

# TECHNICAL SPECIFICATION

High-voltage switchgear and controlgear –  
Part 316: Direct current by-pass switches and paralleling switches

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

## Part 316: Direct current by-pass switches and paralleling switches

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IEC TS 62271-316 has been prepared by subcommittee 17A: Switching devices, of IEC technical committee 17: High-voltage switchgear and controlgear. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
17A/1407/DTS	17A/1414/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

This document shall be read in conjunction with IEC TS 62271-5:2024, to which it refers, and which is applicable unless otherwise specified in this document. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC TS 62271-5. Modifications to these clauses and subclauses are given under the same references whilst additional subclauses are numbered from 101.

A list of all parts in the IEC 62271 series, published under the general title *High-voltage switchgear and controlgear*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 316: Direct current by-pass switches and paralleling switches

#### 1 Scope

This part of IEC 62271, which is a Technical Specification, is applicable to direct current (DC) by-pass switches (BPS) and paralleling switches (PS) designed for indoor or outdoor installation and for operation on HVDC transmission systems having direct voltages of 100 kV and above.

Switches other than mechanical switching devices used for the same applications specified here are not covered by this document.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60050-441, *International Electrotechnical Vocabulary (IEV) – Part 441: Switchgear, controlgear and fuses*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60050-442, *International Electrotechnical Vocabulary (IEV) – Part 442: Electrical accessories*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60050-461, *International Electrotechnical Vocabulary (IEV) – Part 461: Electric cables*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60050-601, *International Electrotechnical Vocabulary (IEV) – Part 601: Generation, transmission and distribution of electricity – General*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60050-614, *International Electrotechnical Vocabulary – Part 614: Generation, transmission and distribution of electricity – Operation*, (available at [www.electropedia.org](http://www.electropedia.org))

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60071-11:2022, *Insulation coordination – Part 11: Definitions, principles and rules for HVDC system*

IEC 60071-12:2022, *Insulation coordination – Part 12: Application guidelines for LCC HVDC converter stations*

IEC 60296, *Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment*

IEC 60376, *Specification of technical grade sulphur hexafluoride (SF<sub>6</sub>) and complementary gases to be used in its mixtures for use in electrical equipment*

IEC 60480, *Specifications for the re-use of sulphur hexafluoride (SF<sub>6</sub>) and its mixtures in electrical equipment*

IEC 60633:2019, *High-voltage direct current (HVDC) transmission – Vocabulary*

IEC TS 62271-5:2024, *High-voltage switchgear and controlgear – Part 5: Common specifications for direct current switchgear*

IEC 62271-102:2018, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*  
IEC 62271-102:2018/AMD1:2022

IEC TS 62271-315:2024, *High-voltage switchgear and controlgear – Part 315: Direct current (DC) transfer switches*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-151, IEC 60050-441, IEC 60050-442, IEC 60050-461, IEC 60050-601, IEC 60050-614, IEC TS 62271-5 and IEC 60633, some of which are recalled hereunder, and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

NOTE Terms and definitions are classified in accordance with IEC 60050-441. Reference from other parts than IEC 60050-441 are classified so as to be aligned with the classification used in IEC 60050-441.

#### 3.1 General terms and definitions

##### 3.1.101

##### **switchgear and controlgear**

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures

[SOURCE: IEC 60050-441:1984, 441-11-01]

##### 3.1.102

##### **indoor switchgear and controlgear**

switchgear and controlgear designed solely for installation within a building or other housing, where the switchgear and controlgear is protected against wind, rain, snow, abnormal dirt deposits, abnormal condensation, ice and hoar frost

[SOURCE: IEC 60050-441:1984, 441-11-04]

##### 3.1.103

##### **outdoor switchgear and controlgear**

switchgear and controlgear suitable for installation in the open air, i.e. capable of withstanding wind, rain, snow, dirt deposits, condensation, ice and hoar frost

[SOURCE: IEC 60050-441:1984, 441-11-05]

**3.1.104****ambient air temperature**

temperature, determined under prescribed conditions, of the air surrounding the complete switching device

Note 1 to entry: For switching devices installed inside an enclosure, it is the temperature of the air outside the enclosure.

[SOURCE: IEC 60050-441:1984, 441-11-13, modified – "or fuses" removed in note 1 to entry]

**3.1.105****temperature rise**

difference between the temperature of the part under consideration and the ambient air temperature

**3.1.106****external insulation**

distances in atmospheric air, and along the surfaces in contact with atmospheric air of solid insulation of the equipment which are subject to dielectric stresses and to the effects of atmospheric and other environmental conditions from the site

Note 1 to entry: Examples of environmental conditions are pollution, humidity, vermin, etc.

[SOURCE: IEC 60050-614:2016, 614-03-02]

**3.1.107****internal insulation**

internal distances of the solid, liquid or gaseous insulation of equipment which are protected from the effects of atmospheric and other external conditions

[SOURCE: IEC 60050-614:2016, 614-03-03]

**3.2 Assemblies of switchgear and controlgear**

No particular definitions.

**3.3 Parts of assemblies**

No particular definitions.

**3.4 Switching devices****3.4.101****switching device**

device designed to make or break the current in one or more electric circuits

[SOURCE: IEC 60050-441:2000, 441-14-01]

**3.4.102****mechanical switching device**

switching device designed to close and open one or more electric circuits by means of separable contacts

Note 1 to entry: Any mechanical switching device may be designated according to the medium in which its contacts open and close, for example, air, SF<sub>6</sub>, oil.

[SOURCE: IEC 60050-441:1984, 441-14-02]

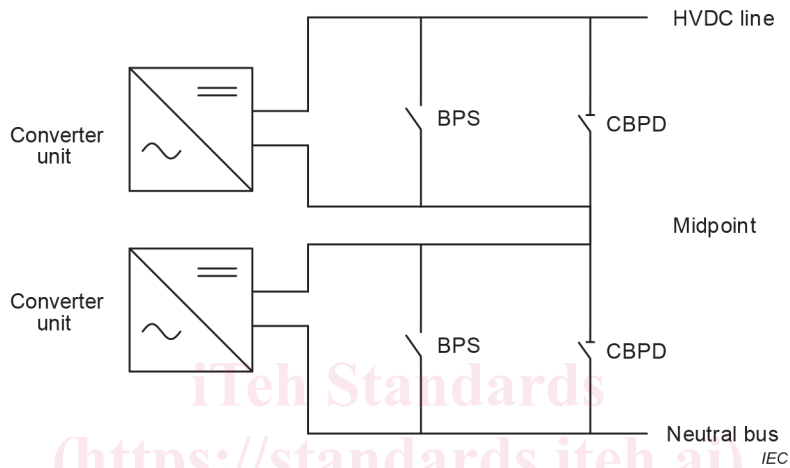
**3.4.103**  
**by-pass switch**  
**BPS**

high-speed DC switch connected across each converter unit in HVDC schemes using more than one independent converter unit per pole, designed to close rapidly to bypass a converter unit that is being taken out of service and commutate the current back into a converter unit that is being taken back in service

Note 1 to entry: A BPS may also be used for prolonged shunting of the converter unit(s).

Note 2 to entry: Figure 1 illustrates the position of the BPS.

Note 3 to entry: BPS are most commonly used in LCC HVDC schemes.



**Key**

BPS By-pass switch

BPD By-pass disconnector

NOTE Figure 1 shows an example of the location of the BPS for one polarity only.

**Figure 1 – Example of the location of BPSs in an HVDC transmission system**

[SOURCE: IEC 60633:2019, 9.30, modified – The wording "converter valve group" and "group" replaced with "converter unit" in the definition; Notes 1 and 2 to entry changed; Note 3 to entry and Figure 1 added.]

**3.4.104**  
**paralleling switch**  
**PS**

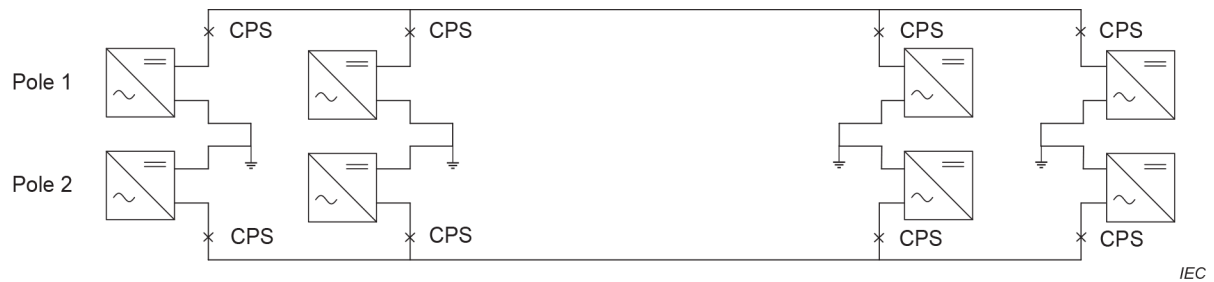
mechanical switching device intended for rapid configuration of a HVDC system

Note 1 to entry: A PS can either be a converter paralleling switch or a line paralleling switch.

**3.4.105**  
**converter paralleling switch**  
**CPS**

high-speed DC switch connected in series with each converter at the high-voltage DC terminal in HVDC schemes where two or more converters are connected in parallel onto a common pole conductor, designed to allow additional converter(s) to be connected in parallel or disconnected without affecting the load current in the other converter

Note 1 to entry: Figure 2 illustrates the position of the CPS.

**Key**

CPS Converter paralleling switch

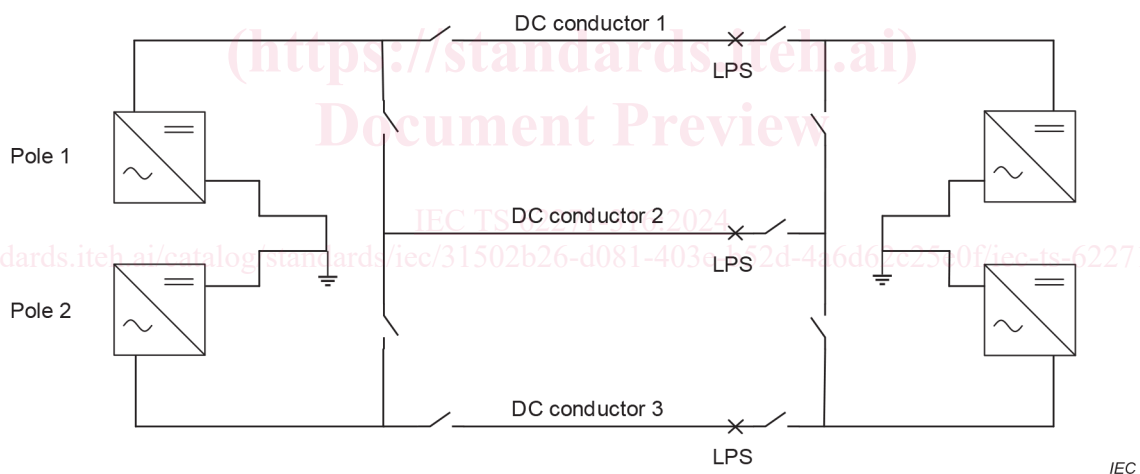
**Figure 2 – Example of the location of a CPS in an HVDC transmission system**

[SOURCE: IEC 60633:2019, 9.28, modified – Note 1 to entry changed and Figure 2 added.]

### 3.4.106 line paralleling switch LPS

DC commutation switch placed in series with one or more high-voltage pole conductors, allowing two or more lines to be connected in parallel or to revert to single-line operation while conducting load current

Note 1 to entry: Figure 3 illustrates the position of the LPS.

**Key**

LPS Line paralleling switch

**Figure 3 – Example of the location of a LPS in an HVDC transmission system**

[SOURCE: IEC 60633:2019, 9.29, modified – Note 1 to entry changed and Figure 3 added.]

## 3.5 Parts of switchgear and controlgear

### 3.5.101 main circuit

<of a switching device> all the conductive parts of a switching device included in the circuit which it is designed to close or open

[SOURCE: IEC 60050-441:1984, 441-15-02]

**3.5.102****main contact**

contact included in the main circuit of a mechanical switching device, intended to carry, in the closed position, the current of the main circuit

[SOURCE: IEC 60050-441:1984, 441-15-07]

**3.5.103****arcing contact**

contact on which the arc is intended to be established

Note 1 to entry: An arcing contact may serve as a main contact; it may be a separate contact so designed that it opens after and closes before another contact which it is intended to protect from injury.

[SOURCE: IEC 60050-441:1984, 441-15-08]

**3.5.104****"a" contact****make contact**

control or auxiliary contact which is closed when the main contacts of the mechanical switching device are closed and open when they are open

[SOURCE: IEC 60050-441:1984, 441-15-12]

**3.5.105****"b" contact****break contact**

control or auxiliary contact which is open when the main contacts of a mechanical switching device are closed and closed when they are open

[SOURCE: IEC 60050-441:1984, 441-15-13]

**3.5.106****release**

<of a mechanical switching device> device, mechanically connected to a mechanical switching device, which releases the holding means and permits the opening or the closing of the switching device

[SOURCE: IEC 60050-441:1984, 441-15-17]

**3.5.107****arc control device**

device, surrounding the arcing contacts of a mechanical switching device, designed to confine the arc and to assist in its extinction

[SOURCE: IEC 60050-441:1984, 441-15-18]

**3.5.108****terminal**

conductive part of a device, electric circuit or electric network, provided for connecting that device, electric circuit or electric network to one or more external conductors

Note 1 to entry: The term "terminal" is also used for a connection point in circuit theory.

[SOURCE: IEC 60050-151:2001, 151-12-12]