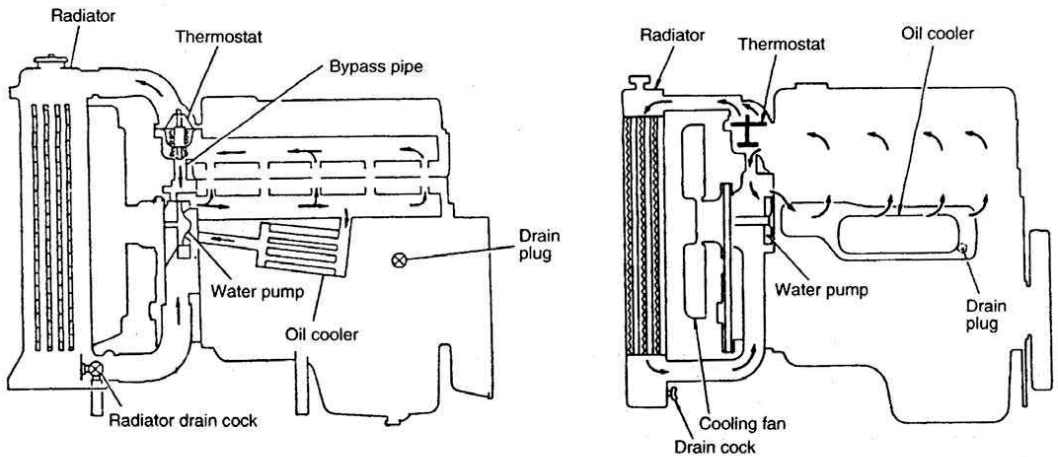


1.GENERAL

The engine is cooled by forced circulation of coolant by the water pump.

The illustration below shows the coolant flow.



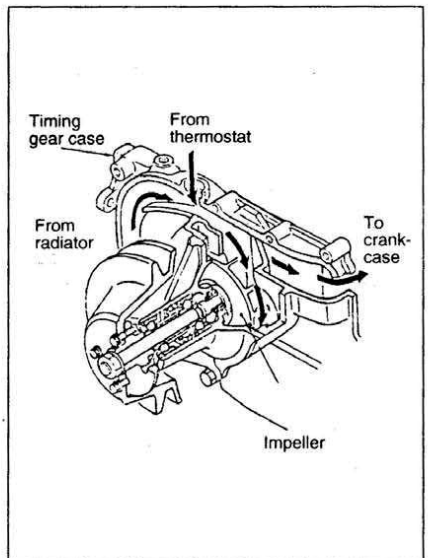
(1) Water pump

Of a centrifugal type, the water pump is driven by the V-belt from the crankshaft pulley.

A unit seal is installed between the impeller and water pump that prevents leakage of coolant. There is a drain hole provided at the bottom of the water pump case, which ensures that coolant, should it leak from the unit seal, does not enter bearings.

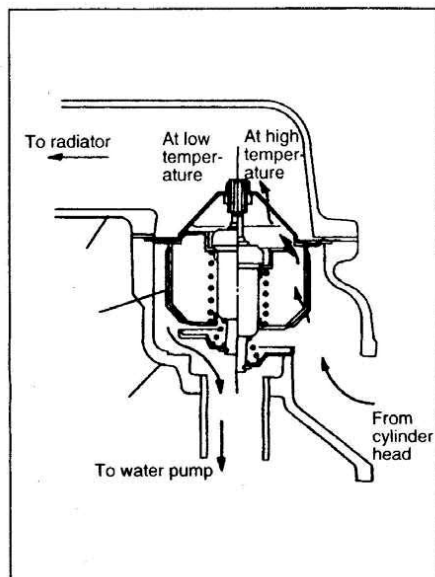
The water pump is mounted on the timing gear case provided with a suction pipe and swirl chamber.

Pressed into the one end of water pump shaft is the impeller with combination-type blades which feeds coolant under pressure into the engine.



(2) Thermostat

The thermostat is bottom bypass type that stops supply of coolant to the bypass side when the path to the radiator becomes full open.

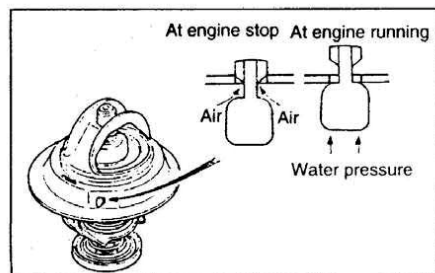


The thermostat pellet, of wax pellet type, contains a special wax which changes from a solid to liquid state and vice versa, depending on heat, and consequent change in its volume causes the valve to open or close, thereby changing the quantity of coolant which flows into the radiator and water pump (bypass side) to control the coolant temperature.

A jiggle valve is provided in the air purge hole of the thermostat to quickly increase the coolant temperature.

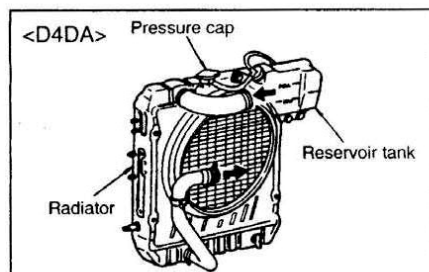
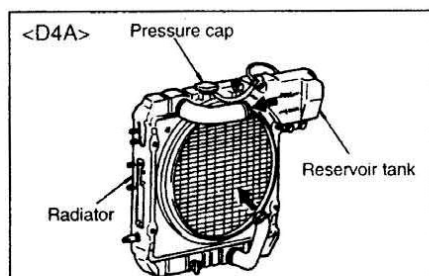
The jiggle valve is in down position by its own weight when the engine is stationary. When pouring in coolant, the air in the system is forced into the radiator through the clearance between the air purge hole and jiggle valve.

When the engine is started, coolant circulates and the jiggle valve is forced upward by the hydraulic pressure. As a result, the valve closes the air purge hole, preventing outflow of coolant the air purge hole.



(3) Radiator

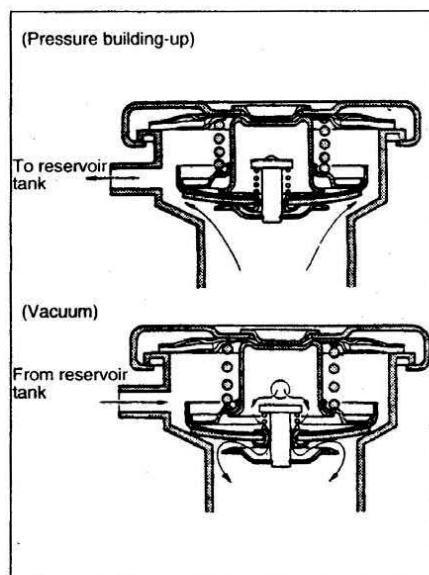
The radiator, with a tube-and-corrugated-fin type core, not only cools the engine coolant but also separates vapor from liquid water and regulates pressure in the cooling system.



The radiator is of a simple closed type equipped with a pressure cap. The reservoir tank is open to atmosphere. The coolant overflowing from the radiator is therefore stored in the reservoir tank, maintaining the radiator full with coolant at all times.

The pressure cap regulates the pressure in the cooling system. When the pressure builds up exceeding the predetermined level, the pressure valve compresses the pressure spring relieving the excessive pressure to the atmosphere.

As the coolant temperature falls forming a vacuum in the radiator, the vent valve opens to admit air into the radiator, thus preventing the radiator from being deformed by the vacuum.



2. SPECIFICATIONS

Item \ Model	D4AN/AF	D4AK	D4DA
Cooling method	Water-cooling, forced circulation	←	←
Coolant capacity	8.3 lit. (engine proper)	←	←
Water pump Type Drive	Centrifugal type V-belt	← ←	Velt-driven involute type ←
V-belt Type x q'ty	(Cooling Fan) Low edge cogged B type x 1 (Water pump) Low edge cogged B type x 1	Low edge cogged B type x 2	←
Thermostat Type/valve opening temperature	Wax-pellet, bottom bypass(with jiggle valve)/ 82℃	←	←
Fan Type	Polypropylene, pusher	←	←
Cap Type	Pressure type	←	←

3. SERVICE STANDARDS

1. Service Standard Table

Unit : mm

Description			Nominal value [Basic diameter]	Limit	Correction and remarks
Water pump	Interference between pump shaft and and flange		[17] 0.08~0.10	Reassembly up to twice	Replace
	Interference between pump shaft and impeller		[13] 0.03~0.06		
	Pump case to impeller installed dimension		20.8~21.7		Replace
Thermo-stat	Valve opening tempera- ture		80~84℃		Replace
	Valve lift / tempera- ture		10 or more/95℃		Replace
V-belt deflection (between alternator and water pump)			10~15		Replace
Radiator	Opening pressure of radiator cap		0.75~1.05kg/cm²		Replace
		Vacuum	0.05kg/cm² less		
	Radiator cap inspection pressure		1.4kg/cm²		

2. Tightening Torque Table

Description	Thread size O.D. × pitch mm	Tightening torque (kgf m)	Remarks
Cooling fan attaching bolt	M8 × 1.25	20(2)	
Fan coupling attaching bolt	M8 × 1.25	20(2)	
Alternator attaching nut	M12 × 1.25	91(9.3)	
Alternator adjusting bolt	M12 × 1.25	82(8.4)	
Water pump flange attaching nut	M14 × 1.5	88(9)	
	M22 × 1.5	155(16)	

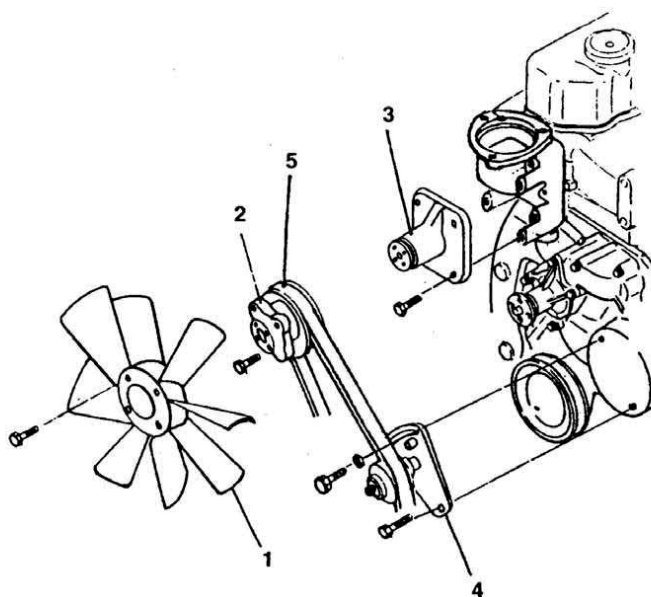
ProCatManuals.com

4. SPECIAL TOOLS

Tool name	Part number	Shape (Unit : mm)	Use
Puller	MH061298		Removal of water pump flange
Water pump impeller puller	MH061417		Removal of water pump impeller

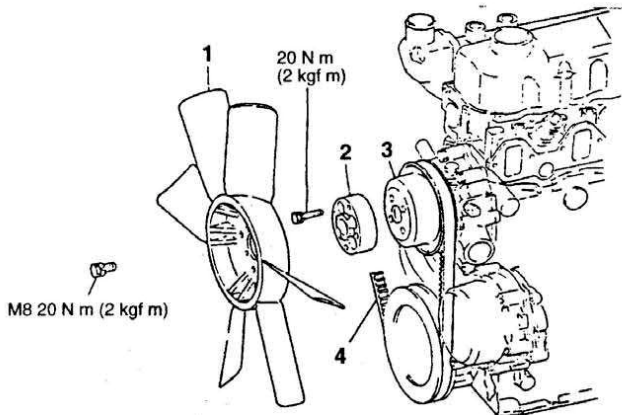
5. SERVICE PROCEDURES

Removal and Installation



- 1 Cooling fan
- 2 Fan pulley
- 3 Fan drive ass'y
- 4 Tension pulley
- 5 V-belt

5-1 Cooling fan



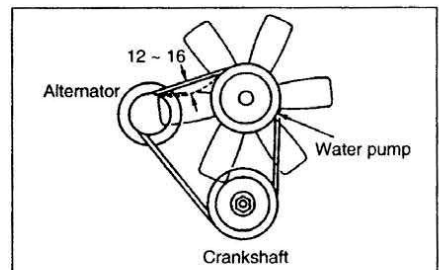
- 1 Cooling fan
- 2 Spacer
- 3 Water pump pulley
- 4 V-belt

5-2 Inspection and Adjustment of V-Belt tension.

- 1) Adjust the belt tension to obtain the specified belt deflection when the center of each belt is pressed with a force of approximately 98 N (10kgf).

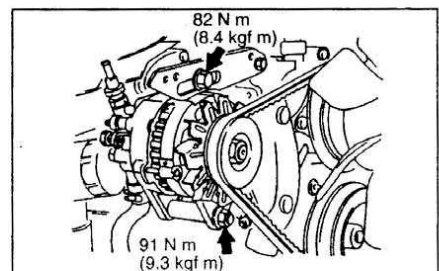
NOTE:

1. A slack belt can be a cause of over heating and undercharge.
2. An excessively tight belt may result in damaged bearings and belts.



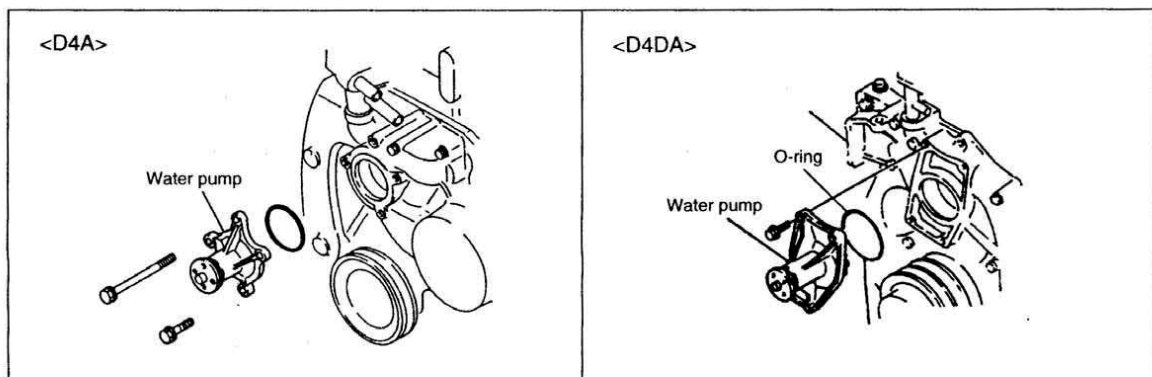
- 2) Adjustment of Fan Belt

To adjust the fan belt tension, slightly back off the alternator attaching nut and adjusting bolt and move the alternator.

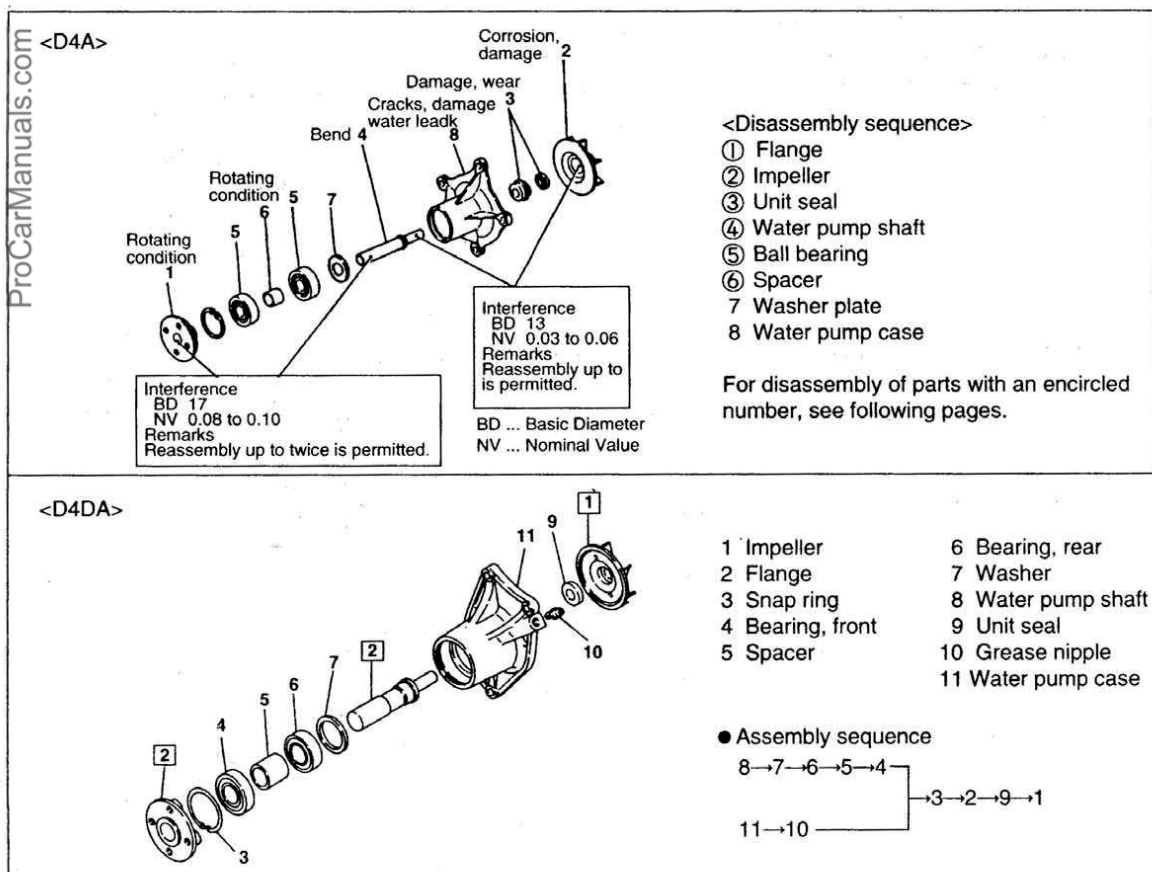


5-3 Water pump

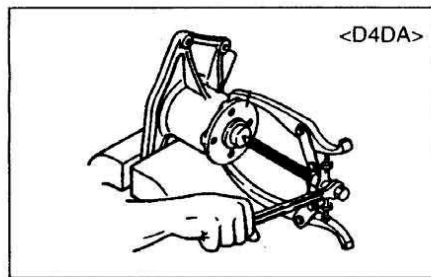
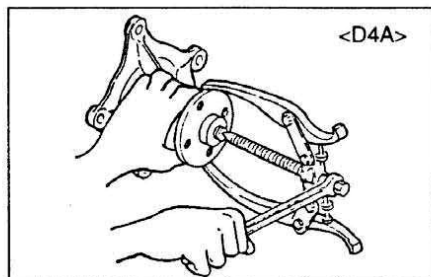
5-3-1 Removal and Installation



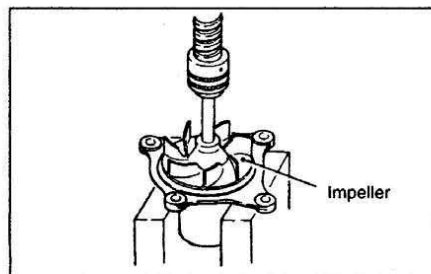
5-3-2 Disassembly and Inspection



- (a) Using gear puller, remove the flange.



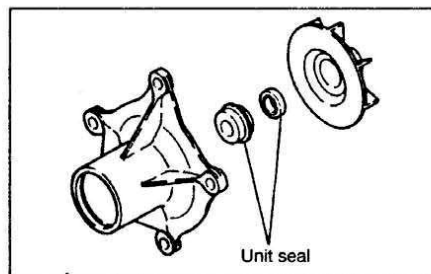
- (b) After removing the snap ring, withdraw the water pump shaft together with the ball bearing by using a press and remove the impeller. Heating the water pump case to approximately 80°C helps make the job easier.



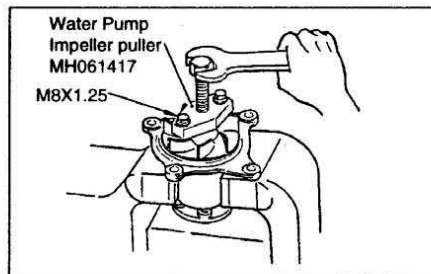
- (c) Check the unit seals installed in the impeller and water pump case for damage and wear. If defects are evident, or when water leaks during operation, replace the unit seals with new ones.

NOTE:

Whenever the unit seal is removed, it must be replaced with a new one.



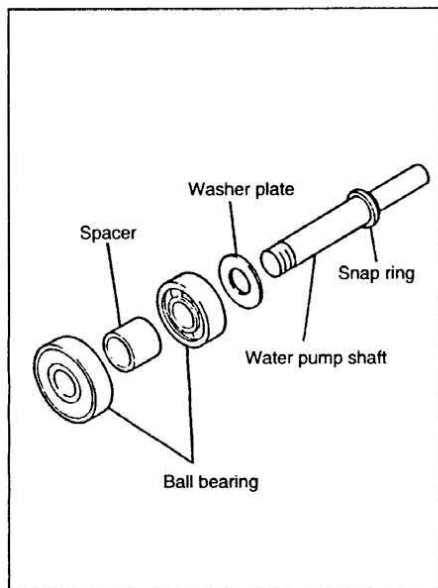
When the unit seals alone are to be replaced, tap two holes in the impeller to M8 and, using Water Pump Impeller Puller (special tool), remove the impeller.



(d) Using a gear puller or press, remove the ball bearings.

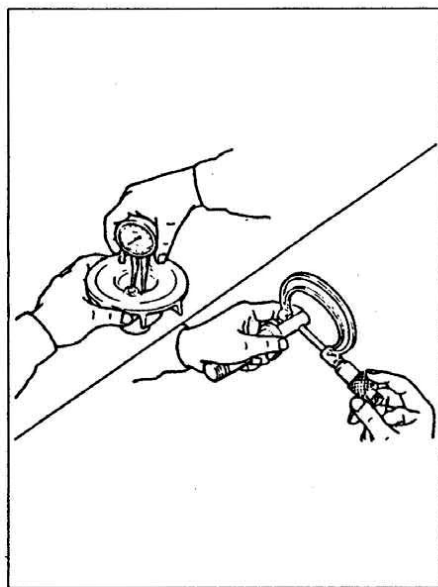
NOTE:

Do not remove the snap ring from the water pump shaft.

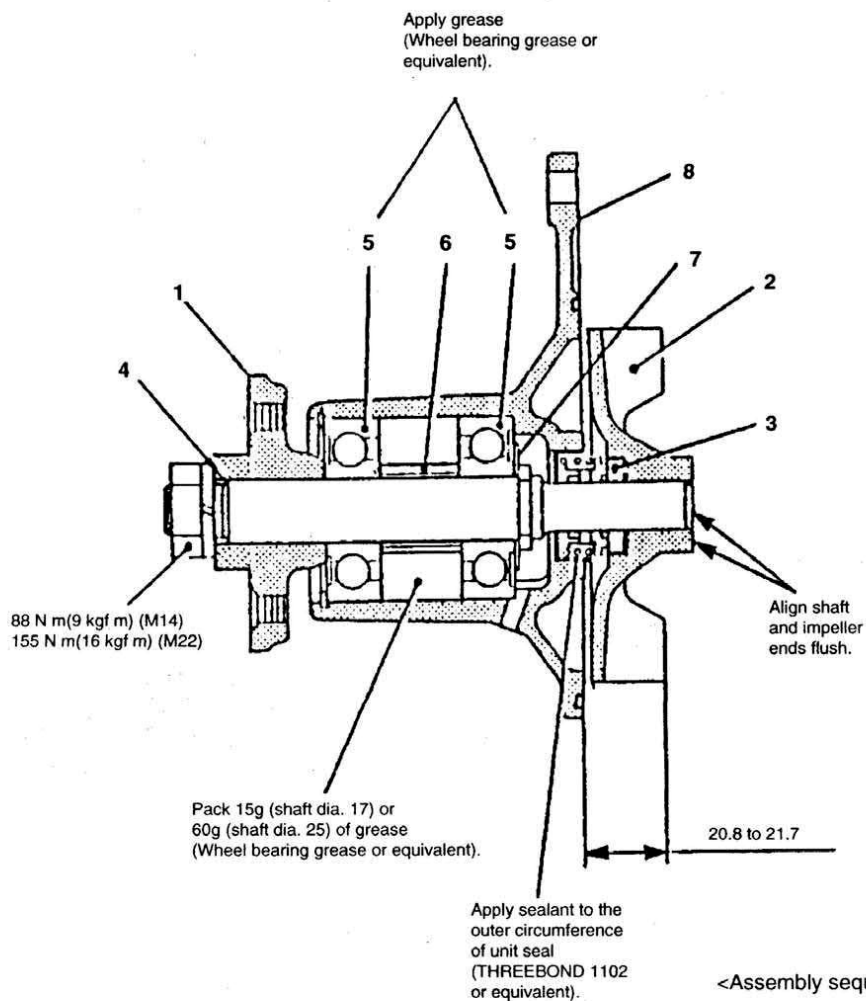


(e) When the impeller and flange are removed from the water pump shaft, it may result in insufficient interference.

If they are reassembled three times or more, or if the interference is below the specification even reassembly is two times or less, they must be replaced with new ones.



5-3-3 Reassembly



<Assembly sequence>

4→7→5→6→8→3→2→1

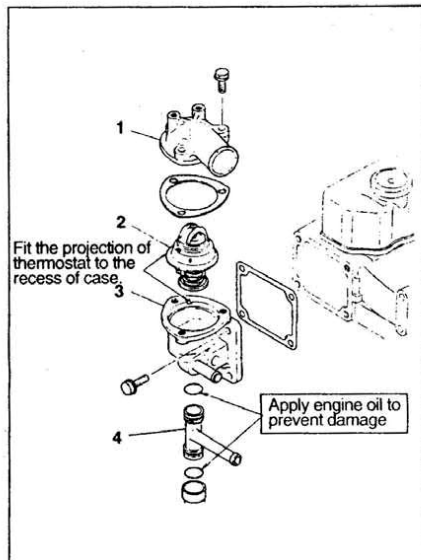
NOTE:

1. After reassembly, install the water pump onto the timing gear case and make sure that the impeller is not in contact with the timing gear case.
2. Reassembly of the flange and impeller into the water pump shaft is allowed up to two times.

5-4 Thermostat

5-4-1 Removal and Installation

- 1 Thermostat cover
- 2 Thermostat
- 3 Thermostat case
- 4 Bypass pipe

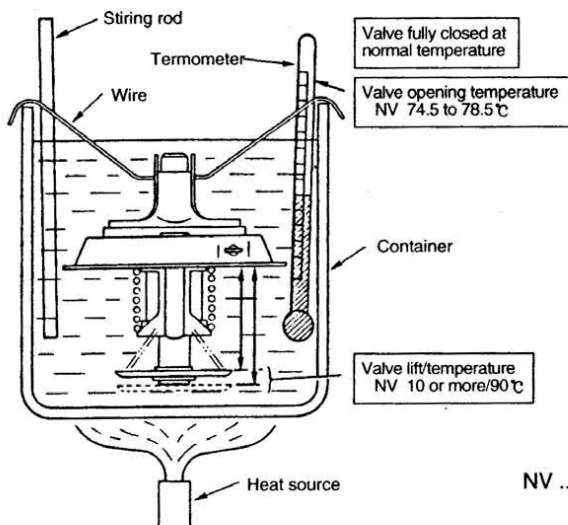


5-4-2 Inspection

Agitate water in the container with the stirrer to obtain uniform temperature.

For the inspection, use the following procedures.

- 1 Slowly heat water to the thermostat valve opening temperature. Keep this condition for about five minutes and make sure that the valve is open.
 - 2 Raise the water temperature up to 95°C.
Keep the condition for five minutes and measure the lift of pellet.
 - 3 Lower temperature down to 65°C or below and ensure that the valve is fully closed.
- If the thermostat is found defective in any of the above items, replace it with a new one.

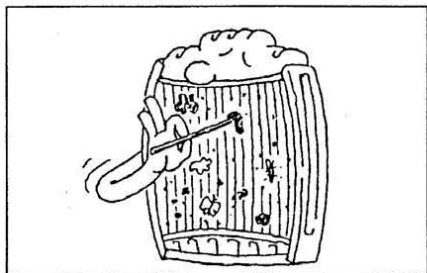


NV ... Nominal Value

5-5 Radiator

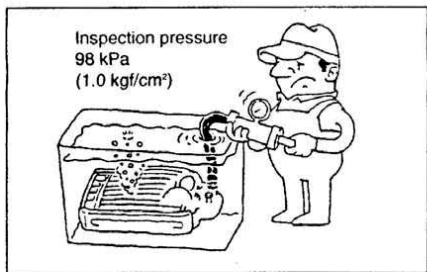
5-5-1 Inspection

- (1) Using a copper wire or similar device, remove dirt, mud, and bugs from the front of radiator core with care to prevent damage to tubings.



- (2) Connect a hose to one of the radiator ports, cap the other port, and immerse the radiator into water. Using a radiator cap tester, force the compressed air under the specified inspection pressure from the hose end to check for leaks.

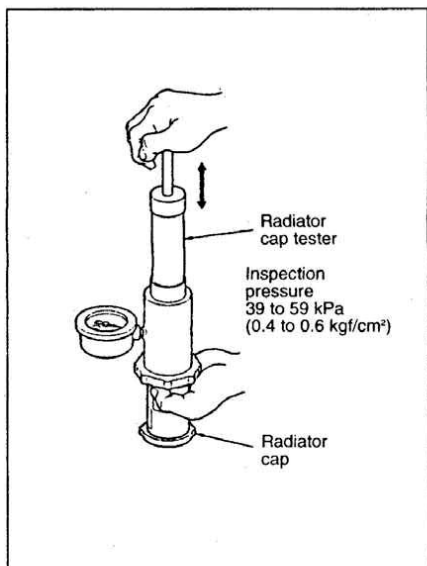
If there is a leak, resolder the point of leakage or replace the radiator.



③ Inspection of Radiator Cap

Check the spring tension and sealing condition of the pressure valve and vent valve. If defective, replace.

Check the pressure valve opening pressure, using a radiator cap tester.



5-6 Cleaning of Cooling System

If the radiator is used for a long time, rust, scale, mud, etc. are deposited inside, resulting in overheat. Clean the cooling system with city water by using the following procedures.

The city water to be used should have the following properties.

Required Properties of City Water

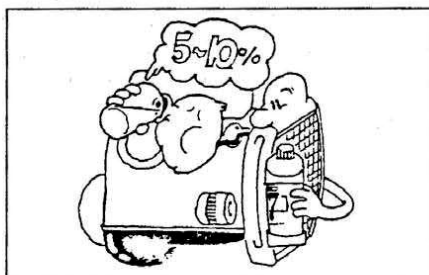
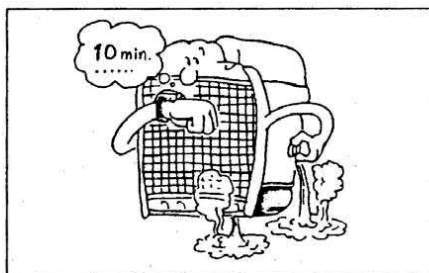
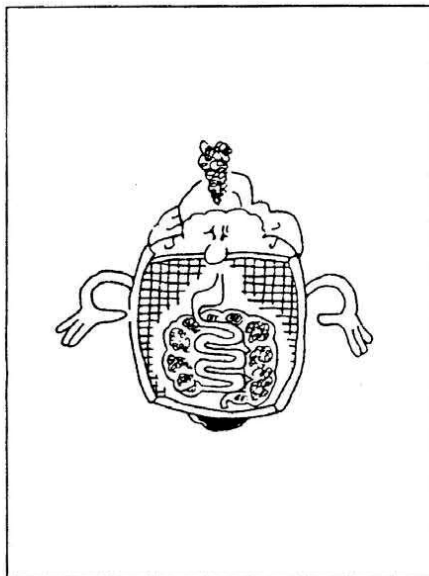
Total hardness	300 ppm or less
Sulfate SO_4^{2-}	100 ppm or less
Chloride Cl^-	100 ppm or less
Total dissolved solids	500 ppm or less
PH	6 to 8

NOTE:

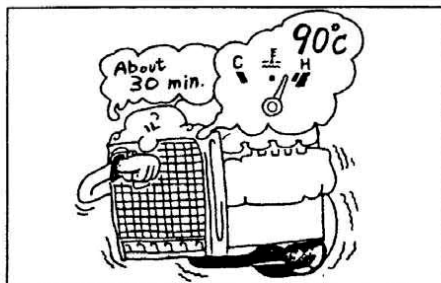
1. Use a cleaning solution if the radiator is seriously obstructed or coolant is seriously contaminated.
2. When the cooling system is cleaned or washed with water, make sure that the coolant temperature is maintained at 90°C ; the coolant temperature below the valve opening temperature closes the thermostat resulting in poor coolant circulation.

- (1) Washing with Water (Every six months at coolant change or before and after the use of antifreeze)
 - (a) Discharge coolant from the radiator, and crankcase.
 - (b) After draining the system, fill it with tap water (preferably hot water) and, with the water temperature kept at around 90°C , run the engine at idle for about 10 minutes. Then, discharge water.
Continue flushing until the drained water runs clear.

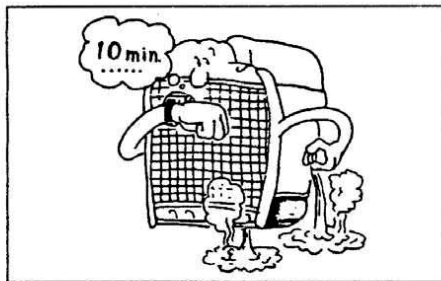
- (2) Washing with Cleaning Solution (Radipet-7 or equivalent) (When radiator clogging or coolant contamination are serious)
 - (a) Discharge coolant from the radiator and crankcase.
 - (b) Ready a mixture of Fuso Radiator Cleaner (Radipet-7 or equivalent: 5 to 10%) and cooling water.
pour the specified amount of mixture into the radiator.



- (c) Run the engine to raise the solution temperature to around 90°C. Let the engine run at idle another 30 minutes, then remove the solution.

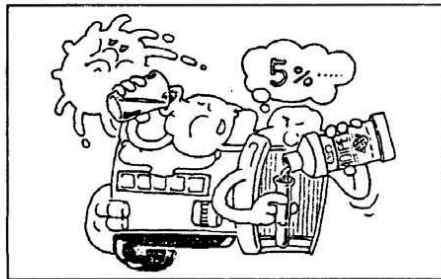


- (d) After discharging the solution, fill the system with tap water (preferably hot water) and, with the water temperature kept at around 90°C, run the engine at idle for about 10 minutes. Then, drain water. Continue flushing until the drained water runs clear.



(3) Antirust and Antifreeze

- (a) After cleaning, add the Fuso Radiator Antirust (Radipet-9B) or equivalent at a ratio of 5% to the coolant quantity to prevent corrosion in summer.



- (b) In winter, add the Fuso Antifreeze or equivalent at a ratio of 30 to 60% to prevent freezing.

NOTE:

1. Make sure that the antirust is added in summer and the antifreeze in winter at the specified ratios.
2. The antifreeze or antirust added coolant used for a season (about six months) must not be reused.
3. Use the antifreeze at a proper mixing ratio of 30 to 60% suitable for the atmospheric temperature. If the mixing ratio is less than 30%, the antirust effect will fall. If the ratio exceeds 60%, the antifreeze effect will fall, and engine overheating will result.

5-7 Gas Leak Test

Air or exhaust gas leaked into the coolant promotes corrosion and rust formation.

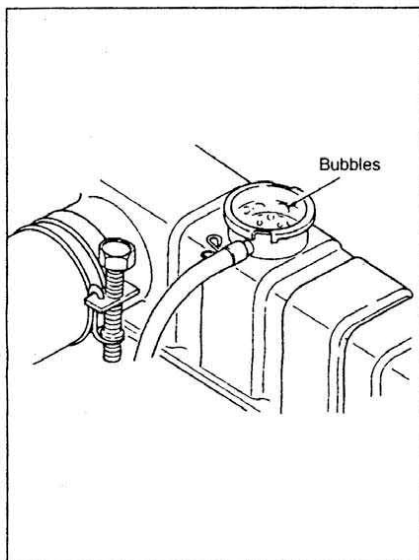
Perform the following check and, if defects are found, take remedial action.

(1) Inspection

Remove the pressure cap from the radiator, and run the engine to raise the coolant temperature up to around 90 °C.

(2) Causes

- (a) If air is trapped in coolant, check cylinder head bolts, water pump mounting bolts, and hose and its connections for looseness. Check also hoses for damage.
- (b) If the exhaust gas has leaked into coolant, check the cylinder head gasket or nozzle tube end stake for damage. Check also cylinder head for cracks.



5-8 Bleeding the Cooling System

- (1) With the pressure cap removed from the radiator, let the engine run at idle with coolant temperature of about 90 °C to bleed the system completely.
- (2) After the system has been bled of air, add coolant to radiator as required.

6. TROUBLESHOOTING

