

Operation and Maintenance Manual and User Service Guide for Industrial Power WP10 Series Diesel Engine

PREFACE

Industrial power covers six industries: land generation power, marine generation power, emergency marine generation power, pump power, air compressor power and fixation power for other purposes.

On the basis of Weichai WD615 series diesel engines, the industrial power WP10 series diesel engines, as special power, are independently researched and developed by our company for meeting stricter emission requirements. This series of diesel engines are featured by compact structure, reliable operation, advanced economic technical index, quick startup, easy operation and convenient maintenance etc. This series of diesel engines are not limited to use for power generation, the other application fields are not covered by this manual.

This manual describes the operation and maintenance, inspection essentials and service guide of industrial power WP10 series diesel engines, and can be used as reference.

In order for the industrial power WP10 series diesel engines to better service and give full play to its effectiveness, the users are expected to carefully read and learn the diesel engine structure, maintenance and operation methods. The diesel engine useful life can be greatly prolonged if the users can follow this manual for maintenance.

As the industrial power WP10 series diesel engines have increasingly models and been improved, users are expected to timely pay attention to the technical information issued by our company. This manual will be subjected to modify without any prior notification.

June, 2013

Notice

1. Before delivery, this series of diesel engines have already been tested, strictly following the test codes. Therefore, never dismantle the lead sealing on the throttle to raise its openness; never dismantle or impact the rotor of turbocharger which belongs to the sophisticated parts; never loosen or remove the main bearings of diesel engine and bolts attached to the connecting rod which have strict requirements for torque and turning angles. Otherwise, our factory will not perform the “Three-guarantee”. Hope the user pay attention to it.
2. As the bolts for connecting rod are disposable, never reuse them.
3. The operator should carefully read this Operation and Maintenance Manual, be familiar with the structure of the diesel engine and closely abide by the technical operation and maintenance procedures specified in this manual.
4. At any time of starting the diesel engine, please check whether the coolant and oil is filled up.
5. For the new diesel engine, 50h running-in is needed, with maximum load not more than 80% of the rated load and average load not more than 60%.
6. The starting time of the engine should not last for more than 30s. If the engine can't be started within 30s, wait for 1-2min for startup again.
7. After the diesel engine is cold started, please slowly increase the rotating speed and never idle running for long time. After engine running with heavy load, do not immediately stop it. It is necessary to idle running for 5-10 min at low speed.
8. After engine is stopped, if the ambient temperature is less than 0℃, moreover the antifreeze additive is not applied, please completely drain the water in radiator and diesel engine.
9. The diesel engine is prohibited to work without air cleaner which could prevent the air not to be filtrated from entering the cylinder.

10. Please select the specified fuel and oil grades which will be filled into the diesel engine (it is suggested to use the Weichai special oil sold at all service stations of Weichai). Use the special clean container. The fuel and oil should be filtrated through the strainer before being added. Let the fuel precipitate for more than 72h.
11. Do not simultaneously use the diethyl-ether-assisted starting equipment and flame preheater or glow plug.
12. The inspection of electrical system should be done by the personnel mastering the electrical knowledge.
13. The valid duration of oil sealing of diesel engine is one year. If they expire, please take necessary supplement measures.
14. Feedback of engine quality information:

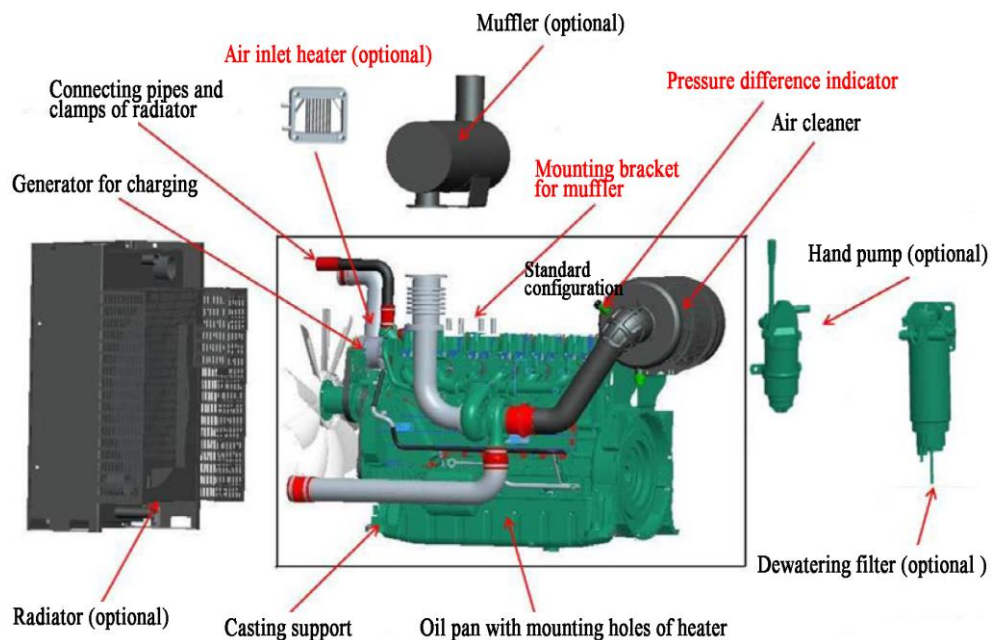
Our company perform the quality-trace filing for industrial power WP10 series diesels engine, therefore users are expected to fill the card and then send it back to our company. Keep relation with our user by this card.

June, 2013

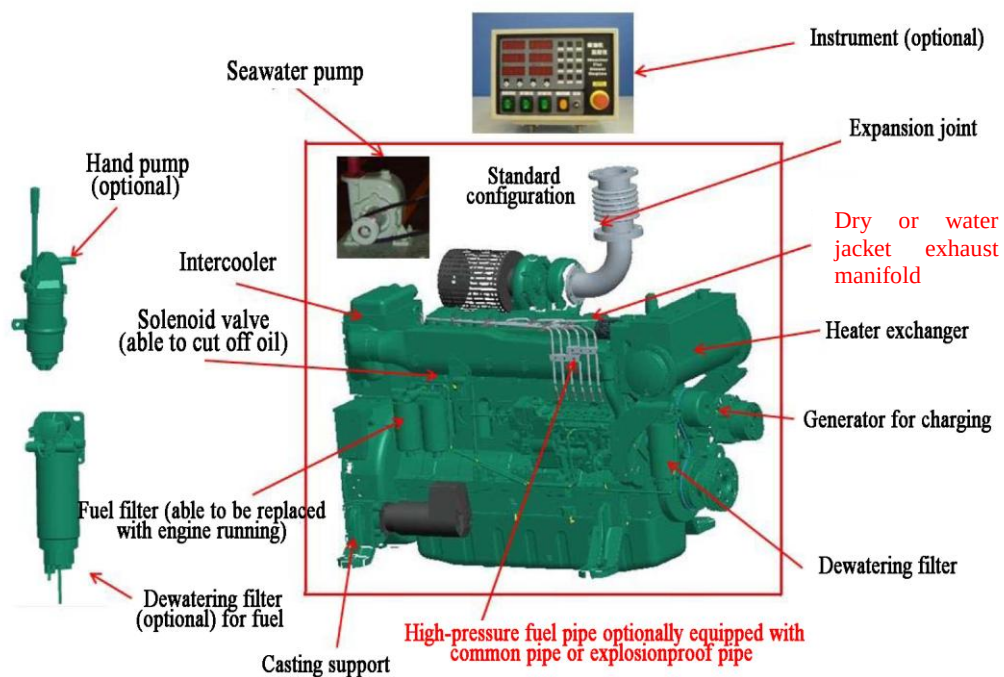
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I . Operation and maintenance for industrial power WP10 series land diesel engines



Schematic for WP10 series land diesel engine



Schematic for WP10 series marine diesel engine

1 Fuel, lubricating oil and coolant used for diesel engines

1.1 Oil

1.1.1 Quality grade

Refer to the quality and feature to divide the oil into API and GB standards.
Oil allowed to be used:

API grade: CF-4 and CH-4

GB grade: CF-4 and CH-4

It is allowed to use the oil with higher quality grade to take place of one with lower quality grade.

1.1.2 Oil viscosity

Refer to table 1-1 for selection of oil viscosity.

Table 1-1 The relation between oil viscosity and ambient temperature

Lubricating oil	SAE Viscosity grade	Ambient temperature (°C)
	5W/30	−30-35
	10W/30	−25-35
	15W/40	−20-40
	20W/50	−15-50



Notice: Before starting of diesel engine, thoroughly check the oil level in the oil sump.

Do not check engine oil level with engine running.

It is not allowed to mix the different grades of oil.

Suggestion:

It is recommended to use the Weichai special oil, which is mixed by the imported quality basic oil and selected additive. This oil is sold at all the service stations of Weichai at the unified national sale price.

1.2. Fuel

1.2.1 The diesel engine uses the light diesel as the fuel;

1.2.2 Quality grade

Sulfur content in the fuel with specified grade should not be higher than 1%.

It is allowed to use the following diesel fuels:

-GB252 0 , -10 , -20 , -35 , -50

-DIN 51601

-NATO CODES F54, F57, F76

-BS 2869: A1, A2 (for A2, pay attention to the sulfur content)

-ASTM D975-81: 1-D, 2-D

-W-F-800C: DF-A, DF-1, DF-2

- Apply the following grades of diesel fuel based on the ambient temperature.

If the ambient temperature is higher than 5℃, it is recommended to use the 0# diesel fuel (GB 252-94) .

At low temperature, the diesel fuel may precipitate the waxy material, leading to poor mobility of diesel fuel. In such case, the fuel system will be clogged, causing failure of diesel engine. Therefore, if the ambient temperature is less than 0℃, please use the diesel fuel suitable for winter. According to the GB252 diesel fuel standard, if the ambient temperature is -5℃ or more, please choose the -10# diesel fuel. If the ambient temperature is -14℃ or more, please choose the -20# diesel fuel. If the ambient temperature is -29℃ or more, please choose the -35# diesel fuel. If the ambient temperature is -44℃ or more, please choose the -50# diesel fuel.

1.3 Coolant

1.3.1 Coolant must be filled in the cooling system of diesel engine

The coolant for the industrial power engine, which is glycol type, should have the features like antifreezing, anticorrosion and scale proofing, as well as high boiling point.

Coolant classification

Coolants are classified into two grades according to the engine loads:

- a. Coolant for light engine load
- b. Coolant for heavy engine load

1.3.2 Correct selection of coolant

Coolant selection is dependent on the ambient temperature. Generally, the antifreeze selection standard is to be lower than ambient temperature by 10°C. Never use water as the coolant.

Relation between the freezing point of coolant and mass fraction of glycol

Freezing point of coolant /°C	Mass fraction of glycol (%)	Mass fraction of water (%)	Density/(kg.m ⁻³)
-10	26.4	73.6	1.0340
-20	36.2	63.8	1.0506
-30	45.6	54.4	1.0627
-40	52.3	47.7	1.0713
-50	58.0	42.0	1.0780
-60	63.1	36.9	1.0833

1.3.3 Correct use of coolant

- a. Do not overhasty fill the coolant. Otherwise, the gas in the engine can not be drained. It is better to keep the filling speed at 13.5L/min.
- b. Do not fill the radiator up for the first time. Start engine to let its temperature rise, then check the coolant level again. If needed, refill again.
- c. The concentration of antifreeze should be inspected every 1000h. The antifreeze should be changed every two years to avoid corrosion.
- d. Each time of maintenance or starting engine, check for coolant level and leakage.
- e. Avoid continuously running diesel engine with coolant lower than 60°C or higher than 100°C. If the coolant temperature is lower than 60°C or higher than 100°C, find out the cause and resolve it.



Suggestion:

It is recommended to use the Weichai Power heavy-load engine coolant which is sold at all the service stations of Weichai at the unified national sale price.

Heavy-duty engine coolant				
Product Name	Model	Features	Applicable range	
 Product specification :4kg, 10kg	Coolant	-25° • Super anti-freezing or boiling features, able to prevent against radiator freezing or boiling, being suitable for wide-range temperature conditions. • Anti-scale agent together with the metallic ion could ensure excellent heat exchange rate, preventing the coolant from overheating. • Special antifreeze and anticorrosion can protect the radiator, such as steel, casting, aluminum and zinc. • Coolant has excellent compatibility with the sealing materials, which can prevent against sealing material.	It is suggested that the coolant is used for the heavy-duty truck, engineering vehicles and buses.	
		-35°		

1.4 Disposal of used oil/fuel/coolant

Use the special container to collect the waste. As the oil, fuel and coolant is toxic, neither drink nor touch them.

2 Diesel engine installation and connection

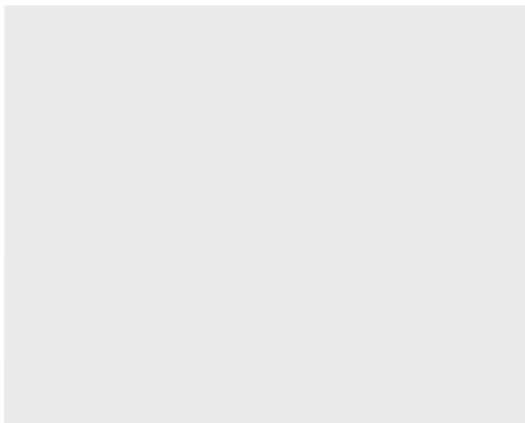
- 2.1 Before installation of diesel engine, the installers should carefully read the on-board documents to be familiar with the diesel engine structure and installation requirements.
- 2.2 The installers should be mechanical technicians and electrical ones with a certain installation experience.

If the diesel engine to be mounted is greatly different from the information provided by the factory, please ask for professional.

2.3 WP10 series diesel engine unpacking and hoisting

During unpacking the diesel engine, do not damage the parts of diesel engine. After unpacking, check whether the exposed port seals of oil/fuel/coolant pipes are in intact. It is prohibited that the foreign material gets into the pipes. Refer the packing list of diesel engine to check whether the on-board documents and spare parts are all in readiness.

Use the ring screw to hoist the diesel engine, during which, the crankshaft should be kept horizontally. It is recommended to use the following rings (see fig. A).



图A

If the wire is to be used, the inclination angle of the two wires from the vertical direction must be kept within 20 degree.

2.4 Diesel engine installation

2.4.1 During installation, the sufficient space should be reserved at the upside of engine room and in front and rear of diesel engine for later maintenance and operation.

2.4.2 To prevent the stress developed by the deformation of chassis where the diesel engine is installed from acting on the diesel engine, this portion of chassis should possess sufficient rigid and good flatness that should be less than 0.2mm. Moreover, adopt the grinding method to eliminate the clearance between the engine frame and chassis. Although the diesel engine used for power generation is connected to the chassis by a vibration isolator, ensure this portion of chassis has the flatness of 0.2mm or less. The diesel engine models are different, so are the lengths from the engine frame to the center line of crankshaft.

2.4.3 WP10 series auxiliary marine diesel engine can be installed together with the SAE I flywheel housing and marine gearbox. Elastic coupling is permissible for connecting the engine with the machine. After the couplings are connected, the crankshaft is not allowed to be subjected to axial force, which otherwise may damage to the thrust of diesel engine. During installation, the coaxiality of crankshaft and input shaft of main machine should no more than $\phi 0.2\text{mm}$. After installation, check the accuracy of connection.

2.4.4 Installation of output equipment in front end of diesel engine

The output pulley in the front end of diesel engine could drive the coolant pump, hydraulic pump and generator etc, which have power less than 10kW in total. If there are a many equipments needed to be driven by the diesel engine, the pulley with independent base should be designed and then connected to the pulley via the elastic coupling. The coaxiality of engine pulley and one with independent base should be less than $\phi 0.2\text{mm}$, as shown in the fig. B.



Fig. B



All accessories should be symmetrically arranged at the both sides of diesel engine to prevent the crankshaft from being subject to the one-way tension.

If the diesel engine is to drive the large-scale mechanical devices such as hauler and large-scale hydraulic pump etc, the elastic coupling must be used for connection, with coaxiality not more than $\phi 0.15\text{mm}$. After installation, check the accuracy of installation. In addition, periodically check the accuracy of coaxiality for correctness, which otherwise may damage to the crankshaft and so on.

2.4.5 Installation of intake system

In order for the diesel engine to aspirate enough fresh air during operation, the intake inlet should be arranged at the well-ventilated position. Intake pipe of diesel engine should not be very long, reduce the quantity of elbows and adopt the large-arc transition. The inside diameter of intake pipe should not be less than 120mm and the inside wall should be free of welding slag. During installation, avoid any foreign material from getting into the intake pipe, and ensure the connection pipe from the air cleaner to the supercharger of diesel engine is well sealed, without any crack or leakage. The air cleaner inlet should be properly guarded (mesh) to prevent the water or foreign material from getting in. The air inlet should be kept away from all kinds of thermal sources. Meanwhile, the exhaust gas should be not absorbed into the intake pipe. If the air cleaner is arranged in engine room, engine room should be equipped with ventilation facilities to ensure diesel engine can work normally.

2.4.6 Installation of exhaust system

Exhaust pipe outside connected is made of steel pipe, should be flexibly connected to the supercharger of diesel engine. The inside diameter of extended exhaust pipe should be more than 120mm. Moreover, the extended exhausted pipe should not be bent as possible as you can, and should be reliably fixed without any vibration. Do not place the weight of the extended exhaust pipe on the expansion pipe of diesel engine. In addition, it is not allowed to use the expansion joint to eliminate the centring tolerance between pipes. After the exhaust system is installed, the back pressure of diesel engine should not be more than 6kPa, which otherwise may impair the diesel engine performance!

Exhaust system must function to prevent sea water, rain or foreign material from getting into the diesel engine. With diesel engine running, the exhaust pipe is very hot; therefore, the installation of exhaust pipe should be kept away from the inflammables. In order to prevent any fire and scald etc, heat insulation measures should be taken around the surface of exhaust pipe.

If some diesel engines installed together and share the same extended exhaust pipe, some problems will emerge: condensed water developed by the exhaust will enter the inoperative diesel engine, which can easily damage to the parts of diesel engine. Therefore, each diesel engine should possess its own independent exhaust system.

The muffler if needed should be rationally selected and installed. Meanwhile, reduce the exhaust system back pressure increased by the installation of muffler as possible as you can.

2.4.7 Installation of cooling system

The cooling line in diesel engine has already installed before delivery, therefore, it is unnecessary to install it again.

Whereas, it is needed to install the cooling pipeline (sea water or river) outside of diesel engine. Sea water pump driven by a B-type V-belt can be installed on one side of diesel engine according to the working environment. Cooling pipeline should be of resistance to corrosion and be shortened as possible as you can. And minimize the number of elbows. In addition, the inside diameter of this pipe should not be less than the counterpart of parts to be connected so as to reduce the coolant resistance.

3 Precautions and operational requirements for diesel engine

3.1 Preparation for operation

3.1.1 Unsealing

After the diesel engine is unpacked, user should firstly refer to the packing list to check the diesel engine and accessories, to check whether there is damage on the surface of diesel engine and whether the connecting parts are loosened, then perform the following procedures:

- a. Wipe the antirust coat and anticorrosive agent on the exposed parts.
- b. Drain the sealing oil in the fuel filter and parts in the fuel system (it is allowed to start the engine with the sealing oil not drained. But it is prohibited to load the engine until the sealing oil is completely consumed and then diesel fuel begins to be supplied.)
- c. Check whether the coolant/oil plugs are in good state and whether the coolant/oil temperature sensors are supplied. In addition, any part provided by the user should be installed.

Note: Do not start the diesel engine until it is correctly installed and connected. If diesel engine runs in enclosed room, ventilation must be conducted to ensure the exhaust is drained to the outside.

3.1.2 Filling oil

- a. Oil filling should meet the requirements. If not, oil pressure may be insufficient, which can speed up the wear and lead to difficult startup. It is essential to keep the oil clean.
- b. Tighten the oil drain bolt.
- c. Open the oil filler cap to fill the oil which should be filtrated by a mesh.
- d. Diesel engine should be placed horizontally, take out the dipstick to check the oil level. It is better that the oil level is between the two scales, if not, refill or drain the oil. In addition, if the oil level is higher the last-filled oil level, check whether there is diesel fuel or water mixed into the oil. For the P10 model, it is suggested to fill 20L oil.
- e. Tighten the oil filler cap.

Note: At each time of starting diesel engine, check the oil level.

3.1.3 Filling fuel

- a. The filled diesel fuel should meet the specifications.
- b. Keep the diesel fuel clean, and the diesel fuel should be sedimentated for 72h or more and then filled into the fuel tank through the built-in mesh. Check whether the fuel level is proper, whether the valves on the fuel pipeline are opened and whether the fuel is leaked. Then loosen the fuel-return screw on the high-pressure pump, and use a manual fuel supply pump to drain the air. After that, tighten the fuel-return screw. Continue pumping fuel until the low-pressure chamber in fuel supply pump has the pressure of 50kPa.

Note: At each time of starting diesel engine, check the diesel fuel level.

3.1.4 Outgassing of fuel system

- a. Loosen the screw at the outlet of fuel supply pump by half circle. Repeat pressing down the hand pump until the diesel emerges, then tighten the screw.
- b. Loosen the vent screw on the fuel filter. Repeat pressing down the hand pump until the diesel emerges, then tighten the vent screw.
- c. Loosen the vent screw on the fuel injection pump. Repeat pressing down the hand pump until the diesel emerges, then tighten the vent screw.
- d. Continue to pump the hand pump to check whether the fuel pipe leaks, then tighten the hand pump.

3.1.5 Filling coolant

Coolant is formulated by the softened clean water, anticorrosive agent and antifreezing agent, which should strictly follow the regulations from additive manufacturer. The coolant should be filled via the inlet of radiator and heat exchanger to drain the air in the cooling system. Check the coolant level in fresh-water cooler, if needed, refill properly. With diesel engine running at low speed, observe whether the coolant level in the fresh-water cooler drops. A few minutes after the engine is switched off, check whether the level returns to the original height. If not, refill the coolant to the level. As the coolant may suddenly rush upward, it is accurate that measuring the level should be conducted conditioned by coolant staying still.

Note: At each time of starting diesel engine, check the coolant level.

3.2. Operation precautions

- 3.2.1 Before startup of engine, firstly crank the crankshaft by a few circles to ensure there is no obstacle. Then refer to stipulated methods and supplied data to check whether the advance angle of fuel supply and 1st cylinder distribution timing meet the requirements, if not, adjust them. Careful inspection should be done for correct parameter determination, which otherwise may damage to the diesel engine.
- 3.2.2 Check whether the circuit is correct, reliable and insulative, whether the ground wire is rational, and whether the battery is correctly charged. That can ensure the diesel engine can be started normally. Turn the ignition key to ON and check whether the instrument can work normally. In particular, for the diesel engine with stopping solenoid valve, it should be inspected whether the stopping solenoid valve can timely stop the engine by rules.
- 3.2.3 If the diesel engine is not started within 5s, immediately release the start button, and waiting after 1min for the second startup. If the engine could not be started for 3 consecutive times, please stop start up at once, troubleshoot for starting again.
- 3.2.4 After the diesel engine is successfully started, idle running for 2-3min and the oil pressure should not be less than 100kPa. Otherwise, find out the cause. If the coolant is still less than 60℃, do not suddenly load the engine, which otherwise impair the abrasive resistance and reliability.
- 3.2.5 After startup each time, check the “three-leakage”.
- 3.2.6 Before stopping of the loaded diesel engine, please reduce the load and rpm, and idle it for 5~10min. Avoid stopping engine with full load.
- 3.2.7 Engine oil level inspection: it is correct to check the oil level 5min after engine is stopped.

3.3 Engine Stopping

To stop engine, firstly reduce the openness of throttle, shift the main machine clutch to the neutral, then idle it with rpm at 2/3 of the rated. In addition, ensure the coolant temperature at outlet drops to 60℃, and then keep the diesel engine idle running for 4-5min. At last, pull the stop brake handle. After the engine is stopped, check whether the fuel line and coolant line are

leaked. Switch off the main power switch to deenergize the diesel engine for avoidance leakage of electricity.

In winter or cold regions, if the diesel engine is not used for long time and the antifreeze is not added into the coolant, open the drain valves on the heat exchanger (sea water and fresh water) and intercooler to completely drain the coolant, which can prevent the engine body from being frozen.

3.4 Stopping in emergency case

If abnormal conditions were appeared during the engine is running, stop the engine imminently. After engine is stopped in emergency case, barring the crankshaft for a few circles, then check whether for abnormal. In addition, as the engine is still hot shortly after stop, scuffing of cylinder or piston seize should be prevented.

3.5 Operational environment

If the ambient temperature is higher than -15°C , the diesel engine can be normally started. If the ambient temperature is within -15°C - 35°C , some assistant equipments should be used for normal startup. If the diesel engine is used in high-altitude or hot regions, their power will drop. As the diesel engine is not explosion proof, its operational environment should be free of inflammable and explosive.

4. Maintenance specifications for industrial engines

Maintenance intervals and specifications of industrial engines are suitable for P4, P6, 10L, 12L, 13L and Baudouin series.

4.1 Maintenance intervals and specifications of industrial engines

4.1.1 Maintenance intervals of industrial diesel engines

Initial maintenance (P)	New engine running for	30-50h
Level 1 maintenance (WD1)	Diesel engine running interval	250h
Level 2 maintenance (WD2)	Diesel engine running interval	500h
Level 3 maintenance (WD3)	Diesel engine running interval	1000h
Level 4 maintenance (WD4)	Diesel engine running interval	3000h

4.1.2 Daily maintenance for diesel engine

4.1.2.1 With diesel engine running, always note that the oil temperature, oil pressure and coolant temperature at outlet, and check for “three-leakage” (oil, gas and water). In case of any abnormal, find out the cause for troubleshooting.

4.1.2.2 After the diesel engine is stopped, check the fuel, fresh-water coolant and oil capacity, if needed, refill it.

4.1.2.3 Drain the water in the stage-one fuel filter.

4.1.2.4 Check the tension of belts, adjust it if necessary.

4.1.2.5 If the ambient temperature is less than 0°C, and the diesel engine is not filled with antifreeze, drain the coolant to prevent the diesel engine parts from being froze.

4.1.2.6 Check oil level in the fuel injection pump and governor, if needed, refill it properly.

4.1.3 Inspection and maintenance works for diesel engine

Items	Initial maintenance	Routine checking	WD1	WD2	WD3	WD4
Replace oil and oil filter element	▲		▲	▲	▲	▲
Replace fuel filter			▲	▲	▲	▲
Check and adjust valve clearance	▲		▲	▲	▲	▲
Check the coolant level and refill if needed	▲	▲	▲	▲	▲	▲
Check the water pump for leakage	▲		▲	▲	▲	▲
Clean coarse filter of fuel pump			▲	▲	▲	▲
Tighten the intake pipe and hose	▲		▲	▲	▲	▲
Clean the oil cooler element					▲	▲
Clean the intercooler element					▲	▲
Clean the fan and radiator					▲	▲
Replace or clean air cleaner element.				▲	▲	▲
Check and tighten the belt	▲	▲	▲	▲	▲	▲
Check the fuel injection pump at the service station						▲

Note: ▲ means items needed to be maintained.

Note: The maintenance intervals are based on the diesel engine working for 1500h every year. If the diesel engine works for 500h or less every year, its maintenance intervals should be 1/2 of ones in above table.

4.1.4 Spare parts and oil/fuel grade specifications

It is suggested for the users to go to the Weichai special service stations for purchasing the special spare parts and oil (CF-4, 15W-40) which can ensure engine works normally, and prolonging its service life.

4.1.5 Maintenance Instruction

In case of any failure within the period of “three- guaranty”, timely call 400-618-3066, and then the call center will range Weichai special service center for inspection and repair at once. Weichai will bear no responsibility in case of failures caused by using special spare parts or oil not from the Weichai or maintenance not done at Weichai special service station.

4.2 Maintenance intervals and specifications of industrial gas engines

4.2.1 Maintenance intervals of industrial gas engines

Initial maintenance (P)	New engine running for 30-50h	
Level 1 maintenance (WD1)	Engine running interval	250h
Level 2 maintenance (WD2)	Engine running interval	500h
Level 3 maintenance (WD3)	Engine running interval	1000h
Level 4 maintenance (WD4)	Engine running interval	3000h

4.2.2 Maintenance for gas engines

Items	Maintenance content	Maintenance mileage
Daily inspection	Oil level; coolant level; drive belt for wear; cooling fan for damage; gas supply system for leakage; hot water filled in gas supply system for cycle normal; electrical system for reliability; air cleaner for looseness.	Refer to the routine inspection and maintenance intervals. Refer to level 1 maintenance for the WD2, WD3 and WD4 maintenance. Use the Weichai special oil and oil filter.
Initial mandatory maintenance	Replace the oil and oil filter element; check the belt tension, pipeline clamp, bolt tension and tighten the cylinder head bolts	
Routine inspection	Fuel filter; each clamp of pipeline (coolant pipe, air pipeline, fuel line and oil pipe); fuel system for leakage and pressure.	
WD1 maintenance	Valve clearance; air cleaner; belt tension, each clamp of pipeline (coolant pipeline, air pipe, fuel line and oil line); spark plug; high-pressure wire; ignition advance angle; gas filter element and coolant level.	

Items	Maintenance content	Maintenance mileage
WD2 maintenance	Replace the service kit of voltage stabilizer; clean the mixer, electronic throttle and clean the injection valve.	
WD3 maintenance	Check the high-voltage wire of spark plug and it is suggested to replace it.	
WD4 maintenance	Check the supercharger, air compressor; clean the cooling system; change the coolant; replace the service kit of pressure reducer.	

4.2.3 Spare parts and oil/fuel grade specifications

It is suggested for the users to go to the Weichai special service stations for purchasing the special spare parts and oil, which can ensure engine works normally, prolonging its service life.

4.2.4 Maintenance Instruction

After the Weichai industrial engines are installed, user is expected to notify the Weichai special service center for commissioning. In case of any failure happening within “three-guaranty” period, timely notify the Weichai special service center. Weichai will bear no responsibility in case of failures caused by using special spare parts or oil not from Weichai Power or maintenance not done at Weichai special service station.

Friendly reminder: please carefully read the maintenance instruction for your legitimate interest.

4.2.4.1 Weichai Power will bear no responsibility in case of failures caused by using special spare parts or oil not from the Weichai Power or maintenance not done at Weichai Power special service station.

4.2.4.2 Weichai Power will bear no responsibility in case of any failure caused by using engine for other purposes or mismatching the engine parts.

5 Maintenance specifications for main accessories of diesel engine

5.1. Use and maintenance of fuel injection pump

5.1.1 Preparation for operation

- a. Before installing the fuel injection pump, check whether the pump model is correct, if not, replace it.
- b. Wipe the anti-rust oil on the surface of fuel injection pump.
- c. Clean the anti-rust oil inside of governor and fuel injection pump, and refill the lubricant with stipulated grade.
- d. Anti-rust oil in fuel pipe should be removed before it is put into use, then fill the pipe connected to the fuel injection pump with fuel, and continuously crank the camshaft of fuel injection pump until the clean fuel is rejected from the fuel outlet valve.

5.1.2 Fuel

Using the inferior fuel not only could reduce the engine performance, but also could greatly shorten the service life of fuel injection pump and engine.

- a. Use the high-quality fuel. Generally, 0# light diesel fuel is used for summer and -10# or higher grade light diesel fuel for winter.
- b. The fuel to be filled should be clean, without any foreign material and moisture. Therefore, fuel to be filled should be sedimentated for 72h or more. Periodically clean the filter element and fuel supply pump mesh. In addition, timely change any damaged one.
- c. As the air mixed in fuel can hinder the fuel injection pump to work normally, drain the air entered into the pump and low-pressure fuel pipeline if the fuel injection pump is not used for long time or fuel pipe joint is replaced. For draining air, loosen the overflow valve joint, repeat pressing down the hand pump. After that, timely tighten the overflow valve joint.

5.1.3 Lubricant

- a. Generally, fuel injection pump is forcefully lubricated by connecting it to the engine lubricating system which can provide the lubricant. The

new fuel injection pump before being put into use should be filled with proper lubricant, because it can't be lubricated before engine provides the lubricant. Refer to the engine maintenance interval to service the fuel injection pump by loosening the bolts at the back housing of it to drain the used lubricant. After that, tighten the bolts and refill the new lubricant.

- b. For the fuel injection pump non-forcedly lubricated (for example: P9 series pump), fill it with the stipulated-grade oil to the proper level measured by a dipstick. That can lubricate the fuel injection pump with engine running. Refer to the engine maintenance interval to service the fuel injection pump by loosening the bolts at the back housing of it to drain the used lubricant. After that, tighten the bolts and refill the new lubricant.

5.1.4 Adjust the fuel injection advance angle

After the fuel injection pump is installed, refer to the engine requirements to adjust the fuel injection advance angle. Namely, the piston of 1st cylinder should be at optimal injection position before TDC. Loosen the high-pressure fuel pipe of 1st cylinder connected to the fuel injection pump and bolts attached to the fuel injection pump flange and couplings. As you crank the pump or camshaft, observe where engine flywheel scale is when the fuel is just the fuel out coming from the 1st cylinder. Refer to the requirements for fuel injection advance angle for adjustment, and then tighten the loosened bolts and joints.

5.1.5 Seal up for safekeeping

When the fuel injection pump is not used for long time, anti-rust treatment should be done. Change the fuel and lubricant in the pump with anti-rust oil, cover the joint of fuel/oil return pipe and reseal it once very year.

5.1.6 Precautions

- a. Without some experience and testing conditions, it is prohibited to dismantle the fuel injection pump assembly at will in particular the lead sealing parts which can't be unsealed.
- b. The fuel injection pump should be stored in the vent and dry garage and kept away from the chemical goods which can lead to corrosion and rust, such as battery and acid.

5.2. Use and maintenance of supercharger

The oil from the supercharger flows out from the main oil passage of engine, lubricates and cools the supercharger, then return back to the lower portion of crankcase.

- a. Good lubrication is essential to the supercharger. The oil filter element should be periodically cleaned or exchanged.
- b. As the supercharger works at extreme-high rpm (about 70000 ~ 100000r/min), idle the diesel engine after being started for about 5min and then load it. Do not suddenly stop diesel engine which is running at high load or speed, whereas, it is correct to gradually reduce the load and rpm and then idle it for 3-5min. otherwise, supercharger bearing may be damaged or fail.
- c. Periodically remove the air compressor housing and turbine case for cleaning the space developed by the blade and housing. Refill the clean oil at the oil inlet for reassembly of supercharger.
- d. Precaution: Because the rotor of supercharger is of sophisticated high-speed rotating part, users are not allowed to dismantle or impact it. Failing to do so will cause the factory's guarantee invalid.

5.3 Use and maintenance of air compressor

The air compressor mounted on WP10 series diesel engine is of single-cylinder reciprocating-type crank and connecting rod, which is driven by the belt or gear.

- a. The lubricant of air compressor flows from the main oil passage to lubricating the bearing in the air compressor via the lubricant pipeline, and eventually to the oil pan via the timing gear chamber.
- b. The air before entering the air compressor has been filtrated. Then the filtrated air flows out of the air cleaner and into the air compressor through a branch pipe before getting in the supercharger.

5.4 Use and maintenance of coolant pump

The coolant pump suitable for the WP10 series diesel engines is mounted in the front end of it. Its volute over the gear chamber is cast together with it. The out-flowed coolant directly goes into the right coolant chamber of engine. The coolant crossly flows through the oil cooler, goes into the coolant interlayer of cylinder and into the coolant chamber in cylinder head via upper coolant passage. At last, the coolant out-flowed from the cylinder head flows into the coolant pipe at the end of which there is thermostat. There are two

outlets on the thermostat: one is connected to the radiator and the other to the inlet of coolant pump which is also called as short circulation. When coolant hits $80\pm 2^{\circ}\text{C}$, the thermostat begins opening and is fully opened with coolant at 95°C . In such case, all the coolant after flowing through the radiator for cooling will be pumped into cylinder block. However, when the coolant is less than $80\pm 2^{\circ}\text{C}$, thermostat will cut off above mentioned passage, making the coolant directly go into the inlet of coolant pump and accordingly heat the engine rapidly until the required thermal state is reached. Therefore, that can prevent the wear at low temperature and prolong the useful life of diesel engine. In case of coolant pump leaking, replace its seals. Before delivery of diesel engine, the oil chamber of coolant pump has already filled with 120cm all-purpose lithium-base grease for vehicles that should be refilled periodically.

5.5. Use and maintenance of starter

- a. Starter, as short-time working part, should work for 15s at most every time. In addition, the starting interval should be more than 30s.
- b. In winter, if ambient temperature is less than 5°C , preheat the engine before startup.
- c. Release the starting switch the moment the engine is started, separating the drive gear of starter from the gear ring of flywheel.
- d. Do not power the starter until the engine stands still, which can prevent the flywheel from impacting the starter gear.
- e. The installation of starter must follow its wiring drawing. Before removal of starter, ensure the battery is disconnected from the starting wire of starter.
- f. Frequently check whether the fastener and wire insulation of starter are damaged, and whether the wire is well connected. In addition, remove the dirt.

5.6 Use and maintenance of generator

- a. Rational matching: with engine idling, the generator should meet the electricity consumed by all the electrical equipments. The generator mismatching the electrical equipments could lead to lack of electricity in battery and generator overheating that could result in damage to governor and stator burning. Generator should have proper min. running rpm, because too-low working speed (determined by the engine idling)

also can lead to abovementioned failures.

- b. Reliable fixing: generator should be correctly and reliably fixed on the engine. The bolts should be matched with the mounting hole of generator, and the pulley groove should share the same plane with the driving roller groove. The generator bracket should have sufficient rigid and strength, which otherwise may lead to damage to the generator.
- c. Check the belt tension by fingering to press down the middle part of it with force of 150N (15kg force), it is optimal that the deflection is 10-20mm. Belt tension should be checked once every two months. Belt slackening may lead to generator “slippage”, insufficient electricity production (that can result in lack of electricity in battery), stator burning and damage to bearing etc.
- d. Generator should be kept away from the hot source and splashed dirt. Splash should be avoided to enter the inside of generator, which otherwise can damage to it. Therefore, generator should be given a good application environment. Working temperature of generator is $-40-93^{\circ}\text{C}$. Therefore, its installation should be kept away from any heat source (distance of 400mm at least, or effective insulation plate should be installed), which should be approved by the generator factory or supplier.
- e. The wire of generator should be rational, and wiring should be correct and reliable. Each terminal of generator should be correctly connected for fear that the harness burns or generator is damaged. Proper wire diameter is the premise of generator capable to fully output the generated electricity, and the base of electrical safety.
- f. Before removing the generator and welding on engine, disconnect the battery to the generator. Generator removal, installation and repair should be done by the professional. Check whether all insulations are good, and immediately replace any damaged one. The positive pole of generator should be short connected to the housing to avoid series failure.
- g. After the engine is started, slowly increase its speed and observe whether the charging indicator changes from ON to OFF, if not, timely find out the cause.
- h. Check whether the negative pole of battery is grounded, which otherwise may damage to the generator and governor.
- i. With generator running, never adopt “sparking” to check whether the

generator can output electricity, which otherwise can burn the testing bulb or diode.

- j. With the rectifier connected with stator winding, it is prohibited to use a megger or 220V AC power supply to check for insulation of generator.
- k. The generator should be reliably connected to the battery. Moreover, suddenly disconnecting them will generate high voltage, damaging to the generator or governor.
- l. To match the governor with the AC generator, the voltage grade and grounding type of AC generator should be same to those of governor. In addition, the governor power should be not be less than that of generator.
- m. The wiring should be connected correctly.

5.7. Use and maintenance of oil pump

Oil pump for the WP10 diesel engine is of external engaged gear pump. The two gears with same number of teeth could mesh with each other. The two-gear contrarotation and gear space should push the oil from the low-pressure chamber to the high-pressure chamber. The consecutive rotation of gear could continuously provide the each lubricating system with oil.

- a. Pressure-limiting valve is mounted on the oil pump, which functions to prevent the oil pump and lubricating system from having too high pressure and accordingly ensure each part works safely. The pressure-limiting valve also functions as bypass valve. When the oil pressure exceeds the pre-set value, this valve will open, allowing partial oil to flow into the oil pan and accordingly reduce the oil pressure. The oil pressure can be adjusted by a spring of which preload is already well set. Therefore, user is not expected to change it.
- b. The oil pump performance is mainly dependent on the clearance between the gear in the oil pump and its housing (end clearance and radial clearance). Widened clearance can lead to oil leakage, reducing the pressure and amount of oil. Narrowed clearance should result in severe wear.
- c. When the oil pressure drops, repair the oil pump if other failures are ruled out. To check the oil pump, firstly check whether there is leakage or burn happened to the oil pump. If not, firstly check the pressure-limiting valve, and then remove the oil pump. Check whether the pressure-limiting valve spring is softened, or whether the pump and end

cover wear. If needed, replace the oil pump.

- d. If the oil pressure is over high, dismantle and check the pressure-limiting valve, specially, whether the pressure-limiting valve can be open.
- e. During removal and installation of oil pump, pay specially attention to the end cover, interface of pump body and each positioning pin.

5.8 Use and maintenance of air cleaner

Warning! Wrong maintenance may greatly shorten the useful life of engine.

- a. Select the air cleaner according to the performance index of diesel engine. Which otherwise may impair the diesel engine dynamic property and economy.
- b. For the air cleaner with alarm, firstly check the alarm before operation of diesel engine. When the intake resistance indicator becomes red, maintain the air cleaner element.
- c. For the filter with multi-stage filtration, the strainer must be installed.
- d. During installation, do not sharply bend the venting pipe, and check it for leakage.
- e. Water is prohibited to enter the air cleaner.
- f. For the air cleaner with safety element, it is prohibited to remove the safety element during maintenance of air cleaner.
- g. Generally, the main paper element of air cleaner should be maintained every 100-200h. Dismantle the main paper element, and then slightly tap or shake the dust off. Check the seals in each element and replace any damaged one. It is allowed to use the clean and dry compressed air with pressure less than 500kPa to blow the element from the inside to the outside. Place a lamp into the element to check whether the filter element is pervious to the light, whether there is crack, piercing or other damage. Never flush the main element with oil and water.
- h. The main element should be replaced every 1000-2000h, together with the safety element.
- i. In case of the following items, replace the filter element assembly

- The filter element is damaged.
- After the filter element is cleaned, it still gives alarm.
- To replace the element after being cleaned for 3-6 times, select high-quality ones, which can ensure the reliability of diesel engine.
Therefore, it is suggested to purchase the origin parts.

5.9 Use and maintenance of diesel fuel filter

Diesel fuel filter consists of strainer and fine filter. As the time goes by, the dirt or foreign material becomes increasingly accumulated on the filter element surface and bottom of housing, which can clog the element if it is not removed timely. As a result, diesel engine can't be provided with sufficient fuel, reducing the power. Therefore, it is important to periodically maintain or clean the diesel fuel filter.

- a. Periodically open the drain plug at the bottom of housing to drain the dirty fuel or accumulated water.
- b. Generally, filter element should be maintained once every 200-300h, and shortened if the fuel quality is poor. During maintenance, timely replace any damaged filter element.
- c. Before maintenance, block the two holes on the main element to prevent any dirt from getting in. The filter element should be cleaned in clean kerosene and diesel fuel by a soft brush. After that, use clean kerosene and diesel fuel to clean it again. If conditions permit, use clean compressed air to blow it from the inside to the outside.
- d. Use clean kerosene or diesel fuel to clean the inside surface of housing and each hole of end cover.
- e. Check each sealing is damaged, if so, timely replace it.
- f. After maintenance and before use, check there is fuel leakage at each sealing position.

5.10 Use and maintenance of fresh-water cooler

The fresh-water cooler for WP10 series diesel engine is of shell-and-tube heat exchanger of which principle is that the seawater flowing in the coolant pipe cools the fresh water circuitously going in the inside of shell. Thus that can optimize the cooling conditions of diesel engine and then improve the useful life of diesel engine.

- a. If the diesel engine is not in use, do drain the water in the fresh-water cooler, which otherwise is harmful to parts in fresh-water cooler, especially in winter.
- b. The fresh-water cooler should be checked each quarter by smoothing the pipeline, removing the dirt and replacing the zinc slab.
- c. Before reinstalling the fresh-water cooler already cleaned, hydraulic test should be conduct. As a result, there should be no leakage, after it is pressed with pressure of 0.4MPa for 30min.

5.11 Use and maintenance of air cooler

Air cooler for WP10 series diesel engine is of tube-and-fin heat exchanger of which principle is that coolant flowing in tube could dissipate the thermal of supercharged air via the tube wall. Therefore, that can reduce the intake temperature of diesel engine, increase the intake density and increase the power of diesel engine.

- a. If the diesel engine is not in use, do drain the water in the air cooler, which otherwise is harmful to parts in air cooler, especially in winter.
- b. The air cooler should be checked each quarter by smoothing the pipeline, removing the dirt and replacing the zinc slab.
- c. Before reinstalling the air cooler already cleaned, hydraulic test should be conduct. As a result, there should be no leakage, after it is pressed with pressure of 0.4Mpa for 30min.

5.12 Use and Maintenance of electronic governor

The electronic governor of WP10 series diesel engine consists of speed controller, electromagnetic executor, speed sensor, rated idling switch, trimmer potentiometer, control power supply and power switch. The principle will be explained as shown: idea speed of engine is determined by the speed setting potentiometer and speed trimmer potentiometer. Whereas, the actual speed of engine is determined by the speed sensor mounted on the root of flywheel teeth. The signal outputted by the speed sensor is of AC voltage signal with frequency in direct proportion to the speed. This signal can be converted into the DC voltage via the F/V circuit, and then compared to the set value of speed. As a result, the deviation value of speed can be obtained. This deviation value is operationally amplified by the PID I governor, which creates the fuel-supply position value, namely steady-state output position index of executor. After this index of executor is compared with the actual position of executor, the actual position deflection can be

obtained. Then the actual position defection is operationally amplified by PID II governor, and then converted into the current control manner which can output the drive current to the executor and accordingly change the motion displacement of executor.

5.12.1 It is suggested to install the speed sensor onto the gear ring of engine. In addition, the clearance between the sensor and teeth crest should be 0.4mm-0.8mm. Firstly rotate the sensor to the teeth crest and then return it back by 1/3 (pitch 1.5mm) or 1/2 circle (pitch 1mm), then tighten the nut. If there is no flywheel gear ring, use other sensing gear of which material must be permeability magnetic material. Moreover, within engine running speed, the frequency output by the sensor should be not less than 1000Hz.

5.12.2 The electromagnetic executor is mounted on the engine and suggested to be installed together with fuel pump. But in special cases, external mounting type can be used.

5.12.3 Speed controller should be installed in the protection case without any intense impact or electromagnetic interference. In addition, sufficient space should be reserved for installation, maintenance and thermal dissipation. The housing of rpm controller should be properly grounded. In addition, speed sensor and speed trimmer potentiometer should be connected to the controller by shield cable of which shielding layer should be grounded at one point of controller.

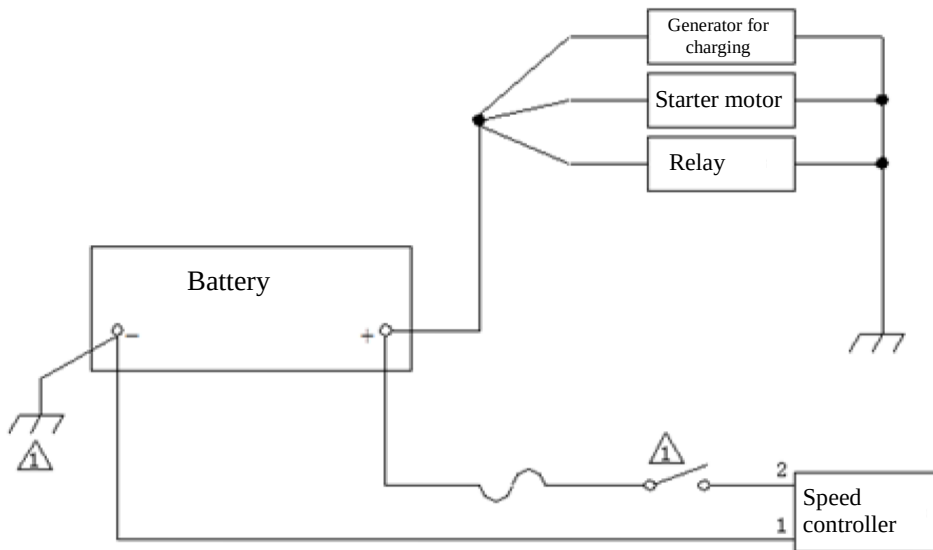
5.12.4 The governor has the working voltage of DC 24V (12V optional) and can be powered by the control battery of engine, starting battery or other regulated/non-regulated power supply, but the peak power consumption and voltage fluctuation of system should meet the related requirements. If the governor is powered by a starting battery, provide a charger and ensure the battery electricity is sufficient. With engine running, battery-output-voltage dropping for short time will not impair the normal working of governor.

5.12.5 Precautions for wiring of governor power supply:

- a. The positive pole (2 pin) of speed controller on electronic governor should be connected to the positive pole of 24V battery via the switch of power supply (stopping switch) and fuse (if needed). Namely, the controlled is directly powered by the positive pole of battery.
- b. The negative pole (1pin) of speed controller on electronic governor should be directly connected to the negative pole of battery. If the

negative pole of power supply is grounded, the negative pole of battery should be grounded at the negative pole of battery rather than at the negative pole (1 pin) of controller.

- c. If the power supply wire has length of less than 10m, its diameter should be more than 0.75 mm^2 (include) and if the power supply wire has length of more than 10mm, thicken it.



5.12.6 Daily maintenance of electronic governor

- a. Timely replace or repair any damaged cable. Cable should be clamped to prevent against rubbing with engine. In addition, the layout of cable should be kept away from the high-temperature parts (such as supercharger and exhaust pipe).
- b. Check whether the executor is reliably installed.
- c. Check whether the executor connector, sensor connector and cable screws are contaminated with oil or loosened, if so, timely clean or tighten them.
- d. Check whether the battery electricity is sufficient, or whether the charger is normal.
- e. For the non-forced circulation oil pump, frequently check the high/low oil level, and replace the lubricant on schedule.
- f. If the engine is started at low temperature, push the rocker arm of

executor for a few times for feeling whether the motion is smooth.

- g. Maintenance every 2000h: remove and clean the speed sensor probe on which the dirt may be accumulated. Open the sight glass cover on the mid of governor to check whether the fasteners or pins attached coupling to the rack of oil pump are loosened, if so, timely tighten it.
- h. Maintenance every 6000h: remove the executor from the high-pressure oil pump to check whether the rack of oil pump can move smoothly.

5.12.7 Precautions

- a. The matched speed sensor is only used for electronic governor rather than other speed measuring devices.
- b. To ensure the safety of engine system, the governing function of electronic governor can't be replaced by the overspeed protection function which should be independently installed.
- c. The emergency-stopping executor of overspeed protection device should be independent and can't be replaced by the electromagnetic executor.
- d. Each time of starting engine, please ensure the "idling/rating" speed switch is at "idling" position.
- e. The potentiometers of controller have already well set at delivery and should not be adjusted by the non-professional.
- f. With engine not running, it is not allowed to adjust (specially increase) the rated speed of the controller, or to set the potentiometer or trimmer potentiometer. The set speed should not be too high, which could lead to overspeed at the beginning of engine startup.
- g. If the engine after being sealed for long time is to be reused or is started at low temperature, push the rocker arm of executor for a few times for feeling whether the motion is smooth. If there is stuck phenomenon, do not start engine.
- h. If the engine after being sealed for long time is to be reused, before startup, shortly connect the two probes of controller and then executor should output max amount of fuel. The executor pointer should return back to zero the moment the two probes are disconnected. Otherwise, timely find out the cause, do not start engine rashly.

6. Common failure analysis and troubleshooting

6.1 Unable to start the diesel engine

S/N	Cause	Troubleshooting
1	Operation causes	
	(1) For the air starter, the air pressure in the air bottle is insufficient or is not at the best starting position.	The starting pressure in the air bottle should frequently stay at 2MPa. Before starting, crank the engine until any piston reaches 15degree after the TDC.
	(2) For the electric starter, the battery electricity is insufficient.	Refer to the service for free-maintenance battery.
	(3) The driving handle is not at the driving position.	Fix the driving handle to the driving position.
	(4) Diesel engine is loaded	Unload the diesel engine.
	(5) Oil viscosity is high, thus, the flowability is poor.	Refer to the ambient temperature to select proper oil, or heat oil.
	(6) There is air in the fuel system.	Degassing of the system
	(7) Water is mixed in the diesel.	Check the fuel tank, and then open the plug at the bottom of diesel filter for draining water.
	(8) The vent screw of fuel injector is not tightened, unable to inject fuel.	Clockwise rotate it.
	(9) Diesel fuel is not properly selected.	Refer the local season for selection.
2	Fuel system causes	
	(1) Fuel pipe joint leaked.	Check and then tighten the joint.
	(2) The fuel pipe is clogged.	Check, clean or blow the clogging.
	(3) Diesel filter is clogged.	Replace or clean filter element
	(4) Fuel injected can't be well atomized.	Adjust and repair the fuel injector, if needed, replace the needle valve assembly.
	(5) Advance angle of fuel supply is wrong.	Adjust according to specifications.
	(6) Fuel injection pump or fuel injector is damaged.	Repair or replace it.

S/N	Cause	Troubleshooting
3	Others	
	(1) Intake valves and exhaust valves are leaked.	Grind or readjust the valve clearance.
	(2) Cylinder leaked.	Check each cylinder gasket, and then tighten nuts on the cylinder head.
	(3) Valve spring is fractured.	Replace it.
	(4) Piston rings leak	Replace the leaked piston ring.
	(5) Piston is stuck with cylinder.	Remove and repair it.
	(6) There is water accumulated in cylinder.	Remove the cylinder head for dewatering, and then find out the cause.
	(7) For air starter, timing of air distribution disk is wrong.	Remove for reinstallation.

6.2 The diesel engine can not output stipulated power

S/N	Causes	Troubleshooting
1	Operation	
	(1) Rotating speed is low.	Adjust to rated speed.
	(2) The local altitude or ambient temperature is too high.	Refer to GB standard "Power Correction Table" for correcting the output power.
2	Fuel system	
	(1) Fuel injector failed (nozzle is clogged; atomization is poor; fuel injection pressure is not insufficient; the height of nozzle protruding from the cylinder head is not correct)	Refer to the specifications to adjust or repair the fuel injector.
	(2) Fuel injection pump unevenly pumps the fuel or some pump does not work.	Adjust the amount of fuel injection or repair the fuel injection pump.
	(3) Fuel injection pump wears, unable to pump enough fuel.	Properly screw out the limiting screw on adjusting rack in fuel injection pump; increase the flow of fuel injection or replace with the new plunger and barrel assembly.

S/N	Cause	Troubleshooting
	(4) Diesel fuel filter is clogged; the fuel pressure in the fuel supply pump is insufficient, the check valve of fuel supply pump is fractured or worn; the spring is fractured.	Check, clean, adjust or replace it.
	(5) Diesel fuel is not properly selected.	Refer to the local season (ambient temperature) for fuel grade selection.
	(6) Advance angle of fuel injection is wrong.	Check and adjust it.
3	Air distribution system	
	(1) Air cleaner, air compressor of supercharger and intercooler is not clean.	Dismantle and then clean them
	(2) The external exhaust pipe does not meet the requirements, and the back pressure of exhaust system is too high.	Refer to the specifications and design to arrange the exhaust pipeline.
	(3) Intake valves and exhaust valves are leaked	Check and grind them.
	(4) Timing of inlet valves and outlet valves is wrong.	Check and adjust it.
	(5) For the air starter, the inflation valve or starting valve on the cylinder head are leaked.	Dismantle and then grind them.
4	Others	
	(1) The compression pressure is insufficient (compression ratio is wrong or the piston rings are severely worn.)	Check, adjust or replace the piston.
	(2) Piston scuffs the cylinder lining, or other wear parts failure.	Remove the cylinder head to check inside surface of cylinder liner or other wear parts. If needed, timely repair or replace it.
	(3) Diesel engine can not sufficiently cool down and therefore overheats.	Check the belt tension, each part of cooling system, or remove the scale.
	(4) Bearings overheat, caused by poor lubrication.	Repair or clean the lubricating system.

6.3 Exhaust system smokes

S/N	Cause	Troubleshooting
1	Gray-white smoke	
	(1) Diesel engine temperature is very low.	Increase the coolant temperature at the inlet of engine.
	(2) Cylinder leaks water.	Remove the exhaust pipe or check the cylinder head.
	(3) Combustion in cylinder is not insufficient.	Check the compression pressure in the fuel injector or cylinder.
2	Gray-brown smoke	
	(1) Diesel engine is loaded severely.	The load on the engine should drop.
	(2) Some fuel injection pump pumps too much fuel.	Reduce the load.
	(3) Fuel injector fails (for example, if fuel drips at the nozzle, exhaust system will intermittently smoke).	Check the fuel injector or replace the nozzle.
	(4) The advance angle of fuel injection is insufficient (black smoke or flame comes from the exhaust system).	Adjust the advance angle of fuel injection.
3	Blue smoke	
	(1) With engine still at low temperature, oil blows into the combustion chamber.	Increase the coolant temperature at the inlet of engine.
	(2) The engine is new.	Prolong the running-in time.
	(3) Piston rings wear.	Repair.

6.4 Abnormal noise or vibration during diesel engine running

S/N	Cause	Troubleshooting
1	Premature fuel injection or uneven fuel injection causes the clear, rhythmic and metallic knocking noise, especially at starting or low speed.	Adjust the fuel supply advance angle or adjust the uniformity of fuel amount.
2	The clearance between the intake valve and exhaust valve is excessive, making rhythmic and slight knocking noise.	Adjust valve clearance.
3	Increase the load on diesel engine before being preheated. The clearance between the piston and cylinder liner is excessive, making knocking noise.	Unload diesel engine for idling and accordingly warming of diesel engine.
4	The wear of piston, piston ring and cylinder liner is excessive, making knocking noise.	Replace the related parts

5	Each journal severely rubs with bearing bush on crankshaft, making knocking noise along the overall length of diesel engine.	Repair or replace it
6	Compression ratio is too high, causing rough operation and large vibration.	The compression ratio should be adjusted to specification.
7	The clearance between the intake valve and exhaust valve is undersize, or the exhaust or intake timing is not correct, causing that the valve impacts the top of piston.	Adjust valve clearance or timing.
8	Individual cylinder does not work and diesel engine vibration is aggravated.	Check the fuel system and solve the failure.
9	The valve is fractured (the valve lock clip is damaged, valve drops or the piston fractures, causing sudden or strong knocking noise)	Immediately stop the engine for inspection.
10	Air leaks from the cylinder head lining, making howling.	Check the cylinder head nuts for tightness or replace the cylinder liner.
11	Wear of each gear is excessive, making knocking noise.	Check or replace it
12	The fixing bolts attaching to diesel engine is loose or damaged, causing vibration aggravating.	Tighten or replace the bolts
13	Diesel engine is not coaxial to the connected work device, aggravating the vibration.	Check and adjust it
14	Uneven foundation causes the deformation of common base plate.	Check and adjust it

6.5 Diesel operation unsteady

S/N	Cause	Troubleshooting
1	The flyingweight of governor can not move smoothly, or its clearance widens.	Check for stuck phenomenon. Refer to the actual practice for repair or replacement.
2	The buffer circlip in governor is lack of elasticity or fractured, making the adjusting rack shake or unsteady.	Check or replace it
3	Diesel engine speed is too low; with engine idling at mid speed, two-purpose governor can't activate automatically.	Increase to rated speed.
4	The diesel engine load varies frequently.	Check the load output state.
5	Some cylinder intermittently fires, making the fuel be accumulated in cylinder and accordingly	Check the fuel system.

	lead to knocking of cylinder.	
6	The fuel injectors have different amount of fuel distribution and injection time.	Check and adjust it
7	Air enters the fuel system.	Check or degassing.
8	Air enters the fuel system	Check the fuel system and degassing it.
9	Timing gear plays forward/backward.	Check each gear for tightness.

6.6 Water pump can't absorb water or pump enough water

S/N	Cause	Troubleshooting
1	Air enters the water pump or suction pipe.	Fill them with water to drain the air.
2	water pipe is clogged or froze (cold season)	Clean or fill it with hot water or antifreeze.
3	Seals of coolant pump are damaged or leaked.	Repair or replace it
4	Water pump belt is too loose.	Check and adjust it
5	Water pump has too much scale.	Remove the scale.
6	Water pump has excessive suction head.	Refer to the specifications to install the water pump.

6.7 Too low oil pressure

S/N	Cause	Troubleshooting
1	Oil quality is poor (because as the diesel engine is running, the oil pressure gradually drops).	Refer to the specifications to select the oil.
2	Diesel engine overheats or the oil is thinned.	Refer to the section 6.8 in this chapter.
3	Oil filter is clogged.	Clean it.
4	Oil pipe joint is loosened or air enters oil pipeline.	Check and tighten it.
5	Diesel fuel is mixed in the oil.	Find out the cause.
6	Pressure-regulating valve spring is fractured.	Replace it.
7	Oil in the oil tank drop or the suction head of oil pump is excessive big.	Refill the oil, or reinstall the oil pump or oil tank.
8	The clearance between the connecting rod bearing and main bearing is widened.	Check or replace it.

6.8 Diesel engine overheats

S/N	Cause	Troubleshooting
1	Coolant is insufficient.	Refer to the section 6.6 in this chapter.
2	Inlet temperature of coolant is very high.	Decrease the coolant inlet temperature.
3	Oil pressure is too low.	Refer to the section 6.7 in this chapter.
4	Diesel engine is overloaded.	Reduce load and find out the cause.
5	Fuel injection delays.	Check and adjust it.
6	Piston rings leak.	Check or replace it.
7	Matching of bearings too tight.	Inspection and grind them.
8	Ambient temperature is too high.	Correct the power and reduce the load.

II. User Service Guide

Weichai Power Product Warranty Card (for users)

Name	Content	Name	Content
Model		Name	
Order No.		Zip code	
Number		Address	
Purchasing date		Office phone	
Dealer		Home phone	

Respected users:

Thanks for using Weichai products!

In order to correctly use and maintain the diesel engine, please carefully read this manual and closely follow the specifications. In case of any failure, please timely contact with the Weichai Power Maintenance and Service Center or Customer Service Center and we will delivery effective service on time.

“Service Registration Form” should be filled by the Maintenance and Service Center during service and then saved by the user.

Weichai Power Co., Ltd.

Address: No.197 A, Fushou East Street, High-tech Industrial Development Zone, Weifang, Shangdong

Zip code: 261205

Website: <http://www.weichai.com>

Engine sale phone: 0536-8197532

Spare-part sale phone: 0536-2297980

Service Hotline:

400 Free Service Hotline: 400-6183066

800 Free Hotline: 800-8603066

Customer Service Center: 0536-8235369 (fax)

Customer Service Center Complaint: 0536-2297322

Service Registration Form (filled by the service staff)

Name	Content	Name	Content
Model		Name	
Order No.		Zip code	
Number		Address	
Purchasing date		Office phone	
Dealer		Home phone	

Service Center Name	Date	Maintenance items	Replaced parts	Quantity	Signed by the service staff	Signed by user

Repairs instruction

1. “Domestic Repair”

Domestic users could call for 400 618 3066 or 800 860 3066 for repair.

Customer Service Center 800 and 400 hotlines are available for 24h, providing quick and effective high-quality service. Oversea Centers and Authorized Service Centers are on duty for 24h wherever you are. Namely, where there is Weichai product, there is Weichai service.

2. “Oversea Repair”

User could call for Weichai Power International Service Department Hotline: 0536-8197520 or send a fax: 0536-8098063.

Diesel engine “Three-guaranty” warranty specification

1 "Three-guaranty" principle

- 1.1 Under the normal use and maintenance, Weichai Power will free repair or maintain the damaged parts caused by its quality during “Three-guaranty” period.
- 1.2 For the failed engine, first of all, repairing is considered. The related parts can be replaced.
- 1.3 Replacement of entire engine should meet the related specifications.

2 Industrial engine “Three-guaranty” warranty

- 2.1 From the date of purchasing the engine on the invoice, "Three-guaranty" lasts for 18 months or 1500h, whichever comes first. The parts possessing agreement with supporting factory should be warranted according to its agreement.
- 2.2 "Three-guaranty" warranty for the retail products: From the purchasing date on the invoice, the “Three-guaranty” will last for one year or 1500h, whichever comes first.
- 2.3 If the engine after being delivered is stored for one year or more, before starting it, notify the Industry Power Sale Company of Weichai for arranging the Weichai Authorized Service Center for paid maintenance. Otherwise, “Three-guaranty” warranty will be abandoned.

Industrial power diesel engine “Three-guaranty” warranty regulations

Diesel Engine applications				Three-guaranty period	
Diesel engines used for power generating, pump or air compressor				18 months, or 1500h, whichever comes first	
The following parts are the basis ones; any part with manufacturing defects will be warranted for 24 months from the delivery date					
1	Cylinder block	2	Crankshaft	3	Connecting rod
4	Camshaft	5	Crankcase	6	Timing gear chamber
7	Cylinder head	8	Flywheel		Flywheel housing
The following parts, as essential parts, have the warranty period of 18 months, or					

1500h, whichever comes first					
1	High-pressure fuel pump	2	Cylinder head	3	Cylinder liner
4	Oil cooler	5	Seawater –fresh-water heat exchanger	6	Oil pump
7	Piston	8	Seawater pump	9	Fresh-water pump
10	Piston ring	11	Intake and exhaust manifolds	12	Thruster
13	Piston pin	14	Rear oil seal of crankshaft	15	Metallic pipe joint
16	Bearing shell, connecting rod	17	Piston pin circlip	18	Oil-water separator
19	Main bearing shell	20	Front/rear mountings of engine	21	Radiator with fan
22	Camshaft bushing	23	Pulley- crankshaft	24	High-pressure fuel pipe
25	Valve	26	Metallic coolant pipe	27	Warning device for fuel leaking
28	Valve spring	29	Intermediate gear shaft	30	Rotation axle, oil pump
31	Valve spring seat	32	Fuel injector (excluding nozzle)	33	Gear ring of flywheel
34	Valve port	35	High-pressure fuel pump support	36	Bolts on connecting rod
37	Valve guide	38	Coupler, fuel pump	39	Oil filter seat
40	Valve cover	41	All kinds of gaskets and covers	42	Air cleaner (without element)
43	Tappet	44	Metallic fuel pipe	45	Fuel filter (without element)
46	Push rod	47	Muffler	48	Oil filter (without element)
49	Valve rocker	50	Silicon-oil shock absorber	51	Oil strainer (without element)
52	Rocker seat	53	Fan support	54	Dipstick assembly

55	Rocker shaft	56	Hand oil pump	57	Cooling nozzle
58	Oil sump	59	All kinds of gears	60	All kinds of bearings
61	Intercooler	62	Starting valve	63	Oil pressure-limiting valve
64	Air bottle assembly	65	Air bottle head and valve	66	Pulley coupler
67	ECU	68	Common-rail pipe	69	Front cover of gear chamber
70	upper/down end cover	71	Cover of oil radiator	72	Distribution pan
The following parts, as common parts, have the warranty period of 12 months, or 750h, whichever comes first.					
1	Air starter	2	Tensioner	3	Front oil seal of crankshaft
4	Pressure-reducing valve of air starter	5	Oil seals of oil pump	6	Fuel return pipe of fuel injection pump
7	Fuel atomizer, air starter	8	Fuel supply pump	9	Gaskets of intake pipe and exhaust pipe
10	Hand oil pump	11	Gaskets of supercharger	12	Expansion joint
13	Dipstick	14	Fan	15	Bushing of fuel injector
16	Thermostat	17	Gaskets of oil sump	18	Bowl-type plug
19	All kinds of O-rings	20	All kinds of mechanical instruments	21	All kinds of bolts and crews
22	All kinds of weaved hose	23	Electronic regulator	24	Control panel
The following parts, as electrical parts, have the warranty period of 12 months, or 750h, whichever comes first.					
1	Starter	2	All kinds of sensors	3	Electrical pre-supply pump
4	Generator	5	All kinds of instruments	6	Solenoid valve
7	Engine harness	8	Monitor assembly	9	Cutoff-solenoid valve
10	Relay	11	Battery	12	
The following parts, as wear parts, have the warranty period of 7 months or 50h from the delivery date, whichever happens first.					

1	Belt	2	Plunger assembly in high-pressure fuel pump	3	Fuel injection nozzle assembly
4	Clamp	5	All kinds of spin-on elements	6	
7		8		9	

Note: If the timer is fault, the “Three-guaranty” period should be calculated referring to 10h each day.

Industrial power gas engine “Three-guaranty” warranty specifications

Gas engine applications	Three-guaranty
Gas engine for power generation	18 months or 1500h from the date of delivery, whichever comes first.
“Three-guaranty” of gas engine parts is same to that of diesel engine with the same purpose.	

The following parts, as essential parts, have the warranty period of 18 months or 1500h from the delivery date, whichever comes first.

1	Electronic throttle	2	Exhaust control valve	3	Ignition module
4	Fuel metering valve	5	Heat exchanger	6	Gas thermostat
7	ECU	8	Signal generator assembly	9	Mixer assembly
10	Throttle pipe	11	Fuel injection pipe	12	Support
13	Joint pipe	14	Intake elbow	15	Air pipe joint
16	Pad	17	Cover plate	18	All kinds of metallic fuel pipes
19	All kinds of metallic air pipes	20	All kinds of metallic pipe joints		

The following parts, as common parts, have the warranty period of 12 months or 750h from the delivery date, whichever happens first.

1	Evaporation adjuster (for LPG)	2	Pressure stabilizer (for LNG)	3	Pressure reducing regulator (for CNG)
4	Three-way catalyst	5	Electrical control box	6	Polyurethane gas pipe
7	Rubber hose	8			

The following parts, as electrical parts, have the warranty period of 12 months or 750h from the delivery date, whichever happens first.

1	Solenoid valve	2	All kinds of sensors	3	Ignition coil
4	Relay	5	Harness	6	Ignition cable
The following parts, as wear parts, are out of “Three-guaranty”					
1	Spark plug	2	Fuel filter assembly		

Note: If the timer is fault, the “Three-guaranty” period should be calculated referring to 10h each day.

Weichai industrial power engine spare parts “Three-guaranty” warranty specification

Weichai power promise of quality warranty and “Three-guaranty” for spare parts: Under the normal use and maintenance, Weichai Power will free repair or maintain the damaged parts caused by its quality within the “Three-guaranty” period.

1 Spare part “Three Guaranty” specifications

The failed parts have quality defect, the “Three Guaranty” period will calculated according to the date on the sale invoice or sale list printed by Weichai Spare Part System.

1.1 Low-value wear parts are not covered by “Three guaranty”:

Gaskets: all except for cylinder head gaskets;

Filter elements: air cleaner, fuel filter, oil filter;

Rubber: waterproof ring of cylinder liner, sealing rubber ring, sealing gasket of oil sump;

Sensor: coolant temperature sensor, oil pressure sensor;

Mate parts: matching parts of nozzle, injection pump plunger and barrel;

Fasteners: clamp and clip;

Bolts purchased separately: connecting rod, cylinder head, main bearing etc.

1.2 For wear parts and electrical parts, the warranty period is 3months

The following parts belong to wear parts or electrical parts					
1	Starter	2	Belt	3	Preheating device
4	Generator	5	Electronic throttle pedal	6	A/C compressor
7	Fuel/water separator (without element)	8	Engine harness	9	Fuel-saving switch
10	Thermostat	11	Clamp	12	Monitor assembly
13	Solenoid valve	14	Power pre-supply pump	15	Relay
16	Battery	17	Piston ring	18	Piston
19	Cylinder liner				

1.3 For the essential and common parts, the warranty period is 3months

The following parts belong to essential and common parts					
1	Cylinder head	2	Gear shaft	3	Crankshaft balancer
4	Device for lifting of idle speed	5	Gear ring	6	Rear oil seal of crankshaft
7	Supercharger	8	Oil pump	9	Metallic fuel pipe
10	Fan	11	Intake and exhaust manifolds	12	Metallic coolant pipe
13	Piston pin	14	Oil sump	15	Metallic pipe joint
16	Bearing shell, connecting rod	17	Front/rear mountings of engine	18	SCR box
19	Main bearing shell	20	Pulley	21	Oil-gas separator
22	Camshaft bushing	23	Flange	24	ECU
25	Fuel supply pump	26	Telematics	27	Common-rail tube
28	Valve	29	Injection pump	30	High-pressure fuel pipe
31	Valve spring	32	Fuel injector body	33	Cooling nozzle
34	Valve spring seat	35	Shock absorber	36	Dipstick assembly
37	Valve port	38	Strainer	39	Fuel filter body
40	Valve guide	41	Air compressor	42	Oil filter seat
43	Valve cover housing	44	All kinds of gaskets and covers	45	Flywheel
46	Tappet	47	Cylinder gasket	48	Thrust plate
49	Push rod	50	Coolant pump	51	Pressure-limiting valve
52	Valve rocker	53	Oil radiator	54	Dipstick
55	Rocker seat	56	Fan support	57	Piston pin circlip
58	Rocker shaft	59	Silicon-oil fan clutch	60	Electromagnetic fan clutch
61	WEVB system	62	Gear	63	Tensioner
64	Steering pump	65	Bushing of fuel injector	66	Bowl-type plug
67	Front oil seal of crankshaft	68	Other kinds of oil seals	69	All kinds of rubber hoses
70	Fuel return pipe of fuel injection pump	71	Hand pump	72	Fuel supply pump

1.4 For the basis parts, the warranty period is 12 months

In case of any failure within “Three-guaranty” period, the market manager of Maintenance and Service Center should take the picture of it at site and determine the work-hour cost.

The following parts are basis ones					
1	Cylinder block	2	Connecting rod	3	Flywheel housing
4	Crankshaft	5	Camshaft	6	Timing gear chamber
7	Cylinder head	8			

1.5 Any issue caused by assembling quality will not covered by the “Three-guaranty”.

2 The following items are either not covered by “Three-guarantee”

2.1 The engine failures caused by the improper operation, maintenance and matching. Failures caused by user’ transportation, applications exceeding the operational range of this Manual, mismatching, overloading, overspeeding, improper running-in and maintenance, or use of inferior oil, fuel, antifreeze and "Three-filter" etc.

2.2 Failures caused by modifying, adjusting or removing any parts unallowable in this Manual.

2.3 Oil, antifreeze, filter element, hose, belt and fuel injector mate parts which is normally used, consumed or maintained.

2.4 Lack of Warranty Card, invoice or other documents demonstrating that the products are still within “Three-guaranty” period.

2.5 The product model and type on the “Three-guaranty” Certificate or invoice are not consistent to that needed to be guaranteed, or the “Three-guaranty” Certificate or invoice is modified.

2.6 The damaged state is not maintained, making the failure cause unable to be technically determined.

2.7 Failures caused by misoperation.

2.8 Damaged by force majeure, such as war or natural disaster etc.

2.9 Engine is damaged by the traffic accidents.

2.10 Products are used for other purpose without our company permission.