

**YANMAR**

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**DIESEL ENGINE**

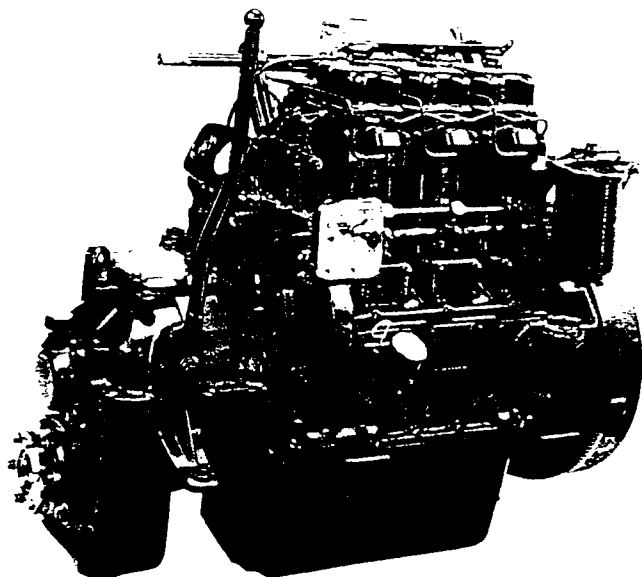
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**OPERATION MANUAL**

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MODEL

2TM·3TM·4TM



**YANMAR DIESEL ENGINE CO., LTD.**

Thank you for purchasing the YANMAR Model 2·3·4TM Diesel Engine.

This Operation Manual contains instructions for proper operation and servicing of your YANMAR Engine.

Before using the Engine, read this manual to become familiar with proper handling and operating procedures.

Correct use and periodic servicing assure you a trouble free life for your engine.

If any trouble should arise or if you have any questions concerning this engine, consult your local YANMAR dealer.

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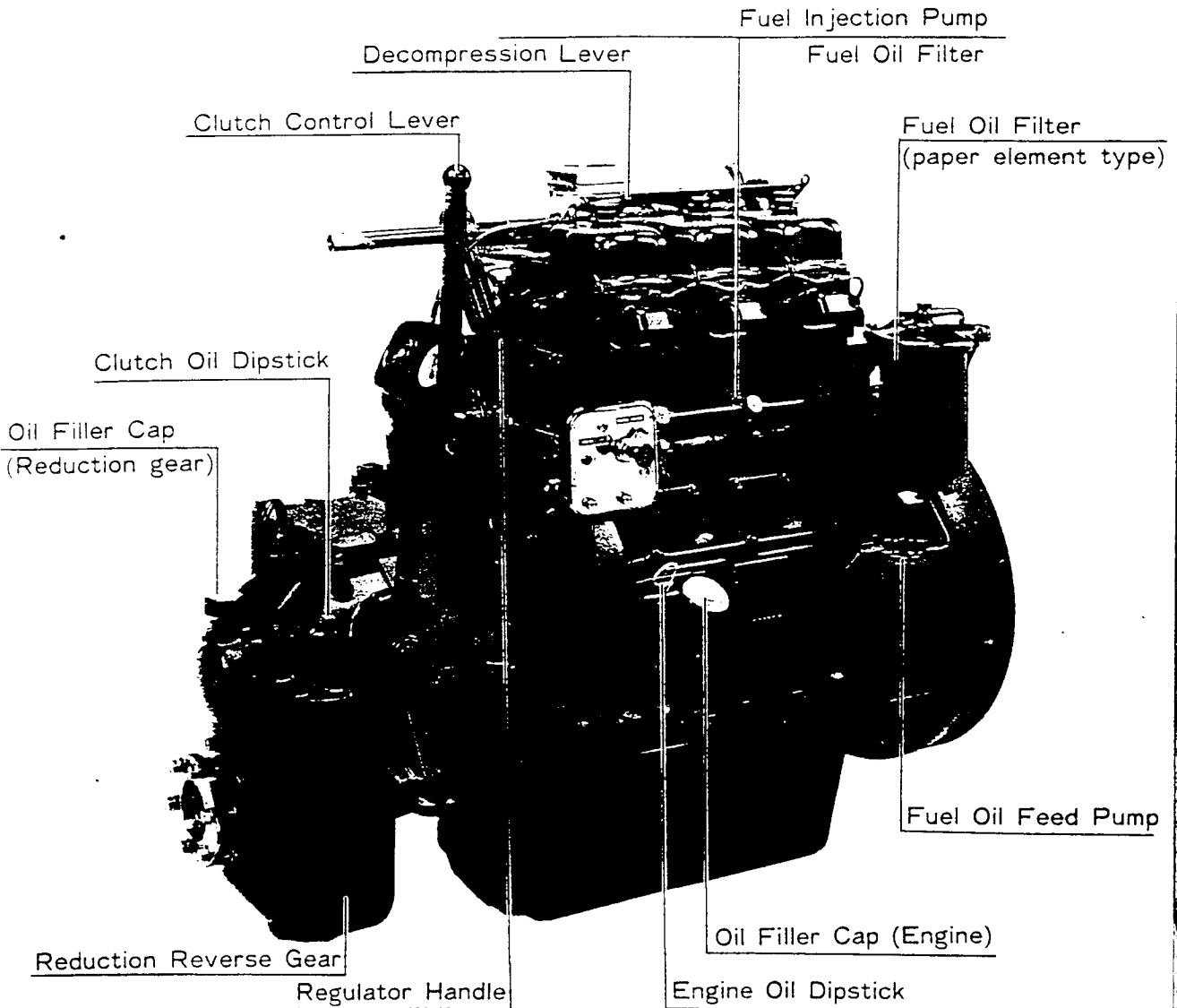
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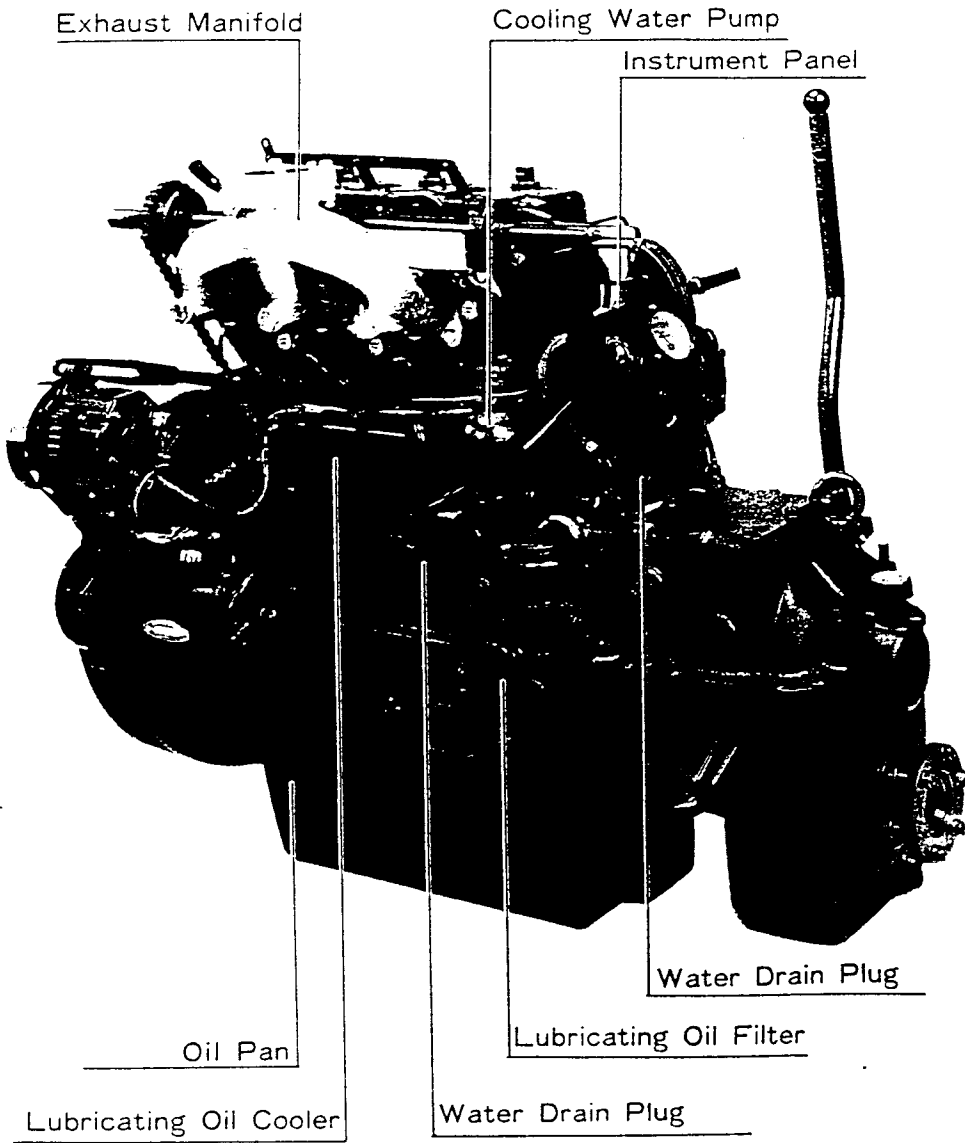
# Location of Major Parts

MODEL 3TM

Starboard side



Port side





# Specifications

Model		2TM	2TMG	2TMGG	3TM	3TMG	3TMGG	4TM	4TMG	4TMGG	4TMGGG	
Number of cylinders		2			3			4				
Type		Vertical, 4-cycle, water cooled diesel engine										
Combustion system		Direct injection										
Crankshaft revolution speed (rpm)		2,100										
Continuous rated output (HP)		26			39			52				
Firing order (from opposite side of flywheel)		1-2-1			1-2-3-1			1-2-4-3-1				
Reduction reverse gear	Reduction ratio	Forward	2.14	2.50	3.14	2.14	2.50	3.14	2.13	2.59	3.22	3.80
	Reverse	2.53	2.59	3.71	2.53	2.95	3.71	2.20	2.68	3.33	3.93	
Direction of revolution	Crankshaft	Counterclockwise										
	Propeller shaft	Clockwise										
Lubricating oil capacity (ℓ)	Engine	8			12			18				
	Reduction reverse gear	1.5							Together with engine			
Lubricating system		Forced lubrication with trockoid pump										
Cooling system		Sea water direct cooling										
Starting system		Speed increasing starting with chain										

Electric starting and combination electric-chain starting are available as options.

# 3 Operation and Maintenance Check

The tips and instructions below will help you get the maximum performance and life from your engine. Follow them carefully.

No.	Checks	Comments						
1	When the engine is new, break it in slowly.	The moving parts of a new engine fit too closely together and rub against each other. If the engine is forced to run at heavy loads before it is thoroughly broken in, wear of parts accelerates and engine life is shortened. During the first 50 hours of operation, keep rpms below 1,800.						
2	<p>(1) Use diesel fuel oil only.</p> <p>(2) Drain sediment thoroughly from the fuel filter, fuel/water separator and fuel</p> <p>(3) Clean the fuel filter every 250 hours of operation.</p>	<p>Poor quality fuel oil leads to trouble in the fuel system. Use high quality fuel oil only.</p> <p>If water is mixed in with the fuel, troubles will occur in injection pump and injection valve, and engine life will be shortened.</p> <p>If the engine is run with a clogged fuel filter, fuel flow is restricted and performance drops.</p>						
3	Use API grade CB class or higher lubricating oil.	Recommended oil CC or CD.						
4	Change the lubricating oil regularly.	Lubricating oil change	Engine	<table border="1"> <tr> <td data-bbox="775 1085 915 1144">First time</td> <td data-bbox="915 1085 1156 1144">First 50 hours</td> </tr> <tr> <td data-bbox="775 1144 915 1242">Thereafter</td> <td data-bbox="915 1144 1156 1242">Every 250 hours</td> </tr> </table>	First time	First 50 hours	Thereafter	Every 250 hours
	First time		First 50 hours					
Thereafter	Every 250 hours							
Carefully clean the lubricating oil filter.	Reduction reverse gear	Every 1,000 hours (2 and 3TM)						
5	The cylinder block, cylinder head and oil cooler (4TM) are protected with the anti-corrosion zinc. Check the anti-corrosion zinc every 500 hours and replace if more than 50% is worn off.	If the anti-corrosion zinc is not replaced at proper intervals, parts will be exposed and corrode easily.						

No.	Checks	Comments
6	In cold weather (when the cooling water may freeze), drain the cooling water thoroughly after using the engine.	If the cooling water freezes, the engine may be damaged beyond repair.
7	Each time the injection valve is removed, clean off the carbon deposits from the valve seating surface and install a new seat packing. Make sure that the dust seal (rubber) for the injection valve is in good condition. Replace if necessary. Never forget to install this dust seal. Apply molybdenum disulfide to the injection valve body before installing.	<p>It will cause gas leakage and rust that you do not perform this service.</p> <p>If gas has been leaking and rust has been built up, it is hard to remove the injection valve.</p> <div data-bbox="529 727 1163 799" style="border: 1px solid black; padding: 5px; margin: 10px 0;">Tighten the fuel injection valve mounting nut to 0.9–1.1 kg-m</div>
8	When shifting the clutch, lower engine speed.	Shifting the clutch without lowering engine speed can result in damage to the reduction reverse gear.
9	Warm up the engine properly.	Warm up the engine at 600–800 rpm for 10 minutes after starting to allow the lubricating oil to reach each part.



# 4 Fuel and Lubricating Oil

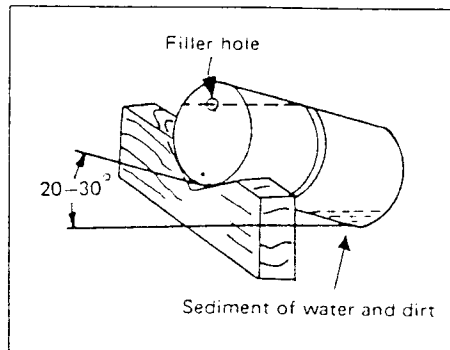
## 4-1 Selection and handling of fuel

### (1) Selection of fuel

Use only diesel fuel oil which maximizes engine performance. In winter, select the fuel with the proper viscosity.

### (2) Handling of fuel

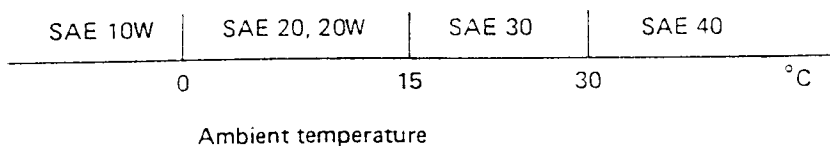
- ❶ Water or dirt in the fuel may cause engine failure.
- ❷ Set the fuel container aside for about 10 days to allow the water and dirt to settle out. Use the clear fuel only.



## 4-2 Selection of lubricating oil

Selection of proper lubricating oil is very important. If improper lubricating oil is used or the lubricating oil is not changed regularly, piston sticking, seizure or premature wear of pistons and cylinder liners, and premature wear of the bearings and other moving parts will result. And engine durability will be reduced. Use API grade CB class oil or higher.

### (1) Viscosity



### (2) Recommended oil brands

#### CB classification

API Classification	SHELL	ESSO	MOBIL
C B	Shell Lotera Oil 10W, 20W-20, 30, 40	—	HD Para Base Motor Oil 10, 20, 30, 40
C C	Shell Lotera SX Oil 10W-30, 15W-40, 10W 20W-20, 30, 40	Exxon SDX 30, 40, 20W-40 10W-30	Mobil Delvac 1100series 1200series
C D	Shell Rimula ZOil 10W, 20W-20, 30, 40	Exxon D-3 10W, 20W, 30, 40 10W-30	Mobil Delvac 1300series

**CAUTION:** Do not mix different types of lubricating oil since they may be incompatible.

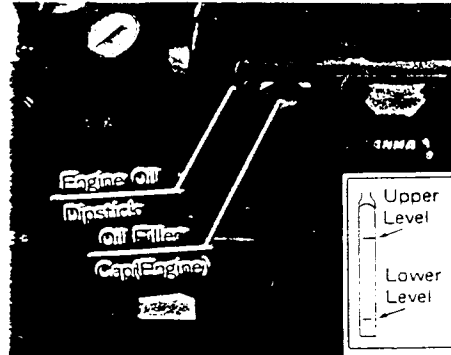
## 5-1 Filling with fuel

Make sure that the inside of the fuel tank and fuel lines are clean. Fill the fuel tank with the recommended fuel only.

## 5-2 Filling with lubricating oil

### (1) Filling the engine oil pan

Fill the engine oil pan with the recommended lubricating oil through the filler hole in the cylinder block side cover.



### (2) Checking the oil level

Check the oil level with the dipstick pushed all the way in. The level should be between the lower and upper marks on the dipstick.

Engine oil capacity (ℓ)	2TM (G, GG)	3TM (G, GG)	4TM (G, GG, GGG)
	8	12	18

### (3) Filling the reduction gear case

Fill the gear case with the recommended lubricating oil through the filler hole shown in the figure. Use the dipstick to check the oil level.



Reduction reverse gear case oil capacity (ℓ)	2TM (G, GG)	3TM (G, GG)	4TM (G, GG, GGG)
	1.5		Same as engine oil

### 5-3 Oiling other parts

Oil the cooling water pump plunger, starter chain, starter idle gear bearing and fuel injection pump rack pin portion (where it is connected to the governor lever) periodically with lubricating oil.

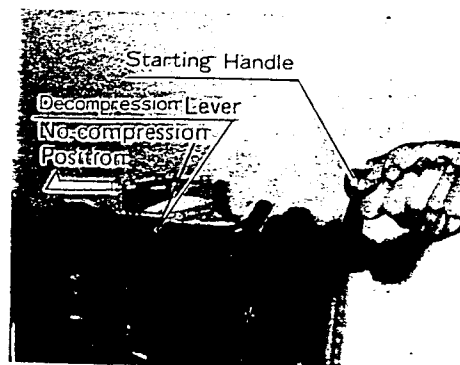
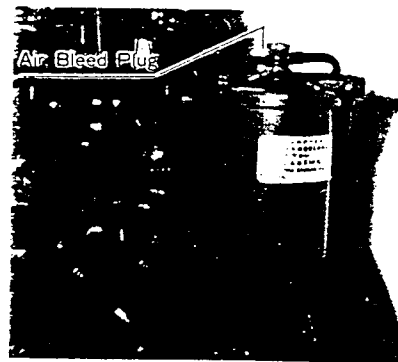
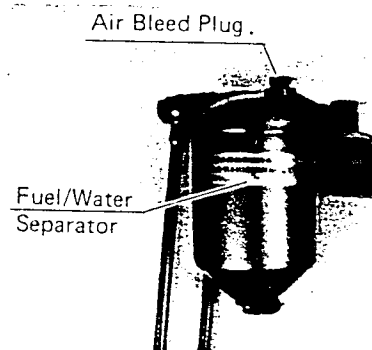
### 5-4 Getting the fuel injection system ready

#### Bleeding air from fuel system

The fuel system runs from the fuel tank to the fuel injection valve. If air enters the system, fuel will not be injected. Bleed the air completely from the system in the following manner. Bleed the system every time the fuel tank runs dry and the fuel filter is cleaned.

- (1) Open the fuel tank cock and bleed the air by loosening the air bleed plug on the fuel/water separator.
- (2) The fuel filter is of paper element type. Bleed air from the filter as follows:  
Loosen the air bleed plug on the fuel filter and bleed until there are no air bubbles in the fuel flowing out of the bleed hole. Then tighten the bleed plug securely.
- (3) Turn the regulator handle to the normal operating position and set the decompression lever to the no-compression position.
- (4) Loosen the fuel injection pipe cap nut (injection valve side). Turn the starter handle and bleed until the air bubbles disappear from the fuel. (Repeat for all cylinders.)
- (5) Tighten the injection pipe cap nut securely. Turn the starter handle again and listen for sound of fuel being injected. If injection can be heard, air bleeding is completed.

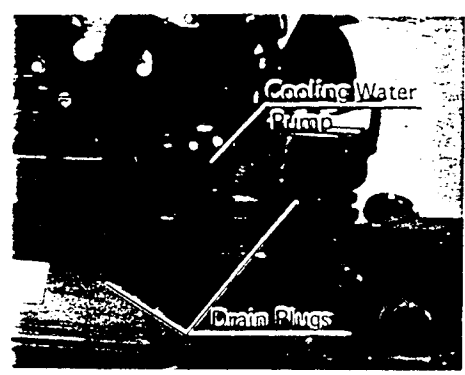
Return the decompression lever to the compression position and the regulator handle to the stop position.





## Tightening the cooling water drain cocks

Make sure that the two cooling water drain cocks are tightened.  
The kingston cock should be opened only when the drain cocks are closed.



## 6-1 Starting

- (1) Make sure that the clutch control lever of the reduction reverse gear is in neutral.
- (2) Turn the regulator handle to the normal operating position.
- (3) Set the decompression lever in the no-compression position and crank the starter handle until the flywheel has sufficient force.
- (4) Put the decompression lever in the compression position. Crank the starter handle 2–3 turns. The engine will start.

### Starting with electric starter (Optional equipment)

- (1) Turn the battery switch ON. Insert the starter key in the switch and put the decompression lever in the no-compression position. Push the starter key and crank the engine 5–10 seconds to allow lubricating oil to reach the moving parts.
- (2) Raise the regulator handle to normal operating position and return the decompression lever to the compression position.
- (3) Push the starter key to start the engine. Release your hand from the starter key as soon as the engine starts and set the regulator handle in the low speed position.

#### CAUTION:

- (1) *Never crank the engine for longer than 20 seconds. Allow the starter motor to rest at least 30 seconds and then try to re-start.*
- (2) *When re-starting, make sure that the engine has stopped completely.*
- (3) *When the engine is hard to start in cold weather, turn the starter motor with the engine decompressed (using the decompression lever) until the flywheel builds up enough inertia, then put the decompression lever in the compression position. The engine should start easily.*

## 6-2 Warming up

- (1) After the engine starts, warm up the engine at non-load (600–800 rpm) for approx. 10 minutes. This allows the lubricating oil to reach each moving part and the the engine to warm up as a whole.

*CAUTION: When operating a new engine for the first time, the engine oil level will drop as oil circulates to all parts. After warming up the engine, turn it off and wait about 10 minutes, then check the engine oil level. Add as required.*

- (2) Check the following items while warming up the engine.
  - ① Check the lubricating oil pressure on the oil pressure gauge. The oil pressure should be above  $0.5 \text{ kg/cm}^2$  at 450 rpm.
  - ② The cooling water should be flowing out of the cooling water outlet.
  - ③ Check for water, oil or gas leaks.
  - ④ Make sure there are no abnormal noises.
  - ⑤ The charging lamp should go off on engines equipped with an alternator.

## 6-3 Cruising

If there are no troubles during warm up, shift the clutch to start cruising and check the items below. Engine speed should be increased gradually.

- (1) Check the lubricating oil pressure on the oil pressure gauge. The oil pressure should be within  $3.0\text{--}4.0 \text{ kg/cm}^2$  at continuous rated output. If the oil pressure does not go up normally, the lubricating oil is probably old and should be changed immediately. If the oil pressure gauge needle fluctuates greatly, the oil may be low. Double-check the oil level with the oil dipstick.
- (2) Make sure that the cooling water is flowing out of the outlet.  
If the cooling water flows irregularly or the water volume is small, stop the engine and check the cooling water passages, pump and kingston cock inlet for blockage.
- (3) The condition of the engine can be checked by looking at the color of the exhaust gas. Black exhaust gas indicates that the engine is overloaded.
- (4) Check for water, oil or gas leaks.
- (5) When operating engines equipped with electric starters, do not turn the battery switch OFF.

Note: Do not run the engine for longer than 6 hours with no load.

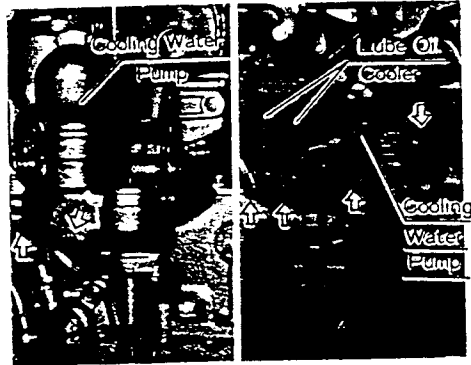
## 6-4 Stopping

- (1) To stop the engine, shift the reduction reverse gear to neutral and allow the engine to run at non-load for about 5 minutes. Then turn the regulator handle to stop position.

*CAUTION: Never stop the engine with the decompression lever. Injection fuel will remain in the top of the piston. This can be dangerous when re-starting.*

- (2) On engines equipped with electric starting, remove the starter key from the starter switch.
- (3) Turn the battery switch OFF (electric starting).
- (4) Close the kingston cock.
- (5) In cold weather, drain the cooling water as follows:

- 1 On model 2TM, the cooling water in the cylinders can be drained by opening the drain cock on the cylinder block and the pipe between the cylinder block and water pump.
- 2 On models 3TM and 4TM, the cooling water in the cylinders can be drained by opening the bottom of the lubricating oil cooler.
- 3 On all models, the cooling water in the water pump can be drained by removing the drain plug on the bottom of the water pump.



## 6-5 Extended storage

For long-term storage, follow these procedures:

- (1) Drain the cooling water according to procedures in **6-4** (5).
- (2) On engines with electric starters, loosen the alternator drive V-belt and remove the battery from the engine. The battery should be fully charged before storing and re-charged once a month.
- (3) Carefully clean the engine and apply anti-rust agent.
- (4) To prevent condensation in the engine, cover the exhaust pipe, intake pipe and electrical parts.
- (5) Whenever the engine is not to be used for 6 months or longer, the following service steps are required:
  - (a) Remove the rocker arm cover and coat the rocker arms and push rods with oil.
  - (b) Remove the cylinder side cover and oil the crankpins.

# 7 Reduction Reverse Gear(2.3TM)

## 7-1 Handling

The durability of the reduction reverse gear depends on how it is handled. When shifting the reduction reverse gear, lower engine speed with the regulator handle and place the selector lever in neutral. Then put the selector lever in forward or reverse.

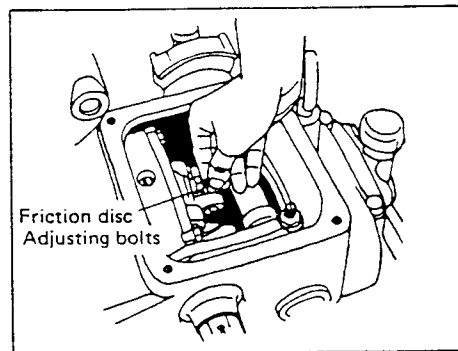
After shifting the reduction reverse gear, raise the engine speed with the regulator handle. Never shift at high speeds or the reduction reverse gear will be severely damaged.

## 7-2 Adjustment of friction disc adjusting bolt for forward clutch

When the reduction reverse gear is shifted forward, the friction disc is pressed in by the two adjusting bolts via the disc spring, transmitting the engine's power.

### Adjustment procedures

- (1) Place the selector lever in neutral and remove the reduction reverse gear upper cover.
- (2) Loosen the two adjusting bolts as far as they will go.
- (3) Then move the clutch control lever to the forward position.
- (4) Tighten the two adjusting bolts with your fingers. Do not use the spanner.
- (5) Put the clutch control lever in neutral.
- (6) Tighten the each adjusting bolt  $3/4$  turn and secure it with the lock nut.
- (7) The clutch control lever force should be 22 kg at the lever end. Re-adjust if necessary.





**7-3**

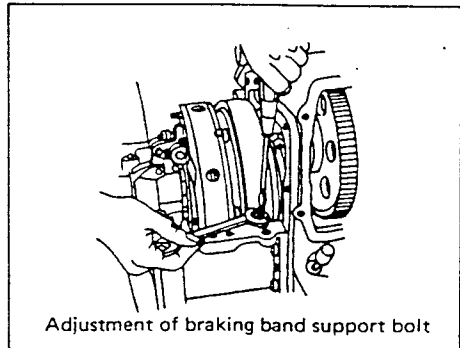
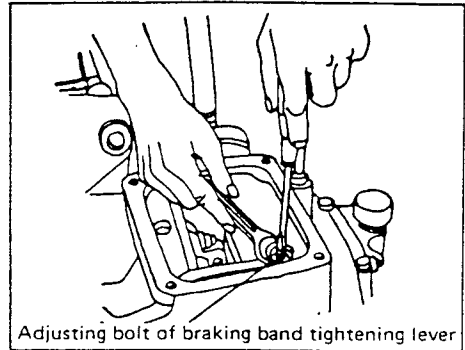
## Adjustment of braking band tightening lever for reverse clutch

When the reduction reverse gear is shifted into reverse, the end of the braking band tightening lever is lifted by the cam and the reverse gear box outer drum is locked by tightening the brake band with the tip of the lever. The output from the crankshaft is transmitted to the reverse output shaft in the opposite direction via the reverse pinion in the gear box.

### Braking band tightening lever adjustment

- (1) Place the clutch control lever in neutral and remove the reduction reverse gear upper cover.
- (2) Loosen the adjusting bolts on the braking band tightening lever.
- (3) Put the clutch control lever into reverse.
- (4) Turn the adjusting bolt until the clearance between the braking band and the gear box is closed.
- (5) Put the clutch control lever in neutral and tighten the adjusting bolt one turn. Tighten the lock nut to secure the adjusting bolt.

Remove the reduction reverse gear upper cover and adjust the braking band support bolt as required so that the braking band fits evenly around the drum.

**7-4**

## Adjustment by further tightening

The above are normal adjustment procedures. However, adjustment can be made by further tightening the two adjusting bolts evenly for forward, and by tightening the adjusting bolt of the braking band tightening lever for reverse. Do not overtighten. The clutch control lever should always be easy to shift.

# Regular Maintenance

Service your engine according to the maintenance schedule below under normal operating conditions. The schedule may vary with operating conditions and handling.

## 8-1 Maintenance schedule

●: Contact your nearest dealer.

Item		Daily	Every 50 hours of operation or once a week	Every 250 hours of operation or once a month	Every 500 hours of operation or every 2-3 months	Every 1,000 hours of operation or every 5-6 months	Every 2,500 hours of operation or once a year
Fuel oil	Check level, refill	○					
	Drain water from tank	○ (Before refilling)					
	Clean filter and fuel/water separator		○				
	Clean auto-clean filter	○ (Remove dirt)		○ (Clean)			
	Replace fuel filter (Paper element)				○		
Lubricating oil	Check level in oil pan and reduction reverse gear	○					
	Drain sediment in oil filter		○				
	Clean oil filter	○ (Remove dirt)		○ (Clean)			
	Check oil pressure	○					
	Change oil	Engine		○ (First time)	○		
Reduction reverse gear (2, 3TM only)						○	
Cooling water	Check exit flow	○					
	Check tightness of packing ground (Cooling water pump)	○					
Fuel injection pump and injection valve	Make sure oil reaches each link		○				
	Check injection timing						●
	Check injection pressure and condition					●	
	Replace injection valve						●
Cylinder head	Adjust IN & EX valve clearances		● (First time)			●	
	Lap IN & EX valves						●
Electrical equipment (Electric starter engine only)	Check alternator drive V-belt (Tension, damage)				○		
	Check battery electrolyte			○			
Check/replace anti-corrosion zinc					○		
Adjust reduction reverse gear						●	

## 8-2 Specifications

Item		Specifications		
		2TM (G, GG)	3TM (G, GG)	4TM (G, GG, GGG)
Injection timing	$^{\circ}$ bTDC (FID)	18 – 20		
Fuel injection pressure	kg/cm <sup>2</sup>	200 – 210		
IN & EX valve clearance	mm	0.25 (cold)		
V-belt tension (Engines with electric starter)	mm	8 – 10		
Engine lubricating oil pressure (at continuous rated speed)	kg/cm <sup>2</sup>	3.0 – 4.0		
Lubricating oil capacity $\ell$	Engine	8	12	18
	Reduction gear	1.5		Together with engine oil

## 8-3 Tightening torque values of major parts

Be sure to use a torque wrench and tighten to the specified torque.

Part	Thread dia x pitch mm	Width across flats mm	Tightening torque kg-m
Cylinder head nuts	M14 x 1.5	22	13.5 – 14.5
Connecting rod bolts	M12 x 1.25	19	9.5 – 10.5
Main bearing bolts	M14 x 1.5	22	19 – 21
Flywheel bolts	M14 x 1.5	19	19 – 21
Cam gear bolts	M16 x 1.5	24	14 – 16
Free wheel nuts	M16 x 1.5	24	14 – 16
Bonnet nut	M8 x 1.25	24	1.3 – 1.7
Injection valve nuts	M8 x 1.25	12	0.9 – 1.1

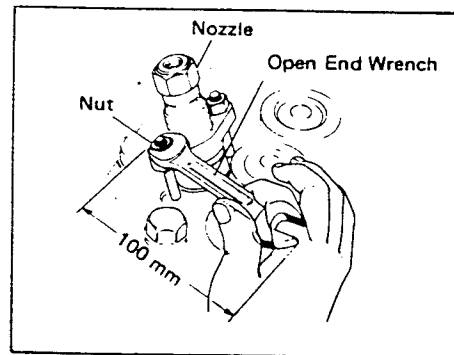
## 8-4

## Tightening torque values of standard bolts

Thread dia x pitch (mm)	Tightening torque (kg-m)	Thread dia x pitch (mm)	Tightening torque (kg-m)
M6 x 1.0	1.1 ± 0.1	M8 x 1.25	2.6 ± 0.2
M10 x 1.5	5.0 ± 0.5	M12 x 1.75	9.0 ± 0.5
M14 x 1.5	14 ± 0.1	M16 x 1.5	23 ± 1.5

**NOTE:** (1) When tightening aluminum part, tighten to 80% of specified torque.

(2) When tightening the fuel injection valve, be sure to use a torque wrench. If a torque wrench is not available, tighten the nuts evenly in several steps with an open end spanner (Length: about 100 mm).



## Regular maintenance procedures

### Daily

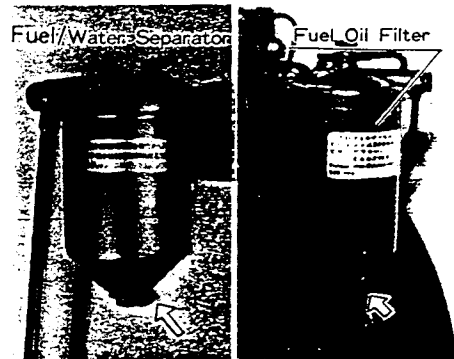
#### (1) Check fuel level, refill

- ① Open the fuel tank drain cock and drain out sediment and water collected in the bottom of the fuel tank.
- ② Check the fuel level in the tank and add if necessary.

#### (2) Check lubricating oil level

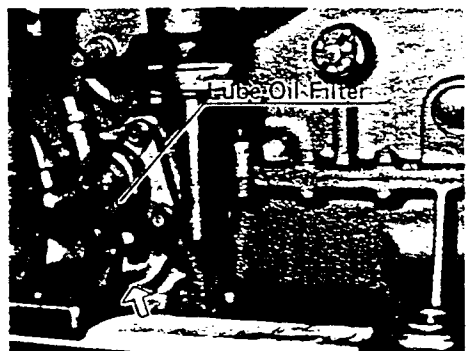
Check both the engine and reduction gear oil levels. If low, fill with the recommended lubricating oil up to the upper mark on the dipstick. (On model 4TM, the engine oil and reduction gear oil are the same.)

- (3) Make sure that the cooling water pump packing ground is securely tightened; retighten if necessary.
- (4) Turn the handle of the lubricating oil filter to the left and right several times and remove any dirt that has accumulated on the filter plate.



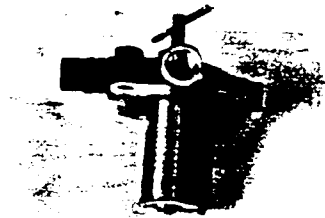
### Every 50 hours of operation

- (1) Loosen the drain plugs of the fuel/water separator, fuel filter (paper element), and lubricating oil filter to drain any sediment and/or water that has accumulated in the bottom.
- (2) After the first 50 hours of operation, change the lubricating oil. Oil change procedures are described on page 19.
- (3) Oiling other parts  
Oil the starter chain, free gear metal, cooling water pump plunger, and rack and link of the fuel injection pump.
- (4) After the first 50 hours of operation, adjust the valve clearance. Adjustment procedures are described on page 22.



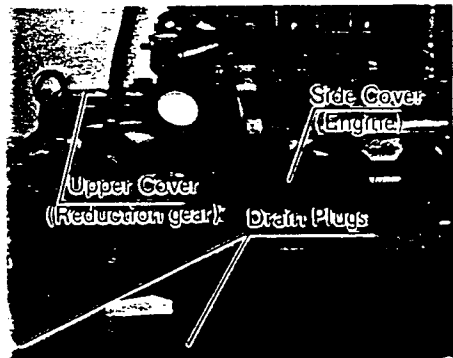
Every 250 hours of operation

- (1) Take out the lubricating oil filter. Clean up the filter mesh and the inside of the filter.



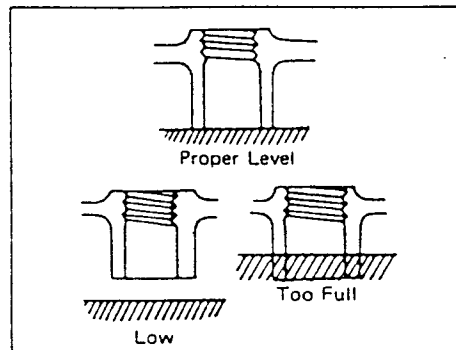
Lube Oil Filter

- (2) Remove the engine side cover, drain the lubricating oil thoroughly with an evacuation pump, and fill with new oil. Oil can also be drained by removing the oil drain plug. Drain oil while the engine is still warm for complete and quick draining.



- (3) Battery electrolyte check  
(Engines with electric starter)

- 1 The battery electrolyte level should be about 10 mm above the pole plates. If low, fill with distilled water.
- 2 Test the electrolyte specific gravity to make sure the battery is charging properly. The specific gravity of a fully charged battery is 1.26 at 20°C.



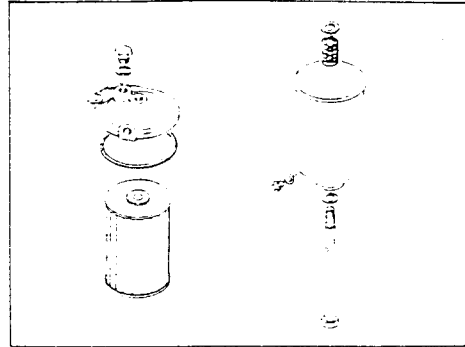
Every 500 hours of operation

(1) Fuel filter replacement  
(Paper element)

Loosen the center bolt and remove the fuel filter.  
Remove the element from the filter and replace it with a new one.

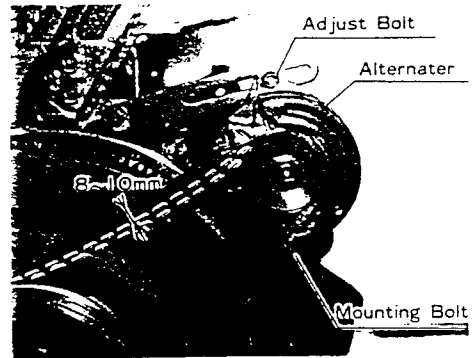
*CAUTION: Thoroughly clean the filter before re-installing. Don't forget to install the spring and washer.*

Tighten the center bolt securely.



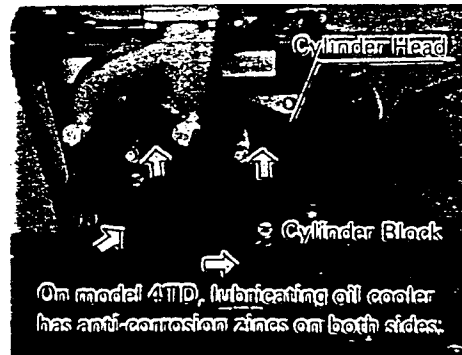
(2) Alternator drive V-belt check  
(Engines with electric starter)

The V-belt tension should be 8–10 mm when pressed down midway between the pulleys with your thumb. If too loose or too tight, loosen the alternator mounting bolt and adjusting bolt and adjust as required.



(3) Check and replace anti-corrosion zinc

Replacement intervals may vary with sea water quality and operating conditions. Check the anti-corrosion zinc according to the maintenance schedule and replace if more than 50% of the zinc is corroded away.

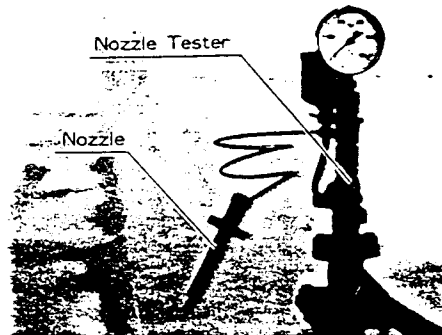


Every 1,000 hours of operation

(1) Check fuel injection valve

Use the nozzle tester to make sure the injection spray is proper. The spray should come out cone-shaped in a fine mist and at the angle shown in the picture below.

Check the injection pressure, and adjust if less than the specified pressure.

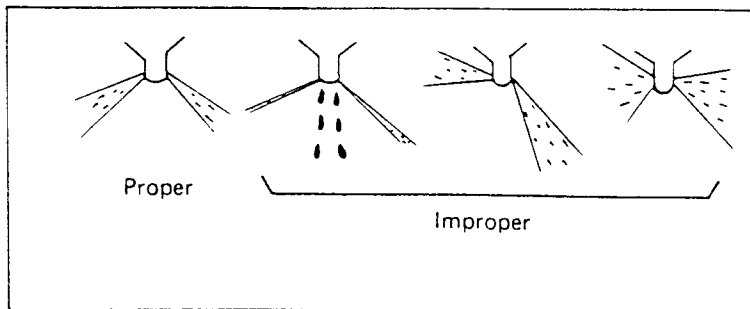


Injection pressure	200–210 kg/cm <sup>2</sup>
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**WARNING:** Keep hands or face away from injection spray. The high pressure can cause serious injury.

**CAUTION:** Each time the fuel injection valve is removed, clean off carbon deposits from the seating surface and replace the seat packing with a new one.

**NOTE:** When installing the injection valve, apply molybdenum disulfide to the injection valve body. Do not forget to install the dust (rubber) seal.

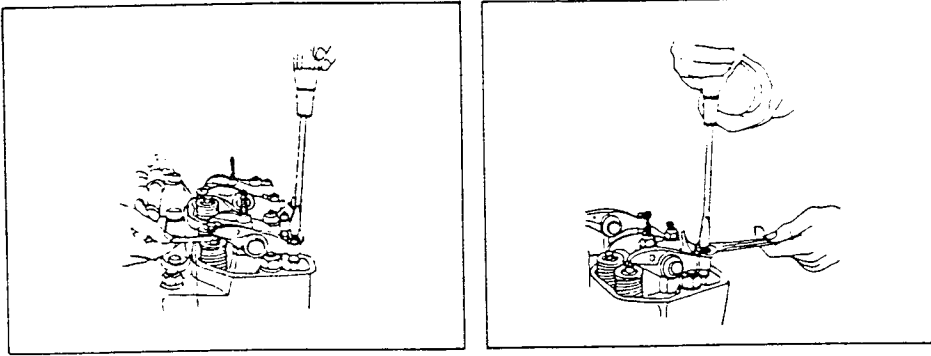




(2) Adjust intake and exhaust valve clearance

Valve clearance should be checked and adjusted while the engine is cold, and the intake and exhaust valves should be completely closed with the piston at top dead center on the compression stroke. The clearance between the rocker arm and valve head should measure 0.25 mm on an accessory thickness gauge.

- ① Loosen the lock nut and turn the adjusting screw until there is a slight drag on the thickness gauge.
- ② Hold the adjusting screw and tighten the lock nut. Recheck the valve clearance.



(3) Replace reduction gear case lubricating oil (2 and 3TM)

Remove the drain plug from the reduction gear, then drain the lubricating oil. Fill the reduction gear case with lubricating oil. (See page 7)

(4) Adjust reduction reverse gear

See Handling of reduction reverse gear on page 13.

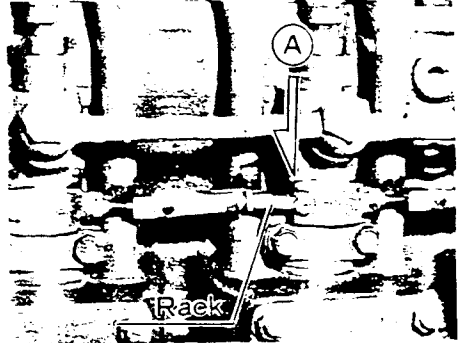
Every 2,500 hours of operation

(1) Check fuel injection timing

To check the injection timing, disconnect the injection pipe at the injection valve and open and close the injection valve by turning the flywheel. Stop the flywheel just as the fuel oil in the end of the injection pipe starts to flow. Measure the injection timing using the graduation angle scale on the flywheel.

Inspection procedures

- ① Disconnect the fuel injection pipe at the injection valve.
- ② Line up the mark on the rack with the A surface of the pump body.
- ③ Put the decompression lever in the no-compression position and bleed out air in the injection pipe by turning the starter handle.
- ④ Position cylinder No. 1 about  $35^{\circ}$  before top dead center on compression stroke and then slowly turn the flywheel in the direction it normally rotates.
- ⑤ Stop the flywheel just as the fuel oil in the pipe end starts to flow. The pointer should indicate  $18-20^{\circ}$ .

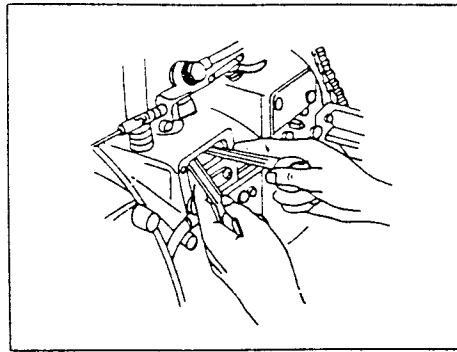
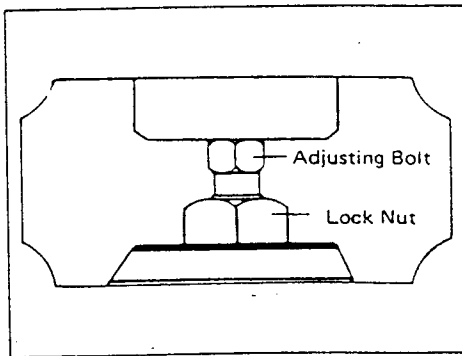


*NOTE: When moving the push rod up and down by hand with the 1T mark on the flywheel lined up with the pointer, there should be a little play if the piston is at top dead center on the compression stroke. If the piston is not at top dead center, rotate the flywheel one turn.*

## (2) Adjusting fuel injection timing

The injection timing does not normally need adjusting. If adjustments become necessary, it is best to contact your nearest dealer.

- 1 Line up the mark on the rack with the A surface of the pump body.
- 2 Remove the inspection window from the underside of the injection pump by removing the two 8 mm bolts and nuts.
- 3 Loosen the lock nut and adjust the timing with adjusting bolt. Screw it in to slow the timing, and screw out to speed it up. After adjusting, tighten the lock nut to secure the adjusting bolt. Be careful not to turn the adjusting bolt at the same time.

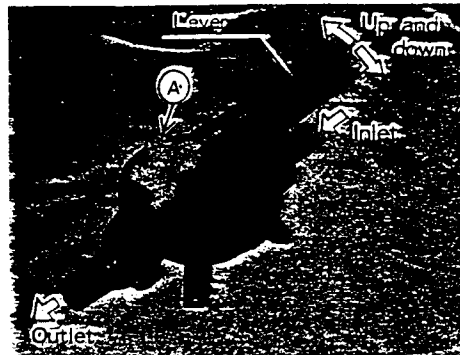


## 8-6 Manual bilge pump (Optional equipment)

The bilge water can be drained with the bilge pump by pumping the lever up and down. The bilge pump can be attached to the hull.

### NOTE:

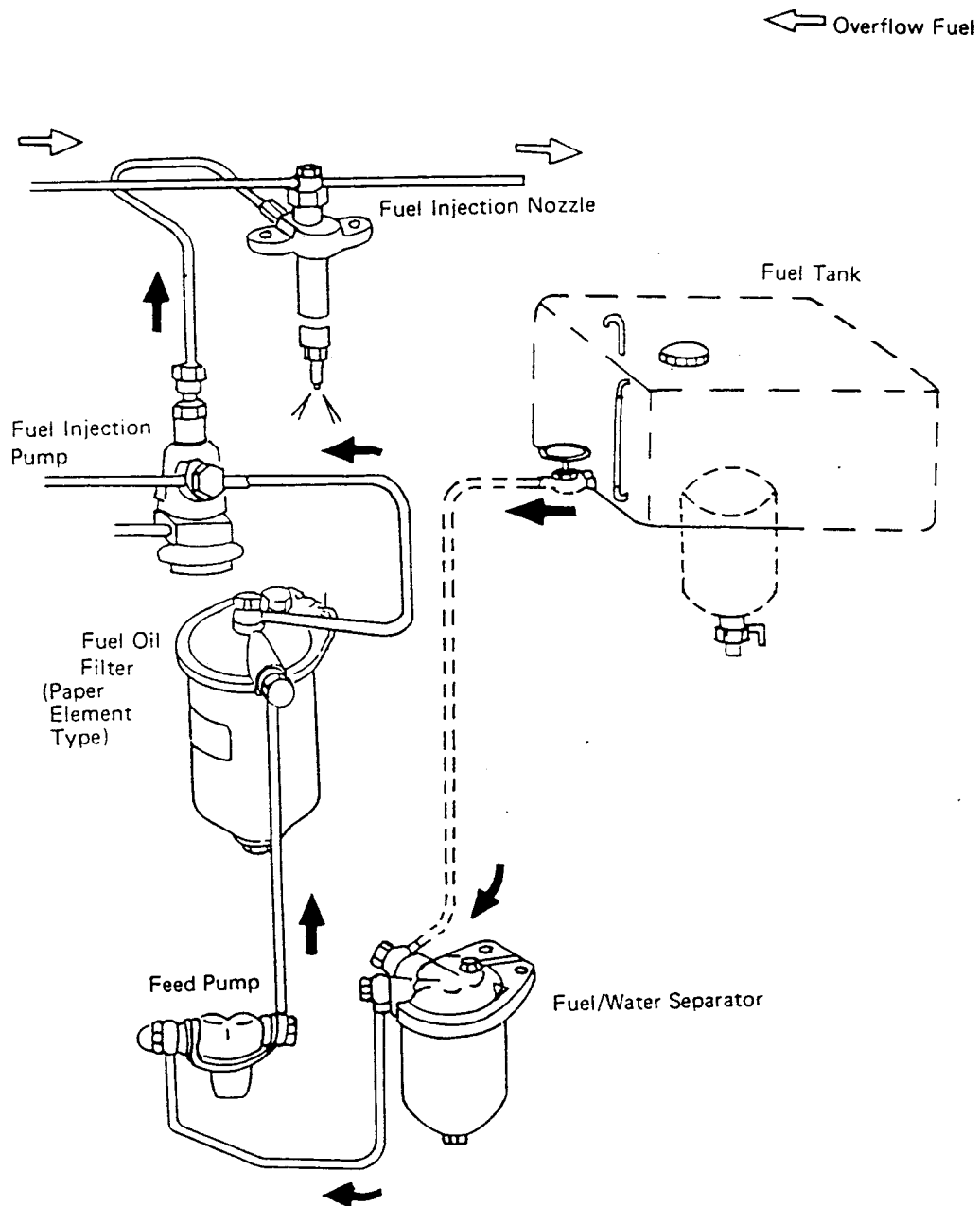
- (1) Put the inlet hose end into the deepest part of the bilge water.
- (2) The height difference between the ends of the inlet and outlet hoses must be less than 3 m.
- (3) Pump the lever slowly.
- (4) Do not use this pump to drain and fill with lubricating oil.



The pump can be used by pulling the lever out and putting it into position A.

# 9 System Diagrams

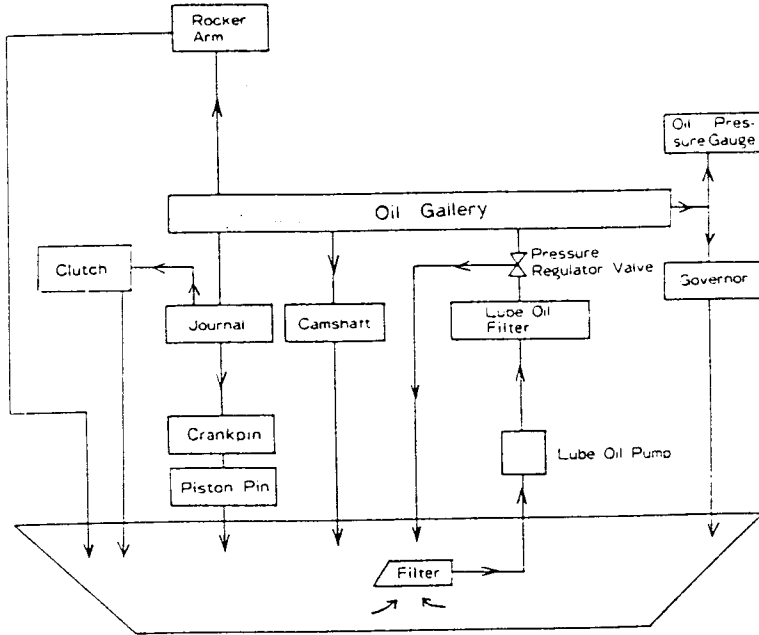
## 9-1 Fuel system



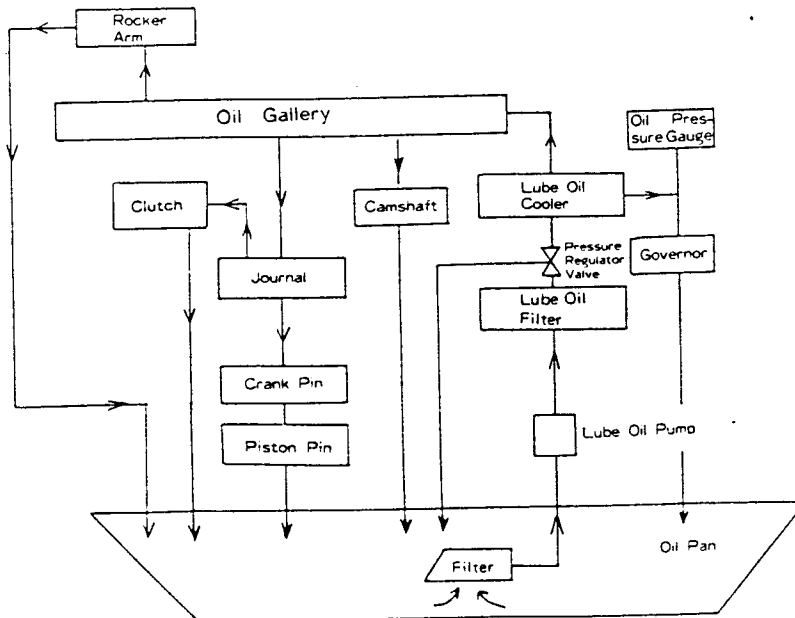
**NOTE:** Install the fuel tank so that the bottom of the tank is higher than the fuel injection pump.

१-२ Lubricating system

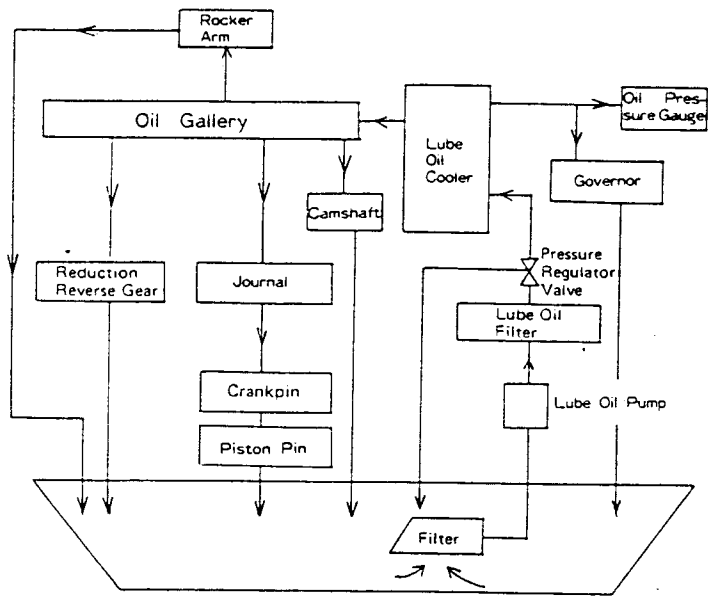
2TM (G,GG)



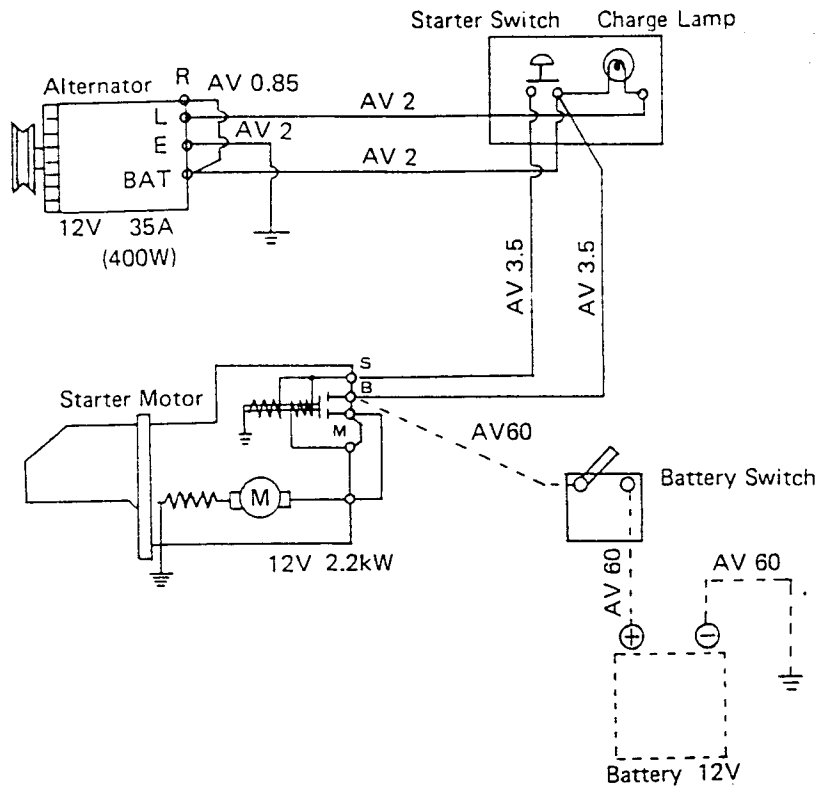
3TM (G,GG)



# 4TM (G, GG, GGG)



## Electric starting system (option)



1. Wiring indicated by ..... is arranged according to user specs.
2. Use 12 V battery only. The capacity should be 70 Ah (20 hours) or higher.
3. Route cables and harnesses properly.
4. Do not turn the battery switch OFF while the engine is running.
5. When giving the battery a quick charge, turn the battery switch OFF.



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