

OPERATION&MAINTENANCE MANUAL



SERIE DIESEL ENGIEN

OPERATION&MAINTENANCE MANUAL

揚動股份有限公司

YANGDONG CO., LTD

Foreword

Series Yangdong multi-cylinder diesel engines are ideal power units for light vehicle, agro motor, small tractor, air conditioner in bus, generator set and engineering machinery.

The normal and reliable operation and long service life of the engine depend not only on the manufacturing quality, but also on the reasonable operation and correct maintenance.

In order to provide the detailed description and instruction of this engine for operators to manipulate it correctly in short time, we offer this manual which briefly describes the performance of series Yangdong diesel engines to operators, maintenance workers and relevant managers.

Since the construction of this engine is subject to frequent improvement and development during production and practice, it is possible that the engine supplied is somewhere not exactly the same as one described herein. Please pay attention to that when reading the manual.

Warning Notice

- 1, It is strictly forbidden to use inferior and dirty diesel fuel or lube oil. Please choose to use fuel and lube oil with stipulated number according to the instruction.
- 2, It is strictly forbidden to leak out from an intake system (air filter, pipelines and connecting components)
- 3, It is strictly forbidden to have hard water (well water or spring water) as cooling water, if necessary to apply the hard (water), soften it first.
- 4, It is strictly forbidden to start under the circumstances of lack of lube oil or water
- 5, It is strictly forbidden to operate at overload or under other conditions against the rules
- 6, It is strictly forbidden to regulate the fuel injection pump at will
- 7, It is strictly forbidden to change the diameter of the pulley
- 8, To control the starting time (less than 15 seconds) and the starting interval (more than 2 minutes) strictly
- 9, It's must to maintain the diesel engine technically in the allotted time

10, ambient temperature under 0°C, discharge all the coolant to prevent frostbite after stop

11, all the filters(include air pump filter) maintain, repair or instead according to the provision

Notice of winter

Make sure the usual running of engine; please pay attention the items as following:

- 1、 please use “-10#”light diesel oil
- 2、 please use Class CC or CD 10W/30 or 5w/30 diesel fuel, and the Class CD diesel fuel for turbine charger
- 3、 Make sure the connecting reliable and available between battery and start motor
Battery capacity should be conform to specification of manual
The total length of front line, ground line should less 2 meters, and area more than 40 mm²
The total length of front line, ground line should more than 2 meters, and area more than 70 mm²
- 4、 The temperature starting should be below -5°C, and add hot water and fuel
- 5、 Eliminate the air of fuel system
- 6、 Check if the pulverization of injector is normal or no

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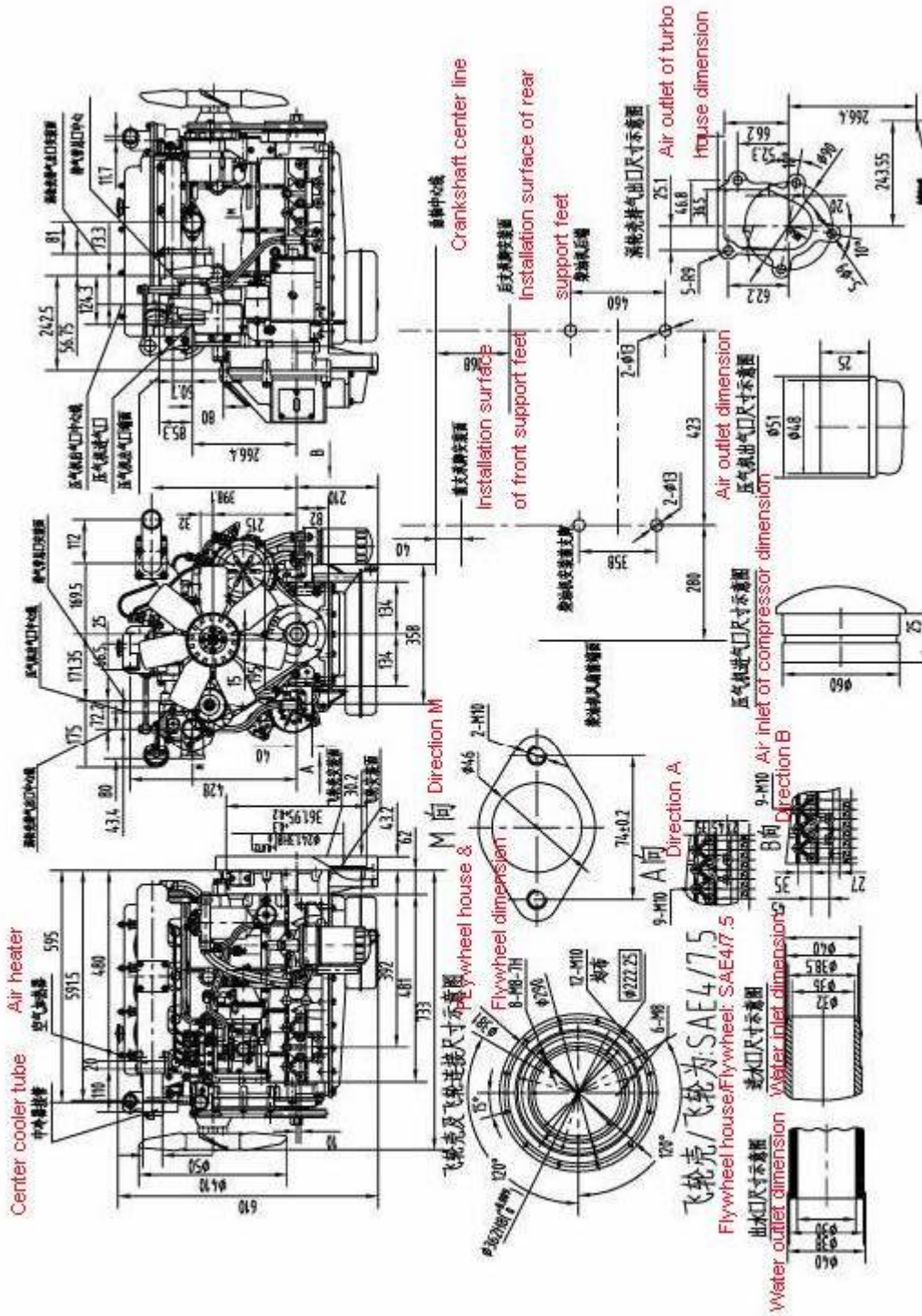
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Wearing parts order sheet

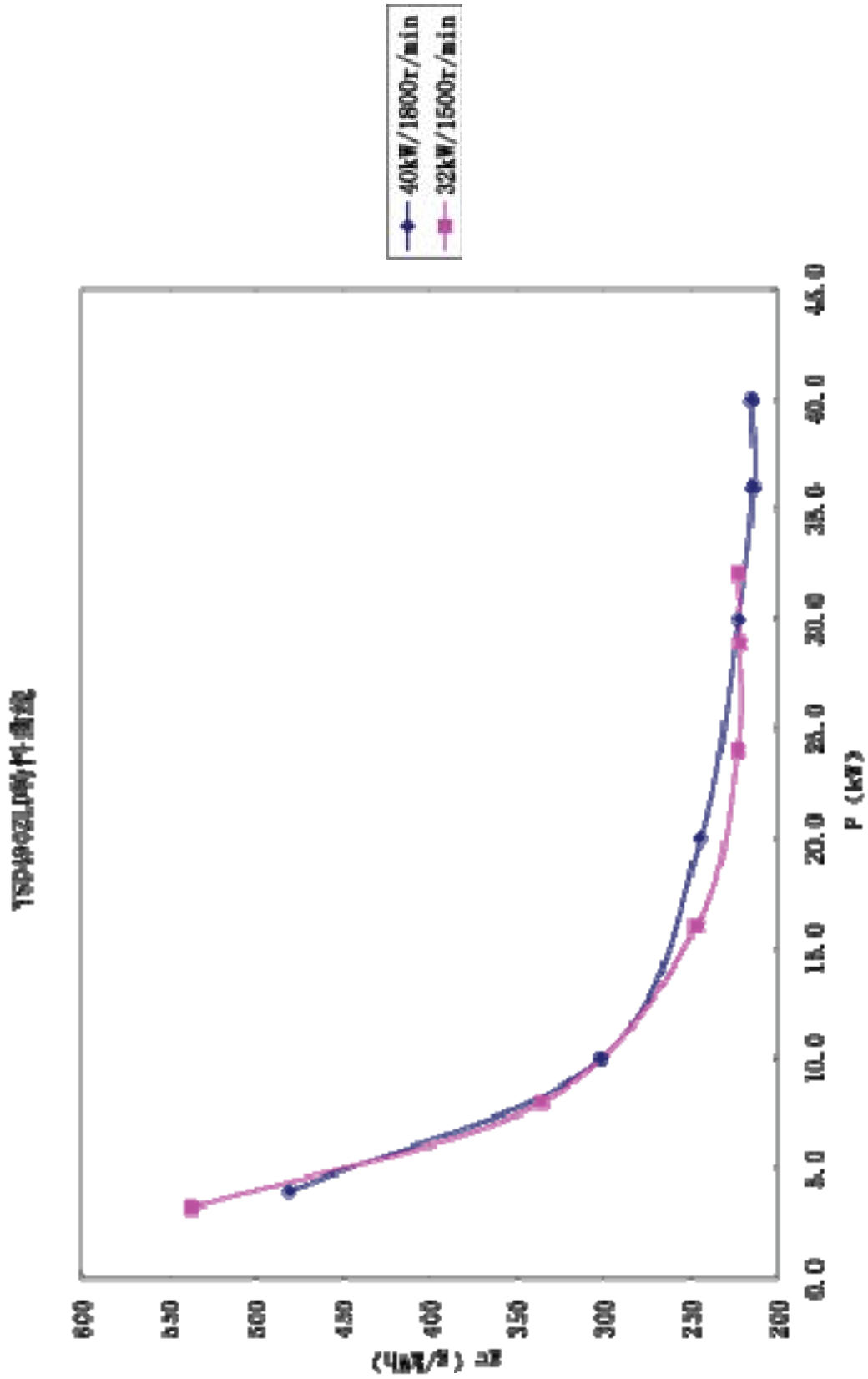
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图十 YSD490ZL外形安装连接尺寸图
Drawing 10. YSD490ZL overall dimension

X



图七 TSD190ZL 的特性曲线

Chart 7. the load characteristic curve of YSD490ZLD

Section 1. Diesel engine specification and technical dates

1、specification of diesel engine

Model	YSD490ZLD	
Type	line、water cool 、 four stroke、 direct combustion chamber	
Cylinder No.	4	
Bore (mm)	90	
Stroke (mm)	100	
Compression ratio	18	
Total displacement (L)	2.54	
Firing order	1-3-4-2-	
Related power (kw)	32	38.4
Related speed (r/min)	1500	1800
Fan diameter (mm)	410	
Advance injection fuel Angle (Before) (°CA)	6±1	
Min.specific fuel consumption at full load (g/kw.h)	≤225	
Oil-fuel consumption ratio (g/kW.h)	≤2.72(the condition of out of factory)	
Direction of crankshaft rotation(facing to flywheel)	counterclockwise	
cooling methods	Forced water cooling	
lubricating methods	Pressure and splash lubrication	
Starting methods	electric	

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Net mass (kg)	280
Dimension (L×W×H) (mm)	733×628×610

2, specification of the main accessories

No.	Name	Specification	
		Y385	Y485
1	Fuel injection pump	Type	Series I or BQ pump
		Governor	All-speed, mechanical centrifugal
		Plunger diameter (mm)	7
		Fuel delivery pump	Single-acting piston-type
2	Fuel injector	model	00P21-15N
		Nozzle set	ZS4S1
		Diameter of nozzle hole	1
		Injection pressure (Mpa)	13.2±0.5
3	Lube pump	Model	Rotor type
		speed (r/min)	1300
		capacity (L/min)	18
		Pressure (kpa)	400
4	Water pump	Model	Centrifugal, volute, single-suction
		speed (r/min)	3000
		capacity (L/min)	80
5	Starting motor	Type	Silicon rectifying shunt dynamo
		Model	QD1322、QD1315A、D138Y、QD138C
		Voltage (V)	12
		power (KW)	1.8 或 2.5
6	Alternator	Type	Brushless alternator

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		Model	JF13 或 JF15
		Voltage (V)	14
		Power (W)	350 或 500
7	Fuel filter	Type	Single stage, paper element
		Model	C0506A
8	Lube oil filter	Type	Single stage, paper element
		Model	J0708 或 J0810 或 J0810H
9	Air filter	Type	Oil-immersed
		Model	K1317A 或 CN212

1-4

NO.	Name		Specification		
			YSAD380	YD480	YND485
1	Fuel injection pump	Type	Series I or BQ pump		
		Governor	All-speed, mechanical centrifugal		
		Plunger	7.5		7.5
		Fuel delivery	Single-acting piston-type		
2	Fuel injector	model	P78-1	P78-1	PF68509
		Nozzle set	ZCK154S423	ZCK154S423	ZCK154S425
		Diameter of	4-φ0.23		4-φ0.25
		Injection	19.6 ⁺¹ ₀		
3	Lube pump	Model	Rotor		Gear
		speed	1300		2748
		capacity	18		22.4
		Pressure	400		
4	Water pump	Model	Centrifugal, volute, single-suction		
		speed	3000		4000
		capacity	80		160
5	Starting motor	Type	series shunt DC motor		
		Model	QD1315A、D138Y		
		Voltage (V)	12		
		power (KW)	2.5		
6	Alternator	Type	Silicon rectifying shunt dynamo		

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		Model	JF11 或 JFW13 或 JFW15
		Voltage (V)	14
		Power (W)	350 或 500
7	Fuel filter	Type	Single stage, paper element
		Model	C0506A
8	Lube oil filter	Type	Single stage, paper element
		Model	J0708 或 J0810 或 J0810H
9	Air filter	Type	Oil-immersed
		Model	K1317A

NO.	Name		Specification	
			YSD490ZL	
1	Fuel injection pump	Type	Series I or BQ pump	
		Governor	Single-acting piston-type	
		Plunger	8	
		Fuel delivery	Single-acting piston-type	
2	Fuel injector	model	P78-1	
		Nozzle set	ZCK154S423	
		Diameter of	4-φ0.23	
		Injection	19.6 ⁺¹ _{,0}	
3	Lube pump	Model	Rotor pump	
		speed (r/min)	1300	
		capacity	18	
		Pressure	400	
4	Water pump	Model	Centrifugal, volute, single-suction	
		speed (r/min)	3000	
		capacity	80	
5	Starting motor	Type	series shunt DC motor	Speed down motor
		Model	QD1315A 或 D138Y 或	QD2636A 或 QDJ2508F
		Voltage (V)	12 或 24	
		power (KW)	2.5 或 4.5	
6	Alternator	Type	Silicon parallel shunt motor	
		Model	JFW13 或 JFW25	

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		Voltage (V)	14 或 28
		Power (W)	350 或 500
7	Fuel filter	Type	Single stage, paper element
		Model	C0708B、CX0708B
8	Lube oil filter	Type	Single stage, paper element
		Model	J0810、J0810H、J0814、JX0814
9	Air filter	Type	Oil-immersed
		Model	KW1532、K1526

3, Main technical Data of diesel engines

1. Valve lash(mm)

	YSD490ZL
intake valve(cold)	0.30~0.35
exhaust valve(cold)	0.35~0.40

2. Sink age of valve

	YSD490ZL
sink age of valve	0.7~0.9

3. torque limits of main bolts and nut (N.m)

	YSD490ZL
cylinder head bolts	125~145
connecting rod bolts	100~120
main bearing cap bolts	140~160
flywheel bolts	100~120
clutch house bolts	90~120
crankshaft belt bolts	200~260

4. Temperature and pressure limit

	YSD490ZL
exhaust temperature (°C)	≤590

- (1) exhaust temperature (°C) refer to above chart
 (2) Cooling water temperature (°C) 80-95
 (3) Lube oil temperature (°C) ≤100

- (4) Lube oil pressure in main passage (MPa)

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At normal operation 0.2~0.4

At min. steady speed ≥0.065

5. Governor characteristics

Min .Idling steady speed (r/min) ≤900 steady regulation (%) ≤5

6. Oil sump capacity

	YSD490ZL
oil sump capacity (L)	About 7

7. Battery (engine not include) capacity (A) ≥150

4、Fit clearance and wear limit of main parts

NO.	Name	YSD490ZL	
		Assembly limit	Wear limit
1	connecting rod journal and connecting rod	0.052~0.118	0.20
2	piston pin and connecting rod small end	0.025~0.048	0.10
3	piston skirt and cylinder liner	0.130~0.195	0.40
4	clearance between the 1 st ring and its groove	0.080~0.112	0.20
5	clearance between the 2 nd ring and its groove	0.030~0.065	0.18
6	clearance between the oil scraper and its	0.030~0.065	0.18
7	gap of the 1 st ring	0.309~0.450	1.50
8	gap of the 2 nd ring and oil scraper ring	0.250~0.400	1.50
9	crankshaft main journal and main bearing	0.070~0.154	0.25
10	camshaft journal and bushing	0.100~0.176	0.25
11	idle gear shaft journal and bushing	0.025~0.075	0.18
12	intake valve stem and valve guild	0.030~0.072	0.23
13	Exhaust valve stem and valve guild	0.040~0.082	0.24
14	rocker arm shaft and bushing	0.020~0.071	0.20
15	Axial clearance of crankshaft	0.070~0.262	0.40
16	Axial clearance of camshaft	0.080~0.260	0.50

Section 2. Operation and security requirements of engine

1, Fuel, lube Oil and Cooling water

1. Fuel. Users can choose diesel adopted according to local ambient temperature. In China, we choose according to GB252 light diesel. In summer adopt No."0" light diesel, in winter adopt No."10" light diesel. The diesel must be a long time precipitation before inject into tank (not less than 48h). During refueling should us cloth filters. Thus can extended fuel pump and injector life.
2. Oil. In China generally adopt according to GB11122 Diesel Oil. In summer adopt No.CC40 diesel oil; in winter adopt No.30 diesel oil, used CD class diesel oil for turbo diesel engine. Must filter through strainer when inject in to diesel engine.
3. Coolant. Applications of rainwater, tap water or clean water are suitable. The water wells for water or well water should not be used. If the water contains more minerals, diesel engine cooling water system will have more scale, easy to cause failure. Therefore, If you want to use wells, springs and other water sources, must be softening. There are two ways to soften: (1) boiled (2) in 30 liters of water to add 20 grams of caustic soda (caustic soda), made solution. Can add antifreeze in cold winter. Ant freezing Fluid is the most commonly used public glycol (TEG) aqueous or alcohol. Diesel difficult to start in low temperature, cooling water can be heated to 80 °C to use.

2. Preparation before starting

- 1, Check if the joints that fix the diesel engine are reliable and if the operating handle is flexible.
- 2, Rotate the crank for several times to check if the moving parts are flexible and if there is any obstacle.
- 3, Check if the oil surfaces inside the oil sump and injection pump are within regulated scale range, and if the oil tank is full and if the fule loop is smooth.
- 4, Turn on the fuel tank valve to check if there is are inside the loop, if yes; loosen the

discharge bolts of the diesel filter and injection pump. Then press handle pump on the transmission oil pump until the air inside the oil loop is discharged completely. Then screw up the discharge bolt before loosening the high pressure oil pipe joint nut at the end of the oil injector. Rotate the rank to discharge the air inside the high pressure oil pipe. After air is totally discharge, screw up the pipe joint nut and meanwhile check if there is any oil leakage at each oil pipe joint.,

5, Check if the water tank is filled with coolant, and if there is any water leakage at the water pipe joints.

6, Check if the joints of the parts of diesel engine are reliable or not. Check if the storage battery is charged sufficiently, and if the joints of the lines of electric appliance system are correct and reliable.

7, Check if the clutch is out of position.

3. Starting

1, Position the timing handle and medium speed position;

2, Rotate the ignition switch to the pre-heating position to make the thermo switch preheated for 20 to 30 seconds;

3, Rotate the ignition switch to open position, and press the start button to make the diesel engine start. If the diesel engine cannot be started, loosen the button right away and wait for 2 to 3 minutes to restart it. If the diesel engine fails in starting for three times successively, check the fault cause and eliminate the faults before restart.

4, After the diesel engine is started, loosen the button, and rotate the ignition switch to another position. Connect the generator charging circuit to charge the generator. At the same time, adjust the gun to observe the rotation velocity meter. Make the diesel engine runs in 600~800rpm and check if the diesel engine is normal or if there are any abnormal sounds. Especially pay attention to see if the pressure of oil is correct. Then pull the timing handle gradually to make the rotation speed of diesel engine reach 1800~2000 rpm, and warm the machine without load.

4, Running

1, when the coolant temperature reaches 50°C and the oil temperature over 40°C, working with load is permitted. When using normal conditions, the water temperature shall

reach about 80°C.

2, Increase or decrease of the diesel engine load and rotation speed shall be carried out evenly and gradually. Under normal conditions, it is not allowed to add or remove the load suddenly.

3. During the operation time of the diesel engine, pay attention often to seek if the reading on the instruments on the instrument panel is normal. Pay attention to the exhausted gas color and the operation sound. Stop the machine for inspection if there is anything abnormal.

5、 Stopping

1. Before diesel engine stopping, it should reduce the load speed gradually to make the speed at 900rpm around until the water temperature dropped to below 70 ° C, then it can be stopped by manipulation of the handle.

2. After diesel engine stops, it should rotate the ignition switch to the middle Place.

3. In Winter, when the environmental temperature below 5 ° C, after stopping, open the water switch on the body and radiator when temperature is below 60 ° C, give out the cooling water to prevent frozen machine. There is no need of giving water out if water has been added Ant freezing Fluid.

6、 Security requirements

1. When engine works for generating-set, all the exposed parts and rotation parts that may be danger to operators must device with a warning mark.

Protective Shell, partition steel should have sufficient rigidity, that only be removed in the use of tools.



2. Diesel engine workplace must be well-ventilated, whenever possible accumulation of flammable, toxic or asphyxiated gas in place, should be installed ventilation facilities.

3. The Diesel Engine operation place must have non-slip cover. Work channel, manipulation platforms, staircases and other

regional operators must be installed guardrail to prevent people and goods sliding down.

4. The engine when is working, need to equipped with water temperature meter, oil pressure meter and instructions system.
5. When engine is in operation of adjustment, and there is abnormal sound, running away or lubrication failure or the environment when used in the combustible exhaust temperature exceeds the limit, we should promptly cut off fuel (put handle off, cut off the fuel line method) and air (blocked) inlet or adopt other effective measures to stop the engine quickly.
6. The inlet of fuel tank and the outlet of air flow should far away from the surface of high temperature and the electronic equipment. Make sure the fixing bolt of fuel tank is well fixed to allow the fuel tank without leakage.
7. When locate the heat changer should put at eye-catching place with warning mark. And make a caution to operator that shouldn't open the cover of heat changer immediately to prevent burn injury.
8. The air outlet of diesel engine and silencer are the surface of high temperature. Operator should not touch the surface under the operation state of diesel engine. If the user takes the insulation material as a protection, make sure the fuel oil not into it to prevent fire.
9. When use the diesel engine at follow condition: 1.ship use 2. Gasoline industry use 3. Fuel use 4. Chemical industry use 5. Gen-set use 6. Common use, use coolant to the air outlet and the silencer of the diesel engine or some effected protection as well as warning mark. And the insulation material should be flameproof also make sure the fuel not leak into it to against the burn and fire.

Section 3 Maintenance

To make engine work reliably, lower abrasion parts, extend service life, make sure the regular maintenance for the engine system according to the following technology rules:

1、 Routine maintenance

- 1、 Check the oil level is under the gauge rated range. New machine or long time no used machine should stop after five~ten minute low speed running when gas. Then use gauge measure the oil level.
- 2、 Check the water level of heat changer
- 3、 Check the oil level on the oil pump of the governor whether if at rated level.
- 4、 Exclude the leakage situation of water, oil and gas on the diesel engine.
- 5、 Check the fasten class and the layout correction of parts on the diesel engine.
- 6、 Check every holding parts and connectors whether if connect well.
- 7、 Pretend the clear of diesel engine. Use the duster that diped some gas to clear oil, water, and dust especially make sure the clear and dry of electronic equipment, also clear the dust of the heat sink on the water tank
- 8、 Should replace the oil at the oil house, oil pump and governor at once after the 50 hours running, and wash clear the oil filter, the oil house and the oil filter net.
- 9、 Eliminate all faulty and unmoral situations.

2、 Maintenance after 100 accumulated operating hours

Except the daily maintenance, make sure to do the following as well:

1. Replace the sump oil.
2. Clean or replace oil filters.
3. Clean or replace diesel filter (after working continuously 200 hours).
4. Check the bolt firmness of cylinder
5. Check Valve Gap to measure up, adjusted it if necessary.
6. Check fan belt tension extent, adjust it if necessary.
7. Oil ZG-4 lubricant into the water pump bearing with grease gun.
8. Clean the dust accumulated in the air inlet pipe, dust pan of the air filter and on the surface of paper filtering core, and remove the dust inside the air exhaust pipe and the muffler.
9. After 200 hours running in total, check the oil injection pressure and the injection status. Clean the needle valve parts if necessary, and re-adjust the oil injection pressure.
10. Check the battery voltage and liquid proportion, which shall be 1.27-1.28(when the air temperature is 20°C).If the proportion drop to 1.14,charge the battery. The

electrolyzed liquid surface shall be 10-15mm higher than the electrode board, and supplement distilled water when the electrolyzed liquid is insufficient.

11, Components disassembled due to maintenance work shall be cleaned before re-assembly, and the installation position shall be guaranteed correctly. Then start the diesel engine and check its operation. Remove errors and abnormal phenomena found.

3、 The maintenance after 500 hours' operation

Besides the items in “maintenance after 100 hours' operation”, the following jobs shall be added as well:

1, Check the oil injection pressure of the injector and observe the pulverization quality of oil injection. Clean the needle valve parts and re-adjust the oil injection pressure if necessary.

2, Check the working conditions and the oil supply advanced angle of the oil injection pump, re-adjust if necessary. Re-adjust the oil supply to the oil pump on the oil pump test bench if conditions allow.

3, Check the sealing condition of air inlet and exhaust valve and the air valve stand. Grand and rectify if necessary, and re-adjust the clearance between the air valves.

4, Check the fixing status of connection rod bolt, main bearing bolt and flywheel bolt.

5, Re-fasten the bolt of cylinder cover, and adjust the clearance between the air valves according the regulations.

6, Clean or change the filtering core of the air filter.

7: Clean the cooling system, the detergent comprised by 150g NaOH and 1L water. Discharge the water in cooling system before cleaning, and then fill full it with detergent. Start the diesel engine after reserving the detergent for 8~12 hours. and stop when the water temperature reaches the working temperature. Discharge the detergent immediately to avoid the furring deposit. Clean the cooling system with water at last.

8, Check the working conditions of the thermostat, and check the water prop inside the water discharging hole in the water pump. If water drop is serious, replace the water seal.

9, Check the joints of the electric circuits of the electric equipment are firm or not, and the lead contact is good or not. If there is burning mark found, clean it immediately.

10. After 1000 hours of working accumulatively, add the following work:

(1) Generally inspect the parts of the diesel engine, and carry out necessary repair and adjustment.

(2) Dismantle the generator and the motor to clean the old butter on the bearing and replace new butter, meanwhile check the gears on the driving motor.

11. After 1500 hours of working accumulatively, add the following work:

(1) Dismantle the cylinder cover; check other parts between air valve and air valve stand and cylinder cover set.

(2) Remove the deposited carbon on such parts as cylinder lid, cylinder cover, piston and piston ring, and clean thoroughly.

(3) Check and measure the abrasion of piston and piston ring.

(4) Check and measure the abrasion of internal holes of cylinder cover.

(5) Check and measure the abrasion of crank necks.

(6) Check and measure the abrasion of main shafting and connection rod shaft.

(7) Clean the oil tunnels inside the engine and change oil.

4、preservation and storage of engine

When the diesel engine is to be stopped for a long time, the following methods can be taken for sealing and preservation.

1. After stopping the engine, discharge oil, coolant and fuel thoroughly when they are hot. Clean the oil sump and the filter.

2, Clean the dust and oil on the surface. Apply anti-rust oil onto the parts that without paint. No oil shall be supplied onto rubber and plastic products.

3, Heat the filtered oil to 110~120°C, until foams disappear totally. Then fill the dehydrated oil to the oil sump until it reaches the upper scale of the oil gauge and turn the crank to make the whole lubrication system full of oil.

4, Add some dehydrated oil to the cylinder from the oil injector installation hole on the cylinder lid and then turn the crank to make the oil adhere onto piston, piston

ring, cylinder cover and air valve sealed surface.

5, The mouths of air inlet and exhaust pipes(muffler) shall be blocked with wood lid or plastic cloth to avoid immunities enter.

6, Diesel engine shall be placed in dry and clean location with good ventilation. It shall be covered to avoid dust drop. It is prohibited to pile chemical products near the diesel engine.

The aforesaid oil sealing method can be used to preserve the machine for 3 months. When exceeding such time limit, re-seal it with oil.

Section 4 Engine adjustment

1、 adjustment of valve lash

When carrying repair or technical maintenance to the diesel engine, it necessary to check the clearance between the air valves. The adjustment method for clearance between the air valves and the distribution structure is as follows(Please refer to the figure):

1, Dismantle the cylinder cover, check and fasten the bolt on the air valve rocker shaft stand.

2 Turn the crank to the first cylinder piston stop position, when the "O" scale on the crank belt wheel aims exactly with the indicator in the timing gear cover.

3, Insert the thick and thin dividers respectively into the air and exhaust valves of the first cylinder and the rocker, check and adjust the clearance between the air valves and keep the cool clearance between within regulated valve. After that, according to the cylinder working order 1-3-4-2 to rotate the crank(i.e. 1800),and adjust

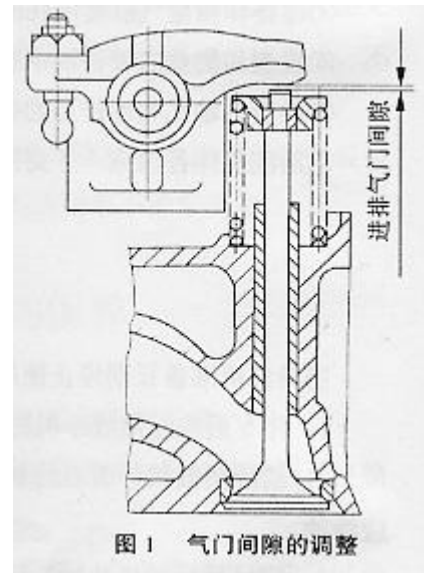


Figure 1
adjustment of valve lash

2、 adjustment of injection timing

In order to obtain the most economic fuel consumption rate and good operation functions of the diesel engine, the advanced for oil supply shall be adjusted properly. The adjusted value of the advanced angle for oil supply must comply with the requirements of technical parameters of the diesel engine.

The method for adjusting the advance angle for oil supply is as following:

1, Remove the air inside the fuel system, and repeated the rotating of crank to make the oil injection pump full of fuel. Dismantle the high pressure oil pipe of the first cylinder, and slowly turn the crank in positive directions, and pay close attention to the oil surface inside the oil pipe joint hole. When the oil surface waves, stop rotating the crank.

2, Check the scale that the finger marked on the crank belt wheel according to the best angle in regulation.

3, If the advanced angle for oil supply is too large or too small, loosen the 3 bolts that connect the high pressure oil pump with the gear room and adjust by rotate the high pressure oil pump,(as figure 2). From the front to the rear, the oil injection pump will move clockwise, and the advanced angle for oil supply gets smaller; move anticlockwise, the advanced angle gets enlarger. During every rotate, it shall be fasten 3 bolts and countercheck the advanced angle, till to make the oil supply advanced angle according the regulation.

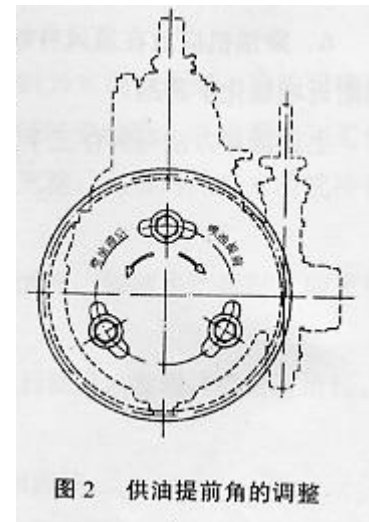


Figure 2
adjustment of injection
timing

3、 adjustment of injector

The test and adjustment of oil injector shall be carried out on the test bench, with its purpose to adjust the oil injection pressure, and observe the pulverization quality and remove the errors.

When the oil injection pressure of the oil injector is too high or too low, injection

abnormal or parts are damaged, the diesel engine might have errors during operations such as block smoke, power and rotation speed decreases, temperature discharge too high or impact on the cylinder, etc. The judgment on oil injector with errors can adopt stop-in-turn method, i.e. loosen the connection nuts between oil injector and high pressure oil pipe one by one to stop oil injection, and meanwhile observe the color of smoke exhaust. If there is any oil injector with faults, stop the oil injection and no smoke will be discharged; rotation speed changes little or without any change. It is also feasible to rotate the flywheel one by one to listen to the oil injection sound, when clear sound is lost; it means the oil injector in this cylinder might have errors on it.

1. Adjustment of the oil injector

(1) Handle the pump to the gauge pressure close to the oil injection pressure, and keep slowly pressing the handle pump to increase the surface pressure to regulated oil injection pressure. Observe the oil injection hole, where should not have oil drop or leakage. If after several times of test, there is still oil drop, dismantle the injection nozzle parts to clean, check or grind before carrying out the test.

(2) Adjust the oil injection pressure to regulated the pressure, and dismantle the pressure adjusting nut, loosen or fasten this nut, make the oil injection pressure accord to the regulated oil injection pressure, then fasten the nut and try again.

(3) Observe the spraying quality. Carry out pulverization test in the once/second oil injection speed. The oil shall be even fog without any visible splashed oil foam, partially uneven thickness or single side injection abnormal, etc. Clear sound shall be occur when cutting off the fuel. In general, abnormal oil injection occurs caused by the inflexible movement of injection nozzle needle valve. The drop of oil on the injection hole usually occurs because of damage on the sealed surface, and the oil separation from the carbon accumulation on the nozzle or hears deformation.

1. Dismantle and repair of oil injection

(1) When dismantle the oil injection, clean the external part to make the nozzle face upward and clamp it to the table pliers with bronze pad. Screw down the nut to take out the needle valve parts and pull out the needle valve to soak into clean diesel. Turn the oil injector for 180° and clamp. Take down the pressure adjusting nuts and screw to take out pressure adjusting spring and top rod.

(2) If the needle valve parts are snapped or the pulverization is not good, clean it right away. If the needle valve parts are snapped, soak them in diesel for some time,

and then clamp the needle valve with iron thread plier, and pull out lightly to avoid napping. When cleaning the needle valve parts, scratch with wooden piece with gasoline or diesel but metal piece is not allowed. When the needle valve and its parts are not smooth or the movement is inflexible, grind adjustment can be carried out. Use clean diesel when grinding. Grinding in pairs shall not impact on the needle valve or its stand, and clean after grinding without any metal dirt reserved.

4、 adjustment of lube oil pressure

Adjustment of oil pressure is shown in Figure 3. Loosen and fasten the nuts; adjust the nuts with spanner to make the oil pressure within 200-400kPa (it is allowed to be higher when the machine is cold). Screw up the nuts after adjustment.

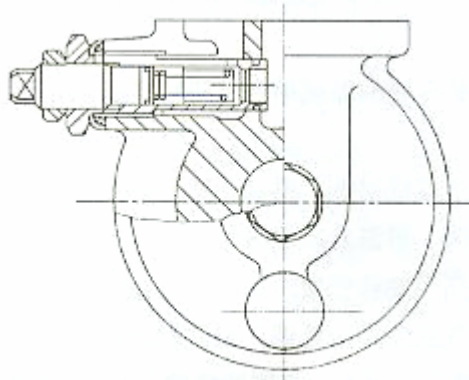


图 3 机油压力的调整

Figure 3: adjustment of lube oil pressure

5、 adjustment of injection pump

The oil injection pump has been adjusted and checked before delivery. If re-adjustment is required, it shall be carried out on special oil injection pump test bench with standard oil injector and standard length high pressure oil pipe according to relevant instructions on oil injection pump.

6、 adjustment of decompression arm lash

Turn the Crank to the first cylinder piston stop position, when the "0" scale on the crank belt wheel aims exactly with the indicator in the timing gear cover. Inset the thick and thin

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dividers respectively into the air inlet and exhaust valves of the first cylinder and the rocker, check and adjust the clearance between the air valves and keep the cool clearance between within regulated value. After that, according to the cylinder working order to half rotate the vcrand and adjust the clearance between the air valves.

Section 5 Construction of diesel engine

1、cylinder head

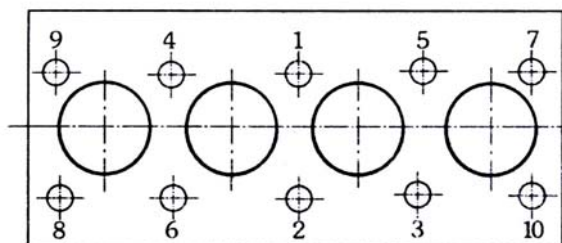


Fig.4 Tightening sequence of cylinder head bolts

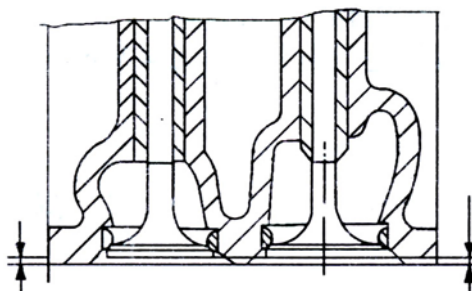


Fig.5 Valve sinkage

The cylinder head is made of HT200 cast iron (with copper chrome). Fix it on the cylinder body with bolts for the cylinder head. When tightening the bolts for assembling, torsion spanner is employed to tighten as the figure 4 indicated below, then the required tightening force moment is achieved. After the cylinder head has been assembled and heated for the first time, all the bolts for the cylinder head shall be re-tightened as required and readjust clearance of the air valves.

The air inlet and air outlet is made of different materials. The air inlet, air outlet and valve seat have been matched and grinded to avoid air leakage.

When the air valve and seal surface of the valve seat are burned, air leakage, grinding is required. After grinding is completed, check air leakage of the valve and inspect the sealing conditions.

The valve seat is made of alloy cast iron. Normal width of the air valve and valve seat is 1.2-1.6mm. After long-term use and grinding for many times, if the sealing surface becomes wider which leads to poor sealing, reamer is adopted to amend inner hole positioning of air valve conduit, then grind the valves and the inner hole positioning as

required.

As for a new one, sinking distance between the plane of the air inlet and air outlet and the plane of the cylinder head is 0.7-0.9mm, as figure 5 indicated. After amendment to it for many times, the sinking distance may be increased. When it exceeds 2mm, it's recommended to change the valve seat.

The valve clearance shall be checked regularly. See Section 1 of chapter V for detail on adjustment methods. If the valve clearance is excessive, it may affect correctness of gas distribution and timing and increase noise of the valve structure; insufficient clearance may lead to incomplete closing and burning of the air valve.

2、cylinder block

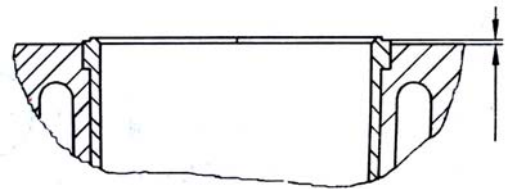


Fig.6 protruding height of the liner flange plane relative to the plane of cylinder block

The cylinder body is made of cast iron HT250 and portal shape structure is adopted. Besides the installation hole, bolt hole for cylinder head on the top of the cylinder body, the water hole to the cylinder head, and lubricant hole at the back of the cylinder body to the cylinder head are on it.

Water pump and engine oil pump are installed at upper part and lower part of front-end of the cylinder body. Fly wheel casing is installed at back-end of the cylinder body. The lubricant inlet and bolt hole for installing crankcase oil tray are located at the bottom of the cylinder body. When dismantling the diesel for repair, each oil channel shall be repaired to ensure clean and unblocking. Bulkhead of each channel shall be sealed and oil leakage is not allowed.

The main bearing is of fully-supported suspending type. Matching brazing is employed for main bearing casing and the cylinder body. Matching marks are marked on the cylinder body and main bearing casing. Any exchange or reverse assembling is not allowed. The main shaft bushing is the shafting bushing of high tin bronze zergarl. When

dismantling it for cleaning, do not mistake the upper and low shaft bushings (the upper shaft bushing with oil groove). The thrust plate is located at the last piece of the main bearing. Each of the two is located at the front and back end respectively. The thrust plate bears axial thrust of the crankshaft, with oil groove on the work surface and the reverse side. After crankshaft assembly is completed, it shall be flexible.

The cylinder sleeve is made of boron cast-iron and of wet type. Flange surface of the cylinder surface is 0.02-0.10mm higher than the body top to ensure sealing of cylinder sleeve and head. See figure 6.

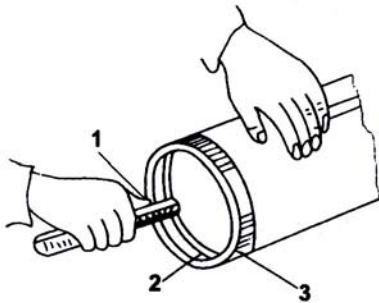


Fig.7 Measurement of piston

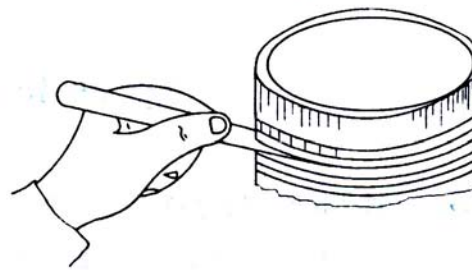


Fig.8 Measurement of side surface gap
of piston ring

ring end gap

1. Thickness feeler(gauge) 2.piston ring 3. Cylinder liner

3、 Piston and connecting Rod

The piston connection rod assembly consists of piston, piston ring, piston pin, retainer ring, connecting rod, connecting rod casing, connecting rod bolt, connecting rod bushing and connecting rod lining and etc. Mass deviation of the connecting rod assembly of the piston for the same diesel shall be no more than 3g. ZL109 alloy aluminum is employed for the piston.

The gaseous ring is made of alloy cast iron. External circle of the first gaseous ring is coated with porosity chrome, which can reduce abrasion between cylinder sleeve and piston ring. The second gaseous ring is a taper-face ring, the surface marked TOP faces the top face. Reversing assembly is not allowed.

Caulking ring is employed for the oil control ring. As its resilience reduces by

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abrasion, it still remains a certain of radial resilience, therefore, it extends service life of the oil control ring.

Please check clearance of the opening before installing the piston. Keep the piston ring flat. 15-20mm away from top face of the cylinder sleeve. Then measure it gas feeler, clearance of the opening shall be 0.3-0.4mm. See figure 7 for detail. If with clearance of the opening is smaller, amend it with a file; if clearance of the opening is larger, change a new one, In addition, it's necessary to measure the end face clearance between the piston ring and the piston ring groove with a gap feeler. Clearance for the first gaseous ring shall be 0.060-0.092mm, and the second gaseous ring shall be 0.040-0.072mm, see figure 8 for detail.

Special purpose tool shall be employed for dismantling the piston ring. When assembling, opening positions of each piston ring shall stagger 120 degrees and not put on the direction of the piston pin.

During maintenance, if the piston ring can not move smoothly, immerse it in diesel (diesel or petroleum) for twenty-four hours or longer, then knock on the piston ring. After it is released by itself, take it out of the diesel and clean it with diesel or carbon tetrachloride.

Check if there is any rupture or crack on the piston ring, change a new one if any defect is found.

No.45 steel with die forging technology is made of the connecting rod. Section surface of the connection rod body is I-beam axle. Parting plane of the big end is 45 degrees to the connecting rod body. The connecting rod and connecting rod casing shall be corresponding borehole. Assemble it with marks and no error shall be made during assembly. Positioning lip is used for positioning for the connecting rod and connecting rod casing. Bolts for connecting rod are made of 40Cr steel. The upper and lower shaft bushings for the connecting rod are made of copper-lead alloy and tin-aluminum with support. When the clearance exceeds its limit value by abrasion or the surface wears off or burns. Please change the new ones in couple.

Before overhaul for the diesel or assembling(disassembling) the connecting rod assembly, clean the deposit carbon and oil stain on upper part of the cylinder sleeve. Coat clean engine oil on cylinder trepan boring, external surface of the piston, piston ring, shaft bush for connecting rod, crankshaft, connecting rod journal and etc, then place the guide bush on the cylinder sleeve. Rotate the crankshaft, assemble the connecting rod in

the cylinder sleeve carefully, and tighten the bolts in turn with required force moment.

4、 crankshaft and flywheel

Timing gear for the crankshaft and belt pulley are installed at the front of the crankshaft, The flying wheel is installed at the back flange and positioned by the positioning pin. Six bolts are used for tightening the flying wheel as specified force moment, one 6203-z bearing is installed at the center of flange of the back of the crankshaft to support the transmission shaft of the transmission case, scale mark of provided at belt pulley of the crankshaft for observing the angle of the advance for blowout.

The flying wheel is made of high temperature. Ring gear of the flying wheel is located at the external circle of the flying wheel. Scale mark is provide at flying wheel for observing the angle of advance of oil blowout

5、 camshaft

In the front of the last cam of the cam shaft (from the frond side), there is gear which support the driving oil pump. When the cam shaft is rotating, the cam pushed the standing pillar to control air inlet and air outlet of each cylinders.

Thrust flange is provided for the second shift can bearing casing, it can control axial direction drunkenness of the can shaft. Bearings for each shift of the can shaft receive lubricant from the main oil channel. When installing lining for the front end, please check the oil holes of the lining and body are connected or not. As the camshaft gear is engaged with the driven gear on the oil pump, therefore, before dismantling the camshaft, it is necessary to disassemble the lube oil pump, and then draw the camshaft out from the front end.

The axis of the tappet deviates from the center line of of cam width. During operating, the tappet rotates so as to provide an even wearing on the bottom surface and the cylindrical surface of tappet.

6、 gear transmission system

The gear transmission system consists of timing gear for crankshaft, timing gear for cam shaft, timing gear for fuel injection pump and one inertia pump.

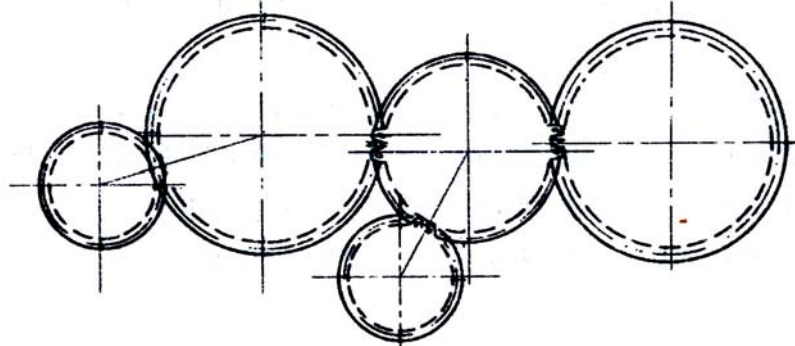


Fig9: timing gear meshing signs

Each timing gear is marked with timing gear except the gear for hydraulic pump. Tooth position is the gear shall be in corresponding position, (the gear marked with number shall be in the middle of th4e gears adjacent numbers), to ensure mutual motion relation of the parts, see figure 9 for detail. When installing gear for fuel injection pump separately, the angel of advance for oil supply shall be met first, and no mark is necessary, if marking is required, marks of the said three positions shall be aligned.

Special purpose tools are employed for assembling and disassembling for timing gear of the crankshaft maybe installed by utilizing the two M8 screws on the wheel spoke of the gear and serrated screws. Slippage positioning is employed for timing inertia gear and the body. The timing gear of fuel injection pump is installed at the advance for oil supply, which is fixed on the cam shaft of the fuel injection pump, only by unscrewing two M8X35 bolt should we take out the gear for fuel injection pump.

7、 fuel and governing system

Seventh. Fuel and speed adjustment system is the mail operational parts of the diesel, which includes fuel conveying pimp, diesel filter, oil blowout pump, adjuster, advancer, high-low duct and etc, see figure 10 for details

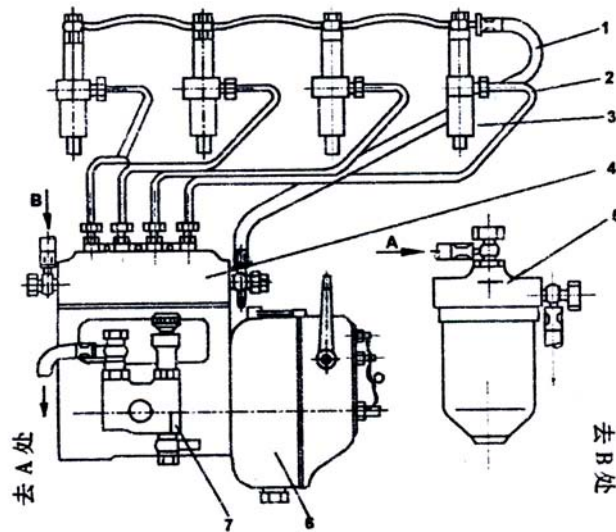


Figure 10 fuel adjustment diagrams

1. fuel return pipe 2. Fuel injection pipe 3. Injector 4. injection pump 5. Fuel filter 6. Governor
7. fuel delivery pump

The fuel conveying pump takes charge of conveying the fuel to the diesel filter, then to the fuel blowout pump. The fuel generates high pressure in the fuel blowout pump, then spray into the combustion room to burn from fuel injector through high pressure duct in the form of mist.

The fuel conveying pump is a single action piston oil pump. Installed at the external side of the oil injection pump and driven by the eccentric gear on cam shaft of the fuel injection pump.

The fuel injection pump has been calibrated by the manufacturer. Do not dismantle it without permission. If dismantling for repair and adjustment are required, please keep it clean. Plunger piston, oil outlet and other couple part can not be exchanged.

Fully mechanical adjuster is employed. Rotation speed of the diesel increase relatively; when the speed adjustment handle moves towards the direction for releasing the spring, the oil supply amount reduces and rotation speed of the diesel reduces, too. Do not change positions of the two screws for rotation speed limitation and limit screws for maximum oil amount.

Stop working handle is installed on the casing of the adjuster, when the diesel needs stopping,

move the stopping working handle to realize emergency stop.

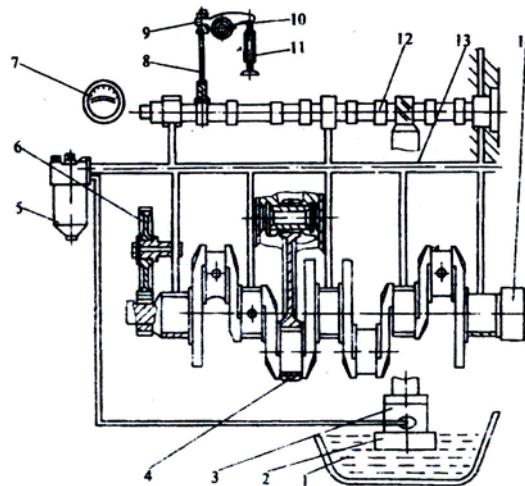
Pin valve of the fuel injection nozzle and pin valve body are the precise couple parts by grinding, during dismantling, do not exchange it and keep it clean.

8、 Lubrication systems

The lubrication system consists of the oil collecting and filter, oil pump, lubrication filter and kinds of the pipes, referring to Fig11.

Diesel adopts pressure and splash lubricate. Crankshaft headstock, connecting rod bearing, rocker shaft and camshaft and bushing adopt pressure lubricate. cylinder bushing, piston, piston pin, connecting rod bushing, camshaft and lever, valve and valve guide and so on are depend on the oil-burme splash lubricate. Moreover the roll bearing in water pump adopts to inject the grease lubricate.

The lubrication in the sump must to pass the oil collecting and filter, and will be inbreathed to the oil pump pass the vitta, after adding the pressure get to the lubrication filter, then put in the engine divide into three ways: one of them pass the headstock, reach the connecting rod bearing through the crankshaft hole; one reach to oil slot on the back shaft of the cam bush and supply the oil by intermissive; one reach to the gear wheel bearing. oil pump adopt rotor pump by slantwise. oil filter is single paper sieve core, and it is instead. during using, if the filter core plug, open the safety valve the lubrication in flood the main oil pipe, but lose the filter, so must conform to the rule of "maintain technology", clear or change the filter core by stated.



- 1, Sump 2, Oil collecting filter 3, Oil pump 4, Piston-connecting rod assembly
 5, Oil filter 6, Great system 7, Oil pressure gauge 8, Valve push rod, Valve lever 9, Rocker arm 10, Valve rocker shaft 11, Valve and valve Guide 12, Camshaft and bushing 13, Oil passage in the cylinder block
 14, Crankshaft and bearing

Fig.11 the Lubricating System Schematic Map

9、cooling system

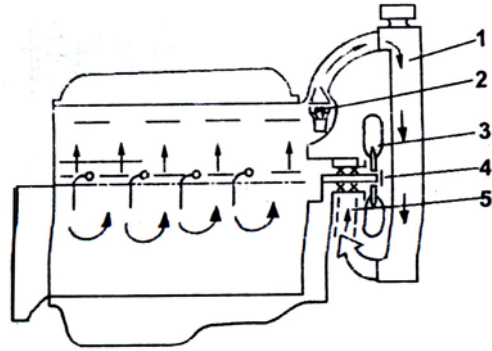


Fig12 Cooling system

1 radiator 2 heat retainer 3 fan 4 water pump 5 inlet pipe

The cooling system is of forcible circulating water-cooled type, see figure 12 for detail. The cooling system contains radiator, water pump, fan, heat retainer, air guide cover and etc.(diesel engine without air guide cover and radiator)

Cooling liquid in the radiator is delivered to water channel by water pump, and then enters into the surrounding of the cylinder sleeve and last flows into cylinder header by the cylinder sleeve. The used cooling liquid returns to the radiator through heat retainer at the front of the cylinder head and the outlet pipe. The heat retainer closes when the temperature of the water flowing out is less than 70°C, and the cooling liquid flows into inlet pipe of the water pump through a small circulation on front plate of the cylinder, then it flowed into the water pump a second time to realize a small circulation; when the water flowing out is 70°C~80°C, the heat retainer opens, and the cooling liquid flows into the header tank of the radiator through the heat retainer, and flows into the lower tank through a flat copper pipe. During the process, the cooling liquid is cooled by the drafting or exhausted by the fan. Up to now, a big circulation is completed. Air drafting or exhausting is adopted for the fan as required.

Water pump is a centrifugal type. The water pump is driven by fan belt surround the shaft belt pulley. During use, if the water backfill is damaged, which leads to serious water leakage in the lower part of the water pump, please change a new one. Do not clock the water backfill if it is damaged, otherwise, it may enter into the bearing and

accelerate abrasion of the bearing. If some unusual noise be heard when bearing operates, it should be changed. As the "Technical Maintenance" required, the calcium-radical lubricant will be added to the Oil cup of the water pump regularly. The lubricant should not be added more than 1/2~1/3 of cavum of the bearing, otherwise will cause the bearing hotness. Hot retainer is a rival pipe and single valve type, contains liquid sensitive to temperature which can auto control the valve's operation.

According to "Technical Maintenance", check and adjust tension of the belt between the fan and belt of generator regularly. The adjustment method is press down it 10-20mm.

10、electric system

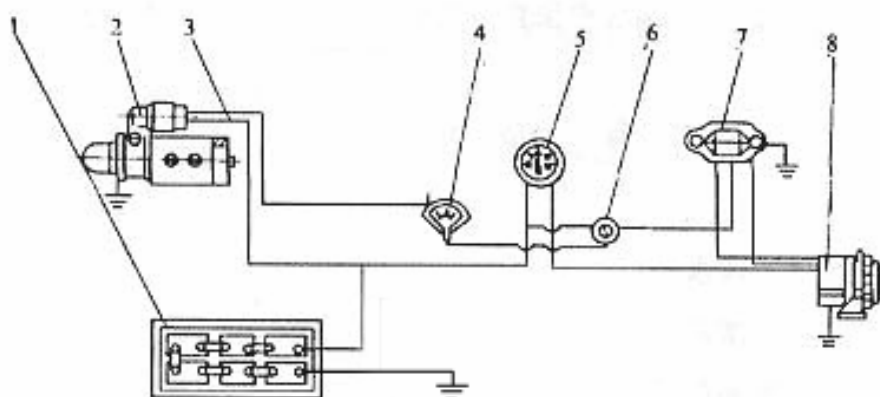


图 13 电器系统示意图

1. 蓄电池 2. 起动机 3. 电线部件 4. 预热启动开关 5. 电流表 6. 点火开关
7. 调节器 8. 充电发电机

Fig13: electric system

- 1 storage battery 2 starting motor 3 wiring 4 preheat starting switch
5 ampere meter 6 ignition switch 7 adjuster 8 charging generator

Appliance system

The appliance system includes storage battery, stating motor, charging generator, electric heating plug, starting button, instrument and etc.(diesel without storage battery, starting button , instrument and etc.)

Storage battery adopts 6-Q-135 type.

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Charging generator adopt silicon commutate and shunt excitation JF21 model. It is comprised of three-phase A.C motor and silicon diode. The negative pole is grounded; otherwise, it may damage the generator. See operation and maintenance Manual for Silicon Commutate Generator of JF Series on operation and maintenance of the generator.

Tooth of starting motor and flying wheel gear ring of diesel is controlled by electromagnetic switch. When the starting switch is connected, the electromagnetic switch makes tooth of the gear and flying wheel gear ring, connect the circuit for starting the motor and then drive the flying wheel.

After the diesel is connected, turn off the starting motor immediately. The iron core drives the gear to its original position under the control of spring. Continuation for use of the starting motor may not exceed 15 seconds. The interval for two starts shall be 2-3 minutes. If the diesel can not be started for continual three times, please check and remove the faults. The duration for powering the electric heating plug may not exceed 30 minutes.

Section 6 Operation notice of turbo- charger diesel engine

Turbocharger mounted at the exhaust pipe of the diesel engine. Exhaust gas discharged from the cylinder entry turbocharger casing through exhaust pipe drives impeller of the turbine, then drives impeller of the compressor push the pressed air filtered by air filtered into cylinder. Due to more air pressed into cylinder, more fuel can be injected and burned more enough, then diesel discharge more power and lower displacement. Meanwhile, it can be compensated the power when the diesel engine operates at plateau area(turbocharger with discharge valve owns advantages such as large torque at low speed , high and low speed performance)

Caution for diesel operation as followed:

1 Favorable lubrication is the key to extend service life of turbocharger and diesel engine, because turbocharger is a precise part. The faster speed of the rotor, the higher temperature of the turbine (usual above 640°C), and the pressure of the lubricant set up rotor shaft (called floating bearing) to work. So the lubricant shall be clear and pressurized, with high quality. Pressured lubricant filtered from lubricant system be used at turbocharger. Speed of turbocharger is much higher than that of diesel, then inferior quality, dirty or poor lubricate capability, all can damage the turbocharger. So seriously affect the diesel to work well. Therefore, it is necessary to use CD oil for diesel, change oil, filter core of oil filter, clear oil sump and oil pump suction regularly according to the technical maintenance requirement of diesel operation manual. If the damage of the turbocharger and diesel is caused by the above caution such as use inferior quality oil, not change oil, filter core of oil filter, clear oil sump and oil pump suction regularly , causes oil aging, deterioration result in

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coking of oil or blocking lubrication pipe, the responsibilities shall be borne by the customers.

Selected oil brand under different temperatures

Ambient temperature	oil brand	corresponding oil brand of SAE
-10°C or colder	15W/40 CD grade	15W/40 CD grade
-5°C~20°C	10W/30 CD grade	10W/30 CD grade
20°C or warmer	5W/30 CD grade	5W/30 CD grade

The above-mentioned brand can be sold around China. The manufacturers are: Dalian Petrochemical Company(Qixing brand), Lanzhou Oil Refining Plant (Feitian brand), Jinxi Oil Refining Plant(Bohai brand), Maoming Petroleum Industry Company(Nanhai brand), Jinan Oil Refining Plant and etc.

2 Air flow in the air filter of YSD490ZL turbocharger diesel engine shall be no less than 250m³/h, and the mounted place shall be more than 500mm away from exhaust pipe and turbocharger. Change filter core regularly as requirement of the technical maintenance to ensure ventilation. Inner diameter of the inlet pipe shall be no less than 54mm. Keep its inner wall smooth and clean. Air leakage is not allowed at any connection of the pipe system. The flexible duct for connection adopts rubber pipe with steel inside. Meanwhile set a net to prevent aspirating large dust, otherwise the dust will block the duct, which may cause insufficient air supply, low power, smoking and oil leakage in the compressor of the turbocharger. Turning angle of the pipe shall exceed 90 degrees, and no more than two turnings shall be provided. Radius of turning shall be 3 times as diameter of the pipe, which shall be shortened as much as possible.

3 Inner diameter of the exhaust pipe shall no less than 48mm. Turning angle of connection pipe shall exceed 90 degrees, and no more than two turning shall be provided. Radius of turning shall be 3 times as diameter of the pipe, which shall be shortened as much as possible. Muffler not only meeting

the requirement of noise-damping, but also the resistance not exceed the permissible value(13~20kPa), power loss of the diesel not exceed than 3%~4%.

4 Fan of diameter 420mm is a standby accessories for turbcharging diesel. We recommend to use the fan whose a diameter no less than 420mm when change it.

Heat radiation area: heat radiation area for YSD490ZL turbo charging diesel according to the power. It shall be adjusted and checked during install the whole engine. Air guide cover must be installed, 20mm away from the fan in axial distance. Front end surface of the fan shall be at least 20mm away from the radiator.

6 Fuel injection pump and adjuster of the diesel have been adjusted to the best conditions at the leaving factory test and sealed. If the lead seal is damaged or it is adjusted, the customers shall bear its responsibilities. If any adjustment is required, please contact the nearest service center of our factory to conduct for you, then seal.

7 After the diesel is started, running at idling speed of 2-3 minutes is required before loading more capacity to ensure lubricate. Immediate loading may lead to insufficient lubrication of bearing in the turbocharger and damage to the bearing.

8 If customers wants to repair the diesel by itself, need to assembly or disassembly the turbocharger, please prevent any foreign material from entering into turbocharger and inlet or inlet system. Otherwise cause deadly damage to the turbocharger and diesel. If we find the damage of the turbocharger due to foreign material in the inlet and outlet system, the customer bears the responsibility. Attention: do not take the push rod for exhaust valve mounted outside of the bypass type turbocharger as a carry-gripe. Do not push it without purpose, otherwise, it may affect sensitivity

of the push rod and turbocharger can not work normally. Attention: the diesel can not work under the conditions of no air filter providing or available, and leakage of the air inlet and outlet system.

9 Prohibit operations under long-term overload condition. The diesel work overload for a long time, the speed of engine will be slow, cause low speed of the turbocharger, departure high effective area. The turbocharger can not increase air inlet flow, but increase air inlet resistance, then the diesel work badly, temperature rise of outlet water, accelerating oil aging so much as coking oil, the depravation of the whole lubricant system, a series of grave faults, come into be a vicious circle, affect the service life of the diesel and its reliability.

10 Do not stop the diesel immediate when you want to park. Likewise, a 3-5 minute idling speed is necessary. After temperature of the diesel drops evidently, stop the diesel. Stopping the diesel at once when driving on declining area is not allowed.

11 Pay attentions to start diesel under low temperature. when the ambient temperature is too low or the vehicle stop for long time, strong sticky will affect the diesel have oil pressure and flow. Check and fill lubrication for the oil filter at the front of the turbo charging and its oil inlet pipe. Running 3-5 minutes in idling speed after start the diesel, and then running at high speed.

Running at idling speed shall not exceed ten minutes. The long-term idling speed running will cause temperature fall of the firebox, insufficient burn, blocking fuel injection and cause coking of plunger ring and air valve. As for turbo charging, low pressure of turbine and compressor or low speed of turbo charging may leak oil into the turbine casing from the sealing parts.

When open and check the turbo charging, please operate after the diesel is cooled. The turbo charging will be damaged if the diesel without inlet pipe and oil filter.

When the diesel is heated, do not touch the turbo charging and its connections to avoid scalding.

Section 7 faults and remedies for diesel engine

1、 hard or refuse to start

causes	remedies
1、 fuel filter and fuel pipeline blocked	clean
2 air in the fuel system	exhaust the air and tighten all of the fuel pipeline connector
3 fuel delivery advance angle incorrect	Readjust it according to specifications
4 spray fuel atomization is bad	readjust the spray fuel pressure according to specification
5、 compression pressure low	clean or replace the injector needle valves sets
6、 clearance between the air vales is wrong	check or replace the piston ring、 cylinder sleeve and grind valves, cylinder head nuts should be tightened in case of leakage on cylinder head gaskets

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7、battery lose electricity	Charge the battery
8、wires connections loosened	check and tighten wire connections, clean contact points
9 ambient tem. is too low, and oil too vicious	Heat up the cooling water and lubricant

2、power insufficiency

cause	remedies
1 Compress pressure in cylinder is too low	Reference to fifth solution of first fault, replace a new part if exceed its wear limit
2 delivery fuel advance angle incorrect	Adjust according to specifications
3 clearance between air valves is incorrect	Adjust according to specifications
4 fuel supply imbalance among every cylinder	Adjust injection pumps to proper supply
5 air filter blocked	Clean
6 fuel injection pumps, fuel injector sets worn off or fuel injection pressure incorrect	Replace them with new parts, adjust fuel injection pressure and check fuel spray
7 speed incorrect	adjust the speed control handle, make the speed to reach rated speed

3、Smoking exhaust

causes	remedies
1 over load	reduce the load, if they are unsuitable matching , adjust it

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2 spray instruction ill	check the spray pressure and atomization, if the fuel pump is damaged, replace it
3 inferior quality of fuel	Use eligible fuel
4 combustion incomplete	Main reason is :fuel pump atomizes bad, delivery fuel advanced angle incorrect, leakage at cylinder cover gaskets and low compression pressure. solve in accordance with specific problems

4、 knocking noise in engine

causes	remedies
1 delivery fuel advance angle is incorrect	Adjust the angle according to the specification
2 air in fuel system	Exhaust air
3 fuel supply imbalance among every cylinder	Adjust injector pump to proper supply
4 inferior quality fuel	replace to eligible fuel
5 parts are worn exceed itself limit	replace the part

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5、 lube oil insufficiency or no pressure

1 oil lever in oil sump too low	Add oil up to mark line on dip sticks
2 serious leakage from oil pipelines	Eliminate leakage
3 extract oil filter, oil filter and pipe blocked	Clean, or replace filter core
4 oil gauges damaged or gauge pipe blocked	Repair or replace it
5 oil is too dilute	use the eligible oil
6 oil pump gears seriously worn off, with excessive clearance	Adjust the clearance or replace them
7 pressure relief valves of oil filter cease to function	Check and repair or replace it
8 main bearings connecting-rod bearings and camshaft bushing seriously worn off with excessive clearance	Repair or replace them

6 、 overheating of engine

cause	remedies
1 temperature of cooling water too high	
(1)insufficient cooling water or vapor lock in water pipes	(1)fill the tank to make cooling water level higher than the center line of water pump
(2)bad working state of water pumps	(2)check water pump clearance and tightness of belts, eliminate leakage
(3)water scale in cooling systems too thick	(3)remove it
2 oil temperature too high	
(1)insufficient or excessive oil	(1)check whether the oil level is between the dip stick scale lines

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(2)oil pressure too low with insufficient flow	(2)refer to paragraph V.
3 engines overload	Relieve load

7、 engine running away

CAUSE	REMEDIES
1 governor failure	Stop immediately ,then check and repair
2 the fuel pump pull rod locked	Stop immediately ,then check and repair
3 injection pump supply to much more fuel	Stop immediately, readjust oil supply
4 burn lubricant to much	Stop immediately ,then check and repair

Section 8 The faults diagnose of diesel engine turbo-charger

When the engine breakdowns, besides checking and eliminating the diesel engine itself according to the trouble diagnosis explanations, should check and evaluate the working condition and judging the malfunction of the turbocharger.

The usual troubles of the turbocharger are as follows:

- a) Insufficient power
- b) Excessive consumption of tube oil
- c) Black smoke
- d) Unordinary noise

Any malfunction in the above maybe caused by the internal fault of the diesel engine or the fault of the air super-turbo charging system formed by the

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turbocharger and the diesel engine. If believing the trouble caused by turbocharger doesn't unload the turbocharger from the diesel immediately, especially neither disassembles it. Eliminating the fault by replacing the turbocharger simply can't solve the problem, but also causes the new problem. Should diagnose the fault, and eliminate it after finding out the problem.

A turbocharger with a good running generally can operate normally in the later service. If the blade wheel can rotate freely and don't scrape the internal surface of the turbocharger, it is not necessary to determine the fault of the turbocharger itself. The experience shows that most of the malfunctions owe to the unordinary use of the diesel engine .Therefore the following recommend fault diagnose chart mainly about the whole air-supercharging system. After finishing the fault diagnose chart and noting the results in details, if necessary, unload the turbocharger and diagnose further. The turbocharger should be taken to the repair station or the diesel engine manufacture to diagnose and analyze.

Section 9 The faults diagnose list of turbo-charger

Symptom								Trouble shooting diagram	
Turbo-charger side oil seal leakage	compress or side oil seal leakage	supercharger Periodic abnormal noise	High noise for supercharger	Blue exhaust smoke	Excessive consumption of lub-oil	Insufficient output power	exhaust Black smoke	Problem	Solution
	√			√	√	√	√	Air filter too dirty	Clean or replace filter core
			√					Leak air for the pipe	Tighten fastener or

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								between air filter and compressor	replace the sealing element
			√	√	√	√	√	The pipe between the compressor and the intake pipe leakage	Tighten fastener or replace sealing element
			√	√	√	√	√	The contacting face of the intake manifold branch the cylinder head of the diesel engine leak-off	replace gasket or tighten fastener
	√	√	√	√	√	√	√	Compressor's intake pipe blockage	Eliminate impurity or replace damaged parts
			√				√	Compressor's outlet pipe blockage	Eliminate impurity or replace damaged parts
			√				√	Engine's intake pipe blockage	Eliminate impurity
	√		√				√	Turbine combustion intake leak gas	Tighten fastener or replace sealing element
	√		√				√	Leak air between outtake manifold and	Tighten fastener or replace sealing

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								cylinder head	element
	√		√	√	√	√	√	Engine's outlet pipe blockage	Eliminate impurity
			√					Turbine combustion outtake leak gas	Tighten fastener or replace sealing element
	√					√	√	Muffler or exhaust tail pipe blockage	Eliminate impurity or change
√	√			√	√			Supercharger's oil return pipe blockage	Eliminate impurity or replace oil return pipe
√	√			√	√			Crankcase's breathing apparatus blockage	Eliminate impurity or replace
				√	√	√	√	Supercharger's middle case dirty or baking	Replace oil and oil filter or change engine
√	√	√	√	√	√	√	√	Turbine blade or compressor blade dirty	Clean compressor or replace oil and oil filter element

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	√							Compressor's impeller wear out or damage	Clean air intake system or replace supercharger
√					√			Supercharger's bearing, bearing bore or shaft diameter wear out	Replace supercharger
					√			Improper lube oil	Choose specified lube oil

Appendix: wearing parts order sheet

No.	Name	No.	Name
1	Cylinder sleeve	10	Waterproof ring
2	Piston ring	11	Bead apex
3	Piston	12	Bearing bush/sleeve
4	Oil seal	13	fuel injector
5	Charger	14	injection pump plunger
6	Start motor	15	injection pump fuel-out valve
7	Air gate	16	Gaskets
8	Valve retainer	17	Filter element
9	Valve guide		

The life of wearing parts has a great deal with customer's operation,

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maintenance. Please operate and maintenance according to our manual to prolong wearing part's life, otherwise the life will be shortened seriously.



生产许可证号: XK06-205-00141
XK06-00141
产品标准: Q/321284 JCA03-2002
Q/321284 JCA06-2002

Production permit No.: XK06-205-00141/XK06-00141

Product standard: Q/321284 JCA03-2002; Q/321284 JCA06-2002



address: No.230LuotangEastRoad.Jiayangyan
City Jiangsu province China
website: www.yangdong.com
email: yangdong@yangdong.com
phone: (0523)88209898 88209878
fax: (0523)88209992
post code 225500