

Discussion on Fire and Explosion Prevention of Electrical Equipment

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Abstract: Electrical equipment fire and explosion-proof is to protect industrial production and daily life safety is an important task, in the context of the new era, the continuous development of science and technology, the types and number of electrical equipment is increasing, its fire and explosion-proof work is also facing new challenges. In this paper, on the basis of in-depth analysis of the causes of electrical equipment fire and explosion accidents, discusses the technical measures and management measures of electrical equipment fire and explosion prevention, in order to improve the safety of electrical equipment to provide reference.

Keywords: Electrical equipment; Fire protection; Explosion protection

Electrical equipment in various fields of application is more and more widely, its safety and reliability issues are also increasingly concerned about, electrical equipment, once a fire or explosion, not only will the equipment itself causes great losses, more likely to endanger the lives and property of people safety, and even the stability and development of the whole society has a serious impact, the need to continue to explore and innovate, to take more scientific and effective technical measures and management measures to ensure the safe operation of electrical equipment and the safety of people's lives and property. Need to explore and innovate, take more scientific and effective technical measures and management measures to ensure the safe operation of electrical equipment and the safety of people's lives and property.

1. Causes of fire and explosion in electrical equipment

1.1 Fire

Generally speaking, short-circuit is the most important cause of electrical equipment fire, electrical line short-circuit failure is easy to ignite the surrounding combustible materials, which in turn led to fire accidents, for example, in December 2007, Wenzhou, Zhejiang Province, 28-storey building due to short-circuit faults in the electrical line leading to fire, resulting in 21 deaths. The main cause of short-circuit failure is generally insulation damage (high voltage breakdown, corrosion, moisture, mechanical damage, high temperature, aging, etc. may occur insulation damage), must be actively risk aversion. In addition, overloading of electrical wiring equipment, poor contact, arcing and sparking are also causes of fires.

Electrical wiring equipment overload (flow through the current exceeds the safe value, so that the temperature rises abnormally), usually in the design stage or selection stage of the conductor cross-section of the design or selection of unreasonable, resulting in the actual load higher than the safety of the conductor itself; or the use of the process of the line access to the line is too much, the power of too large a device. Poor contact is relatively affected by the operation and installation of the link is relatively large, the installation quality is not high resulting in the instability of the articulation point, the joints are subjected to heat or vibration resulting in loose joints, copper and aluminium wires mixed connection and so on is more common. Arc and electric spark is usually regarded as a phenomenon of gas discharge, and many situations may bring about electric spark.

1.2 Blast

The causes of fires and explosions in electrical equipment can be attributed to the following aspects: Firstly, when combustible substances are fully and uniformly mixed with air or oxygen, their concentration rises to a specific range, i.e. the so-called explosion limit is reached, and within this concentration range, even a very small amount of ignition energy may trigger a violent explosion.

Secondly, if there is an open flame in the mixing environment and the energy level of the ignition source reaches the minimum ignition energy to ignite the mixture, then a fire or explosion occurs; even if there is no obvious ignition source, a fire or explosion may occur if there is a high temperature in the environment and the temperature reaches the spontaneous ignition point of the combustible substance. Preventing

the build-up of combustible materials, controlling sources of ignition and keeping ambient temperatures within safe limits are essential safety measures for the operation and maintenance of electrical equipment.

2. Importance of fire and explosion protection for electrical equipment

The importance of fire and explosion-proof electrical equipment is self-evident, first of all, fire and explosion-proof to protect personnel safety to the greatest extent possible, electrical equipment fire, explosion accidents may lead to casualties, fire prevention, explosion-proof measures to reduce the probability of accidents, to protect personnel safety; second, to protect the safety of property, electrical equipment is an important piece of equipment for the production of the enterprise is an important asset of the country, once the fire, Explosion accident, may lead to equipment damage, production line shutdown and other serious consequences, bringing huge economic losses to the enterprise, fire prevention, explosion-proof measures can reduce the occurrence of such accidents, to protect the safety of enterprise property; Finally, to maintain social stability, electrical equipment is widely used in various fields, once a fire, explosion accidents, may lead to social panic and instability, fire prevention and explosion-proof measures can reduce the probability of occurrence of the accident, to maintain social stability. The fire and explosion prevention measures can reduce the probability of accidents and maintain social stability.

3. Relevant studies on fire and explosion prevention of electrical equipment

3.1 Preventive strategies

3.1.1 Fire prevention

Fire hazard areas are categorised into the following areas according to the potential for fire accidents and their possible consequences. Refer to the table below (Table 1):

Table 1 Reference table for classification of fire hazardous areas of electrical equipment

District name	Standard
District 21	Flammable liquids with a flash point above ambient temperature, in quantities and configurations capable of causing a fire
District 22	Explosive or combustible dusts in suspension or accumulation which, although not capable of forming explosive mixtures, are nevertheless capable of causing fires in quantities and configurations.
District 23	Having a solid combustible substance in a quantity and configuration capable of causing a fire

On top of that, fire hazard prevention is enhanced in both the equipment and wiring dimensions.

3.1.1.1 Electrical equipment

Firstly, in environments where the risk of fire is high, it is important to ensure that electrical equipment that may generate sparks during normal operation and have a high surface temperature of the enclosure are kept at a safe distance from combustible materials to prevent potential fire hazards.

Secondly, the use of electric heaters is normally not recommended in fire hazardous environments. However, when production requirements do require the use of electric heaters, strict safety measures must be taken, specifically, they should be mounted on a base plate of non-flammable material to reduce the likelihood of a fire and ensure a safe production environment.

3.1.1.2 Electrical wiring

For one thing, it should be ensured that the design, selection and installation of electrical wiring are in accordance with national standards and safety codes, especially in fire hazard areas, where cables and insulation materials with flame retardant properties should be selected to reduce the likelihood of fire. In the more sensitive fire-hazardous environments of Zone 21 or Zone 23, it is advisable to use hard plastic pipe wiring; for electrical wiring along unplastered wooden ceilings, wooden walls and within wooden boring ceilings, it is recommended that steel pipes be used for open wiring in order to ensure their safety and stability.

Secondly, the electrical line should be regularly inspected and maintained, timely detection and treatment of line aging, damage, poor contact and other safety hazards, to ensure the stability and safety of the line. In addition, according to the working characteristics of electrical equipment and the use of the environment, a reasonable configuration of the line load, to prevent line overload caused by fire.

Thirdly, in fire hazard areas, necessary fire separation measures, such as fire walls and fire partitions, should be installed to isolate the source of fire and prevent the spread of fire. At the same time, appropriate fire-fighting equipment and devices should be provided so that the fire can be extinguished in time to reduce losses in the event of a fire.

3.1.2 Explosive Preparedness

3.1.2.1 Avoidance of explosive atmospheres

Combined with the table below (Table 2):

Table 2 Explosive gas environment hazardous area classification reference table

District name	Standard
District 0	Continuous (or prolonged) presence of explosive gas mixtures
District 1	Explosive gas mixtures may occur during normal operation
District 2	Explosive gas mixtures are unlikely to occur during normal operation or, if they do occur, they are transient.

At the process design stage, the formation of explosive gas mixtures (or the reduction of the time of accumulation of explosive gas mixtures) should be prevented by means of processes that eliminate and reduce the formation and concentration of flammable substances, depending on the zoning.

3.1.2.2 Based on the actual installation of additional explosion-proof electrical equipment

According to the detailed zoning of the explosion hazardous area, the characteristics of the electrical equipment and explosion-proof structure design needs, select the electrical equipment to match, the level and group must be at least with the highest level and group of explosive gas mixtures in the explosive gas environment to ensure that there is no danger; the existence of two or more kinds of flammable substances mixed with the formation of the explosive gas environment, should be based on the highest degree of risk of the level and group to select explosion-proof electrical equipment to ensure maximum safety.

First, explosion-proof equipment. It has an explosion-proof shell, can ignite the explosive mixture of components completely enclosed in a solid shell, not only can withstand the internal explosive mixture of explosive pressure, but also effectively prevent the explosion to the surrounding explosive mixture propagation. Such equipment in the installation, you need to confirm whether the nameplate on the equipment is clearly marked by the national inspection unit issued by the "explosion-proof certificate" number; to ensure that the equipment is fixed firmly, the shell is intact, no cracks, no obvious corrosion, all parts of the screws and washers should be complete, no loose phenomenon.

Secondly, safety-enhancing equipment. Under normal operating conditions, this type of equipment does not produce sparks or dangerous temperatures capable of igniting explosive mixtures, and its safety is enhanced by specific structural design to avoid ignition under normal and specified overload conditions.

Third, intrinsically safe equipment. Whether in normal operation or under standard experimental conditions, the sparks or thermal effects produced by such electrical equipment are not sufficient to ignite the explosive mixture, thus ensuring intrinsic safety.

3.1.2.3 Active maintenance of explosion-proof electrical equipment

As soon as any non-compliant equipment or wiring is found in the work area of the explosion-proof electrical equipment, it should be disconnected from the power supply and removed after the situation has been thoroughly ascertained in order to ensure the safety of the workplace. Work such as electrical measurements and voltage withstand in the workplace of explosion-proof electrical equipment must be strictly prohibited during the production process in order to avoid any safety risks that may be triggered.

3.1.2.4 Regular inspection and maintenance

Explosion-proof electrical equipment should be inspected and maintained on a regular basis to ensure its stable performance, safety and reliability. The inspection should include the appearance of the equipment, wiring, seals, explosion-proof signs, grounding, etc. Problems found should be dealt with immediately. At the same time, the equipment should be regularly cleaned and lubricated to maintain the good condition of the equipment.

3.1.2.5 Strict management of the use of electrical equipment

In the working area of explosion-proof electrical equipment, the use of electrical equipment should be strictly managed. Any non-explosion-proof electrical equipment is not allowed to enter the area, and for non-explosion-proof electrical equipment that must be used, strict safety measures should be taken, such as the use of explosion-proof isolation covers and the installation of explosion-proof switches. In addition, the training and management of operators of electrical equipment should be strengthened to improve their safety awareness and operating skills.

3.1.2.6 Strengthening emergency response measures

3.2 Regulations and standards

In addition to the technical level, the legal and regulatory level of electrical equipment fire and explosion prevention is also very important, usually, including the following aspects.

One of them is the strict implementation of relevant national regulations and standards, including but not limited to the Electrical Safety Regulations, the Code for Fire Protection Design of Electrical Equipment and other key documents, which provide clear guidance and requirements for fire and explosion prevention measures for electrical equipment, ensuring that all measures can meet the safety benchmarks set by the State, thereby protecting the lives and property of the people.

Second, the development of industry norms. In order to solve the problem of fire and explosion prevention of electrical equipment in a more refined manner, it is necessary to develop specific industry norms and standards for the specific conditions of different industries and fields. These industry norms or standards will be based on the characteristics and needs of their respective industries, to provide more targeted guidance on fire and explosion prevention, which will help to enhance the safety management level of the industry as a whole, to build a more comprehensive and efficient safety protection system.

4. Conclusion

In summary, the fire and explosion prevention of electrical equipment involves many aspects, from technical precautions to regulations and standards, all need to pay great attention. In practice, it is also necessary to continue to strengthen safety education and training, while establishing and improving the safety management system and emergency plans to ensure that in the event of a safety accident can be quickly and effectively disposed of, to provide a more comprehensive and effective protection of fire and explosion prevention of electrical equipment, to ensure the safe operation of electrical equipment, and to contribute to the stability and development of society.

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