

## COOLING SYSTEM

	Page
DESCRIPTION .....	6 - 1
WATER PUMP .....	6 - 3
Removal .....	6 - 4
Disassembly .....	6 - 4
Inspection & Repair .....	6 - 4
Assembly .....	6 - 5
Installation .....	6 - 5
RADIATOR .....	6 - 5
Removal .....	6 - 6
Inspection & Repair .....	6 - 6
Installation .....	6 - 6
THERMOSTAT .....	6 - 6
Inspection .....	6 - 6
Installation .....	6 - 6
FAN MOTOR .....	6 - 6
Removal .....	6 - 7
Disassembly .....	6 - 7
Inspection .....	6 - 7
Assembly .....	6 - 7
RADIATOR THERMIC CONTROL SWITCH .....	6 - 8
Inspection .....	6 - 8
RADIATOR THERMIC CONTROL RELAY .....	6 - 8



## DESCRIPTION

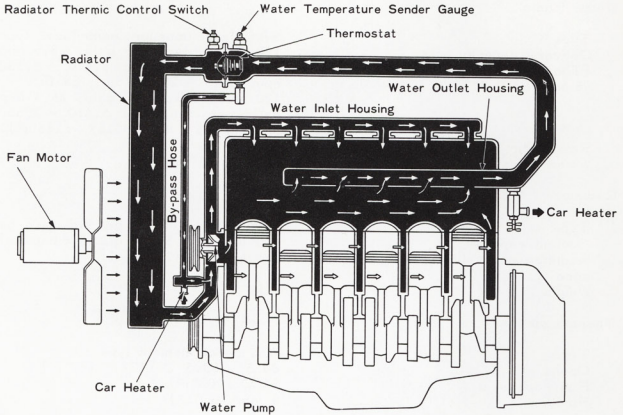


Fig.6-1 Engine Cooling System

Y5047

The cooling system of this engine is of a pressure forced circulation type, insuring positive cooling efficiency.

The coolant used must be of Long-life coolant (Permanent-type coolant).

The radiator is a cross-pass-flow corrugated fin and tube type, and the pressure type radiator cap maintains a pressure of approximately  $0.9 \text{ kg/cm}^2$  (12.8 psi) in the cooling system when the engine is at normal operating temperature.

The water pump is of a centrifugal type provided with six blade impeller installed at the right front of the engine, to shorten the engine overall length.

The thermostat is a wax pellet element type, and it enables the engine to warm up quickly in cold weather, and provides efficient regulation of the coolant temperature.

The coolant pumped from the bottom of the radiator is forced circulated into the passages, and water jackets in the cylinder block, and around the combustion chambers where the engine heats up to the highest temperature to prevent hot spots, and then is returned through the upper outlet into the radiator.

The cooling fan is electro-motion type, and when the coolant temperature reaches about  $90 \sim 95^\circ \text{C}$  ( $194 \sim 203^\circ \text{F}$ ) the fan motor will operate. The operation is controlled by the radiator thermic control switch, and provides efficient regulation of the coolant temperature.

## 6-2 COOLING SYSTEM - Description

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### Specification

#### Water Pump

Type	Six blade impeller centrifugal type
Delivery capacity (Thermostat opening stroke at 5 mm or 0.2")	130 liters (34.3 US gals, 28.6 Imp gals) per minute at 3,470 ~ 3,530 rpm at 15 ~ 20°C (59 ~ 68°F). 120 liters (31.7 US gals, 26.4 Imp gals) per minute at 3,470 ~ 3,530 rpm at 75 ~ 85°C (167 ~ 185°F).
Revolution ratio with crankshaft	128 to 115
Water seal	Mechanical seal

#### Radiator

Type	Cross flow corrugated fin and tube
Coolant capacity	4.3 liters (4.5 US qts, 3.8 Imp qts)
Radiator cap valve opening pres- sure	0.9 kg/cm <sup>2</sup> (12.8 psi)
Weight	6 kg (13.2 lb)

#### Thermostat

Type	Wax pellet element type
Opens at	80.5 ~ 83.5°C (177 ~ 182°F)
Fully opens at	95°C (203°F)
Stroke	8 mm (0.31")

#### Fan Motor

Motor type	Direct current, series wound
Voltage	12 volts
Direction of revolution	Clockwise
No-load characteristic	
Voltage	at 12 volts
Amperage	Less than 3.2 amperes
Revolution	More than 4,000 rpm
Loaded characteristic	
Voltage	at 12 volts
Torque	at 0.78 ~ 0.82 cm-kg (0.68 ~ 0.71 in lb)
Revolution	2,300 ~ 2,900 rpm
Amperage	4.6 ~ 4.7 amperes

#### Radiator Thermic Control Relay

Voltage	12 volts
Amperage	Less than 0.15 ampere
Point contact pressure	More than 100 grams (3.53 oz)

WATER PUMP

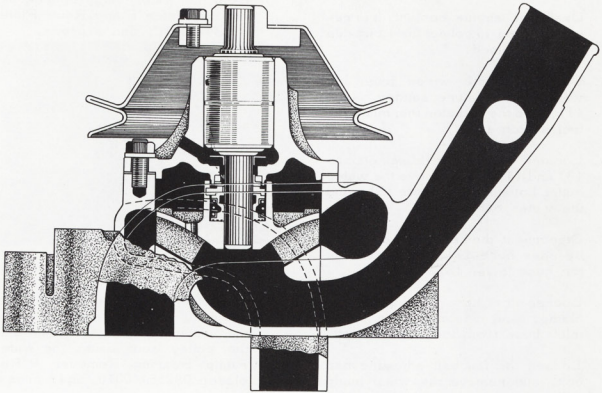
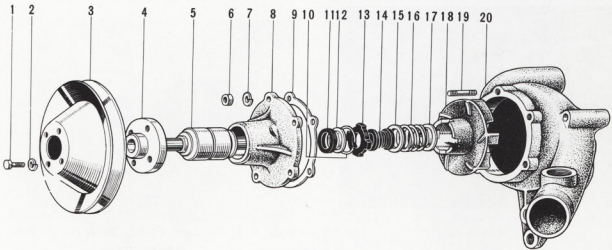


Fig. 6-2 Cross Sectional View of Water Pump

Y2346



- |                |                     |                 |
|----------------|---------------------|-----------------|
| 1. Bolt        | 8. Water pump cover | 15. Spring seat |
| 2. Lock washer | 9. Gasket           | 16. Spring      |
| 3. Pulley      | 10. Hole snap ring  | 17. Spring seat |
| 4. Pulley seat | 11. Gasket          | 18. Rotor       |
| 5. Bearing     | 12. Floating seat   | 19. Stud bolt   |
| 6. Nut         | 13. Thrust washer   | 20. Body        |
| 7. Lock washer | 14. Shaft seal      |                 |

Fig. 6-3 Water Pump Components

Y5048

**Removal**

1. Drain the engine coolant. It is recommended to collect the Long-life coolant if used.
2. Disconnect the wires from the water temperature sender gauge (1), and the radiator thermic control switch (2).
3. Loosen the water hose clamps (3) and (4), and remove the water outlet housing connector (5), and the water outlet (6).
4. Disconnect the heater hose, water by-pass hose (7), and the radiator hose lower (8).
5. Loosen the hose heat protector clamp, and disconnect the water inlet hose from the water pump.
6. Loosen the fan belt adjusting bar bolt, and remove the water pump pulley.  
Remove the "V" belt.
7. Remove the water pump assembly.

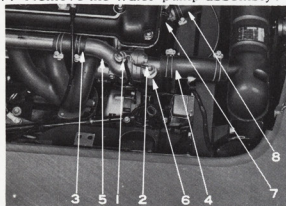


Fig. 6-4 Water Pump Removal V1267

**Disassembly**

1. Separate the water pump cover from the water pump body.
2. Pull up the water pump pulley seat from the water pump bearing using the Water Pump Pulley Seat Puller 09235-20010.

3. Remove the water pump rotor from the water pump bearing using the Water Pump Rotor Puller 09239-40010, and a press.

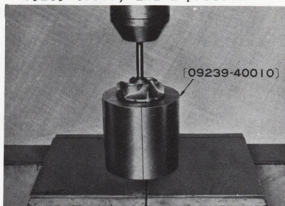


Fig. 6-5 Removing Water Pump Rotor W0656

4. Heat the water pump cover to about 80° C (176° F), and remove the water pump bearing towards the pulley seat using the Water Pump Bearing Remover & Replacer 09238-40010, and a press.
5. Remove the hole snap ring (1), and remove the water pump seal (2) from the water pump rotor (3).

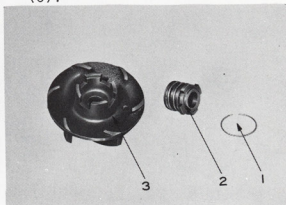


Fig. 6-6 Water Pump Rotor V1268 Disassembly

6. If necessary, remove the water pump floating seat, and the gasket from the water pump cover.

**Inspection & Repair**

Wash all parts except the water pump bearing, and the water pump seal in

cleaning solvent.

The bearing is a permanent sealed and lubricated bearing, and should not be washed in cleaning solvent.

1. Inspect the bearing for roughness or excessive end play.
2. Inspect the water pump body, and the water pump cover for cracks.
3. Inspect the seat for seal on the rotor for pits or scores.
4. Check the water pump seal for wear or damage.  
It is recommended that seal should be replaced at the time of assembly.
5. Inspect the rotor and pulley seat fitting portion at the end of the water pump bearing.  
If necessary, replace the bearing, rotor, and the pulley seat.

### Assembly

Follow the disassembly procedures in the reverse order.

1. Heat the water pump cover to about 80°C (176°F), and install the bearing into the water pump cover using the Water Pump Bearing Remover & Replacer 09238-40010, and a press.

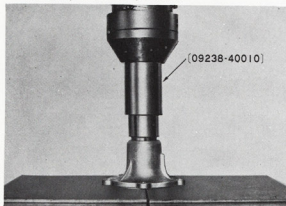


Fig.6-7 Installing Water Pump Bearing W0659

Applying pressure onto the outer race of the bearing until it is flush with the front of the water pump cover.

2. When assembling the water pump rotor onto the bearing shaft, coat the water pump thrust washer with engine oil.  
Apply pressure onto the rotor until it is flush with the end of the bearing shaft.
3. After the assembly, check the water pump rotor for free movement.

### Installation

Follow the removal procedures in the reverse order.

1. Adjust the "V" belt tension with the fan belt adjusting bar to 8 to 10 mm (0.31 ~ 0.39").
2. After installation, operate the engine, and check for water leaks.

The coolant capacity is 14 liters (14.8 US qts, 12.3 Imp qts)

### RADIATOR

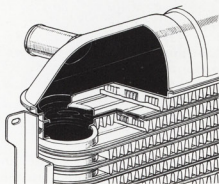


Fig.6-8 Radiator Cross Section View G0080

Removal

1. Drain the engine coolant. If a Long life coolant is used, do not discard the coolant.
2. Unscrew the radiator lower shroud securing bolts, and remove the shroud.
3. Loosen the hose clamps, and disconnect the radiator hoses upper and lower from the radiator.
4. Unscrew the radiator mounting bolts, then remove the radiator.

Inspection & Repair

1. Check the radiator for leaks.
2. Check the radiator core fin for clogging the air passages.
3. If the clogging of the radiator core is more than 20 percent of the radiator area, replace the radiator.
4. Check the radiator cap operation. Several types of pressure gauges are available for use, therefore, it is recommended that the gauge, manufacturer's instructions be followed when performing the test. The radiator cap valve opening pressure should be  $0.9 \text{ kg/cm}^2$  (12.8 psi).

Installation

Follow the removal procedures in the reverse order.

## THERMOSTAT

1. Drain the engine coolant.
2. Disconnect the wire from the radiator thermic control switch, and loosen the hose clamps. Remove the radiator upper hose.
3. Separate the water outlet from the water outlet housing connector, then remove the thermostat.

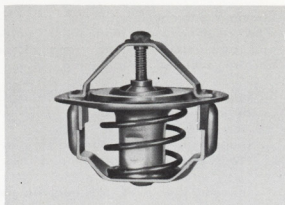


Fig.6-9 Thermostat V1269

Inspection

The thermostat which opens at normal temperature should be replaced. Submerge the thermostat into hot water for test.

Agitate the water thoroughly during the test to obtain uniform temperature. The thermostat is satisfactory if it begins to open, fully open, and closes at the specified temperature.

Replace the thermostat if it is not within the specified operation.

Installation

Follow the removal procedures in the reverse order.

When installing, position the hole in the thermostat flange upward.

## FAN MOTOR

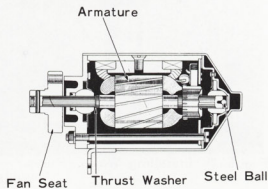


Fig.6-10 Cross Sectional View of Fan Motor X6172



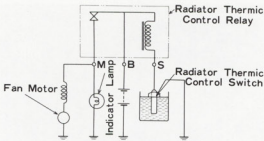


Fig.6-11 Cooling Fan Circuit X6173

Removal

1. Disconnect the engine room inspection light wire, and remove the engine hood.
2. Disconnect the fan motor wire from the wire connector, and remove the fan blade.
3. Unscrew the fan motor mounting bolts, then remove the fan motor, and the fan motor base shim.

Disassembly

1. Remove the fan motor cover from the fan motor.
2. Remove the fan seat lock screw and pin, then remove the fan seat.
3. Remove the through bolts (5), and nuts, and separate the fan motor bearing holder (1), armature (4).

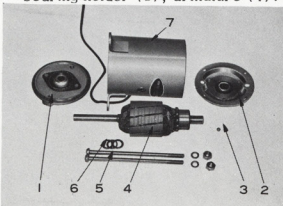


Fig.6-12 Fan Motor V1270 Disassembly

and the end frame (2) from the yoke (7).  
Do not lose the steel ball (3) at the end of the armature shaft.

Inspection

1. Check the armature coil for ground by connecting the tester between the commutator segment, and the armature core.
2. Check the armature coil for open circuit. Connect the tester between the two segments.
3. Check the armature for short circuit by placing the armature on a growler, and hold a hacksaw blade over the armature core while the armature is rotated.  
If the hacksaw blade vibrates, the armature coil is shorted.
4. Check the field coil for ground. Connect the tester between the field coil lead, and the yoke.
5. Check the field coil for open circuit. Connect the tester between the field coil lead, and the other lead.
6. Check the brush length, and if the length is less than 8.0 mm (0.31") replace the brush/es.
7. Check the commutator for roughness, burnt or scored surface, and if necessary, clean or dress the commutator.  
The diameter serviceable limit is 22.5 mm (0.89").

Assembly

Follow the disassembly procedures in the reverse order.

1. Apply a coat of multipurpose grease at the ends of the armature shaft and the steel ball.
2. After assembling, check the armature shaft thrust clearance.

The clearance should be 0.05 to 0.25 mm (0.002 ~ 0.01"). If necessary, adjust the clearance with the thrust washer.

3. After installing the cover over the fan motor, apply an adhesive cement between the cover, and the fan motor, and an eyelet to the lead wire.

RADIATOR THERMIC CONTROL SWITCH

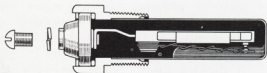


Fig.6-13 Radiator Thermic X6174 Control Switch

Inspection

Submerge the control switch into hot water for conductance test. Agitate the water thoroughly during the test to obtain uniform temperature. Connect the tester between the terminal screw, and the body. If the control switch becomes conductive at 90 ~ 95°C (194 ~ 203°F), and cuts off at 83 ~ 90°C (181 to 194°F), it is satisfactory. If defective, replace the switch.

RADIATOR THERMIC CONTROL RELAY

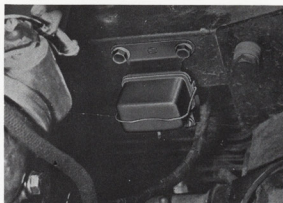


Fig.6-14 Radiator Thermic Control Relay V1279

This relay is mounted on the upper cross member, and is for the purpose in supplying large current to the fan motor, and is to protect the radiator thermic control switch.

Connect the battery positive lead to the "B" terminal, and negative lead to the "S" terminal on the relay. At this time, if the armature of the switch is pulled with 8 ~ 10 volts, the relay is satisfactory.

An arrow mark is stamped on the relay cover, therefore, this mark must be positioned upward upon installation.

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