

# **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.

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## 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 the preset temperature, the thermostat remains closed. The coolant flows through the heater circuit. This permits the engine to warm up quickly.

- 2nd phase (thermostat open)

When the engine coolant temperature becomes higher than the preset temperature, the thermostat opens. The coolant flows through the radiator where it is cooled.

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

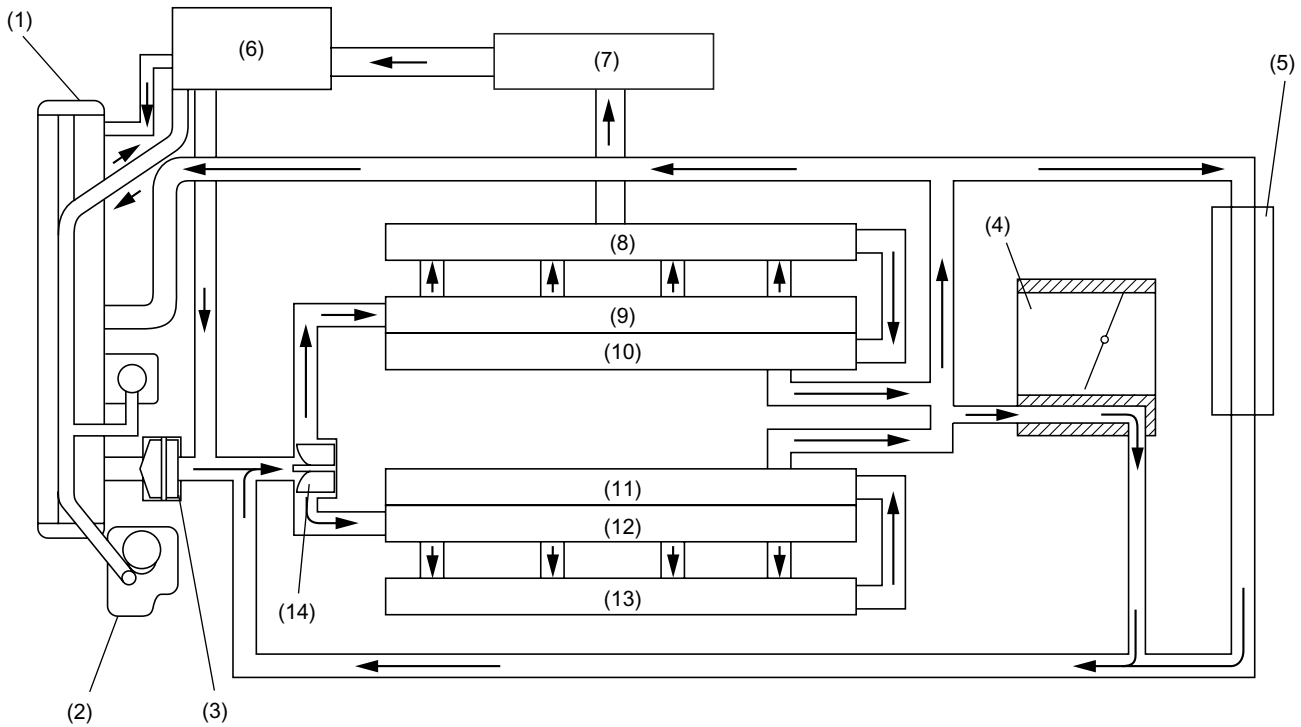
When the engine coolant temperature sensor becomes hotter than the preset value, the ECM receives signals from the engine coolant temperature sensor and causes the radiator fan(s) to operate. When the engine is stopped after high-speed operation, vapor produced in the turbocharger cooling section flows 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.

**NOTE:**

Refer to the Service Manual for preset engine coolant temperature values for each stage.

# COOLING CIRCUITS

## COOLING

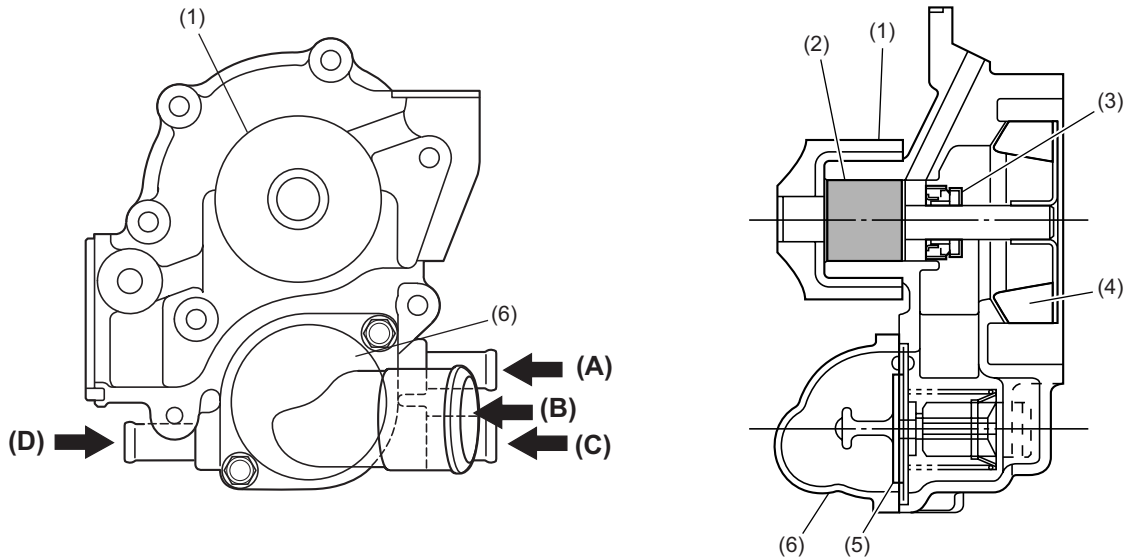


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- |                                   |                         |
|-----------------------------------|-------------------------|
| (1) Radiator                      | (8) Cylinder head RH    |
| (2) Engine coolant reservoir tank | (9) Cylinder jacket RH  |
| (3) Thermostat                    | (10) Cylinder block RH  |
| (4) Throttle body                 | (11) Cylinder block LH  |
| (5) Heater core                   | (12) Cylinder jacket LH |
| (6) Coolant filler tank           | (13) Cylinder head LH   |
| (7) Turbocharger                  | (14) 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-02117

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

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

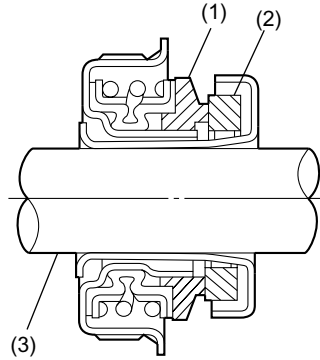
# MECHANICAL SEAL

COOLING

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## 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.

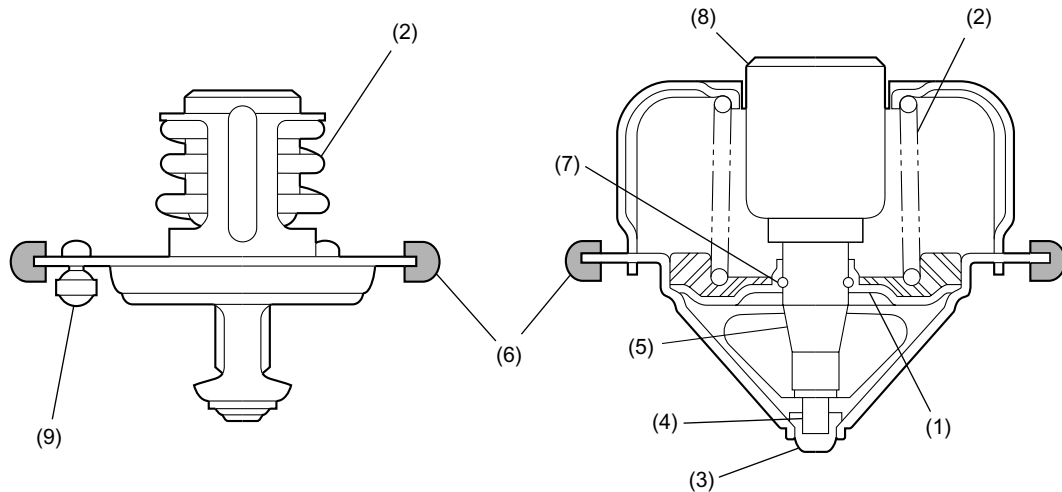


CO-00058

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

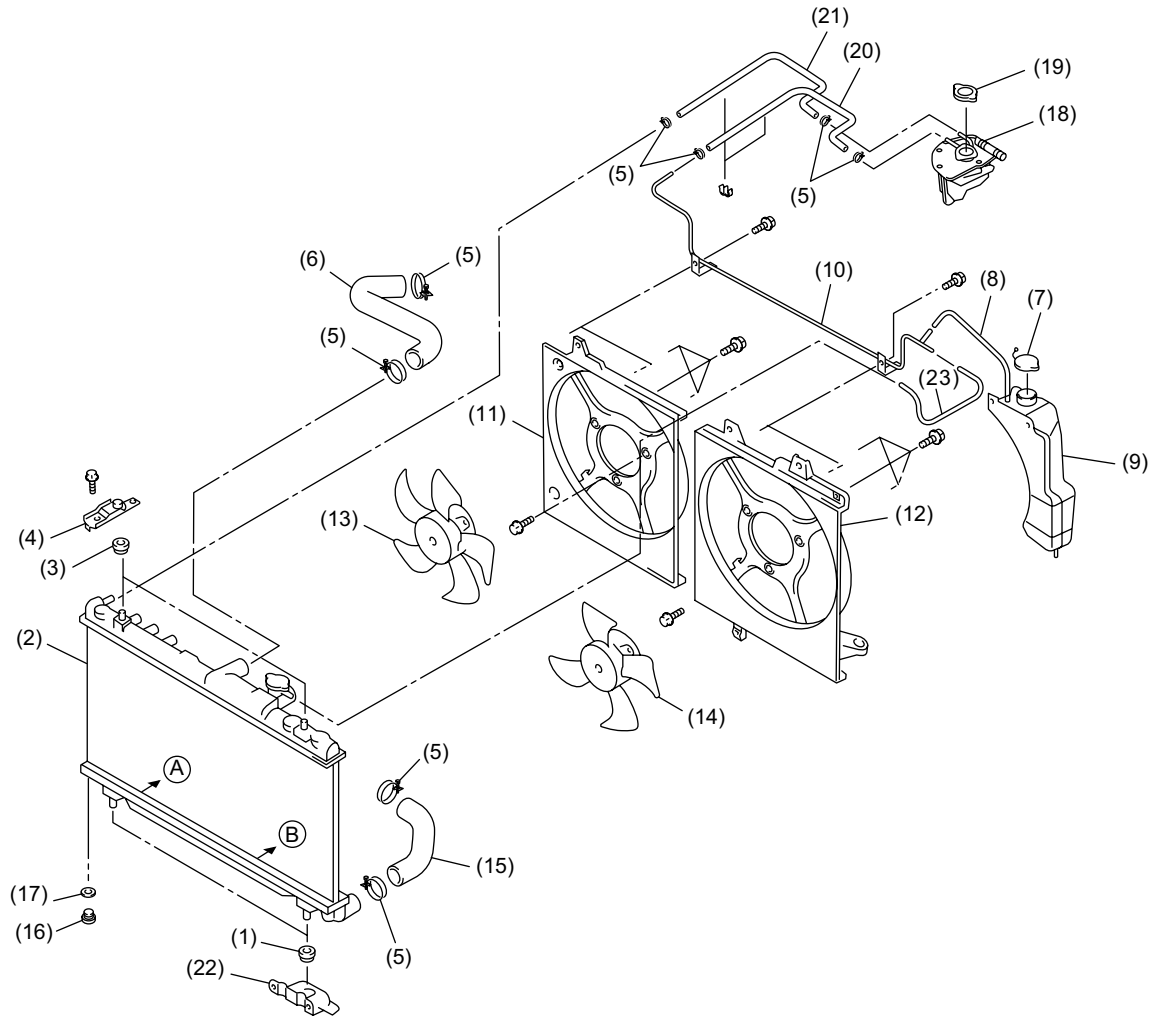
# RADIATOR FAN

COOLING

## 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.



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# RADIATOR FAN

COOLING

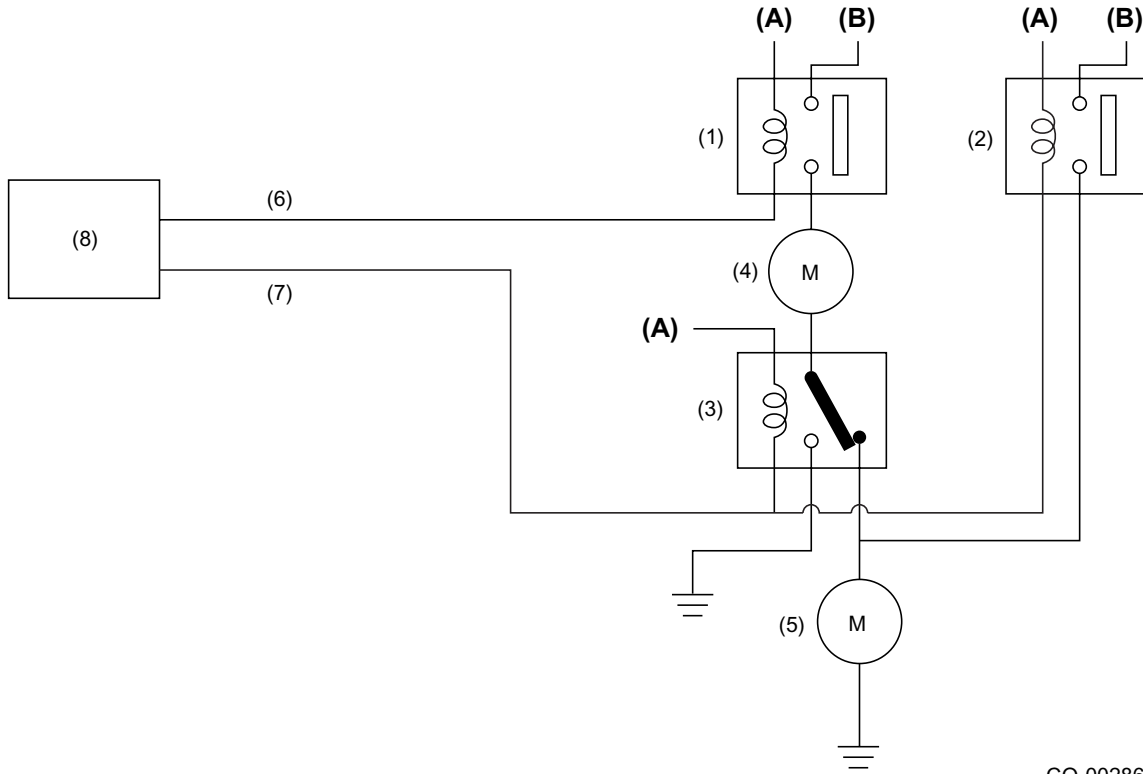
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- |                                       |  |
|---------------------------------------|--|
| (1) Radiator lower cushion            | (13) Radiator main fan assembly                    |
| (2) Radiator                          | (14) Radiator sub fan assembly                     |
| (3) Radiator upper cushion            | (15) Radiator hose B                               |
| (4) Radiator upper bracket            | (16) Radiator drain plug                           |
| (5) Clamp                             | (17) O-ring  |
| (6) Radiator hose A                   | (18) Engine coolant filler tank                    |
| (7) Engine coolant reservoir tank cap | (19) Radiator cap (engine coolant filler tank cap) |
| (8) Overflow hose A                   | (20) Engine overflow hose                          |
| (9) Engine coolant reservoir tank     | (21) Engine air breather hose                      |
| (10) Overflow pipe                    | (22) Radiator lower bracket                        |
| (11) Radiator main fan shroud         | (23) Overflow hose B                               |
| (12) Radiator sub fan shroud          |  |

# RADIATOR FAN

## COOLING

To reduce fan noise, the fan output is two-stepped and can be switched to Low or High according to the load on A/C, coolant temperature, and vehicle speed. This control is accomplished by a circuit as shown below; the output is changed by switching the connection of two motors between serial and parallel instead of using components such as resistors.



CO-00286

- |                      |                          |
|----------------------|--------------------------|
| (1) Sub fan relay    | (6) Low speed signal     |
| (2) Main fan relay 1 | (7) High speed signal    |
| (3) Main fan relay 2 | (8) ECM                  |
| (4) Sub fan motor    | (A) From ignition switch |
| (5) Main fan motor   | (B) From battery         |

# RADIATOR FAN

## B: FUNCTION

The ECM receives signals from the engine coolant temperature sensor, vehicle speed sensor and A/C switch, and based on these signals, the ECM controls the radiator fan speed to high or low.

**NOTE:**

Refer to the Service Manual for operation of each model.

**Operation example:**

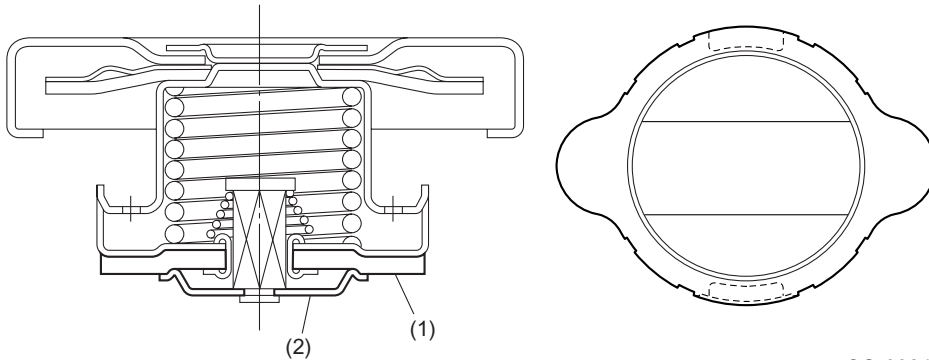
Vehicle speed	A/C compressor load	Engine coolant temperature		
		Rising: below 94°C (201°F) Lowering: below 91°C (196°F)	Rising: between 95 and 96°C (203 and 205°F) Lowering: between 92 and 94°C (198 and 201°F)	Rising: over 97°C (207°F) Lowering: over 95°C (203°F)
		Operation of radiator fans	Operation of radiator fans	Operation of radiator fans
When accelerating: below 19 km/h (12 MPH) When decelerating: below 10 km/h (6 MPH)	OFF	OFF	Low-speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 20 and 69 km/h (12 and 43 MPH) When decelerating: between 11 and 64 km/h (7 and 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: between 70 and 105 km/h (43 and 65 MPH) When decelerating: between 65 and 100 km/h (40 and 62 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
When accelerating: over 106 km/h (66 MPH) When decelerating: over 101 km/h (63 MPH)	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed

# RADIATOR CAP

COOLING

## 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

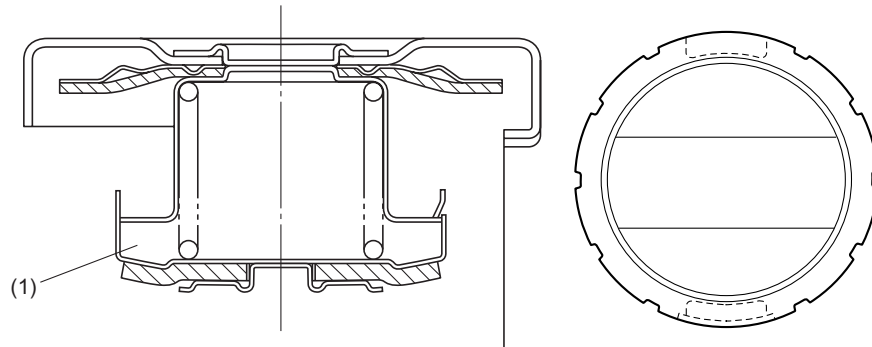
- (1) Pressure valve
- (2) Vacuum valve

## 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