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**Guide for Modeling of Electrochemical Energy Storage
Power Station**
电化学储能电站建模导则

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Guide for Modeling of Electrochemical Energy Storage Power Station

1 Scope

This document specifies the technical requirements for the electrochemical energy storage station modeling for power system load flow calculation, electromagnetic transient, electromechanical transient and mid-long term dynamic simulation.

This document is applicable to electrochemical energy storage power stations connected to the power grid with a voltage level of 10(6) kV and above. Other electrochemical energy storage power stations may refer to it for implementation.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB 38755 Code on Security and Stability for Power System

GB/T 40581 Calculation Specification for Power System Security and Stability

DL/T 2528 Basic Terminology of Electrical Energy Storage

3 Terms and Definitions

What is defined in DL/T 2528, and the following terms and definitions are applicable to this document.

3.1 electrochemical energy storage station model

Electrochemical energy storage station model refers to a simulation model of electrochemical energy storage power station for power system load flow calculation, and the calculation and analysis of electromagnetic transient, electromechanical transient and mid-long term dynamic process.

NOTE: generally, it includes one or multiple sets of electromechanical energy storage system model, electrochemical energy storage station control model and in-station power collection and boosting system model.

3.9 mid-long term dynamic simulation model

Mid-long term dynamic simulation model refers to a model used for the simulation of the long-term dynamic process in the power system, which mainly reflects the dynamic characteristics of each component of the power system from tens of seconds to tens of minutes.

4 Overall Requirements

4.1 The electrochemical energy storage station model shall be able to reflect the electrical characteristics, battery energy state, and charging and discharging characteristics of the electrochemical energy storage power station, and satisfy the requirements for power system simulation analysis and calculation specified in GB 38755 and GB/T 40581.

4.2 The electrochemical energy storage station model shall be constructed in accordance with the actual electrical structure of the power station, and include one or multiple sets of electrochemical energy storage system model, electrochemical energy storage station control model and in-station power collection and boosting system model. See Appendix A for the typical structure of the electrochemical energy storage station model.

4.3 For multiple electrochemical energy storage systems in the station consisting of energy storage batteries and converters of the same specification and model, and the same topological structure, they can be equivalent to the same electrochemical energy storage system for modeling. The electrochemical energy storage systems with different specifications, models and topological structures should be respectively modeled. When the mode of equivalent modeling is adopted, influencing factors, for example, the impedance of the converging circuits should be considered.

4.4 The electrochemical energy storage station model should adopt measured parameters. When the measured parameters cannot be obtained, parameter identification shall be performed based on exit-factory parameters and experimental curves or digital-analog hybrid simulation models.

4.5 The electrochemical energy storage station model shall be subject to simulation tests in accordance with the actual working conditions, so as to verify the validity of the model.

5 Load Flow Calculation Model

5.1 The load flow calculation model of the electrochemical energy storage power station shall be constructed in accordance with the topological structure of the primary system in the station, and include electrochemical energy storage system model and in-station power collection and boosting system model, etc. See Appendix B for the model structure.

5.2 The electrochemical energy storage system should set the type of load flow calculation nodes in accordance with the control mode and the demands for load flow calculation, and include the node types of constant active and reactive power (PQ node), and constant active voltage (PV node), etc.

5.3 The parameters of the load flow calculation model of the electrochemical energy storage station shall include the active power and reactive power limits of each electrochemical energy storage system, and the current power setting value and voltage setting value of the electrochemical energy storage system.

6 Electromagnetic Simulation Model

6.1 The electromagnetic transient simulation model of the electrochemical energy storage power station shall be able to simulate the dynamic characteristics of the energy storage power station on a time scale of microseconds to seconds. It can be used for the analysis of the dynamic response characteristics between the energy storage power station and the power system in the full electromagnetic transient simulation of large power grids, as well as the simulation calculation of fast action characteristics simulation of power electronic equipment in the energy storage power station and control parameter setting, etc.

6.2 The electromagnetic transient simulation model of the electrochemical energy storage power station shall include the electrochemical energy storage system model and in-station boosting transformer. See Appendix C for the model structure.

6.3 The primary circuit of the electrochemical energy storage system model shall be composed of main equipment models, such as: energy storage batteries and converters, etc., among which:

- a) The energy storage battery model shall include battery cluster equivalent module, which shall calculate the equivalent internal electric potential and internal resistance in accordance with the connection mode and parameters of the battery cluster;
- b) The converter model shall be constructed in accordance with the actual circuit topology. The model shall include modules such as: converter bridge, DC capacitor and AC filter circuit, etc. See Appendix D for the typical structure of the AC filter circuit;
- c) The converter bridge model shall be selected in accordance with the simulation scenario. The system-level simulation should adopt average value model, and the equipment-level simulation should adopt switching function model.

6.4 The control system modeling method of the electrochemical energy storage system model shall be selected in accordance with the types of model, which include digital-analog hybrid simulation model, electromagnetic transient packaging model and electromagnetic transient structural model, etc., among which:

- a) The digital-analog hybrid simulation model shall be composed of digital model, physical simulation system for control and protection, and digital-analog hybrid simulation interface, and the overall model shall be subject to experimental verification;
- b) The control system of the electromagnetic transient packaging model shall be formed

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