

DIESEL ENGINE

OPERATION INSTRUCTION



YANBEN

MADE IN CHINA

CONTENTS

Chapter 1: General Description.....	2
Chapter 2: Mounting Dimensions and Selection of Belt Pulley Size.....	3
Chapter 3: Operation and Uses of the Diesel Engine.....	4
Chapter 4: Adjustment.....	12
Chapter 5: Dismounting and Reassembly.....	15
Chapter 6: Maintenance of the Diesel Engine.....	19
Chapter 7: Defects and Eliminations.....	21
Chapter 8: Preservation and Storage.....	24

Please Always Use Original Spare Parts of the **YANBEN** Diesel Engine.

Design and Specifications Are Subject to Change Without Notice

Chapter 1: General Description

YANBEN(YB) engine is a kind of horizontal, four-stroke engine with single-cylinder and water-evaporative-cooling. Adopting some advanced techniques, it possesses many advantages, such as enough power; low consumption of fuel; easy starting and simple installation.

It is suitable for tractor; small four-wheel tractor; engineering machinery; motor vehicle; propulsion of small ship; small generator; air compressor as well as for irrigation and drainage equipment and processing machinery for agricultural and sideline products (thresher; flee miller; grinder; forage pulverize etc).

Normal and relished service depends on a correct exemption and good maintenance, which will prolong the demotion of the engine to the maximum. You should pay attention to the following cardinal demands before operating it:

1. The fuel must be chosen as required and completely precipitated and fully filtered before poured into the fuel tank. All the filters must be kept in good order.
2. The lubrication oil must be kept clean and periodically changed. The Lubricant oil must meet the specified requirement.
3. The air filter must be frequently cleaned (clean the dust or replace inner oil of oil hah type air filter).
4. The engine is to be operated under the cooling water which is boiling in the hopper.
5. The cooling water should always be kept in such a level that the red float must not be allowed to go down below the mouth of the funnel of the hopper.

Chapter 2: Mounting Dimensions and Selection of Belt Pulley Size

When the flywheel of the diesel engine is directly connected with working machines, it must be assured that the axiality of them should be less than 0.10mm, otherwise parts should be damaged.

When the diesel engine is connected with working machines by pulleys, the selection of the size of pulleys should affect directly the operating conditions and the productivity of the driven machines. The size of pulleys should be selected according to the following formulas:

$$D_1 = (D_2 \times N_2) / N_1; \quad D_2 = (D_1 \times N_1) / N_2$$

Where: D_1 is the diameter of the pulley on the engine shaft (adopting pitch diameter incase V-belt pulley is used);

D_2 is the diameter of the pulley on the driven shaft;

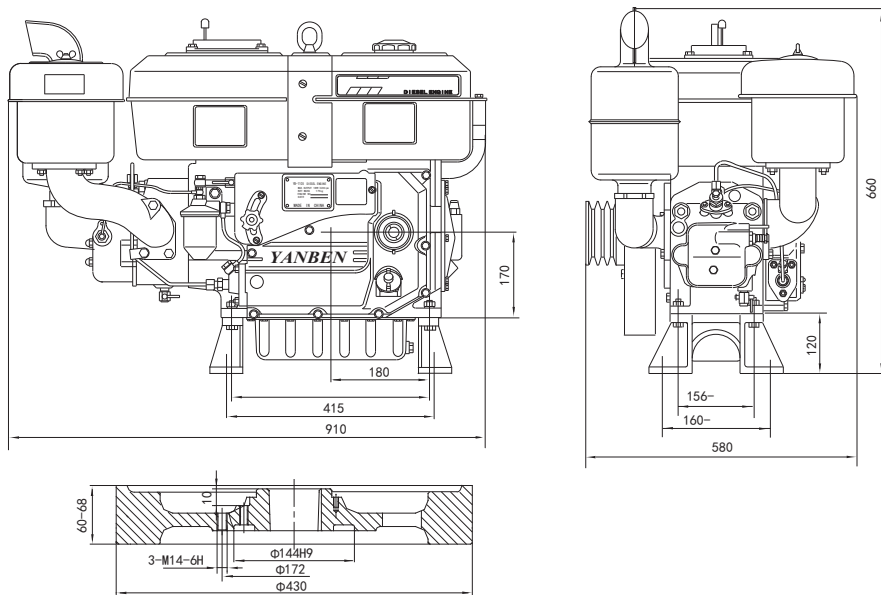
N_1 is the rotation speed of the diesel engine;

N_2 is the rotation speed of the driven shaft.

For the user's selection, the engine for powering the working tractor on its delivery from the factory, is supplied with the following two pulleys.

I -Flat pulley, the diameter of which is 130mm.

II -V- belt pulley, the pitch diameter of which is 125mm..



Drawing of Outline Installing Dimensions of Diesel Engine

Chapter 3: Operation and Uses of the Diesel Engine

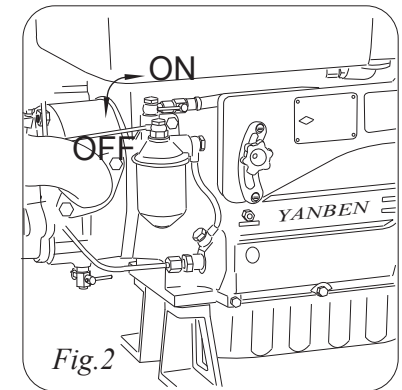
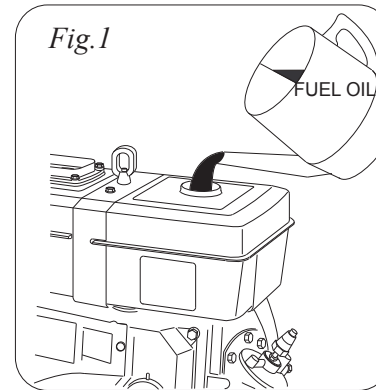
1. Preparatory Works

1.1 Diesel oil

0# light diesel oil is selected in summer and -10# or -20# light diesel oil should be used in winter.

Diesel oil should be stored in a clean and closed container and should be precipitated for a long time before use. Filtrate it again with screen when filling, Open fuel tank cover, fill clean diesel oil into it fully (Fig. 1).

Open the cock of the fuel tank (Fig 2). Then the fuel will flow through a fuel filter to the injection pump.



1.2 Lubricant oil

The lubricant oil with certain viscosity according to ambient temperature should be selected and it should conform to the stipulations of 40# lubricant oil is selected in summer and 30# lubricant oil in winter. The oil should be precipitated and filtered before use.

Lubricant oil should be stored in a clean and closed container so as to prevent impurities entering. When filling draw out the oil dipstick and fill clean lubricant oil into the oil sump (Fig. 3).

CAUTION: The oil level must not go over the upper line, nor fall down below the lower one when the engine is in operation.

Different kinds of lubricant all should not be mixed together when filling.

The amount of filled oil should be about 2.5kg, Check oil level with oil dipstick to see if the level is between two marking lines (Fig. 4).

Note: The oil level should not be over the upper line when filling and below the

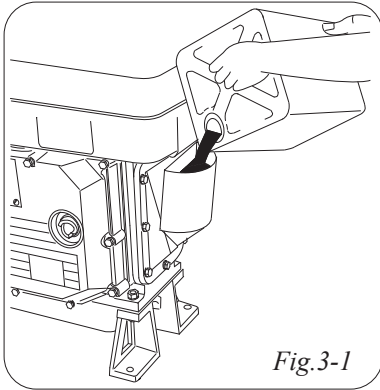


Fig.3-1

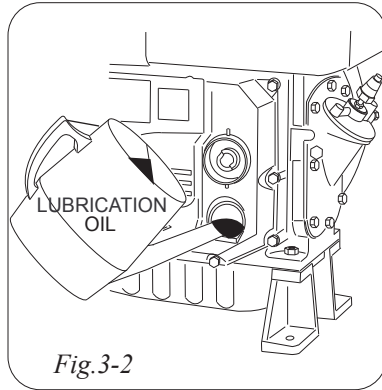


Fig.3-2

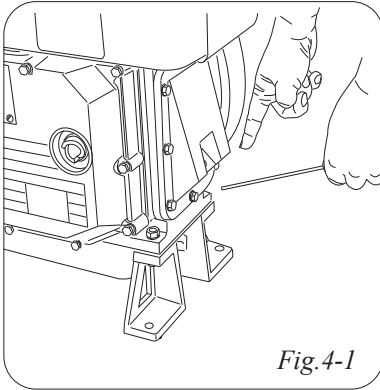


Fig.4-1

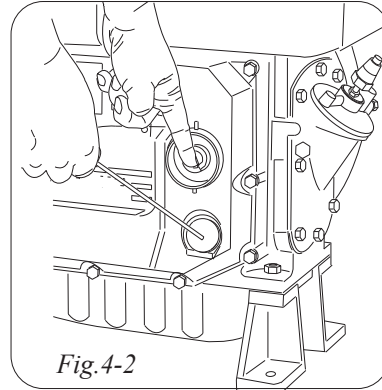


Fig.4-2

bottom line when running normally.

1.3 Cooling water

Clean soft water should be used as cooling water and waste or hard water (well water for example) is not allowed to use. If it has to use hard water in certain conditions, it should be softened. The simplest way is to boil it and then precipitate and filtrate it before use, otherwise water channel should be blocked. Often replace cooling water in tank to remove impurities and dirt.

The red mark in float should rise to its highest position while filling water into the tank (Fig.5).

If the engine is cooled by cooling water circulation and water is forced to circulate by a pump, the cooling water is stored in a pool or other container by the side of the engine (Fig.6). The water level must be above the water pump. The length of connecting tube $\leq 3\text{m}$. The distance from water exit to water level $\leq 3\text{m}$. It is recommended to use river or stream water, clean and free from impurities.

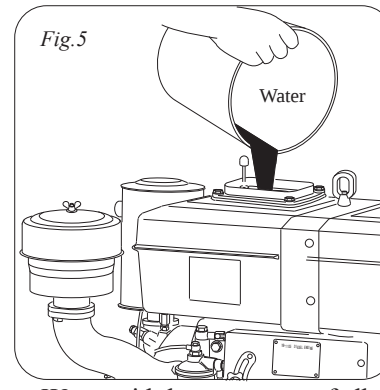


Fig.5

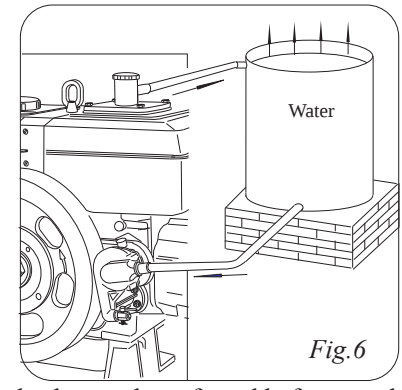


Fig.6

Water with large content of alkaline and salt must be softened before use, lest the water duct should be clogged with dirt or scale, thus affecting the normal operating of the engine.

When supplying cooling water: Raise the rubber inlet pipe of the water pump over the upper side of the engine. Use a kettle to pour cooling water into the jacket of the engine block and cylinder head through the pump. Keep up pouring until the outlet pipe on the water tank cover begins to overflow. Then, connect up the rubber pipe with the cooling water drum.

1.4 Remove air from fuel

Loosen the fuel pipe connecting belt on the fuel injection pump or loosen delivery pipe connections, in order that the air, if any, in the fuel pipe line may get out. When the fuel flows without air bubbles out, re-tighten the vent screw (Fig.7).

Set the speed-control lever knob at the "START" position indicated on the panel. And move the fuel priming handle with double open-end wrench 13×16 to and fro- until a "CHATTERING" sound from the fuel injector is heard (Fig.8).

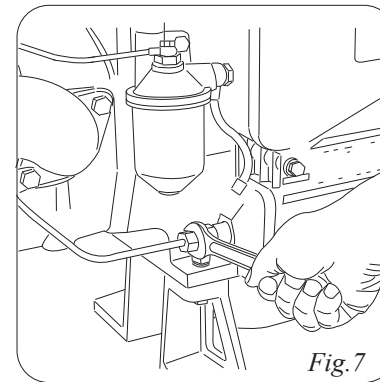


Fig.7

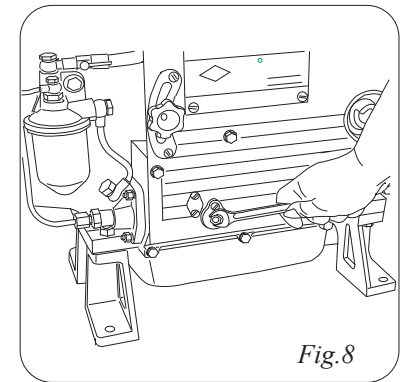


Fig.8

2. Starting the Engine

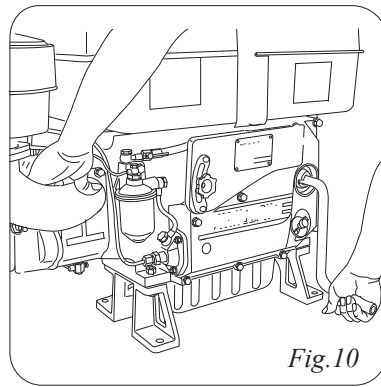
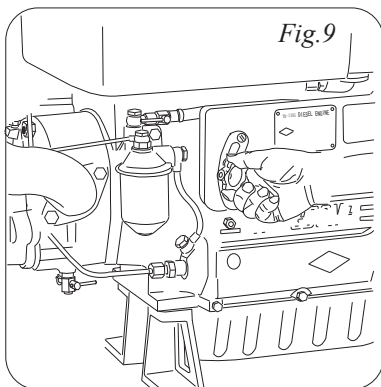
A careful check should be made, after all preparations mentioned above have been done. Then start the engine following the procedures below:

2.1 Set the speed-control lever knob at the "START" position indicated on the panel. (Fig.9).

2.2 Open the decompression lever with your left hand and crank up the rocker arm until normal injection sound is heard.

2.3 Move the decompression lever towards the fight with your left hand and hold it. Crank the engine with you right hand by the start handle and gradually speed up. When the cranking speed attains its maximum, suddenly release the decompression lever to subject the air in the engine cylinder to compression, while continue to crank the engine with full effort. Then the engine will start up running itself (Fig. 10).

2.4 Once the engine starts up running, the start handle will disengage and slip out. **CAUTION:** Once the engine starts up running, the starting handle, because of the action of the spiral-jaws on its clutching end, will disengage and jerk out of itself, and therefore the operator must keep on holding it firmly so as to prevent any incident.



3. Running the Engine

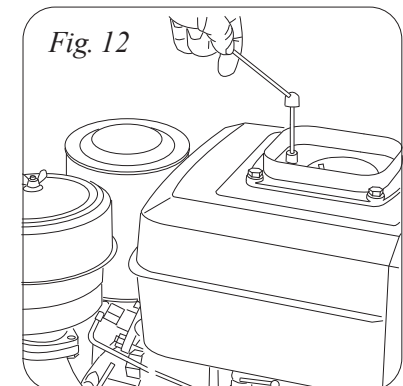
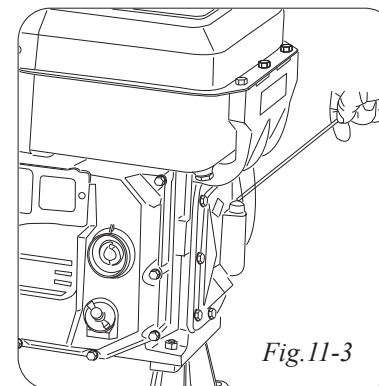
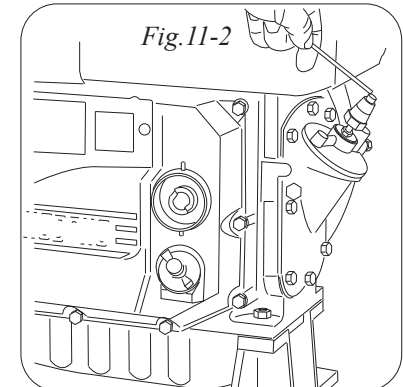
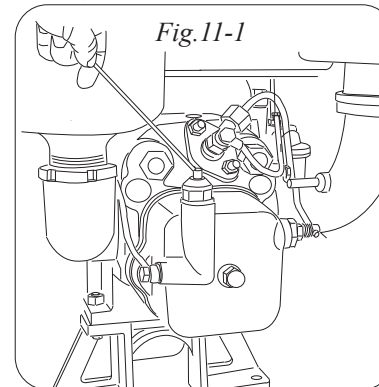
3.1 After starting, let the engine run for 3-5 minutes at low speed without any sound. Then accelerate the speed gradually and load the engine. Running the engine at high speed or with high load immediately after starting is strictly forbidden. To the forced cooling engine: when increase the speed of the engine gradually, if at that time the outlet pipe begins to water and a rated speed is obtained, slowly load the engine. It is strongly advised not to increase the load

suddenly.

3.2 Set the speed-control lever knob at the "STOP" position. Turn clock wise the decompression lever with your left hand, so as to make sure that the engine is in the decompressed state. At the same time, crank the engine by means of the start handle inserted into the starting shaft, gradually speed up and observe whether the red float in the oil indicator on the cylinder head cover rises up (Fig. 11). The rising up of the red float means normal operation of the lubricating oil pump with sufficient quantity of oil. Otherwise, the quantity of oil may be insufficient in the pump, or there may be some defects or troubles in the lubricating oil pump itself. In that case, carefully check and take appropriate measure.

3.3 The engine should run at the rated speed. Over speed may damage the engine, and low speed may cause waste.

3.4 To fill the hopper, use soft water (drinking water or rain water free of dust and mud), Add water when the red ball attached to the baffle cover falls to the



same level as the water port during operation.(Fig. 12)

3.5 During the period of first 50 hours when a new these engine is used, operate it carefully and do not run the engine with the largest load. Check again and retighten all loosened bolts and nuts after that period.

3.6 Precautions During Running of the Engine

3.6.1. Cooling Water

The cooling system is water-evaporative type, the water in the hopper keeps boiling during the operation. Do not feed fresh water as soon as boiling is seen. However, sufficient quantity of fresh water must be fed at once when the water in the hopper decreases due to evaporation, to such an extent that the red ball of the float goes down to the mouth of the funnel of the hopper.

3.6.2. Lubricating oil

Frequent observation should be made to see whether the red float of the oil indicator rises up. In case it drops down, stop the engine at once for examination and check.

3.6.3. Fuel oil

Often check the fuel level of the tank and refill the fuel in time, when the engine goes short of fuel.

3.6.4. Exhaust Smoke

The engine normally works without black smoke. Any black smoke in the exhaust during operation, if everything else is normal, it may indicate that the engine is overloaded. in that case, the load on the engine should be reduced, or the pulley on the driven machine should be enlarged. In case it results from some defects of the engine, stop the engine, to find out the defect and eliminate it.

3.6.5. Engine Noise

It is advisable to listen to the engine noise frequently, and if any abnormal sound is heard, the engine should be immediately stopped and checked.

4. Stopping the Engine

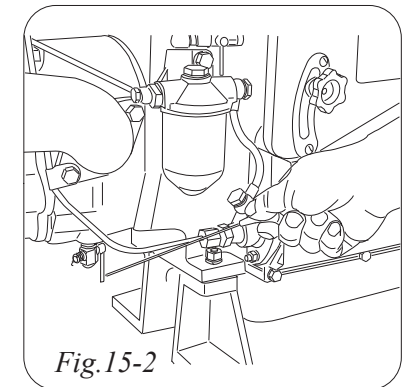
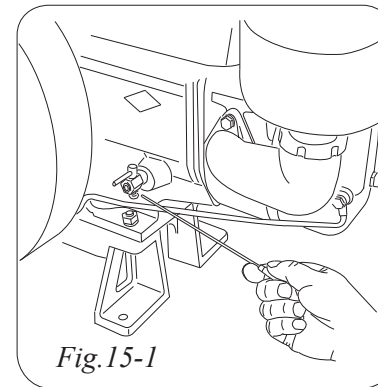
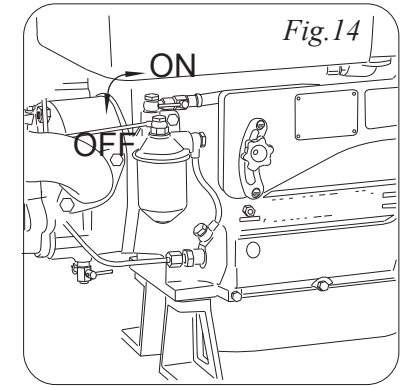
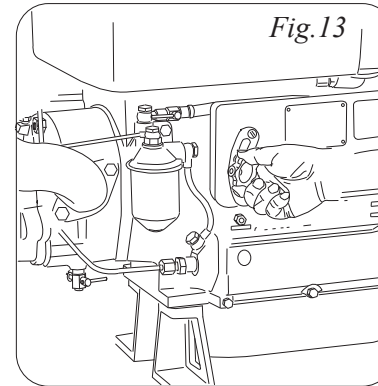
4.1 Unload the engine and run it at lower speed for a while.

4.2 Set the speed-control lever knob at the “STOP” position indicated on the panel (Fig.13), the engine should go out itself.

Note: Stopping the engine with the decompression lever is strictly prohibited.

4.3 Close the cock of the fuel tank. (Fig.14).

4.4 Drain out all cooling water in winter or when stopping the engine for a long time. Remove drain cock regularly to dredge water channel and remove dirt (Fig. 15).



4.5 Set the exhaust valve closed to prevent vapor or impurities entering into the cylinder. The method is as follows:

4.5.1 Turn the flywheel until it can not be turned.

4.5.2 Open the decompression lever to continue turning the flywheel until its mark. of T. D.C. is directly against the mark on the water tank (Fig. 16).

4.6 Examine the oil in the air filter. If it becomes either dirty or diluted, it should be changed with clean oil, after both the filter cartridge and the filter body have been cleaned and wiped. The quantity of oil such that its level is just up to the marked line inside the body.

CAUTION: Special attention should be paid to it when the engine has been operated under dusty conditions.

4.7 Frequently check the bolts connecting the engine and its foundation for reliability. When a new cylinder head gasket is replaced, it is necessary to retighten

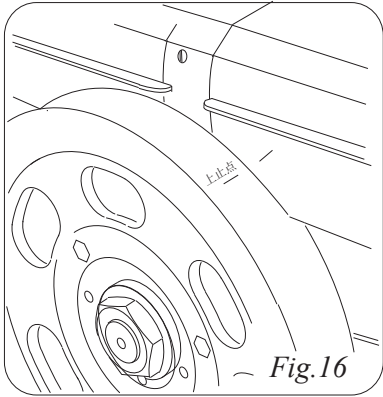


Fig. 16

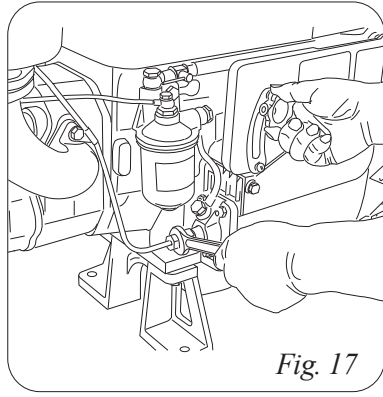


Fig. 17

the nuts once again after the engine has been running for a few hours. When a hopper packing is replaced, or the fixing belts become loose, they should also be duly tightened.

4.8 Adjusting file valve clearance to the specified value is a primary factor to ensure normal operation of the engine(Intake valve clearance 0.35mm, exhaust valve clearance 0.45mm).

4.9 Emergency stop

4.9.1 Unload the engine and let it rum idle for a while. Then move the speed-control lever knob to the "STOP" position, loosen the connecting nuts on high-pressure fuel pipe (Fig. 17) or open the decompress or to stop the engine running at once if abnormal sound is heard suddenly or flying running occurs. The engine will then stop running.

4.9.2. Under special conditions when emergency stop is necessary, it is advisable to take off the air filter and block the engine intake pipe with hand (Fig.18),

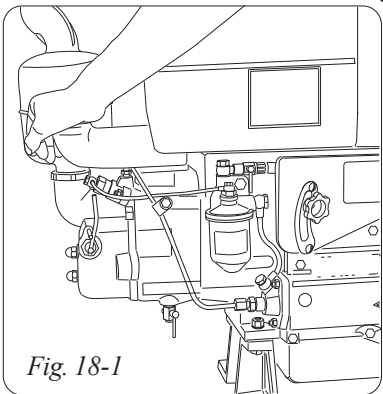


Fig. 18-1

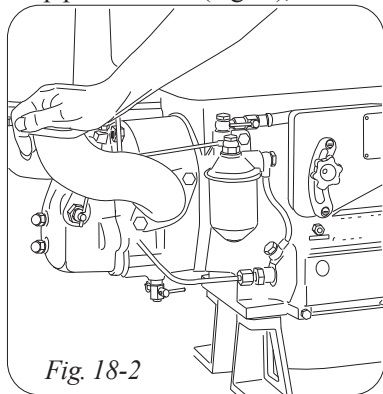


Fig. 18-2

Chapter 4: Adjustment

A. Adjustment of Valve Clearance

1. Turn the flywheel until the mark T. D.C. on its periphery matches with the line on the hopper, to set the piston at its top dead center position in the compression stroke not exhaust stroke(Fig. 19).

2. Remove the cylinder head cover.

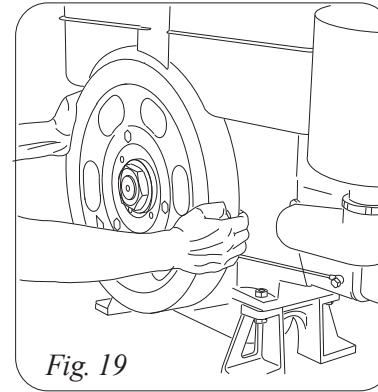


Fig. 19

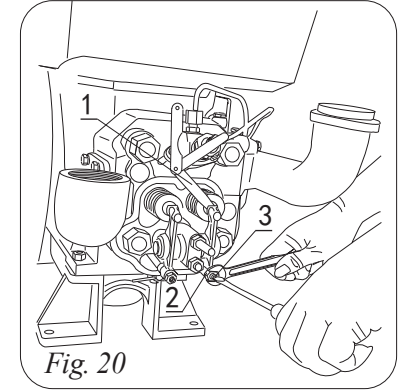


Fig. 20 Adjusting the valve clearance

- 1 - Feeler gauge
- 2 - Locking nut
- 3 - Adjusting screw

3. Loosen the locking nut and turn the adjusting screw on the rocker arm with screw driver(Fig. 20), to set the valve clearance to the specified value by inserting feeler gauge between the valve stem and the rocker arm(Intake valve clearance is 0.35mm, and exhaust valve clearance is 0.45 mm)

4. Adjusting the screw to such an extent that file push rod is just free to turn but not too loose. When this is done, tighten the locking nut to prevent any loosening afterwards turn.

5. Remove the feeler gauge and mm flywheel 2 or 4 rounds then check the clearance once again.

B. Adjustment of the Beginning of Fuel Delivery

1. Disconnect the high pressure fuel pipe from the injector,

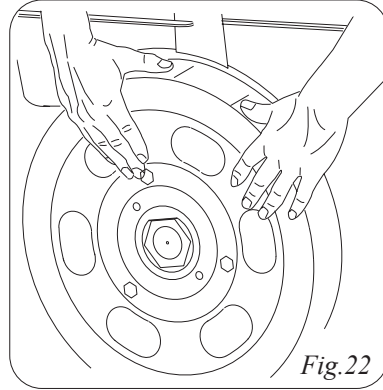
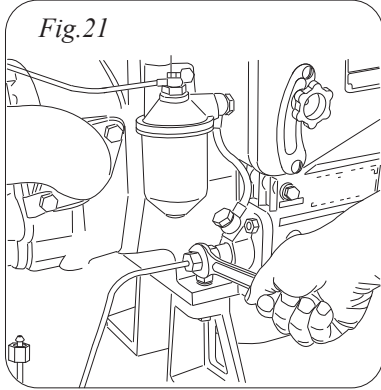
2. Loosen the nut which connects the high pressure fuel pipe with the injection pump, turn the pipe around so that the open end of the pipe is upwards, and re – tighten the nut as shown on(Fig.21).Then fill up the high pressure fuel pipe with fuel by the fuel pruning handle.

3. Turn the flywheel slowly along working direction until the fuel just begins to flout of the open end of the pipe. Stop turning and check whether the fuel

delivery mark line on the periphery of the flywheel matches with the mark - line on the hopper (Fig.22).

In case they do not match with each other (record down whether the fuel delivery is too advanced or too lagging behind). Adjustment is then necessary and made according to the following procedures:

3.1 Close the fuel cock in the low pressure fuel pipe.



3.2 Remove the inspection hole cover on the gear casing and set the speed-control lever knob at the middle position.

3.3 Disconnect the fuel inlet pipe from the injection pump.

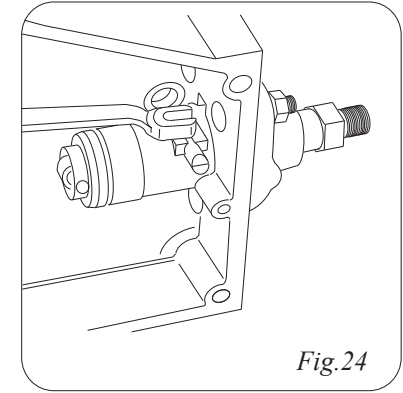
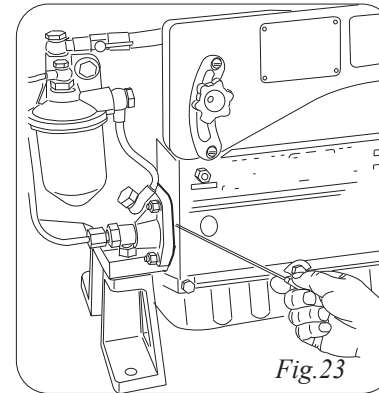
3.4 Screw off the pump fixing nuts, and take off the pump.

3.5 Increase or decrease the number of shims between the pump flange and the mounting surface of the gear casing according to whether the delivery is to be delayed or advanced (Fig.23).

3.6 Mount back the injection pump and tighten the fixing nuts. While doing so, it is necessary to pay special attention to that the ball of the plunger adjusting arm must be engaged with the slot on the speed-governing fork (Fig.24) inside the gear casing. This should be checked once again through the inspection hole, after the pump has been mounted back, so as to prevent the engine from "RUNNING AWAY" resulted from possible miscounting.

After adjustment, it is advisable to make a check according to the item 3 above mentioned. Re-adjustment must be made if the two mark-lines fail to meet.

The beginning of fuel delivery of the injection pump, whose adjournment is effected by increasing or decreasing the number of shims located between the pump flange and the mounting surface of the gear casing, is already carefully adjusted by the engine manufacturer on delivery of the engine and will not change of itself. Therefore, it is not recommended that the engine operator increase or



decrease the number or shims at option, which would affect the normal operation of the engine.

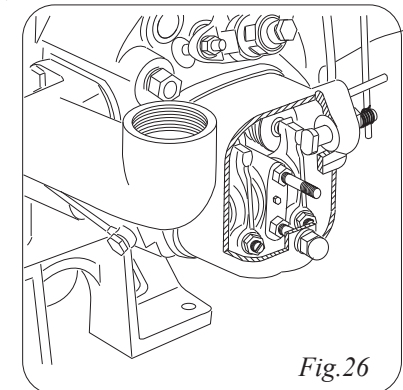
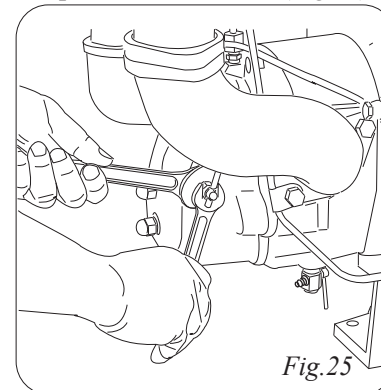
C. Adjustment of Decompression Device

The good function of the decompression device may be tested by hand feeling in the following way. Turn the decompression lever clockwise with your left hand, and at the same time, crank the engine (by the starting handle) with your right hand. If your left hand feels heavy while your right hand feels light, then the decompression device works well. However attention should be paid to that the decompression shaft must not touch the rocker arm while the engine is running, after the decompression lever has been re-leased back.

If it is contrary to this case, adjustment must be made as follows:

1. Lacking the looking nut slightly.

2. Turn the eccentric bushing through an angle to make the adjustment. Turn it clockwise if the decompression is too little, turn it counter-clockwise if the decompression is too much (Fig.25) (Fig.26).



Chapter 5: Dismounting and Reassembly

If it is necessary to dismount the engine for maintenance and repair, it is recommended to proceed in the following order:

A. Draining out the cooling water by opening the drain cock

B. Removing the cylinder head cover and the cylinder head

1. Turn off the pipe connection bolt from the inlet of the oil indicator and the fixing nut on the cylinder head cover. Then the cylinder head cover may be removed.
2. Disconnect the fuel leak - off connecting bolt from the injector.
3. Screw off the bolts fixing the air filter and remove the air filter, at the same time, cover the mouth of the intake pipe in order to keep something else in out.
4. Screw off the nuts which connect the exhaust silencer with the cylinder head and remove the silencer.
5. Turn off the two nuts which bold down the rocker-arm shaft support on the cylinder head, remove the support and draw out the two valve push rods.
6. Remove the high pressure fuel pipe.

While re - installing the high pressure fuel pipe, it is necessary to screw on the two nuts on both ends of the pipe simultaneously. First tighter the one which connects the pipe with the injection pump. Operate the pump with the fuel priming handle until fuel flows out of the other end of the pipe without air bubbles. Then tighten the nut on this end.

7. Screw off the nuts fixing the injector, then remove the injector.

While re-installing the injector, the sealing copper washer should be supplied on to the nozzle before it is put back into its place. The two nuts are to be tightened evenly.

8. Remove the cylinder head gasket.

C. Removing the fuel tank and the hopper

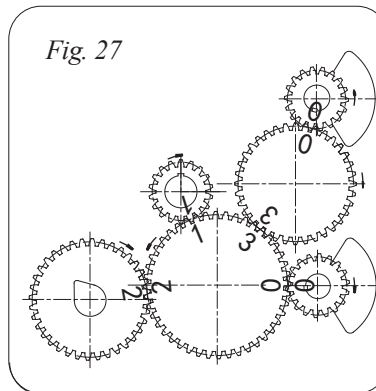
1. Close the fuel cock in the fuel supply pipe.
2. Remove the lifting eye-nut.
3. Disconnect the fuel supply pipe from the fuel filter.
4. Screw off the two bolts located above the rear cover of the cylinder block, which fix the fuel tank on the block, and also screw off the bolt connecting the fuel tank and the hopper together. Then remove the fuel tank.
5. Remove the funnel assembly from the hopper.
6. Screw off the four bolts inside the hopper, which fix the hopper on the

cylinder block. Then take off the hopper and its packing.

7. Remove the upper cover of the cylinder block and its packing.

D. Dismounting the gear casing

1. Disconnect the fuel filter and fuel pipe to the injection pump.
2. Screw off the bolts which connect the gear casing with the cylinder block, and take off the gear casing.
3. Draw out the camshaft, and take off the starting gear.
4. Dismantle the speed-governor gear, sliding ball- race and steel balls. While assembling, it is necessary that the tooth-mesh marks on all the gears must be respectively lined up with one another as they were dismantled before (Fig. 27).
5. Reassembling gear casing, need to the priming handle with wrench and push the gear casing touch the surface of cylinder block, don't knock it with hammer.



E. Removing the rear cover of the cylinder block

1. Take out the oil dipstick.
2. Unscrew the bolts which fix the rear cover on the cylinder block, then remove the rear cover and its packing.

F. Dismantling and re - installing the piston connecting rod assembly

1. Turn the flywheel until the big end of the connecting rod is in the position nearest the rear opening of the cylinder block, in order to facilitate the removing of connecting rod bolts.
2. Cut off the steel wire which locks the connecting rod bolts and remove it.
3. Unscrew the connecting rod bolts by the special wrench supplied with the engine.
4. Take off the connecting rod cap.

CAUTION: The connecting rod beating shells must be well protected while taking off the cap.

5. Turn the flywheel slowly until the piston is at its top dead center position (Any carbon deposit on the wall of the cylinder liner should be per moved). Then push slowly the piston connecting rod assembly out of the cylinder bore by a wooden rod against file big end of the connecting rod , through the rear opening of the cylinder block..

CAUTION: Be careful of this operation, not to damage the crankpin, the cylinder liner and the piston, while re - installing, the 45° parting surface of the big end of the connecting rod must be kept downwards, the cap must be fitted in such a way that the matching marks on both the cap and the rod should be on the same side. The piston rings are to be so fitted on to the piston that the gaps are spaced 120° apart from one another. The connecting rod bolts are tightened with a torque of about 88-108N.m(9-11kgf.m), but before being completely tightened, it is necessary to mm the flywheel to see if the moving parts move freely, and then tighten the bolts evenly and completely. Further-more, While re-installing, the crankpin, the connecting rod bearing, the piston and the piston rings are all to be smeared with a little clean lubricating oil. If it is necessary to replace the small end bushing of the connecting rod, then after replacement, the connecting rod should be so assembled back with the piston as it was before. When mounting or dismounting the piston pin, the piston should be heated to 150 °C in hot engine oil, then push the pin in or out lightly.

G. Dismantling the flywheel

1. Remove the pulley'.
2. Unlock the lock washer of the flywheel nut.
3. Loosen the flywheel nut by a special wrench (Knock the handle of the wrench with a hammer counter- clockwise, if necessary), but do not screw it off (Fig.28).
4. Pull out the flywheel by the puller. A hummer may be used to knock the center of the bridge of the puller if the flywheel is difficult to be pulled out (Fig.29).

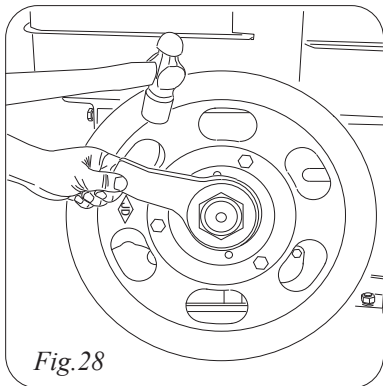


Fig.28

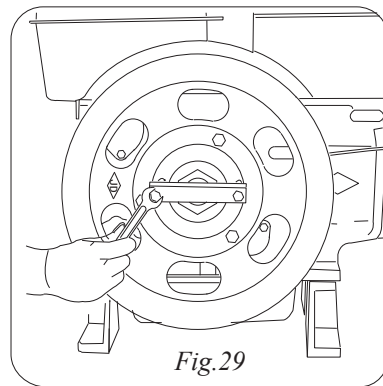


Fig.29

5. Screw off the flywheel nut and take off the flywheel. Be careful not to damage the thread on the end of the crankshaft while taking off the flywheel, and

do it with great care since the flywheel is heavy.

6. Remove the flat key from the crankshaft by a M6 cap screw.

H. Removing and reassembling the crankshaft

1. Take off the oil pipe by screw off the connecting bolts which links the main bearing housing and the oil indicator.
2. Remove all the fixing bolts of the main beating housing.
3. Pull out the main bearing housing by screwing two M8 bolts simultaneously and slowly into the two holes which are diagonally spaced on the housing, until it is pushed out. During this operation, be careful not to let the crankshaft move out. Push it back is it does. Otherwise, the crankshaft may drop down and get damaged.
4. Carefully take the crankshaft out of the cylinder block. **CAUTION:** During this operation, all the journals of the crankshaft should be well protected from being scratched or damaged. While reassembling, they must be smeared with a layer of clean lubricating oil.

I. Removing and reassembling the balancing shafts

Under ordinary conditions, it is unnecessary to remove the balancing shafts. But if the ball beatings am worn and need to be replaced, they may be removed and reassembled according to the following procedures.

1. Take off the beating cover of the upper balancing shaft on die flywheel side of the engine, and remove the lubricating oil pump from the lower balancing shaft on the same side.
2. Screw off the bolts on the gears end of both the balancing shafts and remove the gears by the puller.
3. Remove the circles from the block.
4. Tap both the balancing shafts from the flywheel side of the engine by a wooden hammer or a copper rod, until the ball beatings on the other end of the shafts come out of cylinder block, and then remove the ball bearings.
5. Similarly push the balancing shafts towards the flywheel side and remove the ball bearings on this end of the shafts.
6. After removing the ball bearings, take out the balancing shafts carefully from the cylinder block..

Chapter 6: Maintenance of the Diesel Engine

Item	Description	Period (hours)
1. Cooling water	As soon as the red ball of the float in the hopper goes down near the mouth of the funnel, replenish water.	As required
2. Lubricating oil	a. As soon as the oil level in the sump drops down near the lower marked line on the dipstick, replenish oil. b. After the first 100 hours of operation of a new engine, it is necessary to clean file crankcase and the oil sump once, and renew the oil. c. Hereafter, the crankcase and the road of the lubrication oil must be cleaned for every 200 hours operation, at the same time, change the oil..	Every' shift First 100 Hours 200 Hours
3. Lubricating oil strainer	a. After the first 100 hours of operation of a new engine, it is necessary to dismantle the strainer and clean it. b. Hereafter, the strainer must be clued for every 200 hours of operation.	100 Hours 200 Hours
4. Air filter	Ordinarily, the filter is to be cleared every 100 hours But when the engine is used to power a walking tractor, the cleaning of the filter is to be done every 50 hours. In case the engine is operating in a dusty constancy, it is necessary m clean the filter every shift of woke.	100 200 Hours Every shift
5. Filtering cartridge of fuel filter	Clean the paper cartridge of the filter with clean fuel or kerosene, and blow it from inside out. Replace it if the cartridge is worn.	200 Hours
6. Fuel tank and filling screen	a. Remove the screen from the inlet of the fuel tank and clean it in fresh fuel. b. Clean the inside of the fuel tank with clean fuel.. If the fuel isn't clean, reduce the clean cycle. Replace the primary fuel filter in front of the fuel cock connecting flange.	50 Hours 500 Hours

Item	Description	Period (hours)
7. Lapping of valve	Smear file valve seal with a little bit of lapping paste and lap it together with the valve cane fully. CAUTION: Do not let file lapping paste get into the valve guide). After lapping, wash the valve and the valve seat with fresh fuel and wiped them dry. Checking the valve for tightness may be done by pouting into the intake and exhaust port a small quantity of fuel, and observe whether it leaks out	500 Hours
8. Valve clearance	Adjust according to the recommended procedure.	100
9. Cylinder head, cylinder liner and piston	Relive carbon deposit if any, and dean them with fresh fuel. It may not be necessary to dismantle them for cleaning if the engine operate normally.	100 Hours
10. The connecting rod bolts	a. Tightening the connecting rod bolts with a torque for every 100 hours. b. Adjust according to the recommended procedure.	100 Hours
11. Fuel injector	a. Examine spraying quantity under normal case, ought to be fog columns, not any fuel drop. b. If spraying quantity is bad, may use carbon deposit.	As required
12. Oil ducts in the Crankshaft.	Screw off the oil duct plug from the crankshaft. Clean the inner cavity of the crankshaft in fresh fuel.	500 Hours
13. Cooling water passages	Pour into the water passage a solution of hydrochloric acid (HCl) of 25% concentration, keep it for about 10 minutes and then blow-wash fresh water. Repeat it again if not thoroughly cleaned. NOTE: the hopper must be removed from the engine before cleaning.	500 Hours

Chapter 7: Defects and Eliminations

A. Engine Fails to Start

Cause	Remedy
1. Unsteady fuel flow	Check the fuel tank and the cartridge of the fuel filter whether there is any water or dirt. Clean the cartridge in clean fuel if it is choked with dirt, or clean the fuel tank and fill it with clean fuel of recommended grade if any water is found in the tank. Vent and then tighten all fuel pipe connections. Adjust according to the recommended procedure. Adjust according to the recommended procedure.
2. Air in the fuel pipe line	
3. Beginning of fuel delivery incorrect	
4. Valve clearance incorrect	
5. In cold weather lubricating oil becomes too viscous, difficult to crank the engine	Pour hot water into the hopper, or preheat the lubricating oil before pouring it into the oil sump, but do not heat the oil sump with external fire. It is also advisable to disconnect the engine from the driven machine by pulling off the belt, then start the engine. Stop it after the engine has been warmed up, put the belt on and start the engine again.
6. Insufficient compression in the cylinder	Pour hot water into the hopper, or preheat the lubricating oil before pouring it into the oil sump, but do not heat the oil sump with external fire. It is also advisable to disconnect the engine from the driven machine by pulling off the belt, then start the engine. Stop it after the engine has been warmed up, put the belt on and start the engine again.
7. Pumping element (plunger and barrel) of the injection pump or the injection nozzle worn-out	The wearing-out of intake and exhaust valves, piston rings and cylinder liner is the main factor to give rise to insufficient Compression. Injection about 25 grams of lubrication oil into the intake pipe will be of some assistance to increasing the compression pressure in the cylinder. If leakage at the cylinder head gasket occurs, it is then necessary to tighten the cylinder head nuts. Any worn gasket should be replaced. Replace with new matched parts. 1. Examine spraying quantity, procedure: Slack the high-pressure fuel pipe, turn it an angle, and tighten up, then mount the injector, crank the engine, observe spraying quality, under normal case, ought to be fog column, not any fuel drop. 2. If spraying quantity is bad, may remove any carbon deposit. 3. If necessary, loose the lock nut, replace a new nozzle assembly.

B. Engine Does Not Develop Full power

Cause	Remedy
1. Insufficient compression in the cylinder	Reference item 6 under “engine fails to start” . If parts are worn, in excess of the specified wear limit, then replacement should be made.
2. Beginning of fuel delivery incorrect	Adjust according to the recommended procedure.
3. Valve clearance incorrect	Adjust according to the recommended procedure.
4. Air filter choked	Clean it in clean fuel or kerosene.
5. Engine speed too low or too high.	Adjust the speed-control lever knob to make the speed attain its rated value.

C. Engine Stalls

Cause	Remedy
1. Flow of fuel interrupted	Supply with sufficient quantity of fuel to the fuel tank if it is exhausted, if there is air in the fuel pipe line or the fuel filter is choked, vent and remove all dirt.
2. Quantity of lubricating oil insufficient, or some parts seized due to faults in lubrication system	Examine the quantity of oil by the dipstick replenish if insufficient. Inspect the oil pump to see if it works normally and check all oil duct. Find out the trouble and remove them. Replace the seized parts with new ones if any exists.
3. Sticking of the needle valve with the nozzle body of the injector	If no “CHATTERING” is heard from the injector with turning the starting haft of the engine, it will often indicate that the needle valve is stuck or seized. In that case, clean it in clean fuel and lap it for a little while with the nozzle body. Replace it if necessary.

D. Rotational Speed Raised Suddenly

Cause	Remedy
1. Speed-control implement work abnormally	Stop the engine at once. Examine the speed-control system.
2. Sticking of the rack inside the fuel injection pump	Stop the engine at once. Examine and adjust it.
3. The ball of the rock is not engaged with the slot on the speed-governing fork while mounting the injection	Stop the engine at once, mount the injection pump again.
4. Lots of lubricating oil hums	Examine the lubricating oil where it comes from and obviate.

E. Engine Exhausts Dense Black Smoke

Cause	Remedy
1. Engine over loaded	Reduce the load appropriately. If the belting or connecting with the driven machine is not right, correct it.
2. Faulty injector	Check the opening pressure of the injector and the atomization of the fuel spray. Correct it if necessary, or replace it if worn.
3. Incomplete combustion	This results mainly from faulty injector, incorrect beginning of fuel injection, leakage through the cylinder head gasket and insufficient cylinder compression, etc. Remedy whatever the real cause may be.
4. Air filter choked	Maintain it according to the recommended procedure.
5. The inner frictional force is big.	Necessary, replace the air filter cartridge.
6. The road of the lubricating oil has a breakdown	Reference item 6 under "engine fails to start". After stopping the engine, keep the engine in the decompressed state, crank the engine. If you feel frictional force big, check the engine and obviate at once.

F. The Cooling Water Pump Fails to Pump Water or Fails to Discharge Water

Cause	Remedy
1. No water in the water pump therefore no vacuum funned.	Fill the pump with water.
2. Water pump jacket blocked by impurities.	Dismantle it and remove the impurities
3. Water inlet pipe leaks.	Replace it with a new one.
4. Vacuum is so formed in the Water jacket that no water is discharged.	Pull the outlet rubber tube off the water tank cover to let air go into the jacket.

G. Other Defects

If any of the following condition and it is necessary to stop the engine immediately

Cause	Remedy
1. Engine speed "hunting"	Check the sensitivity of the lovelorn system, and vent the fuel supply line if there is any air in it.
2. Abnormal engine noise suddenly arises	Make a careful cheek for every moving part.
3. Engine suddenly exhausts black smoke	Examine the fuel injection system, especially the injector.
4. Red float in the indicator suddenly drape down	Examine the lubrication system to see if the oil strainer screen and other oil duct are choked and to observe whether the oil pump operates normally.

Chapter 8: Preservation and Storage

If the engine is to be put out of service for a comparatively long period of time, it is necessary to preserve it according to the following procedure, in order to prevent any corrosion and erosion.

1. Drain out the lubricating oil form the oil sump by screwing off the oil-drain plug (Fig.30). Screw back the plug after draining. This operation may better be performed immediately after the engine stops running when the oil temperature is comparatively high.

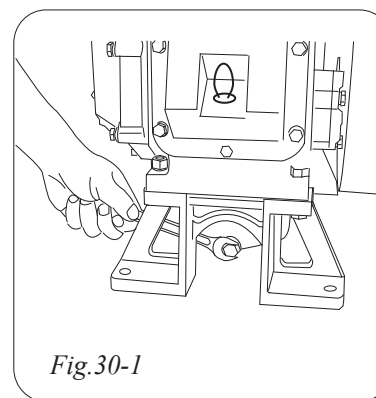


Fig.30-1

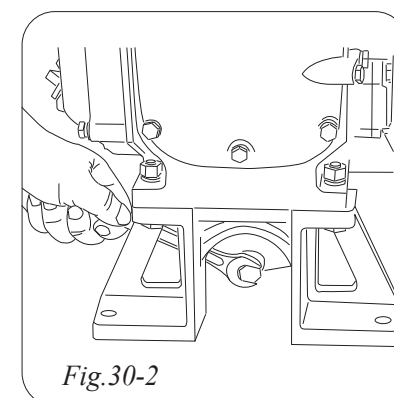


Fig.30-2

2. Drain out the cooling water completely by opening the water-drain cock.

3. Drain out the fuel from the fuel tank.

4. Remove the rear cover of the cylinder block.. Take out the oil strainer, dismount and clean it.

5. Clean the crankcase, and then reinstall the oil strainer.

6. Clean the filtering cartridge and the inside of the air filter.

7. Take 1.8 kg of filtered lubricating oil of grade 10W/30W and give it a dehydration treatment heat it to 110°C-150°C, until all bubbles on the oil disappear. Pour into the crankcase about 1 kg of this treated oil, and turn the engine until the red float in the oil indicator rises up so as to make sure that the lubricating system is completely filled up with this oil.

8. Pour into the intake pipe about 0.3 kg of this dehydrated oil, turn the engine to make sure that the piston, the cylinder liner and the valve seat are all

covered with a layer of this oil. Then set the piston at its top dead center position in the compression stroke by turning the engine slowly, in order to isolate the inside of the cylinder from outside.

9. Add about 0.2 kg of industrial vase line to the remaining of the dehydrated oil, and heat it with agitation until the mixing is homogenous.

10. Remove the cylinder head cover and clean it. Smear the rocker arm, the rocker arm shaft, and other parts with the above - mentioned mixture by brushing evenly.

11. Install all the parts that have been dismantled. Clean all the outside surface of the engine.

12. Wrap up the air filter properly, the exhaust pipe outlet and the funnel – mouth of the hopper with any kind of preservative paper in order to prevent any dust from getting in.

13. Smear with the above - mentioned mixture all the exposed surface of the engine which have not been painted (such as flywheel, oil pipe, etc).

14. It is advisable not to smear the mixture on the surface of any parts made of rubber or plastics.

15. Store the engine in room of good ventilation and low humidity but without any dust. It is strictly forbidden to store the engine wherever there are chemicals (such as synthetic fertilizer, agricultural insecticide, etc.).

The preservation according to the above procedure may be good for twelve months.

Over this period, repeat tiffs procedure.