COOLING
H4DOTC

1. General

● The engine cooling system consists of a down-flow radiator which features high heat-dissipation performance, an electric-motor-driven fan, a water pump, a thermostat, and an engine coolant temperature sensor.

● The reservoir tank is made of translucent resin and enables easy confirmation of the coolant level. Also, coolant should be added to the reservoir tank when replenishment is necessary.

● The ECM controls the operation of the radiator main fan and sub fan depending on the signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch.

2. Cooling Circuits

The cooling system operates in three different phases depending on the temperature of the engine coolant.

- 1st phase (thermostat closed)

When the engine coolant temperature is below 76 °C (169 °F), the thermostat remains closed. The coolant flows through the bypass and heater circuits. This permits the engine to warm up quickly.

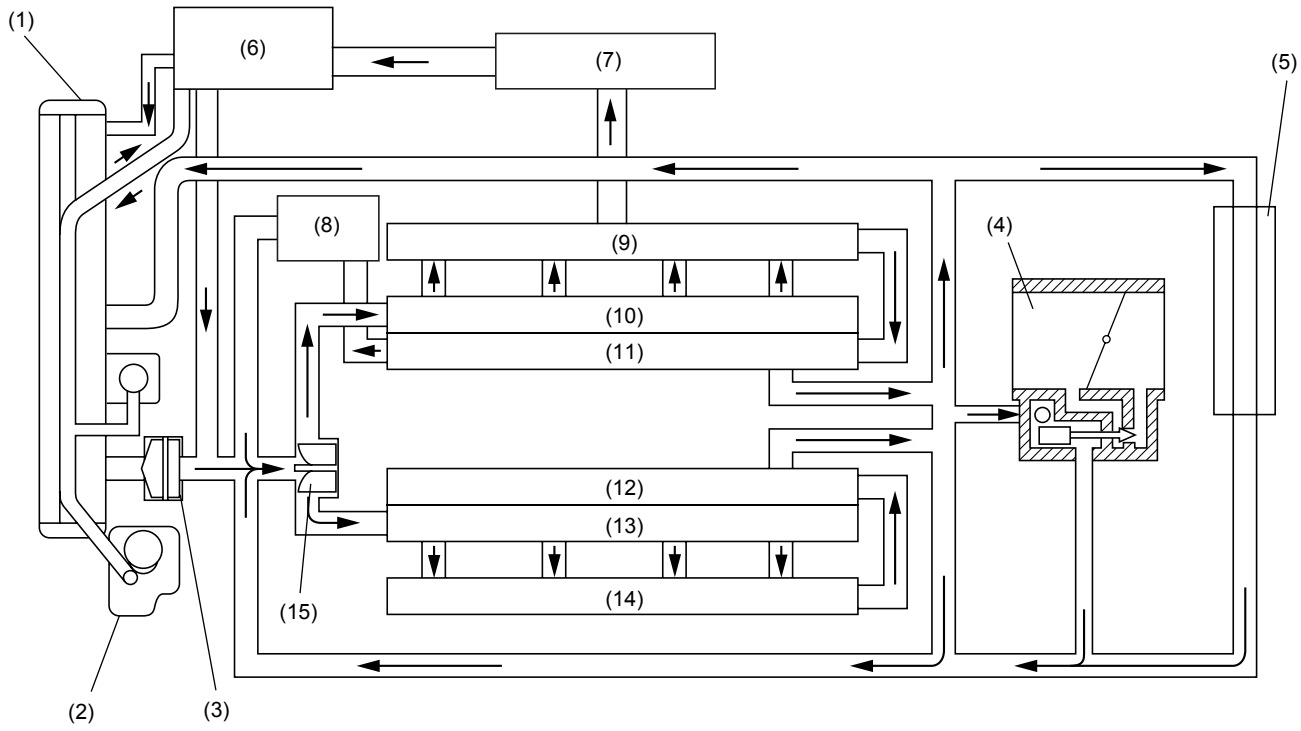
- 2nd phase (thermostat open)

When the engine coolant temperature is above 76 — 80°C (169 — 176°F), the thermostat opens.The coolant flows through the radiator where it is cooled.

- 3rd phase (thermostat open and radiator fan operating)

When the engine coolant temperature sensor sends a signal indicating a temperature above 95 °C (203°F) to the ECM, it causes the radiator fan (or fans) to operate. When the engine is stopped after high-speed operation, vapor produced in the turbocharger cooling section flows from the coolant filler tank to the reservoir tank where it condenses back into water. Water is then absorbed by the coolant filler tank as the engine cools down.

COOLING CIRCUITS

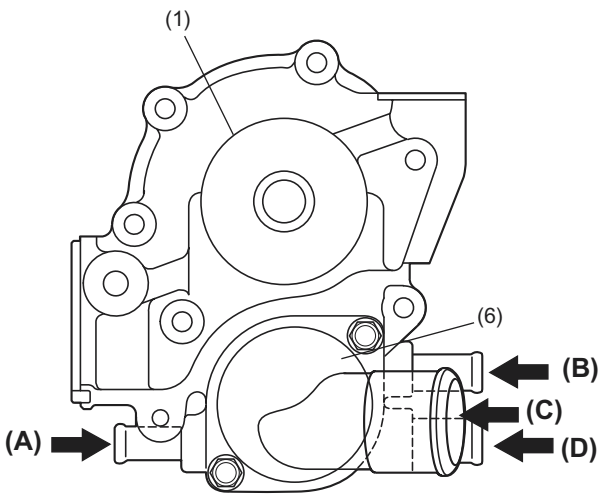


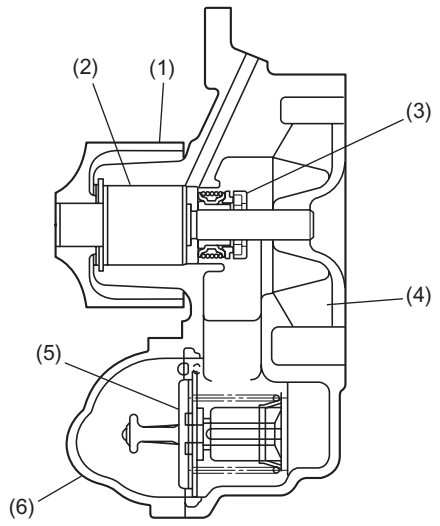
CO-00238

(1) Radiator
(2) Engine coolant reservoir tank
(3) Thermostat
(4) Throttle body
(5) Heater core
(6) Coolant filler tank
(7) Turbocharger
(8) Oil cooler (water cooled)
(9) Cylinder head RH
(10) Cylinder jacket RH
(11) Cylinder block RH
(12) Cylinder block LH
(13) Cylinder jacket LH
(14) Cylinder head LH
(15) Water pump

3. Water Pump

The water pump is located in the front portion of the left bank cylinder block and is driven by the engine through the timing belt. The thermostat is fitted into the coolant inlet at the bottom of the water pump. When the pump's impeller rotates, the coolant is drawn into the pump from the lower pipe (which is connected to the radiator hose) via the thermostat. It then flows along the perimeter of the impeller and then is discharged for circulation through a circuit depending on the coolant temperature.





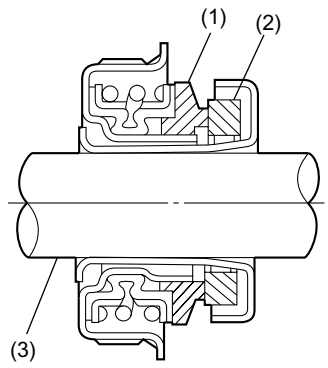
CO-00068

(A) From engine oil cooler
(B) From water tank
(C) From radiator
(D) From heater

(1) Pulley
(2) Ball bearing
(3) Mechanical seal
(4) Impeller
(5) Thermostat
(6) Thermostat cover

4. Mechanical Seal

The mechanical seal has its seat tightly fitted on the water pump shaft. Since it is a hermetic seal forming an integral part of the water pump, the water pump cannot be disassembled.

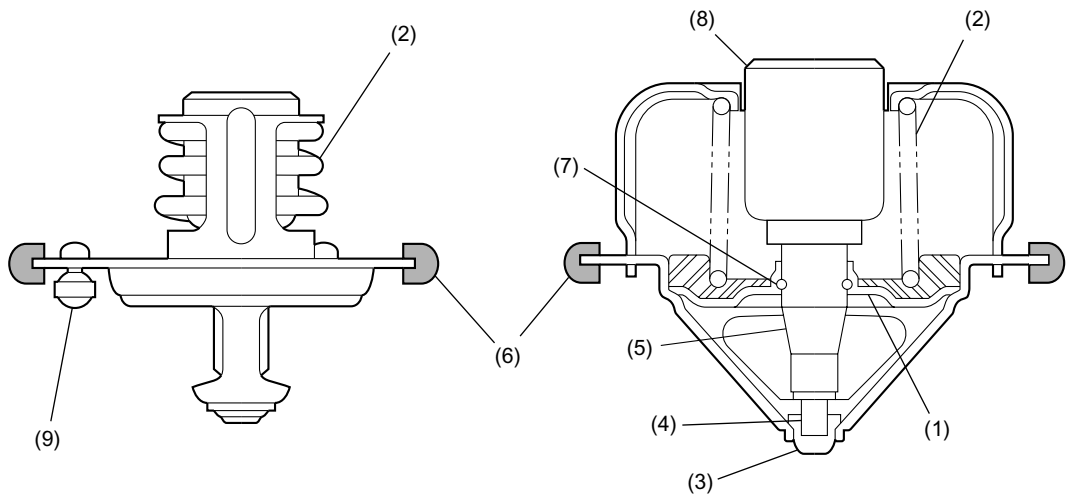


CO-00058

(1) Carbon seal
(2) Ceramics seat
(3) Water pump shaft

5. Thermostat

The thermostat has a totally-enclosed wax pellet which expands as the coolant temperature increases. It opens and closes accurately at the preset temperatures and features high durability.



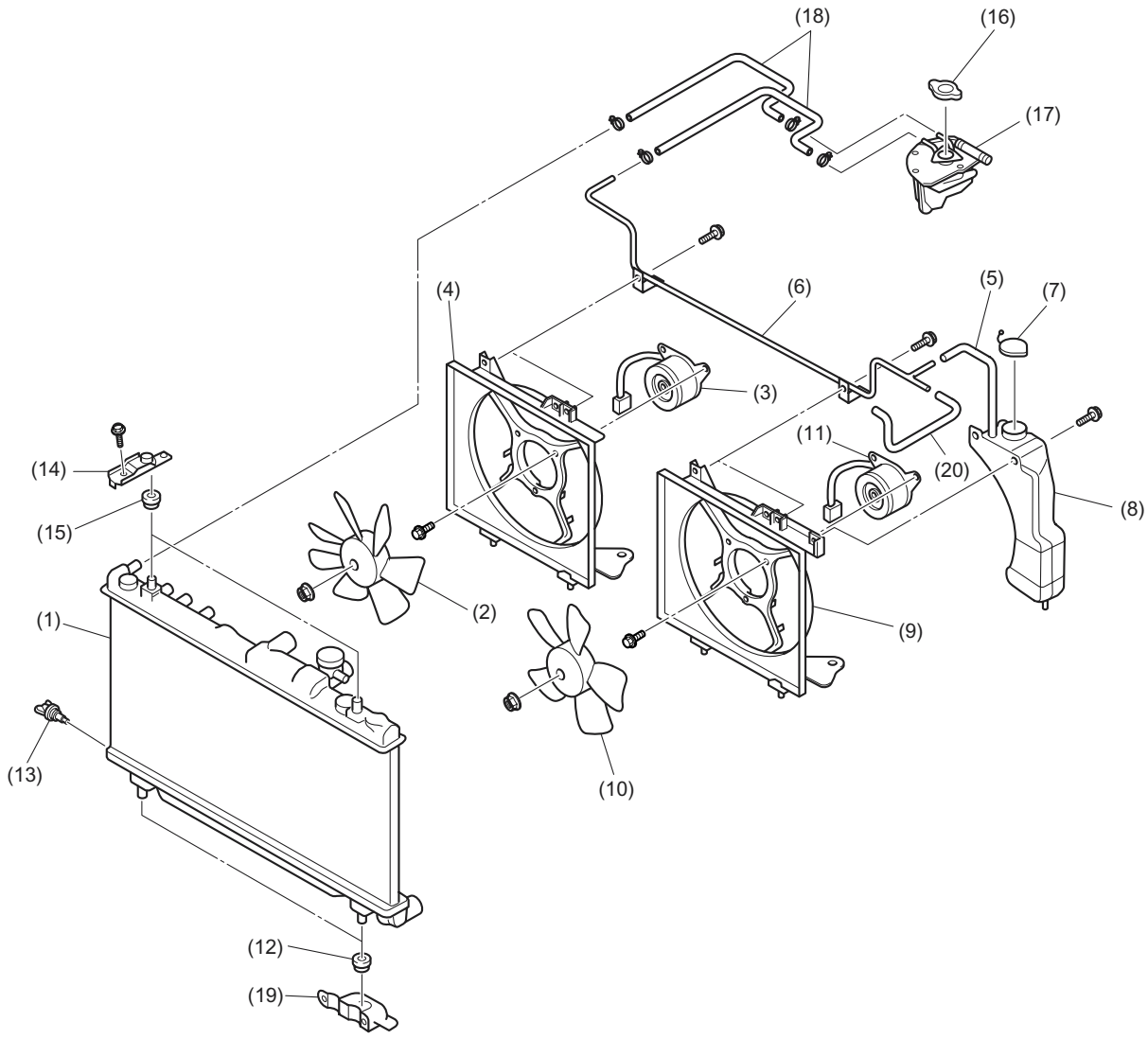
CO-00059

(1) Valve
(2) Spring
(3) Stopper
(4) Piston
(5) Guide
(6) Rubber packing
(7) Stop ring
(8) Wax element
(9) Jiggle valve

6. Radiator Fan

A: DESCRIPTION

Each radiator fan is made of plastic. It is driven by an electric motor which is retained on a shroud.



CO-00244

(1) Radiator
(2) Radiator sub fan (models with A/C)
(3) Radiator sub fan motor (models with A/C)
(4) Radiator sub fan shroud (models with A/C)
(5) Overflow hose (A)
(6) Overflow pipe
(7) Reservoir tank cap
(8) Reservoir tank
(9) Radiator main fan shroud
(10) Radiator main fan
(11) Radiator main fan motor
(12) Lower cushion
(13) Drain plug
(14) Upper bracket
(15) Upper cushion
(16) Radiator cap (coolant filler tank cap)
(17) Coolant filler tank
(18) Coolant hose
(19) Lower bracket
(20) Overflow hose (B)

A/C: Air conditioning system

B: FUNCTION

1. MODELS WITHOUT A/C

The ON-OFF control and Hi-Low control of the radiator fan is performed by the ECM which receives signals from the engine coolant temperature sensor.

Vehicle speed	Engine coolant temperature		
	Lower than 90°C (194°F)	Between 90 and 95°C (194 and 203°F)	Higher than 96°C (205°F)
	Operation of radiator fans	Operation of radiator fans	Operation of radiator fans
Lower than 19 km/h (12 MPH)	OFF	OFF	Low speed
Between 20 and 69 km/h (12 and 43 MPH)	OFF	OFF	High-Speed
Between 70 and 105 km/h (43 and 65 MPH)	OFF	OFF	High-Speed
Higher than 106 km/h (66 MPH)	OFF	OFF	High-Speed

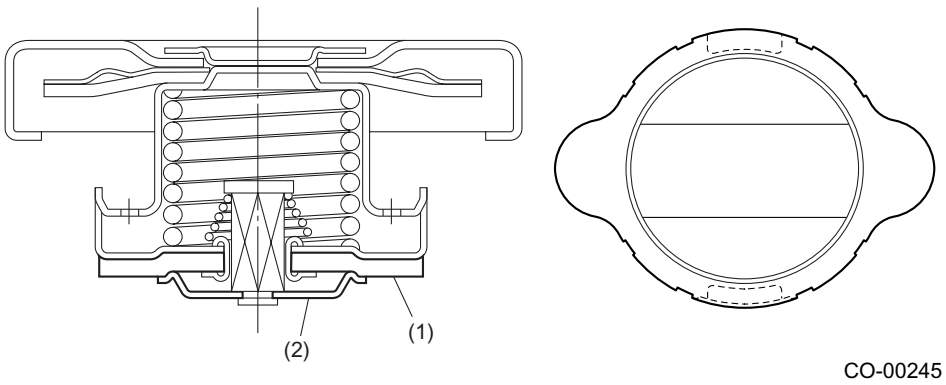
2. MODELS WITH A/C

On models equipped with an air conditioning system, the ECM or ECM/TCM receives signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch, and based on these signals, the ECM controls the HIGH-LOW of the radiator main fan and sub fan.

Vehicle speed	A/C compressor	Engine coolant temperature					
		Lower than 90°C (194°F)		Between 90 and 95°C (194 and 203°F)		Higher than 96°C (205°F)	
		Operation of radiator fans		Operation of radiator fans		Operation of radiator fans	
		Main fan	Sub fan	Main fan	Sub fan	Main fan	Sub fan
Lower than 19 km/h (12 MPH)	OFF	OFF	OFF	OFF	OFF	Low-Speed	Low-Speed
	ON	Low-Speed	Low-Speed	High-Speed	High-Speed	High-Speed	High-Speed
Between 20 and 69 km/h (12 and 43 MPH)	OFF	OFF	OFF	OFF	OFF	High-Speed	High-Speed
	ON	High-Speed	High-Speed	High-Speed	High-Speed	High-Speed	High-Speed
Between 70 and 105 km/h (43 and 65 MPH)	OFF	OFF	OFF	OFF	OFF	High-Speed	High-Speed
	ON	Low-Speed	Low-Speed	Low-Speed	Low-Speed	High-Speed	High-Speed
Higher than 106 km/h (66 MPH)	OFF	OFF	OFF	OFF	OFF	High-Speed	High-Speed
	ON	OFF	OFF	Low-Speed	OFF	High-Speed	High-Speed

7. Radiator Cap

The radiator cap at the coolant filler tank side has a pressure valve and a vacuum valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. Also, when the radiator inner pressure becomes lower than the atmospheric pressure during the cooling down phase, the vacuum valve opens to send back coolant from the reservoir tank to the radiator. These functions prevent damage to the radiator components.



CO-00245

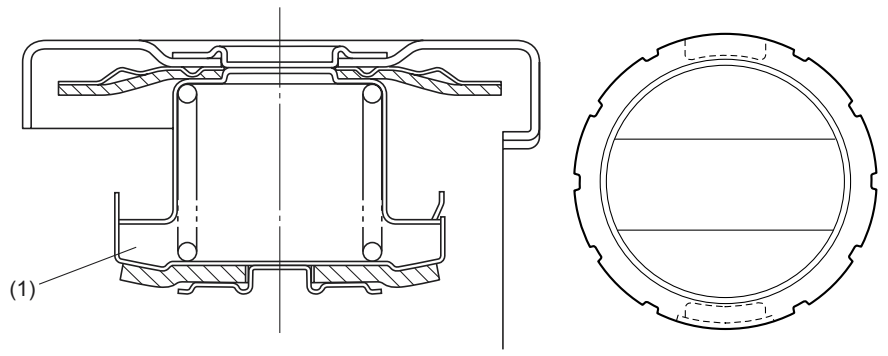
(1) Pressure valve

(2) Vacuum valve

8. Relief Valve Cap

The relief valve cap at the radiator side has a pressure valve. When the radiator inner pressure becomes higher than specified, the pressure valve opens to send coolant to the reservoir tank. This function prevents damage to the radiator components.

CAUTION:
Due to the difference in construction, the relief valve cap cannot be used in place of the radiator cap at the coolant filler tank side. If the relief valve cap is fit on the coolant filler tank, overheating may occur.



CO-00246

(1) Pressure valve