

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**High-voltage switchgear and controlgear –
Part 104: Alternating current switches for rated voltages of 52 kV and above**

**Appareillage à haute tension –
Partie 104: Interrupteurs à courant alternatif pour tensions assignées égales ou
supérieures à 52 kV**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 104: Alternating current switches
for rated voltages of 52 kV and above**

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International Standard IEC 62271-104 has been prepared by subcommittee 17A: High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This standard cancels and replaces IEC 60265-2 (1988).

The main changes with respect to IEC 60265-2 are as follows:

- alignment with IEC 62271-1 and IEC 62271-100;
- requirements for capacitive current switching aligned with those in IEC 62271-100: classes C1 and C2 are introduced.

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

| FDIS | Report on voting |
|--------------|------------------|
| 17A/857/FDIS | 17A/865/RVD |

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

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

This standard is to be read in conjunction with IEC 62271-1 (2007), IEC 62271-100, IEC 62271-102 (2001) and IEC 62271-110 (2005). In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1. Modifications to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

A list of all the parts in the IEC 62271, 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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 104: Alternating current switches for rated voltages of 52 kV and above

1 General

1.1 Scope

This part of IEC 62271 is applicable to three-pole alternating current switches for rated voltages 52 kV and above, having making and breaking current ratings, for indoor and outdoor installations, and for rated frequencies up to and including 60 Hz.

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

NOTE 1 Switches for gas insulated switchgear are covered by this standard.

NOTE 2 Switches having a disconnecting function and called switch-disconnectors are also covered by IEC 62271-102.

NOTE 3 Earthing switches are not covered by this standard. Earthing switches forming an integral part of a switch are covered by IEC 62271-102.

The main object of this standard is to establish requirements for switches used in transmission and distribution systems. General-purpose switches for this application are designed to comply with the following service applications:

- carrying rated normal current continuously;
- carrying short-circuit currents for a specified time;
- switching of mainly active loads;
- switching of no-load transformers;
- switching of the charging current of unloaded cables, overhead lines or busbars;
- switching of closed-loop circuits;
- making short-circuit currents.

A further object of this standard is to establish requirements for limited-purpose and special-purpose switches used in transmission and distribution systems.

Limited-purpose switches shall comply with one or more of the service applications indicated above.

Special-purpose switches may comply with one or more of the service applications indicated above and, in addition, shall be suitable for one or more of the following applications:

- switching single capacitor banks;
- switching back-to-back capacitor banks;
- switching shunt reactors including secondary or tertiary reactors switched from the primary side of the transformer;
- applications requiring an increased number of operating cycles;
- switching under earth fault conditions in non-effectively earthed neutral systems.

1.2 Normative references

The following referenced documents are indispensable for the application 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 60050-441:1984, *International Electrotechnical Vocabulary – Chapter 441: Switchgear, controlgear and fuses*

IEC 60059, *IEC standard current ratings*

IEC 60071 (all parts), *Insulation co-ordination*

IEC 60071-1: *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

IEC 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*

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

IEC 62271-101: *High-voltage switchgear and controlgear – Part 101: Synthetic testing*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-110:2005, *High-voltage switchgear and controlgear – Part 110: Inductive load switching*

2 Normal and special service conditions

Clause 2 of IEC 62271-1 is applicable.

3 Terms and definitions

For the purposes of this document, definitions of general terms are based on IEC 60050-441 and IEC 60071-1.

Additional terms and definitions are based solely on IEC 60050-441.

3.1 General terms

No particular definitions.

3.2 Assemblies

No particular definitions.

3.3 Parts of assemblies

No particular definitions.

3.4 Switching devices

3.4.101

switch

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 short-circuit

[IEV 441-14-10]

3.4.102

switch-disconnector

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

[IEV 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; capable of carrying and making short-circuit currents

NOTE Refer to 4.108 for specific ratings of a general-purpose switch.

3.4.104

limited-purpose switch

switch which complies with one or more, but not with all, service applications of a general-purpose switch

3.4.105

special-purpose switch

switch suitable for switching requirements other than those specified for a general-purpose switch

NOTE Examples of such requirements are capacitor bank switching, shunt reactor switching, switching under earth fault conditions, and a capability of an increased number of operating cycles.

3.4.106

class C1 switch

special-purpose switch with low probability of restriking during capacitive current breaking as demonstrated by specific type tests

3.4.107

class C2 switch

special-purpose switch with very low probability of restriking during capacitive current breaking as demonstrated by specific type tests

3.4.108

single capacitor bank switch

special-purpose switch intended for switching of a single capacitor bank with charging currents up to its rated single capacitor bank breaking current

3.4.109

back-to-back capacitor bank switch

special-purpose switch intended for breaking capacitor bank-charging currents, with one or more capacitor banks connected to the bus or supply side of the switch, up to its rated back-to-back capacitor bank breaking current. The switch shall be capable of making the associated inrush current, up to its rated capacitor bank inrush making current

**3.4.110
shunt reactor switch**

special-purpose switch intended for switching a shunt reactor, including secondary or tertiary reactors switched from the primary side of the transformer

3.5 Parts of switches

No particular definitions.

3.6 Operation

No particular definitions.

3.7 Characteristic quantities

3.7.101

breaking capacity (of a switching device or a fuse)

value of prospective current that a switching device or a fuse is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

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

NOTE 2 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.

[IEV 441-17-08]

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 no-load transformer circuit

3.7.104

closed-loop breaking capacity

breaking capacity when opening a closed transmission line loop circuit, or a transformer in parallel with one or more transformers, i.e. a circuit in which both sides of the switch remain energized after breaking, and in which the voltage appearing across the terminals is substantially less than the system voltage

3.7.105

cable-charging breaking capacity

breaking capacity when opening a cable circuit at no load

3.7.106

line-charging breaking capacity

breaking capacity when opening an overhead line circuit at no load

3.7.107

busbar charging breaking capacity

breaking capacity when opening a busbar circuit at no load

3.7.108

single capacitor bank breaking capacity

breaking capacity when opening a single capacitor bank circuit connected to a supply that does not include another capacitor bank adjacent to the bank being switched

3.7.109**back-to-back capacitor bank breaking capacity**

breaking capacity when opening a capacitor bank circuit connected to a supply that includes one or more capacitor banks adjacent to the bank being switched

3.7.110**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

NOTE The frequency and magnitude of the inrush current depend upon the values of capacitance and the values of the inductance between the capacitor banks.

3.7.111**shunt reactor breaking capacity**

breaking capacity when opening a shunt reactor circuit, including secondary or tertiary reactors switched from the primary side of the transformer

3.7.112**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

3.7.113**cable and line charging breaking capacity under earth fault conditions**

breaking capacity in the sound phases of an effectively earthed neutral or 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

3.7.114**breaking current** (of a switching device or a fuse)

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

[IEV 441-17-07]

3.7.115**(peak)-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 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 Where, for a polyphase circuit, a single value of (peak) making current is referred to, it is, unless otherwise stated, the highest value in any phase.

3.7.116**short-circuit making capacity**

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

[441-17-10]

3.7.117**simultaneity between poles**

maximum difference between the instant of contact touch in the first pole and the last pole when closing and the maximum time difference between the instant of contact separation between the first pole and the last pole when opening

4 Ratings¹

Clause 4 of IEC 62271-1 is applicable with the additions indicated below.

4.1 Rated voltage (U_r)

Subclause 4.1 of IEC 62271-1 is applicable.

4.2 Rated insulation level

Subclause 4.2 of IEC 62271-1 is applicable.

4.3 Rated frequency (f_r)

Subclause 4.3 of IEC 62271-1 is applicable.

4.4 Rated normal current and temperature rise (I_r)

Subclause 4.4 of IEC 62271-1 is applicable.

4.5 Rated short-time withstand current (I_k)

Subclause 4.5 of IEC 62271-1 is applicable.

4.6 Rated peak withstand current (I_p)

Subclause 4.6 of IEC 62271-1 is applicable.

4.7 Rated duration of short-circuit (t_k)

Subclause 4.7 of IEC 62271-1 is applicable.

4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits (U_a)

Subclause 4.8 of IEC 62271-1 is applicable.

4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits

Subclause 4.9 of IEC 62271-1 is applicable.

4.10 Rated pressure of compressed gas supply for controlled pressure systems

Subclause 4.10 of IEC 62271-1 is applicable.

4.11 Rated filling levels for insulation and/or operation

Subclause 4.11 of IEC 62271-1 is applicable.

¹ Note concerning the rated values:

In English, the terms "rated making current" and "rated breaking current" are now used where formerly "rated making capacity" and "rated breaking capacity" were used, the intended meaning being adequately conveyed by the use of "rated". In French, the terms "pouvoir de fermeture assigné" and "pouvoir de coupure assigné" continue to be used.

4.101 Rated earth fault breaking current

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

NOTE The TRV (transient recovery voltage) of an isolated neutral system is more severe than the TRV of a resonant earthed system, even if detuned.

4.102 Rated short-circuit making current

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

4.103 Rated mainly active load-breaking current

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.

4.104 Rated closed-loop breaking current

The rated closed-loop breaking current is the maximum closed-loop current the switch shall be capable of breaking. Separate ratings for transmission line loop current and parallel transformer current may be assigned.

4.105 Rated capacitive switching currents

4.105.1 Rated line-charging breaking current

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

4.105.2 Rated cable-charging breaking current

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

4.105.3 Rated single capacitor bank breaking current

The rated capacitor bank breaking current is the maximum capacitor current the switch shall be capable of breaking at the rated voltage under the conditions of use and behaviour prescribed in this standard. The breaking current refers to the switching of a shunt capacitor bank where no shunt capacitors are connected to the source side of the switch.

4.105.4 Rated back-to-back capacitor bank breaking current

The rated back-to-back capacitor bank breaking current is the maximum capacitor bank breaking current that the 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, such as to produce the rated capacitor bank inrush making current.

This breaking current refers to the switching of a shunt capacitor bank where one or several shunt capacitor banks are connected to the source side of the switch giving an inrush making current equal to the rated back-to-back capacitor bank inrush making current.

NOTE Similar conditions could apply for switching at substations with cables.