BS EN IEC 62271-103:2023

BSI Standards Publication

High-voltage switchgear and controlgear

Part 103: Alternating current switches for rated voltages above 1 kV up to and including 52 kV

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Full document details: BS EN IEC 62271-103:2023

National foreword

This British Standard is the UK implementation of EN IEC 62271-103:2023. It is identical to IEC 62271-103:2021. It supersedes BS EN 62271-103:2011, which is withdrawn.

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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Published by BSI Standards Limited 2023

ISBN 978 0 539 04036 4

ICS 29.130.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2023.

Amendments/corrigenda issued since publication

Date	Text affected

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62271-103

November 2023

ICS 29.130.10

Supersedes EN 62271-103:2011

English Version

High-voltage switchgear and controlgear - Part 103: Alternating current switches for rated voltages above 1 kV up to and including 52 kV (IEC 62271-103:2021)

Appareillage à haute tension - Partie 103: Interrupteurs à courant alternatif pour tensions assignées supérieures à 1 kV et inférieures ou égales à 52 kV (IEC 62271-103:2021)

Hochspannungs-Schaltgeräte und -Schaltanlagen - Teil 103: Lastschalter für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-103:2021)

This European Standard was approved by CENELEC on 2021-06-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 17A/1297/FDIS, future edition 2 of IEC 62271-103, prepared by SC 17A "Switching devices" of IEC/TC 17 "High-voltage switchgear and controlgear" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62271-103:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-05-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-11-10

This document supersedes EN 62271-103:2011 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62271-103:2021 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60059	NOTE	Harmonized as EN 60059
IEC 62271-105	NOTE	Harmonized as EN 62271-105
IEC 62271-200	NOTE	Harmonized as EN 62271-200
IEC 62271-201	NOTE	Harmonized as EN 62271-201
IEC 60507	NOTE	Harmonized as EN 60507
IEC 62271-100	NOTE	Harmonized as EN 62271-100
IEC 60071-1	NOTE	Harmonized as EN IEC 60071-1

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60050-441	-	International Electrotechnical Vocabulary. Switchgear, controlgear and fuses	-	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
-	-		+ corrigendum May	1993
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	2002
IEC 62271-1	2017	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear	EN 62271-1	2017
IEC 62271-102	2018	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches	EN IEC 62271-102	2018
IEC 62271-110	2017	High-voltage switchgear and controlgear - Part 110: Inductive load switching	EN IEC 62271-110	2018

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Annex ZB
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN and/or CENELEC member.

This European Standard does not fall under any Directive/Regulation of the EU.

In the relevant CEN and/or CENELEC countries, these A-deviations are valid instead of the respective provisions of the European Standard until the national situation causing the A-deviation has changed

Clause	Deviation
General	**Italy**
	CAPITOLO VSR 8.B D.M. 1 DICEMBRE 1980 e succ. Modifiche
	Disciplina dei contenitori a pressione di gas con membrature miste di materiale isolante e di materiale metallico, contenenti parti attive di apparecchiature elettriche.
	Gas filled compartments having a design pressure exceeding 0,5 bar (gauge) or a volume exceeding 2 m^3 shall be designed according to the Italian pressure vessel code for electrical switchgear.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 103: Alternating current switches for rated voltages above 1 kV up to and including 52 kV

FOREWORD

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IEC 62271-103 has been prepared by subcommittee 17A: Switching devices, of IEC technical committee 17: High-voltage switchgear and controlgear. It is an International Standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

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

a) this document has been aligned with IEC 62271-1:2017 and IEC 62271-102:2018;
b) clarifications regarding the behaviour of the switch during breaking tests regarding current interruption and restrikes have been added;
c) conditions of the switch after making and breaking tests have been clarified;
d) a new informative Annex B intended to provide guidance for the calculation of I_{ef1} and I_{ef2} has been added;

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e) new rules for the combination of 50 Hz and 60 Hz switching tests have been defined and a new table (Table 7) has been added;

f) tests with specified TRV have been modified to be in accordance with the practice described in IEC 62271-100;

g) the behaviour of the switch during breaking tests has been clarified and boundaries for restrike allowance have been defined;

h) explanations for short-circuit making tests have been added;

i) vacuum integrity check after mechanical operations has been defined;

j) all test voltages for single-phase capacitive testing have been grouped under 7.101.7.3.2 and have been confirmed by simulation and calculation.

The text of this International Standard is based on the following documents:

Draft	Report on voting
17A/1297/FDIS	17A/1303/RVD

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 International Standard 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.

This document is to be read in conjunction with IEC 62271-1:2017, 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 62271-1:2017. Amendments to these clauses and subclauses are given under the same numbering 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 reader's attention is drawn to the fact that Annex C lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

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,
- 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.

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 103: Alternating current switches for rated voltages above 1 kV up to and including 52 kV

1 Scope

This part of IEC 62271 is applicable to three-phase, alternating current switches and switch-disconnectors for their switching function, having making and breaking current ratings, for indoor and outdoor installations, for rated voltages above 1 kV up to and including 52 kV and for rated frequencies from 16 2/3 Hz up to and including 60 Hz. This document is also applicable to single-pole switches used on three-phase systems.

This document is also applicable to the operating devices of these switches and to their auxiliary equipment.

For switch-disconnectors, refer also to IEC 62271-102 for their disconnecting function.

Devices not covered by this document are:

– devices that require a dependent manual operation;
– earthing switches. Earthing switches forming an integral part of a switch are covered by IEC 62271-102;
– switching devices attached as an element of a high-voltage fuse assembly or its mounting and operated by opening and closing the fuse assembly.

General principles and provisions of this document can also be applicable to single pole switches intended for application in single-phase systems, the requirements for dielectric tests and making and breaking tests being in accordance with the requirements of the specific application.

This document establishes requirements for general, limited and special purpose switches used in distribution systems.

NOTE Except where special clarification is required, the term "switch" is used to refer to all kinds of switches and switch-disconnectors within the scope of this document.

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 60050-441, *International Electrotechnical Vocabulary (IEV) – Part 441: Switchgear, controlgear and fuses* (available at http://www.electropedia.org)

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD1:2013

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

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

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

IEC 62271-110:2017, *High-voltage switchgear and controlgear – Part 110: Inductive load switching*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-441 and IEC 62271-1 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 62271-1:2017.

3.1 General terms and definitions

Subclause 3.1 of IEC 62271-1:2017 is applicable with the following additions:

3.1.101
effectively earthed neutral system
system earthed through a sufficiently low impedance such that for all system conditions the ratio of the zero-sequence reactance to the positive-sequence reactance (X_0/X_1) is positive and less than 3, and the ratio of the zero-sequence resistance to the positive-sequence reactance (R_0/X_1) is positive and less than 1

Note 1 to entry: Normally such systems are solidly earthed (neutral) systems or low impedance earthed (neutral) systems.

Note 2 to entry: The earthing conditions depend not only on the physical earthing conditions around the relevant location but also on the total system.

3.1.102
non-effectively earthed neutral system
system other than effectively earthed neutral system, not meeting the conditions given in 3.1.101

Note 1 to entry: Normally such systems are isolated neutral systems, high impedance earthed (neutral) systems or resonant earthed (neutral) systems

Note 2 to entry: The earthing conditions depend not only on the physical earthing conditions around the relevant location but also on the total system.

3.2 Assemblies of switchgear and controlgear

Subclause 3.2 of IEC 62271-1:2017 applies.

3.3 Parts of assemblies

Subclause 3.3 of IEC 62271-1:2017 applies.

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3.4 Switching devices

Subclause 3.4 of IEC 62271-1:2017 applies with the following additions:

3.4.101
switch
mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions, which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions, such as those of a short-circuit

Note 1 to entry: Some switches can be capable of making short-circuit currents.

Note 2 to entry: A switch is not capable of breaking short-circuit currents.

[SOURCE: IEC 60050-441:2000, 441-14-10, modified – In the term, "(mechanical)" has been deleted and the Note has been replaced with two Notes to entry.]

3.4.102
switch-disconnector
switch which, in the open position, satisfies the isolating requirements specified for a disconnector

[SOURCE: IEC 60050-441:2000, 441-14-12]

3.4.103
general purpose switch
switch capable of performing, with currents up to its rated breaking currents, all making and breaking operations which may normally occur in distribution systems, regardless of whether it is an effectively earthed neutral system or non-effectively earthed neutral system, and able to carry and make short-circuit currents

3.4.104
limited purpose switch
switch which has a rated continuous current, a rated short-time withstand current, and one or more but not all switching capabilities of a general purpose switch

3.4.105
special purpose switch
general purpose switch or limited purpose switch suitable for one or more of the following applications:

– switching single capacitor banks;
– switching back-to-back capacitor banks;
– switching of motors under steady-state and stalled conditions;
– switching of closed-loop circuits consisting of large power transformers in parallel

Note 1 to entry: Large power transformers are different from distribution transformers (typically power higher than 2 500 KVA).

3.5 Parts of switchgear and controlgear

Subclause 3.5 of IEC 62271-1:2017 applies with the following addition:

3.5.101
main contact zone
area of the contact intended to carry its rated continuous current

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3.6 Operational characteristics of switchgear and controlgear

Subclause 3.6 of IEC 62271-1:2017 applies with the following additions:

3.6.101
operating cycle
<of a mechanical switching device> succession of operations from one position to another and back to the first position through all other positions, if any

Note 1 to entry: This may be a closing operation followed by an opening operation or vice versa.

[SOURCE: IEC 60050-441:2000, 441-16-02, modified – The note to entry has been added.]

3.6.102
electrical endurance of a general purpose switch
capability of a general purpose switch to perform a defined number of making and breaking operations for a defined voltage and current under specified operation conditions

3.6.103
mechanical endurance of a switch
capability of a switch to perform a defined number of close-open operations without voltage on or current through under specified operation conditions

3.7 Characteristic quantities

Subclause 3.7 of IEC 62271-1:2017 applies with the following additions:

3.7.101
breaking capacity
<of a switching device> current that a switching device is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

Note 1 to entry: The voltage to be stated and the conditions to be prescribed are dealt with in the relevant publications.

Note 2 to entry: For switching devices, the breaking capacity may be termed according to the kind of current included in the prescribed conditions, e.g. line-charging breaking capacity, cable-charging breaking capacity, single capacitor bank breaking capacity, etc.

Note 3 to entry: Any breaking capacity implies also the making capacity of the corresponding circuit.

[SOURCE: IEC 60050-441:2000, 441-17-08, modified – The domain has been limited to switching devices, "a value of prospective" and "or a fuse" have been deleted, Note 3 to entry has been added.]

3.7.102
mainly active load-breaking capacity
breaking capacity when opening a mainly active load circuit in which the load can be represented by resistors and reactors in parallel

3.7.103
no-load transformer breaking capacity
breaking capacity when opening a transformer circuit under no-load conditions

Note 1 to entry: Because of the variety of transformers and associated circuits, it is not possible to define a rating for this breaking capacity. However, all switches capable of switching an active load are capable of breaking no-load transformer breaking currents.

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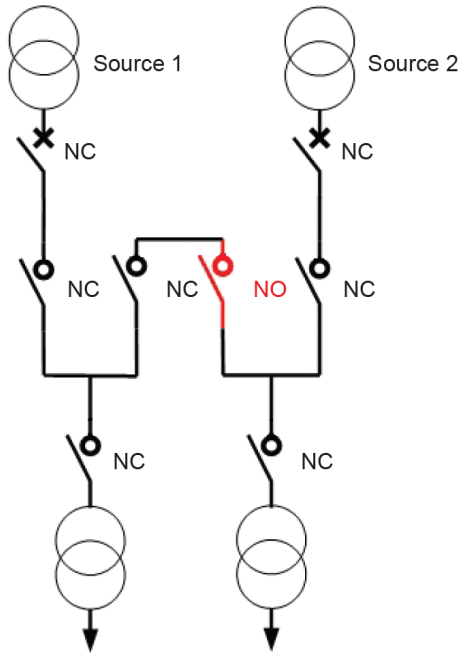
3.7.104
closed-loop breaking capacity
breaking capacity when opening a closed-loop distribution line circuit, or a power transformer in parallel with one or more power transformers, i.e. a circuit in which both sides of the switch remain energized after breaking

EXAMPLE 1 The switch NO can be operated to close the loop and avoid loss of service for the downstream users. Then another switch in the loop that has a closed-loop breaking capacity is opened.



NC: Switch or circuit-breaker normally closed

NO: Switch normally open

The switch NO can be closed to avoid loss of service for the downstream users. Another switch NC located in the same loop can be open for example for maintenance of a branch of the loop.

It may happen that both switches and transformers are not located in the same area.

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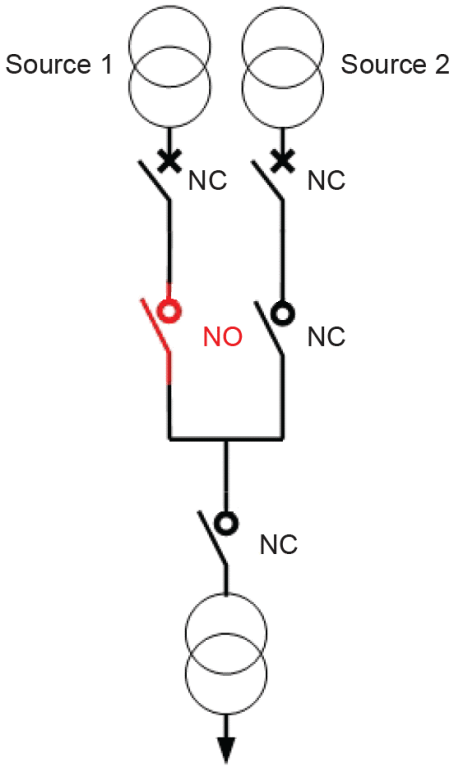
EXAMPLE 2 The switch NO can be operated to switch circuits of large power transformers in parallel.



NC: Switch or circuit-breaker normally closed

NO: Switch normally open

The switch NO can be closed to avoid loss of service of the downstream users. The switch NC located in the other branch can be open for example for maintenance.

Generally, both switches and transformers are in close location.

3.7.105
cable-charging breaking capacity
breaking capacity when opening a cable circuit under no-load conditions

3.7.106
line-charging breaking capacity
breaking capacity when opening an overhead line circuit under no-load conditions

3.7.107
single capacitor bank breaking capacity
breaking capacity when opening a single capacitor bank circuit connected to a supply where there are no other capacitors connected in parallel to the system sufficiently close to increase the inrush current significantly

3.7.108
back-to-back capacitor bank breaking capacity
breaking capacity when opening a capacitor bank circuit connected to a supply where there are other capacitors connected in parallel to the system sufficiently close to increase the inrush current significantly

3.7.109
back-to-back capacitor bank inrush making current
high-frequency and high-magnitude current occurring when closing a capacitor bank circuit onto a supply including one or more capacitor banks adjacent to the bank being switched

3.7.110
motor breaking capacity
breaking capacity when opening a motor circuit under steady-state and stalled conditions

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3.7.111
earth fault breaking capacity
breaking capacity in the faulty phase of a non-effectively earthed neutral system when clearing an earth fault on an unloaded cable or overhead line on the load side of the switch

3.7.112
cable- and line-charging breaking capacity under earth fault conditions
breaking capacity in the sound phases of a non-effectively earthed neutral system when switching off an unloaded cable or overhead line, with an earth fault on the supply side of the switch

3.7.113
breaking current
current in a pole of a switching device or in a fuse at the instant of initiation of the arc during a breaking process

[SOURCE: IEC 60050-441:2000, 441-17-07]

3.7.114
making current
peak value of the first major loop of the current in a pole of a switch during the transient period following the initiation of current during a making operation

Note 1 to entry: The peak value may differ from one pole to another and from one operation to another as it depends on the instant of current initiation relative to the wave of the applied voltage.

Note 2 to entry: Where, for a three-phase circuit, a single value of making current is referred to, it is, unless otherwise stated, the highest value in any phase.

3.7.115
short-circuit making capacity
making capacity for which the prescribed conditions include a short circuit at the terminals of the switching device

[SOURCE: IEC 60050-441:2000, 441-17-10]

3.7.116
capacitive breaking capability of a switch
capability of a switch to perform capacitive current breaking for defined voltage and current under specified operation conditions and restrike performance

3.7.117
re-ignition
<of an AC mechanical switching device> resumption of current between the contacts of a mechanical switching device during a breaking operation with an interval of zero current of less than a quarter cycle of power frequency

[SOURCE: IEC 60050-441:2000, 441-17-45]

3.7.118
restrike
<of an AC mechanical switching device> resumption of power frequency current, or in the case of capacitive current interruption a resumption of current in the main load circuit, between the contacts of a mechanical switching device during a breaking operation with an interval of zero current of a quarter cycle of power frequency or longer

[SOURCE: IEC 60050-441:2000, 441-17-46, modified – "power frequency" and "or in the case of capacitive current interruption a resumption of current in the main load circuit" have been added.]

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4 Normal and special service conditions

Clause 4 of IEC 62271-1:2017 is applicable.

5 Ratings

5.1 General

Subclause 5.1 of IEC 62271-1:2017 is applicable with the following additional ratings and classes:

k) rated mainly active load-breaking current (I_{load});

l) rated closed-loop breaking current (I_{loop});

m) rated parallel power transformer breaking current (I_{pptr});

n) rated cable-charging breaking current (I_{cc});

o) rated line-charging breaking current (I_{lc});

p) rated single capacitor bank breaking current (I_{sb});

q) rated back-to-back capacitor bank breaking current (I_{bb});

r) rated back-to-back capacitor bank inrush making current (I_{in});

s) rated earth fault breaking current (I_{ef1});

t) rated cable- and line-charging breaking current under earth fault conditions (I_{ef2});

u) rated motor breaking current (I_{mot});

v) rated short-circuit making current (I_{ma});

w) mechanical endurance class of switches (M1 or M2);

x) electrical endurance class of general purpose switches (E1, E2 or E3);

y) capacitive breaking capability class of switches (C1 or C2).

The conditions for applicability of these additional ratings are given in 5.113, depending on the type of switch (see 5.113.1) and/or application.

The conditions for applicability of classes indicated above are given in 5.114, 5.115 and 5.116.

5.2 Rated voltage (U_r)

Subclause 5.2 of IEC 62271-1:2017 is applicable.

5.3 Rated insulation level (U_d, U_p, U_s)

Subclause 5.3 of IEC 62271-1:2017 is applicable.

5.4 Rated frequency (f_r)

Subclause 5.4 of IEC 62271-1:2017 is applicable.

5.5 Rated continuous current (I_r)

Subclause 5.5 of IEC 62271-1:2017 is applicable.

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5.6 Rated short-time withstand current (I_k)

Subclause 5.6 of IEC 62271-1:2017 is applicable.

5.7 Rated peak withstand current (I_p)

Subclause 5.7 of IEC 62271-1:2017 is applicable.

5.8 Rated duration of short-circuit (t_k)

Subclause 5.8 of IEC 62271-1:2017 is applicable.

5.9 Rated supply voltage of auxiliary circuits and control circuits (U_a)

Subclause 5.9 of IEC 62271-1:2017 is applicable.

5.10 Rated supply frequency of auxiliary and control circuits

Subclause 5.10 of IEC 62271-1:2017 is applicable.

5.11 Rated pressure of compressed gas supply for controlled pressure systems

Subclause 5.11 of IEC 62271-1:2017 is applicable with the following additions:

This rating applies only to power sources of operating devices.

NOTE Controlled pressure systems for insulation or switching are no longer manufactured for a level up to 52 kV. Therefore, only gas supply for operating devices is considered.

5.101 Rated mainly active load-breaking current (I_{load})

The rated mainly active load-breaking current is the maximum mainly active load current that the switch shall be capable of breaking at its rated voltage. Its value shall be equal to the rated continuous current if no other value is indicated on the nameplate.

5.102 Rated closed-loop breaking current (I_{loop})

The rated closed-loop breaking current is the maximum closed-loop current the switch shall be capable of breaking.

5.103 Rated parallel power transformer breaking current for special purpose switches (I_{pptr})

The rated parallel power transformer breaking current is the maximum closed-loop parallel power transformer current that a special purpose switch shall be capable of breaking.

5.104 Rated cable-charging breaking current (I_{cc})

The rated cable-charging breaking current is the maximum cable-charging current that the switch shall be capable of breaking at its rated voltage.

5.105 Rated line-charging breaking current (I_{lc})

The rated line-charging breaking current is the maximum line-charging current that the switch shall be capable of breaking at its rated voltage.

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5.106 Rated single capacitor bank breaking current for special purpose switches (I_{sb})

The rated single capacitor bank breaking current is the maximum capacitor bank current that a special purpose switch shall be capable of breaking at its rated voltage with no capacitor bank connected to the supply side of the switch adjacent to the bank being switched.

5.107 Rated back-to-back capacitor bank breaking current for special purpose switches (I_{bb})

The rated back-to-back capacitor bank breaking current is the maximum capacitor bank current that a special purpose switch shall be capable of breaking at its rated voltage with one or more capacitor banks connected on the supply side of the switch adjacent to the bank being switched.

The preferred rated back-to-back capacitor bank breaking current is 400 A.

5.108 Rated back-to-back capacitor bank inrush making current for special purpose switches (I_{in})

The rated back-to-back capacitor bank inrush making current is the peak value of the current that a special purpose switch shall be capable of making at its rated voltage and with a frequency of the inrush current appropriate to the service conditions.

The assignment of a rated back-to-back capacitor bank inrush making current is mandatory for switches that have a rated back-to-back capacitor bank breaking current.

The preferred rated back-to-back capacitor bank inrush making current is 20 kA peak, with a frequency of the inrush current of 4 250 Hz.

NOTE The frequency and magnitude of the inrush current are dependent upon the size and configuration of the capacitor bank being switched, the capacitor bank already connected to the supply side of the switch and the inclusion of limiting impedances, if any.

5.109 Rated earth fault breaking current (I_{ef1})

The rated earth fault breaking current is the maximum capacitive earth fault current in the faulted phase that the switch shall be capable of breaking at its rated voltage, when used on a non-effectively earthed neutral system.

NOTE The maximum value of capacitive earth fault current occurring in an isolated neutral earthing system can reach up to three times the cable- and line-charging current of the network. Further guidance is given in Annex B.

5.110 Rated cable- and line-charging breaking current under earth fault conditions (I_{ef2})

The rated cable- and line-charging breaking current under earth fault conditions is the maximum capacitive current in the non-faulty phases that the switch shall be capable of breaking at its rated voltage, when used on a non-effectively earthed neutral system.

NOTE The maximum value of capacitive current on non-faulty phases under earth fault conditions occurring in an isolated neutral earthing system can reach up to √3 times the cable- and line-charging current of the network. Further guidance is given in Annex B.

5.111 Rated motor breaking current for special purpose switches (I_{mot})

The rated motor breaking current is the maximum steady-state current of a motor that a special purpose switch shall be capable of breaking at its rated voltage. Refer to IEC 62271-110:2017.

NOTE Typically the breaking current for the condition of a stalled motor is in the order of eight times the rated continuous current of the motor.

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5.112 Rated short-circuit making current (I_{ma})

The rated short-circuit making current is the maximum peak current that the switch shall be capable of making at its rated voltage.

5.113 Types of switches and their associated ratings

5.113.1 Types of switches

Every switch complying with this document shall be designated by type as general purpose, limited purpose, or special purpose.

5.113.2 Rated making and breaking currents for general purpose switches

A general purpose switch shall have specific ratings for each switching duty as follows:

– rated mainly active load-breaking current equal to or higher than the rated continuous current;
– rated closed-loop breaking current equal to or higher than the rated continuous current;
– rated cable-charging breaking current (which should be selected from Table 1);
– rated line-charging breaking current (which should be selected from Table 1);
– rated short-circuit making current equal to the rated peak withstand current;
– rated earth fault breaking current;
– rated cable- and line-charging breaking current under earth fault conditions.

The rated values should be selected from the R10 series specified in IEC 60059 [1][1].

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

[1] Numbers in square brackets refer to the bibliography.

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Table 1 – Preferred values of rated line- and cable-charging breaking currents for general purpose switches

Rated voltage U_r kV	Rated cable-charging I_{cc} A	Rated line-charging I_{lc} A
3,6	4	0,3
4,76[a]	4	0,3
7,2	6	0,5
8,25[a]	6	0,5
12	10	1
15[a]	10	1
15,5[a]	10	1
17,5	10	1
24	16	1,5
25,8[a]	16	1,5
27[a]	16	1,5
36	20	2
38[a]	20	2
40,5	20	2
48,3[a]	24	2,5
52	24	2,5

[a] Based on current practice in some countries, including the USA.

5.113.3 Rated making and breaking currents for limited purpose switches

A limited purpose switch shall have one or more, but not all, switching capabilities of a general purpose switch (see 5.113.2).

5.113.4 Rated making and breaking currents for special purpose switches

A special purpose switch may have one or more of the switching capabilities of a general purpose switch (see 5.113.2) and shall have switching capabilities appropriate for the specific special service application for which the switch is designed. One or more of the following ratings shall be assigned:

– rated parallel power transformer breaking current;
– rated single capacitor bank breaking current;
– rated back-to-back capacitor bank inrush making current;
– rated motor breaking current.

The rated values should be selected from the R10 series specified in IEC 60059 [1].

5.113.5 Ratings for switches backed by fuses

General purpose, limited purpose and special purpose switches may be backed by fuses.

If this is the case, short-circuit ratings, short-time withstand currents, and making currents of switches may be selected by consideration of the limiting effect on the duration and value of the short-circuit current by fuses. IEC 62271-105 [2] may be used for this purpose.

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5.114 Mechanical endurance class of switches

5.114.1 Class M1 switch

Switch having a mechanical endurance of 1 000 close-open operations and tested in accordance with 7.102.2.1.

5.114.2 Class M2 switch

Switch having a mechanical endurance of 5 000 close-open operations and tested in accordance with 7.102.2.2.

5.115 Electrical endurance class of general purpose switches

5.115.1 Class E1 general purpose switch

General purpose switch capable of performing a basic electrical endurance of load-breaking currents and short-circuit makings. The level of performance required is given in the corresponding columns of Table 3 and Table 4, and the tests to demonstrate the performance are described in 7.101.1.2 and 7.101.1.3.

NOTE This class is typically adequate for applications where infrequent switching operations are performed or where appropriate inspection and replacement of switching parts is permissible.

5.115.2 Class E2 general purpose switch

General purpose switch capable of performing a medium electrical endurance of load-breaking currents and short-circuit makings. The level of performance required is given in the corresponding columns of Table 3 and Table 4, and the tests to demonstrate the performance are described in 7.101.1.2 and 7.101.1.3.

NOTE This class is typically adequate for applications where infrequent switching operations are performed but where inspection and replacement of switching parts is not permissible or possible.

5.115.3 Class E3 general purpose switch

General purpose switch capable of performing a high electrical endurance of load-breaking currents and short-circuit makings. The level of performance required is given in the corresponding columns of Table 3 and Table 4, and the tests to demonstrate the performance are described in 7.101.1.2 and 7.101.1.3.

NOTE This class is typically adequate for applications where frequent switching operations are performed and inspection and replacement of switching parts is not permissible or possible.

5.116 Capacitive breaking capability class of switches

5.116.1 General

It is possible that a switch may be classified as class C2 for cable-charging for example, but as class C1 for capacitor bank.

5.116.2 Class C1 switch

Switch with demonstrated capability of capacitive current breaking which has exhibited restrikes during at least one of the following specific type tests (test duties TD_{cc2}, TD_{cc1}, TD_{lc}, TD_{sb2}, TD_{sb1}, TD_{bb2} and TD_{bb1}) and is not complying with the conditions to be class C2.

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5.116.3 Class C2 switch

Switch with very low probability of restrike during capacitive current breaking as demonstrated by not exhibiting restrikes during the specific type tests (test duties TD_{cc2}, TD_{cc1}, TD_{lc}, TD_{sb2}, TD_{sb1}, TD_{bb2} and TD_{bb1}) for which the switch is rated. However, is also considered belonging to this class, a switch exhibiting a single restrike for at least one of the indicated test duties but no restrike during repetition of the specific test duty. See 7.101.8.

6 Design and construction

6.1 Requirements for liquids in switchgear and controlgear

Subclause 6.1 of IEC 62271-1:2017 is applicable.

6.2 Requirements for gases in switchgear and controlgear

Subclause 6.2 of IEC 62271-1:2017 is applicable.

6.3 Earthing of switchgear and controlgear

Subclause 6.3 of IEC 62271-1:2017 is applicable.

6.4 Auxiliary and control equipment and circuits

Subclause 6.4 of IEC 62271-1:2017 is applicable.

6.5 Dependent power operation

Subclause 6.5 of IEC 62271-1:2017 is applicable.

6.6 Stored energy operation

Subclause 6.6 of IEC 62271-1:2017 is applicable with the following addition:

See also 6.105 of IEC 62271-102:2018 for maximum manual operating (storing energy) forces.

6.7 Independent unlatched operation (independent manual or power operation)

Subclause 6.7 of IEC 62271-1:2017 is applicable with the following addition:

See also 6.105 of IEC 62271-102:2018 for maximum manual operating (storing energy) forces.

6.8 Manually operated actuators

Subclause 6.8 of IEC 62271-1:2017 is applicable.

6.9 Operation of releases

Subclause 6.9 of IEC 62271-1:2017 is applicable.

6.10 Pressure/level indication

Subclause 6.10 of IEC 62271-1:2017 is applicable.

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