YANMAR

OPERATION MANUAL

4JM-TE

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MARINE DIESEL ENGINE

MODEL 4JM-TE

Thank you for purchasing your YANMAR DIESEL ENGINE

This manual describes the various engine parts and prescribes simple steps for normal engine maintenance.
Before starting up your new engine, we recommend that you read this manual carefully to insure proper handling and use. If you have any questions, please contact your nearest dealer or sales outlet.
Because of our continuing efforts to improve quality and performance, engine parts may sometimes be changed. This may result in some discrepancies in this manual.

⚠CAUTION

This safety alert symbol indicates important safety messages. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

IMPORTANT

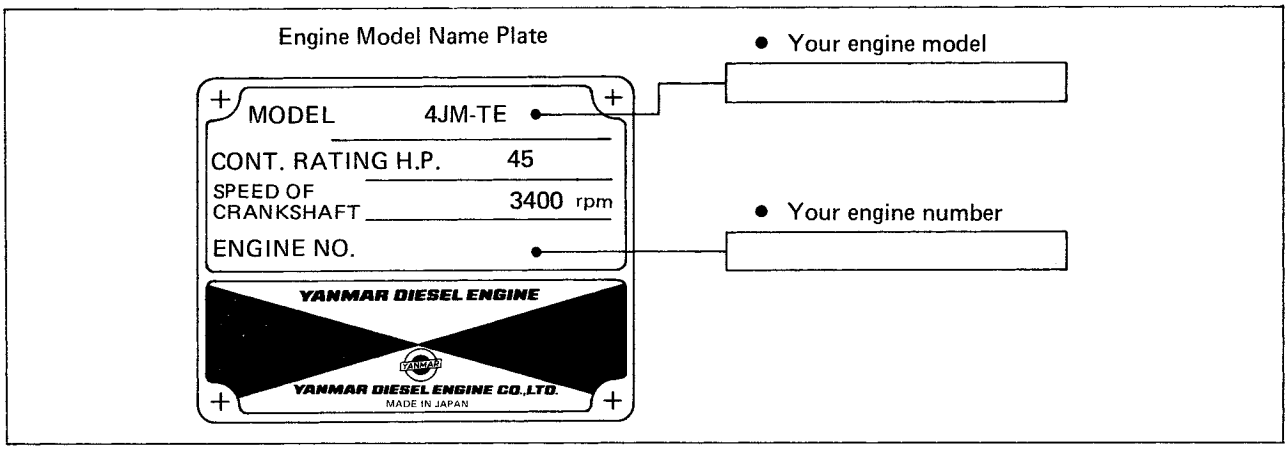
This stop symbol indicates important operation information. When you see this symbol, carefully read the message that follows.

REMARKS:

The marine gearbox used in Model 4JM-TE is not of Yanmar make. Please note that the marine gearbox is not covered by Yanmar's warranty.

CONTENTS

To insure that you get the proper parts, we need accurate data on your particular engine. The information needed is outlined in the illustration below. For handy reference, please record the information in the spaces provided under the illustrations.

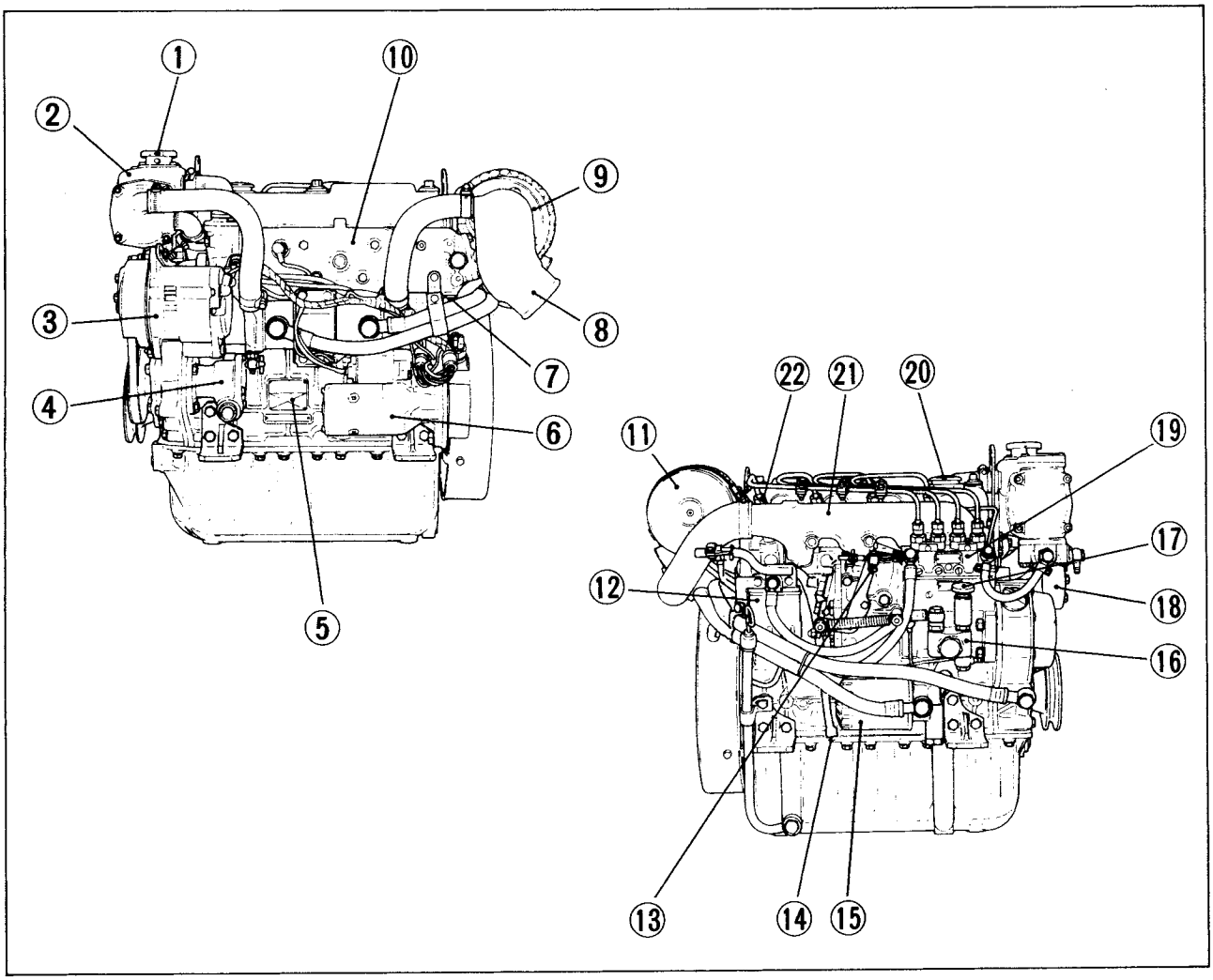


NOTE: *The output indication on the engine name plate (Cont. rating 45HP/3400 rpm, DIN.6270A) conforms with the Export Inspection Regulations of Marine Propulsion Engines of the Japanese Government. Model 4JM-TE however has a rated output of 50HP/3600 rpm (DIN.6270B rating).*

I. Engine specifications

Model		4JM-TE (without marine gear box)
Type		Vertical 4-cycle turbo-charged water-cooled diesel engine
No. of cylinders		4
Continuous rating output (DIN 6270A) Hp/rpm		45/3400
1-hr rating output (DIN 6270B) Hp/rpm		50/3600
Combustion system		Swirl chamber type
Firing order		1–3–4–2 (bTDC 7.5±1)
Turbocharging system		Exhaust turbocharger
Direction of rotation	Crankshaft	Counter-clockwise viewed from flywheel
Lubricating system	Engine	Forced lubrication with internal gear pump
Lube oil capacity	Crank case	7ℓ
Cooling system		Fresh water cooling by centrifugal pump with heat exchanger
Cooling water capacity	Water tank	5.5ℓ
	Sub-tank	0.8ℓ
Starting system		Electric
Electrical equipment	Starting motor	12V – 1.8kW
	Alternator	12V – 55A
Dry weight kg (lbs)		227 (500)

II. Names of parts



No.	Names of Parts	No.	Names of Parts
1	Pressure cap (water feed port)	12	Fuel oil filter
2	Fresh water tank (fresh water cooler)	13	Speed control lever
3	Alternator	14	Oil dipstick
4	Cooling water pump (sea water)	15	Lube oil filter
5	Engine model name plate	16	Fuel feed pump
6	Starting motor	17	F.O. priming knob
7	Exhaust manifold water drain plug	18	Cooling water pump (fresh water)
8	Mixing elbow	19	Fuel oil injection pump
9	Turbo-charger	20	Lube oil feed port
10	Exhaust manifold	21	Air intake manifold
11	Air intake silencer	22	Fuel injection valve

III. Engine installation

3-1. Inspection after unpacking

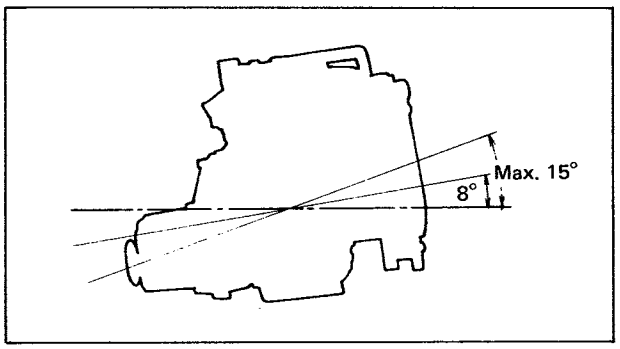
When unpacking the engine, be careful not to break the engine base.

Check the following points:

1. Have any nuts or bolts become loose or fallen off?
2. Have any parts become rusty?
3. Is there any water inside the engine?
4 Has any part of the engine been broken, chipped, or crushed?
5. Are any of the accessory parts/items broken or defective?

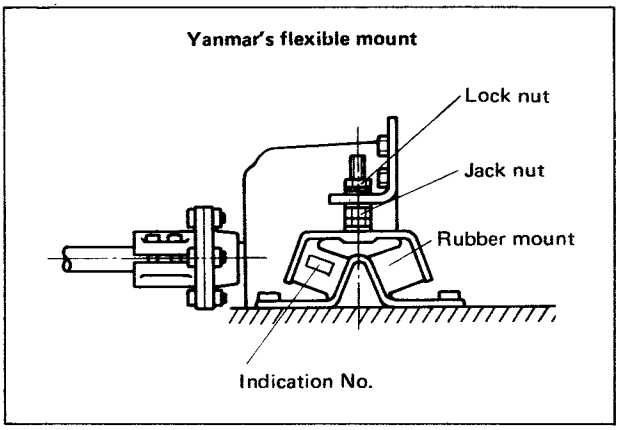
3-2. Preparation of the engine foundation plate

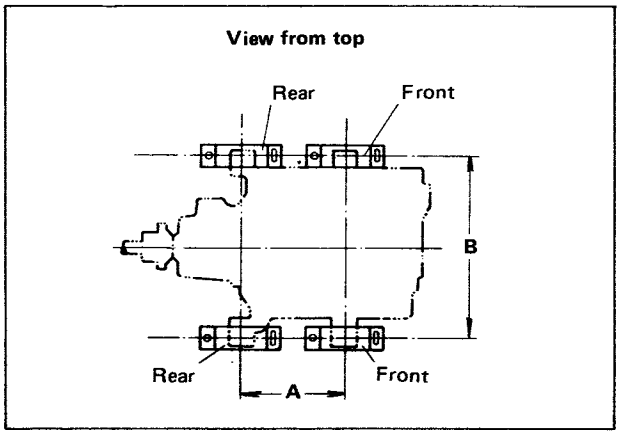
The installation angle will differ with the vessel configuration and installation location of the engine. The most suitable installation angle is 8 degrees and the maximum installation angle is 15 degrees. If the angle is larger, horsepower will be lost, engine parts will wear out faster and overall performance impaired.



3-3. Engine installation

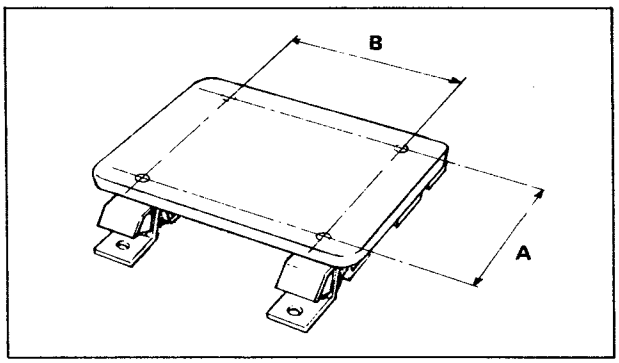
1. For engine installation, be sure to use the flexible rubber mount.
   Yanmar offers as an accessory flexible mounts which match the respective engine characteristics.



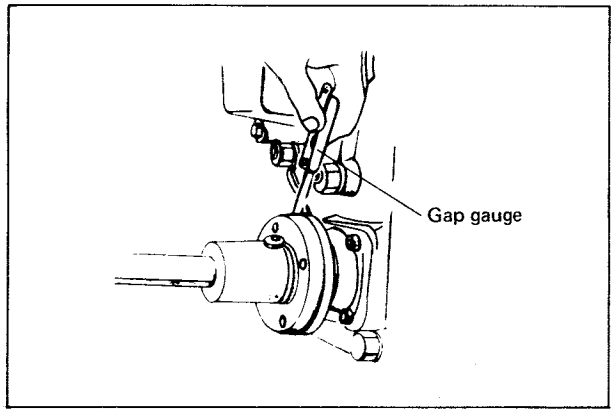


Engine model	Indication #		Installation distance (unit: mm)	
	Front	Rear	A	B
4JM-TE	150	150	510	470

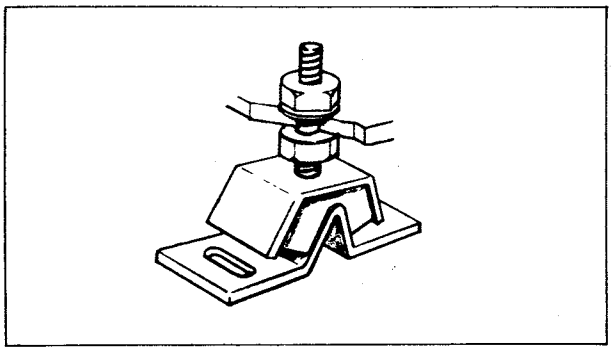
For convenient installation, make the GUIDE PLATE as illustrated.



2. Be sure the propeller shaft lines up with and matches both shaft joints. If necessary, adjust the height of the engine with a jack nut to line up the propeller shaft and the engine. Attach the propeller shaft and the intermediate shaft, if there is one, to the engine. With a gap gauge, measure the gap of the connection at the top, bottom, right, and left. The maximum tolerance should be less than 0.2 mm.
The lock nut should be as low as possible.



3. Tighten the installation bolts firmly and evenly. Do not force the bolts in if the propeller shaft does not line up.



IMPORTANT

After 50 hours of operation, make sure that the propeller shaft is still lined up, and readjust if necessary.

3-4. Propeller, propeller shaft

1. Select a propeller which is suitable for the size and shape of the vessel, as well as for its intended usage. A propeller that is too small or large will reduce the speed of the vessel and overload the engine, which may lead to engine breakdown. The best way to make sure ,the propeller fits the vessel is to conduct a test run after installation.

2. It is effective to use a suitable flexible stern tube to reduce vibrations.

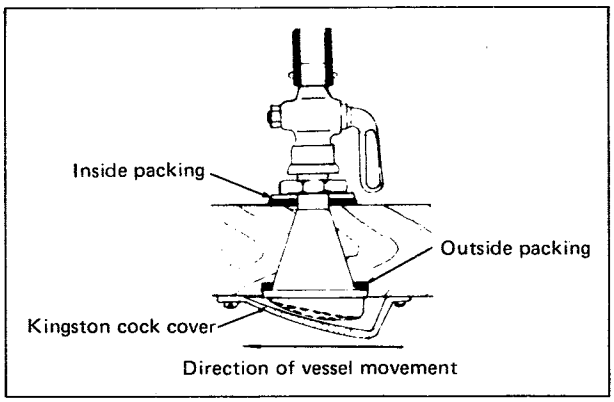
3-5 Cooling water supply device

1. The engine should be operated only after the cooling water piping is checked.

IMPORTANT

If the cooling water pump is operated without water, the rubber impeller inside the pump breaks.

2. Kingston cock installation. Install the canvas on the outside of the hull, and the canvas or rubber packing on the inside of the hull; tighten the kingston cock. Installation directions are given in the figure at the right. Install the kingston cock cover as shown.



3. Piping

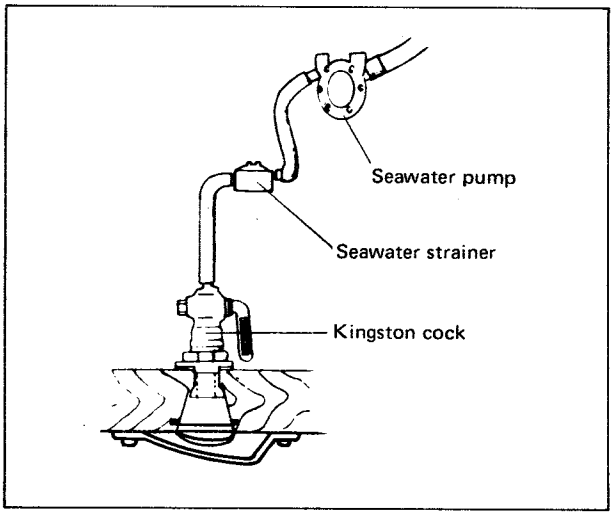
For the cooling water pipe, use a rubber hose with an inside diameter of 25.4 mm. Piping should be kept as straight and short as possible. If the pipe is too long, it will be difficult to draw water into the pump.

See Page 35 for piping diagram.

4. Connect the rubber hoses to the kingston cock, cooling water pump inlet, and engine cooling water outlet, and secure with hose clamps.

5. Seawater strainer

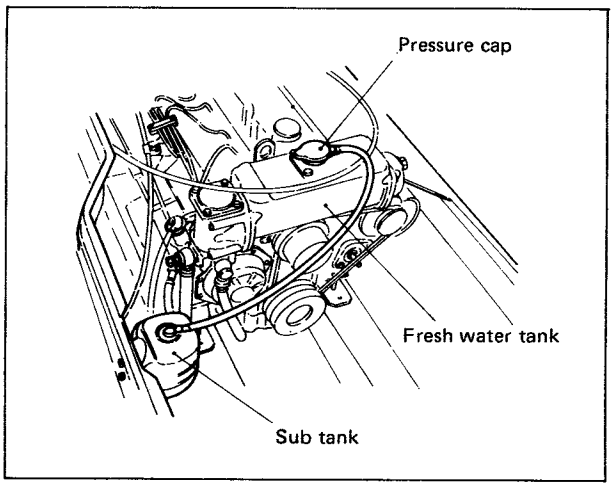
The seawater pump will be damaged if foreign matter is allowed to get into it. Therefore, attach a seawater strainer between the seawater pump inlet and the seawater cock when the seawater cock is not already so equipped.

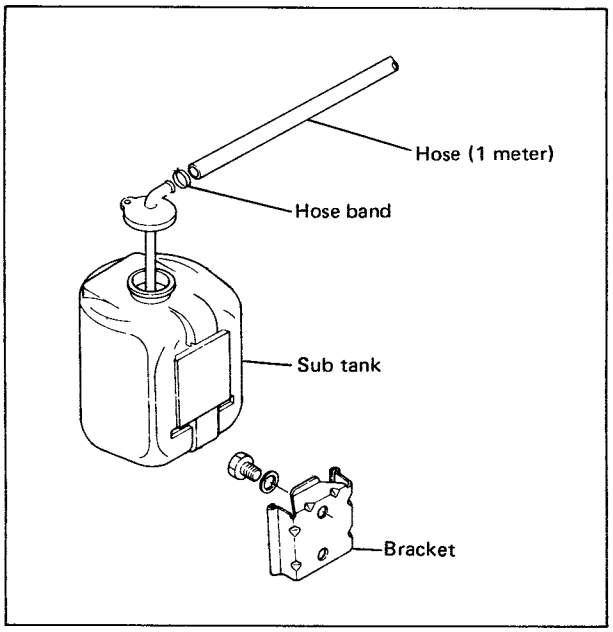


6. Sub-tank

When the engine is running, the fresh cooling water temperature rises. This is cooled by the fresh water cooler via seawater circulation. When the engine is overloaded, or operated continuously for long periods of time, the temperature of the fresh cooling water rises further and vapor develops inside the fresh cooling water system. When the vapor pressure rises to over 0.9 kg/cm^3, the pressure cap opens to release the vapor. The subtank provides additional fresh cooling water to make up for cooling water loss due to evaporation. Always keep the level of the water in the subtank between the "Low" and "Full" marks.

(Installation of subtank)
It is recommended that the subtank be installed so that the upper surface of the sub tank is at the same level as the upper surface of the heat exchanger (fresh water tank), or 100 mm below the upper surface of the heat exchanger.

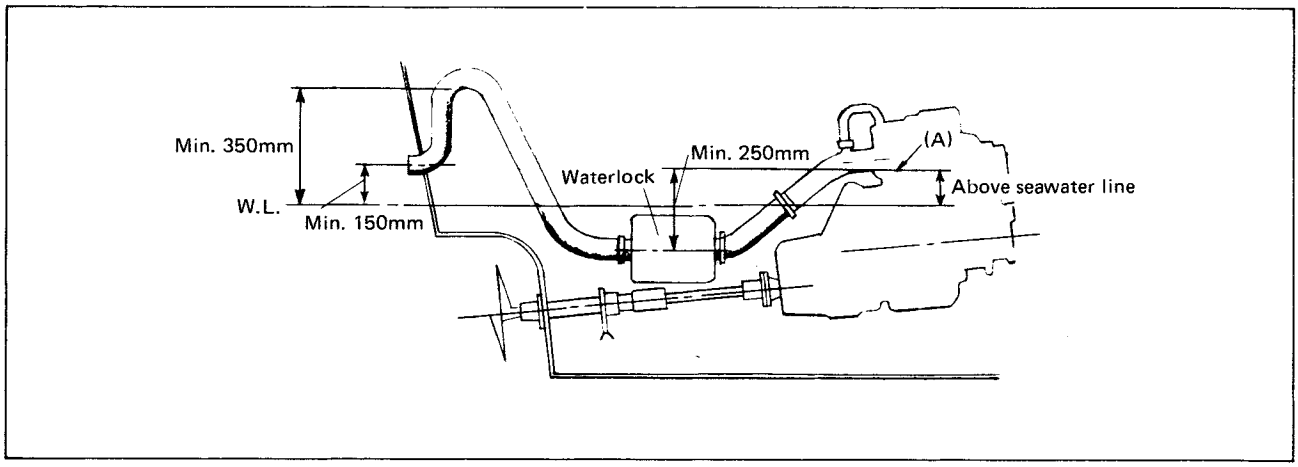




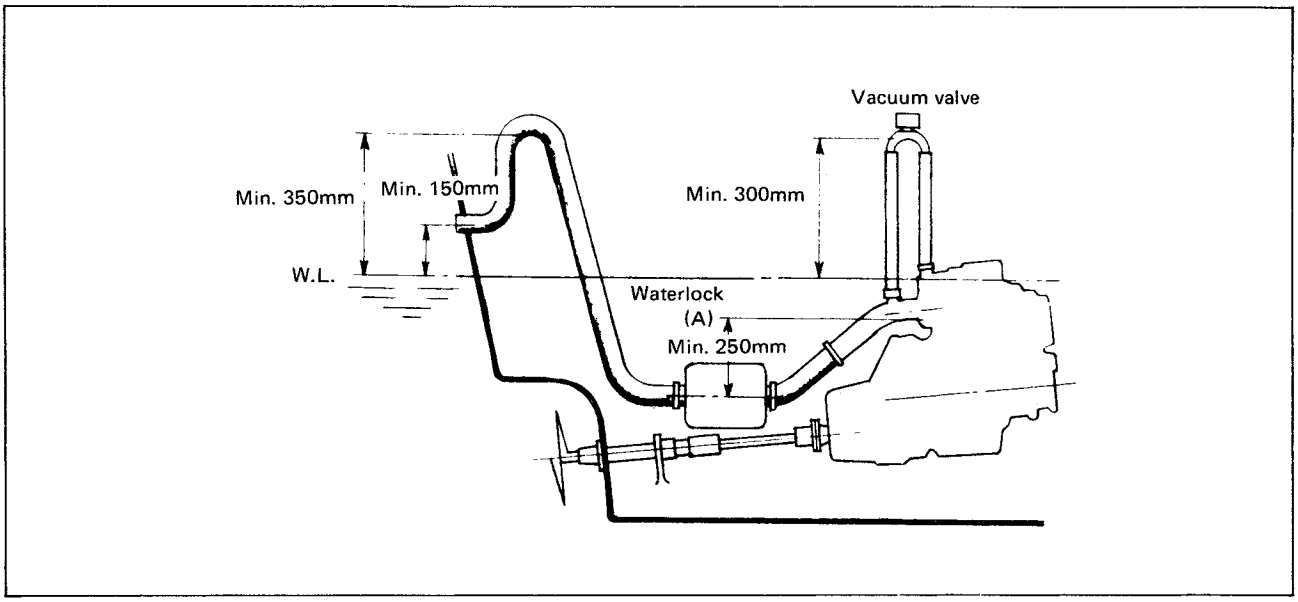
7. Exhaust pipe layout

Be sure to use the waterlock. Piping should be installed as shown in the following diagram.

(1) When the water outlet of the engine side (A) is above the water line.



(2) When the water outlet of the engine side (A) is below the water line.



8. Air ventilation and intake pipe

If the engine is run at below normal output, incomplete combustion can occur as a result of an over-heated engine room. Therefore, the engine room should be adequately ventilated.

IMPORTANT

During piping, cover the intake opening to prevent foreign matter from entering.

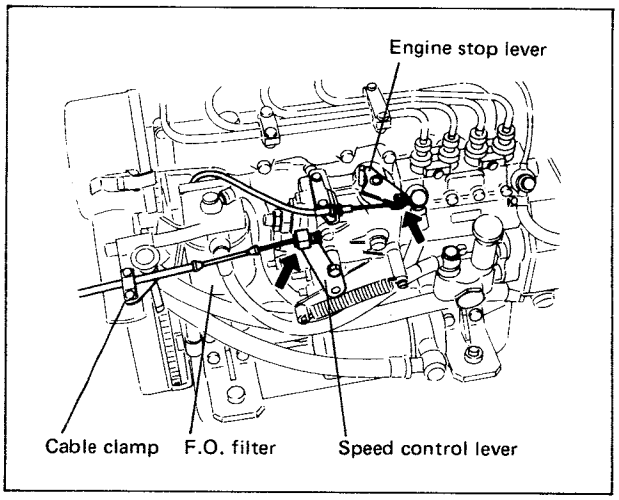
3-6. Remote control

1. Control cable

Recommended cable	Control cable	Cable clamp	Connecting metal fitting
Speed control	Morse 33-C	Yanmar made (Standard)	
Engine stop (option)	Yanmar made (1.5ϕ ~ 2.5ϕ)	–	–

2. Speed control

(1) A spring is attached to the connector to absorb shock when operating the speed control lever.
The wiring should be arranged so that the spring works when the throttle is "idling".



NOTE

1) Attach the wire to the cable clamp of the F.O. filter side.

2) The cable connector has M5 thread.

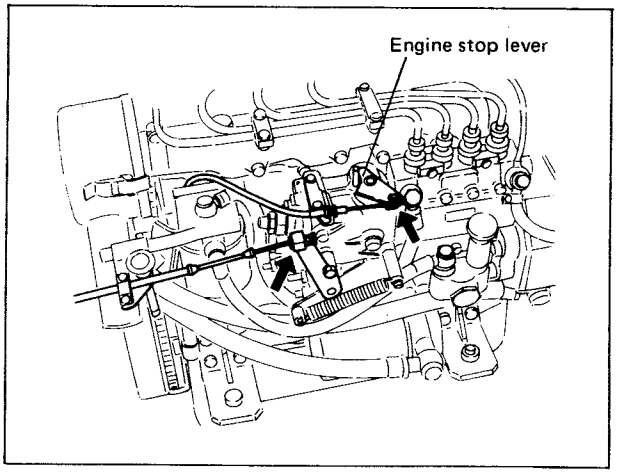
(2) After completing the wiring, check the following points:

a) The remote control lever and speed control lever should move smoothly throughout the stroke.

b) The idle speed adjuster should regulate the speed to 650 – 700 rpm, after all preparations for starting the engine have been completed.

3. Engine stop remote control

After checking the wiring, connect the engine stop remote control cable so that the stop lever moves smoothly throughout the stroke.



3-7. Recommended battery capacity

Use battery of sufficient capacity.

4JM-TE	12V – 100AH (mini.)

IV. After Launching

1. Check for water or air coming in around the gland part of the stern tube and the kingston cock fitting.
2. Make sure that the engine installation bolts and shaft joints are firmly secured.

V. Fuel and lubricating oil

5-1. Selection and handling of fuel oil

1. Choice of fuel oil

United States	ASTM/D975	No. 1-D or No. 2-D diesel oil
United Kingdom	BS2869	Class A1 or Class A2

Comparable fuel oils available in countries other than those listed above may be used.
Use the chart below to determine the correct grade of fuel.

Air temperature	Diesel/fuel (ASTM/D975)
Below 5°C (40°F)	1-D
Above 5°C (40°F)	2-D

(1) To further ensure satisfactory operation, use fuel with less than 0.5% sulphur content.

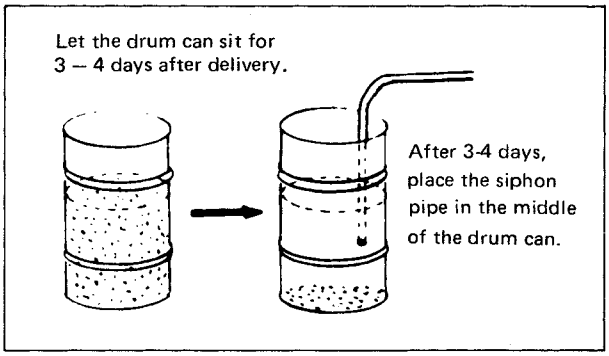
(2) For maximum filter life, sediment and water should not exceed 0.1%.

(3) To maintain proper fuel delivery during cold weather operation, use grade No. 1-D diesel fuel as defined in ASTM Designation D975 with a pour point at least 5.6°C (10°F) below the lowest outside air temperature.

(4) The cetane number should be 40 at minimum.
Low atmospheric temperature and high altitude operation may require the use of a fuel with a higher cetane number.

2. Storing fuel

Proper fuel storage is especially important.
Keep all dirt, water and other contaminants out of the fuel.
Avoid storing fuel over long periods of time.
Store fuel in a convenient place away from buildings.

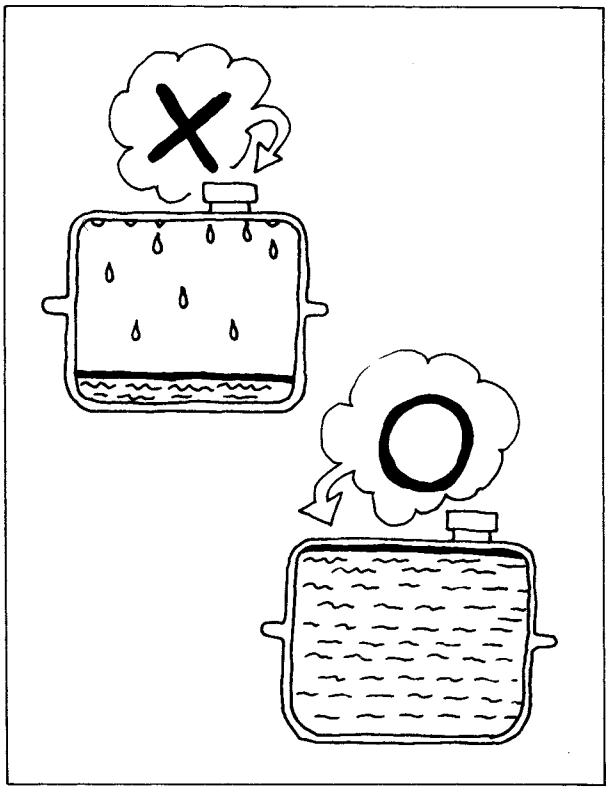


IMPORTANT

The presence of water or dirt in the fuel may cause failure of the engine and rapid wear of the fuel injection equipment. Water and dirt in the fuel tank should be filtered out before use.

3. After each day's operation

Fill the fuel tank at the end of each day's operation. This prevents condensation in the fuel tank.



5-2. Selection of lubricating oil

1. Choice of lube oil

Lube oil selection is very important to a diesel engine. If an unsuitable oil is used, or oil is not changed regularly, it may result in damage and shorter engine life.
When selecting the lube oil, choose from one of the following.

2. Kinds of lube oil

Choose a lube oil with API service classifications CD.

3. Lube oil viscosity

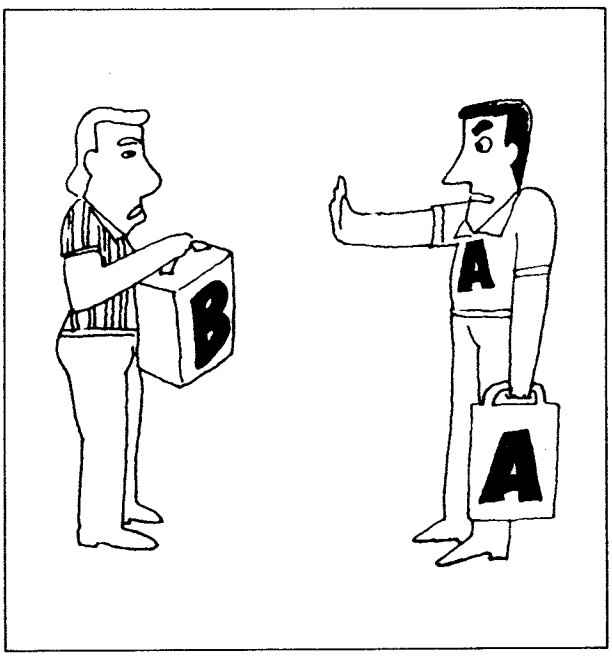
The viscosity of the lube oil greatly influences engine starting and running performance. The lube oil weight number should match the season and temperature.

Recommended SAE viscosity

SAE No.	SAE10W	SAE20 or 20W	SAE30	SAE40
Engine room temperature	0°C	15°C	30°C	45°C

NOTE

1) **When selecting a lube oil, consult your nearest Yanmar dealer if you are not sure which oil is best.**
2) **Use of lube oils below the recommended standards will significantly shorten engine life.**
3) **Do not mix different lube oils since this lowers lubricating effeciency.**



VI. Starting the new engine for the first time

IMPORTANT

Before starting the engine for the first time, carefully check the following:

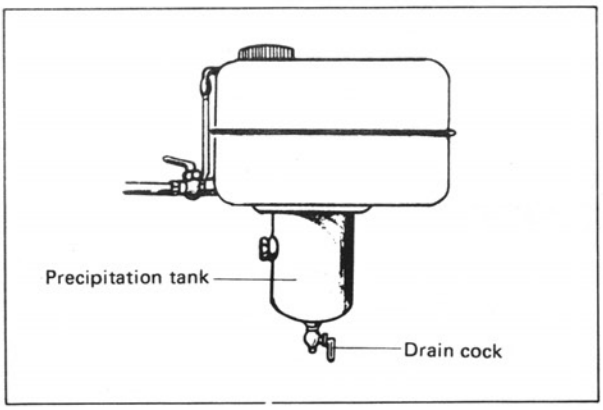
6-1. Supply of fuel oil

1. Add fuel to the fuel tank

When you add fuel from a storage tank, put the inlet of the syphon in the middle of the storage tank. Make sure foreign matter floating on the surface or sediment on the bottom of the storage tank do not get into the fuel tank.

2. Draining the fuel tank

Be sure to equip the fuel tank with a precipitation tank, as shown in the figure, and install a drain cock to remove any dirt and water that have accumulated in the fuel.
Before starting the engine, open the drain cock to remove any precipitation and dirt.

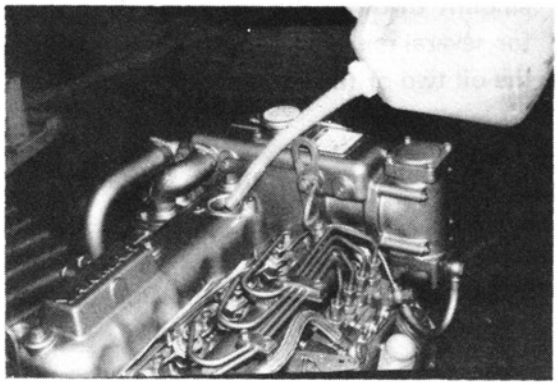


6-2. Supply of lubricating oil

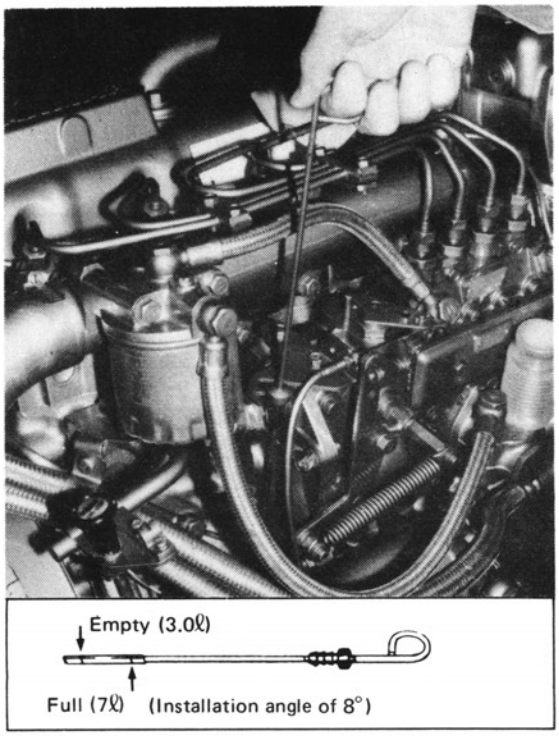
1. Lube oil to the crankcase

(1) Remove the lube oil supply port (yellow cap) and add the approved lube oil.

See page 10 for the approved lube oil.



(2) Check the amount of lube oil by inserting the dipstick as far as possible. The oil level should come up to the full mark.



Volume of lube oil when filled to the upper mark on the dipstick (with an installation angle of 8°).

ENGINE CRANKCASE	
4JM-TE	7ℓ

NOTE

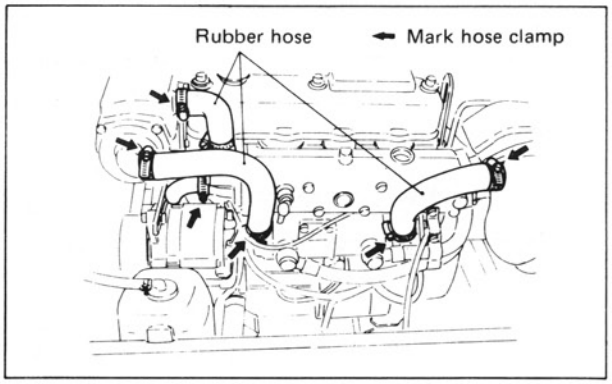
When running the engine for the first time, the lube oil flows to the piping thus reducing the

amount of oil in the crankcase. Run the engine for several minutes, then turn it off and re-check the oil two or three minutes later.

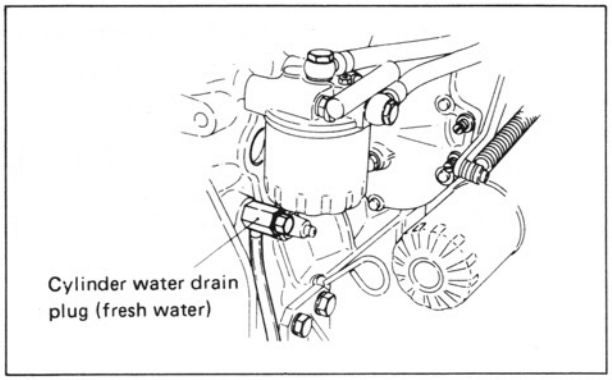
2. Supplying fresh water to the tank

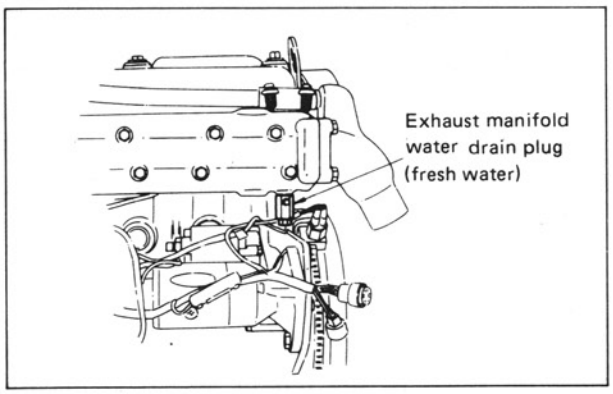
(1) Checks before supplying

a) Make sure the hose clamp on the fresh water line is tight enough.



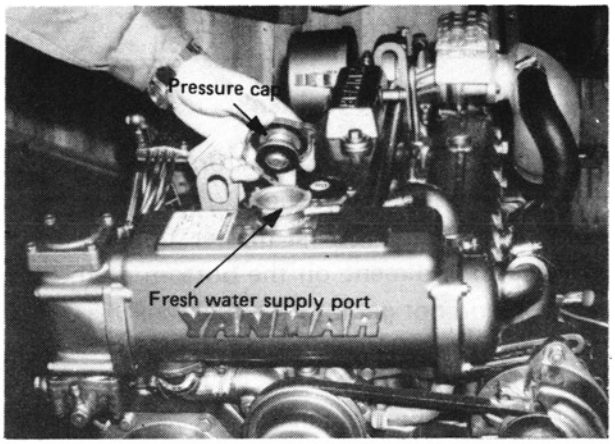
b) Make sure the drain plugs on the cylinder block and exhaust manifold are tight enough.

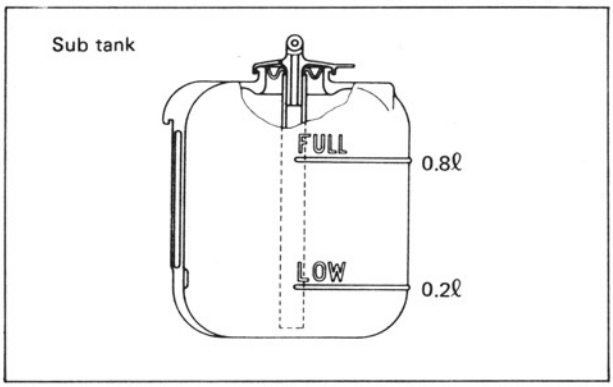




(2) Supplying water

Remove the filler cap (pressure cap) on the fresh water tank, and add water until it overflows from the port. For the sub tank, add water up to the full mark.





NOTE

Be sure to tighten the filler cap. If it is loose, water will be lost during operation, and hot water may boil over causing serious burns.

Be sure to use soft (tap) water and add anti-rust. If anti-rust is not added, scale and rust develop in the fresh water cooling system, lowering cooling efficiency.

In cold areas and during the winter, add anti-freeze, as well as anti-rust.

6-3. Bleeding air from the fuel system

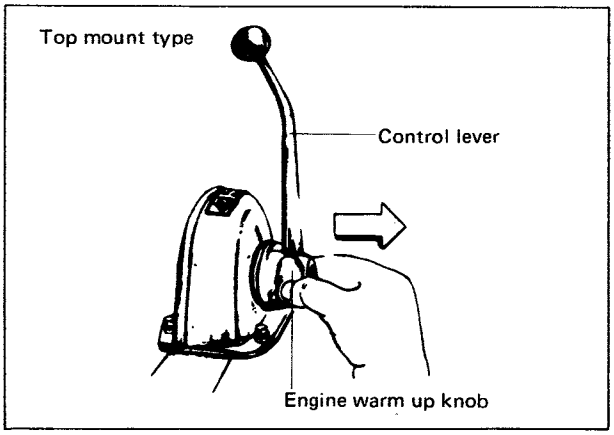
☞ **See page 22 for air bleeding procedures.**

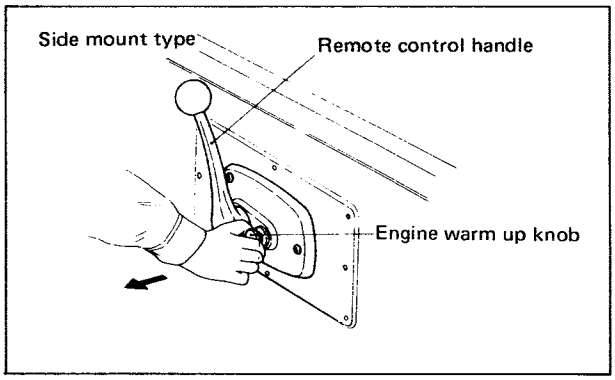
6-4. External inspection

1. Thoroughly check for loose nuts and bolts.
2. Check around the revolving parts and the upper part of the engine where jigs and other tools may have been placed and forgotten. Make sure the engine room is always kept neat and clean.

6-5. Remote control device check

1. Pull out the engine warm up nob, change the control lever from the "speed decrease" position to the "speed increase" position.





2. Check for slippage of the lever on the bridge and in the engine room, and adjust if necessary.

NOTE

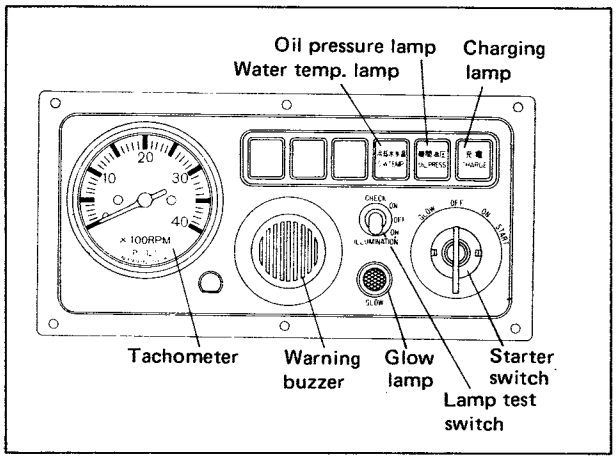
1) The knob for engine warm up can only be operated when the control lever is placed in the "Neutral" position.

2) Push the engine warm up knob back in, set the control lever to "Ahead", "Neutral", and "Astern", check for slippage in the engine room, and make necessary adjustments.

☞ **See page 29 for adjustment procedures.**

6-6. Checking the instrument panel alarm system

Turn on the battery switch. Then place the key in the "ON" position and check the condition of the lamps on the panel (with the engine stopped).



1. Lube oil warning lamp.
   Should be lit.
2. Cooling water temperature warning lamp.
   Should be out. Raise the CHECK switch to

"ON" to make sure the cooling water temperature warning lamp lights.

3. Charging warning lamp.
   Should be lit.

4. Warning buzzer.
   Should sound.

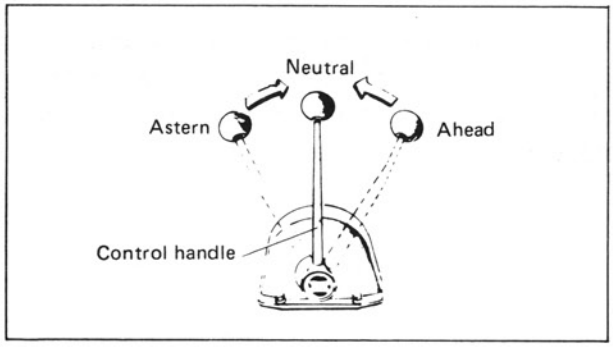
NOTE

All these signals will continue until the start button is pushed or the key is turned off.

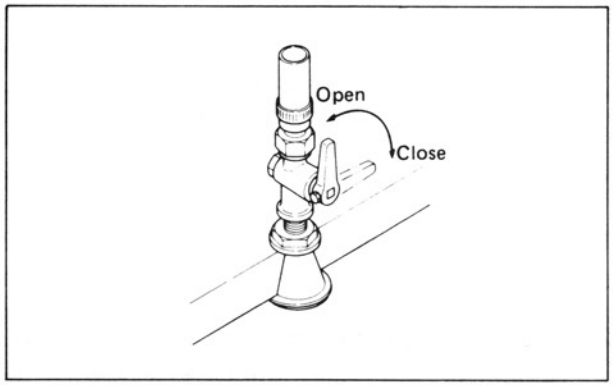
6-7. Turning

To allow the lube oil to reach all parts, turn in the following sequence.

1. Place the control lever in "NEUTRAL".



2. Open the kingston cock.



3. **Engine stop cable**

While pulling on the engine stop cable, insert the key into the starter switch, and turn it to "START". Run the engine for 3 – 5 seconds with the starting motor, and check for abnormal sounds.

⚠CAUTION

1) **Do not release the engine stop cable when handling the key.**

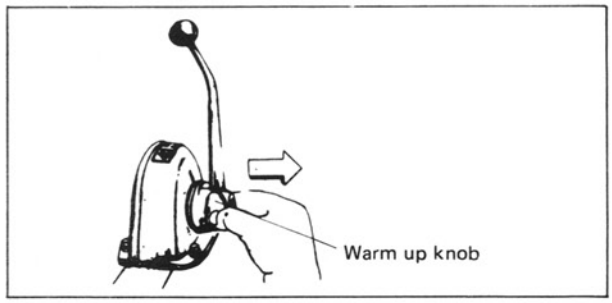
2) **Before starting the engine make sure there are no tools, etc. left in the engine area, especially in areas where there are revolving parts.**

VII. Method of operation

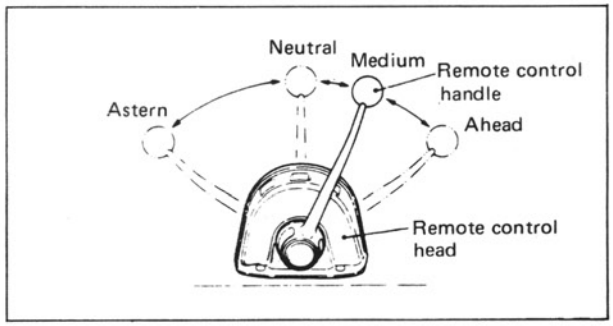
7-1. Starting

1. Electric starting

(1) Pull out the engine warm up knob and place the control lever in the "HALF SPEED" position.



(2) Set the remote control handle halfway between the "Ahead", and "Neutral" positions.

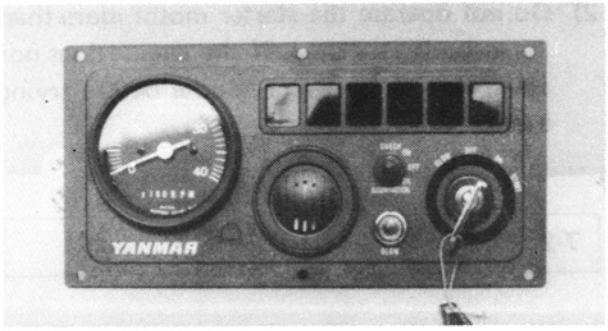


(3) Turn the battery switch "ON".

(4) Insert the key and turn it to the "GLOW" position. The glow lamp should light for about 15 seconds, and then should go off.

(5) As soon as the glow lamp goes off, turn the key to the "START" position. The engine will start. When the engine starts, release the key. The key automatically returns to the "ON" position.

(6) When the engine is started, return the remote control handle to the "NEUTRAL" position. (Do not turn off the battery switch even after the engine starts. In the "ON" position, power is supplied to the gauges and warning devices on the instrument panel.)



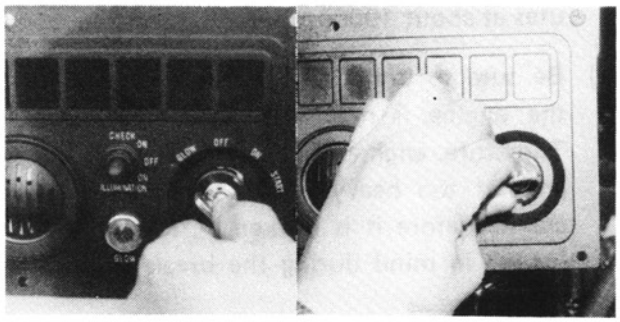
NOTE

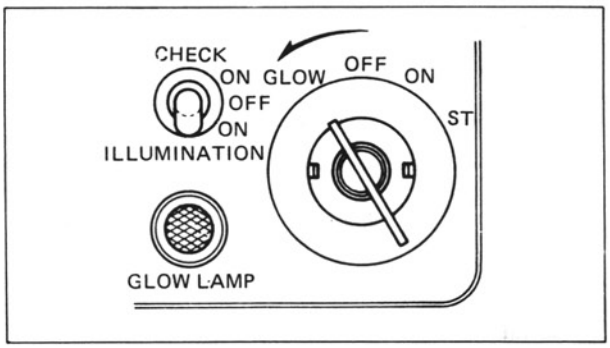
In this engine, the "GLOW" position is standard even in warm climates. Be sure to turn the key to the "GLOW" position when starting the engine. After the glow lamp has been lit for about 15 seconds, turn the key to the "START" position.

IMPORTANT

1) RELEASE the key switch when the engine starts.

If the key switch is released before the engine starts, wait until the starter motor and engine stop running before trying again.





2) **Do not operate the starter motor more than 15 seconds at a time. If the engine does not start, wait at least one minute before trying again.**

7-2. Cautions after starting the engine

1. Warm up the engine for at least 5 minutes, since lube oil does not reach all the moving parts as soon as the engine is started. Operate the engine at around 650 – 700 rpm.

2. Then, stop the engine and:

(1) Check the oil in the pan with the dipstick.

(2) Remove the pressure cap on the fresh water tank, and check the water level. When it is low, add water until it overflows from the feeding port.

IMPORTANT

1) **When running the engine for the first time after launching, let it run for 15 – 20 minutes at about 1000 rpm.**

2) **Be sure to break in the new engine. When the engine is new, engine parts are tight. Therefore, engine life can be seriously shortened if too heavy a load is placed on the engine before it is broken in. Keep the following in mind during the break-in period.**

Do not run the engine at heavy load the first 5 hours after installation.
Be sure to operate below 3000 rpm.

With the control lever in "NEUTRAL", check the following. Be sure that water comes out of the cooling water outlet pipe after the engine starts up.

3. Check the warning lamps on the instrument panel with the key switch at "ON" position.

	Normal condition		Abnormal condition
	Key switch ON (with the engine stopped)	Engine start (over 1000 rpm)	
Lube oil	ON	OFF	ON (Pressure down)
Cooling water	OFF	OFF	ON (Temp. rise)
Charge	ON	OFF	ON (No-charge)
Warning buzzer	BUZZ	OFF	BUZZ (Only for LOW pressure and C.W. temp. troubles)

If any of the warning lamps do not go off when the engine goes above 700 rpm, they are malfunctioning. Stop the engine immediately and contact your nearest Yanmar dealer.

7-3. Cautions during operation

The following should be checked at least once a day.

1. Fuel

Check and add fuel oil as needed.
If air is allowed to enter the fuel injection device, it will cause the engine to stop and necessitate bleeding of the fuel lines.

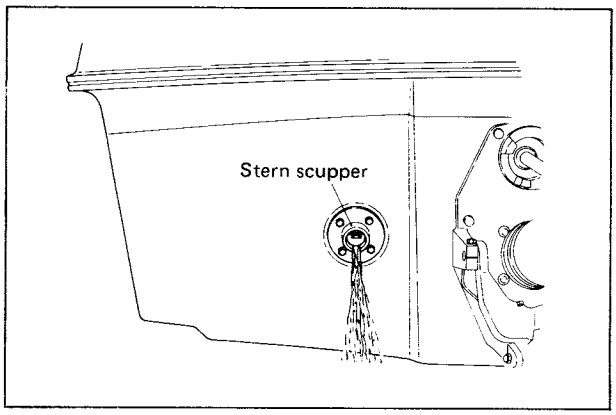
See page 22 for air bleeding.

2. Lube oil

If the warning lamp stays on while the engine is running, it indicates a problem.
First, check the amount of oil.

3. Cooling water

Make sure the cooling water is flowing from the outlet pipe and that the cooling temperature lamp is out. If water comes out irregularly, or if the amount is small, check:



(1) If air is being taken into the cooling water system.

(2) For damage of the cooling sea-water pump or fresh water pump.

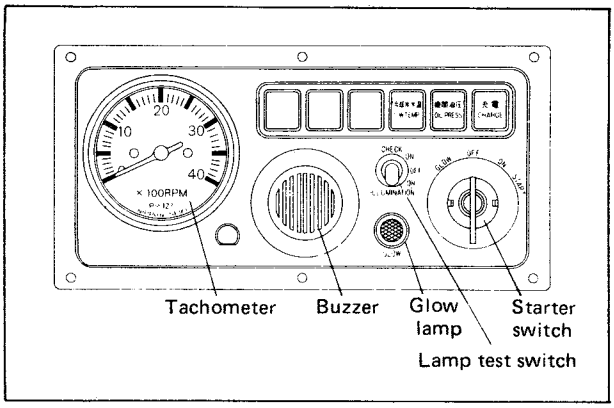
(3) If dirt has plugged up the cooling water pipe or the kingston cock.

(4) Cooling water efficiency drops due to contamination of the heat exchanger.

See page 26.

4. Charge

Make sure that the charge lamp is off.
If the charge lamp does not go off, even when engine rpms are raised to more than 700, charging is not taking place because of some malfunction in the charge system.
Consult your dealer.



5. Temperature of parts

Under full power, the surface temperature of each engine part will be about 80~85°C, or slightly hot to the touch. If the temperature is too high, there is some abnormality. These may include a shortage of oil or improper alignment of the propeller shaft. Consult your nearest dealer if the temperature of the engine parts is too high.

6. Exhaust smoke

Black exhaust smoke indicates that the engine is being overworked. Consequently, the life of the intake and exhaust valves, piston rings, cylinder liners, and fuel injection valve will be shortened.

7. Water/oil leaks

Check for any water or oil leaks, gas leakage, loose bolts, abnormal sounds, excessive generation of heat, and vibrations. If there is anything wrong, consult your nearest Yanmar dealer.

8. Engine resonance

A sudden, large vibration of the vessel may be caused when vibrations (resonance) of the engine and vibrations of the hull occur at the same time.
When this happens you should either increase or decrease engine speed.

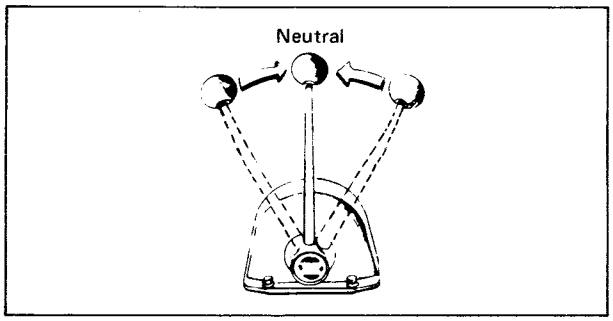
9. Abnormal sounds during operation

If abnormal sounds are detected, or the warning buzzer sounds during operation, you should immediately stop the engine and consult your nearest dealer.

7-4. Stopping

1. Stopping procedure

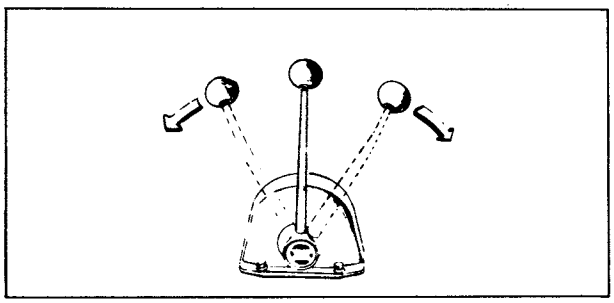
(1) Place the clutch handle in the "neutral" position and idle the engine for about 5 minutes.



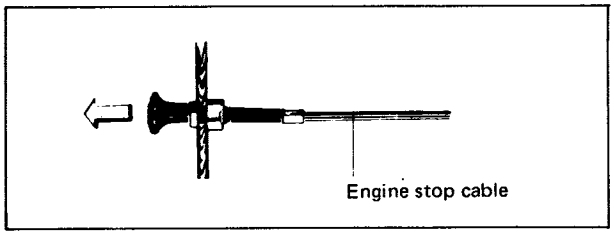
IMPORTANT

If the engine is stopped suddenly at a high temperature, the temperature of various parts will increase, and engine troubles may occur.

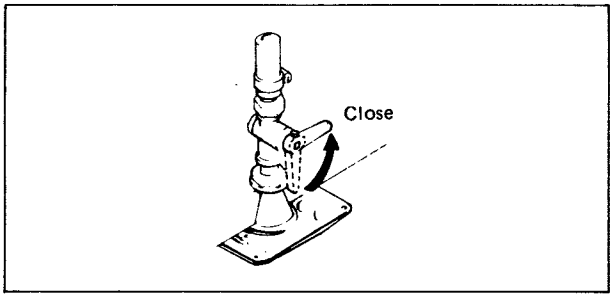
(2) After five minutes' idling, place the speed control lever in the "full" position and raise the rpms to about 3600 to blow out any burnt gas in the cylinder.



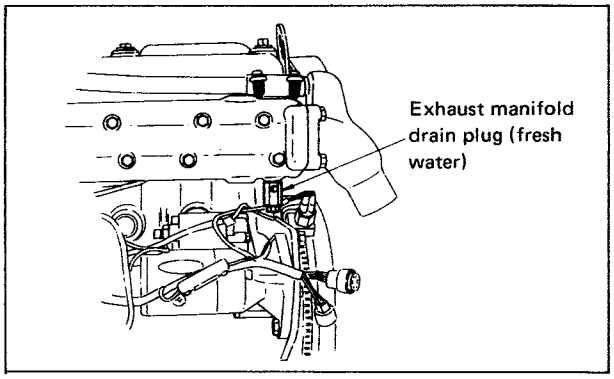
(3) Set the engine to the lowest speed (about 650~700 rpm), cut the fuel, and stop the engine.

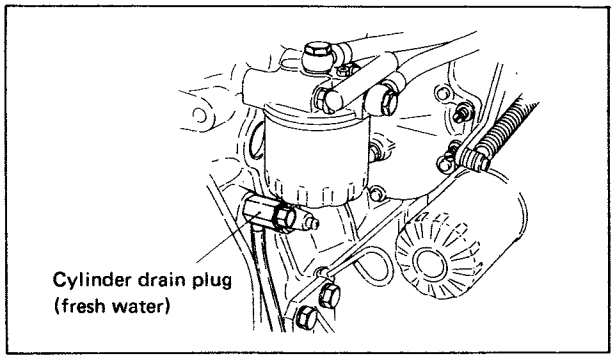


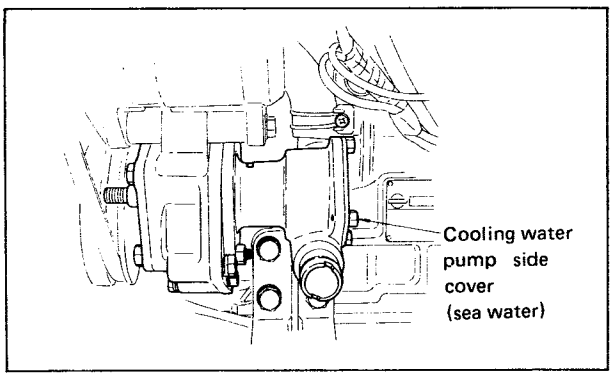
2. Be sure to close the kingston cock after stopping.



3. Drain out the cooling water. In winter and cold areas, the cooling water should be drained out after use.







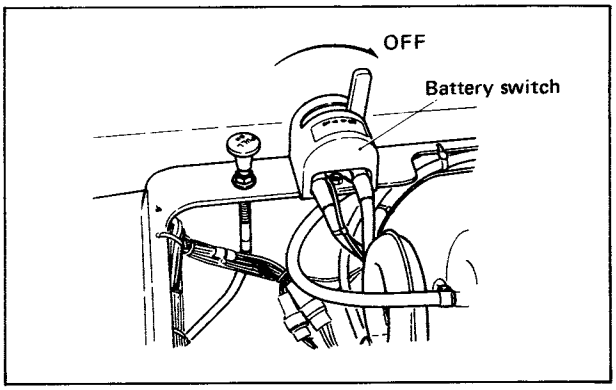
(1) Open up the cylinder body side cock located below the intake silencer and drain out the water in the cylinder.

(2) Open up the cock in the lower part of the exhaust manifold and drain the water from the manifold.

(3) Turn the crankshaft 2~3 times with the starter motor to remove any water remaining in the cooling pump.

4. While the engine is still warm, wipe off any dirt and grime that has accumulated.

5. Turn off the battery switch.



NOTE

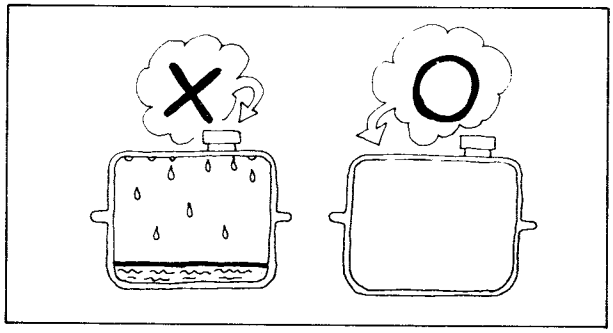
When stopping the engine with the starter switch "ON", the lube oil pressure warning buzzer will sound. This does not indicate engine trouble.

VIII. Storage

8-1. Storing

When the engine is not to be used for several months, follow these steps for proper storage to minimize corrosion and wear.

1. Drain the fuel completely from the fuel tank, or moisture will form in the fuel system and mix with the fuel.



2. Flush the cooling system with clean tap water and drain the cooling water from the engine.

(1) Cylinder body

(2) Exhaust manifold

(3) Cooling water pump
Remove the cover of the cooling water pump and drain out the water inside.

3. Apply an anti-rust compound to any parts which rust easily.

4. Since the battery automatically discharges, disconnect it when fully charged, wipe off the exterior and store in a dry, well-aired place.
Re-charge once a month during storage.

5. Use tape to seal air inlets, exhaust pipe, and fuel tank cap.

6. Clean the engine thoroughly.
Touch up any painted surfaces that are scratched or chipped.

7. If the vessel must be stored outside, cover it with a waterproof material.

8-2. Removing engine from storage

1. Wipe off anti-rust oil and make sure that the remote control system moves smoothly.

2. **Wiring the battery**

(1) Rewire as shown in the wiring diagram

See page 35.

Pay special attention to the diameter of the wire.

(2) Make sure the wires are connected to the correct terminals.

IMPORTANT

If wires are improperly connected, the A.C. generator may break.

(3) The terminals must be covered and protected.

(4) Unseal all openings sealed in Step 1-5.

(5) Also, follow the steps outlined in section VI. STARTING THE NEW ENGINE FOR THE FIRST TIME.

IX. Periodical inspection and maintenance

			Before starting	After 50 hrs or one month	Every 100 hrs	Every 300 hrs	Every 600 hrs	Every 1000 hrs
Fuel system	Check the oil level		○					
	Fill fuel		○					
	Drain the fuel tank			○		○		
	Replace the fuel filter element					○ (Replace)		
	Check the injection timing						○	
	Check the injection spray condition						○	
Lubricating system	Check the oil level	Crankcase	○					
	Replace the oil	Crankcase		○ (First)	○			
	Check the oil pressure warning lamp function		○					
	Replace the lube oil filter				○ (First)	○		
Cooling system	Seawater outlet		During operation					
	Adjust the tension of cooling water pump driving belt			○		○		
	Check the impeller of the cooling water pump (sea water pump)						○ (Replace)	
	Check the thermostat function						○	
Air cleaner, etc.	Clean the intake silencer element							
	Clean the exhaust/water mixing elbow					○		
	Clean the breather pipe					○		
	Check the exhaust gas condition		During operation					
	Blower cleaning for turbocharger					○		
Electrical system	Check the charge lamp function		○					
	Check the electrolyte level in the battery		○					
	Adjust the tension of the alternator driving belt			○ (First)		○		
	Check the wiring connectors					○		
Cylinder head, etc.	Check for leakage of water and oil		○	○				
	Retighten all major nuts and bolts			○		○		
	Retighten the cylinder head bolts			○ (First)				○
	Adjust intake/exhaust valve clearance			○ (First)			○	
Remote control system, etc.	Checking the remote control operation			○ (First)			○	
	Adjust the propeller shaft alignment			○ (First)			○	

MAINTENANCE STANDARD

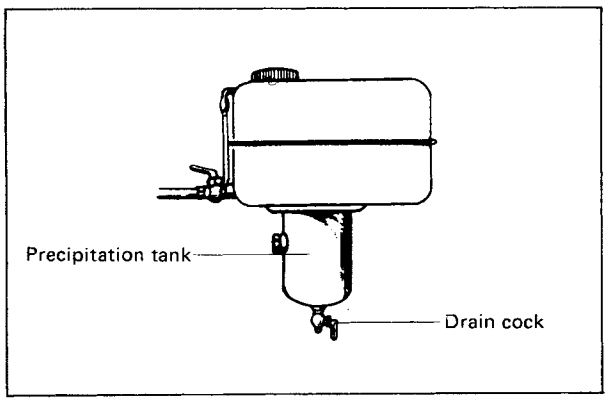
Fuel system	Fuel injection pressure		120kg/cm^2
	Fuel injection timing		bTDC7.5°
Lubricating system	Warning buzzer and lamp operating pressure		Below 0.5kg/cm^2
	Crankcase lube oil amount (with an installation angle of 8°)		4JM-TE, 7ℓ
Cooling system	Thermostat open	Partially open	76.5°C
		Fully open	90°C
	Warning buzzer and lamp operating temperature		ON 95°C OFF 88°C
Electrical system	Alternator belt tension (with 10kg thumb force)		10mm
Cylinder head, etc.	Cylinder head tightening torque (M10)		4JM-TE, 9kg-m
	Intake/exhaust valve clearance		0.2mm

9-1. Fuel oil system

1. Fuel tank and fuel supply

(1) Fill the tank.

See page 9 for selection of fuel oil, and page 11 for filling method.



(2) Drain the fuel tank every 300 hours of operation.

Open the fuel tank drain cock to drain out any foreign matter which may have accumulated in the bottom of the tank.
When you start the new engine for the first time, or after long storage, drain after the first 50 hours of operation.

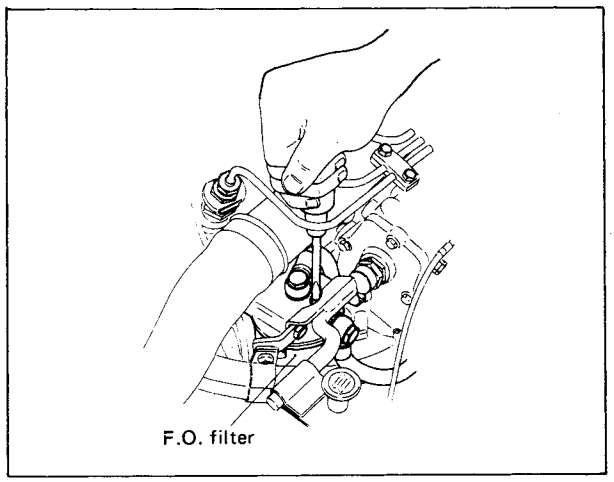
(3) If the vent in the fuel tank cap is blocked, fuel will not flow. Clean the fuel tank cap and blow dry periodically.

2. Air bleeding in the fuel system

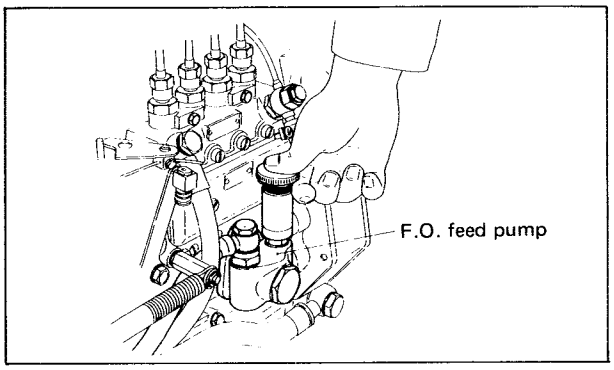
If the engine is operated when the fuel tank is empty, or with the fuel tank outlet cock closed, air is sucked into the fuel oil system, and the engine stops. When this happens, vent air as in the following:

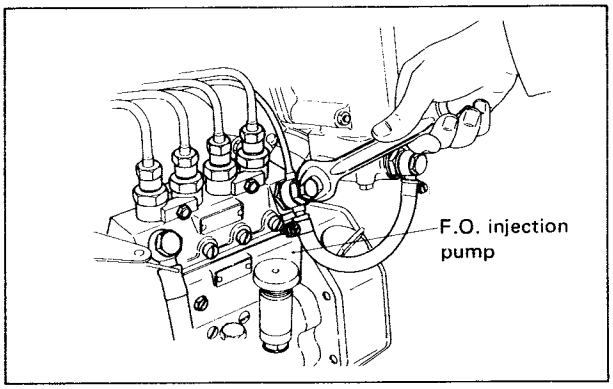
(1) Add fuel to the fuel tank.

(2) Loosen the air-vent screw on the fuel oil filter, and push the fuel feed pump priming knob several times.
When no air is observed in the oil, tighten the air-vent screw firmly.

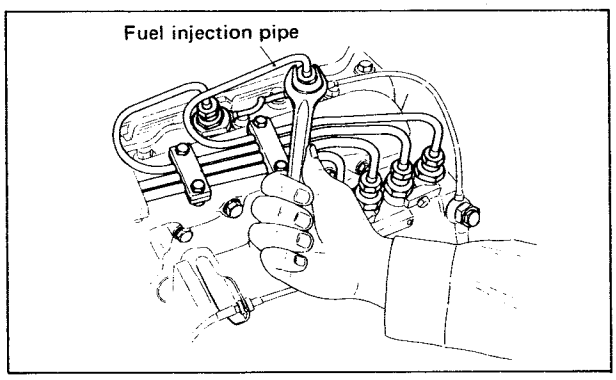


(3) Loosen the hexagon bolt of the fuel pump overflow valve. Push the fuel feed pump priming knob to vent the air. After venting the air, firmly tighten the hexagon bolt.





(4) Next, vent air in the fuel injection piping. Loosen the fuel injection pipe nipple on the fuel injection valve side. Put the remote control handle in the intermediate speed position, and the key switch in the "ST" position to run the engine. Repeat this procedure several times. After venting, tighten the fuel injection pipe nipple firmly.



(5) After bleeding air from all of the cylinders, turn the engine with the starter motor. Make sure that the fuel injection for each cylinder gives off a high-pitched hissing sound.

3. **Fuel injection timing and spray condition.**

⚠CAUTION

Diesel fuel escaping under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before disconnecting lines, be sure to relieve all pressure in the system; make sure no connections are damaged. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood to check suspected leaks. If injury occurs, see a doctor at once, or serious infection may result.

IMPORTANT

Modification or alteration of the injection pump, the injection pump timing, or the fuel injection valves in ways not recommended by the manufacturer will terminate the warranty.

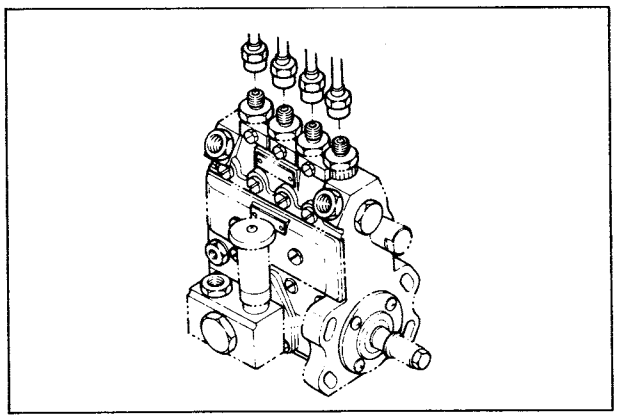
Check the fuel injection timing as follows:

(1) Remove the starter motor to check the fuel injection timing.

NOTE

1/4 shows the No. 1 cylinder and No. 4 cylinder. These are the cylinders on the flywheel side and not the timing gear case side. (T.D.C. mark)

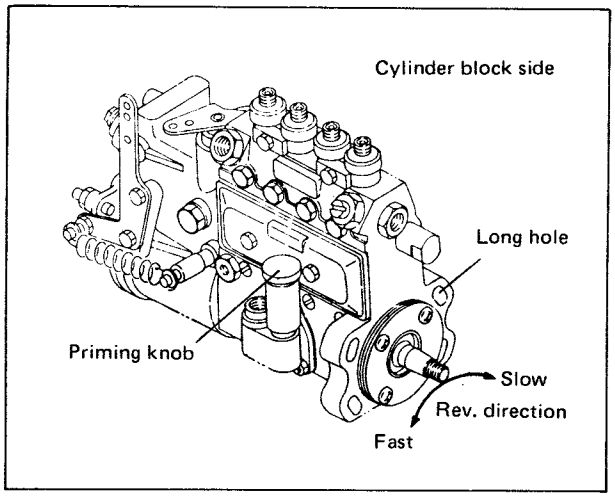
(2) Remove the high pressure pipe from the fuel injection pump.



(3) Pull the engine warm up knob out and place the control lever in the "half speed" position.

(4) Push the fuel feed pump priming handle, and vent air in the pump.

(5) Rotate the engine to check the fuel injection timing. At the same time the arrow timing mark on the cylinder block and flywheel should line-up, and fuel should bubble out of the delivery valve of the fuel injection pump.

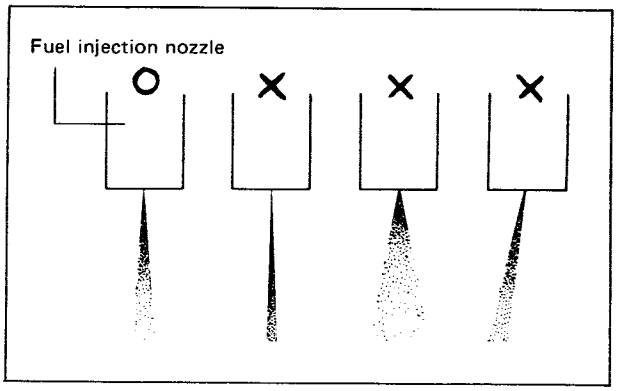


(6) To adjust the fuel injection timing, adjust the installation position at the long hole of the pump. When it falls to the cylinder block side, injection timing is slower; when it falls to the other side, injection timing is faster.

Fuel injection timing
F.I.D. (b.T.D.C): 7.5°

(7) Check the fuel injection timing for all of the cylinders.

(8) Remove the fuel injection nozzle and check the injection spray condition. The spray should be cone-shaped.



If the spray is not cone-shaped, the following may apply:

a) injection pressure too low.

b) fuel bad.

IMPORTANT

For disassembly, adjustment and inspection of the fuel injection pump and fuel injection valve, consult your nearest Yanmar dealer.

NOTE

It is convenient to check simultaneously the exhaust/intake valve clearance when removing the starter motor.

See page 27.

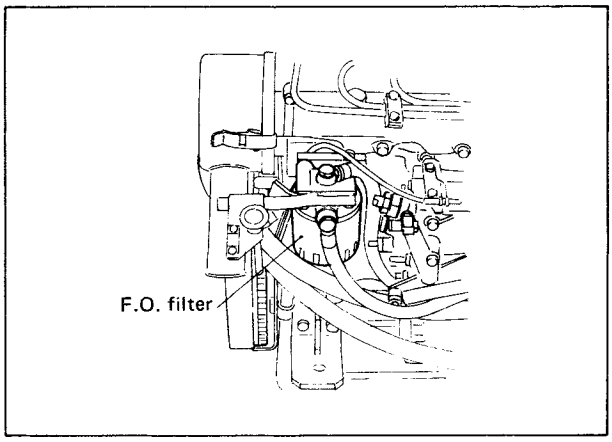
4. Replacing the fuel filter element.

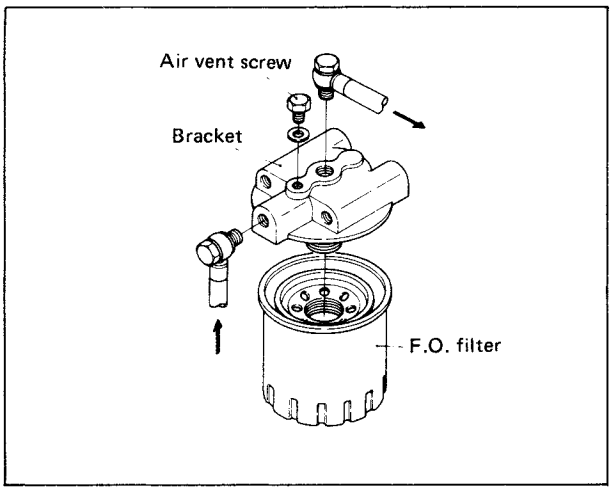
(1) Since the fuel oil filter is of the cartridge type, the element cannot be cleaned by removing the filter. Replace the filter as a unit after the specified period of use.

Replace: Every 300 hours (or 6 months)

(2) When installing the fuel oil filter, remove any dust and foreign matter from the contact surface.

(3) After installing the filter, run the engine and check for oil leaks.





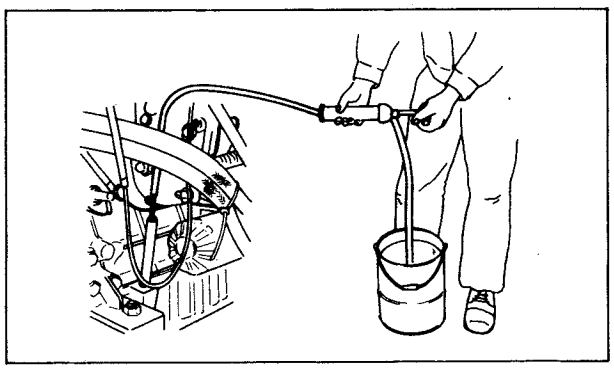
9-2. Lubricating oil system

1. Engine lube oil

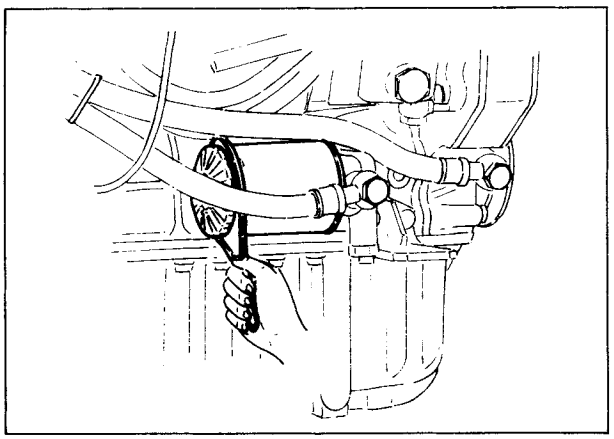
(1) Check the oil level before operation.

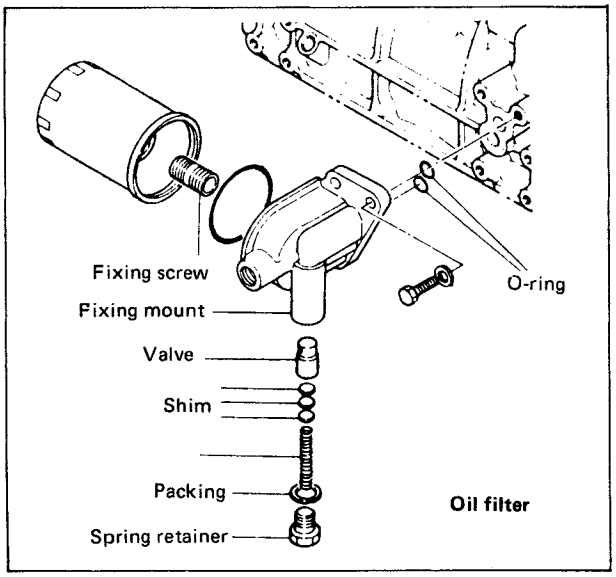
☞ See page 11.

(2) Replace the oil after 50 hours of operation (for the first time or after long storage) and every 100 hours of operation.
Lube oil changes can be performed most effectively while the engine is still warm. The oil will flow easily and can be drained thoroughly.
The oil should be drained from the crankcase by moving the handle of the oil evacuation pump forward and backward.



(3) Replacing the lube oil filter.
Replace the lube oil filter after 100 hours of operation (First time or after long storage) and every 300 hours of operation.





a) Unscrew the canister by hand or with a filter replacer tool.

b) Make sure that the threaded adaptor is secure in the headcasting.

c) Discard used canister.

d) Coat the top of the seal of the new canister with new lube oil.

e) Screw the new canister onto the filter headcasting until the canister seal just touches the headcasting, and then tighten by hand a half turn more.

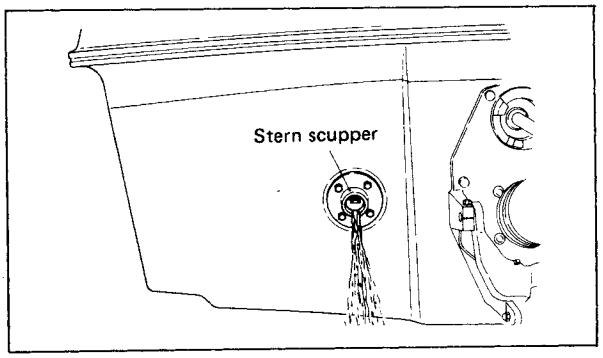
IMPORTANT

If the canister is too tight, it may be difficult to remove and may damage the filter.

f) Start the engine and check for leaks. Check the oil level after running the engine for several minutes and fill when necessary.

9-3. Cooling water system

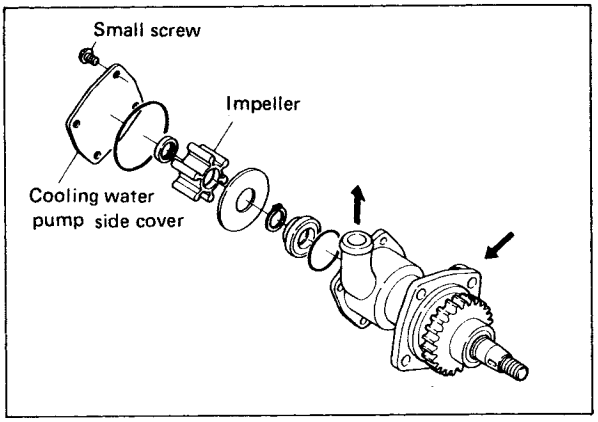
1. Make sure that water is coming out of the cooling water outlet pipe during operation.



2. **Inspection and replacement of cooling water pump**

(1) Impeller of cooling water pump

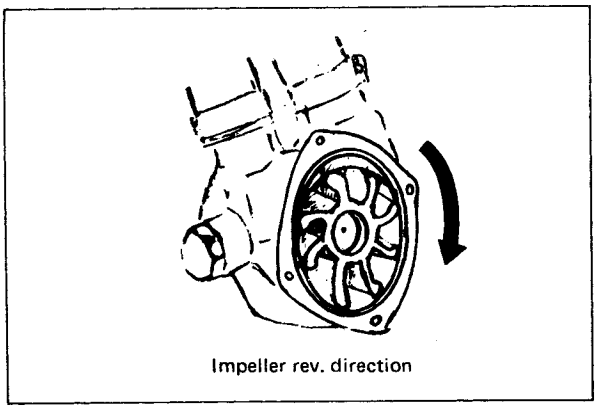
a) Remove the cooling water pump cover, take out the impeller, and check for damage to the impeller and mechanical seal parts.
If damaged, replace with a new one.



b) When reassembling the pump, coat the fittings of the pump shaft and impeller, both sides of the impeller, and the vane tips with grease.

IMPORTANT

When installing the impeller, make sure the direction of the impeller corresponds to that indicated in the figure.



3. **When the cooling water temperature is too high.**

When the cooling water temperature exceeds 85°C, check the fresh water cooling system and sea water cooling system for the following:

(1) The fresh water pump is defective, or the fresh water circuit is blocked, restricting fresh water flow.

(2) The thermostat is defective, and fresh water does not pass through the fresh water cooler.

(3) The sea water pump is defective, or the sea water circuit is blocked restricting sea water flow.

(4) Fresh water isn't cooled due to contamination of the cooler.

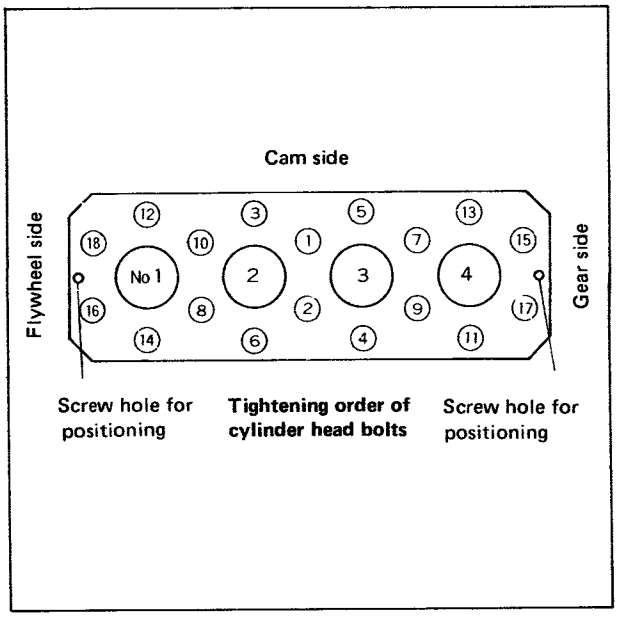
(5) When adding fresh cooling water, the engine was not completely air-vented.

If the cause of the trouble cannot be located, consult your nearest Yanmar agent.

9-4. Inspection of engine body

1. Retightening cylinder head nuts

Retighten each nut with a torque wrench after the first 50 hours of operation.
The sequence for tightening the nuts is shown in the figure.

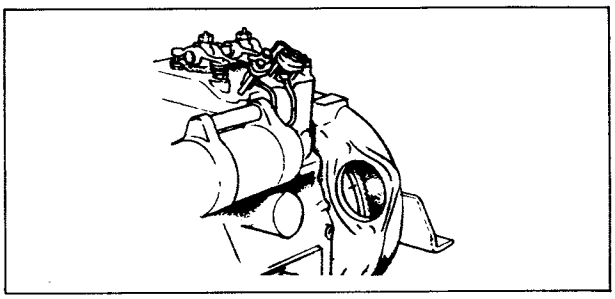


Cylinder head bolts tightening torque	9±0.2 kg-m

2. Exhaust/intake valve head clearance adjustment.

The clearance of the valve affects overall performance of the engine, so it is important that it be correctly adjusted.
Check the clearance every 50 hours of operation. Adjustment should be done while the engine is cold.

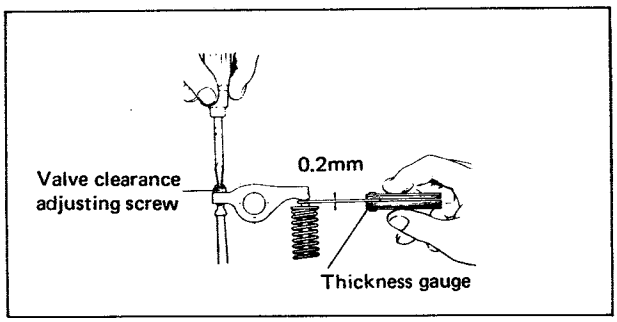
(1) Remove the valve rocker arm cover and starter motor.



(2) Crank the engine and set the No. 1 (flywheel side) piston to top dead center (TDC) on the compression stroke.

NOTE

The valve rocker arm shaft should not move even when the crankshaft is turned to the left or right of the T mark.



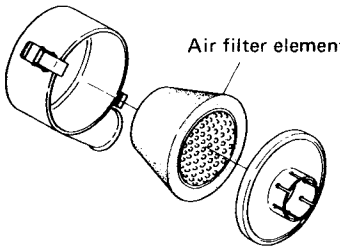
Maintenance standard

Intake/exhaust valves	0.2 mm

(3) Check and adjust the intake and exhaust valve head clearances of the No. 1 cylinder.
Loosen the valve clearance adjusting screw lock nut, adjust the clearance to the maintenance standard with a thickness gauge, and retighten the lock nut.

9-5. Washing the air intake silencer element

Wash the element inside the air intake silencer with a neutral detergent every 150 hours of operation.



9-6. Electrical equipment

1. Checking the warning lamps on the instrument panel.

Check the "ON" and "OFF" function of the warning lamps before operation.

See page 13 for warning lamp function.

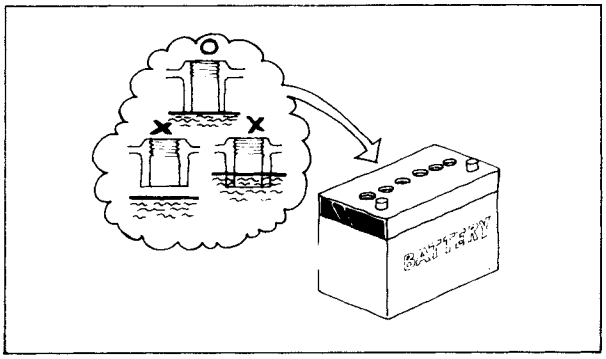
2. Checking and maintenance of the battery.

Proper battery maintenance is vital for dependable service.

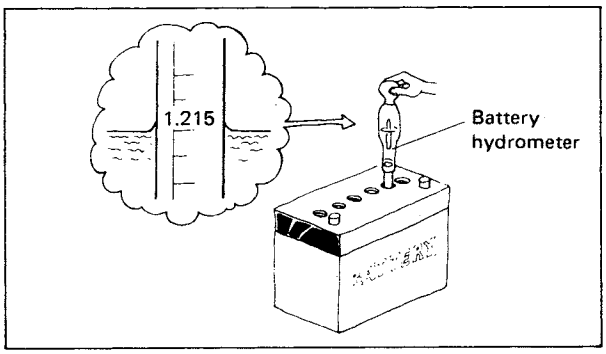
(1) Keep the battery clean by wiping it with a damp cloth.
Keep all connections clean and tight.
Remove any corrosion, and wash the terminals with a solution of baking soda and water.

(2) Keep the battery fully charged, especially during cold weather. If the battery needs to be charged, charge it after disconnecting the battery cables from the battery.

(3) Check the level of the electrolyte in each cell at least every 200 hours. If low, fill to the bottom of the filler neck with distilled water.



(4) To check the battery, use a battery hydrometer. Check the specific gravity of the electrolyte in each cell. Charge the battery if the reading is below 1.215.



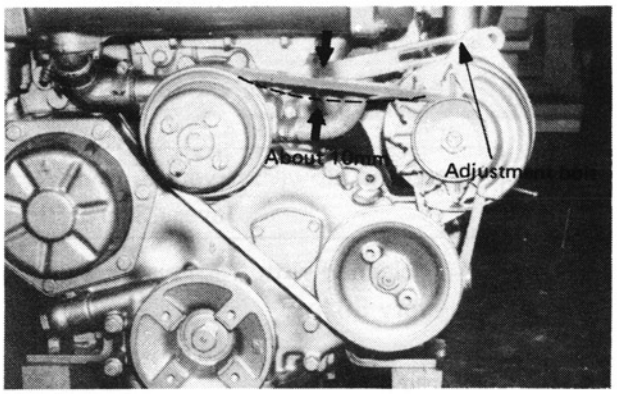
⚠CAUTION

Keep all sparks and flames away from batteries. To avoid sparks, connect the earth [illegible] last and disconnect it first.

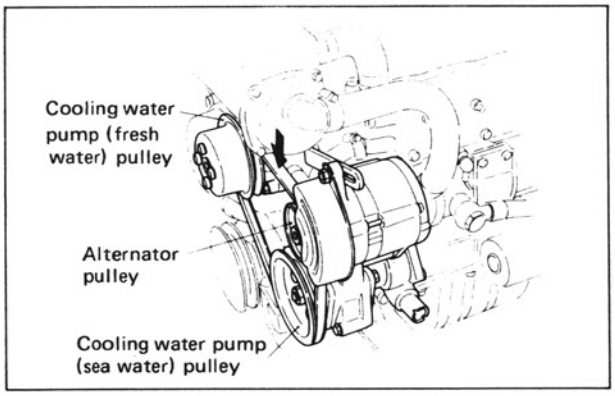
IMPORTANT

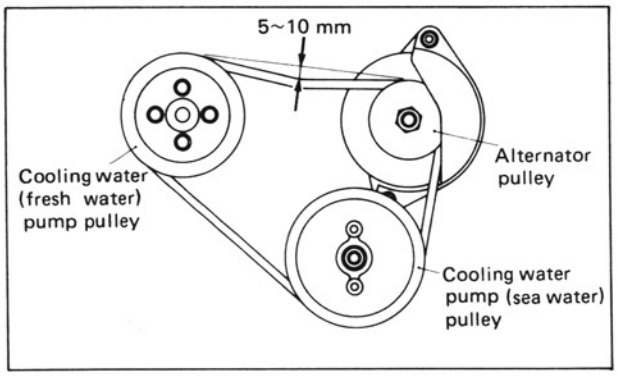
Do not add distilled water in freezing we[illegible] without running the engine at least 30 minu[illegible] to ensure thorough mixing.

3. Checking and adjustment of the alternator (electric generator) V-belt tension.
If the tension for the V-belt is too tight, the V-belt may be easily damaged. On the other hand, if the tension is too loose, slippage results and generator efficiency drops.



(1) Checking the tension.
With the engine stopped, press the belt midway between the pulleys and measure the "give".
The belt should give 10 mm with about 10 kg of force.





(2) If the belt needs adjustment, loosen the adjusting bolt and pull on the alternator.
While holding the alternator in position, tighten the adjusting bolt. A worn or cracked belt should be replaced.

(3) V-belt tension tightens when the alternator is moved to the outside, and loosens when moved to the inside.

IMPORTANT

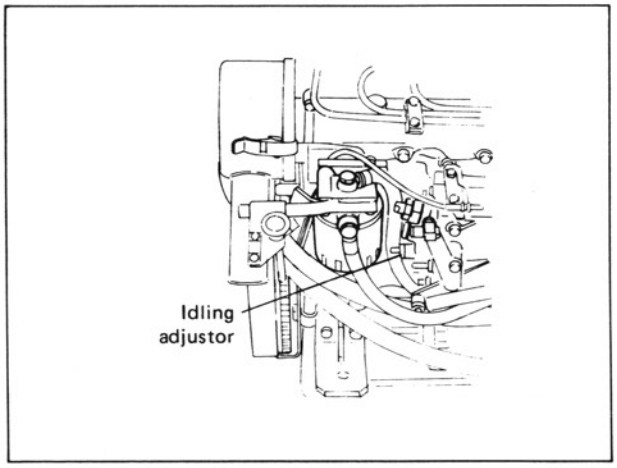
Make sure there is no oil on the belt, or slippage will result.

9-7. Remote control cable adjustment

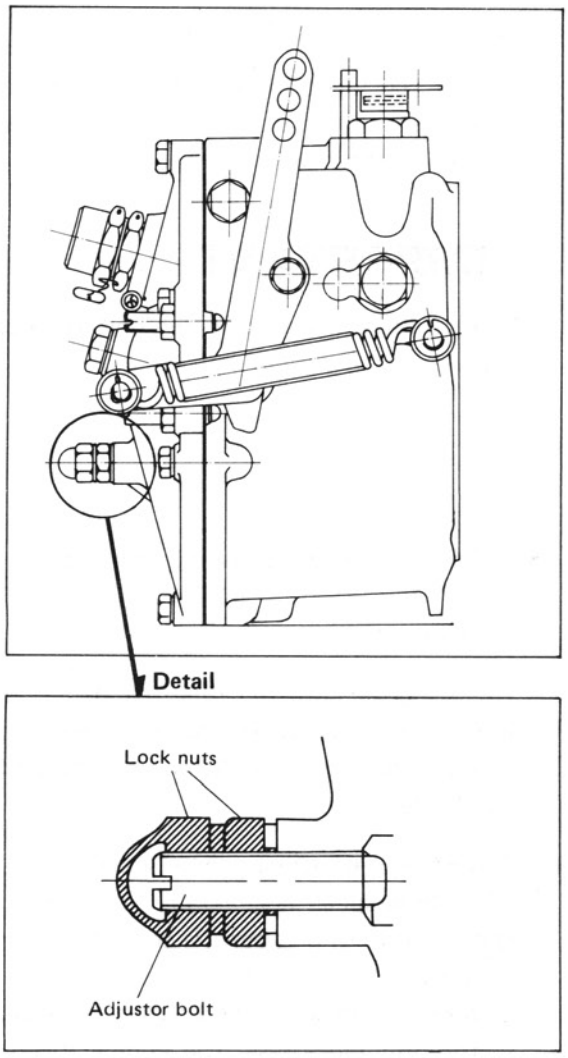
1. Speed control

(1) Checking the control cable fitting.
Make sure the control cable is fixed at the clamp. The cable should not be too tight or too loose.

(2) Adjustment of idling engine speed
The idling speed is generally set at 650~700 rpm. If the idling speed is too low, adjust as follows:
Loosen the lock not and turn the idling adjustor bolt clockwise; the engine speed will increase.



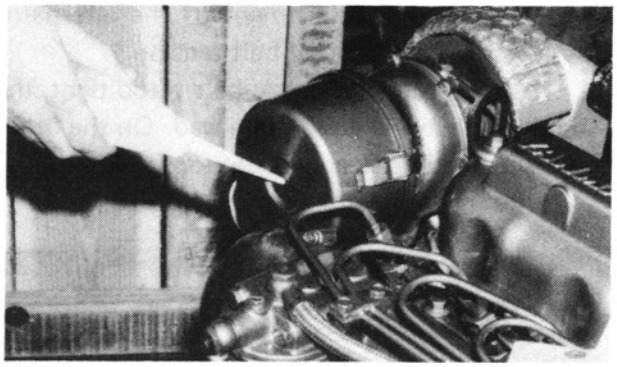
If the idling speed is too high, turn the adjustor bolt counter-clockwise to lower engine speed.



After a suitable engine speed has been reached, tighten the idling adjustor bolt with the lock nut.
After resetting the idling engine speed, be sure to adjust the speed control cable so that the speed control lever touches the idling adjustor bolt when the remote control lever is in the neutral position.

(3) Inspecting the turbo-charger (Model RH52, IHI make)

a) Cleaning the turbo-charger blower



Clean the blower: Every 6 months (every 300 hrs.)

*** If cleaned with fresh water, clean every 50 hrs.**

b) Cleaning procedures

i) With the engine at service load, add 50cc of cleaning agent (" Blower Wash", IHI brand) using a feeder.

ii) After 3–5 minutes, add 50cc of fresh water for about 10 seconds.

iii) Use a vinyl container or the like for adding the cleaning agent and water. If a large amount of cleaning agent or fresh water is fed into the turbocharger all at once, trouble (damage to the blower fan wheel, etc.) may occur. Pay careful attention to the amount fed and the time.

iv) If there is no change in the turbocharging pressure or in the exhaust temperature, repeat the above cleaning procedures after 10 minutes. If there is still no change after repeating the cleaning procedures 3–4 times, the blower is heavily contaminated, or there is some other problem. Disassemble the turbo-charger and clean the blower.

v) After cleaning, run the engine with load for at least 15 minutes to allow it to dry.

X. Troubleshooting

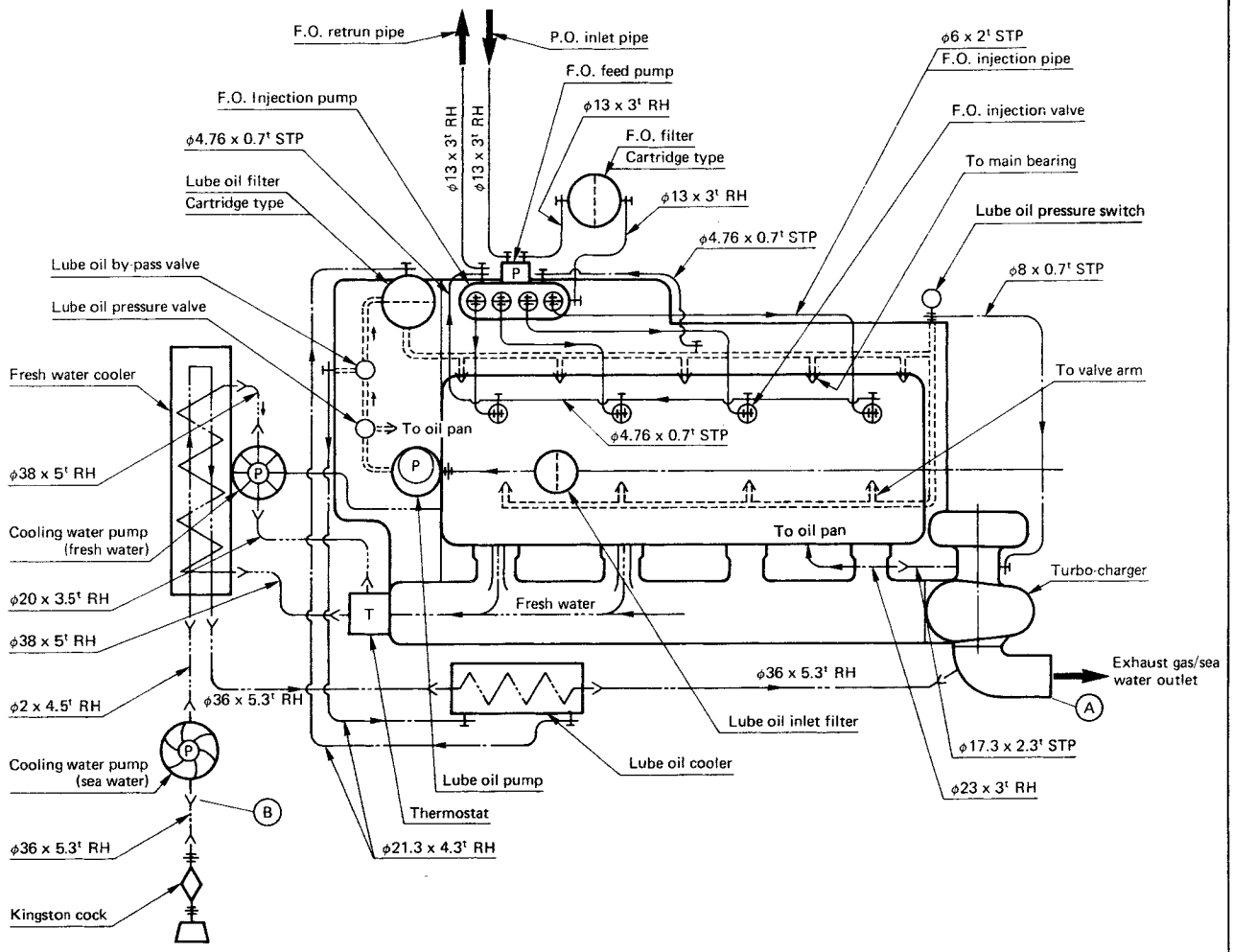
Problem	Possible cause	Possible remedy	See
1) Engine * Engine hard to start or will not start	1) Incorrect speed control position	* Set remote control lever in the high idle speed position	Page 13
	2) No fuel	* Check fuel tank	
	3) Fuel shut off valve closed	* Open shut off valve	
	4) Defective fuel feed pump	* Replace fuel feed pump	Your YANMAR Dealer
	5) Clogged fuel filter	* Replace filter element	Page 24
	6) Air in fuel system	* Bleed air	Page 22
	7) Water, dirt in fuel system	* Drain, flush, fuel system	Page 22
	8) Dirty or faulty injectors		Your YANMAR Dealer
	9) Improper compression		Your YANMAR Dealer
	10) Improper type of fuel	* Use proper type of fuel; consult fuel supplier	Page 9
	11) Improper type of crank-case lube oil	* Use proper lube oil	Page 10
* Engine knocks	1) Improper type of fuel	* Use proper type of fuel; consult fuel supplier	Page 9
	2) Incorrect fuel injection timing	* Check injection timing	Page 23
	3) Idle speed too slow	* Adjust idling speed	Page 29
	4) Improper cylinder top clearance		Your YANMAR Dealer
	5) Defective piston or piston ring		Your YANMAR Dealer
	6) Defective crankshaft bearing or piston pin bearing		Your YANMAR Dealer
	7) Improper valve clearance	* Adjust	Page 27
* Engine runs irregularly or stalls frequently	1) Vent in fuel tank cap obstructed	* Clean cap in solvent; blow dry	Page 22
	2) Clogged fuel filter	* Replace fuel filter element	Page 24
	3) Water, dirt, or air in fuel system	* Drain, flush, fill and bleed air in the system	Page 22
	4) Dirty or faulty injectors		Your YANMAR Dealer
	5) Faulty governor linkage		Your YANMAR Dealer
	6) Defective fuel feed pump	* Replace fuel feed pump	Your YANMAR Dealer
	7) Improper valve clearance	* Adjust proper valve clearance	Page 27
	8) Defective valve spring	* Replace valve spring	Your YANMAR Dealer
	9) Improper compression		Your YANMAR Dealer
* Lack of engine power	1) Engine overloaded	* Reduce load (check, propeller matching)	Your YANMAR Dealer
	2) Air intake restriction	* Service air cleaner	Page 28
	3) Clogged fuel filter	* Replace filter element	Page 24
	4) Improper type of fuel	* Use proper fuel	Page 9

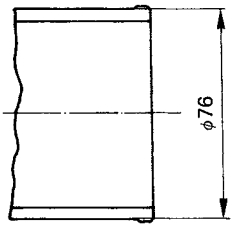
Problem	Possible cause	Possible remedy	See
	5) Improper valve clearance	* Adjust proper valve clearance	Page 27
	6) Dirty or faulty injectors		Your YANMAR Dealer
	7) Incorrect fuel injection	* Check the fuel injection timing	Page 23, your YANMAR Dealer
	8) Improper engine compression		Your YANMAR Dealer
	9) Vent in fuel tank cap obstructed	* Clean cap in solvent Blow dry	Page 22
* Engine overheats	1) Engine overloaded	* Reduce load	
	2) Defective cooling water	* Check cooling water pump	Page 26
	3) Loose or defective cooling water hose clamp	* Check hose clamp	Page 12
	4) Cooling system needs flushing	* Flush cooling system	Your YANMAR Dealer
	5) Defective thermostat	* Replace thermostat	Your YANMAR Dealer
	6) Defective temperature lamp or sender	* Check bulb, fuse and wiring	Page 28, your YANMAR Dealer if needed
	7) Cooling water leaks from water passage	* Check water passage	Page 26, your YANMAR Dealer
* Engine emits black or gray exhaust smoke	1) Improper type of fuel	* Use proper fuel	Page 9
	2) Clogged or dirty air cleaner	* Service air cleaner element	Page 28
	3) Defective injection pump	* Have your dealer check for fuel injection pump	Your YANMAR Dealer
	4) Faulty injectors	* Have your dealer check for injectors	Your YANMAR Dealer
	5) Incorrect fuel injection timing	* Check the injection timing	Page 23, and see your YANMAR Dealer
	6) Improper valve clearance	* Adjust valve clearance	Page 27
	7) Lube oil level too high	* Drain surplus	Page 25
	8) Improper lube oil	* Use proper viscosity oil	Page 10
* Low lube oil pressure	1) Low lube oil level	* Add lube oil	Page 11
	2) Improper lube oil viscosity	* Drain, add proper lube oil	Page 10
	3) Defective lube oil pump		Your YANMAR Dealer
	4) Defective oil pressure lamp and/or sender	* Replace lamp and/or sender	Page 13
* High lube oil consumption	1) Too light viscosity oil	* Use proper viscosity oil	Page 10
	2) Oil leaks	* Check for leaks in lines, around gasket and drain plug	
	3) Improper type of oil	* Use oil proper viscosity	Page 10
	4) Clogged breather system	* Clean breather system	
	5) Defective piston ring, piston, cylinder liner, valve guide and seat		Your YANMAR Dealer

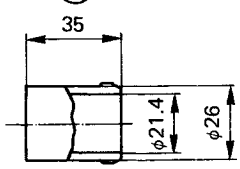
Problem	Possible cause	Possible remedy	See
* High fuel consumption	1) Improper type of fuel	* Use proper fuel	Page 9
	2) Clogged or dirty air cleaner element	* Service air cleaner element	Page 28
	3) Engine overloaded	* Reduce load	
	4) Improper valve clearance	* Adjust valve clearance	Page 27
	5) Incorrect fuel injection timing	* Check the injection timing	Page 23, your YANMAR Dealer
	6) Low engine temperature	* Check thermostat	See Diagram page 36
	7) Improper compression	* Have your dealer check for compression	Your YANMAR Dealer
* Abnormal noise	1) Worn bearing or gear		Your YANMAR Dealer
	2) Defective bearing or gear		Your YANMAR Dealer
	3) Loose bolt or nut		Your YANMAR Dealer
	4) Low lube oil level	* Add lube oil up to specified level	Page 11
2) Electrical system * Battery will not charge	1) Loosen or corroded connections	* Clean and tighten connection	Page 28
	2) Sulfated or warm-out battery	* Check electrolyte level and specific gravity	Page 28
	3) Defective alternator	* Replace alternator	Your YANMAR Dealer
	4) Loose or defective alternator drive belt	* Adjust belt tension or replace belt	Page 28
* Charge warning lamp glows with engine running	1) Low engine speed	* Increase engine speed	
	2) Defective battery	* Check electrolyte level and specific gravity	Page 28
	3) Defective alternator	* Replace alternator	Your YANMAR Dealer
	4) Slipping alternator drive belt	* Tighten the belt after checking for oil on the belt	Page 28
* Starter does not work properly	1) Loose or corroded connections	* Clean and tighten loose connections	Page 28
	2) Low battery output	* Check electrolyte level and specific gravity	Page 28
	3) Defective magnetic switch	* Replace magnetic switch	Your YANMAR Dealer
	4) Defective starter switch	* Replace starter switch	Your YANMAR Dealer
	5) Defective wiring	* Check the wiring	Page 36
* Starter crank slow	1) Low battery output	* Check electrolyte level and specific gravity	Page 28
	2) Too heavy viscosity lube oil	* Use proper viscosity oil	Page 10
	3) Loose or corroded wiring	* Clean and tighten loose connections	Page 28

Problem	Possible cause	Possible remedy	See
* Cooling water temperature warning light always glows	1) Defective temperature switch	* Replace C.W. temperature switch	Your YANMAR Dealer
* All warning lamps stop glowing	1) Faulty bulbs	* Replace bulbs	
	2) Improper wiring	* Check wiring	Page 36, your YANMAR Dealer
* Starter switch does not work properly	1) Poor battery	* Check electrolyte level and specific gravity	Page 28
	2) Loose or corroded connections	* Clean and tighten loose connections	Page 28
	3) Faulty starter switch	* See your dealer	Your YANMAR Dealer
* Tachometer does not work properly	1) Faulty tachometer or sender unit	* Replace tachometer or sender unit	Your YANMAR Dealer
	2) Loose or corroded connections	* Clean and tighten loose connections	Page 28, your YANMAR Dealer

XI. Fuel oil, lubricating oil and cooling water piping diagram

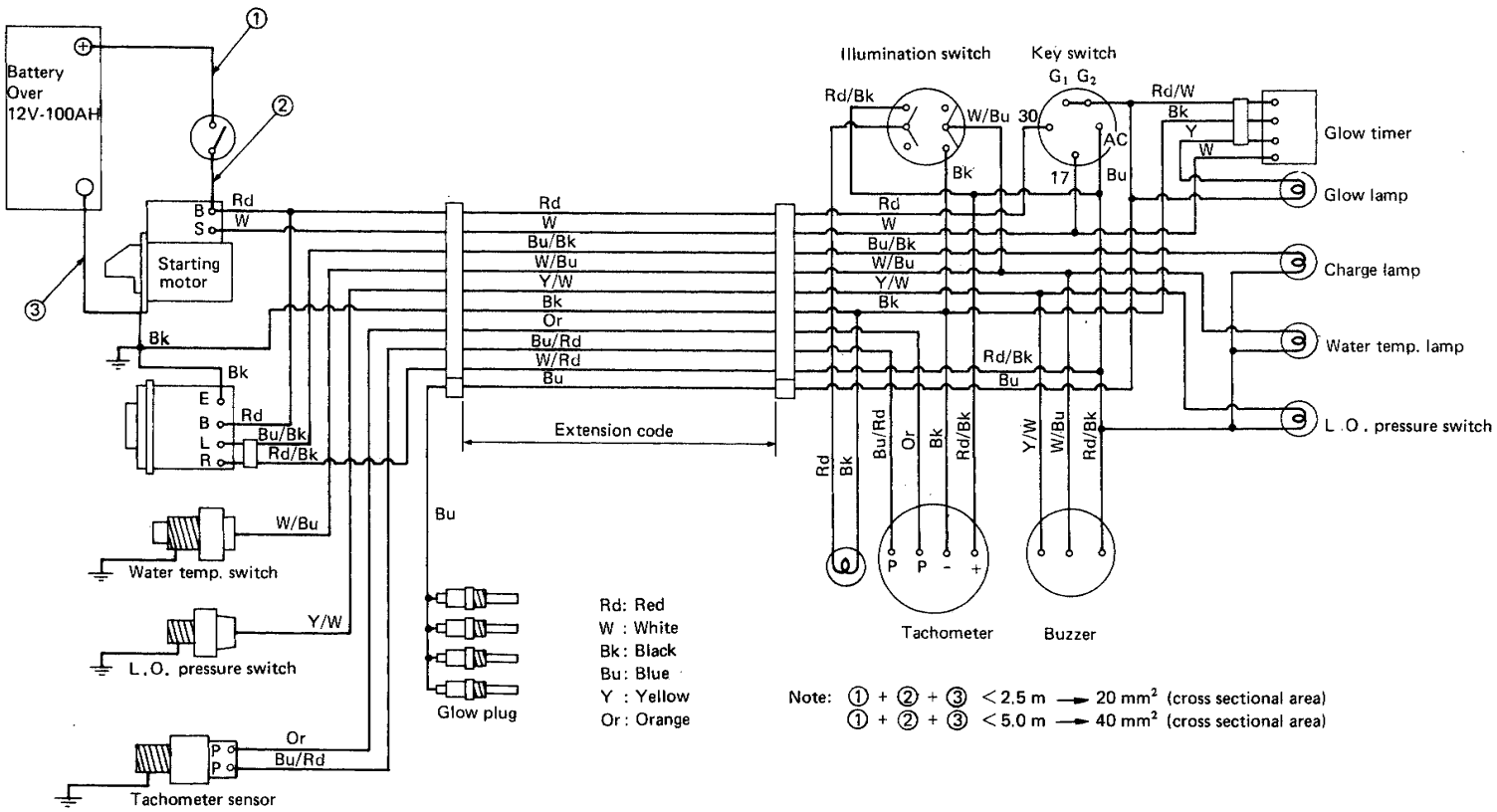






Marks
RH: Rubber hose
STP: Steel pipe
: Cock
: Bayonet joint
: Screw joint
: Ball & socket joint
: Drill hole
: Cooling water (fresh water) pipe
: Cooling water (sea water) pipe
: Lube oil pipe
: Fuel oil pipe

XII. Electrical wiring diagram



YANMAR DIESEL ENGINE CO.,LTD.

1-1, 2-chome, Yaesu, Chuo-ku, Tokyo 104, Japan
Cable: YANMAR TOKYO Telex: 0222-4733, 0222-2310

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