7. ENGINE COOLING SYSTEM

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7–1. Description

The engine is cooled by coolant set in forced recirculation through jackets formed in the engine body and through the radiator. For the water pump, a high-capacity centrifugal pump is used. For the radiator, a tube-and-fin type, large in heat dissipating capacity, is used.

The thermostat is of wax pellet type, accurately responsive to temperature changes and durable in construction. It maintains the coolant temperature within a narrow range during operation.

7–2. Cooling Water Circuit

The thermostat remains in closed condition - its valve is closed - when the coolant is cold. Under this condition, the coolant being pumped flows through the circuit comprising cylinder block, cylinder head, inlet manifold, bypass hose and water pump, in that order.

As the temperature rises to 82° C (179° F) or thereabout, the thermostat begins to open, thereby allowing some of the coolant in recirculation to flow through the radiator. At about 95° C(203° F) of rising coolant temperature, the thermostat becomes completely open so that little or no flow occurs through the bypass hose: the coolant now flow through the radiator and back to the pump, releasing the most of heat to the atmosphere through the radiator core.

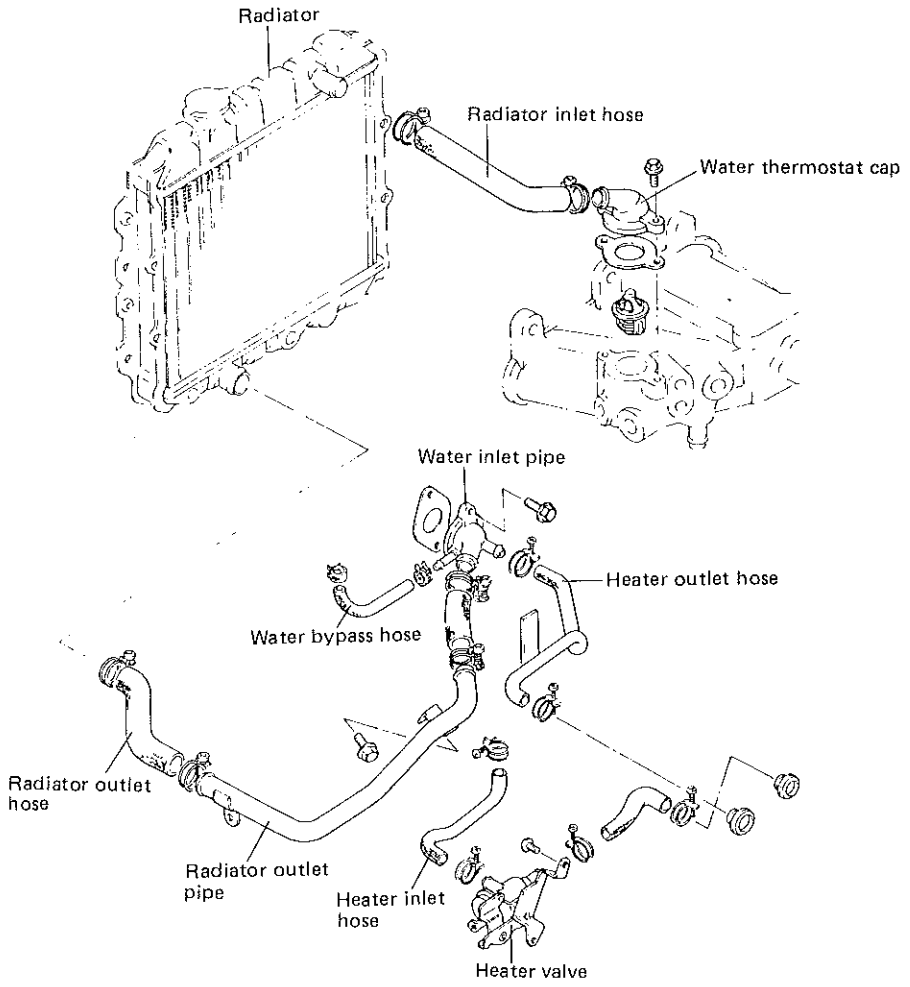


Fig. 7-1

7–3. Removal

Coolant draining

Disconnect the lead wire from the radiator fan thermo switch, and remove the thermo switch on the radiator to empty its water.

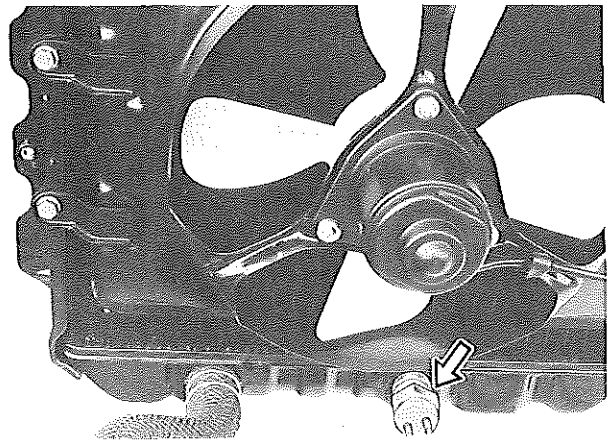


Fig. 7-2

The drain plug ② for engine water jackets is located below the exhaust manifold. To change the coolant, or to drain the jackets for one reason or another, loosen this plug, too.

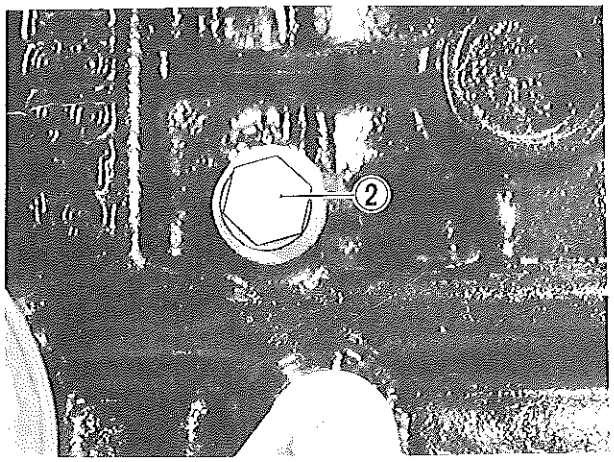


Fig. 7-3

Radiator removal

Remove the front grille.

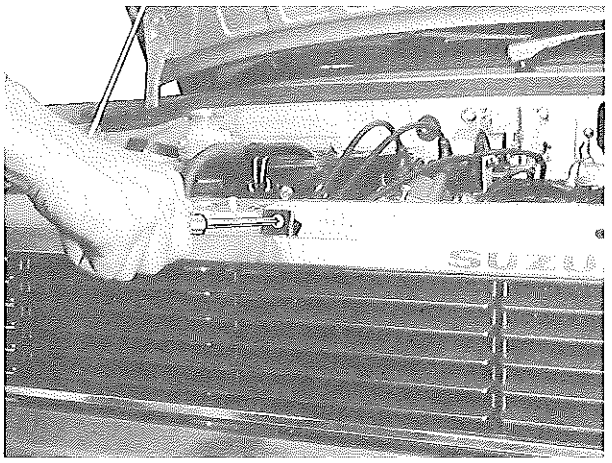


Fig. 7-4

Disconnect each water hose at the joint.

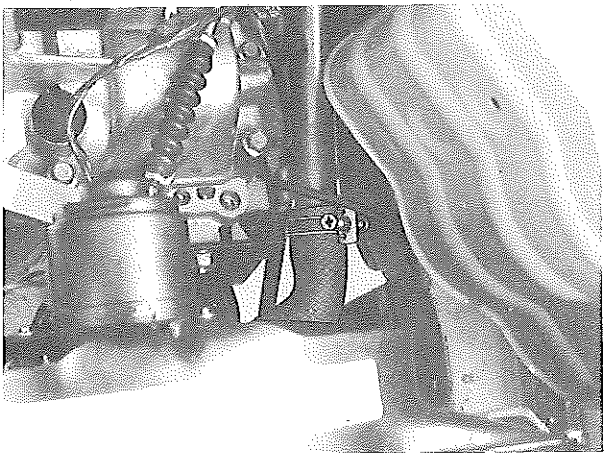


Fig. 7-5

Disconnect the radiator fan lead wire at the coupler .

Remove the radiator.

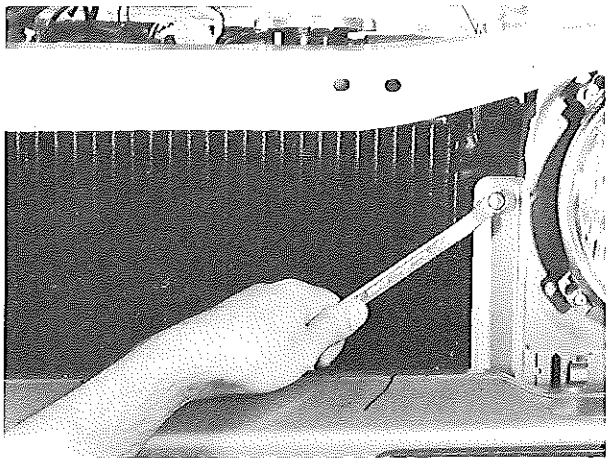


Fig. 7-6

Water pump removal

The water pump can be removed without taking down the engine from the body. Remove the pump in the order of Fig. 4-12, 4-14, 4-15, 4-17, 4-18, 4-19, 4-20, 4-21, 4-22, 4-23, and 4-25 in the volume on Engine, group 4.

> **CAUTION:**
> Carefully study the "Caution" items for each of above figures.

When installing the water pump, refer to Fig. 4-135, 4-136, 4-137, 4-138, 4-139, 4-140, 4-141, 4-142, 4-143 and 4-147.

7–4. Functional Description of Major Components

Water reservoir tank

This reservoir, a small tank, is so located relative to, and so associated with the radiator that it receives the excess coolant that would otherwise spill out by overflowing. The excess is due to coolant expansion caused by temperature rise. When the coolant cools down, its volume contracts, and the coolant in the reservoir returns to the radiator.

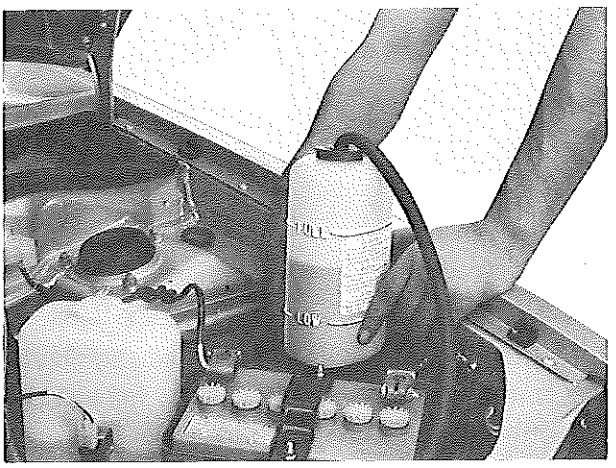


Fig. 7-7

Thermostat

The temperature-sensitive material in the thermostat is a wax pellet. It is hermetically contained in a metal case, and expands and contracts according as the coolant temperature rise and falls. When it expands, the case pushes down the valve to open it.

If, during operation, the valve is suspected of remaining closed while it is expected to open increasingly, the cause is most likely a ruptured wax case.

In the top portion of the thermostat, an air bleed valve is provided; this hole is for venting out the gas or air, if any, that has accumulated in the coolant circuit.

Thermostat functional specifications	
Temperature at which valve begins to open	82° C (179° F)
Temperature at which valve becomes full open	95° C (203° F)
Valve lift	8 mm (0.31 in.)

Thermostat

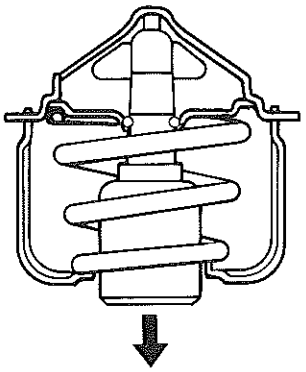


Fig. 7-8

Radiator filler cap

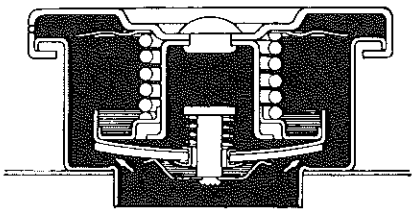
This cap has two built-in valves and, by these valves, allows the internal pressure of coolant circuit to rise to a certain level slightly above that of the atmosphere.

Of the two built-in valves, one is an adjusting valve and the other is a negative-pressure valve. The former opens only when the internal pressure rises by 0.9 kg/cm^2. This means that the coolant's boiling temperature is substantially above 100° C (212°F) - if the coolant is straight Water - and that, under normal running condition, no boiling occurs to reduce the coolant's heat capacity.

Following a shutting down of the engine, the coolant will cool off and the internal pressure will drop. If the pressure should be allowed to keep on falling, there happens the danger of coolant pipes and radiator cores becoming subjected to a large collapsing pressure: the pipes or radiator cores or any weakest point might give in. The negative-pressure valve opens in such a case to admit atmospheric pressure into the coolant circuit, thereby avoiding a build-up of negative pressure.

The cap has its face marked "0.9", which means that its pressure adjusting valve opens at 0.9 kg/cm^2.

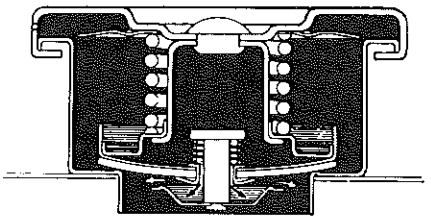
Radiator tank cap



Operating pressure adjusting valve

Fig. 7-9

Radiator tank cap



Operating vacuum valve

Fig. 7-10

Water pump

The pump rotor is supported by a totally sealed bearing. The seals are of high-durability type and do not permit disassembly. For this reason, the pump must be replaced by a new one when any part of it has developed a malcondition of a kind that can be corrected in an ordinary water pump by disassembly and servicing.

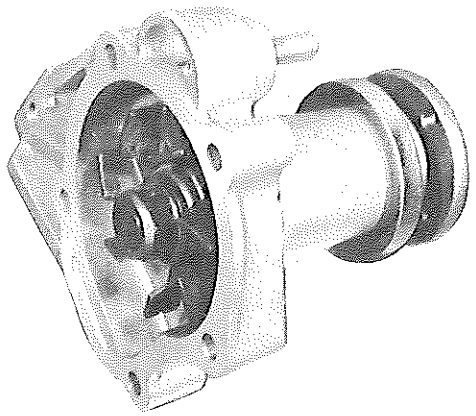


Fig. 7-11

Requirements on coolant

The long-term reliability and cooling capacity of the engine cooling system depends much on the quality of cooling water used. "Hard water," if used, will foul up the cooling circuit by scale formation, for such water is usually high in silicate and mineral contents. Scales are poor heat conductors.

Use of water high in acid concentration is just as bad; such water promotes rusting. For similar reasons, river water, well water, not to mention sea water, are not fit as engine cooling water.

Tap water available from city water supply is the best available water, in a practical sense, for the cooling system. Distilled water is ideal but is a luxury in most cases.

For protection of the cooling circuit, it is recommended that GOLDEN CRUISER 1200 (which is included as a regular item in the supply of materials from SUZUKI) be added to the cooling water in a proportion determined by the lowest atmospheric temperature expected.

Standard vehicles is shipped from the factory with its cooling circuit filled with a 30 % solution of GOLDEN CRUISER 1200; this solution does not freeze down to -16° C (3° F).

NOTE:
For the vehicles to be shipped to European market, a 50% solution of GOLDEN CRUISER is poured in the cooling circuit.

Many brands of ANTI-FREEZE compounds are sold in the market. In no case, allow two or more different brands to be mixed in the cooling circuit of the engine.

GOLDEN CRUISER 1200 - "Anti-freeze and Summer Coolant" - its effects and use

(1) Effects of GOLDEN CRUISER 1200 coolant.
   (a) Its freezing temperature is much lower and depends on the concentration of GOLDEN CRUISER 1200. It is an anti-freeze coolant.
   (b) It does not corrode the metal surfaces of the cooling circuit. It is an anti-corrosion coolant.
   (c) It does not develop foam or bubbles. It is a foam-inhibited coolant.
   (d) It stands long usage. The renewal intervals is much longer.

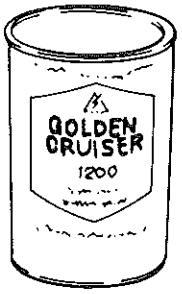


Fig. 7-12

(2) How to proportion GOLDEN CRUISER 1200 to cooling water

GOLDEN CRUISER 1200 is a multi-purpose anti-freeze compound. Its aqueous solution as engine coolant can be kept in service as long as two years in a single stretch, regardless of changes of season.

To prepare an anti-freeze coolant with GOLDEN CRUISER 1200, proportion this compound to water according to the following chart, in which the proportions are indicated for seven levels of temperature as the lowest expected levels:

ANTI-FREEZE PROPORTIONING CHART

Freezing Temperature	°C	-9	-12	-16	-20	-25	-30	-36
	°F	16	10	3	-4	-13	-22	-33
GOLDEN CRUISER concentration	%	20	25	30	35	40	45	50
Ratio of compound to cooling water	ltr.	0.72/ 2.88	0.90/ 2.70	1.08/ 2.52	1.26/ 2.34	1.44/ 2.16	1.62/ 1.98	1.80/ 1.80
	US pt.	1.52/ 6.08	1.90/ 5.70	2.28/ 5.32	2.66/ 4.94	3.04/ 4.56	3.42/ 4.18	3.80/ 3.80
	Imp. pt.	1.27/ 5.07	1.59/ 4.75	1.90/ 4.44	2.22/ 4.12	2.54/ 3.80	2.85/ 3.49	3.17/ 3.17

NOTE:
Remember, the radiator capacity is 3.6 litres (7.60/6.34 US/Imp. pt.) which includes the reservoir tank capacity of 0.6 litre (1.27/1.06 US/Imp. pt.)

Water temperature gauge

This gauge constitues a system of its own, with an indicator mounted in the instrument panel, an engine unit or sensor of thermistor type and a regulator for passing a constant current. These three-engine unit, indicator and regulator-are connected as shown in the diagram below:

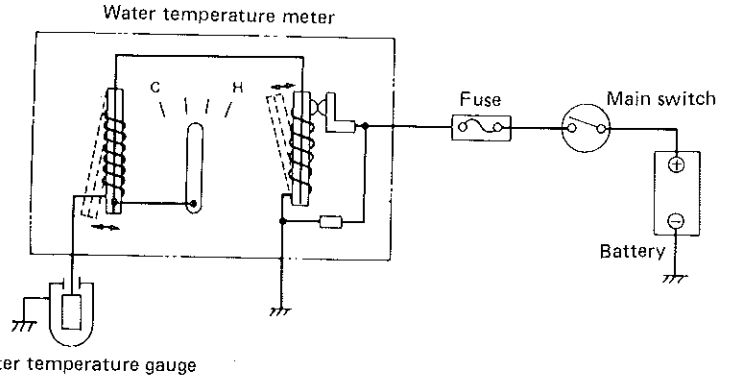


Fig. 7-13

The indicator is of bimetal type; its bimetal element is wrapped with a heater coil and becomes heated by the current flowing in the coil. By deflecting, the element actuates the indicating hand, making the hand move along the temperature scale.

The magnitude of the current is determined by the state of the thermistor in the engine unit. This unit is installed on the intake manifold. Speaking generally, a thermistor is a semiconductor resistive element whose ohmic resistance decreases as its temperature rises; its resistance has a negative temperature coefficient. When the coolant temperature rises, the thermistor offers a decreasing resistance, so that the current increases, thereby deflecting the indicating hand wider.

The regulator is a means of maintaining a constant current in the circuit for each ohmic resistance state of the thermistor, and does so function under the varying voltage condition of the battery.

Thermostat

If the thermostat valve is suspected of malfunctioning, check first the possibility of some foreign matters being stuck on the valve seat to prevent the valve from seating tight. Next, check the thermostatic movement of the wax element in the following manner:

Heat water in a pan by placing the pan on a stove, as shown in Fig. 7-14. Grip the end of a thread or small string by pinching it in the valve and suspend the thermostat unit by holding the other end of the thread or string. Immerse it in the water, holding it about 20 mm (0.78 in.) above the bottom, and read the water temperature on the column thermometer.

If the suspended unit falls to the bottom (by releasing the gripped end of the thread or string) just when the temperature rises to 82° C(179° F) or thereabout (which is the temperature at which the valve should begin to open), the thermostat unit may be deemed to be in sound condition.

If the valve begins to open at a temperature substantially below or above, the thermostat unit should be replaced by a new one. Such a unit, if re-used, will bring about overcooling or overheating tendency.

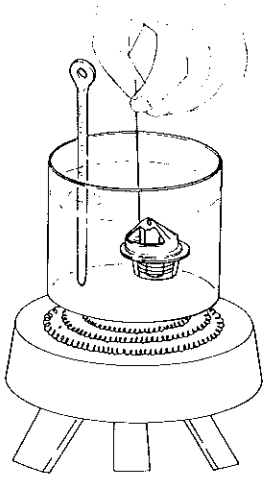


Fig. 7-14

Make sure that the air bleed valve of the thermostat is clear. Should this valve be clogged, the engine would tend to overheat.

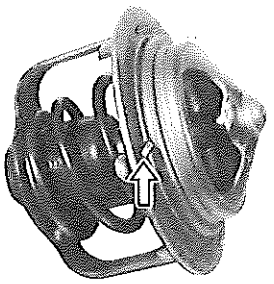


Fig. 7-15

Water pump belt

This belt drives both alternator and water pump. Check the belt for tension. The belt is in proper tension when a thumb pressure applied to the middle point of its span deflects it about 10 - 15 mm (0.4 - 0.6 in.). Inspect the belt for signs of deterioration and replace it as necessary.

Belt tension specification	10 - 15 mm (0.4 - 0.6 in.) as deflection

NOTE:
When replacing the belt with a new one, adjust belt tension to 8 - 10 mm (0.3 - 0.4 in.).

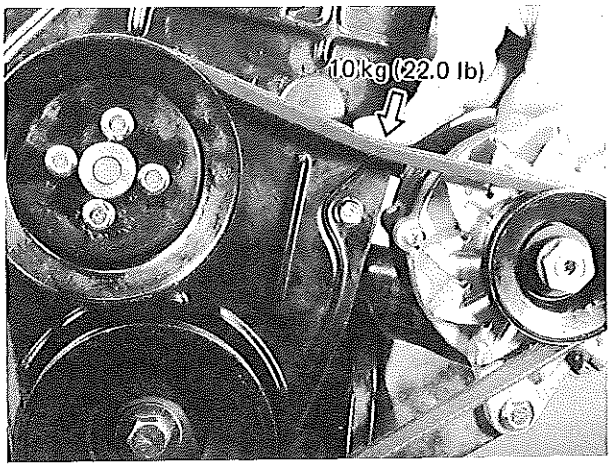


Fig. 7-16

To adjust the belt for proper tension, loosen the 3 bolts securing the generator in place, and displace it to slacken or tighten the belt.
A loose belt, or a belt tending to break off or otherwise defective, is often the cause of engine overheating. Because of the importance of this belt, it is strongly recommended that the belt be replaced at regular intervals even when the belt looks satisfactory in appearance.

Belt replacement interval	Two years (recommended)

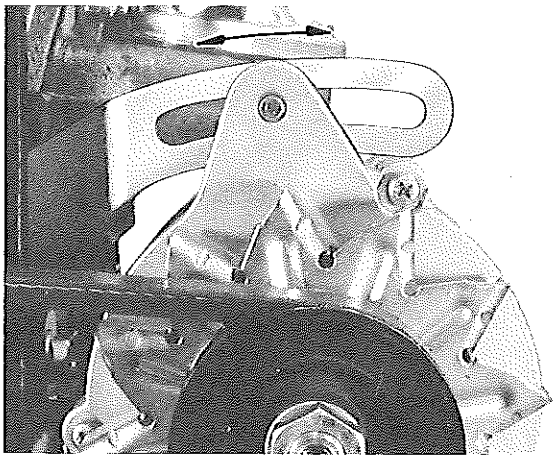


Fig. 7-17

Radiator

> **WARNING:**
> When the water temperature is still high, loosen the radiator filler cap slightly with a cloth placed over the cap, and remove it after the water temperature has cooled. If the cap is removed while the water is hot, hot water will gush out and may cause burns.

If the water side of the radiator is found excessively rusted or covered with scales, clean it by flushing with the radiator cleaner compound.
This flushing should be carried out at regular intervals for scale or rust formation advances with time even where a recommended type of coolant is used. Periodical flushing will prove more economical.
Inspect the radiator cores and straighten the flattened or bent fins, if any. Clean the cores, removing road grimes and trashes.

Excessive rust or scale formation on the wet side of the radiator lowers the cooling efficiency.
Flattened or bent fins obstruct the flow of air through the core to impede heat dissipation.

Radiator flushing interval	Two years (recommended)

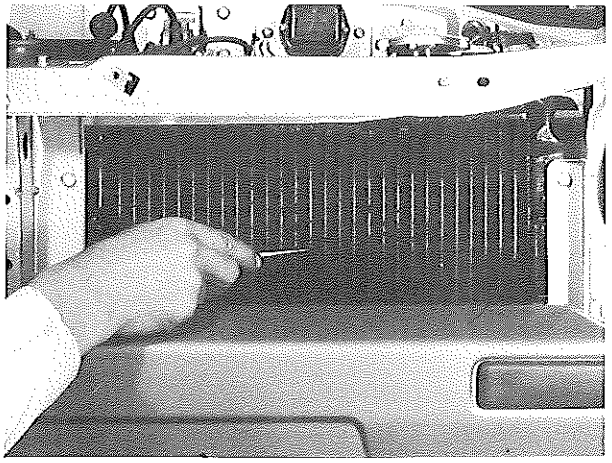


Fig. 7-18

Coolant level

Cooling water in service decreases its volume gradually on account of progressive loss due to water evaporation. Check to be sure that the water surface is up to anywhere between FULL and LOW marks on the reservoir tank. The user should be reminded of the need to daily check the water level.

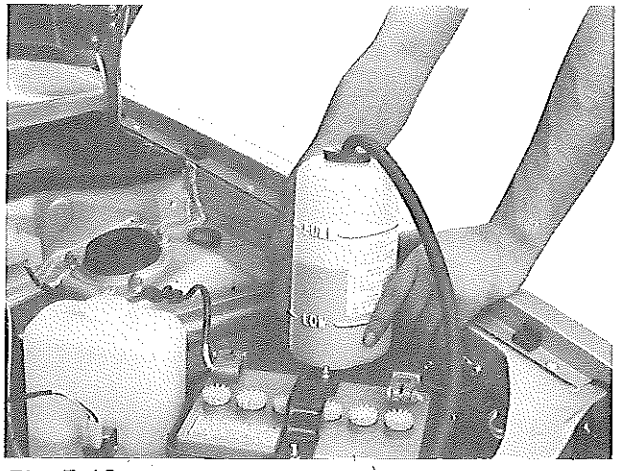


Fig. 7-19

Water hoses

Inspect each water hose for evidence of cracking or breakage, and be sure that its connection is tight. A defective hose or a hose showing signs of malcondition must be replaced. Tighten the hose connections as necessary.

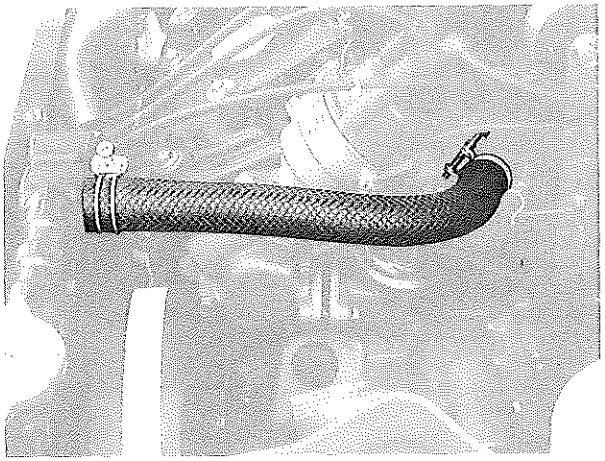


Fig. 7-20

7–6. Important Re-installing Steps

Filling up the cooling system

Park the machine on a flat level floor, and fill in until you see the coolant come up to the well part of the radiator filler. Then, run the engine two or three minutes to recirculate the coolant. This recirculation will drive out air, if any, trapped inside, and will lower the coolant surface at the filler. Add coolant until its surface shows up again in the filler, and fill up the reservoir tank, raising the surface to FULL mark.

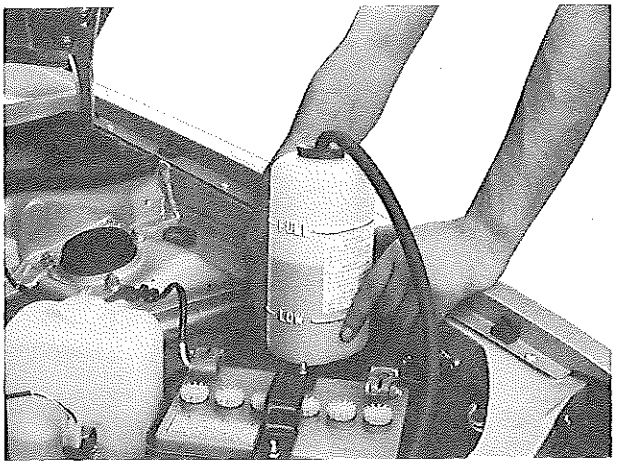


Fig. 7-21

7–7. Cooling Blower Motor

Circuit of the cooling blower motor is shown below.

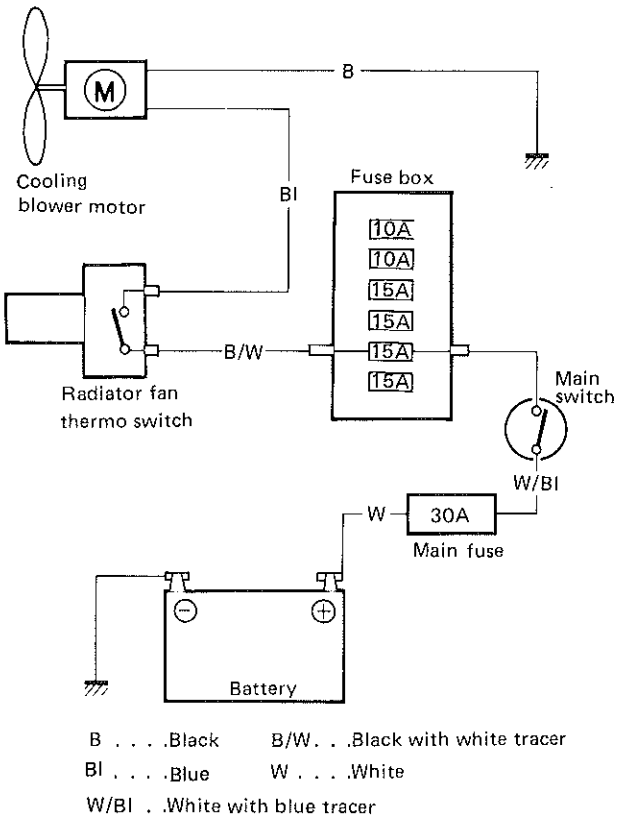


Fig. 7-22

When the water temperature goes up to 86-90° C (186 - 194° F), the thermoswitch of the cooling blower motor is switched on, and the motor starts to run. When the water temperature falls to 81 - 85° C (177 - 185° F), the blower motor stops.

The blower motor forcibly cools the engine when ambient cooling is insufficient: for example, in the summer, when running up a long slope at low speed or running for a long time at low speed, etc.

Inspection

Radiator fan thermo switch

1) Remove the thermo switch from radiator.
2) Heat water in a pan by placing the pan on a stove, as shown in Fig. 7-23.
3) Immerse the switch in hot water keeping the coupler joint part ① above the water surface.
4) In the above 3) state, connect the tester terminals ⊕ and ⊖ with the coupler joint part and check for continuity. If the switch conducts when the temperature of the hot water rises as high as 86 - 90°C (186 - 194°F) and it doesn't when the temperature falls down to 81 - 85°C (177 - 185°F), it is in good condition.

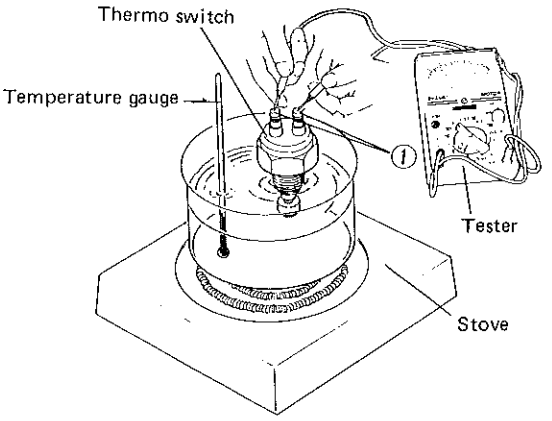


Fig. 7-23