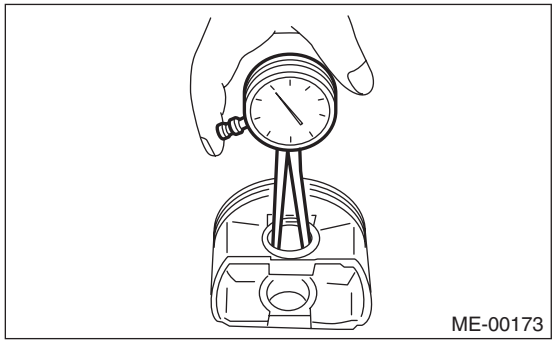
NOTE:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

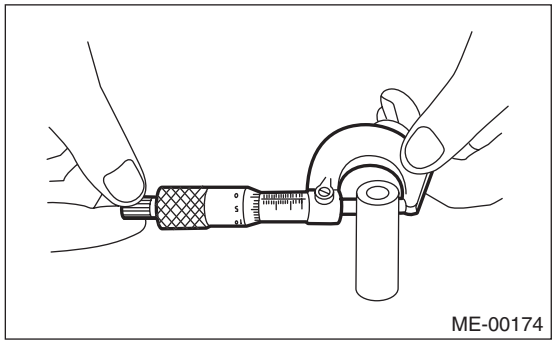
Cylinder inner diameter boring limit (diameter):
To 100.005 mm (3.9372 in)

3. PISTON AND PISTON PIN

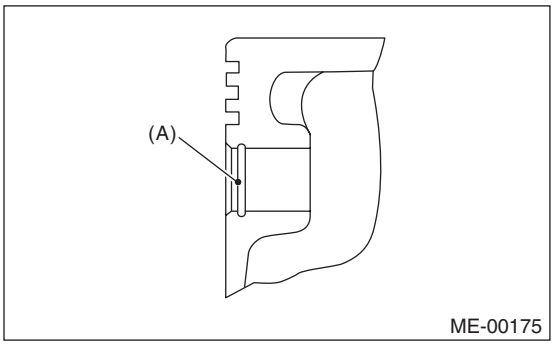
1) Check the piston and piston pin for damage, cracks or wear. Replace if faulty.
2) Check the piston ring groove for wear or damage. Replace if faulty.
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

Clearance between piston pin hole and piston pin:
Standard
0.004 — 0.008 mm (0.0002 — 0.0003 in)


ME-00173


ME-00174

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



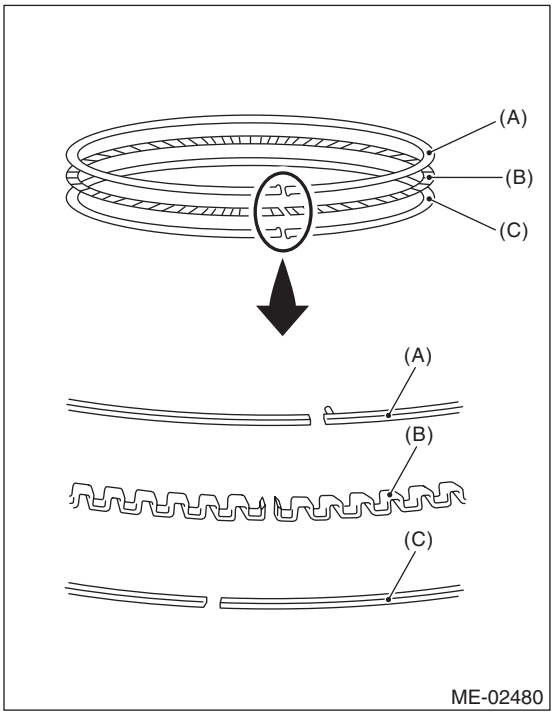
ME-00175

5) Check the snap ring for distortion, cracks and wear.

4. PISTON RING

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

NOTE:
• The top ring and second ring have the mark to determine the direction for installing. When installing the ring to piston, face marks to the top side.
• Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.

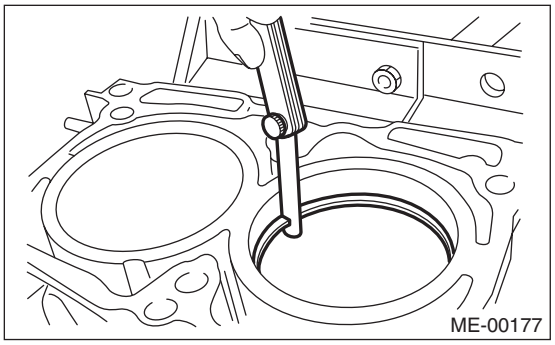


ME-02480

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

2) Using the piston, insert the piston ring and oil ring into the cylinder block so that they are perpendicular to the cylinder wall, and measure the piston ring gap using a thickness gauge.

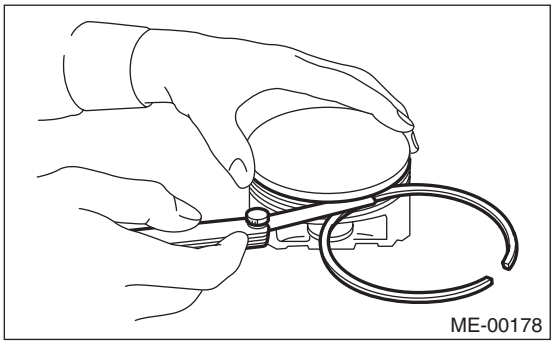
		Standard mm (in)
Piston ring gap	Top ring	0.23 — 0.28 (0.0091 — 0.0110)
	Second ring	0.37 — 0.52 (0.015 — 0.020)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)



3) Fit the piston ring straight into the piston ring groove, then measure the clearance between piston ring and piston ring groove with a thickness gauge.

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

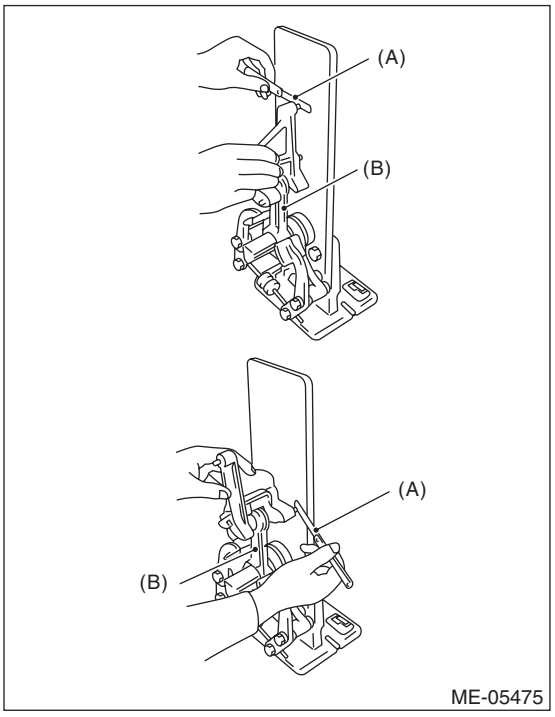
		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.
2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

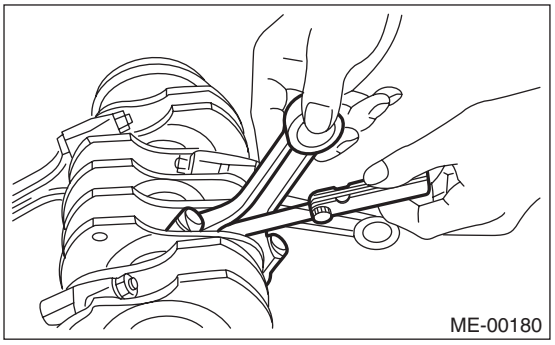
Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



(A) Thickness gauge
(B) Connecting rod

3) Install the connecting rod with bearings attached to the crankshaft, and using a thickness gauge, measure the thrust clearance. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

Connecting rod thrust clearance:
Standard
0.070 — 0.330 mm (0.0028 — 0.0130 in)



4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or undersize as necessary.

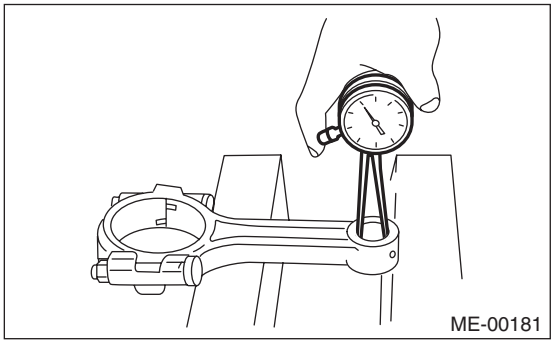
Connecting rod oil clearance:
Standard
0.017 — 0.045 mm (0.0007 — 0.0018 in)

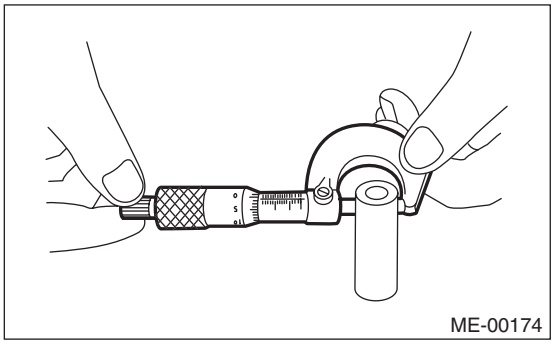
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.506 (0.0587 — 0.0593)	51.976 — 52.000 (2.0463 — 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 (2.0447 — 2.0453)
0.25 (0.0098) Undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect the bushing at connecting rod small end, and replace the connecting rod if it is worn or damaged.
7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace the connecting rod and piston pin as a set.

Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)


ME-00181

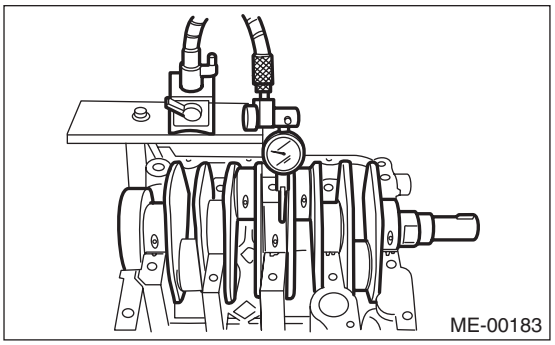

ME-00174

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. If defective, replace the crankshaft.
2) Measure warping of the crankshaft. If it exceeds the limit, correct or replace it.

NOTE:
If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

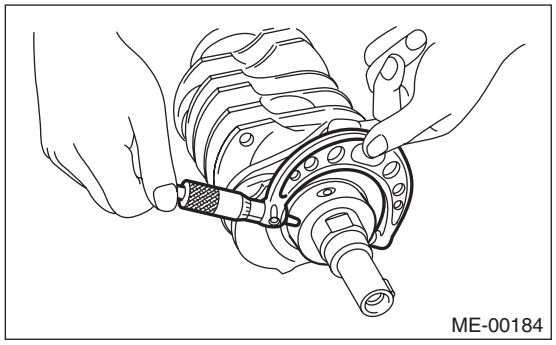
Crankshaft bend limit:
0.035 mm (0.0014 in)


ME-00183

3) Inspect the crank journal and crank pin for wear. If they are not within the standard, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the specified dimensions according to the undersize bearing to be used.

Crank pin:
- ***Cylindricality***
  - ***Limit***
  - ***0.006 mm (0.0002 in)***
- ***Out-of-roundness***
  - ***Limit***
  - ***0.005 mm (0.0002 in)***
- ***Grinding limit (dia.)***
  - ***To 51.750 mm (2.0374 in)***

Crank journal:
- ***Cylindricality***
  - ***Limit***
  - ***0.006 mm (0.0002 in)***
- ***Out-of-roundness***
  - ***Limit***
  - ***0.005 mm (0.0002 in)***
- ***Grinding limit (dia.)***
  - ***To 59.758 mm (2.3527 in)***

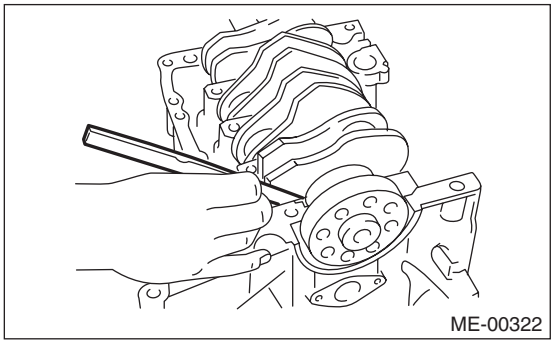


Unit: mm (in)

		Crank journal diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.984 — 60.008 (2.3616 — 2.3625)	59.984 — 60.008 (2.3616 — 2.3625)	51.976 — 52.000 (2.0463 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.015 (0.0787 — 0.0793)	2.000 — 2.017 (0.0787 — 0.0794)	1.490 — 1.506 (0.0587 — 0.0593)
0.03 (0.0012) Undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) Undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

4) Use a thickness gauge to measure the thrust clearance of crankshaft at #5 crank journal bearing. If clearance exceeds the standard, replace the bearing.

Crankshaft thrust clearance:
Standard
0.030 — 0.115 mm (0.0012 — 0.0045 in)



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.
6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or grind to correct the crankshaft as necessary.

Crankshaft oil clearance:
Standard
0.010 — 0.030 mm (0.00039 — 0.0012 in)

21.Intake and Exhaust Valve

A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(STI)-70, REMOVAL, Cylinder Head.> <Ref. to ME(STI)-70, INSTALLATION, Cylinder Head.>

22.Piston

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(STI)-80, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-84, INSTALLATION, Cylinder Block.>

23.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(STI)-80, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-84, INSTALLATION, Cylinder Block.>

24.Crankshaft

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(STI)-80, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-84, INSTALLATION, Cylinder Block.>

25.Engine Trouble in General

A: INSPECTION

NOTE:
The “RANK” shown in the chart shows the possibilities of the cause of trouble in order from “Very often” to “Rarely”.
A — Very often
B — Sometimes
C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective starter	B
	Battery	Improper connection of terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
	Immobilizer system <Ref. to IM(diag)-2, Basic Diagnostic Procedure.>		A
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Lubrication system	Incorrect oil pressure	B
		Defective rocker cover gasket	C
	Cooling system	Over-heating	C
	Others	Evaporative emission control system malfunction	A
		Stuck or damaged throttle valve	B

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Lubrication system	Incorrect oil pressure	B
	Cooling system	Over-heating	C
		Over-cooling	C
	Others	Evaporative emission control system malfunction	A

Symptoms	Problem parts etc.	Possible cause	RANK
4. Surging	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Cooling system	Over-heating	B
	Others	Evaporative emission control system malfunction	C
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Over-heating	B
	Others	Evaporative emission control system malfunction	B
7. After burning in exhaust system	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Lubrication system	Incorrect oil pressure	C
	Cooling system	Over-cooling	C
	Others	Evaporative emission control system malfunction	C

Symptoms	Problem parts etc.	Possible cause	RANK
8. Knocking	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
	Cooling system	Over-heating	A
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
	Lubrication system	Loosened oil pump attaching bolts and defective gasket	B
		Defective oil filter gasket	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
		Loosened oil pan fitting bolts or defective oil pan	B
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Dirty air cleaner element	A
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	B
	Lubrication system	Incorrect oil pressure	C
	Cooling system	Over-cooling	C

26.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
	Oil pressure is normal.	• Loosened flywheel mounting bolt • Damaged engine mounting
High-pitched clank	Sound is noticeable when accelerating with an overload condition.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong heat range of spark plug • Improper octane value gasoline
Clank when engine speed is between 1,000 and 2,000 rpms.	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• 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.*	• Unusually worn valve lifter • Worn cam sprocket • Worn camshaft journal bore in cylinder head
Squeaky sound	—	• Insufficient generator lubrication
Rubbing sound	—	• Poor contact of generator brush and rotor
Gear scream when starting engine	—	• Defective ignition starter switch • Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	• Loose V-belt • Defective water pump shaft
Hissing sound	—	• Insufficient compression • Air leakage in air intake system, hose, connection or manifold
Timing belt noise	—	• Loose timing belt • Timing belt contacting with adjacent part
Valve noise	—	• Incorrect valve clearance

* When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-63, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-49, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

EXHAUST

EX(STI)

Page

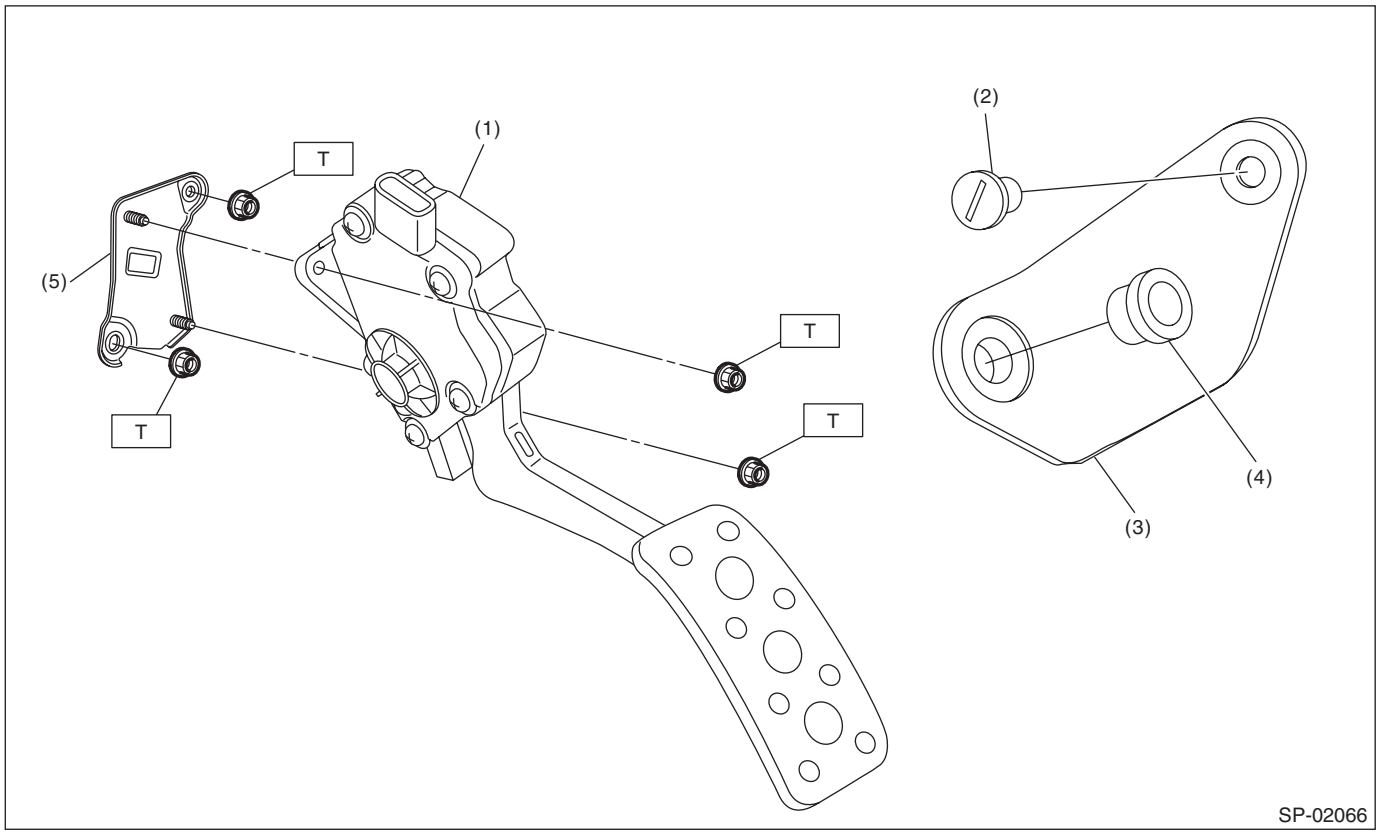
1. General Description 2
2. Front Exhaust Pipe 6
3. Center Exhaust Pipe 8
4. Joint Pipe 12
5. Rear Exhaust Pipe 13
6. Muffler 15

1. General Description

A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	50 — 59 mm (1.97 — 2.32 in)

B: COMPONENT



(1) Accelerator pedal ASSY
(2) Clip
(3) Accelerator plate
(4) Accelerator stopper
(5) Accelerator pedal bracket

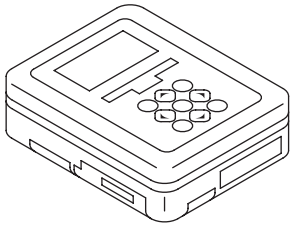
Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.3)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for inspecting the accelerator pedal.

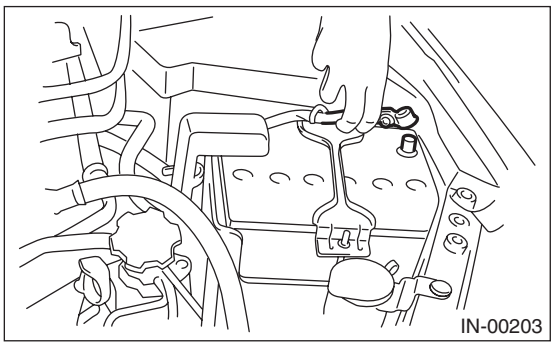
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring voltage.

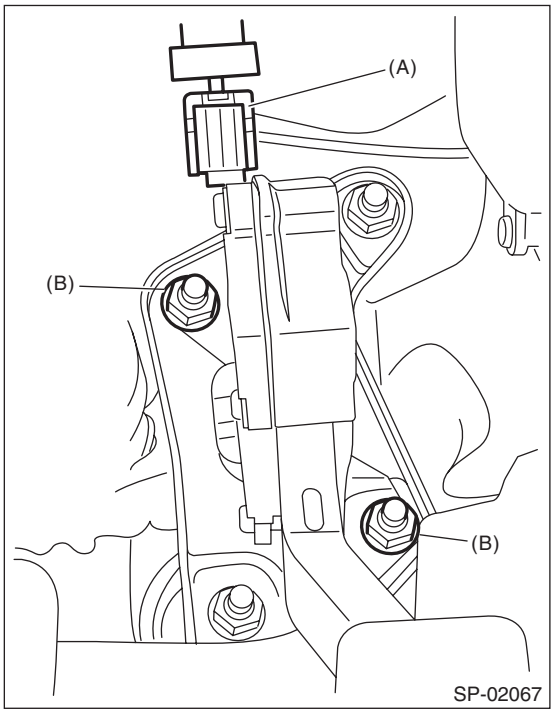
2. Accelerator Pedal

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A).
3) Remove the nut (B) securing accelerator pedal assembly, and remove the accelerator pedal assembly.



B: INSTALLATION

Install in the reverse order of removal.

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

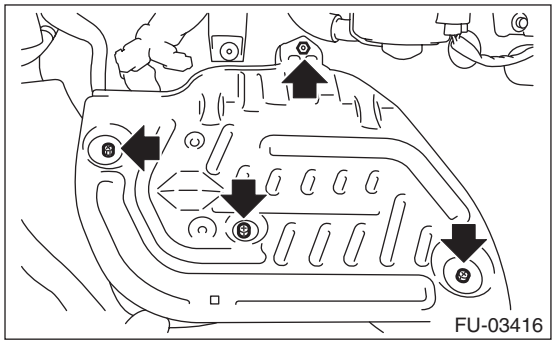
C: DISASSEMBLY

NOTE:
The accelerator pedal cannot be disassembled.

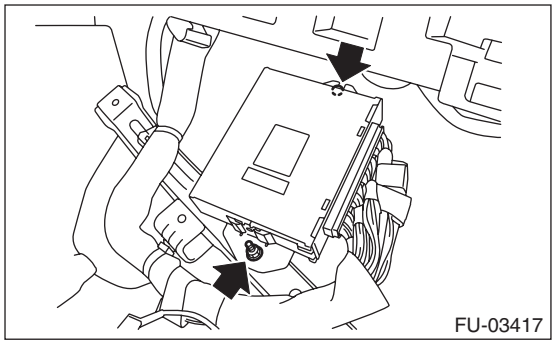
D: INSPECTION

1. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

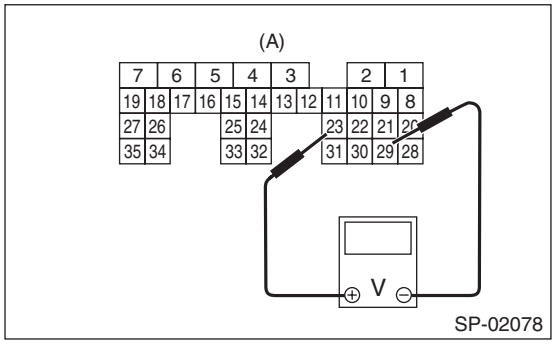


4) Remove the nuts and bolts which hold the ECM to the bracket.



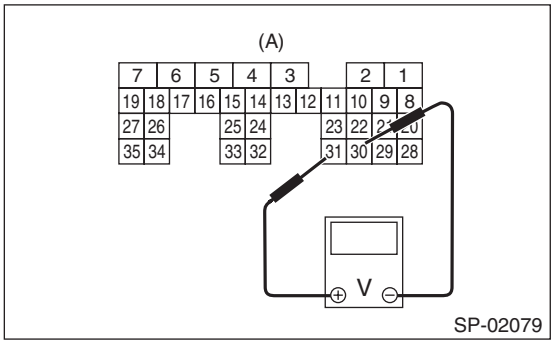
5) Turn the ignition switch to ON. (engine OFF)
6) Measure the voltage between ECM connector terminals.

- Main sensor side



(A) To ECM connector

- Sub sensor side



(A) To ECM connector

Accelerator pedal sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (Full closed)	23 (+) and 29 (–)	0.4 — 1.0 V
	Depressed (Full opened)		2.4 — 3.7 V
Sub	Not depressed (Full closed)	31 (+) and 30 (–)	0.3 — 1.1 V
	Depressed (Full opened)		2.3 — 3.8 V

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

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

2. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the accelerator pedal opening angle signal and voltage of accelerator pedal sensor using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-41, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

Accelerator pedal sensor	Accelerator pedal opening angle signal	Standard
Main	0.0%	0.4 — 1.0 V
	100.0%	2.4 — 3.7 V
Sub	0.0%	0.3 — 1.1 V
	100.0%	2.3 — 3.8 V

3. OTHER INSPECTIONS

1) Check that the accelerator pedal does not have deformation, cracks or damage.
2) Check for smooth operation when the accelerator pedal is depressed.
3) Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

IGNITION

IG(STI)

Page

1. General Description 2
2. Spark Plug 4
3. Ignition Coil 7

1. General Description

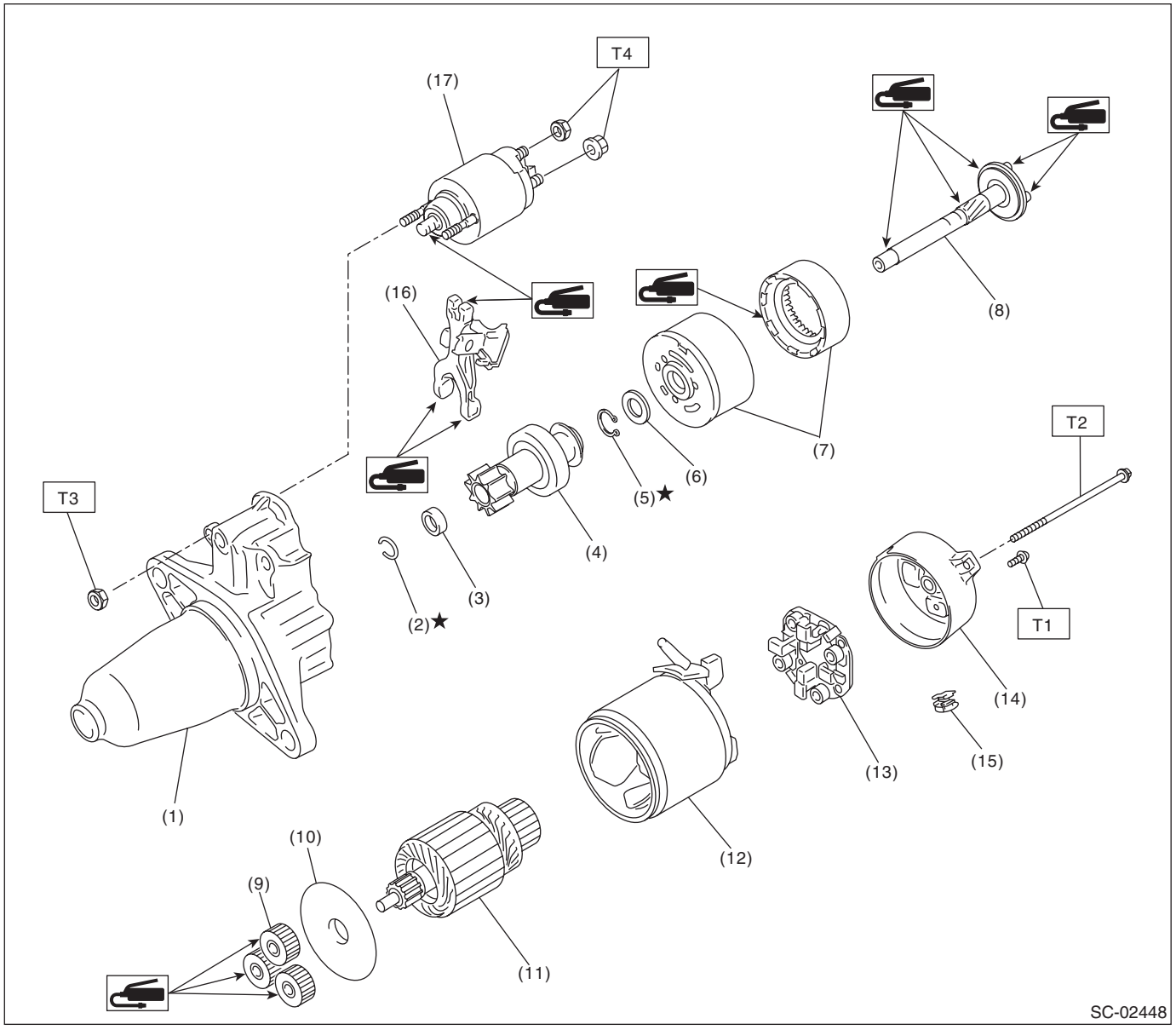
A: SPECIFICATION

Item			Specifications	
Vehicle model			6MT	5MT
Starter	Type		Reduction type	
	Model		428000-5760	M000T30475
	Manufacturer		DENSO	Mitsubishi Electric
	Voltage and output		12 V — 1.0 kW	
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		9	8
	Armature commutator runout	Standard	0.05 mm (0.0020 in)	0.05 mm (0.0020 in)
		Limit	0.10 mm (0.0039 in)	0.10 mm (0.0039 in)
	Armature depth of segment mold	Standard	0.5 mm (0.020 in)	0.5 mm (0.020 in)
	Brush length	Standard	12.3 mm (0.484 in)	12.3 mm (0.484 in)
		Limit	7.0 mm (0.276 in)	7.0 mm (0.276 in)
	Brush spring force	Standard	15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf)	15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf)
		Limit	2.5 N (0.25 kgf, 0.56 lbf)	2.5 N (0.25 kgf, 0.56 lbf)
	No-load characteristics	Voltage	11 V	11 V
		Current	90 A or less	95 A or less
		Rotating speed	2,860 rpm or more	2,500 rpm or more
	Load characteristics	Voltage	8 V	7.5 V
		Current	280 A	300 A
		Torque	9.3 N·m (0.9 kgf-m, 6.9 ft-lb) or more	8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more
		Rotating speed	860 rpm or more	870 rpm or more
	Lock characteristics	Voltage	4 V	4 V
		Current	515 A or less	680 A or less
		Torque	16 N·m (1.6 kgf-m, 11.8 ft-lb) or more	17 N·m (1.7 kgf-m, 12.5 ft-lb) or more
Generator	Type		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A3TG6591	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 110 A	
	Polarity on ground side		Negative	
	Direction of rotation		Clockwise (when observed from pulley side)	
	Stator connection		3-phase △ type	
	Output current		1,500 rpm — 50 A or more 2,500 rpm — 91 A or more 5,000 rpm — 105 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
	Rotor slip ring outer diameter	Standard	22.7 mm (0.894 in)	
		Limit	22.1 mm (0.870 in)	
	Brush length	Standard	18.5 mm (0.728 in)	
		Limit	5.0 mm (0.197 in)	
Battery	Type and capacity		12 V — 48 AH (55D23L)	12 V — 48 AH (55D23L)
	CCA		356 A	356 A

B: COMPONENT

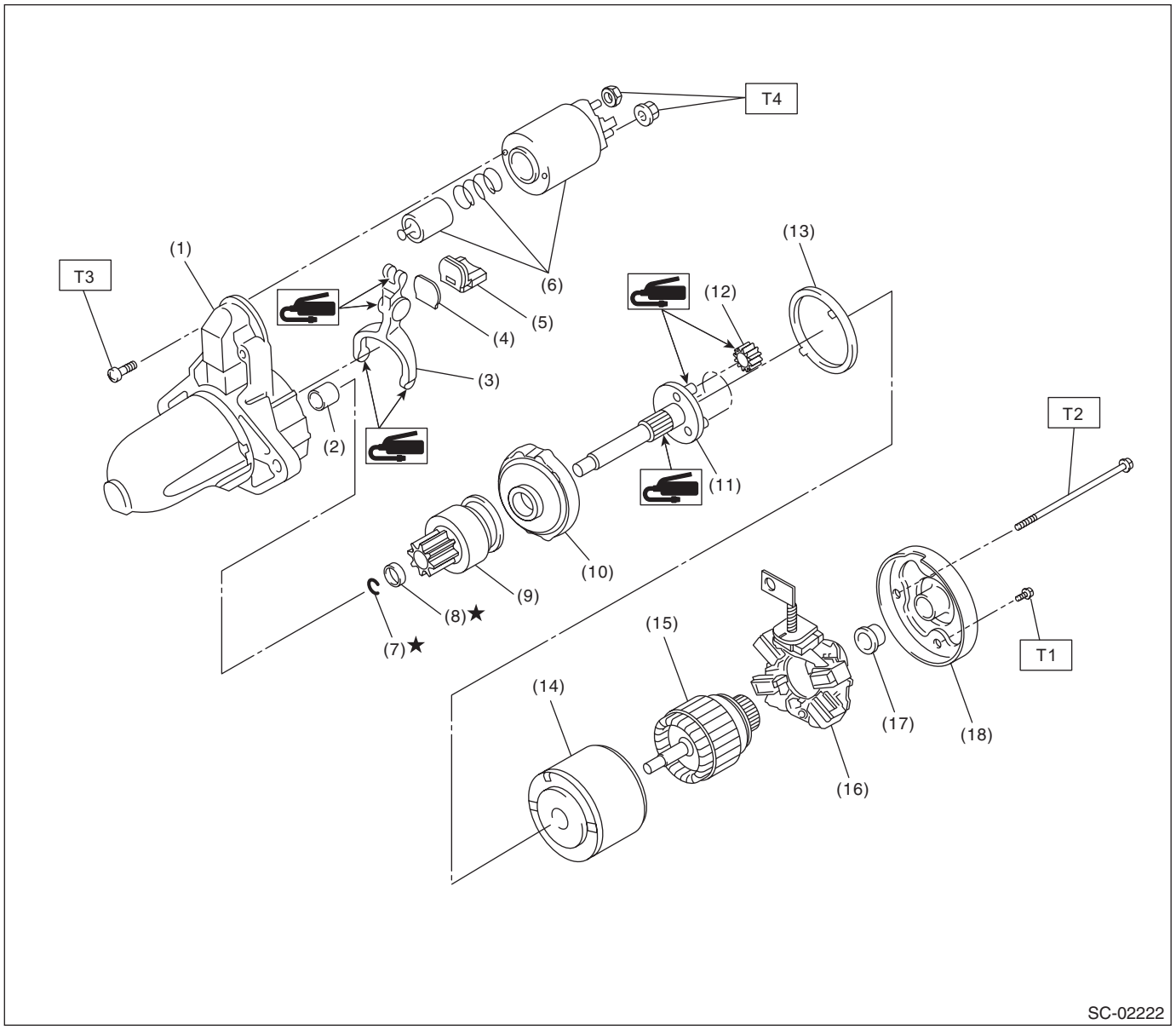
1. STARTER

- STI model



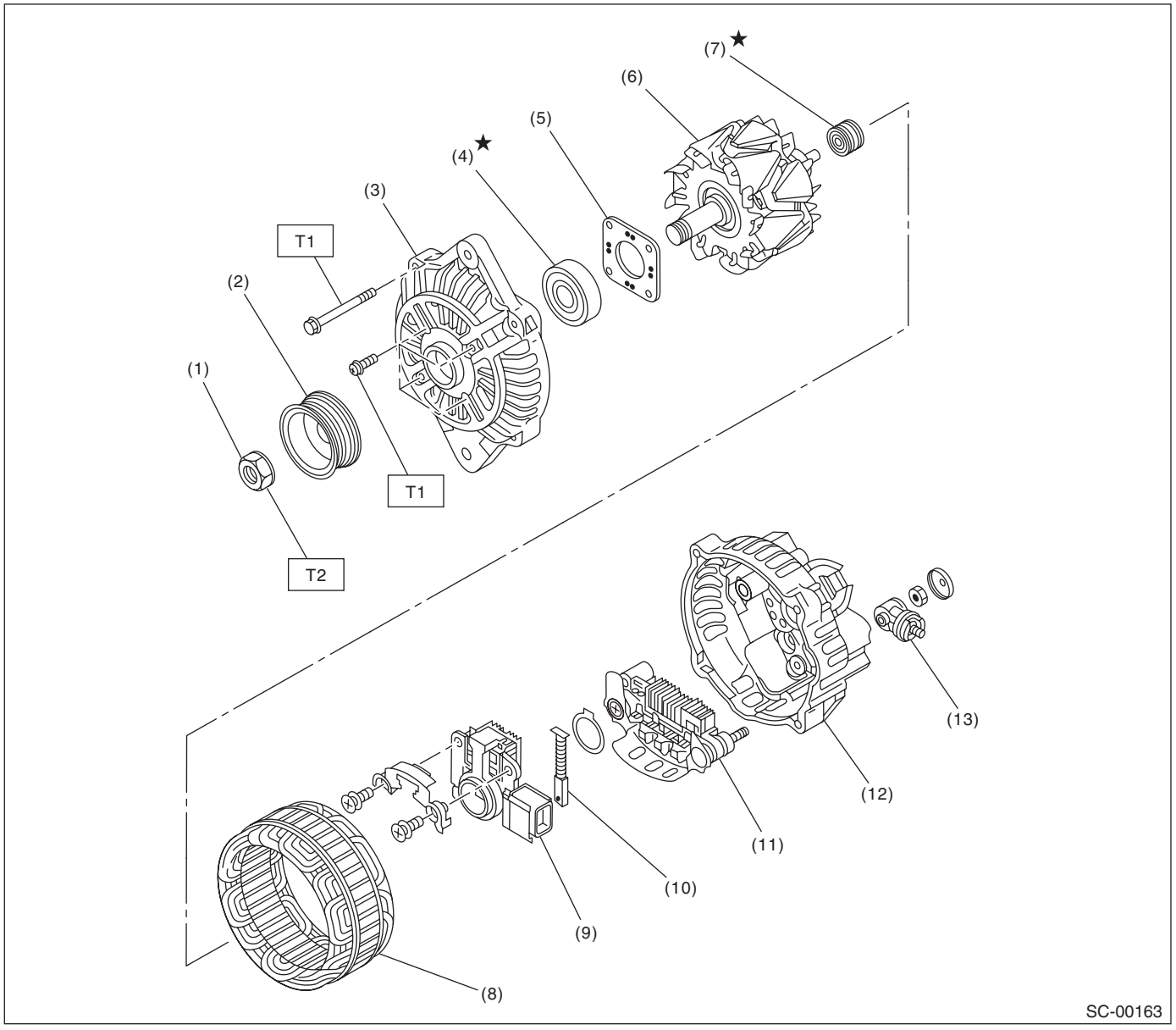
(1)	Starter housing ASSY	(9)	Pinion gear	(17)	Magnet switch ASSY
(2)	Snap ring	(10)	Starter plate		
(3)	Stopper	(11)	Armature	***Tightening torque: N·m (kgf-m, ft-lb)***	
(4)	Overrunning clutch	(12)	Yoke ASSY	***T1:***	***1.4 (0.1, 1.0)***
(5)	Snap ring	(13)	Brush holder ASSY	***T2:***	***6 (0.6, 4.4)***
(6)	Washer	(14)	Starter cover ASSY	***T3:***	***7.5 (0.8, 5.5)***
(7)	Internal gear ASSY	(15)	Drain duct	***T4:***	***10 (1.0, 7.4)***
(8)	Shaft	(16)	Shift lever		

- Except for STI model



(1)	Starter housing ASSY	(9)	Overrunning clutch	(17)	Sleeve bearing
(2)	Sleeve bearing	(10)	Internal gear ASSY	(18)	Starter cover ASSY
(3)	Shift lever	(11)	Shaft		
(4)	Plate	(12)	Pinion gear	***Tightening torque: N·m (kgf-m, ft-lb)***	
(5)	Seal rubber	(13)	Seal rubber	***T1:***	***1.4 (0.1, 1.0)***
(6)	Magnet switch ASSY	(14)	Yoke ASSY	***T2:***	***6 (0.6, 4.4)***
(7)	Snap ring	(15)	Armature ASSY	***T3:***	***7.5 (0.8, 5.5)***
(8)	Stopper	(16)	Brush holder ASSY	***T4:***	***10 (1.0, 7.4)***

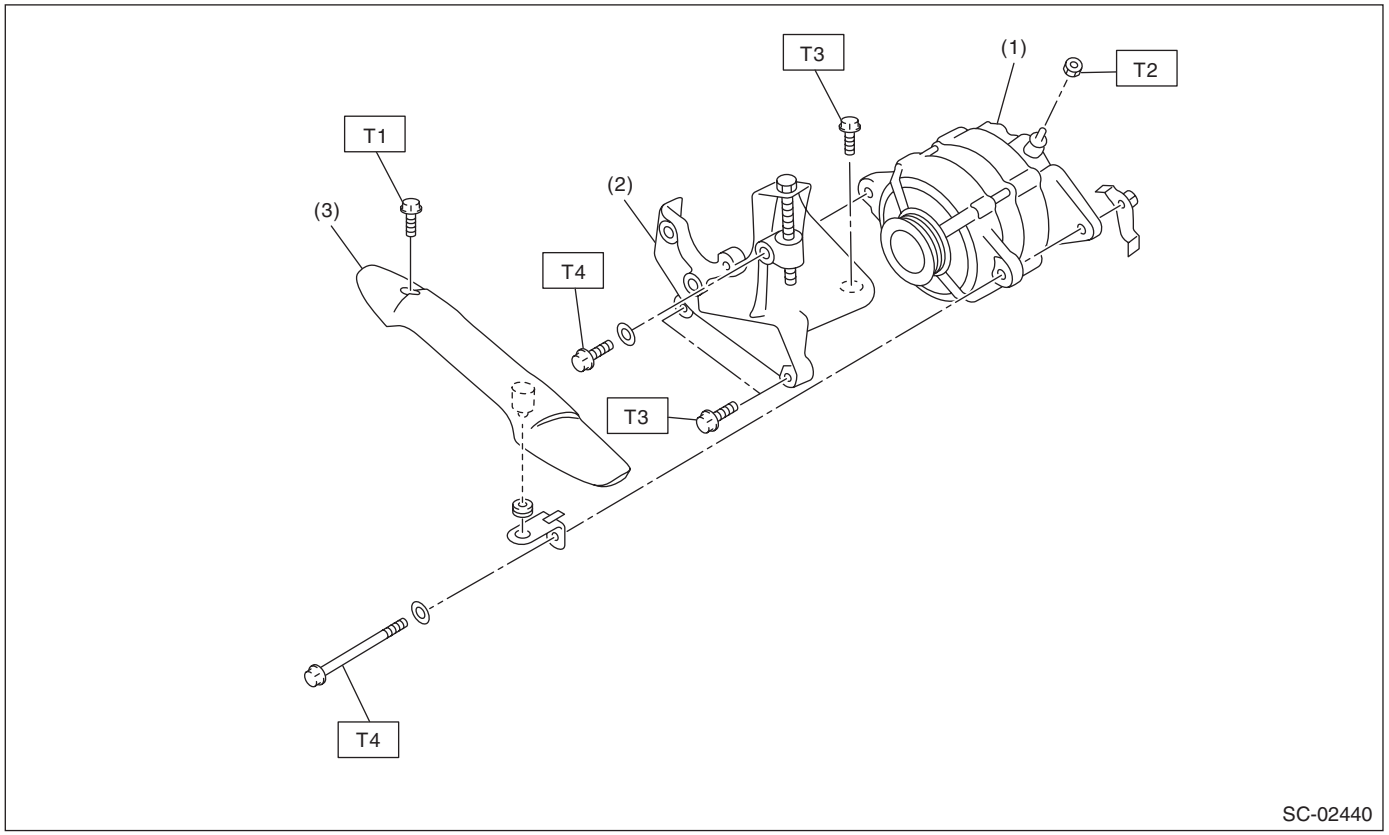
2. GENERATOR



(1) Pulley nut
(2) Pulley
(3) Front cover
(4) Ball bearing
(5) Bearing retainer
(6) Rotor
(7) Bearing
(8) Stator coil
(9) IC regulator with brush
(10) Brush
(11) Rectifier
(12) Rear cover
(13) Terminals

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.7 (0.5, 3.5)
T2: 108 (11.0, 79.8)

3. GENERATOR BRACKET



(1) Generator
(2) Power steering pump bracket
(3) V-belt cover

Tightening torque: N·m (kgf-m, ft-lb)
T1: 13 (1.3, 9.6)
T2: 16 (1.6, 11.8)
T3: 22 (2.2, 16.2)
T4: 25 (2.5, 18.4)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
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- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

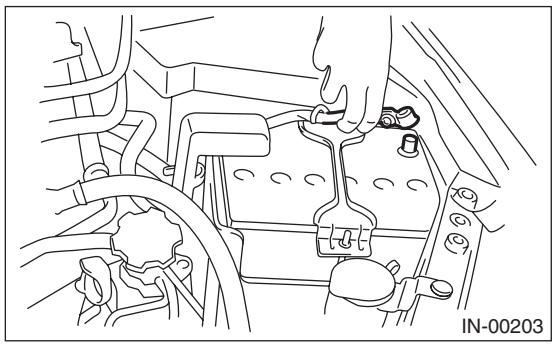
1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

2. Starter

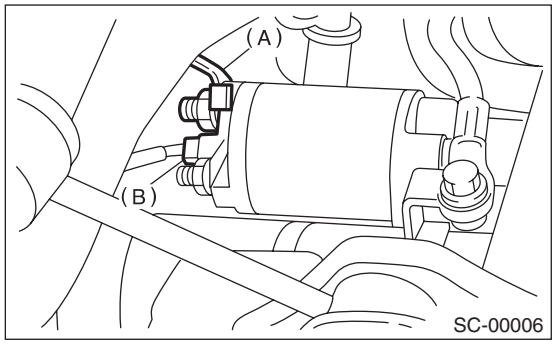
A: REMOVAL

1) Disconnect the ground cable from battery.

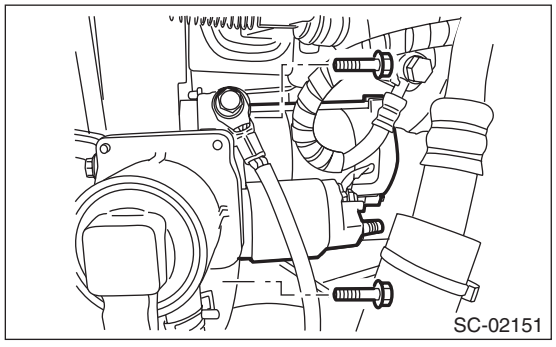


2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>

3) Disconnect the connector (B) and terminal (A) from starter.



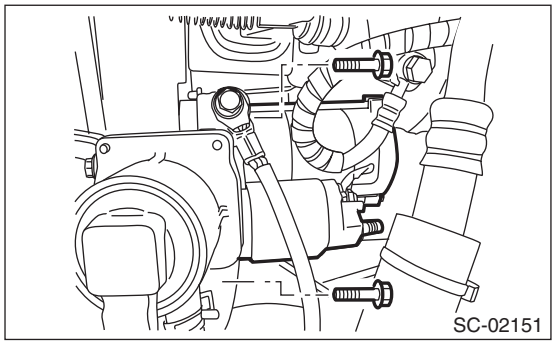
4) Remove the starter from transmission.



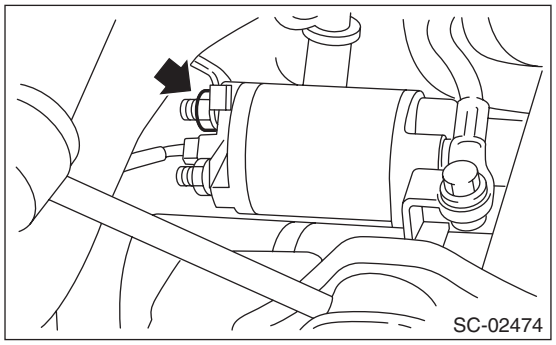
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



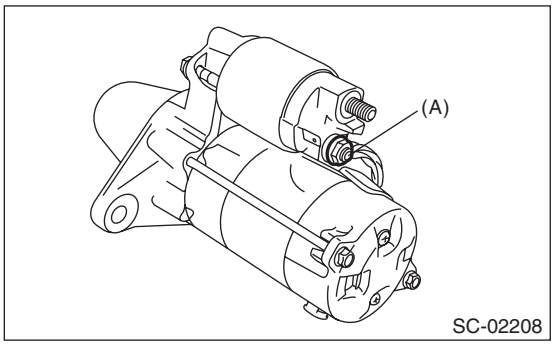
Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



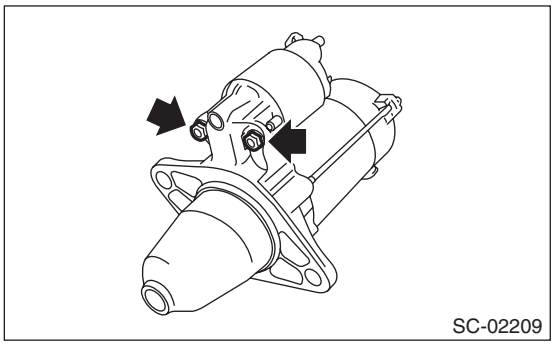
C: DISASSEMBLY

1. STI MODEL

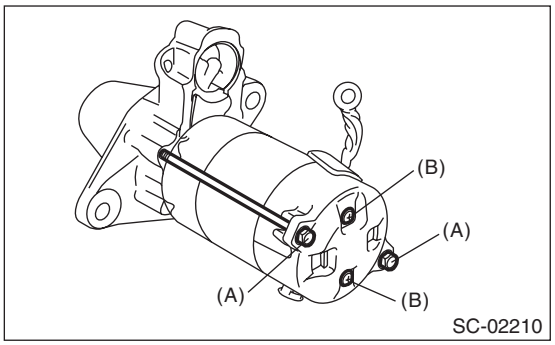
1) Disconnect cable from terminal M (A) of the magnet switch assembly.



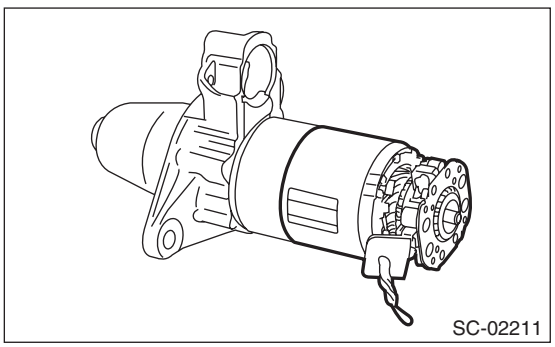
2) Remove the magnet switch assembly from the starter housing assembly.



3) Remove through bolts (A) on both sides and the brush holder screws (B), and remove the starter cover assembly.

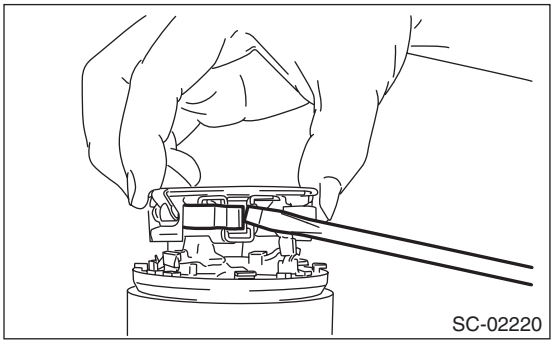


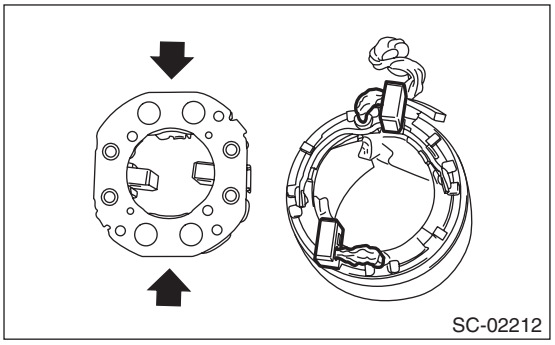
4) Remove the yoke assembly and brush holder assembly as a unit.



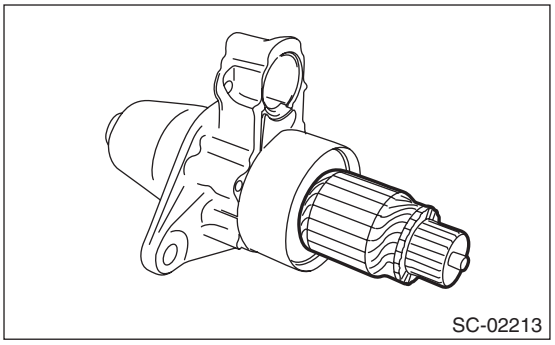
5) Remove the two brushes wired to the yoke assembly, and separate the yoke assembly and the brush holder assembly.

NOTE:
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and remove the brush.

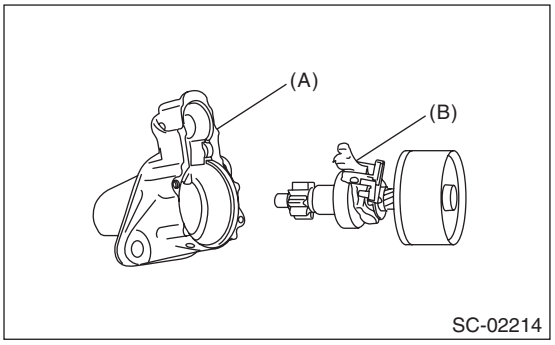




6) Remove the armature from the internal gear assembly.

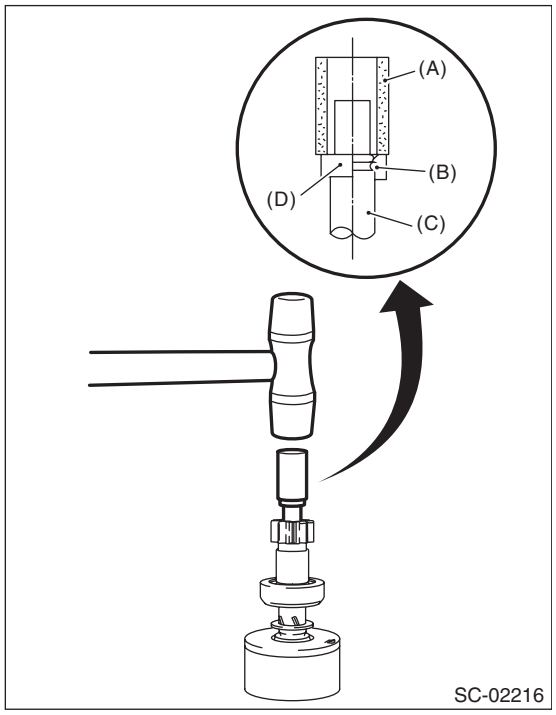


7) Remove the starter housing assembly (A) then remove the shift lever (B).



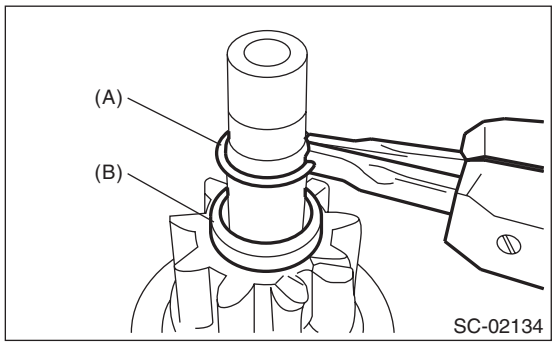
8) Use the following procedures to remove the overrunning clutch from the shaft.

(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.

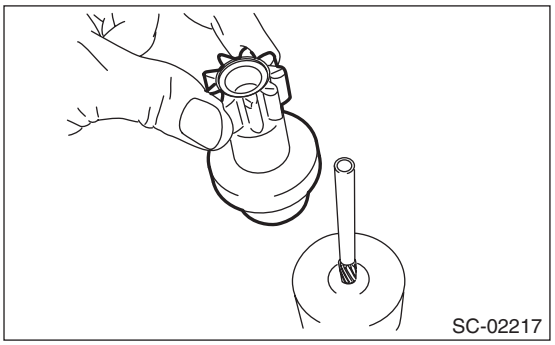


(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

(2) Remove snap ring (A) from the shaft, and remove stopper (B).

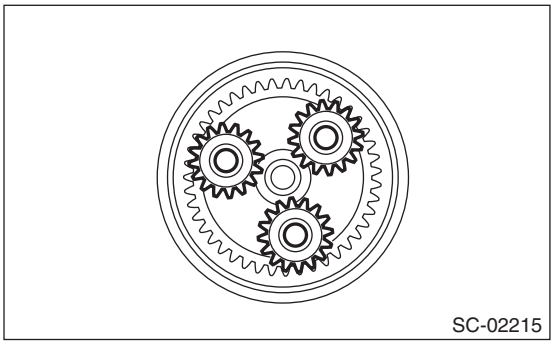


(3) Remove the overrunning clutch from the shaft.

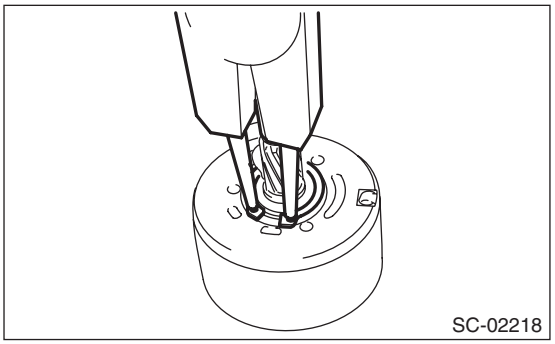


9) Use the following procedures to remove the shaft.

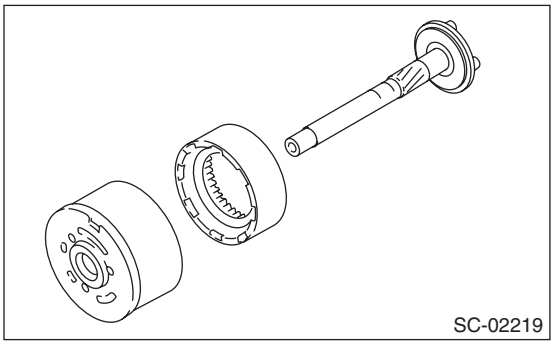
(1) Remove the starter plate, and remove the pinion gear.



(2) Remove the snap ring from the shaft.

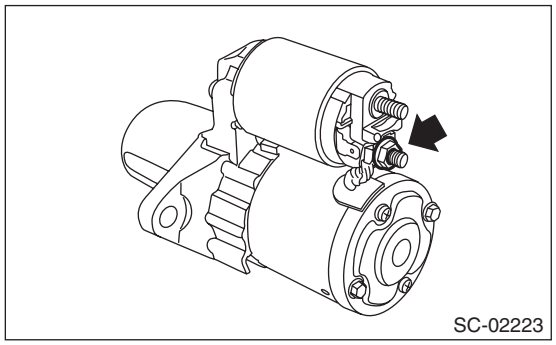


(3) Remove the shaft from the internal gear assembly.

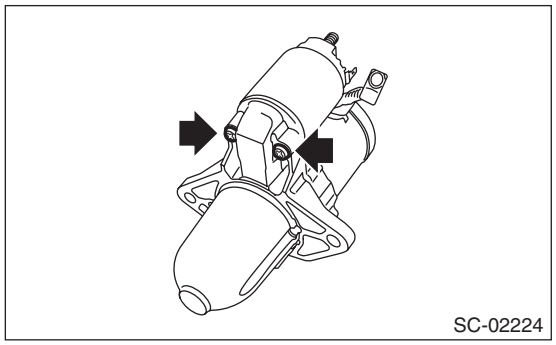


2. EXCEPT FOR STI MODEL

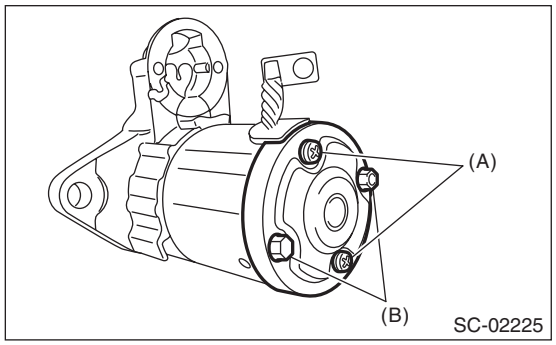
1) Disconnect the cable from the terminal M of the magnet switch assembly.


SC-02223

2) Remove the magnet switch assembly from the starter housing assembly.


SC-02224

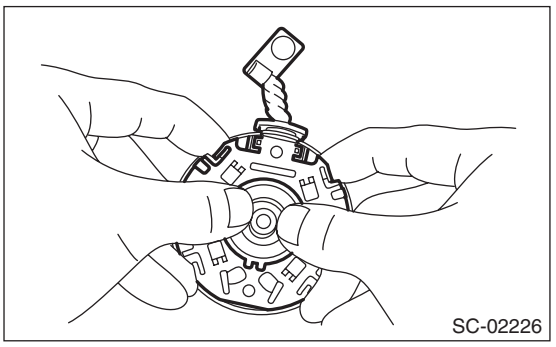
3) Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.



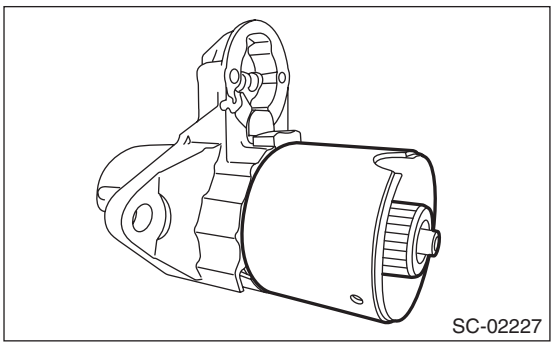
SC-02225

4) Remove the brush holder assembly from the armature assembly.

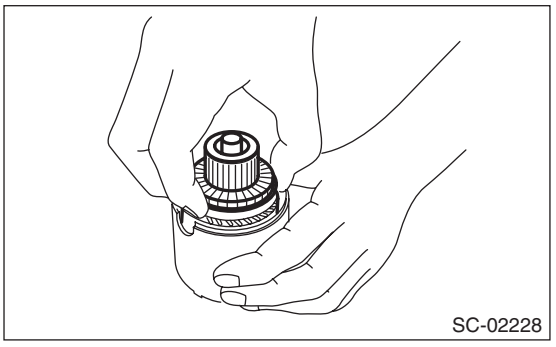
NOTE:
Hold the brush with your fingers so that the brush spring does not come flying out.


SC-02226

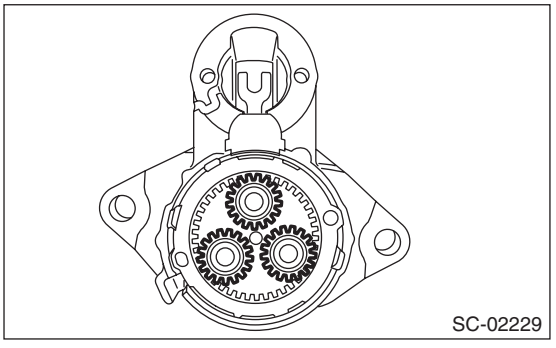
5) Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.


SC-02227

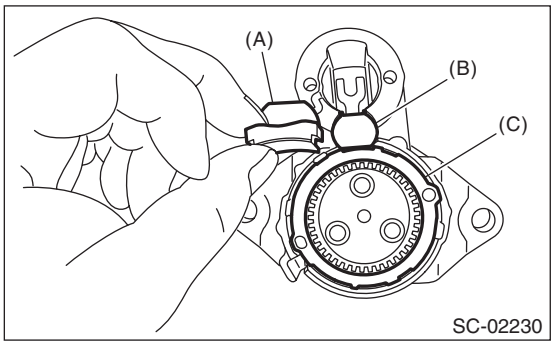
6) Separate the armature assembly and yoke assembly.


SC-02228

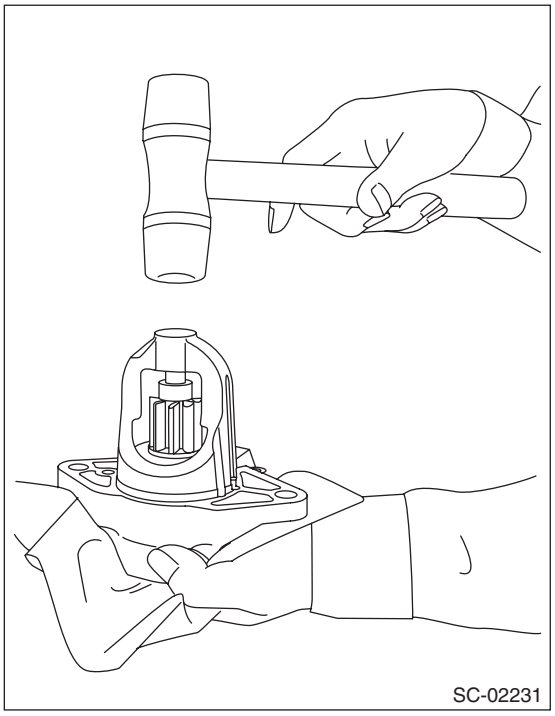
7) Remove the pinion gear from the internal gear assembly.

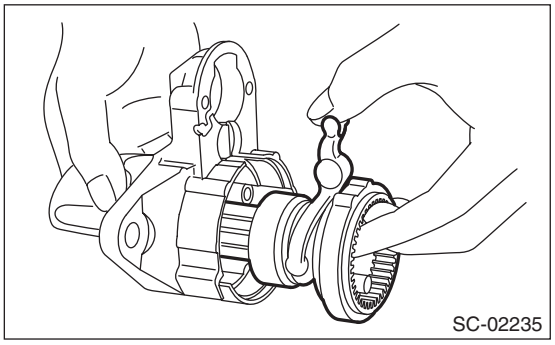

SC-02229

8) Remove seal rubber (A), plate (B), and seal rubber (C).



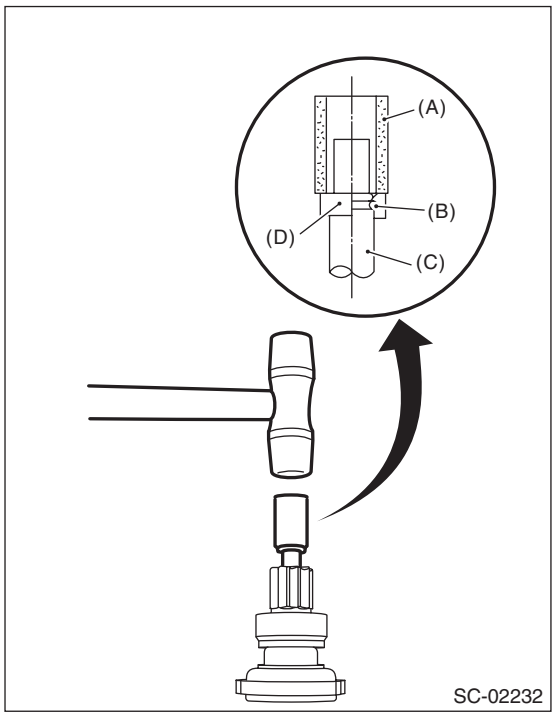
9) Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.





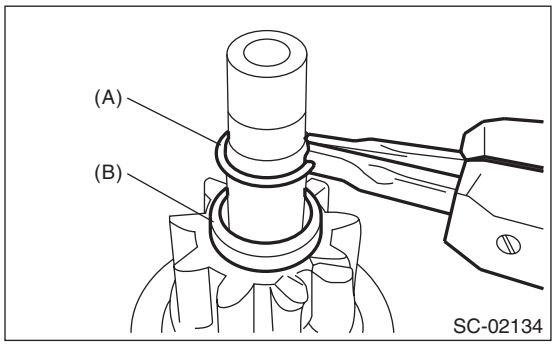
10) Use the following procedures to remove the overrunning clutch from the shaft.

(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.

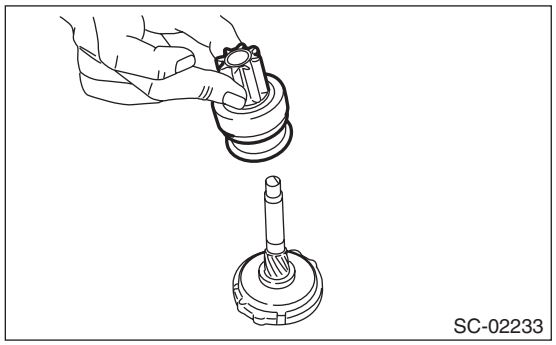


(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

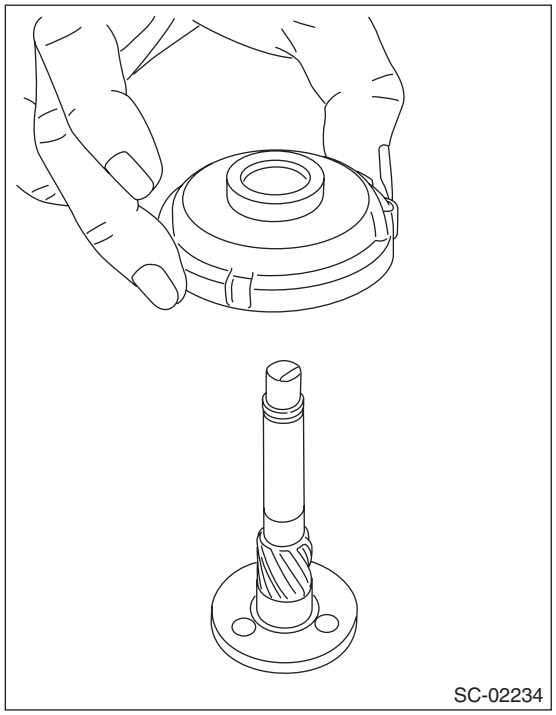
(2) Remove snap ring (A) from the shaft, and remove stopper (B).



(3) Remove the overrunning clutch from the shaft.


SC-02233

11) Separate the internal gear assembly and shaft.


SC-02234

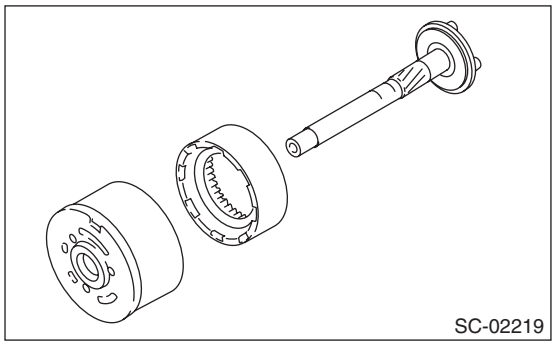
D: ASSEMBLY

1. STI MODEL

1) Use the following procedures to install the shaft.
(1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

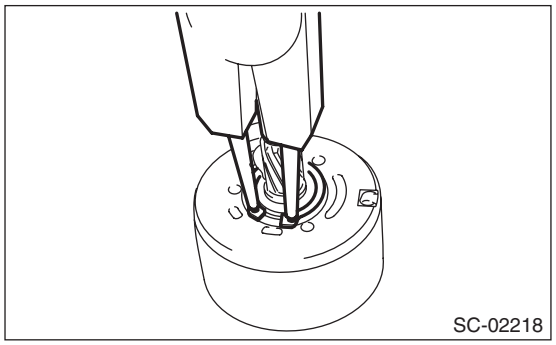
Grease:
DENSO HL50

(2) Assemble the shaft to the internal gear assembly.


SC-02219

(3) Install the snap ring to shaft.

NOTE:
Use new snap rings.


SC-02218

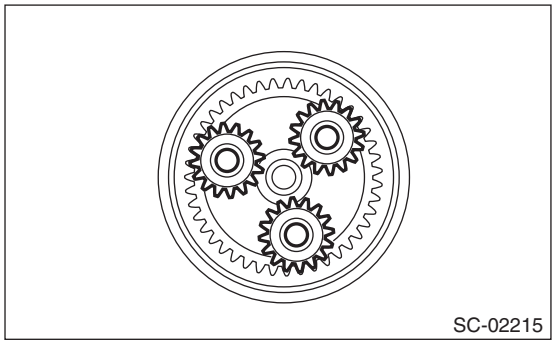
(4) Apply grease to the pinion gear attachment area.

Grease:
DENSO HL50

(5) Attach the pinion gear to the pin.
(6) Apply grease to the pinion gear, internal gear assembly, and on top of the shaft pin.

NOTE:
- Apply grease so that it contacts each gear.
- Be careful not to allow dirt to get in.

Grease:
DENSO HL50

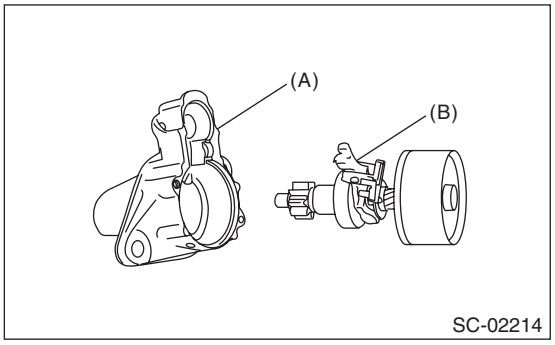

SC-02215

(7) Install the starter plate.

2) Assemble the overrunning clutch and shift lever (B) to the starter housing (A) as a unit.

NOTE:
Apply grease to the contact portion of the shift lever.

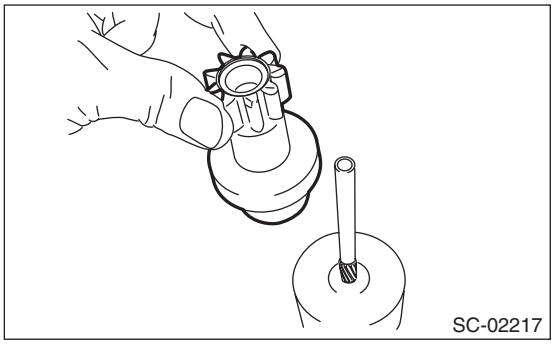
Grease:
DENSO HL50



3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

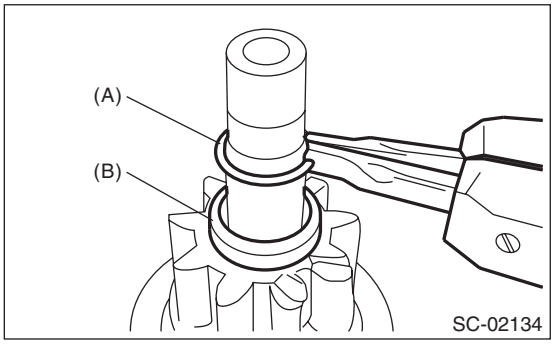
Grease:
DENSO HL50

(2) Install the overrunning clutch to shaft.

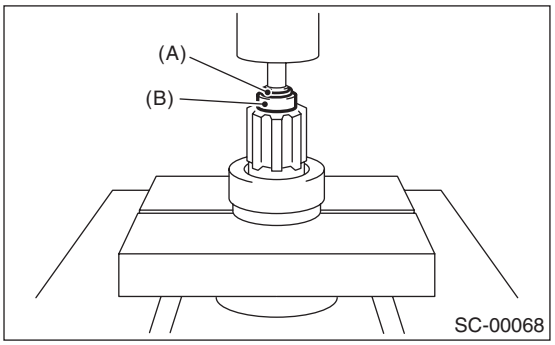


(3) Pass stopper (B) through the shaft, and attach snap ring (A).

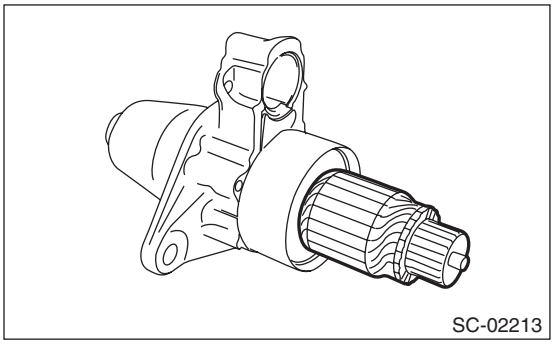
NOTE:
Use new snap rings.



(4) Using a press, pressure fit stopper (B) into snap ring (A).

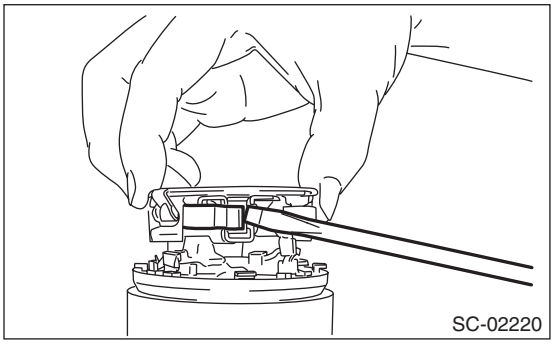


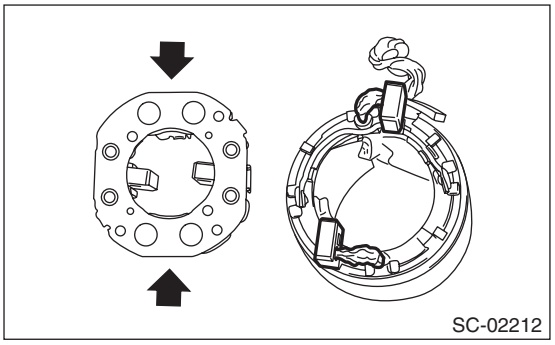
4) Install the armature to the internal gear assembly.



5) Attach the two brushes wired to the yoke assembly to the brush holder assembly.

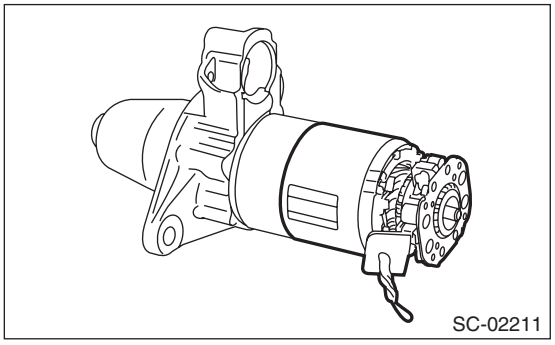
NOTE:
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and insert the brush while being careful not to damage the brush.





6) Install the yoke assembly and brush holder assembly as a single unit to the armature.

NOTE:
Spread the brush with your fingers, being careful not to damage the brush.

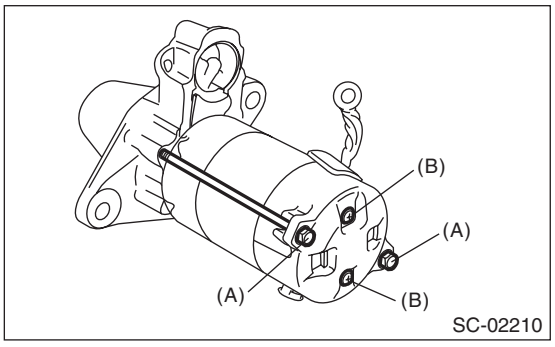

SC-02211

7) Install starter cover assembly to the brush holder assembly with screws (B).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

8) Tighten the through bolts (A) on both sides.

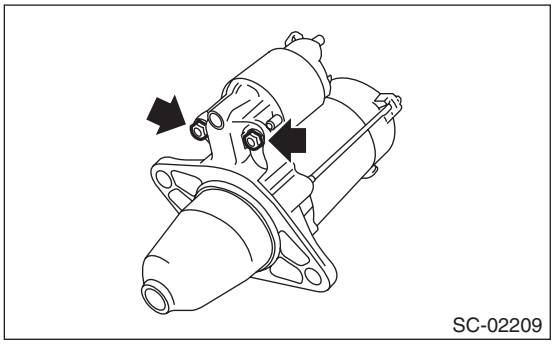
Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



SC-02210

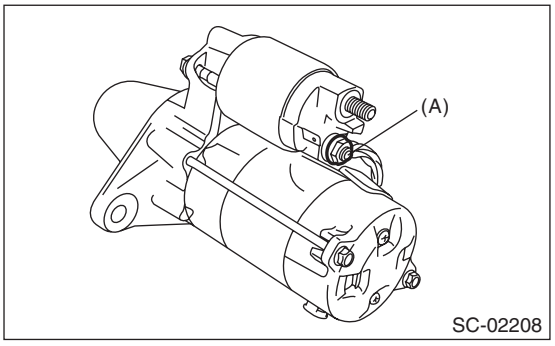
9) Attach the magnet switch assembly to the starter housing assembly.

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


SC-02209

10) Connect terminal M (A) to magnet switch assembly.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



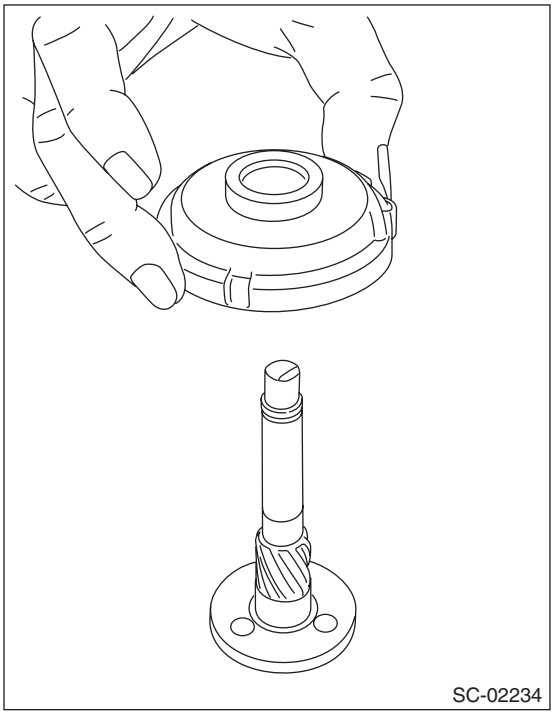
SC-02208

2. EXCEPT FOR STI MODEL

1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

Grease:
Multemp #6129 or equivalent

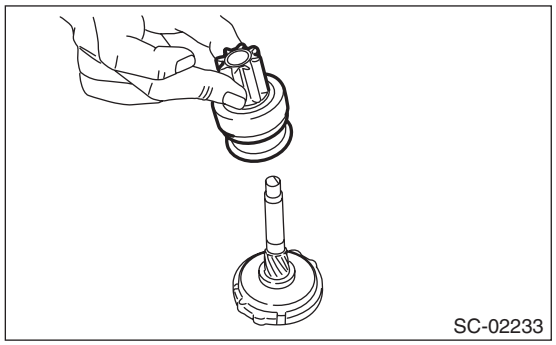
2) Assemble the shaft to the internal gear assembly.


SC-02234

3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

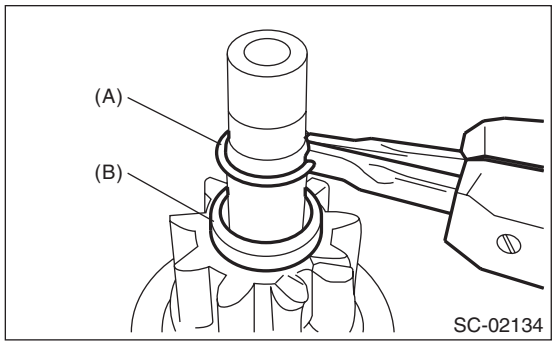
Grease:
Multemp #6129 or equivalent

(2) Install the overrunning clutch to shaft.


SC-02233

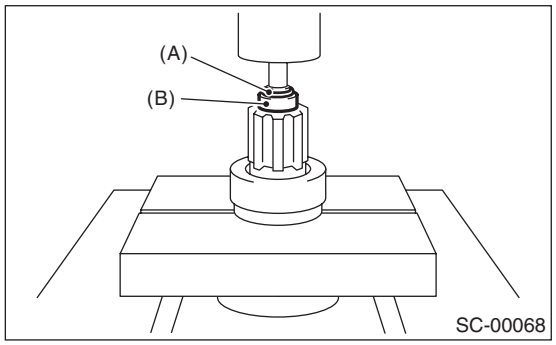
(3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).

NOTE:
Use new stoppers and snap rings.



SC-02134

(4) Using a press, pressure fit stopper (B) into snap ring (A).

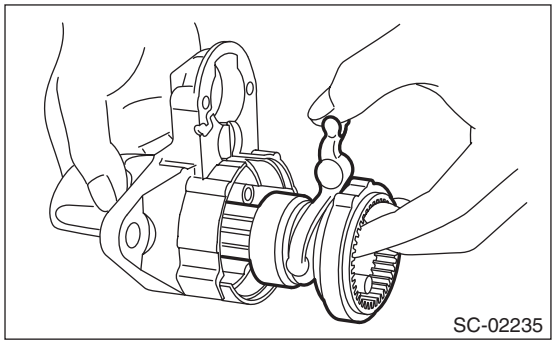


SC-00068

4) Assemble the overrunning clutch, internal gear assembly, shaft and shift lever as a single unit into the starter housing assembly.

NOTE:
Apply grease to the moving parts of the shift lever.

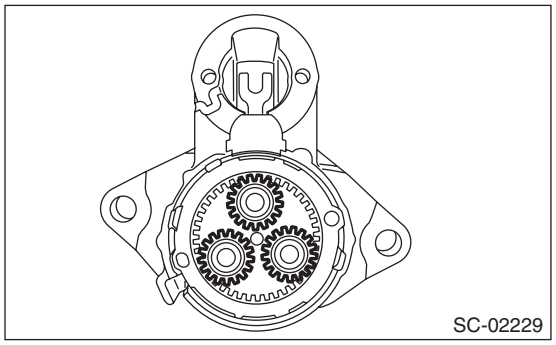
Grease:
Multemp #6129 or equivalent


SC-02235

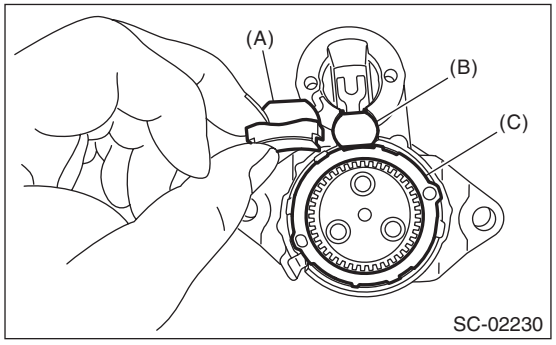
5) Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

NOTE:
- Apply grease evenly to the contact surfaces of each gear.
- Be careful that no debris becomes attached.

Grease:
Molykote® AG650 or equivalent

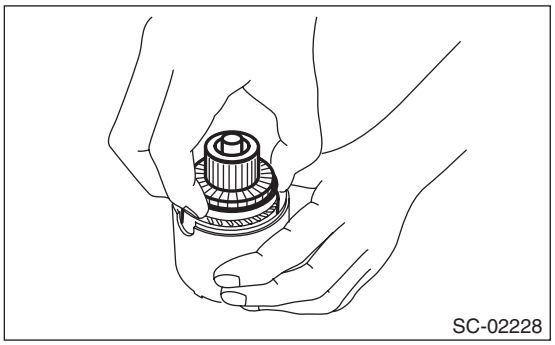

SC-02229

6) Install seal rubber (A), plate (B), and seal rubber (C).



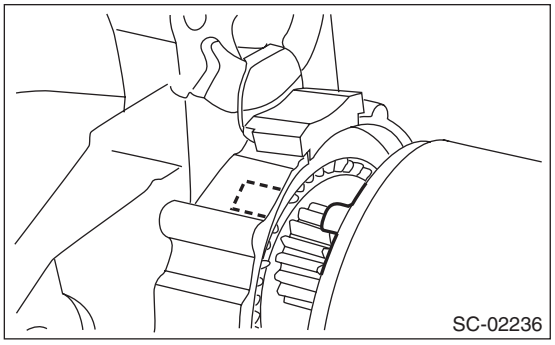
SC-02230

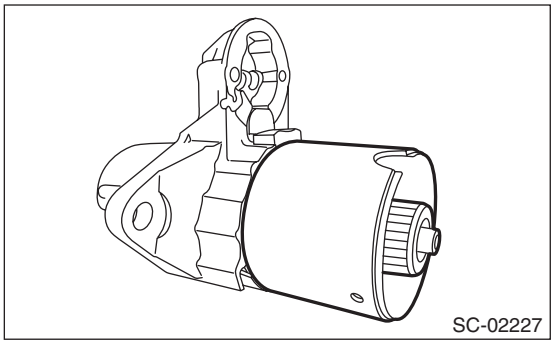
7) Assemble the armature assembly to the yoke assembly.


SC-02228

8) Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

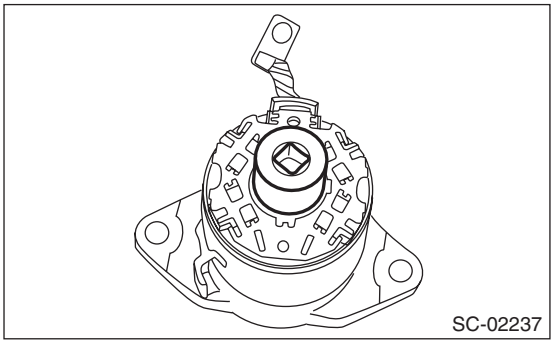
NOTE:
As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.


SC-02236


SC-02227

9) Use an appropriate tool (such as correctly sized socket wrenches) and attach the brush holder assembly to the armature assembly.

NOTE:
Be careful not to damage the brushes.

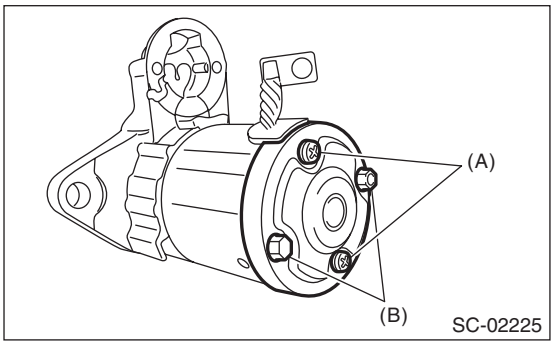

SC-02237

10) Secure starter cover assembly to the brush holder assembly with screws (A).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

11) Install through bolts (B) on both sides.

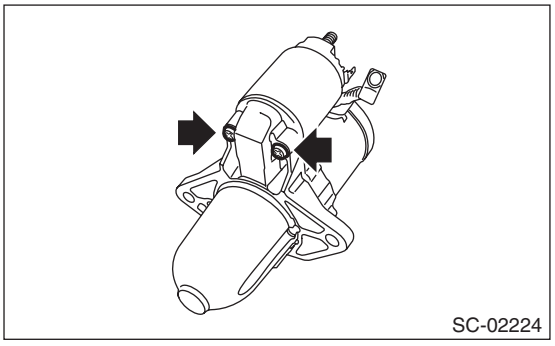
Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



SC-02225

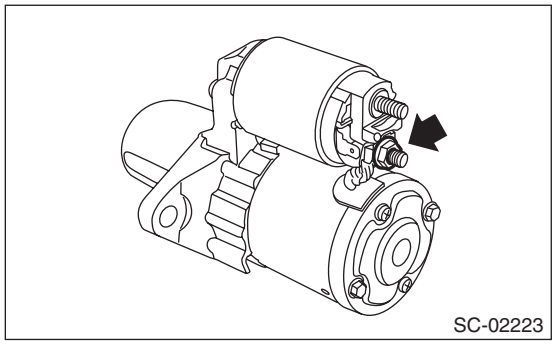
12) Attach the magnet switch assembly to the starter housing assembly.

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


SC-02224

13) Attach the cable to the terminal M of the magnet switch assembly, and secure with nuts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

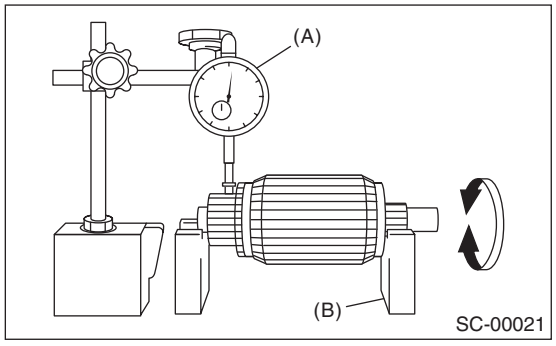


E: INSPECTION

1. ARMATURE

1) Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
2) Check for runout on the commutator. If excessive, replace the armature.

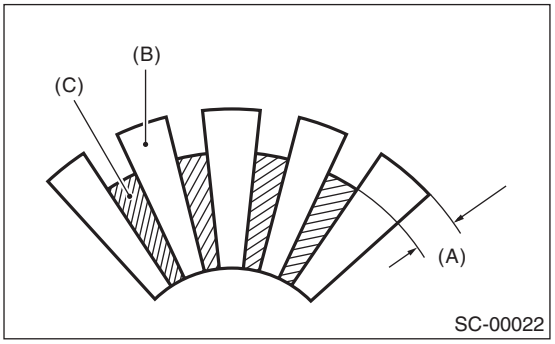
Commutator runout:
Standard
0.05 mm (0.0020 in)
Limit
0.10 mm (0.0039 in)



(A) Dial gauge
(B) V-block

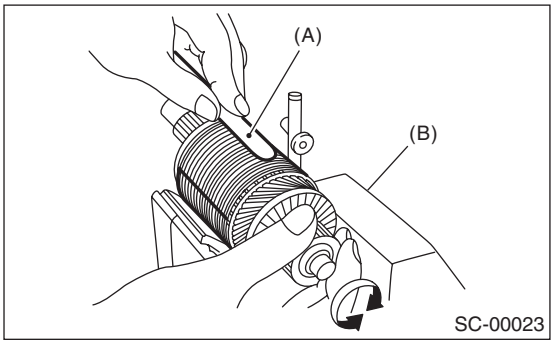
3) Check the depth of the segment mold. If it is not within the standard, replace the armature.

Depth of segment mold:
Standard
0.5 mm (0.020 in)



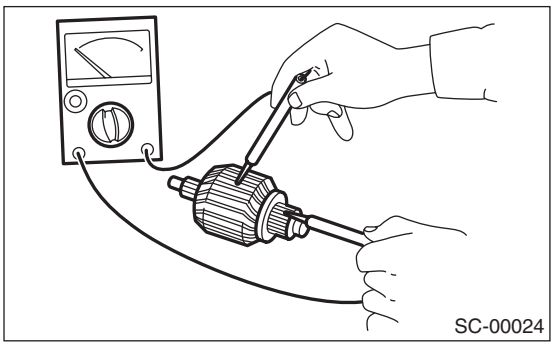
(A) Depth of mold
(B) Segment
(C) Mold

4) Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace the armature.



(A) Steel sheet
(B) Growler tester

5) Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is continuity, replace the armature.



2. YOKE

Make sure that the pole is set at the predetermined position.

3. OVERRUNNING CLUTCH

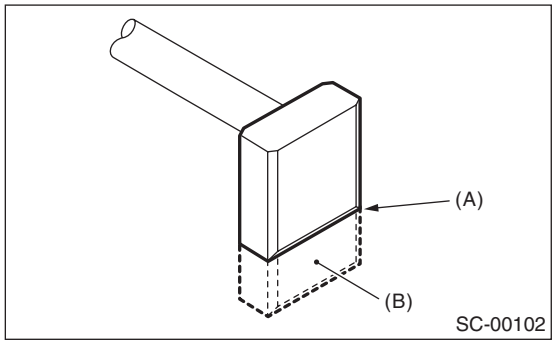
Check that there is no wear or damage to the piston teeth. Replace the overrunning clutch if it is damaged.
Check that it rotates smoothly when rotated in the correct direction (counterclockwise) and does not return to the other direction. Replace the overrunning clutch if any fault is found.

CAUTION:
To prevent spilling of grease, do not clean the overrunning clutch with oil.

4. BRUSH AND BRUSH HOLDER

1) Measure the length of the brush. Replace if it exceeds service limits or there is abnormal wear or cracks.

Brush length:
Standard
12.3 mm (0.484 in)
Limit
7.0 mm (0.276 in)



(A) Service limit line
(B) Brush

2) Check that the brush moves smoothly in the brush holder.
3) Measure the brush spring force with a spring scale. Replace the brush holder if below the service limit.

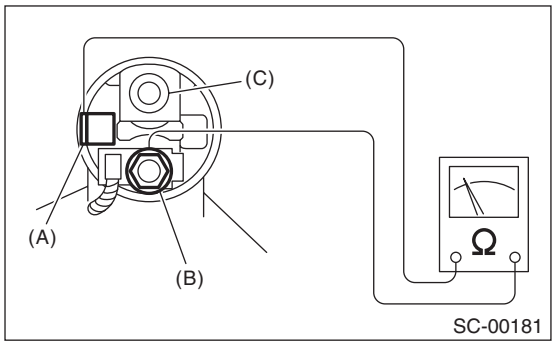
Brush spring force:
Standard
15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (When new)
Limit
2.5 N (0.25 kgf, 0.56 lbf)

5. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground.
Also check to be sure there is no continuity between M terminal and B.

Resistance between switch assembly terminals:

Terminals	Standard
S — M	1 Ω or less
S — Ground	1 Ω or less
M — B	1 MΩ or more

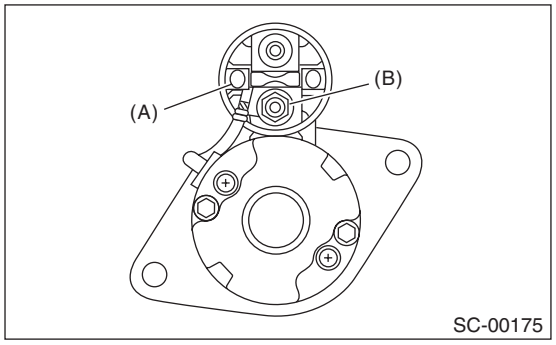


(A) S terminal
(B) M terminal
(C) B terminal

6. SWITCH ASSEMBLY OPERATION

1) Using a lead wire, connect the terminal S of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

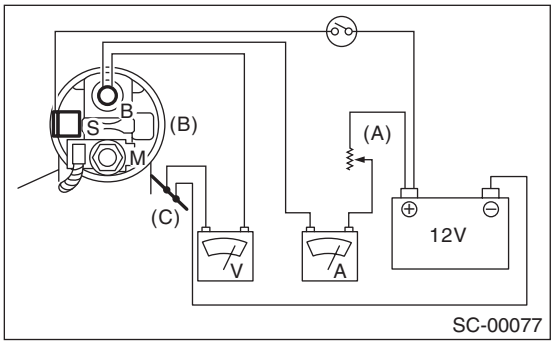
NOTE:
With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.
2) Disconnect the connector from terminal M. Then using a lead wire, connect the positive terminal of battery and terminal M, and ground terminal to starter body.
In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) Terminal S
(B) Terminal M

7. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.



(A) Variable resistance
(B) Magnet switch
(C) Starter body

1) Adjust the variable resistance with the switch on until the voltage is 11 V, and read the value displayed by the ammeter to measure starter speed. Compare these values with the standard.

No-load test (standard):

Voltage/Current
6MT
Max. 11 V/90 A or less
5MT
Max. 11 V/95 A or less

Rotating speed
6MT
2,860 rpm or more
5MT
2,500 rpm or more

2) Apply the specified braking torque to starter. The condition is normal if the current draw and starter speed are within standard.

Load test (standard):

Voltage/Load
6MT
8 V/9.3 N·m (0.9 kgf-m, 6.9 ft-lb) or more
5MT
7.5 V/8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more

Current/Speed
6MT
280 A/860 rpm or more
5MT
300 A/870 rpm or more

3) With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

Lock test (standard):

Voltage/Current
6MT
4 V/515 A or less
5MT
4 V/680 A or less

Torque
6MT
16 N·m (1.6 kgf-m, 11.8 ft-lb) or more
5MT
17 N·m (1.7 kgf-m, 12.5 ft-lb) or more

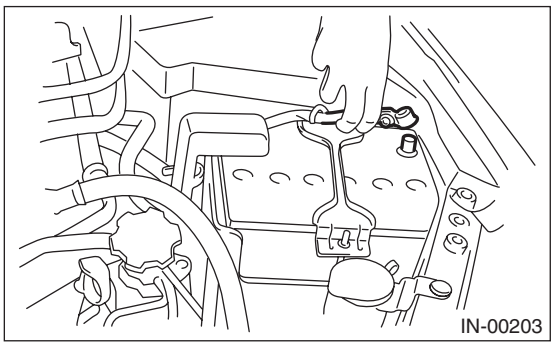
8. OTHER INSPECTIONS

Check that the starter does not have deformation, cracks and any other damage.

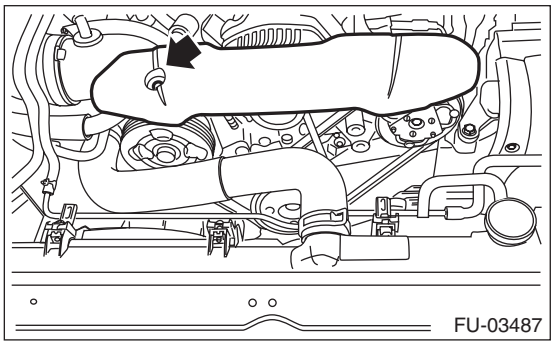
3. Generator

A: REMOVAL

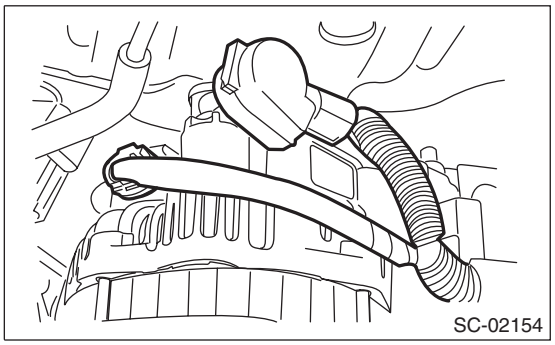
1) Disconnect the ground cable from battery.



2) Remove the V-belt covers.

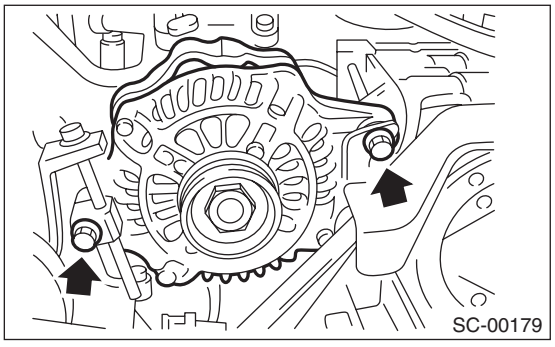


3) Disconnect the connector and terminal from generator.



4) Remove the front side belts. <Ref. to ME(STI)-40, FRONT SIDE BELT, REMOVAL, V-belt.> <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, REMOVAL, V-belt.>

5) Remove the bolts which install the generator onto bracket.

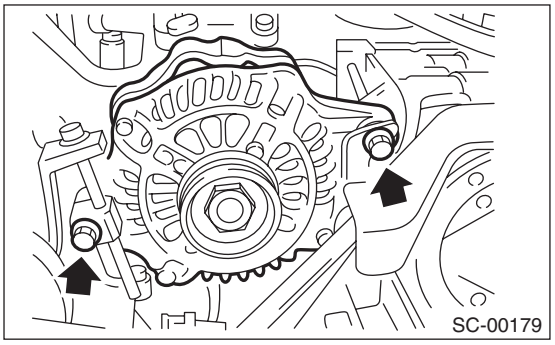


B: INSTALLATION

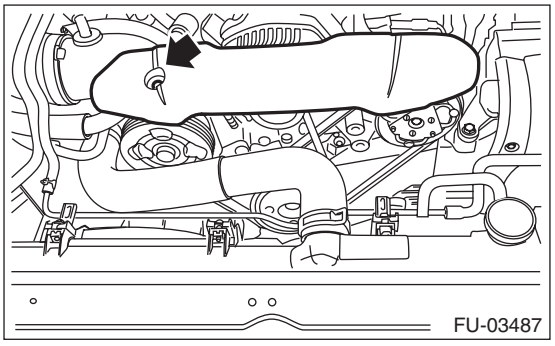
Install in the reverse order of removal.

CAUTION:
Check and adjust the front side belt tension. <Ref. to ME(STI)-46, FRONT SIDE BELT, INSPECTION, V-belt.> <Ref. to ME(w/o STI)-44, FRONT SIDE BELT, INSPECTION, V-belt.>

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

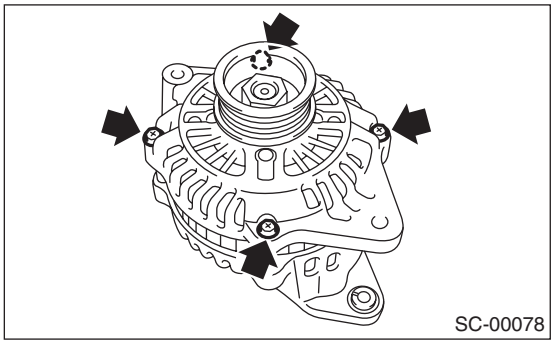


Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

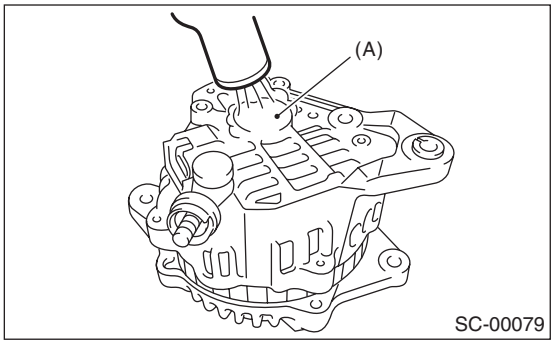


C: DISASSEMBLY

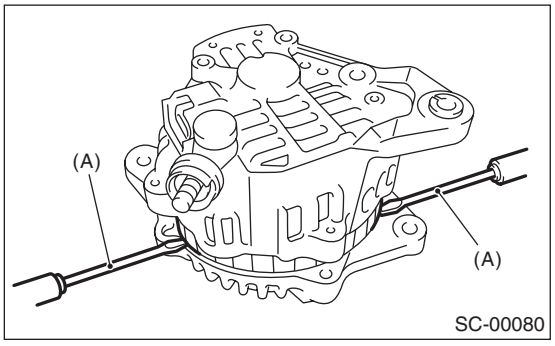
1) Remove the four through-bolts.



2) Use a drier to heat the rear cover (A) portion to 50°C (122°F).



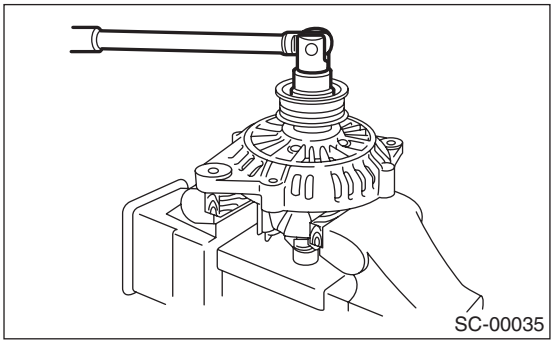
3) Insert the end of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

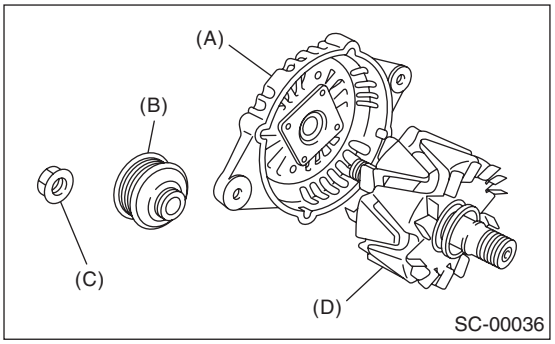


(A) Screwdriver

4) Using a vise, support the rotor and remove the pulley nut, and remove the rotor from the front cover.

CAUTION:
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.

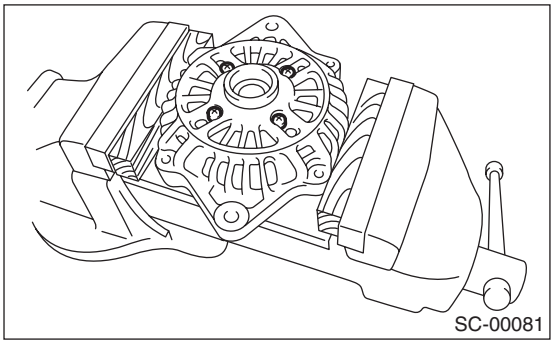




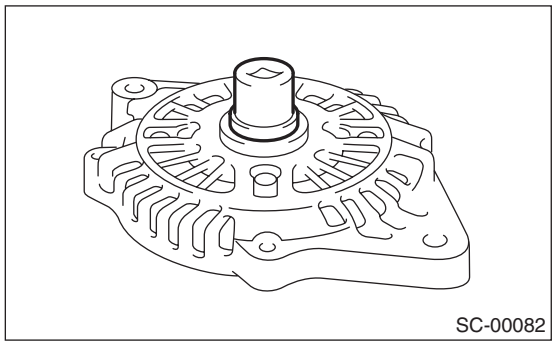
(A) Front cover
(B) Pulley
(C) Pulley nut
(D) Rotor

5) Use the following procedures to remove the ball bearings.

(1) Remove the bolt, and then detach the bearing retainer.

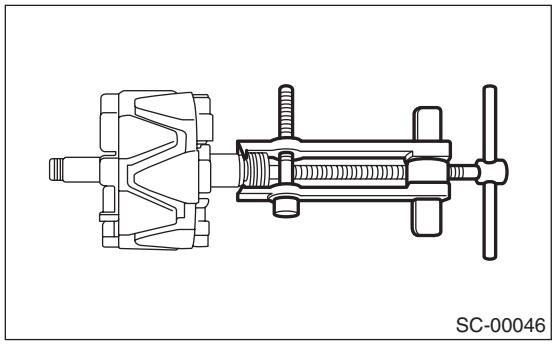


(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.


SC-00082

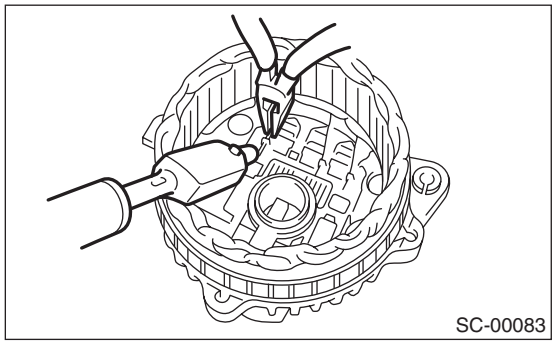
(3) Use the press to push the ball bearings out from the front cover.

6) Using the bearing puller, remove the bearings from the rotor.


SC-00046

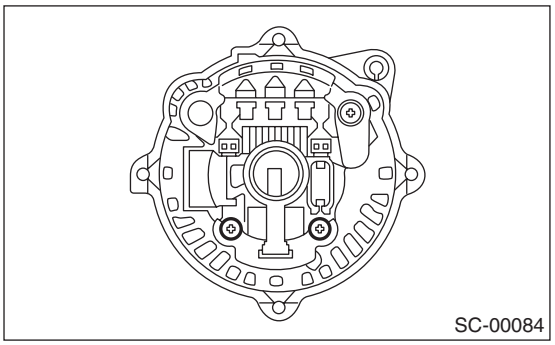
7) Disconnect the connection between the rectifier and stator coil, then remove the stator coil.

CAUTION:
The rectifier is easily damaged by heat. Do not allow a 180 — 270 W soldering iron to contact the terminals for 5 seconds or more at a time.

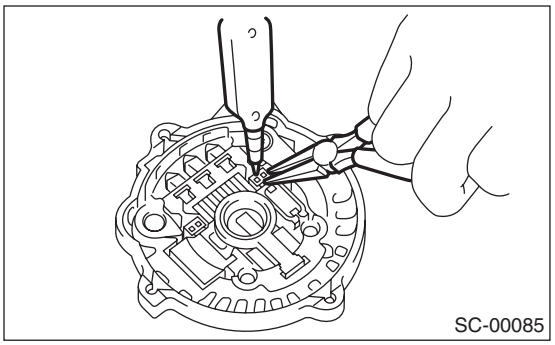

SC-00083

8) Use the following procedures to remove the IC regulator.

(1) Remove the screws which secure the IC regulator to the rear cover.

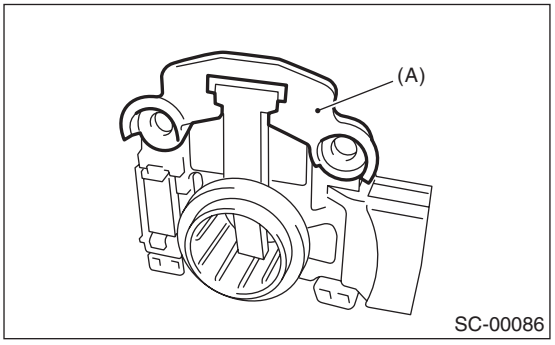

SC-00084

(2) Disconnect the connection between the IC regulator and rectifier, then remove the IC regulator.


SC-00085

9) Use the following procedures to remove the brush.

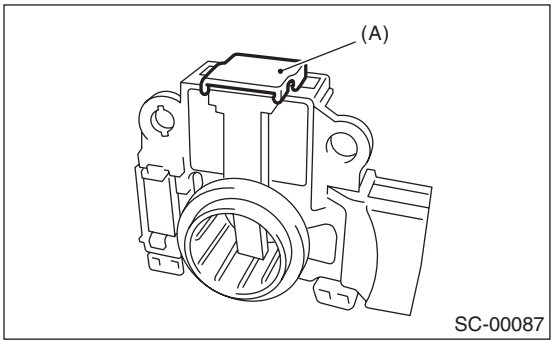
(1) Remove the cover A.



SC-00086

(A) Cover A

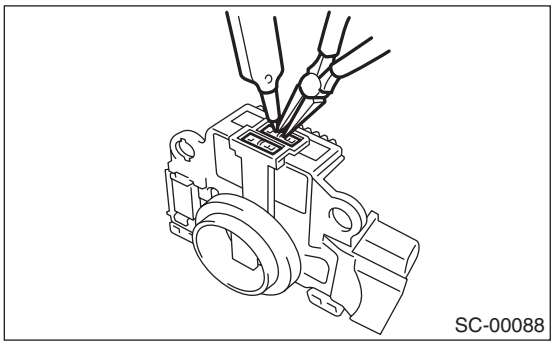
(2) Remove the cover B.



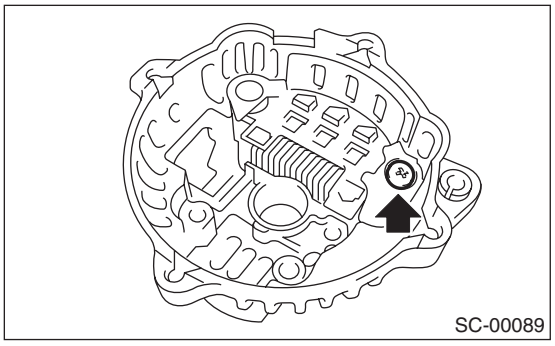
SC-00087

(A) Cover B

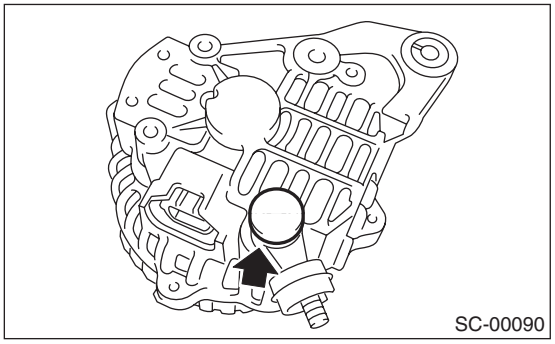
(3) Disconnect the connection and remove the brush.


SC-00088

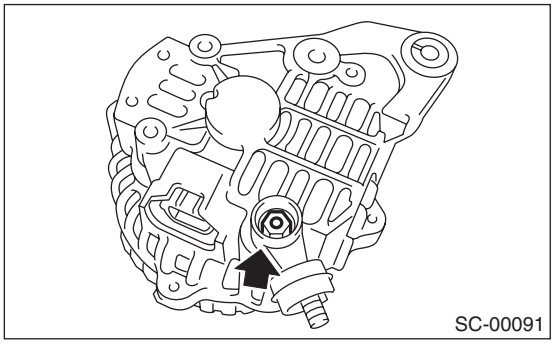
10) Remove the rectifier as follows.
(1) Remove the bolts which secure the rectifier.


SC-00089

(2) Remove the cover on terminal B.


SC-00090

(3) Remove the nuts of terminal B, then remove the rectifier.


SC-00091

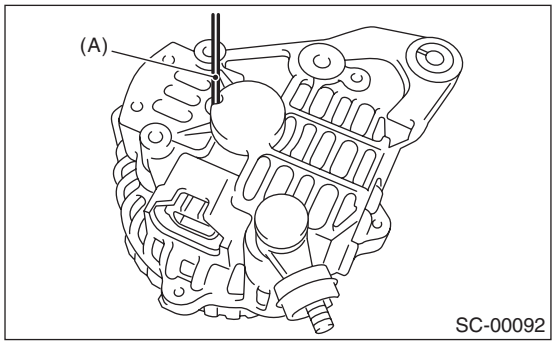
D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:
• Refer to component for tightening torque of each part. <Ref. to SC(STI)-5, GENERATOR, COMPONENT, General Description.>
• After assembling, manually turn the pulley to check that the rotor rotates smoothly.

1) Push of the brush
Before assembling the front and rear parts, press the brush down into the brush holder, then fix the brush in that position by inserting a wire [1 mm (0.08 in) dia., 40 — 50 mm (1.6 — 2.0 in) long] through the hole as shown in the figure.

CAUTION:
After assembling, remove the wire.



SC-00092

(A) Wire

2) Install the ball bearings
(1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
(2) Using a press to press the ball bearings into the specified location.
(3) Install the bearing retainer.

3) Install the bearings.

CAUTION:
Do not apply grease to the bearings. If there is any oil on the bearing box, remove it completely.

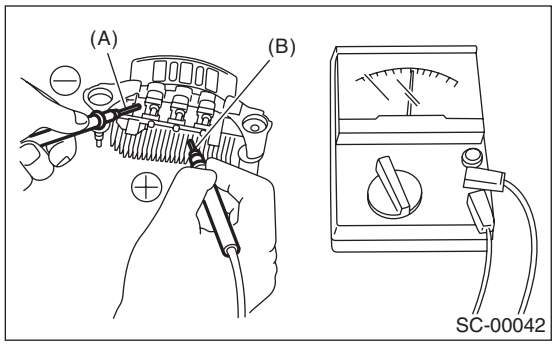
(1) Use a press to install the bearings to the rotor shaft.
(2) Heat the bearing box in rear cover at 50 to 60°C (122 to 140°F), and then press the bearing into rear cover.

E: INSPECTION

1. DIODE

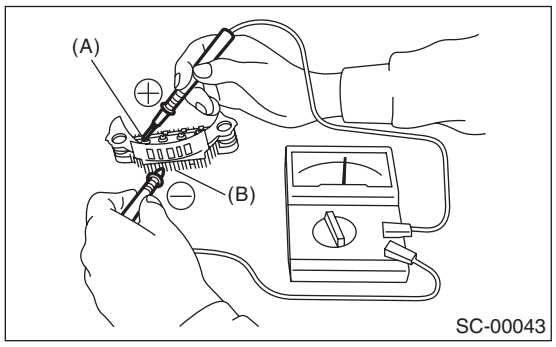
CAUTION:
There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.

1) Check for continuity between the diode lead and positive side heat sink. If resistance is 1 Ω or more only in the direction from the diode lead to the heat sink, replace the rectifier.



(A) Diode lead
(B) Heat sink (positive side)

2) Check for continuity between the negative side heat sink and diode lead. If resistance is 1 Ω or more only in the direction from the heat sink to the diode lead, replace the rectifier.



(A) Diode lead
(B) Heat sink (negative side)

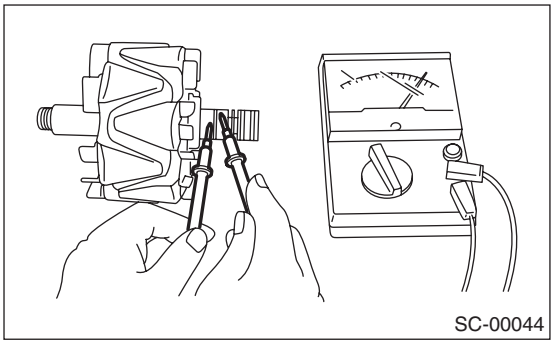
2. ROTOR

1) Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.
2) Measure the slip ring outer diameter. Replace the rotor if the slip ring is worn.

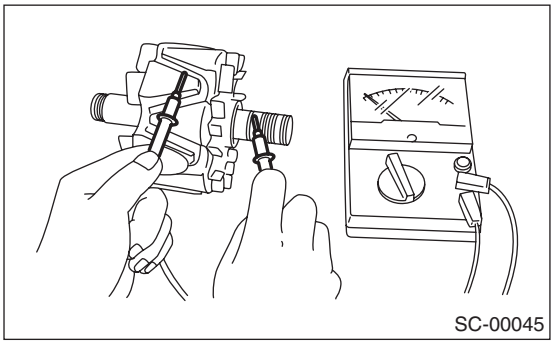
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Using a circuit tester, check the resistance between slip rings. If resistance exceeds the standard, replace the rotor.

Standard:
Approx. 1.8 — 2.2 Ω



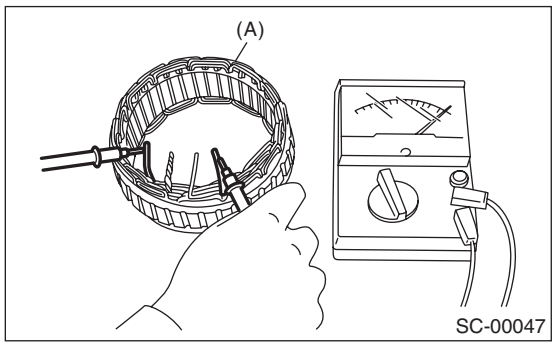
4) Check the continuity between slip ring and rotor core or shaft. If there is continuity, replace the rotor because the rotor coil is grounded.



5) Check the bearings. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

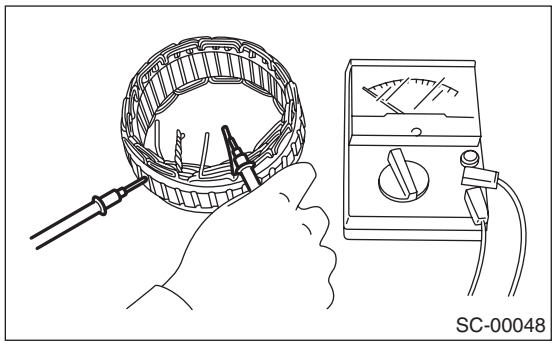
3. STATOR COIL

1) Inspect continuity between the stator coil lead wire terminals. If the resistance is 1 MΩ or more, replace the stator coil.



(A) Stator coil

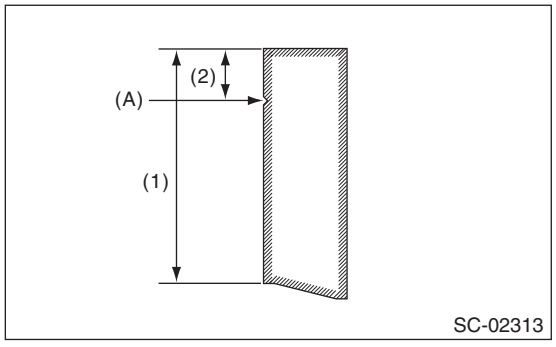
2) Inspect the continuity between the stator coil stator core and lead wire terminals. If the resistance is 1 Ω or less, replace the stator coil.



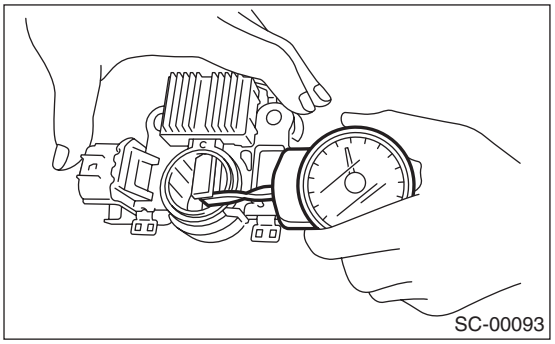
4. BRUSH

1) Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

Brush length:
Standard (1)
18.5 mm (0.728 in)
Limit (2)
5.0 mm (0.197 in)



2) Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is 2.648 N (270 g, 9.52 oz) or less, replace the brush spring with a new part. 4.609 — 5.786 N (470 — 590 g, 16.58 — 20.810 oz) pressure is required on the new spring.



5. BALL BEARING

Check the ball bearings. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

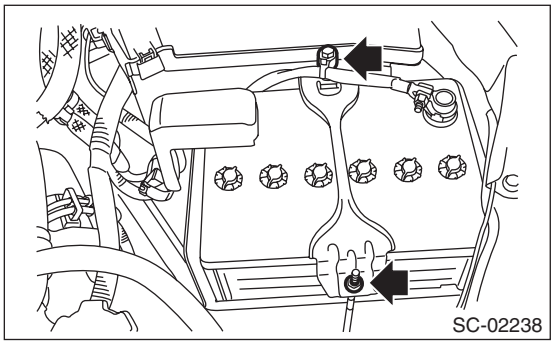
6. OTHER INSPECTIONS

Check that the generator does not have deformation, cracks and any other damage.

4. Battery

A: REMOVAL

1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
2) Remove the harness clip of the negative terminal from the battery rod.
3) Remove the flange nut from battery rod and remove battery holder.



4) Remove the battery.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
3.5 N·m (0.4 kgf-m, 2.6 ft-lb)

NOTE:
• Clean the battery cable terminals and apply grease to retard the formation of corrosion.
• Connect the positive (+) terminal, and then connect the negative (–) terminal of the battery.
• After the battery is installed, initial diagnosis of the electronic throttle control is performed. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

C: INSPECTION

WARNING:
• Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.
• Make sure the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.
• In addition, be careful not to let the electrode contact with the coated parts.
• Be careful when handling the batteries because they produce explosive gases.
• Be sure to keep battery away from any fire.
• For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.
• Ventilate sufficiently when using or charging battery in enclosed space.
• Before starting work, remove rings, metal watch-bands, and other metal jewelry.
• Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle.

1. EXTERNAL PARTS

Check the battery case, top cover, vent plugs, and terminal posts for dirt or cracks. If necessary, clean with water and wipe with a dry cloth.
Apply a thin coat of grease on the terminal posts to prevent corrosion.

2. ELECTROLYTE LEVEL

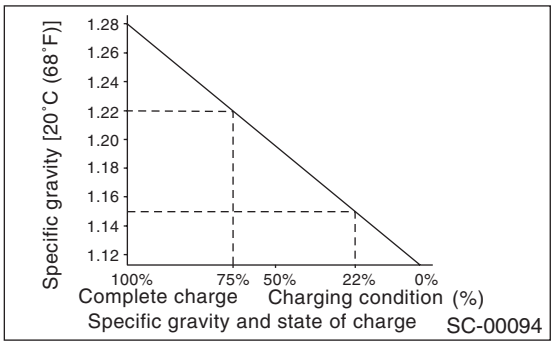
Check the electrolyte level in each cell. If the level is below MIN level, bring the level to MAX level by pouring distilled water into the battery cell. Do not fill beyond MAX level.

3. SPECIFIC GRAVITY OF ELECTROLYTE

1) Measure specific gravity of electrolyte using a hydrometer and a thermometer.
Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following calculation:

S_{20} = St + 0.0007 × (t – 20)
S_{20}: Specific gravity corrected at electrolyte temperature of 20°C (68°F)
St: Measured specific gravity
t: Measured temperature (°C)
Judge whether or not the battery requires charging according to corrected specific gravity.
Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]

2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



D: MEASUREMENT

WARNING:
Do not bring an open flame close to the battery when working.

CAUTION:
• Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.
• Be careful since battery electrolyte overflows while charging the battery.
• Observe instructions when handling the battery charger.
• Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.

1. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte should be held within the specific range of 1.250 — 1.290 for one hour or more.
2) Voltage per battery cell should be held at a specific value in a range of 2.5 — 2.8 V for one hour or more.

2. CHECK CONDITION OF CHARGE WITH HYDROMETER

Hydrometer indicator	State of charge	Corrective action
Green dot	65% or more	Load test
Dark dot	65% or less	Charge battery
Clear dot	Low electrolyte	Replace the battery.* (If cranking is difficult)
* Check electrical system before replacement.		

3. NORMAL CHARGING

Charge the battery at the current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING

CAUTION:
• Observe the items in "3. NORMAL CHARGING".
• Never use 10 A or more when charging the battery because it will shorten the battery life.

Quick charging is a method that the battery is charged in a short period of time with a relatively large current by using a quick charger.
Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, quick charging must be carried out within a current range that will not raise the electrolyte temperature to 40°C (104°F) or more.
Also the quick charging is a temporary mean to bring battery voltage up to some level, and battery should be charged slowly with low current as a rule.

ENGINE 2 SECTION

FUEL INJECTION (FUEL SYSTEMS)	FU(w/o STI)
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)	EC(w/o STI)
INTAKE (INDUCTION)	IN(w/o STI)
MECHANICAL	ME(w/o STI)
EXHAUST	EX(w/o STI)
COOLING	CO(w/o STI)
LUBRICATION	LU(w/o STI)
SPEED CONTROL SYSTEMS	SP(w/o STI)
IGNITION	IG(w/o STI)
STARTING/CHARGING SYSTEMS	SC(w/o STI)

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD.

G1180BE3

FUEL INJECTION (FUEL SYSTEMS)

FU(w/o STI)

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