# Design of explosion-proof induction lamp temperature test system

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**Abstract:** Temperature test is an item to be tested in the type test of explosion-proof induction lamp. Temperature test is an item to be tested in the type test of explosion-proof induction lamp. A temperature test system based on single chip microcomputer integrated control and automatic trigger is proposed to improve the efficiency and stability of temperature test of explosion-proof induction lamp. Based on the analysis of the working principle of the explosion-proof induction lamp, the explosion-proof induction lamp temperature test system is designed, and the full-power trigger module of the explosion-proof induction lamp is designed in detail, so as to realize the automatic operation of the explosion-proof induction lamp temperature test.

**Keywords:** Explosion-proof, induction lamp; Temperature test; Trigger module.

## 1. Introduction

Temperature test is an important test item in the type test and research and development process of explosion-proof induction lamps.The national standard GB/T 3836.1-2021 "Explosive atmospheres-Part 1: General requirements for equipment" and the industrial standard MT/T 221-2005 "Explosion-proof lamps for coal mines" all put forward clear requirements for explosion-proof induction lamp temperature test.Explosion-proof induction lamp is an energy-saving and environment-friendly product, which can operate in full power and low power. At present, the temperature test of the explosion-proof induction lamp needs to be triggered by the light-emitting side of the lamp manually to ensure that the temperature test process is in the most unfavorable condition, and the temperature test takes several hours (usually more than 4 hours) to complete, which increases the workload of the tester, reduces the inspection efficiency and hinders the intelligent development of the inspection industry.Therefore, it is of great significance to study the temperature test technology of explosion-proof induction lamp and develop a test system that automatically triggers the operation state of explosion-proof induction lamp.

## 2. Explosion-proof induction lamp

Explosion-proof induction lamp is suitable for use in coal mines, underground alleyways, refuge rooms, power plantsBelt Way, various places, gas stations, gas filling station, chemical plants, underground pump rooms, underground parking lots and other places with methane, coal dust and other explosive mixtures of gases and harmful gases, as fixed lighting.Explosion-proof induction lamp will be radar microwave induction technology applied in the drive control to achieve explosion-proof induction lamp between low power and full power operation. According to the pedestrian and mobile equipment automatically intelligent switching, so as to achieve energy-saving and intelligent control of the explosion-proof sensor light.When a person or vehicle leaves the microwave induction range or stops moving in the range, the explosion-proof induction lamp switches to low power state after a delay, which can effectively play the role of energy saving and emission reduction. When someone or a vehicle moves within the induction range, the explosion-proof induction light switches to full power operation state and runs at rated power.Explosion-proof induction lamp has the characteristics of environmental protection, energy saving, intelligence, etc. at the same time, both good stability, significantly reduce maintenance costs, play a positive role in promoting the overall production of coal mines, energy saving and consumption reduction, and enhance its economic benefits.

Fig 1 Physical diagram of the explosion-proof induction luminaire

## 3. Temperature test system

The design of the explosion-proof induction lamp temperature test system is based on the modular idea. The explosion-proof induction lamp temperature test system mainly includes microcontroller module, display module, trigger module, warning module, environmental parameter monitoring module, temperature detection module, power supply module, the system structure sketch is shown in Figure 2.The microcontroller module is used to collect the system temperature and environment parameter information, and perform calculation and processing. The display module is used to display the system parameters, operation status and parameter settings. The trigger module is used to trigger the operation status of the explosion-proof induction lamp to ensure that the temperature test process is in full power operation. The warning module is used for system failure and test end warning. The environmental parameter monitoring module is used to monitor the temperature, humidity, pressure and wind speed of the environment. Temperature detection module is used to collect temperature data of explosion-proof induction lamps and lanterns. The power supply module is used to supply power to the test system and the explosion-proof induction lamp.

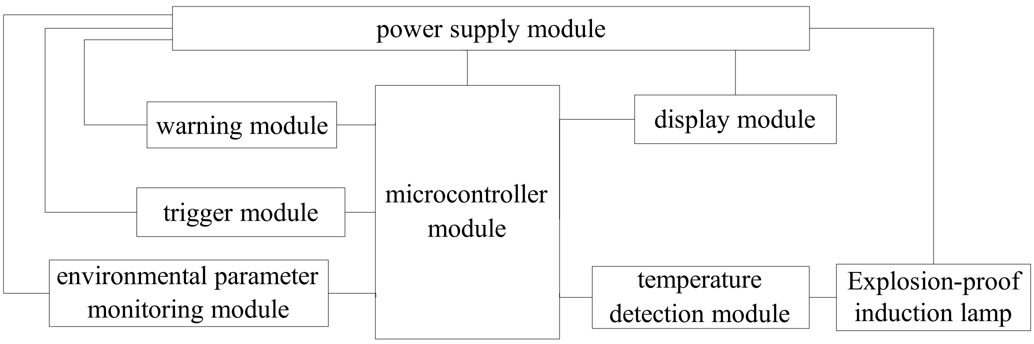


Fig 2 Structure diagram of explosion-proof induction lamp temperature test system

National and industrial standards require that the explosion-proof induction lamp temperature test should be conducted under the most unfavorable conditions. Usually, the temperature test of explosion-proof induction lamp is carried out at room temperature, and the collected data needs to be converted into the test data under the most unfavorable conditions.

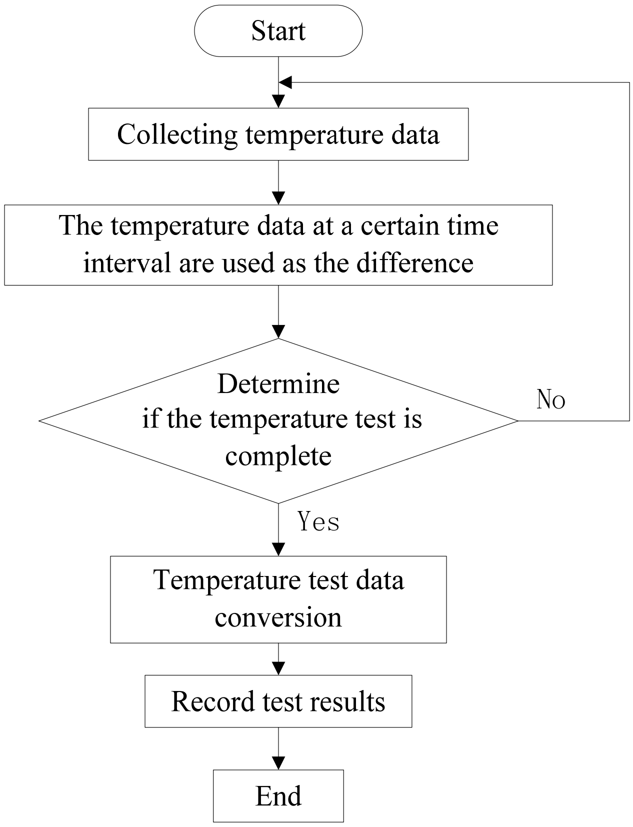


Fig3 Temperature test flow of explosion-proof induction lamp

## 4. Explosion-proof induction lamps are triggered by full power

Explosion-proof induction lamps are energy-saving special explosion-proof lamps, which work in two power consumption sections. Before induction, they are in low-power and energy-saving operation, and after induction, they are in full-power operation. Under the most unfavorable conditions, the temperature test should be carried out at the stage of maximum power. Therefore, it is necessary to trigger the induction function of explosion-proof induction lamps in real time, and calculate the power of explosion-proof induction lamps according to the voltage and current to ensure that the explosion-proof induction lamps run in the most unfavorable conditions. The explosion-proof induction lamps are triggered by wireless driving mode, and PIC single chip microcomputer system controls the movement of the mobile module through the touch screen to ensure that the explosion-proof induction lamps are in full power operation. Under the low power operation state of the explosion-proof induction lamp, the PIC single-chip microcomputer system controls the moving module to move from the far side along the straight line L in the tangent direction with the explosion-proof induction lamp as the center (The moving module is too close to the explosion-proof induction lamp to affect the temperature test results, and the moving module is too far away from the explosion-proof induction lamp to ensure that the explosion-proof induction lamp is always in full power operation. In comprehensive consideration of the impact on the explosion-proof induction lamp temperature test results and to ensure that the explosion-proof induction lamp is always in full power operation conditions, the vertical distance from L to the explosion-proof induction lamp is 2m), When the explosion-proof induction lamp moves to point A and switches from low power consumption to full power operation, point A is the sensing point of the explosion-proof induction lamp. Method also find the other explosion-proof induction lamp induction point D.. Mark the running track points b and c of the mobile module on the straight line l, where BO=0.6AO and CO=0.6DO, then b and c are the two end points of the running track of the mobile module, and the mobile module moves back and forth at the two points B and C .

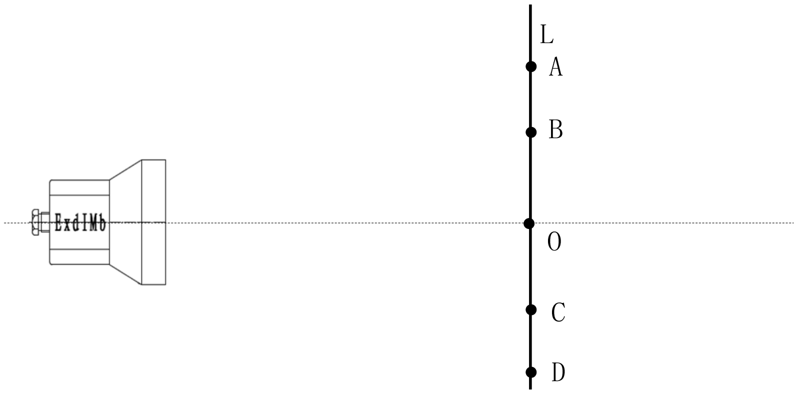


Fig4 Schematic diagram of movement track of mobile module

In order to ensure that the temperature test process of explosion-proof inductive lamps is always under the most unfavorable conditions, the PIC single-chip microcomputer system needs to collect the voltage and current signals during full power operation and temperature test, calculate the maximum power and operating power of explosion-proof inductive lamps, and then judge whether the explosion-proof inductive lamps operate under the most unfavorable conditions. The judgment methods are as follows:

(1)PIC single chip microcomputer system collects the voltage and current signals of explosion-proof induction lamps and lanterns when they are running at full power, and carries out operation processing to obtain the full power of explosion-proof induction lamps and lanterns (taking the average value from multiple measurements, and measuring five times in general). The calculation method is as follows:

$$P_{\max}=U_{\max}\times I_{\max} \tag{2}$$

Among them, $P_{\max}$ is the full power of explosion-proof induction lamps, and the unit is Watt (W); $U_{\max}$ is the voltage of explosion-proof induction lamps in full power operation, and the unit is volts (V); $I_{\max}$ is the current of explosion-proof induction lamp when it is running at full power, and the unit is ampere (A).

(2) PIC single chip microcomputer system collects the voltage and current data in the most unfavorable condition temperature test process of explosion-proof induction lamps in real time, performs calculation and processing, and obtains the operating power of explosion-proof induction lamps. The calculation method is as follows:

$$P=U\times I \tag{3}$$

Among them, $P$ is the operating power of explosion-proof induction lamps, and the unit is Watt (W); $U$ is the operating voltage of explosion-proof induction lamps, and the unit is volts (V); $I$ is the operating current of explosion-proof induction lamps, and the unit is ampere (A).

(3)PIC single chip microcomputer system calculates the difference between the full power $P_{\max}$ of explosion-proof induction lamps and the running power $P$ of explosion-proof induction lamps. The calculation process is as follows:

$$\Delta P=P_{\max}-P \tag{4}$$

Among them, $\Delta P$ is the difference between the full power of the explosion-proof induction lamp $P_{\max}$ and the operating power of the explosion-proof induction lamp $P$, and the unit is watt (W);

If $\Delta P$ is less than or equal to zero, it is considered that the explosion-proof induction lamp does not operate at full power, and the temperature test under the most unfavorable conditions of the explosion-proof induction lamp is stopped; If $\Delta P$ is greater than zero, it is considered that the explosion-proof induction lamp operates at full power, and the temperature test under the most unfavorable conditions of the explosion-proof induction lamp continues.

## 5. Conclusion

Explosion-proof induction lamp is an energy-saving and environment-friendly product, which has a wide application space in coal mines, petrochemicals and other places.Explosion-proof induction lamp temperature test system has the advantages of simple structure, high stability and good security, realizing automatic testing of explosion-proof induction lamps and providing parameters for intelligent inspection technology of explosion-proof induction lamps.

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