Chapter1 Technical Specifications

1.1 PERFORMANCE SPECIFICATIONS:	
Model	NB485BPG
Type	In-line, water cooled, four stroke, direct injection ω-shaped combustion chamber
No.of Cylinders	4
Cylinder Bore	85mm
Stroke	100mm
Total Displacement	2.27 liters
Firing Order	1-3-4-2
Compression Ratio	18
Rated Power/Rated Speed	30kW/2600rpm
Max. Torque/Speed	131N.m/1820rpm
Min. Fuel Consumption on Full Load Curve	≤245g/kW.h
Oil Consumption	≤2.45glkW.h
Exhaust Smoke	≤4.5 Bosch
Min. Steady Speed Without Load	≤730±25 rpm
Direction Of Rotation (Viewed from Flywheel End)	Counterclockwise
Cooling System	Closed cycle, forced water cooling
Lubricating System	Pressured and splashed
Starting Device	Electric motor
Net Weight	210kg
Overall Dimensions	697.2 x 495.5 x 623.35mm

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Chapter 3 Maintenance

For reliable performance and good engine life, it is essential to conduct maintenance according to the following guidelines:

3.1 Daily Maintenance:

3.1.1 Check oil level in the oil sump to see if it is between the two marks on the dipstick and near the upper mark. For a new engine or a long standing by one, fill in lubricating oil till it reaches the upper mark. Run the engine at low speed for 5 to 10 minutes and shut it down. Recheck oil level by the dipstick.

3.1.2 Check radiator for its water level.

3.1.3 Check injection pump for its oil level. Fill oil to its specified level if insufficient.

3.1.4 Check if there is any oil, water or gas leakage.

3.1.5 Check soundness of fastening of all components and auxiliaries.

3.1.6 Check the fastening of the engine mounting bracket and all joint connections of auxiliaries.

3.1.7 Check cleanness of the engine. Wipe away oil sludge or dirt with a piece of cloth, dry or wetted with some gasoline. Pay special attention to dryness and cleanness of the electric appliances.

3.1.8 For a new engine, after first 250 hours running with light load, lubricating oil (including that in the injection pump) and oil filter cartridge should be renewed and the oil sump and oil strainer should be cleaned.

3.1.9 Put right all the troubles or abnormalities discovered.

3.2 Maintenance after every 100 Hours Service:

In addition to the items listed in the daily maintenance, the following operations should be carried out.

3.2.1 Renew lubricating oil in oil sump.

3.2.2 Clean or renew fuel filter cartridge. (Spin-on cartridge could be renewed after 1000 hours or 50,000km service)

3.2.3 Check the tightness of cylinder head bolts.

3.2.4 Check valve clearances, adjust them if necessary.

3.2.5 Check tension of V belt, adjust it if necessary.

3.2.6 Fill grease nipples with grease.

3.2.7 Check nozzle opening pressure and the spray after 200 hours service, adjust it if necessary.

3.2.8 Check voltage of the battery. The specific gravity of the electrolyte should be between 1.28 and 1.29 (at ambient temperature of 15°C), it should not be under 1.27.Check if the electrolyte level is 10 to 15mm higher than the lead plates. Add distilled water if necessary.

3.2.9 After every 200 hours service (or conforming to the contaminating condition of cooling water) renew cooling water. Remove thermostat, fit back its cover, and run the engine at variable speeds to make cooling water flush all the contaminating deposits in the cooling system. Open drain cocks on cylinder block and radiator and shut down the engine. Fill clean water into the radiator continuously, start the engine and run it at idle speed. Watch the water drained out through the drain cocks, until it becomes clean.Then close the drain cocks, shut down the engine and refit the thermostat.

3.2.10 When refitting the parts or auxiliaries dismantled during maintenance operations, make sure that they are in the right position, fixed reliably and clean.

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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.

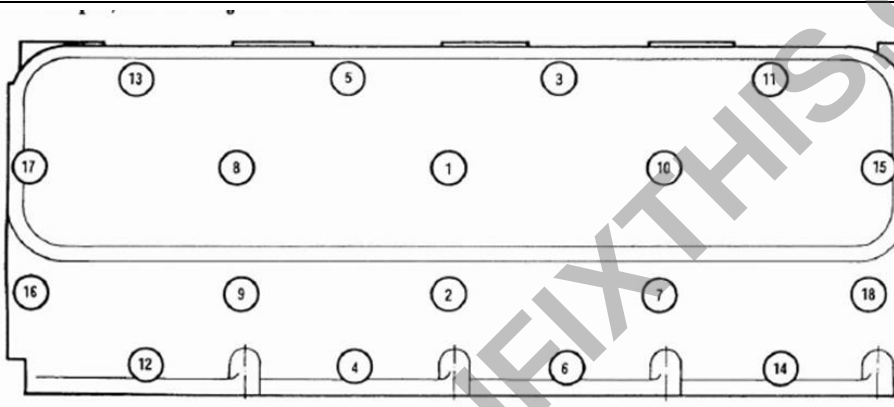


Fig.2 Tightening Sequence of Cylinder Head Bolts

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.

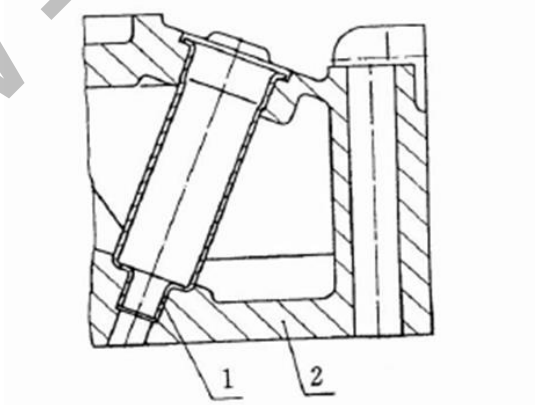


Fig.3 Fitting of Injector Sleeve
1–Copper Sleeve 2–Cylinder Head

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Chapter 6 Troubleshooting

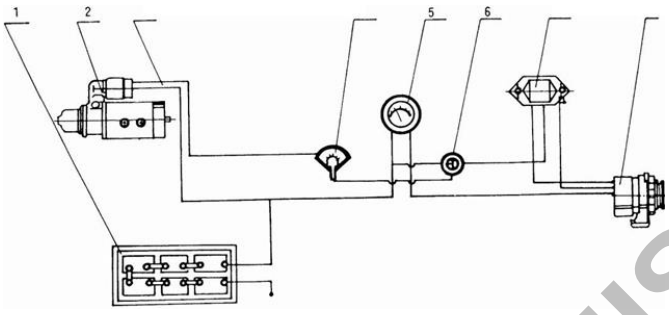
Cause of Trouble	Remedies
1. Engine Fails to Start	
(1) Starting speed too low:	
a. Insufficiently charged battery or loose connection.	a. Charge battery or fasten connection.
b. Fault in alternator.	b. Repair or replace generator. (2)
Faults in fuel system:	
a. Empty fuel tank or closed fuel cock.	a. Fill up fuel tank or open the cock.
b. Fuel piping blocked by air in fuel system, water in fuel or other impurities.	b. Release trapped air, drain away water trapped or clean up fuel piping.
c. Faults in injection pump, injector.	c. Repair or replace the component governor or With faults.
d. Fuel filter blocked.	d. Clean or replace fuel cartridge.
(3) Low compression ratio:	
a. Valve clearances too small.	a. Re-adjust valve clearances to their specified values.
b. Gas leakage through valves. Cylinder gasket leaks.	b. Lap valves together with their seats. c. Change gasket, tighten cylinder head bolts with specified torque. d.
Cylinder rings worn or stuck.	d. Clean or change cylinder rings.
(4) Other causes:	
a. Ambient temperature too low.	a. Fill hot water into cooling system.
b. Too thick lubricating oil.	b. Use oil with appropriate viscosity.
2. Abnormal Lubricating Oil Pressure	
(1) No or too low oil pressure:	
a. Oil level too low.	a. Fill in lubricating oil.
b. Too low oil viscosity.	b. Use oil with appropriate viscosity. c. Weld, tight or change relevant parts.
c. Broken oil pipeline or loose pipe connection.	
d. Damaged oil pressure gauge.	d. Replace with a good gauge.

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4.9 ELECTRICAL SYSTEM: The electrical system is shown in Fig. 14.

FIG. 14 ELECTRICAL SYSTEM



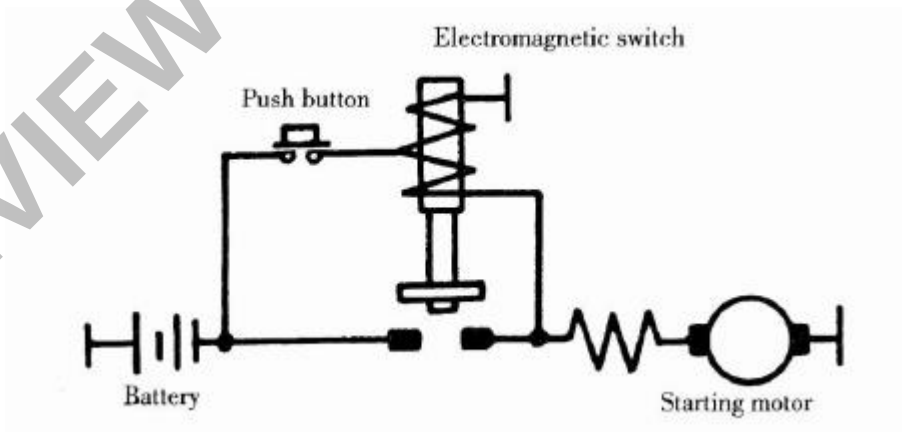
1-Battery 2-Starter 3-Wiring 4-Starting And Preheating Switch
5-Ampere Meter 6-Master Switch 7-Regulator 8-Alternator

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 ALTERNATOR: The alternator 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.l5 shows the wiring of alternator with regulator.

4.9.3 STARTER: The time used for the starter 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 starter should be avoided. Fig.15 shows the wiring of the starter.

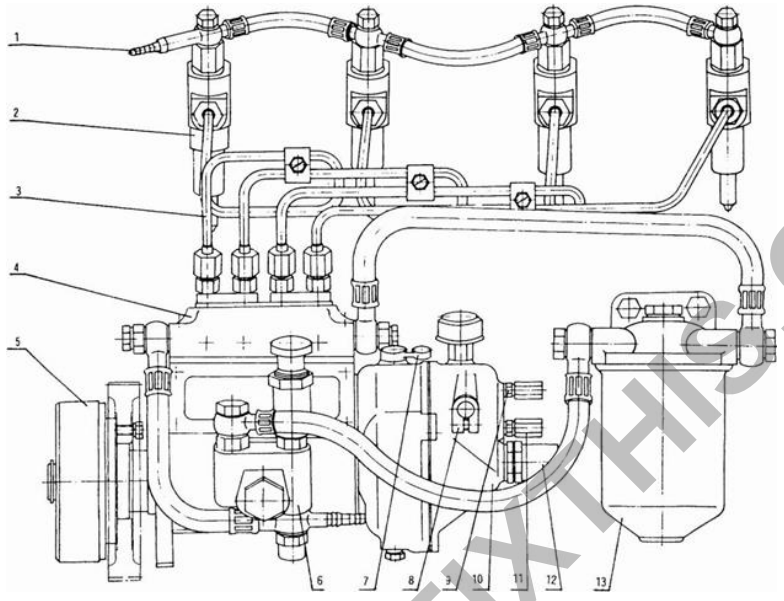
FIG. 15 WIRING OF STARTER



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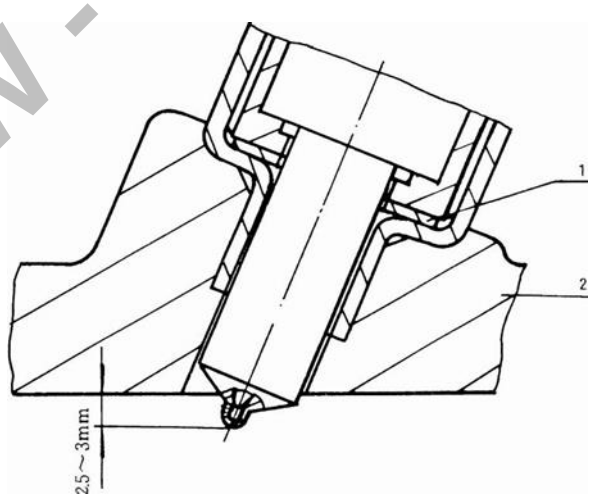
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FIG. 11 FUEL SYSTEM



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

FIG. 12 PROJECTION OF NOZZLE TIP BEYOND CYLINDER HEAD BOTTOM FACE



1-WASHER 2-CYLINDER HEAD

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1.2 TECHNICAL DATA:	
1.2.1 VALVE TIMING (in crank angle):	
Intake Valve Open	12° before T.D.C.
Intake Valve Closed	38° after B.D.C.
Exhaust Valve Open	50° before B.D.C.
Exhaust Valve Closed	14° after T.D.C.
1.2.2 INTAKE AND EXHAUST VALVE CLEARANCES (Cooled State)	0.28-0.33mm
1.2.3 INJECTION TIMING (STATIC)	17±0.5°CA before T.D.C.
1.2.4 OPENING PRESSURE OF THE INJECTOR	20.3-20.8 MPa

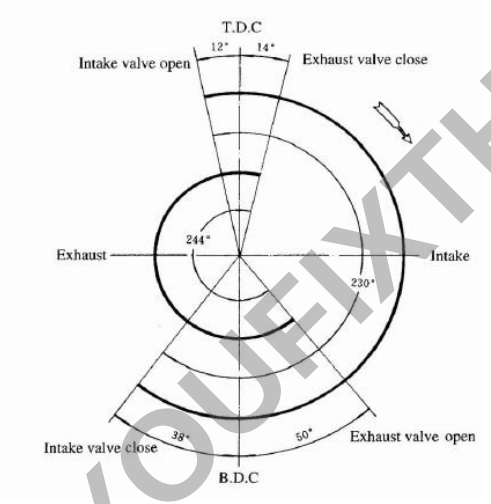


FIG.1 VALVE TIMING

1.2.5 RANGES OF TEMPERATURES AND PRESSURE:	
Exhaust temperature	≤823K (550°C)
Oil temperature	≤368K (95°C)
Outlet water temperature at rated power	343-368K (70°C-95°C)
Oil pressure	196-441kPa
Oil pressure at idle speed	≥49kPa
1.2.6 TIGHTENING TORQUES OF MAIN BOLTS:	
Cylinder head bolt	120-140N.m
Main bearing bolt	120-140N.m
Connecting rod bolt	88-93N.m
Flywheel bolt	110-130N.m
1.2.7 OIL SUMP CAPACITY	≈7 liters

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3.3 Maintenance after Every 500 Hours Service:

In addition to the items listed in section 3.2, the following operations should be carried out.

3.3.1 Check injection timing, adjust it if necessary.

3.3.2 Check sealing condition of valves, lap with their seats if necessary.

3.3.3 Clean fuel piping.

3.3.4 Check connecting rod bolts, main bearing bolts and flywheel bolts for their tightness and their lock condition.

3.3.5 Retighten cylinder head bolts. Re-adjust valve clearances.

3.3.6 Renew oil in injection pump.

3.3.7 Clean or renew oil filter cartridge.

3.3.8 Clean or renew air filter cartridge (according to the contamination of the atmosphere, this operation can also be carried out in section 3.2.).

3.3.9 Clean cooling system. First drain out cooling water in the system, then fill in with cleaning fluid (a water solution of 40 grams of soda Na2C03 and 10 grams of water glass Na2Si03 in each liter of water).After stay still for 8 to 12 hours run the engine until the fluid reaches normal working temperature. Shut down the engine and immediately drain the fluid out before scale can settle down. Finally, flush the system with clean water.

3.3.10 Check thermostat.

3.3.11 Check starter and alternator, and re-fill grease. Check connections of the electric appliances.

3.3.12 Clean the dirt deposited on intake and exhaust manifolds and exhaust muffler.

3.3.13 Check various parts of the engine and carry out necessary repairing or adjustment.

3.4 Storage of the Engine:

3.4.1 If an engine is going to be out of service for a long period, after it's shutting down, drain off lubricating oil, cooling water and fuel completely before the engine cools down. Clean oil sump and strainer.

3.4.2 Carry out relevant maintenance.

3.4.3 Dismantle intake and exhaust manifolds. Fill into each cylinder through the ports with 200 grams of clean dehydrated lubricating oil (oil having been heated to 110°C to 120°C to expel all water content),and turn round the crankshaft to distribute the oil over the surfaces of valves, cylinder liners and pistons.

3.4.4Wipe away all oil sludge and dirt from surfaces of the engine. Smear unpainted surfaces (except those made of rubber or plastic) with antirust oil (a mixture of dehydrated lubricating oil and grease).

3.4.5 Plug up inlet and outlet water ports and openings of intake manifold, exhaust manifold and exhaust muffler with wooden plugs or plastic films.

3.4.6 The engine should be stored in a dry and clean place with good ventilation.

With this method the engine is able to be stored for three months. After three months this operation should be carried out again.

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