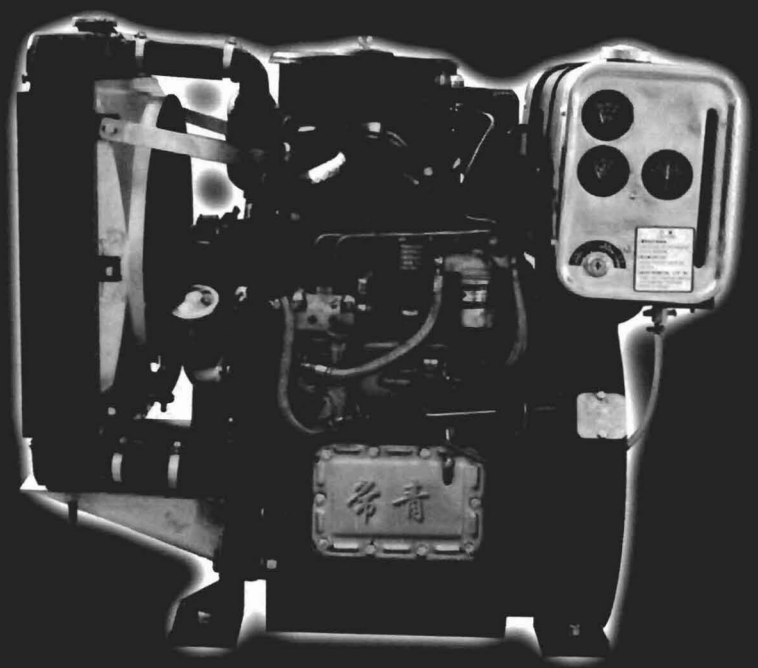
常青®

Model

295 & 2100 DIESELENGINE



OPERATION MANUAL,
PARTS LIST AND MAINTENANCE

CHANGZHOU CHANGQING POWER MACHINERY CO.,LTD.
THE PEOPLE'S REPULIC OF CHINA

FOREWORD

Model 295,2100 Diesel Engine is a sort of the series 95,100 diesel engines designed by China herself and also a standard model of the nation-wide utilitzation. It is characterized by advanced index of economy and dynamics, high level in standardization,systematization and commonality,and by easy derivative in construction to satisfy the comprehensive utilization.

We hope that by the aid of this operation manual sent by us our users may get familiar with the engine construction in a shortest possible time and be trained skillful in operating so that the desired normal running of the engine is ensured. This operation manual gives a brief description on running,maintenance and repair of the engine and it is for your reference only.

The normal running and service life of the engine not only depend on the manufacturing quality, but also on the reasonable use and careful maintenance. So you'd better get yourself acquainted with engine construction, running and maintenance beforehand if you want to keep your engine running well, working in its best efficiency and lasting a longer time.

Contents inclosed in this manual which may be slightly different to the actual condition of the engine will be frequently improved. Besides our renewing the manuals periodically, the user shall also pay certain attention to this.

Since Model 295, 2100 Diesel Engine is a new product, there will certainly be much room for improvement. We are looking forward to receiving suggestio ns from our users so as to better our engine quality.

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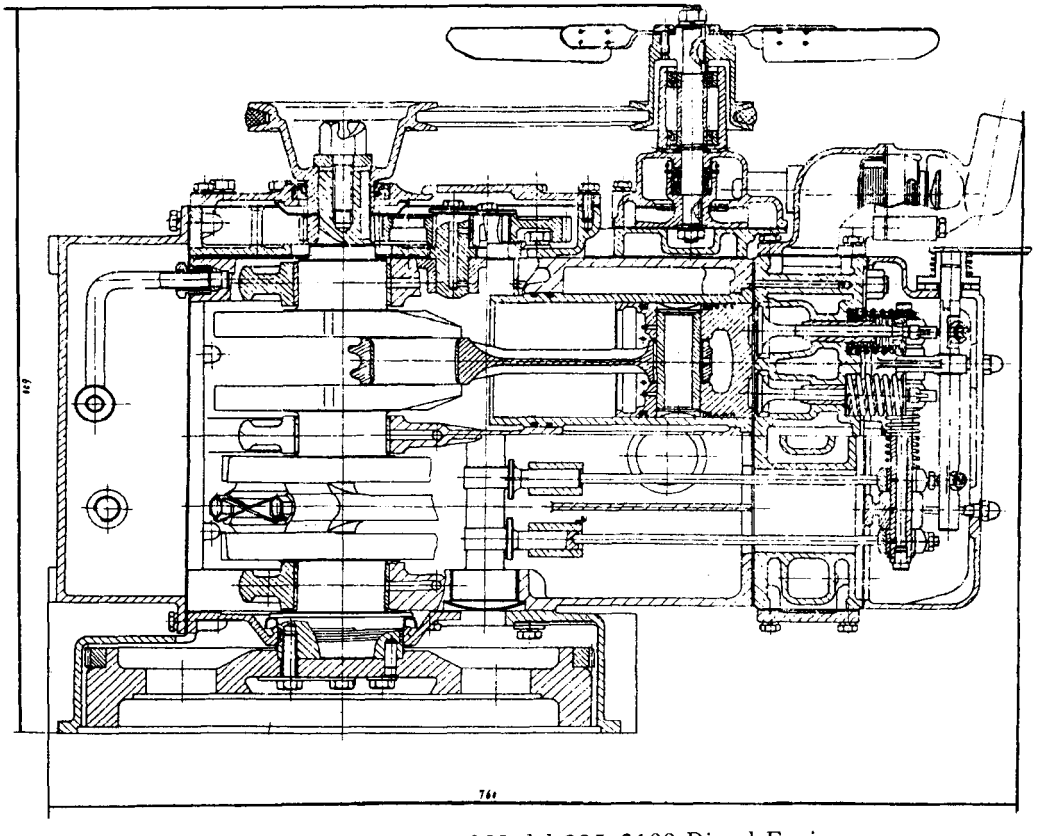
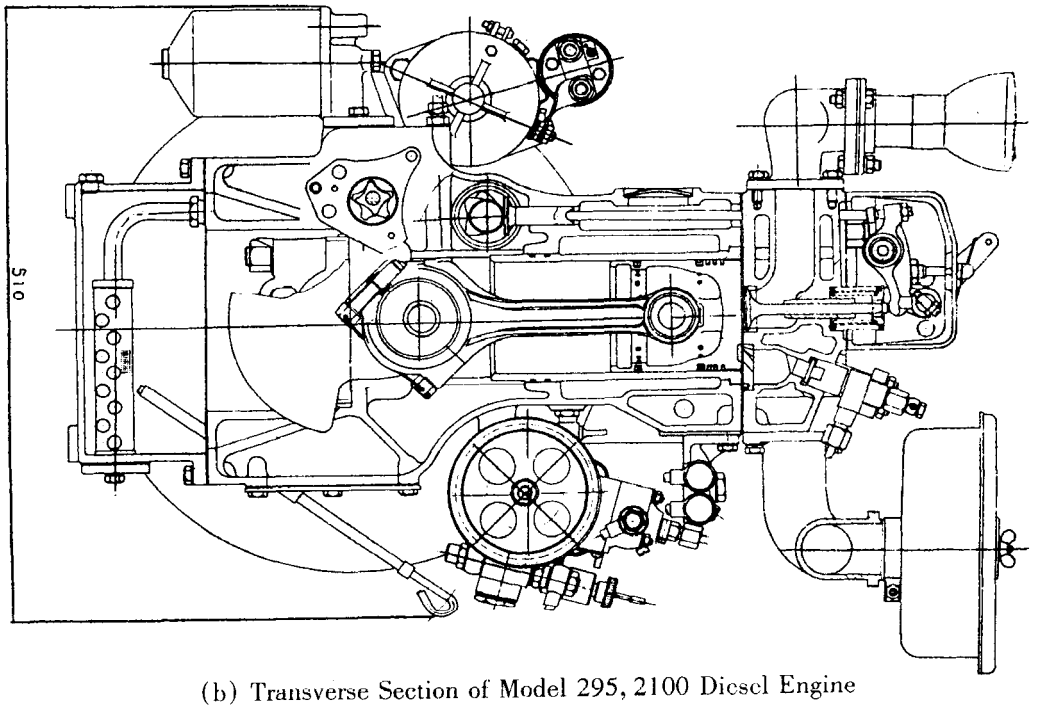
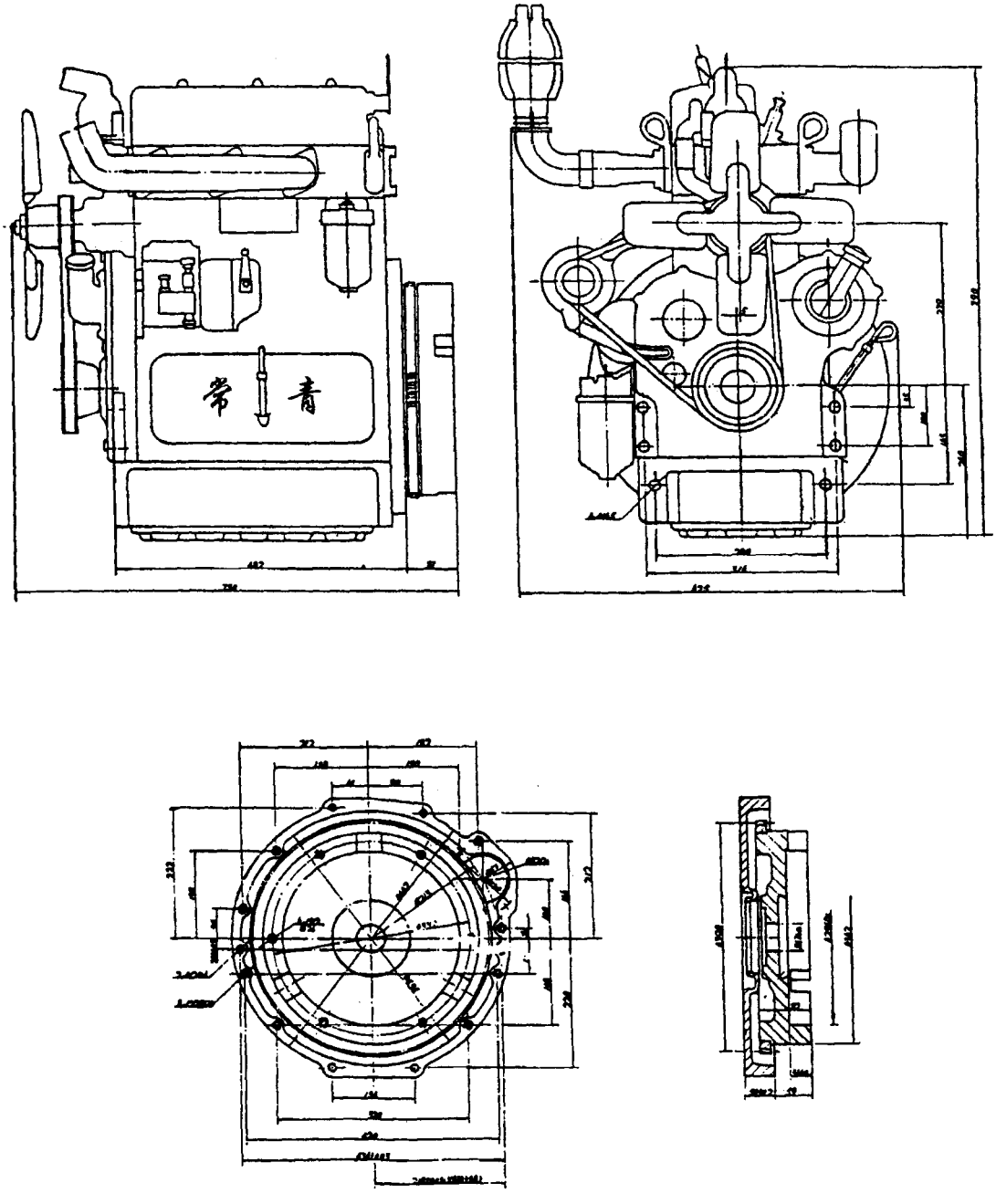


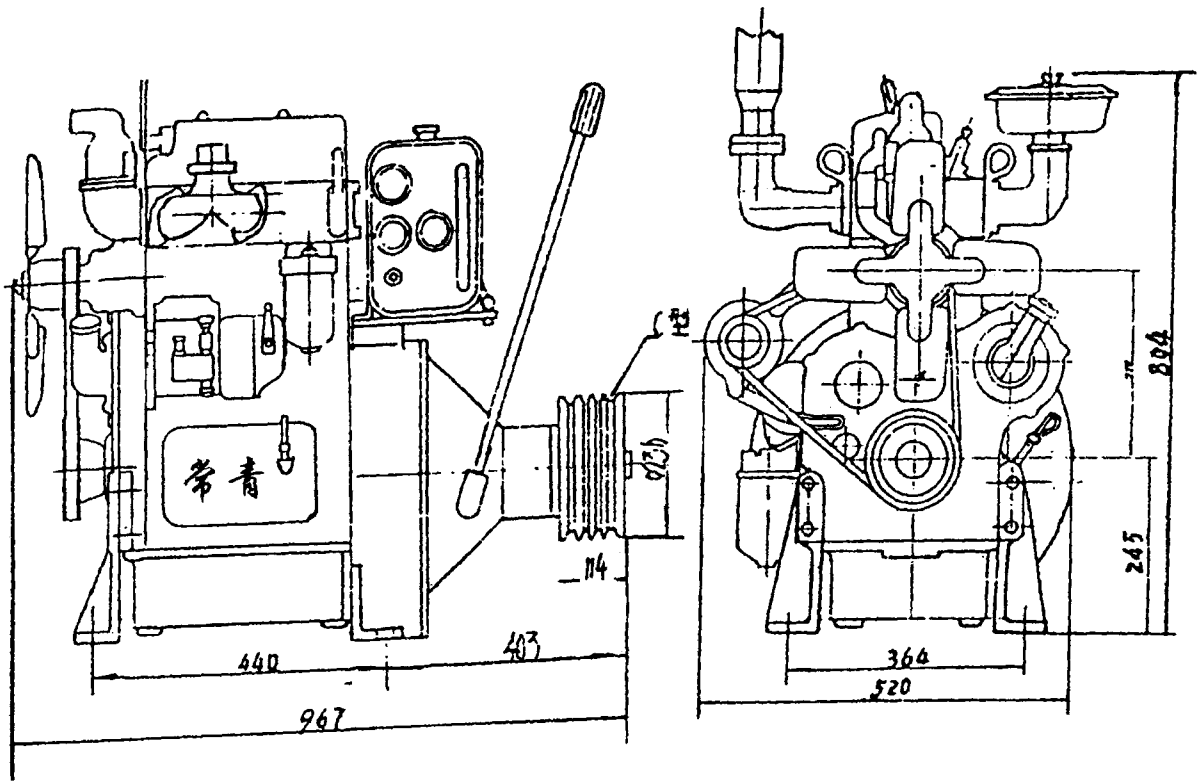
(a) Longitudinal Section of Model 295, 2100 Diesel Engine



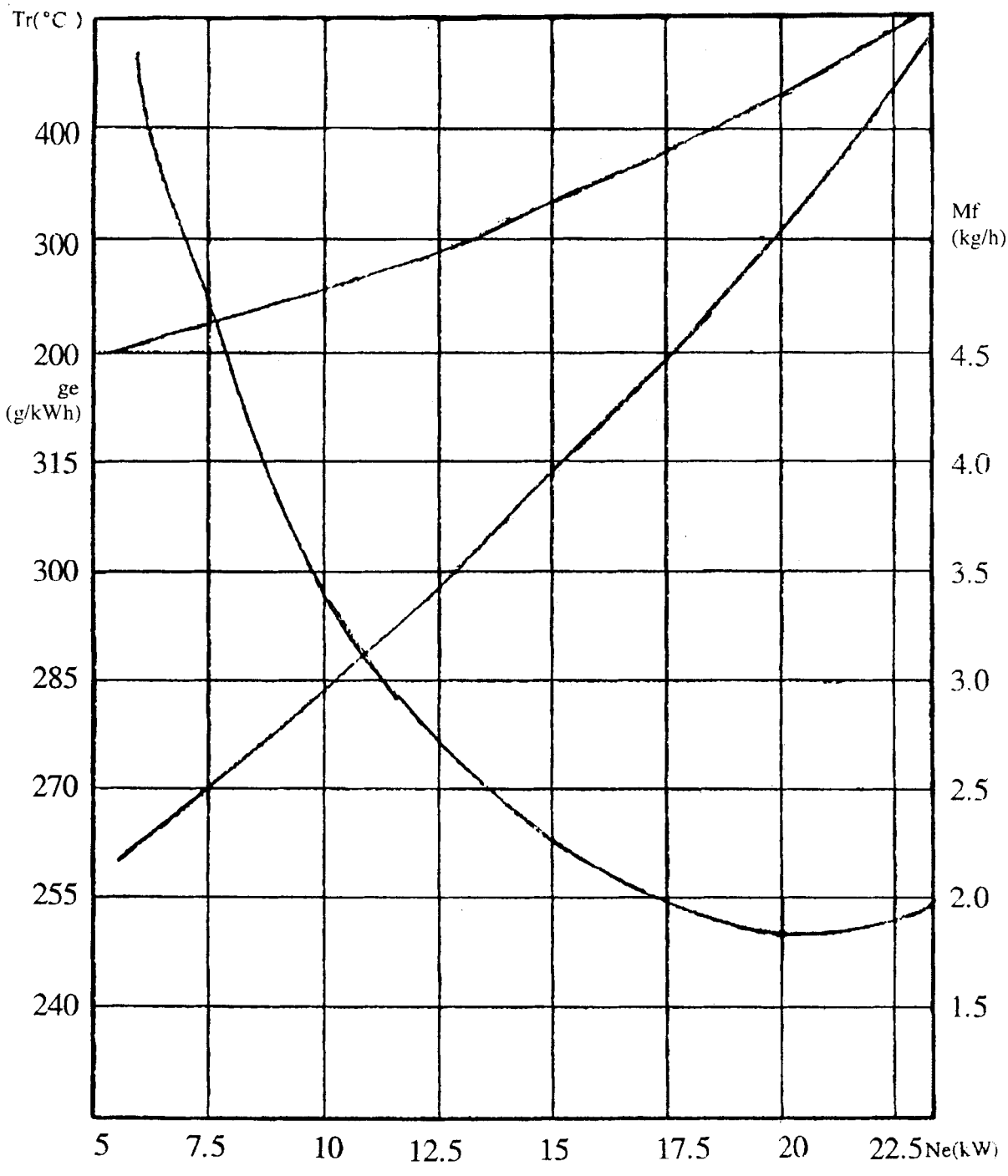
(b) Transverse Section of Model 295, 2100 Diesel Engine



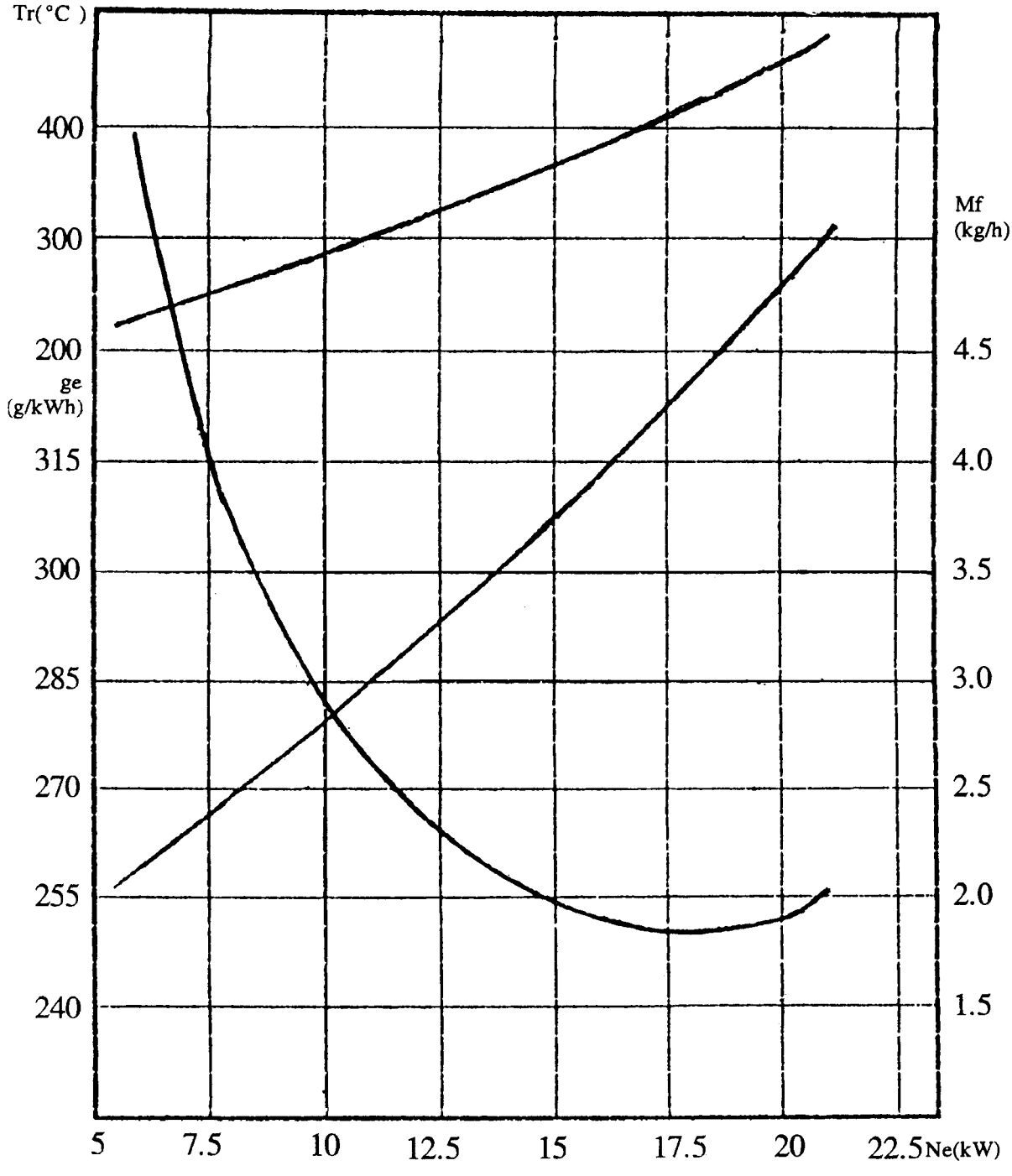
Mounting Drawings of Model 295, 2100 Diesel Engine



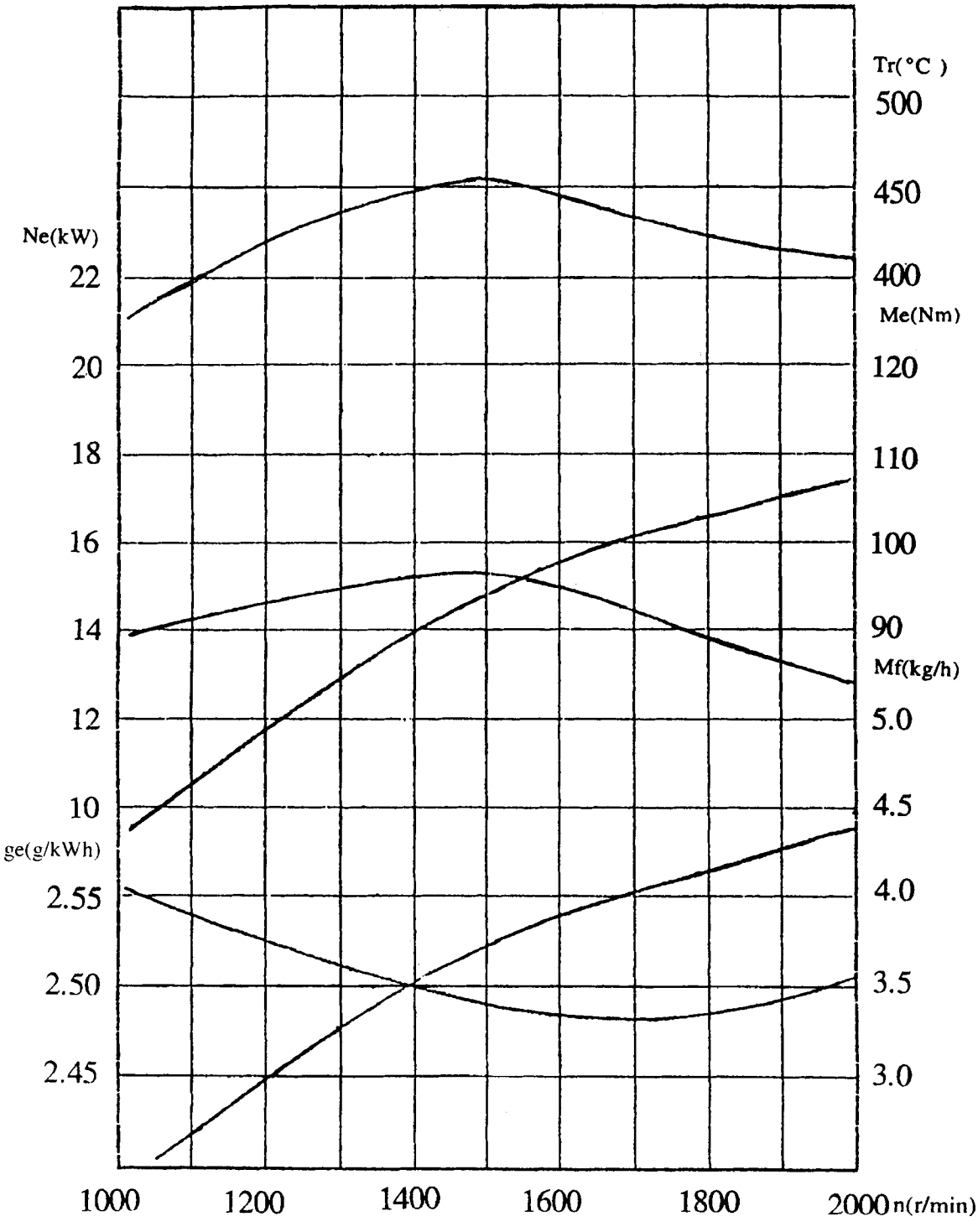
Overall Dimensions of Model 295L,2100G diesel Engine



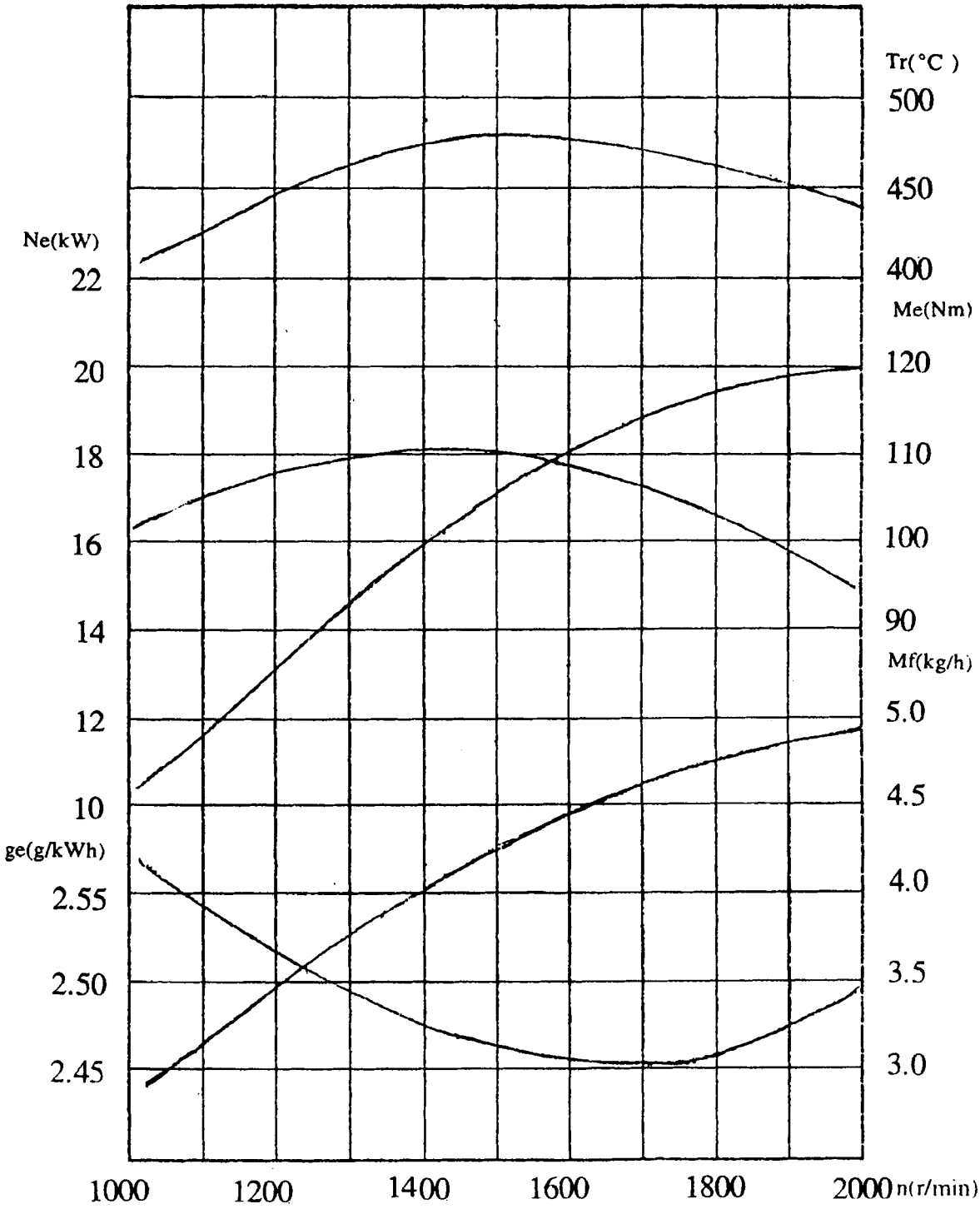
295 Model Diesel Engine load Charactristics



2100 Model Diesel Engine load Charactristics



295 Model Diesel Engine speed Charactristics



2100 Model Diesel Engine speed Charactristics

Chapter I. Technical Specifications of Model 295, 2100 Diesel Engine

A. Main Technical Specifications

Specifications of the engines	
Model	295; 2100
Type	Vertical in - line 4 - stroke water - cooled swirl combustion chamber
Number of cylinders	2
Bore/Stroke	95mm/115mm; 100mm/115mm
1 - hr. rating output	19. 3kW/2000r/min; 22kW/2000r/min
12 - hr. rating output	17. 6kW/2000r/min; 20kw/2000r/min
Compression ratio	20: 1
Advance angle of fuel delivery	15°~ 17°
Total displacement	1. 630L, 1. 806L
Mean effective pressure	'648kPa, 664kPa(12 - hr. rating output)
Specific fuel consumption	265. 2g/kW · h; 263. 8g/kW · h
Direction of rotation of crankshaft (view from flywheel end)	Counter - clockwise
Cooling method	Close type circulation
Lubrication method	Combination of pressure and splash
Starting method	Electric
Overall dimensions	620 × 625 × 790mm
Net weight	220 ± 5kg
Specifications of the Main Components	
Injection pump	No. 1 injection pump, plunger dia. 8mm
Nozzle	ZS4S1(A)
Bubricating oil pump	Inner - and - outer rotor type Displacement ≥ 12L/min
Cooling water pump	Centrifugal type Displacement ≥ 70L/min
Fuel filter	C0506(A) (paper cartridge)
Lubricating oil filter	J0708(C) (paper cartridge)
Air filter	K1706(paper cartridge) for the stationary engine
Starting motor	QD1247A 1. 5kW 12V
Generator	2JF200(silicon rectified, 12V, 180W)

Voltage regulator	FT111
Battery	6 – Q – 140 (provide for yourself)
Thermostat	Type 141
V – belt	Type B 1120
Ammeter	Type DT52
Water temperature gauge	Type 302
Water temperature sensor plug	Type 306
Oil temperature gauge	WT 102
Oil pressure gauge	QF – 308

B. Engine Main Data. Table of Fit and Wear Limits

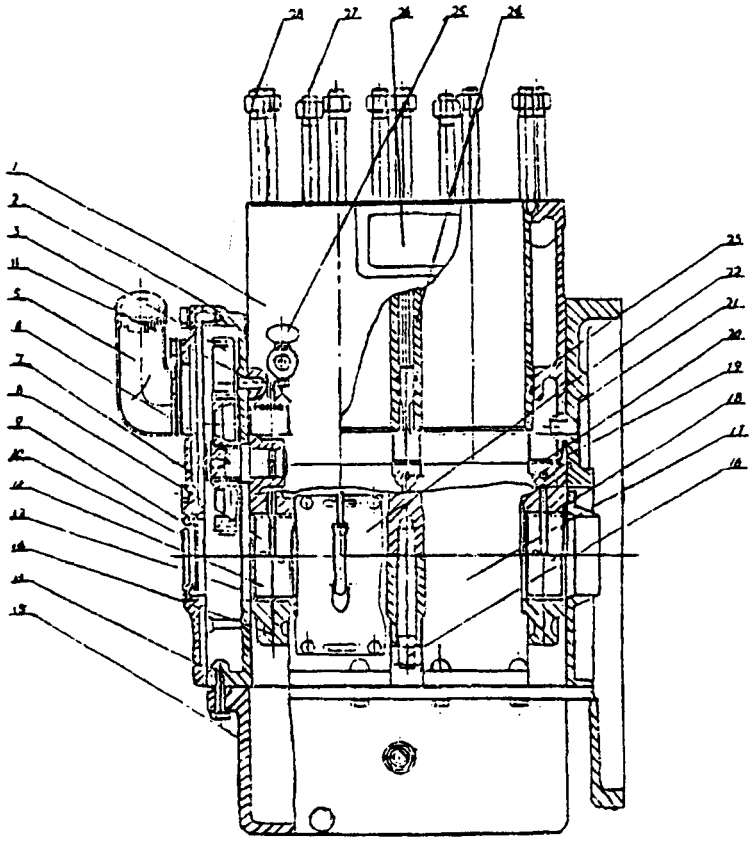
Valve timing	
Opening of the intake valve	17° before T. D. C.
Closing of the intake valve	43° after B. D. C.
Opening of the exhaust valve	43° before B. D. C.
Closing of the exhaust valve	17° after T. D. C.
Valve clearance	
Intake (cold)	0. 35mm
Exhaust (cold)	0. 40mm
Clearance for decompression	1 ~ 1. 5mm
Injection pressure	13 + 1. 0MPa
Bolts and nuts torque limits	
Cylinder head nuts	118 ~ 137N · m
Main bearing cap nuts	137 ~ 157N · m
Connecting rod bolts	79 ~ 108N · m
Flywheel bolts	98 ~ 137N · m
Temperature and pressure at 12 hr. rating output	
Exhaust temperature	≤500℃
Lubricating oil temperature	≤100℃
Outlet cooling water temperature	75 ~ 95℃
Lubricating oil pressure	196 ~ 392kPa
Lubricating oil pressure at the minimum idling steady speed	49kPa
Governor characteristics	
Maximum speed	2200rpm
Minimum iding steady speed	≤600rpm
Stable adjusting speed rate	≤8% (in Engineer); ≤10% (in Tractor)

3. Table of fits and wear limits

Item No.	Designation	Standard dimensions	Type of fit	Assembly limits (mm)	Wear limits (mm)
1	Crankpin / Connecting rod dearing	$\Phi 65\ ^{0}_{-0.02}$ / $\Phi 65\ ^{+0.098}_{+0.050}$	Clearance	0.050~0.018	0.30
2	Piston pin / Connecting rod small end bushing	$\Phi 35\ ^{+0.011}_{0}$ / $\Phi 35\ ^{+0.045}_{+0.020}$	Clearance	0.020~0.056	0.12
3	Oil scraper gap	$6\ ^{0}_{-0.015}$ / $6\ ^{+0.05}_{+0.03}$	Ring gap	0.05~0.65	0.18
4	1st piston ring gap in bore		Ring gap	0.30~0.50	0.20
5	2nd & 3rd piston ring gap in bore		Ring gap	0.25~0.45	0.18
6	Crankshaft main journal / Main bearing hole	$\Phi 75\ ^{0}_{-0.020}$ / $\Phi 75\ ^{+0.118}_{+0.070}$	Clearance	0.070~0.138	0.25
7	Crankshaft thrust ring surface / Crankshaft thrust surface		Axial clearance	0.072~0.291	0.4
8	Camshaft journal / Bushing hole	$\Phi 46\ ^{-0.080}_{-0.105}$ / $\Phi 46\ ^{+0.025}_{0}$	Clearance	0.080~0.130	0.25

Chapter II . Description of Main Components

A.Cylinder Block



1. Cylinder block
2. Gear chamber
3. Injection pump gear
4. Dowel pin
5. Oil filler
6. Idle gear units
7. Gear chamber cover
8. Main plain bearing (upper)
9. Oil seal
10. Gasket
11. Main plain bearing (lower)
12. Gasket
13. Main bearing cap
14. Oil sump gasket
15. Oil sump
16. Main bearing nut
17. Thrust ring
18. Thrust ring
19. Expansion plug
20. Camshaft bushing
21. Flywheel housing
22. Side cover units
23. Seal ring
24. Cylinder liner
25. Water drain cock
26. Name plate
27. CyLinder head stud
28. Cylinder head nut

Fig. II -1 Cylinder Block

The cylinder block is designed in an arch style to strengthen its rigidity. The distance between the centre line of the main bearing and the engine undersurface is 120mm. The crankshaft is of full support type. The main bearing caps and main bearing seats have match marks and are therefore not interchangeable.

A thrust ring is installed on the flywheel side of the cylinder block for recieving the axial thrust from the crankshaft. The cylinder liner is pressed into the block. On the lower part of the cylinder liner are mounted two rubber seal rings used for prevention of water leakage. When the cylinder liner is installed, its top surface should be 0.04 ~ 0.17mm above the surface of cylinder block (see Fig. II -2). The center distance between cylinders is 124mm long.

In the front end of the cylinder block is mounted the gear chamber in which all the timing gears are installed. In installation, all the marks on gears must coincide without mistake (see Fig. II -3).

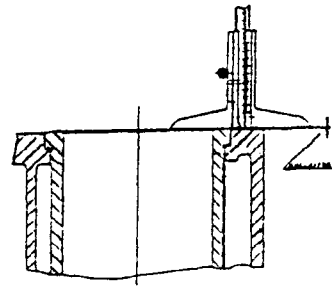


Fig. II-2

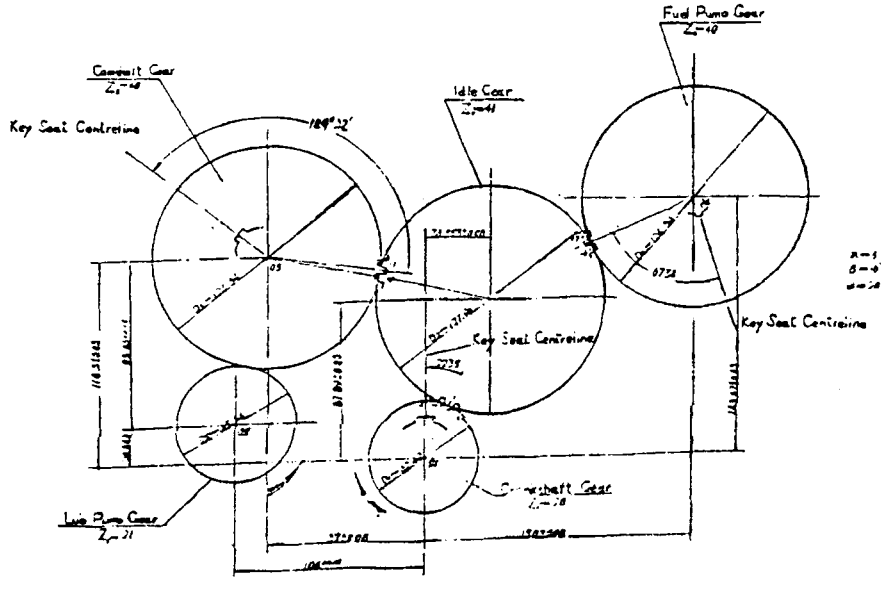


Fig. II – 3 Installation Diagram of Timing Gears

In the rear end of the cylinder block is mounted the flywheel housing and on the undersurface of it the oil sump is located for the purpose of storing lubricating oil.

B. Cylinder Head

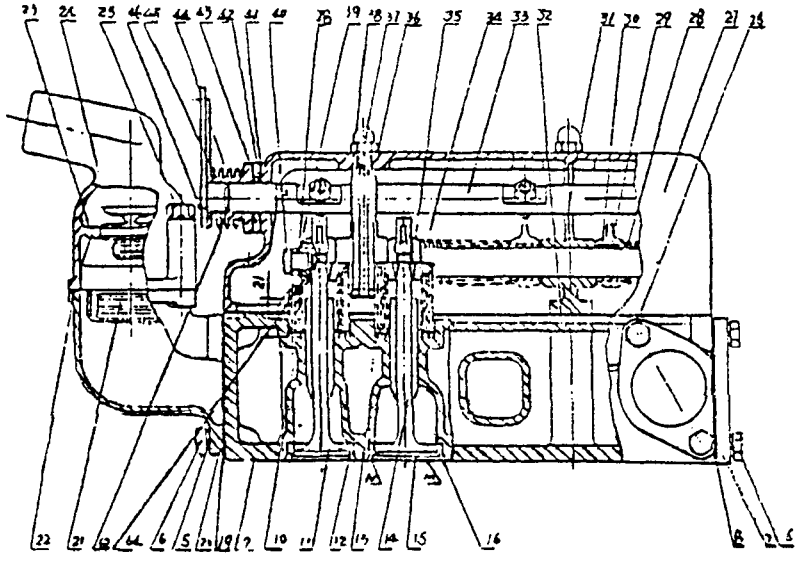


Fig. Ⅱ -4 Cylinder Head

The cylinder head is of monoblock type and is mounted on the cylinder block with ten M14 studs. Between the cylinder head and the cylinder block the gasket made of copper and asbestos is placed. Intake and exhaust ports are respectively located on both sides of the cylinder head. On the cylinder head, intake and exhaust valve seat inserts and the swirl chamber inserts in the shape of the shallow basin are inlaid. The upper part of the cylinder head are mounted four valve guides and the rocker arm mechanism. The intake and exhaust valves are fitted in the valve guides.

To serve as starting auxiliaries, a decompression mechanism is mounted on the cover of the cylinder head. The intake and exhaust manifolds are located on both sides of the cylinder head respectively.

C. Crankshaft and Connecting Rod

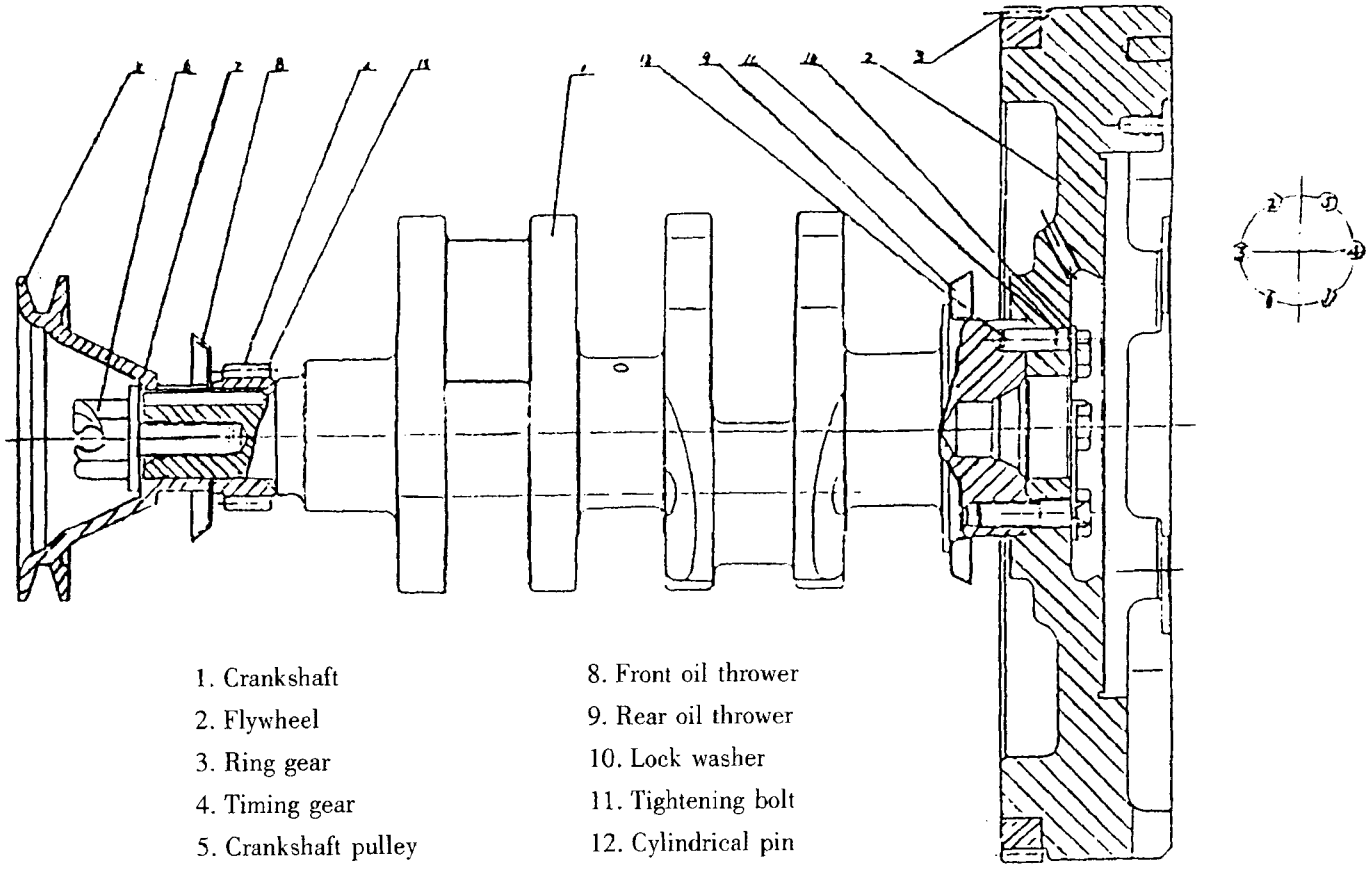
The crankshaft made of magnesium-rare earth nodular cast iron is mounted on the main bearing. It has two hollow crankpins. The crankshaft is provided

on the main bearing. It has two hollow crankpins. The crankshaft is provided with rubber oil seals both in the front and rear. The flywheel is positioned with Φ10 dowel pins and fixed to the flange of the crankshaft with six bolts to ensure that the flywheel is mounted in correct position. The marks "上" meaning "the T.D.C." and "16" meaning "the advance angle of fuel delivery", are made on the periphery of flywheel and used for adjusting injection timing and valve timing.

Thin-wall bearing shells made of steel back covered with a layer of high tin -aluminium alloy are used for main bearings and connecting rod bearings. The clearance between the journal and bearing is not adjustable. If the clea-rance is over its wear limits. It is necessary to renew a standard-sized bearing or a undersized one after the crankshaft being refinished. When the bearing shell is inserted in the bore and the cap, it will be noted that a small lip has been pressed into one half of the bearing shell and a corresponding notch is provided in the bore. This lip, When dropped into the notch, Positions the shell and also prevents it from turning in the bore with the rotation of the crank-shaft. (see Fig. II -5).

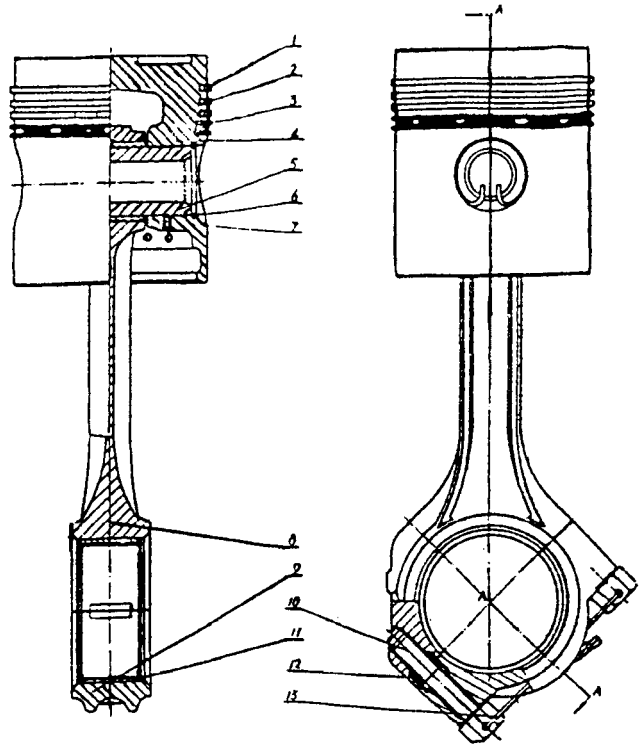
The piston is made of aluminium alloy. Each piston is equipped with four piston rings made of alloyed cast iron. The upper three of them are compressi on rings (The first ring is chromium plated.) The fourth rings are oil scraper ring. The piston pin is of full-floating type. When the piston reaches a specified temperature,the piston pin can rotate in the connecting rod bushing and in the piston pin boss. But at room temperature, the piston pin is fitted in the pin hole with interference. So before installing or removing the piston pin the piston should be heated to 80 °~ 100 ℃ .

The connecting rod is made of forged medium carbon steel The rod body is of "I" section. The centre line of the connecting rod is at an angle of 45 ° with repect to joint plane of the connecting rod and the rod cap. The connecting rod and the rod cap are located by two dowel bushings and bolted together by means of two bolts and locked with lock wires. (see Fig. II -6)



1. Crankshaft
2. Flywheel
3. Ring gear
4. Timing gear
5. Crankshaft pulley
6. Starting jaw
7. Washer
8. Front oil thrower
9. Rear oil thrower
10. Lock washer
11. Tightening bolt
12. Cylindrical pin
13. Flat key

Fig. Ⅱ－5 Crankshaft and Flyweel



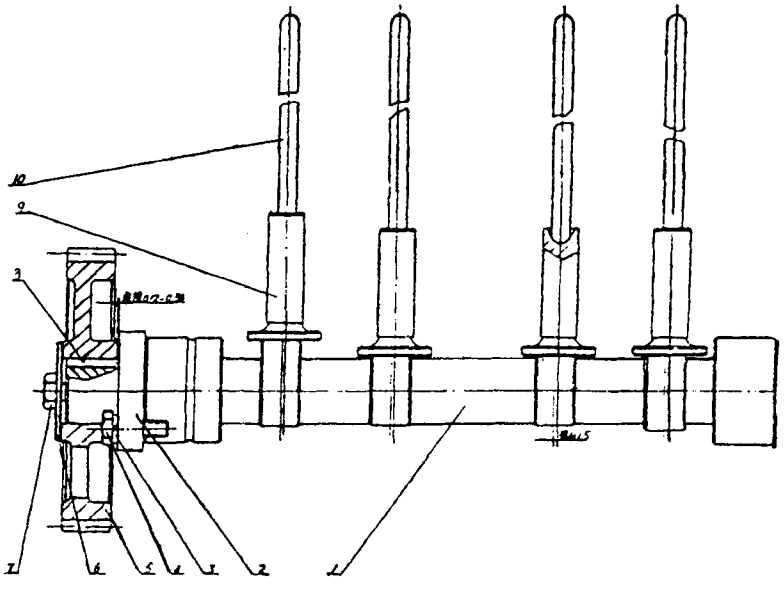
1. Compression ring(1)
2. Compression ring(2,3)
3. Oil scraper ring
4. Piston
5. Piston pin
6. Connecting rod bushing
7. Connecting rod
8. Connecting rod cap
9. Connecting rod bolt
10. Connecting rod bearing
11. Piston pin circlip
12. Dowel bushing
13. Lock wire

Fig . II - 6 Piston and Connecting Rod

D. Valve Mechanism

The camshaft is made of magnesium-rare earth nodular cast iron and mounted in the three camshaft bearings which are installed on the cylinder block. Mounted in the front end of the camshaft is a timing gear behind which is a thrust plate controlling the end play. The cams control the opening and closing of the valves by means of the valve tappets, push rods and rocker arms. A proper valve clearance between the top of the valve stem and the rocker arm should be maintained in order to meet the requirements of the valve timing.

The bottom of the valve tappet is flat and has undergone heat-treatment to increase wear resistance. There is a relative deviation of the centre line between the tappet and cam, which can cause the tappet to rotate round its centre line in operation and wear evenly in surface.



1. Camshaft
2. Thrust plate
3. Washer
4. Hexagon head bolt
5. Timing gear
6. Retainer
7. Hexagon head bolt
8. Flat key
9. Valve tappet
10. Push rod

Fig. II -7 Camshaft

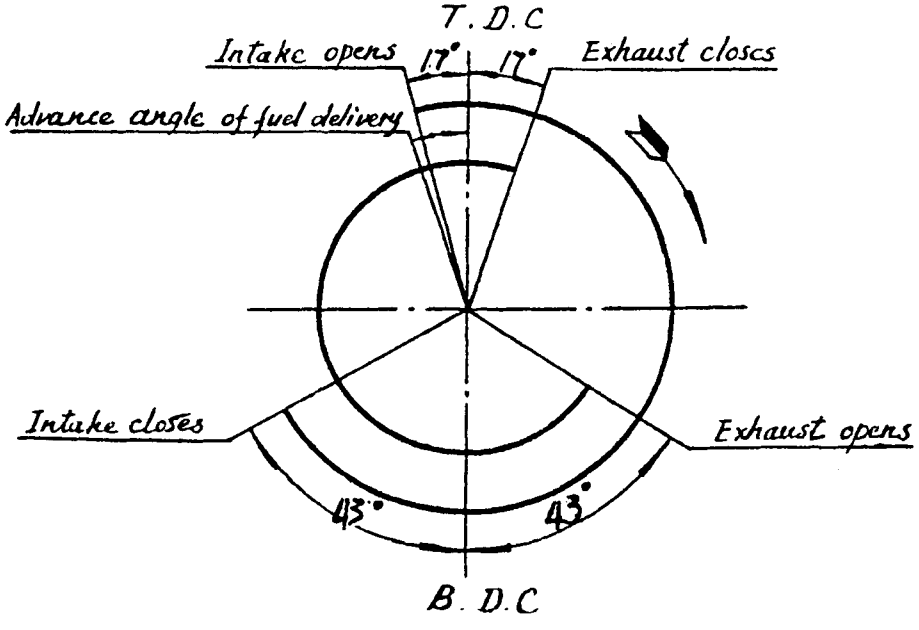
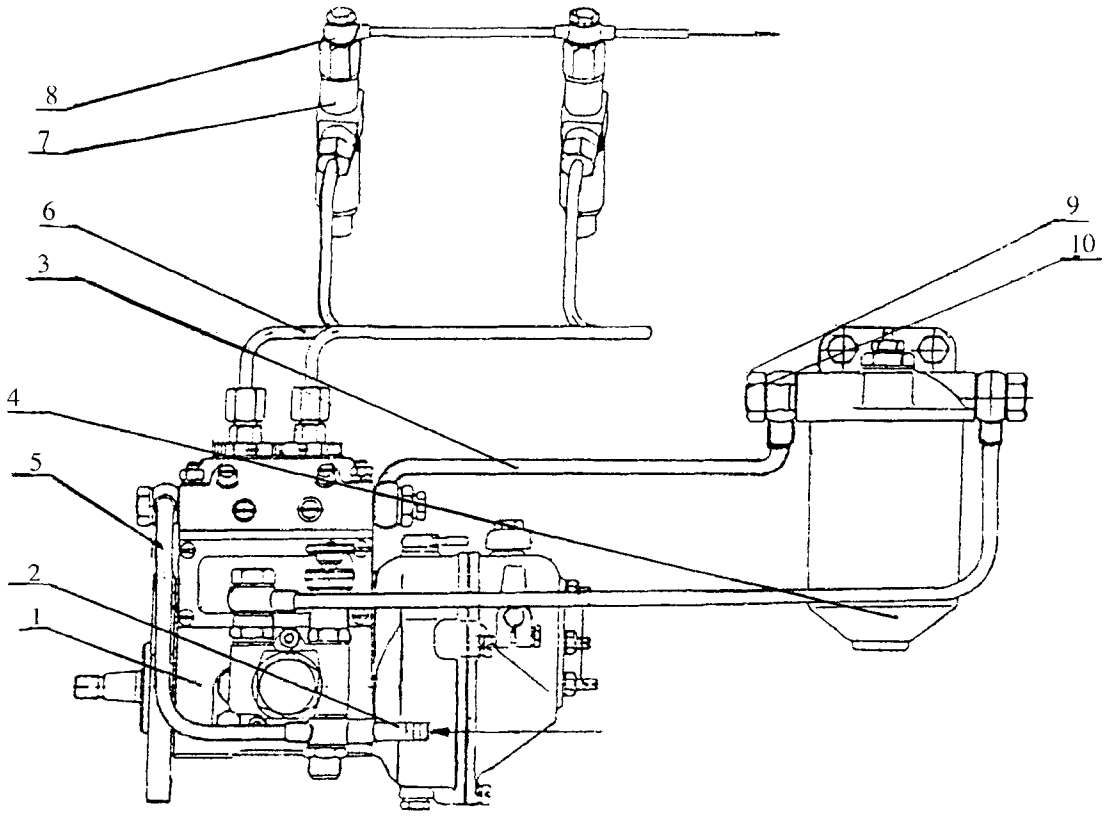


Fig. II -8 Valve timing

E. Fuel System



1. Fuel injection pump
2. Fuel inlet pipe
3. Fuel feed pump
4. Fuel filter
5. Fuel return pipe
6. High pressure pipe
7. Injector
8. Fuel leak-off pipe
9. Bolt
10. Washer

Fig. II -9 Fuel System

Fuel flows to the fuel feed pump and then the filter from the fuel tank. After being filtered by cartridge, clean fuel is sucked into the fuel injection pump. In the fuel injection pump, the fuel compressed by the plunger produces a high pressure, opens the delivery valve and the needle valve of the injector, and sprays into the combustion chamber. The fuel leaked out from the injector flows back to the fuel tank through the leak-off pipe. As the fuel feed pump supplies more fuel than the injection pump needed, the surplus fuel flows back

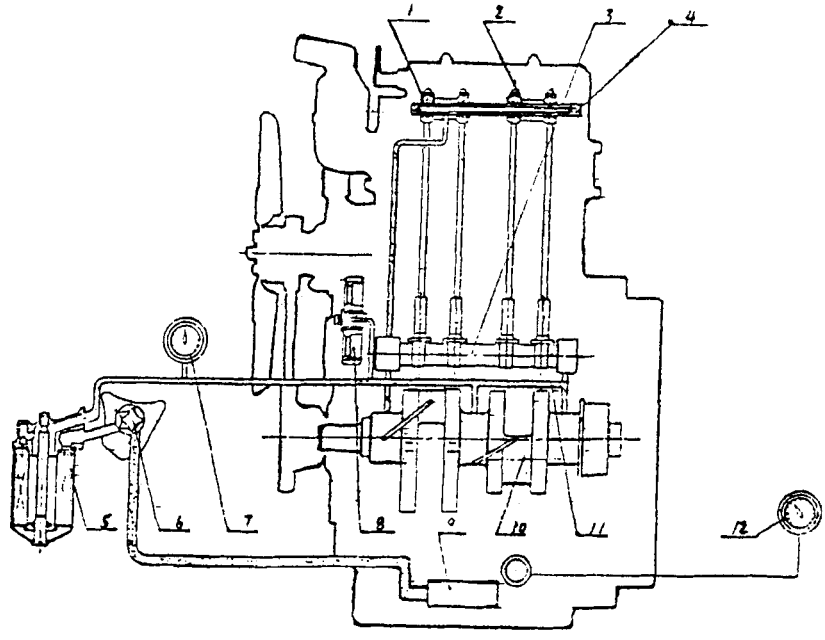
to the fuel feed pump and fuel filter through the one-way valve.

F. Lubricating System

The lubricating system of the engine is of a compound type. For some parts, Pressure lubrication is adopted. For some parts, Splash lubrication is used. And for the water pump bearings, periodic grease lubrication is applied.

The lubrication circuit is as follows: The lubrication oil pump sucks in lubricating oil from the oil sump through the strainer; the oil gallery and then respectively enters main bearings, connectiong rod bearings, camshaft bushings and idle gear bushings. At the first camshaft bushing a oil duct is drilled to the cylinder head. Oil enters the rocker shaft through cylinder head and rocker shaft seat to lubricate the rocker mechanism.

Splash lubrication is carried out for the cylinder, small end of the connecting rod, timing gears, vakves and valve guides, etc.



1. Rocker arm
2. Rocker arm seat
3. Camshaft
4. Rocker arm shaft
5. Lubricating oil filter
6. Lubricating oil pump
7. Lubricating oil pressure gauge
8. Idle gear
9. Crankshaft
10. Strainer
11. Main oil gallery
12. Lubricating oil temperature gauge

Fig. II -10 Lubricating System

The lubricating oil pump is of inner engaged rotor type. It consists of the pump body, cover, inner and outer rotors, shims and so on.

The lubricating oil pump is driven by the transmission gear. When the speed reaches 1905r/min, the oil pressure is 0.3MPa and the oil flow should be no less than 12L/min. In installation, make sure that the seal at the pipe joints is reliable and leakproof.

The pump having worked for a period, the end play of the rotors should be adjusted with paper shims and kept within 0.05 ~ 0.10mm.

The inner and outer rotors are made of iron-base powder metallurgy. The oil pump, before mounted on the engine, shoule be filled with oil for the lubrication of the pump itself and the convenience of sucking oil when starting the engine.

The lubricating oil filter is of full-flow type with a paper cartridge. In both ends of the cartridge there are gaskets which are pressed tightly with the spring and supporting pan. The lubricating oil from the pump enters the outer cavity of the cartridge and after being filtered it flows into the inner cavity of the cartridge and then into the main oil gallery. To avoid the case occurs that lubricating oil can't enter the main oil gallery because of the cartridge being blocked up by impurities, the filter cartridge is provided with a safety valve(i.e. by-pass valve) in the outer cavity which opens under a differential pressure of no less than 0.14MPa and causes the lubricating oil to flow directly into the inner cavity without being filtered. The pressure of the lubricating oil in the main oil gallery is kept stable by means of a pressure adjusting valve in the filter seat which throttles the back-flow of the lubricating oil to the oil sump. In case the oil pressure is too low or too high, it may be readjusted by tightening or loosening the adjusting screw of the pressure adjusting valve. After adjustment, the lock nut should be tightened and then the oil-seal nut screwed on(see Fig. II -11, IV -4).

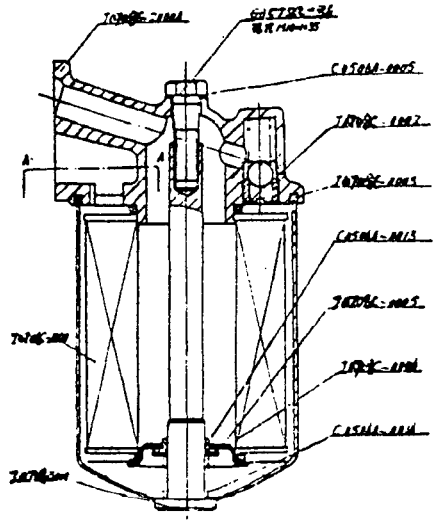
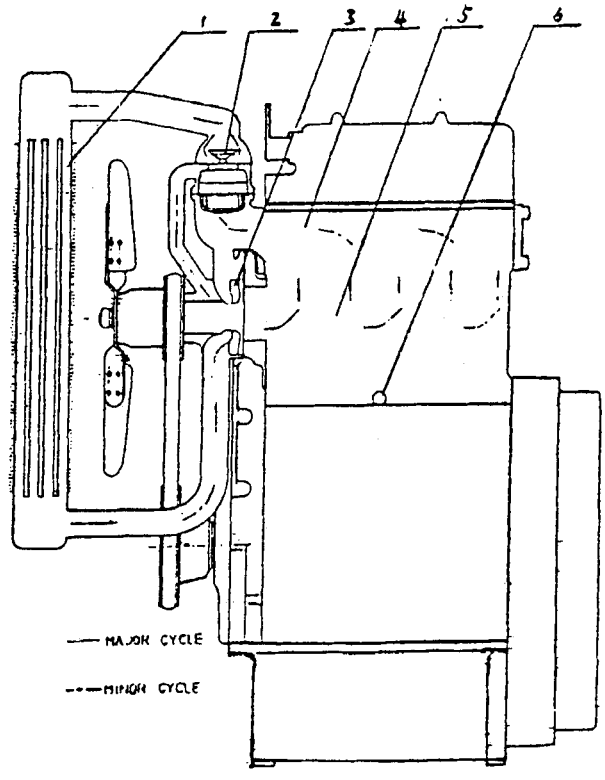


Fig. II -11 Lubricating Oil Filter

G. Cooling System

Forced water circulation cooling is carried out for this diesel engine. Cooling water is pumped from the lower cabinet of the radiator into the water main on the upper right side of the cylinder block. Some of the water flows through three holes into the water jackets to cool the cylinder liners. Some of the water flows through other two holes into the water jackets of the cylinder head. To enhance the cooling effect of the triangle zone formed by the swirl chamber and the intake and exhaust ports and make the temperature even, the direction of the cooling water in the cylinder head is guided by casting baffles. After circulating the cooling water flows back to the radiator tank through the outlet pipe and forms a closed-circuit cooling system(see Fig. II -12).



1. Radiator
2. Thermostat
3. Water pump
4. Cylinder head
5. Cylinder block
6. Drain cock

Fig. II -12 Cooling System

To control the water temperature, decrease the differential temperature of component parts and reduce the wearing of the cylinder liner and piston, a thermostat openning at 70 ℃ is installed at the front of the outlet pipe. When the engine is slightly loaded and the water temperature is low, the thermostat is closed. In such case, cooling water fails to flow to the radiator but flows back to the water pump through the by-pass pipe of the cover of the thermostat and constitutes a minor circulation. When the water temperature rises more than 70 ℃, the valve of thermostat begins to open and fully opens at 85 ℃. In such case, the cooling water flows into the upper water cabinet of the radiator through the thermostat, then into the lower water cabinet through the flat copper pipes and thus constitutes the major circulation. The cooling water, while flowing, cools the concerned parts and is cooled itself by the air sucked in by the fan (see Fig. Ⅱ 13).

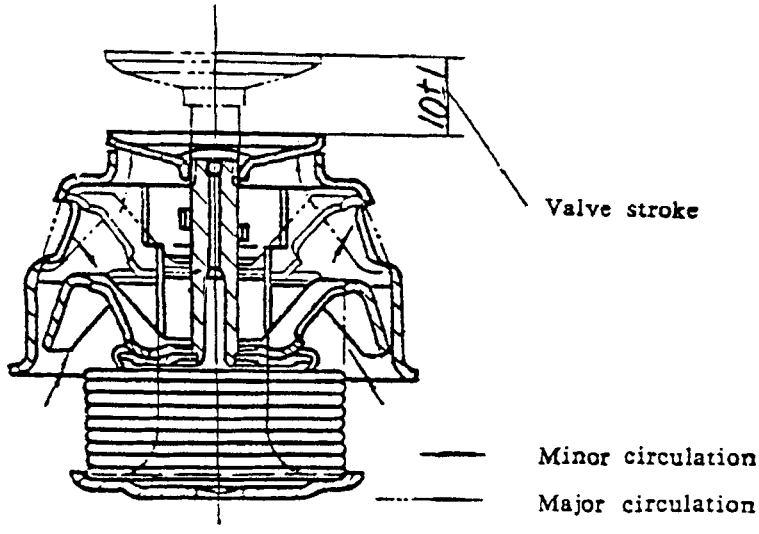


Fig. Ⅱ -13 Thermostat

Pressure water for circulation in the cooling system is supplied by the centrifugal water pump. In front of it a pulley and a cooling fan are mounted. The pump is driven by a pulley located in front of the crankshaft with a V -belt. As the lift is 6 metres, the displacement of water should not be less than 70 L/min. In such case the speed of the pump is 2550r/min, the diametre of the impeller of the pump is 90mm (see Fig. Ⅱ -14).

Water seal is applied between the impeller and the pump shaft. It is a interchangeable part. When it is worn out,or severe leakage from the weep hole at the bottom of the pump body is found, the water seal should be replaced. Blocking up the weep hole is not allowed. Otherwise, water would enter the bearings and soon damage them.

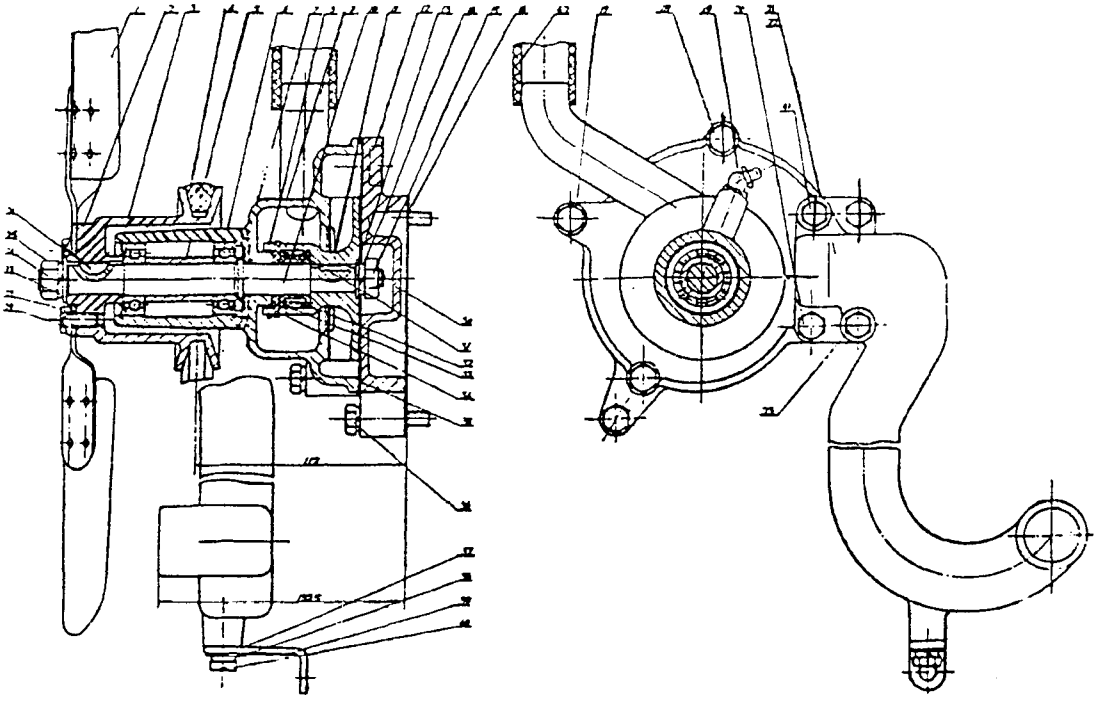
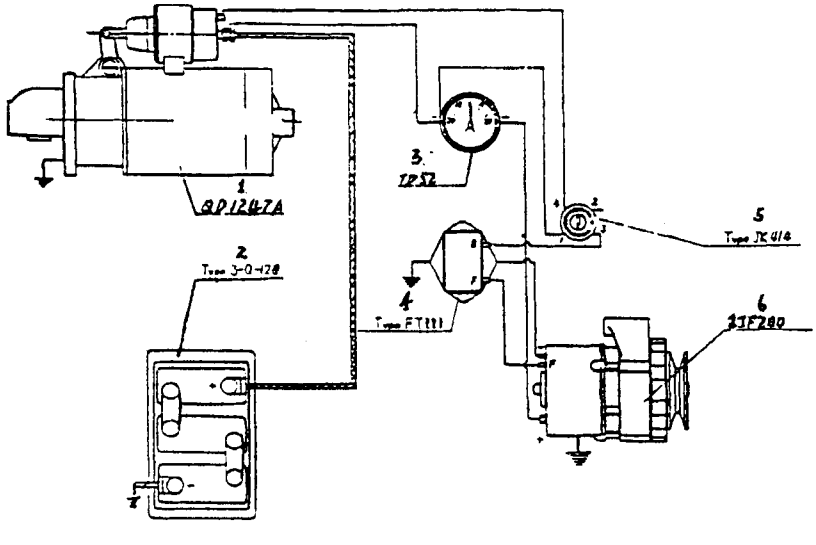


Fig. II -14 Fan and Water Pump

H. Electrical System



1. Starting motor
2. Battery
3. Ammeter
4. Voltage regulator
4. Voltage regulator
5. Ignition switch
6. Generator

Fig. II -15 Electric System Wiring Diagram

As a stationary engine the engine is provided with a complete set of electric apparatus such as generator voltage regulator, battery, starting motor, electric instruments and switches, etc. Which make up a single wire (with negative pole grounded) generating, supplying and utilizing system. (see Fig. II -15).

The generator is of 2JF200 type, silicon rectifying, with rated power 180w, working voltage 12V and output current 13A. This is a A.C. generator provided with silicon rectifying components. After being rectified, D.C. is transmitted out. In operation, it should be matched with a regulator of FT111 type. Negative pole should be grounded (connected to the engine frame). No reverse connection of the two poles is allowed or the silicon rectifying components would be burnt out.

The generator is driven by the crankshaft pulley with V-belt in proper tension. Belt tension may be adjusted by means of an adjusting bracket. Pressing the middle of the belt with a force of 30 ~ 40N, the belt should slop down about 10 ~ 15mm.

Voltage regulator is of FT111 type and matches with the silicon rectified generator in operation. It automatically keeps the generator output voltage stable within a specified range. (when the speed is changed).

When turning on or off the circuit by means of the key switch the circuits of the field winding of the generator and the battery are correspondingly switched on or off ,and cause the battery to be charged by the generator.

Battery is of 6-Q-140 type with rated voltage 12V and capacity 126 ah. Before being used,battery should be precharged according to specifications at the department where a charging set is provided.

When the diesel engine is running, the charging current should constantly be watched. That the current approaches to zero shows the battery is full charged and the charging circuit should be switched off.

In operation, water in battery electrolyte vapourizes continuously. Therefore it is recommended to check the liquid level in each battery cell which should be 10 ~ 15mm above the plates at an intermittence of 5 ~ 7 days. No metal stick should be used in the measurement of the liquid level because it would react chemically with battery electrolyte. If the electrolyte is insufficient, add distilled water instead of electrolyte in order to avoid the increase of the specific gravity of electrolyte, and prolong the service life of the battery. Boiled water or rainwater or snowbroth precipitated to remove impurities may be used. No river water or well water should be used. In winter water should be added only when the diesel engine is operating and battery is being charged in order to guard against freezing arising from the uneven mixing of water with electrolyte.

In routine maintenance, make sure to turn the plug tight, keep the breathing

hole on the plug through and the exterior of the battery clean and dry.

Starting motor is a series excited D.C. motor of QD1247 type with working voltage 12V and maximum output power 1.5kW. The engagement of the pinion of the starting motor with the ring gear on the flywheel is controlled by electro -magnet. When the starting switch is turned on, the electromagnetic core engages the motor pinion with the ring gear on the flywheel and makes the starting motor circuit closed and thus the flywheel will be driven to rotate.

As soon as the engine has been started the starting switch should be turned off . The iron core affected by a spring causes the gear to withdraw to its initial position.

Each starting operation should be potted over fifteen seconds. If the first time you fail to start the engine, there should be a two minutes intermission before starting for the second time, or the motor would be damaged.

Chapter Ⅲ . Operation

A. Fuel, Lubricating Oil and Cooling Water

1. Fuel

The grade RC-0 light diesel oil (GB252-87, used in summer) or RC-10 (GB252-87, in winter) are adopted for this engine. Before being filled into the fuel tank, the fuel must be precipitated sufficiently for a long time (Normally, no less than 48 hours, because the service life of fuel injection pump and injector will last long by using the fuel precipitated sufficiently), and use the supernatant. The fuel should be filtered with three layers of silk as filling it into the fuel tank.

2. Lubricating Oil

In summer the grade CC30 lubricating oil is used, and the grade CC20 oil in winter. Lubricating oil must be filtered with screen before filling it into the oil sump.

3. Cooling Water

Cooling water used for the engine must be clean soft water (rain, snowbrot h) or clean river water. Hard water (well or spring water, etc.) should be softened, if they are used. There are two softening methods:

(1) Boil up the hard water;

(2) Add 20g caustic sodium to each 30 litre hard water.

B. Preparations for Starting the Engine

1. Check the fuel tank whether there is sufficient fuel in it. Fill the tank with precipitated fuel. Filling tools must be clean.

2. Check whether there is any air in the fuel piping. If it is found, loose the vent screw of the filter and injection pump, and move to and fro the hand -pump handle until air bubbles flow out and then tighten the vent screw. After that, loose the union nut of high pressure oil pipe, and then tighten the union nut.

3. Check the lube oil level in oil sump, if necessary, add clean lubricating oil, until the oil level rises up to the position between the lower and upper marks of the oil dipstick. Filling tools should be clean, so as to prevent clay and sand, foreign materials, etc, from entering into the oil sump.

4. If the engine has been stopped for a long period, or after replacing lubricating oil filter cartridge, it is necessary to rotate the crankshaft by hand, so that the whole lubricating system would be full of lubricating oil, until the pointer of the lubicating oil pressure gauge rises up.

5. Check if all connecting parts are tightened, the battery is fully charged, and the connections of the electrical system are correct and tight.

6. Fill the radiator of barrel with clean soft water (clean river water). The water level should be higher than the water outlet on the cooling water pump.

C. Starting and Running

After all preparations mentioned above have been completed, start the engine as follows:

1. Let out the clutch, place the operation handle of the tractor gear box in idle position.

2. Keep the fuel injection pump at greater throttle.

3. Turn the decompression lever to the decompression position.

4. Start the engine

(1) Normal diesel engine can start at once by starting motor.

(2) When starting motor make the engine run faster, release the decompres sion lever quickly, so that the engine starts. At this movement, observe whether the pressure of the lubricating oil pressure gauge rises, if not, stop engine immediately, and check causes. If the engine fails to start for the first time, it is necessary to wait for two minutes, then try the second time. The starting time of starting motor can not exceed 15 seconds each time.

5. After starting, check the engine if there is an abnormal sound. It is strictly prohibited that the engine runs on heavy load and at high speed as soon as it starts, and it is necessary to run the engine for 3 ~ 5 minutes without any load and at a low speed, then increase gradually the rotating speed to warm up he engine. And tractor must also be driven at a low speed without any load. When temperature of lubricating oil and cooling water rise over 45 ℃ , the engine can be operated with load.

6. Care must be taken to observe the smoke colour and noise while the engine is operating. The engine is not allowed to run under black smoke exhaust conditions. Attention must be paid to the lubricating oil pressure and cooling water temperature which should be within the specified limits, and check for the leakage of oil and water.

7. When the speed of the generator exceeds 1300r/min, it begins to charge the battery. At this moment, the ammeter pointer points to the positive direction.

D. Stopping

1. Gradually unload the engine before stopping, and then pull down the stop lever and shut off the fuel delivery to stop the engine after if runs for several minutes without any load.

2. Turn off the fuel tank switch.

3. If the engine is to be put out of service for a long period of time, it is then necessary to drain out the cooling water completely. Especially, in winter, the cooling water must be drained out immediately after the engine has been stopped, in order to prevent subsequent cracking of cylinder block and radiator because of freezing. Open carefully intake cover on the radiator not to burn your hand during drainage.

Chapter Ⅳ . Adjustment of the Engine

A. Adjustment of the Advance Angle of Fuel Delivery

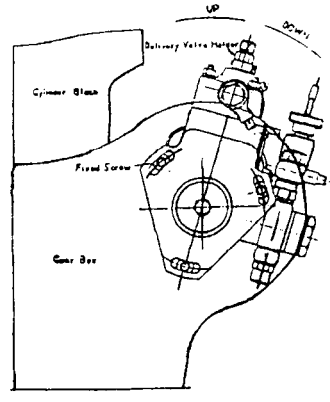
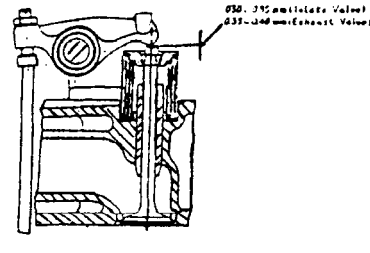


Fig. Ⅳ -1 Adjustment of Advance Angle of Fuel Delivery

Disconnect the high pressure fuel pipe of the cylinder (Fig. Ⅳ -1) then rotate the crankshaft until the fuel level in the open end of delivery valve holder on the fuel injection pump slightly rises. Check if fuel delivery mark-line on the flywheel coincides with the line on the flywheel casing. If the mark-line on the flywheel is in front of the line on the casing (flywheel rotates clockwise as viewed from the front end of the engine), the advance angle of fuel delivery is too small. In that case,loosen the three screws of the fuel injection pump fixed on the gear box, and trun the injection pump toward the cylinder block. If the mark-line on flywheel is behind of the line on the casing, the advance angle of fuel delivery is too large. The adjustment reverses that given above. After adjusting, the advance angle of fuel delivery should be checked again, and retighten the three screws to fix the injection pump. For the adjustment of the advance angle of fuel delivery the first cylinder only.

B. Adjustment of Valve Clearance



Ⅳ -2 Adjustment of valve clearance

Remove the cylinder head cover and totate the crankshaft, let the first cylinder be at its top dead center in the compression stroke, loosen the adjusting screw and nut of the valves, turn the adjusting screw driver, and insert a feeler gauge between the top surface of valve stem and rocker arm head to make an adjustment(under cold condition clearance of intake valve is 0.30-0.35mm. and the clearance of exhaust valve is 0.35-0.4mm). (Fig. Ⅳ -2) After adjusting, check it again. The procedure of adjusting the valve clearance of the second cylinder is the same as that of the first.

C. Adjustment of the Decompressor

Remove the cylinder nead cover and rotate the crankshaft, make the exhaust valve of the 1st cylinder closed, loosen the decompression nut, turn the decompression screw with a screw driver, so that the head of decompression screw just touches the top surface of the valve when the decompression shaft is in operation. Then retighten the decompression screw one and half turns. so as to open the valve 1 ~ 1.5mm. After that, tighten the nut. After adjusting the decompression screws of the two cylinders, it is mecessary to crank the engine to check its decompression effect,and make sure that the piston should be free from inpact against the valve.

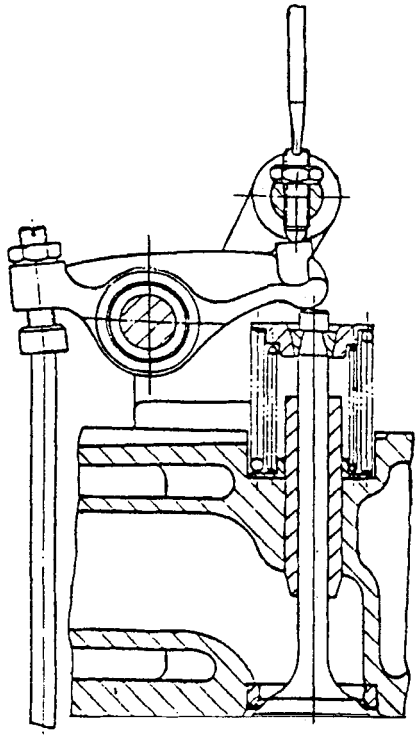
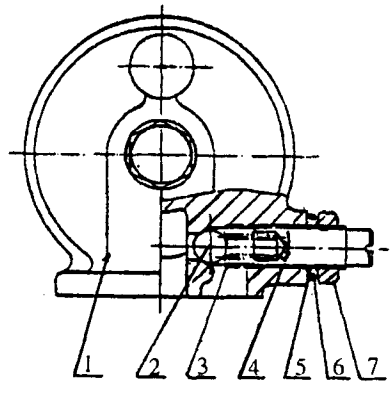


Fig. Ⅳ -3 Adjustment of Decompressor

D. Adjustment of the Pressure of Lubricating Oil



1. filter seat
2. steel ball
3. adjusting spring
4. adjusting screw
5. seal ring
6. washer
7. hexagon mut

Fig.IV-4 Adjustment of Lubricating Oil Pressure

Unscrew the helmet of the pressure adjusting valve,loosen the nut, turn the pressure adjusting screw with a screw driver so as to ensure a pressure range of 0.2 ~ 0.4MPa(The pressure may be higher when the engine is in cold conditio n).After adjusting retighten the nut.

Chapter V. Dismounting and Reassembly of the Engine and the Selection of the Pulley Size

A. Dismounting and Reassembly of the Engine

1. Do not scratch the surface of the bearing ,cylinder and piston.

2. tighten the cylinder head muts diagonally and alternately one by one according to the sequence shown in Fig .V-1.

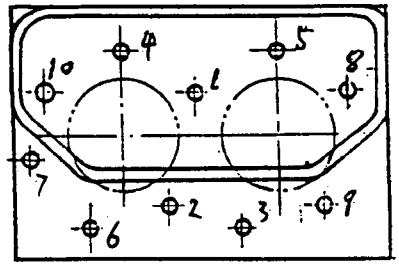


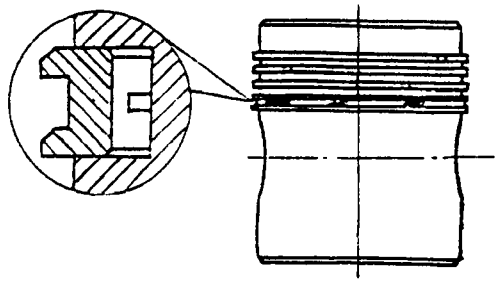
Fig.V-1 Cylinder head nuts tightening sequence

3. The nuts holding down the injector clamping plate should be screwed alternately and uniformly.Union nuts on two ends should be tightened alternate -ly and uniformly when the high pressure pipe is mounted on injector and injection pump.Be careful not to damage the spherical head.

4. Crankshaft timing gear, camshaft timing gear,injection pump gear and idle gear in gear box are all stamped with the match mark. Do not make a wrong mounting.

5. Dismounting and reassembly of piston ring and connecting rod bolt.

(1) There are three compression rings and one oil scraper ring on each piston(The cylindrical surface of the first compression ring is porously chrome plated).Oil scraper ring is made of alloy cast iron and a spring expoander is backed in it. The edge of the upper surface has a 0.75mm × 45 °chamfer.Do not mount the oil scraper ring reversely ,or it will disturb the oil scrapping effect (Fig.V-2).



(2) When the piston ring is placed into the ring groove,check the gap(the first ring is 0.3 ~ 0.50mm the others are 0.25 ~ 0.4mm)and the side clearances betweeen the ring and its groove (the first ring is 0.05 ~ 0.095mm, the others are 0.03 ~ 0.07mm). The piston ring gaps in the grooves should be staggered by spacing 120 °apart from one another. It is much important that the gap direction of the piston rings should not coincide with the center line of the piston pin hole(Fib.V-3)

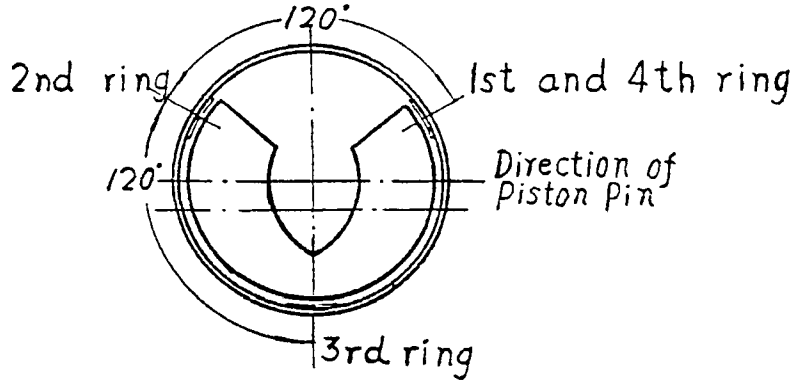


Fig. V-3

(3) When tightening or loosening the commecting rod particular care should be taken to check for its damage and prolongation, of any, replace it in time.

6. Piston assembly: When assembling the piston and connecting rod, make sure that, the spade shaped dent of the piston crown is in the same direction with the bearing cap of the connecting rod. Do not make a wrong mounting. When piston and connecting rod assembly are installed into the cylinders, make sure that the spade shaped dent is on the side of the fuel injector.

7. When dismounting the camshaft,loosen two fixing bolts of the thrust plate from the holes in the timing gear first, then arise the tappet,the gear can be withdrawn together with the camshaft.

8. Fill the lubricating oil pump with sufficient clean lubricating oil when reassembling the pump, in order that it supplies lubricating oil as soon as the engine starts.

B.The Selection of the Pulley Size

when the diesel engine is used to drive working machines the transmission of engine power and the proper operation of the matching machines are depened on the accurate selection of the pulley size.

The size of the pulleys can be calculated as follows:

$$D_2 = \frac{D_1 N_1}{N_2}$$

where D1-----Pulley dia. on the engine shaft
D2-----The matching machine pulley dia.
N1-----The engine rotating speed
N2-----The matching machine rotating speed.

Be careful not to reduce the rotating speed of the engine to meet the requiremen of the rotating speed of the matching machine,otherwise the engine could not efficiently develop the power.

Chapter VI.Maintenance of the Engne

To ensure the normal and reliable operation, reduce wears of parts and prolong service life, users must execute the regulation of engine maintenance. Classes of maintenance are as follows:

1. Routine maintenance (during operation and after each shift).
2. First class maintenance(after 125 working hours).
3. Second class maintenance(after 500 working hours).
4. Preservation and storage of the engine

A. Routine Maintenance

Perform the following maintenance daily

1) Check the lubricating oil level in the oil sump and fuel injection pump, refill oil to a level between upper and lower mark lines on the dipstick if it is not sufficient.

2) Check accessories and instruments of the engine for rigidity and reliabi lity.

3) Check the fixing bolts of the engine and mounting screws of accessories for tightness.Timely tighten them if necessary.

4) Make sure that the engine is free from leakege of water,oil and air.

5) Be sure to keep the engine clean.Remove oil sludge,water and dust from all parts of the engine using dry rags of rags soaked with a little gasoline.Take special care not to foul the electrical equipments.clean the water tank,radiator and fins.

6) Remedy troubles and abnormalities discovered.

7) After the first 60 hours of test-run of a new engine,replace lubricating oil in the oil sump,fuel injection pump and governor,and clean the strainer and filter cartridge.

8) When the engine operates in a very dusty environment,the air filter car tridge sbould be cleaned every day.

B.First Class Maintenance

In addition to " Routine maintenance " , the following should be perfor-med:

1) Grease the water pump bearings with a grease gun.

2) Grease the bearings of power output shaft with grease gun.

3) Check the voltage of battery and specific gravity of electrolyte. The spec ific gravity of electrolyte should be 1.27 ~ 1.28(The atmospheric temperature os 20 ℃) . If specific grevity is decreased to 1.14,charge the battery.Electrolyte level should be kept 10 ~ 15mm above the plate. Fill with distilled water if

electrolyte is unsufficient.

4) Clean the dust at the bottom of the air filter and on the surface of the filter cartridge.

5) Check the belt tension.Adjust it if necessary.

6) Remove side cover plate of cylinder block.check galvanized locking wires of the connecting rod.

7) Check the clearance of the valve and adjust it to the specified value.

8) After every 250 hours of operation,replace the lubricating oil filter cart ridge and seal ring ,clean the filter and renew oil.

9) Clean fuel filter and its cartridge after every 250 hours of operation.

10) Those parts removed for maintenance must be cleaned and located cor rectly while reassembling.Then start the engine,check its operation and remedy troubles and abnormalities if they occur.

C.Second Class Maintenance

In addition to " First Class Maintenance " , Proceed as follows:

1) Check the opening pressure of the injector and the atomization of the fuel spray, clean the nozzle assembly and readjust the pressure if necessary.

2) check the operation of injection pump and the advance angle of fuel de

livery,lap them and readjust the valve clearance.

3) Check both intake and exhaust valves and valve seats for leakage. If necessary,lap then and readjust the valve clearance.

4) check the connecting rod bolts,main bearing nuts of the crankshaft and cylinder head nuts for tightness.

5) Check electrical equipments if all connections are firmly connected. If any trace of burning is found, it should be well treated.

6) Check the weep hole of the water pump for leakage. If serious leakage occurs, replace the water seal.

7) Clean the fuel tank and pipes.

8) Additional maintenance should be perfomed as follows after every 1000 hours of operation:

a. Inspect each part of the engine and perform necessary repairs and adjustments.

b. Disconnect the generator and the starting motor. Remove the spent grease from the bearings and renew the grease. Simultaneously check the gear drive unit of the starting motor.

c. Remove the water scale of the cooling system(If scale is not much, prolong the cleaning intervals correspondingly.)

9) Additional maintenance should be performed as follows after every 1500 hours of operation:

a. Remove the cylinder head and check the valves, valve insert seats and other parts of the cylinder head assembly.

b. Remove the carbon deposit from the cylinder head,cylinder liners,pistons and piston rings.Then clean all these parts.

c. Check and measure the wear of the pistons and piston rings.

d. Check and measure the wear of the bore of the cylinder liner.

e. check and measure the wear of all the journals of the crankshaft and clean the oil ducts in the crankshaft.

f. Check the wear of the main bearings and connecting rod bearings.

g. Clean the oil galleries of the cylinder block and refill oil.

D.Preservation and Storage of the Engine

If the engine is to be put out of service for a long period of time,it is necessary to preserve it according to the following procedure:

1) Remove dust and sludge from the outer surface of the engine.

2) Drain out the lubricating oil, cooling water, and fuel.

3) Clean the crank case, oil pump, oil strainer, and cooling system.

4) Heat the filtered oil of grade CC20 to 110 °~ 120 °C until all bubbles in the surface of oil disappear. Then pour the dehydrated oil into the oil sump up to the upper mark line of the dipstick,and rotate the crankshaft so that the entire lubricating system is filled up with the dehydrated oil.

5) Pour a small amount of the dehydrated oil into the cylinder liners through the two ports on the cylinder head where the oil injectors are located. Then rotate the crankshaft so that the pistons, piston rings, cylinder liners and the sealing surface of the valve are all covered with a layer of this oil.

6) Smear anti-rust oil on to all exposed machined surfaces of the engine. (The anti-rust oil is a uniform mixture of the dehydrated oil and vaseline).

7) All the exposed tubular openings (air intake and exhaust pipes, water inlet and outlet, etc.)should be properly covered to prevent foreign matters from getting in.

8) Rubber components are prohibited to be smeared with oil.

9) The diesel engine should be stored in dry and clean room with good ventilation. It should be covered against dust and is not allowed to put in places in the presence of chemical fertilizer and agricultural insecticide.

10) If the storage time is over three months,the engine should be checked, and repeat this procedure described above if necessary.

Chapter Ⅶ . Troubleshooting

During operation, minor engine troubles are liable to cause serious accidents and shorten its cervice life if not corrected timely. There fore every trouble must be treated carefully.

When seeking the causes of troubles, it is imperative to make close observations and analyses so as to adopt proper measures them. Aimless dismanting is analysis forbidden.

Ordinary troubles and their remedies are listed in the following table for reference.

A. Failure to Start

Cause	Remedy
1. Faults in the fuel system	
1) No fuel in fuel tank, or its cock is off.	Fill the tank with fuel, or turn on the cock.
2) Air within the fuel system.	Inspect all piping connections for tighteness. Bleed air from fuel system.
3) The fuel piping or filter clogged.	Clean fuel piping and filter. Replace filter cartridge if necessary.
4) The fuel feed pump out of order.	Check if there is any air in the fuel intake piping. If not, inspect the fuel feed pump.
5) The fuel injection pump plunger worn and the fuel delivery valve leaks.	Replace the plunger and barrel assembly. Lap the valve.
6) Injector out of order.	Check and repair.
7) Incorrect advance angle of fuel delivery.	Readjust.
2. Starting system troubles	
1) Faulty wiring or bad contact in electric starting system.	Check all wirings and reconnect.
2) Battery not fully charged.	Renew or recharge it.
3. Insufficient compression pressure	
1) The piston ring, piston, and cylinder liner excessively worn.	Repair or replace the piston ring, pistion and cylinder liner.
2) Piston ring seized.	Clean with fuel or kerosene.
3) Leakage in valve.	Check the valve clearance, valve spring, valve guide and valve stem and the seating of the valves. Readjust, renew and relap if necessary.
4) Incorrect engagement of timing gears.	Realign.
5) The engine is not liable to start because of high viscosity of oil resulting from cold weather.	Fill hot lubricating oil into the oil sump and heat intake air with electric heating plug.

B. Insufficient Output

Cause	Remedy
1. Insufficient air supply due to the air filter and intake port clogged.	Clean the air filter and intake port.
2. Exhaust port and silencer chocked.	Clean the exhaust port and silencer.
3. Insuficient fuel supply resulting from the partly clogged fuel piping and filter.	Clean the fuel piping and filter. Replace the filter cartridge if necessary.
4. Air within the fuel system.	Bleed air from the fuel system. Tighten the fuel piping connections.
5. Faulty injection pump or injector.	Repair or replace the pumping element (plunger and barrel) or injection nozzle.
6. Water presence in fuel.	Drain water. Renew the fuel.
7. Incorrect advance angle of fuel delivery.	Readjust it wihtin the specified range.
8. Insufficient compression pressure in cylinders.	Inspect for reasons and make correction.

C. Engine Stalls

Cause	Remedy
1. Fuel tank empty.	Fill the tank with sufficient quantity of fuel.
2. Air within the fuel system.	Bleed air from the fuel system.
3. Water presence in fuel.	Clean fuel tank, fuel filter and fuel piping. Renew fuel.
4. The fuel filter clogged.	Clean the filter or replace the filter cartridge.
5. The piston seized in the cylinder.	Repair or replace the piston, piston ring and cylinder liner.
6. The main bearing or connecting rod bearing shell seized.	Scraping and lapping, or replacing them.

D. Overspeeding

Cause	Remedy
1. Governor out of order.	Stop the engine immediately, dismantle the governor and repair it.
2. The pull rod of fuel injection pump stuck.	Stop the engine immediately, dismantle the pump and repair the pull rod.

E. Unordinary Noise

Cause	Remedy
1. Injection too early and faulty injector	Readjust injection timing, check the injector.
2. When running, the engine emits clear sharp noise as a result of excessive clearance between the piston pin and the connecting rod small end bushing.	Replace the connecting rod small end bushing and make sure the clearance is within the specified range.
3. When running, the engine emits low heavy pounding noise as a result of excessive clearance of the connecting rod large end bearings or crankshaft main bearings.	Replace the connecting rod large end bearings or the main bearings.
4. Valve bumps against the top of the piston.	Remove the cylinder head cover, inspect for causes of bumping and adjust the valve clearance.
5. Metallic clicking noise from the valve operating mechanism as a result of incorrect clearance between the valve stem and rocker arm.	Check and adjust clearance between the valve stem and rocker arm.

F. Smoky Exhaust

Cause	Remedy
1. Black smoke	
1) Engine overloaded.	Reduce the load.
2) Uneven distribution of fuel quantity by the fuel injection pump.	Readjust.
3) Injection timing too late. Some of fuel burns in the exhaust pipe.	Readjust the advance angle of fuel delivery within 15°~19°.
4) Air filter clogged.	Clean. Replace the filter cartridge if necessary.
5) Incorrect valve clearance and leaky valve.	Check the valve clearance and lap it.
2. White smoke	
1) Water in fuel system.	Clean the fuel tank and filter, and renew fuel.
2) Cylinder head cracked.	Renew the cylinder head.
3) Cylinder head gasket damaged.	Renew the cylinder head gasket.
4) Leaky nozzle, poor atomization, too low injection pressure.	Repair or renew the nozzle. Calibrate the injection pressure.

Cause	Remedy
3. Blue smoke	
1) Excessively high oil level in the oil sump causing lubricating oil to get into the cylinder.	Release excessive oil.
2) The piston ring excessively worn or seized, oil getting into the cylinder.	Clean or replace the piston ring.
3) Oil leaks into the cylinder from the top of the cylinder head through clearance between the valve and valve guide.	Check the clearance between the valve and valve guide. Reduce the oil accumulated on the top of the cylinder head.

G. Overheating

Cause	Remedy
1. Insufficient air blow from the cooling fan and air duct or high water temperature due to the faulty of the water pump.	Repair the cooling fan, air duct or the water pump.
2. Insufficient lubricating oil.	Check oil level in the oil sump and take care to add oil timely.
3. Engine overloaded.	Reduce the load.
4. Timing of fuel delivery too late (high exhaust temperature) or leakage at the nozzle.	Check and repair them.

H. Excessive Consumption of Lubricating Oil

Cause	Remedy
1. Piston rings stuck or worn, piston ring gaps overlapped.	Replace the piston ring or cylinder liner if necessary.
2. Oil return holes on the piston blocked by carbon deposits.	Remove carbon deposits or replace oil scraper rings.
3. The chamfer angle of the oil scraper ring assembled reversely on the piston.	Reassemble it in correct position.

I . Rising of Oil Level in the Oil Sump

Cause	Remedy
1. Water presence in oil.	Fetch 0.25kg of oil from the oil sump and put it in a glass. After one hour, observe if there is a transparent layer of water precipitated at the bottom of the glass.
2. The water seal ring at the lower part of the cylinder damaged.	Replace.
3. Cylinder head gasket damaged.	Replace.
4. Cracks at the cylinder head, causing white smoke at exhaust.	Replace the cylinder head.

J. Insufficient Lubricating Oil Pressure

Cause	Remedy
1. Lubricating oil level in oil sump too low.	Fill to "full" mark on dipstick.
2. The oil filter clogged.	Clean or replace the filter cartridge.
3. The oil strainer clogged.	Dismantle and repair it.
4. Leakage in the lubricating oil piping and the clearance of the crankshaft main bearings too large.	Check the lubricating system and the clearance of main bearings.
5. The oil pump worn resulting in excessive clearance, or air leakage.	Check and replace it.
6. The oil pressure control valve spring damaged.	Replace the spring.
7. The oil manometer damaged, or the connecting piping blocked.	Replace the manometer. Clean the oil piping.

K. Outlet Water Temperature Too High

Cause	Remedy
1. Insufficient cooling water supply, water leakage and the cooling system blocked by air.	Add water to water tank, release air and check piping connection for tightness.
2. Insufficient water circulation.	Check the water pump.
3. Too much scale in the cooling system.	Descale the cooling system and use demineralized water.
4. Water pump impeller damaged.	Replace the impeller.
5. Tension of fan belt too loose.	Readjust or replace the belt.
6. Inaccurate water thermometer and inoperative thermostat.	Replace the thermometer. Inspect the thermostat.
7. Excessively long period of overload running of the engine.	Reduce the load.

L. Ordinary Failure of Fuel Injection Pump and Their Remedies

Cause	Remedy
1. Failure of fuel injection	
1) No fuel in the fuel tank.	Fill the tank with fuel.
2) The fuel filter or fuel piping clogged, the small filter cartridge in the pipe connector of the fuel feed pump clogged.	Clean or replace the fuel filter cartridge.
3) Air within the fuel system.	Bleed.
4) Plunger and barrel worn.	Replace them.
5) The fuel delivery valve cannot be closed tightly.	Dismantle and clean the valve, remedy it by lapping, or replace it and its washer.
6) Trouble with the fuel feed pump.	Check and repair it.
2. Uneven distribution of fuel quantity	
1) Air within the fuel system.	Bleed.
2) The fuel delivery valve spring broken.	Replace the valve spring.
3) The fuel pump plunger spring broken.	Replace it.
4) Fuel pump plunger clogged by foreign matters.	Wash the plunger and remove the foreign matters.
5) Fuel supply pressure too low.	Inspect and wash the fuel filter or replace its cartridge.
6) Incorrect fitting of the fork of the pull rod.	Check and regulate it.
3. Insufficient fuel delivery	
1) Leakage in fuel delivery valve.	Repair the valve by lapping, or replace it.
2) Leakage in connections.	Inspect all the connections and repair them.
3) Plunger and barrel worn.	Replace them.
4) Faulty assembly.	Reassemble and readjust them.
4. Fuel injected too much	
1) Unequal fuel quantity delivered to cylinders.	Readjust.

M.Ordinary Failure of the Governor and Their Remedies

Cause	Remedy
1. Unsteady speed regulation	
1) Insufficient fuel quantity to cylinders.	Set the fork to the proper position.
2) Fuel injector nozzle blocked by carbon deposits and fuel drips from the nozzle.	Repair the nozzle to ensure a smooth passage through it, or replace it if necessary.
3) The fuel pump plunger spring broken.	Replace it.
4) The fuel delivery valve spring broken.	Replace it.
2. Fail in idle running	
1) Improper adjustment of the idle speed adjusting screw.	Readjust it.
2) The fork lightly seized by the adjusting arm.	Inspect and correct them.
3) The governor spring seized.	Inspect and correct it.
4) Excessive fuel supply at idling speed.	Make necessary readjustment.
3. Hunting	
1) The governor spring distorted after long period service.	Replace it.
2) Elasticity of the governor spring decreased.	Replace it.
3) Excessive clearance between the fork and the adjusting arm.	Repair or replace them.
4) The governor spring and disc severely worn.	Repair or replace them.
4. Running away	
1) Abnormally high running speed.	Stop the engine immediately and check the causes. Inspect all parts, disassemble the lead seal of the high speed limiting screw and readjust them.
2) The adjusting arm of the fuel injection pump loosened.	Repair or replace it.
3) The fuel injection pump pull rod stuck.	Dismantle the pump and repair it.
4) The governor spring broken.	Replace it.

N. Ordinary Failure of the Fuel Injector and Their Remedies

Cause	Remedy
1. Fuel injected too little or failure of fuel injection	
1) Air within the fuel line.	Bleed.
2) The needle valve seized by valve body.	Repair or replace them.
3) Fitting of the needle valve and valve body too loose.	Replace them.
4) Serious fuel leakage in fuel system.	Tighten fuel piping connections or replace them.
5) Irregular fuel delivery by fuel injection pump.	Inspect and repair the fuel injection pump.
2. Fuel injection pressure too low	
1) The pressure adjusting screw loosened.	Readjust the pressure to the specified value.
2) Pressure regulating spring distored.	Replace the spring.
3. Fuel injection pressure too high	
1) Tension of the pressure regulating spring too high.	Regulate pressure or replace spring.
2) The needle valve stuck.	Repair the fuel injector.
3) The nozzle orifice clogged.	Clean and repair it.
4. Serious leakage at the nozzle	
1) The pressure regulating spring broken.	Replace it.
2) Needle valve seat damaged.	Replace the nozzle body and needle valve.
3) The needle valve seized.	Clean or replace the nozzle body and needle valve.
4) The cap nut distorted after long period service.	Replace it.
5) Surface between the nozzle and the nozzle holder not completely in contact.	Lap or replace it.
5. Fuel spray not well atomized	
1) The nozzle body distorted or worn.	Replace the nozzle body and the needle valve.
2) Needle valve seat worn or burnt out.	Replace the nozzle body and the needle valve.
6. Fuel spray in straight solid form	
1) Needle valve seat excessively worn.	Replace the nozzle body and the needle valve.
2) Needle valve stuck.	Clean or replace the nozzle body and the needle valve.

Cylinder Block I (Fig.1-1)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	395-01000	Gear box gasket	1	9	GB/T5782-2000	Hexagon head bolt, M8×16	4
2	395-01001	Oil filler gasket	1	10	GB/T5782-2000	Hexagon head bolt, M10×70	8
3	395-01310	Oil filler cover	1	11	GB/T5782-2000	Hexagon head bolt, M8×25	11
4	395-01320	Oil filler	1	12	GB/T4877-1-1988	Oil seal PG55×80×12	1
5	GB/T97.1-1985	Plain washer, Φ 10-140HV	9	13	395-01018	Belt tightening pulley bracket	1
6	GB/T97.1-1985	Plain washer, Φ 8-140HV	15	14	GB/T6171-2000	Hexagon nut, AM8	1
7	GB/T93-1987	Spring washer, Φ 10	13	15	395-01003	Geat box cover	1
8	GB/T93-1987	Spring washer, Φ 8	34				

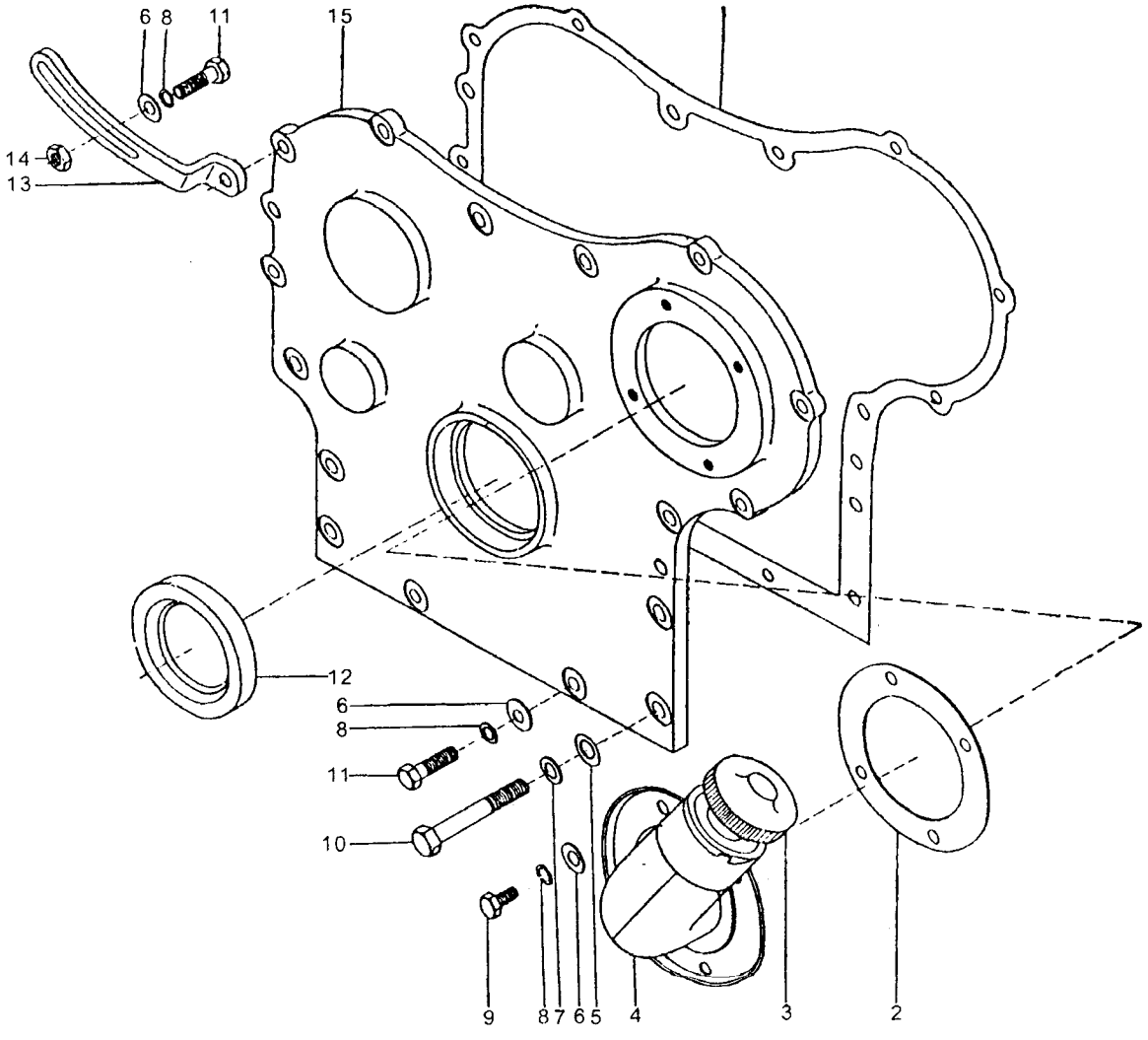


Fig. 1-1 Cylinder Block

Cylinder Block II (Fig. 1-2)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	395-01006	Fuel pump gear	1	29	GB/T5782-2000	Hexagon head bolt, M12×35	8
2	GB/T119-2000	Cylindrical pin	4	30	GB/T93-1987	Spring washer, Φ 12	8
3	GB/T119-2000	Cylindrical pin	2	31	295-01014	Flyweel housing	1
4	GB/T5782-2000	Hexagon head bolt, M8×16	1	32	295-01035	Crankshaft end cover	1
5	GB/T93-1987	Spring washer, Φ 8	40	33	295-01036	Crankshaft end cover gasket	1
6	395-01202	Retainer	1	34	295-01110	Camshaft bushing II	1
7	395-01211	Idle gear	1	35	395-01109	Main oil gallery plug	1
8	395-01212	Idle gear bushing	1	36	295-01023	Lower side cover gasket	1
9	395-01201	Idle gear shaft	1	37	295-01611	Side cover	1
10	295-01201	Camshaft bushing I	1	38	295-01620	Dipstick	1
11	395-01005	Gear box	1	39	GB/T5782-200	Hexagon head bolt, M8×18	10
12	GB/T5782-2000	Hexagon head bolt, M10×28	4	40	GB/T97.1-1985	Washer, Φ 8-140HV	10
13	GB/T93-1987	Spring washer, Φ 10	4	41	395-01024	Thrust ring	2
14	GB/T5782-2000	Hexagon head bolt, M8×22	2	42	395-01108	Rear main bearing cap	1
15	395-01034	Bracket bolt	1	43	395-01106	Main bearing cap stud	8
16	395-01015	Generator bracket	1	44	395-01103	Middle main bearing cap	1
17	GB/T97.1-1985	Washer, Φ 10	4	45	395-01026	Front or rear bearing(lower)	2
18	GB/T6171-2000	Hexagon nut, AM10	1	46	395-01027	Front or rear bearing(lower)	2
19	295-01101	Cylinder block	1	47	395-01028	Mid main bearing(upper)	1
20	295-01116	Expansion plug	2	48	395-01029	Mid main bearing(lower)	1
21		Water cock KG3/8″	1	49	395-01102	Front main bearing cap	1
22	195-01004	Water seal ring	4	50	395-01105	Locking gasket	6
23	195-01003	Cylinder liner	2	51	395-01104	Main bearing cap nut	6
24	395-01008	Cylinder head stud(1)	8	52	395-01002	Gear box gasket	1
25	295-01012	Cylinder head gasket	1	53	395-01020	Nipple gasket	1
26	395-01010	Cylinder head stud(2)	2	54	395-01019	Lubricating oil pressure gauge nipple	1
27	395-01009	Cylinder head nut	10				
28	195-03023	Plug	2	55	395-01111	Lubricating oil gallery plug	3
				56	395-01113	Camshaft fixed gasket	1
The special parts of model 2100 diesel Engine				19	2100-0113	Cylinder Black	1
				22	S1100A-01004-1	Water seal ring	4
				23	S1100A$_2$-01003	Cylinder liner	2
				25	2100-01012	Cylinder Read gasket	1

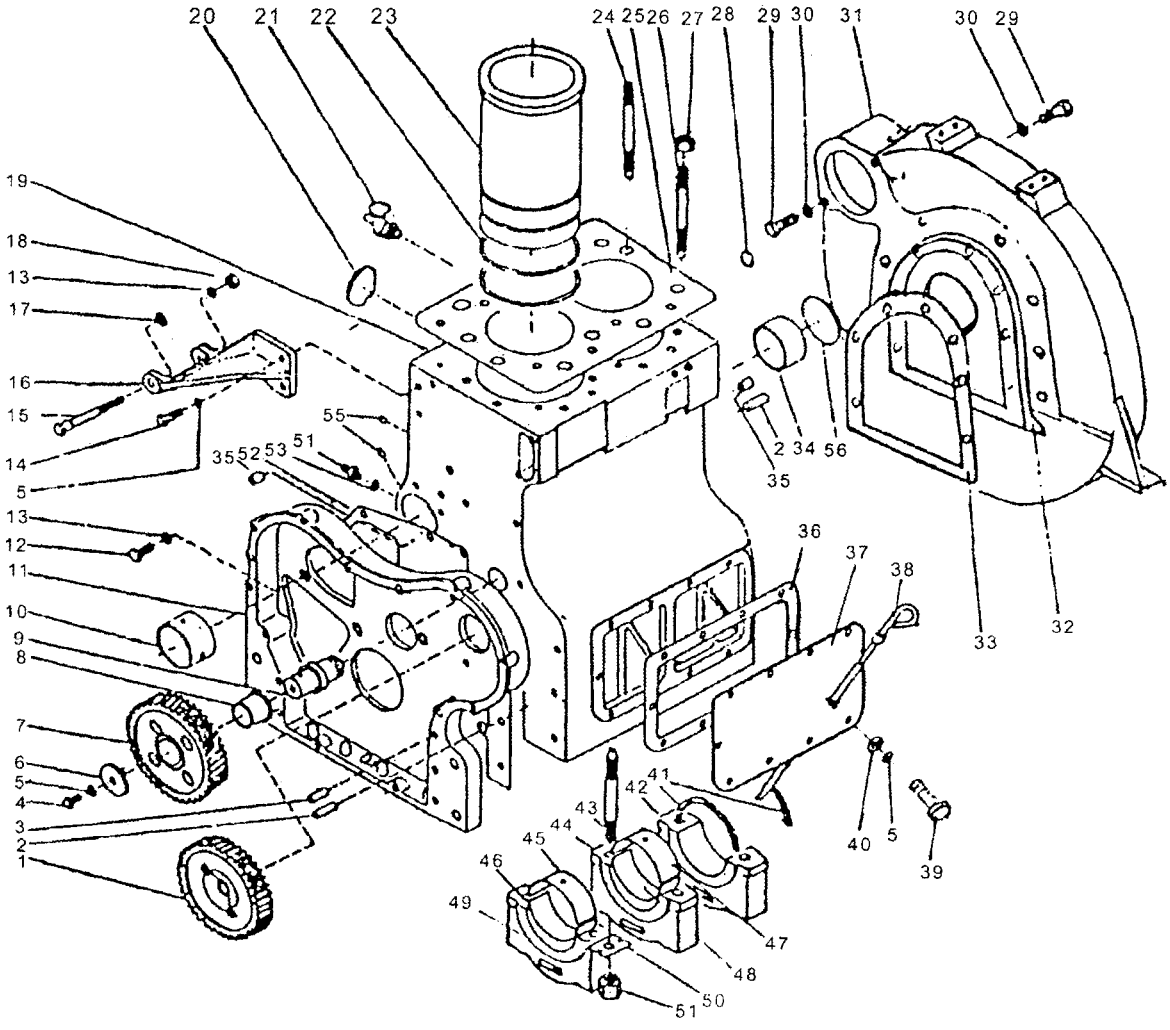
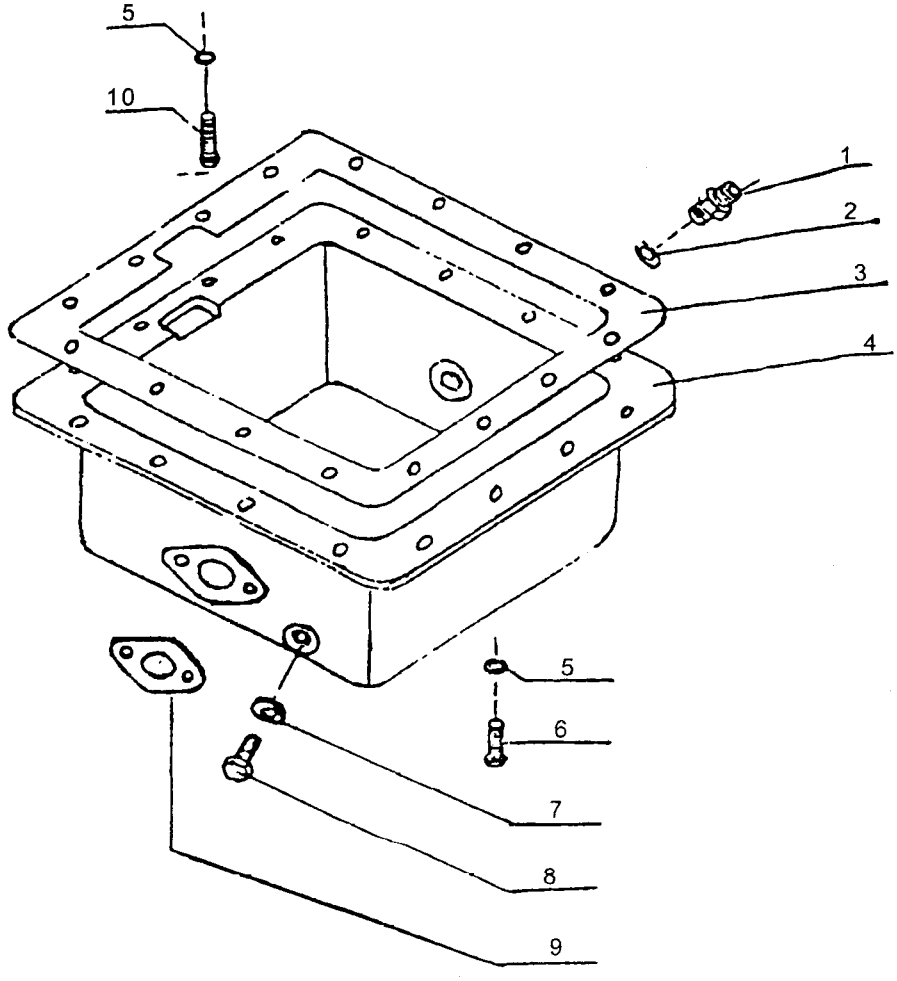


Fig. 1-2 Cylinder Block

Cylinder Block Ⅲ (Fig. 1 – 3)

Ⅲ us. no.	Part No.	Name of Part	qt.
1	395 – 01508	Lubricating oil temperature gauge nipple	1
2	395 – 01507	Nipple gasket	1
3	295 – 01001	Oil sump gasket	1
4	295 – 01501	Oil sump	1
5	GB/T93-1987	Spring washer, Φ 8	16
6	GB/T5782-2000	Hexagon head bolt, M8 × 25	14
7	195 – 01025	Drain plug gasket	1
8	195 – 01026	Drain plug	1
9	295 – 09103	Flange plate gasket	1
10	GB/T5782-2000	Hexagon head bolt, M8 × 35	2



Camshaft Assembly (Fig.2)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of part	qt.
1	GB/T5782-2000	Hexagon head bolt, M8 × 30	1	6	395 – 02002	Camshaft thrust plate	1
2	GB/T93-1987	Spring washer, Φ 8	3	7	295 – 02001	Camshaft	1
3	395 – 01202	Retainer	1	8	GB/T1096-1979	Flat key, C8 × 22	1
4	295 – 02003	Timing gear	1	9	395 – 02006	Valve tappet	4
5	GB/T5782-2000	Hexagon head bolt, M8 × 25	2	10	195 – 02004	Valve push rod	4

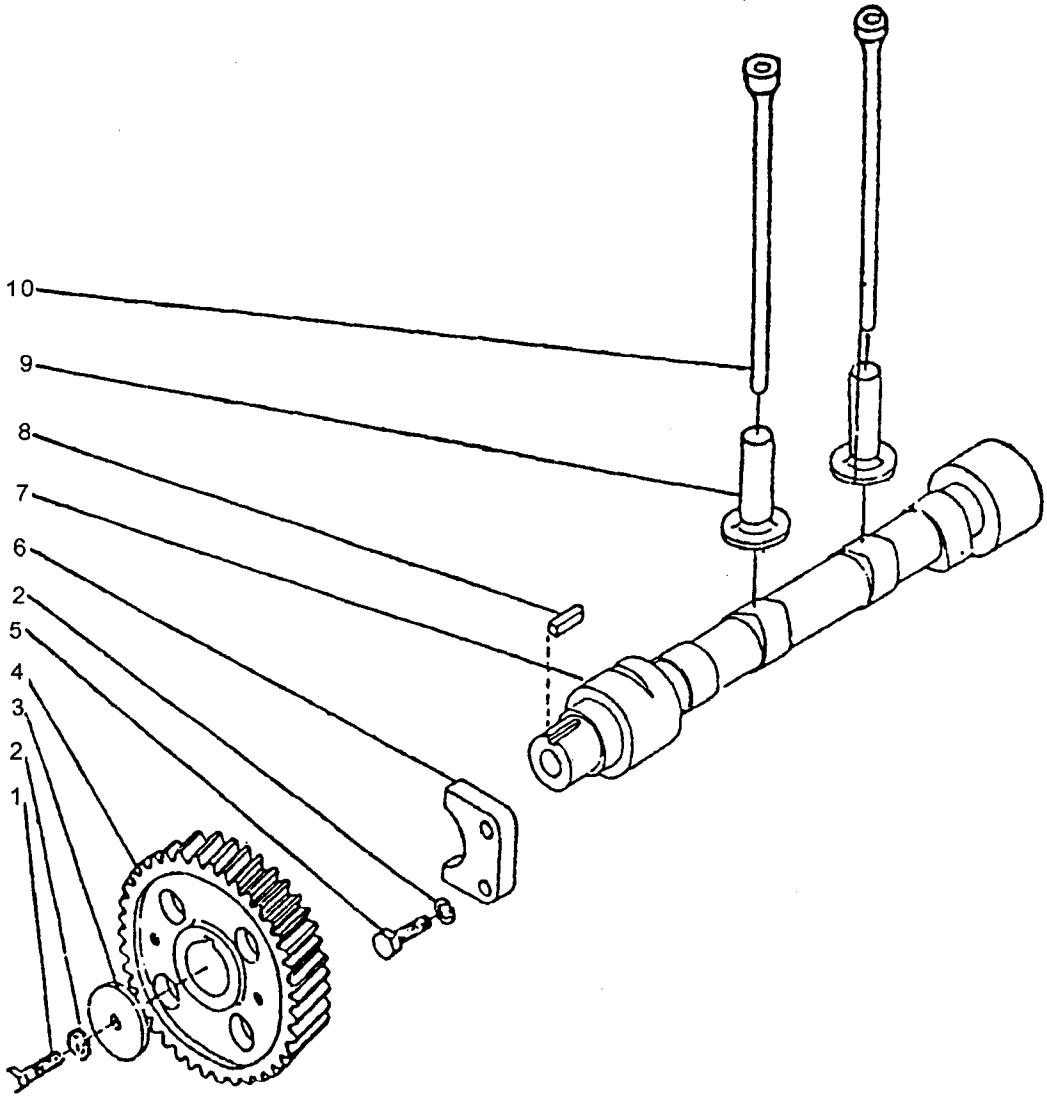


Fig. 2 Camshaft

Cylinder Head (Fig.3)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Patr No.	Name of Patr	qt.
1	GB/T93-1987	Spring washer, Φ 8	33	32	195-03020	Intake valve	2
2	GB5782-86	Hexagon head bolt, M8×50	2	33	195-03021	Intake valve seat	2
3	395-03008	Thermostat	1	34	395-03104	Swirl combustion chamber insert	2
4	395-03009	Gasket	1	35	395-03028	Exhaust pipe gasket	2
5	395-03010	Water sealing gasket	1	36	395-03007	Front cover plate gasket	1
6	395-03011	Thermostat cover	1	37	395-01112	Oil gallery plug	5
7	295-03012	Cylinder head cover gasket	1	38	395-03006	Front cover plate	1
8	295-03202	Cylinder head cover	1	39	GB/T6172-2000	Nut, AM8×1	4
9	395-03209	Washer	2	40	GB/T6171-2000	Nut, AM10	2
10	GB/T923-1988	Crown nut	2	41	GB/T6171-2000	Nut, BM8×1	2
11	395-03206	Gasket	2	42	395-03201	Decompression screw	2
12	395-03204	Decompressin limitator	1	43	GB/T6171-2000	Button head cap screw,M6×22	2
13	395-03207	Decompression connecting sleeve	1	44	GB/T93-1987	Spring washer, Φ 6	2
14	395-03208	Decompression handle torsional spring	1	45	395-03015	Rocker arm shaft spring	2
15	GB/T1235-1976	Rubber seal ring 16×24	1	46	195-03005	Rocker arm shaft bushing	4
16	295-03203	Decompression shaft	1	47	395-03022	Valve clearance adjusting screw	4
17	395-03205	Decpmpression limited pin	1	48	195-03004	Rocker arm	4
18	395-03401	Decompression hanle	1	49	395-03016	Rocker arm support	2
19	295-03017	Rocker arm shaft	1	51	395-03023	Rocker arm support bolt	2
20	195-02003	Rocker arm shaft plug	2	52	195-03008	Upper valve spring seat	4
21	GB/T3894-1988	Rocker arm shaft circlip	2	53	195-03007	Valve collet	4
22	395-03019	Elastic circlip 16	2	54	195-03009	Outer valve spring	4
23	GB/T6171-2000	Nut, AM8	6	55	195-03023	Expansion plug	1
24	395-03025	Hoisting hold	2	56	195-03010	Inner valve spring	4
25	GB/T5782-2000	Bolt, M8×20	4	57	395-03001	Lower valve spring seat	4
26	GB/T93-1987	Spring washer, Φ 10	7	58	195-03011	Valve guide	4
27	GB/T5782-2000	Bolt, M8 × 28	19	59	195-03013	Injector clamping plate	2
28	395-03021	Rear cover plate	1	60	195-03022	Intake manifold gasket	2
29	395-03020	Rear cover plate gasket	1	61	195-03014	Injector clamp plate stud	4
30	195-03028	Exhaust valve seat	2	62	295-03101	Cylinder head	1
31	195-03019	Exhaust valve	2				
The specical parts of model 2100 diesel Engine				34	2100-03104	Swirl combustion chamber insert	2
				62	2100-03101	Cylinder head	1

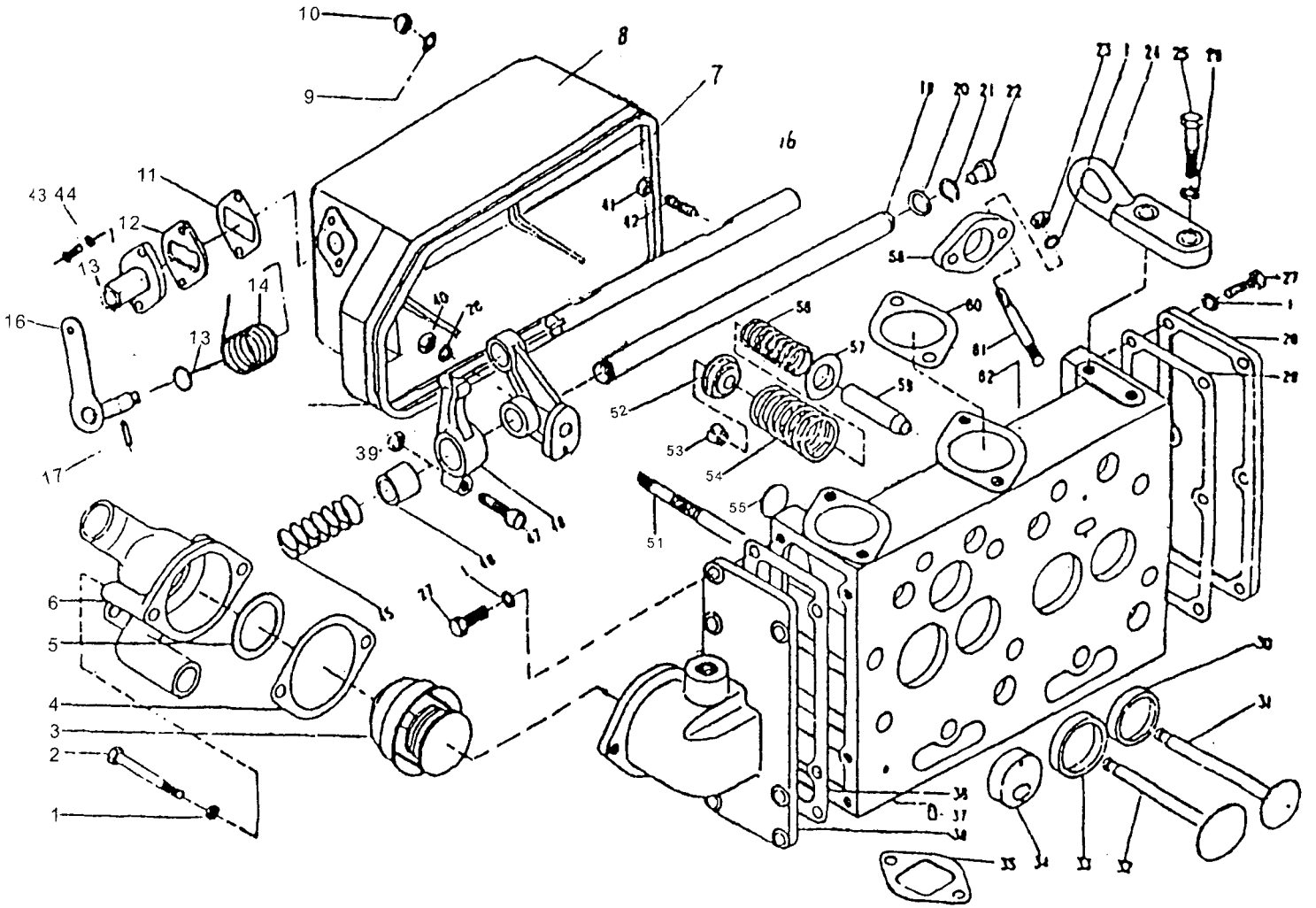


Fig. 3 Cyinder Head

Piston and Connecting Rod (Fig. 4)

Illus. No.	Part No.	Name of part	qt.	Illus No.	Part No.	Name of part	qt
1	195-04001 (S110A-04001)	Compression ring (1)	2	8	395-04006	Connectiong rod	2
2	195-04002-1 (S1100A-04002)	Compression ring (2.3)	4	9	195-04010	Dowel bushing	4
3	195-04003 (S110A-04100)	Oil Scraper ring	2	10	195-04011	Connecting rod bearing	2
4	195-04005-3 (S1100A-04003)	Piston	2	11	195-04009	Connecting rod cap	2
5	195-04013	Piston pin	2	12	195-04008	Connecting rod bolt	4
6	195-04004	Piston pin circlip	4	13		Locking wire Φ 1.8×170	2
7	195-04012-1	Connecting rod bushing	2				

Note: Code names in brackets are special use for model 2100 diesel engine, and used of the model s1100A2 diesed engine produced by changChai Co.,LTD.

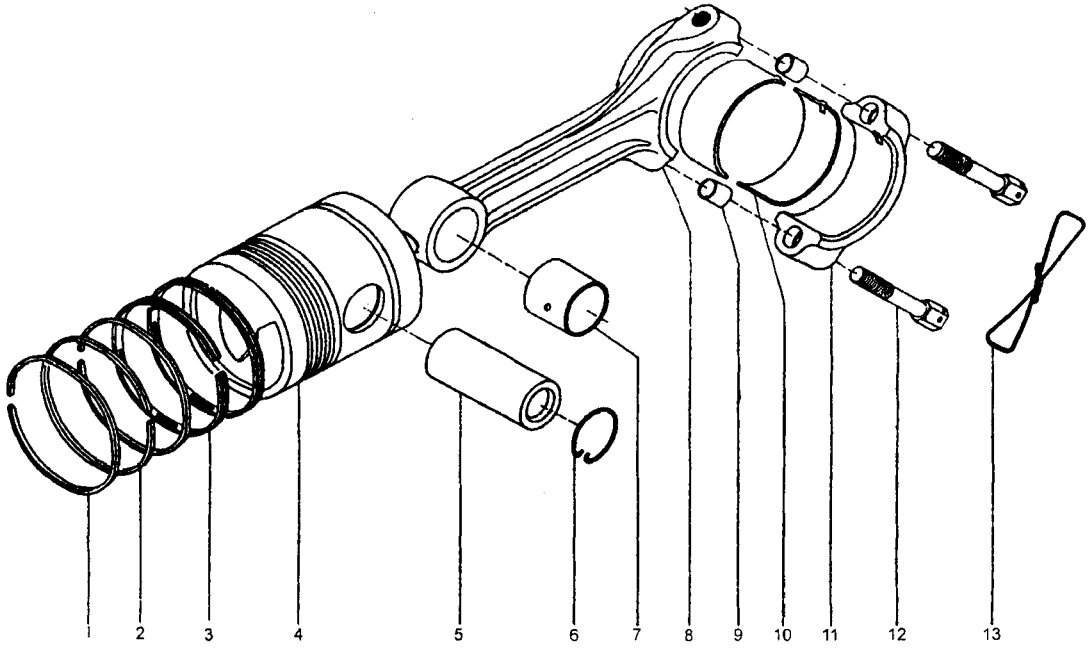


Fig. 4 Piston Connecting Rod

Crankshaft and Flywheel (Fig. 5)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	395-05006	Starting jaw	1	8	395-05011	Tightening bolt	6
2	395-05007	Washer	1	9	295-05002	Flywheel	1
3	395-05005	Crankshaft pulley	1	10	395-05007	Ring gear	1
4	395-05008	Front oil thrower	1	11	295-05009	Rear oil thrower	1
5	395-05004	Timing gear	1	12	295-05001	Crankshaft	1
6	GB/T119-2000	pin B10×30	1	13	GB/T1096-1979	Flat key C10×55	1
7	395-05010	Lock washer	3				

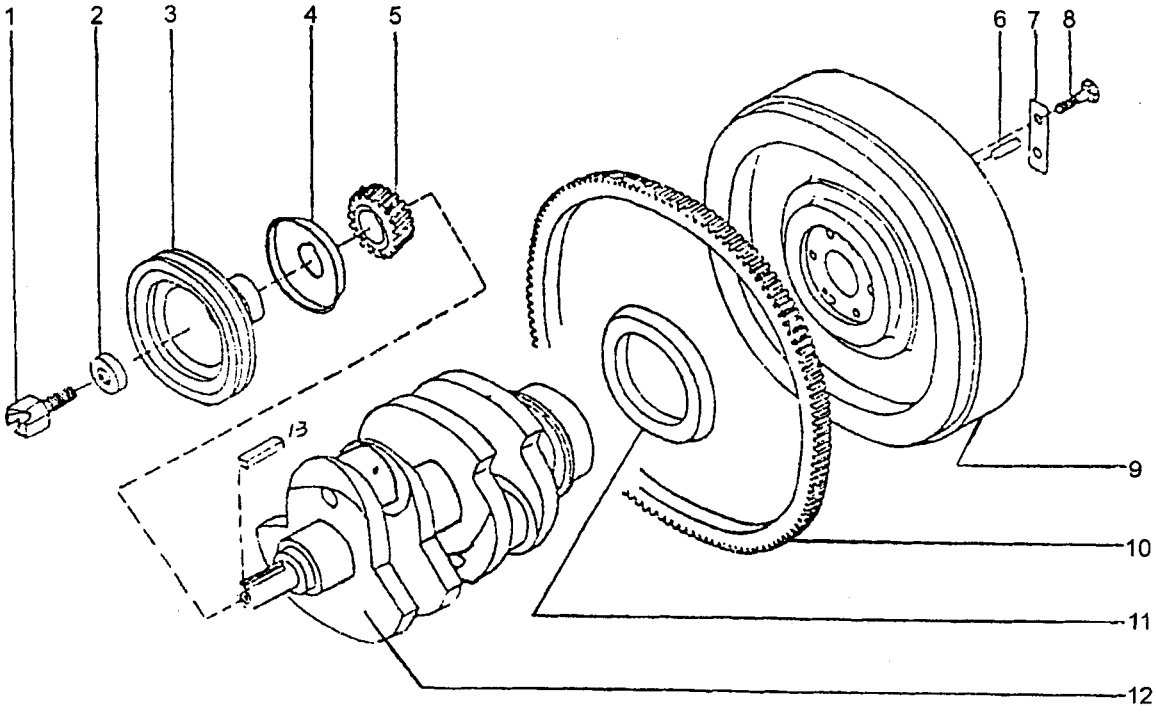


Fig. 5 Crank and Flywheel

Fan and Water pump (Fig. 6)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	395-06100	Fan element	1	24	395-06019	Spring seat	2
2		Type B V-belt 1120	1	25	395-06018	Water sealing spring	1
3	395-06002	Water pump pulley	1	26	395-06008	Water pump inpeller	1
4	GB893-86	Elastic circlip, Φ 40	1	27	GB/T97.1-1985	Washer, Φ 8-140HV	1
5	GB278-64	Ball bearing 60203	2	28	GB/T93-1987	Spring washer, Φ 8	1
6	395-06003	Sleeve	1	29	GB/T6171-2000	Hexagon nut, M×10	1
7	395-06005	Water thrower	1	30	395-06013	Water pump support gasket	1
8	GB/T1099-1979	Woodruff Key 4×19	1	31	395-06010	Water pump support	1
9	395-06007	Water pump shaft	1	32	GB/T5782-2000	Thtough intake pipe gasket	2
10	395-06500	Φ 35 Clamp ring assembly	2	33	395-06023	Water intake pipe gasket	1
11	395-06025	Water pump bypass Φ 25×5×85	1	34	395-06022	Water intake pipe	1
12	395-06006	Water pump body	1	35	GB/T5782-2000	Hexagon head bolt, M8×40	1
13	GB/T93-1987	Spring washer, Φ 8	9	36	395-06026	Water pipe bracket	1
14	GB/T5782-2000	Hexagon head bolt, M8×70	1	37	GB/T5782-2000	Hexagon head bolt, M8×18	1
15	GB/T5782-2000	Hexagon head bolt, M8×42	2	38	GB/T97.1-1985	Washer, Φ 8-140HV	1
16	GB/T1096-1979	Flat key, A4×16	1	39	HG4-549-67	Rubber pipe Φ 38×Φ 46×140	2
17	GB/T5782-2000	Hexagon head bolt, M8×25	1	40	395-06400	Φ 46 Clamp ring assembly	2
18	GB/T5782-2000	Hexagon head bolt, M8×55	1	41	395-06011	Locking washer	2
19	395-06012	Water pump gasket	1	42	GB/T5782-2000	Hexagon head bolt, M8×16	4
20	GB/T1153-1979	Lubricating fitting	1	43	GB/T93-1987	Spring washer, Φ 12	1
21	GB/T894-2000	Elastic circlip, Φ 40	1	44	GB/T6171-2000	Hexagon nut, AM12	1
22	395-06016	Sealing washer	1	45	GB/T97.1-1985	Washer, Φ 12-140HV	1
23	395-06017	Water seal ring	1				

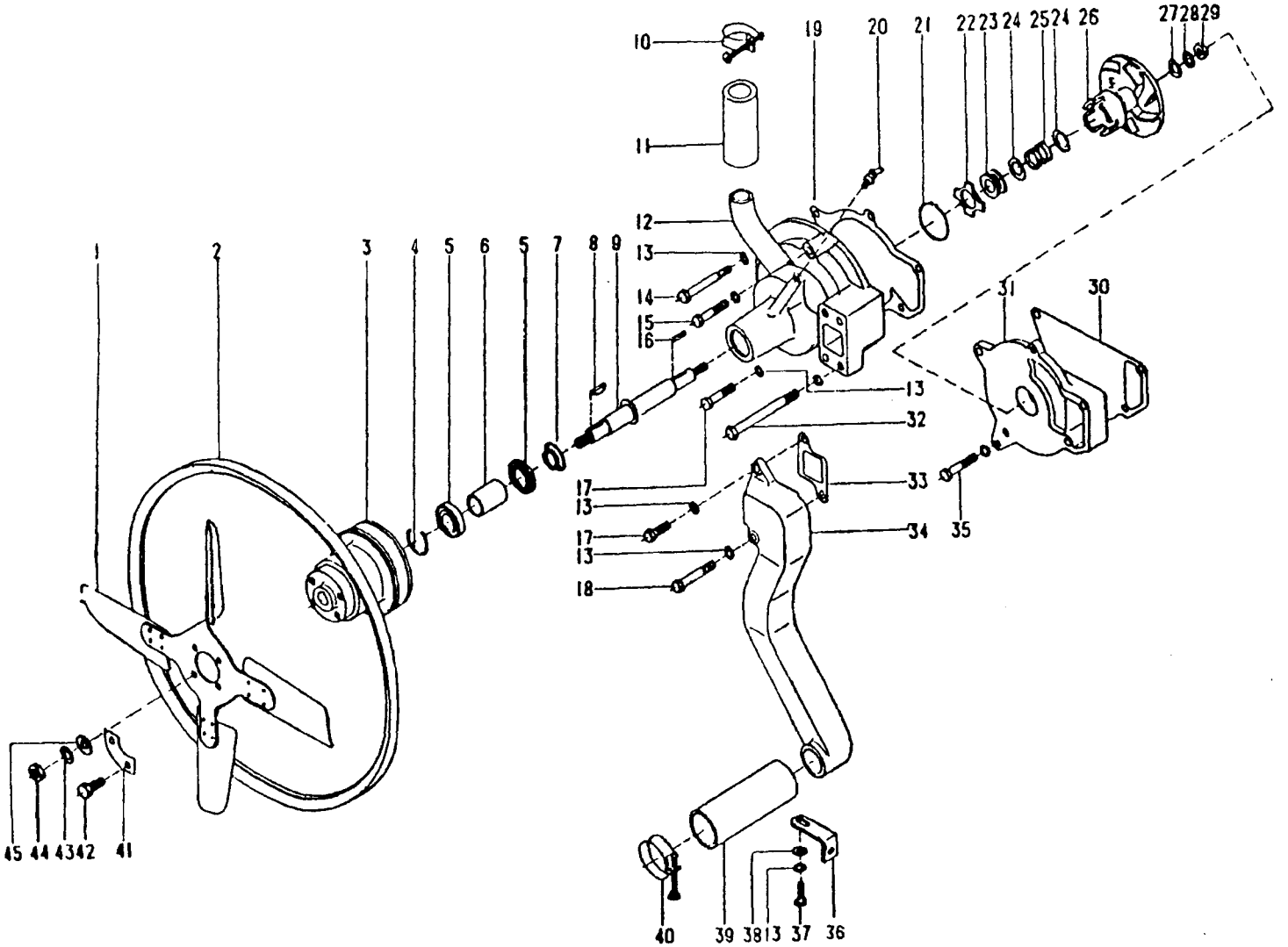


Fig. 6 Fan and Water Pump

Air Intake System (Fig.7)

Illus. No.	Part No.	Name of Part	qt.
1	K1700	Air filter assembly	1
2		Cartridge unit	1
3	295 – 07001	Intake manifold	1

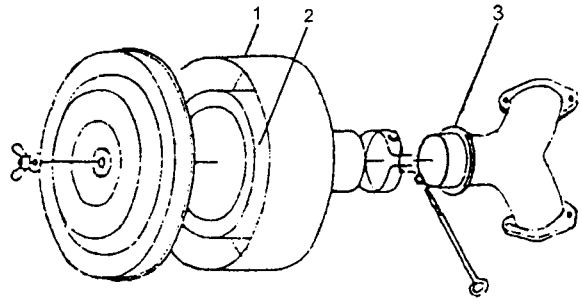


Fig. 7 Air Intake System

Exhaust System (Fig.8)

Illus. No.	Part No.	Name of Part	qt.
1	295 – 08000	Exhaust manifold	1
2	GB/T93-1987	Spring washer. Φ 8	7
3	GB/T5782-2000	Hexagon head bolt, M8 × 25	4
4	295 – 08007	Exhaust elbow gasket	1
5	295 – 08001	Muffter assembly	1
6	GB/T5782-2000	Hexagon head bolt M8 × 30	3
7	GB/T6171-2000	Hexagon nut, M8	3

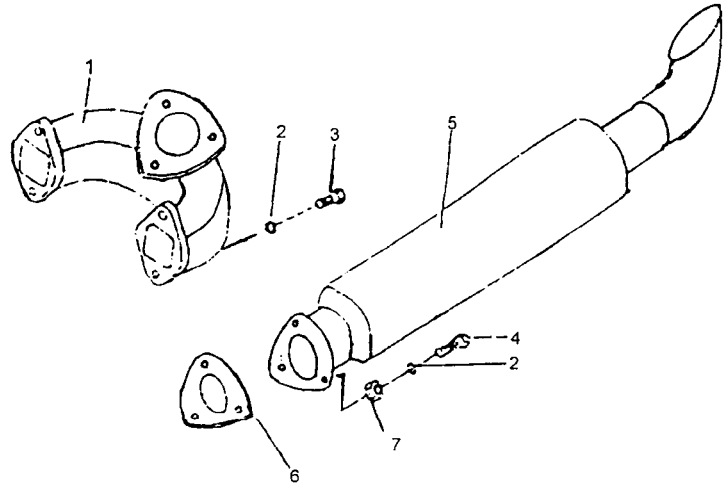


Fig. 8 Exhaust System

Lubrication System (Fig.9)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of part	qt.
1	GB/T5782-2000	Hexagon head bolt, M8 × 35	3	10	395 - 09201	Oil pump body	1
2	GB/T93-1987	Spring washer, Φ 8	3	11	395 - 01035	Oil pump gasket	1
3	GB/T117-2000	Taper pin A5 × 28	1	12	GB/T5782-2000	Hexagon head bolt M8 × 15	2
4	395 - 09203	Oil pump gear	1	13	GB/T93-1987	Spring washer, Φ 8	2
5	395 - 00202	Oil pump cover	1	14	295 - 19100	Oil strainer assembly	1
6	395 - 09205	Shim	1	15	295 - 09300	Suction strainer	1
7	295 - 09207	Inner rotor	1	16	395 - 09500	Oil pipe unit	1
8	GB/T119-2000	Cylindrical pin A5 × 18	1	17	GB/T119-2000	Cylindrical pin A5 × 12	2
9	295 - 09206	Outer rotor	1	18	295 - 09204	Oil pump shaft	1

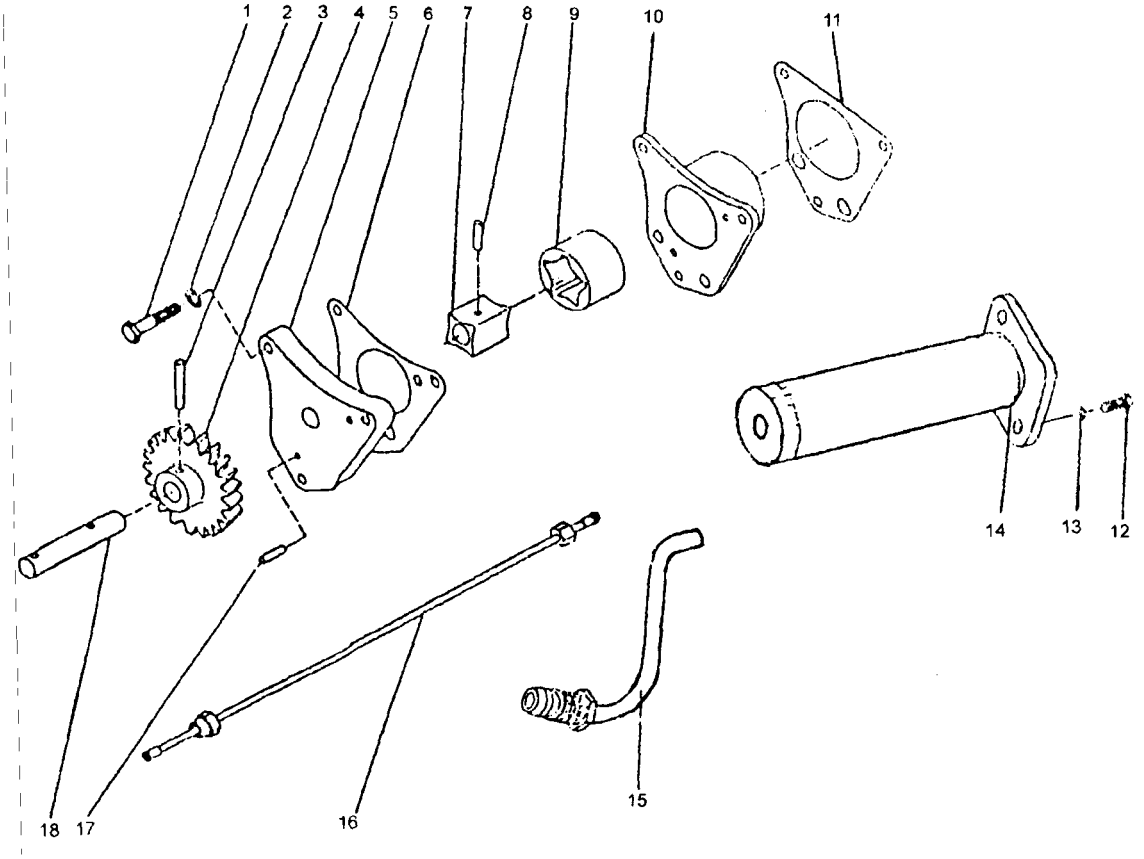


Fig. 9 Lubrication System

Fuel system (Fig. 10)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1		Fuel injection pump assembly	1	6	C0506(A)	Fule filter assembly	1
2	395-10200	Fuel injection pump Inlet pipe	1	7	395-10404	2nd fule injection pipe part	1
3		Fuel tank inlet pipe	1	8	395-10403	1st fuel injection pipe part	1
4	295-10300	Fuel delivery pipe	1	9	ZS4S1A	Injector assembly	2
5	295-10300	Fuel overflow pipe of injection pump	1	10	295-10500	Fuel overflow pipe of injector	1

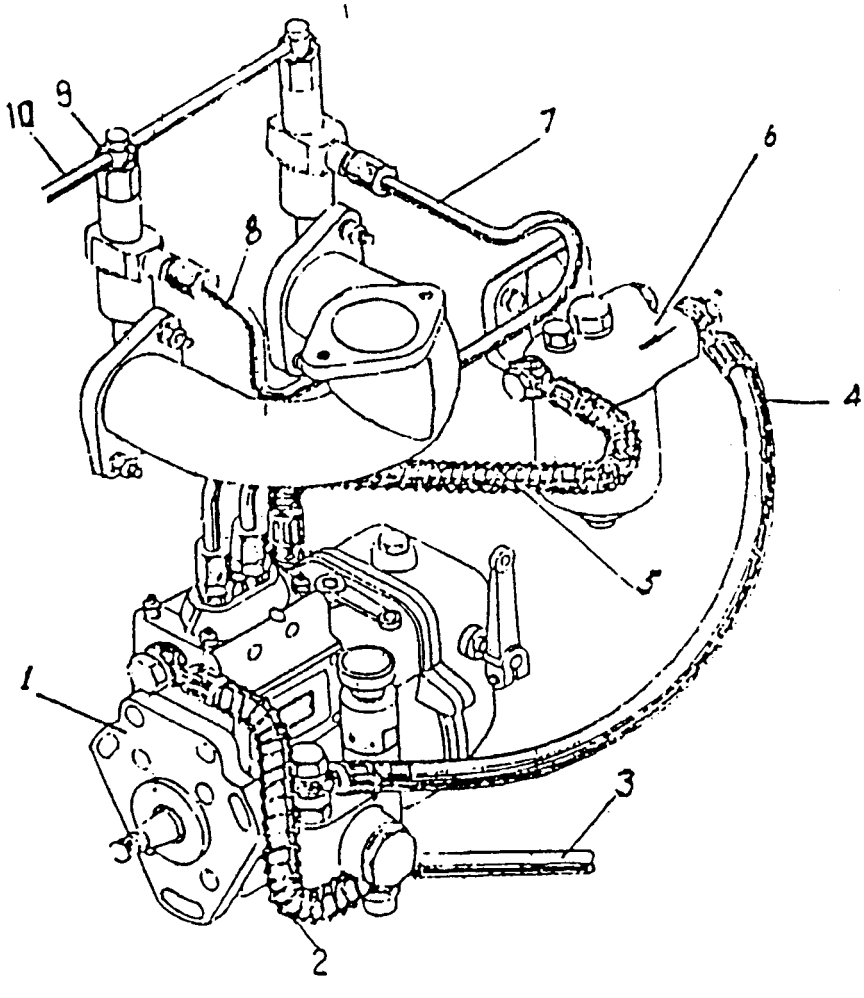


Fig. 10-5 Fuel System

Fuel Tank (Fig.11)

Illus. No.	Part No.	Name of Part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	295-50300	Fuel tank cover	1	8	295-50705	Fule tank bracket	2
2	295-50100	Fuel tank assembly	1	9	GB/T93-1987	Spring washer Φ 8	2
3	GB/T5782-2000	Hexagon head bolt M8×70	2	10	GB/T5782-2000	Hexagon nut, M8	2
4	GB/T5782-2000	Hexagon head Bolt M8×15	4	11	295-50701	Fnd tank pad	4
5	GB/T93-1987	Spring washer Φ 8	4	12	295-50600Q	Fule tank drain switch	1
6	295-50704	Cylindrical pin	2	13	295-5004	Draim plug washer	1
7	295-50702	Fuel tank tighting rope	2	14	295-5005	Draim hexagon head bolt	1

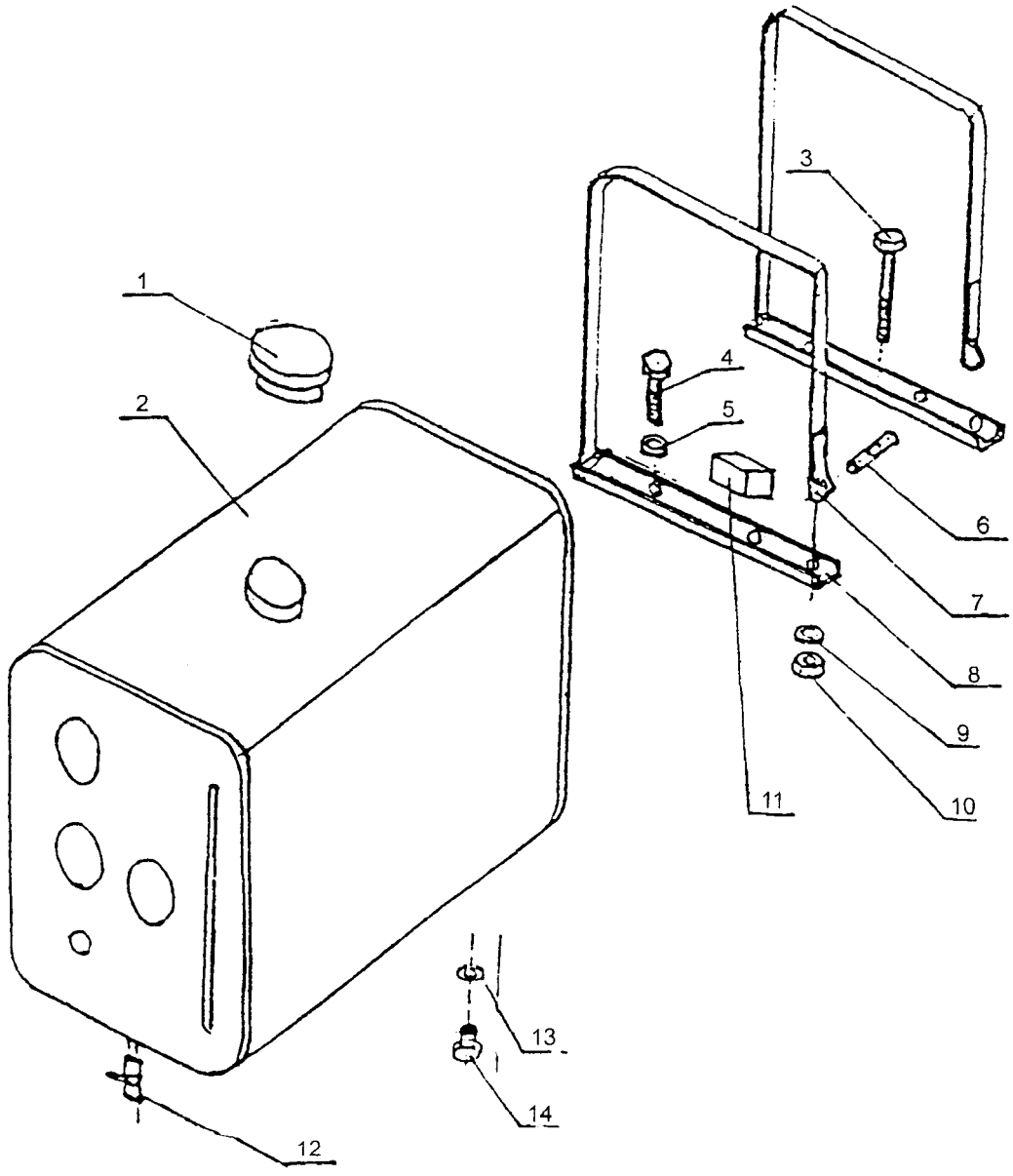


Fig. 11 Radiator and Bracket

Radiator and Bracket (Fig. 12)

Illus. No.	Part No.	Name of part	qt.	Illus. No.	Part No.	Name of Part	qt.
1	FG4-5600	No.4 water intake cap assembly	1	11	395-06201	Radiater drain pipe Φ38×Φ40×90	1
2	395-06200	235A radiator assembly	1		395-06202	Radiater intake pipe Φ38×Φ46×140	1
3	395-06400	Hose clamp Φ 46	4	12	GB/T6171/2000	Hexagon nut, M6	6
4	GB/T5782-2000	Hexagon head Bolt M6×12	6	13	GB/T93-1987	Spring washer Φ 6	6
5	295-01803-1	Front braket (left)	1	14	GB/T97.1-1985	Washer Φ 6-140HV	6
6	GB/T93-1987	Spring washer Φ 16	4	15	395-06200	Radiater water tank	1
7	GB6170-86	Hexagon nut M16	4	16	GB/T6171-2000	Hexagon nut M12	2
8	295-01803-2	Back bracket (right)	1	17	GB/T93-1988	Spring washer, Φ 12	2
9	GB/T5782-2000	Hexagon head bolt M16×80	4	18	GB/T5784-1986	Hexagon head bolt, M12×50	2
10	395D-13007-1	Water tank bracket	1	19	FS1-0218.00A	Drian switch assembly	1

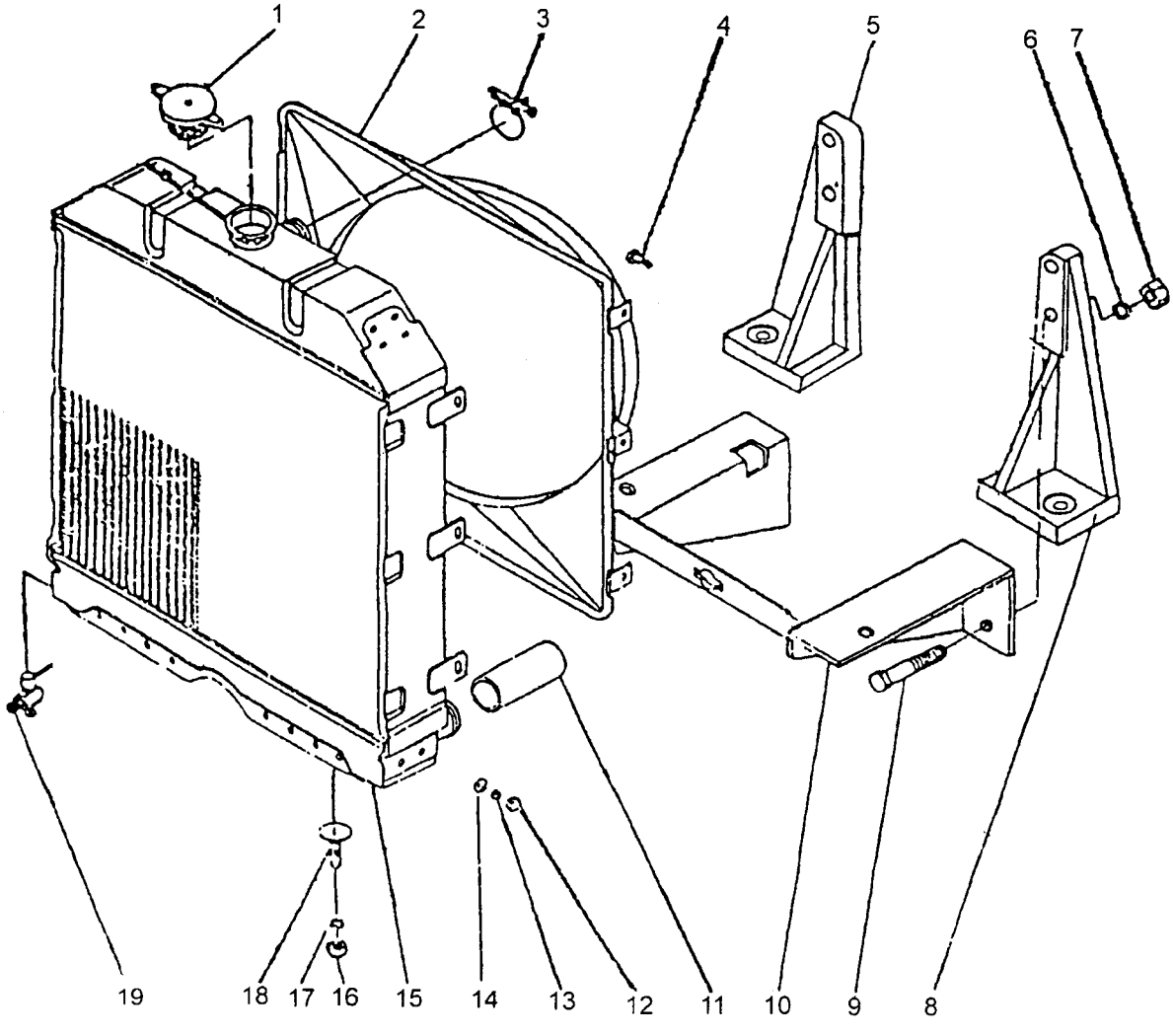


Fig. 12 Radiator and Bracket

295、2100 Diesel engine packing list

一、Diesel engine			
二、Technical documents			
No.	Name of Parts	Quantity	Remark
1	Instruction	1	
2	Packing list	1	
3	Acceptance certificate	1	
三、Attachment			
No.	Name of Parts	Quantity	Remark
1	Silencer	1	
2	Air filter	1	
3	Diesel oil tank	1	In accordance with contract
四、Spart parts			
No.	Name of Parts	Quantity	Remark
1	Engine oil filter core	1	
2	Fuel oil filter core	1	
3	Piston ring	1	
4	Cylinder cover packing	1	
五、Tools			
No.	Name of Parts	Quantity	Remark
1	Gas gate thick - thin gauge	1	
2	Spanner handle	1	
3	Spanner	5	Opening size: 13、16、18、22、24mm
4	Starting handle	1	In accordance with contract
5	Tools box	1	