

ICS 29.220.01
CCS K 84

NB

**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 11488-2024

**General specification for power conversion system of flow
battery energy storage system**

液流电池储能系统变流器通用技术条件

Issued on: May 24, 2024

Implemented on: November 24, 2024

Issued by: National Energy Administration of the PRC

Table of Contents

Foreword	3
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Classification and coding	3
4.1 Product classification	3
4.2 Product coding	4
5 Normal service conditions	5
5.1 Appearance and construction	5
5.2 Environmental conditions	5
5.3 Electrical conditions for grid-connected operation	5
5.4 Conditions for stand-alone operation	5
6 Basic functions	6
6.1 Start-up and shutdown	6
6.2 Zero-voltage start-up and pre-charging	6
6.3 Voltage limiting	6
6.4 Power control	6
6.5 Switching between grid-connected and stand-alone operation	6
6.6 Operating modes	6
6.7 Alarm and protection	7
6.8 Insulation resistance monitoring	7
6.9 Communication	7
6.10 Monitoring of operating information	7
6.11 Statistics	7
6.12 Data display and storage	7
7 Performance requirements	7
7.1 Electrical performance	7
7.2 Safety performance	16
7.3 Mechanical performance	21
7.4 Electromagnetic compatibility	21
8 Auxiliary systems	24
8.1 Cooling system	24

8.2 Power supply	25
9 Inspection rules	25
9.1 General requirements	25
9.2 Type tests	25
9.3 Factory tests	25
9.4 Test items	25
10 Test methods	27
10.1 Check of the communication function	27
10.2 Testing of the protection functions	27
10.3 Testing of the electrical performance	30
10.4 Testing of the safety performance	51
10.5 Testing of the environmental adaptability	56
10.6 Testing of the electromagnetic compatibility	57
11 Marking, packaging, transport and storage	59
11.1 Marking	59
11.2 Packaging	59
11.3 Transport	60
11.4 Storage	60
Annex A (Informative) Typical topologies of the energy storage converter	61
Annex B (Normative) Equipment marking symbols	62
Annex C (Normative) Safety item requirements	63
Annex D (Normative) Test apparatus	66
Annex E (Normative) Verification method for the hardware-in-the-loop simulation test model of the energy storage converter	70
Annex F (Normative) Method of determining the response time, settling time and control deviation of active power control	72

Foreword

This document was issued on 24 May 2024 by the National Energy Administration of the PRC and takes effect on 24 November 2024.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 29.220.01, Chinese classification K 84.

This document was drafted in accordance with the rules given in GB/T 1.1-2020 Directives

for standardization - Part 1: Rules for the structure and drafting of standardizing documents.

Please note that some of the content of this document may be the subject of patent rights. The issuing body of this document assumes no responsibility for identifying patents.

This document was proposed by, and is under the administration of, the energy storage standardization technical committee of the energy industry.

This document is issued for the first time.

1 Scope

NB/T 11488-2024 is the Chinese specification for the power conversion system - the PCS - of a flow battery energy storage installation. It exists because the flow battery is the technology China is building for storage measured in hours, and because the converter, not the battery, is what the grid actually sees. The stacks and the vanadium tanks store the energy, but every ampere entering or leaving them passes through the PCS, and it is the PCS that decides whether the plant behaves as an asset the system operator can rely on or as a liability that trips off at the worst moment. A flow battery also makes demands a lithium converter does not: its terminal voltage swings widely with state of charge, the pumps have to keep running, and constant current and constant voltage charging both have to be held precisely, which is why this document defines stabilized current precision and stabilized voltage precision as measured quantities rather than marketing terms. The requirements that matter most are the grid ones. The converter has to ride through faults rather than disconnect: low voltage ride through when the system voltage dips, high voltage ride through when it rises, and frequency ride through, each within a specified range and time. It has to provide primary frequency modulation, with the response time defined as reaching 90 percent of the commanded power change and the settling time as the point after which the error never again exceeds 5 percent. It has to provide inertia response, adjusting active power according to the rate of change of frequency to slow it. And it has to have anti-islanding protection so it cannot energise a dead network. Around those, the document sets the classification by grid connection and by voltage level, the normal service conditions for grid-connected and stand-alone operation, twelve basic functions from zero-voltage start-up and pre-charging through mode switching to data storage, and the full performance requirements for electrical, safety, mechanical and electromagnetic compatibility, together with the auxiliary cooling and supply systems. Half the document is test method: six clauses of testing and six annexes, including the normative safety item requirements, the test apparatus, the verification method for the hardware-in-the-loop simulation model of the converter, and the method of determining active power control response time, settling time and deviation. It applies to converters up to 1 kV AC at 50 Hz with battery side voltage up to 1 500 V DC. It was issued on 24 May 2024 by the National Energy Administration and took effect on 24 November 2024.

This document specifies the normal service conditions, the basic functions, and the

performance requirements for the electrical performance, the safety performance, the mechanical performance and the auxiliary systems of the power conversion system of a flow battery energy storage system, hereinafter referred to as the energy storage converter, and sets out the requirements for the inspection rules, the test methods, the marking, the packaging, the transport and the storage.

This document applies to three-phase and single-phase converters that use an electrochemical flow battery as the storage medium.

This document applies to converters whose alternating current side voltage is 1 kV and below, whose alternating current side frequency is 50 Hz, and whose battery side direct current voltage is 1 500 V and below. Energy storage system converters connected through a transformer to an alternating current side above 1 kV may use it for reference.

The direct current converters (DC/DC) of a flow battery energy storage system, and the integrated photovoltaic and storage converters with a PV port, may also use it for reference.

2 Normative references

The contents of the following documents constitute indispensable provisions of this document through normative reference in the text. For dated references, only the edition corresponding to that date applies to this document. For undated references, the latest edition, including all amendments, applies to this document.

GB/T 34120 Technical specification for power conversion system of electrochemical energy storage system

GB/T 34133 Technical specification for testing of power conversion system for energy storage

GB/T 3859.23 Semiconductor converters - General requirements and line commutated converters - Part 1-2: Application guide

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

GB/T 2423.4 Environmental testing for electric and electronic products - Part 2: Test methods - Test Db: Damp heat, cyclic

GB/T 7251.1 Low-voltage switchgear and controlgear assemblies - Part 1: General rules

GB/T 12325 Power quality - Deviation of supply voltage

GB/T 12326 Power quality - Voltage fluctuation and flicker

GB/T 13384 General specifications for packing of mechanical and electrical products

GB/T 14549 Power quality - Harmonics in public supply network