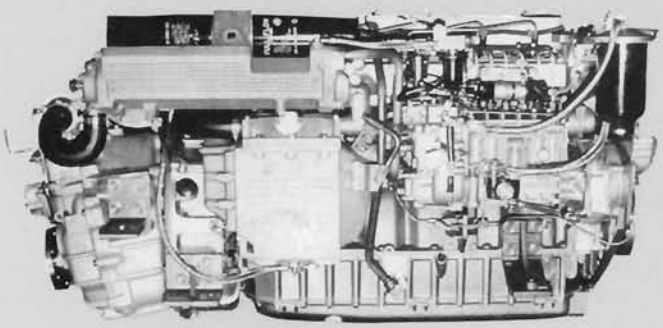
YANMAR

YANMAR

OPERATION MANUAL

YANMAR DIESEL ENGINE
6LY-UTE



YANMAR DIESEL ENGINE CO.,LTD.

Thank you very much for selecting the
6LY-UTE
YANMAR DIESEL ENGINE.

This manual includes all the information necessary to operate, check and service your YANMAR engine as well as important instructions for safety precautions.
Before starting up your new engine, you are required to carefully read this manual to ensure the proper operation of the engine and the best engine condition. If you have any questions, please consult your nearest dealer or sales agency.

YANMAR OPERATION MANUAL for 6LY-UTE

Thank you for purchasing a Yanmar product.

This Operation Manual tells you how to operate and service your new Yanmar engine. Please read it before using the engine to insure proper handling and operation. Follow the instructions carefully to keep your engine in the best running condition. If you have any question concerning this manual, or any suggestions, please contact your nearest Yanmar dealer.

This Operation Manual deals with the main points for operation of the 6LY-UTE.

> In order to insure safe working conditions, be sure to read the precaution sections for safe operation of your engine.

Pay special attention to statements preceded by the following words:

Warning:
Indicates a strong possibility of severe personal injury or loss of life if instructions are not followed.

⚠ Caution:
Indicates a possibility of personal injury or equipment damage if instructions are not followed.

Note:
Gives helpful information.

> If a problem should arise, or if you have any questions about the engine, consult an authorized Yanmar dealer.

Warning:
The Yanmar 6LY-UTE engine is designed to give safe and dependable service provided that it is operated according to instructions.
Read and understand the Operation Manual before operating your engine. Failure to do so could result in personal injury or equipment damage.

TIPS ON SAFETY

Warning:

1. PREVENTING FIRES

Never add fuel to the fuel tank while the engine is running. Wipe away all fuel spills with a clean cloth. Keep gasoline, Kerosene, matched, other explosives and inflammables away from the engine, since the temperature around the exhaust muffler and exhaust bend are very high during operation.

2. PREVENTING EXHAUST GAS INHALATION

- Exhaust gas contains poisonous carbon monoxide.
- Never use the engine in poorly ventilated conditions, provide proper ventilation so that people and animal will not be affected.

3. PREVENTING BURNS

- Never touch the muffler, muffler exhaust bend, Turbocharger or engine body while the engine is running or hot.

4. OTHER SAFETY TIPS

- Know how to stop the engine quickly and understand operation of all the controls. Never permit anyone to operate the engine without proper instructions.
- Do not operate under the influence of alcohol.
- Keep children and pets away from the engine when it is in operation.
- Keep away from rotating parts while the engine is running.
- When the engine is coupled with a machine, be sure to provide suitable covers for the belt, coupling and other dangerous parts.
- Work according to the rules and regulations of work area. When working with others, be sure to maintain good communication with everyone else.
- Use correct tools and equipment.

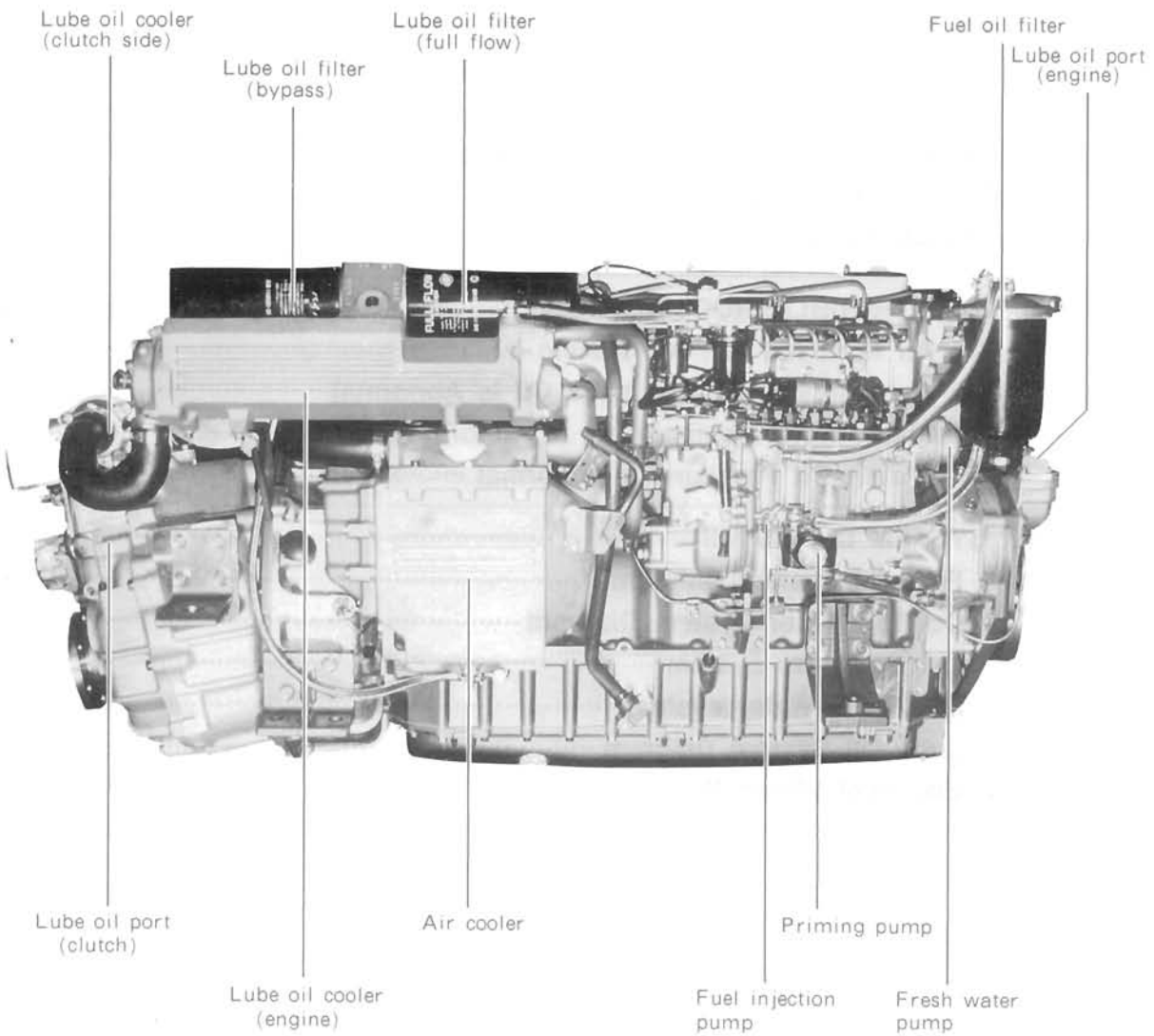
5. WHEN CHARGING THE BATTERY

- Battery electrolyte contains sulphuric acid. Protect your eyes, skin and clothing. In case of contact, flush thoroughly with water and get prompt medical attention, especially if your eyes are affected.
- Batteries generate hydrogen gas which can be highly explosive. Do not smoke or allow flames or sparks near a battery, especially during charging.
- Charge the battery in a fully ventilated place.

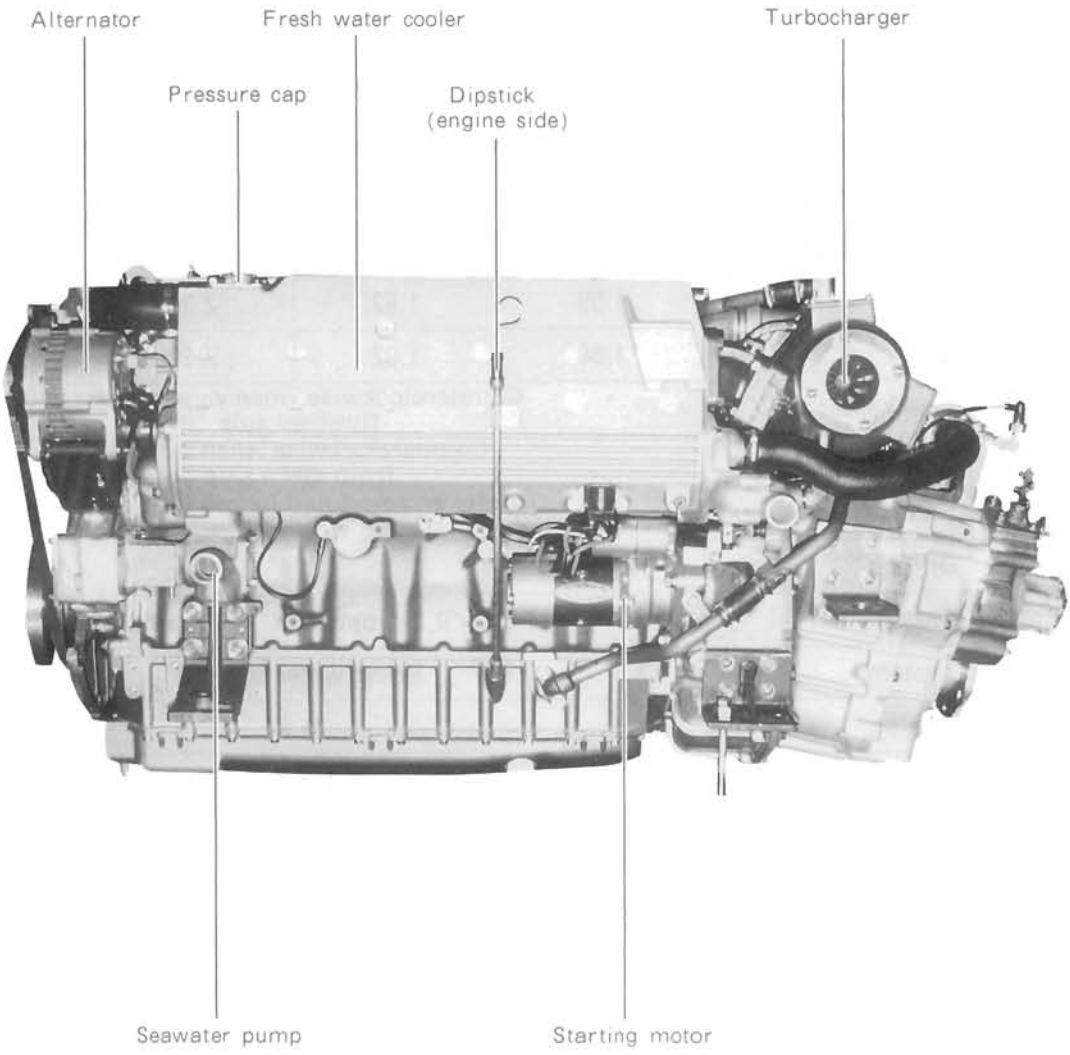
CONTENTS

1. IDENTIFICATION OF IMPORTANT PARTS

Operating side



Non-operating side



2. ENGINE SPECIFICATIONS

Item

Type			Vertical water-cooled 4-cycle diesel engine			
Model			6LY-UTE			
No. of cylinders			6			
Comtinuous rating output	Output rotational speed		260 HP/3100 rpm			
	Net average effective pressure		14.6 kg/cm²			
	Average piston speed		11.4 m/s			
Conbustion system			Direct injection			
Intake/exhaust valve system			2 intake valves and 2 exhaust valves			
Fuel injection timing			13° ±1			
Reduction and reversing gear (clutch)	Hydraulic type	Model	KMH6A			
		Reduction ratio Ahead	1.58	1.92	2.26	—
		Reduction ratio Astern	1.58	1.92	2.26	—
Direction of rotation	Crankshaft		Counterclockwise when viewed from flywheel side			
	Propeller shaft		Counterclockwise when viewed from stern side			
Lubrication system			Totally enclosed and forced lubrication system with gear pump			
Lube oil capacity	Oil pan		20 ℓ			
	Clutch		3.5 ℓ / 0.3 ℓ between "F" and "L"			
Cooling system			Fresh water cooling			
Fresh water volume	Engine		24 ℓ			
	Subtank		0.8 ℓ			
Cooling water delivery (at engine speed of 3200 rpm)		Fresh water	17000 ℓ / Hr			
		Seawater	8500 ℓ / Hr			
Starter system			Electric starting			
Electrical equipment	Starting motor		DC12V 2.5kW			
	Alternator (generator)		DC12V 80A			
Turbocharger	Type		IHI Model RHC7W			
	Cooling system		Water cooling			

3. PRECAUTIONS

To prolong the service life of your YANMAR engine, be sure to observe the following precautions.

No.	Precautions	Troubles Due Failure to Observe
1	Be sure to break-in the new YANMAR engine.	Some components of a new engine may not form a smooth fit with each other, imposing undue load on the engine and shortening its service life. For this reason, observe the following precautions for new engines. **⚠ Caution :** **Do not impose any undue load on the engine for at least 50 hours after installation and running of the engine. Be sure to operate the engine at 2500 rpm of lower.**
2	(1)It is recommended that a diesel light oil (JIS–K2204–2) be used. Use of A–heavy oil (JIS–K2205–1) is also possible. (2)Be sure to properly drain the fuel filter, oil-water separator, and fuel tank. For draining procedures, see Sec. 8–1. (3)Replace the fuel filter element every 500 service hours. See Sec. 8–1 for details of replacement.	(1)If you use the engine in cold weather, use No. 3 special light oil. Use of any other fuel oil may result in frozen oil and cause stoppage of oil flow. (2)Be sure to use A–heavy oil of cetane number 45 or more. Use of a cetane number less than 45 may deteriorate the combustion performance (ignition). Fuel oil mixed with water or moisture may cause failures to occur in the fuel injection pump and injection valve, and may significantly shorten the service life of the engine. If the filter element has been used for a long period of time without servicing, it will become clogged so that the flow rate of fuel oil will drop, causing engine trouble.
3	Use lubricant complying to SAE J183 15W40 (Class CD). If oil of this grade is not available, contact nearest our dealer.	Using an oil other than the one recommended may shorten the service life of the engine, due to, for example, piston ring sticking, seizure of pistons and liners, premature wear of moving parts, or other trouble.

No.	Precautions	Troubles Due to Failure to Observe
3	Be sure to change both the lube oil and filter element at the time intervals indicated on the right.	(1)Lube oil change Engine side 1st change: At 50 service hrs 2nd and subsequent changes: Every 250 service hrs Clutch side 1st change: After 50 service hrs 2nd change: After 250 service hrs 3rd and subsequent changes: Every 1000 service hrs or every 5 or 6 months Replacement of filter element 1st replacement: After 50 service hrs 2nd and subsequent replacements: Every 500 service hrs Cleaning of clutch oil filter 1st washing: At 50 service hrs after overhauling or initial operation 2nd washing: At 250 service hrs after overhauling 3rd and subsequent washings: Every 1000 service hrs or every 5 or 6 month ⚠ **Caution 1**: Using old lube oil may cause premature wear of each part, leading to serious trouble. ⚠ **Caution 2**: Using the filter element for an excessively long period of operation will cause it to clog with dirt. This in turn will cause various problems such as low oil pressure, metal seizure, and entry of dirt between the metal parts, resulting in premature wear. ⚠ **Caution 3**: The clogged clutch oil filter may cause reduction in hydraulic oil pressure, clutch slipping, or dirt attached to the metal parts or pump. This will result in the quick wear of clutch.
4	Important : Extra care should be taken when using fresh water.	
	Use tap water or clean rain water as fresh water.	⚠ **Caution**: If hard water such as that taken from a well is used, foreign deposits in the water will build up on the cooling water passage. As a result, the cooling performance drops as the temperature of the cooling water rises abnormally, causing seizure of pistons and liners.
	Be sure to add YANMAR antirust agent to the fresh water. For further details, see Sec. 8–3–7).	Once the cooling water passage begins to corrode, the corrosion in the passage will spread quickly, and the cooling performance will be consequently lowered. This can shorten the service life of the engine.
	In cold weather, use a YANMAR antifreeze (YANMAR SUPER FREEZE). For further details, see Sec. 8–3–7).	⚠ **Caution**: Antifreeze prevents the fresh water passage from being cracked by freezing.Determine the mixing ratio of fresh water and antifreeze according to the lowest ambient temperature. The mixing ratio of more than the specified value may cause engine overheating.
	Change the fresh water every 1000 service hours.	Contamination of fresh water lowers the cooling performance, abnormally raises the engine temperature, and causes engine trouble such as seizure.
	Before starting the engine, check the fresh water level in the subtank. In addition, check the water level in the fresh water tank at least once a week. For further details, see Sec. 5–3–2).	If the level of fresh water goes down, the temperature of the fresh water abnormally rises and causes seizure of the parts.

No.	Precautions	Troubles Due to Failure to Observe
4	Do not loosen the pressure cap during operation, or immediately after the engine has been stopped. Wait until the temperature falls below 60 ℃.	**Warning:** If the pressure cap is loosened while the fresh water is still hot, hot water may gush out and cause injury to the operator (burns). Should the pressure cap be loosened while the water is still hot, cover the cap with waste cloth, etc.
	When the temperature of the cooling water rises to 85 ℃ or higher, remove scales accumulated on the fresh water and seawater passages.	Higher temperature of the cooling water, in most cases, causes decrease in the cooling performance. If the engine continues to run with decreased cooling performance, the service life of the engine will be shortened or seizure of parts may occur. In such a case, consult the nearest YANMAR dealer.
5	Do not operate the engine while the seawater pump is not drawing up seawater.	**Caution:** If the engine runs while the pump is not drawing up seawater, the seawater pump impeller will seize after approximately 30 seconds and be permanently damaged. If the operation will be continued under such conditions, the temperature of the fresh water will rise excessively, and serious faulty will occur, such as seizure of pistons or crank shaft. An alarm is employed to detect the abnormally high temperature of fresh water.
	When turning the engine manually, be sure to turn it in the normal engine rotating direction. For further details, see Sec. 5–9.	The seawater pump impeller will fracture and be damaged permanently.
	In cold weather, be sure to completely drain the water from the seawater passage after engine shutdown. For further details, see Sec. 6–4–4).	**Caution:** If seawater remains in the passage and freezes, it will cause the cooler and seawater pump to break down.
	Seawater flows inside the fresh water cooler, engine oil cooler, and air cooler. Therefore, check the anticorrosive zinc inside these coolers every 500 service hours, and replace the zinc if it is worn by 1/2 or less of its original thickness. For further details, see Sec. 8–3–2.	**Caution:** Use of anticorrosion zinc more than 500 service hours may cause corrosion of each part.

No.	Precautions	Troubles Due to Failure to Observe
6	When removing the fuel injection valve, thoroughly remove carbon deposits on the perforated nozzle seat surface, and replace the seat packing with a new one.	Carbon deposits on the nozzle seat surface may cause gas leakage or corrosion. Consequently, gas leakage or corrosion may make it difficult to pull out the fuel injection valve or requires replacement of the nozzle sleeve. Be sure to ask the authorized YANMAR dealer to perform overhaul and assembly of the fuel injection valve.
	Do no forget to place the dust seal back onto the fuel injection valve. If the dust seal has aged or become damaged, replace it with a new one.	⚠ **Caution:** Torque the fuel injection valve securing nut to 0.4~0.5 kg-m.
7	When trawling, run the engine at a speed of 1400 rpm or lower, and do not continue trawling more than 2 hours. When not trawling, set the trawling lever to the H position (high speed), and be sure to lock it.	Failure to do this will cause the clutch friction plate to seize up.
8	Be sure to warm up the engine. For further details, see Sec. 6-2.	To allow lube oil to be distributed to all necessary parts, warm up the engine for approximately 5 minutes at 700 to 800 rpm after starting the engine. Insufficient warming up may cause abnormal wear or seizure of the moving parts.
9	Check the alternator drive belt for tension, and adjust it whenever necessary. For details of the adjustment, see Sec. 8-7-4).	⚠ **Caution:** If the tension is not properly adjusted, power is not transmitted appropriately and the drive belt may be damaged or broken. Moreover, improper belt tension may cause insufficient electric charging, with the result that the engine cannot be started.
10	Do not continuously use the starter motor for more than 15 seconds.	⚠ **Caution:** Prolonged operation of the starter motor (continuously for more than 15 seconds) may cause seizure of the starter motor.

No.	Precautions	Troubles Due to Failure to Observe
11	Be sure to properly ventilate the engine room.	**Warning:** Install a ventilator or provide vent holes. Insufficient air intake will increase the temperature in the engine room, resulting in reduction of engine output or deterioration of engine performance. (The capacity of the ventilator should be 40 m³/min. or greater.)
12	Important : Extra care should be taken when handling the turbocharger and air cooler.	
	(1)Check that the joint section between the turbocharger and the manifold is not damaged, or air does not leak from the joint section.	Damage or leakage may cause reduction in output.
	(2)Do not suddenly reduce the load or stop the engine after full-speed navigation.	The turbocharger impeller may be damaged.
	(3)If the air intake pressure drops, clean the pre-filter and blower.	If the engine is operated with reduced air intake pressure, the combustion performance will be lowered. For further details, refer to Section "Handling the Turbocharger."
13	When you restart the engine after long suspension of operation, sufficiently lubricate the engine. To do this, pull the engine stop knob, and rotate the engine using the starting motor for 5 to 10 seconds.	Do not start the engine without lubricating the engine. Otherwise, the cylinder liner, metal, or movable parts in the valve system may seize up, and the service life of the engine may be shortened.

To insure that the diesel engine can be used under best conditions, your YANMAR dealer offers periodical checks and servicing under the " Service Contract." Signing the Service Contract will allow your YANMAR dealer to provide all the servicing described in the green section of Sec. 3. We strongly recommend you to take advantage of this service contract.

4. FUEL AND LUBE OIL

4-1 Selection and Handling of Fuel

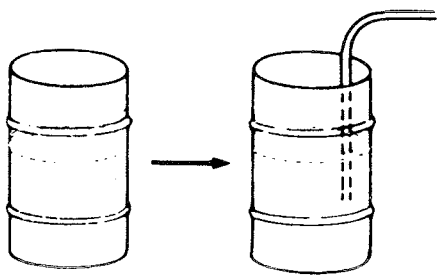
1) Selection of fuel

It is recommended that a diesel light oil (JIS-K2204-2) or YANMAR heavy oil be used, whichever is best-suited for the required engine performance. Use of A-heavy oil is also possible. Be sure to use A-heavy oil of cetane number 45 or more.

2) Handling of fuel

(1) Fuel containing water, dirt, sludge or other impurities may cause engine trouble.

(2) Place the drum of fuel oil upright, and allow it to stand until all impurities have settled. After this, place a suction tube halfway down the drum, and draw up fuel oil at that level.



Immediately after purchase

Allow the drum to stand for 3 to 4 days without subjecting it to vibration or movement.

After 3 to 4 days

Place s suction tube halfway down the drum to draw up fuel.
Caution: Impurities such as water and dirt will settle at the bottom of the drum.

⚠ Caution:

We are not liable to damages on the engine caused by use of improper fuel oil.

4-2 Selection of Lube Oil

1) Selection of lube oil

Selection of the proper lube oil is essential to the optimum operation of the diesel engine. Using an improper lube oil or failure to regular oil changes will result in the following problems:

1. Piston ring sticking
2. Seizure or premature wear of pistons and cylinder liners
3. Premature wear of bearings and other moving parts
4. Shorter engine life

2) Types of lube oil

YANMAR's genuine Oil is ideally suited as the lube oil for the engine. This oil is available at authorized YANMAR dealers or YANMAR INDUSTRY CO., LTD.

Company name	Brand name
YANMAR INDUSTRY CO., LTD.	YANMAR SUPER ROYAL OIL 15W40

⚠ Caution:

- If you have any questions regarding the selection of the proper lube oil, consult your nearest YANMAR dealer.
- If a lube oil other than those recommended avobe is used, the service life of the engine may be substantially reduced.
- If lube oils of different brands are blended the quality of the lube oil may deteriorate. To prevent this, do not use a mixed lube oil.
- We are not liable to damages on the engine caused by use of improper lube oil.

5. INITIAL OPERATION OF NEW ENGINE

When operating a new engine for the first time, follow the procedures described below.

5-1 Fuel Supply

Check again that the inside of the fuel tank and the pipes in the fuel system have been thoroughly cleaned.
After doing this, supply fuel to the tank.
Follow these steps after the 1st operation:

1) Draining impurities

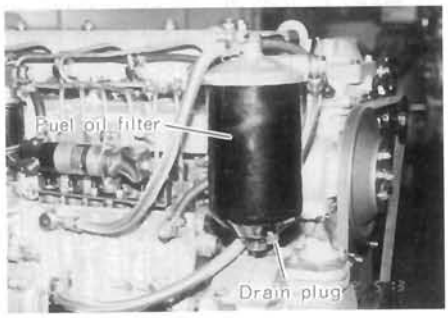
Even if supernatant fuel is primed out and fed to the tank, some dirt and water may have been mixed in the fuel.
To prevent these impurities from entering various components, therefore, it is necessary to eliminate them. This step is called drainage.

2) Drainage of fuel tank

Be sure to provide an oil-water separator or precipitation tank having a drain valve to the fuel tank, to drain out dirt and water. Periodically open the drain valve to eliminate impurities.

3) Drainage fuel oil filter

Loosen the drain plug shown in the photo to drain the filter. If reddish and rusty colored water comes out, there may be a considerable accumulation of water and dirt. In this case, disassemble and clean the fuel oil filter.
For further details, see Sec. 8-1.

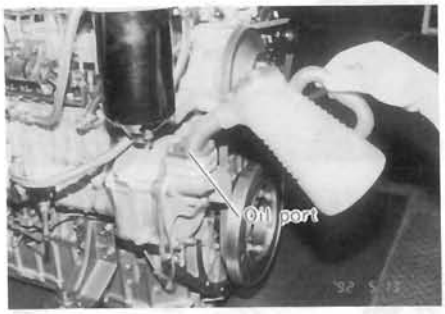


4) Be sure to also drain the separate-type oil-water separator and the filter.

5-2 Lube Oil Supply

1) Lube oil supply to oil pan

Remove the oil port cap from the side plate, and supply lube oil as shown in the photo below.



2) Checking the oil level

Completely insert the dipstick and check the oil level. If the oil level is lowered, supply lube oil up to the upper limit marker on the dipstick.

Operating side

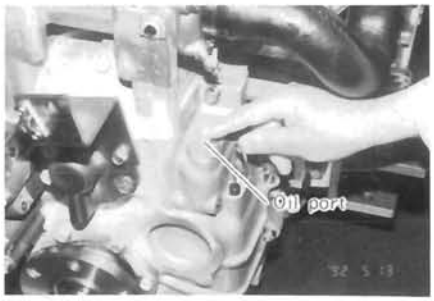
Non-operating side

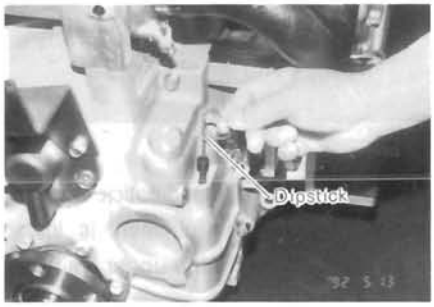
Do not feed excessive amount of lubricant.

Amount of oil at the upper limit makers on the dipstick	20 ℓ

3) Lube oil supply to reduction and reversing gear

Supply lube oil from the oil port shown in the photo below. The procedures for supplying lube oil and checking the oil level in the reduction and reversing gear box are similar to that for the engine.





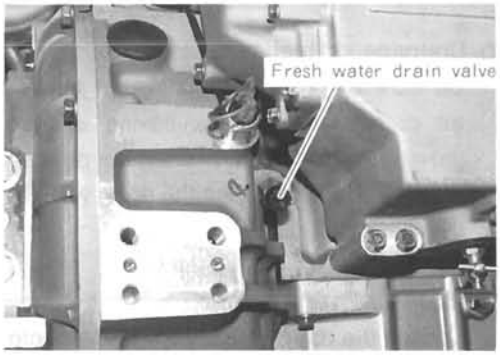
Amount of oil at the upper limit marker on the dipstick	KMH6A	3.5 ℓ

5-3 Cooling Water Supply to Fresh Water Tank

Use clean soft water (tap water) for the fresh water tank.

1) Tightening the fresh water drain valve

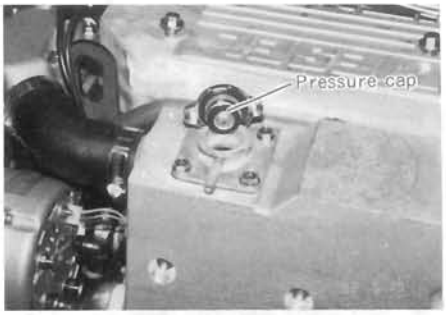
Before supplying fresh water to the tank, be sure to tighten the 2 water drain valves shown in the photo below.



2) Water supply

Check that the rubber pipe joint between the subtank and fresh water tank is securely tightened. The subtank must be in position where the top of the subtank is equal to that of the fresh water tank, or lower by approximately 5 cm than the fresh water tank.)

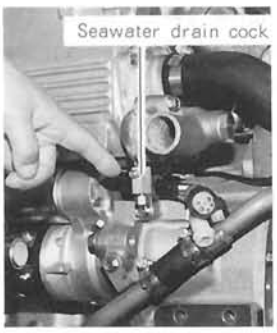
Remove the pressure cap of the fresh water tank, and supply fresh water to the fresh water tank until water flows out of the port. Supply fresh water also to the subtank to the upper limit level.
For the amount of fresh water, see Sec. 2.



3) Tighten the pressure cap securely.
If the pressure cap is not tightened sufficiently, fresh water may spill out during operation. In addition, hot water may gush out to cause injury to the operator (burns).

5-4 Tightening Drain Cock of Seawater System

Before you start the engine, be sure to tighten 3 drain valves shown in the photos below:

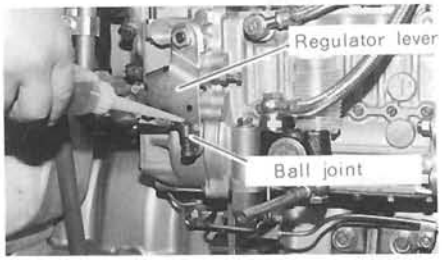


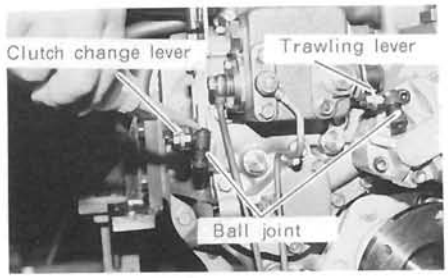
5-5 Bleeding Air from Fuel System

For the air removal procedures, refer to Sec. 9-1.

5-6 Lubricating Each Section

Lubricate the ball joints of regulator lever of fuel pump, clutch change lever, and remote control cable.





5-7 External Inspection

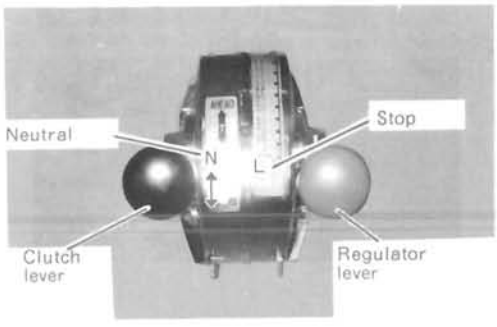
Check that tools or other things are not placed on the moving parts or on the engine, and ensure that the engine room is neat.

5-8 Checking Operation of Remote Control Unit

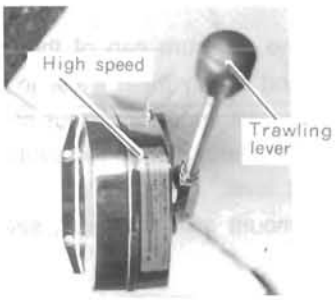
(1) While operating the regulator lever from the DECEL position to the ACCEL position, check that there is no difference in operation between the wheel house and engine side. If difference is detected, adjust the regulator lever.
(2) While operating the clutch lever from the AHEAD position, NEUTRAL position, to ASTERN position, check that there is no difference in operation between the wheel house and clutch side. If difference is detected, adjust the clutch lever.
(3) While operating the trawling lever from the H position to the L position, check that there is no difference between in operation the wheel house and the clutch side. If difference is detected, adjust the trawling lever.

5-9 Turning

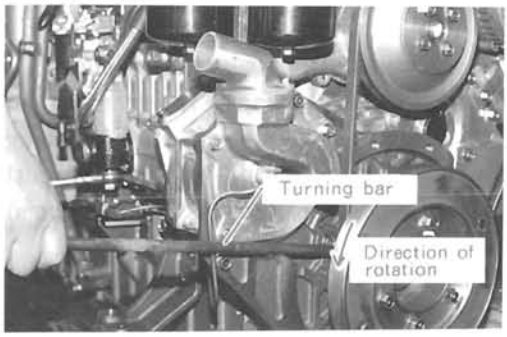
To distribute lube oil sufficiently to various parts, follow the steps below:
(1) Set the clutch lever to the N (neutral) position.
(2) Set the regulator lever to the L (stop) position.



(3) Set the trawling lever to the H (high speed) position.



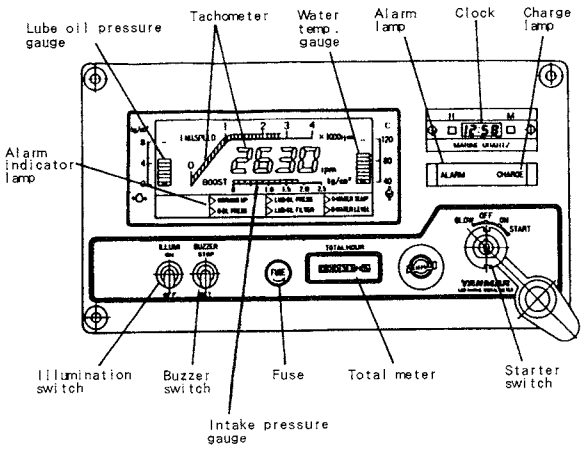
(4) Open the kingston valve.
(5) Turn on the battery switch.
(6) Insert the key into the starter switch, and then set the key to the START position. While rotating the engine using the starting motor for 3 to 5 seconds, check the engine for abnormal noise.



5-10 Checking Operation of Gauges

When you set the starter switch to the ON position, the condition of gauges on the instrument panel are as follows:
(1) The lamps of all the gauges light for 3 seconds.
(2) One of the lube oil pressure gauge lamps lights (0).
(3) One of the cooling water temp. gauge lamps lights (40°C).
(4) One of the tachometer lamps lights, and one of the intake pressure gauge lamp lights.
(5) The digital tachometer indicates "0."
(6) The total timer is operating.

(7) Turn on the illumination switch, and check that the illumination lamps of lube oil pressure gauge, intake pressure gauge, cooling water temp. gauge, tachometer, and clock light.



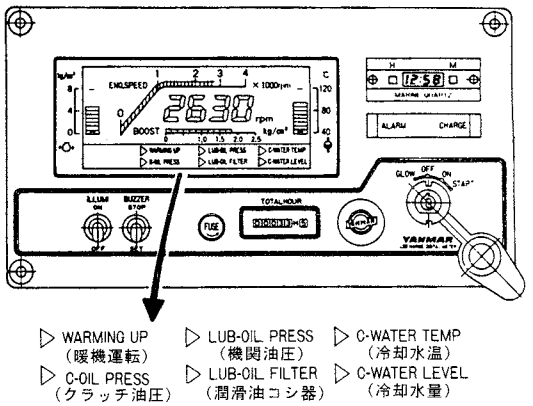
Checking Alarm Devices

Warning: Set the buzzer switch to the SET position, and then set the starter switch to the ON position.

When the starter switch is set to the ON position, the operation of alarm devices are checked automatically while sounding the buzzer for 3 seconds. After checking one alarm device, the lamp of the next alarm device to be checked lights, and its checking starts.

The alarm devices to be checked are as follows:

●Warming-up ●Lube oil pressure ●Cooling water temperature ●Clutch oil pressure ●Lube oil filter ●Cooling water level



Caution 1: If an alarm lamp does not go out or the buzzer does not stop sounding after 3 seconds, something is wrong with the alarm device. Consult your nearest YANMAR dealer.

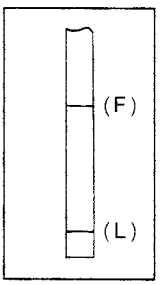
Caution 2: After the engine is started, the charge lamp lights and remains lit until electric charging starts.

Caution 3: The warming-up lamp remains lit until the engine is warmed up.

Re-checking Immediately After Starting Engine

After a new engine has been run for the first time, the level of the oil in the oil pan may slightly go down because the lube oil has been thoroughly distributed to the lube oil cooler and lube oil filter. In this case, stop the engine and leave it for a while (approx. 5 minutes), and then check again for the following items:

1) Check the oil level in the oil pan using the dipstick.
2) Check the oil level in the reduction and reversing gear box using the dipstick. The level may be lower than full marker F; however, this is not abnormal.



Supply oil if the oil level lowers below lower limit position L.

The amount of oil between upper limit position F and lower limit position L is approximately 0.5 liters.

The oil level is normal when it is between upper limit position F and lower limit position L.

3) Remove the pressure cap from the fresh water tank, and check the water level. The level may be lower due to air entry from the fresh water passage. In this case, supply fresh water until water flows out of the water port.

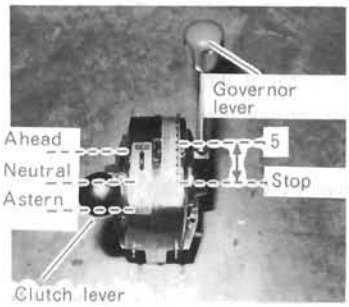
6. OPERATION

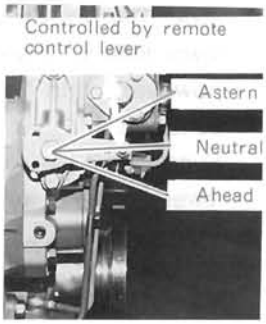
Before starting the engine, check around the engine especially the rotating parts to see that there is nothing that may prevent safe operation.

6-1 Starting

Follow these steps to start the engine:

1) Set the remote control clutch lever to neutral position N.
2) Set the remote control governor lever to the normal speed position (midpoint between H position and L position).
3) Set the trawling lever to the H position (high speed).





Turn the key of the starter switch to the START position to start the engine. As soon as the engine is started, release the key; the key automatically returns to the ON position.

⚠ **Important:** Do not turn off the battery switch even after starting the engine.

With the start switch at the ON position, the gauges and alarms on the instrument panel are activated.

⚠ **Important:**

(1) To protect the battery, do not continue running the starting motor for more than 15 seconds. If you fail to start the engine, wait about 15 seconds and then try again.

(2) When restarting the engine, make sure that the engine has stopped and turn the starter switch key to the START position. If the starter switch is turned while the engine is still running, the starter motor and/or flywheel gears may be damaged.

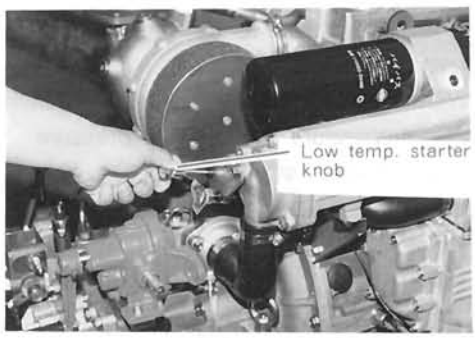
(3) To facilitate the start-up of the engine in cold weather:

- Use a light oil. Since the cetane number of a light oil is large, use of light oil facilitates the start-up of the engine.
- Turn off the boost compensator. Pull the low temp. starter knob all the way to the initial position, and the engine will start. The boost compensator once turned off will automatically be activated after starting the engine.

⚠ **Caution:** Use the low temp. starter knob only when start-up of the engine is not easy. During normal operation, push and keep the knob as it is.

Warning:

Disconnect the terminals from the battery before repairing or inspecting electrical parts.



6-2 Cautions Required Immediately After Starting

While keeping the clutch lever at the neutral position, follow the procedures described below.

1) Immediately after starting the engine, run the engine for 2 to 3 minutes at approximately 600 rpm.
2) Check that water is flowing out of the cooling water outlet pipe.
3) Check that the CHARGE lamp goes out.
4) Operate the engine at 700 to 800 rpm, and check that the WARMING UP alarm lamp lights.
   Do not run the engine under load if the WARMING UP alarm lamp is on. This is to thoroughly distribute lube oil to all the moving parts (including white metal bearings) and to warm up the engine.
   This step is called "warming up."
5) If the WARMING UP alarm lamp goes out, run the engine under load.

Note 1: After launching and running the engine for the first time, continue to warm-up the engine for 10 to 15 minutes.

Note 2: If the WARMING UP alarm lamp and other alarm lamps do not go out, consult the nearest YANMAR dealer.

6-3 Cautions Required During Navigation

Caution:

Be sure to check the following items once or twice daily during navigation.

1) Cooling water (seawater)

Check that water is flowing out of the cooling water outlet pipe.

If water is flowing out intermittently or the volume of the flowing water is small, there may be the following problems:

(1) Air has been taken in to the cooling water system.
(2) The impeller or other parts of the cooling water pump are malfunctioning.
(3) The cooling water pipe or kingston valve is clogged with foreign solids.

If you cannot identify the cause of the problem, return to nearest port at low speed and consult the nearest YANMAR dealer.

Caution:

2) Cooling water (fresh water)

The temperature of fresh water must not rise above 90°C (75°C to 85°C for a new engine) during operation. Temperatures higher than 90°C indicate that a problem has occurred in the cooling water system. The cause of the problem may be as follows:

(1) The volume of fresh water rapidly reduces due to leakage from the cooling system. If the temperature of fresh water rises abnormally or the volume of fresh water reduces abnormally, the alarm devices trigger.
(2) The flow rate of fresh water is insufficient due to failure in the fresh water pump or clogging of the fresh water passage.
(3) The seawater pump is malfunctioning, or the seawater passage is clogged.
(4) Fresh water is not cooled sufficiently due to the contaminated cooler.

If you cannot identify the cause of the problem, return to port at low speed and consult the nearest YANMAR dealer.

Cautions:

Temperature of fresh water

When the temperature of fresh water rises after start-up, heated water flows into the subtank from the fresh water tank and the volume of fresh water in the subtank increase consequently. Note that this is normal.

After the water temperature drops after stopping the engine, the water automati-

cally returns to the fresh water tank.

3) Fume color

Black fumes are a sign of improper engine operation. As a result, the service life of suction valves, exhaust valves, piston rings, cylinder liners, and, especially, the fuel injection valves are shortened. Do not operate the engine if black fume is emitted.

⚠ Caution:

4) Water and oil leakage, and other operating conditions

From time to time, check that there is no water leakage, oil leakage, gas leakage, loosened bolts, abnormal noise, abnormal heat, and abnormal vibration. If any of such abnormalities are found, consult the nearest YANMAR dealer.

5) Resonating rotation

Depending on the structure of the hull, the vessel begins to resonate at a certain engine speed, thereby increasing the vibrations suddenly. Avoid operation in such a speed range.

⚠ Caution:

6) Operation of clutch lever

When operating the clutch lever, lower engine speed down below 1000 rpm.)

Engaging or disengaging the clutch suddenly during high speed operation or operating the clutch at a half-engaged position may result in clutch seizure and shorten the service life of the clutch. For trawling instructions, see Sec. 7-2.

⚠ Caution:

7) Abnormal noise during operation

If unusual noise is generated during operation, or if the alarm buzzer sounds during operation, check first to see which alarm lamp is lit, and turn off the buzzer switch. Then immediately stop the engine. Note that sudden deceleration may activate the clutch oil pressure alarm. However, this is not abnormal.

Investigate the possible causes of the trouble. If the cooling system and lube oil system are free of problems, return to the nearest port at low speed and consult the nearest YANMAR dealer.

8) Prolonged operation at low speed

When operating the engine at low speed for a prolonged period of time, "race" the engine every 3 to 4 hours or so.

⚠ Important:

"Racing" is required to discharge the deposits that have accumulated on the cylinders during low speed operation and to prevent the contamination of the cylinders.

For "racing," disengage the clutch and run the engine at 1800 rpm for about 1 minute.

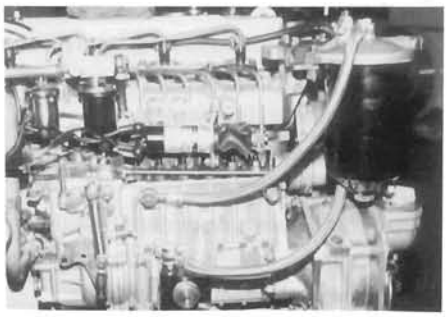
6-4 Stopping

1) Before stopping the engine, race the engine.

(1) Set the clutch lever to the N position (neutral), and race the engine for about 5 minutes at as low a speed as approximately 500 to 600 rpm.

(2) Set the regulator lever to the normal speed position, and race the engine for about 5 seconds at approximately 1,800 rpm.

(3) Reduce speed to the lowest speed (500 to 600 rpm), stop the supply of fuel, and stop the engine.



⚠ **Caution:** If the engine is stopped in a heated condition, the temperatures of the fresh water and the engine parts may rise rapidly, possibly causing troubles.

2) After stopping the engine, set the starter switch to the OFF position, and set the buzzer switch to the OFF position.

3) Be sure to close the kingston valve after stopping the engine.

4) Discharge of cooling water:

In cold weather, cooling water (seawater) may freeze. After shutting down the engine, be sure to discharge the water from the system. (Use antifreeze for fresh water.)

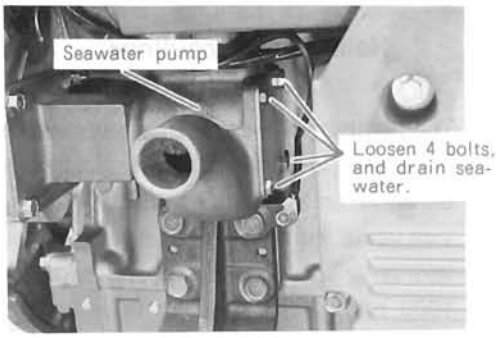
When the engine is not used for a prolonged period of time, discharge all the water from the system.

If seawater is left in the system, it may freeze and break the cooler or the seawater pump.

Discharge cooling water (seawater) by following the steps:

(1) Loosen the water drain valve of the clutch lube oil cooler.

(2) Loosen the bolts on the seawater pump lid (Yabusco pump).



5) Thoroughly remove dust and dirt while the engine is still warm.

6) Turn off the battery switch.

7. HANDLING THE CLUTCH

7-1 Handling Precautions

1) The durability of the clutch largely depends on how it is handled. When shifting the clutch lever to ASTERN from AHEAD or vice versa, be sure to shift down the regulator lever to reduce the speed (lower than 1000 rpm), set the clutch lever once to the neutral position, and then set it to the ASTERN or AHEAD position.
2) Do not attempt to operate the regulator lever before completing the operation of the clutch lever. Shifting the clutch lever suddenly to AHEAD or ASTERN with the engine running at high speed may cause the clutch to malfunction. Never perform such an operation.

7-2 Trawling

1) The reduction and reversing gear is equipped with a trawling device. Operating the trawling lever sails the boat at a speed lower than the minimum engine speed.

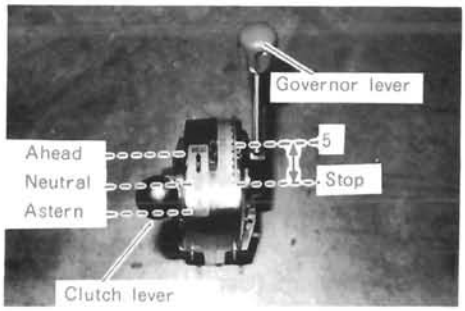
2) Trawling operation

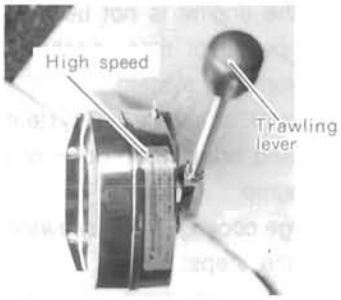
To use the trawling device, follow these steps:

(1) Lower the engine speed to 1400 rpm or lower.
(2) Shift the clutch lever to the AHEAD position from the N position (neutral).
(3) Shift the trawling lever through each position from H to L to set the desired engine speed.
(4) Do not continue trawling operation for more than 2 hours.
Such long operation causes excessively high temperature rise of lube oil, and may damage the friction plate.

3) Returning to normal operation

When returning from trawling to normal operation, reduce the engine speed to 600 to 700 rpm, and then set the trawling lever to the H position. After that, turn the knob of the lever clockwise to lock the lever.





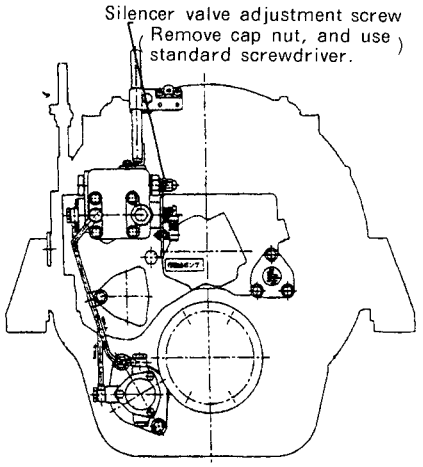
⚠ **Caution:** If the trawling lever is operated during high speed rotation of the engine, the clutch disc may be damaged.

7-3 Silencer Valve

In the low speed range (between minimum speed and approximately 800 rpm), the engine speed largely fluctuates and the reduction and reversing gear may generate large noise.
To prevent such a large noise, a silencer valve is installed on a reduction and reversing gear. Before shipment, the silencer valve is adjusted in the factory, though the following problems may occur, depending upon the propeller or propeller shaft:

- The clutch changeover response is poor.
- The noise from the reduction and reversing gear is still too large.

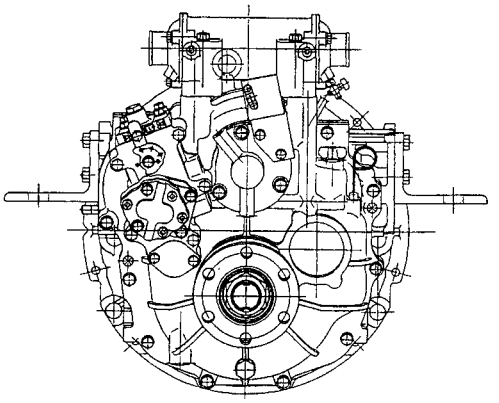
In the above cases, consult the nearest YANMAR dealer for readjustment.

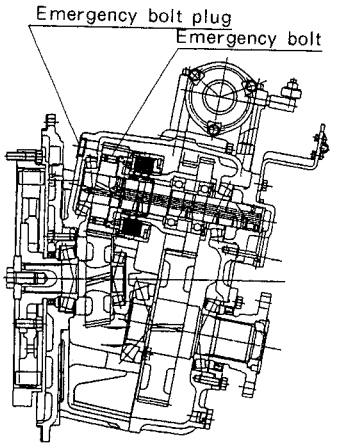


7-4 Handling the Emergency Bolts

1) Should trouble occur in the clutch lube oil system during operation, stop the engine and remove the emergency bolt plug from the clutch case. Then slightly and uniformly tighten four emergency bolts on the clutch rotation section by turning them clockwise. After that, firmly tighten the bolts again.
2) Now the clutch is connected to the ahead side. You can temporarily run the engine at a low speed (1000 rpm or less).

Warning:
High speed operation may cause seizure of the clutch disc or metal.





Warning:
(1) To tighten the emergency bolts, turn the engine until the head of the bolt lines up with the hole, and tighten the four bolts evenly.
(2) When using the emergency bolts, the clutch is directly connected to the ahead side and cannot be used in the neutral or astern position. Thus, special care must be taken when starting the engine and entering port.
(3) After returning to port using the emergency bolts, ask the nearest YANMAR dealer to service the engine as soon as possible.
(4) Turn off the battery main switch before inspecting the clutch.

Checking and Adjusting the Reduction and Reversing Gear

1) Checking the clutch lube oil
   Remove the dipstick before starting the engine, and check that the oil level is between the upper limit and lower limit. Supply lube oil if required.

2) Cleaning the clutch lube oil cooler fouled or clogged by seawater

3) Changing the clutch lube oil

4) **Checking the bearings, friction plate thickness, rubber block, and seal**
   To check the bearings, friction plate, rubber block, and seal, the reduction and reversing gear needs to be disassembled. Ask the nearest dealer to undertake the servicing.

5) Cleaning the lube oil filter

6) Checking connection of the remote control cable

The items 1) through 6) above are prerequisite to correct operation. For further details, see Sec. 8.

8. PERIODICAL CHECK AND SERVICE

To use the engine at the best condition, periodical check is essential. The parts that require periodical maintenance are gathered on top of the engine. To facilitate the maintenance, the label attached to the top of the engine shows the parts to be serviced and the maintenance procedures. For the maintenance items and inspection schedules, refer to the maintenance list below.

Maintenance

1. Reserve tank: Check and replenish cooling water
2. Fuel oil filter: Replace filter every 250 hours if A-heavy oil is used.
   Replace filter every 500 service hours if light oil is used.
3. Intake pressure unit, hydraulic pressure sender unit, hydraulic pressure switch: Replace them by removing their covers.
4. Lube oil full flow filter: Replace filter every 500 service hours. (1st replacement: At 50 service hours)
5. Lube oil bypass filter: Replace filter every 500 service hours. (1st replacement: At 50 service hours)
6. Turbocharger compressor: Clean compressor every 250 service hours.
7. Lube oil dipstick and oil drain pipe: Before start-up check oil level using dipstick.
   Drainage method: Remove dipstick, and drain waste oil by pumping it up using the oil drain pipe.
8. Subtank oil drain pipe:
   Drainage method: Remove bull plug, and drain waste oil by pumping it up using the oil drain pipe.
9. Lube oil port
   Applicable lube oil: Class CD, 15W-40
   Lube oil replacement: Every 250 service hours for use of A-heavy oil
   Every 500 service hours for use of light oil
   Replacement amount: 20 liters

Maintenance List

● : Consult nearest dealer.
○ : Check ◉ : Replace

Item	Description		Schedule: Daily	Every 50 service hrs. (or weekly)	Every 250 service hrs. (or monthly)	Every 500 service hrs. (or every 2 or 3 months)	Every 1000 service hrs. (or every 5 or 6 months)	Every 2500 service hrs. (or annually)	Page
Fuel	Check of oil volume in tank and supply of oil		○						26
	Drainage of tank		○(Before oil supply)						26
	Drainage of filter and oil-water separator			○					27
	Replacement of filter element					◉			27
Lube oil and hydraulic oil	Check of oil level in oil pan, and oil supply		○						27–28
	Replacement of filter element (including bypass filter)			◉ (1st time)		◉			27–28
	Cleaning of lube oil cooler							●	28
	Change of lube oil	Engine side		○ (1st time)	○(A-heavy oil)	○ (Light oil)			28
									—
Cooling water (seawater side)	Check of cooling water discharge		○						29
	Check and replacement of impeller						○	◉	29
	Check and replacement of anticorrosive zinc					◉			—
	Cleaning of seawater system (including fresh water and lube oil cooler)						●		30
Cooling water (fresh water side)	Check and supply of fresh water level		○						30
	Replacement of fresh water						●		31
	Cleaning of fresh water system (including fresh water cooler)							●	31
Fuel injection pump and fuel injection valve	Adjustment of injection timing							●	26
	Overhaul and check of fuel feed pump							●	37
	Adjustment of injection pressure and atomizing condition				● (1st time)		●		24
	Replacement of fuel injection valve							●	24

Item	Description	Schedule							
		Daily	Every 50 service hrs (or weekly)	Every 250 service hrs (or monthly)	Every 500 service hrs (or every 2 or 3 months)	Every 1000 service hrs (or every 5 or 6 months)	Every 2500 service hrs (or annually)	Every 6000 service hrs (or once every 2 years)	Page
Cylinder head	Adjustment of clearance between intake and exhaust valve head		● (1st time)				●		24
	Seating of intake and exhaust valves							○	—
Check and adjustment of remote control cable			○(1st time)		○				33
Electrical parts	Check of alarm lamps	○							33
	Check of battery electrolyte volume			○					33
	Adjustment of alternator (generator) drive belt tension				○				34
	Replacement of battery of liquid crystal display clock							○	34
Turbo-charger	Flushing of blower			○					36
Intercooler	Flushing of blower			○					—
Reduction and reversing gear	Check and cleaning of lube oil cooler						●		28
	Check and cleaning of lube oil inlet filter net		○(1st time)		○	●			28
	Check of bearings, friction plate, and seal							●	32
	Check of lube oil level, and oil supply	○							32
	Change of lube oil		○(1st time)		○	○			28

Adjustment table

Item			Standard value
			6LY-UTE
Clearance between intake and exhaust valve heads (in cold condition)			Intake : 0.1±0.05 mm ; Exhaust : 0.4±0.05 mm
Intake valve	Open	Crank angle : Before T.D.C.	36°±5
	Close	Crank angle : After B.D.C.	40°±5
Exhaust valve	Open	Crank angle : Before B.D.C.	51°±5
	Close	Crank angle : After T.D.C.	39°±5
Fuel injection start		Crank angle : Before T.D.C.	13° ± 5
Pressure		Fuel injection start pressure	240±5kg/cm²
		Engine lube oil pressure	5±0.5kg/cm²
Temperature		Cooling water temperature at engine outlet	45℃ or less (at inlet: 30℃) ; Seawater temperature: +10℃
		Lube oil temperature at cooler inlet	95℃ or less
Engine fresh water capacity			24 ℓ
Amount of lube oil			F : 20 ℓ L : 12 ℓ
Axial clearance of each clutch shaft		Input shaft	Clearance : ±0.05 mm
		Intermediate shaft	Clearance : ±0.05 mm
		Output shaft	Shrink range : 0~0.1mm
Clutch oil pressure		Original pressure in neutral status	2~3kg/cm² (500rpm)
		Hydraulic oil pressure in engaged status	24 ±0.5kg/cm² (3300rpm)
		Lube oil pressure	2.0±0.5kg/cm² (3300rpm)

Torque Requirements for Major Parts

Engine	Torque requirements for major parts	Cylinder head bolt	23±1kg−m
		Main bearing retaining bolt	26±1kg−m
		Connecting rod bolt	14±0.5kg−m
		Flywheel mounting bolt	30±1kg−m
		Fuel oil valve tightening nut	0.4~0.5kg−m
		Valve arm support shaft tightening nut	1.7±0.2kg−m
		Fuel oil pump drive gear tightening nut	13±1kg−m

Clutch	Part	Screw diameter	Tightening torque (kg−m)
	Pump tightening bolt	M8	2.1±0.2
	Emergency bolt	M10	4.0±0.2
	Output shaft joint bolt	M16	23±1.5
	Output shaft snap nut	M40	70±2.5

Torque Requirements for Standard Bolts

Screw diameter × pitch (mm)	M6×1	M8×1.5	M10×1.5	M10×1.75	M14×1.5	M16×1.5
Torque (kg-m)	1.1±0.1	2.6±0.2	5.0±0.5	9.0±0.5	14±1	23±1.5

Notes:

Torque requirements for bolts other than the major bolts should conform to the table above.

The bolts to be tightened to the torques specified above should be those made of S45C material which are identified by having "7" marked on the bolt head.

Bolts marked with "M" are not used in this engine.

(When the material of the tightening part is aluminum, tighten it to 80% of the torque listed above.)

Fuel Oil System

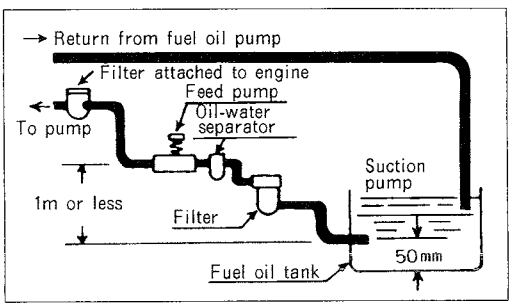
For the diagram of the fuel oil system, refer to Sec 10.

1) Checking the fuel oil level in the fuel tank and replenishing

Level check	Daily

Replenish fuel oil whenever necessary. For details of the procedures, refer to Sec. 4-1.

[Reference] The fuel piping system is generally configured as shown in the figure below.



Some fuel oil systems are equipped with a fuel service tank indicated by the dotted line.

2) Draining the fuel oil tank

Open the drain valve of the tank, and discharge impurities accumulated on the bottom of the tank.

Schedule	Daily (or before oil replenishment)

3) Draining the fuel oil filter and changing the filter element

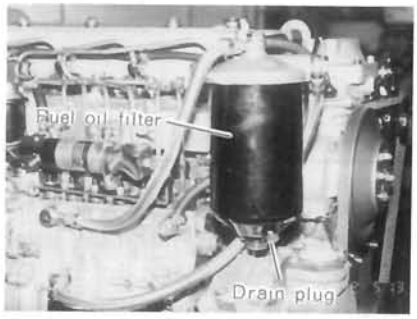
(1) Draining the filter attached to the engine
Remove the drain plug, and discharge water and dirt accumulated in the filter.

Schedule	Every 50 service hrs (or weekly)

(2) Changing the filter element

1) Remove the element using the element removal tool.
2) Replace the element with a new one, and reassemble the filter.
Before you install the packing, clean the packing installation surface. Install the packing while checking that there are no foreign materials on the packing installation surface.
3) Operate the engine, and check that fuel oil is not leaking.

Schedule	Every 500 service hrs (or 2 or 3 months)



⚠ **Important:** For the separate-type fuel oil filters, remove impurities and change the element by using the procedure in Sec. 8-1-3).

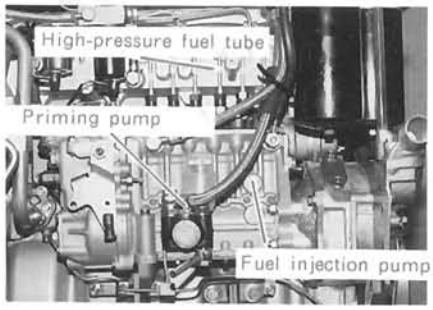
4) Checking and adjusting the fuel injection timing

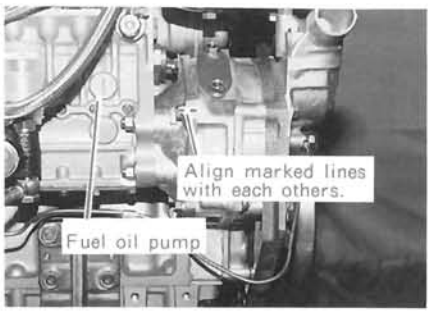
(1) Remove the high-pressure fuel oil pipe from the fuel injection pump.

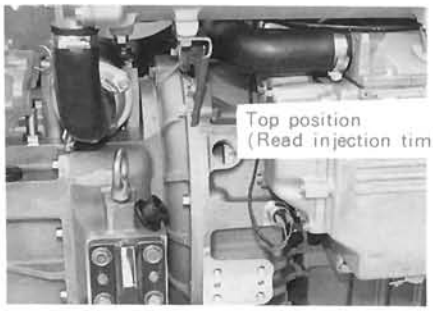
(2) While manually turning the flywheel slowly, check that the timing of the fuel flowing out of the discharge valve holder of the cylinder injection pump conforms to the specified timing by visually inspecting the flywheel and indicator.

(3) Check the fuel injection timing of all the cylinders by following the step (2) above. (If the observed timing does not conform to the specified timing, consult the nearest YANMAR dealer.)

Inspection schedule	Every 2500 service hrs (or annually)
Fuel injection timing	6LY-UTE 13° ± 1



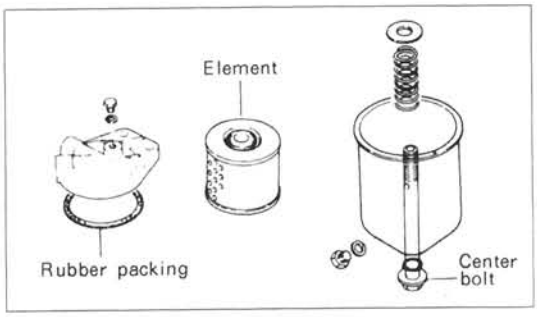




5) Drainage of oil-water separator

Remove the drain plug, and discharge water and dirt accumulated in the oil-water separator.

Schedule	Every 50 service hrs (or weekly)



8-2 Lube Oil System

1) Checking the lube oil level in oil pan

For the diagram of the lube oil system, refer to Sec. 10.

Remove the dipstick before starting the engine, and check that the oil level is between the upper limit and lower limit.

Replenish the lube oil whenever necessary.

For details of the lube oil check, refer to Sec. 5-2.

Inspection schedule	Daily (before start-up)

2) Changing the lube oil filter element

Remove the filter, and replace the filter element with a new one.

Schedule (including bypass filter)	1st replacement	At 50 service hrs (or 1 week)
	2nd and subsequent replacements	Every 500 service hrs (or monthly)

- Procedure for changing the filter element

(1) Remove the filter element using the element removal tool.

(2) Replace the filter element with a new one. At the same time, clean the seating surface of the packing to prevent improper sealing caused by foreign material.

(3) Check that there is no oil leakage during operation.

3) Changing the lube oil

Change the lube oil while the engine is still warm after shutdown.
In this condition, the oil flows smoothly and can be drained completely.

Schedule	1st change	At 50 service hrs (or 1 week)
	2nd and subsequent changes	Every 250 service hrs (or monthly)

Change the lube oil of the reduction and reversing gear by following the procedure described above.

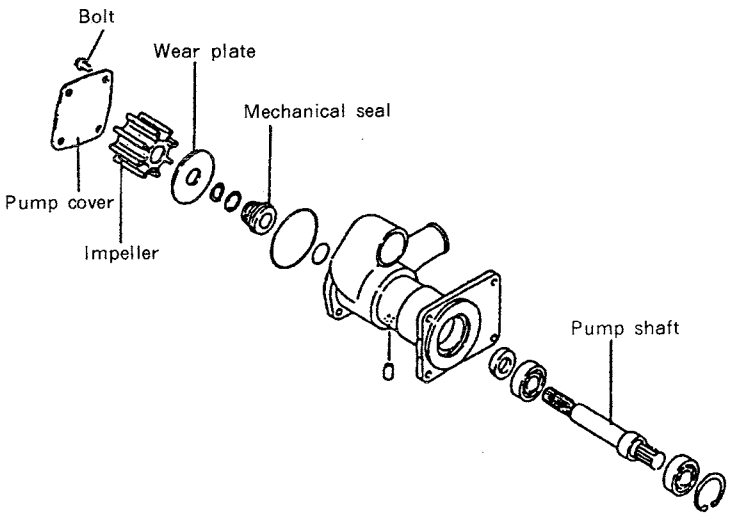
4) Cleaning the lube oil cooler

Consult the nearest dealer.

Schedule	Every 2500 service hrs (or annually)

6-3 Cooling Water System (Seawater and Fresh Water)

Seawater System



1) Checking the seawater discharge conditions

During operation, occasionally check that the water is properly flowing out of the seawater outlet pipe. If the seawater comes out intermittently or the rate of the water flow is lower during high-speed operation, immediately stop the engine and identify the cause of the trouble.

(For further details, refer to Sec. 6-3-1).

Inspection schedule	Daily (during operation)

Inspection schedule	Every 500 service hrs (or 2 or 3 months)

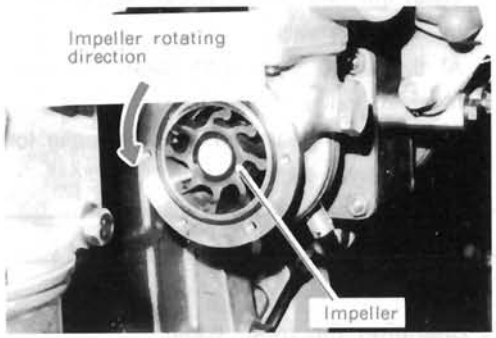
2) Checking and changing the seawater impeller and casing

(1) Remove the lid of the seawater pump, and pull out the impeller. Check to see if there is damage on the impeller, wear plate, lid, and mechanical seal.

(2) If the wear plate or lid is worn out, turn it over for reuse.

(3) When assembling the pump, apply grease to the engagement parts of the pump and impeller, both end surfaces of the impeller, and the tips of the blades.

(4) To mount the impeller, set the impeller blades as shown in the photo below.



Inspection schedule	Every 1000 service hrs (or 5 or 6 months)
Impeller replacement	Every 2500 service hrs (or annually)

⚠ Caution:

3) Cleaning the seawater system (including fresh water and lube oil cooler)

When the seawater system has been used for a prolonged period of time, the cooler will be contaminated by dirt, and the cooling performance drops. As a result, the temperature of the fresh water rises abnormally (higher than 85 °C). To avoid such a problem, cleaning is required. Ask the dealer to clean and service the seawater system.

Schedule	Every 1000 service hrs (or 5 or 6 months)

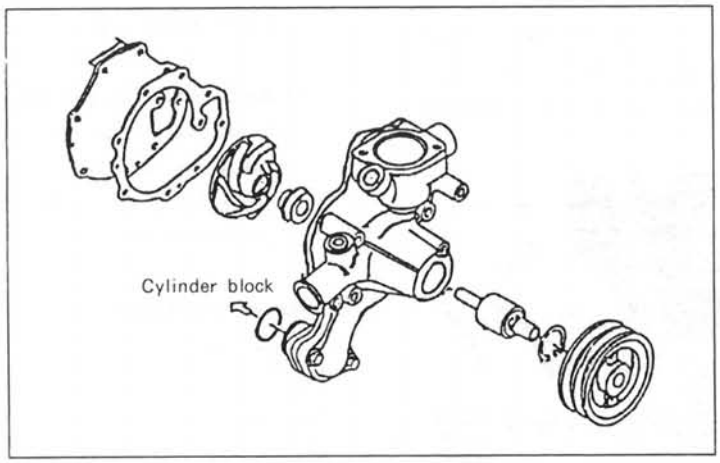
4) Checking the fresh water level

(1) Checking the fresh water level in tank

Remove the pressure cap from the fresh water tank, and check the water level in the tank. Normally, the tank should be filled to

its maximum capacity. If the water level is low, add water to fill up the tank.

Fresh water system



(2) Checking the fresh water level in subtank

Normally, the fresh water tank should be filled to its maximum capacity, and the water level in the subtank to at least the lower limit level mark. If the water level in the subtank is below the lower limit level mark, add water so that the water level reaches the upper limit level mark.

⚠ Important:

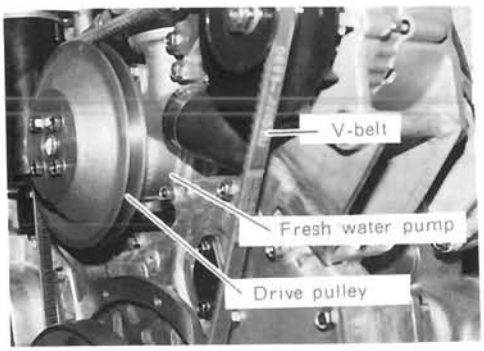
1. If water is left in the subtank even though the water level in the fresh water tank is lowered, the rubber rubber joint between the fresh water tank and subtank may be loosened or the pressure cap may be damaged. In this case, consult the nearest YANMAR dealer.
2. Checking the volume of the fresh water only by the water level in the subtank is unreliable. Check the water levels in both the fresh water tank and the subtank.

Inspection schedule	Daily

5) Checking of water leakage from fresh water pump

Water leakage from the fresh water pump may cause serious problems such as engine seizure.

Check that water is not leaking from the water leakage pipe of the fresh water pump. If water has leaked from the leakage pipe, consult the nearest YANMAR dealer.



Inspection schedule	Daily

6) Cleaning the fresh water cooler and thermostatic valve

When the fresh water cooler has been used for a prolonged period of time, the cooler will be contaminated by dirt. As a result, the temperature of fresh water rises abnormally (higher than 85 °C), and the cooling performance drops. Be sure to clean the fresh water cooler at the regular time intervals.

At the same time, also clean the thermostatic valve.

Consult your nearest YANMAR dealer for maintenance service.

Schedule	Every 1000 service hrs (or 5 or 6 months)

7) Changing the fresh water

Schedule	Every 1000 service hrs (or 5 or 6 months)

(1) Application of antirust agent

Fresh water forms deposits of scales and rust on the fresh water passage, which lowers the cooling performance. Add YANMAR ANTIRUST to the fresh water. When adding antirust, use the following mixing ratio:

Mixing ratio

YANMAR ANTIRUST: 1

Fresh water: 10

(2) Application of antifreeze

In cold areas where cooling water may freeze, be sure to add YANMAR ANTIFREEZE to the fresh water. Do not add an excessive volume of anti-freeze.

Use of antifreeze

Lowest ambient temperature (°C)	−5	−10	−15	−20	−25	−30	−35	−40
Ratio to fresh water volume (%)	15	25	30	35	40	45	50	55
Antifreeze volume (ℓ)	3.5	5.8	6.9	8.1	9.2	10.4	11.5	12.7

8-4 Checking and Adjusting the Engine Parts

1) Checking and adjusting valve arm lubrication

After starting the engine, keep the engine at a low speed (approx. 500 rpm) and remove the valve arm chamber lid to check that the valve arm is sufficiently lubricated.

If the valve arm is not lubricated, consult the nearest YANMAR dealer.

Lubrication of external parts

Lubricate the regulator lever of the fuel oil pump, clutch lever, and ball joint of the remote control cable.

8-5 Checking the Reduction and Reversing Gear

1) Checking the lube oil level and replenishing the lube oil

Before start-up, remove the dipstick and check that the oil level is at the midpoint between the upper and lower limit marks. If the oil level is below the midpoint, replenish the lube oil.

For the check and replenishment methods, refer to Sec. 5-12.

Inspection schedule	Daily (before start-up)

2) Changing the lube oil

Change the lube oil while the engine is still warm after shutdown.

In this condition, the oil flows smoothly and can be drained completely.

To remove the waste oil, pump up the oil by connecting the hose of the engine waste oil pump to the dipstick guide, or drain the oil by loosening the drain plug on the clutch case.

For details on oil supply, refer to Sec. 5-2.

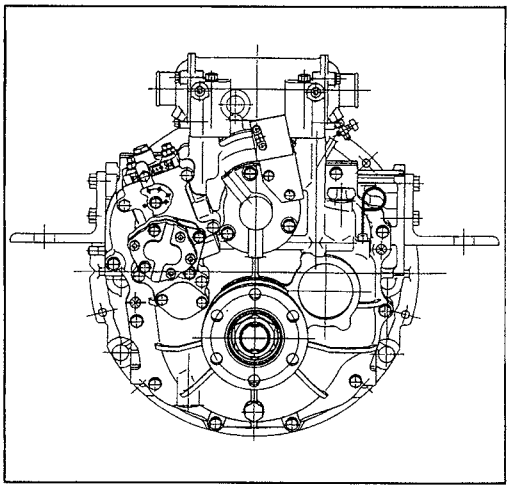
Amount of the lube oil at the upper limit marker on the dipstick	KMH6A	3.5 ℓ

Schedule	1st change : At 50 service hrs 2nd change : At 250 service hrs 3rd and subsequent change : Every 1000 service hrs (or 5 or 6 months)

3) Checking and cleaning the lube oil filter

Remove the filter from the clutch case, and wash it with clean oil.

Before you clean the lube oil filter, consult the nearest dealer.



Inspection schedule	1st inspection : At 50 service hrs after overhauling 2nd inspection : At 250 service hrs after overhauling 3rd and subsequent inspections : Every 1000 service hrs (or 5 or 6 months)

4) Checking and cleaning the oil cooler

Consult the nearest dealer.

Inspection schedule	Every 2500 service hrs (or annually)

5) Checking and replacing the bearings, friction plate, rubber block, and seal

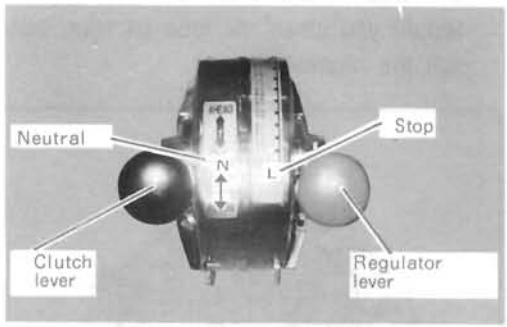
Consult the nearest dealer.

Schedule	Every 6000 service hrs (or 4 years)

8-6 Adjusting the Remote Control Cable

1) Adjusting the regulator lever

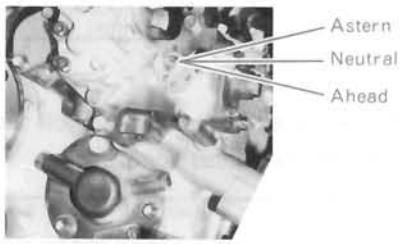
Shift the regulator lever from the DECEL position to the ACCEL position, and check that the corresponding lever position is indicated in the wheel house. If there is any difference in indication, adjust the regulator lever by using the cable adjustment bolt.



2) Adjusting the clutch lever

Operate the clutch lever to the AHEAD, NEUTRAL and ASTERN positions, and check that the lever for the reduction and reversing gear moves firmly to the intended position. If the lever does not operate properly, adjust the lever by using the cable adjustment nut.

Controlled by remote control lever



3) Adjustment of trawling lever

Operate the trawling lever, and check that the lever for the clutch comes in contact with the stopper when the trawling lever is set to the H and L positions. If the lever does not operate properly, adjust the lever by using the cable adjustment nut.

Adjustment schedule	1st adjustment	At 50 service hrs (or 1 month)
	2nd and subsequent adjustments	Every 500 service hrs (or 2 or 3 months)

8-7 Checking the Electrical Parts

Warning:

Disconnect the terminals from the battery before inspecting electrical parts.

1) Checking the alarm lamps

2) Checking the alarm devices

For details of the procedures for checking the alarm devices, refer to Sec. 5-9 and 5-10.If any abnormality is found, consult the nearest YANMAR dealer.

Inspection schedule	Daily

3) Checking the battery electrolyte

The volume of electrolyte gradually decreases through repeated charging and discharging. (In particular, the amount of decrease is larger in hot weather than cold weather.)

Before starting up, check the level of the battery electrolyte. If the level is lower, add commercially-available distilled water.

Inspection schedule	Monthly

Warning: Handle the battery with utmost care. If you accidentally touch the battery liquid, wash it away completely with water.

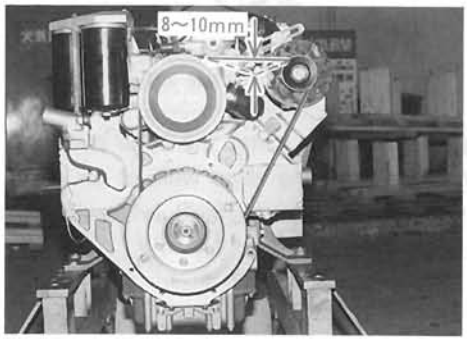
4) Checking and adjusting the alternator (generator) drive belt tension

The tension of the V-belt that drives the alternator (generator) should be correctly adjusted. Excessive tension may accelerate wear of the belt. In contrast, a loose belt may cause pulley slippage, with the result that power is not generated.

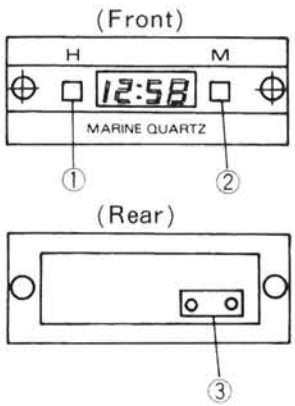
(1) To exert tension on the V-belt, loosen the fastening bolt shown in the photo below and pry the alternator away from the engine. To loosen the belt, loosen the fastening bolt and push the alternator toward the engine block.

(2) Do not handle the belt with greasy hands or allow any oil to come in contact with the belt. Oil on the belt will cause the belt to slip.

Belt tension	Approx. 8~10 mm or less deflection
Inspection schedule	Every 500 service hrs (or 2 or 3 months)



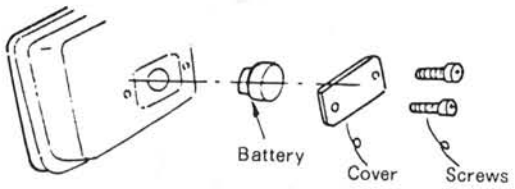
5) Handling of liquid crystal display clock



No.	Name	
1	Hour adjustment	Pressing this pushbutton advances the hour.
2	Minute adjustment	Pressing this pushbutton advances the minute.
3	Battery box	Silver oxide battery G13 × 1

Replacing the battery

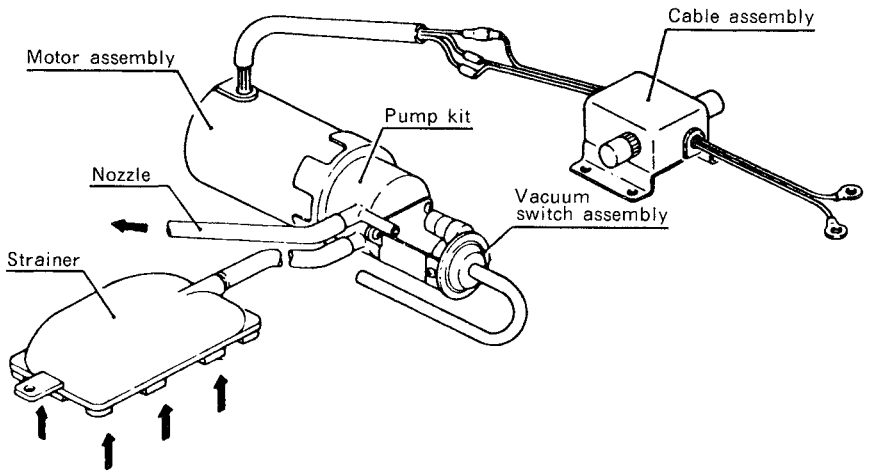
Use silver oxide battery G13.



Replace the battery every 2 years.

- Insert the battery with the "+" side forward, and close the cover. Then adjust the hour and minute of the clock.

Handling of Electrical Bilge Pump



1) Features

(1) The bilge pump is durable, because it consists of vinyl chloride, acidproof, and alkaliproof materials where in contact with bilge.

(2) To prevent the bilge pump from seizure caused by non-load operation, the pump is designed to stop when no bilge water is pumped.

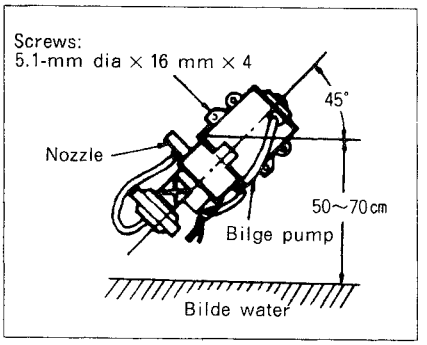
2) Installing and operating the bilge pump

(1) Connect the red wire to the "+" terminal and the black wire to the "-" terminal.

(2) The bilge pump has a 3-m cable. Install the pump on an appropriate position according to the positions of the battery, pump, and switches.

(3) Install the strainer of the bilge pump on the bottom of the boat where there is much bilge water. Firmly secure the strainer using the fixing metals.

(4) Press the start switch of the bilge pump, and the pump will start discharging the bilge overboard. Since the pump automatically stop operating, you do not have to hold the start switch for a long time.



⚠ **Important:** Install the bilge pump 50 to 70 cm above the bilge well, at an angle of 45 with a horizontal level, while the nozzle directed upward.

8-9 Checking the Turbocharger

1) Cleaning the turbocharger blower

(1) Hints on cleaning schedule

Cleaning schedule	When the intake pressure lowers approx. 10% compared with that of the test run, or every 250 service hrs (or monthly)
Remarks	Example : Intake pressure in test run : 1.8 kg/cm² (at 3200 rpm) If intake pressure lowers to 1.5 kg/cm² (at 3200 rpm), clean the blower.

2) Procedures for cleaning

Step 1

While operating the engine under a normal load (3/4 to 4/4 load), inject detergent using a 50-cc oiler (commercially-available gasoline supply container, etc.) for approximately 10 seconds.

Step 2

After adding the detergent, wait 3 to 5 minutes to allow dirt to dissolve, and then add 50 cc of water over approximately 10 seconds, using a vinyl container or the like.

Step 3

Do not supply all the volume of detergent or fresh water at once. Otherwise, too much detergent and fresh water may momentarily flow to the turbocharger, and may cause blower blade fracture or other troubles. Be sure to use the appropriate volume of detergent and fresh water, and conform to the specified injection time.

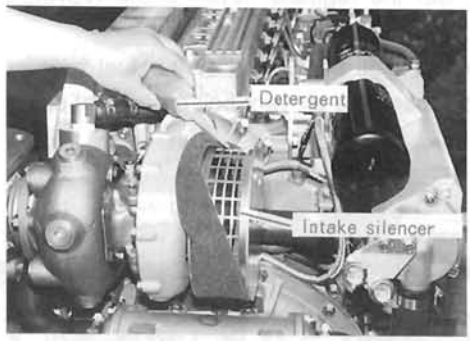
Step 4

If the air intake pressure or exhaust temperature does not change before and after cleaning, repeat the above cleaning procedures 10 minutes later.

If no change occurs after repeating the cleaning 3 or 4 times, the blower may have been excessively contaminated, or other problems may have been occured. In this case, overhaul and clean the blower.

Step 5

After cleaning, operate the engine under a normal load for at least 15 minutes to dry the blower.



3) Checking the connection parts

For details on checking the connection part, refer to Sec. 3 "Precautions".

Inspection schedule	Daily

4) Checking operation of the major parts

Consult the nearest YANMAR dealer.

Schedule	Every 2500 service hrs (or annually)

Air Cooler

1) Replacement of anticorrosion zinc

For details on replacement of anticorrosion zinc, refer to Sec. 8-3.

Inspection schedule	Every 500 service hrs (or 2 or 3 months)

9. EASY TROUBLESHOOTING GUIDE

9-1 Air Is Mixed in Fuel System

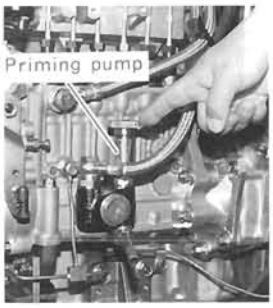
The fuel system includes the fuel tank, oil-water separator, fuel oil filter, feed pump, fuel injection pump, high pressure pipe and fuel injection valve.

If air enters this system, fuel oil cannot be injected. Completely bleed air from the fuel system by using the following procedure:

(1) Set the regulator lever to the NORMAL position.

(2) Open all the valves of the fuel system.

(3) Loosen the air vent bolt of the fuel pump.



(4) Operate the priming pump attached to the side of the fuel pump. (Turn the knob counterclockwise, and the piston of the priming pump will move up and down.) Check that fuel oil flows out of the air vent hole and air is completely purged, and then tighten the air vent bolt. Also turn the knob of the priming pump clockwise to lock it. (Photo above)

(5) Loosen the cap nut of the high-pressure fuel pipe. While turning the flywheel by running the starting motor, check that fuel flows out of the cap nut portion, and then tighten the cap nut. Repeat this procedure for all cylinders.

(6) After bleeding air from all the cylinders, turn the flywheel, and check that fuel is being injected by the sound Brr! Brr! the injectors generate.

9-2 Pressures of Engine Lube Oil Is Abnormal

The engine lube oil pressure has been factory-adjusted before shipping. Normally, therefore you need not readjust them. However, if the lube oil pressure is not normal (4.5 to 5.5 kg/cm^2) or if the LUB-OIL PRESS alarm lamp does not go out, consult the nearest YANMAR dealer.

9-3 Fresh Water Temperature Is Abnormally High

If the fresh water temperature exceeds 90℃, the following problems may be affecting the fresh water system or seawater system.

(1) The fresh water passage is blocked due to failure of the fresh water pump or clogging of the fresh water passage.

(2) Fresh water does not circulate through the cooler due to malfunction of the thermostat.

(3) The flow rate of fresh water is reduced due to failure of the seawater pump or clogging of the seawater passage.

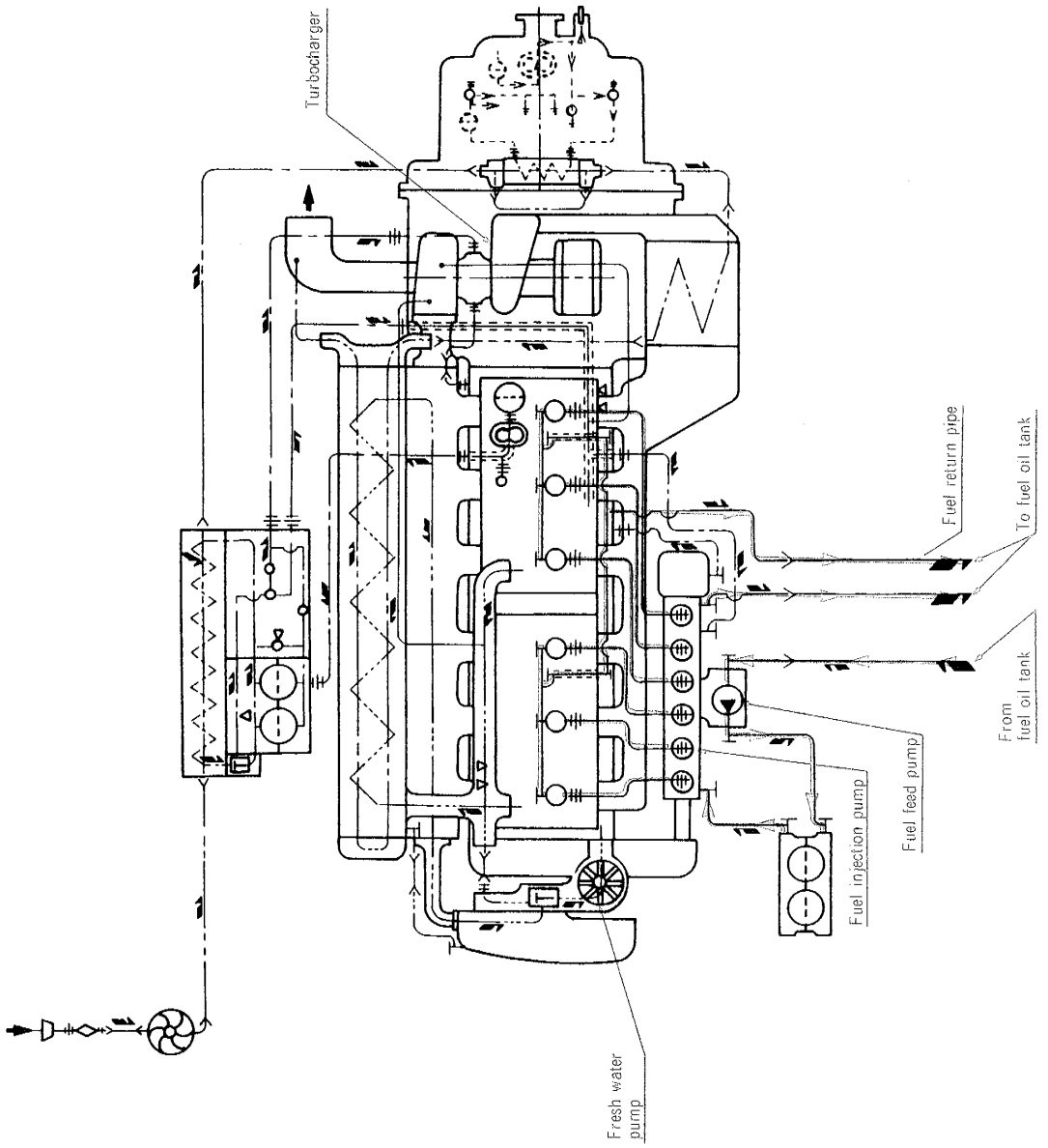
(4) Fresh water is not cooled due to contamination of the cooler. In this case, consult the nearest YANMAR dealer.

Clutch Oil Pressure Is Abnormal

The clutch oil pressure has been factory-adjusted before shipment.
However, if the slipping of the clutch should be caused by a drop in clutch oil pressure, temporarily tighten the emergency bolt, and the boat can sail ahead.
For details on the emergency bolt, refer to Sec. 7-4.
The LUB-OIL PRESS alarm lamp may light when the engine speed is rapidly reduced. Note that this is not abnormal.

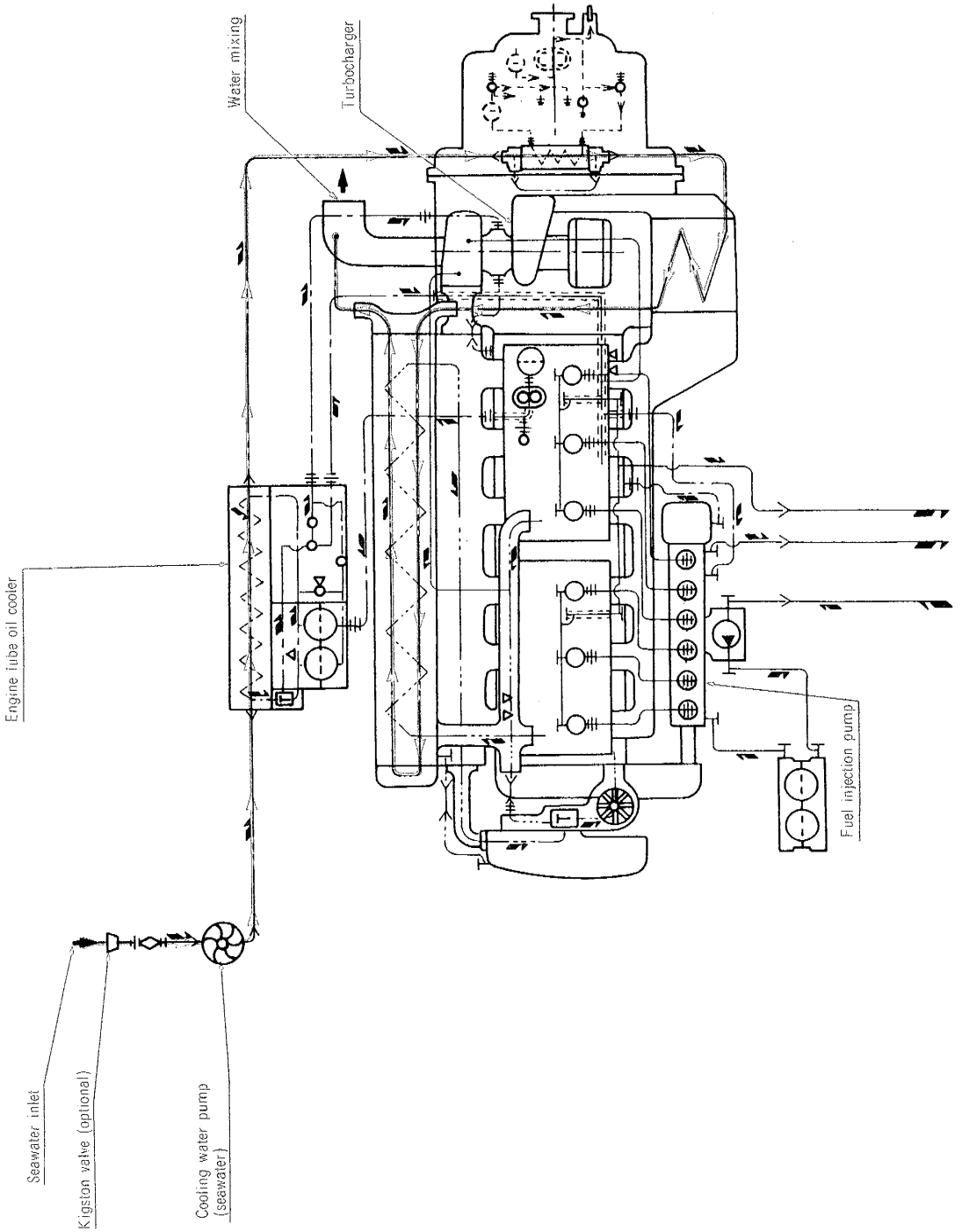
10. SYSTEM DIAGRAMS

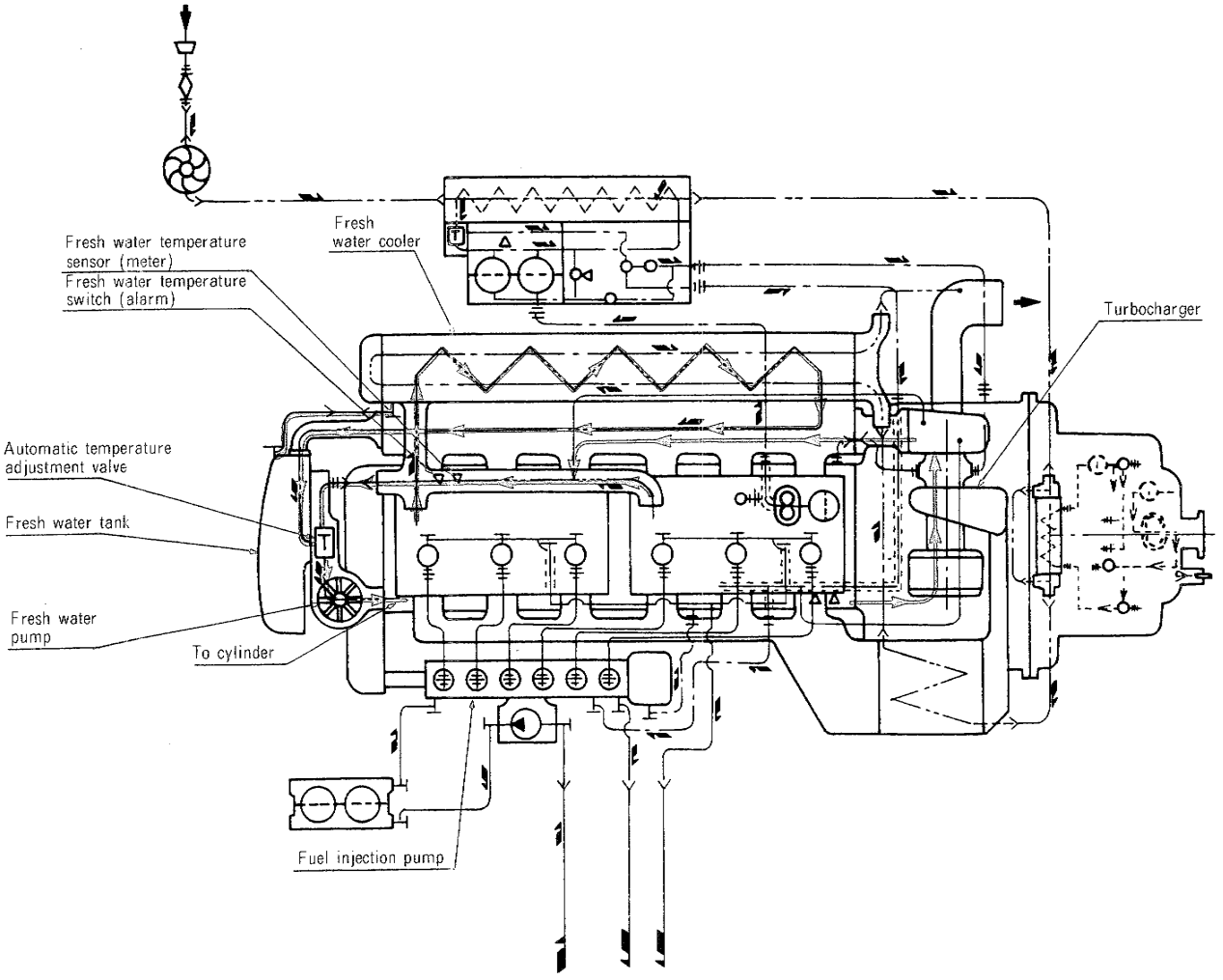
1) Fuel oil system diagram



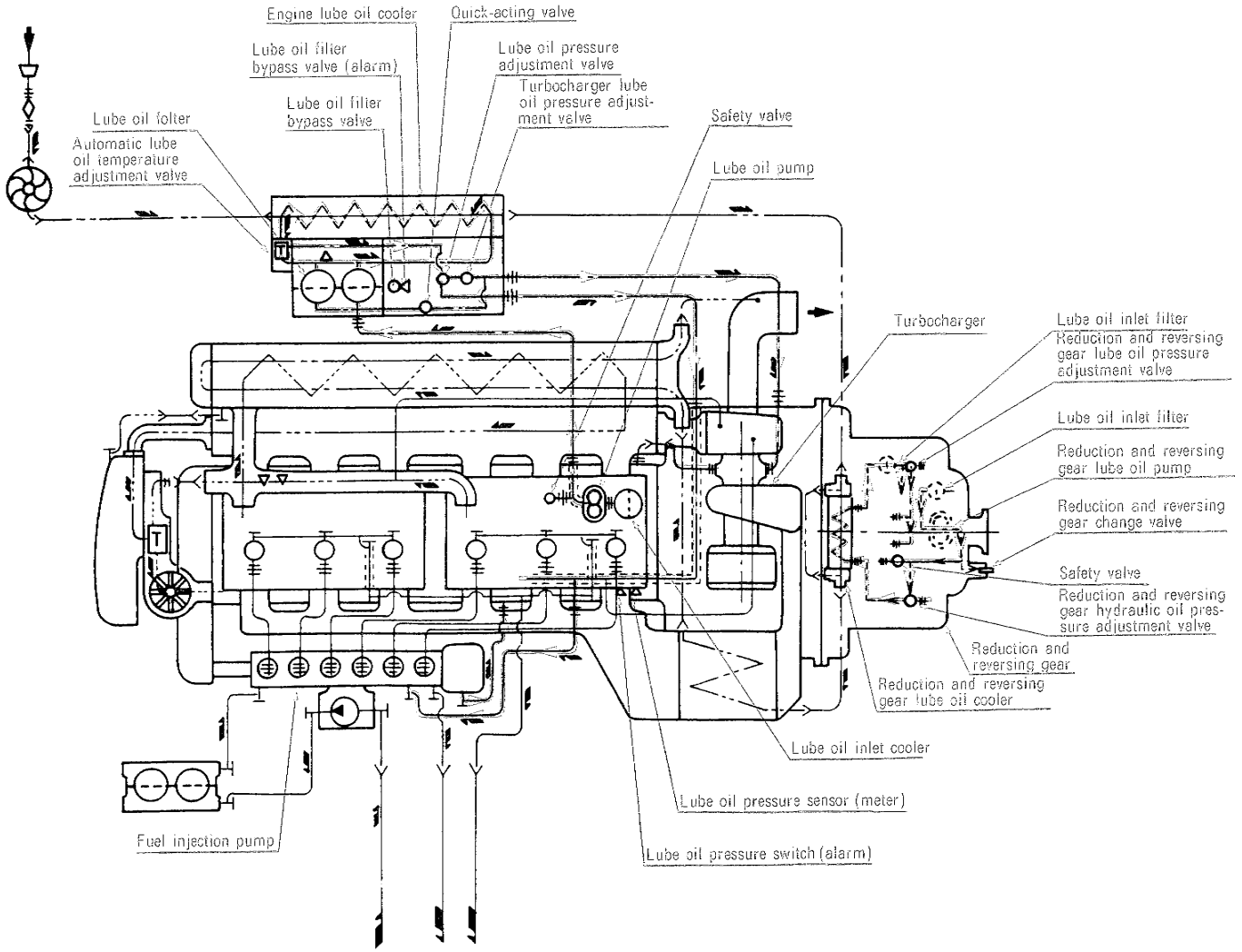
2) Cooling water system diagram

2)-1 Seawater system

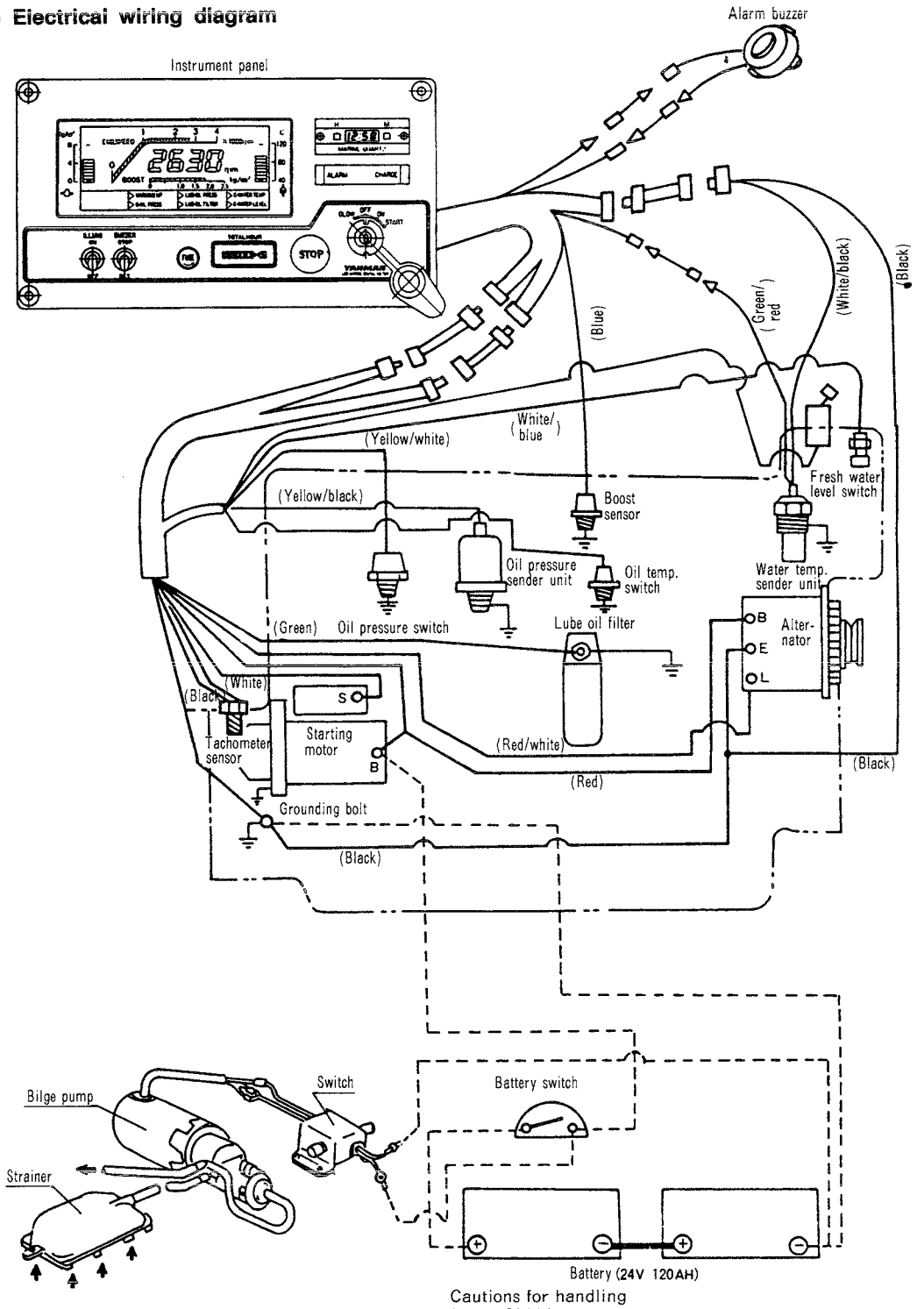



Fresh water temperature sensor (meter)
Fresh water temperature switch (alarm)
Fresh water cooler
Turbocharger
Automatic temperature adjustment valve
Fresh water tank
Fresh water pump
To cylinder
Fuel injection pump

3) Lube oil system diagram



4) Electrical wiring diagram



Notes
1. Cables indicated by dotted lines (- - - - -) shall be connected by the Purchaser.
2. The same color cables shall be used from the instrument panel to the engine via the cable junction assembly.
3. The cables used for the instrument panel shall be AV 0.5 (red/black) , unless otherwise specified.

Cautions for handling
1. Use 24-V battery.
2. Before you connect the cables, be sure to turn off the battery switch.
3. Do not connect cables to wrong terminals.
4. Do not turn off the battery switch during engine operation.
5. Before starting quick charge, be sure to turn off the battery switch.

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