YANMAR

OPERATION MANUAL

BY series
4BY
6BY

BY series

OPERATION MANUAL

4BY
6BY

P/N: 0ABY0-G00100

YANMAR

MARINE ENGINES

Disclaimers:

All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Moreover, because of our continuous product improvement policy, we may modify information, illustrations and / or specifications to explain and / or exemplify a product, service or maintenance improvement. We reserve the right to make any change at any time without notice. Yanmar and YANMAR are registered trademarks of Yanmar Co., Ltd. in Japan, the United States and / or other countries.

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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 designed after 1996 meet most of the present and future emission regulations, such as BSO II, SAV, EPA II, IMO and RCD.

To help you enjoy your Yanmar BY 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 contact 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.

RECORD OF OWNERSHIP

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

Engine Model: _____

Engine Serial No.: _____

Date Purchased:_____

Dealer:_____

Dealer Phone:_____

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 labels. 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

Danger (the word "DANGER" is in white letters with a red rectangle behind it) – indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations.

0000001en

WARNING

Warning (the word "WARNING" is in black letters with an orange rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

0000001en

⚠ CAUTION

Caution (the word "CAUTION" is in black letters with a yellow rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

0000001en

CAUTION

Caution *without the safety alert symbol* indicates a potentially hazardous situation that can cause damage to the engine, personal property and / or the environment or cause the engine to operate improperly.

0000001enMarine

SAFETY PRECAUTIONS

Before You Operate

CAUTION

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.**
- **See your authorized Yanmar marine dealer or distributor for additional training.**

0000002enMarine

During Operation and Maintenance

DANGER

EXPLOSION HAZARD!

- Keep the area around the battery well-ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame and any other form of ignition away while the engine is running or battery is charging.
- Failure to comply will result in death or serious injury.

0000003en

DANGER

SCALD HAZARD!

- NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will escape and seriously burn you. Allow the engine to cool before attempting to remove the filler cap.
- Securely tighten the filler cap after checking the coolant level. Steam can escape during engine operation if the cap is loose.
- Failure to comply will result in death or serious injury.

0000002enMarine

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

0000009en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- NEVER use diesel fuel as a cleaning agent.
- Failure to comply will result in death or serious injury.

0000012en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- NEVER remove the fuel cap with the engine running.
- Failure to comply will result in death or serious injury.

0000011en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Only use the key switch to start the engine.**
- **NEVER jump start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.**
- **Failure to comply will result in death or serious injury.**

0000004en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.**
- **NEVER refuel with the engine running.**
- **Wipe up all spills immediately.**
- **Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.**
- **NEVER overfill the fuel tank.**
- **Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.**
- **Failure to comply will result in death or serious injury.**

0000005en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.**
- **Failure to comply will result in death or serious injury.**

0000015en

DANGER

EXPLOSION HAZARD!

- **NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
- **If the electrolyte is frozen, slowly warm the battery before you recharge it.**
- **Failure to comply will result in death or serious injury.**

0000007en

DANGER

NEVER start the engine unless the air filter is installed.

Failure to comply will result in death or serious injury.

0000025en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.**
- **NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.**
- **Failure to comply will result in death or serious injury.**

0000014en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **If the unit has an electric fuel pump, when you prime the fuel system, turn the key switch to the ON position for 10 to 15 seconds to allow the electric fuel pump to prime the system.**
- **If the unit has a mechanical fuel pump, when you prime the fuel system, operate the fuel priming lever of the mechanical fuel pump several times until the fuel filter cup is filled with fuel.**
- **NEVER open the air vent valve while the fuel system is being primed. The fuel filter has an internal air bleed port.**
- **Failure to comply will result in death or serious injury.**

0000010en

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **When you prime the fuel system, operate the fuel priming lever of the mechanical fuel pump several times until the fuel filter cup is filled with fuel.**
- **NEVER open the air vent valve while the fuel system is being primed. The fuel filter has an internal air bleed port.**
- **Failure to comply will result in death or serious injury.**

0000016en

⚠ DANGER

CRUSH HAZARD!

- **When you need to transport an engine for repair have a helper assist you attach it to a hoist and load it on a truck.**
- **NEVER stand under hoisted engine. If the hoist mechanism fails, the engine will fall on you, causing serious injury or death.**
- **Failure to comply will result in death or serious injury.**

0000008en

DANGER

CRUSH HAZARD!

- **ALWAYS use the engine lifting eyes when lifting the marine engine. The lifting eyes are engineered to lift the weight of the marine engine only.**
- **ALWAYS use lifting equipment with sufficient capacity to lift the marine engine. Additional equipment is necessary to lift the marine engine and marine gear together.**
- **NEVER stand under hoisted marine engine. If the hoist mechanism fails, the marine engine will fall on you, causing serious injury or death.**
- **Failure to comply will result in death or serious injury.**

0000026en

WARNING

SEVER HAZARD!

- **Keep hands and other body parts away from moving / rotating parts such as the flywheel or PTO shaft.**
- **Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.**
- **Remove all jewelry before you operate or service the engine.**
- **NEVER start the engine in gear. Sudden movement of the engine and / or vessel could cause death or serious personal injury.**
- **NEVER operate the engine without the guards in place.**
- **Before you start the engine make sure that all bystanders are clear of the area.**
- **Keep children and pets away while the engine is operating.**
- **Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.**
- **Failure to comply could result in death or serious injury.**

0000002enMarine

⚠ WARNING

EXHAUST HAZARD!

- **NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.**
- **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.**

0000003en

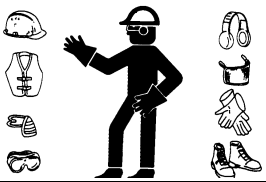
⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- **NEVER operate the engine while you are under the influence of alcohol or drugs.**
- **NEVER operate the engine when you are feeling ill.**
- **Failure to comply could result in death or serious injury.**

0000004en

⚠ WARNING



EXPOSURE HAZARD!

- **Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.**
- **NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the flywheel or PTO shaft.**
- **ALWAYS tie back long hair when you are working near moving / rotating parts such as a flywheel or PTO shaft.**
- **NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.**
- **Failure to comply could result in death or serious injury.**

0000005enMarine

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- **Be sure the boat is in open water away from other boats, docks, and other obstructions before increasing rpm.**
- **Failure to comply could result in death or serious injury.**

0000006enMarine

⚠ WARNING

BURN HAZARD!

- **Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If battery fluid contacts the eyes and / or skin, immediately flush the affected area with a large amount of clean water and obtain prompt medical treatment.**
- **Failure to comply could result in death or serious injury.**

0000007en

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar marine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

0000008enMarine

⚠ WARNING

SHOCK HAZARD!

- **Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.**
- **Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.**
- **Failure to comply could result in death or serious injury.**

0000009en

⚠ WARNING

WELDING SHOCK HAZARD!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable and the leads to the alternator when welding on the vessel.
- Remove the multi-pin connector to the engine control unit. 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 leads to the alternator and engine control unit prior to reconnecting the batteries.
- Failure to comply could result in death or serious injury.

0000117en

⚠ WARNING

ENTANGLEMENT HAZARD!

- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

0000010en

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Failure to comply could result in death or serious injury.

0000016en

⚠ WARNING

BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Failure to comply could result in death or serious injury.

0000011en

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before draining seawater from the cooling system. Hot seawater may splash and burn you.
- Failure to comply could result in death or serious injury.

0000016enMarine

⚠ WARNING

BURN HAZARD!

- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

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⚠ WARNING

FIRE HAZARD!

- Undersized wiring systems can cause an electrical fire.
- Failure to comply could result in death or serious injury.

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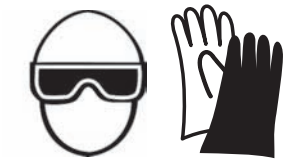
⚠ CAUTION

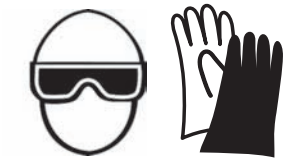


COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.**
- **Failure to comply may result in minor or moderate injury.**

0000005enMarine

⚠ CAUTION



COOLANT HAZARD!

When adding large amounts of coolant, NEVER pour cold coolant into a hot engine.

The cylinder block and cylinder head could crack.

00000029

⚠ CAUTION

FLYING OBJECT HAZARD!

- **ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.**
- **Failure to comply may result in minor or moderate injury.**

0000003en

CAUTION

- **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.**

0000004enBY

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

0000021en

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.

0000152en

CAUTION

The illustrations and descriptions of optional equipment in this manual, such as the operator's console, are for a typical engine installation. Refer to the documentation supplied by the optional equipment manufacturer for specific operation and maintenance instructions.

0000018en

CAUTION

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.

0000029en

CAUTION

NEVER hold the key in the START position for longer than 10 seconds or the starter motor will overheat.

0000201en

CAUTION

NEVER clean the coolant system with caustic soda. The aluminum parts may be damaged.

0000175en

CAUTION

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the engine and shorten its life. If adjustment is ever required, see your authorized Yanmar marine dealer or distributor.

0000045enMarine

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- **NEVER run the engine if the ambient temperature is above +40°C (+104°F) or below -16°C (+5°F)**
  - **If the ambient temperature exceeds +40°C (+104°F) the engine may overheat and cause the engine oil to break down.**
  - **If the ambient temperature falls below -16°C (+5°F) rubber components such as gaskets and seals will harden causing premature engine wear and damage.**
  - **See your authorized Yanmar marine engine dealer or distributor if the engine will be operated in either temperature extreme.**
- **See your 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.**

0000065enMarine

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- **Avoid operating in extremely dusty conditions.**
- **Avoid operating in the presence of chemical gases or fumes.**

0000003enMarine

CAUTION

- **Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and / or shorten engine life.**
- **Prevent dirt and debris from contaminating engine coolant. Carefully clean the heat exchanger cap and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.**

0000006enTrans

CAUTION

New Engine Break In:

- **On the initial engine start-up, check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.**
- **During the first 50 hours of operation operate your new engine under a substantial load at all times. For best break-in results operate the engine at various speeds.**
- **Operating the engine in NEUTRAL must be avoided. During the first 50 hours, avoid operation below 2000 rpm.**
- **During the break-in period, carefully observe the engine oil pressure and engine temperature.**
- **During the break-in period, check the engine oil and coolant levels frequently.**

0000011enMarine

CAUTION

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.

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CAUTION

If the alarm window with audible alarm fails to display and go out about three seconds later when the rocker switch is pushed to the ON position, see your authorized Yanmar marine dealer or distributor for service before operating the engine.

0000028enMarine

CAUTION

- **NEVER overfill the engine with engine oil.**
- **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

0000015enBY

CAUTION

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

0000008enYDG

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

0000009en

CAUTION

Make sure the engine is installed on a level surface. 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.

0000010enMarine

CAUTION

Be careful not to get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if it is damaged.

0000153enMarine

CAUTION

If seawater is left inside of the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0°C (32°F).

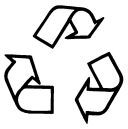
0000154en

CAUTION

NEVER allow engine oil or diesel fuel oil to contact the flexible rubber mount. Oil makes rubber deteriorate.

0000155en

CAUTION



- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

CAUTION

Protect the air cleaner, turbocharger and electric components from damage when you use steam or high-pressure water to clean the engine.

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CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine.

See your authorized Yanmar marine dealer or distributor for assistance when checking items marked with a ●.

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CAUTION

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.

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CAUTION

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

0000061en

CAUTION

- **When the engine is operated in dusty conditions, clean the air cleaner element more frequently.**
- **NEVER operate the engine with the air cleaner or element(s) removed. This may allow foreign material to enter the engine and damage it.**

0000026en

CAUTION

Clean or replace the air cleaner element if the air intake restriction exceeds the value listed in the Operation and Service Manuals.

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PRODUCT OVERVIEW

YANMAR BY-SERIES FEATURES AND APPLICATIONS

The BY-series engines are in-line 4- and 6-cylinder direct injection diesel engines. The engines are turbocharged and equipped with a liquid cooling system.

These engines are designed for pleasure craft use.

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

The engine must be installed correctly with the seawater or cooling water piping, exhaust gas piping and electrical wiring. Any auxiliary equipment attached to the engine should be easy to use and accessible for service. To handle the drive equipment, propulsion systems (including the propeller) and other onboard equipment be sure to observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

The laws of some countries may require hull and engine inspections, depending on the use, size and cruising area of the boat. The installation, fitting and surveying of this engine all require specialized knowledge and engineering skills. See Yanmar's local subsidiary in your region or your authorized Yanmar marine dealer or distributor.

This engine is designed for pleasure boat applications. The engine is designed to be operated at: Maximum throttle for less than 5% of its total operation time (30 minutes out of every 10 hours). The engine should be operated at cruising speed (3200 - 3300 rpm) for less than 90% of its total operation time (9 hours out of every 10 hours).

COMPONENT IDENTIFICATION

Left Side - 4BY

Figure 1, **Figure 2**, and **Figure 3** illustrate a typical version of a 4BY engine. Your engine may have different equipment from that illustrated.

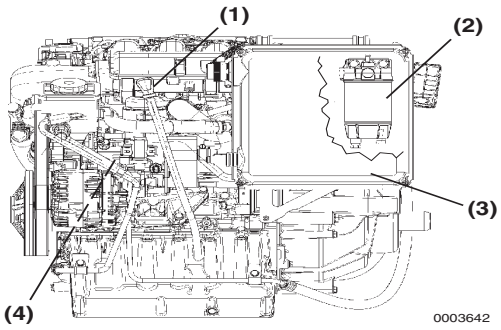


Figure 1

1 – Engine Oil Dipstick
2 – Fuel Filter / Water Separator
3 – E-Box Panel
4 – High Pressure Fuel Pump

Right Side - 4BY

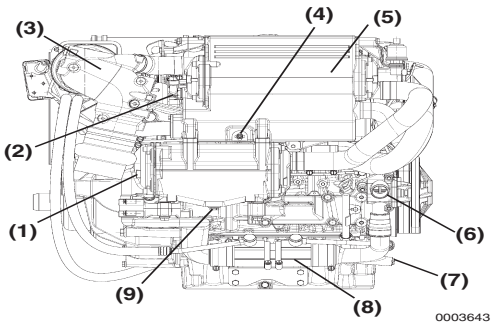


Figure 2

1 – Zinc Anode
2 – Zinc Anode
3 – Exhaust / Water Mixing Elbow
4 – Coolant Drain Cock
5 – Heat Exchanger
6 – Seawater Pump
7 – Seawater Drain Cock
8 – Hydraulic Oil Cooler
9 – Water Drain Plug

Top View - 4BY

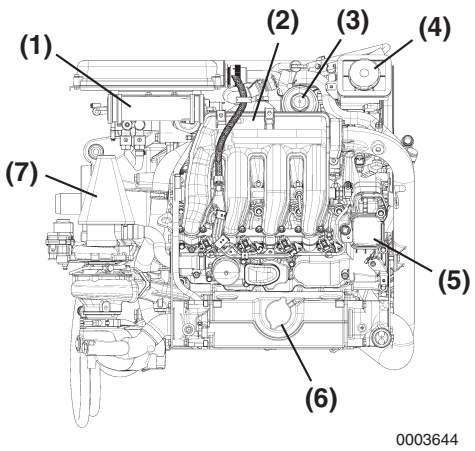


Figure 3

1 – Fuel Fine Filter
2 – Intake Air Manifold
3 – Engine Oil Filter
4 – Power Steering Filler Port (if equipped)
5 – Engine Oil Filler Port
6 – Coolant Filler Port
7 – Air Filter

Left Side - 6BY

Figure 4, **Figure 5**, and **Figure 6** illustrate a typical version of a 6BY engine. Your engine may have different equipment from that illustrated.

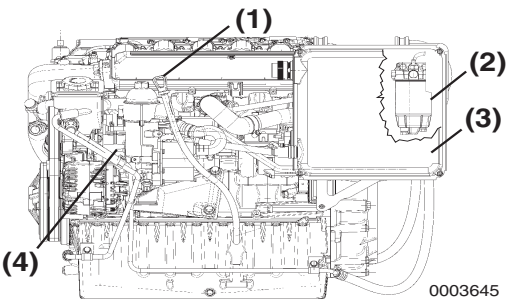


Figure 4

1 – Engine Oil Dipstick
2 – Fuel Filter / Water Separator
3 – E-Box Panel
4 – High Pressure Fuel Pump

Right Side - 6BY

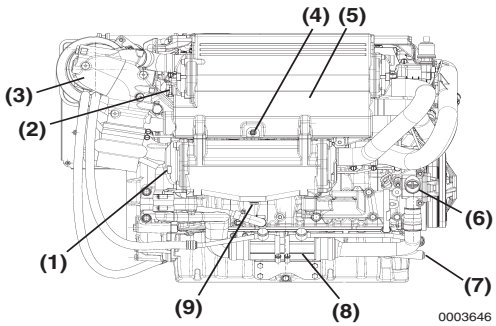


Figure 5

1 – Zinc Anode
2 – Zinc Anode
3 – Exhaust / Water Mixing Elbow
4 – Coolant Drain Cock
5 – Heat Exchanger
6 – Seawater Pump
7 – Seawater Drain Cock
8 – Hydraulic Oil Cooler
9 – Water Drain Plug

Top View - 6BY

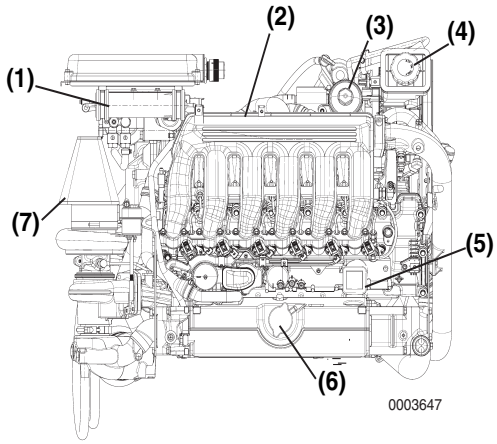


Figure 6

1 – Fuel Fine Filter
2 – Intake Air Manifold
3 – Engine Oil Filter
4 – Power Steering Filler Port (if equipped)
5 – Engine Oil Filler Port
6 – Coolant Filler Port
7 – Air Filter

LOCATION OF LABEL AND NAMEPLATES

The engine data and drive information nameplates on Yanmar BY series engines are shown in **Figure 7**. Replace if damaged or lost.

The typical location of the engine name plate is shown for Yanmar 4BY Series marine engines **(Figure 7)**. 6BY engines are similar.

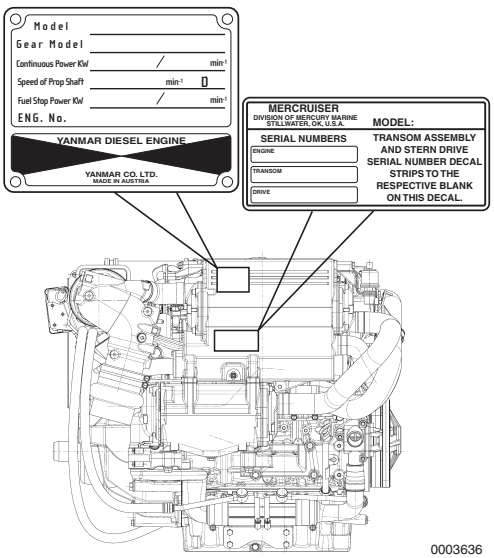


Figure 7

The engine block information label is located on the cylinder block behind the engine oil cooler near the end of the starting motor **(Figure 8)**.

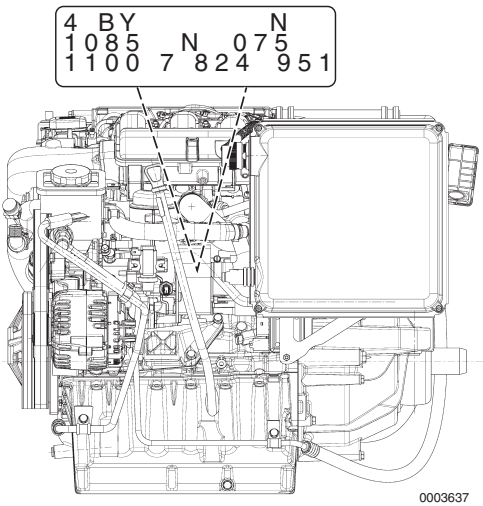


Figure 8

FUNCTION OF MAJOR COMPONENTS

Name of Component	Function
Fuel Filter / Water Separator	Removes dirt and water from the fuel. The filter element should be replaced periodically. *See Replace Fuel Filter / Water Separator Element on page 90*. The water separator should be drained periodically. *See Drain the Fuel / Water Separator on page 54.*
Fuel Fine Filter	Removes extremely fine contaminants from fuel prior to entering fuel injection system.
Fuel Feed Pump	Pumps fuel from the tank to the fuel injection system.
Engine Oil Fill Port	To add engine oil.
Engine Oil Filter	Filters fine metal fragments and carbon from the engine oil. Filtered engine oil is distributed to the engine's moving parts. The filter is a cartridge type and the element should be replaced periodically. *See Change the Engine Oil and Replace the Engine Oil Filter on page 83*.
Coolant System	There are two cooling systems: 1) closed cooling with coolant and 2) seawater. The engine is cooled by the closed cooling system. The closed system coolant is cooled by seawater using a heat exchanger. The seawater also cools the marine gear or power steering oil, and the combustion intake air through cooler(s) in an open circuit.
Closed Cooling Circulation Pump	The centrifugal coolant pump circulates coolant inside the engine. The circulating pump is driven by a poly V-belt.
Seawater Pump	Pumps seawater from outside vessel to the engine. The seawater pump is belt-driven and has a replaceable rubber impeller. Avoid impeller damage, do not operate it without seawater.
Coolant Fill Cap	When the coolant temperature rises, the pressure inside the heat exchanger increases, causing the pressure valve in the filler cap to open, forcing hot water and steam through a rubber hose to the coolant recovery tank. When the engine becomes cool and the pressure inside the coolant recovery tank drops, the vacuum valve in the filler cap opens and the coolant in the coolant recovery tank returns to the heat exchanger through the hose and filler cap. This minimizes coolant consumption.

Name of Component	Function
Coolant Recovery Tank	The coolant fill cap valve releases vapor and hot water overflow to the coolant recovery tank. When the engine stops and the coolant cools, the pressure in the heat exchanger drops. The fill cap valve then opens to send coolant back from the coolant recovery tank. This minimizes coolant consumption. The closed cooling system coolant level can easily be checked and refilled in this tank.
Oil Cooler - Engine	A heat exchanger that cools high temperature engine oil using engine coolant.
Oil Cooler - Hydraulic	A heat exchanger that cools the marine gear oil or power steering fluid using seawater.
Turbocharger	The turbocharger pressurizes the air coming into the engine. It is powered by a turbine that is driven by exhaust gases.
Air Filter	The air filter removes dirt from the intake combustion air reducing engine wear.
Nameplates	Nameplates are provided on the engine and the marine gear and have the model, serial number and other data.
Electrical Panel (E-Box)	The electrical panel houses the engine electrical system fuses, relays, and ECU. The ECU monitors data from the various sensors and controls such functions as low-pressure fuel pump operation, fuel injection pressure, fuel injection system volume, and the timing and volume of fuel injected by the Bosch electronic fuel injectors. Throttle control is fly-by-wire meaning it is controlled by electric signals from the helm. The throttle control is either analog or digital depending on the level of control options installed. The ECU also uses sensor inputs to monitor engine condition and will set a trouble code if a system or sensor indicates a problem. In most cases, a Check Engine light will be displayed. The engine may or may not run normally depending on the fault. Not all inputs are monitored by the ECU. Low oil pressure and water in fuel are two examples. Either of these conditions will result in a warning indicator and possible audible alarm. Low oil pressure will also be indicated by the oil gauge at the helm.
Electrical Panel (E-Box) Circuit Breaker (80 A)	The electrical panel circuit breaker is installed in the positive (+) cable of the electrical panel power lead, and provides overload protection for the electrical panel. The electrical panel power leads must be connected directly to the battery, and must have an 80 A breaker installed in the B+ (red) lead.

FUSES AND RELAYS

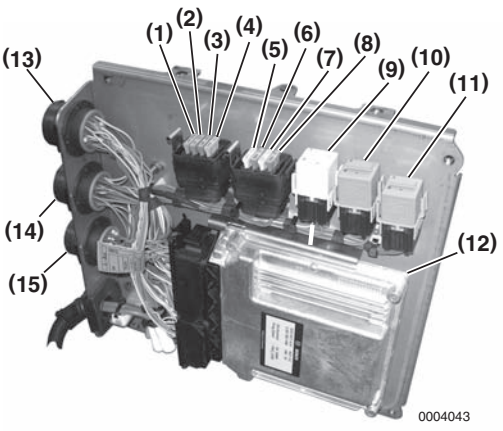


Figure 9

1 – Fuse F1 (3 A) - Switched B+ to CAN
2 – Fuse F2 (10 A) - B+ to Key Switch
3 – Fuse F3 (10 A) - Fuel Supply Pump
4 – Fuse F4 (30 A) - Switched B+ to ECU
5 – Fuse F5 (20 A) - Power to Sensors and Actuators
6 – Fuse F6 (10 A) - Auxiliary Power
7 – Jumper Fuse F7 (3 A) - Single / Starboard Selection
8 – Jumper Fuse F8 (3 A) - CAN / Analog Throttle Selection
9 – K1 - Starter Relay
10 – K3 - Fuel Supply Pump Relay
11 – K2 - Main Power Relay
12 – ECU
13 – Connector X1 - Communication to Helm Display
14 – Connector X21/1 - Engine Wiring Harness
15 – Connector X22/1 - Fuel Injector Wiring Harness

IMPORTANT

The electrical panel cables must be connected directly to the battery, and must have an 80 A circuit breaker installed in the B+ (red) lead.

ENGINE COVER

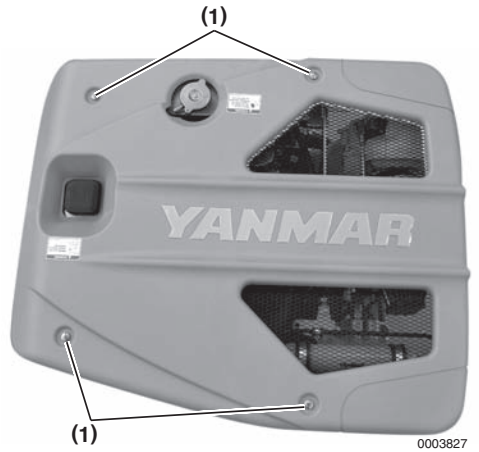


Figure 10

1. Turn screws **(Figure 10, (1))** one-quarter turn to loosen.
2. Lift cover off of engine.

BEFORE YOU OPERATE

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

CAUTION

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.**
- **See your authorized Yanmar marine dealer or distributor for additional training.**

0000002enMarine

⚠ DANGER

SCALD HAZARD!

- **NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will escape and seriously burn you. Allow the engine to cool before attempting to remove the filler cap.**
- **Securely tighten the filler cap after checking the coolant level. Steam can escape during engine operation if the cap is loose.**
- **Failure to comply will result in death or serious injury.**

0000002enMarine

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.**
- **NEVER refuel with the engine running.**
- **Wipe up all spills immediately.**
- **Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.**
- **NEVER overfill the fuel tank.**
- **Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.**
- **Failure to comply will result in death or serious injury.**

0000005en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.**
- **NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.**
- **Failure to comply will result in death or serious injury.**

0000014en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 500 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 500 hours of engine operation, whichever comes first.**
- **Failure to comply will result in death or serious injury.**

0000015enBY

⚠ WARNING

HIGH PRESSURE HAZARD!

- Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar marine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

0000008enMarine

⚠ WARNING

BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Failure to comply could result in death or serious injury.

0000011en

⚠ WARNING

BURN HAZARD!

- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

0000015enBY

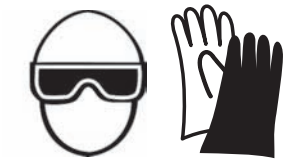
⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before draining seawater from the cooling system. Hot seawater may splash and burn you.
- Failure to comply could result in death or serious injury.

0000016enMarine

⚠ CAUTION

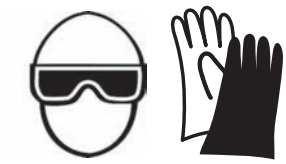


COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.**
- **Failure to comply may result in minor or moderate injury.**

0000005enMarine

⚠ CAUTION



COOLANT HAZARD!

When adding large amounts of coolant, NEVER pour cold coolant into a hot engine.

The cylinder block and cylinder head could crack.

00000029

CAUTION

NEVER hold the key in the START position for longer than 10 seconds or the starter motor will overheat.

0000201en

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

0000021en

CAUTION

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.

0000060enMarine

CAUTION

- **NEVER overfill the engine with engine oil.**
- **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

0000015enBY

CAUTION

- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

CAUTION

- **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.**

0000004enBY

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

0000005en

CAUTION

- **Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and / or shorten engine life.**
- **Prevent dirt and debris from contaminating engine coolant. Carefully clean the heat exchanger cap and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.**

0000006enTrans

DIESEL FUEL

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several specifications for diesel fuels.

DIESEL FUEL SPECIFICATION	LOCATION
No. 2-D, No. 1-D, ASTM D975-94	USA
EN590:96	European Union

Additional Technical Fuel Requirements

- The fuel cetane number should be equal to 48 or higher.
- The sulfur content must not exceed 0.3% by volume. Less than 0.05% is preferred.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Ash content not to exceed 0.01% by mass.
- 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.
- NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- NEVER use Biocide or mix winter and summer fuels.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and / or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance. See your authorized Yanmar marine dealer or distributor for more information.

Diesel Fuel Lines

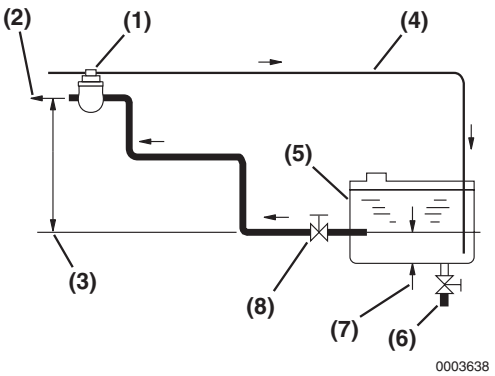


Figure 1

1 – Optional Boat Builder-Installed Fuel Filter / Water Separator (30 micron Pre-Filter)
2 – To Fuel Feed Pump
3 – Less Than 500 mm (19.68 in.)
4 – Fuel Return Line
5 – Fuel Tank
6 – Fuel Tank Drain Cock
7 – 20 - 30 mm (0.75 - 1.125 in.)
8 – Fuel Shutoff Valve

Shown is a typical installation of a boat fuel system. Fuel supply **(Figure 1, (2))** and return **(Figure 1, (4))** lines connect to fittings at the engine.

Filling the Fuel Tank

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.
- NEVER refuel with the engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.
- NEVER overfill the fuel tank.
- Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.
- Failure to comply will result in death or serious injury.

0000005en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Failure to comply will result in death or serious injury.

0000014en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.**
- **Failure to comply will result in death or serious injury.**

0000015en

CAUTION

- **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.**

0000004enBY

IMPORTANT

Operate bilge ventilation (blowers) for a minimum of 5 minutes to purge fumes from engine compartment after refueling.

Never operate bilge blower while refueling. Doing so can pump explosive fumes into the engine compartment and result in an explosion.

To fill the fuel tank:

1. Clean the area around the fuel cap.
2. Remove the fuel cap from the fuel tank filler port.
3. Stop fueling when the gauge shows the fuel tank is full. NEVER overfill the fuel tank.
4. Replace the fuel cap and hand-tighten. Over-tightening the fuel cap will damage it.

Bleeding the Fuel System

The fuel system needs to be bled under the following conditions:

- Before starting the engine for the first time.
- After running out of fuel and fuel has been added to the fuel tank.
- After fuel system maintenance such as changing the fuel filter and draining the fuel filter / water separator, or replacing a fuel system component.

The fuel feed pump is ECU-controlled and will operate for only 10 seconds when the key switch is turned ON while the engine is not running or being started. For this reason, the key switch must be repeatedly turned ON then OFF to sufficiently bleed the fuel system.

1. Turn the key switch on and leave on for 10 seconds.

CAUTION

NEVER hold the key in the START position for longer than 10 seconds or the starter motor will overheat.

0000201en

2. Turn key switch OFF for 5 seconds, then turn key switch ON for 10 seconds.
3. Repeat steps 1 and 2 five more times.

Note: The engine may run rough and misfire for a few seconds when first started until any remaining air is purged from the fuel system.

4. Attempt to start the engine. If the engine does not start within a reasonable time, repeat steps 1 and 2 until the engine starts and runs.

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

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ENGINE OIL

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

0000005en

Engine Oil Specifications

Use a full synthetic - long life engine oil that meets or exceeds the following guidelines and classifications:

Service Categories

- API Service Categories SM, SL, SJ, SH/CF
- ACEA Service Categories A3, B3 and B4

Definitions

- API Classification (American Petroleum Institute)
- ACEA Classification (Association des Constructeurs Européens d'Automobilies)

Notes:

1. Be sure the engine oil, engine oil storage containers, and engine oil filling equipment are free of sediment and water.
2. Change the engine oil after the first 50 hours of operation and then at every 250 hours thereafter.
3. Select the oil viscosity based on the ambient temperature where the engine is being operated. See the SAE Service Grade Viscosity Chart.
4. Yanmar does not recommend the use of engine oil "additives."

Engine Oil Viscosity

Select the appropriate engine oil viscosity based on the ambient temperature shown in the SAE Service Grade Viscosity Chart **(Figure 2)**.

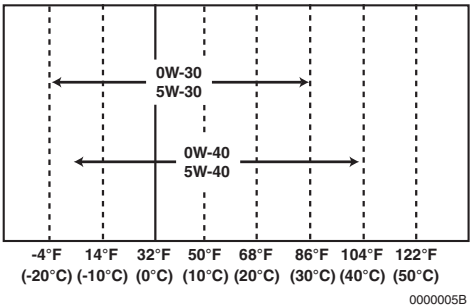


Figure 2

Recommended Engine Oil

LongLife 01 Oils

Trade name	Producer/Supplier
Addinol Super power MV 0537	Addinol Lube Oil GmbH
Agip Formula LL B 01	ENI S.p.A. Refining and Marketing Division
Agip Sint 2000 Evolution	ENI S.p.A. Refining and Marketing Division
Agip TECSINT SL	ENI S.p.A. Refining and Marketing Division
ALPINE Longlife	Mitan Mineralöl GmbH
Aral SuperTronic B	Aral
Aral SuperTronic G	Aral
AXCL S-Class Motor Oil	AXCL Gulf FZE
BMW Quality Longlife 01	BMW
BP Visco 7000	BP Oil International
BP Visco 7000 GM	BP Oil International
BP Visco 7000 Turbo Diesel	BP Oil International
Castrol Edge	Castrol Limited
Castrol Formula RS Power and Protection	Castrol Limited
Castrol Formula SLX	Castrol Limited
Castrol Formula SLX LL01	Castrol Limited
Castrol Formula SLX Long Tex	Castrol Limited
Castrol Formula SLX Turbodiesel	Castrol Limited
Castrol Syntec	Castrol Limited
Castrol Syntec 0W-30 European Formula	Castrol Limited
Castrol Super Racing 0W-40	Castrol Limited
Castrol TXT Softec LL01	Castrol Limited
Cepsa Star Mega Synthetic	Cepsa Lubricantes S.A.
Divinol Syntholight	Zeller+Gmelin
Elf Excellium Full-Tech	Total
Elf Excellium LDX	Total

Trade name	Producer/Supplier
Elf Excellium XLL	Total
Esso Ultron FE	ExxonMobil
Galp Formula XLD	Petrogal SA
Gulf Formula TLX	Total
Havoline Synthetic BM	Chevron Texaco
Havoline Ultra BM	Chevron Texaco
Igol Process Compact P	Igol France S.A.
INA Futura Compact P	INA Maziva Rijeka
Jet Top Level	ConocoPhillips GmbH
Labo RC	Fuchs Labo Auto S.A.
Liqui Moly Longtime High Tech	Liqui Moly
Megol Motorenöl New Generation	Meguin GmbH
Mobil 1	ExxonMobil
Mobil 1 Turbo Diesel	ExxonMobil
Mobil 1 Spezial XS	ExxonMobil
Motorex Profile B-XL	Bucher AG
Motorex Select SP-X	Bucher AG
Motul Specific LL-01	Motul S.A.
OMV full syn plus	OMV AG
Opaljet Longlife	Unil Opal
Panolin Exclusive BD	Panolin AG
Pennzoil European Formula Ultra	Pennzoil-Quaker State
Pentospeed 0W-30 VS*	Deutsche Pentosin-Werke
Petronas Syntium 3000 LL	Petronas
Q8 Formula Special	Kuwait Petroleum
Quaker State European Formula Ultra	Pennzoil-Quaker State
Ravenol HCL	Ravensburger Schmierstoffvertrieb GmbH
Repsol Elite Common Rail	Repsol YPF

Trade name	Producer/Supplier
Shell Helix Ultra AB	Shell International Petroleum Company
Shell Helix Ultra AL	Shell International Petroleum Company
Statoli LazerWay B	Statoil Lubricants
Tecar Motorenöl Supersyn	Techno-Einkauf GmbH
Titan Supersyn SL	Fuchs Petrolub AG
Titan Supersyn SL Longlife	Fuchs Petrolub AG
Tor Synthetic LL	De Oliebron
Total Activa Expertise 9000	Total
Total Quartz Expertise 9000	Total
Valvoline SynPower MXL	Valvoline
Veedol Powertron LL01	Veedol International
Veedol Syntron	Veedol International
Veritas Syntolube	Ölwerke Julius Schindler GmbH
Wako's Super Synthe	Wako Chemical Co.Ltd
Wintershall VIVA 1 Longlife	SRS Schmierstoff Vertrieb GmbH
Yacco VX 1600	Yacco S.A.S.

LongLife 04 Oils

Trade name	Producer/Supplier
Addinol Super power MV 0537	Addinol Lube Oil GmbH
Agip Formula MS B04	ENI S.p.A.
Aral SuperTronic	Aral
BMW Longlife-04	BMW
Castrol Edge Sport	Castrol Limited
Castrol Edge Turbo Diesel	Castrol Limited
Castrol Formula RS	Castrol Limited
Castrol GTX Magnatec	Castrol Limited
Castrol SLX LL-04	Castrol Limited
Castrol TXT LL-04	Castrol Limited
Elf Excellium LSX	Total
Galp Energy Ultra LS	Petrogal SA
Liqui Moly TopTec 4100	Liqui Moly
Midland ® Synova	Oel-Brack AG
Midland ® Synova	Oel-Brack AG
Mobil 1 ESP Formula	ExxonMobil
Motorenöl Low Emission	Meguin GmbH
Motul 1 Specific LL-04	Motul S.A.
OMV eco plus	OMV AG
Repsol Elite Evolution	Repsol YPF
Shell Helix Ultra AP	Shell International Petroleum Company
Titan GT1	Fuchs Petrolub AG
Wintershall VIVA 1 topsynth alpha LS	SRS Schmierstoff Vertrieb GmbH
York 848	Ginouves SAS

Checking Engine Oil

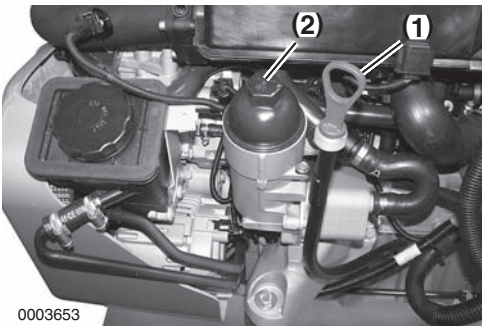


Figure 3

Note: 4BY series shown. 6BY is similar.

1. Remove dipstick **(Figure 3, (1))** and wipe with clean cloth.
2. Fully reinsert dipstick.

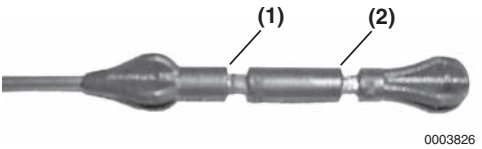


Figure 4

3. Remove dipstick. The oil level should be between upper **(Figure 4, (1))** and lower lines **(Figure 4, (2))** on the dipstick.
4. Fully reinsert dipstick.

Adding Engine Oil

CAUTION

- **NEVER overfill the engine with engine oil.**
- **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

0000015enBY

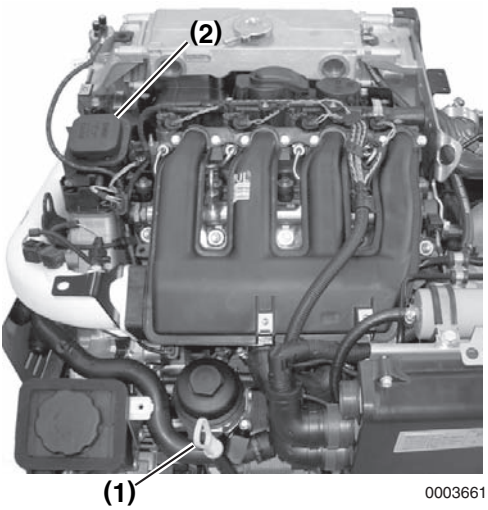


Figure 5

Note: 4BY series shown. 6BY is similar.

1. Remove the oil filler port cap **(Figure 5, (2))** and pour engine oil into filler port. *See Engine Oil Specifications on page 43*.
2. Fill with oil to the upper limit on the dipstick **(Figure 5, (1))**. Insert the dipstick fully to check the level.
3. Tighten the fill port cap securely by hand.

MARINE GEAR OR STERN DRIVE OIL

Refer to the instruction book for each marine gear or stern drive.

ENGINE COOLANT

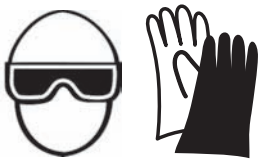
⚠ DANGER

SCALD HAZARD!

- **NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will escape and seriously burn you. Allow the engine to cool before attempting to remove the filler cap.**
- **Securely tighten the filler cap after checking the coolant level. Steam can escape during engine operation if the cap is loose.**
- **Failure to comply will result in death or serious injury.**

0000002enMarine

⚠ CAUTION



COOLANT HAZARD!

- **Wear eye protection and rubber gloves when you handle Long Life engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.**
- **Failure to comply may result in minor or moderate injury.**

0000005enMarine

CAUTION

- **Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and / or shorten engine life.**
- **Prevent dirt and debris from contaminating engine coolant. Carefully clean the filler cap and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.**

0000006enTrans

Recommended Engine Coolant

Trade Name	Manufacturer
Addinol Antifreeze Super	Addinol Lube Oil GmbH
Aral Antifreeze Extra	Aral AG
AVIA Antifreeze APN	AVIA Mineralöl AG
BMW Coolant	BMW AG
BP anti-frost X 2270A	BP Schmierstoff GMBH, Hamburg
Caltex CX Engine Coolant	Caltex
Castrol ANTI-FREEZE NF	Castrol International
Fridex G48	Velena s.a.
Glacelf Plus	Total
GlycoShell	Shell International
Glyco star	Bremin Mineralöl GmbH & Co.
Glysantin G48-24 Engine Coolant	UNICO Ltd.
Glysantin Protect Plus / G48	BASF
GUSOFROST LV 505	Chemische Industrielle Gesellschaft
Mobil Frostchutz 600	Mobil Schmierstoff GmbH
Havoline AFC (BD04)	Chevron Texaco/Arteco
Mobil Frostschutz 600	ExxonMobil
OMV Kühlerfrostschutz	OMV AG
Total Thermofreeze Plus	Total

POWER STEERING FLUID SPECIFICATIONS

Refer to the stern drive manufacturer's literature for power steering fluid specifications.

Checking Power Steering Fluid Level

1. Remove power steering filler cap.

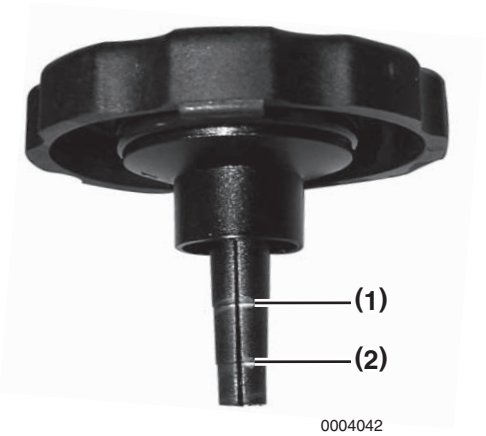


Figure 6

2. Power steering fluid level must be between the upper **(Figure 6, (1))** and lower **(Figure 6, (2))** level marks.
3. Add fluid if necessary.

DAILY CHECKS

Before you head out for the day, make sure the Yanmar engine is in good operating condition. Make sure you check the following items.

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar marine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

0000008enMarine

⚠ WARNING

ENTANGLEMENT HAZARD!

- **Stop the engine before you begin to service it.**
- **NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.**
- **If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.**
- **Failure to comply could result in death or serious injury.**

0000010en

CAUTION

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.

0000060enMarine

Visual Checks

1. Check the exterior of the engine for leaks, wear, or damage.
2. Check for engine oil leaks.
3. Check for fuel leaks.
4. Check for engine coolant leaks.
5. Check for damaged or missing parts.
6. Check for loose, missing, or damaged fasteners.
7. Check the seawater inlet and outlet for blockage or damage.
8. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
9. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

0000021en

Checking Diesel Fuel, Engine Oil, and Engine Coolant Levels

Follow the procedures in *Filling the Fuel Tank on page 40* and *Checking Engine Oil on page 48* to check these levels.

Checking the Battery Electrolyte Level

Check the battery electrolyte level before use. *See Check the Battery Electrolyte Level (Serviceable Batteries Only) on page 86.*

Checking the Alarm Indicators

Check the instruments and alarm indicators at regular intervals.

Preparing Fuel, Oil and Coolant in Reserve

Prepare sufficient fuel for the day's operation. Always store engine oil and coolant in reserve (for at least one refill) on board, to be ready for emergencies.

Checking Power Steering Fluid

See Checking Power Steering Fluid Level on page 52.

Drain the Fuel / Water Separator

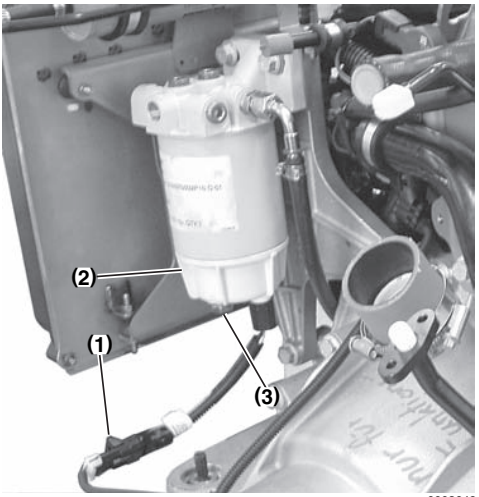


Figure 7

Check the fuel filter / water separator for presence of water and contaminants. If you find any water or contaminants, drain the fuel filter / water separator. If you have to drain the fuel filter / water separator frequently, drain the fuel tank and check for water in your fuel supply. *See Drain the Fuel Tank on page 88*.

1. Turn engine OFF.
2. Ensure the fuel cock is closed.
3. Loosen the drain plug **(Figure 7, (3))** at the bottom of the fuel filter / water separator and drain off any water or sediment.
4. Dispose of waste properly.
5. Tighten the drain plug and open the fuel cock.

ENGINE OPERATION

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

CAUTION

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.**
- **See your authorized Yanmar marine dealer or distributor for additional training.**

0000002enMarine

DANGER

EXPLOSION HAZARD!

- Keep the area around the battery well-ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame and any other form of ignition away while the engine is running or battery is charging.
- Failure to comply will result in death or serious injury.

0000003en

DANGER

FIRE AND EXPLOSION HAZARD!

- Only use the key switch to start the engine.
- NEVER jump start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
- Failure to comply will result in death or serious injury.

0000004en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- NEVER remove the fuel cap with the engine running.
- Failure to comply will result in death or serious injury.

0000011en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 500 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 500 hours of engine operation, whichever comes first.
- Failure to comply will result in death or serious injury.

0000015enBY

⚠ WARNING

SEVER HAZARD!

- Keep hands and other body parts away from moving / rotating parts such as the flywheel or PTO shaft.
- Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the engine.
- NEVER start the engine in gear. Sudden movement of the engine and / or vessel could cause death or serious personal injury.
- NEVER operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Failure to comply could result in death or serious injury.

0000002enMarine

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- Be sure the boat is in open water away from other boats, docks, and other obstructions before increasing rpm.
- Failure to comply could result in death or serious injury.

0000006enMarine

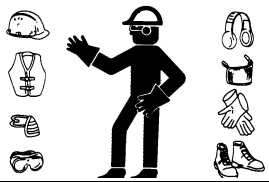
⚠ WARNING

EXHAUST HAZARD!

- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- 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.

0000003en

⚠ WARNING



EXPOSURE HAZARD!

- **Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.**
- **NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the flywheel or PTO shaft.**
- **ALWAYS tie back long hair when you are working near moving / rotating parts such as a flywheel or PTO shaft.**
- **NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.**
- **Failure to comply could result in death or serious injury.**

0000005enMarine

⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- **NEVER operate the engine while you are under the influence of alcohol or drugs.**
- **NEVER operate the engine when you are feeling ill.**
- **Failure to comply could result in death or serious injury.**

0000004en

⚠ WARNING

BURN HAZARD!

- **Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.**
- **Failure to comply could result in death or serious injury.**

0000015enBY

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- **Avoid operating in extremely dusty conditions.**
- **Avoid operating in the presence of chemical gases or fumes.**

0000003enMarine

CAUTION

NEVER hold the key in the START position for longer than 10 seconds or the starter motor will overheat.

0000201en

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

0000009en

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

0000021en

CAUTION

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

0000061en

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.

0000152en

STARTING THE ENGINE

1. Open the seacock (if equipped).
2. Open the fuel cock.
3. Turn the battery master switch (if equipped) ON.
4. Put remote control handle in NEUTRAL.
5. Ensure lanyard is connected to emergency stop switch.
6. Attach lanyard to clothing.
7. Turn key switch to ON. Ensure that the instrument panel indicators are powered and working.

CAUTION

NEVER hold the key in the START position for longer than 10 seconds or the starter motor will overheat.

0000201en

8. Turn key switch to START. Release the key switch when the engine has started.

Starting at Low Temperatures

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

0000009en

Comply with local environmental requirements. Use optional glow plugs (if equipped) to avoid starting problems and white smoke. Do not use starting aids such as gasoline or ether.

To limit white smoke, run the engine at low speed and under moderate load until the engine reaches normal operating temperature. A light load on a cold engine provides better combustion and faster engine warm-up than no load.

Avoid running the engine at idling speed any longer than necessary.

SHUTTING DOWN THE ENGINE

Under normal operating conditions, shut down the engine by turning the key switch to OFF.

There may be a delay of up to 3-seconds after turning the key to OFF. This is normal and allows the ECU computer to store data.

Emergency Shut Down

1. Ensure lanyard is connected to the emergency stop switch.
2. Attach the lanyard to a secure place on the operator's clothing or life vest - not where it might tear away.

   IMPORTANT

   Do not cut or re-tie the lanyard. If it is too long, shorten it by knotting or looping it.

   Test the emergency engine shut off switch before each outing.
3. Disconnecting the clip from the stop switch will stop the engine.

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.

0000152en

CHECKING THE ENGINE AFTER OPERATION

- Check that the key switch is in the OFF position and battery master switch (if equipped) is OFF.
- Fill the fuel tank. Make sure that the fill cap and the area around the fill opening are clean to avoid contamination of the fuel.
- Close seawater cock(s).
- If there is a risk of freezing, check that the cooling system contains enough coolant. *See Engine Coolant on page 49.*
- If there is a risk of freezing, drain the seawater system. *See Drain Seawater Cooling System on page 108*.

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PERIODIC MAINTENANCE

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

SAFETY PRECAUTIONS

Before You Operate

CAUTION

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.**
- **See your authorized Yanmar marine dealer or distributor for additional training.**

0000002enMarine

During Operation and Maintenance

DANGER

EXPLOSION HAZARD!

- **Keep the area around the battery well-ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.**
- **Keep sparks, open flame and any other form of ignition away while the engine is running or battery is charging.**
- **Failure to comply will result in death or serious injury.**

0000003en

DANGER

SCALD HAZARD!

- **NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will escape and seriously burn you. Allow the engine to cool before attempting to remove the filler cap.**
- **Securely tighten the filler cap after checking the coolant level. Steam can escape during engine operation if the cap is loose.**
- **Failure to comply will result in death or serious injury.**

0000002enMarine

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

0000009en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- NEVER use diesel fuel as a cleaning agent.
- Failure to comply will result in death or serious injury.

0000012en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- NEVER remove the fuel cap with the engine running.
- Failure to comply will result in death or serious injury.

0000011en

DANGER

FIRE AND EXPLOSION HAZARD!

- Only use the key switch to start the engine.
- NEVER jump start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
- Failure to comply will result in death or serious injury.

0000004en

DANGER

CRUSH HAZARD!

- When you need to transport an engine for repair have a helper assist you attach it to a hoist and load it on a truck.
- NEVER stand under hoisted engine. If the hoist mechanism fails, the engine will fall on you, causing serious injury or death.
- Failure to comply will result in death or serious injury.

0000008en

DANGER

FIRE AND EXPLOSION HAZARD!

- Diesel fuel is flammable and explosive under certain conditions.
- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.
- NEVER refuel with the engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.
- NEVER overfill the fuel tank.
- Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.
- Failure to comply will result in death or serious injury.

0000005en

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 500 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 500 hours of engine operation, whichever comes first.**
- **Failure to comply will result in death or serious injury.**

0000015enBY

DANGER

EXPLOSION HAZARD!

- **NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
- **If the electrolyte is frozen, slowly warm the battery before you recharge it.**
- **Failure to comply will result in death or serious injury.**

0000007en

DANGER

NEVER start the engine unless the air filter is installed.

Failure to comply will result in death or serious injury.

0000025en

⚠ WARNING

SEVER HAZARD!

- **Keep hands and other body parts away from moving / rotating parts such as the flywheel or PTO shaft.**
- **Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.**
- **Remove all jewelry before you operate or service the engine.**
- **NEVER start the engine in gear. Sudden movement of the engine and / or vessel could cause death or serious personal injury.**
- **NEVER operate the engine without the guards in place.**
- **Before you start the engine make sure that all bystanders are clear of the area.**
- **Keep children and pets away while the engine is operating.**
- **Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.**
- **Failure to comply could result in death or serious injury.**

0000002enMarine

⚠ WARNING

EXHAUST HAZARD!

- **NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.**
- **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.**

0000003en

⚠ WARNING

ALCOHOL AND DRUG HAZARD!

- NEVER operate the engine while you are under the influence of alcohol or drugs.
- NEVER operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

0000004en

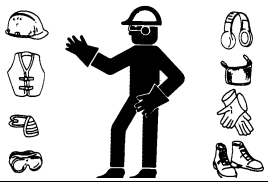
⚠ WARNING

BURN HAZARD!

- Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If battery fluid contacts the eyes and / or skin, immediately flush the affected area with a large amount of clean water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

0000007en

⚠ WARNING



EXPOSURE HAZARD!

- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving / rotating parts such as the flywheel or PTO shaft.
- ALWAYS tie back long hair when you are working near moving / rotating parts such as a flywheel or PTO shaft.
- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.
- Failure to comply could result in death or serious injury.

0000005enMarine

⚠ WARNING

SUDDEN MOVEMENT HAZARD!

- **Be sure the boat is in open water away from other boats, docks, and other obstructions before increasing rpm.**
- **Failure to comply could result in death or serious injury.**

0000006enMarine

⚠ WARNING

HIGH PRESSURE HAZARD!

- **Avoid skin contact with high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.**
- **NEVER check for a fuel leak with your hands. ALWAYS use a piece of wood or cardboard. Have your authorized Yanmar marine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

0000008enMarine

⚠ WARNING

SHOCK HAZARD!

- **Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.**
- **Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.**
- **Failure to comply could result in death or serious injury.**

0000009en

⚠ WARNING

ENTANGLEMENT HAZARD!

- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

0000010en

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Failure to comply could result in death or serious injury.

0000016en

⚠ WARNING

BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Failure to comply could result in death or serious injury.

0000011en

⚠ WARNING

BURN HAZARD!

- Wait until the engine cools before draining seawater from the cooling system. Hot seawater may splash and burn you.
- Failure to comply could result in death or serious injury.

0000016enMarine

⚠ WARNING

BURN HAZARD!

- Keep your hands, and other body parts, away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

0000015enBY

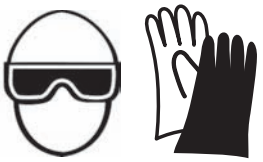
⚠ WARNING

FIRE HAZARD!

- Undersized wiring systems can cause an electrical fire.
- Failure to comply could result in death or serious injury.

0000027en

⚠ CAUTION



COOLANT HAZARD!

- Wear eye protection and rubber gloves when you handle Long Life engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.
- Failure to comply may result in minor or moderate injury.

0000005enMarine

⚠ CAUTION

FLYING OBJECT HAZARD!

- ALWAYS wear eye protection when servicing engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

0000003en

CAUTION

- **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.**

0000004enBY

CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

0000021en

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.

0000152en

CAUTION

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- **NEVER run the engine if the ambient temperature is above +40°C (+104°F) or below -16°C (+5°F)**
  - **If the ambient temperature exceeds +40°C (+104°F) the engine may overheat and cause the engine oil to break down.**
  - **If the ambient temperature falls below -16°C (+5°F) rubber components such as gaskets and seals will harden causing premature engine wear and damage.**
  - **See your authorized Yanmar marine engine dealer or distributor if the engine will be operated in either temperature extreme.**
- **See your 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.**

0000065enMarine

CAUTION

- **Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and / or shorten engine life.**
- **Prevent dirt and debris from contaminating engine coolant. Carefully clean the filler cap and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.**

0000006enTrans

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

0000005en

CAUTION

- **NEVER overfill the engine with engine oil.**
- **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

0000015enBY

CAUTION

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

0000008enYDG

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

0000009en

CAUTION

NEVER clean the coolant system with caustic soda. The aluminum parts may be damaged.

0000175en

CAUTION

Make sure the engine is installed on a level surface. 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.

0000010enMarine

CAUTION

New Engine Break In:

- **On the initial engine start-up, check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.**
- **During the first 50 hours of operation operate your new engine under a substantial load at all times. For best break-in results operate the engine at various speeds.**
- **Operating the engine in NEUTRAL must be avoided. During the first 50 hours, avoid operation below 2000 rpm.**
- **During the break-in period, carefully observe the engine oil pressure and engine temperature.**
- **During the break-in period, check the engine oil and coolant levels frequently.**

0000011enMarine

CAUTION

Be careful not to get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if it is damaged.

0000153enMarine

CAUTION

If seawater is left inside of the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0°C (32°F).

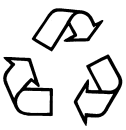
0000154en

CAUTION

NEVER allow engine oil or diesel fuel oil to contact the flexible rubber mount. Oil makes rubber deteriorate.

0000155en

CAUTION



- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

CAUTION

Protect the air cleaner, turbocharger and electric components from damage when you use steam or high-pressure water to clean the engine.

0000014enBY

CAUTION

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.

0000060enMarine

CAUTION

- **When the engine is operated in dusty conditions, clean the air cleaner element more frequently.**
- **NEVER operate the engine with the air cleaner or element(s) removed. This may allow foreign material to enter the engine and damage it.**

0000026en

CAUTION

Clean or replace the air cleaner element if the air intake restriction exceeds the value listed in the Operation and Service Manuals.

0000046enMarine

CAUTION

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

0000061en

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 operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.**
- **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.**

0000003en

The Importance of Daily Checks

Periodic Maintenance Schedules assume that the daily checks are performed on a regular basis. Make it a habit of performing daily checks before the start of each operating day. *See Daily Checks on page 52.*

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 50, 250, and 500 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

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.

Ask 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.

Required EPA Maintenance

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations Engines, it is essential that you follow the *Periodic Maintenance Schedule on page 79* and *Periodic Maintenance Procedures which start on page 83*.

EPA REQUIREMENTS

The EPA emission regulation is applicable only in USA.

Conditions to Ensure Compliance with EPA Emission Standards

This product is an EPA-approved engine.

The following are the conditions that must be met in order to ensure that the emissions during operation meet the EPA standards. Be sure to follow these:

The operating conditions should be as follows:

- Ambient temperature: -16° to +40°C (-3° to 104°F)
- Relative humidity: 80% or lower
- 4BY: Maximum exhaust backpressure: 18.0 kPa (1835 mmAq) or lower
  6BY: Maximum exhaust back pressure: 20.0 kPa (2039 mmAq) or lower
- Maximum air inlet restriction: 25 mbar

Be sure to perform inspections as outlined in *Periodic Maintenance Procedures on page 83* and keep a record of the results.

Pay particular attention to these important points:

- Replacing the engine oil
- Replacing the lube oil filter
- Replacing the fuel filter
- Cleaning the air filter

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

Inspection and Maintenance

See *Inspection and Maintenance of EPA Emission-Related Parts* on page *82*.

Inspection and maintenance procedures not shown in the *Inspection and Maintenance of EPA Emission-Related Parts* section are covered in *Periodic Maintenance Schedule* on page *79*.

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.

PERIODIC MAINTENANCE SCHEDULE

Daily and periodic maintenance is important to keep the engine in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on engine application, loads, diesel fuel and engine oil used and are hard to establish definitively. The following should be treated only as a general guideline.

CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine.

See your authorized Yanmar marine dealer or distributor for assistance when checking items marked with a ●.

0000024en6LY3

○: Check ◇: Replace ●: Contact your authorized Yanmar marine dealer or distributor

System	Item	Periodic Maintenance Interval			
		Daily	Every 50 hours or monthly whichever comes first	Every 250 hours or one year whichever comes first	Every 500 hours or 2 years whichever comes first
Whole	Visual inspection of engine exterior	○ Before starting			
Fuel System	Check for fuel leakage	○ Before starting			
	Check the fuel level and refill if necessary	○ Before starting			
	Drain water and sediment from fuel tank			○	
	Drain the fuel filter / water separator If necessary	○			
	Replace the fuel pre-filter			◇	
	Replace the fuel fine filter			◇	
	Replace fuel filter / water separator element			◇	
	Check the fuel pump and fuel lines				●
Lubricating System	Check the engine oil level and refill if necessary	○ Before starting			
	Change the engine oil and replace the oil filter element		◇ Initial 50	◇	
Cooling System - Engine Coolant	Visual inspection of cooling system	○ Before starting			
	Check coolant level and check for leaks	○ Before starting			
	Replace coolant				◇

○: Check ◇: Replace ●: Contact your authorized Yanmar marine dealer or distributor

System	Item	Periodic Maintenance Interval			
		Daily	Every 50 hours or monthly whichever comes first	Every 250 hours or one year whichever comes first	Every 500 hours or 2 years whichever comes first
Cooling System - Seawater Circuit	Visual inspection of cooling system	○ Before starting			
	Check the seawater outlet	○ Before starting			
	Check seawater pump belt for wear, replace if necessary			◇	
	Check seawater filter (if equipped) and inlet		○		
	Replace the zinc anodes*			◇	
	Check or replace the seawater pump impeller			●	
Air Intake and Exhaust System	Visual inspection	○ Before starting			
	Replace turbocharger heat shield			●	
	Check the exhaust pipe	○			
	Check the air intake pipes		○		
	Check the exhaust / water mixing elbow			●	
	Clean or replace the air filter element**			○	
Electrical System	Check the electrolyte level in the battery (serviceable batteries only)		○		
	Check the wiring connectors	○ Before starting			
	Check alternator belt for wear, replace if necessary			◇	

○: Check ◇: Replace ●: Contact your authorized Yanmar marine dealer or distributor

System	Item	Periodic Maintenance Interval			
		Daily	Every 50 hours or monthly whichever comes first	Every 250 hours or one year whichever comes first	Every 500 hours or 2 years whichever comes first
Miscellaneous Items	Check the alarm and indicators (if equipped)	○			
	Check or change power steering fluid	○		●	
	Check for water or oil leakage	○ Before starting			
	Check shift cable adjustment		● Initial 50	●	
	Adjust the propeller shaft alignment (if equipped with marine gear)		● Initial 50	●	
	Check hydraulic oil cooler			●	
	Check and replace rubberized hoses (fuel and water)			●	

* Check zinc anodes periodically. Any anode having less than 1/2 its original size remaining should be replaced - use this to establish a regular replacement interval.

** Recommendation: Use washing kit BMC WA250-355.

Note: These procedures are considered normal maintenance and are performed at the owner's expense.

Inspection and Maintenance of EPA Emission-Related Parts

Parts	Interval
Check turbocharger adjustment	3000 hours

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

PERIODIC MAINTENANCE PROCEDURES

After Initial 50 Hours of Operation

Perform the following maintenance after the initial 50 hours of operation.

- **Change the Engine Oil and Replace the Engine Oil Filter**
- **Check Shift Cable Adjustment**
- **Adjust the Propeller Shaft Alignment (If Equipped with Marine Gear)**

Change the Engine Oil and Replace the Engine Oil Filter

The engine oil on a new engine becomes contaminated from the initial break-in of internal parts. It is very important that the initial oil replacement is performed as scheduled.

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

⚠ WARNING

BURN HAZARD!

- **If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.**
- **ALWAYS wear eye protection.**
- **Failure to comply could result in death or serious injury.**

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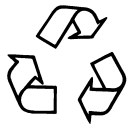
CAUTION



- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

1. Turn engine OFF.
2. Remove engine cover.

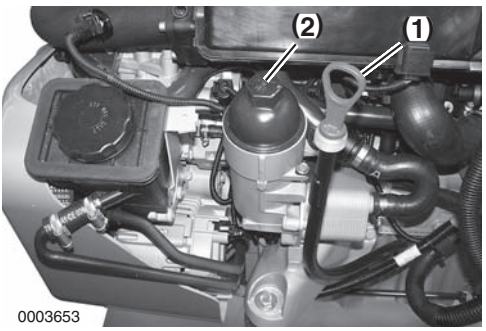


Figure 1

3. Loosen the engine oil filter cap **(Figure 1, (2))** 1 - 2 turns with a socket wrench. Allow to sit a few minutes to allow oil to drain into crankcase.
4. Remove the engine oil dipstick **(Figure 1, (1))**. Attach an oil drain pump and pump out the oil. Dispose of waste properly.
5. Remove the engine oil cap and filter assembly.
6. Remove the filter element from stem.

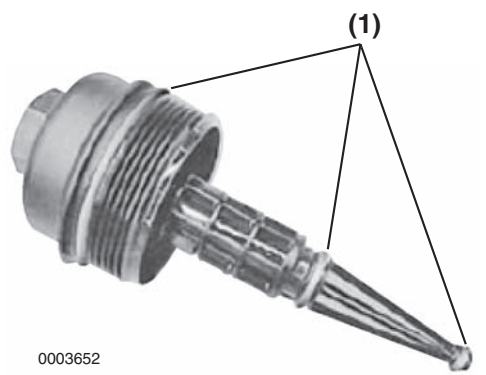


Figure 2

7. Replace the three O-rings **(Figure 2, (1)**) on the stem.
8. Install a new filter element. Ensure the filter fits snugly in the filter cap.
9. Install the cap and filter assembly. Tighten cap by hand until the seal touches the housing.
10. Tighten to 25 N·m (225 in.-lb).

CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.**
- **Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

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11. Fill with new engine oil. *See Adding Engine Oil on page 48.*

CAUTION

- **NEVER overfill the engine with engine oil.**
- **ALWAYS keep the oil level between upper and lower lines on the dipstick.**

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12. Perform a trial run and check for oil leaks.

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

Check Shift Cable Adjustment

See your authorized Yanmar dealer or distributor.

Adjust Propeller Shaft Alignment (If Equipped with Marine Gear)

The flexible engine mounts are slightly compressed during initial engine operation and may cause misalignment between the engine and the propeller shaft.

This adjustment requires specialized knowledge and techniques. See your authorized Yanmar dealer or distributor.

Every 50 Hours of Operation

After you complete the initial 50 hour maintenance procedures, perform the following procedures every 50 hours thereafter.

- **Check Seawater Filter (If Equipped) and Inlet**
- **Check the Air Intake Pipes**
- **Check Battery Electrolyte Level (Serviceable Batteries Only)**

Check the Seawater Filter (If Equipped) and Inlet

Refer to boat builder's literature for information on the seawater filter.

Check the Air Intake Pipes

Check the air intake system for damage or wear. If necessary, consult your authorized Yanmar dealer or distributor for repair.

Check the Battery Electrolyte Level (Serviceable Batteries Only)

⚠ WARNING

BURN HAZARD!

- **Batteries contain sulfuric acid. NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result. ALWAYS wear safety goggles and protective clothing when servicing the battery. If battery fluid contacts the eyes and / or skin, immediately flush the affected area with a large amount of clean water and obtain prompt medical treatment.**
- **Failure to comply could result in death or serious injury.**

0000007en

CAUTION

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

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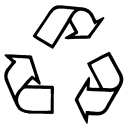
CAUTION



- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

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Check the Battery Electrolyte Level (Continued)

IMPORTANT

NEVER attempt to remove the covers or fill a maintenance-free battery.

1. Turn the battery master switch OFF (if equipped) or disconnect the negative (-) battery cable.
2. Do not operate with insufficient battery electrolyte as the battery will be destroyed.
3. Remove the caps and check the electrolyte level in all cells.

4. If the level is lower than the minimum fill level **(Figure 3, (1))**, fill with distilled water **(Figure 3, (2))** (available locally) up to the upper limit **(Figure 3, (3))** of the battery.

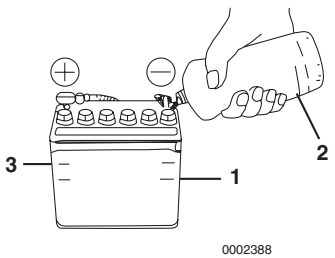

Figure 3

Note: The maximum fill level is approximately 10 - 15 mm (3/8 - 9/16 in.) above the plates.

Battery fluid tends to evaporate in high temperatures, especially in summer. In such conditions, inspect the battery more often.

Every 250 Hours of Operation

Perform the following maintenance every 250 hours of operation.

- **Drain the Fuel Tank**
- **Replace the Fuel Pre-Filter**
- **Replace the Fuel Fine Filter**
- **Replace the Fuel Filter / Water Separator Element**
- **Change the Engine Oil and Replace the Engine Oil Filter Element**
- **Check or Replace the Seawater Pump Belt**
- **Replace the Zinc Anodes**
- **Check or Replace the Seawater Pump Impeller**
- **Replace the Turbocharger Heat Shield**
- **Check the Exhaust / Water Mixing Elbow**
- **Clean or Replace the Air Filter Element**
- **Check or Replace the Alternator Belt**
- **Change the Power Steering Fluid**
- **Check the Shift Cable Adjustment**
- **Adjust the Propeller Shaft Alignment**
- **Check the Hydraulic Oil Cooler**
- **Check or Replace Rubber Hoses**

Drain the Fuel Tank

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

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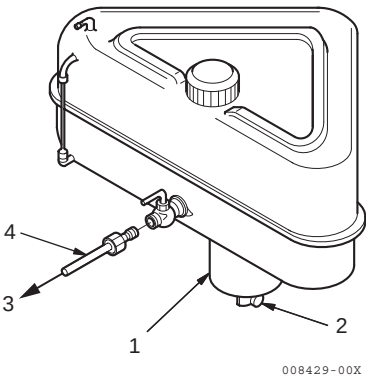

Figure 4

Note: Typical fuel tank shown. Actual equipment may differ.

1. Turn engine OFF.
2. Put a container under the drain cock **(Figure 4, (2))** to catch fuel.
3. Open the drain cock and drain water and sediment. Close the drain cock when the fuel is clean.
4. Dispose of waste properly.

Replace the Fuel Pre-Filter

See the boatbuilder's information for instructions.

Replace the Fuel Fine Filter

DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

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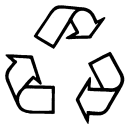
CAUTION



- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

1. Disconnect the battery negative (-) cable.
2. Close the fuel tank cock.

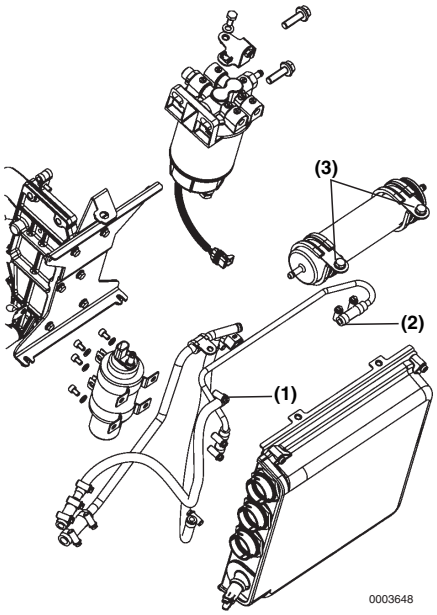


Figure 5

3. Loosen inlet **(Figure 5, (1))** and outlet **(Figure 5, (2))** hose clamps and remove hoses from filter.
4. Remove bolts **(Figure 5, (3))**.
5. Remove mounting brackets and install on new filter. Ensure fuel flow direction is correct.

IMPORTANT

When replacing fuel filters, always pre-fill them with fresh, clean fuel to improve the system ability to be bled.

6. Install on electrical bracket and tighten screws securely.
7. Install hoses and tighten new clamps to specification. *See Hose Clamps on page 114.*
8. Connect battery negative (-) cable.
9. Bleed the fuel system and check for leaks. *See Bleeding the Fuel System on page 41.*

Replace Fuel Filter / Water Separator Element

⚠ DANGER

FIRE AND EXPLOSION HAZARD!

- **Diesel fuel is flammable and explosive under certain conditions.**
- **When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.**
- **NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.**
- **Wipe up any spills immediately.**
- **Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.**
- **Failure to comply will result in death or serious injury.**

0000009en

CAUTION

- **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 irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

0000013en

1. Disconnect the battery negative (-) cable.
2. Close the fuel tank cock.

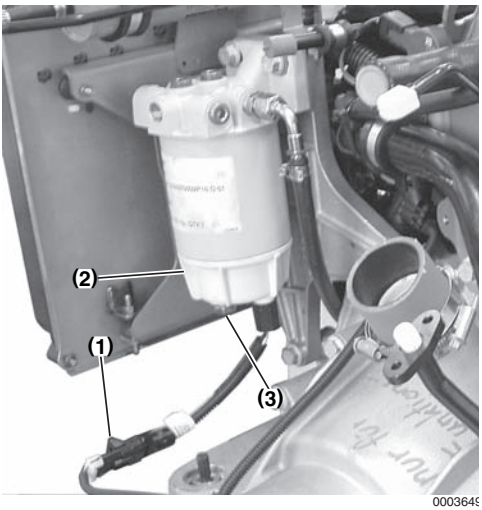


Figure 6

3. Loosen the drain plug **(Figure 6, (3))** on the bottom of the fuel filter / water separator and drain off any water or sediment.
4. Disconnect water sensor connector **(Figure 6, (1))**.
5. Turn the filter bowl **(Figure 6, (2))** counterclockwise to remove.
6. Remove the old filter element.

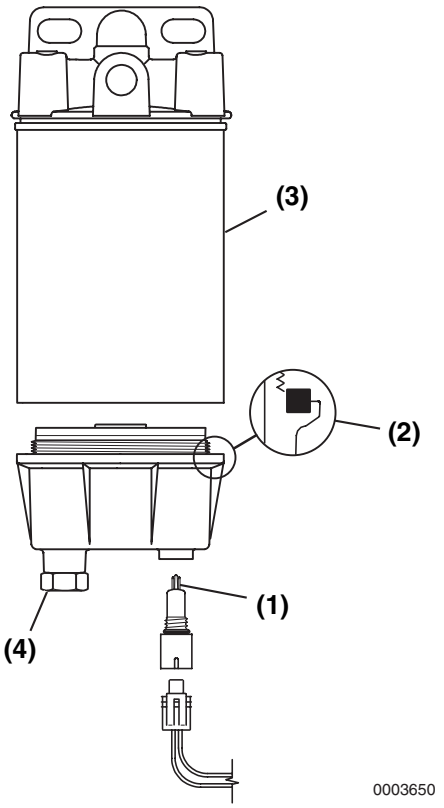


Figure 7

7. Clean the filter bowl. Inspect the water sensor probe **(Figure 7, (1))** for damage. Inspect the bowl seal **(Figure 7, (2))**.

IMPORTANT

When replacing fuel filters, always pre-fill them with fresh, clean fuel to improve the system ability to be bled.

8. Lubricate the seal at the top of the new filter element and install **(Figure 7, (3))**.
9. Lubricate the filter bowl seal and install the filter bowl. Turn clockwise by hand to tighten.
10. Ensure drain plug **(Figure 7, (4))** is securely tightened.
11. Connect water sensor connector.
12. Open the fuel tank cock.
13. Connect the battery negative (-) cable.
14. Bleed air from the fuel system and check for leaks. *See Bleeding the Fuel System on page 41.*

Change the Engine Oil and Replace Engine Oil Filter Element

To change engine oil and replace the engine oil filter element, see *Change the Engine Oil and Replace the Engine Oil Filter on page 83*.

Check or Replace the Seawater Pump and Alternator Belts

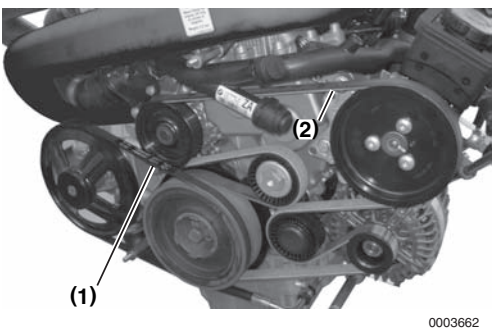


Figure 8

CAUTION

Be careful not to get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if it is damaged.

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1. Disconnect battery negative (-) cable from the battery.
2. Remove belt guard.

3. Check the seawater pump belt **(Figure 8, (1)**) and alternator belt **(Figure 8, (2)**) for wear, cracks or damage.
4. Replace if necessary. See your authorized Yanmar dealer or distributor.
5. Install belt guard and connect battery negative (-) cable.

Replace the Zinc Anodes

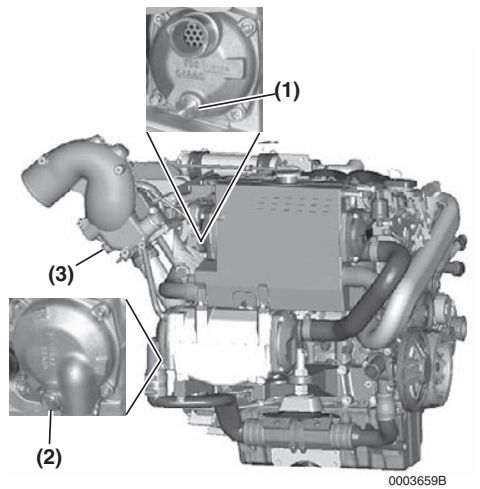

Figure 9

There are zinc anodes in the seawater cooling system and they should be inspected and replaced periodically.

Zinc anodes are located in the heat exchanger **(Figure 9, (1))** and the charge air cooler **(Figure 9, (2))**.

A zinc anode is also located in the optional high-rise elbow **(Figure 9, (3))**

1. Disconnect battery negative (-) cable.
2. Remove each anode and inspect for corrosion. Any anode having less than 1/2 its original size remaining should be replaced.

IMPORTANT

Never use thread sealer or thread sealing tape when installing zinc anodes. Anodes must make good metal-to-metal contact to perform properly.

3. Install each anode using a new copper gasket and tighten to 25 N·m (18 ft-lb).
4. Start engine and check for water leaks.

Check or Replace the Seawater Pump Impeller

See your authorized Yanmar dealer or distributor.

Replace the Turbocharger Heat Shield

See your authorized Yanmar dealer or distributor.

Check Exhaust / Water Mixing Elbow

See your authorized Yanmar dealer or distributor.

Clean or Replace Air Filter Element

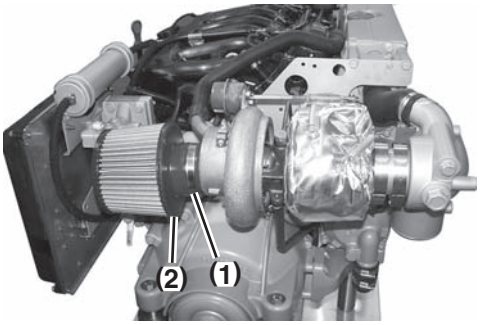

Figure 10

Note: Washing kit WA250-355 is recommended for cleaning. Consult your authorized Yanmar dealer or distributor for more information.

1. Turn engine OFF.
2. Remove engine cover.
3. Remove clamp **(Figure 10, (1)).**
4. Remove air filter **(Figure 10, (2)).**
5. Clean or replace as required.

Change Power Steering Fluid

See your authorized Yanmar dealer or distributor.

Check Shift Cable Adjustment

See Check Shift Cable Adjustment on page 85.

Adjust the Propeller Shaft Alignment

See Adjust Propeller Shaft Alignment (If Equipped with Marine Gear) on page 85.

Check Hydraulic Oil Cooler

See your authorized Yanmar dealer or distributor.

Check or Replace Rubber Hoses

Check rubber water and fuel hoses for wear or damage. See your authorized Yanmar dealer or distributor for replacement.

Every 500 Hours of Operation

Perform the following maintenance every 500 hours of operation.

- **Check the Fuel Pump and Fuel Lines**
- **Drain and Refill Closed Cooling System (Engine Coolant)**

Check the Fuel Pump and Fuel Lines

See your authorized Yanmar dealer or distributor.

Drain and Refill Closed Cooling System (Engine Coolant)

⚠ DANGER

SCALD HAZARD!

- **NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will escape and seriously burn you. Allow the engine to cool before attempting to remove the filler cap.**
- **Securely tighten the filler cap after checking the coolant level. Steam can escape during engine operation if the cap is loose.**
- **Failure to comply will result in death or serious injury.**

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1. Disconnect battery negative (-) cable.
2. Remove engine cover.
3. Remove the coolant pressure cap from heat exchanger.
4. Remove the heat exchanger to access the cylinder block drain plug behind it.

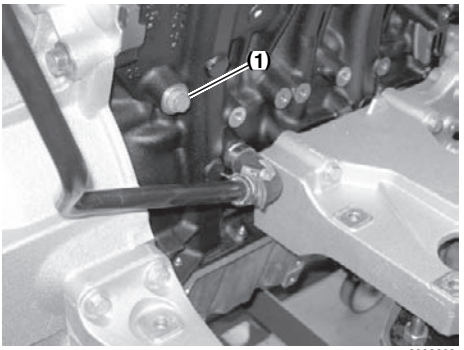

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Figure 11

Note: The charge air cooler has been removed for clarity of **Figure 11**.

5. Remove drain plug **(Figure 11, (1))** from the engine block. Allow coolant to drain into a container of appropriate size.
6. Install cylinder block drain plug with a new gasket.

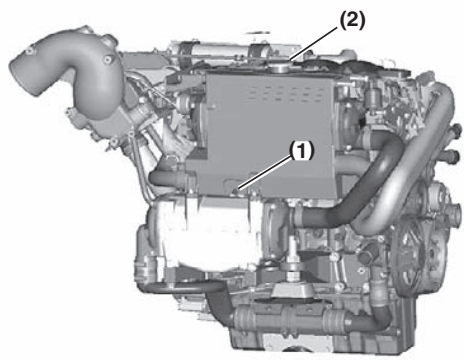

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Figure 12

7. Install heat exchanger. Ensure the drain cock **(Figure 12, (1))** on the heat exchanger is closed.
8. Remove the pressure cap **(Figure 12, (2))** from the heat exchanger.
9. Inspect the cap gasket and flange on the filler neck for damage. Replace if necessary.
10. Check the rubber hose connecting the coolant recovery tank to the heat exchanger. Be sure the hose is securely connected and there is no damage.
11. Pour coolant mix slowly into the heat exchanger to prevent the formation of air pockets. Fill until the heat exchanger is completely full.
12. Install the pressure cap and tighten firmly.
13. Remove the coolant recovery tank cap and fill with coolant mix to approximately 50 mm (2 in.) below the full line. Replace cap. Never fill to the full line.
14. After filling an empty cooling system, test-run the engine for about five minutes and check the engine coolant level at the recovery tank again.

TROUBLESHOOTING

If a problem occurs, stop the engine immediately. Refer to the Problem / Symptom column in the Troubleshooting Chart to identify the problem.

TROUBLESHOOTING CHART

Starting Trouble

Problem / Symptom	Cause	Action
Engine Will Not Crank	Discharged battery	Charge / replace battery
	Blown fuse	Replace fuse
	Defective starter motor	See your authorized Yanmar dealer or distributor
	Loose wiring connections	Tighten connections
	Electrical panel power circuit breaker is tripped	Reset circuit breaker
Engine Cranks but Will Not Start	No fuel to engine	Check fuel level in tank
		See your authorized Yanmar dealer or distributor
	No fuel to cylinders	Clean or replace clogged pre-filter (if equipped)
		Check fuel filter / water separator
		Clean or replace clogged fuel fine filter
		Bleed air from fuel system
		Replace blown fuse (F3)
		See your authorized Yanmar dealer or distributor
	Low ambient temperature	See your authorized Yanmar dealer or distributor
	Oil high	Replace with correct viscosity oil for operating conditions

Exhaust Color

Problem / Symptom	Cause	Action
White Smoke	Cold engine	Allow engine to warm to operating temperature
		See your authorized Yanmar dealer or distributor
	Incorrect fuel	Replace fuel with correct type
	Defective (leaking) fuel injector	See your authorized Yanmar dealer or distributor
	Injection timing is incorrect	
White Smoke with Water Vapor	Leaking cylinder head gasket	See your authorized Yanmar dealer or distributor
	Leaking charge air cooler	
	Cracked cylinder head	
	Cracked cylinder	

Problem / Symptom	Cause	Action
Blue Smoke	Worn piston rings / cylinders	See your authorized Yanmar dealer or distributor
	Oil leak in turbocharger (oil present in intake manifold)	
	Damaged piston cooling nozzles	
Black Smoke Under Load	Clogged intake air filter	Replace or clean as necessary
	Incorrect valve timing	See your authorized Yanmar dealer or distributor
	Defective (leaking) fuel injector	
	Low charge air pressure	Clean or replace clogged air filter
		See your authorized Yanmar dealer or distributor
	Excessive exhaust back pressure	See your authorized Yanmar dealer or distributor
	Plugged intake port(s)	See your authorized Yanmar dealer or distributor

Vibration - Drive Disengaged

Problem / Symptom	Cause	Action
Rough at All Engine Speeds	Air in fuel system	Bleed fuel system
	Faulty fuel injector	See your authorized Yanmar dealer or distributor
	Leaking cylinder head gasket	
	Damaged intake or exhaust valves	
	Incorrect injection pressure	

Vibration - Drive Engaged

Problem / Symptom	Cause	Action
Rough at All Speeds	Engine and propeller shaft misaligned	See your authorized Yanmar dealer or distributor
	Leaking cylinder head gasket	
	Bent propeller shaft	
Rough at Higher Speeds	Bent propeller	See your authorized Yanmar dealer or distributor
	Slipping clutch / clutch dog	
	Incorrect injection pressure	
	Injection timing is incorrect	

Engine Knocks

Problem / Symptom	Cause	Action
Excess Fuel Injected	Defective fuel injector	See your authorized Yanmar dealer or distributor
	High fuel injection pressure	
Noise Changes with Engine Load	Incorrect or poor quality fuel	Drain and refill tank with proper fuel
	Worn crankshaft / bearings	See your authorized Yanmar dealer or distributor
	Broken piston /rings	

Low Power Output

Problem / Symptom	Cause	Action
Miscellaneous	Clogged air filter	Clean or replace
	Leaking cylinder head gasket	See your authorized Yanmar dealer or distributor
	Damaged turbocharger	
	Incorrect propeller	
	Excessive exhaust back pressure	
Fuel	Plugged fuel filter(s)	Replace as necessary
	Faulty fuel supply pump	See your authorized Yanmar dealer or distributor
Low Fuel Injection Pressure	Defective fuel pressure regulator / sensor	See your authorized Yanmar dealer or distributor
	Worn high-pressure fuel pump	
	Injection timing is incorrect	
Low RPM at Wide Open Throttle	Propeller pitch too great	See your authorized Yanmar dealer or distributor
	Engine overheated	
	Damaged turbocharger	

Engine Overheat

Problem / Symptom	Cause	Action
Instrument Shows High Temperature	Clogged seawater inlet	Clean
	Low coolant level	Fill with coolant / inspect for leaks
	Clogged seawater filter (if equipped)	Clean
	Clogged hydraulic cooler	See your authorized Yanmar dealer or distributor
	Seawater pump worn or damaged	
	Defective sensor / instrument	
	Defective thermostat	
	Damaged closed coolant pump	
	Combustion gas leakage (causes loss of coolant)	
	Seawater pump belt slips or pump pulley loose on pump shaft	
	Clogged heat exchanger	

Engine Runs Cold

Problem / Symptom	Cause	Action
Instrument Shows Low Temperature	Defective sensor / instrument	See your authorized Yanmar dealer or distributor
	Defective thermostat	
	Cabin heater or boiler too large	

Coolant Loss

Problem / Symptom	Cause	Action
Repeated Low Coolant Level	Defective cylinder head gasket (external leakage)	See your authorized Yanmar dealer or distributor
	External leakage at connection	
Coolant Forced Out of Coolant Recovery Tank	Turbocharging pressure enters cooling system via leaking charge air cooler	See your authorized Yanmar dealer or distributor
	Defective cylinder head gasket (internal leakage)	
White Smoke when Engine Hot Indicates Water Vapor	Crack in cylinder head (not cracks between valve seats)	See your authorized Yanmar dealer or distributor
	Cracked cylinder wall	
	Leaking cylinder head gasket	

TROUBLESHOOTING INFORMATION

If your engine does not operate properly, refer to the troubleshooting chart or see your authorized Yanmar marine dealer or distributor.

Supply the authorized Yanmar marine dealer or distributor with the following information:

- Model name and serial number of your engine
- Boat name, hull material, size
- Use and type of boating
- Total number of operation hours (refer to hourmeter), age of boat
- Operating conditions when the problem occurred:
  - Engine rpm
  - Color of exhaust smoke
  - Type of diesel fuel
  - Type of engine oil
  - Any abnormal noises or vibration
- Operating environment such as high altitude or extreme ambient temperatures, etc.
- Engine maintenance history and previous problems
- Other factors that contribute to the problem

Diagnostic Trouble Codes

When certain faults occur, or when certain limits have been exceeded, the engine ECU may generate a “Check Engine” warning or turn on a check engine light (if equipped). Some of these faults may also generate a DTC or Diagnostic Trouble Code and an audible alarm. If a DTC is generated, the engine ECU will store that code or codes for reference. To read the DTC codes, a special tool is used by the technician. The technician then can use a list to more quickly find the cause of the fault and correct it.

Some conditions will produce an alarm but do not generate a trouble code. An example is engine overheat (over 108°C) caused by an obstructed seawater inlet. The overheat alarm will sound and the engine torque will be reduced to protect the engine, but no code will be set.

Under some conditions, the warning alarm will sound until the fault code is checked and corrected. Under other conditions, the alarm will be canceled if the engine is turned off and then restarted.

For further information, please contact your nearest Yanmar distributor or dealer.

Diagnostic Trouble Code Table

Code	Part or System	Mode	Run Or Condition	Engine Can Start	Check Engine Alarm
No Code	Coolant Temp	Under 0°C (32°F)	1000 rpm	yes	no
No Code	Coolant Temp	Over 108°C (226°F)	reduce	yes	alarm
No Code	Charge Air Temp	Over 110°C (230°F)	reduce	yes	no
No Code	Boost Pressure Reading	4BY - over 1.9 bar (27.5 psi) (relative) or 2.9 bar (42.0 psi) (absolute) 6BY - over 2.3 bar (33.3 psi) (relative*) or 3.3 bar (42.9 psi) (absolute**)	reduce	yes	alarm
No Code	Fuel Temperature	Over 90°C (194°F)	reduce	yes	no
No Code	Neutral Switch	Only in case of analog throttle or in case of CAN-fault (U0001), wrong configuration - neutral position	no	no	alarm
P0001	Fuel Metering Unit	Not connected	reduce	yes	alarm
P0003	Fuel Metering Unit	Short circuit to Ground	no	no	alarm
P0004	Fuel Metering Unit	Short circuit to B+	reduce	yes	alarm
P0087	Fuel Rail Pressure System Deviation	Fuel rail pressure out of range	reduce or shut off	depends on fault	alarm
P0088	Fuel Rail Pressure System Deviation	Fuel rail pressure out of range	reduce or shut off	depends on fault	alarm
P0089	Fuel Rail Pressure System Deviation	Fuel rail pressure out of range	yes	yes	alarm
P0090	Fuel Pressure Control Valve	Not connected / valve failure	no	no	alarm
	Fuel Rail Pressure System Deviation	Fuel rail pressure out of range	reduce	yes	alarm
P0091	Fuel Pressure Control Valve	Short circuit to Ground	reduce	yes	alarm
P0092	Fuel Pressure Control Valve	Short circuit to B+	no	no	alarm
P0112	Charge Air Temp	Over 125°C (257°F)	reduce	yes	alarm
	Charge Air Temp Sensor	Short circuit to B+	reduce	yes	alarm
P0113	Charge Air Temp	Under -20°C (-4°F)	reduce	yes	alarm
	Charge Air Temp Sensor	No connection / short circuit to Ground	reduce	yes	alarm
P0117	Coolant Temp Sensor	Short circuit to B+	reduce	yes	alarm
P0118	Coolant Temp Sensor	No connection / short circuit to Ground	reduce	yes	alarm

Code	Part or System	Mode	Run Or Condition	Engine Can Start	Check Engine Alarm
P0122	Throttle Signal	Both throttle signals are missing / short circuit to Ground	1600	yes	alarm
	Throttle Signal	Throttle signal 1 is missing / short circuit to Ground	reduce	yes	alarm
P0123	Throttle Signal	Both throttle signals are short circuited to B+	1600	yes	alarm
	Throttle Signal	Throttle signal 1 short circuit to B+	reduce	yes	alarm
P0182	Fuel Temperature Sensor	Short circuit to B+	reduce	yes	alarm
P0183	Fuel Temperature Sensor	No connection / short circuit to Ground	reduce	yes	alarm
P0192	Fuel Rail Pressure Sensor	Short circuit to Ground	reduce	yes	alarm
P0193	Fuel Rail Pressure Sensor	No connection / short circuit B+	reduce	yes	alarm
P0201	Injector No. 1	Open circuit / short circuit to Ground	reduce	yes	alarm
P0202	Injector No. 2	Open circuit / short circuit to Ground	reduce	yes	alarm
P0203	Injector No. 3	Open circuit / short circuit to Ground	reduce	yes	alarm
P0204	Injector No. 4	Open circuit / short circuit to Ground	reduce	yes	alarm
P0205	Injector No. 5	Open circuit / short circuit to Ground	reduce	yes	alarm
P0206	Injector No. 6	Open circuit / short circuit to Ground	reduce	yes	alarm
P0222	Throttle Signal	Both throttle signals are missing / short circuit to Ground	1600	yes	alarm
	Throttle Signal	Throttle signal 2 is missing / short circuit to Ground	reduce	yes	alarm
P0223	Throttle Signal	Both throttle signals are short circuited to B+	1600	yes	alarm
	Throttle Signal	Throttle signal 2 short circuited to B+	reduce	yes	alarm
P0230	Fuel Feed Pump	Not connected	no	no	alarm
P0231	Fuel Feed Pump	Short circuit to Ground	reduce	yes	alarm
P0232	Fuel Feed Pump	Short circuit to B+	no	no	alarm
P0236	Boost Pressure	Plausibility check with APS (ambient air pressure sensor) fail	reduce	yes	alarm

Code	Part or System	Mode	Run Or Condition	Engine Can Start	Check Engine Alarm
P0237	Boost Pressure	Under 0.5 bar (7.3 psi) (absolute**)	reduce	yes	alarm
	Boost Pressure Sensor	No connection / short circuit to Ground	reduce	yes	alarm
P0238	Boost Pressure	4 bar (58.0 psi) (absolute**)	reduce	yes	alarm
	Boost Pressure Sensor	Short circuit to B+	reduce	yes	alarm
P0261	Injector No. 1	Short circuit to B+	reduce	yes	alarm
P0264	Injector No. 2	Short circuit to B+	reduce	yes	alarm
P0267	Injector No. 3	Short circuit to B+	reduce	yes	alarm
P0270	Injector No. 4	Short circuit to B+	reduce	yes	alarm
P0273	Injector No. 5	Short circuit to B+	reduce	yes	alarm
P0276	Injector No. 6	Short circuit to B+	reduce	yes	alarm
P0344	Crankshaft Speed Sensor	Disagreement between camshaft speed sensor and crankshaft speed sensor	no	no	alarm
P0380	Glow Control Relay Actuator	Not connected, short circuit	yes	yes	alarm
P0562	System Voltage Low	-	yes	no	alarm
P0563	System Voltage High	-	yes	yes	alarm
P0602	Control Module Programming Error (Hwemon)	Overvoltage / undervoltage	no	no	alarm
	Shut Off Path	Control module programming error	no	no	alarm
P0607	Injector Chip Fault	Injector control module performance	no	no	alarm
P0642	Sensor Supply Monitoring 1	Short circuit	reduce	yes	alarm
P0643	Sensor Supply Monitoring 1	Short circuit	reduce	yes	alarm
P0650	Check Engine Lamp	Not connected, short circuit	yes	yes	alarm
P0652	Sensor Supply Monitoring 2	Short circuit	reduce	yes	alarm
P0653	Sensor Supply Monitoring 3	Short circuit	reduce	yes	alarm
P0670	Glow Plug Control Module	Failure, short circuit, over-current	yes	yes	alarm
P0671	Glow System - Glow Spark No. 1	Not connected, short circuit	yes	yes	alarm

Code	Part or System	Mode	Run Or Condition	Engine Can Start	Check Engine Alarm
P0672	Glow System - Glow Spark No. 2	Not connected, short circuit	yes	yes	alarm
P0673	Glow System - Glow Spark No. 3	Not connected, short circuit	yes	yes	alarm
P0674	Glow System - Glow Spark No. 4	Not connected, short circuit	yes	yes	alarm
P0675	Glow System - Glow Spark No. 5	Not connected, short circuit	yes	yes	alarm
P0676	Glow System - Glow Spark No. 6	Not connected, short circuit	yes	yes	alarm
P0689	Main Relay	Power relay sense short circuit low	no	no	alarm
P0690	Main Relay	Power relay sense short circuit high	no	no	alarm
P2049	4BY - Injector Bank 1	Short circuit on high side to Ground / B+	no	no	alarm
	6BY - Injector Bank 1	Short circuit on high side to Ground / B+	reduce	no	
P2052	4BY - Injector Bank 2	Short circuit on high side to Ground / B+	reduce	yes	alarm
	6BY - Injector Bank 2	Short circuit on high side to Ground / B+	reduce	yes	
P2227	Atmospheric Pressure	Plausibility check with BPS (boost pressure sensor) fail	yes	yes	alarm
P2228	Atmospheric Pressure	Short circuit low	yes	yes	alarm
P2229	Atmospheric Pressure	Short circuit high	yes	yes	alarm
P2614	Camshaft Speed Sensor	No connection / short circuit	reduce	yes	alarm
P2617	Crankshaft Speed Sensor	No connection / short circuit	no	no	alarm
U0001	CAN Throttle Signal	No signal	idle	yes	alarm
U0426	Immobilizer	Manipulation error	no	no	alarm

* *Relative value is the value read on a pressure gauge attached to the intake pipe.*

** *Absolute is the value reported by the ECU and displayed at the helm digital display.*

LONG-TERM STORAGE

If the engine is not to be used for an extended period of time, special measures should be taken to protect the coolant system, fuel system and combustion chambers from corrosion and the exterior from rusting. It is recommended that you see your authorized Yanmar marine dealer or distributor to prepare the engine for long-term storage.

The engine can normally stand idle for up to six months. If it remains unused for longer than this, please contact your authorized Yanmar marine dealer or distributor.

Winter Storage

Drain water from fuel tank and fuel filters before and after extended storage.

To reduce the risk of condensation in the fuel tank during winter storage, fill the tank with fuel and treat with diesel fuel stabilizer.

PREPARE ENGINE FOR LONG-TERM STORAGE

IMPORTANT

Do not drain closed cooling system for long-term storage.

Antifreeze must be used to avoid freezing and damaging of components. Antifreeze will prevent rusting during long-term storage.

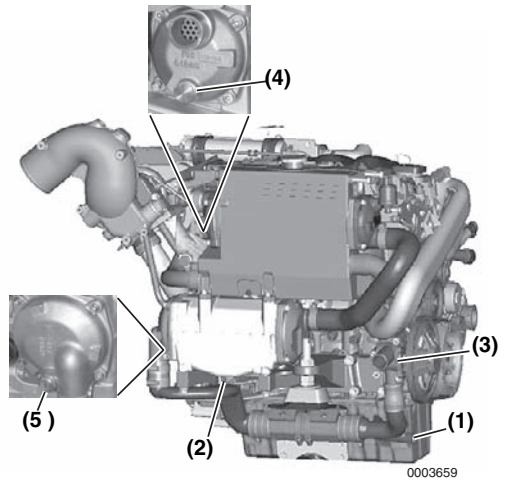
1. Change engine oil and filter.
2. Drain seawater cooling system. *See Drain Seawater Cooling System on page 108.*
3. Wipe off any dust or oil from the outside of engine.
4. Drain fuel tank or fill the tank to prevent condensation.
5. Grease the exposed areas and joints of the remote control cables and the bearings of the remote control handle.
6. Seal the intake silencer, exhaust pipe, etc. to prevent moisture or contamination from entering engine.
7. Completely drain bilge in hull bottom.

8. Waterproof the engine room to prevent rain or seawater from entering.
9. Charge the battery once a month to compensate for battery's self-discharge.
10. Remove key from key switch and cover key switch with moisture cap (if equipped).

Drain Seawater Cooling System

IMPORTANT

If water fails to drain from any open drain cock or port, remove the cock completely and probe the opening with a small piece of wire to loosen debris.



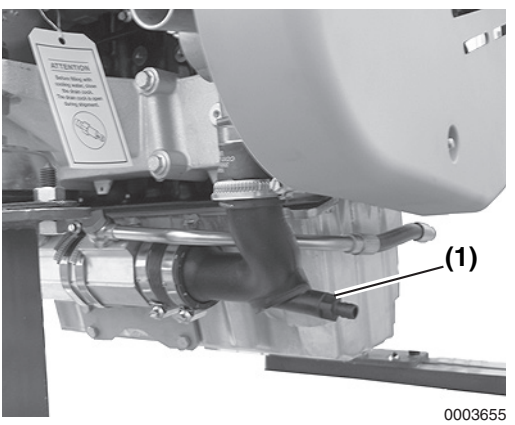


Figure 1

1. Open the lower seawater drain cock **(Figure 1, (1))** located in the piping between the seawater pump and hydraulic oil cooler. Allow to drain.
2. Open the drain cock **(Figure 1, (2))** on the bottom of the charge air cooler.

3. Remove the seawater pump cover. See your authorized Yanmar dealer or distributor.
4. Remove zinc anodes from the heat exchanger **(Figure 1, (4))** and charge air cooler **(Figure 1, (5))** and allow water to drain from housings.

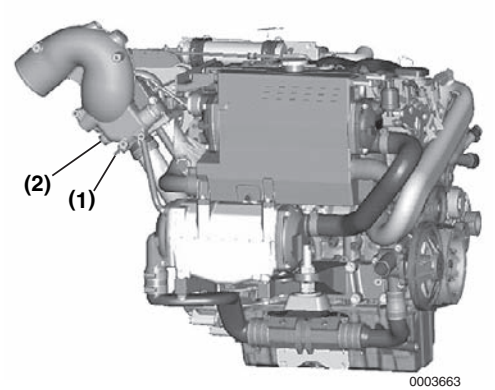


Figure 2

5. **Engines having the optional high-rise exhaust elbow:** Open drain cock **(Figure 2, (1))** and allow water to drain. Remove and inspect zinc anode **(Figure 2, (2)).**

IMPORTANT

Do not use thread sealer or thread sealing tape when installing zinc anodes. Anodes must make good metal-to-metal contact to perform properly.

6. Inspect condition of zinc anodes. Install anodes. *See Replace the Zinc Anodes on page 93*.
7. Close all drain cocks.

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SPECIFICATIONS

ENGINE SPECIFICATIONS

Engine Model	4BY150 / 150Z	4BY180 / 180Z	6BY220 / 220Z	6BY260 / 260Z
Application Design	Models numbers with no suffix letter are used in marine gear applications. Models having a “Z” suffix are used with stern drive.			
Number of Cylinders	In-line 4		In-line 6	
Type	15° inclined, water-cooled, dual overhead camshaft, 4-stroke diesel			
Combustion System	Direct injection			
Aspiration	Turbocharged with charge air cooler			
Bore x Stroke	84 mm x 90 mm (3.307 in. x 3.543 in.)			
Displacement	1.995 L (122 cu in.)		2.994 L (183 cu in.)	
Firing Order*	1-3-4-2		1-5-3-6-2-4	
Compression Ratio	16.5:1		16.5:1	
Rated Power Output**	4BY150 / 4BY150Z	4BY180 / 4BY180Z	6BY220 / 6BY220Z	6BY260 / 6BY260Z
kW (metric hp) at 4000 rpm	110 kW (150 hp)	132 kW (180 hp)	162 kW (220 hp)	191 kW (260 hp)
Mean Pressure	1.66 MPa (240.76 psi)	1.98 MPa (287.18 psi)	1.62 MPa (234.96 psi)	1.92 MPa (278.47 psi)
Torque	317 N·m (234 ft-lb)	355 N·m (262 ft-lb)	487 N·m (359 ft-lb)	545 N·m (402 ft-lb)
Low Idle Speed (Warm Engine @ 88°C [190°F])	750 rpm (ECU-controlled)		670 rpm (ECU-controlled)	
Cold Start Speed @ 20°C (68°F)	1200 rpm gradually decreasing to warm engine idle @ 88°C (190°F) (ECU-controlled)			
Rev Limit (fuel cut-off)	4600 rpm (ECU-controlled)			
Prop rpm at Wide Open Throttle	4000 - 4100 rpm			
Rotation Direction	Counterclockwise (viewed from flywheel)			

SPECIFICATIONS

Engine Model	4BY150 / 150Z	4BY180 / 180Z	6BY220 / 220Z	6BY260 / 260Z
No. of Valves per Cylinder	4			
Valve Adjustment	Hydraulic self-adjusting			
Turbocharger	MHI w/pneumatic wastegate		HOLSET w/pneumatic wastegate	
Charge Air Cooler	Seawater cooled			
Electrical System	12 V			
Starter	12 V / 2 kW (2.7 hp)			
Charging System	12 V / 150 A			
Battery Capacity - Recommended	12 V / 74 Ah / 680 CCA			
Fuel Injection System	Common rail (ECU-controlled)			
Fuel Injection Pressure	Variable depending on rpm; 250 - 1600 bar (3626 - 23,206 psi)			
Injection Timing	Variable (ECU controlled)			
ECU Threshold Voltage	7.8 V			
Maximum Allowable Exhaust Backpressure	1835 mmAq (72.3 in.Aq)		2039 mmAq (80.3 in.Aq)	
Cooling System	Closed cooling system with seawater heat exchanger			
Coolant Capacity (Approximate)	10.0 L (10.6 qt)		13.5 L (14.3 qt)	
Seawater Pump	Rubber impeller, belt driven			
Capacity	140 L/min (37 gpm) at 4000 engine rpm			
Maximum Lift	2000 mm (78.75 in.)			
Hydraulic Oil Cooler	Seawater cooled			
Lubrication System	Totally enclosed, forced lube system			
Oil Cooler	Engine coolant system			
Lube Oil Pressure at 4000 rpm	3.8 - 6.0 bar (55 - 87 psi)			
Lube Oil Pressure at 1000 rpm	0.7 - 0.8 bar (10 - 12 psi)			
Lube System Capacity***	8.0 L (8.5 qt)****		11.0 L (11.5 qt)****	
Crankcase Ventilation	Closed, with filter			
Drive Options				
Stern Drive	Bravo-1, -2, -3			
Marine Gear	ZF45A; Kanzaki			
Installation Angles: Static Angle				
Front-to-Rear	± 4°			
Left-to-Right	± 0°			

Engine Model	4BY150 / 150Z	4BY180 / 180Z	6BY220 / 220Z	6BY260 / 260Z
Operational Angles: Front-to-Rear and Left-to-Right				
Continuous	10° maximum			
Peak	20° maximum			
Height	721 mm (28.4 in.)			
Length (without marine gear)				
Stern Drive (front-to-middle of engine mount)	760 mm (29.9 in.)		942 mm (37.1 in.)	
Marine Gear (front-to-marine gear mounting face)	644 mm (25.4 in.)		825.5 mm (32.5 in.)	
Overall Length	861 mm (33.9 in.)		1001 mm (39.4 in.)	
Width	670 mm (26.4 in.) (local exceeding)			
Weight (without marine gear)				
Dry (without mixing elbow)	250 kg (551 lb)		310 kg (683 lb)	
Wet (with mixing elbow)	270 kg (595 lb)		340 kg (750 lb)	

* Cylinder numbering starts at the coolant pump end of the engine.

** Rating condition: ISO 8665. Temperature of fuel: 40°C (104°F) at fuel pump inlet
1 hp (metric horsepower) = 0.7355 kW
Fuel condition: Density at 15°C (59°F) = 0.827 g/cm^3
Fuel temperature at the inlet of the fuel injection pump

*** The “Total Engine Lubricating Oil Capacity” includes oil in the oil pan, channels, coolers, and filter. The “Effective Engine Lubricating Capacity” indicates the difference in maximum scale of the dipstick and minimum scale.

**** Capacity may vary depending on installation angle.

Tightening Fasteners

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

Standard Torque Values

Hexagon Bolts and Nuts

Nominal Diameter	Grade (Lubricated)		
	8.8 or 8	10.9 or 10	12.9 or 12
M4	2.7 N·m (24 in.-lb)	3.88 N·m (34.3 in.-lb)	4.6 N·m (41 in.-lb)
M5	5.5 N·m (48.6 in.-lb)	8 N·m (71 in.-lb)	9.5 N·m (84 in.-lb)
M6	9.5 N·m (84 in.-lb)	13 N·m (115 in.-lb)	16 N·m (142 in.-lb)
M7	15 N·m (133 in.-lb)	22 N·m (195 in.-lb)	26 N·m (230 in.-lb)
M8	23 N·m (204 in.-lb)	32 N·m (24 ft-lb)	39 N·m (29 ft-lb)
M8 x 1	25 N·m (221 in.-lb)	35 N·m (26 ft-lb)	42 N·m (31 ft-lb)
M10	46 N·m (34 ft-lb)	64 N·m (47 ft-lb)	77 N·m (57 ft-lb)
M10 x 1.25	49 N·m (36 ft-lb)	68 N·m (50 ft-lb)	82 N·m (60 ft-lb)
M12	80 N·m (59 ft-lb)	110 N·m (81 ft-lb)	135 N·m (100 ft-lb)
M12 x 1.5	88 N·m (65 ft-lb)	125 N·m (92 ft-lb)	150 N·m (111 ft-lb)

Hose Clamps

Note: Reuse and retightening is prohibited for all hose clamps. Always install new hose clamps.

Size	Specification
5mm Hex Head	1.0 - 1.5 N·m (8.9 - 13 in.-lb)
6mm Hex Head	2.5 - 3.5 N·m (22 - 31 in.-lb)

EPA WARRANTY
USA ONLY

YANMAR CO., LTD. LIMITED EMISSION CONTROL SYSTEM WARRANTY - USA ONLY

The following EPA Warranty only applies to engines built on or after January 01, 2006 and labeled with the proper nameplate.

THIS EMISSION WARRANTY APPLIES TO THE ENGINES CERTIFIED TO UNITED STATES EPA 40 CFR 94 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 deals 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 **2000 hours** of use, whichever occurs first. In the absence of a device to measure hours of use, the engine as a warranty period of **five (5) years**.

Warranty Coverage:

Repair or replacement of any warranted parts will 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:

1. Fuel Injection System
2. Turbocharger System
3. Charge Air Cooler
4. 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.

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 must present 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 contact Yanmar Marine USA Corporation for assistance.

Yanmar Marine USA Corporation
101 International Parkway
Adairsville, GA 30103
USA
Telephone: 770-877-9894
Fax: 770-877-7567

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Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust and Noise emission requirements of Directive 94/25/EC as amended by 2003/44/EC

(To be completed by manufacturer of outboard or inboard engines with integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

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

Post Code: 530-8311 Country: Japan

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

Street: Brugplein 11 Town: Almere-de Vaart

Post Code: 1332 BS Country: The Netherlands

Name of Notified Body for exhaust emission assessment: Germanischer Lloyd

Street: Vorsetzen 32/35 Town: Hamburg

Post Code: 20459 Country: Germany ID Number: 0098

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

Street: Nipkowweg 9 Town: Joure

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

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

Module used for noise emission assessment: Aa ☒ G ☐ H ☐

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type: ☒ Inboard engine ☒ z or sterndrive with integral exhaust	Fuel Type: Standard ☒ Diesel ☐ Petrol	Combusion cycle: Other information document used ☐ 2-stroke ☒ 4-stroke	See technical file
Annex I.B – Exhaust Emissions			
engine identification (I.B.1)			☐
exhaust emission requirements	EN ISO 8178-1:1996		☒
durability			☐
owner's manual			☐
Annex I.C – Noise Emissions			
Noise emission levels (I.C.1)	EN ISO 14509		☒
owner's manual (I.C.2)			☐

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
Family name BY	35626-06 HH
Model name	
4BY150Z	
4BY180Z	
6BY220Z	
6BY260Z	

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

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

Date: (yr/month/day) 2006 / 03 / 28

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust and Noise emission requirements of Directive 94/25/EC as amended by 2003/44/EC

(To be completed by manufacturer of outboard or inboard engines with integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

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

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Street: Brugplein 11 **Town:** Almere-de Vaart

Post Code: 1332 BS **Country:** The Netherlands

Name of Notified Body for exhaust emission assessment: Germanischer Lloyd

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

Street: Nipkowweg 9 **Town:** Joure

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

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

Module used for noise emission assessment: Aa ☒ G ☐ H ☐

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type: ☒ Inboard engine ☒ z or sterndrive with integral exhaust	**Fuel Type:** Standard ☒ Used ☐ Diesel ☐ Petrol	**Combusion cycle:** Other normative document used ☐ 2 stroke ☒ 4 stroke	See technical file
Annex I.B – Exhaust Emissions			
engine identification (I.B.1)			☐
exhaust emission requirements	EN ISO 8178-1:1996		☒
durability			☐
owner's manual			☐
Annex I.C – Noise Emissions			
Noise emission levels (I.C.1)	EN ISO 14509		☒
owner's manual (I.C.2)			☐

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	**EC Type certificate number (exhaust)**
Family name BY	35626-06 HH
Model name	
4BY150Z	
4BY180Z	
6BY220Z	
6BY260Z	

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

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

Date: (yr/month/day) 2006 / 03 / 28