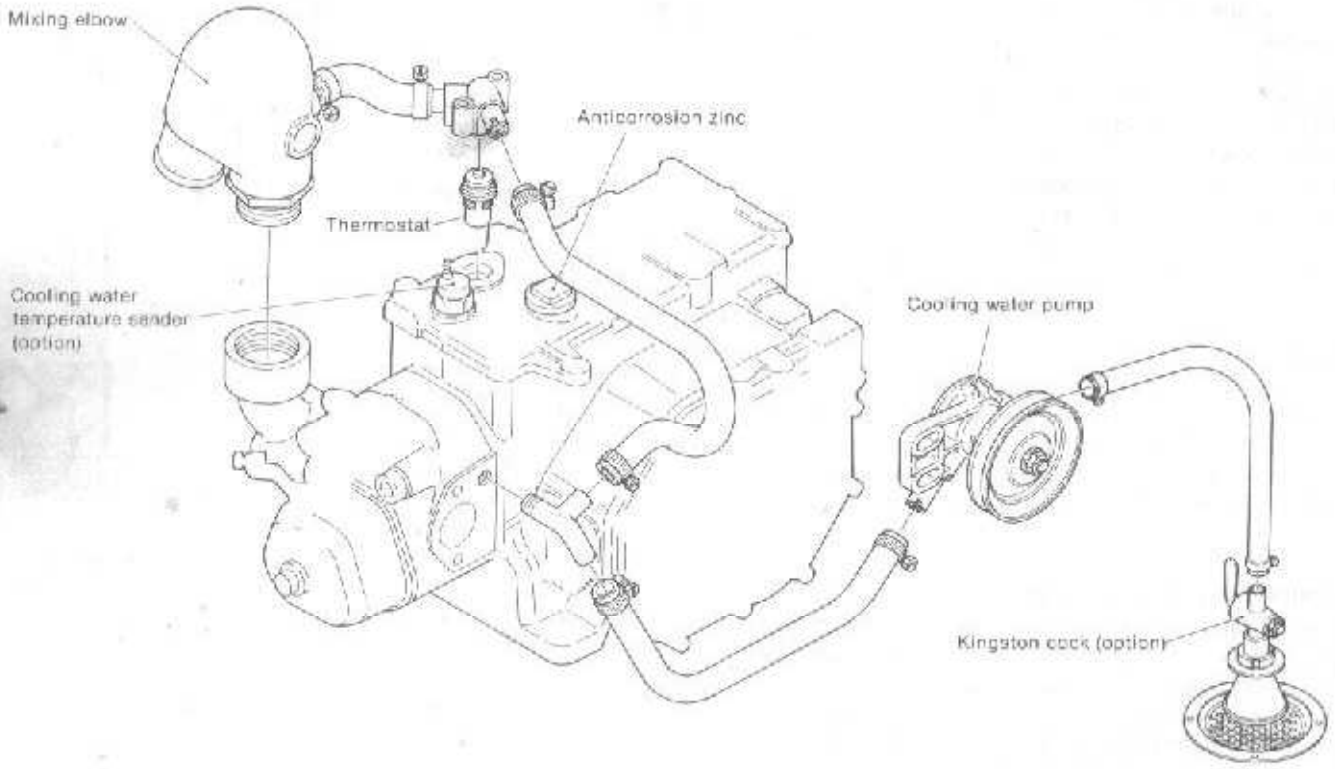
CHAPTER 7

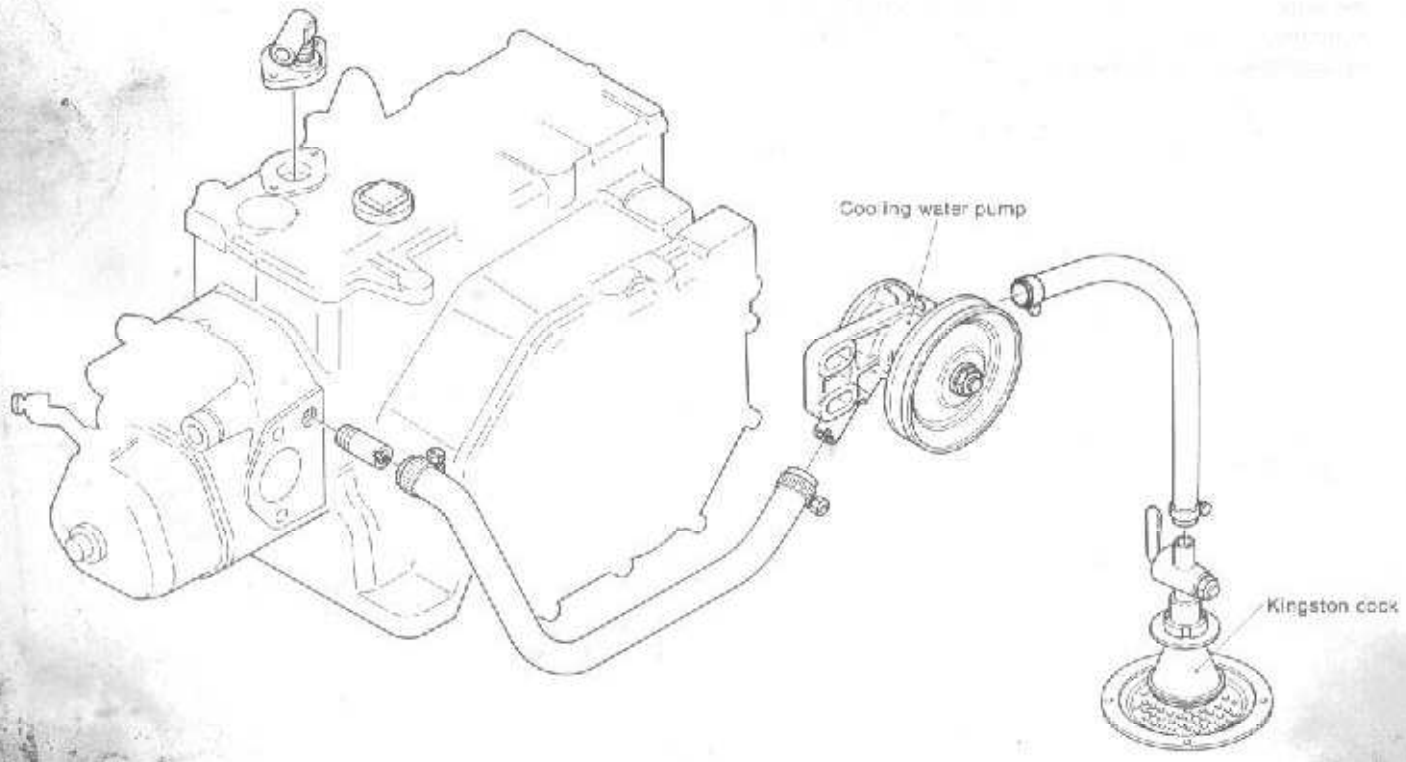
COOLING SYSTEM

1. Cooling System

1. YSM8-R, YSM12-R



2. YSM8-Y, YSM12-Y



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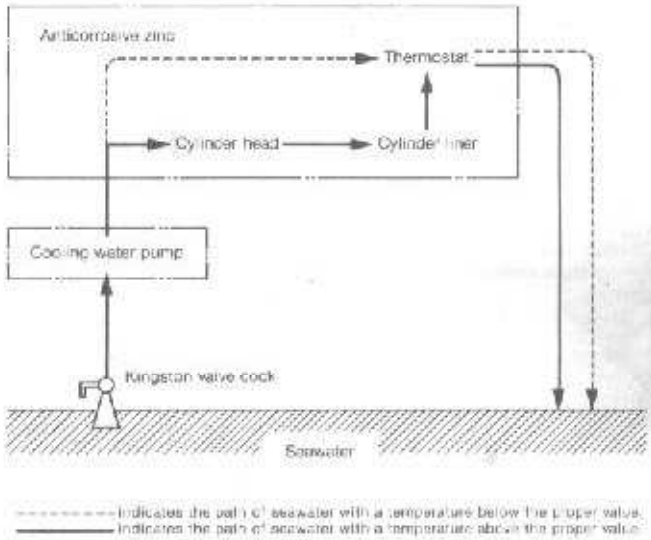
1-1 Composition

(1) A sea water direct cooling system incorporating a rubber impeller pump is employed.
(2) A themostat is installed on the water-outlet of cylinder jacket and a bypass circuit is provided to keep the cooling water temperature constant at all times.
This not only prevents overcooling at initial operation, but also improves the combustion performance and increases the durability of moving parts by keeping the temperature constant. (R-type)
(3) Anticorrosion zinc is provided at the cylinder jacket to prevent electrolytic corrosion of the cylinder jacket and cylinder head by the sea water.
(4) A cooling water temperature sender is installed so that an abnormal rise in the cooling water temperature is indicated at the lamp on the instrument panel. (R-type)
(5) A tandem type bilge pump for bilge pumping is also available.
(6) A scoop strainer is provided at the water intake kingston cock to remove dirt and vinyl from the water.
(7) Rubber hoses are used for all interior piping. This eliminates pipe brazing damage due to engine vibration and simplifies the engine's mounting.

1-2 Cooling water route (R-type)

The cooling water is sucked up by the water pump through a kingston cock installed on the hull. The water delivered from the water pump is branched in two directions at the cylinder intake coupling: one part of the water enters the cylinder head and the other bypasses the mixing elbow.
The water that enters the cylinder head cools the cylinder head and then rises to the cylinder through the passage and cools the cylinder liner jacket. From the cylinder liner, the water enters the mixing elbow through the thermostat mounting. At the mixing elbow, this water is mixed with the exhaust gas and is discharged out of the vessel.

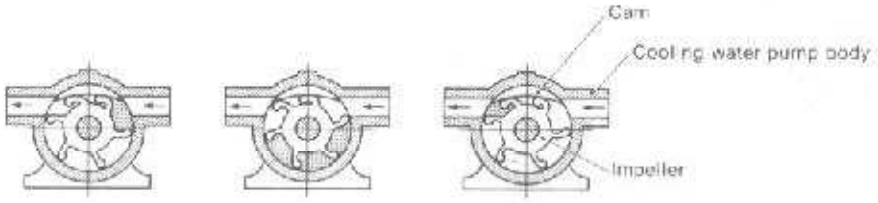
The temperature of the seawater which is sucked up by the cooling water pump to be used as cooling water is kept constant by the thermostat installed on the upper lid of the cylinder. If the temperature should rise abnormally, it is detected by the temperature sender installed on the upper lid of the cylinder and warning device.



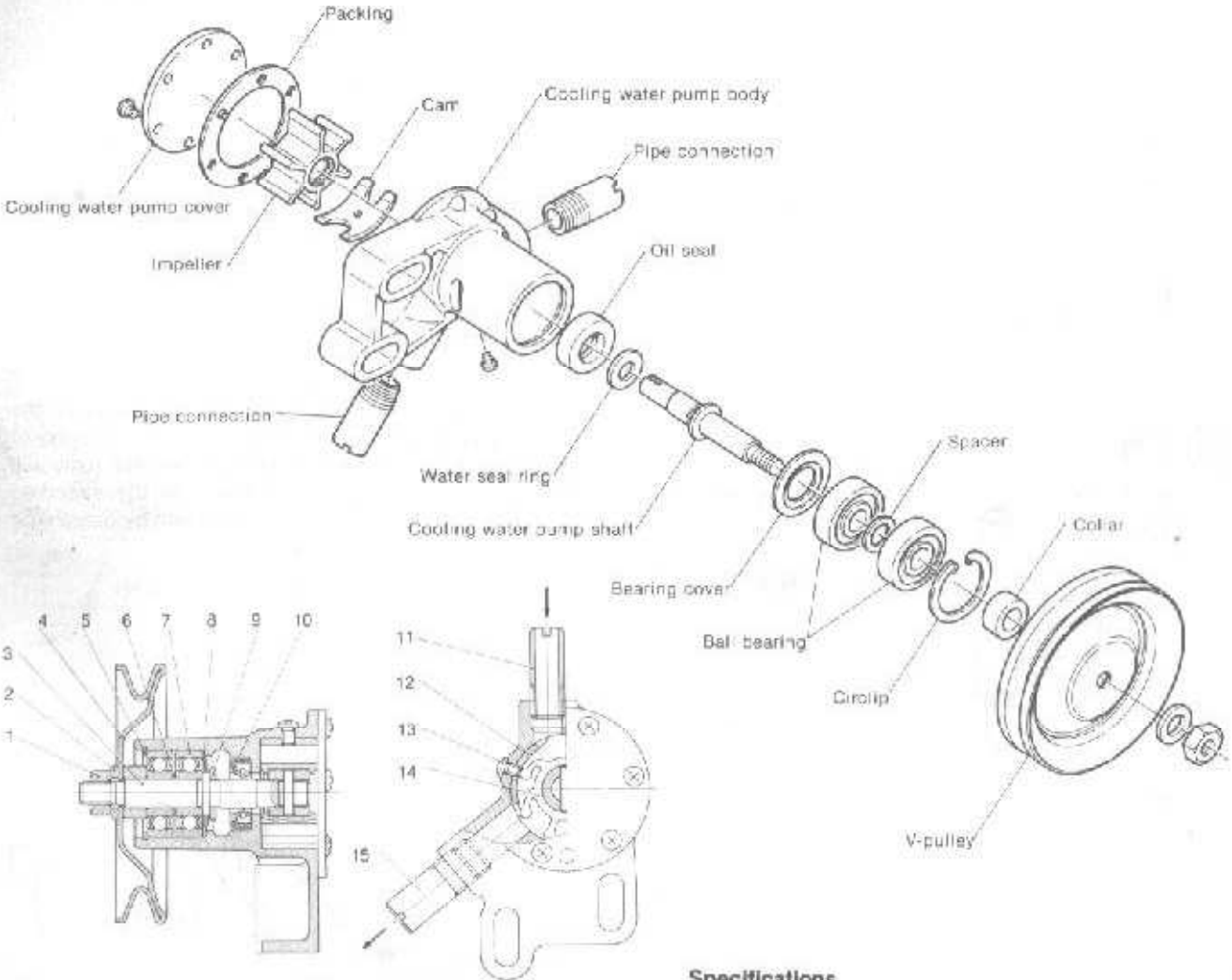
2. Water Pump

2-1 Construction and operation

The water pump is a rubber impeller type pump driven from the crankshaft by a V-belt.
The rubber impeller, which has ample elasticity, is deformed by the offset plate inside the casing, causing the water to be discharged. This pump is ideal for small, high-speed engines.



2-2 Cooling water pump (without bilge pump)



1 Nut
2 Washer
3 Cooling water pump shaft
4 V-pulley
5 Circlip
6 Spacer
7 Ball bearing
8 Bearing cover
9 Water seal ring
10 Oil seal
11 Pipe connection (inlet)
12 Cam
13 Set screw
14 Impeller
15 Pipe connection (outlet)

Specifications m (in.)

Rated speed	2000 rpm
Suction head	1(39.37)
Total head	3(78.74)
Delivery Capacity	550 ℓ/hr.

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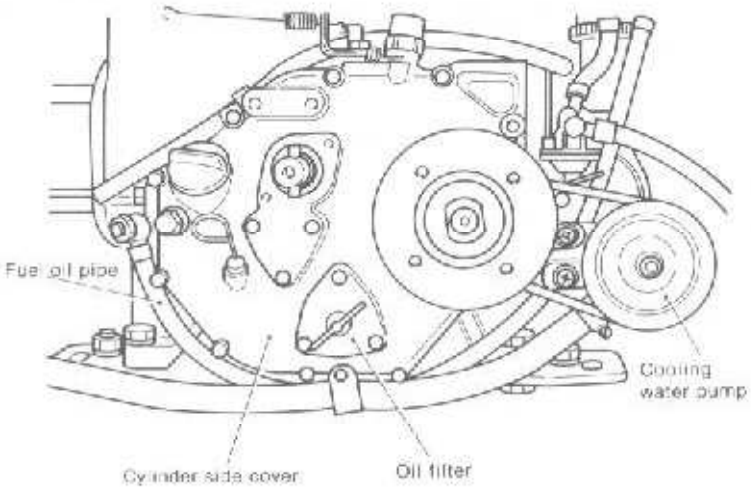
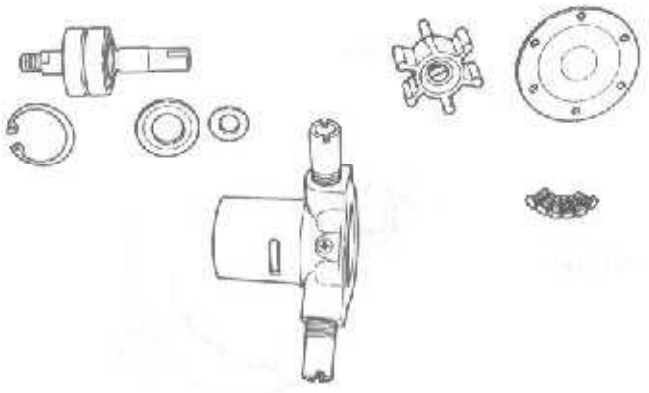
2-3 Disassembly

(1) Loosen the water pump mounting bolts, remove the V-belt and remove the water pump ass'y from the cylinder.



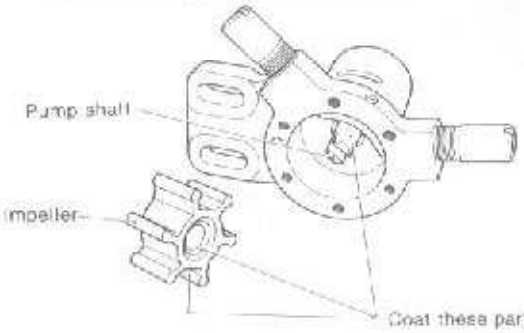
(2) Remove the V-pulley mounting bolt and V-pulley.
(3) Remove the snap ring for fastening the bearing.
(4) Remove the lid for the pump chamber.
(5) Pull out the drive shaft by tapping it with a copper hammer from the impeller side toward the pulley side.
(6) Remove the rubber impeller.
(7) Extract the seal from the pump.
(8) From the drive shaft remove the two bearings, one nylon packing and one rubber seal.



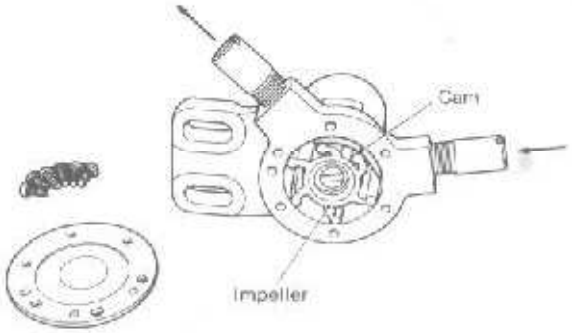
Disassembling the cooling water pump

2-4 Reassembly precautions

(1) Before inserting the rubber impeller into the casing, coat the sliding face, pump shaft and impeller fitting section with grease or Monton X.



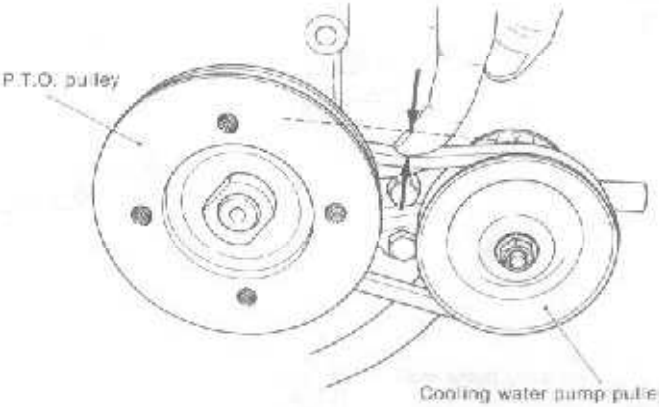
(2) Be sure that the direction of curving of the impeller is correct.
The impeller is curved in the direction opposite the direction of rotation.



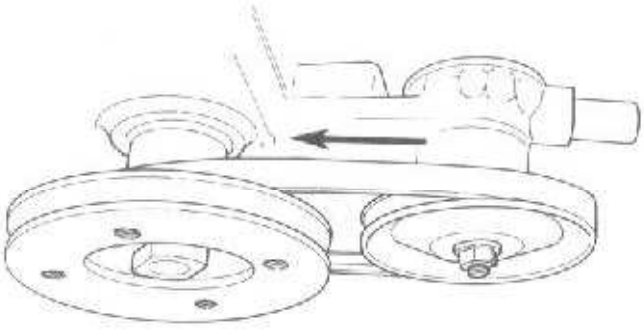
(3) Adjust the V-belt tension.
If the V-belt tension is slack, the discharge of the cooling water will diminish; if it is too tight, the play of the pump bearings and the wear of the wear plate will be accelerated. Adjust the tension to the specified value. Check the deflection of the V-belt by pressing it in the center with your fingers.

mm (in.)

V-Belt deflection	5 to 7 (0.1968 ~ 0.2755)



NOTE: Mount the belt in the direction of pump rotation.



(4) If the sliding surface of the V-belt is cracked or worn or is stained with oil, etc., replace it with a new one.

V-belt for driving cooling water pump	size	19
	code No.	104511 ~ 78780

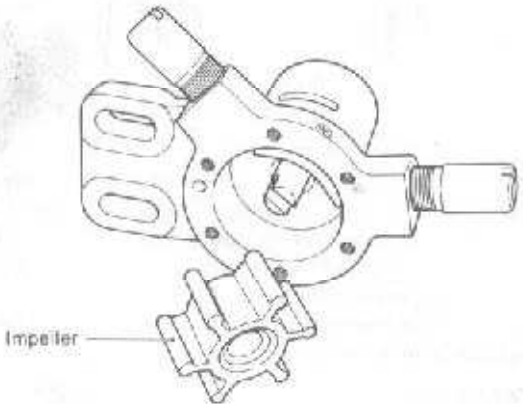
(5) Check after assembly
After assembly, attach the belt and run the engine to ascertain whether or not it provides the specified discharge.

2-5 Handling precautions

(1) Never operate the water pump dry as this will damage the rubber impeller.
(2) Always turn the engine in the correct direction of rotation as turning the engine in the opposite direction will damage the rubber impeller.
(3) Inspect the pump after every 1,500 hours of operation and replace if faulty.

2-6 Inspection

(1) Inspect the rubber impeller for fractures, cracks and other damage, and replace if faulty.



(2) Check the pump chamber lid and the impeller sliding surface of the main unit for wear. If they are defective, replace them.

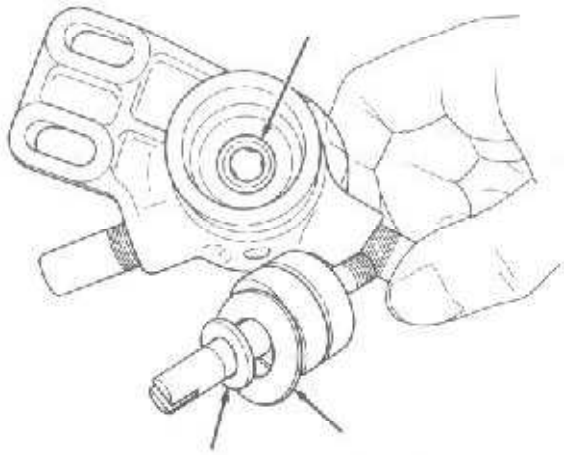
mm (in.)

		Maintenance standard	Clearance at assembly	Maximum allowable clearance	Wear limit
Water pump	Impeller width	19±0.1 (0.744 ~ 0.752)	0.2 (0.0079)	0.4 (0.0157)	
	Housing width	18.9 (0.7441) (without packing) 19.2 (0.7559) (with packing)			
	Wear plate wear				0.2 (0.0079)

(3) Water pump impeller shaft oil seal section wear.

mm(in.)

	Maintenance standard	Wear limit
Oil seal section shaft diameter	10.0 (0.3937)	9.9 (0.3898)



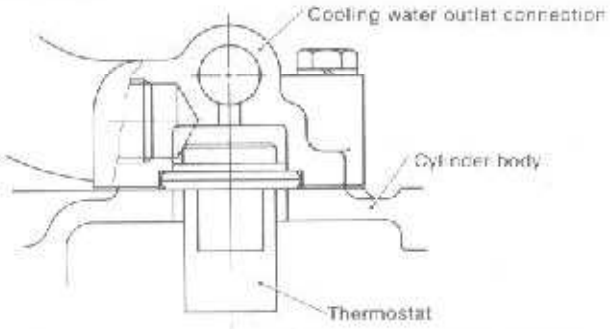
If water leaking from the scupper increases while the engine is running, or if the components are found to be defective when disassembled, replace them.

(4) Inspect the bearing for play and check for seizing at the impeller shaft fitting section. Replace the bearing if there is any play.

3. Thermostat

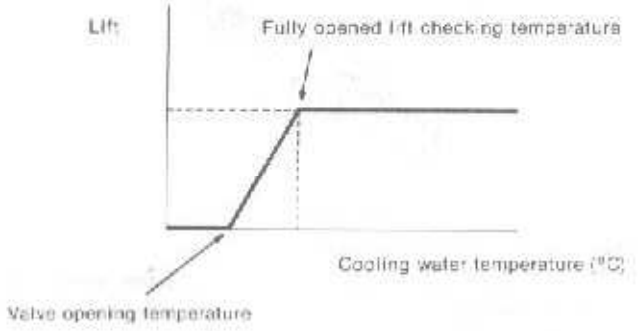
3-1 Construction and operation

The thermostat remains closed until the cooling water temperature reaches a fixed temperature. Until the cooling water reaches this fixed temperature, it collects at the cylinder head and the water flowing from the water pump is discharged through the bypass circuit. When the cooling water temperature exceeds a fixed temperature, the thermostat opens and the cooling water flows through the main circuit of the cylinder and cylinder head. The thermostat serves to prevent overcooling and improve combustion performance by maintaining the cooling water temperature at a specified level. The thermostat of this engine is installed at the cooling water outlet on the cylinder body.



Thermostat operating temperature

Opening temperature	42±2°C
Full open temperature	52±2°C

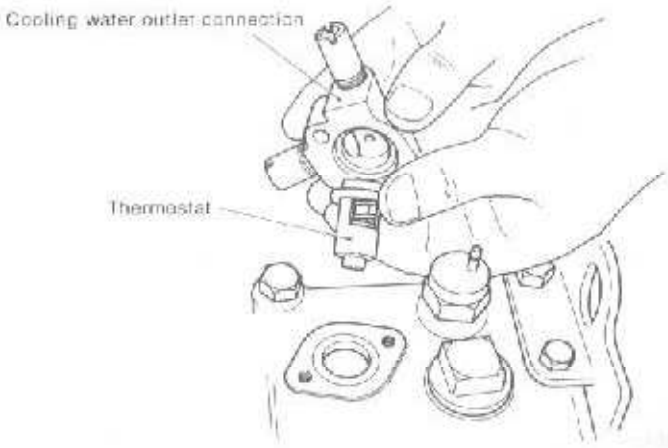


Characteristic of Thermostat

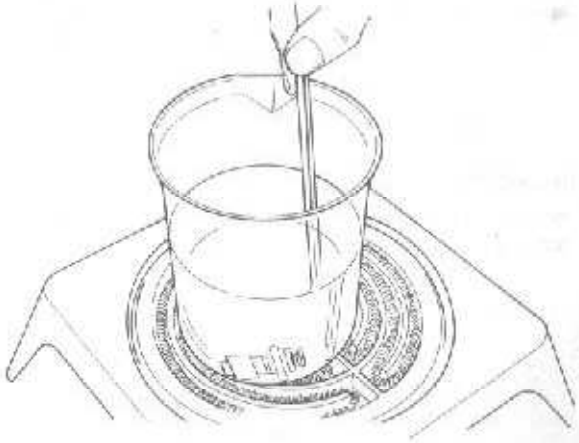
When the seawater temperature is below 42°C, the pumped-up seawater is discharged outside directly from the thermostat section, and circulation of the cooling water into the cylinder is stopped until the water temperature rises. When the water temperature reaches 52°C, the thermostat valve is opened fully.

3-2 Inspection

(1) Remove the water outlet coupling at the top of cylinder body to remove and inspect the thermostat. Remove any dirt or foreign matter that has built up in the thermostat, and check the spring, etc. for damage and corrosion.



(2) Testing the thermostat
Place the thermostat in a container filled with water. Heat the container with an electric heater. If the thermostat valve begins to open when the water temperature reaches about 42°C and becomes fully open at 52°C, the thermostat may be considered all right. If its behaviour differs much from the above, or if it is found to be broken, replace it.



(3) In general, inspect the thermostat after every 300 hours of operation. However, always inspect it when the cooling water temperature has risen abnormally and when white smoke is emitted for a long period of time after the engine starts.

(4) Replace the thermostat when it has been in use for a year, or after every 2000 hours of operation.

Part No. code of thermostat	105582 ~ 49200

(5) Attaching the thermostat to the colling water system
Before attaching the thermostat to the system, be sure to check its packing and make sure there are no leaks.

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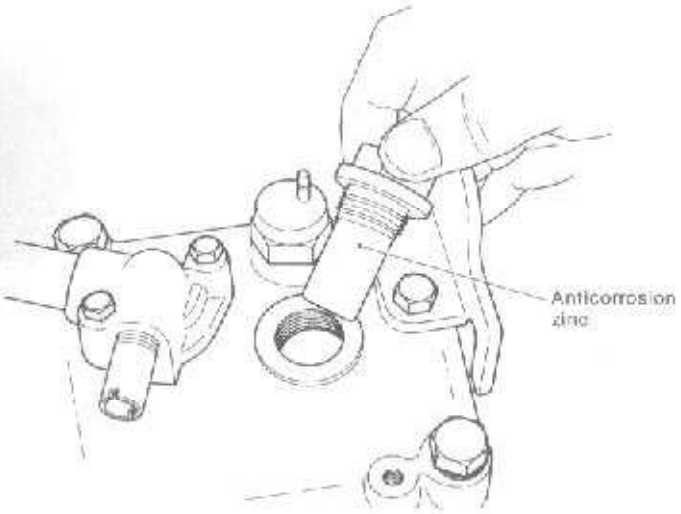
4. Anticorrosion Zinc

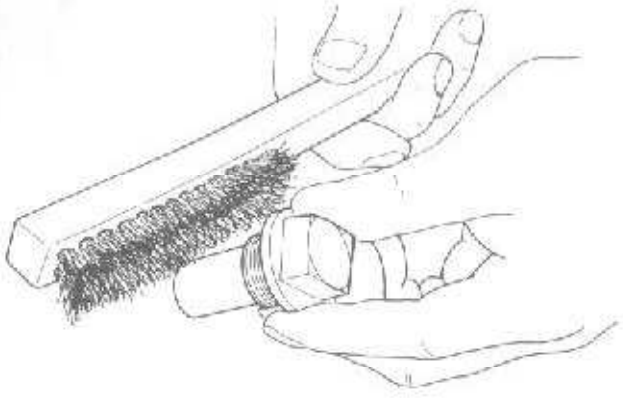
4-1 Principles

Anticorrosion zinc is installed to prevent electrolytic corrosion by sea water.
When different metals, i.e., iron and copper, are placed in an highly conductive liquid, such as sea water, the iron gradually rusts. The anticorrosion zinc provides protection against corrosion by corroding in place of the cylinder, cylinder liners and other iron parts.
Anticorrosion zinc is provided at the cylinder water jacket.

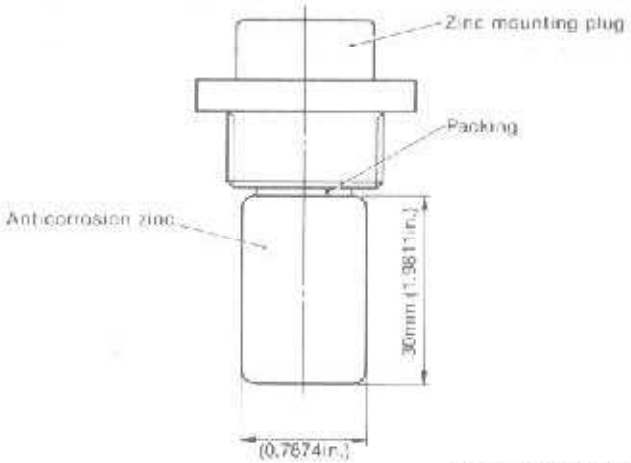


4-2 Inspection

Generally, replace the anticorrosion zinc after every 500 hours of operation. However, since this period depends on the properties of the sea water and operating conditions, periodically inspect the anticorrosion zinc and remove the oxidized film on its surface.



Replace the anticorrosion zinc after 50% corrosion.



Part no. 27210-20030

Replace the anticorrosion zinc by pulling the old zinc from the zinc mounting plug and screwing in the new zinc.

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5. Deposit Removing

If deposit formed on the cooling water passageways the flow of the cooling water will be hampered, giving rise to engine trouble. So it is necessary to remove deposit from the passageways by running fresh water through them.

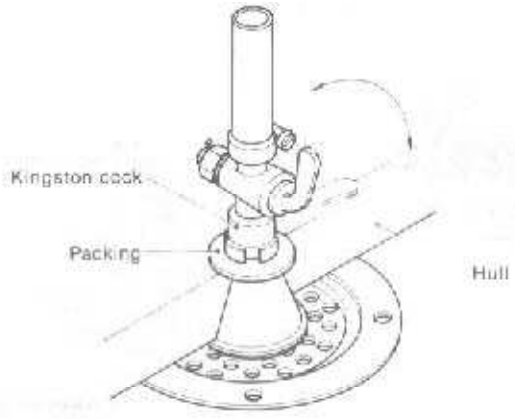
6. Kingston Cock

6-1 Construction

The Kingston cock, installed on the bottom of the hull, controls the intake of cooling water into the boat. The Kingston cock serves to filter the raw water so that mud, sand, and other foreign matter in the water does not enter the water pump.
Numerous holes are drilled in the raw water side of the Kingston cock, and a scoop strainer is installed to prevent sucking in of vinyl, etc.

6-2 Handling precautions

Caution the user to always close the Kingston cock after each day of use and to confirm that it is open before beginning operation.
If the Kingston cock is left open, water will flow in reverse and the vessel will sink if trouble occurs with the water pump.
Moreover, if the engine is operated with the Kingston cock closed, the cooling water will not be able to come in, resulting in engine and pump trouble.



6-3 Inspection

When the cooling water volume has dropped and the pump is normal, remove the vessel from the water and check for clogging of the Kingston cock.
Moreover, when water leaks from the cock, disassemble the cock and inspect it for wear, and repair or replace it.

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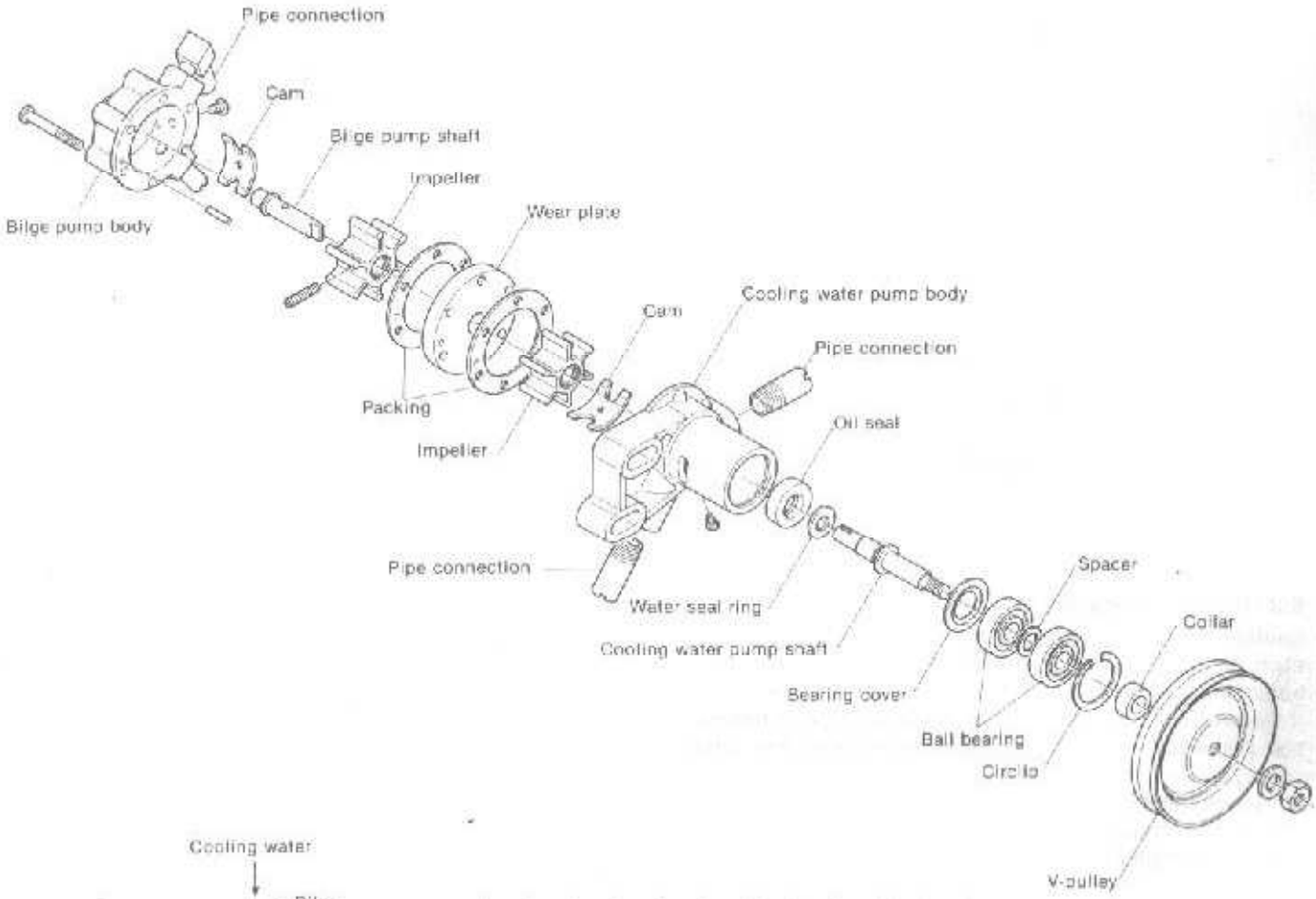
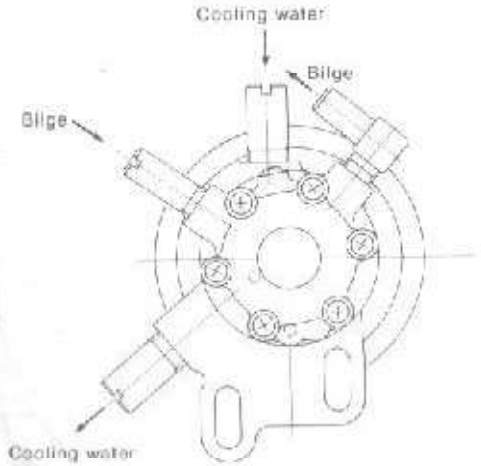
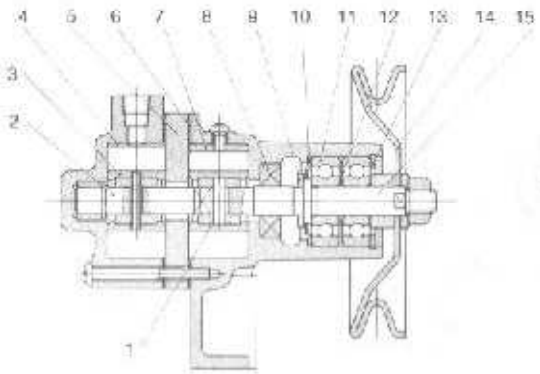
7. Bilge Pump

7-1 Construction of bilge pump

The construction of the bilge pump is similar to that of rotary rubber impeller type cooling water pump. It is mounted on the lid side of the cooling water pump. By inserting the impeller shaft into the slit of the impeller shaft of the cooling water pump, it is driven by the PTO V pulley simultaneously with the cooling water pump.







1 Impeller
2 Bilge pump shaft
3 Impeller
4 Cam
5 Wear plate
6 Packing
7 Cam
8 Oil seal
9 Water seal ring
10 Bearing cover
11 Ball bearing
12 Spacer
13 Circlip
14 V-pulley
15 Cooling water pump shaft

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7-2 Specifications

m (in.)

Rated speed	2000 rpm
Suction head	1 (39.37)
Total head	2 (78.74)
Delivery capacity	150 ℓ/hr.

7-3 Disassembling the bilge pump

(1) By removing the fitting bolt for the bilge pump, remove the bilge pump as a unit.
(2) Remove the packing and the wear plate.
(3) Pull out the impeller and impeller shaft from the pump.
(4) By removing the setscrew remove the impeller from the impeller shaft.
(5) Remove the cam from the bilge pump.

7-4 Inspection

(1) Inspect the rubber impeller for fractures, cracks and other damage, and replace if faulty.
(2) Rubber impeller side wear and wear plate clearance.

mm (in.)

		Maintenance standard	Clearance at assembly	Maximum allowable clearance	Wear limit
Bilge pump	Impeller width	19 +0.1 (0.744 ~ 0.752)	0.2 (0.0079)	0.4 (0.0157)	
	Housing width	18.9 (0.7441) (without packing) 19.2 (0.7559) (with packing)			
	Wear plate wear				0.2 (0.0079)

(3) Inspect the bearing for play and check for seizing at the impeller shaft fitting section. Replace the bearing if there is any play.
(4) Bilge pump impeller shaft and bushing clearance measurement.

mm (in.)

		Maintenance standard	Clearance at assembly	Maximum allowable clearance
Wear plate	Impeller shaft outside diameter	9.5 (0.3740)	0.005 ~ 0.045 (0.0002 ~ 0.0018)	0.2 (0.0079)
	Bushing inside diameter	9.5 (0.3740)		
Bilge pump body	Impeller shaft outside diameter	9.5 (0.3740)	0.005 ~ 0.045 (0.002 ~ 0.0018)	0.2 (0.0079)
	Bushing inside diameter	9.5 (0.3740)		

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