

Construction Technology of Electrical Projects in Data Centers

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Abstract: With the continuous development of big data technology in China, large-scale enterprises and financial institutions have established data center computer rooms due to the need to process massive amounts of data. Due to the electrical system of this engineering project is relatively complex, the application of construction technology will directly affect the subsequent construction quality and the safety of the data center. Therefore, this paper studies the construction technology of data center electrical engineering projects. Based on a simple analysis of the design and construction content of data center electrical projects, it discusses the key points of preparatory work. At the same time, it analyzes the difficulties and key points in multiple aspects such as wire piping, distribution box installation, and lamp installation during the installation and construction process of data center electrical projects.

Keywords: Data center; Electrical project; Construction technology

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1. Introduction

At present, China's large enterprises and financial institutions, especially in the field with high requirements for information security and integrity, are facing the challenge of the continuous expansion of data scale. They need to store, develop and use these data efficiently, which puts forward higher requirements for the professional quality of employees. To this end, these enterprises and institutions have introduced advanced information technology equipment and established special data center computer rooms to realize the centralized collection, analysis, processing and storage of data. However, the internal electrical system structure of the data room is complex, which is closely related to lightning protection and grounding, power supply and distribution and other links. Only by ensuring the construction quality can we give full play to the potential value of the data center computer room and avoid data processing errors. This paper discusses the key points of construction technology for the electrical project of data room, in order to provide a reference for the relevant electrical installation work.

2. Analysis of construction content of data room electrical project

According to the actual situation of the data center computer room designed by large enterprises and institutions in China, the construction content of the electrical project mainly includes the following aspects:

- (1) Installation of power distribution equipment: Power distribution equipment is the core component of the electrical project of the data room, and its selection and installation directly affect the construction quality, progress and the operation safety and stability of the electrical system. At present, the power distribution equipment in the data room is mainly based on basic equipment such as distribution boxes and meters. During the construction process, the construction personnel shall strictly detect and control the parameters and performance of the equipment, scientifically select the equipment model according to the actual operation requirements of the electrical project in the machine room, and install it in strict accordance with the approved construction scheme ^[1];
- (2) Electrical circuit laying: Electrical line laying is an important part of the electrical engineering of the data room. The line connects multiple electrical equipment and power supplies, and its construction quality is directly related to the operation stability and safety of the entire electrical system. Therefore, the construction unit should attach great importance to the line laying work, comprehensively optimize the design scheme, reasonably plan the line direction, and check whether there is line collision according to the installation requirements and layout of electrical equipment, so as to ensure that the line laying can fully meet the equipment operation requirements;
- (3) Switch socket installation: As an indispensable part of the electrical system in the data room, the switch socket has a significant impact on the operation of electrical equipment and the stability of system functions. The construction unit shall reasonably adjust the position of the switch socket according to the equipment layout, and arrange professionals to be responsible for its maintenance and cleaning work, and ensure that the safety performance of the switch socket meets the requirements of relevant standards through the implementation of moisture-proof, sun protection and other measures ^[2];
- (4) Lightning protection and grounding: With the increasing number and scale of electrical equipment in the data center computer room, lightning and other external factors may cause safety accidents. Therefore, in the construction process of electrical projects, lightning protection and grounding work is particularly critical. The construction unit shall scientifically formulate lightning protection and grounding measures according to the local lightning activities, so as to effectively reduce the impact of lightning weather on electrical equipment and systems and ensure operation safety.

The optimization and implementation of the above construction contents can provide a solid guarantee for the stable operation of the electrical project in the data room.

3. Preliminary preparations for the construction of data room electrical project

The preliminary preparation for the construction of the electrical project in the data room has an important impact on the quality and progress of subsequent projects. Before the construction is officially started, the relevant units need to give priority to preparing the power of attorney for electrical design, so as to ensure that the construction unit has a comprehensive grasp of the specific steps of electrical equipment installation, and enable the construction unit to form a clear understanding of the construction method and process ^[3]. The power of attorney shall specify the technical category requirements for the installation of electrical equipment, scientifically mark the

equipment parameters and safety indicators in the construction process, and ensure that the electrical design work can achieve the expected goals. For the possible problems in the power of attorney, solutions shall be put forward in time to ensure that the quality of electrical engineering meets the requirements of the relevant standards.

After completing the preparation of the electrical power of attorney, it is necessary to carry out the review and determination of drawings. Relevant units shall comprehensively review the contents of construction drawings at the initial stage of design, adjust unreasonable parts according to the established design principles, and avoid adverse effects on the final design results. At the same time, the principle of “review drawings before design” shall be strictly followed. In the drawing design stage, the design unit and the construction unit needs to establish an efficient communication mechanism to plan the construction process of electrical projects from the perspective of macro-engineering construction. The composition structure of the electrical system in the data room is shown in **Figure 1**.

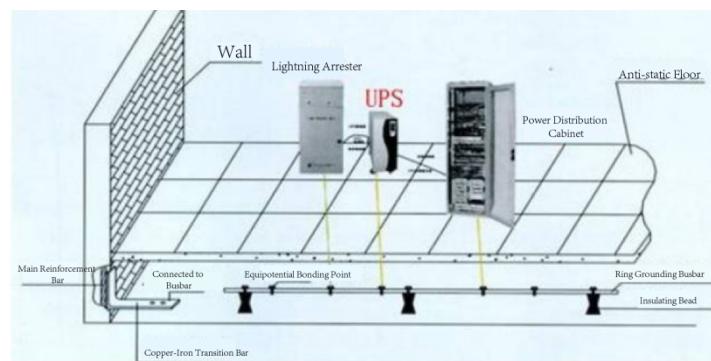


Figure 1. Composition analysis of electrical system in data room.

After the construction design is completed, the relevant units need to prepare the equipment and materials required for the project. The construction unit shall fully realize the importance of equipment model selection, and scientifically select construction materials in combination with the actual needs of electrical projects, so as to effectively control economic costs and reduce unnecessary losses. In the selection process, it is necessary to objectively evaluate the material quality and equipment performance, comprehensively review the qualification of suppliers, and give priority to the selection of high-quality equipment and materials, so as to further improve the construction quality and overall effect of electrical engineering. Through solid preparatory work, it can provide a solid guarantee for the smooth implementation of the data room electrical project.

4. Analysis on key points of construction technology of data room electrical project

4.1. Laying of wireways

During the construction of the electrical project in the data room, pipeline laying is a basic link. At the stage of electrical line laying, the construction unit shall give priority to the selection of thin pipes, such as black iron pipes or PVC pipes, and reasonably set transition boxes during the installation process to avoid wire stringing or damage. However, in practice, when the pipeline is connected with the metal pipe, the construction personnel often ignore the burr treatment of the metal pipe orifice, resulting in poor joint quality. In addition, the installation of steel pipe grounding device is unscientific, which may cause hidden dangers in the operation of electrical system. When the pipeline on the wall radiates, the pipeline distribution is uneven and chaotic, which may also affect the

civil engineering^[4]. Concurrently, after the wire pipe enters the wire box, it is not fastened or sleeved, which leads to the lack of standardization of construction behavior and affects the quality of pipeline laying.

In order to avoid the above problems, the construction unit should strictly abide by the design drawings and installation specifications, control the whole process, and eliminate the use of unqualified conduits. The construction personnel shall scientifically process the supporting pipeline and calculate the bending radius: the bending radius of the concealed pipeline shall exceed 6 times of the outer diameter of the pipeline, and that of the pipeline buried in concrete or underground shall exceed 10 times. If the inner diameter of galvanized pipe is less than 25 mm, manual elbow can be used. If it exceeds 32 mm, use hydraulic bends. In the pipeline laying process, it is also necessary to reasonably determine the pipeline specification, model and radiation method. In addition, in the actual construction, attention should be paid to the anti-corrosion treatment of the pipeline. For example, the pipeline in the humid environment should be painted with anti-rust paint to extend the service life. At the same time, the pipeline laying path should avoid being close to high-temperature equipment or inflammables to reduce potential risks. These measures can significantly improve the reliability and durability of pipeline laying and ensure the long-term stable operation of the electrical system.

4.2. Installation of distribution box

During the installation of the distribution box, common problems include excessive clearance between the box and the wall, incomplete cleaning of construction waste, unreasonable opening, and damage to the paint protective layer during welding. Moreover, the fuzzy grounding wire, insufficient conductor cross-sectional area, and wiring operations that do not meet the specifications may also lead to the problem of redundant wires. These problems not only affect the appearance, but also may cause safety accidents such as short circuits or leakages.

To solve these problems, the construction personnel must ensure that the civil construction and distribution box installation are coordinated. At the initial stage, it is necessary to clean the garbage inside the box. If the incoming line pipe cannot be directly connected to the box, it shall be transformed with perforation equipment and the opening specification shall be determined. In the grounding construction, it is necessary to strictly abide by the specifications and reasonably set the grounding point and conductor of the power distribution box to avoid direct operation at the bottom of the box. At the same time, insulation test and load test shall be carried out after installation to ensure that the box sealing and electrical performance meet the standards. The location of the distribution box is also very important. It should be placed in a well-ventilated and easy-to-maintain area to avoid humid or high temperature environment. Through standardized operation, the failure rate can be effectively reduced and the overall project quality can be improved.

4.3. Installation of lamps

During the installation of lamps and lanterns, common problems include unreasonable embedding of lamp position box, resulting in position deviation of large chandeliers. Improper handling of the pendant lamp hook and wiring device, resulting in an exposed conductor. The installation position of the ceiling lamp is too low and the fixing frame is unstable, which affects the service effect and service life of the lamp. These problems may lead to uneven lighting or potential safety hazards, such as lamp falling off.

Therefore, when embedding the hook in the concrete, it is necessary to weld the main reinforcement, and use the steel pipe as the jumping rod and down lead pipe of the lamp, so as to avoid the boom being too long, followed by threading the conductor into it. The construction personnel shall plan the perforation of the lamp port according

to the actual needs of the project to ensure that the wire is smoothly connected to the interior of the lamp. The installation height of metal halide lamp shall be controlled at about 5 meters, and an appropriate distance shall be kept from the connecting column and power line ^[5]. Furthermore, the lamp shall be equipped with current limiter and trigger. When the installation height of the lamp is less than 2.4 m, the shell shall be grounded for protection. After installation, light test and voltage withstand test shall be carried out to ensure uniform brightness and no flicker. At the same time, considering the energy-saving demand, LED lamps can be selected to reduce energy consumption and prolong service life. Through refined installation, efficient lighting and safety can be achieved.

4.4. Lightning protection setting

Lightning protection equipment is the key premise to ensure the safe and stable operation of the electrical project in the data room. However, designers often ignore the description of test points in the design of lightning protection devices. During the construction, the welding of lightning protection grounding plate and lightning protection network did not meet the specification, and the grounding resistance test point was not set, resulting in insufficient lightning protection performance. These defects may cause equipment damage or data loss in the thunderstorm season.

Therefore, the construction unit should recognize the importance of lightning protection devices and reasonably fix the lightning protection network. The grounding electrode of the arrester shall be welded with the foundation reinforcement and pile foundation reinforcement, and connected to the lightning protection network through the column reinforcement. At the same time, adjust the position of the test point and select galvanized flat iron material. If the lightning protection grounding electrode is the foundation reinforcement, it is necessary to set the internal and external main reinforcement and ensure that the lap joint is firmly welded. On top of that, the grounding resistance shall be measured regularly to ensure that the value is lower than the specification requirements. In lightning-prone areas, surge protective devices can be additionally installed to improve the lightning protection efficiency with a multi-layer protection system. Through scientific setting, it can effectively resist the risk of lightning strokes and protect the core equipment of the computer room.

4.5. Installation and connection of conductor

In the connection of sockets and switch terminals of the distribution box, some construction personnel have the situation that one terminal is connected to multiple wires. After the wire is combed, there are still wire ends left. The grounding wire is crossed and integrated with other lines, and the wiring layout is unreasonable. If the connection of multiple conductors is involved, appropriate materials shall be selected for crimping treatment, and different colors of conductors shall be selected according to the actual project, so as to distinguish the types. These problems may lead to poor contact or short circuit.

In order to optimize the connection, the construction personnel should use professional tools such as crimping pliers to ensure that the joint is fastened without looseness. Moreover, the length of conductor insulation stripping shall be controlled to avoid too long exposure. After connection, it shall be wrapped with insulating tape and subjected to tensile test. In the complex wiring environment, the wire slot or label system can be introduced to improve the convenience of maintenance. By standardizing the connection, the failure rate can be reduced and the efficient operation of the electrical system can be ensured.

5. Conclusion

The construction of data room electrical projects involves multiple interconnected technical stages. From preliminary preparation to on-site installation, strict quality control is essential to ensure system stability and operational safety. The analysis of construction content, preparatory work, and key technical points presented in this paper demonstrates that scientific planning and standardized execution are critical to project success. Looking ahead, the introduction of intelligent monitoring technologies can further enhance construction efficiency and management effectiveness. In parallel, relevant organizations should strengthen personnel training to improve professional competence. Ultimately, these measures will support the efficient operation of data rooms and promote the continued development of information infrastructure.

Disclosure statement

The author declares no conflict of interest.

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