

Research on Thermal Fault Detection System of Electrical Equipment Based on Image Feature Analysis

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Abstract

The incidence of poor contact accidents of factory electrical equipment is relatively high and it accounts for a relatively large proportion of electrical faults in the entire system, which is a very common fault problem. Once the maintenance and management personnel of the electrical system improperly handle the operation, it will cause serious waste of energy and raw materials, which will have a negative impact on the establishment of a resource-saving society in my country. In recent years, from the analysis of the failure of the electrical equipment in our country's factories, the probability of the occurrence of poor contact is very high, which has a negative impact on the normal production of the enterprise. It is necessary to take active measures to solve the problem by using image features in response to the current situation. Fully guarantee the safety of engineering production. Carrying out daily regular inspections, the staff have a high sense of responsibility. Electrical maintenance work cannot be completed overnight. Long-term inspections and inspections are required to ensure that all parts are in a good and stable working condition. If there is any abnormality, immediately shut down for maintenance. In the daily management of electrical equipment, it is necessary to strengthen inspections, find existing faults in time and take necessary measures in a targeted manner, so as to eliminate potential safety hazards, ensure smooth production and improve operational safety.

Keywords: Image Feature, Electrical Equipment, Malfunction;

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1. Introduction

Power generation equipment is an important place for hydroelectric power generation. Power generation equipment converts water energy into electrical energy through various equipment. Electrical equipment is the general term for primary equipment and secondary equipment in power generation equipment. Among them, the primary equipment directly participates in the electric energy production and distribution of power generation equipment, mainly including hydroelectric generators, switchgear, main transformers, busbars, reactors, lightning protection facilities, etc.; secondary equipment is mainly used for primary equipment Detection, protection and

control, including automatic control equipment, electrical instrument signals, relay protection devices, control cables, etc. Electrical equipment plays a key role in the normal operation of power generation equipment. Therefore, the operation and maintenance and troubleshooting of electrical equipment are also extremely important. A scientific electrical equipment maintenance and repair system is the basis for ensuring the safe and economic operation of power generation equipment. However, there are still many problems in the operation, maintenance and troubleshooting of electrical equipment in my country, which also bring great hidden dangers to the safe and stable operation of power generation equipment. First of all, during the

operation of my country's power generation equipment, the problem of heavy use and light maintenance of electrical equipment is more serious. Some power generation equipment is pursuing economic benefits unilaterally and electrical equipment can continue to work without effective maintenance for a long time. On the one hand, it affects the operating efficiency of power generation equipment, on the other hand, it also increases the failure rate, laying a huge hidden danger to the safe operation of power generation equipment. Secondly, there are also many problems in the current maintenance mode of power generation equipment in our country. The maintenance of equipment still uses the traditional planned maintenance mode of fault maintenance and regular maintenance. The efficiency of this maintenance mode is low. On the one hand, it causes a waste of human resources and on the other hand. The utilization rate of electrical equipment is reduced and the unscientific maintenance mode will lead to an increase in the failure rate of competing production equipment, which directly affects the stable and efficient operation of power generation equipment^[1].

2. Power failure analysis of electrical equipment

2.1. Switch failure

Switches are the most commonly used parts of mechanical and electrical equipment. They are used to control the start and stop of mechanical and electrical equipment. They are frequently used daily. Once their service life is exceeded, the switch shrapnel is prone to failure and jamming. At the same time, long-term use will cause a phase to loosen, poor contact and even contact burning phenomenon, which may cause tripping or fire. In addition, some technical personnel do not operate properly, press the switch too hard, or do not pay attention to daily maintenance, which causes frequent switch failures and affects the normal use of mechanical equipment^[2]. The electrical equipment system is in the figure below.



Figure 1. Electrical equipment system.

2.2. Short circuit fault

The electrical circuits in mechanical electrical equipment are intricate and the number of electrical components is large. Affected by vibration or environmental factors during the operation of the mechanical equipment, some electrical components are dropped or damp, the dropped components are overlapped on different phase circuits, or the insulation of the circuit is reduced , Resulting in the direct connection of the different phase circuits and a short circuit fault occurs. The impact of short-circuit faults on mechanical and electrical equipment is very serious. It is easy to burn electrical components and even cause fire, causing irreparable damage to mechanical and electrical equipment. In addition, some mechanical and electrical equipment is in a complex environment. Some dust and corrosive substances adhere to the internal circuits, corrode the internal circuits, reduce the insulation of the internal circuits and cause short-circuit failures^[3]. The electrical equipment circuit is in the figure below.

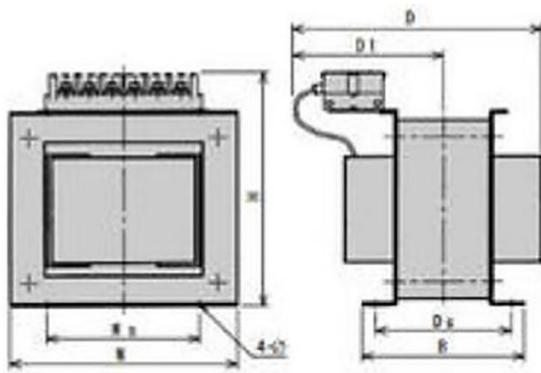


Figure 2. Electrical equipment circuit.

2.3. Component burnout failure

There are two reasons for the failure of mechanical and electrical equipment components to burn out: (1) Human causes. The use of mechanical and electrical equipment is not standardized and the actual operating load is higher than the rated load for a long time, causing the internal circuit current to exceed the maximum allowable value of the component and burn out. In addition, mechanical and electrical equipment is exposed to a high temperature environment for a long time, which causes the insulation of internal components to decrease and burn out due to local short circuits. (2) Natural causes. In the operation of mechanical and electrical equipment, the protective measures are not in place, such as not paying attention to rain protection, lightning protection, etc., resulting in rainwater or lightning strikes, short circuits or excessive internal currents and burns^[4]. The electrical equipment tool is in the figure below.



Figure 3. Electrical equipment tool.

3. Thermal failure analysis of electrical equipment

3.1. External thermal failure problem

External thermal failure is the main manifestation of thermal failure of electrical equipment, which is caused by poor equipment contact. In the actual operation of electrical equipment, if the bare electrical connector is exposed to the air for a long time, it will inevitably lead to poor contact. When there is a problem of poor contact, the huge current

will cause the temperature of the device joint to continue to rise, which will cause serious thermal failure problems and also bring safety risks. According to related investigations and studies, the probability of electrical equipment thermal failures caused by poor external contact accounts for 90%, so the prevention and control of such failures is very critical. Under normal circumstances, according to the external fault temperature, the external thermal faults of electrical equipment can be divided into the following three levels, namely general level, severe level and critical level. In practice, fault handling needs to be performed according to the level^[5]. The electrical equipment thermal system is in the figure below.



Figure 4. Electrical equipment thermal system.

3.2. Internal thermal failure problem

For electrical equipment, in order to improve its safety and service life, its external structure is mostly sealed by metal shells or insulating materials. It is precisely because of this structure that electrical equipment has a certain degree of internal thermal failure. Due to the thermal failure inside the electrical equipment, the heat will be transferred to the insulating material after a period of time, which will inevitably cause the temperature of the electrical equipment to be too high and at the same time highlight the detailed location of the failure point.

4. Image-based fault detection of electrical equipment

4.1. DCS equipment monitoring

Facilities and components are the main parts of electrical equipment and their main functions are to transmit, receive, solve, transform, implement and output electrical energy or electrical signals. Electrical problems mainly occur in facilities and components, so electrical problems in testing facilities and components are the most important content. The types of electrical facilities and components in electrical equipment are complex, such as motors, controllers, contactors, relays, automation control systems, etc. and their structures, functions and performance are all different, so it is difficult for the staff To detect the hidden dangers through a certain method, the following is a classification analysis. The DCS system interference fault is eliminated. The electrical control facilities of electrical equipment are not from the same supplier, which is complicated and has a large workload, so it is difficult for the control facilities to connect with the DCS system; most electrical equipment has more electrical control facilities, especially The use of frequency converters will cause serious magnetic field disturbance, which will cause confusion in the instrument and DCS system. To prevent this from happening, electrical equipment must be isolated and shielded to prevent magnetic field induction and charging^[6]. The electrical equipment connect system is in the figure below.



Figure 5. Electrical equipment connect system.

4.2. Detection of signal failure

For electrical equipment, it is inevitable that there will be environmental impacts such as vibration, dust and high temperature during the production process and the signals at the production site are all generated by some contactors, relays, switches with different types of functions and measuring tools.

Failures can easily occur in such an environment. The first is to inquire about digital signal problems. The first step is to check the power supply and circuits to see if there are any problems. Based on the problem status and the fault information provided by the central control room, pay attention to whether the start-stop conditions and soft and hard chain conditions of the facility exist; the facility Whether there is a problem with the contact points of the components in the control cabinet, whether there is a problem with the logic control loop, whether there is a problem with the connection line; whether the control signal can be transmitted, whether the signal insurance is disconnected and the digital signal is based on the mastery of the facility control principle. The problem is easy to detect. The second is to query the analog signal problem. For incorrect signals, such as temperature, check the thermal resistance, whether the thermocouple is connected, its position, whether the wiring port is connected, rust, etc.; if it is a pressure or flow signal, check whether the circuit is unblocked and whether each valve is intact, etc. For response errors, problems and signals that are not reminded, check the power supply, connection ports and wires of the production site to see if there are any damages, check the facilities and check whether the set values are correct and everything is excessive. There are also the integrity of various sensors. Although the switch is also a common mechanical and electrical equipment failure, and it is relatively easy to find and eliminate the fault, but also because of this, it is often ignored in the actual maintenance and maintenance of mechanical and electrical equipment. After long-term use of switches, most of them are prone to problems such as damage, heat generation, and short-circuit burnout of contacts, and further cause serious mechanical and electrical equipment failures, such as the tripping of mechanical and electrical equipment, which has a serious impact on the normal operation of the industry. The staff must pay full attention to the switch problem, and check carefully during the daily maintenance and maintenance of mechanical and electrical equipment,

especially the contact connection position of the double-throw knife switch. Once it is found that the current passing through this position is too large, the contact continues to heat up. In case of failure, it is necessary to immediately investigate the cause of the failure and further determine whether it is necessary to replace the accessories. If the staff needs to replace the accessories but do not carry them, they can first connect the moving contact and the static contact to the cable as a short circuit, so as to reduce the impact on industrial output due to the long outage. The fault caused by the three-phase short circuit of loop cable will continue to expand the scope of the fault under certain conditions. Therefore, the staff must take emergency strategy in time when discovering the fault, so as to stop it in time. damage. Therefore, the three-phase short circuit of the loop cable is a relatively serious kind of common faults in all mechanical and electrical equipment. The staff can start with the following aspects when carrying out relevant emergency treatment. First, for the long maintenance period, the staff must first seriously consider the use technology and application standards of mechanical and electrical equipment, and then on the basis of in-depth analysis, the copper core cable that caused the three-phase short circuit of the loop cable can be removed. The replacement can completely solve the fault caused by the three-phase short circuit of the loop cable, but the entire replacement process takes a long time, and the equipment must stop working for a long time during the replacement. Second, for the short repair time, the staff can solve the related faults temporarily through handling. In the actual processing, first, the staff needs to use artificial gas welding to weld the lines, and then use the cable sheath to wrap the lines. This is to ensure the insulation of the cable and improve the heat resistance of the cable; secondly, make two The bracket with good insulation performance should be installed in the cable trench scientifically and reasonably, and then the three-phase wires should be laid on the two brackets. The laying method must be laid in parallel. The advantage of this is that it can

improve heat dissipation. It can also prevent many cables from being mixed up and causing short circuits.

4.3. Electrical facilities at the production site

The electrical facilities used in the production site are relatively complicated and the scope of installation is relatively wide. The analysis is mainly based on the motor. The types of external equipment of the motor are complicated and problems with these equipment will cause problems with the motor. For example, the load problem will cause the motor to fail to start, the running load is too large, heat, vibration and serious will cause the motor to burn. In electrical equipment, the amount of dust is very large and the point contact problem is a frequent problem, but it is also the most difficult problem to detect. For example, if the main contact is not in contact, such a problem will cause the motor to run out of phase and the temperature of the motor will be too high or burned; and the main contact will have been burned but still connected together. It will cause the motor to receive electrical energy even when it is turned off. When the machine is turned on, it will catch fire and other phenomena, which seriously threatens the lives of workers. If you want to reduce the occurrence of problems with electrical equipment, you should start with the formulation of a system. The corresponding steps can be divided into the following steps: First of all, it is impossible to have no rules, which reminds us that we should establish and improve related systems and make this system a guarantee for work. When establishing such a system, we must consider the specific conditions of the basic masses and listen to opinions from all sides. We cannot use the original system template to analyze the current situation. We must formulate a system that meets the standards based on actual conditions. Secondly, the electrical industry cannot be separated from the organization. It must always move closer to the country, based on the country's guarantee, absorb advanced science and technology, discard outdated ideas, carefully formulate and plan work, and improve the technical level. In the face of some waste of resources,

applicable laws and regulations should be found to stop them, so as to ensure the maximum effect of energy conservation and environmental protection. Let the whole work proceed smoothly. Finally, pay attention to the attitude and enthusiasm of the participants, and mobilize the enthusiasm of the majority of workers.

5. Conclusion

Mechanical equipment is often affected by various factors in the operation process. Therefore, once a failure occurs, it should be dealt with immediately. The relevant technical personnel also need to continuously improve their own technical level and sum up experience in the work, so that they can better deal with each. This kind of failure problem can be solved in time to reduce unnecessary economic losses for the enterprise. The research and development of mechanical and electrical equipment has played a very important role in our country. Therefore, relevant technical personnel must focus on troubleshooting to avoid affecting the normal operation of the equipment. Technicians should earnestly learn the knowledge of malfunctioning instruments and master the skills and methods of professional measuring instruments. In the actual operation of mechanical electrical equipment, the cause of the fault is complicated. To ensure that the fault is eliminated as soon as possible, the technician should use a variety of troubleshooting methods. For example, the location of the fault and the cause of the fault can be roughly determined through the empirical method and then the measurement method can be used to further Accurate positioning, troubleshooting mechanical and electrical equipment as soon as possible.

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