

Design and Fault Analysis of Electrical System of Construction Machinery

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Abstract: Electrical system is the main component of construction machinery. Its quality and operation determine the braking and operation of construction machinery. In recent years, with the accelerated development of social modernization, the development of industrial engineering has been promoted. The number of engineering projects has increased year by year, and stricter requirements have been imposed on the design and operation of electrical systems. In actual work, electrical system failure often occurs. The failure of sensors and alarm devices is prone to occur which affects the normal operation of the electrical system. Only by grasping the specific conditions of the failure, taking appropriate inspections and solutions, and troubleshooting, can the performance of the construction machinery be guaranteed. This article mainly analyzes the electrical system design and fault analysis of construction machinery, and clarifies the main failure in order to provide a certain reference for the improvement of the electrical system of construction machinery.

1. Introduction

In the process of social development and construction, the number of large-scale engineering projects has raised so that the use of construction machinery and equipment has gradually increased. As an important part of construction machinery, electrical systems have received considerable attention in terms of design and operation. Although in recent years, with the continuous development of science and technology, the performance of construction machinery and equipment also becomes better, there are still some common faults in the operation of electrical systems, such as sensor failure. Doing a good job of researching and analyzing faults, clarifying the circuit and environmental factors that they produces, and formulating targeted solutions can ensure the normal operation of construction machinery and equipment and the quality of the entire project.

2. Electrical System Design of Construction Machinery

In the electrical system design of construction machinery, we need to pay attention to the rationality and safety. The overall planning is important as well. We must fully consider the proportion of electrical systems based on the overall structure of the construction machinery, so as to adopt appropriate design scheme, including schematic design, total cost analysis, selection of electric device and design of wire harness.

2.1 Schematic Design

The rationality of schematic design determines the scientific nature of the subsequent design, which can effectively ensure the smooth progress of the subsequent design work. Before the schematic design begins, the designer needs to fully consider the entire construction machinery, understand the technical points and electrical configuration of the electrical system, and then have an overall conception of the schematic diagram of the electrical system. During the design process, the electric components need to be marked with symbols, so that the required electric components are clear. In addition, the wiring of the electric components of the electrical system is also very complicated. It is necessary to arrange all the wiring involved in the electrical system in order, and use the connector method to mark them to avoid the circuit being too complicated and causing a mess, which is beneficial to the smooth connection of subsequent electric components and wire

harness

2.2 Total Cost Analysis

The total cost analysis is related to the budget and cost control of the electrical system design. After the schematic diagram is designed according to the relevant requirements, the relevant personnel need to conduct a comprehensive analysis based on the schematic diagram design, the electrical system operating requirements, and the surrounding environment in order to select electrical components appropriately and budget and analyze the total cost properly.

2.3 Electrical Components

The choice of electrical components type is related to the operation of the electrical system. Therefore, when we design the electrical system, the selection of electrical components is particularly important. Not only the schematic design and the actual situation of the construction machinery project, but also the overall budget must be fully considered to choose the right electrical components. First of all, it is necessary to fully consider the performance and use characteristics of electrical components, and conduct a scientific analysis of the compatibility and versatility of electrical components. Secondly, the selection of electrical components needs to comply with relevant standards, which can ensure the safety and high performance of the overall operation of the electrical system. Thirdly, we need to select the electrical components of higher configuration, which are suitable for the construction machinery projects within the overall budget.

2.4 Wire Harness Design

The design drawing of the wire harness should have all the information about the production. The designer should fully consider the choice of electrical components. The wiring involved in the electrical system is diverse and very complex, and the wire harness usage involved in each wiring is also different. During the design process, different wire harness designs need to be clearly identified, so that the general design drawing of the electrical system of the construction machinery can be clearly displayed, avoiding the circuit being too complicated, causing a mess, and forming a certain security risk.

3. Environmental Factors Affecting Electrical System Faults of Construction Machinery

3.1 Temperature

In addition to the circuit problem, the electrical system failure of the construction machinery also includes environmental factors. The first factor is temperature. The operation of the electrical system is a process of applying work, which converts part of the energy into heat energy to increase the temperature. Excessive temperature will cause poor heat dissipation inside the system, exceeding the temperature range that the device can withstand. Over time, the internal materials of the system are aging and cause serious problem, which causes greatly reduction of the service life.

3.2 Humidity

If the moisture content in the environment of electrical system increases, the humidity will raise, which will affect the insulation ability of the equipment. Moreover, it is easy to breed some fungi in humid places. The growth and propagation of these fungi will corrode the electrical system, cause the loss of equipment, affect the use performance and service life, which will form system failure over time.

3.3 Pressure

In the process of operation, the impact of pressure on the equipment cannot be ignored. Strengthening the reduction of the temperature rise of the equipment can cause the increase of the internal pressure which results in the increase of the volume, which is likely to cause an explosion inside the equipment. In view of this situation, the factory generally does not choose the area where the altitude is too high to build the factory, which can fully protect the equipment from the influence

of pressure.

4. Fault Analysis of Electrical System of Construction Machinery

4.1 Flashing of Charging Alarm Light

In the electrical system design of construction machinery, the device of charging alarm light will be added. When there is an abnormal situation, the alarm light will send out an alarm signal. When the charging alarm light flashes in the electrical system, there are many reasons for the failure. It is possible that the fuse is blown, the instrument is faulty, the generator does not generate power and the wire harness is open circuit. When we check the specific causes, different diagnosis methods are used to find the location of failure. Generally, when a fuse is blown, you can check whether some specific fuses are blown. During the inspection of the generator, the generator can be operated to check the situation of output voltage. For the inspection of the open circuit of the wire harness, the overall line resistance of the charging alarm can be measured to see whether there is poor contact or short circuit. After the above three kinds of faults are eliminated, it is necessary to check whether there is any fault in the instrument. If there is no result, we can replace the instrument with a new one for inspection.

4.2 The Overheating of Engine Coolant

The overheating of engine coolant is due to the failure of sensor and instrument, and the main cause of the failure is the short circuit in the electrical system caused by the overheating of engine during operation. Sensors play an important role in the electrical system. If there is sensor failure, it is easy to cause the collapse of the whole periodic system. Therefore, it should be solved in time to ensure the normal operation of the electrical system. When inspecting the specific location of the failure, we need to remove the sensor and measure the resistance at both ends of the sensor. A number of zero indicates that the corresponding sensor for coolant temperature has failed. At the same time, it is necessary to check the resistance value of the sensor wire harness. If the measuring result is zero, it indicates that the harness is short circuit. When we check the instrument failure, it is necessary to observe the value of the instrument and the sensor in order to make a comparative analysis between them. If the difference is large, it is likely that the instrument has failed.

4.3 The Flashing of Oil Pressure Alarm Lamp

The flashing fault of oil pressure alarm lamp may be caused by blown fuse, short circuit in wire harness, control switch fault, disconnection of electrical components and peripheral harness, etc. The inspection method of blown fuse and short circuit in wire harness is the same as that of charging alarm lamp flashing. When checking the failure of the control switch, we need to press the switch of the relevant electrical parts, and then measure the resistance value of the two pins of the switch when the electric lock is in the off position and after starting the engine. If the measured value is up or down 1M, the switch is normal. If the data changes or is abnormal, it indicates that the fault is caused by the control switch. We can also measure the internal resistance of the electrical parts to see if it is normal. If the value is zero, it means that there is a fault inside the electrical components. At the same time, it is necessary to test whether the wire harness fault is caused by the disconnection between electrical components and peripheral harness.

5. Conclusion

To sum up, with the increasing demand for construction machinery, some safety requirements for the project are more and more strict. Therefore, it is necessary to do a good job in the research and analysis of the fault problems of the electrical system of construction machinery, clarify the main causes of the fault, fully understand the fault problems of the electrical system, further standardize and improve the design of the electrical system, formulate emergency plans, improve the efficiency of detecting and solving the fault, ensure the safe operation of the electrical system, and improve the overall performance of the construction machinery to provide better services for the project and

promote the sustainable development of industry.

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