

Application and Maintenance of UPS Power Supply in Transmitter Rooms: Postprint

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Abstract

Amidst the backdrop of ongoing social development in China, corresponding scientific and technological products continue to emerge. Their widespread adoption and application have enabled transmitter rooms to achieve optimal operating conditions. Among these, the deployment of UPS power supplies is particularly extensive and critical. Accordingly, this study focuses on this topic, examining the specific applications of such power systems in transmitter rooms and proposing fundamental measures for their effective maintenance, to serve as a reference.

Full Text

UPS Power Supply Application and Maintenance in Transmitter Rooms

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Abstract: Against the backdrop of continuous social development in China, scientific and technological products have emerged and become widely adopted, enabling transmitter rooms to achieve optimal operational states. Among these technologies, Uninterruptible Power Supply (UPS) systems have proven particularly crucial and widely deployed. This study focuses on the specific applications of UPS power supplies in transmitter rooms and outlines fundamental maintenance measures to ensure effective operation, providing a reference for industry practitioners.

Keywords: UPS power supply; transmitter room; application; maintenance measures

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Introduction

For transmission operations, instability in the power system can easily lead to issues such as leakage and power outages, which not only adversely affect normal operations but also increase maintenance costs, hindering industry development. With the advancement of technology in recent years, UPS equipment has been introduced to effectively mitigate power system instability. UPS systems ensure continuous operation even during power failures, preventing work disruptions. As UPS applications become increasingly widespread, it is essential to investigate and discuss their operation and maintenance.

1.1 Characteristics

As social development and construction progress in China, the requirements for transmitter room operations have become more stringent. Transmission work is particularly critical during equipment operation, directly affecting the stability of the power supply system within the room. When the power system operates under unstable conditions, it can cause surge interference and even lead to power outages and voltage fluctuations. These issues not only impact normal power supply to the room but also increase maintenance expenses for the power system department. Furthermore, transmitter rooms are subject to natural factors during operation, such as lightning, which can adversely affect the power system's performance.

The adoption of UPS technology can effectively address these challenges. UPS systems exhibit high reliability, providing effective battery backup when power outages occur in transmitter rooms, thereby delivering continuous power service to users and preventing operational disruptions. Additionally, UPS power supplies offer strong performance advantages and will become an important power source for future social development.

1.2 Working Principle

The working principle of UPS can be categorized into three main types: standby, line-interactive, and online configurations. Based on current industry development trends, online UPS is the most widely adopted. Its primary operating principle involves connecting the equipment to its corresponding power interface and a third channel. In this setup, one circuit path passes through a switch, connecting the power source and inverter to form an integrated unit, which then connects to a charger to complete the circuit.

During actual operation, the charger facilitates the conversion of AC power to DC power. This DC power then flows through the inverter, where it is converted back to AC power, simultaneously charging the battery pack [1]. During this conversion process, the online UPS utilizes its internal battery as the main power source, enabling seamless automatic switching between inverter states without requiring external power participation. Moreover, UPS equipment can provide uninterrupted power supply without any time gap. However, to effectively achieve this function during actual operation, it is essential to ensure that the battery has not been subjected to prolonged discharge and does not suffer from low voltage issues.

The second pathway switch of the online UPS connects to the bypass when overload occurs, affecting the entire circuit. Once conditions return to normal, the system automatically resumes its operational state. Additionally, the third pathway of the UPS circuit requires manual bypass operation. This pathway is not used in daily operations but is typically employed only during maintenance and servicing procedures.

2.1 EP3000 UPS

The EP3000 UPS is a high-performance, uninterruptible power supply with robust protective functions for electronic equipment. When power outages occur or current suddenly drops, the system can disconnect power to prevent adverse effects on electrical equipment. Additionally, the EP3000 UPS can mitigate voltage fluctuations caused by sudden voltage drops or surges by disconnecting the main circuit to block power and prevent system damage.

During operation, such UPS equipment primarily relies on internal batteries to provide continuous power supply to the entire system, ensuring uninterrupted operation. When external power is restored or the internal battery is fully discharged, the UPS equipment ceases operation [2]. The EP3000 UPS employs dual-conversion technology, which effectively eliminates grid interference during application. This equipment also demonstrates strong anti-interference capabilities and, under certain conditions, exhibits excellent direct-pass capability for power management, preventing circuit operation disruptions during power interruptions and ensuring safe power supply.

2.2 Related Power Systems

Network equipment rooms typically house multiple receiving devices, making them susceptible to power outages that adversely affect normal power supply operations. To prevent sudden power failures, it is necessary to add a backup power source to the existing equipment. For the external circuit, the room's distribution box should be connected, with one output path serving as the backup power source for the equipment system, while the other path functions as the main power source for connecting receiving devices [3].

Experimental work on UPS power supplies demonstrates that they can continue operating for approximately one hour after a power outage, providing fundamental assurance for stable equipment operation and preventing circuit accidents. This allows sufficient time for personnel to effectively handle faults when circuit anomalies occur, thereby avoiding impacts on power supply and ensuring effective power transmission.

2.3 Power Failure Alarm Settings

During normal circuit system operation, power outages can occur. When such incidents happen, they can often be attributed to components not working in unison, potentially causing adverse effects on power operations. Therefore, it is essential to promptly detect UPS equipment power issues during actual operations and continuously monitor UPS power failure conditions [4]. This necessitates the configuration of appropriate UPS alarms in the equipment room.

The power distribution system in equipment rooms typically includes components such as UPS, PDF, and PDU. The UPS provides uninterrupted power supply assurance, while equipped batteries ensure normal power supply during outages. Data center equipment room power monitoring typically employs monitoring software developed by UPS manufacturers, offering convenience and efficiency. By connecting a computer with monitoring software installed to the UPS via a serial port, communication of UPS status information is supported, and control of UPS operations can be achieved. The monitoring program can also display relevant UPS parameter information for user review [5].

During monitoring software operation, users can set system administrator passwords to ensure security and effectively prevent external attacks. Beyond basic daily monitoring functions, users can also perform battery maintenance through the monitoring software, such as scheduling automatic battery discharge routines. The equipment room intelligent system management center can read the monitoring software's log information, and the monitoring software can autonomously transmit relevant information to the management center.

3.1 Battery Power Supply Maintenance

Currently, batteries used in transmitter rooms are mostly sealed and maintenance-free, but this does not mean that battery maintenance can be neglected. To ensure battery lifespan and performance effectiveness, the following three maintenance measures should be implemented:

First, according to battery environmental requirements, ensure good ventilation in the work area while maintaining dryness and cleanliness to prevent short circuits or corrosion caused by excessive dust. For temperature control, it is best to maintain approximately 26°C and place batteries in shaded areas away from direct sunlight.

Second, to effectively enhance battery activity, regular battery discharge operations are necessary. When discharge ends, the circuit will recharge, which affects the battery's discharge characteristics.

Finally, during battery maintenance, mixing multiple batteries is strictly prohibited. Since internal resistance differs between old and new batteries, mixed usage negatively impacts storage functionality.

3.2 Host Unit Maintenance

In transmitter room UPS power supply equipment, the host unit has relatively high requirements for environmental conditions. Typically, the host should be placed in a front-and-rear ventilated environment without obstructions at ventilation points, while ensuring the environment remains dry and clean. To prevent dust accumulation, regular fan dust cleaning should be performed. During cleaning operations, appropriate tools should be selected—preferably soft brushes to avoid damaging host components. Additionally, vacuum cleaners can be used for dust removal.

To prevent host power supply startup issues, frequent switching on and off should be avoided. When shutting down the host, a specific sequence must be followed: first close the load to prevent live operation. To ensure proper power connection, operations should strictly follow the instruction manual to guarantee correct circuit sequencing.

Conclusion

Discussions on UPS power supply application and maintenance in transmitter rooms must begin with understanding UPS characteristics and working principles, analyze their practical applications in real-world working conditions, and ensure strengthened host management and effective battery power supply maintenance in future operations. This approach guarantees stable power system operation and ensures safe electricity usage for personnel.

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