



Talking about the Meteorological wind Direction and Speed of the high Plateau Airport Equipment Anti-icing Precautions

Shunde Yan*, Xingping Xue, Haipeng Wang

Delingha Airport Branch, Qinghai Airport Co., Ltd., West Airport Group, Delingha, Qinghai, China.

How to cite this paper: Shunde Yan, Xingping Xue, Haipeng Wang. (2023) Talking about the Meteorological wind Direction and Speed of the high Plateau Airport Equipment Anti-icing Precautions. *Engineering Advances*, 3(4), 359-362. DOI: 10.26855/ea.2023.08.016

Received: July 15, 2023

Accepted: August 12, 2023

Published: September 8, 2023

***Corresponding author:** Shunde Yan, Delingha Airport Branch, Qinghai Airport Co., Ltd., West Airport Group, Delingha, Qinghai, China.

Abstract

Qinghai is located in the Qinghai-Tibet Plateau. Winter is cold and snowy. The average temperature in winter is minus 8°C, and the lowest temperature can reach minus 30°C. The most snowfall days reach more than 40 days, the least can reach more than 20 days; Meteorological requirements have accurate measurement of wind direction and wind speed sensor equipment, and winter low temperature snow, precipitation caused by wind speed sensor equipment ice or snow, resulting in wind direction and wind speed sensor can not work normally, directly resulting in wind direction and wind speed parameters may be abnormal, often snowfall or other weather phenomena, easy to lead to runway surface pollution. According to the requirements of the Air Traffic Management Rules of Civil Aviation, in the case of runway pollution (snow, water, frost, ice, wet), it is not allowed to take off and land downwind, and when the controller refers to the wrong meteorological wind direction and speed, the aircraft is prone to deviate from the runway and unsafe incidents occur.

Keywords

Wind direction and speed sensors, runway surface pollution, aircraft aerial attitude, weather forecast and warning protective covers, application of antifreeze oil or antifreeze

1. Current situation and existing risks of existing meteorological wind direction and speed equipment

Meteorological wind direction and speed are important reference data for aircraft taking off and landing at the airport. The controller decides to use the runway according to the meteorological wind direction and speed, and the captain adjusts the attitude of the aircraft according to the wind direction and speed. However, in actual operation, when the winter temperature is lower than 0 degrees, snow and rain, ice phenomenon often occurs in the wind direction and wind speed sensor, resulting in the wind direction and wind speed sensor can not work normally, directly resulting in abnormal wind direction and wind speed parameters. Many weather stations are equipped with meteorological wind direction and speed sensors WAW151 and WAV151, do not have heating function, because the height of the wind pole is 10 meters, can not effectively carry out snow and ice work [1].

When snowfall or rainfall occurs, it usually leads to runway surface pollution. According to the requirements of the Civil Aviation Air Traffic Management Rules, it is not allowed to take off and land downwind when the runway is polluted (snow, water, frost, ice, wet). If the controller refers to the wrong weather direction and wind speed, it may lead to unsafe incidents.

2. The working principle of meteorological wind direction and speed sensor and icing prevention

At present, most of us use single-wing wind direction sensors and wind cup wind speed sensors; The single-wing wind direction sensor uses a wind vane component with low inertia as the sensing component. The wind vane component rotates with the wind, drives the wind direction code plate at the lower end of the rotating shaft, and outputs the signal after a certain conversion. When the wind beacon rotates, the gray code disk (usually 7 bits, resolution of 2.8°) is driven, according to the design of the code disk slot, every 2.8° of the code disk, the photocell group will produce a new 7-bit parallel gray code output [2]. The wind speed sensor uses a three-cup sensor, and the wind cup is made of carbon fiber reinforced plastic. When the wind cup rotates, it drives the coaxial multi-tooth cut disc to rotate; so that the following photosensitive triode sometimes receives the light emitted by the above LED and conducts, and sometimes receives the light irradiated by the above LED and cuts off. In this way, the pulse signal proportional to the speed of the wind cup can be obtained, and the pulse signal is counted by the counter, and the actual wind speed value can be obtained after conversion. At the same time, when the wind cup rotates, the coaxial magnetic rod is driven to rotate, and the pulse signal proportional to the wind speed is induced in the Hall integrated circuit, and the actual wind speed is output after the counter processing. Due to its structural characteristics, when the temperature is low, there is rain and snow, the wind direction and wind speed sensor are easy to freeze. This requires the observer to always pay attention to the operating status of the sensor and whether the wind data is normal when on duty. If the wind cup (wind vane) is found to rotate slowly or stop running, it is immediately combined with the weather reality at the time, backup station data or a portable wind direction and anemometer to determine whether the wind sensor is frozen [3].

Usually, if the weather direction and wind speed sensor is frozen, it is necessary to remove the ice immediately on the wind pole. (1) The wind sensor is installed on the top of the wind pole, the height of the ground is not less than 10 meters, at this time the wind pole is cold and slippery, the observer must pay attention to personal safety when operating the wind pole, wear gloves, and take safety protection measures if necessary. (2) When removing the ice outside the sensor, be careful, gently scrape the ice on the sensor with a tool, and then wipe it clean with a dry towel, and pay attention to the safety of personnel and equipment when placing the wind lever. Sometimes rain will penetrate down the sensor into the sensor, causing freezing inside. If there is water inside the sensor, the wind sensor will soon be frozen. In this case, you need to use external tools, such as hair dryers. Use a wire to connect the socket, plug in the hair dryer to blow inside the sensor, and wait for the internal water to be cleared; the instrument can resume normal operation [4].

According to the weather observatory forecast, the following preventive measures can be taken to analyze the effectiveness of the.

(1) Add thermal insulation cotton, wrap thermal insulation cotton on the bearing of the wind direction and wind speed sensor and the connection of the wind pole and other easy icing parts, pay attention to the normal rotation of the upper and lower parts, avoid winding too tight wind direction and wind speed sensor bearing can not turn, affecting the meteorological data detection; Because the winding of the thermal insulation cotton is too loose to start the antifreeze effect, too tight winding will affect the bearing rotation.

(2) Apply antifreeze oil or antifreeze, apply antifreeze oil or antifreeze at the bearing of the wind direction and wind speed sensor and the connection of the wind pole to prevent the wind direction and wind speed sensor from freezing. The effectiveness of antifreeze oil or antifreeze is short, and it is frequently necessary to apply the wind pole after putting it down, and the wind pole needs more manpower and material resources.

(3) Install an electric thermal incubator, install an electric thermal incubator in the parts where the wind direction and wind speed sensor are easy to freeze, and prevent the bearing of the wind direction and wind speed sensor from freezing by heating. This method changes the spatial structure around the wind direction and speed test. Compared with the original shape, the electric thermal incubator is installed, and the shape is much larger, which affects the data collection of wind direction and speed.

(4) Install the electric heating silicone module, install the electric heating silicone module at the bottom of the wind direction sensor, and achieve the effect of deicing and anti-icing through the effect of the heat conduction of the sensor itself [5].

Through the analysis, taking into account the effectiveness and timeliness of deicing, as well as the convenience of operation, we consider recommending the use of electric heating silicone module, which can prevent the wind speed sensor from icing after installation.

3. Electric heating silicone module installation and testing

Through research, the traditional wind direction and wind speed internal structure is mainly, sensor shaft, sensor bearing, gray code tray and other structures, the shell material is aluminum alloy castings, no temperature sensitive devices. The following work is mainly to discuss and analyze the functions of the heating device: (1) to achieve the heat-

ing function without damaging or changing the original shape and function; (2) The working hours are limited to snow or low temperature weather, need to achieve remote control function; (3) According to the seasonal temperature difference, the temperature detection function is realized and the temperature upper limit is set.

Because the shape of the wind direction and speed sensor is cylindrical, such as the use of aluminum foil heating module, it can not be effectively fixed, the shape of the sensor is damaged, and there is a problem of uneven heating; If filamentous heating is selected, the heating area of the sensor is too small and the efficiency is too low. Finally, through comparison, the silicone deformable heating module is selected, which can be designed according to the shape of the wind direction sensor device, and the device can be bent and wrapped, heated evenly, and will not damage the surface of the original equipment, and it is easy to disassemble and install. Through the test installation, the position of the wind direction and speed sensor can be installed, the package is tight, there is no gap, the heating condition is tested, the bottom temperature and the top temperature are high, and the temperature difference is less than 5 degrees Celsius.

To realize the temperature detection function, install a temperature sensor on the heating module to monitor the temperature of the sensor in real time, and set an adjustable temperature switch. To prevent damage to components in the sensor caused by high temperature, adjust the upper limit temperature as required. In order to realize the remote start of the heating device at any time, the remote control device is installed, and the equipment is flexibly opened and closed according to the weather conditions.

The wind direction and speed sensor heating module includes four parts: electric heating silicone module, temperature monitoring module, remote control module and power supply module. The electric heating silicone module is located at the wind direction and speed at the top of the wind pole. The temperature monitoring sensor is located in the heating module, and the temperature display is located lower than the chassis. The remote control module is located in the bottom shelf. The remote control is mainly controlled through visual distance. The power supply module is located in the bottom shelf and supplies power from the wind direction and wind speed sensor. First, pay attention to preventing equipment damage and personnel injury when the wind pole is put down; The second is outdoor power connection, pay attention to the tightness of the cable, to avoid the problem of short circuit of power supply caused by poor sealing; The third is the height of the bottom device chassis, the recommended height is 1.5 meters, to avoid too low to cause the remote control device can not effectively accept the signal.

Finally, through the installation test, we organized the freezing and deicing experiment of the meteorological wind direction and wind speed sensor. Through the experiment, the anti-icing heating device has high heating efficiency, and it only takes 10 minutes from 0 degrees to 70 degrees. The remote control function is realized, and the remote control distance of the observation personnel can reach 3 kilometers. When the temperature is below 0° and there is rain or snow, the heating device can be remotely started in the remote meteorological observation room. Finally, it can effectively prevent the ice problem of meteorological wind speed sensor. At the same time, electric heating is our main plan to achieve the purpose at this stage, in order to improve the dual prevention of heating and prevention; we consider installing a protective sleeve on the top of the bearing. By avoiding the direct contact between the bearing and rain or snow to cause icing, the protective sleeve is installed on the top without increasing the top weight of the wind direction and speed sensor. And carry out the test of meteorological wind direction and wind speed sensor start-up wind speed, to ensure that the sensor operating standards meet the standards of civil aviation meteorological measuring instruments.

In the weather station installed with the silicone heating module of the meteorological wind direction and wind speed sensor, it is necessary to test whether the heating function of the equipment is caused before the arrival of winter, and whether the heating efficiency of the remote control test module is caused after the wind rod is put down. If the meteorological wind direction and wind speed sensor module is abnormal, it is timely to replace the meteorological wind direction and wind speed sensor module. Check the tightness of the heating module to the shape of the package sensor. If the package is not tight or loose, replace or reinforce it in time to avoid foreign objects falling in the flight area and causing other hazards. The surge protection module and surge protection grounding are added to the power supply module. The top of the wind pole is struck by lightning during thunderstorms. This prevents lightning from entering the power supply module through the heating module, temperature monitoring module, remote control module, and the overall power supply.

At present, the most common meteorological wind direction and wind speed sensors used in the civil aviation industry are mostly mechanical wind direction and wind speed of Vaisala, Finland, and Vaisala ultrasonic wind with heating function is more expensive, and there are problems in interface transformation. If all the traditional mechanical wind direction and speed are replaced by ultrasonic wind, it is bound to cause great operating pressure. Such as the use of meteorological wind speed sensor anti-icing heating device, a single set of cheap cost, installation and maintenance is simpler, only need to install the sensor anti-icing heating device, can meet the safety needs.

4. Conclusion

Meteorological observation data is the basis of weather forecasting and early warning, climate forecasting and fore-

casting, meteorological services and scientific research, and is the driving force to promote the development of meteorological science. Civil aviation has higher requirements for the accuracy of meteorological wind direction and speed. We must ensure the equipment stable operating rate, reporting rate and data availability; By studying the four heating methods of thermal insulation cotton, antifreeze liquid or antifreeze oil, electric thermal incubator and electric silicone module, we analyzed and compared the heating efficiency, the convenience of operation and the long-term efficiency, and selected the electric silicone module for testing, which can be heated according to meteorological conditions and can effectively prevent the safety risks caused by icing.

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