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This extended version of IEC 62271-209:2019+AMD1:2022 includes the content of the references made to IEC 62271-1:2017+AMD1:2021 CSV and IEC 62271-203:2011

**High-voltage switchgear and controlgear –
Part 209: Cable connections for gas-insulated metal-enclosed switchgear for
rated voltages above 52 kV – Fluid-filled and extruded insulation cables –
Fluid-filled and dry-type cable-terminations**



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.130.10

ISBN 978-2-8322-5678-7

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 62271-1
Edition 2.0 2017-07

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 1: Common specifications for alternating
current switchgear and controlgear**

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by IEC technical committee 17: High-voltage switchgear and controlgear.

The text of this interpretation sheet is based on the following documents:

DISH	Report on voting
17/1090/DISH	17/1095/RVDISH

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

Interpretation of 4.2.2 of IEC 62271-1:2017 regarding the altitude correction factor

Subclause 4.2.2 of IEC 62271-1:2017 contains two references for calculation of the required insulation withstand level at altitudes higher than 1 000 m, IEC 60071-2:1996 and IEC TR 62271-306. The two references are in conflict, as the altitude correction factor according to IEC 60071-2:1996 starts at sea level and that of IEC TR 62271-306 starts at an altitude of 1 000 m. This results in different altitude correction factors.

As already stated in 5.3 of IEC 62271-1:2017, the rated insulation levels refer to normal service conditions. Altitudes up to 1 000 m above sea level are covered and need no altitude correction.

For altitudes higher than 1 000 m the equation provided in 4.5.1.1 b) of IEC TR 62271-306:2012 and in H.3.4 of IEC 60071-2:2018 shall be used, i.e.

$$k_{\text{alt}} = e^{m \left(\frac{H-1\,000}{8\,150} \right)}$$

where

k_{alt} is the altitude correction factor;

H is the altitude in m above sea level;

m is an exponent.

Conservative values for the exponent m are provided in Table 4 of IEC TR 62271-306:2012. For further details about the exponent m , see H.4 of IEC 60071-2:2018.

CONTENTS

FOREWORD	6
INTRODUCTION TO Amendment 1	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	12
3.1 General terms and definitions	12
3.2 Assemblies of switchgear and controlgear	15
3.3 Parts of assemblies	15
3.4 Switching devices	15
3.5 Parts of switchgear and controlgear	16
3.6 Operational characteristics of switchgear and controlgear	19
3.7 Characteristic quantities	23
3.8 Index of definitions	23
4 Normal and special service conditions	27
4.1 General	27
4.2 Normal service conditions	27
4.2.1 Indoor switchgear and controlgear	27
4.2.2 Outdoor switchgear and controlgear	28
4.3 Special service conditions	28
4.3.1 Altitude	28
4.3.2 Pollution	30
4.3.3 Temperature and humidity	30
4.3.4 Vibrations, shock or tilting	30
4.3.5 Wind speed	30
4.3.6 Other parameters	30
5 Ratings	31
5.1 General	31
5.2 Rated voltage of the equipment of the cable connection (U_{rm})	31
5.3 Rated insulation level (U_d , U_p , U_s)	31
5.4 Rated frequency (f_r)	31
5.5 Rated continuous current (I_r)	31
5.6 Rated short-time withstand current (I_k)	32
5.7 Rated peak withstand current (I_p)	32
5.8 Rated duration of short circuit (t_k)	32
6 Design and construction	32
6.1 Gas and vacuum tightness	32
6.1.1 General	32
6.1.2 Controlled pressure systems for gas	32
6.1.3 Closed pressure systems for gas	33
6.1.4 Sealed pressure systems	33
6.101 Limits of supply	33
6.101.1 General	33
6.101.2 Over-voltage protection and earthing	33
6.102 Filling pressure of insulating gas in the cable connection enclosure	34
6.103 Pressure withstand requirements	35

6.104	Mechanical forces on cable terminations	35
6.105	Switchgear connection interface and cable termination connection interface	35
7	Type tests	36
7.1	General	36
7.1.1	Basics	36
7.1.2	Information for identification of test objects	36
7.1.3	Information to be included in type-test reports	36
7.2	Electrical type tests of cable terminations	37
7.2.1	General	37
7.2.2	Electrical type test of cable terminations in a single-phase enclosure	37
7.2.3	Electrical type test of cable termination in a three-phase enclosure	37
7.2.4	Additional electrical type tests on the insulator to be installed by switchgear manufacturer (plug in cable termination)	37
7.1.101	Power-frequency voltage tests on the main circuit	38
7.1.102	Partial discharge measurement	38
7.3	Pressure test on the insulator of a cable termination	40
7.4	Leak rate type test on the insulator of a cable termination	40
8	Routine tests	40
8.1	General	40
8.2	Pressure test	40
8.3	Visual inspection	40
9	Standard dimensions	40
9.1	General	40
9.2	Fluid-filled cable terminations	41
9.3	Dry-type cable terminations	41
9.4	Three-phase cable connection enclosure	41
10	Information to be given with enquiries, tenders and orders	41
11	Rules for transport, storage, erection, service and maintenance	41
11.1	General	41
11.2	Conditions during transport, storage and installation	42
11.3	Installation	42
11.3.1	General	42
11.3.2	Unpacking and lifting	42
11.3.3	Assembly	42
11.3.4	Mounting	42
11.3.5	Connections	43
11.3.6	Information about gas and gas mixtures for controlled and closed pressure systems	43
11.3.7	Final installation inspection	43
11.3.8	Basic input data by the user	44
11.3.9	Basic input data by the manufacturer	44
11.4	Operating instructions	44
11.5	Maintenance	45
11.5.1	General	45
11.5.2	Information about fluids and gas to be included in maintenance manual	45
11.5.3	Recommendations for the manufacturer	45
11.5.4	Recommendations for the user	46
11.5.5	Failure report	46

11.2 Tests after cable system installation.....	48
12 Safety practices and constraints during installation of cable connection to switchgear ...	48
13 Influence of the product on the environment.....	48
Annex A (normative) Identification of test objects	54
A.1 General.....	54
A.2 Data.....	54
A.3 Drawings.....	54
Annex B (informative) Determination of the equivalent RMS value of a short-time current during a short-circuit of a given duration	56
Annex C (normative) Method for the weatherproofing test for outdoor switchgear and controlgear	57
Annex D (informative) References for auxiliary and control circuit components.....	60
Annex E (normative) Tolerances on test quantities during tests	62
Annex F (informative) Information and technical requirements to be given with enquiries, tenders and orders.....	65
F.1 General.....	65
F.2 Normal and special service conditions (refer to Clause 4)	65
F.3 Ratings (refer to Clause 5).....	66
F.4 Design and construction (refer to Clause 6).....	66
F.5 System information	67
F.6 Documentation for enquiries and tenders.....	67
Annex G (informative) List of symbols.....	68
Annex H (informative) Electromagnetic compatibility on site	69
Annex I (informative) List of notes concerning certain countries.....	70
Annex J (informative) Extension of validity of type tests.....	71
J.1 General.....	71
J.2 Dielectric tests.....	71
J.3 Short-time withstand current tests	71
J.4 Continuous current test.....	71
J.5 Electromagnetic immunity test on auxiliary and control circuits.....	72
J.6 Environmental tests on auxiliary and control circuits	72
Annex K (informative) Exposure to pollution.....	73
K.1 General.....	73
K.2 Pollution levels	73
K.3 Minimum requirements for switchgear	73
Annex A (informative) Mechanical forces applied on the flange of the cable connection enclosure.....	75
A.1 General.....	75
A.2 Recommendation when connecting cable systems to switchgear	75
Bibliography.....	77
Figure 1 – Altitude correction factor	30
Figure 1 – Operating pressure of the gas insulation in the cable connection enclosure	34
Figure 2 – Fluid-filled cable connection assembly – Typical arrangement.....	50

Figure 3 – Fluid-filled cable connection – Assembly dimensions	51
Figure 4 – Dry-type cable connection assembly – Typical arrangement	52
Figure 5 – Dry-type cable connection assembly – Assembly dimensions	53
Figure B.1 – Determination of short-time current	56
Figure C.1 – Arrangement for weatherproofing test	58
Figure C.2 – Nozzle for weatherproofing test	59
Table 1 – Reference table of service conditions relevant to GIS	30
Table 1 – Test voltages for additional electrical type tests according to 7.2.4	38
Table 7 – On site test voltages	39
Table D.1 – List of reference documents for auxiliary and control circuit components	60
Table E.1 – Tolerances on test quantities for type test	63
Table K.1 – Environmental examples by site pollution severity (SPS) class	74
Table K.2 – Minimum nominal specific creepage distance by pollution level	74
Table A.1 – Moment and forces applied on the flange of the cable connection enclosure attached to the cable termination during normal operation	76

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV – Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable terminations

FOREWORD

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This extended version (EXV) of the official IEC Standard provides the user with a comprehensive content of the Standard.

IEC 62271-209:2019+AMD1:2022 EXV includes the content of the references made to IEC 62271-1:2017+AMD1:2021 CSV and IEC 62271-203:2011.

Particular subclauses of IEC 62271-1:2017+AMD1:2021 CSV and IEC 62271-203:2011 are displayed in the content on a blue background.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62271-209 edition 2.1 contains the second edition (2019-02) [documents 17C/696/FDIS and 17C/701/RVD] and its amendment 1 (2022-03) [documents 17C/833/FDIS and 17C/841/RVD].

International Standard IEC 62271-209 has been prepared by subcommittee 17C: Assemblies, of IEC technical committee 17: High-voltage switchgear and controlgear.

This second edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) New numbering in accordance with ISO/IEC directives, Part 2 (2016) and to IEC 62271-1:2017;
- b) Clause 3: addition of a definition for plug-in cable termination, filling pressure and minimum function pressure for insulation;
- c) Clause 7: An additional dielectric type test for plug-in cable termination was added; also a pressure type test as well as a leak rate test on the insulator of a cable termination was implemented;
- d) Clause 12: New clause about safety practices;
- e) Clause 13: New clause about influence of the product on the environment;
- f) New informative Annex A: Mechanical forces applied on the flange of the cable connection enclosure.

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

This standard is to be read in conjunction with IEC 62271-1:2017, to which it refers and which is applicable unless otherwise specified in this standard. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1. Amendments 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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under webstore.iec.ch in the data related to the specific publication. At this date, the publication will be

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

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INTRODUCTION TO Amendment 1

This amendment includes the following modifications:

- a) In accordance with the decision taken at IEC Plenary Meeting October 2019 in Shanghai (17C/Shanghai/Sec07) Subclause 6.103, Figure 1 and Figure 2 have been modified;
- b) The CDV was modified in accordance with the above-mentioned documents and based on the decision taken at the virtual IEC Plenary Meeting in October 2021 (17C/823/RM).

NOTE CIGRE has published TB 784 "Standard design of a common, dry type plug-in interface for GIS and power cables up to 145 kV describing the basis for further standardisation of such a common interface. The matter will be dealt with during the next revision of IEC 62271-209.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV – Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable terminations

1 Scope

This part of IEC 62271 covers the connection assembly of fluid-filled and extruded cables to gas-insulated metal enclosed switchgear (GIS), in single- or three-phase arrangements where the cable terminations are fluid-filled or dry-type and there is a separating insulating barrier between the cable insulation and the gas insulation of the switchgear.

The purpose of this document is to establish electrical and mechanical interchangeability between cable terminations and the gas-insulated metal-enclosed switchgear and to determine the limits of supply. It complements and amends, if applicable, the relevant IEC standards. For the purpose of this document the term "switchgear" is used for "gas-insulated metal enclosed switchgear".

It does not cover directly immersed cable terminations, as described in CIGRE brochure 89 [4]¹.

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, *IEC standard voltages*

IEC 60050-131:2002, *International Electrotechnical Vocabulary (IEV) – Part 131: Circuit theory*

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050-192:2015, *International Electrotechnical Vocabulary (IEV) – Part 192: Dependability*

IEC 60050-351, *International Electrotechnical Vocabulary (IEV) – Part 351: Control technology*

IEC 60050-441:1984, *International Electrotechnical Vocabulary (IEV) – Part 441: Switchgear, controlgear and fuses*
IEC 60050-441:1984/AMD1:2000

IEC 60050-551, *International Electrotechnical Vocabulary (IEV) – Part 551: Power electronics*

¹ Numbers in square brackets refer to the Bibliography.

IEC 60050-581:2008, *International Electrotechnical Vocabulary (IEV) – Part 581: Electromechanical components for electronic equipment*

IEC 60050-601, *International Electrotechnical Vocabulary (IEV) – Chapter 601: Generation, transmission and distribution of electricity – General*

IEC 60050-605, *International Electrotechnical Vocabulary (IEV) – Chapter 605: Generation, transmission and distribution of electricity – Substations*

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 60050-826:2004, *International Electrotechnical Vocabulary (IEV) – Part 826: Electrical installations*

IEC 60060-1:2010, *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 60071-1:2006, *Insulation co-ordination – Part 1: Definitions, principles and rules*
IEC 60071-1:2006/AMD1:2010

IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*

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

IEC 60141 (all parts), *Tests on oil-filled and gas-pressure cables and their accessories*

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 – Unused mineral insulating oils for transformers and switchgear*

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

IEC 60480, *Guidelines for the checking and treatment of sulphur hexafluoride (SF₆) taken from electrical equipment and specification for its re-use*

IEC 60507, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems*

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 TS 60815-1:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC TS 60815-2:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC TS 60815-3:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems*

IEC 60840, *Power cables with extruded insulation and their accessories for rated voltages above 30 kV ($U_m = 36$ kV) up to 150 kV ($U_m = 170$ kV) – Test methods and requirements*

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*

IEC 61000-4-17:2009, *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 d.c. input power port immunity tests*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity 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 61810-7:2006, *Electromechanical elementary relays – Part 7: Test and measurement procedures*

IEC 62067, *Power cables with extruded insulation and their accessories for rated voltages above 150 kV ($U_m = 170$ kV) up to 500 kV ($U_m = 550$ kV) – Test methods and requirements*

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 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF₆) and its mixtures*

IEC 62271-203:2011, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

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

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-131, IEC 60050-151, IEC 60050-192, IEC 60050-351, IEC 60050-441, IEC 60050-551, IEC 60050-581, IEC 60050-601, IEC 60050-605, IEC 60050-614, IEC 60050-811 and IEC 60050-826, some of which are recalled hereunder, and the following apply.

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

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

NOTE Terms and definitions are classified in accordance with IEC 60050-441. References 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

3.1.1

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 60050-441:2000, 441-11-01]

3.1.2

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]

3.1.3

degree of protection

extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or ingress of water and against mechanical impact

[SOURCE: IEC 60529:1989, 3.3, modified – leave out “verified by standardized test methods” and add “against mechanical impact” after “water and”.]