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Technical rule for electrochemical energy storage system connected to power grid

电化学储能系统接入电网技术规定

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Technical rule for electrochemical energy storage system connected to power grid

1 Scope

This standard specifies the technical requirements for power quality, power control, power grid adaptability, automatic protection and safety devices, communication and automation, power metering, grounding and safety identification, and grid connection testing of electrochemical energy storage systems connected to a power grid.

This standard is applicable to electrochemical energy storage systems with a rated power of 100 kW and above and an energy storage time of not less than 15 min. For electrochemical energy storage systems with other power levels and energy storage time, this standard can be implemented by reference.

2 Normative references

The following documents contain the provisions which, through normative reference in this document, constitute the essential provisions of this document. For the dated referenced documents, only the versions with the indicated dates are applicable to this document; for the undated referenced documents, only the latest version (including all the amendments) is applicable to this document.

GB 2894 Safety signs and guideline for the use

GB/T 12325 Power quality - Deviation of supply voltage

GB/T 12326 Power quality - Voltage fluctuation and flicker

GB 14050 Types and safety technical requirements of system earthing

GB/T 14285 Technical code for relaying protection and security automatic equipment

GB/T 14549 Quality of electric energy supply - Harmonics in public supply network

GB/T 15543 Power quality - Three-phase voltage unbalance

GB/T 19862 General requirements for monitoring equipment of power quality

GB/T 24337 Power quality - Interharmonics in public supply network

GB/T 31464 The grid operation code

GB 50057 Code for design protection of structures against lightning

GB/T 50065 Code for design of ac electrical installations earthing

GB/T 36548 Test specification for electrochemical energy storage system connected to power grid

DL/T 448 Technical administrative code of electric energy metering

DL/T 584 Setting guide for 3 kV~110 kV power system protection equipment

DL/T 645 Multi-function watt-hour meter communication protocol

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 electrochemical energy storage system

A system in which an electrochemical cell is used as the energy storage carrier, and the cyclic electric energy storage and release is carried out through a power conversion system.

Note: Generally, it includes a battery system, a power conversion system, related auxiliary facilities, etc. For an electrochemical energy storage system connected to a voltage level of 10(6) kV and above, it usually also includes a collection line, a step-up transformer, etc.

3.2 power conversion system

A device that connects a battery system with a power grid (and/or load) to realize bidirectional power conversion.

3.3 point of interconnection

For an energy storage system with a step-up transformer, it refers to the busbar or node on the high-voltage side of the step-up transformer. For an energy storage system without a step-up transformer, it refers to the output aggregation point of the energy storage system.

Note: See Appendix A for an illustration of the point of common coupling.

3.4 point of common coupling

The connection point where an energy storage system is connected to a utility grid.

4.5 The electrical equipment at the point of interconnection of an electrochemical energy storage system shall meet the dielectric withstand voltage regulations for electrical equipment of the corresponding voltage level.

4.6 The point of interconnection of an electrochemical energy storage system shall be equipped with an interconnection disconnecting device that is easy to operate, can be locked, and has obvious disconnection indications.

4.7 An electrochemical energy storage system participating in frequency regulation and peak regulation of a power system shall comply with the relevant provisions of GB/T 31464.

4.8 The startup and shutdown time of an electrochemical energy storage system shall meet the requirements of the power dispatching agreement (and/or users), and an electrochemical energy storage system connected to a utility grid through a voltage level of 10(6) kV and above shall be able to execute the startup and shutdown commands from power system operators.

5 Power quality

5.1 Harmonics

5.1.1 The harmonic voltage of an electrochemical energy storage system connected to the point of common coupling shall meet the requirements of GB/T 14549.

5.1.2 The inter-harmonic voltage of an electrochemical energy storage system connected to the point of common coupling shall meet the requirements of GB/T 24337.

5.2 Voltage deviation

The voltage deviation of an electrochemical energy storage system connected to the point of common coupling shall meet the requirements of GB/T 12325.

5.3 Voltage fluctuation and flicker

The voltage fluctuation and flicker value of an electrochemical energy storage system connected to the point of common coupling shall meet the requirements of GB/T 12326.

5.4 Voltage unbalance

The voltage unbalance of an electrochemical energy storage system connected to the point of common coupling shall meet the requirements of GB/T 15543.

5.5 DC component

The DC current component of an electrochemical energy storage system connected to

6.2 Active power control

6.2.1 An electrochemical energy storage system connected to a utility grid with a voltage level of 10(6) kV and above shall have the functions of local and remote charging and discharging power control, and shall have the function of automatically executing the commands issued by power system operators.

6.2.2 An electrochemical energy storage system connected to a utility grid with a voltage level of 110(220) kV and above shall have the ability to participate in primary frequency regulation and have the function of automatic generation control (AGC).

6.2.3 For an electrochemical energy storage system connected to a utility grid with a voltage level of 10(6) kV and above, the dynamic response characteristics shall meet the following requirements:

a) The response time for charging/discharging of the power control of the energy storage system is not more than 2 s, the regulation time for charging/discharging is not more than 3 s, the transfer time from charging to discharging and the transfer time from discharging to charging are not more than 2 s;

b) After the regulation time, the deviation between the actual output curve of the system and the dispatching command or the planned curve is not more than ±2% of the rated power.

6.3 Reactive power control

An electrochemical energy storage system connected to a utility grid through a voltage level of 10(6) kV and above shall have both local and remote reactive power control and voltage regulation functions.

7 Power grid adaptability

7.1 Frequency adaptability

An electrochemical energy storage system connected to a utility grid shall meet the frequency operation requirements in Table 1.

9.4 The information provided by an electrochemical energy storage system, which is connected to a utility grid with a voltage level of 10(6) kV and above and dispatched by the power grid, to the power system operator includes but is not limited to the following content:

a) Electrical analog quantity: frequency, voltage, injected grid current, injected active power and reactive power, power factor, power quality data, etc. about the point of interconnection;

b) Electric energy and state of charge: chargeable/dischargeable capacity, charging capacity, discharging capacity, state of charge, etc.;

c) State quantity: state of disconnecting equipment, charging and discharging state, fault information, remote terminal state, communication state, AGC state, etc. about the point of interconnection;

d) Other information: other information required by the power dispatching agreement.

10 Energy metering

10.1 Before an electrochemical energy storage system is connected to a power grid, the electricity metering point shall be specified. The setting of electricity metering points shall follow the following regulations:

a) The electrochemical energy storage system shall be connected to the utility grid by a dedicated line, and the electricity metering point shall be set at the point of common coupling;

b) The electrochemical energy storage system shall be connected to the public line by a T connection, and the electricity metering point is set at the outlet side of the electrochemical energy storage system;

c) If the electrochemical energy storage system is connected to the user's internal power grid, the electricity metering point shall be set at the point of interconnection.

10.2 An electrochemical energy storage system shall be equipped with an electric energy metering device, and the equipment configuration and technical requirements shall meet the requirements of DL/T 448.

10.3 The electric energy metering device of an electrochemical energy storage system shall have the functions of two-way active and reactive power metering, event recording, local and remote communication, and its communication protocol shall comply with the provisions of DL/T 645.

11 Grounding and safety signs

11.1 The lightning protection and grounding of an electrochemical energy storage system shall meet the requirements of GB 14050, GB 50057, and GB/T 50065.

11.2 An electrochemical energy storage system shall have a prominent sign, and the shape, color, size, and height of the sign shall meet the requirements of GB 2894.

12 Test for connecting to power grids

12.1 Basic requirements

12.1.1 Before being connected to a power grid, the main components of an electrochemical energy storage system, such as the energy storage carrier and the power conversion system, shall pass performance tests, and the tests shall be carried out by organizations or departments with corresponding qualifications.

12.1.2 An electrochemical energy storage system connected to a voltage level of 10(6) kV and above shall provide a grid connection test report issued by a qualified organization to the power system operator or relevant management department within 6 months of grid connection operation.

12.1.3 The test point where an electrochemical energy storage system is connected to a power grid shall be the point of interconnection or the point of common coupling of the electrochemical energy storage system.

12.1.4 When the main components such as the energy storage carrier and the power conversion system of an electrochemical energy storage system are changed, the electrochemical energy storage system shall be retested for being connected to the power grid.

12.2 Test content

The test for an electrochemical energy storage system being connected to a power grid shall be carried out in accordance with GB/T 36548 or other relevant standards or regulations, which shall include but not be limited to the following content:

a) Power quality test;

b) Power control test;

c) Power grid adaptability test;

d) Testing for automatic protection and safety devices;

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