

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**High-voltage switchgear and controlgear –  
Part 107: Alternating current fused circuit-switchers for rated voltages above  
1 kV up to and including 52 kV**

**Appareillage à haute tension –  
Partie 107: Circuits-switchers fusibles pour courant alternatif de tension  
assignée supérieure à 1 kV et jusqu'à 52 kV inclus**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 107: Alternating current fused circuit-switchers  
for rated voltages above 1 kV up to and including 52 kV**

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International Standard IEC 62271-107 has been prepared by subcommittee 17A: High voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition cancels and replaces the first edition, published in 2005. It constitutes a technical revision.

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

- the reference to IEC 60694 has been changed to IEC 62271-1;
- the new clauses and subclauses from IEC 62271-1 have been added and where necessary new wording has been provided;
  - 4.11 Rated filling levels for insulation and/or operation
  - 5.19 X-ray emission
  - 5.20 Corrosion

- 6.10 Additional tests on auxiliary and control circuits
  - 6.11 X-radiation test procedure for vacuum interrupters
  - 12 Influence of the product on the environment
- the normative references have been updated: IEC 60265-1 to IEC 62271-103, IEC 60787 to IEC/TR 60787, IEC 60466 to IEC 62271-201, and IEC/TR 60787 was moved to the bibliography;
  - the figures and tables have been placed in the document where they are first cited;
  - the numbering of figures and tables has been changed to obtain the correct order;
  - the definition of NSDD was deleted. This definition is included in IEC 62271-1;
  - the acceptance criteria have been aligned with 6.101.4 of IEC 62271-103:2011;
  - the various provisions expressed about "extension of the validity of type tests" have been grouped under 6.103: some of the rules were duplicated in Clauses 6 and 8, and it seems better fitted to deal within each type test sub-clause only with the type test to be performed. Conditions have not been changed, but the wording is clearer;
  - new numbering of subclauses in Clauses 8 and 9 to avoid conflict with clauses from IEC 62271-1.

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

FDIS	Report on voting
17A/997/FDIS	17A/1004/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.

<https://standards.ieh.org/standards/servlet?doc=c27-0b4b-4f5c-9d7c-c11525005820/iec->  
 This International Standard is to be read in conjunction with IEC 62271-1:2007, 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. Amendments 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 series, under the general title *High-voltage switchgear and controlgear*, can be found on the IEC website.

The committee has decided that the contents of this 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

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



## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 107: Alternating current fused circuit-switchers for rated voltages above 1 kV up to and including 52 kV

## 1 General

### 1.1 Scope

Subclause 1.1 of IEC 62271-1:2007 is not applicable, and is replaced as follows.

This part of IEC 62271 applies to three-pole operated units for distribution systems that are functional assemblies of a circuit-switcher and current-limiting fuses designed so as to be capable of:

- breaking, at the rated recovery voltage, any load or fault current up to and including the rated short-circuit breaking current;
- making, at the rated voltage, circuits to which the rated short-circuit breaking current applies.

They are intended to be used for circuits or applications requiring only a normal mechanical and electrical endurance capability. Such applications cover protection of HV/LV transformers for instance, but exclude distribution lines or cables, as well as motor circuits and capacitor bank circuits.

Short-circuit conditions with low currents, up to the fused circuit-switcher rated take-over current, are dealt with by supplementary devices (strickers, relays, etc.), properly arranged, tripping the circuit-switcher. Fuses are incorporated in order to ensure that the short-circuit breaking capacity of the device is above that of the circuit-switcher.

NOTE 1 In this standard the term "fuse" is used to designate either the fuse or the fuse-link where the general meaning of the text does not result in ambiguity.

This standard applies to fused circuit-switchers designed with rated voltages above 1 kV up to and including 52 kV for use on three-phase alternating current systems of either 50 Hz or 60 Hz. Comparison with other existing switching devices is provided in Clause 8.

NOTE 2 Other circuit-switchers exist; see reference [1]<sup>1</sup>.

Devices that require a dependent manual operation are not covered by this standard.

Fuses are covered by IEC 60282-1.

Earthing switches forming an integral part of a circuit-switcher are covered by IEC 62271-102.

Installation in enclosure, if any, is covered either by IEC 62271-200 or by IEC 62271-201.

### 1.2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For

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<sup>1</sup> Numbers between brackets refer to the Bibliography.

undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60282-1:2009, *High-voltage fuses – Part 1: Current-limiting fuses*

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

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

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

IEC 62271-103:2011, *High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV*

IEC 62271-105:—, *High-voltage switchgear and controlgear – Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV*<sup>2</sup>

IEC 62271-200, *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, *High-voltage switchgear and controlgear – Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

## 2 Normal and special service conditions

Clause 2 of IEC 62271-1:2007 is applicable.

## 3 Terms and definitions

Clause 3 of IEC 62271-1:2007 is applicable with the following additions:

### 3.1 General terms

Subclause 3.1 of IEC 62271-1:2007 is applicable.

### 3.2 Assemblies of switchgear and controlgear

Subclause 3.2 of IEC 62271-1:2007 is applicable.

### 3.3 Parts of assemblies

Subclause 3.3 of IEC 62271-1:2007 is applicable.

### 3.4 Switching devices

Subclause 3.4 of IEC 62271-1:2007 is applicable, with the following additions.

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<sup>2</sup> To be published.

**3.4.101****circuit-switcher**

mechanical switching device suitable for making, carrying and interrupting currents under normal circuit conditions and for interrupting specified fault currents that may be less than its short-time withstand current

Note 1 to entry: Other circuit-switchers exist; see reference [1].

**3.4.102****fused circuit-switcher**

device comprising a three-pole circuit-switcher and three current limiting fuses, capable of making and breaking any load or fault current up to its short-circuit breaking current, under TRV and power factor conditions defined in this standard

**3.4.103****fused circuit-switcher base****device base**

fused circuit-switcher without fuse-links mounted

**3.5 Parts of switchgear and controlgear**

Subclause 3.5 of IEC 62271-1:2007 is applicable, with the following additions.

**3.5.101****release**

device, mechanically connected to a mechanical switching device, which releases the holding means and permits the opening or the closing of the switching device

[SOURCE: IEC 60050-441: 2007, 441-15-17]

**3.5.102****over-current release**

release which permits a mechanical switching device to open with or without time-delay when the current in the release exceeds a predetermined value

[SOURCE: IEC 60050-441: 2007, 441-16-33]

**3.5.103****shunt release**

release energized by a source of voltage

[SOURCE: IEC 60050-441: 2007, 441-16-41]

**3.6 Operation**

Subclause 3.6 of IEC 62271-1:2007 is applicable, with the following additions.

**3.6.101****independent manual operation** (of the fused circuit-switcher)

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: 2007, 441-16-16]

**3.6.102****stored energy operation** (of the fused circuit-switcher)

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

[SOURCE: IEC 60050-441: 2007, 441-16-15]

### 3.7 Characteristic quantities

Subclause 3.7 of IEC 62271-1:2007 is applicable, with the following additions.

#### 3.7.101

**prospective current** (of a circuit and with respect to a switching device or a fuse)  
current that would flow in the circuit if each pole of the switching device or the fuse were replaced by a conductor of negligible impedance

[SOURCE: IEC 60050-441: 2007, 441-17-01]

#### 3.7.102

**prospective peak current**

peak value of a prospective current during the transient period following initiation

Note 1 to entry: The definition assumes that the current is made by an ideal switching device, i.e. with instantaneous transition from infinite to zero impedance. For circuits where the current can follow several different paths, e.g. polyphase circuits, it further assumes that the current is made simultaneously in all poles, even if only the current in one pole is considered.

[SOURCE: IEC 60050-441: 2007, 441-17-02]

#### 3.7.103

**maximum prospective peak current**

prospective peak current when initiation of the current takes place at the instant which leads to the highest possible value

Note 1 to entry: For a multiple device in a polyphase circuit, the maximum prospective peak current refers to a single pole only.

[SOURCE: IEC 60050-441: 2007, 441-17-04]

#### 3.7.104

**prospective breaking current**

prospective current evaluated at a time corresponding to the instant of the initiation of the breaking process

Note 1 to entry: Specifications concerning the instant of the initiation of the breaking process are to be found in the relevant publications. For mechanical switching devices or fuses, it is usually defined as the moment of initiation of the arc during the breaking process.

[SOURCE: IEC 60050-441: 2007, 441-17-06]

#### 3.7.105

**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: 2007, 441-17-07]

#### 3.7.106

**minimum breaking current**

minimum value of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441: 2007, 441-18-29]

#### 3.7.107

**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: 2007, 441-17-10]

**3.7.108****take-over current**

current co-ordinate of the intersection between the time-current characteristics of two over-current protective devices

[SOURCE: IEC 60050-441: 2007, 441-17-16]

**3.7.109****thermal current** $I_{th}$ 

maximum current carried continuously without the temperature rise of the various parts exceeding the limits specified

**3.7.110****fused short-circuit current**

conditional short-circuit current when the current limiting device is a fuse

[SOURCE: IEC 60050-441: 2007, 441-17-21]

**3.7.111****applied voltage**

voltage which exists across the terminals of a pole of a switching device just before the making of the current

[SOURCE: IEC 60050-441: 2007, 441-17-24]

**3.7.112****recovery voltage**

voltage which appears across the terminals of a pole of a switching device or a fuse after the breaking of the current

Note 1 to entry: This voltage may be considered in two successive intervals of time, one during which a transient voltage exists, followed by a second one during which the power frequency or the steady-state recovery voltage alone exists.

[SOURCE: IEC 60050-441: 2007, 441-17-25]

**3.7.113****transient recovery voltage****TRV**

recovery voltage during the time in which it has a significant transient character

Note 1 to entry: The transient recovery voltage may be oscillatory or non-oscillatory or a combination of these depending on the characteristics of the circuit and the switching device. It includes the voltage shift of the neutral of a polyphase circuit.

Note 2 to entry: The transient recovery voltages in three-phase circuits is, unless otherwise stated, that across the first pole to clear, because this voltage is generally higher than that which appears across each of the other two poles.

[SOURCE: IEC 60050-441: 2007, 441-17-26]

**3.7.114****power frequency recovery voltage**

recovery voltage after the transient voltage phenomena have subsided

[SOURCE: IEC 60050-441: 2007, 441-17-27]

**3.7.115****prospective transient recovery voltage**

transient recovery voltage following the breaking of the prospective symmetrical current by an ideal switching device

Note 1 to entry: The definition assumes that the switching device or the fuse, for which the prospective transient recovery voltage is sought, is replaced by an ideal switching device, i.e. having instantaneous transition from zero to infinite impedance at the very instant of zero current, i.e. at the "natural" zero. For circuits where the current can

follow several different paths, e.g. a polyphase circuit, the definition further assumes that the breaking of the current by the ideal switching device takes place only in the pole considered.

[SOURCE: IEC 60050-441: 2007, 441-17-29]

### 3.7.116

**minimum opening time** (of the fused circuit-switcher)

minimum interval of time between the initiation of the opening, from an external source, and the first instant of the separation of the arcing contacts in any one pole

### 3.7.117

**fuse-initiated opening time** (of a fused circuit-switcher)

time taken from the instant at which arcing in the fuse commences to the instant when the arcing contacts have separated in all poles

Note 1 to entry: This definition applies only for fused circuit-switchers fitted with fuse-striker release.

## 3.101 Fuses

### 3.101.1

**fuse-base**

**fuse mount**

fixed part of a fuse provided with contacts and terminals

[SOURCE: IEC 60050-441: 2007, 441-18-02]

### 3.101.2

**striker**

mechanical device forming part of a fuse-link which, when the fuse operates, releases the energy required to cause operation of other apparatus or indicators or to provide interlocking

[SOURCE: IEC 60050-441: 2007, 441-18-18]

### 3.101.3

**cut-off current**

maximum instantaneous value of current attained during the breaking operation of a switching device or a fuse

Note 1 to entry: This concept is of particular importance when the switching device or the fuse operates in such a manner that the prospective peak current of the circuit is not reached.

[SOURCE: IEC 60050-441: 2007, 441-17-12]

### 3.101.4

$I^2t$

**Joule integral**

integral of the square of the current over a given time interval:

$$I^2t = \int_{t_2}^{t_1} i^2 dt$$

Note 1 to entry: The pre-arcing  $I^2t$  is the  $I^2t$  integral extended over the pre-arcing time of the fuse.

Note 2 to entry: The operating  $I^2t$  is the  $I^2t$  integral extended over the operating time of the fuse.

Note 3 to entry: The energy in joules liberated in one ohm of resistance in a circuit protected by a fuse is equal to the value of the operating  $I^2t$  expressed in A<sup>2</sup>s.

[SOURCE: IEC 60050-441: 2007, 441-18-23]

## 4 Ratings

Clause 4 of IEC 62271-1:2007 is applicable with the following additions and exceptions.

In addition to the ratings listed in IEC 62271-1:2007 the following ratings apply:

- a) rated short-circuit breaking current;
- b) rated transient recovery voltage;
- c) rated short-circuit making current;
- d) rated take-over current;
- e) rated maximal thermal current.

#### **4.1 Rated voltage ( $U_r$ )**

Subclause 4.1 of IEC 62271-1:2007 is applicable.

#### **4.2 Rated insulation level**

Subclause 4.2 of IEC 62271-1:2007 is applicable.

#### **4.3 Rated frequency ( $f_r$ )**

Subclause 4.3 of IEC 62271-1:2007 is applicable with the following addition.

NOTE In some cases, the rated characteristics of a fused circuit-switcher when used on a 60 Hz system may be different from its rated characteristics when used on a 50 Hz system.

#### **4.4 Rated normal current and temperature rise**

##### **4.4.1 Rated normal current ( $I_r$ )**

Subclause 4.4.1 of IEC 62271-1:2007 is not applicable.

A rated normal current is normally not assigned to the fused circuit-switcher. When fused circuit-switchers are combined into larger enclosed assemblies, the rated normal current of the connecting busbars shall be in accordance with IEC 62271-200 or IEC 62271-201.

See also 4.4.101.

##### **4.4.2 Temperature rise**

Subclause 4.4.2 of IEC 62271-1:2007 is applicable with the following addition.

As far as fuses are concerned, Clause 6 of IEC 60282-1: 2009 applies.

##### **4.4.101 Rated maximum thermal current ( $I_{th}$ )**

The rated maximum thermal current is the maximum value of the thermal current for the fused circuit-switcher.

It is not required that the thermal current is selected from the R10 series.

NOTE The actual thermal current depends on the fuses installed.

#### **4.5 Rated short-time withstand current ( $I_k$ )**

Subclause 4.5 of IEC 62271-1:2007 is not applicable.

#### **4.6 Rated peak withstand current ( $I_p$ )**

Subclause 4.6 of IEC 62271-1:2007 is not applicable.