YANMAR

OPERATION MANUAL

4JHE • 4JH-TE
4JH-HTE • 4JH-DTE

YANMAR
OPERATION MANUAL

MARINE DIESEL ENGINE

MODEL

4JHE
4JH-TE
4JH-HTE
4JH-DTE

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 somethimes be changed. This may result in some discrepancies in this manual.
This manual is concemed with the 4LH-TE model.
Although the 4LH-TE, 4LH-HTE, seem to be different on the outside. their handling is the same.

⚠CAUTION

This safety alert symbol indicates important safety messages. To insure the safest possible operation, carefully read the message that follows.

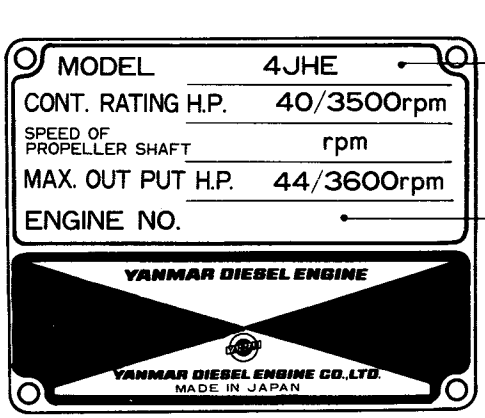
IMPORTANT

This stop symbol indicates important operation information. To insure maximum performance, carefully read the message that follows.

Contents

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

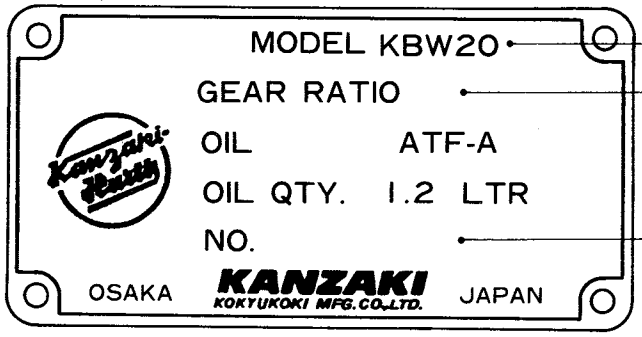
Engine Model Name Plate



- Your engine model
- Your engine number

Marine Gear Model Name Plate

- 4JHE, 4JH-TE

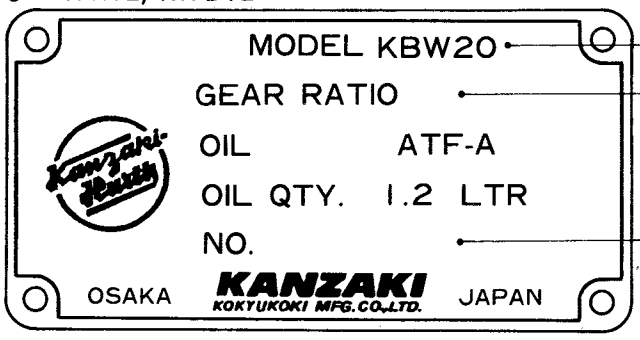


Yanmar marine gear model

Reduction ratio

Yanmar marine gear number

- 4JH-HTE, 4JH-DTE



Yanmar marine gear model

Reduction ratio

Yanmar marine gear number

Note: *The outputs indicated on the engine name plate are continuous rating-DIN 6270A, and maximum output-DIN 6270B.*

I. Specifications

1-1. Engine specifications

Model		4JHE	4JH-TE	4JH-HTE	4JH-DT(B)E
Type		Vertical 4-cycle turbo-charged water-cooled diesel engine			
No. of cyliders		4			
Continuous rating output (DIN 6270A)	hp/rpm	40/3500	50/3500	60/3500	70/3500
Maximum output (DIN 6270B)	hp/rpm	44/3600	55/3600	66/3600	77/3600
Combustion system		Direct injection			
Firing order		1–3–4–2 (bTDC 12° ± 1°)			
Aspiration		Naturally aspirated	Exhaust turbocharger		
Direction of rotation	Crankshaft	Counter-clockwise viewed from flywheel			
	Propeller shaft	Clockwise viewed from stern			
Lubricating system		Forced lubrication with trochoid pump			
Lube oil capacity	Crank case	6.5ℓ			8.0ℓ
Cooling system		Fresh water cooling by centribufal pump with heat exchange			
Cooling water capacity	Water tank	6.0ℓ			
	Sub-tank	0.8ℓ			
Starting system		Electric			
Electrical equipment	Starting motor	12V – 1.8kW			
	Alternator	12V – 55A			
Dry weight (with Marine gear)	kg (lbs)	234 (516)	239 (527)	243 (535)	246 (544)

1-2. Marine gear specifications

(1) 4JHE, 4JH-TE, 4JH-HTE, 4JH-DTE

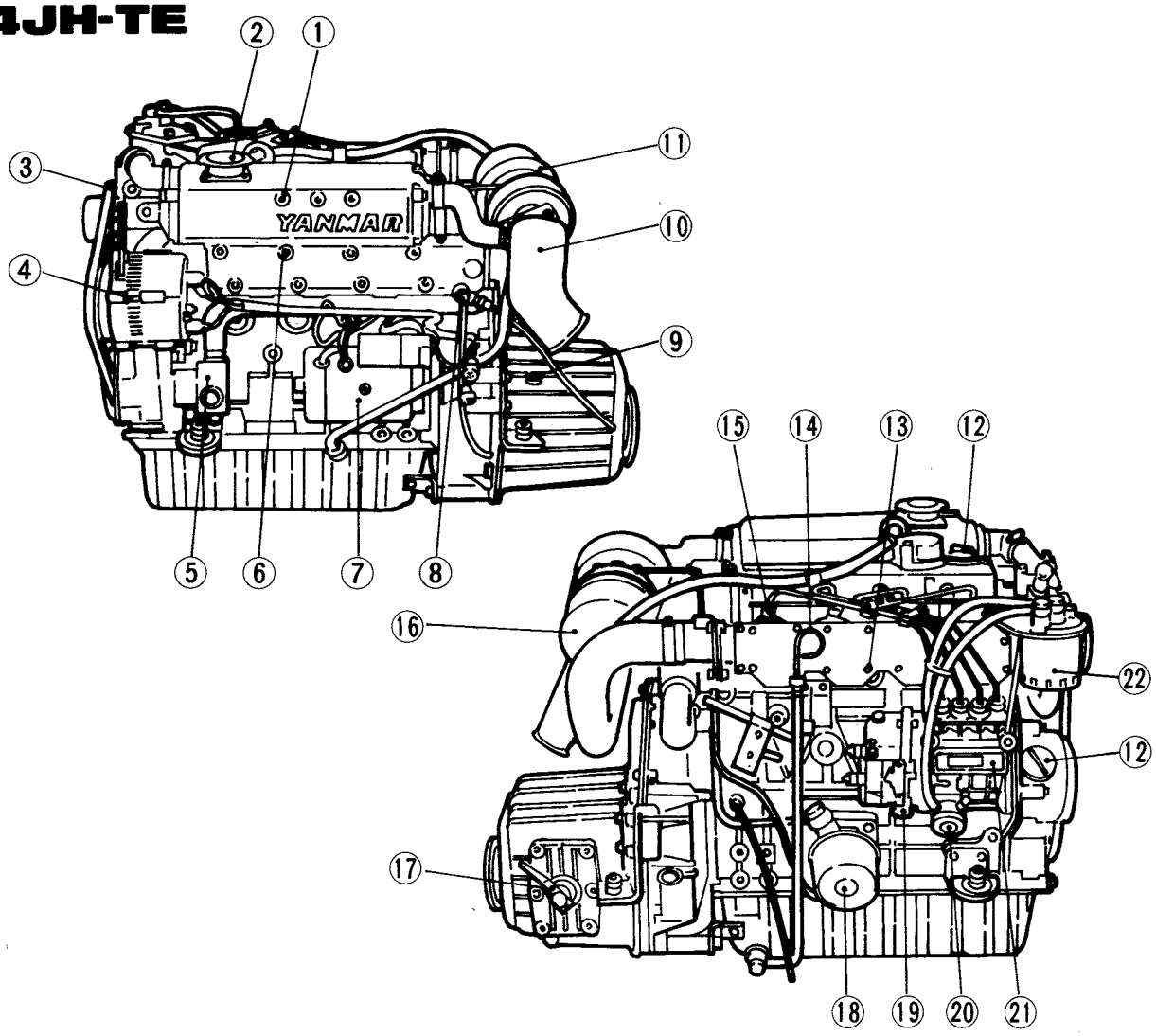
Model		KBW 20		KBW21
Type		Multi disc, wet, mechanical clutch		
Reduction ratio	Ahead	2.17	2.62	3.28
	Astern	3.06		
Lubricating system		Splash		
Lube oil capacity		1.2ℓ		
Cooling system		Forced cooling with fan mounted on flywheel		Sea water cooling

(2) 4JH-DTBE

Model		KM4-A		
Type		Multi disc, wet, mechanical clutch		
Reduction ratio	Ahead	2.14	2.63	3.30
	Astern	2.14	2.63	3.30
Lubricating system		Splash		
Lube oil capacity		1.6ℓ		
Cooling system		Forced cooling with fan mounted on flywheel		

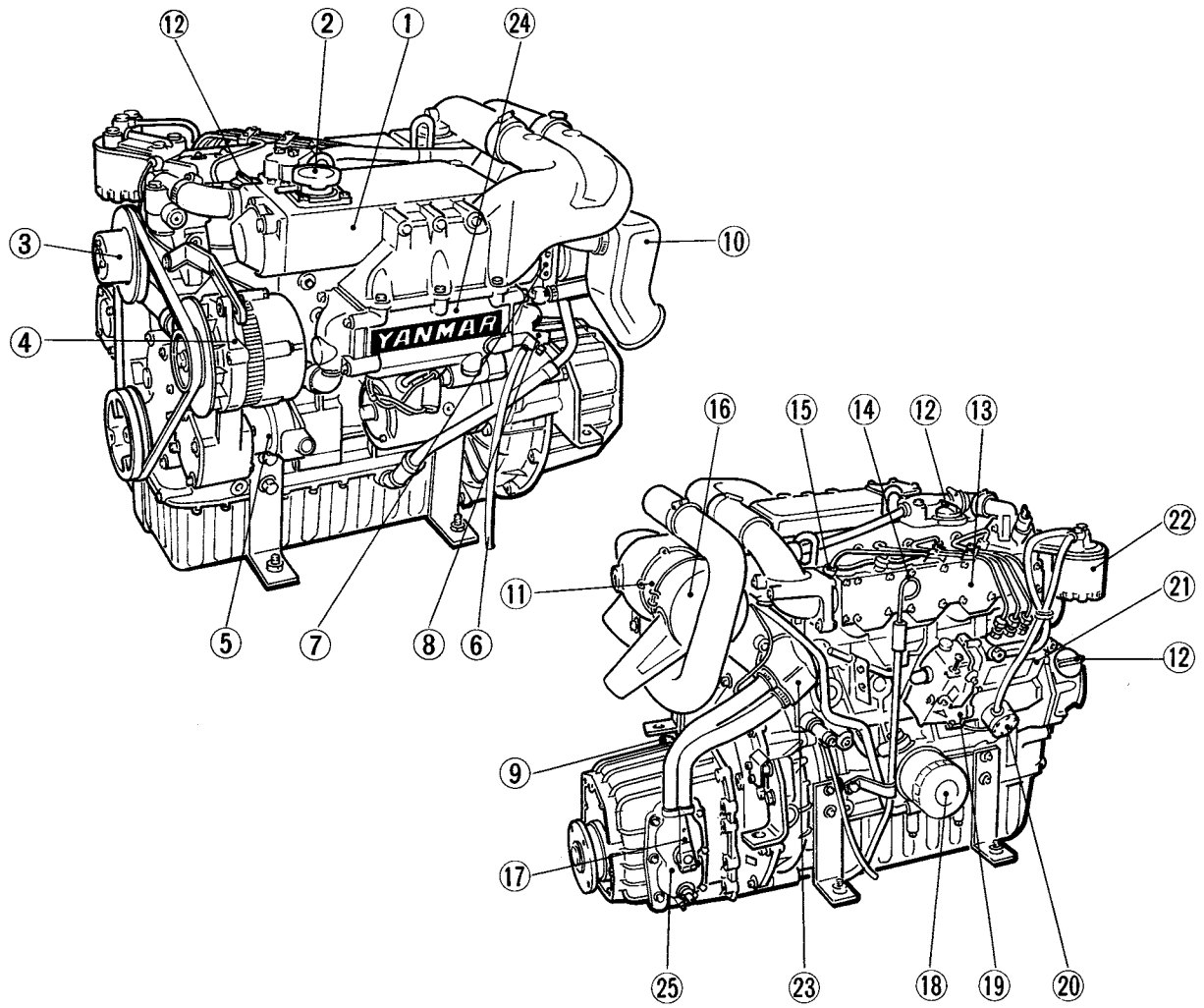
II. Names of parts

4JH-TE



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

4JH-HTE



No.	Names of parts
1	Fresh water tank (fresh water cooler)
2	Pressure cap (water feed port)
3	Cooling water pump (fresh water)
4	Alternator
5	Cooling water pump (sea water)
6	Exhaust manifold
7	Starting motor
8	Exhaust manifold water drain plug
9	Marine gear lube oil dipstick
10	Mixing elbow
11	Turbo-charger
12	Lube oil feed port
13	Air intake manifold

No.	Names of parts
14	Oil dipstick
15	Fuel injection valve
16	Air intake silencer
17	Clutch shift lever
18	Lube oil filter
19	Speed control lever
20	Fuel feed pump
21	Fuel oil injection pump
22	Fuel oil filter
23	Lube oil cooler
24	Air cooler
25	Clutch oil cooler

III. Engine installation

3-1. Inspection after unpacking

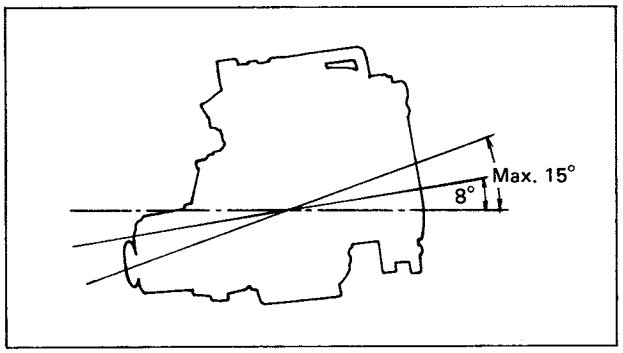
When unpacking the engine, be careful not to break the engine base.

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?

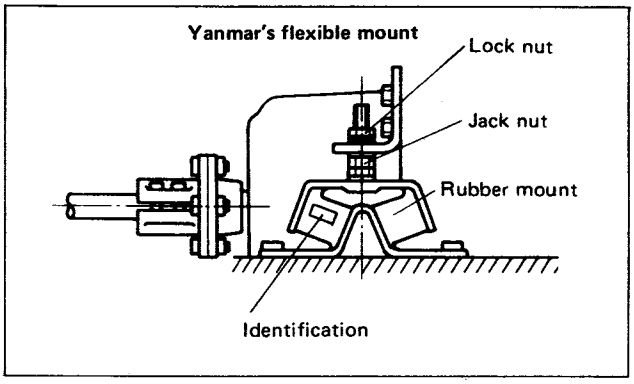
3-2. Preparation of the engine foundation plate

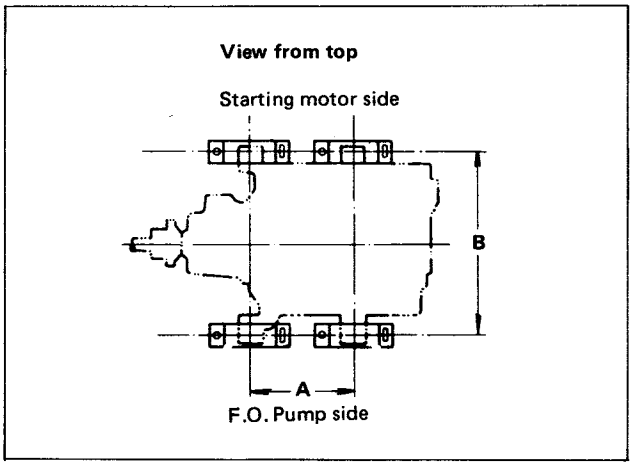
The installation angle will differ with the type of vessel and location of the engine. The most suitable installation angle is 8 degrees and the maximum installation angle is 15 degrees. If the angle is too large horsepower will be lost, engine parts will wear out faster and overall performance will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

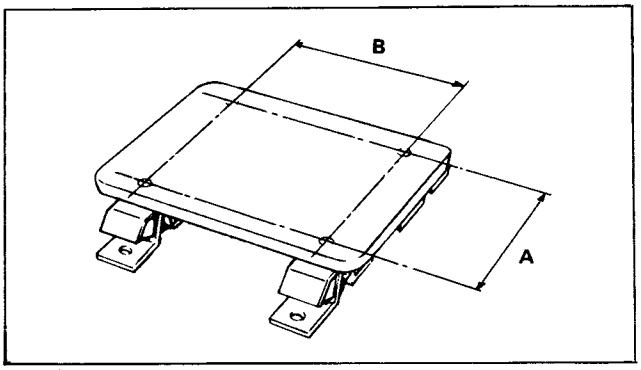




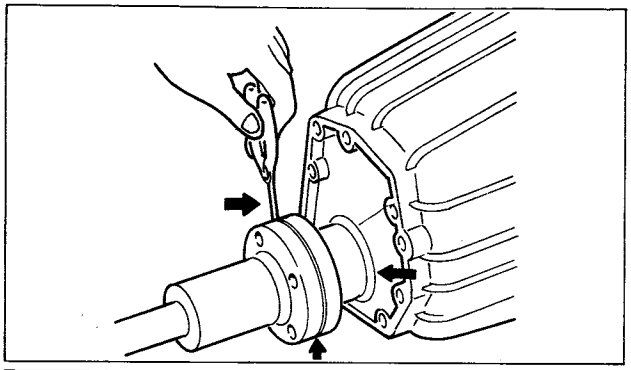
Identification		Installation distance (unit: mm)	
F.O. pump side	Starting motor side	A	B
150	200	492.5	470

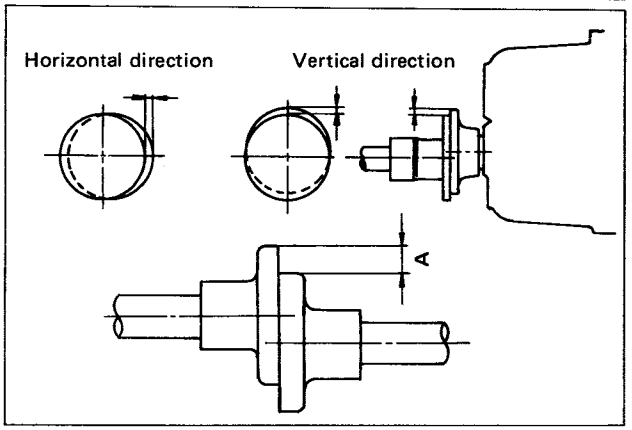
When determining the overall height of the engine bed, remember that the weight of the engine will depress the rubber mounts approx. 4 mm.

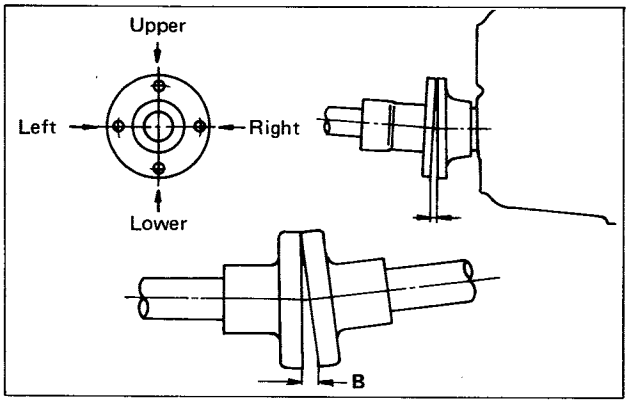
For convenient installation, make the GUIDE PLATE as illustrated.



2. Before connecting the clutch propeller shaft with the propeller shaft, make sure that the flange surfaces of both parts are parallel to each other, and that their centers line up.







mm (in.)

Coupling misalignment A	0.1~0.3 (0.0039~0.0118)
Coupling face run-out B	0~0.2 (0~0.0079)

If necessary, adjust the height of the engine with jack nuts. The maximum tolerance should be less than 0.2 mm. After finishing centering, tighten the lock nuts, rubber mounts and propeller shaft.

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 use. 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. To help reduce vibrations, use a suitable flexible stern tube.

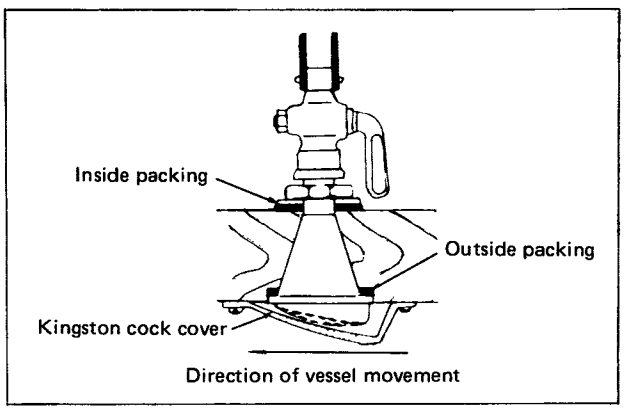
3-5. Cooling water supply device

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. For 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 left. Install the kingston cock cover as shown.



3. Piping

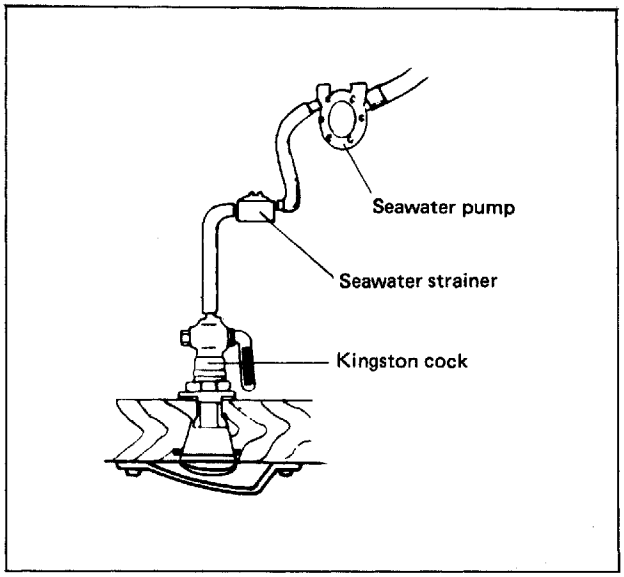
For the cooling water pipe, use a rubber hose with an inside diameter of 25.4 mm. Piping should be kept as straight and short as possible. If the pipe is too long, it will be difficult to draw water into the pump.

☞ See page 36 for piping diagram.

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

5. Seawater strainer

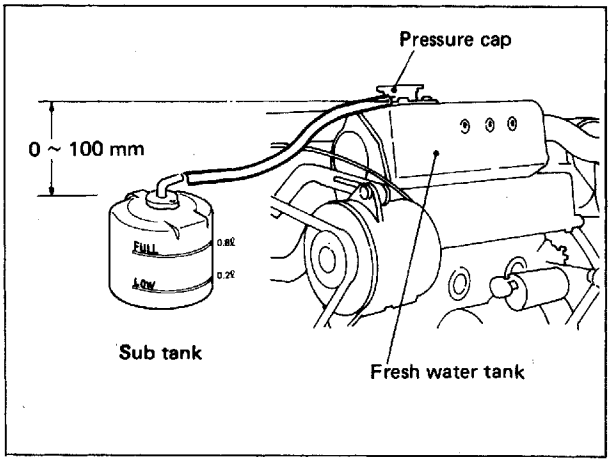
The seawater pump will be damaged if foreign matter is allowed to get into it. Therefore, attach a seawater strainer between the seawater pump inlet and the seawater cock when the seawater strainer is not already so equipped.

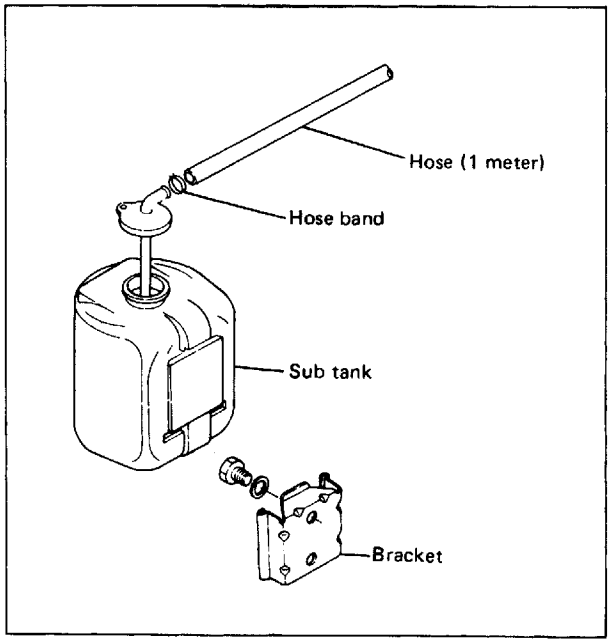


6. Sub-tank

When the engine is running, the fresh cooling water temperature rises. This is cooled by the fresh water cooler via seawater circulation. During operation, the temperature of the fresh water will rise and its cubic volume will increase, and water will flow out of the hole on the side of the pressure cap. A sub-tank has been installed to catch this overflow. Water collected in the sub-tank return to the heat-exchanger automatically when the engine cools. 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.

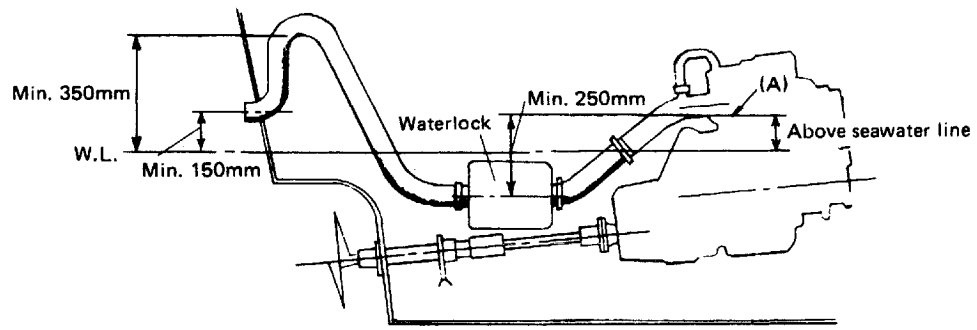




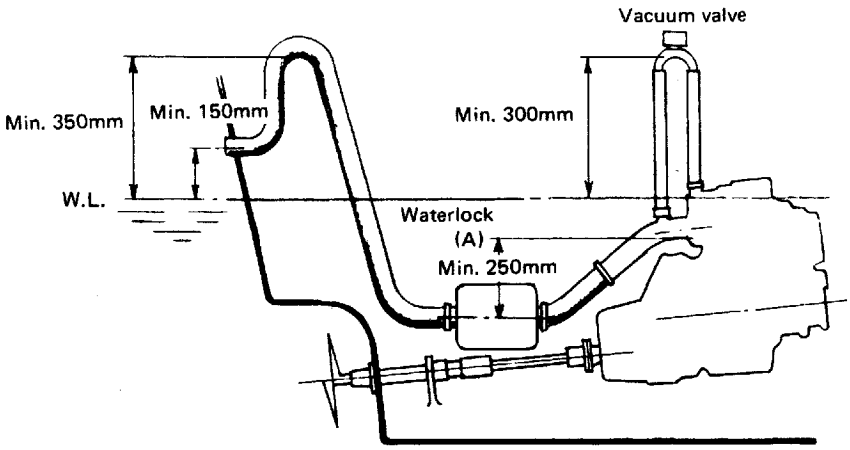
7. Exhaust pipe layout

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

Intake air is essential for maximum engine performance. Therefore, the engine room must be adequately ventilated. Yanmar recommends that both an air intake port and forced discharge ventilator be installed in the engine room.

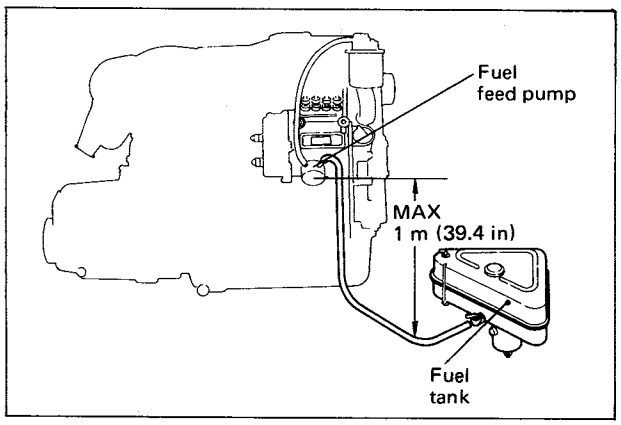
IMPORTANT

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

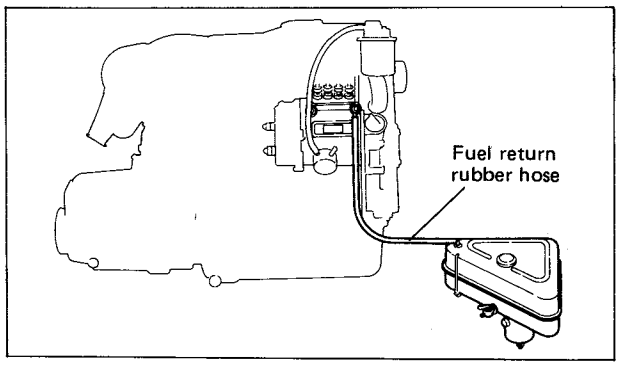
3-6. Fuel oil supply device

(1) The fuel tank should be installed as far as possible from the engine itself.

(2) The height of the fuel tank must not be more than 1 meter below the fuel feed pump attached to the enigne. If lower, an extra feed pump should be attached.



(3) Since the fuel that overflows from the injection nozzle returns to the injection pump, connect the fuel return rubber hose between the fuel injection pump and fuel tank.



3-7. Remote control

IMPORTANT

This engine is designed to use a single lever handle remote control head. A two lever type can not be used.

1. Control cable

Recommended cable	Control cable	Cable clamp	Connecting metal fitting
Speed control	Morse 33-C (optional)	Yanmar made (Standard)	
Engine stop (optional)	Yanmar made (1.5ϕ)	—	—
Gear shift	Morse 33-C (optional)	Yanmar made (Standard)	

2. Speed control

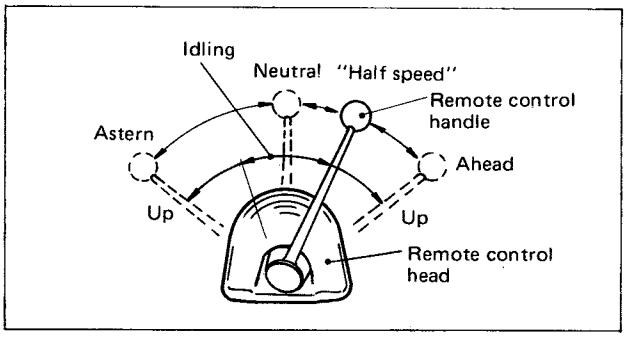
A spring is attached to the connector to absorb shock when operating the speed control lever. The wiring should be arranged so that the spring works when the throttle is "idling".

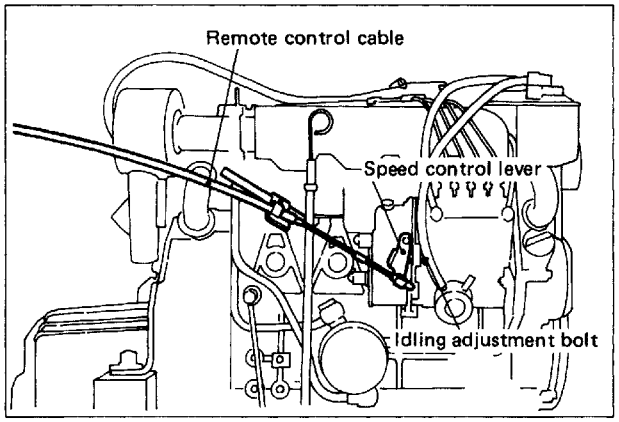
3. Adjustment of the speed remote control cable

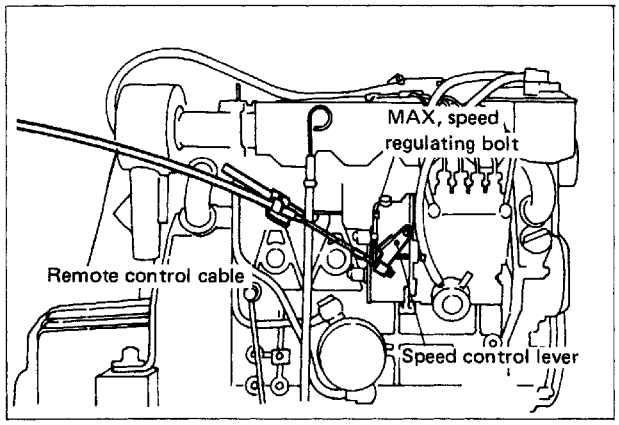
After completing wiring, check the following points.

(1) Place the control head lever in "Neutral" and make sure that the speed control lever on the engine side touches the idling adjustment bolt.

(2) Place the control head lever in the "Full" speed position and make sure that the speed control lever on the engine touches the maximum speed regulating bolt. If it doesn't adjust the length of the control cable with the adjusting screw.

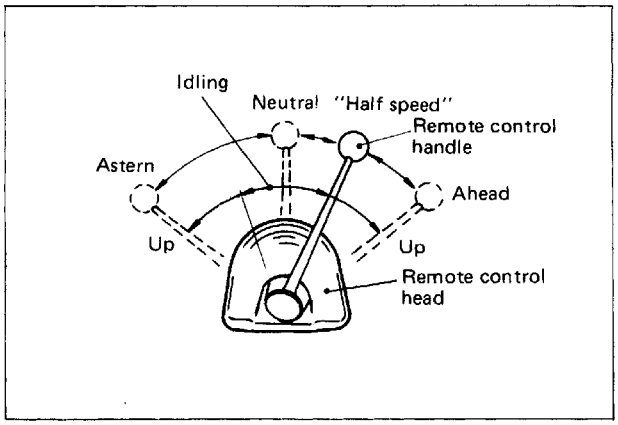


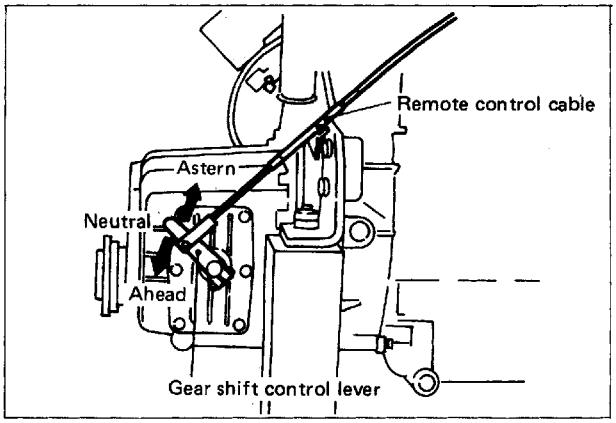




4. Reversing gear shift remote control

The wiring should be arranged when the control lever on the marine gear and the control head lever are bothe in "Neutral". After completing wiring, make sure that both levers move in the same direction.



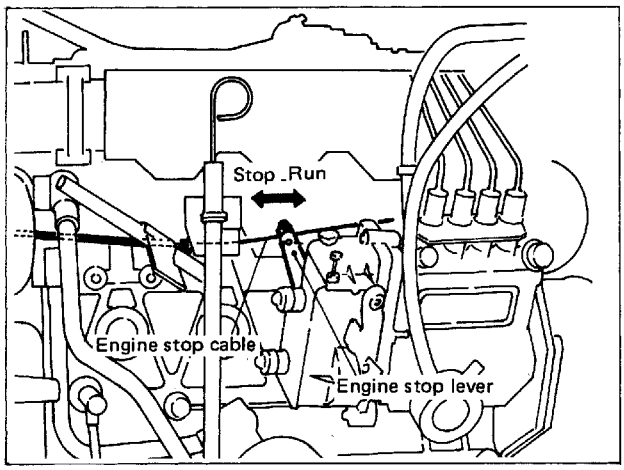


5. Testing remote control cables

Move the control lever on the control head to "Ahead", "Neutral" and "Astern" as well as to the "Low" and "Full" positions, and make sure that the clutch shift lever and the speed control lever on the engine side function properly.

6. 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.



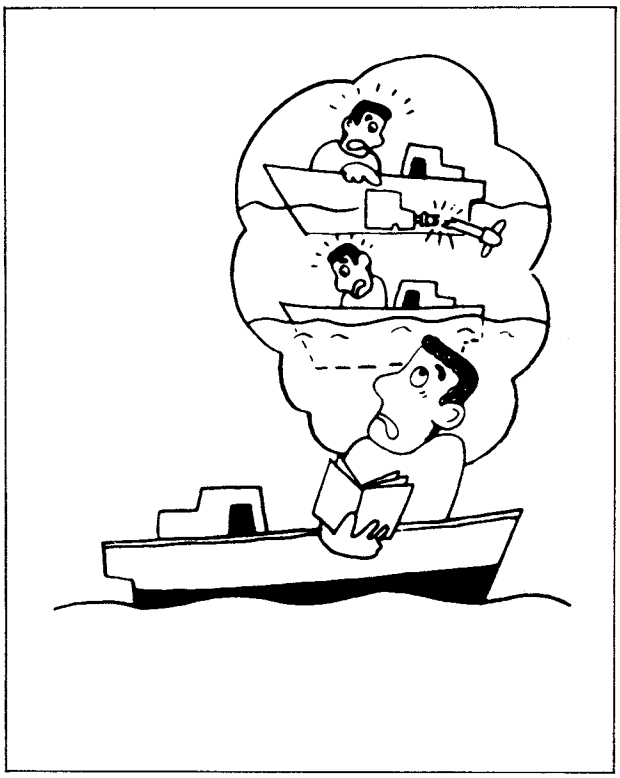
3-8. Recommended battery capacity

Use battery of sufficient capacity.

4JHE 4JH-TE 4JH-HTE 4JH-DTE	12V – 100AH (mini)
	12V – 120AH (standard)
	12V – 150AH (cold weather)

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 insure peak performance, use fuel with less than 0.5% sulphur content.

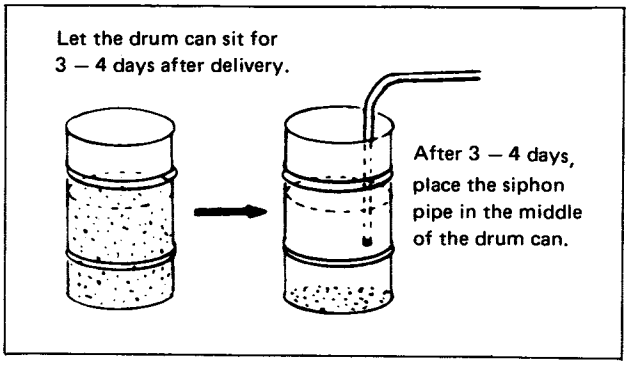
(2) For maximum filter life, sediment and water should not exceed 0.1%.

(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 (42°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.

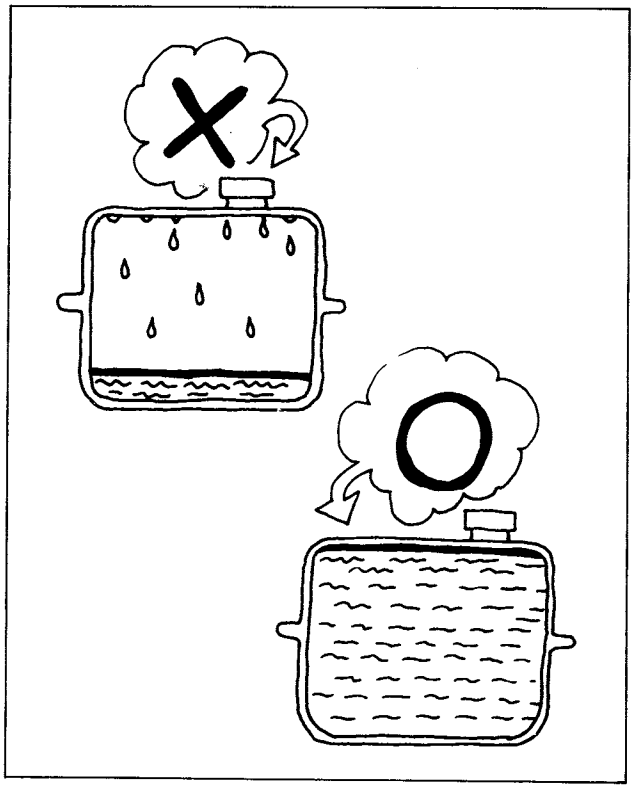


IMPORTANT

Water of dirt in the fuel may cause engine failure and rapid wear of the fuel injection equipment. Water and dirt in the fuel tank should be filtered out.

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. Engine lube 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.

(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.	SAE 10W	SAE20 or 20W	SAE30	SAE40
Engine room temperature	Below 0°C ~ 15°C ~ 30°C ~ 45°C			

2. Marine gear lube oil

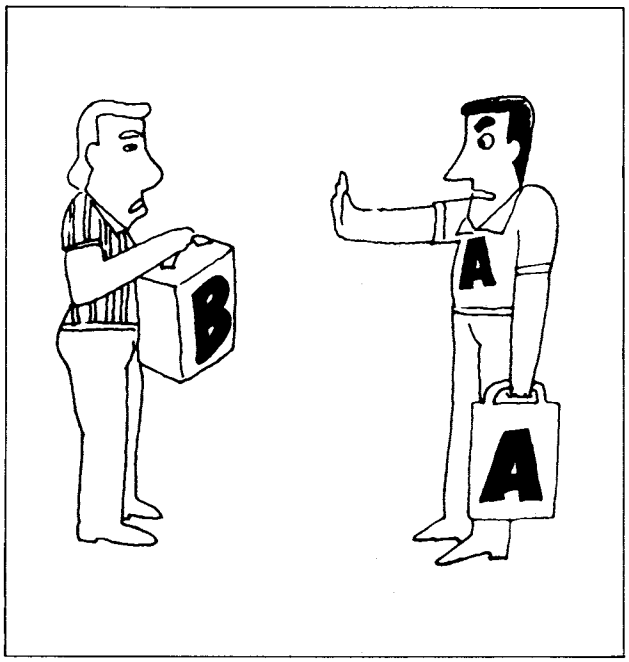
The marine gear lube oil is different from the engine lube oil. Choose a good quality lube oil from the list below.

Recommended brands of lube oil

Supplier	Brand name
SHELL	SHELL DEXRON
CALTEX	TEXAMATCI FLUID (DEXRON)
ESSO	ESSO ATF
MOBIL	MOBIL ATF220
B.P.	B.P.AUTRAN DX

NOTE

1) **When selecting a lube oil, consult your near-eat 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 efficiency.**



VI. Starting the new engine for the first time

IMPORTANT

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

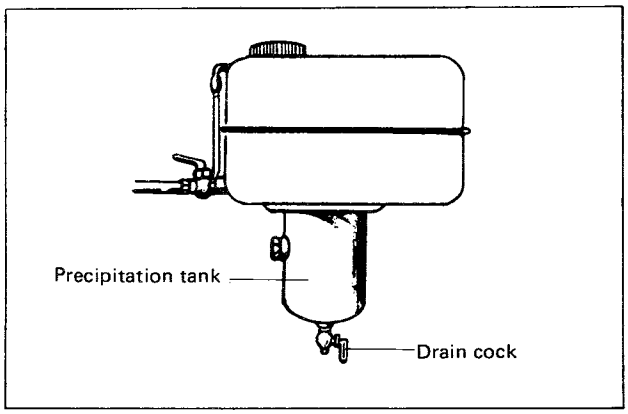
6-1. Supply of fuel oil

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 water and dirt.

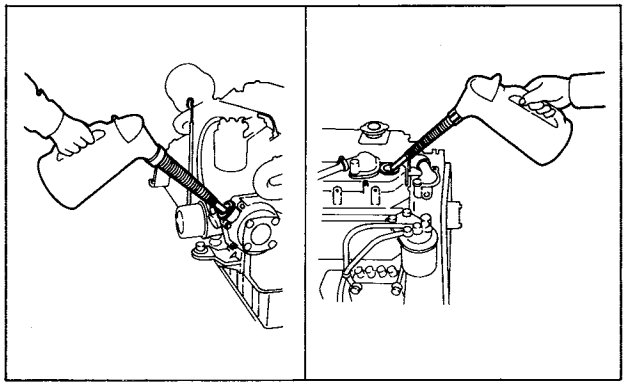


6-2. Supply of lubricating oil

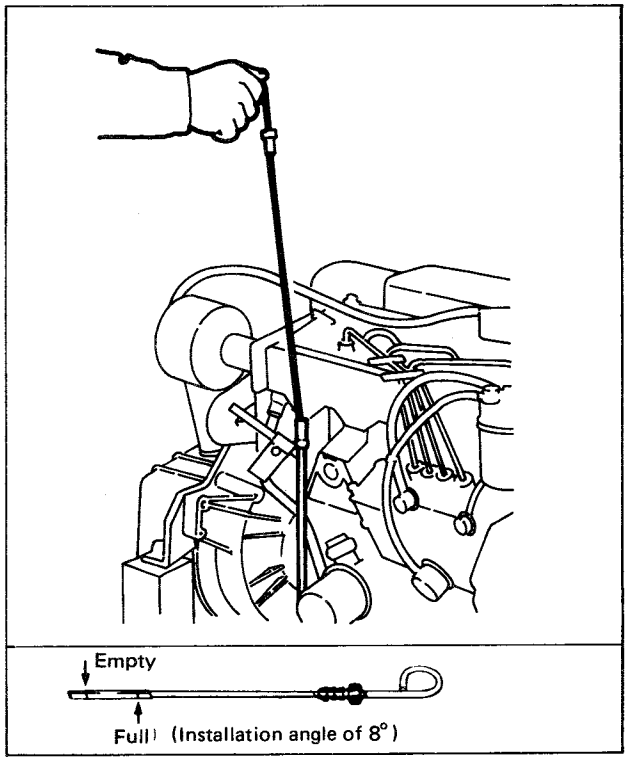
1. Lube oil to the crankcase

(1) Remove the lube oil supply port (yellow cap) and add the approved lube oil.
There are two supply ports. One is on the cylinder head cover, the other is on the gear case cover.

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	
4JH-(T)(HT)E	6.5ℓ
4JH-DTE	8.0ℓ

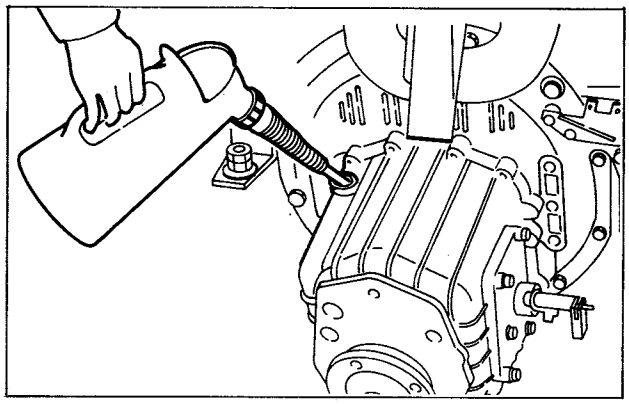
NOTE

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

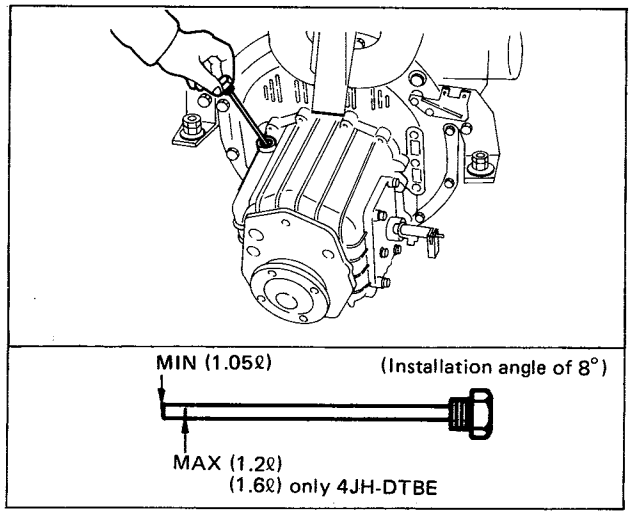
amount of oil in the crankcase. Run the engine for several minutes, then turn it off and re-check the oil two or three minutes later.

2. Lube oil to the marine gear

(1) Loosen and remove the dipstick on the marine gear and pour in the approved lube oil.



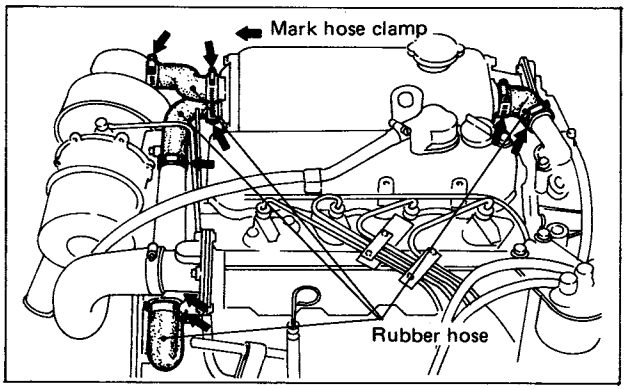
(2) Check the lube oil with the dipstick. Do not screw the dipstick in; push it only to the top of the lube oil filler hole.



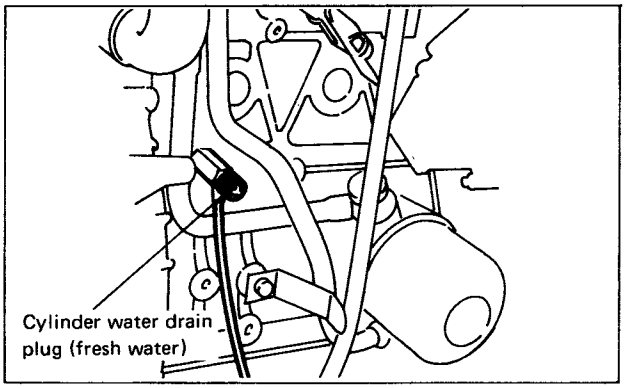
3. Supplying fresh water to the tank

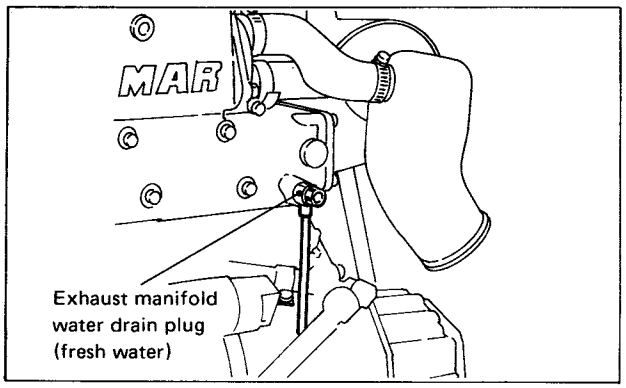
(1) Checks before supplying

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.



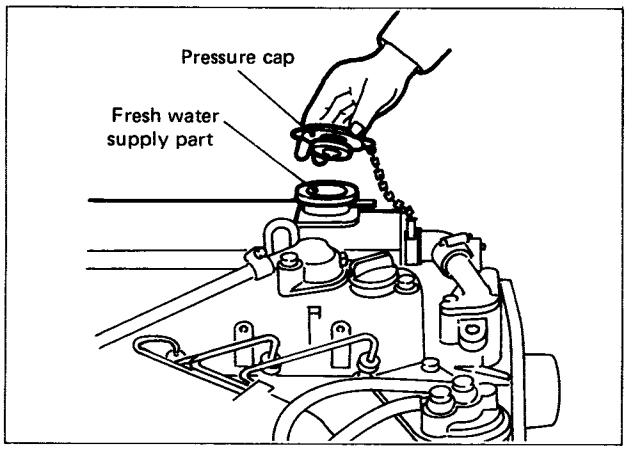


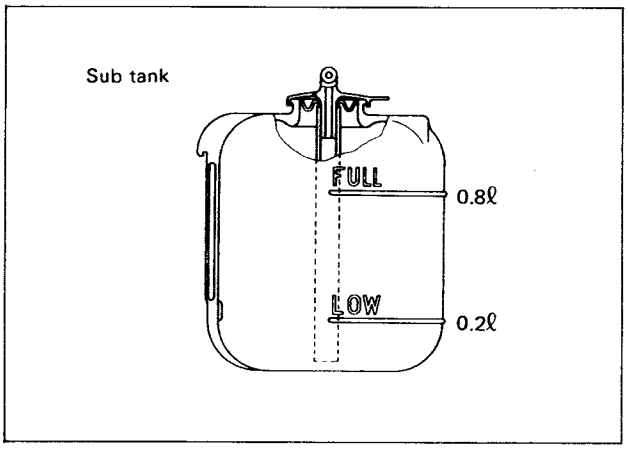
(2) Supplying water

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.

- Fresh water capacity

Fresh water tank	6.0ℓ
Sub tank	0.8ℓ





NOTE

(1) When running the engine for the first time or after replacing the cooling water, the cooling water flows to the piping and the amount of water in the heat exchanger drops. Run the engine for several minutes. Then turn it off and re-check the water.

(2) Be sure to tighten the filler cap. If it is loose, water will be lost during operation, leading to engine overheating.

(3) 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.

(4) 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 24 for air bleeding procedures.

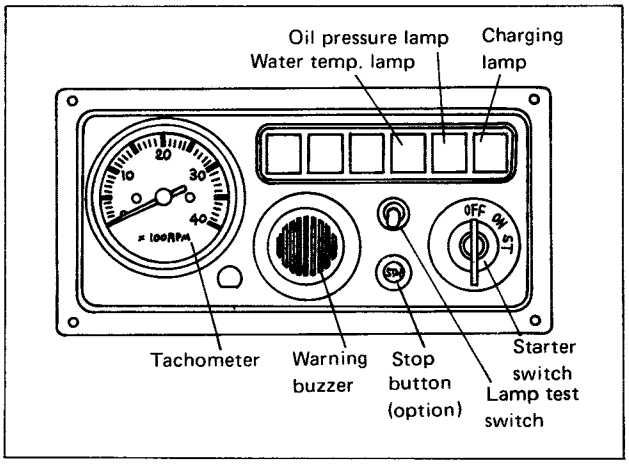
6-4. External inspection

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 left.
   Make sure the engine room is always kept neat and clean.

6.5 Checking the instrument panel alarm system

Yanmar offers three different instrument panels to choose from. In this manual, the B-2 type is explained. For details on other types, see the manuals provided with them.

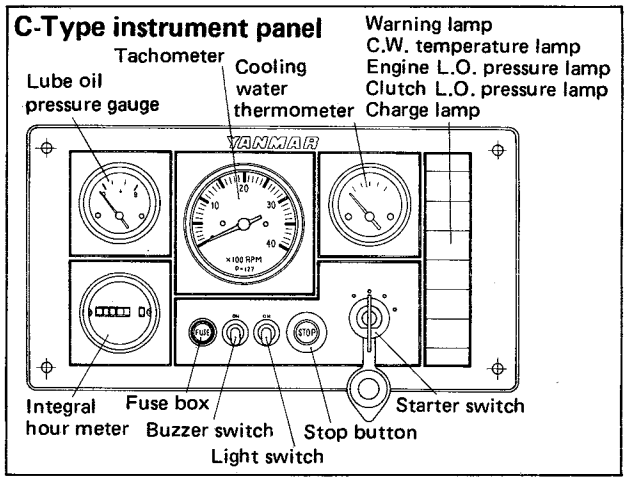
Turn on the battery switch. Then place the key in the "ON" position and check the condition of the lamps on the panel (with the engine stopped).

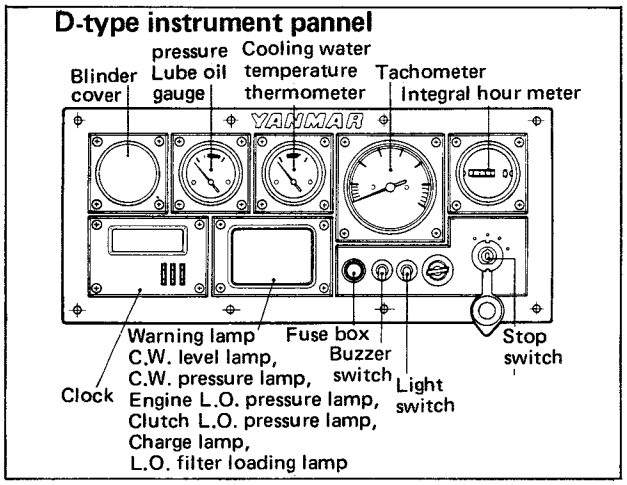


1. Lube oil warning lamp.
   Should be lit.
2. Cooling water temperature warning lamp.
   Should be out. Raise the CHECK switch to "ON" to make sure the cooling water temperature warning lamp lights.

3. Charging warning lamp.
   Should be lit.

4. Warning buzzer.
   Should sound.





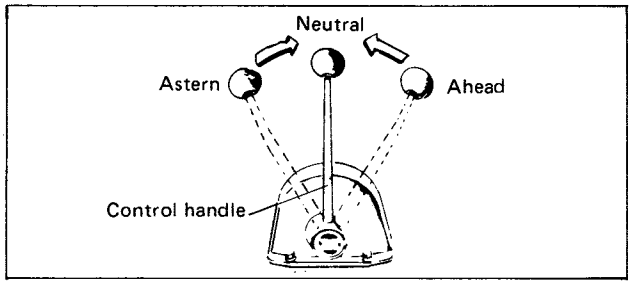
NOTE

All these signals will continue until the engine starts up or the key is turned off.

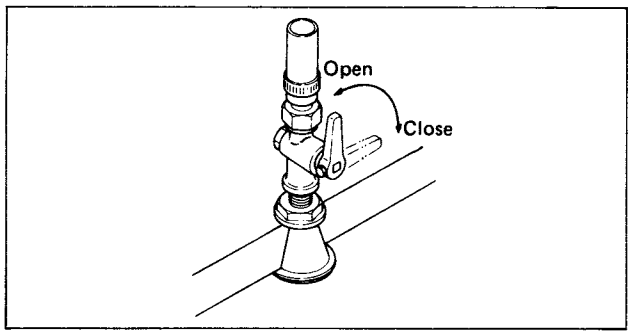
6-6. Turning

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.

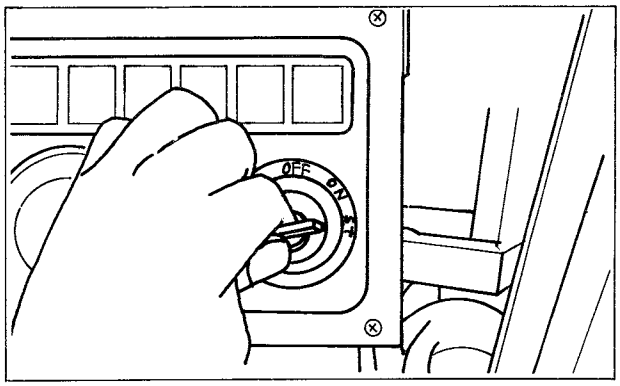


3. Pre-start test

Yanmar offers two engine stop methods. Conduct the following test depending on your stop method.

(1) Manual engine stop type

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.



(2) Electrical engine stop type

While pushing the engine stop button, follow the same procedure as with the manual stop type.

⚠CAUTION

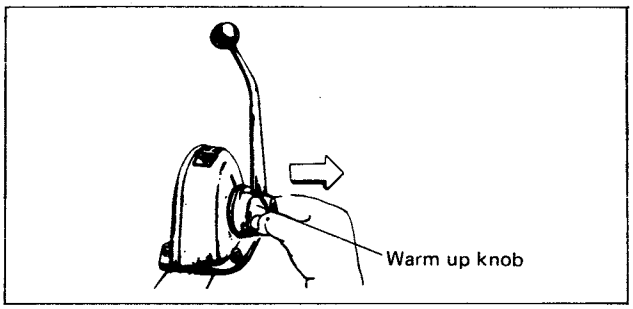
1) **Do not release the engine stop cable or stop button when handling the key.**

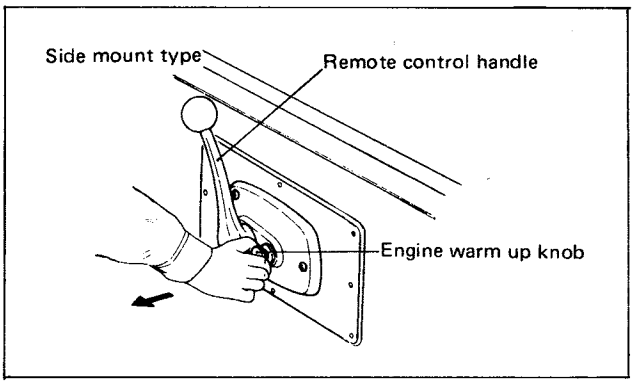
2) **Before starting the engine make sure there are no tools, etc. left in the engine area, especially in areas where there are revolving parts.**

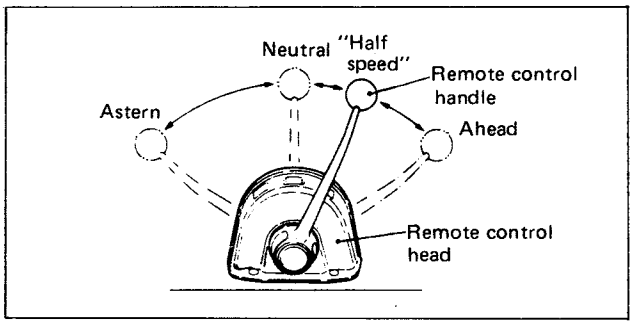
VII. Method of operation

7-1. Starting

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







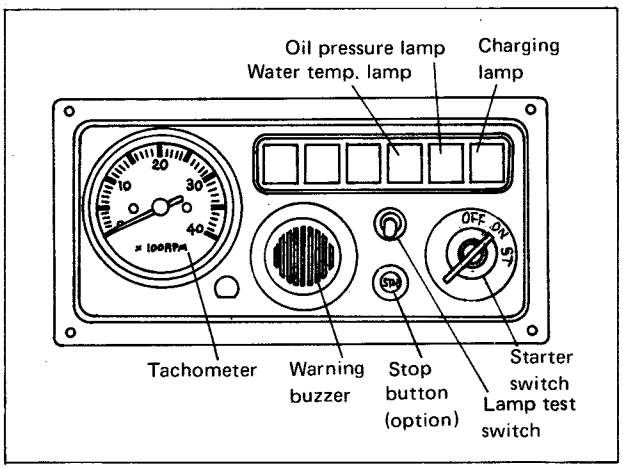
NOTE

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

2. Turn the battery switch "ON".

3. Turn the key to the "START" positon. The engine will start. When the engine starts, release the key. The key automatically returns to the "ON" position.

4. 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.)



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.**

3) **When the engine is operated at a low idling speed (below 1000rpm) for a long time (over 2 hours), excessive carbon and fuel residue tends to accumulate due to incomplete combustion.**
Carbon deposits on the injection holes of the fuel injection valve exhaust valve, the turbine blades of the turbocharger, etc. cause a drop in engine output, knocking, and other troubles. To prevent these problems, be sure to blow off the carbon accumulations by full speed operation.
Operate the engine at over 2500rpm for one minute in every two(2) hours of continuous low idling operation.

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, nor does the cooling water reach the specified temperature. Operate the engine at around 1000 rpm.

IMPORTANT

1. **When running the engine for the first time after launching, or after long storage, 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.
3. With the control lever in "NEUTRAL", make sure that water comes out of the cooling water outlet pipe after the engine starts up.
4. 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 650 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 650 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 24 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

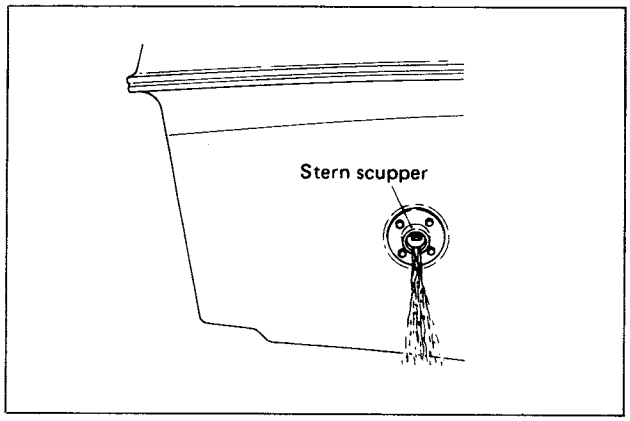
Make sure the cooling water is flowing from the outlet pipe and that the cooling temperature lamp is out. If water comes out irregularly, or if the amount is small, check:

(1) Whether air is being taken into the cooling water system. Air usually leaks in because of loose hoses on the kingston cock or seawater pump.

(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.

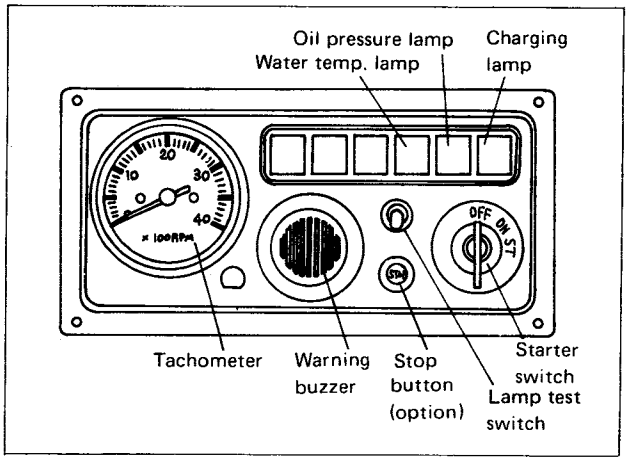
(4) Cooling water efficiency drops due to contamination of the heat exchanger.



☞ See page 28.

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 650, 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.

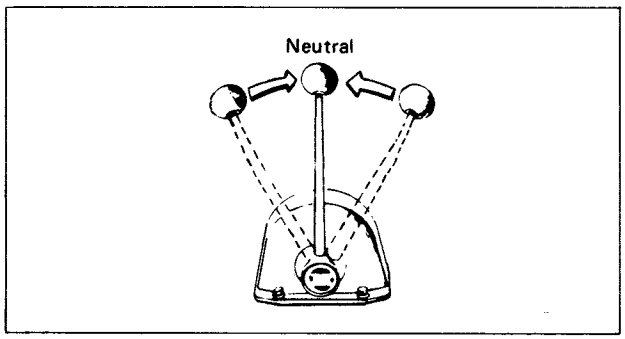
9. Abnormal sounds during operation

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

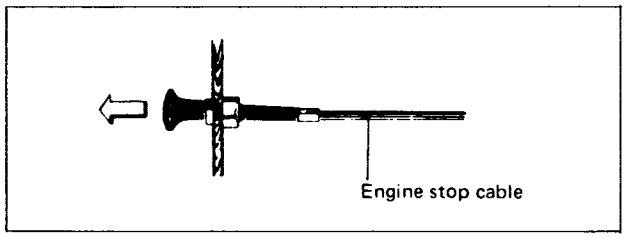
(1) Place the control handle in the "neutral" position and run the engine at approx. 650 rpm for about 5 minutes.

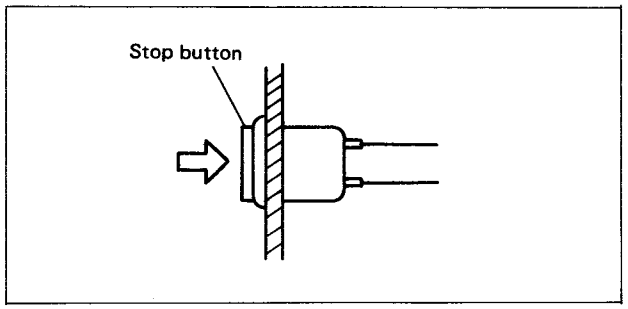


IMPORTANT

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

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



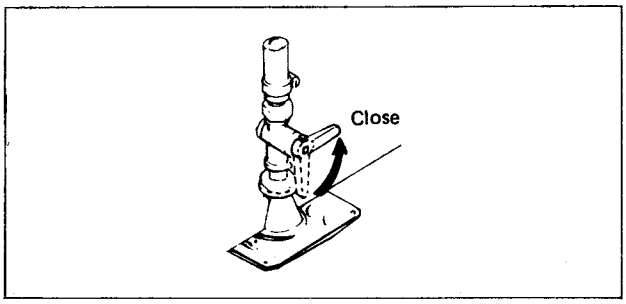


(3) Turn off the key switch.

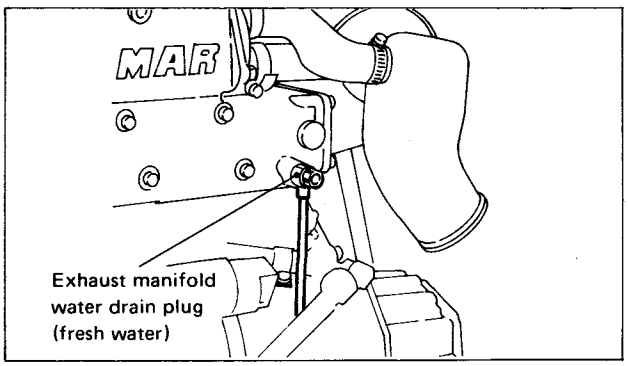
NOTE

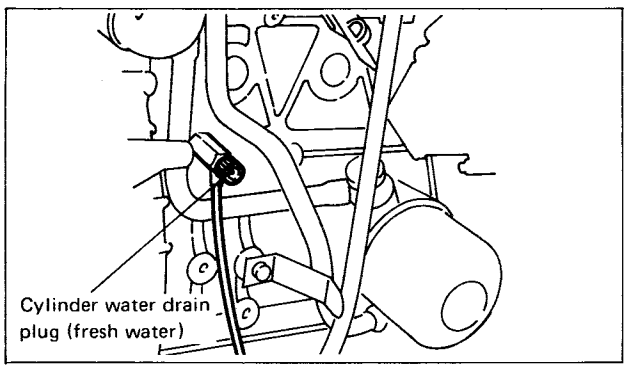
When stopping the engine with the starter switch "ON", the lube oil pressure warning buzzer will sound. This is normal and does not indicate engine trouble.

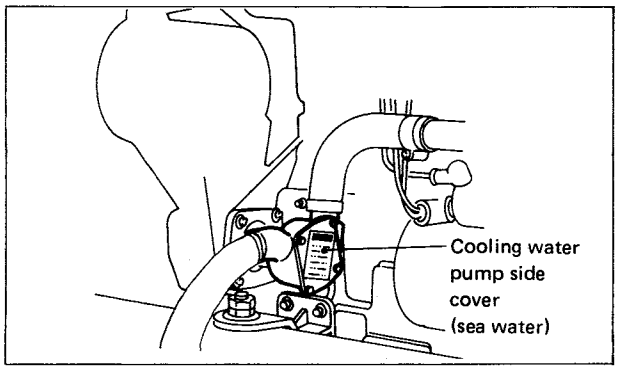
2. Be sure to close the kingston cock after stopping.

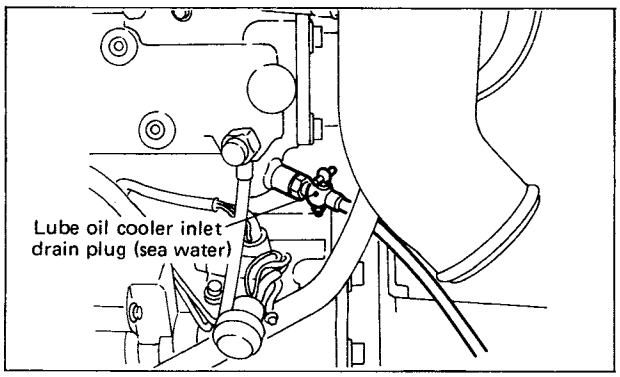


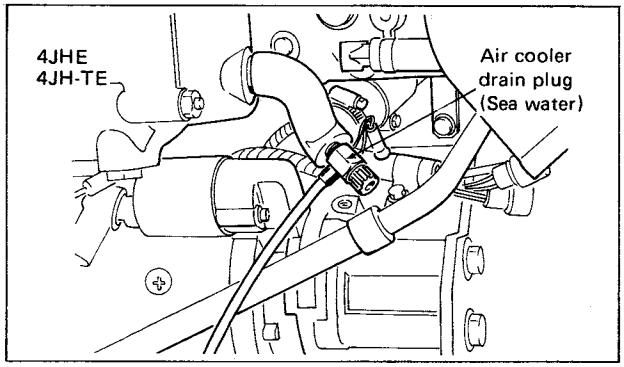
3. Drain out the cooling water from the five positions as shown below. In winter and cold areas, the cooling water should be drained out after use.

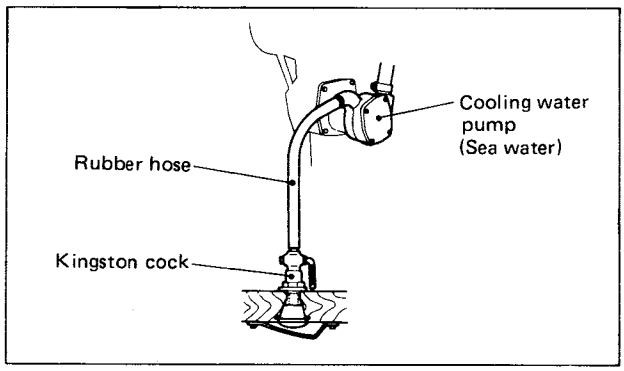












4. While the engine is still warm, wipe off any dirt and grime that has accumulated.

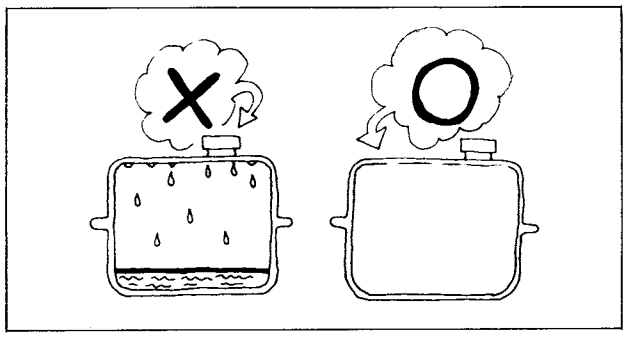
5. Turn off the battery switch.

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.

☞ See page 20. 7–4, 3

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-ventilated place.
   Re-charge once a month during storage.
5. Use tape to seal air inlets, the 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 38.

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 150 hrs	Every 300 hrs	Every 600 hrs
Fuel system	Check the oil level		○				
	Fill with fuel		○				
	Drain the fuel tank			○ (First)		○	
	Replace the fuel filter					○ (Replace)	
	Check the injection timing						○
	Check the injection spray condition						○
Lubricating system	Check the oil level	Crankcase	○				
		Marine gear	○				
	Replace the oil	Crankcase		○ (First)	○		
		Marine gears		○ (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			○ (First)		○	
	Check the impeller of the cooling water pump (sea water pump)						○ (Replace)
	Check the thermostat function						○
Air intake and exhaust system	Clean the steel mesh of the air intake silencer					○	
	Clean the exhaust/water mixing elbow					○	
	Clean the breather pipe					○	
	Check the exhaust gas condition		During operation				
	Compressor 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		○ (After starting)				
	Retighten all major nuts and bolts						○
	Retighten the cylinder head bolts						○
	Adjust intake/exhaust valve clearance			○ (First)			○
Remote control system, etc.	Checking the remote control operation			○ (First)			○
	Adjust the propeller shaft alignment			○ (First)			○

MAINTENANCE STANDARD

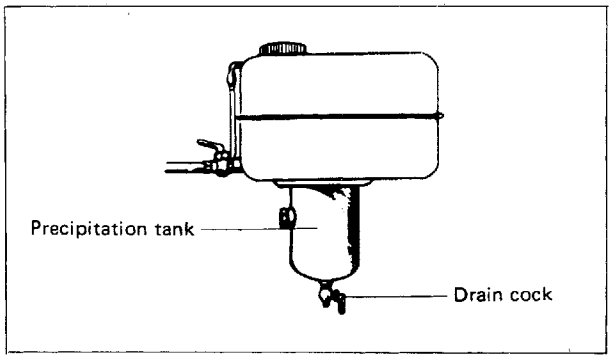
Fuel system	Fuel injection pressure		200±5kg/cm^2
	Fuel injection timing		bTDC12°±1°
Lubricating system	Warning buzzer and lamp operating pressure		Below 0.5kg/cm^2
	Crankcase lube oil amount (with an installation angle of 8°)		6.5ℓ
	Marine gear lube oil amount		1.2ℓ
Cooling system	Thermostat open	Partially 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)		8±0.5kg-m
	Intake/exhaust valve clearance		0.2mm

9-1. Fuel oil system

1. Fuel tank and fuel supply

(1) Fill the tank.

See page 11 for selection of fuel oil, and page 13 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.

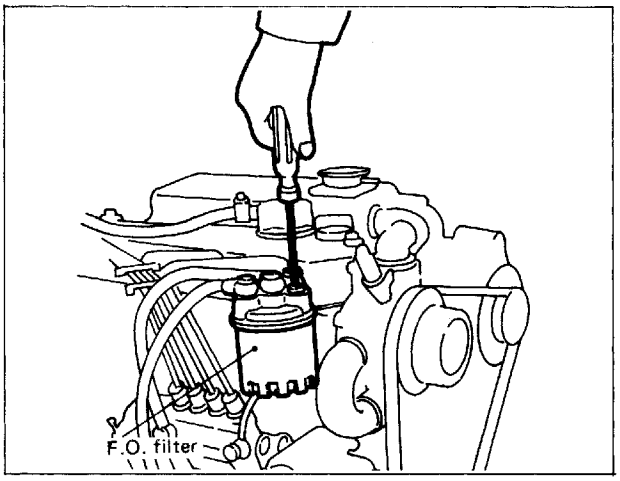
(3) If the vent in the fuel tank cap is blocked, fuel will not flow. Clean the fuel tank cap and blow dry periodically.

2. Air bleeding in the fuel system

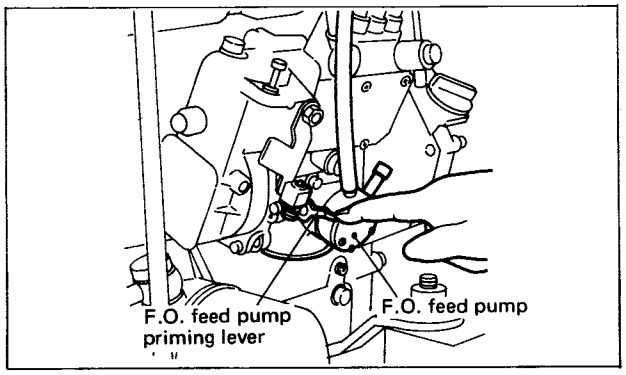
If the engine is operated when the fuel tank is empty, or with the fuel tank outlet cock closed, air is sucked into the fuel oil system, and the engine stops. When this happens, vent air as in the following:

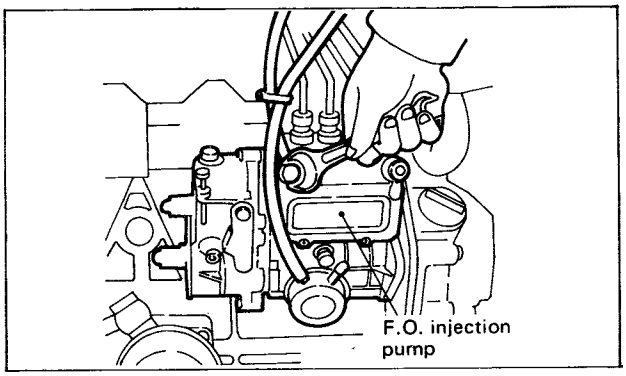
(1) Add fuel to the fuel tank.

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

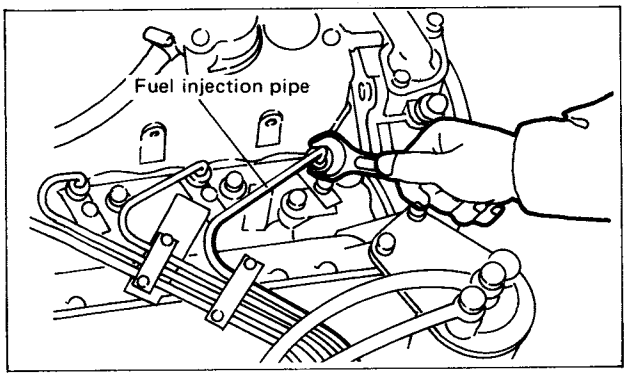


(3) Loosen the hexagonal bolt on the fuel pump. Push the fuel feed pump priming lever to vent the air. After venting the air, firmly tighten the hexagonal bolt.





(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

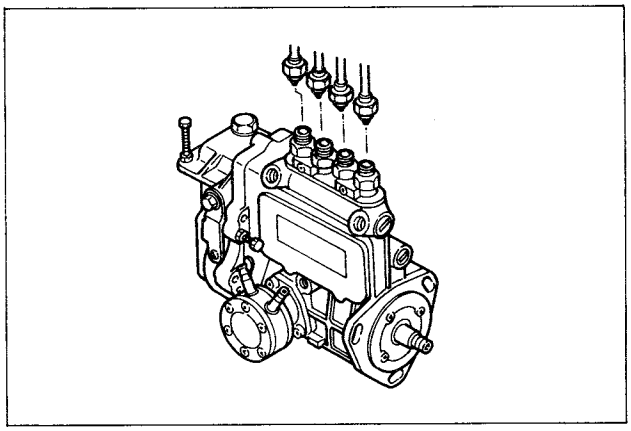
Diesel fuel escaping under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood to check suspected leaks. If injury occurs, see a doctor at once, or serious infection 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.

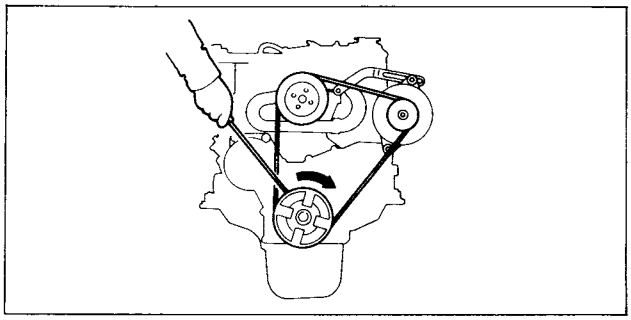
Check the fuel injection timing as follows:

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



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

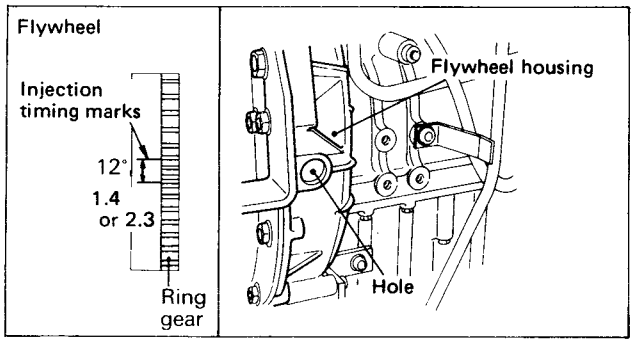
(3) Insert a turning bar into the hole on the crank pully on the front side. Crank the engine lightly to check the fuel injection timing.



(4) Timing marks on the flywheel can be seen through the hole on the flywheel housing.

NOTE

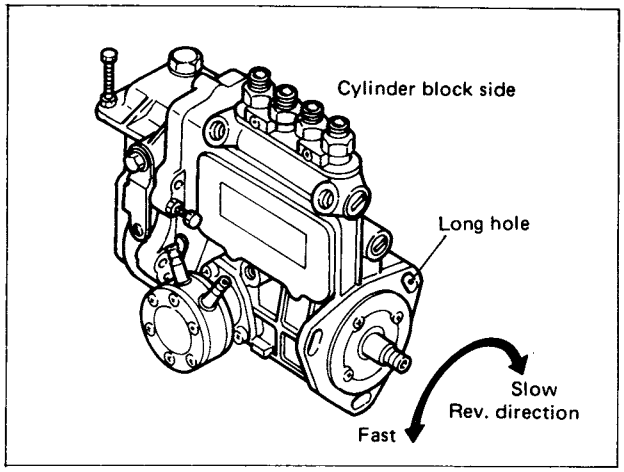
All timing marks on the flywheel are indicated by number; for example, 1.4 or 2.3. These indicate top dead center of the pistons. Fuel injection timing marks are described 12° before this TDC mark.



(5) Fuel should bubble out at the same time the timing mark on the flywheel and the indication mark on the flywheel housing line up.

(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): 12° ±1°



(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) wear or sticking of the fuel injection nozzle.
c) fuel bad.

IMPORTANT

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

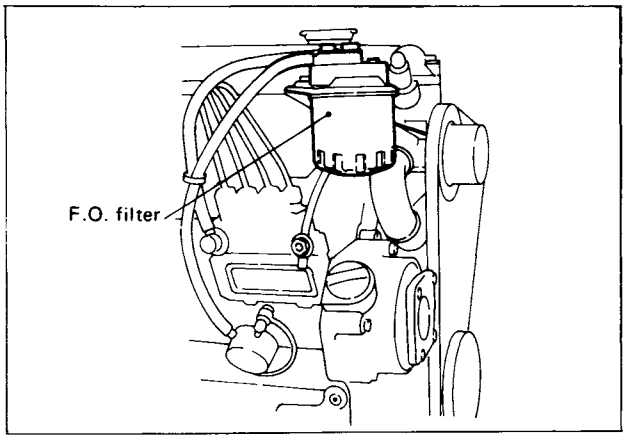
4. Replacing the fuel filter

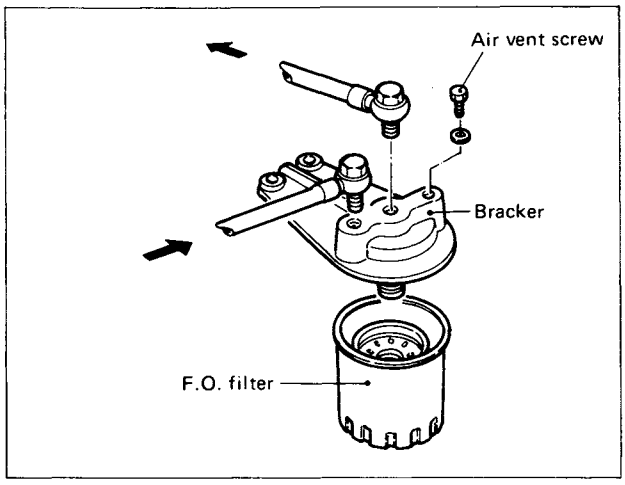
(1) Since the fuel oil filter is of the cartridge type, the element cannot be cleaned by removing the filter. Replace the filter as a unit after the specified period of use.

Replace: Every 300 hours

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

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





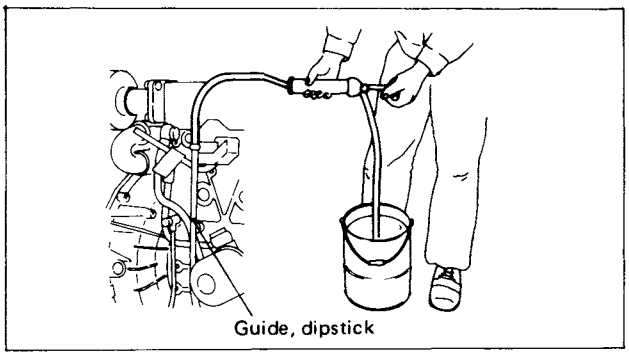
9-2. Lubricating oil system

1. Engine lube oil

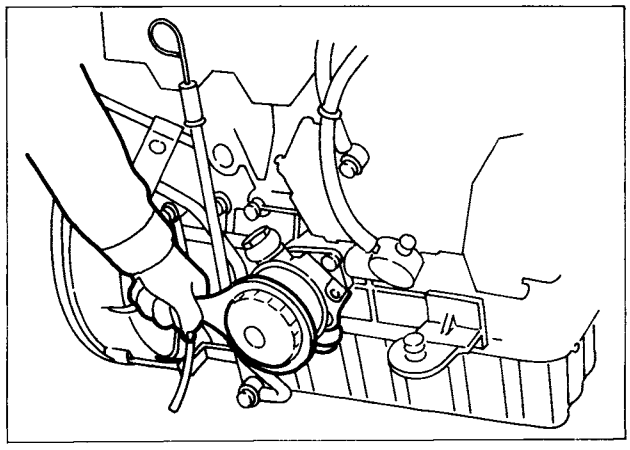
(1) Check the oil level before operation.

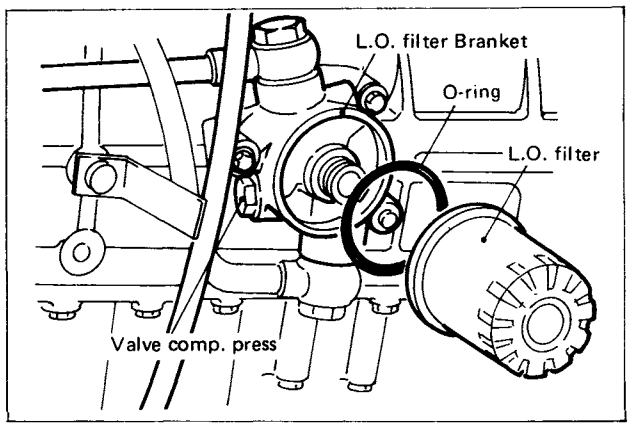
See page 13

(2) Replace the oil after 50 hours of operation (after starting for the first time or after long storage) and every 150 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 pumped out through the dipstick hole. Put the evacuation pump rubber hose over the dipstick hole.
Outer diameter of dipstick hole..... ϕ15 and ϕ19.



(3) Replacing the lube oil filter.
Replace the lube oil filter after 50 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 canisters.

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.

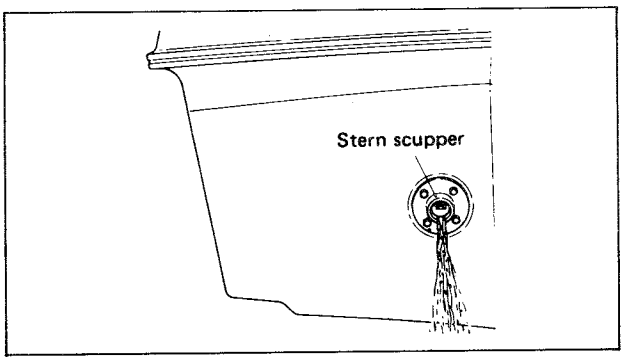
IMPORTANT

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

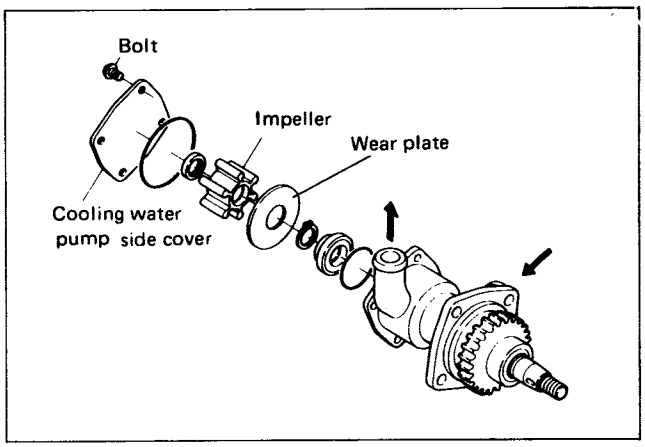
1. Make sure that water is coming out of the cooling water outlet pipe during operation.



2. Inspection and replacement of cooling water pump

(1) Impeller of cooling water pump

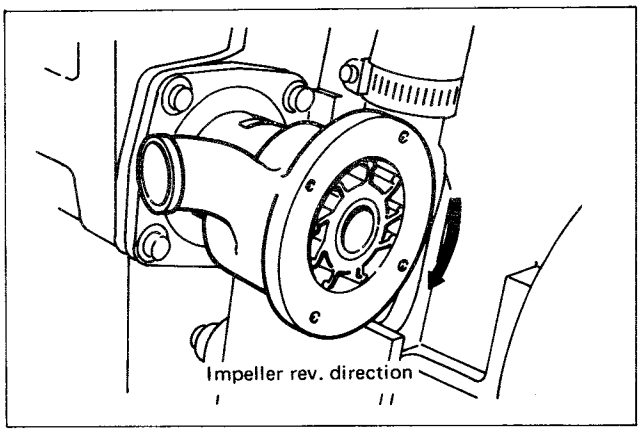
a) Remove the cooling water pump cover, take out the impeller, and check for damage to the impeller, side cover and wear plate.
If damaged, replace with a new one.



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, or the sea water pump sucks air.

(4) Fresh water isn't cooled due to contamination of the sea water passage of the heat exchanger.

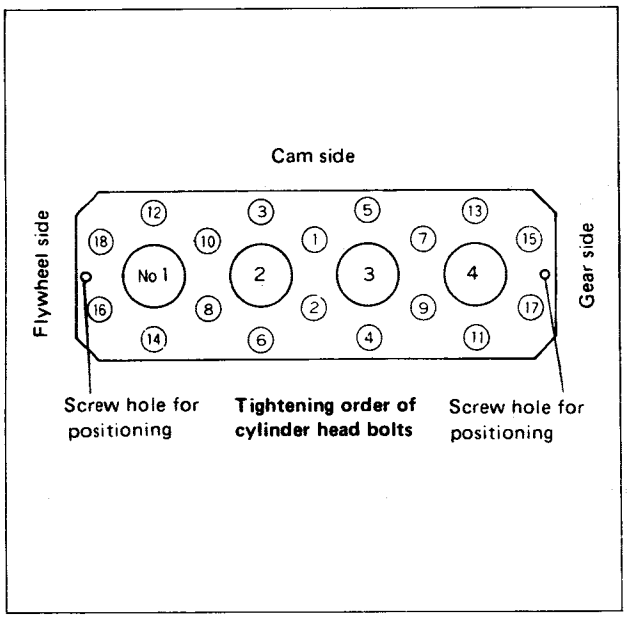
(5) When adding fresh cooling water was added, the engine was not completely air-vented.

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	8 ± 0.5 kg-m

2. Exhaust/intake valve head clearahce adjustment.

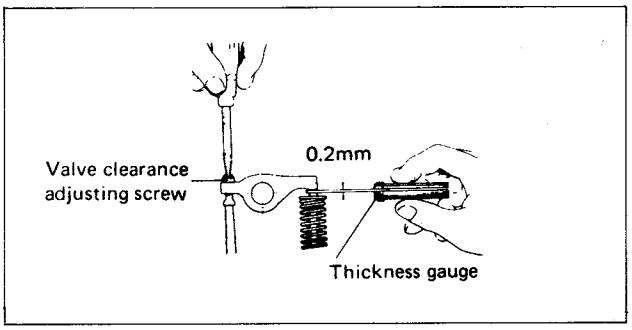
The clearance of the valve affects the overall performance of the engine, so it is important that it be correctly adjusted.
Check the clearance after the first 50 hours of operation and every 600 hours there after Adjustment should be done while the engine is cold.

(1) Remove the valve rocker arm cover.

(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.



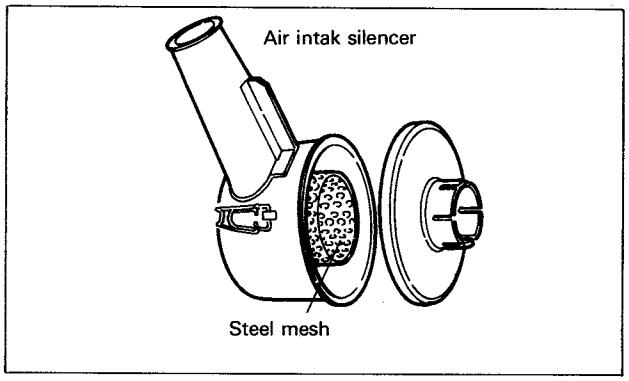
Maintenance standard

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 steel mesh inside the air intake silencer with a neutral detergent every 300 hours of operation.



9-6. Electrical equipment

1. Checking the warning lamps on the instrument panel.

Before operation, make sure the warning lamps go "ON" and "OFF".

See page 15 for warning lamp function.

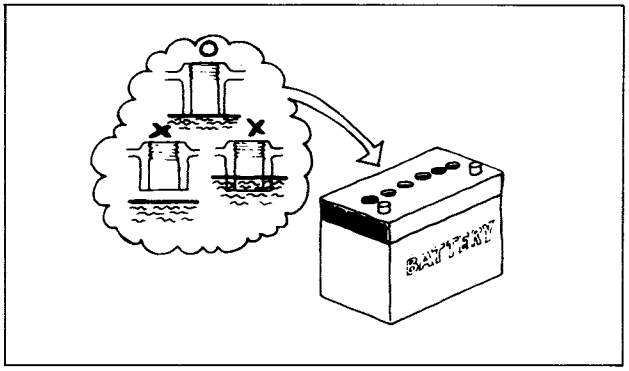
2. Checking and maintenance of the battery.

Proper battery maintenance is vital for dependable service.

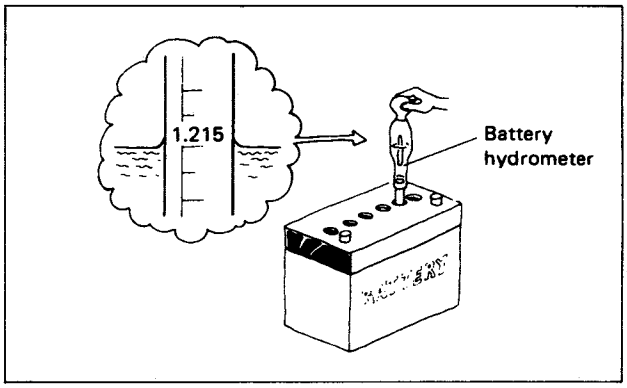
(1) Keep the battery clean by wiping it with a damp cloth.
Keep all connections clean and tight.
Remove any corrosion, and wash the terminals with a solution of baking soda and water.

(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 before starting. 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.



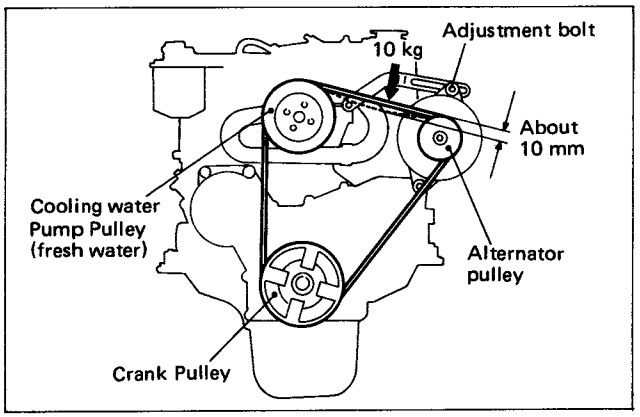
⚠CAUTION

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

IMPORTANT

When adding distilled water in freezing weather, run the engine at least 30 minutes to ensure thorough mixing.

3. Checking and adjustment of the alternator (electric generator) V-belt tension.
If the V-belt is too tight, it can be easily damaged. Hand, if it is too loose, slippage results and generator efficiency drops.
sults 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.

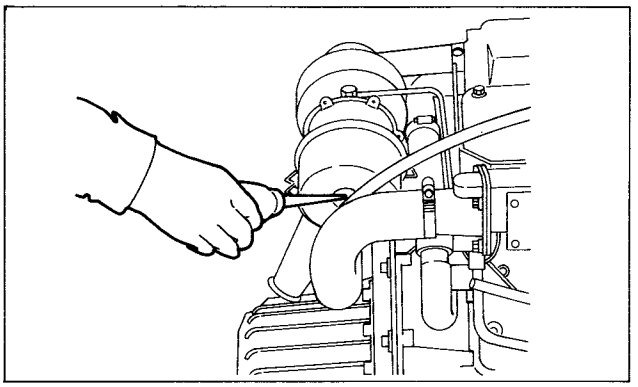
(3) The V-belt tightens when the alternator is moved to the outside, and loosens when moved to the inside.

IMPORTANT

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

9-7. Inspecting the turbo-charger (Model RHB52, IHI make)

1. Cleaning the turbo-charger compressor



Clean the compressor: Every 150 hours.

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

2. Cleaning procedures

(1) With the engine at maximum load, add 50cc of cleaning agent ("Blower Wash", IHI brand) for about 10 seconds using a feeder.

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

(3) 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 turbo-charger all at once, trouble (damage to the compressor fan wheel, etc.) may occur. Pay careful attention to the amount fed and the time.

(4) If there is no change in the turbo-charging 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. Consult your nearest Yanmar dealer.

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

X. Trouble shooting

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 17
	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	Page 26
	6) Air in fuel system	* Bleed air	Page 24
	7) Water, dirt in fuel system	* Drain, flush fuel system	Page 24
	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 11
	11) Improper type of crank-case lube oil	* Use proper lube oil	Page 12
* Engine knocks	1) Improper type of fuel	* Use proper type of fuel; consult fuel supplier	Page 11
	2) Incorrect fuel injection timing	* Check injection timing	Page 25
	3) Idle speed too slow		Your YANMAR Dealer
	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 29
* Engine runs irregularly or stalls frequently	1) Vent in fuel tank cap obstructed	* Clean cap in solvent; blow dry	Page 24
	2) Clogged fuel filter	* Replace fuel filter	Page 26
	3) Water, dirt, or air in fuel system	* Drain, flush, fill and bleed air in the system	Page 24
	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 29
	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 restricted	* Service air cleaner	Page 30
	3) Clogged fuel filter	* Replace fuel filter	Page 26
	4) Improper type of fuel	* Use proper fuel	Page 11

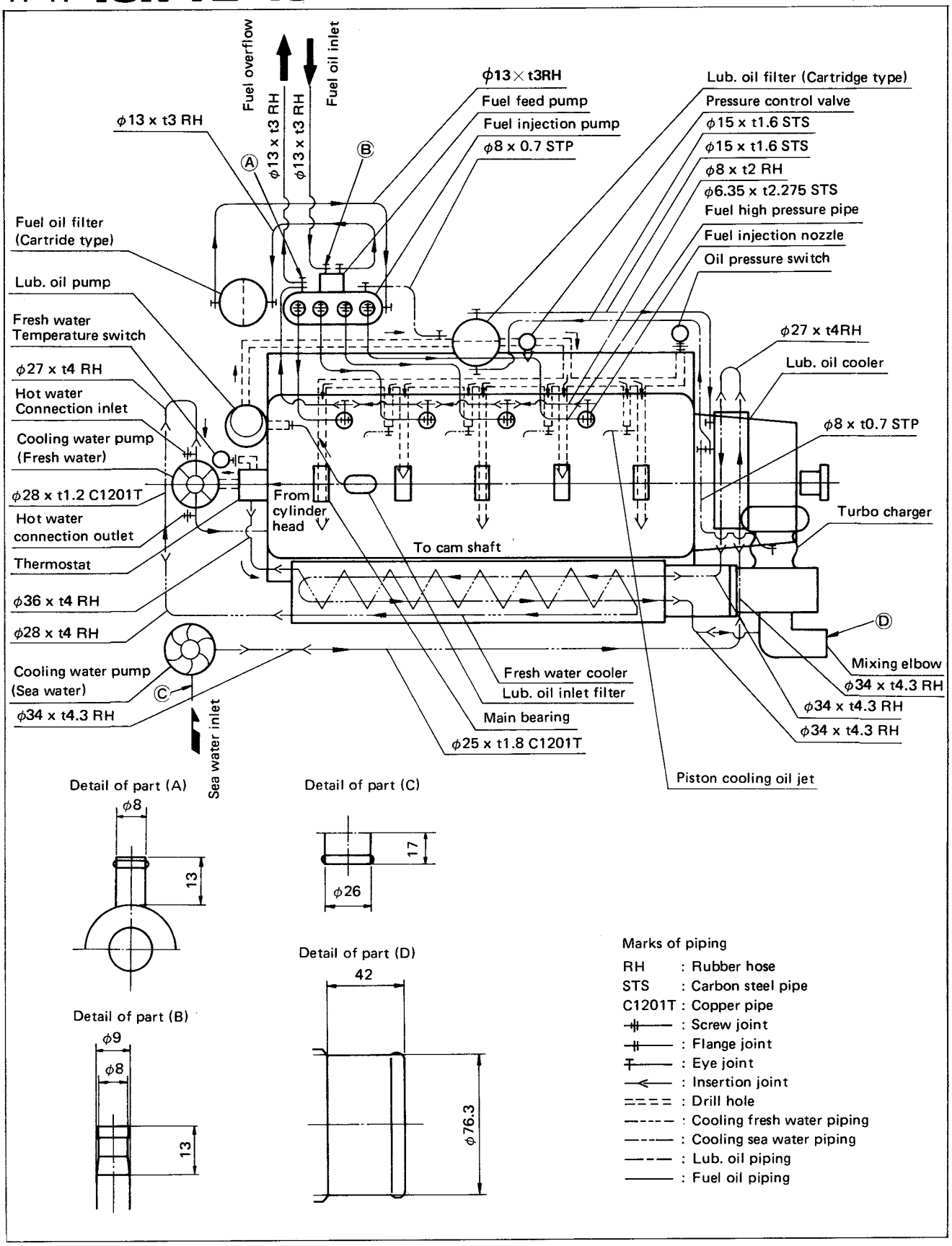
Problem	Possible cause	Possible remedy	See
	5) Improper valve clearance	* Adjust proper valve clearance	Page 29
	6) Dirty or faulty injectors		Your YANMAR Dealer
	7) Incorrect fuel injection	* Check the fuel injection timing	Page 26, your YANMAR Dealer
	8) Improper engine compression		Your YANMAR Dealer
	9) Vent in fuel tank cap obstructed	* Clean cap in solvent Blow dry	Page 24
* Engine overheats	1) Engine overloaded	* Reduce load	
	2) Defective cooling water	* Check cooling water pump	Page 28
	3) Loose or defective cooling water hose clamp	* Check hose clamp	Page 14
	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 15, your YANMAR Dealer if needed
	7) Cooling water leaks from water passage	* Check water passage	Page 28, your YANMAR Dealer
* Engine emits black or gray exhaust smoke	1) Improper type of fuel	* Use proper fuel	Page 11
	2) Clogged or dirty air intake	* Service air intake silencer	Page 30
	3) Defective injection pump	* Have your dealer check fuel injection pump	Your YANMAR Dealer
	4) Faulty injectors	* Have your dealer check injectors	Your YANMAR Dealer
	5) Incorrect fuel injection timing	* Check the injection timing	Page 25, and see your YANMAR Dealer
	6) Improper valve clearance	* Adjust valve clearance	Page 29
	7) Lube oil level too high	* Drain surplus	Page 27
	8) Improper lube oil	* Use proper viscosity oil	Page 12
* Low lube oil pressure	1) Low lube oil level	* Add lube oil	Page 13
	2) Improper lube oil viscosity	* Drain, add proper lube oil	Page 12
	3) Defective lube oil pump		Your YANMAR Dealer
	4) Defective oil pressure lamp and/or sender	* Replace lamp and/or sender	Page 15
* High lube oil consumption	1) Too light viscosity oil	* Use proper viscocity oil	Page 12
	2) Oil leaks	* Check for leaks in lines, around gasket and drain plug	
	3) Improper type of oil	* Use oil proper viscosity	Page 12
	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 11
	2) Clogged or dirty air intake silencer	* Service air intake silencer	Page 30
	3) Engine overloaded	* Reduce load	
	4) Improper valve clearance	* Adjust valve clearance	Page 29
	5) Incorrect fuel injection timing	* Check the injection timing	Page 25, your YANMAR Dealer
	6) Low engine temperature	* Check thermostat	See Diagram page 36
	7) Improper compression	* Have your dealer check 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 13
2) Electrical system * Battery will not charge	1) Loosen or corroded connections	* Clean and tighten connection	Page 30
	2) Sulfated or warn-out battery	* Check electrolyte level and specific gravity	Page 30
	3) Defective alternator	* Replace alternator	Your YANMAR Dealer
	4) Loose or defective alternator drive belt	* Adjust belt tension or replace belt	Page 31
* Charge warning lamp glows with engine running	1) Low engine speed	* Increase engine speed	
	2) Defective battery	* Check electrolyte level and specific gravity	Page 30
	3) Defective alternator	* Replace alternator	Your YANMAR Dealer
	4) Slipping alternator drive belt	* Tighten the belt after checking for oil on the belt	Page 31
* Starter does not work properly	1) Loose or corroded connections	* Clean and tighten loose connections	
	2) Low battery output	* Check electrolyte level and specific gravity	
	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 37
* Starter crank slow	1) Low battery output	* Check electrolyte level and specific gravity	Page 30
	2) Too heavy viscosity lube oil	* Use proper viscosity oil	Page 12
	3) Loose or corroded wiring	* Clean and tighten loose connections	

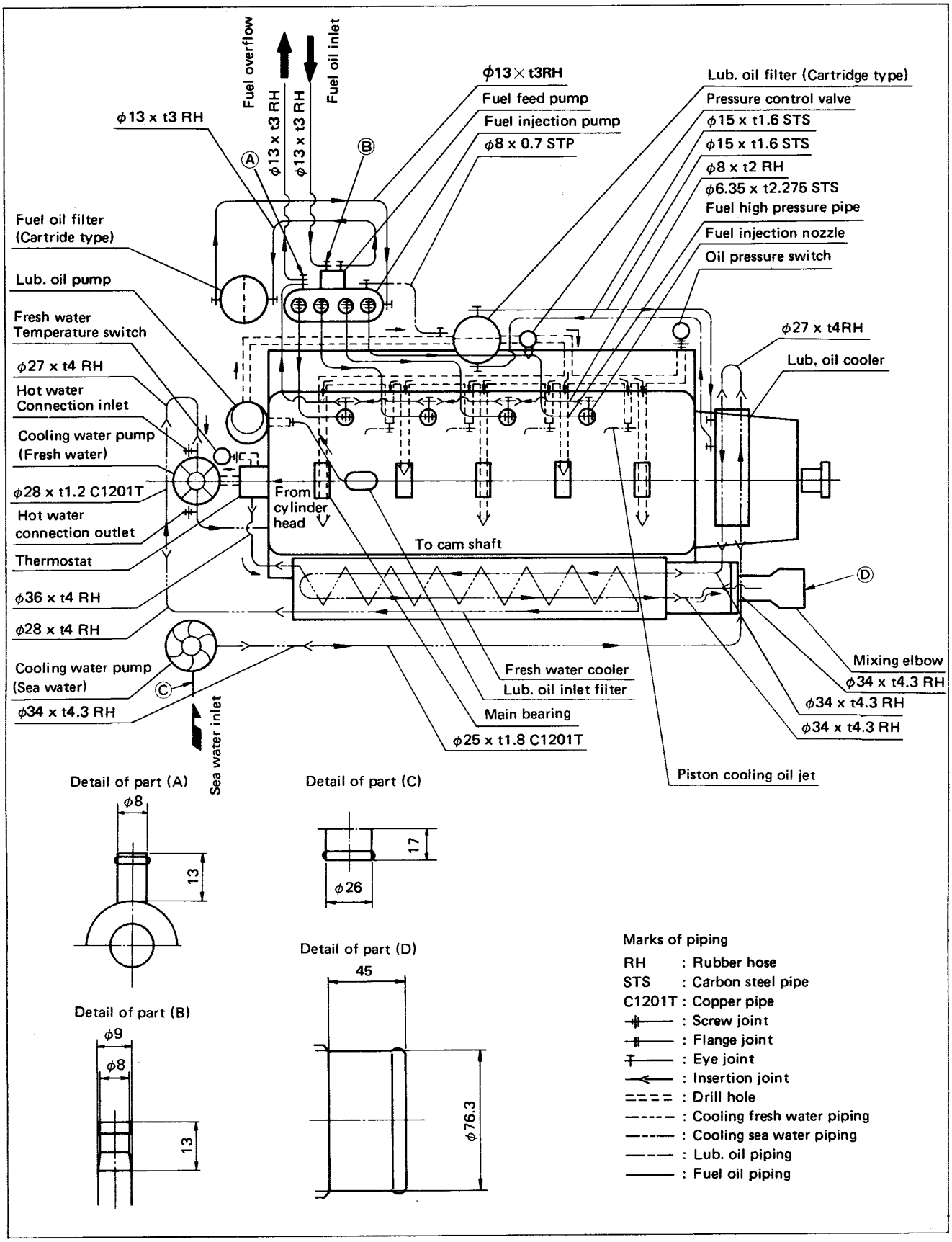
Problem	Possible cause	Possible remedy	See
* Cooling water temperature warning light always glows	1) Defective temperature switch	* Replace C.W. temperature switch	Your YANMAR Dealer
* All warning lamps stop glowing	1) Faulty bulbs 2) Improper wiring	* Replace bulbs * Check wiring	 Page 37, your YANMAR Dealer
* Starter switch does not work properly	1) Poor battery 2) Loose or corroded connections 3) Faulty starter switch	* Check electrolyte level and specific gravity * Clean and tighten loose connections * See your dealer	Page 30 Your YANMAR Dealer
* Tachometer does not work properly	1) Faulty tachometer or sender unit 2) Loose or corroded connections	* Replace tachometer or sender unit * Clean and tighten loose connections	Your YANMAR Dealer

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

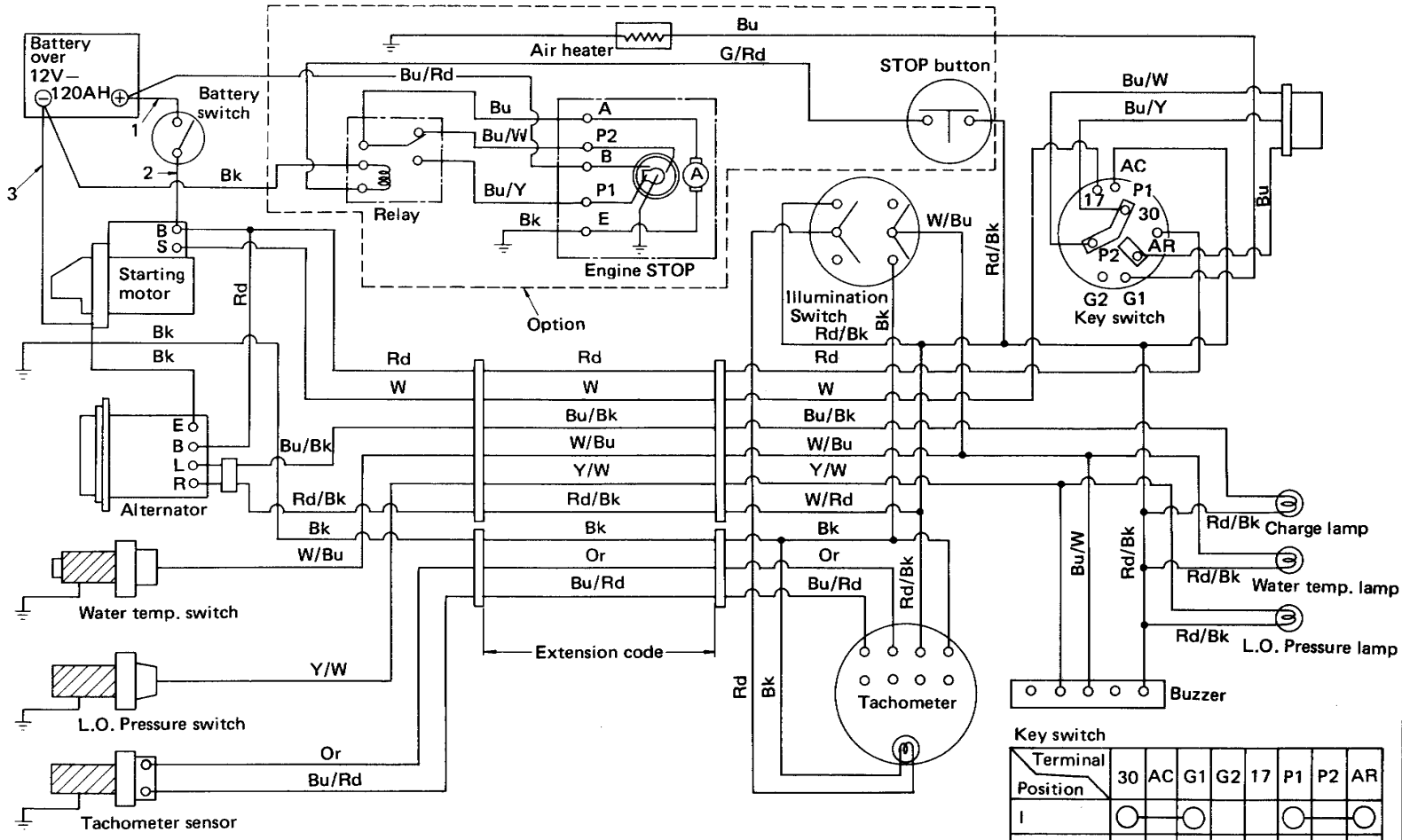
11-1. 4JH-TE 4JH-HTE 4JH-DTE



11-2. 4JHE


Fuel overflow
Fuel oil inlet
φ13 x t3 RH
φ13 x t3 RH
φ13 x t3 RH
φ13×t3RH
Fuel feed pump
Fuel injection pump
φ8 x 0.7 STP
Lub. oil filter (Cartridge type)
Pressure control valve
φ15 x t1.6 STS
φ15 x t1.6 STS
φ8 x t2 RH
φ6.35 x t2.275 STS
Fuel high pressure pipe
Fuel injection nozzle
Oil pressure switch
Fuel oil filter (Cartride type)
Lub. oil pump
Fresh water Temperature switch
φ27 x t4 RH
Hot water Connection inlet
Cooling water pump (Fresh water)
φ28 x t1.2 C1201T
Hot water connection outlet
Thermostat
φ36 x t4 RH
φ28 x t4 RH
Cooling water pump (Sea water)
φ34 x t4.3 RH
Sea water inlet
φ27 x t4RH
Lub. oil cooler
From cylinder head
To cam shaft
Fresh water cooler
Lub. oil inlet filter
Main bearing
φ25 x t1.8 C1201T
Piston cooling oil jet
Mixing elbow
φ34 x t4.3 RH
φ34 x t4.3 RH
φ34 x t4.3 RH
Detail of part (A)
φ8
13
Detail of part (C)
17
φ26
Detail of part (D)
45
φ76.3
Detail of part (B)
φ9
φ8
13
Marks of piping
RH : Rubber hose
STS : Carbon steel pipe
C1201T : Copper pipe
: Screw joint
: Flange joint
: Eye joint
: Insertion joint
: Drill hole
: Cooling fresh water piping
: Cooling sea water piping
: Lub. oil piping
: Fuel oil piping

B-2 type instrument pannel

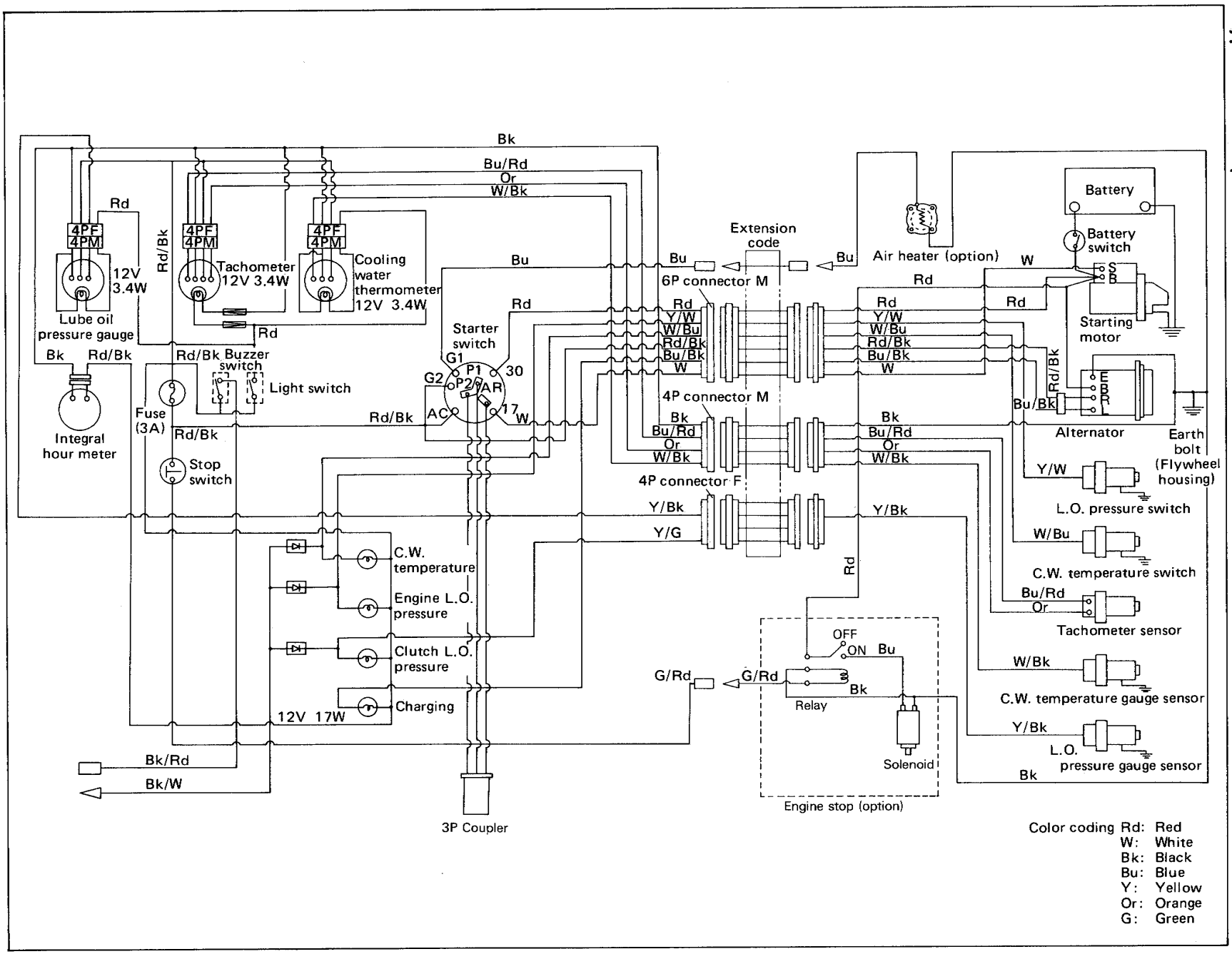


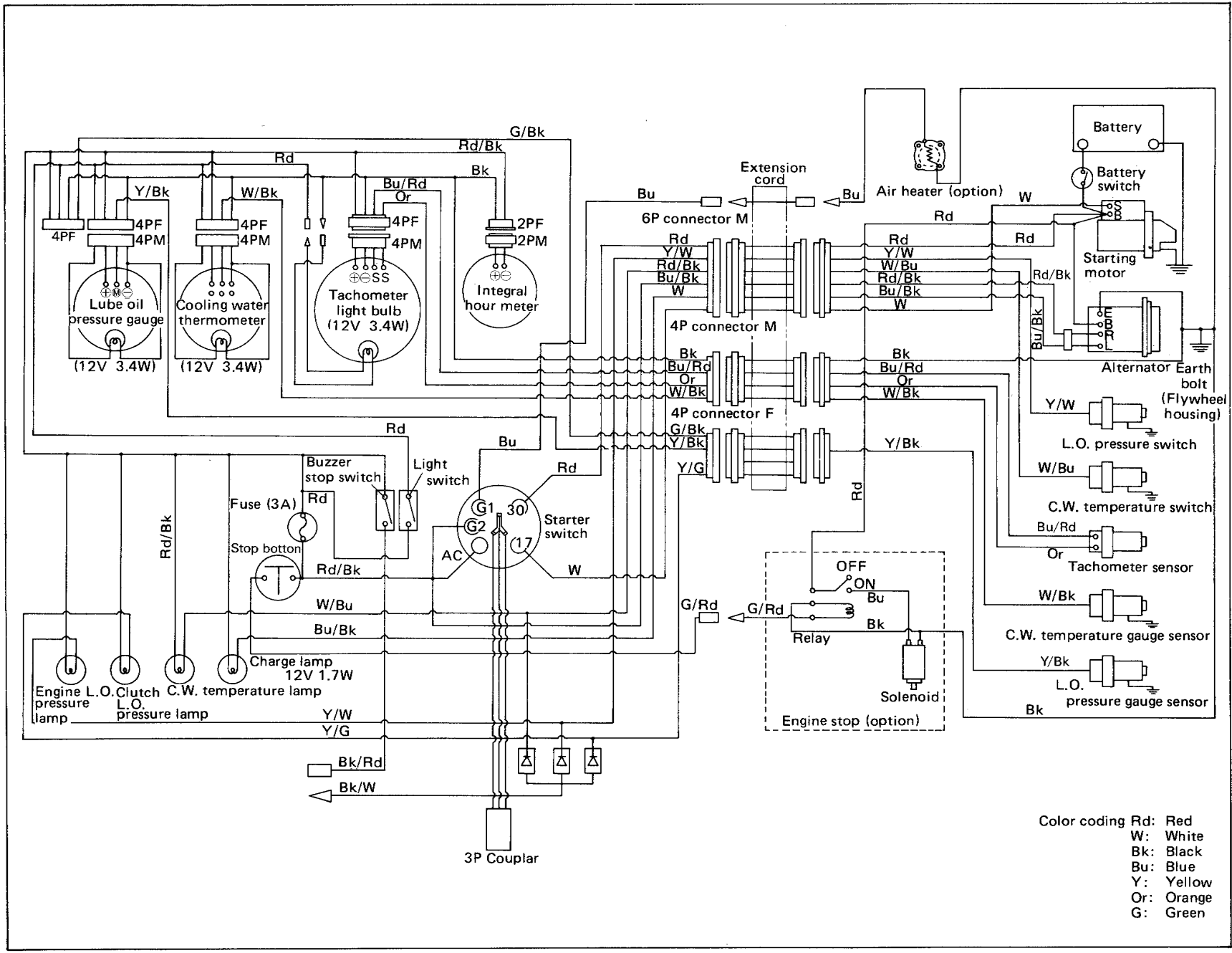
Key switch

Terminal / Position	30	AC	G1	G2	17	P1	P2	AR
I	○		○			○		○
OFF						○		○
II(ON)	○	○					○	○
III(START)	○			○	○		○	○

Rd: Red
W : White
Bk: Black
Bu: Blue
Y : Yellow
Or: Orange
G : Green

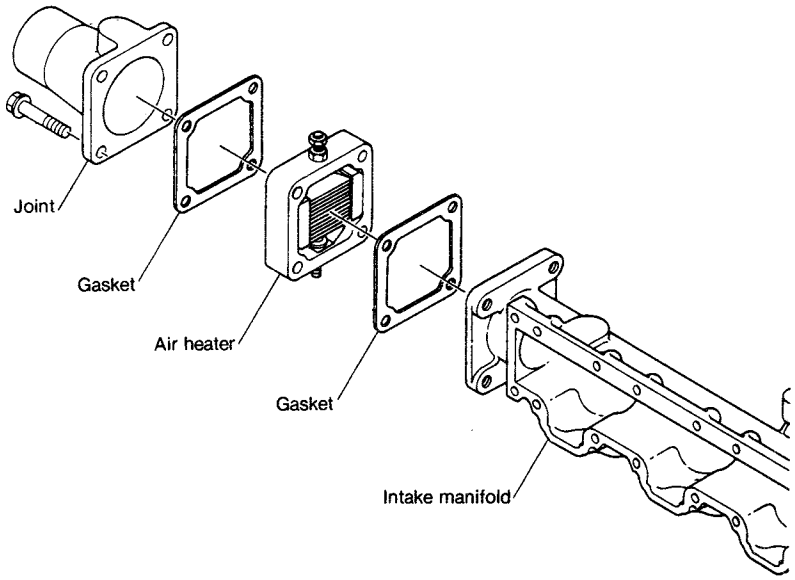
Note: 1 + 2 + 3 <2.8 m → 40 mm² (cross sectional area)

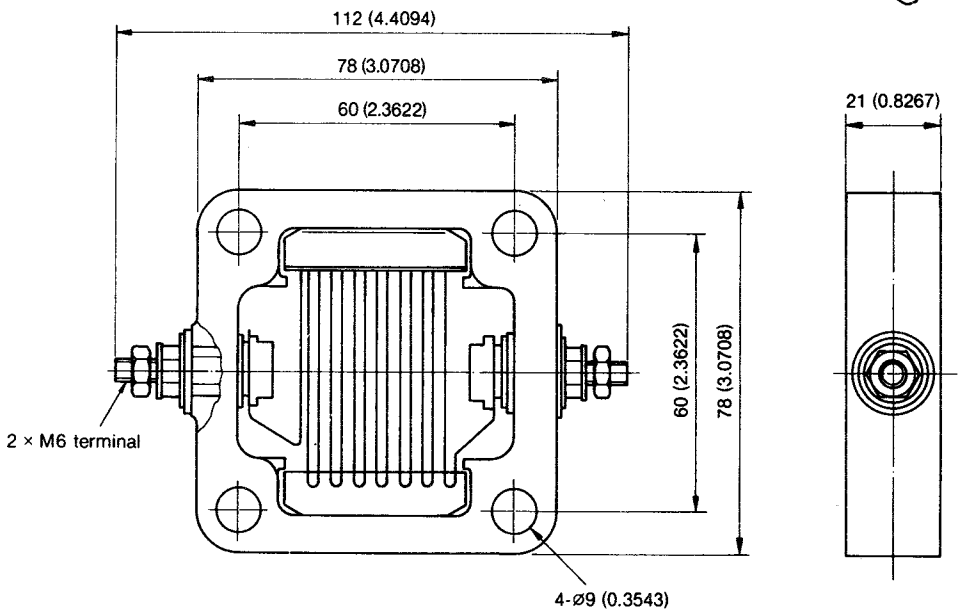

Bk
Bu/Rd
Or
W/Bk
Rd
4PF
4PM
12V
3.4W
Lube oil
pressure gauge
Rd/Bk
Tachometer
12V 3.4W
Cooling
water
thermometer
12V 3.4W
Rd
Bk
Rd/Bk
Rd/Bk
Buzzer
switch
Light switch
Integral
hour meter
Fuse
(3A)
Rd/Bk
Stop
switch
Bu
Rd
Starter
switch
G1
G2
P1
P2
AR
AC
30
17W
Rd/Bk
Extension
code
Bu
Bu
6P connector M
Rd
Y/W
W/Bu
Rd/Bk
Bu/Bk
W
4P connector M
Bk
Bu/Rd
Or
W/Bk
4P connector F
Y/Bk
Y/G
Air heater (option)
Battery
Battery
switch
S
B
W
Rd
Rd
Y/W
W/Bu
Rd/Bk
Bu/Bk
W
Starting
motor
E
B
R
Rd/Bk
Bu/Bk
Alternator
Earth
bolt
(Flywheel
housing)
Bk
Bu/Rd
Or
W/Bk
Y/W
L.O. pressure switch
W/Bu
C.W. temperature switch
Bu/Rd
Or
Tachometer sensor
W/Bk
C.W. temperature gauge sensor
Y/Bk
L.O.
pressure gauge sensor
Bk
Y/Bk
C.W.
temperature
Engine L.O.
pressure
Clutch L.O.
pressure
Charging
12V 17W
Rd
OFF
ON
Bu
G/Rd
G/Rd
Bk
Relay
Solenoid
Engine stop (option)
Bk/Rd
Bk/W
3P Coupler
Color coding Rd: Red
W: White
Bk: Black
Bu: Blue
Y: Yellow
Or: Orange
G: Green


G/Bk
Rd/Bk
Rd
Bk
Y/Bk
W/Bk
Bu/Rd
Or
4PF
4PM
2PF
2PM
SS
Lube oil pressure gauge
(12V 3.4W)
Cooling water thermometer
(12V 3.4W)
Tachometer light bulb (12V 3.4W)
Integral hour meter
Extension cord
Bu
6P connector M
4P connector M
4P connector F
Air heater (option)
Battery
Battery switch
Starting motor
Alternator
Earth bolt (Flywheel housing)
L.O. pressure switch
C.W. temperature switch
Tachometer sensor
C.W. temperature gauge sensor
L.O. pressure gauge sensor
Buzzer stop switch
Light switch
Fuse (3A)
Stop botton
Starter switch
G1
G2
AC
30
17
Rd/Bk
W/Bu
Bu/Bk
G/Rd
OFF
ON
Relay
Solenoid
Engine stop (option)
Charge lamp 12V 1.7W
Engine L.O. pressure lamp
Clutch L.O. pressure lamp
C.W. temperature lamp
Y/W
Y/G
Bk/Rd
Bk/W
3P Couplar
Color coding Rd: Red
W: White
Bk: Black
Bu: Blue
Y: Yellow
Or: Orange
G: Green

Air Heater (Optional)

An air heater is available for warming intake air during starting in cold areas during winter. The air heater is mounted between the intake manifold and intake manifold coupling.
The device is operated by the glow switch on the instrument panel.

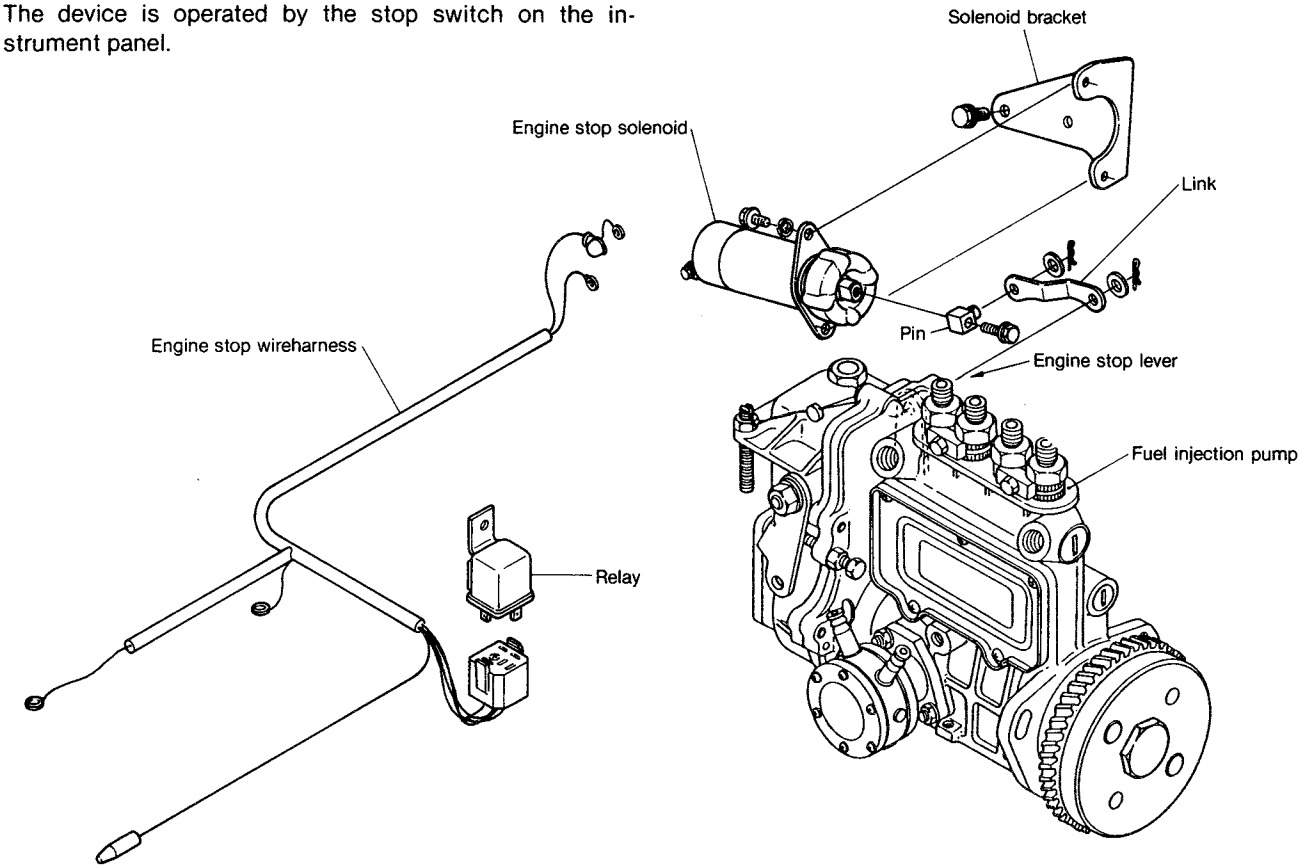




Rated output	400W
Rated current	33.3A
Rated voltage	DC 12V
Rated operating time	Engine operation: 60 sec. Engine stop: 30 sec.
Range of operating temperature	+50°C ~ 30°C (122°F ~ −22°F)
Part code No.	129400-77500

Electric type Engine Stopping Device

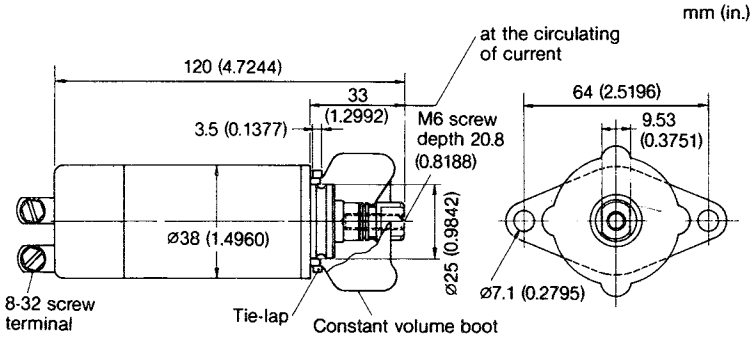
To employ the electric engine stop device, the stop lever of the fuel injection pump is connected to the solenoid with a connection metal.
The device is operated by the stop switch on the instrument panel.

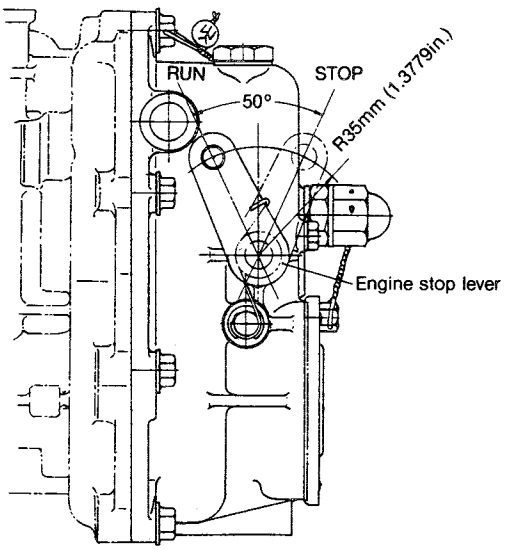


Solenoid

Solenoid model	1502-12A7U1B
Rated voltage	12V
Loaded current	30A
Loaded force	9kg (19.84lb)
No-load current	0.7A
No-load force	4kg (8.82lb)

mm (in.)





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