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COOLING

General Description

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1. General Description

A: SPECIFICATION

Cooling system			Electric fan + Forced engine coolant circulation system	
Total engine coolant capacity			Approx. 7.7 (8.1, 6.8)	
Water pump	Type		Centrifugal impeller type	
	Discharge performance I	Discharge rate	\varnothing (US gal, Imp gal) /min	20 (5.3, 4.4)
		Pump speed — Discharge pressure		760 rpm — 2.9 kPa (0.3 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance II	Discharge rate	\varnothing (US gal, Imp gal) /min	100 (26.4, 22.0)
		Pump speed — Discharge pressure		3,000 rpm — 49.0 kPa (5.0 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance III	Discharge rate	\varnothing (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 case	Standard	mm (in)	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	kPa (kg/cm ² , psi)	Above: 108±14.7 (1.1±0.15, 16±2.1) Below: -1.0 to -4.9 (-0.01 — -0.05, -0.1 — -0.7)
		Radiator side	kPa (kg/cm ² , psi)	Above only: 137±14.7 (1.40±0.15, 20±2.1)
	Fins			Corrugated fin type
Reservoir tank	Capacity	\varnothing (US qt, Imp qt)	0.45 (0.48, 0.40)	

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	Recommended materials	Item number	Alternative
Coolant	Subaru Super Coolant (Concentrated type)	—	None
	Subaru Super Coolant (Diluted type)	K0670Y0000	
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	None

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

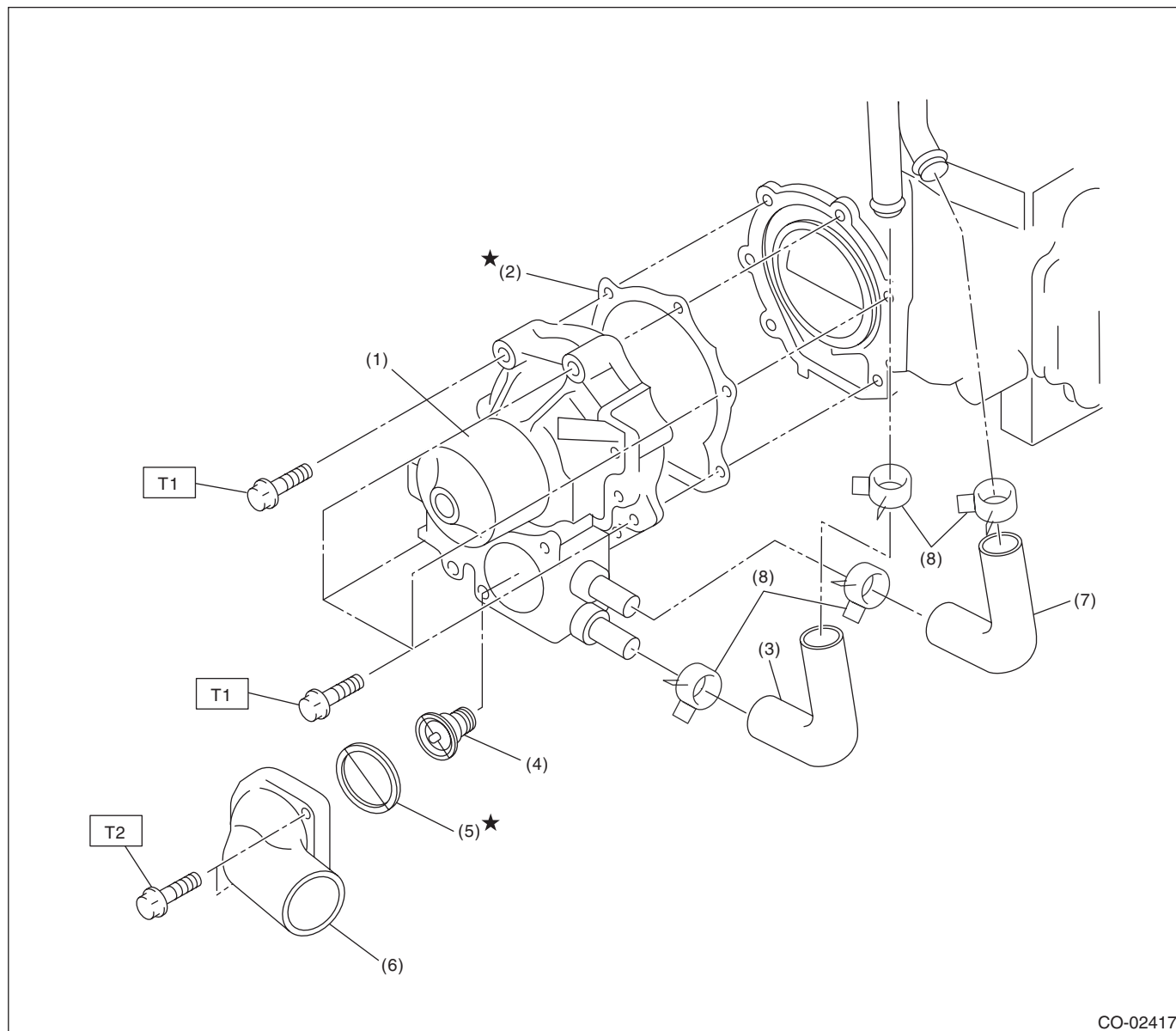
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B: COMPONENT

1. WATER PUMP



CO-02417

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

Tightening torque:N·m (kgf·m, ft·lb)

T1: First 12 (1.2, 8.9)

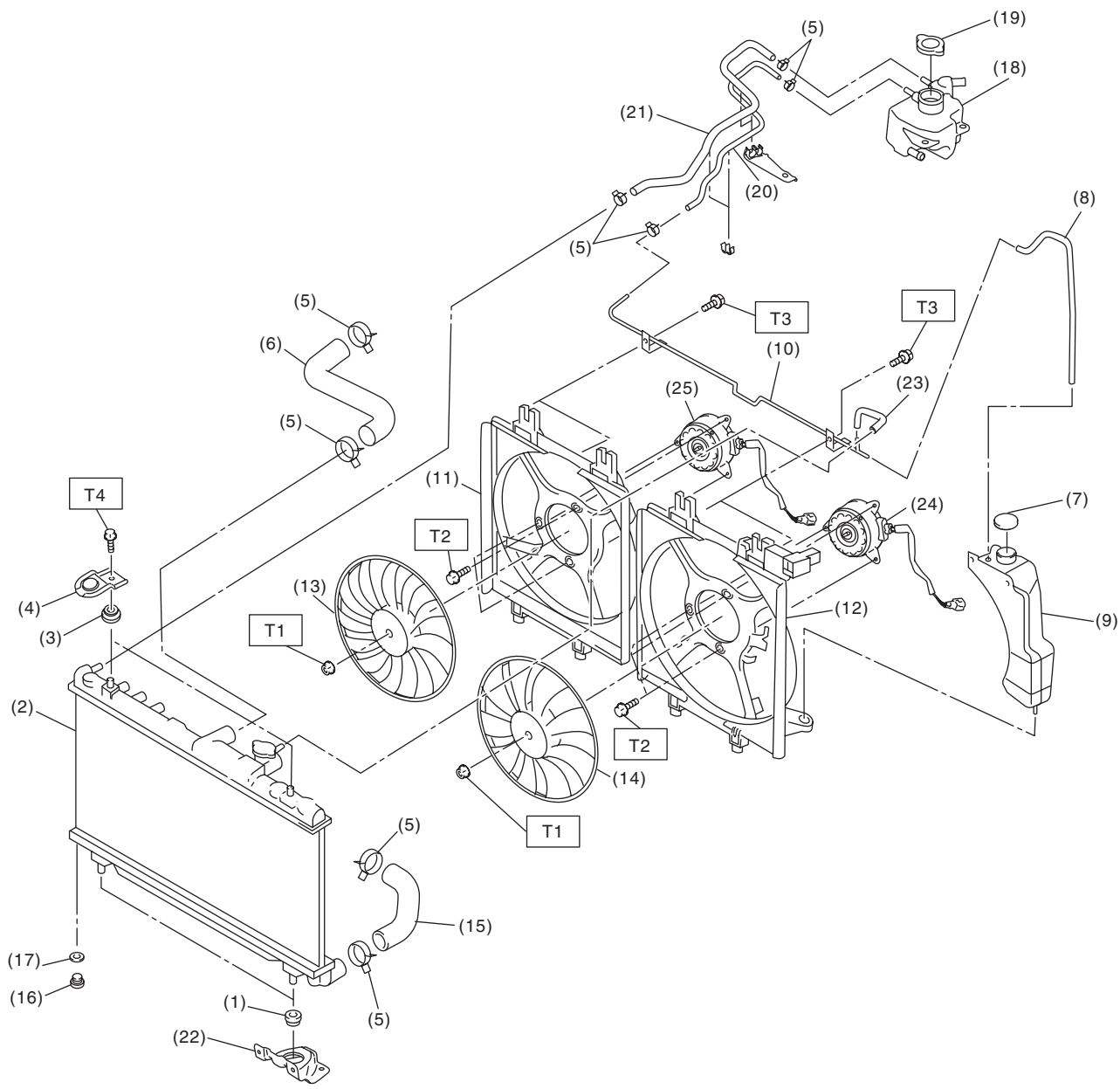
Second 12 (1.2, 8.9)

T2: 12 (1.2, 8.9)

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2. RADIATOR AND RADIATOR FAN



CO-02405

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

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)**

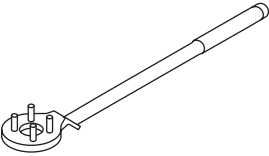
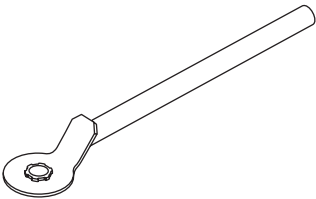
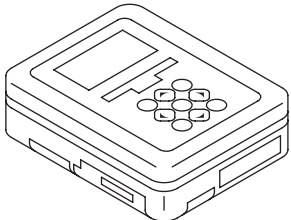
C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing engine coolant.

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D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499977100</p>	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 <p>ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 <p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

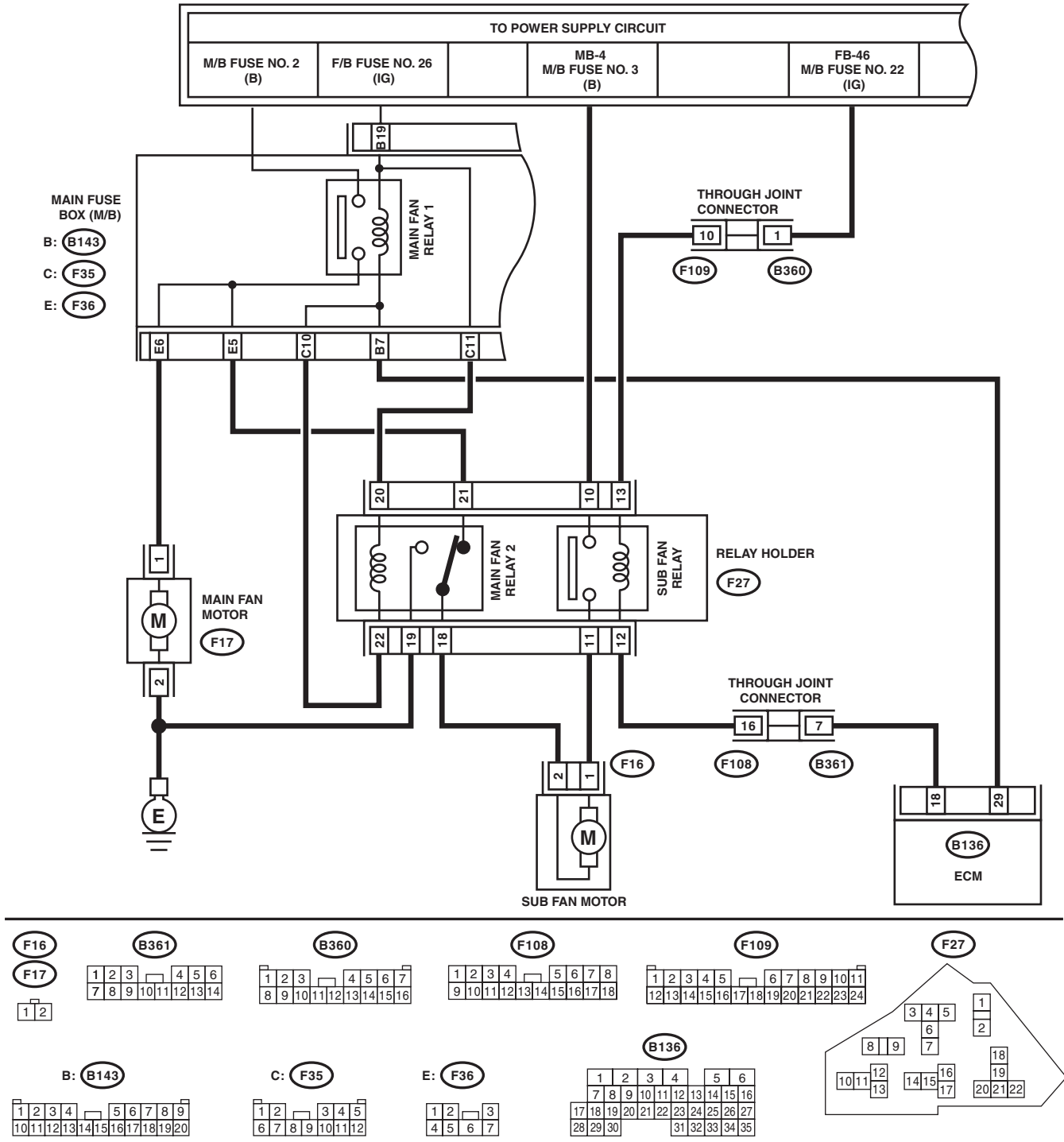
Radiator Fan System

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2. Radiator Fan System

A: WIRING DIAGRAM



CO-02396

Radiator Fan System

B: INSPECTION

DETECTING CONDITION:

- Engine coolant temperature is 90°C (194°F) or more.
- Vehicle speed is 19 km/h (12 MPH) or below.

TROUBLE SYMPTOMS:

Radiator main fan and the sub fan do not rotate under the above conditions.

Step	Check	Yes	No
1 CHECK OPERATION OF RADIATOR FAN. 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and the 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(STI)(diag)-55, Compulsory Valve Operation Check Mode.>	Do the radiator main fan and sub fan rotate at low speed?	Go to step 2.	Go to step 3.
2 CHECK OPERATION OF RADIATOR FAN. 1) Connect the 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 the 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(STI)(diag)-55, Compulsory Valve Operation Check Mode.>	Do the radiator main fan and sub fan 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 the sub fan relay terminal 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 the sub fan relay terminal 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.

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Step	Check	Yes	No
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.
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. <i>Terminals</i> <i>No. 10 — No. 11:</i>	Is the resistance 1 M Ω or more?	Go to step 8.	Replace the sub fan relay.
8 CHECK SUB FAN RELAY. 1) Connect the sub fan relay terminals No. 12 and No. 13 to the battery. 2) Measure the resistance between sub fan relay terminals. <i>Terminals</i> <i>No. 10 — No. 11:</i>	Is the resistance less than 1 Ω ?	Go to step 9.	Replace the sub fan relay.
9 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR. 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector. <i>Connector & terminal</i> <i>(F16) No. 1 — (F27) No. 11:</i>	Is the resistance less than 1 Ω ?	Go to step 10.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
10 CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR. 1) Remove the 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. <i>Connector & terminal</i> <i>(F16) No. 2 — (F27) No. 18:</i>	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 POOR CONTACT. Check for poor contact of sub fan motor connector.	Is there poor contact in 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 of main fan relay 2. <i>Terminals</i> <i>No. 21 — No. 18:</i>	Is the resistance less than 1 Ω ?	Go to step 14.	Replace the main fan relay 2.

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Step	Check	Yes	No
14 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 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 terminal and main fan motor connector. <i>Connector & terminal (F17) No. 1 — (F27) No. 2:</i>	Is the resistance less than 1 Ω ?	Go to step 15.	Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.
15 CHECK MAIN FAN MOTOR AND GROUND CIRCUIT. Measure the resistance between main fan motor connector and chassis ground. <i>Connector & terminal (F17) No. 2 — Chassis ground:</i>	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 POOR CONTACT. Check poor contact of main fan motor connector.	Is there poor contact in 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 AND ECM. 1) Disconnect the connectors from the ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. <i>Connector & terminal (B136) No. 18 — (F27) No. 12:</i>	Is the resistance less than 1 Ω ?	Go to step 19.	Repair the open circuit of harness between sub fan relay terminal and ECM.
19 CHECK POOR CONTACT. Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact of the ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(STI)(diag)-43, 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 of terminal in main fan relay 1 switch.	Is the resistance 1 M Ω 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 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 terminal and main fan motor connector. <i>Connector & terminal (F17) No. 1 — (F36) No. 6:</i>	Is the resistance less than 1 Ω ?	Go to step 23.	Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.

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	Step	Check	Yes	No
23	CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM. 1) Disconnect the connectors from the ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. Connector & terminal (B136) No. 29 — (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 terminal and ECM.
24	CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM. Measure the resistance between main fan relay 2 terminal and ECM connector. Connector & terminal (B136) No. 29 — (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 terminal and ECM.
25	CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 26.
26	CHECK POOR CONTACT. Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact of the 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 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 the main fan relay 2 from the relay holder. 2) Measure the resistance between main fan relay 2 terminal 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 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 terminal 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 of main fan relay 2. Terminals (F27) No. 18 — (F27) No. 19:	Is the resistance 1 M Ω or more?	Go to step 31.	Replace the main fan relay 2.
31	CHECK MAIN FAN RELAY 2. 1) Connect the battery to main fan relay 2 terminals No. 20 and No. 22. 2) Measure the resistance of main fan relay 2. Terminals (F27) No. 18 — (F27) No. 19:	Is the resistance less than 1 Ω ?	Go to step 23.	Replace the main fan relay 2.

3. Engine Coolant

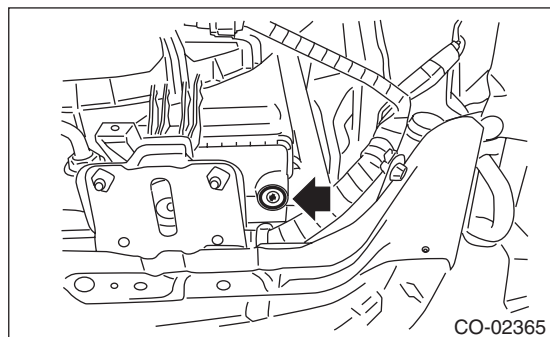
A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Remove the drain plug to drain engine coolant into container.

NOTE:

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



- 5) Install the drain plug.

2. FILLING OF ENGINE COOLANT

- 1) Pour cooling system conditioner through the filler neck.

Cooling system protective agent:

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

Coolant level:

Refer to “SPECIFICATION” for the recommended engine coolant. <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. Always use Subaru Super Coolant since other coolants 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 the 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 2,000 rpm or less until radiator fan starts and stops.

NOTE:

Be careful with the engine coolant temperature gauge 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 heater core, repeat the procedures from step 9) again.

Engine Coolant

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B: 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)

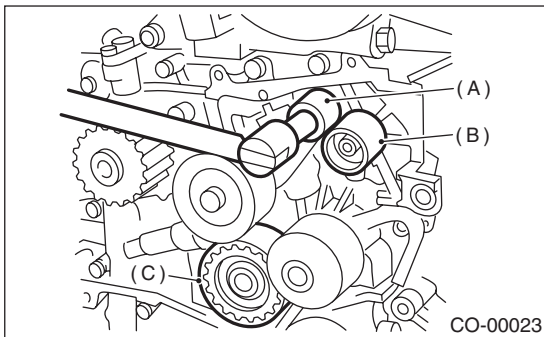
Engine coolant and diluting water:

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

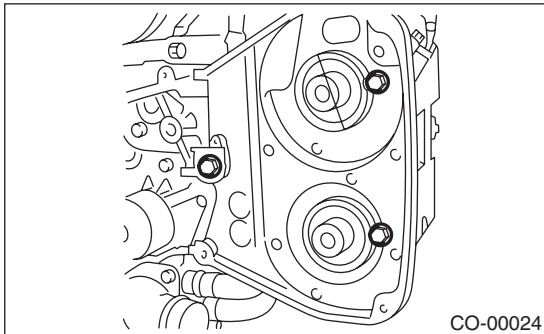
4. Water Pump

A: REMOVAL

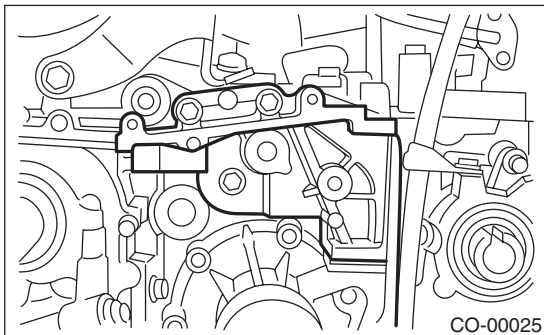
- 1) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.>
- 2) Remove the V-belts. <Ref. to ME(STI)-39, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(STI)-47, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt. <Ref. to ME(STI)-48, 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)-57, REMOVAL, Cam Sprocket.>
- 10) Remove the belt cover No. 2 LH.

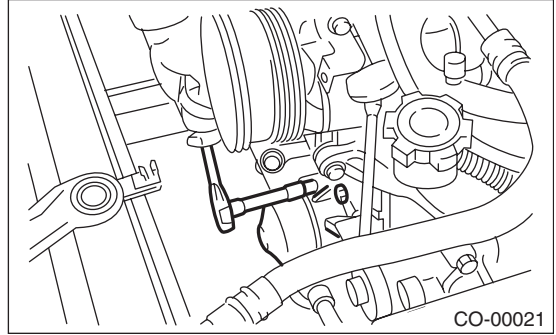


- 11) Remove the tensioner bracket.



- 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.

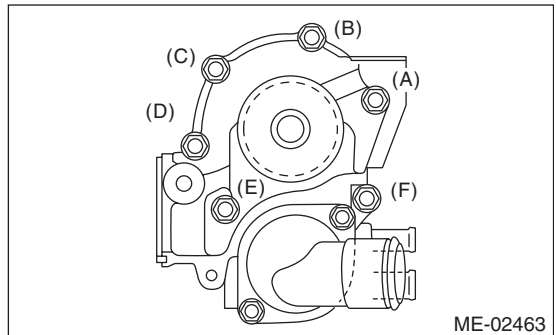
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.9 ft-lb)

Second:

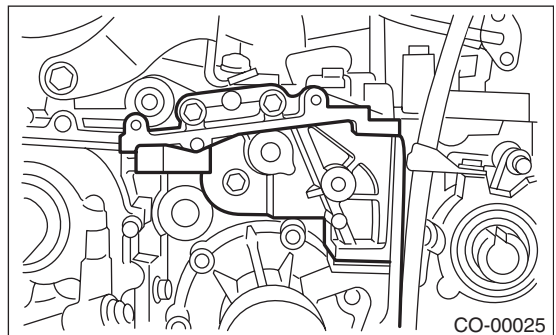
12 N·m (1.2 kgf-m, 8.9 ft-lb)



- 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)

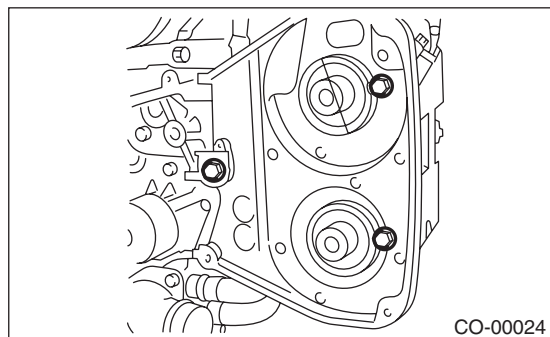


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4) Install the belt cover No. 2 LH.

Tightening torque:

5 N·m (0.5 kgf·m, 3.7 ft·lb)



5) Install the cam sprocket LH. <Ref. to ME(STI)-57, INSTALLATION, Cam Sprocket.>

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

Tightening torque:

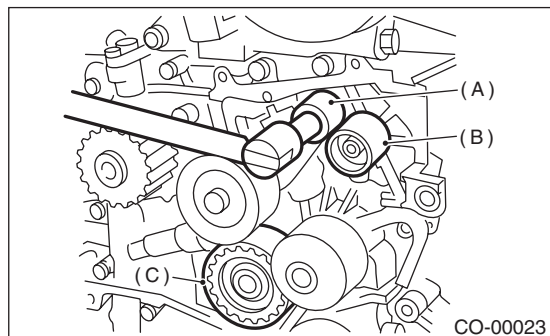
39 N·m (4.0 kgf·m, 28.8 ft·lb)

7) Install the belt idler (B).

Tightening torque:

25 N·m (2.5 kgf·m, 18.4 ft·lb)

8) Install an automatic belt tension adjuster (A) with the tension rod held by a pin. <Ref. to ME(STI)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>



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

10) Install the timing belt cover. <Ref. to ME(STI)-47, INSTALLATION, Timing Belt Cover.>

11) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>

12) Install the V-belts. <Ref. to ME(STI)-39, INSTALLATION, V-belt.>

13) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.>

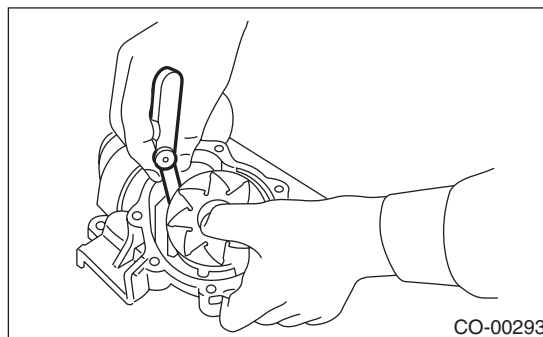
C: INSPECTION

- 1) Check the water pump bearing for smooth rotation.
- 2) Check the water pump pulley for abnormalities.
- 3) Make sure the impeller is not 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)

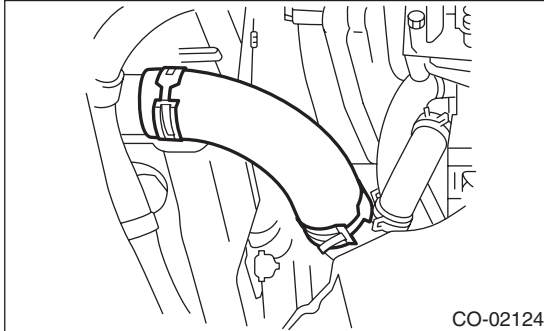


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

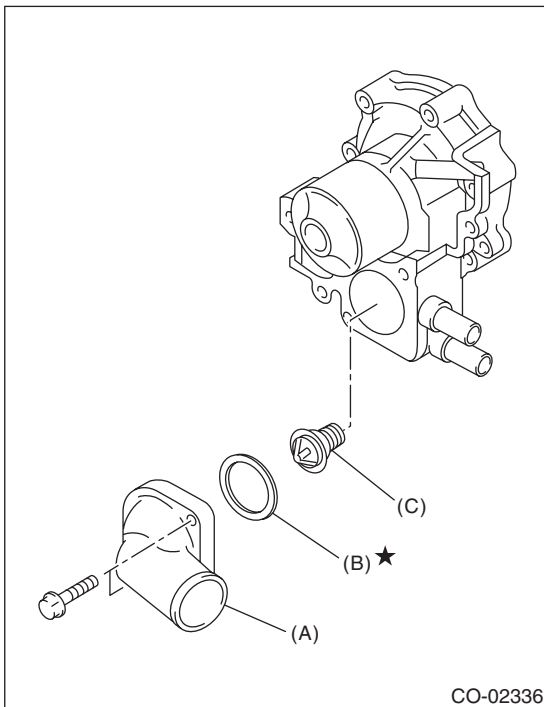
5. Thermostat

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely.
 <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Disconnect the radiator outlet hose from thermostat cover.



- 6) 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.

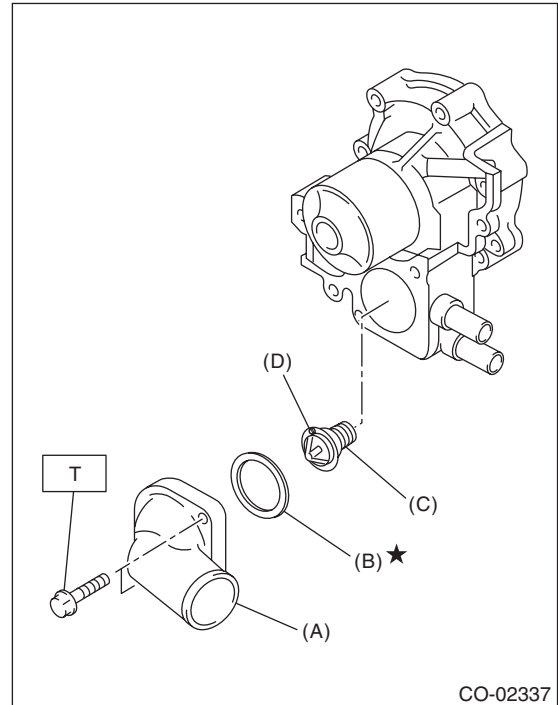
- 2) Install the thermostat and thermostat cover.

NOTE:

The thermostat must be installed 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.

- 5) Lower the vehicle.

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

C: INSPECTION

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

- Inspection method

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

NOTE:

- 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 with container bottom.

Opening start temperature:

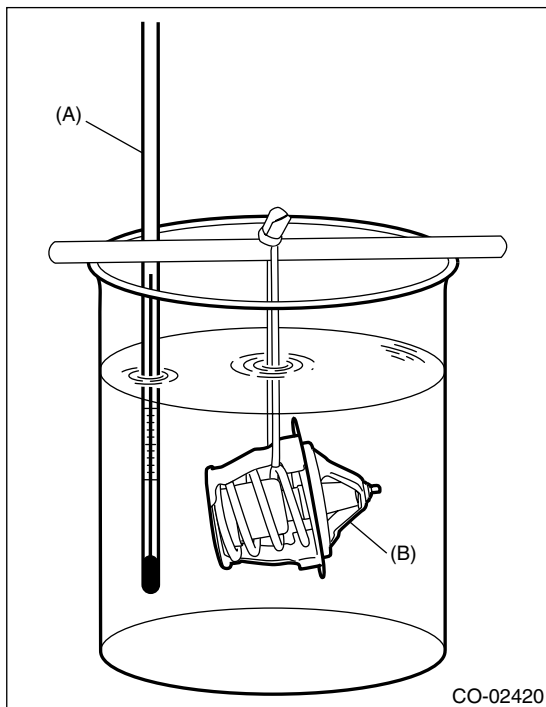
76 — 80°C (169 — 176°F)

Full open temperature:

91°C (196°F)

Valve lift:

9.0 mm (0.354 in) or more



- (A) Thermometer
- (B) Thermostat

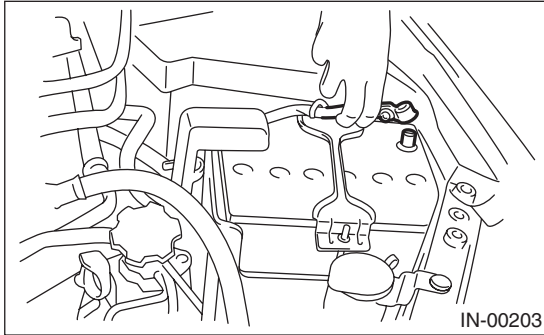
6. Radiator

A: REMOVAL

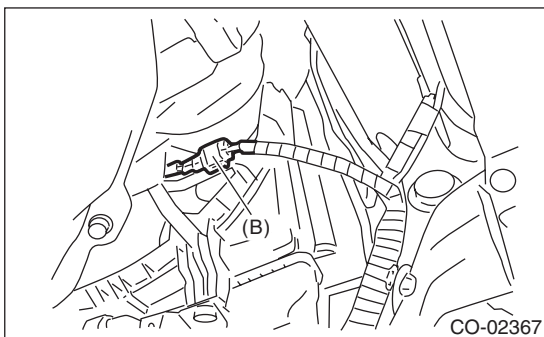
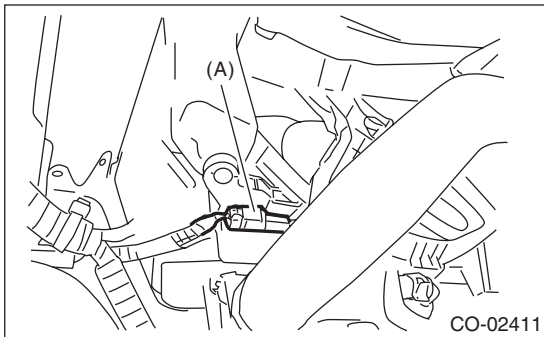
CAUTION:

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

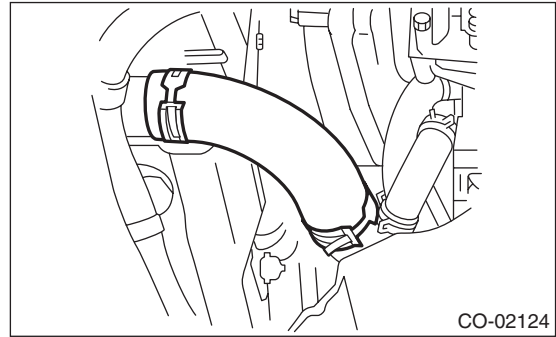
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



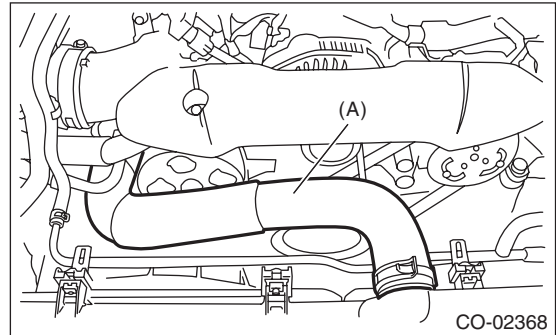
- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Drain engine coolant completely.
 <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 6) Disconnect the connectors of the main fan motor (A) and sub fan motor (B).



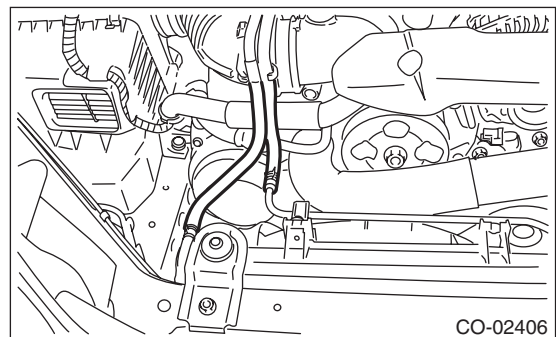
- 7) Disconnect the radiator outlet hose from thermostat cover.



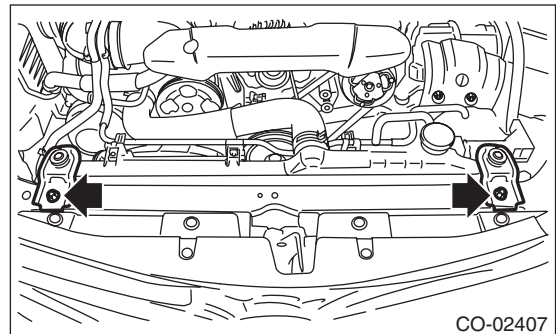
- 8) Lower the vehicle.
- 9) Remove the air intake duct. <Ref. to IN(STI)-9, REMOVAL, Air Intake Duct.>
- 10) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
- 11) Disconnect the radiator inlet hose (A) from the radiator.



- 12) Disconnect the two coolant filler tank hoses from the radiator.



- 13) Remove the radiator upper brackets.



Radiator

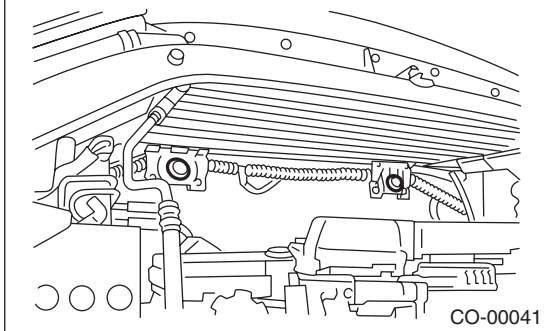
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- 14) Move the radiator to the left while lifting it upward.
- 15) Lift the radiator up and away from vehicle.

B: INSTALLATION

- 1) Attach the radiator lower cushion to the hole on the radiator lower bracket.



- 2) Install the radiator to vehicle.

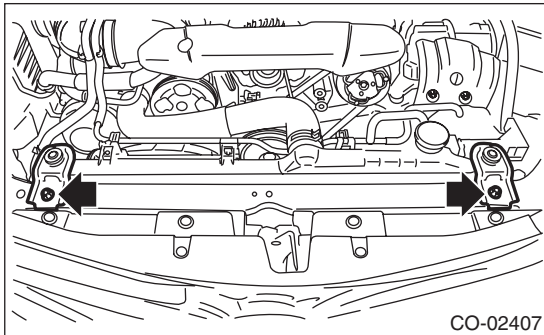
NOTE:

Make pins on the lower side of radiator be fitted into the radiator lower cushions on body side.

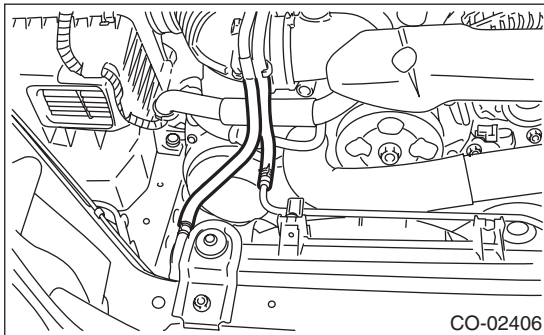
- 3) Install the radiator upper brackets and tighten the bolts.

Tightening torque:

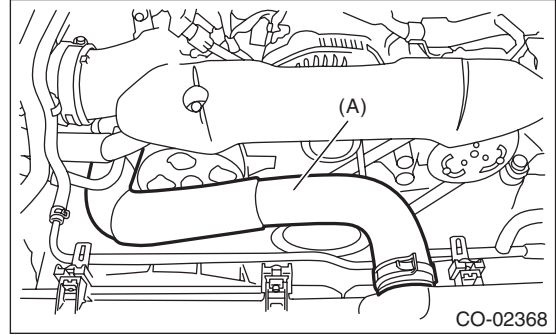
12 N·m (1.2 kgf·m, 8.9 ft·lb)



- 4) Connect the two coolant filler tank hoses to the radiator.



- 5) Connect the radiator inlet hose (A).

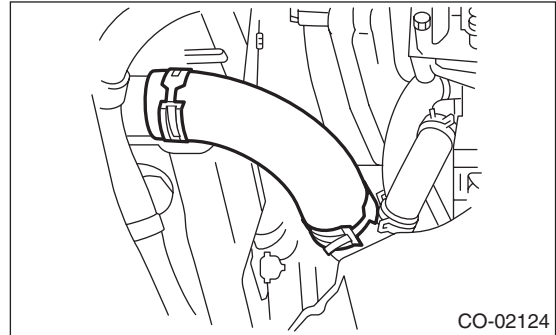


- 6) Install the reservoir tank. <Ref. to CO(STI)-27, INSTALLATION, Reservoir Tank.>

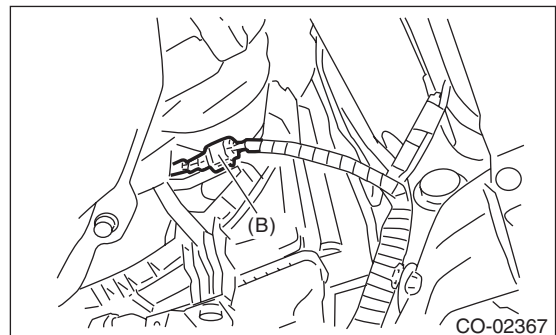
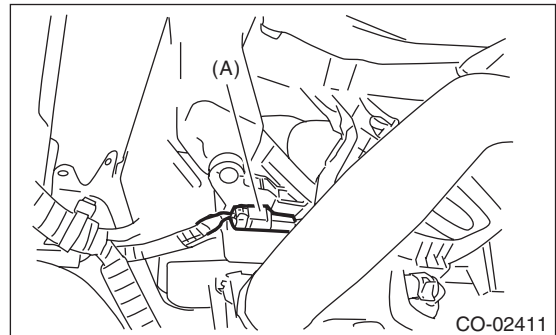
- 7) Install the air intake duct. <Ref. to IN(STI)-9, INSTALLATION, Air Intake Duct.>

- 8) Lift up the vehicle.

- 9) Connect the radiator outlet hose.



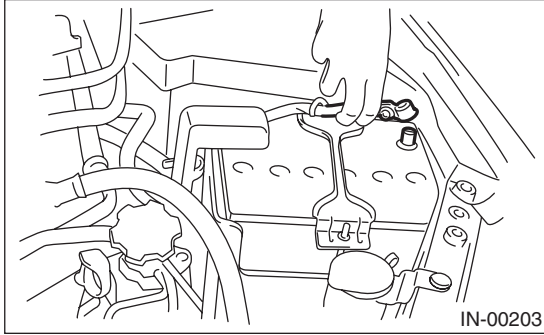
- 10) Connect the connectors to the main fan motor (A) and sub fan motor (B).



- 11) Install the under cover.

- 12) Lower the vehicle.

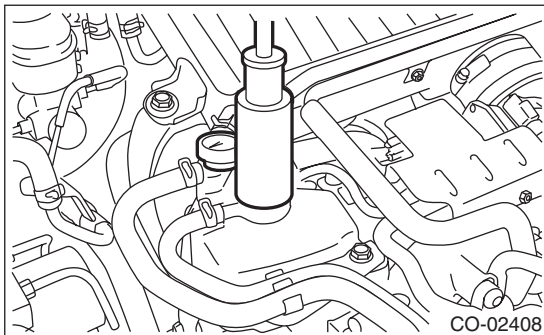
13) Connect the ground cable to the battery.



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

C: INSPECTION

1) Remove the coolant filler tank cap, fill the coolant filler tank with engine coolant, then install the tester to the installation position of the cap.



2) Apply a pressure of 122 kPa (1.2 kg/cm², 18 psi) to the radiator and check the following points:

- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

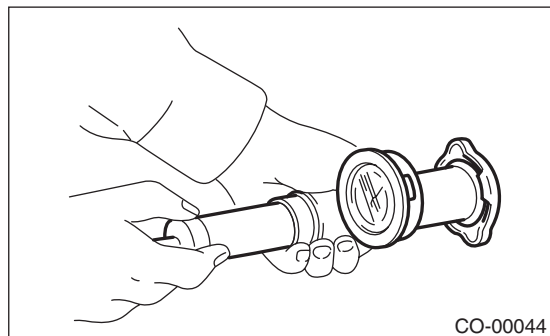
CAUTION:

- **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 of the spurt of engine coolant when removing the tester.**
- **Be careful not to deform the filler neck of the coolant filler tank when installing and removing the tester.**

7. Radiator Cap

A: INSPECTION

1) Attach the radiator cap to tester.



2) Increase pressure until the tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for five to six seconds. Replace the cap if it is opened under a pressure less than the service limit value.

Coolant filler tank side

Standard:

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

Service limit:

83 kPa (0.85 kg/cm², 12 psi)

Radiator side

Standard:

**122 — 152 kPa (1.24 — 1.55 kg/cm²,
18 — 22 psi)**

Service limit:

112 kPa (1.14 kg/cm², 16 psi)

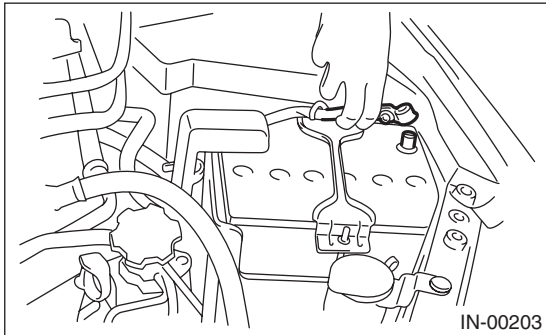
CAUTION:

- 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.

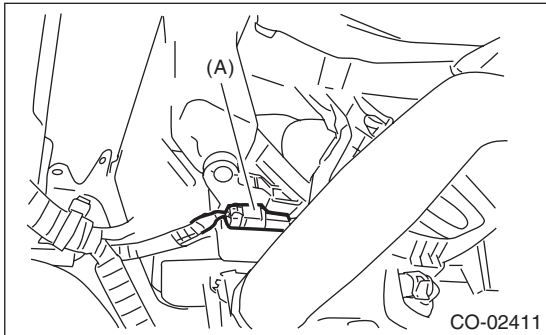
8. Radiator Main Fan and Fan Motor

A: REMOVAL

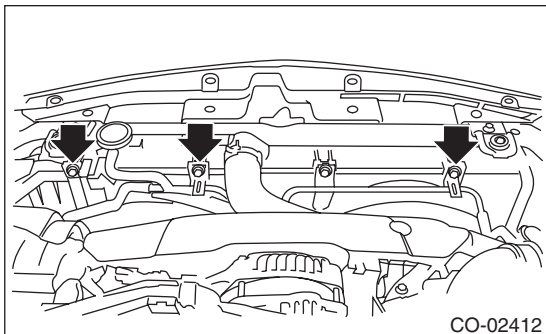
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the main fan motor connector (A).



- 6) Lower the vehicle.
- 7) Remove the air intake duct. <Ref. to IN(STI)-9, REMOVAL, Air Intake Duct.>
- 8) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
- 9) Remove the mounting bolts from radiator main fan motor assembly and over flow pipe.



- 10) Remove the radiator main fan motor assembly by lifting it up and out from the vehicle.

B: INSTALLATION

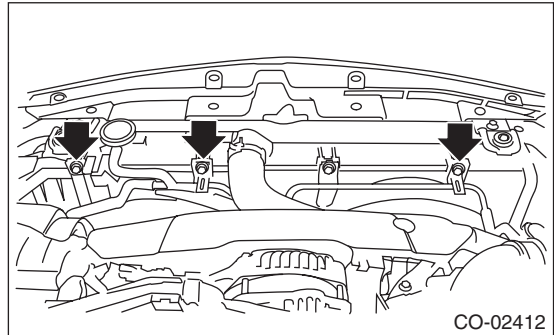
Install in the reverse order of removal.

CAUTION:

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

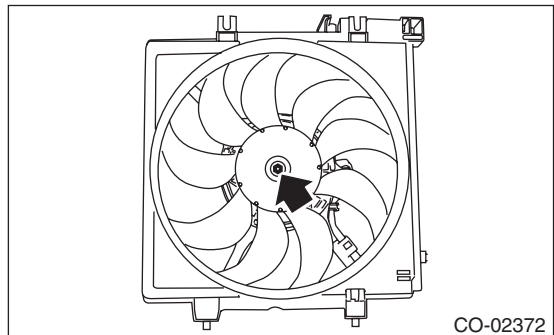
Tightening torque:

7.5 N·m (0.8 kgf·m, 5.5 ft·lb)

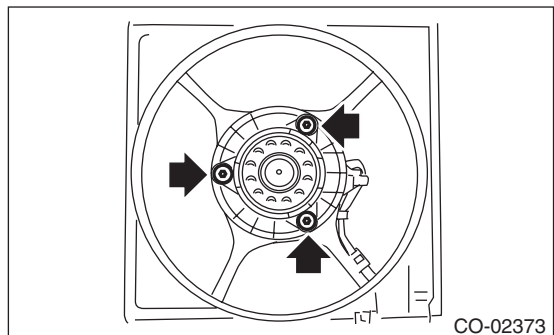


C: DISASSEMBLY

- 1) Remove the clip holding the main fan motor connector on the radiator main fan shroud.
- 2) Remove the nuts holding the radiator main fan to the main fan motor.



- 3) Remove the bolts holding the main fan motor onto the radiator main fan shroud.



Radiator Main Fan and Fan Motor

COOLING

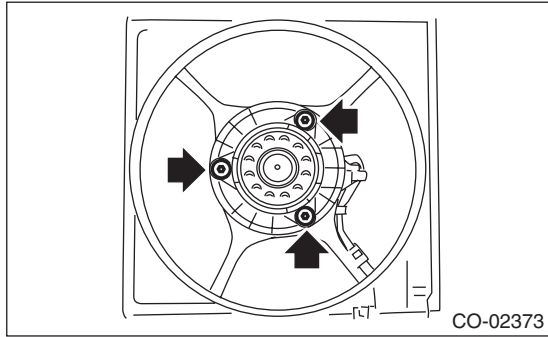
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D: ASSEMBLY

Assemble in the reverse order of disassembly.

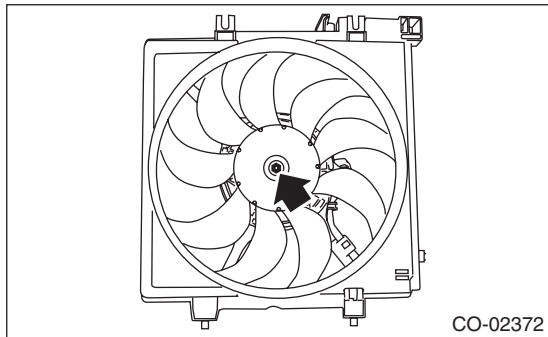
Tightening torque:

4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:

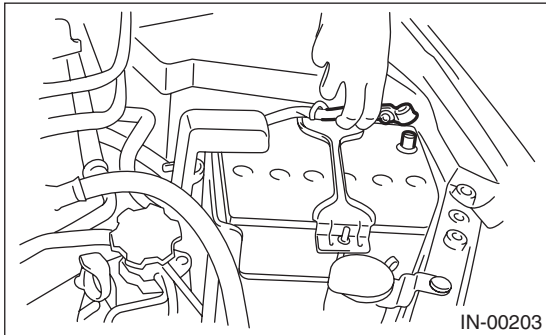
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



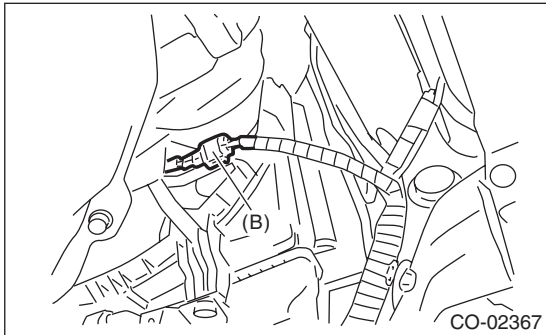
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

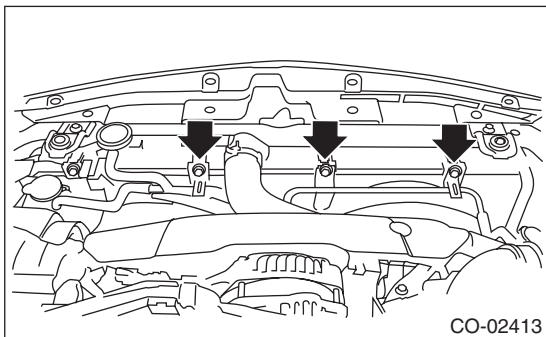
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the sub fan motor connector (B).



- 6) Lower the vehicle.
- 7) Remove the air intake duct. <Ref. to IN(STI)-9, REMOVAL, Air Intake Duct.>
- 8) Remove the mounting bolts from the radiator sub fan motor assembly and over flow pipe.



- 9) Raise the radiator sub fan motor assembly slightly, lift the pin on the lower side of the radiator sub fan motor assembly from the radiator hole, and remove the sub fan from underneath the vehicle.

B: INSTALLATION

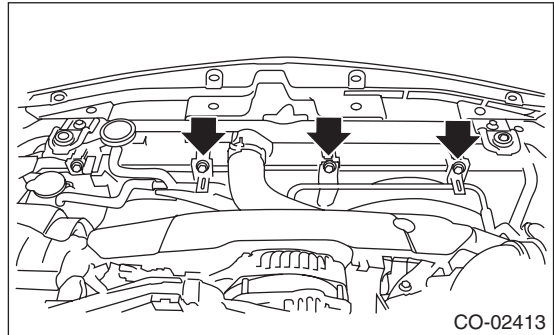
Install in the reverse order of removal.

CAUTION:

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

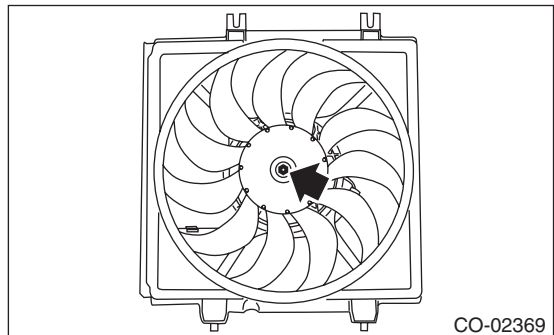
Tightening torque:

7.5 N·m (0.8 kgf·m, 5.5 ft·lb)

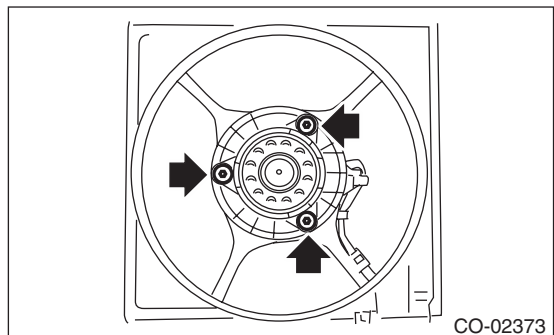


C: DISASSEMBLY

- 1) Remove the clip holding the sub fan motor connector on the radiator sub fan shroud.
- 2) Remove the nuts holding the radiator sub fan to the sub fan motor.



- 3) Remove the bolts holding the sub fan motor to the radiator sub fan shroud.



Radiator Sub Fan and Fan Motor

COOLING

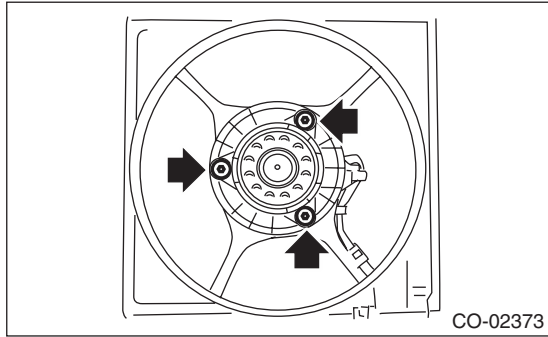
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D: ASSEMBLY

Assemble in the reverse order of disassembly.

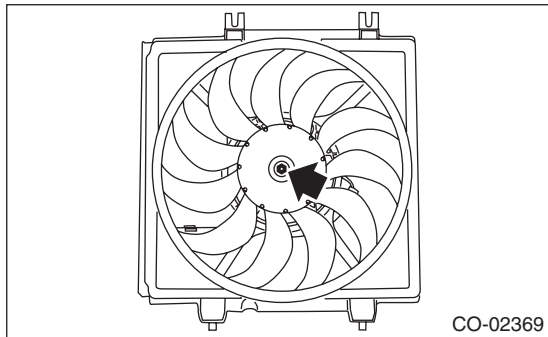
Tightening torque:

4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:

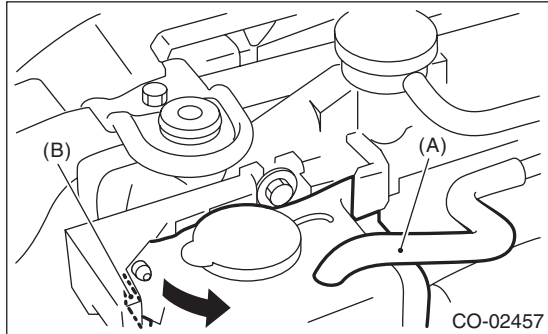
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



10. Reservoir Tank

A: REMOVAL

- 1) Disconnect 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

Make sure the engine coolant level is between "FULL" and "LOW".

COOLING

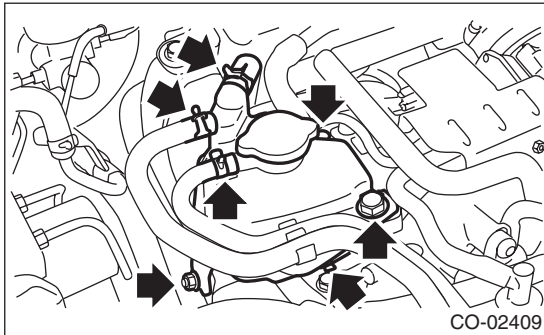
11. Coolant Filler Tank

A: REMOVAL

WARNING:

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

- 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 bolts which install the coolant filler tank.
- 4) Remove the coolant filler tank.

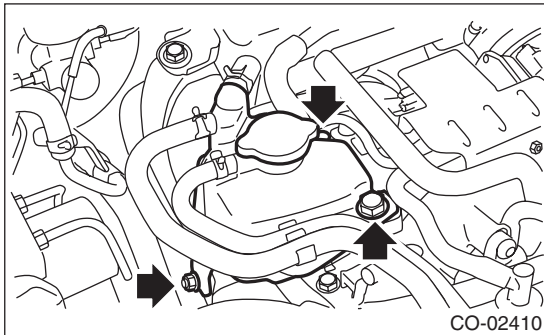


B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

16 N·m (1.6 kgf·m, 11.8 ft·lb)



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

12.Engine Cooling System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Overheat	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(STI)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Engine oil mixed in engine coolant	Replace the engine coolant. If ineffective, check, repair or replace engine components.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(STI)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjust.
	o. 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 gasket.
	e. Damaged or cracked cylinder head and cylinder block	Repair or replace.
	f. Damaged or cracked thermostat case	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.

Engine Cooling System Trouble in General

COOLING

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