CHAPTER 0

FOR SAFETY

1. For Safe Servicing 0-1
2. Precaution for Safe Servicing 0-2

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FOREWORD

This service manual has been complied for engineers engaged in sales, service, inspection and maintenance. Accordingly, descriptions of the construction and functions of the engine are emphasized in this manual while items which should already be common knowledge are omitted.
One characteristic of a marine diesel engine is that its performance in a vessel is governed by the applicability of the vessel's hull construction and its steering system.
Engine installation, fitting out and propeller selection have a substantial effect on the performance of the engine and the vessel. Moreover, when the engine runs unevenly or when trouble occurs, it is essential to check a wide range of operating conditions — such as installation to the hull and suitability of the ship's piping and propeller — and not just the engine itself. To get maximum performance from this engine, you should completely understand its functions, construction and capabilities, as well as proper use and servicing.
Use this manual as a handy reference in daily inspection and maintenance, and as a text for engineering guidance.
Model 4JH3E has been used for the illustrations in this service manual, but they apply to models 3JH3E, 3JH3BE, 3JH3CE, 4JH3BE, and 4JH3CE as well.

METRIC
ALL DIMENSIONS IN MILLIMETERS
UNLESS OTHERWISE SPECIFIED

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2. Precaution for Safe Servicing

(A) Service Shop (place)

⚠ WARNING ● **Place allowing sufficient ventilation**



Jobs such as engine running, part welding and polishing the paint with sandpaper should be done in a well-ventilated place.

[Failure to Observe]

Very dangerous for human body due to the possibility of inhaling poisonous gas or dust.

⚠ CAUTION ● **Sufficiently wide and flat place**

The floor space of the service shop for inspection and maintenance should be sufficiently wide and flat without any holes.

[Failure to Observe]

An accident such as a violent fall may be caused.

⚠ CAUTION ● **Clean, orderly arranged place**

No dust, mud, oil or parts should be left on the floor surface.

[Failure to Observe]

An unexpected accident may be caused.

⚠ CAUTION ● **Bright, safety illuminated place**



The working place should be illuminated sufficiently and safely.

For a job in a dark place where it is difficult to see, use a portable safety lamp.

The bulb should be covered with a wire cage for protection.

[Failure to Observe]

The bulb may be broken accidentally causing ignition of leaking oil.

⚠ CAUTION ● **Place equipped with a fire extinguisher**



Keep a first aid kit and fire extinguisher close at hand in preparation for fire emergencies.

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SERVICE MANUAL

MARINE DIESEL ENGINE

3JH3(B)(C)E(A),
4JH3(B)(C)E,4JH3CE1

2002.4

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SERVICE MANUAL

MARINE DIESEL ENGINE

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MODEL

3JH3(B)(C)E(A), 4JH3(B)(C)E
4JH3CE1

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2. Exhaust Gas Regulations

This engine conforms to the EPA exhaust gas regulations (19kW and under 37kW) for a low emission engine.

The ARB standard is the same as the EPA's

Exhaust emission		EPA Standard (Tier 1) (Max.) Variable speed (EPA E3 Mode)		Condition
NOx+NMHC	g/kWh	19kW and under 37kW	9.5	· EPA recommended
CO			5.5	
PM			0.8	

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1. For Safe Servicing

● Most accidents are caused by failing to observe basic safety rules and precautions. To prevent accidents, it is important to recognize the signs of approaching problems, and eliminate the problems in the early stage before they can cause accidents.
Please read this manual carefully before starting repairs or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures. Attempting a repair or maintenance job without sufficient knowledge

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Publication No.	HINSHI H8009

History of Revision

Manual Name	Service Manual for Marine Diesel Engine
Engine Model:	**3JH3(B)(C)E(A), 4JH3(B)(C)E, 4JH3CE1**

Number of revision	Date of revision	Reason for correction	Outline of correction	Ccorrection item No (page)	Corrected by
● New edition	Oct.1995				
1 st	Oct.2000	For EPA certified engine 3JH3E (E/# A01158 and after)	●"Fuel injection timing adjustment for EPA certified engine"added. ●Tightening torque for crankshaft V-pulley fastening bolt of 3JH3(B)(C)E changed.	Added pages: -i-, -ii-, -iii-, 3-45～3-48. Revised pages: 1-3,10-28,10-40 and contents table.	Quality Assurance Dpt.
2 nd	Mar.2001	Tightening torque	●Added the tightening torque of the nut for the remote control cable connection of clutch shifting lever (for KBW20/21). ●Corrected the crankshaft V-pulley bolt tightening torque.	8-2 10-40	Quality Assurance Dept.
3 rd	Apr.2002	For EPA/ARB certified engine(3JH3Eseries)	●ARB(EPA)certified tamper resistance (cap type for fuel injection volume and wire and lead seal for high idling speed)and EPA/ARB emission control label added. ●Safe servicing information added. ●New marine gears KM35P/KM35A have been installed on 3.4JH3E (Feb.2002)(no torgue limiter applied) ●4JH3CE1×SD-40 sail drive added informaton (4JH3CE1 the same as 4JH3CE except rating output) ●3JH3CE×SD-40 sail drive information added.	Added and revised pages: -iv-,3-45,3-46,3-47,3-48. and contents Added pages: chapter 0,0-1, 0-2,0-3,0-4,0-5. Added and revised pages: 1-4-i,1-4-ii,1-5 1-9-i,1-9-ii,1-9-iii 1-9-iv,3-1,7-1, 7-2,7-3,7-12, 7-13,7-29,7-30, 7-31,7-40,7-41	Quality Assurance Dept.

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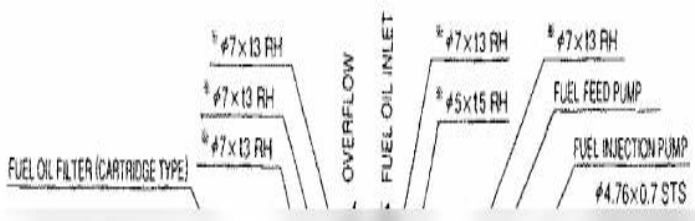
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4. Piping D

4-1 3,4JH3(B)(C)E

Note : The following piping diagram is for the 4JH3E model. The piping diagram for the 3JH3E model is the same with the exception that this model has 3 cylinders.

MARKS OF PIPING	NAME
RH	RUBBER HOSE
SGP STS	STEEL PIPE
C1201T	COPPER PIPE



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8. Flywheel and Housing

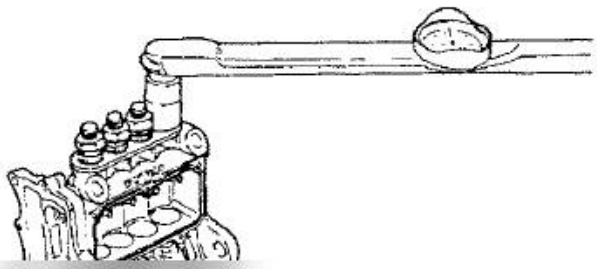
The function of the flywheel is through inertia, to rotate the crankshaft in a uniform and smooth manner by absorbing the turning force created during the combustion stroke of the engine, and by compensating for the decrease in turning force during the other strokes.
The flywheel is mounted and secured by 6 bolts on the crankshaft end at the opposite end to the gear case; it is be kept below the specified value for the crankshaft as the flywheel rotates with the crankshaft at high speed.
To achieve this, the balance is adjusted by drilling holes in the side of the flywheel, and the unbalanced momentum is adjusted by drilling holes in the circumference.
The ring gear is shrink fitted onto the circumference of the flywheel, and this ring gear serves to start the engine by

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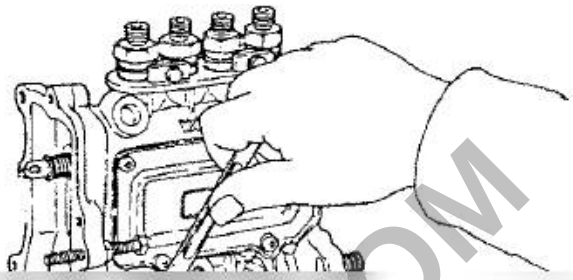
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(18) Tighten the delivery valve retainer.



(20) Mount the fuel feed pump



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1. Intake System

Air enters in the intake silencer mounted at the end of the intake manifold, is fed to the intake manifold and then on to each cylinder.

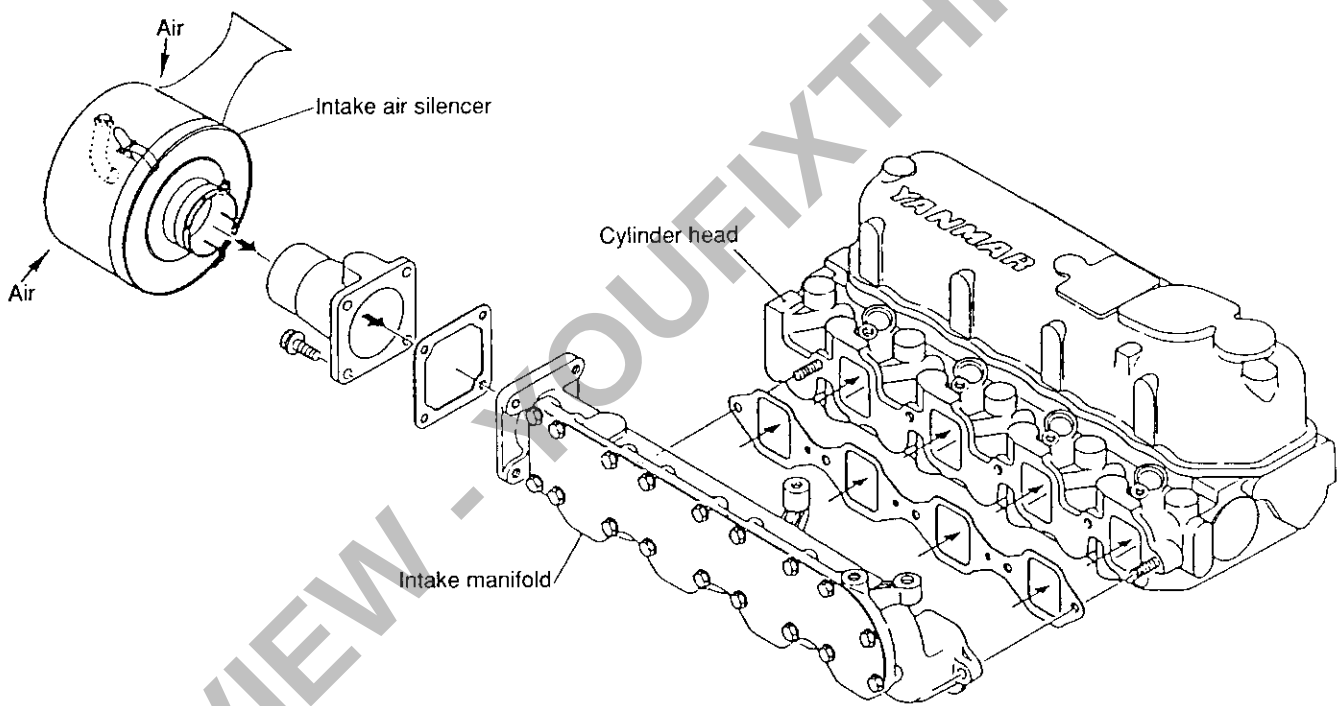
Exhaust gas goes into the exhaust manifold (in the fresh water tank) mounted on the cylinder head discharge. After cooling it enters the mixing elbow which is directly connected wilh the exhaust manifold, and is discharged from the ship along with waste cooling water.

When the inside of the intake manifold becomes dirty, intake resistance is created reducing engine power. Periodically check the inside of the intake manifold. In the same way, the net portion of the intake air silencer should be checked for dirt periodically and cleaned.

When the intake manifold is being attached to the cylinder head, the attachment surfaces should be checked for dirt and cleaned. Care should also be taken to insure there is no air leakage.

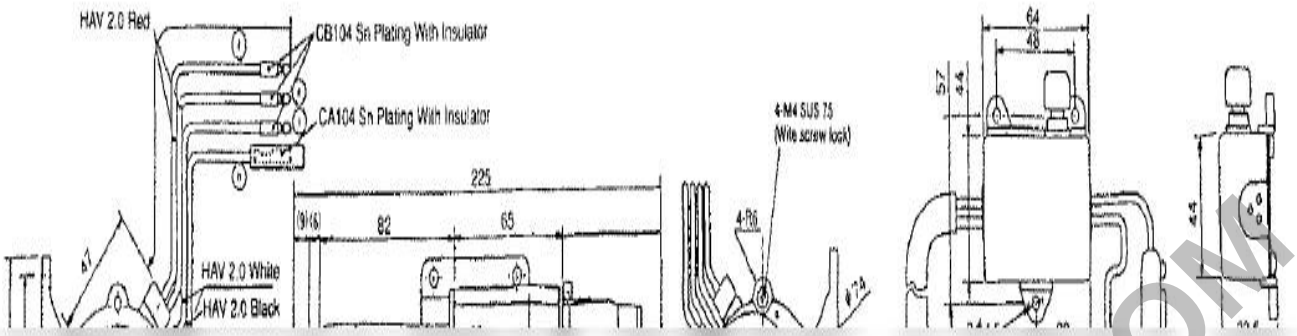
Do not operate with the intake air silencer removed.

Intake system



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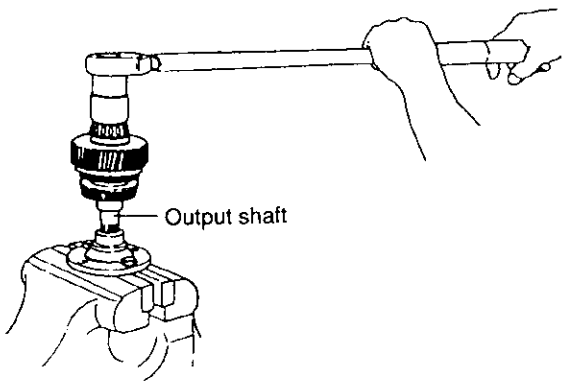


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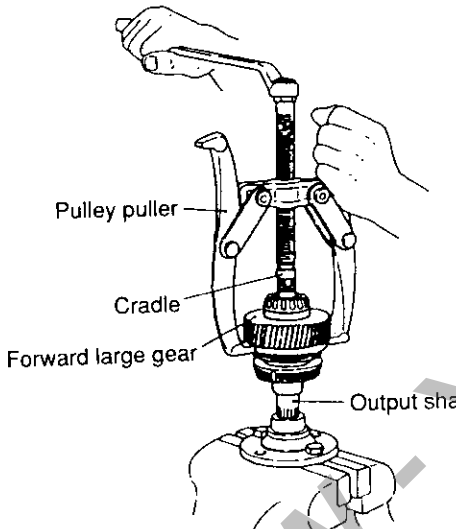
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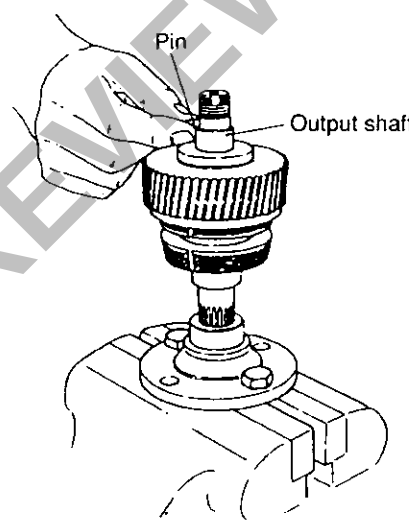
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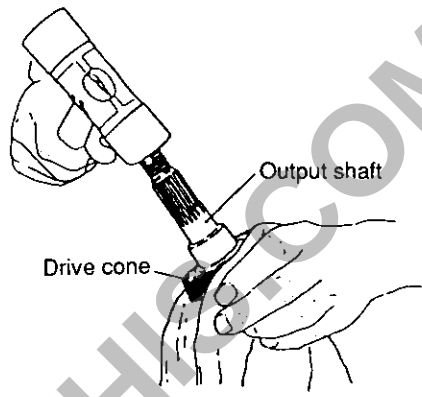
(3) Place the pulley extractor against the end surface of the forward large gear, and withdraw the forward large gear, thrust collar A, cup spring, and inner bearing race.

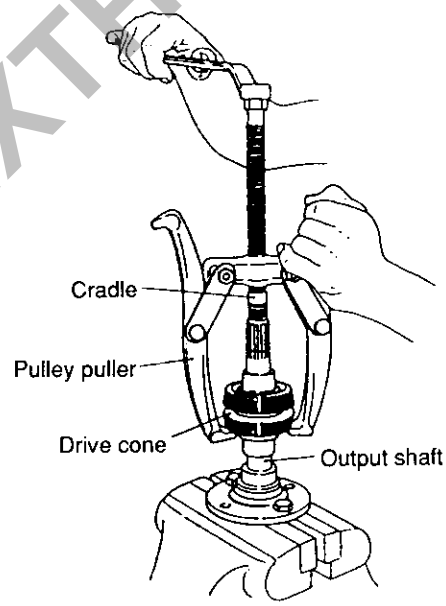




NOTE : Take care as the nut has left-handed thread.

(4) While gripping the drive cone, tap the end of the shaft with a plastic headed hammer,and withdraw the thrust extractor may be used.

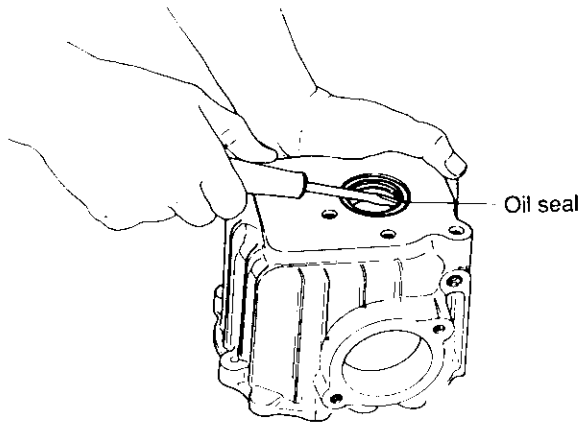




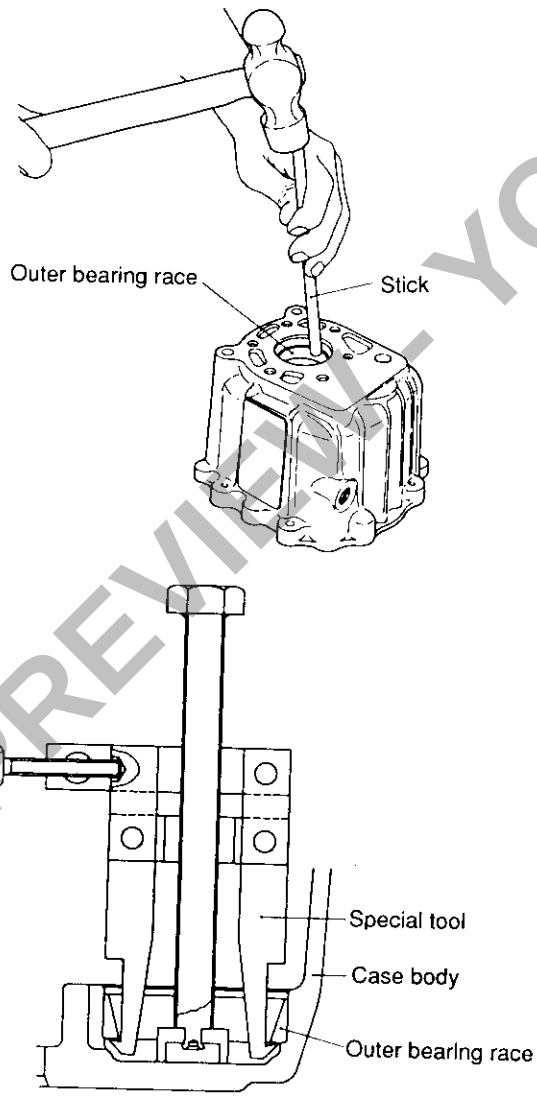
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(10) Remove the oil seal of the output shaft from the case body.



(11) Remove the outer bearing race from the case body by using the special tool.



(12) Remove the oil seal of the input shaft from the mounting flange.

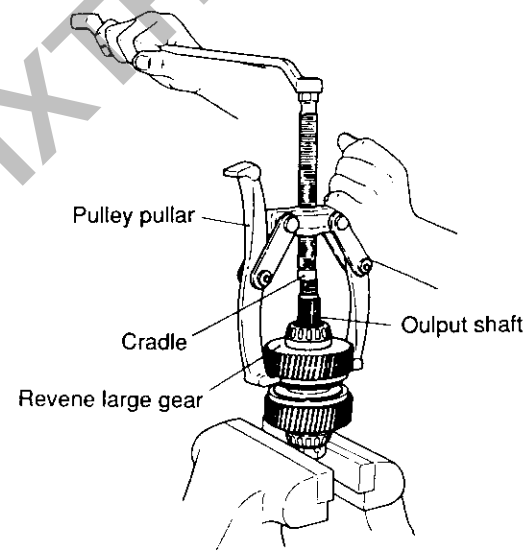
(13) Remove the outer bearing race from the mounting flange in the same way as with the case body.

(14) Remove each adjusting plate from the input our output shaft.

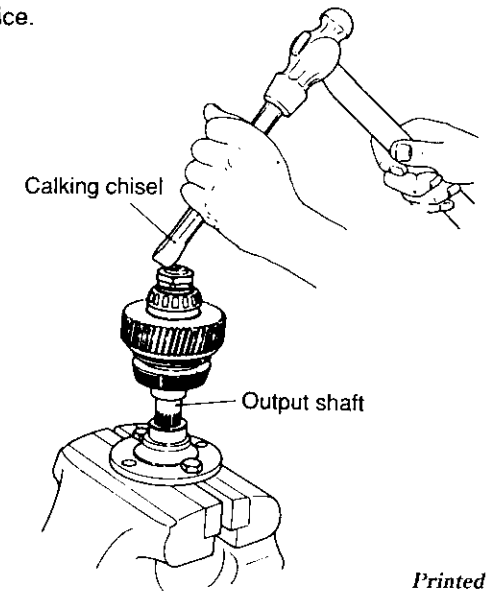
NOTE : The same adjusting plates can be revsed when the following parts are not replaced.
When any part is replaced however, readjustment is necessary.

4-2 Removal of the output shaft

(1) Take out the reverse large gear, thrust collar A, cup spring, spring retainer and inner bearing race.
The reverse large gear must be withdrawn using a pulley extracter, by fixing the nut at the forward end in a vice.



(2) Loosen the calking of the forward nut and remove the nut and spacer.
Remove the nut by using a torque wrench after setting the output shaft coupling and fixing the coupling bolt in a vice.



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17) The Pinion Stopper Clip

The Pinion Stopper Clip is removed with a standard screwdriver while the Pinion Stopper is pushed toward the Pinion.

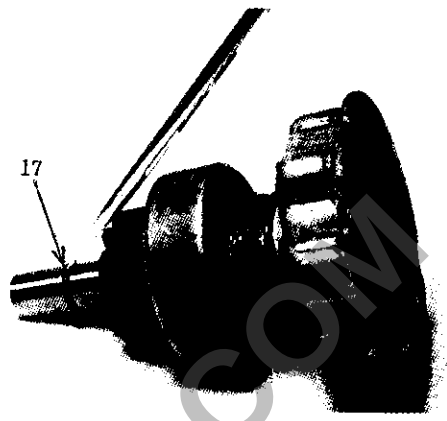


Fig. 13

18) Pinion Stopper
19) Pinion

The Pinion Stopper and the Pinion can be disassembled once the Pinion Stopper Clip has been removed.

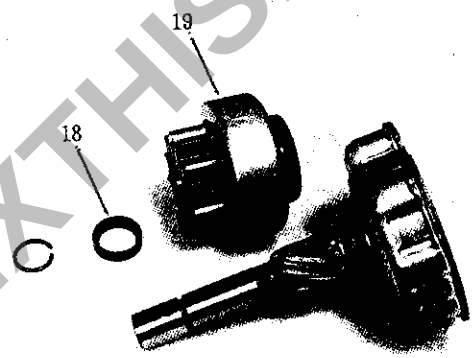


Fig. 14

20) E Ring

The E Ring is removed by hammer with special fixture.

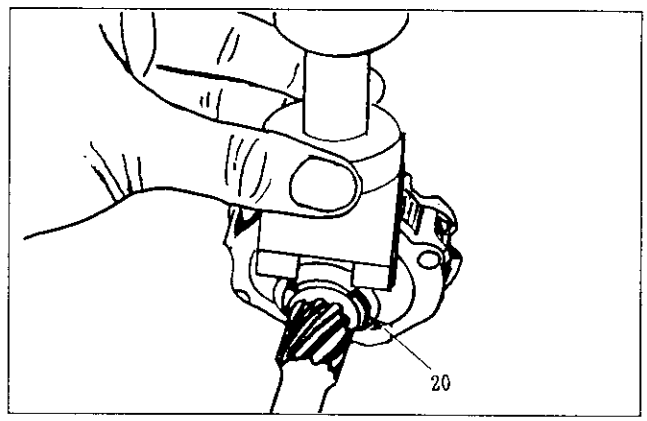


Fig. 15

21) Washer (2)
22) Center Bracket (p)
23) Pinion Shaft

The Center Bracket (P) and the Pinion Shaft can be diassembled once the E Ring is removed.

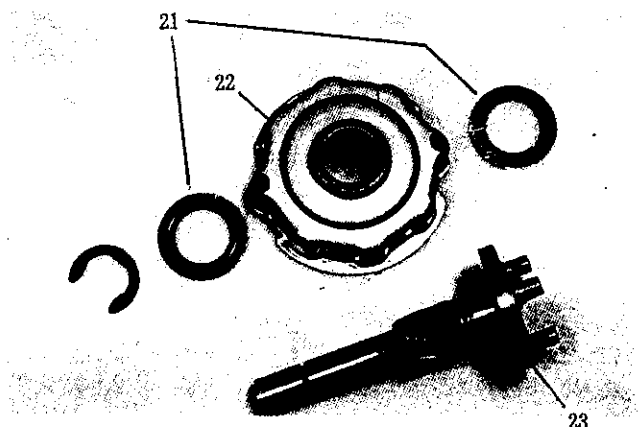


Fig. 16

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6-3 Extension codes

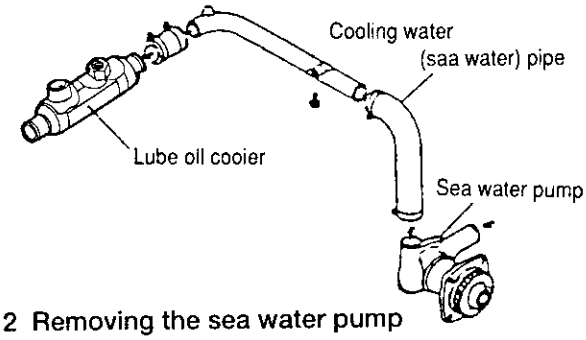


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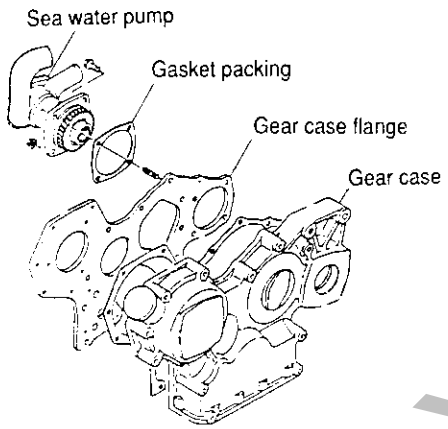
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3-1.11 Removing the cooling water (sea water) pipe (sea waler pump-Lube oil cooler).



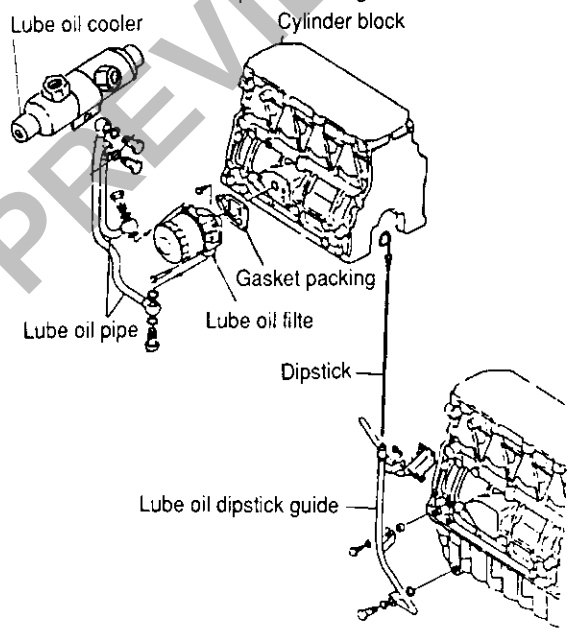
3-1.12 Removing the sea water pump

(1) Pull out the bearing mounts, receptacles from the sea water pump mounting side and from the opposite side of the gear case.
(2) Remove the sea water pump.



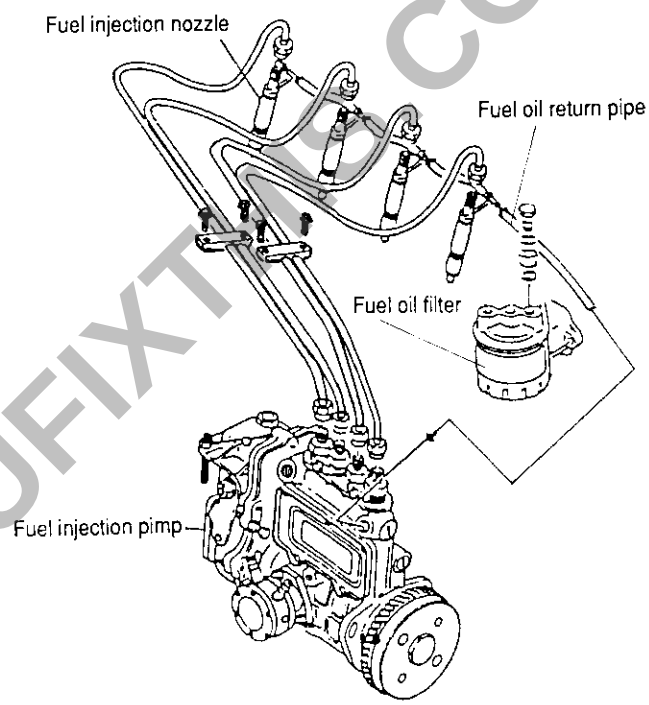
3-1.13 Removing the lube oil filter

(1) Remove the lube oil pipe (lube oil cooler-filter bracket filter bracket-lube oil cooler)
(2) Remove the filter bracket (with lube oil filter element) from the cylinder block
(3) Remove the lube oil pipe (cylinder block-fuel injection pump)
(4) Remove the tube oil dipstick and guide.



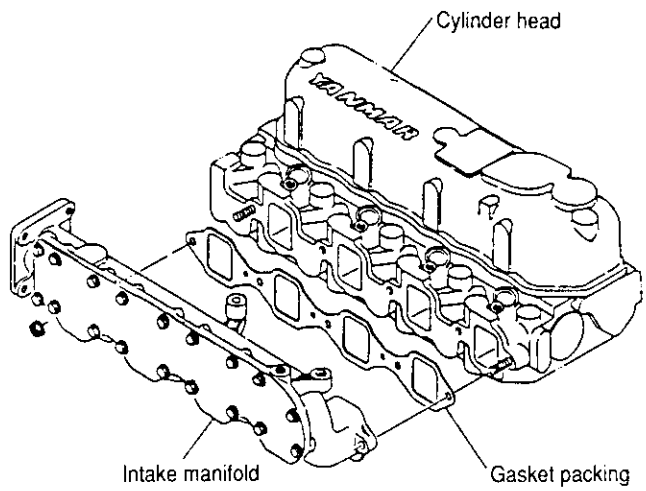
3-1.14 Removing the high pressure fuel pipe

(1) Remove the high pressure fuel pipe vibration stop from the intake manifold.
(2) Loosen the box nuts on both ends of the high pressure fuel pipe and remove the high pressure fuel pipe
(3) Remove the fuel oil return pipe (fuel injection nozzle-fuel injection pump)



3-1.15 Removing the intake manifold

(1) Remove the governor speed remote control bracket.
(2) Remove the intake manifold and gasket packing.



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