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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		ℓ (US qt, Imp qt)	MT: approx. 6.8 (7.2, 6.0) AT: approx. 6.7 (7.1, 5.9)
Water pump	Type		Centrifugal impeller type
	Discharge performance I	Discharge rate ℓ (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 ℓ (US gal, Imp gal) /min	100 (26.4, 22.0)
		Pump speed — Discharge pressure	3,000 rpm — 49 kPa (5.0 mAq)
		Engine coolant temperature	80°C (176°F)
	Discharge performance III	Discharge rate ℓ (US gal, Imp gal) /min	200 (52.8, 44.0)
		Pump speed — Discharge pressure	6,000 rpm — 225.4 kPa (23 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 — 0.060)
Thermostat	Type		Wax pellet type
	Starting temperature to open		80 — 84°C (176 — 183°F)
	Fully opens		95°C (203°F)
	Valve lift	mm (in)	9.0 (0.354) or more
	Valve bore	mm (in)	35 (1.38)
Radiator fan	Motor input	Main fan	90 W
		Sub fan	90 W
	Fan diameter / Blade	Main fan	300 mm (11.81 in)/4
		Sub fan	300 mm (11.81 in)/5
Radiator	Type		Down flow, pressure type
	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 kPa (kg/cm <sup>2</sup> , psi)		Above: 108±15 or more (1.1±0.15, 16±2) Below: -1.0 to -4.9 or less (-0.01 — -0.05, -0.1 — -0.7)
	Fins		Corrugated fin type
Reservoir tank	Capacity		ℓ (US qt, Imp qt)
			0.45 (0.48, 0.40)

Coolant	Recommended materials	Item number	Alternative
Coolant	SUBARU coolant	000016218	Phosphoric acid (non-amine) type
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	None

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Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 95°C (203°F) or less Decrease: 92°C (198°F) or less	Increase: 96 — 99°C (205 — 210°F) Decrease: 93 — 94°C (199 — 201°F)	Increase: 100°C (212°F) or more Decrease: 95°C (203°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 — 134 km/h (43 — 83 MPH) During deceleration: 65 — 129 km/h (40 — 80 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
During acceleration: 135 km/h (84 MPH) or more During deceleration: 130 km/h (81 MPH) or more	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

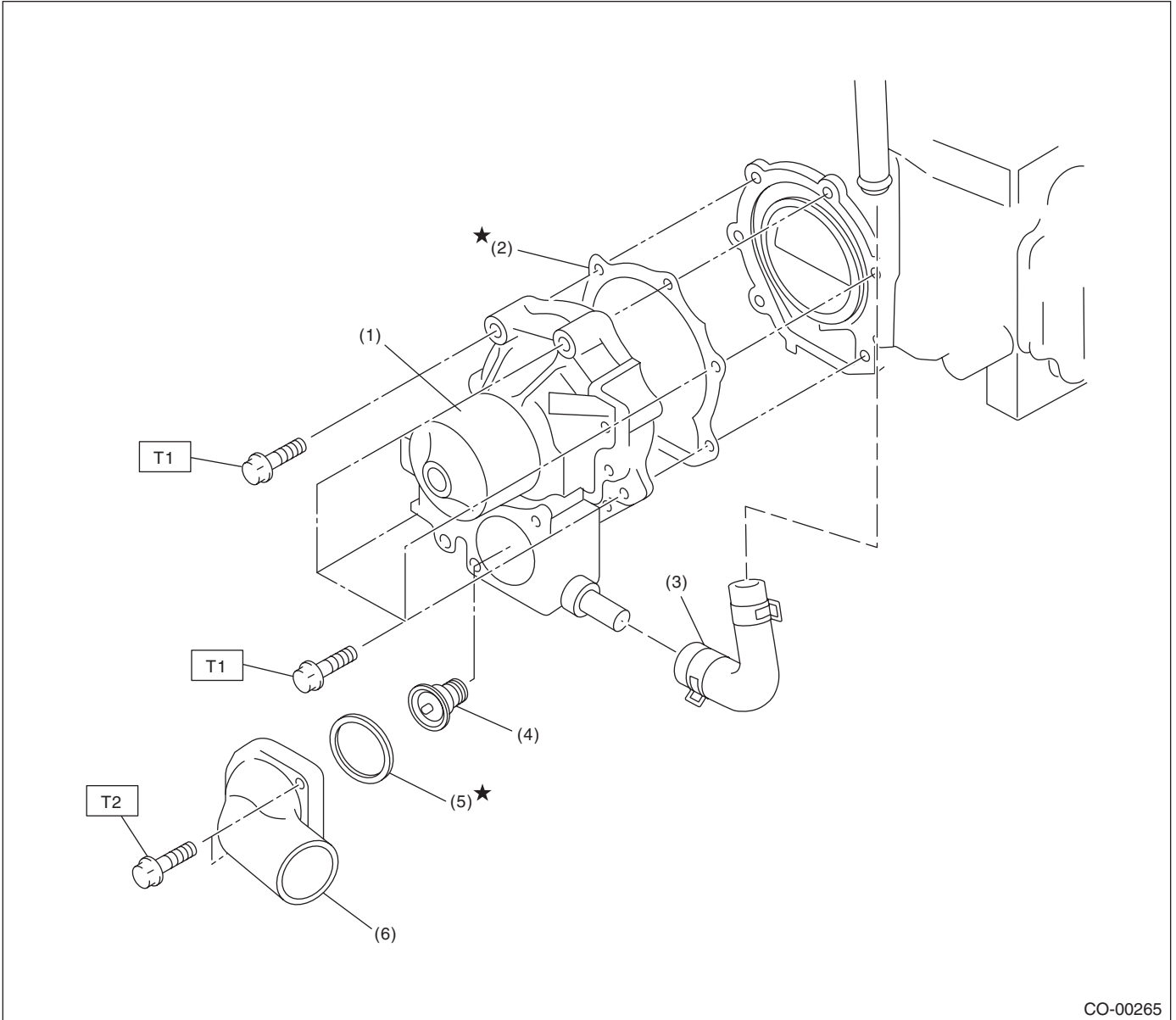
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### B: COMPONENT

#### 1. WATER PUMP



CO-00265

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

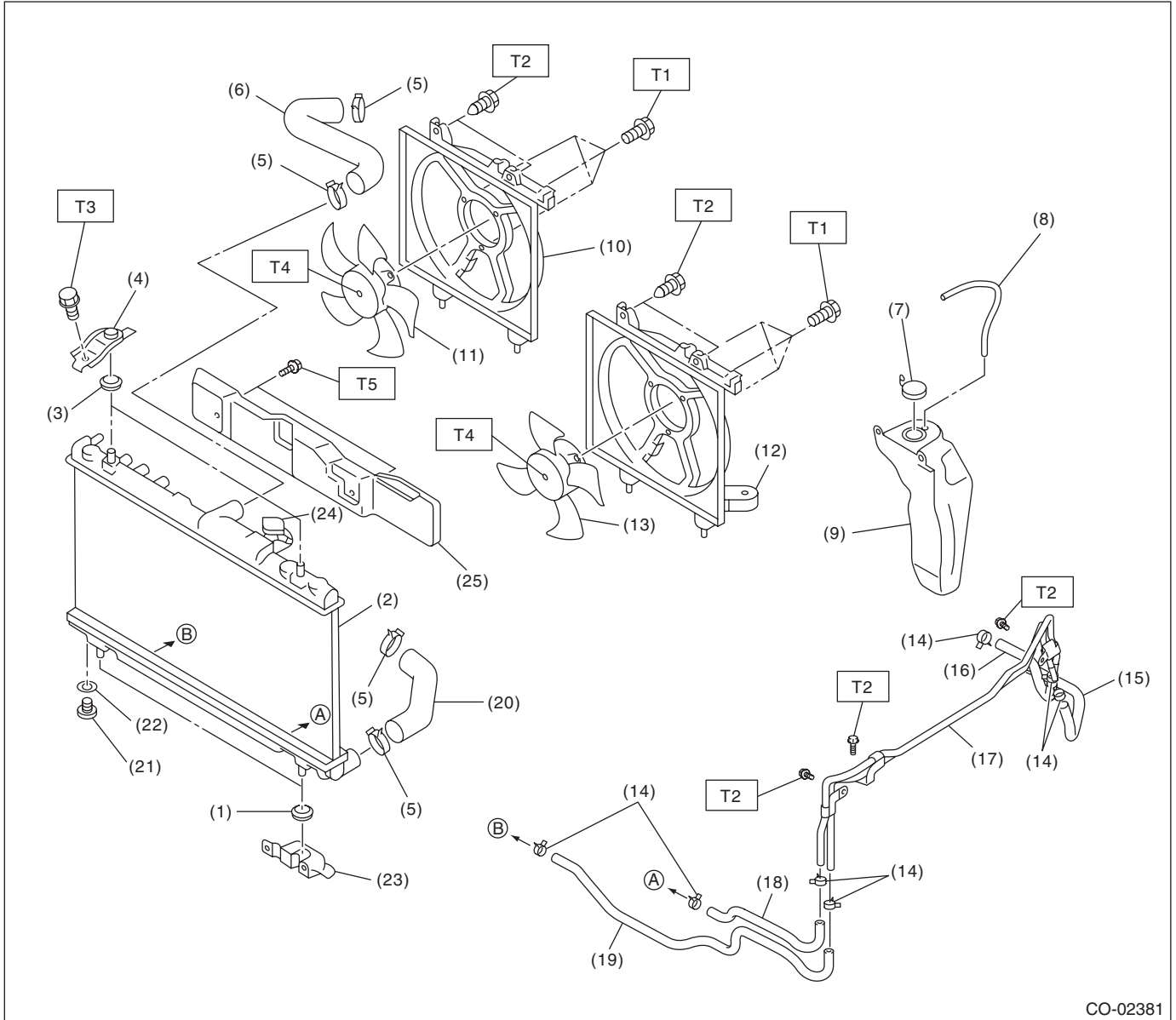
**Tightening torque: N·m (kgf·m, ft·lb)**

**T1: First 12 (1.2, 8.9)**

**Second 12 (1.2, 8.9)**

**T2: 12 (1.2, 8.9)**

## 2. RADIATOR & RADIATOR FAN



CO-02381

- |  |  |                             |
|--|--|-----------------------------|
| (1) Radiator lower cushion                         | (12) Radiator main fan shroud                        | (23) Radiator lower bracket |
| (2) Radiator                                       | (13) Radiator main fan, radiator main fan motor ASSY | (24) Radiator cap           |
| (3) Radiator upper cushion                         | (14) ATF hose clamp (AT model)                       | (25) Heat shield cover      |
| (4) Radiator upper bracket                         | (15) ATF hose A (AT model)                           |                             |
| (5) Clamp  | (16) ATF hose B (AT model)                           |                             |
| (6) Radiator hose A                                | (17) ATF pipe (AT model)                             |                             |
| (7) Engine coolant reservoir tank cap              | (18) ATF hose C (AT model)                           |                             |
| (8) Over flow hose                                 | (19) ATF hose D (AT model)                           |                             |
| (9) Engine coolant reservoir tank                  | (20) Radiator hose B                                 |                             |
| (10) Radiator sub fan shroud                       | (21) Radiator drain plug                             |                             |
| (11) Radiator sub fan, radiator sub fan motor ASSY | (22) O-ring  |                             |

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

**T1: 5 (0.5, 3.7)**

**T2: 7.5 (0.76, 5.5)**

**T3: 12 (1.2, 8.9)**

**T4: 3.4 (0.35, 2.5)**

**T5: 3 (0.3, 2.2)**

#### **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.

# General Description

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## D: PREPARATION TOOL

### 1. SPECIAL 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. (MT model)
<p>ST-499977400</p>	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model)
<p>ST18231AA010</p>	18231AA010	CAM SPROCKET WRENCH	<ul style="list-style-type: none"> <li>Used for removing and installing cam sprocket.</li> <li>CAM SPROCKET WRENCH (499207100) can also be used.</li> </ul>
<p>ST1B021XU0</p>	1B021XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting for electrical system.

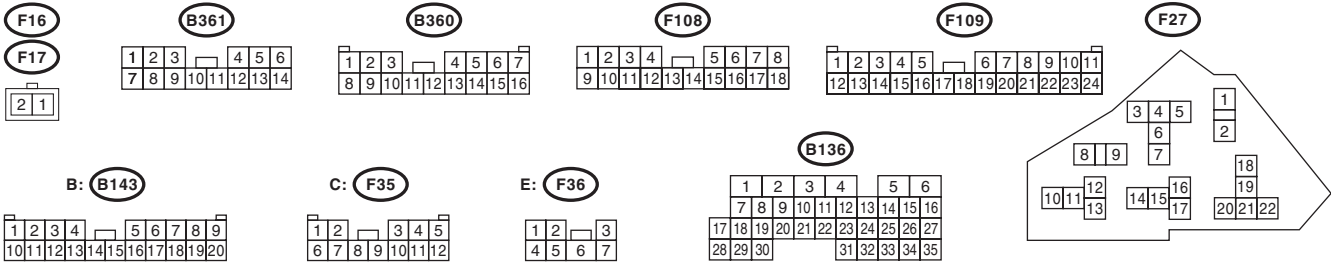
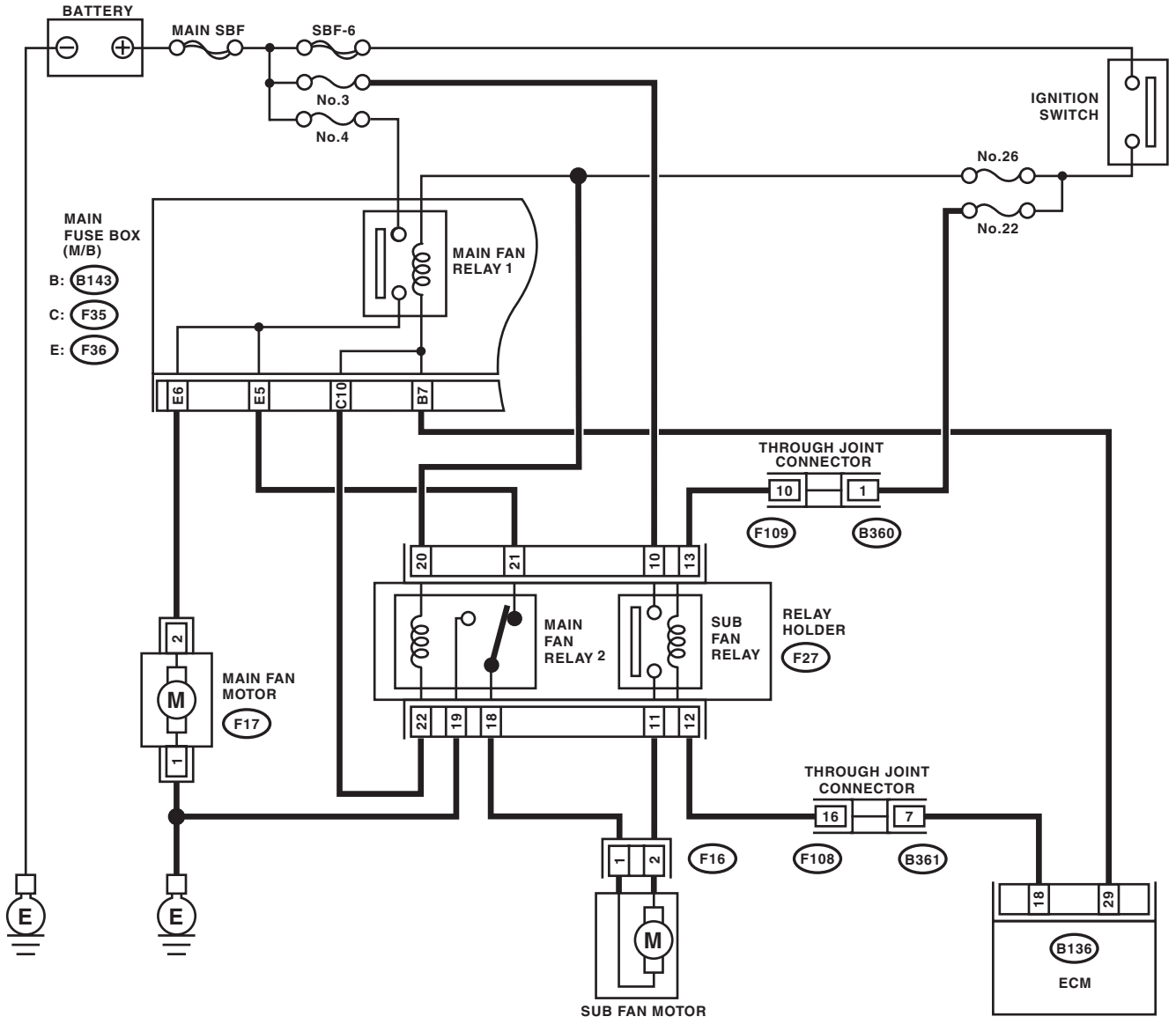
# Radiator Fan System

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## 2. Radiator Fan System

### A: WIRING DIAGRAM



CO-02319



# Radiator Fan System

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## B: INSPECTION

### DETECTING CONDITION:

- Engine coolant temperature is 96°C (205°F) or more.
- Vehicle speed is 19 km/h (12 MPH) or below.

### TROUBLE SYMPTOMS:

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

Step	Check	Yes	No
<b>1 CHECK OPERATION OF RADIATOR FAN.</b> 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 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(H4SO)(diag)-53, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at low speed?	Go to step 2.	Go to step 3.
<b>2 CHECK OPERATION OF RADIATOR FAN.</b> 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 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(H4SO)(diag)-53, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step 27.
<b>3 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 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. <i>Connector &amp; terminal</i> <i>(F27) No. 10 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 4.	Go to step 5.
<b>4 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between the sub fan relay terminal and chassis ground. <i>Connector &amp; terminal</i> <i>(F27) No. 13 (+) — Chassis ground (-):</i>	Is the voltage 10 V or more?	Go to step 7.	Go to step 6.
<b>5 CHECK FUSE.</b> 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.

# Radiator Fan System

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Step	Check	Yes	No
<b>6 CHECK FUSE.</b> 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.
<b>7 CHECK SUB FAN RELAY.</b> 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 $\Omega$ or more?	Go to step 8.	Replace the sub fan relay. <Ref. to AC-36, Relay and Fuse.>
<b>8 CHECK SUB FAN RELAY.</b> 1) Connect the sub fan relay terminals No. 13 and No. 12 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 $\Omega$ ?	Go to step 9.	Replace the sub fan relay. <Ref. to AC-36, Relay and Fuse.>
<b>9 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.</b> 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 &amp; terminal</i> <i>(F16) No. 2 — (F27) No. 11:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 10.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
<b>10 CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.</b> 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 &amp; terminal</i> <i>(F16) No. 1 — (F27) No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 11.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
<b>11 CHECK POOR CONTACT.</b> Check 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.
<b>12 CHECK SUB FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 2 of the sub fan motor, and the ground (-) terminal to terminal No. 1.	Does the sub fan rotate?	Go to step 13.	Replace the sub fan motor. <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.>
<b>13 CHECK MAIN FAN RELAY 2.</b> Measure the resistance of main fan relay 2. <i>Terminals</i> <i>No. 21 — No. 18:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 14.	Replace the main fan relay 2. <Ref. to AC-36, Relay and Fuse.>
<b>14 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.</b> 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 &amp; terminal</i> <i>(F17) No. 2 — (F27) No. 21:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 15.	Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.

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Step	Check	Yes	No
<b>15 CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.</b> Measure the resistance between main fan motor connector and chassis ground. <i>Connector &amp; terminal (F17) No. 1 — Chassis ground:</i>	Is resistance less than 5 $\Omega$ ?	Go to step 16.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
<b>16 CHECK POOR CONTACT.</b> 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.
<b>17 CHECK MAIN FAN MOTOR.</b> Connect the battery positive (+) terminal to terminal No. 2 of the main fan motor, and the ground (–) terminal to terminal No. 1.	Does the main fan rotate?	Go to step 18.	Replace the main fan motor. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.>
<b>18 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. <i>Connector &amp; terminal (B136) No. 18 — (F27) No. 12:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 19.	Repair the open circuit of harness between sub fan relay terminal and ECM.
<b>19 CHECK POOR CONTACT.</b> Check for poor contact of the ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-41, Read Diagnostic Trouble Code (DTC).>
<b>20 CHECK MAIN FAN RELAY 1.</b> 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 $\Omega$ or more?	Go to step 21.	Replace the main fan relay 1. <Ref. to AC-36, Relay and Fuse.>
<b>21 CHECK MAIN FAN RELAY 1.</b> 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 $\Omega$ ?	Go to step 22.	Replace the main fan relay 1. <Ref. to AC-36, Relay and Fuse.>
<b>22 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.</b> 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 &amp; terminal (F17) No. 2 — (F36) No. 6:</i>	Is resistance less than 1 $\Omega$ ?	Go to step 23.	Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.
<b>23 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.</b> 1) Disconnect the connectors from the ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. <i>Connector &amp; terminal (B136) No. 29 — (B143) No. 7:</i>	Is the resistance less than 1 $\Omega$ ?	Go to step 24.	Repair the open circuit of the harness between main fan relay 1 terminal and ECM.

# Radiator Fan System

## COOLING

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Step	Check	Yes	No
<b>24 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.</b> Measure the resistance between main fan relay 2 terminal and ECM connector. <i><b>Connector &amp; terminal</b></i> <i><b>(B136) No. 29 — (F27) No. 22:</b></i>	Is resistance less than 1 Ω?	Go to step 25.	Repair the open circuit of the harness between main fan relay 2 terminal and ECM.
<b>25 CHECK FUSE.</b> 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 4 and 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 26.
<b>26 CHECK POOR CONTACT.</b> 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.
<b>27 CHECK OPERATION OF RADIATOR FAN.</b> 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 sub fan rotate?	Go to step 20.	Go to step 28.
<b>28 CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.</b> 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(F27) No. 19 — Chassis ground:</b></i>	Is resistance less than 1 Ω?	Go to step 29.	Repair the open circuit of harness between main fan relay 2 and chassis ground.
<b>29 CHECK POWER SUPPLY TO MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. <i><b>Connector &amp; terminal</b></i> <i><b>(F27) No. 20 (+) — Chassis ground (-):</b></i>	Is the voltage 10 V or more?	Go to step 30.	Repair the power supply line.
<b>30 CHECK MAIN FAN RELAY 2.</b> 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. <i><b>Terminals</b></i> <i><b>(F27) No. 18 — (F27) No. 19:</b></i>	Is the resistance 1 MΩ or more?	Go to step 31.	Replace the main fan relay 2. <Ref. to AC-36, Relay and Fuse.>
<b>31 CHECK MAIN FAN RELAY 2.</b> 1) Connect the battery to main fan relay 2 terminals No. 20 and No. 22. 2) Measure the resistance of main fan relay 2. <i><b>Terminals</b></i> <i><b>(F27) No. 18 — (F27) No. 19:</b></i>	Is the resistance less than 1 Ω?	Go to step 23.	Replace the main fan relay 2. <Ref. to AC-36, Relay and Fuse.>

## 3. Engine Coolant

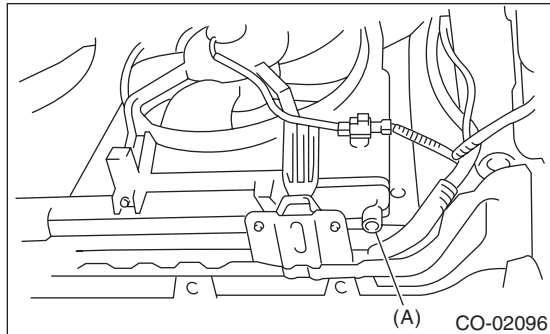
### A: REPLACEMENT

#### 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 radiator cap so that engine coolant will drain faster.



(A) Drain plug

- 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(H4SO)-2, SPECIFICATION, General Description.>**

- 2) Pour engine coolant into the radiator up to the filler neck position.

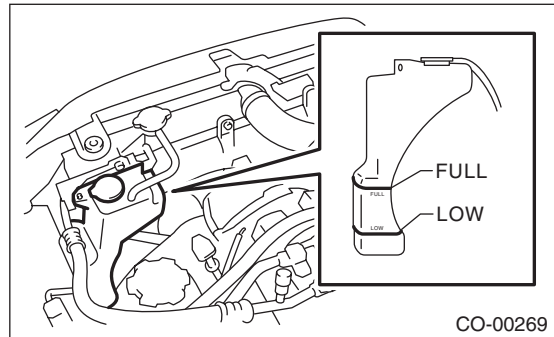
**Recommended engine coolant:**

**Refer to SPECIFICATION for the recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>**

**Coolant level:**

**Refer to "SPECIFICATION" for the recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>**

- 3) Fill engine coolant into the reservoir tank up to "FULL" level.



- 4) Close the radiator 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, open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.

- 6) Perform the procedures 4) and 5) again.

- 7) Attach the radiator cap and reservoir tank cap properly.

- 8) Start the engine and operate the heater at maximum hot position and the blower speed setting at "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 drops to 30°C (86°F) or less.

- 11) Open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.

- 12) Attach the radiator cap correctly.

- 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 at this time, perform the procedures from 9) again.

## COOLING

### B: INSPECTION

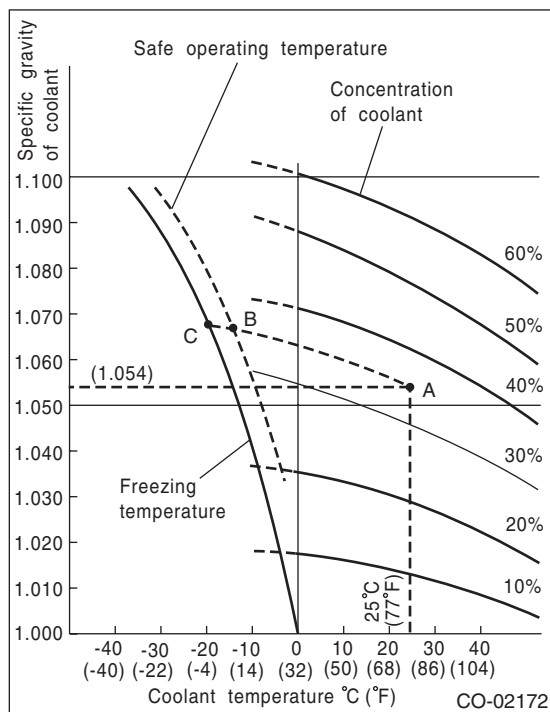
#### 1. RELATIONSHIP OF ENGINE COOLANT CONCENTRATION AND FREEZING TEMPERATURE

The concentration and safe operating temperature of engine coolant is shown in the diagram 1. Measuring the temperature and specific gravity of the coolant will provide this information.

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).

- Diagram 1



#### 2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of coolant according to temperature, find the proper engine coolant concentration in the diagram 1 and replace the necessary amount of coolant with an undiluted solution of engine coolant (concentration 50%).

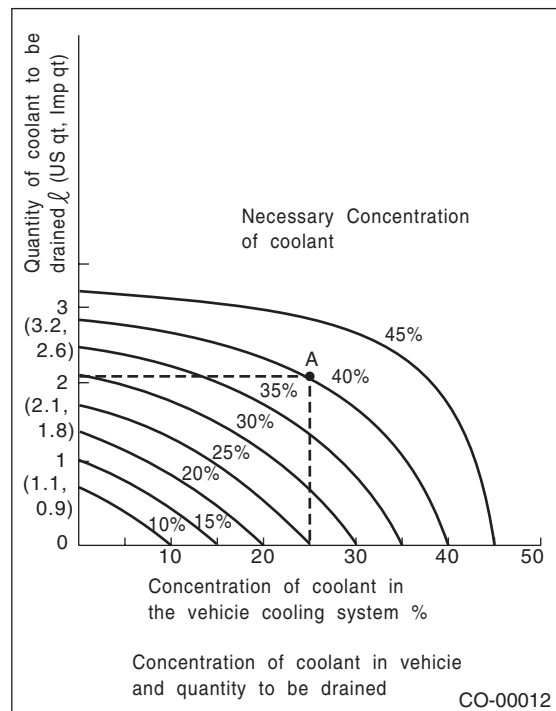
The amount of engine coolant that should be replaced can be determined using the diagram 2.

[Example]

Assume that the engine coolant concentration must be increased from 25% to 40%. Find point A, where the 25% line of engine coolant concentration intersects with the 40% curve of the necessary engine coolant concentration, and read the scale on the vertical axis of the graph at height A. The quantity of coolant to be drained is 2.1 ℓ (2.2 US qt, 1.8 Imp qt). Drain 2.1 ℓ (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 ℓ (2.2 US qt, 1.8 Imp qt) undiluted engine coolant solution.

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

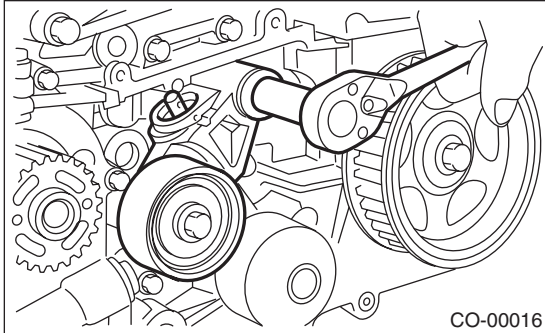
- Diagram 2



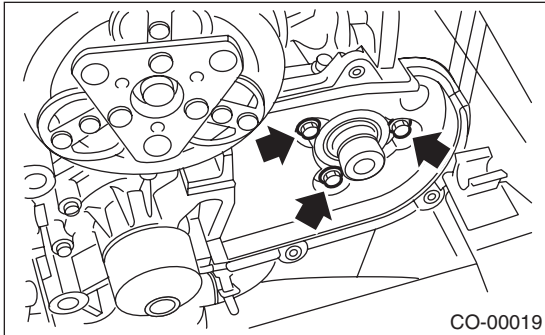
## 4. Water Pump

### A: REMOVAL

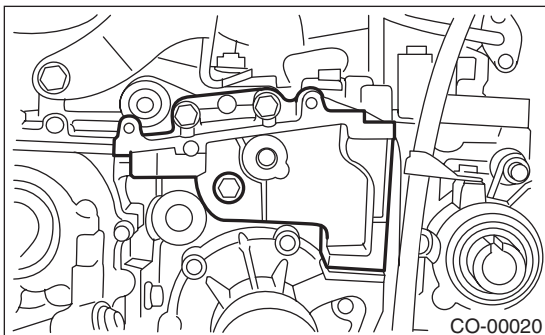
- 1) Remove the radiator. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
- 2) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-47, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt. <Ref. to ME(H4SO)-50, TIMING BELT, REMOVAL, Timing Belt.>
- 6) Remove the automatic belt tension adjuster.



- 7) Remove the camshaft position sensor. <Ref. to FU(H4SO)-24, REMOVAL, Camshaft Position Sensor.>
- 8) Remove the cam sprocket LH. <Ref. to ME(H4SO)-55, REMOVAL, Cam Sprocket.>
- 9) Remove the belt cover LH No. 2.

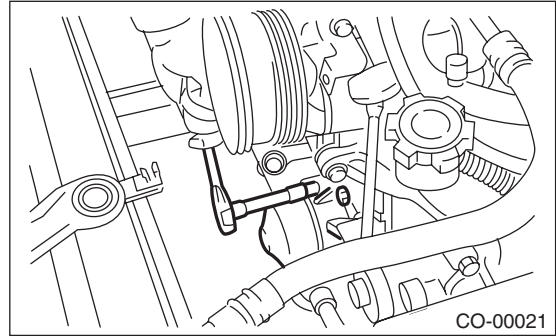


- 10) Remove the tensioner bracket.



- 11) Disconnect the hose from water pump.

- 12) 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.

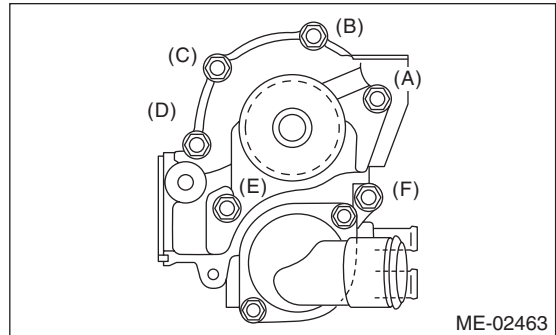
#### Tightening torque:

##### 1st

**12 N·m (1.2 kgf-m, 8.9 ft-lb)**

##### 2nd

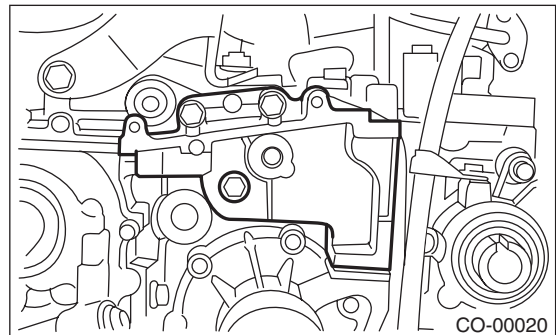
**12 N·m (1.2 kgf-m, 8.9 ft-lb)**



- 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)**

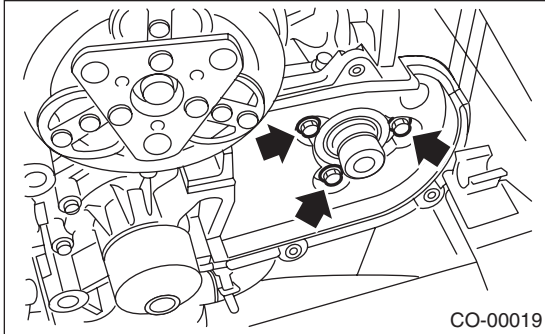


## COOLING

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(H4SO)-55, INSTALLATION, Cam Sprocket.>

6) Install the camshaft position sensor. <Ref. to FU(H4SO)-24, INSTALLATION, Camshaft Position Sensor.>

7) Install an automatic belt tension adjuster with the tension rod held by a pin. <Ref. to ME(H4SO)-51, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

8) Install the timing belt. <Ref. to ME(H4SO)-52, TIMING BELT, INSTALLATION, Timing Belt.>

9) Install the timing belt cover. <Ref. to ME(H4SO)-49, INSTALLATION, Timing Belt Cover.>

10) Install the crank pulley. <Ref. to ME(H4SO)-47, INSTALLATION, Crank Pulley.>

11) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

12) Install the radiator. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>

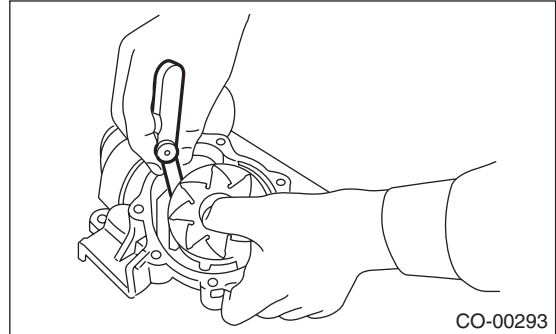
## C: INSPECTION

- 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 — 0.060 in)**



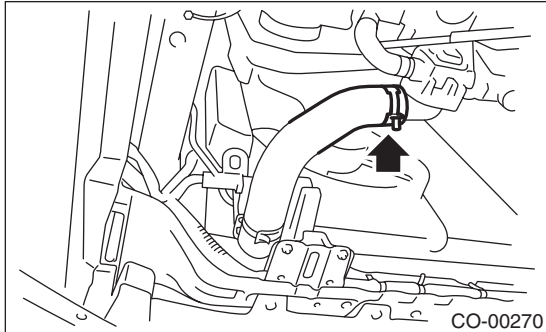
- 5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.



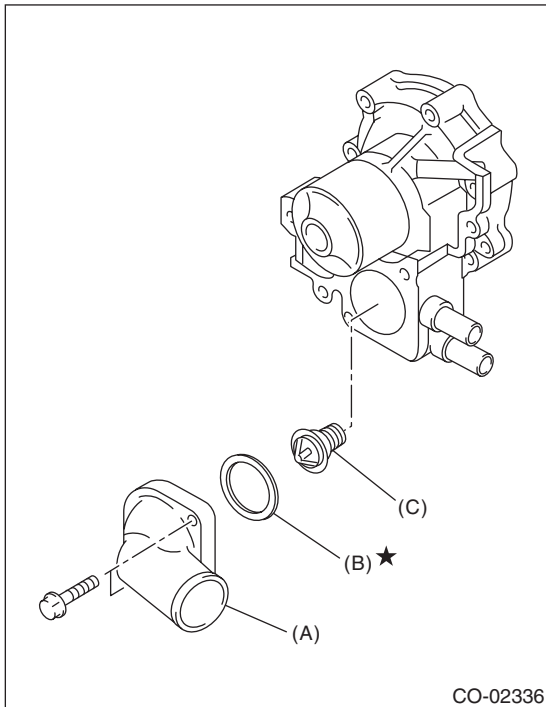
## 5. Thermostat

### 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(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Remove the front exhaust pipe. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
- 6) Disconnect the radiator outlet hose from thermostat cover.



- 7) 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.

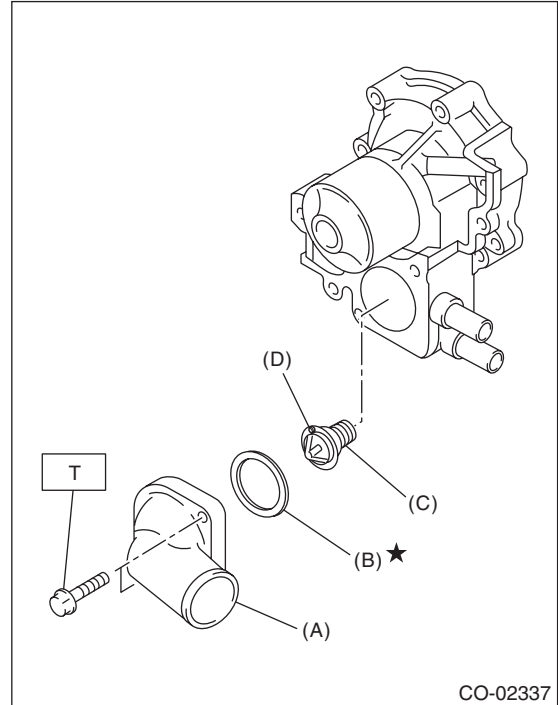
- 2) Install the thermostat and thermostat cover.

**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 front exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>
- 5) Install the under cover.
- 6) Lower the vehicle.
- 7) Fill engine coolant. <Ref. to CO(H4SO)-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 valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

**Opening start temperature:**

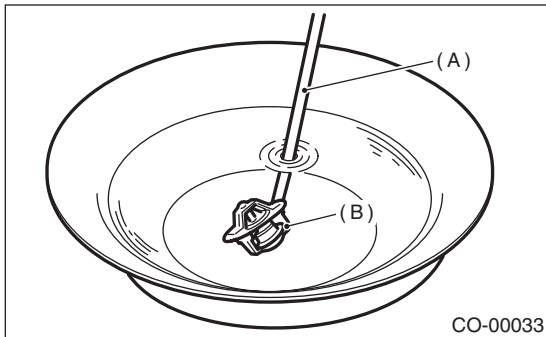
**80 — 84°C (176 — 183°F)**

**Full open temperature:**

**95°C (203°F)**

**Valve lift:**

**9.0 mm (0.354 in) or more**



- (A) Thermometer
- (B) Thermostat

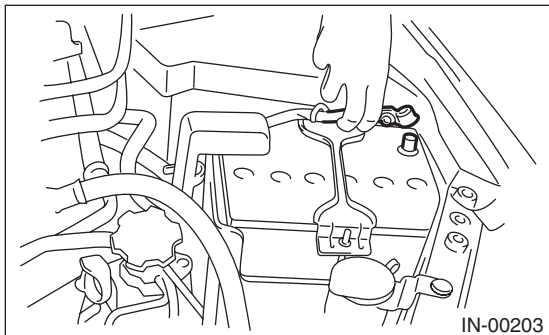
## 6. Radiator

### A: REMOVAL

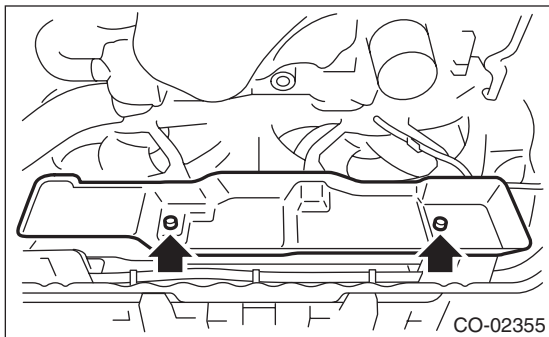
#### CAUTION:

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.

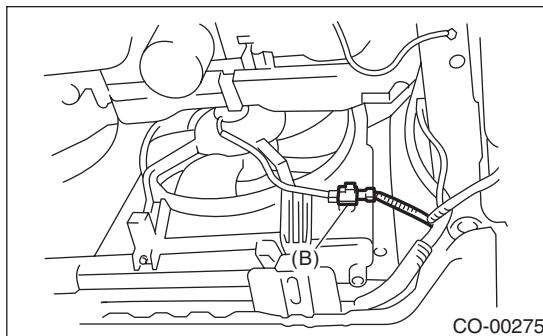
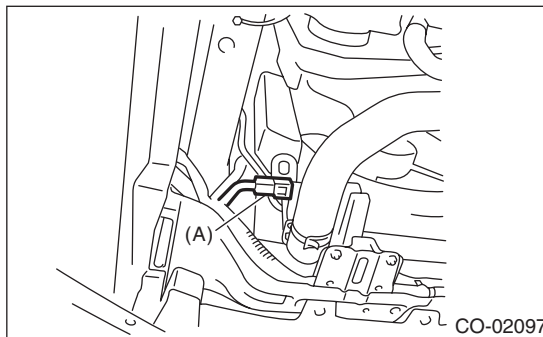


- 3) Lift up the vehicle.
- 4) Remove the under cover.
- 5) Remove the heat shield cover from radiator. (AT model)

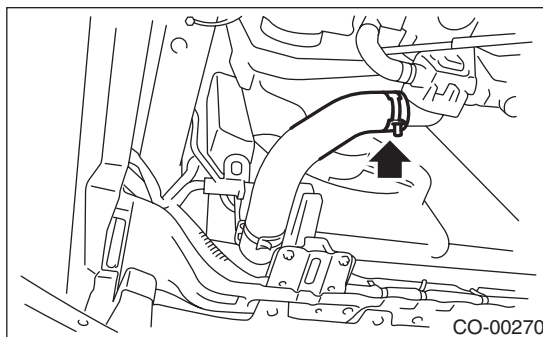


- 6) Drain engine coolant completely.  
 <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

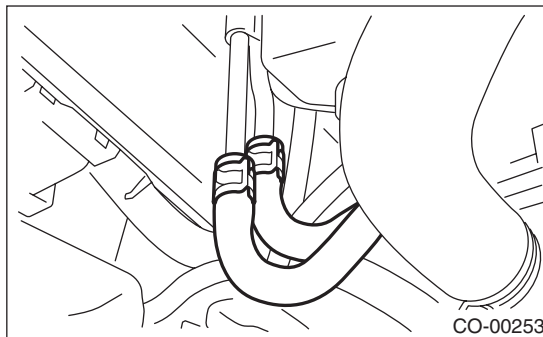
- 7) Disconnect the connectors of radiator main fan motor connector (A) and sub fan motor connector (B).



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



- 9) Disconnect the ATF cooler hoses from ATF pipes. (AT model)  
 Plug the ATF pipe to prevent ATF from leaking.

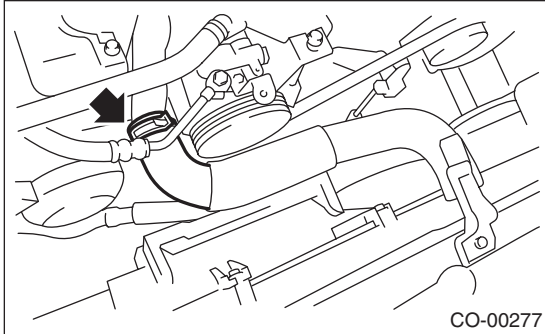


# Radiator

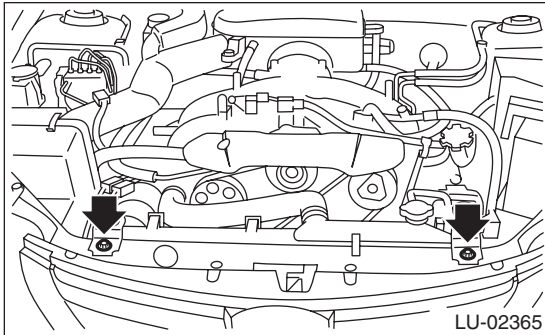
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## COOLING

- 10) Lower the vehicle.
- 11) Disconnect the over flow hose.
- 12) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>
- 13) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
- 14) Disconnect the radiator inlet hoses from the engine.



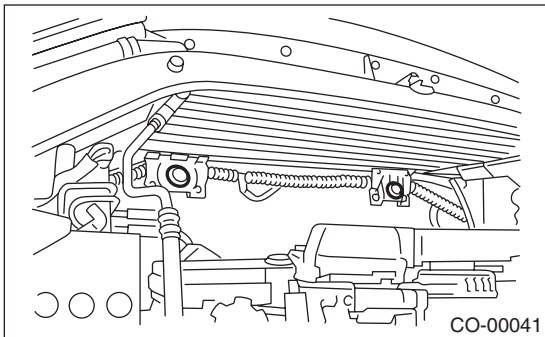
- 15) Remove the radiator upper brackets.



- 16) 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.

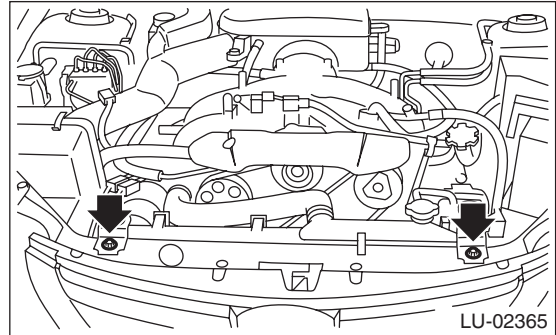
### NOTE:

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

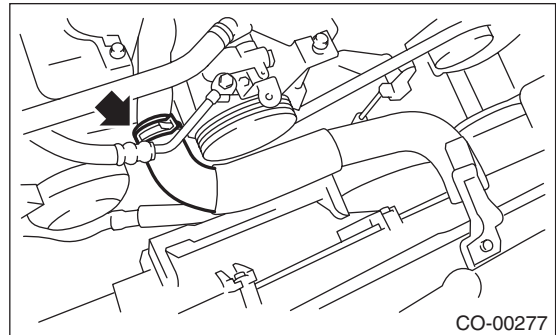
- 3) Install the radiator upper brackets and tighten the bolts.

### Tightening torque:

**12 N·m (1.2 kgf-m, 8.9 ft-lb)**



- 4) Connect the radiator inlet hose.



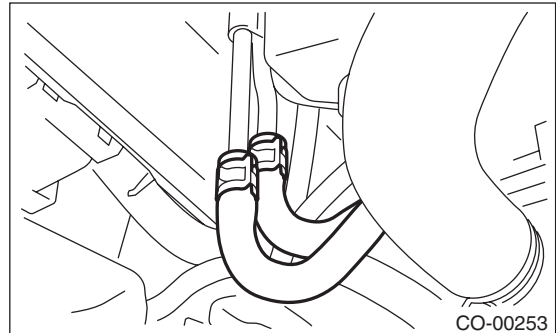
- 5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

- 6) Install the reservoir tank. <Ref. to CO(H4SO)-27, INSTALLATION, Reservoir Tank.>

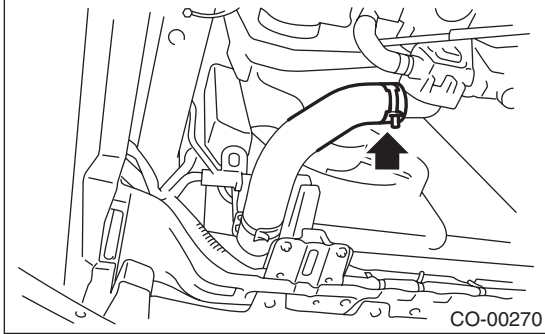
- 7) Connect the over flow hose.

- 8) Lift up the vehicle.

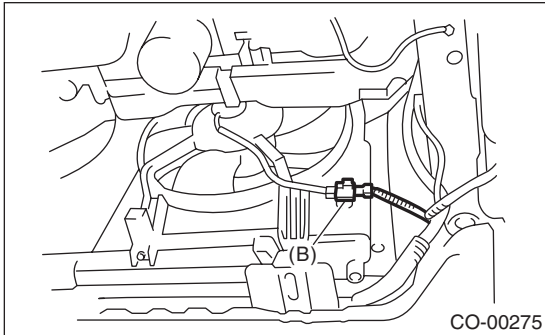
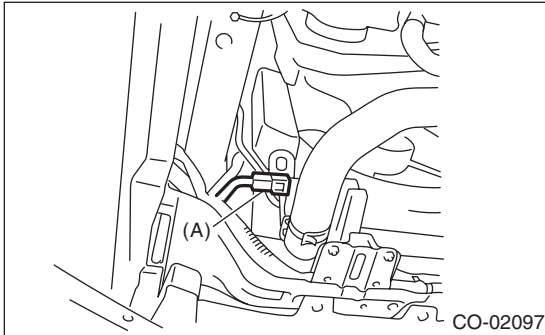
- 9) Connect the ATF cooler hoses. (AT model)



10) Connect the radiator outlet hose.



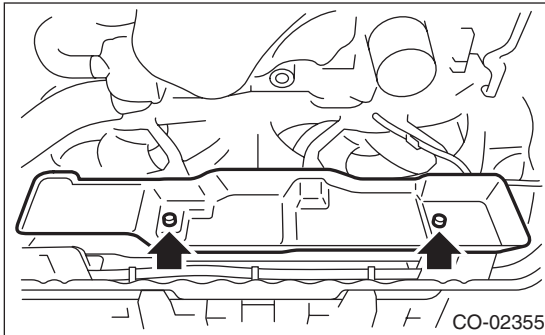
11) Connect the connectors of radiator main fan motor connector (A) and sub fan motor connector (B).



12) Install the heat shield cover. (AT model)

**Tightening torque:**

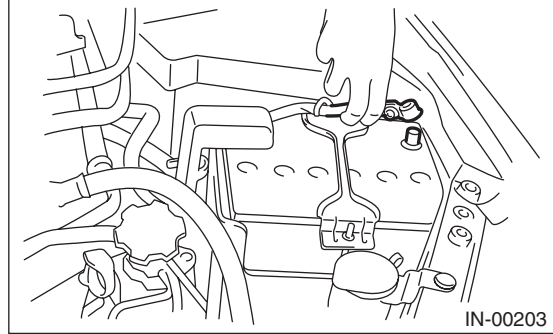
**3 N·m (0.3 kgf·m, 2.2 ft·lb)**



13) Install the under cover.

14) Lower the vehicle.

15) Connect the battery ground cable to battery.

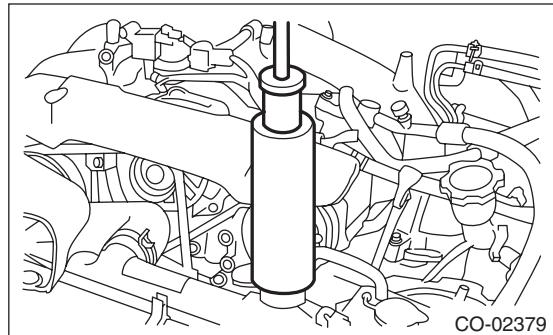


16) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

17) Check the ATF level. <Ref. to 4AT-26, INSPECTION, Automatic Transmission Fluid.>

## C: INSPECTION

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



2) Apply a pressure of 157 kPa (1.6 kg/cm<sup>2</sup>, 23 psi) to the radiator and check the following points:

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

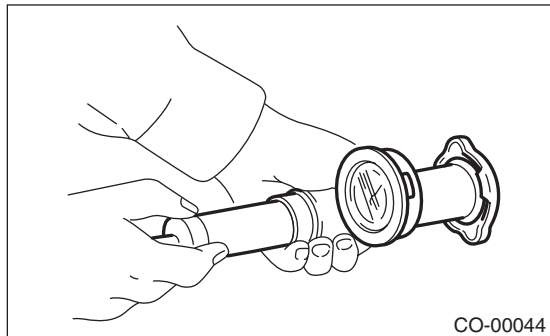
### CAUTION:

- Engine should be turned off.
- Wipe engine coolant from check points in advance.
- Be careful of engine coolant from spurting out when removing the tester.
- Be careful not to deform the filler neck of radiator 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.

**Standard:**

**93 — 123 kPa (0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)**

**Service limit:**

**83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)**

**CAUTION:**

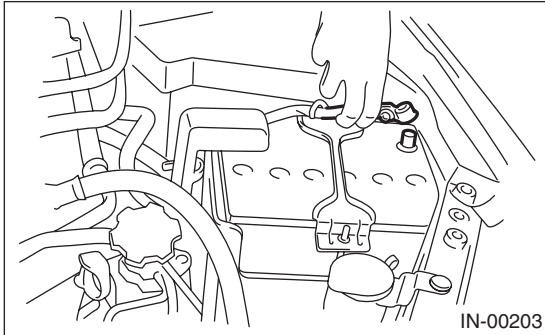
Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.



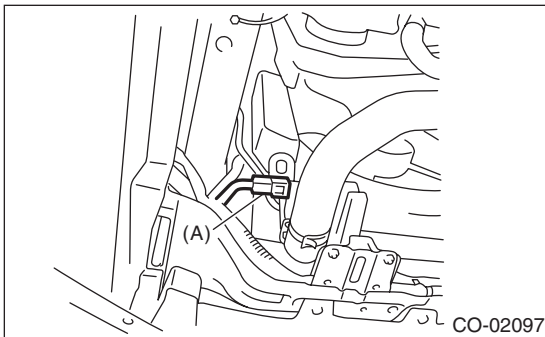
## 8. Radiator Main Fan and Fan Motor

### A: REMOVAL

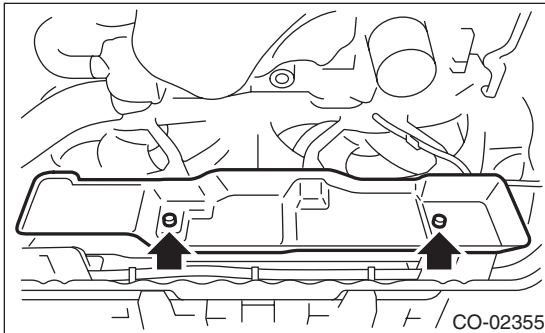
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



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

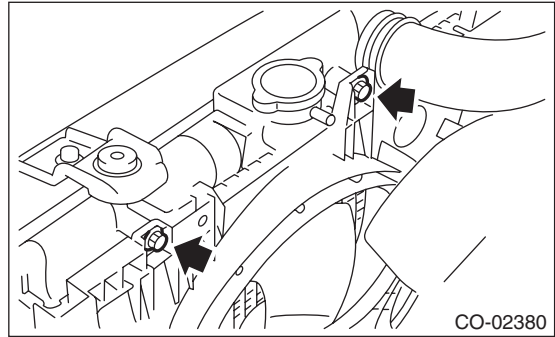


- 6) Remove the heat shield cover. (AT model)



- 7) Remove the ATF hose from the clip of the radiator main fan motor assembly. (AT model)
- 8) Lower the vehicle.
- 9) Disconnect the over flow hose.
- 10) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>

- 11) Remove the bolts which hold the radiator main fan shroud to the radiator.



- 12) Remove the radiator main fan motor assembly.

### B: INSTALLATION

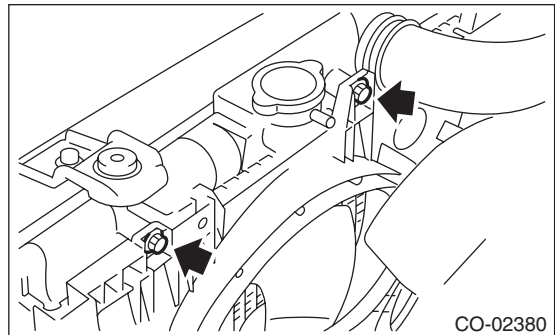
Install in the reverse order of removal.

#### NOTE:

If the installation of the radiator main fan motor assembly is difficult, attempt installation after loosening the bolts which hold the radiator sub fan motor assembly.

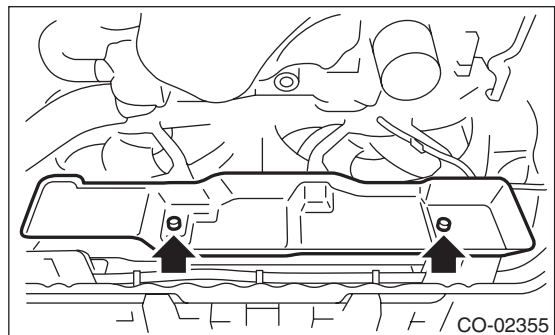
#### Tightening torque:

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



#### Tightening torque:

**3 N·m (0.3 kgf-m, 2.2 ft-lb)**



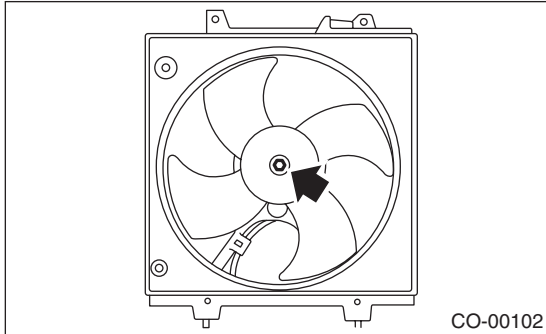
# Radiator Main Fan and Fan Motor

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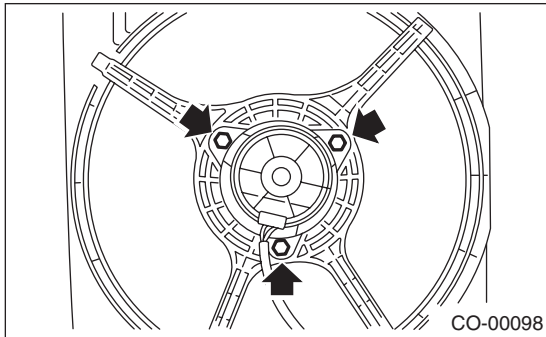
## COOLING

### C: DISASSEMBLY

- 1) Remove the clip which holds motor connector onto the shroud.
- 2) Remove the nuts which hold the fan to the fan motor.



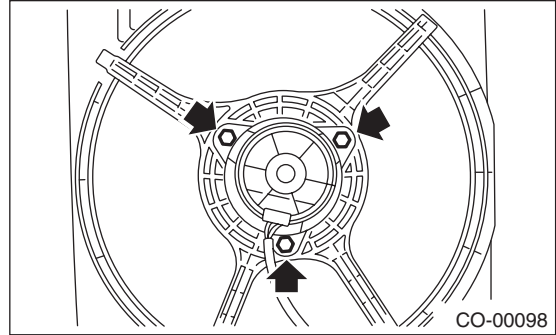
- 3) Remove the bolts which hold fan motor onto shroud.



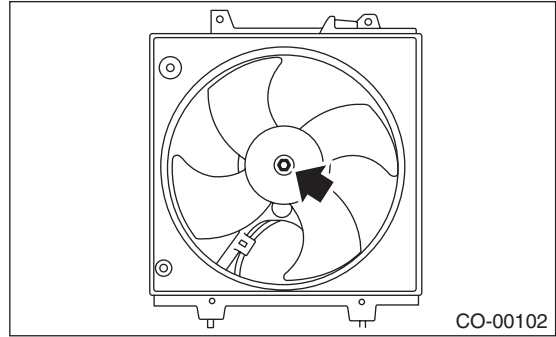
### D: ASSEMBLY

Assemble in the reverse order of disassembly.

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



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

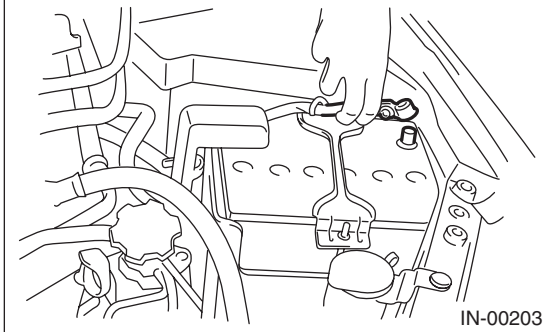




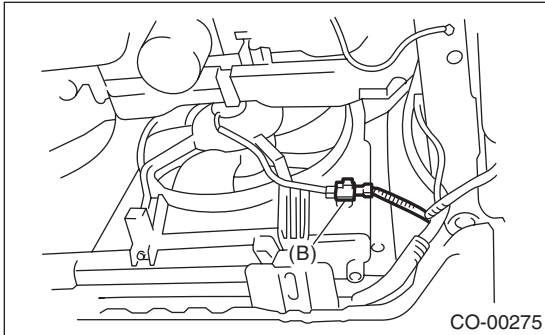
## 9. Radiator Sub Fan and Fan Motor

### A: REMOVAL

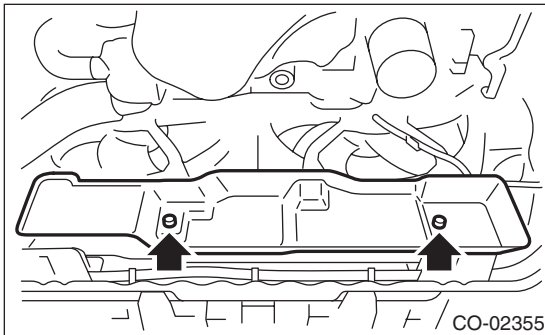
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



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

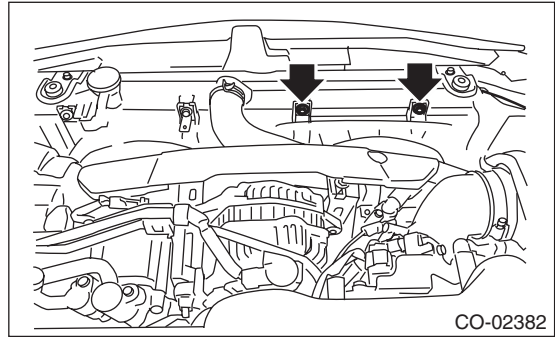


- 6) Remove the heat shield cover. (AT model)



- 7) Remove the ATF hose from the clip of the radiator sub fan motor assembly. (AT model)
- 8) Lower the vehicle.
- 9) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

- 10) Remove the bolts which hold the radiator sub fan shroud to the radiator.



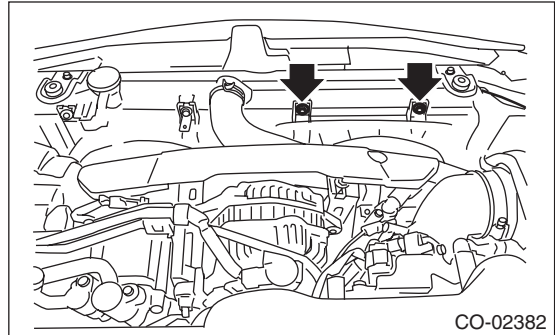
- 11) Remove the radiator sub fan motor assembly from underneath the vehicle.

### B: INSTALLATION

Install in the reverse order of removal.

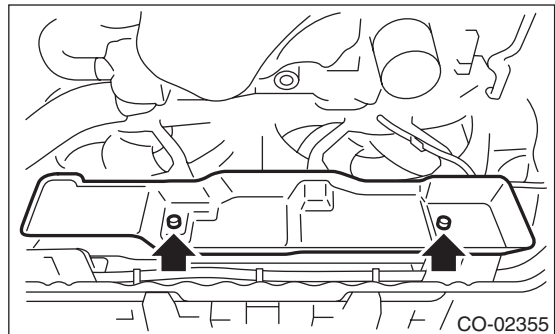
#### **Tightening torque:**

**7.5 N·m (0.76 kgf-m, 5.5 ft-lb)**



#### **Tightening torque:**

**3 N·m (0.3 kgf-m, 2.2 ft-lb)**



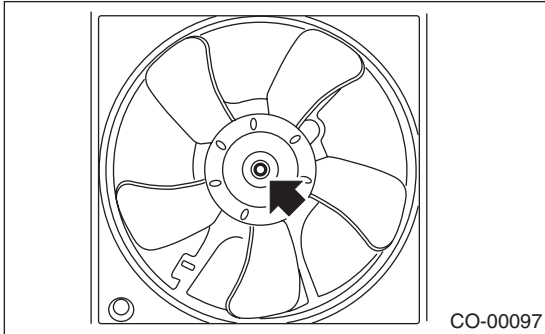
# Radiator Sub Fan and Fan Motor

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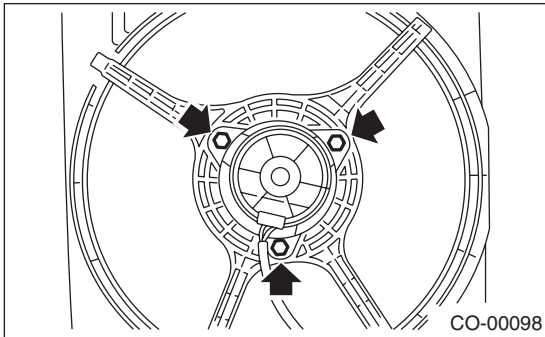
## COOLING

### C: DISASSEMBLY

- 1) Remove the clip which holds the fan motor connector to the shroud.
- 2) Remove the nuts which hold the fan to the fan motor.



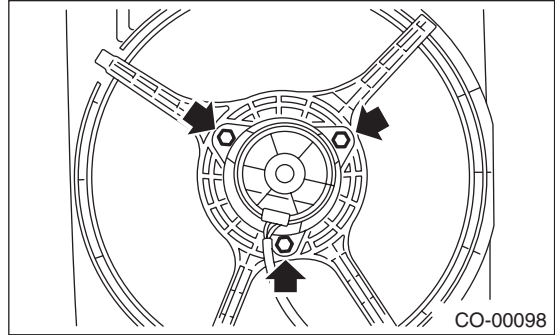
- 3) Remove the bolts which hold fan motor onto shroud.



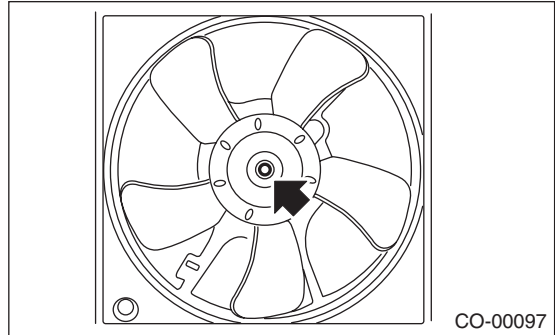
### D: ASSEMBLY

Assemble in the reverse order of disassembly.

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



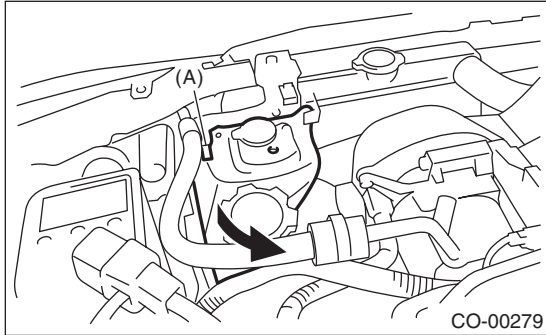
**Tightening torque:**  
**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**



## 10. Reservoir Tank

### A: REMOVAL

- 1) Disconnect the over flow hose connected to the radiator filler neck.
- 2) Push in the hook (A), and pull the reserve tank in the direction of the arrow to remove.



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

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

# Engine Cooling System Trouble in General

COOLING

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## 11.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(H4SO)(diag)-2, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Engine oil mixed in engine coolant	Replace the engine coolant. If it is ineffective, inspect and repair the engine side.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4SO)(diag)-2, 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	Correct 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	Correct or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Correct or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace gasket.
	e. Cylinder head and block damaged or cracked	Correct or replace.
	f. Damaged or cracked thermostat case	Correct or replace.
	g. Leakage from radiator	Correct or replace.
Abnormal 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.