YANMAR

OPERATION MANUAL

MARINE DIESEL ENGINE

6LYA-STP
6LY2A-STP

en English

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	6LYA-STP, 6LY2A-STP
	Code	49961-205581

[INTRODUCTION]

- This Operation Manual describes the operation, maintenance and inspection of the **6LYA-STP, 6LY2A-STP** 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 transfered to subsequent owners. This manual should be considered a permanent part of the engin 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 other than model KMH6A/KMH6A1, refer to the Marine Gear Operation Manual.

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page No.

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

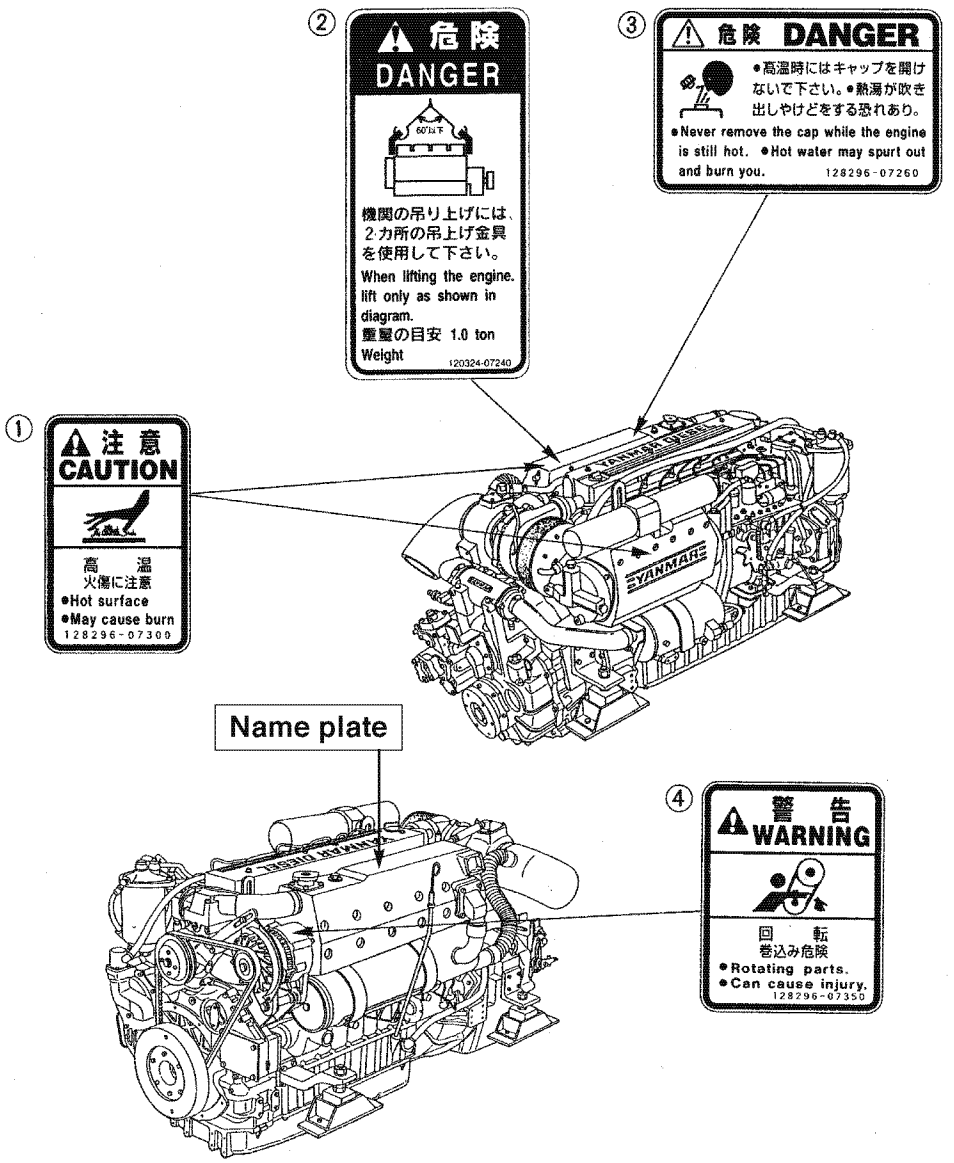
- Put oil or liquids to be disposed in a container. Never dispose of waste oil or other fluids outside, in a sewer, river, or the sea.
- Treat waste materials safely observing all regulations and laws. Ask a waste recovery company to collect and dispose of it.

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. 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 for the parts.

Warning Device Labels, Parts Numbers

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



2. Explanation of Product

2.1 Use, Driving System, etc.

In the case of engine with marine gear, connect the propeller shaft to the marine gear output shaft.

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

Engine model			6LYA-STP	6LY2A-STP
Type			Vertical water cooled 4-cycle diesel engine	
No. of clinders			6	
Bore × Stroke		mm	100×110	105.9×110
Displacement		ℓ	5.184	5.813
Fuel stop power at crankshaft		kw(hp)/rpm	*272 (370) / 3300 **264 (359) / 3300	*324 (440) / 3300 **315 (427) / 3300
Cont. power at crankshaft.		kw(hp)/rpm	213 (290) / 3100	257 (350) / 3100
High idling		rpm	3720±25	3670±25
Low idling		rpm	700±25	
Combustion system			Direct injection	
Starting system			Electric starting	
Cooling system			Fresh water cooling	
Lubrication system			Forced lubrication system with gear pump	
Direction of rotation (crankshaft)			Counter clockwise (viewed from flywheel side)	
Lube oil capacity	All	ℓ	20	
	Oil pan	ℓ	18(including oil filter capacity)(oil pan 16.4)	
Cooling water capacity		ℓ	Engine:20, Subtank :1.5	
Turbochager	Model		RHC7W (IHI made)	
	Type		Water cooled turbine housing	
Dry mass(gear less)		kg	530	535
Recommended battery capacity			12V×120Ah	
Recommended type of remote control handle			Single lever type	
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℃ = 0.860, Fuel oil temperature *: 25℃ at the fuel injection pump inlet
**: ISO 8665 (Fuel oil temp. 40℃ at the fuel injection pump inlet)

● Marine gear (Option)

• For 6LYA-STP

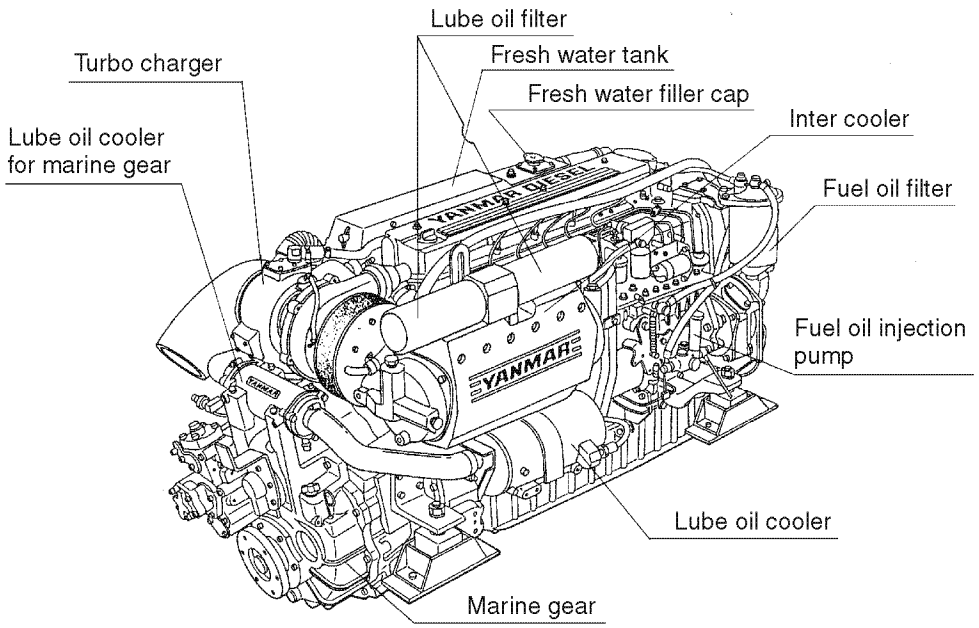
Model		KMH6A			HSW800A2					MG5050A				
Type		10°Angle			8°Angle					10°Angle				
		wet and multi-disc												
Reduction ratio		1.58	1.92	2.26	1.2	1.4	1.6	2.0	2.5	1.12	1.5	1.8	2.04	2.5
Lube oil capacity	Full ℓ	4.0			Refer to the maker's manual									
	Effective ℓ	0.3												

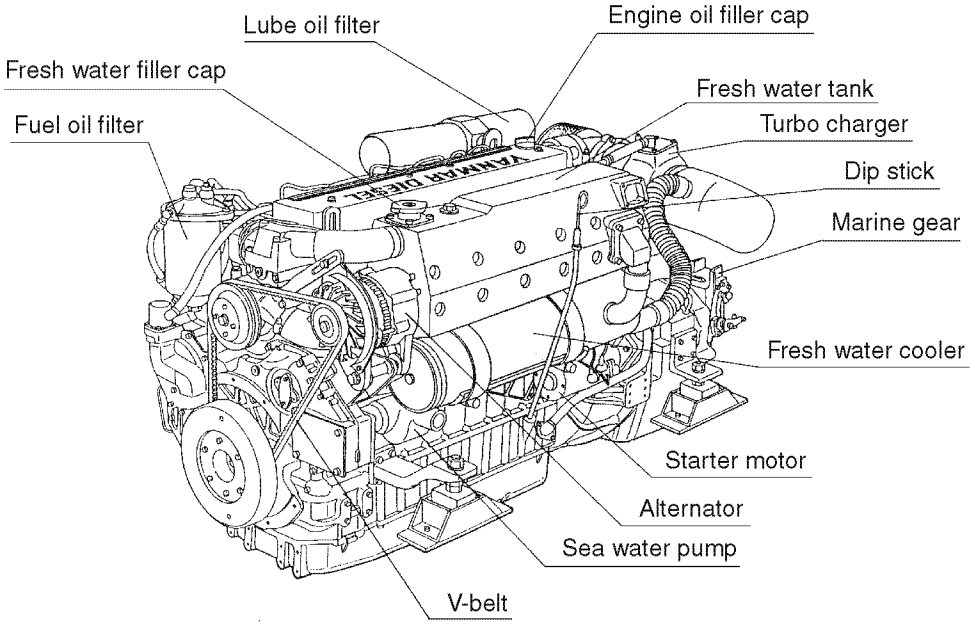
• For 6LY2A-STP

Model		KMH6A1			MG5061A				
Type		10° Angle			7° Angle				
		wet and multi-disc							
Reduction ratio		1.58	1.92	2.26	1.13	1.54	1.75	2.00	2.47
Lube oil capacity	Full ℓ	4.0			Refer to the maker's manual				
	Effective ℓ	0.3							

(Note)
Reduction ratio:
Both ahead and astern

2.3 NAMES OF PARTS





〈Note〉 This illustration shows Yanmar marine gear (Model : KMH6A) when it has been attached.

2.4 Major Servicing Parts

Name of Part	Function
●Fuel filter	Removes dust and water from fuel. Drain the filter periodically, (there is a drain plug at the bottom). The internal element (filter) should be changed periodically.
●Fuel feed pump	Feeds fuel to the fuel injection pump. Equipped with mechanical pump attached with the fuel injection pomp.
●Engine oil filler cap	Filler port for engine lube oil.
●Lube oil filters (Full-flow & by-pass)	Filters fine metal fragments and carbon from the lube oil. The oil through the full flow filter is sent to the engine's moving parts and another ones through the by-pass filter returns to oil pan.
[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 throgh 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 then the pressure rises inside the fresh water tank, the pressure regulating valve releases vapor and hot water overflow to the sub tank. The hose is connected betweev 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 is 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 pressurizes 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	Starter powered by the battery.
●Alternator	Rotates by belt drive, 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.

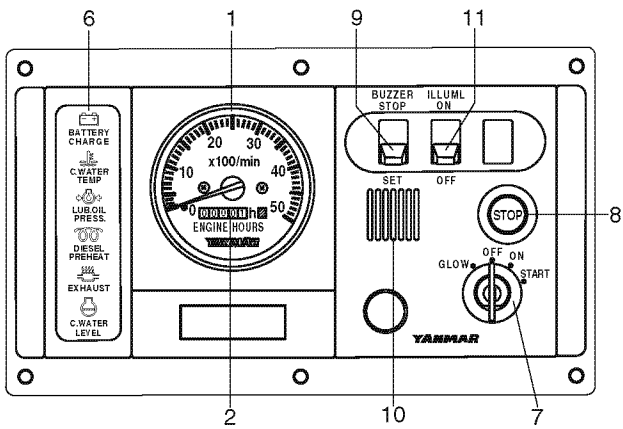
2.5.1 Control Panel (Optional)

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

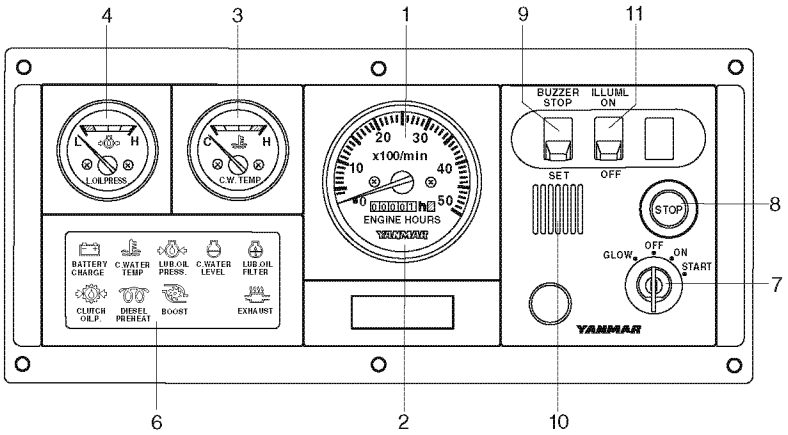
No.	Model		New B-type	New C-type	New D-type
7	Switch unit	Key switch (Starter switch)	●	●	●
8		Engine stop switch	●	●	●
10		Alarm buzzer	●	●	●
9		Alarm buzzer stop switch	●	●	●
11		Illumination switch for meters	●	●	●
6	Alarm lamp unit	Battery not charging	●	●	●
		C.W. high temperature	●	●	●
		L.O. low pressure (engine)	●	●	●
		C.W level	●	●	●
		Exhaust	●	●	●
		Boost	—	●	●
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	● (optional)	● (optional)	●

● Avalable, — Not avalable

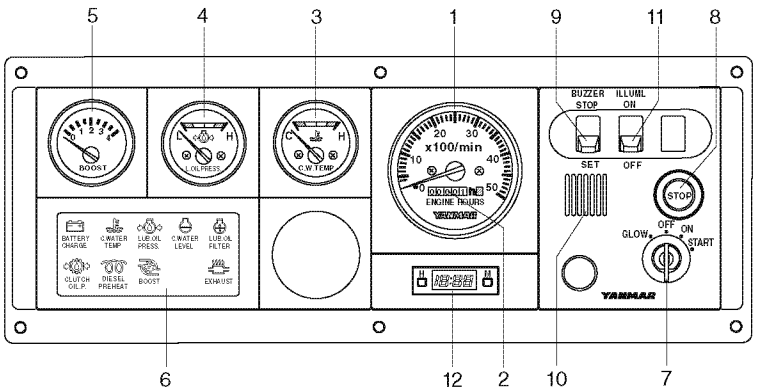
● New B-type



● New C-type



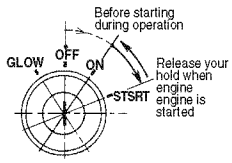
● New D-type



● Available switches (for alarm) and senders (for meter) (attached with engine)

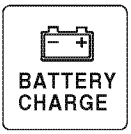
			6LYA-STP	6LY2A-STP
Switches	Battery not charge		○	○
	C.W.high temperature		○	○
	L.O low pressure		○	○
	C.W.level		×	△
	Exhaust (C.S.W flow)		×	△
	Boost		×	△
Senders	Tachometer		○	○
	C.W. temperature		△	△
	L.O.pressure		△	△
	Boost		△	△
	C.W.temp.	For two stations	△	△
	L.O. press.	For two stations	△	△
○ : Standard △ : Optional × : Not available				

(1) Gauges and Equipment

Gauges & Equipment	Functions
Starter switch 	OFF: The switch key can be inserted or removed. All power is turned off. ON: For engine operation. Gauges and alarm devices are turned on. START: For engine starting. When the key is released after starting, it moves automatically to ON. GLOW: For the air heater (optional)
	(Note) ●The engine cannot be stopped by the starter switch.
Engine stop switch	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.
Alarm buzzer	The buzzer sounds if an abnormality arises. See explanation under (2).
Warning lamps	The lamps come on when an abnormality arises. See explanation under (2).
Buzzer stop switch	The switch is used to stop the buzzer noise temporarily. Do not turn the buzzer off except when inspecting for an abnormality.
Illumination switch	Switch for lighting control panel.
Hour meter	Total operation hours are shown in the window below the tachometer. Refer to the figure as a standard for periodic inspections.
Lube.Oil. pressure meter	The needle shows engine oil pressure.
Cooling water temperature meter	The needle shows engine cooling fresh water temperature.
Boost meter	The needle shows intake air pressure (intake air boost pressure of turbocharger.)
Heat up indicating lamp for air heater 	The lamp comes on when the air heater is heated up to start the engine easily under low temperature condition. (Refer to 3.3.2(3)) (The lamp is located in warning lamp display column.)

(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 (switchs) 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 

Cooling Water Level Warning Lamp.

The lamp comes on when the cooling water (LLC) in the cooling water tank falls below the normal level.
Check the cooling water level in the cooling water tank.

⑤ 

Exhaust : Cooling seawater Discharg Warning Lamp.

The lamp comes on when the cooling seawater flow becomes too small.
Check for clogging in the seawater cooling system.

⑥ 

Boost Pressure Warning Lamp

The lamp comes on when the intake air boost pressure (intake air boost pressure of turbocharger) rises abnormaly.

(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, LUB. OIL PRESS. and EXHAUST lamps 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.

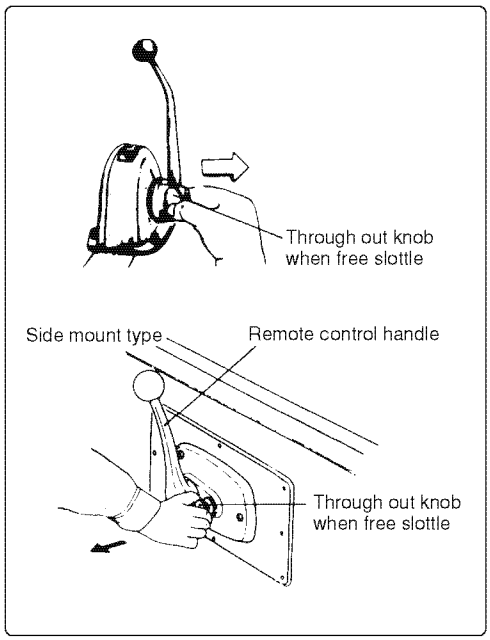
Function of Alarm Devices		
Key Operation	Before starting OFF →ON	After Starting START →ON
Alarm Buzzer	**On**	**Off**
Alarm Lamps		
Charge Lamp	**On**	**Off**
Cooling Water Temperature	**Off**	**Off**
Engine Oil Pressure	**On**	**Off**
Cooling Water Level	**Off**	**Off**
Exhaust	**On**	**Off**
Boost	**Off**	**Off**

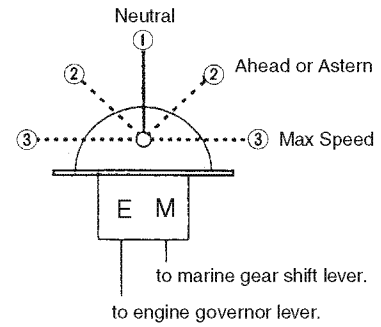
2.5.2 Remote Control Handle

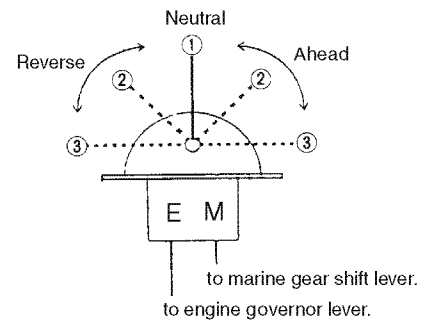
Use the remote control handle in the steering room for ahead, astern and speed control.

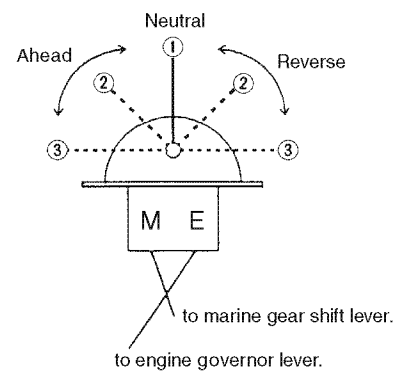
- Operation of Single Lever Remote Control Handle (Option)

① : The marine gear shift lever is in neutral.
② : The marine gear shift lever is in ahead or astern
③ : Engine's max. speed position.
②~③ : Acceleration position









3. 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

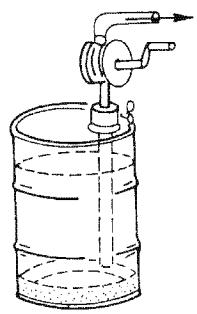
Use the following diesel fuels for best engine performance:
ISO8217 DMA, BS2869 A1 or A2

Fuels equivalent to Japanese Industrial Standard, JIS. No. K2204-2

Cetane fuel number should be 45 or greater

(2) Fuel Handling

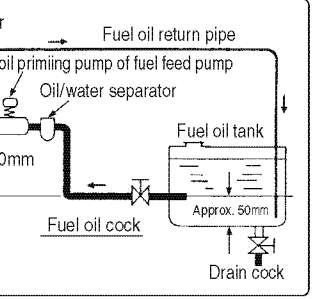
1) Water and dust in the fuel oil can cause operation failure.
   Use containers which are clean inside to store fuel oil. Store the containers away from rain water and dust.
2) Before supplying fuel, let the fuel container rest for several hours so that water and dust in the fuel are deposited on the 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.



Pump up only fuel above the down half, leaving dreg accumulated on the bottom.

(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 and a fuel filter in the middle of the fuel piping.



3.1.2 Lube oil

[NOTICE]

Use of lube oils not specified in this operation manual may cause the seizure or premature wear of internal parts and shorten the engine's life.

(1) Selection of Engine Lube Oil

Use the following lube oil:

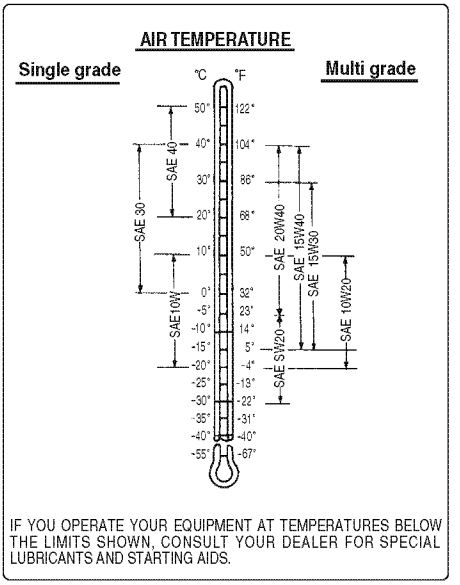
- API Classification.....CD, CF-4, CI-4
- SAE Viscosity 15W40

(2) Selection of Oil for marine gear.

- Yanmar KMH6A, KMH6A1···SAE Viscosity 30
  Follow the instructions for other types of Marine Gear.

(3) Handling the Lube Oil

1) When handling and storing lube oil, be careful not to allow dust and water to enter the lube oil. Clean around the filter port before refilling.
2) If lube oil of different brands are blended, the quality of lube oil may deteriorate. To prevent this, do not mix the lube oil.
3) Lube oil supplied to the engine will undergo natural degeneration with time even when the engine is not used.
   Lube oil should be replaced at the specified intervals regardless of whether the engine is being used or not.



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 coolans/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 Before Initial Operation

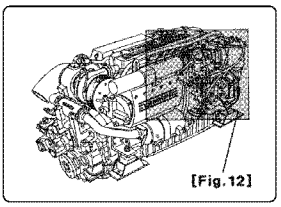
Prepare for initial operation according to the following procedures :

3.2.1 Supplying Fuel and Bleeding Air in the Fuel System.

⚠ DANGER

●Gasoline will catch fire! Check again before supplying that you are using the proper fuel.

●If any fuel is spilled, clean it off completely.

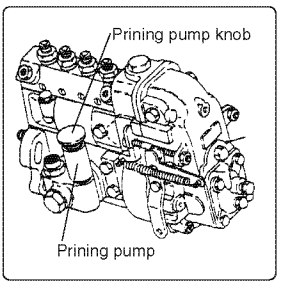


[Fig.12]

(1) Supplying Fuel

1) Before supplying fuel, flush the fuel tank and the fuel system parts with clean kerosene or diesel fuel.

2) Supply fuel with no dust and water to the fuel tank



(2) Bleeding Air in the Fuel System

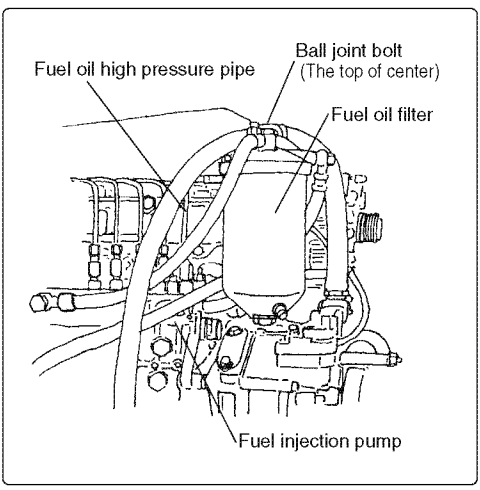
Bleed air in the fuel system according to the following procedurs. When there is air in the fuel system, the fuel injection pump will not able to do the function.

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 come 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 ball joint bolt on the top of center of the fuel filter. And relese fuel from there until fuel with no air bubbles come out, then tighten the ball joint bolt.

4) Push down the priming pump knob and turn it clockwise to fasten.

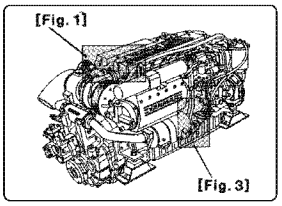


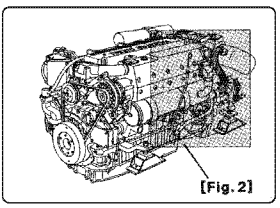
3.2.2 Supplying Engine Lube Oil

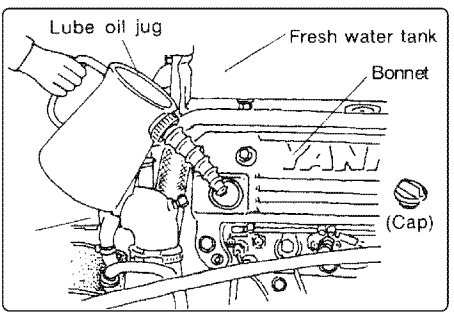
1) Remove the filler cap and supply the engine lube oil.
2) Supply lube oil up to the upper limit on the oil dipstick. To check the oil level, insert the dipstick in fully.
   Engine Lube Oil Capacity : All 20.0ℓ
   (oil pan full 16.4ℓ)
3) Fasten the filler cap fully.

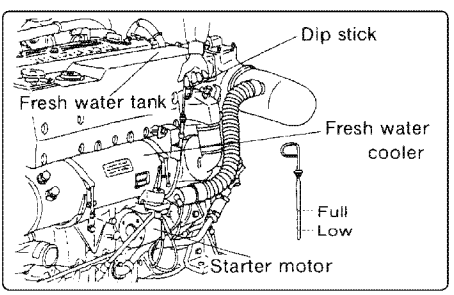
[NOTICE]

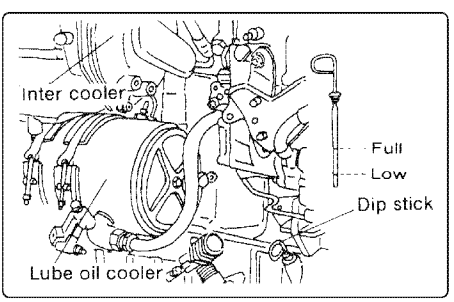
Never supply too much lube oil.
If overfilled, oil may come out from the breather and cause engine trouble.







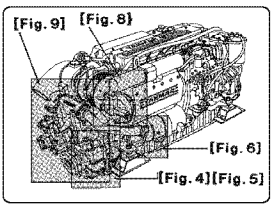


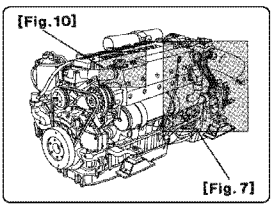


3.2.3 Supplying lube oil to marine gear

(for Yanmar model KMH6A, KMH6A1)

1) Remove the filler cap and supply the lube oil to the marine gear.
2) Supply lube oil up to the upper limit on the oil dipstick. To check the oil level, insert the dipstick in fully.
   Lube Oil Capacity : Full 4.0ℓ
3) Fasten the filter cap fully.





3.2.4 Supplying Cooling Water

Supply cooling water according to the following procedures. Be sure to add LLC to the fresh water.

1) Close the water drain cocks (Close both the fresh water line drain cocks and the sea water line drain cocks.)

Number of drain Cock

Fresh water line	Sea water line
2	4

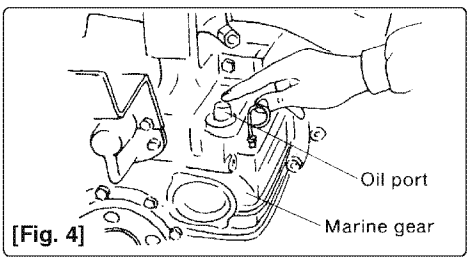
(Note) The water drain cocks are opened before shipping from the plant.

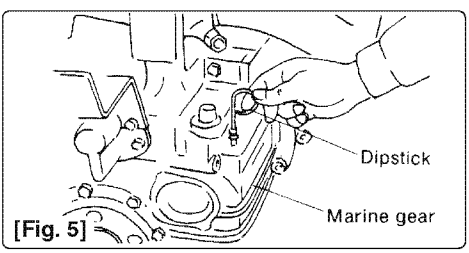
2) Remove the filler cap of the fresh water tank. (Turn the filler cap by 1/3 turn counterclockwise to remove.)

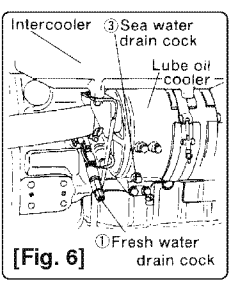
3) Supply cooling water slowly to the fresh water tank so that no air bubbles will develop. Supply until the water overflows from the filler port.

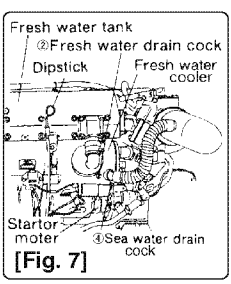
4) After supplying cooling water, fasten the filler cap firmly. If loose, trouble will occur due to water leakage.
   To fasten, align the notch at the rear of the cap with the slot of the filler port and turn the cap by 1/3 turn.

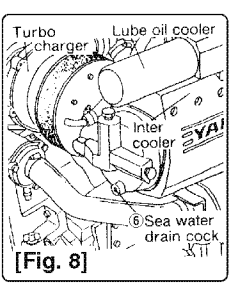
5) Remove the cap of the sub-tank, supply water to the full limit and fasten the cap.

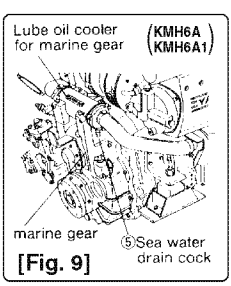




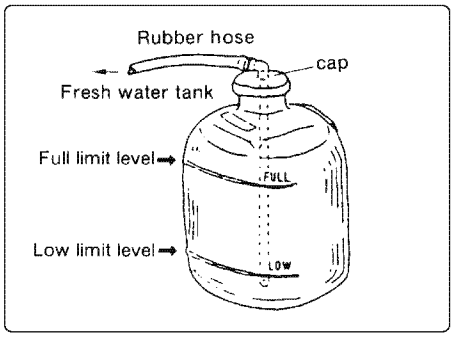


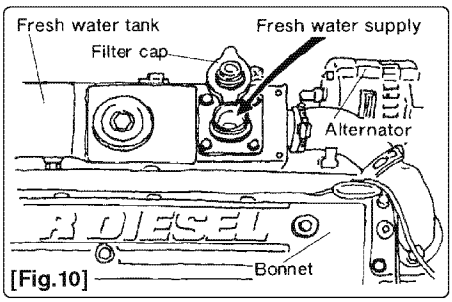






6) Check the rubber hose connecting the sub-tank with the fresh water tank. If the hose is not water-tight, a lot of coolling water will be consumed.





[Fig.10]

⚠ DANGER

If the filler cap is loose, hot steam and water will spout out and you may be burned.

3.2.5 Starting after storage or new engine

If the engine has not been operated for a long time, the lube oil in the clearance between moving parts will be lost. If operated in that condition, the engine could be damaged.
If starting the engine for the first time or after long storage, the engine should be turned over without firing to distribute lube oil according to the following procedure.

1) Open the kingston cock (kingston cock: optional)
2) Open the fuel tank valve
3) Shift the marine gear remote control handle to neutral
4) Turn the battery switch on (battery switch: local supply)
5) Hold the stop button on;
   Do not release the stop button while cranking. If released the engine will start.
6) Insert the key into the starter switch and turn the key to the ON position. The alarm buzzer should sound and the alarm lamps come on . This is normal.
   (See 2.5.1(3).)
   (Note) The C.WATER TEMP, C.WATER LEVEL and BOOST lamps will not come on.
7) Turn the key to the start position and hold for 5 seconds. The engine will not start. (cranking) This will distribute oil to the lubricated parts.
8) Release the stop button. Turn the key to start the engine. Release the key when the engine has started. The alarm buzzer should stop and the alarm lamps go out. Raise the engine speed gradually and check for abnormal sounds. Also check that sufficient cooling seawater is being discharged from the exhaust and that the color of the exhaust is normal. When you raise the engine speed, more cooling water should be discharged from the exhaust outlet.

3.2.6 Checking and Resupplying Lube Oil and Cooling Water

When engine lube oil, marine gear lube oil or fresh water is supplied for the first time or they have to be replaced, conduct trial operation of the engine for about 5 minutes and check the quantity of lube oil and fresh water. The trial engine operation will send the lube oil and cooling water to the parts, so the lube oil and fresh water levels will fall. check and resupply lube oil and fresh water as necessary.

1) Resupplying engine lube oil (See 3. 2. 2.)
2) Resupplying lube oil to marine gear (for Yanmar model : KMH6A, KMH6A1) (See 3. 2. 3.)
3) Resupplying fresh water (See 3. 2. 4.)

3.3 How to Operate

⚠ WARNING

●To prevent exhaust gas poisoning, ensure good ventilation during operation. Install ventilation windows, ports or ventilators in the engine room.

●Never touch or allow your clothes to touch the moving parts of the engine during operation. If the front pulleys, V-belt, propeller shaft, etc. catch your body or clothes, serious injury may result. Check that no tools, cloth, etc. are left on or around the engine.

⚠ CAUTION

●The engine is very hot during operation and immediately after stopping, especially the turbocharger, fresh water tank, exhaust pipe and high pressure fuel pipe. Avoid burns!
Never touch or allow your clothes to touch these parts.

3.3.1 Inspection before Starting

Before starting the engine, make it a daily check to conduct the following inspections:

(1) Visual Checks

Check for the following:

1) Lube Oil leakage from the engine
2) Fuel oil leakage from the fuel system
3) Water leakage from the cooling water system
4) Damage to parts
5) Loosening or loss of bolts

If any failure is found, never operate the engine before completing repairs.

(2) Checking and Resupplying Fuel

Check the fuel level inside the fuel tank and resupply with the recommended fuel if necessary. (See 3. 2. 1)

(3) Checking and Resupplying Engine Lube Oil

1) Check the engine lube oil level with the oil dipstick.
2) If lube oil level is low, resupply with the recommended lube oil to the filler port on the bonnet. Resuppiy lube oil up to the upper level mark on the lube oil dipstick. (See 3. 2. 2)

(4) Checking and Resupplying marine gear Lube Oil (for Yanmar model : KMH6A, KMH6A1)

1) Check the marine gear oil level with the oil dipstick.
2) If the lube oil level is low, resupply with the recommended lube oil using the filler port. Resupply up to the top mark on the oil dip stick. (See 3. 2. 3)

Refer to the attached operation manual for the marine gears other than model **KMH6A, KMH6A1.**

(5) Checking and Resupplying Cooling Fresh Water

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 reading will be misleading due to thermal expansion.

Only check and resupply fresh water routinely at the subtank. Do not remove the filler cap of the fresh water tank during operation.

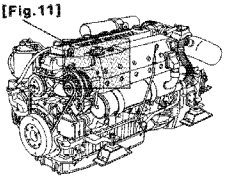
1) Check that cooling fresh water level is in betweer Full and Low mark on the side of the sub-tank.
2) If the water level is below to the Low level mark, open the sub-tank cap and supply fresh water.
3) When the water in the sub-tank runs out, open the filler cap of the fresh water tank and supply water until it overflows from the filler port. (See 3. 2. 4)

⚠ DANGER

Do not open the filler cap during operation or immediately after stopping the engine.

Hot steam and water will spout out. To remove the cap, wait until the engine has cooled down, wrap the cap with a cloth and loosen the cap slowly. After checking, fasten the filler cap firmly.

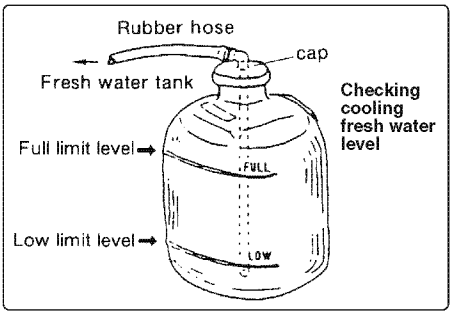
[Fig.11]



[NOTICE]

If the cooling fresh water runs out too often, or only the cooling fresh water in the fresh water tank falls without any change in the water level of the sub-tank, there may be some leakage of water or air.

In such cases, consult your Yanmar dealer or distributor without delay.



(Note) The water level rises in the sub-tank during engine operation. This is not an abnormality. After stopping the engine, the cooling water cools down and the extra water in the sub-tank returns to the fresh water tank.

(6) Checking the Remote Control Handle

Be sure to check that the remote control handle lever moves smoothly before use it. If it is hard to operate, lubricate the joints of the remote control cable and also the lever bearings.

(See 4. 3. 4 (3),(4).)

[NOTICE]

If the shift stroke of the remote control cable is inadequate at the marine gear end, it may be impossible to shift into either ahead or astern or clutch (marine gear) slippage may occur.

(7) Checking the Alarm Devices

When operating the starter switch, check that the alarm devices work normally.

(See 2. 5. 1 (3).)

(8) Preparing Fuel, Lube Oil and Cooling Fresh Water in Reserve

Prepare sufficient fuel for the day's operation. Always store lube oil and cooling fresh water in reserve (for at least one refill) onboard, to be ready for emergencies.

3.3.2 How to Start the Engine

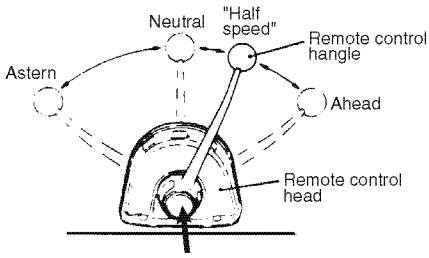
(1) Start the engine according to the following procedures:

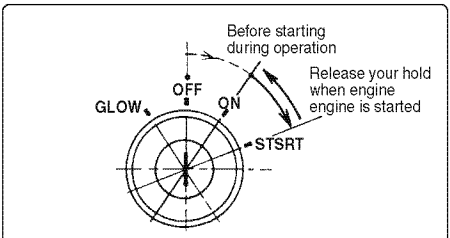
1) Open the Kingston cock (optional).
2) Open the fuel tank cock (local supply).
3) Pull the→knob of remote control handle and tilt the lever slightly to "Ahead" .
4) Turn the battery switch on.
5) Insert the key into the starter switch and turn the key to ON: when the alarm buzzer sounds and the alarm lamps come on the alarm devices are normal.

(See 2. 5. 1 (3).)

6) Turn the key to START to start the engine. Release the key when the engine has started. The key returns automatically to ON. The alarm buzzer should stop and the alarm lamps go out.

[Singlele lever remote contool handle]





(2) Re-starting after Starting Failure

Before turning the starter switch key again, be sure to confirm that the engine has stopped completely. If the engine is re-started while the engine still has not stopped, the pinion gear of the starter motor will be damaged.

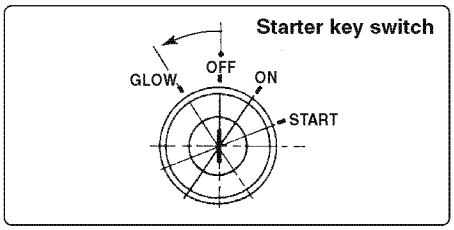
[NOTICE]

Do not hold the starter switch on for more than 15 seconds at a time. If the engine does not start first time, wait for about 15 seconds before trying again. After the engine has started, do not turn the key OFF position. (It should return to ON.)

Alarm device will not work when the key is OFF.

(3) Start up of the engine in cold weather

When starting the engine under low temperature conditions (approx.0℃ 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.

Note: When you choose the air heater (optional), we recommend you to choose the control panel (optional) having the air heater heated up indicating lamp. (New B,C,D panel). When the air heater is heated up, the lamp comes on to turn the key to START position.

[NOTICE]

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

(4) After the Engine has Started

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

1) Check that the gauges and alarm devices on the control panel are normal.
2) Check that no water or oil leak from the engine.
3) Check that exhaust color, engine vibrations and sound are normal.

[NOTICE]

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

4) When there are no problems, operate the engine at low speed with the boat still stopped (warming up operation for about 5 minutes) to send lube oil to all parts of the engine.
5) Check that sufficient sea water is discharged from the seawater outlet pipe.
   Operation with too little seawater discharge will damage the impeller of the seawater pump.
   If seawater discharge is too small, stop the engine immediately, identify the cause and repair:
   - Is the Kingston cock open ?
   - Is the inlet of the Kingston cock on the hull bottom clogged ?
   - Is the seawater suction hose broken, or does the hose suck in air due to a loose joint ?

3.3.3 Shifting

3.3.3.1 Single-lever type remote control handle (optional)

[NOTICE]

Do not accelerate or decelerate sharply, overload, etc. for the first 50 hours when using a new engine.

Return the control lever to neutral before performing the following operation.

(1) Ahead (Forward)

Gradually tilt the control handle to "Ahead". Tilting the handle gradually to accelerating side, the clutch is thrown in and the boat sails ahead.

(2) Astern (Reverse)

Gradually tilt the control handle to "Astern". Tilting the handle gradually to accelerating side, the clutch is thrown in and the boat sails astern.

(3) Neutral

Be sure to set the clutch marine gear handle at "Neutral".

[NOTICE]

Engine trouble can arise, if the engine is operated for a long time under overloaded conditions with the remote control handle in the full throttle position (max. engine speed position), exceeding the maximum engine speed.
Use the engine speed of about 100rpm below than at the full throttle position.

3.3.4 Checking during Operation

Always be on the look out for problems during engine operation.
Pay particular attention to the following.

(1) Is sufficient seawater 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

Repeat a cycle of high speed and low speed operation about 5 times at no load with the clutch (marine gear) in Neutral position.
Engine racing removes carbon deposits from the cylinder and the tip of the fuel injection valve.
If racing is neglected, the exhaust color may worsen and performance may drop.

3.3.5 Stopping the Engine

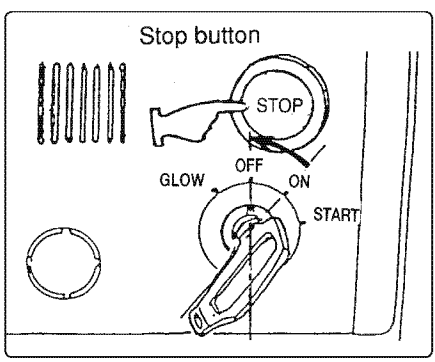
Stop the engine according to the following procedures:

1) Shift the remote control leve to low engine speed and handle to Neutral position to stop the boat.
2) Be sure to race the engine before stopping. (See 3.3.4-(7).)
3) Operate the engine at low speed (approx. 1000rpm) for about 5 minutes to decrease the engine temperature.

[NOTICE]

If engine is stopped quickly during high speed operation, the engine temperature will rise sharply, causing lube oil to degenerate and moving parts to stick.

4) Press the stop button until the engine stops completely. If you release the button early, the engine may continue running.
5) Turn the starter switch to OFF. Pull out the key and store it carefully
6) Turn the battery switch off.
7) Close the fuel tank cock.
8) Close the kingston cock.



[NOTICE]

Be sure to close the kingston cock, or water may enter and sink the boat.

3.4 Long Term Storage

(1) In cold temperatures or before long term (3 months or more) storage, be sure to drain the water from the seawater cooling system.

[NOTICE]

If water is left inside, it may freeze and damage parts of the cooling system (fresh water cooler, lube oil cooler, sea-water pump, etc.)

1) Loosen the 6 bolts fixing the side cover of the seawater pump, remove the cover and drain the water from inside.
2) After draining, put the pump's side cover back on.
3) Open the seawater drain cocks (3 positions as illustrated at right for engine side) and drain the seawater.
   [Fig.17] shows the position of the seawater drain cock for Yanmar model KMH6A, KMH6A1. For detailed information on models other than Yanmar models, refer to the Marine Gear Operation Manual.
4) Close the drain cocks after draining the sea-water

(2) Be sure to drain from the fresh water cooling system if LLC is not used.

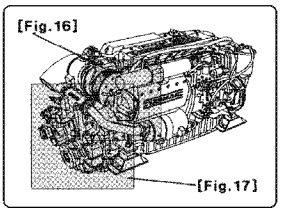
1) Open the fresh water drain cocks (2 postions) and drain the fresh water.
2) Close the drain cocks after draining the fresh water.

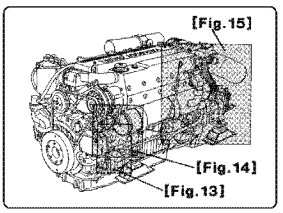
[NOTICE]

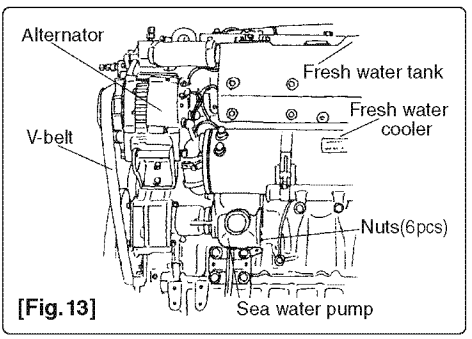
If the water is not drained, it may freeze and damage parts of the cooling water system (fresh water tank, fresh water cooler, cylinder block, cylinder head, etc.)

(3) Carry out the next periodic inspection before placing the engine in storage.
Remove dust and wipe off oily contamination from the outside of the engine.
Clean the engine.

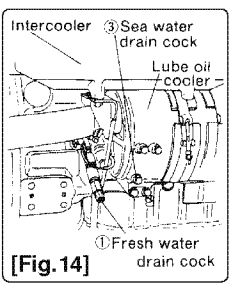
(4) To prevent condensation inside the fuel tank, either extract all fuel or fill the tank.



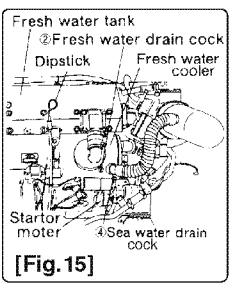




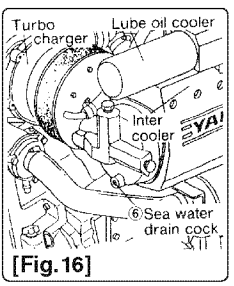
[Fig.13]



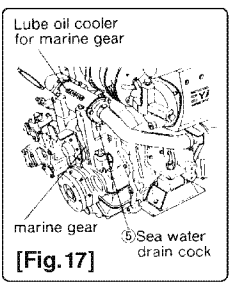
[Fig.14]



[Fig.15]



[Fig.16]



[Fig.17]

(5) Oil and grease the exposed area and joints of the remote control cable and the bearings of the remote control handle.

(6) Cover the turbocharger, exhaust pipe, etc. with vinyl sheets and seal them to prevent moisture from entering.

(7) Drain bilge in the hull bottom completely.
(If water leakage is found in the hull and water can enter, the boat must be hauled for repair.)

(8) Water-proof the engine room to prevent rain and seawater from entering.

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

(10) When using the engine after long storage, follow the procedures for starting a new engine.

4. Maintenance & Inspection

4.1 General Inspection Rules

Conduct Periodic Inspection for Your Safety:

The functions of engine components will degenerate and engine performance will fall if periodic inspections are not performed. If the countermeasures of the problems are not taken, you may encounter unexpected troubles while cruising at sea. If the periodic inspections are not performed, 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.

Periodic Inspections at Fixed Intervals:

Periodic inspections must be made after 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 equipment.

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.×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)

4.2 Periodic Inspection

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 should 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.

[NOTICE]

Schedule your own periodic inspection plan according to the operational conditions of your engine and inspect every item. Neglect of periodic inspection may lead to engine troubles and shorten the life of the engine. Inspection and servicing at 2000 hours of operation and thereafter require special knowledge and techniques.
Consult your dealer or distributor or the Yanmar subsidiary in your region.

Preiodical Inspection and Maintenance.

● : Consult nearest dealer
○ : Check ◎ : Replace

Item	Description	Schedule						
		Daily	Every 50 service hrs.	Every 250 service hrs. (or 1 yr.)	Every 500 service hrs. (or 2 yrs.)	Every 1000 service hrs. (or 4 yrs.)	Every 2000 service hrs.	Page
Fuel	Check of fuel level	○						20
	Draining of tank		○					37
	Drain of filter and water separator		○					37 39
	Replacement of filter element			◎				41
Engine lube oil	Check oil level in oil pan, add if necessary	○						21
	Replacement of filter element		◎ (1st time)	◎				36
	Cleaning of lube oil cooler						●	44
	Change of lube oil / Engine side		◎ (1st time)	◎				36
Cooling water (seawater side)	Check of cooling water discharge	○						29
	Check and replacement of impeller					○	●	43
	Cleaning of seawater system (including fresh water and lube oil cooler)					○	●	44
	Replacement of anti-corrosive zinc			◎				42
Cooling water (fresh water side)	Check and supply of fresh water level	○						26
	Replacement of fresh water			◎				43
	Cleaning of fresh water system (including heat exchanger tank)						●	44

Item	Description	Schedule						
		Daily	Every 50 service hrs.	Every 250 service hrs. (or 1 yr.)	Every 500 service hrs. (or 2 yrs.)	Every 1000 service hrs. (or 4 yrs.)	Every 2000 service hrs.	Page
Fuel injection pump and fuel injection valve	Adiustment of injection timing						●	45
	Overhaul and check of fuel feed pump						●	45
	Adiustment of injection pressure and atomizing condition			● (1st time)		●		44
Cylinder head	Adjustment of clearance intake and exhaust valve			● (1st time)		●		44
	Lapping the intake/exhaust valve						●	45
Check and adjustment of remote control cable		○		○				39 40
Electrical parts	Check of alarm devices	○						14
	Check of battery electolyte volume		○					38
	Adjustment of alternator(generator) drive belt tension				○			43
Turbo charger	Cleaning of blower			○				40
Marine gear(Yanmar marine gear)	Check and cleaning of lube oil cooler						●	44
	Check and cleaning of lube oil inlet filter net		○ (1st time)	○ (2nd time)		○		37
	Check of bearings, friction plate, and seal						●	44
	Check of lube oil level	○						27
	Replacement of lube oil		◎ (1st time)	◎ (2nd time)		◎		27
General	Chack for leakage of C.W., L.O., F,O. and exh. gas (inclusing mixing elbow)	○						28

4.3 Periodic Inspection Items

4.3.1 Inspection after Initial 50 Hrs. Operation

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

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, too, at this time.

Engine lube oil is convenient to drain before the engine has cooled down.

①Remove the lube oil dipstick and connect the hose of the drain oil pump (optional part) to the guide of the oil dipstick.

②Prepare a container to receive drain oil and pump out oil using the drain oil pump.

③Remove the lube oil filter with the filter wrench.
(Turn counterclockwise.)

④Clean the filter installation face.

⑤Screw the lube oil filter fully into the installation face by hand and further fasten the filter by about 3/4 turns with the filter wrench.
(Turn clockwise.)

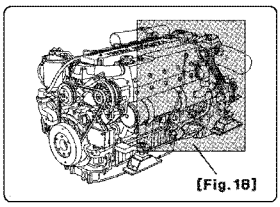
⑥Supply new lube oil to the specified level.
(See 3. 2. 2.)
Test operation the engine for 5 minutes.
Check that no oil leaks out during operation.

⑦Wait about 10 minutes after stopping the engine. Check the oil level with the oil dipstick and refill to the specified level.

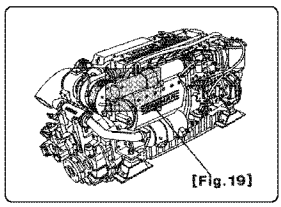
Lube oil filter Yanmar P/N	
Full flow	119593-35100
By-pass	119593-35400

⚠ CAUTION

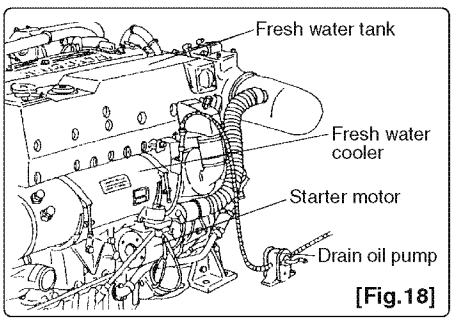
Beware of oil splashes if extracting the lube oil while it is hot.



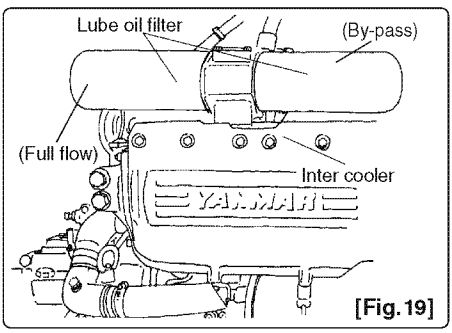
[Fig.18]



[Fig.19]



[Fig.18]



[Fig.19]

(2) **Replacing Marine gear Lube Oil and Cleaning the Filter (Ist time)**

During initial operation of the engine, the lube oil is contaminated quickly due to initial wear. The lube oil must be replaced early. Clean the clutch lube oil filter, too, at this time.

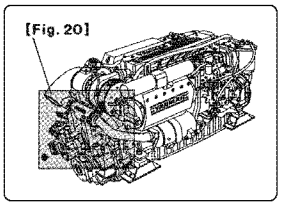
①Remove the filler port cover, insert the drain oil pump hose to the bottom of the marine gear and pump out the lube oil from inside the marine gear.

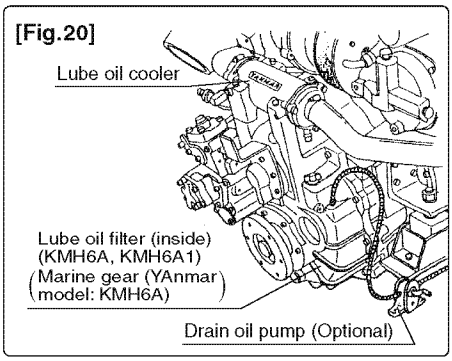
②Remove the filter in the side cover, extract the filter and clean the filter with kerosene.

③When installing the filter, attach the side cover by pressing it by coil spring.
Do not forget to place the O-ring inside the side cover.

④Supply new lube oil to the specified level.
(See 3. 2. 3.)

⑤Trially operate the engine and check that no oil leaks.





4.3.2 Inspection Every 50 Hours

(1) **Draining of the Fuel Tank (Hull) (local supply)**

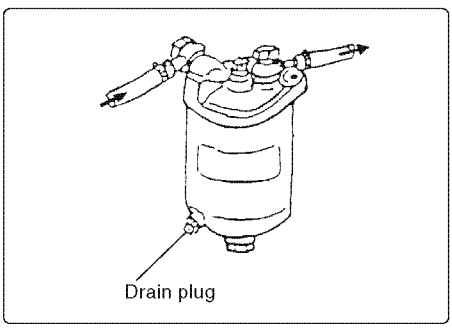
Open the drain cock of the fuel tank to extract drain (water, dust, etc.) from the tank's bottom. Receive the drain in a container. Drain until fuel with no water and dust flows out. Then close the drain cock.

(2) **Draining of the Oil / Water Separator (optional)**

①Close the fuel cock.

②Remove the drain plug at the bottom of the oil/water separator and drain water and dust from inside.

③After draining of the oil/water separator, be sure to vent air from the fuel system.
(See 3. 3. 2 (3))



(3) 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

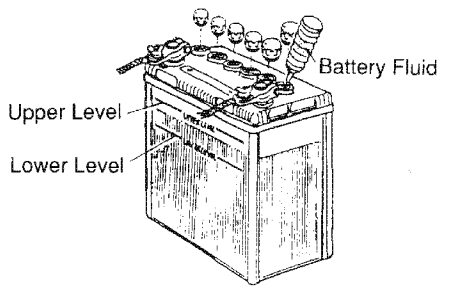
Be sure the area around the battery is well-ventilated and there is nothing which could start a fire. During operation and charging, hydrogen gas is emitted from the battery and can be easily ignited.

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 turns over at a slower than usual rate and refuses to start, recharge the battery.
- If the engine still will not start after charg ing,replace the battery.

Local supply



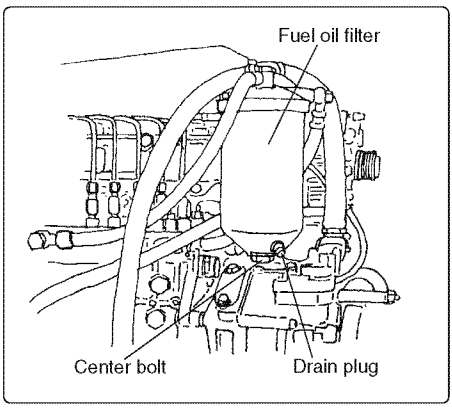
Follow the instructions and precautions in the manual from the battery maker.

[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.

(4) Draining the fuel oil filter

1) Remove the drain plug at the bottom of fuel oil filter and discharge water and dust collected in the fuel oil filter.
2) After draining bleed air from the fuel system.
(For further details, see Sec. 3. 2. 1 (2))



4.3.3 Inspection after First 250 Hrs.

(1) Inspection and Adjustment of Intake/Exhaust Valve Head 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 dear or distributor.

(2) 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.

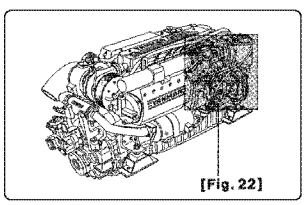
4.3.4 Inspection Every 250 Hrs.(or 1 yr.)

(1) Replacement of Marine gear Lube Oil and cleaning the Filter (2nd time)

Replace marine gear lube oil and clean filter for the second time.

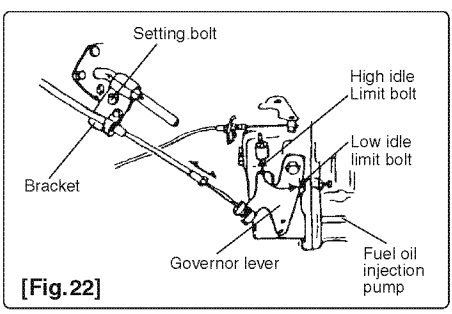
(2) Replacing the Engine Lube oil and Filter

Replace the engine lube oil every 250 hours. Replace the lube oil filter, too. (See 4.3.1(1).)


[Fig. 22]

(3) Adjusting the (Governor Lever) 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 (next page):



[Fig.22]

①Remove 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.

②Loosen 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.)

(4) Adjusting the Marine Gear Remote Control Cable

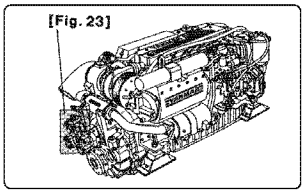
①Check to see that the clutch lever on the marine gear side is in the neutral position when the remote control handle is in **NEUTRAL.**

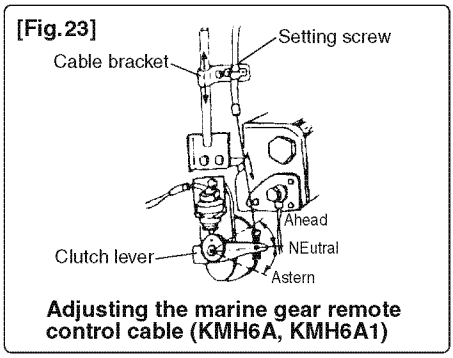
②If the position of the clutch lever is incorrect, loosen the setting screw of the cable bracket and adjust the position of the cable.

③Check the clutch lever in
▲FWD (Forward) (Ahead)
▼REV (Reverse) (Astern)
making sure it is correctly aligned.

④Make any necessary adjustments using **NEUTRAL** as the central point.

⑤Make sure the control cable is securely fastened to the clutch lever.
For other models, refer to the marine gear operation manual.





Adjusting the marine gear remote control cable (KMH6A, KMH6A1)

(5) Cleaning the Turbocharger Blower

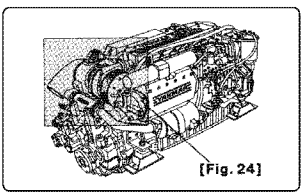
Contamination of the turbocharger blower causes blower speed to drop and engine output to down.

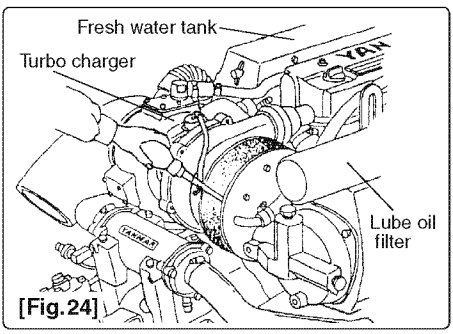
①Prepare blower cleaning agent, fresh water and a small pitcher.

②Remove the pre-cleaner (filter) of the turbocharger air inlet.

③Pour about 50cc of blower cleaning agent little by little at about 10 second intervals through the air inlet under no load operation (2500-~3000 rpm)

④Wait about 3 minutes, and pour 50cc fresh water into the air inlet in the same manner at about 10 second intervals.





⑤Run the engine at load for about 10 minutes to dry the turbocharger and check that engine output has recovered.
If the output has not recovered, repeat the above cleaning cycle 3 or 4 times.
If the output still has not recovered, consult your Yanmar dealer or distributor.

⑥Clean the pre-cleaner with detergent, dry it and install it to the blower air inlet.
Replace the pre-cleaner(filter), if broken.

Blower wash agent (4ℓ)	
Yammar P/N	974500-00400

[NOTICE]

Do not pour a large quantity of blower cleaning agent or fresh water in at once. The blower may be broken or water-hammer may occur.

(6) Replacing the Fuel Filter Element

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

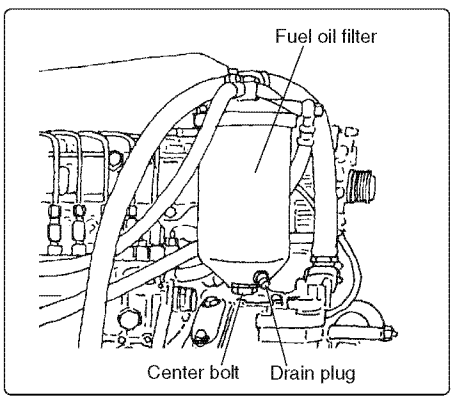
①Close the fuel cock of the fuel tank.

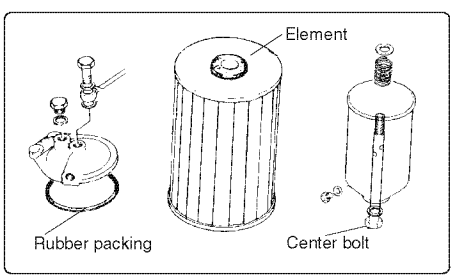
②Remove the drain plug and discharge the fuel oil in the fuel filter. (put a pan under the drain to catch the fuel)

③Loosen center bolt of the filter, remove the lower case, and replace the element.

④Bleed air the fuel system. (See 3.2.1(2))

Fuel filter element	
Yammar P/N	41650-550810



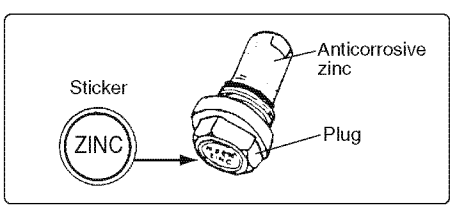


(7) Inspecting and Replacing Anticorrosive Zinc

The timing for replacing anticorrosive zinc varies depending on the characteristics of the seawater and operational conditions.

Inspect the zinc periodically and remove the corroded area on the surface.

Replace the anticorrosive zinc when it has decreased to less than 1/2 of the original volume. If replacement of zinc is neglected and operation is continued with a small volume of anticorrosive zinc, corrosion of the seawater cooling system will occur and water leakage or parts breakage will result.



The label shown in the figure is stuck on the plugs which have the anticorrosive zinc.

Be sure to close the kingston cock before removing the plug to replace the anticorrosive zinc.

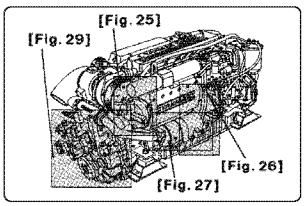
<Note>

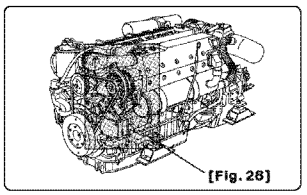
[Fig 29] shows the position of the Yanmar marine gear (Model KMH6A).

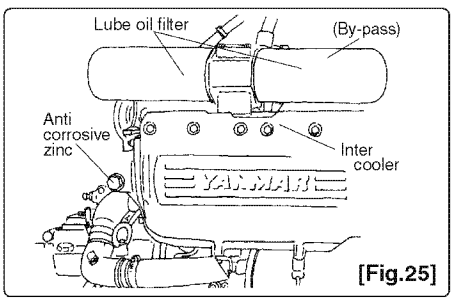
For detailed information on marine gears other than Yanmar ones, refer to the Marine Gear Operation Manual.

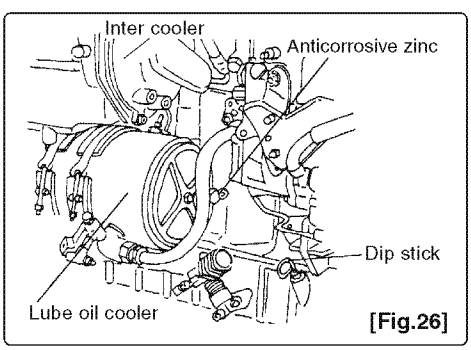
Attached zinc location	Yanmar P/N	Qnt'y
Inter-cooler	119574-18790	1
Marine gear lube oil cooler	27210-200370 (KMH6A only)	1
Engine lube oil cooler	119574-44150	2
Fresh water cooler	119574-44150	2

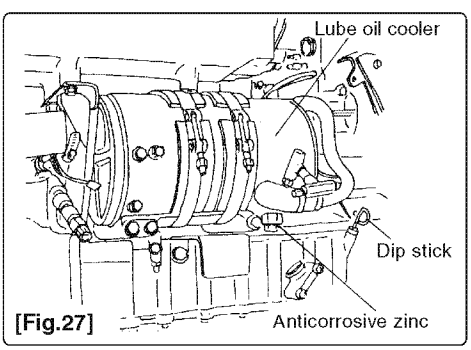
Marine gear KMH6A : has no zinc.

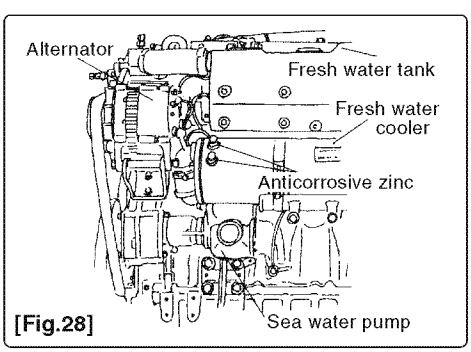


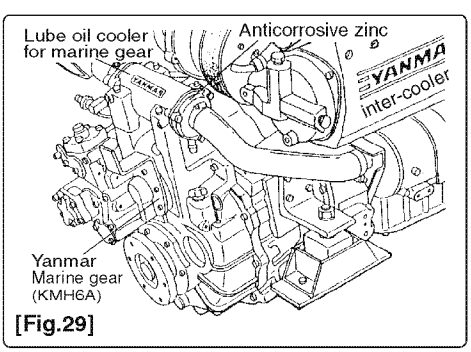












(8) Replacing Cooling Fresh Water

Cooling performance drops when 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.

To extract the cooling water, open the cooling water cocks (two positions) as shown in 3.4(2).

To resupply cooling water, refer to 3. 2. 4.

4.3.5 Inspection Every 500 Hrs.(or 2 yrs.)

(1) Inspection of Alternator V-Belt Tension

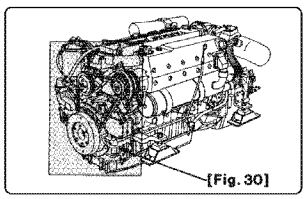
When the V-belt tension falls, the alternator will fail to generate power due to V-belt slippage, the cooling water pump will fail to supply cooling water and overheating of the engine will occur.

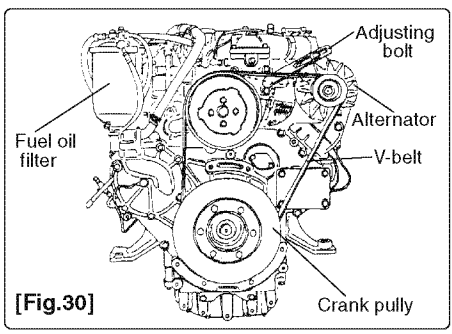
When the V-belt tension is too tight, the V-belt is liable to earlier damage and the bearings of the alternator and cooling water pump may be damaged.

① Check the tension of the V-belt by pressing the middle of the belt with your finger. With proper flexion, the V-belt should sink 8~10mm.

② Loosen the set bolt and move the alternator to adjust V-belt tension.

③ Be careful not to deposit oil on the V-belt. If stained with oil, it is liable to slip and to stretch. If damaged replace a V-belt.


[Fig. 30]



[Fig.30]

V-belt	
Yammar P/N	119593-42280

4.3.6 Inspection Every 1000 Hrs.(or 4 yrs.)

(1) Inspecting Inner Parts of the Seawater Pump

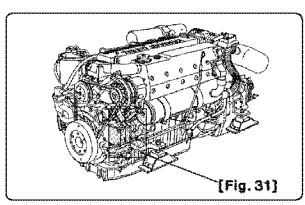
The discharge performance of the seawater pump falls depending on the use.

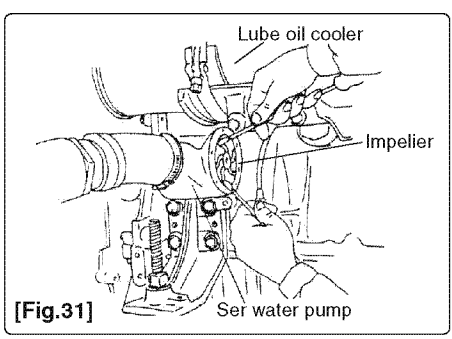
The seawater pump must be inspected periodically. If the discharge volume of cooling seawater has decreased: (When disassembly servicing of the seawater pump is necessary, consult yanmar dealer or distributor.)

①Loosen the side cover set bolts and remove the side cover. (6 mounting bolts)

②Illuminate the inside of the the seawater pump with a flashlight and inspect.

③When the following damage is found, disas-assembly and maintenance are necessary:


[Fig. 31]



[Fig.31]

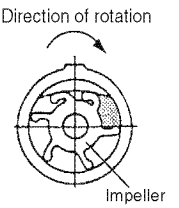
1) Cracks and loss of impeller ; flaws or excessive wear of impeller tips and side faces.
(Note) The impeller must be replaced periodically (every 2000 hours).
2) Damage to wear plate

④If 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 reinstalled in the counterclockwise direction. During reassembly, be sure to install the impeller blades correctly as shown in the illustration at right.
When turning the engine manually, never turn it in the reverse direction.
The impeller will be twisted and damaged.



(2) Inspection and Adjustment of Intake/Exhaust Valve Clearance

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

(3) Inspecting and Adjusting the Fuel Injection Valve

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

(4) Replace the marine gesr oil and clean filter.

4.3.7 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 lowers 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 coolers reduces cooling efficiency and accelerates lube oil coolers 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.

5. Troubleshooting

Trouble	Probable Cause	Measure	Reference
●Alarm buzzer sounds and alarm lamps go on during operation	**[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.**		
○Eng. L.O. Press. Warning Lamp goes on.	Engine L.O. insufficient; L.O. filter clogged.	L.O. level check, resupply, replace Replace L.O. filter Replace Eng. L.O.	3.2.2 4.3.1(1) 4.3.1(1)
○Marine gear lube oil pressure warning light goes on. (if having)	Insufficient marine gear lube oil	Check the oil level and supply.	3.2.3
○C.W. Temp.(Fresh Water) Warning Lamp goes on.	Fresh water cooler water level low. Cooling seawater discharge insufficient Contamination inside the cooling system.	Check C.W. level resupply System clogged; air has entered the system Ask for repairs.	3.2.4(1)
○Fuel Oil Warning Lamp goes on. (if having)	F.O. tank fuel level low.	Refill.	3.2.1
●Warning Devices are Faulty. When Switch is Turned ON:	**[NOTICE]** **Do not run the engine with alarm devices still unrepaired. Trouble will progress and a serious problems may result.**		
○Alarm buzzer does not sound ○Warning lamps do not go on -Eng. L.O. Press, Exhaut.	Circuit broken or buzzer defective.	Ask for repairs.	2.5
	(Note) Other warning lamps do not go on when the switch is turned on. They only go on when there is an abnormality.		
○Charge lamp does not go on.	Circuit broken or lamp burnt out.	Ask for repairs.	
When the Key Returned to ON from START after Engine Starting:			
○Buzzer keeps on sounding	Short-circuit (if lamp goes out)	Ask for repairs.	
○One of the warning lamps does not go out.	Sensor switches faulty	Ask for repairs.	

Trouble	Probable Cause	Measure	Reference
○Charge lamp does not go out during operation	V-belt broken or loose	Replace V-belt; adjust tension	4.3.5(1)
	Battery defective.	Check fluid level, specific gravity; replace.	4.3.2(3)
	Alternator power generation failure	Ask for repairs.	
●Starting Failures			
○Starter works but engine does not start	No fuel	Resupply fuel; bleed air.	3.2.1(1)
	Improper fuel	Use recommended fuel.	3.1.1
	Fuel injection faulty.	Ask for repairs.	
	Compression leaks from intake/exhaust valve.	Ask for repairs.	
○Starter does not work or works only slowly. (eng.can be turned manually)	Neutral safety switch engaged	Shift clutch to Neutral.	3.3.2(1)
	Battery charging insufficient.	Check fluid level; re-charge; replace.	4.3.2(3)
	Cable terminal contact failure	Remove rust from terminal; retighten.	
	Switch of safety device faulty.	Ask for repairs.	
	Starter switch faulty.	Ask for repairs.	
	Battery power lacking due to other use.	Consult your dealer.	
○Engine can't be turned manually	Internal parts seized; broken.	Ask for repairs.	
●Poor Exhaust Color			
○Black smoke	Load increased	Inspect propeller system	
	Turbocharger blower contaminated.	Clean blower.	
	Fuel improper.	Use recommended fuel	3.1.1
	Faulty spraying by F.O. injection valve		
	Int./exh. valve head clearance excessive	Ask for repairs.	
○White smoke	Improper fuel	Use recommended fuel	3.1.1
	Faulty spraying by F.O. injection valve	Ask for repairs.	
	F.O. injection timing lags	Ask for repairs.	
	Lube oil burns; excessive consumption	Ask for repairs.	

6. SYSTEM DIAGRAMS

6.1 Piping Diagram

(See Appendix A at the back of this Manual)

1 Fuel Oil Overflow
2 Fuel Oil Filter
3 Oil Pump
4 Fuel Feed Pump
5 Fuel Oil Inlet
6 From Fuel Oil Tank
7 Fuel Injection Pump
8 Oil Pressure Regulator Valve
9 Engine Lube Oil Cooler
10 Lube Oil Filter (Full)
11 Lube Oil Filter (By-pass)
12 Safety Valve
13 Hot Water Heater Return
14 Water Temperature Switch
15 Cooling Fresh Water pump
16 Hot Water Heater Return
17 Thermostat
18 Water Temperature Sender (Optional)
19 Cooling Seawater Pump
20 Cooling Seawater Inlet
21 Intercooler
22 To Room Heater by Hot Water
23 Marine Gear Lube Oil Cooler (KMH6A, KMH6A1)
24 Mixing Elbow (optional)
25 Cooling Seawater Outlet
26 Main Bearing
27 Camshaft Bearing
28 Oil Inlet Filter
29 Cooling Nozzle of Piston
30 Fresh Water Cooler
31 Exhaust Manifold
32 Rocker Shaft
33 Fuel Injection Nozzle

6.2 Wiring Diagram

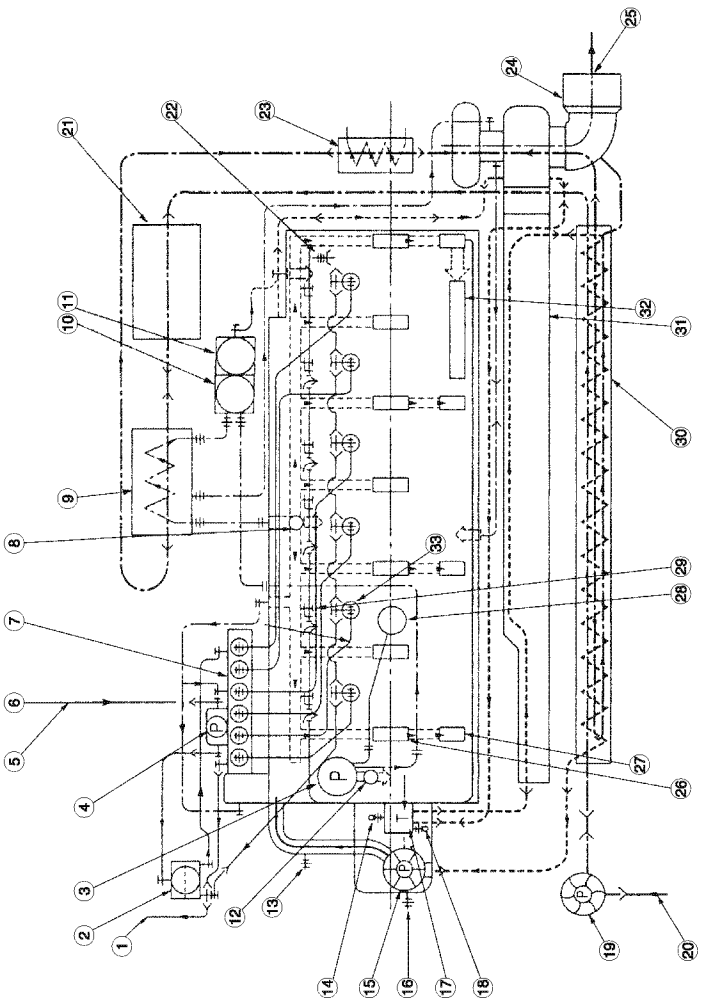
(See Appendix B at the back of this Manual)

Engine Harness

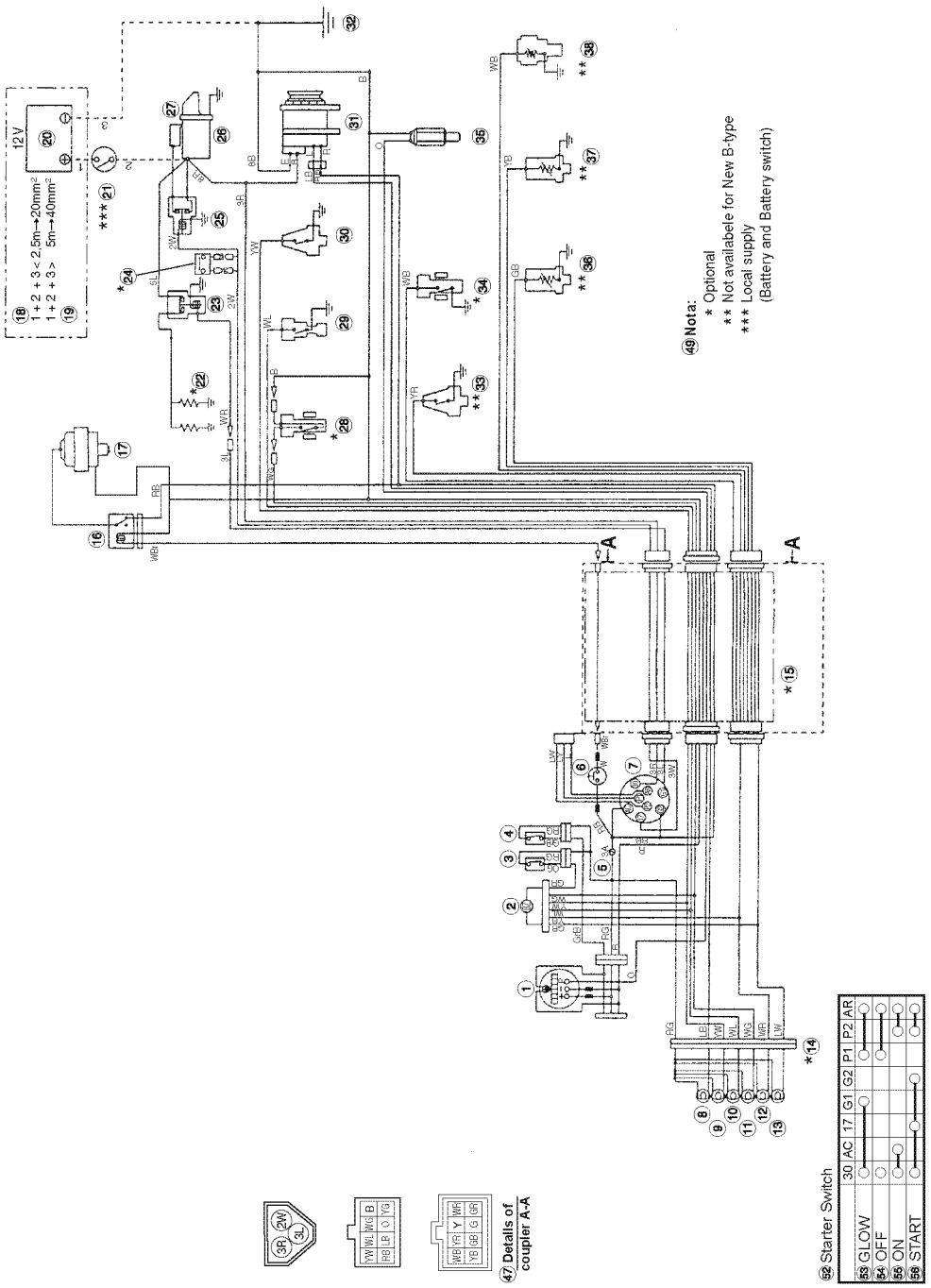
R	Red
B	Black
W	White
Y	Yellow
L	Blue
G	Green
O	Orange
Lg	Light green
Lb	Light blue
Br	Brown
P	Pink
Gr	Grey
Pu	Purple

1 Tacho with Hour Meter
2 Buzzer
3 Buzzer Stop
4 Illumination
5 Fuse
6 Stop Switch
7 Starter Switch
8 Charge
9 Engine Oil Pressure
10 Cooling Water Temperature
11 Exhaust
12 Cooling Water Level
13 Diesel Preheat
14 *Control Panel
15 *Wire Harness
16 Relay
17 Engine Stop Solenoid
18 Procured by Customer
19 (Cross sectional area)
20 Battery
21 ***Battery Switch
22 *Glowplug
23 Relay
24 *Neutral Switch
25 Starter Relay
26 Starter
27 S or C
28 Seawater Flow Switch
29 Cooling Water Temperature Switch
30 Engine Oil Pressure Switch
31 Alternator
32 Earth Bolt
33 **Boost Switch
34 Cooling Water Level Switch
35 Tacho Sensor
36 **Boost Sender
37 **Engine Oil Pressure Sender
38 **Cooling Water Temperature sender
39 Engine Oil Pressure Meter
40 Cooling Water Temperature Meter
41 Boost
42 Fuel Empty
43 Wire Harness for 2 Panels
44 Boost Meter
45 *Control Panel (No 2 station) Option (in case of New C-type)
46 *Control Panel (No 2 station) Option (in case of New B-type)
47 Details of coupler A-A
48 Details of coupler C-C
49 **Note:**
* Optional
** Not available for New B-type
*** Local supply (Battery and Battery Switch)
50 **Note:**
* Optional
** Not available for New C-type
*** Local supply (Battery and Battery Switch)
51 **Note:**
* Optional
*** Local supply (Battery and Battery Switch)
52 Starter Switch
53 GLOW
54 OFF
55 ON
56 START

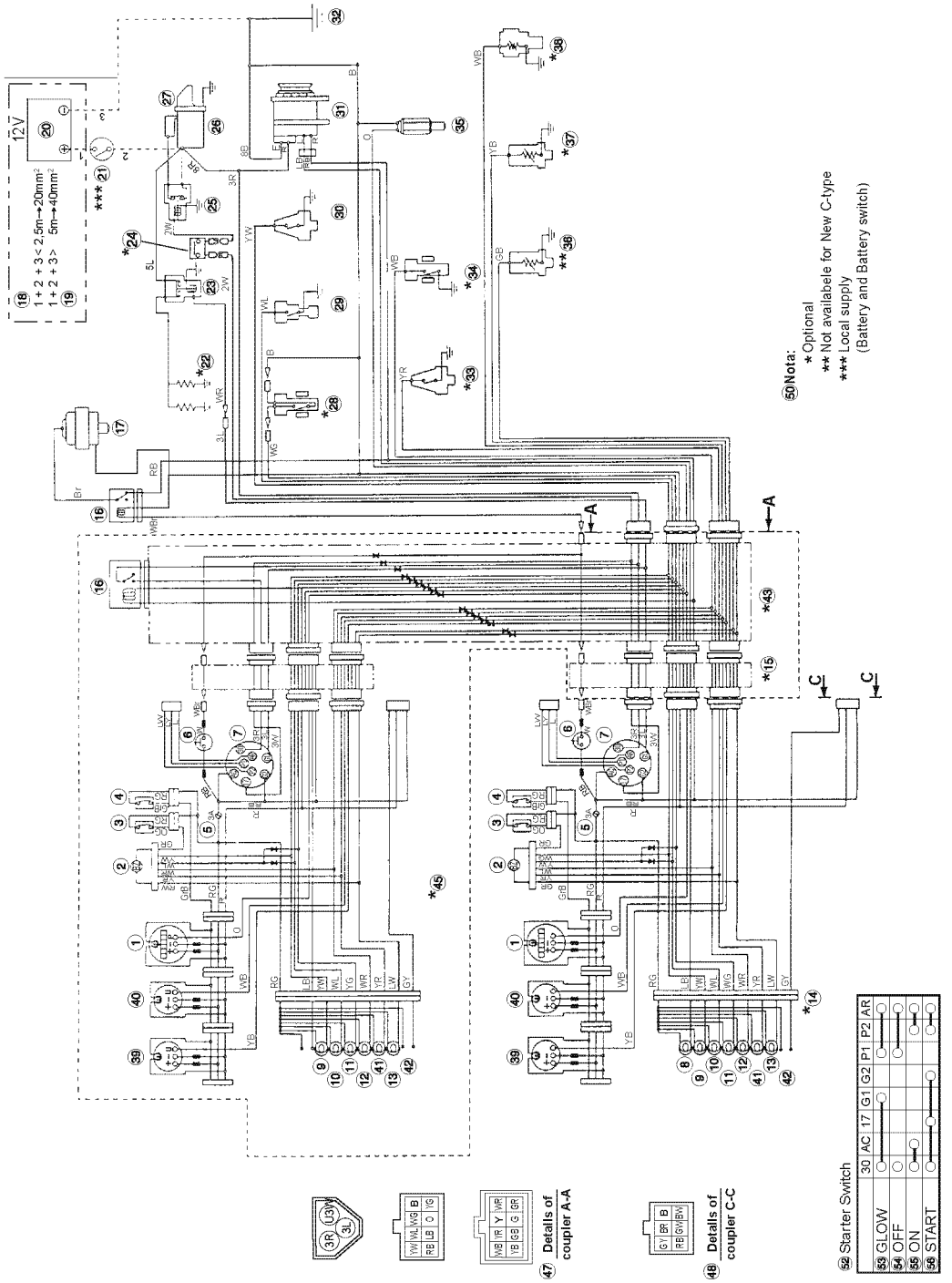
APPENDIX A Piping diagrams



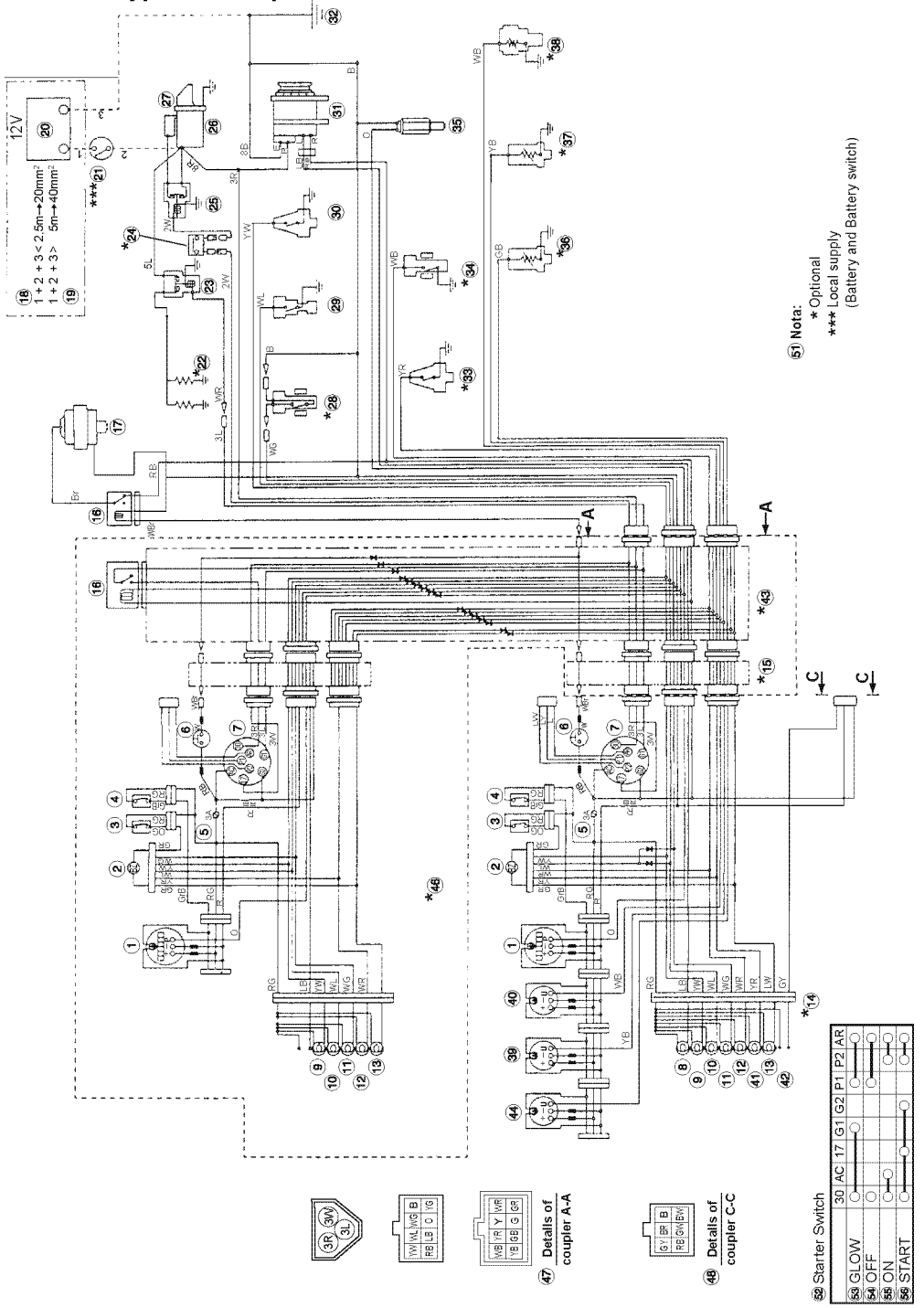
⓪-① (1) New B-type Control panel



⑩-2 (2) New C-type Control panel



(03) (3) New D-type Control panel



WARRANTY SERVICE

Owner Satisfaction

Your satisfaction and good will are important to your dealer and to us.
Normally, any problems conceming 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 yourYanmar local Subsidiary Company.

Yanmar Marine International B.V.
P.O. Box 30112, 1303AC Almere, The Netherlands
Brugplein 11, 1332 BS Almere-De Vaart, The Netherlands
Phone: +31 36-5493200
Fax: +31 36-5493209

Yanmar Co., Ltd
Head Office
1-32, Chayamachi, Kita-Ku, Osaka 530-8311, Japan

Yanmar America Corporation (Marine Business Unit)
101 International Parkway, Adairsville, GA 30103, USA
Phone: +1 770-877-9894
Fax: +1 770-877-9009

Yanmar Asia (Singapore) Corporation Pte Ltd.
4 Tuas Lane. Singapore 638613
Phone: +65 6595-4200
Fax: +65 6862-5195

Dealer Network: www.yanmarmarine.com

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.

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

(To be completed by manufacturer of inboard engines without integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-32 **Town:** Chayamachi, Kitaku, Osaka-City

Post Code: 530-8311 **Country:** Japan

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

Street: Brugplein 11 **Town:** Almere-de Vaart

Post Code: 1332 BS **Country:** The Netherlands

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

Street: 11, route de Luxembourg **Town:** Sandweiler

Post Code: L-5230 **Country:** Luxembourg **ID Number:** 0499

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

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

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type:
- ☐ z or sterndrive without integral exhaust
- ☒ Inboard engine

Fuel Type:
- ☒ Diesel
- ☐ Petrol

Combustion cycle:
- ☐ 2 stroke
- ☒ 4 stroke

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

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
	SNCH*94/25*2003/44*
RCD-1GM10X1	0009*00
RCD-2YM15X1	0004*00
RCD-3YM30X1	0005*00
RCD-4JH4X1	0014*00
RCD-4JH3TX1	0011*01
RCD-4LHAX1	0015*00
RCD-6LPADX1	0012*00
RCD-6LPASX1	0007*00
RCD-6CXMX1	0006*00
RCD-6LY2X1	0008*00
RCD-6LY3X1	0010*01
RCD-4JH3TX2	0016*00
RCD-4JH4TX2	0017*00
RCD-4JH4TX1	0018*00
RCD-6LPASX2	0023*00
RCD-4JH4AX1	0025*00
RCD-6CX53X1	0028*00

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

Name: Mitsuo Kaji **Signature and title:** M. Kaji

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

Manager
YMI Development Dept.
Development Dept.
Marine Operations Dept.
Yanmar Co.,Ltd.

Date: (yr/month/day) 2008 / 4 / 16

YANMAR CO., LTD.

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