

# TECHNICAL SPECIFICATION



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**High voltage direct current (HVDC) power transmission – System requirements  
for DC-side equipment  
Part 1: Using line-commutated converters**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HIGH VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION –  
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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 63014, which is a Technical Specification, has been prepared by IEC technical committee 115: High Voltage Direct Current (HVDC) transmission for DC voltages above 100 kV.

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

Enquiry draft	Report on voting
115/167/DTS	115/178/RVDTS

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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# HIGH VOLTAGE DIRECT CURRENT (HVDC) POWER TRANSMISSION – SYSTEM REQUIREMENTS FOR DC-SIDE EQUIPMENT

## Part 1: Using line-commutated converters

### 1 Scope

This Technical Specification is intended to provide an overall and consistent set of guidelines to facilitate the specification of equipment for the DC-side of a high-voltage direct current (HVDC) system using line-commutated converters. For point-to-point HVDC transmission systems, this document covers all DC-side equipment located between the converter valves and the DC overhead line or cable termination, excluding the converter valves themselves. For back-to-back HVDC systems, this document covers all DC-side equipment excluding the converter valves themselves. Throughout this publication, the terms 'direct voltage' and 'DC voltage' are used interchangeably, as are 'direct current' and 'DC current'.

Traditionally, the largest items of such equipment, such as the DC smoothing reactor and DC harmonic filters, have generally been located outdoors but increasingly the trend is to locate such equipment indoors (although not in the valve hall itself) to provide protection from pollution. Although product standards exist for some DC-side equipment types, many such items of equipment have only standards written for AC applications and, in such cases, the purpose of this document is to provide guidance as to how to specify the additional requirements (particularly with regard to testing) for such equipment to cover their use in DC conditions.

The converter itself is excluded from this scope, being covered by IEC 60700-1 [1]<sup>1</sup> and IEC 60700-2 [2].

Although this document includes requirements for DC disconnectors and certain types of specialised DC switching devices (such as the Metallic Return Transfer Switch (MRTS)), it excludes any type of DC circuit-breaker designed to interrupt fault currents.

DC-side equipment for HVDC systems based on voltage-sourced converter (VSC) technology is excluded from this document and will be covered in a future Part 2 of IEC 63014.

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

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-5, *Insulation co-ordination – Part 5: Procedures for high-voltage direct current (HVDC) converter stations*

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<sup>1</sup> Numbers in square brackets refer to the Bibliography.



IEC 60076-6:2007, *Power transformers – Part 6: Reactors*

IEC 60099-9:2014, *Surge arresters – Part 9: Metal-oxide surge arresters without gaps for HVDC converter stations*

IEC 60168, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000 V*

IEC 60353, *Line traps for a.c. power systems*

IEC 60358-1, *Coupling capacitors and capacitor dividers – Part 1: General rules*

IEC 60383 (all parts), *Insulators for overhead lines with a nominal voltage above 1 000 V*

IEC 60437, *Radio interference test on high-voltage insulators*

IEC 60633, *Terminology for high-voltage direct current (HVDC) transmission*

IEC TS 60815-4, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 4: Insulators for d.c. systems*

IEC 60871-1:2014, *Shunt capacitors for a.c. power systems having a rated voltage above 1 000 V – Part 1: General*

IEC 60871-4:2014, *Shunt capacitors for AC power systems having a rated voltage above 1 000 V – Part 4: Internal fuses*

IEC TS 61245, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on d.c. systems*

IEC 61462, *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*

IEC 61466 (all parts), *Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V*

IEC 61850-9-2, *Communication networks and systems for power utility automation – Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

IEC 61869-9, *Instrument transformers – Part 9: Digital interface for instrument transformers*

IEC 61869-14, *Instrument transformers – Part 14: Specific requirements for DC current transformers*<sup>2</sup>

IEC 61869-15, *Instrument transformers – Part 15: Specific requirements for DC voltage transformers*<sup>3</sup>

IEC TS 61936-2, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 2: DC*

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<sup>2</sup> Under preparation. Stage at the time of publication: IEC/FDIS 61869-14:2017.

<sup>3</sup> Under preparation. Stage at the time of publication: IEC/FDIS 61869-15:2017.

IEC 62217, *Polymeric HV insulators for indoor and outdoor use – General definitions, test methods and acceptance criteria*

IEC 62231, *Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV – Definitions, test methods and acceptance criteria*

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-109:2008, *High-voltage switchgear and controlgear – Part 109: Alternating-current series capacitor by-pass switches*

IEC 62772, *Composite hollow core station post insulators for substations with a.c. voltage greater than 1 000 V and d.c. voltage greater than 1 500 V – Definitions, test methods and acceptance criteria*

IEC TS 62896, *Hybrid insulators for AC and DC for high-voltage applications – Definitions, test methods and acceptance criteria*

IEC Guide No. 111, *Electrical high-voltage equipment in high-voltage substations – Common recommendations for product standards*

IEC/IEEE 65700-19-03:2014, *Bushings for DC application*