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Wind turbine generator system technical specification of electric pitch system

风力发电机组电动变桨控制系统技术规范

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Foreword

This standard is applicable to the electric pitch system of grid-connected wind turbines on the ground, as the basis for the design, manufacture, testing and certification.

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed by China Electrical Equipment Industry Association.

This standard shall be under the jurisdiction of the Energy Industry Standardization Working Committee on Wind Power (NEA/TC 1).

The main drafting organizations of this standard: China Electric Power Equipment and Technology C., Ltd., XUJI Group Corporation, Shanghai Electric Group Co., Ltd. Power Transmission and Distribution Branch, Huarui Wind Power Technology (Group) Co., Ltd., Zhejiang Zhongke Automation Engineering Technology Co., Ltd., Guangdong Mingyang Wind Power Technology Co., Ltd., Beijing Jingcheng New Energy Co., Ltd., Shanghai Institute of Electrical Science, Huaxin Technology Inspection Co., Ltd., China General Certification, Machinery Industry Beijing Institute of Electric and Economic Technology.

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Wind turbine generator system technical specification of electric pitch system

1 Scope

This standard specifies the technical requirements, test methods, inspection rules, marking, labels, instruction manuals, packaging, transportation and storage of electric pitch systems for grid-connected wind turbines on the ground.

This standard is applicable to the electric pitch system of grid-connected wind turbines on the ground, as the basis for the design, manufacture, testing and certification.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 191 Packaging – Pictorial marking for handling of goods

GB 755-2008 Rotating electrical machines – Rating and performance

GB/T 2422 Environmental testing for electric and electronic products – Terms and definitions (GB/T 2422-1995, neq IEC 60068-5-2:1990)

GB/T 2423.1-2008 Environmental testing for electric and electronic products – Part 2: Test methods – Test A: Cold (idt IEC 60068-2-1:2007)

GB/T 2423.2-2008 Environmental testing for electric and electronic products – Part 2: Test methods – Test B: Dry heat (idt IEC 60068-2-2:2007)

GB/T 2423.3-2006 Environmental testing for electric and electronic products – Part 2: Test methods – Test Cab: Damp heat steady state (IEC 60068-2-78:2001, IDT)

GB/T 2423.4-2008 Environmental testing for electric and electronic products – Part 2: Test methods – Test Db: Damp heat, cyclic (12h+12h cycle) (eqv IEC 60068-2-30:1980)

GB/T 2887-2000 Specification for electronic computer field

GB/T 2900.1 Electrotechnical terminology – Fundamental terms

GB/T 2900.53 Electrotechnical terminology – Wind turbine generator system

GB/T 3797-2005 Electrical control assemblies

GB/T 3859.1-1993 Semiconductor convertors – Specification of basic requirements

GB 4208 Degree of protection provided by enclosure (IP code) (eqv IEC 60529)

GB/T 4365 Electrotechnical terminology – Electromagnetic compatibility

GB 5226.1 Safety of machinery – Electrical equipment of machines – Part 1: General requirements

GB/T 9969 General principles for preparation of instructions for use of industrial products

GB/T 11287-2000 Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section one: Vibration tests (sinusoidal) (IEC 60255-5:2000, IDT)

GB/T 14537-1993 Shock and bump tests on measuring relays and protection equipment (idt IEC 60255-21-2:1998)

GB/T 14598.3-2006 Electrical relays – Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests (IEC 60255-5:2000, IDT)

GB/T 15543-2008 Power quality – Three-phase voltage

GB/T 15969.1-2007 Programmable controllers – Part 1: General information

GB/T 15969.2-2008 Programmable controllers – Part 2: Equipment requirements and tests

GB/T 17626.2-2006 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Electrostatic discharge immunity test

GB/T 17626.3-2006 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Radiated radio-frequency electromagnetic field immunity test

GB/T 17626.4-2008 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Electrical fast transient/burst immunity test

GB/T 17626.5-2008 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Surge immunity test

GB/T 17626.6-2008 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Immunity to conducted disturbances induced by radio-frequency fields

GB/T 17626.12-1998 Electromagnetic compatibility (EMC) – Testing and measurement techniques – Ring wave immunity test

GB/T 18451.1-2001 Wind turbine generator systems – Design requirements

GB/T 19608.1-2004 Classification of special environmental condition – Part 1: Dry heat

GB/T 19608.2-2004 Classification of special environmental condition – Part 2: Dry heat desert

GB/T 19608.3-2004 Classification of special environmental condition – Part 3: Plateau

GB/T 20641-2006 Empty enclosures for low-voltage switchgear and controlgear assemblies – General requirements

GB/T 21714.4-2008 Protection against lightning – Part 4: Electrical and electronic systems within structures

GB/T 20540 Digital data communication for measurement and control – Fieldbus for use in industrial systems – Type 3: PROFIBUS specification

ISO 11898 Road vehicles – Controller area network

EN 175301-801-2007 Detail specification – High density rectangular connectors, round removable crimp contacts

3 Terms and definitions

The terms and definitions as defined in GB/T 2900.53, GB/T 2422, GB/T 2900.1, and GB/T 4365 AND the following terms and definitions apply to this standard.

3.1

Wind turbine generator system (WTGS)

It refers to the system which convert the wind energy into power energy.

3.2

Failure

It refers to the termination of certain executed specified function.

It refers to the rated input voltage specified on the nameplate of the pitch motor.

3.16

the rated speed of pitch motor

It refers to the rated speed specified on the nameplate of the pitch motor.

3.17

the rated torque of pitch motor

It refers to, under rated operating conditions, the maximum torque value at which the pitch motor can operate continuously without exceeding the limit.

3.18

Redundancy

It refers to the application of two circuits of devices or systems to ensure that when one circuit of device or system fails, the other circuit can still effectively perform the required functions.

3.19

Blade

It refers to the component which absorbs wind energy to drive the wind wheel to rotate.

4 Technical requirements

4.1 Conditions of Use

4.1.1 Environmental conditions of normal use

It is applicable to the following conditions AND can work properly.

a) Working ambient temperature.

1) Room temperature: -20 °C ~ +45 °C.

2) low temperature type: -30 °C ~ +45 °C.

b) Relative humidity.

The air is clean, AND at the maximum temperature of +45 °C, the relative humidity is not more than 50%. At lower temperatures, it is allowed for a relatively large relative humidity. For example: at + 20 °C, the relative

d) The response period of the pitch to the command as issued from the master control system is not more than 20ms;

e) The time delay of the three-blade angle feedback to the master control system is not more than 20ms.

4.2.5.2 Remote manual pitch

The issuing speed, acceleration and pitch angle command of the man-machine interface of the control system of the wind turbine generator system are used for pitch control. The pitch system shall operate normally within the entire pitch range, realize the blade synchronization, AND the pitch performance shall comply with the technical requirements of 4.2.5.1.

4.2.6 Safety feathering

4.2.6.1 Power-down of power grid

In case of power down of the power grid, the pitch system shall be able to automatically tap the backup power supply to complete the safe feathering.

4.2.6.2 Communication fault

In the event of a communication fault between the pitch system and the master control system, the pitch system shall be capable of automatically finishing the safe feathering.

4.2.6.3 Safe chain disconnection

The safe chain is divided into two parts: the safe chain of the pitch system and the safe chain from the master control system to the pitch system.

The safety chain of the pitch system may include the following: emergency shutdown button press down, controller fault (for pitch system including controller), and any drive fault. When the safe chain is disconnected, the pitch system shall be able to automatically complete the safe feathering.

4.2.7 Troubleshooting

Pitch system shall have self-diagnosis and protection functions, be able to detect the equipment fault or abnormal conditions, AND have good safe strategy for processing. There is complete accident record information to facilitate fault diagnosis, AND the information shall be able to send to the control system in a real-time manner. The diagnosis and protection shall include the following:

a) Lightning protection action.

b) Fuse or protective switch action.

c) Cabinet temperature abnormality.

4.2.9.1 Battery backup power supply system

4.2.9.1.1 Capacity

The capacity of the battery pack shall be such as able to finish 3 emergency feathering actions at the specified load of the blade. USE the following formula to calculate the feathering time:

Emergency feathering time (s) = 90°/maximum pitch rate (°/s) ……. (1)

The specified load shall be in accordance with the provisions of 7.4 of GB 18451.1-2001.

4.2.9.1.2 Charging time

REFER to the charging requirements of the battery, to select appropriate charging current to minimize the charging time, AND the charging time is generally 6 ~ 10h.

4.2.9.1.3 Charging mode

It is generally divided into two modes, which is determined in accordance with the system requirements:

a) Cyclic charging by a shared charger;

b) Independent charging of each battery pack.

4.2.9.1.4 Monitoring function

The system shall have the following monitoring functions:

a) Charge control function:

CONTROL the charging of the battery as required. When the on-line monitoring battery and charger are in fault, it shall be able to stop charging AND to protect the battery.

b) Temperature control function:

To make the battery operates within the specified temperature range, so that the battery capacity and the service life comply with the design requirements.

c) System monitoring:

1) The battery status monitoring function, including overvoltage, undervoltage, and overtemperature.

2) The charge and discharge circuit completeness, and the charger status (overtemperature, output short circuit, overload, input voltage anomaly).

The communication protocol for the product shall follow the requirements of the product standard.

4.3 Performance requirements

4.3.1 Overload capacity

The overload capacity of the pitch system shall be such that the continuous operating time shall not be less than 3 s at 2 times the rated current.

4.3.2 Power grid adaptability

The pitch system shall work normally under the following power supply conditions:

a) Comply with the conditions of 4.1.5; AND it shall negotiate with the manufacturer if beyond this condition.

b) When the power grid voltage drops to the voltage required for low voltage crossing, it cooperates with the master control system of the unit within the specified duration, so that the fan does not operate in an off-grid manner.

4.3.3 Electromagnetic compatibility performance

4.3.3.1 Pulse train immunity

The system shall be able to withstand the pulse train immunity test of the harsh rating of level 3 as specified in chapter 5 of GB/T 17626.12-1998.

4.3.3.2 Electrostatic discharge immunity

The system shall be able to withstand the electrostatic discharge immunity test of the harsh rating of level 3 as specified in chapter 5 of GB/T 17626.2-2006.

4.3.3.3 Radiation electromagnetic field immunity

The system shall be able to withstand the radiation electromagnetic field immunity test of the harsh rating of level 3 as specified in chapter 5 of GB/T 17626.3-2006.

4.3.3.4 Electrical fast transient burst pulse train immunity

The system shall be able to withstand the electrical fast transient burst pulse train immunity test of the harsh rating of level 3 as specified in chapter 5 of GB/T 17626.4-2008.

4.3.3.5 Surge immunity

The system shall be able to withstand the surge immunity test of the harsh rating of level 3 as specified in chapter 5 of GB/T 17626.5-2008.

d) The precision of the other test instruments shall comply with the requirements of the relevant standards, AND it is within in the validity period as certified by the metering department.

5.3 Inspection and testing

5.3.1 Structure and appearance inspection

The test of the structure and appearance shall be carried out in accordance with the requirements of 5.2.1 of GB/T 3797-2005.

5.3.2 Laying and connection inspection of cable and conductor

FOLLOW the requirements of chapter 14 of GB 5226.1.

5.3.3 Component inspection

CHECK whether the components comply with the requirements of 4.2.3.

5.3.4 Service operation function inspection

CONDUCT test in accordance with 4.2.4.

5.3.5 Synchronous pitch function inspection

5.3.5.1 Communication test

After normal power-on, OBSERVE whether the normal communication can be realized between the pitch system and the control system, AND it may control the man-machine interface or PC to conduct observation.

5.3.5.2 Control pitch of master control system

CONDUCT pitch control through the pitch angle command as issued from the man-machine interface of the control system of the wind turbine generator system. CHECK whether the pitch system works normally within the entire pitch range.

5.3.6 Safe feathering test

5.3.6.1 Power-down of power grid

DISCONNECT main power switch of the system; OBSERVE the power supply, safe shutdown process, operation status, and the display and upload of the fault alarm information of the backup power supply.

5.3.6.2 Communication fault

DISCONNECT the communication line; OBSERVE the shutdown process and fault alarm status.

5.3.6.3 Safe chain disconnection

system configuration) and INPUT it into the driver or controller, to observe the shutdown process and fault alarm status.

5.3.7.8 Charger fault

SIMULATE the charger fault output, to observe whether the system can perform alarming and communication upload.

5.3.7.9 Charging circuit open circuit

Artificially DISCONNECT the charging circuit, to observe whether the system can perform alarming and communication upload.

5.3.7.10 Backup power supply voltage abnormality

SIMULATE the backup power supply overvoltage and undervoltage, to observe whether the system can perform alarming and communication upload.

5.3.8 Power-on safety test

Firstly, DISCONNECT the system power; INCREASE the set value of the power-on temperature detection switch to make it be higher than environment temperature; then CLOSE the main power supply switch of the system; at this time, the system shall not be live; DECREASE the set value of the power-on temperature detection switch to make it be less than the ambient temperature, at this time, the system shall be powered on and operate.

5.3.9 Backup power supply test

The capacity of the backup power supply is checked on the simulation test platform in accordance with the load specified in 4.2.9, AND the method are as follows:

Firstly, PITCH to 0° position; MAKE the loading system load; then TRIGGER the master control system to the pitch safe chain, AND the capacity of the backup power supply shall be able to satisfy the requirements from 0° to 90° feathering. If requiring finishing multiple feathering capacity, continuously CONDUCT multiple tests.

Other tests are subject to inspection in accordance with the requirements of 4.2.9.

5.3.10 Communication test

The communication protocol of the system is tested in accordance with the test method as specified in the relevant product standard.

5.3.11 Overload capacity test

CONTROL the load through the test platform loading motor, to check whether it complies with the requirements of 4.3.1.

The test of the impulse voltage shall be carried out in accordance with the method as specified in GB/T 14598.3-2006.

5.3.15 Mechanical properties

5.3.15.1 Vibration test

Vibration response test and vibration durability test shall be carried out in accordance with the method as specified in GB/T 11287-2000.

5.3.15.2 Impact and collision test

The impact response test and impact durability test shall be carried out in accordance with the method as specified in GB/T 14537-1993.

The collision test shall be carried out in accordance with the method as specified in GB/T 14537-1993.

5.3.16 Electric shock protection

Electric shock protection shall be checked in accordance with the requirements of 5.2.1 in GB/T 3797-2005.

5.3.17 Degree of protection

The test of the degree of protection (IP code) of the enclosure shall be carried out in accordance with the method as specified in GB 4208.

5.3.18 Lightning protection requirements

Lightning protection requirements shall be checked in accordance with the provisions of GB/T 21714.4-2008.

5.3.19 Temperature rise test

The test may be carried out in accordance with the requirements of 6.4.6 of GB/T 3859.1-1993. The temperature measurer may use thermometers, thermocouples, thermal elements, infrared thermometers or other effective methods. Under the rated operating conditions, after all the components reach thermal stabilization, MEASURE the temperature rise in accordance with Table 4, AND the temperature rise shall be within the range as specified for each component.

5.3.20 Low temperature performance test

The test method is in accordance with the “Test A” in GB/T 2423.1-2001.

5.3.21 High temperature performance test

The test method is in accordance with “Test B” in GB/T 2423.2-2001.

5.3.22 Damp heat resistance test

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