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Replacing GB/T 19070-2003

Stall regulation wind turbines –

Control system - Test method

失速型风力发电机组 控制系统 试验方法

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Foreword

This Standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces GB/T 19070-2003 “Test method for electrical controller of wind turbine generator systems”.

As compared with GB/T 19070-2003, in addition to editorial modifications, the main technical changes of this Standard are as follows:

- CHANGE “off-field on-line test” to “field test” (SEE 3.1; 3.2 of the 2003 version);
- DELETE “panel”, “operation panel”, USE “HMI” in this article (SEE Chapter 4 of the 2003 version);
- IMPROVE “test environment” (SEE 6.1; 6.1 of the 2003 version);
- ADJUST “general inspection” (SEE 7.1, 7.2; 7.1 of the 2003 version);
- ADD “monitoring function test” (SEE 7.3);
- ADJUST the order of control function tests (SEE 7.4, 7.5, 7.6, 7.7; 7.2 of the 2003 version);
- In the test of automatic control function, ADD “power-on self-resetting” (SEE 7.7);
- MODIFY “soft grid-connected function test” (SEE 7.8; 7.4.1 of the 2003 version);
- MODIFY “compensation capacitor opening-closing test” (SEE 7.9; 7.4.2 of the 2003 version);
- DELETE “small motor-large motor switch test” (SEE 7.4.3 of the 2003 version);
- DELETE “large motor-small motor switch test” (SEE 7.4.4 of the 2003 version);
- ADD “communication test” (SEE 7.10);
- ADD “supercritical value of generator speed” (SEE 7.11.2);
- DELETE “large motor grid-connected signal loss” (SEE 7.3.10 of the 2003 version);
- DELETE “small motor grid-connected signal loss” (SEE 7.3.11 of the 2003 version);

Stall regulation wind turbines - Control system - Test method

1 Scope

This Standard specifies the test conditions, test methods, and preparation requirements of test report for control system of fixed-pitch stall regulation grid-connected wind turbines.

This Standard is applicable to the control system of fixed-pitch stall regulation wind turbines, which operates in parallel with the power grid and uses asynchronous generator.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the versions with the dates indicated are applicable to this document. For the undated references, the latest version (including all the amendments) are applicable to this document.

GB/T 2423.1-2008 Environmental testing - Part 2: Test methods - Tests A: Cold

GB/T 2423.2-2008 Environmental testing - Part 2: Test methods - Tests B: Dry heat

GB/T 2423.3-2016 Environmental testing - Part 2: Testing method - Test Cab: Damp heat, steady state

GB/T 2900.53 Electrotechnical terminology - Wind turbine generator systems

GB/T 3797-2016 Electrical control assemblies

GB/T 11287 Relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section one: Vibration tests (sinusoidal)

GB/T 14537 Shock and bump tests on measuring relays and protection equipment

GB/T 16935.1 Insulation coordination for equipment within low-voltage systems - Part 1: Principles requirements and tests

GB/T 17626.1 Electromagnetic compatibility - Testing and measurement techniques - Overview of immunity tests

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

GB/T 17626.3 Electromagnetic compatibility - Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test

GB/T 17626.4 Electromagnetic compatibility - Testing and measurement techniques - Electrical fast transient/burst immunity test

GB/T 17626.5 Electromagnetic compatibility - Testing and measurement techniques - Surge immunity test

GB/T 17626.6 Electromagnetic compatibility - Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields

GB/T 17626.12 Electromagnetic compatibility - Testing and measurement techniques - Ring wave immunity test

GB/T 17627.1 High-voltage test techniques for low-voltage equipment - Part 1: Definitions, test and procedure requirements

GB/T 17627.2 High-voltage test techniques for low-voltage equipment - Part 2: Measuring system and test equipment

GB/T 17949.1 Guide for measuring earth resistivity, ground impedance and earth surface potentials of a ground system - Part 1: Normal measurements

GB/T 18451.2 Power performance measurements of electricity producing wind turbines

GB/T 19069 Stall regulation wind turbines - Control system - Technical condition

GB/T 19568 Wind turbines - Assembling and installation regulation

JB/T 7879 The rule for naming the product of wind energy conversion system

3 Terms and definitions

What defined in GB/T 2900.53 and GB/T 19069, and the following terms and definitions are applicable to this document.

3.1 Field test

accordance with the provisions of 7.2 in GB/T 3797-2016.

7.2 Electrical safety test

It mainly includes: the insulation level inspection, grounding system examination, and voltage withstand test of engine room control cabinet (box), tower bottom control cabinet (box), and other electrical equipment. The above examinations and tests shall be carried out in accordance with the requirements of GB/T 16935.1, GB/T 17949.1, GB/T 17627.1, and GB/T 17627.2, respectively.

7.3 Monitoring function test

When the operating parameters and operating state of the turbines change, through HMI, monitoring system, and other monitoring points, the correctness of collected data is observed; to verify the integrity and reliability of the processing by control system for the operating parameters and operating state.

According to the “operating instructions” of test turbines, by HMI, artificially CHANGE the fault triggering limit value and resetting limit value of control system; in turn, INSPECT whether each fault can be correctly activated and reset. When the fault is activated, the control system shall, according to the fault classification, accurately make the corresponding alarm or shutdown. When the fault is reset, the control system, for the self-recoverable fault, shall be able to restart the unit automatically. While for the non-self-recoverable fault, the control system shall ensure that the unit cannot restart automatically.

7.4 Control function test for tower bottom

According to the requirements and procedures of “operating instructions” of test turbines, CONDUCT the following tests:

- a) Manual start: By operating the corresponding function key at the tower bottom, COMMAND the test turbines to start; OBSERVE whether the grid-connected process of generator is stable;
- b) Manual immediate start: By operating the corresponding function key at the tower bottom, COMMAND the test turbines to immediately start; OBSERVE whether the grid-connected process of generator is stable;
- c) Manual shutdown: When the test turbines are in normal operation, by operating the corresponding function key at the tower bottom, COMMAND the turbines to normally shut down; OBSERVE whether the wind wheel blade spoiler is thrown away, and whether the mechanical damper brake action is effective;
- d) Manual resetting: By operating the corresponding function key at the tower bottom, RESET the turbines; OBSERVE whether the turbines clear the

closed contacts of pendulum vibration switch; OBSERVE shutdown process and fault alarm state.

7.11.4 Excess cable twist (simulation test method)

Simulation method: TOUCH the analog switch of normally open and normally closed contacts of cable twist switch; OBSERVE shutdown process and fault alarm state.

7.11.5 Emergency shutdown

Simulation method: PRESS the emergency shutdown switch on the control cabinet or the emergency shutdown switch in the engine room; OBSERVE shutdown process and fault alarm state.

7.11.6 Secondary power supply failure

Simulation method: DISCONNECT the secondary power supply; OBSERVE shutdown process and fault alarm state.

7.11.7 Power grid failure

Simulation method: When the turbines are in grid-connected operation, under the condition that the output power of generator is below 20% of the rated value, DISCONNECT the air switch of major loop; OBSERVE shutdown process and fault alarm state.

7.11.8 Brake wear

Simulation method: TOUCH the limit switch of brake wear sensor; OBSERVE shutdown process and fault alarm state.

7.11.9 Wind speed signal loss

Simulation method: When the turbines are in grid-connected operation, DISCONNECT the wind speed signal of wind speed sensor; OBSERVE shutdown process and fault alarm state.

7.11.10 Wind direction signal loss

Simulation method: When the turbines are in grid-connected operation, DISCONNECT the wind direction signal of wind speed sensor; OBSERVE shutdown process and fault alarm state.

7.11.11 Motor grid-connected signal loss

Simulation method: After the motor grid-connected contactor is sucked, DISCONNECT the feedback signal line of the contactor; OBSERVE shutdown

When the turbines are in grid-connected operation, MAKE the load power of generator lower than 10% of the rated power; and MAKE the wind speed sensor generate an equivalent wind speed signal above 8 m/s for several seconds (The specific time is in accordance with the “operating instructions” of turbines); OBSERVE shutdown process and fault alarm state.

7.11.27 Distortion of wind speed measured value (low)

When the turbines are in grid-connected operation, MAKE the load power of generator higher than 10% of the rated power; and MAKE the wind speed sensor generate an equivalent wind speed signal below 3 m/s for several seconds (The specific time is in accordance with the “operating instructions” of turbines); OBSERVE shutdown process and fault alarm state.

7.11.28 Wind wheel speed sensor failure

When the turbines are in grid-connected operation, MAKE the generator speed higher than 100 rpm; after disconnecting the signal of wind wheel speed sensor, OBSERVE shutdown process and fault alarm state.

7.11.29 Generator speed sensor failure

When the turbines are in grid-connected operation, MAKE the wind wheel speed higher than 2 rpm; after disconnecting the signal of generator speed sensor, OBSERVE shutdown process and fault alarm state.

7.11.30 Motor contactor and bypass contactor cannot be removed at the same time

Simulation method: After giving the signal of disconnecting motor contactor and bypass contactor, the control system keeps the feedback signal of motor contactor and bypass contactor always effective; OBSERVE shutdown process and fault alarm state.

7.12 Electromagnetic compatibility performance tests

7.12.1 The anti-electromagnetic interference test of the control system of turbines is carried out in accordance with the provisions of GB/T 17626.1. When there is interference of high-frequency electromagnetic wave, all kinds of sensors shall not send signals by mistake; and the executive components shall not malfunction.

7.12.2 The electrostatic discharge immunity test is carried out in accordance with the method specified in GB/T 17626.2.

7.12.3 The radiated, radio-frequency, electromagnetic field immunity test is carried out in accordance with the method specified in GB/T 17626.3.