



BSI Standards Publication

High-voltage switchgear and controlgear

Part 102: Alternating current disconnectors and earthing switches

National foreword

This British Standard is the UK implementation of EN IEC 62271-102:2018. It is identical to IEC 62271-102:2018. It supersedes BS EN 62271-102:2002+A2:2013, which is withdrawn.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 secretary.

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English Version

High-voltage switchgear and controlgear -
Part 102: Alternating current disconnectors and earthing
switches
(IEC 62271-102:2018)

Appareillage à haute tension -
Partie 102: Sectionneurs et sectionneurs de terre à courant
alternatif
(IEC 62271-102:2018)

Hochspannungs-Schaltgeräte und -Schaltanlagen -
Teil 102: Wechselstrom-Trennschalter und -
Erdungsschalter
(IEC 62271-102:2018)

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European foreword

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- latest date by which the national (dow) 2021-06-19
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document have to be withdrawn

This document supersedes EN 62271-102:2002.

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Endorsement notice

The text of the International Standard IEC 62271-102:2018 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 60507:2013	NOTE	Harmonized as EN 60507:2014 (not modified).
IEC 60447:2004	NOTE	Harmonized as EN 60447:2004 (not modified).
IEC 60060-1:2010	NOTE	Harmonized as EN 60060-1:2010 (not modified).

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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-151	-	International Electrotechnical Vocabulary - - Part 151: Electrical and magnetic devices		-
IEC 60050-441	-	International Electrotechnical Vocabulary - - (IEV) - Chapter 441: Switchgear, controlgear and fuses		-
IEC 60050-471	-	International Electrotechnical Vocabulary - - Part 471: Insulators		-
IEC 60050-614	-	International electrotechnical vocabulary - - Part 614: Generation, transmission and distribution of electricity - Operation		-
IEC 60071-2	-	Insulation co-ordination - Part 2: Application guidelines	EN IEC 60071-2	-
IEC 60137	-	Insulated bushings for alternating voltages above 1000 V	EN 60137	-
IEC 60270	-	High-voltage test techniques - Partial discharge measurements	EN 60270	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529 corr. May	1991 1993
+A1	1999		+A1	2000
+A2	2013		+A2	2013
IEC 60865-1	-	Short-circuit currents - Calculation of effects - Part 1: Definitions and calculation methods	EN 60865-1	-
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

EN IEC 62271-102:2018

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62271-100	2008	High-voltage switchgear and controlgear -	EN 62271-100	2009
+A1	2012	Part 100: Alternating current circuit-	+A1	2012
+A2	2017	breakers	+A2	2017
IEC 62271-101	2012	High-voltage switchgear and controlgear -	EN 62271-101	2013
+A1	2017	Part 101: Synthetic testing	-	-
IEC 62271-200	2011	High-voltage switchgear and controlgear -	EN 62271-200	2012
		Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV		
IEC 62271-201	2014	High-voltage switchgear and controlgear -	EN 62271-201	2014
		Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV		
IEC 62271-203	2011	High-voltage switchgear and controlgear -	EN 62271-203	2012
		Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV		
IEC/TR 62271-305	-	High-voltage switchgear and controlgear -	-	-
		Part 305: Capacitive current switching capability of air-insulated disconnectors for rated voltages above 52 kV		
ISO 2768-1	-	General tolerances -	EN 22768-1	-
		Part 1: Tolerances for linear and angular dimensions without individual tolerance indications		

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 102: Alternating current disconnectors and earthing switches

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62271-102 has been prepared by subcommittee 17A: Switching devices, of IEC technical committee 17: High-voltage switchgear and controlgear.

This second edition cancels and replaces the first edition published in 2001, Amendment 1:2011 and Amendment 2:2013. This edition constitutes a technical revision.

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

- a) new numbering according to IEC 17/1025/RQ to harmonize with ISO/IEC Directives, Part 2, and IEEE Std. C37.100.1;
- b) clause numbering has been aligned with IEC 62271-1:2017;
- c) the Scope has been extended to cover all indoor and outdoor installations. Consideration of switching devices having disconnecting and/or earthing switch functionalities, apart from other functions, are also covered by this document;

- d) ratings have been moved from Annexes B, C and E to Clause 5; the order of the subclauses now corresponds to the order of subclauses in Clause 7;
- e) new rating values for bus-transfer current and bus-transfer voltage have been assigned;
- f) new class of mechanical endurance for earthing switches has been added (M1);
- g) subclause "Rated values of electrical endurance for earthing switches" is now called "Classification of earthing switches for short-circuit making capability";
- h) new subclause with ratings for ice-coating has been added;
- i) new subclause with classification of bus-charging switching capability has been added;
- j) new withstand requirements for interlocking devices have been added;
- k) the way to comply with the requirements of the isolating distance of disconnectors has been modified;
- l) design and construction requirements for position-indicating devices have been modified, aligning the requirements for position indication and signalling;
- m) the value of the operating force has been changed;
- n) the test procedures and validation criteria have been revised and modified where necessary;
- o) requirements for applied voltage during single-phase test on non-simultaneous closing earthing switches have been changed;
- p) non-verifiable requirements have been deleted;
- q) a new subclause has been added for testing mechanical interlocking devices;
- r) the high- and low-temperature test is mandatory if the temperature limits for the service conditions of the apparatus (defined by the manufacturer) are above +40 °C or below –5 °C, and a more detailed testing procedure is given;
- s) the testing procedure to verify the proper functioning of the position-indicating device allows a more practicable testing for every technology used;
- t) a new Annex B has been added with title: "Current-switching capability required of disconnectors and earthing switches";
- u) a new Annex C has been added with title: "Tolerances on test quantities for type tests";
- v) a new Annex E has been added with title: "Extension of validity of type tests".

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 order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses, except annexes, is used as in IEC 62271-1:2017. Additional subclauses are numbered from 101.

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

FDIS	Report on voting
17A/1173/FDIS	17A/1180/RVD

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

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

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 this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 102: Alternating current disconnectors and earthing switches

1 Scope

This part of IEC 62271 applies to alternating current disconnectors and earthing switches, designed for indoor and outdoor installations for nominal voltages above 1 000 V and for service frequencies up to and including 60 Hz.

It also applies to the operating devices of these disconnectors and earthing switches and their auxiliary equipment.

Additional requirements for disconnectors and earthing switches in enclosed switchgear and controlgear are given in IEC 62271-200, IEC 62271-201 and IEC 62271-203.

NOTE Disconnectors in which the fuse forms an integral part are not covered by this standard.

This document is also applicable to switching devices having disconnecting and/or earthing functionalities apart from other functions, such as high-speed earthing switch, circuit-breaker and switch-disconnector.

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 60050-151, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60050-441, *International Electrotechnical Vocabulary – Chapter 441: Switchgear controlgear and fuses*

IEC 60050-471, *International Electrotechnical Vocabulary – Part 471: Insulators*

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

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

IEC 60137, *Insulating bushings for alternating voltages above 1 000 V*

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

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

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60865-1, *Short-circuit currents – Calculation of effects – Part 1: Definitions and calculation methods*

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 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*

IEC 62271-100:2008/AMD1:2012

IEC 62271-100:2008/AMD2:2017

IEC 62271-101:2012, *High-voltage switchgear and controlgear – Part 101: Synthetic testing*
IEC 62271-101:2012/AMD1:2017

IEC 62271-200:2011, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-201:2014, *High-voltage switchgear and controlgear – Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

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

IEC/TR 62271-305, *High-voltage switchgear and controlgear – Part 305: Capacitive current switching capability of air-insulated disconnectors for rated voltages above 52 kV*

ISO 2768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-151, IEC 60050-441, IEC 60050-471, IEC 60050-614, 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>

3.1 General terms and definitions

3.1.101

indoor switchgear and controlgear

switchgear and controlgear designed solely for installation within a building or other housing, where the switchgear and controlgear is protected against wind, rain, snow, abnormal dirt deposits, abnormal condensation, ice and hoar frost

[SOURCE: IEC 60050-441:2000, 441-11-04]

3.1.102

outdoor switchgear and controlgear

switchgear and controlgear suitable for installation in the open air, i.e. capable of withstanding wind, rain, snow, dirt deposits, condensation, ice and hoar frost

[SOURCE: IEC 60050-441:2000, 441-11-05]

3.1.103

user

person or legal entity using the disconnectors or earthing switches

Note 1 to entry: This can include the purchaser (for example an electricity supplier), but it can also include the contracting company, the staff responsible for erection of installation, the maintenance or operating staff or anybody else temporarily or permanently responsible for the disconnector, earthing switch or electrical installation, or even the operation of the switchgear.

3.2 Assemblies of switchgear and controlgear

3.2.1

test object

equipment needed to represent the specimen for a particular type test

[SOURCE: IEC 62271-1:2017, 3.2.1, modified – "switchgear and controlgear" replaced by "specimen"]

3.3 Parts of assemblies

Subclause 3.3 of IEC 62271-1:2017 is applicable.

3.4 Switching devices

3.4.101

disconnector

mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements

Note 1 to entry: A disconnector is capable of opening and closing a circuit when either negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the poles of the disconnector occurs. It is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short-circuit.

Note 2 to entry: "Negligible current" implies currents such as the capacitive currents of bushings, busbars, connections, very short lengths of cable, currents of permanently connected grading impedances of circuit-breakers and currents of voltage transformers and dividers (see also IEC/TR 62271-305). For $U_r \leq 420$ kV, a current not exceeding 0,5 A is a negligible current for the purpose of this definition; for $U_r > 420$ kV and currents exceeding 0,5 A, the manufacturer should be consulted. "No significant change in voltage" refers to such applications as the by-passing of induction voltage regulators or circuit-breakers and bus transfer.

[SOURCE: IEC 60050-441:2000, 441-14-05, modified – Note 2 to entry has been added]

3.4.102

divided support disconnector

divided support earthing switch

disconnector (or earthing switch) in which the fixed and moving contacts of each pole are not supported by a common base or frame

Note 1 to entry: A typical example is the pantograph or semi-pantograph disconnector (or earthing switch).

[SOURCE: IEC 60050-441:2000, 441-14-06 and -07, modified – The term "earthing switch" is completed with "divided support" and the term "disconnector" substituted by "earthing switch" in Note 1 to entry when appropriate; Note 2 to entry deleted.]

3.4.103

centre-break disconnector

disconnector in which both contacts of each pole are movable and engage at a point substantially midway between their supports

Note 1 to entry: This term applies to high-voltage disconnectors only.

[SOURCE: IEC 60050-441:2000, 441-14-08]

3.4.104

double-break disconnecter

disconnecter that opens a circuit at two points

[SOURCE: IEC 60050-441:2000, 441-14-09]

3.4.105

resistor-fitted disconnecter

disconnecter fitted with resistor in series or in parallel to the switching contacts in order to mitigate the very fast transient overvoltage (VFTO) during both the opening and closing operation in metal-enclosed gas-insulated switchgear

3.4.106

earthing switch

mechanical switching device for earthing parts of a circuit, capable of withstanding for a specified time currents under abnormal conditions such as those of short-circuit, but not required to carry current under normal conditions of the circuit

Note 1 to entry: An earthing switch may have a short-circuit making capacity.

Note 2 to entry: An earthing switch of $U_r > 52$ kV may have a rating for switching and carrying induced currents.

Note 3 to entry: These devices may sometimes be operated against short-circuit. The different classes of earthing switches are related to the number of short-circuit making operations.

Note 4 to entry: In some cases, earthing switches are used as fault-initiating devices.

[SOURCE: IEC 60050-441:2000, 441-14-11, modified – the Notes 2, 3 and 4 to entry have been added]

3.4.107

combined function earthing switch

earthing switch having a common contact system for earthing and at least one of the following functions:

- disconnecting;
- making and/or breaking of currents up to the short-circuit current.

3.4.108

switch-disconnector

switch which, in the open position, satisfies the isolating requirements specified for a disconnecter

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

3.5 Parts of switching devices

3.5.101

pole of a switching device

portion of a switching device associated exclusively with one electrically separated conducting path of its main circuit and excluding those portions which provide a means for mounting and operating all poles together

Note 1 to entry: A switching device is called single-pole if it has only one pole. If it has more than one pole, it may be called multipole (two-pole, three-pole, etc.) provided the poles are or can be coupled in such a manner as to operate together.

[SOURCE: IEC 60050-441:2000, 441-15-01]

3.5.102

main circuit

<of a switching device> all the conductive parts of a switching device included in the circuit which it is designed to close or open

[SOURCE: IEC 60050-441:2000, 441-15-02]

3.5.103

contact

<of a mechanical switching device> conductive parts designed to establish circuit continuity when they touch and which, due to their relative motion during an operation, open or close a circuit or, in the case of hinged or sliding contacts, maintain circuit continuity

[SOURCE: IEC 60050-441:2000, 441-15-05]

3.5.104

main contact

contact included in the main circuit of a mechanical switching device, intended to carry, in the closed position, the current of the main circuit

[SOURCE: IEC 60050-441:2000, 441-15-07]

3.5.105

control contact

contact included in a control circuit of a mechanical switching device and mechanically operated by this device

[SOURCE: IEC 60050-441:2000, 441-15-09]

3.5.106

"a" contact

make contact

control or auxiliary contact that is closed when the main contacts of the mechanical switching device are closed and open when they are open

[SOURCE: IEC 60050-441:2000, 441-15-12]

3.5.107

"b" contact

break contact

control or auxiliary contact that is open when the main contacts of a mechanical switching device are closed and closed when they are open

[SOURCE: IEC 60050-441:2000, 441-15-13]

3.5.108

position-indicating device

part of a mechanical switching device that indicates whether it is in the open, closed, or where appropriate, earthed position

[SOURCE: IEC 60050-441:2000, 441-15-25]

3.5.109

position-signalling device

part of a disconnector or earthing switch which uses auxiliary energy to indicate whether the contacts of the main circuit are in the open or closed position

3.5.110**terminal**

conductive part of a device, electric circuit or electric network, provided for connecting that device, electric circuit or electric network to one or more external conductors

[SOURCE: IEC 60050-151:2014, 151-12-12, modified – the note has been deleted.]

3.5.111**contact zone**

<for divided support disconnectors and earthing switches> spatial region of positions the fixed contact may take up for correct engagement with the moving contact

3.5.112**power kinematic chain**

mechanical connecting system between the operating mechanism and the moving contacts, both included

Note 1 to entry: Refer to Figure 1.

3.5.113**position-indicating kinematic chain**

mechanical connecting system between the moving contacts and the position-indicating device(s), both included

3.5.114**position-signalling kinematic chain**

mechanical connecting system between the moving contacts and the position of the signalling device(s)

3.5.115**connecting point**

most upstream point (i.e. the closest to the source of energy) of the common part of the power and position-indicating/signalling kinematic chains

3.5.116**strain limiting device**

device that limits to a defined value the torque or force transmitted to the downstream side of the device irrespective of the torque or force applied to the upstream side

3.5.117**torque (force) controlling system**

system that monitors and controls the torque (force) transmitted to the downstream side of the device in comparison with defined value

3.5.118**bushing**

device that enables one or several conductors to pass through a partition such as a wall or a tank, and insulate the conductors from it

[SOURCE: IEC 60050-471:2007, 471-02-01, modified – Notes 1 and 2 to entry deleted]

3.5.119**source of energy**

origin of the energy released or of the force/torque applied to the power kinematic chain of a switching device during an operation or at any stable position of it

Note 1 to entry: The origin of the energy or force/torque can be human, electrical, hydraulics, pneumatics and mechanics i.e. springs, weights, etc. alone or in combination.

3.6 Operation

3.6.101

operation

<of a mechanical switching device> transfer of the moving contact(s) from one position to an adjacent position

Note 1 to entry: For a circuit-breaker, this may be a closing operation or an opening operation.

Note 2 to entry: If distinction is necessary, an operation in the electrical sense, e.g. make or break, is referred to as a switching operation, and an operation in the mechanical sense, e.g. close or open, is referred to as a mechanical operation.

[SOURCE: IEC 60050-441:2000, 441-16-01]

3.6.102

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

[SOURCE: IEC 60050-441:2000, 441-16-02]

3.6.103

closing operation

<of a mechanical switching device> operation by which the device is brought from the open position to the closed position

[SOURCE: IEC 60050-441:2000, 441-16-08]

3.6.104

opening operation

<of a mechanical switching device> operation by which the device is brought from the closed position to the open position

[SOURCE: IEC 60050-441:2000, 441-16-09]

3.6.105

dependent manual operation

<of a mechanical switching device> operation solely by means of directly applied manual energy, such that the speed and force of the operation are dependent upon the action of the operator

Note 1 to entry: Dependent manual operation may be performed by a crank or by a swing lever (horizontal or vertical).

Note 2 to entry: Switching devices with dependent manual operation have not any inherent switching capability.

[SOURCE: IEC 60050-441:2000, 441-16-13, modified – Notes 1 and 2 to entry have been added]

3.6.106

dependent power operation

<of a mechanical switching device> operation by means of energy other than manual, where the completion of the operation is dependent upon the continuity of the power supply (to solenoids, electric or pneumatic motors, etc.)

[SOURCE: IEC 60050-441:2000, 441-16-14]

3.6.107**stored energy operation**

<of a mechanical switching device> operation by means of energy stored in the mechanism itself prior to the completion of the operation and sufficient to complete it under predetermined conditions

Note 1 to entry: This kind of operation may be subdivided according to:

- 1) the manner of storing the energy (spring, weight, etc.);
- 2) the origin of the energy (manual, electric, etc.);
- 3) the manner of releasing the energy (manual, electric, etc.).

[SOURCE: IEC 60050-441:2000, 441-16-15]

3.6.108**independent manual operation**

<of a mechanical switching device> stored energy operation where the energy originates from manual power, stored and released in one continuous operation, such that the speed and force of the operation are independent of the action of the operator

[SOURCE: IEC 60050-441:2000, 441-16-16]

3.6.109**closed position**

<of a mechanical switching device> position in which the predetermined continuity of the main circuit of the device is secured

Note 1 to entry: Predetermined continuity means that the contacts are fully closed to carry the rated continuous and the rated short-circuit currents, as applicable.

[SOURCE: IEC 60050-441:2000, 441-16-22, modified – Note to entry has been added]

3.6.110**open position**

<of a mechanical switching device> position in which the predetermined clearance between open contacts in the main circuit of the device is secured

[SOURCE: IEC 60050-441:2000, 441-16-23]

3.6.111**toggle point**

point beyond which any further movement of the charging mechanism causes the stored energy to be released

3.6.112**mechanical endurance**

<of a disconnector or earthing switch> capability of a disconnector or earthing switch to perform a defined number of operations without voltage on or current through the circuit under specified operation conditions

3.7 Characteristic quantities**3.7.101****peak making current**

<of an earthing switch> peak value of the first major loop of the current in a pole of the earthing switch during the transient period following the initiation of current during a making operation

Note 1 to entry: Where, for a three-phase circuit, a single value of (peak) making current is referred to, this is, unless otherwise stated, the highest value in any phase.

3.7.102**peak current**

peak value of the first major loop of current during the transient period following initiation

3.7.103**short-time withstand current**

current that a circuit or a switching device in the closed position can carry during a specified short time under prescribed conditions of use and behaviour

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

3.7.104**peak withstand current**

value of peak current that a circuit or a switching device in the closed position can withstand under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441:2000, 441-17-18]

3.7.105**insulation level**

set of withstand voltages specified which characterize the dielectric strength of the insulation

[SOURCE: IEC 60050-614:2016, 614-03-23]

3.7.106**power frequency withstand voltage**

RMS value of sinusoidal power frequency voltage that the insulation of the given equipment can withstand during tests made under specified conditions and for a specified duration

[SOURCE: IEC 60050-614:2016, 614-03-22]

3.7.107**lightning impulse withstand voltage**

peak value of the lightning impulse voltage which the insulation of the disconnector or earthing switch withstands under specified test conditions

3.7.108**switching impulse withstand voltage**

peak value of the switching impulse voltage which the insulation of the disconnector or earthing switch withstands under specified test conditions

3.7.109**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.

Note 2 to entry: External insulation is either weather-protected or non-weather-protected, designed to operate inside or outside closed shelters, respectively.

[SOURCE: IEC 60050-614:2016, 614-03-02, modified – Note 2 to entry has been added]

3.7.110**internal insulation**

internal distances of the solid, liquid or gaseous insulation of equipment which are protected from the effects of atmospheric and other external conditions

[SOURCE: IEC 60050-614:2016, 614-03-03]

3.7.111**self-restoring insulation**

insulation which completely recovers its insulating properties within a short time after a disruptive discharge

[SOURCE: IEC 60050-614:2016, 614-03-04]

3.7.112**non-self-restoring insulation**

insulation which loses its insulating properties, or does not recover them completely, after a disruptive discharge

Note 1 to entry: Definitions 3.7.111 and 3.7.112 apply only when the discharge is caused by the application of a test voltage during a dielectric test. However, discharges occurring in service can cause a self-restoring insulation to lose partially or completely its original insulating properties.

[SOURCE: IEC 60050-614:2016, 614-03-05, modified – Note to entry has been added]

3.7.113**parallel insulation**

insulator arrangement with two insulators in parallel where the distance between the two insulators might influence the dielectric strength

Note 1 to entry: With open terminal disconnectors and earthing switches, parallel insulation is used when a drive insulator is situated next to a support insulator.

3.7.114**disruptive discharge**

failure of insulation under electric stress, in which the discharge completely bridges the insulation under test, reducing the voltage between electrodes to practically zero

Note 1 to entry: Non-sustained disruptive discharge in which the test object is momentarily bridged by a spark or arc may occur. During these events the voltage across the test object is momentarily reduced to zero or to a very small value. Depending on the characteristics of the test circuit and the test object, a recovery of dielectric strength may occur and may even allow the test voltage to reach a higher value. Such an event should be interpreted as a disruptive discharge unless otherwise specified by the relevant technical committee.

Note 2 to entry: A disruptive discharge in a solid dielectric produces permanent loss of dielectric strength; in a liquid or gaseous dielectric the loss may be only temporary.

[SOURCE: IEC 60060-1:2010, 3.1.1]

3.7.115**clearance**

distance between two conductive parts along a string stretched the shortest way between these conductive parts

[SOURCE: IEC 60050-441:2000, 441-17-31]

3.7.116**clearance between poles**

clearance between any conductive parts of adjacent poles

[SOURCE: IEC 60050-441:2000, 441-17-32]

3.7.117

clearance to earth

clearance between any conductive parts and any parts which are earthed or intended to be earthed

[SOURCE: IEC 60050-441:2000, 441-17-33]

3.7.118

clearance between open contacts

total clearance between the contacts, or any conductive parts connected thereto, of a pole of a mechanical switching device in the open position

Note 1 to entry: The total clearance is the sum of the clearances existing between the contacts.

[SOURCE: IEC 60050-441:2000, 441-17-34, modified – Note to entry has been added]

3.7.119

mechanical terminal load

external load acting on each terminal

Note 1 to entry: The external load is the result of the combined mechanical forces which may be applied to the terminals of the switching device. Wind forces acting on the equipment itself are not included as they do not contribute to the external load acting on terminals.

Note 2 to entry: A disconnector or earthing switch can be subjected to several mechanical forces different in value, direction and point of action.

Note 3 to entry: The terminal loads as defined here do not usually apply to enclosed switchgear.

3.7.119.1

static mechanical terminal load

static mechanical terminal load at each terminal equivalent to the mechanical force to which this terminal of the disconnector or earthing switch is subjected by the flexible or rigid conductor connected to this terminal

Note 1 to entry: The static mechanical terminal load includes forces resulting from ice, wind and connected conductors.

3.7.119.2

dynamic mechanical terminal load

combination of the static mechanical load and the electromagnetic forces under short-circuit conditions

3.7.120

bus-transfer current switching

opening and closing of disconnectors under load when this load is not interrupted, but transferred from one bus to a parallel bus

3.7.121

bus-transfer current

current that flows when a load is transferred from one bus system to another

3.7.122

bus-transfer voltage

power frequency voltage across the open disconnector after breaking or before making the bus-transfer current

3.7.123**induced current switching**

making or breaking of inductive or capacitive currents by an earthing switch, whereupon the currents are induced in an earthed or unearthed system by adjacent energized lines or cables

Note 1 to entry: When two or more transmission lines are mounted together, energy will be induced electrostatically and/or electromagnetically from a live system into a de-energized system resulting in capacitive or inductive currents flowing in this system, depending whether it is earthed at one or at both ends.

3.7.124**electromagnetically induced current**

<on an earthing switch> inductive current that flows through an earthing switch when it connects to and disconnects from earth one termination of a de-energized transmission line, with the other termination earthed, and with an energized line carrying current in parallel with, and in proximity to, the earthed line

Note 1 to entry: The inductive current in a de-energized line earthed at both terminations is dependent upon the current in the energized line and the coupling factor to the energized line, as determined by the circuit configuration.

3.7.125**electrostatically induced current**

<on an earthing switch> capacitive current that flows through an earthing switch when it connects to and disconnects from earth one termination of a de-energized transmission line, with the other termination open, and with an energized line in parallel with, and in proximity to, the earthed line

Note 1 to entry: The capacitive current in a de-energized line earthed at one termination is dependent upon the voltage of the energized line, the coupling factor to the energized line as determined by the circuit configuration, and the length of the earthed line between the earthed termination and the open termination.

3.7.126**bus-charging current switching**

making or breaking of bus-charging currents by disconnectors

3.7.127**bus-charging current**

capacitive current that flows when an isolated part of a busbar system is energised or de-energised

3.7.128**transient voltage to earth**

U_{TVE}

voltage to earth which appears at the first prestrike during a closing operation of a disconnector

3.7.129**filling pressure for insulation and/or switching****filling density for insulation and/or switching**

pressure in Pascal (Pa) for insulation and/or for switching, referred to the standard atmospheric air conditions of +20 °C and 101,3 kPa (or density), which may be expressed in relative or absolute terms, to which the assembly is filled before being put into service, or automatically replenished

[SOURCE: IEC 62271-1:2017, 3.6.5.1]

3.7.130**minimum functional pressure for insulation and/or switching****minimum functional density for insulation and/or switching**

pressure (Pa) for insulation and/or for switching, referred to the standard atmospheric air conditions of +20 °C and 101,3 kPa (or density), which may be expressed in relative or

absolute terms, at which and above which rated characteristics of switchgear and controlgear are maintained and at which a replenishment becomes necessary

[SOURCE: IEC 62271-1:2017, 3.6.5.5]

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4 Normal and special service conditions

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

5 Ratings

5.1 General

Clause 5 of IEC 62271-1:2017 is applicable for a disconnector or earthing switch, including their operating devices and auxiliary equipment. The list of ratings is complemented with the following items:

- k) rated short-circuit making current (for earthing switches only);
- l) rated contact zone;
- m) rated static mechanical terminal load;
- n) rated ice-coating;
- o) rated values of the bus-transfer current switching capability (for disconnectors only);
- p) rated values of the induced current switching capability (for earthing switches only);
- q) rated values of the bus-charging current switching capability (for disconnectors only).

In addition to the rated values given above, the following classifications may be assigned:

- r) short-circuit making class (for earthing switches only);
- s) mechanical endurance class;
- t) induced current switching class (for earthing switches only);
- u) bus-charging current switching class (for disconnectors only).

Disconnectors or earthing switches being classified for more than one switching capability may indicate their classification by combined class designations. For example, an earthing

switch having short-circuit making capability class E1 and an induced current switching capability class B may be classified as class B+E1.

Ratings for making and breaking capabilities cannot be assigned to disconnectors and earthing switches with only manual dependent operation.

In the case of disconnectors and earthing switches with both dependent power and dependent manual operation, any making and breaking capability is not valid for dependent manual operation.

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 with the following addition:

For disconnectors rated above 52 kV and disconnectors having an isolating distance in parallel to the base of the disconnector and having integrated earthing switches, the insulation level between moving parts of the earthing switch and the opposite live parts, during operation of the earthing switch, shall be at least the short-duration power frequency withstand voltage for the smallest gap between them specified in 7.2.6.

If national safety regulations specify higher withstand values for earthing switches that have manual operating mechanisms only, this has to be agreed upon between the user and the manufacturer.

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. This subclause applies only to disconnectors.

5.6 Rated short-time withstand current (I_k)

Subclause 5.6 of IEC 62271-1:2017 is applicable with the following addition.

An earthing switch may be assigned a rating different from the rating of the related main circuit (if applicable).

An earthing switch forming an integral part of a combined function earthing switch may be assigned a rating different from the rating of its main circuit.

5.7 Rated peak withstand current (I_p)

Subclause 5.7 of IEC 62271-1:2017 is applicable with the following addition.

An earthing switch may be assigned a rating different from the rating of the related main circuit (if applicable).

An earthing switch forming an integral part of a combined function earthing switch may be assigned a rating different from the rating of its main circuit.

5.8 Rated duration of short-circuit (t_k)

Subclause 5.8 of IEC 62271-1:2017 is applicable with the following addition:

An earthing switch may be assigned a rating different from the rating of the related main circuit (if applicable).

An earthing switch forming an integral part of a combined function earthing switch may be assigned a rating different from the rating of its main circuit.

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

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

5.10 Rated supply frequency of auxiliary circuits 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 addition:

5.11.101 Rated pressure of compressed gas supply for insulation and/or switching

The limits of pressure shall be given by the manufacturer.

5.11.102 Rated pressure of compressed gas supply for operation

External pneumatic or hydraulic supply:

Unless otherwise specified by the manufacturer, the limits of the operating pressure are 85 % and 110 % of the rated pressure.

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

The rated short-circuit making current is applicable only to the earthing switches class E1 and E2. This shall be equal to the rated peak withstand current.

Subclause 5.102 provides a classification of earthing switches for short-circuit making capability.

5.102 Classification of earthing switches for short-circuit making

The short-circuit making capability of earthing switches to perform a defined number of short-circuit making operations, without major maintenance, shall correspond to one of the classes given in Table 1.

NOTE The increased number of making operations of Class E2 is typically related to voltages up to and including 52 kV depending on the operating conditions and the protection systems of such networks.

Table 1 – Classification of earthing switches for short-circuit making

Class	Type of earthing switch
E0	Earthing switch with no short-circuit making capability
E1	Earthing switch with capability to perform two short-circuit making operations
E2	Earthing switch with capability to perform five short-circuit making operations

5.103 Rated contact zone

In case of divided support disconnectors and divided support earthing switches the manufacturer shall state the rated values of the contact zone (indicated by x_r , y_r and z_r). Preferred values are given in Table 2 and Table 3. The rated values shall be specified by the manufacturer. This refers also to a tolerable angular displacement of the fixed contact.

Table 2 – Preferred contact zones for "fixed" contacts supported by flexible conductors

Rated voltage U_r kV	x mm	y mm	z_1 mm	z_2 mm
72,5 – 100	100	300	200	300
123 – 145		350		
170	200	400	250	450
245		500		
300				
362				
420			400	500
550				
800		250	650	450
1 100 – 1 200	300	700	500	600

x = total amplitude of longitudinal movement of the supporting conductor (temperature).

y = total horizontal deflection (perpendicular to supporting conductor) (wind).

z = vertical deflection (temperature and ice).

NOTE z_1 are values for short-span, z_2 are values for long-span of the flexible conductors to which the fixed contacts are mounted.

Table 3 – Preferred contact zones for "fixed" contacts supported by rigid conductors

Rated voltage U_r kV	x mm	y mm	z mm
72,5 – 100 – 123 – 145	100	100	100
170 – 245 – 300 – 362 – 420	150	150	150
550	175	175	175
800	200	200	200
1 100 – 1 200	250	250	250

x = total amplitude of longitudinal movement of the supporting conductor (temperature).
 y = total horizontal deflection (perpendicular to supporting conductor) (wind).
 z = vertical deflection (ice).

5.104 Rated static mechanical terminal load

When disconnectors or earthing switches are intended to be directly connected to lines, i.e. flexible or rigid conductors, the rated static mechanical terminal load of each terminal shall be assigned, indicating the directions of application.

The maximum static mechanical terminal load to which a terminal of a disconnector or earthing switch is allowed to be subjected under the most disadvantageous conditions is the rated static mechanical terminal load.

Preferred values of static mechanical terminal loads are given in Table 4 and are intended to be used as a guide.

Table 4 – Preferred static mechanical terminal loads

Rated voltage U_r kV	Rated continuous current I_r A	Two- and three-column disconnectors or earthing switches		Divided support disconnectors or earthing switches		Vertical Force F_c^a N
		Straight load F_{a1} and F_{a2}	Cross-load F_{b1} and F_{b2}	Straight load F_{a1} and F_{a2}	Cross-load F_{b1} and F_{b2}	
		In Figure 9		In Figure 8		
		N	N	N	N	
72,5	≤ 1 600	400	130	800	200	500
	> 1 600	500	170	800	200	
100 – 123 – 145	≤ 1 600	500	170	800	200	1 000
	> 1 600	600	200	1 000	300	
170	≤ 1 600	600	200	1 000	300	
	> 1 600	800	250	1 250	400	
245	≤ 2 500	800	270	1 250	400	1 250
	> 2 500	1 000	330	1 600	500	
300 – 362	≤ 2 500	1 000	400	1 600	500	1 500
	> 2 500	1 500	500	1 800	600	
420	≤ 3 150	1 600	530	2 000	800	1 500
	> 3 150	2 000	660	4 000	1 600	
550	≤ 3 150	1 600	530	2 000	800	1 500
	> 3 150	2 000	660	4 000	1 600	
800	≤ 3 150	1 600	530	2 000	800	1 500
	> 3 150	2 000	660	4 000	1 600	
1 100 – 1 200	≤ 4 000	2 000	660	4 000	1 600	2 000
	> 4 000	2 500	1 000	5 000	2 000	
^a F_c simulates the downward forces caused by the weight of the connecting conductors. F_c does not apply to flexible conductors.						
NOTE The static mechanical terminal load includes forces resulting from ice, wind and connected conductors.						

5.105 Classification of disconnectors for mechanical endurance

The mechanical endurance of disconnectors shall correspond to one of the classes given in Table 5. The performance is associated to a programme of maintenance defined by the manufacturer.