

The basic knowledge about cylinder in the construction machinery

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Abstract: Mechanical Construction Machinery is one of the industries are in the process of development, with many types of modern machines are built and invested to meet the demand for use and exploitation in our country. Today's construction machines are increasingly used in real life because of the utility it brings. Machine life is determined by the main engine clusters, such as the engine, transmission, working life of the clusters, determined by the life of the main components. Therefore, the study of wear and tear to provide corrective measures and measures to improve life expectancy is a matter of great concern.

Keywords: construction machinery, cylinder, mechanical engineering

1. Introduction

The mechanization and automation of construction is an indispensable step in the production process. It decides to increase labor productivity, lower production costs, and reduce manual and mental labor for workers. At the same time, it contributes significantly to the shortening of construction time, quickly putting the works into exploitation and use, raising economic efficiency, quality and aesthetics to speed up the economic growth. citizen. In order to carry out construction works, construction machines are indispensable. The world has built specialized equipment in the construction of high-rise buildings, industrial, civil, road construction, construction of hydropower plants. Construction equipment is increasingly modernized.

In Vietnam, our economy is in a strong stage of development. Construction needs include the construction of industrial buildings, residential buildings, schools, bridges, roads, ports, hydroelectric facilities, underground constructions. exciting in the whole country. Demand for construction is demanding and need a lot of construction machines with high productivity and technical features. We are in the process of industrialization and modernization of the country. Mechanical Construction Machinery is one of the industries are in the process of development, with many types of modern machines are built and invested to meet the demand for use and exploitation in our country. Today's construction machines are increasingly used in real life because of the utility it brings. Machine life is determined by the main engine assemblies such as the engine, transmission, and service life of the clusters determined by the life of the main components. They are meant to provide remedies and measures to improve longevity are of great concern. In all clusters, engine components wear out the most because parts of it have to work in difficult, hard conditions, typically groups of coarse-Cylinder. In general, the level of abrasion of the cylinder or crankshaft is often used to make molds for repairs. Knowing the importance of the engine cylinder, in the process of studying at school, through the interns inside and outside the school I have very much caught the basic knowledge of the internal combustion engine on the machine, the termination. Structure of the technology, methods of diagnosis, maintenance, basic repair. During the graduation exam this year, with the honor of the school delivered the topic of diagnosis, maintenance and repair of internal combustion engine cylinder on the Construction Machine.

Construction machines are of various types and variants, for ease of application research, can be classified by purpose, source, control method or moving system.

Based on the utility, construction machines are divided into groups as follows

- Power generators: to provide motivation for other machines to work as generators, compressors,
- Horizontal transport: horizontal transport such as means of transport by road, rail, waterway or air.
- Continuous conveying machine: transporting materials and goods into continuous streams: conveyors, loading screws,
- Hoist: vertical transport: jack, hoist, hoist, crane, crane,
- Soil cultivator: for soil preparation: bulldozer, excavator, compactor,
- Ice making machine: grinding machine, sieving machine, stone sand washing machine,
- Machines for concrete work: mixers, compactors, concrete pumps,
- Steel working machines: Welding machines, steel cutters, straightening machines, steel bending machines, ...
- Platform reinforcement machine: piling machine, pile press machine, pile drilling machine, penetrator plug.
- Specialized machines for each industry: canal digging machines, asphalt concrete machines, asphalt road milling machines, bridge girder.

Based on motivation

- Motor driven internal combustion engines
- Electric motors
- Hydraulic motor drives

Based on the migration system

- Tire moving machine
- Track crawler
- Machines moving by iron wheels on rails
- Machine moving on float
- Machine moving by self-stepping mechanism

Based on the control method

- Mechanical control machine
- Hydraulic machine
- Electric machines
- Pneumatic control machine



Figure 1. Construction machinery

2. General information about the cylinder on the Construction Machine

Engine cylinder is usually made of cast iron, alloy steel, hardness $HRC = 26 \div 33$, the surface of the cylinder is nitrided with a depth of $0.3 \div 0.6$ mm. The structure of cylinder type diesel engine used in Vietnam is shown in the following:

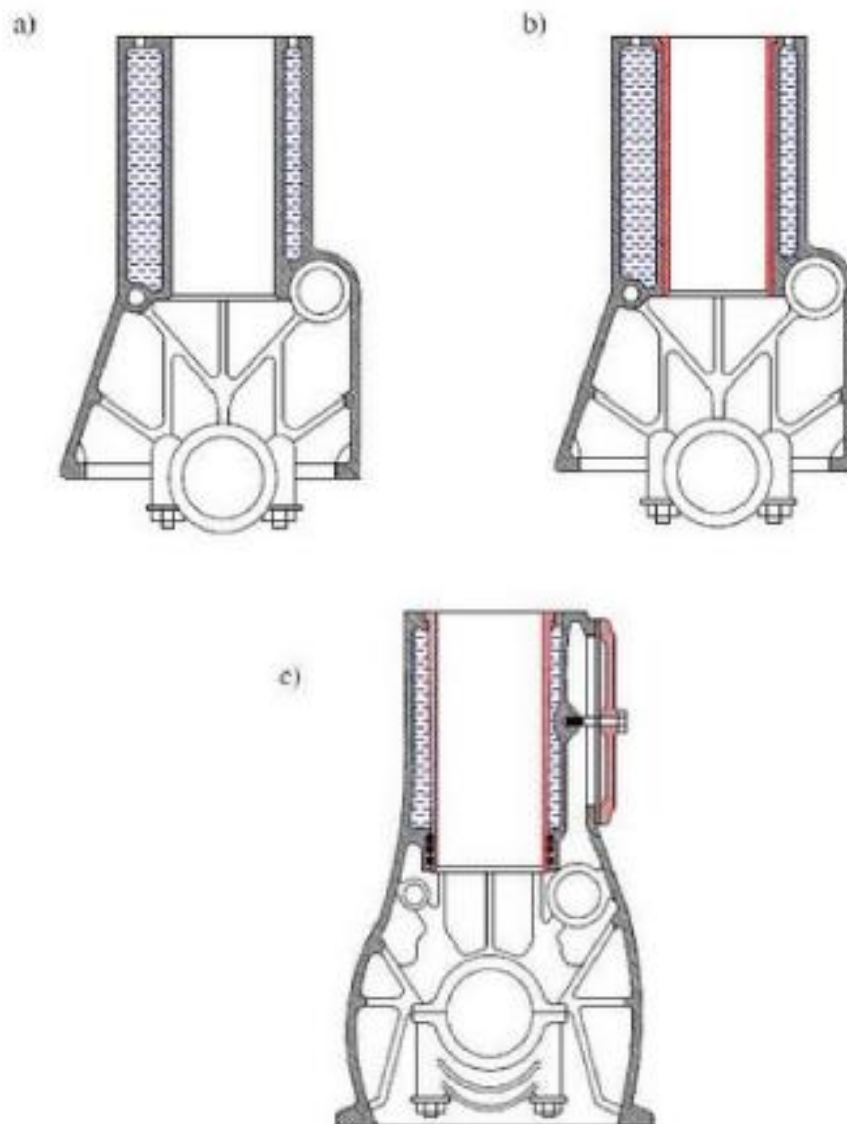


Figure 2. The cylinder of construction machinery

The task of the cylinder is to combine the piston-ring and the cap to form the combustion chamber for the engine, guide the piston. The cylinder of engines are classified into two categories:

Instant cylinder: The cylinder type is molded together with the machine body, high rigidity, good heat transfer.

Casting cylinders: These are molded into tubes, called cylinder liners, which have the advantage of saving the material. The cylinder liner is divided into two types:

* Dry cylinder liners: This coolant jacket does not come into direct contact with the cylinder liner wall, but through the body wall it is thinly worked to ensure good heat transfer. The inside and outside of the dry cylinder liner are polished and have high precision.

High hardness, no leakage, water leakage, shrouded material but complex assembly cooling is not complete.

* Wet cylinder liner: This type is widely used, direct cooling water in contact with the outer wall of the cylinder liner. Good rooting, good cooling, removal, repair easily.

Technical requirements: High mechanical strength, high pressure, low coefficient of friction, less corrosion, good abrasion, and thermal expansion coefficient, and good heat transfer.

3. Wear on the cylinder

Because of its extreme temperature, corrosive environment, lubricant grease, lubricants and scale dirty fuels. During the entire journey of the pistons, the different positions of the cylinder are subjected to different frictional conditions so that the cylinder wears unevenly. The top of the cylinder is worn out more than the bottom, so the cylinder after a period of time the cylinder will be tapered; In the direction of the cylinder's glass wears out in an oval shape. The largest abrasive in the cylinder corresponds to the upper dead band of the first cylinder. This is because at the upper end of the cylinder the working condition of the cylinder is the worst, the pressure of the cylinder is the largest, the maximum working temperature, the worst lubrication condition. The pressure of the cement on the cylinder depends on the strength of the cement and the pressure of the combustion gases on the back of the cement. The pressure on the first one is the greatest. As the piston goes down, the pressure in the cylinder decreases, so the pressure acting on the cylinder decreases. When the force acting perpendicular to the friction face is larger, the molecules of the friction surfaces become more intertwined and therefore the upper part of the cylinder wears the most.

Effect of temperature on the cylinder wear: The temperature at different positions of the cylinder is different. The temperature of the upper cylinder is high, for example in some reciprocating water-cooled engines, the average temperature of the piston's dead zone is about 350°C, in the dead zone of less than 200°C. For some air-cooled engines, the temperature can be as high as 430°C at the upper and 220°C at the bottom. The temperature of the first cigarette is higher than the temperature of the cylinder. Increasing temperatures cause the viscosity of the oil to drop, thus weakening the oil film, even the oil film at high temperatures can burn. On the other hand, the oil supply to the upper part of the cylinder is also difficult. The reason why the upper part of the cylinder is worn out. When the engine working in the cylinder forms three temperature zones:

High temperature zone: High temperature lubricant has no lubricating effect, the oil film is destroyed, the pressure of the strong spray mist also affects the lubricating film, properties, and values. Cylinder wear depends on the heat regime, the engine's structure and the different cooling levels of the cylinders in the supply of a motor. When the cylinder temperature is lower than the fogging temperature of the combustion products on the cylinder wall, condensed water vapor, sulfuric acid and sulfur compounds in the fuel also increase wear and tear. Lubricants in the burned area are arranged soot and resin in the cylinder to adversely affect the work process, reducing the heat transfer, causing the nozzle to clog, causing the wear of metal surfaces. As the fuel burns at elevated temperatures, the lubricant film is expanded locally, heated by injection fuel at high speed, by the airflow blowing into the cylinder, due to the pressure change during the stretching process. Due to the reduction of the velocity of the air to zero and the change in direction of its movement leading to the destruction or reduction of the film thickness of the lubricating film, causing the metal surfaces to come in direct contact with each other. These elements wear out unevenly on the cylinder length.

Average temperature region: In this temperature range, the fire and oil products make the glue, causing the cement clogs, eroding the cylinder and the cement.

Low temperature area: At this temperature, lubricating oil is almost the same, with less volatilisation, so when the gas enters the teats, in the fuel oil, the stored fuel Fluorocarbons, organic acids, which have the effect of loosening lubricant oils, also cause corrosion. To reduce the consumption of additives, we add multifunctional additives to reduce oxidation, plasticity, anti-corrosion. Throughout the entire journey of the pistons, the work of the cylinder is different, subjected to different friction conditions, so that the cylinders' wear is unevenly distributed. The top of the cylinder is worn more than the bottom of the cylinder, in the direction of the glass the cylinder is worn out of the oval shape, the largest wear on the cylinder corresponds to the upper dead center of the first cylinder.

Influence of compressed air on the cylinder wall: Inflated air streams on the cylinder wall also cause uneven cylinder wear in the cross section. Corrosion can be seen in the direction of the maximum wear of the cylinder at the position opposite to the loading cylinder. The blowing effect of the air entering the cylinder causes its temperature to drop, so that the erosion occurs more intensively and thus the wear intensity increases. In addition, the cooling of the engine also affects the cylinder's wear in the direction of the glass. Many experiments have shown that the position of the cylinder's worn edge is not always completely opposite to the load, where at the lowest speed. In fact, on a motor the worn characteristics of the cylinders are generally the same but the absolute wear is different. Most worn out cylinders have a lower temperature than the other cylinders. The maximum worn position of different cylinders is also different, depending on the position of the loader and the cooling conditions of the engine. During the loading process, the air blows on the cylinder wall and the condensed fuel cleans the lubricant on the cylinder wall, damaging the lubricating film also increases the abrasive strength of the cylinder. .

Impact of Fuel on Cylinder Abrasion: The effect of fuel on cylinder wear is primarily determined by the amount of impurities in the fuel, including the most highly acidic, sulfuric, and sulfuric acids. Sulfur is capable of corrosion of the engine parts, in addition to the viscosity of the fuel and the quality of the fuel

injected into the cylinder. When the engine produces SO_2 and SO_3 , in the case when combined with water vapor produces H_2SO_3 and H_2SO_4 both types of acids together with dust and some other acids in the engine corrosive fuel. very fast. The erosion of combustion products also affects the degree and erosion characteristics of the cylinder, the combustion products include CO_2 , SO_2 , NO_2 water vapor and organic CH_2O , $\text{C}_2\text{H}_4\text{O}_2$. Cylinder is either water-soluble or corrosive, so corrosion by the two types is equally effective as chemical abrasion and mono-chemical. The degree of corrosion of the cylinder depends on the temperature of the cylinder wall, the higher the temperature, the stronger the corrosion. In this case the upper part of the cylinder also suffered the worst conditions. Specifically, although the upper part of the cylinder is high due to the large air pressure, condensation leads to poor lubrication, the corrosion resistance of the oil film is almost nonexistent and the abrasion is also great. The viscosity of the fuel required is the engine working normally. If the viscosity is large, the mobility will cause great obstacle to bad spray quality. Baby viscosity reduces fuel injection pressure, leaks through the gap between the piston and the engine, the injector and the fuel injection nozzle blend into the lubricant to reduce the chemical and physical wear that results in wear and tear. It also takes into account the value of the fuel because when the diesel engine uses fuel with a small cylinder value, it lasts the period of ignition, the black smoke engine located on the carbon black, the fuel consumption increased. , causing a crashing of the cylinder. Therefore, in order to increase the economic and technical indicators, to reduce the abrasion, diesel fuel must meet the following requirements: Temperature temperature, turbidity temperature, viscosity must be correct to ensure the level the fuel through the nozzle is uninterrupted, contains less impurities, acids, sulfur, dust; there should be a shorter fuse period; It must have good self-inflammability (elevated cetane value); It is no black smoke, no black coal, diesel fuel. Impact of lubricant quality: The quality of the lubricating oil influences the wear of the cylinder. In addition to the basic functions: lubrication, cleaning, cooling, sealing, anti-rust, lubricating oil must have features to reduce wear, ensure long-lasting work so lubrication must reach meet the following requirements: Ability to create a strong oil film on the work surface of the details; Capable of freezing at low temperatures; Make it at least; Chemical stability for oxygen and air.; No mechanical impurities. The water content of the mats accumulates in the lubricating oil when the engine is working Low levels also affect the wear and tear. Water will impair the lubricity of the membrane. When entering the cylinder surface, it will accelerate the process of erosion.

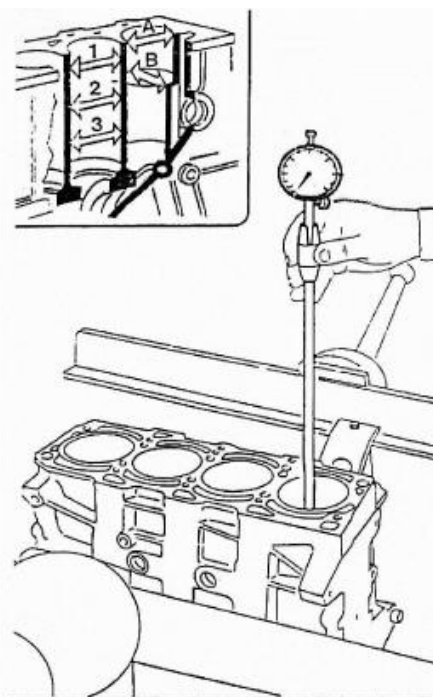


Figure 3. The check of the cylinder of construction machinery

4. Conclusion

For the detection of fissures on the surface, color defect detection is used to identify the fissures. After checking the bushings, it is decided that the repair method consists of: repairing by repair or repair size by replacing the new one. During the inspection, if any defects are detected, the cylinder must be removed for

replacement. Cracks in any size, location; There is rust on the working surface of the total area of over 20cm² which cannot be cleaned; There are streaks of over 40 mm in length, depths exceeding 0.3 mm; - distortion and taper greater than 0.15mm.

References

- [1] Heybroek K., Palmberg J.O. and Larsson J., “Open circuit solution for pump controlled actuators,” Proceedings of The 4th FPNI-PhD Symposium, 2006. Sarasota, Florida, USA.
- [2] Habibi S. and Singh G., “Derivation of design requirements of optimization of a high performance hydrostatic actuation system,” International Journal of Fluid Power, 1(2):11–23, 2000.
- [3] Wendel G., “Hydraulic system configurations for improved efficiency,” Proceedings of the 49th National Conference on Fluid Power, pp. 567–573, March 2002.
- [4] Rahmfeld R. and Ivantysynova M., “Displacement controlled linear actuator with differential cylinder - a way to save primary energy in mobile machines,” Proceedings of The 5th International Conference on Fluid Power Transmission and Control, ICFP’2001, pp. 296–301, 2001.
- [5] Rahmfeld R., Ivantysynova M. and Weber J., “Displacement controlled wheel loader - a simple and clever solution,” Proceedings of The 4th International Fluid Power Conference (IFK’2004), 2004.
- [6] Williamson C. and Ivantysynova M., “The effect of pump efficiency on displacement controlled actuators,” Proceedings of The 10th Scandinavian International Conference on Fluid Power, SICFP’07, 2007. Tampere, Finland.
- [7] Heybroek K. and Palmberg J.O., “Applied control strategies for a pump controlled open circuit solution,” Proceedings of The 6th International Fluid Power Conference Dresden, IFK’08, 2008. Dresden, Germany.
- [8] Heybroek K., Palmberg J.O. and Larsson J., “Mode switching and energy recuperation in open circuit pump control,” Proceedings of The 10th Scandinavian International Conference on Fluid Power, SICFP’07, 2007. Tampere, Finland.