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INTRODUCTION

Welcome to the world of Yanmar Marine! Yanmar Marine offers engines, drive systems and accessories for all types of boats, from runabouts to sailboats, and from cruisers to mega yachts. In marine leisure boating, the worldwide reputation of Yanmar Marine is second to none. We design our engines to respect nature. This means quieter engines, with minimal vibrations, cleaner than ever. All of our engines meet applicable regulations, including emissions, at the time of manufacture.

To help you enjoy your Yanmar 6LT series engine for many years to come, please follow these recommendations:

- Read and understand this *Operation Manual* before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
- 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 authorized Yanmar Marine dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- 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 these differences, please consult your authorized Yanmar Marine dealer or distributor.
- The specifications and components (instrument panel, fuel tank, etc.) described in this manual may differ from ones installed on your vessel. Please refer to the manual provided by the manufacturer of these components.
- Refer to the Yanmar Limited Warranty Handbook for a complete warranty description.

RECORD OF OWNERSHIP

Take a few moments to record the information you need when you consult Yanmar for service, parts or documentation.

Engine Model: _____

Engine Serial No.: _____

Date Purchased: _____

Dealer: _____

Dealer Phone: _____

■ To Register Your Yanmar Engine

1. Visit https://yanmar.microsoftcrmportals.com/
   or our website: https://www.yanmar.com/marine/
2. Click on “Register Your Engine”.

SAFETY

Yanmar considers safety of great importance and recommends that anyone that comes into close contact with its products, such as those who install, operate, maintain or service Yanmar products, exercise care, common sense and comply with the safety information in this manual and on the machine's safety decals. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label at the same time.

This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, *will* result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, *could* result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, *could* result in minor or moderate injury.

NOTICE

Indicates a situation which can cause damage to the machine, personal property and/or the environment, or cause the equipment to operate improperly.

SAFETY PRECAUTIONS

General Information

There is no substitute for common sense and careful practices. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, other bodily injury or death. This information contains general safety precautions and guidelines that must be followed to reduce risk to personal safety. Special safety precautions are listed in specific procedures. Read and understand all of the safety precautions before operation or performing repairs or maintenance.

Before You Operate

⚠ DANGER

The safety messages that follow have DANGER level hazards.

Never permit anyone to install or operate the engine without proper training.

Read and understand this *Operation Manual* before you operate or service the engine to ensure that you follow safe operating practices and maintenance procedures.

Safety signs and labels are additional reminders for safe operating and maintenance techniques.

Consult authorized Yanmar Marine dealer or distributor for additional training.

During Operation and Maintenance

⚠ WARNING

The safety messages that follow have WARNING level hazards.

Explosion Hazard

While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flames and any other form of ignition out of the area.

Fire and Explosion Hazard

Diesel fuel is flammable and explosive under certain conditions.

Never use a shop rag to catch the fuel.

Wipe up all spills immediately.

Never refuel with the engine running.

Fire Hazard

Undersized wiring systems can cause an electrical fire.
Never use improper capacity of fuses.

Store any containers containing fuel or other flammable products in a well-ventilated area, away from any combustibles or source of ignition.

Store any equipment in a designated area away from moving parts.

Never use the engine compartment for storage.

⚠ WARNING

Sever Hazard

Rotating parts can cause severe injury or death. Never wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing and always tie long hair back when working near moving/rotating parts such as the flywheel or PTO shaft. Keep hands, feet and tools away from all moving parts.

Alcohol and Drug Hazard

Never operate the engine while under the influence of alcohol or drugs, or when feeling ill.

Exposure Hazard

Always wear personal protective equipment including appropriate clothing, gloves, work shoes, and eye and hearing protection as required by the task at hand.

Sudden Movement Hazard

Never operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

Burn Hazard

Some of the engine surfaces become very hot during operation and shortly after shutdown. Keep hands and other body parts away from hot engine surfaces.

Exhaust Hazard

Never block windows, vents or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.

⚠ CAUTION

The safety messages that follow have CAUTION level hazards.

Poor Lighting Hazard

Ensure that the work area is adequately illuminated. Always install wire cages on portable safety lamps.

Tool Hazard

Always use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.

Flying Object Hazard

Always wear eye protection when servicing the engine or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.

Coolant Hazard

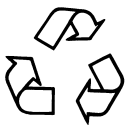
Wear eye protection and rubber gloves when you handle engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.

NOTICE

The safety messages that follow have NOTICE level hazards.

It is important to perform daily checks as listed in the *Operation Manual*. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor engine performance and helps extend the life of the engine.

Consult authorized Yanmar Marine dealer or distributor if you need to operate the engine at high altitudes. At high altitudes the engine will lose power, run rough and produce exhaust gases that exceed the design specifications.



Always be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

Never dispose of hazardous materials by dumping them into a sewer, on the ground, or into ground water or waterways.

If a Yanmar Marine Engine is installed at an angle that exceeds the specifications stated in the Yanmar Marine *Installation Manuals*, engine oil may enter the combustion chamber causing excessive engine speed, white exhaust smoke and serious engine damage. This applies to engines that run continuously or those that run for short periods of time.

NOTICE

If you have an installation with two or three engines and only one engine is operating, the water pickup (thru-hull) of the non-running engine(s) should be closed. This will prevent water from being forced past the seawater pump and eventually finding its way into the engine. The result of water entering the engine could cause seizure or other serious problems.

If you have an installation with two or three engines, and only one engine is operating, please note that if the propeller shaft thru-hull (stuffing box) is lubricated by engine water pressure and the engines are interconnected, care must be taken that water from the running engine does not enter the exhaust of the non-running engine(s). This water could cause seizure of the non-running engine(s). Consult authorized Yanmar Marine dealer or distributor for a complete explanation of this condition.

If you have an installation with two or three engines, and only one engine is operating, it is important to limit the amount of throttle applied to the running engine. If you observe black smoke or movement of the throttle does not increase engine speed, you are overloading the engine that is running. Immediately throttle back to approximately 2/3 throttle or to a setting where the engine performs normally. Failure to do so may cause the running engine to overheat or cause excess carbon buildup which may shorten the engine's life.

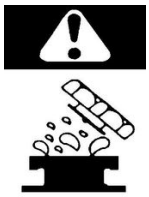
Never turn off the battery switch (if equipped) or short the battery cables during operation. Damage to the electrical system will result.

Safety Signs

Some warning labels shown below are affixed to the engine.

***NOTE:** Labels containing an exclamation mark highlight a potential danger.*

Lifting point (only the engine).



Risk of burns:
Expulsion of pressurised hot water.

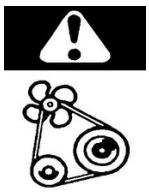
Fuel filling cap
(on the tank, if present).

Risk of burns:
Presence of parts at high temperature.

Engine oil filling cap.

Risk of fire:
Presence of fuel.

Engine oil level dipstick.



Risk of injury from moving parts:
Presence of fans, pulleys, belts or other.

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PRODUCT OVERVIEW

YANMAR 6LT COMMON RAIL SERIES FEATURES AND APPLICATIONS

The 6LT common rail series are four-stroke diesel engines equipped with direct injection common rail system and with liquid coolant systems.

The 6LT is 6-cylinder and turbocharged with an air to seawater intercooler.

The engines are typically equipped with a marine gear. (Optional)

These engines are designed for recreational and light duty commercial craft use.

Applying for any other purpose except recreational and light duty commercial can lead to reduced vessel performance, lead to increased smoke levels and cause permanent damage to your engine.

The engine must be installed correctly with coolant lines, exhaust gas lines and electrical wiring. No auxiliary equipment without prior agreement by YMI is allowed. To handle the drive equipment, propulsion systems (including the propeller) and other inboard equipment, always observe the instructions and cautions given in the operation manuals supplied by the boatyard and equipment manufacturers.
The 6LT common rail series engines are designed to be operated at maximum throttle (*1) for less than 5% of total engine time (30 minutes out of every 10 hours) and at maximum cruising speed or less the rest of the time (*2).
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. See Yanmar's local subsidiary in your region or your authorized Yanmar Marine dealer or distributor.

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*1 maximum throttle: fuel stop power engine speed, 2530 RPM.

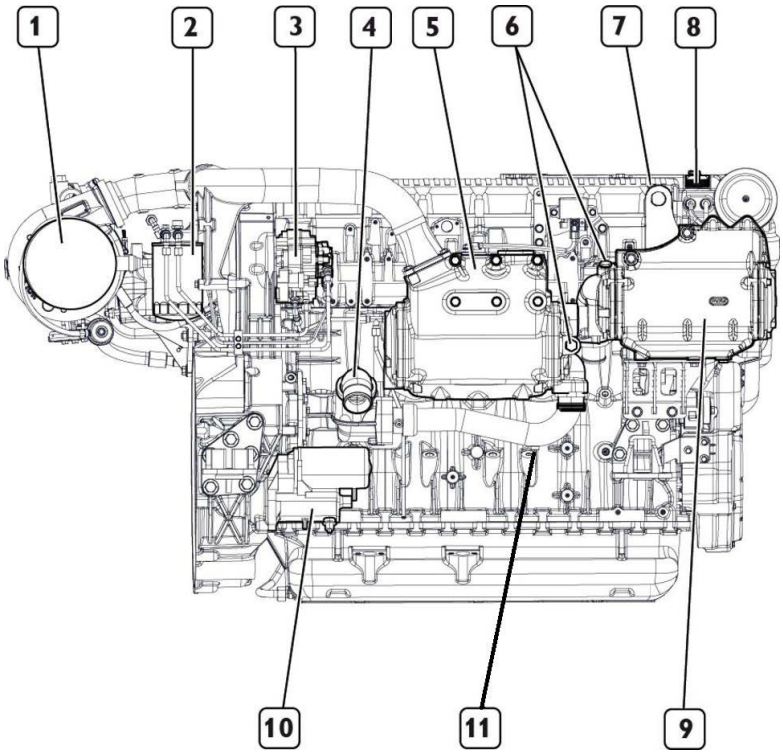
*2 cruising speed: 90% load, 2400 RPM.

NEW ENGINE BREAK-IN

Thanks to modern engine construction technologies a particular run-in procedure is not required. However, it is recommended to avoid using the engine at high or low power for long periods during the first 50 hours.

COMPONENT IDENTIFICATION

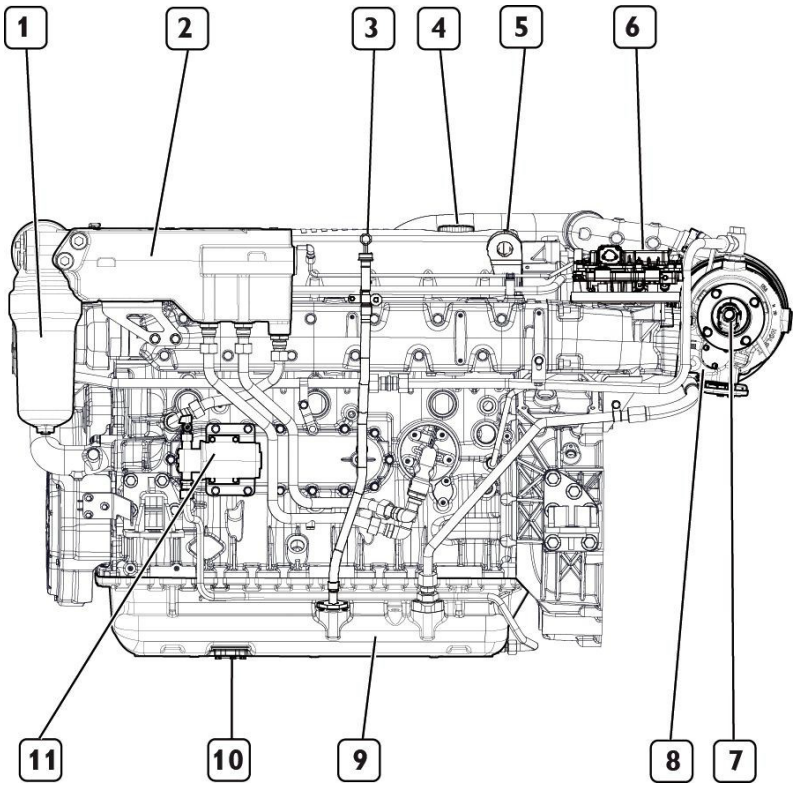
Right side view



1 Air filter
2 Fuel filter
3 High-pressure pump for common rail system
4 Seawater pump inlet
5 Air-seawater heat exchanger
6 Sacrificial anodes
7 Lifting eye
8 Coolant Filler Cap
9 Engine coolant-seawater heat exchanger
10 Starter motor
11 Seawater Drain

Figure 1

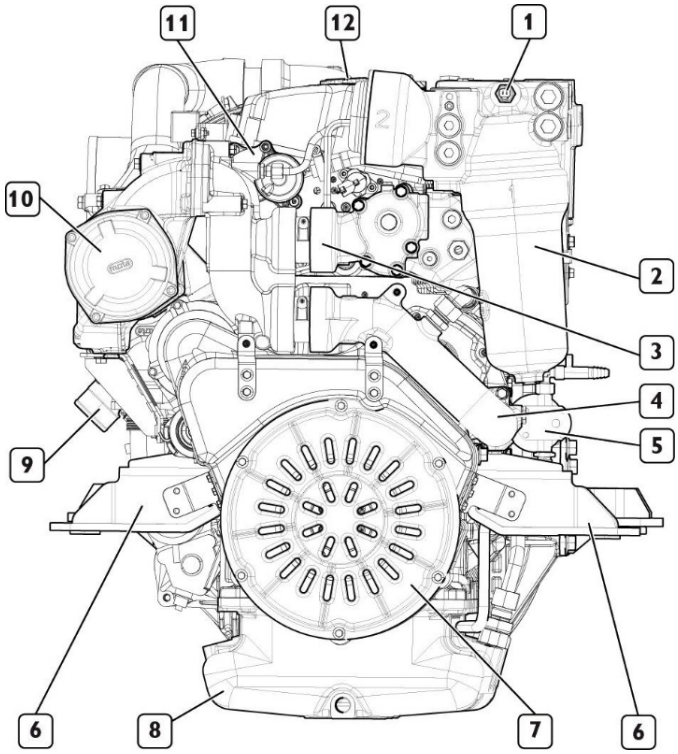
Left side view



1 Oil filters
2 Coolant expansion tank
3 Oil level dipstick
4 Oil filler cap
5 Lifting eye
6 Electronic control unit
7 Exhaust and seawater outlet
8 Turbocharger
9 Oil sump
10 Oil drain plug
11 Oil sump evacuation pump

Figure 2

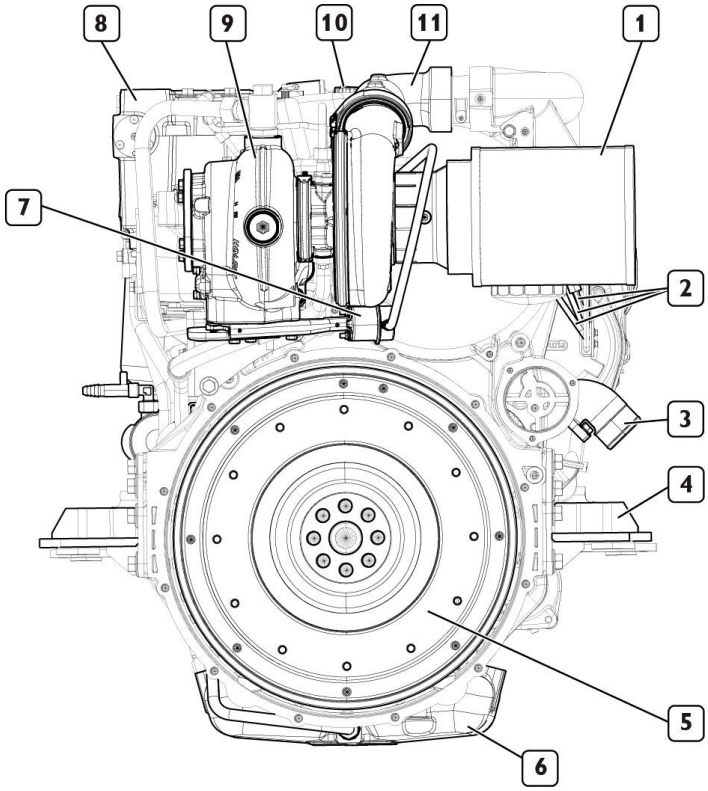
Front view



1 Coolant expansion tank
2 Oil filter
3 Thermostat body
4 Coolant inlet pipe going to engine water pump
5 Oil evacuation pump
6 Engine mounts
7 Pulley on crankshaft
8 Oil sump
9 Seawater pump inlet
10 Engine coolant-seawater heat exchanger
11 Blow-by gas valve
12 Oil filler cap

Figure 3

Rear view



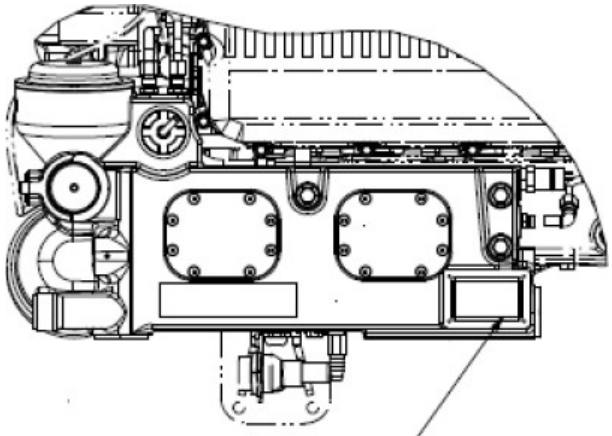
1 Air filter
2 Fuel Pipes
3 Seawater pump inlet
4 Engine mounts
5 Engine flywheel
6 Oil sump
7 Turbine geometry actuator
8 Coolant expansion tank
9 Turbocharger
10 Oil filler cap
11 Intake pipe

Figure 4

NAMEPLATES

IDENTIFICATION DATA

The plates are fixed to the engine coolant tank.



6LT500
6LT580
6LT640

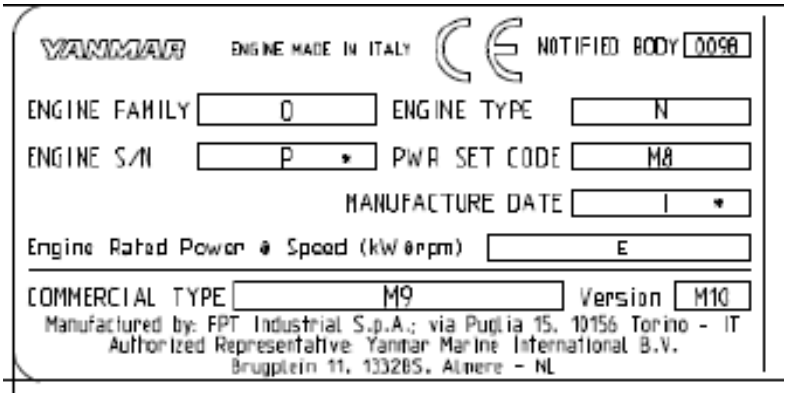
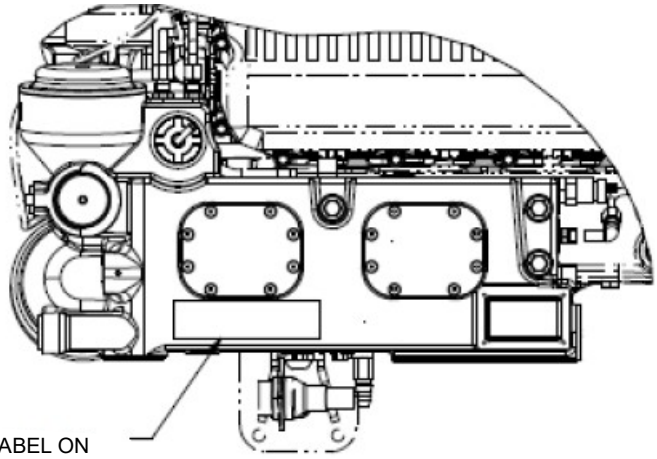


Figure 5



EPA LABEL ON
EXPANSION TANK

6LT500
6LT580

YANMAR Yanmar Marine International B.V. EMISSION CONTROL INFORMATION ENGINE MADE IN: ITALY

EPA Engine Family:	A		Sales Model:	B		Engine Serial Number:	P *				
Manufacture Date:	I *		Engine Category:	M1		Displacement/Cyl:	L	l	Power Density:	M4	kW/l
Maximum Power:	kW	kW	Engine Rated Power @ Speed:	E	kW@rpm				Useful Life:	M2	hrs/years
Emission Standards: THC+NOx	M5	g/kW-hr	CO:	M6	g/kW-hr				PM:	M7	g/kW-hr

Commercial Variable-Speed Propulsion Engine Used with Fixed-Pitch Propeller

This Category 1 Marine Engine complies with U.S. EPA regulations for H Model Year.
This Engine is certified for operation only with diesel fuel. Modifying the engine to operate on residual or intermediate fuel may be a violation of federal law subject to civil penalties (40 CFR 1042.601).
This engine does not comply with international marine regulations for commercial vessels unless it is also covered by an EIAPP certificate.
This Engine is certified to operate on: LOW SULFUR DIESEL FUEL

6LT640

YANMAR Yanmar Marine International B.V. EMISSION CONTROL INFORMATION ENGINE MADE IN: ITALY

EPA Engine Family:	A		Sales Model:	B		Engine Serial Number:	P *				
Manufacture Date:	I *		Engine Category:	M1		Displacement/Cyl:	L	l	Power Density:	M4	kW/l
Maximum Power:	kW	kW	Engine Rated Power @ Speed:	E	kW@rpm				Useful Life:	M2	hrs/years
Emission Standards: THC+NOx	M5	g/kW-hr	CO:	M6	g/kW-hr				PM:	M7	g/kW-hr

Recreational Variable-Speed Propulsion Engine Used with Fixed-Pitch Propeller

Installing this recreational engine in commercial vessel or using the vessel for commercial purposes may violate federal law subject to civil penality.
This Category 1 Marine Engine complies with U.S. EPA regulations for H Model Year.
This Engine is certified for operation only with diesel fuel. Modifying the engine to operate on residual or intermediate fuel may be a violation of federal law subject to civil penalties (40 CFR 1042.601).
This engine does not comply with international marine regulations for commercial vessels unless it is also covered by an EIAPP certificate.
This Engine is certified to operate on: LOW SULFUR DIESEL FUEL

Figure 6

VESSEL CONTROL SYSTEM (VC20)

The 6LT series engine is a fully electronically controlled engine, using Yanmar's original "Vessel Control System (VC20)".

The control equipment consists of the Switch Panel, the Display, the Drive & Helm ECU, the Control Head and the Backup Panel, which are connected by the cable harness to the engine and marine gear or stern drive for remote control operation.

NOTE: *The Yanmar Vessel Control System (VC20) was designed to operate the 6LT engine and drive system. There are many control functions and diagnostic functions that are integrated together to insure safe operation. If this system is not utilized in specific accordance with the instructions in this manual or the system is modified in any way, Yanmar will not be responsible for any warranty failures in the operation of the system or the vessel utilizing the system. Yanmar has designed the Vessel Control System (VC20) in conjunction with the 6LT engine. The system has many functions that must be configured and calibrations must be made before the vessel can be operated. Please arrange to have a Yanmar trained technician inspect the vessel prior to the vessels operation.*

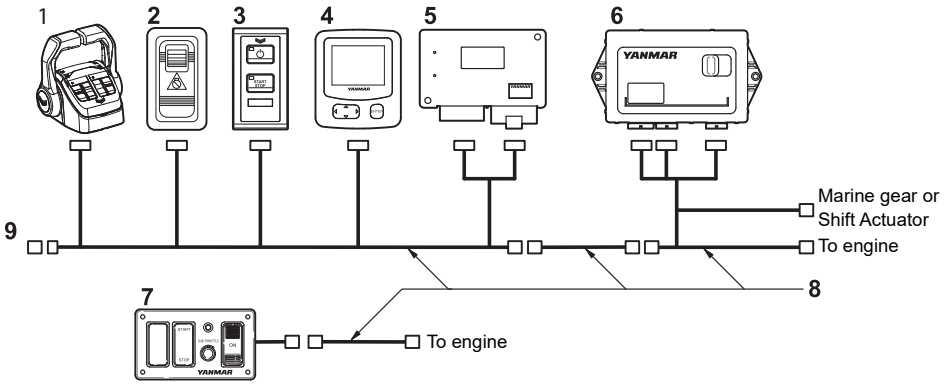


Figure 7

No.	Description
1	Shift and Throttle Control Head
2	Emergency Stop Switch (Option)
3	Switch Panel (to start and stop the engine)
4	Display
5	Helm ECU
6	Drive ECU
7	Backup Panel
8	Cable Harness Set
9	Adapter, Terminal

Display

The multi-function information display has the following functions.

■ Display Function

Runtime Engine Data Tri-Screen

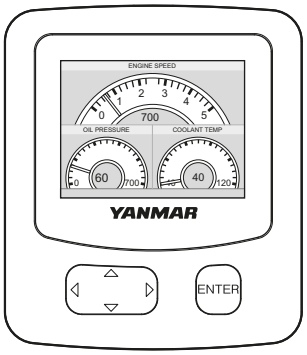


Figure 8

This screen displays real time engine data and alarm indications.

Alarm Indicators

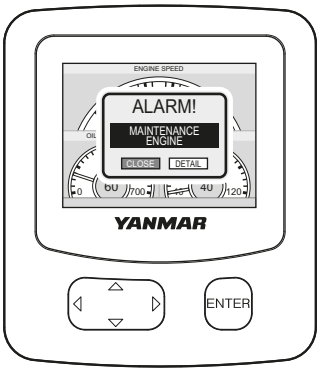


Figure 9

The alarm window appears with an audible alarm when abnormal engine activity occurs.

NOTE: *When starting the engine, make it a rule to check that when the switch panel is pressed to the power switch, the welcome screen appears on the display and goes out. If the system does not function normally, consult your authorized Yanmar Marine dealer or distributor and ask for diagnostics.*

Diag Codes Screen

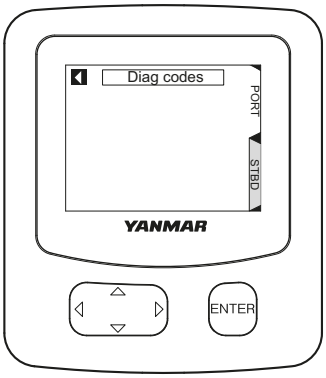


Figure 10

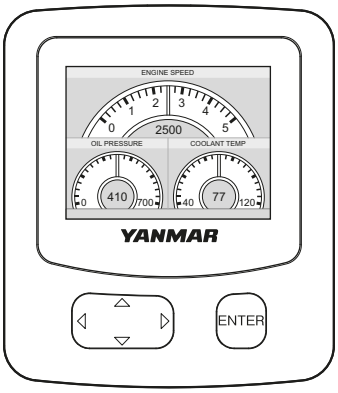
Alarm Indicator Functions

The alarm indicators and buzzer are activated when sensors detect an abnormality during engine operation. The alarm indicators are off during normal operation, but are activated as follows when an abnormality arises:

- The coolant temperature alarm indicator activates when the coolant gets too hot.
- The engine oil pressure alarm indicator activates when the engine oil pressure drops.
- The electric charge alarm indicator activates when there is a charging failure.

■ Operation of the Display's Buttons

Buttons



ENTER

- Act on pop-up menu (MAIN MENU)
- Perform the function

▲ Up Arrow moves menu selection up

▼ Down Arrow moves menu selection down

◀ Left Arrow acts on current menu item

▶ Right Arrow acts on current menu item

Figure 11

Hot Key List

Item	Operation	Indication
MAIN MENU	Press the [ENTER] button.	Display MAIN MENU.
MENU LAYER SKIP	Hold the ◀ button down for 1 second.	Close MENU and return to the normal screen.
ICON INFO	Press the ▼ button while the icon with a detail information indication function is displayed.	Display the related setting screen of the relevant icon. If there are multiple items, execute with the [ENTER] button after selecting with the ◀ ▶ buttons.
Adjusting Brightness	Press the ▲ button.	Display the brightness adjustment screen and adjust brightness with the ▲ ▼ buttons. (Manual dimmer mode only)
Switching Night Mode	Press the ◀ button.	Switch to the night mode indication.
Setting Complete	Hold the [ENTER] button down for 1 second while the ◀ icon is highlighted.	Close the setting screen and MENU and return to the normal indication.
Switching Monitor Display Indication	Press the ▶ button.	Switch to the monitor screen in the normal indication. Send the screen in order with the ◀ ▶ buttons. The monitor screen is fixed when there is no operation with the ◀ ▶ buttons for 5 seconds.

Dimmer Linkage

The same brightness as the setting of Display is applied to Switch panel and Control head.

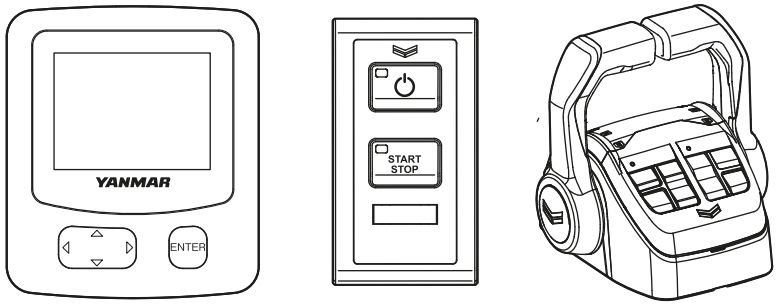


Figure 12

Auto Dimmer

Auto dimmer is enabled, the brightness of each device is automatically adjusted according to the ambient brightness.

1. Select “Auto dimmer”.
   (Display: Auto dimmer)
   - “YES”: Auto dimmer mode
   - “NO”: Manual dimmer mode

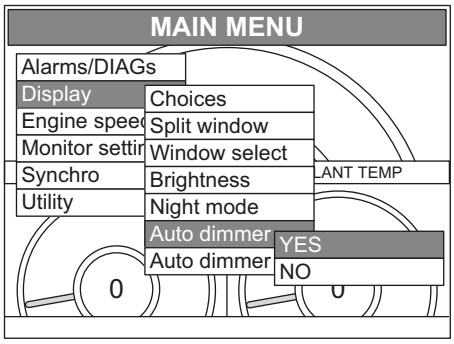


Figure 13

2. Select “Auto dimmer limit”.
   (Display: Auto dimmer limit)

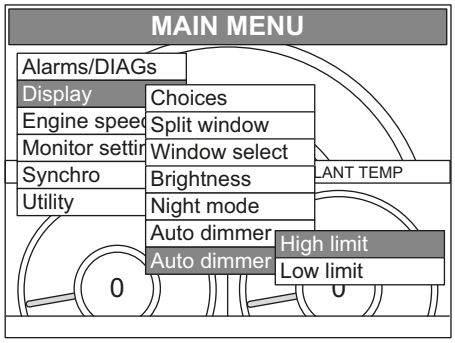


Figure 14

3. Set the minimum and maximum brightness as required.
   - The brightness is adjusted in 8 steps.

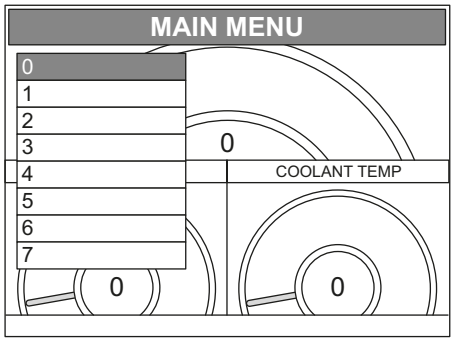


Figure 15

■ Switch Panel (to start and stop the engine)

The switch panel has the following functions.

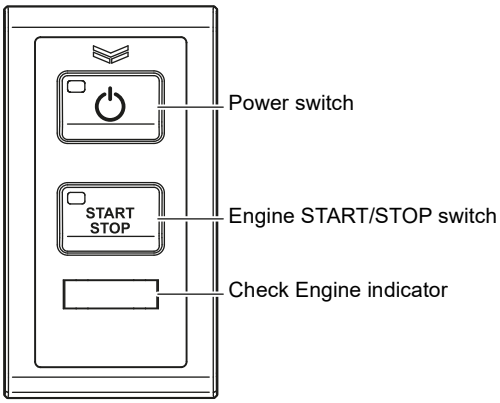


Figure 16

To start and stop the engine:

Press the START/STOP switch.

■ Emergency Stop Switch (Option)

Use this switch only in an emergency.

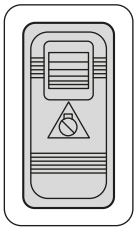


Figure 17

NOTICE

Under normal circumstances, do not use the Emergency Stop Switch to stop the engine. The engine shuts down suddenly when the Emergency Stop Switch is pressed. After the engine has stopped, press the Emergency Stop Switch to release the emergency stop.

VC20 has the following functions, which can be set in the Utility screen of MAIN MENU in the Digital Display. For more details, refer to the Vessel System Installation Manual.

Station Protect

It is a function to prevent the operation from the other stations while steering.

- Select “YES” to enable “Station protect”. The display and control head of that station can no longer be operated.
- Select “NO” or turn off the system power to disable “Station protect”.

Sys on by ID, Start by ID

It is a function to check ID for the purpose of anti-theft.

- If you select “YES” in “Sys on by ID”, it is necessary to enter the Owner ID on the display when turning on the system power. If you select “YES” in “Start by ID”, it is necessary to enter the owner ID on the display at engine start.
- The initial ID is “00000” and it can be changed with the below “Owner ID change” function.
- Even when the system power is turned off, the selected “Sys on by ID” and “Start by ID” cannot be disabled and it is required to enter the Owner ID at each time.
- After entering the ID and verification, if you don’t operate for 10 seconds, the entry becomes invalid and it is required to enter the Owner ID again.

Owner ID Change

The ID used in “Sys on by ID” and “Start by ID” can be set and changed as follows.

- If you select “Owner ID change”, the ID verification screen is displayed and you are asked to enter the current ID (Default: “00000”).
- If you enter the wrong ID 5 times, the ID is locked and you are no longer able to make an input. The lock can be released by turning off the system power.
- ID can be changed to any 5 digit number from 00000 to 99999.
- Select the number from 0 to 9 with the ▲ ▼ buttons. The fixed number is displayed by an asterisk when you press the ▶ button and the next digit is highlighted.
- Press the [ENTER] button after highlighting it with the ▶ button when all 5 digits are entered and the new ID becomes valid.

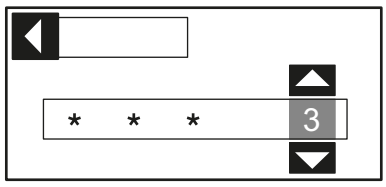


Figure 18

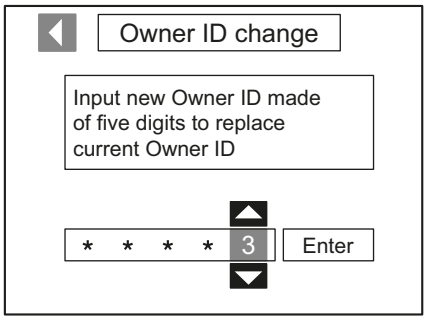


Figure 19

Emergency Stop

■ Electric Emergency Stop

NOTICE

Never use the Emergency Stop switch for a normal engine shutdown. Use this switch only when stopping the engine suddenly in an emergency.

1. Pressing the Emergency Stop switch will stop the engine immediately.
2. The Emergency Stop screen will be shown on the display, and the buzzer will sound.
3. After the engine has stopped, press the Emergency Stop switch to release the emergency stop. After releasing, it may take sometime to restart.

NOTE:

1. *The Emergency Stop switch should only be used in emergencies. Use the Engine START/STOP switch to stop the engine normally.*
2. *The engine cannot be started while the Emergency Stop switch is pressed (emergency stop mode not canceled).*

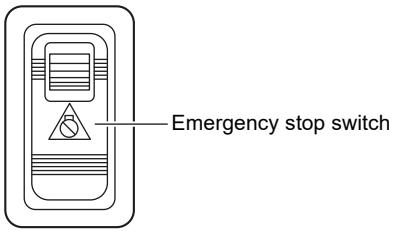


Figure 20

CONTROL THE BACKUP PANEL

⚠ WARNING

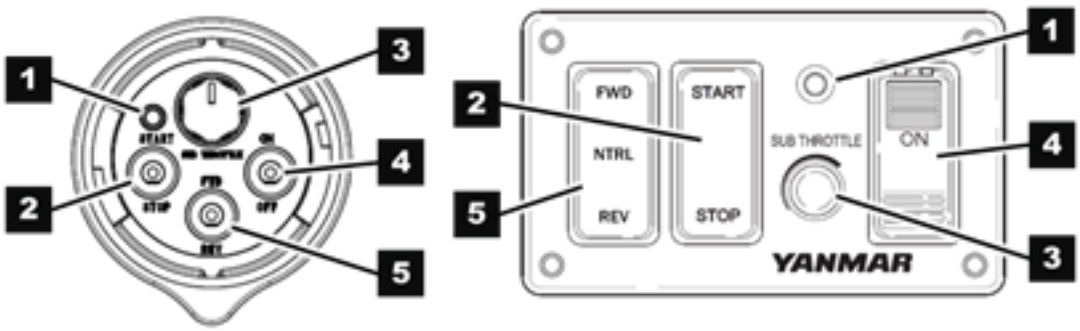
Only use this in an emergency.

1. Pull out the protect cover.
2. Check that the power switch on the switch panel is OFF and that the control head handle and backup panel's shift switch are in the N (Neutral) position.
3. Press the power switch to the "ON" position on the backup panel. The lamp will come and control by the backup panel is enabled.
4. The engine can be started or stopped with the START/STOP switch.
5. Shift gears using the shift switch. (FWD: forward, NTRL: neutral, REV: reverse)
6. Adjust the engine speed using the sub throttle control volume. (counter-clockwise: lower engine speed, clockwise: raise engine speed)

When controlling the throttle, first move it fully counter-clockwise.

NOTICE

- The throttle and gear shift of the engine that has been turned on can be controlled.
- When controlling the throttle, always move it fully anti-clockwise first.
- Be sure to lower the engine speed by turning the sub throttle volume fully to anti-clockwise before stopping the engine.



1 **Backup Active Lamp (LED color: Red)**

2 **Engine Start Stop SW (Momentary switch)**

3 **Sub Throttle Dial**

4 **Backup Active SW (Alternate switch)**

5 **Shift Position SW (Alternate switch)**

Figure 21

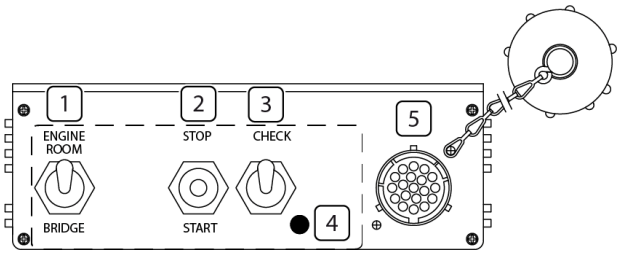


Figure 22

No.	Description
1	Control station selector
2	Start/stop and manual acceleration control
3	Button not active
4	Led not used in this version
5	Connector for diagnostic tool

ATTENTION: *It is strictly prohibited to switch the ENGINE ROOM / BRIDGE selector when the engine is running.*

ENGINE MANAGEMENT FROM RELAY BOX

Only for secondary backup

The engine equipment includes a unit, known as “Relay Box” which is generally fitted near the engine room and can manage the following functions:

- Start-up and stop.
- Selection of the control station: bridge or engine room.
- Increasing and reducing the rotation speed.
- Self-diagnostics test (to be carried out only by Technical Service Network personnel).

Engine start procedure

1. Move the switch (1) to the ENGINE ROOM position, thereby enabling the adjacent START-STOP (2) button; this operation excludes all the functions on the instrument panel on the dashboard.
2. Move the button (2) to the START position until the engine starts.
3. To accelerate or decelerate: press and hold button (2) in the START position until the required engine speed is reached, then release it; this operation will generate acceleration and deceleration effects alternately. The engine speed reached at each change will be maintained until the next change or until the engine is stopped.

Engine stop procedure

1. Move the button (2) to the STOP position until the engine has stopped completely.
2. Move the switch (1) to the BRIDGE position to allow use of the controls on the instrument panels and exclude the use of the START-STOP button from the “Relay Box”.

BEFORE YOU OPERATE

INTRODUCTION

This section of the *Operation Manual* describes the diesel fuel, engine oil and engine coolant specifications and how to replenish them.

SAFETY PRECAUTIONS

Before performing any operations within this section, review the *Safety* section on page *3*.

DIESEL FUEL SPECIFICATIONS

⚠ WARNING

Diesel fuel is flammable and explosive under certain conditions.

NOTICE

Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA warranty requirements. Only use clean diesel fuel.

Diesel fuel should comply with the following specifications: Fuel compliant with standard EN 590, (Sulfur content less than 10 ppm) and/or ASTM D975 (Sulfur content less than 15 ppm).

The table lists several worldwide specifications for diesel fuels.

DIESEL FUEL SPECIFICATION	LOCATION
ASTM D975 No. 2-D S15, No. 1-D S15	USA
EN590-2009	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan

Biodiesel Fuels

Yanmar approves the use of biodiesel fuels that do not exceed a blend of 7% non-mineral oil based fuel with 93% standard diesel fuel. Such biodiesel fuels are known in the marketplace as B7 biodiesel fuels. B7 biodiesel fuel can reduce particulate matter and the emission of “greenhouse” gases compared to standard diesel fuel.

If the B7 biodiesel fuel used does not meet the approved specifications, it will cause abnormal wear of injectors, reduce the life of the engine and it may affect the warranty coverage of your engine.

B7 diesel fuels must meet certain specifications.

The biodiesel fuels must meet the minimum specifications for the country in which they are used:

- In Europe, biodiesel fuels must comply with the European Standard EN590-2009, EN14214.
- In the United States, biodiesel fuels must comply with the American Standard ASTM D-6751 Grade-S15, D7467 Grade B7-S15.

Biodiesel should be purchased only from recognized and authorized diesel fuel suppliers.

Precautions and concerns regarding the use of biofuels:

- Biodiesel fuels have a higher content of methyl-esters, which may deteriorate certain metal, rubber and plastic components of the fuel system. The customer and/or boat builder are responsible to verify the usage of biodiesel compatible components on the vessel fuel supply and return systems.
- Free water in biodiesel may result in plugging of fuel filters and increased bacterial growth.
- High viscosity at low temperatures may result in fuel delivery problems, supply pump seizures and poor injection nozzle spray atomization.
- Biodiesel may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.

- Even biodiesel fuels that comply with a suitable standard as delivered will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and/or fuel storage containers, may be necessary.
- The use of biodiesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.

Additional Technical Fuel Requirements

- The fuel cetane number should be 45 or higher.
- The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred. Especially in U.S.A. and Canada, Ultra Low sulfur fuel (:s; 15 ppm) must be used.
- Never mix kerosene, used engine oil or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Ash content not to exceed 0.01% by volume.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- Do not use Biocide.
- Lubricity: Wear mark of WS1.4 should be Max. 0.016 in. (400 µm) at HFRR test.
- Low temperature diesel:
  EN 590 specifications distinguish different classes of diesel fuel, identifying the characteristics of those best suited to low temperatures.
  It is entirely up to the fuel supply companies to comply with these regulations, which require that fuels suited to the climatic and geographic conditions of the various Countries be distributed.

Diesel fuel for low temperatures

Diesel Fuel Standard EN 590 defines different diesel classes, identifying the characteristics of those most suitable for use at low ambient temperatures. It is responsibility of the owner to obtain fuel suitable for the climatic and geographical conditions of the various countries. Winter fuel should be obtained before very cold temperatures are expected.

⚠ WARNING

Risk of damage

Refueling from drums or tanks can cause contamination of the diesel fuel, with the consequent risk of damaging the injection system; if necessary, perform suitable filtration or settling of the impurities before refueling. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

REFILLING

Parts to be refilled	Litres (kg)
Cooling circuit*1	38 L
Lubrication circuit*2 Total capacity*3	28 L (25.5 kg)
Periodical replacement: Oil sump at minimum level Oil sump at maximum level	 15.5 L (14 kg) 24 L (21.5 kg)

*1: Engine coolant: Yanmar Long Life Coolant recommended or organic base long life coolant compliant with specifications ASTM D6210 Type 1-FF. If concentrated products are used, they must be mixed 50% with water.

*2: Yanmar 15W40 Oil is recommended. Minimum engine oil specifications: compliant with specifications ACEA E7 e/o API CI-4. Viscosity grade: 15W-40. Engine oil 15W-40 can be used throughout the year.
If you operate your equipment at temperatures outside the limits shown, consult your authorized Yanmar dealer or distributor for special lubricants or starting aids.

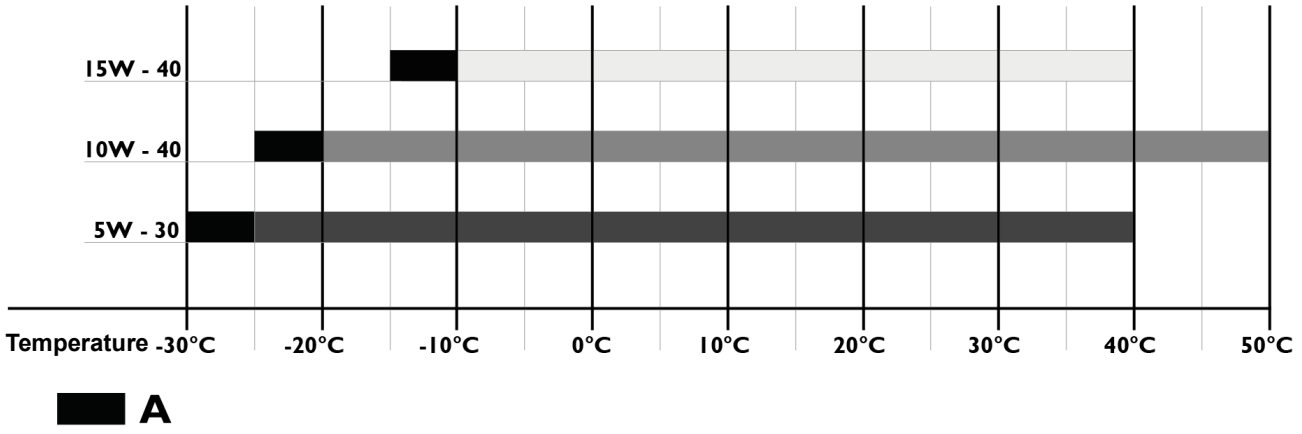
*3: The quantity indicated refers to the first filling and includes the engine, oil sump and filter.

NOTICE

- An inorganic based engine coolant can be used, compliant with specifications ASTM D6210 Type 1-FF, provided that the internal engine cooling circuit has been suitably washed beforehand. Wash the circuit with “fresh” water and a specific additive to facilitate removal of any residue before changing the fluid. If a concentrated product is used, mix it 50% with water.
- It is not permitted to mix different fluids, organic and inorganic based, as they are not compatible.
- If using an inorganic based engine coolant, the replacement interval must be shortened to 1200 h or 2 years.

Marine Gear

Refer to the manual supplied by the Manufacturer for information on the quantity and type of oil to be used.



A. Installation of engine coolant heating system with heater on the crankcase is recommended.

ENGINE OPERATION

INTRODUCTION

This section of the *Operation Manual* describes the procedures for starting the engine, checking engine performance during operation and shutting down the engine.

SAFETY PRECAUTIONS

Before performing any operations within this section, review the *Safety* section on page *3*.

⚠ WARNING

Fire and Explosion Hazard

Never jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
Only use the start switch on the instrument panel to start the engine.

Sudden Movement Hazard

Be sure the boat is in open water away from other boats, docks or other obstructions before increasing engine speed. Avoid unexpected equipment movement. Shift the marine gear into the NEUTRAL position any time the engine is at idle.

To prevent accidental equipment movement, never start the engine in gear.

Sever Hazard

Keep children and pets away while the engine is operating.

NOTICE

If any indicator illuminates during engine operation, stop the engine immediately.

Determine the cause and repair the problem before you continue to operate the engine.

PRELIMINARY CHECKS

Each time before starting the engine:

- Make sure that the sea-water inlet valve is open. Dry operation of the seawater pump will quickly cause damage to the internal impeller.
- Check the level of the fluids: fuel, engine oil, coolant and gear oil.

⚠ WARNING

Risk of injury

Before starting the engine, make sure that there are no gas or combustible vapors in the engine room.
Failure to comply with these warnings can result in the risk of serious injury.

FOR PROPER USE OF THE ENGINE

- Do not continue activating the starter motor when the engine is already running.
- After starting the engine, begin navigation at a low speed - do not remain in dock while waiting for the engine to warm up; allowing the engine to run at medium power will allow the operating temperatures to be reached correctly.
- Do not idle for long periods as this increases the production of harmful emissions from the engine and does not guarantee its optimum performance.
- The engine speed must be increased and decreased gradually so as to permit normal combustion and the optimum functioning of all engine components.
- Maximum cruising speed must not exceed 90% of maximum load - 2400 RPM (see page *9*).
- During navigation, check that:
  - The temperature of the engine coolant has not exceeded the alarm thresholds.
  - The oil pressure remains within the expected normal values.

SPECIAL WARNINGS

High coolant temperature

If high temperature is indicated by the instruments or with an alarm, reduce the engine speed and return to port to check the status of the seawater inlet and the cooling circuits; also check the following:

1. the tension of the water pump and alternator drive belts.
2. the operation of the thermostatic valve.
3. the cleanliness of the heat exchangers.

⚠ WARNING

Burn hazard

Never remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will spray out and seriously burn you. Allow the engine to cool down before you attempt to remove the cap.

Low engine oil pressure

Should the pressure indicated by the instrument be considered insufficient or if the “low oil pressure” warning light comes on, stop the engine and check the oil level. Top-up as needed (see page *28*).

If the fault persists, return to low speed, and contact a Service center.

Presence of water in the fuel pre-filter

It is advisable to drain the water from the filters before the relevant warning light comes on. Do not use the engine if the tank only contains the quantity of fuel kept as reserve; this condition promotes the formation of condensate and the intake of sludge or air, causing the engine to stop.

⚠ WARNING

Contamination, fire

When refuelling, always make sure that no solid or liquid pollutants enter the fuel tank; remember that it is prohibited to smoke or use naked flames when refuelling.
Failure to comply with these warnings can result in serious injury and serious damages.

Clogged air filter and exhaust system obstructions

Regularly inspect the cleanliness of the air intake inlets and the exhaust ducts. The maintenance intervals contained in this manual only take into account the performances of the engine parts and not of those parts manufactured at the boatyard or any other external modifications.

⚠ WARNING

Risk of burns

Visually check that the exhaust circuit is not clogged or damaged, to prevent hazardous or toxic emissions inside the pipes.
Failure to comply with these warnings can result in the risk of serious injury and serious damages.

Battery or alternator charging fault

Periodically check the cleanliness, condition and correct tensioning of the drive belt.

⚠ WARNING

Risk of injury

The rotating elements are located below the protective covers. They must only be removed when the engine is not running. Failure to comply with these warnings can result in serious injury.

Electrical system irregularities

Periodically check, especially in winter, to ensure that the batteries are clean and in full working order, checking and topping up as indicated on page *48*. Close attention must be paid to the caution notices. If they need to be replaced, strictly observe the specifications as indicated on page *65*.

VC20 STARTING THE ENGINE

1. Open the seacock.
2. Open the fuel tank cock.
3. Turn the battery switch on for engine and VC20.
4. Press the Power switch on the switch panel of the selected station (1, **Figure 1**).
   - The switch panel lamp will come on, and the control head (**Figure 2**) “SEL” lamp (**Figure 3**) will come on or flash.
   - To use the Engine START/STOP switch, be sure to turn the Power switch ON.
5. If the “Sys on by ID” has been set, enter the password into the display.
6. Press the control head “SEL” switch.
   - Wait until the display shows the engine data. The display is shown.
7. If the “Start by ID” has been set, enter the password into the display.
   - The “Start by ID” has been set, the engine can be started in 10 seconds after entering the password into the display.
8. Move the control head handle to the N (Neutral) position.
9. Press the Engine START/STOP switch (2, **Figure 1**) and power on the starter.
   - When the engine starts, the VC20 display will show the screen with engine conditions (**Figure 4**).

NOTE:

1. *Concerning the control head “SEL” lamp. For Multi-Station: the “SEL” lamp will flash and for Single Station: the “SEL” lamp will come on.*
2. *Pressing the Engine START/STOP switch when the “SEL” lamp is flashing allows the station to be selected as the engine is started.*
3. *The engine will not start or stop if the Power switch is OFF. The Power switch must be ON at all times when the engine is running.*
4. *Do not press the engine START/STOP switch except for stopping the engine.*

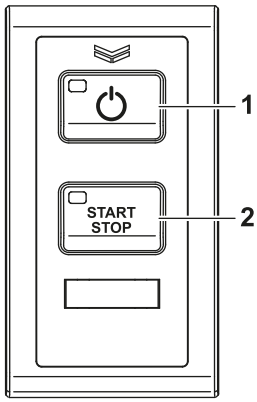


Figure 1

Figure 2

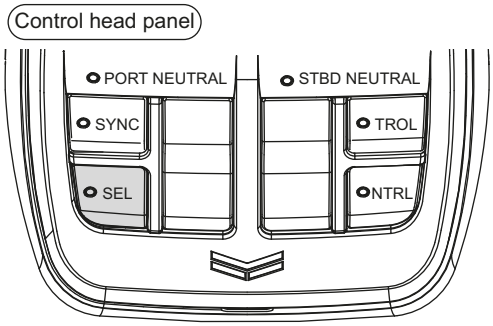


Figure 3

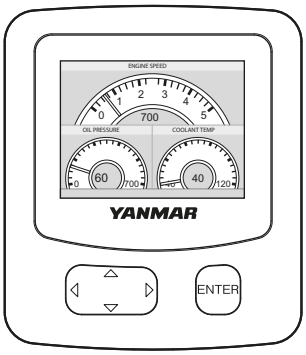


Figure 4

If the Engine Fails to Start

Before pressing the Start switch again, confirm that the engine has stopped completely. If the starter motor is operated before the engine has completely stopped, the starter motor pinion gear will be damaged.

NOTICE

Starter should not be operated for more than 15 seconds at a time. After this wait at least 15 seconds before operating starter again. If the engine does not start the first time, wait for about 15 seconds before trying again.

NOTICE

If the engine's exhaust system is equipped with a water lift (water lock) muffler, excessive cranking could cause seawater to enter the cylinders and damage the engine. If the engine does not start after cranking 15 seconds, close the thru-hull water intake valve to avoid filling the muffler with water. Crank for 15 seconds or until the engine starts. When the engine does start, stop the engine immediately by pressing the stop switch. Be sure to re-open the seacock and restart the engine. Operate the engine normally.

After the Engine has Started

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

1. Check that the indicators on the display and the control head 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 to send engine oil to all parts of the engine.
5. Check that sufficient seawater 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 of the seacock on the hull bottom clogged?
   - Is the seawater suction hose broken, or does the hose suck in air due to a loose joint?

NOTICE

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

WARM UP MODE (SHIFT DISCONNECT)

1. Move the control head handle to the N (Neutral) position. (The NEUTRAL lamp will come on)
2. Press the "NTRL" switch of the selected station control head.
3. The NEUTRAL lamp will come on, and the NEUTRAL lamp will flash.
4. Move the Throttle Handle. The engine speed can be controlled while the gear shift is in neutral.
5. Move the control head handle to the N (Neutral) position, press the "NTRL" switch and cancel warm up mode.

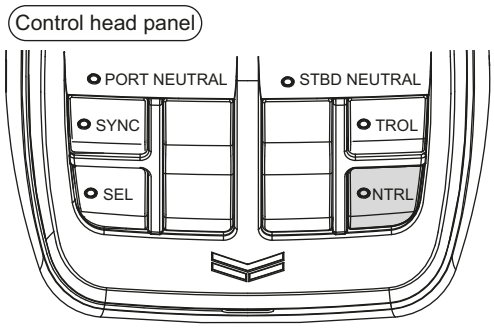


Figure 5

THROTTLE AND SHIFT CONTROL

⚠ WARNING

Suddem movement hazard

The boat will start to move when the marine gear is engaged:

- Ensure the boat is clear of all obstacles forward and aft.
- Quickly shift to the FORWARD position then back to the NEUTRAL position.
- Observe whether the boat moves in the direction you expect.

Neutral

1. Move the control head handle to the N (Neutral) position. (The NEUTRAL lamp will come on)
2. When switching between forward and reverse, move the handle slowly between the forward and reverse positions. Move the handle firmly into either the forward or reverse position.

Forward

Move the handle toward F (forward) to the forward-idle notch position. The engine will remain idling. Moving the handle forward further will increase the engine speed.

Reverse

Move the handle toward R (reverse) to the reverse-idle notch position. The engine will remain idling. Pulling the handle back further will increase the engine speed.

Forward (Reverse) to Reverse (Forward)

Moving the handle quickly and switching from forward (reverse) to reverse (forward) will activate the gear shift delay (astern delay). The engine speed will decrease to idle speed for several seconds.

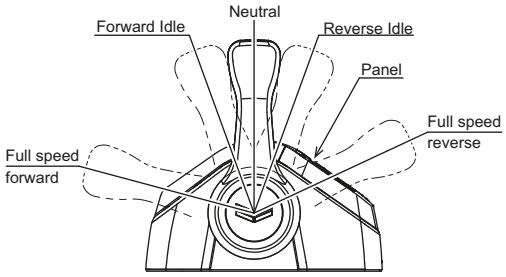


Figure 6

ENGINE SPEED LIMIT MODE

1. Move the control head handle to the Forward Idle position. (Both sides in the case of twin engine.)
2. Press the “NTRL” switch of the selected station. (The lamp above “NTRL” switch will flash.)
3. Even if you tilt the handle to accelerate, the engine speed increases only up to the setting value.
4. Move the control head handle to the N (Neutral), Forward Idle, or Reverse Idle position (both sides in the case of twin engine) and press the “NTRL” switch to release the [Engine Speed Limit Mode].

NOTE: *The setting value can be set by the VC20 display. The default value is 50%.*

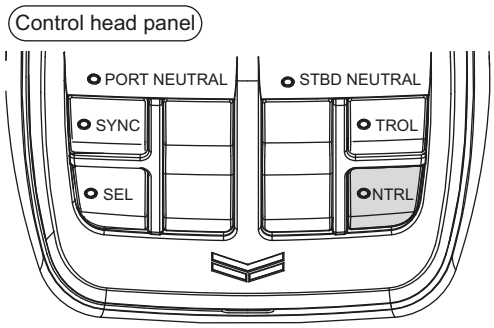


Figure 7

CAUTIONS DURING OPERATION

NOTICE

- Engine trouble can arise if the engine is operated for a long time under overloaded conditions with the control lever in the full throttle position (maximum engine speed position), exceeding the continuous rated output engine speed. While cruising, operate the engine at about 90% power level - 2400 RPM.
- If the engine is in the first 50 hours of operation, see *New Engine Break-in* on page *9*.

Always be on the lookout for problems during engine operation.

Pay particular attention to the following:

1. Is sufficient seawater being discharged from the exhaust and 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?

   NOTICE

   Excessive vibration may cause damage to the engine, marine gear, hull and onboard equipment. In addition, it causes noticeable passenger and crew discomfort.

   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.

   NOTICE

   If any alarm indicator with audible alarm sound appears on the display during engine operation, stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.
5. Is there water, oil, or fuel leakage, or are there any loose bolts? Check the engine room periodically for any problems.
6. Is there sufficient diesel fuel in the diesel fuel tank? Replenish diesel fuel before leaving the dock to avoid running out of fuel during operation.
7. Never turn off the battery switch (if equipped) or short the battery cables during operation. Damage to the electric system will result.

SHUTTING DOWN THE ENGINE (STOPPING)

Stop the engine in accordance with the following procedures:

Normal Stopping

1. Move the control head handle to the N (Neutral) position. (The NEUTRAL lamp will come on.)
2. Cool the engine down at low speed (below 1000 min^{-1} (rpm)) for about 5 minutes.

NOTICE

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger and exhaust system, to cool slightly before the engine itself is shut down.

3. Press the Engine START/STOP switch on the switch panel of the selected station to stop the engine.
4. Press the Power switch to turn the power OFF.

⚠ CAUTION

Do not press the Engine START/STOP switch when the engine is stopped. The engine will restart.
Do not turn the Battery switch OFF before turning the Power switch OFF.

NOTICE

Wait 4 seconds or more before turning battery switch off for secure system settle down.

5. Turn the battery switch off for engine and VC20.
6. Close the fuel tank cock.
7. Close the seacock.

⚠ CAUTION

- **Be sure to close the seacock. Neglecting to close the seacock could allow water to leak into the boat and may cause it to sink.**
- **If seawater is left inside the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0 °C (32 °F).**

Figure 8

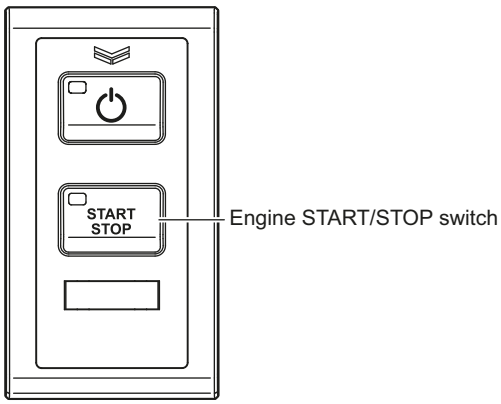


Figure 9

CHECKING THE ENGINE AFTER OPERATION

- Check that battery switch is turned to OFF.
- Fill the fuel tank.
- Close seacock(s).
- If there is a risk of freezing, check that the cooling system contains enough coolant. See page *28*.
- If there is a risk of freezing, drain the seawater system.
- At temperatures below 0 °C (32 °F), drain seawater system and connect the engine heater (if equipped).

Check fluid levels

See instructions in *Before You Operate* on page *25*.

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INSPECTION AND MAINTENANCE

INTRODUCTION

This section of the *Operation Manual* describes the procedures for proper care and maintenance of the engine.

SAFETY PRECAUTIONS

Before performing any maintenance procedures within this section, read the following safety information and review the *Safety* section on page *3*.

⚠ WARNING

Crush Hazard

If the engine needs to be transported for repair, have a helper assist you attach it to a hoist and load it on a truck.

The engine lifting eyes are engineered to lift the weight of the marine engine only. Always use the engine lifting eyes when lifting the engine.

Additional equipment is necessary to lift the marine engine and marine gear together. Always use lifting equipment with sufficient capacity to lift the marine engine.

⚠ WARNING

Welding Hazard

- **Always turn off the battery switch (if equipped) or disconnect the negative battery cable and the leads to the alternator when welding on the equipment.**
- **Remove the engine control unit multi-pin connector. Connect the weld clamp to the component to be welded and as close as possible to the welding point.**
- **Never connect the weld clamp to the engine or in a manner which would allow current to pass through a mounting bracket.**
- **When welding is completed, reconnect the alternator and engine control unit prior to reconnecting the batteries.**

Entanglement Hazard

Never leave the power switch on when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it.

Shock Hazard

Always turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the equipment.

Always keep the electrical connectors and terminals clean. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.

⚠ WARNING

Never use undersized wiring for the electrical system.

Tool hazard

Always remove any tools or shop rags used during maintenance from the area before operation.

NOTICE

Any part which is found defective as a result of inspection, or any part whose measured value does not satisfy the standard or limit, must be replaced.

Modifications may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may void its warranty. Be sure to use Yanmar genuine replacement parts.

PRECAUTIONS

The Importance of Periodic Maintenance

Engine deterioration and wear occur in proportion to the length of time the engine has been in service and the conditions the engine is subjected to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

Performing Periodic Maintenance

⚠ WARNING

Exhaust Hazard

Never block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death. Make sure that all connections are tightened to specifications after repair is made to the exhaust system. Failure to comply could result in death or serious injury.

The Importance of Daily Checks

The Periodic Maintenance Schedule assumes that the daily checks are performed on a regular basis. Make it a habit to perform daily checks before the start of each operating day.

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced alternator) and parts used for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 150, 300, 600, 900, 1200, 2400 and 3000 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

NOTICE

Failure to perform periodic maintenance will shorten the life of the engine and may void the warranty.

Yanmar Replacement Parts

Yanmar recommends that you use genuine Yanmar parts when replacement parts are needed. Genuine replacement parts help ensure long engine life.

Tools Required

Before you start any periodic maintenance procedure, make sure you have the tools you need to perform all of the required tasks.

Consult Your Authorized Yanmar Marine Dealer or Distributor for Help

Our professional service technicians have the expertise and skills to help you with any maintenance or service related procedures you need help with.

Tightening Fasteners

Use the correct amount of torque when you tighten fasteners on the engine. Applying excessive torque may damage the fastener or component and not enough torque may cause a leak or component failure.

NOTICE

The tightening torque in the Standard Torque Chart should be applied only to the bolts with a “8.8” head (JIS strength classification: 8.8). Apply 60% torque to bolts that are not listed. Apply 80% torque when tightened to aluminum alloy.

Bolt Diameter x Pitch (mm)		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
Tightening Torque	N·m	10.8 ± 1.0	25.5 ± 3.0	18.8 ± 2.2	88.2 ± 10.0	140.0 ± 10.0	230.0 ± 10.0
	ft-lb	8.0 ± 0.7	18.8 ± 2.2	36.2 ± 3.7	65.1 ± 7.4	103 ± 7.2	170 ± 7.2

Taper Plugs		1/8	1/4	3/8	1/2
Tightening Torque	N·m	9.8	19.6	29.4	58.8
	ft-lb	7.4	14.5	21.7	43.2

When lock adhesive is applied, decide separately.

Pipe Joint Bolts		M8	M10	M12	M14	M16
Tightening Torque	N·m	14.7 ± 2	22.5 ± 3	29.4 ± 5	44.1 ± 5	53.9 ± 5
	ft-lb	10.9 ± 1.5	16.6 ± 2.2	21.7 ± 3.7	32.6 ± 3.7	69.8 ± 3.7

When seal washer applied, torque is 34 ± 5 N·m (25.1 ± 3.7 ft-lb).

EPA MAINTENANCE REQUIREMENTS

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations for Engines, it is essential that you follow the *Maintenance Schedule* on page *43* and the *Maintenance Procedures* on page *45*.

EPA Requirements for USA and Other Applicable Countries

The EPA emission regulation is applicable only in the USA and other countries that have adopted the EPA requirements in part or in whole. Determine and follow the emission regulations in the country where your engine will be operating to assist you in specified compliance.

Environmental Condition for operation and maintenance

The following environmental operating conditions and maintenance should be observed, in order to keep engine performance.

- Ambient temperature: -15 °C to +40 °C (5 °F to +104 °F)
- Relative humidity: 80% or lower

The diesel fuel should be:

- ASTM D975 No. 1-D S15, No. 2-D S15, or equivalent (minimum of cetane No. 45)

The lubricating oil should be:

- API Service Categories CI and CI-4.

Be sure to perform inspections as outlined in *Maintenance Procedures* on page *45* and keep a record of the results.

Pay particular attention to these important points:

- Replacing the engine oil
- Replacing the engine oil filter
- Replacing the fuel filter
- Cleaning the intake silencer (air cleaner)

Inspections are divided into two sections in accordance with who is responsible for performing the inspection: the user or the maker.

Inspection and Maintenance

Inspection and maintenance procedures are covered in *Maintenance Schedule* on page *43*.

This maintenance must be performed to keep the emission values of your engine in the standard values during the warranty period. The warranty period is determined by the age of the engine or the number of hours of operation.

MAINTENANCE SCHEDULE

Item	Periodic Maintenance Interval							
	Daily	150	300	600	900	1200	2400	3000
	Daily	Every 150 hours or monthly whichever comes first	Every 300 hours or 1 year whichever comes first	Every 600 hours or 1 year whichever comes first	Every 900 hours or 1 year whichever comes first	Every 1200 hours or 2 years whichever comes first	Every 2400 hours or 4 years whichever comes first	Every 3000 hours or 5 years whichever comes first
Engine oil level check	○							
Engine coolant level check	○							
Drain the water from the pre-filter.		○						
Check the level of the electrolyte solution and clean the battery poles.		○ / or every 6 months						
Check the condition of the air filter. Clean and replace if necessary.			○			Replace		
Check zinc anode wear; replace (4) if necessary. In warm and very salty waters such as the Mediterranean, please check anodes every 6 months.			○					
Check the condition of the oil vapour recirculation filter; replace the filter if necessary.			○	Replace at 600 h				
Engine oil replacement (2)			○					
Replace the engine oil filter (2).			○					
Check the condition of the filter at the seawater pump inlet. Clean if necessary.					○			
Fault memory reading via diagnostics tool			○					
Check the state of wear of the seawater pump rotor. Replace if necessary.			○					
Check the sections of the seawater cooling circuit pipes and clean if necessary.			○					

1) Fuel compliant with standard EN 590 (sulfur content less than 10 ppm) and/or ASTM D975 (sulfur content less than 15 ppm)

2) Minimum specifications of engine oil: compliant with standard ACEA E7 and/or API CI-4. Degree of viscosity: see the table on the page *28*.

3) Engine coolant standard solution: organic base compliant with specifications ASTM D6210 Type 1-FF. If concentrated products are used, they must be mixed 50% with water. Original Yanmar products are recommended.

4) The anode must be replaced if the corrosion has affected more than 50% of the volume of zinc.

5) Seawater/combustion air heat exchanger: clean both the air and water section; seawater/engine coolant exchanger: clean the seawater section; seawater/oil exchanger: clean the seawater section.

Item	Periodic Maintenance Interval							
	Daily	150	300	600	900	1200	2400	3000
	Daily	Every 150 hours or monthly whichever comes first	Every 300 hours or 1 year whichever comes first	Every 600 hours or 1 year whichever comes first	Every 900 hours or 1 year whichever comes first	Every 1200 hours or 2 years whichever comes first	Every 2400 hours or 4 years whichever comes first	Every 3000 hours or 5 years whichever comes first
Check seawater/engine oil heat exchanger, seawater/engine coolant heat exchanger and intercooler heat exchanger (air-seawater). Clean if necessary (5).					○			
Turbocharger visual inspection					○			
Fuel pre-filter replacement (1)				Replace at 600 h				
Fuel filter replacement (1)				Replace at 600 h				
Check auxiliary belt (V belt) (alternator and engine cooling water pump).				○		Replace every 3 years		
Check for signs of condensation inside the fuel tank. Clean if necessary.			○					
Coolant replacement (3)							○	
Check integrity of damper pulley mounted on the crankshaft (front side).							○	
Check valve clearance.						○		
Check the condition of exhaust duct(s).	○							
Check the oil level in the gearbox.	○							
Change the oil level in the gearbox.	Refer to the marine gear operation manual							

1) Fuel compliant with standard EN 590 (sulfur content less than 10 ppm) and/or ASTM D975 (sulfur content less than 15 ppm)

2) Minimum specifications of engine oil: compliant with standard ACEA E7 and/or API CI-4. Degree of viscosity: see the table on the page *28*.

3) Engine coolant standard solution: organic base compliant with specifications ASTM D6210 Type 1-FF. If concentrated products are used, they must be mixed 50% with water. Original Yanmar products are recommended.

4) The anode must be replaced if the corrosion has affected more than 50% of the volume of zinc.

5) Seawater/combustion air heat exchanger: clean both the air and water section; seawater/engine coolant exchanger: clean the seawater section; seawater/oil exchanger: clean the seawater section.

MAINTENANCE PROCEDURES

CHECK THE ENGINE OIL LEVEL

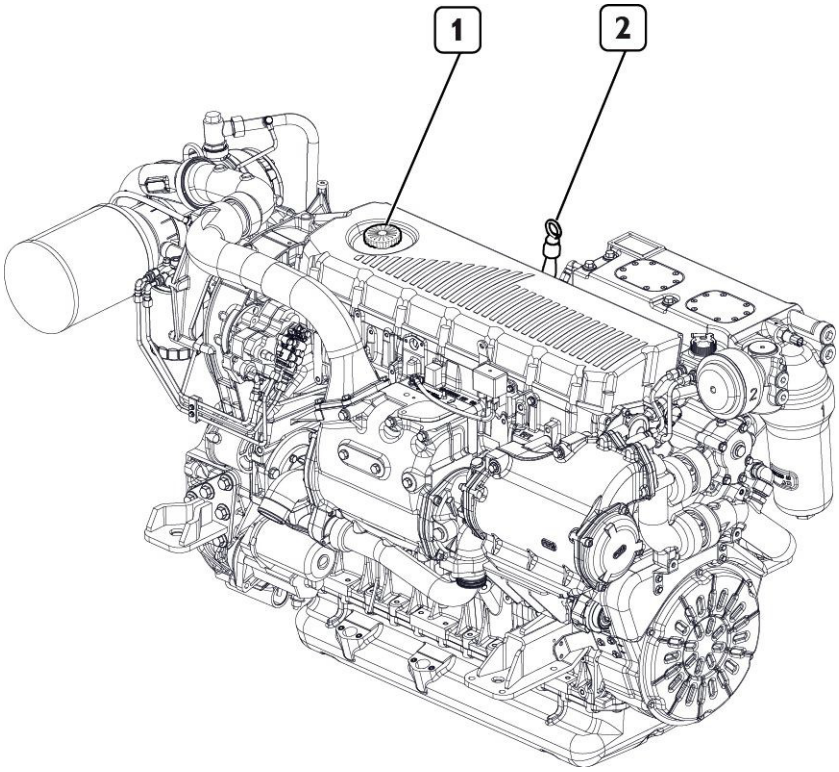

Figure 1

Only check when the engine is cool and not running to avoid burns.

- Using the dipstick (2), check that the oil level is between the “Min” and “Max” levels.
- If the level is low, remove the filler cap (1) and top up through the filler port on the cylinder head cover.

ATTENTION: *After topping up the oil, make sure that the level does not exceed the “Max” notch on the dipstick. Make sure that the dipstick is fully inserted and that the filler cap is tightened fully in the clockwise direction.*

CHECK THE OIL LEVEL IN THE MARINE GEAR

Check the level of the oil in the Marine Gear following the instructions provided in the manual supplied by the Manufacturer.

CHECK THE COOLANT LEVEL

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Remove the pressure cap from the tank.
- Visually check that the fluid level is a few centimeters below the filler hole.
- Top-up the tank, if required, using a mix as indicated in the table on page 28.

Do not over fill the tank.

⚠ WARNING

Risk of injury

When the engine is hot, the pressure inside the cooling circuit can be such that it may expel the hot liquid in an extremely violent manner with the risk of burns. Only open the pressure cap of the coolant tank when the engine is cold. Failure to comply with these instructions can result in the risk of serious injury.

NOTICE

General instructions

The failure to observe the aforesaid procedure does not guarantee the presence of the correct quantity of coolant in the engine.

Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

CHECK THE CONDITION OF THE EXHAUST DUCT(S)

Visually check that the exhaust gas / exhaust system is not obstructed or damaged.

Make sure that there is no risk of any dangerous fumes inside the hull. Contact the boatyard if necessary.

DRAINING THE WATER FROM THE FUEL PRE-FILTER

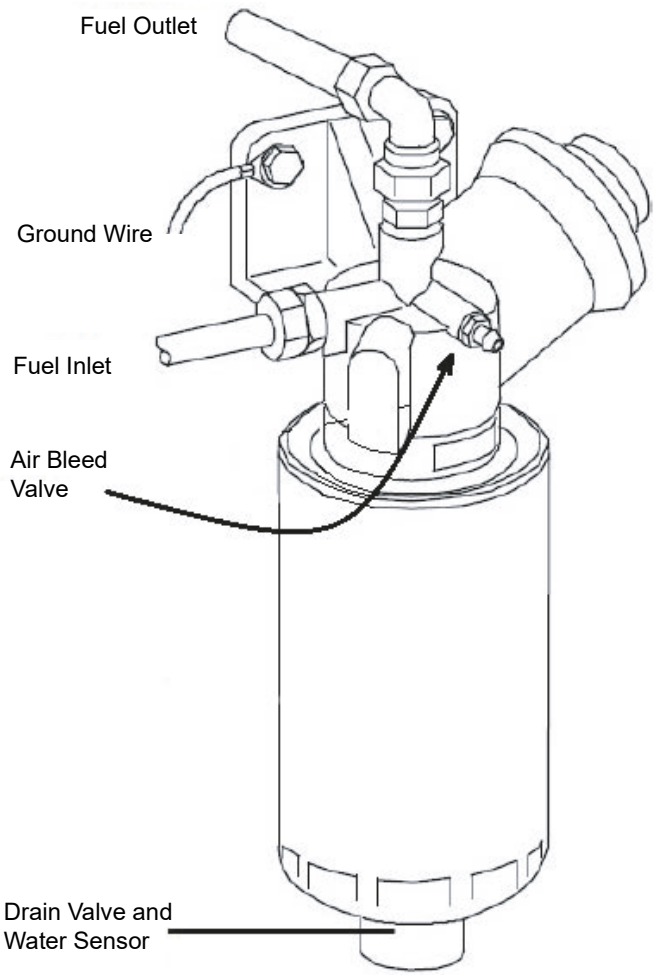

Figure 2

Only proceed when the engine is off:

1. Place a container for collecting the liquids under the pre-filter.
2. Unscrew the Drain Valve plug located at the bottom of the pre-filter. (The plug includes the sensor for detecting water in fuel.)
3. Drain the liquid until only diesel is released.
4. Manually close the Drain Valve by screwing it in completely.
5. Loosen the Air Bleed Valve.
6. Work the manual pump until the fuel comes out of the Air Bleed Valve, then close the Valve.

⚠ WARNING

Risk of injury

Dispose of consumable materials and the parts in contact with them (for example filters) in accordance with the law. The workshops of the Service Network are equipped for this purpose. Correct behavior will ensure that vehicle is used as environmentally friendly as possible.

CHECK THE ELECTROLYTE LEVEL OF THE BATTERIES – CLEAN TERMINALS

⚠ WARNING

Risk of damage

The batteries contain sulfuric acid which is highly caustic and corrosive. Always wear gloves and protective glasses while topping up. If possible, ensure that the check is carried out by specialised personnel.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle.

⚠ WARNING

Risk of injury

During the checks do not smoke or allow naked flames near the batteries. Ensure that the work area is suitably ventilated.
Failure to comply with these prescriptions can result in the risk of serious injury.

Proceed after positioning the batteries on a horizontal surface. (Flooded lead acid batteries only)

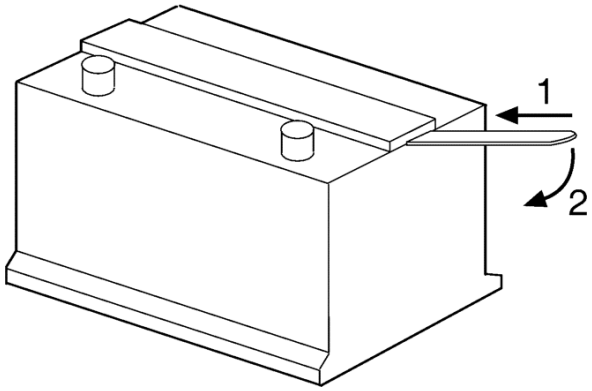

Figure 3

- Visually check that the level of the fluid is between the “Min” and “Max” limits. If there are no references, check that the fluid covers the Lead plates in the elements by approx. 5 mm.
- When required, only use distilled water to top up the elements whose level is below the minimum.
- Diagnose the state of efficiency of the battery charging system if a voltage level of less than 27 V (for nominal 24 V systems) is detected while the engine is running.
- Check that the terminals and clamps are clean, well tightened and protected by battery terminal grease or petroleum jelly.

Some batteries are equipped with a single cover for the inspection plugs. To access the elements, use a lever as indicated in the figure.

Clean terminals

⚠ WARNING

Hazard warning

Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls). Failure to comply with these prescriptions can result in the risk of serious injury.

Check that the battery terminals and cable clamps are clean, well tightened and protected by battery terminal grease or petroleum jelly.

In the event of dirty cable clamps and battery terminals:

- Loosen the nut and remove the clamp from the negative terminal (indicated by the “-”).
- Loosen the nut and remove the clamp from the positive terminal (indicated by the “+”).
- Use a metal brush or fine grade emery paper to clean the cable clamps and battery terminals until they are shiny.
- Smear the cable clamps with battery terminal grease or petroleum jelly and insert them onto the battery terminals making sure that the positive pole is connected first, followed by the negative pole, and then tighten each clamp.

Check the level of wear and corrosion of the cables and clamps. They must be replaced if deterioration is detected.
Visually check the state of the battery. The terminals must not show signs of deterioration and the body must not be damaged, otherwise they should be replaced.

CLEAN THE AIR FILTER

Only proceed with engine off:

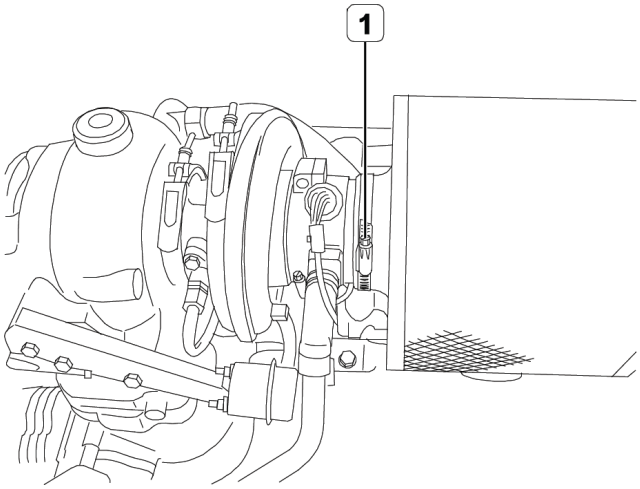

Figure 4

- Unlock the clamp (1), then remove the air filter.
- Blow a jet of dehumidified compressed air onto the filtering element, working from the inside out (maximum pressure 200 kPa).
- Check the wear of the air filter before refitting. Replace if it is broken or torn.
- Refit the air filter.
- Insert the clamp (1).

⚠ WARNING

Risk of damage

Do not use detergents or diesel to clean the air filter. Never strike the filter element with tools. Make sure that the parts are fitted correctly. Incorrect assembly could cause the engine to take in unfiltered air, causing serious damage to the engine.
Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

⚠ WARNING

Risk of injury

When using compressed air, it is required to use suitable personal protections for hands, face and eyes.The requirements can be found in the ACCIDENT PREVENTION paragraph. Failure to comply with these prescriptions can result in the risk of serious injury.

CHECK THE STATE OF CORROSION OF THE ZINC ANODES

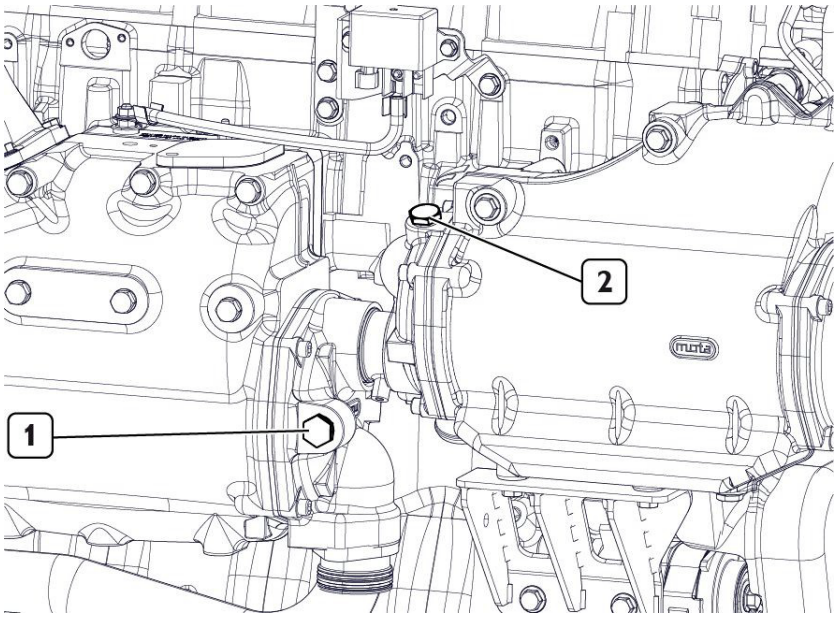

Figure 5

1. Only proceed with the operation when the engine is not in operation and is at a low temperature:
    1. Use suitable containers to ensure that while removing the anodes no water is released inside the hull.
    2. Remove the anodes (1) and (2) unscrewing them from their seat.
    3. Make sure that no more than 50% of the zinc has been affected by corrosion. Otherwise replace them.
    4. Reposition the anodes in their seat also replacing the sealing gaskets.

Components	Tightening torque
2 anodes M18 X 1.5	30 N•m

Check the condition of oil vapor filter

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

With a clogged sensor:

- Refer to the indications provided by the sensor and if a clogged status is signaled, replace the filter as indicated in this document.

With no clogged sensor:

- Remove as indicated in the instructions for replacement.
- Check that the filter element shows no sign of deposits and replace, if necessary.
- Reposition the filter in its seat following the indications provided for replacement.

Drain impurities from fuel tank

Carry out the draining/suction of water and condensation from the fuel tank following the instructions given in the manual supplied by the boat builder.

CHANGE THE ENGINE OIL

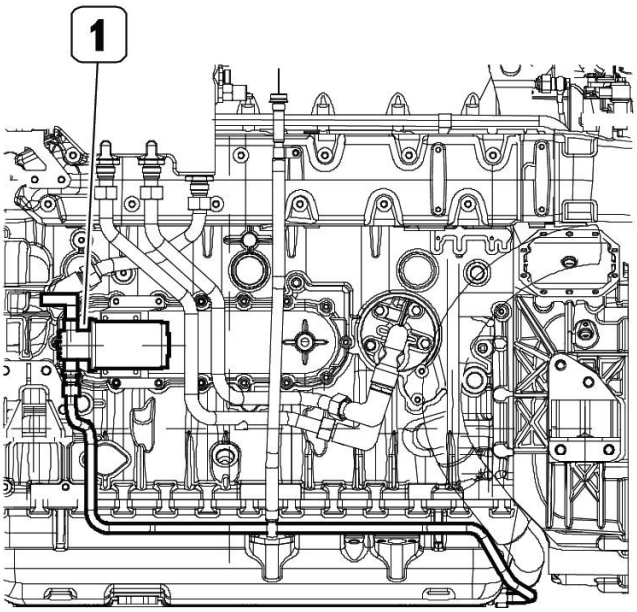

Figure 6

Proceed only with engine not running and at low temperature to avoid any risk of burns.

The operations for emptying and filling the engine oil are carried out by pressing the button located on the panel of the relative electronic module; for reasons of safety, the controls are only enabled when the power is on but engine is not started.

- Place a container for collecting the spent oil under the circuit charge/ discharge tap (1).
- Open the tap and move the button (A) on the panel to DISCHARGE until the sump is completely empty.

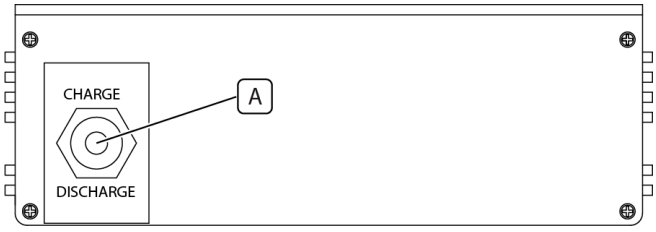

Figure 7

- Connect the tap to the container of the oil to be added and move the button on the panel to CHARGE until the specified quantity has been filled.
- Reclose the charge/discharge tap and use the dipstick to check that the oil quantity in the sump is between the MIN and MAX limits.
- Dispose of used oil according to current requirements.

CHANGE ENGINE OIL FILTERS

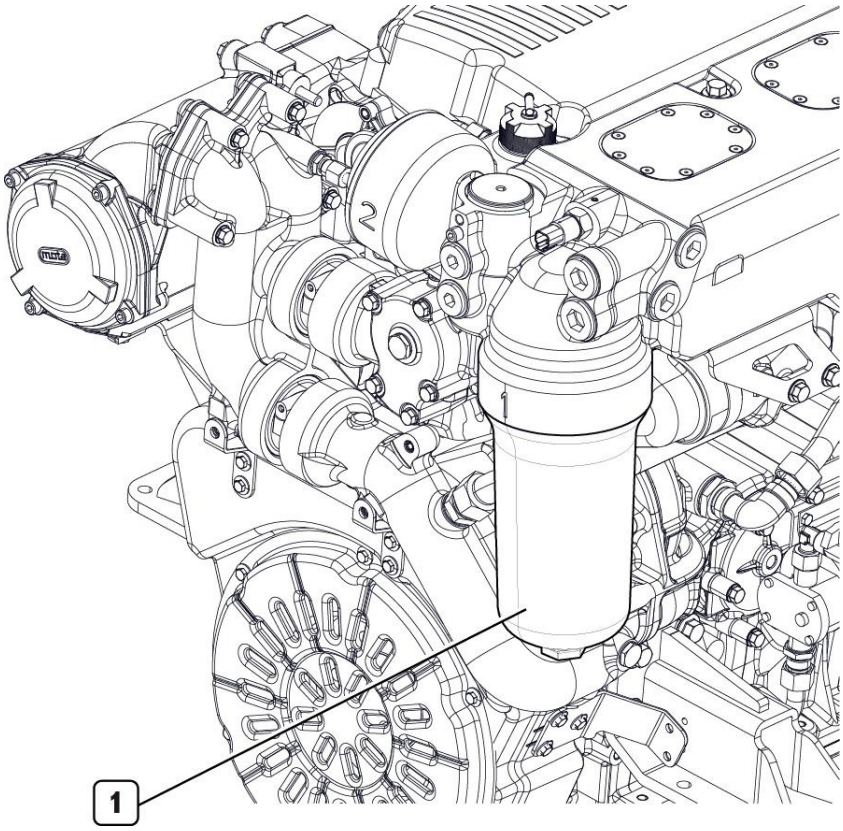

Figure 8

NOTE: *The following procedure is by way of example only.*

Only use original Yanmar filters.

Only proceed once the engine is stationary and has been allowed to cool, and preferably after having drained the waste oil, in order to avoid the risk of burns.

- Place a container under the filter support to collect the used oil.
- Unscrew and remove the filter (1).
- Carefully clean the surfaces.
- Apply a thin layer of oil on the sealing gasket of the new filters.
- Manually tighten the new filters on the bracket until it comes into contact with the gasket, then tighten by 3/4 of a turn.
- Dispose of the used filters according to the applicable regulations in force.

CHANGE THE FUEL FILTER

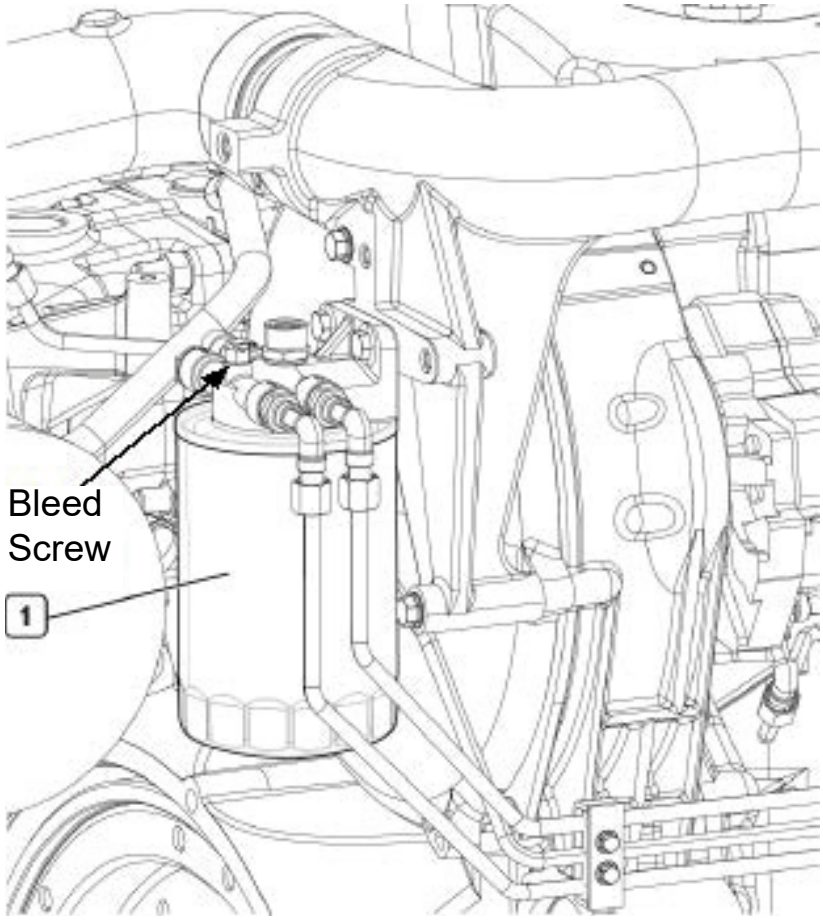

Figure 9

To avoid the risk of burns, only proceed once the engine is stationary and has been allowed to cool. Only use original Yanmar filters.

- Remove the filter (1) by unscrewing it.
- Moisten the sealing gasket of the new filter with diesel or engine oil.
- Manually tighten the new filter on the support until it comes into contact with the gasket, then tighten by 3/4 of a turn.
- Loosen the Bleed Screw on the filter mount and pump the pre-filter hand pump until the fuel comes out with no air bubbles present.
- Tighten the Bleed Screw and start the engine while pumping the hand pump during the first stages of start-up.

General directions

Do not fill the new fuel filter until it has been installed on the support, to prevent any damaging impurities from entering the fuel circuit and injection system.

NOTICE

Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

CHANGE FUEL PRE-FILTER

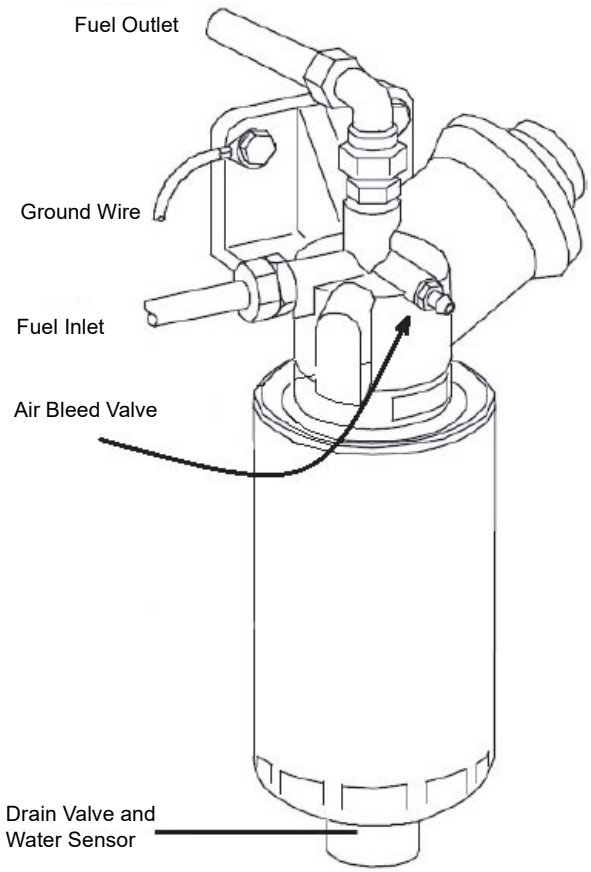

Figure 10

Proceed only with the engine not running and at a low temperature to avoid any risk of burns:

1. Place a bowl to collect any fuel which may come out from the pre-filter.
2. Disconnect the electrical connection from the Drain Valve and Water Sensor.
3. Loosen the Drain Valve and let all the fuel drain out.
4. Remove the pre-filter from the mounting bracket.
5. Install the new filter element on the mounting bracket.
6. Reinstall the Drain Valve and Water Sensor in the filter.
7. Connect the electrical connection to the Water Sensor.
8. Open the Air Bleed Valve and work the hand priming pump until only fuel comes out.
9. Close the Air Bleed Valve.

⚠ WARNING

Risk of injury

Dispose of consumable materials and the parts in contact with them (for example filters) in accordance with the law. The workshops of the Service Network are equipped for this purpose.

CHECK TENSION AND CONDITION OF AUXILIARY BELT

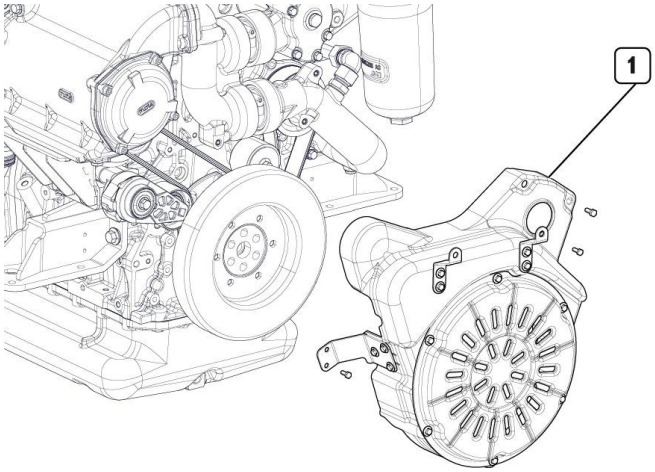

Figure 11

Proceed only with engine not running and at low temperature to avoid any risk of burns.

- Remove the belt cover (1) from the pulley and the belt.

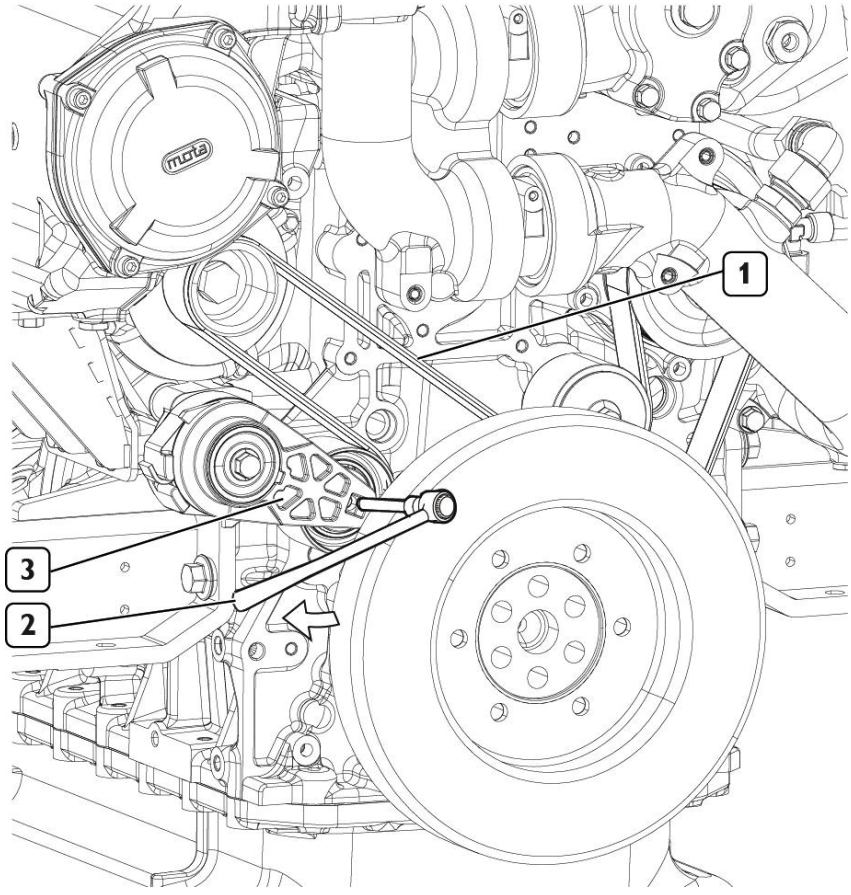

Figure 12

- Check that the belt (1) is not worn, soiled with oil or fuel, or showing signs of tears. If any of these conditions are identified, replace the belt.
- Check the efficiency of the tensioner (3) using the tool (2) on the tensioner as indicated in the figure.
- Reposition the belt cover in its seat and tighten the fasteners.

CHANGE ENGINE COOLANT

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Use suitable containers to ensure that the coolant is not dispersed into the environment.
- Remove the caps of the cooling system components and wait until the system has emptied completely (the position of the caps is indicated on page *10*). After emptying, refit the caps in their housings, ensuring that the sealing rings are intact.
- Refill the circuit completely as indicated in the table on page *28*.
- Run the engine briefly while observing the coolant level at the filler cap and top up as required.
- Bleed the coolant circuit as follows:
- Leave the engine idling and carefully loosen the screw positioned on the coolant tank beside the cap.
- Once a sufficient amount of time has passed, tighten the screw to the specified torque and stop the engine.
- Check the coolant level again and top up if necessary.

CHANGE AIR FILTER

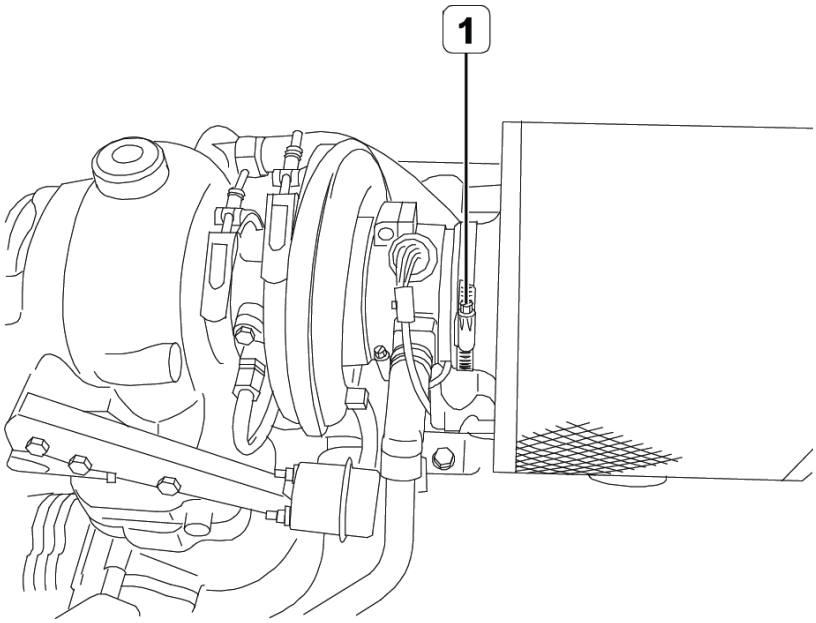

Figure 13

- Remove the filter after removing the clamp (1) indicated in the figure.
- Replace the part.
- Restore the correct operating conditions after having placed the filter in its seat.

CHANGE OIL VAPOR FILTERS

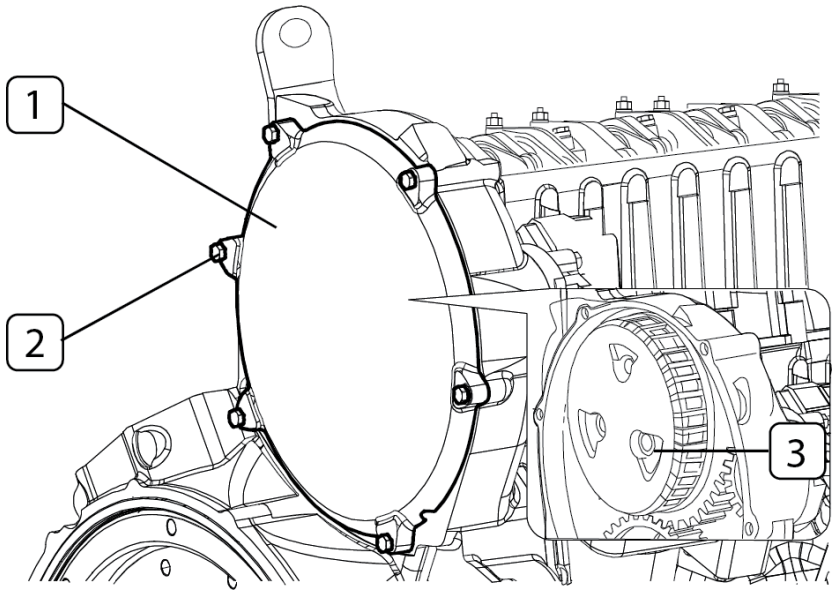

Figure 14

Only proceed when the engine is not turning and is at low temperature so as to prevent the risk of burns:

- Unscrew the screws (2) and remove the cover (1). Remove the centrifugal filter (3) below and replace it.
- Close the cover (1) and tighten the screws (2).

ATTENTION: *The blow-by body must be fit in perfect alignment with the camshaft to prevent damaging the gasket.*

PERIODIC AND EXTRAORDINARY MAINTENANCE OPERATIONS

Check wear of sea water pump impeller

Adjustment of valve/rocker arm clearance

Auxiliary component belt replacement

Cleaning of heat exchangers

Turbocharger checking

NOTICE

General instructions

The operations indicated above require the use of specific equipment which will guarantee that the result is safe, effective and of a good quality. It is recommended that these operations are carried out by qualified personnel belonging to the Yanmar Service Network. Consult an authorized Yanmar Marine dealer or distributor. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

CHANGE THE AUXILIARY BELT

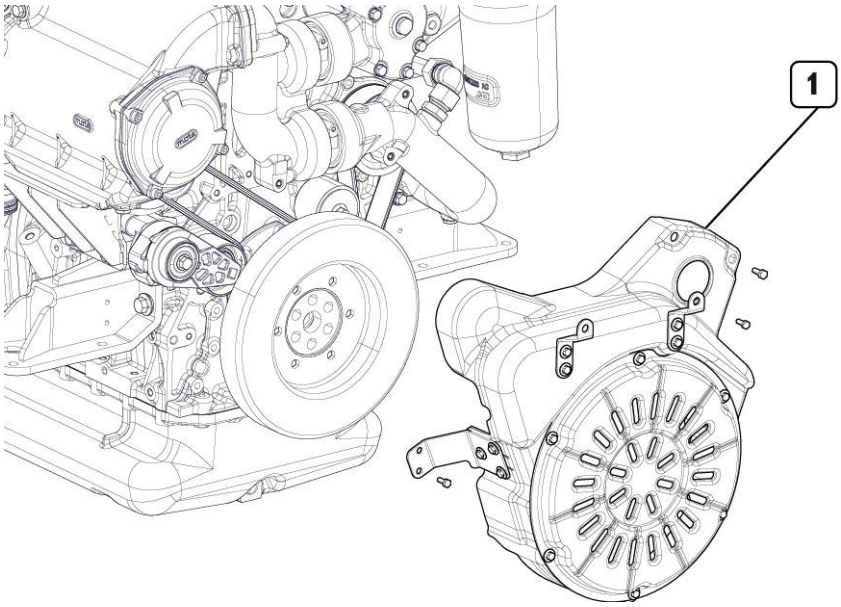

Figure 15

Only proceed with the operation when the engine is not in operation and is at a low temperature. This is to avoid the risk of burns:

- Remove the belt cover. (1)

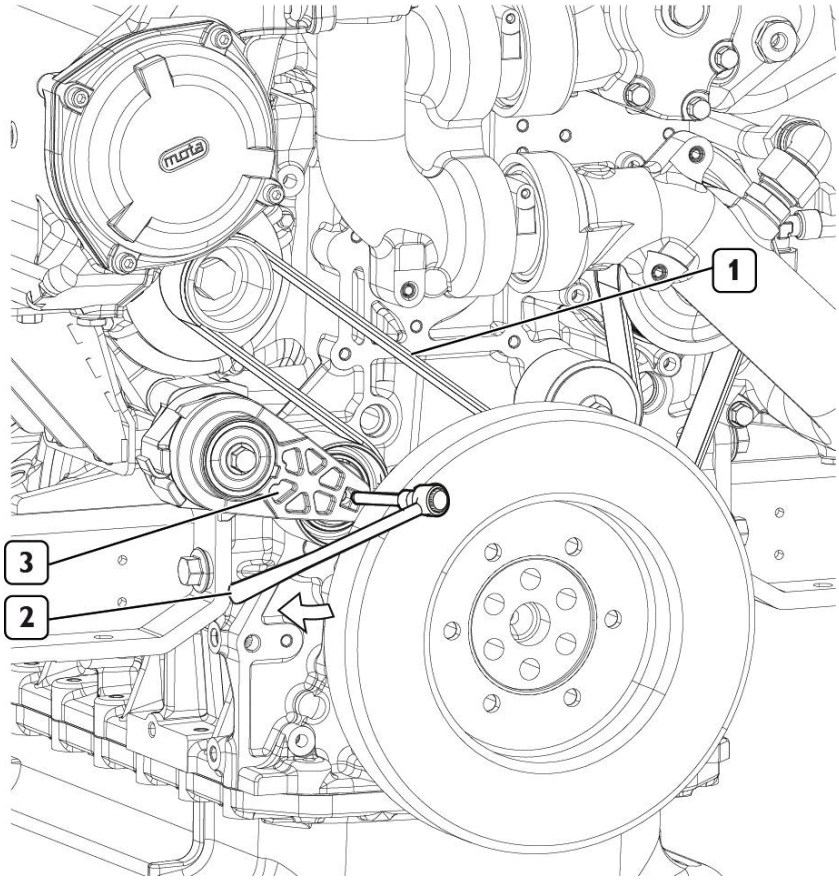

Figure 16

- Using a socket wrench (2), act on the belt tensioner (3) and remove the auxiliary belt (1).
- Fit the new belt (1) on the guide rollers and onto the belt tensioner (3) using the wrench (2).
- Check the correct operation of the belt tensioner (3).
- Reposition the belt cover in its seat and tighten the fasteners.

⚠ WARNING

Risk of damage

Replace the auxiliary belt if there is any sign of abrasion, cracks or tears, oil or fuel stains. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty.

⚠ WARNING

Risk of injury

When the engine is off, but still hot, the belt may start to move without warning. Wait for the engine temperature to decrease to prevent serious danger of an accident. Failure to comply with these prescriptions can result in the risk of serious injury.

LONG TERM STORAGE

The engine should be started and run for 30 minutes every 3 months. If this is not possible the following steps are required.

PREPARING THE ENGINE FOR LONG TERM STORAGE

3 months to 24 months

To prevent the interior parts of the engine and components of the injection system from rusting or corroding, prepare the engine as follows:

Arrange a place where the engine can be run at idle with a cooling water supply.

1. Drain the engine oil from the sump after warming up the engine.
2. Add Preservative Oil (*1) up to the “minimum” level indicated on the dipstick.
3. Connect the fuel circuit to a tank containing Calibration Fluid (*2) Start the engine and run it for approx. 10 min. Stop the engine and let it cool. Remove the air filter.
4. Prepare a sprayer with approx. 90 g (10 g per litre of displacement) Preservative Oil (*1).
5. Prepare to crank the engine without starting by energizing terminal 50 of the electric starter motor with positive system voltage using a specially arranged conductor.
6. Spray the Preservative Oil (*1) into the turbocharger inlet, while cranking the engine as described above for about 15 seconds.
7. Close all of the engine’s intake, discharge, ventilation and bleeding holes with plugs or seal them with adhesive tape.
8. Drain the residual Preservative Oil (*1) from the sump, which can be used for an additional 2 preparations.
9. Place warning notices “ENGINE WITHOUT OIL, WITH COOLANT” on the Engine and on the instrument panel.
10. Drain the coolant if it was not mixed with antifreeze and corrosion inhibitors, providing signs that this operation was performed.

To protect the external parts of the engine, spray the unpainted metal parts such as the flywheel, pulleys, etc. with Protective Spray (*3).
Do not spray it on belts, connector cables and electrical equipment.

(1) Preservative Oil - TECTYL® 915W40E, Petronas PROT 30M or equivalent (MILPRF-21260E2).
(2) Diesel Injection Calibration Fluid according to SAE J967 and ISO 4113.
(3) Protective Spray LPS®3 or equivalent.

ENGINE START-UP AFTER A LONG PERIOD OF INACTIVITY

1. Change the oil and fuel filters. Drain any residual Preservative Oil from the sump.
2. Fill the engine with engine oil of the type and quantity indicated in the table on page *28*.
3. Remove the plugs and/or seals from the engine's intake, discharge, ventilation and bleeder holes, restoring normal conditions of use. Reconnect the air filter to the turbocharger intake.
4. Connect the fuel supply circuit to the boat's tank. During initial startup, connect the fuel return pipe to a collection tank to prevent any residual Diesel Calibration Fluid from flowing into the fuel tank of the boat.
5. Check the engine and if necessary refill with coolant following the directions provided. Prime the seawater pump as described in the following section.
6. Start the engine and let it idle for at least 5 minutes.
7. Check that the indications on the dashboard are plausible and that there are no alarm signals.
8. Run the engine until the thermostat opens - coolant temperature of 68 °C, checking for leaks. Stop the engine.
9. Check fluid levels and top up as needed. Remove the warning notices of "ENGINE WITHOUT OIL" from the engine and instrument panel.

DIRECTIONS FOR THE FIRST START-UP AND START-UP AFTER A LONG PERIOD OF INACTIVITY

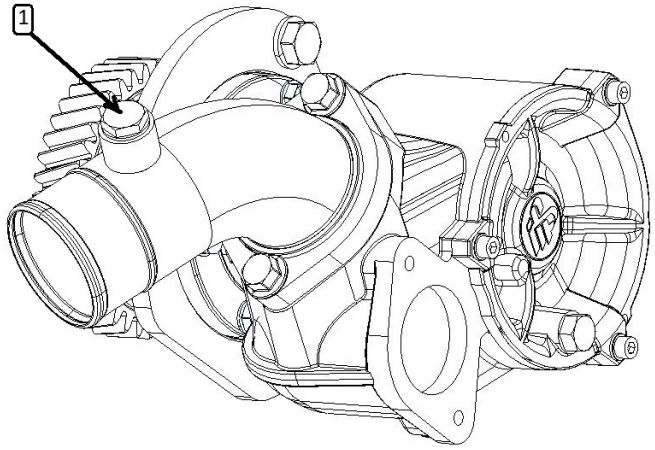

Figure 1

- Fill the engine according to the directions provided in the table on page *28*.
- Remove the plug (1) on the seawater inlet and introduce 1.5 L of water through the hole. This is necessary to allow priming of the seawater pump.
- Reposition the plug (1) in its seat.

Bleed the coolant circuit as follows:

- Leave the engine idling and carefully loosen the screw positioned on the coolant tank beside the cap.
- Once a sufficient amount of time has passed, tighten the screw to the specified torque and stop the engine.
- Check the coolant level again and top up if necessary.

ENGINE MALFUNCTIONS

ENGINE MALFUNCTION

The electronic unit which oversees management and control of the entire engine operation is able to recognize when any anomalies are occurring, and can adopt strategies which allow for safe navigation.

The event, signaled by the switching on of the EDC FAULT indicator on the dashboard involves the programmed limitation of power within the thresholds determined based on the severity of the situation.

In the case of temporary faults, the performance will be reduced until the engine stops.

If anomalies are detected in the engine control circuits, the engine's electronic control unit will adopt strategies defined as "minimum accelerated speeds" allowing safe navigation of the boat under emergency conditions.

ATTENTION: *The engine's electronic control unit may adopt the safety strategies at any point during navigation when conditions arise which could compromise the integrity of the engine. If any of these conditions occur, proceed with extreme caution checking that on-board personnel are firmly holding onto the safety grips.*

NOTE: *It is possible to proceed at higher speeds than the minimum accelerated speeds, controlling the start/stop functions, and the acceleration and deceleration functions as indicated on page 22.*

ATTENTION: *Engine control from the "Relay Box" requires exclusion of the controls from the bridge; as a result, the only way to quickly interrupt the propulsive thrust of the engine from the bridge involves acting on the Gearbox disengagement control.*

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SPECIFICATIONS

PRINCIPLE ENGINE SPECIFICATIONS

Specification		6LT500	6LT580	6LT640
Use		For light duty commercial use		For recreational use
Type		Vertical water cooled 4-cycle diesel engine		
Combustion System		Direct injection (Common rail system)		
Air Charging		Turbocharged with air cooler		
Number of Cylinders		6		
Bore x Stroke		117 mm x 135 mm		
Displacement		8.710 cm^3		
Fuel stop power		367 kW / 2530 min^{-1}*	426 kW / 2530 min^{-1}*	470 kW / 2530 min^{-1}*
Installation		Flexible mounting		
Fuel Injection Timing		Variable timing (Electronic control)		
Fuel Injection Pressure		Variable pressure (Maximum injection pressure: 160 MPa)		
Direction of Rotation	Crankshaft	Counterclockwise viewed from flywheel side		
Cooling System		Long Life Coolant with heat exchanger		
Lubrication System		Forced lubrication system		
Cooling Water Capacity (coolant)		38 L		
Lubricating Oil Capacity (engine)	Total	28 L		
	Effective	8.5 L		
Electrical System	Starter Type	Electric		
	Starting motor	DC 24 V - 5.5 kW		
	Alternator	24 V - 90 A		
	Battery	120 A·h or above, 2 x 900 A or above		
Marine gear		ZF305-3 or ZF305-3A		
Engine Dimension	Overall length	1978 mm		
	Overall width	881 mm		
	Overall height	994 mm		
Engine Dry Mass (including marine gear)		1225 kg		

* Rating Condition: Temperature of fuel; 40 °C at fuel pump inlet; ISO 8665 & Back pressure; 15 kPa

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EPA WARRANTY
USA ONLY

EPA WARRANTY USA ONLY

THIS EMISSION WARRANTY APPLIES TO THE ENGINES CERTIFIED TO UNITED STATES EPA 40 CFR Part 1042 AND SOLD BY YANMAR THAT ARE INSTALLED IN VESSELS FLAGGED OR REGISTERED IN THE UNITED STATES.

Your Warranty Rights and Obligations:

Yanmar warrants to the first user and each subsequent purchaser the emission control system on your engine for periods of time listed below provided the engine has been installed according to Yanmar installation requirements and there has been no abuse, neglect, or improper maintenance of your Yanmar Marine engine.

Yanmar warrants that the engine is designed, built and tested using genuine parts and equipped so as to conform to all applicable emission requirements of the U.S. Environmental Protection Agency and is free from defects in material and workmanship which would cause this engine to fail to conform to the applicable emission regulations over its limited emission control system warranty period.

Where a warrantable emissions condition exists, Yanmar will repair your engine at no charge to you for diagnosis, parts, and labor. Warranty service or repair will be provided at authorized Yanmar Marine dealers or distributors.

It is recommended that any replacement parts used for maintenance, repair or replacement of emission control systems are Yanmar parts. The owner may elect to have maintenance, replacement or repair of the emission control components and systems performed by any repair establishment or individual and may elect to use parts other than Yanmar parts for such maintenance, replacement or repair. However, the cost of such service or parts and subsequent failures from such service or parts will not be covered under this emission control system warranty:

Warranty Period:

The warranty starts on either the date of delivery to the first end-user, or the date the unit is first leased, rented, or loaned.

The warranty period is **five (5) years** or **1000 hours** of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of **five (5) years**.

Warranty Coverage:

Yanmar recommends that repair or replacement of any warranted parts be performed at an authorized Yanmar dealer or distributor. This limited emission control system warranty covers engine components that are a part of the emission control system of the engine as delivered by Yanmar to the original retail purchaser. Such components may include the following:

- Fuel Injection System
- Intake Manifold
- Exhaust Manifold
- Turbocharger System
- After cooler
- Electronic Engine Control Units and its associated Sensor and Actuators

Exclusions:

Failures other than those arising from defects in material and / or workmanship are not covered by this limited emissions warranty. This warranty does not extend to the following: malfunction caused by abuse, misuse, improper adjustment, modification, alteration, tampering, disconnection, improper or inadequate maintenance, improper storage or use of non-recommended fuels and lubricating oils, accident-caused damage, and replacement of expendable and / or consumable items made in connection with scheduled maintenance.

Yanmar disclaims any responsibility for incidental or consequential damages such as loss of time, inconvenience, loss of use of marine vessel / engine or commercial loss.

Owner’s Responsibility:

As the Yanmar Marine engine owner, you are responsible for the performance of the required maintenance listed in your *Operation Manual*. Yanmar recommends that you retain all documentation, including receipts, covering maintenance on your marine engine, but Yanmar cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with applicable emission requirements. You are responsible for initiating the warranty process. You are responsible for presenting your marine engine to an authorized Yanmar dealer or distributor as soon as a problem exists.

Customer Assistance:

If you have any questions regarding your warranty rights and responsibilities or would like information on the nearest authorized Yanmar dealer or distributor, you should consult Yanmar Marine International Americas Division for assistance.

EU DECLARATION OF CONFORMITY

Declaration of Conformity for Recreational Craft Propulsion Engines (inboard engines and stern drive engines without integral exhaust) with the requirements of the Recreational Craft Regulations 2017 as amended.

Name of engine manufacturer: FPT Industrial S.p.A.
Address: Via Puglia 15
Town: Torino **Post Code:** 10156 **Country:** Italy

Name of Authorised Representative: Yanmar Marine International B.V.
Address: Brugplein 11
Town: Almere **Post Code:** 1332BS **Country:** the Netherlands

Name of Notified Body for exhaust emission assessment: HPI-CEproof Ltd
Address: The Manor House Howbery Park
Town: Wallingford **Post Code:** OX108BA **Country:** United Kingdom **ID Number:** 1521

Module used for exhaust emission assessment: ☐ B+C ☒ B+D ☐ B+E ☐ B+F ☐ G ☐ H

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Propulsion Engine:		Fuel Type:		Combusion Cycle:	
☐	z or sterndrive without integral exhaust	☒	Diesel	☐	2 stroke
☒	Inboard engine	☐	Petrol	☒	4 stroke

Essential requirements	Standards Used	Other normative document used	See technical documen-tation
Annex I.B – Exhaust Emissions			
engine identification			5802836700 5802836963
exhaust emission requirements	EN ISO 18854:2015		
durability			UP0081
owner's manual			0A6LT-M000100 0B6LT-EN0010
Annex I.C – Noise Emissions	see craft manufacturer's Declaration of Conformity		

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):		Type examination certificate
Engine Type		Number of certificate
C87ENTM65Y	F2CJ0686G*Q F2CJ0686H*Q F2CJ0686J*Q	HPiUK-R1323-003-I-01-00

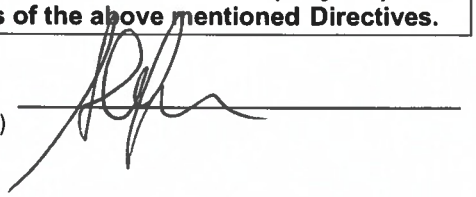
This declaration of conformity is issued under the sole responsibility of the engine manufacturer. I declare on behalf of the manufacturer that the recreational craft propulsion engine(s) mentioned above fulfil(s) the requirements specified in Part 2 Regulation 6 and Schedule I of the Recreational Craft Regulations 2017 as amended.

CAUTION

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 Directives.

Name / function: Alessandro Sezza / **Plant Director**
(identification of the person empowerred to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:
(or an equivalent marking)



Date and place of issue (dd/mm/yyyy): 22 /11 /2022 Torino, ITALY

UK Type Examination Certificate

This is to certify that the product listed below conforms to the requirements of the

Recreational Craft (Safety) Regulations 2017

SI 2017 no. 737 as amended: Schedule 1.B - Module B

Certificate Number	HPiUK-R1323-003-I-01-00
Date of Issue	05-Aug-2022
Date of Expiry	04-Aug-2032
Manufacturer	FTP Industrial S.p.A Via Puglia 15 Torino 10156 Italy
Engine Family ID:	C87ENTM65Y
Parent Engine	F2CJ0686G*Q
Models within engine family	F2CJ0686G*Q, F2CJ0686H*Q, F2CJ0686J*Q
Commercial description	Yanmar C87ENTM65Y
Description	Diesel Propulsion Engine
Standard applied & Cycle	ISO 18854:2015 / ISO 8178-4:2007 Test Cycle E3
Number of Test Report	RCDB00000AM

Check this certificate is genuine

Quality Director

Technical Director

This certificate is supported by a report bearing the same certificate number.
This certificate is the property of HPiVS & may not be amended or issued to others.
The manufacturer must inform HPiVS of any changes that affect any of the assessed Essential Requirements.
Failure to do this will invalidate the Certificate.

UK Approved Body No. 1521
Company registered in England #7217086

Tel +44 1491 822818
Email enquiries@hpivs.com
Web www.hpivs.com
HPi Verification Services Ltd.
The Manor House
Howbery Park, Wallingford
OX10 8BA, United Kingdom

Quality System Assessment Decision - Production

This is to certify that the product listed below conforms to the requirements of the

Recreational Craft (Safety) Regulations 2017

SI 2017 no. 737 as amended: Schedule 1.A - Module D

Certificate Number	HPiUK-R1323-014-Q-01-00		
Date of Issue	05-Aug-2022	**Date of Expiry**	04/08/2027
		Date of Surveillance	04/08/2023
Manufacturer	FPT Industrial S.p.A Via Puglia 15, 10156 Torino Italy		
Description of Product	Compression ignition marine engines		
Types covered by this certificate	C16ENTMP100, NEF-550Y, C87ENTM65Y, NEF-570, NX0ENTM-3, C90ENTMW, C8.7, C12.9, S30ENTM, N67ENTM-2, C87ENTM, NEF-550, C13ENTM83-2		
Premises covered	FPT Industrial S.p.A Via Puglia, 15, 10156 Torino, Italy		
Other Certifications	ISO 9001:2015 Certificate (DNV 214084-2017-AQ-ITA-ACCREDIA), RCDD0000007		
Standards Applied	ISO 18854:2015 / ISO 8178-4:2007 Test Cycle E3		
Type / Examination Cert Ref	See report reference		
Report Reference	HPiUK-R1323-014-Q-01-00		

This Certificate is valid in the United Kingdom.

This Report has been issued by HPi Verification Services Ltd. which is an Approved Body according to the provisions of the Recreational Craft (Safety) Regulations 2017 (Approved Body number 1521).

This Report is issued following the assessment of the documentation and implementation of the Quality System in accordance with the provisions of the quoted Conformity Assessment Module of the above regulations. The UK Mark may be affixed to the Pressure Equipment within the scope of approval as described above once the 'declaration of conformity' has been signed by the responsible person. The number '1521', being HPi Verification Services Ltd's Approved Body number should also be placed on the equipment dataplate.

Check this certificate is genuine

Quality Director

Technical Director

UK Approved Body No. 1521
Company registered in England #7217086

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