

## **Realization of substation equipment condensation control method based on temperature and humidity control**

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Based on the substation temperature and humidity data monitoring, substation equipment to achieve condensing surface generates conduct real-time monitoring of substation equipment and thus control the generation of condensation surface. The substation of the dew real-time monitoring data acquisition device can detect 10kV, 35kV switch condensation condense case room ambient temperature, humidity and switch mechanism box, Control cabinets and other enclosed spaces. Surface dew equipment monitors the situation and signal processing, from data acquisition comparison, thereby controlling the exhaust system and heating tidal flooding means, avoiding prolonged open the exhaust system to increase the indoor temperature difference and humidity. It results in deterioration of the indoor environment, heating system into tidal flooding for a long time caused by energy waste.

*Keywords:* Dew; Signal Acquisition; Sensor; Online Monitoring.

### **1. Introduction**

Human energy consumption has gradually increased greenhouse gas concentrations in the atmosphere and is considered the main source of global warming. Hebei Zhangjiakou Bashang area is high altitude alpine region, average altitude are 1486 meters, average annual temperature is 1 °C~ 2 °C, Frost-free period 90 to 120 days, Annual rainfall is around 40mm, The average wind speed is 6.3 m/s, the Coldest temperature is -47 °C. In winter, due to the great temperature difference between inside and outside on Bashang area, so Caused 10kV, 35kV switch room, outdoor switch mechanism cabinet prone to dew phenomenon[1-3].

Dew can be understood literally as follows: Condensation of dew, So the dew is also known as the condensation. dew's conditions occurs depends on: When the water vapor in the air to reach saturation, A phenomenon at a relatively low temperature of the object condensed. For dew's phenomena in terms of electrical cabinets, It refers to the cabinet inner wall surface

temperature drops below the dew point temperature, Drops of water will condense inside wall surface, this phenomenon is called dew[4-5].

Dew is the dewdrop; After High temperature moisture faced with Cold air and then In the surface condenses into water. The most common is the water droplets window glass in fall and winter seasons. When absolute humidity achieved Saturated the water vapor content, Air temperature under the dew point temperature will condense. Insulation of electrical equipment in power system will Condense dew when environment and temperature have large changes, It will greatly reduce the insulation of this device, Cause the device in surface discharge ( Creep age Distance is reduced).Damage a short circuit fault Insulation of electrical equipment in power system. In electrical cabinets, insulation material, etc. occurs dew condensation phenomenon, It will reduce the cabinet and insulation material's insulation class, and occur creep age distance, flashover and other accidents easily. Dew phenomenon's happening, So that in May 2014 Chabei 220kV transformer substation No.2 main transformer 35kV302 bus line counters phase short circuit and discharge, Due to housing design is unreasonable, Rainwater from the wall bushing 302 into the line counters, Inside the cabinet produces water vapor, which caused Phase short circuit and discharge, and burn down the bus insulation sheathing serious, and then caused transformer tripping. Serious or even happen an equipment explosion, and caused damage to the substation equipment. Such accidents have occurred at Bashang area, How to do "Dew" Control, so It's our top priority at this stage. The development of the substation dew indoor monitoring data acquisition device, which is in order to effectively address this phenomenon.

Ambient temperature, relative humidity and dew temperature curve diagram Under certain temperature conditions, the higher the relative humidity in the air, the temperature of the dew in the ambient air is more closer, that is, the dew point of the temperature approaching the ambient temperature, dew occur more easily than usual. The air temperature is not the main factor in the formation of condensation the dew point temperature is always lower than the ambient temperature. For example: air temperature 20 degrees, the relative humidity in the range of 60%, then the condensation temperature is 12 degrees.

From the principle of Dew occurs in Figure 1, we can conclude: To prevent the occurrence of condensation, the surface temperature must be allowed to happen dew's sites is always higher than its surrounding ambient dew. In the circuit breaker device as an example, in order to prevent the occurrence of dew inside the switchgear, just keep the temperature inside the switch cabinet is always higher than the external ambient temperature.

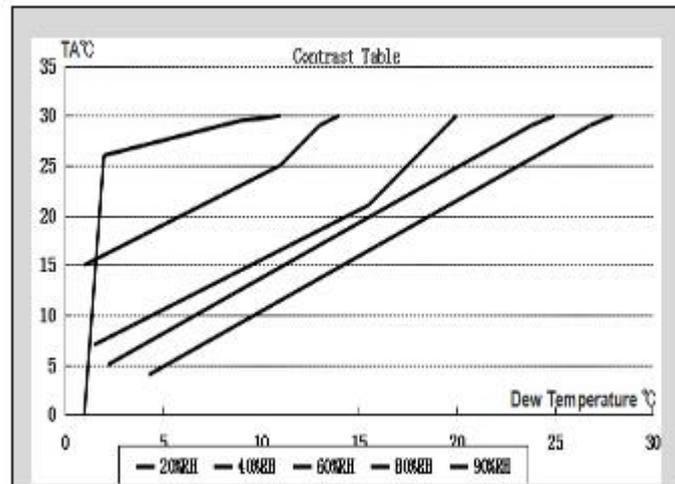


Fig. 1 Curve can learn

## 2. Theory

In substation dew's monitoring data acquisition device can detect substation 10kV, 35kV switch's temperature, humidity and dew condensation indoor conditions, And inside switch gear equipment surface dew will monitor and signal processing, through the data acquisition comparison, and then control the switch outside the chamber exhaust system and heating tidal flooding device, avoid prolonged open the exhaust system and to increase the indoor temperature difference and humidity, The results caused by the deterioration of indoor environment, tidal flooding heating system to work long hours cause energy waste. At the same time, there is a waste which no effective human resources to be used on the equipment on overhaul. Under is a schematic diagram of substation monitoring data acquisition device indoor dew principle[6].

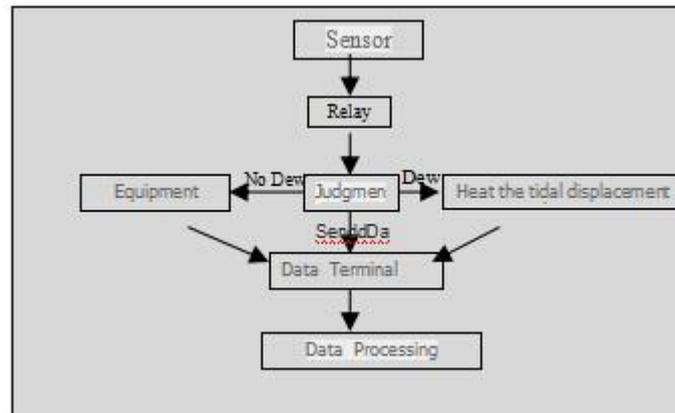


Fig. 2 Dew Indoor Substation Monitoring Data Acquisition Device Principle

The device can detect the dew's indoor moisture situations. When the device occurs dew condensation, Signals through sensors, spread relays and determine the phenomenon, choice the next step: If dew phenomenon happened, then the relay work, it makes heating tidal flooding device and exhaust system work, and sends a signal to the data terminal signal recording; If the environment and the equipment running in good condition, the relay sends a signal to the data terminal, Recording signal data comparison. Related data were processed to the data terminal, record equipment normal .state and fault state, , draw curve of running state in the equipment running real-time monitoring.

### 3. Data Acquisition Device Profile

Working principle is: By adjusting the variable resistor dew sensor sensitivity, The condensation sensor control unit according control unit to the set in real-time or time intervals condensation is detected, If it detects the presence of condensation, the diode emitting light. And then optical coupler use light which diode emits into an electrical signal, And electrical signals sent to the double voltage comparator to compare, After that comparing the output signal to the master unit, the master unit based on the received signal of the presence dew, the output control unit to the drive, the drive unit driving heating means and excepting tidal means ,except heating and tide in switch room.

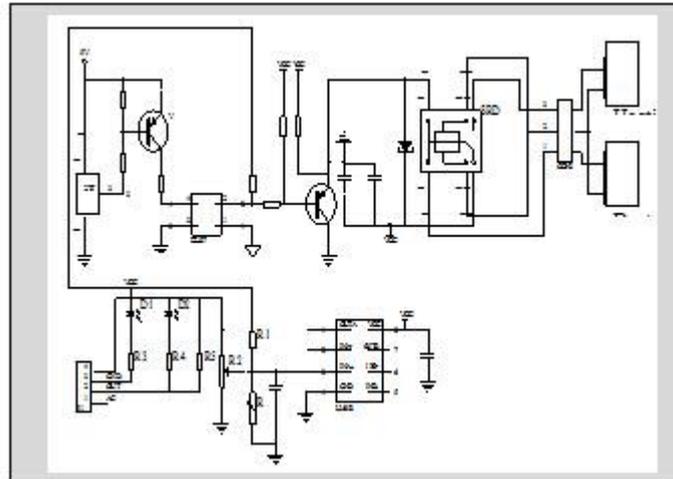


Fig. 3 Dew Substation Indoor Monitoring Data Acquisition Device Wiring Diagram

The device comprises a main control unit as the control center. The main control unit is connected to the main control room of the control unit. Data acquisition unit for detecting indoor dew substation switch, the signal output of the data acquisition unit connected to the master unit acquisition signal input terminal; For the switching mechanism box and switch room to remove indoor condensation execution unit, the execution unit of the signal input terminal connected to the master unit by the drive unit. Acquisition device can be detected substation indoor switch's dew in a timely manner, and it can be carried out in time. Prevent dew caused by equipment Power phase discharge, and to ensure the normal operation of the substation equipment.

#### 4. Summary

In the daily repair and maintenance process, We usually combine weather forecasts, switch maintenance service life, failure rate, etc., development of maintenance plan, We just in accordance with established standards developed mechanical equipment repair and maintenance work, Running status, operating environment and other factors in the equipment which are not taken into account, This makes the maintenance of equipment running costs increased significantly. For example, equipment runs in a good environment, in perfect condition, at the same time the device doesn't require maintenance; on the contrary, equipment is in harsh environments, it's insulation aging rapidly, Although its life less than overhaul but the device has been need to be repaired.

Bashang area with four distinct seasons, the weather changes quickly, if the time of making plan does not refer to the weather, it might make difficulties to maintenance work. Meanwhile, if the indoor leak water, and other uncertainties, it will greatly increase the difficulty of repair, even for the accident lay hidden. Dew monitor is based on the means of monitoring on the existing substation, it's an important adjunct to the substation equipment operating of environment, temperature, humidity and other technical indicators, By monitoring substation equipment environment, we can judged substation equipment life, the degree of insulation cracking, and provide the basis for the daily maintenance of substation equipment maintenance. Thus, the condensation detection is necessary to promote the used, it isn't limited to Zhangjiakou Bashang alpine region, as an important adjunct to monitor, dew condensation control is playing a very important role. In the future path of development of power industry, dew control will play an important and irreplaceable role.

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