

Maintenance of Diesel Engine

The correct, timely and careful maintenance may guarantee normal working of the diesel engine to avoid fault, reduce wear, prolong the lifetime and reduce the operation cost. The user should maintain the diesel engine according to the requirements in this section.

Table Maintenance Items and Schedule

Maintenance name	Maintenance items
Routine maintenance (daily)	<ol style="list-style-type: none"> (1) Check the engine oil level of the engine; (2) Check the coolant level of the engine; (3) Check the fuel level of the fuel tank; (4) Check for three leakages; (5) Check the working conditions of all kinds of instruments; (6) Keep the complete machine clean. (7) Check and maintain the electrical circuits.
Grade I maintenance (running for every 100 hours)	<ol style="list-style-type: none"> (1) All routine maintenance items; (2) Check the belt tightness of the fan; (3) Check and adjust the clearance between the air intake valve and exhaust valve; (4) Check and refill the battery electrolyte; (5) Replace the engine oil (first Grade I maintenance for the new machine or engine after overhaul); (6) Clean the oil inlet filter of the oil transfer pump.
Grade II maintenance (running for every 250~500 hours)	<ol style="list-style-type: none"> (1) All Grade I maintenance items; (2) Clean the air filter; (3) Check the opening pressure of fuel injector; (4) Check the static advance angle of oil supply; (5) Check the contact conditions of all connections of electrical circuits. <p>Running for every 400~500 hours;</p> <ol style="list-style-type: none"> (1) Clean the water scale; (2) Clean the fuel tank; (3) Replace the engine oil and oil filter; (4) Replace the diesel filter. (5) Check the oil-gas separator and replace the filter element.
Grade III maintenance (running for 1500~2000 hours)	<ol style="list-style-type: none"> (1) Clear the oil stain, carbon deposit and coking; (2) Check the tightening conditions of major parts; (3) Check the wear and deformation conditions of friction pair and moving parts; (4) Check the working conditions of fuel injection pump; (5) Check the working conditions of fuel injector; (6) Check the working conditions of oil pump; (7) Check the working conditions of starter motor; (8) Check the working conditions of generator; (9) Check the working conditions of turbocharger; (10) Check the torsion damper; (11) Check the thermostat and sealing gasket; (12) Check the oil-gas separator and the filter element;

	(13) Check the fan; (14) Check the water pump. Running for every 5000 hours or every 2 years; Replace the antifreeze liquid.
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6.1 Routine maintenance (daily maintenance)

6.1.1 Check the engine oil level of the engine

Check the engine oil volume one time after every 8 hours of diesel engine continuous running.

6.1.2 Check the coolant level of the engine

1) Keep the coolant level of the engine radiator above the working plane and fill up the oil sump in case of insufficiency.

2) Keep the joints of connection pipe without leakage and ensure the inner chamber of cooling system free of air (except the radiator).

3) The radiator should be filled with coolant as much as possible in order to avoid accelerated corrosion of radiator.

4) It is forbidden to fill coolant during operation of the engine.

5) It is forbidden to handle the radiator, open the radiator cap or disassemble the connection hose when it is uncooled.

6) It is not allowed to open the fan cover during running of the fan.

6.1.3 Check the fuel level of the fuel tank

Check the fuel tank is between “high” and “low”. In case of low fuel level, refueling is required.

6.1.4 Check for three leakages

Check and eliminate the water leakage, oil leakage and air leakage.

6.1.5 Check the working conditions of all kinds of instruments

Observe whether the readings are correct and repair or replace the damaged electrical elements timely.

6.1.6 Keep the complete machine clean

The complete machine should be kept clean without dust and dirt. The electrical equipment should be free of oil stain, so as to avoid short circuit.

6.1.7 Check and maintain the electrical circuits.

1) Check whether the cables are damaged and repair it timely in case of damage.

2) Check the electronic components, battery wirings, wiring mounting fasteners of starter wiring are loose and fasten it timely in case of looseness.

3) Check whether the connectors of all components, sensor connectors, cables and fastening screw are with oil stain or loosened and corresponding treatments should be taken.

6.2 Grade I maintenance

Except for the routine maintenance, the following maintenance items should be added for the engine after every 100 hours of running

Items:

6.2.1 Check and adjust the clearance between the air intake valve and exhaust valve

Technical requirements (under the cold status):

6.2.2 Check and refill the battery electrolyte

Check the electrolyte level of the battery and fill up in case of insufficiency.

The battery should be kept clean

The battery should be kept clean and dry, and the dirt and oxides of the battery could cause short circuit, discharge or voltage drop of the battery in wet weather. The oxides on the battery terminal and conductor could be cleared with a brass brush, and then applied with grease (petrolatum), to prevent them from oxidation again.

6.2.3 Replace the engine oil (first Grade I maintenance for the new machine or engine after overhaul)

Replace engine oil for the first Grade I maintenance of a new machine or engine after overhaul, which should be carried out immediately after the engine is stopped and the cooled.

Method:

a) Remove the oil drain plug from the bottom of the side of oil sump to discharge the engine oil, and the impurities are prone to be discharged with oil at this time. The discharged waste oil should be collected, so as to avoid environment pollution.

b) Check whether the sealing washer of oil drain plug is damaged, and replace it with new sealing washer and tighten the torque as required in case of any damage.

c) Fill in the new engine oil to the high level mark of the oil scale.

d) Start the engine and check visually where there is any oil leakage.

e) Stop the engine, and re-check the oil level of the oil scale after waiting for 15 minutes until the oil returns to the oil sump. The engine oil should be between the upper limit and lower limit of the oil scale (near the upper limit) and fill up in case of insufficiency.

Replace the oil filter in case of insufficient oil pressure (to be conducted at the same time when the engine oil is replaced).

6.3 Grade II maintenance

Except for Grade I maintenance, the following items should be added to the engine after every 250~300 hours of running:

6.3.1 Clean the air filter

Stop the engine for maintenance after running of 150~200 hours of the air cleaner. Loosen the end cover nuts, remove the end cover, and take out the filter element, put it on the clean place, and after gently tap it or remove the dust with a brush, then blow it with compressed air (with the pressure no more than 588kPa) from inside to outside. The oil and water are forbidden to be used to clean the filter element which should be carefully checked after maintenance. Method: put a light at the inner side of the filter element for check and replace it with a new filter element in case of defects such as filter paper damage, end cover degumming or after maintenance of 5~6 times under normal operation.

Attention should be paid on the correct installation of filter element after maintenance. Please do not miss spare parts.

6.3.2 Check the opening pressure of fuel injector

Adjustment method of injection pressure: remove the pressure regulating screw cap, screw in or screw out the pressure regulating screw as required. Screw in to increase the injection pressure and screw out to decrease the injection pressure.

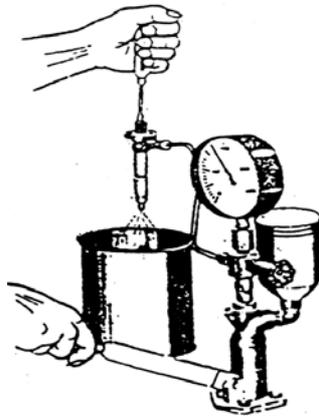


Fig.6-3 Check the Opening Pressure of Fuel Injector

The decrease of the opening pressure of fuel injector will affect the atomizing quality of fuel, causing direct impact on the performance of diesel engine. It is required that the fuel spray injected from fuel injector should be uniform with good atomizing quality which the elaioleucite is fine and uniform, there is a clear sound during injection and without any oil leakage. Replace the nozzle matching parts in case of poor atomization after adjustment.

Note: the replaced nozzle matching parts must be the products of same model and same manufacturer!

6.3.3 Check the contact conditions of all connections of electrical circuits

Check the contact conditions of all connections of electrical circuits and handle it in case of looseness.

6.3.4 Remove water scale

Perform descaling in case of over-temperature condition, so as to ensure the cooling effect; there are external clean and internal clean.

External clean

In the dust or the filthy environment, the cracks on the radiator may be blocked by chips and insects which will affect the effect of radiator. Those light sediments could be cleaned regularly with low pressure steam injector, while those dirties which are hard to be cleaned could be spray-washed with low pressure hot water with detergent, by spaying steam or water toward the fan in front of the radiator. Spraying in reverse direction will push the dirties into the center of radiator. The engine should be protected with rubber cloth when adopting this method.

Internal clean

Cleaning fluid formula: add 750~800 grams of sodium hydroxide (caustic soda) and 150 grams of kerosene for every 10 litres of water and stir them together into mixture.

Cleaning method:

- a) Drain off the coolant of the engine completely.
- b) Add the cleaning fluid to the cooling system from water tank.
- c) Start the engine to the rated speed, keep the engine running for 10~15 minutes by taking

such cleaning fluid as coolant to raise the temperature of cleaning fluid, and keep the cleaning fluid in the waterway and radiator of the engine for 10~12 hours, then start the engine to make it run for 10~15 minutes at rated speed to raise the temperature of cleaning fluid and drain off the cleaning fluid.

d) Add clean water (soft water), keep the engine running at rated speed for a period of time and drain off the clean water.

e) In case of heavy water scale, repeat this process for 2~3times.

Note: as the sodium hydroxide is of strong alkalinity, do not put it in your mouth or contact with skin, and clean it immediately with water after contact with skin.

6.3.5 Clean the fuel tank

The fuel tank is provided by the user. It is recommended that a drain cock or plug screw should be equipped by the user at the bottom of fuel tank when designing the fuel tank for cleaning.

As the oil drain plug is at the bottom of fuel tank, the condensed water produced in the unfilled fuel tank is more than the condensed water in the fully-filled fuel tank. If the fuel level of the fuel tank is too low, the cold air makes the temperature of fuel tank dropping faster than the fuel level, increasing the condensation of water vapor, thus, the condensed water produced in the fuel tank will be increased. So, the fuel tank should be kept near the fully-filled state.

In case of high humidity of the working environment or the moisture in the fuel tank is more than usual when checking the fuel tank, it is advised to install an oil-water separator at the user's own cost.

6.3.6 Replace engine oil and oil filter

Replace engine oil

a) Start the engine, keep running until the normal working temperature, and then shut down the engine.

b) Remove the oil drain plug from the bottom of the side of oil sump to discharge the engine oil.

c) Check whether the sealing washer of oil drain plug is damaged, and replace it with a new sealing washer in case of any damage.

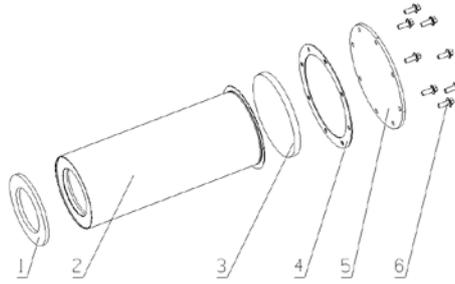
Clean the filter screen of the oil strainer

Method:

a) Remove the spare parts such as filter screen cover, filter screen cover plate, washer and filter screen components from the side of oil sump, see fig. 6-4;

b) Clean up the impurities on the filter screen components and felt with kerosene and brush;

c) For the compound filter screen components and related spare parts, tighten the 4 pieces of bolts in a diagonal cross order and the bolt torque is controlled as (20-30) N.m.



1. felt seal 2. filter screen component 3. filter screen cover 4. plate 5. filter screen cover 6. bolt

Fig. 6-4 Installation Diagram of Filter Screen of Oil Filer

Replace the oil filter

Completely wipe clean the dirt around the oil filter, to avoid the dirt entering into the new filtration container when replacing the oil filter with new one.

Put the prepared plates under the filter. Take out the rotary type filter wrench from the tool kit, fit it on the oil filter to be disassembled, and clamp the oil filter, and then unscrew it anti-clockwise forcibly to remove the oil filter element.

Fill up the new engine oil filter with new engine oil.

Perform lubrication on the rubber seal ring with a small amount of clean engine oil, and screw it with a hand until the sealing gasket touches the filter head, then screw it down for 3/4~1 circle.

After the above operations are completed, add oil and check the oil scale, and the oil level should near the high level mark of the oil scale.

Start the engine, and keep it running for several minutes under no-load, and check whether the oil pressure is normal.

Visually check whether there is oil leakage at the removed parts.

Stop the engine, and re-check the oil level of the oil scale after waiting for 10-15 minutes until the oil returns to the oil sump. Add oil in case of necessity.

Notes:

- a. The discharged waste oil should be collected, so as to avoid environment pollution.
- b. The removed old oil filter should be disposed properly.

6.3.7 Replace the diesel filter

Turn off the fuel tank switch.

Completely wipe clean the dirt around the oil filter, to avoid the dirt entering into the new filtration container when replacing the oil filter with new one.

Replacing method is the same as "replace the oil filter".

Notes:

- a. The removed old oil filter element should be disposed properly;

b. In order to avoid the fuel dropping on the heat source of the engine to cause fire, the engine must be shut down when replacing the diesel filter element, and the replacement could be carried out only after the engine is cooled.

6.3.8 Check the oil-gas separator and replace the filter element

Replace the filter element of oil-gas separator, check the tightening conditions of oil-gas separator and relevant connectors after replacement, and tighten it in case of looseness.

6.4 Grade III maintenance

The grade III maintenance is conducted for checking and adjusting the engine assembly after running for 1500~2000 hours (to be conducted with reference to the Grade I / Grade II maintenance), to eliminate the fault risks. The engine must be disassembled in case of serious air leakage and oil leakage of the engine, early wear of the cylinder bore and the oil pressure cannot be adjusted to the specified pressure. If the engine runs in normal condition, the following items may be selected for maintenance or the mileage for Grade III maintenance may be extended appropriately.

6.4.1 Disassemble the complete machine and clear the oil stain , carbon deposit and coking

Disassemble and clean the complete machine, clear the carbon deposit, oil stain and gum deposit and clean all the lubricating pipes and oil ducts.

6.4.2 Check the tightening conditions of major parts

Check the main bearing bolts, cylinder head bolts and connecting rod bolts and retighten them to the specified torque in case of looseness.

6.4.3 Check the wear and deformation conditions of friction pair and moving parts

Check the wear conditions of parts such as the air valve, valve seat, valve guide pipe, valve spring, push rod and rocker arm and grind or exchange them if necessary.

Check the wear conditions of the piston ring, cylinder bore, bushing for small end of the connecting rod and connecting rod shaft hole, and replace them if necessary except that the cylinder liner may be bored or sleeved for repair.

Check the wear conditions of the main bearing bushing and thrust plate, and replace them if necessary.

Check the wear conditions of the gear and the gear backlash, and replace it if necessary.

6.4.4 Check the working conditions of fuel injection pump

Remove the fuel injection pump, and check it on the fuel pump check table to identify whether the fuel supply of all cylinders of the fuel injection pump is normal.

Check the camshaft oil seal of fuel injection pump, to ensure there is no lubricating oil leakage on the actuator.

6.4.5 Check the working conditions of fuel injector

Check the atomization conditions of fuel injector, grind the injector nozzle matching parts or replace them if necessary.

6.4.6 Check the working conditions of oil pump

Check the oil pump gear and oil pump body and replace them if necessary.

6.4.7 Check the working conditions of starter motor

Check all the spare parts and clear the dust and dirt inside and outside. The lubricating grease is applied for gear and spiral spline, and the lubricating oil is applied for bearing.

6.4.8 Check the working conditions of turbocharger

Check the clearance between the bearings of turbocharger and it is not necessary to remove the turbocharger from the engine when checking. The clearance between rotor spindle and end face could be measured with a dial indicator, and the radial clearance could be measured with a thickness gauge. Replace the turbocharger if necessary.

6.4.9 Check the torsion damper

Check whether there is fluid leakage, air leakage and shaking of the damper, visually check the thickness of the damper to identify whether there is deformation or whether there is bulge of the front cover plate of the damper, and replace the damper in case of change or deformation.

6.4.10 Check the thermostat and sealing gasket

Remove the thermostat from the thermostat seat, to check the switch temperature of the thermostat, and replace it in case of it fails to meet the requirements.

6.4.11 Check the oil-gas separator and the filter element

Remove the oil-gas separator, clean up the dirt inside with kerosene, blow-dry it with compressed air and check the filter element. Replace the filter element after running for every 500 hours.