

TECHNICAL SPECIFICATION



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

(<https://standards.iteh.ai>)

Document Preview

[IEC TS 62271-5:2024](https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024)

<https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024>





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International
Standards
Document Preview
(iteh.ai)

[IEC TS 62271-5:2024](https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024)

<https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024>



TECHNICAL SPECIFICATION



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

iteh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC TS 62271-5:2024](https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024)

<https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.130.10

ISBN 978-2-8322-8774-3

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	9
INTRODUCTION.....	11
1 Scope.....	12
2 Normative references	12
3 Terms and definitions	14
3.1 General terms and definitions	14
3.2 Assemblies of switchgear and controlgear	19
3.3 Parts of assemblies	19
3.4 Switching devices	19
3.5 Parts of switchgear and controlgear	21
3.6 Operational characteristics of switchgear and controlgear.....	25
3.6.5 Terms and definitions relative to pressure (or density).....	26
3.6.6 Terms and definitions relating to gas and vacuum tightness	27
3.6.7 Terms and definitions relating to liquid tightness.....	29
3.7 Characteristic quantities	29
3.8 Index of definitions.....	30
4 Normal and special service conditions	33
4.1 Normal service conditions	33
4.1.1 General	33
4.1.2 Indoor switchgear and controlgear.....	33
4.1.3 Outdoor switchgear and controlgear	34
4.2 Special service conditions.....	34
4.2.1 General	34
4.2.2 Altitude	34
4.2.3 Exposure to pollution.....	35
4.2.4 Temperature and humidity	35
4.2.5 Exposure to abnormal vibrations, shock or tilting	35
4.2.6 Wind speed	35
4.2.7 Other parameters	35
5 Ratings.....	36
5.1 General.....	36
5.2 Rated direct voltage (U_{rd}).....	36
5.2.1 General	36
5.2.2 Rated voltages	37
5.3 Rated insulation level (U_{dd} , U_p , U_s).....	37
5.4 Rated continuous current (I_{rd})	40
5.5 Rated values of short-time withstand current.....	40
5.5.1 Typical waveform of short-circuit current.....	40
5.5.2 Rated short-time withstand direct current (I_{kd})	43
5.5.3 Rated peak withstand current (I_{pd}).....	43
5.5.4 Rated duration of short-circuit (t_{kd}).....	43
5.6 Rated supply voltage of auxiliary and control circuits (U_a)	43
5.6.1 General	43
5.6.2 Rated supply voltage (U_a)	44
5.7 Rated supply frequency of auxiliary and control circuits	44

6	Design and construction	45
6.1	Requirements for liquids in switchgear and controlgear	45
6.2	Requirements for gases in switchgear and controlgear	45
6.3	Earthing of switchgear and controlgear	45
6.4	Auxiliary and control equipment and circuits	45
6.4.1	General	45
6.4.2	Protection against electric shock	46
6.4.3	Components installed in enclosures	46
6.5	Dependent power operation	50
6.6	Stored energy operation.....	50
6.6.1	General	50
6.6.2	Energy storage in gas receivers or hydraulic accumulators	50
6.6.3	Energy storage in springs (or weights).....	50
6.6.4	Manual charging	50
6.6.5	Motor charging	51
6.6.6	Energy storage in capacitors	51
6.7	Independent unlatched operation (independent manual or power operation)	51
6.8	Manually operated actuators	51
6.9	Operation of releases.....	51
6.9.1	General	51
6.9.2	Shunt closing release	52
6.9.3	Shunt opening release	52
6.9.4	Capacitor operation of shunt releases.....	52
6.9.5	Under-voltage release	52
6.10	Pressure/level indication	52
6.10.1	Gas pressure	52
6.10.2	Liquid level	52
6.11	Nameplates.....	53
6.11.1	General	53
6.11.2	Application.....	53
6.12	Locking devices	54
6.13	Position indication.....	55
6.14	Degrees of protection provided by enclosures	55
6.14.1	General	55
6.14.2	Protection of persons against access to hazardous parts and protection of the equipment against ingress of solid foreign objects (IP coding)	55
6.14.3	Protection against ingress of water (IP coding)	55
6.14.4	Protection against mechanical impact under normal service conditions (IK coding).....	55
6.15	Creepage distances for outdoor insulators	55
6.16	Gas and vacuum tightness	56
6.16.1	General	56
6.16.2	Controlled pressure systems for gas	56
6.16.3	Closed pressure systems for gas	56
6.16.4	Sealed pressure systems.....	56
6.17	Tightness for liquid systems.....	57
6.17.1	General	57
6.17.2	Leakage rates.....	57
6.18	Fire hazard (flammability)	57

6.19	Electromagnetic compatibility (EMC).....	57
6.20	X-ray emission.....	57
6.21	Corrosion.....	57
6.22	Filling levels for insulation, switching and/or operation.....	57
7	Type tests.....	58
7.1	General.....	58
7.1.1	Basics.....	58
7.1.2	Information for identification of test objects.....	58
7.1.3	Information to be included in type-test reports.....	58
7.2	Dielectric tests.....	59
7.2.1	General.....	59
7.2.2	Ambient air conditions during tests.....	59
7.2.3	Wet test procedure.....	60
7.2.4	Arrangement of the equipment.....	60
7.2.5	Criteria to pass the test.....	60
7.2.6	Application of the test voltage and test conditions.....	61
7.2.7	Tests of switchgear and controlgear.....	63
7.2.8	Artificial pollution tests for outdoor insulators.....	65
7.2.9	Partial discharge tests.....	65
7.2.10	Dielectric tests on auxiliary and control circuits.....	65
7.2.11	Voltage test as condition check.....	65
7.3	Resistance measurement.....	66
7.3.1	Measurement of the resistance of auxiliary contacts class 1 and class 2.....	66
7.3.2	Measurement of the resistance of auxiliary contacts class 3.....	66
7.3.3	Electrical continuity of earthed metallic parts test.....	66
7.3.4	Resistance measurement of contacts and connections in the main circuit as a condition check.....	66
7.4	Continuous current tests.....	67
7.4.1	Condition of the test object.....	67
7.4.2	Arrangement of the equipment.....	67
7.4.3	Test current and duration.....	68
7.4.4	Temperature measurement during test.....	69
7.4.5	Resistance of the main circuit.....	70
7.4.6	Criteria to pass test.....	70
7.5	Short-time withstand current and peak withstand current tests.....	74
7.5.1	General.....	74
7.5.2	Arrangement of the equipment and of the test circuit.....	74
7.5.3	Test current and duration.....	75
7.5.4	Conditions of the test object after test.....	76
7.6	Verification of the protection.....	76
7.6.1	Verification of the IP coding.....	76
7.6.2	Verification of the IK coding.....	76
7.7	Tightness tests.....	77
7.7.1	General.....	77
7.7.2	Controlled pressure systems for gas.....	78
7.7.3	Closed pressure systems for gas.....	78
7.7.4	Sealed pressure systems.....	79
7.7.5	Liquid tightness tests.....	79
7.8	Electromagnetic compatibility tests (EMC).....	79

7.8.1	Emission tests	79
7.8.2	Immunity tests on auxiliary and control circuits	82
7.8.3	Additional EMC tests on auxiliary and control circuits	85
7.9	Additional tests on auxiliary and control circuits	86
7.9.1	General	86
7.9.2	Functional tests	86
7.9.3	Verification of the operational characteristics of auxiliary contacts	86
7.9.4	Environmental tests	87
7.9.5	Dielectric test	88
7.10	X-radiation test for vacuum interrupters	88
7.10.1	General requirements	88
7.10.2	Test voltage and measurement procedure	90
7.10.3	Acceptance criteria	90
8	Routine tests	91
8.1	General.....	91
8.2	Dielectric test on the main circuit	91
8.3	Tests on auxiliary and control circuits	91
8.3.1	Inspection of auxiliary and control circuits, and verification of conformity to the circuit diagrams and wiring diagrams	91
8.3.2	Functional tests	92
8.3.3	Verification of protection against electrical shock	92
8.3.4	Dielectric tests	92
8.4	Measurement of the resistance of the main circuit.....	92
8.5	Tightness test	93
8.5.1	General	93
8.5.2	Controlled pressure systems for gas	93
8.5.3	Closed pressure systems for gas	93
8.5.4	Sealed pressure systems	93
8.5.5	Liquid tightness tests	93
8.6	Design and visual checks	93
9	Guide to the selection of switchgear and controlgear (informative)	94
9.1	General.....	94
9.2	Selection of rated values.....	94
9.3	Cable-interface considerations	94
9.4	Continuous or temporary overload due to changed service conditions.....	94
9.5	Environmental aspects	94
9.5.1	Service conditions	94
9.5.2	Clearances affected by service conditions	94
9.5.3	High humidity.....	94
9.5.4	Solar radiation	95
10	Information to be given with enquiries, tenders and orders (informative).....	95
10.1	General.....	95
10.2	Information with enquiries and orders	95
10.3	Information with tenders.....	96
11	Transport, storage, installation, operating instructions and maintenance.....	97
11.1	General.....	97
11.2	Conditions during transport, storage and installation	97
11.3	Installation	97
11.3.1	General	97

11.3.2	Unpacking and lifting	97
11.3.3	Assembly	98
11.3.4	Mounting	98
11.3.5	Connections	98
11.3.6	Information about gas and gas mixtures for controlled and closed pressure systems	98
11.3.7	Final installation inspection.....	99
11.3.8	Basic input data by the user	99
11.3.9	Basic input data by the manufacturer	99
11.4	Operating instructions	100
11.5	Maintenance	100
11.5.1	General	100
11.5.2	Information about fluids and gas to be included in maintenance manual	100
11.5.3	Recommendations for the manufacturer.....	100
11.5.4	Recommendations for the user	101
11.5.5	Failure report.....	102
12	Safety.....	103
12.1	General.....	103
12.2	Precautions by manufacturers.....	104
12.3	Precautions by users	104
13	Influence of the product on the environment	105
Annex A (informative) Examples of HVDC side switchgear arrangement for one pole in an HVDC substation		106
Annex B (informative) Exposure to pollution.....		108
B.1	General.....	108
B.2	Minimum requirements for switchgear in normal service condition.....	108
B.3	Minimum requirements for switchgear in special service condition	108
Annex C (informative) Preferred insulation levels for rated voltages lower than 105 kV.....		109
Annex D (informative) Short-circuit current in HVDC systems		110
D.1	VSC HVDC	110
D.2	LCC HVDC	111
D.3	Special case of LCC HVDC DC faults – LCC as diode bridge.....	111
D.4	HVDC systems with DC circuit-breakers.....	113
D.5	Calculation of the rated short-time withstand direct current	114
D.6	Calculation of Joule integral value (E_j)	115
Annex E (informative) References for auxiliary and control circuit components		116
Annex F (informative) List of symbols		118
Annex G (normative) Method for the weatherproofing test for outdoor switchgear and controlgear		120
Annex H (normative) Tolerances on test quantities during tests		123
Annex I (informative) Extension of validity of type tests.....		126
I.1	General.....	126
I.2	Dielectric tests	126
I.3	Short-time withstand current and peak withstand current tests	126
I.4	Electromagnetic immunity test on auxiliary and control circuits	126
I.5	Environmental tests on auxiliary and control circuits	126
Annex J (normative) Identification of test objects		128
J.1	General.....	128

J.2	Data.....	128
J.3	Drawings.....	128
Annex K (informative)	Test circuit for superimposed impulse voltage tests.....	130
K.1	General.....	130
K.2	Test circuit using blocking capacitor.....	130
K.3	Test circuit using sphere gap.....	130
Annex L (informative)	Information and technical requirements to be given with enquiries, tenders and orders.....	132
L.1	General.....	132
L.2	Normal and special service conditions (refer to Clause 4).....	132
L.3	Ratings (refer to Clause 5).....	133
L.4	Design and construction (refer to Clause 6).....	133
L.5	System information.....	134
L.6	Documentation for enquiries and tenders.....	134
Annex M (informative)	Electromagnetic compatibility on site.....	135
Annex N (informative)	Standardization activities of HVDC.....	136
Bibliography.....		137
Figure 1	– Schematic representation of superimposed impulse voltage tests.....	40
Figure 2	– Typical waveform of a short-circuit current in an HVDC system.....	42
Figure 3	– Examples of classes of contacts.....	49
Figure 4	– Diagram of connections of a switching device.....	62
Figure 5	– Test sequence for polarity reversal tests.....	65
Figure 6	– Diagram of a test circuit for the radio interference voltage test.....	81
Figure 7	– Test location of radiation survey instrument.....	90
Figure A.1	– Example of HVDC side switchgear arrangement for one pole in an HVDC substation.....	107
Figure D.1	– VSC HVDC under worst-case, pole-pole DC fault.....	110
Figure D.2	– LCC HVDC under worst-case, pole-pole DC fault.....	111
Figure D.3	– Special case LCC HVDC under worst-case, pole-pole DC fault.....	112
Figure D.4	– HVDC system with DC circuit-breaker under worst-case, pole-pole DC fault 113	
Figure D.5	– DC circuit-breaker simple model.....	113
Figure D.6	– Equivalent fault current for calculation of rated short time withstand direct current.....	114
Figure G.1	– Arrangement for weatherproofing test.....	121
Figure G.2	– Nozzle for weatherproofing test.....	122
Figure K.1	– Test circuit for superimposed impulse tests using blocking capacitor.....	130
Figure K.2	– Test circuit for superimposed impulse tests using sphere gap.....	131
Table 1	– Preferred rated insulation levels.....	38
Table 2	– Direct voltage of auxiliary and control circuits.....	44
Table 3	– Alternating voltage of auxiliary and control circuits.....	44
Table 4	– Auxiliary contact classes.....	49
Table 5	– Nameplate information.....	54
Table 6	– Test conditions in general case.....	62

Table 7 – Test conditions in case of impulse voltage tests across the isolating distance (or open switching device)	62
Table 8 – Test conditions in case of superimposed impulse voltage tests	63
Table 9 – Test conditions for polarity reversal tests	65
Table 10 – Limits of temperature and temperature rise for various parts, materials and dielectrics of high-voltage switchgear and controlgear	71
Table 11 – Permissible leakage rates for gas systems	78
Table 12 – Application of voltages at the fast transient/burst test	83
Table 13 – Application of voltage at the damped oscillatory wave test.....	84
Table 14 – Assessment criteria for transient disturbance immunity.....	85
Table C.1 – Preferred insulation levels for rated voltages lower than 105 kV.....	109
Table E.1 – List of reference documents for auxiliary and control circuit components.....	116
Table H.1 – Tolerances on test quantities for type test.....	123
Table J.1 Drawing list and contents	128

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC TS 62271-5:2024](https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024)

<https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 5: Common specifications for direct current
switchgear and controlgear**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TS 62271-5 has been prepared by IEC technical committee 17: High-voltage switchgear and controlgear. It is a Technical Specification.

The text of this document is based on the following documents:

Draft	Report on voting
17/1136/DTS	17/1143B/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 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

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

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

ITeH Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC TS 62271-5:2024](https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024)

<https://standards.iteh.ai/catalog/standards/iec/01986ec5-db09-4848-98d3-9c6533bec250/iec-ts-62271-5-2024>

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*