

MARINE ENGINE

4LHA-HTP
4LHA-DTP
4LHA-STP
4LHA-HTZP
4LHA-DTZP
4LHA-STZP

**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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OPERATION MANUAL	MODEL	4LHA-HTP, 4LHA-DTP, 4LHA-STP, 4LHA-HTZP, 4LHA-DTZP, 4LHA-STZP
	CODE	49961-205434

YANMAR
MARINE DIESEL ENGINE
MODELS : 4LHA-HTP/-HTZP/-DTP/-DTZP/-STP/-STZP
OPERATION MANUAL

Thank you for purchasing the YANMAR Marine Diesel Engine.

[INTRODUCTION]

- This Operation Manual describes the operation, maintenance and inspection of the **4LHA-HTP/-HTZP/-DTP/-DTZP/-STP/-STZP** Yanmar marine diesel engines.
- Read this Operation Manual carefully before operate the engine to ensure that the engine is used correctly and that it stays in the best possible condition.
- 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 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 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 such difference, please contact your Yanmar Dealer or Distributor.
- For detailed information marine gears, refer to the Marine Gear Operation Manual.

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1. FOR SAFE OPERATION

Following the precautions described in this manual will enable you to use this engine with complete satisfaction. Failure to observe any of the rules and precautions, however, may result in injury, burns, fires, and engine damage. Read this manual carefully and be sure you fully understand it before beginning operation.

1.1 Warning Symbols

These are the warning signs which are used in this manual and on the products. Pay special attention to them.



DANGER

DANGER- Indicates an imminently hazardous situation which, if not avoided, **WILL** result in death or serious injury.



WARNING

WARNING- Indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.



CAUTION

CAUTION- Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury. It may also be used to alert against unsafe practices.

- The descriptions captioned by **[NOTICE]** are for the particularly important cautions for handling. If you ignore them, the performance of your machine may deteriorate leading to trouble.

1.2 Safety Precautions

(Observe these instructions for your own safety.)

■ Precautions for Operation

▲ DANGER



Burns from Scalding

- Never remove the filler cap of the fresh water cooler while the engine is still hot. Steam and hot water will spurt out and seriously burn you. Wait until the water temperature has dropped, then wrap a cloth around the cap and loosen it slowly.
- After inspection, refasten the filler cap firmly. If the cap is not secure, steam or scalding water may be emitted during operation causing burns.

▲ DANGER



Proper Ventilation of the Battery Area

- Be sure the area around the battery is well-ventilated and there is nothing which could start a fire. During operation and charging, hydrogen gas is emitted from the battery and can be easily ignited.

▲ DANGER



Fires from Oil Ignition

- Be sure to use the correct type of fuel when refueling. Mistakenly filling with gasoline or the like will result in ignition.
- Be sure to stop the engine before refueling. If you spill fuel, wipe such spillage carefully.
- Never place oils or other flammable material close to the engine as this could result in ignition.

▲ WARNING



Exhaust Gas Poisoning

- Be sure to establish good ventilation in the engine room with windows, vents, or other ventilation equipment. Check again during operation to be sure that ventilation is good. Exhaust gas contains poisonous carbon monoxide and should not be inhaled.

▲ WARNING



Moving Parts

- Do not touch the moving parts of the engine (propeller shaft, V-belt, PTO-pulley, etc.) during operation or let your clothing get caught in them as this can result in injury.
- Never operate the engine without the covers on the moving parts.
- Check before starting the engine to see that any tools or cloths used in maintenance have been removed from the area.

▲ CAUTION



Burns from Contact with Hot Engine Parts

- The whole engine is hot during operation and immediately after stopping. The turbocharger, exhaust manifold, exhaust pipe, and engine are very hot. Never touch these parts with your body or clothing.

⚠ WARNING

Alcohol

- Never operate the engine while you are under the influence of alcohol or when you are ill or feel unwell as this results in accidents.

■ Safety Precautions for Inspection

⚠ DANGER



Battery Fluid

- Battery fluid is diluted sulfuric acid. It can blind you if it gets in your eyes, or burn your skin. Keep the fluid away from your body. Wash it off immediately with a large quantity of fresh water if you get any on you.

⚠ WARNING



Fire due to Electric Short-Circuits

- Always turn off the battery switch or detach the earth cable (–) before inspecting the electrical system. Failure to do so could cause short-circuiting and fires.

⚠ WARNING



Precautions for Moving Parts

- Stop the engine before you service it. If you must inspect while the engine is operating, never touch moving parts. Keep your body and clothing well clear of all moving parts as this could result in injury.

⚠ CAUTION



Precautions for Removing Hot Oil and Water to Prevent Burns

- If extracting oil from the engine while it is still hot, do not let the oil splash on you.
- Wait until the temperature has dropped before removing cooling water from the engine to avoid getting scalded.

[NOTICE]

Do not alter the diesel engine.

Rebuilding the engine or altering parts to increase the speed or the amount of fuel discharged, etc. will make operation unsafe, and result in damage and shortening of engine life.

[NOTICE]

Disposal of waste materials

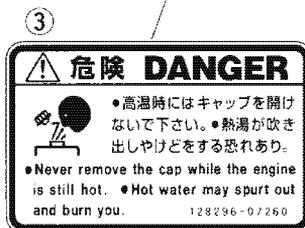
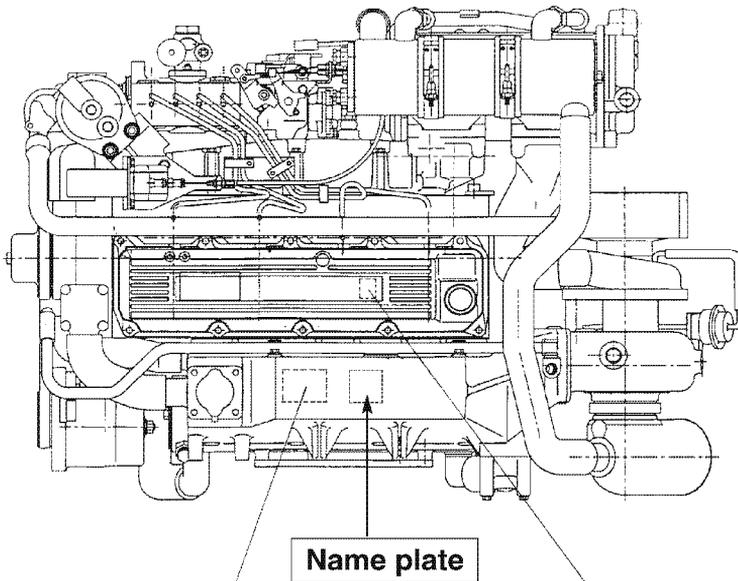
- Put oil or liquids to be disposed in a container. Never dispose of waste oil or other fluids outside, in a sewer, river, or the sea.
- Treat waste materials safely observing all regulations and laws. Ask a waste recovery company to collect and dispose of it.

1.3 Location of product Safety Labels

To insure safe operation, warning device labels have been attached. Their location is shown in the diagram below and next page. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, replace labels when parts are replaced, ordering them in the same way as the parts.

Warning device labels, Parts numbers

No.	Part Code No.
①	128296-07300
②	120324-07240
③	128296-07260
④	128296-07350

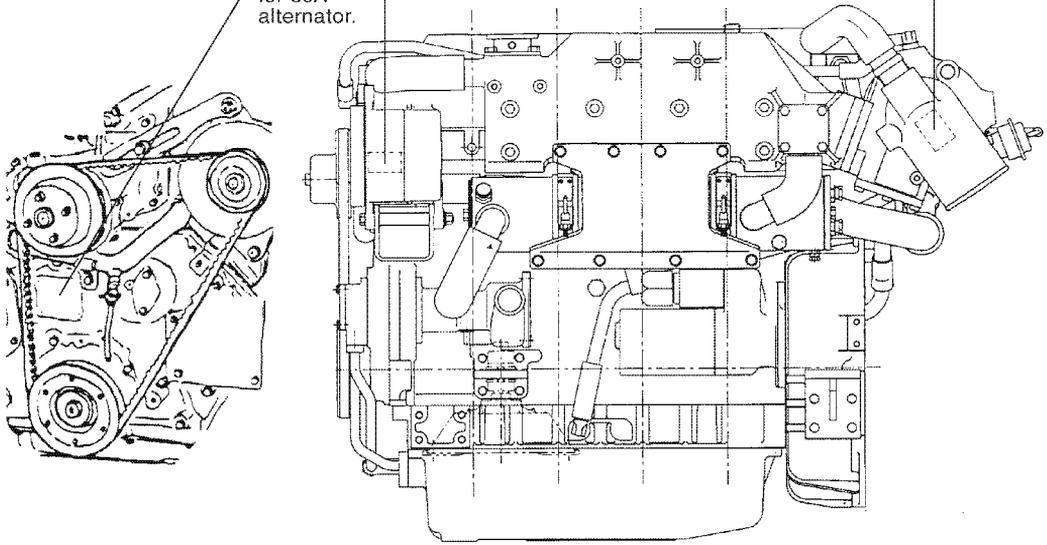


④



for 60A
alternator.

for 80A alternator.



①



2. EXPLANATION OF PRODUCT

2.1 Use, Driving System, etc.

In the case of 4LHA-HTP/-DTP/-STP engines with marine gear (HSW450A2, HSW630A1), connect the propeller shaft to the marine gear output shaft. Also the 4LHA-HTZP/-DTZP/-STZP engine are connected the stern drive Bravo.

In order to obtain full performance from your engine, it is imperative that you check the size and structure of the hull and use a propeller of the appropriate size.

The engine must be installed correctly with safe cooling water and exhaust piping and electrical wiring.

To handle the drive equipment, driven systems (including the propeller) and other onboard equipment, be sure to observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

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.

Consult Yanmar's local subsidiary in your region or your distributor or dealer.

WARNING

Never modify this product or release the limit devices (which limit engine speed, fuel injection quantity, etc.). Modification will impair the safety and performance of the product and functions and shorten the product life.

Please note that any troubles arising from modification of the product will not be covered by our warranty.

2.2 Engine Specifications

● 4LHA-HTP/HTZP

Engine model	4LHA-HTP		4LHA-HTZP	
Type	Vertical water cooled 4-cycle diesel engine			
No. of cylinders	4			
Bore × Stroke	mm	100 × 110		
Displacement	ℓ	3.455		
Fuel stop power at crankshaft	kw(hp)/rpm	*118 (160) / 3300 **113 (154) / 3300		
Cont. power at crankshaft.	kw(hp)/rpm	91.2 / (124) / 3100		
High idling	rpm	3700 ± 25		
Low idling	rpm	750 ± 25		
Combustion system	Direct injection			
Starting system	Electric starting (12V-2.5kW)			
Charging system	Regulator built in Alternator DC12V-60A (Optional: 80A)			
Cooling system	Constant high temperature fresh water cooling (2 systems : sea & fresh water)			
Lubrication system	Forced lubrication system with trochoidal gear pump			
Direction of rotation (crankshaft)	Counter-clockwise (viewed from flywheel side)			
Lube oil capacity	All	ℓ	13.0	
	Oil pan	ℓ	10.0	
Cooling water capacity	ℓ	15 (Engine) , 0.8 (Sub-tank)		
Turbocharger	Model	RHC61W (IHI made)		
	Type	Water cooled turbine housing		
Dimension (L × W × H) (gear less)	mm	937 × 681 × 741	1039 × 777 × 830	
Dry mass (gear less)	kg	360	388	
Recommended battery capacity	12V × 120Ah			
Recommended type of remote control handle	Single lever type only			
Engine installation style	On the flexible engine mount			

(Note) 1. Rating condition : ISO 3046-1, 8665 2. 1hp = 0.7355 kW

3. Fuel condition : Density at 15°C = 0.860, Fuel oil temperature * : 25°C at the fuel injection pump inlet

** : ISO 8665 (Fuel oil temp. 40°C at the fuel injection pump inlet)

● Marine gear (Optional)

Model	HURTH HSW450A2	KMH40A	MERCURUISER		
			Bravo X-1	Bravo X-2	Bravo X-3
Type	8° down Hydraulic	8° down Hydraulic	Stern drive		
Available engine	4LHA-HTP		4LHA-HTZP		
Reduction ratio (Both ahead and astern)	1.26	1.24	1.36	1.50	1.36
	1.51	1.53	1.50	1.65	1.50
	2.03	2.04	1.65	1.81	1.65
	2.43	2.45		2.00	1.81
				2.20	2.00
				2.20	

For further detail, refer to the maker's manual

● 4LHA-DTP/DTZP

Engine model		4LHA-DTP	4LHA-DTZP
Type		Vertical water cooled 4-cycle diesel engine	
No. of cylinders		4	
Bore × Stroke	mm	100 × 110	
Displacement	ℓ	3.455	
Fuel stop power at crankshaft		*147 (200) / 3300	
kw(hp)/rpm		**140 (190) / 3300	
Cont. power at crankshaft.		116 / (158) / 3100	
kw(hp)/rpm			
High idling	rpm	3700 ± 25	
Low idling	rpm	750 ± 25	
Combustion system		Direct injection	
Starting system		Electric starting (12V-2.5kW)	
Charging system		Regulator built in Alternator DC12V-60A (Optional: 80A)	
Cooling system		Constant high temperature fresh water cooling (2 systems : sea & fresh water)	
Lubrication system		Forced lubrication system with trochoidal gear pump	
Direction of rotation (crankshaft)		Counter-clockwise (viewed from flywheel side)	
Lube oil capacity	All	ℓ	
	Oil pan	ℓ	
Cooling water capacity	ℓ	15 (Engine), 0.8 (Sub-tank)	
Turbocharger	Model	RHC61W (IHI made)	
	Type	Water cooled turbine housing	
Dimension (L × W × H) (gear less)	mm	937 × 686 × 741	1039 × 787 × 830
Dry mass (gear less)	kg	365	388
Recommended battery capacity		12V × 120Ah	
Recommended type of remote control handle		Single lever type only	
Engine installation style		On the flexible engine mount	

(Note) 1. Rating condition : ISO 3046-1, 8665 2. 1hp = 0.7355 kW
 3. Fuel condition : Density at 15°C = 0.860, Fuel oil temperature *: 25°C at the fuel injection pump inlet
 **: ISO 8665 (Fuel oil temp. 40°C at the fuel injection pump inlet)

● Marine gear (Optional)

Model	HURTH HSW450A2	KMH40A	MERCURUISER		
			Bravo X-1	Bravo X-2	Bravo X-3
Type	8° down Hydraulic	8° down Hydraulic	Stern drive		
Available engine	4LHA-DTP		4LHA-DTZP		
Reduction ratio (Both ahead and astern)	1.26	1.24	1.36	1.50	1.36
	1.51	1.53	1.50	1.65	1.50
	2.03	2.04	1.65	1.81	1.65
	2.43	2.45		2.00	1.81
				2.20	2.00
					2.20
For further detail, refer to the maker's manual					

● 4LHA-STP/-STZP

Engine model	4LHA-STP		4LHA-STZP	
Type	Vertical water cooled 4-cycle diesel engine			
No. of cylinders	4			
Bore × Stroke	mm	100 × 110		
Displacement	ℓ	3.455		
Fuel stop power at crankshaft		*177 (240) / 3300		
kw(hp)/rpm		**169 (230) / 3300		
Cont. power at crankshaft.		140 / (190) / 3100		
kw(hp)/rpm				
High idling	rpm	3700 ± 25		
Low idling	rpm	750 ± 25		
Combustion system	Direct injection			
Starting system	Electric starting (12V-2.5kW)			
Charging system	Regulator built in Alternator DC12V-60A (Optional:80A)			
Cooling system	Constant high temperature fresh water cooling (2 systems : sea & fresh water)			
Lubrication system	Forced lubrication system with trochoidal gear pump			
Direction of rotation	Counter-clockwise (viewed from flywheel side)			
Lube oil capacity	All	ℓ	13.0	
	Oil pan	ℓ	10.0	
Cooling water capacity	ℓ	15 (Engine) , 0.8 (Sub-tank)		
Turbochager	Model	RHC61W (IHI made)		
	Type	Water cooled turbine housing		
Dimension (L × W × H) (gear less)	mm	1001 × 686 × 741	1039 × 714 × 782	
Dry mass (gear less)	kg	365	385	
Recommended battery capacity	12V × 120Ah			
Recommended type of remote control handle	Single lever type only			
Engine installation style	On the flexible engine mount			

(Note) 1. Rating condition : ISO 3046-1, 8665 2. 1hp = 0.7355 kW

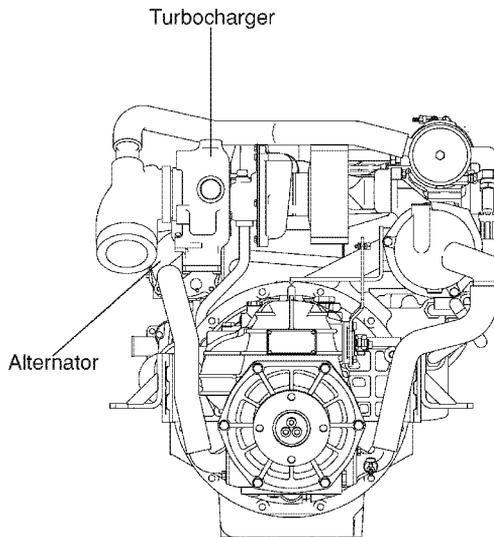
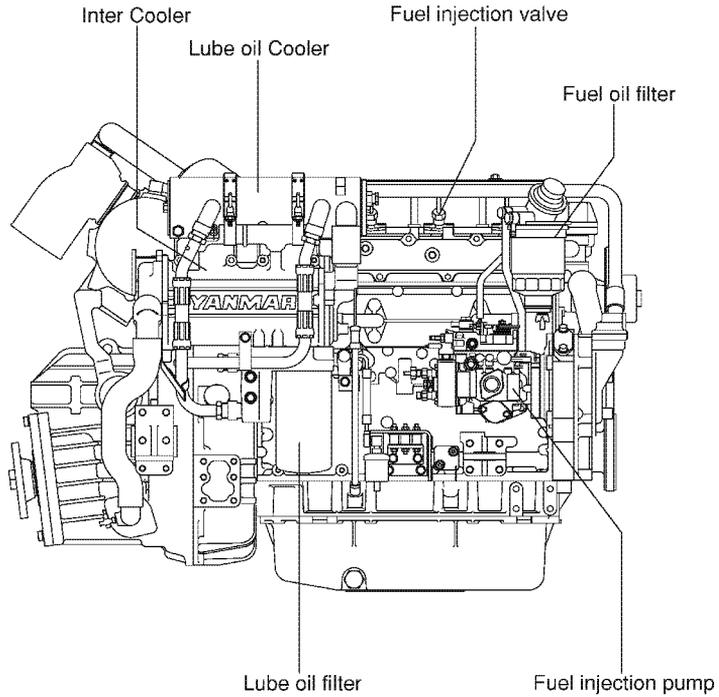
3. Fuel condition : Density at 15°C = 0.860, Fuel oil temperature *: 25°C at the fuel injection pump inlet

** : ISO 8665 (Fuel oil temp. 40°C at the fuel injection pump inlet)

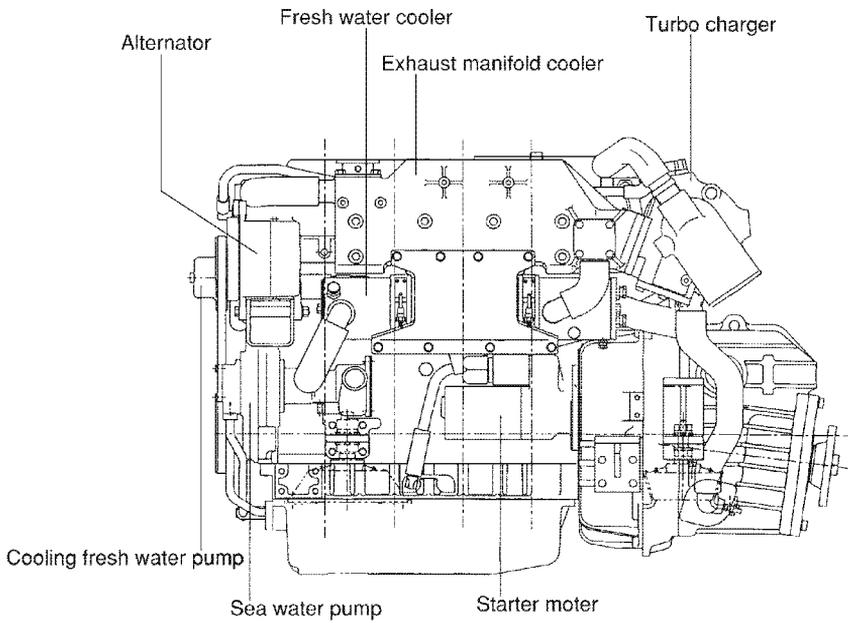
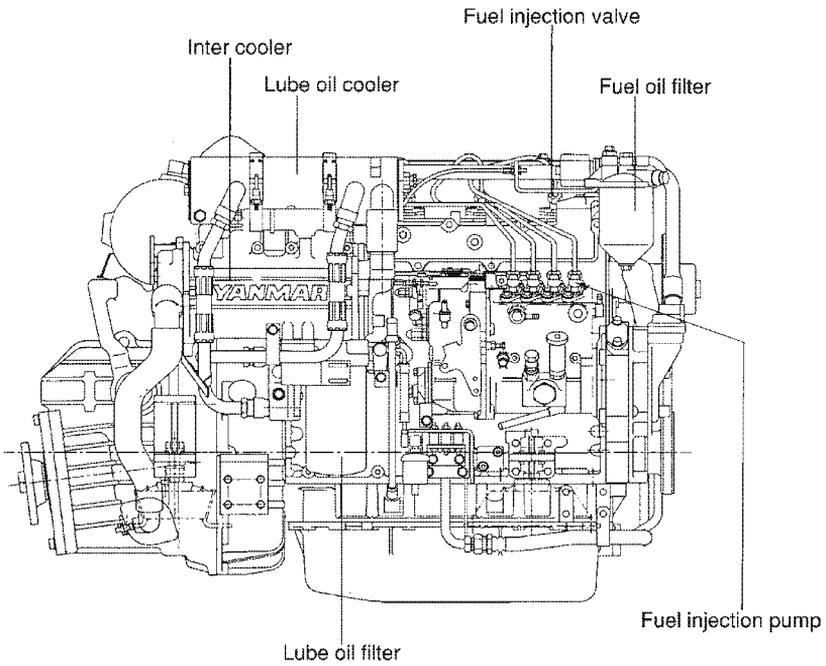
● Marine gear (Optional)

Model	HURTH HSW630A1	KMH40A	MERCURUISER		
			Bravo X-1	Bravo X-2	Bravo X-3
Type	8° down Hydraulic	8° down Hydraulic	Stern drive		
Available engine	4LHA-STP		4LHA-STZP		
Reduction ratio Hsw630A1 : Ahead/Astern Bravo X-1,2,3 : Both Ahead and Astern	1.22/1.21	1.67	1.36	1.50	1.36
	1.56/1.58	2.13	1.50	1.65	1.50
	2.04/2.10	2.43	1.65	1.81	1.65
	2.52/2.53			2.00	1.81
				2.20	2.00
					2.20
For further detail, refer to the maker's manual					

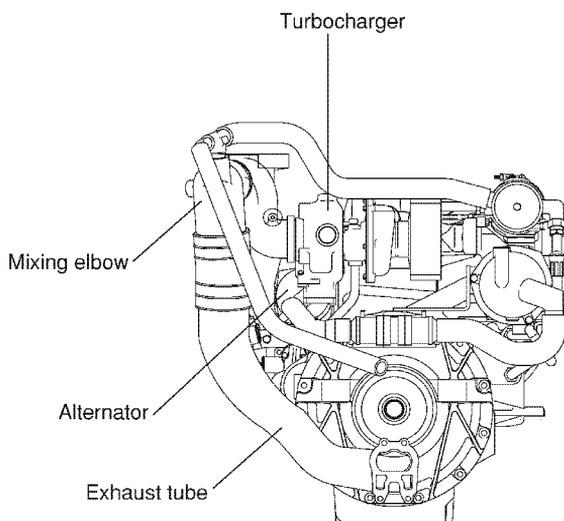
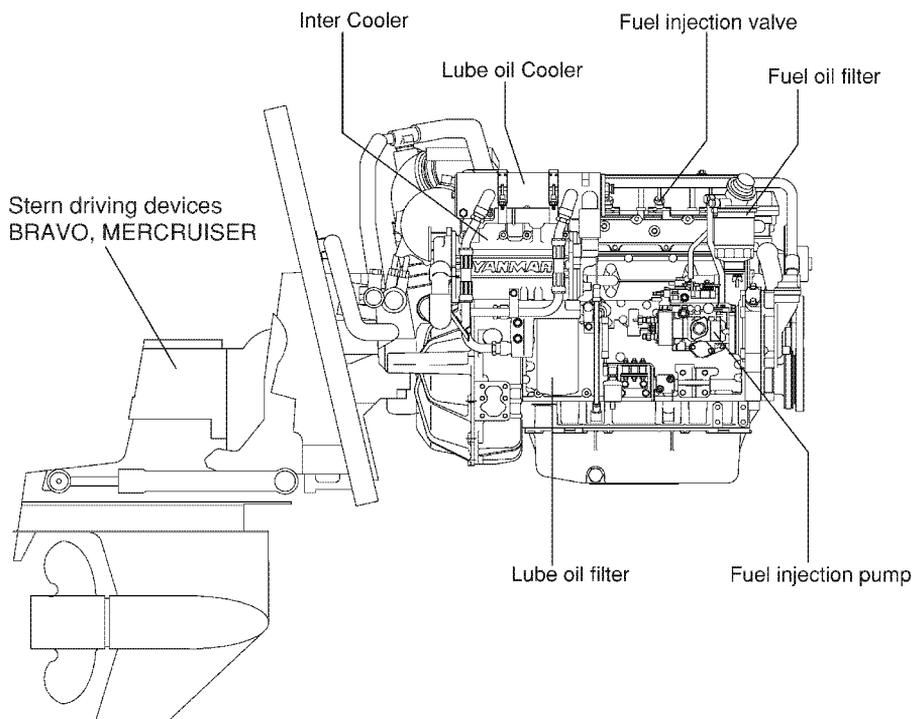
2.3 Names of parts



[Note] This illustration shows the 4LHA-HTP engine.



[Note] This illustration shows the 4LHA-DTP engine.



[Note] This illustration shows the 4LHA-HTZP engine.

2.4 Major Servicing Parts

Name of Part	Function
● Fuel filter	Removes dust and water from fuel. The filter is a cartridge type, and the fuel element should be replaced before clogging occurs. A water separator is on the bottom of the filter and should be drained periodically. (for 4LHA-HTP/HTZP). For 4LHA-DTP-DTZP-STP-STZP, drain the dust and water periodically removing the drain plug at the bottom of filter.
● Fuel feed pump	Feeds fuel to the fuel injection pump built-in the fuel injection pump (4LHA-HTP/HTZP). For 4LHA-DTP-DTZP-STP-STZP, it is attached with the fuel injection pump.
● Fuel priming pump	This is a manual fuel pump. Moving the knob on the top of fuel filter feeds the fuel. The pump is also used to bleed air from the fuel system (4LHA-HTP/HTZP). For 4LHA-DTP-DTZP-STP-STZP, moving the knob on the fuel feed pump attached with the fuel injection pump feeds the fuel to bleed air.
● Lube oil filler cap	Filler port for engine lube oil.
● Lube oil filter	Filters fine metal fragments and carbon from the lube oil. The filter is a cartridge type and the filter element should be replaced before clogging occurs.
[Cooling Water System]	This engine has two cooling water systems (for fresh water & for seawater). Fresh water flows from the fresh water tank into the fresh water cooler, where the fresh water is cooled by sea water. The fresh water then flows into the cylinder block through the fresh water pump. It further cools the turbocharger and goes back to the fresh water tank.
● Fresh water cooler ○ Filler cap ○ Sub tank ○ Rubber hose	The fresh water cooler is a heat exchanger using sea water. The filler cap mounted on the fresh water tank has a pressure regulating valve. When the cooling water temp. rises and the pressure rises inside the fresh water cooler, the pressure regulating valve releases vapor and hot water overflows to the sub tank. The hose connects the filler cap and sub tank. Vapor and hot water discharged to the sub tank. When the engine stops and cooling water cools, the pressure in the cooling water tank also drops to negative pressure. The filler cap valve then opens to suck water back from the sub tank. This minimizes cooling water consumption.
● Fresh water pump	The centrifugal water pump circulates fresh cooling water inside the engine. The pump driven by the V-belt.
● Seawater pump	The rubber impeller-type pump is driven by gears. Do not operate it without seawater, due to damage the impeller.
● Oil cooler	This heat exchanger cools high temp. engine oil by seawater.
● Turbocharger	The pressurized intake air feeding device: the exhaust gas turbine is rotated by the exhaust gas, and the power is used to rotate the blower. This pressurises the intake air for sending to the cylinder.
● Inter-cooler	This heat exchanger cools the pressurized intake air from the turbocharger with seawater.
● Anticorrosive zinc	The metal area of the seawater cooling system is prone to electrical corrosion. The anti-corrosive zinc is installed in the oil cooler, inter-cooler, etc. to prevent this. The anti-corrosive zinc is itself reduced over time by electrical corrosion, so it must be replaced at fixed intervals before it is completely consumed in order to ensure that the metal area of the seawater cooling system remains fully protected.
● Name plate	Name plates are provided on the engine and have the model, serial number and other data.
● Starter motor	Starts the engine powered by the battery.
● Alternator	Driven by belt, and generates electricity and charges the battery.

2.5 Control Equipment

The control equipment consists of the control panel and remote control handle, which are connected by the wires and cables to the control levers for remote control operation.

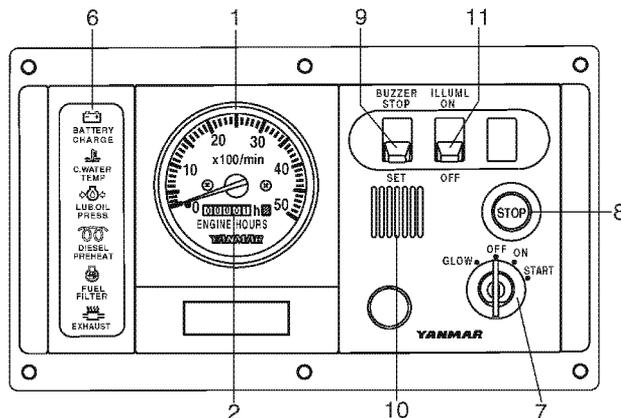
2.5.1 Control Panel (Optional)

The control panel has the following gauges and alarm devices (optional accessories):

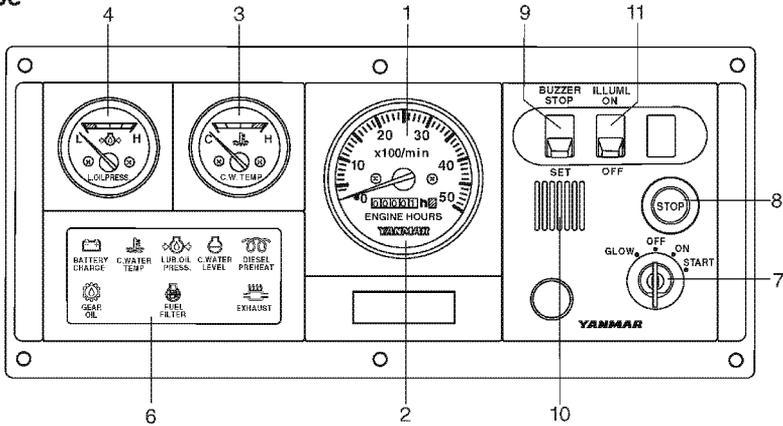
● Available, — Not available

No.	Model		New B-type	New C-type	New D-type
7	Switch unit	Key switch (Starter switch)	●	●	●
8		Engine stop switch	●	●	●
10		Alarm buzzer	●	●	●
9		Alarm buzzer stop switch	●	●	●
11		Illumination switch for meters	●	●	●
6	Alarm lamp unit	Battery not charging	●	●	●
		C.W. high temperature	●	●	●
		L.O. low pressure (engine)	●	●	●
		C.W level	—	—	—
		Exhaust	—	—	—
		Boost	—	●	●
		Fuel filter	●	●	●
		Gear oil (stern drive)	—	●	●
1	Tachometer unit	Tachometer with hour meter	●	●	●
4	Sub meter unit	LO. pressure meter	—	●	●
3		C.W. temperature meter	—	●	●
5		Boost meter (Turbo)	—	—	●
12	Clock unit	Quartz clock	● (option)	● (option)	●

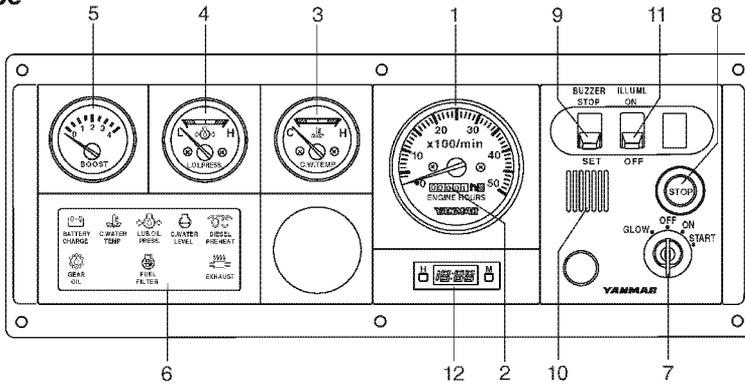
● New B-type



● New C-type



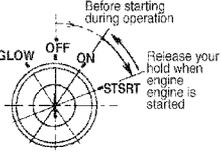
● New D-type



● Available switches (for alarm) and senders (for meter)

		4LHA-HTP	4LHA-HTZP	4LHA-DTP	4LHA-DTZP	4LHA-STP	4LHA-STZP
Switches	Battery not charge				○		
	C.W.high temperature				○		
	L.O low pressure				○		
	C.W. level				×		
	Exhaust (C.S.W flow)				×		
	Gear oil (Stern)	×	△	×	△	×	△
Fuel filter	○	○	×	×	×	×	
Senders	Tachometer				○		
	C.W. temperature				△		
	L.O.pressure				△		
	Boost				△		
	C.W.temp.	For two stations				△	
	L.O. press.					△	
		○ : Standard △ : Optional × : Not available					

(1) Gauges and Equipment

Gauges & Equipment	Functions
<p>Starter switch</p> 	<p>OFF: The switch key can be inserted or removed. All power is turned off.</p> <p>ON: For engine operation. Gauges and alarm devices are turned on.</p> <p>START: For engine starting. When the key is released after starting, it moves automatically to ON.</p> <p>GLOW: For the air heater (optional)</p> <p>(Note) ● The engine cannot be stopped by the starter switch.</p>
<p>Engine stop switch</p>	<p>Press the button to stop the engine by fuel cut. And continue to push the stop button until the engine has come to a complete stop.</p>
<p>Alarm buzzer</p>	<p>The buzzer sounds if an abnormality arises. See explanation under (2).</p>
<p>Warning lamps</p>	<p>The lamps come on when an abnormality arises. See explanation under (2).</p>
<p>Buzzer stop switch</p>	<p>The switch is used to stop the buzzer noise temporarily. Do not turn the buzzer off except when inspecting for an abnormality.</p>
<p>Illumination switch</p>	<p>Switch for lighting control panel.</p>
<p>Hour meter</p>	<p>Total operation hours are shown in the window below the tachometer. Refer to the figure as a standard for periodic inspections.</p>
<p>Lube.Oil. pressure meter</p>	<p>The needle shows engine oil pressure.</p>
<p>Cooling water temperature meter</p>	<p>The needle shows engine cooling fresh water temperature.</p>
<p>Boost meter</p>	<p>The needle shows intake air pressure (intake air boost pressure of turbocharger.)</p>
<p>Heat up indicating lamp for air heater</p> 	<p>The lamp comes on when the air heater is heated to start the engine easily under low temperature condition. (Refer to 4.3.2) (The lamp is located in warning lamp display column.)</p>

(2) Functions of Alarm Devices (Alarm Buzzer & Lamps)

- 1) The alarm buzzer sounds when any warning lamp (except the charge lamp) comes on.
- 2) Warning lamps come on when sensors (switches) detect an abnormality during engine operation. The warning lamps in the display column of the control panel are off during normal operation, but come on as follows when an abnormality arises:

①



Charge Lamp

The lamp comes on when there is a charging failure. The alarm buzzer does not sound. Check for breakage in the alternator V-belt

②



Cooling Water Temp. Warning Lamp

The lamp comes on when the cooling water (LLC) gets too hot. Check the water level in the sub-tank and cooling water tank, and the discharge volume of the cooling seawater.

③



Lube Oil Pressure Warning Lamp

The lamp comes on when the engine lube oil pressure drops. Check the engine oil level.

④



Fuel Filter Drain Warning Lamp.

The lamp comes on when the drain in the water separator located bottom of the fuel filter becomes excessive. Clean out the drain in the water separator.

⑤



Gear Oil Level In The Stern Drive Warning Lamp

The lamp comes on when the gear oil level in the stern drive falls below the specified level. Check the amount of gear oil in the stern drive.

(3) Functions of Warning Devices

When the key switch is turned on, the alarm devices functions as follows

- 1) Turning the key to ON :

- ① Warning buzzer sounds
- ② The BATTERY CHARGE and LUB. OIL PRESS. come on. The C.WATER TEMP, FUEL FILTER, GEAR OIL lamps do not come on.

(Note) When the warning buzzer and lamps function as above, everything is normal.

- 2) When the key switch is turned to START to start the engine and then returned to ON after the engine starting up.

- ① The warning buzzer stops sounding.
- ② All warning lamps go off. After the engine starts up, make it the rule to check alarm devices. If they do not work normally, contact your dealer.

Function of Alarm Devices		
Key Operation	Before starting OFF →ON	After Starting START →ON
Alarm Buzzer	On	Off
Alarm Lamps		
Charge Lamp	On	Off
Cooling Water Temperature	Off	Off
Engine Oil Pressure	On	Off
Fuel filter	Off	Off
Gear Oil	Off	Off

2.5.2 Remote Control Handle

This engine is controlled by the remote control handle located in the cockpit. The speed control lever on the engine side and clutch lever on the marine drive are connected by remote control cable with the remote control handle in the cockpit. There are the following kinds of remote control handles. When using other kinds of remote control devices, consult their operation manuals.

Morse Remote Control Handle (Optional)

This is a single-handle control device connected by a remote control cable. It operates the clutch to neutral, forward, and reverse and controls the engine speed.

Model MT-3 : Top mounting type. **Model MV** : Side mounting type.

The labels for operation on the handle are:

- ▲ **FWD** : Forward (Ahead)
 - NEUTRAL**: Clutch disengage position.
 - THROTTLE**: Position to reduce engine speed.
 - ▼ **REV** : Reverse (Astern)
- Operation of the handle is as follows.

● **Starting and stopping**

Put the handle in **NEUTRAL**. This puts the clutch in the disengage position (stop) and idles the engine at a low speed.

● **Forward**

Move the handle from **NEUTRAL** to ▲ **FWD** (forward). This engages the clutch in forward and simultaneously increases the engine speed. Pushing the handle further in the same direction increases engine speed to full speed.

● **Reverse**

Move the handle from **NEUTRAL** to ▼ **REV** (reverse). This engages the clutch in reverse and simultaneously increases the engine speed. Pushing the handle further in the same direction increases engine speed to full speed.

● **Free throttle operation**

When the boat is stopped (clutch is in neutral position), the idling speed of the engine can be increased in the following manner.

- ① Leave the handle lever in **NEUTRAL**.
- ② Disengage the clutch.

MT-3: Pull out the handle lever all the way.

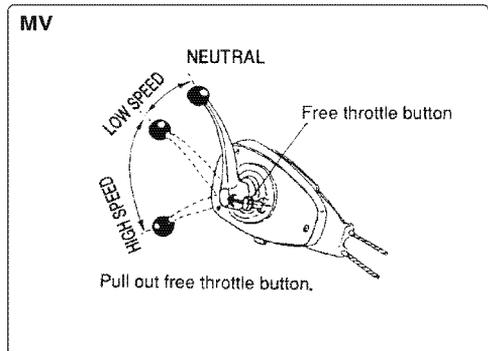
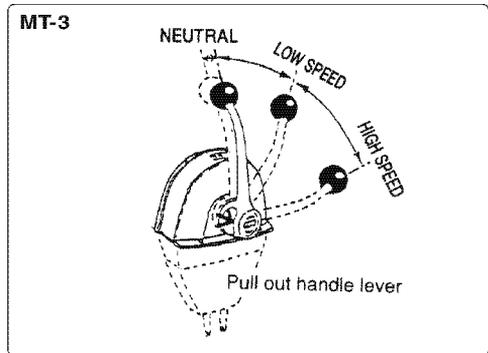
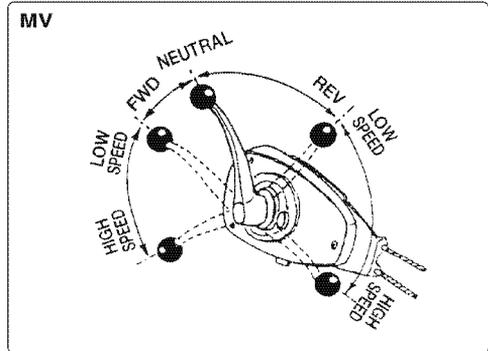
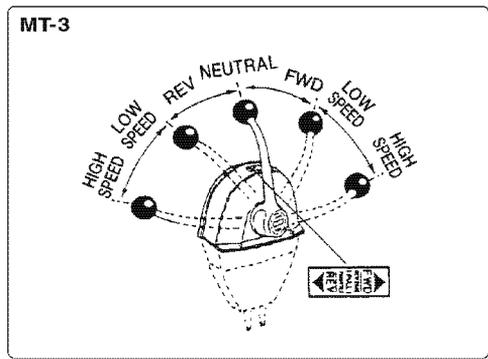
MV : Pull out the free throttle button next to the handle lever.

- ③ With the lever or button pulled out, move the handle lever in either the forward or reverse direction to increase idling speed.

- Returning to normal operation from free throttle operation.

MT-3: Return the handle lever to **NEUTRAL**. The lever will return automatically to the normal position.

MV: Return the handle lever to **NEUTRAL**. Push the free throttle button in.



3. BEFORE OPERATION

3.1 Fuel Oil, Lube Oil & Cooling Water

3.1.1 Fuel

[NOTICE]

Use of fuels not recommended in this Operation Manual may cause a decrease in engine performance and cause components to fail.

(1) Selection of fuel

Use the following diesel fuels for best engine performance:

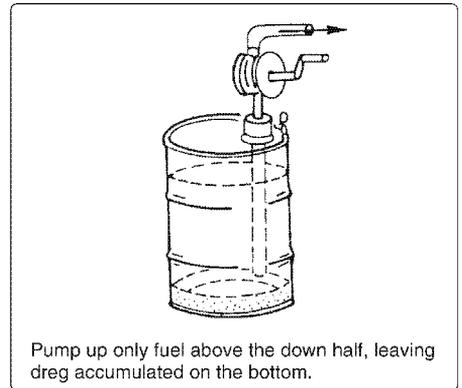
BS2869 A1 or A2, ASTM D975 No.1-D or No.2-D, EN590, ISO 8217 DMX

Fuels equivalent to Japanese Industrial Standard, JIS. No. K2204

Cetane fuel number should be 45 or greater

(2) Fuel Handling

- 1) Water and dust in the fuel oil can cause operation failure.
Use containers which are clean inside to store fuel oil. Store the containers away from rain water and dust.
- 2) Before supplying fuel, let the fuel container rest for several hours so that water and dust in the fuel are deposited on the bottom. Pump up only the clean fuel.
- 3) Use fuel with a Cetane number of over 45.
- 4) When supplying fuel to a new boat for the first time, be sure to extract all fuel from the F. O. tank and check for impurities in the fuel.

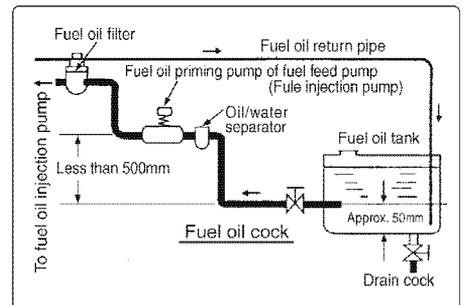


(3) Fuel piping

Install the piping between the fuel tank and the engine's fuel injection pump, as illustrated on the right.

Be sure to install a drain cock at the bottom of the fuel tank to remove water and dust.

Install an oil/water separator (optional) and a fuel filter in the middle of the fuel piping.



3.1.2 Lube oil

(1) Selection of Engine Lube Oil

Use the following lube oil:

- *API Classification.....CD
(Standards of America Petroleum Institute)
- *SAE Viscosity.....15W40
(Standards of Society of Automotive Engineering)

[NOTICE]

Using other than the specified lube oil will lead to seizure of parts inside the engine and gear device, abnormal wear, and shorten engine life. It will also effect the starting ability and power output.

(2) Selection of Marine Drive Oil

Refer to the operation manual for the marine drive unit for the selection of the proper lube oil.

- For **MERCUISER's** stern-driven device (**BRAVO**) use the following lube oil.

4LHA-HTZP/-DTZP/-STZP

System Oil	Specified lube oil
Drive oil	Quicksilver® High Performance Gear Lube
Power steering oil	Quicksilver® Power Trim and Steering Fluid or Dexlone-II
Power trim oil	Quicksilver® Power Trim and Steering Fluid or SAE 10W-30 or 10W-40 engine oil

Quicksilver® is registered trademark of Brunswick Corporatoin.

For further more instructions, refer to the maker's manual.

- Follow the maker's instructions for the marine gears.

(HSW450A2 (HURTH)(4LHA-HTP/-DTP))
(HSW630A1 (HURTH)(4LHA-STP))

3.1.3 Cooling Water

[NOTICE]

Be sure to add Long Life Coolant/Antifreeze (LLC) to cooling fresh water. In cold seasons, the LLC is especially important. Without LLC, cooling performance will decrease due to scale and rust in the cooling water line. Without LLC, cooling water will freeze and expand, breaking various parts.

(1) Handling of Cooling Water

1) Always use purified soft water or distilled water for the fresh water. Never use dirty water or hard water.

Impurities in the fresh water cause scale and rust to build up on the cooling water passage, reducing cooling efficiency and causing the engine to overheat.

2) Choose LLC which will not have any adverse effects on the materials (cast iron, aluminum, copper, etc.) of the engine's fresh water cooling system.

Consult your Yanmar dealer or distributor on the use of coolant/antifreeze, and detergents. The coolants/antifreezes, which are good performance for example, are shown below.

- TEXACO LONG LIFE COOLANT ANTIFREEZE, both standard and pre-mixed.

Product codes 7997 and 7998.

- HAVOLINE EXTENDED LIFE ANTIFREEZE/COOLANT.

Product code 7994.

3) Strictly use the proper mixing ratio of LLC to fresh water as instructed by the LLC maker. If incorrect ratio of LLC to fresh water is used, the cooling performance of the cooling water will drop and the engine may become overheated.

4) Do not mix different types (brand) of LLC, chemical reactions may make the LLC useless and engine trouble could result.

5) Replace the cooling water periodically according to the maintenance schedule given in this operation manual.

6) Remove the scale from the cooling water system periodically according to the instructions this operation manual.

[NOTICE]

Excessive use of LLC also lowers the cooling efficiency of the engine.

Be sure to use the mixing ratios specified by the LLC maker for your temperature range.

3.2 Supplying Fuel

⚠ DANGER



Fires from Oil Ignition

- Be sure to use the correct type of fuel when refueling. Mistakenly filling with gasoline or the like will result in ignition.
- Be sure to stop the engine before refueling. If you spill fuel, wipe such spillage carefully.
- Never place oils or other flammable material close to the engine as this could result in ignition.

3.2.1 Filling the Fuel Tank

Fill the tank with clean fuel which has not been contaminated with water or dust.

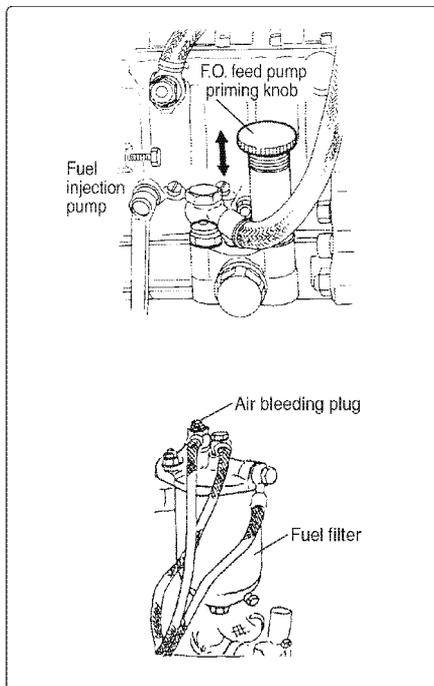
Fill the tank to approximately 90% of its capacity, and take care not to let the fuel spill over during operation.

3.2.2 Bleeding the Fuel System

Bleed the fuel system according to the following procedure. When there is air in the fuel system, the fuel injection pump will not be able to function.

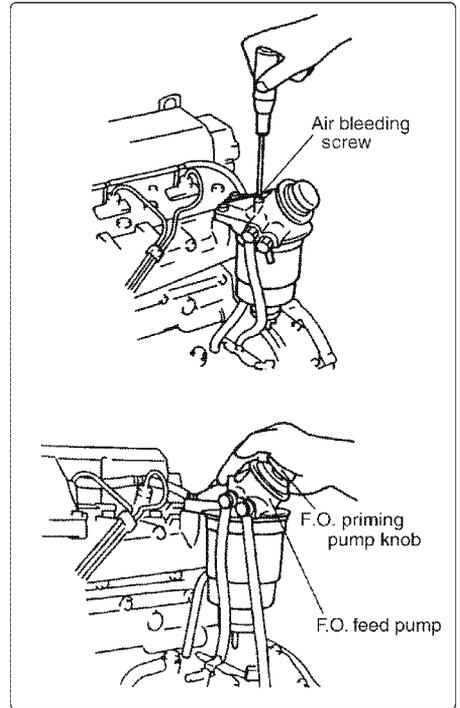
● 4LHA-DTP/DTZP/STP/STZP

- ① Open the cock on the fuel oil inlet pipe line, and loosen the air bleeding bolt on the top of the water/fuel oil separator (optional) by turning 2~3 times using spanner. When fuel with no air bubbles came out, tighten the air bleeding bolt.
- ② Loosen the priming pump knob turning counter-clockwise and repeatedly push the knob by hand to feed fuel oil to the fuel filter.
- ③ Loosen the air bleeding plug on the top of the fuel filter using a spanner. And release fuel from there until fuel with no air bubbles comes out then tighten the air bleeding plug.
- ④ Push down the priming pump knob and turn it clockwise to fasten.



● 4LHA-HTP/HTZP

- ① Open the cock on the fuel oil inlet pipe line.
- ② Loosen the air bleeding screw on the fuel filter by turning 2~3 times to the counter-clockwise using a screw driver.
- ③ Feed the fuel with the priming pump.
The priming pump is on the top of the fuel filter.
Move the priming pump knob up and down until fuel mixed with air bubbles flows out of the air bleeding port.
- ④ When the fuel coming out is clear and not mixed with any bubbles, tighten the air bleeding screw.



3.3 Supplying Engine Lube Oil

Fill with the specified amount of engine oil.

- ① Remove the filler cap on the top of the bonnet and fill with oil.
- ② Remove the oil dipstick and supply lube oil to the upper limit on the oil dipstick. To check the oil level, insert the dipstick in fully.

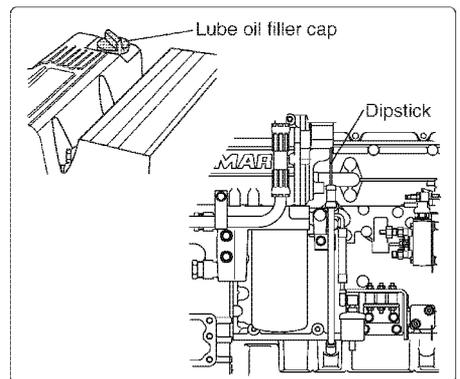
Engine oil capacity : ALL: 13 ℓ

Oil pan : 10 ℓ

- ③ Reinstall the dipstick and tighten the filler cap firmly by hand.

[NOTICE]

Do not overfill.
Overfilling will cause oil to be sprayed out from the breather during operation and into the suction inlet, and lead to engine problems.



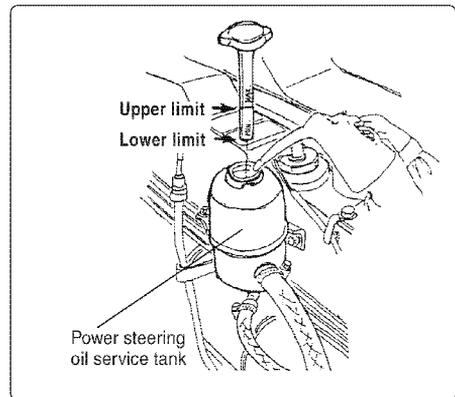
3.4 Supplying Marine Drive Oil

- Marine gear (HSW450A2, HSW630A1)
For the marine gear, follow the maker's instructions.
- For **MERCUISER's** stern-driven device (**BRAVO**), supply lube oil in accordance with the maker's instructions. (4LHA-HTZP/-DTZP/-STZP)
- For **MERCUISER's** stern-driven device (**BRAVO**), there is the power steering oil service tank on the engine side. Fill with the specified amount of the power steering oil.
(4LHA-HTZP/-DTZP/-STZP)
 - ① Remove the cap from the power steering oil service tank by turning it to the right, and supply the power steering oil.
 - ② Fill with the oil to the upper limit marked on the dipstick attached to the inside of the cap.
To check the oil level, wipe the dipstick with a cloth, and then measure the oil level by inserting the dipstick and tightening the cap. Fill with the necessary amount of oil.
 - ③ Reinstall the cap and tighten.

[NOTICE]

Do not overfill.

Overfilling will cause oil to be sprayed out during operation and effect the efficiency of the marine drive.



3.5 Supplying Cooling Water

⚠ DANGER



Burns from Scalding

- Never remove the filler cap of the fresh water cooler while the engine is still hot. Steam and hot water will spurt out and seriously burn you. Wait until the water temperature has dropped, then wrap a cloth around the cap and loosen it slowly.
- After inspection, refasten the cap firmly. If the cap is not secure, steam or scalding water may be emitted during operation causing burns.

Fill the fresh water tank and the subtank with fresh cooling water.

① Before filling, check to be sure the drain cocks are closed (Close both the fresh water line drain cocks and the sea water line drain cocks).

② Remove the filler cap of the fresh water tank. (Turn the filler cap by 1/3 turn counter-clockwise to remove.)

③ Supply cooling water slowly to the fresh water tank so that no air bubbles will develop. Supply until the water overflows from the filler port.

④ After supplying cooling water, fasten the filler cap firmly. If loose, trouble will occur due to water leakage.
To fasten, align the notch at the back of the cap with the slot of the filler port and turn the cap by 1/3 turn.

⑤ Remove the cap of the subtank, supply water to the full limit and fasten the cap.

Fresh water capacity :

Engine 1.5 ℓ

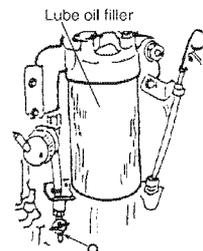
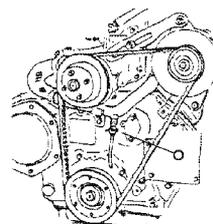
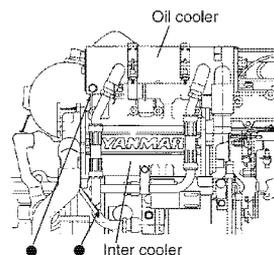
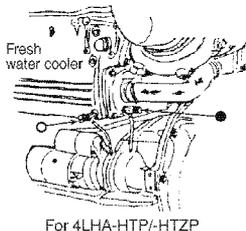
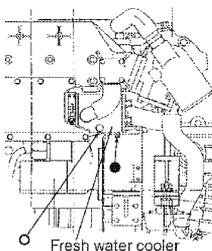
Sub-tank 0.8 ℓ

Model	Seawater cooling system	Fresh water cooling system
All engines	3	3

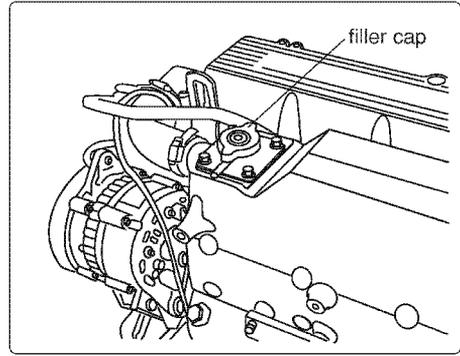
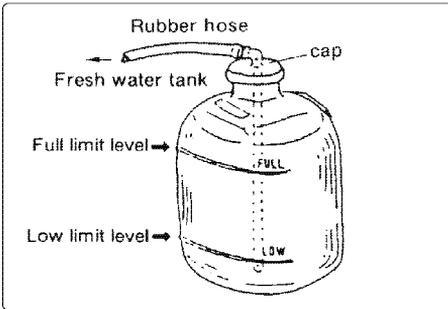
(Note) The water drain cocks are opened before shipping from the plant.

Position of cocks

- Fresh water
- Sea water



- ⑥ Check the rubber hose connecting the subtank to with the fresh water tank. If the hose is not water-tight a lot of cooling water will be consumed.



3.6 Cranking

When the engine is being used for the first time or if it has not been used for a long period of time, perform cranking before starting to distribute oil to all of the parts. Using an engine which has been stored for a long period of time without the cranking procedure may result in engine seizure, since there will no longer be oil on the moving parts after storage.

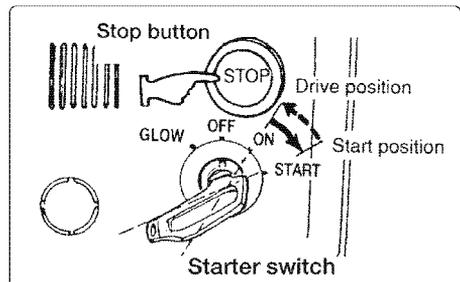
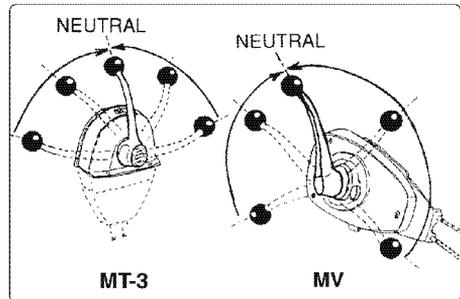
- ① Open kingston cock (optional).
- ② Put marine drive in **NEUTRAL**
- ③ Crank the engine.

Push the stop button to stop fuel injection while cranking.

- 1) Put the key into the starter switch.
- 2) While pushing the stop button, turn the key to the **START** position and hold it there. The engine will begin turning.

If you remove your hand from the stop button, the engine will start. Do not take your hand off the button.

- ④ Continue cranking the engine for about 5 seconds, checking for abnormal sounds.
- ⑤ Return the key to the **OFF** position. The engine will stop.



3.7 Checking the Lube Oil and Cooling Water

When lube oil, gear oil, and cooling water are put in for the first time, or after they have been replaced, their levels should be checked after a trial operation. Oil and water will be distributed to the various parts during the operation, lowering the levels of oil and water. Replenish to the proper amounts.

- **Supplying engine lube oil** → See 3.3
- **Supplying marine drive oil** → See 3.4
- **Supplying cooling water** → See 3.5

4. HOW TO OPERATE

⚠ WARNING

Alcohol

- Never operate the engine while you are under the influence of alcohol or when you are ill or feel unwell as this results in accidents.

⚠ WARNING



Exhaust Gas Poisoning

- Be sure to establish good ventilation in the engine room with windows, vents, or other ventilation equipment. Check again during operation to be sure that ventilation is good. Exhaust gas contains poisonous carbon monoxide and should not be inhaled.



Moving Parts

- Do not touch the moving parts of the engine (propeller shaft, V-belt, PTO-pulley, etc.) during operation or let your clothing get caught in them as this can result in injury.
- Never operate the engine without the covers on the moving parts.
- Check before starting the engine to see that any tools or cloths used in maintenance have been removed from the area.

⚠ CAUTION



Burns from Contact with Hot Engine Parts

- The whole engine is hot during operation and immediately after stopping. The turbocharger, exhaust manifold, exhaust pipe, and engine are very hot. Never touch these parts with your body or clothing.

4.1 Inspection Before Starting

Be sure to check the following items daily before starting the engine.

(1) Visual Check

Check for the following:

If any problem is found, do not use the engine until repairs have been completed.

- Oil leakage from the lube oil system.
- Fuel oil leakage from the fuel system
- Water leakage from the cooling water system
- Loosening or loss of bolts
- Damage to parts

(2) Checking and Resupplying Fuel Oil

Check the fuel level inside the fuel tank and supply with the recommended fuel, if necessary.

→ See 3.2

(3) Checking and Resupplying Engine Lube Oil

- ① Check the engine oil level with the oil dipstick.
- ② If the oil level is low, supply with the recommended lube oil to the filler port.

Supply oil up to the top mark on the oil dipstick.

→ See 3.3

(4) Checking and Resupplying Marine drive Oil

- ① Refer to the instructions accompanying the marine drive for the amount of lube oil.
- ② Supply with the recommended oil if necessary.

(5) Checking and Resupplying Cooling Water

▲ DANGER



Burns from Scalding

- **Never remove the filler cap of the fresh water cooler while the engine is still hot.**

Steam and hot water will spurt out and seriously burn you. Wait until the water temperature has dropped, then wrap a cloth around the cap and loosen it slowly.

- **After inspection, refasten the filler cap firmly. If the cap is not secure, steam or scalding water may be emitted during operation causing burns.**

- ① Check the cooling water level in the subtank.

If the water level is close to the lower limit, remove the subtank cap and fill with fresh water to the upper limit.

- ② When the water level in the subtank is low, remove the filler cap for the fresh water tank and check the amount of cooling water in the fresh water tank. Fill with fresh water the fresh water tank, if the level is low. → See 3.5

- Check the fresh water level before operation while the engine is cold.

Checking the water level while the engine is hot is dangerous, and the cooling water level reading will be misleading due to thermal expansion.

- Check the cooling water daily at the subtank and supply if necessary.

Do not remove the fresh water tank filler cap regularly.

- The amount of water in the subtank will increase during operation. This is normal.

When the engine is stopped, the temperature of the cooling water will drop causing the extra water in the subtank to return to the fresh water tank.

[NOTICE]

If the cooling water runs out too often, or if the water level in the fresh water tank falls without any change in the subtank water level, there may be some leakage of water or air. In such cases, consult your Yanmar dealer or distributor without delay.

(6) Checking the Remote Control Handle

Be sure to check that the remote control handle lever moves smoothly before use. If it is hard to operate, lubricate the joints of the remote control cable and also the lever bearings. If the lever comes out or there is play in the lever, adjust the remote control cable. → See 5.2.3(5)

(7) Preparing Reserves of Fuel, Lube Oil, and Cooling Water

Have sufficient fuel ready for the day's operation. In addition, have a reserve of fuel, lube oil, and cooling water (sufficient for at least one refill).

4.2 Checking the Control Panel and Alarm Devices

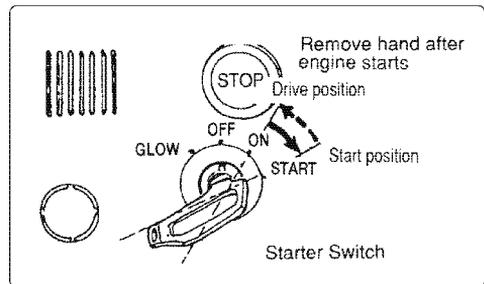
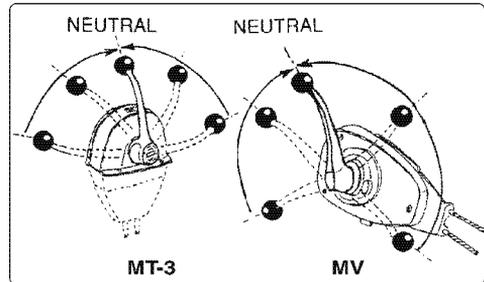
Be sure to check the alarm devices and other instruments on the panel before and after starting the engine. If the devices are not working properly, it is impossible to prevent any problems arising from insufficient oil and water in the engine. Make checking the alarm and other devices before and after starting a regular practice. If having the optional control panel New B or New C or New D-type, refer to 2.5.1(2)

4.3 Starting

4.3.1 Daily Starting

Follow the following procedures for starting under normal conditions.

- ① Open the kingston cock (optional).
- ② Open the fuel tank cock (local supply).
- ③ Put the remote control handle in **NEUTRAL**.
- ④ Turn on the battery switch.
- ⑤ Insert the key into the starter switch and turn it to **ON**, the buzzer sounds and the alarm device lamps (BATTERY CHARGE and LUBE OIL PRESS) come on (refer to 2.5.1(3)), indicating that the alarm equipment is working properly.
- ⑥ Turn the key to **START** to start the engine. When the engine has started, remove your hand from the key. The key will automatically return to the **ON** position. Check to see that alarm lamps have gone off and the buzzer has stopped.



4.3.2 Starting Under Low Temperature Conditions

When starting the engine under low temperature conditions (approx 0°C or lower), use the air heater (optional) to enable easier starting.

- Turn the starter key from the **OFF** position to **GLOW**. Continue to hold the key in the **GLOW** position to heat up the air heater for about 15 seconds.
- Then, return the starter key to **START** to start the engine.

[NOTICE]

Do not leave the air heater on for longer than 20 seconds at a time. Leaving the air heater on for longer periods of time will result in damage.

Note : When you choose the air heater (optional), we recommend you to choose the control panel (optional) having the air heater heat up indicating lamp. (New B, C, D-type).

When the air heater is heated up, the lamp comes on to turn the key to **START** position.

4.3.3 Restarting After Starting Failure

When attempting to restart the engine after starting failure, be sure that the engine is at a complete stop before turning the starter switch key. If the engine is restarted while the engine still has not stopped, the pinion gear of the starter motor will be damaged.

- When the engine will not start after several attempts, check the fuel system. If there is air in the fuel system, the fuel will not be fed and starting will not be possible.

After bleeding air from the system, attempt to restart the engine. →See 3.2.2

[NOTICE]

Do not hold the starter switch on for more than 15 seconds at a time. If the engine does not start the first time, wait for about 15 seconds before trying again.

4.3.4 After the Engine has Started

(1) Warming-up running

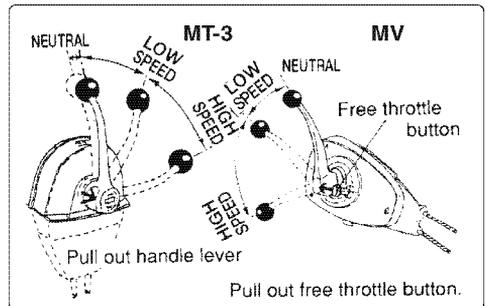
After the engine has started, let it run for about 5 minutes. This warms up the engine and distributes oil to all of the parts.

[NOTICE]

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

■ Morse Remote Control Handle

- ① Leave the remote control handle in **NEUTRAL**.
- ② Pull out the handle lever (MT-3) or the free throttle button (MV) and adjust the speed to no more than 1500rpm and run the engine at low speed with no load.



(2) Checking for problems

While warming up the engine, check the following items.

- ① Check that the meters and alarm devices on the control panel are normal. →See 2.5.2
- ② Check for water or oil leakage from the engine.
- ③ Check that exhaust color, engine vibrations and sound are normal.
- ④ Check that sufficient cooling water is discharged from the seawater outlet pipe.

Operation with too little seawater discharge will burn the impeller of the seawater pump.

If seawater discharge is too small, stop the engine immediately, identify the cause and repair

- Is the kingston cock open ?
- Is the inlet of the kingston cock clogged ?
- Is the seawater suction hose broken, or does the hose suck in air due to a loose joint ?

4.4 Adjusting the Engine Speed

Adjust the speed of the engine by moving the remote control handle slowly and smoothly. Move the handle forward and adjust the speed between low speed and high speed.

■ For the Morse remote control handle, adjust the speed between ▲ **FWD** and ▼ **REV**.

[NOTICE]

For a new engine be especially careful not to change speeds abruptly or attach a heavy load for the first 50 hours of operation. Doing so will result in damage and shorten the life of the engine.

4.5 Clutch Operation for the Marine Drive

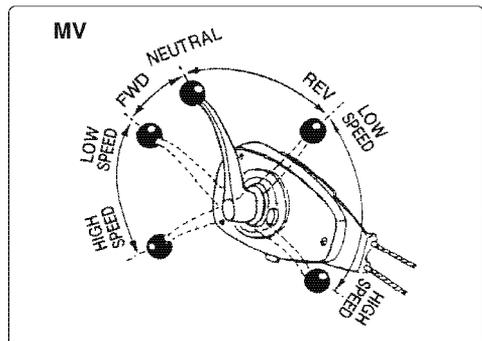
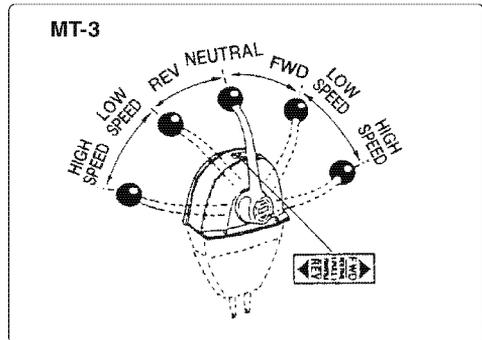
4.5.1 Forward, Neutral, Reverse

Use the remote control handle to operate the clutch for the marine drive (FORWARD, NEUTRAL, REVERSE). Use a single lever type remote control handle.

- Return the handle to **NEUTRAL** before moving it to another position securely. Always move the handle smoothly; never change positions abruptly.
- Be sure to securely position the handle in FORWARD, NEUTRAL, or REVERSE.

■ Morse Remote Control Handle (optional)

- Put the handle in **NEUTRAL** (middle position) to stop the boat. The engine will idle at low speed.
- Move the handle to ▲ **FWD** to go forward. When the clutch is engaged in forward, the speed will increase.
- Move the handle to ▼ **REV** to go in reverse. When the clutch is engaged in reverse, the speed will increase.



4.6 Check During Operation

Always be on the look out for problems during engine operation.

Pay particular attention to the following.

(1) Is sufficient water being discharged from the 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 black exhaust smoke shows engine overloading.

This shortens the engine's life, so should be avoided.

(3) Are there abnormal vibrations or noise ?

Do not operate at speeds which produce violent vibrations.

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.

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

(5) Is there water, oil, or gas leakage, or are there any loose bolts ?

Check the engine room periodically for any problems.

(6) Is there sufficient oil in the fuel tank ?

Replenish fuel oil in advance to avoid running out of fuel during operation.

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

How to Race the Engine

■ Morse Remote Control Handle

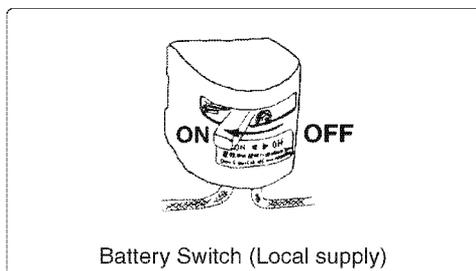
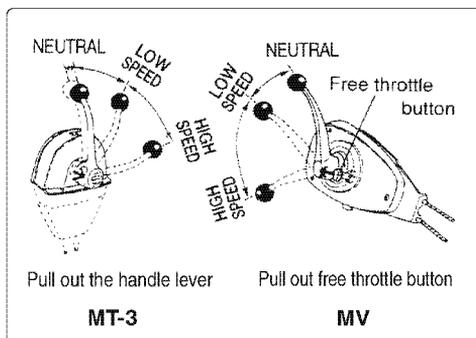
Pull out the handle lever (MT-3) or the free throttle button (MV) and shift the engine speed from high to low several times.

Racing the engine removes carbon built up in the combustion chamber and around the fuel injection valve.

Neglecting to race the engine will become poor smoke color and drop engine performance.

[NOTICE]

Never turn off the battery switch or spark the battery cable during operation. Damage to parts in the electric system will result.



4.7 Stopping the Engine

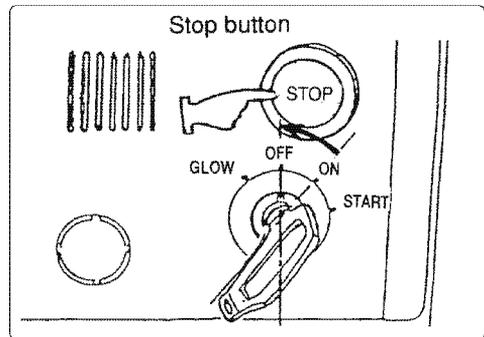
Stop the engine in accordance with the following procedures.

- ① Stop the boat.
Put the remote control handle in **NEUTRAL** to stop the boat.
- ② Be sure to race the engine before stopping it.
→ See 4.6 (7)
- ③ Cool down the engine at low speed (1000rpm or lower) for about 5 minutes.
- ④ Continue to push the stop button until the engine is completely stopped. If you release the button before the engine has completely stopped, it may restart.
- ⑤ Turn the starter switch to **OFF**, remove the key and place it in a safe place.
- ⑥ Turn off the battery switch.
- ⑦ Close the fuel tank cock.
- ⑧ Close the kingston cock.

In the rare instance where the engine does not stop when the stop button is pushed, stop the engine by closing the fuel cock on the fuel tank.

[NOTICE]

Stopping the engine suddenly after operating at high speed without cooling it down will cause the engine temperature to rise quickly resulting in deterioration of the lube oil and sticking of parts.

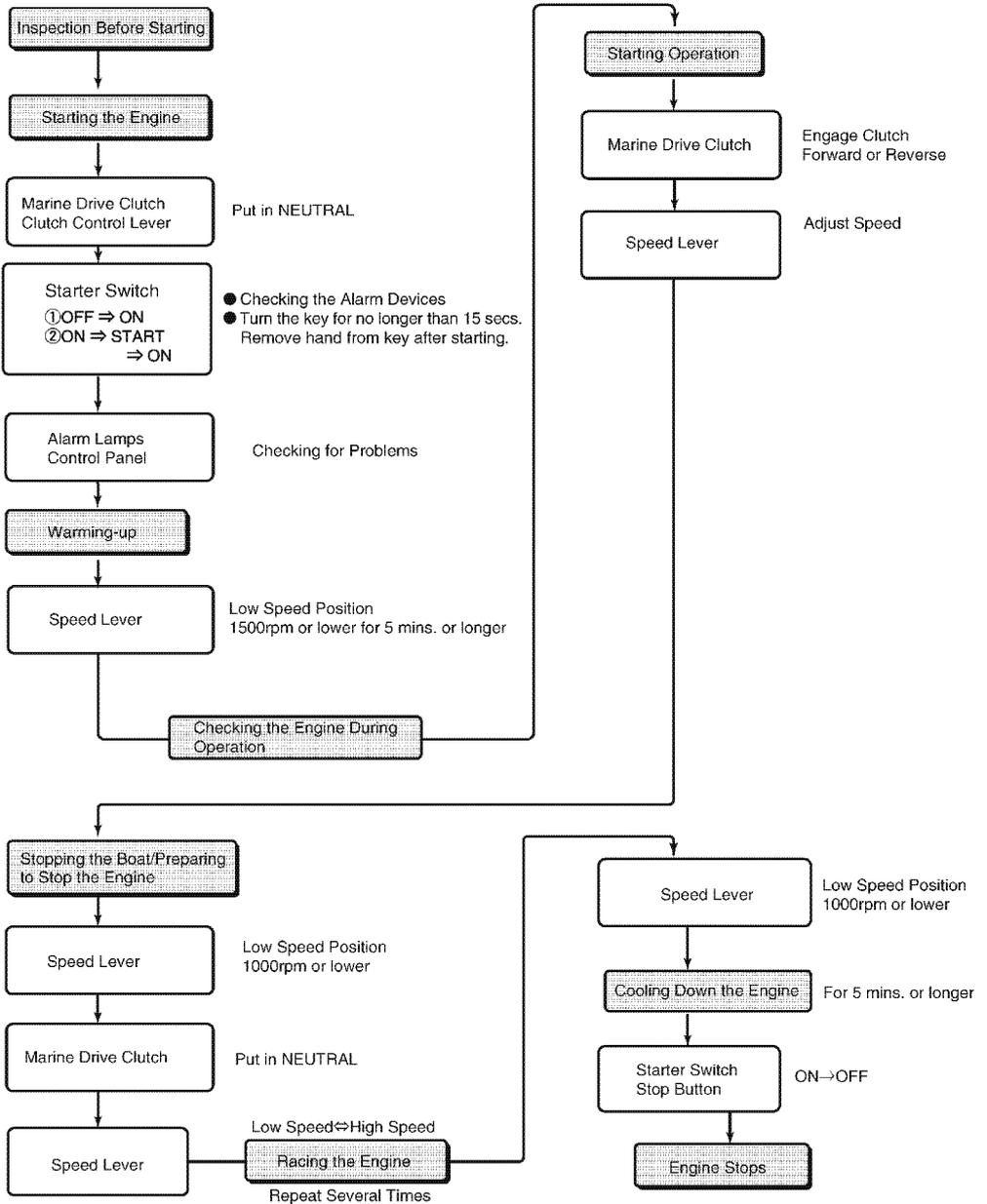


[NOTICE]

Neglecting to close the kingston cock will allow water to leak into the boat and may cause it to sink. Be sure to close the cock.

4.8 Operation Procedure

The following diagram shows the procedures for operation explained up to this point. Parts of the operation may differ depending on the marine drive and remote control system being used. Accompanying operation manuals should be read carefully and understood.



4.9 Long-Term Storage

4.9.1 Before storing for long periods of time, perform the following.

(1) Periodic Inspection

If the time for a periodic inspection is close, perform it before storing the engine for a long period of time (3 months or more)

(2) Draining the Cooling Water

When not using LLC, be sure to drain the water from the inside of the engine.

⚠ CAUTION



Precautions for Removing Hot Water to Prevent Burns

Wait until the temperature has dropped before removing cooling water from the engine to avoid getting scalded.

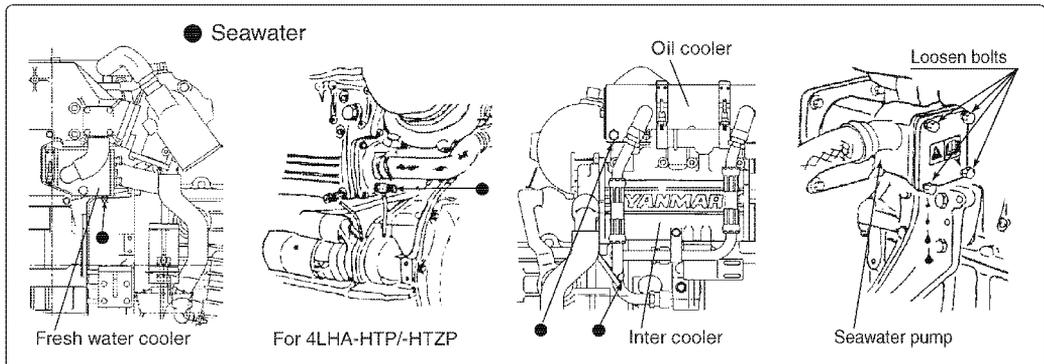
Drain the water from both the seawater and fresh water systems.

[NOTICE]

If the water is not drained, it may freeze and damage parts of the cooling water system .

■ Draining the water from the seawater system

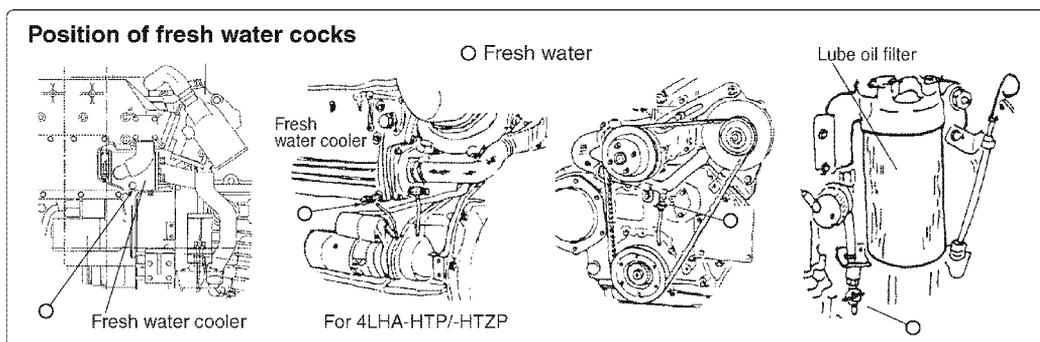
- ① Open the water drain cock on the seawater side of the fresh water cooler and drain off the cooling seawater.
- ② Open the water drain cock on the oil cooler and intercooler and drain off the cooling seawater.
- ③ Open the cock on the marine gear (follow the marine gear manual)
- ④ Loosen the bolts (4) on the side cover of the seawater pump and move the cover to drain off the cooling seawater inside.
- ⑤ After draining off the water, tighten the water drain cocks and reinstall the side cover on the seawater pump.



■ Draining the water from the cooling fresh water system

If antifreeze has not been added to the fresh cooling water, be sure to drain the water from the fresh water system.

- ① Open the drain cock at the side of the cylinder block, and drain off the water inside.
- ② Open the fresh water cooler cock and drain off the water inside.
- ③ Open the drain cock on the fresh water pipe of the front of engine (under the cooling fresh water pump)
- ④ Close the drain cocks after draining the water.



(3) Cleaning, Draining Fuel Oil, Greasing

- Clean the outside of the engine wiping off any dust or oil.
- To prevent condensation inside the fuel tank, either drain off the fuel or fill the tank.
- Grease the exposed area and joints of the remote control cable and the bearings of the remote control handle.

(4) Safeguarding the Engine Against Water and Moisture

- Cover the intake silencer, exhaust pipe, etc. with vinyl sheets and seal them to prevent moisture from entering.
- Drain bilge in the hull bottom completely.
- Water may leak into the boat when it is moored, and whenever possible it should be landed.
- Waterproof the engine room to prevent rain and seawater from entering.

(5) Maintaining the Battery Charge

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

4.9.2 Checking the Engine for Reuse After a Long Storage Period

When using the engine after a long period of storage, prepare for operation in the same manner as for a new engine.

→See [3. Before Operation]

5. MAINTENANCE & INSPECTION

Conduct Periodic Inspection for Your Safety.

The functions of engine components will degenerate and engine performance will fall according to the use of the engine. If periodic inspections are not performed, you may encounter unexpected troubles while cruising at sea, and consumption of fuel or lube oil may become excessive and exhaust gas and engine noise may increase. These all shorten the life of the engine.

Daily and periodic inspection and servicing increase your safety operation.

Inspect Before Starting.

Make it a daily rule to inspect before starting. →See [4.1 Inspection Before Starting]

Monitor the hour meter and conduct periodic inspections.

Keep a daily record of operation and maintenance. When the time for an inspection approaches, study the relevant pages in the Operation Manual. Inspections should be made after every 50, 250(or 1 yr.), 500 (or 2 yrs.), 1000(or 4 yrs.), and 2000 hours of use.

Monitor the hourmeter and conduct periodic inspections according to the procedures described in this Operation Manual.

Use Genuine Parts.

Be sure to use genuine parts for consumable and replacement parts.

Use of other parts will reduce engine performance and shorten the life of the engine.

Servicing Tools :

Prepare servicing tools onboard to be ready for inspecting and servicing the engine and other equipments.

Tightening Torque of Nuts & Bolts

Over-tightening of bolts and nuts causes them to come off or their threads to be damaged. Insufficient tightening causes oil leakage from the installation face or troubles due to the loosening of bolts. Nuts and Bolts must be tightened to the appropriate tightening torque.

Important parts must be tightened with a torque wrench to the correct tightening torque and in the right order. Consult with your dealer or distributor if the servicing requires the removal of such parts.

The tightening torque for standard nuts & bolts is listed below:

[NOTICE]

● Apply the following tightening torque to bolts having "7" on the head.
(JIS strength classification : 7T)



○ Tighten bolts with no "7" mark to 60% tightening torque.

○ If the parts to be tightened are made from aluminum alloy, tighten the bolts to 80% tightening torque.

Bolt dia. x pitch	mm	M6×1.0	M8×1.25	M10×1.5	M12×1.75	M14×1.5	M16×1.5
Tightening torque	N·m (Kgf·m)	10.8±1.0 (1.1±0.1)	25.5±2.9 (2.6±0.3)	49.0±4.9 (5.0±0.5)	88.3±9.8 (9.0±1.0)	137±9.8 (14.0±1.0)	226±9.8 (23.0±1.0)

5.1 List of Periodic Inspections

Daily and periodic inspection are important to keep the engine in its best condition. The following is a summary of inspection and servicing items by inspection interval. Periodic inspection intervals vary depending on the uses, loads, fuels and lube oils used and handling conditions, and are hard to establish definitively. The following should be treated only as a general standard. Schedule your own periodic inspection plan according to the operational conditions of your engine and inspect every item. Neglecting periodic inspection leads to engine troubles and shortens the life of the engine. Refer to the various accompanying operation manuals for periodic inspection and maintenance for marine drive and remote control system.

○: Check ⊙: Replace ●: Consult local dealer

Item	Content	Daily	Interval term				
			Every 50hrs	Every 250hrs (1 yr.)	Every 500hrs (2 yrs.)	Every 1,000hrs (4 yrs.)	Every 2000hrs
Fuel oil	Check & supply of oil to the tank	○					
	Drain the fuel tank		○				
	Drain the fuel filter and water separator		○				
	Replace the fuel filter element			⊙			
Lube oil	Check the quantity of lube oil	○					
	Replace the lube oil		⊙ (First)	⊙			
	Replace the lube oil filter element		⊙ (First)	⊙			
	Wash engine oil cooler						●
Drive oil	Check the quantity of drive oil	○	Refer to operation manual of marine drive.				
	Replace drive oil						
	Check power trim oil	○					
	Check power steering oil	○					
marine gear oil	For informations marine gears, refer to the maker's manual.						
Fresh cooling water system	Check & supply of cooling water tank	○					
	Replace the fresh cooling water			⊙			
	Clean & check the cooling water passage						●
Seawater cooling water system	Check the seawater outlet and discharge	○					
	Check & replace the impeller of seawater pump				○		●
	Check & replace the anti corrosive zincs			⊙			
	Clean & check the seawater passage						●
Piping	Check & fuel oil pipe, cooling water pipe	○					
	Check mixing elbow.	○					
Electrical equipment	Check the alarm lamps & devices	○					
	Check supply electrolyte in battery		○				
Belt	Check V-belt				○		
Remote control handle	Check the remote control operation & grease	○					
	Adjusting the remote control cable			○			
Intake and exhaust system	Wash turbocharger blower			○			
	Adjust the intake and exhaust valve clearance			●(First)		●	
	Lapping the intake / exhaust valve						●
Fuel injection	Check & adjust the fuel injection pressure & atomizing condition			●(First)		●	
	Check & adjust the fuel injection timing						●

5.2 Periodic Inspection Items

5.2.1 Inspection After Initial 50Hrs. Operation

(1) Replacing the Engine Lube Oil and Lube Oil Filters (1st time)

CAUTION



Precautions for Removing Hot Oil to Prevent Burns

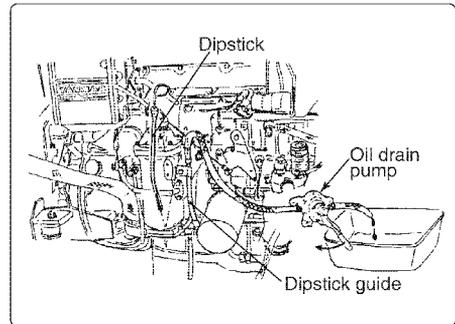
If extracting oil from the engine while it is still hot, do not let the oil splash on you.

During initial operation of the engine, the oil is quickly contaminated due to the initial wear of internal parts. The lube oil must therefore be replaced early. Replace the lube oil filter at the same time.

① Drain off the lube oil.

It is easier and more effective to drain the engine lube oil while the engine is still warm after operation.

- 1) After removing the oil dipstick, attach the hose of the oil drain pump (optional) to the dipstick guide.
- 2) Drain off the oil with the drain pump.
- 3) Remove the drain plug at the bottom of the engine oil cooler and drain off the oil inside.

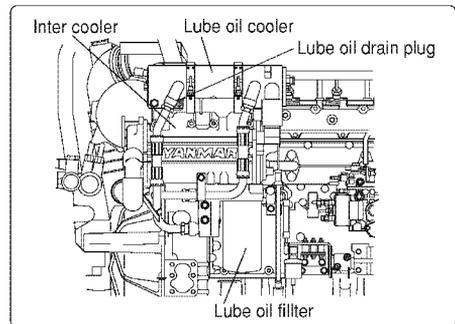


② Replace the lube oil filter.

- 1) Turn the lube oil filter to the left using the filter wrench and remove.
- 2) Clean the filter installation face.
- 3) Apply engine oil to the installation face and lightly screw in the filter in position and tighten it until the gasket comes into contact with the seat by hand. Next, tighten an additional 3/4 of a turn with the filter wrench.

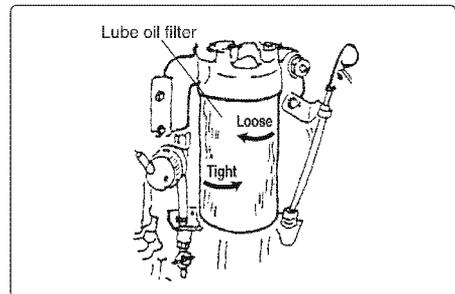
Part Number :

lube oil filter 127695-35150



③ Fill with new lube oil.

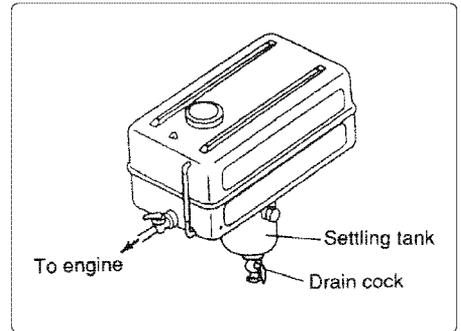
- 1) Fill with the specified amount of oil.
→ See 3.3
- 2) Run the engine for approximately 5 minutes and check to see if there is any oil leakage.
- 3) Approximately 10 minutes after stopping, check the oil level again with the oil dipstick and add more oil if necessary.



5.2.2 Inspection Every 50 Hours

(1) Draining the Fuel Tank (local supply)

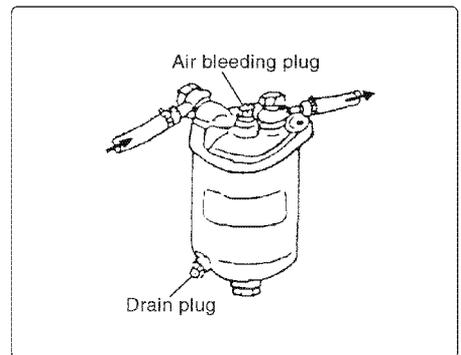
- ① Put a pan under the drain to catch the fuel.
- ② Loosen the drain cock at the bottom of the fuel tank, and drain off any water and dirt collected inside.
- ③ Once the water and dirt have been drained off and the fuel coming out is clear, close the drain cock.



(2) Draining the Oil/Water Separator (Optional)

- ① Close the fuel cock.
- ② Loosen the plug screw at the bottom of the oil/water separator and drain water and dust from inside.
- ③ After draining of the oil/water separator, be sure to vent air from the fuel system.

(4LHA-DTP/-DTZP/-STP/-STZP)



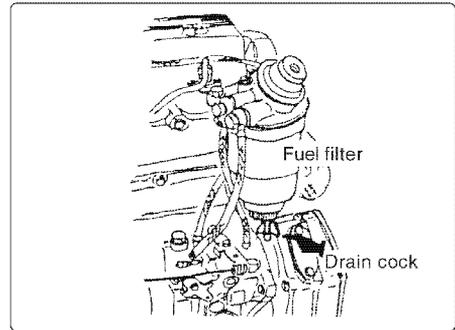
(3) Drain the fuel filter

When water and dirt are mixed in with the fuel, it becomes impossible for the fuel injection pump and the valve to work. Drain periodically to keep the filter from becoming clogged. When there is a lot of drain collected in the oil/water separator at the bottom of the fuel filter, the fuel filter alarm lamp on the control panel (optional) will light up. (4LHA-HTP/-HTZP)

1) 4LHA-HTP/-HTZP

- ① Close the fuel cock on the fuel pipe line.
- ② Open the drain cock at the bottom of the fuel filter oil/water separator, and drain off any water and dirt collected inside.
- ③ Close the drain cock.
- ④ Be sure to bleed air out of the fuel system.

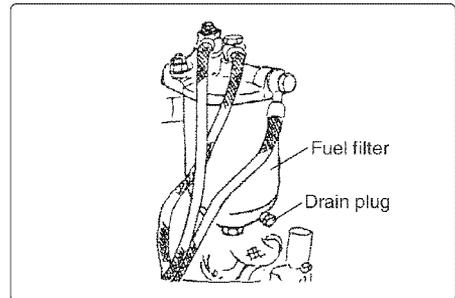
→ See 3.2.2.



2) 4LHA-DTP/-DTZP/-STP/-STZP

- ① Close the fuel cock on the fuel pipe line.
- ② Loosen the drain plug at the bottom of the fuel filter and drain off any water and dirt collected inside.
- ③ Retighten the drain plug.
- ④ Be sure to bleed air out of the fuel system.

→ See 3.2.2.



(4) Inspection of Battery

⚠ WARNING



Fire due to Electric Short-Circuits

Always turn off the battery switch or detach the earth cable (-) before inspecting the electrical system. Failure to do so could cause short-circuiting and fires.



Proper Ventilation of the Battery Area

Be sure the area around the battery is well-ventilated and there is nothing which could start a fire. During operation and charging, hydrogen gas is emitted from the battery and can be easily ignited.

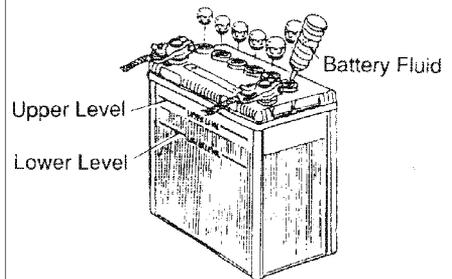


Battery Fluid

Battery fluid is diluted sulfuric acid. It can blind you if it gets in your eyes, or burn your skin. Keep the fluid away from your body. Wash it off immediately with a large quantity of fresh water if you get any on you.

- Check the level of fluid in the battery.
When the amount of fluid nears the lower limit, fill with battery fluid (available in the market) to the upper limit. If operation continues with insufficient battery fluid, the battery life is shortened, and the battery may overheat and explode.
- Battery fluid tends to evaporate more quickly in the summer, and the fluid level should be checked earlier than the specified times.
- If the engine cranking speed is so slow that the engine does not start up, recharge the battery.
- If the engine still will not start after charging, replace the battery.

Local supply



Follow the instructions and precautions in the manual from the battery maker.

[NOTICE]

The capacity of the specified alternator and battery is sufficient for regular operation, however, the capacity may be insufficient, if they are used for other purposes such as lights inside the boat, etc. Consult your Yanmar dealer or distributor.

5.2.3 Inspection Every 250 Hrs. or 1 yr.

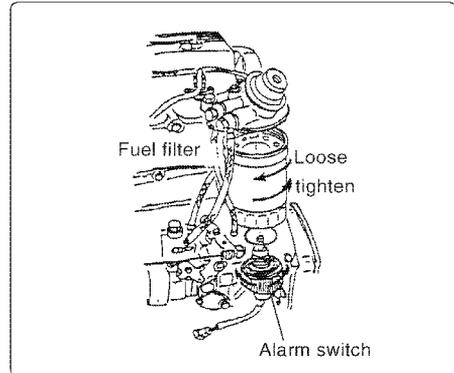
(1) Replacing the Fuel Filter

1) 4LHA-HTP/-HTZP

- ① Close the fuel cock of the fuel tank.
- ② Drain the fuel from the fuel drain cock at the bottom of fuel filter. See. 5.2.2(3)
- ③ Remove the connectors of the wiring and remove the alarm switch using spanner.
- ④ Remove the fuel filter using filter wrench.
- ⑤ Tighten the new fuel filter. (Clean the fuel filter mounting surface).

Part No. of the fuel filter : 121857 - 55710

- Install the alarm switch to the new fuel filter.
 - Apply fuel to the gasket of the new fuel filter.
 - Lightly screw in the fuel filter in position and tighten it until the gasket comes into contact with the seat.
 - Manually tighten the filter by a 3/4 turn.
[tightening torque: 14.7~19.6N·m(1.5~2.0kgf·m)]
 - Connect the alarm switch wiring.
- ⑥ Fill fuel to the fuel filter. (see 3.2.2)
 - If you spill fuel, wipe such spillage carefully.
 - Start the engine to check for fuel leakage.



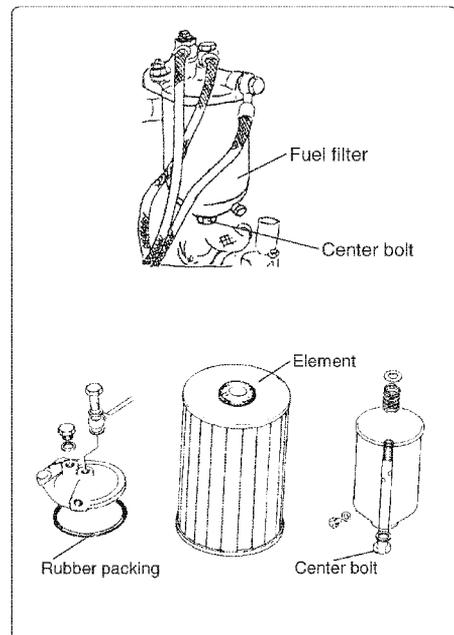
2) 4LHA-DTP/-DTZP/-STP/-STZP

Replace the fuel filter element periodically before there is clogging and the fuel flow is reduced.

- ① Close the fuel cock of the fuel tank.
- ② Remove the drain plug and discharge the fuel oil in the fuel filter. (put a pan under the drain to catch the fuel)
- ③ Loosen center bolt of the filter, remove the lower case, and replace the element.

Part No. of the fuel filter element : 41650-550800

- ④ Fill fuel to the fuel filter (See 3.2.2)
 - If you spill fuel, wipe such spillage carefully.
 - Start the engine to check for fuel leakage.



(2) Replacing Engine Lube Oil and Lube Oil filter. (See 5.2.1(1))

(3) Replacing Cooling Fresh Water

Cooling performance drops when the cooling water is contaminated with rust and scale.

Even if LLC is added, the cooling water must be periodically replaced because the properties of the agent will degenerate. Replace the cooling water periodically.

- Draining the Cooling Fresh Water → See 4.9.1.
- Supplying Cooling Fresh Water → See 3.5.

(4) Inspecting and Replacing Anti-Corrosive Zinc

Inspect and replace the anti-corrosive zinc periodically.

- ① Close the kingston cock.
- ② Drain the cooling seawater.
After draining, close the cocks.

→ See 4.9.1

- ③ Remove the plug labeled ZINC and indicated in the diagram.

Anti-corrosive zinc is on the following parts.

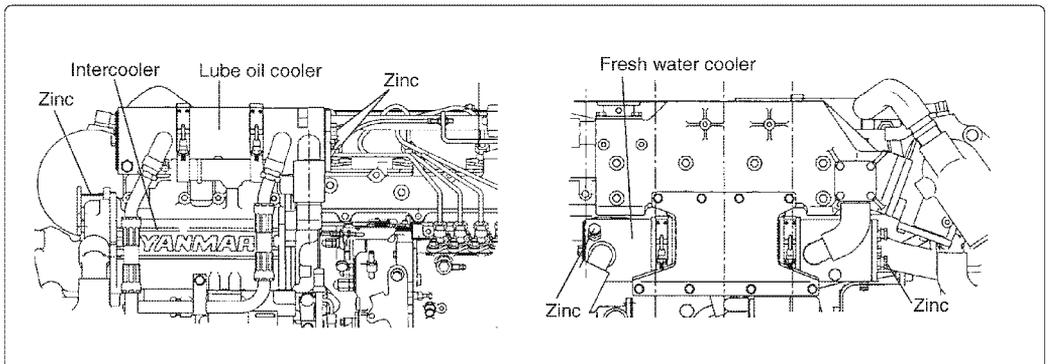
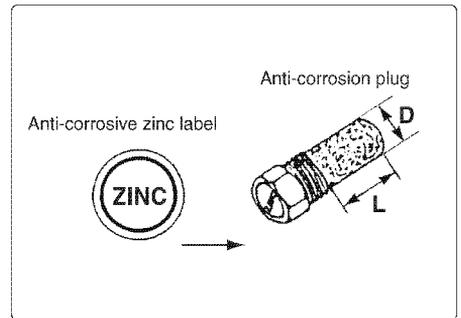
Part	Parts No.	Quantity	Dimensions DXL
Intercooler	119574-18790	1	1/2"×1"
Engine oil cooler	119574-44150	2	1/2"×1"
* Fresh water cooler	119574-44150	2	1/2"×2"

* : For 4LHA-DTP/-DTZP/-STP/-STZP

- ④ Check the zinc on the inside of the plug to determine the amount of wear to the anti-corrosive zinc.
 - Replace the anti-corrosive zinc when it has been reduced to less than 1/2 of its original size.
 - If there is only a little bit of wear, clean the surface by sanding off any corroded areas.
- ⑤ Replace plug.
- ⑥ Open the kingston cock and check water leakage.

[NOTICE]

If replacement of zinc is neglected and operation is continued with a small volume of anti-corrosive zinc, corrosion of the seawater cooling system will occur and water leakage, parts breakage, or accidents will result.

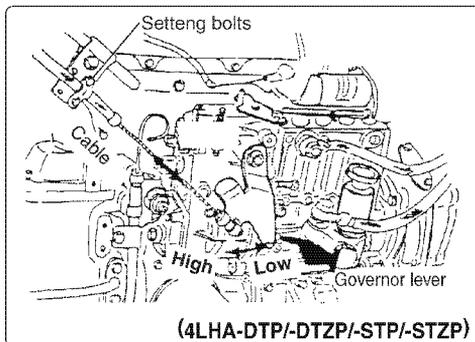
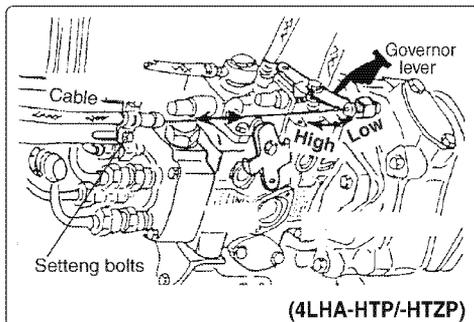


(5) Adjusting the Remote Control Cable

1) Adjusting the engine speed control cable

Check the governor lever (speed control lever) at the engine side makes uniform contact with the high speed and low speed side stopper when the remote control handle is in the high speed (high idle) or low speed (idle) position. If either the high speed or the low speed side does not make contact with stopper, adjust as follows:

- ① Remove the threaded area and the connecting pivot of the remote control cable from the governor lever. Adjust the cable stroke by adjusting the fastening distance of the threaded area.
- ② Loosen the setting bolt of the remote control cable clamp bracket and adjust the fixing position of the remote control cable. (However, the adjustment of the remote control cable stroke must be made as in ① above.)



2) Adjusting the marine gear control cable

Refer to the maker's manual.

(6) Washing the Turbocharger Blower

When engine speed seems sluggish or the exhaust color poor, the blades of the turbocharger blower may be dirty. Wash the blower in the following manner.

- ① Have ready blower wash (liquid detergent), fresh water, and a small pitcher.

Blower Wash (4L)

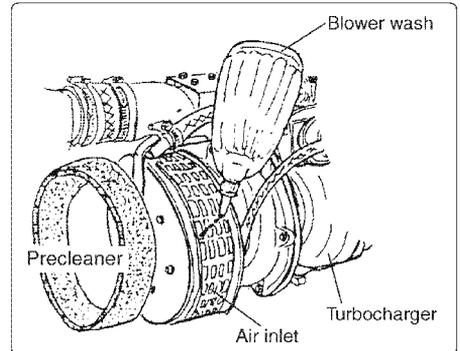
Parts Code : 974500-00400

- ② Remove the precleaner.
- ③ Put the clutch in neutral and run the engine at high speed (2500~3000rpm).
- ④ Slowly pour approximately 50cc of blower wash into the turbocharger suction inlet over a period of about 10 seconds.
- ⑤ After about 3 minutes, pour in approximately 50cc of fresh water in the same manner over a period of about 10 seconds.
- ⑥ After under load operating the engine for about 10 minutes, check the boost pressure and power output. If there is no improvement after washing the blower, repeat the washing process several times.
- ⑦ Reattach the precleaner. If the precleaner is excessively dirty, wash with detergent and dry before reattaching. If the precleaner is damaged, replace it.

If there is still no improvement consult your local Yanmar dealer.

[NOTICE]

Do not pour in a large amount of blower wash at one time (pour it in gradually) as this can damage the blower blades and get water hammer in the combustion chamber leading to accidents.



(7) Inspection and Adjustment of Intake/Exhaust Valve Clearance (1st Time)

Inspection and adjustment must be made to correct opening/closing timing lags of the intake/exhaust valves which might arise due to initial parts wear. This inspection requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(8) Inspection and Adjustment of Fuel Injection Valve (1st Time)

Inspection and adjustment are necessary to obtain optimal fuel injection to ensure the good engine performance. This inspection requires specialized knowledge and techniques. Consult your Yanmar dealer, or distributor.

5.2.4 Inspection Every 500 Hrs.or 2 yrs.

(1) Checking the Tension of the V-Belt of the Alternator

When there is not enough tension in the V-belt, the belt will slip making it impossible for the alternator to generate power.

Additionally, the fresh water pump will not work causing the engine to overheat.

Check the tension of the V-belt in the following manner.

① Press the V-belt down with your thumb at the middle of the belt to check the tension. The give in the V-belt should measure about 8~10mm at the depression.

② To adjust the V-belt tension, loosen the set bolt and move the alternator.

③ Replace the belt if it is damaged.

Parts No: 121850-42280

(2) Checking the Tension of the V-Belt of the Power Steering Pump

When there is not enough tension in the V-belt, the oil pump will not turn making steering impossible and operation dangerous.

Check the tension of the V-belt in the following manner.

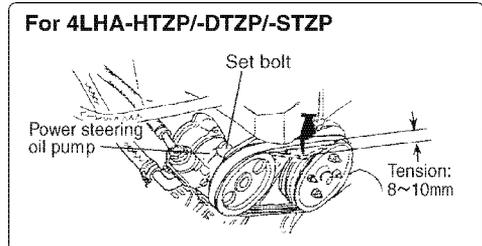
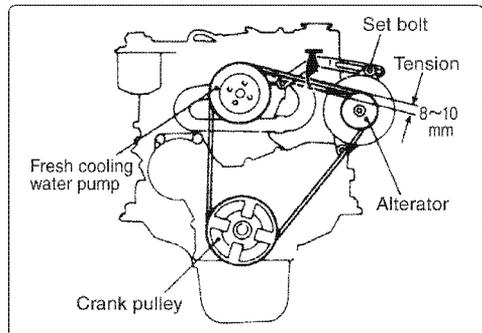
① Press the V-belt down with your thumb at the middle of the belt to check the tension. The give in the V-belt should measure about 8~10mm at the depression.

② To adjust the V-belt tension, loosen the set bolt and move the oil pump.

③ Replace the belt if it is damaged. **Parts No: 119175-26500**

[NOTICE]

- If the V-belt tension is too tight, the belt and the bearings of the alternator will be damaged.
- Be careful not to spill any oil on the V-belt as this will lead to stretching and slippage.



5.2.5 Inspection Every 1000 Hrs. or 4 yrs.

(1) Adjustment of Intake/Exhaust Valve clearance (2nd time & after)

This maintenance requires specialized knowledge. Consult your Yanmar dealer or distributor. Adjustment is necessary to maintain the correct timing for the opening and closing of valves. Neglecting adjustment will cause the engine to run noisily and result in reduced power output and other damage.

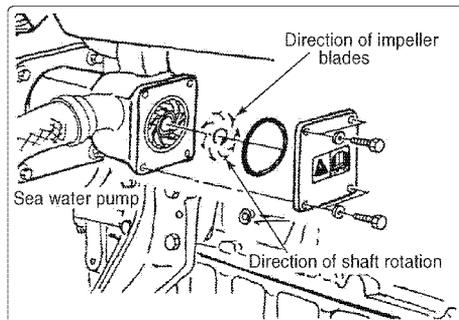
(2) Inspecting and Adjusting Fuel Injection Valves (2nd time & after)

This maintenance requires specialized knowledge. Consult your Yanmar dealer or distributor. Fuel injection must be adjusted to ensure optimal engine performance.

(3) Inspecting Inner Parts of the Seawater Pump

The discharge performance of the seawater pump falls depending on the use.

The seawater pump must be inspected periodically. If the discharge volume of cooling seawater has decreased: (When disassembly servicing of the seawater pump is necessary, consult Yanmar dealer or distributor.)



- ① Loosen the side cover set bolts and remove the side cover. (4 mounting bolts)
- ② Illuminate the inside of the the seawater pump with a flashlight and inspect.
- ③ When the following damage is found, disassembly and maintenance are necessary:

1) Cracks and loss of impeller ; flaws or excessive wear of impeller tips and side faces.

If any, replace the damaged part (consult Yanmar dealer or distributor)

(Note) The impeller must be replaced periodically (every 2000 hours).

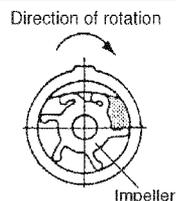
2) Damage to the wear plate

- ④ If there is no problem with the inner parts, fit the O-ring to the groove of the joint face and re-install the side cover.

If water leaks continuously from the water drain pipe beneath the seawater pump during operation, disassembly and maintenance (replacement of the oil seal) is necessary.

[NOTICE]

The seawater pump revolves clockwise, but the impeller blades must be installed in the counterclockwise direction. During reassembly, be sure to install the impeller blades correctly shown in the illustration right . When turning the engine manually, never turn it in the reverse direction. The impeller will be twisted and damaged.



5.2.6 Inspection Every 2000 Hrs.

(1) Cleaning the Cooling Water System and Inspecting & Adjusting Parts

Rust and scale are deposited inside the seawater and fresh water cooling systems during long use. This drops cooling performance, so it is necessary to clean and maintain the following parts in addition to replacing the cooling water.

The internal contamination of the engine lube oil cooler reduces cooling efficiency and accelerates lube oil cooler degeneration.

Servicing jobs above require specialized knowledge.

Consult your Yanmar dealer or distributor.

Relevant Cooling Water System Parts:

Seawater pump, engine lube oil cooler,

intercooler, fresh water pump, fresh water cooler, thermostat, etc.

(2) Lapping of Intake/Exhaust Valves

Adjustment necessary to maintain proper contact of valves and seats.

This maintenance requires specialized knowledge.

Consult your Yanmar dealer or distributor.

(3) Inspection and Adjustment of Fuel Injection Timing

Fuel injection timing must be adjusted to ensure optimal engine performance.

This maintenance requires specialized knowledge.

Consult your Yanmar dealer or distributor.

6. TROUBLESHOOTING

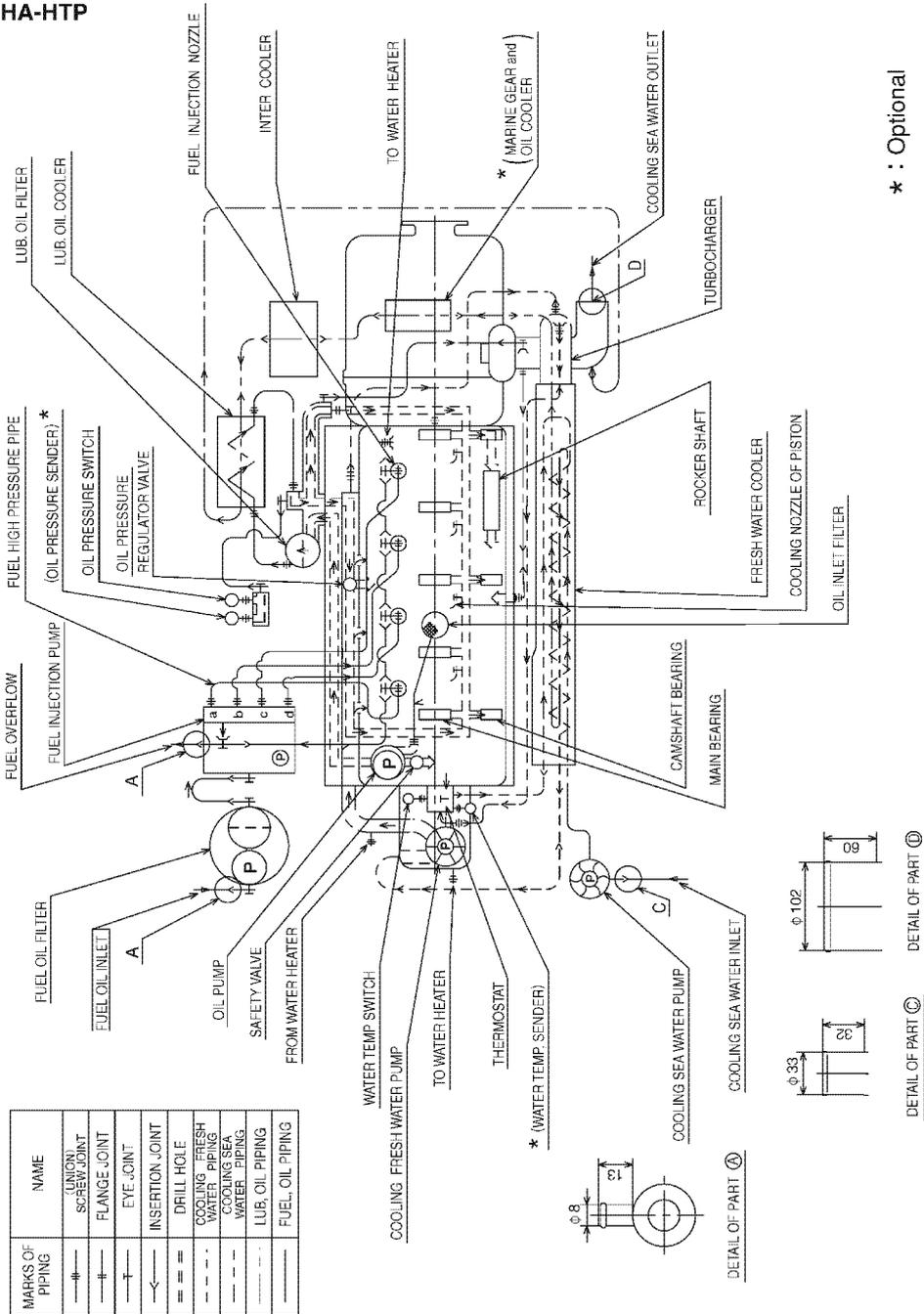
Trouble	Probable Cause	Measure	Reference
<ul style="list-style-type: none"> ● Alarm buzzer sounds and alarm lamps go on during operation ○ Eng. L.O. Press. Warning Lamp goes on. ○ Marine gear lube oil level light goes on. ○ C.W. Temp.(Fresh Water) Warning Lamp goes on. ○ Fuel Filter drain Lamp goes on (4LHA-HTP/-HTZP) 	<p>[NOTICE] Shift to low speed operation immediately, check which lamp has come on and stop the engine for inspection. If no abnormality is identified and there is no problem with operation, return to port at your lowest speed and request repairs.</p> <p>Engine L.O. insufficient; L.O. filter clogged.</p> <p>Insufficient marine gear lube oil</p> <p>Fresh water tank water level low. Cooling seawater discharge insufficient Contamination inside the cooling system.</p> <p>Drain excessive in the W/O separator</p>	<p>L.O. level check, resupply, replace Replace L.O. filter Replace Eng. L.O.</p> <p>Check the oil level and supply.</p> <p>Check C.W. level resupply System clogged; air. has entered the system Ask for repairs.</p> <p>Drain the water in the W/O separator of the fuel filter</p>	<p>3.3 5.2.1(1) 5.2.1(1)</p> <p>3.4</p> <p>3.5</p> <p>5.2.2(3)</p>
<ul style="list-style-type: none"> ● Warning Devices are Faulty. When Switch is Turned ON: ○ Alarm buzzer does not sound ○ Warning lamps do not go on Eng. L.O. Press. ○ Charge lamp does not go on. <p>When the Key Returned to ON from START after Engine Starting:</p> <ul style="list-style-type: none"> ○ Buzzer keeps on sounding ○ One of the warning lamps does not go out. 	<p>[NOTICE] Do not run the engine with alarm devices still unrepaired. Trouble will progress and a serious problems may result.</p> <p>Circuit broken or buzzer defective.</p> <p>(Note) Other warning lamps do not go on when the switch is turn on. They only go on when there is an abnormality.</p> <p>Circuit broken or lamp burnt out.</p> <p>Short-circuit (if lamp goes out) Sensor switches faulty</p>	<p>Ask for repairs.</p> <p>Ask for repairs.</p> <p>Ask for repairs.</p> <p>Ask for repairs.</p>	<p>2.5</p>

Trouble	Probable Cause	Measure	Reference
○Charge lamp does not go out during operation	V-belt broken or loose Battery defective. Alternator power generation failure	Replace V-belt; adjust tension Check fluid level, specific gravity; replace. Ask for repairs.	5.2.4(1) 5.2.2(4)
<p>●Starting Failures</p> <p>○Starter works but engine does not start</p> <p>○Starter does not work or works only slowly. (eng.can be turned manually)</p> <p>○Engine can't be turned manually</p>	<p>No fuel Improper fuel Fuel injection faulty. Compression leaks from intake/exhaust valve.</p> <p>Battery charging insufficient. Cable terminal contact failure Starter switch faulty. Battery power lacking due to other use.</p> <p>Internal parts seized; broken.</p>	<p>Resupply fuel; bleed air. Use recommended fuel. Ask for repairs. Ask for repairs.</p> <p>Check fluid level; re-charge; replace. Remove rust from terminal; retighten. Ask for repairs.</p> <p>Consult your dealer.</p> <p>Ask for repairs.</p>	<p>3.2.2 3.1.1</p> <p>5.2.2(4)</p>
<p>●Poor Exhaust Color</p> <p>○Black smoke</p> <p>○White smoke</p>	<p>Load increased</p> <p>Turbocharger blower contaminated. Fuel improper. Faulty spraying by F.O. injection valve Int./exh. valve head clearance excessive</p> <p>Improper fuel Faulty spraying by F.O. injection valve F.O. injection timing lags Lube oil burns; excessive consumption</p>	<p>Inspect propeller system</p> <p>Clean blower. Use recommended fuel</p> <p>Ask for repairs.</p> <p>Use recommended fuel</p> <p>Ask for repairs. Ask for repairs.</p> <p>Ask for repairs.</p>	<p>3.1.1</p> <p>3.1.1</p>

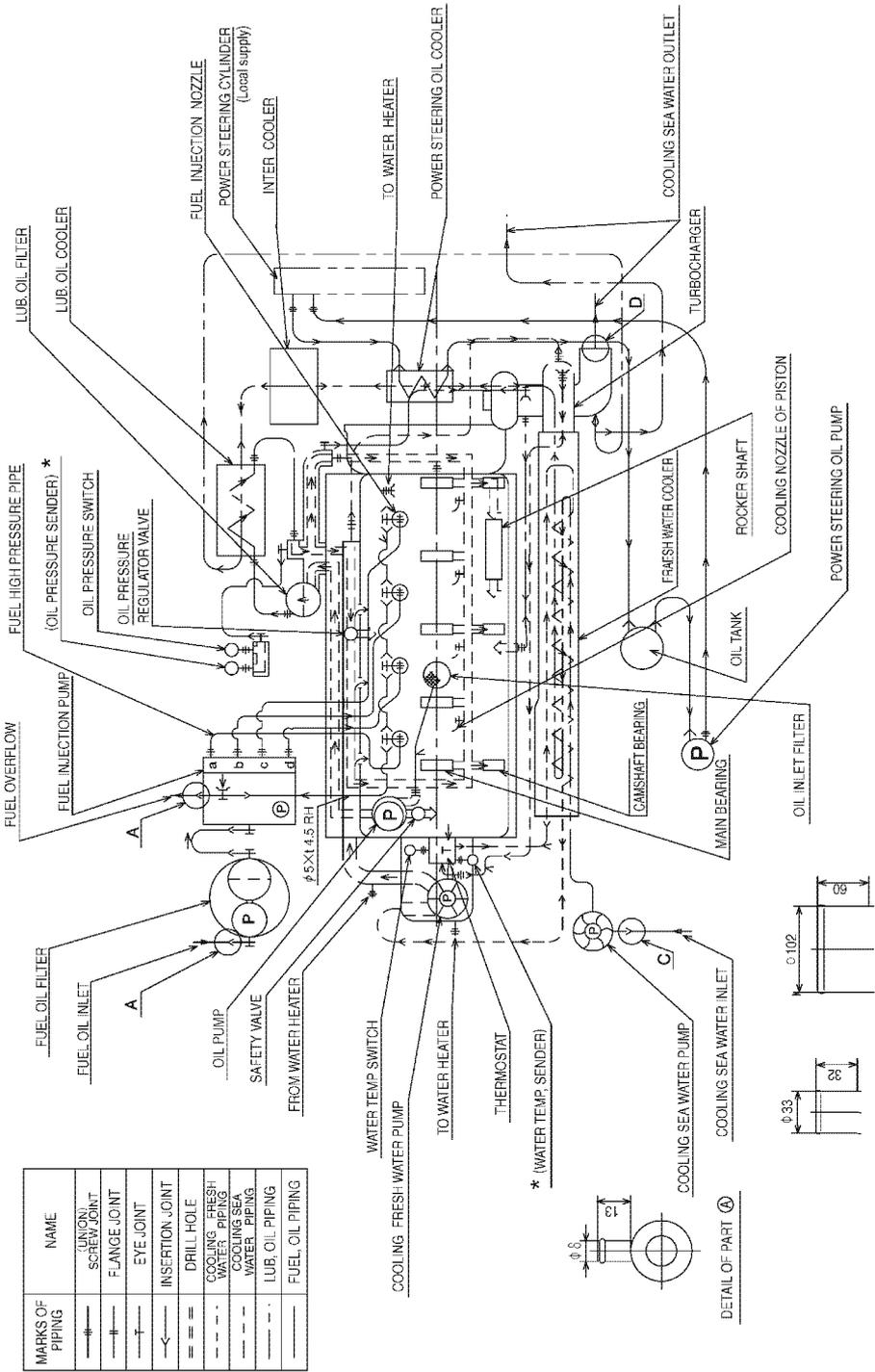
7. SYSTEM DIAGRAMS

7.1 Piping diagram

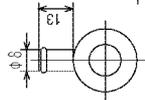
● 4LHA-HTP



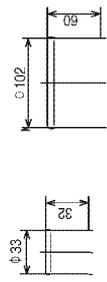
● 4LHA-HTZP



MARKS OF PIPING	NAME
—●—	UNION SCREW JOINT
— —	FLANGE JOINT
—<—	EYE JOINT
—=—	INSERTION JOINT
—•—	DRILL HOLE
—- - -	COOLING FRESH WATER PIPING
—- - -	COOLING SEA WATER PIPING
— · · ·	LUB. OIL PIPING
— — —	FUEL OIL PIPING



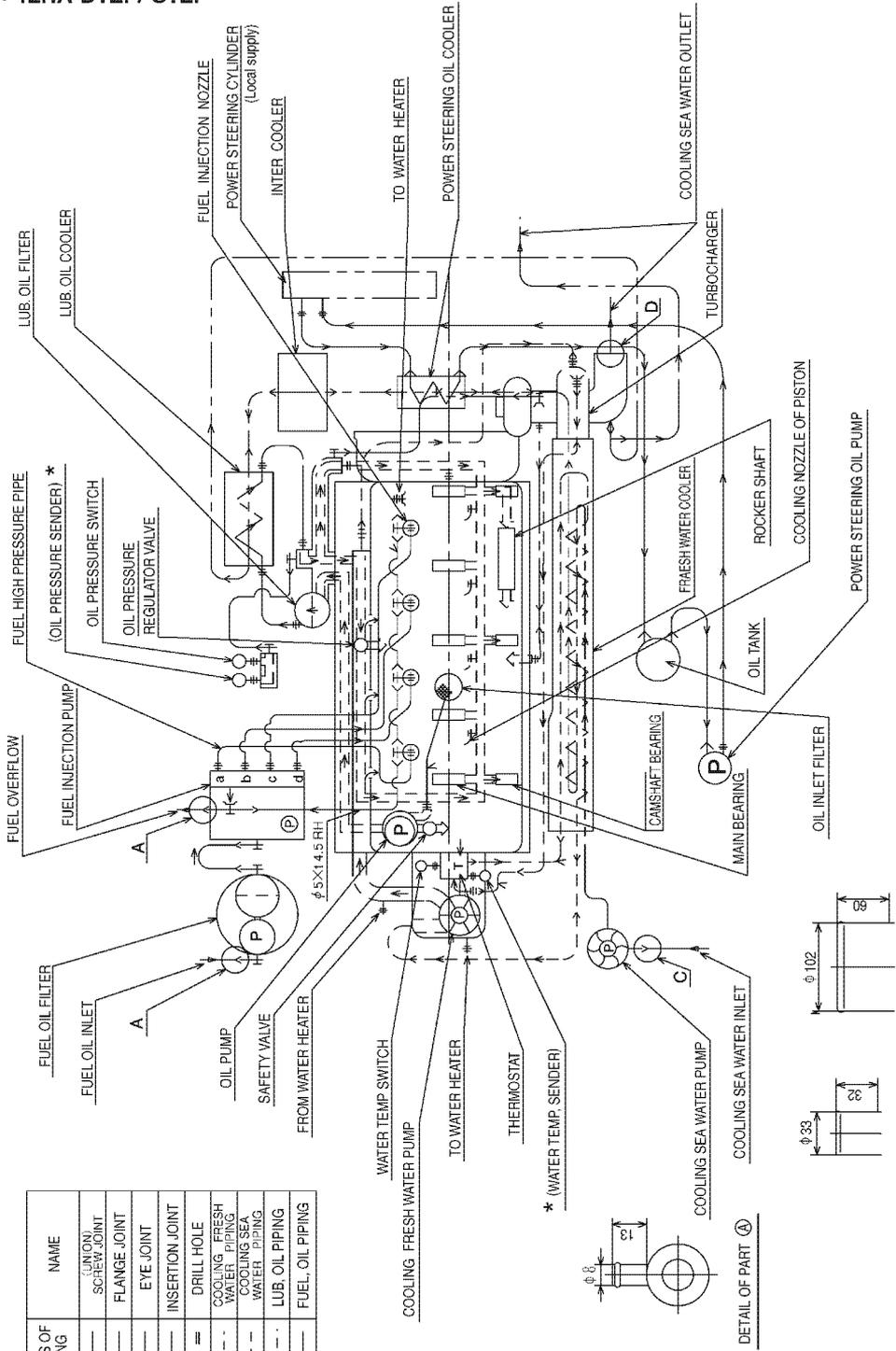
DETAIL OF PART ④



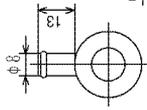
DETAIL OF PART ⑤

* : Optional

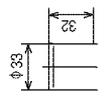
● 4LHA-DTZP/-STZP



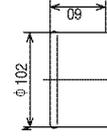
MARKS OF PIPING	NAME
—●—	(UNION) SCREW JOINT
— —	FLANGE JOINT
—T—	EYE JOINT
—<—	INSERTION JOINT
—=—	DRILL HOLE
—- - -	COOLING FRESH WATER PIPING
—- - -	COOLING SEA WATER PIPING
— · —	LUB. OIL PIPING
— · —	FUEL OIL PIPING



DETAIL OF PART (A)



DETAIL OF PART (B)

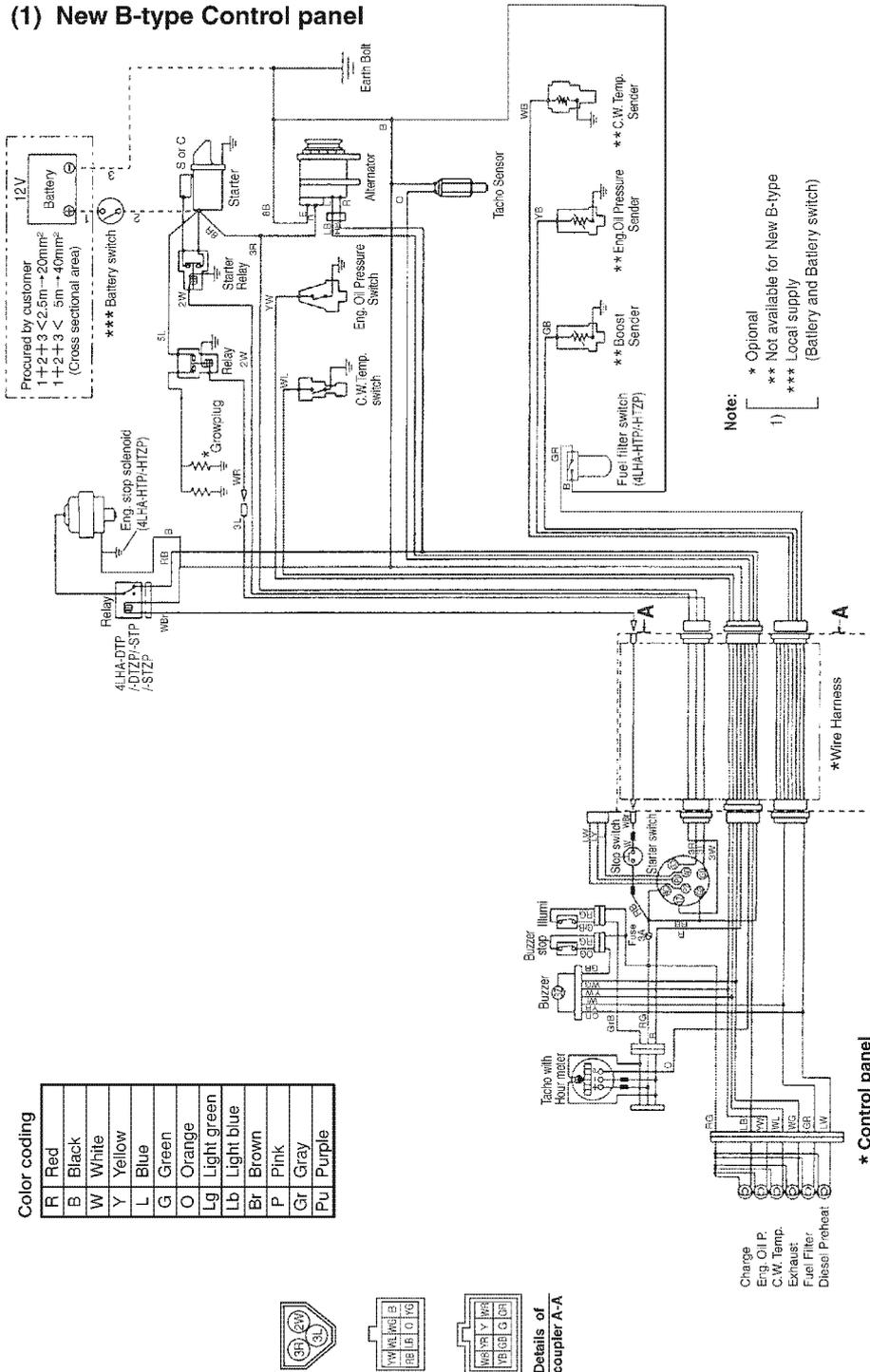


DETAIL OF PART (C)

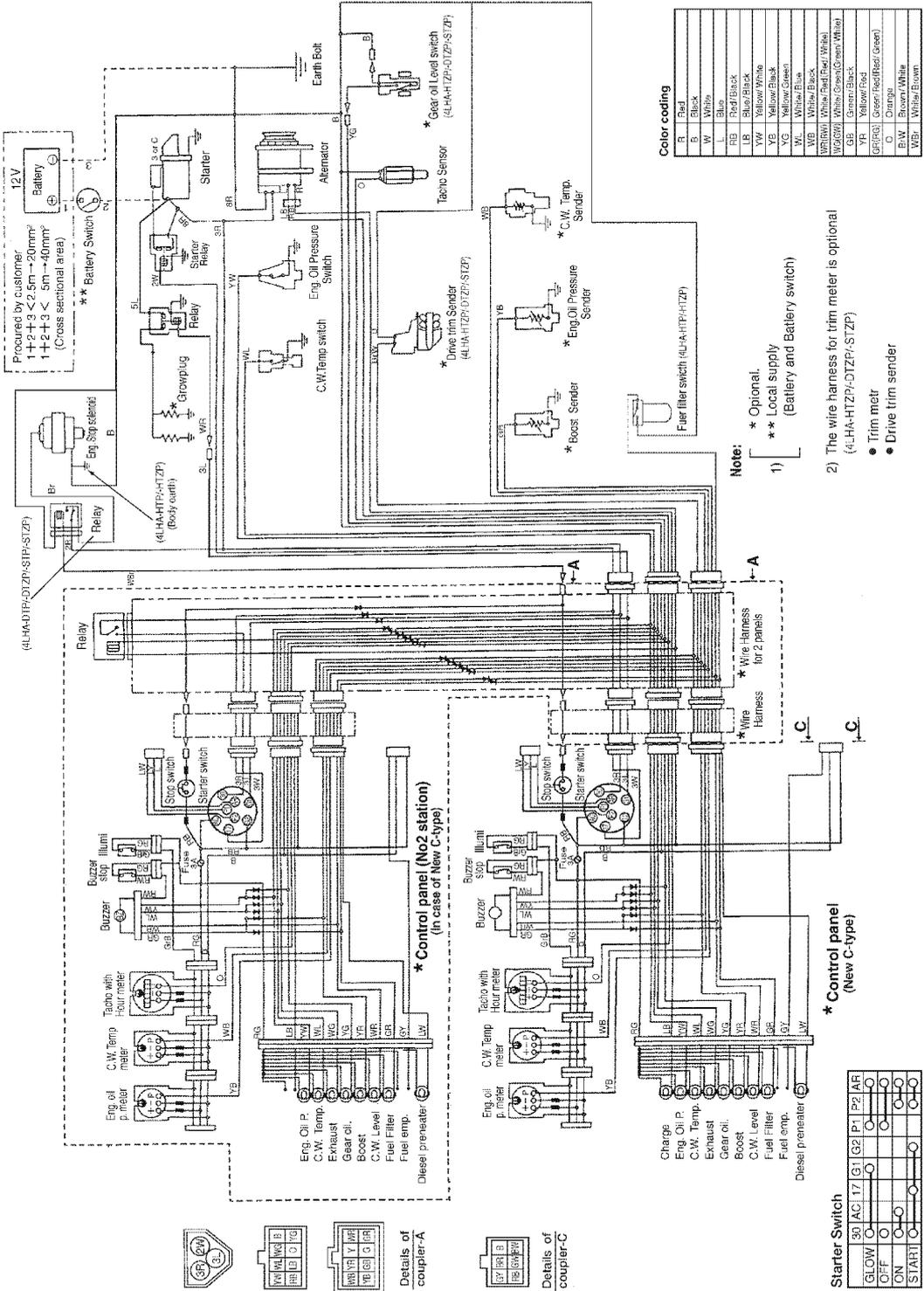
* : Optional

7.2 Wiring diagram

(1) New B-type Control panel



(2) New C-type Control panel



WARRANTY SERVICE

Owner Satisfaction

Your satisfaction and good will are important to your dealer and to us.

Normally, any problems concerning the product will be handled by our dealer's service department. If you have a warranty problem that has not been handled to your satisfaction, we suggest you take the following action:

- Discuss your problem with a member of dealership management. Often complaints can be quickly resolved at that level. If the problem has already been reviewed with the Service Manager, contact the owner of the dealership or the General Manager.
- If your problem still has not been resolved to your satisfaction, contact your Yanmar local Subsidiary Company.

We will need the following information in order to assist you:

- Your name, address and telephone number
- Product model and serial number (see the name plate affixed on the engine)
- Date of purchase
- Dealer name and address
- Nature of problem

After reviewing all the facts involved, you will be advised of what action can be taken. Please bear in mind that your problem will likely be resolved at the dealership, using the dealer's facilities, equipment and personnel, so it is very important that your initial contact will be with the dealer.

User's record

Date of purchase
Place of purchase (Name of dealer)

YANMAR CO., LTD.

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As of May 1st, 2016

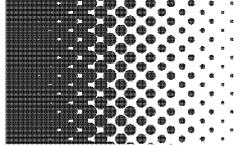
OPERATION MANUAL

4LHA-HTP, 4LHA-DTP, 4LHA-STP,
4LHA-HTZP, 4LHA-DTZP, 4LHA-STZP

1st edition: July 2004
3rd edition: June 2009
4th edition: April 2010
5th edition: January 2012
5th edition 1st rev.: January 2017

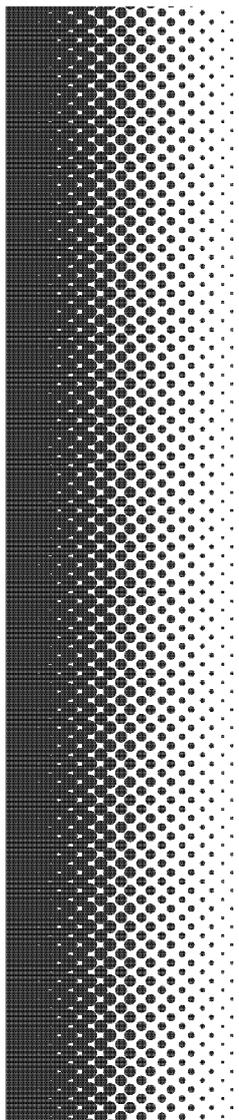
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