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Wind energy generation systems - Automatic fire protection systems for wind turbines

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5 General Requirements

5.1 Automatic fire protection systems consist of fire detectors, sound and light sensors, fire controllers, fire extinguishing devices, and remote monitoring systems.

5.2 The automatic fire suppression system should be based on the operating conditions of the wind turbine generator set, including ambient temperature, humidity, vibration, electromagnetic interference, altitude, and geographical location. Differentiated designs are made based on conditions such as climate.

5.3 The design of automatic fire protection systems should divide fire protection zones according to the structural characteristics of wind turbine generator sets, and each fire protection zone should adopt appropriate fire protection measures. Fire detectors, fire extinguishing devices, and fire extinguishing methods that are appropriate for the characteristics of the fire.

5.4 In the context of wind turbine generator sets, automatic fire suppression systems should not use materials that could cause injury or death, and should preferably use non-toxic and harmless fire extinguishing media.

5.5 The automatic fire suppression system should have the function of uploading fire alarm, fault, and action signals to a remote monitoring platform, and should be compatible with wind turbine generator sets. The main control system and video monitoring system are linked, and it has manual or automatic start and stop functions.

5.6 The compatibility of interfaces and communication protocols between various devices in an automatic fire protection system shall comply with relevant regulations.

5.7 The automatic fire suppression system shall be installed and commissioned before the wind turbine generator is put into operation to ensure that the automatic fire suppression system functions normally.

5.8 The maintenance content and frequency of daily inspections, patrols, and functional tests of automatic fire suppression systems shall comply with GB 50166 and GB 50263. Regulation.

5.9 Electromagnetic compatibility (EMC) meets the requirements of Table 1.

6 Protective Zones

6.1 Based on the structural characteristics of the wind turbine generator set, it is divided into the following areas. The protective area zoning view is shown in Figure

1.Each area may include multiple The protection unit is divided into the following sections.

a) FPZ1 zone. includes blades, each blade being a protection unit, and a typical installation example of its fire protection measures is shown in Appendix A.

b) FPZ2 zone. including the wind turbine (including the blade baffles and hub), nacelle, pitch control unit within the hub, and other independent metal cabinets with independent protection. Protection unit, gearbox and oil pan in the engine room, high-speed brake coupling, generator, transformer (box-type or open type) and other components in the

engine room. All of his electrical cabinets are independent protection units.

3 Zone. Includes the entire tower section. This zone is demarcated downwards from the yaw bearing and includes the tower section physical isolation layer and the first-level working layer. The platform and the basement space; each physical isolation layer can be regarded as an independent protective unit.

d) FPZ4 zone. including generator sets, transformers and other ancillary facilities. The transformer substation and other ancillary facilities can be regarded as an independent fire protection unit.

6.2 The protective measures for different fire compartments are as follows:

a) Fire extinguishing measures combining automatic fire detection and extinguishing devices with physically heat-absorbing extinguishing agents should be adopted in FPZ1 zones;

b) In the oil-risk areas of the engine compartment in FPZ2 zone, point-type smoke and heat detectors and non-pressurized superconducting detectors for re-ignition prevention should be used. Fire extinguishing systems using fine dry powder extinguishing agents should preferably employ S-type aerosol or perfluorohexanone in electrical cabinets located in areas with electrical risks. Fire extinguishing devices using extinguishing agents;

c) Non-pressurized ultrafine dry powder extinguishing agents should be used in the wheel hubs and fairings of FPZ2 zones, while S-type aerosol or full-type extinguishing agents should be used in electrical cabinets. Fire extinguishing devices that use fluorohexanone as the extinguishing agent;

d) Fire extinguishing devices using S-type aerosol as the extinguishing medium should be used in the area of the FPZ4 zone with the substation below. Figure

7 Automatic fire alarm system

7.1 The design and installation of automatic fire alarm systems shall comply with the provisions of GB 50116-2013.

7.2 The selection of fire detectors for each protection unit of a wind turbine generator set shall be carried out in accordance with the following requirements.

a) Fire detectors in FPZ1 zone. Detectors are selected based on actual engineering experimental data.

b) For fire detectors in FPZ2 zone, point-type smoke detectors and point-type heat detectors are selected, combined with multi-element fire detectors. Devices (such as infrared thermal imaging temperature sensors, image-type, visual smoke, flame, and temperature-sensing magnetoelectric component detectors, etc.) or non-metallic Linear fire detector with a wire core.

c) For FPZ3 zone fire detectors, thermal imaging temperature sensors, cable-type linear temperature sensors, or temperature-sensing magnetic power generation components should be selected.

d) Various electrical cabinets shall be equipped with temperature-sensing magnetic power generation components, point-type smoke detectors, point-type heat detectors, and combined electrical fire detectors. Measuring device.

e) Automatic fire alarm system, with the following functions. 1) Communication function with the fire control platform; 2) Local manual/automatic switching function and remote manual/automatic switching function; 3) Local manual start function and remote manual start function; 4) Equipped with status display and audible/visual alarm functions; the status display content covers fire alarm status, automatic system fault status, and automatic alarm status. The fire suppression system is in manual/automatic mode.

f) When the wind turbine generator or automatic alarm system is under maintenance, the automatic fire suppression system only responds to the local manual start logic.

g) The backup power supply for the fire detectors meets the requirement of continuous operation for 8 hours in the event of a power outage of the unit.

7.3 The point-type heat-sensing fire detectors used in automatic fire alarm systems shall comply with the provisions of GB 4716.

7.4 The point-type smoke detectors used in automatic fire alarm systems shall comply with the provisions of GB 4715.

7.5 The image-type fire detectors used in automatic fire alarm systems shall comply with the provisions of GB 15631.

7.6 Linear heat detectors used in automatic fire alarm systems shall comply with the provisions of GB 16280.

7.7 The automatic control methods of fire alarm systems and fire extinguishing systems shall comply with the following provisions.

8.1 Perfluorohexanone fire extinguishing system

8.1.1 It shall comply with the requirements of GB 45944.

8.1.2 The service life should match the service life of the wind turbine generator set, preferably 10 years.

8.1.3 The working environment temperature should be between -40°C and 70°C.

8.1.4 It should have signal feedback function.

8.2 Aerosol Fire Extinguishing Device