

SECTION 6

ENGINE COOLING SYSTEM

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6-1. GENERAL DESCRIPTION

The cooling system consists of the radiator cap, radiator, water reservoir tank, hoses, water pump, cooling fan, thermostat. The radiator is of tube-and-fin type.

Cooling System Circulation

During engine warm-up (thermostat closed), the water pump discharges coolant into the water jacket chamber adjacent to No. 1 cylinder. Coolant then flows through the cylinder block and the cylinder head. Coolant then returns to the water pump through intake manifold, heater inlet hose, heater unit, heater outlet hose, and water intake pipe.

(As for vehicle not provided with heater, coolant flows as follows: water pump → cylinder block → cylinder head → intake manifold → Bypass hose → water intake pipe.)

During normal temperatures (thermostat open), coolant takes the same basic route but is now allowed to flow past the thermostat, the inlet hose and the radiator, and then back to the water pump through the outlet hose and the water intake pipe.

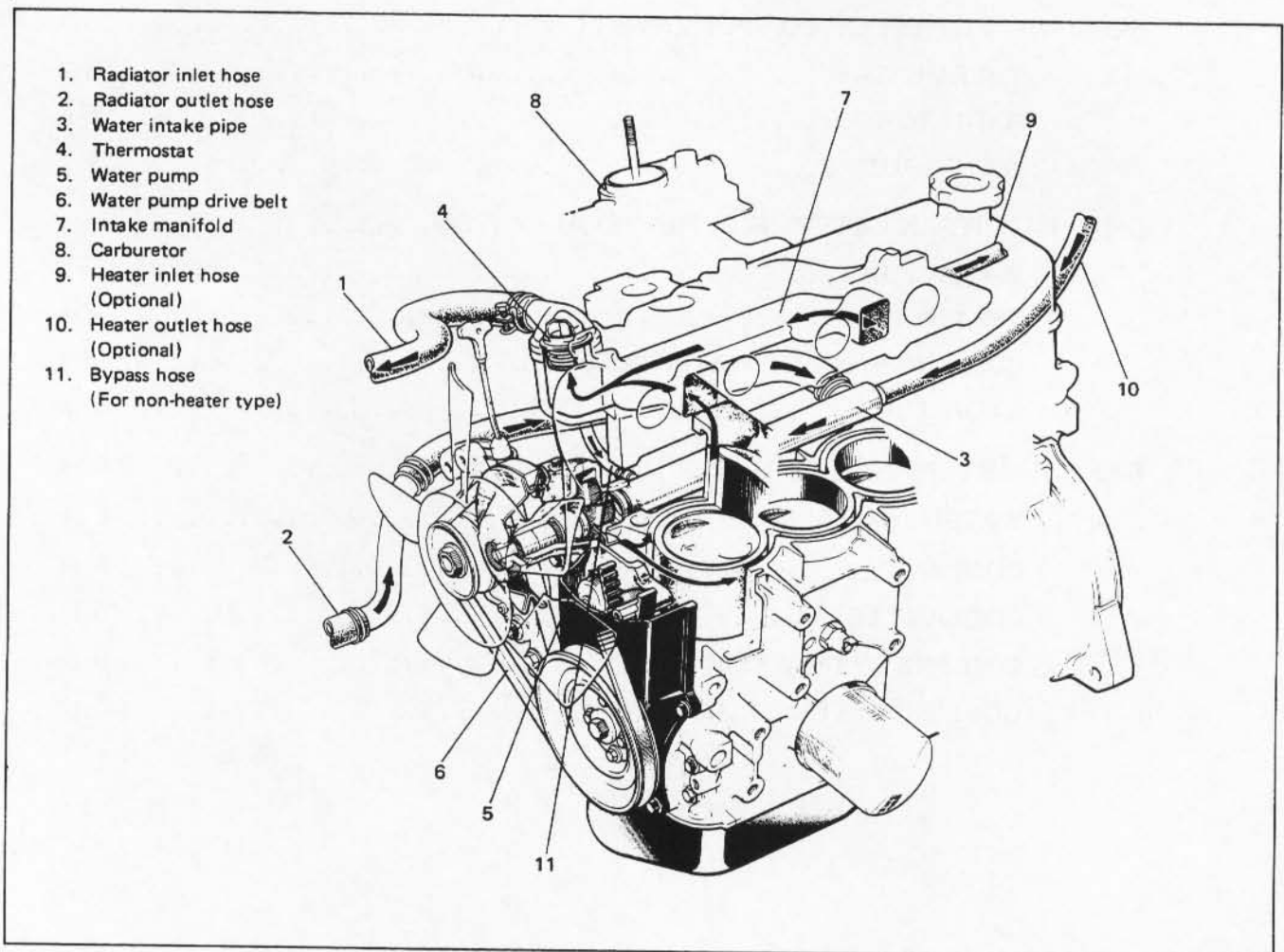


Fig. 6-1 Cooling system

Radiator Cap

A pressure-vent cap is used on the radiator. The cap contains a pressure valve and vacuum valve. The pressure valve is held against its seat by a spring of pre-determined strength which protects the cooling system by relieving the pressure if the pressure in cooling system rises by 0.9 kg/cm² (12.8 psi, 90 kPa). The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created in the system when it cools off and which otherwise might cause the radiator to collapse.

The cap has its face marked 0.9, which means that its pressure valve opens at 0.9 kg/cm² (12.8 psi, 90 kPa).

NOTE:

Do not remove radiator cap to check engine coolant level; check coolant visually the see-through water reservoir tank.

Coolant should be added only to reservoir tank as necessary.

WARNING:

As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.

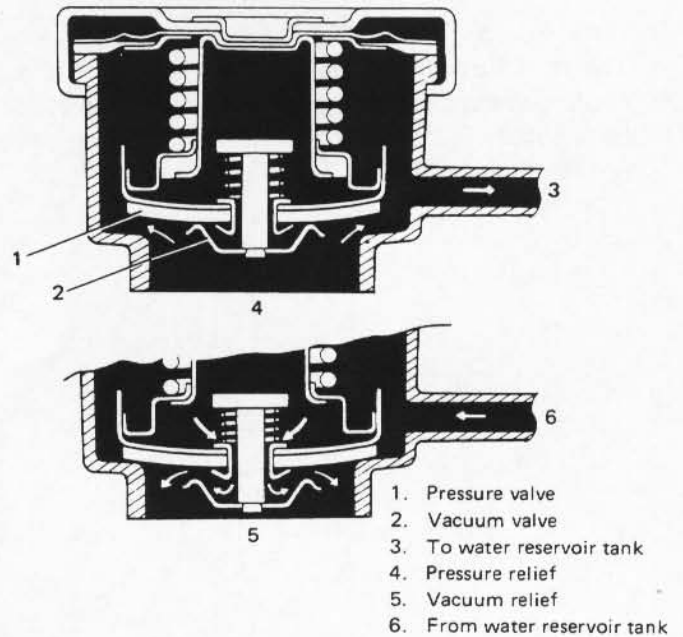


Fig. 6-2

Water Reservoir Tank

A "see-through" plastic reservoir tank is connected to the radiator by a hose. As the car is driven, the coolant is heated and expands. The portion of the coolant displaced by this expansion flows from the radiator into the reservoir tank.

When the car is stopped and the coolant cools and contracts, the displaced coolant is drawn back into the radiator by vacuum.

Thus, the radiator is kept filled with coolant to the desired level at all times, resulting in increased cooling efficiency.

Coolant level should be between "FULL" and "LOW" marks on the reservoir tank.

Coolant should be added only to the reservoir tank as necessary.

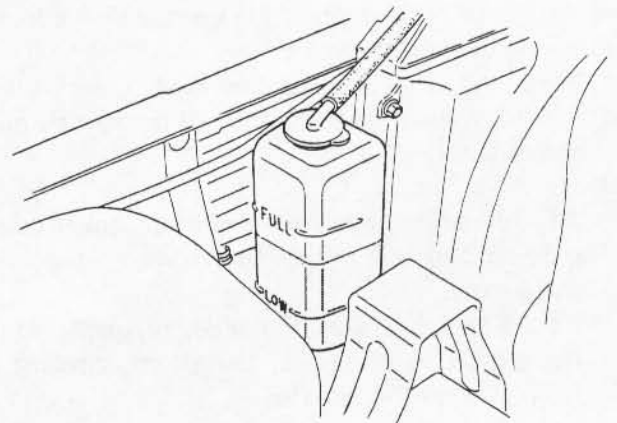


Fig. 6-3 Water reservoir tank

Water Pump

The centrifugal type water pump is used in the cooling system. The pump impeller is supported by a totally sealed bearing. The water pump can not be disassembled.

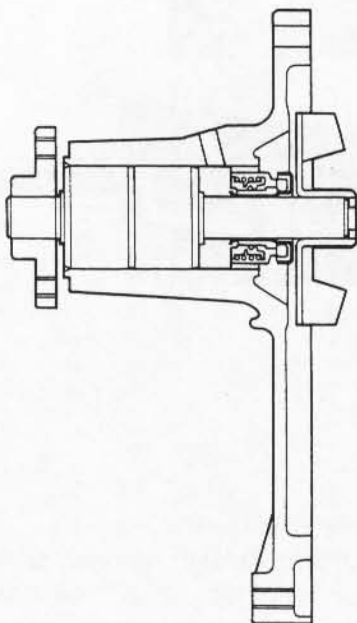


Fig. 6-4

Thermostat

A wax pellet type thermostat is used in the coolant outlet passage to control the flow of engine coolant, to provide fast engine warm up and to regulate coolant temperatures.

A wax pellet element is hermetically contained in a metal case, and expands when heated and contracts when cooled.

When the pellet is heated and expands, the metal case pushes down the valve to open it.

As the pellet is cooled, the contraction allows a spring to close the valve.

Thus, the valve remains closed while the coolant is cold, preventing circulation of coolant through the radiator.

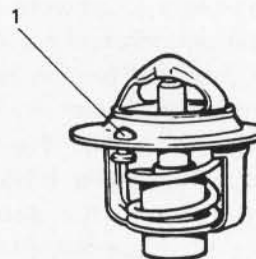
At this point, coolant is allowed to circulate only throughout the engine to warm it quickly and evenly.

As the engine warms, the pellet expands and the thermostat valve opens, permitting coolant to flow through the radiator.

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

There are two types of thermostat, A and B, as given below. Either one is used depending on vehicle specifications. The temperature at which the valve begins to open is stamped on each thermostat. Be sure to note this stamped temperature for replacement.

Thermostat functional spec. $\pm 1.5^{\circ}\text{C}$ (34.7°F)		
	Thermostat "A"	Thermostat "B"
Temp. at which valve begins to open	82°C (179°F)	88°C (190°F)
Temp. at which valve become fully open	95°C (203°F)	100°C (212°F)
Valve lift	More than 8 mm at 95°C	More than 8 mm at 100°C



1. Air bleed valve

Fig. 6-5 Thermostat

6-2. REMOVAL

WARNING:

- Check to make sure that cooling water temperature is cold before removing any part of cooling system components.
- Also be sure to disconnect \ominus cord from battery \ominus terminal before removing any part.

1. Coolant Draining

- 1) Remove radiator cap.
- 2) Loosen drain plug ① on radiator to empty its water side.

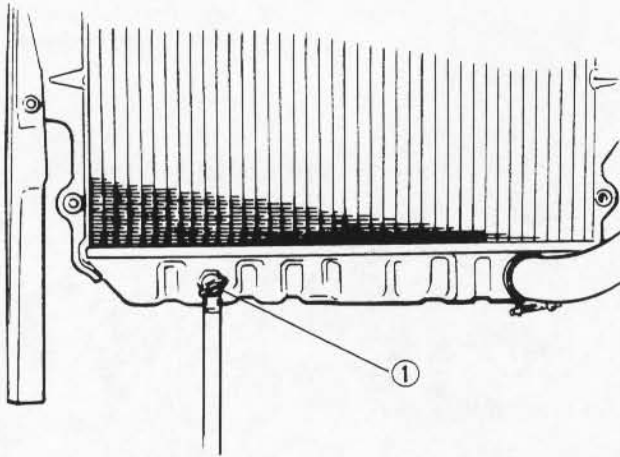


Fig. 6-6

2. Removal of Cooling Water Pipes or Hoses

- 1) Drain cooling system.
- 2) To remove these pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

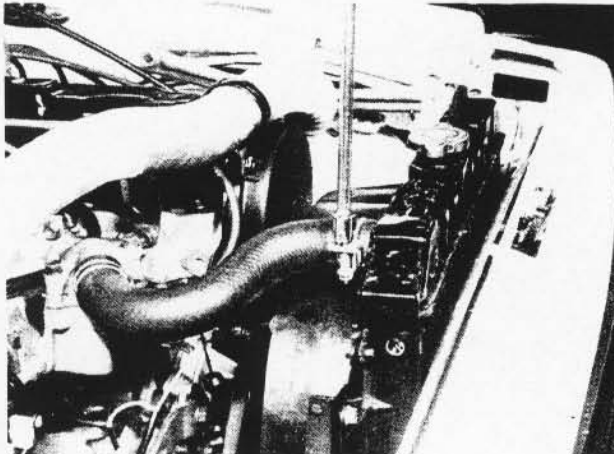


Fig. 6-7

3. Cooling Fan and Pump Belt

- 1) Remove radiator shroud securing bolts (4 pcs) and cooling fan securing nuts (or bolts, 4 pcs).

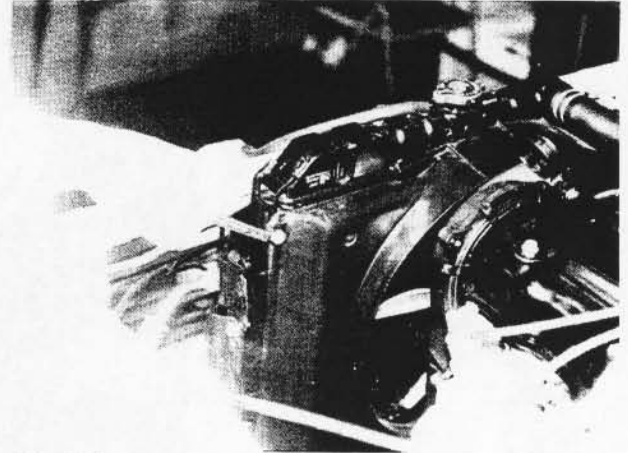


Fig. 6-8

- 2) Then remove radiator shroud and cooling fan at the same time.
- 3) Loosen water pump drive belt tension.
- 4) Remove pump belt.

4. Radiator Removal

- 1) Drain cooling system.
- 2) Loosen water pump drive belt tension.
- 3) Remove radiator shroud and cooling fan at the same time.
- 4) Disconnect water hoses from radiator.
- 5) Remove radiator.

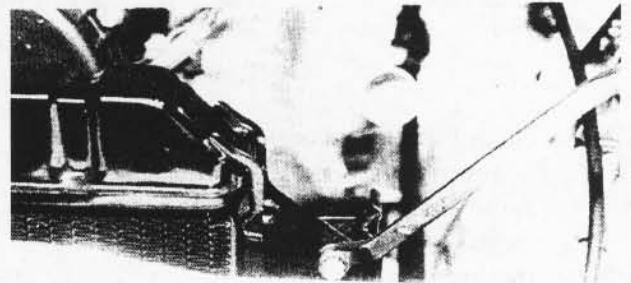


Fig. 6-9

5. Thermostat Removal

- 1) Drain cooling system.
- 2) Disconnect thermostat cap from intake manifold.

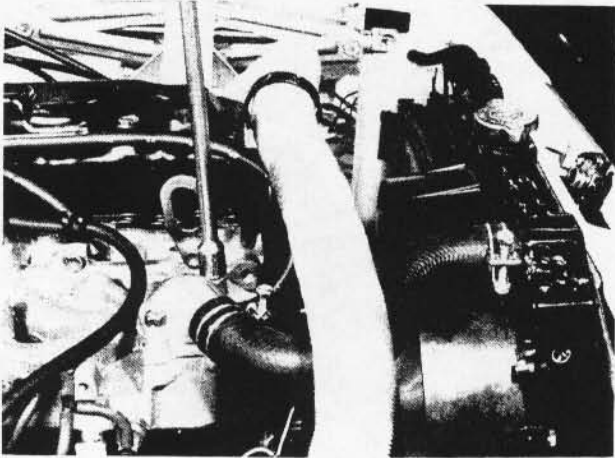


Fig. 6-10

- 3) Remove thermostat.

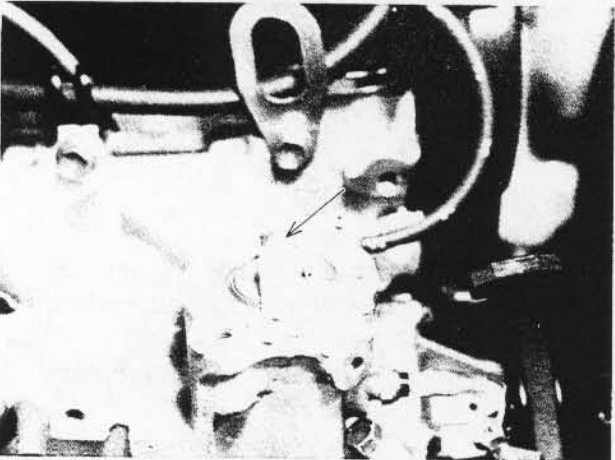
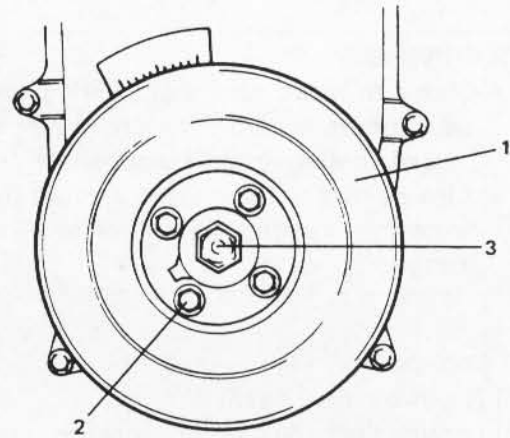


Fig. 6-11



1. Crankshaft pulley
2. Crankshaft pulley bolt
3. Crank timing belt pulley bolt

Fig. 6-12

- 5) Remove timing belt outside cover.

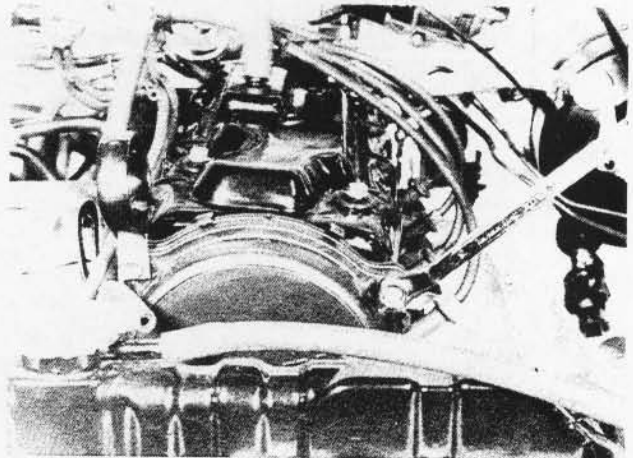


Fig. 6-13

6. Water Pump Removal

- 1) Drain cooling system.
Refer to 1. Coolant removal or previous page.
- 2) Remove the radiator shroud and cooling fan at the same time.
Refer to 3. Cooling fan and pump belt removal on previous page.
- 3) Loosen water pump drive belt tension.
Then remove water pump pulley and pump drive belt.
- 4) Remove crankshaft pulley by removing 4 pulley bolts. Crankshaft timing belt pulley bolt at the center is needs not to be loosened.

6) Loosen tensioner bolt and stud, and remove belt from crank timing belt pulley and camshaft pulley after pushing up tensioner plate fully with finger as shown in Figure.

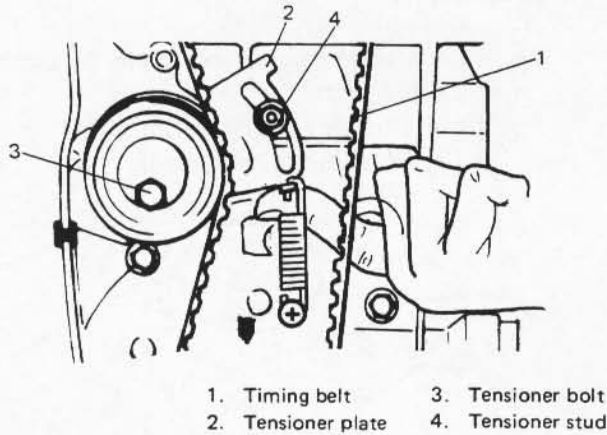
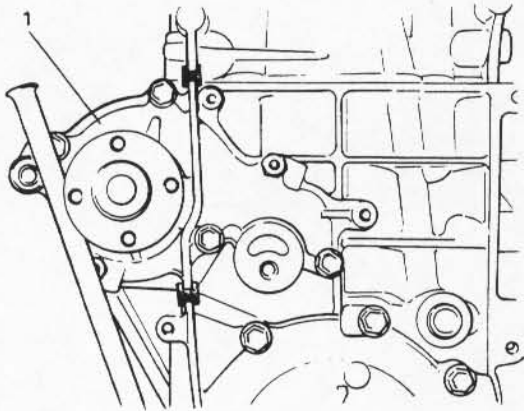


Fig. 6-14

7) Remove timing belt tensioner, plate and spring.
8) Remove water pump assembly.



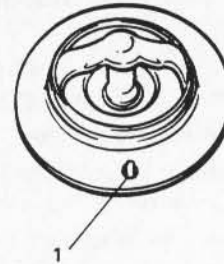
1. Water pump

Fig. 6-15

6-3. INSPECTION OF COMPONENTS

Thermostat

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

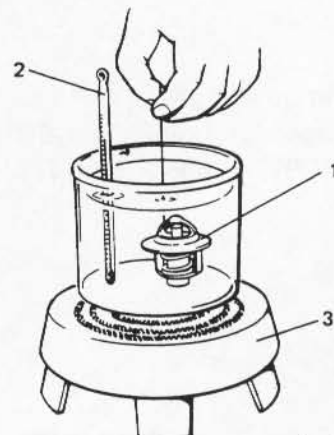


1. Air bleed valve

Fig. 6-16

2) Check valve seat for some foreign matters being stuck which prevent valve from seating tight.
3) Check thermostatic movement of wax pellet as follows:

- Immerse thermostat in water, and heat water gradually.
- Check that valve starts to open at specification temp.
- If valve starts to open at a temperature substantially below or above, thermostat unit should be replaced with a new one. Such a unit, if re-used, will bring about overcooling or overheating tendency.



1. Thermostat
2. Thermometer
3. Heater

Fig. 6-17

Radiator

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)
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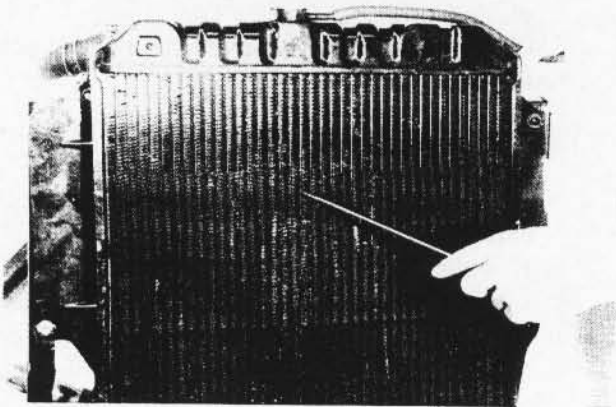


Fig. 6-18

Water Temperature Gauge

For gauge inspection, refer to SECTION 21 BODY ELECTRICAL EQUIPMENT of this manual.

Water Pump

NOTE:

Do not disassemble water pump.

If any repair is required on pump, replace it as assembly.

- Rotate water pump by hand to check for smooth operation.
If pump does not rotate smoothly or makes an abnormal noise, replace it.

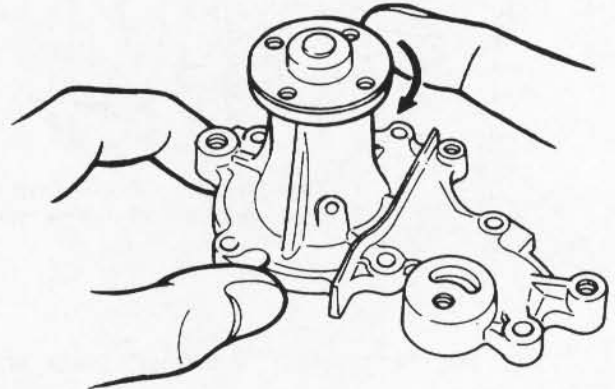


Fig. 6-19

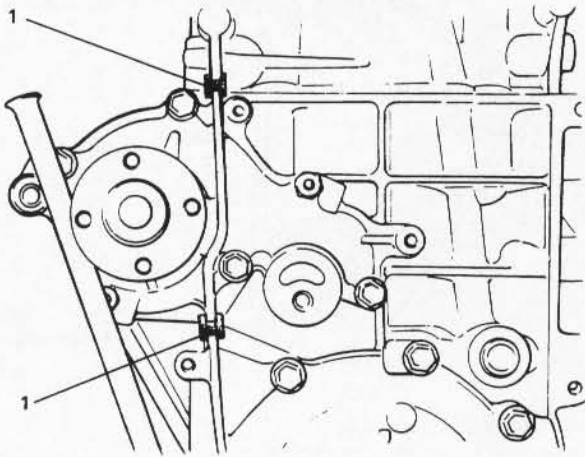
6-4. IMPORTANT STEPS FOR REINSTALLATION

Water Pump

- 1) Install new pump gasket to cylinder block.
- 2) Install water pump to cylinder block.

Tightening torque for bolts & nuts	10 – 13 N·m
	1.0 – 1.3 kg·m
	7.5 – 9.0 lb·ft

After installing water pump, install rubber seal between water pump and oil pump, and another between water pump and cylinder head.



1. Rubber seal

Fig. 6-20

- 3) Install belt tensioner plate, tensioner, tensioner spring, timing belt and timing belt outside cover.

NOTE:

- Special care must be used when installing belt tensioner and timing belt. Be sure to refer to p. 3-48 of this manual.
- Torque each bolt and nut to specification.

- 4) Install crankshaft pulley, water pump pulley, pump drive belt, cooling fan and radiator shroud.
- 5) Adjust intake and exhaust valve lashes.
(For adjustment and related data, refer to p. 3-53 of this manual).
- 6) Adjust water pump belt tension.
(Refer to P. 6-10).
- 7) Connect negative cable at battery.
- 8) Fill the cooling system.

Thermostat

- 1) When positioning the thermostat on the intake manifold, be sure to bring its air breather valve ① to front side of the engine.

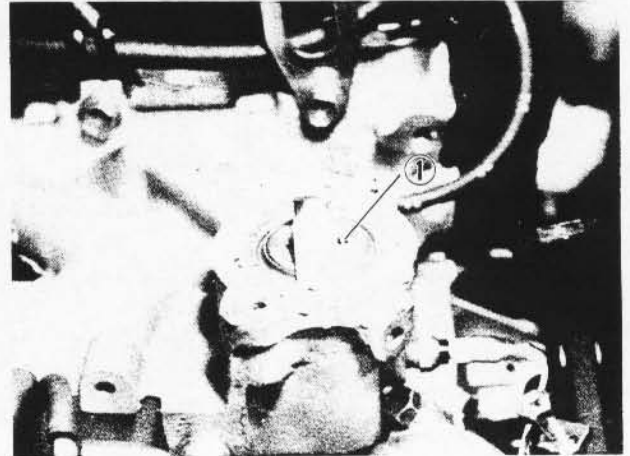


Fig. 6-21

- 2) Install new gasket and thermostat cap to intake manifold.
- 3) Fill the cooling system.

Cooling Fan and Water Pump Belt

Once cooling fan or water pump belt has been removed, make sure to tighten bolts and nuts securely in reinstallation and adjust pump belt tension to specification. (For specified tension, refer to p. 6-10.)

Radiator

- 1) Tighten bolts securely for proper installation. Also, fix joints of 2 hoses with clamps.

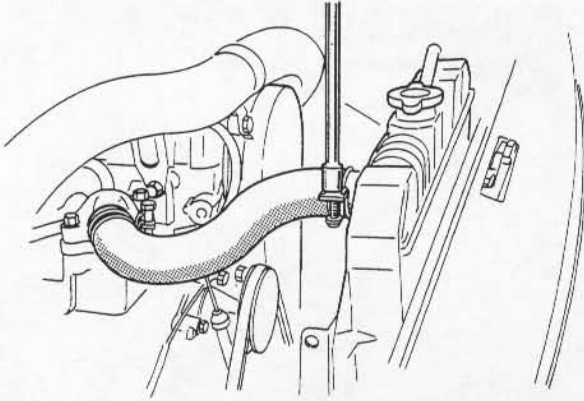


Fig. 6-22

- 2) Install radiator shroud and cooling fan at the same time.
- 3) Tighten shroud bolts and fan nuts (or bolts).
- 4) Adjust water pump belt tension.
- 5) Fill specified amount of coolant.

6-5. MAINTENANCE SERVICE

Water Pump Belt

- 1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. Check belt for tension. Belt is in proper tension when it deflects 6 to 9 mm (0.24 – 0.35 in.) under thumb pressure (about 10 kg or 22 lb.).

Belt tension specification	6 – 9 mm (0.24 – 0.35 in.) as deflection
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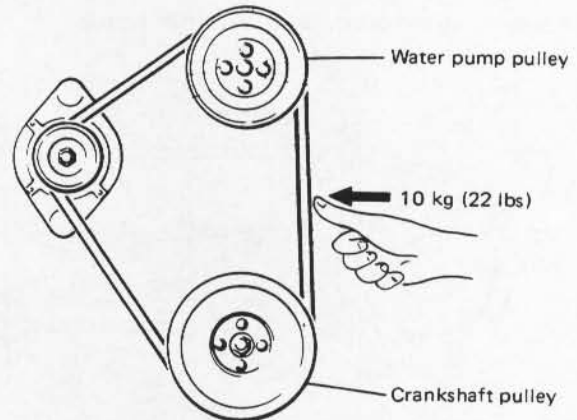


Fig. 6-23

- 2) If belt is too tight or too loose, adjust it to proper tension by displacing alternator position.

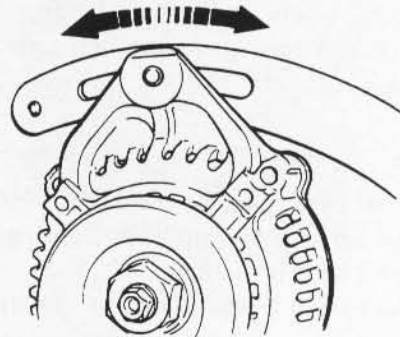


Fig. 6-24

- 3) Tighten alternator adjusting bolt and pivot bolt.
- 4) If it is necessary to replace belt, refer to p6-5 for procedure.

WARNING:

All adjustments described above are to be performed with ENGINE NOT RUNNING.

Coolant

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir tank.

When the system cools down, the coolant is drawn back into the radiator.

The cooling system has been filled at the factory with a quality coolant that is either 50/50 mixture of water and GOLDEN CRUISER 1200 or 30/70 mixture of water and GOLDEN CRUISER 1200.

The 50/50 mixture coolant solution provides freezing protection to -36°C (-33°F), the 30/70 mixture coolant solution provides freezing protection to -16°C (3°F), and it has been formulated to be used for two full calendar years or 40,000 km, whichever occurs first, of normal operation without replacement, provided the proper concentration of coolant is maintained.

GOLDEN CRUISER 1200 – “Anti-freeze and Summer Coolant” – its effects

- 1) Its freezing temperature is much lower and depends on the concentration of GOLDEN CRUISER 1200. It is an anti-freeze coolant.
- 2) It does not corrode the metal surfaces of the cooling circuit. It is an anti-corrosion coolant.
- 3) It does not develop foam or bubbles. It is a foam-inhibited coolant.

When changing the engine coolant, use mixture of 50% water and 50% GOLDEN CRUISER 1200 for the market where ambient temperature falls lower than -16°C (3°F) in winter and mixture of 70% water and 30% GOLDEN CRUISER 1200 for the market where ambient temperature doesn't fall lower than -16°C (3°F).

ANTI-FREEZE PROPORTIONING CHART

Freezing Temperature	$^{\circ}\text{C}$	-16	-36
	$^{\circ}\text{F}$	3	-33
GOLDEN CRUISER Concentration	%	30	50
Ratio of compound to cooling water	ltr.	1.50/3.50	2.50/2.50
	US pt.	3.17/7.39	5.28/5.28
	Imp. pt.	2.64/6.16	4.40/4.40

COOLANT CAPACITY	
Engine, radiator and heater	4.4 liters (9.3/7.7 US/Imp pt.)
Reservoir tank	0.6 liters (1.3/1.1 US/Imp pt.)
Total	5.0 liters (10.6/8.8 US/Imp pt.)

NOTE:

- Alcohol or methanol base coolants or plain water alone should not be used in cooling system at any time, as damage to cooling system could occur.
- Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% GOLDEN CRUISER 1200 should be used for the purpose of corrosion protection and lubrication.

Coolant Level

To check level, lift hood and look at “see through” water reservoir tank.

It is not necessary to remove radiator cap to check coolant level.

WARNING:

To help avoid danger of being burned:

- do not remove reservoir tank cap while coolant is “boiling”, and
- do not remove radiator cap while engine and radiator are still hot.

Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.

When engine is cool, check coolant level in reservoir tank. A normal coolant level should be between “FULL” and “LOW” marks on reservoir tank.

If coolant level is below “LOW” mark, remove reservoir tank cap and add proper coolant to tank to bring coolant level up to “FULL” mark. Then, reinstall cap.

NOTE:

If proper quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system. They may be harmful to proper operation of system, and are unnecessary expense.

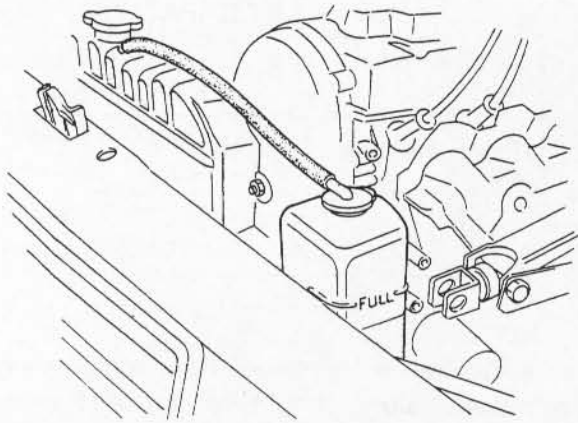


Fig. 6-25

Cooling System Service

Cooling system should be serviced as follows.

- 1) Check cooling system for leaks or damage.
- 2) Wash radiator cap and filler neck with clean water by removing radiator cap when engine is cold.
- 3) Check coolant for proper level and freeze protection.
- 4) Using a pressure tester, check system and radiator cap for proper pressure holding capacity 0.9 kg/cm² (12.8 psi, 90 kPa). If replacement of cap is required, use proper cap specified for this vehicle.
- 5) Tighten hose clamps and inspect all hoses. Replace hoses whenever cracked, swollen or otherwise deteriorated.
- 6) Clean frontal area of radiator core.

NOTE:

After installing radiator cap ① to radiator, make sure that its ear ② is aligned with reservoir tank hose ③ as shown in Figure. If not, turn cap more to align its ear with hose.

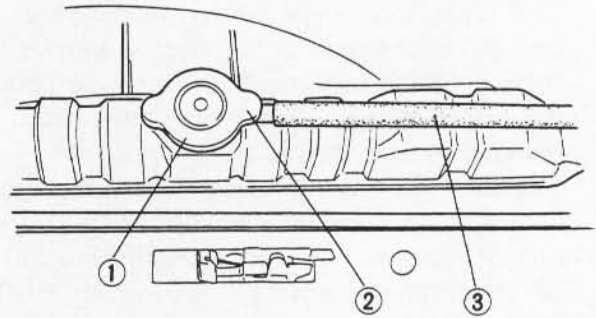


Fig. 6-26 Installation of radiator cap

Cooling System, Flush and Refill

- 1) Remove radiator cap when engine is cool:

WARNING:

To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

- 2) With radiator cap removed, run engine until upper radiator hose is hot (this shows that thermostat is open and coolant is flowing through system).
- 3) Stop engine and open radiator drain plug ① to drain coolant.

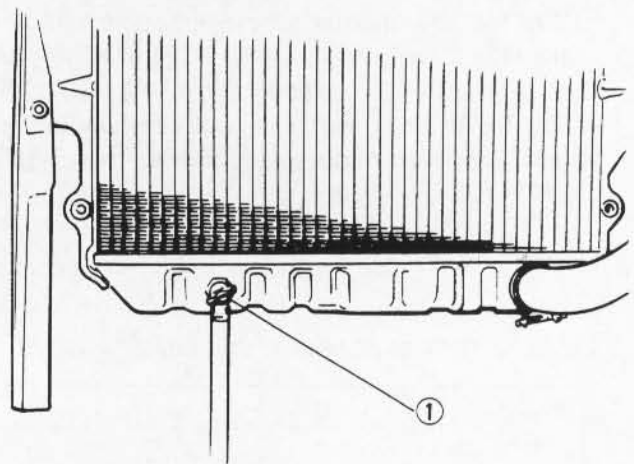


Fig. 6-27 Radiator drain plug

- 4) Close drain plug. Add water until system is filled and run engine until upper radiator hose is hot again.
- 5) Repeat steps 3) and 4) several times until drained liquid is nearly colorless.
- 6) Drain system and then close radiator drain plug tightly.
- 7) Disconnect hose from water reservoir tank. Remove tank and pour out any fluid. Scrub and clean inside of tank with soap and water. Flush it well with clean water and drain. Reinstall tank and hose.
- 8) Add proper mixture coolant (refer to page 6-11 of GOLDEN CRUISER 1200 and water to radiator and tank.

Fill radiator to the base of radiator filler neck and reservoir tank to "FULL" level mark. Reinstall reservoir tank cap.

- 9) Run engine, with radiator cap removed, until radiator upper hose is hot.
- 10) With engine idling, add coolant to radiator until level reaches the bottom of filler neck. Install radiator cap, making sure that the ear of cap lines up with reservoir tank hose.

Cooling Fan Clutch

(Applicable to car with clutch equipped cooling fan)

Inspect fluid coupling for oil leakage.

If necessary, replace fan clutch assembly. Do not disassemble clutch assembly.

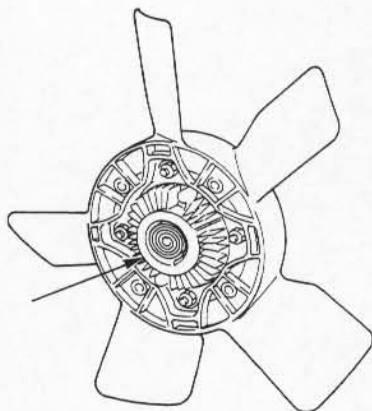


Fig. 6-28