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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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Replacing GB/T 32509-2016

General specification for vanadium flow battery

全钒液流电池通用技术条件

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1 Scope

This document specifies the conditions of use, technical requirements, inspection rules, marking, instruction for use, packaging, transportation and storage of vanadium flow battery, and describes the corresponding test methods.

This document applies to the research, development, production, manufacturing, and testing of vanadium flow battery (hereinafter referred to as "battery").

2 Normative references

GB/T 9969

GB/T 29840

GB/T 33339-2025

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in GB/T 29840, apply.

3.1 vanadium flow battery; VFB

vanadium flow battery system An energy storage device that achieves the interconversion of electrical energy and chemical energy through the electrochemical reaction of vanadium ions in different valence states in the positive and negative electrode electrolytes.

Note. A vanadium flow battery is mainly composed of power units (stacks or modules), energy storage units (electrolyte and storage tanks), electrolyte delivery units (pipelines, valves, pumps, heat exchangers, etc.), and battery management systems, but does not include charging and discharging equipment.

[Source. GB/T 29840-2013, 2.1]

3.2 rated charging capacity

The charging capacity that a battery can achieve under specified test conditions and methods.

Note. The unit of rated charging capacity is watt-hour (Wh), kilowatt-hour (kWh), or megawatt-hour (MWh).

3.3 rated discharging capacity

The discharging capacity that a battery can achieve under specified test conditions and methods.

Note. The unit of rated discharging capacity is watt-hour (Wh), kilowatt-hour (kWh), or megawatt-hour (MWh).

3.4 rated energy efficiency

The ratio of the discharging capacity to the charging capacity of a battery under specified test conditions and methods.

Note. Rated energy efficiency is expressed as a percentage (%).

3.5 range coefficient of fuel cell stack

The ratio of the difference between the maximum and minimum voltage values of all battery stacks to the average value of the battery under specified test conditions and methods.

Note. The range coefficient of fuel cell stack is expressed as a percentage (%).

4 Environmental conditions

Environmental conditions shall meet the following requirements.

- a) Temperature. $-30^{\circ}\text{C} \sim 40^{\circ}\text{C}$;
- b) Relative humidity. $5\% \sim 95\%$;
- c) Altitude. $\leq 2\,000\text{ m}$.

Note 1. The electrolyte temperature range shall be determined by the manufacturer based on the electrolyte characteristics.

Note 2. The scope of use beyond environmental conditions shall be determined through consultation between the manufacturer and the user.

5.1 Appearance

The appearance shall meet the following requirements.

- a) The exterior surface shall be clean, with no electrolyte leakage or seepage, no structural damage, and no oxidation or corrosion at electrical contact points;
- b) The product marking shall be displayed in a prominent external location, as shown in 8.1.

5.2.1 Rated energy efficiency

The rated energy efficiency of the battery shall meet the following requirements.

- Batteries with a rated power of less than 50 kW shall have a rated energy efficiency of no less than 65%;
- Batteries with a rated power of 50 kW ~ 150 kW shall have a rated energy efficiency of no less than 68%;
- Batteries with a rated power greater than 150 kW shall have a rated energy efficiency of no less than 70%.

5.2.2 Rated charging capacity

The charging capacity of the battery shall not be lower than the rated charging capacity specified in the product's nominal specifications.

5.2.3 Rated discharging capacity

The rated discharging capacity of the battery shall not be lower than the rated discharging capacity specified in the product's nominal specifications.

5.2.4 Charging overload capacity

The charging overload capacity shall meet the following requirements.

- a) For batteries with a maximum charging time of 100 minutes or more at rated power, the charging time at 1.1 times the rated power shall not be less than 10 minutes, and the charging time at 1.2 times the rated power shall not be less than 1 minute;
- b) For batteries with a maximum charging time of less than 100 minutes at rated power, the charging time at 1.1 times the rated power shall not be less than 10% of the total charging time, and the charging time at 1.2 times the rated power shall not be less than 1% of the total charging time.

5.2.5 Discharging overload capacity

The discharging overload capacity shall meet the following requirements.

- a) For batteries with a maximum charging time of 100 minutes or more at rated power, the discharging time at 1.1 times the rated power shall not be less than 10 minutes; and the discharging time at 1.2 times the rated power shall not be less than 1 minute.
- b) For batteries with a maximum discharging time of less than 100 minutes at rated power, the discharging time at 1.1 times the rated power shall not be less than 10% of the total charging time, and the discharging time at 1.2 times the rated power shall not be less than 1% of the total charging time.

5.2.6 High-temperature storage performance

Tested in accordance with 6.2.6, the discharging capacity shall not be less than the rated discharging capacity specified in the product's nominal specifications.

5.2.7 Low-temperature storage performance

Tested in accordance with 6.2.7, the discharging capacity shall not be less than the rated discharging capacity specified in the product's nominal specifications.

5.2.8 Stack voltage consistency

The range coefficient of fuel cell stack shall not exceed 4%.

5.3 Monitoring and protection functions

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