

YANMAR
®

GM **series**

OPERATION MANUAL

1GM10
1GM10C
1GM10V

P/N: 0AGMM-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 GM 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 **DANGER** level hazards.



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

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

Entanglement Hazard

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.

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 water pickup (thru-hull) of the non-running engine(s) should be closed. This will prevent water from being forced past the seawater pump and entering the engine. The result of water entering the engine could cause engine seizure or other serious problems.

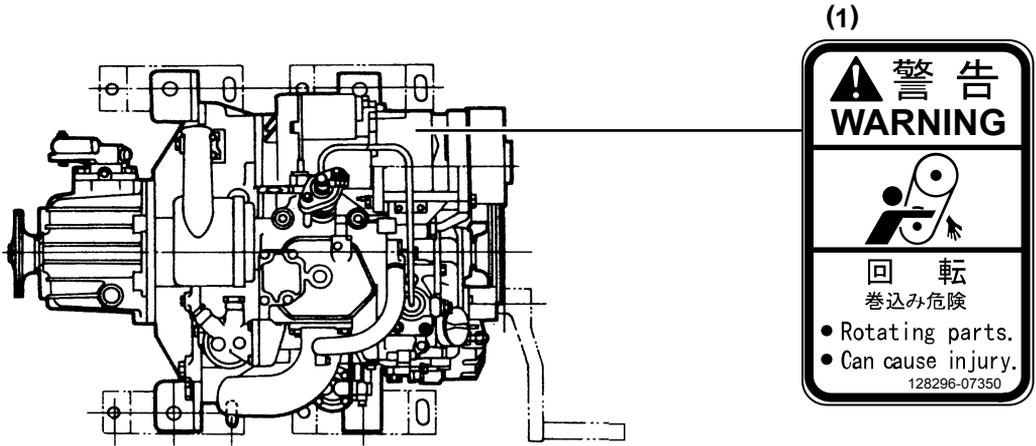
If you have an installation with two or three engines, and only one engine is operating, please note that if the propeller shaft thru-hull (stuffing box) is lubricated by engine water pressure and the engines are interconnected, care must be taken that water from the running engine does not enter the 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 GM series marine engines.

GM Engines



0005961

Figure 1

1 – Part Number: 128296–07350

PRODUCT OVERVIEW

YANMAR GM FEATURES AND APPLICATIONS

The GM series engines are four-stroke direct injection diesels equipped with direct seawater coolant systems.

The 1GM10 is a naturally aspirated 1-cylinder engine equipped with a KM2P marine gear.

The 1GM10C is a naturally aspirated 1-cylinder engine equipped with an SD20 sail-drive.

The 1GM10V is a naturally aspirated 1-cylinder engine equipped with a KM3V marine gear.

The 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 to 200 rpm above the Maximum Rated Power Output rpm (3700 to 3800) to allow for some added weight and hull resistance. The engine must be able to reach the Maximum Rated Power Output (3600 rpm) under full load at all times.

Failure to do so can lead to reduced vessel performance and 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 original equipment manufacturers.

The GM 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 structural design, vessel application and installation 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 your engine is operated during its first 50 hours of operation plays a very 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 bearing surfaces and other friction-related components, such as piston rings and valve guides, to wear in properly in order to stabilize engine lubrication and combustion.

During the break-in period, the engine coolant temperature gauge should be monitored closely. The temperature should remain 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 49.

COMPONENT IDENTIFICATION

Service Side - 1GM10 with KM2P

Figure 1 and Figure 2 illustrate a typical version of a 1GM10 engine. Your engine may have different equipment from that illustrated.

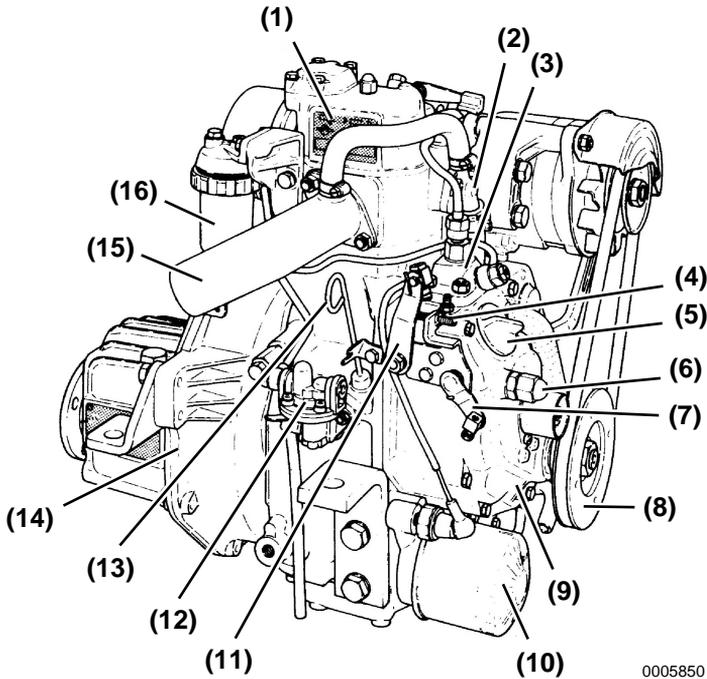
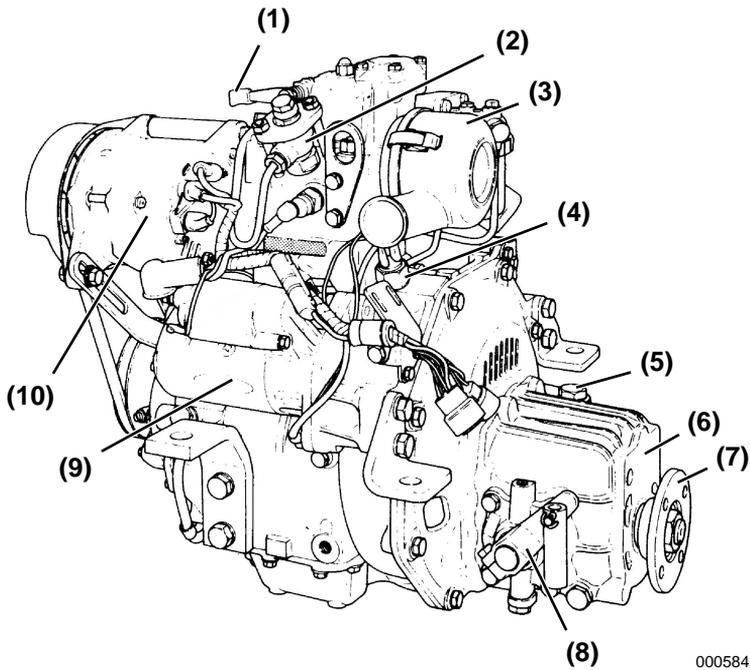


Figure 1

- | | |
|----------------------------|--------------------------|
| 1 – Nameplate | 9 – Seawater Pump |
| 2 – Thermostat Cover | 10 – Engine Oil Filter |
| 3 – Fuel Injection Pump | 11 – Regulator Handle |
| 4 – Idle Adjuster | 12 – Fuel Feed Pump |
| 5 – Oil Filler Cap | 13 – Engine Oil Dipstick |
| 6 – Fuel Injection Limiter | 14 – Mounting Flange |
| 7 – Engine Stop Lever | 15 – Mixing Elbow |
| 8 – Crankshaft V-Pulley | 16 – Fuel Filter |

PRODUCT OVERVIEW

Non-Service Side - 1GM10 with KM2P



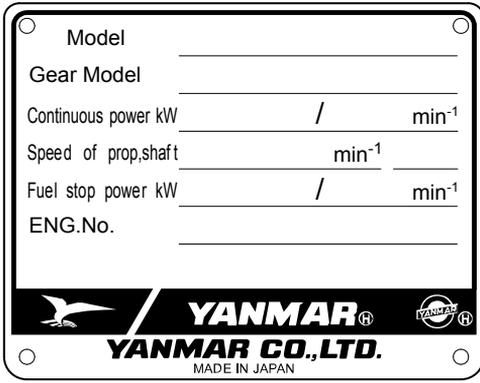
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Figure 2

- | | |
|--|----------------------------------|
| 1 – Decompression Lever | 6 – Marine Gearbox |
| 2 – Fuel Injection Valve | 7 – Output Shaft Coupling |
| 3 – Intake Silencer (Air Cleaner) | 8 – Shift Lever |
| 4 – Tachometer Sensor | 9 – Starter Motor |
| 5 – Marine Gear Dipstick | 10 – Alternator |

LOCATION OF NAMEPLATES

The nameplate of the Yanmar GM series engine is shown in **Figure 3**. Check the engine's model, output, rpm and serial number on the nameplate. Replace it if it is damaged or lost.



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Figure 3

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

The marine gear nameplate (**Figure 4**) is attached to the marine gear. Check the marine gear's model, gear ratio, oil used, oil quantity and serial number.

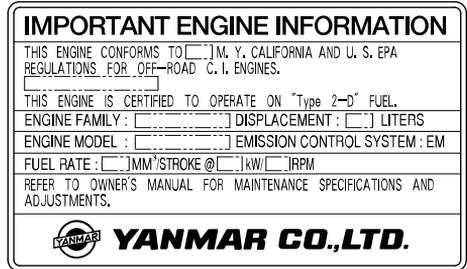


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Figure 4

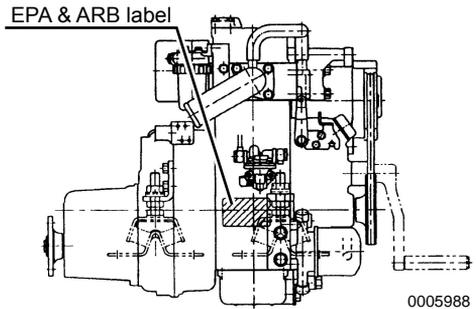
Emission-Control Labels

To ensure safe operation, emission-control labels have been attached to the engine. Their location is shown in **Figure 6**. They should always be visible. Replace labels if damaged or lost.



0005987

Figure 5



0005988

Figure 6

PRODUCT OVERVIEW

MAJOR COMPONENTS AND FUNCTIONS

Name of Component	Function
Decompression Lever	Opens the exhaust valve and releases cylinder pressure to aid in manual engine starting
Fuel Filter	Removes dirt and water from the fuel. Drain the filter periodically. The filter element (filter) should be replaced periodically.
Fuel Feed Pump (Priming Lever)	Pumps fuel from the tank to the fuel injection system. Pumping the priming lever up and down supplies fuel to the engine when the fuel system needs to be primed.
Engine Oil Filler Port	Filler port for engine oil
Marine Gear Oil Filler Port	Filler port for marine gear 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 50.</i>
Cooling System	Direct seawater cooling
Seawater Pump	Pumps seawater from outside the vessel and through the engine. The seawater pump has a replaceable rubber impeller.
Zinc Anode	The metal surfaces of the seawater cooling system are prone to corrosion. The zinc anode is installed in the cylinder block to prevent this. The surface of the zinc anode erodes so it needs to be replaced at fixed intervals in order to fully protect the seawater cooling system of the engine.
Intake Silencer (Air Cleaner)	The intake silencer guards against dirt entering the engine induction system and reduces the noise of air intake.
Nameplates	Nameplates are provided on the engine and the marine gear and contain the model, serial number and other data.
Starter Motor	The starter motor cranks the engine and is powered by the battery.
Alternator	The alternator is belt driven and generates electricity to charge the battery.
Engine Oil Dipstick	Gauge stick for checking the engine oil level

CONTROL EQUIPMENT

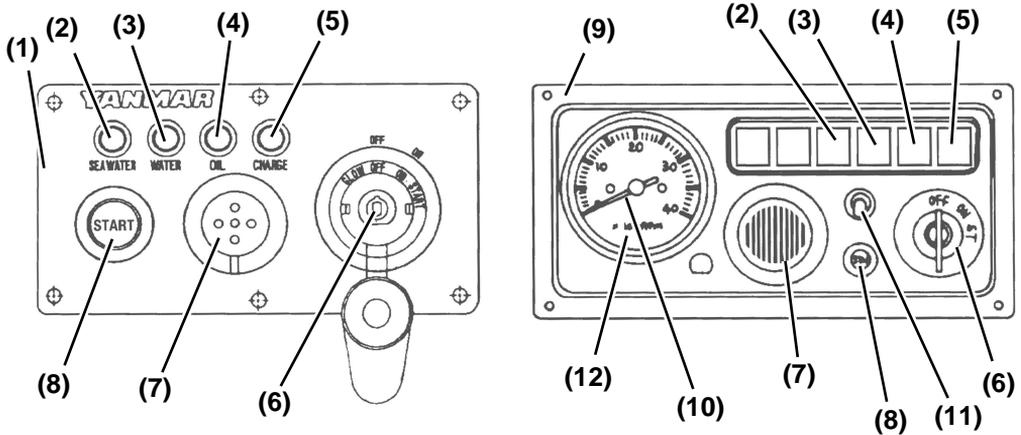
The control equipment at the helm makes remote control operation possible. It consists of the instrument panel, which is connected to the engine by a wire harness, and the throttle and shift console, which is connected by control cables to the engine control lever and marine gear.

Instrument Panel (Optional)

Equipment and Functions

The instrument panel is located at the helm and is available in two options. The following controls and indicators enable you to start, stop and monitor the condition of the engine during operation.

Instrument Panel Options and Components



0005848

Figure 7

- 1 – Option “A” Instrument Panel
- 2 – Seawater in Marine Gear Warning Lamp
- 3 – Water Temperature Warning Lamp
- 4 – Oil Pressure Warning Lamp
- 5 – Battery Low Charge Warning Lamp
- 6 – Key Switch
- 7 – Warning Buzzer
- 8 – Start Button
- 9 – Option “B” Instrument Panel
- 10 – Engine Tachometer
- 11 – Instrument Panel Light Switch
- 12 – Hour Meter

PRODUCT OVERVIEW

Gauges

Instrument	Function
Tachometer	Shows the engine rotation speed
Hour Meter	Shows the number of operating hours; can be used as a guide for periodic maintenance checks. The hour meter 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

When the key is in the OFF position (**Figure 8, (1)**) the electric current is off. The key can be inserted or removed in this position.

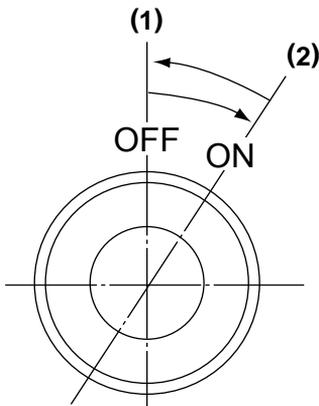


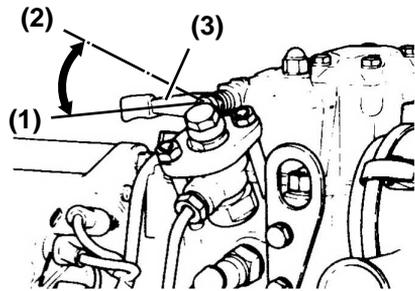
Figure 8

- 1 – OFF Position
- 2 – ON Position

The ON position (**Figure 8, (2)**) 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 pull the engine stop knob. After stopping the engine, turn the key to the OFF position.

Engine Decompression Lever

The engine decompression lever (**Figure 9, (3)**) releases cylinder pressure to aid in manual starting.



0005838

Figure 9

- 1 – RUN Position
- 2 – Decompression Position
- 3 – Decompression Lever

Raising the decompression lever to the decompression position (**Figure 9, (2)**) opens the exhaust valve and makes hand cranking of the engine possible. Returning the lever to its RUN position (DOWN) (**Figure 9, (1)**) closes the exhaust valve and normal engine operation can resume.

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 10

Battery Low Charge Indicator (Figure 10) - 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 11

Water Temperature Indicator and Alarm (Figure 11) - When water 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 12

Engine Oil Low Pressure Indicator and Alarm (Figure 12) - 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 13

Water in Sail-Drive Seal Indicator and Alarm (Figure 13) - When seawater is detected between the seals of the sail-drive, the indicator will light and the alarm will sound.

Engine Stop Control

The engine is stopped by pulling out the engine stop knob (Figure 14, (1)). This cable is connected to the engine stop lever and cuts off the fuel supply to the engine.

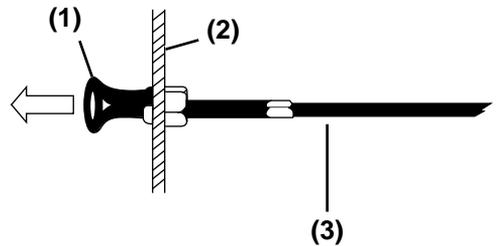


Figure 14

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- 1 – Engine Stop Knob
- 2 – Bulkhead
- 3 – Engine Stop Cable

PRODUCT OVERVIEW

Alarms

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

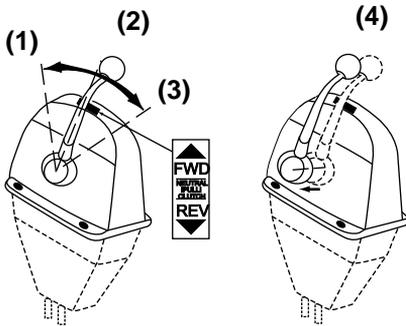
Key Switch		OFF ⇒ ON	START ⇒ ON
Engine		Before start	Running
Alarm		Sound	No sound
Indicators	Battery Low Charge Indicator	ON	OFF
	Water Temperature Indicator	OFF	OFF
	Engine Oil Low Pressure Indicator	ON	OFF
	Water In Sail-Drive Indicator	OFF	OFF

Note: All warning indications will continue until the engine starts or the key switch is in the OFF position.

Optional Single-Lever Throttle and Shift Console

This console (Morse Type) uses a single lever to operate the throttle and the shifting mechanism.

FORWARD (FWD) (Figure 15, (1)) - The drive shaft is engaged and the engine propels the vessel forward.



0005846

Figure 15

- 1 – FORWARD (FWD)**
- 2 – NEUTRAL (N)**
- 3 – REVERSE (REV)**
- 4 – Pull out the lever to disengage the clutch.**

NEUTRAL (N) (Figure 15, (2)) - The drive shaft is disengaged from the propeller and the engine idles.

REVERSE (REV) (Figure 15, (3)) - The drive shaft is engaged and the engine propels the vessel aft.

With the lever in the NEUTRAL position, pull the lever out from the console **(Figure 15, (4))** to disengage the clutch.

The lever controls the direction of the vessel (ahead or astern) and acts as an accelerator, increasing the engine speed (rpm) as it is pushed further in the FWD or REV direction. When the lever is pulled out, engine speed can be controlled without moving the vessel. The clutch is disengaged and the vessel is in NEUTRAL (no-load position).

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

BEFORE YOU OPERATE

This section of the *Operation Manual* describes diesel fuel and engine oil, 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 not to exceed 0.01% by volume.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- Do not use Biocide.
- Do not use kerosene or residual fuels.

Handling Diesel Fuel

DANGER

Only use diesel fuel in the fuel tank. 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.

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)**).

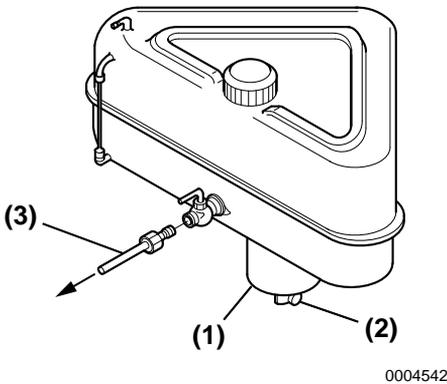


Figure 1

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

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

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.

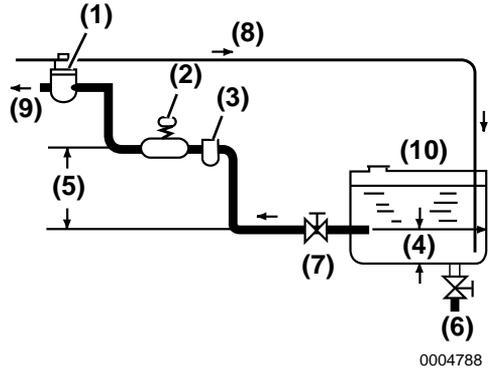


Figure 2

- 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**

BEFORE YOU OPERATE

Filling the Fuel Tank

Before filling the 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.

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.

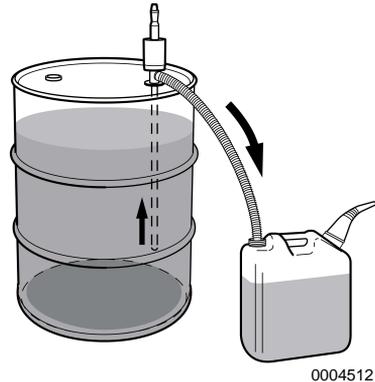


Figure 3

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.

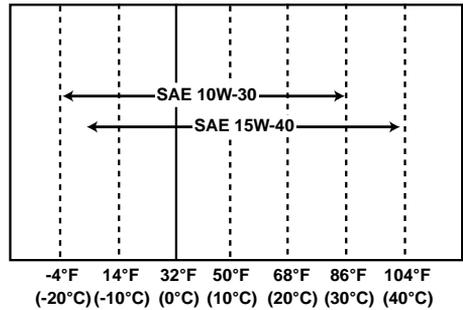
NOTICE:

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 50.**
3. **Select the oil viscosity based on the ambient temperature where the engine is being operated. See the SAE Service Grade Viscosity Chart (Figure 4).**
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 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 46.*

Engine Oil Viscosity



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Figure 4

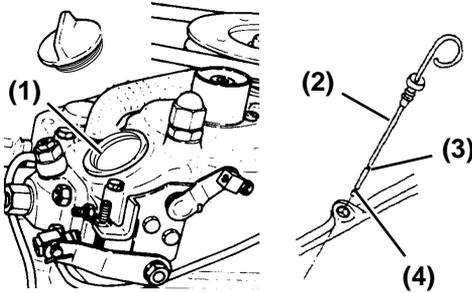
Select the appropriate engine oil viscosity based on the ambient temperature shown in the SAE Service Grade Viscosity Chart in Figure 4.

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.*

BEFORE YOU OPERATE

Checking the Engine Oil

1. Make sure the engine is off. It is recommended that the engine be as level as possible before checking the oil.
2. Remove the dipstick (**Figure 5, (2)**) and wipe with a clean cloth. **NOTICE: Prevent dirt and debris from contaminating the engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.**



0005852

Figure 5

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

3. Fully reinsert the dipstick.
4. Remove the dipstick. The oil level should be between the upper (**Figure 5, (3)**) and lower (**Figure 5, (4)**) lines on the dipstick.
5. Add oil if necessary. *See Adding Engine Oil on page 24.*
6. Fully reinsert the dipstick.

Adding Engine Oil

1. **NOTICE: Prevent dirt and debris from contaminating the engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.** Remove the yellow oil filler port cap from filler port (**Figure 5, (1)**) on the rocker arm cover and fill with engine oil.
2. Fill with engine oil to the upper limit (**Figure 5, (3)**) on the dipstick (**Figure 5, (2)**). **NOTICE: NEVER overfill the engine with engine oil.**

Engine Oil Capacity	
1GM10 (V) (C)	Full: 1.5 L (1.5 qt)

3. Insert the dipstick fully to check the level. **NOTICE: ALWAYS keep the oil level between upper and lower lines on the oil cap / dipstick.**
4. Hand-tighten the filler port cap securely.

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 drive oil.

SD20:

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

Checking Marine Gear Oil

1. Turn the engine off. Make sure the engine is as level as possible and wipe area clean around the marine gear filler port (**Figure 6, (4)**).

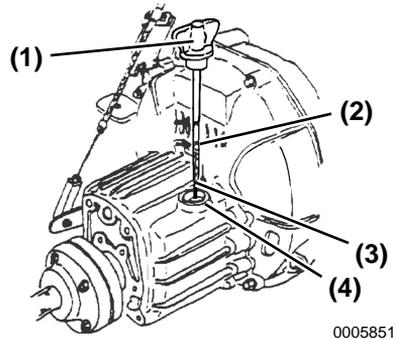


Figure 6

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

Marine Gear Oil Capacity	
KM2P	0.3 L (0.63 pt)

2. Remove the filler cap at the top of the housing.
3. Remove the dipstick (**Figure 6, (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 6, (2)**) and lower (**Figure 6, (3)**) lines on the dipstick.
6. Fully reinsert the dipstick.

¹ QuickSilver is a registered trademark of Brunswick Corporation.

BEFORE YOU OPERATE

Adding Marine Gear Oil

1. Make sure the engine is as level as possible.
2. Remove the filler cap / dipstick (**Figure 6, (1)**) at the top of the housing.
3. Fill with oil to the upper limit on the dipstick (**Figure 6, (2)**). **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

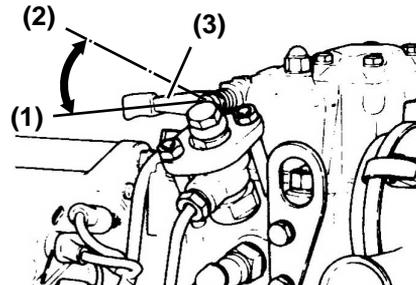
Refer to the *Sail-Drive Operation Manual* for the procedure for checking and filling the sail-drive oil.

CRANKING THE ENGINE MANUALLY

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 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 the NEUTRAL position.
4. Raise the decompression lever (**Figure 7, (3)**) up.



0005838

Figure 7

- 1 – RUN Position
- 2 – Decompression Position
- 3 – Decompression Lever

- Slide the starter handle (**Figure 8, (2)**) on the starter shaft (**Figure 8, (1)**), align the groove and pin, and turn the engine over about 10 times.

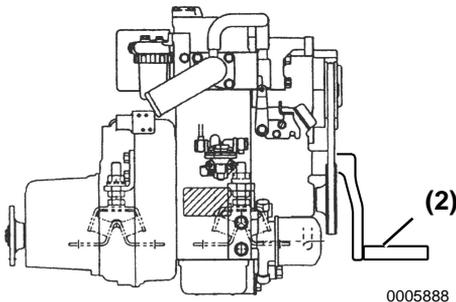
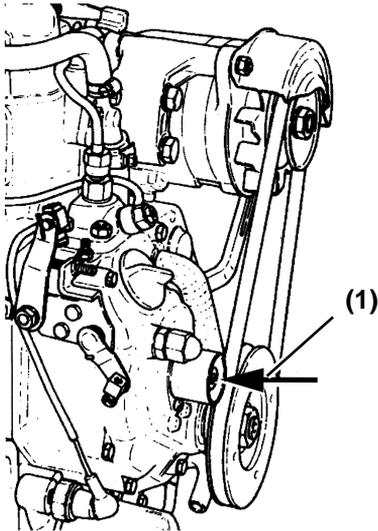


Figure 8

- 1 – Starter Shaft**
- 2 – Starter Handle**

- Listen for any abnormal noises while cranking the engine.
- Remove the starter handle.
- Place the decompression lever in the RUN position.

CRANKING THE ENGINE ELECTRICALLY

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:

- Open the seacock.
- Open the fuel cock.
Note: If the engine has not been operated for a long period of time, check that the key can be moved from the OFF to the ON position smoothly.
- Put the remote control shift lever in the NEUTRAL position.
- Pull the engine stop knob (**Figure 9, (1)**) out and hold continuously while cranking.

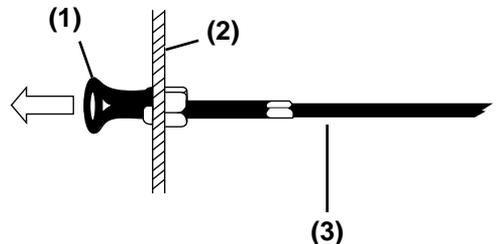


Figure 9

- 1 – Engine Stop Knob**
- 2 – Bulkhead**
- 3 – Engine Stop Cable**

- With the key in the ON position, push the start button and the engine will begin cranking.
- Continue cranking for about 5 seconds and listen for any unusual noises.

NOTICE: *If the engine stop knob is released (pushed in) during the cranking procedure, the engine will start. NEVER start the engine in this mode.*

Recheck the Engine Oil

When the oil is distributed throughout the internal components, start the engine and run at no load for about 5 minutes. This will ensure that all oil galleys, oil filters and oil tubes are full of oil. Shut the engine down and recheck the engine oil level. See *Checking the Engine Oil on page 24*. Add oil to the proper level, if necessary.

DAILY CHECKS

Before starting for the day, make sure the Yanmar engine is in good operating condition. **CAUTION!** *It is important to perform 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 you 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 the damage.*
3. Check for engine seawater 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.

8. Check the fuel filter / water separator for water and contaminants. If you find any water or contaminants, drain the fuel filter / water separator. *See Draining the Fuel Filter / Water Separator on page 52.* 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 49.*

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

Checking Diesel Fuel and Engine Oil

Follow the procedures in *Filling the Fuel Tank on page 22* and *Checking the Engine Oil on page 24* to check these levels.

Checking and Refilling Marine Gear Oil

See Checking Marine Gear Oil on page 25.

Checking the Battery Electrolyte Level

Check the battery electrolyte level before use. *See Inspecting the Battery Electrolyte Level (Serviceable Batteries Only) on page 53.*

Checking the Alternator Belt

Check the belt tension before use.

See Checking and Adjusting the Alternator V-Belt Tension on page 51.

Checking the Throttle and Shift Console

Check the operation of the throttle and shift control lever. Make sure it moves smoothly. If it is hard to operate, grease the joints of the control cable and lever bearings. If the lever has excessive play, adjust the control cable connectors and clamps. *See Inspecting and Adjusting the Throttle and Shift Control Cables on page 51.*

Checking the Warning Indicators

Check to ensure the engine instruments and warning indicators are functioning properly. *See Alarms on page 18.* Check them often during operation.

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.

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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 you continue to operate the engine. If the alarm indicator lamps and audible alarm fail to display or sound 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 ELECTRICALLY

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 thru-hull water intake valve 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 shift lever in the NEUTRAL position (**Figure 1, (1)**).

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

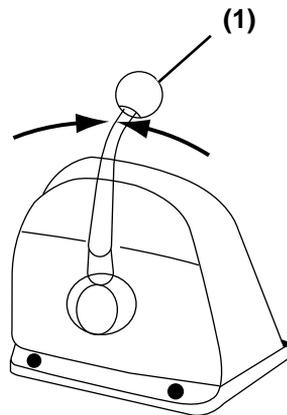


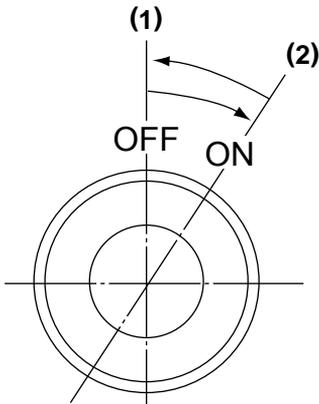
Figure 1

1 – NEUTRAL (N)

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

- Turn the key switch to the ON position (**Figure 2, (2)**). Ensure that the instrument panel indicators light and the alarm sounds. This indicates that the indicators and the alarm are working correctly.

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



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Figure 2

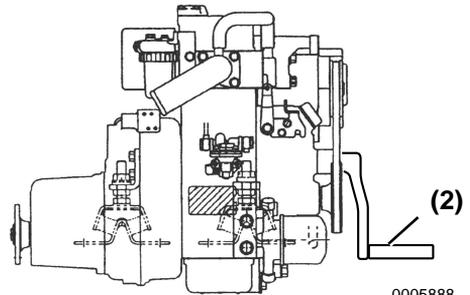
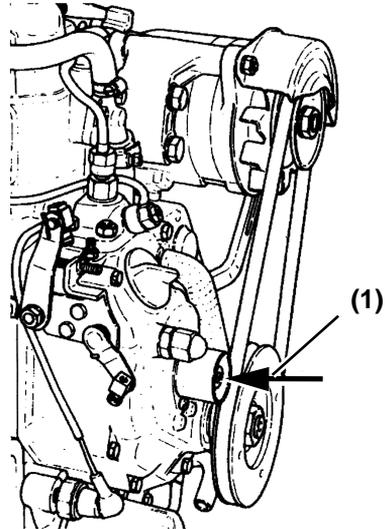
- 1 – OFF position
- 2 – ON position

- Push the start button. Release the start button when the engine has started. **NOTICE: NEVER hold the start button for longer than 15 seconds or the starter motor will overheat.**
- The alarm should stop and the indicator lamps 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.**

Starting the Engine Manually

- Open the seacock (if equipped).
- Open the fuel cock.
- Put the remote control shift lever in the NEUTRAL position (**Figure 3, (1)**).

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



0005888

Figure 3

- 1 – Starting Shaft
- 2 – Starting Handle

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

ENGINE OPERATION

5. Raise the decompression lever up. See *Cranking the Engine Manually on page 26*.
6. Slide the starter handle **(Figure 3, (2))** on the starter shaft **(Figure 3, (1))**, align the groove and pin, and turn by hand.
7. Turn the handle vigorously. When engine rotation is rapid, return the decompression handle to the RUN position.
8. Remove the starter handle from the starter shaft after the engine starts.

Restarting After Starting Failure

Before pushing the start button 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 start button 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 from 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 from the fuel system according to the following steps:

1. Check the fuel tank level.
2. Loosen the air vent bolt at the top of the fuel / water separator. When fuel is free of bubbles, retighten the air vent bolt.
3. Loosen the air vent bolts of the fuel filter and fuel injection pump.
4. Pump fuel with the fuel feed pump by moving the lever on the left side of the fuel feed pump up and down.

5. Allow the fuel containing air bubbles to flow out of the air vent bolt holes.
6. When the fuel no longer contains air bubbles, tighten the air vent bolts.
7. Try starting the engine again.

Starting at Low Temperatures

Comply with local environmental requirements. Do not use starting aids.

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.

After the Engine Has Started

After the engine has started, check the following items at a low engine rpm.

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.
5. 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.**
 - Is the seacock open?
 - Is the inlet of the seacock on the hull bottom clogged?
 - Is the seawater suction hose broken or does the hose suck air because of a loose clamp?

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 59* or *Troubleshooting Chart on page 61*.

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

THROTTLE AND SHIFT LEVER OPERATION

Acceleration and Deceleration

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

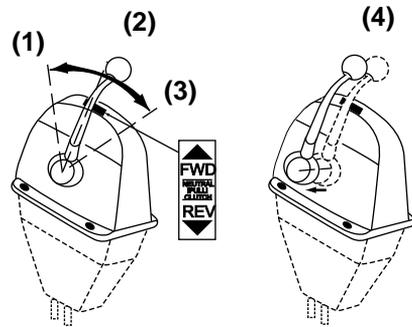
Use the throttle handle to control acceleration and deceleration. Move the handle slowly.

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 4, (1)) and REVERSE (Figure 4, (3)), bring the clutch to NEUTRAL (Figure 4, (2)) and pause before slowly shifting to the desired position. Do not shift abruptly from FORWARD to REVERSE or vice versa.



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Figure 4

- 1 – FORWARD (FWD)
- 2 – NEUTRAL (N)
- 3 – REVERSE (REV)
- 4 – Pull the lever to disengage the clutch.

PRECAUTIONS DURING OPERATION

Always check for problems during engine operation.

1. Is sufficient seawater being discharged from the seawater outlet?
If the discharge is too little, stop the engine immediately and correct the problem.
2. Is the exhaust color normal?
The continuous emission of black smoke indicates engine overloading. This shortens engine life and should be avoided.
3. Be aware of any abnormal vibration and unusual engine noises. NEVER operate at speeds that produce violent vibrations. Depending on the hull structure, engine and hull resonance may become great at a certain speed range. Avoid operating in this range. Stop the engine and inspect any unusual engine noise.
4. Ensure that there are no warning indicators active. If an indicator activates during operation, lower the engine speed immediately, check the indicator and stop the engine for repairs.
5. Check for any water, oil or fuel leaks. Check the engine room periodically.
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.

6. Is there sufficient fuel in the tank?
Replenish fuel in advance to avoid running out of fuel during operation.
7. When operating the engine at low speed for long periods of time, race the engine once every 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.

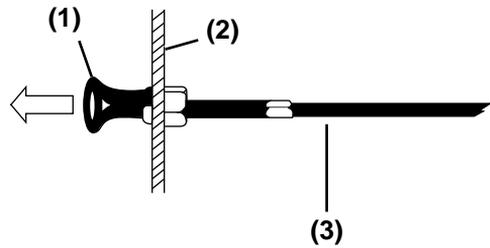
NOTICE: Never turn OFF the battery switch or spark the battery during operation. Damage to electrical parts will result.

SHUTTING DOWN THE ENGINE

NOTICE: NEVER stop the 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 itself is shut down.

1. Reduce the engine speed to low idle and put the shift control lever 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 the engine to run at low speed (approximately 1000 rpm) without load for five minutes.
4. With the key in the ON position, pull and hold the engine stop knob (Figure 5, (1)) until the engine has come to a complete stop. After the engine has stopped, turn the key switch to OFF.

Note: Continue to hold the engine stop knob until the engine is completely stopped. If the knob is released before the engine has completely stopped, it may restart.



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Figure 5

- 1 – Engine Stop Knob
- 2 – Bulkhead
- 3 – Control Cable

5. Turn off the master battery switch (if equipped).
6. Remove the key.
7. Close the fuel cock.
8. Close the seacock (if equipped).

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

Note: The engine may be stopped by raising the decompression lever, but avoid doing so except in times of emergency. The decompression lever releases compression pressure in the cylinder which causes the engine to stop. However, fuel injection does not stop and fuel continues to be pumped into the cylinder. This can lead to abnormal combustion when the engine is restarted and is not desirable.

CHECKING THE ENGINE AFTER OPERATION

- Check that the key switch is in the OFF position and master battery switch (if equipped) is turned to OFF.
- Fill the fuel tank. *See Filling the Fuel Tank on page 22.*
- Close the seacock (if equipped).
NOTICE: Be sure to close the seacock. Neglecting to close the seacock could allow water to leak into the boat and may cause it to sink.
- If there is a risk of freezing, drain the seawater system. *See Draining the Cooling System on page 66.*
- At temperatures below 0°C (32°F), drain seawater system 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 you need to transport an engine 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. Be sure to use Yanmar genuine replacement parts.

PRECAUTIONS

The Importance of Periodic Maintenance

Engine deterioration and wear occur in proportion to the length of time the engine has been in service and the conditions the engine is subjected to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor 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 any 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 28.*

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, 150, 300 and 600 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

Yanmar Replacement Parts

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

Tools Required

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

Ask Your Authorized Yanmar Marine Dealer or Distributor For Help

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

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. When working on critical components that require calibrated tools, special procedures and specific tightening sequences, consult with your Yanmar distributor or dealer.

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.*



Bolt diameter x pitch (mm)		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
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
	lb-in	—	—	—	—	—	—

EPA MAINTENANCE REQUIREMENTS

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations for Engines, it is essential that you follow the *Periodic Maintenance Schedule on page 46* and the *Periodic Maintenance Procedures on page 49*.

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.

Conditions to Ensure Compliance with EPA Emission Standards

The 1GM10, 1GM10C and 1GM10V 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 49* 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 48* for the EPA emission-related parts. Inspection and maintenance procedures not shown in the *Inspection and Maintenance of EPA Emission-Related Parts on page 48* section are covered in *Periodic Maintenance Schedule on page 46*.

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

PERIODIC MAINTENANCE SCHEDULE

Daily and periodic maintenance is important to keep the engine in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on engine application, loads, diesel fuel and engine oil, and are hard to establish definitively. The following should be treated only as a general guideline. **CAUTION!** *Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at 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							
System	Item	Periodic Maintenance Interval					
		Before Starting See Daily Checks on page 28.	Initial 50 Hours	Every 50 Hours	Every 150 Hours	Every 250 Hours or 1 Year	Every 1000 Hours or 4 Years
Whole	Visually inspecting the engine exterior	○					
Fuel System*	Inspecting the fuel level	○					
	Draining the fuel tank		○			○	
	Draining the fuel filter / water separator			○			
	Replacing the fuel filter element					◇	
	Inspecting the fuel injection timing Inspecting the fuel injection nozzle spray pattern					●*	●
Lubricating System	Inspecting the oil level	Engine	○				
		Marine Gear	○				
	Changing the oil	Engine		◇		◇	
		Marine Gear		◇		◇	
	Inspecting the function of the oil pressure warning lamp	○ During Operation					
Replacing the engine oil filter element		◇			◇		
Cooling System	Inspecting the seawater outlet	○ During Operation					
	Inspecting the seawater pump impeller					○	◇
	Inspecting the zinc anode					◇	
Air Intake and Exhaust System	Cleaning the intake silencer (air filter)					○	
	Cleaning the exhaust / water mixing elbow					○	
	Cleaning the breather pipe					○	
	Inspecting the exhaust gas condition	○ During Operation					
Electrical System	Inspecting the function of the battery charge warning lamp	○					
	Inspecting the battery electrolyte level	○			○		
	Checking and adjusting the alternator V-belt tension		○			○	◇
	Checking the wiring connectors					○	
Engine Cylinder Head and Block	Inspecting for fuel, oil or engine leaks	○ After Starting					
	Tightening all major nuts and bolts						●
	Adjusting the intake / exhaust valve clearances		○			●	
Miscellaneous Items	Inspecting and adjusting the throttle and shift control cables		○			●	
	Adjusting the propeller shaft alignment		○				●

* For EPA requirements, see *Inspection and Maintenance of EPA Emission-Related Parts* on page 48.

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

PERIODIC MAINTENANCE

Inspection and Maintenance of EPA Emission-Related Parts

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

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

Parts	Interval
Clean fuel injection nozzle	1500 hours
Check fuel injection nozzle pressure and spray pattern	3000 hours
Check fuel injection pump adjustment	3000 hours

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

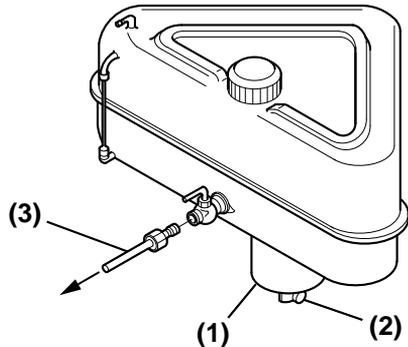
Perform the following maintenance after the initial 50 hours of operation.

- Draining the Fuel Tank
- Draining the Fuel Filter / Water Separator
- 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 the Intake / Exhaust Valve Clearances
- Inspecting and Adjusting the Throttle and Shift Control Cables
- Adjusting the 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.

1. Put a pan under the drain cock (Figure 1, (2)) to catch the fuel.



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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 differ.

2. Open the drain cock and drain water and sediment. Close the drain cock when the fuel is clean and free of water.

Draining the 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.

1. Close the fuel cock.
2. Put a pan under the fuel / water separator.
3. Remove the fuel filter cover and drain any water and dirt collected inside.
4. Reassemble the fuel filter.

PERIODIC MAINTENANCE

5. Purge air from the fuel system. See *Air Bleeding from the Fuel System After Starting Failure* on page 34.

Changing the Engine Oil

The engine oil in 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. This includes the replacement of the oil filter at this time.

It is easiest and most effective to drain the engine oil after operation while the engine is still warm. **WARNING! If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned. ALWAYS wear eye protection.**

1. Turn the engine OFF.
2. **NOTICE: Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove 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 24. **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 as necessary.

Replacing the Engine Oil Filter Element

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

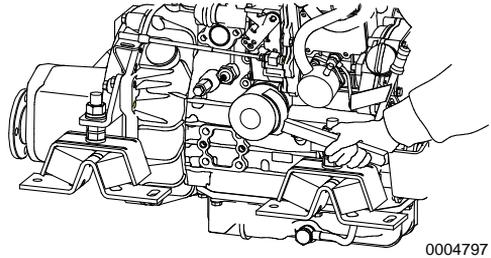


Figure 2

3. Remove the engine oil filter.
4. Clean the face of the filter mounting flange and apply a light coat of oil to the gasket of the new oil filter.
5. Install a new filter element and tighten by hand until the seal touches the housing.
6. Turn filter an additional 3/4 turn with a box wrench. Tighten to 20 to 24 N·m (14 to 17 lb-ft.).
7. Perform a trial run and check for oil leaks.

Changing the Marine Gear Oil

Note: Refer to the Operation Manual supplied with your marine gear or sail-drive unit for service and maintenance details.

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

1. Remove the cap from the filler port and attach an oil drain pump. Drain the marine gear oil.
2. Fill the marine gear with clean marine gear oil. See *Marine Gear Oil Specifications* on page 25.
3. Perform a trial run and check for oil leaks.

4. After approximately 10 minutes, stop the engine and check the oil level. Add oil if the level is too low.

Checking and Adjusting the Alternator V-Belt Tension

Inadequate V-belt tension will cause reduced electrical power generation and increase the wear on the belt. Too much V-belt tension can cause damage to the alternator bearing.

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

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

1. Inspect the V-belt for any damage or wear and replace it if necessary.
2. Find a location on the belt that is in the middle of the two pulleys.
3. Check the tension by pushing on the middle of the belt.
With proper tension, the belt should deflect 8 to 10 mm (approximately 3/8 in.).
4. Loosen the alternator bolt and move the alternator to adjust the V-belt tension, as required.
5. Hold the alternator in position and tighten the bolt.
6. Recheck tension by repeating step 3.

Inspecting and Adjusting the Intake / Exhaust Valve Clearances

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 clearances.

Inspecting and Adjusting the Throttle and Shift Control Cables

Various control levers and cables on the engine and marine gear are connected to the throttle and shift control console. The entire assembly loosens and stretches with prolonged use and initial break-in movements. It is dangerous to operate under these conditions. The throttle and shift control console should always be maintained in proper adjustment and should be inspected periodically.

NOTICE: The high speed stop bolt on the engine governor is set at the factory. Do not adjust. Adjustments to this bolt will void the engine warranty.

Adjusting the Governor Control Cable

1. With the engine off, move the throttle lever to the high speed position.
2. Check the governor control lever on the engine and verify that the lever is making contact with the high speed stop bolt.
3. Move the throttle lever to the low speed position.
4. Verify that the governor control lever on the engine is in contact with the low speed stop bolt.

If adjustment is needed, loosen the bracket that holds the control cable and adjust its position as necessary. Adjust the high speed position first and then the low speed position. **NOTICE: The high speed stop bolt on the engine governor is set at the factory. Do not adjust. Adjustments to this bolt will void the engine warranty.**

PERIODIC MAINTENANCE

Adjusting the Marine Gear Control 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 for the shift control cable on the marine gear and adjust its position as necessary.

Adjusting the 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

After you complete the initial 50-hour maintenance procedures, perform the following procedures every 50 hours of operation.

- **Draining the Fuel Filter / Water Separator**

Draining the Fuel Filter / Water Separator

WARNING! *When you remove 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 you remove any fuel system component.*

See Draining the Fuel Filter / Water Separator on page 49.

Every 150 Hours of Operation

Perform the following maintenance every 150 hours of operation.

- Changing the Engine Oil
- Changing the Marine Gear Oil
- Inspecting the Battery Electrolyte Level

Changing the Engine Oil

See *Changing the Engine Oil* on page 50.

Changing the Marine Gear Oil

Refer to the *Operation Manual* supplied with your marine gear or sail-drive unit for service and maintenance details.

Inspecting the Battery Electrolyte Level (Serviceable Batteries Only)

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: 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 master battery 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.**

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

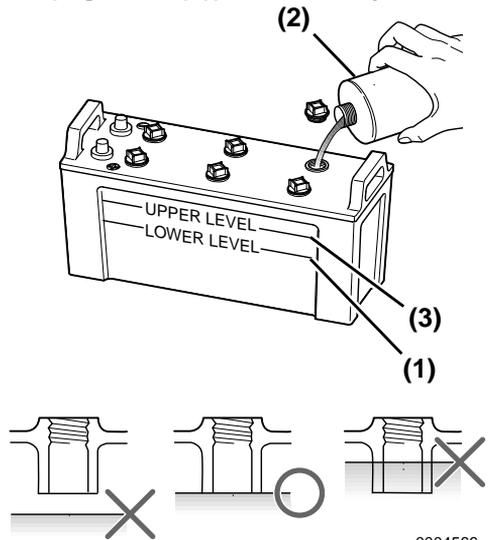


Figure 3

- 1 – Lower Level
- 2 – Battery Fluid
- 3 – Upper Level

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If the engine cannot be started or the rpm does not rise to rated output, measure the specific gravity of the battery with a hydrometer. The specific gravity of a fully charged battery is 1.27 or more at 20°C (68°F). Specific gravity of 1.24 or lower requires battery charging.

If charging the battery does not raise the specific gravity, replace the battery.

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

PERIODIC MAINTENANCE

NOTICE: *The standard alternator with the recommended battery is designed to produce electrical power for regular engine operations only. If power is being used for onboard lights and other systems, the charging system may be inadequate. Consult your authorized Yanmar Marine dealer or distributor.*

Every 250 Hours of Operation

Perform the following maintenance every 250 hours or 1 year of operation.

- **Draining the Fuel Tank**
- **Replacing the Fuel Filter Element**
- **Inspecting the Fuel Injection Nozzle Spray Pattern**
- **Replacing the Engine Oil Filter Element**
- **Inspecting the Seawater Pump Impeller**
- **Inspecting the Zinc Anode**
- **Cleaning the Intake Silencer (Air Filter)**
- **Cleaning the Exhaust / Water Mixing Elbow**
- **Cleaning the Breather Pipe**
- **Checking and Adjusting the Alternator V-Belt Tension**
- **Checking the Wiring Connectors**
- **Inspecting and Adjusting the Intake / Exhaust Valve Clearances**
- **Inspecting and Adjusting the Throttle and Shift Control Cables**

Draining the Fuel Tank

See Draining the Fuel Tank on page 49.

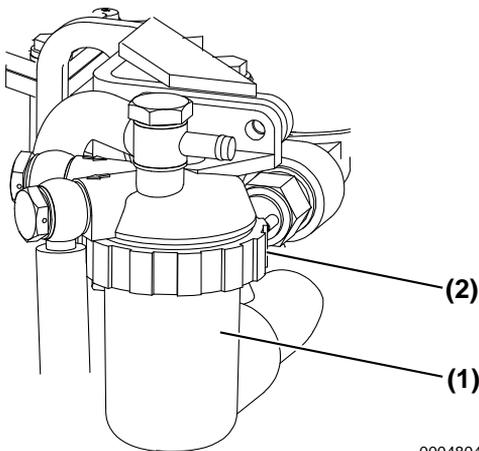
Replacing the Fuel Filter Element

WARNING! *When you remove 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 you remove any fuel system component.*

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. Loosen the retaining ring (**Figure 4, (2)**) counterclockwise with 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.



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Figure 4

- 1 – Fuel Filter Housing**
- 2 – Retaining Ring**

4. Remove the fuel filter housing (**Figure 4, (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 fuel filter housing thoroughly, install the O-ring and hand-tighten the retainer ring. Use a filter wrench and tighten to 12 N·m (8.8 lb-ft).
7. Air will enter the fuel system when the filter is disassembled and should be vented. Bleed the fuel system. *See Air Bleeding from the Fuel System After Starting Failure on page 34.* Dispose of waste properly.

Inspecting the Fuel Injection Nozzle Spray Pattern

See your authorized Yanmar Marine dealer or distributor.

Replacing the Engine Oil Filter Element

See Replacing the Engine Oil Filter Element on page 50.

Inspecting the Seawater Pump Impeller

Note: The seawater pump impeller must be replaced every 1000 hours or every four years, even if it is not damaged.

The seawater pump impeller will wear and deteriorate with prolonged use. This will reduce its capacity to move cooling water through the engine. Inspect the seawater pump impeller at its scheduled maintenance interval or sooner if the discharge volume of seawater is diminished. Refer to **Figure 5** when performing this inspection.

PERIODIC MAINTENANCE

1. Loosen the cover bolts and remove the pump side cover (**Figure 5, (7)**).

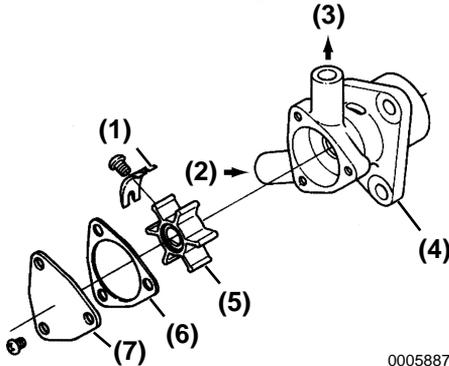


Figure 5

- 1 – Cam
- 2 – Inlet
- 3 – Outlet
- 4 – Seawater Pump Body
- 5 – Impeller
- 6 – Gasket
- 7 – Side Cover

2. Inspect the internal components of the pump.
 - Inspect the impeller blades (**Figure 5, (5)**). Look for nicks, cracks and any evidence of damage. This includes excessive scratches and marring of the surface of the impeller blades.
 - Inspect the condition of the pump body (**Figure 5, (4)**). Look for corrosion and evidence of structural damage to any surface that is in contact with the impeller blades. Make sure the walls of the pump chamber are smooth and free of gouges and corrosive pitting.

If no damage is found, reassemble the side cover.

Inspect the drain pipe under the pump during operation. If excessive amounts of water leak continuously, the oil seal needs to be replaced. See your authorized Yanmar Marine dealer or distributor.

NOTICE: *During normal operation, the pump impeller rotates in a counterclockwise direction (Figure 6, (1)). Use caution when installing the impeller to ensure that all the blades of the impeller are set in the proper direction. When turning the engine over manually, do not reverse the normal direction of engine rotation or the blades of the seawater pump impeller (Figure 6, (3)) may be damaged.*

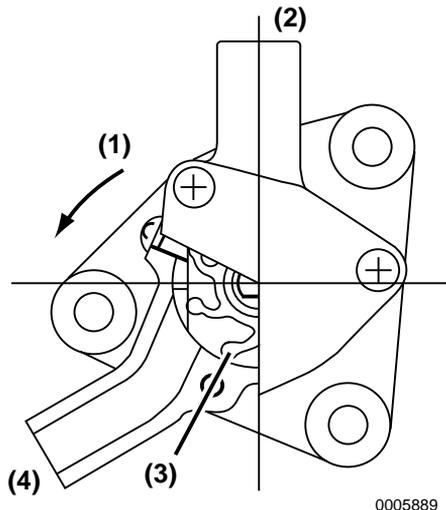


Figure 6

- 1 – Direction of Rotation
- 2 – Outlet
- 3 – Impeller
- 4 – Inlet

Inspecting the Zinc Anode

The inspection intervals and replacement schedule for the zinc anode are determined by seawater characteristics and your operating environment. Inspect the zinc anode a minimum of every 300 hours of operation, but shorten this interval if your operating conditions show a higher corrosion rate.

Replace the zinc anode when its surface area has been reduced to less than half of its original size.

If neglected, seawater will begin to react with the internal surface areas of the engine cooling system. This will lead to seawater leaks, internal corrosion and eventual failure of engine components.

The zinc anode is located on the inside of the anode plug and is labeled "Anticorrosion Zinc."

Cleaning the Intake Silencer (Air Cleaner)

1. Open the clamps that secure the air cleaner cover.
2. Remove the air filter element.
3. Wash the air filter element with a mild neutral detergent and water.
4. Allow the element to dry completely.
5. Remove any debris from the filter housing and cover.
6. Reinstall the filter element and secure the cover with the clamps.

Cleaning the Exhaust / Water Mixing Elbow

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

Cleaning the Breather Pipe

See your authorized Yanmar Marine dealer or distributor.

Checking and Adjusting the Alternator V-Belt Tension

See *Checking and Adjusting the Alternator V-Belt Tension* on page 51.

Checking the Wiring Connectors

See your authorized Yanmar Marine dealer or distributor.

Inspecting and Adjusting the Intake / Exhaust Valve Clearances

See *Inspecting and Adjusting the Intake / Exhaust Valve Clearances* on page 51. See your authorized Yanmar Marine dealer or distributor.

Inspecting and Adjusting the Throttle and Shift Control Cables

See *Inspecting and Adjusting the Throttle and Shift Control Cables* on page 51.

Every 1000 Hours of Operation

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

- **Inspecting the Fuel Injection Timing**
- **Inspecting the Seawater Pump Impeller**
- **Checking and Adjusting the Alternator V-Belt Tension**
- **Tightening All Major Nuts and Bolts**
- **Adjusting the Propeller Shaft Alignment**

Inspecting the Fuel Injection Timing

See your authorized Yanmar Marine dealer or distributor.

Inspecting the Seawater Pump Impeller

See Inspecting the Seawater Pump Impeller on page 55.

Checking and Adjusting the Alternator V-Belt Tension

See Checking and Adjusting the Alternator V-Belt Tension on page 51.

Tightening All Major Nuts and Bolts

See Tightening Fasteners on page 44 or see your authorized Yanmar Marine dealer or distributor.

Adjusting the Propeller Shaft Alignment

See Adjusting the Propeller Shaft Alignment on page 52. 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. 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 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 under way. This will generate higher exhaust temperatures, which will help clean out hard carbon deposits, maintain engine performance and prolong the life of the engine.

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 the 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 the fuel tank in advance to avoid running out of fuel. If the tank runs out of fuel, bleed the fuel system. *See Air Bleeding from the Fuel System After Starting Failure on page 34.*

TROUBLESHOOTING INFORMATION

If the engine does not operate properly, refer to the *Troubleshooting Chart on page 61* or see your authorized Yanmar Marine dealer or distributor.

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

- Model name and serial number of your engine
- Boat model, hull material, size (tons)
- Use, type of boating, number of hours run
- Total number of operation hours (refer to hour meter), 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
 - 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.	<i>See Checking the Engine Oil on page 24.</i>
	Engine oil filter is clogged.	Replace engine oil filter. Replace engine oil.	<i>See Replacing the Engine Oil Filter Element on page 50.</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.	—
Coolant High Temperature Alarm lights	Insufficient seawater discharge 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. Serious accidents may result if abnormalities are not identified because of faulty indicators or alarm.		
Indicators do not light: <ul style="list-style-type: none"> When key is turned on When any trouble occurs (oil pressure, e.g.) 	No electrical current available. Circuit broken or lamp burned out.	See your authorized Yanmar Marine dealer or distributor.	—
One of the indicators does not go out.	Sensor switch is faulty.	See your authorized Yanmar Marine dealer or distributor.	—
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 51.</i>
	Battery is defective.	Check battery fluid level and specific gravity, or replace battery.	<i>See Inspecting the Battery Electrolyte Level (Serviceable Batteries Only) on page 53.</i>
	Alternator power generation failure.	See your authorized Yanmar Marine dealer or distributor.	—

TROUBLESHOOTING

Symptom	Probable Cause	Measure	Reference
Starting Failures:			
Starter turns but engine does not start.	No fuel	Add fuel. Bleed fuel system. Ensure that fuel shut-off valve is open.	See <i>Filling the Fuel Tank</i> on page 22.
	Fuel filter is clogged.	Replace filter element.	See <i>Replacing the Fuel Filter Element</i> on page 55.
	Improper fuel	Replace with recommended fuel.	See <i>Diesel Fuel Specifications</i> on page 19.
	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.	—
Starter does not turn or turns slowly (engine can be turned manually).	Faulty clutch position	Shift to NEUTRAL and start.	See <i>Restarting After Starting Failure</i> on page 34.
	Insufficient battery charge	Check fluid level. Recharge. Replace.	See <i>Inspecting the Battery Electrolyte Level (Serviceable Batteries Only)</i> on page 53.
	Cable terminal contact failure	Remove corrosion from terminals. Tighten battery cables.	See <i>Inspecting the Battery Electrolyte Level (Serviceable Batteries Only)</i> on page 53.
	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 because accessory drive is engaged	See your authorized Yanmar Marine dealer or distributor.	—
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 	Engine is overloaded.	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) on page 57.</i>
	Improper fuel	Replace with recommended fuel.	<i>See Diesel Fuel Specifications on page 19.</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 19.</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.	—
	Engine burning oil (excessive 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 six 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 the engine.
2. Drain any water from 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 66.*)
5. Grease the exposed areas and joints of the remote control cables and the bearings of the throttle and shift control handle.
6. Seal the intake silencer, exhaust pipe, etc., to prevent moisture or contamination from entering engine.
7. Completely drain the bilge in the hull bottom.
8. Waterproof the engine room to prevent rain or seawater from entering.
9. Charge the battery once a month to compensate for the battery's self-discharge.

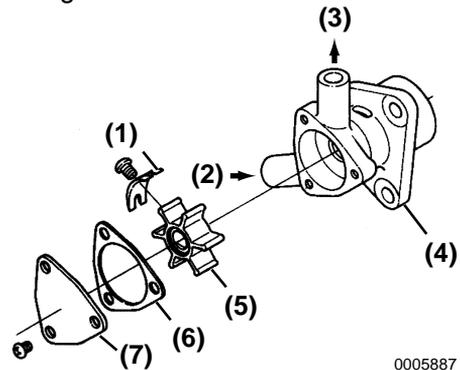
LONG-TERM STORAGE

10. Remove the key from the key switch and cover the key switch with the moisture cap (if equipped).

DRAINING THE COOLING SYSTEM

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

1. Put a pan under the seawater drain cocks.
2. Loosen the drain cock at the side of the thermostat cover and drain the water from the inside.
3. Loosen the three bolts holding the side cover (**Figure 1, (7)**) of the seawater pump. Remove the cover and drain the seawater from the pump body (**Figure 1, (4)**). Reinstall the cover and retighten the bolts when finished.



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Figure 1

- 1 – Cam
- 2 – Inlet
- 3 – Outlet
- 4 – Seawater Pump Body
- 5 – Impeller
- 6 – Gasket
- 7 – Side Cover

4. Close the drain cock.

SPECIFICATIONS

PRINCIPAL ENGINE SPECIFICATIONS

1GM10 Engine Specifications

Type	Vertical 4-cycle water-cooled diesel engine	
Combustion System	Swirl pre-combustion chamber	
Number of Cylinders	1	
Bore and Stroke	75 mm x 72 mm (2.95 in. x 2.83 in.)	
Displacement	0.318 L (19.4 cu. in.)	
Continuous Rating Output	Output at Crankshaft / Engine Speed	5.9 kW (8 hp metric) / 3400 rpm*
	Brake Mean Effective Pressure	6.66 kg/cm ² (94.73 psi)
	Piston Speed	8.16 m / sec. (26.77 ft / sec.)
Maximum Rating Output	Output at Crankshaft / Engine Speed	6.7 kW (9 hp metric) / 3600 rpm* 6.6 kW (9 hp metric) / 3600 rpm**
	Brake Mean Effective Pressure	7.07 kg/cm ² (100.56 psi)
	Piston Speed	8.64 m / sec. (28.35 ft / sec.)
Compression Ratio	23.0 : 1	
Fuel Injection Timing (BTDC)	15° ± 1°	
Fuel Injection Pressure	170 ± 5 kg/cm ² (2347- 2489 psi)	
Main Power Take Off	At flywheel end	
Front Power Take Off	At crankshaft V-pulley end	
Direction of Rotation	Crankshaft	Counterclockwise viewed from stern
	Propeller Shaft (Ahead)	Clockwise viewed from stern
Cooling System	Direct seawater cooling (Rubber impeller water pump)	
Lubrication System	Complete enclosed forced lubrication system	

* 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

SPECIFICATIONS

Starting System	Type	Electric and manual			
	Starting Motor	12 VDC, 1.0 kW (12 VDC, 1.4 hp metric)			
	AC Generator	12V, 35A			
Marine Gear System	Model	KM2P			
	Type	Mechanical cone clutch with single stage for both ahead and astern			
	Reduction Ratio	Forward	2.21 : 1	2.62 : 1	3.22 : 1
		Reverse	3.06 : 1	3.06 : 1	3.06 : 1
		Forward	1540 rpm	1298 rpm	1055 rpm
		Reverse	1113 rpm	1113 rpm	1113 rpm
	Lubricating Oil Capacity	0.3 L (0.317 qt)			
Weight	10.3 kg (22.71 lb)				
Dimensions	Overall Length	554 mm (21.81 in.)			
	Overall Width	410 mm (16.14 in.)			
	Overall Height	485 mm (19.09 in.)			
Engine Lubricating Oil Capacity (8° Rake Angle)	Total	1.3 L (1.373 qt)			
	Effective	0.6 L (0.634 qt)			
Engine Weight with Marine Gear		76 kg (167 lb)			

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

1GM10C Engine Specifications

Type	Vertical 4-cycle water-cooled diesel engine		
Combustion System	Swirl pre-combustion chamber		
Number of Cylinders	1		
Bore and Stroke	75 mm x 72 mm (2.95 in. x 2.83 in.)		
Displacement	0.318 L (19.4 cu. in.)		
Continuous Rating Output	Output at Crankshaft / Engine Speed	5.9 kW (8 hp metric) / 3400 rpm*	
	Brake Mean Effective Pressure	6.66 kg/cm ² (94.73 psi)	
	Piston Speed	8.16 m / sec. (26.77 ft / sec.)	
Maximum Rating Output	Output at Crankshaft / Engine Speed	6.7 kW (9 hp metric) / 3600 rpm* 6.6 kW (9 hp metric) / 3600 rpm**	
	Brake Mean Effective Pressure	7.07 kg/cm ² (100.56 psi)	
	Piston Speed	8.64 m / sec. (28.35 ft / sec.)	
Compression Ratio	23.0 : 1		
Fuel Injection Timing (BTDC)	15° ± 1°		
Fuel Injection Pressure	170 ± 5 kg/cm ² (2347-2489 psi)		
Main Power Take Off	At flywheel end		
Front Power Take Off	At crankshaft V-pulley end		
Direction of Rotation	Crankshaft	Counterclockwise viewed from stern	
	Propeller Shaft (Ahead)	Clockwise viewed from stern	
Cooling System	Direct seawater cooling (Rubber impeller water pump)		
Lubrication System	Complete enclosed forced lubrication system		
Starting System	Type	Electric and manual	
	Starting Motor	12 VDC, 1.0 kW (12 VDC, 1.4 hp metric)	
	AC Generator	12V, 35A	
Marine Gear System	Model	SD20	
	Type	Sail-Drive unit, dog-type clutch with spiral gear	
	Reduction Ratio	Forward	2.64 : 1
		Reverse	2.64 : 1
	Propeller Speed	Forward	1290 rpm
Reverse		1290 rpm	

* 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

SPECIFICATIONS

Dimensions	Overall Length	412 mm (16.22 in.)
	Overall Width	410 mm (16.14 in.)
	Overall Height	485 mm (19.09 in.)
Engine Lubricating Oil Capacity (8° Rake Angle)	Total	1.3 L (1.373 qt)
	Effective	0.6 L (0.634 qt)
Engine Weight with Sail-Drive		104 kg (229 lb)

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

1GM10V Engine Specifications

Type	Vertical 4-cycle water-cooled diesel engine	
Combustion System	Swirl pre-combustion chamber	
Number of Cylinders	1	
Bore and Stroke	75 mm x 72 mm (2.95 in. x 2.83 in.)	
Displacement	0.318 L (19.4 cu. in.)	
Continuous Rating Output	Output at Crankshaft / Engine Speed	5.9 kW (8 hp metric) / 3400 rpm*
	Break Mean Effective Pressure	6.66 kg/cm ² (94.73 psi)
	Piston Speed	8.16 m / sec. (26.77 ft / sec.)
Maximum Rating Output	Output at Crankshaft / Engine Speed	6.7 kW (9 hp metric) / 3600 rpm* 6.6 kW (9 hp metric) / 3600 rpm**
	Break Mean Effective Pressure	7.07 kg/cm ² (100.56 psi)
	Piston Speed	8.64 m / sec. (28.35 ft / sec.)
Compression Ratio	23.0 : 1	
Fuel Injection Timing (BTDC)	15° ± 1°	
Fuel Injection Pressure	170 ± 5 kg / cm ² (2347-2489 psi)	
Main Power Take Off	At flywheel end	
Front Power Take Off	At crankshaft V-pulley end	
Direction of Rotation	Crankshaft	Counterclockwise viewed from stern
	Propeller Shaft (Ahead)	Clockwise viewed from stern
Cooling System	Direct seawater cooling (Rubber impeller water pump)	
Lubrication System	Complete enclosed forced lubrication system	
Starting System	Type	Electric and manual
	Starting Motor	12 VDC, 1.0 kW (12 VDC, 1.4 hp metric)
	AC Generator	12V, 35A

* 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

SPECIFICATIONS

Marine Gear System	Model	KM3V		
	Type	V-Drive, Mechanical cone clutch with single stage for both ahead and astern (15°)		
	Reduction Ratio	Forward	2.36 : 1	
		Reverse	3.16 : 1	
	Propeller Speed DIN 6270A Rating	Forward	1441 rpm	
		Reverse	1076 rpm	
	Lubricating Oil Capacity		0.8 L (0.845 qt)	
Weight		19.5 kg (43.0 lb)		
Dimensions	Overall Length		680 mm (26.77 in.)	
	Overall Width		450 mm (17.71 in.)	
	Overall Height		554 mm (21.81 in.)	
Lubricating Oil Capacity (8° Rake Angle)	Total	1.3 L (1.373 qt)		
	Effective	0.6 L (0.634 qt)		
Engine Weight with Marine Gear			90 kg (198 lb)	

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

SYSTEM DIAGRAMS

PIPING DIAGRAMS

Notation	
	Screw Joint (Union)
	Spherical Pipe Joint
	Drilled Hole
	Cooling Seawater Piping
	Lubricating Oil Piping
	Fuel Oil Piping
STP	Steel Pipe
RH	Rubber Hose
VH	Vinyl Pipe

1GM10 Piping Diagram

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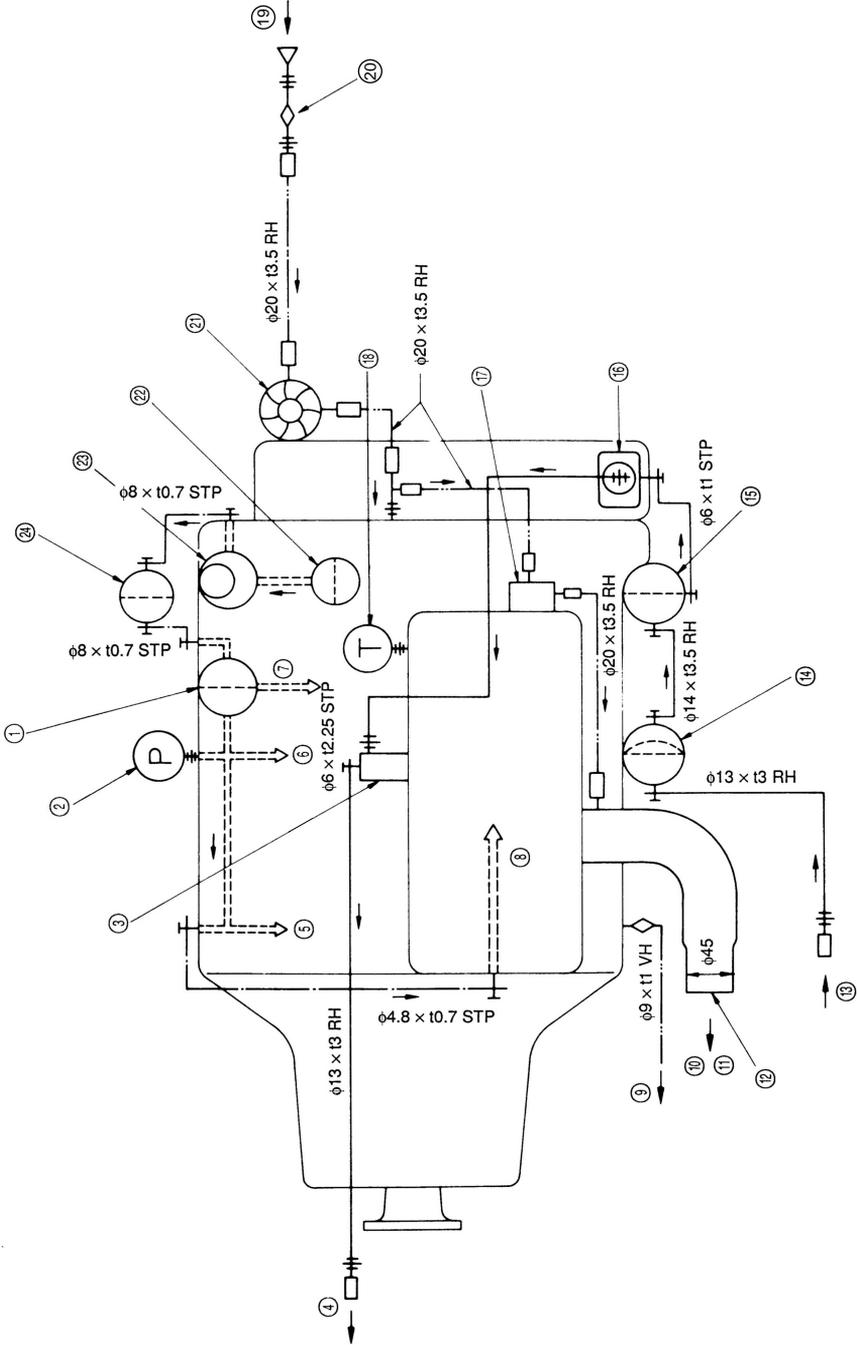


Figure 1

Notation	
	Fuel Pump
	Engine Oil Pipe
	Cooling Water Pipe
	Drilled Hole
	Spherical Pipe Joint
	Screw Joint
	Bayonet Joint
	Cock
STP	Steel Pipe
RH	Rubber Hose
VH	Vinyl Pipe

Key	Description
1	Engine Oil Pressure Adjusting Valve
2	Oil Pressure Switch
3	Fuel Injection Nozzle
4	Fuel Return Pipe
5	To Main Bearing
6	To Main Bearing
7	To Oil Pan
8	To Valve Rocker Arm
9	Cooling Water Drain
10	Exhaust Gas
11	Cooling Water
12	Mixing Elbow
13	Fuel Inlet
14	Fuel Feed Pump
15	Fuel Filter
16	Exhaust Gas
17	Cooling Water
18	Thermostat
19	Seawater Inlet
20	Seawater Pump
21	Fuel Filter
22	Engine Oil Filter (Inlet Side)
23	Engine Oil Pump
24	Engine Oil Filter (Outlet Side)

WIRING DIAGRAMS

1GM10 Series A-Type Instrument Panel

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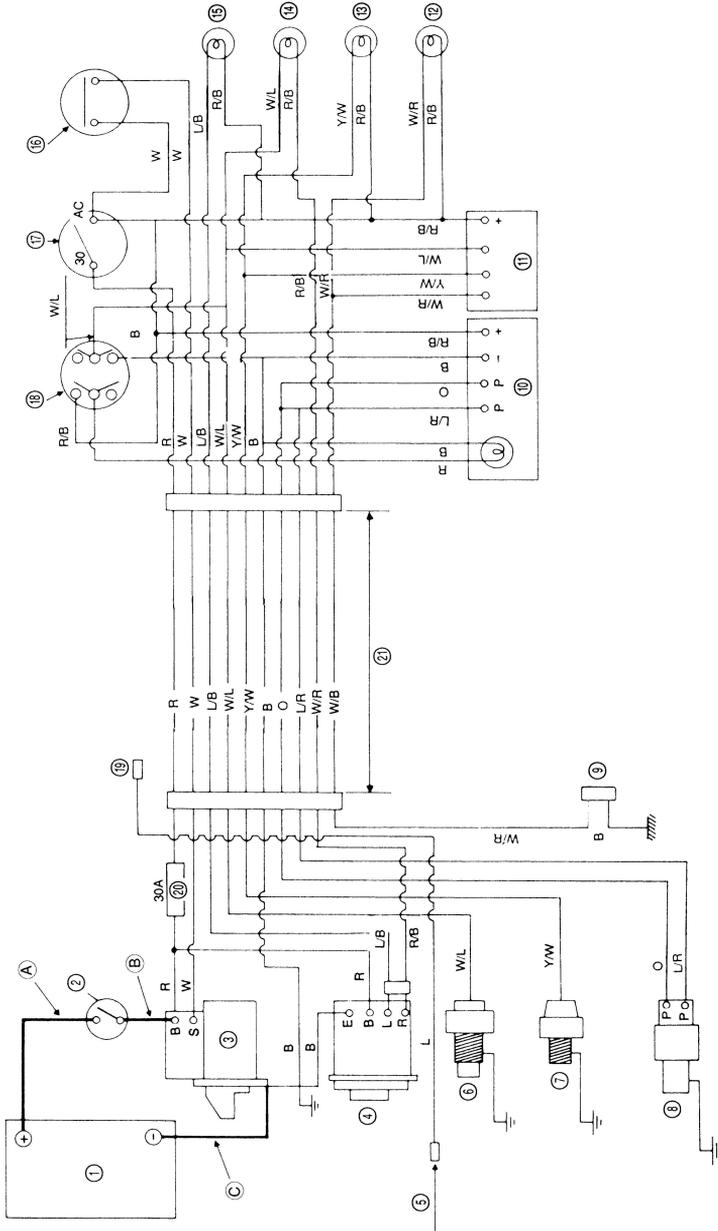


Figure 2

Color Coding	
R	Red
W	White
B	Black
O	Orange
L/B	Blue/Black
W/L	White/Blue
Y/W	Yellow/White
W/R	White/Red
L/R	Blue/Red
W/B	White/Black
R/B	Red/Black
<p><i>Note: $A + B + C < 2.5\text{ m} \rightarrow 20\text{ mm}^2$ (Cross sectional area)</i></p> <p><i>$A + B + C < 5\text{ m} \rightarrow 40\text{ mm}^2$ (Cross sectional area)</i></p>	

Key	Description
1	Battery
2	Battery Switch
3	Starter Motor
4	Alternator
5	Not Used
6	Cooling Water Temperature Switch
7	Engine Oil Pressure Switch
8	Tachometer Sender
9	Sail-Drive Connector (Rubber Seal Switch)
10	Tachometer
11	Buzzer
12	Rubber Seal Lamp (Sail-Drive)
13	Engine Oil Pressure Lamp
14	Cooling Water Temperature Lamp
15	Charge Lamp
16	Push Button Switch
17	Key Switch
18	Light Switch
19	Not Used (Except 1GM10)
20	Fuse
21	Extension Cable 3 m (Standard). The total length extension cable must be less than 6 m.

Color Coding	
R	Red
W	White
B	Black
O	Orange
L/B	Blue/Black
W/L	White/Blue
Y/W	Yellow/White
W/R	White/Red
L/R	Blue/Red
W/B	White/Black
R/B	Red/Black
<p><i>Note: $A + B + C < 2.5\text{ m} \rightarrow 20\text{ mm}^2$ (Cross sectional area)</i></p> <p><i>$A + B + C < 5\text{ m} \rightarrow 40\text{ mm}^2$ (Cross sectional area)</i></p>	

Key	Description
1	Battery
2	Battery Switch
3	Starter Motor
4	Alternator
5	Not Used
6	Cooling Water Temperature Switch
7	Engine Oil Pressure Switch
8	Spare Connector
9	Spare Connector
10	Extension Cable 3 m (Standard). The total length extension cable must be less than 6 m.
11	Buzzer
12	Engine Oil Pressure Lamp
13	Cooling Water Temperature Lamp
14	Charge Lamp
15	Push Button Switch
16	Key Switch
17	Not Used (Except 1GM10)
18	Fuse

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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.

<p>Engines rated at or above 19 kW \leq and less than < 37 kW (25.5 hp \leq and less than < 49.6 hp)</p>	<p>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.</p>
<p>Engines rated under 19 kW > (25.5 hp >)</p>	<p>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.</p>

EMISSION SYSTEM WARRANTY

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