

# INTERNATIONAL STANDARD

# IEC 62271-105

First edition  
2002-08

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## High-voltage switchgear and controlgear – Part 105: Alternating current switch-fuse combinations

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –****Part 105: Alternating current switch-fuse combinations**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62271-105 has been prepared by subcommittee 17A, High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This first edition cancels and replaces the second edition of IEC 60420, published in 1990, and constitutes a technical revision. A reference table to explain the new numbering in this series is provided at the end of this foreword.

The text of this standard is based the following documents:

FDIS	Report on voting
17A/633/FDIS	17A/640/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 3.

This standard should be read in conjunction with IEC 60694, second edition, published in 1996, 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 60694. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

Annex A is for information only.

Annex B forms an integral part of this standard.

The committee has decided that the contents of this publication will remain unchanged until 2013. At this date, the publication will be

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

### **New numbering**

In accordance with the decision taken at the joint SC 17A/SC 17C meeting in Frankfurt, June 1998 (item 20.7 of 17A/535/RM), a common numbering system will be established of the standards falling under the responsibility of SC 17A and SC 17C. IEC 62271 (with the main title of *High-voltage switchgear and controlgear*) is the basis of the common standard.

The numbering of these standards will apply the following principle:

- a) Common standards prepared by SC 17A and SC 17C will start with IEC 62271-001;
- b) Standards of SC 17A will start with IEC 62271-100;
- c) Standards of SC 17C will start with IEC 62271-200;
- d) Guides prepared by SC 17A and SC 17C will start with IEC 62271-300.

The following table provides an overview of the relationship between the old and new numbering.

[IEC 62271-105:2002](https://standards.iteh.ai/catalog/standards/sic/4f36717-0655-4eac-b1af-be8569629dd4/iec-62271-105-2002)

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**Common numbering of IEC 62271 standards falling under the responsibility  
of sub-committees 17A and 17C \***

IEC 62271 Part	HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR Original title	Old IEC number, if any
001	Common specifications for high-voltage switchgear and controlgear standards	60694
100	High-voltage alternating current circuit-breakers	60056
101	Synthetic testing of high-voltage alternating current circuit-breakers	60427
102	Alternating current disconnectors and earthing switches	60129
103	Switches for rated voltages above 1 kV and less than 52 kV	60265-1
104	High-voltage switches for rated voltages of 52 kV and above	60265-2
105	Alternating current switch-fuse combinations	60420
106	High-voltage alternating current contactors and contactor-based motor-starters	60470
107	High-voltage alternating current switchgear-fuse combinations	New
108	Switchgear having combined functions	New
109	Alternating-current series capacitor by-pass switches	
200	AC metal enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV	60298
201	AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 38 kV	60466
202	High-voltage/low-voltage prefabricated substations	61330
203	Gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above	60517
204	Rigid high-voltage, gas-insulated transmission lines for rated voltages of 72,5 kV and above	61640
300	Guide for seismic qualification of high-voltage alternating current circuit-breakers	61166
301	High-voltage alternating current circuit-breakers – Inductive load switching	61233
302	High-voltage alternating current circuit-breakers – Guide for short-circuit and switching test procedures for metal-enclosed and dead tank circuit-breakers	61633
303	High-voltage switchgear and controlgear – Use and handling of sulphur hexafluoride (SF <sub>6</sub> ) in high-voltage switchgear and controlgear	61634
304	Additional requirements for enclosed switchgear and controlgear from 1 kV to 72,5 kV to be used in severe climatic conditions	60932
305	Cable connections for gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above – Fluid-filled and extruded insulation cables – Fluid-filled and dry type cable-terminations	60859
306	Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above	61639
307	High-voltage switchgear and controlgear – The use of electronic and associated technologies in auxiliary equipment of switchgear and controlgear	62063
308	Guide for asymmetrical short-circuit breaking test duty T100a	62215

\* The table is subject to change pending the transfer of technical reports to standards.



## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 105: Alternating current switch-fuse combinations

#### 1 General

##### 1.1 Scope

This part of IEC 62271 applies to three-pole units for public and industrial distribution systems which are functional assemblies of switches including switch-disconnectors and current-limiting fuses designed so as to be capable of

- breaking, at the rated recovery voltage, any 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.

It does not apply to fuse-circuit-breakers, fuse-contactors, combinations for motor-circuits or to combinations incorporating single capacitor bank switches.

In this standard, the word “combination” is used for combination in which the components constitute a functional assembly. Each association of a given type of switch and a given type of fuse defines one type of combination.

In practice, different types of fuses may be combined with one type of switch, which gives several combinations with different characteristics, in particular concerning the rated currents. Moreover, for maintenance purposes, the user should know the types of fuses that can be associated to a given switch without impairing compliance to the standard, and the corresponding characteristics of the so-made combination.

A switch-fuse combination is then defined by its type designation and a list of selected fuses is defined by the manufacturer, the so-called “reference list of fuses”. Compliance with this standard of a given combination means that every combination using one of the selected fuses is proven to be in compliance with this standard.

The fuses are incorporated in order to extend the short-circuit breaking rating of the combination beyond that of the switch alone. They are fitted with strikers in order both to open automatically all three poles of the switch on the operation of a fuse and to achieve a correct operation at values of fault current above the minimum melting current but below the minimum breaking current of the fuses. In addition to the fuse strikers, the combination may be fitted with either an over-current release or a shunt release.

NOTE 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 combinations 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.

Fuses are covered by IEC 60282-1.

Switches, including their specific mechanism, should be in accordance with IEC 60265-1 except for the short-time current and short-circuit making requirements where the current-limiting effects of the fuses are taken into account.

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

## 1.2 Normative references

Subclause 1.2 of IEC 60694 is applicable with the following additions.

IEC 60265-1:1998, *High-voltage switches – Part 1: Switches for rated voltages above 1 kV and less than 52 kV*

IEC 60282-1:2002, *High-voltage fuses – Part 1: Current-limiting fuses*

IEC 60694:1996, *Common specifications for high-voltage switchgear and controlgear standards*

IEC 60787:1983, *Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit applications*

IEC 62271-100:2001, *High-voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers*

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

## 2 Normal and special service conditions

Clause 2 of IEC 60694 is applicable.

## 3 Definitions

For the purposes of this part of IEC 62271, the definitions of IEC 60050(441) and IEC 60694, as well as the following definitions, apply.

Some of them are recalled hereunder for easier use.

### 3.1 General terms

None.

### 3.2 Assemblies

None.

### 3.3 Parts of assemblies

None.

### 3.4 Switching devices

#### 3.4.101

##### **switch-fuse combinations (includes fuse-switch combinations)**

combination of a three-pole switch with three fuses provided with strikers, the operation of any striker causing all three poles of the switch to open automatically

#### 3.4.102

##### **switch-fuse combinations base (or combination base)**

switch-fuse combination without fuse-links mounted

#### 3.4.103

##### **switch-fuse**

[IEV 441-14-14]

#### 3.4.104

##### **fuse-switch**

[IEV 441-14-17]

#### 3.4.105

##### **switch-disconnector**

[IEV 441-14-12]

#### 3.4.106

##### **release operated combination**

combination in which automatic opening of the switch can also be initiated by either an over-current release or a shunt release

### 3.5 Parts of switching devices

#### 3.5.101

##### **release**

[IEV 441-15-17]

#### 3.5.102

##### **over-current release**

[IEV 441-16-33]

#### 3.5.103

##### **shunt release**

[IEV 441-16-41]

### 3.6 Operation

#### 3.6.101

##### **independent manual operation (of the switch)**

[IEV 441-16-16]

#### 3.6.102

##### **stored energy operation (of the switch)**

[IEV 441-16-15]

### 3.7 Characteristic quantities

#### 3.7.101

**prospective current** (of a circuit and with respect to a switching device or a fuse)  
[IEV 441-17-01]

#### 3.7.102

**prospective peak current**  
[IEV 441-17-02]

#### 3.7.103

**maximum prospective peak current**  
[IEV 441-17-04]

#### 3.7.104

**prospective breaking current**  
[IEV 441-17-06]

#### 3.7.105

**breaking current**  
[IEV 441-17-07]

#### 3.7.106

**minimum breaking current**  
[IEV 441-18-29]

#### 3.7.107

**short-circuit making capacity**  
[IEV 441-17-10]

#### 3.7.108

**cut-off current**  
**let-through current** (of a fuse)  
[IEV 441-17-12]

#### 3.7.109

**transfer current** (striker operation)

value of the three-phase symmetrical current at which the fuses and the switch exchange breaking duties

NOTE Above this value the three-phase current is interrupted by the fuse only. Immediately below this value, the current in the first-pole-to-clear is interrupted by the fuse and the current in the other two poles by the switch, or by the fuses, depending on the tolerances of the fuse time current characteristic and the fuse-initiated opening time of the switch.

#### 3.7.110

**take-over current**  
[IEV 441-17-16]

#### 3.7.111

**minimum take-over current** (of a release-operated combination)

current determined by the point of intersection of the time-current characteristics of the fuse and the switch corresponding to

- a) the maximum break time plus, where applicable, the maximum operating time of an external over-current or earth-fault relay,
- b) the minimum pre-arcing time of the fuse

See Figure 12.

**3.7.112****maximum take-over current** (of a release-operated combination)

current determined by the point of intersection of the time-current characteristics of the fuse and the switch, operated by the release

**3.7.113****fused short-circuit current**

[IEV 441-17-21]

**3.7.114****applied voltage**

[IEV 441-17-24]

**3.7.115****recovery voltage**

[IEV 441-17-25]

**3.7.116****transient recovery voltage (TRV)**

[IEV 441-17-26]

**3.7.117****power-frequency recovery voltage**

[IEV 441-17-27]

**3.7.118****prospective transient recovery voltage**

[IEV 441-17-29]

**3.7.119****fuse-initiated opening time** (of the switch)

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

**3.7.120****release-initiated opening time** (of the switch)

release-initiated opening time is defined according to the tripping method as stated below with any time-delay device forming an integral part of the switch adjusted to a specified setting:

- a) for a switch tripped by any form of auxiliary power, interval of time between the instant of energizing the opening release, the switch being in the closed position, and the instant when the arcing contacts have separated in all poles.
- b) for a switch tripped (other than by the striker) by a current in the main circuit without the aid of any form of auxiliary power, interval of time between the instant at which, the switch being in the closed position, the current in the main circuit reaches the operating value of the over-current release and the instant when the arcing contacts have separated in all poles

**3.7.121****minimum release-initiated opening time** (of the switch)

release-initiated opening time when the specified setting of any time-delay device forming an integral part of the switch is its minimum setting

**3.7.122****maximum release-initiated opening time** (of the switch)

release-initiated opening time when the specified setting of any time-delay device forming an integral part of the switch is its maximum setting

**3.7.123****break-time**

[IEV 441-17-39]

**3.7.124****arcing time** (of a pole or a fuse)

[IEV 441-17-37]

**3.8 Fuses****3.8.101****reference list of fuses**

list of fuses defined by the manufacturer for a given type of switch-fuse combination base, for which compliance to the present standard of all corresponding switch-fuse combinations is assessed

NOTE This list can be updated. Conditions for extending the validity of the type tests are given in 8.102.

**3.8.102****fuse-base**

fuse mount

[IEV 441-18-02]

**3.8.103****striker**

[IEV 441-18-18]

**3.8.104****pre-arcing time**

melting time

[IEV 441-18-21]

**3.8.105****operating time**

total clearing time

[IEV 441-18-22]

**3.8.106****arcing time** (of a pole or a fuse)

[IEV 441-17-37]

**3.8.107** **$I^2t$  – Joule integral**

[IEV 441-18-23]