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Analysis on the application of intelligent system for automatic spray maintenance and dust suppression of super high-rise core tube

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Abstract: *In recent years, with the rapid growth of China's social economy and the rapid development of the construction industry, the number of high-rise and super-high-rise buildings in cities has increased significantly, providing great convenience for people's lives. During the construction of super-high-rise buildings, a large amount of water resources are needed to maintain concrete, and the effective application of the intelligent system of automatic spray maintenance and dust reduction of super-high-rise core tube can not only effectively solve the problem that the outside maintenance of super-high-rise core tube shear wall is not in place, but also ensure the dust control effect on the construction site and realize the recycling of water resources. Based on this, the thesis will take automatic identification, mobile terminal control, rapid maintenance and dust reduction as the main ideas, and elaborate the dust reduction and maintenance automation of super-storey buildings in urban centers.*

Keywords: *Super high-rise, Automatic spraying, Intelligent maintenance, Recycling of water resources*

1. Introduction

In order to further alleviate the pressure of urban land resources, the scale of buildings in cities is gradually developing towards high-rise and super-high-rise. Therefore, in order to make full use of super-high-rise buildings, construction enterprises should ensure the construction quality and efficiency of super-high-rise buildings. As far as the development of domestic super-high-rise buildings is concerned, the continuous maintenance of the outer wall of the core tube without operating surface is an important measure to ensure the concrete strength to reach the standard. Most super-high-rise buildings are located in the city center, which requires relatively high environmental protection for building construction. In addition, some cities are short of water resources. Therefore, how to effectively save water resources while ensuring the concrete maintenance effect has become a major problem that all construction enterprises need to solve urgently.

2. Working principle of intelligent system for automatic spray maintenance and dust suppression of super-high core tube

Automatic spray curing system of super-high-rise core tube is mainly composed of fire water tank, high-pressure water pump, water pump control system, filter, soft connection of high-pressure oil pipe, electromagnetic valve, wireless remote control switch, atomizing nozzle, water pipe and pipe fittings [1]. Among them, the length of the spray main pipe is calculated according to the perimeter of the core tube of the tower, the required water flow is calculated according to the number of nozzles, and finally the flow of the water pump and the diameter of the water pipe are determined. The lift of the pump is determined according to the height of the tower, and the pressure resistance grade of the water pipe is subject to the actual demand of the construction site.

The dust-fall maintenance mode of super-high core tube automatic spray maintenance system is mainly divided into three stages, that is, collecting information from small weather stations to identify the flying dust height, mobile terminal control and on-site automatic spray maintenance system work. The intelligent control system will take the data of the weather station as the main basis to reflect whether spraying dust is used on the site, and then use PLC to control the frequency converter to control and adjust the start-stop frequency of the spraying pump, so as to ensure that the spraying flow rate and the dust amount on the construction site are consistent with the specified design standards. Before the system is officially started, the function of each equipment will be self-tested, which mainly includes:

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determining the working state of the transmitter, the accuracy and accuracy of analog acquisition, the indication and alarm of the test results of each equipment. After the self-test results are normal, if the PM value is higher than the set value, the PLC will control the frequency converter to start, and the pump will start running [2].

3. Application points of intelligent system for automatic spray maintenance and dust suppression of super-high-rise core tube

3.1. Select water source

First of all, the underground water source in the pit foundation precipitation should be used for the site construction water, and the rainwater and wastewater generated during the construction process should be collected to ensure that the water source can be used in the construction site after passing the tertiary precipitation test. Secondly, a fire water tank should be set up in the construction site to store qualified water sources. In the fire water tank, a float valve and an overflow pipe should be set to ensure that the water tank can be automatically filled when the water quantity is too small, and automatically discharged when the water quantity is too large, so that automatic control of water source storage can be realized without excessive manual intervention. Third, drainage ditches and tertiary sedimentation tanks should be set inside the construction site to ensure that the water resources in the construction site can be recycled, so as to meet the environmental protection requirements of the construction site and effectively save water resources.

3.2. Laying automatic spray straight pipe

When laying the automatic spray straight pipe, the main pipe [3] of the intelligent system for automatic spray maintenance and dust suppression of the super-high-rise core pipe should be set around the core pipe on the lower and third floors of the climbing frame lifting device. Among them, DN50 galvanized steel pipes should be used for dust suppression and connected by thread connection, while DN40PPR pipes should be used for maintenance and connected by hot melting. High-pressure oil pipe soft connection should be adopted at the corner of the main pipe, so as to ensure that the main pipe is disconnected when climbing the formwork and recovered after climbing. The branch pipe of the intelligent system for automatic spray maintenance and dust suppression of super-high-rise core tube shall adopt DN15 double-threaded galvanized pipe with a length of 200mm, and an atomizing nozzle shall be arranged every two meters, and the atomizing nozzle shall be connected with the galvanized steel pipe in the way of thread connection.

3.3. System work

In the actual operation process, the intelligent system for automatic spray maintenance and dust suppression of super-high core tube will analyze the dust information collected by small weather stations on the construction site. When it is found that the dust on the construction site exceeds the set index, it will take the initiative to turn on the full-automatic frequency conversion and speed regulation water supply equipment, and use the PLC control frequency converter to adjust and control the start and stop frequency of spray pump. Therefore, the relevant personnel of the project can complete the dust suppression work on the construction site only by remotely controlling the mobile terminal.

4. Characteristics of intelligent dust control system for super high-rise core tube automatic spray maintenance

4.1. Saving resources

Actually, the intelligent system of automatic spray maintenance and dust suppression of super-high-rise core tube can spray the water resources in a large range after atomization treatment, forming floating fog in the air, which not only can effectively absorb dust particles and impurities in the air, but also can make the ground more humid after spraying at high altitude for a period of time, significantly improving the air humidity of the construction site, thus effectively inhibiting the dust from rising again, and no need to use sprinklers to treat the ground of the construction site. Therefore, the application of this system can greatly reduce the manpower, material resources and water resources needed in dust control, further reduce the construction cost while ensuring the dust control effect, and provide a strong guarantee for the

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economic and environmental benefits of construction enterprises.

4.2. High economic practicability.

As the intelligent system of automatic spray maintenance and dust suppression of super-high-rise core tube can atomize the water resources in the dewatering well or fire pool before operation, compared with the previous spray dust suppression equipment (such as gun trucks and sprayers), this system can not only significantly reduce the water consumption of dust suppression and maintenance, but also greatly improve the utilization efficiency of water resources. As a result, after one investment, the construction enterprises don't have to invest too much in other costs, and the subsequent maintenance cost of the system is relatively low. Therefore,

4.3. No secondary pollution

When sprinklers are used for spraying, the problem of water accumulation is often caused by poor control of water quantity, thus causing secondary pollution to the construction site. However, the intelligent system of automatic sprinkler maintenance for super-high-rise core tube can carry out dust maintenance by spraying, and the atomized water will not gather, so secondary pollution will not occur in practical application.

4.4. Spray cooling

Due to the high summer temperature in most areas of China, the surface temperature of the construction site is as high as 40℃, so it is usually impossible to carry out the construction work normally at noon. However, by using the intelligent system of automatic spray maintenance and dust reduction of super-high-rise core tube, it can spray regularly every day, and implement "artificial rainfall" on the construction site, which will reduce the temperature of the construction site by 3℃-5℃, thus effectively improving the hot working environment of the construction site in summer and providing convenience for the construction workers to carry out high-temperature operations.

4.5. The maintenance area is comprehensive.

The intelligent system of automatic sprinkler maintenance for super-high-rise core tube can not only maintain the main structure of the building by spraying water mist during the whole construction period, but also the relevant personnel can adjust the water quantity of the sprinkler according to the actual demand of the construction site, so that the water resources can form "fog" or "rain" which can achieve the best maintenance effect, thus ensuring that the maintenance area covers the whole structure area, thus effectively improving the actual effect of dust maintenance.

4.6. High altitude fire control

The application of the intelligent system of automatic spray maintenance and dust suppression of super-high-rise core tube can increase the spray water volume by adjusting the spray device when a fire accident occurs in the construction site, and cover the construction site from high altitude in all directions to cooperate with the existing fire safety measures, thus playing a certain role in controlling the fire and effectively avoiding the spread of the fire.

5. Application effect of intelligent system for automatic spray maintenance and dust suppression of super-high core tube

The application of the intelligent system of automatic spray maintenance and dust suppression of super-high-rise core tube can choose to spray and spray the construction site in an intelligent, automatic or manual way according to the information obtained by the weather station, effectively solving the problem that the concrete maintenance of the outer wall of super-high-rise core tube is not in place and achieving a good dust suppression effect; In high-temperature weather, spraying can reduce the site temperature, improve the construction efficiency and further speed up the construction progress; When a fire accident occurs, the use of high-altitude spray can also play a good control effect on the fire, thus providing a strong guarantee for the safety of construction personnel.

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6. Conclusion

The thesis mainly expounds the intelligent system of automatic spray maintenance and dust reduction in the construction process of super-high-rise buildings, and puts forward a feasible method of automatic maintenance and spray dust reduction which is in line with the requirements of the construction site of super-high-rise buildings. It aims to provide corresponding experience for the maintenance of the outer side of super-high-rise core shear wall, hoping to be helpful to the development of super-high-rise buildings in China.

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