

YANMAR

OPERATION MANUAL

MARINE PROPULSION ENGINE

**8LV320
8LV350
8LV370
8LV320Z
8LV350Z
8LV370Z**

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.

California Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and reproductive harm.
Wash hands after handling.

Disclaimers:

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INTRODUCTION

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

To help you enjoy your Yanmar 8LV 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 contact your authorized Yanmar Marine dealer or distributor.
- The specifications and components (instrument panel, fuel tank, etc.) described in this manual may differ from ones installed on your vessel. Please refer to the manual provided by the manufacturer of these components.
- Refer to the Yanmar Limited Warranty Handbook for a complete warranty description.

INTRODUCTION

RECORD OF OWNERSHIP

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

Engine Model: _____

Engine Serial No.: _____

Date Purchased: _____

Dealer: _____

Dealer Phone: _____

SAFETY

Yanmar considers safety of great importance and recommends that anyone 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

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

WARNING

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

CAUTION

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

NOTICE

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

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

⚠ WARNING

- 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.
- Contact your authorized Yanmar Marine dealer or distributor for additional training.

During Operation and Maintenance

⚠ DANGER

CRUSH HAZARD



- Never stand under hoisted engine. If the hoist mechanism fails, the engine will fall on you.

- 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

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.

WARNING**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.
- Never use diesel fuel as a cleaning agent.
- Store any containers containing fuel or other flammable products in a well-ventilated area, away from any combustibles or sources of ignition.
- Never jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion. Only use the key switch to start the engine.

WARNING**FIRE HAZARD**

- Undersized wiring systems can cause an electrical fire.

- 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. Never operate the engine without the guards in place.

- Before you start the engine make sure that all bystanders are clear of the area. Keep children and pets away while the engine is operating.
- Check the engine that any tools or shop rags used during maintenance have been removed from the area.

WARNING**ALCOHOL AND DRUG HAZARD**

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

WARNING**EXPOSURE HAZARD**

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

WARNING**ENTANGLEMENT HAZARD**

- Never leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it.
- Never operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

⚠ WARNING

PIERCING HAZARD

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



⚠ WARNING

BURN HAZARD

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

⚠ WARNING

SUDDEN MOVEMENT HAZARD

- Always stop the engine before beginning service.
- Be sure the boat is in open water away from other boats, docks or other obstructions before increasing rpm. Avoid unexpected equipment movement. Shift the marine gear into the NEUTRAL position any time the engine is at idle.
- To prevent accidental equipment movement, Never start the engine in gear.

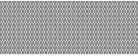


⚠ WARNING

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 and special precautions are required to avoid carbon monoxide poisoning.

- Always ensure that all connections are tightened to specifications after repair is made to the exhaust system. All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.



⚠ 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.



⚠ WARNING

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.

⚠ WARNING

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

⚠ CAUTION**POOR LIGHTING HAZARD**

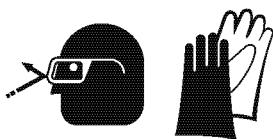
- Ensure that the work area is adequately illuminated. Always install wire cages on portable safety lamps.

⚠ CAUTION**TOOL HAZARD**

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

⚠ CAUTION**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.

⚠ CAUTION**COOLANT HAZARD**

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

⚠ CAUTION

- 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).

NOTICE

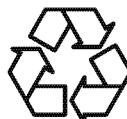
It is important to perform daily checks as listed in the *Operation Manual*. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor engine performance and helps extend the life of the engine.

NOTICE

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

NOTICE

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.

NOTICE

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

NOTICE

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, 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). Contact your authorized Yanmar Marine dealer or distributor for a complete explanation of this condition.

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.

NOTICE

If you have an installation with two or three engines, and only one engine is operating, it is important to limit the amount of throttle applied to the running engine. If you observe black smoke or movement of the throttle does not increase engine rpm, you are overloading the engine that is running. Immediately throttle back to approximately 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.

NOTICE

New Engine Break In: On the initial engine start-up, check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and/or gauges. During the first 50 hours of operation operate your new engine under a substantial load at all times. For best break-in results operate the engine at various speeds. Operating the engine in NEUTRAL must be avoided. During the first 50 hours, avoid operation below 2000 min⁻¹ (rpm). During the break-in period, carefully observe the engine oil pressure and engine temperature. During the break-in period, check the engine oil and coolant levels frequently.

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. Contact your authorized Yanmar Marine dealer or distributor for service before operating the engine.

NOTICE

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 (+3 °F).
- If the ambient temperature exceeds +40 °C (+104 °F), the engine may overheat and cause the engine oil to break down.
- If the ambient temperature is below -16 °C (+3 °F), rubber components such as gaskets and seals will harden causing premature engine wear and damage.
- Contact your authorized Yanmar Marine engine dealer or distributor if the engine will be operated outside of this standard temperature range.

NOTICE

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

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.

NOTICE

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.

LOCATION OF SAFETY DECALS

Figure 1 and Figure 2 show the location of safety decals on Yanmar 8LV series marine engines.

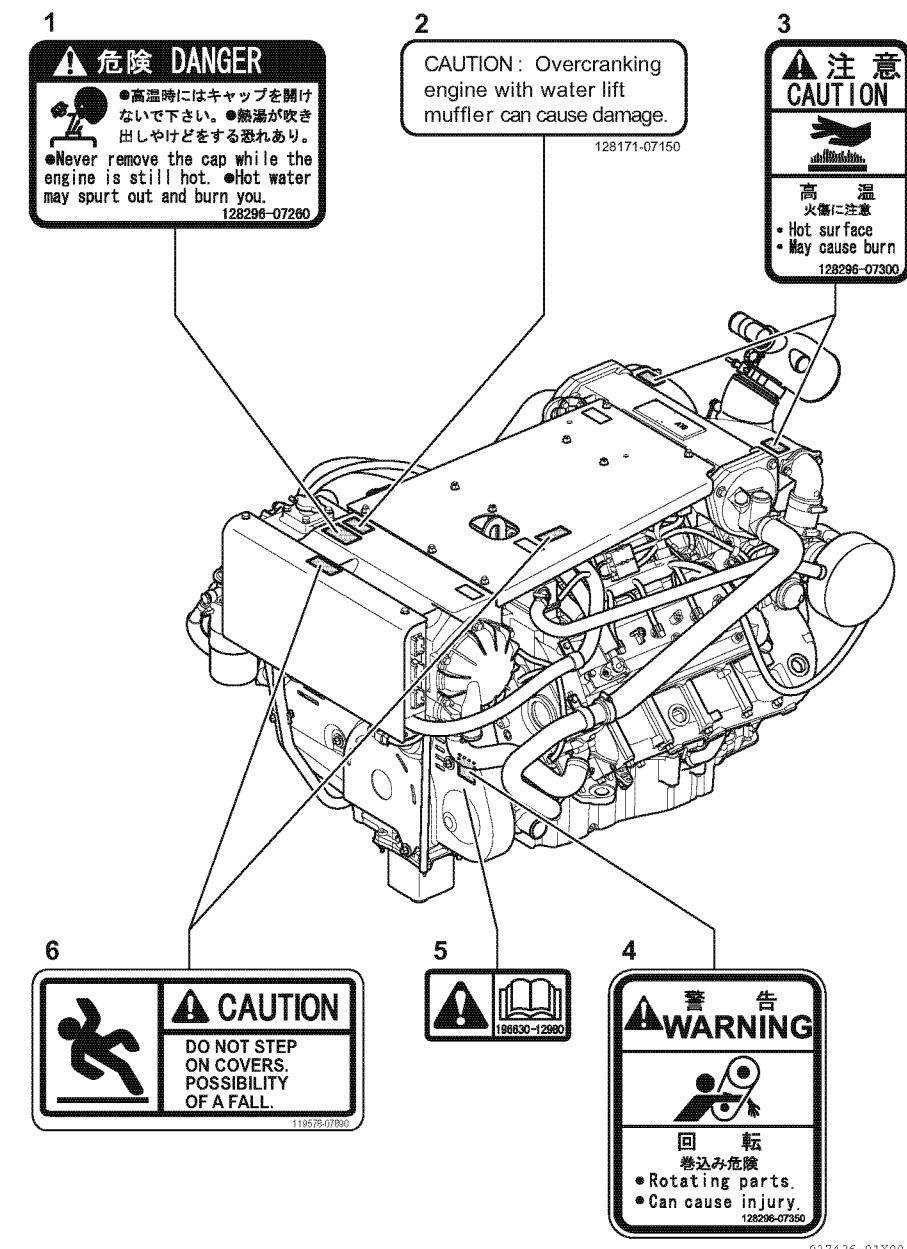


Figure 1

No.	Part Number
1	128296-07260
2	128171-07150
3	128296-07300
4	128296-07350
5	196630-12980
6	119578-07890

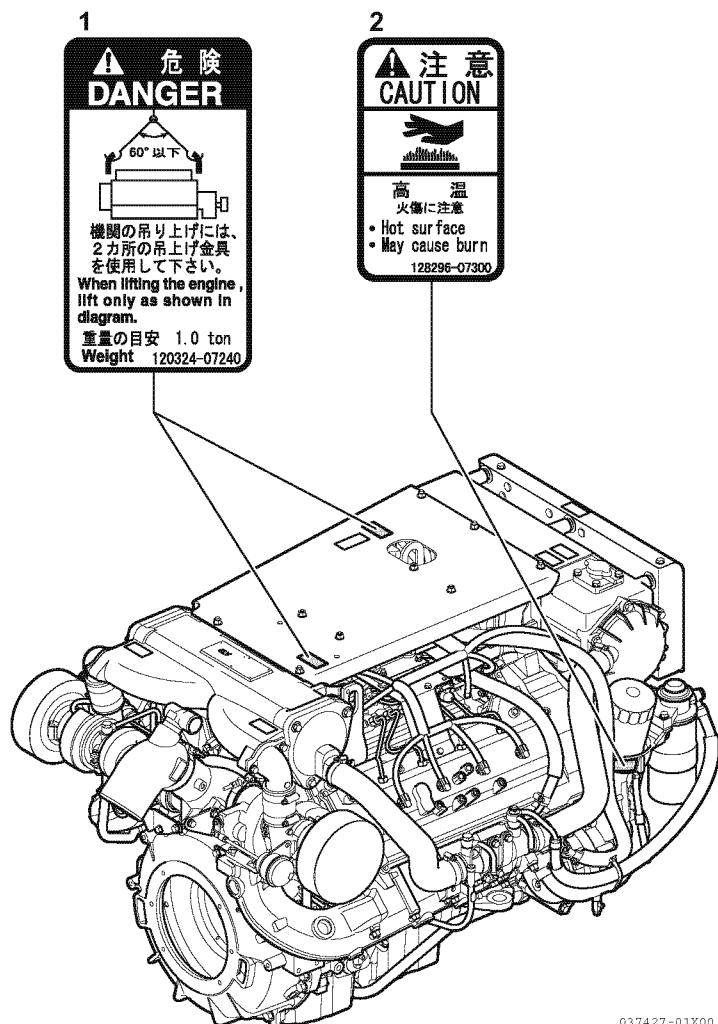


Figure 2

No.	Part Number
1	120324-07240
2	128296-07300

PRODUCT OVERVIEW

YANMAR 8LV FEATURES AND APPLICATIONS

The 8LV series are four-stroke direct injection diesel engines equipped with liquid coolant systems.

The 8LV series is V-8-cylinder and turbocharged with an air cooler and equipped a common rail fuel injection system.

This engine is designed for pleasure craft use.

It is recommended that new vessels be propped so the engines can operate at 95 % load at 3800 min⁻¹ (rpm).

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 onboard equipment, always observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

The 8LV series engines are designed to be operated at maximum throttle (3600 to 3800 min⁻¹ (rpm)) for less than 5 % of total engine time (30 minutes out of every 10 hours) and cruising speed (3600 min⁻¹ (rpm) or less) for less than 90 % of total engine time (9 hours out of every 10 hours).

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

PRODUCT OVERVIEW

New Engine Break-In

As with all reciprocating engines, the way 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 lower than 80 °C (176 °F).

During the first 10 hours of operation, the engine should be run at maximum min^{-1} (rpm) minus 400 to 500 min^{-1} (rpm) (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 lube 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 rev up the engine (i.e. increase the engine speed for a short time) to clean the carbon from the cylinders and fuel injection valve.

Perform this procedure in seawaters:

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

Once past the initial 10 hours until 50 hours, the engine should be used over its full operating range, with special emphasis on running at relatively high power settings. This is not the time for an extended cruise at idle or low speed. The boat should be run at maximum speed minus 400 min^{-1} (rpm) most of the time (approximately 70 % load), with a 10 minute run at maximum minus 300 min^{-1} (rpm) (approximately 80 % load) every 30 minutes and a 4 - 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 rev up the engine.

To complete engine break-in, perform *After Initial 50 Hours of Operation maintenance procedures* on page 47.

COMPONENT IDENTIFICATION

Service Side

Figure 1 and Figure 2 illustrate a typical version of a 8LV series engine. Your engine may have different equipment from that illustrated.

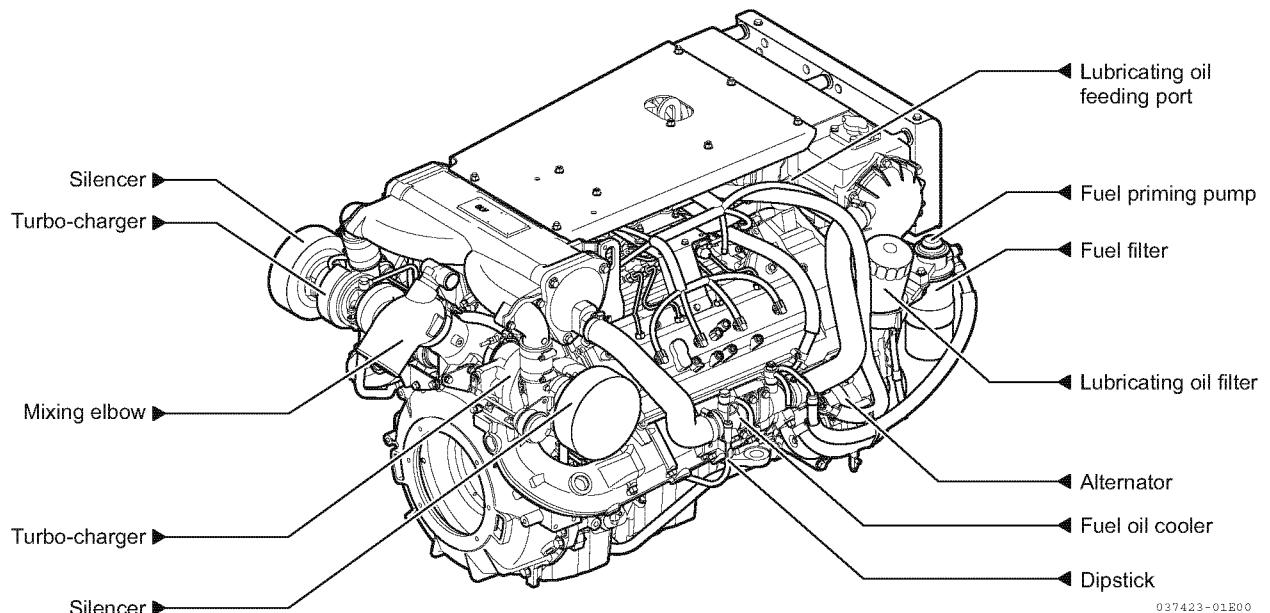


Figure 1

Non-Service Side

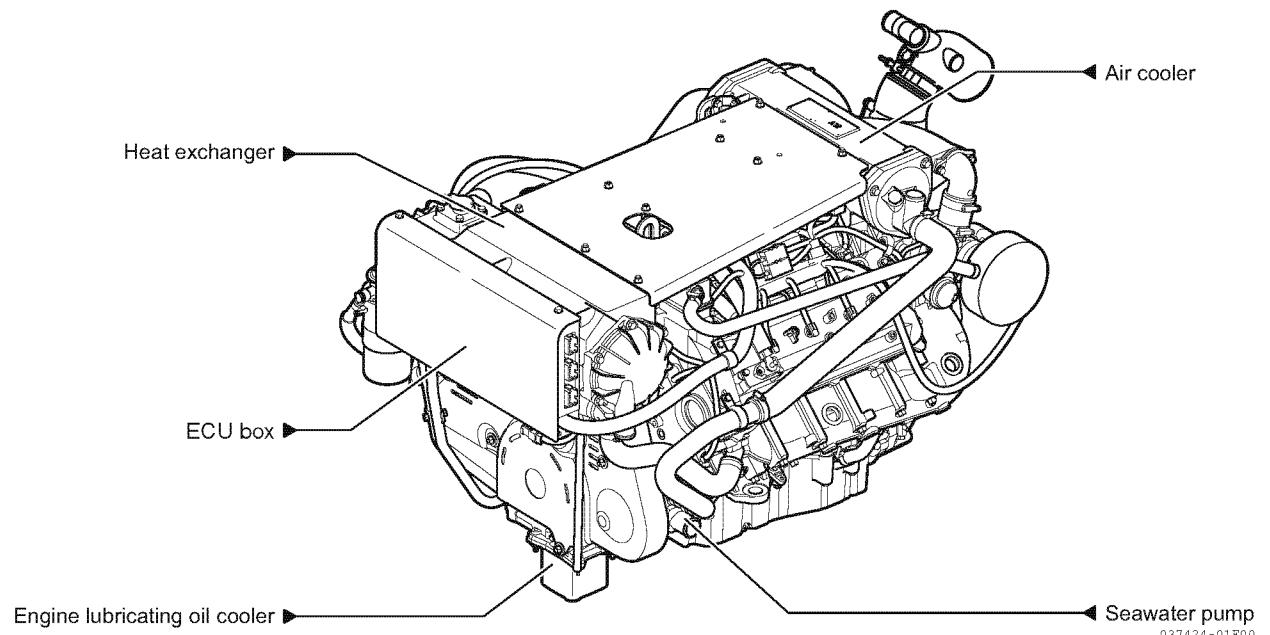


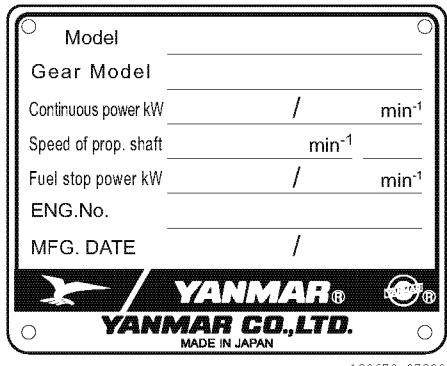
Figure 2

PRODUCT OVERVIEW

LOCATION OF NAMEPLATE

The nameplate of Yanmar 8LV series engines are shown in **Figure 3**. Check the engine's model, output, rpm and serial number on the nameplate. Please replace if damaged or lost.

The engine nameplate is attached to the top surface of the engine air cooler (**Figure 4**).



129670-07200

Figure 3

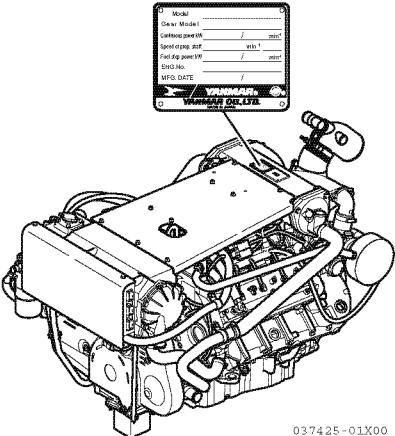


Figure 4

FUNCTION OF MAJOR COMPONENTS

Name of Component	Function
Fuel Filter	Removes dirt and water from the fuel. Drain the filter periodically. The filter element should be replaced periodically. The fuel/water separator (if equipped) should be drained periodically. See <i>Draining the Fuel/Water Separator</i> on page 48.
Fuel Supply Pump	Pumps fuel from the tank to the fuel injection system.
Fuel Priming Pump	This is a manual fuel pump. Pushing the knob on the top of the fuel filter feeds the fuel. The pump is also used to bleed air from the fuel system.
Fuel Cooler	Cool the fuel with seawater to reduce the high temperature of the fuel circuit.
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</i> on page 51.
Cooling System	There are two cooling systems: closed cooling with coolant (freshwater) 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 through the air cooler(s) in an open circuit.
Closed Cooling Circulation Pump	The centrifugal water pump circulates coolant inside the engine. The circulating pump is driven by a belt.
Seawater Pump	Pumps seawater from outside vessel to the engine. The seawater pump is belt-driven and has a replaceable rubber impeller. Never operate it without seawater, as this will damage the impeller.
Coolant Filler Cap	When the coolant temperature rises, the pressure inside the coolant tank increases and opens the pressure valve in the filler cap. When the pressure valve in the filler cap is opened, hot water and steam pass through a rubber hose to the coolant reservoir tank. When the engine cools and the pressure inside the coolant tank drops, the vacuum valve in the filler cap opens and the coolant in the coolant reservoir tank returns to the coolant tank through the pipe and filler cap. This minimizes coolant consumption.
Coolant Reservoir Tank	The pressure valve in the filler cap releases vapor and hot water overflow to the coolant reservoir tank. When the engine stops and the coolant cools, the pressure in the coolant tank drops. The filler cap vacuum valve then opens to send water back from the coolant reservoir tank. This minimizes coolant consumptions. 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.
Turbo-charger	The turbo-charger pressurizes the air coming into the engine. It is driven by a turbine that is energized by exhaust gases.
Charge Air Cooler	This heat exchanger cools the pressurized charging air from the turbo-charger 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.
Nameplates	Nameplates are provided on the engine and the marine gear and have the model, serial number and other data.
Starter	Starter motor for the engine. Powered by the battery.
Alternator	Driven by belt and generates electricity and charges the battery.
Engine Oil Dipstick	Gauge stick for checking the engine oil level.

PRODUCT OVERVIEW

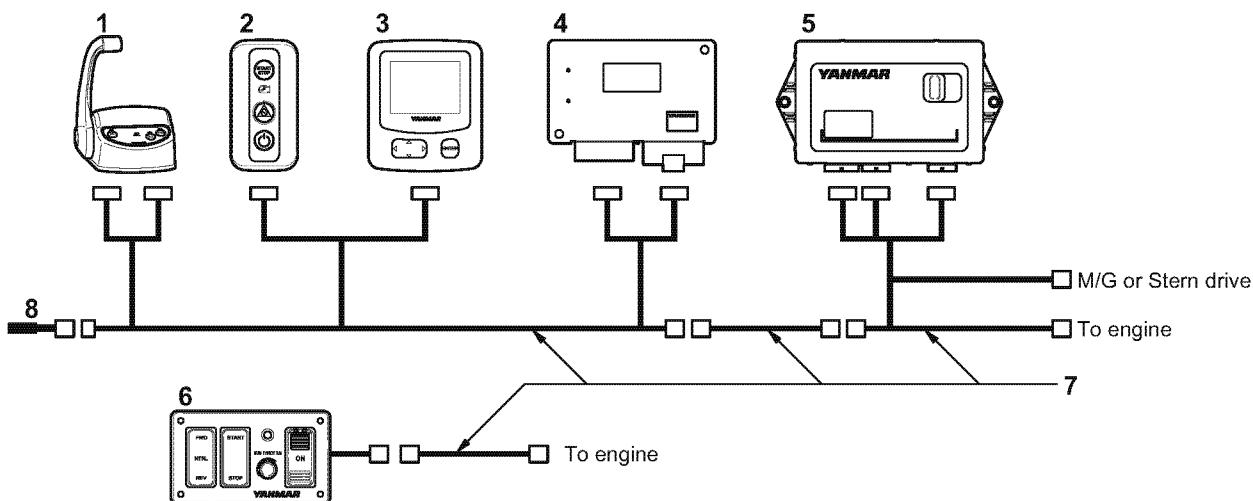
VESSEL CONTROL SYSTEM (VCS)

8LV series engine is a fully electric engine, which is controlled by Yanmar's original "Vessel Control System (VCS)".

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 stern drive for remote control operation.

Note: The Yanmar Vessel Control System (VCS) was designed to operate the 8LV engine 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 (VCS) in conjunction with the 8LV engine. 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.



037618-00E00

Figure 5

No.	Description
1	Shift and Throttle Control Head
2	Switch Panel (to start and stop the engine)
3	VCS 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

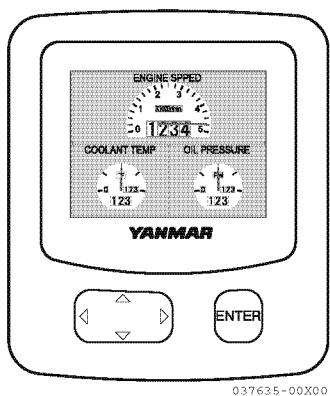


Figure 6

This screen displays real time engine data and alarm indications.

Alarm Indicators

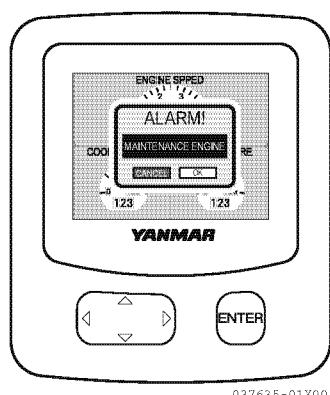


Figure 7

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, contact your authorized Yanmar Marine dealer or distributor and ask for diagnostics.

Diag Codes Screen

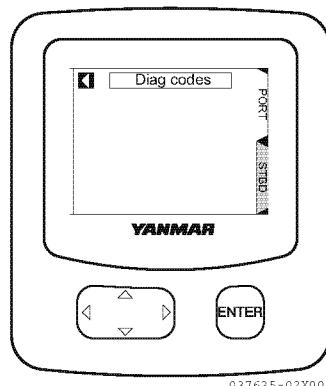


Figure 8

Alarm Indicator Functions

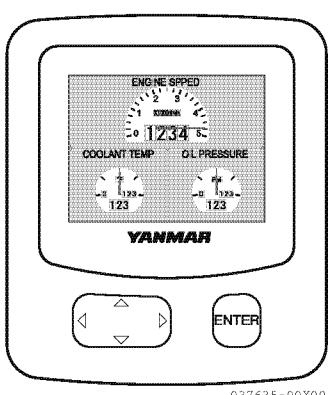
The alarm indicators and buzzer are activated when sensors detect an abnormality during engine operation. The alarm indicators are off during normal operation, but are activated as follows when an abnormality arises:

- 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.

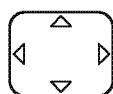
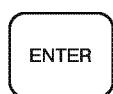
PRODUCT OVERVIEW

■ Operation of the Display's Buttons

Buttons



037635-00X00



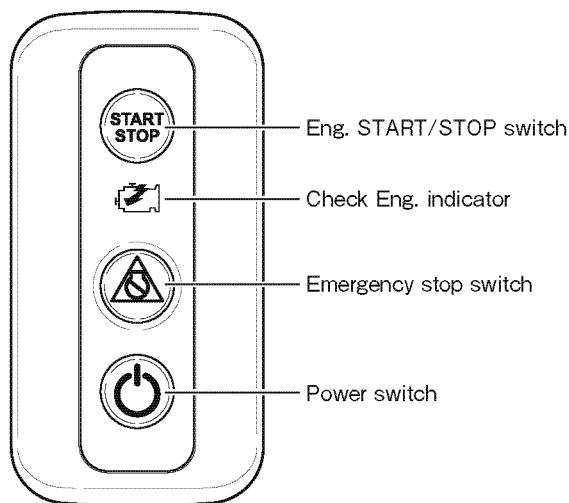
- Act on pop-up menu (MAIN MENU)
 - Perform the function
- ▲ Up Arrow moves menu selection up
▼ Down Arrow moves menu selection down
◀ Left Arrow acts on current menu item
▶ Right Arrow acts on current menu item

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.



037627-00E04

Figure 9

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

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

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

BEFORE YOU OPERATE

DIESEL FUEL

! DANGER

Diesel fuel is flammable and explosive under certain conditions. See *Safety on page 3*.

Diesel Fuel Specifications

NOTICE

Only use diesel fuels recommended by Yanmar Marine 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
No. 2-D, No. 1-D, ASTM D6751, D7467	USA
EN590:2009, EN14214	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan

■ Bio-Diesel 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.

! CAUTION

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 D6751, D7467.

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

Precautions and concerns regarding the use of bio-fuels:

- Biodiesel fuels have a higher content of methyl-esters, which may deteriorate certain metal, rubber and plastic components of the fuel system. The customer and/or boat builder are responsible to verify the usage of biodiesel compatible components on the vessel fuel supply and return systems.
- Free water in biodiesel may result in plugging of fuel filters and increased bacterial growth.
- High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures, and poor injection nozzle spray atomization.
- Biodiesel may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
- Even biodiesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and/or fuel storage containers, may be necessary.
- The use of biodiesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or biodiesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.

■ Additional Technical Fuel Requirements

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

■ Handling of Diesel Fuel

- 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.

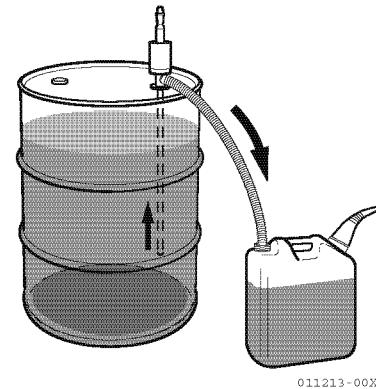


Figure 1

- 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 (Option)

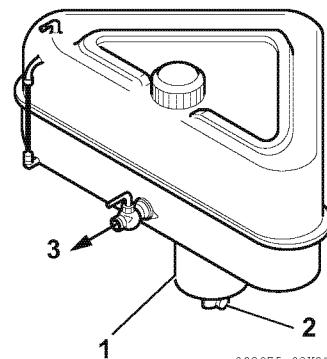


Figure 2

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

The fuel outlet should be positioned 20 to 30 mm (0.8 to 1.2 in.) above the bottom of the tank so that only clean fuel is distributed to the engine (3, **Figure 2**).

BEFORE YOU OPERATE

Filling the Fuel Tank

! DANGER

Never refuel with the engine running. See Safety on page 3.

Before filling the fuel tank for the first time, rinse the fuel tank with kerosene or diesel fuel. Dispose of waste properly.

■ To Fill the Fuel Tank

! WARNING

Operate the bilge ventilation (blowers) for a minimum of 5 minutes to purge fumes from engine compartment after refueling. Never operate the bilge blower(s) while refueling. Doing so can pump explosive fumes into the engine compartment and result in an explosion.

1. Clean the area around the fuel cap.
2. Remove the fuel cap from the fuel tank.
3. Fill the tank with clean fuel free of oil and dirt.

! WARNING

Hold the hose nozzle firmly against the filler port while filling. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.

4. Stop fueling when the gauge shows the fuel tank is full.

! CAUTION

Never overfill the fuel tank.

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

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.

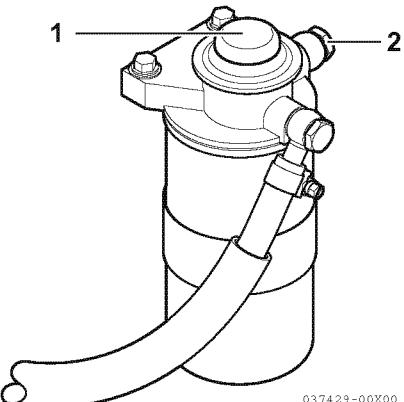


Figure 3

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

! WARNING

Always wear safety glasses when bleeding the fuel system.

3. Loosen the air bleed screw (2, Figure 3).
4. Push up and down on the priming pump (1, Figure 3) to release air out of the air bleed screw.
5. Continue pumping until a solid stream of fuel with no air bubbles begins to flow.
6. Tighten the air bleed screw.

ENGINE OIL

Engine Oil Specifications

NOTICE

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, CI-4
- AECA: E3, E4, E5
- JASO: DH2, DL-1
- SAE Viscosity: 15W40. Engine oil 15W40 can be used throughout the year

NOTICE

- Make sure that 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.
- Yanmar does not recommend the use of engine oil "additives".

■ Handling Engine Oil

1. When handling and storing engine oil, be careful not to allow dust and water to contaminate the oil. Clean around the filler port before filling.
2. Do not mix lubrication 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

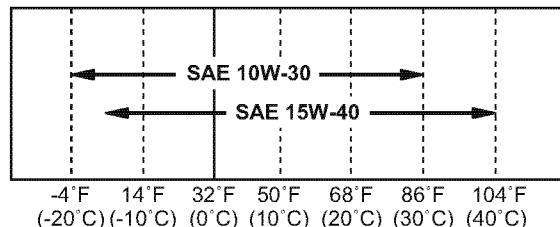
SAE15W40 is the recommended oil viscosity.

If you operate your equipment below -15 °C (5 °F) or above 40 °C (104 °F), consult your authorized Yanmar Marine dealer or distributor for special lubricants or starting aids.

The 8LV series engine has an oil filler port for rocker arm cover.

The engine has a dipstick on the right side.

An additional dipstick on the left side is available as an option (**Figure 1** on page 13).



Ambient Temperature 037779-00E00

Figure 4

BEFORE YOU OPERATE

Checking the Engine Oil

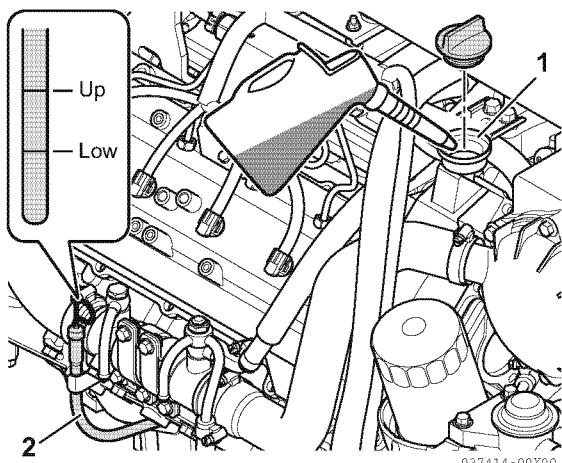


Figure 5

1. Make sure the engine is level.
2. Remove dipstick (2, **Figure 5**) and wipe with clean cloth.
3. Fully reinserst dipstick.
4. Remove dipstick. The oil level should be between upper and lower lines on the dipstick.
5. Add oil if necessary. *See Adding Engine Oil on page 26.*
6. Fully reinserst dipstick.

Adding Engine Oil

1. Remove the yellow oil filler port cap from filler port (1, **Figure 5**) and fill with engine oil.

NOTICE

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

2. Fill with oil to the upper limit on the dipstick (2, **Figure 5**).

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 dipstick.

4. Hand-tighten the filler port cap securely.

ENGINE COOLANT

Engine Coolant Specifications

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

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

NOTICE

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

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

Coolant (Closed Cooling System)

NOTICE

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

Checking and Adding Coolant

NOTICE

The 8LV series engine has filter port on the coolant tank.

1. Ensure all drain cocks are closed.

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

2. Loosen the filler cap (1, **Figure 6**) of the coolant tank to relieve the pressure, then remove the filler cap.

! DANGER

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.

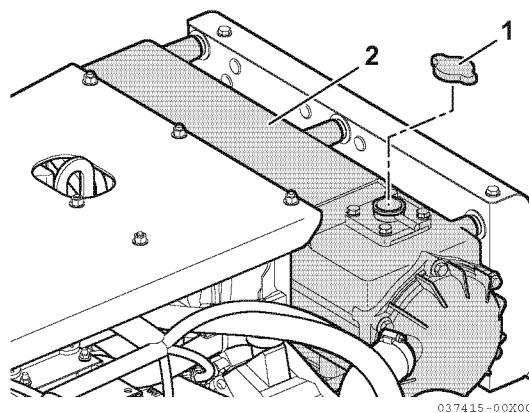


Figure 6

3. Pour coolant slowly into the coolant tank (2, **Figure 6**) to avoid air bubbles. Fill until coolant overflows from the filler port.

NOTICE

Never pour cold coolant into a hot engine.

BEFORE YOU OPERATE

4. Tighten filler cap.

WARNING

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

NOTICE

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

5. Check the coolant level in the coolant reservoir tank. The level should be at the FULL mark. Add coolant if necessary.

NOTICE

Never pour cold coolant into a hot engine.

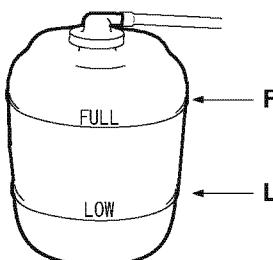


Figure 7

6. Remove coolant reservoir tank cap to add coolant if necessary.
7. Replace filler cap and tighten it firmly. Failure to do so will cause water leakage.

Coolant Reservoir Tank Capacity
1.25 l (2.6 pt)

8. Check the rubber hose connecting the coolant reservoir tank to the coolant tank/heat exchanger. Replace if damaged.

Note:

- The level of the coolant tank often decrease.
- The level of the reservoir tank does not change. In these cases, there may be water or air leaks in the cooling system. Contact your authorized Yanmar Marine dealer or distributor.

CHECKING THE ENGINE OIL AND ENGINE COOLANT

When engine oil or coolant is supplied for the first time or when they must be replaced, conduct a trial operation of the engine and check the quantity of engine oil and coolant. The trial engine operation will send the engine oil and coolant to the passages, so the engine oil and coolant levels will drop. Check and resupply as necessary:

1. Approximately 5 minutes after stopping the engine, remove the oil dipstick (2, **Figure 5**) and check the oil level. Add oil if the level is too low.
2. Add coolant to the coolant reservoir tank to stay within the upper or lower limit (**Figure 7**).

ENGINE OPERATION

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

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

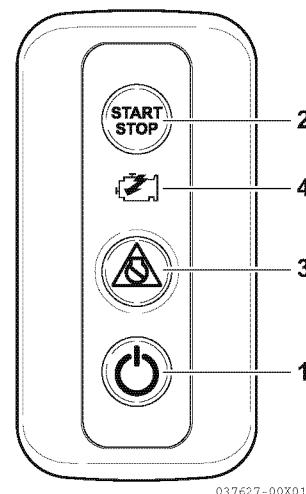
ENGINE OPERATION

STARTING THE ENGINE (START UP)

1. Open the seacock.
2. Open the fuel tank cock.
3. Turn the battery switch on for engine and VCS.
4. Press the Power switch on the switch panel of the selected station (1, **Figure 1**).
 - The switch panel lamp will come on, and the control head (**Figure 2**) “SEL” lamp (**Figure 3**) will come on or flash.
 - To use the Engine START/STOP switch, be sure to turn the Power switch ON.
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 control head handle to the N (Neutral) position.
9. For stern drives, check that it is not aligned with the trailer position.
10. Press the Engine START/STOP switch (2, **Figure 1**) and power on the starter.
 - When the engine starts, the VCS display will show the screen with engine conditions (**Figure 4**).

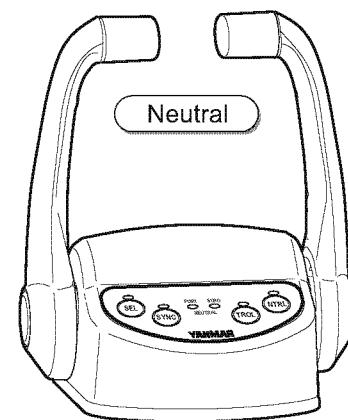
Note:

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.*
5. *If the stern drive is in the trailer position, the buzzer sounds and the engine does not start.*



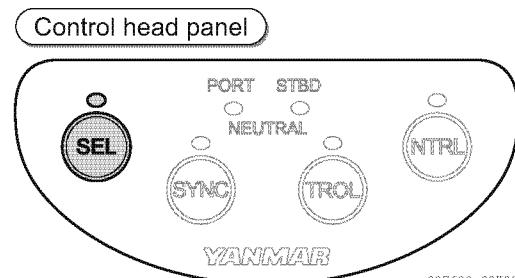
037627-00X01

Figure 1



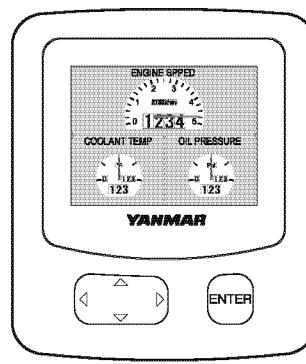
037639-00E00

Figure 2



037628-00X00

Figure 3



037635-00X00

Figure 4

VCS 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 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.

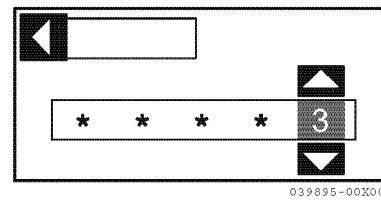


Figure 5

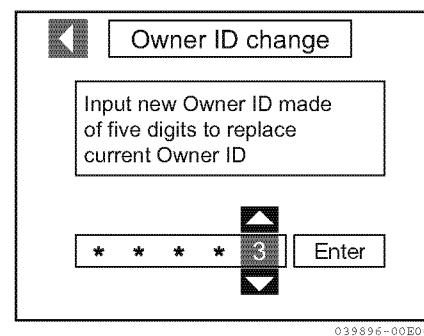


Figure 6

ENGINE OPERATION

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

The engine will seize if it is operated when seawater discharge is too small or if load is applied without any warming up operation.

NOTICE

The starter will run continuously for 15 seconds and then stop.

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

After the Engine has Started

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

1. Check that the indicators on the display and the control head are normal.
2. Check for water or oil leakage from the engine.
3. Check that exhaust color, engine vibrations, and sound are normal.
4. When there are no problems, keep the engine at low speed to send engine oil to all parts of the engine.
5. Check that sufficient seawater is discharged from the seawater outlet pipe. Operation with inadequate seawater discharge will damage the impeller of the seawater pump. If seawater discharge is too small, stop the engine immediately. Identify the cause and repair.
 - Is the seacock open?
 - Is the inlet of the seacock on the hull bottom clogged?
 - Is the seawater suction hose broken, or does the hose suck in air due to a loose joint?

WARM UP MODE (SHIFT DISCONNECT)

1. Move the control head 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 Throttle Handle. The engine speed can be controlled while the gear shift is in neutral.
5. Move the control head handle to the N (Neutral) position, press the "NTRL" switch and cancel warm up mode.

Control head panel

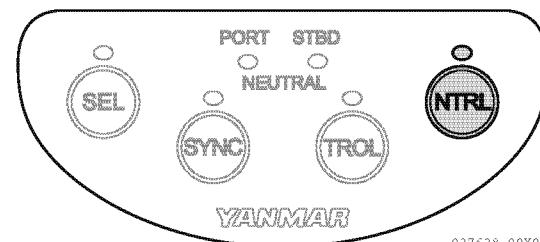


Figure 7

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 control head 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.

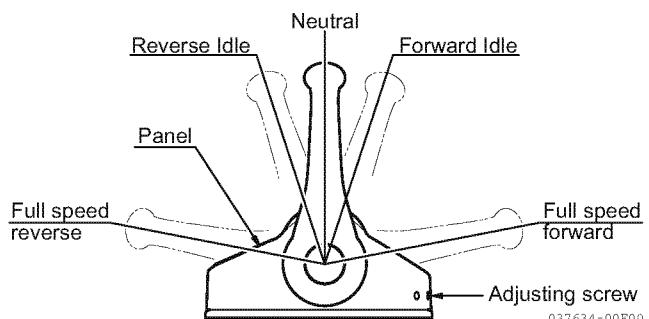


Figure 8

ENGINE SPEED LIMIT MODE

1. Move the control head 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 control head 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 VCS display. The default value is 50 %.

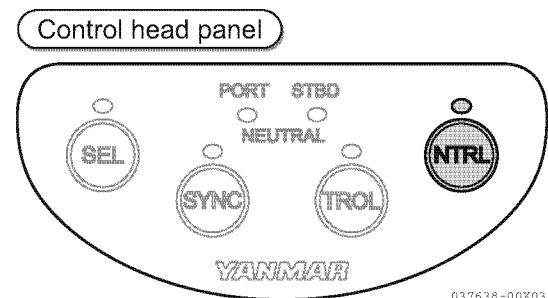


Figure 9

ENGINE OPERATION

CAUTIONS DURING OPERATION

NOTICE

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

1. 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.
2. Is the exhaust color normal?
The continuous emission of black exhaust smoke indicates engine overloading. This shortens the engine's life and should be avoided.
3. 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 noticeable 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.

4. 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.

5. Is there water, oil, or fuel leakage, or are there any loose bolts? Check the engine room periodically for any problems.
6. 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.
7. When operating the engine at low speed for long periods of time, rev up the engine once every 2 hours.

NOTICE

Revving up the engine: With the gear in NEUTRAL, accelerate from the low speed position to the high speed position and repeat this process about 5 times. This is done to clean out carbon from the cylinders and the fuel injection valve. Neglecting to rev up the engine will result in poor exhaust color and reduce engine performance.

8. If possible, periodically operate the engine at near maximum rpm, 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 control head handle to the N (Neutral) position. (The NEUTRAL lamp will come on.)
2. Cool the engine down at low speed (below 1000 min⁻¹ (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.**

Do not turn the Battery switch OFF before turning the Power switch OFF.

NOTICE

Wait 4 seconds or more before turning battery switch off for secure system settle down.

5. Turn the battery switch off for engine and VCS.
6. Close the fuel tank cock.
7. 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).

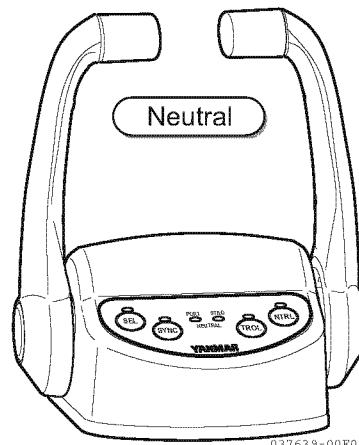


Figure 10

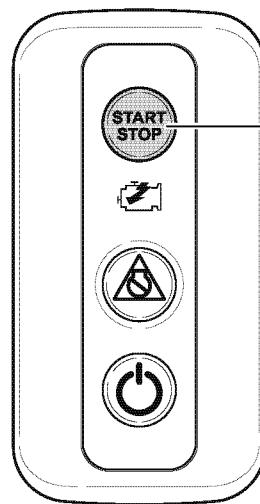


Figure 11

ENGINE OPERATION

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.

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).*

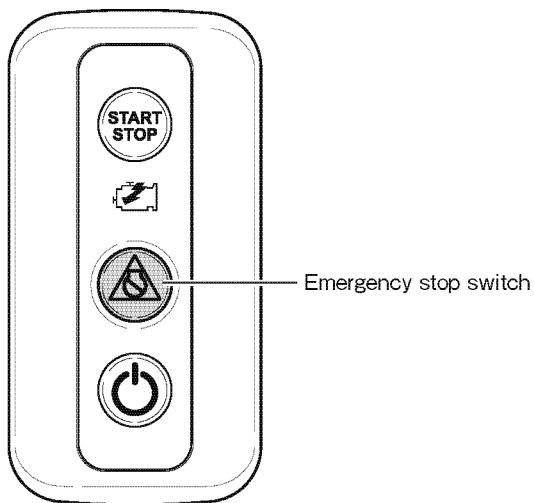


Figure 12

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 and gear shift 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.

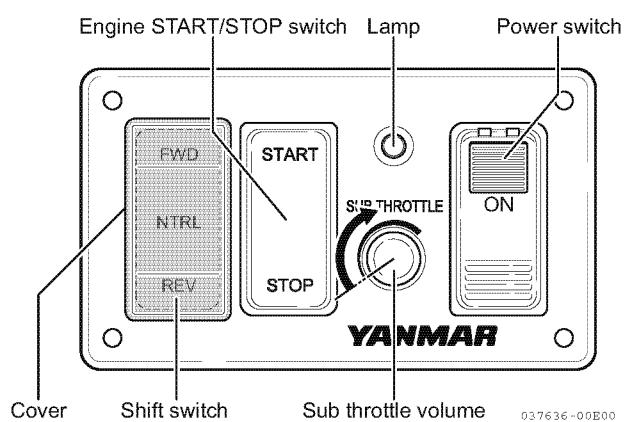


Figure 13

CHECKING THE ENGINE AFTER OPERATION

- Check that battery switch is turned to OFF.
- Fill the fuel tank. *See Filling the Fuel Tank on page 24.*
- Close seacock(s).
- If there is a risk of freezing, check that the cooling system contains enough coolant. *See Engine Coolant Specifications on page 27.*
- If there is a risk of freezing, drain the seawater system. *See Draining the Seawater Cooling System on page 58.*
- At temperatures below 0 °C (32 °F), drain seawater system and connect the engine heater (if equipped).

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PERIODIC MAINTENANCE

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

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

PERIODIC MAINTENANCE

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

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 of performing daily checks before the start of each operating day. See *Daily Checks* on page 46.

Keep a Log of Engine Hours and Daily Checks

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

NOTICE

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

Yanmar Replacement Parts

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

Tools Required

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

Ask Your Authorized Yanmar Marine Dealer or Distributor for Help

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

Tightening Fasteners

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

■ Main Bolt and Nut Tightening Torque

No.	Tightening Parts	Thread Dia. × Pitch	Material	Lubricant	Tightening Torque N·m (kgf·m)
1	Exhaust Manifold	M10 × 1.25	S45C	—	36 ± 4 (3.7 ± 0.4)
2	Mounting Foot	M12 × 1.25	SCM435	—	80 ± 10 (8.2 ± 1.0)
3	Union, Lubricating Oil Filter	3/4 - 16 UNF		Apply lubricating oil	43.1 (4.4)
4	Lubricating Oil Filter	3/4 - 16 UNF		Apply lubricating oil	14.7 - 19.6 (1.5 - 2.0)
5	Bolts, Installation of Seawater Pump	M8 × 1.25	S45C	—	20 ± 3 (2.0 ± 0.3)
6	Support, Lubricating Pipe (Lubricating Oil Filter in/out)	M8 × 1.25	S45C	—	5 ± 1 (0.5 ± 0.1)
7	Nut, Starter B Terminal	M8 × 1.25	S45C	—	21 ± 2 (2.1 ± 0.2)
8	Bracket, EDU (Head Cover Insert of Resin)	M6 × 1	S45C	—	10 ± 1 (1.0 ± 0.1)
9	Battery Terminal (Head Cover Insert of Resin)	M6 × 1	S45C	—	10 ± 1 (1.0 ± 0.1)
10	Nut, Battery Terminal	M8 × 1.25		—	10 ± 1 (1.0 ± 0.1)
11	V Band, Turbo-charger and Mixing Elbow			Apply Molybdenum Coat on the threads	After tightening at 6 ± 1 (0.6 ± 0.1), hit the outer circumference with a plastic hammer (3 times evenly at 3 places or more), and retighten at 6 ± 1 (0.6 ± 0.1).
12	Bolts, Installation of Vibration Isolator	M16 × 2	SMC435	—	196 ± 10 (20.0 ± 1.0)

PERIODIC MAINTENANCE

■ Standard Tightening Torque

Thread Diameter		M6	M8	M10	M12	M10	M12
Pitch	mm	1.0	1.25	1.5	1.75	1.25	1.25
Width across flat	mm	10	12	14	17	14	17
Tightening torque	N·m (kgf·m)	10.8 ± 1 (1.1 ± 0.1)	25.5 ± 3 (2.6 ± 0.3)	49 ± 5 (5.0 ± 0.5)	88.2 ± 10 (9.0 ± 1.0)	52 ± 5 (5.3 ± 0.5)	93 ± 10 (9.5 ± 1.0)

NOTICE



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

■ Torque for Pipe Joint Bolts

Thread Diameter		M8	M10	M12	M14	M16
Pitch	mm	1.25	1.25	1.25	1.5	1.5
Width across flat	mm	14	14	17	19	22
Tightening torque	N·m (kgf·m)	14.7 ± 2 (1.5 ± 0.2)	22.5 ± 3 (2.3 ± 0.3)	29.4 ± 5 (3.0 ± 0.5)	44.1 ± 5 (4.5 ± 0.5)	53.9 ± 5 (5.5 ± 0.5)

Note: Do not apply oil on bolts.

■ Torque for Piping Taper Screw

Thread Diameter		1/8	1/4	3/8	1/2
Tightening torque	N·m (kgf·m)	9.8 (1.0)	19.6 (2.0)	29.4 (3.0)	58.8 (6.0)

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 44* and the *Periodic Maintenance Procedures on page 46*.

EPA Requirements for USA and Other Applicable Countries

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

See Conditions to Ensure Compliance with EPA Emission Standards on page 43. Clean or replace the air cleaner element if the air intake restriction exceeds the referenced specifications.

EPA Requirements

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

Conditions to Ensure Compliance with EPA Emission Standards

The 8LV series is an EPA-certified engine.

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

The operating conditions should be as follows:

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

The diesel fuel should be:

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

The lubricating oil should be:

- Type API, Class CD, CF, CF-4, CI, CI-4

Be sure to perform inspections as outlined in *Periodic Maintenance Procedures on page 46* and keep a record of the results.

Pay particular attention to these important points:

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

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

Inspection and Maintenance

See Inspection and Maintenance of EPA Emission-Related Parts on page 45 for the EPA emission-related parts. Inspection and maintenance procedures not shown in the *Inspection and Maintenance of EPA Emission-Related Parts* section are covered in *Periodic Maintenance Schedule on page 44*.

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

PERIODIC MAINTENANCE

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

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

System	Item	Periodic Maintenance Interval				
		Daily See Daily Checks on page 46.	Every 50 Hours or Monthly Whichever Comes First	Every 250 Hours or One Year Whichever Comes First	Every 500 Hours or Two Years Whichever Comes First	Every 1000 Hours or Four Years Whichever Comes First
Whole	Visual inspection of engine exterior	○				
Fuel System	Check fuel level and refill if necessary	○				
	Drain water and sediment from fuel tank		○ Initial 50	○		
	Drain fuel filter/water separator		○			
	Replace fuel filter element			◇		
Lubricating System	Check engine oil level	○ Engine Marine Gear				
	Replace engine oil	Engine	◇ Initial 50	◇		
		Marine Gear (if equipped)	◇ Initial 50	◇		
	Replace oil filter element	Engine	◇ Initial 50	◇		
		Marine Gear (if equipped)	◇ Initial 50	◇		
Cooling System	Seawater outlet	○ During operation				
	Check coolant level	○				
	Check or replace seawater pump impeller			○		◇
	Replace coolant		Every year			
	Clean and check seawater passages					●
	Replace zinc anode			◇		

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

System	Item	Periodic Maintenance Interval				
		Daily See Daily Checks on page 46.	Every 50 Hours or Monthly Whichever Comes First	Every 250 Hours or One Year Whichever Comes First	Every 500 Hours or Two Years Whichever Comes First	Every 1000 Hours or Four Years Whichever Comes First
Air Intake and Exhaust System	Clean intake air filter			○		
	Clean or replace exhaust/water mixing elbow			○	◇	
	Clean turbo-charger*			●		
	Replace the lagging of turbo-charger					●
Electrical System	Check alarm and indicators	○				
	Check electrolyte level in the battery		○			
	Damage of belt			○		
	Check wiring connectors			○		
Engine Cylinder Head and Block	Check for leakage of fuel, engine oil and engine coolant	○ After starting				
	Tighten all major nuts and bolts			●		
Miscellane- ous Items	Adjust the propeller shaft alignment		● Initial 50			●
	Replace rubber hoses (fuel and water)				◇	

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

Inspection and Maintenance of EPA Emission-Related Parts

Marine diesel engines greater than 37 kW: 8LV series is certified as an EPA CI marine engine.

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

Action	Interval
Check turbo-charger adjustment	3000 hours
Check electronic engine control unit and its associated sensors and actuators	

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

PERIODIC MAINTENANCE

PERIODIC MAINTENANCE PROCEDURES

WARNING

Always wear personal protective equipment. Refer to *Explosion Hazard* on page 4.

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

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. Contact your authorized Yanmar Marine dealer or distributor and repair any damage.

3. Check for engine coolant leaks.
4. Check for damaged or missing parts.
5. Check for loose, missing or damaged fasteners.
6. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
7. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.

8. Check the fuel filter/water separator for presence of water and contaminants. If you find any water or contaminants, drain the fuel filter/water separator. See *Draining the Fuel/Water Separator* on page 48. 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 47.

NOTICE

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

■ Checking Diesel Fuel, Engine Oil and Engine Coolant Levels

Follow the procedures in *Diesel Fuel* on page 22, *Engine Oil* on page 25 and *Engine Coolant* on page 27 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 49.

■ Checking the Alternator Belt

Check the belt tension before use. See *Damage of Belt* on page 54.

■ Checking the Alarm Indicators

When operating the start switch on the rocker switch panel, check that there is no alarm message on the display and the alarm indicators work normally. See *Vessel Control System (VCS)* on page 16.

■ Preparing Fuel, Oil, and Coolant in Reserve

Prepare sufficient fuel for the day's operation. Always store engine oil and coolant in reserve (for at least one refill) onboard, to be prepared 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 Filter (if equipped)
- Adjusting the Propeller Shaft Alignment

■ Draining the Fuel Tank

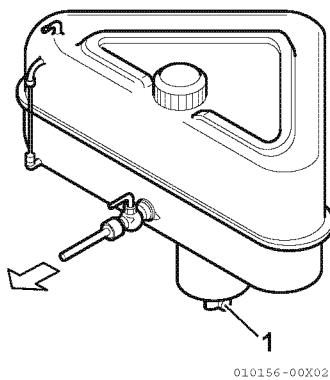


Figure 1

1. Put a pan (1, **Figure 1**) under the drain cock 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 effective to drain the engine oil after operation while the engine is still warm.

⚠ WARNING

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

1. Remove the yellow oil filler port cap from filler port (1, **Figure 5 on page 26**). Remove the drain plugs (both in the right and left) in the lower portion of the oil pan and drain the engine oil.

NOTICE

- Prevent dirt and debris from contaminating engine oil. Carefully clean the oil filler cap on the cylinder block side cover plate and the surrounding area before you remove the oil filler cap.
- Always be environmentally responsible.

2. Turn the engine oil filter counterclockwise with a filter wrench.

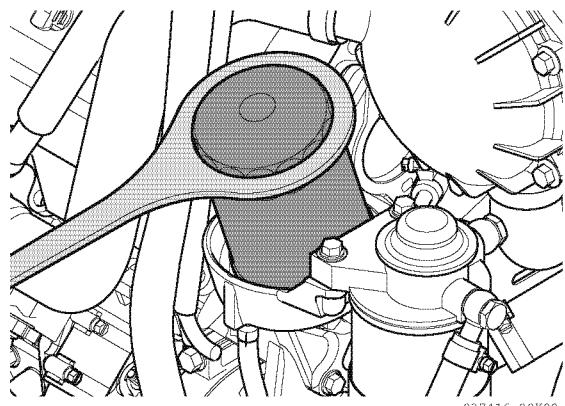


Figure 2

3. Remove the engine oil filter.
4. Install new engine oil filter and tighten by hand until the seal touches the housing.

PERIODIC MAINTENANCE

5. Turn the filter an additional 3/4 to one turn with a filter wrench.
6. Fill with new engine oil. See *Adding Engine Oil* on page 26.

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.

■ 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 47.

■ Adjusting the Propeller Shaft Alignment

The flexible engine mounts are compressed a little 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 gradually increasing and decreasing the engine speed.

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

Every 50 Hours of Operation

Perform the following maintenance every 50 hours or monthly of operation, whichever comes first.

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

■ Draining the Fuel/Water Separator

⚠ WARNING

When removing any fuel system component to perform maintenance (such as changing the fuel filter), put an approved container under the opening to catch the fuel. Never use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive. Wipe up any spills immediately. Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.

The 8LV series engine already have the optional fuel/water separator installed. If not, the customer should install a fuel/water separator attached to the hull.

Water Separator (Option)

1. Draining the separator:

- Remove the plug at the bottom of the water separator and drain any water and dirt.
- After draining the separator, reinstall the plug securely.

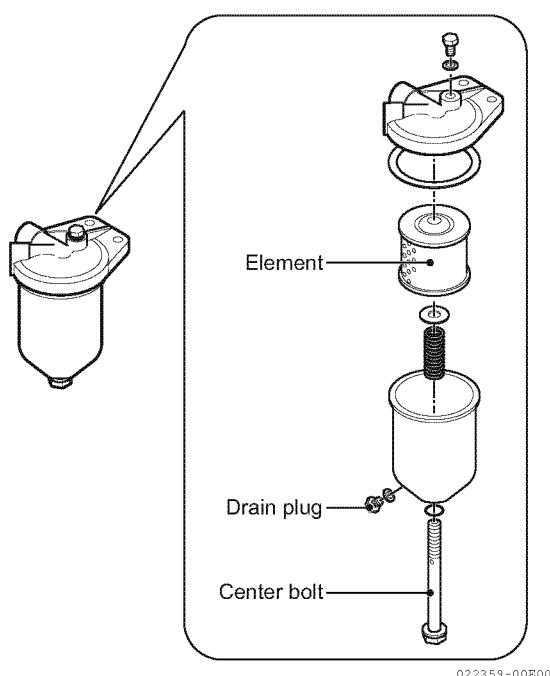


Figure 3

2. Replacing the element:

- Remove the center separator bolt, then the filter case and element.
- Wash the separator case and replace the element and O-ring with new ones.
- Do not forget to reinstall the spring and washer. Fasten the center bolt securely.

- Always make sure to bleed the air after the element has been replaced.

**Figure 4**

■ Checking the Battery Electrolyte Level (Serviceable Batteries Only)

⚠ WARNING

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

NOTICE

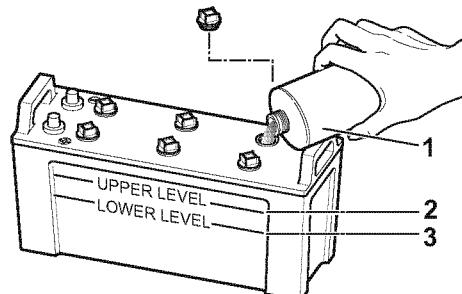
- Never turn off the battery switch (if equipped) or short the battery cables during operation. Damage to the electric system will result.
- Never operate with insufficient battery electrolyte. Operating with insufficient electrolyte will destroy the battery.
- Battery fluid tends to evaporate in high temperatures, especially in summer. In such conditions, inspect the battery earlier than specified.

- Turn the battery master switch to OFF or disconnect the negative (-) battery cable.
- Do not operate with insufficient battery electrolyte as the battery will be destroyed.
- Remove the plugs and check the electrolyte level in all cells.

NOTICE

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

- If the level is lower than the minimum, fill level (3, **Figure 5**), fill with distilled water (1, **Figure 5**) (available in the grocery store) up to the upper limit (2, **Figure 5**) of the battery.

**Figure 5**

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

PERIODIC MAINTENANCE

Every 250 Hours of Operation

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

- Draining the Fuel Tank
- Replacing the Fuel Filter Element
- Changing the Engine Oil and Replacing the Engine Oil Filter Element
- Checking or Replacing the Seawater Impeller
- Replacing the Zinc Anode
- Changing the Coolant
- Cleaning the Intake Silencer (Air Cleaner) Element
- Cleaning the Turbo-charger
- Cleaning the Exhaust/Seawater Mixing Elbow
- Damage of Belt
- Checking the Wiring Connectors
- Tightening All Major Nuts and Bolts

■ Draining the Fuel Tank

See *Draining the Fuel Tank* on page 47.

■ Replacing the Fuel Filter Element

⚠ WARNING

- When removing any fuel system component to perform maintenance (such as replacing the fuel filter), put an approved container under the opening to catch the fuel. Never use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive. Wipe up any spills immediately. Wear eye protection. The fuel system is under pressure and fuel could spray out when removing any fuel system component.
- Perform this check with engine off and key removed to avoid contact with moving parts.

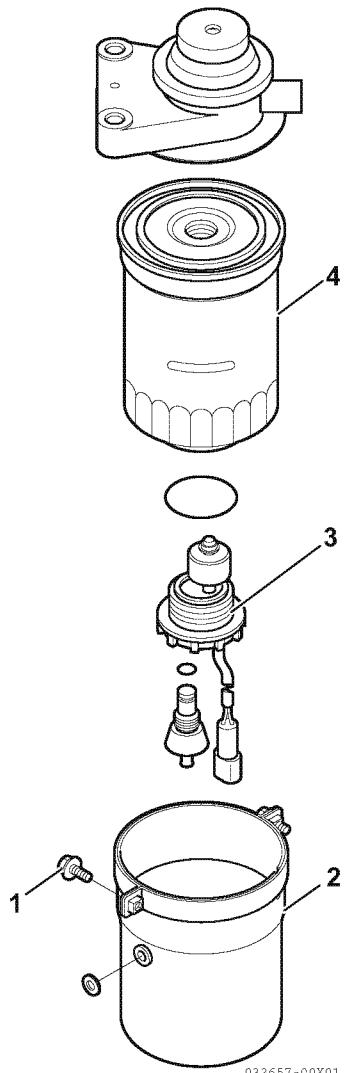
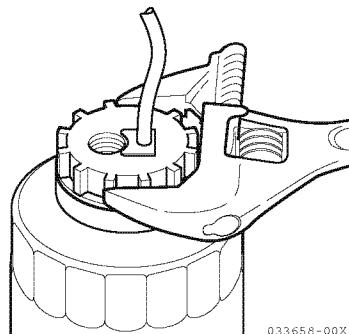


Figure 6

1. Close the fuel cock of the fuel tank.

2. Remove the two mounting screws (1, **Figure 6**) and the housing (2, **Figure 6**).
3. Drain the fuel from the fuel drain cock on the bottom of the fuel/water separator.
4. Disconnect the alarm switch harness.

**Figure 7**

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

Component	Part No.
Fuel Filter Element	119798-55110

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 (130.1 - 173.5 in.-lb).
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 24.

Dispose of waste properly.

■ Changing the Engine Oil and Replacing the Engine Oil Filter Element

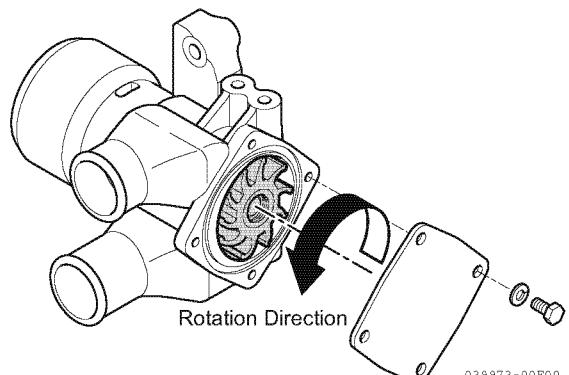
See Changing the Engine Oil and Replacing the Engine Oil Filter Element on page 47.

■ Checking and Replacing the Seawater Pump Impeller

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

Replacing the Seawater Pump Impeller

Note: The impeller must be replaced periodically (every 1000 hours) even if there is no damage.

**Figure 8**

PERIODIC MAINTENANCE

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

NOTICE

The seawater pump turns counterclockwise as viewed from the side cover, so the impeller must be installed as shown in **Figure 8**. If the impeller has been removed it must be installed in the correct direction. Additionally, if the engine is being turned over manually, be careful to turn it in the correct direction. Incorrect turning will twist the impeller blades and cause damage.

Puller A (Standard)

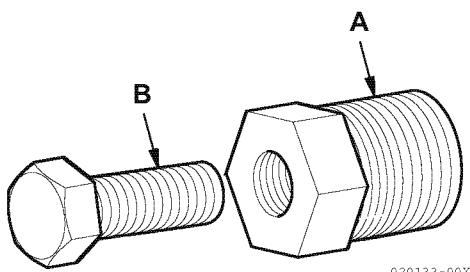


Figure 9

Puller A	Jack Screw B
120325-92110	26116-100504
M18 × 1.5	M10 × 50

1. Remove the side cover of the seawater pump.
2. Install the puller (A, **Figure 9**) in the impeller.

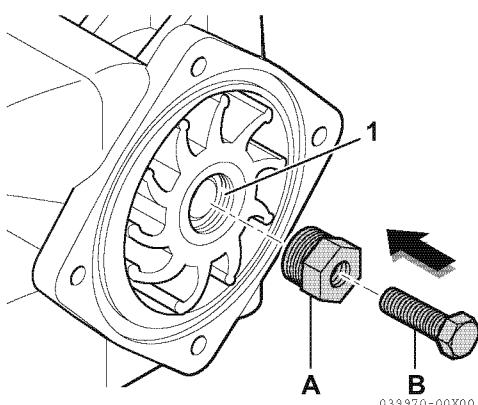


Figure 10

3. Turn the jack screw (B, **Figure 9**) clockwise to remove the impeller from the pump body.

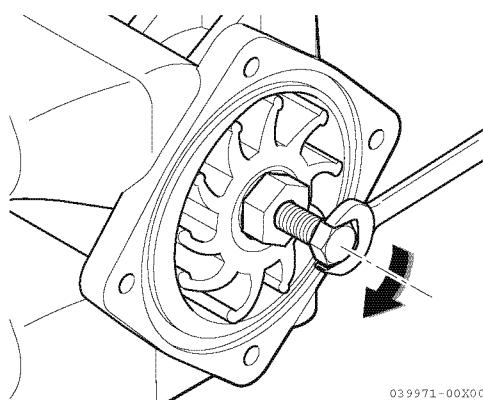


Figure 11

*Note: When replacing a used impeller with a new one, the impeller must have an M22 × 1.5 thread (1, **Figure 10**). Turn the M18 screw-side of the impeller to the cover side and install (**Figure 11**).*

Puller B (Option) Part No. 129671-92100

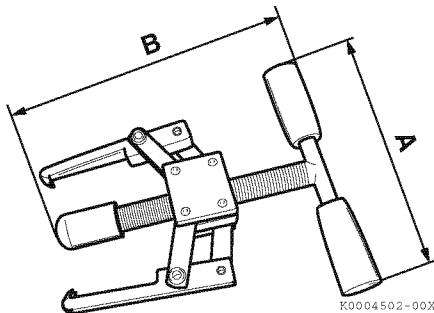


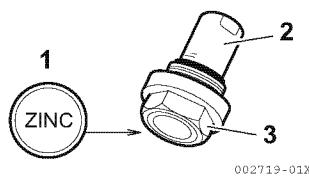
Figure 12

A	B
110 mm (4.33 in.)	140 mm (5.51 in.)

■ Replacing the Zinc Anode

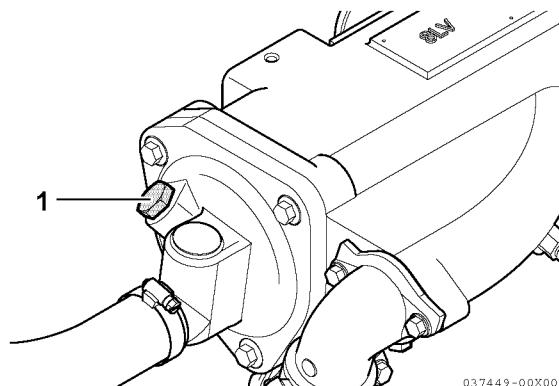
The timing for replacing zinc anode varies depending on the characteristics of the seawater and operational conditions. Inspect the zinc periodically and remove the corroded area on the surface. Replace the zinc anode when it has decreased to less than 1/2 of the original volume. If replacement of zinc is neglected and operation is continued with a small volume of zinc anode, corrosion of the seawater cooling system will occur and water leakage or parts breakage will result.

The label shown in the figure is stamped on the plugs which have the zinc anode. Be sure to close the seacock before removing the plug to replace the zinc anode.



- 1 - Sticker
- 2 - Zinc Anode
- 3 - Plug

Figure 13



- 1 - Heat Exchanger Zinc Anode

Figure 14

■ Changing the Coolant

CAUTION

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

Replace coolant every year.

NOTICE

Never mix different types and/or colors of coolants.

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

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

1. Open all coolant drain cocks.
2. Allow the coolant to drain completely. Dispose of waste properly.
3. Close all the drain cocks.
4. Fill coolant tank and coolant reservoir tank with appropriate coolant. See *Engine Coolant Specifications* on page 27 and See *Checking and Adding Coolant* on page 27.

■ Location of Coolant Drain Cocks (Colored Gray)

Lubricating Oil Cooler

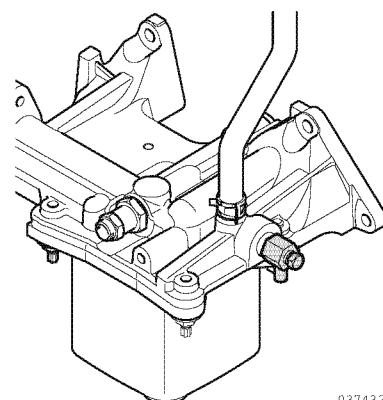


Figure 15

PERIODIC MAINTENANCE

Exhaust Manifold (RH Side)

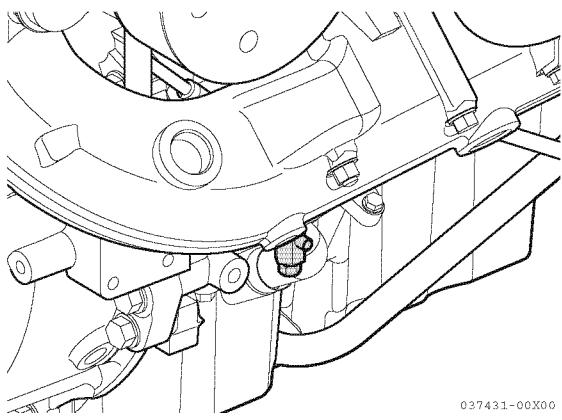


Figure 16

Exhaust Manifold (LH Side)

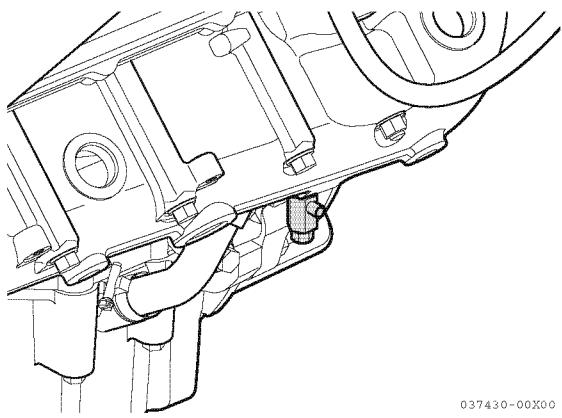


Figure 17

Coolant Piping

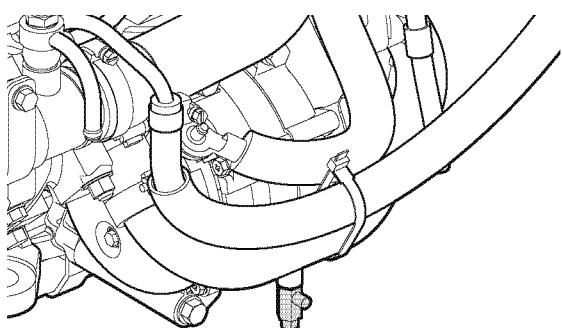


Figure 18

■ Cleaning the Intake Silencer (Air Cleaner) Element

Refer to (Figure 1 on page 13) for the illustration.

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

■ Cleaning the Exhaust/Seawater Mixing Elbow

The mixing elbow (Figure 1 on page 13) is attached to the turbo-charger (Figure 1 on page 13).

The exhaust gas is mixed with seawater in the mixing elbow.

1. Remove the mixing elbow.
2. Clean any dirt and scale out of the exhaust and seawater passages.
3. If the mixing elbow is damaged, repair or replace.
4. Inspect the gasket and replace if necessary.

■ Cleaning the Turbo-charger

Contamination of the turbo-charger causes revolutions to drop and engine output to fall.

If a significant drop in engine output is noted (10 % or more), clean the turbo-charger.

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

■ Damage of Belt

WARNING

Perform this check while engine and system power are turned off, to prevent from rolling into the belt and pulleys. Otherwise you may get seriously injured.

NOTICE

- Never get any oil on the belt(s). Oil on the belt causes slipping and stretching.

Inspecting V-Ribbed Belt

- Visually check the belt for excessive wear, frayed cords, etc.
- If any defects are found, replace the V-ribbed belt.

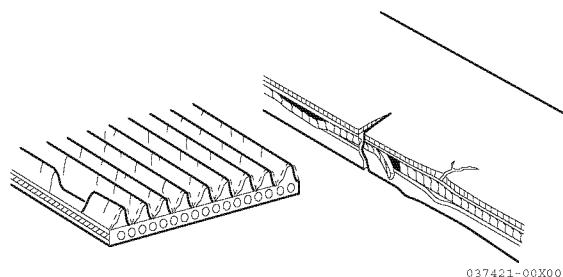
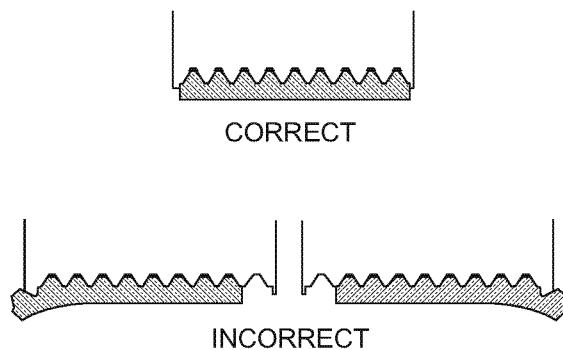
NOTICE

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

- 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.

**Figure 19****Figure 20****■ Checking the Wiring Connectors**

Contact your authorized Yanmar Marine dealer or distributor to check the wiring connectors.

■ Tightening All Major Nuts and Bolts

See *Tightening Fasteners* on page 41 or contact your authorized Yanmar Marine dealer or distributor.

Every 500 Hours of Operation

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

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

■ Replacing the Rubber Hoses

Replace the rubber hoses every 500 hours or 2 years, whichever comes first.

Contact your authorized Yanmar Marine dealer or distributor.

■ Replacing the Exhaust/Water Mixing Elbow

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

PERIODIC MAINTENANCE

Every 1000 Hours of Operation

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

- Replacing the Seawater Pump Impeller
- Cleaning and Checking the Seawater Passages
- Adjusting the Propeller Shaft Alignment
- Replacing the Lagging of Turbo-charger

■ Replacing the Seawater Pump Impeller

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

See Checking and Replacing the Seawater Pump Impeller on page 51.

■ Cleaning and Checking the Seawater Passages

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

- Heat Exchanger
- Pressure Cap

Contact your authorized Yanmar Marine dealer or distributor.

■ Adjusting the Propeller Shaft Alignment

Contact your authorized Yanmar Marine dealer or distributor.

■ Replacing the Lagging of Turbo-charger

Contact your authorized Yanmar Marine dealer or distributor.

Component	Part No.
Lagging of turbo-charger	119798-18340

LONG-TERM STORAGE

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

The engine can normally stand idle for up to 6 months. If it remains unused for longer than this, please contact 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.

LONG-TERM STORAGE

PREPARING THE ENGINE FOR LONG-TERM STORAGE

NOTICE

Do not drain closed cooling system for long-term storage. Antifreeze must be used to avoid freezing and damaging of components. Antifreeze will prevent rusting during long-term storage.

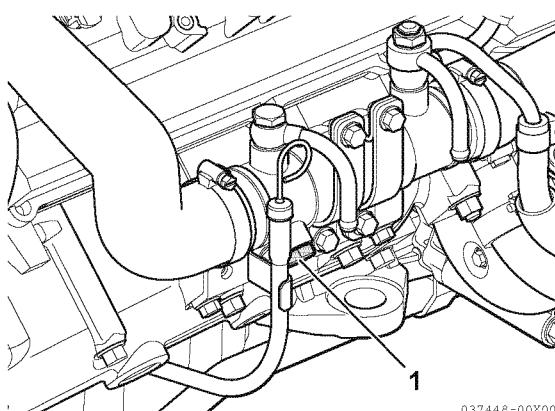
Note: If the engine is close to a periodic maintenance interval, perform those maintenance procedures before putting the engine into long-term storage.

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

Draining the Seawater Cooling System

■ Location of Seawater Drain Plug (Colored Gray)

Fuel Oil Cooler

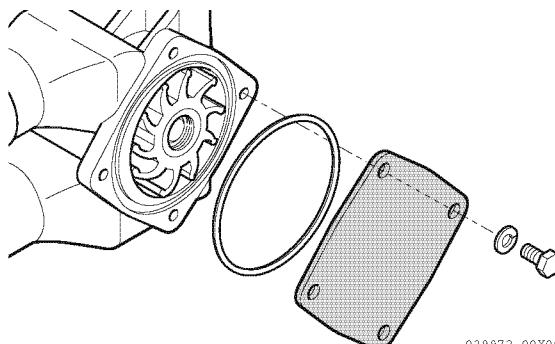


037448-00X00

1 - Drain Plug

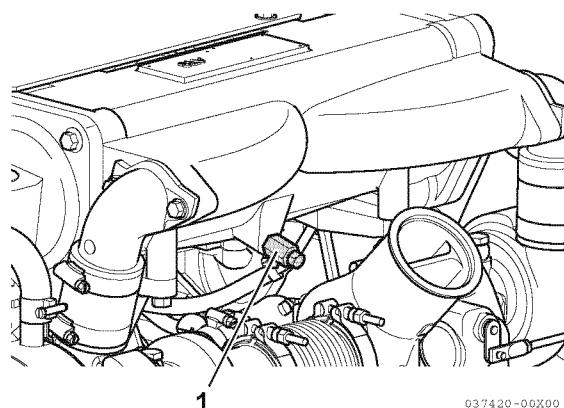
Figure 1

Remove the 5 bolts that secure the side cover of the seawater pump to drain the seawater from inside.



039972-00X00

Figure 2



1 - Condensed Water Drain Plug

Figure 3

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

⚠ WARNING

- Drain the seawater from the seawater cooling system after the engine has cooled down. Be careful to avoid burns.
- If seawater is left inside, it may freeze and damage parts of the cooling system (heat exchanger, seawater pump, etc.) when ambient temperature is below 32 °F (0 °C).

1. Loosen the seawater drain plug and drain off the seawater inside the engine. If no liquid comes from the drain plug, it may be necessary to use a stiff wire to remove any debris to allow drainage.
2. Loosen the 5 bolts attaching the side cover of the seawater pump, remove the cover and drain the water from inside. Retighten the bolts when finished.
3. Close the drain plug.

Do not drain the freshwater/coolant in the cold season or before long-term storage. If LLC (Long Life Coolant) has not been added to the cooling freshwater, be sure to add LLC or drain off the freshwater from the cooling system daily after use.

NOTICE

If the freshwater without LLC is not removed, it may freeze and damage parts of the cooling water system (heat exchanger, cylinder block, cylinder head, etc.) when ambient temperature is below 0 °C (32 °F).

When draining the freshwater:

- Open the freshwater drain cocks (2 positions) and drain the freshwater from inside the engine.
- Close the drain cocks after draining the freshwater.

Carry out the following periodic inspection before placing the engine in storage:

1. Clean the outside of the engine wiping off any dust or oil.
2. To prevent condensation inside the fuel tank, either drain off the fuel or fill the tank.
3. Cover the turbo-charger, exhaust pipe, etc. with vinyl sheets and seal them to prevent moisture from entering.
4. Drain bilge in the hull bottom completely. Water may leak into the boat when it is moored, and whenever possible it should be hauled out, covered and blocked.
5. Waterproof the engine room to prevent rain and seawater from entering.

During long-term storage, charge the battery once a month to compensate for the battery's self-discharge.

When storing an engine for a long time, run the engine periodically according to the following procedure to prevent rust inside the engine:

- Change the engine oil and the filters before running the engine.
- Supply fuel if the fuel in the fuel tank was removed, and bleed the fuel system of air.
- Confirm that there is the coolant in the engine.
- Operate the engine at the low idling speed for about 5 minutes (if possible, once a month).

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TROUBLESHOOTING

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

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

TROUBLESHOOTING

TROUBLESHOOTING AFTER STARTING

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

Is sufficient water being discharged from the seawater outlet pipe?

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

Is the exhaust color normal?

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

Are there abnormal vibrations or noise?

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

Alarm sounds during operation.

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

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

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

Is there sufficient fuel in the fuel tank?

Refill fuel in advance to avoid running out of fuel. If the tank runs out of fuel, bleed the fuel system. See *Bleeding the Fuel System on page 24*.

When operating the engine at low speed for long periods of time, rev up the engine once every 2 hours. Revving up the engine with the marine 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 valves.

NOTICE

Neglecting to rev up the engine will result in poor exhaust color and reduce engine performance.

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

TROUBLESHOOTING INFORMATION

If the engine does not operate properly, refer to the *Troubleshooting Chart on page 64* or contact your authorized Yanmar Marine dealer or distributor.

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

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

TROUBLESHOOTING

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.	
Engine does not start or starts with difficulty		
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
No fuel injection	Insufficient battery charge	Charge
	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 injector	Failure of fuel supply pump	Repair or replace
	Faulty valve seat	Replace
	Sticking of nozzle	Replace
	Worn nozzle	Replace
Failure in fuel injection system	Clogged injection hole	Replace
	Loose fuel injection pipe joint	Tighten
	Broken fuel injection pipe	Replace
Engine compressed air leak	Air trapped in fuel injection pipe	Bleed air from pipe
	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
Other	Broken valve spring	Replace
	Failure of engine system	Conduct servicing
	Clogged intake or exhaust pipe	Clean
	Controller defects system error	Check DTC and conduct servicing

Symptom	Probable Cause	Measure
Engine is not running smoothly		
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
Engine stops suddenly		
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
Abnormal exhaust color		
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	Clogged air filter	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	Clean
	Improper fuel	Replace with proper fuel
	Clogged intake/exhaust valve	Clean

TROUBLESHOOTING

Symptom	Probable Cause	Measure
Insufficient output		
Insufficient fuel injection	Oil leak from fuel injection pipe joint	Tighten
	Faulty operation of regulator valve	Replace
	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	Clogged air filter	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
Knocking		
Failure of fuel injector	Broken fuel valve spring	Replace
	Sticking nozzle	Replace
	Poor atomization	Replace
Fuel regulator valve failure	Faulty operation of regulator valve	Repair
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

Symptom	Probable Cause	Measure
Breakdown of turbo-charger		
Drop in intake pressure	Dirty air filter	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 filter
	Drop in air pressure in engine room	Ensure intake air path is unrestricted from outside air
	Broken seal ring	Replace
	Broken turbine impeller	Replace
	Broken nozzle ring	Replace
	Dirty turbine impeller	Clean
	Clogged nozzle	Clean
	Clogged exhaust pipe	Clean
Increased intake pressure	Exhaust gas leak	Re-mount turbo-charger
	Failure in fuel injection system	Overhaul injection pump, repair or replace any defective parts Disassemble and inspect injection valve, replace injection valve
	Deformed turbine nozzle	Replace
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

TROUBLESHOOTING

Symptom	Probable Cause	Measure
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
Other malfunctions		
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
Low lubrication oil pressure	Clogged engine oil filter	Replace
	Engine oil temperature too high	Check the seawater 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 gauge or sender unit	Replace
Coolant temperature too high	Insufficient seawater	Replace seawater pump impeller
	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

FAILSAFE DIAGNOSIS FUNCTIONAL SPECIFICATION CHART

Failsafe Actions

Level 1: Reduce engine speed to 2000 min⁻¹ or less

Level 2: Reduce engine speed to 1000 min⁻¹ or less

Level 3: Reduce engine speed to low idle

DTC	SPN	FMI	With FFD	DTC Description	Failsafe Action					
					Warning	Level 1	Level 2	Level 3	ENG Stop	Note
Engine ECU related DTC	P0087	157	10	Fuel Rail Pressure - Too Low Change	x					
	P0088	157	0	x Fuel Rail Pressure - Too High (over 230 MPa)	x		x			
	P0093	157	1	x Fuel System Leak Detected - Large Leak	x		x		x	Engine slows down and shuts off in 30 sec.
	P0110	105	3	Intake Air Temperature Sensor Circuit - High Input	x					
			4	Intake Air Temperature Sensor Circuit - Low Input	x					
	P0115	110	3	Engine Coolant Temperature Sensor Circuit -High Input	x					Display value is fixed but engine is still operational.
			4	Engine Coolant Temperature Sensor Circuit -Low Input	x					
	P0120	91	3	Main Analog Throttle Position Sensor Circuit -High Input	x			x		Engine slows down, then Backup Panel is activated. (displayed when Analog Throttle is operated only)
			4	Main Analog Throttle Position Sensor Circuit -Low Input	x			x		
			12	CAN Throttle Position Sensor Circuit Failure	x			x		
	P0168	174	0	x Fuel Temperature - Too High (over 110 degC)	x					
	P0180	174	3	Fuel Temperature Sensor Circuit - High Input	x					
			4	Fuel Temperature Sensor Circuit - Low Input	x					
	P0190	157	3	Fuel Rail Pressure Sensor Circuit - High Input	x	x				
			4	Fuel Rail Pressure Sensor Circuit - Low Input	x	x				
	P0201	651	5	Injection Circuit/Open. Cylinder 1	x	x				
	P0202	652	5	Injection Circuit/Open. Cylinder 2	x	x				
	P0203	653	5	Injection Circuit/Open. Cylinder 3	x	x				
	P0204	654	5	Injection Circuit/Open. Cylinder 4	x	x				
	P0205	655	5	Injection Circuit/Open. Cylinder 5	x	x				
	P0206	656	5	Injection Circuit/Open. Cylinder 6	x	x				
	P0207	657	5	Injection Circuit/Open. Cylinder 7	x	x				
	P0208	658	5	Injection Circuit/Open. Cylinder 8	x	x				
	P0217	110	0	x Engine Coolant Temperature - Too High	x	x				
	P0219	190	0	x Engine Overspeed Condition	x				x	
	P0220	29	3	Sub Throttle Position Sensor Circuit - High Input	x		x			(When Backup Panel is operated only.)
			4	Sub Throttle Position Sensor Circuit - Low Input	x		x			
	522245	6		Sub Throttle Lamp Circuit Over Current	x					Backup Panel Light comes to be unavailable.
	P0234	102	0	x Turbocharger Overboost Condition	x	x				
	P0235	102	1	Manifold Absolute Pressure Sensor - Too Low	x					
			3	Manifold Absolute Pressure Sensor Circuit - High Input	x					
			4	Manifold Absolute Pressure Sensor Circuit - Low Input	x					
	P0335	637	2	Crankshaft Position Sensor Circuit Incorrect	x			x		
			5	Crankshaft Position Sensor Circuit Low Input	x			x		
	P0340	522401	2	Camshaft Position Sensor Circuit Intermittent	x		x			
			5	Camshaft Position Sensor Circuit Low Input (STA ON)	x	x				
			8	Camshaft Position Sensor Circuit Incorrect	x	x				
	P0380	676	5	Glow Plug Circuit "A" Relay Coil Open	x					Glow Relay 1 shuts off but engine is still operational.
			6	Glow Plug Circuit "A" Relay Coil Shorted Ground	x					
	P0382	677	5	Glow Plug Circuit "B" Relay Coil Open	x					Glow Relay 2 shuts off but engine is still operational.
			6	Glow Plug Circuit "B" Relay Coil Shorted Ground	x					
P0512	1041	3		Starter Interlock	x					Engine can not start while it's active.
P0520	100	3	Engine oil Pressure Sensor Circuit - High Input	x						
			4	Engine oil Pressure Sensor Circuit - Low Input	x					
P0524	100	1	x	Engine oil Pressure - Too Low	x		x			
P0560	158	0		System Voltage - Too High	x				x	
		1		System Voltage - Too Low	x					
P0612	523010	5		EDU1 Power Relay Coil Open	x	x				EDU 1 Power Relay shuts off to cut off cylinders.
		6		EDU1 Power Relay Coil Shorted Ground	x	x				
P1612	523017	5		EDU2 Power Relay Coil Open	x	x				EDU 2 Power Relay shuts off to cut off cylinders.
		6		EDU2 Power Relay Coil Shorted Ground	x	x				
P0615	522249	5		Starter Relay Coil Circuit Open	x					Starter Relay shuts off and engine restart is still unavailable.
		6		Starter Relay Coil Circuit Shorted Ground	x					
P0627	633	5		Fuel Pump Control Circuit Open	x			x		
		6		Fuel Pump Control Circuit Shorted Ground	x			x		
P062A	168	0		Pump Voltage - Too High	x			x		
		1		Pump Voltage - Too Low	x			x		
P062D	2797	5		Fuel Injector Driver Circuit Performance Bank1	x	x				EDU 1 Power Relay shuts off to cut off cylinders.
P062E	2798	5		Fuel Injector Driver Circuit Performance Bank2	x	x				EDU 2 Power Relay shuts off to cut off cylinders.

TROUBLESHOOTING

DTC	SPN	FMI	With FFD	DTC Description	Failsafe Action					
					Warning	Level 1	Level 2	Level 3	ENG Stop	Note
Engine ECU Related DTC	P062F	630	12	EEPROM ERROR	x					
	P0641	3509	0	Sensor VOLT (+5 V) Above Normal or Short High	x					
		1		Sensor VOLT (+5 V) Below Normal or Short Low	x					
	P0650	624	6	Warning Lamp Circuit Over Current	x					Warning Lamp comes to be unavailable.
	P0685	1485	5	ECU Main Relay Coil Open	x					ECU Main Relay shuts off but engine is still operational.
			6	ECU Main Relay Coil Shorted Ground	x					
	P1000	3607	14	Emergency Switch Active	x				x	
	P1229	157	7	Fuel Pump Pressure Exceed the target	x	x				
	P1627	522978	5	Pump Power Relay Coil Open	x				x	Power Relay of Fuel Pump shuts off and engine stops.
		6		Pump Power Relay Coil Shorted Ground	x				x	
	P1628	523019	6	Alarm Relay Coil Shorted Ground	x					
	P1630	523223	12	QR Code Checksum ERROR	x					
Drive ECU related DTC	P1631	523221	12	QR Code Data Not written	x					
	P1632	523221	13	QR Code Invalid Failure	x					
	P2269	97	0	Water In Fuel Condition	x					
	P2502	167	1	Charging System Failure	x					
	U0146	91	9	CAN Communication Error	x			x		Engine slows down, then Backup Panel is activated.
	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 comes to be unavailable.
Helm ECU related DTC	P0720	191	8	Prop Speed Sensor Low Range	x					C-type trolling function is switched to E-type.
	P0218	177	0	Gear Oil Temp Too High	x					Trolling function comes to be unavailable.
	P0710	177	4	Gear Oil Temp Low Range	x					
			3	Gear Oil Temp High Range	x					
	U103	525	10	Shift & Trolling CAN Communication Error	x					Shift is changed to Neutral position.
	U100	190	10	Engine ECU CAN Communication Error	x					
	U404	525	2	Invalid Shift Data	x					Shift is changed to Neutral position.
	U402	684	2	Invalid Trolling Data	x					Trolling function comes to be unavailable.
	P1811	523721	3	Tilt Up Actuator High Range	x					
			4	Tilt Up Actuator Low Range	x					Trim adjustment function (UP) comes to be unavailable.
	P1812	523723	3	Tilt Trailer Actuator High Range	x					
			4	Tilt Trailer Actuator Low Range	x					Trailer mode function comes to be unavailable.
	P1813	523722	3	Tilt Down Actuator High Range	x					
			4	Tilt Down Actuator Low Range	x					Trim adjustment function (DOWN) comes to 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) come to be unavailable.
	P1816	520719	1	Reserve Tank Level Low Range	x					
	P0560	158	1	Battery Voltage Too Low	x					
Helm ECU related DTC	U0100	523760	9	CAN Communication Error Eng ECU to Helm ECU	x		x			Station change comes to be unavailable.
	U0404	523761	9	CAN Communication Error Drive ECU to Helm ECU	x		x			Shift change comes to be unavailable.
	U1201	523762	9	CAN Communication Error Helm ECU to Helm-ECU	x					Station change comes to be unavailable.
	U1202	523763	9	CAN Communication Error Helm Local	x			x		Station change, Synch. operation, Warmup operation, and Engine speed limit mode come to be unavailable.
	U1203	523764	9	Lost Communication with Display	x					Station change and Display operation come to be unavailable.
	B1001	523543	4	Neutral Switch Failure	x					Station change, Warmup operation, and Engine speed limit mode come to be unavailable.
	B1002	523542	4	Station Select Switch Failure	x					Station change and Indicator Dimming operation come to be unavailable.
	B1003	523544	4	Synchronization Switch Failure	x					Station change and Synchronization feature come to be unavailable.
	B1004	523545	4	Trolling Switch Failure	x					Station change and Trolling function come to be unavailable.
	B1005	523541	3	Start/Stop Switch Failure	x					Station change comes to be unavailable.
	B1011	523546	3	Tilt Switch Failure	x					Station change and Trim adjustment come to be unavailable.
	B1013	523548	3	Trailer Switch Failure	x					Station change and Trailer mode function come to be unavailable.
	P0120	91	3	Throttle Lever Failure (High)	x			x		
			4	Throttle Lever Failure (Low)	x			x		Station change and Trolling function come to be unavailable.
	B1020	91	13	Throttle Lever Calibration Failure	x			x		Station change and Trailer mode come to be unavailable.
	B1043	523768	12	Helm ECU EEPROM	x					Station change comes to be unavailable.

SPECIFICATIONS

PRINCIPAL ENGINE SPECIFICATIONS

8LV Series Engine Specifications

Engine Model	8LV320(Z)	8LV350(Z)	8LV370(Z)
Use	Pleasure use		
Type	V, 4-Cycle, water-cooled diesel engine		
Crankshaft rotation (viewed from flywheel)	Counterclockwise		
Combustion system	Direct injection		
Aspiration	Turbo-charger with air cooler		
Number of cylinders	V-8		
Firing order	1-2-7-3-4-5-6-8		
Bore × stroke	86 mm × 96 mm (3.4 in. × 3.8 in.)		
Displacement	4.461 l (272 Cu in.)		
High idling speed	4000 ± 25 min⁻¹		
Low idling speed	550 ± 25 min⁻¹		
Continuous rating output at crankshaft (at 3683 min⁻¹ (rpm))	214 kW (291 PS)	234 kW (318 PS)	248 kW (337 PS)
Maximum output at crankshaft (at 3800 min⁻¹ (rpm))	235 kW (320 PS)	257 kW (350 PS)	272 kW (370 PS)
Installation	Flexible mounting		
Main power take off	At flywheel end		
Cooling system	Freshwater cooling with heat exchanger		
Engine lubrication system	Enclosed, forced with gear pump		
Engine oil capacity at rake angle 0° (Effective/total)	3.5/10 l (3.7/10.6 qt)		
Oil pressure max rating	400 ± 50 kPa (58 ± 7.3 PSI)		
Oil pressure low idle at 550 min⁻¹ (rpm)	≥ 60 kPa (≥ 8.7 PSI)		

SPECIFICATIONS

Engine Model	8LV320(Z)	8LV350(Z)	8LV370(Z)
Turbo-charger		MHI TD04	
Starter motor		DC 12 V - 2.7 kW	
Alternator		12 V - 180 A	
Engine dimension without marine gear	Overall length	1133 mm (44.61 in.)	
	Overall width	884 mm (34.80 in.)	
	Overall height	783.5 mm (30.85 in.)	
Dry weight (without gear)		435 kg (960 lb)	
Minimum battery capacity		12 V - 120 Ah (5 hours rate, JIS 145G51 or equivalent)	

Cylinder Arrangement

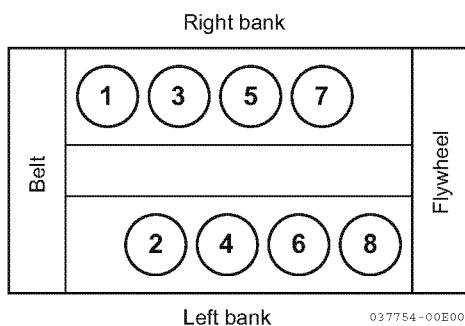


Figure 1

8LV Series Marine Gear Specifications

Engine Model	8LV320		8LV320Z
	8LV350		8LV350Z
	8LV370		8LV370Z
Marine gear model	KMH50A	KMH52V	ZT370
Specification	8 deg. down angle with hydraulic shift	12 deg. down angle with hydraulic shift	Stern drive
Gear ratio (Ahead/Astern)	1.67, 2.13, 2.43	1.22, 1.58, 2.08, 2.47	1.65, 1.78
Lubricating oil capacity (Effective/Maximum)	0.4/2.0 l (0.4/2.1 qt)	0.4/5.4 l (0.4/5.7 qt)	2.5 l (2.6 qt)
Dry weight	41 kg (90 lb)	59 kg (130 lb)	100 kg (221 lb)

SYSTEM DIAGRAMS

WIRING DIAGRAM

8LV series-Type Instrument Panel

8LV series Instrument Panel are available for 12 V standard.

SYSTEM DIAGRAMS

8LV Wiring Diagram

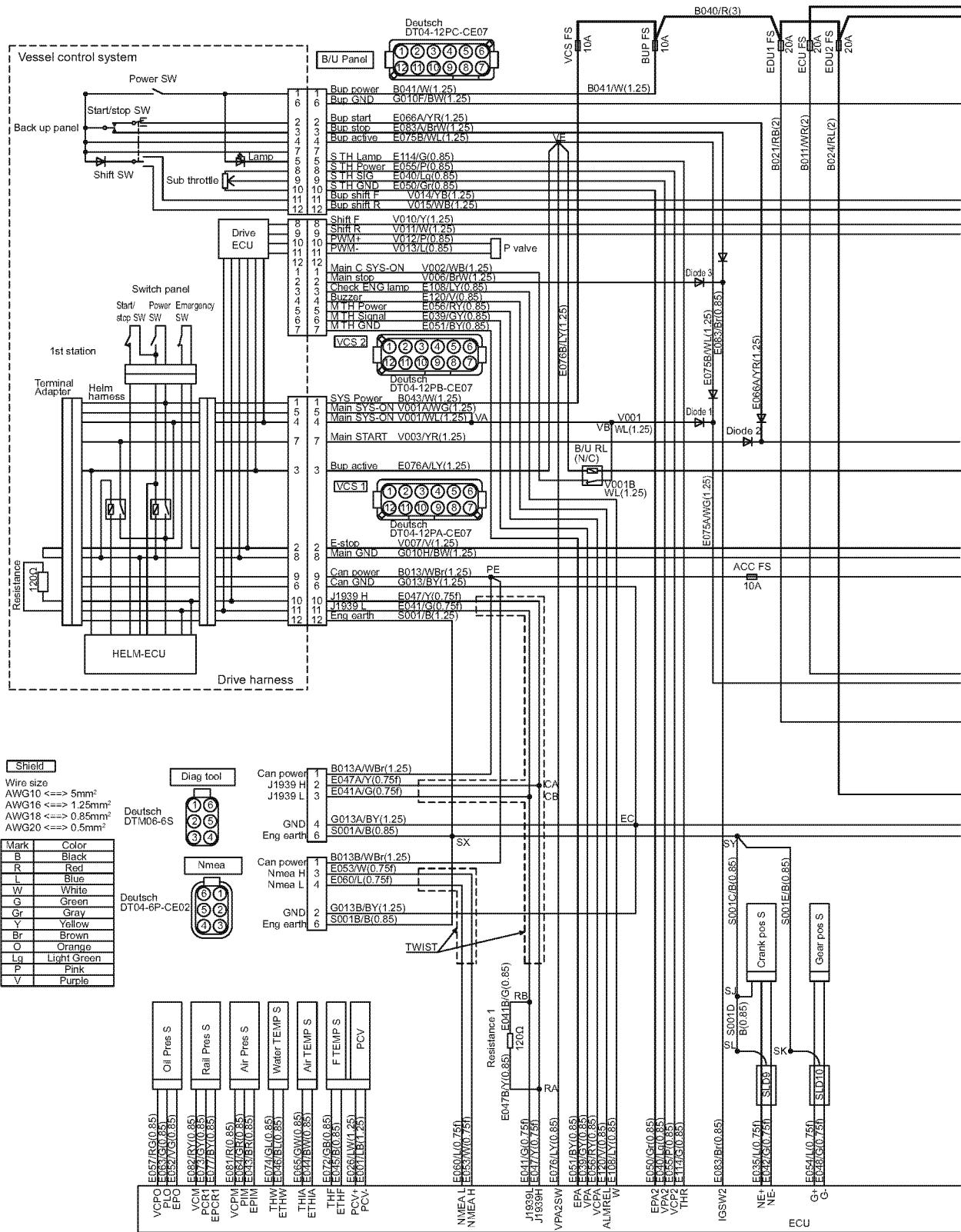


Figure 1

SYSTEM DIAGRAMS

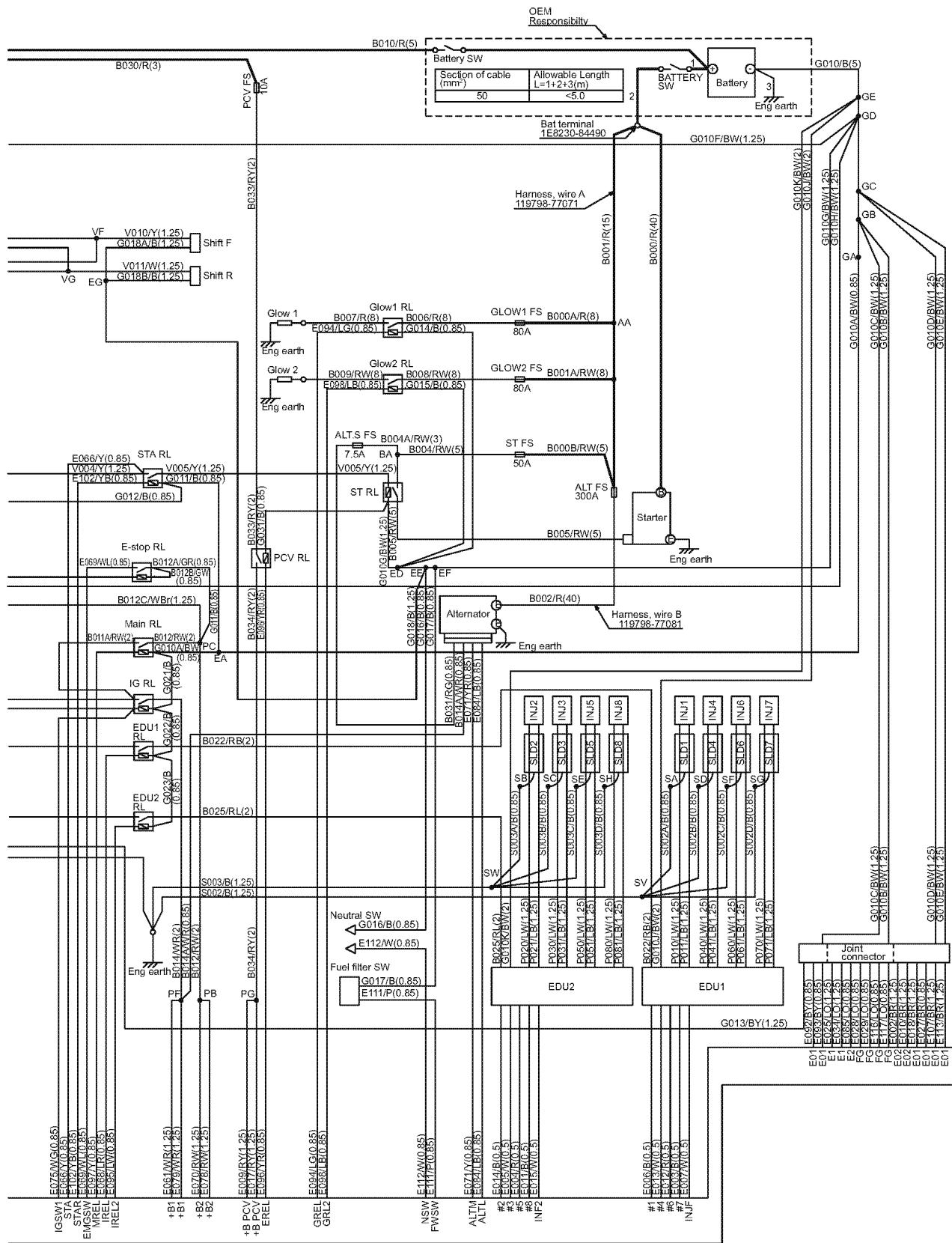


Figure 2

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EPA WARRANTY USA ONLY

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

The following EPA Warranty only applies to engines built on or after November 21, 2010 and labeled with the proper nameplate (**Figure 1**).

No.	Part Number	Engine Model
1	119798-07600	8LV370
	119798-07610	8LV350
	119798-07620	8LV320
	119799-07700	8LV370Z
	119799-07710	8LV350Z
	119799-07720	8LV320Z

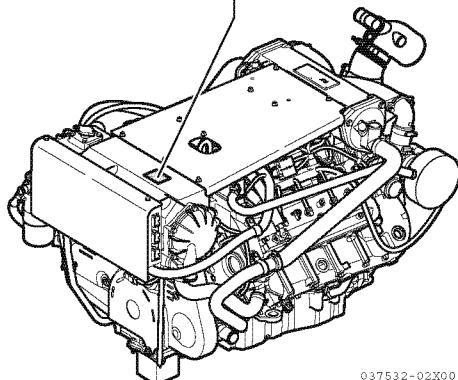
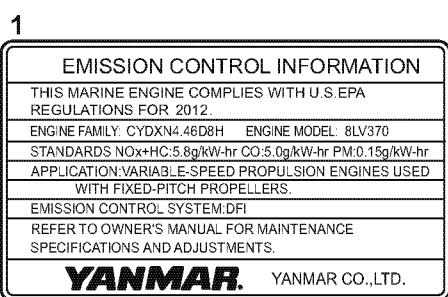


Figure 1

EPA WARRANTY USA ONLY

THIS EMISSION WARRANTY APPLIES TO THE ENGINES CERTIFIED TO UNITED STATES EPA 40 CFR 94 AND SOLD BY YANMAR THAT ARE INSTALLED IN VESSELS FLAGGED OR REGISTERED IN THE UNITED STATES.

Your Warranty Rights and Obligations

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

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

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

For Pleasure Use: The warranty period is **five (5) years** or **2000 hours** of use, whichever occurs first. In the absence of a device to measure hours of use, the engine has a warranty period of **five (5) years**.

Warranty Coverage

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

1. Fuel Injection System
2. Turbo-charger System
3. Aftercooler
4. Electronic Engine Control Units and its associated Sensor and Actuators

Exclusions

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

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 must present your marine engine to an authorized Yanmar Marine 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 Marine dealer or distributor, you should contact Yanmar America Corporation for assistance.

Yanmar America Corp. (YA)

(Marine Business Unit)

101 International Parkway
Adairsville, GA 30103, U.S.A.

Phone: 1-770-877-9894
Fax: 1-770-877-9009

EPA WARRANTY USA ONLY

Maintenance Log

EPA WARRANTY USA ONLY

Date	Operating Hours	Maintenance Performed	Dealer Name	Stamp or Signature

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

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-9

Town: Tsuruno-cho, Kitaku, Osaka-City

Post Code: 530-8311

Country: Japan

Name of Authorised Representative: Yanmar Co.,Ltd. Marine Operations Division

Street: 5-3-1

Town: Tsukaguchi Honmachi, Amagasaki, Hyogo

Post Code: 661-0001

Country: Japan

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

Street: 11, route de Luxembourg

Town: Sandweiler

Post Code: L-5230

Country: Luxembourg

ID Number: 0499

Module used for exhaust emission assessment: B+C B+D B+E B+F G H

or engine type-approved according to: stage II of Directive 97/68/EC Directive 88/77/EC

Other Community Directives applied: 2004/108/EC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type:

- z or sterndrive without integral exhaust
- Inboard engine

Fuel Type:

- Diesel
- Petrol

Combustion cycle:

- 2 stroke
- 4 stroke

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

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
RCD-1GM10X1	SNCH*94/25*2003/44*
RCD-2YM15X1	0009*00
RCD-3YM30X1	0004*02
RCD-4JH4X1	0005*03
RCD-4JH3TX1	0014*01
RCD-4LHAZ1	0011*01
RCD-4LHPADX1	0015*00
RCD-6LPASX1	0012*00
RCD-6CXM1	0007*00
RCD-6CXM1	0006*00
RCD-6LY2X1	0008*00
RCD-6LY3X1	0010*04
RCD-4JH3TX2	0016*00
RCD-4JH4TX2	0017*01
RCD-4JH4TX1	0018*02
RCD-6LPASX2	0023*01
RCD-4JH4AX1	0025*02
RCD-6CX53X1	0028*01
RCD-4JH5X1	0029*00
RCD-3JH5X1	0030*00
RCD-8LVX1	0038*01

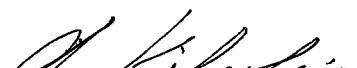
I declare on behalf of the engine manufacturer that the engine(s) will meet the exhaust emission requirements of Directive 94/25/EC as amended by Directive 2003/44/EC when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s)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

Name: Yukio Kikuchi

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

Signature and title:

(or an equivalent marking)



Senior Manager
Application Engineering Dept.
Marine Operations Division
Yanmar Co.,Ltd.

Date: (yr/month/day) 2012 / 2 / 29

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust and Noise emission requirements of Directive 94/25/EC as amended by 2003/44/EC
(To be completed by manufacturer of outboard or inboard engines with integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-9

Town: Tsuruno-cho, Kitaku, Osaka-City

Post Code: 530-8311

Country: Japan

Name of Authorised Representative (if applicable): Yanmar Co.,Ltd. Marine Operations Division

Street: 5-3-1

Town: Tsukaguchi Honmachi, Amagasaki, Hyogo

Post Code: 661-0001

Country: Japan

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

Street: 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)

Street: Nipkowweg 9

Town: Joure

Post Code: 8500 AB

Country: The Netherlands

ID Number: 0613

Module used for exhaust emission assessment: B+C B+D B+E B+F G H

or engine type-approved according to: stage II of Directive 97/68/EC Directive 88/77/EC

Module used for noise emission assessment: Aa G H

Other Community Directives applied: 2004/108/EC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type:

- Outboard
 z or sterndrive with integral exhaust

Fuel Type:

- Diesel
 Petrol

Combusion cycle:

- 2 stroke
 4 stroke

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
RCD-4LHAX1	SNCH*94/25*2003/44*
4LHA-HTZP	0015*00
RCD-6LY2X1	0008*00
4LHA-DTZP	
4LHA-STZP	
RCD-6LPADX1	0012*00
6LPA-DTZP	
RCD-6LPASX1	0007*00
6LPA-STZP	
RCD-6LPASX2	0023*01
6LPA-STZP2	
RCD-8LVX1	0038*01
8LV320Z	
8LV350Z	
8LV370Z	

Essential requirements	Standards Used	Other normative document used	See technical file
Annex I.B – Exhaust Emissions			
engine identification (I.B.1)			<input type="checkbox"/>
exhaust emission requirements	EN ISO 8178-1:1996		<input checked="" type="checkbox"/>
durability			<input type="checkbox"/>
owner's manual			<input type="checkbox"/>
Annex I.C – Noise Emissions			
Noise emission levels (I.C.1)	EN ISO 14509		<input checked="" type="checkbox"/>
owner's manual (I.C.2)			<input type="checkbox"/>

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

Name: Yukio Kikuchi Signature and title: _____
 (identification of the person empowered to sign on (or an equivalent marking)
 behalf of the engine manufacturer or his authorised representative)

Date: (yr/month/day) 2012 / 2 / 29


 Senior Manager
 Application Engineering Dept.
 Marine Operations Division
 Yanmar Co.,Ltd.

YANMAR CO., LTD.

■Yanmar (Head office)

Umeda Gate Tower 1-9 Tsurunocho, kita-ku, Osaka,
Japan 530-8311

■Marine Operations Division

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3-1, 5-Chome, Tsukaguchi-honmachi, Amagasaki,
Hyogo, Japan 661-0001
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■Yanmar Asia (Singapore) Corporation Pte Ltd. (YASC)

4 Tuas Lane, Singapore 638613
Phone: 65-6595-4200 Fax: 65-6862-5189

■Yanmar America Corporation (YA)

101 International Parkway
Adairsville, GA 30103, U.S.A.
Phone: 1-770-877-9894 Fax: 1-770-877-9009

■Yanmar Engine (Shanghai). Co., Ltd.

10F, E-Block POLY PLAZA, No.18 Dongfang Road,
Pudong Shanghai, CHINA P.R.C 200120
Phone: 21-6880-5090 Fax: 21-6880-8090

OPERATION MANUAL

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