

CHAPTER 9

MODIFYING THE COOLING SYSTEM

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1. General

1-1. Direct sea water-cooled engine and fresh water-cooled engine

Engine models 2GM20, 3GM30 and 3HM35 are sea water-cooled, and models 2GM20F, 3GM30F and 3HM35F are fresh water-cooled.

The main parts of both sea water-cooled and fresh water-cooled engines are the same; only the cooling systems are different. Sea water-cooled engines can therefore be modified into fresh water cooling by the special parts kit prepared by YANMAR for this modification.

1-2. Modification method

When modifying a seawater-cooled engine into a fresh water-cooled engine, follow the sequence described in Section 2.

1-3. Testing a modified engine

Any engine modified as a fresh water-cooled engine must be given an operating test (running) to check for leakage. This test shall be made before delivery.

1-4. Warranty

Engines modified as fresh water-cooled engines are not covered by the general warranty.

1-5. Kit for modification into a fresh water-cooled engine

The kits for modification into a fresh water-cooled engine differ according to the engine model.

When ordering the modification kit state the following code number.

Applicable Engine Model	2GM20 → 2GM20F	3GM30 → 3GM30F	3HM35 → 3HM35F
Fresh water cooling kit	728271-99510	728374-99510	728671-99510
Mixing elbow Ass'y	○	—	—
Fresh water pump Ass'y	○		
Sea water pump Ass'y	○		—
Heat exchanger Ass'y	*○	*○	*○
Subtank Ass'y	○		
Thermostat Ass'y	○		
Cooling water pipe Ass'y	○		*○
Fuel oil pipe Ass'y	*○	*○	*○
Speed control cable bracket Ass'y	○	—	—
V-belt and other parts Ass'y	○		*○

NOTES: ○ parts marked are those included in the modification kit (necessary for modification).

— parts marked are those not included in the kit (unnecessary for modification).

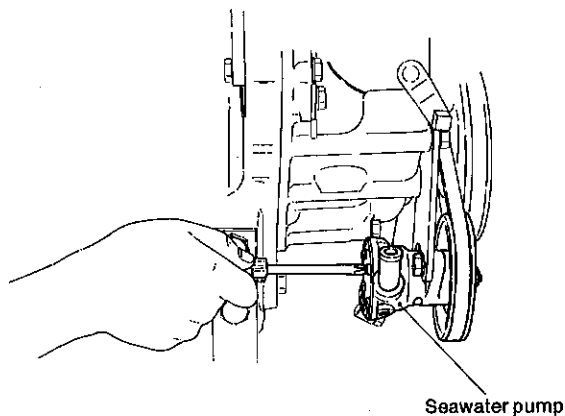
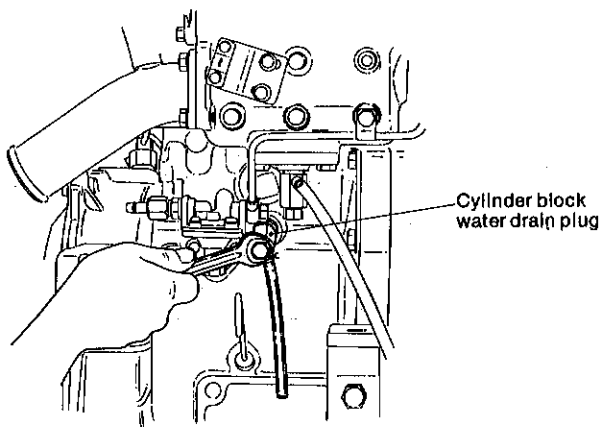
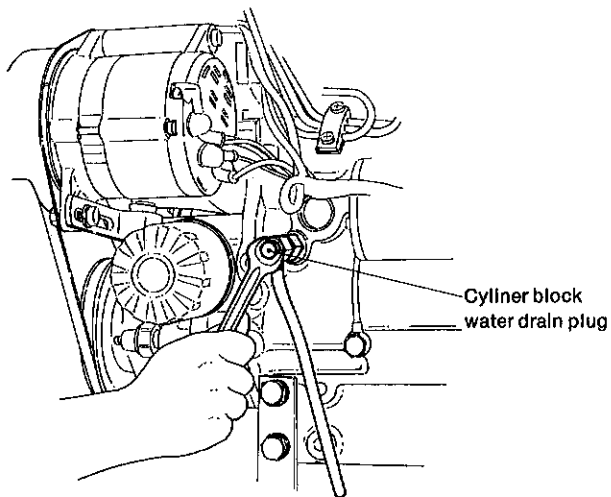
*○ parts marked are those which differ according to the engine model (not interchangeable).

2. Disassembly of sea water-cooled engine

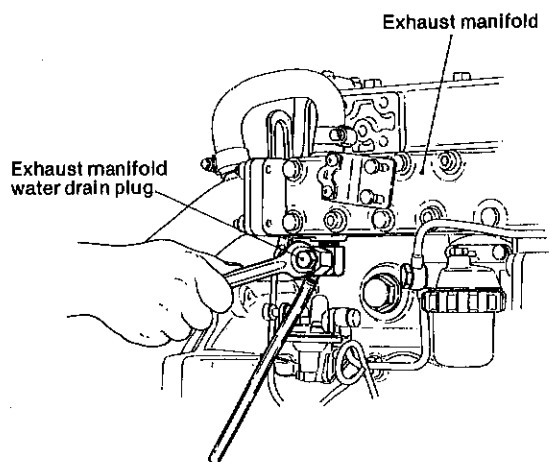
2-1. Drain the cooling sea water

Locations of Cooling Water Drain Plugs

	2GM20	3GM30	3HM35
Cylinder block	○ (Intake side)	○ (Exhaust side)	○ (Exhaust side)
Cooling water pump	○	○	○
Exhaust manifold	—	○	○

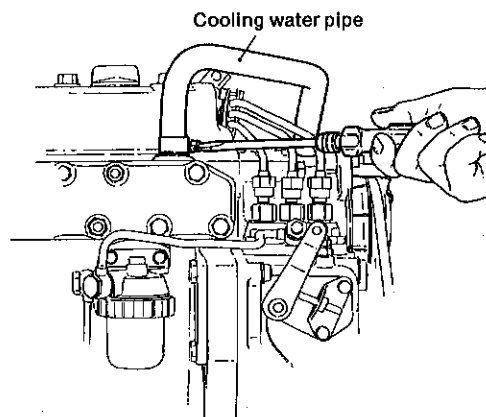


Note: CSW = Cooling Sea Water
CFW = Cooling Fresh Water



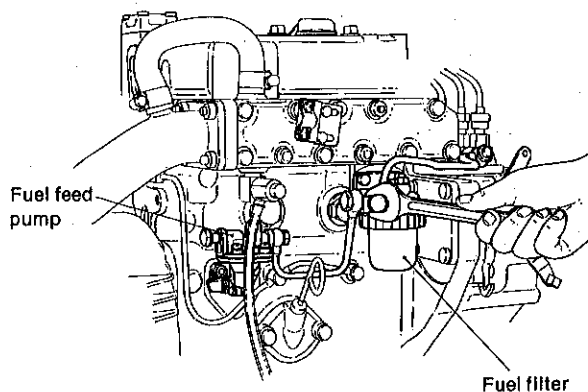
2-2. Remove the cooling water pipe

- (1) For model 2GM20, remove the CSW hose between the thermostat and mixing elbow.
- (2) For models 3GM30 and 3HM35, remove the CSW hose between the thermostat and exhaust manifold.



2-3. Remove the fuel oil pipe

- (1) Remove the fuel pipe between the oil filter and fuel pump.
- (2) Remove the fuel pipe between the fuel feed pump and fuel filter.



2-4. Remove the fuel filter (2GM20)

For models 3GM30 and 3HM35, the filter may be removed as assembled to the exhaust manifold.

2-5. Remove the remote control bracket (2GM20)

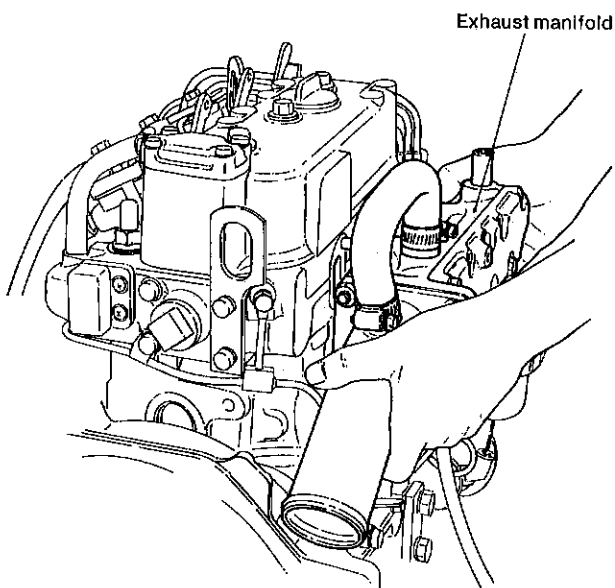
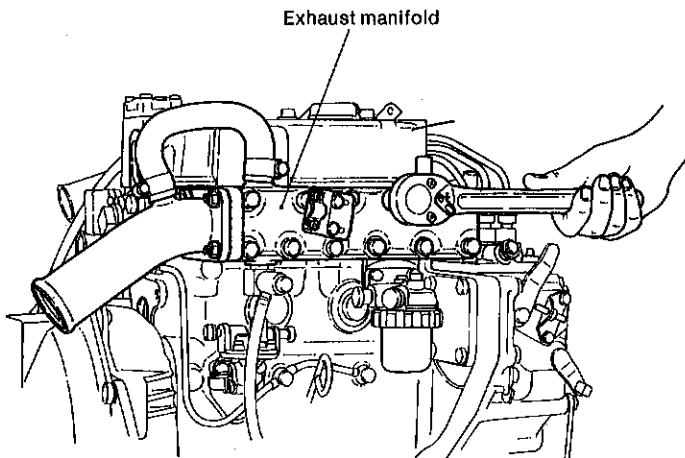
For models 3GM30 and 3HM35, the bracket may be removed as assembled on the exhaust manifold.

2-6. Remove the mixing elbow (2GM20)

For models 3GM30 and 3HM35 the elbow may be removed as assembled on the exhaust manifold.

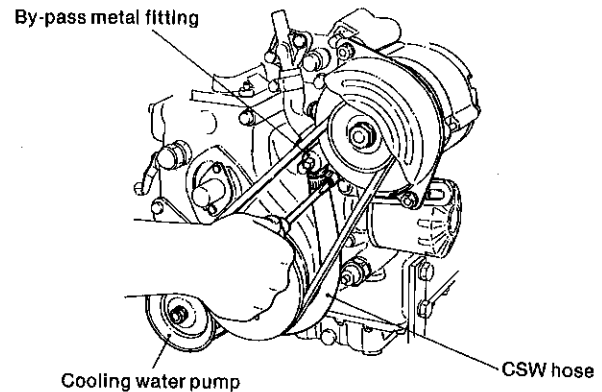
2.7 Remove the exhaust manifold (3GM30, 3HM35)

- (1) For models 3GM30 and 3HM35, the exhaust manifold may be removed with the fuel filter, remote control bracket and mixing elbow assembled on the exhaust manifold.
- (2) Remove the exhaust manifold fixing studs.



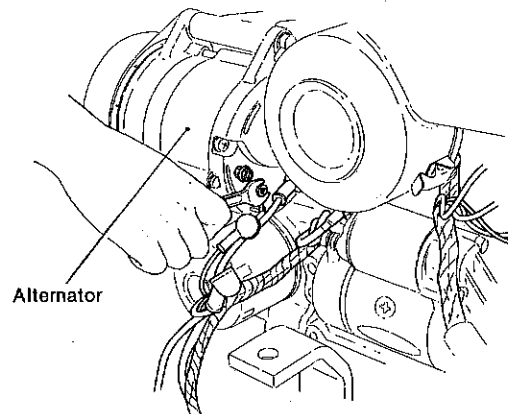
2-8. Remove the cooling water pipe

Remove the CSW hose between the CSW pump and by-pass metal fitting.



2-9. Remove the electrical wiring

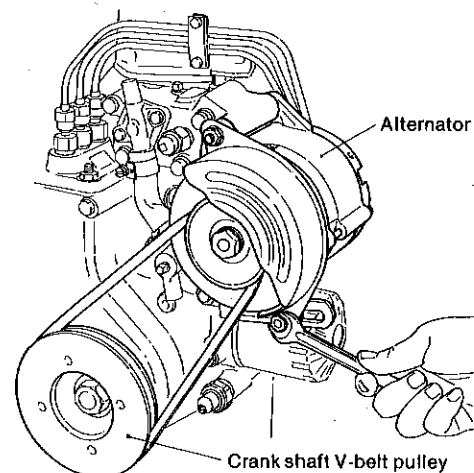
Remove the wiring connected to the alternator and cooling water temperature sender.



2-10. Remove the alternator

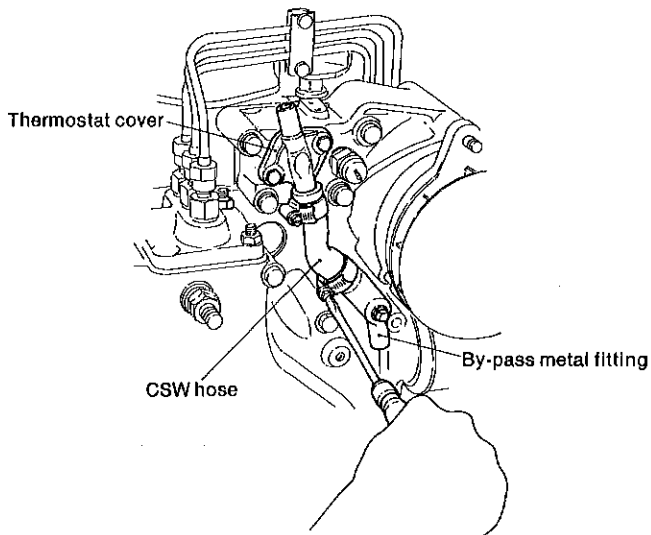
Remove the alternator cover and V belt after loosening the alternator adjusting bolt.

The alternator can be more easily removed when removed as assembled on the thermostat bracket.

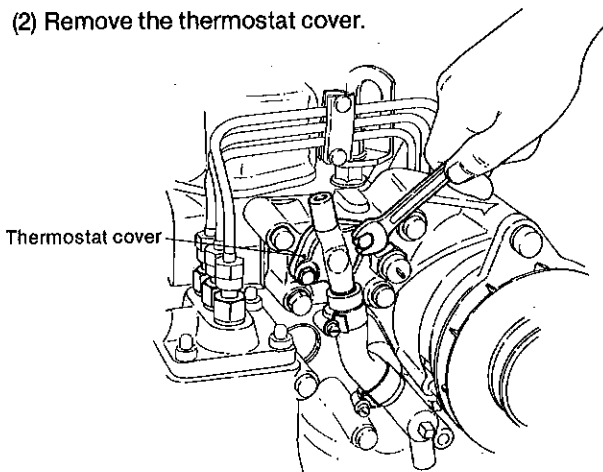


2-11. Remove the thermostat cover

- (1) Loosen the clamp of the cooling water hose between the by-pass metal fitting and thermostat at the by-pass metal fitting side.



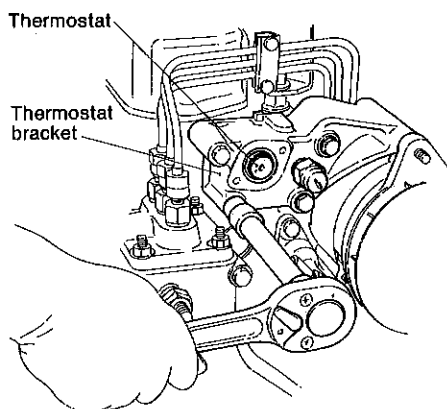
- (2) Remove the thermostat cover.



2-12. Remove the high pressure pipe anti-swing metal fitting from the thermostat bracket.

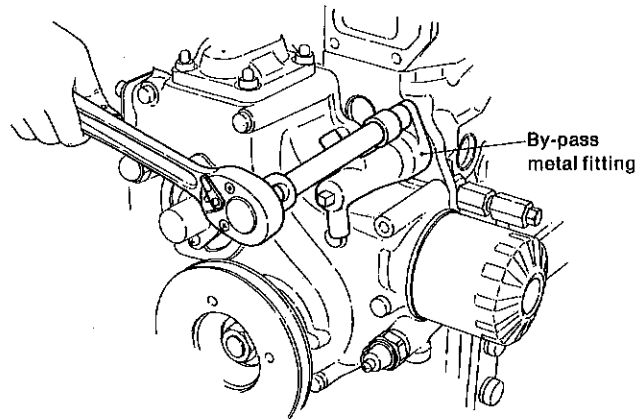
2-13. Remove the thermostat bracket

Remove the cooling water temperature sensor and alternator as assembled on the thermostat bracket.

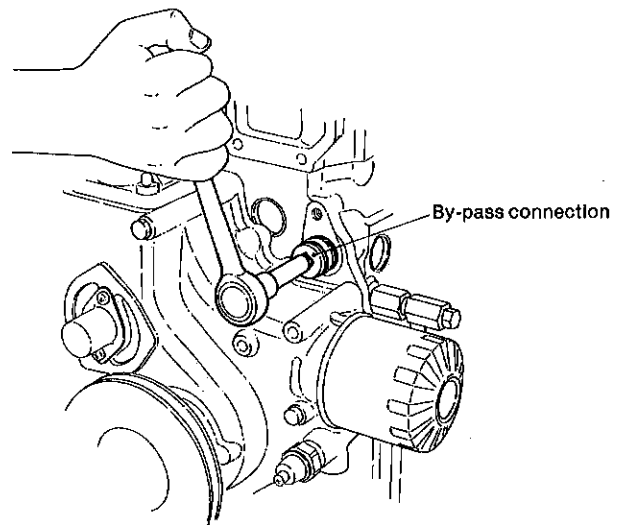


2-14. Remove the cooling water by-pass connection

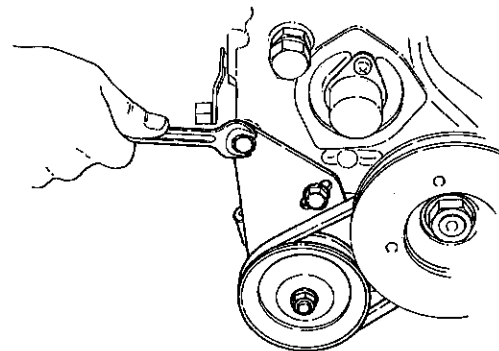
- (1) Remove the cooling water by-pass metal fitting (L-type joint).



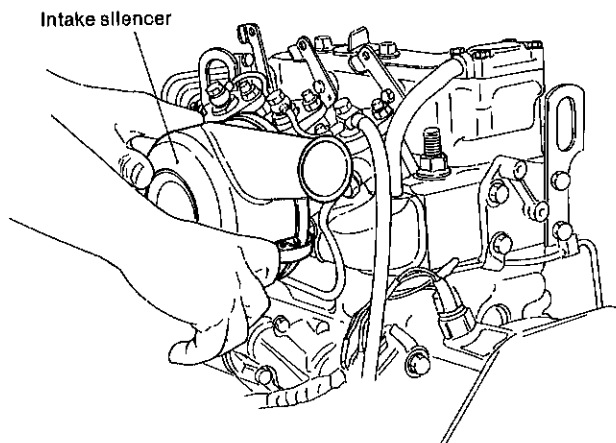
- (2) Extract the by-pass connection screwed into the cylinder block.



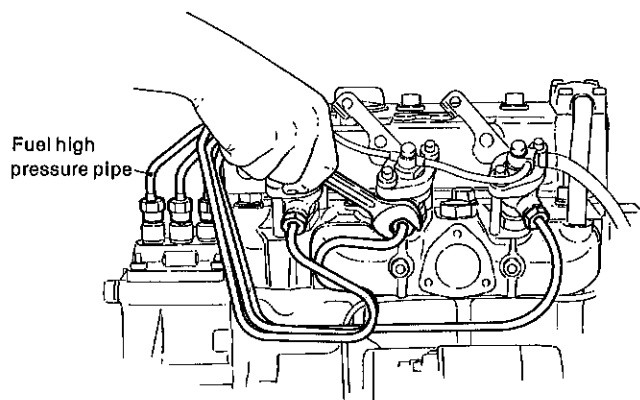
2-15. Remove the CSW pump



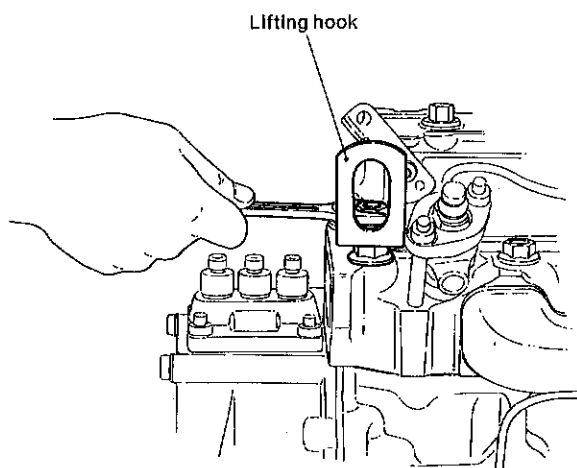
2-16. Remove the intake silencer



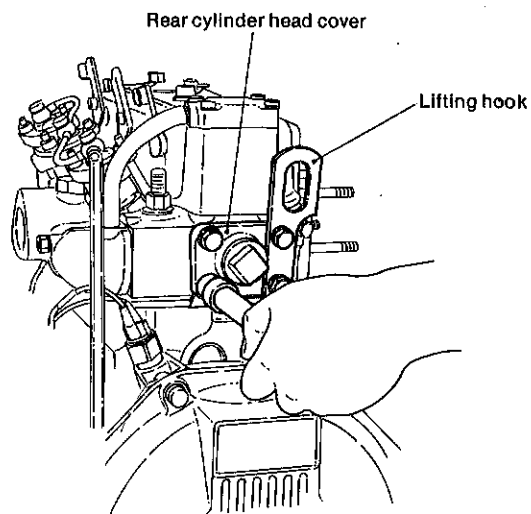
2-17. Remove the fuel high pressure pipe



2-18. Remove the lifting hook at the front of the engine (3GM30, 3HM35)



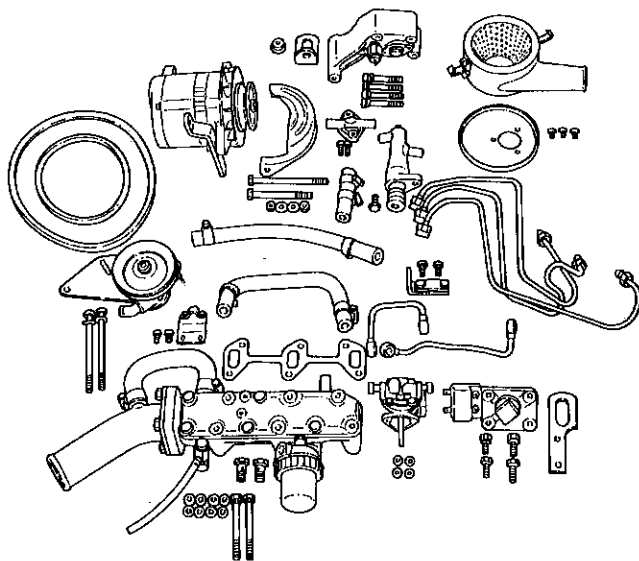
2-19. Remove the lifting hook at the rear of the engine together with the rear cylinder head cover



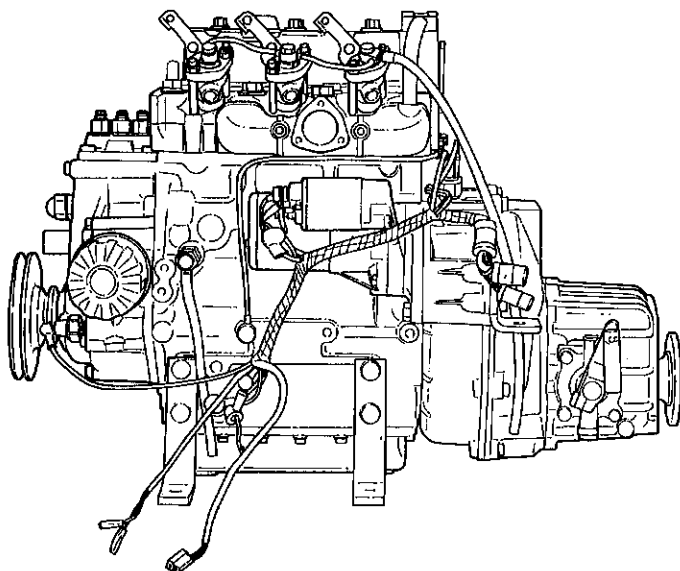
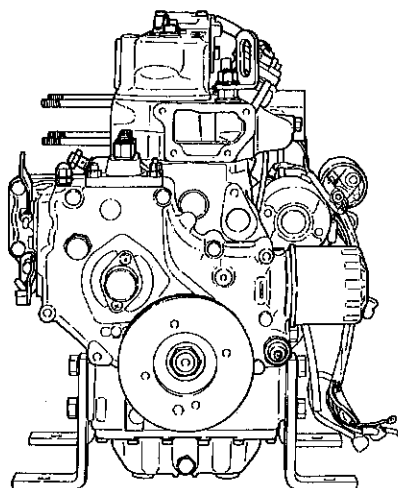
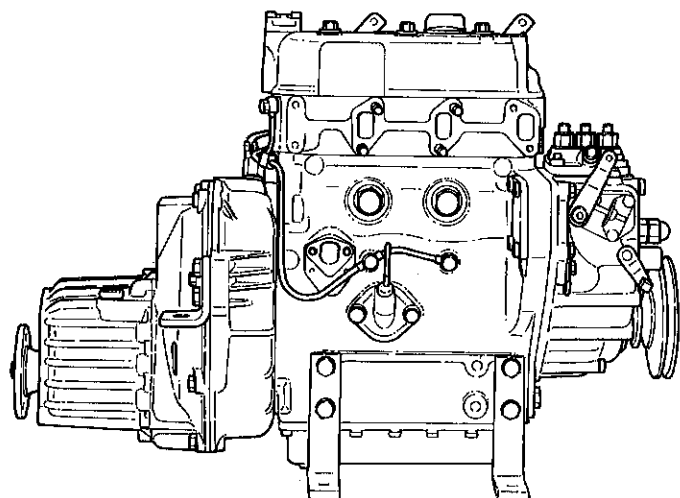
The disassembly necessary to modify a sea water-cooled engine into a fresh water-cooled engine is completed with

this step. The removed parts, and the appearance of the engine after disassembly are shown below:

Removed parts

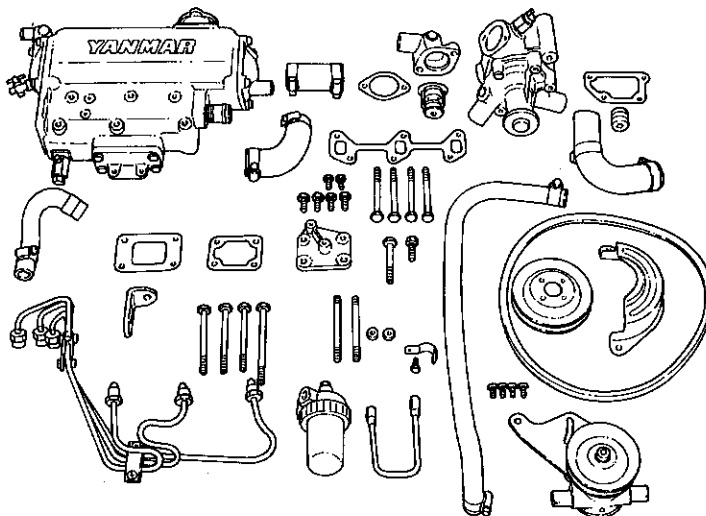


Appearance of engine after disassembly (Example Model, 3GM30)

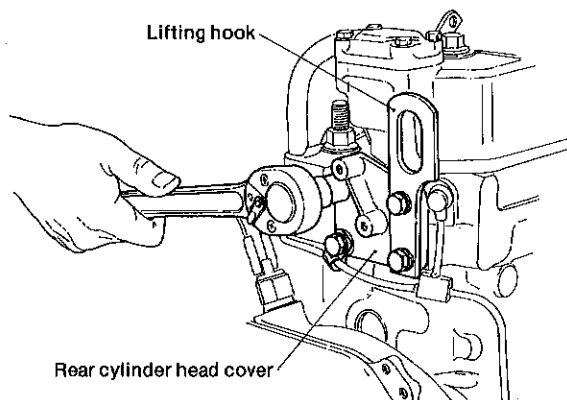


3. Assembling modified parts to the fresh water-cooled engine

The parts required to modify a sea water-cooled engine to a fresh water-cooled engine are as shown below.



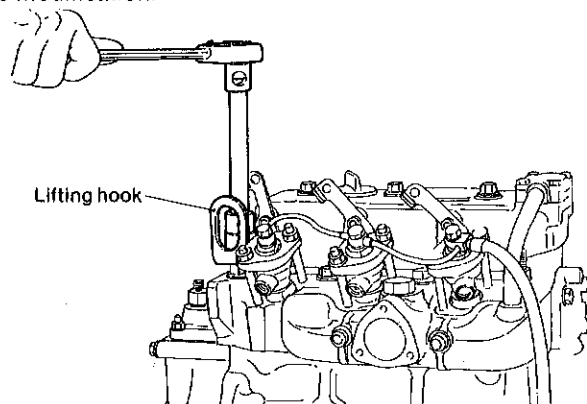
3-1. Assemble the rear cylinder head cover together with the rear lifting hook.



NOTE: New packing should be used.
 Apply Threebond No.4 on both surfaces of packing.

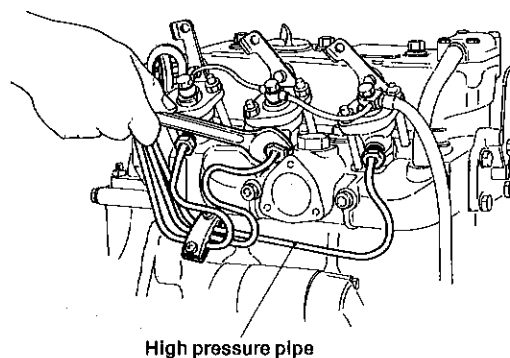
3-2. Assemble the front lifting hook (3GM30, 3HM35)

The hook on the model 2GM20 is in a position not affected by the modification.



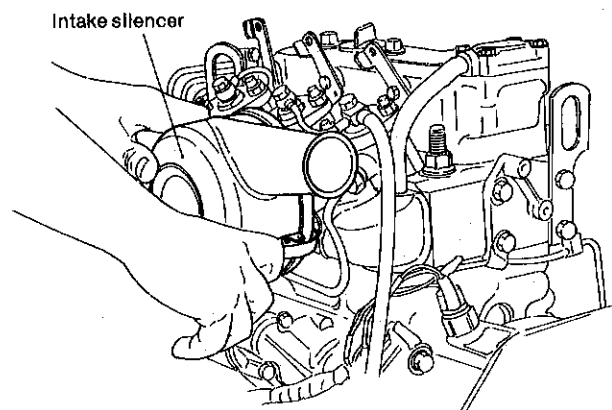
NOTE: Use the special lifting hook for the fresh water-cooled engine.

3-3. Assemble the fuel injection tube



NOTE: Use the special high pressure pipe for a fresh water-cooled engine. The shape and dimensions are different from those for a sea water-cooled engine.

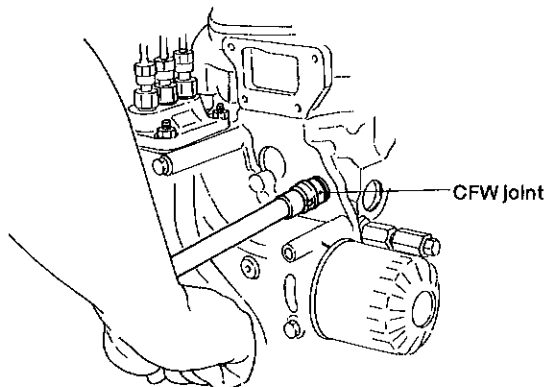
3-4. Assemble the intake silencer



NOTE: The intake silencer is the same for both the fresh water and sea water-cooled engines.

3-5. Assemble the CFW joint to the cylinder block

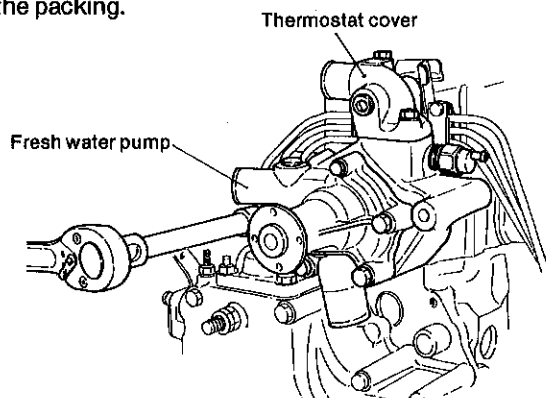
Apply Threebond No.20 to the threads and screw.



Tightening torque	2.5 ~ 3.5 kg-m (18 ~ 25 ft-lb)
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3-6. Assemble the CFW pump assembly

Assemble after applying Threebond No.4 to both surfaces of the packing.



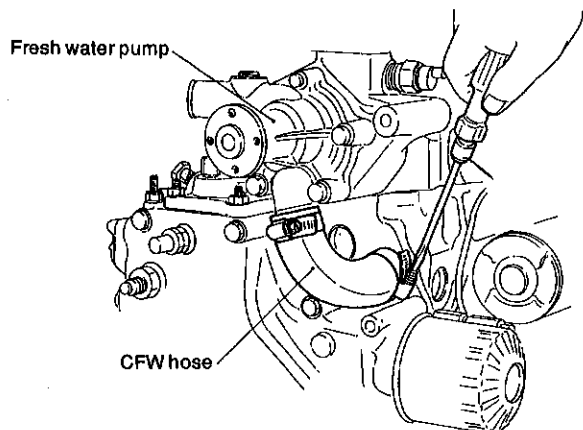
Tightening torque	2 ~ 2.5 kg-m (14.5 ~ 18 ft-lb)
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3-7. Assemble the thermostat and thermostat cover

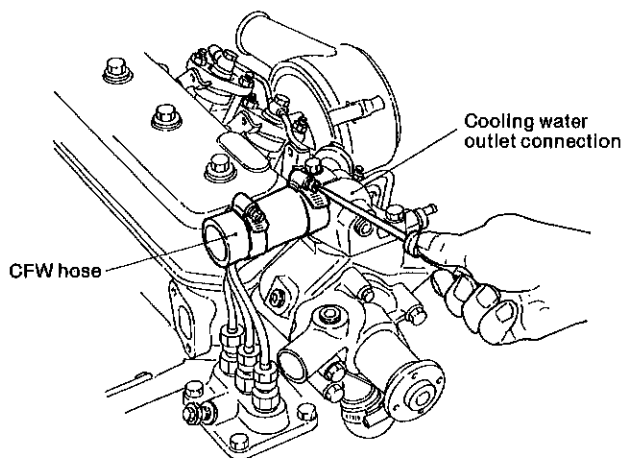
NOTE: Apply Threebond No.4 to both surfaces of the packing.

3-8. Assemble the CFW hose

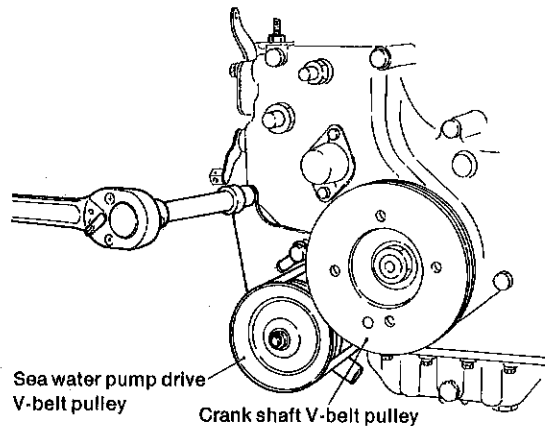
(1) Connect the CFW hose between the CFW pump and cylinder block and tighten the hose clamp.



(2) Connect the CFW hose between the CFW pump and heat exchanger by connecting it to the CFW pump; tighten the hose clamp slightly. The hose clamp will be securely tightened after the heat exchanger is assembled.



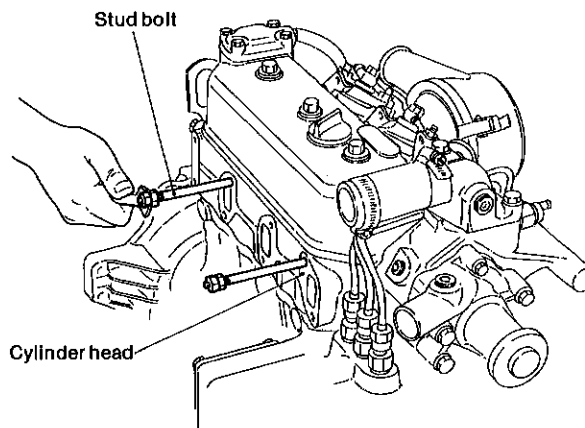
3-9. Assemble the CSW pump



V-belt tension Pushed with a force of 10kg (22 lb.)	5 ~ 7mm (0.1969 ~ 0.2756 in.)
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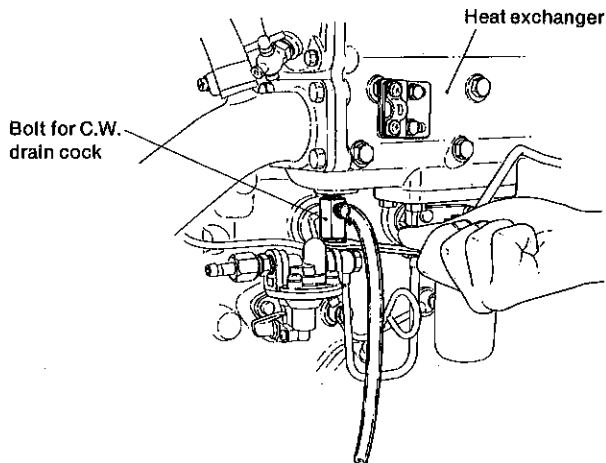
3-10. Insert the stud bolt for fitting the heat exchanger

Apply Three bond 203M to the threads.

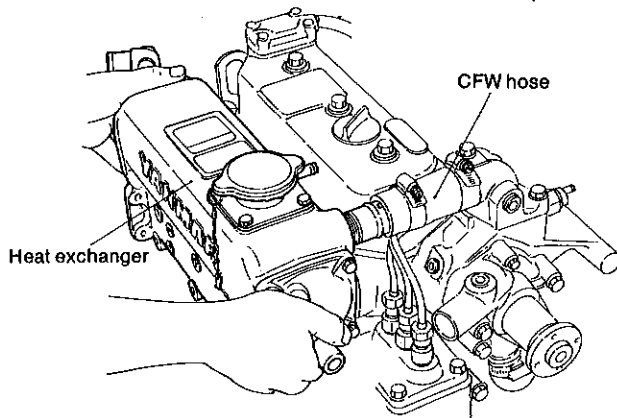


Tightening torque	1 ~ 1.5 kg-m (7.3 ~ 10.9 ft-lb)
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3-11. Assemble the heat exchanger



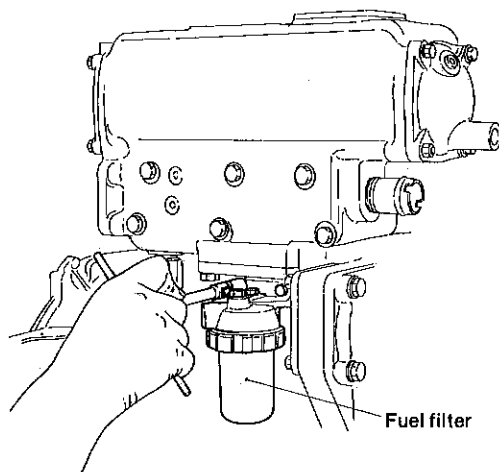
For model 3GMD, connect the pipes after removing the CW drain cock bolt at the bottom of the heat exchanger to prevent the pipe from jamming against the fuel feed pump.



NOTE: New gasket packing must be used.

Tightening torque	2 ~ 2.5 kg-m (14.5 ~ 18 ft.-lb)
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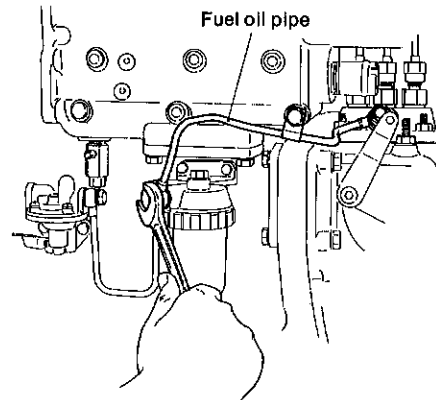
3-12. Assemble the fuel filter



NOTE: The same fuel filter is used as for a sea water-cooled engine.

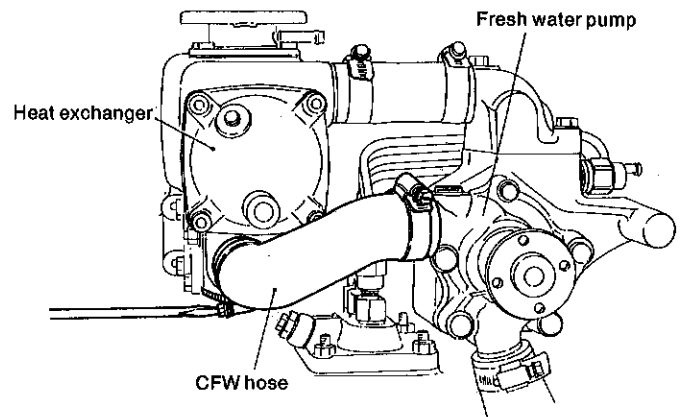
3-13. Assemble the fuel oil pipe

- (1) Connect the fuel oil pipe between the fuel feed pump and fuel injection pump.
- (2) Connect the fuel oil pipe between the fuel filter and fuel injection pump.



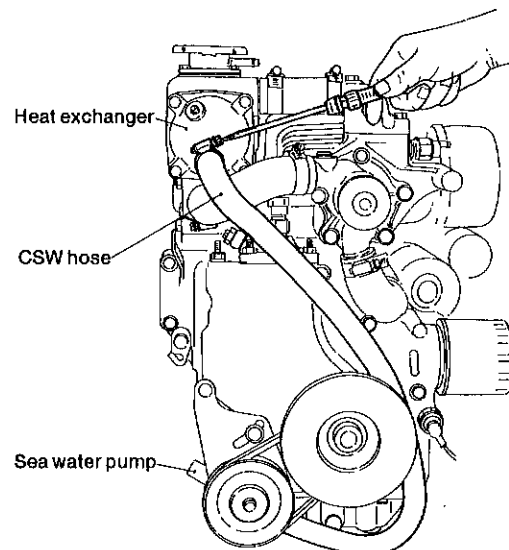
3-14. Assemble the CFW hose

Connect the CFW hose between the CFW pump and heat exchanger and tighten the hose clamp.

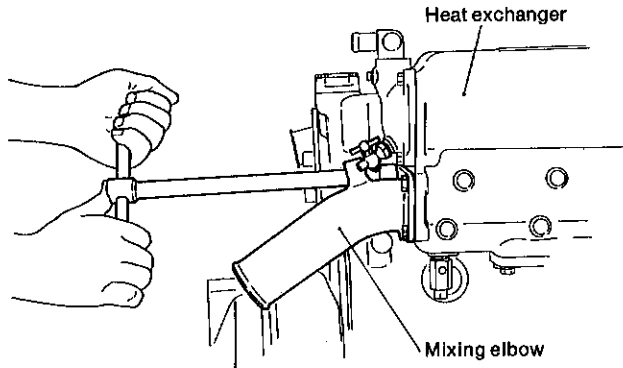


3-15. Assemble the CSW hose

Connect the CSW hose between the CSW pump and heat exchanger and tighten the hose clamp.

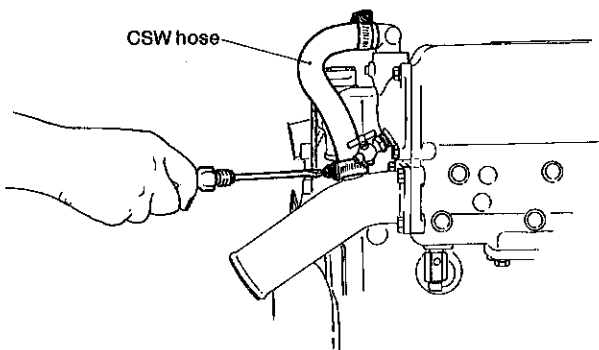


3-16. Assemble the mixing elbow

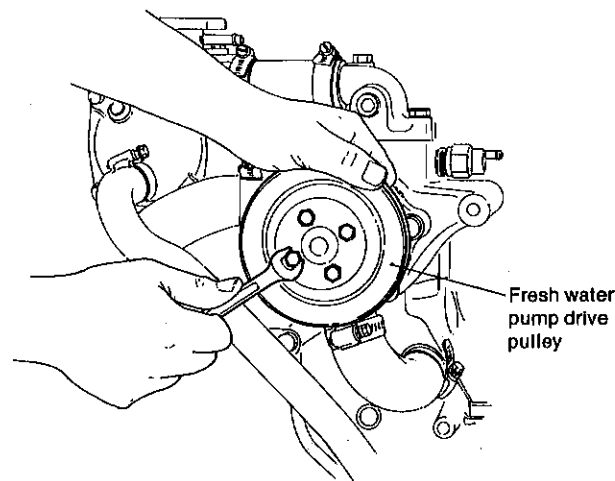


NOTE: New gasket packing must be used.

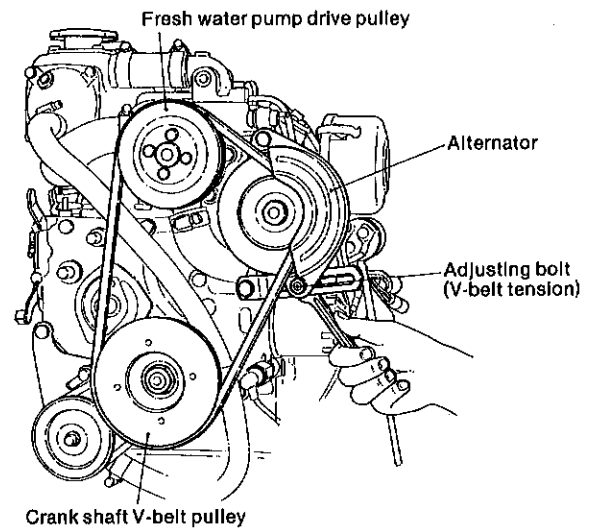
3-17 Connect the CSW hose between the head exchanger and mixing elbow and tighten the hose clamp.



3-18. Assemble the CFW pump V-belt pulley



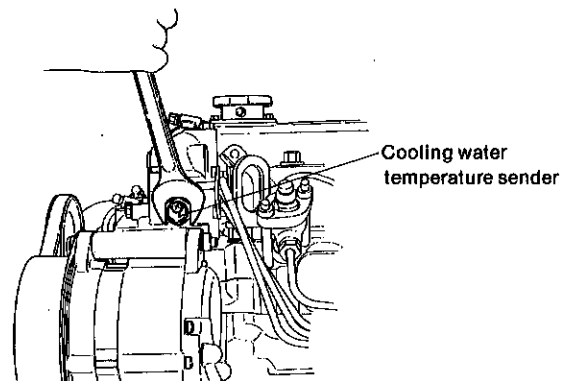
3-19. Assemble the alternator



V-belt tension Depressed with a force of 10kg (22 lb.)	Approx. 10mm (Approx. 0.3937 in.)
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3-20. Assemble the cooling water temperature sensor

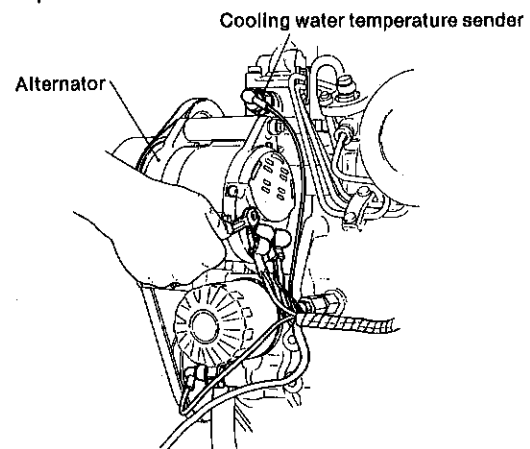
First fit the cooling water temperature sender to the CFW pump and then assemble both units together.



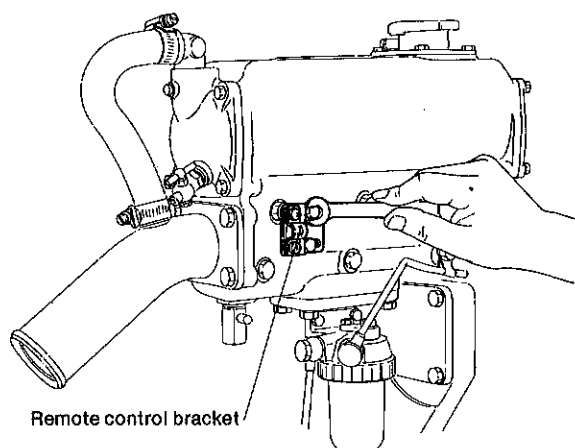
NOTE: Apply Threebond No.4 to the threads.

3-21. Connect electrical wiring

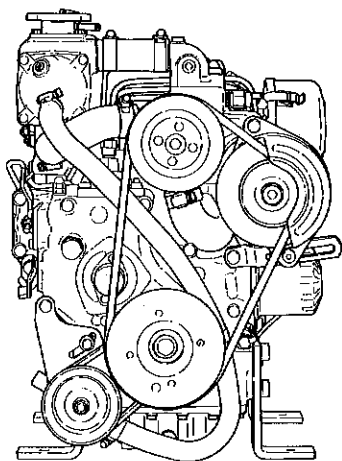
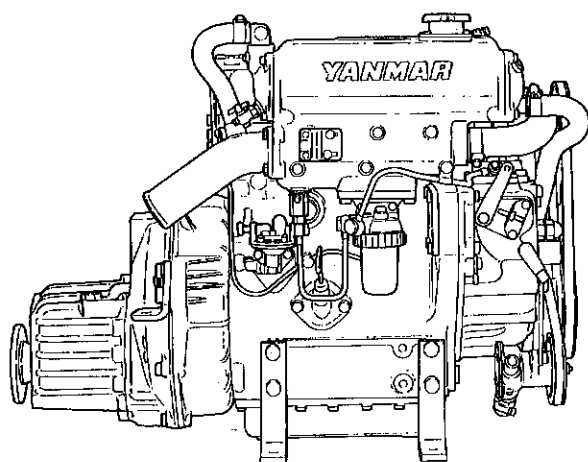
Connect the electrical wirings to the alternator and cooling water temperature sender.



3-22. Assemble the remote control bracket.

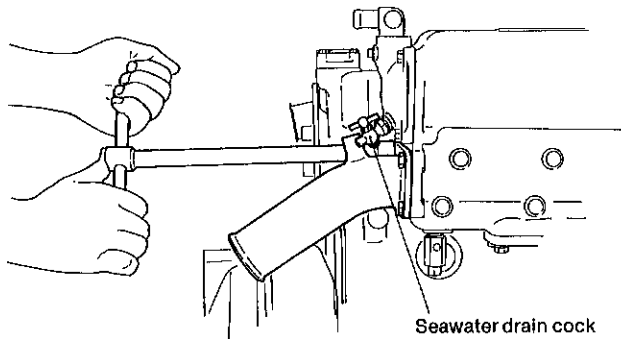


The sea water-cooled engine has now been modified as a fresh water-cooled engine.



4. Cautions when the engine is installed inboard

- (1) In the case of a fresh water-cooled engine, a fresh water subtank must be installed. For the installation method, refer to the "Installation of the subtank" section.
- (2) A seawater drain cock and the fresh water drain plug are provided in the heat exchanger; a drain hose should be fitted to each plug.



- (3) There is no problem when the engine is installed in a newly built ship, but when an engine in use is modified, care must be taken because the cooling water piping is different.

	2GM20 → 2GM20F	3GM30 → 3GM30F	3HM35 → 3HM35F
Hose at CSW pump inlet (Kingston cock—CSW pump) outer dia/inner dia	φ20/13 → φ24/17	φ20/13 → φ24/17	φ24/17 = φ24/17
Kingston cock to be used	10A → 15A	10A → 15A	15A

NOTE: Kingston cocks are optional.

10A	Part No.43662 — 010030	1GM10, 2GM20, 3GM30
15A	Part No.43662 — 015020	2GM20F, 3GM30F, 3HM35F

Pin diameter of mixing elbow is different

2GM20 → 2GM20F

(44mm) (51mm)

(1.7323in.) (2.0079in.)