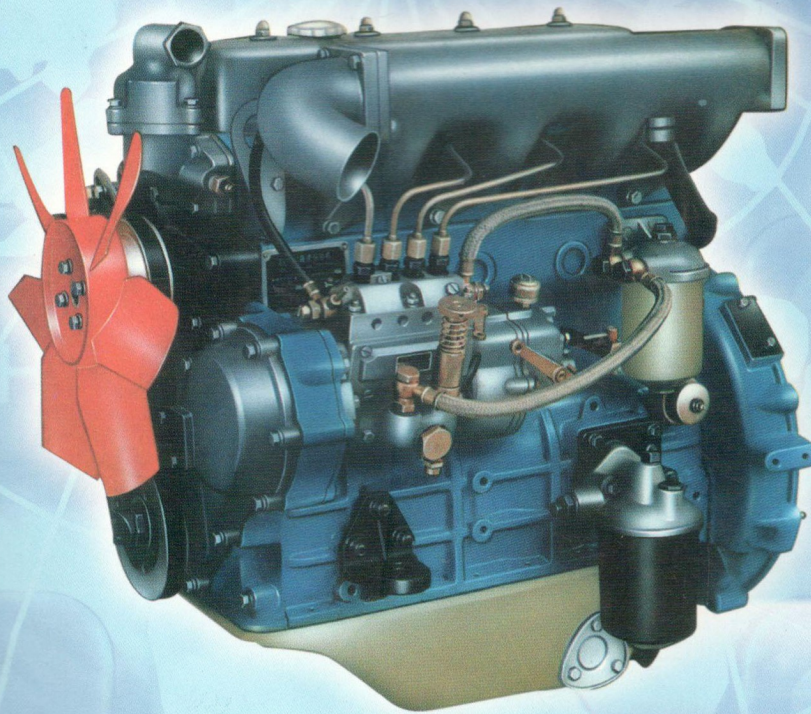




495B Series

Operator's Manual for Diesel Engine

495B Series



ZHEJIANG XINCHAI CO.,LTD

Chapter 1 Technical Specifications

1.1 Performance Specifications:

Model		495B	495BPG	495BT		
Type		In-line, water cooled, four stroke, direct injection				
No. of cylinders		4				
Cylinder bore (mm)		95				
Stroke (mm)		105				
Total displacement (L)		2.98				
Firing order		1-3-4-2				
Compression ratio		18:1				
Rated power and speed (kW)/(r/min)	At 15 min	52.5/3200	47.8/3000	42/2650	36.8/2400	33.5/2400
Maximum torque and the rate of the speed N·m/r/min		≥ 180.2/2000~2200		≥ 180.2/2000~2200	≥ 176/1800~2000	≥ 164.5/1600~1800
Maximum mean effective pressure (kPa)		760	734	742	694	
Minimum specific fuel consumption (g/kW·h)		≤ 238				
Specific lubricating oil consumption (g/kW·h)		≤ 1.6				
Direction of rotation of crankshaft (viewed from the flywheel end)		Counter-clockwise				
Cooling system		Closed cycle, forced water cooling				
Lubricating system		Pressured and splashed				
Starting device		Electric motor				
Net weight (kg)		≤ 260	≤ 260	≤ 255		
Overall dimensions (mm)		696×541×696	751×565×700.5	726×550×700.5		

1.2 Technical Data:

1.2.1 Valve timing(in crank angle):

Intake valve open	11°before T.D.C
Intake valve close	41°after B.D.C
Exhaust valve open	49°before B.D.C.
Exhaust valve close	11°after T.D.C.

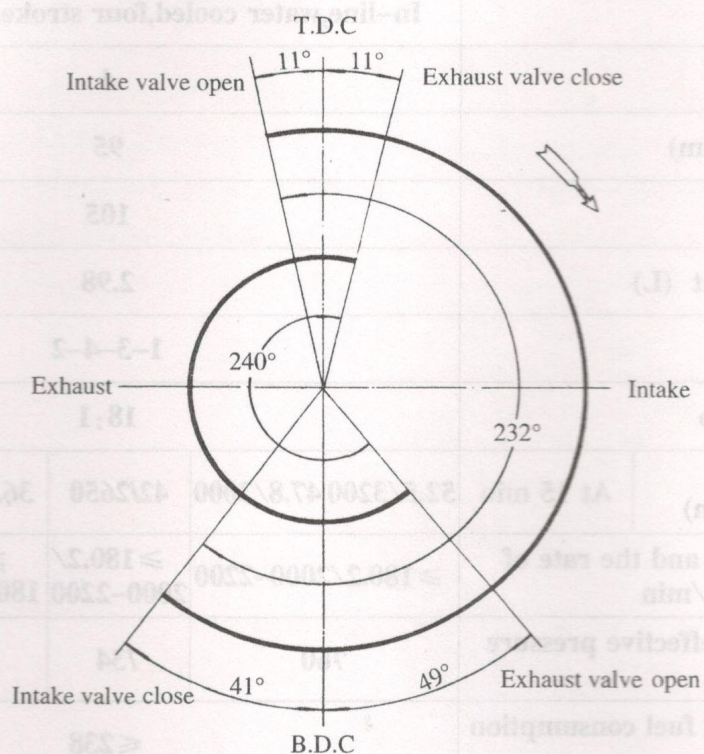


Fig.1 Valve Timing

1.2.2 Valve clearances(cooled state)

Intake clearances	0.35mm
Exhaust clearances	0.45mm

1.2.3 Injection timing(static, with timing advancer)

17±0.5°C before T.D.C.

1.2.4 Ranges of temperatures and pressures:

Exhaust temperature	495B ≤ 893K (620°C)
	495BT ≤ 823K (550°C),
	495BPG ≤ 823K (550°C)
Oil temperature	≤ 368K (95°C)
Outlet water temperature at rated power	348~368K (75°C~95°C)
Oil pressure	200~440kPa

1.2.5 Tightening torques of main bolts:

Cylinder head bolt

117.6~137.2N.m

Main bearing bolt

137.2~156.8N.m

Connecting rod bolt

98.1~117.6N.m

Flywheel bolt

98.1~117.6N.m

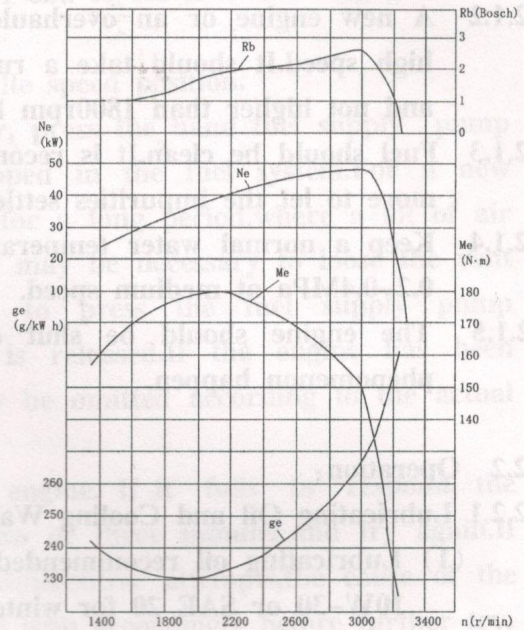
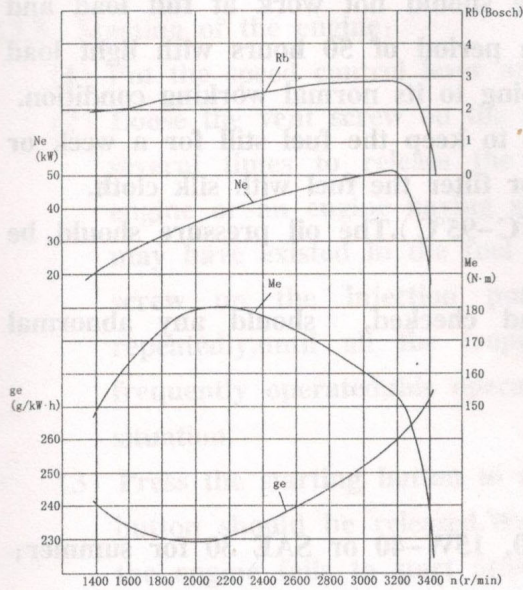
Starting claw

127.4~147N.m

1.2.6 Oil sump capacity

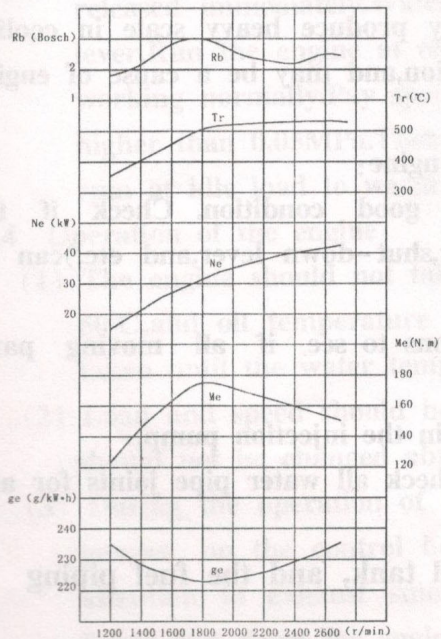
≈ 6L

1.3 Full Load Characteristic Curve

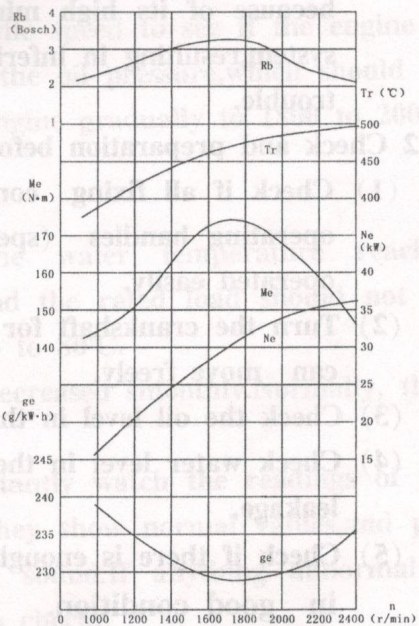


Full Load Characteristic Curve of Diesel Engine 495B (52.5kW/3200r/min)

Full Load Characteristic Curve of Diesel Engine 495B (47.8kW/3000r/min)



Full Load Characteristic Curve of Diesel Engine A495BPG



Full Load Characteristic Curve of Diesel Engine 495BT

Chapter 4 Construction

4.1 Cylinder Head:

The cylinder head is fixed on the cylinder block with cylinder head bolts. In tightening these bolts, torque wrench should be used. And the specified tightening torque value should be reached step by step and following the tightening sequence shown in fig.2. If the cylinder head has been dismantled and remounted, after the engine is warmed up in its first running, shut down the engine and re-tighten cylinder head bolts to the specified tightening torque, and re-adjust valve clearances.

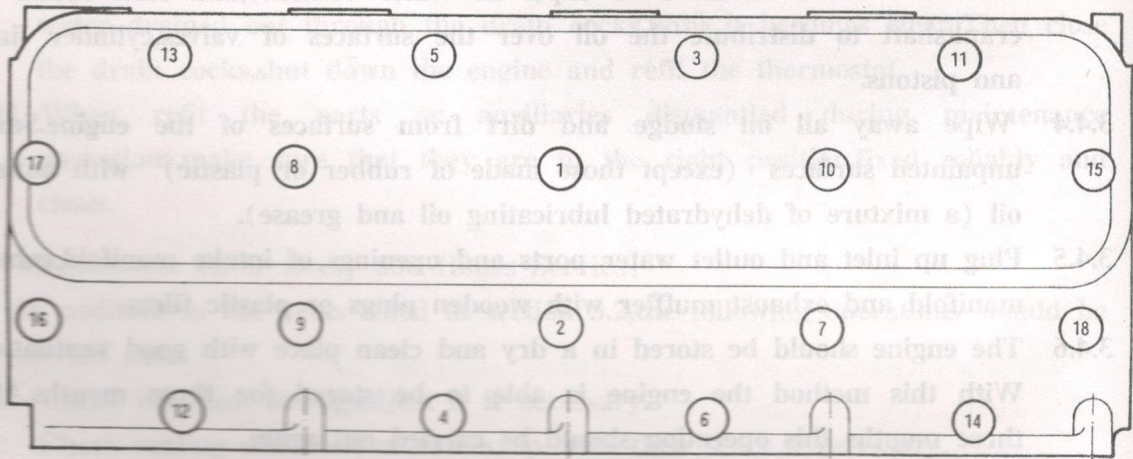


Fig.2 Tightening Sequence of Cylinder Head Bolts

In cylinder head, injector sleeves are press-fitted, shown in fig.3. In fitting in sleeves, any oil sludge or dirt on their surfaces and the matching surfaces of cylinder head should be cleaned away, and smeared with sealing glue Loctite 620.

4.1.1 Intake and exhaust valves, seats and guides:

When there are burn spots or pits on sealing bands of valves or seats, or the sealing bands have worn, causing gas leakage, the sealing bands should be lapped. Lay some lapping paste on the sealing bands and lap the valve together with its matching seat, until

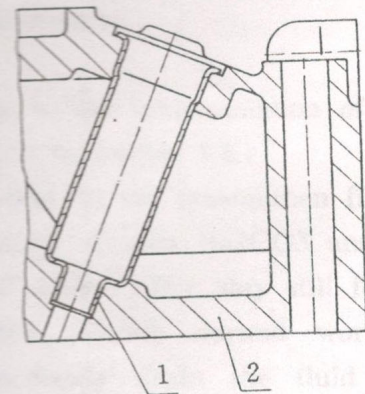


Fig.3 Fitting of Injector Sleeve
1-Copper Sleeve 2-Cylinder Head

continuous lackluster sealing bands are formed. Lapping paste getting into valve guides should be carefully avoided. After the lapping operation, carefully clean valves, seats and guides, as guide wear caused by lapping paste will impair gas tightness. After lapping pour some kerosene into intake or exhaust port; watch the time it takes to seep through the closed valve.

The cone angle of sealing bands of valves and seats are 90° ; normally their widths are 1.2 to 1.6mm. After several times of lapping operation, the width may be too wide, causing ill tightness. They should be re-reamed with reamers of 75° and 30° , center positioned by inner hole of the guide, as shown in fig.4. Re-reamed seats should be lapped with their matching valves.

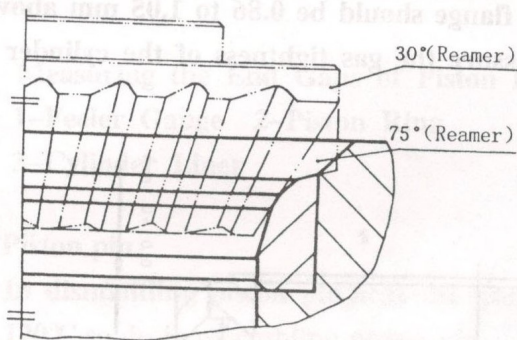


Fig.4 Re-reaming of Valve Seats

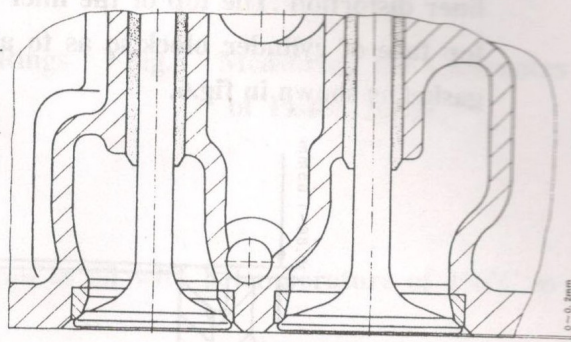


Fig.5 Recession of Valves

The recession of valves into the cylinder head bottom surface, as shown in fig.5, is 0 to 0.2mm. After several times of re-reaming, increase of recession may affect compression ratio of the engine; so when the recession value exceeds 1.2mm, the valve seat has to be changed.

In assembling, the protrusion of valve guides from the bearing face of valve spring on the cylinder head should be 4.5 to 5mm.

4.1.2 Cylinder head gasket:

Cylinder head gasket should be flat and smooth. If there is warp or burn in the gasket, it should be changed. The thickness of the gasket is to be selected to assure that the clearance between piston top face and cylinder head bottom face is between 0.9 to 1.0mm.

4.2 Cylinder Block:

4.2.1 Oil galleries:

In engine repairing, all oil galleries in cylinder block should be carefully cleaned, and all plugs should be tightly fitted without any leakage.

4.2.2 Main bearings:

The cylinder block and its main bearing caps have been stamped with matching marks. The caps are not interchangeable. They should be at their

right position and should not be in the reversed direction. In fitting on the foremost main bearing cap, its front face should flush with the front face of the cylinder block; otherwise it would harm the correct mounting of the gear housing. Main bearing bolts should be tightened step by step and alternatively until the tightening torque reaches its specified value. Before tightening the rearmost cap bolts, make sure that the upper and lower halves of the thrust bearing are in flush with each other, so that the crankshaft can turn round freely in the bearings, which should be checked by hand after assembling.

4.2.3 Cylinder liners:

When pressing cylinder liners into cylinder block, it should be careful for the liner distortion. The top of the liner flange should be 0.86 to 1.05 mm above the top face of cylinder block, so as to assure the gas tightness of the cylinder head gasket, as shown in fig.6.

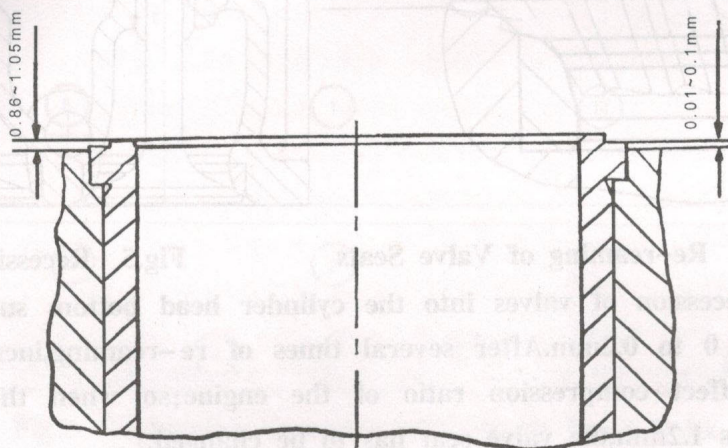


Fig.6 Projection of Liner Flange Over the Top Face of Cylinder Block

4.3 Piston-Connecting Rod Assembly:

4.3.1 Weight difference:

The weight differences of piston-connecting rod assemblies within the same engine should be not more than 15 grams.

4.3.2 Piston rings:

The second piston ring is a twisted type, which should be correctly fitted in piston ring groove with the side marked with a sign "CYPR" facing upward.

Check end gaps of the rings. Put the ring in a cylinder liner at a depth of 15 to 20mm from the top of the liner. Check the end gap with a feeler gauge as shown in fig.7. The clearance of ring should be between 0.30 to 0.50 mm, the oil ring should be between 0.30 to 0.50 mm. Check clearances of rings in piston ring grooves with a feeler gauge, as shown in fig.8. The clearance of the second ring 0.062 to 0.092 mm and the oil ring 0.03 to 0.062 mm.

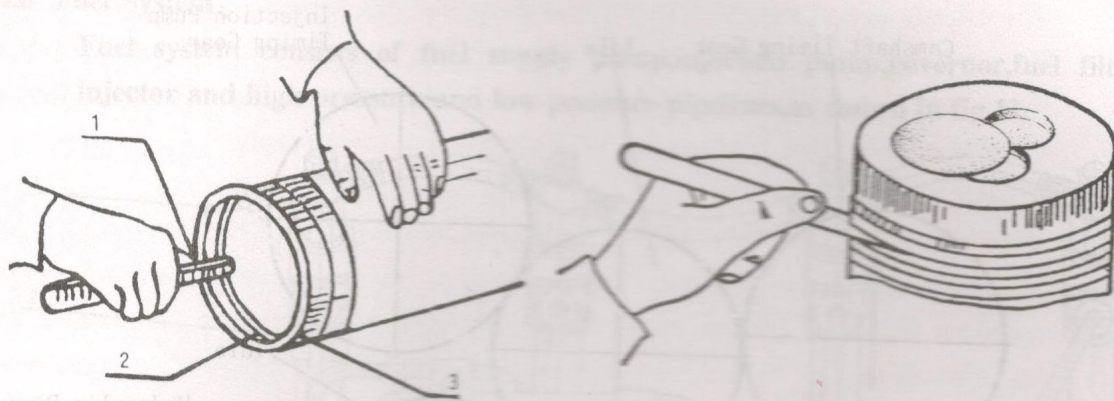


Fig.7 Measuring the End Gaps of Piston Rings

1-Feeler Gauge 2-Piston Ring
3-Cylinder Liner

Fig.8 Measuring the Clearances of Piston Rings

4.3.3 Piston pin :

In dismantling piston pin,heat the piston in oil with a temperature of 100°C to 120°C,so do in assembling piston pin.

The matching marks on piston top face and connecting rod should be in the same direction,pointing to the front of the engine.

4.3.4 Connecting rod :

Connecting rod body and its cap have matching marks on them,and are not interchangeable.Use a guiding sleeve to assemble piston -connecting rod assemblies into cylinder liners.

Put some fixing glue Loctite 271 on connecting rod bolts before inserting them into thread holes;tighten the bolts step by step and alternatively until the tightening torque reaches its specified value.

4.4 Crankshaft and Flywheel:

4.4.1 Flywheel is fixed on the crankshaft by six bolts, which should be tightened to a specified torque value,and secured by 3 lock sheets.

4.4.2 It is prohibited to fix a V-belt wheel directly on the flywheel to drive another machine.In this way a transverse force will be exerted on the crankshaft,which may bring about harmful effect to the crankshaft and main bearings.

4.5 Gear Train:

4.5.1 Gear train:

There are timing marks on the timing gears.They should align with the relevant marks on the matching gears in assembling,as shown in fig.9.

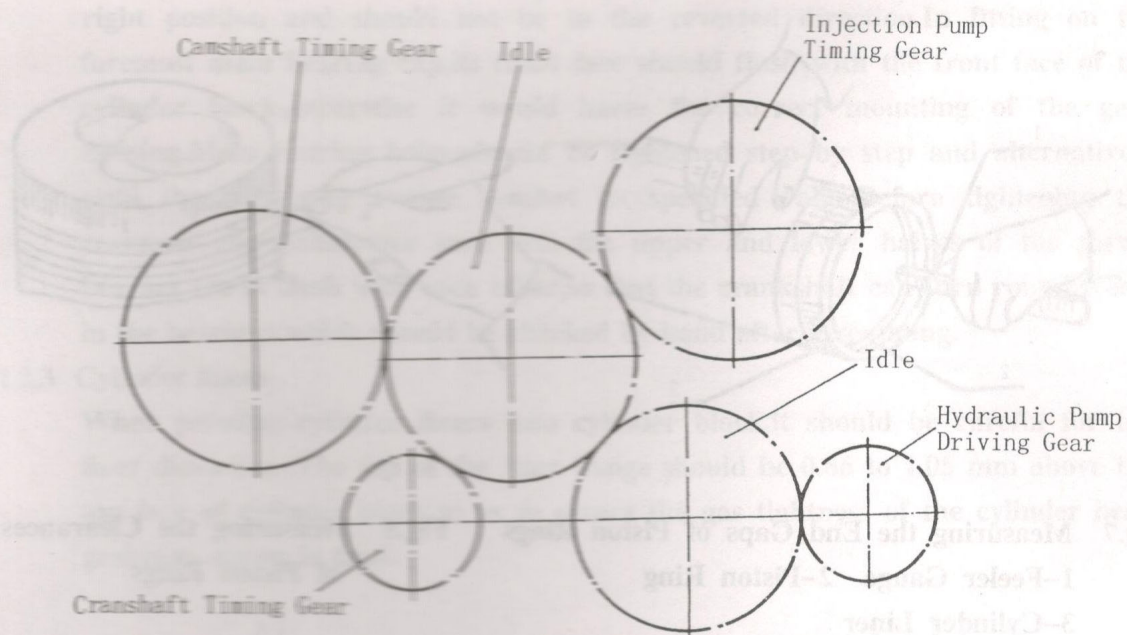


Fig.9 Gear Train 495BPG

4.5.2 Hydraulic pump driving gears(495BPG):

The hydraulic pump is connected to its driving gears through a spline, $6-20 \frac{D}{db} \times 16 \frac{D7}{dc7} \times 4 \frac{De4}{dd}$. The speed ratio between the hydraulic pump and the crankshaft is 1:1. The driving gears are mounted on bearings 7207E and bearings 109 respectively, which in turn are inserted in gear housing and gear housing cover, as shown in fig.10.

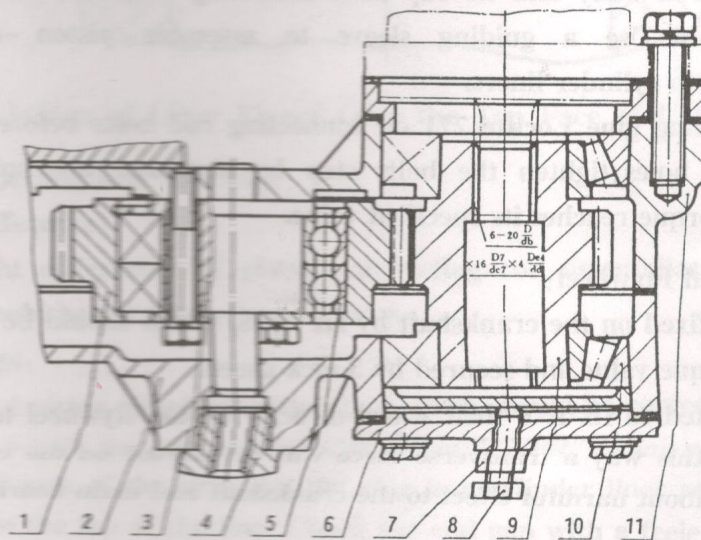


Fig.10 Driving Gears for Hydraulic Pump 495BPG

- 1-Idle Gear 2-Gear Housing Cover 3-Idle Gear Axle 4-Screw Plug
- 5-Bearing 109 6-End Cover 7-Nut 8-Adjusting Screw
- 9-Hydraulic Pump Gear 10-Gear 7207E 11-Gear Housing

4.6 Fuel System:

Fuel system consists of fuel supply pump, injection pump, governor, fuel filter, injector and high pressure and low pressure pipelines, as shown in fig.11.

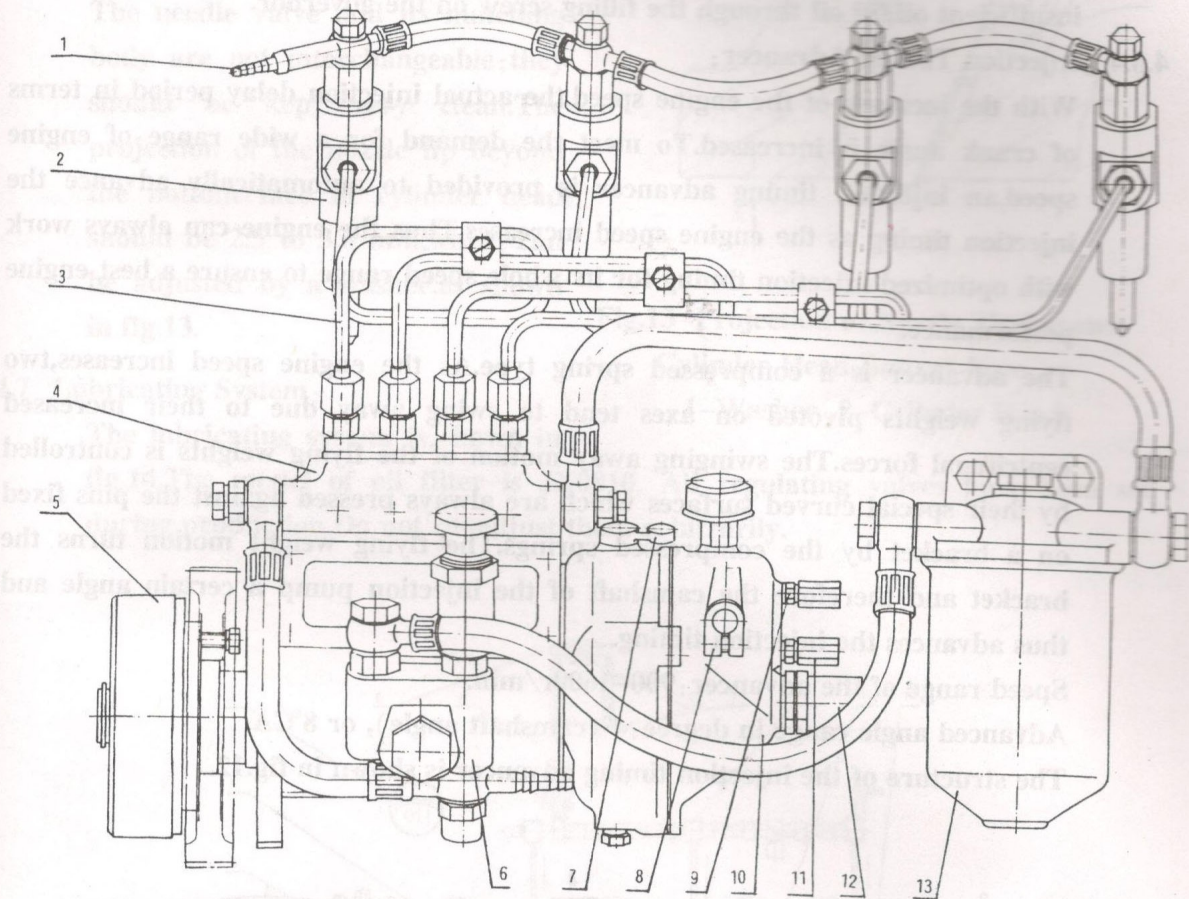


Fig.11 Fuel System

- 1-Leak-off Tube 2-Injector 3-High Pressure Tube 4-Injection Pump
5-Injection Timing Advancer 6-Fuel Supply Pump 7-Shut-down Lever
8-Speed Control Lever 9-Max. Speed Limit Screw 10-Governor
11-Idle Speed Limit Screw 12-Max.Fuel Limit Screw 13-Fuel Filter

4.6.1 Fuel supply pump:

There is a filter screen in the inlet adaptor of fuel supply pump, which should be regularly cleaned.

4.6.2 Fuel filter:

Spin-on fuel filter should be changed after every 300 hours in service.

4.6.3 Injection pump and governor:

The injection pump is a series I in-line pump. Its precision plunger and its matching barrel, and delivery valve and its matching body are not interchangeable.

The adjustment of injection pump and governor has been set during production. Do not reset adjustment arbitrarily. An oil filling and vent screw is on the top of the governor, and a drain cock on the bottom. If the injection pump shows sign of insufficient oil, fill oil through the filling screw on the governor.

4.6.4 Injection Timing Advancer :

With the increase of the engine speed, the actual injection delay period in terms of crank angle is increased. To meet the demand for a wide range of engine speed, an injection timing advancer is provided to automatically advance the injection timing as the engine speed increases. Thus the engine can always work with optimized injection timing for its whole speed range to ensure a best engine performance.

The advancer is a compressed spring type. As the engine speed increases, two flying weights pivoted on axes tend to swing away due to their increased centrifugal forces. The swinging away motion of the flying weights is controlled by their special curved surfaces which are always pressed against the pins fixed on a bracket by the compressed springs. The flying weight motion turns the bracket and therefore the camshaft of the injection pump a certain angle and thus advances the injection timing.

Speed range of the advancer : 900–1600r/min.

Advanced angle range in degree : 4° (camshaft angle), or 8° CA.

The structure of the injection timing advancer is shown in fig.12.

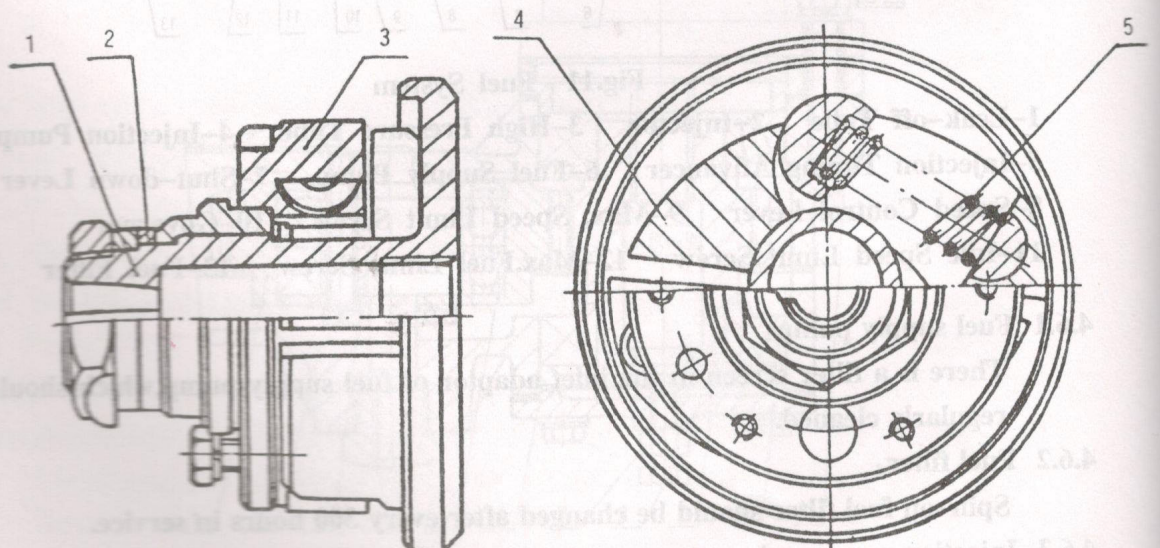


Fig.12 Injection Timing Advancer

1-Bracket 2-Spacer 3-Injection Timing Gear

4-Flying Weight 5-Spring

4.6.5 The injector is a series S model PF68S4 one. Its opening pressure is 20.3 to 20.8MPa.

The needle valve and its matching body are not interchangeable; they should be kept very clean. The projection of the nozzle tip beyond the bottom face of cylinder head should be 2.5 to 3.0 mm, which can be adjusted by a washer, as shown in fig.13.

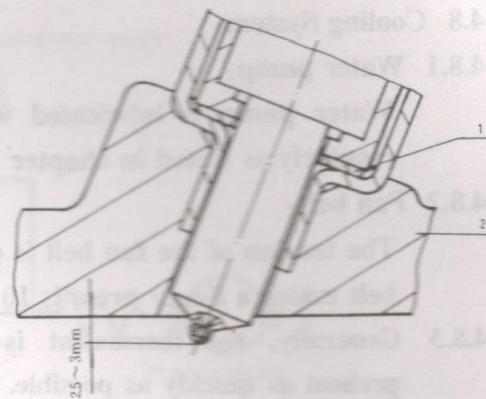


Fig.13 Projection of Nozzle Tip beyond Cylinder Head Bottom Face
1-Washer 2-Cylinder Head

4.7 Lubricating System:

The lubricating system is shown in fig.14. The model of oil filter is JX0810. All regulating valves have been set during production. Do not re-adjust them arbitrarily.

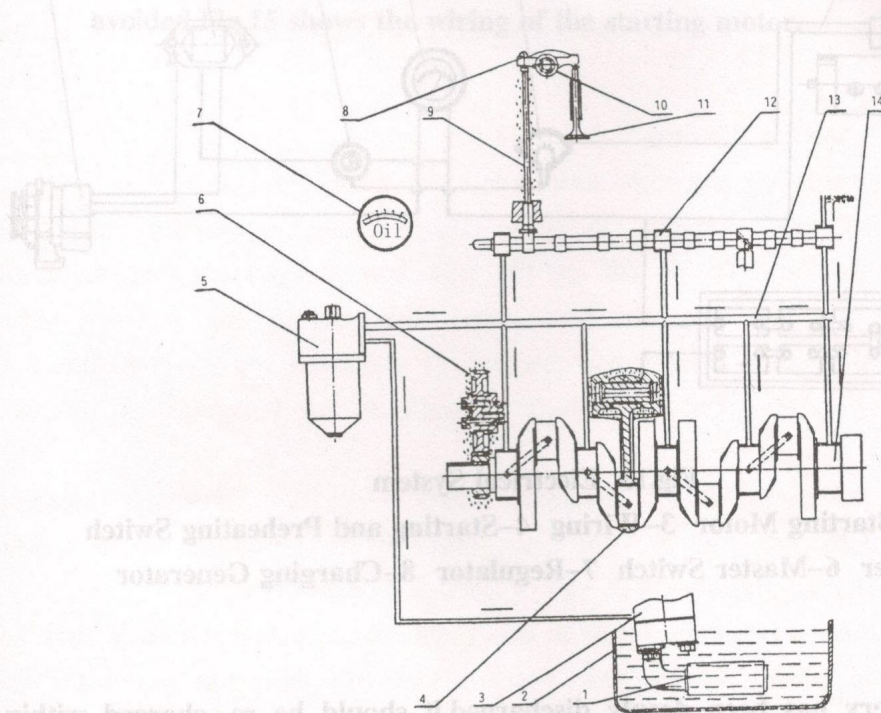


Fig.14 Lubricating System
1-Strainer 2-Oil Sump 3-Oil Pump 4-Piston-Connecting Rod Assemblies and Liners 5-Oil Filter 6-Gear Train 7-Oil Pressure Gauge
8-Rocker Arms 9-Push Rods, Tappets and Tappet Holes
10-Rocker Arm Shaft 11-Valves and Guides 12-Camshaft and Bushings
13-Oil Galleries 14-Crankshaft and Bearing

4.8 Cooling System:

4.8.1 Water pump:

Water pump is lubricated with calcium based grease, which should be filled regularly, as stated in chapter 3.

4.8.2 Fan belt:

The tension of the fan belt is checked by finger press. The appropriate sag of the belt under a finger press is 10 to 15 mm.

4.8.3 Generally, the thermostat is installed on the diesel engine with the purpose to preheat as quickly as possible. But when operating under the hot weather, it's not necessarily to install the thermostat in order to stress the cooling effect.

4.9 Electrical System:

The electrical system is shown in fig.15.

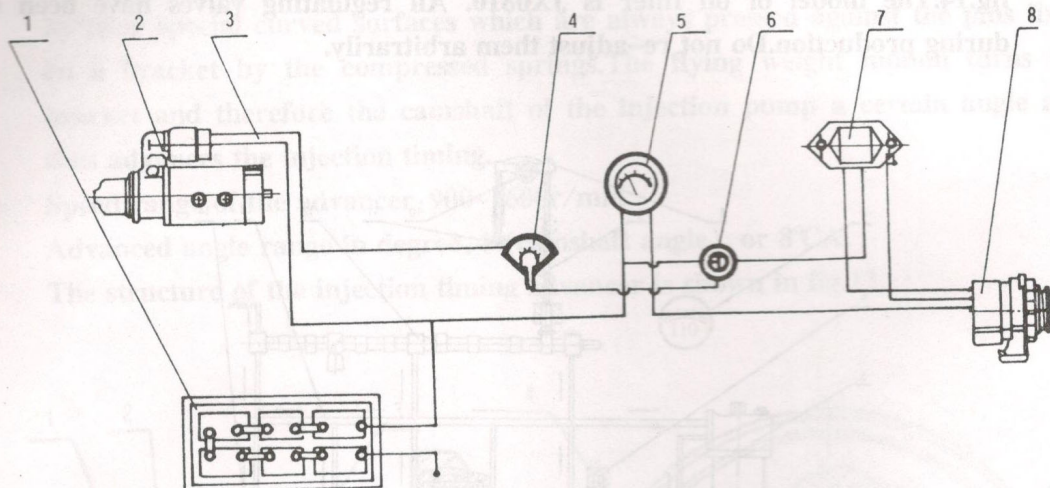


Fig.15 Electrical System

1-Battery 2-Starting Motor 3-Wiring 4-Starting and Preheating Switch
5-Ampere Meter 6-Master Switch 7-Regulator 8-Charging Generator

4.9.1 Battery:

After battery has been deeply discharged, it should be re-charged within 24 hours. If the battery is going to stand by for a quite long time, it should be fully charged before storing, and re-charged every month during storage.

4.9.2 Charging generator:

The charging generator should be lubricated with grease every 1000 h in service. The regulator has been set during production process, and should not be reset arbitrarily. Fig.16 shows the wiring of charging generator with regulator.

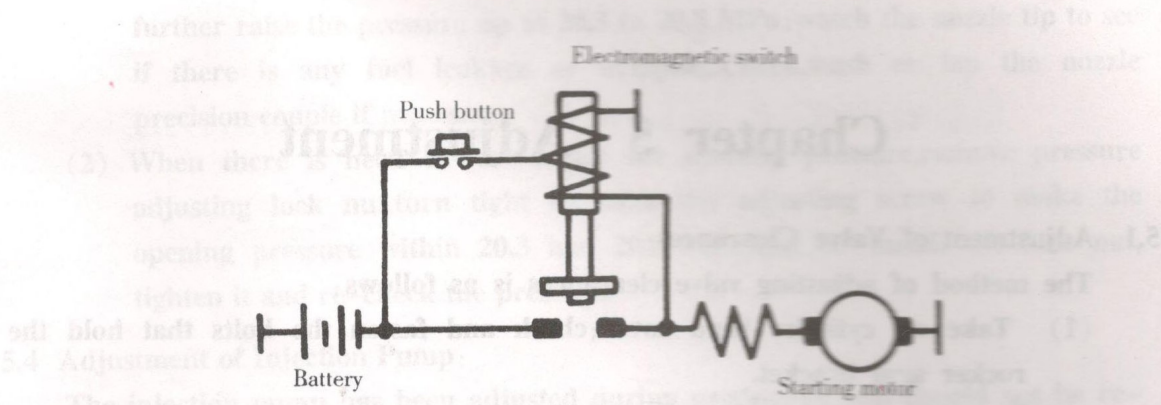


Fig.16 Wiring of Starting Motor

4.9.3 Starting motor:

The time used for the starting motor to start the engine each time should not exceed 5 seconds. The time interval between 2 consecutive tries should be longer than 2 minutes. Troubles should be found and dealt with accordingly after 3 consecutive unsuccessful tries. Water splashed on the starting motor should be avoided. Fig.15 shows the wiring of the starting motor.

Chapter 5 Adjustment

5.1 Adjustment of Valve Clearances:

The method of adjusting valve clearances is as follows:

- (1) Take off cylinder head cover; check and fasten the bolts that hold the rocker arm bracket.
- (2) Turn round the crankshaft until the first piston is at its top dead center, when the mark of the observing window on the flywheel housing is just in line with the "0" mark on the flywheel, or the indicating pin on the gear housing cover is just pointing to the "0" mark on the V belt pulley.
- (3) Measure the intake and exhaust valve clearances of the first cylinder with a feeler gauge; adjust them to 0.35 mm and 0.45 mm respectively in cooled state. Then turn the crankshaft for 180° CA each time to adjust the other cylinders' valve clearances following the firing sequence of the engine.

5.2 Adjustment of Injection Timing:

The method of adjusting injection timing is as follows:

- (1) Release the air trapped in the fuel system; repeatedly turn the crankshaft to and fro to fill up the injection pump with fuel. Dismantle the first high pressure tube; blow away the fuel in the delivery valve adapter; slowly turn round the crankshaft clockwise and watch the fuel in the adapter; stop the crankshaft as soon as the first sign of the fuel moving up is discovered.
- (2) Check if the mark of the observing window on the flywheel housing or the indicating pin on the gear housing cover points to the right timing marks on the flywheel and V belt pulley respectively.
- (3) If the injection advancing angle is not right, loose three M8 nuts that fix the injection pump on the gear housing; turn the injection pump off the cylinder block if the angle is too big or otherwise if too small; then tighten the three nuts.

5.3 Adjustment of Injector:

The method of adjusting injector is as follows:

- (1) Install the tested injector on injector testing rig; quickly push its handle to raise the fuel pressure to 18 MPa; gradually push the handle to

further raise the pressure up to 20.3 to 20.8 MPa; watch the nozzle tip to see if there is any fuel leakage or dripping. Check, wash or lap the nozzle precision couple if necessary.

- (2) When there is need to re-adjust the opening pressure, remove pressure adjusting lock nut, turn tight or loose the adjusting screw to make the opening pressure within 20.3 and 20.8 MPa, and re-install the lock nut, tighten it and re-check the pressure.

5.4 Adjustment of Injection Pump:

The injection pump has been adjusted during production and should not be re-adjusted arbitrarily. In case there is need to do so, it should be done on a special testing machine by a professional mechanic.