



MARINE DIESEL ENGINE

MODEL:2YM15/3YM20/3YM30

OPERATION MANUAL

The 2YM15/3YM20/3YM30 is an EPA Certified Engine.
It meets the low emission standards set by the EPA.

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<p>California Proposition 65 Warning</p> <p>Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.</p>	<p>California Proposition 65 Warning</p> <p>Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash your hands after handling.</p>
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INTRODUCTION

Thank you for purchasing a YANMAR Marine Diesel Engine.

This Operation Manual describes the operation, maintenance and inspection of the 2YM15/3YM20/3YM30 Yanmar Marine Diesel Engines.

Read this Operation Manual carefully before operating the engine to ensure that it is used correctly and that it stays in the best possible condition.

Keep this Operation Manual in a convenient place for easy access.

If this Operation Manual is lost or damaged, order a new one from your dealer or distributor.

Make sure this manual is transferred to subsequent owners. It should be considered as a permanent part of the engine and remain so.

Constant efforts are made to improve the quality and performance of Yanmar products, so some details included in this Operation Manual may differ slightly from your engine. If you have any questions about this, please contact your Yanmar dealer or distributor.

Operation Manual (Marine Engine)	Model	2YM15/3YM20/3YM30
	Code. No.	49961-206364

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The essentials of the sail drive are described in this manual. For further details on its use, refer to the sail drive manual.

1. FOR YOUR SAFETY

1. FOR YOUR SAFETY

1.1 Warning Symbols

Most operation, maintenance and inspection problems arise due to users' failure to comply with the rules and precautions for safe operation described in this operation manual. Often, users do not understand or recognize the signs of approaching problems. Improper handling can cause burns and other injuries and can result in death.

Be sure to read this operation manual carefully before operating the engine and observe all of the instructions and precautions described in this manual. Follow the warning signs below in this manual. Pay special attention to parts containing these words and signs.



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.

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CAUTION indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury. This sign is also used to alert against unsafe practices.

The descriptions captioned by **NOTICE** are particularly important cautions for handling. If you ignore them, the performance of your machine may deteriorate leading to problems.

1. FOR YOUR SAFETY

1.2 Safety Precautions

(Observe these instructions for your own safety!)

Precautions for Operation

⚠ DANGER



Filler Cap of Coolant Tank

Never open the cap of the coolant tank while the engine is still hot. Steam and hot water may spurt out and burn you seriously. Wait until the temperature of the coolant tank has dropped, wrap a cloth around the filler cap, loosen the cap very carefully and slowly to remove the system pressure before removing the cap. After inspection, refasten the cap firmly.

⚠ DANGER



Battery

Never smoke or permit sparks near the battery, because it may emit explosive hydrogen gas. Place the battery in a well-ventilated place.

⚠ DANGER



Fuel

Use only diesel fuel. Never use other fuels, including gasoline, kerosene, etc., because they could cause a fire. The wrong fuel could also cause the fuel injection pump and injector to fail due to lack of proper lubrication. Be sure to check that you have selected the correct diesel fuel before filling the fuel tank.

Do not use starting fluids or sprays. Their use may cause explosion, serious injury and engine damage.

⚠ WARNING



Fire Prevention

Be sure to stop the engine and confirm that there are no open flames in the vicinity before fueling. If you do spill fuel, wipe such spillage carefully and dispose of the wiping materials properly. Wash your hands thoroughly with soap and water.

Never place oil or other flammable material in the engine room.

Install a fire extinguisher near the engine room, and familiarize yourself with its use.

⚠ WARNING



Exhaust Gas

Exhaust gas contains poisonous carbon monoxide and should not be inhaled.

Be sure to install ventilation ports or ventilators in the engine room and ensure good ventilation during engine operation.

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1. FOR YOUR SAFETY

⚠ WARNING



Moving Parts

Do not touch or let your clothing get caught in the moving parts of the engine, such as the front drive shaft, V-belt or propeller shaft, during engine operation. You will be injured.

Never operate the engine without covers on the moving parts.

⚠ CAUTION



Burns

The whole engine is hot during operation and immediately after shut-down. The exhaust manifold, exhaust pipe and high pressure fuel lines are very hot. Never touch these parts with your body or clothing.

⚠ WARNING



Alcohol

Never operate the engine while you are under the influence of alcohol.

Never operate the engine when you are ill or not feeling well.

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⚠ DANGER



Battery Fluid

Battery fluid is dilute sulphuric acid. It can blind you if it gets in your eyes, or burn your skin. Keep the fluid away from your body.

If you touch it, wash it off immediately with a large quantity of fresh water and call your doctor for treatment.

⚠ WARNING



Fire by Electric Short-Circuits

Always turn off the battery switch before inspecting the electrical system.

Failure to do so could cause short-circuiting and fires.

⚠ WARNING



Stop the engine before you service it.

Turn the battery switch off. If you must inspect while the engine is in operation, never touch moving parts. Keep your body and clothing well clear of all moving parts.

1. FOR YOUR SAFETY

CAUTION



Scalds

When extracting oil from the engine while it is still hot, don't let the oil splash on you.

Wait until the temperature has dropped before extracting cooling water from the engine. Don't let it splash on you.

DANGER

Forbidden Modifications.

Never release the limiting devices such as the engine speed limit, fuel injection limit, etc.

Modification will impair the safety and performance of the product and shorten product life.

Also note that any troubles arising from modification are not covered by our warranty.

DANGER

Precautions for Treating Waste.

Never dispose of waste oil or other fluid in a field, sewer, river, or the sea.

Treat waste matters safely observing regulations or laws.

Ask a waste recovery company to collect it.

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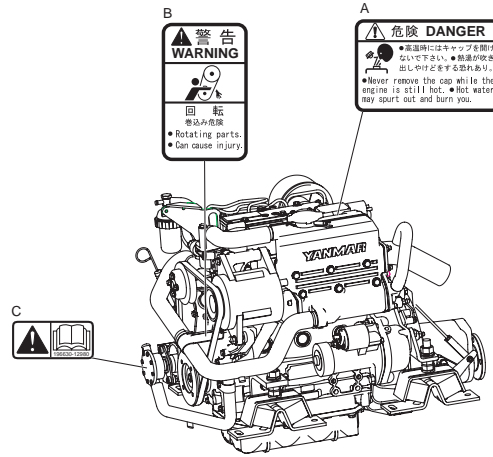
1. FOR YOUR SAFETY

1.3 Warning Labels

Safety Precautions for Inspection

To insure safe operation, warning device labels have been attached. Their location is shown below and they should always be visible. Please replace if damaged or lost.

Product Safety Labels	
No.	Part Code No.
A	128377-07260
B	128377-07350
C	196630-12980



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2. PRODUCT EXPLANATION

2. PRODUCT EXPLANATION

2.1 Use, Propulsion System, Etc.

The engine is equipped with a marine gear or a sail drive unit. The marine gear output shaft connects with the propeller shaft.

In order to obtain full performance from your engine, it is imperative that you check the displacement and structure of the hull and use a propeller of the appropriate size. As new boats are used, owners add additional equipment and completely fill the fuel and water tanks adding to the overall displacement (weight) of the vessel. Extra canvas enclosures, bottom paint, and bottom fouling can add additional hull resistance. It is recommended that new vessels be propped so the engines can operate at 100-200 rpm above rated rpm to allow for some added weight and hull resistance. Failure to do so can lead to reduced vessel performance, lead to increased smoke levels and cause permanent damage to your engines.

The engine must be installed correctly with safe cooling water and exhaust piping and electrical wiring. Any auxiliary equipment attached to the engine should be easy to use and accessible for service.

To handle the drive equipment, propulsion systems (including the propeller) and other onboard equipment be sure to observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

The laws of some countries may require hull and engine inspections, depending on the use, size and cruising area of the boat.

The installation, fitting and surveying of this engine all require specialized knowledge and engineering skills. Consult Yanmar's local subsidiary in your region or your distributor or dealer.

NOTICE

This engine is designed for pleasure boat applications.

The engine is designed to be operated at:

Maximum throttle (3600-3800 rpm) for less than 5% of total engine time. (30 minutes out of every 10 hours)

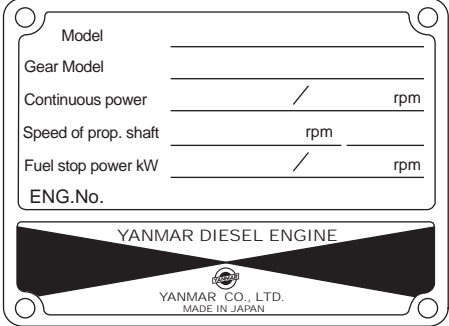
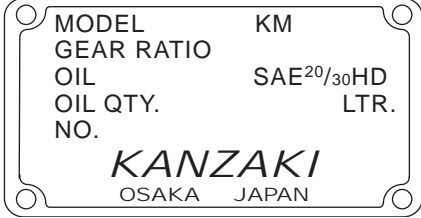
Cruising Speed (3400 rpm or lower) for less than 90% of total engine time (9 hours out of every 10 hours)

⚠ WARNING

Never modify this product or release the limit devices (which limit engine speed, fuel injection quantity, etc.). Modification will impair the safety and performance of the product and functions and shorten the product life. Please note that any troubles arising from modification of the product will not be covered by our warranty.

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2. PRODUCT EXPLANATION

DETAIL OF NAMEPLATE	
<p>The nameplate shown below is attached to the engine. Check the engine's model, output, rpm and serial number on the nameplate.</p>	<p>The nameplate shown below is attached to the marine gear. Check the marine gear's model, gear ratio, oil used, oil quantity and serial number.</p>
 <p>The image shows a rectangular nameplate for a Yanmar Diesel Engine. It contains the following fields: Model, Gear Model, Continuous power (with a slash and 'rpm' on the right), Speed of prop. shaft (with 'rpm' on the right), Fuel stop power kW (with a slash and 'rpm' on the right), and ENG.No. Below these fields is a black banner with 'YANMAR DIESEL ENGINE' in white. At the bottom, there is a logo and the text 'YANMAR CO., LTD. MADE IN JAPAN'.</p>	 <p>The image shows a rectangular nameplate for a marine gear. It contains the following fields: MODEL (with 'KM' on the right), GEAR RATIO, OIL (with 'SAE^{20/30}HD' on the right), OIL QTY. (with 'LTR.' on the right), and NO. Below these fields is the brand name 'KANZAKI' in a stylized font, followed by 'OSAKA JAPAN'.</p>

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2. PRODUCT EXPLANATION

2.2 Engine Specifications

Engine Model		unit	2YM15	
Marine gear model		-	KM2P-1	SD-20
Use		-	Pleasure use	
Type		-	Vertical water-cooled 4-cycle diesel engine	
Combustion system		-	Swirl pre-combustion chamber	
Number of cylinders		-	2	
Bore x stroke		mm(inch)	70x74(2.76x2.91)	
Displacement		L	0.570	
Continuous power	Output at crankshaft/ Engine speed	kW(hp)/ min ⁻¹ [1]	9.4(12.8)/3489(at Fuel temp. 25°C) ^[2]	
Fuel stop power	Output at crankshaft/ Engine speed	kW(hp)/ min ⁻¹ [1]	10.3(14.0)/3600(at Fuel temp. 25°C) [2] /10.0(13.6)/3600(at Fuel temp. 40°C) [2]	
	Output at propeller/ Engine speed	kW(hp)/ min ⁻¹ [1]	10.0(13.6)/3600(at Fuel temp. 25°C) [2] /9.7(13.2)/3600(at Fuel temp. 40°C) [2]	-
Installation		-	Flexible mounting	
Fuel injection opening pressure		MPa	12.3+0.98-0	
Direction of rotation	Crankshaft	-	Counter-clockwise viewed from stern	
	Propeller shaft (Ahead)	-	Clockwise viewed from stern	-
Cooling system		-	Fresh water-cooling with heat exchanger	
Lubrication system		-	Complete enclosed forced lubrication	
Cooling water capacity (fresh)		L(quant)	Engine 3.0 (3.2), Coolant recovery tank: 0.8(0.8)	
Lubricating oil capacity (engine)	Rake angle	°(deg)	at rake angle 8°	at rake angle 0°
	Total ^[3]	L(quant)	2.0(2.1)	1.8(1.9)
	Effective ^[4]		0.95(1.0)	0.9(1.0)
Starting system	Type	-	Electric	
	Starting motor	V-kW	DC 12V - 1.4 kW	
	AC generator	V-A	12V - 60A (12V - 80A optional)	
Engine dimension	Overall length	mm(inch)	613(24.1)	-
	Overall width		463(18.2)	
	Overall height		528(20.8)	
Engine dry mass (include marine gear)		kg	113	134(with SD20)

[1] hp = 0.7355 kW

[2] Fuel temperature at the inlet of the fuel injection pump.

[3] The "Total" oil quantity includes oil in oil pan, channels, coolers and filter.

[4] The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

Note: Fuel condition: Density at 15 °C = 0.842

Rating condition ISO 3046-1, at fuel temp. 25°C ; ISO 3046-1, at fuel temp. 40°C inlet; ISO 8665. At FO pump inlet.

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2. PRODUCT EXPLANATION

Engine Model		unit	3YM20		3YM30	
Marine gear model		-	KM2P-1	SD-20	KM2P-1	SD-20
Use		-	Pleasure use		Pleasure use	
Type		-	Vertical water-cooled 4-cycle diesel engine		Vertical water-cooled 4-cycle diesel engine	
Combustion system		-	Swirl pre-combustion chamber		Swirl pre-combustion chamber	
Number of cylinders		-	3		3	
Bore x stroke		mm(inch)	70x74(2.76x2.91)		76x82(2.99x3.23)	
Displacement		L	1.115		1.115	
Continuous power	Output at crankshaft/ Engine speed	kW(hp)/min ⁻¹ [1]	14.7(20.0)/3489(at Fuel temp. 25°C) ^[2]		20.1(27.3)/3489(at Fuel temp. 25°C) [2]	
	Fuel stop power	kW(hp)/min ⁻¹ [1]	16.2(22.0)/3600(at Fuel temp. 25°C) [2] /15.3(20.8)/3600(at Fuel temp. 40°C) [2]		22.1(30.0)/3600(at Fuel temp. 25°C) [2] /21.3(29.0)/3600(at Fuel temp. 40°C) [2]	
Fuel stop power	Output at propeller/Engine speed	kW(hp)/min ⁻¹ [1]	15.7(21.3)/3600(at Fuel temp. 25°C) [2] /14.9(20.2)/3600(at Fuel temp. 40°C) [2]	-	21.4(29.1)/3600(at Fuel temp. 25°C) [2] /20.7(28.1)/3600(at Fuel temp. 40°C) [2]	-
	Installation	-	Flexible mounting		Flexible mounting	
Fuel injection opening pressure		MPa	12.3+0.98-0		12.3+0.98-0	
Direction of rotation	Crankshaft	-	Counter-clockwise viewed from stern		Counter-clockwise viewed from stern	
	Propeller shaft (Ahead)	-	Clockwise viewed from stern	-	Clockwise viewed from stern	-
Cooling system		-	Fresh water-cooling with heat exchanger		Fresh water-cooling with heat exchanger	
Lubrication system		-	Complete enclosed forced lubrication		Complete enclosed forced lubrication	
Cooling water capacity (fresh)		L(quart)	Engine 4.5 (4.8), Coolant recovery tank: 0.8(0.8)		Engine 4.9(5.2), Coolant recovery tank: 0.8(0.8)	
Lubricating oil capacity (engine)	Rake angle	°(deg)	at rake angle 8°	at rake angle 0°	at rake angle 8°	at rake angle 0°
	Total ^[3]	L(quart)	2.7(2.85)	2.4(2.5)	2.8(3.0)	2.5(2.6)
	Effective ^[4]		1.4(1.5)	1.5(1.6)	1.4(1.5)	1.5(1.6)
Starting system	Type	-	Electric		Electric	
	Starting motor	V-kW	DC 12V - 1.4 kW		DC 12V - 1.4 kW	
	AC generator	V-A	12V - 60A (12V - 80A optional)		12V - 60A (12V - 80A optional)	
Engine dimension	Overall length	mm(inch)	693(27.3)	-	715(28.1)	-
	Overall width		463(18.2)		463(18.2)	
	Overall height		528(20.8)		545(21.5)	
Engine dry mass (include marine gear)		kg	130	151(with SD20)	133	154(with SD20)

[1] hp = 0.7355 kW

[2] Fuel temperature at the inlet of the fuel injection pump.

[3] The "Total" oil quantity includes oil in oil pan, channels, coolers and filter.

[4] The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

Note: Fuel condition: Density at 15 °C = 0.842

Rating condition ISO 3046-1, at fuel temp. 25°C ; ISO 3046-1, at fuel temp. 40°C inlet; ISO 8665. At FO pump inlet.

2. PRODUCT EXPLANATION

Marine gear or Sail Drive	Model	Unit	KM2P-1(S)	KM2P-1(G)	KM2P-1(GG)	SD20 (coupled at boat builder)
	Type	-	Mechanical cone clutch			Dog clutch
	Reduction ratio (Forward/Reverse)	-	2.21/3.06	2.62/3.06	3.22/3.06	2.64/2.64
	Propeller speed (Forward/Reverse) ^[1]	min ⁻¹	1580/1140	1332/1140	1083/1140	1322
	Lubrication system	-	Splash			Oil bath
	Lubricating oil capacity	L (quart)	0.3 (0.32)			2.2 (2.3)
	Mass	kg	9.8			30

[1] At continuous power engine speed 3489 min⁻¹

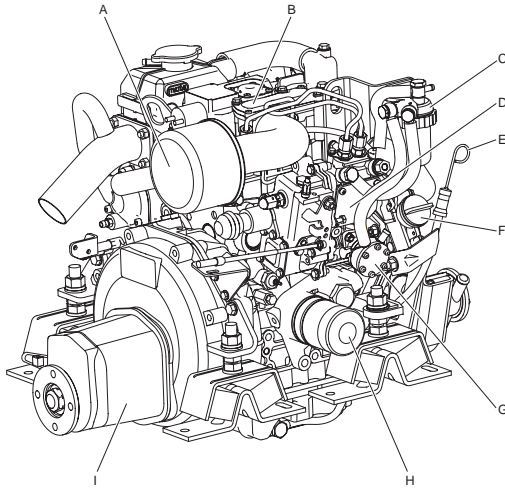
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2. PRODUCT EXPLANATION

2.3 Names of Parts

2YM15

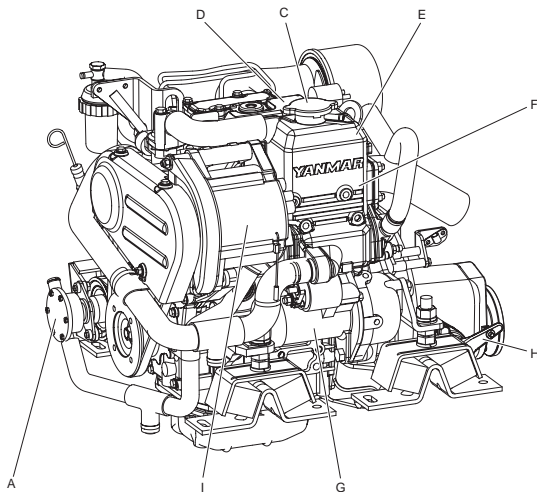
Operation Side



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- | | |
|-----------------------|--------------------------|
| A Intake silencer | F Oil filler cap |
| B Intake manifold | G Fuel feed pump |
| C Fuel filter | H Lubricating oil filter |
| D Fuel injection pump | I Marine gear |
| E Dipstick | |

Non Operation Side

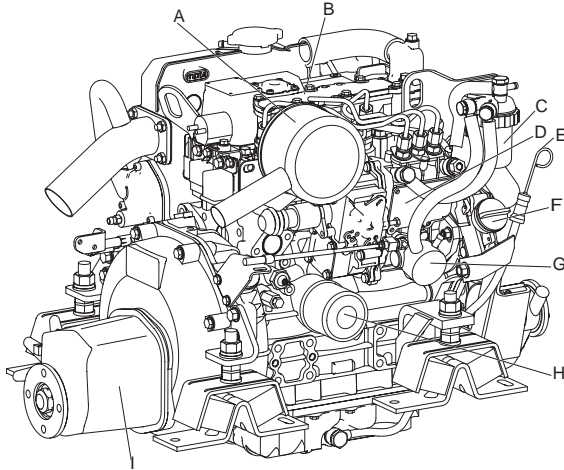


- | | |
|-----------------------------------------------|--------------------|
| A Seawater pump | F Exhaust manifold |
| C Filler cap | G Starter motor |
| D Engine name plate (on the rocker arm cover) | H Shift lever |
| E Coolant tank / Heat exchanger | I Alternator |

2. PRODUCT EXPLANATION

3YM20

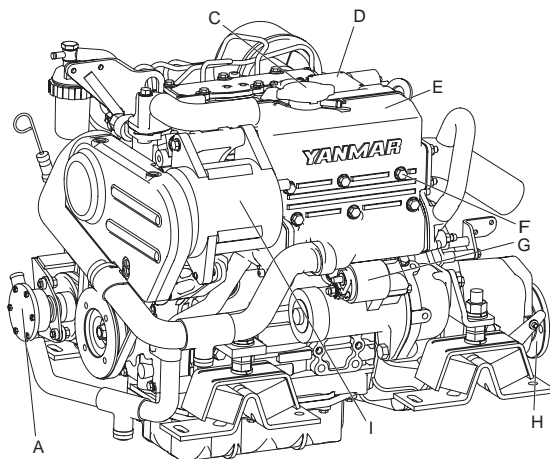
Operation Side



- | | |
|-----------------------|--------------------------|
| A Intake silencer | F Oil filler cap |
| B Intake manifold | G Fuel feed pump |
| C Fuel filter | H Lubricating oil filter |
| D Fuel injection pump | I Marine gear |
| E Dipstick | |

EN

Non Operation Side

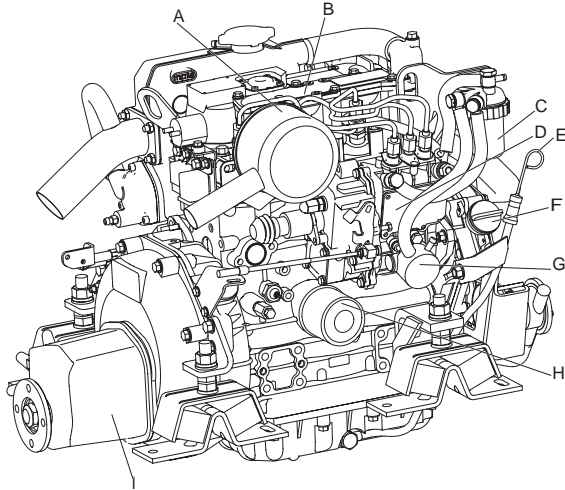


- | | |
|-----------------------------------------------|--------------------|
| A Seawater pump | F Exhaust manifold |
| C Filler cap | G Starter motor |
| D Engine name plate (on the rocker arm cover) | H Shift lever |
| E Coolant tank / Heat exchanger | I Alternator |

2. PRODUCT EXPLANATION

3YM30

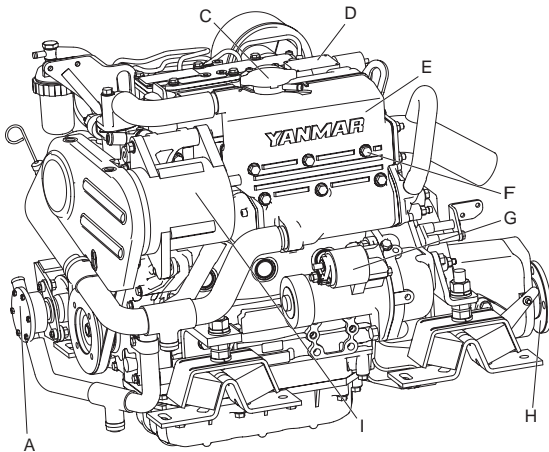
Operation Side



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- | | |
|-----------------------|--------------------------|
| A Intake silencer | F Oil filler cap |
| B Intake manifold | G Fuel feed pump |
| C Fuel filter | H Lubricating oil filter |
| D Fuel injection pump | I Marine gear |
| E Dipstick | |

Non Operation Side



- | | |
|-----------------------------------------------|--------------------|
| A Seawater pump | F Exhaust manifold |
| C Filler cap | G Starter motor |
| D Engine name plate (on the rocker arm cover) | H Shift lever |
| E Coolant tank / Heat exchanger | I Alternator |

2. PRODUCT EXPLANATION

2.4 Major Service of Parts

Name of part	Function
Fuel filter	Removes dirt and water from fuel. Drain the filter periodically. The element (filter) should be changed. See maintenance section 4.3.5
Fuel feed pump	Pumps fuel from tank to the fuel injection pump.
Priming lever	Moving the priming lever up and down feeds the fuel. The priming lever is used to bleed air from the fuel system after running out of fuel.
Filler port (engine)	Filler port for engine lubricating oil.
Filler port (marine gear)	Filler port for marine gear lubricating oil.
Lubricating oil filter	Filters fine metal fragments and carbon from the lubricating oil. Filtered lubricating oil is distributed to the engine's moving parts.
Cooling System	There are two cooling systems: fresh water and seawater. The engine's combustion heat is cooled by the fresh water/coolant in a closed circuit. The fresh water is cooled by seawater using heat exchanger. The seawater also cools the engine- and gear-oil (and depending on the model also intake air) through coolers in an open circuit.
Fresh water pump	The centrifugal water pump circulates fresh cooling water inside the engine. The fresh water pump is driven by the V-belt.
Seawater pump	Pumps seawater from outside the vessel to the engine by passing through the engine's coolers. The seawater pump is belt driven and has a replaceable rubber impeller.
Fresh water/coolant filler cap	The filler cap on the coolant tank covers the water supply port. The cap has a pressure regulating valve. When the cooling water temperature rises the pressure rises inside the fresh water system.
Coolant recovery tank	The pressure regulating valve releases vapour and hot water overflows to the coolant recovery tank. When the engine stops and cooling water cools, the pressure in the cooling water tank also drops very low. The filler cap valve then opens to send water back from the coolant recovery tank. This minimizes cooling water consumption. Fresh water/coolant level can easily be checked and refilled in this tank.
Intake silencer	The intake silencer guards against dirt in the air and reduces the noise of air intake.
Nameplates	Nameplates are provided on the engine and the marine gear and have the model, serial number and other data.
Starter	Starter motor for the engine. Powered by the battery.
Alternator	Rotated by belt drive, generates electricity and charges the battery.

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2. PRODUCT EXPLANATION

2.5 Control Equipment

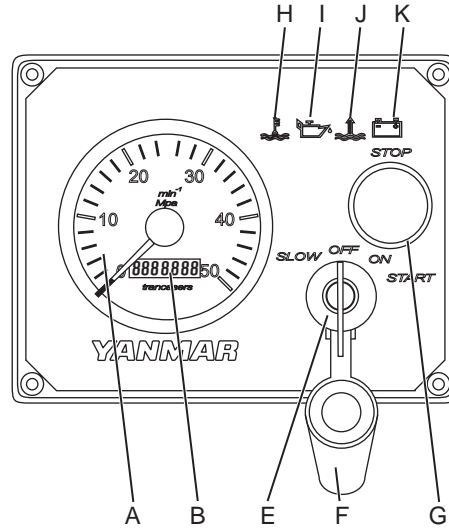
The equipment in the control room, making remote control possible, consists of the instrument panel, which is connected by wire harness and the remote control handle, which is hooked up by remote control cables to the engine control lever and marine gear.

2.5.1 Instrument Panel

2.5.1.1 Controls and equipment

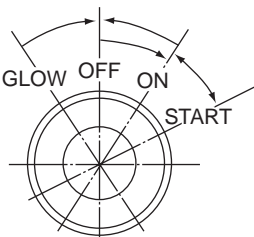
The instrument panel is located in the control room. The following instruments enable you to start / stop the engine and to monitor its condition during operation.

B type



- A Tachometer
- B Hour meter
- E Key switch
- F Moisture cap for key switch
- G Stop button switch
- H Coolant high temperature alarm
- I Lubricating oil low pressure alarm
- J Water in sail drive seal alarm
- K Battery low charge alarm

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Instruments, equipment	Functions	
Key switch Rotary switch with 4 positions 	OFF	The switch key can be inserted or removed. All electric current is cut off.
	ON	The electric current to the controls and equipment is turned on. Engine keeps running. To stop the engine, the key switch should be in ON position. After stopping the engine, please turn OFF the key switch.
	START	The start position of the engine. The electric current to the starting motor is turned on. When you release the key, it will automatically turn to ON position.
	GLOW	The start aid position of the engine. The electric current to the air heater /glow plug is turned on. When you release the key, it will automatically turn to ON position.
Note: When you don't use the engine, please remove the key from the key switch and cover the keyhole with the cap to protect from corrosion.		
Stop button switch	Push button switch to stop the engine. The electric current to the stop solenoid is turned on.	

2. PRODUCT EXPLANATION

2.5.1.2 Meters





B type panels use analog electric systems and have a pointer indicator.

Instruments, equipment	Functions
Tachometer	The engine's rotation speed is indicated.
Hour meter	The number of hours of operation is indicated, and can be used as a guide for periodic maintenance checks. The hour meter is at the bottom of the tachometer.
Panel lights	When turning the key switch to ON, the meters light, for easy viewing.

2.5.1.3 Alarm equipment (lamps and buzzer)

When the sensor detects a problem during operation, the lamp comes on and the buzzer sounds.

The alarm lamps are located on the panel, the buzzer is located on the back of panel. Under normal conditions, the monitors are off. When there is a problem, the monitors lights up.

	Battery low charge alarm	When the alternator output is too low, the lamp will come on. When charge begins, the lamp will turn off. (The alarm buzzer will not sound, when the lamp comes on.)
	Coolant high temperature alarm	When the temperature reaches the maximum (95°C [203°F] or higher), the lamp will light and the buzzer will sound. Continuing operation at temperatures exceeding the maximum limit will result in damage and seizure. Check the load and the fresh water cooling system for any abnormalities.
	Lubricating oil low pressure alarm	When the lubricating oil pressure falls below normal, the oil pressure sensor will register this and the lamp will come on and the alarm will sound. Continuing operation with insufficient oil pressure will result in damage and seizure. Check the oil level.
	Water in sail drive seal alarm	When seawater is detected between the seals of the sail drive, the lamp will come on and the alarm will sound.

EN

2.5.1.4 Normal action of alarm devices

Alarm devices act as shown below. Please check that alarm lamps and buzzer are working normally, when the key is turned on.

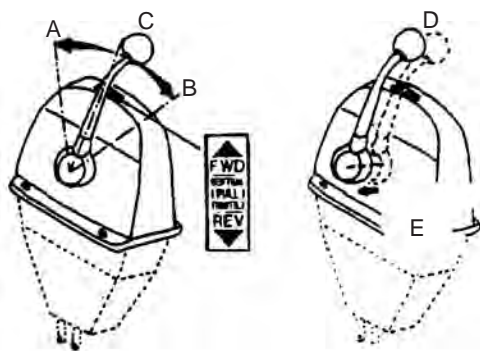
Key switch		OFF->ON	START->ON
Engine		Before start	Running
Alarm buzzer		Sounds	Stops
Alarm lamps	Battery low charge alarm	Lights	Off
	Coolant high temperature alarm	Off	Off
	Lubricating oil low pressure alarm	Lights	Off
	Water in sail drive seal alarm	Off	Off

2. PRODUCT EXPLANATION

2.5.2 Single Lever Remote Control Handle

This remote control system uses a single-handle to operate the marine gear-clutch (neutral, forward, reverse) and to control the engine speed.

NEUTRAL: Power to the propeller shaft is cut off and the engine idles.



A FWD (forward)
B REV (reverse)
C NEUTRAL (boat is stopped)
D Clutch is disengaged
E Pull out handle

The handle controls the direction of the boat (ahead or astern) and, at the same time, acts as an accelerator increasing the engine speed as it is pushed further in the FWD or REV direction. If the handle is pulled out, engine speed can be controlled without engaging the clutch (clutch remains in the NEUTRAL, no load position).

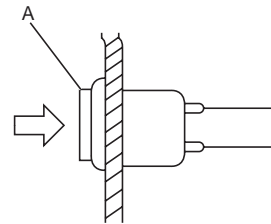
NOTICE

Yanmar recommends the use of a single-lever type for the remote control system. If only the two-lever type is available in the market, operate the engine at 1000 rpm or lower before engaging and disengaging the marine gear-clutch.

2.5.3 Shut-down Equipment

Electric Operation

Engine shut-down by stop button



A Stop button on the instrument panel

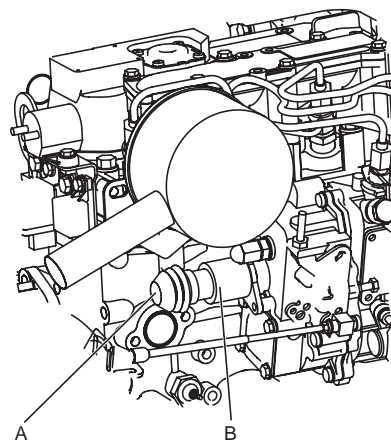
Push the stop button on the instrument panel when the key is in the ON position.

CAUTION

If the engine is stopped suddenly at a high temperature, the temperature of various parts will increase and engine trouble may occur.

Emergency Stop

When you can't stop the engine by the stop button on the panel, push the button at the back of the stop solenoid.



A Emergency stop button B Stop solenoid

EN

3. OPERATION

3. OPERATION

3.1 Fuel Oil, Lubricating Oil, and Cooling Water

3.1.1 Fuel Oil

NOTICE

Only use the recommended fuel to obtain the best engine performance and to keep the durability of the engine, also to comply with the emission regulations.

(1) Selection of Fuel Oil

Diesel fuel oil should comply with the following specifications.

- The fuel specifications need to comply with each national standard or international standards.
- ASTM D975 No.1-DNo.2-D ... for USA
- EN590:96 for EU
- ISO 8217 DMX International
- BS 2869-A1 or A2 for UK
- JIS K2204 for JAPAN

The following requirements also need to be fulfilled.

- Cetane number should be equal to 45 or higher.
- Sulphur content of the fuel. It should not exceed 0.5%by volume. (Preferably it should be below 0.05 %)
- Water and sediment in the fuel oil should not exceed 0.05% by volume.
- Ash should not exceed 0.01%by mass.
- 10% Carbon residue content of the fuel. It should not exceed 0.35%by volume. (Preferably it should be below 0.1 %)

- Aromatics (total) content of the fuel. It should not exceed 35% by volume. (Preferably it should be below 30% and aromatics (PAH*) content of the fuel preferably it should be below 10%)

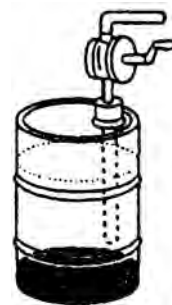
PAH*: polycyclic aromatic hydrocarbons

- DO NOT use Biocide.
- DO NOT use Kerosene, residual fuels.
- DO NOT mix winter fuel and summer fuel.

Note: Engine breakdown can be attributed to insufficient quality of fuel oil.

(2) Handling of Fuel Oil

1. Water and dust in the fuel oil cause engine failure. When fuel is stored, be sure that the inside of the storage container is clean, and that the fuel is stored away from dirt or rain water.
2. Keep the fuel container stationery for several hours to allow any dirt or water to settle to the bottom. Use a pump to extract the clear, filtered fuel from the top of the container for use.



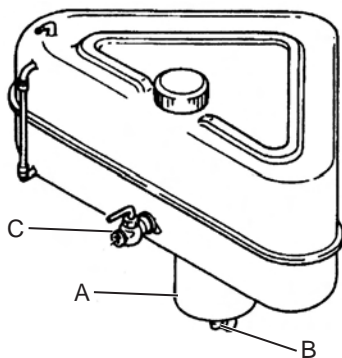
Use the clear filtered fuel from the upper middle section of the container only, leaving any contaminated fuel at the bottom.

EN

3. OPERATION

(3) Fuel Tank

The inside of the fuel tank should always be clean enough and it should be dry for the first use. Drain the water according to the maintenance (section 5) with a drain valve.



A Sediment
B Drain cock

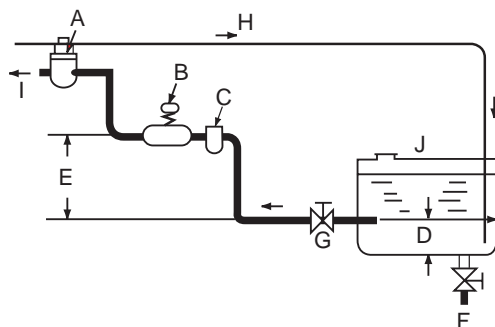
C To engine

EN

(4) Fuel System

Install the fuel pipe from the fuel tank to the fuel pump in accordance with the diagram. The fuel/water separator (optional) is placed at the center section of the line.

Fuel System



A Fuel filter
B Fuel feed pump (priming lever)
C Fuel/water separator
D Approx. 20-30 mm (3/4"-1 1/8")
E Within 500 mm (20")
F Drain cock
G Fuel cock
H Fuel return
I To fuel injection pump
J Fuel tank

NOTICE

When other than the specified fuel oil is used, the engine will not perform to full capacity and parts may be damaged.

3.1.2 Lubricating Oil

NOTICE

Using other than the specified lubricating oil will lead to seizure of parts, abnormal wear, and shorten engine life.

(1) Selection of Engine Lubricating Oil

Use the following Lubricating oil:

- API Classification CD or better
TBN value: 9 or more

The oil must be changed when the Total Base Number (TBN) has been reduced to 2.0.

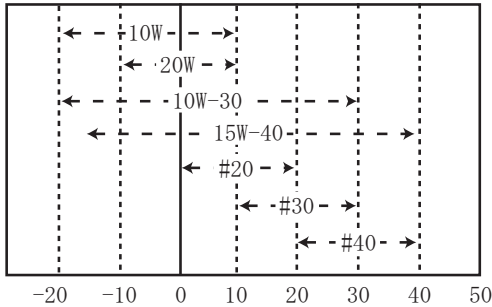
*TBN (mgKOH/g) test method;
JIS K-2501-5.2-2(HCl), ASTM
D4739(HCl)

- SAE viscosity 10W30 or 15W40

If you operate your engine at temperatures below the limits shown below, consult your dealer for special lubricants and starting aids.

3. OPERATION

Selection of viscosity (SAE Service grade)



Atmospheric temperature (°C)
10W-30 can be used almost throughout the year.

DO NOT use The following engine oils.

API : CG-4, CH-4

ACEA : E-1, E-2, B grade

JASO : DH-2, DL-1

Reason

- API CG-4, CH-4
In case CG-4, CH-4 is to be used for YANMAR YM diesel engine series, there is a possibility that excessive wears occur on the valve train system due to the content of oil.
- ACEA E-1, E-2, B
These fuels are developed for the different type of diesel engines.
- JASO DH-2, DL-1
These fuels are developed for the different type of diesel engines.

(2) Selection of Oil for Marine Gear

- API Classification CD or better
- SAE viscosity #20 or #30

(3) Selection of Oil for Sail Drive Unit

- API service gradeGL4.5
- SAE Viscosity 90 or 80W90

or QuickSilver® High Performance Gear Lube

QuickSilver® is a registered trademark of the Brunswick Corporation.

(4) Handling the Lubricating Oil

1. When handling and storing lubricating oil, be careful not to allow dust and water to enter the lubricating oil. Clean around the filler port before refilling.
2. Do not mix lubricating oils of different types or brands. Mixing may cause the chemical characteristics of the lubricating oil to change and lubricating performance to drop, reducing the engine's life. Before supplying lubricating oil to the engine and marine gear for the first time, extract any lubricating oil remaining in the tank. Use new lubricating oil.
3. Lubricating oil supplied to the engine will undergo natural degradation with time even when the engine is not used. Lubricating oil should be replaced at the specified intervals, regardless of whether the engine is being used or not.
If you operate your equipment at temperatures below the limits shown, consult your dealer for special lubricants and starting aids.

EN

⚠ CAUTION

Contact with engine oil may result in the roughened skin. Care should be taken so as not to contact with engine oil wearing protective gloves and clothing.

When handling the engine oil, make sure to use the protective gloves at any time.

If contact, wash with soap and water thoroughly.

3. OPERATION

3.1.3 Cooling fresh water

Use clean soft water and always be sure to add LLC (Long Life Coolant) in order to prevent rust built up and freezing. (Do not use water only.)

The recommended LLC conform to the following specifications.

- JIS K-2234
- SAE J814C, J1941, J1034, J2036
- ASTM D3306
- ASTM D4985

Consult your Yanmar dealer or distributor on the use of coolant/antifreeze, and detergents. Examples of LLC which provide good performance are:

- TEXACO LONG LIFE COOLANT ANTIFREEZE, both standard and pre-mixed.

Product code 79947 and 7998.

- HAVOLINE EXTENDED LIFE ANTIFREEZE/COOLANT.

Product code 7994

EN

NOTICE

- Always be sure to add LLC to soft water. In particular, in cold season, to add LLC is important.

Without LLC,

Cooling performance will decrease due to scale and rust in the cooling water system.

This causes serious damage in the cooling system.

- Be sure to use the proper amount of coolant concentrate specified by the LLC manufacturer depending on the

ambient temperature. LLC concentration should be 30% as a minimum and 60% as a maximum.

- DO NOT mix the different types of brand of LLC, otherwise harmful sludge may yield.
- DO NOT use hard water.
- Water should be free from sludge and/or particles.

CAUTION

When handling LLC, use protective gloves to avoid skin contact.

In case it comes in contact with your skin or eyes, wash it out with clean water.

3.1.3.1 Handling of Coolant

- (1) **Choose LLC, which will not have any adverse effects on the materials (cast iron, aluminium, copper, etc.) of the engine's fresh water cooling system.**
- (2) **Replace the cooling water periodically, according to the maintenance schedule given in this operation manual.**
- (3) **Remove the scale from the cooling water system periodically, according to the instructions in this operation manual.**

NOTICE

Excessive use of LLC also lowers the cooling efficiency of the engine. Be sure to use the mixing ratios specified by the antifreeze maker for your temperature range.

3. OPERATION

3.2 Before Initial Operation

Perform the following before using the engine for the first time:

3.2.1 Supply Fuel Oil

⚠ DANGER



Using gasoline, etc. may cause a fire.

To avoid mistakes, be sure to double-check the kind of fuel before filling. Wipe off any spilled fuel carefully.

- (1) Before filling with fuel, wash out the fuel tank and fuel system with clean kerosene or light oil.
- (2) Fill the tank with clean fuel oil, free of dirt and water.

3.2.2 Supply Engine Lubricating Oil

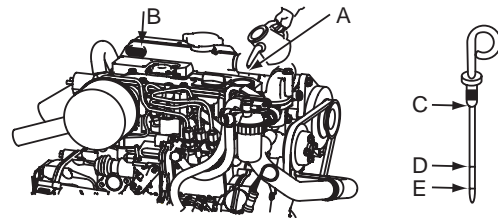
- (1) Remove the filler port cap (yellow) at the top of the rocker arm cover, and fill with engine oil.
- (2) Fill with oil to the upper limit on the dipstick. Insert the dipstick fully to check the level.
- (3) Tighten the filler port cap securely by hand.

Engine Oil Capacity	
3YM30 with KM2P-1	Full: 2.8 L (3.0 quarts)
3YM30 with SD20	Full: 2.5 L (2.6 quarts)
3YM20 with KM2P-1	Full: 2.7 L (2.9 quarts)
3YM20 with SD20	Full: 2.4 L (2.5 quarts)
2YM15 with KM2P-1	Full: 2.0 L (2.1 quarts)
2YM15 with SD20	Full: 1.8 L (1.9 quarts)

NOTICE

Do not overfill.

Overfilling will cause oil to be sprayed into the cylinder and lead to engine problems.



- A Filler port
- B Rocker arm cover
- C Dipstick
- D Upper limit
- E Lower limit

3.2.3 Supply Marine Gear Lubricating Oil

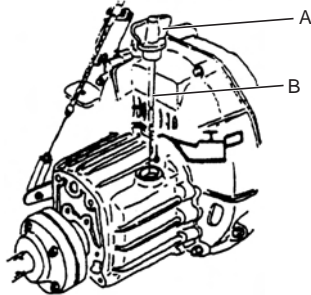
- (1) Remove the filler port cap at the top of the housing, and fill with marine gear lubricating oil.
- (2) Fill with oil to the upper limit on the dipstick, insert the dipstick fully to check the level.
- (3) Tighten the filler port cap securely by hand.

Marine gear oil capacity

KM2P-1	Full 0.30 L (0.64 pints)
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EN

3. OPERATION



A Oil filler cap B Dipstick

3.2.4 Supply Cooling Water

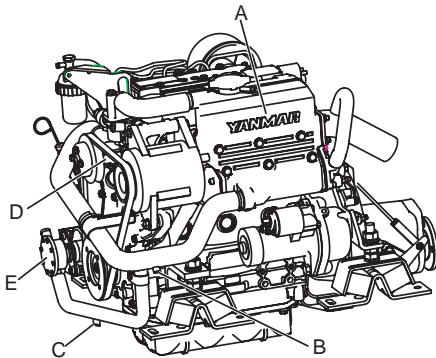
Supply cooling water according to the following procedures. Be sure to add anti-freeze to the cooling water.

(1) Be sure to close the 4 water drain cocks/plugs.

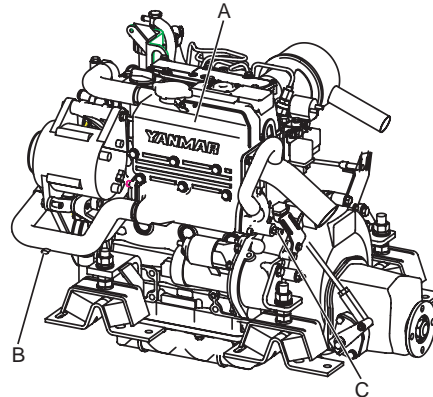
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Fresh water line	Seawater line
2	2

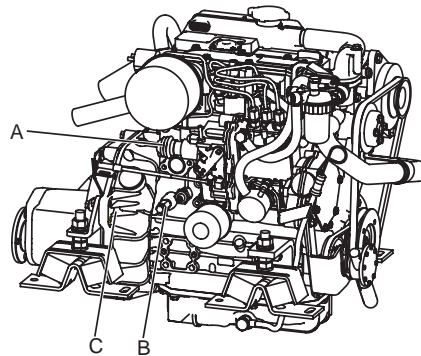
Note: The water drain cocks are opened before shipping from the plant.



A Coolant tank D Fresh water pump
B Drain plug for coolant E Seawater pump
C Drain plug for seawater

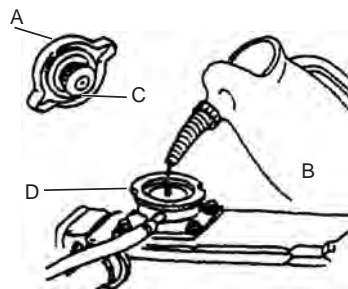


A Coolant tank C Drain cock for seawater
B Drain plug for coolant



A Stop solenoid C Flywheel housing
B Drain cock for fresh water

(2) Remove the filler cap of the fresh water cooler by turning the cap counterclockwise 1/3 of a turn.



A Filler cap C Tabs
B Fresh water cooler D Notches

3. OPERATION

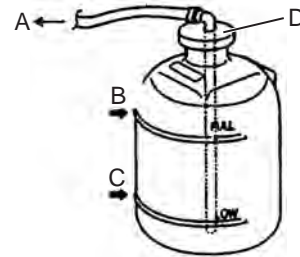
- (3) Pour cooling water slowly into the fresh water/coolant tank so that air bubbles do not develop. Pour until the water overflows from the filler port.

⚠ DANGER

If the filler cap is loose, hot steam and water will spout out which may cause burns.



- (4) After supplying cooling water, replace the filler cap and tighten it firmly. Failure to do so will cause water leakage. To replace the cap, align the tabs on the bottom of the cap with the notches on the filler port and turn clockwise 1/3 of a turn.
- (5) Remove the coolant recovery tank cap and fill with coolant mix to the lower limit.
Replace the cap.
Coolant recovery tank capacity:
0.8 L(1.7 pints)
- (6) Check the rubber hose connecting the coolant recovery tank to the fresh water cooler. Be sure the hose is securely connected and there is no looseness or damage.
When the hose is not watertight, an excessive amount of cooling water will be used.



A To fresh water cooler
B Upper limit
C Lower limit
D Cap

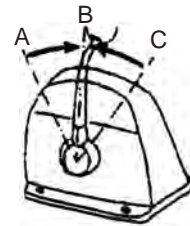
3.2.5 Cranking

When the engine has not been used for a long period of time, lubricating oil will not be distributed to all of the operating parts. Using the engine in this condition will lead to seizure.

After a long period of disuse, distribute lubricating oil to each part by cranking. Perform in accordance with the following procedures before beginning operation.

EN

- (1) Open seacock.
- (2) Open fuel cock.
- (3) Put remote control lever in NEUTRAL



A Forward
B Neutral
C Reverse

- (4) Turn on the battery switch and insert the key into key switch. Turn the key to the ON position.
- (5) Electric stop device
Push the stop button on the instrument panel continuously while cranking.

3. OPERATION

- (6) When the key switch is turned, the engine will begin cranking. Continue cranking for about 5 seconds, and check for abnormal noise during that time. (If you remove your hand from the stop knob or stop button while cranking, the engine will start.)

3.2.6 Check and Re-supply Lubricating Oil and Cooling Water

When engine oil, clutch oil, or cooling water is supplied for the first time or when they must be replaced, conduct a trial operation of the engine for about 5 minutes and check the quantity of lubricating oil and cooling water. The trial engine operation will send the lubricating oil and cooling water to the passages, so the lubricating oil and cooling water levels will drop. Check and re-supply as necessary.

- (1) **Supplying engine lubricating oil (See 3.2.2). Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.**
- (2) **Supplying marine gear lubricating oil (See 3.2.3).**
- (3) **Supplying cooling water (See 3.2.4).**

⚠ DANGER



Never open the cap of the coolant tank while the engine is still hot. Steam and hot water will spurt out and burn you seriously. Wait until the temperature of the coolant tank has dropped, wrap a cloth around the filler cap and loosen the cap slowly. After inspection, refasten the cap firmly.

3.3 Operating your engine

⚠ WARNING

To prevent exhaust gas poisoning, ensure good ventilation during operation. Install ventilation windows, ports or ventilators in the engine room. Never touch or allow your clothes to touch the moving parts of the engine during operation. If the front drive shaft, V-belt, propeller shaft, etc. catches your body or clothes, serious injury may result. Check that no tools, cloth, etc. are left on or around the engine.

⚠ CAUTION

The engine is very hot during operation and immediately after stopping, especially the exhaust manifold and the exhaust pipe. Avoid burns! Never touch or allow your clothes to touch any part of the engine.

3.3.1 Daily Start Up Inspection

Before starting the engine, make it a daily rule to conduct the following inspections:

(1) Visual Checks

Check for the following:

1. Lubricating oil leakage from the engine
2. Fuel oil leakage from the fuel system
3. Water leakage from the cooling water system
4. Damage to parts
5. Loosening or loss of bolts

If any problem is found, do not operate the engine before completing repairs.

3. OPERATION

(2) Checking and Re-supplying Fuel Oil

Check the fuel level inside the fuel tank and supply with the recommended fuel, if necessary. (See 3.2.1)

(3) Checking and Re-supplying Engine Lubricating Oil.

1. After removing the oil filler cap, check the engine oil level with the oil dipstick.
2. If the oil level is low, supply with the recommended lubricating oil using the filler port. Supply oil up to the top mark on the oil dipstick. (See 3.2.2)

(4) Check and Re-supply Marine Gear Lubricating Oil

1. Check the marine gear oil level with the oil dipstick.
2. If the oil level is low, supply with the recommended lubricating oil using the filler port. Fill oil up to the top mark on the oil dipstick. (See 3.2.3)

(5) Check and Re-supply Fresh Water (For Fresh Water Cooling System)

Check the fresh water level before operation while the engine is cold.

Checking the water level while the engine is hot is dangerous, and the cooling water reading will be misleading due to thermal expansion.

Check and supply cooling water routinely at the coolant recovery tank only.

Do not remove the filler cap of the coolant tank during usual operation.

DANGER

Do not open the filler cap during operation or immediately after stopping the engine. Hot steam and

water will spout out. To remove the cap, wait until the engine has cooled down, wrap the cap with a cloth and loosen the cap slowly. After checking, replace the cap and tighten firmly.

1. Check that the coolant level is above the lower limit on the side of the coolant recovery tank.
2. If the coolant level is close to the lower limit, remove the filler cap and supply fresh coolant.
3. When the water in the coolant recovery tank runs out, remove the filler cap of the fresh water cooler and supply water until it overflows from the filler port. (See 3.2.4)

NOTICE

If the coolant runs out too often, or only the coolant in the fresh water tank drops without any change in the water level of the coolant recovery tank, there may be some leakage of water or air. In such cases, consult your Yanmar dealer or distributor without delay.

Note: The water rises in the coolant recovery tank during engine operation. This is not abnormal. After stopping the engine, the cooling water cools down and the extra water in the coolant recovery tank returns to the coolant tank.

(6) Check the Remote Control Handle

Be sure to check that the remote control handle lever moves smoothly before use. If it is hard to operate, lubricate the joints of the remote control cable and also the lever bearings. If the lever comes out or there is play in the lever, adjust the remote control cable. (See 4.3.1 (5))

EN

3. OPERATION

(7) Check the Alarm Devices Electric Operation

When operating the key switch, check that the alarm devices work normally. (See 2.5.1 (4))

(8) Prepare Fuel, Lubricating Oil, and Cooling Fresh Water in Reserve

Always store lubricating oil and coolant water in reserve (for at least one refill) onboard, to be ready for emergencies.

3.3.2 How to Start the Engine

(1) Start the engine according to the following procedures:

Electric Operation

1. Open the seacock.
2. Open the fuel cock.
3. Set the remote control lever in NEUTRAL.

EN

NOTICE

Safety equipment should make it impossible to start the engine in any other position than NEUTRAL



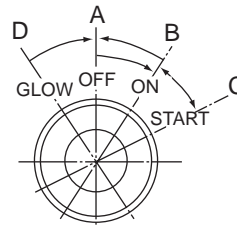
A NEUTRAL

4. Turn on the battery switch.
5. Insert the key into the key switch and turn the key to ON. If the alarm buzzer sounds and alarm lamps come on, the alarm devices are normal.

Note: The coolant high temperature alarm lamp does not come on. (See 2.5.1.(4))

6. Turn the key switch to start the engine.

Release the key switch when the engine has started. The alarm buzzer should stop and the alarm lamps go out.



A OFF position

B ON position

C START position

D GLOW position

(2) Starting at low ambient temperature

If the engine is hard to start in cold weather (approx. 0°C or below), use the glow plug for easier starting.

Follow steps 1 to 5 of the above procedure, and then follow the steps below.

Turn the key from the OFF to the GLOW and stay there for approx. 4 to 5 seconds until the glow plug is heated up.

Turn the key to the START position. After the engine starts, release the key.

NOTICE

Limit the activation of the glow plug within 10 seconds to one attempt. Lengthy operation damages the plug.

(3) Re-starting After Starting Failure

Before turning the key switch again, be sure to confirm that the engine has stopped completely. If the engine is re-started while the engine still has not stopped, the pinion gear of the starter motor will be damaged.

3. OPERATION

NOTICE

Turn the key for a maximum of 15 seconds in the start position. If the engine does not start the first time, wait for about 15 seconds before trying again. After the engine has started, do not turn the key off. (It should remain ON.)

Alarm devices will not work when the key is OFF.

⚠ CAUTION

If vessel is equipped with a water lift (water lock) muffler, excessive cranking could cause seawater to enter the cylinders and damage the engine.

(4) Air Venting of the Fuel System After Starting Failure

If the engine only idles or won't start after several attempts, there may be air in the fuel system. If air is in the fuel system, fuel cannot reach the fuel injection pump. Vent the air in the system according to the following procedures.

Fuel System Air Venting Procedures

1. Check the fuel level in the fuel tank. Replenish if insufficient.
2. Loosen the air vent bolt at the top of the fuel/water separator by turning it 2 or 3 times. When fuel, which does not contain air bubbles comes out of the bolt hole, tighten the air vent bolt.
3. Loosen the air vent bolt of the fuel filter by turning it 2 or 3 turns.
4. Feed fuel with the fuel feed pump by moving the lever on the left side of the feed pump up and down.

5. Allow the fuel containing air bubbles to flow out from the air vent bolt holes. When the fuel coming out no longer contains bubbles, tighten the air vent bolt. This completes the air venting of the fuel system. Try starting the engine again.

6. In subsequent engine operation after the start-up, the automatic air-venting device works to purge the air in the fuel system. No manual air-venting is required for normal engine operation.

(5) After the engine has started

After the engine has started, check the following items at a low engine speed:

1. Check that the gauges and alarm devices on the instrument panel are normal.
2. Check for water or oil leakage from the engine.
3. Check that exhaust color, engine vibrations and sound are normal.
4. When there are no problems, keep the engine at low speed with the boat still stopped to send lubricating oil to all parts of the engine.
5. Check that sufficient cooling water is discharged from the seawater outlet pipe. Operation with inadequate seawater discharge will damage the impeller of the seawater pump. If seawater discharge is too small, stop the engine immediately. Identify the cause and repair.
 - Is the seacock open?
 - Is the inlet strainer on the hull bottom clogged?
 - Is the seawater suction hose broken, or does the hose suck in air due to a loose joint?

EN

3. OPERATION

NOTICE

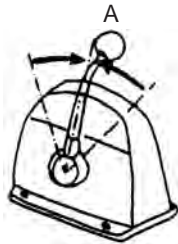
The engine will seize if it is operated when cooling seawater discharge is too small or if load is applied without any warming up operation.

3.3.3 Operation

(1) Engine acceleration and deceleration

Use the throttle handle to control acceleration and deceleration. Move the handle slowly.

(2) FORWARD- NEUTRAL (boat stopped) - REVERSE Clutch



A NEUTRAL

Use the clutch handle to change from FORWARD to NEUTRAL (boat stopped) to REVERSE.

NOTICE

Shifting the marine gear while operating at high speed or not pushing the handle fully into position (partial engagement) will result in damage to the marine gear parts and abnormal wear.

1. Before using the marine gear, be sure to move the throttle handle to a low idle position (less than 1000 rpm).

Move the throttle handle slowly to a higher speed position after completing clutch engagement.

2. When changing between FORWARD and REVERSE, bring the clutch to NEUTRAL and pause before slowly shifting to the desired position. Do not shift abruptly from FORWARD to REVERSE or vice versa.
3. Move the clutch handle accurately and fully into the FORWARD, NEUTRAL, and REVERSE positions.

3.3.4 Cautions During Operation

Always be on the lookout for problems during engine operation.

Pay particular attention to the following:

(1) Is sufficient water being discharged from the seawater outlet pipe?

If the discharge is small, stop the engine immediately; identify the cause and repair.

(2) Is the exhaust color normal?

The continuous emission of black exhaust smoke indicates engine overloading. This shortens the engine's life and should be avoided.

(3) Are there abnormal vibrations or noise?

Depending on the hull structure, engine and hull resonance may suddenly become great at a certain engine speed range, causing heavy vibrations. Avoid operation in this speed range. If you hear any abnormal sounds, stop the engine and inspect.

(4) Alarm buzzer sounds during operation.

If the alarm buzzer sounds during operation, lower the engine speed immediately, check the warning lamps, and stop the engine for repairs.

3. OPERATION

- (5) **Is there water, oil, or gas leakage, or are there any loose bolts?**

Check the engine room periodically for any problems.

- (6) **Is there sufficient fuel oil in the fuel oil tank?**

Replenish fuel oil in advance to avoid running out of fuel during operation.

- (7) **When operating the engine at low speed for long periods of time, race the engine once every 2 hours.**

Note: Racing the Engine

With the clutch in **NEUTRAL**, accelerate from the low speed position to the high speed position and repeat this process about 5 times. This is done to clean out carbon from the cylinders and the fuel injection valve. Neglecting to race the engine will result in poor exhaust color and reduce engine performance.

- (8) **If possible, periodically operate the engine at near maximum rpm., while underway. This will generate higher exhaust temperatures, which will help clean out hard carbon deposits, maintaining engine performance and prolonging the life of the engine.**

NOTICE

Electric Operation

Never turn off the battery switch during operation. Damage to parts in the electric system will result.

3.3.5 Engine shut-down

Stop the engine in accordance with the following procedures:

- (1) **Put the remote control handle in NEUTRAL**
- (2) **Be sure to race the engine before shut-down. (See 3.3.4 (7))**

- (3) **Cool down the engine at low speed (approximately 1000 rpm) for about 5 minutes.**

NOTICE

Always remember to allow engine to idle below 1000 rpm for five minutes prior to shut-down to remove heat from major components.

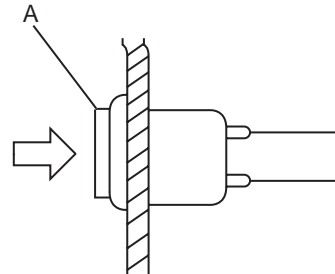
Shutting down the engine suddenly while operating at high speed will cause the engine temperature to rise quickly, causing deterioration of the oil and sticking of parts.

Electric stop device

Push the stop button on the instrument panel when the key is in the ON position.

EN

Engine shut-down by stop button



A Stop button on the instrument panel

- (4) **Close the fuel cock.**
- (5) **Close the sea cock.**

NOTICE

Neglecting to close the seacock could allow water to leak into the boat and may cause it to sink. Be sure to close the seacock.

3. OPERATION

Emergency Stop

When you can't stop the engine by the stop button on the panel, push the button at the back of the stop solenoid. (See 2.5.3)

3.4 Long Term Storage

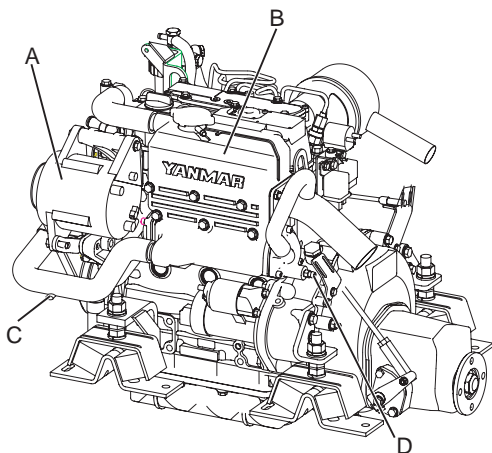
- (1) In cold temperatures or before long term storage, be sure to drain the seawater from the seawater cooling system.

⚠ CAUTION

Drain seawater from the seawater cooling system after the engine has cooled down. Be careful to avoid burns.

NOTICE

If seawater is left inside, it may freeze and damage parts of the cooling system (fresh water cooler, seawater pump, etc.) when ambient temperature is below 0°C[32°F].



A Alternator
B Coolant tank

C Drain plug for coolant
D Drain cock for seawater

1. Loosen the drain cocks/plugs attached on the pipe and on the heat exchanger, and drain off the seawater inside.

If no liquid comes from the drain cocks/plugs, it may be necessary to use a stiff wire to remove any debris to allow drainage.

2. Loosen the 4 bolts attaching the side cover of the seawater pump, remove the cover and drain the water from inside.

Retighten the bolts when finished.

3. Close the drain cocks/plugs.

- (2) Do not drain fresh water/coolant in the cold season or before the long storage.

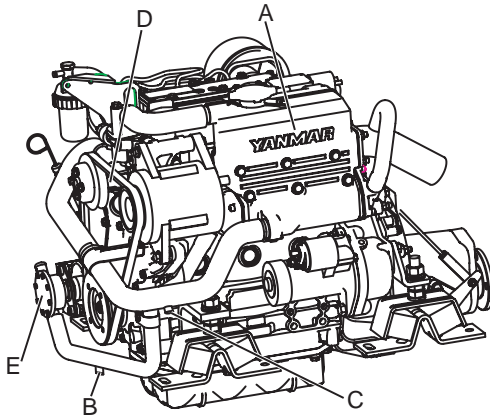
If LLC (Long Life Coolant) has not been added to the cooling fresh water, be sure to add LLC or drain off the fresh water from the fresh water cooling system daily after use

NOTICE

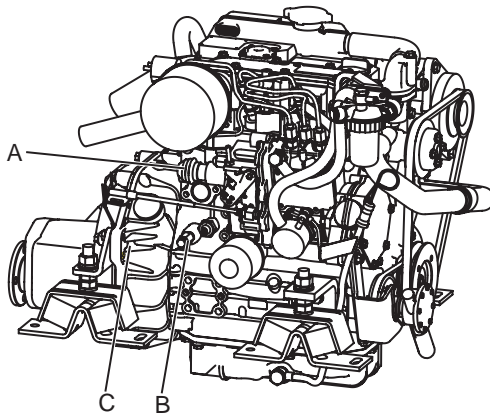
If the fresh water without LLC is not removed, it may freeze and damage parts of the cooling water system (fresh water cooler, cylinder block, cylinder head, etc.) when ambient temperature is below 0°C[32°F].

1. Open the fresh water drain cocks/plugs (2 positions as illustrated) and drain the fresh water from inside.
2. Close the drain cocks/plugs after draining the fresh water.

3. OPERATION



A Coolant tank D Fresh water pump
 B Drain plug for seawater E Seawater pump
 C Drain plug for fresh water



A Stop solenoid C Flywheel housing
 B Drain cock for fresh water

- (3) Carry out the following periodic inspection before placing the engine in storage. Clean the outside of the engine wiping off any dust or oil.
- (4) To prevent condensation inside the fuel tank, either drain off the fuel or fill the tank.

- (5) Grease the exposed area and joints of the remote control cable and the bearings of the remote control handle.
- (6) Cover the intake silencer, exhaust pipe, etc. with vinyl sheets and seal them to prevent moisture from entering.
- (7) Drain bilge in the hull bottom completely.
 Water may leak into the boat when it is moored, and whenever possible it should be hauled out, covered and blocked.
- (8) Waterproof the engine room to prevent rain and seawater from entering.
- (9) During long-term storage, charge the battery once a month to compensate for the battery's self-discharge.
- (10) When storing an engine for long time, run the engine periodically according to the following procedure because the rust occurrence inside the engine, the rack agglutination of the fuel pump, and so on are likely to occur (In case that the engine is equipped with a boat).
 1. Replace the lube oil and the filter with new ones before the engine running.
 2. If the fuel in the tank was removed, re-supply and bleed the fuel system.
 3. Confirm that there is the coolant in the engine.
 4. Operate the engine at the low idling speed for about five minutes. (If it can be done, once a month)

EN

4. MAINTENANCE AND INSPECTION

4. MAINTENANCE AND INSPECTION

4.1 General Inspection Rules

(1) Conduct Periodic Inspection for Your Safety.

The functions of engine components will degenerate and engine performance will drop according to the use of the engine. If countermeasures are not taken, you may encounter unexpected troubles while cruising at sea. Consumption of fuel or lubricating oil may become excessive and exhaust gas and engine noise may increase. These all shorten the life of the engine. Daily and periodic inspection and servicing increase your safety at sea.

EN

(2) Inspect Before Starting.

Make it a daily rule to inspect before starting. (See 3.3.1)

(3) Periodic Inspections at Fixed Intervals

Periodic inspections must be made after every 50, 100, 150, 250 and 1000 hours of use.

Conduct periodic inspections according to the procedures described in this Operation Manual.

(4) Use Genuine Yanmar Parts.

Be sure to use genuine Yanmar parts for consumable and replacement parts. Use of other parts will reduce engine performance and shorten the life of the engine.

(5) Consult Your YANMAR Dealer or Distributor.

Specialized technicians are ready to assist you with periodic inspections and maintenance. Consult your YANMAR dealer or distributor in accordance with the service agreement.

(6) Servicing Tools

Prepare servicing tools onboard to be ready for inspecting and servicing the engine and other equipment.

(7) Tightening Torque of Bolts & Nuts

Over-tightening of bolts and nuts causes them to come off or their threads to be damaged. Insufficient tightening causes oil leakage from the installation face or troubles due to the loosening of bolts.

Bolts and nuts must be tightened to the appropriate tightening torque. Important parts must be tightened with a torque wrench to the correct tightening torque and in the right order. Consult with your dealer or distributor if the servicing requires the removal of such parts.

The standard tightening torque for standard bolts & nuts is listed below.

4. MAINTENANCE AND INSPECTION

NOTICE

Apply the following tightening torque to bolts having "7" on the head. (JIS strength classification: 7T) Tighten

bolts with no "7" mark to 60% tightening torque. If the parts to be tightened are made from light alloy aluminium, tighten the bolts to 80% tightening torque.

Bolt dia. x pitch (mm)		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
Tightening torque	(Nm)	11 ± 1	26 ± 3	50 ± 5	90 ± 10	140 ± 10	230 ± 10
	(kgf-m)	1.1 ± 0.1	2.7 ± 0.3	5.1 ± 0.5	9.2 ± 1	14.3 ± 1	23.5 ± 1
	(lb-ft)	8.0 ± 0.7	19 ± 2.1	37 ± 3.6	66 ± 7.2	103 ± 7.2	170 ± 7.2

4.2 List of Periodic Inspection Items

Daily and periodic inspections are important to keep the engine in its best condition. The following is a summary of inspection and servicing items by inspection interval. Periodic inspection intervals should vary depending on the uses, loads, fuels and lubricating oils used and handling conditions, and are hard to establish definitively. The following should be treated as a general standard only.

Section 4.3 gives a detailed explanation of which parts must be inspected and the procedure for doing so for each interval.

NOTICE

Schedule your own periodic inspection plan according to the operational conditions of your engine and inspect every item. Neglect of periodic inspections may lead to engine troubles and shorten the life of the engine.

Inspection and servicing at 1000 hours and thereafter require special knowledge and techniques. Consult your Yanmar dealer or distributor.

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4. MAINTENANCE AND INSPECTION

		○: check ⊗: Replace ●: Consult local dealer						
System	Item	Before starting	Initial 50 hrs	Every 50 hrs or monthly ^[1]	Every 100 hrs or six months ^[1]	Every 150 hrs or one year ^[1]	Every 250 hrs or one year ^[1]	Every 1000 hrs or 4 years ^[1]
Fuel system	Check the fuel level, and refill	○						
	Drain the fuel tank		○				○	
	Drain the fuel/water separator			○				
	Replace the fuel filter						⊗	
	Check the injection timing							●
	Check the injection spray condition							● ^[2]
Lubricating system	Check the lubricating oil level	Crankcase	○					
		Marine gear	○					
	Replace the lubricating oil	Crankcase		⊗			⊗	
		Marine gear		⊗			⊗	⊗
		Sail drive				⊗		
Replace the engine lubricating oil filter		⊗				⊗		
Cooling system	Seawater outlet	○ During Operation						
	Check cooling water level	○						
	Check the impeller of the cooling water pump (seawater pump)						○	⊗
	Replace the fresh water coolant	Every year When long life coolant is used of a specified type (see page 24), a replacement period of two years can be obtained.						
	Clean & check the water passages							●
Air intake and exhaust system	Clean the element of the air intake silencer						○	
	Clean the exhaust/water mixing elbow						○	
	Clean the breather pipe						○	
	Check the exhaust gas condition	○ During Operation						
	Diaphragm assembly inspection							●
Electrical system	Check the alarm lamps & devices	○						
	Check the electrolyte level in the battery			○				
	Adjust the tension of the alternator driving belt		○				○	⊗
	Check the wiring connectors						○	
Cylinder head, etc.	Check for leakage of water and oil	○ After starting						
	Retighten all major nuts and bolts							●
	Adjust intake/exhaust valve clearance		○					●
Remote control system, etc.	Check/adjust the remote control operation	○	○					●
	Adjust the propeller shaft alignment		○ First					●

[1] Whichever comes first.

[2] For EPA requirements see also 4.4

4. MAINTENANCE AND INSPECTION

4.3 Periodic Inspection Items

4.3.1 Inspection on Initial 50 Hrs. of Operation (or after 1 Month)

(1) Replace the Engine Lubricating Oil and Lubricating Oil Filter (1st time)

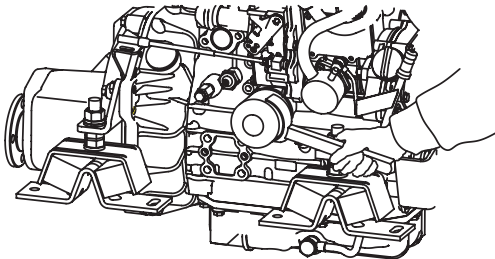
During initial operation of the engine, the oil is quickly contaminated due to the initial wear of internal parts. The lubricating oil must therefore be replaced early. Replace the lubricating oil filter at the same time.

It is easiest and most effective to drain the engine lubricating oil after operation while the engine is still warm.

1. Remove the lubricating oil dipstick. Attach the oil drain pump and pump out the oil.

For easier draining, remove the oil filler cap (yellow) at the top of the rocker arm cover or gear case cover.

2. Remove the lubricating oil filter with the filter detach/attach tool (Turn counterclockwise.)
3. Clean the filter installation face and attach the new filter, tightening by hand until the seal touches.



4. Turn an additional 3/4 of a turn with the attachment tool. (Turn clockwise. Tightening torque: 20 - 24 Nm (177-212 lb-in))
5. Fill with new lubricating oil. (See 3.2.2)
6. Perform a trial run and check for oil leaks.

7. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

⚠ CAUTION

Beware of oil splashes if extracting the lubricating oil while it is hot.

(2) Replace the Marine Gear Lubricating Oil (1st time)

During initial operation, the oil is quickly contaminated due to the initial wear of internal parts. The lubricating oil must therefore be replaced early.

1. Remove the cap from the filler port and attach the oil drain pump. Drain off oil.
2. Fill with new lubricating oil. (See 3.2.3)
3. Perform a trial run and check for oil leakage.

(3) Replace the Sail Drive Oil (1st time)

Refer to the operation manual of the sail drive for the procedure of the oil replacement.

(4) Draining the (optional) Fuel Tank

Put a pan under the drain to catch the fuel.

Open the drain cock and drain off any water or dirt collected.

Once the water and dirt has been drained off and the fuel coming out is clear, close the drain cock.

(5) Inspection and Adjustment of Intake/ Exhaust Valve Head Clearance (1st time)

Settling of a new engine and individual engine use will cause changes in the intake/exhaust valve and rocker arm clearance, and adjustment is necessary. This adjustment requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

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4. MAINTENANCE AND INSPECTION

(6) Adjusting the Remote Control Cable

The various control levers on the engine side are connected to the remote control lever by remote control cables. The cables will become stretched and the attachments loose after long hours of use causing deviation. It is dangerous to control operation under these conditions, and the remote control cables must be checked and adjusted periodically.

1. Adjusting the Throttle Remote Control Cable

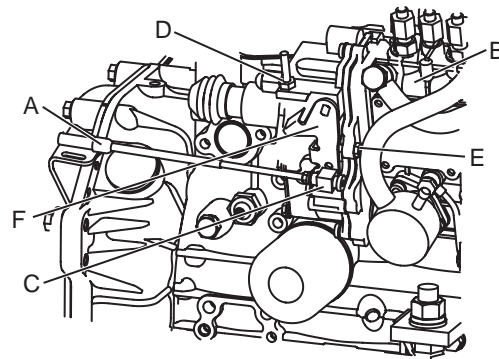
Check to see that the control lever on the engine side moves to the high speed stop position and low speed stop position when the remote control lever is moved to H (high speed) and L (low speed) respectively.

When there is deviation, loosen the bracket for the remote control cable on the engine side and adjust.

Adjust the high-speed stop position first and then adjust the low speed idling by the adjustment bolt on the remote control lever.

⚠ CAUTION

Never adjust the high-speed stop bolt. This will render your warranty void.

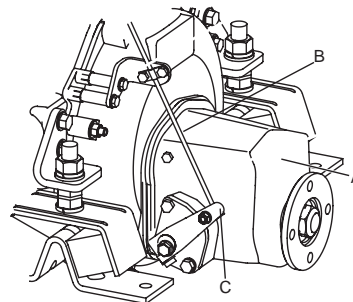


A Cable
B Fuel injection pump
C Adjustment
D High speed stop bolt
E Low speed stop bolt
F Control lever

2. Adjusting the Clutch Remote Control Cable

Check to see that the control lever moves to the correct position when the remote control handle is put in NEUTRAL, FORWARD, REVERSE.

Use the NEUTRAL position as the standard for adjustment. When there is deviation, loosen the bracket for the remote control cable on the clutch side and adjust.



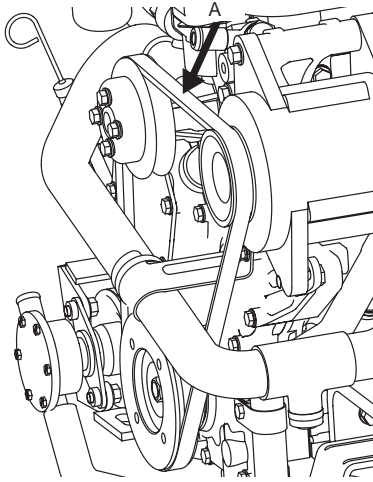
A Marine gear
B Cable
C Adjustment

EN

4. MAINTENANCE AND INSPECTION

(7) Adjusting the Tension of Alternator Driving Belt

When there is not enough tension in the V-belt, it will slip and the fresh water pump will fail to supply cooling water. Engine over-heating and seizure will result.



A Push

When there is too much tension in the V-belt, the belt will become damaged more quickly and the bearing of the fresh water pump may be damaged.

1. Check the tension of the V-belt by pressing down on the middle of the belt with your finger (approx. 98N(10kgf)). With proper tension, the V-belt should deflect 8-10 mm (0.315-0.393 inches).
2. If the V-belt deflection is out of the limit, adjust the V-belt tension. Loosen the set bolt and move the alternator to adjust the V-belt tension.
3. Be careful not to get any oil on the V-belt. Oil on the belt causes slipping and stretching. Replace the belt if it is marred.

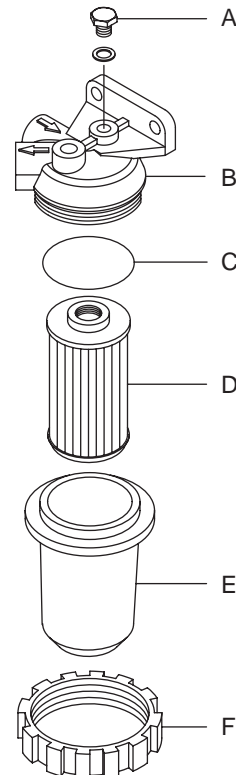
4.3.2 Inspection Every 50 Hrs. (or Monthly)

(1) Drain the fuel/water separator.

1. Close the fuel cock of a fuel tank.
2. Loosen the retaining ring and remove the filter cup. Drain off any water and dirt collected inside.
3. After reassembly, be sure to vent air from the fuel system.

If air is in the fuel system, fuel cannot reach the fuel injection pump.

Vent the air in the system according to the following procedures.



(Fuel filter)

- | | |
|---------------------|------------------|
| A Air bleeding bolt | D Filter element |
| B Bracket | E Filter cap |
| C O-ring | F Retaining ring |

Fuel system air bleeding procedures

EN

4. MAINTENANCE AND INSPECTION

1. Check the fuel level in the fuel tank. Replenish if Insufficient
2. Loosen the air bleeding bolt at the top of the fuel filter by turning it 2 or 3 times.
3. Feed fuel with the fuel feed pump by moving the lever on the left side of the feed pump up and down.
4. Allow the fuel containing air bubbles to flow out from the air bleeding bolt hole. When the fuel no longer contains bubbles, tighten the air bleeding bolt. This completes the air bleeding of the fuel system.
5. After the engine start-up, the automatic air-bleeding device works to purge the air in the fuel system. No manual air-venting is required for normal engine operation.

2. Loosen the drain plug and drain off any water and dirt collected inside.

Note: If no drain drips when the drain plug is opened, loosen the air bleeding plug on the top of the fuel/water separator by turning counter-clockwise 2-3 times. (This may occur if the position of the fuel/water separator position is higher than the fuel oil level in the fuel tank).

3. After draining, be sure to tighten the air bleeding plug.
4. Be sure to bleed air in the fuel system.

(3) Check the Electrolyte Level in a Battery

⚠ WARNING

Before inspecting the electrical system, be sure either to turn off the battery switch or to disconnect the (-) terminal of the ground cable. Otherwise, a short-circuit could cause a fire.

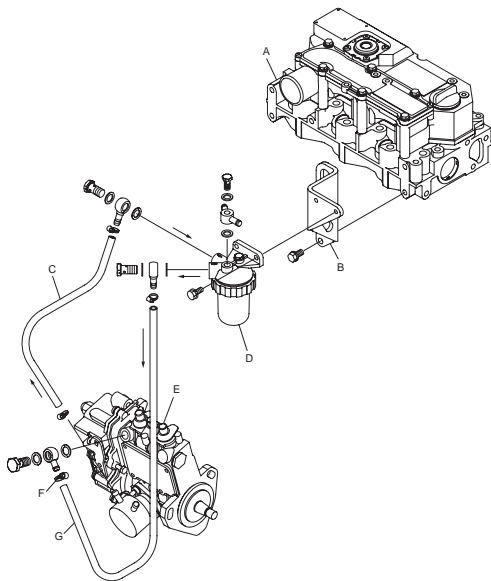
Ensure good ventilation when charging the battery. The use of open flames is strictly prohibited. Hydrogen gas may also catch fire.

Battery fluid is dilute sulphuric acid. It can blind you or burn your eyes or skin. Wear goggles and gloves when handling battery fluid. Should the fluid be deposited on your skin, wash with a large quantity of fresh water and seek treatment from a doctor.

1. If operation continues with insufficient battery fluid, the battery will be destroyed.

Check the fluid level periodically. If the level is lower than specified, fill with distilled water (available in the market) up to the upper limit of the battery.

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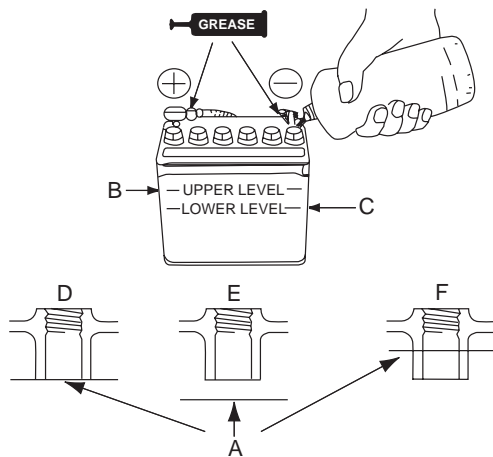
- | | |
|-----------------|-----------------------|
| A Cylinder head | E Fuel injection pump |
| B Bracket | F Clamp |
| C Fuel pipe | G Fuel pipe |
| D Fuel filter | |

(2) Drain the fuel/water separator (optional).

1. Close the fuel cock of the fuel tank.

4. MAINTENANCE AND INSPECTION

(Battery fluid tends to evaporate in high temperatures, especially in summer. In such cases, inspect the battery earlier than specified.)



- | | |
|---------------------|-------------|
| A Electrolyte level | D OK |
| B Upper limit | E Too low |
| C Lower limit | F Excessive |

- If the starter rpm is too low and the engine cannot be started, measure the specific gravity of the battery with a hydrometer.

When the specific gravity of the fluid is over 1.27(at 20°C)[68°F], it is fully charged.

Fluid with a specific gravity of below 1.24 needs charging. If the specific gravity cannot be raised by charging, the battery must be replaced.

NOTICE

The capacities of the standard alternator and the recommended battery assume only the power necessary for regular operation.

If the power is also used for inboard lighting or other purposes, the generating and charging capacities

may be insufficient. In such cases, consult your Yanmar dealer or distributor.

4.3.3 Inspection Every 100 Hrs (or six months).

(1) Replace the Sail Drive Oil

Refer to the operation manual of the sail drive for the procedure of the oil replacement

4.3.4 Inspection Every 150 Hrs (or one year).

(1) Replace the Engine Oil

Refer to 4.3.1(1).

(2) Replace the Marine Gear oil

Refer to 4.3.1(2).

4.3.5 Inspection Every 250 Hrs (or one year).

(1) Replace the Fuel Tank

Refer to 4.3.1(4).

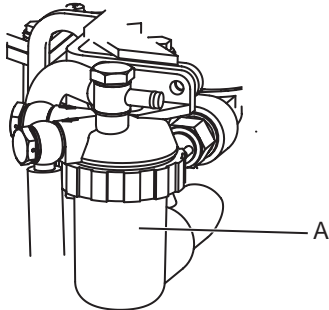
(2) Replace the Fuel Filter

When there is dirt in the fuel, the filter becomes clogged, and the fuel will not flow easily. Check and replace the element.

- Close the fuel cock.
- Remove the filter case by loosening the retainer ring (Turn counterclockwise) with the filter wrench.
- Pull the element out from the bottom, and replace with a new one.
- Clean the inside of the case thoroughly, put on the O-ring, and close with the retainer ring. (Turn clockwise: Tightening torque:12 Nm (106 lb-in))
- Air will enter into the fuel system when the filter is disassembled, and should be vented. (See 3.3.2(4))

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4. MAINTENANCE AND INSPECTION

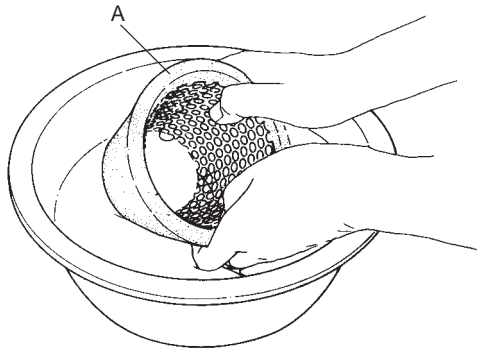


A Fuel filter

- (3) **Replace the Lubricating Oil Filter (See 4.3.1 (1))**
- (4) **Adjusting the Tension of the Alternator Driving Belt (See 4.3.1 (7)).**
- (5) **Clean the Intake Silencer**

EN

Disassemble the intake silencer and clean the inside thoroughly. Remove the silencer by taking off the clamp. Clean the element with a neutral detergent. Reassemble after it is completely dry.



A Element

- (6) **Inspect Inner Parts of the Seawater Pump**

Depending on the use, the inside parts of the seawater pump deteriorate and discharge performance drops. At the specified interval or when the volume

of seawater discharged is reduced, inspect the seawater pump in accordance with the following procedures:

1. Loosen the side cover bolts and remove the side cover.
2. Illuminate the inside of the seawater pump with a flashlight and inspect.
3. If any of the following problems are found, disassembly and maintenance are necessary:
 1. Impeller blades are cracked or nicked. Edges or surfaces of the blades are marred or scratched.

Note: The impeller must be replaced periodically (every 1000 hrs.)

2. Wear plate is damaged.
3. If no damage is found when inspecting the inside of the pump, re-assemble the side cover.

Fit the O-ring to the groove of the joint face before replacing the side cover.

If a large amount of water leaks continuously from the water drain pipe beneath the seawater pump during operation, disassembly and maintenance (replacement of the lip seal) are necessary.

When disassembly and maintenance of the seawater pump are necessary, consult your Yanmar dealer or distributor.

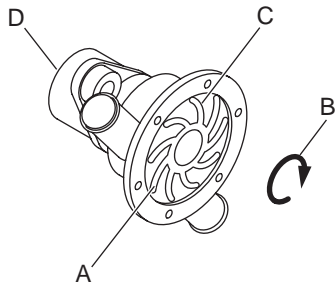
NOTICE

The seawater pump turns in the direction as shown in the below figure, and the impeller must be installed while considering the impeller direction.

If the impeller has been removed for any reason and must be re-assembled, be very careful not to make a mistake and turn it in the wrong direction. Additionally, if the engine is being turned manually, be

4. MAINTENANCE AND INSPECTION

careful to turn it in the correct direction. Incorrect turning will twist the impeller and damage it



A Direction of Impeller B Impeller rotating direction
C Impeller D Seawater pump

(7) Clean the Exhaust/Water Mixing Elbow.

There are two types of mixing elbows, the L-type and the U-type. The mixing elbow is attached to the exhaust manifold. The exhaust gas is mixed with seawater in the mixing elbow.

1. Clean dirt and scale out of the air pass and seawater pass of the mixing elbow.
2. Repair the crack or damage of the mixing elbow by welding, or replace if necessary.
3. Inspect the gasket and replace if necessary.

(8) Check the Wiring Connectors

Check that each electric connection part has not become loose.

4.3.6 Inspection Every 1000 Hrs (or 4 years).

(1) Inspection and Adjustment of Intake/ Exhaust Valve Clearance.

When operating for long periods of time, the clearance between the intake/exhaust valve and the rocker arm will change and affect engine performance.

Adjustment of the valve clearance is necessary and the adjustment requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(2) Inspect and Adjust the Fuel Injection Spray Condition.

Adjustment is necessary to obtain the optimal fuel injection to ensure the best possible engine performance. This inspection requires specialized knowledge and techniques.

Consult your Yanmar dealer or distributor.

(3) Adjusting the Remote Control Cables (See 4. 3. 1(6))

(4) Inspect and Adjust the Fuel Injection Timing

Fuel injection timing must be adjusted to ensure optimal engine performance.

Consult your Yanmar dealer or distributor.

(5) Diaphragm assembly inspection

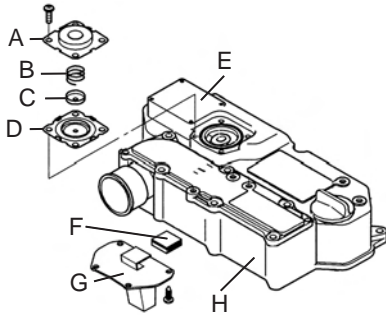
Inspect the diaphragm assembly on the rocker arm cover.

1. Loosen screws, remove the diaphragm assembly, and check for oil and contaminants between the diaphragm and the cover. If oil and contaminants enter into the diaphragm assembly, the diaphragm will not operate as designed.
2. Inspect the diaphragm rubber and spring for damage. If necessary, replace with new ones.

EN

4. MAINTENANCE AND INSPECTION

Breather system component



- | | |
|-------------------|--------------------|
| A Diaphragm cover | E Rocker arm cover |
| B Spring | F Breather baffle |
| C Center plate | G Baffle plate |
| D Diaphragm | H Intake manifold |

NOTICE

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1. When the diaphragm is damaged, crankcase pressure control is affected. Excessive crankcase pressure will cause leaks at seals and mating part surfaces.
 2. At lubricating oil replacement or lubricating oil fill, do not fill above the standard upper limit. If the lubricating oil quantity is above the upper limit, the amount of crankcase oil mist may increase resulting in oil hammer.
- (6) Clean & Check the Water Passages**
When it is used for a long time, cleaning of the cooling water passages such as cooling water rubber hoses and heat exchanger is periodically necessary. Because dirt, scale, rust, and so on collect in the cooling water passages and the cooling performance declines.
This maintenance requires specialized knowledge. Consult your Yanmar dealer or distributor.

(7) Adjust the Propeller Shaft Alignment

The rubber tension of the flexible engine mounts is lost after many hours' use. This leads to a drop in vibration absorption performance, and also causes centering misalignment of the propeller shaft.

This maintenance requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

Note: Be sure to replace the Yanmar flexible engine mounts every 1000 hours or 4 years, whichever comes first.

(8) Retighten all Major Nuts and Bolts.

After long time usage, the major nuts and bolts of the engine may loosen. Retighten the major nuts and bolts by the standard tightening torques. This inspection requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(9) Check the Impeller of a Seawater Pump

The impeller must be replaced with new one periodically (every 1000 hrs or 4 years whichever comes first). (See 4.3.5(6) for the procedure.)

(10) Adjust the Tension of an Alternator Driving Belt

Replace the alternator driving belt with new one every 1000 hours or four years, whichever comes first, even if there is no crack or damage in the surface.

(See 4.3.5(7) for the procedure.)

4.3.7 Annually

(1) Replace Fresh Water Coolant

Cooling performance drops when cooling water is contaminated with rust and scale.

4. MAINTENANCE AND INSPECTION

Even if LLC (Long Life Coolant) or anti-rust is added, the cooling water must be replaced periodically because the properties of the agent will degenerate.

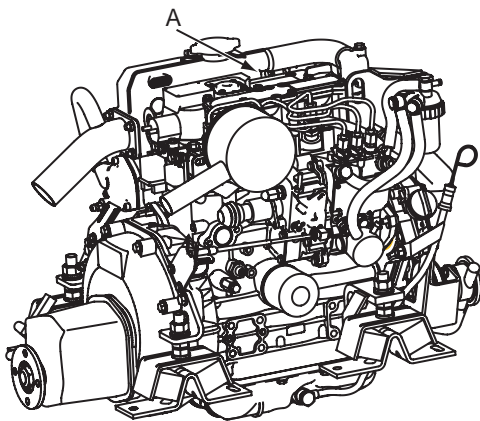
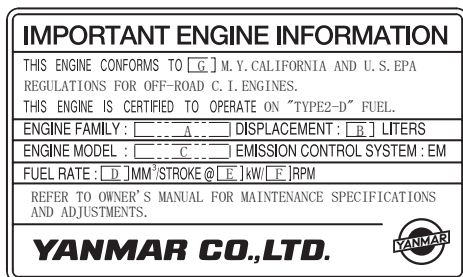
To drain the fresh water/coolant, open the fresh water cocks/plugs (two places) as shown in 3.2.4 and 3.4(2).

(Refer to 3.2.4 for resupplying cooling water.)

4.4 EPA Requirements

4.4.1 EPA Certification Plate

This engine has the following EPA Certification Plate attached:



A Attachment Position for Certification Plate (attached to the top of the rocker arm cover)

4.4.2 Conditions to Insure Compliance with Emission Standards

This product is an EPA approved engine.

The following are the conditions that must be met in order to insure that the emission during operation meets the EPA standards.

Be sure to follow these.

(1) The operating conditions should be as follows:

1. Ambient temperature: -20 – 40°C
2. Relative humidity: 80% or lower
3. Permissible value for intake negative pressure: 3.9 kPa (400 mmAq) or lower
4. Permissible value for exhaust back pressure: 14.7 kPa (1500 mmAq) or lower

(2) The fuel and lubricating oil used should be as follows:

1. Fuel: The diesel fuel oil ISO 8217 DMX, BS 2869 A1 or A2 (Cetane No. 45 minimally.)

2. Lubricating oil: Type API, class CD

(3) Do not remove the seals limiting the amount of fuel injected and the engine speed.

(4) Be sure to carry out inspections.

Follow the basic guidelines outlined in 4.3 (Periodic Inspection Items) of this manual and keep a record of the results. Pay particular attention to these important points: replacing the lubricating oil, lubricating oil filter, the fuel filter and cleaning the intake silencer element.

Note: Inspections are divided into two sections in accordance with whom is in charge of carrying out the inspection: (the User) and (the Maker).

EN

4. MAINTENANCE AND INSPECTION

(5) Quality guarantee period for the emission related parts

If the schedule of periodic maintenance outlined in 4.4.3 (Inspection and Maintenance) is followed, the quality guarantee period is determined by the age of the engine or the number of hours of operation as indicated below.

Power rating	Parts	Quality guarantee period
kW<19	Fuel nozzle, fuel pump	1500 hrs. of operation or 2 years
19= \leq kW<37	Fuel nozzle, fuel pump	3000 hrs. of operation or 5 years

4.4.3 Inspection and Maintenance

Inspection and maintenance for EPA emission related parts are shown in the chart below. (Inspection and maintenance not noted below are the same, see 4.2 and 4.3)

Parts	Interval term
Check fuel valve nozzle (clean)	1500 hours
Check & adjustment of fuel injection pressure & atomizing condition	3000 hours
Check fuel pump (adjust)	3000 hours

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Note: The inspection and maintenance shown above are to be performed at your Yanmar dealer or distributor

5. TROUBLE AND TROUBLESHOOTING

5. TROUBLE AND TROUBLESHOOTING

Trouble	Probable Cause	Measure	Reference
Alarm buzzer and alarm lamps on during operation	<p style="text-align: center;">NOTICE</p> <p>Shift to low speed operation immediately, and check which lamp has come on. Stop the engine for inspection. If no abnormality is identified and there is no problem with operation, return to port at your lowest speed and request repairs.</p>		
Lubricating oil low-pressure alarm. Warning lamp goes on	Engine Lubricating Oil level low.	Check Lubricating Oil, Add or replace.	3.2.3
	Lubricating oil filter clogged.	Replace.	4.3.1(1)
Water in sail drive seal alarm goes on.	Breakage of rubber seal on the sail drive	Check and change the rubber seal.	
Coolant temperature high alarm warning lamp goes on	Insufficient water in coolant tank.	Check coolant and replenish.	3.2.4
	Insufficient seawater causing temperature to rise.	Check seawater system.	
	Contamination inside cooling system.	Ask for repairs.	
Faulty warning devices	<p style="text-align: center;">NOTICE</p> <p>Do not operate the engine if the alarm devices are not repaired. Serious accidents may result if difficulties are not spotted due to faulty alarm lamps. When the switch is turned ON: Alarm buzzer does not sound. Circuit broken or buzzer defective. Ask for repairs.</p>		
Warning lamps do not go on	Lubricating oil low pressure. Water in sail drive seal alarm. No current available. Circuit broken or lamp burnt out.	Ask for repairs.	
One of the warning lamps does not go out	Sensor switches faulty.	Ask for repairs.	
Battery low charge lamp does not go out during operation	V-belt is loose or broken.	Replace V-belt; adjust tension.	4.3.1(6)
	Battery defective.	Check fluid level, specific gravity. Replace.	4.3.2(2)
	Alternator failure.	Ask for repairs.	

Note: Other warning lamps do not light up when the switch is turned on. They only light up when there is an abnormality.

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5. TROUBLE AND TROUBLESHOOTING

Trouble	Probable Cause	Measure	Reference
Starting Failures			
Starter turns, but engine does not start	No fuel.	Replenish fuel; vent air.	3.3.2(3)
	Fuel filter is clogged.	Replace element.	4.3.5(1)
	Improper fuel.	Replace with recommended fuel.	
	Faulty fuel injection.	Ask for repairs.	
	Compression leakage from intake/exhaust valve.	Ask for repairs.	
Starter does not turn or turns slowly (Engine can be turned manually)	Faulty clutch position.	Shift to NEUTRAL and start.	3.3.2.3
	Insufficient battery charge.	Check fluid level; recharge; replace.	4.3.2(2)
	Cable terminal contact failure.	Remove corrosion from terminal; Retighten.	
	Faulty safety switch device.	Ask for repairs.	
	Faulty starter switch.	Ask for repairs.	
	Power lacking due to accessory drive engaged.	Consult your dealer.	
Engine cannot be turned manually	Internal parts seized; broken.	Ask for repairs.	
Abnormal Exhaust Color Black smoke	Load increased.		
	Improper propeller matching		
	Contaminated intake silencer.	Clean element.	4.3.5(4)
	Improper fuel.	Replace with recommended fuel.	
	Faulty spraying of fuel injector.	Ask for repairs.	
	Incorrect intake/exhaust valve clearance.	Ask for repairs.	
White smoke	Improper fuel.	Ask for repairs.	3.1.1
	Faulty spraying of fuel injector.	Ask for repairs.	
	Fuel injection timing off.	Ask for repairs.	
	Lubricating oil burns; excessive consumption.	Ask for repairs.	

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5. TROUBLE AND TROUBLESHOOTING

Consulting Your Yanmar Dealer or Distributor

Refer difficult problems and repairs to your Yanmar dealer or distributor.
At the time of trouble, check and report the following:

- (1) **Engine model and number:**
- (2) **Boat name, material of hull, size (tons):**
- (3) **Use, type of boating done, no. of hours run:**
- (4) **Total number of operation hours (refer to hour meter), age of boat:**
- (5) **Condition before trouble (engine rpm, type of operation, load condition, etc.):**
- (6) **Details of trouble:**
(Exhaust color; sound of engine; does engine start; can engine be turned manually; type of fuel used; brand and viscosity of lubricating oil; etc.)
- (7) **Past problems and repairs: This should be a one-page report with the heading SERVICE HISTORY**
Date - Engine Hours - Service completed

WARRANTY SERVICE

Owner Satisfaction

Your satisfaction and goodwill are important to us and to your dealer.

Normally any problems concerning the product will be handled by our dealer's service department. If you have a warranty problem that has not been handled to your satisfaction, we suggest you take the following action:

- Discuss your problem with a member of dealership management.

Complaints can often quickly be resolved at this level. If the problem has already been reviewed with the Service Manager, contact the owner of the dealership or the General Manager.

- If your problem still has not been resolved to your satisfaction, contact your local Yanmar Subsidiary Company. (See the back of this manual for addresses)

We will need the following information in order to assist you:

- Your name, address and telephone number
- Product model and serial number
- Purchase date
- Dealer's name and address
- Nature of the problem

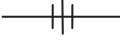
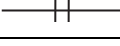
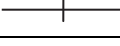
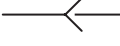
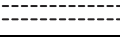
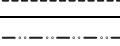
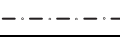
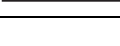

After reviewing all the facts involved, you will be advised of what action can be undertaken. Please remember that your problem will most likely be resolved at the dealership, using the dealer's facilities, equipment and personnel. It is therefore very important that your initial contact be with the dealer.

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6. PIPING DIAGRAMS

6. PIPING DIAGRAMS

See Appendix A. at the back of this manual.

Notation	
RH	Rubber hose
SGP STS	Steel Pipe
	Screw joint (Union)
	Flange Joint
	Eye Joint
	Insertion Joint
	Drilled hole
	Cooling fresh water piping
	Cooling seawater piping
	Lubricating oil piping
	Fuel oil piping

EN

1	Overflow
2	Fuel oil inlet
3	Fuel feed pump
4	Fuel injection pump
5	Lubricating oil filter (cartridge type)
6	Fuel high pressure lines
7	Fuel injection nozzle
8	Oil pressure switch
10	Mixing elbow
11	Coolant tank/Heat exchanger
12	Lubricating oil inlet filter
13	Main bearing
14	Seawater inlet
15	Cooling water pump (seawater)
16	Hot water connection outlet (to heater)
17	Thermostat
18	Cooling water pump (fresh water)
19	Hot water connection inlet (from heater)
20	Fresh water temperature switch
21	Lubricating oil pump
22	Pressure control valve
23	Fuel oil filter (cartridge type)
24	From cylinder head
25	To cam shaft
50	Detail of part A
51	Detail of part B
52	Detail of part C
53	Detail of part D

7. WIRING DIAGRAMS

7. WIRING DIAGRAMS

See Appendix B. at the back of this manual.

Color coding	
R	Red
B	Black
W	White
L	Blue
RB	Red/Black
LB	Blue/Black
YW	Yellow/White
YB	Yellow/Black
YG	Yellow/Green
WL	White/Blue
WB	White/Black
WG	White/Green
GR	Green/Red
O	Orange
WBr	White/Brown

1	Starter switch
2	Stop switch
3	Tachometer hour meter
4	Buzzer
5	Lubricating oil low pressure alarm
6	Coolant high temperature alarm
7	Water in sail drive seal alarm
8	Battery low charge alarm
9	Relay (for 2 station: Option)
10	Fuse (3A)
21	Glow plug
22	Engine stop solenoid
23	Stop relay
24	Starter relay
25	Starter
26	Coolant high temperature switch
27	Lubricating oil low pressure switch
29	Alternator
30	Water in sail drive seal sensor (on sail drive)
31	Water in sail drive seal sensor amplifier (Sail drive only)
33	Battery
34	Procured by customer
35	Battery switch
36	Earth bolt
37	Key switch
38	Only for sail drive
39	Wire harness. Option.
40	Instrument panel
41	Diodes
42	Alarm lamps

EN

- MANUFACTURER'S DECLARATION FOR MACHINERY PARTS ACCORDING TO 94/25/EEC(ANNEX-15) & 89/336/EEC
- MANUFACTURER: YANMAR CO., LTD.
1-32, Chayamachi, Kita-ku, Osaka, Japan
- DESCRIPTION OF THE MACHINERY PARTS
- CATEGORY: Diesel engine
 1. MAKE: YANMAR
 2. THIS MACHINERY PART MUST NOT BE PUT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF THE DIRECTIVE.
- IMPORTER IN THE EU: YANMAR MARINE INTERNATIONAL B.V.
Brugplein 11
1332 BS Almere-de Vaart, The Netherlands



Nagahama, Japan, Sept. 21, 1997
Place and date issued

Y. Sugita
Manager
Quality Assurance Dept.
Power System Operation Div.

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC
(To be completed by manufacturer of inboard engines without integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.
 Street: 1-32 Town: Chayamachi, Kitaku, Osaka-City
 Post Code: 530-8311 Country: Japan

Name of Authorised Representative: Yanmar Marine International B.V.
 Street: Brugplein 11 Town: Almere-de Vaart
 Post Code: 1332 BS Country: The Netherlands

Name of Notified Body for exhaust emission assessment: Société Nationale de Certification et d'Homologation
 Street: 11, route de Luxembourg Town: Sandweiler
 Post Code: L-5230 Country: Luxembourg ID Number: 0499

Module used for exhaust emission assessment: B+C B+D B+E B+F G H
 or engine type-approved according to: stage II of Directive 97/68/EC Directive 88/77/EC
 Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(S) AND ESSENTIAL REQUIERMENTS

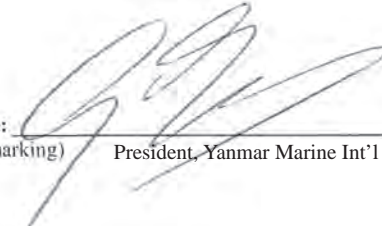
Engine Type: z or sterndrive without integral exhaust Inboard engine
Fuel Type: Diesel Petrol
Combustion cycle: 2 stroke 4 stroke

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
	SNCH*94/25*2003/44*
RCD-1GM10X1	0009*00
RCD-2YM15X1	0004*00
RCD-3YM30X1	0005*00
RCD-4JH4X1	0014*00
RCD-4JH3TX1	0011*01
RCD-4LHAX1	0015*00
RCD-6LPADX1	0012*00
RCD-6LPASX1	0007*00
RCD-6CXXM1	0006*00
RCD-6LY2X1	0008*00
RCD-6LY3X1	0010*00
RCD-4JH3TX2	0016*00
RCD-4JH4TX2	0017*00

Essential requirements	Standards Used	Other normative document used	See technical file
Annex I.B – Exhaust Emissions			
engine identification			
exhaust emission requirements	EN ISO 8178-1:1996		X
durability			
owner's manual			
Annex I.C – Noise Emissions	see craft manufacturer's Declaration of Conformity		

I declare on behalf of the engine manufacturer that the engine(s) will meet the exhaust emission requirements of Directive 94/25/EC as amended by Directive 2003/44/EC when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s) must not be put into service until the recreational craft into which it is (they are) to be installed has been declared in conformity with the relevant provisions of the above mentioned Directive.

Name: G.J. Mantel Signature and title:  President, Yanmar Marine Int'l
 (identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative) (or an equivalent marking)

Date: (yr/month/day) 2005 / 10 / 21

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust and Noise emission requirements of Directive 94/25/EC as amended by 2003/44/EC
(To be completed by manufacturer of outboard or inboard engines with integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-32 Town: Chayamati, Kitaku, Osaka-City

Post Code: 530-8311 Country: Japan

Name of Authorised Representative (if applicable): Yanmar Marine International B.V.

Street: Brugplein 11 Town: Almere-de Vaart

Post Code: 1332 BS Country: The Netherlands

Name of Notified Body for **exhaust emission assessment**: Société National de Certification et d'Homologation

Street: 11, route de Luxembourg Town: Sandweiler

Post Code: L-5230 Country: Luxembourg ID Number: 0499

Name of Notified Body for **noise emission assessment**: Nederlands Keurings Instituut voor Pleziervaartuigen

Street: Nipkowweg 9 Town: Joure

Post Code: 8500 AB Country: The Netherlands ID Number: 0613

Module used for exhaust emission assessment: **B+C** **B+D** **B+E** **B+F** **G** **H**
or engine type-approved according to: stage II of Directive 97/68/EC Directive 88/77/EC

Module used for noise emission assessment: **Aa** **G** **H**

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(S) AND ESSENTIAL REQUIERMENTS

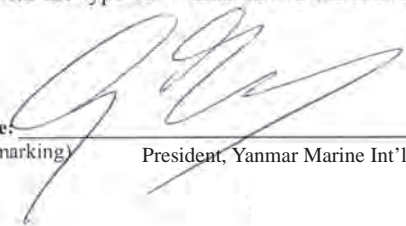
Engine Type: Outboard z or sterndrive with integral exhaust
Fuel Type: Diesel Petrol
Combusion cycle: 2 stroke 4 stroke

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
RCD-4LHAX1	SNCH*94/25*2003/44*
4LHA-HTZP	0015*00
RCD-6LY2X1	0008*00
4LHA-DTZP	
4LHA-STZP	
RCD-6LPADX1	0012*00
6LPA-DTZP	
RCD-6LPASX1	0007*00
6LPA-STZP	

Essential requirements	Standards Used	Other normative document used	See technical file
Annex I.B – Exhaust Emissions			
engine identification (I.B.1)			<input type="checkbox"/>
exhaust emission requirements	EN ISO 8178-1:1996		<input checked="" type="checkbox"/>
durability			<input type="checkbox"/>
owner's manual			<input type="checkbox"/>
Annex I.C – Noise Emissions			
Noise emission levels (I.C.1)	EN ISO 14509		<input checked="" type="checkbox"/>
owner's manual (I.C.2)			<input type="checkbox"/>

I declare on behalf of the engine manufacturer that the engine(s) mentioned above complie(s) with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name: G.J. Mantel Signature and title:  (or an equivalent marking) President, Yanmar Marine Int'l
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Date: (yr/month/day) 2005 / 10 / 20