

Translated English of Chinese Standard: NB/T42107-2017

www.ChineseStandard.net → Buy True-PDF → Auto-delivery.

Sales@ChineseStandard.net

NB

ENERGY INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 29.120.40

K 43

Filing No.: 59884-2017

NB/T 42107-2017

High-voltage direct current circuit-breaker

高压直流断路器

Issued on: August 02, 2017

Implemented on: December 01, 2017

Issued by: National Energy Administration

Table of Contents

Foreword	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Normal and special use conditions	11
5 Rated value	11
5.1 Rated DC voltage	11
5.2 Rated current	12
5.3 Rated short-circuit current	12
5.4 Rated interrupting current	12
5.5 Maximum continuous operating current	12
5.6 Insulation level	12
5.7 Number of mechanical operations	13
5.8 Number of breakings of rated interrupting current	13
5.9 Rated power consumption	13
5.10 Rated energy absorption	13
5.11 Rated auxiliary and control circuit power supply voltage	14
6 Structure and performance requirements	14
6.1 Overview	14
6.2 General requirements	14
6.3 Terminal mechanical load	14
6.4 Creepage distance	15
6.5 Auxiliary and control equipment	15
6.6 Power operation	15
6.7 Degree of protection of enclosure	15
6.8 Nameplate	15
6.9 Electromagnetic compatibility (EMC)	16
7 Type test	16

7.1 General.....	16
7.2 Insulation test.....	16
7.3 Measurement of main circuit resistance	16
7.4 Temperature rise test	16
7.5 Verification of degree of protection	17
7.6 Sealing test	17
7.7 Electromagnetic compatibility test (EMC)	17
7.8 Mechanical operation test at ambient air temperature	17
7.9 Terminal static load test.....	17
7.10 Breaking test of DC circuit-breaker	17
7.11 Seismic test.....	19
8 Exit-factory test	19
8.1 Overview	19
8.2 Exit-factory test of the whole machine (when applicable).....	19
8.3 Measurement of main circuit resistance	19
8.4 Design and appearance inspection	19
9 Special test.....	20
10 Field test	20
11 Rules for transportation, storage, installation, operation, maintenance.....	20
11.1 Overview	20
11.2 Conditions for transportation, storage, installation.....	20
11.3 Installation	20
11.4 Operation	20
11.5 Maintenance.....	21
12 Safety	22
13 Impact of the product on environment	22
Appendix A (Informative) Guidelines for the selection of DC circuit-breakers	23
Appendix B (Informative) Overload current of DC transmission system.....	25
Appendix C (Informative) DC circuit-breaker test circuit and test current waveform	26
References	30

High-voltage direct current circuit-breaker

1 Scope

This standard applies to high-voltage DC circuit-breakers (hereinafter referred to as DC circuit-breakers) for DC 6 kV and above power systems. This standard is mainly for mechanical DC circuit-breakers. Power electronic and hybrid DC circuit-breakers can also refer to this standard.

This standard specifies the operating environment conditions, terms and definitions, ratings, technical requirements, type tests, exit-factory tests, special tests, field tests, etc. of DC circuit-breakers.

This standard also applies to the operating mechanism of DC circuit-breakers and their auxiliary equipment.

Note: This standard covers lightning arresters, capacitors, reactors and other devices used in DC circuit-breakers.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 1094.6-2011 Power transformers - Part 6: Reactors

GB 1984-2014 High-voltage alternating-current circuit-breakers

GB/T 2900.20-2016 Electrotechnical terminology - High-voltage switchgear and controlgear

GB/T 11022-2011 Common specifications for high-voltage switchgear and controlgear standards

GB/T 13498-2017 Terminology for high-voltage direct current (HVDC) transmission

GB/T 13540 Seismic qualification for high voltage switchgear and controlgear

Note: Where there are special requirements for DC voltage, it shall be determined by negotiation between the supplier and the buyer.

5.2 Rated current

It shall comply with the provisions of 4.5.1 of GB/T 11022-2011.

5.3 Rated short-circuit current

The DC current expected to be interrupted by the DC circuit-breaker is selected from the following values (kA): 2, 5, 8, 10, 12.5, 16, 20, 25, 31.5, 40, 50, 63, 80, 100, 125.

Note: Where there are special requirements for current, it shall be determined by negotiation between the supplier and the buyer.

5.4 Rated interrupting current

The DC current interrupted by the DC circuit-breaker is selected from the following values (kA): 4, 5, 6.3, 8, 10, 12.5, 16, 20, 25, 31.5.

Note: Where there are special requirements for the current, it shall be determined by negotiation between the supplier and the buyer.

5.5 Maximum continuous operating current

The maximum continuous operating current is generally 1.05 ~ 1.25 times the rated current.

5.6 Insulation level

The rated insulation level of the DC circuit-breaker shall be selected from the values given in Table 1.

5.11 Rated auxiliary and control circuit power supply voltage

Complies with the provisions of 4.9 of GB/T 11022-2011.

6 Structure and performance requirements

6.1 Overview

In DC systems, DC circuit-breakers often use several parallel branches to complete the breaking task. Generally, DC circuit-breakers are composed of three parts:

- a) Low-resistance on-state current conducting branch;
- b) High-resistance current limiting and commutation branch during the breaking process;
- c) Energy absorption branch.

For the mechanical, power electronic, hybrid DC circuit-breakers described in this standard, each has different topological structures and different technical characteristics. The general topological structures of these three DC circuit-breakers are described in Appendix A.

6.2 General requirements

DC circuit-breakers shall be equipped with open and closed status indicators; their installation locations shall be clearly visible and reliable.

All components of DC circuit-breakers shall be corrosion-resistant or undergo corrosion-resistant treatment.

6.3 Terminal mechanical load

The mechanical load of the wiring terminals in DC circuit-breakers shall not be less than:

- Horizontal longitudinal: 2000 N;
- Horizontal transverse: 1500 N;
- Vertical: 1500 N.

Note 1: See 6.2.3 of GB/T 25309-2010.

Note 2: The wiring load under different voltage levels shall meet the requirements of actual working conditions.

6.4 Creepage distance

It shall be in accordance with actual engineering requirements.

6.5 Auxiliary and control equipment

Comply with the provisions of 5.4 of GB/T 11022-2011 and make the following supplement: For DC circuit-breakers using forced air cooling or water cooling, the relevant requirements of control equipment shall be considered.

6.6 Power operation

Comply with the provisions of 5.5 of GB/T 11022-2011.

6.7 Degree of protection of enclosure

Comply with the provisions of 5.13 of GB/T 11022-2011 and make the following supplement: The degree of protection of enclosure shall not be less than IP23.

6.8 Nameplate

The technical parameters on the nameplate shall at least include the following parameters:

- Rated DC voltage;
- Rated current;
- Rated power consumption;
- Rated short-circuit current (optional);
- Maximum continuous operating current;
- Rated lightning impulse withstand voltage;
- Rated DC withstand voltage;
- Rated interruption current;

7.5 Verification of degree of protection

Conform to the provisions of 6.7 of GB/T 11022-2011.

7.6 Sealing test

Conform to the provisions of 6.8 of GB/T 11022-2011 (when applicable).

7.7 Electromagnetic compatibility test (EMC)

Conform to the provisions of 6.9 of GB/T 11022-2011.

7.8 Mechanical operation test at ambient air temperature

Conform to the provisions of 6.101.2 of GB 1984-2014 and make the following supplement: Only mechanical operation test is carried out on mechanical disconnecting device.

7.9 Terminal static load test

The terminal force shall meet the requirements of 6.3. The test shall be carried out in accordance with the requirements of 6.101.6 of GB 1984-2014.

7.10 Breaking test of DC circuit-breaker

7.10.1 Overview

The purpose of this test is to verify whether the DC circuit-breaker has the ability to break the specified DC short-circuit current.

This test verifies that the DC circuit-breaker can successfully interrupt the DC current within the rated short-circuit current range, and that the interrupter can withstand the recovery voltage between the breaks. According to the actual project requirements, the test circuit shall be equivalent to the actual operating conditions of this type of DC circuit-breaker.

The interruption test shall at least include the following requirements:

- a) Recommended tests for products above 10 kV, see Table 2;

9 Special test

Performed in accordance with the agreement between the manufacturer and the user.

10 Field test

The purpose of the field test is to check whether the DC circuit-breaker and its auxiliary equipment are not damaged due to transportation and storage, and to verify the overall performance of the assembled DC circuit-breaker.

The field test includes the inspection and testing of the DC circuit-breaker components and the DC circuit-breaker as a whole.

Each component is implemented in accordance with its own standards.

The test methods and requirements are negotiated by the supplier and the buyer.

11 Rules for transportation, storage, installation, operation, maintenance

11.1 Overview

Comply with the provisions of Chapter 10 of GB/T 11022-2011.

11.2 Conditions for transportation, storage, installation

Comply with the provisions of 10.1 of GB/T 11022-2011.

11.3 Installation

Comply with the provisions of 10.2.1 ~ 10.2.4 of GB/T 11022-2011.

11.4 Operation

The instructions provided by the manufacturer shall include the following information:

- General description of the equipment, with particular attention to its characteristics and technical description of operation, so that the user fully understands the main principles involved;

- Description of the safety performance of the equipment;
- Description of the actions taken to operate, isolate, ground, maintain, test the equipment related to operation.

11.5 Maintenance

11.5.1 Overview

The effectiveness of maintenance depends mainly on the content of the instructions written by the manufacturer and the extent to which the user implements the instructions.

11.5.2 Recommendations for manufacturers

The manufacturer shall provide a maintenance manual that includes the following information:

- Scope and frequency of maintenance:
- Detailed description of maintenance work;
- A complete set of drawings of switchgear and controlgear details that are critical to maintenance, with clear markings of general assembly, subassembly, important parts on the drawings;
- Limit values and allowable deviations; if there are deviations, make necessary corrections;
- Specifications of auxiliary maintenance materials, including warnings for known incompatible materials;
- List of special tools, lifting and maintenance equipment:
- Test items after maintenance;
- Recommended spare parts (description, code, quantity) and storage recommendations;
- Estimates of effective planned maintenance time;
- At the end of the operating life of the equipment, how to deal with the equipment, including environmental requirements.

11.5.3 Recommendations for users

If the user wishes to perform maintenance by himself, his staff shall have a detailed understanding of the corresponding switchgear and controlgear.

Appendix A

(Informative)

Guidelines for the selection of DC circuit-breakers

A.1 Overview

This Appendix applies to DC circuit-breakers for DC transmission with voltage levels of 6 kV and above. The recommended values of the rated parameters of DC circuit-breakers are as shown in Chapter 5 of this standard.

In order to make the DC circuit-breaker suitable for the specified operating task, it shall be selected according to the various rated values required by the load conditions and fault conditions.

A.2 Selection of DC circuit-breaker ratings

A.2.1 Selection of rated DC voltage

The rated DC voltage of the DC circuit-breaker can be selected from 5.1.

A.2.2 Selection of rated current

The rated operating current of the DC circuit-breaker is determined by the rated current of the DC project.

The rated current of the DC circuit-breaker can be selected from 5.2.

A.3 Selection of DC circuit-breaker type

The typical schemes of DC circuit-breakers are: mechanical, power electronic, hybrid.

- a) Mechanical DC circuit-breakers are generally composed of breaking device (CB), commutation capacitor (C), commutation reactor (L), commutation switch (G), lightning arrester (MOV), as shown in the dotted box in Figure A.1;
- b) Power electronic DC circuit-breakers are generally composed of power electronic components (S) and lightning arrester (MOV), as shown in the dotted box in Figure A.2;
- c) Hybrid DC circuit-breakers are generally composed of fast mechanical disconnecter (FD), auxiliary DC switch (FS), main DC switch (MS), lightning arrester (MOV), among which the main DC switch and auxiliary DC switch are both power electronic components. As shown in the dotted box in Figure A.3.

DB1 and DB2 in Figures A.1, A.2, A.3 are auxiliary isolation devices used to interrupt residual current.

This is an excerpt of the PDF (Some pages are marked off intentionally)

Full-copy PDF can be purchased from 1 of 2 websites:

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

----- The End -----