



YANMAR
®

YM

series

OPERATION MANUAL

2YM15

3YM20

3YM30

P/N: 0AYMM-G00100

**MARINE
ENGINES**

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INTRODUCTION

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

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

- Read and understand this *Operation Manual* before you operate the engine 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.
- Refer to the Yanmar Limited Warranty Handbook for a complete warranty description.

INTRODUCTION

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 who comes in 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 engine's safety decals. Keep the decals 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 decal attached to it, make sure you order the new part and decal at the same time.



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

SAFETY PRECAUTIONS

General Information

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

Before You Operate

DANGER

The safety messages that follow have **WARNING** level hazards.



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

- Read and understand this Operation Manual before you operate or service the engine to ensure that you follow safe operating practices and maintenance procedures.
- Safety signs and decals are additional reminders for safe operating and maintenance techniques.
- See your authorized Yanmar Marine dealer or distributor for additional training.

During Operation and Maintenance

DANGER

The safety message that follows has **DANGER** level hazards.

Crush Hazard



NEVER stand under a hoisted engine. If the hoist mechanism fails, the engine will fall on you.

Fire Hazard



Ensure that appropriate fire detection and extinguishing equipment are installed and checked periodically for proper operation.

⚠ WARNING

The safety messages that follow have WARNING level hazards.

Explosion Hazard

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

Fire and Explosion Hazard

Diesel fuel is flammable and explosive under certain conditions.

NEVER use a shop rag to catch the fuel.

Wipe up all spills immediately.

NEVER refuel with the engine running.

Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.

Fire Hazard

Undersized wiring systems can cause an electrical fire.

Sever Hazard

NEVER wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing and ALWAYS tie back long hair when working near moving / rotating parts such as the flywheel or PTO shaft. Keep hands, feet and tools away from all moving parts.

Alcohol and Drug Hazard

NEVER operate the engine while under the influence of alcohol or drugs or if you are feeling ill.

Exposure Hazard

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

Sudden Movement Hazard

ALWAYS stop the engine before beginning service.

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.

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

Stop the engine before you begin to service it.

WARNING

Piercing 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.

Burn Hazard



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

Exhaust Hazard



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

CAUTION

The safety messages that follow have CAUTION level hazards.

Poor Lighting Hazard

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

Tool Hazard

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

Flying Object Hazard

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

Coolant Hazard



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

NOTICE**The safety messages that follow have NOTICE level hazards.**

It is important to perform daily checks as listed in the *Operation Manual*.

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor engine performance and helps extend the life of the engine.

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.



ALWAYS be environmentally responsible.

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

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

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

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

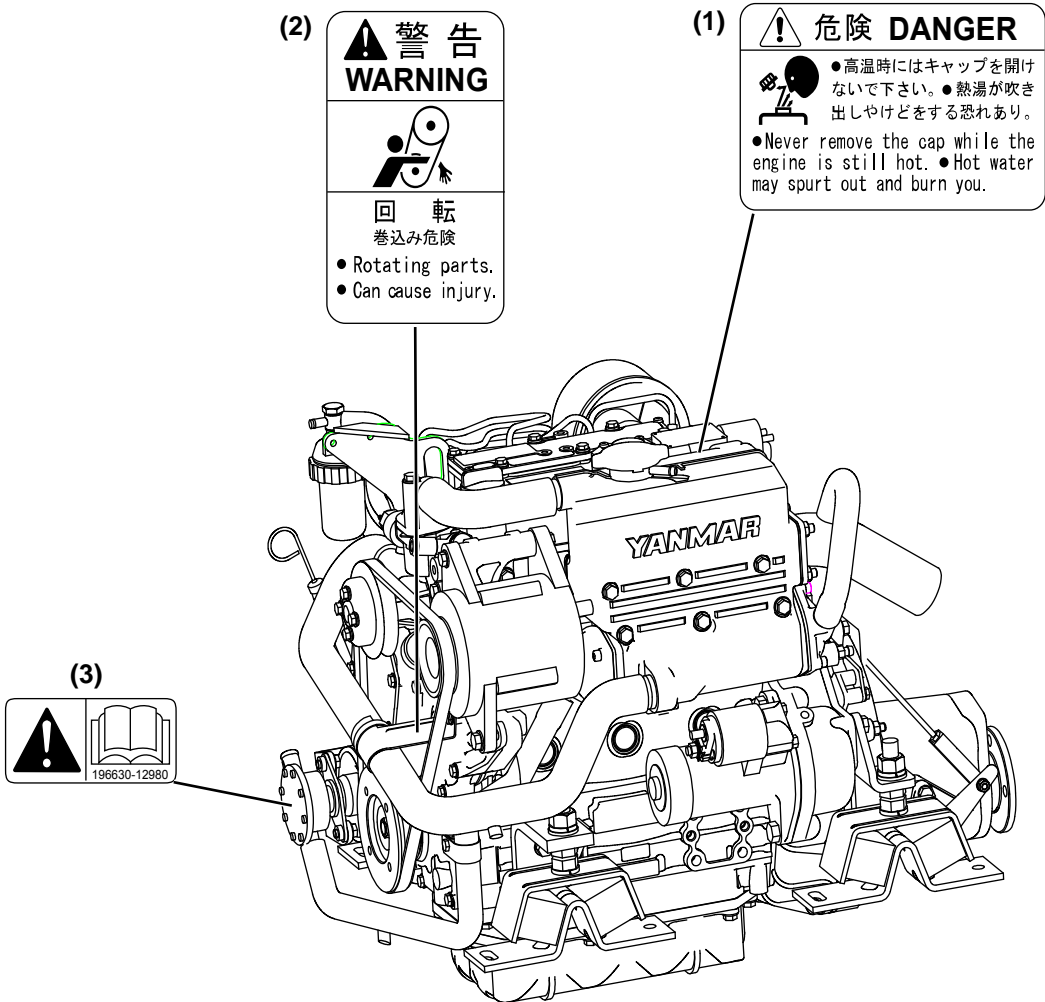
If you have an installation with two or three engines, and only one engine is operating, please note that if the propeller shaft thru-hull (stuffing box) is lubricated by engine water pressure and the engines are interconnected, care must be taken that water from the running engine does not enter the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

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

LOCATION OF SAFETY DECALS

Figure 1 shows the location of safety decals on Yanmar YM series marine engines.

YM Engines



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Figure 1

- 1 – Part Number: 128377-07260**
- 2 – Part Number: 128377-07350**
- 3 – Part Number: 196630-12980**

PRODUCT OVERVIEW

YANMAR YM FEATURES AND APPLICATIONS

The YM series are four-stroke direct injection diesel engines equipped with liquid coolant systems.

The 2YM15 is a 2-cylinder engine and is naturally aspirated.

The 3YM20 is a 3-cylinder engine and is naturally aspirated.

The 3YM30 is a 3-cylinder engine and is naturally aspirated.

These engines are equipped with a marine gear or sail drive unit.

These engines are designed for pleasure craft use.

It is recommended that new vessels be propped so the engines can operate at 100 - 200 rpm above the Maximum Rated Power Output rpm (3700 - 3800) to allow for some added weight and hull resistance. The engine must be able to reach the Maximum Rated Power rpm (3600) under full load at all times.

Failure to do so can lead to reduced vessel performance, increased smoke levels and can cause permanent damage to your engine, which is not covered by warranty.

The engine must be installed correctly with coolant lines, exhaust gas lines 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, always observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

The YM series engines are designed to be operated at maximum throttle (3600 rpm) for less than 5% of total engine time (30 minutes out of every 10 hours) and cruising speed (3400 rpm or less) for less than 90% of total engine time (9 hours out of every 10 hours).

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.

PRODUCT OVERVIEW

New Engine Break-In

As with all reciprocating engines, the way the engine is operated during its first 50 hours of operation plays a significant role in determining how long it will last and how well the engine will perform over its lifetime.

A new Yanmar diesel engine must be operated at suitable speeds and power settings during the break-in period to allow the sliding parts, such as piston rings, to break in properly and to stabilize engine combustion.

During the break-in period, the engine coolant temperature gauge should be monitored. The temperature should be between 71° and 87°C (160° and 190°F).

During the first 10 hours of operation, the engine should be operated at maximum rpm minus 400 to 500 rpm (approximately 60 to 70% of load) most of the time. This will ensure the sliding parts break in properly.

NOTICE: During this period, avoid operating at maximum engine speed and load to avoid damaging or scoring sliding parts.

NOTICE: NEVER operate at WOT (wide open throttle) for more than a minute at a time during the first 10 hours of operation.

Do not operate the engine at low idle or at low speed and light load for more than 30 minutes at a time. Since unburned fuel and engine oil will adhere to the piston rings when operating at low speeds for long periods, this will interfere with proper movement of the rings and the diesel fuel consumption may increase. Low idle speed does not allow break-in of sliding parts.

If operating the engine at low speed and light load, you must race the engine to clean the carbon from the cylinders and the fuel injection valve.

Perform this procedure in open waters:

- With the clutch in NEUTRAL, accelerate from the low speed position to the high speed position briefly.
- Repeat this process five times.

Once past the initial 10 hours until 50 hours, the engine should be used over its full operating range, with special emphasis on running at relatively high power settings. This is not the time for an extended cruise at idle or low speed. The boat should be operated at maximum speed minus 400 rpm most of the time (approximately 70% load), with a 10 minute run at maximum minus 200 rpm (approximately 80% load) every 30 minutes and a 4 to 5 minute period of operation at WOT (wide open throttle) once every 30 minutes. During this period, be sure not to operate the engine at low speed and light load for more than 30 minutes. If operating engine at low speed and light load is necessary, race the engine after low idle operation.

To complete engine break-in, perform *After Initial 50 Hours* maintenance procedures. See *After Initial 50 Hours of Operation* on page 52.

COMPONENT IDENTIFICATION

Service Side - 2YM15

Figure 1 and **Figure 2** illustrate a typical version of a 2YM15 engine. Your engine may have different equipment from that illustrated.

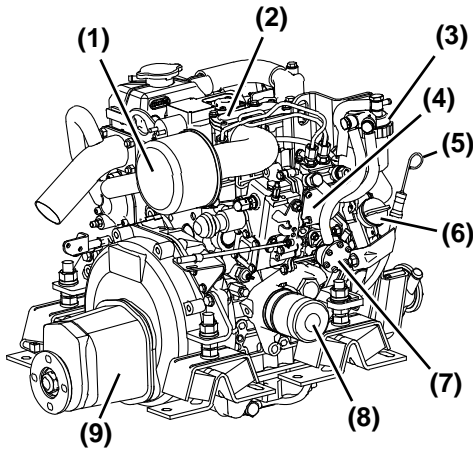


Figure 1

- 1 – Intake Silencer (Air Cleaner)
- 2 – Intake Manifold
- 3 – Fuel Filter
- 4 – Fuel Injection Pump
- 5 – Engine Oil Dipstick
- 6 – Engine Oil Filler Cap
- 7 – Fuel Feed Pump
- 8 – Engine Oil Filter
- 9 – Marine Gear

Non-Service Side - 2YM15

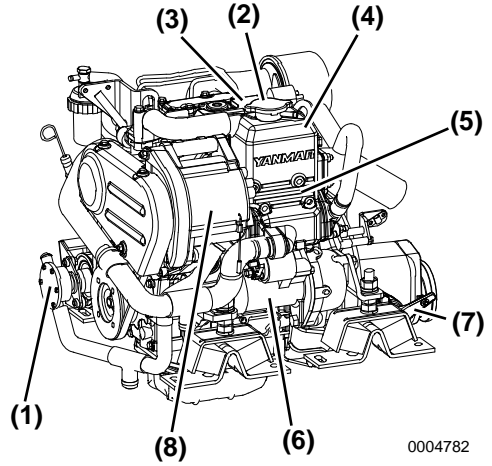


Figure 2

- 1 – Seawater Pump
- 2 – Coolant Filler Cap
- 3 – Engine Nameplate (On Rocker Arm Cover)
- 4 – Coolant Tank / Heat Exchanger
- 5 – Exhaust Manifold
- 6 – Starter Motor
- 7 – Shift Lever
- 8 – Alternator

PRODUCT OVERVIEW

Service Side - 3YM20

Figure 3 and Figure 4 illustrate a typical version of a 3YM20 engine. Your engine may have different equipment from that illustrated.

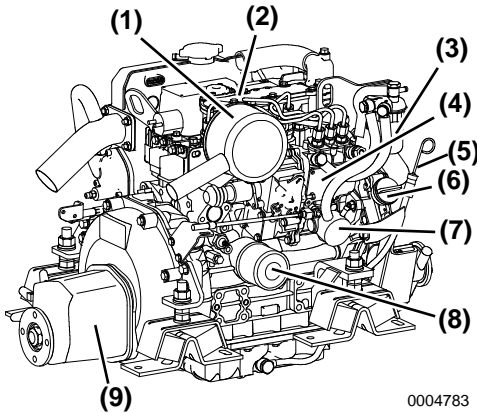
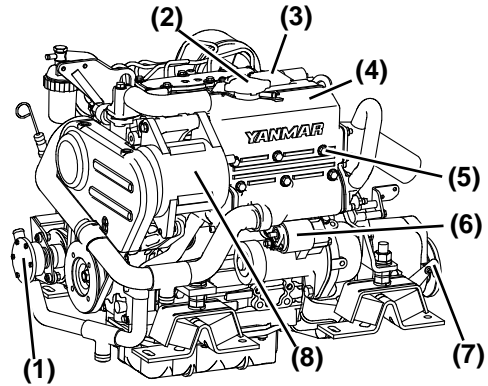


Figure 3

- 1 – Intake Silencer (Air Cleaner)
- 2 – Intake Manifold
- 3 – Fuel Filter
- 4 – Fuel Injection Pump
- 5 – Engine Oil Dipstick
- 6 – Engine Oil Filler Cap
- 7 – Fuel Feed Pump
- 8 – Engine Oil Filter
- 9 – Marine Gear

Non-Service Side - 3YM20



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Figure 4

- 1 – Seawater Pump
- 2 – Coolant Filler Cap
- 3 – Engine Nameplate (On Rocker Arm Cover)
- 4 – Coolant Tank / Heat Exchanger
- 5 – Exhaust Manifold
- 6 – Starter Motor
- 7 – Shift Lever
- 8 – Alternator

Service Side - 3YM30

Figure 5 and **Figure 6** illustrate a typical version of a 3YM30 engine. Your engine may have different equipment from that illustrated.

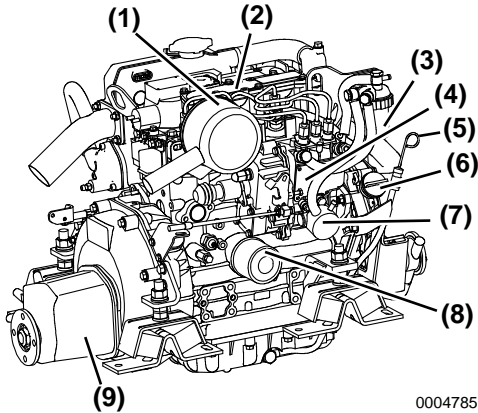


Figure 5

- 1 – Intake Silencer (Air Cleaner)
- 2 – Intake Manifold
- 3 – Fuel Filter
- 4 – Fuel Injection Pump
- 5 – Engine Oil Dipstick
- 6 – Engine Oil Filler Cap
- 7 – Fuel Feed Pump
- 8 – Engine Oil Filter
- 9 – Marine Gear

Non-Service Side - 3YM30

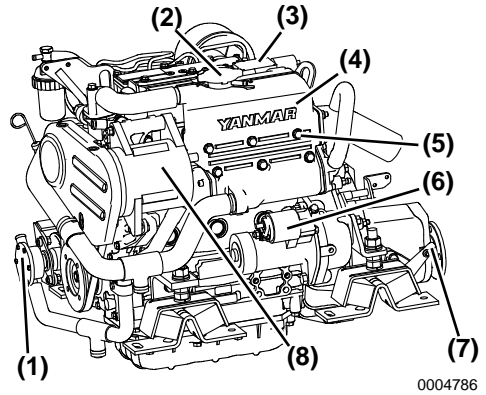


Figure 6

- 1 – Seawater Pump
- 2 – Coolant Filler Cap
- 3 – Engine Nameplate (On Rocker Arm Cover)
- 4 – Coolant Tank / Heat Exchanger
- 5 – Exhaust Manifold
- 6 – Starter Motor
- 7 – Shift Lever
- 8 – Alternator

PRODUCT OVERVIEW

LOCATION OF NAMEPLATES

The nameplate of the Yanmar YM series engine is shown in **Figure 7**. Check the engine's model, output, rpm and serial number on the nameplate. Replace it if it is damaged or lost.

The engine nameplate is attached to the engine rocker arm cover.

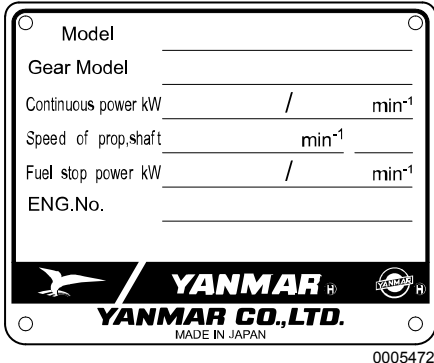


Figure 7

The marine gear nameplate (**Figure 8**) is attached to the marine gear. Check the marine gear's model, gear ratio, oil used, oil quantity and serial number

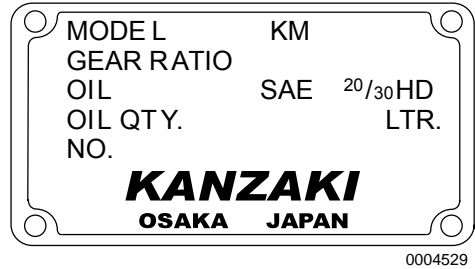


Figure 8

FUNCTION OF MAJOR COMPONENTS

| Name of Component | Function |
|---------------------------------|--|
| Fuel Filter | Removes dirt and water from the fuel. Drain the filter periodically. The filter element should be replaced periodically. The water separator (if equipped) should be drained periodically. <i>See Draining Fuel Filter / Water Separator on page 56.</i> |
| Fuel Feed Pump | Pumps fuel from the tank to the fuel injection system. Pushing the manual lever on the side of the feed pump supplies fuel to the engine when fuel priming is needed. |
| Fuel Feed Lever | Moving the fuel feed lever up and down feeds the fuel. The lever is used to bleed air from the fuel system after running out of fuel. |
| Engine Oil Filler Port | Filler port for the 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 spin-on type and the element should be replaced periodically. <i>See Replacing the Engine Oil Filter Element on page 53.</i> |
| Marine Gear Filler Port | Filler port for marine gear oil; located on top of the marine gear case. |
| Cooling System | There are two cooling systems: closed cooling with coolant (fresh water) and seawater. The engine is cooled by the closed cooling circuit. The closed circuit is cooled by seawater using a heat exchanger. The seawater also cools the engine / marine gear oil. |
| Closed Cooling Circulation Pump | The centrifugal water pump circulates coolant inside the engine. The circulating pump is driven by a V-belt. |
| Seawater Pump | Pumps seawater from outside vessel to the engine. The seawater pump has a replaceable rubber impeller. |
| Coolant Filler Cap | The filler cap on the heat exchanger / coolant tank covers the water supply port. The cap has a pressure regulating valve. When the cooling water temperature rises, the pressure rises inside the coolant system. |
| Coolant Recovery Tank | The pressure valve in the filler cap releases vapor and hot water overflow to the coolant recovery tank. When the engine stops and the coolant cools, the pressure in the coolant tank drops. The filler cap vacuum 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. |
| Engine Oil Cooler | A heat exchanger that cools high temperature engine oil using coolant. |
| Intake Silencer (Air Cleaner) | The intake silencer guards against dirt in the air and reduces the noise of air intake. |
| Nameplates | Nameplates are provided on the engine and the marine gear and have the model, serial number and other data. <i>See Location of Nameplates on page 14.</i> |
| Starter | Starter motor for the engine; powered by the battery. |
| Alternator | Driven by a belt and generates electricity and charges the battery. |
| Engine Oil Dipstick | Gauge stick for checking the engine oil level. |

CONTROL EQUIPMENT

The control equipment at the helm makes remote control operation possible. It consists of the instrument panel, which is connected to the engine by a wire harness, and the remote control handle, which is connected by control cables to the engine control lever and marine gear.

Instrument Panel (Optional) Equipment and Functions

The instrument panel is located at the helm. The following instruments enable you to start or stop the engine and to monitor its condition during operation. A typical instrument panel is shown in **Figure 9**.

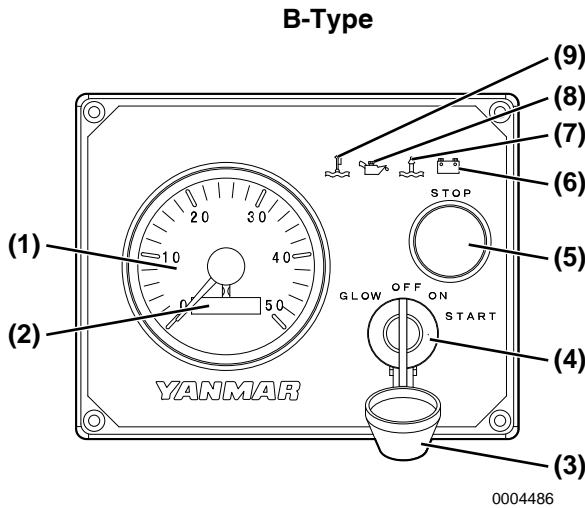


Figure 9

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 – Tachometer 2 – Hourmeter 3 – Moisture Cap for Key Switch 4 – Key Switch 5 – Stop Button | <ul style="list-style-type: none"> 6 – Battery Low Charge Indicator 7 – Water in Sail Drive Seal Indicator 8 – Engine Oil Low Pressure Indicator 9 – Coolant High Temperature Indicator |
|---|---|

Gauges

B-Type panels use analog electric gauges with needle indicators.

| Instrument | Function |
|-------------------------|--|
| Tachometer | Shows the engine rotation speed. |
| Hourmeter | Shows the number of operating hours; can be used as a guide for periodic maintenance checks. The hourmeter is located at the bottom of the tachometer. |
| Instrument Panel Lights | When turning the key switch to ON, the gauges will illuminate for easier viewing. |

Key Switch

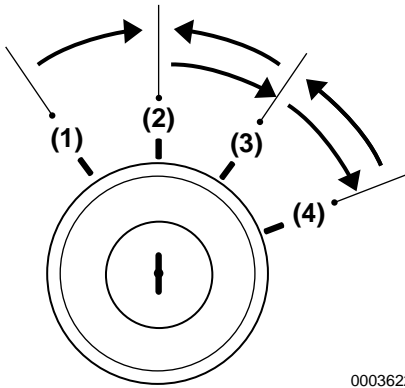


Figure 10

0003622

- 1 – GLOW**
- 2 – OFF**
- 3 – ON**
- 4 – START**

The GLOW position (**Figure 10, (1)**) is the start aid position. Electric current to the glow plug is turned on. When the key is released, the switch will automatically move to the ON position.

The START position (**Figure 10, (4)**) allows current to the starting motor. When starting the engine, move the key to the START position and release. The key will automatically move to the ON position.

When the key is in the OFF position (**Figure 10, (2)**) the electric current is off. The key can be inserted or removed in this position.

The ON position (**Figure 10, (3)**) allows electrical current to the controls and equipment and allows the engine to keep running. To stop the engine, keep the key switch in the ON position and push the stop button. After stopping the engine, turn the key to the OFF position.

Indicators and Alarms (Optional)

When a sensor detects a problem during operation, the indicator on the instrument panel will light and an alarm will sound. Indicators are located on the instrument panel. The alarm is located on the back of the panel. Under normal operating conditions, the indicators are off.



Figure 11

Battery Low Charge Indicator (Figure 11) - When the alternator output is too low, the indicator will light. When charging begins, the indicator will turn off. No alarm will sound for low battery charge.



Figure 12

Coolant High Temperature Indicator and Alarm (Figure 12) - When coolant temperature reaches the maximum allowable temperature (95°C [203°F] or higher), the indicator will light and the alarm will sound. Continuing operation at temperatures exceeding the maximum limit will result in damage and seizure. Check the load and troubleshoot the cooling system.



Figure 13

Engine Oil Low Pressure Indicator and Alarm (Figure 13) - When the engine oil pressure falls below normal, the oil pressure sensor will send a signal to the indicator causing it to light and the alarm to sound. Stop operation immediately to avoid damage to the engine. Check the oil level and troubleshoot the lubrication system.

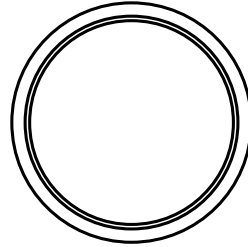


Figure 14

Water in Sail Drive Seal Indicator and Alarm (**Figure 14**) - When seawater is detected between the seals of the sail drive, the indicator will light and the alarm will sound.

Stop Button

STOP



0005439

Figure 15

Push the STOP button switch to stop the engine. The key switch must be in the ON position for the stop button to operate. After the engine has come to a complete stop, you can turn the key to the OFF position.

Alarms

Check that indicators and alarms are working normally when the key is turned to ON.

| | | | |
|------------|------------------------------------|--------------|------------|
| Key Switch | | OFF ⇒ ON | START ⇒ ON |
| Engine | | Before start | Running |
| Alarm | | Sound | No sound |
| Indicators | Battery Low Charge Indicator | ON | OFF |
| | Coolant High Temperature Indicator | OFF | OFF |
| | Engine Oil Low Pressure Indicator | ON | OFF |
| | Water In Sail Drive Indicator | OFF | OFF |

Single-Lever Remote Control Handle

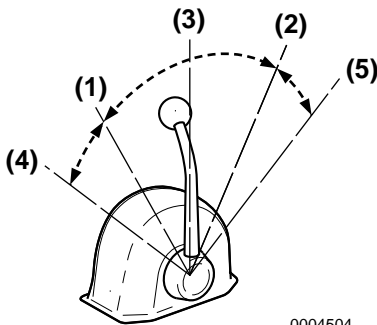


Figure 16

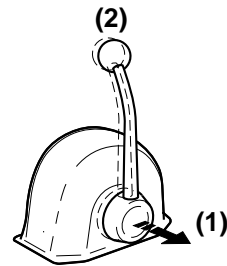
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- 1 – Low Speed - FWD or REV**
- 2 – Low Speed - FWD or REV**
- 3 – NEUTRAL - Power to the propeller shaft is cut off and the engine idles**
- 4 – Maximum Engine Speed - FWD or REV**
- 5 – Maximum Engine Speed - FWD or REV**

A single-lever handle type (**Figure 16**) should be used to operate the marine gear clutch (NEUTRAL, FORWARD, and REVERSE) and to control the engine speed.

The lever controls the direction of the boat (ahead or astern) and also acts as an accelerator by increasing engine speed as the lever is pushed further in the FORWARD or REVERSE directions.

When the lever is pulled out (**Figure 17, (1)**), the engine speed can be controlled without engaging the clutch. The clutch remains in NEUTRAL, no load position. Turn the knob (**Figure 17, (2)**) counterclockwise to move the lever or clockwise to lock the lever.



0004511

Figure 17

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

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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 checks.

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

DIESEL FUEL

Diesel Fuel Specifications

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

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

| DIESEL FUEL SPECIFICATION | LOCATION |
|-----------------------------|----------------|
| ASTM D975 No. 2-D, No. 1-D, | USA |
| EN590:96 | European Union |
| ISO 8217 DMX | International |
| BS 2869-A1 or A2 | United Kingdom |
| JIS K2204 Grade No. 2 | Japan |

BEFORE YOU OPERATE

Additional Technical Fuel Requirements

- The fuel cetane number should be 45 or higher.
- The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred.
- NEVER mix kerosene, used engine oil or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Ash content should not exceed 0.01% by volume.
- Carbon residue content should not 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 use Biocide.
- NEVER use kerosene or residual fuels.

Handling of Diesel Fuel

DANGER

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.

ALWAYS store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.

ALWAYS put 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.

Fuel Tank (Optional)

NOTICE: Water and / or dust in the fuel may cause engine failure. When fuel is stored, check that the inside of the storage container is clean and dry, and that the fuel is stored away from dirt or rain.

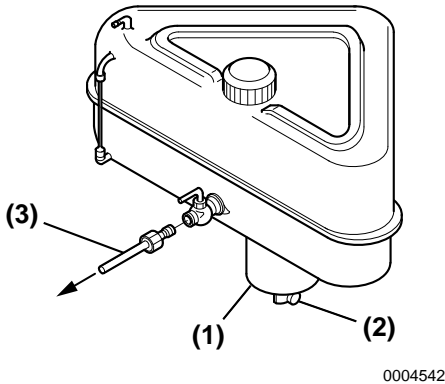


Figure 1

- 1 – Sediment Bowl
- 2 – Drain Cock
- 3 – Fuel Line to Engine

Install a drain cock (**Figure 1, (2)**) at the bottom of the fuel tank to remove water and contaminants from the sediment bowl (**Figure 1, (1)**).

The fuel outlet should be positioned 20 to 30 mm (0.75 to 1.125 in.) above the bottom of the tank (**Figure 2, (4)**) so that only clean fuel is distributed to the engine.

Fuel System

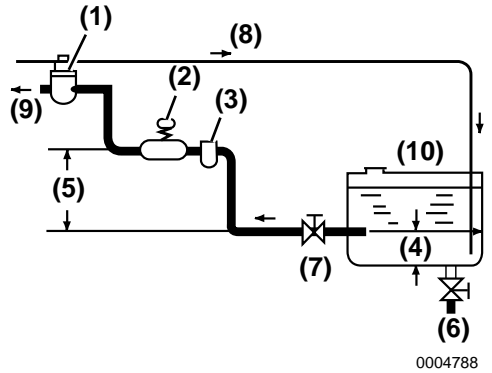


Figure 2

- 1 – Fuel Filter
- 2 – Fuel Feed Pump (Priming Lever)
- 3 – Fuel / Water Separator (Optional)
- 4 – Approximately 20 - 30 mm (0.75 - 1.125 in.)
- 5 – Within 500 mm (20 in.)
- 6 – Drain Cock
- 7 – Fuel Cock
- 8 – Fuel Return Line
- 9 – To Fuel Injection Pump
- 10 – Fuel Tank

Install the fuel line from the fuel tank to the fuel injection pump as shown in **Figure 2**. The recommended fuel / water separator (**Figure 2, (3)**) (optional) is installed at the center section of that line.

BEFORE YOU OPERATE

Filling the Fuel Tank

Before filling fuel tank for the first time:

Rinse the fuel tank with kerosene or diesel fuel. Dispose of waste properly.

To fill the fuel tank:

NOTICE: *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.*

1. Clean the area around the fuel cap.
2. Remove the fuel cap from the fuel tank.
3. Fill the tank with clean fuel free of oil and dirt. **WARNING! Hold the hose nozzle firmly against the filler port while filling. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.**
4. Stop fueling when the gauge shows the fuel tank is full. **CAUTION! NEVER overfill the fuel tank.**
5. Replace the fuel cap and hand-tighten. Over-tightening the fuel cap will damage it.

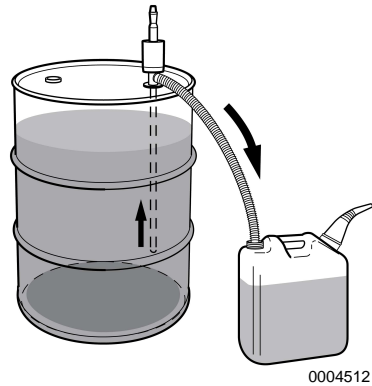


Figure 3

If filling the tank from a storage container (**Figure 3**), keep the fuel container stationary for several hours to allow any dirt or water to settle to the bottom of the container. Use a pump to extract the clear, filtered fuel from the top of the container.

Bleeding the Fuel System

The fuel system has an automatic air bleeding device that purges air from the fuel system. No manual air bleeding is required for normal operation. Manual bleeding must be done if any fuel system maintenance has been performed (replacement of fuel filter, etc.) or if the engine does not start after several attempts.

Bleeding the Fuel System

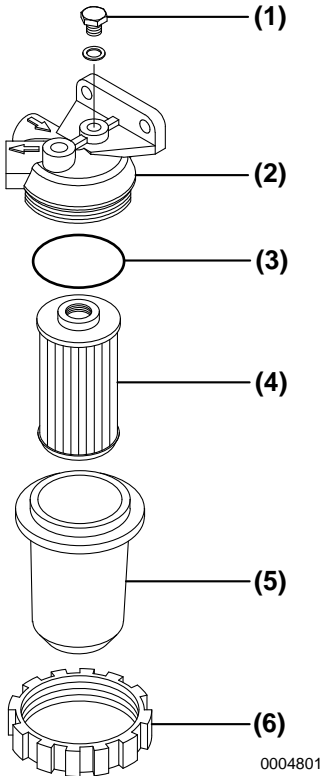


Figure 4

- 1 – Air-Bleed Screw**
- 2 – Bracket**
- 3 – O-Ring**
- 4 – Fuel Filter Element**
- 5 – Fuel Filter Housing**
- 6 – Retaining Ring**

1. Check the fuel level in the fuel tank. Refill if necessary.

2. Open the fuel cock of the fuel tank.
WARNING! Always wear safety glasses when bleeding the fuel system.
3. Loosen the air-bleed screw (**Figure 4, (1)**) 2 to 3 turns.
4. Push up and down on the manual priming lever located on the side of the fuel feed pump to release air out of the air-bleed screw. Always use an approved container to catch the diesel fuel.
5. Continue pumping until a solid stream of fuel with no air bubbles begins to flow.
6. Tighten the air-bleed screw.

Note: After engine start-up, the automatic air-bleeding device works to purge the air in the fuel system.

BEFORE YOU OPERATE

ENGINE OIL

Engine Oil Specifications

NOTICE: *Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize and / or shorten engine life. NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.*

Use an engine oil that meets or exceeds the following guidelines and classifications:

- API Service Categories: CD or higher
TBN value: 9 or more

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

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

- Recommended SAE Viscosity: 10W30, 15W40. Engine oil 10W30 and 15W40 can be used throughout the year.
- NEVER use API Service Category CG-4 or CH-4 oils.

NOTICE:

1. **Be sure the engine oil, engine oil storage containers and engine oil filling equipment are free of sediment or water.**
2. **Change the engine oil after the first 50 hours of operation and then at every 150 hours thereafter. See *Changing the Engine Oil* on page 53.**
3. **Select the oil viscosity based on the ambient temperature where the engine is being operated. See the *SAE Service Grade Viscosity Chart (Figure 5)*.**
4. **Yanmar does not recommend the use of engine oil “additives.”**

Handling Engine Oil

1. When handling and storing engine oil, be careful not to allow dust and water to contaminate the oil. Clean around the filler port before filling.
2. Do not mix lube oils of different types or brands. Mixing may cause the chemical characteristics of the oil to change and lubricating performance to decrease, reducing the engine's life.
3. Engine oil should be replaced at the specified intervals, regardless of the engine's operation history. See *Periodic Maintenance Schedule* on page 48.

Engine Oil Viscosity

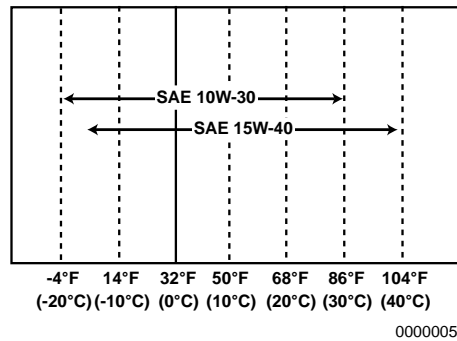


Figure 5

Select the appropriate engine oil viscosity based on the ambient temperature shown in the SAE Service Grade Viscosity Chart in Figure 5.

NOTICE: *If you intend to operate your equipment at temperatures outside the limits shown, you must consult your authorized Yanmar Marine dealer or distributor for special lubricants or starting aids.*

Checking the Engine Oil

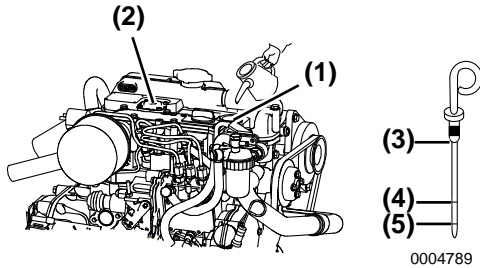


Figure 6

- 1 – Filler Port
- 2 – Rocker Arm Cover
- 3 – Dipstick
- 4 – Upper Limit
- 5 – Lower Limit

Note: 3YM30 shown. Other models are similar.

1. Make sure the engine is off. It is recommended that the engine be as level as possible before checking the oil.
2. **NOTICE: Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick, filler port cap and the surrounding area before you remove the cap.** Remove the dipstick (**Figure 6, (3)**) and wipe with a clean cloth.
3. Fully reinsert the dipstick.
4. Remove the dipstick. The oil level should be between upper (**Figure 6, (4)**) and lower (**Figure 6, (5)**) lines on the dipstick.
5. Add oil if necessary. *See Adding Engine Oil on page 27.*
6. Fully reinsert the dipstick.

Adding Engine Oil

1. **NOTICE: Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick, filler port cap and the surrounding area before you remove the cap.** Remove the yellow oil filler port cap from the filler port (**Figure 6, (1)**) on the rocker arm cover (**Figure 6, (2)**) and fill with engine oil.
2. Fill with engine oil to the upper limit (**Figure 6, (4)**) on the dipstick (**Figure 6, (3)**). **NOTICE: NEVER overfill the engine with engine oil.**
3. Insert the dipstick fully to check the level. **NOTICE: ALWAYS keep the oil level between the upper and lower lines on the oil cap / dipstick.**
4. Hand-tighten the filler port cap securely.

BEFORE YOU OPERATE

MARINE GEAR OR SAIL DRIVE OIL

Marine Gear Oil Specifications

Use marine gear oil that meets or exceeds the following guidelines and classifications:

KM2P-1 (S), (G) or (GG):

- API Service Categories: CD or higher
- SAE Viscosity: #20 or #30

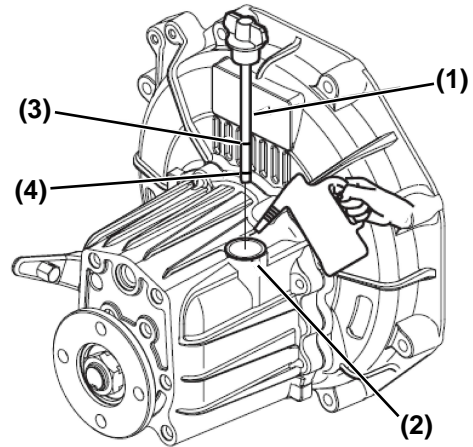
Sail Drive Oil Specifications - SD20

Refer to the *Sail-Drive Operation Manual* for the procedure to fill or replace the sail drive oil.

SD20:

- API Service Category: GL4.5
- SAE Viscosity: 90 or 80W90
- QuickSilver^{® 1} High Performance Gear Lube.

Checking Marine Gear Oil



0004811

Figure 7

- 1 – Dipstick**
- 2 – Marine Gear Filler Port**
- 3 – Upper Limit**
- 4 – Lower Limit**

1. Make sure the engine is off. Make sure the engine is as level as possible and wipe area clean around the marine gear filler port (**Figure 7, (2)**).
2. Remove the filler cap at the top of the housing.
3. Remove the dipstick (**Figure 7, (1)**) and wipe with a clean cloth.
4. Fully reinsert the dipstick.
5. Remove the dipstick. The oil level should be between the upper (**Figure 7, (3)**) and lower (**Figure 7, (4)**) lines on the dipstick.
6. Fully reinsert the dipstick.

¹ QuickSilver is a registered trademark of Brunswick Corporation.

Adding Marine Gear Oil

1. Make sure the engine is as level as possible.
2. Remove the filler cap at the top of the housing.
3. Fill with oil to the upper limit on the dipstick (**Figure 7, (3)**). See *Marine Gear Oil Specifications on page 28*.
NOTICE: NEVER overfill the marine gear with oil.
4. Fully reinsert the dipstick.
5. Hand-tighten the filler port cap.

Checking and Adding Sail Drive Oil

Refer to the *Sail-Drive Operation Manual* for the procedure for checking and filling the sail drive oil.

ENGINE COOLANT

Engine Coolant Specifications

- Texaco Long Life Coolant (LLC), both standard and premixed, product code 7997 and 7998.
- Havoline Extended Life Antifreeze / Coolant, product code 7994.

Note: In the U.S., LLC is required for the warranty to be valid.

NOTICE: Following the manufacturer's recommendations, use a proper LLC which will not have any adverse effects on the materials (cast iron, aluminum, copper, etc.) of the engine's cooling system. See Engine Coolant Specifications on page 33.

ALWAYS use the mixing ratios specified by the antifreeze manufacturer for the temperature range.

NOTICE: ALWAYS add LLC to soft water – especially when operating in cold weather. NEVER use hard water. Water should be clean and free from sludge or particles. Without LLC, cooling performance will decrease due to scale and rust in the coolant system. Water alone may freeze and form ice; it expands approximately 9% in volume. Use the proper amount of coolant concentrate for the ambient temperature as specified by the LLC manufacturer. LLC concentration should be a minimum of 30% to a maximum of 60%. Too much LLC will decrease the cooling efficiency. Excessive use of antifreeze also lowers the cooling efficiency of the engine. NEVER mix different types or brands of LLC, as a harmful sludge may form. Mixing different brands of antifreeze may cause chemical reactions, and may make the antifreeze useless or cause engine problems.

BEFORE YOU OPERATE

Replace the engine coolant periodically, according to the maintenance section in this *Operation Manual*.

Checking and Adding Coolant Component Identification

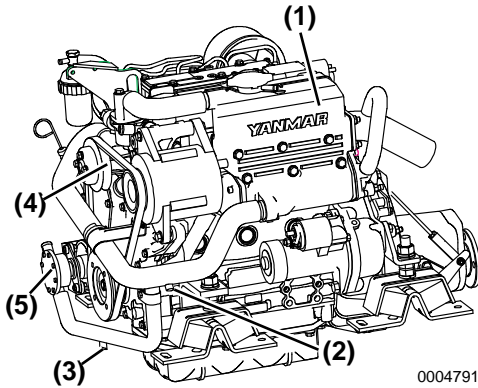


Figure 8

- 1 – Coolant Tank / Heat Exchanger
- 2 – Coolant Drain Plug
- 3 – Seawater Drain Plug
- 4 – Coolant Pump
- 5 – Seawater Pump

Remove scale from the cooling system periodically by flushing the system.

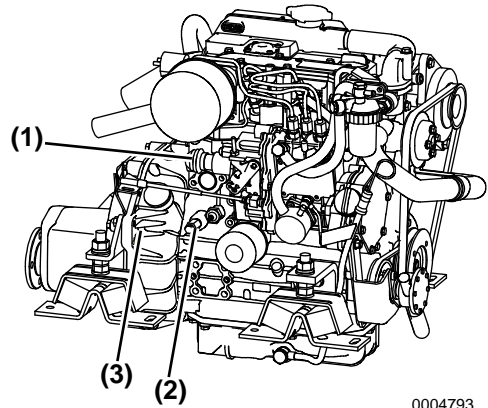


Figure 10

- 1 – Stop Solenoid
- 2 – Seawater Drain Plug
- 3 – Flywheel Housing

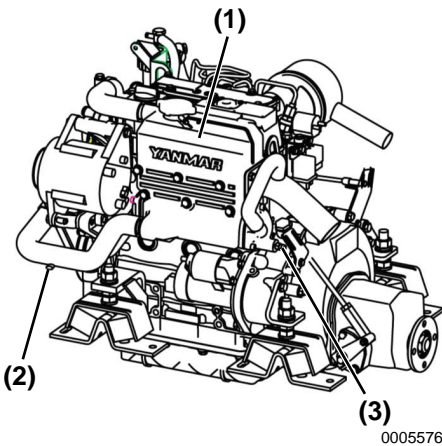


Figure 9

- 1 – Coolant Tank / Heat Exchanger
- 2 – Coolant Drain Plug
- 3 – Seawater Drain Cock

Note: The drain cocks are opened before shipping from the factory. Close all drain cocks before filling the system with coolant.

1. Allow the engine to cool.
2. Ensure all drain cocks are closed.
3. Loosen the coolant tank filler cap to relieve the pressure, then remove the filler cap. **WARNING! NEVER remove the coolant filler cap if the engine is hot. Steam and hot engine coolant will spray out and seriously burn you. Allow the engine to cool down before you attempt to remove the cap.**

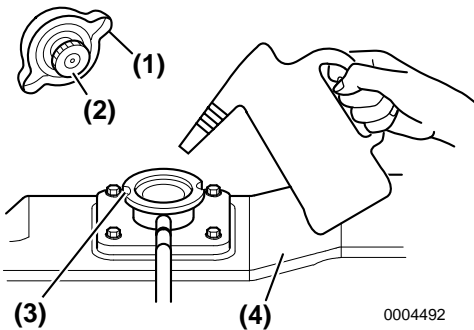


Figure 11

- 1 – Filler Cap Tabs
- 2 – Coolant Filler Cap
- 3 – Filler Port Notches
- 4 – Coolant Tank / Heat Exchanger

4. **NOTICE: NEVER pour cold coolant into a hot engine.**
Pour coolant slowly into the coolant tank / heat exchanger (Figure 11, (4)) to avoid air bubbles. Fill until coolant overflows from the filler port.

5. Align the filler cap tabs (Figure 11, (1)) with filler port notches (Figure 11, (3)) and tighten the filler cap (Figure 11, (2)).

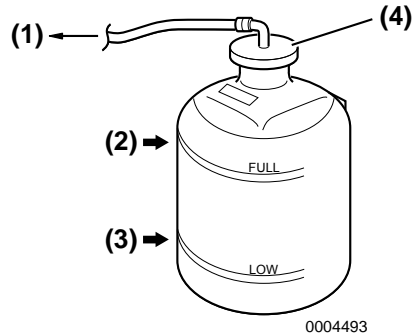


Figure 12

- 1 – Rubber Hose to Coolant Tank
- 2 – FULL Mark
- 3 – LOW Mark
- 4 – Coolant Recovery Tank Cap

6. Check the coolant level in the coolant recovery tank. The level should be at the FULL mark (Figure 12, (2)). Add coolant if necessary.

Note: The coolant level rises in the coolant recovery tank during operation. After stopping the engine, the coolant will cool down and the extra coolant will return to the coolant tank.

NOTICE: NEVER pour cold coolant into a hot engine.

7. Remove coolant recovery tank cap (Figure 12, (4)) to add coolant if necessary. NEVER add water.
8. Replace the filler cap and tighten it firmly. Failure to do so will cause coolant to leak.

WARNING! ALWAYS tighten the coolant tank cap securely after checking the coolant tank. Steam can spray out during engine operation if the cap is loose.

| Coolant Recovery Tank Capacity |
|--------------------------------|
| 0.8 L (0.95 qt) |

BEFORE YOU OPERATE

9. Check the rubber hose (Figure 12, (1)) connecting the coolant recovery tank to the coolant tank / heat exchanger. Replace if damaged.

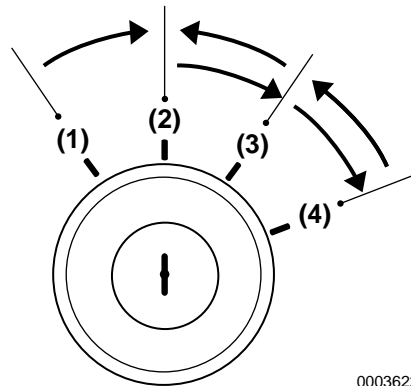
NOTICE: *If the coolant runs low too often or only the coolant level in the coolant tank / heat exchanger drops without any change in the level in the coolant recovery tank, there may be coolant or air leaks in the cooling system. See your authorized Yanmar Marine dealer or distributor.*

CRANKING THE ENGINE

NOTICE: *When performing engine break-in or if the engine has not been used for a long period of time, engine oil will not be distributed to all of the operating parts. Using the engine in this condition will lead to seizure.*

After a long period of non-use, distribute engine oil to each part by cranking the engine. Perform the following procedure before beginning operation:

1. Open the seacock.
2. Open the fuel cock.
3. Put the remote control shift lever in NEUTRAL.
4. Turn the battery switch to ON (if equipped).



0003622

Figure 13

- 1 – GLOW
- 2 – OFF
- 3 – ON
- 4 – START

Note: If the engine has not been operated for a long period of time, check that the key moves smoothly from the START to ON positions.

5. Turn the key to ON (Figure 13, (3)).

6. While pushing the STOP button on the control panel, turn the key to the START position (**Figure 13, (4)**). **NOTICE: NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.**
7. When the key is in the START position, the engine will begin cranking. Continue cranking for about 5 seconds and listen for abnormal noise during that time.

NOTICE: If the STOP button is released during the cranking procedure, the engine will start. NEVER start the engine in this mode.

DAILY CHECKS

Before you start for the day, make sure the engine is in good operating condition.

CAUTION! It is important to perform the daily checks as listed in this 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.

Make sure to check the following items:

Visual Checks

1. Check for engine oil leaks.
2. Check for fuel leaks.
WARNING! Avoid skin contact with the 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 any damage.
3. Check for engine coolant leaks.
4. Check for damaged or missing parts.
5. Check for loose, missing or damaged fasteners.
6. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
7. Check hoses for cracks, abrasions and damaged, loose or corroded clamps.

BEFORE YOU OPERATE

8. Check the fuel filter / water separator for presence of water and contaminants. If any water or contaminants are found, drain the fuel filter / water separator. *See Draining Fuel Filter / Water Separator on page 56.* If you have to drain the fuel filter / water separator frequently, drain the fuel tank and check for water in your fuel supply. *See Draining the Fuel Tank on page 52.*

CAUTION! *If any problem is noted during the visual check, the necessary corrective action should be taken before operating the engine.*

Checking Diesel Fuel, Engine Oil and Engine Coolant Levels

Follow the procedures in *Filling the Fuel Tank on page 24*, *Checking the Engine Oil on page 27* and *Checking and Adding Coolant on page 30* to check these levels.

Checking and Refilling Marine Gear Oil

See Checking Marine Gear Oil on page 28.

Checking the Battery Electrolyte Level

Check the battery electrolyte level before use. *See Checking the Battery Electrolyte Level (Serviceable Batteries Only) on page 57.*

Checking the Alternator Belt

Check the belt tension before use. *See Checking and Adjusting the Alternator V-Belt Tension on page 54.*

Checking the Remote Control Handle

Check the operation of the remote control handle and ensure it moves smoothly. If it is hard to operate, grease the joints of the remote control cable and lever bearings. If the lever is too loose, adjust the remote control cable. *See Checking and Adjusting the Remote Control Cables on page 54.*

Checking the Alarm Indicators

Check the instruments and alarm indicators at regular intervals.

Preparing Fuel, Oil and Coolant in Reserve

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

ENGINE OPERATION

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

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

WARNING

Fire and Explosion Hazard



NEVER jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion. ONLY use the key switch to start the engine.

Sudden Movement Hazard

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

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

Sever Hazard



Keep children and pets away while the engine is operating.

Exhaust Hazard



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

NOTICE

If any indicator illuminates during engine operation, stop the engine immediately. Determine the cause and repair the problem before continuing to operate the engine. If the alarm window with audible alarm fails to display and go out about 3 seconds later when the ignition switch is in the ON position, see your authorized Yanmar Marine dealer or distributor for service before operating the engine.

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.
- 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 is below -16°C (+5°F), rubber components such as gaskets and seals will harden causing premature engine wear and damage.
- Contact your authorized Yanmar Marine engine dealer or distributor if the engine will be operated outside of this standard temperature range.

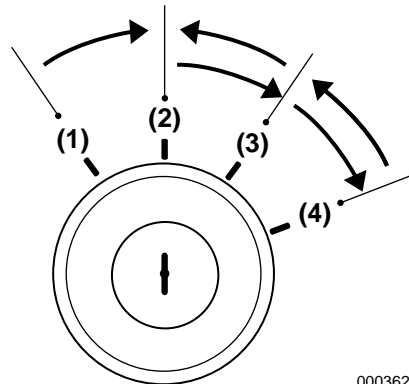
NEVER engage the starter motor while the engine is running. Damage to the starter motor pinion and / or ring gear will result.

STARTING THE ENGINE

NOTICE: *If the vessel is equipped with a water lift (water lock) muffler, excessive cranking could cause seawater to enter the cylinders and damage the engine. If the engine does not start after cranking for 10 seconds, close the seacock to avoid filling the muffler with water. Crank for 10 seconds or until the engine starts. When the engine does start, stop the engine immediately and turn the switch to the OFF position.*

1. Open the seacock (if equipped).
2. Open the fuel cock.
3. Put the remote control handle in NEUTRAL.

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



0003622

Figure 1

- 1 – GLOW
- 2 – OFF
- 3 – ON
- 4 – START

4. Turn the battery master switch (if equipped) to ON.

5. Turn key switch to ON (**Figure 1, (3)**). Ensure that the instrument panel indicators light and the alarm sounds. This indicates that indicators and alarm are working correctly.
Note: The coolant high temperature alarm indicator and water in Sail-Drive indicator should not come on during start-up.
6. Turn key switch to START (**Figure 1, (4)**). Release the key switch when the engine has started. **NOTICE: NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.**
7. The alarm should stop and the indicators should go out. **NOTICE: If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar Marine dealer or distributor for service before operating the engine.**

Note: When the engine has not been used for a long period of time, check that the key moves smoothly from the START position to the ON position.

Restarting After Starting Failure

Before turning the key switch again, be sure the engine has stopped completely. NEVER attempt to restart the engine while the engine is running. The pinion gear on the starter motor will be damaged. **NOTICE: NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.**

NOTICE: NEVER attempt to restart the engine if the engine has not stopped completely. Pinion gear and starter motor damage will occur.

Air Bleeding the Fuel System After Starting Failure

If the engine does not start after several attempts, there may be air in the fuel system. If air is in the fuel system, fuel cannot reach the fuel injection pump. Bleed the air out of the system. See *Bleeding the Fuel System* on page 25.

Starting at Low Temperatures

Comply with local environmental requirements. Use engine heaters to avoid starting problems and white smoke. **NOTICE: NEVER use an engine starting aid such as ether. Engine damage will result. Using a starting aid may void the warranty.**

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.

Starting with Air Heater (If Equipped)

1. Open the seacock (if equipped).
2. Open the fuel tank cock.
3. Put remote control handle in NEUTRAL.
4. Turn the battery master switch (if equipped) ON.
5. Turn key switch to GLOW for 15 seconds.
6. Turn key switch to ON. Ensure that the instrument panel indicators light and the alarm sounds. This shows that indicators and alarm are working correctly.

Note: The coolant high temperature alarm indicator and water in Sail-Drive indicator should not come on during start-up.

7. Turn key switch to START. Release the key switch when the engine has started. The alarm should stop and the indicators should go out. **NOTICE:** ***NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.***

After the Engine Has Started

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

1. Check that the gauges, indicators and alarm are normal.
2. Check for any water, fuel, engine coolant or engine oil leaks. If any leaks are found, shut down the engine and perform the necessary repairs. **WARNING!** ***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. Avoid skin contact with the 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.***
3. Check that the exhaust color, engine vibration and sound are normal.
4. When there are no problems, keep the engine at low speed with the boat still stopped to distribute engine oil to all parts of the engine.

Check that water is being discharged from the seawater outlet pipe. Operation with inadequate seawater discharge will damage the impeller of the seawater pump. If seawater discharge is too low, stop the engine immediately. Identify the cause and repair. **NOTICE:** ***The engine will seize if it is operated when cooling seawater discharge is inadequate or if load is applied without any warm-up operation.***

When operating the engine at low speed for long periods of time, race the engine once every two hours. Race the engine with the clutch in NEUTRAL, accelerate from the low speed position to the high speed position and repeat this process about five times. This cleans out carbon from the cylinders and the fuel injection valves.

NOTICE: ***Neglecting to race the engine will result in poor exhaust color and reduce engine performance.***

Periodically operate the engine near maximum speed while underway. This will generate higher exhaust temperatures, which will help clean out hard carbon deposits, maintain engine performance and prolong the life of the engine.

For troubleshooting assistance, see *Troubleshooting After Starting* on page 65 or *Troubleshooting Chart* on page 67.

If necessary, see your authorized Yanmar Marine dealer or distributor.

REMOTE CONTROL HANDLE OPERATION

Acceleration and Deceleration

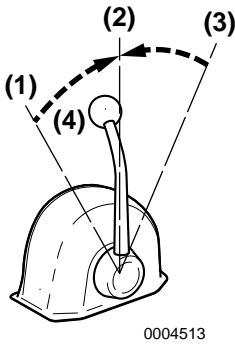


Figure 2

- 1 – Forward or Reverse**
- 2 – Neutral**
- 3 – Reverse or Forward**
- 4 – Throttle Handle / Clutch Handle**

Note: Direction of travel will vary depending on installation location.

Use the throttle handle (**Figure 2, (4)**) to control acceleration and deceleration. Move the handle slowly.

Shifting the Engine

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

1. Before using the marine gear, be sure to move the throttle handle to a low idle position (less than 1000 rpm). Move the throttle handle slowly to a higher speed position after completing clutch engagement.
2. **NOTICE: NEVER shift the marine gear at high engine speed. During normal operation, the marine gear should only be shifted with the engine at idle.** When moving the handle between FORWARD (**Figure 2, (1)**) and REVERSE (**Figure 2, (3)**), bring the clutch to NEUTRAL (**Figure 2, (2)**) and pause before slowly shifting to the desired position. Do not shift abruptly from FORWARD to REVERSE or vice versa.

SHUTTING DOWN THE ENGINE

NOTICE: NEVER stop engine abruptly during operation. Yanmar recommends that when shutting the engine down, allow the engine to run, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the exhaust system, to cool slightly before the engine is shut down.

1. Reduce engine speed to low idle and put remote control handle in NEUTRAL.
2. Accelerate from low speed to high speed and repeat five times. This will clean out the carbon from the cylinders and the fuel injection nozzles.
3. Allow engine to run at low speed (approximately 1000 rpm) without load for 5 minutes.

4. With the key in the ON position, push and hold the stop button (**Figure 3, (1)**). After the engine has stopped, turn the key switch to OFF.
Note: Continue to hold the stop button in until the engine is completely stopped. If the button is released before the engine has completely stopped, it may restart. If the engine does not shut down, see Emergency Shutdown on page 40.

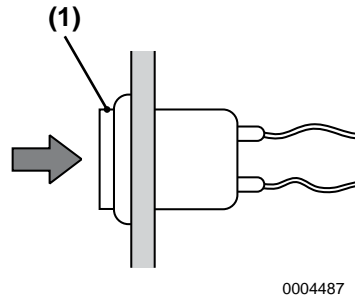


Figure 3

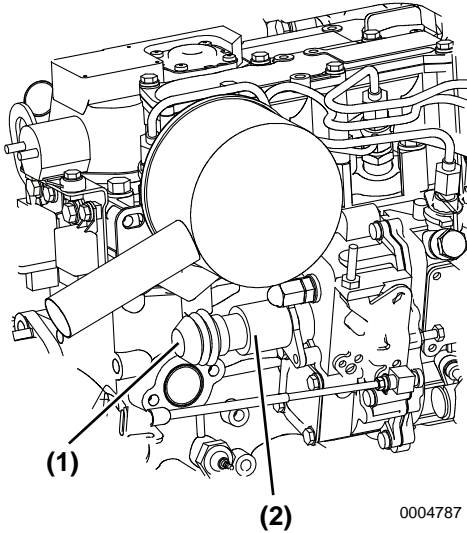
1 – STOP Button

5. Remove the key and cover the key switch with the moisture cap.
6. Turn off the battery master switch (if equipped).
7. Close the fuel cock.
8. Close the seacock (if equipped).
NOTICE: ALWAYS close the seacock. Neglecting to close the seacock could allow water to leak into the boat and may cause it to sink.

Emergency Shutdown

NOTICE: NEVER use the emergency stop switch for a normal engine shutdown. Use this switch only when stopping the engine suddenly in an emergency.

If the engine cannot be shut down by the STOP button on the panel, stop the engine by pushing the button **(Figure 4, (1))** at the back of the stop solenoid **(Figure 4, (2))**.



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Figure 4

- 1 – STOP Button
- 2 – Stop Solenoid

CHECKING THE ENGINE AFTER OPERATION

- Check that the key switch is in the OFF position and that the battery master switch (if equipped) is turned to OFF.
- Fill the fuel tank. *See Filling the Fuel Tank on page 24.*
- Close seacock(s).
- If there is a risk of freezing, check that the cooling system contains enough coolant. *See Engine Coolant Specifications on page 29.*
- If there is a risk of freezing (temperatures below 0°C [32°F]), drain the seawater system. *See Draining the Cooling System on page 72* and connect the engine heater (if equipped).

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PERIODIC MAINTENANCE

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

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

SAFETY PRECAUTIONS

WARNING

Crush Hazard



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

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

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

WARNING

Welding Hazard

- ALWAYS turn off the battery switch (if equipped) or disconnect the negative battery cable and the leads to the alternator when welding on the equipment.
- 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 prior to reconnecting the batteries.

Exhaust Hazard



ALWAYS ensure that all connections are tightened to specifications after repair is made to the exhaust system.

All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.

Shock Hazard



ALWAYS turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the

equipment.

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

NOTICE

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

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

PRECAUTIONS

The Importance of Periodic Maintenance

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

Performing Periodic Maintenance

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

The Importance of Daily Checks

The Periodic Maintenance Schedule assumes that the daily checks are performed on a regular basis. Make a habit of performing daily checks before the start of each operating day. *See Daily Checks on page 33.*

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is operated 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, 100, 150, 250 and 1000 engine hours. **NOTICE: Failure to perform periodic maintenance will shorten the life of the engine and may void the warranty.**

Yanmar Replacement Parts

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

Tools Required

Before starting any periodic maintenance procedure, make sure you have the tools needed 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 with any maintenance or service related procedures.

PERIODIC MAINTENANCE

Tightening Fasteners

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

NOTICE: *The tightening torque in the Standard Torque Chart should be applied only to the bolts with a “7” head (JIS strength classification: 7T). Apply 60% torque to bolts that are not listed. Apply 80% torque when tightened to aluminum alloy.*



Standard Torque Chart

| Bolt diameter x pitch (mm) | | M6 x 1.0 | M8 x 1.25 | M10 x 1.5 | M12 x 1.75 | M14 x 1.5 | M16 x 1.5 |
|----------------------------|-------|------------|------------|------------|-------------|--------------|--------------|
| Tightening Torque | N·m | 11.0 ± 1.0 | 26.0 ± 3.0 | 50.0 ± 5.0 | 90.0 ± 10.0 | 140.0 ± 10.0 | 230.0 ± 10.0 |
| | kgf·m | 1.1 ± 0.1 | 2.7 ± 0.3 | 5.1 ± 0.5 | 9.2 ± 1.0 | 14.3 ± 1.0 | 23.5 ± 1.0 |
| | lb·ft | 8.0 ± 0.7 | 19.0 ± 2.1 | 37 ± 3.6 | 66.0 ± 7.2 | 103 ± 7.2 | 170 ± 7.2 |

EPA MAINTENANCE REQUIREMENTS

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations for Engines, it is essential to follow the *Periodic Maintenance Schedule on page 48* and the *Periodic Maintenance Procedures on page 52*.

EPA Requirements for USA and Other Applicable Countries

The following are the requirements for the EPA. Unless these requirements are met, the exhaust gas emissions will not be within the limits specified by the EPA.

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

Conditions to Ensure Compliance with EPA Emission Standards

The 2YM15, 3YM20 and 3YM30 are EPA-certified engines.

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

- Ambient temperature: -20° to +40°C (-4° to +104°F)
- Relative humidity: 80% or lower

The diesel fuel should be:

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

The lubricating oil should be:

- Type API, Class CD or higher

Perform the inspections as outlined in *Periodic Maintenance Procedures on page 52* and keep a record of the results.

Pay particular attention to these important points:

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

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

Inspection and Maintenance

See *Inspection and Maintenance of EPA Emission-Related Parts on page 51* for the EPA emission-related parts. Inspection and maintenance procedures not shown in the *Inspection and Maintenance of EPA Emission-Related Parts on page 51* section are covered in *Periodic Maintenance Schedule on page 48*.

This maintenance must be performed to keep the emission values of the engine within 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 to perform the required periodic maintenance at the 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 ●.**

PERIODIC MAINTENANCE

| ○: Check or Clean ◇: Replace ●: Contact your authorized Yanmar Marine dealer or distributor | | | Periodic Maintenance Interval | | | | | |
|---|--|---|-------------------------------|---|---|---|---|---|
| System | Item | Before Starting <i>See Daily Checks on page 33</i> | Initial 50 Hours | Every 50 hours or monthly whichever comes first | Every 100 hours or six months whichever comes first | Every 150 hours or one year whichever comes first | Every 250 hours or one year whichever comes first | Every 1000 hours or 4 years whichever comes first |
| Whole | Visual inspection of engine exterior | ○ | | | | | | |
| Fuel System | Check the fuel level and refill if necessary | ○ | | | | | | |
| | Drain water and sediment from the fuel tank | | ○ | | | | ○ | |
| | Drain the fuel / water separator | | | ○ | | | | |
| | Replace the fuel filter element | | | | | | ◇ | |
| | Check the fuel injection timing | | | | | | | ● |
| | Check the fuel injector spray pattern | | | | | | | ●* |
| Lubricating System | Check the engine oil level | Engine | ○ | | | | | |
| | | Marine Gear | ○ | | | | | |
| | Replace the engine oil | Engine | | ◇ | | | ◇ | |
| | | Marine Gear | | ◇ | | | | ◇ |
| | Sail Drive | | | | ◇ | | | |
| Replace the oil filter element | Engine | | ◇ | | | | ◇ | |
| Cooling System | Seawater outlet | ○ During Operation | | | | | | |
| | Check coolant level | ○ | | | | | | |
| | Check or replace the seawater pump impeller | | | | | | ○ | ◇ |
| | Replace coolant | Every year. When Long Life Coolant (LLC) is used, replace every two years. <i>See Engine Coolant Specifications on page 29.</i> | | | | | | |
| | Clean and check the seawater passages | | | | | | | ● |

PERIODIC MAINTENANCE

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

| System | Item | Periodic Maintenance Interval | | | | | | |
|--------------------------------|---|---|------------------|---|---|---|---|---|
| | | Before Starting <i>See Daily Checks on page 33</i> | Initial 50 Hours | Every 50 hours or monthly whichever comes first | Every 100 hours or six months whichever comes first | Every 150 hours or one year whichever comes first | Every 250 hours or one year whichever comes first | Every 1000 hours or 4 years whichever comes first |
| Air Intake and Exhaust System | Clean the intake silencer (air cleaner) element | | | | | | ○ | |
| | Clean or replace the exhaust / water mixing elbow | | | | | | ○ | |
| | Clean the breather pipe | | | | | | ○ | |
| | Check the exhaust gas condition | ○ During Operation | | | | | | |
| | Check diaphragm assembly | | | | | | | ● |
| Electrical System | Check the alarm and indicators | ○ | | | | | | |
| | Check the electrolyte level in the battery | | | ○ | | | | |
| | Adjust the tension of the alternator V-belt or replace V-belt | | ○ | | | | ○ | ◇ |
| | Check the wiring connectors | | | | | | ○ | |
| Engine Cylinder Head and Block | Check for leakage of fuel, engine oil and engine coolant | ○ After Starting | | | | | | |
| | Tighten all major nuts and bolts | | | | | | | ● |
| | Adjust intake / exhaust valve clearance | | ○ | | | | | ● |
| Miscellaneous Items | Check the remote control cables | ○ | ○ | | | | | ● |
| | Adjust the propeller shaft alignment | | ○ | | | | | ● |

* For EPA requirements, see *Inspection and Maintenance of EPA Emission-Related Parts on page 51*.

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

Inspection and Maintenance of EPA Emission-Related Parts

- Marine diesel engines less than 37 kW (50 hp) are certified as EPA non-road engine
- Marine diesel engines greater than 37 kW (50 hp) are certified as EPA CI marine engines

Inspection and Maintenance of EPA Emission-Related Parts for Non-Road and CI Marine Engines

| Parts | Interval |
|---|------------|
| Clean the fuel injection nozzle | 1500 hours |
| Check the fuel injection nozzle pressure and spray pattern | 3000 hours |
| Check the fuel injection pump adjustment | |
| Check turbocharger adjustment (if equipped) | |
| Check the electronic engine control unit and its associated sensors and actuators (if equipped) | |

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

PERIODIC MAINTENANCE PROCEDURES

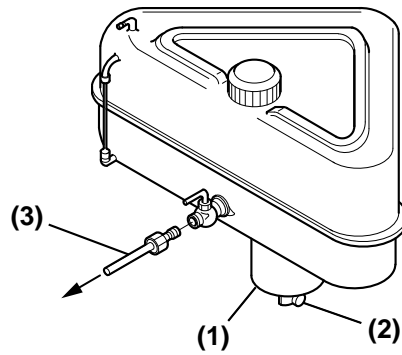
After Initial 50 Hours of Operation

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

- Draining the Fuel Tank
- Changing the Engine Oil
- Replacing the Engine Oil Filter Element
- Changing the Marine Gear Oil
- Checking and Adjusting the Alternator V-Belt Tension
- Inspecting and Adjusting Intake / Exhaust Valve Clearance
- Checking and Adjusting the Remote Control Cable
- Adjusting the Remote Control Cables
- Adjusting Propeller Shaft Alignment

Draining the Fuel Tank

WARNING! *When you are draining the fuel tank to perform maintenance, put 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.*



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Figure 1

- 1 – Sediment Bowl
- 2 – Drain Cock
- 3 – Fuel Line To Engine

Note: Optional fuel tank shown. Actual equipment may be different.

1. Put a pan under the drain cock (**Figure 1, (2)**) to catch fuel.
2. Open the drain cock and drain water and sediment. Close the drain cock when the fuel is clean and free of air bubbles.

Changing the Engine Oil

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! If the engine oil must be drained while it is still hot, stay clear of the hot engine oil to avoid being burned. ALWAYS wear eye protection.**

1. Turn the engine OFF.
2. **NOTICE: Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before removing the dipstick.** Remove the engine oil dipstick. Attach the oil drain pump (if equipped) and pump out the oil. For easier draining, remove the engine oil fill cap.
3. Fill with new engine oil. *See Adding Engine Oil on page 27.* **NOTICE: 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.**
4. Perform a trial run and check for oil leaks.
5. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

Replacing the Engine Oil Filter Element

1. Turn the engine OFF.
2. Turn the engine oil filter (**Figure 2**) counterclockwise with a wrench.
3. Remove the engine oil filter.

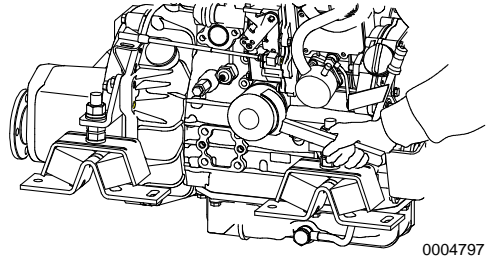


Figure 2

Note: 3YM20 shown.

4. Install a new filter element and hand-tighten until the seal touches the housing.
5. Turn filter an additional 3/4 turn using a box wrench. Tighten to 20 to 24 N·m (177 to 212 lb-in.).
6. Perform a trial run and check for oil leaks.

Changing the Marine Gear Oil

Note: Refer to the Marine Gear Operation Manual for procedure.

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

1. Remove cap from the filler port and attach an oil drain pump. Drain marine gear oil.
2. Fill marine gear with clean marine gear oil. *See Marine Gear Oil Specifications on page 28.*
3. Perform a trial run and check for oil leaks.
4. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

PERIODIC MAINTENANCE

Checking and Adjusting the Alternator V-Belt Tension

NOTICE: NEVER get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if it is damaged.

WARNING! Perform this check with engine OFF and key removed to avoid contact with moving parts.

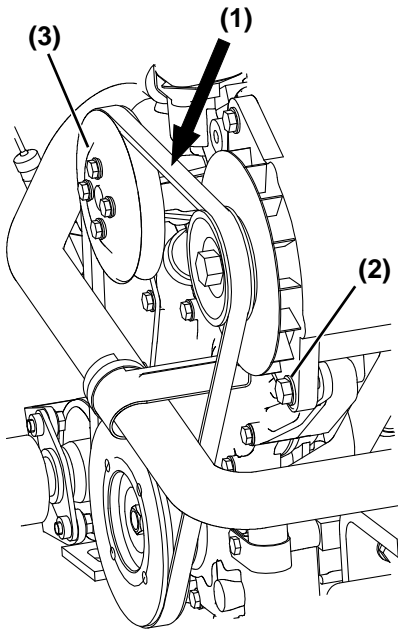


Figure 3

- 1 – Middle Of V-Belt
- 2 – Alternator Bolt
- 3 – V-Pulley (Coolant Pump)

Note: 3YM20 shown.

1. Remove the belt cover.
2. Check the belt by pushing on the middle of the belt (**Figure 3, (1)**) with your finger.
With proper tension, the belt should deflect 8 to 10 mm (approximately 3/8 in.).
3. Loosen the alternator bolt (**Figure 3, (2)**) and move the alternator to adjust the V-belt tension.

4. Install the belt cover.

Note: If replacing the V-belt, loosen the V-pulley (**Figure 3, (3)**) of the coolant pump to remove the V-belt.

Inspecting and Adjusting Intake / Exhaust Valve Clearance

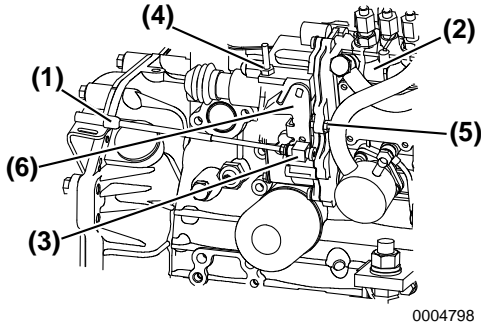
Proper adjustment is necessary to maintain the correct timing for opening and closing the valves. Improper adjustment will cause the engine to run noisily, resulting in poor engine performance and engine damage. See your authorized Yanmar Marine dealer or distributor to adjust the intake / exhaust valve clearance.

Checking and Adjusting the Remote Control Cables

NOTICE: Never adjust the high speed stop bolt (**Figure 4, (4)**) on the governor. This will void the engine warranty.

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

Adjusting the Throttle Remote Control Cable



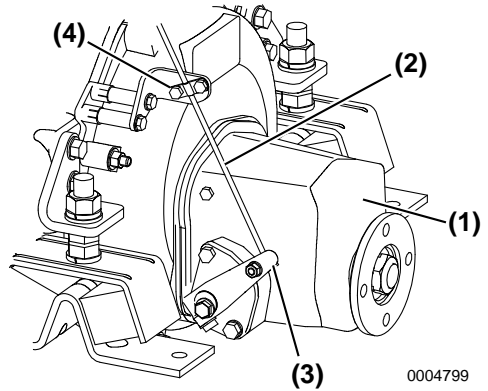
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Figure 4

- 1 – Cable
- 2 – Fuel Injection Pump
- 3 – Adjustment
- 4 – High Speed Stop Bolt
- 5 – Low Speed Stop Bolt
- 6 – Control Lever

1. Check that the control lever on the engine side moves to the high speed stop position and low speed stop position when the remote control lever is moved to H (high speed) and L (low speed) respectively.
2. When there is deviation, loosen the bracket for the remote control cable on the engine side and adjust.
3. Adjust the high-speed stop position first and then adjust the low speed idling by the adjustment bolt on the remote control lever.

Adjusting Clutch Remote Control Cable



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Figure 5

- 1 – Marine Gear
- 2 – Control Cable
- 3 – Control Lever
- 4 – Bracket (Cable)

1. Check that the control lever moves to the correct position when the remote control cable handle is moved to the NEUTRAL, FORWARD and REVERSE positions.
2. Use the NEUTRAL position as the standard for adjustment. When there is deviation, loosen the bracket (**Figure 5, (4)**) for the remote control cable on the clutch side and adjust.

PERIODIC MAINTENANCE

Adjusting Propeller Shaft Alignment

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

After the first 50 hours of operation, the alignment should be checked and readjusted if necessary. This is considered normal maintenance and the adjustment requires specialized knowledge and techniques. Consult your authorized Yanmar Marine dealer or distributor.

Every 50 Hours of Operation

When completing the initial 50 hour maintenance procedures, perform the following procedures every 50 hours thereafter or monthly, whichever comes first.

- **Draining Fuel Filter / Water Separator**
- **Checking Battery Electrolyte Level**

Draining Fuel Filter / Water Separator

WARNING! When removing any fuel system component to perform maintenance (such as changing the fuel filter), put 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 removing any fuel system component.

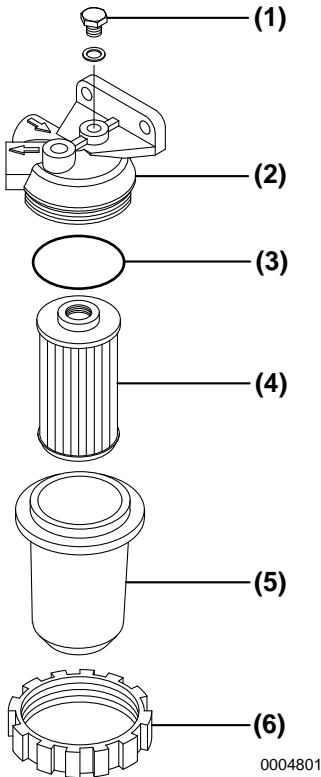


Figure 6

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- 1 – Air Bleed Screw
- 2 – Bracket
- 3 – O-Ring
- 4 – Fuel Filter Element
- 5 – Fuel Filter Housing
- 6 – Retaining Ring

1. Close the fuel cock of the fuel tank.
2. Put a pan under the fuel water separator.
3. Loosen the retaining ring (**Figure 6, (6)**) and remove the filter housing (**Figure 6, (5)**) and drain off any water or sediment collected inside.
4. After draining, tighten the air bleed screw (**Figure 6, (1)**).
5. Be sure to bleed air from the fuel system. *See Bleeding the Fuel System on page 25.*

Checking the Battery Electrolyte Level (Serviceable Batteries Only)

NEVER operate with insufficient battery electrolyte. Operating with insufficient electrolyte will destroy the battery.

WARNING! 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.

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

NOTICE: Battery fluid tends to evaporate in high temperatures, especially in summer. In such conditions, inspect the battery earlier than specified.

1. Make sure the engine is off and the key is removed.
2. Turn the battery master switch to OFF (if equipped) or disconnect the negative (-) battery cable.
3. Remove the plugs and check the electrolyte level in all cells. **NOTICE: NEVER attempt to remove the covers or fill a maintenance-free battery.**

PERIODIC MAINTENANCE

- If the electrolyte level is lower than the minimum fill level (**Figure 7, (1)**), fill with distilled water (**Figure 7, (2)**) (available locally) up to the upper limit (**Figure 7, (3)**) of the battery.

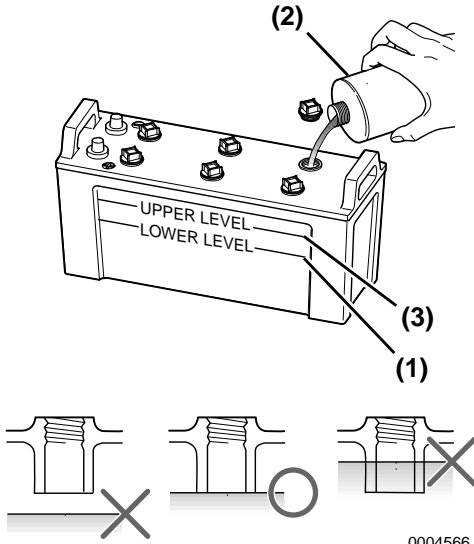


Figure 7

- 1 – Lower Level**
- 2 – Distilled Water**
- 3 – Upper Level**

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

Every 100 Hours of Operation

Perform the following maintenance every 100 hours or every six months of operation, whichever comes first.

- **Changing the Sail-Drive Gear Oil**

Changing the Sail-Drive Gear Oil

Refer to the *Sail-Drive Operation Manual* for the procedure for changing gear oil.

Every 150 Hours of Operation

Perform the following maintenance every 150 hours or every year of operation, whichever comes first.

- **Changing the Engine Oil**

Changing the Engine Oil

See Changing the Engine Oil on page 53.

Every 250 Hours of Operation

Perform the following maintenance every 250 hours or one year of operation, whichever comes first.

- **Draining the Fuel Tank**
- **Replacing the Fuel Filter Element**
- **Replacing the Engine Oil Filter Element**
- **Changing the Marine Gear Oil**
- **Checking or Replacing the Seawater Pump Impeller**
- **Replacing the Coolant**
- **Cleaning Intake Silencer (Air Cleaner) Element**
- **Cleaning or Replacing the Exhaust / Water Mixing Elbow**
- **Adjusting the Tension of the Alternator V-Belt**
- **Cleaning the Breather Pipe**
- **Checking the Wiring Connectors**

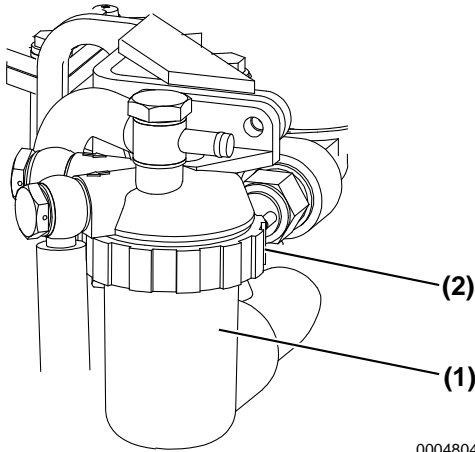
Draining the Fuel Tank

See Draining the Fuel Tank on page 52.

PERIODIC MAINTENANCE

Replacing the Fuel Filter Element

WARNING! When removing any fuel system component to perform maintenance (such as changing the fuel filter), put 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 removing any fuel system component.



0004804

Figure 8

- 1 – Housing
- 2 – Retaining Ring

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

1. Close the fuel cock of the fuel tank.
2. Place an approved container under the fuel filter.

3. Remove the filter case by loosening the retaining ring (**Figure 8, (2)**). Turn the ring counterclockwise using a filter wrench.

Note: When removing the fuel filter, hold the bottom of the fuel filter with a cloth to prevent the fuel from spilling. Wipe up any spilled fuel immediately.

4. Remove the housing (**Figure 8, (1)**) and remove the element. Replace the element with a new one.
5. Apply a thin film of clean diesel fuel to the sealing surface of the new filter gasket.
6. Clean the inside of the housing thoroughly, install the O-ring and hand-tighten the retainer ring. Use a filter wrench and tighten to 12 N·m (106 in.-lb).
7. Air will enter the fuel system when the filter is disassembled. Bleed the fuel system to remove any air from the system. See *Bleeding the Fuel System* on page 25.
8. Dispose of waste properly.

Replacing the Engine Oil Filter Element

See *Replacing the Engine Oil Filter Element* on page 53.

Changing the Marine Gear Oil

See *Changing the Marine Gear Oil* on page 53.

Checking or Replacing the Seawater Pump Impeller

1. Loosen side cover bolts and remove the side cover.
2. Inspect the inside of the seawater pump with a flashlight. If any of the following are found, service the seawater pump:
 - Impeller blades are cracked or nicked. Edges or surfaces of the blades are marred or scratched.
 - Wear plate is damaged.

3. If no damage is found when inspecting the inside of the pump, install the O-ring and side cover.
4. If a large amount of water leaks continuously from the water drain line below the seawater pump during operation, replace the mechanical seal. See your authorized Yanmar Marine dealer or distributor.

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

The seawater pump turns in the direction as shown in **Figure 9**. The impeller must be installed while considering the impeller direction.

NOTICE: If the impeller has been removed for any reason and must be reassembled, avoid turning the impeller in the wrong direction. If the impeller is turned in the wrong or opposite direction of normal rotation, damage to the impeller may occur.

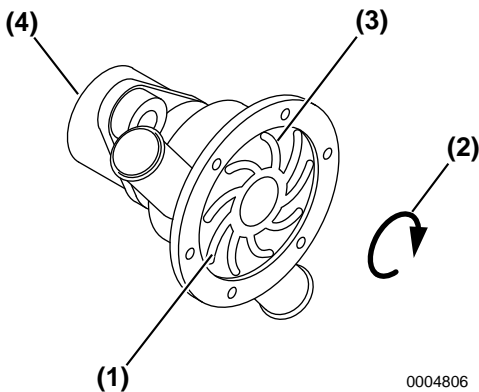


Figure 9

- 1 – Impeller Vane Direction
- 2 – Impeller Rotating Direction
- 3 – Impeller
- 4 – Seawater Pump

Replacing the Coolant

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

Replace coolant every year.

Note: If Long Life Coolant (LLC) is used, replace coolant every two years.

Note: The drain cocks are opened before shipping from the factory. Close all drain cocks before filling the system with coolant.

1. Put a pan under the coolant drain cocks.
2. Open all coolant drain cocks.
3. Allow to drain completely. Dispose of waste properly.
4. Close all the drain cocks.
5. Fill coolant tank and coolant recovery tank with appropriate coolant. See *Engine Coolant Specifications on page 29* and *See Checking and Adding Coolant on page 30*.

Cleaning the Intake Silencer (Air Cleaner) Element

1. Disassemble the intake silencer (air cleaner).
2. Remove element (**Figure 10, (1)**). Clean element and housing with a neutral detergent.
3. Dry completely and reassemble.

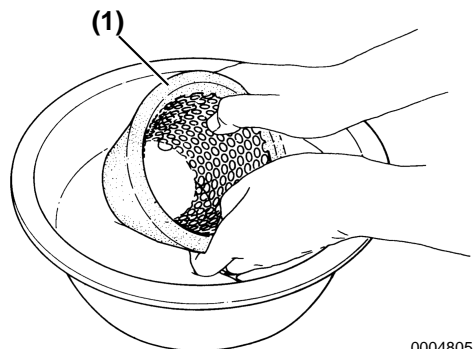


Figure 10

PERIODIC MAINTENANCE

Cleaning or Replacing the Exhaust / Water Mixing Elbow

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

1. Remove the mixing elbow.
2. Clean dirt and scale out of the exhaust and seawater passages.
3. If the mixing elbow is damaged, repair or replace it. See your authorized Yanmar Marine dealer or distributor.
4. Inspect the gasket and replace if necessary.

Replace the mixing elbow with a new one every 500 hours or two years, whichever comes first, even if no damage is found.

See your authorized Yanmar Marine dealer or distributor.

Adjusting the Alternator V-Belt Tension

See *Checking and Adjusting the Alternator V-Belt Tension* on page 54.

Cleaning the Breather Pipe

See your authorized Yanmar Marine dealer or distributor.

Checking the Wiring Connectors

See your authorized Yanmar Marine dealer or distributor.

Every 1000 Hours of Operation

Perform the following maintenance every 1000 hours or 4 years of operation, whichever comes first.

- **Checking the Fuel Injection Timing**
- **Checking the Fuel Injector Spray Pattern**
- **Replacing the Seawater Pump Impeller**
- **Cleaning and Checking the Seawater Passages**
- **Checking Diaphragm Assembly**
- **Replacing the Alternator V-Belt**
- **Adjusting Intake / Exhaust Valve Clearance**
- **Checking and Adjusting the Remote Control Cables**
- **Adjusting the Propeller Shaft Alignment**
- **Tightening All Major Nuts and Bolts**

Checking the Fuel Injection Timing

See your authorized Yanmar Marine dealer or distributor.

Checking the Fuel Injector Spray Pattern

See your authorized Yanmar Marine dealer or distributor.

Replacing the Seawater Pump Impeller

The seawater impeller must be replaced every 1000 hours or every 4 years even if it is not damaged.

See *Checking or Replacing the Seawater Pump Impeller* on page 60.

Cleaning and Checking the Seawater Passages

After prolonged use, clean the seawater passages to remove dirt, scale, rust and other contaminants that collect in the coolant passages. This can cause poor engine cooling. Inspect these items:

- Heat Exchanger
- Pressure Cap

See your authorized Yanmar Marine dealer or distributor.

Checking the Diaphragm Assembly

NOTICE: If the diaphragm is damaged, crankcase pressure control is affected. Excessive crankcase pressure will cause leaks at seals and mating part surfaces. **NOTICE: When changing or filling engine oil NEVER fill above the standard limit. If engine oil quantity is above the upper limit, the amount of crankcase oil mist may increase resulting in oil hammer.**

Inspect the diaphragm assembly on the rocker arm cover.

1. Loosen screws and remove diaphragm assembly.
2. Check for oil and contaminants between the diaphragm and cover.
NOTICE: If oil and contaminants enter the diaphragm assembly, the diaphragm will not operate properly.
3. Inspect the diaphragm rubber and spring for damage. If necessary, replace with new ones.

Breather System Components

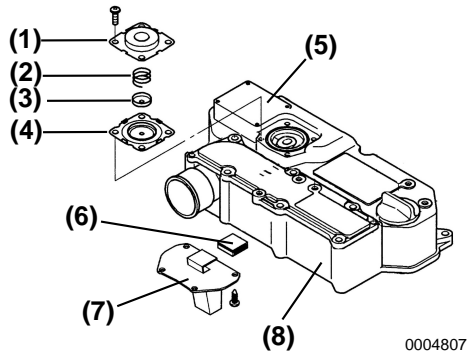


Figure 11

- 1 – Diaphragm Cover
- 2 – Spring
- 3 – Center Plate
- 4 – Diaphragm
- 5 – Rocker Arm Cover
- 6 – Breather Baffle
- 7 – Baffle Plate
- 8 – Intake Silencer (Air cleaner)

Replacing the Alternator V-Belt

Replace the alternator V-belt.

1. Remove the V-belt cover.
2. Loosen the V-belt tension adjusting bolt of the alternator.
3. Remove the alternator V-belt.
4. Install a new alternator V-belt.
5. Adjust the alternator V-belt tension.
See Checking and Adjusting the Alternator V-Belt Tension on page 54.
6. Replace the V-belt cover.

Adjusting Intake / Exhaust Valve Clearance

See your authorized Yanmar Marine dealer or distributor.

Checking and Adjusting the Remote Control Cables

See Checking and Adjusting the Remote Control Cables on page 54.

PERIODIC MAINTENANCE

Adjusting the Propeller Shaft Alignment

See your authorized Yanmar Marine dealer or distributor.

Tightening All Major Nuts and Bolts

See *Tightening Fasteners on page 46* or see your authorized Yanmar Marine dealer or distributor.

TROUBLESHOOTING

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

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

TROUBLESHOOTING AFTER STARTING

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

Is sufficient water being discharged from the seawater outlet pipe?

- If the discharge is low, stop the engine immediately. Identify the cause and repair.

Is the exhaust color normal?

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

When operating the engine at low speed for long periods of time, race the engine once every two hours. Racing the engine with the clutch in NEUTRAL, accelerate from the low speed position to the high speed position and repeat this process about five times. This is done to clean out carbon from the cylinders and the fuel injection valves. **NOTICE: Neglecting to race the engine will result in poor exhaust color and reduce engine performance.**

Periodically operate the engine near maximum speed while underway. This will generate higher exhaust temperatures, which will help clean out hard carbon deposits, maintain engine performance and prolong the life of the engine.

TROUBLESHOOTING

Are there abnormal vibrations or noise?

- Depending on the hull structure, engine and hull resonance may suddenly increase at certain engine speed ranges, causing heavy vibrations. Avoid operation in this speed range. If any abnormal sounds are heard, stop the engine and inspect for cause.

Alarm sounds during operation.

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

Is there water, oil or fuel leakage? Are there any loose bolts or connections?

- Check the engine room daily for any leaks or loose connections.

Is there sufficient fuel in the fuel tank?

- Refill fuel in advance to avoid running out of fuel. If the tank runs out of fuel, bleed the fuel system. *See Bleeding the Fuel System on page 25.*

Troubleshooting Information

If the engine does not operate properly, refer to the *Troubleshooting Chart on page 67* or see your authorized Yanmar Marine dealer or distributor.

Supply your authorized Yanmar Marine dealer or distributor with the following information:

- Model name and serial number of your engine
- Boat model, hull material, size (tons)
- Use, type of boating, number of hours run
- Total number of operation hours (refer to hourmeter) and age of boat
- The operating conditions when the problem occurs:
 - 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

TROUBLESHOOTING CHART

| Symptom | Probable Cause | Measure | Reference |
|---|---|---|---|
| Indicators light on the instrument panel and alarm sounds during operation | Shift to low speed operation immediately, and check which indicator has come on. Stop the engine and inspect. If no abnormality is identified and there is no problem with operation, return to port at lowest speed and see your authorized Yanmar Marine dealer or distributor. | | |
| <ul style="list-style-type: none"> Engine oil low pressure alarm indicator lights | Engine oil level is low. | Check engine oil level. Add or replace as necessary. | <i>See Checking the Engine Oil on page 27</i> |
| | Engine oil filter is clogged. | Replace engine oil filter. Replace engine oil. | <i>See Changing the Engine Oil on page 53</i> |
| <ul style="list-style-type: none"> Water in sail drive seal indicator lights | Rubber sail drive seal is broken. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> Coolant high temperature alarm lights | Coolant in coolant tank / heat exchanger is low. | Check coolant level and refill. | <i>See Checking and Adding Coolant on page 30</i> |
| | Insufficient seawater level causing temperature to rise. | Check seawater system. | - |
| | Contamination inside cooling system. | See your authorized Yanmar Marine dealer or distributor. | - |
| Faulty Warning Devices | Do not operate the engine if alarm devices are not repaired. See you authorized Yanmar Marine dealer or distributor. Serious accidents may result if abnormalities are not identified due to faulty indicators or alarm. | | |
| Indicators Do Not Light: <ul style="list-style-type: none"> When key is turned ON When any trouble occurs (low oil pressure etc.) | No electrical current available. Circuit broken or lamp burned out. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> One of the indicators does not go out | Sensor switch is faulty. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> Battery low charge indicator does not go out during operation | V-belt is loose or broken. | Replace V-belt or adjust tension. | <i>See Checking and Adjusting the Alternator V-Belt Tension on page 54</i> |
| | Battery is defective. | Check battery fluid level, specific gravity or replace battery. | <i>See Checking the Battery Electrolyte Level (Serviceable Batteries Only) on page 57</i> |
| | Alternator power generation failure. | See your authorized Yanmar Marine dealer or distributor. | - |

TROUBLESHOOTING

| Symptom | Probable Cause | Measure | Reference |
|---|---|--|---|
| Starting Failures: | | | |
| <ul style="list-style-type: none"> Starter turns but engine does not start | No fuel. | Add fuel. Bleed fuel system. | <i>See Filling the Fuel Tank on page 24 and See Bleeding the Fuel System on page 25</i> |
| | Fuel filter is clogged. | Replace filter element. | <i>See Replacing the Fuel Filter Element on page 60</i> |
| | Improper fuel. | Replace with recommended fuel. | <i>See Diesel Fuel Specifications on page 21</i> |
| | Problem with fuel injection. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Compression leakage from intake / exhaust valve. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> Starter does not turn or turns slowly (engine can be turned manually) | Faulty clutch position. | Shift to NEUTRAL and start. | <i>See Restarting After Starting Failure on page 37</i> |
| | Insufficient battery charge. | Check fluid level. Recharge or replace battery. | <i>See Checking the Battery Electrolyte Level (Serviceable Batteries Only) on page 57</i> |
| | Cable terminal contact failure. | Remove corrosion from terminals. Tighten battery cables. | - |
| | Faulty safety switch device. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Faulty starter switch. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Power lacking due to accessory drive being engaged. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> Engine cannot be turned manually | Internal parts seized. | See your authorized Yanmar Marine dealer or distributor. | - |

TROUBLESHOOTING

| Symptom | Probable Cause | Measure | Reference |
|---|---|--|--|
| Abnormal Exhaust Color: | | | |
| <ul style="list-style-type: none"> Black smoke | Load increased. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Improper propeller matching. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Dirty intake silencer (air cleaner). | Clean element. | <i>See Cleaning the Intake Silencer (Air Cleaner) Element on page 61</i> |
| | Improper fuel. | Replace with recommended fuel. | <i>See Diesel Fuel Specifications on page 21</i> |
| | Faulty spraying of fuel injector. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Incorrect intake / exhaust valve clearance. | See your authorized Yanmar Marine dealer or distributor. | - |
| <ul style="list-style-type: none"> White smoke | Improper fuel. | Replace with recommended fuel. | <i>See Diesel Fuel Specifications on page 21</i> |
| | Faulty spraying of fuel injector. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Fuel injection timing off. | See your authorized Yanmar Marine dealer or distributor. | - |
| | Excessive diesel fuel consumption. | See your authorized Yanmar Marine dealer or distributor. | - |

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LONG-TERM STORAGE

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

If the engine will not be used for an extended period of time, special measures should be taken to protect the cooling system, fuel system and combustion chamber from corrosion and the exterior from rusting.

The engine can normally stand idle for up to 6 months. If it remains unused for longer than this, please contact your authorized Yanmar Marine dealer or distributor.

PREPARE ENGINE FOR LONG-TERM STORAGE

NOTICE: NEVER 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.

Note: If the engine is close to a periodic maintenance interval, perform those maintenance procedures before putting the engine into long-term storage.

1. Wipe off any dust or oil from the outside of engine.
2. Drain water from the fuel filters.
3. Drain the fuel tank completely or fill the tank to prevent condensation.
4. Drain the Cooling System (see *Draining the Cooling System on page 72*).
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 the 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 the key from key switch and cover the key switch with moisture cap.

DRAINING THE COOLING SYSTEM

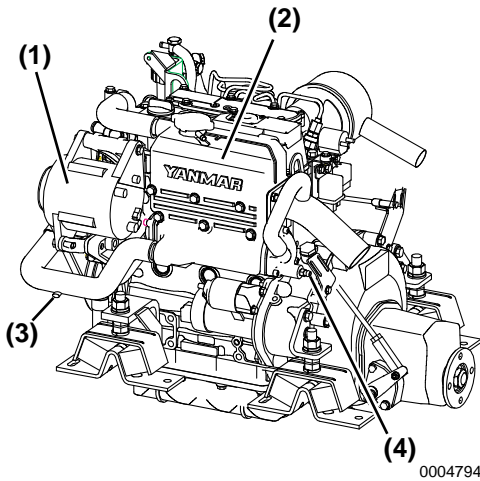


Figure 1

- 1 – Alternator
- 2 – Coolant Tank / Heat Exchanger
- 3 – Coolant Drain Cock
- 4 – Seawater Drain Cock

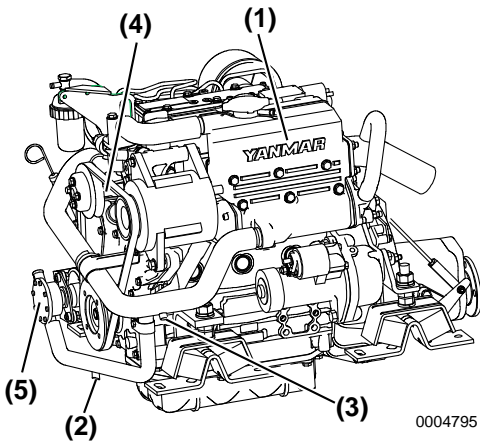


Figure 2

- 1 – Coolant Tank / Heat Exchanger
- 2 – Seawater Drain Cock
- 3 – Coolant Drain Cock
- 4 – Coolant Pump
- 5 – Seawater Pump

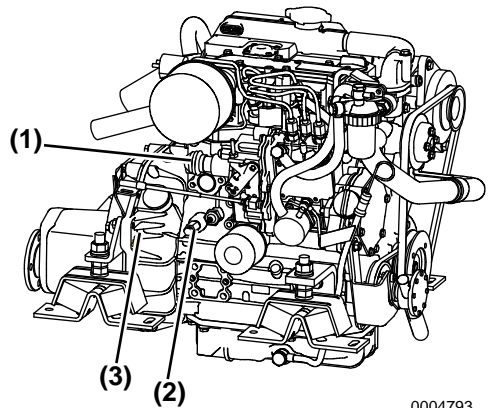


Figure 3

- 1 – Stop Solenoid
- 2 – Coolant Drain Cock
- 3 – Flywheel Housing

Note: The drain cocks are opened before shipping from the factory. Close all drain cocks before filling the system with coolant.

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

1. Put a pan under the seawater drain cocks.
2. Open the seawater drain cocks on the pipe and on the heat exchanger. Allow to drain.
3. Remove the four bolts fastening the side cover of the seawater pump. Remove the cover and drain the seawater.
4. Install the cover and tighten bolts.
5. Close all drain cocks.

NOTICE: NEVER drain engine coolant in the cold season or before long storage. If LLC (Long Life Coolant) has not been added to the cooling system, add LLC or drain the coolant from the coolant system after daily use. If the coolant without LLC is not removed, it may freeze and damage parts of the cooling system or engine when ambient temperature is below 0°C (32°F).

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SPECIFICATIONS

PRINCIPAL ENGINE SPECIFICATIONS

2YM15 Engine Specifications

| Specification | | 2YM15 | |
|---------------------------------|-------------------------------------|---|-------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Use | | Pleasure use | |
| Type | | Vertical water cooled 4-cycle diesel engine | |
| Combustion System | | Swirl pre-combustion chamber | |
| Air Charging | | Natural aspiration | |
| Number Of Cylinders | | 2 | |
| Bore X Stroke | | 70 mm x 74 mm (2.76 in. x 2.92 in.) | |
| Displacement | | 0.570 L (35.0 cu in.) | |
| Continuous Rated Output | Output At Crankshaft / Engine Speed | 9.4 kW (12.8 hp metric) / 3489 rpm* | |
| Maximum Rated Output | Output At Crankshaft / Engine Speed | 10.3 kW (14.0 hp metric) / 3600 rpm* 10.0 kW (13.6 hp metric) / 3600 rpm** | |
| | Output At Propeller / Engine Speed | 10.0 kW (13.6 hp metric) / 3600 rpm* 9.7 kW (13.2 hp metric) / 3600 rpm** | - |
| Installation | | Flexible mounting | |
| Fuel Injection Timing | | FID 21 ± 1° BTDC | |
| Fuel Injection Opening Pressure | | 12.3 - 13.28 MPa (125 - 135 kgf/cm ²) | |
| Main Power Take Off | | At flywheel end | |
| Direction Of Rotation | Crankshaft | Counterclockwise viewed from stern | |
| | Propeller Shaft (Ahead) | Clockwise viewed from stern | - |
| Cooling System | | Closed coolant system with heat exchanger | |
| Lubrication System | | Complete enclosed forced lubrication system | |
| Coolant Capacity | | Engine 3.0 L (3.17 qt), Coolant recovery tank: 0.8 L (0.95 qt) | |

SPECIFICATIONS

| Specification | | 2YM15 | |
|---|----------------|------------------------------------|--------------------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Lubricating Oil Capacity (Engine) | Rake Angle | at rake angle 8° | at rake angle 0° |
| | Total*** | 2.0 L (2.1 qt) | 1.8 L (1.9 qt) |
| | Effective**** | 0.95 L (1.0 qt) | 0.9 L (0.95 qt) |
| Starting System | Type | Electric | |
| | Starting Motor | DC 12 V - 1.4 kW | |
| | AC Alternator | 12 V - 60 A (12 V - 80 A optional) | |
| Engine Dimension | Overall Length | 613 mm (24.1 in.) | - |
| | Overall Width | 463 mm (18.2 in.) | |
| | Overall Height | 528 mm (20.8 in.) | |
| Engine Dry Mass (Including Marine Gear) | | 115 kg (253 lb) | 134 kg (295 lb) |

* Rating Condition: Temperature of fuel; 25°C at fuel pump inlet; ISO 3046-1

** Rating Condition: Temperature of fuel; 40°C at fuel pump inlet; ISO 8665

*** The "total" oil quantity includes oil in oil pan, channels, coolers and filter.

**** The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

Note: Density of fuel: 0.842g/cm³ at 15°C. Fuel temperature at the inlet of the fuel injection pump.

1 hp metric = 0.7355 kW

3YM20 Engine Specifications

| Specification | | 3YM20 | |
|-----------------------------------|-------------------------------------|---|------------------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Use | | Pleasure use | |
| Type | | Vertical water cooled 4-cycle diesel engine | |
| Combustion System | | Swirl pre-combustion chamber | |
| Air Charging | | Natural aspiration | |
| Number Of Cylinders | | 3 | |
| Bore X Stroke | | 70 mm x 74 mm (2.76 in. x 2.92 in.) | |
| Displacement | | 0.854 L (52.0 cu in.) | |
| Continuous Rated Output | Output At Crankshaft / Engine Speed | 14.7 kW (20.0 hp metric) / 3489 rpm* | |
| Maximum Rated Output | Output At Crankshaft / Engine Speed | 16.2 kW (22.0 hp metric) / 3600 rpm* 15.3 kW (20.8 hp metric) / 3600 rpm** | |
| | Output At Propeller / Engine Speed | 15.7 kW (21.3 hp metric) / 3600 rpm* 14.9 kW (20.2 hp metric) / 3600 rpm** | - |
| Installation | | Flexible mounting | |
| Fuel Injection Timing | | FID 22 ± 1° BTDC | |
| Fuel Injection Opening Pressure | | 12.3 - 13.28 MPa (125 - 135 kgf/cm ²) | |
| Main Power Take Off | | At flywheel end | |
| Direction Of Rotation | Crankshaft | Counterclockwise viewed from stern | |
| | Propeller Shaft (Ahead) | Clockwise viewed from stern | - |
| Cooling System | | Closed coolant system with heat exchanger | |
| Lubrication System | | Complete enclosed forced lubrication system | |
| Coolant Capacity | | Engine 4.1 L (4.3 qt), Coolant recovery tank: 0.8 L (0.85 qt) | |
| Lubricating Oil Capacity (Engine) | Rake Angle | at rake angle 8° | at rake angle 0° |
| | Total*** | 2.7 L (2.85 qt) | 2.4 L (2.54 qt) |
| | Effective**** | 1.4 L (1.48 qt) | 1.5 L (1.59 qt) |
| Starting System | Type | Electric | |
| | Starting Motor | DC 12 V - 1.4 kW | |
| | AC Alternator | 12 V - 60 A (12 V - 80 A optional) | |

SPECIFICATIONS

| Specification | | 3YM20 | |
|---|----------------|--------------------|--------------------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Engine Dimension | Overall Length | 693 mm (27.3 in.) | - |
| | Overall Width | 463 mm (18.2 in.) | |
| | Overall Height | 528 mm (20.8 in.) | |
| Engine Dry Mass (Including Marine Gear) | | 130 kg (287 lb) | 151 kg (333 lb) |

* Rating Condition: Temperature of fuel; 25°C at fuel pump inlet; ISO 3046-1

** Rating Condition: Temperature of fuel; 40°C at fuel pump inlet; ISO 8665

*** The "total" oil quantity includes oil in oil pan, channels, coolers and filter.

**** The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

Note: Density of fuel: 0.842g/cm³ at 15°C. Fuel temperature at the inlet of the fuel injection pump.

1 hp metric = 0.7355 kW

3YM30 Engine Specifications

| Specification | | 3YM30 | |
|-----------------------------------|-------------------------------------|---|------------------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Use | | Pleasure use | |
| Type | | Vertical water cooled 4-cycle diesel engine | |
| Combustion System | | Swirl pre-combustion chamber | |
| Air Charging | | Natural aspiration | |
| Number Of Cylinders | | 3 | |
| Bore X Stroke | | 76 mm x 82 mm (2.99 in. x 3.23 in.) | |
| Displacement | | 1.115 L (68.04 cu in.) | |
| Continuous Rated Output | Output At Crankshaft / Engine Speed | 20.1 kW (27.3 hp metric) / 3489 rpm* | |
| Maximum Rated Output | Output At Crankshaft / Engine Speed | 22.1 kW (30.0 hp metric) / 3600 rpm* 21.3 kW (29.0 hp metric) / 3600 rpm** | |
| | Output At Propeller / Engine Speed | 21.4 kW (29.1 hp metric) / 3600 rpm* 20.7 kW (28.1 hp metric) / 3600 rpm** | - |
| Installation | | Flexible mounting | |
| Fuel Injection Timing | | FID 16 ± 1° BTDC | |
| Fuel Injection Opening Pressure | | 12.3 - 13.28 MPa (125 - 135 kgf/cm ²) | |
| Main Power Take Off | | At flywheel end | |
| Direction Of Rotation | Crankshaft | Counterclockwise viewed from stern | |
| | Propeller Shaft (Ahead) | Clockwise viewed from stern | - |
| Cooling System | | Closed coolant system with heat exchanger | |
| Lubrication System | | Complete enclosed forced lubrication system | |
| Coolant Capacity | | Engine 4.9 L (5.2 qt), Coolant recovery tank: 0.8 L (0.85 qt) | |
| Lubricating Oil Capacity (Engine) | Rake Angle | at rake angle 8° | at rake angle 0° |
| | Total*** | 2.8 L (2.96 qt) | 2.5 L (2.64 qt) |
| | Effective**** | 1.4 L (1.48 qt) | 1.5 L (1.59 qt) |
| Starting System | Type | Electric | |
| | Starting Motor | DC 12 V - 1.4 kW | |
| | AC Alternator | 12 V - 60 A (12 V - 80 A optional) | |

SPECIFICATIONS

| Specification | | 3YM30 | |
|---|----------------|--------------------|--------------------|
| Marine Gear Model | | KM2P-1 | SD-20 |
| Engine Dimension | Overall Length | 715 mm (28.1 in.) | - |
| | Overall Width | 463 mm (18.2 in.) | |
| | Overall Height | 545 mm (21.5 in.) | |
| Engine Dry Mass (Including Marine Gear) | | 133 kg (293 lb) | 154 kg (339 lb) |

* Rating Condition: Temperature of fuel; 25°C at fuel pump inlet; ISO 3046-1

** Rating Condition: Temperature of fuel; 40°C at fuel pump inlet; ISO 8665

*** The "total" oil quantity includes oil in oil pan, channels, coolers and filter.

**** The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

Note: Density of fuel: 0.842g/cm³ at 15°C. Fuel temperature at the inlet of the fuel injection pump.

1 hp metric = 0.7355 kW

Marine Gear and Sail Drive Specifications

| Model | KM2P-1(S) | KM2P-1(G) | KM2P-1 (GG) | SD20 (coupled at boat builder) |
|--------------------------------------|--------------------------------|-----------------|------------------|--|
| Type | Mechanical cone clutch | | | Dog Clutch |
| Reduction Ratio (Forward / Reverse) | 2.21 / 3.06 | 2.62 / 3.06 | 3.22 / 3.06 | 2.64 / 2.64 |
| Propeller Speed (Forward / Reverse)* | 1580 / 1140 rpm | 1332 / 1140 rpm | 1083 / 1140 rpm | 1322 rpm |
| Lubrication System | Splash | | | Oil bath |
| Lubricating Oil Capacity (Total) | 0.3 L (0.32 qt) | | | 2.2 L (2.3 qt) Standard 2.5 L (2.6 qt) Long Reach |
| Lubricating Oil Capacity (Effective) | 0.05 L (0.05 qt) | - | 0.15 L (0.16 qt) | - |
| Cooling System | Air cooling by fan on flywheel | | | - |
| Weight | 10.3 kg (27.7 lb) | | | 30 kg (66.1 lb) |

* At continuous power engine speed 2907 rpm

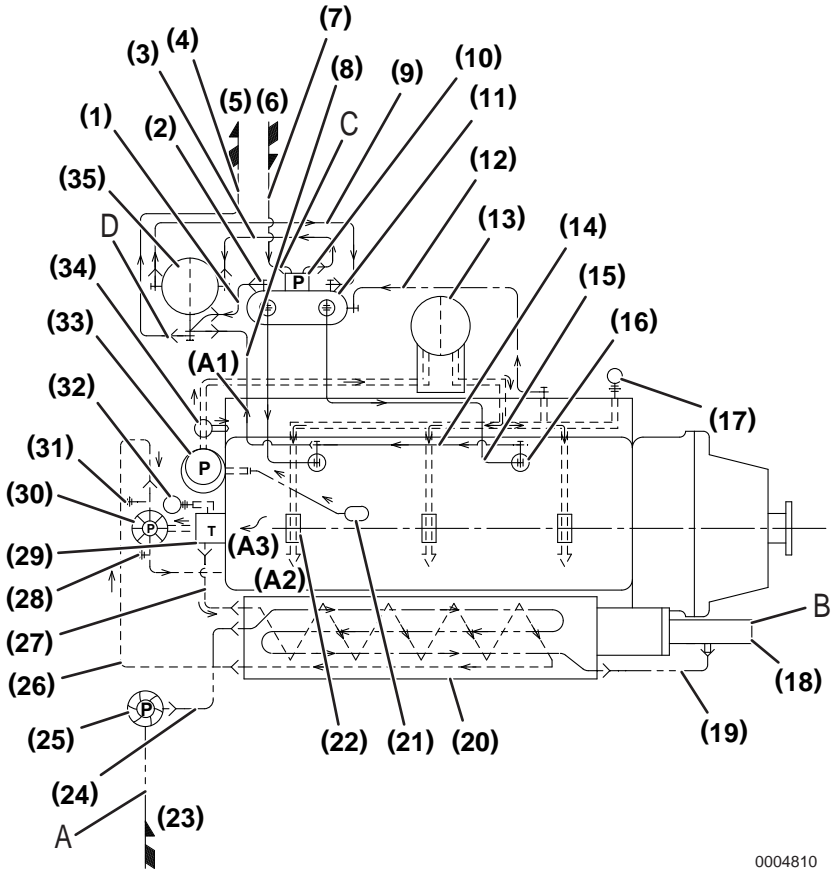
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SYSTEM DIAGRAMS

PIPING DIAGRAMS

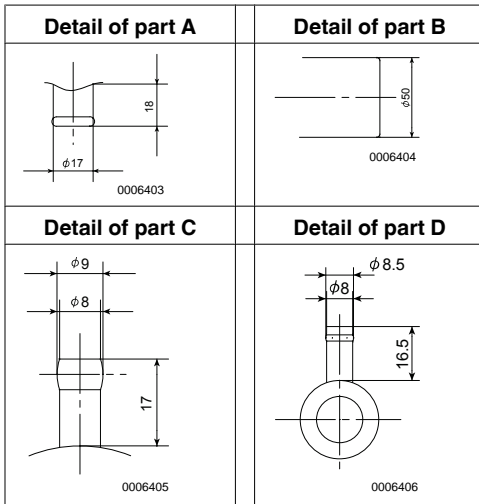
Piping diagrams and wiring diagrams are provided for reference only. Contact your authorized Yanmar Marine dealer or distributor for the most current diagrams.

2YM15 with KM2P-1 Marine Gear



0004810

Figure 1



| Marks of Piping | |
|-----------------|---------------------|
| ←— | Screw joint (Union) |
| +— | Flange joint |
| +— | Eye joint |
| —← | Insertion joint |
| :::~::~ | Drill hole |
| ----- | Coolant piping |
| ----- | Seawater piping |
| ----- | Engine oil piping |
| ----- | Diesel fuel piping |

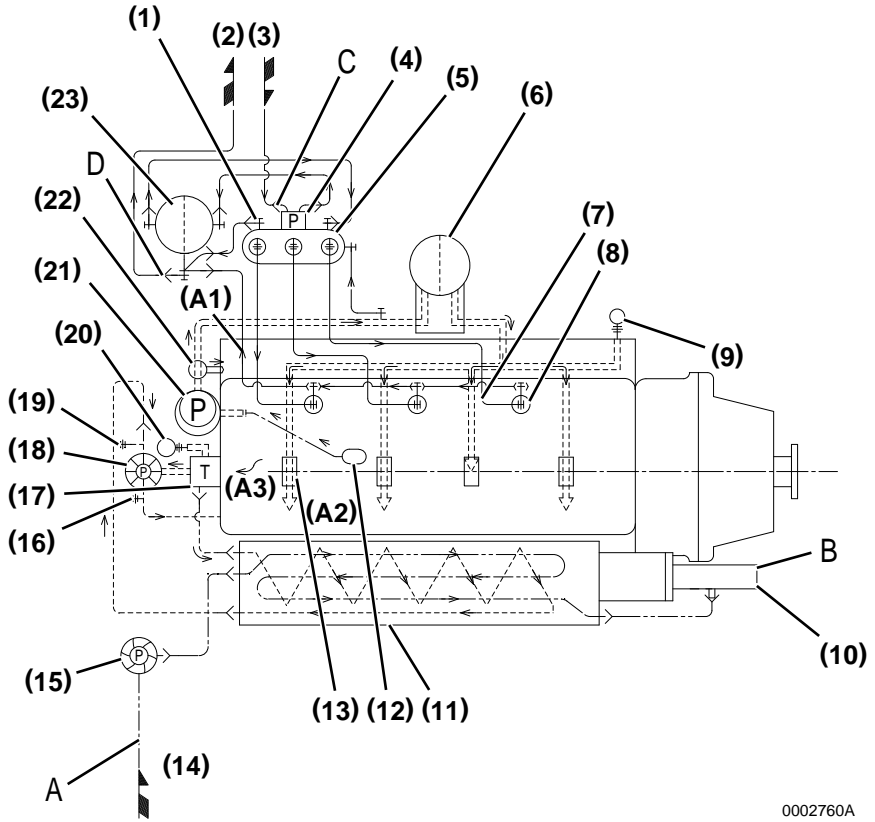
| Key | Description |
|-----|------------------------|
| 1 | 7.8 x t4.5 Rubber Hose |
| 2 | Check Valve |
| 3 | 7.8 x t4.5 Rubber Hose |
| 4 | 7.8 x t4.5 Rubber Hose |
| 5 | Overflow |
| 6 | Fuel Oil Inlet |
| 7 | 7.8 x t4.5 Rubber Hose |
| 8 | 5 x t4.5 Rubber Hose |
| 9 | 7.8 x t4.5 Rubber Hose |
| 10 | Fuel Feel Pump |

| Key | Description |
|-----|------------------------------------|
| 11 | Fuel Injection Pump |
| 12 | 4.76 x t0.7 Steel Pipe |
| 13 | Engine Oil Filter (Cartridge Type) |
| 14 | 4.76 x t0.7 Steel Pipe |
| 15 | Fuel High Pressure Pipe |
| 16 | Fuel Injection Nozzle |
| 17 | Oil Pressure Switch |
| 18 | Mixing Elbow |
| 19 | 17 x 14 Rubber Hose |
| 20 | Heat Exchanger |
| 21 | Engine Oil Inlet Filter |
| 22 | Main Bearing |
| 23 | Seawater Inlet |
| 24 | 17 x t4 Rubber Hose |
| 25 | Seawater Pump |
| 26 | 28 x t4 Rubber Hose |
| 27 | 28 x t4 Rubber Hose |
| 28 | Hot Water Connection Outlet (R3/8) |
| 29 | Thermostat |
| 30 | Coolant Pump |
| 31 | Hot Water Connection Inlet (R3/8) |
| 32 | Coolant Temperature Switch |
| 33 | Engine Oil Pump |
| 34 | Pressure Control Valve |
| 35 | Diesel Fuel |
| A1 | To oil pan |
| A2 | To cam shaft |
| A3 | From cylinder head |

Notes:

1. Steel pipe shows OD x wall thickness, rubber hose shows ID x wall thickness.
2. Rubber fuel lines meet EN/ISO7840.
3. Unit: mm

3YM20 and 3YM30 with KM2P-1 Marine Gear



0002760A

Figure 2

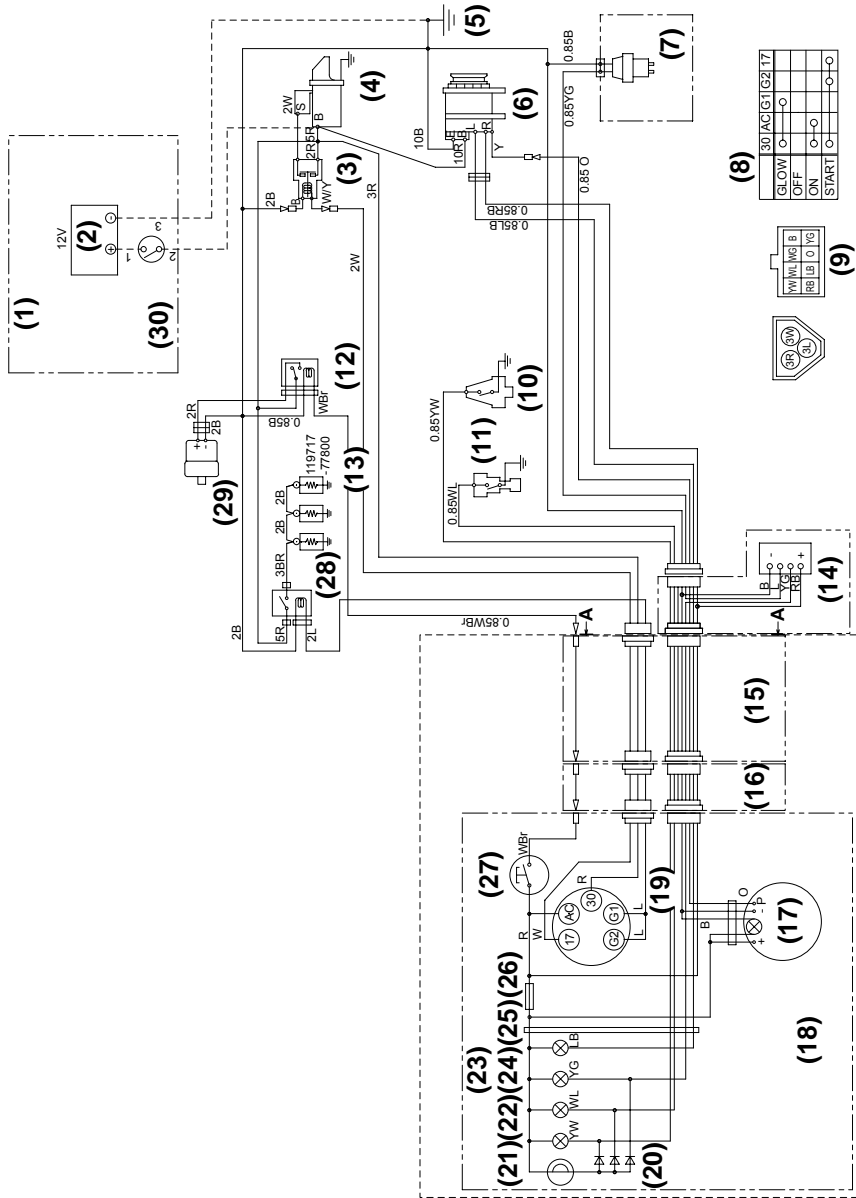
| Detail of part A | Detail of part B |
|------------------|------------------|
| <p>0006403</p> | <p>0006404</p> |
| Detail of part C | Detail of part D |
| <p>0006405</p> | <p>0006406</p> |

| Marks of Piping | |
|-----------------|---------------------|
| RH | Rubber hose |
| SGP STS | Steel pipe |
| C1201T | Copper pipe |
| → | Screw joint (Union) |
| + | Flange joint |
| + | Eye joint |
| ← | Insertion joint |
| | Drill hole |
| | Coolant piping |
| | Seawater piping |
| | Engine oil pipe |
| | Diesel fuel pipe |

| Key | Description |
|-----|------------------------------------|
| 1 | PCV |
| 2 | Overflow |
| 3 | Diesel Fuel |
| 4 | Fuel Feed Pump |
| 5 | Fuel Injection Pump |
| 6 | Engine Oil Filter (Cartridge Type) |
| 7 | Fuel High Pressure Pipe |
| 8 | Fuel Injection Nozzle |
| 9 | Oil Pressure Switch |
| 10 | Mixing Elbow |
| 11 | Heat Exchanger |
| 12 | Engine Oil Inlet Filter |
| 13 | Main Bearing |
| 14 | Seawater Inlet |
| 15 | Seawater Pump |
| 16 | Hot Water Connection Outlet |
| 17 | Thermostat |
| 18 | Coolant Pump |
| 19 | Hot Water Connection Inlet |
| 20 | Coolant Temperature Switch |
| 21 | Engine Oil Pump |
| 22 | Pressure Control Valve |
| 23 | Fuel Oil Filter |
| A1 | To oil pan |
| A2 | To cam shaft |
| A3 | From cylinder head |

WIRING DIAGRAMS

2YM15, 3YM20, 3YM30 - B-Type Instrument Panel



0003810

Figure 3

| Allowable Length by cross sectional area of battery cable | |
|--|-----------------------------|
| Section of cable (mm ²) | Allowable Length L=1+2+3(m) |
| 15 (mm ²) | <0.86 (m) |
| 20 (mm ²) | <1.3 (m) |
| 30 (mm ²) | <2.3 (m) |
| 40 (mm ²) | <2.8 (m) |
| 50 (mm ²) | <3.5 (m) |
| 60 (mm ²) | <4.1 (m) |

| Color Coding | |
|---------------------|----------------|
| R | Red |
| B | Black |
| W | White |
| L | Blue |
| RB | Red / Black |
| LB | Blue / Black |
| YW | Yellow / White |
| YG | Yellow / Green |
| WL | White / Blue |
| WG | White / Green |
| GR | Green / Red |
| O | Orange |
| WBr | White / Brown |

| | |
|----|---------------------------------|
| 1 | Procured by Customer |
| 2 | Battery |
| 3 | Starter Relay |
| 4 | Starter |
| 5 | Ground Bolt |
| 6 | Alternator |
| 7 | Sensor (only for sail drive) |
| 8 | Key Switch |
| 9 | Coupler (View from A-A) |
| 10 | Eng. Oil Pressure Switch |
| 11 | Coolant Temperature Switch |
| 12 | Stop Relay |
| 13 | Glow Plug |
| 14 | Amplifier (only for Sail Drive) |
| 15 | Wire Harness Option (L=6M) |
| 16 | Wire Harness Option (L=3M) |
| 17 | Tacho Meter Hour Meter |
| 18 | Instrument Panel |
| 19 | Key Switch |
| 20 | Diodes |
| 21 | Buzzer Oil Pressure |
| 22 | Cooling Temperature |
| 23 | Alarm Lamps |
| 24 | Sail Drive Seal |
| 25 | Charge |
| 26 | 3A Fuse |
| 27 | Stop Switch |
| 28 | Relay |
| 29 | Engine Stop Solenoid |
| 30 | Battery Switch |

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EMISSION SYSTEM WARRANTY

NON-ROAD EMISSION SYSTEM WARRANTY

Yanmar Co., Ltd. Limited Emission Control System Warranty - USA Only

Your Warranty Rights and Obligations:

*Note: Please refer to Yanmar's Limited
Warranty Handbook for a description of the
normal (non-EPA) warranty.*

California

The California Air Resources Board (CARB), the Environmental Protection Agency (EPA) and Yanmar Co., Ltd. hereafter referred to as Yanmar, are pleased to explain the emission control system warranty on your compression-ignition engine. In California, model year 2000 or later off-road compression-ignition engines must be designed, built and equipped to meet the state's stringent anti-smog standards. In all states, 1998 and later non-road compression-ignition engines must be designed, built and equipped to meet the United States EPA emissions standards. Yanmar warrants the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system.

Where a warrantable condition exists, Yanmar will repair your non-road compression-ignition engine at no charge to you including diagnosis, parts and labor.

Manufacturer's Warranty Period:

The model year 1998 or later certified and labeled non-road compression-ignition engines are warranted for the periods listed below. If any emission-related part on your engine is found to be defective during the applicable warranty period, the part will be replaced by Yanmar.

EMISSION SYSTEM WARRANTY

| | |
|--|--|
| Engines rated at or above 19 kW \leq and less than < 37 kW (25.5 hp \leq and less than < 49.6 hp) | The warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of five (5) years. |
| Engines rated under 19 kW > (25.5 hp >) | The warranty period is two (2) years or 1,500 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of two (2) years. |

Warranty Coverage:

This warranty is transferable to each subsequent purchaser for the duration of the warranty period. Repair or replacement of any warranted part will be performed at an authorized Yanmar Marine engine dealer or distributor.

Warranted parts not scheduled for replacement as required maintenance in the *Operation Manual* shall be warranted for the warranty period. Warranted parts scheduled for replacement as required maintenance in the operation manual are warranted for the period of time prior to the first scheduled replacement. Any part repaired or replaced under warranty shall be warranted for the remaining warranty period.

During the warranty period, Yanmar is liable for damages to other engine components caused by the failure of any warranted part during the warranty period.

Any replacement part which is functionally identical to the original equipment part in all respects may be used in the maintenance or repair of your engine, and shall not reduce Yanmar's warranty obligations. Add-on or modified parts that are not exempted may not be used. The use of any non-exempted add-on or modified parts shall be grounds for disallowing a warranty.

Warranted Parts:

This warranty covers engine components that are a part of the emission control system of the engine as delivered by Yanmar to the original retail purchaser. Such components may include the following:

- Fuel Injection System
- Cold Start Enrichment System
- Positive Crankcase Ventilation System

Since emissions-related parts may vary slightly between models, certain models may not contain all of these parts and other models may contain the functional equivalents.

Exclusions:

Failures other than those arising from defects in material and / or workmanship are not covered by this warranty. The warranty does not extend to the following: malfunctions caused by abuse, misuse, improper adjustment, modification, alteration, tampering, disconnection, improper or inadequate maintenance or use of non-recommended fuels and lubricating oils; accident-caused damage, and replacement of expendable items made in connection with scheduled maintenance. Yanmar disclaims any responsibility for incidental or consequential damages such as loss of time, inconvenience, loss of use of equipment / engine or commercial loss.

Owner's Warranty Responsibilities:

As the engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Yanmar recommends that you retain all documentation, including receipts, covering maintenance on your non-road compression-ignition engine, but Yanmar cannot deny warranty solely for the lack of receipts, or for your failure to ensure the performance of all scheduled maintenance.

Yanmar may deny your warranty coverage of your non-road compression-ignition engine if a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

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 emissions requirements.

You are responsible for initiating the warranty process. You must present your engine to a Yanmar dealer as soon as a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible.

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

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

Name of engine manufacturer: Yanmar Co., Ltd.

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

Post Code: 530-8311 Country: Japan

Name of Authorised Representative: Yanmar Marine International B.V.

Street: Brugplein 11 Town: Almere-de Vaart

Post Code: 1332 BS Country: The Netherlands

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

Street: 11, route de Luxembourg Town: Sandweiler

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

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

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(S) AND ESSENTIAL REQUIERMENTS

Engine Type:
 z or sterndrive without integral exhaust
 Inboard engine

Fuel Type:
 Diesel
 Petrol

Combustion cycle:
 2 stroke
 4 stroke

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

ENGINE(S) COVERED BY THIS DECLARATION

| Engine model(s) or engine family name(s): | EC Type certificate number (exhaust) |
|---|--------------------------------------|
| | SNCH*94/25*2003/44* |
| RCD-1GM10X1 | 0009*00 |
| RCD-2YM15X1 | 0004*00 |
| RCD-3YM30X1 | 0005*00 |
| RCD-4JH4X1 | 0014*00 |
| RCD-4JH3TX1 | 0011*01 |
| RCD-4LHAX1 | 0015*00 |
| RCD-6LPADX1 | 0012*00 |
| RCD-6LPASX1 | 0007*00 |
| RCD-6CXMX1 | 0006*00 |
| RCD-6LY2X1 | 0008*00 |
| RCD-6LY3X1 | 0010*00 |
| RCD-4JH3TX2 | 0016*00 |
| RCD-4JH4TX2 | 0017*00 |
| | |
| | |
| | |
| | |

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

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

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