

HINSHI-H8009

SERVICE MANUAL

MARINE DIESEL ENGINE

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

2002.4

YANMAR

SERVICE MANUAL

MARINE DIESEL ENGINE

MODEL

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

FOREWORD

This service manual has been compiled 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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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) | <ul style="list-style-type: none"> ● "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 | <ul style="list-style-type: none"> ● 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) | <ul style="list-style-type: none"> ● 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 torque 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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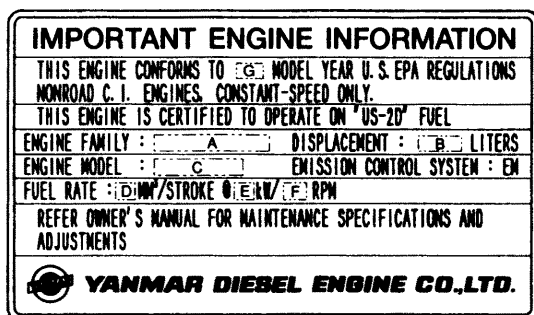
The EPA (U.S. Federal) and Air Resources Board (ARB, California) Off-road Compression Ignition engines regulations

The engines for EPA regulations will be used in the States, and the engines for ARB regulations will only be used in the State of California.

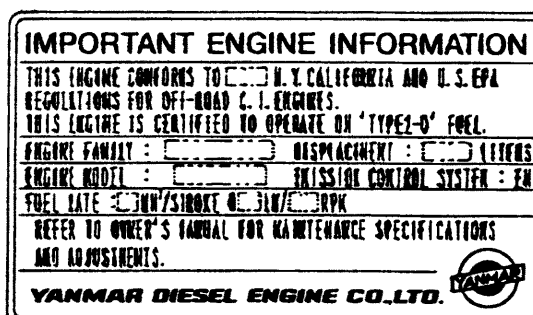
1. Engine identification (3JH3E series)

With the regulations on engine emission worldwide, it has become necessary to identify engines in a manner to determine which regulations they comply with, hence

a) Emission control label as shown below which will contain:



(EPA label)



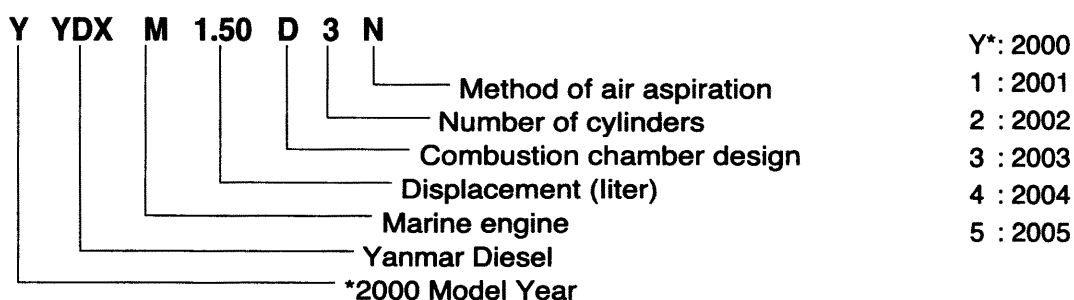
(EPA and ARB label)

*Emission Control is accomplished through Engine Modification (EM-Design)

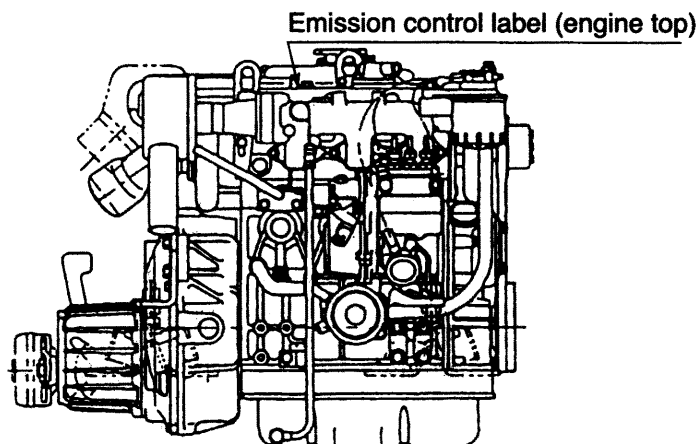
- EPA certified 3JH3E series engines : E/# A01158 and after.
- ARB(EPA)certified 3JH3E series engines : installed the tamper resistance device to prevent illegal change of fuel injection volume and high idling speed. (Fuel injection volume : cap type, High idling speed : wire and lead seal)

• Engine family name as assigned by EPA/ARB identifying engine family group

YYDXM1.50D3N and this identifies



b) Label location:



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.) | | Condition |
|-------------------------------|-------|------------------------------|-----|---------------------------------|
| | | Variable speed (EPA E3 Mode) | | |
| NOx+NMHC | g/kWh | 19kW and under 37kW | 9.5 | · EPA recommended fuel is used. |
| CO | | | 5.5 | |
| PM | | | 0.8 | |
| Transit smoke ACC/LUG/PEAK | % | | | |

3. Guarantee Conditions for Emission Standard

The following guarantee conditions are set down in the operation manual. In addition to making sure that these conditions are met, check for any deterioration that may occur before the required periodic maintenance times.

● Requirement on engine installation condition

(1) Air intake depression kPa (mmH₂O)

| |
|---------------|
| Permissible |
| ≤ -0.49 (-50) |

(2) Exhaust gas back pressure kPa (mmH₂O)

| |
|--------------|
| Permissible |
| ≤ 7.84 (800) |

● Fuel oil and lubricating oil

(1) Fuel : The diesel fuel oil [ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)]

(2) Lube oil : API grade, class CD

● Do not remove the seals restricting injection quantity and engine speed.

● Perform maintenance without fail.

Note: Inspections to be carried out by the user and by the maker are divided and set down in the "List of Periodic Inspections" on the operation manual and should be checked carefully.

EPA allows to apply Maintenance schedule for Emission related parts as follows.

| | | |
|----------|---|--|
| — | Check Fuel Injection Nozzle and clean | Adjust, cleaning and repair of Fuel Injection Pump, Fuel Valve Nozzle and Turbocharger |
| kW ≤ 130 | 1500 hours of use and at 1500-hour intervals thereafter | 3000 hours of use and at 3000-hour intervals thereafter |

● Quality guarantee period for exhaust emission related parts

For exhaust emission related parts, follow the inspections outlined in the "List of Periodic Inspections", on the operation manual, and use the table below to carry out inspections based on operation hours or time in years. Whichever comes first is the guarantee period.

| | |
|-----------------|-----------------------|
| 19 ≤ Range < 37 | 3000 hours or 5 years |
|-----------------|-----------------------|

The specific emissions-related parts are (1) Fuel injection nozzle (2) Fuel injection pump
(3) Turbocharger (if installed)


The EPA (U.S. Federal) and Air Resources Board (ARB, California) Off-road Compression Ignition engines regulations

The engines for EPA regulations will be used in the States, and the engines for ARB regulations will only be used in the State of California.

1. Engine identification (3JH3E series)

With the regulations on engine emission worldwide, it has become necessary to identify engines in a manner to determine which regulations they comply with, hence

a) Emission control label as shown below which will contain:

| IMPORTANT ENGINE INFORMATION | |
|---|---|
| THIS ENGINE CONFORMS TO <input type="checkbox"/> M. Y. CALIFORNIA AND U. S. EPA REGULATIONS FOR OFF-ROAD C. I. ENGINES. | |
| THIS ENGINE IS CERTIFIED TO OPERATE ON "Type 2-D" FUEL. | |
| ENGINE FAMILY: <input type="text"/> | DISPLACEMENT: <input type="text"/> LITERS |
| ENGINE MODEL: <input type="text"/> | EMISSION CONTROL SYSTEM: EM |
| FUEL RATE: <input type="text"/> MM ³ /STROKE @ <input type="text"/> KW/ <input type="text"/> RPM | |
| REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS. | |
|  YANMAR CO., LTD. | |

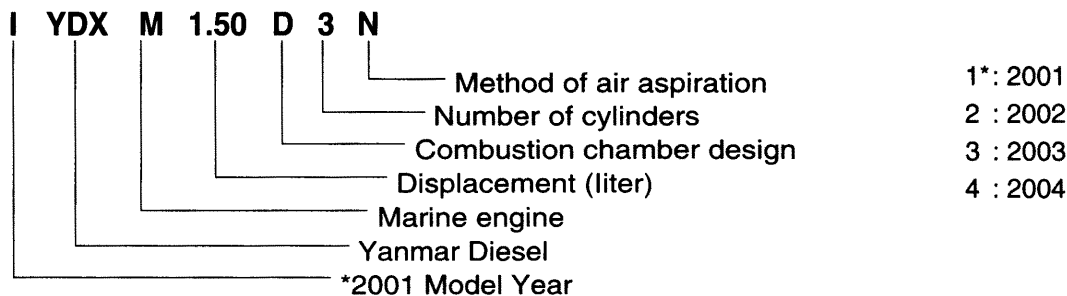
(EPA and ARB label)

*Emission Control is accomplished through Engine Modification (EM-Design)

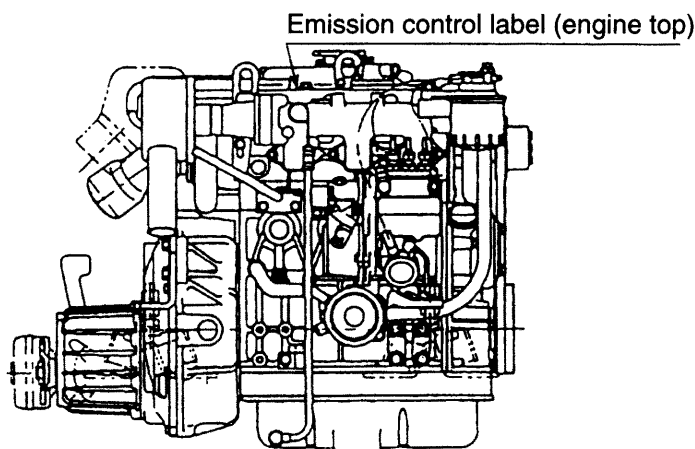
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- The emission standard is the same as the EPA's

• Engine family name as assigned by EPA/ARB identifying engine family group

IYDXM1.50D3N and this identifies



b) Label location:



MODELS

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

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CHAPTER 0

FOR SAFETY

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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 may cause an unexpected accident.
- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consideration for safety is required in addition to the matters marked  CAUTION. Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.
- Safety marks used in this manual and their meanings are as follows:



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- Any matter marked [NOTICE] in this manual is especially important in servicing. If not observed, the product performance and quality may not be guaranteed.

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.



(B) Working Wear

⚠ CAUTION

● Wears for safe operation



Wear a helmet, working clothes, safety shoes and other safety protectors suited to the job. It is especially important to wear well-fitting work clothes.

[Failure to Observe]

A serious accident such as trapping by a machine may occur.

(C) Tools to be Used

⚠ WARNING

● Appropriate holding and lifting

Never operate when the engine is supported with blocks or wooden pieces or only with a jack.

To lift and hold the engine, always use a crane with a sufficient allowance in limit load or a rigid jack.

[Failure to Observe]

A serious accident may occur.

⚠ WARNING

● Use of appropriate tools



Use tools appropriate for the jobs to be done. Use a correctly sized tool for loosening or tightening a machine part.

[Failure to Observe]

A serious injury or engine damage may occur.

(D) Use of Genuine Parts, Oil and Grease

⚠ CAUTION

● Always use genuine parts.



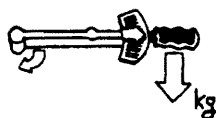
[Failure to Observe]

Shortening of engine life or an unexpected accident may arise.

(E) Bolt and Nut Tightening Torque

⚠ WARNING

● Always tighten to the specified torque if designated in the manual.



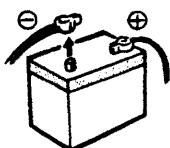
[Failure to Observe]

Loosening or falling may cause parts damage or injury.

(F) Electrical Parts

⚠ WARNING

● Harness short-circuit



Disconnect the battery negative (⊖) terminal before starting the service job.

[Failure to Observe]

Short-circuiting of a harness may occur to start a fire.

⚠ WARNING

● Battery charging



Since flammable gas is generated during battery charging, keep anything which could cause a fire away from the battery.

[Failure to Observe]

Explosions may occur.

⚠ WARNING

● Battery electrolyte



Since the electrolyte is diluted sulfuric acid, do not let it be splashed onto the clothes or skin.

[Failure to Observe]

The clothes or skin may be burnt.

(G) Waste Treatment

⚠ CAUTION

Observe the following instructions with regard to waste disposal. Negligence of each instruction will cause environmental pollution.

- Waste fluids such as engine oil and cooling water shall be discharged into a container without spillage onto the ground.
- Do not let waste fluids be discharged into the sewerage, a river or the sea.
- Harmful wastes such as oil, fuel, solvents, filter elements and battery shall be treated according to the respective laws and regulations.
Ask a qualified collecting company for example.

(H) Handling the Product

WARNING



● Supplying the Fuel

When supplying the fuel, always keep any fire source like a cigarette or match away.

[Failure to Observe]

A fire or explosion may arise.

WARNING



● Pay attention to hot portions.

Do not touch the engine during running or immediately after it is stopped.

[Failure to Observe]

Scalding may be caused by a high temperature.

WARNING



● Pay attention to the rotating part.

Never bring clothes or a tool close to the rotating part during engine running.

[Failure to Observe]

Injury may be caused by entrapping.

CAUTION

● Safety Label Check

Pay attention to the product safety label.

A safety label (caution plate) is affixed on the product for calling special attention to safety.

If it is missing or illegible, always affix a new one.

California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

California Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.

CHAPTER 1

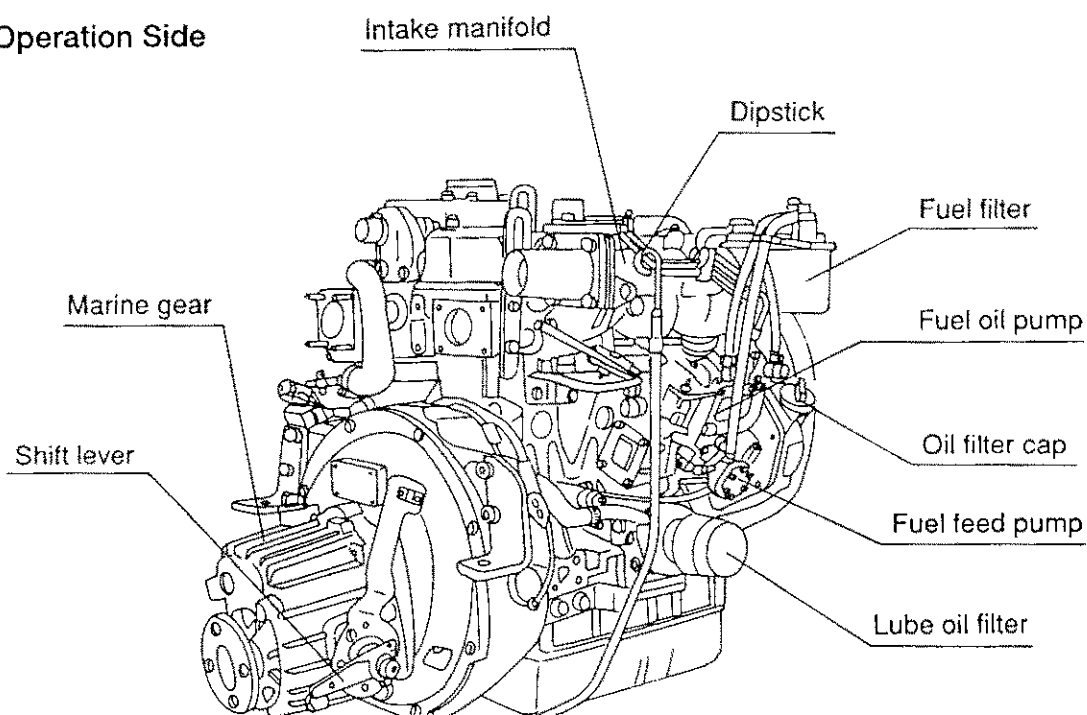
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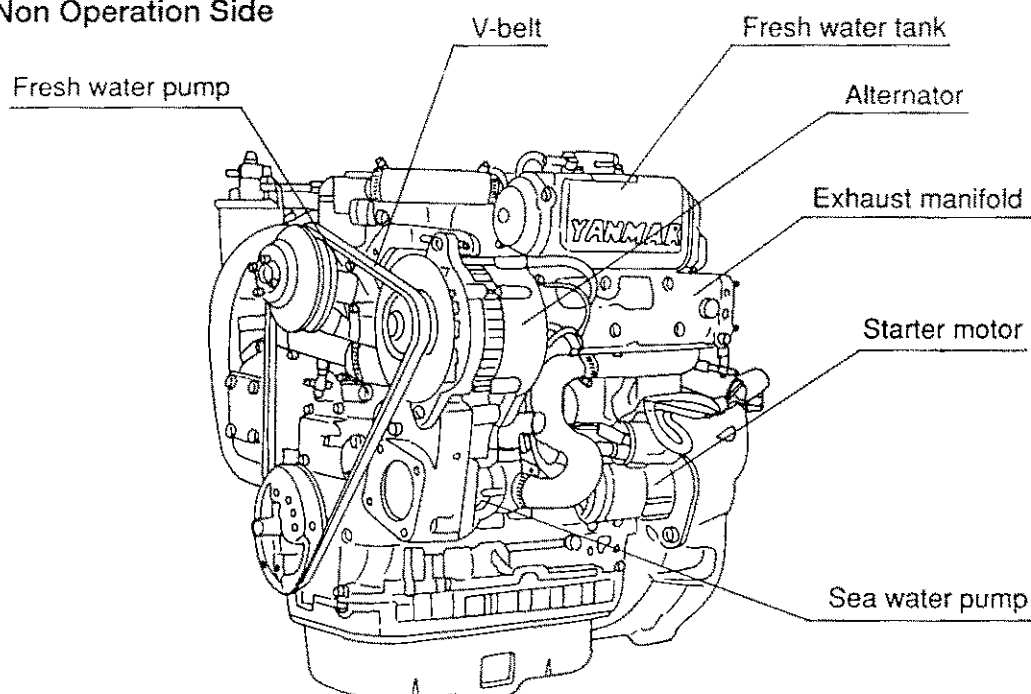
1. Exterior Views

1-1 3JH3E

● Operation Side



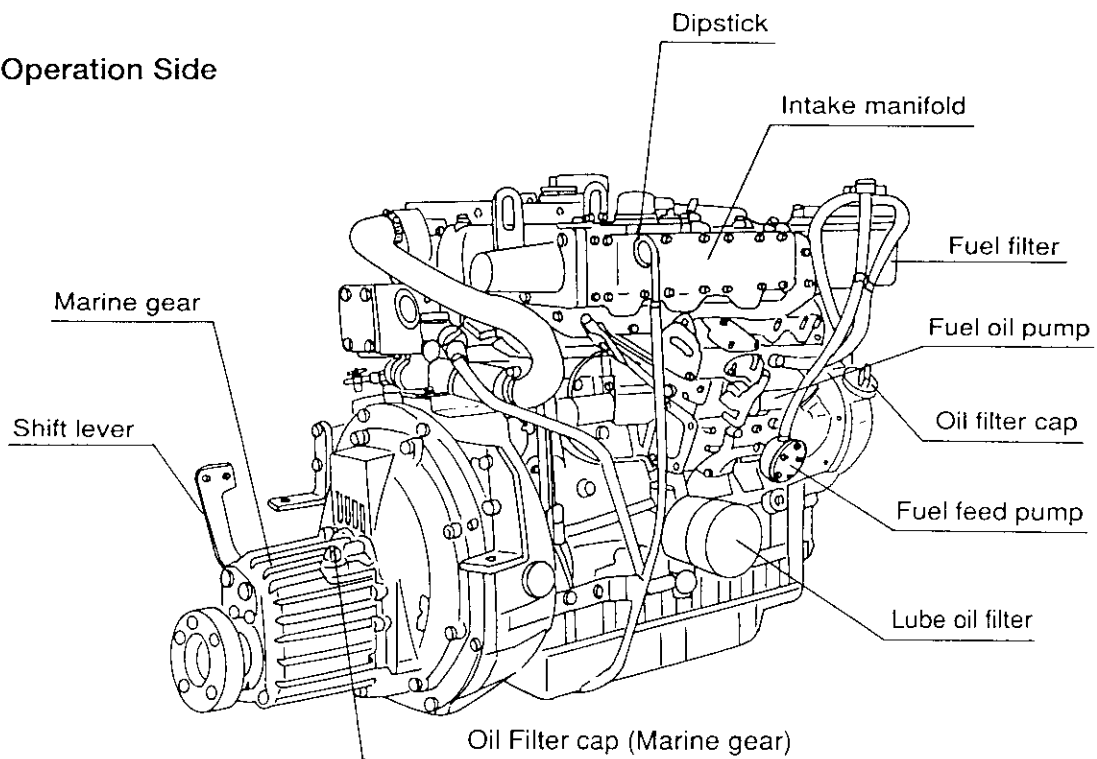
● Non Operation Side



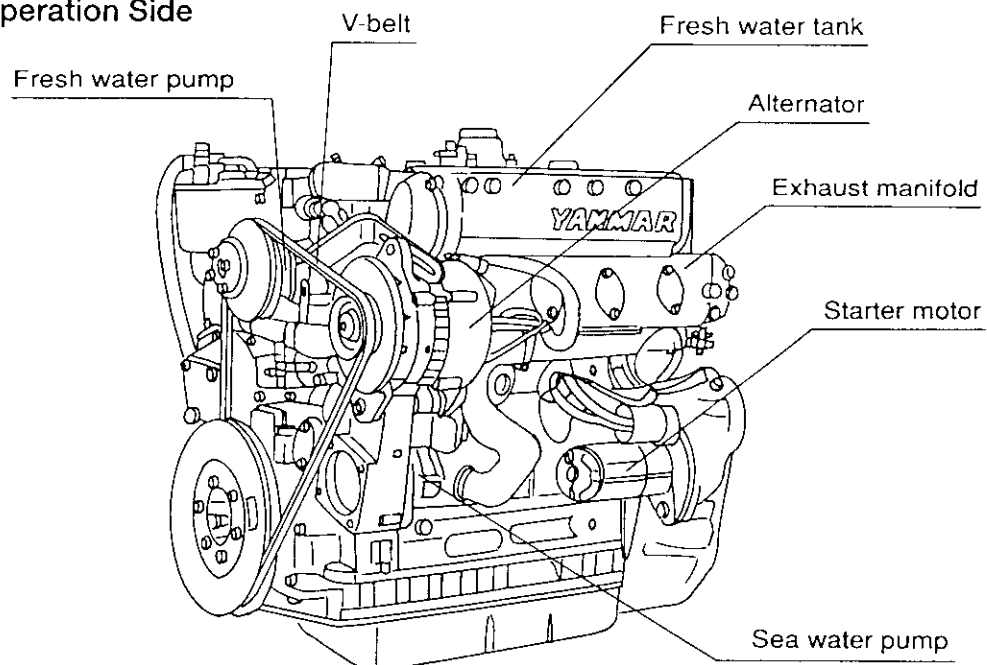
〈Note〉 This illustration shows Yanmar marine gear (Model : KM3P) when it has been attached.

1-2 4JH3E

● Operation Side



● Non Operation Side



〈Note〉 This illustration shows Yanmar marine gear (Model : KM3P) when it has been attached.

2. Specifications

2-1 3JH3E, 3JH3BE, 3JH3CE

| Model | | | 3JH3E | 3JH3BE | 3JH3CE |
|---|---|--------------------|--|---------|---|
| Type | | | Vertical 4-cycle water cooled diesel engine | | |
| Combustion system | | | Direct injection | | |
| Aspiration | | | Normal aspiration | | |
| Number of cylinders | | | 3 | | |
| Bore × stroke | | mm | 84 × 90 | | |
| Displacement | | R | 1.496 | | |
| One hour rating output (flywheel output) | Output/crankshaft speed | kW/rpm (HP/rpm) | 26.5/3650 (36/3650) | | |
| | Brake mean effective pressure | kgf/cm² | 5.93 | | |
| | Piston speed | m/sec. | 10.95 | | |
| Continuous rating output (DIN6270A) flywheel output | Output/crankshaft speed | kW/rpm (HP/rpm) | 29.4/3800 (40/3800) | | |
| | Brake mean effective pressure | kgf/cm² | 0.621 (6.33) | | |
| | Piston speed | m/sec. | 11.4 | | |
| Compression ratio | | | 17.7 | | |
| Fire order | | | 240° 240° 240° 1 — 3 — 2 — 1 | | |
| Fuel injection pump | | | YPES-CL (with Timer) | | |
| Fuel injection timing (b.T.D.C.) | | degree | FID 12° For EPA certified FIC :15±1, (FID:14±1) | | |
| Fuel injection pressure | | kgf/cm² | 200±5 | | |
| Fuel injection nozzle | | | Hole type | | |
| Direction of rotation | (Crankshaft) | | Counter-clock wise viewed from stern | | |
| Power take off | | | At Flywheel side | | |
| Cooling system | | | Constant high temperature fresh water cooling Fresh water : Centrifugal pump Sea water :Rubber impeller pump | | |
| Lubrication system | | | Forced lubrication with trochoid pump | | |
| Starting system | Starting motor | | DC 12V,1.2kW | | |
| | AC generato | | 12V,55A (12V80A : Option) | | |
| Marine Gear | Model | | KM3P | | (Sail Drive SD-31 can be used directly on location.) |
| | Type | | Mechanical cone clutch | | |
| | Reduction rate (ahead/astern) | | 2.36/3.16 2.61/3.16 3.20/3.16 | | |
| | Propeller speed (ahead/astern) | | 1610/1203 1457/1203 1188/1203 | | |
| | Standard propeller (Dia. ×pitch×number) | | mm | | |
| | Propeller shaft dia. × Countershaft dia. | | mm | | |
| | Lubrication system | | Splash | | |
| | Lube oil pan | Total capacity | R | 0.35 | 0.45 |
| | | Effective capacity | R | 0.05 | 0.05 |
| | Cooling system | | | | |
| Weight | | [kg] | [13] | [13] | |
| Dimensions | Overall length | mm | 755.6 | 752.8 | 545.8 |
| | Overall width | mm | 520.6 | | 520.6 |
| | Overall height | mm | 628.6 | | 628.6 |
| Engine weight without marine gear (dry) | | kg | 186 | | 173 |
| Lubricating oil capacity Effect/max. | | R | 4.4/1.8 | 4.9/2.1 | 4.9/2.1 |

(Note) Rating condition : ISO — 3046/1, 1HP ≡ 0.7355kW

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for your reading.**

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