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High-voltage switchgear and controlgear – Part 5: Common specifications for direct current switchgear and controlgear

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –**Part 5: Common specifications for direct current
switchgear and controlgear**

FOREWORD

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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 document 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. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The list of all parts of the IEC 62271 series 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 "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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INTRODUCTION

This Technical Specification has been prepared by TC 17 and it defines common specifications for high-voltage direct current (HVDC) switchgear and controlgear covering both types of air insulated (AIS) and gas insulated (GIS) equipment of HVDC substations. This document includes rules for service conditions, ratings, design and construction requirements. Test requirements and criteria to proof for passing type and routine tests are defined in this document for development and manufacturing of HVDC switchgear.

This specification is applicable for both LCC and VSC HVDC technology.

SC 17A is in the process of preparing documents for the following HVDC switching devices:

- circuit-breakers (IEC TS 62271-313 [1])¹;
- disconnectors and earthing switches (IEC TS 62271-314 [2]);
- transfer switches (IEC TS 62271-315 [3]);
- by-pass switches and paralleling switches (IEC TS 62271-316 [4]).

SC 17C is in the process of preparing a document for DC gas insulated switchgears (IEC TS 62271-318 [5]).

Standardization of direct voltages is the responsibility of TC 8 (System aspects of electrical energy supply).

TC 99 (Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC) defines requirements of DC substations for safety of insulation, equipment, installation and earthing (IEC 61936-2).

TC 115 (High Voltage Direct Current (HVDC) transmission for DC voltages above 100 kV) is responsible for DC transmission system aspects. It is the responsibility of TC 115 to define requirements for different equipment (e. g. switching devices) from system point of view. These definitions are implemented in documents from other TCs. Several Working Groups and Maintenance Teams are preparing documents on reliability, EMC, asset management, system design, DC harmonics, testing, HVDC grids, VSC and LCC converter and insulation coordination for HVDC systems.

¹ Numbers in square brackets refer to the Bibliography.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 5: Common specifications for direct current switchgear and controlgear

1 Scope

This part of IEC 62271, which is a Technical Specification, applies to DC switchgear and controlgear designed for operation on HVDC transmission systems having direct voltages of 100 kV and above.

This document applies to all high-voltage switchgear and controlgear for indoor and/or outdoor installation except as otherwise specified in the relevant IEC documents for the particular type of switchgear and controlgear.

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 60038:2009, *IEC standard voltages*

IEC 60050-614:2016, *International Electrotechnical Vocabulary (IEV) – Part 614: Generation, transmission and distribution of electricity – Operation*

IEC 60050-811, *International Electrotechnical Vocabulary (IEV) – Part 811: Electric traction*

IEC 60050-826:2022, *International Electrotechnical Vocabulary (IEV) – Part 826: Electrical installations*

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

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-2:2018, *Insulation co-ordination – Part 2: Application guidelines*

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

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60255-21-1:1988, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section One: Vibration tests (sinusoidal)*

IEC 60270, *High-voltage test techniques – Partial discharge measurements*

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

IEC 60376, *Specification of technical grade sulphur hexafluoride (SF₆) and complementary gases to be used in its mixtures for use in electrical equipment*

IEC 60417:2006, *Graphical symbols for use on equipment (available at <http://www.graphical-symbols.info/equipment>)*

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

IEC 60480, *Specifications for the re-use of sulphur hexafluoride (SF₆) and its mixtures in electrical equipment*

IEC 60512-2-2, *Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

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

IEC TS 60815-4:2016, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 4: Insulators for DC systems*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-17:1999, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on DC input power port immunity tests*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

IEC 61180, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

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

IEC 61810-7:2006, *Electromechanical elementary relays – Part 7: Test and measurement procedures*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*
IEC 62271-1:2017/AMD1:2021

IEC 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for gases for insulation and/or switching*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 16-1 (all parts), *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

CISPR TR 18-2, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits*