

OPERATION MANUAL

MARINE ENGINES

6LY2A

6LY2A-STP

6LY2A-UTP

 English

YANMAR

California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

Disclaimers:

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OPERATION MANUAL	MODEL	6LY2A-STP, 6LY2A-UTP
	CODE	0ALY2-EN0032

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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 6LY2A series engine for many years to come, please follow these recommendations:

- Read and understand this *Operation Manual* before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
- Keep this *Operation Manual* in a convenient place for easy access.
- If this *Operation Manual* is lost or damaged, order a new one from your authorized Yanmar Marine dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- Constant efforts are made to improve the quality and performance of Yanmar products, so some details included in this *Operation Manual* may differ slightly from your engine. If you have any questions about these differences, please consult your authorized Yanmar Marine dealer or distributor.
- The specifications and components (instrument panel, fuel tank, etc.) described in this manual may differ from ones installed on your vessel. Please refer to the manual provided by the manufacturer of these components.
- Refer to the Yanmar Limited Warranty Handbook for a complete warranty description.

INTRODUCTION

RECORD OF OWNERSHIP

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

Engine Model: _____

Engine Serial No.: _____

Date Purchased: _____

Dealer: _____

Dealer Phone: _____

SAFETY

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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

SAFETY PRECAUTIONS

General Information

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

Before You Operate

DANGER

The safety messages that follow have DANGER level hazards.



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

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

- Safety signs and labels are additional reminders for safe operating and maintenance techniques.
- Consult authorized Yanmar Marine dealer or distributor for additional training.

During Operation and Maintenance

WARNING

The safety messages that follow have WARNING level hazards.

Explosion Hazard



While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery

well-ventilated and keep sparks, open flames and any other form of ignition out of the area.

Fire and Explosion Hazard

Diesel fuel is flammable and explosive under certain conditions.

Never use a shop rag to catch the fuel.

Wipe up all spills immediately.

Never refuel with the engine running.

Fire Hazard



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

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

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

Never use the engine compartment for storage.

⚠ WARNING**Sever Hazard**

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

Alcohol and Drug Hazard

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

Exposure Hazard

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

Sudden Movement Hazard

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

Burn Hazard

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

Exhaust Hazard

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

CAUTION

The safety messages that follow have CAUTION level hazards.

Poor Lighting Hazard

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

Tool Hazard

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

Flying Object Hazard

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

Coolant Hazard



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

NOTICE

The safety messages that follow have NOTICE level hazards.

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

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



Always be environmentally responsible.

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

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

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

NOTICE

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

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

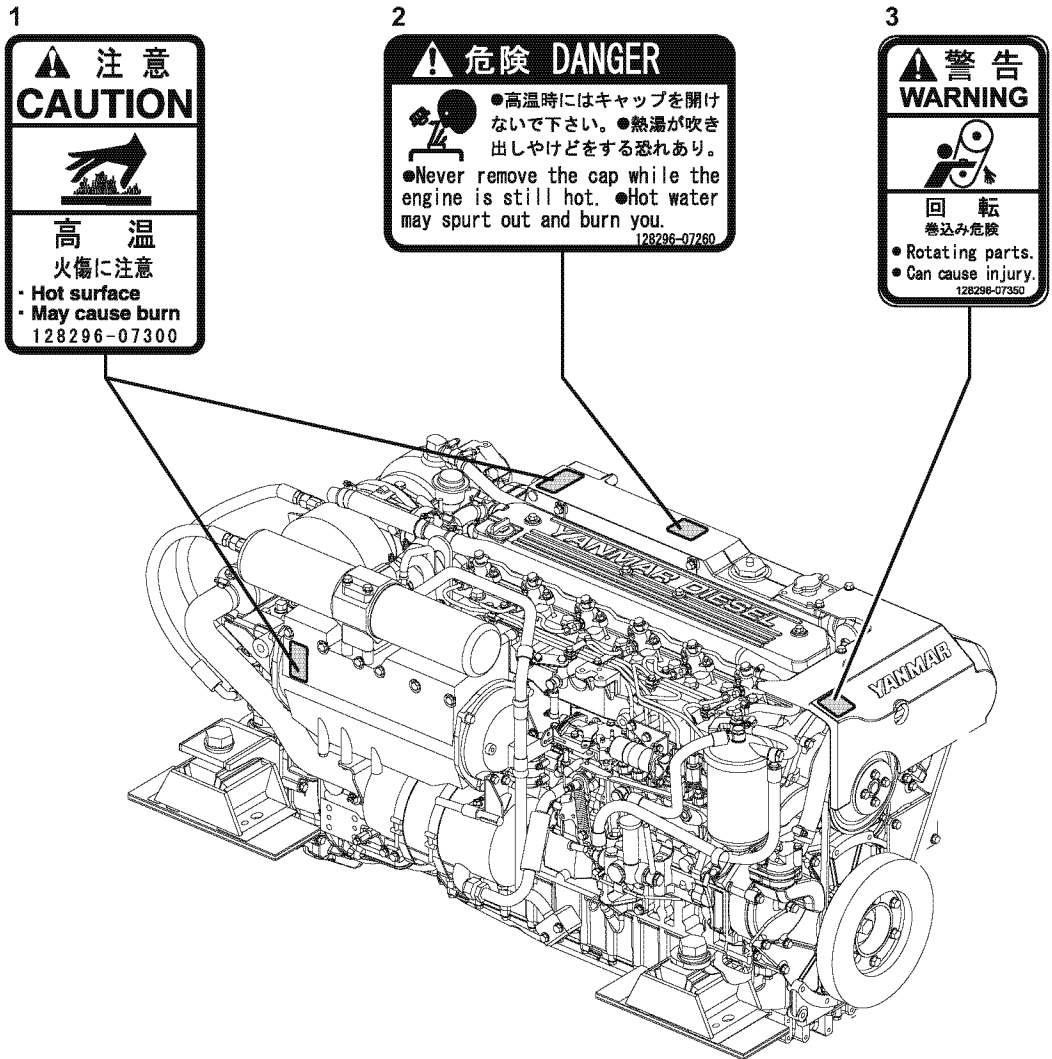
If you have an installation with two or three engines, and only one engine is operating, it is important to limit the amount of throttle applied to the running engine. If you observe black smoke or movement of the throttle does not increase engine speed, you are overloading the engine that is running.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

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

LOCATION OF SAFETY DECALS

Figure 1 and Figure 2 show the location of safety decals on Yanmar 6LY2A series marine engine.

6LY2A Engine



063141-00X00

Figure 1

1-Part Number: 128296-07300

2-Part Number: 128296-07260

3-Part Number: 128296-07350

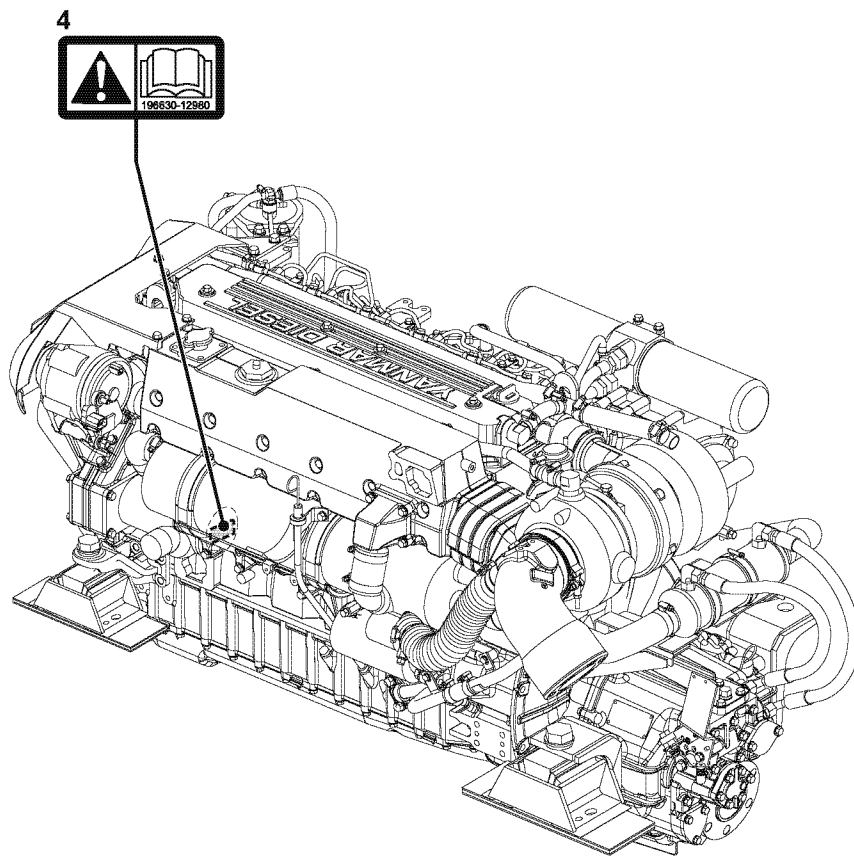


Figure 2

4-Part Number: 196630-12980

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PRODUCT OVERVIEW

YANMAR 6LY2A SERIES FEATURES AND APPLICATIONS

The 6LY2A series are four-stroke diesel engines equipped with direct injection diesel system and with liquid coolant systems.

The 6LY2A is 6-cylinder and turbocharged with an air cooler.

The engines are equipped with a marine gear. (Option)

These engines are designed for recreational craft use.

It is recommended that new vessels be propped so the engines can operate at 50 to 100 min⁻¹ above the fuel stop power engine speed to allow for some added weight and hull resistance.

Failure to do so can lead to reduced vessel performance, lead to increased smoke levels and cause permanent damage to your engine.

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

The 6LY2A series engines are designed to be operated at maximum throttle*¹ for less than 5% of total engine time (30 minutes out of every 10 hours) and cruising speed*².

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

*¹ maximum throttle: fuel stop power engine speed

*² cruising speed: fuel stop power engine speed -200 min⁻¹ or less

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 make the sliding parts, such as piston rings, break-in properly and to stabilize engine combustion.

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

During the first 10 hours of operation, the engine should be run at maximum engine speed minus 400 to 500 min⁻¹ (approximately 60 to 70% of load) most of the time. This will ensure the sliding parts break in properly. During this period, avoid operating at maximum engine speed and load to avoid damaging or scoring sliding parts.

NOTICE

Do not 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 engine oil consumption may increase. Low idle speed does not allow break-in of sliding parts.

If operating engine at low speed and light load, you must race the engine to clean the carbon from the cylinders and 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 run at maximum speed minus 400 min⁻¹ most of the time (approximately 70% load), with a 10 minute run at maximum minus 200 min⁻¹ (approximately 80% load) every 30 minutes and a 4 to 5 minute period of operation at WOT (wide open throttle) once each 30 minutes. During this period, be sure not to operate your engine at low speed and light load for more than 30 minutes. If operating engine at low speed and light load by necessity, just after the low idle operation, be sure to race the engine.

To complete engine break-in, perform *After Initial 50 Hours of Operation* maintenance procedures. *After Initial 50 Hours of Operation* on page 57.

COMPONENT IDENTIFICATION

Figure 1 and Figure 2 illustrate a typical version of 6LY2A series engines. Your engine may have different equipment from that illustrated.

Right Side (Viewed from Flywheel) - 6LY2A-STP/6LY2A-UTP

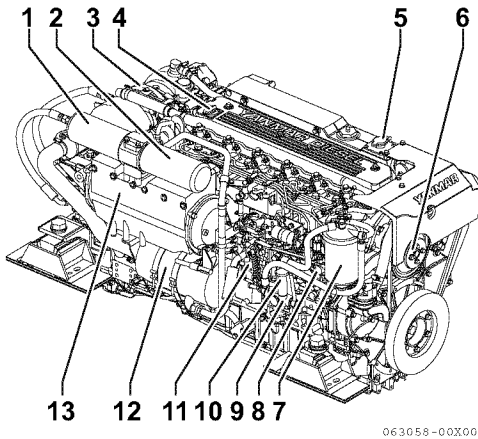


Figure 1

- 1 – Engine oil filters (Full Flow)
- 2 – Engine oil filter (Bypass)
- 3 – Turbocharger
- 4 – Engine oil filler cap
- 5 – Coolant filler cap
- 6 – Coolant pump
- 7 – Fuel filter
- 8 – Fuel Injection Pump
- 9 – Fuel feed pump
- 10 – Fuel Priming Pump
- 11 – Control lever
- 12 – Engine oil cooler
- 13 – Air cooler

Left Side (Viewed from Flywheel) - 6LY2A-STP/6LY2A-UTP

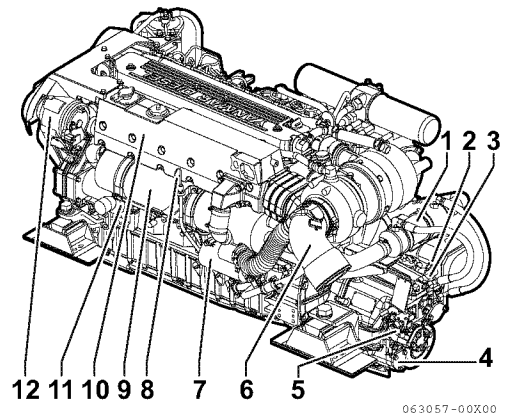


Figure 2

- 1 – Marine gear oil cooler (KMH60A)
- 2 – Marine gear oil dipstick
- 3 – Marine gear filler port
- 4 – Lubrication oil inlet strainer (Marine gear)
- 5 – Shift lever
- 6 – Exhaust/water mixing elbow
- 7 – Starter motor
- 8 – Engine oil dipstick
- 9 – Heat exchanger
- 10 – Exhaust manifold (Coolant tank)
- 11 – Seawater pump
- 12 – Alternator

PRODUCT OVERVIEW

NAMEPLATES

The nameplates of Yanmar 6LY2A series engines are shown in **Figure 3**. Check the engine's model, output, min^{-1} and serial number on the nameplate. Please replace if damaged or lost.

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

Model	_____
Gear Model	_____
Continuous power kW	_____ kW/ _____ min^{-1}
Speed of prop.shaft	_____ min^{-1} _____
Fuel stop power kW	_____ / _____ min^{-1}
ENG.No.	_____
MFG.DATE	_____ / _____
YANMAR YANMAR CO.,LTD. MADE IN JAPAN	

129670-07201

Figure 3

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

MODEL	_____
MFG. NO.	_____
GEAR RATIO	_____
OIL	_____
YANMAR KANZAKI KOKYUKOKI MFG CO., LTD. MADE IN JAPAN	

177524-02903

Figure 4

FUNCTION OF MAJOR COMPONENTS

Name of Component	Function
Fuel Filter	The fuel filter removes contaminants and sediments from the diesel fuel. Periodic replacement of the fuel filter is necessary. <i>See Periodic Maintenance Schedule on page 53</i> for the replacement frequency.
Fuel pre-filter (Water separator)	The water separator removes contaminants, sediment and water from diesel fuel going to the fuel filter. This is a required component of the fuel system and is standard equipment with every engine. The water separator is installed between the fuel tank and the fuel feed pump. Periodically drain the water from the water separator using the drain cock at the bottom of the separator and replace the filter element.
Fuel Priming Pump	This is a manual fuel pump. Pushing the knob on the top of the fuel pre-filter feeds the fuel. This pump is also used to bleed air from the fuel system.
Engine Oil Filler Port	Filler port for engine oil.
Engine Oil Filter	Filters fine metal fragments and carbon from the engine oil. Filtered engine oil is distributed to the engine's moving parts. The filter is a cartridge type and the element should be replaced periodically. <i>See Changing the Engine Oil and Replacing the Engine Oil Filter Element on page 58.</i>
Marine Gear Filler Port	Filler port for marine gear lube oil. Located on top of the marine gear case.
Cooling System	There are two cooling systems: closed cooling with coolant and seawater. The engine is cooled by the closed cooling circuit. The closed circuit is cooled by seawater using a heat exchanger. The seawater also cools the engine/marine gear oil and intake air through the cooler(s) in an open circuit.
Coolant pump	The centrifugal water pump circulates coolant inside the engine. The circulating pump is driven by a V-belt.
Seawater Pump	Pumps seawater from outside vessel to the engine. The seawater pump is gear-driven and has a replaceable rubber impeller. Do not operate it without seawater, as this will damage the impeller.
Reservoir	The pressure valve in the filler cap releases vapor and hot water overflow to the reservoir. When the engine stops and the coolant cools, the pressure in coolant tank drops. The filler cap vacuum valve then opens to send water back from the reservoir. This minimizes coolant consumption. The closed cooling system coolant level can easily be checked and refilled in this tank.
Oil Cooler - Engine	A heat exchanger that cools high temperature engine oil using seawater.
Oil Cooler - Marine Gear (Optional)	This heat exchanger cools the marine gear (KMH60A) oil using seawater.
Turbocharger	The turbocharger pressurizes the air coming into the engine. It is driven by a turbine that is energized by exhaust gases.
Air cooler	This heat exchanger cools the pressurized charging air from the turbocharger with seawater to increase the charging air quantity.
Intake Silencer (Air Cleaner)	The intake silencer guards against dirt in the air and reduces the noise of air intake.
Zinc Anode	The metal area of the seawater cooling system is prone to galvanic corrosion. The zinc anode is installed in the various coolers to prevent this. When the zinc anode becomes worn, components in the fresh water cooler, oil cooler, etc. will corrode. Periodic replacement of the zinc anode is necessary.
Nameplates	Nameplates are provided on the engine and the marine gear and have the model, serial number and other data.
Starter	Starter motor for the engine. Powered by the battery.
Alternator	Driven by belt and generates electricity and charges the battery.
Engine Oil Dipstick	Gauge stick for checking the engine oil level.

PRODUCT OVERVIEW

CONTROL EQUIPMENT

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

Instrument Panel (Optional)

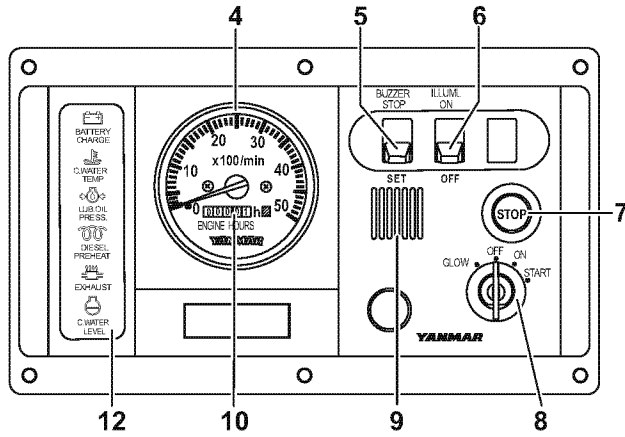
Equipment and Functions

The instrument panel has the following gauges and alarm devices.

○ = Available, — = Not Available

Gauge or Switch		New B-Type Panel See (Figure 5)	New C-Type Panel See (Figure 6)	New D-Type Panel See (Figure 7)
Switches	Key (Starter) Switch	○	○	○
	Engine Stop Button	○	○	○
	Alarm (Buzzer)	○	○	○
	Alarm (Buzzer) Stop Switch	○	○	○
	Backlight Switch for Gauges	○	○	○
Warning Indicators	Battery Low Charge	○	○	○
	Coolant High Temperature	○	○	○
	Engine (Lube) Oil Low Pressure	○	○	○
	Coolant Level	—	○	○
	Exhaust (Cooling Seawater Flow)	○	○	○
	Gear Oil (Option: with KM60A)	—	○	○
Gauges	Tachometer with Hourmeter	○	○	○
	Engine (Lube) Oil Pressure Gauge	—	○	○
	Coolant Temperature Gauge	—	○	○
	Turbocharger Boost Pressure Gauge	—	—	○
Clock	Quartz Clock	○ (Option)	○ (Option)	○
Indicator	Preheat Indicator	○ (Option)	○ (Option)	○

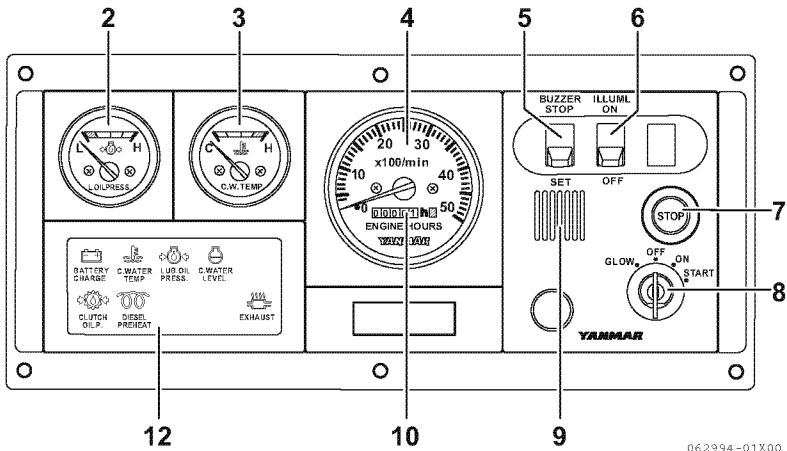
New B-Type



062993-00X00

Figure 5

New C-Type



062994-01X00

Figure 6

New D-Type

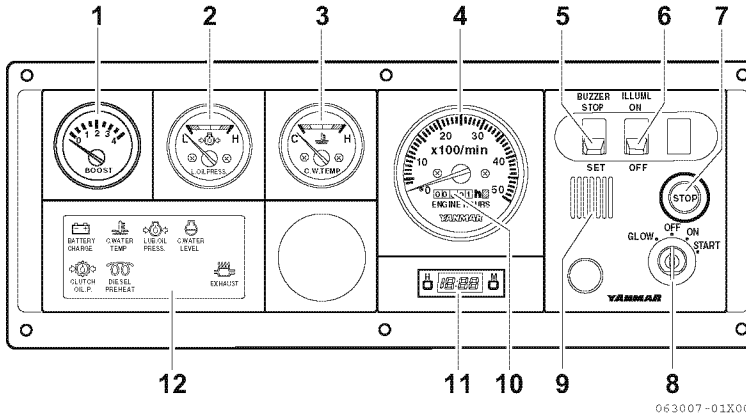


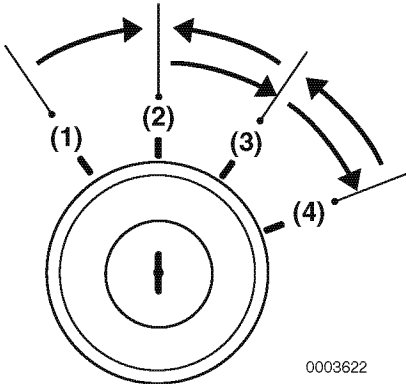
Figure 7

- 1 – Turbocharger Boost Pressure Gauge
- 2 – Engine Oil Pressure Gauge
- 3 – Coolant Temperature Gauge
- 4 – Tachometer
- 5 – Alarm Stop Switch
- 6 – Panel Illumination Switch
- 7 – Engine Stop Button
- 8 – Start (Key) Switch
- 9 – Alarm
- 10 – Hourmeter
- 11 – Clock
- 12 – Warning Indicator Display

Available Alarm Switches and Meter Senders

		○ = Standard, □ = Optional	
Switches	Battery Not Charging	○	
	Coolant Temperature Too High	○	
	Engine (Lube) Oil Pressure Too Low	○	
	Coolant Level Too Low	□	
	Exhaust (Cooling Seawater Flow) Restriction	□	
	Gear Oil (Stern Drive Models Only)	□	
Senders	Tachometer	○	
	Coolant Temperature	□	
	Engine (Lube) Oil Pressure	□	
	Boost Pressure	□	
	Coolant Temperature	For two stations	□
	Engine (Lube) Oil Pressure		□

Switches and Gauges

Switch or Gauge	Function
 <p>0003622</p> <p>Starter (Key) Switch</p>	<p>OFF (2): The key can be inserted or removed from switch. All power is turned off. *</p> <p>ON (3): For engine operation. Gauges and alarms are operational.</p> <p>START (4): For starting engine. When key is released after engine starts, key automatically moves to ON position.</p> <p>NOTICE</p> <p>Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.</p> <p>GLOW (1): For air heater (optional).</p>
Engine Stop Button	Press the button to stop the engine by cutting off the fuel flow. Continue to press the button until the engine has stopped. **
Warning Alarm (Buzzer)	The alarm sounds if an abnormality is detected. <i>Warning Devices on page 20.</i>
Warning Indicators	The lamps illuminate when an abnormality is detected. <i>Warning Devices on page 20.</i>
Alarm (Buzzer) Stop Switch	<p>The switch is used to shut the alarm off temporarily. Turn the alarm (buzzer) OFF when inspecting for cause.</p> <p>WARNING</p> <p>Inspect and repair the abnormality immediately.</p>
Backlight Switch	Turns instrument panel backlighting OFF or ON.
Hourmeter	Shows the total number of operating hours. Can be used as a guide for periodic maintenance checks. The hourmeter is located at the bottom of the tachometer.
Engine (Lube) Oil Pressure Gauge	Shows the engine (lube) oil pressure.
Coolant Temperature Gauge	Shows the coolant temperature.
Turbocharger Boost Pressure Gauge	Shows the intake air pressure (intake air boost pressure of turbocharger).
Preheat Indicator (If equipped)	Illuminates when the air heater is heating up for easier starting in cold temperatures. Indicator is located in the warning lamp cluster.

* The engine cannot be stopped by the starter (key) switch. Use the engine stop button to turn engine OFF.

** Releasing the engine stop button before the engine has stopped rotating will cause the engine to continue to run.

PRODUCT OVERVIEW

Warning Devices

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.

- Alarm (Buzzer): If a warning lamp illuminates, the alarm will sound. However, no alarm will sound when the battery charging lamp illuminates.
- Alarm (Buzzer) Stop Switch: When investigating the cause of an alarm, press the alarm (buzzer) stop switch.

WARNING

The switch is used to shut the alarm off temporarily. Turn the alarm (buzzer) OFF when inspecting for cause. Inspect and repair the abnormality immediately.

- Warning Indicators: When operation is normal, the warning indicators are OFF. If an abnormality is detected, the sensor will trigger the appropriate warning indicator to light.

Battery Low Charge Indicator



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.

Coolant High Temperature Indicator and Alarm



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

Engine (Lube) Oil Low Pressure Indicator and Alarm



When the engine oil pressure falls below the specified level, 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.

Coolant Level Indicator and Alarm



0004882

When the amount of cooling water in the coolant tank falls below normal, the 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 water level in the cooling water recovery tank and troubleshoot the cooling system.

Exhaust (Cooling Seawater Flow) Restriction



When the amount of cooling seawater being discharged is too low, the sensor will activate the warning indicator. Stop operation immediately to avoid damage to the engine. Check the seawater cooling system for restriction or damage.

Alarms

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

Key Switch		OFF ⇒ ON	START ⇒ ON
Engine		Before starting	Running
Alarm		ON	OFF
Indicators	Battery Low Charge Indicator	ON	OFF
	Coolant High Temperature Indicator	OFF	OFF
	Engine (Lube) Oil Low Pressure Indicator	ON	OFF
	Coolant Level Indicator	OFF	OFF
	Exhaust (Cooling Seawater Flow) Restriction Indicator	ON	OFF

Indicator (Diesel pre-heat lamp)



When the atmospheric temperature is low, by pre-heating the intake before starting the engine, the engine will start smoothly. In this case, by turning the key switch from OFF to GLOW for 15 seconds to preheat the intake, and then turning the key switch from OFF to ON, the heater will again be in the preheating state for 15 seconds, and the alert lamp display board will indicate "DIESEL PRE-HEAT".

Key Switch		OFF	GLOW	OFF	ON	START	ON
Engine		Before starting				Cranking	Running
Indicators	Diesel pre-heat indicator lamp	OFF			ON (15 second)	OFF	OFF
Heater plug		OFF	ON (15 second)	OFF	ON (15 second)	OFF	ON (5 minutes)

PRODUCT OVERVIEW

Key (Starter) Switch

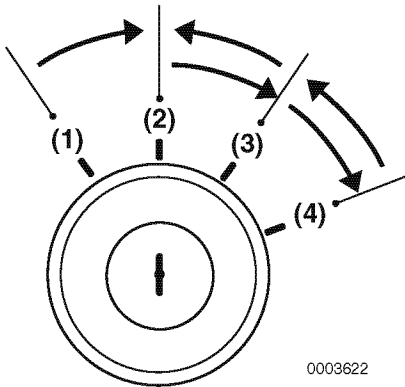


Figure 8

The GLOW position (**Figure 8, (1)**) is the start aid position. Electric current to the air heater (if equipped) is turned on.

The START position (**Figure 8, (4)**) allows current to the starting motor. When starting the engine, move the key to the START position and release. The key will automatically move to the ON position.

NOTICE

Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

When the key is in the OFF position (**Figure 8, (2)**) the electric current is off. The key can be inserted or removed in this position.

The ON position (**Figure 8, (3)**) allows electrical current to the controls and equipment and allows the engine to keep running. To stop the engine, keep the key switch in the ON position and push the engine stop button. After stopping the engine, turn key to OFF position.

Engine Stop Button

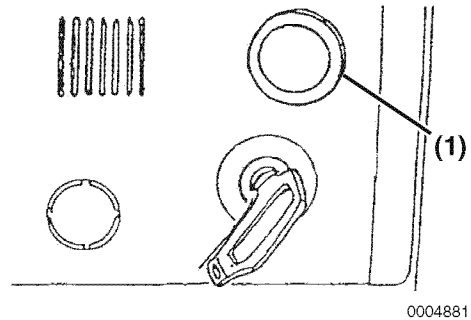


Figure 9

Push and hold the stop button (**Figure 9, (1)**) on the instrument panel to stop the engine. When the stop button is pushed, the solenoid valve on the fuel injection pumps stops the fuel supply to the engine.

Press and hold the engine stop button until the engine has come to a complete stop.

NOTICE

Releasing the engine stop button before the engine has stopped rotating will cause the engine to continue to run.

Single-Lever Remote Control Handle

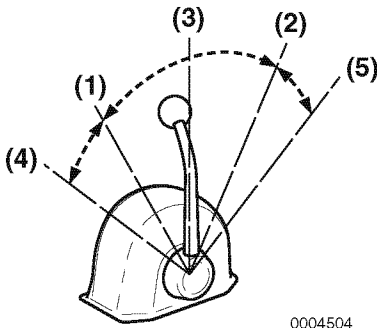


Figure 10

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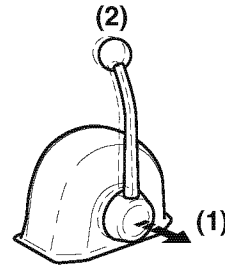
Note: Direction of travel will vary depending on installation location.

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

A single handle-type (**Figure 10**) should be used to operate the marine gear clutch (NEUTRAL, FORWARD and REVERSE) and to control the engine speed.

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

When the handle is pulled out (**Figure 11, (1)**), the engine speed can be controlled without engaging the clutch. The clutch remains in NEUTRAL, no load position. Turn the knob (**Figure 11, (2)**) counterclockwise to move the handle or clockwise to lock the handle.



0004511

Figure 11

Note: Yanmar recommends the use of a single-lever type for the remote control system. If only a two-lever type is available in the market, reduce engine speed to 1000 min⁻¹ or less before engaging and disengaging the marine gear clutch.

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BEFORE YOU OPERATE

INTRODUCTION

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

SAFETY PRECAUTIONS

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

DIESEL FUEL

Diesel Fuel Specifications

WARNING

Fire and Explosion Hazard.
Diesel fuel is flammable and explosive under certain conditions.

Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage. 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
EN590-2009	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan

Biodiesel Fuels

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

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

B7 diesel fuels must meet certain specifications.

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

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

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

Precautions and concerns regarding the use of biofuels:

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

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

Additional Technical Fuel Requirements

- The fuel cetane number should be 45 or higher.
- The sulfur content must not exceed 0.5% by volume.
Less than 0.05% is preferred.
- 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.

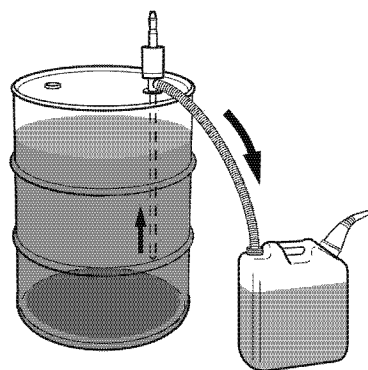
Handling of Diesel Fuel

⚠ WARNING

Fire and Explosion Hazard.
Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine. Never refuel with the engine running. Wipe up all spills immediately. Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.

Fire and Explosion Hazard.
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.

1. Water and dust in the fuel may cause engine failure. When fuel is stored, be sure that the inside of the storage container is clean and dry, and that the fuel is stored away from dirt or rain.



0004512

Figure 1

BEFORE YOU OPERATE

- 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.

Fuel Tank (Optional)

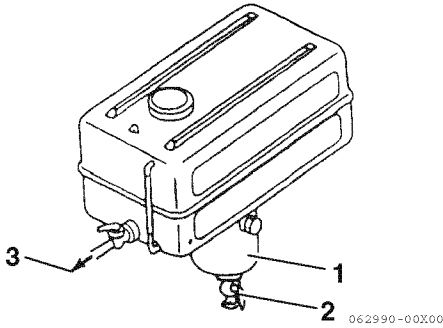


Figure 2

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

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

The fuel outlet should be positioned 20 to 30 mm (0.8 to 1.2 in.) above the bottom of the tank so that only clean fuel is distributed to the engine.

Fuel System

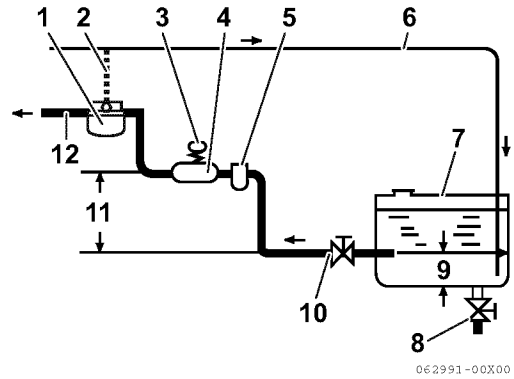


Figure 3

- 1 – Fuel Filter
- 2 – Orifice for air bleeding
- 3 – Fuel priming pump
- 4 – Fuel feed pump
- 5 – Fuel filter/Water separator
- 6 – Fuel return line
- 7 – Fuel Tank
- 8 – Drain cock
- 9 – Approximately 20 to 30 mm (0.8 to 1.2 in.)
- 10 – Fuel Cock
- 11 – Less than 500 mm (20 in.)
- 12 – To Fuel Injection Pump

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

Filling the Fuel Tank

Before filling fuel tank for the first time:

WARNING

Fire and Explosion Hazard.
Never refuel with the engine running.

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

To fill the fuel tank:

WARNING

Fire and Explosion Hazard.
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

Fire and Explosion Hazard.
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.

WARNING

Fire and Explosion Hazard.
Never overfill the fuel tank.

5. Replace the fuel cap and hand-tighten. Over-tightening the fuel cap will damage it.

BEFORE YOU OPERATE

Bleeding the Fuel System

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

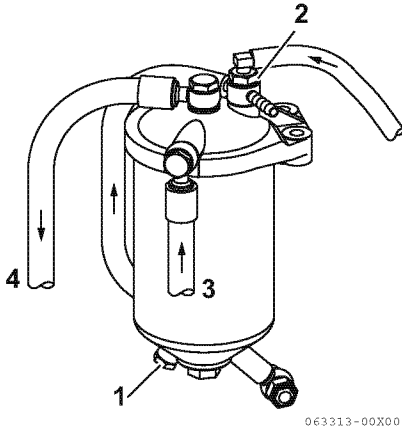


Figure 4

- 1 – Drain plug
- 2 – Air Bleed Screw
(Check valve assembly)
- 3 – From Fuel Tank
- 4 – To Fuel Injection Pump

1. Check the fuel level in the fuel tank. Refill if necessary.
2. Open the fuel cock of the fuel tank.

⚠ WARNING

Exposure Hazard.
Always wear safety glasses when bleeding the fuel system.

3. Loosen the air bleed screw (Figure 4, (2)) half turns.

4. Push up and down on the priming pump to release air out of the air bleed screw.
5. Continue pumping until a stream of fuel with no air bubbles begins to flow.
6. Tighten the air bleed screw.

NOTICE

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

ENGINE OIL

Engine Oil Specifications

Using engine oil that does not meet or exceed the following guidelines or specifications may cause seizure of parts, abnormal wear and shorten engine life.

Service Categories

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

- API Service Categories CD, CF, CF-4, CI and CI-4.
- SAE Viscosity:
15W-40. Engine oil 15W-40 can be used throughout the year.

NOTICE

- Be sure the engine oil, engine oil storage containers and engine oil filling equipment are free of sediment or water.
- Change the engine oil after the first 50 hours of operation and then at every 250 hours thereafter.
- Select the oil viscosity based on the ambient temperature where the engine is being operated. See the SAE Service Grade Viscosity Chart (**Figure 5**).
- Yanmar does not recommend the use of engine oil “additives”.

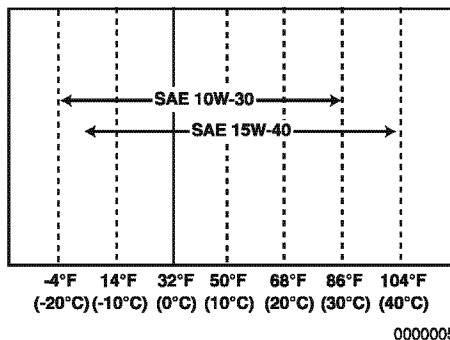


Figure 5

Handling Engine Oil

1. When handling and storing engine oil, be careful not to allow dust and water to contaminate the oil. Clean around the filler port before filling.
2. Do not mix lube oils of different types or brands. Mixing may cause the chemical characteristics of the oil to change and lubricating performance to decrease, reducing the engine's life.
3. Engine oil should be replaced at the specified intervals, regardless if the engine has been operated.

Engine Oil Viscosity

SAE 15W-40 is the recommended oil viscosities.

If you operate your equipment at temperatures outside the limits shown, consult your authorized Yanmar dealer or distributor for special lubricants or starting aids.

BEFORE YOU OPERATE

Checking the Engine Oil

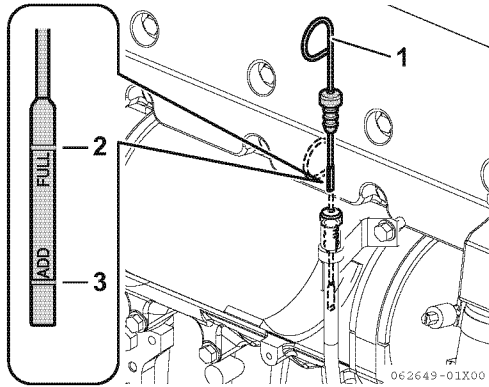


Figure 6

1. Make sure the engine is level.
2. Remove dipstick (**Figure 6, (1)**) and wipe with clean cloth.
3. Fully reinsert dipstick.
4. Remove dipstick. The oil level should be between upper (**Figure 6, (2)**) and lower (**Figure 6, (3)**) lines on the dipstick.
5. Add oil if necessary. See *Adding Engine Oil* on page 32.
6. Fully reinsert dipstick.

Adding Engine Oil

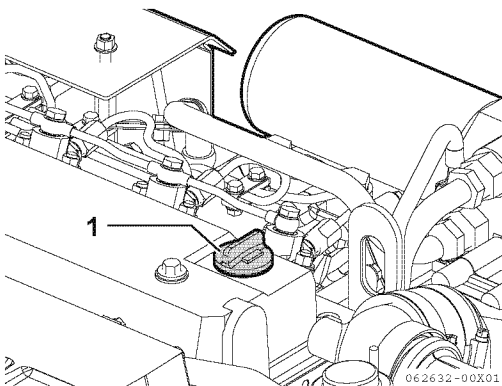


Figure 7

1. Remove the yellow oil filler port cap from filler port (**Figure 7, (1)**) and fill with engine oil.

NOTICE

Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before you remove the cap.

2. Fill with oil to the upper limit (**Figure 6, (2)**) on the dipstick (**Figure 6, (1)**).

NOTICE

Never overfill the engine with engine oil.

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 OIL

Note: Refer to the marine gear manufacturer's operation manual for the marine gear oil specifications.

Marine Gear Oil Specifications

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

KMH60A (Option)

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

Checking Marine Gear Oil

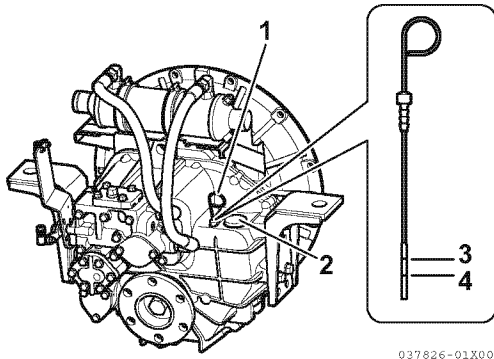


Figure 8

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

Note: KMH60A marine gear shown.

1. Make sure engine is level.
2. Remove the filler cap (**Figure 8, (2)**) at the top of the housing.
3. Remove dipstick (**Figure 8, (1)**) and wipe with clean cloth.
4. Fully reinsert dipstick.

5. Remove dipstick. The oil level should be between upper (**Figure 8, (3)**) and lower (**Figure 8, (4)**) lines on the dipstick.
6. Fully reinsert dipstick.

Adding Marine Gear Oil

1. Make sure the engine is level.
2. Remove the filler cap (**Figure 8, (2)**) at the top of the housing.
3. Fill with oil to the upper limit on the dipstick (**Figure 8, (3)**). *See Marine Gear Oil Specifications on page 33.*

NOTICE

Never overfill the marine gear with oil.

4. Fully reinsert the dipstick.
5. Tighten the filler port cap by hand.

ENGINE COOLANT

Engine Coolant Specifications

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

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

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

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

Coolant (Closed Cooling System)

NOTICE

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

Checking and Adding Coolant

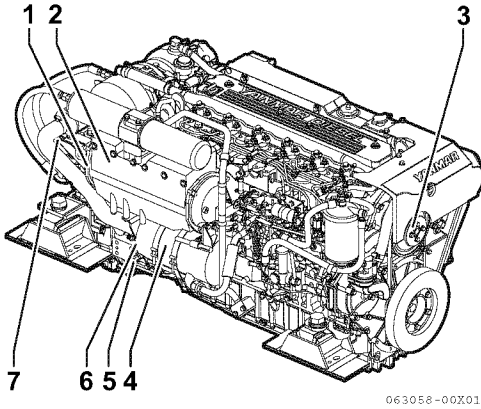


Figure 9

- 1 – Seawater drain cock
(Air cooler)
- 2 – Air cooler
- 3 – Coolant pump
- 4 – Engine oil cooler
- 5 – Seawater drain cock
(Engine oil cooler)
- 6 – Coolant drain cock
(Cylinderblock)
- 7 – Seawater drain cock
(Marine gear oil cooler)

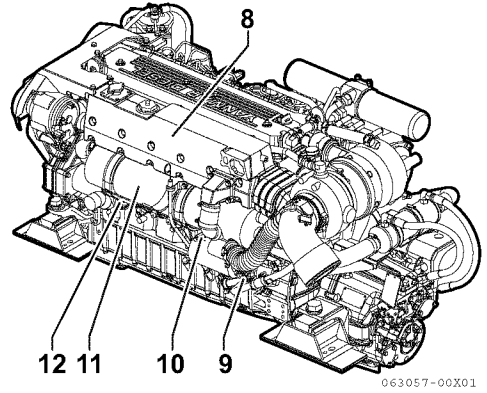


Figure 10

- 8 – Coolant tank
- 9 – Seawater drain cock
(Heat exchanger)
- 10 – Coolant drain cock
(Heat exchanger)
- 11 – Heat exchanger
- 12 – Seawater pump
(Drain from pump cover)

BEFORE YOU OPERATE

1. Ensure all drain cocks are closed.

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

2. Loosen the filler cap of coolant tank to relieve the pressure, then remove the filler cap.

⚠ WARNING

Burn Hazard.

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

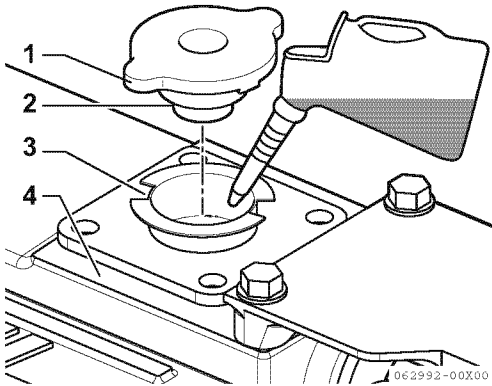


Figure 11

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

3. Pour coolant slowly into coolant tank (**Figure 11, (4)**) to avoid air bubbles. Fill until coolant overflows from the filler port.

NOTICE

Never pour cold coolant into a hot engine.

4. Align filler cap tabs (**Figure 11, (1)**) with filler port notches (**Figure 11, (3)**) and tighten filler cap (**Figure 11, (2)**) firmly.

NOTICE

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

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

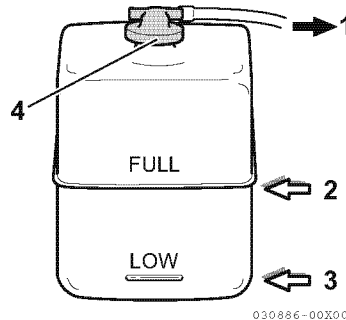


Figure 12

5. Check the coolant level in the reservoir. The level should be at the FULL mark (**Figure 12, (2)**). Add coolant if necessary.

NOTICE

Never pour cold coolant into a hot engine.

6. Remove reservoir cap (**Figure 12, (4)**) to add coolant if necessary. Do not add water.
7. Replace filler cap and tighten it firmly. Failure to do so will cause water leakage.

Reservoir Capacity
1.5 L (1.59 qt)

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

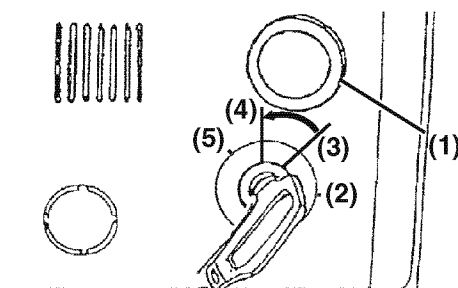
Note: If the coolant runs low too often or the coolant level in coolant tank drops without any change in the level in the reservoir, there may be water or air leaks in the cooling system. Consult authorized Yanmar dealer or distributor.

CRANKING THE ENGINE

NOTICE

When 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 no use, distribute engine oil to each part by cranking. Perform in accordance with the following procedures before beginning operation.

1. Open the seacock.
2. Open the fuel cock.
3. Put the remote control shift lever in the NEUTRAL See *Starting the Engine on page 41*.
4. Turn on the battery switch (if equipped).



0004890

Figure 13

5. Turn key to ON (**Figure 13, (3)**). It is normal for the alarm to sound and the warning indicators to light during cranking.

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

BEFORE YOU OPERATE

6. While pushing the STOP button (**Figure 13, (1)**), turn the key to the START position (**Figure 13, (2)**).

NOTICE

Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

7. When the key is in the START position, the engine will begin cranking. Continue cranking for about 5 seconds and listen for abnormal noise during that time.

Note: If the STOP button is released during the cranking procedure, the engine will start. Do not start the engine in this mode.

8. Move key to OFF position (**Figure 13, (4)**). The engine will stop cranking.

⚠ WARNING



Never touch or allow your clothes to touch the moving parts of the engine during operation. If a part of your body or clothing is caught in the front drive shaft, V-belt, propeller shaft, etc. serious injury may result. Check to see that no tools, pieces of cloth, etc. are left on or around the engine.

ENGINE OPERATION

INTRODUCTION

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

SAFETY PRECAUTIONS

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

WARNING

Fire and Explosion Hazard



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

Sudden Movement Hazard

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

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

Sever Hazard



Keep children and pets away while the engine is operating.

NOTICE

If any indicator illuminates during engine operation, stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

If the alarm indicator with audible alarm fails to display and go out about 3 seconds after the ignition switch is turned on, consult authorized Yanmar Marine dealer or distributor for service before operating the engine.

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 at a time until the engine starts. When the engine does start, stop the engine immediately and turn off the switch.

Be sure to re-open the seacock and restart the engine. Operate the engine normally.

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).

NOTICE

- 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.

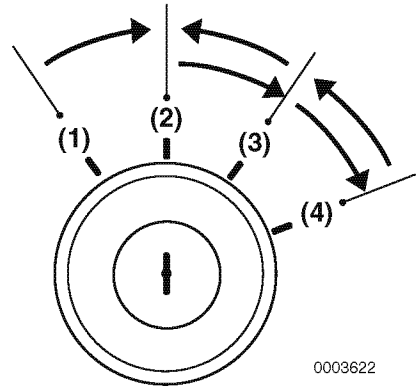
Never engage the starter motor while the engine is running. Damage to the starter motor pinion and / or ring gear will result.

STARTING THE ENGINE

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

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

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



0003622

Figure 1

5. Turn key switch to ON (**Figure 1, (3)**). Ensure that the instrument panel indicators light and the alarm sounds. This indicates that indicators and alarm are working correctly.

Note: The coolant high temperature alarm indicator does not come on during start-up.

6. Turn the key switch to START (**Figure 1, (4)**). Release the key switch when the engine has started.

NOTICE

Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

7. The alarm should stop and the indicators should go out.

NOTICE

If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar Marine dealer or distributor for service before operating the engine.

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

If the Engine Fails to Start

Before turning the start switch again, be sure to confirm that the engine has stopped completely. If an attempt to restart is made while the engine is running, the pinion gear of the starter motor will be damaged.

NOTICE

Never hold for longer than 15 seconds or the starter motor will overheat.

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

Note: Hold the key switch for a maximum of 15 seconds. If the engine does not start the first time, wait for about 15 seconds before trying again.

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 15 seconds, close the thru-hull water intake valve to avoid filling the muffler with water. Crank for 10 seconds at a time until the engine starts. When the engine does start, stop the engine immediately and turn off the power switch. Be sure to re-open the seacock and restart the engine. Operate the engine normally.

Air Bleeding the Fuel System After Starting Failure

If the engine does not start after several attempts, there may be air in the fuel system. If air is in the fuel system, fuel cannot reach the fuel injection pump. Bleed the air out of the system. See *Bleeding the Fuel System on page 30*.

Starting at Low Temperatures

Comply with local environmental requirements. Use engine heaters to avoid starting problems and white smoke. Do not use starting aids.

NOTICE

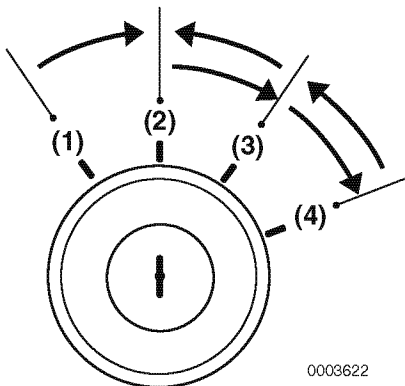
Never use an engine starting aid such as ether. Engine damage will result.

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

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

Starting with Air Heater (If Equipped)

1. Open the seacock (if equipped).
2. Open the fuel tank cock.
3. Put remote control handle in NEUTRAL.
4. Turn the battery switch on (if equipped).



0003622

Figure 2

5. Turn key switch to GLOW (**Figure 2, (1)**) for 15 seconds.

NOTICE

Never run the air heater (GLOW position) for more than 20 seconds at a time or engine damage will result.

6. Turn key switch to ON (**Figure 2, (3)**). Ensure that the instrument panel indicators light and the alarm sounds. This shows that indicators and alarm are working correctly.

Note: The coolant high temperature alarm indicator does not come on during start-up.

7. Turn key switch to START (**Figure 2, (4)**). Release the key switch when the engine has started. The alarm should stop and the indicators should go out.

NOTICE

NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

ENGINE OPERATION

After the Engine has Started

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

1. Check that the gauges, indicators and alarm are normal.
 - Normal coolant operating temperature is approximately 71° to 85°C (160° to 185°F).
 - Normal oil pressure at 3000 min⁻¹ is 0.44 to 0.54 MPa (64 to 78 psi).
2. Check for water, fuel or oil leakage from the engine.
3. Check that the smoke 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 sufficient seawater is discharged from the seawater outlet. 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 seawater discharge is too small or if load is applied without any warming up operation.

For troubleshooting assistance, see *Troubleshooting After Starting on page 71* or *Troubleshooting Chart on page 73*. If necessary, consult authorized Yanmar dealer or distributor.

REMOTE CONTROL HANDLE OPERATION

Acceleration and Deceleration

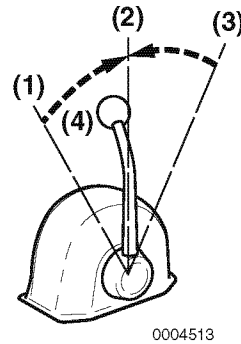


Figure 3

- 1 – FORWARD or REVERSE
- 2 – NEUTRAL
- 3 – REVERSE or FORWARD
- 4 – Throttle Handle / Shifting Handle

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

Use the throttle handle (**Figure 3, (4)**) to control acceleration and deceleration. Move the handle slowly.

Shifting the Engine

⚠ WARNING

Sudden Movement Hazard. The boat will start to move when the marine gear is engaged:

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

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 min⁻¹). Move the throttle handle slowly to a higher speed position after completing marine gear engagement.
2. When moving the handle between FORWARD (**Figure 3, (1 or 3)**) and REVERSE (**Figure 3, (3 or 1)**), bring the handle to NEUTRAL (**Figure 3, (2)**) and pause before slowly shifting to the desired position. Never shift abruptly from FORWARD to REVERSE or vice versa.

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 sailing, set the remote control handle in NEUTRAL. Not doing so WILL introduce slippage or any damage and void your warranty.

CAUTIONS DURING OPERATION**NOTICE**

Engine trouble can arise if the engine is operated for a long time under overloaded conditions with the control handle in the full throttle position (maximum engine speed position), exceeding the continuous rated output engine speed. Operate the engine at about 100 min⁻¹ lower than the full throttle engine speed.

Note: If the engine is in the first 50 hours of operation, see New Engine Break-In on page 12 .

Always be on the lookout for problems during engine operation.

Pay particular attention to the following:

- Is sufficient seawater being discharged from the exhaust and seawater outlet pipe?

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

- Is the smoke color normal?

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

ENGINE OPERATION

- Are there abnormal vibrations or noise?

NOTICE

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

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

- Alarm buzzer sounds during operation.

NOTICE

If any alarm indicator with audible alarm sound appears on the display during engine operation, stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

- Is there water, oil or fuel leakage, or are there any loose bolts?

Check the engine room periodically for any problems.

- Is there sufficient diesel fuel in the diesel fuel tank?

Replenish diesel fuel before leaving the dock to avoid running out of fuel during operation.

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

NOTICE

Racing the engine: With the gear 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 valve. Neglecting to race the engine will result in poor smoke color and reduce engine performance.

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

NOTICE

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

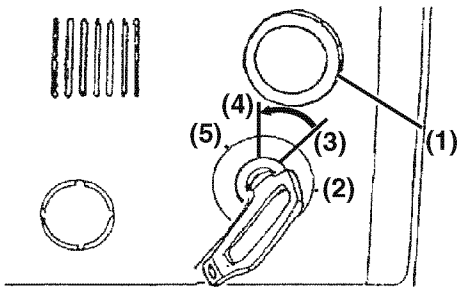
SHUTTING DOWN THE ENGINE

Normal Shutdown

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

NOTICE

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



0004890

Figure 4

4. With the key in the ON position, push and hold the STOP button (**Figure 4, (1)**). After the engine has stopped, turn the key switch to OFF (**Figure 4, (4)**).

5. Remove the key and cover the key switch with the moisture cap.

NOTICE

Continue to hold the stop button in until the engine is completely stopped. If the button is released before the engine has completely stopped, it may restart. If the engine does not shut off when the engine stop button is pushed, close the fuel cock on the fuel tank.

6. Turn off the battery switch (if equipped).
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.
- If seawater is left inside the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0°C (32°F).

CHECKING THE ENGINE AFTER OPERATION

- Check that the key switch is off and that the battery switch (if equipped) is turned to off.
- Fill the fuel tank. *See Filling the Fuel Tank on page 29.*
- Close seawater cock(s).
- If there is a risk of freezing, check that the cooling system contains enough coolant. *See Engine Coolant Specifications on page 34.*
- If there is a risk of freezing, drain the seawater system. *See Drain Seawater Cooling System on page 76.*
- At temperatures below 0°C (32°F), drain seawater system and connect the engine heater (if equipped).

PERIODIC MAINTENANCE

INTRODUCTION

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

SAFETY PRECAUTIONS

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

WARNING

Crush Hazard



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

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

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

WARNING

Welding Hazard

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

Entanglement Hazard



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

Shock Hazard



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

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

Never use undersized wiring for the electrical system.

Tool Hazard

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

NOTICE

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

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

PRECAUTIONS

The Importance of Periodic Maintenance

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

Performing Periodic Maintenance

WARNING

Exhaust Hazard.

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

The Importance of Daily Checks

The Periodic Maintenance Schedule assumes that the daily checks are performed on a regular basis. Make it a habit to perform daily checks before the start of each operating day. *See Daily Checks on page 56.*

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced alternator) and parts used for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 50, 250, 500 and 1000 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

NOTICE

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

Yanmar Replacement Parts

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

Tools Required

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

Consult Your Authorized Yanmar Marine Dealer or Distributor for Help

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

PERIODIC MAINTENANCE

Tightening Fasteners

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

NOTICE



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

Bolt Diameter x Pitch (mm)		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
Tightening Torque	N·m	10.8 ± 1.0	25.5 ± 3.0	49 ± 5.0	88.2 ± 10.0	140.0 ± 10.0	230.0 ± 10.0
	ft·lb	8.0 ± 0.7	18.8 ± 2.2	36.2 ± 3.7	65.1 ± 7.4	103 ± 7.2	170 ± 7.2

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

When lock adhesive is applied, decide separately.

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

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

PERIODIC MAINTENANCE SCHEDULE

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

NOTICE

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

Consult authorized Yanmar Marine dealer or distributor for assistance when checking items marked with a ●.

PERIODIC MAINTENANCE

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

System	Item	Periodic Maintenance Interval					
		Daily <i>See Daily Checks on page 56.</i>	Every 50 hours or monthly whichever comes first	Every 250 hours or 1 year whichever comes first	Every 500 hours or 2 years whichever comes first	Every 1000 hours or 4 years whichever comes first	Every 2000 hours or 8 years whichever comes first
Whole	Visual inspection of engine exterior	○					
Fuel System	Check the fuel level and refill if necessary	○					
	Drain water and sediment from fuel tank		○ Initial 50	○			
	Drain the fuel / water separator		○				
	Replace the fuel filter element			◇			
	Check the fuel injection timing						●
	Check the fuel injector spray pattern				● Initial 250	●	
Lubricating System	Check the lube oil level	○					
	Replace the lube oil		◇ Initial 50	◇			
	Replace the oil filter element		◇ Initial 50	◇			
	Cleaning the engine oil cooler						●
Cooling System (Seawater)	Seawater outlet	○ During Operation					
	Check or replace the seawater pump impeller					○	●
	Check or replace the zinc anodes			◇			
	Check and clean the seawater passage					○	●
Cooling System (Coolant)	Check coolant level	○					
	Replace coolant	Every year. When Long Life Coolant is used, replace every 2 years. See <i>Engine Coolant Specifications on page 34.</i>					
	Check and clean the coolant passage						●

PERIODIC MAINTENANCE

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

System	Item	Periodic Maintenance Interval					
		Daily <i>See Daily Checks on page 56.</i>	Every 50 hours or monthly whichever comes first	Every 250 hours or 1 year whichever comes first	Every 500 hours or 2 years whichever comes first	Every 1000 hours or 4 years whichever comes first	Every 2000 hours or 8 years whichever comes first
Air Intake and Exhaust System	Clean intake silencer (air cleaner) element			○			
	Clean or replace the exhaust / water mixing elbow			○			
	Wash the turbocharger blower			●			
Electrical System	Check the alarm and indicators	○					
	Check the electrolyte level in the battery		○				
	Adjust the tension of the alternator V belt or replace V belt				○		
	Check the wiring connectors			○			
Engine Cylinder Head and Block	Check for leakage of fuel, engine oil and engine coolant	○ After starting					
	Adjust intake / exhaust valve clearance			● Initial 250		●	
Marine Gear	Check the lube oil level	Refer to the marine gear operation manual.					
	Replace the lube oil						
	Clean the oil strainer						
Miscellaneous Items	Check the remote control cable operation	○		○			
	Replace rubberized hoses (fuel and water)	Replace every 2 years.					

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

PERIODIC MAINTENANCE PROCEDURES

WARNING

Exposure Hazard.

Always wear personal protective equipment when performing periodic maintenance procedures.

Daily Checks

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

NOTICE

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

Make sure you check the following items.

Visual Checks

1. Check for engine oil leaks.
2. Check for fuel leaks.

WARNING

Piercing Hazard.

Avoid skin contact with the high-pressure diesel fuel spray caused by a fuel system leak, such as a broken fuel injection line.

High-pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high-pressure fuel spray, obtain prompt medical treatment. Never check for a fuel leak with your

hands.

Always use a piece of wood or cardboard. Have your authorized Yanmar Marine dealer or distributor repair any damage.

3. Check for engine coolant leaks.
4. Check for damaged or missing parts.
5. Check for loose, missing or damaged fasteners.
6. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
7. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.
8. Check the fuel filter / water separator for presence of water and contaminants. If you find any water or contaminants, drain the fuel filter / water separator. *See Draining Fuel Filter / Water Separator on page 59.* If you have to drain the fuel filter / water separator frequently, drain the fuel tank and check for the presence of water in your fuel supply. *See Draining the Fuel Tank on page 57.*

NOTICE

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

Check Diesel Fuel, Engine Oil and Engine Coolant Levels

Follow the procedures in *Diesel Fuel on page 26*, *Engine Oil on page 31* and *Engine Coolant on page 34* to check these levels.

Checking and Refilling Marine Gear Oil

Refer to the *Operation Manual* for the marine gear.

Checking the Battery Electrolyte Level

Check the battery electrolyte level before use. See *Checking the Battery Electrolyte Level (Serviceable Batteries Only)* on page 60.

Checking the Alternator Belt

Check the belt tension before use. See *Checking and Adjusting the Alternator V-Belt Tension* on page 67.

Checking the Remote Control Handle

Check the operation of the remote control handle and ensure it moves smoothly. If it is hard to operate, grease the joints of the remote control cable and lever bearings. If the lever is too loose, adjust the remote control cable. See *Checking and Adjusting Remote Control Cables* on page 64.

Checking the Alarm Indicators

When operating the start switch on the instrument panel, check that there is no alarm message on the display and the alarm indicators work normally. See *Control Equipment* on page 16.

Preparing Fuel, Oil and Coolant in Reserve

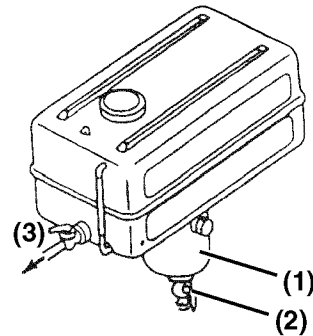
Prepare sufficient fuel for the days operation. Always store engine oil and coolant in reserve (for at least one refill) onboard, to be ready for emergencies.

After Initial 50 Hours of Operation

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

- **Draining the Fuel Tank**
- **Changing the Engine Oil and Replacing the Engine Oil Filter Element**

Draining the Fuel Tank



0004898

Figure 1

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

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

PERIODIC MAINTENANCE

Changing the Engine Oil and Replacing the Engine Oil Filter Element

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

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

WARNING

Burn Hazard.

If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned. Always wear eye protection.

1. Turn the engine off.
2. 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. Dispose of used oil properly.

NOTICE

- Prevent dirt and debris from contaminating engine oil. Carefully clean the dipstick and the surrounding area before removing the dipstick.
- Always be environmentally responsible.

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

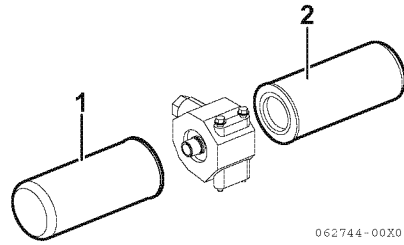


Figure 2

- 1 – Full Flow Engine Oil Filters**
- 2 – Bypass Engine Oil Filter**

4. Install a new filter element and tighten by hand until the seal touches the housing.
5. Turn the filters an additional 3/4 to one turn with a filter wrench.
6. Fill with new engine oil. *See Adding Engine Oil on page 32.*

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.

7. Perform a trial run and check for oil leaks.
8. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

NOTICE

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

Every 50 Hours of Operation

Perform the following procedures every 50 hours thereafter or monthly, whichever comes first.

- **Draining Fuel Filter / Water Separator**
- **Checking Battery Electrolyte Level (Serviceable Batteries Only)**

Draining Fuel Filter / Water Separator

⚠ WARNING

Fire and Explosion Hazard.

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.

Exposure Hazard.

Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.

Water separator (Attach to Hull)

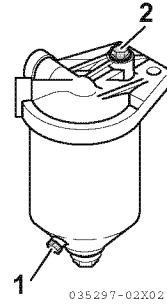


Figure 3

1. Close the fuel tank cock.
2. Loosen the drain plug (**Figure 3, (1)**) of the water separator and drain off any water or dirt collected inside. Dispose of the collected water and dirt properly.

NOTICE

Always be environmentally responsible.

3. After draining, tighten the air bleed screw (**Figure 3, (2)**).
4. Be sure to bleed air from the fuel system. See *Bleeding the Fuel System* on page 30.

PERIODIC MAINTENANCE

Checking the Battery Electrolyte Level (Serviceable Batteries Only)

⚠ WARNING

Exposure Hazard.

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

NOTICE

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

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

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

1. Turn off the battery switch (if equipped) or disconnect the negative (-) battery cable.
2. Do not operate with insufficient battery electrolyte, as the battery will be destroyed.
3. Remove the 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 level is lower than the minimum fill level (Figure 4, (1)), fill with distilled water (Figure 4, (2)) (available in the grocery store) up to the upper limit (Figure 4, (3)) of the battery.

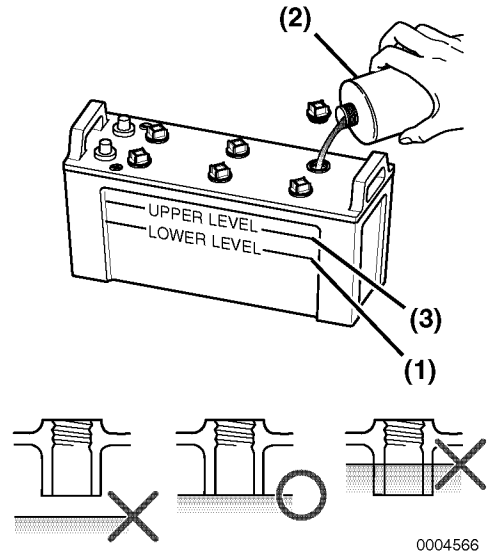


Figure 4

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

0004566

After Initial 250 Hours of Operation

Perform the following maintenance after the initial 250 hours of operation.

- **Checking the Fuel Injector Spray Pattern**
- **Inspecting and Adjusting Intake / Exhaust Valve Clearance**

Checking the Fuel Injector Spray Pattern

Consult authorized Yanmar Marine dealer or distributor.

Inspecting and Adjusting Intake/Exhaust Valve Clearance

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

Every 250 Hours of Operation

Perform the following maintenance every 250 hours or 1 year of operation, whichever comes first.

- **Draining the Fuel Tank**
- **Replacing the Fuel Filter Element**
- **Changing the Engine Oil and Replacing the Engine Oil Filter Element**
- **Checking or Replacing Zinc Anodes**
- **Cleaning the Intake Silencer (Air Cleaner) Element**
- **Cleaning the Exhaust / Water Mixing Elbow**
- **Wash the Turbocharger blower**
- **Checking the Wiring Connectors**
- **Checking and Adjusting Remote Control Cables**

Draining the Fuel Tank

See Draining the Fuel Tank on page 57.

PERIODIC MAINTENANCE

Replacing the Fuel Filter Element

⚠ WARNING

Fire and Explosion Hazard.

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.

Exposure Hazard.

Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.

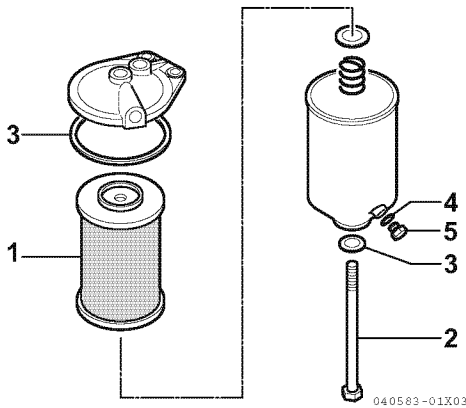


Figure 5

1. Close the fuel tank cock.
2. Loosen the drain plug and drain the fuel from the drain plug.
3. Remove the center bolt (**Figure 5, (2)**) at the bottom of the filter and take out the filter element (**Figure 5, (1)**).

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

4. Apply a thin film of clean diesel fuel to the sealing surface of the new filter gasket.

Component	Part No.
Fuel filter element kit -	41650-502330

5. Install a new filter and hand-tighten. Use a filter wrench and tighten to 20 to 24 N·m (14.75 to 17.7 ft·lb).
6. Bleed the fuel system. See *Bleeding the Fuel System* on page 30. Dispose of waste properly.
7. Check for fuel leaks.

Changing the Engine Oil and Replacing the Engine Oil Filter Element

See *Changing the Engine Oil and Replacing the Engine Oil Filter Element* on page 58.

Checking or Replacing Zinc Anodes

Inspect and replace the zinc anodes periodically.

NOTICE

If zinc anodes are not replaced periodically, corrosion and engine damage will result.

1. Close the seacock.
2. Drain the seawater cooling system. See *Drain Seawater Cooling System* on page 76.



062662-01X00

Figure 6

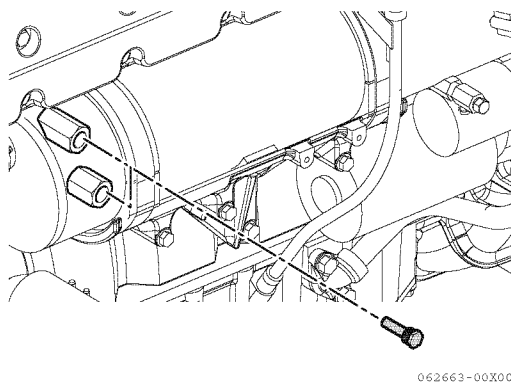
3. Remove all the plugs (**Figure 7**), (**Figure 8**) and (**Figure 9**) labeled ZINC (**Figure 6**).
4. Measure the remaining zinc in the plug. Replace the zinc anode when it is less than one-half its original size. See chart for sizes.
5. Install a new zinc in a new plug.

NOTICE

Never use sealing tape to install the zinc anode. The anode must make metal-to-metal contact.

6. Install plug.
7. Open the seacock and check for leaks.

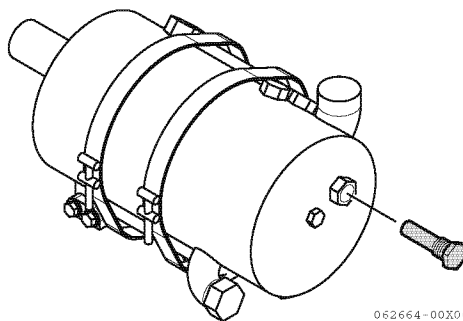
Heat exchanger



062663-00X00

Figure 7

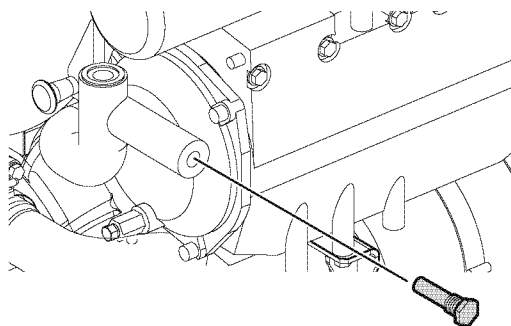
Engine oil cooler



062664-00X00

Figure 8

Air cooler



062692-01X00

Figure 9

PERIODIC MAINTENANCE

Note: Some marine gears have additional zinc anodes. Check the manufacturer's documentation for location and other information.

Cleaning the Intake Silencer (Air Cleaner) Element

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

Cleaning the Exhaust / Water Mixing Elbow

The mixing elbow is attached to the turbocharger. 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. Consult authorized Yanmar Marine dealer or distributor.
4. Inspect the gasket and replace if necessary.

Wash the Turbocharger blower

Contamination of the turbocharger causes revolutions to drop and engine output to fall.

If a significant drop in engine output is noted (10% or more), wash the turbocharger blower.

This should be done only by a trained and qualified technician. Consult authorized Yanmar Marine dealer or distributor.

Checking the Wiring Connectors

Consult authorized Yanmar Marine dealer or distributor.

Checking and Adjusting Remote Control Cables

NOTICE

Never adjust the high-speed stop bolt on the governor. This will void the engine warranty.

Adjusting Engine Speed Remote Control Cable

Ensure the control lever on the engine side moves to the high-speed stop position and low-speed stop position when the remote control lever is moved to HIGH and then to LOW.

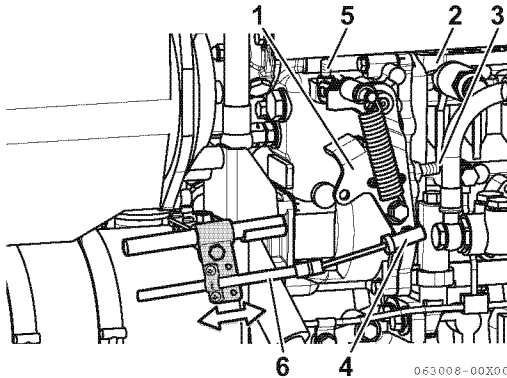


Figure 10

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

1. To adjust, loosen the adjustment screw (Figure 10, (4)) for the remote control cable on the engine side and adjust.
2. Adjust the high-speed stop (Figure 10, (5)) position first and then adjust the low-speed stop (Figure 10, (3)) with the adjustment screw on the remote control lever (Figure 10, (1)).

Every 1 Year of Operation

Perform the following maintenance every 1 year of operation.

- Changing the Coolant

Changing the Coolant

⚠ CAUTION

Coolant Hazard.

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

Change the coolant every year.

NOTICE

Never mix different types and / or colors of coolants.

Discard old coolant in an approved manner according to environmental laws.

Note: If Long Life coolant is used, replace coolant every 2 years.

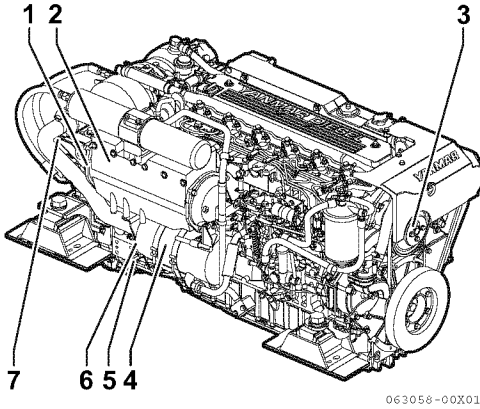


Figure 11

- 1 – Seawater drain cock (Air cooler)
- 2 – Air cooler
- 3 – Coolant pump
- 4 – Engine oil cooler
- 5 – Seawater drain cock (Engine oil cooler)
- 6 – Coolant drain cock (Cylinderblock)
- 7 – Seawater drain cock (Marine gear oil cooler)

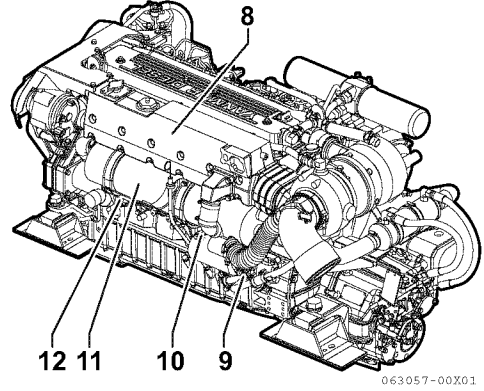


Figure 12

- 8 – Coolant tank
- 9 – Seawater drain cock (Heat exchanger)
- 10 – Coolant drain cock (Heat exchanger)
- 11 – Heat exchanger
- 12 – Seawater pump (Drain from pump cover)

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

1. Open all coolant drain cocks.
2. Allow to drain completely. Dispose of waste properly.
3. Close all the drain cocks.
4. Fill coolant tank and reservoir with appropriate coolant.

See Engine Coolant Specifications on page 34 and Checking and Adding Coolant on page 35.

Every 500 Hours of Operation

Perform the following maintenance every 500 hours or 2 years of operation, whichever comes first.

- **Checking and Adjusting the Alternator V-Belt Tension**

Checking and Adjusting the Alternator V-Belt Tension

⚠ WARNING

Sever Hazard.

Perform this check with the power switch off and the battery switch turned off to avoid contact with moving parts.

NOTICE

- When there is not enough tension in the V-belt, it will slip and the coolant pump will fail to supply coolant. Engine overheating and seizure will result.
- When there is too much tension in the V-belt, the belt will become damaged more quickly and the coolant pump bearing may be damaged.
- Never get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if it is damaged.

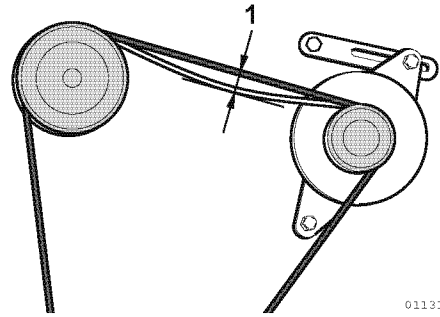


Figure 13

011317-01X02

1. Remove the belt cover.
2. Check the belt by pushing on the middle of the belt (**Figure 13, (1)**) with your finger.

With proper tension, the belt should deflect 8 to 10 mm (approximately 3/8 in.).

3. Loosen the alternator bolt and move the alternator to adjust the V-belt tension.
4. Install the belt cover.

Note: If replacing the V-belt, loosen the V-pulley of the coolant pump to remove V-belt.

Every 1000 Hours of Operation

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

- **Checking the Fuel Injector Spray Pattern**
- **Checking or Replacing Seawater Pump Impeller**
- **Cleaning and Checking the Seawater Passages**
- **Inspecting and Adjusting Intake / Exhaust Valve Clearance**

Checking the Fuel Injector Spray Pattern

Consult authorized Yanmar Marine dealer or distributor.

Checking or Replacing Seawater Pump Impeller

1. Loosen side cover bolts and remove the side cover.
2. Inspect the inside of the seawater pump with a flashlight. If any of the following are found, disassembly and maintenance are required:
 - Impeller blades are cracked or nicked. Edges or surfaces of the blades are marred or scratched.
 - Wear plate is damaged.
3. If no damage is found when inspecting the inside of the pump, install the O-ring and side cover.
4. If a large amount of water leaks continuously from the water drain line below the seawater pump during operation, replace the mechanical seal. Consult authorized Yanmar Marine dealer or distributor.

Replacing the Seawater Pump Impeller

Note: The impeller must be replaced periodically (every 2000 hours) even if there is no damage.

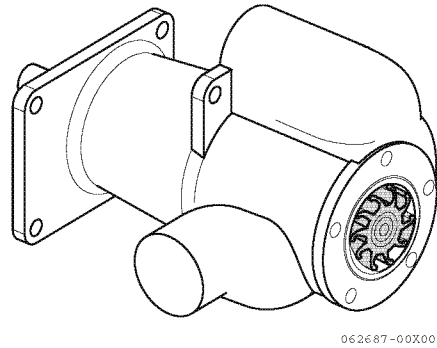


Figure 14

There are two types of special service tools for removing the impeller:

Puller A (standard)

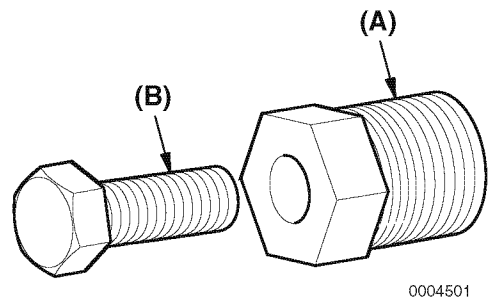


Figure 15

Puller A	Jack Screw B
M24x2	M10x40 mm length

1. Remove the side cover of the seawater pump.
2. Install puller (**Figure 15, (A)**) in the impeller.
3. Turn the jack screw (**Figure 15, (B)**) clockwise to remove the impeller from the pump body.

4. When installing the impeller, position blades of the impeller as shown in the illustration. (**Figure 17**)

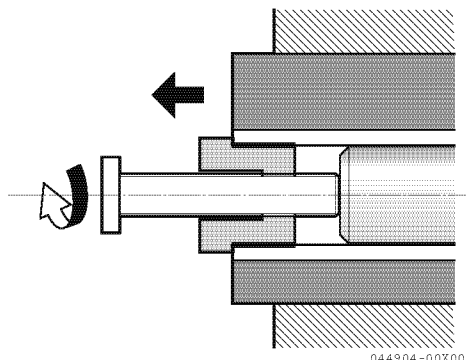


Figure 16

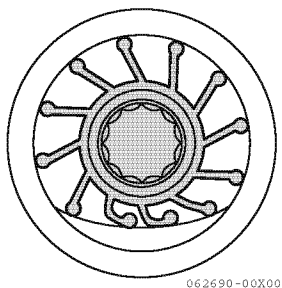


Figure 17

*Note: When replacing a used impeller with a new one, the impeller must have an M24x2 thread (**Figure 16**). Turn the M24 screw side of the impeller to the cover side and install.*

Cleaning and Checking the Seawater Passages

After prolonged use, clean the seawater passages to remove trash, scale, rust and other contaminants that collect in the cooling water passages. This can cause declining cooling performance. The following items need to be inspected:

- Heat Exchanger
- Pressure Cap

Consult authorized Yanmar Marine dealer or distributor.

Inspecting and Adjusting Intake/Exhaust Valve Clearance

Consult authorized Yanmar Marine dealer or distributor.

Every 2000 Hours of Operation

Perform the following maintenance every 2000 hours or 8 years of operation, whichever comes first.

- **Check the Fuel Injection Timing**
- **Cleaning the Engine Oil Cooler**
- **Replacing the Seawater Pump Impeller**
- **Cleaning and Checking the Seawater Passages**
- **Check and Clean the Coolant Passage**

Check the Fuel Injection Timing

Consult authorized Yanmar Marine dealer or distributor.

Cleaning the Engine Oil Cooler

Consult authorized Yanmar Marine dealer or distributor.

Replacing the Seawater Pump Impeller

The seawater impeller must be replaced every 2000 hours even if it is not damaged.

See Checking or Replacing Seawater Pump Impeller on page 68.

Cleaning and Checking the Seawater Passages

Consult authorized Yanmar Marine dealer or distributor.

Check and Clean the Coolant Passage

Consult authorized Yanmar Marine dealer or distributor.

Every 2 Years of Operation

Perform the following maintenance every 2 years of operation.

- **Replace Rubberized Hoses (Fuel and Water)**

Replace Rubberized Hoses (Fuel and Water)

The rubberized hoses (fuel and water) must be replaced every 2 years even if it is not damaged.

Consult authorized Yanmar Marine dealer or distributor.

TROUBLESHOOTING

SAFETY PRECAUTIONS

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 smoke color normal?

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

Are there abnormal vibrations or noise?

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

Alarm sounds during operation.

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

TROUBLESHOOTING

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

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

Is there sufficient fuel in the fuel tank?

Refill fuel in advance to avoid running out of fuel. If the tank runs out of fuel, bleed the fuel system. See *Bleeding the Fuel System on page 30*.

When operating the engine at low speed for long periods of time, race the engine once every 2 hours. Racing the engine with the clutch in NEUTRAL, accelerate from the low-speed position to the high-speed position and repeat this process about five times. This is done to clean out carbon from the cylinders and the fuel injection valves.

NOTICE

Neglecting to race the engine will result in poor smoke color and reduce engine performance.

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

TROUBLESHOOTING INFORMATION

If the engine does not operate properly, refer to the *Troubleshooting Chart on page 73* or consult 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 hourmeter), age of boat
- The operating conditions when the problem occurs:
 - Engine speed (min⁻¹)
 - Color of exhaust smoke
 - Type of diesel fuel
 - Type of engine oil
 - Any abnormal noises or vibration
 - Operating environment such as high altitude or extreme ambient temperatures, etc.
 - Engine maintenance history and previous problems
 - Other factors that contribute to the problem

TROUBLESHOOTING CHART

Symptom	Probable Cause	Measure	Reference
Indicators light on the instrument panel and alarm sounds during operation	Shift to low-speed operation immediately, and check which indicator has come on. Stop the engine and inspect. If no abnormality is identified and there is no problem with operation, return to port at lowest speed and request repairs.		
<ul style="list-style-type: none"> Engine oil low pressure alarm indicator comes on 	Engine oil level is low.	Check engine oil level. Add or replace.	See <i>Checking the Engine Oil on page 32</i>
	Engine oil filter clogged.	Replace engine oil filter. Replace engine oil.	See <i>Changing the Engine Oil and Replacing the Engine Oil Filter Element on page 58</i>
<ul style="list-style-type: none"> Coolant high temperature alarm comes on 	Coolant level is low.	Check coolant level and refill.	See <i>Checking and Adding Coolant on page 35</i>
	Insufficient seawater causing temperature to rise.	Check seawater system.	-
	Contamination inside cooling system.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> Faulty Warning Devices 	Do not operate the engine if alarm devices are not repaired. Serious accidents may result if abnormalities are not identified due to faulty indicators or alarm.		
Indicators Do Not Go On:			
<ul style="list-style-type: none"> The tachometer does not turn on, even though the key switch is turned on 	No electrical current available. The battery switch is turned off, the fuse (3 A) on the instrument panel is burned out or the circuit is broken.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> One of the indicators does not go out 	Sensor switch is faulty.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> Battery low charge indicator does not go out during operation 	V-belt is loose or broken.	Replace V-belt or adjust tension.	See <i>Checking and Adjusting the Alternator V-Belt Tension on page 67</i>
	Battery is defective.	Check battery fluid level, specific gravity or replace battery.	See <i>Checking the Battery Electrolyte Level (Serviceable Batteries Only) on page 60</i>
	Alternator power generation failure.	Consult authorized Yanmar Marine dealer or distributor.	-
Starting Failures:			
<ul style="list-style-type: none"> Starter turns but engine does not start 	No fuel.	Add fuel. Bleed fuel system.	See <i>Filling the Fuel Tank on page 29 and Bleeding the Fuel System on page 30</i>
	Fuel filter is clogged.	Replace filter element.	See <i>Replacing the Fuel Filter Element on page 62</i>
	Improper fuel.	Replace with recommended fuel.	See <i>Diesel Fuel Specifications on page 26</i>
	Problem with fuel injection.	Consult authorized Yanmar Marine dealer or distributor.	-
Compression leakage from intake / exhaust valve.	Consult authorized Yanmar Marine dealer or distributor.	-	-

TROUBLESHOOTING

Symptom	Probable Cause	Measure	Reference
<ul style="list-style-type: none"> Starter does not turn or turns slowly (engine can be turned manually) 	Faulty clutch position.	Shift to NEUTRAL and start.	-
	Insufficient battery charge.	Check fluid level. Recharge. Replace.	See <i>Checking the Battery Electrolyte Level (Serviceable Batteries Only)</i> on page 60
	Cable terminal contact failure.	Remove corrosion from terminals. Tighten battery cables.	-
	Faulty safety switch device.	Consult authorized Yanmar Marine dealer or distributor.	-
	Faulty instrument panel.	Consult authorized Yanmar Marine dealer or distributor.	-
Power lacking due to accessory drive being engaged.	Consult authorized Yanmar Marine dealer or distributor.	-	-
<ul style="list-style-type: none"> Engine cannot be turned manually 	Internal parts seized.	Consult authorized Yanmar Marine dealer or distributor.	-
Abnormal Smoke Color:			
<ul style="list-style-type: none"> Black smoke 	Load increased.	Consult authorized Yanmar Marine dealer or distributor.	-
	Improper propeller matching.	Consult authorized Yanmar Marine dealer or distributor.	-
	Dirty intake silencer (air cleaner).	Clean element.	See <i>Cleaning the Intake Silencer (Air Cleaner) Element</i> on page 64
	Improper fuel.	Replace with recommended fuel.	See <i>Diesel Fuel Specifications</i> on page 26
	Faulty spraying of fuel injector.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> Incorrect intake / exhaust valve clearance. 	Consult authorized Yanmar Marine dealer or distributor.	-	-
<ul style="list-style-type: none"> White smoke 	Improper fuel.	Replace with recommended fuel.	See <i>Diesel Fuel Specifications</i> on page 26
	Faulty spraying of fuel injector.	Consult authorized Yanmar Marine dealer or distributor.	-
	Fuel injection timing off.	Consult authorized Yanmar Marine dealer or distributor.	-
	Engine burning oil (excessive consumption).	Consult authorized Yanmar Marine dealer or distributor.	-

LONG-TERM STORAGE

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

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

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

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

NOTICE

- Do not drain the coolant system. A full coolant system will prevent corrosion and frost damage.
- If seawater is left inside of the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0°C (32°F).

PREPARE ENGINE FOR LONG-TERM STORAGE

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

1. Wipe off any dust or oil from the outside of engine.
2. Drain water from fuel filters.
3. Drain fuel tank completely or fill the tank to prevent condensation.
4. Grease the exposed areas and joints of the remote control cables and the bearings of the remote control handle.
5. Seal the intake silencer, exhaust pipe, etc. to prevent moisture or contamination from entering engine.
6. Completely drain bilge in hull bottom.
7. Waterproof the engine room to prevent rain or seawater from entering.
8. Charge the battery once a month to compensate for battery's self-discharge.
9. Remove key from key switch and cover the key switch with moisture cap.

DRAIN SEAWATER COOLING SYSTEM

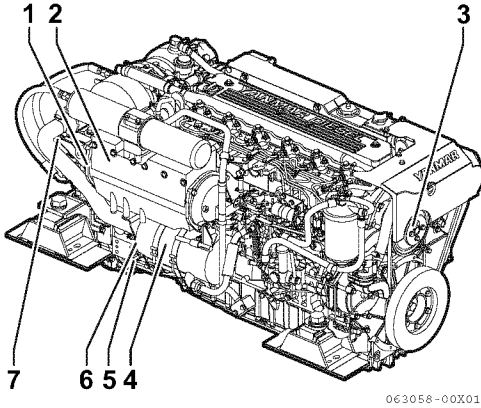


Figure 1

- 1 – Seawater drain cock
(Air cooler)
- 2 – Air cooler
- 3 – Coolant pump
- 4 – Engine oil cooler
- 5 – Seawater drain cock
(Engine oil cooler)
- 6 – Coolant drain cock
(Cylinderblock)
- 7 – Seawater drain cock
(Marine gear oil cooler)

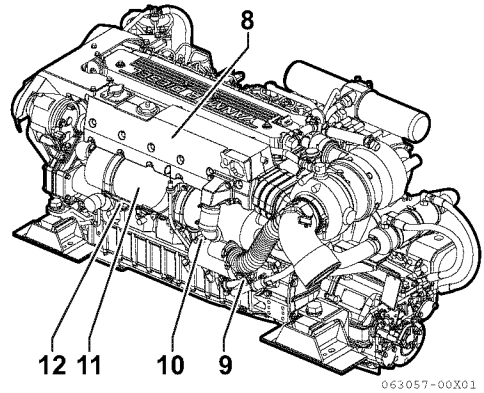


Figure 2

- 8 – Coolant tank
- 9 – Seawater drain cock
(Heat exchanger)
- 10 – Coolant drain cock
(Heat exchanger)
- 11 – Heat exchanger
- 12 – Seawater pump
(Drain from pump cover)

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

NOTICE

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

1. Open the seawater drain cock on the clutch cooler (if equipped). Allow to drain. Open the seawater drain cock on the air cooler and drain. If no water drains, use a stiff brush to remove any debris.
2. Remove four bolts attaching the side cover of the seawater pump. Remove the cover and drain the seawater.
3. Install cover and tighten bolts.
4. Close all the drain cocks.

RETURNING THE ENGINE TO SERVICE

1. Replace the oil and the oil filter before running the engine.
2. Supply fuel if the fuel in the fuel tank was removed, and prime the fuel system.
3. Confirm that there is engine coolant in the engine.
4. Operate the engine at idle speed for 1 minute.
5. Check fluid levels and check engine for leaks.

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SPECIFICATIONS

PRINCIPAL ENGINE SPECIFICATIONS

SPECIFICATIONS

6LY2A-STP Engine

Specification		6LY2A-STP	
Marine Gear Model		Bobtail	KMH60A
Use		For recreational use	
Type		Vertical water cooled 4-cycle diesel engine	
Combustion System		Direct injection	
Air Charging		Turbocharged with air cooler	
Number of Cylinders		6	
Bore x Stroke		105.9 mm x 110 mm (4.17 in. x 4.33 in.)	
Displacement		5.813 L (354.8 cu in.)	
Continuous power		257 kW (350 hp metric) / 3100 min ⁻¹	
Fuel stop power	Output at crankshaft/ engine speed	324 kW (440 hp metric) / 3300 min ⁻¹	
Installation		Flexible mounting	
Fuel Injection Timing		FID 15.5 ± 1° bTDC	
Fuel Injection Opening Pressure		27.5 to 28.5 MPa	
Direction of Rotation	Crankshaft	Counterclockwise viewed from stern	
	Propeller shaft (ahead)	-	Clockwise (Recommendation) or counterclockwise
Cooling System		Coolant cooling with heat exchanger	
Lubrication System		Forced lubrication system	
Cooling Water Capacity (coolant)		Engine 20 L (21.1 qt), Reservoir: 1.5 L (1.6 qt)	
Lubricating Oil Capacity (engine)	Total*	20 L (21.1 qt)	
	Oil pan only	16.4 L (17.3 qt)	
	Effective**	8 L (8.5 qt)	
Starting System	Type	Electric	
	Starting motor	DC 12 V - 3 kW	
	AC generator	12 V - 80 A	
Marine Gear	Down Angle	-	8°
	Type	-	Hydraulic wet multiple disk clutch
	Reduction Ratio (forward / reverse)	-	1.55/1.55, 2.04/2.04, 2.43/2.43
	Lubricating Oil Capacity	-	2.8 L (3.0 qt)
	Dry Mass	-	58 kg (128 lb)
Engine Dimension	Overall length	1250 mm (49.2 in.)	1310 mm (51.6 in.)
	Overall width	717 mm (28.2 in.)	
	Overall height	729 mm (28.7 in.)	746 mm (29.4 in.)
Engine Dry Mass (including marine gear)		535 kg (1179 lb)	593 kg (1307 lb)

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

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

Note: 1 hp metric = 0.7355 kW

6LY2A-UTP Engine

Specification		6LY2A-UTP	
		Bobtail	KMH60A
Use		For recreational use	
Type		Vertical water cooled 4-cycle diesel engine	
Combustion System		Direct injection	
Air Charging		Turbocharged with air cooler	
Number of Cylinders		6	
Bore x Stroke		105.9 mm x 110 mm (4.17 in. x 4.33 in.)	
Displacement		5.813 L (354.8 cu in.)	
Continuous power		213 kW (290 hp metric) / 3100 min ⁻¹	
Fuel stop power	Output at crankshaft/ engine speed	272 kW (370 hp metric) / 3300 min ⁻¹	
Installation		Flexible mounting	
Fuel Injection Timing		FID 15.5 ± 1° bTDC	
Fuel Injection Opening Pressure		27.5 to 28.5 MPa	
Direction of Rotation	Crankshaft	Counterclockwise viewed from stern	
	Propeller shaft (ahead)	-	Clockwise (Recommendation) or counterclockwise
Cooling System		Coolant cooling with heat exchanger	
Lubrication System		Forced lubrication system	
Cooling Water Capacity (coolant)		Engine 20 L (21.1 qt), Reservoir: 1.5 L (1.6 qt)	
Lubricating Oil Capacity (engine)	Total**	20 L (21.1 qt)	
	Oil pan only	16.4 L (17.3 qt)	
	Effective***	8 L (8.5 qt)	
Starting System	Type	Electric	
	Starting motor	DC 12 V - 3 kW	
	AC generator	12 V - 80 A	
Marine Gear	Down Angle	-	8°
	Type	-	Hydraulic wet multiple disk clutch
	Reduction Ratio (forward / reverse)	-	1.55/1.55, 2.04/2.04, 2.43/2.43
	Lubricating Oil Capacity	-	2.8 L (3.0 qt)
	Dry Mass	-	58 kg (128 lb)
Engine Dimension	Overall length	1250 mm (49.2 in.)	1310 mm (51.6 in.)
	Overall width	717 mm (28.2 in.)	
	Overall height	729 mm (28.7 in.)	746 mm (29.4 in.)
Engine Dry Mass (including marine gear)		535 kg (1179 lb)	593 kg (1307 lb)

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

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

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





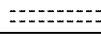
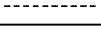
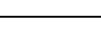
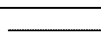

Note: Density of fuel: 0.835 to 0.845 g/cm³ at 15°C. Fuel temperature at the inlet of the fuel injection pump.

Note: 1 hp metric = 0.7355 kW

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SYSTEM DIAGRAMS

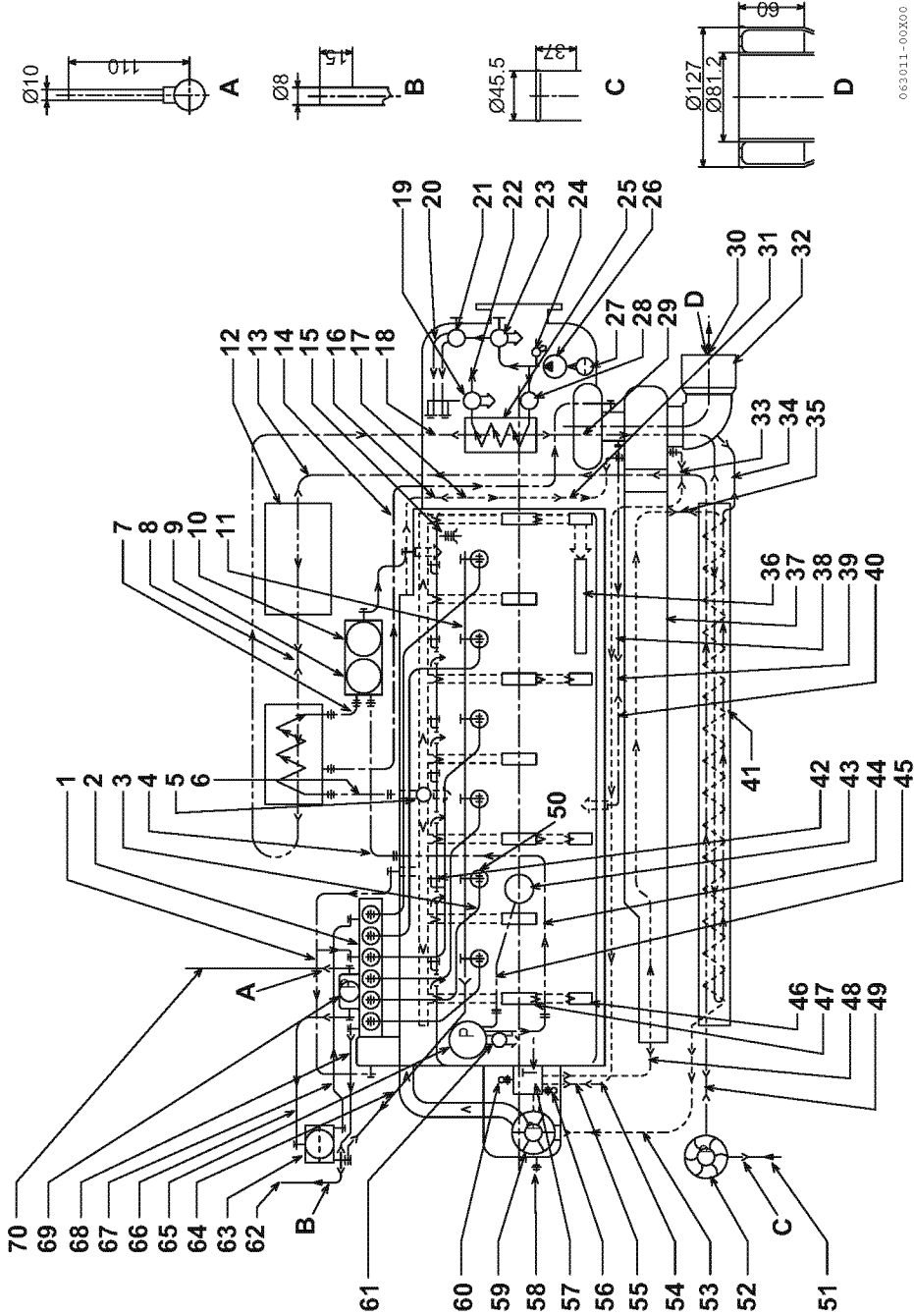
PIPING DIAGRAMS

Notation	Description
	Screw Joint (Union)
	Flange Joint
	Eye Joint
	Insertion Joint
	Drilled Hole
	Coolant Piping
	Cooling Seawater Piping
	Lubricating Oil Piping
	Diesel Fuel Piping

Note:

- Dimension of steel pipe: outer diameter x thickness.
- Dimension of rubber pipe: inner diameter x thickness.
- Fuel rubber pipes (marked *) satisfy EN/ISO7840.

6LY2A with KMH60A Marine Gear

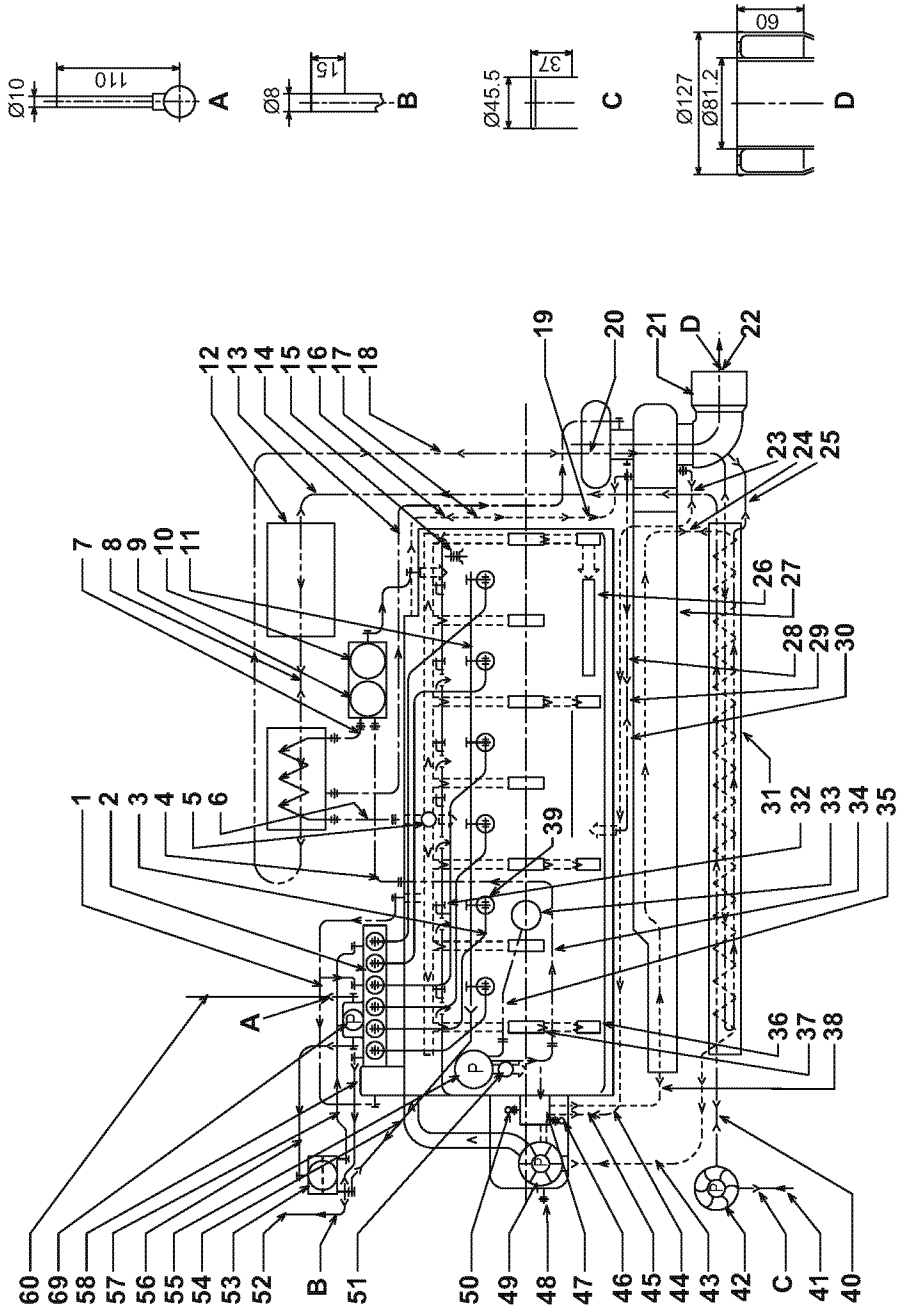


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Figure 1

- | | |
|--|---|
| <ul style="list-style-type: none"> 1 – 4.76 x t0.7 Steel Pipe 2 – Fuel Injection Pump 3 – Fuel High-Pressure Pipe
6.35 x t2.175 STS 4 – Lubrication Oil Pipe
(SAE J526, SAE 100R14) 5 – Pressure Control Valve
(Engine) 6 – Lubrication Oil Pipe
(SAE J526, SAE 100R14) 7 – Lubrication Oil Pipe
(SAE J526, SAE 100R14) 8 – 38.1 x t5 Rubber Hose 9 – Engine oil filters (Full Flow) 10 – Engine oil filter (Bypass) 11 – 6 x t0.7 Steel Pipe 12 – Air cooler 13 – 38.1 x t5 Rubber Hose 14 – Lubrication Oil Pipe
(SAE J526, SAE 100R14) 15 – Hot Water Connection Outlet 16 – 19 x t4 Rubber Hose 17 – 20 x t1.6 STPG370 18 – 38.1 x t5 Rubber Hose 19 – Pressure Control Valve
(Marine Gear) 20 – To Marine Gear Cylinder 21 – Shift Valve 22 – To Lubricate Marine Gear 23 – Trolling Valve 24 – Relief Valve (Hydraulic Oil) 25 – Marine Gear Lubricating Oil
Cooler 26 – Hydraulic Oil Pump 27 – Marine Gear Lubricating Oil
strainer 28 – Hydraulic Oil Pressure Control
Valve 29 – 38.1 x t5 Rubber Hose 30 – Exhaust Gas / Cooling
Seawater Mixed Outlet 31 – 19 x t4 Rubber Hose 32 – Mixing Elbow 33 – 19 x t4 Rubber Hose 34 – 38 x t4 Rubber Hose 35 – 38.1 x t5 Rubber Hose 36 – Rocker Arm Shaft 37 – Exhaust Manifold 38 – 20 x t2 STPG370 | <ul style="list-style-type: none"> 39 – 20 x t3 Rubber Hose 40 – 20 x t2 STPG370 41 – Heat Exchanger 42 – Piston Cooling Oil Jet 43 – Lubrication Oil Inlet strainer 44 – 20 x t2 STPG370 45 – 30 x t2.3 STPG370 46 – Camshaft Bearing 47 – Main Bearing 48 – 44.5 x t5 Rubber Hose 49 – 38.1 x t5 Rubber Hose 50 – Fuel Injection Nozzle 51 – Seawater Inlet 52 – Cooling Water Pump (seawater) 53 – 44.5 x t5 Rubber Hose 54 – 20 x t1.6 STPG370 55 – 19 x t4 Rubber Hose 56 – Coolant Temperature Sensor
(option) 57 – Thermostat 58 – Hot Water Connection Return 59 – Cooling Water Pump (coolant) 60 – Coolant Temperature Switch 61 – Relief Valve
(Engine Lubricating Oil) 62 – Fuel Overflow 63 – Diesel Fuel Filter 64 – 44.5 x t5 Rubber Hose 65 – Lubrication Oil Pump 66 – 7.8 x t5.5 Rubber Hose 67 – 7.8 x t5.5 Rubber Hose 68 – 7.8 x t4.5 Rubber Hose 69 – Fuel Feed Pump 70 – Diesel Fuel Inlet |
|--|---|

6LY2A (Bobtail) without Marine Gear



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Figure 2

- | | |
|---|--|
| <p>1 – 4.76 x t0.7 Steel Pipe</p> <p>2 – Fuel Injection Pump</p> <p>3 – Fuel High-Pressure Pipe
6.35 x t2.175 STS</p> <p>4 – Lubrication Oil Pipe
(SAE J526, SAE 100R14)</p> <p>5 – Pressure Control Valve
(Engine)</p> <p>6 – Lubrication Oil Pipe
(SAE J526, SAE 100R14)</p> <p>7 – Lubrication Oil Pipe
(SAE J526, SAE 100R14)</p> <p>8 – 38.1 x t5 Rubber Hose</p> <p>9 – Engine oil filters (Full Flow)</p> <p>10 – Engine oil filter (Bypass)</p> <p>11 – 6 x t0.7 Steel Pipe</p> <p>12 – Air cooler</p> <p>13 – 38.1 x t5 Rubber Hose</p> <p>14 – Lubrication Oil Pipe
(SAE J526, SAE 100R14)</p> <p>15 – Hot Water Connection Outlet</p> <p>16 – 19 x t4 Rubber Hose</p> <p>17 – 20 x t1.6 STPG370</p> <p>18 – 38.1 x t5 Rubber Hose</p> <p>19 – 19 x t4 Rubber Hose</p> <p>20 – 38.1 x t5 Rubber Hose</p> <p>21 – Mixing Elbow</p> <p>22 – Exhaust Gas / Cooling
Seawater Mixed Outlet</p> <p>23 – 19 x t4 Rubber Hose</p> <p>24 – 38.1 x t5 Rubber Hose</p> <p>25 – 38 x t4 Rubber Hose</p> <p>26 – Rocker Arm Shaft</p> <p>27 – Exhaust Manifold</p> <p>28 – 20 x t2 STPG370</p> <p>29 – 20 x t3 Rubber Hose</p> <p>30 – 20 x t2 STPG370</p> <p>31 – Heat Exchanger</p> <p>32 – Piston Cooling Oil Jet</p> <p>33 – Lubrication Oil Inlet Filter</p> <p>34 – 20 x t2 STPG370</p> <p>35 – 30 x t2.3 STPG370</p> <p>36 – Camshaft Bearing</p> <p>37 – Main Bearing</p> <p>38 – 44.5 x t5 Rubber Hose</p> <p>39 – Fuel Injection Nozzle</p> <p>40 – 38.1 x t5 Rubber Hose</p> <p>41 – Seawater Inlet</p> <p>42 – Cooling Water Pump (seawater)</p> | <p>43 – 44.5 x t5 Rubber Hose</p> <p>44 – 20 x t1.6 STPG370</p> <p>45 – 19 x t4 Rubber Hose</p> <p>46 – Coolant Temperature Sensor
(option)</p> <p>47 – Thermostat</p> <p>48 – Hot Water Connection Return</p> <p>49 – Cooling Water Pump (coolant)</p> <p>50 – Coolant Temperature Switch</p> <p>51 – Relief Valve
(Engine Lubricating Oil)</p> <p>52 – Fuel Overflow</p> <p>53 – Diesel Fuel Filter</p> <p>54 – 44.5 x t5 Rubber Hose</p> <p>55 – Lubrication Oil Pump</p> <p>56 – 7.8 x t5.5 Rubber Hose</p> <p>57 – 7.8 x t5.5 Rubber Hose</p> <p>58 – 7.8 x t4.5 Rubber Hose</p> <p>59 – Fuel Feed Pump</p> <p>60 – Diesel Fuel Inlet</p> |
|---|--|

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WIRING DIAGRAMS

Color Coding	
R	Red
B	Black
W	White
Y	Yellow
L	Blue
G	Green
O	Orange
Lg	Light Green
Lb	Light Blue
Br	Brown
P	Pink
Gr	Gray
Pu	Purple

Allowable Length by Cross Sectional Area of Battery Cable	
Section of Cable mm ² (in. ²)	Allowable Length L = 1 + 2 + 3 m (ft)
40 (0.062)	< 4.5 (14.8)
60 (0.093)	< 7 (23.0)

-
- 1 – Instrument panel
(New B)
 - 2 – Battery low charge indicator
 - 3 – Engine oil low pressure indicator
 - 4 – Coolant high temperature indicator
 - 5 – Exhaust (Cooling Seawater Flow) Restriction Indicator
 - 6 – Coolant level indicator
 - 7 – Diesel pre-heat
 - 8 – Tachometer with Hour meter
 - 9 – Buzzer
 - 10 – Buzzer stop switch
 - 11 – Panel illumination switch
 - 12 – Fuse 3 A
 - 13 – Start switch
 - 14 – Stop switch
 - 15 – Wire harness
 - 16 – SOLAS application
 - 17 – Reset relay
 - 18 – Turnover switch
 - 19 – Relay
 - 20 – Air heater assembly (option)
 - 21 – Coolant temperature switch
 - 22 – Heater plug (option)
 - 23 – Air heater relay (Option)
 - 24 – Heater controller (Option)
 - 25 – Stop relay
 - 26 – Engine stop solenoid
 - 27 – Procured by customer
 - 28 – Cross sectional area
 - 29 – Battery
 - 30 – Battery switch
 - 31 – Starter relay
 - 32 – Starter
 - 33 – Seawater flow switch
 - 34 – Coolant temperature switch
 - 35 – Engine oil pressure switch
 - 36 – Alternator
 - 37 – Ground
 - 38 – Coolant level switch
 - 39 – Tachometer Sensor
 - 40 – Marine gear oil pressure switch
 - 41 – Boost Sender
 - 42 – Engine Oil Pressure Sender
 - 43 – Coolant Temperature Sender
 - 44 – Timer controller
(Coolant level switch)
 - 45 – Timer controller
(Cooling Seawater Flow)
 - 46 – Details of coupler
(wire harness, view from A-A)
 - 47 – Details of coupler
(wire harness, view from B-B)
 - 48 – Details of coupler
(wire harness, view from D-D)
 - 49 – Start switch
(Output status table)

6LY2A with New D + New C (optional) type instrument panel

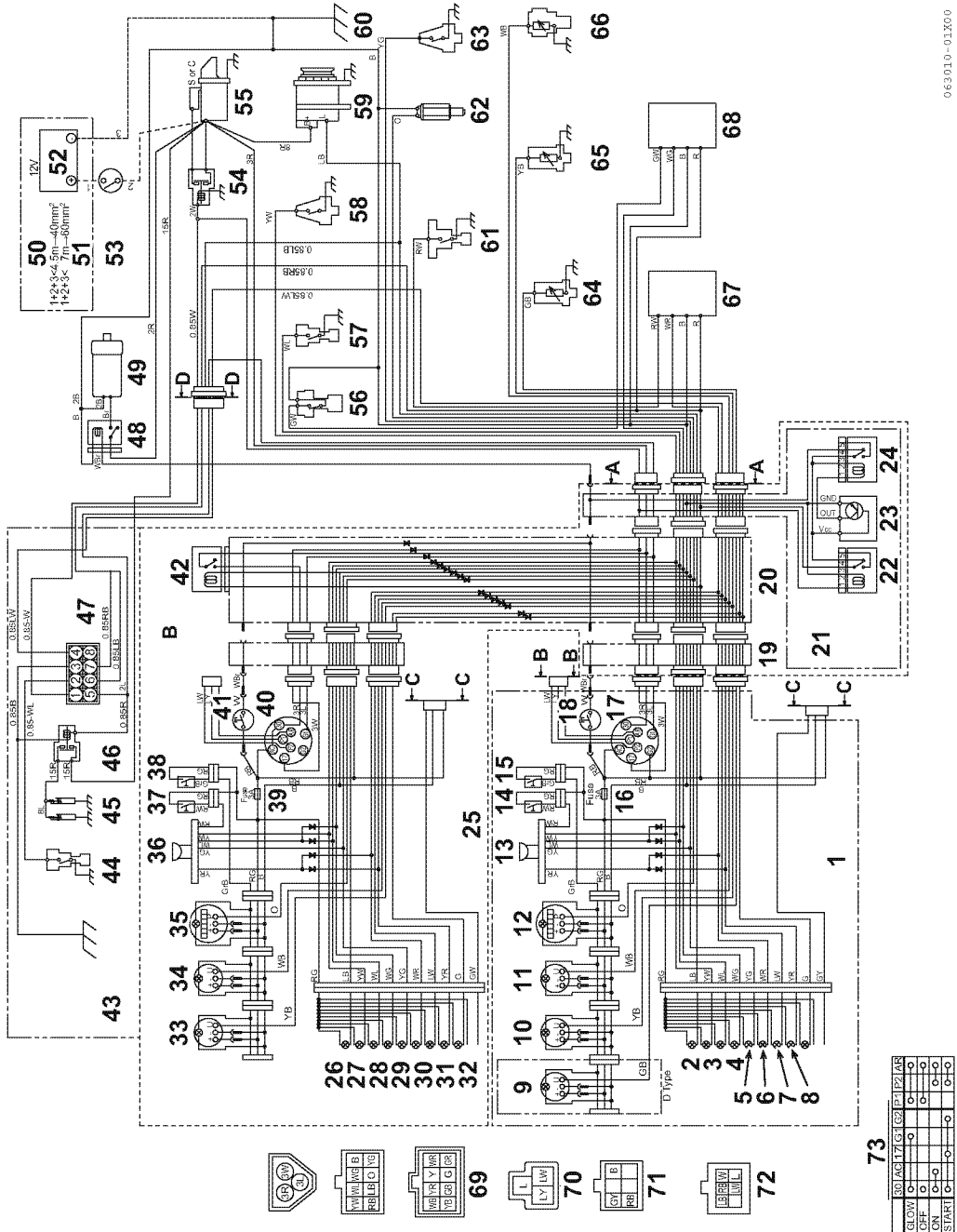


Figure 4

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- | | |
|---|--|
| <ul style="list-style-type: none"> 1 – Instrument panel
(New D) 2 – Battery low charge indicator 3 – Engine oil low pressure indicator 4 – Coolant high temperature indicator 5 – Exhaust (Cooling Seawater Flow) Restriction Indicator 6 – Marine gear oil low pressure indicator 7 – Coolant level indicator 8 – Diesel pre-heat 9 – Turbocharger boost pressure gauge 10 – Engine oil pressure gauge 11 – Coolant temperature gauge 12 – Tachometer with Hour meter 13 – Buzzer 14 – Buzzer stop switch 15 – Panel illumination switch 16 – Fuse 3 A 17 – Start switch 18 – Stop switch 19 – Wire harness 20 – Wire harness for sub panel 21 – SOLAS application 22 – Reset relay 23 – Turnover switch 24 – Relay 25 – Instrument panel
(Sub station: option) 26 – Battery low charge indicator 27 – Engine oil low pressure indicator 28 – Coolant high temperature indicator 29 – Exhaust (Cooling Seawater Flow) Restriction Indicator 30 – Marine gear oil low pressure indicator 31 – Coolant level indicator 32 – Diesel pre-heat 33 – Engine oil pressure gauge 34 – Coolant temperature gauge 35 – Tachometer with Hour meter 36 – Buzzer 37 – Buzzer stop switch 38 – Panel illumination switch | <ul style="list-style-type: none"> 39 – Fuse 3 A 40 – Start switch 41 – Stop switch 42 – Relay 43 – Air heater assembly (option) 44 – Coolant temperature switch 45 – Heater plug (option) 46 – Air heater relay (Option) 47 – Heater controller (Option) 48 – Stop relay 49 – Engine stop solenoid 50 – Procured by customer 51 – Cross sectional area 52 – Battery 53 – Battery switch 54 – Starter relay 55 – Starter 56 – Seawater flow switch 57 – Coolant temperature switch 58 – Engine oil pressure switch 59 – Alternator 60 – Ground 61 – Coolant level switch 62 – Tachometer Sensor 63 – Marine gear oil pressure switch 64 – Boost Sender 65 – Engine Oil Pressure Sender 66 – Coolant Temperature Sender 67 – Timer controller
(Coolant level switch) 68 – Timer controller
(Cooling Seawater Flow) 69 – Details of coupler
(wire harness, view from A-A) 70 – Details of coupler
(wire harness, view from B-B) 71 – Details of coupler
(wire harness, view from C-C) 72 – Details of coupler
(wire harness, view from D-D) 73 – Start switch
(Output status table) |
|---|--|

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