

# OPERATION MANUAL

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MARINE ENGINES

**4LV**

**4LV150      4LV150Z**

**4LV170      4LV170Z**

**4LV195      4LV195Z**

**4LV230      4LV230Z**

**4LV250      4LV250Z**

 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.

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OPERATION MANUAL	MODEL	4LV150, 4LV170, 4LV195, 4LV230, 4LV250, 4LV150Z, 4LV170Z, 4LV195Z, 4LV230Z, 4LV250Z
	CODE	0A4LV-EN0014

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# INTRODUCTION

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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 4LV 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

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### RECORD OF OWNERSHIP

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

**Engine Model:** \_\_\_\_\_

**Engine Serial No.:** \_\_\_\_\_

**Date Purchased:** \_\_\_\_\_

**Dealer:** \_\_\_\_\_

**Dealer Phone:** \_\_\_\_\_

# SAFETY

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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**



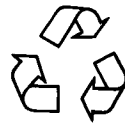
Wear eye protection and rubber gloves when you handle engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.

## 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 4LV series marine engines.

## 4LV Engines

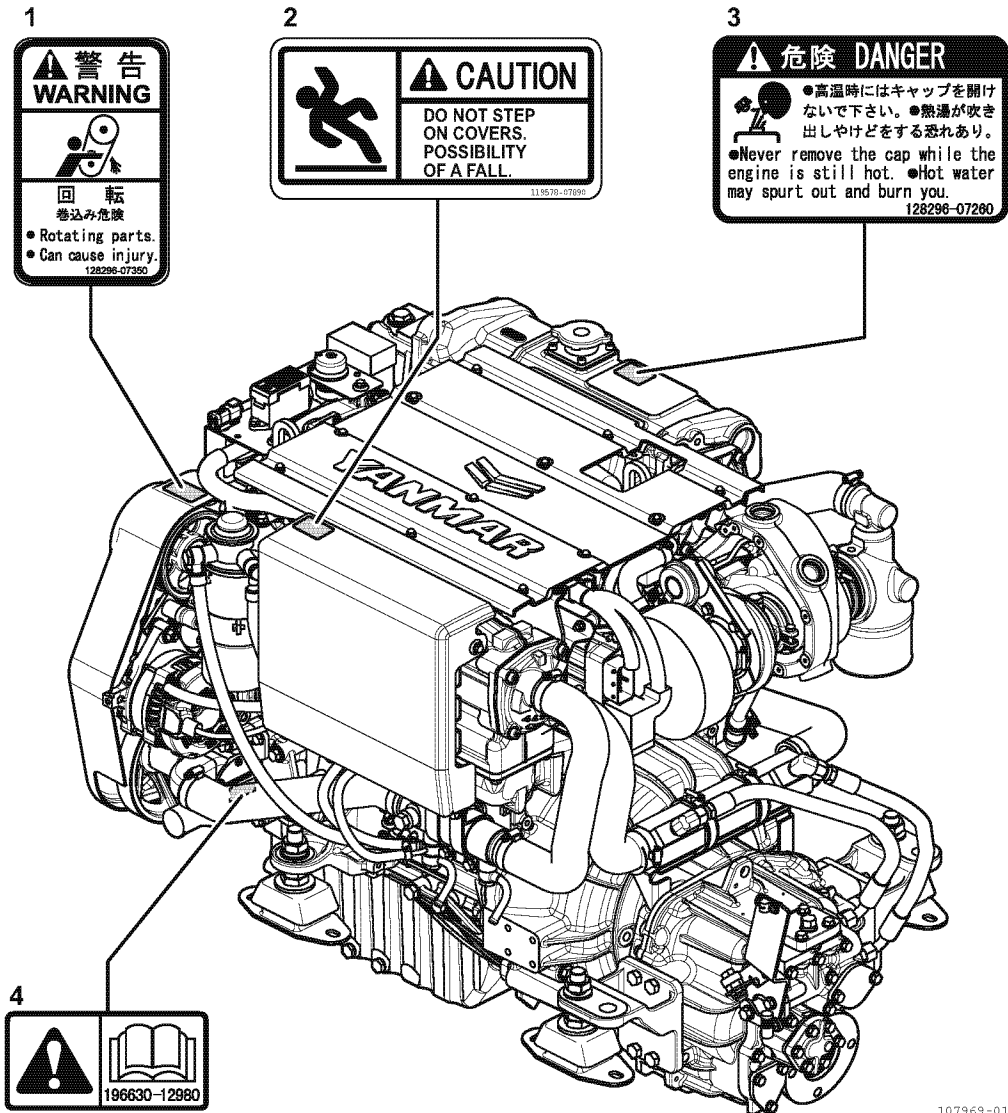
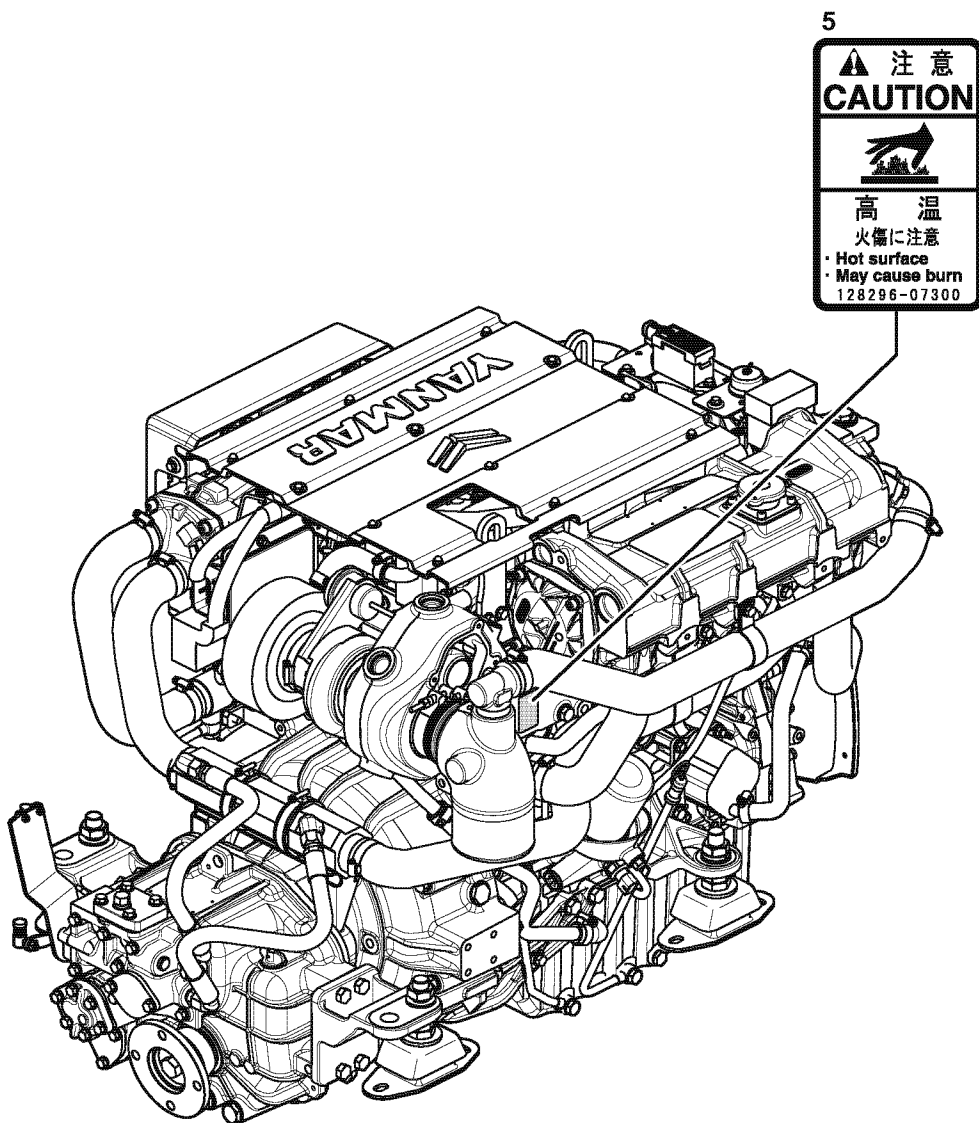


Figure 1

- 1—Part Number: 128296-07350
- 2—Part Number: 119578-07890
- 3—Part Number: 128991-07270
- 4—Part Number: 196630-12980



## 4LV Engines



107970-02X00

*Figure 2*

5-Part Number: 128296-07300

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# PRODUCT OVERVIEW

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## YANMAR 4LV COMMON RAIL SERIES FEATURES AND APPLICATIONS

The 4LV common rail series are four-stroke diesel engines equipped with direct injection common rail system and with liquid coolant systems.

The 4LV is 4-cylinder and turbocharged with an air cooler.

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

These engines are designed for recreational craft use.

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 4LV common rail series engines are designed to be operated at maximum throttle\*<sup>1</sup> for less than 5% of total engine time (30 minutes out of every 10 hours) and cruising speed\*<sup>2</sup>.

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.

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\*<sup>1</sup> maximum throttle: fuel stop power engine speed

\*<sup>2</sup> cruising speed: fuel stop power engine speed -200 min<sup>-1</sup> or less

### 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 80°C (160° and 176°F).

During the first 10 hours of operation, the engine should be run at maximum engine speed minus 400 to 500 min<sup>-1</sup> (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<sup>-1</sup> most of the time (approximately 70% load), with a 10 minute run at maximum minus 200 min<sup>-1</sup> (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 87.*

## COMPONENT IDENTIFICATION

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

### Right Side (Viewed from Flywheel)

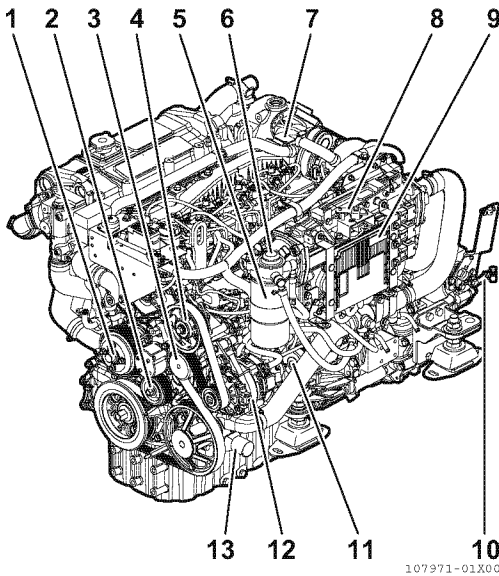


Figure 1

- 1 – Coolant pump
- 2 – Belt tensioner
- 3 – Idler
- 4 – Power steering oil pump (or Idler)
- 5 – Fuel filter
- 6 – Fuel priming pump
- 7 – Mist separator
- 8 – Throttle sensor
- 9 – ECU
- 10 – Shift lever
- 11 – Starter motor
- 12 – Alternator
- 13 – Seawater pump

### Left Side (Viewed from Flywheel)

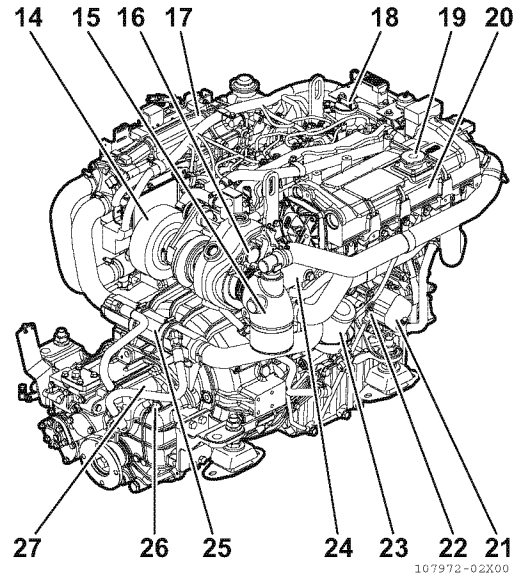


Figure 2

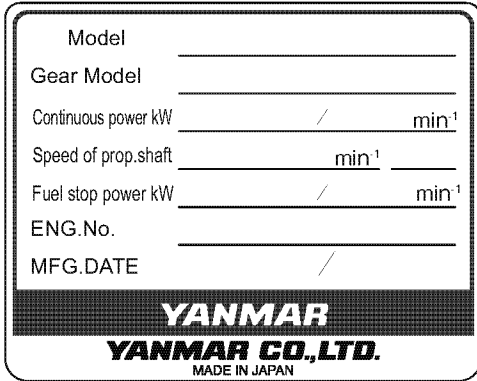
- 14 – Intake silencer
- 15 – Exhaust / water mixing elbow
- 16 – Turbocharger
- 17 – Air cooler
- 18 – Engine oil filler cap
- 19 – Coolant filler cap
- 20 – Coolant tank / Heat exchanger
- 21 – Engine oil cooler
- 22 – Engine oil dipstick
- 23 – Engine oil filter
- 24 – Exhaust manifold
- 25 – Marine gear oil cooler
- 26 – Marine gear oil dipstick
- 27 – Marine gear (KMH50A)

# PRODUCT OVERVIEW

## NAMEPLATES

The nameplates of Yanmar 4LV common rail series engines are shown in **Figure 3**. Check the engine's model, output, min<sup>-1</sup> and serial number on the nameplate. Please replace if damaged or lost.

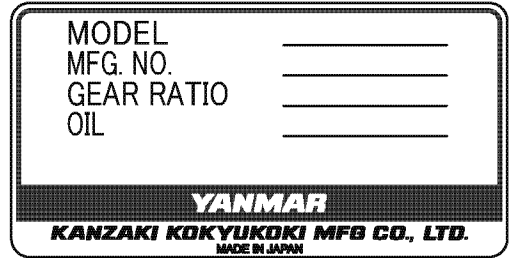
The engine nameplate is attached to the top surface of the engine coolant tank (heat exchanger).



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 and serial number.



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. See <i>Periodic Maintenance Schedule on page 84</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 filter. 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 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. See <i>Changing the Engine Oil and Replacing the Engine Oil Filter Element on page 96</i> .
Marine Gear Filler Port (Marine Gear is option)	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 marine gear oil and intake air (depending on model) 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-ribbed 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 coolant.
Oil Cooler - Marine Gear (Marine Gear is option)	This heat exchanger cools the marine gear (KMH50A or KMH50V) 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.

# ELECTRONIC CONTROL SYSTEM

### WARNING

- The 4LV common rail series engines use a high pressure common rail system.
  - The fuel is injected at extremely high pressure.
  - Never disassemble the fuel system parts.
  - Failure to comply may result in death or serious injury.
  - If a malfunction occurs, consult your nearest Yanmar dealer or distributor.
- 
- Never use the ECU for other purposes than intended or in other ways than specified by Yanmar. Doing so could result in the violation of emission control regulations and will void the product warranty.
  - Be sure to use the ECU in conjunction with the engines whose models or serial numbers are specified by Yanmar. Other ECU/engine combinations than specified will void the engine warranty.
  - Replacing the fuel injector involves rewriting the fuel injection data in the ECU. Be sure to consult your local Yanmar dealer before replacing the fuel injector. Failure to rewrite the fuel injection data before replacing the fuel injector will void the engine warranty.
  - Improper use or misuse of the ECU may result in death or serious injury due to an abrupt and unexpected increase in engine speed.

- Replacing the ECU involves migrating the fuel injection data to the existing ECU to the new unit. Be sure to consult your local Yanmar dealer before replacing the ECU. Failure to migrate the fuel injection data before replacing the ECU will void the engine warranty.

### NOTICE

- Do not plug or unplug the ECU for a period of at least 6 seconds after power to the unit has been turned on or off.
  - Do not touch connector pins of the ECU with bare hands. Doing so may result in corrosion of the connector pins and/or damage to the internal circuits of the ECU due to static electricity.
  - Do not force a measuring probe into the female coupler. Doing so may cause contact failure of the connector pins, resulting in malfunction of the ECU.
  - Take care to prevent water from entering the couplers when plugging or unplugging the connector. Water inside the couplers may cause corrosion, resulting in malfunction of the ECU.
  - Avoid plugging/unplugging the connector more than approx. 10 times. Frequent plugging/unplugging of the connector may cause contact failure of the connector pins, resulting in malfunction of the ECU.
  - Do not use the ECU that has ever suffered drop impact.
- 
- Always check the battery for proper charge. Otherwise the electronically controlled engines may fail to start.
-



## MAIN ELECTRONIC CONTROL COMPONENTS AND FEATURES

Component/feature	Description
Controller	By controlling the fuel injection timing, volume, pressure and number in accordance with the target speed indication entered from the accelerator sensor, the controller adjusts the engine speed and power.
Fuel pump (supply pump)	The fuel pump supplies fuel to the common rail.
Common rail	The common rail stores the compressed high-pressure fuel from the supply pump and distributes fuel to the injector in each cylinder.
Fuel injector	The Fuel Injectors the high-pressure fuel from the rail to the engine combustion room after receiving a signal from the ECU in the most appropriate injection timing, injection volume, injection ratio, number of injection and spray condition.
Accelerator sensor	Unlike mechanical governors, the common rail fuel injection system has no governor lever. The accelerator sensor serves as the governor lever to provide the speed command signal (voltage signal) to the ECU for engine speed control.
Engine diagnosis tool	Allows the operator to troubleshoot the cause of a problem based on detailed information regarding the problem occurring in the ECU. This tool can also be used for data maintenance tasks including programming and mapping. <i>See Troubleshooting on page 103</i>

## CONTROL EQUIPMENT

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

### Instrument Panel

#### Equipment and Functions

The instrument panel is located in the cockpit. The following instruments enable you to start or stop the engine and to monitor its condition during operation.

#### B25-Type

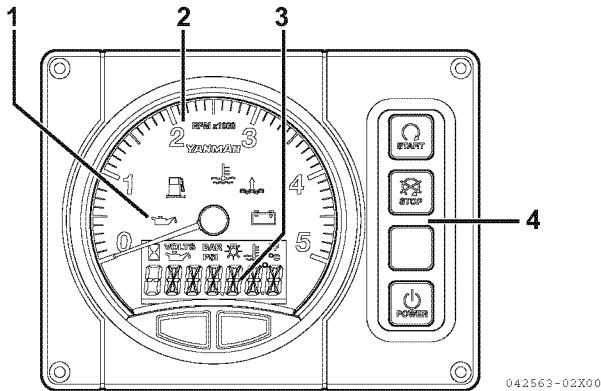


Figure 5

#### C35-Type

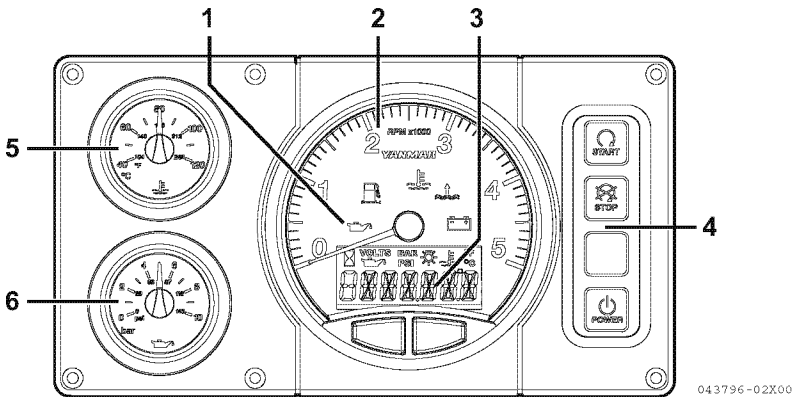


Figure 6

- 1 – Alarm lamp
- 2 – Tachometer
- 3 – LCD

- 4 – Switches (push-buttons)
- 5 – Coolant temperature gauge
- 6 – Engine oil pressure gauge

**Meters**

<b>Instrument</b>	<b>Function</b>
Tachometer	Shows engine rotation speed.
Hour meter	Shows number of operating hours. Can be used as a guide for periodic maintenance checks. The hour meter is located at the bottom of the tachometer.
Coolant Temperature Gauge	Shows the coolant temperature.
Engine Oil Pressure Gauge	Shows the engine oil pressure. (If oil pressure sensor equipped)
Panel Lights	When the power switch is pushed, the gauges will illuminate for easier viewing.

*Note: The LCD on the instrument panel show hour meter, coolant temperature, display brightness, oil pressure and battery voltage. See LCD control on page 22. Other indicators in the LCD can be added by display setting. See Selection of the display setting on page 26.*

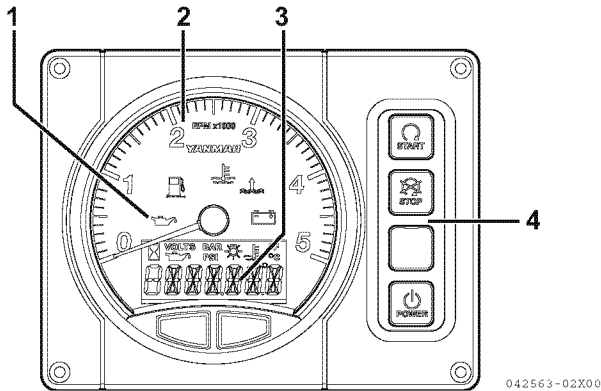
**Coolant temperature and oil pressure display (option)**

- B25, C35-Type panels have a digital LCD screen inside the tachometer.
- C35-Type panels have an electric gauge with a needle.

# PRODUCT OVERVIEW

## Instrument Panel

The formats for the instrument panel are shown below.



**Figure 7**

- 1 – Alarm lamp
- 2 – Tachometer

- 3 – LCD
- 4 – Switches (push-buttons)

### **Control panel switches**

All switches are push-buttons.

#### **Start switch**



042564-01X00

Pushing this switch operates the starter and starts the engine.

#### **Power switch**



042567-01X00

Pushing this switch turns on or off the power.

#### **Stop switch**



042565-01X00

Pushing this switch stops the engine.

## Indicators and Alarms (Optional)

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

### Battery Low Charge Indicator



When the alternator output is too low, the indicator will light. When charging begins, the indicator will turn off.

### Coolant High Temperature Indicator and Alarm



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

### Engine Oil Low Pressure Indicator and Alarm



When the engine oil pressure falls below normal, the oil pressure sensor will send a signal to the indicator, causing it to light and the alarm to sound. Stop operation to avoid damage to the engine. Check the oil level and troubleshoot the lubrication system.

### Water in Sail Drive Seal Indicator and Alarm



When water is detected between the seals of the sail drive, the indicator will light and the alarm will sound.

### Water in Fuel Filter Indicator and Alarm



When the water level in the fuel filter/water separator becomes too high, the indicator will light and the alarm will sound. Drain the water from the fuel filter/water separator. *See Draining Fuel Filter/Water Separator on page 92.*

# PRODUCT OVERVIEW

## LCD control

(hour meter, coolant temperature, display brightness, oil pressure, battery voltage, alarms)

You can switch (scroll) between displays by pressing the buttons on the bottom as the default setting.

- **Switching screens by pressing the right button (Pressing the left button switches the screens in the opposite direction.)**

Press the power switch.

- After 4 seconds, the LCD shows the hour meter.

Pressing the right button on the bottom of the LCD shows the temperature display. Select between Metric units (°C) and Imperial units (°F) at the "System Units screen" on page 24.

Pressing the right button again shows the LCD brightness settings.

To set the brightness of the backlight:

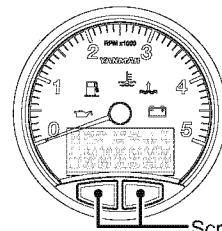
- 1** Press the left button continuously and the digits of the LCD start flashing.
- 2** In this condition, press the left button to increase the brightness.
- 3** Press the right button to decrease the brightness. (The brightness changes in 6 steps of 20 %.)

To set the desired brightness, do not touch the buttons for 3 seconds.

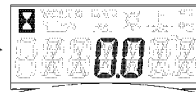
*Note: Continuously pressing means holding the button for approx. 2 seconds.*

Next, press the right button to show the pressure display. Select between Metric units (BAR) and Imperial units (PSI) at the "System Units screen" on page 24.

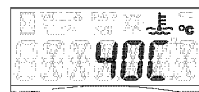
Press again to show the battery voltage.



Engine hour (>300 min<sup>-1</sup>)



Coolant temperature

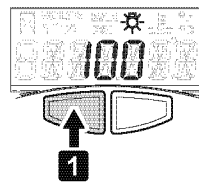


Metric

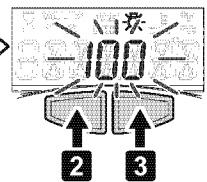


Imperial units

Backlighting Brightness



Push and hold (display will blink when ready)



Scroll 100, 80, 60, 40, 20, 0 (value will be set after 3 seconds)

Oil pressure



Metric



Imperial units

Battery voltage



055130-00EN02

Figure 8

Pressing the button once more, shows the engine alarms “ALARMS”.

- 1** Press and hold the left button, “WAIT” will display in the LCD about 1 second while DTC is being read.

*Note: DTC means Diagnosis Trouble Code*

“NO dTC” or the number of DTC will show when DTC process is finished.

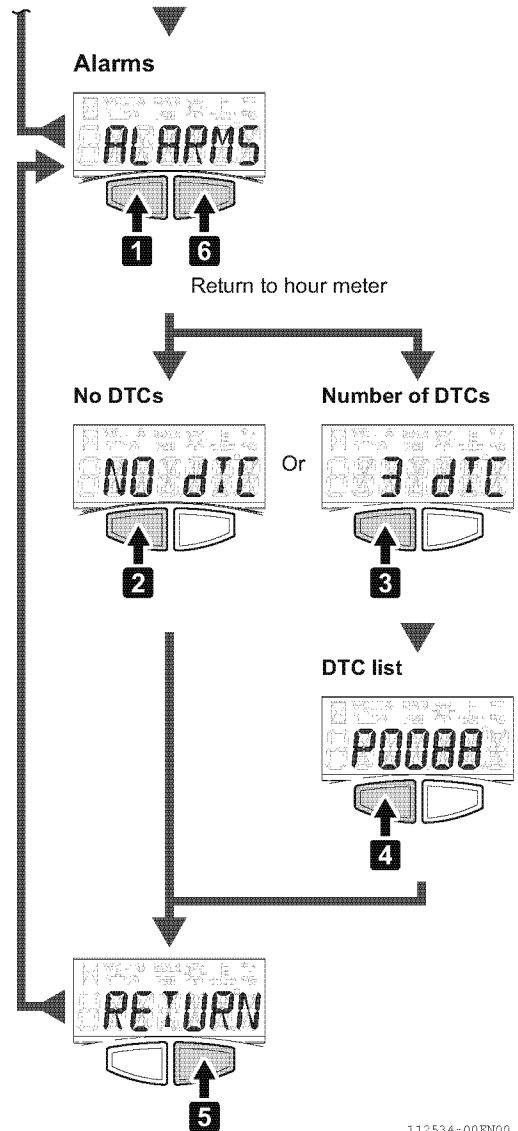
- 2** When “NO dTC” is indicated on the screen, press the left button and go to the next screen “RETURN”.

- 3** Press and scroll the left button for the number of DTCs to see all the applying trouble codes.

Look up the codes in the Failsafe Diagnosis Functional Specification Chart on page 110 and consult your authorized Yanmar Marine dealer or distributor for repairment.

*Note: When “UNKNOWN” is displayed, consult your authorized Yanmar Marine dealer or distributor.*

- 4** When you are done browsing the DTC list, press the left button to go to “RETURN”.
- 5** When “RETURN” is displayed, press the right button to return to “ALARMS”.
- 6** Press the right button again to return to the initial hour meter.



112534-00EN00

Figure 9

# PRODUCT OVERVIEW

## Setup screen access and control (Setting the temperature, pressure units and others)

Use the buttons on the bottom of the LCD display to set the instrument panel. Press the left button to switch between displays.

- 1 Press and hold both buttons until "SET UP" appears.
- 2 Press the left button to set the units for the temperature and pressure display.

### Setting the temperature and pressure units

The display says "UNIT".

- 1 Next, press the right button to select Metric units (°C, BAR). The display says "METRIC".
- 2 Press the left button to switch to Imperial units (°F, PSI). The display says "ENGL".
- 3 Press the right button to select and go back to the "UNIT" screen.
- 4 Press the left button and go to the next screen "FUEL".

Confirm that the display indicates "FUEL". Pressing the right button displays the fuel tank level setting screen.

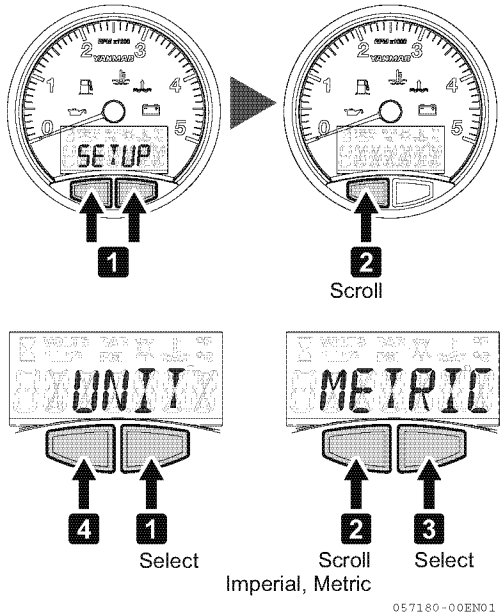


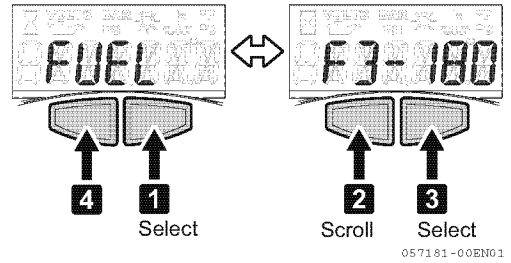
Figure 10



**Selecting the fuel tank level gauge (Usually set at boat builder)**

The display indicates "FUEL".  
 (You can select to the next setting by pressing the left button.)

- 1** Press the right button to select the type of the gauges.
- 2** Change the type by pressing the left button.
- 3** Press the right button to select the type.
- 4** Press the left button and go to the next screen "DISPLAY".



**Figure 11**

There are four types of fuel level gauge setting. The type of level gauge can be changed by scrolling and selecting the setting with the buttons.

<b>Type</b>	F3-180
	F240-3
	F70-3
	CAN

# PRODUCT OVERVIEW

## Selection of the display setting

The following indicators can be displayed on LCD by this setting.

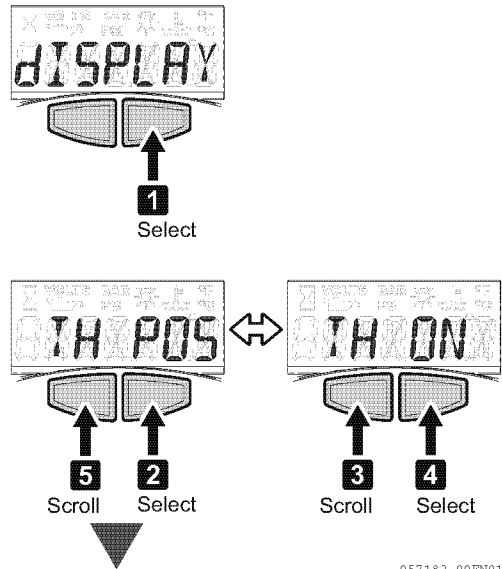
TH POS	TH ON	Throttle position %
	TH OFF	
ENG Ld	Ld ON	Engine load %
	Ld OFF	
FL RT	FR ON	Fuel flow rate L/h or Gal/h
	FR OFF	
AIR PRS	AP ON	Intake air pressure Bar or PSI
	AP OFF	
FL TMP	FT ON	Fuel temperature degC or degF
	FT OFF	
AIR TMP	AT ON	Intake air temperature degC or degF
	AT OFF	
RETURN		Return to dISPLAY

The display indicates "dISPLAY". You can select to the next setting by pressing the left button.

- 1** Press the right button to select the indicator.
- 2** Press the right button to display the setting screen.
- 3** Press the left button to toggle between On/Off.
- 4** Press the right button to select the setting.
- 5** Press the left button and go to the next screen "ENG Ld".

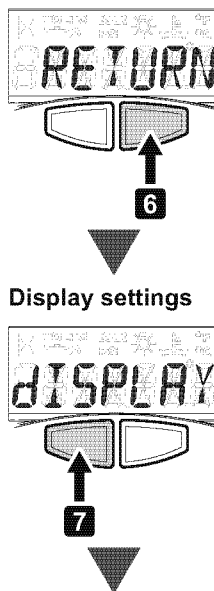
**Setting of the next indicator.**  
Repeat the same procedure to set other indicators.

- 6** When "RETURN" is indicated on the screen, press the right button to return to "dISPLAY" mode.
- 7** Press the left button and go to the next screen "ENGINE".



057182-00EN01

Figure 12

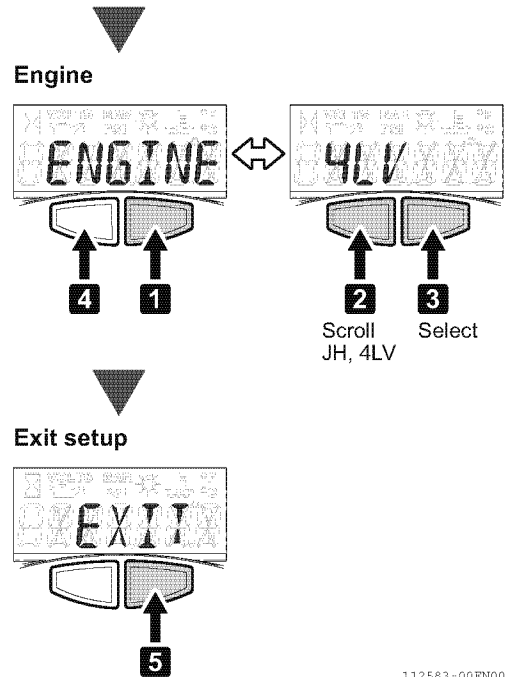


112535-00EN00

Figure 13

**Setting of the engine model**

- 1** When “ENGINE” is indicated, press the right button to select the engine model.
- 2** Press the left button to select “4LV”.  
*Note: Initial setting indicates “JH”.*
- 3** When “4LV” is indicated on the screen, press the right button to return to “ENGINE”.
- 4** When “ENGINE” is indicated, press the left button to go to “EXIT”.
- 5** Press the right button when “EXIT” is shown on the screen to exit the setup mode.  
All LCD light up for a while, and then returns to hour meter.

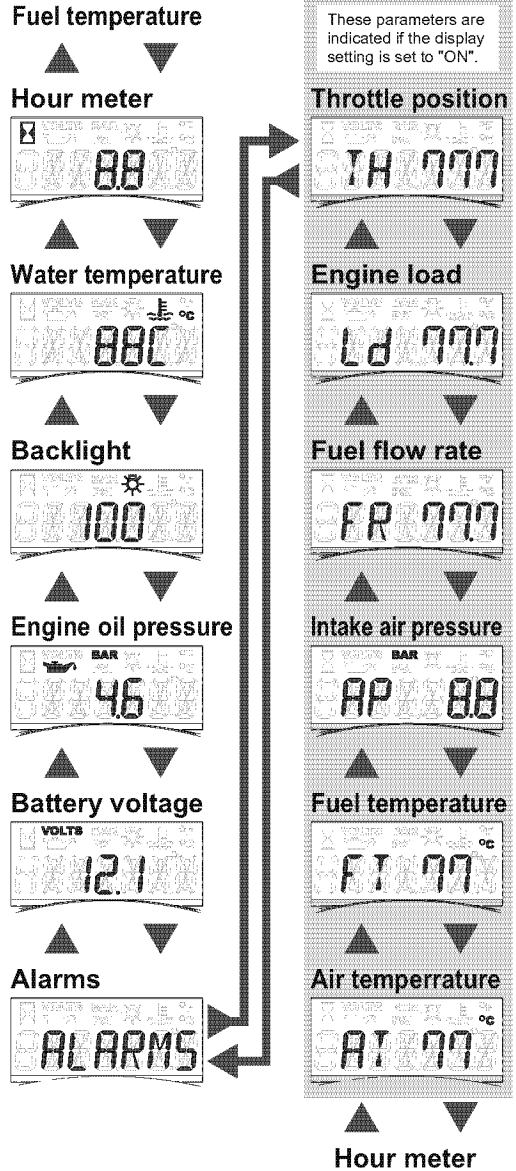


112583-00EN00

**Figure 14**

# PRODUCT OVERVIEW

Scroll the LCD screen with the buttons.



057189-01EN00

Figure 15

**Alarms**

**Checking the Warning Devices**

Be Sure to Check the Warning Devices before Starting the Engine.

If the devices are not working properly, it is impossible to prevent any accidents arising from problems like insufficient oil and water.

**NOTICE**

When the warning devices are activated and normal operation is impossible, stop the engine and do not use it until the problem has been solved.

**Before Engine Start**

1. Turn on the battery switch.
  2. Push the power switch on.
- All alarm lamps light up for 4 seconds.
  - After 4 seconds, the hour meter is displayed.

**After Engine Start**

After engine start, make sure that the warning devices operate correctly and according to “After start” in the below table.

- All alarm lamps turn off. The above check tells you whether the electric circuit for the alarm lamps and alarm buzzer operate correctly. If they do not operate correctly, inspection and repair are required. Consult your dealer or distributor for repairs.

Correct operation of the warning devices				
Instrument panel (power switch)	Power ON			
	Immediately	After 2 seconds	After 4 seconds	-
	Before start			After start
Starter switch	OFF			ON
Alarm buzzer	ON (0.3s)	OFF		OFF
Charge lamp	ON	ON	OFF	OFF
Coolant temperature lamp	ON	ON	OFF	OFF
Engine lubricating oil pressure lamp	ON	ON	OFF	OFF
LCD display	Yanmar	Full display	Hour meter	

## PRODUCT OVERVIEW

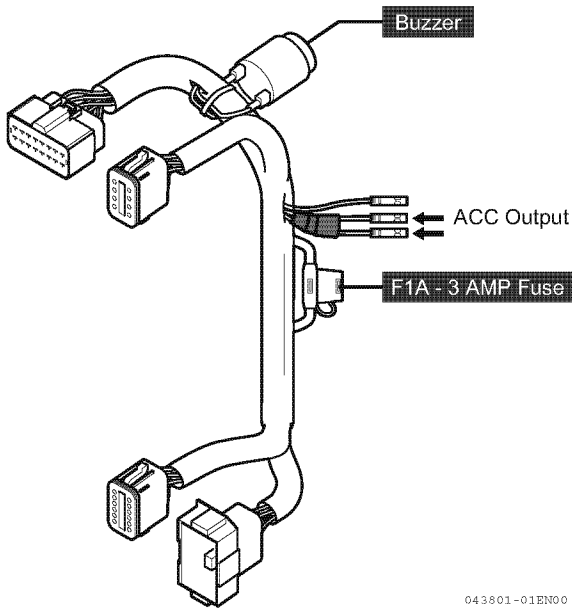
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### Accessory power output

The harness attached to the panel has a terminal where the signal that is synchronized to the panel power supply can be taken off. (**Figure 16**) (Refer to the *Wiring Diagrams on page 133.*)

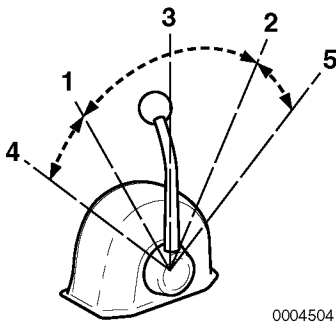
The maximum current of this output terminal is 3 A (Fuse capacity). Do not use a current higher than 3 A.

For the content of the output terminal, refer to the *Wiring Diagrams on page 133.*



**Figure 16**

## Single-Lever Remote Control Handle



**Figure 17**

0004504

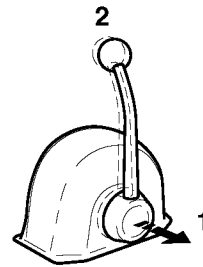
*Note: Direction of travel will vary depending on installation location.*

- 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 17**) 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 18, (1)**), the engine speed can be controlled without engaging the clutch. The clutch remains in NEUTRAL, no load position. Turn the knob (**Figure 18, (2)**) counterclockwise to move the handle or clockwise to lock the handle.



0004511

**Figure 18**

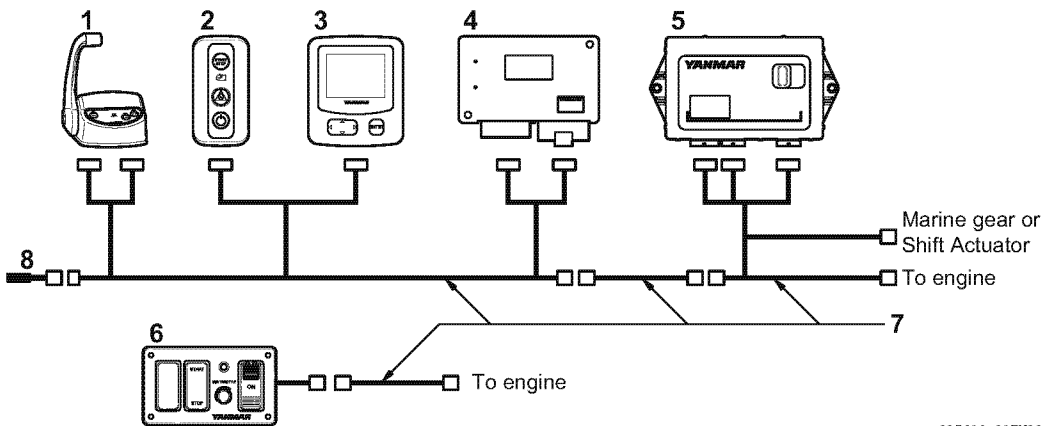
*Note: Yanmar recommends the use of a single-lever type for the remote control system. If only a two-lever type is available in the market, reduce engine speed to 1000 min<sup>-1</sup> or less before engaging and disengaging the marine gear clutch.*

**VESSEL CONTROL SYSTEM (VC10)**

4LV common rail series engine is a fully electronic control engine, which is controlled by Yanmar’s original “Vessel Control System (VC10)”.

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

*Note: The Yanmar Vessel Control System (VC10) was designed to operate the 4LV common rail series and drive system. There are many control functions and diagnostic functions that are integrated together to insure safe operation. If this system is not utilized in specific accordance with the instructions in this manual or the system is modified in any way, Yanmar will not be responsible for any warranty failures in the operation of the system or the vessel utilizing the system. Yanmar has designed the Vessel Control System (VC10) in conjunction with the 4LV common rail series. The system has many functions that must be configured and calibrations must be made before the vessel can be operated. Please arrange to have a Yanmar trained technician inspect the vessel prior to the vessels operation.*



037618-01EN00

**Figure 19**

No.	Description
1	Shift and Throttle Control Head
2	Switch Panel (to start and stop the engine)
3	VC10 Digital Display
4	Helm ECU
5	Drive ECU
6	Backup Panel
7	Cable Harness Set
8	Adapter, Terminal

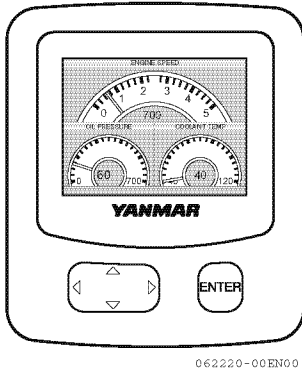


## Display

The multi-function information display has the following functions.

### Display Function

#### Runtime Engine Data Tri-Screen

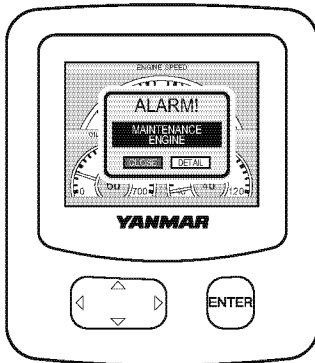


062220-00EN100

Figure 20

This screen displays real time engine data and alarm indications.

#### Alarm Indicators



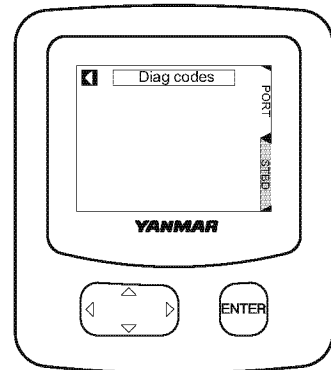
037635-01X01

Figure 21

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

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

#### Diag Codes Screen



037635-02X00

Figure 22

#### Alarm Indicator Functions

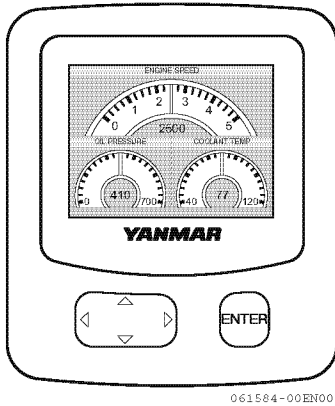
The alarm indicators and buzzer are activated when sensors detect an abnormality during engine operation. The alarm indicators are off during normal operation, but are activated as follows when an abnormality arises:

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

# PRODUCT OVERVIEW

## Operation of the Display's Buttons

### Buttons



061584-00EN00

**Figure 23**

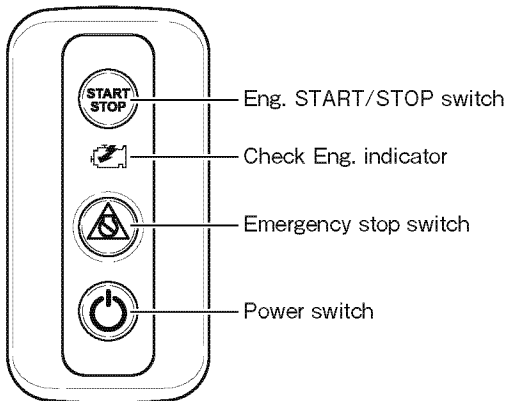
- Act on pop-up menu (MAIN MENU)
- Perform the function
- ▲ Up Arrow moves menu selection up
- ▼ Down Arrow moves menu selection down
- ◀ Left Arrow acts on current menu item
- ▶ Right Arrow acts on current menu item

### Hot Key List

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

## Switch Panel (to start and stop the engine)

The switch panel has the following functions.



037627-00B00

**Figure 24**

### **To start and stop the engine:**

Press the START/STOP switch.

### **Emergency Stop Switch**

Use this switch only in an emergency.

## **NOTICE**

Under normal circumstances, do not use the Emergency stop switch to stop the engine.

The engine shuts down suddenly when the Emergency stop switch is pressed. After the engine has stopped, press the Emergency stop switch to release the emergency stop.

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# BEFORE YOU OPERATE

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## 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.

# BEFORE YOU OPERATE

## DIESEL FUEL

### Diesel Fuel Specifications

#### WARNING

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

#### NOTICE

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

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

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

### Biodiesel Fuels

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

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

#### ***B7 diesel fuels must meet certain specifications.***

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

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

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

#### ***Precautions and concerns regarding the use of biofuels:***

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

- Even biodiesel fuels that comply with a suitable standard as delivered will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and/or fuel storage containers, may be necessary.
- The use of biodiesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.
- Do not use Biocide.
- Lubricity: Wear mark of WS1.4 should be Max. 0.016 in. (400  $\mu$ m) at HFRR test.

### **Additional Technical Fuel Requirements**

- The fuel cetane number should be 45 or higher.
- The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred. Especially in U.S.A. and Canada, Ultra Low sulfur fuel ( $\leq 15$  ppm) must be used.
- Never mix kerosene, used engine oil or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Ash content not to exceed 0.01% by volume.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.

# BEFORE YOU OPERATE

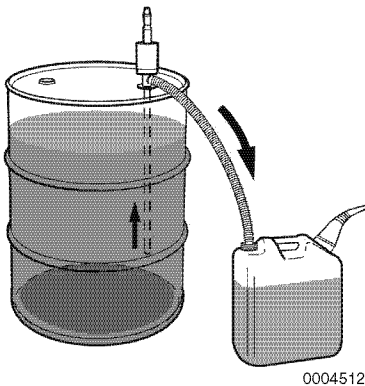
## Handling of Diesel Fuel

### **⚠ 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.
- 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.

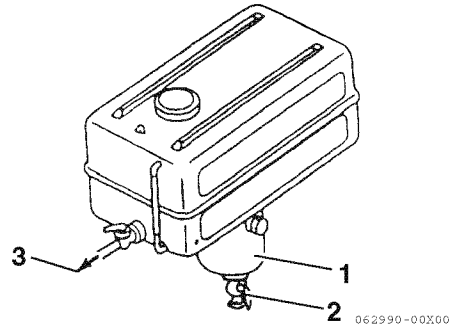
1. Water and dust in the fuel may cause engine failure. When fuel is stored, be sure that the inside of the storage container is clean and dry, and that the fuel is stored away from dirt or rain.



**Figure 1**

2. 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 (0.79 to 1.18 in.) above the bottom of the tank so that only clean fuel is distributed to the engine.



## Fuel System

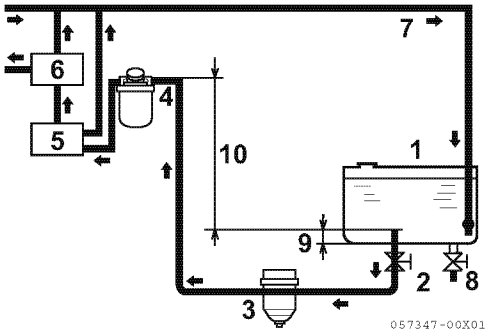


Figure 3

- 1 – Fuel Tank
- 2 – Fuel Cock
- 3 – Pre-filter (Water separator: Option)
- 4 – Fuel filter (with priming pump)
- 5 – Fuel supply pump
- 6 – Common rail
- 7 – Fuel return line
- 8 – Drain cock
- 9 – Approximately 20 to 30 mm (0.79 to 1.18 in.)
- 10 – Less than 500 mm (19.7 in.)

Install the fuel line from the fuel tank to the fuel supply pump as shown in **Figure 3**. The pre-filter (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

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### Bleeding the Fuel System

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.

The fuel system needs to be primed under certain conditions:

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

### **⚠ WARNING**

#### **Fire and Explosion Hazard!**

- Diesel fuel is flammable and explosive under certain conditions.
- Failure to comply could result in death or serious injury.

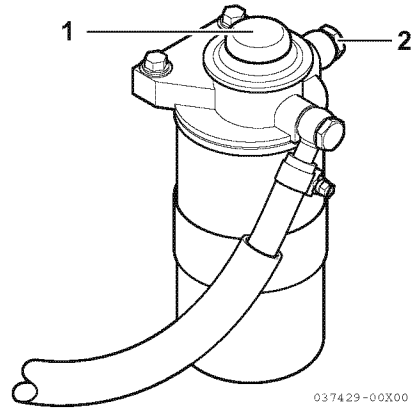
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#### **Exposure Hazard.**

Always wear safety glasses when bleeding the fuel system.

---

### Bleeding the fuel filter



**Figure 4**

1. Check the fuel level in the fuel tank. Refill if necessary.
2. Open the fuel cock of the fuel tank.
3. Loosen the air bleed screw (**Figure 4, (2)**) two to three turns.
4. Push up and down on the priming pump (**Figure 4, (1)**) 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 the starter motor to crank the engine in order to prime the fuel system. This may cause the starter motor to overheat and damage the coils, pinion and/or ring gear.

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**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.

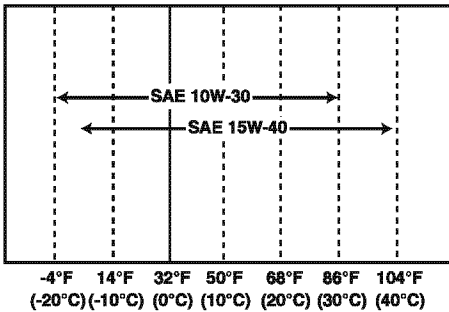
**Service Categories**

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

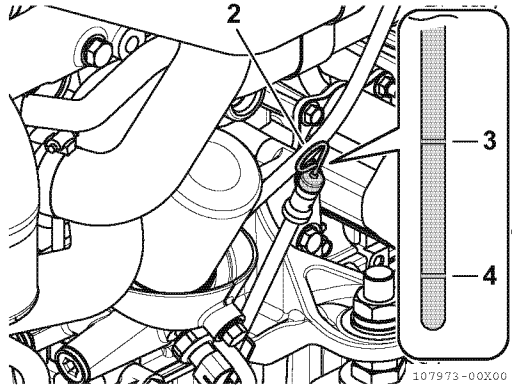
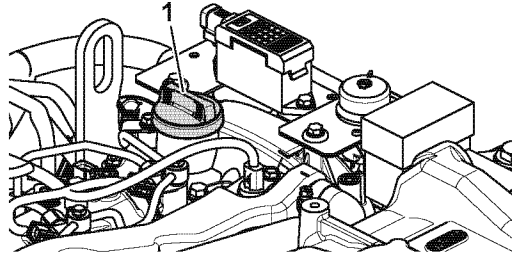
1. When handling and storing engine oil, be careful not to allow dust and water to contaminate the oil. Clean around the filler port before filling.
2. Do not mix lube oils of different types or brands. Mixing may cause the chemical characteristics of the oil to change and lubricating performance to 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 viscosity.

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

## Checking the Engine Oil



**Figure 6**

- 1 – Engine oil filler port cap  
(On the rocker arm cover)
- 2 – Dipstick
- 3 – Upper Limit
- 4 – Lower Limit

1. Make sure the engine is level.
2. Remove dipstick (**Figure 6, (2)**) and wipe with clean cloth.
3. Fully reinsert dipstick.
4. Remove dipstick. The oil level should be between upper (**Figure 6, (3)**) and lower (**Figure 6, (4)**) lines on the dipstick.
5. Add oil if necessary. *See Adding Engine Oil on page 45.*
6. Fully reinsert dipstick.

## Adding Engine Oil

1. Remove the oil filler port cap from filler port (**Figure 6, (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, (3)**) on the dipstick (**Figure 6, (2)**).

### 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

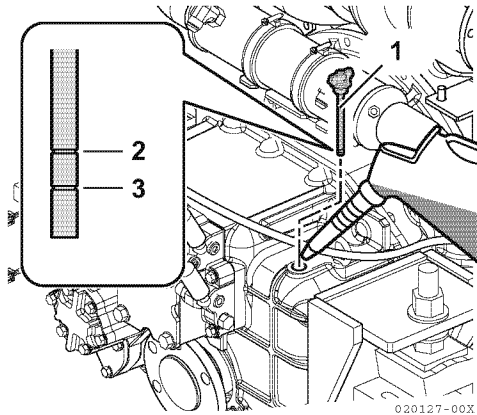
Use marine gear oil that meets or exceeds the following guidelines and classifications:

#### KMH50A, KMH50V (Option):

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

## BEFORE YOU OPERATE

### Checking Marine Gear Oil



**Figure 7**

- 1 – Dipstick  
(Filler cap combined type)**
- 2 – Upper Limit**
- 3 – Lower Limit**

*Note: KMH50A marine gear shown.*

1. Make sure engine is level.
2. Remove the filler cap (**Figure 7, (1)**) at the top of the housing.
3. Remove dipstick (**Figure 7, (1)**) and wipe with clean cloth.
4. Re- insert the dipstick without screw in.
5. Remove dipstick. The oil level should be between upper (**Figure 7, (2)**) and lower (**Figure 7, (3)**) lines on the dipstick.
6. Screw in the dipstick.

### Adding Marine Gear Oil

1. Make sure the engine is level.
2. Remove the filler cap (**Figure 7, (1)**) at the top of the housing.
3. Fill with oil to the upper limit on the dipstick (**Figure 7, (2)**). See *Marine Gear Oil Specifications* on page 45.

### NOTICE

Never overfill the marine gear with oil.

4. Screw in the dipstick.
5. Tighten the filler port cap by hand.

## STERN DRIVE OIL

*Note: Refer to the manufacturer's operation manual for stern drive oil specifications.*

### Stern Drive Oil Specifications

Refer to the Operation Manual of the stern drive for the procedure to fill or replace the stern drive oil.

#### ZT370

- 4LV230Z, 4LV250Z:  
QuickSilver®\*1 High Performance Gear Lube
- 4LV150Z, 4LV170Z, 4LV195Z:  
QuickSilver®\*1 High Performance Gear Lube or GL-5 (SAE 80W90)

#### Power steering oil (4LVZ only)

- QuickSilver® Power Trim and Steering Fluid or Dexlone-III

#### Power trim oil

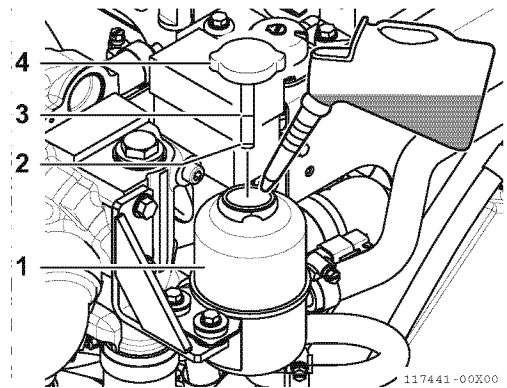
- QuickSilver® Power Trim and Steering Fluid or Dexlone-III

### Checking and Adding Stern Drive Oil

*Note: Refer to the manufacturer's operation manual for the proper procedure to check and fill the stern drive oil.*

\*1: QuickSilver is a registered trademark of Brunswick® Corporation.

### Checking and Adding Power Steering Oil (4LVZ Models)



**Figure 8**

1. Remove the filler cap/dipstick (**Figure 8, (3), (4)**) from the power steering oil service tank (**Figure 8, (1)**) and wipe with a clean cloth.
2. Fully reinsert dipstick.
3. Remove dipstick. The oil level should be between upper (**Figure 8, (3)**) and lower (**Figure 8, (2)**) lines on the dipstick.
4. Fill with oil to the upper limit on the dipstick. See *Stern Drive Oil Specifications* on page 47.

### NOTICE

Never overfill the power steering system with oil.

5. Fully reinsert dipstick and tighten.

### 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)

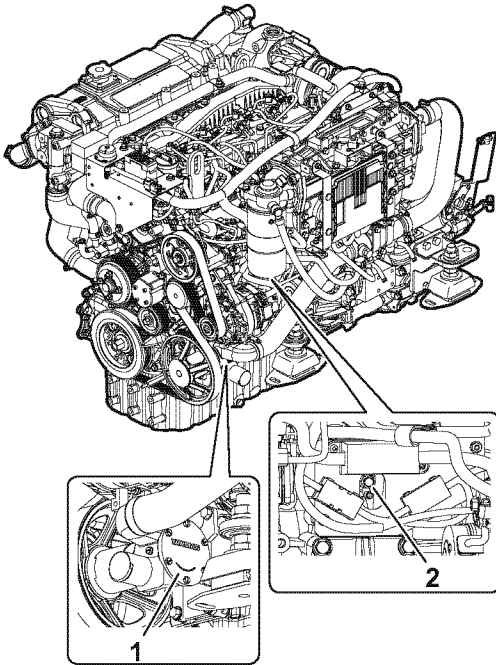
#### **NOTICE**

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.

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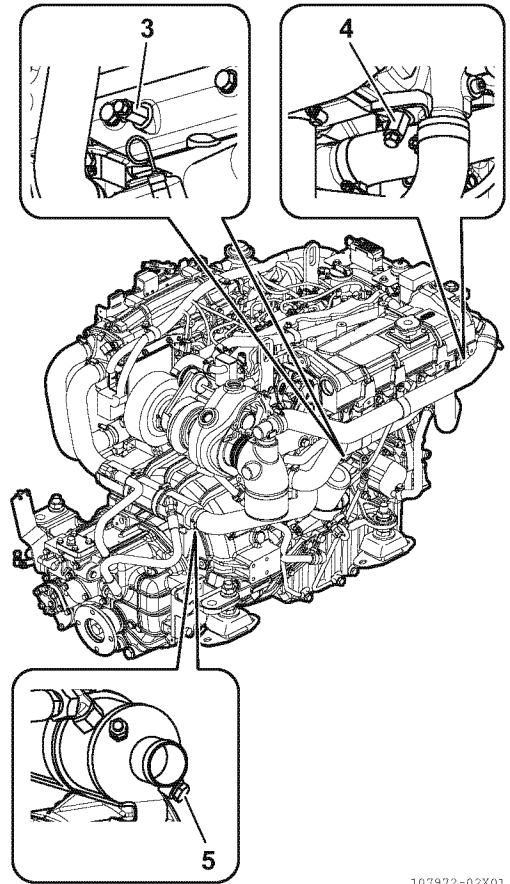
Checking and Adding Coolant



107971-01X01

Figure 9

- 1 – Seawater pump  
(Drain from pump cover)
- 2 – Coolant drain cock  
(Cylinderblock)



107972-02X01

Figure 10

- 3 – Coolant drain cock  
(Exhaust manifold)
- 4 – Seawater drain cock  
(Coolant tank/Heat exchanger)
- 5 – Seawater drain plug  
(Marine gear oil cooler)

## BEFORE YOU OPERATE

1. Ensure all drain cocks are closed.

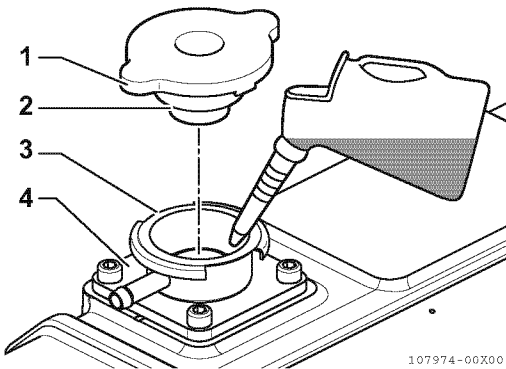
*Note: The drain cocks are opened before shipping from the factory.*

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**

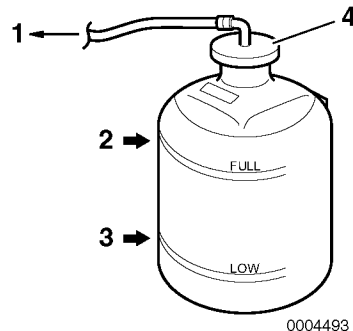
Never pour cold coolant into a hot engine.

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. Install filler cap and tighten it firmly. Failure to do so will cause water leakage.

Reservoir Capacity
0.8 L (0.85 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.*

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# ENGINE OPERATION

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## INTRODUCTION

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

## SAFETY PRECAUTIONS

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

## WARNING

### **Fire and Explosion Hazard**



Never jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.

Only use the start switch on the instrument panel to start the engine.

### **Sudden Movement Hazard**

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

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

### **Sever Hazard**



Keep children and pets away while the engine is operating.

## NOTICE

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

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).
- If the ambient temperature exceeds +40°C (+104°F), the engine may overheat and cause the engine oil to break down.

**NOTICE**

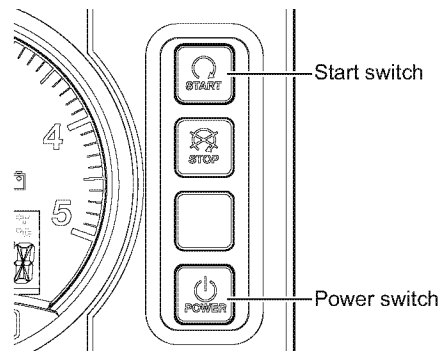
- If the ambient temperature is below  $-16^{\circ}\text{C}$  ( $+5^{\circ}\text{F}$ ), rubber components such as gaskets and seals will harden causing premature engine wear and damage.
- Consult your authorized Yanmar Marine engine dealer or distributor if the engine will be operated outside of this 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.

**OPERATION (B25,C35-TYPE INSTRUMENT PANEL)****Starting the Engine**

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

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



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**Figure 1**

4. Turn on the battery switch for engine and engine control system. Do not turn off the battery switch during engine operation. Also, turn it off when the engine does not operate.
5. If all alarm lamps operate when you turn on the power switch on the instrument panel, the warning devices operate correctly.
6. Pushing the start switch turns on the engine. Release the switch after the engine starts.

### If the Engine Fails to Start

Before pushing 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: Push and hold the start 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 supply pump. Bleed the air out of the system. *See Bleeding the Fuel System on page 42.*

### Starting at Low Temperatures

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

#### NOTICE

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

---

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

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



## After the Engine has Started

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

1. Check that the gauges, indicators and alarm are normal.
  - Normal coolant operating temperature is lower than 80°C (176°F).
  - Normal oil pressure at fuel stop power is 0.45 to 0.55 MPa (65 to 80 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 103 or *Troubleshooting Chart* on page 105.

If necessary, consult authorized Yanmar dealer or distributor.

## REMOTE CONTROL HANDLE OPERATION

### Acceleration and Deceleration

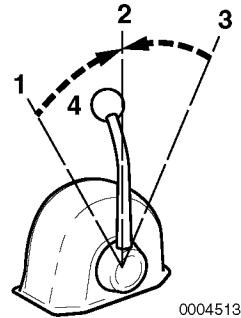


Figure 2

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

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

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

### Shifting the Engine

#### ⚠ 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.

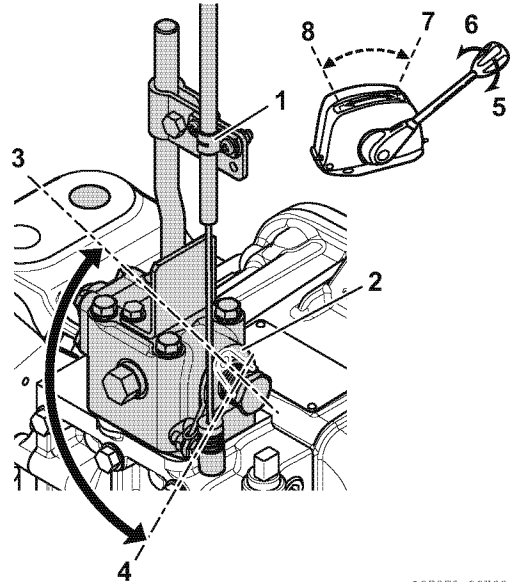
1. Before using the marine gear, be sure to move the throttle handle to a low idle position (less than 1000 min<sup>-1</sup>). Move the throttle handle slowly to a higher speed position after completing marine gear engagement.
2. When moving the handle between FORWARD (**Figure 2, (1 or 3)**) and REVERSE (**Figure 2, (3 or 1)**), bring the handle to NEUTRAL (**Figure 2, (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.
- In case that the marine gear can not be shifted by remote control handle for some reason such as broken cable, remove the cable from shift lever on the marine gear and shift manually by turning the lever.

## Switching to Trolling (KMH50A, KMH50V)

Use the trolling handle to begin trolling. When changing from FORWARD or REVERSE to trolling, the speed of the propeller revolution will be reduced to a minimum.



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**Figure 3**

- 1 – Cable Fitting**
- 2 – Trolling Lever**
- 3 – Low Speed (trolling)**
- 4 – High Speed**
- 5 – Loosen**
- 6 – Tighten**
- 7 – Normal Operation (high speed)**
- 8 – Trolling (low speed)**

1. Operation continues at low engine speed of 1000 min<sup>-1</sup> or less.
2. Reduce the speed by moving the trolling handle from high speed (H) (**Figure 3, (4)**) to low speed (L) (**Figure 3, (3)**). Adjust the speed to the desired rate and secure the trolling handle in place.

3. Before returning to normal operation, be sure to put the trolling handle in high-speed (H) position.
4. Increase engine speed and continue normal operation.

## 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<sup>-1</sup> 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

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- 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.

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- 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.

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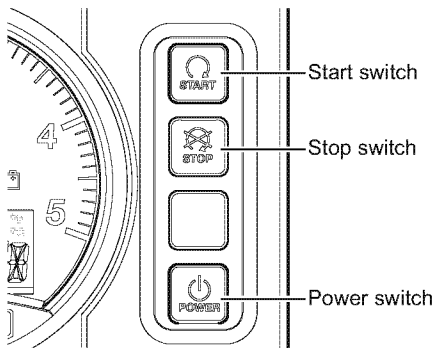
## SHUTTING DOWN THE ENGINE

### 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<sup>-1</sup>) 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 (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.



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**Figure 4**

4. Push and hold the stop switch.  
After the engine has stopped, push the power switch off.

### NOTICE

Continue to hold the stop switch in until the engine is completely stopped. If the switch is released before the engine has completely stopped, it may restart. If the engine does not shut down, see *Engine Auxiliary Stop Switch on page 62 and 63.*

5. Wait 6 seconds or more before turning the battery switch off for secure system settle down.

### NOTICE

- Do not turn the battery switch off before turning the power switch off or immediately after turning off the power switch.
- Turning the battery switch off before secure system settle down may cause alarm to be set at the next activation by turning on the power switch. In an emergency situation, you can start the engine even if the alarm is set. In order to release above alarm, turn off the power switch and wait 6 seconds before turning the power switch on again.

6. Turn off the battery switch (if equipped).
7. Close the fuel cock.

## ENGINE OPERATION

8. Close the seacock (if equipped).

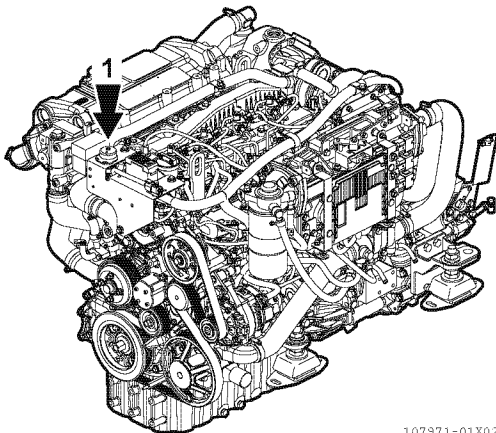
### NOTICE

- 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).

## Engine Auxiliary Stop Switch

### NOTICE

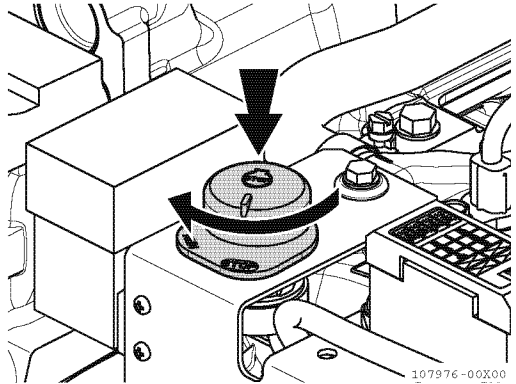
Never use the auxiliary stop switch for a normal engine shutdown. Use this switch only when stopping the engine suddenly in an emergency.



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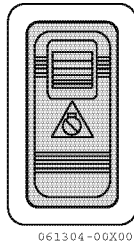
**Figure 5**

1. Pressing the Auxiliary Stop switch on the ECU cover will stop the engine immediately.
2. "AUX STP" will be shown on the LCD of the instrument panel.
3. After the engine has stopped, release the switch by pressing and turning it to the RUN position.



**Figure 6**

**Auxiliary Stop Switch**  
(Option: It is recommended that this switch is installed in an easily accessible location.)



061304-00X00

**Figure 7**

1. Pressing the upper part of the Auxiliary Stop switch will stop the engine immediately.
2. "AUX STP" will be shown on the LCD of the instrument panel.
3. After the engine has stopped, push the bottom part of the switch to release it.

*Note: The engine cannot be started while the Auxiliary Stop switch is pressed. (Auxiliary Stop mode not canceled)*

## NOTICE

- In case of emergency, turning off the battery switch for the engine control unit can also stop the engine immediately.
- You can restart the engine but an alarm may be set up when the power switch is turned on. Unless you are in an emergency situation, in order to release above alarm, turn off the power switch and wait 6 seconds before turning the power switch on again.

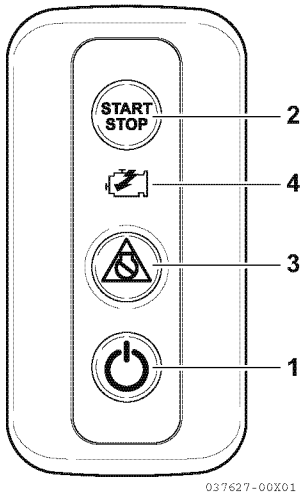
## CHECKING THE ENGINE AFTER OPERATION

- Check that the power 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 41.*
- 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 48.*
- If there is a risk of freezing, drain the seawater system. *See Drain Seawater Cooling System on page 116.*
- At temperatures below 0°C (32°F), drain seawater system and connect the engine heater (if equipped).

## OPERATION (VC10: VESSEL CONTROL SYSTEM)

### Starting the Engine

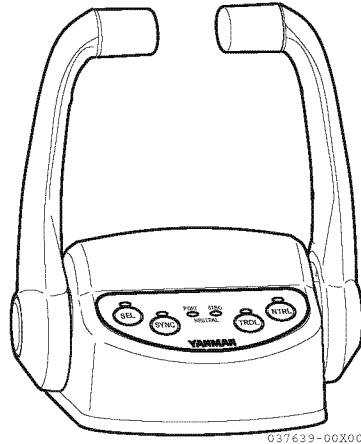
1. Open the seacock (if equipped).
2. Open the fuel tank cock.
3. Turn the battery switch on for engine and engine control system.
4. Press the Power switch on the switch panel of the selected station (**Figure 8, (1)**).
  - The switch panel lamp will come on, and the control head (**Figure 9**) “SEL” lamp (**Figure 10**) will come on or flash.
  - To use the Engine START/STOP switch, be sure to turn the Power switch ON.



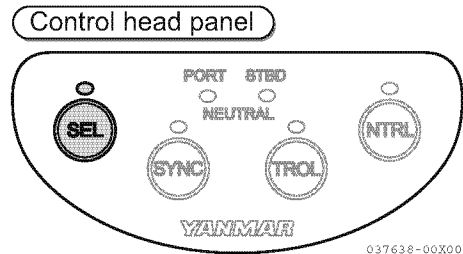
**Figure 8**

5. If the “Sys on by ID” has been set, enter the password into the display.
6. Press the control head “SEL” switch.
  - Wait until the display shows the engine data. The display is shown.

7. If the “Start by ID” has been set, enter the password into the display.
  - The “Start by ID” has been set, the engine can be started in 10 seconds after entering the password into the display.
8. Move the remote control handle to the N (Neutral) position.



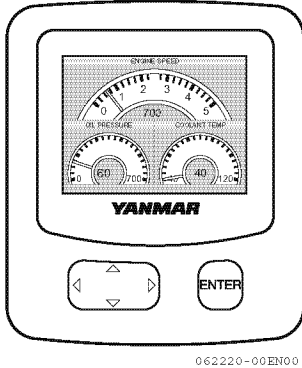
**Figure 9**



**Figure 10**



9. Press the Engine START/STOP switch (**Figure 8, (2)**) and power on the starter.
  - When the engine starts, the VC10 display will show the screen with engine conditions (**Figure 11**).



**Figure 11**

Note:

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

# ENGINE OPERATION

Vessel Control System (VC10) has the following functions, which can be set in the Utility screen of MAIN MENU in the Digital Display. For more details, refer to the Vessel Control System Installation Manual.

## Station Protect

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

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

## Sys on by ID, Start by ID

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

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

## Owner ID Change

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

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

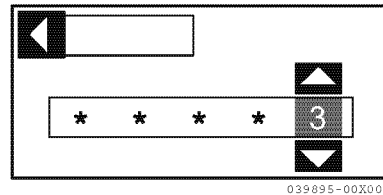


Figure 12

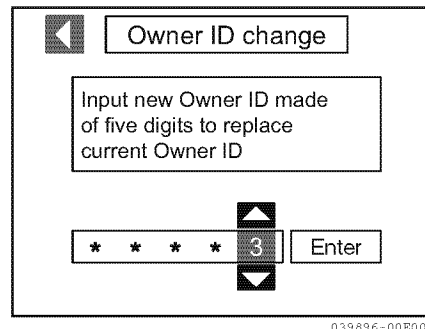


Figure 13

## If the Engine Fails to Start

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

### NOTICE

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: Push and hold the start 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 supply pump. Bleed the air out of the system. *See Bleeding the Fuel System on page 42.*

## Starting at Low Temperatures

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

### NOTICE

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

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

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

## After the Engine has Started

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

1. Check that the gauges, indicators and alarm are normal.
  - Normal coolant operating temperature is lower than 80°C (176°F).
  - Normal oil pressure at fuel stop power is 0.45 to 0.55 MPa (65 to 80 psi).
2. Check for water, fuel or oil leakage from the engine.
3. Check that the smoke color, engine vibration and sound are normal.

## ENGINE OPERATION

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.

## WARM UP MODE (SHIFT DISCONNECT)

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

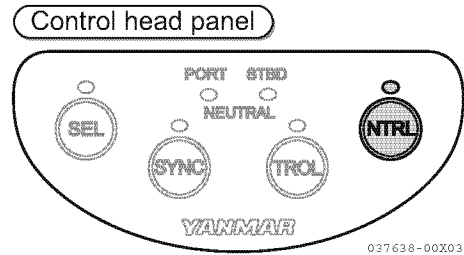


Figure 14

## THROTTLE AND SHIFT CONTROL

### **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.

### Neutral

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

### Forward

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

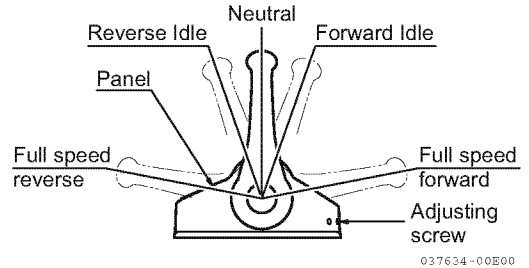
### Reverse

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

### Forward (Reverse) to Reverse (Forward)

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

*Note: The force required to move the throttle or shift handles can be adjusted with the Adjusting Screw.*

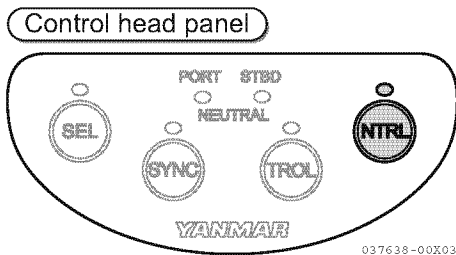


**Figure 15**

## ENGINE SPEED LIMIT MODE

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

*Note: The setting value can be set by the VC10 display. The default value is 50 %.*



**Figure 16**

## 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<sup>-1</sup> 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.

- 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.

### SHUT-DOWN THE ENGINE (STOPPING)

Stop the engine in accordance with the following procedures:

#### Normal Stopping

1. Move the remote control handle to the N (Neutral) position. (The NEUTRAL lamp will come on.)
2. Cool the engine down at low speed (below 1000 min<sup>-1</sup> (rpm)) for about 5 minutes.

#### NOTICE

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

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

#### CAUTION

**Do not press the Engine START/STOP switch when the engine is stopped. The engine will restart.**

5. Wait 6 seconds or more before turning the battery switch off for secure system settle down.

#### NOTICE

- Do not turn the battery switch off before turning the power switch off or immediately after turning off the power switch.
- Turning the battery switch off before secure system settle down may cause alarm to be set at the next activation by turning on the power switch. In an emergency situation, you can start the engine even if the alarm is set. In order to release above alarm, turn off the power switch and wait 6 seconds before turning the power switch on again.

6. Turn the battery switch off for engine and engine control system.
7. Close the fuel tank cock.
8. Close the seacock.

#### CAUTION

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

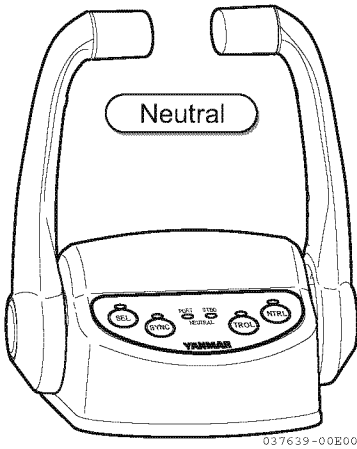


## Emergency Stop

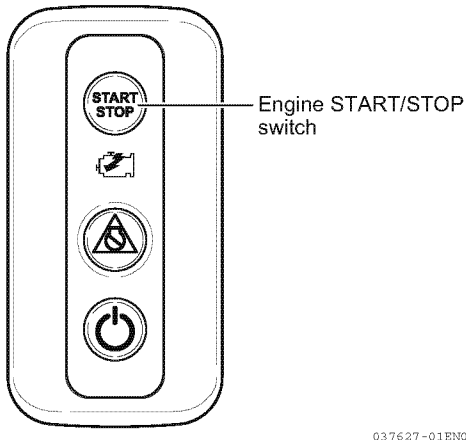
### Electric Emergency Stop

#### **NOTICE**

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



**Figure 17**

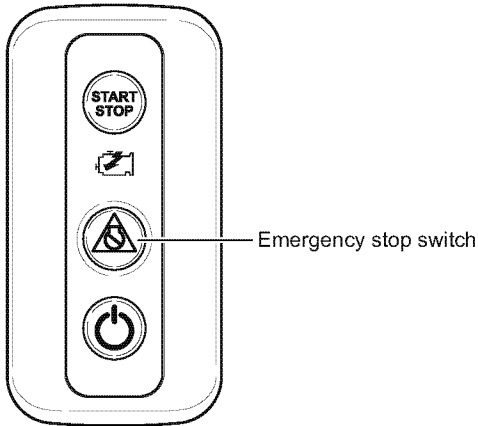


**Figure 18**

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

*Note:*

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



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**Figure 19**

## NOTICE

- In case of emergency, turning off the battery switch for the engine control unit can also stop the engine immediately.
- You can restart the engine but an alarm may be set up when the power switch is turned on. Unless you are in an emergency situation, in order to release above alarm, turn off the power switch and wait 6 seconds before turning the power switch on again.

## CONTROL THE BACKUP PANEL

### ⚠ WARNING

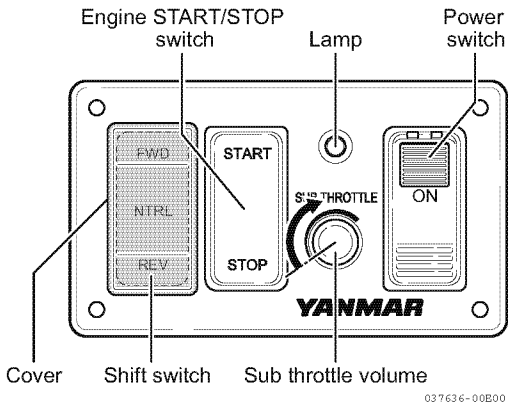
**Only use this in an emergency.**

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

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

## NOTICE

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



**Figure 20**

## CHECKING THE ENGINE AFTER OPERATION

- Check that the power 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 41.*
- 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 48.*
- If there is a risk of freezing, drain the seawater system. *See Drain Seawater Cooling System on page 116.*
- At temperatures below 0°C (32°F), drain seawater system and connect the engine heater (if equipped).

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# PERIODIC MAINTENANCE

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## 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 86.*

### 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 750 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).



## **EPA MAINTENANCE REQUIREMENTS**

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations for Engines, it is essential that you follow the *Periodic Maintenance Schedule on page 84* and the *Periodic Maintenance Procedures on page 86*.

### **EPA Requirements for USA and Other Applicable Countries**

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

## PERIODIC MAINTENANCE

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### Environmental Condition for operation and maintenance

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

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

The diesel fuel should be:

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

The lubricating oil should be:

- API Service Categories CD, CF, CF-4, CI and CI-4.

Be sure to perform inspections as outlined in *Periodic Maintenance Procedures* on page 86 and keep a record of the results.

Pay particular attention to these important points:

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

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

## **Inspection and Maintenance**

Inspection and maintenance procedures are covered in *Periodic Maintenance Schedule on page 84*.

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

## **Installation of Exhaust Sampling Port**

All engines subject to emission standards shall be equipped with a connection in the engine exhaust system that is located downstream of the engine, and before any point at which the exhaust contacts water (or any other cooling / scrubbing medium), for the temporary attachment of gaseous and / or particulate emissions sampling equipment. This connection shall be internally threaded with standard pipe threads of a size not larger than 12.7 mm (0.5 in.), and shall be closed by a pipe plug when not in use. Equivalent connections are allowed.

The instructions for the proper installation and location of the required sample port, in addition to those specified above in the quoted federal regulation, are as follows:

1. The connection should be located as far downstream as reasonably practicable from any sharp bend (of 30 degrees or more) in the exhaust pipe to help ensure that a well-mixed exhaust flow sample may be taken;
2. The requirement that the connection be located before any point at which the exhaust contacts water (or any other cooling / scrubbing medium) does not include contact with water used to cool exhaust manifolds, unless the water is allowed to come into direct contact with the exhaust gases;
3. To allow ready access to the sample port, the connection should be located, if possible given the constraints of vessel design, approximately 0.6 to 1.8 m (2 to 6 ft) above a deck or walkway;
4. To facilitate insertion and withdrawal of an exhaust sample probe, there should be no obstructions for at least one and one-half exhaust pipe / stack diameters perpendicular, i.e., 90 degrees, from the sample port; and
5. If a threaded connection is used, both the internal and external threads should be coated with a high-temperature, anti-seize compound before the initial installation and at every subsequent re-installation to facilitate removal of the connection for testing.

## 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 ●.*

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

System	Item	Periodic Maintenance Interval				
		Daily <i>See Daily Checks on page 86.</i>	Every 50 hours or monthly which-ever comes first	Every 250 hours or 1 year which-ever comes first	500 hours or 2 years which-ever comes first	750 hours or 4 years which-ever 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			◇		
Lubricating System (Engine)	Check the lube oil level	○				
	Replace the lube oil		◇ Initial 50	◇		
	Replace the oil filter element		◇ Initial 50	◇		
Lubricating System (Marine Gear)	Check the lube oil level	○				
	Replace the lube oil		◇ Initial 50	◇		
	Cleaning the Marine Gear Oil Strainer		◇ Initial 50	◇		
Stern Drive system	Check the Stern drive oil	○	Refer to the Stern drive system operation manual			
	Check power steering oil	○				
	Check power trim oil	○				

# 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 86.</i>	Every 50 hours or monthly which-ever comes first	Every 250 hours or 1 year which-ever comes first	500 hours or 2 years which-ever comes first	750 hours or 4 years which-ever comes first
Cooling System	Seawater outlet	○ During Operation				
	Check coolant level	○				
	Check or replace the seawater pump impeller			○		◇
	Replace coolant	Every year. When Long Life Coolant is used, replace every 2 years. <i>See Engine Coolant Specifications on page 48.</i>				
	Clean and check the seawater passages					●
	Replace zinc anode			◇		
Air Intake and Exhaust System	Clean intake silencer (air cleaner) element			○		
	Clean or replace the exhaust/water mixing elbow			○	◇	
	Wash the turbocharger blower			●		
	Replace the lagging of turbo-charger (4LV150, 4LV170, 4LV195 only)					●
Electrical System	Check the alarm and indicators	○				
	Check the electrolyte level in the battery		○			
	Check the belt damage			○		
	Check the wiring connectors			○		
Engine Cylinder Head and Block	Check for leakage of fuel, engine oil and engine coolant	○ After starting				
Miscellaneous Items	Check the remote control cable operation		○ Initial 50			●
	Adjust the propeller shaft alignment		● Initial 50			●
	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

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### PERIODIC MAINTENANCE PROCEDURES

#### WARNING

##### **Exposure Hazard.**

Always wear personal protective equipment when performing periodic maintenance procedures.

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#### 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.

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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 92*. 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 87*.

#### **NOTICE**

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

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#### Check Diesel Fuel, Engine Oil and Engine Coolant Levels

Follow the procedures in *Diesel Fuel on page 38*, *Engine Oil on page 43* and *Engine Coolant on page 48* 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 93.

## Checking the Alternator Belt

Check the belt tension before use. See *Check the belt damage* on page 100.

## 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 90.

## 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 18.

## Preparing Fuel, Oil and Coolant in Reserve

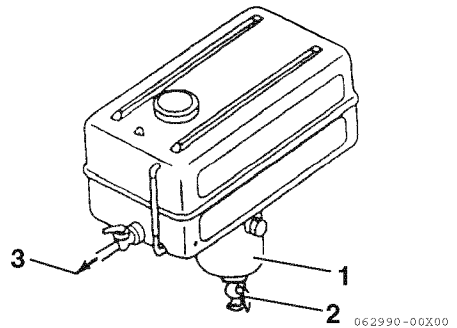
Prepare sufficient fuel for the days operation. Always store engine oil and coolant in reserve (for at least one refill) onboard, to be ready for emergencies.

## 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**
- **Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer**
- **Checking and Adjusting the Remote Control Cables**
- **Adjusting Propeller Shaft Alignment**

### Draining the Fuel Tank



**Figure 1**

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

## PERIODIC MAINTENANCE

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

### Changing the Engine Oil 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.**

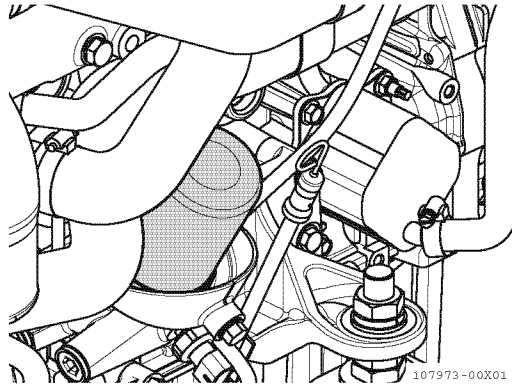
**If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned. Always wear eye protection.**

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**

4. Install a new filter element and tighten by hand until the seal touches the housing.
5. Turn filter an additional 3/4 turn clockwise with a filter wrench.
6. Fill with new engine oil. *See Adding Engine Oil on page 45.*

#### **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.

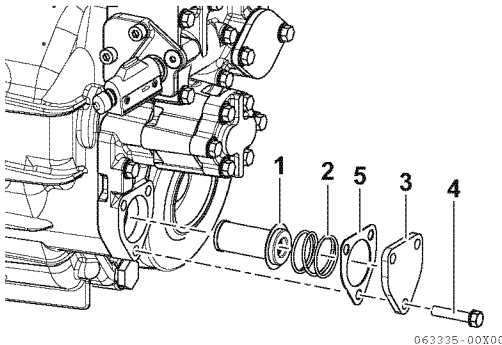
7. Perform a trial run and check for oil leaks.
8. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.



**NOTICE**

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

**Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer**



**Figure 3**

*Note: 4LV engines with KMH50A marine gear shown. Refer to the Operation Manual for the marine gear for procedure.*

1. Remove cap from the filler port and attach an oil drain pump. Drain marine gear oil.

**NOTICE**

Always be environmentally responsible.

2. **KMH50A or KMH50V Marine Gear:**  
Clean the marine gear oil strainer:
  - (a) Remove side cover (**Figure 3, (3)**) and remove the strainer (**Figure 3, (1)**).

- (b) Clean the strainer thoroughly with kerosene or clean diesel fuel.
  - (c) Hold the strainer in place with the coil spring (**Figure 3, (2)**) and insert into the case. Install a new gasket (**Figure 3, (5)**) in the side cover.
  - (d) Install side cover and tighten side cover bolts.
3. Fill marine gear with clean marine gear oil. See *Marine Gear Oil Specifications* on page 45.
  4. Perform a trial run and check for oil leaks.
  5. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

## PERIODIC MAINTENANCE

### Checking and Adjusting Remote Control Cables

#### 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.

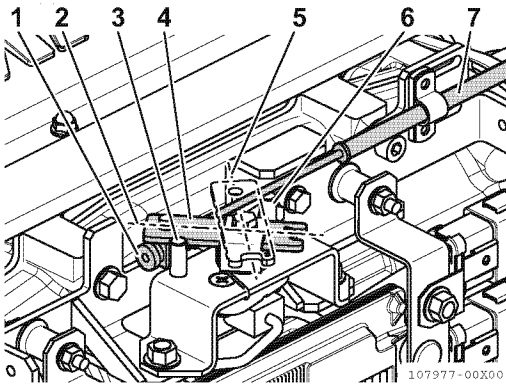


Figure 4

- 1 – Adjustment screw
- 2 – Low-speed stop position
- 3 – Low-speed stop pin
- 4 – Control lever
- 5 – High-speed stop position
- 6 – High-speed stop pin
- 7 – Cable

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

#### Adjusting Marine Gear Remote Control Cable

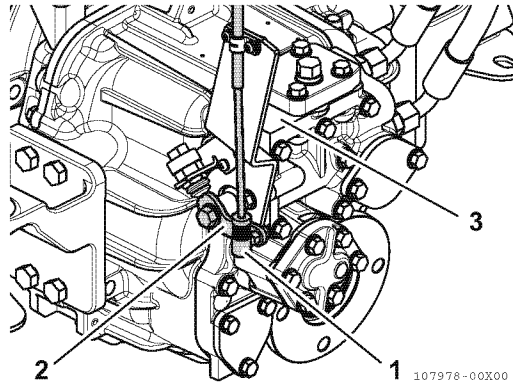
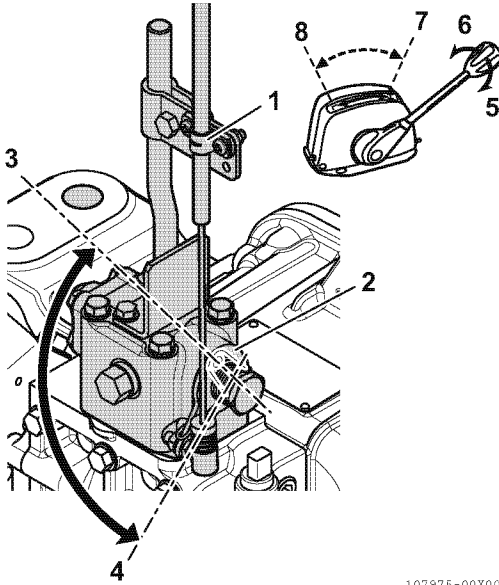


Figure 5

Note: KMH50A marine gear shown.

1. Ensure that the remote control lever (**Figure 5, (2)**) moves to the correct position when the remote control handle is in the NEUTRAL, FORWARD and REVERSE positions. Use the NEUTRAL position as the standard for adjustment.
2. To adjust, loosen and retighten the cable fitting (**Figure 5, (1)**).

**Adjusting Trolling Remote Control Handle - If Equipped**



**Figure 6**

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*Note: KMH50A marine gear shown.*

- 1 – Cable Fitting
- 2 – Trolling Lever
- 3 – Low Speed (trolling)
- 4 – High Speed
- 5 – Loosen
- 6 – Tighten
- 7 – Normal Operation (high speed)
- 8 – Trolling (low speed)

1. Ensure that the trolling lever (**Figure 6, (2)**) is in the high-speed (**Figure 6, (4)**) position when the trolling remote control handle is in high-speed position (**Figure 6, (7)**).
2. Ensure that the trolling lever is in the low-speed (**Figure 6, (3)**) position when the trolling remote control handle is in low-speed position (**Figure 6, (8)**).
3. To adjust, loosen the adjustment screw of the cable fitting (**Figure 6, (1)**) and adjust the position of the cable.

**Adjusting Propeller Shaft Alignment**

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

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

Check for any unusual noise and vibration in the engine/boat hull, while increasing and decreasing the engine speed gradually.

If there is unusual noise and/or vibration, this maintenance requires specialized knowledge and techniques. Consult authorized Yanmar Marine dealer or distributor to adjust the propeller shaft alignment.

## 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.**

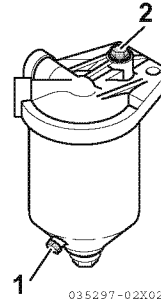
When removing any fuel system component to perform maintenance (such as changing the fuel filter), put an approved container under the opening to catch the fuel.

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 7**

1. Close the fuel tank cock.
2. Loosen the drain plug (**Figure 7, (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 7, (2)**).
4. Be sure to bleed air from the fuel system. See *Bleeding the Fuel System* on page 42.

## 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.

### **NOTICE**

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.

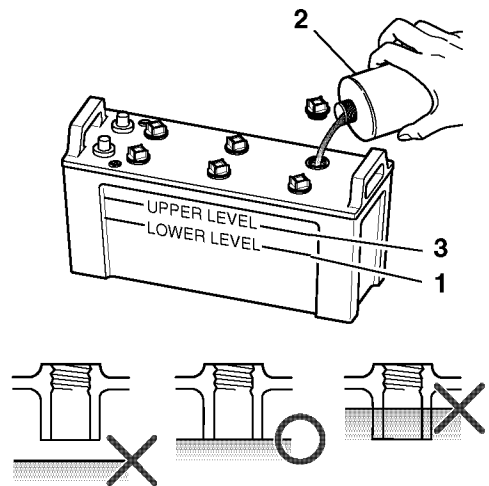
1. Turn off the battery switch (if equipped) or disconnect the negative (-) battery cable.
2. Do not operate with insufficient battery electrolyte, as the battery will be destroyed.

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 8, (1)**), fill with distilled water (**Figure 8, (2)**) (available in the grocery store) up to the upper limit (**Figure 8, (3)**) of the battery.



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**Figure 8**

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

### 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
- Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer
- Checking or Replacing the Seawater Impeller
- Changing the Coolant
- Changing or Replacing Zinc Anodes
- Cleaning the Intake Silencer (Air Cleaner) Element
- Cleaning the Exhaust/Water Mixing Elbow
- Wash the Turbocharger blower
- Check the belt damage
- Checking the Wiring Connectors

#### Draining the Fuel Tank

See *Draining the Fuel Tank* on page 87.

### 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.

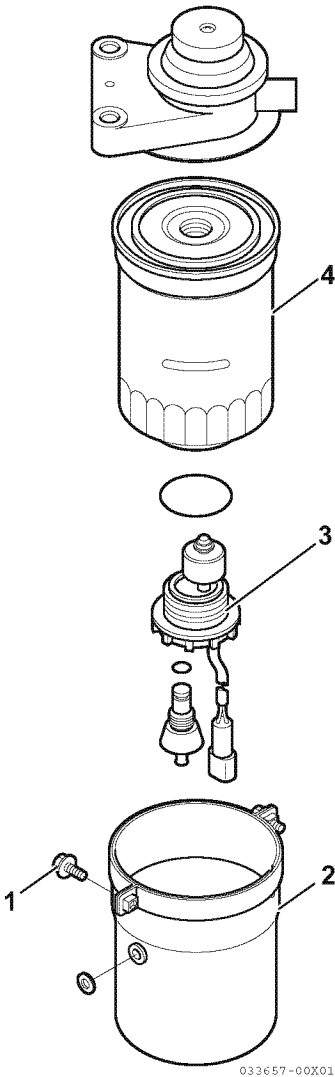
Never use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive. Wipe up any spills immediately.

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#### **Exposure Hazard.**

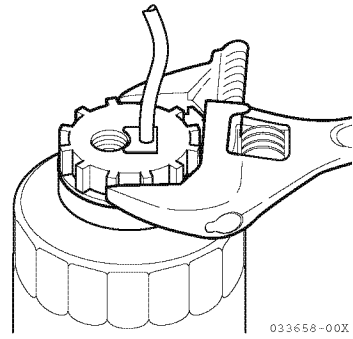
*Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.*

---



**Figure 9**

1. Close the fuel cock of the fuel tank.
2. Remove the two mounting screws (**Figure 9, (1)**) and the housing (**Figure 9, (2)**).
3. Drain the fuel from the fuel drain cock on the bottom of the fuel/water separator.
4. Disconnect the alarm switch harness.



**Figure 10**

5. Remove the alarm switch (**Figure 9, (3)**) and (**Figure 10**) with a wrench.
6. Remove the filter element (**Figure 9, (4)**) with a filter wrench.
7. Install the alarm switch to the new fuel filter.

Component	Part No.
Fuel Filter Element	120670-55110

8. Apply a thin film of clean diesel fuel to the sealing surface of the new filter gasket.
9. Install new filter and hand-tighten. Use a filter wrench and tighten to 14.7 - 19.6 N·m (10.8 - 14.5 lb-ft).
10. Connect the alarm switch harness.
11. Install the housing and mounting screws.
12. Bleed the fuel system.  
*See Bleeding the Fuel System on page 42. Dispose of waste properly.*

## PERIODIC MAINTENANCE

### 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 88.

### Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer

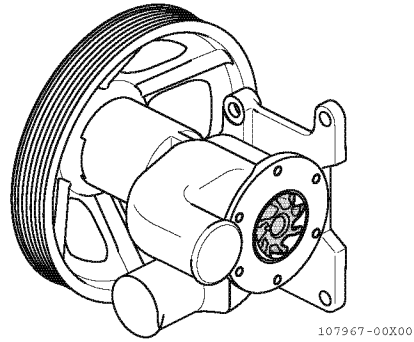
See *Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer* on page 89.

### 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.
  - Side cover is excessively worn. Replace new parts.
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

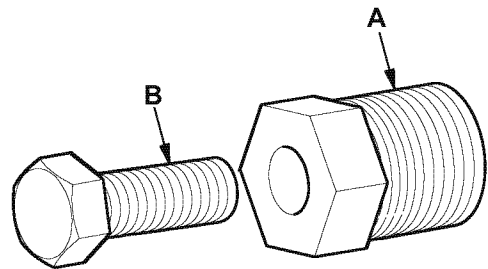
*Note: The impeller must be replaced periodically (750 hours) even if there is no damage.*



**Figure 11**

Special service tools for removing the impeller:

#### Puller A (standard)



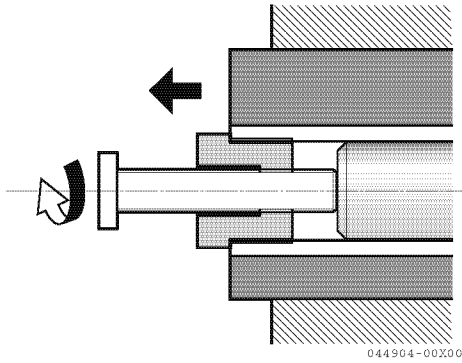
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**Figure 12**

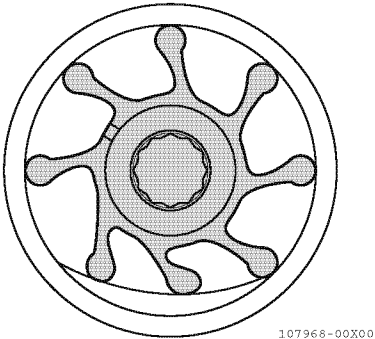
Puller A	Jack Screw B
M16x2	M10x40 mm length

1. Remove the side cover of the seawater pump.
2. Install puller (**Figure 12, (A)**) in the impeller.
3. Turn the jack screw (**Figure 12, (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 14**)





**Figure 13**



**Figure 14**

*Note: When replacing a used impeller with a new one, the impeller must have an M16x2 thread (Figure 13). Turn the M16 screw side of the impeller to the cover side and install.*

## 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.**

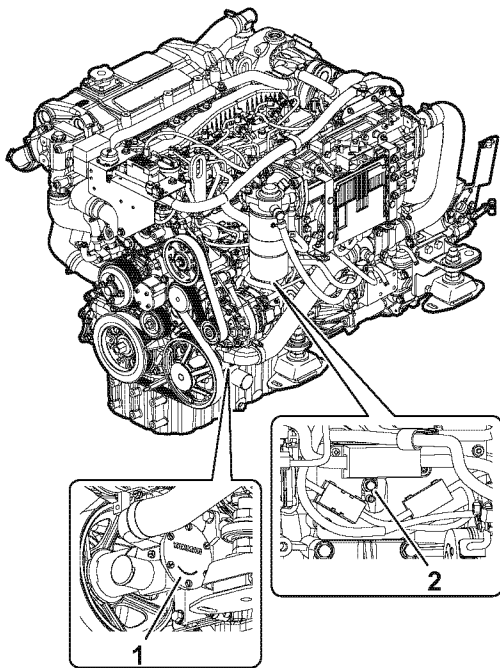
Change the coolant every year.

### **NOTICE**

Never mix different types and/or colors of coolants.

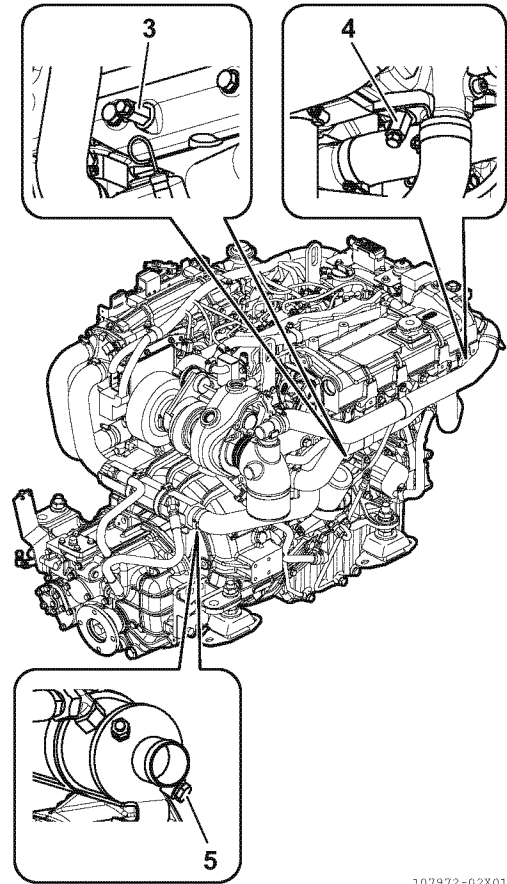
Discard old coolant in an approved manner according to environmental laws.

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



**Figure 15**

- 1 – Seawater pump  
(Drain from pump cover)
- 2 – Coolant drain cock  
(Cylinderblock)



**Figure 16**

- 3 – Coolant drain cock  
(Exhaust manifold)
- 4 – Seawater drain cock  
(Coolant tank/Heat exchanger)
- 5 – Seawater drain plug  
(Marine gear oil cooler)

*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 48* and *Checking and Adding Coolant on page 49*.

## 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 116*.



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**Figure 17**

3. Remove all the plugs (**Figure 18**) labeled ZINC (**Figure 17**).

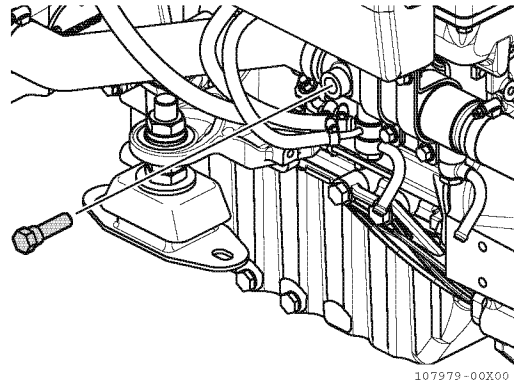
4. Measure the remaining zinc in the plug. Replace the zinc anode when it is less than one-half its original size. See chart for sizes.
5. Install a new zinc in a new plug.

### 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.

## Fuel Oil cooler



**Figure 18**

## 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.

## PERIODIC MAINTENANCE

### 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.

### Check the belt damage

#### Inspecting V-Ribbed Belt

1. Visually check the belt for excessive wear, frayed cords, etc.  
If any defects are found, replace the V-ribbed belt.
2. Check that the belt fits properly in the ribbed grooves.

### NOTICE

Confirm by hand that the belt has not slipped out of the grooves on the bottom of the pulley.

Checks on the rib side of the belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

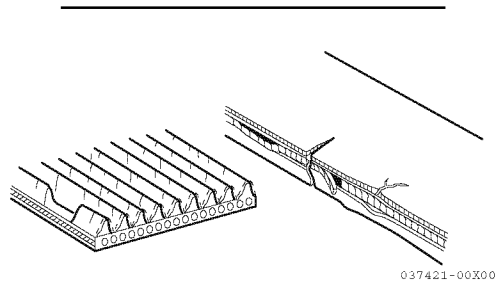
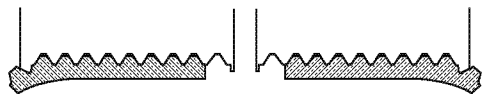


Figure 19



CORRECT



INCORRECT

037422-00EN00

Figure 20

### Checking the Wiring Connectors

Consult authorized Yanmar Marine dealer or distributor.

### 500 Hours of Operation

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

- **Replacing the Exhaust/Water Mixing Elbow**
- **Replacing Rubber Hoses**

#### Replacing the Exhaust/Water Mixing Elbow

Replace the mixing elbow with a new one 500 hours or every 2 years, whichever comes first, even if no damage is found.

Consult authorized Yanmar Marine dealer or distributor.

#### Replacing Rubber Hoses

Replace rubber hoses every 2 years.

Consult authorized Yanmar Marine dealer or distributor.

### 750 Hours of Operation

Perform the following maintenance 750 hours or 4 years of operation, whichever comes first.

- **Replacing the Seawater Pump Impeller**
- **Cleaning and Checking the Seawater Passages**
- **Replacing the Lagging of Turbo-charger (4LV150, 4LV170, 4LV195 only)**
- **Checking the Remote Control Cable Operation**
- **Adjusting the Propeller Shaft Alignment**

#### Replacing the Seawater Pump Impeller

The seawater impeller must be replaced 750 hours even if it is not damaged.

*See Checking or Replacing Seawater Pump Impeller on page 96.*

## PERIODIC MAINTENANCE

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### 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 seawater 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.

### Replacing the Lagging of Turbo-charger (4LV150, 4LV170, 4LV195 only)

Consult your authorized Yanmar Marine dealer or distributor.

Component	Part No.
Lagging of turbo-charger	120672-18381

### Checking the Remote Control Cable Operation

Consult authorized Yanmar Marine dealer or distributor.

### Adjusting the Propeller Shaft Alignment

Consult authorized Yanmar Marine dealer or distributor.

# TROUBLESHOOTING

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## 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 42*.

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 105* 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 hour meter), age of boat
- The operating conditions when the problem occurs:
  - Engine speed (min<sup>-1</sup>)
  - 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
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.	
<b>Engine does not start or starts with difficulty</b>		
Pinion gear does not engage	Loose terminal of battery/engage magnet	Tighten
	Poor contact of starting switch	Correct with sandpaper or replace
	Open coil of magnet switch	Replace
	Burr at gear tooth tip	Correct
	Poor clearance between pinion and ring gear	Correct
Pinion gear is engaged with ring gear, but does not rotate	Loose battery/starter terminal	Tighten
	Poor contact of starting switch	Correct with sandpaper or replace
	Worn brush	Replace
	Open circuit of starter coil	Replace
	Slippage of starter/clutch	Replace
	Excessive resistance of cable between battery and starter	Increase the cable size or shorten
	Insufficient battery charge	Charge
No fuel injection	Incomplete priming of fuel system	Carry out sufficient priming
	Clogged fuel inlet filter	Replace
	Fuel level in fuel tank is low	Add fuel
	Closed cock of fuel tank	Open cock
	Clogged fuel pipe	Clean
	Failure of fuel supply pump	Repair or replace
Failure of fuel injector	Faulty valve seat	Replace
	Sticking of nozzle	Replace
	Worn nozzle	Replace
	Clogged injection hole	Replace
Failure in fuel injection system	Loose fuel injection pipe joint	Tighten
	Broken fuel injection pipe	Replace
	Air trapped in fuel injection pipe	Bleed air from pipe
Engine compressed air leak	Air leak from exhaust valve	Carry out fitting of valve and seat
	Faulty gasket/packing	Replace
	Worn upper portion of cylinder	Replace
	Worn piston ring	Replace
	Sticking piston ring	Overhaul or replace
	Broken valve spring	Replace
No revolution indication on Tachometer during cranking.	Poor connection of crank & cam position sensors.	Check connection of the wire harness
Other	Failure of engine system	Conduct servicing
	Clogged intake or exhaust pipe	Clean
	Controller defects system error	Check DTC and conduct servicing

# TROUBLESHOOTING

Symptom	Probable Cause	Measure
<b>Engine is not running smoothly</b>		
Operation failure of injection valve	Nozzle operation failure	Replace
	Broken fuel valve spring	Replace
Uneven fuel injection quantities	Clogged fuel filter	Replace
	Faulty operation of regulator valve	Replace
	Air trapped in fuel injection system	Bleed air from system and prime system
	Faulty operation of fuel supply pump	Repair
Other	Overload operation	Reduce load
	Moving parts seized	Disassemble, inspect and conduct servicing
	Slippage of gear box	Inspect and repair
<b>Engine stops suddenly</b>		
No fuel feed	Fuel level in fuel tank is low	Add fuel and prime
	Air trapped in fuel system or fuel injection	Bleed air
	Water trapped in fuel tank	Drain water from drain cock and fuel pipe, conduct priming
	Fuel cock closed	Inspect and repair as necessary
	Clogged fuel filter	Replace
	Broken fuel pipe	Replace
	Failure of fuel supply pump	Replace
Other	Moving parts seized	Disassemble and repair, or replace
	Controller defects system error	Inspect DTC and conduct servicing
<b>Abnormal smoke color</b>		
Failure of fuel injector	Clogged injection nozzle	Replace
	Sticking needle valve	Replace
	Reduction in injection pressure	Replace
	Poor atomization	Replace
	Carbon deposit	Clean
Turbo-charger failure (If equipped)	Clogged air cleaner	Clean
	Dirty compressor side	Clean
	Clogged turbine side	Clean
	Damaged bearing	Replace
Other	Overload operation	Reduce load
	Lubricant level too high	Lower the oil level
	Accumulated carbon deposit at intake/exhaust valve	Clean
	Dirty air cooler (If equipped)	Clean
	Improper fuel	Replace with proper fuel
	Clogged intake/exhaust valve	Clean

Symptom	Probable Cause	Measure
<b>Insufficient output</b>		
Insufficient fuel injection	Oil leak from fuel injection pipe joint	Tighten
	Clogged fuel filter	Replace
	Clogged fuel pipe	Clean
	Failure of fuel supply pump	Repair
Insufficient injection by fuel injection nozzle	Clogged injection hole	Replace
	Faulty valve seat	Replace
	Sticking nozzle	Replace
	Loose fuel injection pipe joint	Tighten
	Worn nozzle	Replace
Compressed gas leak in the engine cylinder	Gas leak from intake/exhaust valve	Conduct fitting of the valve
	Worn upper portion of cylinder bore	Lap or replace
	Worn piston ring	Replace
	Sticking piston ring	Overhaul or replace
Turbo-charger failure (If equipped)	Clogged air cleaner	Clean
	Dirty compressor side	Clean
	Clogged turbine nozzle	Clean
	Damaged bearing	Replace
Other	Improper fuel	Replace with correct fuel
	Clogged exhaust duct	Clean
	Seized or overheated moving parts	Disassemble and conduct servicing
	Insufficient seawater	Inspect seawater pump
	Insufficient feed of engine oil	Disassemble and clean engine oil pump and filter
	Controller defects system error	Inspect DTC and conduct servicing
<b>Knocking</b>		
Failure of fuel injector	Broken fuel valve spring	Replace
	Sticking nozzle	Replace
	Poor atomization	Replace
Other	Insufficient seawater	Replace seawater pump impeller
	Piston clearance excessive	Replace
	Bearing clearance excessive	Replace
	Improper fuel	Replace with correct fuel
	Water trapped in fuel	Replace fuel
	Poor compression	Inspect and service

# TROUBLESHOOTING

Symptom	Probable Cause	Measure	
<b>Breakdown of turbo-charger (If equipped)</b>			
Drop in intake pressure	Dirty air cleaner	Clean	
	Leak from intake piping	Repair	
	Leak of exhaust gas	Repair	
	High intake air temperature	Complete thermal insulation of exhaust pipe	
		Ensure intake air path is unrestricted from outside air	
		Clean air cleaner	
	Drop in air pressure in engine room	Ensure intake air path is unrestricted from outside air	
	Broken turbine impeller	Replace	
	Dirty turbine impeller	Clean	
Clogged exhaust pipe	Clean		
Abnormal vibration	Broken turbine impeller	Replace	
	Broken compressor impeller	Replace	
	Deposit of carbon or oxides on turbine	Remove and repair or replace	
	Broken bearing	Replace	
	Bent turbine shaft	Replace	
	Loose parts or fasteners	Tighten	
Noise	Damaged bearing	Replace	
	Contact by revolving parts	Repair or replace	
	Dirty or carbon deposit on turbine and compressor	Clean	
	Entrapment of foreign matter (at turbine entrance)	Repair or replace	
	Rapid change in load (surging)	Stabilize the load or replace turbine nozzle	
Quick contamination of engine oil	Gas trapped in bearing housing	Repair	
	Clogged seal air path	Clean	
	Damaged seal ring	Replace	
	Clogged pressure balance path	Clean	
Pulsation of intake air pressure	Uneven cylinder combustion	Adjust for uniform combustion	
	Rapid change in load	Operate correctly	
	Excessively dirty compressor side	Clean	
	Intake temperature too high	Clean cooling fin	
		Complete thermal insulation of exhaust pipe	
Ensure intake air path is unrestricted from outside air			
Other	Bearing seizure	Replace	
	Corrosion in compressor/turbine impeller or bearing housing	Increase the coolant temperature	
<b>Other malfunctions</b>			
Noise generation	Loose flywheel set bolts	Tighten bolts	
	Loose connecting rod bolts	Tighten bolts	
	Worn crank pin	Replace	
	Excessive gear backlash	Inspect the gear; replace worn gear, shaft, and/or bushing with new ones	

Symptom	Probable Cause	Measure
Low lubrication oil pressure	Clogged engine oil filter	Replace
	Engine oil temperature too high	Check the coolant level
	Failure of oil pump	Overhaul or replace
	Faulty operation of oil pump relief valve	Tighten the adjusting valve
		Replace the safety valve
	Low viscosity of engine oil used	Replace the engine oil
	Insufficient engine oil quantity	Add oil
Faulty pressure switch	Replace	
Coolant temperature too high	Insufficient seawater	Check seawater system
	Faulty thermostat	Replace
	Loose drive belt of coolant pump	Adjust the belt tension
	Overloaded operation	Decrease the load
Other	Controller defects system error	Inspect and conduct servicing

Symptom	Probable Cause	Measure	Reference
<b>Indicators Do Not Go On:</b>			
<ul style="list-style-type: none"> <li>The tachometer does not turn on, even though the power switch is turned on</li> </ul>	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"> <li>One of the indicators does not go out</li> </ul>	Sensor switch is faulty.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> <li>Battery low charge indicator does not go out during operation</li> </ul>	V-ribbed belt is loose or broken.	Replace V-ribbed belt or adjust tension.	<i>See Check the belt damage on page 100</i>
	Battery is defective.	Check battery fluid level, specific gravity or replace battery.	<i>See Checking the Battery Electrolyte Level (Serviceable Batteries Only) on page 93</i>
	Alternator power generation failure.	Consult authorized Yanmar Marine dealer or distributor.	-
<ul style="list-style-type: none"> <li>Instrument panel does not turn on, even though the power switch is turned on</li> </ul>	No electrical current available. The battery switch for the engine control system is turned off, the fuse(10A) in the fuse box is burned out or the circuit is broken.	Consult authorized Yanmar Marine dealer or distributor.	-
<b>Starting Failures:</b>			
<ul style="list-style-type: none"> <li>Starter does not turn or turns slowly (engine can be turned manually)</li> </ul>	Faulty starter relay	Consult authorized Yanmar Marine dealer or distributor.	-
	The fuse(50A) near the starter is burned out or the circuit is broken.	Consult authorized Yanmar Marine dealer or distributor.	-
	Faulty marine gear position.	Shift to NEUTRAL and start.	-
	Faulty safety switch device.	Consult authorized Yanmar Marine dealer or distributor.	-

# FAILSAFE DIAGNOSIS FUNCTIONAL SPECIFICATION CHART

## Fail-safe Actions

Level 1: Engine speed is limited to 2500 min<sup>-1</sup> or less

Level 2: Engine speed is limited to 1500 min<sup>-1</sup> or less

Level 3: Engine speed is kept low idle

DTC	SPN	FMI	With FFD	DTC Description	Fail-safe Action							Note
					Warning	Level 1	Level 2	Level 3	ENG Stop	Others		
P0016	522401	12		Crank & Cam Shaft Speed Sensor Error - Abnormal correlation	x							
P0087	157	10		Rail Pressure Deviation Too Low	x		x					
P0088	157	0	x	Rail Pressure Too High	x		x					
P0093	157	1	x	Rail Pressure Deviation Error - Fuel Leakage	x		x					
P0110	105	3		Charge Air Temperature Sensor High Input	x							Charge Air Temperature is fixed 170 degrees C.
		4		Charge Air Temperature Sensor Low Input	x							
P0115	110	3		Coolant Temperature Sensor High Input	x							Engine is controlled with calculated intake air temperature.
		4		Coolant Temperature Sensor Low Input	x							
P0120	91	3		Main Analog Throttle Sensor High Input	x							Engine can be controlled by Sub Throttle Sensor.
		4		Main Analog Throttle Sensor Low Input	x							
		12		CAN Throttle Sensor Error	x							
P0190	157	3		Rail Pressure Sensor 1 High Input	x	x	x*					*: If P0192 is also detected, Level 2 is applied.
		4		Rail Pressure Sensor 1 Low Input	x	x	x*					
P0191	157	2		Rail Pressure Sensor 1 & 2 Deviation Error	x		x					
P0192	129	3		Rail Pressure Sensor 2 High Input	x	x	x*					*: If P0190 is also detected, Level 2 is applied.
		4		Rail Pressure Sensor 2 Low Input	x	x	x*					
P0201	651	5		Injector 1 Error - Open / Short Circuit	x	x						Only abnormal Injector is stop injection.
P0202	652	5		Injector 2 Error - Open / Short Circuit	x	x						
P0203	653	5		Injector 3 Error - Open / Short Circuit	x	x						
P0204	654	5		Injector 4 Error - Open / Short Circuit	x	x						
P0217	110	0	x	Coolant Temperature Too High	x	x						
P0219	190	0	x	Engine Overspeed Condition	x				x			
P0220	29	3		Sub Throttle Sensor High Input	x					x		Engine speed is fixed 1,000min <sup>-1</sup> .
		4		Sub Throttle Sensor Low Input	x					x		
P0234	102	0	x	Charge Air Pressure Too High	x	x						
P0235	102	1		Charge Air Pressure Too Low	x							Charge Air Pressure is fixed 200kPa.
		3		Charge Air Pressure Sensor High input	x	x						
		4		Charge Air Pressure Sensor Low input	x	x						
P0301	651	2		Injector 1 Error - Abnormal injection	x							
P0302	652	2		Injector 2 Error - Abnormal injection	x							
P0303	653	2		Injector 3 Error - Abnormal injection	x							
P0304	654	2		Injector 4 Error - Abnormal injection	x							
P0335	637	2		Crankshaft Speed Sensor Error - No Signal	x			x				
		3		Crankshaft Speed Sensor High Input	x							
		4		Crankshaft Speed Sensor Low Input	x							
		5		Crankshaft Speed Sensor Error - No Signal at starting	x			x				

DTC	SPN	FMI	With FFD	DTC Description	Failsafe Action							Note
					Warning	Level 1	Level 2	Level 3	ENG Stop	Others		
P0340	522401	3		Camshaft Speed Sensor High Input	x	x						
		4		Camshaft Speed Sensor Low Input	x	x						
		5		Camshaft Speed Sensor Error - No Signal at starting	x	x						
		8		Camshaft Speed Sensor Error - No Signal	x	x						
P0380	676	5		Glow Relay Error - Coil Open Circuit	x					x	Stop the Glow Relay energization.	
		6		Glow Relay Error - Coil Short Circuit	x					x		
P0512	1041	3		Starter Interlock	x							
P0520	100	3		Oil Pressure Sensor High Input	x							
		4		Oil Pressure Sensor Low Input	x							
P0524	100	1	x	Oil Pressure Too Low	x		x					
P0560	158	0		Battery Voltage Too High	x				x			
		1		Battery Voltage Too Low	x							
P0612	523010	5		EDU Relay Error - Coil Open Circuit	x	x				x	Stop the EDU Relay energization.	
		6		EDU Relay Error - Coil Short Circuit	x	x				x		
P0615	522249	5		Starter Relay Error - Coil Open Circuit	x					x	Stop the Starter Relay energization.	
		6		Starter Relay Error - Coil Short Circuit	x					x		
P0627	633	5		Fuel Pump Control Valve Error - Open / Short Circuit	x					x	Stop the EDU Relay energization.	
P062D	2797	5		EDU Error	x					x	Stop the EDU Relay energization.	
		9		EDU CAN Communication Error	x	x				x		
P062F	630	12		EEPROM Error	x						Engine is controlled with default data.	
P0641	3509	0		Sensor 5V High Input	x							
		1		Sensor 5V Low Input	x							
P0685	1485	5		ECU Main Relay Error - Coil Open Circuit	x					x	Stop the ECU Main Relay energization.	
		6		ECU Main Relay Error - Coil Short Circuit	x					x		
		7		ECU Main Relay Error - Contact Stuck	x					x		
P1000	3607	14		Emergency Switch Active	x							
P1001	701	6		ACC Relay Error - Coil Short Circuit	x							
P1005	522778	7		Stop Switch Error - Contact Stuck	x							
P1006	522775	0		Water In Sail drive Seal	x							
P1229	157	7		Fuel Pressure Deviation Too High	x	x						
P1271	786	5		Pressure Regulate Valve Error - Open / Short Circuit	x	x						
P1272	786	2		Pressure Regulate Valve Error - Stuck at Closed Position	x	x						
P1570	523631	7		Engine Turn Over	x					x		
P1606	523254	12		ROM Error - Abnormal INDMAP / MAP	x					x		
P1630	523223	12		QR Code Error - Checksum Error	x						Engine is controlled with default data.	
P1631	523221	12		QR Code Error - No Data	x							
P1632	523221	13		QR Code Error - Invalid Code	x							
P2269	97	0		Water In Fuel	x							
P2502	167	1		Charging System Error	x							
P2530	522308	7		Start Switch Error - Contact Stuck	x							
U0146	91	9		CAN Communication Error	x						Engine can be controlled by Sub Throttle Sensor.	

Engine-ECU related DTC

# TROUBLESHOOTING

DTC	SPN	FMI	With FFD	DTC Description	Failsafe Action						Note
					Warning	Level 1	Level 2	Level 3	ENG Stop	Others	
Drive-ECU related DTC	P0920	773	3	Shift Valve(F) Actuator High Range	x						
			4	Shift Valve(F) Actuator Low Range	x						Shift Valve(F) shuts OFF.
	P0924	784	3	Shift Valve(R) Actuator High Range	x						
			4	Shift Valve(R) Actuator Low Range	x						Shift Valve(R) shuts OFF.
	P0745	740	3	Clutch Valve High Range	x						
			4	Clutch Valve Low Range	x						Trolling function will be unavailable.
	P0720	191	8	PROP SPEED SENSOR L RANGE	x						C-type trolling function will be switched to E-type trolling.
	P0218	177	0	Gear Oil Temperature Too High	x						Trolling function will be unavailable.
	P0710	177	4	Gear Oil Temperature Low Range	x						
			3	Gear Oil Temperature High Range	x						
	U103	525	10	Shift & Trolling CAN Communication Error	x						Shift position will be changed to Neutral.
	U100	190	10	Engine ECU CAN Communication Error	x						
	U404	525	2	Invalid Shift Data	x						Shift position will be changed to Neutral.
	U402	684	2	Invalid Trolling Data	x						Trolling function will be unavailable.
	P1811	523721	3	Tilt Up Actuator High Range	x						
			4	Tilt Up Actuator Low Range	x						Trim adjustment function (UP) will be unavailable.
	P1812	523723	3	Tilt Trailer Actuator High Range	x						
			4	Tilt Trailer Actuator Low Range	x						Trailer function will be unavailable.
	P1813	523722	3	Tilt Down Actuator High Range	x						
			4	Tilt Down Actuator Low Range	x						Trim adjustment function (DOWN) will be unavailable.
P1814	523557	3	Tilt Position Sensor High Range	x							
		4	Tilt Position Sensor Low Range	x							
P1815	523558	10	Tilt CAN Communication Error	x						Trim adjustment function (UP & DOWN) will be unavailable.	
P1816	520719	1	Reserve Tank Level Low Range	x							
P0560	158	1	Battery Voltage Too Low	x							



DTC	SPN	FMI	With FFD	DTC Description	Failsafe Action							Note
					Warning	Level 1	Level 2	Level 3	ENG Stop	Others		
Helm-ECU related DTC	U0100	523760	9	CAN Communication Error Engine ECU to Helm ECU	x			x				Station change will be unavailable.
	U0404	523761	9	CAN Communication Error Drive ECU to Helm ECU	x			x				Shift change will be unavailable.
	U1201	523762	9	CAN Communication Error Helm ECU to Helm ECU	x							Station change will be unavailable.
	U1202	523763	9	CAN Communication Error Helm Local	x				x			Station change, Synch. operation, Warmup operation, and Engine speed limit mode will be unavailable.
	U1203	523764	9	Lost Communication With Display	x							Station change and Display operation will be unavailable.
	B1001	523543	4	Neutral Switch Failure	x							Station change, Warmup operation, and Engine speed limit mode will be unavailable.
	B1002	523542	4	Station Select Switch Failure	x							Station change and Indicator Dimming operation will be unavailable.
	B1003	523544	4	Synchronization Switch Failure	x							Station change and Synchronization feature will be unavailable.
	B1004	523545	4	Trolling Switch Failure	x							Station change and Trolling feature will be unavailable.
	B1005	523541	3	Start/Stop Switch Failure	x							Station change will be unavailable.
	B1011	523546	3	Tilt Switch Failure	x							Station change and Trim adjustment will be unavailable.
	B1013	523548	3	Trailer Switch Failure	x							Station change and Trailer mode will be unavailable.
	P0120	91	3	Throttle Lever Failure (High)	x				x			Station change and Trolling feature will be unavailable.
			4	Throttle Lever Failure (Low)	x				x			
	B1020	91	13	Throttle Lever Calibration Failure	x				x			Station change and Trailer mode will be unavailable.
B1043	523768	12	Helm ECU EEPROM	x							Station change will be unavailable.	

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# LONG-TERM STORAGE

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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

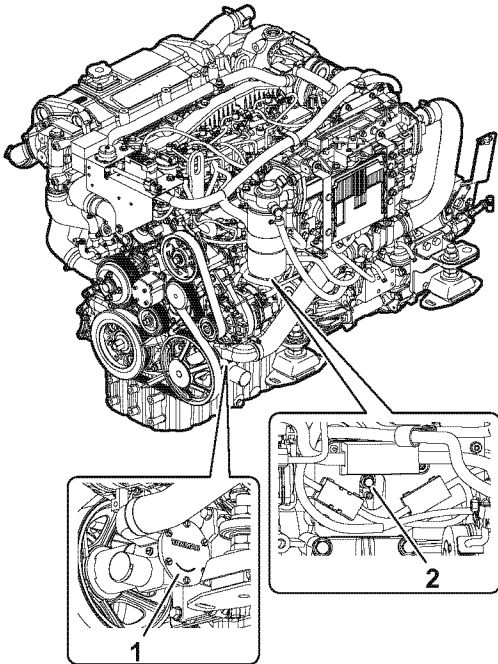
- Do not drain the coolant system. A full coolant system will prevent corrosion and frost damage.
  - If seawater is left inside of the engine, it may freeze and damage parts of the cooling system when the ambient temperature is below 0°C (32°F).
- 

## 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.*

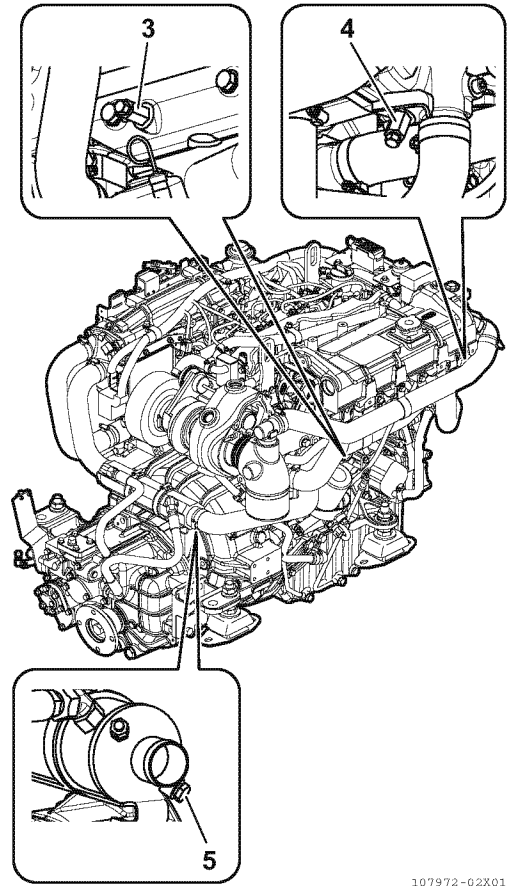
1. Wipe off any dust or oil from the outside of engine.
2. Drain water from fuel filters.
3. Drain fuel tank completely or fill the tank to prevent condensation.
4. Grease the exposed areas and joints of the remote control cables and the bearings of the remote control handle.
5. Seal the intake silencer, 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. Make sure the power switch is off.

**DRAIN SEAWATER  
COOLING SYSTEM**



**Figure 1**

- 1 – Seawater pump  
(Drain from pump cover)
- 2 – Coolant drain cock  
(Cylinderblock)



**Figure 2**

- 3 – Coolant drain cock  
(Exhaust manifold)
- 4 – Seawater drain cock  
(Coolant tank/Heat exchanger)
- 5 – Seawater drain plug  
(Marine gear oil cooler)

*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).

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1. Open the seawater drain cock on the marine gear cooler (if equipped). Allow to drain. Open the seawater drain cock on the heat exchanger 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**

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## **PRINCIPAL ENGINE SPECIFICATIONS**

# SPECIFICATIONS

## 4LV(Z) Engines

Specification		4LV250(Z)	4LV230(Z)	4LV195(Z)	4LV170(Z)	4LV150(Z)
Use		For recreational use				
Type		Vertical water cooled 4-cycle diesel engine				
Combustion System		Direct injection (Common rail system)				
Air Charging		Turbocharged with air cooler				
Number of Cylinders		4				
Bore x Stroke		92 mm x 103.6 mm (3.62 in. x 4.08 in.)				
Displacement		2.755 L (168.1 cu in.)				
Continuous power		168 kW (228 hp metric) / 3683 min <sup>-1</sup>	154 kW (209 hp metric) / 3683 min <sup>-1</sup>	130 kW (177 hp metric) / 3392 min <sup>-1</sup>	114 kW (155 hp metric) / 3392 min <sup>-1</sup>	100 kW (136 hp metric) / 3392 min <sup>-1</sup>
Fuel stop power	Output at crankshaft/ engine speed	184 kW (250 hp metric) / 3800 min <sup>-1</sup> *	169 kW (230 hp metric) / 3800 min <sup>-1</sup> *	143 kW (195 hp metric) / 3500 min <sup>-1</sup> *	125 kW (170 hp metric) / 3500 min <sup>-1</sup> *	110 kW (150 hp metric) / 3500 min <sup>-1</sup> *
Installation		Flexible mounting				
Fuel Injection Timing		Variable timing (Electronic control)				
Fuel Injection Pressure		Variable pressure (Maximum injection pressure: 220 MPa)				
Direction of Rotation	Crankshaft	Counterclockwise viewed from flywheel side				
Cooling System		Coolant cooling with heat exchanger				
Lubrication System		Forced lubrication system				
Cooling Water Capacity (coolant)		Engine 10.0 L (10.6 qt), Reservoir: 0.8 L (0.85 qt)				
Lubricating Oil Capacity (engine)	Total**	8.5 L (8.98 qt)				
	Effective***	2.5 L (2.64 qt)				
Starting System	Type	Electric				
	Starting motor	DC 12 V - 2.0 kW				
	AC generator	12 V - 130 A				
Engine model		4LV			4LVZ	
Marine gear or Stern drive		Bobtail	Marine gear		Stern drive	
			KMH50A	KMH50V	ZT370	
Engine Dimension	Overall length	921 mm (36.3 in.)	1151 mm (45.3 in.)	1152 mm (45.4 in.)	1028.5 mm (40.5 in.)	
	Overall width	761 mm (30.0 in.)	761 mm (30.0 in.)	832 mm (32.8 in.)	795 mm (31.3 in.)	
	Overall height	772 mm (30.4 in.)	772 mm (30.4 in.)	858 mm (33.8 in.)	810 mm (31.9 in.)	
Engine Dry Mass (including marine gear)		334 kg (736 lb)	388 kg (855 lb)	441 kg (906 lb)	334 kg (736 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/cm<sup>3</sup> at 15°C. Fuel temperature at the inlet of the fuel supply pump.

Note: 1 hp metric = 0.7355 kW



**4LV Marine Gear**

Marine Gear Model	KMH50A					KMH50V				
	4LV250	4LV230	4LV195	4LV170	4LV150	4LV250	4LV230	4LV195	4LV170	4LV150
Direction of Rotation Propeller shaft (ahead) viewed from stern	Clockwise (Recommendation) or counterclockwise					Counterclockwise (Recommendation) or clockwise				
Type	Hydraulically actuated multiple disk clutch					Hydraulically actuated multiple disk clutch				
Reduction Ratio (forward/reverse)	1.67 / 1.67 2.13 / 2.13 2.43 / 2.43					1.22 / 1.22 1.58 / 1.58 2.08 / 2.08 2.47 / 2.47				
Propeller Speed (forward/reverse)*	2210 / 2210 min <sup>-1</sup> 1729 / 1729 min <sup>-1</sup> 1517 / 1517 min <sup>-1</sup>		2035 / 2035 min <sup>-1</sup> 1592 / 1592 min <sup>-1</sup> 1397 / 1397 min <sup>-1</sup>			3007 / 3007 min <sup>-1</sup> 2324 / 2324 min <sup>-1</sup> 1772 / 1772 min <sup>-1</sup> 1490 / 1490 min <sup>-1</sup>		2770 / 2770 min <sup>-1</sup> 2140 / 2140 min <sup>-1</sup> 1632 / 1632 min <sup>-1</sup> 1372 / 1372 min <sup>-1</sup>		
Lubrication System	Forced lubrication system					Forced lubrication system				
Lubricating Oil Capacity (total)	2.0 L (2.11 qt)					5.4 L (5.71 qt)				
Lubricating Oil Capacity (effective)	0.4 L (0.42 qt)					0.4 L (0.42 qt)				
Cooling System	Seawater cooling					Seawater cooling				
Weight	54 kg (119 lb)					77 kg (170 lb)				

\* At continuous power engine speed: 4LV250, 4LV230 3683 min<sup>-1</sup>  
4LV195, 4LV170, 4LV150 3392 min<sup>-1</sup>

# SPECIFICATIONS

## 4LVZ Stern Drive

Stern-Drive Model		ZT370				
Engine Model		4LV250Z	4LV230Z	4LV195Z	4LV170Z	4LV150Z
Reduction Ratio		1.65				
		1.78				
		1.97				
		-		2.18		
Direction of Rotation (view from stern)	Input	Counter-clockwise viewed from stern				
	Front Propeller	Counter-clockwise viewed from stern				
	Rear Propeller	Clockwise viewed from stern				
Dimension	Steering Angle	2 × 30 degrees				
	Tilt Angle	51 degrees				
	Trim Zone	-6 to 10 degrees				
Propeller		Counter Rotating Double Propeller				
		Allowable propeller diameter: Max. 406.4 mm (16 in.)				
Oil	Stern-Drive Unit	QuickSilver®*1 High Performance Gear Lube		QuickSilver®*1 High Performance Gear Lube or GL-5 (SAE 80W90)		
	Power Steering System	QuickSilver® Power Trim and Steering Fluid or Dexlone-III				
	Tilt / Trim System	QuickSilver® Power Trim and Steering Fluid or Dexlone-III				
Lubrication System		Forced lubrication system				
Lubricating Oil Capacity (total)		2.5 L (2.64 qt)				
Cooling System		Seawater cooling				
Clutch System		Hydraulic multi-friction disc type with hydraulic pump				
Shift Type		Electrical shift with solenoid				
Power Steering System		Mechanical cable operated hydraulic power assist				
Tilt / Trim System		Electric motor drive hydraulic power operation				
Anti-Corrosion System	Y-CaPS	Electronic control cathodic protection				
Mass (Weight)	Dry Condition	100 kg (220.5 lb)				





*Note: For engine / stern-drive performance, electrical, outline, piping diagrams and related information, see the engine-specific section of Installation Manual and / or the Service Manual.*

*\*1: QuickSilver is a registered trademark of Brunswick® Corporation.*

# SYSTEM DIAGRAMS

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## PIPING DIAGRAMS

Notation	Description
	Screw Joint (Union)
	Flange Joint
	Eye Joint
	Insertion Joint

*Note:*

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

4LV Engine  
Lubricating System

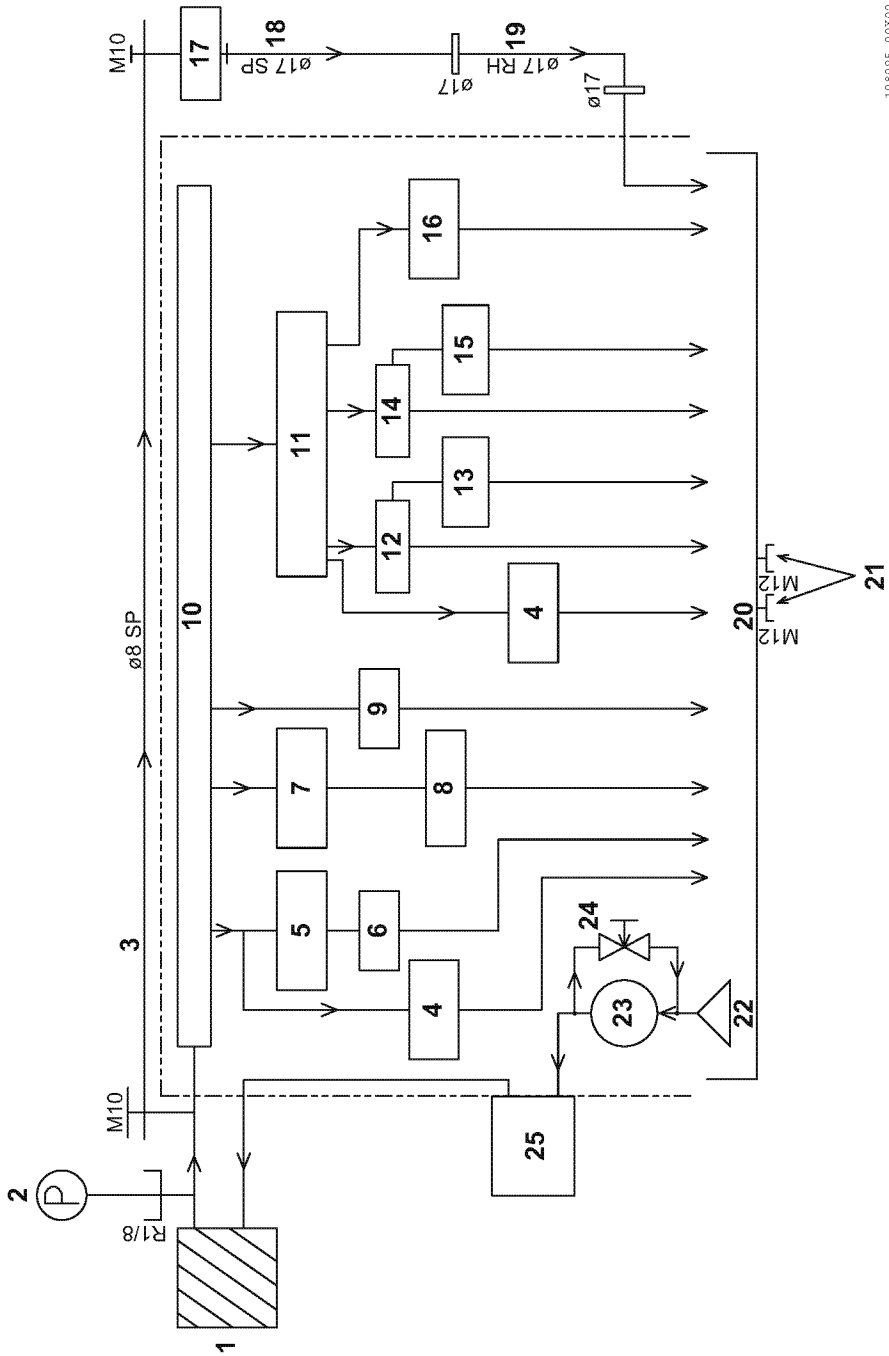


Figure 1

- 1 – Lubricating oil filter (cartridge type)
- 2 – Oil pressure sensor
- 3 –  $\varnothing 8$  Steel pipe
- 4 – No.1 Chain tensioner
- 5 – Main bearing No.1
- 6 – Lubricating oil jet for chain train
- 7 – Main bearing No.2-No.5
- 8 – Connecting rod
- 9 – Piston cooling oil jet
- 10 – Lubricating oil main gallery
- 11 – Cylinder head
- 12 – Intake camshaft
- 13 – Intake lash adjuster
- 14 – Exhaust camshaft
- 15 – Exhaust lash adjuster
- 16 – No.2 Chain tensioner
- 17 – Turbo charger
- 18 –  $\varnothing 17$  Steel pipe
- 19 –  $\varnothing 17$  Rubber hose
- 20 – Oil pan
- 21 – Drain plug
- 22 – Lubricating oil inlet strainer
- 23 – Lubricating oil pump
- 24 – Pressure control valve (Engine)
- 25 – Lubricating oil cooler

4LV Engine with KMH50A, KMH50V Marine Gear  
Cooling System

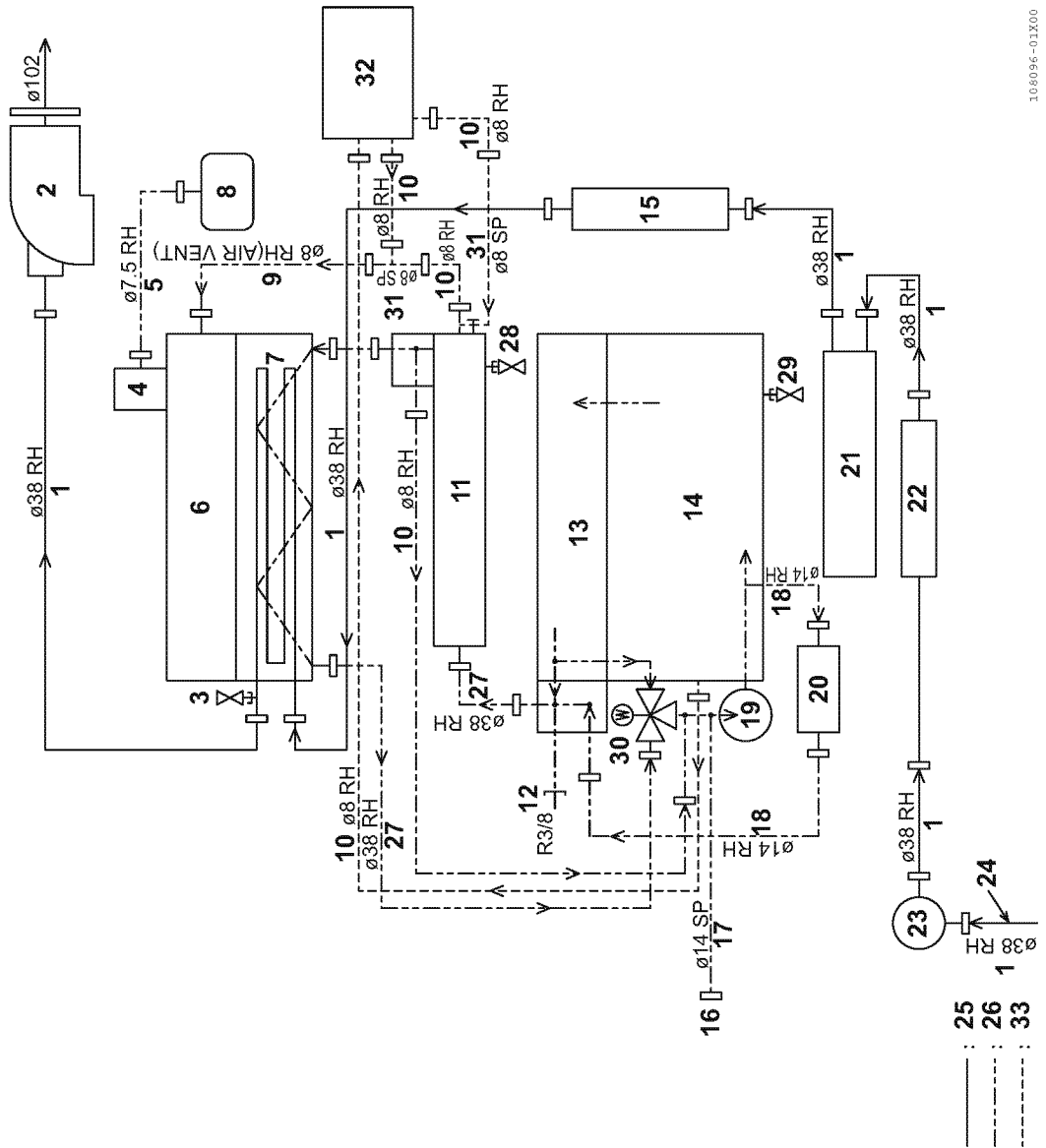


Figure 2

- 1 –  $\varnothing$ 38 Rubber hose
- 2 – Mixing elbow
- 3 – Seawater drain cock  
(Heat exchanger)
- 4 – Coolant filler cap  
(Relief pressure 0.09 MPa)
- 5 –  $\varnothing$ 7.5 Rubber hose
- 6 – Coolant Expansion Tank  
(Coolant tank)
- 7 – Heat exchanger
- 8 – Reservoir
- 9 –  $\varnothing$ 8 Rubber hose (Air vent)
- 10 –  $\varnothing$ 8 Rubber hose
- 11 – Exhaust manifold
- 12 – Hot water connection outlet
- 13 – Cylinder head
- 14 – Cylinder block
- 15 – Marine gear lubricating oil  
cooler
- 16 – Hot water connection return
- 17 –  $\varnothing$ 14 Steel pipe
- 18 –  $\varnothing$ 14 Rubber hose
- 19 – Cooling water pump (coolant)
- 20 – Lubricating oil cooler
- 21 – Air cooler
- 22 – Fuel Cooler
- 23 – Cooling water pump (seawater)
- 24 – Seawater inlet
- 25 – Cooling seawater piping
- 26 – Coolant piping
- 27 –  $\varnothing$ 38 Rubber hose
- 28 – Coolant drain cock (Coolant  
tank)
- 29 – Coolant drain cock (Cylinder  
block)
- 30 – Thermostat
- 31 –  $\varnothing$ 8 Steel pipe
- 32 – Turbocharger cover  
(4LV250, 4LV230 only)
- 33 – Coolant piping  
(4LV250, 4LV230 only)

4LVZ Engine with ZT370 Stern Drive  
Cooling System

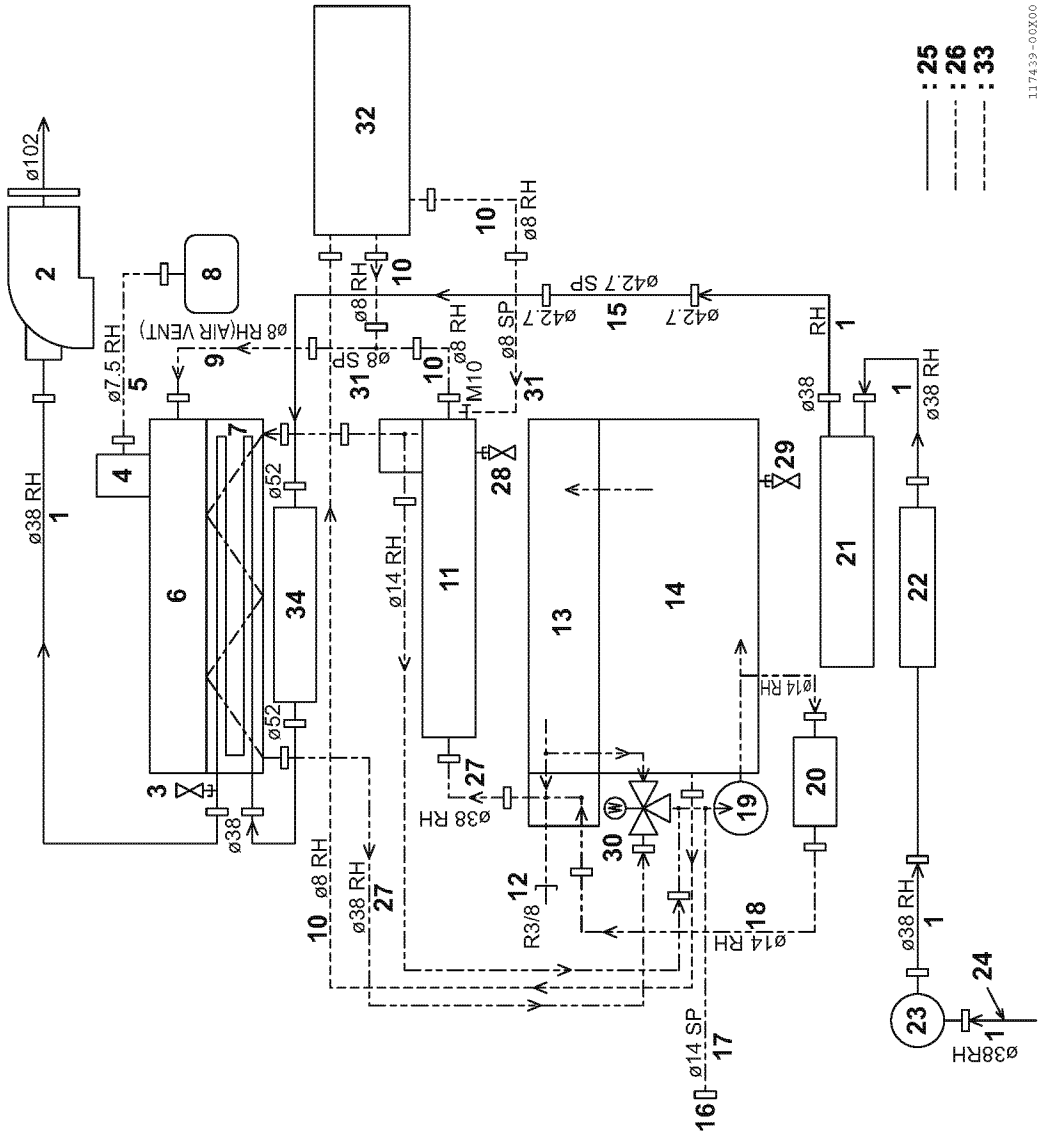
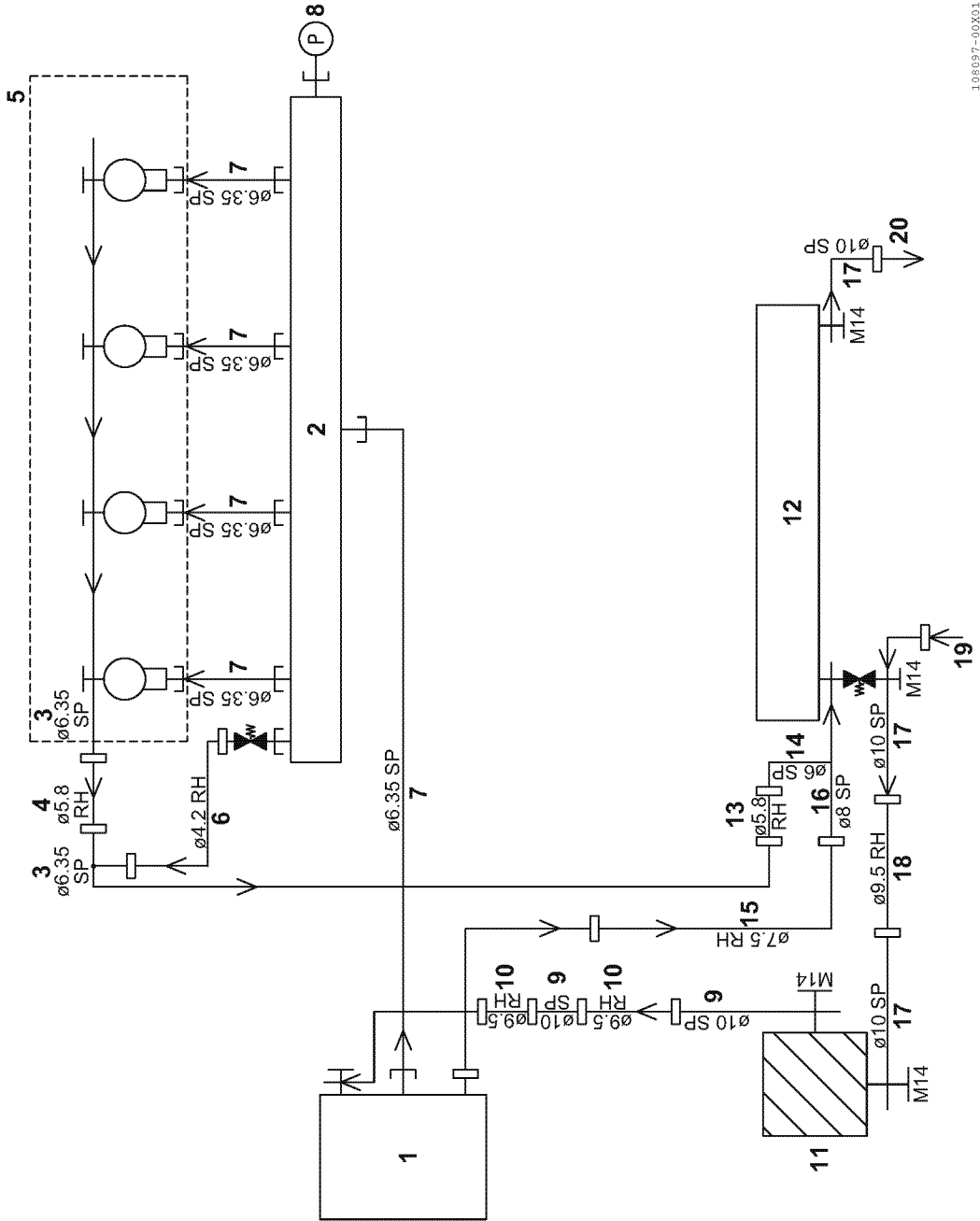


Figure 3



- 1 – ø38 Rubber hose
- 2 – Mixing elbow
- 3 – Seawater drain cock  
(Heat exchanger)
- 4 – Coolant filler cap  
(Relief pressure 0.09 MPa)
- 5 – ø7.5 Rubber hose
- 6 – Coolant Expansion Tank  
(Coolant tank)
- 7 – Heat exchanger
- 8 – Reservoir
- 9 – ø8 Rubber hose (Air vent)
- 10 – ø8 Rubber hose
- 11 – Exhaust manifold
- 12 – Hot water connection outlet
- 13 – Cylinder head
- 14 – Cylinder block
- 15 – ø42.7 Steel pipe (SUS 316L)
- 16 – Hot water connection return
- 17 – ø14 Steel pipe
- 18 – ø14 Rubber hose
- 19 – Cooling water pump (coolant)
- 20 – Lubricating oil cooler
- 21 – Air cooler
- 22 – Fuel Cooler
- 23 – Cooling water pump (seawater)
- 24 – Seawater inlet
- 25 – Cooling seawater piping
- 26 – Coolant piping
- 27 – ø38 Rubber hose
- 28 – Coolant drain cock (Coolant tank)
- 29 – Coolant drain cock (Cylinder block)
- 30 – Thermostat
- 31 – ø8 Steel pipe
- 32 – Turbocharger cover  
(4LV250Z, 4LV230Z only)
- 33 – Coolant piping  
(4LV250Z, 4LV230Z only)
- 34 – Power steering oil cooler  
(4LVZ only)

Fuel System

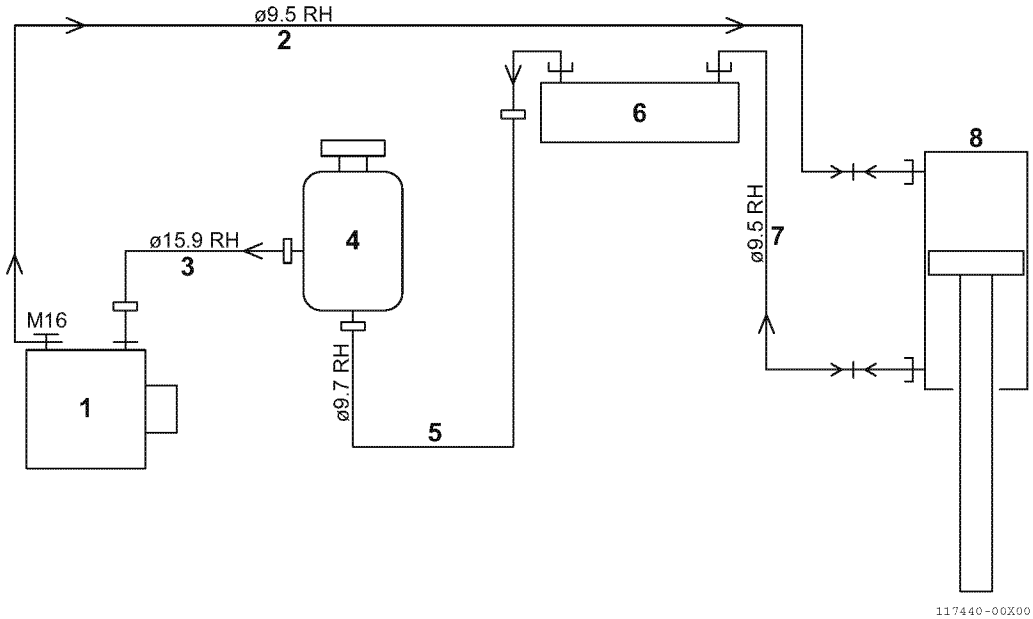


108697-00X01

Figure 4

- 1 – Fuel supply pump
- 2 – Common rail
- 3 –  $\varnothing 6.35$  Steel pipe
- 4 –  $\varnothing 5.8$  Rubber hose
- 5 – Rocker Arm Cover
- 6 –  $\varnothing 4.2$  Rubber hose
- 7 –  $\varnothing 6.35$  Steel pipe
- 8 – Rail pressure sensor
- 9 –  $\varnothing 10$  Steel pipe
- 10 –  $\varnothing 9.5$  Rubber hose
- 11 – Fuel filter (cartridge type)
- 12 – Fuel Cooler
- 13 –  $\varnothing 5.8$  Rubber hose
- 14 –  $\varnothing 6$  Steel pipe
- 15 –  $\varnothing 7.5$  Rubber hose
- 16 –  $\varnothing 8$  Steel pipe
- 17 –  $\varnothing 10$  Steel pipe
- 18 –  $\varnothing 9.5$  Rubber hose
- 19 – Fuel inlet
- 20 – Fuel overflow

## Power Steering System



**Figure 5**

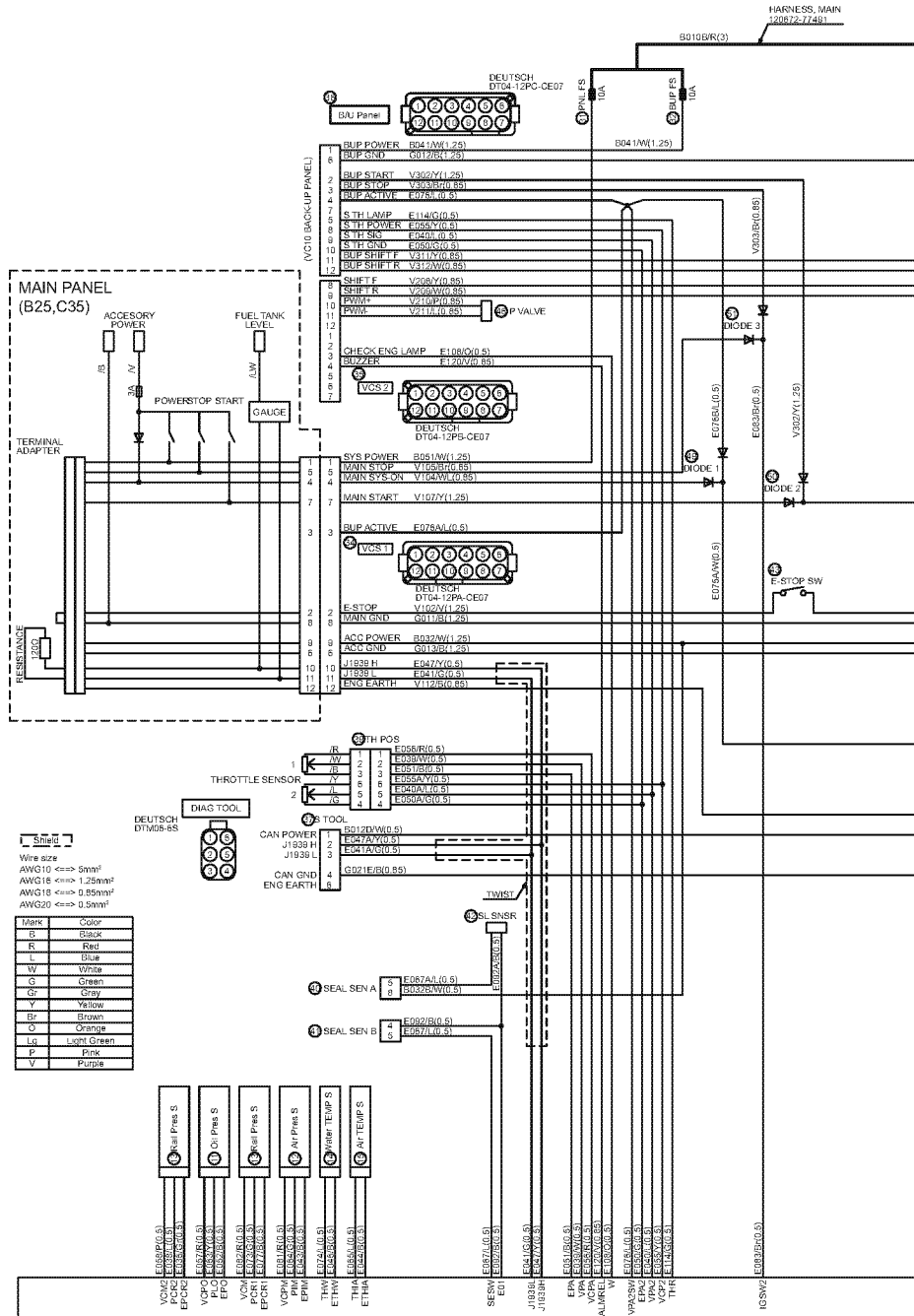
- 1 – Power steering oil pump**
- 2 –  $\varnothing 9.5$  Rubber hose**
- 3 –  $\varnothing 15.9$  Rubber hose**
- 4 – Power steering oil tank**
- 5 –  $\varnothing 9.7$  Rubber hose**
- 6 – Power steering oil cooler**
- 7 –  $\varnothing 9.5$  Rubber hose**
- 8 – Power steering cylinder unit**

## WIRING DIAGRAMS

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

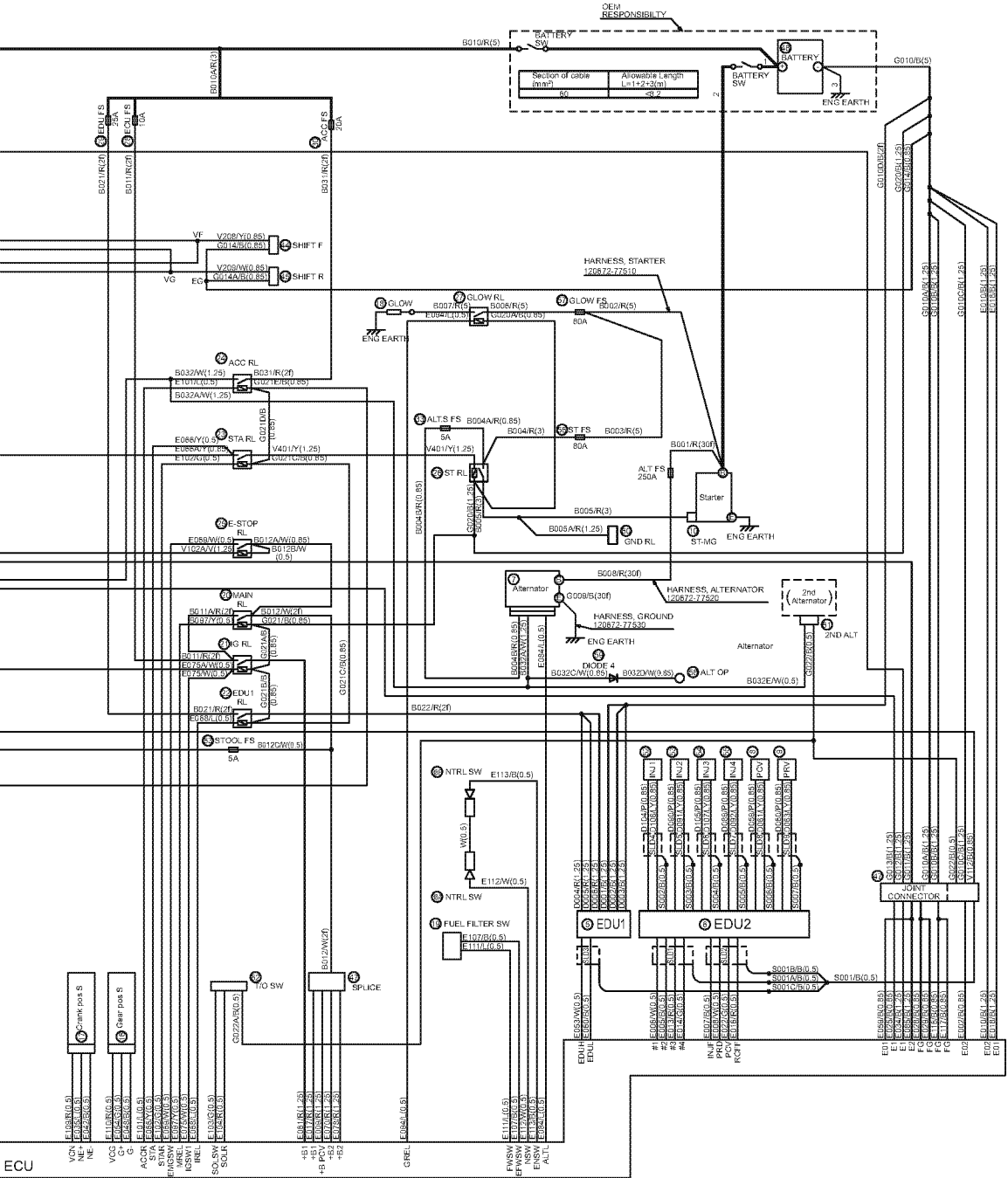
Allowable Length by Cross Sectional Area of Battery Cable	
Section of Cable mm <sup>2</sup> (in. <sup>2</sup> )	Allowable Length L = 1 + 2 + 3 m (ft)
60 (0.093)	< 8.2 (26.9)

## Standard (B25,C35-Type instrument panel)



110243-01EN00

Figure 6



110243-01EN00








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# EPA WARRANTY USA ONLY

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

### EPA Emission Control Label for 4LV150(Z), 4LV170(Z), 4LV195(Z)


EMISSION CONTROL INFORMATION	
THIS MARINE ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR 2019 ULTRA LOW SULFUR DIESEL FUEL ONLY.	
ENGINE FAMILY : KYDXN2, 76E4H ENGINE MODEL : 4LV150	
STANDARDS NOx+HC : 5.8g/kW-hr CO : 5.0g/kW-hr PM : 0.15g/kW-hr	
APPLICATION : VARIABLE-SPEED PROPULSION ENGINES USED WITH FIXED-PITCH PROPELLERS.	
EMISSION CONTROL SYSTEM : DFI	
REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.	
	
YANMAR CO., LTD.	

120672-07510-K

Figure 1

Part Number	Engine Model
120672-07510	4LV150
120672-07520	4LV170
120672-07530	4LV195
120674-07510	4LV150Z
120674-07520	4LV170Z
120674-07530	4LV195Z

### EPA Emission Control Label for 4LV230(Z), 4LV250(Z)

EMISSION CONTROL INFORMATION	
THIS MARINE ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR 2019 ULTRA LOW SULFUR DIESEL FUEL ONLY.	
ENGINE FAMILY : KYDXN2, 76D4H ENGINE MODEL : 4LV230	
STANDARDS NOx+HC : 5.8g/kW-hr CO : 5.0g/kW-hr PM : 0.15g/kW-hr	
APPLICATION : VARIABLE-SPEED PROPULSION ENGINES USED WITH FIXED-PITCH PROPELLERS.	
EMISSION CONTROL SYSTEM : DFI	
REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.	
	
YANMAR CO., LTD.	

120673-07510-K

Figure 2

Part Number	Engine Model
120673-07510	4LV230
120673-07520	4LV250
120674-07540	4LV230Z
120674-07550	4LV250Z

## EPA WARRANTY USA ONLY

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

### Your Warranty Rights and Obligations:

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

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

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

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

### Warranty Period:

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

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

**Warranty Coverage:**

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

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

**Exclusions:**

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

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

**Owner's Responsibility:**

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

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

**Customer Assistance:**

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

**Yanmar America Corporation**

Toll free telephone:

1-855-416-7091 or 1-800-872-2867

E-mail: [CS\\_support@yanmar.com](mailto:CS_support@yanmar.com)

Website: [us.yanmar.com](http://us.yanmar.com)





## Declaration of Conformity for Recreational Craft Propulsion Engines (inboard engines) with the requirements of Directive 2013/53/EU

(To be completed by manufacturer or, if mandated, authorised representative)

Name of engine manufacturer: Yanmar Co., Ltd.

Address: 1-32, Chayamachi, Kita-ku, Osaka

Town: \_\_\_\_\_ Post Code: 530-8311 Country: Japan

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

Address: Brugplein 11

Town: Almere Post Code: 1332 BS Country: the Netherlands

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

Address: 11, route de Luxembourg

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

Conformity assessment module used for exhaust emissions:  B+C/C1  B+D  B+E  B+F  G  H  
or engine type-approved according to:  Directive 97/68/EC  EC Regulation No 595/2009

Other Community Directives applied: 2014/30/EU

### DESCRIPTION OF ENGINE TYPE(s)

#### Main Propulsion ExhaustType:

- With integral exhaust  
 Without integral exhaust

#### Combustion Type:

- Internal combustion, Diesel (CI)  
 Internal combustion, Petrol (SI)  
 Other

#### Combustion cycle:

- 2 stroke  
 4 stroke

### IDENTIFICATION OF ENGINE(S) COVERED BY THIS DECLARATION OF CONFORMITY

Name of engine model or engine family:	Unique engine identification number(s) or engine family code(s)	EC Type-examination certificate or type-approval certificate number
Engine family: RCD2-8LVX1 Engine models: 8LV370, 8LV350, 8LV320		SNCH*2013/53*2013/53* 0051*00
Engine family: RCD2-6LY44X1 Engine models: 6LY440, 6LY400		0054*00
Engine family: RCD2-4LVX1 Engine models: 4LV250, 4LV230, 4LV195, 4LV170, 4LV150		0104*01

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the manufacturer that the recreational craft propulsion engine(s) mentioned above fulfil(s) the requirements specified in Article 4 (1) and Annex 1 of Directive 2013/53/EU.

Name / function: Shigetaka Kawaguchi  
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title:  
(or an equivalent marking)

*Shigetaka Kawaguchi*  
Divisional Manager  
Marine Engineering Division  
Engine Development Division  
Industrial Power Products Management Division  
Power Solution Business  
Yanmar Co., Ltd.

Date and place of issue: (yy/mm/dd) 18/02/16, Industrial Power Products Management Division, Power Solution Business, Yanmar Co., Ltd.



Essential requirements (reference to relevant articles in Annex IB & IC of the Directive)	Harmonised standards Full Application	Harmonised standards Partial application, see tech. file	Other reference documents <sup>1)</sup> Full Application	Other reference documents Partial Application, see tech. file	Other proof of conformity See technical file	Specify the harmonised <sup>2)</sup> standards or other reference documents used  (with year of publication like "EN ISO 8666:2002")
<b>Annex I.A – Design and Construction of products</b>						
Inboard Engine (Annex I.A. 5.1.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ventilation (Annex I.A.5.1.2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exposed parts (Annex I.A.5.1.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fuel system - General (Annex I.A.5.2.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical System (Annex I.A.5.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Steering System (Annex I.A.5.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire protection - General (Annex I.A.5.6.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Discharge prevention (Annex I.A.5.8)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Annex I.B – Exhaust Emissions</b>						
Propulsion Engine Identification (Annex I.B.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exhaust Emission Requirements (Annex I.B.2)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN ISO 18854: 2015
Durability (Annex I.B.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Owner's manual (Annex I.B.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Annex I.C – Noise Emissions</b>						
See Declaration of Conformity of the recreational craft in which the engine(s) has (have) been installed						

<sup>1)</sup> Such as non-harmonised standards, rules, regulations, guidelines, etc.

<sup>2)</sup> Standards published in EU Official Journal

**Declaration of Conformity for Recreational Craft Propulsion Engines (stern drive engines with integral exhaust) with the requirements of Directive 2013/53/EU**

*(To be completed by manufacturer or, if mandated, authorised representative)*

Name of engine manufacturer: Yanmar Co., Ltd.

Address: 1-32, Chayamachi, Kita-ku, Osaka

Town: \_\_\_\_\_ Post Code: 530-8311 Country: Japan

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

Address: Brugplein 11

Town: Almere Post Code: 1332 BS Country: the Netherlands

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

Address: 11, route de Luxembourg

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

Name of Notified Body for **noise emission assessment**: Dutch Certification Institute (DCI)

Address: Nipkowweg 9

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

Conformity assessment module used for exhaust emissions: B+C/C1  B+D  B+E  B+F  G  H   
or engine type-approved according to:  Directive 97/68/EC  EC Regulation No 595/2009

Conformity assessment module used for noise emissions: A  A1  G  H

Other Community Directives applied: 2014/30/EU

**DESCRIPTION OF ENGINE TYPE(S)**

**Main Propulsion Exhaust Type:**

- With integral exhaust  
 Without integral exhaust

**Combustion Type:**

- Internal combustion, Diesel (CI)  2 stroke  
 Internal combustion, Petrol (SI)  4 stroke  
 Other

**Combustion Cycle:**

- 2 stroke  
 4 stroke

**IDENTIFICATION OF ENGINE(S) COVERED BY THIS DECLARATION OF CONFORMITY**

Name of engine model or engine family:	Unique engine identification number(s) or engine family code(s)	EC Type-examination certificate (Exhaust emission)
		SNCH*2013/53*2013/53*
Engine family: RCD2-8LVX1 Engine models: 8LV370Z, 8LV350Z, 8LV320Z		0051*00
Engine family: RCD2-4LVX1 Engine models: 4LV250Z, 4LV230Z, 4LV195Z, 4LV170Z, 4LV150Z		0104*01

This declaration of conformity is issued under the sole responsibility of the manufacturer. I declare on behalf of the manufacturer that the recreational craft propulsion engine(s) mentioned above fulfil(s) the requirements specified in Article 4 (1) and Annex I of Directive 2013/53/EU.

Name / function: Shigetaka Kawaguchi

(Identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title: Shigetaka Kawaguchi

(or an equivalent marking)

Divisional Manager  
Marine Engineering Division  
Engine Development Division  
Industrial Power Products Management Division  
Power Solution Business  
Yanmar Co., Ltd.

Date and place of issue: (yy/mm/dd) 18/10/03, Industrial Power Products Management Division, Power Solution Business, Yanmar Co., Ltd.

Essential requirements  (reference to relevant articles in Annex IB & IC of the Directive)	Harmonised standards Full Application	Harmonised standards Partial application, see tech. file	Other reference documents <sup>1</sup> Full Application	Other reference documents Partial Application, see tech. file	Other proof of conformity See technical file	Specify the harmonised <sup>2</sup> standards or other reference documents used  (with year of publication like "EN ISO 8666:2002")
<b>Annex I.A - Design and Construction of products</b>						
Handling Characteristics (Annex I A.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Inboard Engine (Annex I A. 5.1.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ventilation (Annex I A.5.1.2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exposed parts (Annex I A.5.1.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Outboard propulsion engine starting (Annex I A.5.1.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Tiller-controlled outboard propulsion engines (Annex I A.5.1.6)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fuel system - General (Annex I A.5.2.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical System (Annex I A.5.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Steering System (Annex I A.5.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire protection - General (Annex I A.5.6.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Discharge prevention (Annex I A.5.8)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Annex I.B - Exhaust Emissions</b>						
Propulsion Engine Identification (Annex I B.1)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exhaust Emission Requirements (Annex I B. 2)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN ISO 18854: 2015
Durability (Annex I B.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Owner's manual (Annex I B.4)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Annex I.C - Noise Emissions</b>						
Noise Emissions Level (Annex I.C.1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN ISO 14509-1: 2008
Owner's Manual (Annex I.C.2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Durability (Annex I.C.3)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

<sup>1</sup> Such as non-harmonised standards, rules, regulations, guidelines, etc.

<sup>2</sup> Standards published in EU Official Journal

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As of March 1st, 2019

## OPERATION MANUAL

4LV150, 4LV170, 4LV195, 4LV230, 4LV250,  
4LV150Z, 4LV170Z, 4LV195Z, 4LV230Z, 4LV250Z

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