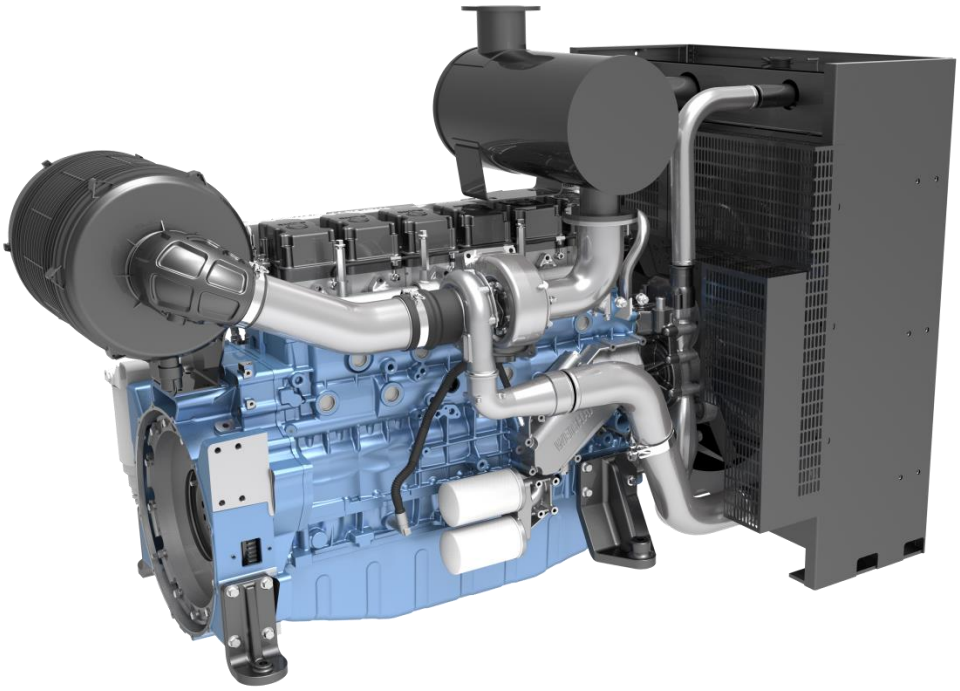
Operation and Maintenance Manual for PowerKit 6M21 Series



Dear Customer,

Thank you for choosing a Baudouin PowerKit engine!

This series has a compact structure, reliable operation, excellent performance, low fuel consumption and meets the requirements of international emission standards. The engine is quick to start, simple to operate and easy to maintain.

We are committed to launching new products and continuously improving our range, therefore notification of changes will be made via our website; please visit Baudouin.com for the latest product information.

This manual covers the basic information for the use and maintenance of the engine. To gain optimal performance and to maintain the engine properly, please carefully read this operation and maintenance manual, and operate in strict accordance with the relevant provisions.

Notice

1. Before delivery, this series of diesel engines have already been tested, strictly following the test specification. 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 connecting rod which have strict requirements for torque and angles.
2. As the bolts attached to connecting rod are disposable, never reuse them.
3. The operator of diesel engine should carefully read this Operation and Maintenance Manual, be familiar with the structure of the diesel engines 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 engine 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, do not make high-speed operation suddenly and never idle running for long time.
8. After engine running with heavy load, do not immediately stop it. It is necessary to idle running for 5-10 min at low speed.
9. After engine is stopped, if the ambient temperature is less than 0℃, moreover additive is not applied; please completely drain the water in radiator and diesel engine.
10. The diesel engine is prohibited to work without air filter which could prevent particulates from entering the cylinder Please select the specified fuel and oil grades which will be filled into the diesel engine (it is suggested to use the Baudouin special oil sold at all service stations of Baudouin when change the lubricating oil). Use the special clean container.
11. The fuel and oil should be filtrated through the strainer before added. Let the fuel precipitate for 72h or more.
12. Do not simultaneously use the diethyl-ether-assisted starting equipment and pre-heater or glow plug.
13. The inspection of electrical system should be done by the personnel mastering electrical knowledge.
14. The invalid duration of oil sealing of diesel engine is one year. If they expire, please take necessary supplement measures.
15. Our company perform the quality-trace filing for industrial power 6M21.

Safety

CAREFULLY READ THIS MANUAL
BEFORE OPERATION

SAFETY WARNING

Failure to comply with the preventive measures and safety instructions included in this manual and with warnings indicated on the engine may lead to injury or even death.

This operation and maintenance manual must therefore be kept on board and must be easily accessible, ready to be consulted at any time.

Furthermore, this manual must stay with the engine if it is sold. The subsequent owner of the engine will also need the information it contains.

Symbols used in the operation and maintenance manual

Foreword

As you read this operation and maintenance manual, take note of the warnings indicating the precautions to be taken to avoid unsafe practices and conditions.

In this manual, the following symbols are used to highlight specific information.

Clearly these safety instructions alone are not sufficient to avoid danger. The only way to avoid accidents is to strictly comply with the specific instructions that apply to each operation and to use common sense.

Hazard warning

WARNING
AUTOMATIC OR
REMOTE START

This "Danger" symbol warns against the risk of automatic or remote start of the installation. The installation must be isolated prior to any intervention.

This warning sign is recognised across the world. In this guide, it is used to highlight the importance of the information that follows. Make sure that you understand the consequences of a dangerous situation and the ways in which to avoid danger. Failure to comply with warnings can result in material damage, injury or even death.

We often see an indication of danger as a general warning. In this Manual, there are different types of warning depending on the possible consequences of the danger (minor injury, serious injury, death).

⚠ WARNING	**This type of warning indicates a potentially dangerous situation, which if not avoided, MAY result in serious injury or even death, or considerable material damage.**
⚠ CAUTION	**This type of warning indicates a potentially dangerous situation, which if not avoided, may result in minor injury or material damage. It can also warn against dangerous practices.**

Before maintenance and repair, please notice that:

◆Avoid repeated exposure to used oil for a long time.

◆ If possible, wear protective clothing and waterproof gloves.

◆Do not keep oil-soaked rags in the pocket.

◆ Prevent oil from soaking the clothes, especially underwear.

◆ Wash the uniform frequently. Throw away the oil-soaked clothes and shoes that cannot be cleaned.

◆Use first aid immediately if there are any cuts or other injuries.

◆Apply protective cream before working so that the mineral oil is easier to get cleaned after getting on the skin.

◆Clean your hands with soap and hot water, or use the hand sanitizer and nail brush to remove all oil. If there's skin natural sebum loss during the wash, products containing lanolin can be used to help moisturize the skin.

◆Do not use gasoline, kerosene, fuel oil, thinner or other solvents to clean the skin.

◆ If you have a skin irritation, consult a doctor immediately.

◆ If possible, remove the oil/grease on the parts before handling them.

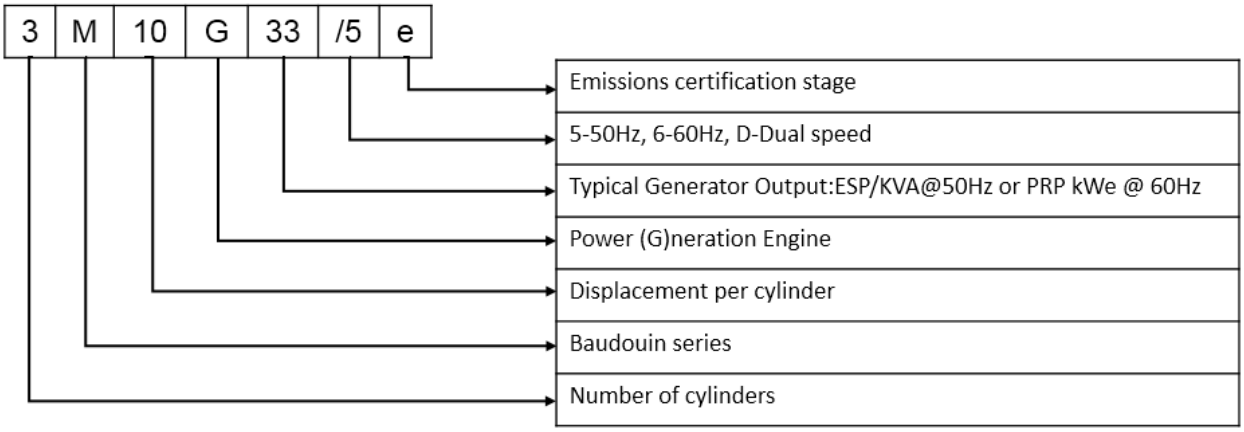
◆If there is possible danger to your eyes, use goggles or face shield. Eye wash solution must be available around the operating location.

◆ When maintaining the engine, do not splash oil or other liquids onto the floor. If there's an accidental release of hydrocarbons or other liquids, take all necessary measures to isolate the leaking area to keep the environment clean and to protect personnel from injury.

◆The handling, storage and recycling of hydrocarbons, ethylene, glycol and petroleum must comply with safety and environmental standards of the country where the operation is done.

Contents

1. Model Meaning of the diesel engine



2. Installation and use of the diesel engine

2.1 Notice for use of new diesel engine

For a new engine, it is essential to perform running in before normal use. Through running-in operation, the ideal matching state of contacting surfaces of kinematic pairs will be achieved to avoid abnormal wear and damage. And the engine can running at full speed with full load only after running for 40-50 hours at rated speed with 50% of rated load.

2.2 Diesel engine unsealing

After opening the engine packing case, please first check the engine and its accessories according to the delivery list,and check the engine appearance for damage and loose connections before carrying out the following tasks:

◆Wipe away the anti-rust layer or anti-corrosion agent on the exposed parts;

◆Drain the sealing oil in the fuel filter and fuel system components (it is only allowed to run the engine with load when the sealing oil is used up and the normal diesel fuel has been supplied).

Notice: The oil seal is only valid for one year. When more than one year has passed, the oil seal should be checked and necessary additional measures should be done.

◆Rotate the flywheel and spray solvent into the intake pipe until the oil sealing oil in the cylinder is completely removed.

◆Spray solvent into the turbocharger intake/exhaust ports until the oil sealing oil is completely removed.

◆Base on the agreement between manufacturer and user, the oil pan shall be filled with oil in

accordance with the requirement; if oil containing running-in accelerant is filled in the oil pan before delivery, it is suggested that the oil should be drained off after running the engine for 50h and then fill with new oil.

◆Base on the agreement between manufacturer and user, if the coolant is already filled according to the user's requirement before delivery, please check the coolant performance when unpacking. If the anti-freezing capability is suitable for -30°C or -35°C, the PH value is 7~8 (neutral), the total hardness number is 5-15°d [9-15°f (hardness)], the coolant can be used. Otherwise, drain the coolant and add new coolant which contains antifreeze additives.

2.3 Diesel engine hoisting

When hoisting the engine, keep the centerline of the engine crankshaft horizontal Inclined or unilateral hoisting is prohibited (Figure 2-1). Engine hoisting and seating should be slow and careful.

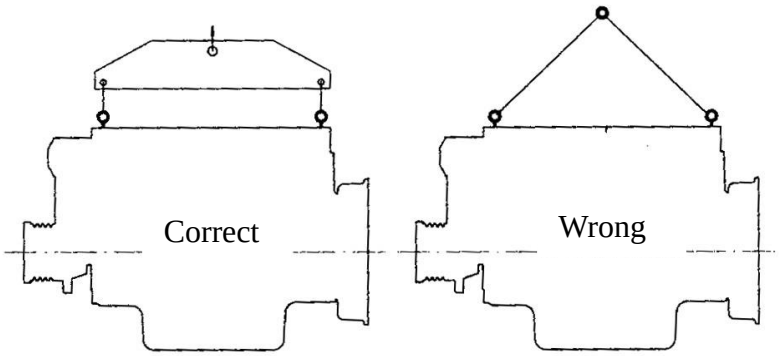


Figure 2-1 Diesel engine hoisting

2.4 Installation of the diesel engine

The power of diesel engine is output at the flywheel end.

When installing, it should be ensure that the centerline of diesel engine crankshaft is concentric with the axis of input shaft of external device and elastic coupling should be used so that the crankshaft is not affected by the additional force originated from the installation. The concentricity of crankshaft centerline and the input shaft centerline of external device should be less than 0.2mm, the end face runout should be less than 0.2mm. The checking method of concentricity is as shown in figure 2-2.

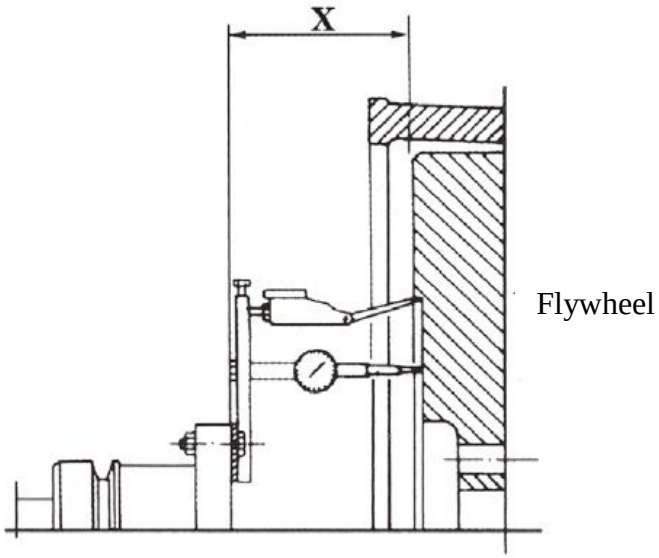


Figure 2-2 Checking of concentricity

In the use process of diesel engine, the user should check regularly according to the above requirements and ensure the normal operation of diesel engine.

2.5 Preparations before starting the diesel engine

◆ Coolant level check

After the engine is installed, the coolant should be at such level that it is visible from the sight hole on the expansion tank; if the coolant is not enough, open the filler cap to refill. It is prohibited to add a large amount of coolant when the engine is still hot. If there is no coolant in exceptional cases, distilled water can be used. When filling, add the coolant from filler port until it overflows. Then start the engine, and continue to fill the cool the engine is running until the liquid level reaches the specified position and maintains stable. And finally close the filler cap.

◆ Fuel level check

Turn on the power switch to check the fuel level from the fuel gauge or check the fuel tank.

◆ Engine oil level check

Engine oil level should be maintained between upper and lower scale lines of the dipstick. Add oil from the oil filler if necessary.

◆Check the connection reliability of various accessories, and phenomenon.

◆ Check the starting system circuit connection, and see if battery charging is sufficient.

◆ Open the fuel tank valve, unscrew the air bleeding screw on the primary fuel filter and operate the hand pump on primary fuel filter to remove the air in fuel system.

2.6 Diesel engine starting

Before starting the diesel engine, check if there is pressure in hand operated fuel supply pump, and if the fuel injection nozzle gives off “gurgle” sound when rotating the diesel engine flywheel; if there is neither pressure nor sound, the air in the fuel passage should be removed.

The starting motor should not work continuously for more than 10s. If the first start failed, the second start should be made 2 min later; if the start failed for three successive times, identify and eliminate the fault before trying to start again.

2.7 Running of the diesel engine

1) After starting the engine, idling fora few minutes and then you can increase the speed to 1000-1200r/min and add some load. Only when the water temperature is above 60°C, the oil temperature is above 50°C, it is allowed to operate the engine with full load. Load and speed increases should be gradual to avoid sudden loading and unloading.

2) During the 50 hours of running-in period, the engine should only work under medium load.

3) It is prohibited to run the engine at idle speed for a long time to avoid oily smoke.

4) When the engine is in normal use, it is allowed to continuously operate at rated power and rated speed. If the engine is running at 110% of rated power, it is allowed to run for only 1h every 12h. After unloading, the engine should idle for 1 to 2 minutes before shutting down.

5) During operation, pay attention to the following parameters and the locations:

Main oil passage pressure: (300-550) kPa (>80kPa at idling);

Oil temperature in oil pan: <110°C;

Outlet temperature of coolant: ≤75~95°C;

Exhaust temperature after turbine: ≤600°C;

Intake temperature after intercooler: 55±5°C

Check the exhaust color to inspect the operation quality and load status of thefuel injector. If there is a lot of black smoke or white smoke, stop the engine to check;

Check the engine for air, water and oil leakages. If leakages are found, stop the engine to repair.

6) The operator should acknowledge the following features of the engine:

① The fuel consumption is relatively low at max torque, and increases along with the rotation

speed rise.

② The torque reaches its peak value within the medium speed range (1,200 ~ 1,600 r/min);

③ The engine power increases along with the speed rise, and reaches its rated value at rated speed.

7) Pay attention to the followings when the engine is operating in the cold environment:

① Fuel: Select the proper grade of diesel fuel according to the ambient temperature in winter;

② Lubricating oil: Select different viscosity grade of lubricating oil based on the season;

③ Coolant: Add anti-freeze into the cooling system, and determine the antifreeze grade according to the ambient temperature.

④ Startup: Use starting aid in winter when necessary. The running speed and load of diesel engine can be increased only after the oil pressure and water temperature become normal.

⑤ Battery: Before the cold season comes, be sure to check the electrolyte level, viscosity and unit voltage of the battery; and if the diesel engine is to be withdrawn out of service for a long time and the ambient temperature is extremely low, it is recommended to remove the battery and keep it in a warm room.

2.8 Shut-down of the diesel engine

Before stop the diesel engine, you should remove the load and reduce the speed gradually, and idle for a few minutes. In case of losing control running, you can cut off the fuel delivery pipe of high pressure fuel pump or block the air filter inlet to force the diesel engine to stop.

After the diesel engine is stopped, the electric key should be disconnected to prevent the battery current from flowing back into the excitation ring of silicon rectification dynamo to avoid battery discharging.

For the diesel engine cooling system, pure coolant must be used. In special cases, water can be used as engine coolant, but if the engine should be stopped for a long time and the atmospheric temperature is below 0°C, the cooling water should be drained off to prevent the engine block from being frost cracked.

2.9 Power definition and usage conditions of land diesel engine for power generation

2.9.1 Power definition

✧ **COP (Continuous Power)**

The maximum power at which the diesel engine continuously runs with constant load and unlimited running time every year. ISO standard power.

✧ **PRP (Prime Power)**

The maximum power at which the diesel engine continuously runs with variable load and unlimited running time every year. ISO standard power which may exceed 10% of the rated load.

✧ **ESP (Emergency Standby Power)**

The maximum power among a series of variable powers where the diesel engine can run for up to 200h every year. ISO standard power with limited fuel consumption.

2.9.2 Power running conditions and applications

For the running conditions and applications of different powers of the diesel engine, see Table 2-1.

Table 2-1 Running conditions of different powers of diesel engine

Power category	Running conditions	Applications
COP	1. Unlimited running time for every year; 2. Running with constant 100% of rated load; 3. Without overload capacity.	Be possible to run under high temperature and high altitude conditions
PRP	1. Unlimited running time for every year; 2. With the average load rate not exceeding 70% continuous 250h duration; 3. Running for no more than 500h every year at 100% of rated load; 4. Be able to run for 1h at the overload rate of 10% within each 12h, and with the accumulated running time not exceeding 25h every year.	Be used under the agreed conditions for power output, e.g., the curtailment of utility power. The generating set can be synchronized to the power system of public utilities.
ESP	1. The annual running time not exceeding 200h, including the annual 25h running time at the most at 100% of rated load. 2. The average load rate not exceeding 80% within each 24h operation cycle; 3. Without overload capacity. 4. The diesel engine starts up without engine warming process, completing the acceleration to the rated speed from startup within	To provide emergency electric power supply during power outage

	10s. For natural aspiration diesel engine, it shall be provided with pre-heating device when the ambient temperature is below 5°C so as to guarantee that the outlet water temperature of diesel engine is over 30°C; when the ambient temperature is over 5°C, no preheating device is required. For the turbocharged diesel engine, if the ambient temperature is below 10°C, the preheating device is required so as to guarantee that the outlet water temperature of diesel engine is over 30°C; if the ambient temperature is over 10°C, no preheating device is required.	

2.10 Power definition and usage conditions of marine diesel engine for power generation

COP: The maximum power at which the marine diesel engine for power generation continuously runs with constant load and unlimited running time every year. ISO standard power.

PRP: The maximum power at which the marine diesel engine for power generation runs with variable load and unlimited running time every year. ISO standard power which may exceed 10% of the rated load.

For the running conditions and purposes of different powers of the marine diesel engine of for power generation, see the table 2-2.

Table 2-2

Power category	Running conditions	Applications
COP	1. Unlimited running time for every year; 2. Running with constant 100% of rated load; 3. 1h overload running is permitted within 12h.	Light seine vessel, Fish freezing vessel
PRP	1. The average load rate not exceeding 70% of PRP within the 24h duration; 2. The annual total running time not exceeding 500h under 100% of PRP; 3. Be able to run for 1h at the overload rate of 10% within each 12h, and the total running time under the overload rate of 10% not exceeding 25h every year.	Main generating set, harbor generating set, emergency generating set
Note: 1. The COP is 0.85 times of the PRP; 2. The usage conditions shall be informed to users upon sales.		

3. Maintenance of the diesel engine

3.1 Fuel, lubricating oil and coolant of the diesel engine

3.1.1 Fuel

Summer: Use No. 0 diesel fuel.

Winter: Use No. -10 light diesel fuel generally. Use No. -20 diesel fuel at ambient temperatures below -15°C. Use No. -35 diesel fuel when temperatures is below -30°C.

Note: The fuel used must meet the requirements specified in Table D.1 of Appendix D of national standard GB 20891-2014.

3.1.2 Lubricating oil

For the first time, the oil filling capacity of the diesel Engine is 25L based on the oil dipstick marks. This diesel engine use grade CH-4 lubricating oil. See Table 3-1“Viscosity selection based on ambient temperature” for the selection of special oil.

Table 3-1 Viscosity selection based on ambient temperature

SAE viscosity grade	Applicable ambient temperature (°C)
10W-30	-25~30
15W-40	-20~40
20W-50	-15~45

Notice:

(1) Always check the oil level of the oil pan before starting the engine.

(2) Do not check the oil level while the engine is still running.

(3) It is not allowed to mix the oils with different grades.

3.1.3 Coolant

The diesel engine cooling system must adopt pure coolant. The coolant can be used to prevent freezing under cold weather and to prevent boiling under high temperature. Furthermore, the coolant contains rust-inhibiting and anticorrosion additives, which offer special protection to the water tank and engine cooling chamber, and avoid cylinder liner and cooling system corrosion.

Baudouin Power special coolant freezing points of-25°C, -35°C and -40°Care available. Please choose different coolant according to the local ambient temperatures. The principle is to choose the coolant with freezing point lower than the local minimum temperature of about 10 degrees.

Notice:

(1) Check the coolant regularly to prevent corrosion damage. Replace the coolant if necessary.

(2) Never use water or low-grade coolant.

3.2Routine maintenance of the diesel engine

Before starting the engine, check the following items:

-- Check the coolant level, engine oil level and fuel level;

-- Check all joints and jointing faces of fuel system, cooling system and lubrication system for leakage;

-- Check the connection reliability of external parts and accessories;

-- After starting the engine, check the running sound and the working of gauges.

◆ Check the coolant level

Check the coolant level through the glass sight hole. When the coolant is not enough, open the filler cap to add coolant, as shown in Figure 3-1.

Note: Press the air relief button first before opening the filler port cap, in order to avoid personal injuries by the hot coolant.

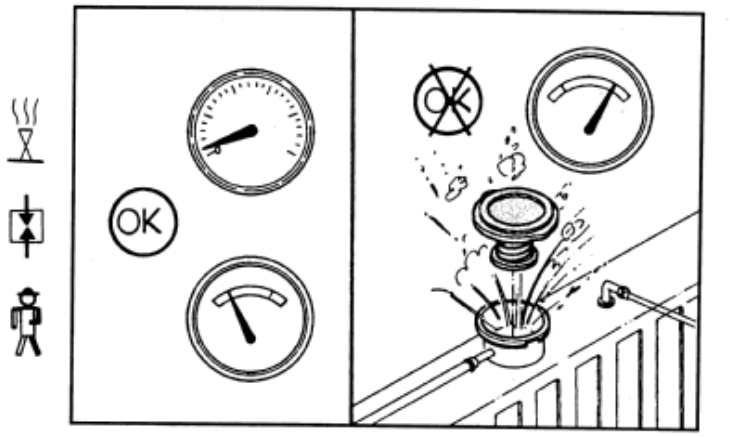


Figure3-1 Coolant filler port cap

◆ Oil level check

Dipstick oil level marks are shown in Figure 3-2.

It is not allowed to start the engine when the oil level is below the lower mark or above the upper mark.

When checking the oil level after the engine shuts down, wait at least 5minutes so that the oil has

sufficient time to flow back into the oil pan.

The oil capacity difference between the “H” mark and the “L” mark of oil dipstick is 3L.

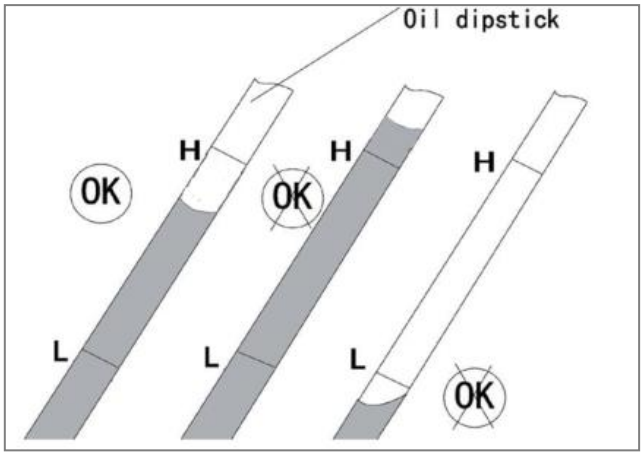


Figure 3-2 Oil dipstick marks

◆ Fuel level check

Check the fuel level indicator on dashboard and add fuel if necessary.

◆ Check the engine for water, gas and oil leakages

◆ Check the fan

Visually inspect the fan blade for damages and the connecting bolts for fastening, as shown in figure 3-3.

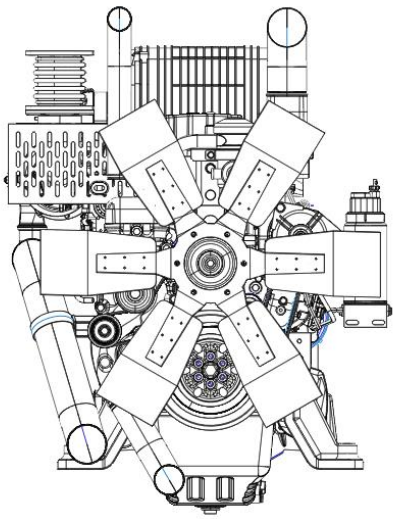


Figure 3-3 Fan of the engine

◆ Check the belt tension

The pulley belt is the ten, and users can press the belt by hand to feel the tension.

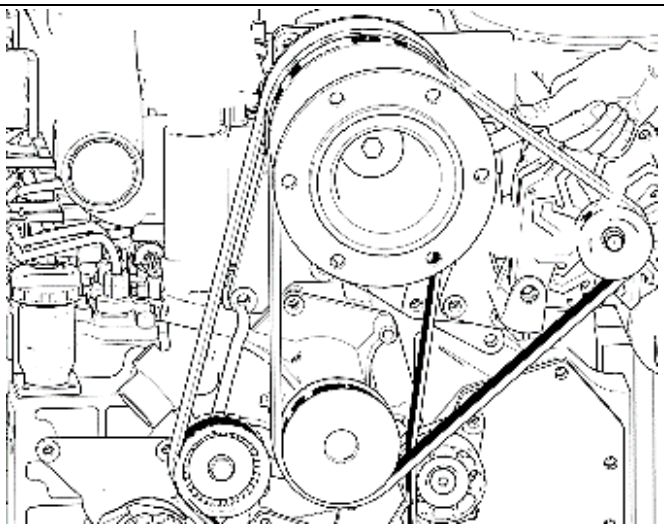


Figure 3-4 Belt tension inspection

◆ Check the color of exhaust

The normal exhaust color during engine operation should be light gray. If there is color change, check the engine for troubleshooting.

Figure 3-5 Exhaust color checking

◆ Check the sound of diesel engine.

◆ Check the speed and vibration of diesel engine.

◆ Replacement of engine oil

Remove drain plug at the bottom of the oil pan to drain off the oil, then screw on the drain plug again; Open the oil filler cap to add oil from the oil filler. Check oil level through oil dipstick, stop adding oil when the requirements are met, and close the filler cap, as shown in figure 3-6 and figure 3-7.

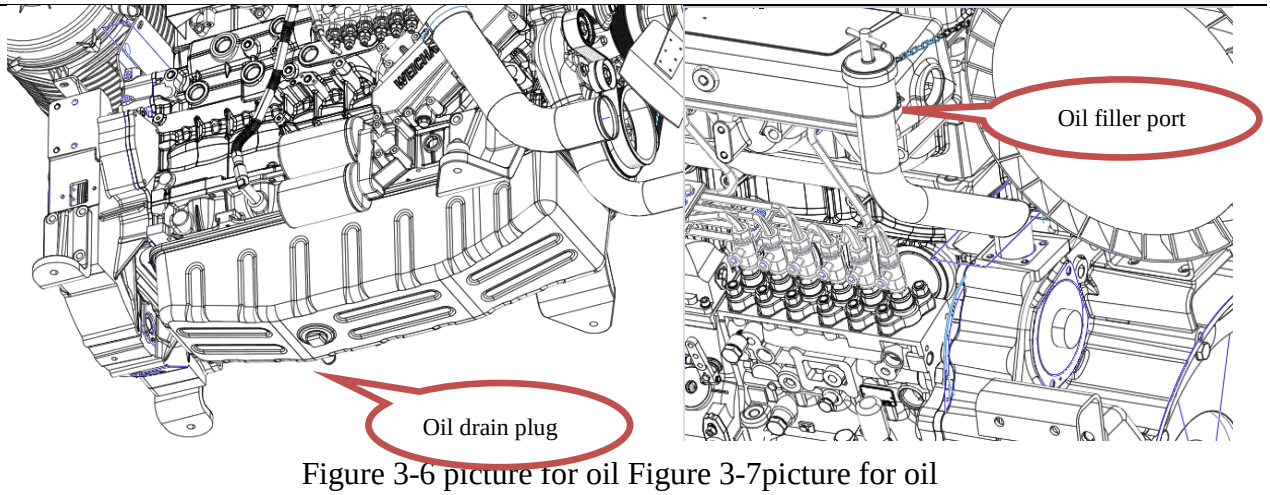


Figure 3-6 picture for oil Figure 3-7picture for oil

◆ Replace the oil filter or filter element (figure 3-8)

(1) Remove the old oil filter;

(2) Fill the new filter with clean oil;

(3) Apply lubricating oil on the sealing gasket before installing the new oil filter;

(4) After the sealing gasket touches the seat, tighten 3/4 to 1 more turns to seal tight;

(5) Start the engine to check for oil leakage.

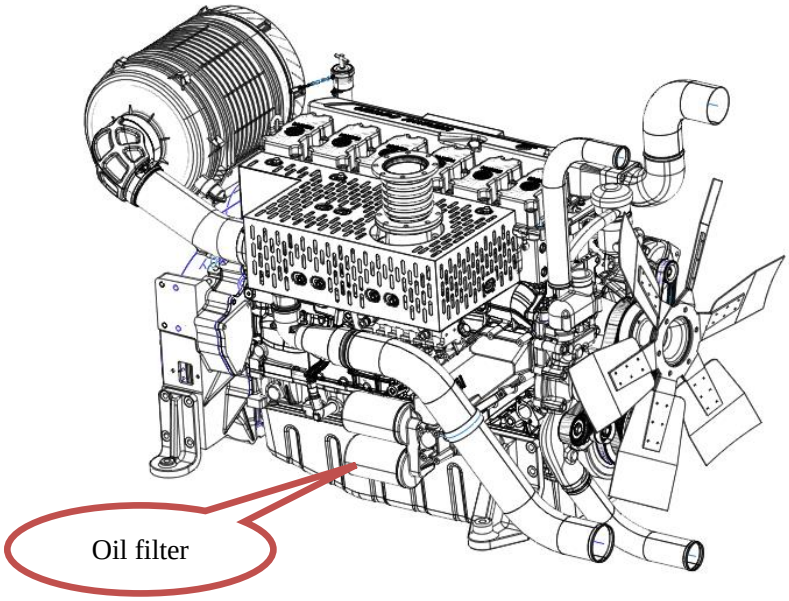


Figure 3-8 Oil filter

◆ Replace the fuel filter element

(1) Remove the old fuel filter element; if the water collector installed on the strainer is still usable remove the collector;

(2) Apply lubricating oil on the sealing port;

(3) Tighten the filter by hand until the sealing surface is secured with the interface;

(4) Continue tighten the filter by hand until the filter is securely installed (about 3/4 turn);

(5) Drain off the air until there are no bubbles appear;

(6) Conduct the leakage test.

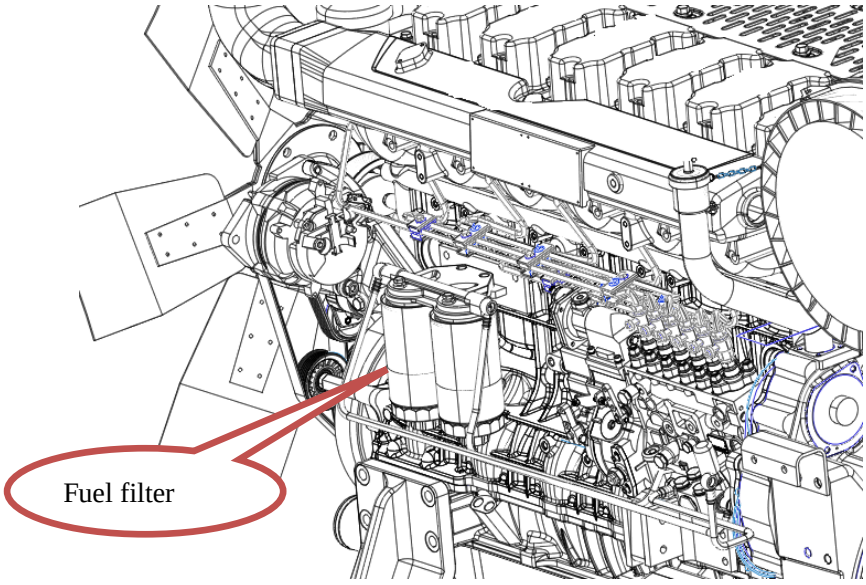


Figure 3-9 Fuel filter

Notice: When replacing spin-on coarse filter or after re-installing the fuel pipe, the air in the coarse filter needs to be driven out. The steps are as follows:

(1) Stop the engine.

(2) Remove the bleed screw.

(3) Use the hand pump to drive out the air until only fuel comes from the bleed screw.

(4) Re-tighten the bleed screw.

Notice: When the water collector is full or after the spin-on filter has been replaced, timely release the water collected. Draining steps are as follows (Figure 3-10):

(1) Open the drain plug 2 at the bottom of water collector 1 to drain off the water.

(2) Re-tighten the drain plug.

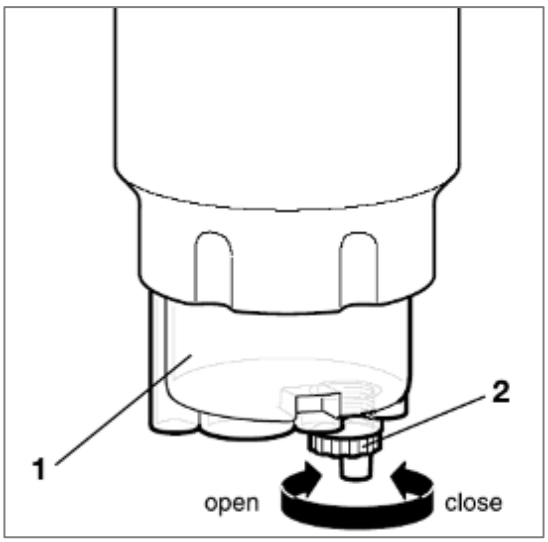


Figure 3-10 Water draining

◆ Replace the water collector (Figure 3-11)

(1) Shut down the engine.

(2) Discharge the water from the collector.

(3) If possible, screw off the screw 1 of the collector. If the screw is too tight, use the special tool in the new water collector to do so.

(4) Use a few drops of lubricating oil to lubricate the sealing gasket 2 of the new collector.

(5) Install the screw by hand and use tools to tighten it.

(6) If the water collector is going to be used on a new spin-on filter, check for damages.

(7) Use the torque wrench to tighten up with a torque of 20Nm.

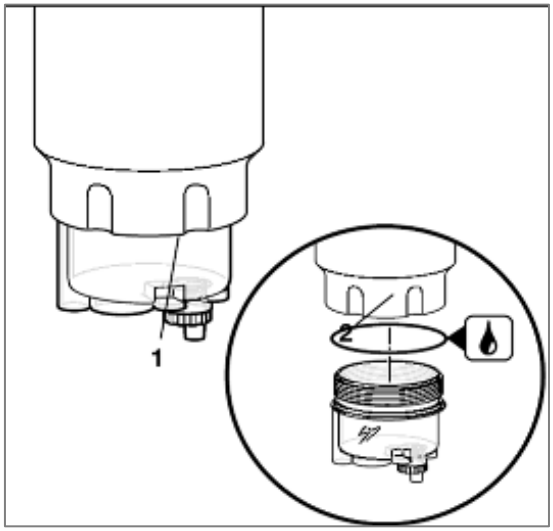


Figure 3-11 Replacement of water collector

◆ Check the air intake system (figure 3-12)

Check the intake hose for cracks due to aging, and the clamp for loosening. Tighten or replace parts if necessary, to ensure tightness of the intake system.

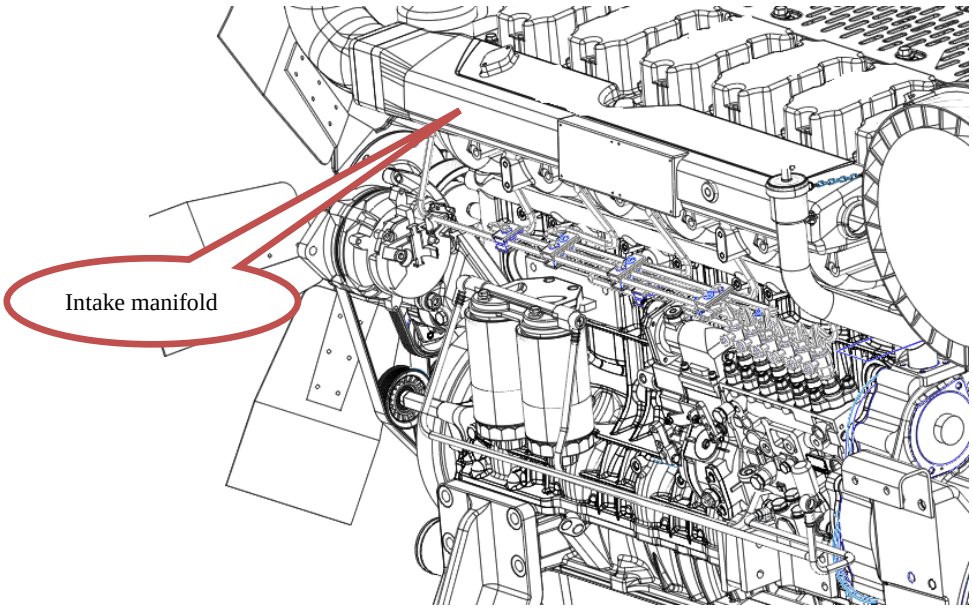


Figure 3-12 Intake system

◆ Check the air filter element

Type A: Radial sealing air filter

When the intake resistance indicator is giving off alarm(become red), stop the engine to maintain the outer filter element of the air filter (Notice: it is prohibited to remove and clean the safety element). Please pay attention to the follows when maintaining:

(1) Check the inner surface of outer filter element and the safety filter element outer surface for dust. If any, it indicates outer filter element damage or installation not in place;

(2) Use clean air of less than 0.5MPa to blow off the dust from the inside out. It is prohibited to use oil or water to clean the filter element.

Notice:

(1) Do not disassemble and clean the safety element;

(2) It is prohibited to blow the outer filter element from outside in. If there is a great amount of dust on the outer surface of the filter element, flap gently with hands to let the dust fall off. The inner filter element (safety filter element) is now allowed to be disassembled and cleaned. When replacing the outer filter element, the safety filter element should be replaced also. As shown in figure 3-13.

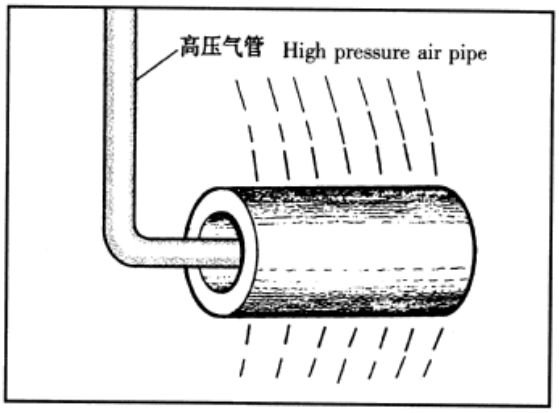


Figure 3-13 Filter element cleaning

Type B: 93 dust filter (Figure 3-14)

(1) Release all the connecting back cover and the housing, remove the back cover, and clean up all the dust on the back cover;

Notice: When stopping the engine to check, use the dust discharge valve to timely remove the dust. Replace the dust discharge valve in time if damaged.

(2) Rotate the yellow sealing cap counterclockwise to remove it, and you can see the outer filter element now.

(3) Hold the outer filter element back cover hanger with hands, and pull out the outer filter element from the air filter housing cavity.

(4) Maintain the outer filter element in accordance with the maintenance instructions.

(5) Clean the dust in the filter inner cavity and cavity thread with a brush or rag before installing the outer filter element back. This is to ensure the smooth thread and to prevent dust from entering the inside of the outer filter.

(6) Put the parts back together and properly seal the parts .Do not miss any parts.

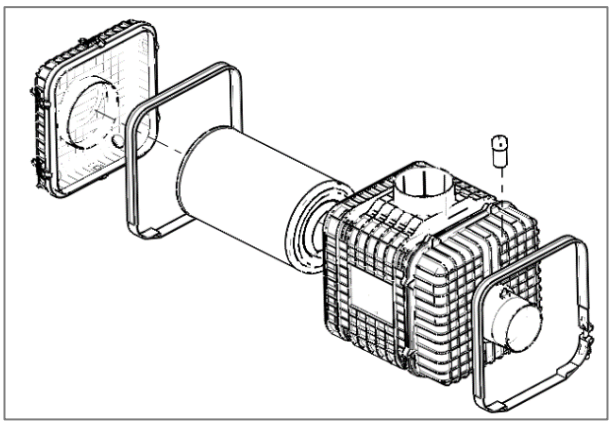


Figure 3-14 Type 93 dust filter

Notice: It is not allowed to operate the engine in the absence of air filters, otherwise dust and impurities will get into the engine and cause early engine wear and tear.

3.3 Regular maintenance cycle

Table 3-7 First inspection, routine inspection and maintenance cycle

First inspection	After operating for 30~50 hours
Routine inspection (P)	Every 250 hours
Level 1 maintenance (WD1)	Every 250 hours
Level 2 maintenance (WD2)	Every 500 hours
Level 3 maintenance (WD3)	Every 1,000 hours
Level 4 maintenance (WD4)	Every 3,000 hours
Note: The maintenance cycle mentioned here is calculated based on the situation that the engine is running 1500 hours per year. For engines running time less than 500 hours per year, the maintenance cycle is half.	

Table 3-8 Engine maintenance specifications

Items	First inspection	Routine inspection	WD1	WD2	WD3	WD4
Change lubricating oil and oil filter	●		●	●	●	●
Replace fuel filter			●	●	●	●
Check and adjust valve clearance	●		●	●	●	●
Check the coolant capacity and add as required	●	●	●	●	●	●
Check the water pump for leakage	●		●	●	●	●
Clean fuel pump primary filter			●	●	●	●
Fasten the air intake pipe and hose	●		●	●	●	●
Clean oil cooler core					●	●
Clean intercooler core					●	●
Clean fan and water tank					●	●
Clean or replace air filter element				●	●	●
Check the belt tension	●	●	●	●	●	●
Check the injection pump at service station						●
Replace heat exchanger Zinc block	●		●	●	●	●

3.4 Maintenance of the diesel engine during long-term storage

◆ Clean the diesel engine

◆ Protection measures

（1） Warm up the engine and drain the oil, clean the oil filter, and add anti-rust oil;

（2） Discharge the fuel, and add anti-rust mixed oil;

（3） Discharge the cooling water and fill with coolant containing rust inhibitor;

（4） Start the engine and run without load for 15 ~ 25 minutes;

（5） Drain off the oil, fuel and coolant;

（6） Take protection measures to other parts.

◆ Protection during storage

Use lids or plastic sheeting to block the inlet and outlet of oil, gas and water; use VCI film to protect the entire diesel engine.

◆Packing case is necessary during transportation of the engine.

3.5 Usage and maintenance specifications for main accessories of the diesel engine

3.5.1 Usage and maintenance of fuel injection pump

◆Preparations before usage

(1) Check whether the model number of fuel injection pump is correct or not before installation, and if not, no installation is allowed.

(2) Wipe out the anti-rust oil on surface.

(3) Clean the inner chambers of speed governor cavity and fuel injection pump, and fill lubricating oil of specified brand.

(4) Clean the anti-rust oil inside fuel pipes before usage by continuously rotate the camshaft of fuel injection pump till clean fuel comes out from the delivery valve seat.

◆Fuel

When using poor-quality fuel, it will not only reduce the performance of engine, but also significantly shorten the service life of fuel injection pump and engine.

(1) It is required to use high-quality and qualified fuel. Generally, 0# diesel fuel should be used in summer while the 10# or above light diesel fuel should be used in winter.

(2) The fuel used must be clean without any impurity and water. So, 72h sedimentation of the fuel

is necessary before usage. The fuel filter element and the filter screen of fuel delivery pump shall be cleaned regularly, and in case of any damage, they shall be replaced timely.

(3) The fuel containing air may affect the normal working of fuel injection pump, and therefore, if the fuel injection pump is not used for a long time or the fuel pipe joint is replaced, before normal using, it is required to eliminate the air entered into the fuel pump or low-pressure fuel line. During air eliminating, it is necessary to continuously operate the hand pump on the fuel delivery pump after loosening the overflow valve connector and timely tighten up the connector after the air is removed.

◆Lubricating oil

(1) The oil pump is connect to the engine lubrication system and forced lubrication method is adopted. The fuel injection pump shall be filled with appropriate amount of lubricating oil before the first use, so as to prevent the engine from being damaged due to bad lubrication before the engine begins supplying lubricating oil. It is required to loosen the fastening bolts of back cover of fuel injection pump at set intervals (synchronizing with the engine maintenance time) to drain out the sump oil, and re-fill in lubricating oil after the back cover is fastened.

(2) For the fuel injection pump of non-forced lubrication (e.g., P9 series pump), as the pump is of separate lubrication type, thus it is necessary to fill in appropriate amount engine oil of specified grade as per the groove mark on dipstick of fuel injection pump to prevent the engine from being damaged due to bad lubrication when the engine is working. It is required to loosen the fastening bolts of back cover of fuel injection pump at set intervals to drain out the sump oil, and re-fill in lubricating oil after the back cover is fastened.

◆Adjustment of fuel supply advance angle

After the fuel injection pump is installed onto the engine, it is required to adjust the fuel supply advance angle as per the requirements of engine, i.e., the piston of 1st cylinder of engine is located at the optimal initial injection position before the compression top dead center (TDC). Loosen the high-pressure fuel pipe of 1st cylinder of fuel injection pump, loosen the fastening bolt of flange plate of fuel injection pump or the adjusting bolt of coupling, rotate the fuel injection pump cam shaft and check whether the fuel is just flowing out of the 1st cylinder fastening seat and check the marker lines of flywheel as well to adjust the fuel supply advance angle as per the requirements, and

then tighten up the loosened bolt and coupling above.

◆Seal up for safekeeping

When the fuel injection pump is left unused for a long time, it is necessary to make rust-proof treatment, drain the fuel and lubricating oil inside the chamber and replace them with anti-rust oil, add the dust cover to connectors of each fuel inlet and return holes, and re-seal them once every other year.

◆Precautions

(1) If the user does not own certain experience and test conditions, it is absolutely prohibited to disassemble the fuel injection pump assembly without approval, especially the lead sealing parts which shall not be unsealed to adjust.

(2) Fuel injection pump assembly shall be stored in a dry warehouse with good ventilation and not allowed to be stored or transported together with battery, acid and other chemicals which may causing corrosion.

3.5.2 Usage and maintenance of turbocharger

The oil of turbocharger comes from the main oil passage of engine, and will return to the lower part of crank case after lubricating and cooling the turbocharger.

(1) The good lubrication is essential for the normal working of turbocharger, and thus it is required to regularly clean or change the oil filter element.

(2) As the turbocharger is working at a higher speed (about 70,000-100,000 r/min), therefore, before run the engine with load, there should be appropriate idle running time after the engine is started (about 5 minutes, which can be shortened in case of short-time shutdown), and the diesel engine cannot be shut down immediately after running at high-speed with heavy-load, during which it is required to gradually reduce the load and speed, and make the engine idle running for 3-5 minutes, otherwise, the bearing of turbocharger will be damaged and failure.

(3) It is required to regularly check the dismounted compressor casing and turbine housing, and wash the inner passage of impeller and housing body. After the turbocharger is dismounted, it is required to fill clean oil from the oil inlet during assembly.

(4) Precautions: The rotor spindle of turbocharger is of precision and high-speed rotating part, and is prohibited from disassembling and impacting; otherwise, the company’s warranty commitment

will be invalid.

3.5.3 Usage and maintenance of air compressor

The air compressor of WP13 series diesel engine is of single-cylinder reciprocating type, and is driven through gear.

(1) The lubricating oil from main oil passage enters into the lubrication bearing of air compressor via the lubricating oil pipe, and then returns to the oil pan via the timing gear chamber.

(2) The inlet air is filtered with air filter and is leading to the air compressor through a branch pipe before the air enters into the turbocharger.

3.5.4 Usage and maintenance of water pump

The water pump of WP13 series diesel engine is installed at the front of diesel engine. And the volute casing of water pump is located at the top of timing gear chamber and is casted as a whole with the latter. The water flowing out of volute casing will directly enter in the water chamber at right side of engine body.The cooling water crosses over the oil cooler and flows into the water interlayer of cylinder liner via the passage hole at right lower part of engine body, and then enters into the water chamber of cylinder head via water feed hole after cooling the cylinder liner, and then enters into the outlet pipe via the water outlet of cylinder head after cooling the cylinder head. There is a thermostat at the end of water outlet pipe. There are two outlets for the thermostat, one leading to the water tank, and the other leading to the inlet of water pump, i.e. the small cycle. When the cooling water temperature is at 80±2°C, the thermostat begins to open, and will be fully opened at 95°C, where all of the cooling water will be pumped into the engine body via water pump after being cooled in radiator, but the thermostat will cut off the said passage when the cooling water temperature is below 80±2°C, in such case the cooling water will directly enter the inlet of water pump to warm the diesel engine as soon as possible to meet the thermal state running conditions avoiding the low-temperature wear. In case of any water leakage of water pump, it is required to replace the water seal of water pump.

3.5.5 Usage and maintenance of starter

(1) The starter is of short-time working component,and its working time cannot exceed 15s every time, and the interval time of successive start shall be larger than 30s.

(2) Pre-heat the engine before startup when the temperature is below -5°C in winter.

(3) Once the engine is started, it is required to loosen the starting switch immediately so as to separate the drive gear of starter from the flywheel ring gear.

(4) The starter shall not be energized before the engine stops rotating, preventing the flywheel and starter gear from being damaged.

(5) The starter must be wired in line with the wiring diagram of starter during installation. Before disassembling the starter, it is necessary to ensure that the storage battery is disconnected from the main starting line of starter.

(6) It is necessary to frequently check the starter's fastener and wire insulation and the lead wire connection, and clean the dirt timely.

3.5.6 Usage and maintenance of alternator

(1) Rational configuration: The electricity consumption of electrical devices of the complete engine should be ensured when the diesel engine is in idle speed state. The irrational configuration of alternator and engine electrical devices will cause shortage of electric power of storage battery, and cause the regulator and stator of alternator damaged due to overheating. The minimum working speed of alternator must be guaranteed, and the said faults may occur as well if the generator's idle speed is too low due to the low idle speed of engine.

(2) Secure mounting: The alternator shall be installed onto the engine in a correct, firm and reliable way. The mounting bolt must match with the mounting hole of alternator and be tightened up, and the belt pulley groove and the driving wheel groove shall in the same plane. The mounting bracket of alternator must meet the required strength and stiffness requirements, otherwise, the alternator may be damaged due to the insecure mounting.

(3) The belt tension shall be neither too loose nor too tight, and when a force of 150N (15kgf) is applied at 1/2 of center distance of two pulleys with hand, if the belt can be pushed down 10-20 mm (or there is not obvious shaking during rotating with load), it is generally deemed ok. The belt tension shall be checked once every two months. If the belt is too loose, it will cause faults such as insufficient generating capacity, shortage of electric power of storage battery, stator burn out, bearing failure, etc.

(4) Avoid the heat source, splashing mud, etc., and prevent the motor from being damaged due to external splash entering into the inside of motor, and make sure that the alternator is provided with a

good application environment as possible. The alternator's operating ambient temperature is generally ranging from -40°C to 93°C, and the alternator shall be installed in positions approved by the engine manufacturer or the alternator supplier and far away from the heat source of engine (distance ≥400mm or to be provided with effective thermal baffles).

(5) The lead wire shall be reasonably selected, and the wiring shall be correct and firm. The terminals of alternator wiring shall not be wrongly connected so as to prevent the harness from being burnt and the electrical device of alternator from being damaged. To ensure electrical safety and the power generated by the alternator be fully outputted, the lead wire should be with reasonable diameter.

(6) In case of dismounting the alternator or welding of the engine, it is required to disconnect the power source of storage battery and the wiring of alternator. The disassembly and repair of alternator must be operated by the professionals. It is necessary to check whether all insulating mats and sleeves are intact without damage during installation, and if any, they must be replaced with new ones! The alternator's positive terminal and shell body shall not be short-circuited so as to prevent from serious accidents of the whole engine.

(7) Carefully observe whether the charge lamp acts from on to off when the engine is running from low speed to high speed after being started, otherwise, please find out the reasons at once;

(8) Check whether the negative of storage battery is grounding, otherwise, the alternator and regulator may be burnt out;

(9) For checking the power generation when the alternator is running, “test fire” method cannot be used, otherwise, the test lamp or diode may be burnt out;

(10) It is prohibited to check the alternator's insulation conditions with a tramegger or 220V AC power supply when the rectifier is connected to the stator winding.

(11) The connection between alternator and storage battery shall be reliable, and the alternator or voltage regulator may be damaged due to excessive high voltage if the said connection is disconnected suddenly.

(12) For matching of the regulator and the AC alternator, the AC alternator's voltage class must be identical with that of the regulator, the ground connection type of AC alternator must be identical with that of the regulator, and the regulator's power shall not be less than that of alternator;

(13) The lines must be connected correctly.

3.5.7 Usage and maintenance of oil pump

The oil pump of WP13 series diesel engine is of external gear pump. The gear pump utilizes two gears with same number of teeth, and the oil is transferred from low-pressure oil chamber to the oil outlet end through the of two gears and the gaps between two gears. With the continuous rotation of gears, the oil inside the pressure oil chamber increased and the pressure is rose so as to guarantee the oil supply of lubricating system of diesel engine.

(1) The oil pump is designed with a pressure relief valve used to prevent excessive pressure inside oil pump and lubricating systems and ensure safely and reliably working of all parts. The pressure relief valve is also serves as a bypass valve, and when the oil feed pressure of oil pump exceeds the preset value, the pressure relief valve is opened, and some oil will flow to the oil pan so as to reduce the oil outlet pressure. The oil feed pressure of pressure relief valve is adjusted through a spring, and thepreload of the spring has been set already before delivery, and the users should not make any adjustment.

(2) The performance of oil pump is mainly dependent on the gaps between oil pump gear and shell body (end gap and radial gap). When the gap is too big, the oil will leak seriously, and when the oil pressure decreases, the oil amount will be reduced. When the clearance is too small, the wear will be very serious.

(3) When the oil feed pressure decreases, if other faults of diesel engine are removed, it is necessary to overhaul the oil pump. During the overhaul of oil pump, it is required to check oil pump for oil leak and burnt damage. If no, it is required to check the pressure relief valve or disassemble the oil pump to check the spring of pressure relief valve, gear, pump body, end cap, and replace the oil pump if necessary..

(4) If the oil pressure is too high, it is required to overhaul the pressure relief valve. Check whether the pressure relief valve can be opened.

(5) Pay special attention not to damage the interfaces of end cap and pump body and all locating pins when disassembling and assembling the oil pump.

3.5.8 Usage and maintenance of air filter

Warning! Wrong maintenance methods will greatly shorten the service life of your engine.

(1) The air filter shall be selected and matched in strict accordance with the performance indexes of the diesel engine. Otherwise, the diesel engine's power and economy will be affected.

(2) For the air filter with an alarming device, it is required to first check the alarm before the diesel engine is working, and when the intake resistance indicator gives out an alarm (turn red), it is required to maintain the air filter element.

(3) If the multistage filter is used, it is required to install the coarse strainer.

(4) The installation of dust pipe must be free of sharp turn, air leakage, etc.

(5) The air filter shall be protected from water entering.

(6) For the air filter with a safety filter element, the safety filter element shall not be dismounted during the maintenance and repair of air filter.

(7) Under general working environment, the main paper filter element of fine filter shall be maintained when the diesel engine is working every 100-200 hours. Dismount the main filter element, and gently tap the filter element and shake off the dust. Check the seal of filter element, and if damaged, replace with a new one. It is allowed to use clean and dry compressed air of less than 500kPa to blow off the dust from the inside out. Place the bulb inside the filter element, and observe the transmittance from the outside so as to confirm whether there is any crack, perforation or other damages. It is prohibited to clean the main filter element with oil or water.

(8) For every working time of 1,000 - 2,000 hours, the main filter element shall be replaced, and at the same time, the safety filter element shall be replaced.

(9) The filter element assembly shall be replaced if:

a. The filter element is broken and damaged.

b. The alarm still sounds after the cleaned filter element is installed.

c. The filter element has been cleaned for 3-6 times

It is required to select filter element products with reliable quality so as to guarantee the reliability of diesel engine, and it is suggested to purchase the genuine parts.

3.5.9 Usage and maintenance of fuel filter

The fuel filter is composed of a primary strainer and secondary filter. Dirt and impurities will accumulate at the surface of filter element and the filter housing bottom in the process of usage, and if failing to clean them timely, the filter element will be blocked, causing insufficient fuel supply

and the power decreasing, and therefore, it is necessary to regularly maintain and clean the fuel filter.

(1) Regularly open the drain plug at bottom of filter housing body to drain off sump oil and water.

(2) In general conditions, the filter element shall be maintained every 200-300 hours, and if the quality of fuel is poor, it is necessary to shorten the maintenance time, and if any damage is found in the filter element during maintenance, it shall be replaced timely.

(3) Block the two holes of filter element during maintenance for preventing the dirt from entering in the internal cavity. The filter element shall be cleaned first with soft brush, and then washed in clean kerosene and diesel oil. Where possible, the clean compressor air can be used to blow from internal cavity to the outside.

(4) Use clean kerosene or diesel oil to wash the internal surface of filter housing body and the holes of end cap.

(5) Check the seals for damage, and replace the same timely if necessary.

(6) Check whether the sealing parts of assembly are leaking oil after maintenance and before usage.

3.5.10 Usage and maintenance of fresh water cooler

The fresh water cooler of WP13 series diesel engine is a kind of shell-and-tube heat exchanger. Its working principle is that the seawater flowing inside cooling pipe cools the fresh water flowing at the shell side via heat exchange, and this can improve the cooling conditions of diesel engine and lengthen the service life of diesel engine.

(1) When the diesel engine is out of service, it is necessary to drain the water inside fresh water cooler, and otherwise, the parts of fresh water cooler will be damaged, especially in winter.

(2) Check the fresh water cooler quarterly, clean the pipe line, remove the dirt and replace the zinc block.

(3) The fresh water cooler must be done with hydrostatic test after being dismounted, cleaned and reassembled, with the pressure maintained at 0.4MPa for 30 minutes, and if no leakage, the fresh water cooler can be installed to the engine then.

3.5.11 Usage and maintenance of air cooler

The air cooler of WP13 series diesel engine is a kind of tube-fin heat exchanger. The heat of

turbocharged air is carried away by the cooling water flowing inside heat exchange tube so as to reduce the intake temperature of diesel engine and increase the air intake density, and improve the power of diesel engine.

(1) When the diesel engine is out of service, it is necessary to drain off the water inside air cooler, and otherwise, the parts of air cooler will be damaged, especially in winter.

(2) Check the fresh water cooler quarterly, clean the pipe line, remove the dirt and replace the zinc block.

(3) The air cooler must be done with hydrostatic test after being dismounted, cleaned and reassembled, with the pressure maintained at 0.4MPa for 30 minutes, and if no leakage, the air cooler can be installed to the engine then.

3.5.12 Usage and maintenance of electronic governor

The electronic governor if WP13 series diesel engine is composed of the speed controller, electromagnetic actuator, speed sensor, transfer switch for idle speed and rated speed, trimmer potentiometer, control power supply and power switch. Its working principle is that the ideal speed of engine is set by the speed setting potentiometer and the speed trimmer potentiometer, and the actual speed of engine is sensed by the speed sensor installed at the tooth root part of flywheel, and the signal outputted by the speed sensor is of AC voltage signal where the frequency is directly proportional to the speed; this signal is converted to the deviation value between the DC voltage and the set voltage via F/V circuit; this deviation value is operational amplified by the PID I regulator to get the positional value of fuel supply amount, i.e., the steady-state output position command of actuator, which is then compared with the actual position value of electromagnetic actuator, to get the actual position deviation value and it will be converted to current control mode to output the drive current to the electromagnetic actuator after being operational amplified by the PID II regulator so as to change the motion displacement of electromagnetic actuator.

(1) The speed sensor is recommended to be installed at the gear ring of engine. The clearance between sensor and tooth tip shall be kept in-between 0.4mm and 0.8mm, and during installation, it is required to first install the sensor onto the tooth tip, rotate it reversely about 1-3 turn (for 1.5mm screw pitch) or 1/2 turn (for 1 mm screw pitch), and then tighten up the nut. If there is no flywheel ring gear, other sensing gear can be used as well but they shall be made of magnetic materials, with

the output frequency of sensor no less than 1,000Hz within the working speed range of engine.

(2) The electromagnetic actuator is installed on the engine, for its installation position and installation method, the oil pump integration installation method is recommended, but the externally installation method is also allowed in special conditions or if required specially.

(3) The speed controller shall be installed inside protection box without intense impact vibration and electromagnetic interference, and be reserved with sufficient space for installation, maintenance and heat dissipation, with the outer shell required to be properly grounded. Wherein, the wiring between speed sensor, speed trimmer potentiometer and controller shall be of shield cables, with the shielding layer only grounded at the point of controller.

(4) The working voltage of speed governor is of DC 24V (12V is available), the power can be supplied by the control storage battery, the starting storage battery of the engine or other regulated power supply, but it is required to meet the peak power consumption of system and voltage fluctuating range requirements. When the starting storage battery is used for power supply, it is required to configure the charging unit to guarantee that the electric quantity of storage battery is sufficient. When engine, the short-time output voltage drop of storage battery will not influence the normal working of speed governor.

(5) Precautions for power supply wiring of speed governor:

The positive terminal of speed controller of electronic governor (pin 2) can be directly connected to the positive pole of 24V storage battery in series (i.e., directly obtaining electric power from the positive pole of storage battery)with the power supply switch (or stop switch), and if necessary, fuse can be used.

The negative terminal of speed controller of electronic governor (pin 1) must be wired directly from the negative pole of storage battery. If the negative pole of power supply is required to be grounded, then the negative pole of power supply is grounded at the negative terminal of storage battery, and it cannot be grounded at the negative terminal of controller (pin 1).

If the power wire is shorter than 10 meters, the selected power line shall be over and equal to 0.75 mm^2; if it is longer than 10 meters, the wire shall be thicker correspondingly.

(6) Routine maintenance of electronic governor

Check whether the cable is damaged. The cable shall be tied up and fastened along the layout route

so as to avoid the cable from wearing due to swing. And the cable shall be from high temperature parts (such as turbocharger, exhaust manifold, etc.).

Check the installation of actuator, and tighten it if necessary.

Check the actuator connector, sensor connector and cable fastening screw for oil stains or looseness.

Check if the electric quantity of storage battery is sufficient, and if the charging unit is normal.

For the non-forced lubricating oil pump, it is required to check the oil levels of the high pump and lower oil pump respectively, and change the lubricating oil of oil pump on schedule.

When starting the engine under low temperature environment, it is required to push the actuator rocker arm with hands for several times till it is felt that the running is smooth.

Conduct maintenance after running for 2,000 hours, and the probe of speed sensor may collect dirt and it shall be dismantled for cleaning. Open the cover plate of observation hole on the intermediate body, check if the connected firmware and pin of actuator coupler and oil pump rack is loose.

Conduct maintenance after running for 6,000 hours, dismantle the actuator from the high-pressure fuel pump, and check if the fuel pump rack is flexible.

(7) Precautions for usage

The matched speed sensor can only be used for electronic governor, and cannot be used together with other speed measurement devices.

In order to ensure the safety of engine system, the speed governing function of electronic governor cannot replace the overspeed protection function, and it is required to install the independent overspeed protective device.

The overspeed protective device's emergency shutdown actuator must be independent, and cannot be replaced by the use of electromagnetic actuator.

Before the engine is started every time, it is required to confirm that the "Idle/rated" speed switch is located at the "Idle" position.

The regulator potentiometers of controller have been set upon delivery, and shall not be adjusted by non-specialized persons without approval.

It is not allowed to adjust (especially increase) the speed controller's rated speed to set the potentiometer and speed trimmer potentiometer when the engine is shut down, which is to prevent from overspeed due to the over high speed setting upon startup.

If the engine is reused after being for a longer time, or is started under low temperature environment, it is required to push the actuator's rocker arm with hand for several times till it is felt that the running is smooth without clamping stagnation. In case of any clamping stagnation, the engine cannot be started.

If the engine is reused after being sealed and stored for a longer time, the controller's "experiment" contactors shall be short-circuited before the engine is started, and when the actuator output reaches the maximum fuel quantity, disconnect the "experiment" contactor and then the actuator output shall return to zero position quickly, in case of any abnormality, check the reason for troubleshooting timely, and do not start the engine.

4. Common faults and troubleshooting

4.1 The diesel engine cannot be started

S/N	Cause	Troubleshooting method
1	Using related	
	(1) For pneumatic starting engine, the internal air pressure of starting air bottle insufficient or not at the optimal startup position	The internal air pressure of air shall be often maintained above 2MPa during starting up turn the crankshaft to make one cylinder piston to the position of about 15°after TDC
	(2) For electric starting engine, storage battery electricity power is not sufficient	Maintain the storage battery in line with the manual
	(3) The starting handle is not at the service position	Turn the starting handle to service position
	(4) The diesel engine is loaded	Remove the load
	(5) The engine oil viscosity is big with poor liquidity	Select the proper engine oil based on the environment temperature or heat the engine oil
	(6) There is air inside the fuel system	Remove the air inside the system
	(7) The diesel oil contains moisture	Check the oil tank, unscrew the plug screw at lower part of oil filter to drain the water
	(8) The air release screw of fuel injector is not tightened, without any fuel injected	Tighten up clockwise
	(9) The diesel fuel is unsuitable	Select as per the region and the season
2	Fuel system related	
	(1) The fuel pipe joint is leaking	Check and tighten the joint
	(2) The fuel pipe is blocked	Check and clean
	(3) The diesel fuel filter is blocked	Disassemble, clean or replace the filter element
	(4) Bad injector spraying	Adjust and overhaul the fuel injector, and replace the needle valve assembly if necessary
	(5) The fuel supply advance angle is not right	Adjust as specified
	(6) The fuel injection pump or injector is damaged	Overhaul or replace
3	Others	
	(1) The inlet and exhaust valves have air leakage	Repair by grinding, and re-adjust the valve clearance
	(2) The cylinder has air leakage	Check the cylinder head gaskets, and tighten the nuts of cylinder head
	(3) The valve spring is broken	Replace
	(4) The piston ring has air leakage	Replace with new piston ring
	(5) The piston is seized inside the cylinder	Remove and repair
	(6) There is water collected inside the cylinder	Disassemble the cylinder head for water removal, and find out the reason
	(7) The timing of the air distribution plate of pneumatic starting engine is error	Dismantle and re-install

4.2 The diesel engine cannot give out the specified power

S/N	Cause	Troubleshooting method
1	Using related	
	(1) Low speed	Adjust to the rated speed
	(2) The local elevation or ambient temperature is too high	Correcting based on the environment conditions referring to the GB “Power correction table”
2	Fuel system related	
	(1) The fuel injector fails (the spray nozzle is blocked; the spraying is poor; the oil spraying pressure is insufficient, and the height of fuel spray nozzle protruding cylinder head is wrong)	Adjust or overhaul the fuel injector as stipulated
	(2) The fuel supply of fuel injection pump is uneven or individual branch pump does not work	Adjust the fuel supply or overhaul the fuel injection pump
	(3) The fuel injection pump is worn, and the fuel supply is insufficient	Adjust the limit screw of control rack of fuel pump to increase the fuel supply or replace the plunger and barrel assembly
	(4) The diesel fuel filter is blocked; the fuel pressure of fuel delivery pump is insufficient; the check valve of fuel delivery pump is broken and worn, and the spring is broken	Check, clean or adjust, replace
	(5) The diesel fuel is unsuitable	Select and use the specified grade of fuel based on the region and season (ambient temperature)
	(6) The fuel supply advance angle is not correct	Check and adjust
3	Air distribution system related	
	(1) The air filter, turbocharger compressor, and intercooler are not clean	Disassemble and clean
	(2) The external exhaust pipe does not meet the requirements, and exhaust back pressure is too high	Design and install the external exhaust pipe as required
	(3) The inlet and exhaust valves have air leakage	Check, grind and repair
	(4) The air inlet/exhaust timing is not correct	Check and adjust
	(5) The charging valve or starting valve on cylinder head of pneumatic starting engine has air leakage	Disassemble, grind and repair
4	Others	
	(1) The compression pressure is insufficient (the compression ratio is not correct or the piston ring is worn excessively)	Check, adjust or replace the piston ring
	(2) The piston and cylinder liner is worn or other wearing part is fault	Disassemble the cylinder head, check the internal surface of cylinder liner or other wearing parts, and make timely repair or replacement
	(3) The diesel engine is not cooled sufficiently, being overheated	Check the tension of belt and the parts of cooling system, or remove the incrustation
	(4) The bearings are poorly lubricated and overheated	Overhaul or clean the lubrication system

4.3 Exhaust with smoke

S/N	Cause	Troubleshooting method
1	Grey white smoke	
	(1) The diesel engine is too cold	Increase the water inlet temperature
	(2) The inside of cylinder has water leakage	Remove the exhaust manifold or check the cylinder head
	(3) The combustion in cylinder is incomplete	Check the fuel injector or compression pressure inside cylinder
2	Grey brown smoke	
	(1) The diesel engine load is too high	Reduce the load
	(2) Too much fuel injected by individual branch fuel injection pump	Adjust as required
	(3) Fuel injector failure (if there is fuel dripping from spray nozzle, then intermittently smoking will occur)	Check the fuel injector or change or repair the spray nozzle
	(4) The fuel supply advance angle is insufficient (exhaust black smoke or flame)	Adjust the fuel supply advance angle as required
3	Sky blue smoke	
	(1) The engine oil comes into combustion chamber when the engine is cold	Increase the water inlet temperature
	(2) The new engine is just put to use	Increase the running-in time
	(3) The piston ring is worn	Check and repair

4.4 The diesel engine gives out abnormal noise or vibration during running

S/N	Cause	Troubleshooting method
1	Too early fuel injection or uneven fuel supply of cylinders causes clear, and rhythmical metal knocking noise occurring inside the cylinder, especially during startup or running at low speed	Adjust the fuel supply advance angle or adjust the evenness of fuel supply
2	The clearance of intake/exhaust valve is too large, giving out rhythmical and gentle knocking noise	Adjust the valve clearance
3	The diesel engine load is increased before warm-up, and knocking noise is produced due to the large clearance between piston and cylinder liner	Remove the load, and warm up the engine at idle running
4	The piston, piston ring and cylinder liner are worn greatly, producing knocking noise	Replace the related parts
5	The journal of crankshaft and bearing shell are worn greatly, causing knocking noise throughout the whole length of engine body	Overhaul or replace
6	The compression ratio is too high; harsh running and large vibration	Adjust the compression ratio as required
7	The intake/exhaust valve clearance is too small or the intake/exhaust timing is not correct, causing the valve to impact the top of piston	Adjust the valve clearance or valve timing
8	Individual cylinder do not work, and the diesel engine vibrates intensely	Check the fuel system to eliminate the faults
9	The valve is broken (or gives out sudden or intense knocking sound due to valve damaging, valve falling or piston fracturing)	Shut down the engine immediately and check
10	There is hissing sound of air leakage at the cylinder head gasket	Check the tightness of cylinder head nuts or replace the cylinder gasket
11	Knocking noise due to excessive wearing of gears	Check and replace
12	The fixing bolt of diesel engine is loose or damaged, with the vibration intensified	Tighten up or replace the bolt
13	The non-concentric vibration of diesel engine and the associated working machine is intensified	Check and adjust
14	The ground foundation is not flat, making the common base plate of engine unit deformed	Check and adjust

4.5 The diesel engine is running unstably

S/N	Cause	Troubleshooting method
1	The speed governor's flyweight does not move flexibly or the wear clearance increased	Check whether there is clamping stagnation, and repair or replace with new ones
2	The buffer spring of speed governor loses its elasticity or has broken, resulting unstable speed due to control rack shaking	Check or replace
3	The speed of diesel engine is too low and can only run at the middle speed, and the land engine double-speed governor cannot work automatically	Increase to the rated speed
4	The diesel engine's load is changing frequently	Check the load output
5	Individual cylinder ignite discontinuously, causing that the fuel picture for oil accumulated in the cylinder burns too intensely and resulting in the cylinder knocking	Check the fuel system
6	The fuel supply and injection time of all branch fuel injection pumps are not consistent	Check and adjust
7	There is air inside the fuel system	Check and bleed the air
8	The fuel contains moisture	Check the fuel and discharge the water
9	The timing gear move forwards and backwards	Check the fastening of gears

4.6 The water pump do not pump water or water supply insufficient

S/N	Cause	Troubleshooting method
1	There is air inside the water pump or the suction pipe	Fill in lead water to eliminate the air
2	The water pipe is blocked or frozen (in cold seasons)	Clean or fill in hot water, or pre-fill in antifreezing solution
3	The water pump sealing device or the sealing gasket is damaged, resulting in air leakage	Overhaul or replace with new ones
4	The water pump belt is too loose	Check and adjust
5	The water pump is scaling seriously	Remove the scale deposit
6	The water pump's suction head lift is too large	Install the water pump as required

4.7 The oil pressure is too low

S/N	Cause	Troubleshooting method
1	The oil is unqualified (it is manifested as that the oil pressure is gradually decreasing along with the running of diesel engine)	Select the oil as required
2	The diesel engine is overheated, and the oil is thinning	See section 4.8
3	The oil filter is blocked	Clean
4	There is oil leaking due to the pipe joint of oil line is loose or there is air in the oil pipe	Check and tighten up
5	There is diesel fuel mixed into the oil	Replace and find out the reason
6	The spring of pressure regulating valve of oil pump has broken	Replace
7	The oil amount inside oil tank is too small or the oil pump's suction head lift is too large	Add oil or re-install the oil pump and oil tank
8	The clearance of connecting rod bearing or main bearing is too large	Check and replace

4.8 The diesel engine is overheated

S/N	Cause	Troubleshooting method
1	The cooling water amount is insufficient	See section 4.6
2	The water inlet temperature is too high	Reduce the water
3	The oil pressure is too low	See 4.7
4	The diesel engine is overloaded	Reduce the load and find out the reason
5	The fuel injection is too late	Check and adjust
6	The piston ring is leaking	Check and replace
7	The bearings are too tight	Check and make proper repair
8	The ambient temperature is too high	Correct the power, and reduce the load

5. Contact Us

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