The optimized design of air heat metering in the fan coil performance test system

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Abstract—With the improvement of the level of economic development and the quality of people's living standards, people's requirements for air quality also increase. The demand for air-conditioning equipment to regulate indoor air quality is also increasing year by year. The resulting high energy consumption and energy waste problems cannot be ignored. All we can do is optimize the equipment on an existing basis to minimize energy consumption. In this paper, the automatic humidification device of the wet bulb thermometer is designed to optimize the thermal performance test system of the fan coil unit, improve the quality of the fan coil, and ultimately achieve the goal of reducing energy consumption.

1. Introduction

With the development of economy, people's comfort requirements for indoor air are getting higher and higher. The improvement of indoor air comfort is achieved through air conditioning. With the large increase of air conditioning demand, energy saving and emission reduction has become an urgent and important issue.

Fan coil is one of the end devices of air conditioning, and is widely used, fan coil thermal performance testing is extremely important, not only for the production of fan coil set a certain threshold, but also in response to the call of national energy conservation and emission reduction.

2. Fan coil unit thermal performance test system design

Now, most fan coil units on the market have insufficient air volume[1], air volume and cooling amount does not match, unit leakage exceeds the standard[2], unit leakage and cooling section after water, comparing the machinery industry departments to give the fan coil heater performance detection method, and finally selected room air enthalpy difference method[3].

The size of the laboratory is 3.7×3.7×3.9m, and the four walls of the laboratory are assembled from steel plates filled with polyurethane material between double-layered steel plates. Air treatment unit air delivery mode for the up and down, air treatment unit by the fan, table cooler, electric heater, humidifier and so on. The wind road system is designed to find the volume of air and the value of air, and the air measurement device meets the test requirements of different air volumes from 340 to 2380 m³/h. The waterway system is used to measure water flow and water temperature to obtain the cooling of a water system. The water cooling system is composed of hot water system, cold water system condensing unit cooling method is water cooling, the volume of the hot water system is about 0.8 m³, the hot water tank is equipped with an electric heater that can regulate heat, the power of the electric heater is 16 kW. Water refrigeration system is mainly composed of refrigeration unit, heater, water circulation pump, water tank evaporator, water supply tank and so on. Air refrigeration system is mainly composed of air heaters, circulating fan, cooling insulation pipe, refrigeration units. The control system is mainly automatic...
control element and automatic electrical control element.[4]

The software measurement and control system uses Visual Basic 6.0 to display the operating status of the device in real time, showing a variety of curves that can determine the stability of the operating conditions.

3. An optimized design for air heat metering

In view of the problem that the balance error of the thermal performance detection system of the fan coil unit exceeds the balance error stipulated in the standard, the optimization scheme design is carried out, and this paper mainly designs the automatic humidification device of the wet bulb thermometer.

The air crucible value is obtained by measuring the temperature of the dry and wet bulb of the air, so the measurement accuracy of the wet bulb is very important, and the main factors affecting the measurement accuracy are the sampling wind speed and the moisture content of the wet gauze. In order to make the measured wet bulb temperature relatively accurate surrounding wind speed is 5 to 7 m/s, and in this wind speed, speed up the evaporation of moisture in wet gauze, wet gauze moisture content is reduced, will directly reduce the accuracy of the measurement. Based on the microcontroller design automatic humidification device, on the one hand to ensure the moisture content of wet gauze, on the other hand to solve the problem of frequent watering and the inconvenience of the test.

The automatic humidification device of wet and dry ball designed in this paper is based on the CONTROL core of AT89S51 microcontroller, and the air humidity signal is transmitted to the A/D converter by the digital humidity sensor HTG3535CH. The analog-to-digital converter converts the humidity analog into discrete information digital quantity to the microcontroller, and displays the air humidity value with LCD1602 through the microcontroller I/O port. The humidity sensor compares the detected humidity value with the humidity range value set by the system, and if the value compared is lower than the lower limit of the set range, the relay then controls the micro-pump to supply water to the wet gauze. When the transmitted signal value is higher than the upper limit, the microcontroller transmits a control signal and stops the water supply through the relay control pump.

The STC89C52 microcontroller is selected for the single-chip crystal circuit, which connects the timer on the pins of the oscillator's input, output XTAL1 and XTAL2. The reset circuit can restore the circuit to its original state, and the reset circuit diagram designed in this paper shows fig.1.[5]

![Fig.1 Crystal circuit diagram](image)

The reset circuit can restore the circuit to its original state, and the reset circuit diagram designed in this paper shows fig.2.
Relays, also known as electric tongs, can not only play the role of automatic circuit regulation, but also play a role in the protection of circuit equipment, conversion circuits and so on. Fig. 3 is the relay circuit diagram.

The relay module designed in this paper has isolation grooves in the control area and the load area, which conforms to international safety standards. This module is a two-sided FR-4 circuit board design, the selection is the pine music genuine relay. When there is a low-level signal at the signal input, the guide is usually at the beginning and the common end, and the equipment and load are directly controlled by the relay. The module size is 43mm × 17mm × 18.5mm and has a net weight of 15g.

The transmitter used in this paper is a current-type transmitter, which has the characteristics of not being easily disturbed, but needs an external power supply to power it. The circuit diagram of the transmitter is shown in Fig. 4 below.
Humidity sensor is selected digital humidity sensor HTG3535CH, humidity control range of 0-100%. This sensor has a wide range of humidity monitoring and is responsive. The same gauze-wrapped humidity sensor wrapped at the bottom of the wet bulb thermometer is selected and placed in a water tank. The water level in the water box of the humidity sensor and in the water tank is consistent with the wet bulb thermometer.

The system is programmed in C language, through a full analysis of circuit principles and their functions, the written program will be burned to the 51 microcontroller, and then the hardware and software debugging, until it conforms to the system functions. Fig.5 is a schematic of the minimum system part of a microcontroller.
According to the above design basis, the design of the automatic humidification device, physical as shown in Fig.6.

4. Conclusion
The measurement accuracy of the radon value in the experiment is directly affected by the measurement accuracy of the wet and dry bulb thermometer\(^6\). In this paper, based on the 51 microcontroller, the automatic humidification device of wet bulb thermometer is designed for the purpose of improving the
accuracy of wet bulb temperature measurement. When the humidity sensor transmits a humidity signal below 80%, the pump starts and the wet bulb thermometer is automatically humidified until the sensor transmits a signal of 99%. The design of the automatic humidification device of the wet bulb thermometer improves the measurement accuracy of the wet bulb temperature on the one hand, on the other hand, reduces the trouble of frequent water addition in order to overcome the problem of water evaporation in the past, so as to optimize the thermal performance test system of the fan coil unit.

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