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**Specification of operation and control for connecting
electrochemical energy storage station to power grid**

电化学储能电站接入电网运行控制规范

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1 Scope

The document fixes the requirements for operation management, power control, grid-connected and off-grid switching, operational adaptability, power quality, relay protection and safety automatic devices, automation and communication, cyber security and electric energy metering of electrochemical energy storage stations connected to the power grid.

It applies to the operation control of electrochemical energy storage stations connected to the public grid at a voltage level of 10 (6) kV and above; storage stations of other types may follow it by reference. The terms and definitions of GB/T 36547 and DL/T 2528 apply.

4 General requirements

The technical requirements for connecting the station to the grid meet GB/T 36547 and its equipment meets GB/T 36558. Before connection the station signs a grid connection dispatching agreement and a power purchase and sale contract with the grid enterprise.

Before commissioning into the power system the station supplies verified data on its model, parameters and control system characteristics, and before grid-connected operation it draws up on-site operating rules and safety rules.

In operation the station carries out the instructions of the dispatching organisation and has the corresponding monitoring, protection and communication functions. The configuration and setting of its protection are matched to the protection on the grid side, and its earthing arrangement is matched to that of the grid it connects to.

5 Operation management

The station takes part in peak shaving, frequency regulation, voltage regulation and emergency reserve of the power system according to dispatching instructions or market trading results, in line with GB/T 31464, GB/T 36547 and GB 38755. Its shift operators are trained for the post, hold the corresponding qualification and carry the certificate for it.

Before its first connection the station submits to the dispatching organisation the technical parameters, measured parameters and security protection scheme related to grid operation. Before connection it carries out grid-connected commissioning under GB/T 36548 and passes start-up acceptance, and it submits the commissioning report to the dispatching organisation within six months of grid-connected operation.

Where main primary equipment such as storage batteries and converters is overhauled or replaced, or main secondary equipment such as monitoring systems and protection is rebuilt or upgraded in a way that affects the grid-related performance of the station, the station passes commissioning tests and acceptance before it is reconnected. Where primary equipment, secondary equipment or the security protection scheme changes after connection, the relevant material is submitted to the dispatching organisation promptly.

For equipment within the jurisdiction of the dispatching organisation the station carries out operations on dispatching instruction; for equipment within the permission range of the dispatching organisation it carries them out after permission has been given. Where carrying out a dispatching instruction could endanger persons or equipment, the shift operator reports to the dispatching organisation and states the reason.

Maintenance of grid-related equipment is reported in advance as a maintenance plan, applied for and carried out only after approval. When grid-related equipment fails, the faulty equipment is taken out of service and the dispatching organisation is informed. After the station or its converters have gone out of service in an emergency or a fault condition, they are not reconnected of their own accord but are brought back under the arrangement of the dispatching organisation.

The station submits proposed charge and discharge plans to the dispatching organisation, which uses them in setting the operating mode and the charge and discharge plan of the station. The station follows the planned curve and the dispatching instructions issued to it, and where the operating mode or the planned curve is adjusted the dispatching organisation informs the station staff in advance.

6 Power control

For active power the station has a remote control mode and a local control mode with manual switching between them, and in remote control mode it carries out the control instructions of the dispatching organisation automatically. It is connected to the automatic generation control system and controls its charge and discharge power on the instruction of the dispatching organisation.

Where the grid fails, a station taking part in emergency power support is able to reach its maximum dischargeable or chargeable power within 200 ms. The dead band of primary frequency regulation and the rate of change of frequency or frequency dead band of the inertia response meet GB/T 36547, and both functions act correctly once the deviation exceeds the dead band.

For a station connected at 10 (6) kV and above, automatic generation control, primary frequency regulation and inertia response are co-ordinated: primary frequency regulation and inertia response take priority over automatic generation control, and both can be put into or taken out of service locally or remotely according to the needs of power system operation.

For reactive power the station is able to connect to the automatic voltage control system and to respond to and carry out the instructions of the dispatching organisation within the specified time. It has power factor, reactive power and voltage control modes with on-line switching between them, and its reactive voltage control has a remote mode, controlled automatically from the dispatching master station, and a local mode, controlled from a reactive power or voltage target given in advance.

7 Grid-connected and off-grid switching, operational adaptability and power quality

Where a disturbance in the system has taken the station off the grid, the station is not reconnected before the grid voltage and frequency have returned to the normal operating range, and once they have, it resumes grid-connected operation under the arrangement of the dispatching organisation. Where an unplanned island is detected during grid-connected operation, the station is disconnected from the grid within 2 s. In an emergency the dispatching organisation may stop the station directly.

For operational adaptability the high and low voltage ride-through and continuous fault ride-through capability of the station, its active and reactive support during ride-through, and its frequency adaptability all meet GB/T 36547.

The power quality at the point of connection meets GB/T 36547. The station preferably carries power quality monitoring equipment that watches and records the power quality data at the point of common coupling in real time. Where a power quality index at the point

of connection falls outside GB/T 36547, the station raises an alarm and uploads it automatically to the dispatching organisation, takes measures to improve the power quality, and is taken out of service if the requirement still cannot be met.

10 Relay protection and safety automatic devices

The protection configuration of the station meets GB/T 14285. The settings of relay protection and safety automatic devices are made as the dispatching organisation requires, and the configuration and settings of the protection match the protection strategy on the grid side.

Relay protection and safety automatic devices are checked and maintained periodically and the check records are kept.

The station carries a fault recording device connected to the dispatching organisation. The device records the data from 10 s before the fault to 60 s after it and supports upload of the fault recording data.

11 Automation and communication

The station connects to the power dispatching data network over a dedicated optical fibre network or a dedicated wireless network and exchanges data in both directions with the dispatching organisation. A station connected at 110 (66) kV and above has two independent optical cable communication channels with the corresponding communication equipment.

The communication method and information transmission protocol between the station and the dispatching organisation meet the general communication conventions of the power system, DL/T 634.5104 and GB/T 26865.2 being preferred.

The information the station uploads meets DL/T 5003 and includes at least the chargeable and dischargeable energy, the charged energy, the discharged energy and the energy state of the station, together with the charge and discharge state, the in-service and out-of-service state of automatic generation control, blocking and remote or local signals, and the in-service, out-of-service and action state signals of primary frequency regulation and of the inertia response.

A station connected at 35 kV and above carries synchronous phasor measurement or wide band measurement equipment and uploads synchronous phasor data to the dispatching organisation in real time. The station also has a unified clock synchronisation system.

12 Cyber security

Network security protection of the station meets GB/T 36572, and the station meets the requirements summed up as security partitioning, dedicated network, lateral isolation and