



BSI Standards Publication

High-voltage switchgear and controlgear

Part 315: Direct current (DC) transfer switches

National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/17, High voltage switchgear, controlgear and assemblies.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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TECHNICAL SPECIFICATION

**High-voltage switchgear and controlgear –
Part 315: Direct current (DC) transfer switches**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.130.10

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 315: Direct current (DC) transfer switches

FOREWORD

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IEC TS 62271-315 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/1412/DTS	17A/1417/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. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

A list of all parts of 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 315: Direct current (DC) transfer switches

1 Scope

This part of IEC 62271 is applicable to direct current (DC) transfer switches designed for indoor or outdoor installation and for operation on HVDC transmission systems having direct voltages of 100 kV and above.

DC transfer switches normally include metallic return transfer switches (MRTS), earth return transfer switches (ERTS), neutral bus switches (NBS) and neutral bus earthing switches (NBES).

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 60060-1:2010, *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 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

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

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

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

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 60270:2000, *High-voltage test techniques – Partial discharge measurements*

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

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

IEC 61000-4-18:2019, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

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

IEC 62271-100:2021, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

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

IEC 62271-207, *High-voltage switchgear and controlgear – Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV*

IEC TS 63014-1, *High-voltage direct current (HVDC) power transmission – System requirements for DC-side equipment Part 1: Using line-commutated converters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60633, IEC TS 63014-1 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>

3.1 General terms and definitions

Subclause 3.1 of IEC TS 62271-5:2024 is applicable.

3.2 Assemblies of switchgear and controlgear

Subclause 3.2 of IEC TS 62271-5:2024 is applicable.

3.3 Parts of assemblies

Subclause 3.3 of IEC TS 62271-5:2024 is applicable.

3.4 Switching devices

Subclause 3.4 of IEC TS 62271-5:2024 is applicable with the following additions:

3.4.101

active DC transfer switch

DC transfer switch with charging device in oscillating branch, installed in parallel to the commutation switch

3.4.102

blank DC transfer switch

DC transfer switch with a sole commutation switch only, without any additional external branches or components

Note 1 to entry: Some commutation switches use internal components to increase voltage drop across the switching units during transfer operation.

3.4.103**passive DC transfer switch**

DC transfer switch without charging device in oscillating branch, installed in parallel to the commutation switch

3.4.104**earth return transfer switch****ERTS**

DC transfer switch used to transfer direct current from a metallic return path to an earth return path

Note 1 to entry: “DC transfer switch” is used instead of “DC commutation switch” to refer to whole switch, including oscillating branch and energy dissipation branch.

Note 2 to entry: Although the term “earth return transfer breaker” (ERTB) has been widely used in the industry for many years, it is misleading since such switches have no ability to interrupt fault current.

[SOURCE: IEC 60633:2019, 9.23, modified – The terms “earth return transfer breaker” and “ERTB” have been removed, “DC commutation switch” has been replaced by “DC transfer switch”, DC current is replaced by direct current, Note 1 to entry and reference to Figure 7 have been deleted.]

3.4.105**metallic return transfer switch****MRTS**

DC transfer switch used to transfer direct current from an earth return path to a metallic return path

Note 1 to entry: “DC transfer switch” is used instead of “DC commutation switch” to refer to whole switch, including oscillating branch and energy dissipation branch.

Note 2 to entry: Although the term “metal return transfer breaker” (MRTB) has been widely used in the industry for many years, it is misleading since such switches have no ability to interrupt fault current.

[SOURCE: IEC 60633:2019, 9.22, modified – The terms “metallic return transfer breaker” and “MRTB” have been removed, “DC commutation switch” has been replaced by “DC transfer switch”, DC current is replaced by direct current, Note 1 to entry is moved to Note 2, and reference to Figure 7 has been deleted.]

3.4.106**neutral bus switch****NBS**

DC transfer switch connected in series with the neutral bus on a bipolar HVDC scheme, designed to commutate current out of the pole conductor or neutral bus and into the electrode line or dedicated metallic return conductor or earth e.g. in response to a fault in a converter or neutral bus

Note 1 to entry: “DC transfer switch” is used instead of “DC commutation switch” to refer to whole switch, including oscillating branch and energy dissipation branch.

[SOURCE: IEC 60633:2019, 9.26, modified, “DC commutation switch” has been replaced by “DC transfer switch” and Note 1 has been replaced by a new Note 1.]

3.4.107**neutral bus earthing switch****NBES**

DC transfer switch connected from the neutral bus to the station earth mat on a bipolar HVDC scheme, designed to provide a temporary earth connection, e.g. in the event of an open circuit fault on the electrode line until the imbalance of current between the two poles can be reduced to a safe minimum level or the electrode line connection can be restored

Note 1 to entry: Although the term “Neutral Bus Grounding Switch” (NBGS) has been widely used in the industry for many years.

Note 2 to entry: In some applications, NBES and high-speed earthing switch (HSES) are used in series.

[SOURCE: IEC 60633:2019, 9.27, modified – The terms “neutral bus grounding switch” and “NBGS” have been removed, “DC commutation switch” has been replaced by “DC transfer switch”, Note 1 and Note 2 have been replaced by new notes.]

3.5 Parts of switchgear and controlgear

Subclause 3.5 of IEC TS 62271-5:2024 is applicable with the following additions:

3.5.101**commutation switch**

mechanical switching device used in the main current path of DC transfer switches

Note 1 to entry: A single pole of an AC circuit-breaker or its modification was often used as commutation switch in DC transfer switch.

Note 2 to entry: Some commutation switches use internal components to increase voltage drop across the switching units during transfer operation.

3.5.102**oscillating branch**

circuit in parallel with the commutation switch in DC transfer switches, consisting of

- capacitors and reactors, in case of passive DC transfer switches;
- capacitors including a charging device and a making switch, in case of active DC transfer switches.

Note 1 to entry: The oscillating branch forces a current oscillation between itself and the commutation switch branch in order to produce current zeros in the last one.

Note 2 to entry: Depending on the stray inductance of the arrangement reactors are not necessarily needed to be installed.

Note 3 to entry: Passive DC transfer switches having a making device in series with the oscillating branch are also known.

3.5.103**current zero device**

oscillating circuit in case of passive DC transfer switch or current impulse generator in case of active DC transfer switch

3.5.104**energy dissipation branch**

impedance circuit in parallel with the commutation switch of DC transfer switches which dissipates the energy stored in the energy storage components (e.g. reactors, stray inductance, stray capacitance, etc.) in DC system after successful commutation of current from commutation switch branch to oscillating branch

Note 1 to entry: In real transfer switch, metal oxide surge arrester commonly is used as energy dissipation device.

3.5.105**charging device**

device used in active DC transfer switches to charge capacitors in current zero device

3.5.106**making switch**

mechanical switch in series with oscillating branch or current injection branch, designed for fast closing

Note 1 to entry: A making switch is used to close the oscillation branch to excite oscillation during current transfer operation.

3.5.107**platform**

support for the oscillating branch and the energy dissipation branch

Note 1 to entry: Two versions are known:

- insulated platform with certain insulation level to earth;
- earthed platform.

3.6 Operational characteristics of DC transfer switches

Subclause 3.6 of IEC TS 62271-5:2024 is applicable.

3.7 Characteristic quantities

Subclause 3.7 of IEC TS 62271-5:2024 is applicable with the following additions:

3.7.101**initiation of (opening or closing) operation**

instant of receipt of command for operation at the control circuit

[SOURCE: IEC 62271-100:2021, 3.7.153]

3.7.102**opening time**

<of mechanical switching device> interval of time between the specified instant of initiation of the opening operation and the instant when the arcing contacts have separated

[SOURCE: IEC 60050-441:1984, 441-17-36, modified – “in all poles” and the Note to entry have been deleted.]

3.7.103**arcing time**

interval of time between the instant of the initiation of the arc and the instant of final arc extinction

[SOURCE: IEC 60050-441:1984, 441-17-37, modified – The words “(of a pole or a fuse)” has been removed from the term and from the definition itself.]

3.7.104**commutation time**

interval of time between the beginning of the opening time of the commutation switch and the end of the arcing time

3.7.105

closing time

interval of time between the initiation of the closing operation and the instant when the contacts touch

[SOURCE: IEC 60050-441:1984, 441-17-41, modified – The words “in all poles” have been removed at the end of the definition.]

3.7.106

open-close time

interval of time between the instant when the arcing contacts have separated and the instant when the contacts touch during a reclosing cycle

3.7.107

arcing withstand capability

maximum duration of commutation switches capable of withstanding an arc with specified current in case of an unsuccessful commutation

Note 1 to entry: This time shall include the open-close time of commutation switch and the time delay of control and protection system.

3.7.108

continuous current

direct current flowing through DC transfer switches with the DC transmission system operating

3.7.109

transfer current

direct current which the DC transfer switch is able to transfer in an adjacent return path

3.7.110

commutation voltage

transient voltage across the terminals of a DC transfer switch during the current commutation process, describing the time development of the voltage

Note 1 to entry: The commutation voltage depends mainly on the characteristics of the DC transfer switch and is characterised by two effects. Until arc extinguishing in the commutation switch the commutation voltage is equal to its arcing voltage, after arc extinguishing the commutation voltage is equal to the charging voltage of current zero device and will be limited in peak by the energy dissipation device.

Note 2 to entry: The value of commutation voltage at the end of commutation process depends on the HVDC transmission system and is equal to the voltage drop across the current path to which the current was transferred.

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neutral bus switch (NBS)	3.4.106

O

open-close time	3.7.106
opening time	3.7.102
oscillating branch	3.5.102

P

passive DC transfer switch	3.4.103
platform	3.5.107

T

transfer current	3.7.109
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4 Normal and special service conditions

Clause 4 of IEC TS 62271-5:2024 is applicable.

5 Ratings

5.1 General

Subclause 5.1 of IEC TS 62271-5:2024 is applicable with the following additions:

- j) rated direct voltage of transfer switch (U_{rts});
- k) rated transfer current (I_t);
- l) rated commutation voltage (U_c);
- m) rated dissipated energy during transfer operation (E_{rd});
- n) rated operating sequence;
- o) rated open-close time.

5.2 Rated direct voltage (U_{rd})

Subclause 5.2 of IEC TS 62271-5:2024 is not applicable and is replaced by 5.101: Rated direct voltage of transfer switch (U_{rts}).

5.3 Rated insulation level (U_{dd} , U_p , U_s)

Subclause 5.3 of IEC TS 62271-5:2024 is not applicable.

The insulation levels for transfer switches shall be selected from the values given in Table 1.

Withstand values given in Table 1 cover the application of transfer switches under normal service conditions defined in 4.1 of IEC TS 62271-5:2024 including altitudes from sea level up to 1 000 m. However, for testing purposes to verify a rating or capability, they shall be considered as insulation values at the standardized reference atmosphere temperature (20 °C), pressure (101,3 kPa) and humidity (11 g/m³) specified in IEC 60071-11:2022. For special service conditions, refer to IEC TR 62271-306 [1]¹.

NOTE According to IEC 60071-11:2022 the insulation levels in Table 1 cover the temperature range of –40 °C up to 40 °C.

The rated withstand voltage values for direct voltage (U_{dd}) and lightning impulse voltage (U_p) shall be selected without crossing the horizontal marked lines in Table 1.

¹ Numbers in square brackets refer to the Bibliography.

Table 1 – Rated insulation levels for transfer switches

Rated direct voltage of transfer switch U_{rts} kV	Rated direct withstand voltage U_{dd} kV	Rated lightning impulse withstand voltage U_p kV
	Terminal-to-earth and across open transfer switch	Terminal-to-earth and across open transfer switch
(1)	(2)	(3)
5	7,5	60
10	15	95
25	37,5	200
50	75	325
75	112,5	450
100	150	550
150	225	650
200	300	750

5.4 Rated continuous current (I_{rd})

Subclause 5.4 of IEC TS 62271-5:2024 is applicable.

5.5 Rated values of short-time withstand current**5.5.1 Typical waveform of short-circuit current**

Subclause 5.5.1 of IEC TS 62271-5:2024 is applicable.

5.5.2 Rated short-time withstand direct current (I_{kd})

Subclause 5.5.2 of IEC TS 62271-5:2024 is applicable.

5.5.3 Rated peak withstand current (I_{pd})

Subclause 5.5.3 of IEC TS 62271-5:2024 is applicable.

5.5.4 Rated duration of short circuit (t_{kd})

Subclause 5.5.4 of IEC TS 62271-5:2024 is applicable.

5.6 Rated supply voltage of auxiliary and control circuits (U_a)**5.6.1 General**

Subclause 5.6.1 of IEC TS 62271-5:2024 is applicable.

5.6.2 Rated supply voltage (U_a)

Subclause 5.6.2 of IEC TS 62271-5:2024 is applicable.

5.7 Rated supply frequency of auxiliary and control circuits

Subclause 5.7 of IEC TS 62271-5:2024 is applicable.

5.8 Rated pressure of compressed gas supply for controlled pressure systems

Subclause 5.8 of IEC TS 62271-5:2024 is applicable.

5.101 Rated direct voltage of transfer switch (U_{rts})

The rated direct voltage of transfer switch (U_{rts}) is the highest direct voltage terminal-to-earth that includes harmonics for which the transfer switch is designed in respect of its insulation as well as other characteristics, to operate as specified for indefinite period of time (lifetime).

NOTE The term "rated maximum voltage" used in most IEEE switchgear standards has the same meaning as the term "rated direct voltage" as used in this document.

The rated direct voltages of transfer switch are 5 kV – 10 kV – 25 kV – 50 kV – 75 kV – 100 kV – 150 kV – 200 kV.

5.102 Rated transfer current (I_t)

The values of rated transfer current should be selected from the R10 series, specified in IEC 60059 [2].

NOTE 1 The R10 series comprises the numbers 1 – 1,25 – 1,6 – 2 – 2,5 – 3,15 – 4 – 5 – 6,3 – 8 and their products by 10^n .

NOTE 2 For certain projects or special applications other values than from R10 series could be chosen by agreement between manufacturer and user.

5.103 Rated commutation voltage (U_c)

The rated commutation voltage is the highest voltage which the transfer switch shall be capable of withstanding after commutating the current into the oscillating branch or after extinguishing the arc inside of the commutation switch.

NOTE 1 The rated commutation voltage of a transfer switch will be defined by its energy dissipation branch.

NOTE 2 Specific ratings can generally not be assigned because they are specific parameters to each project. The commutation voltage for each transfer switch in a specific project will be defined by system studies.

As an estimation the rated commutation voltage could be calculated from the rated voltage of transfer switch (U_{rts}) multiplied with a factor of 1,2.

NOTE 3 The rated commutation voltage is the determining factor for successful current commutation. Lower or higher factors than 1,2 between U_c and the U_{rts} at location of installation could arise for specific applications. In existing projects, this factor is mostly between 0,6 and 2,5. Further information can be found in Clause 9.

5.104 Rated dissipated energy during transfer operation (E_{rd})

The rated dissipated energy during transfer operation is the highest amount of energy which the energy dissipation device inside the DC transfer switch can manage in a single operating sequence without sustained deterioration. The value will be stated by the manufacturer of DC transfer switch according to the requirements at location of installation, usually based on system studies.

NOTE 1 The rated dissipated energy during transfer operation of a DC transfer switch normally regards to the energy dissipation device or the current limitation branch.

NOTE 2 The rated dissipated energy during transfer operation should be higher than the maximum energy which the transmission system could supply during current transfer operation at location of installation of DC transfer switch.

NOTE 3 Depending on the margin between the rated dissipated energy during transfer operation and the maximum energy which the transmission system could supply during current transfer operation at location of installation of DC transfer switch, specific cooling time between two transfer operations has to be considered. Further information should be supplied by the manufacturer.

5.105 Rated operating sequence

The rated operating sequence of direct current transfer switches are as follows:

- a) $O - t - C$: for ERTS, MRTS and NBES
- b) $C - 0,1 \text{ s} - O - t - C$: for NBS

NOTE 1 sequence b) gives a typical operating sequence when NBS is used to connect converter neutral to an already energized current return path in a bipolar or DC grid system.

NOTE 2 The final closing operation in each operation sequence is to protect the commutation switch itself in case of unsuccessful transfer operation.

with:

t is more than the rated open-close time and less than T_{aw} (see 6.102.7).

where

- O represents an opening operation;
- C represents a closing operation.

5.106 Rated open-close time

This value shall be provided by manufacturer.

NOTE All ratings except subclause 5.104 are applicable for commutation switches also.

6 Design and construction

6.1 Requirements for liquids in switchgear and controlgear

Subclause 6.1 of IEC TS 62271-5:2024 is applicable.

6.2 Requirements for gases in switchgear and controlgear

Subclause 6.2 of IEC TS 62271-5:2024 is applicable.

6.3 Earthing of switchgear and controlgear

Subclause 6.3 of IEC TS 62271-5:2024 is applicable.

6.4 Auxiliary and control equipment and circuits

Subclause 6.4 of IEC TS 62271-5:2024 is applicable with the following additions:

- where shunt opening and closing releases are used, appropriate measures shall be taken in order to avoid damage on the releases when permanent orders for closing or opening are applied. For example, those measures can be the use of series control contacts arranged so that when the transfer switch is closed, the close release control contact ("b" contact or break contact) is open and the open release control contact ("a" contact or make contact) is closed, and when the transfer switch is open, the open release control contact is open and the close release control contact is closed;
- where auxiliary switches are used as position indicators, they shall indicate the end position of the transfer switch at rest, open or closed. The signal shall be sustained;
- connections shall withstand the stresses imposed by the transfer switch, especially those due to mechanical forces during operations;
- where special items of control equipment are used, they shall operate within the limits specified for supply voltages of auxiliary and control circuits, making and commutating and/or insulating and operating media, and be able to switch the loads which are stated by the transfer switch manufacturer;

- special items of auxiliary equipment such as liquid indicators, pressure indicators, relief valves, filling and draining equipment, heating and interlock contacts shall operate within the limits specified for supply voltages of auxiliary and control circuits and/or within the limits of use of making and commutating and/or insulating and operating media;
- where anti-pumping devices are part of the transfer switch control scheme, they shall act on each control circuit, if more than one is installed.

6.5 Dependent power operation

Subclause 6.5 of IEC TS 62271-5:2024 is applicable with the following addition:

A transfer switch arranged for dependent power operating with external energy supply shall also be capable of closing immediately following the opening according to its rated operating sequence.

6.6 Stored energy operation

Subclause 6.6. of IEC TS 62271-5:2024 is applicable with the following addition:

A transfer switch arranged for stored energy operating shall also be capable of closing immediately following the opening according to its rated operating sequence.

6.7 Independent unlatched operation (independent manual or power operation)

Subclause 6.7 of IEC TS 62271-5:2024 is applicable.

6.8 Manually operated actuators

Subclause 6.8 of IEC TS 62271-5:2024 is not applicable.

6.9 Operation of releases

Subclause 6.9 of IEC TS 62271-5:2024 is applicable.

6.10 Pressure/level indication

Subclause 6.10 of IEC TS 62271-5:2024 is applicable.

6.11 Nameplates

Subclause 6.11 of IEC TS 62271-5:2024 is applicable with the following additions:

The nameplates for all assemblies of the DC transfer switch should be in accordance with their relevant standards. The nameplate of the DC transfer switch, commutation switch and making switch shall be provided at least as the following (see Table 2):

Table 2 – Nameplate information

Item		Symbol	Unit	(**)			Condition: Marking only required if
				Transfer switch	Commutation switch	Making switch	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Name of manufacturer			X	X	X	
2	Type designation and serial number			X	X	X	
3	Rated direct voltage of transfer switch	U_{rts}	kV	X	X	X	
4	Rated direct withstand voltage	U_{dd}	kV	X	X	X	
5	Rated lightning impulse withstand voltage	U_p	kV	X	X	X	
6	Rated continuous current	I_{rd}	A	X	X		
7	Rated short-time withstand direct current	I_{kd}	kA	X	X		
8	Rated peak withstand current	I_{pd}	kA	X	X		
9	Rated duration of short-circuit	t_{kd}	s	X	X		
10	Rated transfer current	I_t	A	X			
11	Rated commutation voltage	U_c	kV	X	X		
12	Rated dissipated energy during transfer operation	E_{rd}	MJ	X			
13	Filling pressure for insulation(*)	p_e	MPa	X	X	X	
14	Filling pressure for operation(*)	p_m	MPa	X	X	X	
15	Rated supply voltage(s) of auxiliary and control circuits. Specify DC / AC (with rated frequency)	U_a	V	X	X	X	
16	Rated operating sequence			X	X	X	
17	Rated open-close time		ms	X	X		
18	Closing time		ms	X	X	X	
19	Type and mass of fluid (liquid or gas) for insulation	M_f	kg	X	X	X	
20	Mass of switchgear and controlgear (including any fluid)	M	kg	Y	Y	Y	more than 300 kg
21	Year of manufacture			X	X	X	
22	Minimum and maximum ambient air temperature		°C	Y	Y	Y	If different from –5 °C and/or 40 °C
(*) Absolute pressure (abs.) or relative pressure (rel.) to be stated on the nameplate							
(**) X = the marking of these values is mandatory, where applicable. Y = conditions for marking of these values are given in column (8).							
NOTE 1 The symbol in column (3) can be used instead of the terms in column (2) to be stated on the nameplate.							
NOTE 2 When terms in column (2) are used, the word “rated” can be omitted appear.							

6.12 Locking devices

Subclause 6.12 of IEC TS 62271-5:2024 is applicable.

6.13 Position indication

Subclause 6.13 of IEC TS 62271-5:2024 is applicable.

6.14 Degrees of protection by enclosures

Subclause 6.14 of IEC TS 62271-5:2024 is applicable.

6.15 Creepage distances for outdoor insulators

Subclause 6.15 of IEC TS 62271-5:2024 is applicable.

6.16 Gas and vacuum tightness

Subclause 6.16 of IEC TS 62271-5:2024 is applicable.

6.17 Tightness for liquid system

Subclause 6.17 of IEC TS 62271-5:2024 is applicable.

6.18 Fire hazard (flammability)

Subclause 6.18 of IEC TS 62271-5:2024 is applicable.

6.19 Electromagnetic compatibility (EMC)

Subclause 6.19 of IEC TS 62271-5:2024 is applicable.

6.20 X-ray emission

Subclause 6.20 of IEC TS 62271-5:2024 is applicable.

6.21 Corrosion

Subclause 6.21 of IEC TS 62271-5:2024 is applicable.

6.22 Filling levels for insulation, switching and operation

Subclause 6.22 of IEC TS 62271-5:2024 is applicable.

6.101 Seismic requirement for operation

DC transfer switch shall be able to withstand the specified seismic stress and meet the requirements in IEC 62271-207.

6.102 Commutation switch

Subclauses 6.1 to 6.101 of this specification are applicable with the following additions:

6.102.1 General requirement for operation

A commutation switch, including its operating devices, shall be capable of completing its rated operating sequence 5.105 in accordance with the relevant provisions of 6.5 to 6.10 and 6.102.2 for the whole range of ambient temperatures within its minimum and maximum air temperature as defined in Clause 4 of IEC TS 62271-5:2024.