IEC 62271-105

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

High-voltage switchgear and controlgear –
Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV

Appareillage à haute tension –
Partie 105: Combinés interrupteurs-fusibles pour courant alternatif de tensions assignées supérieures à 1 kV et jusqu'à 52 kV inclus

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV

FOREWORD

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

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

This third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

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

a) the document has been updated to be in alignment with the second edition of IEC 62271-1:2017;

b) rated TRV has been removed (TRV is only a test parameter), as in the latest revision of IEC 62271-100;

c) differentiation has been introduced between requirements expressed for fulfilling the function expected from a switch-fuse combination, from requirements only relevant when the function is performed by a stand-alone device. The goal is to avoid duplication or conflicts of requirements with a standard dealing with assemblies, when the function is implemented within such an assembly.

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

FDIS	Report on voting
17A/1300/FDIS	17A/1306/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This document is to be read in conjunction with IEC 62271-1:2017, to which it refers and which is applicable unless otherwise specified. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1:2017. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

A list of all parts in the IEC 62271 series, published under the general title *High-voltage switchgear and controlgear*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV

1 Scope

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

– breaking, at the rated 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 combinations of fuses with circuit-breakers, contactors or circuit switchers, nor for combinations for motor-circuits nor to combinations incorporating single capacitor bank switches.

This document 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.

In this document, the word "combination" is used for a 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 switch-fuse combination. Different types of fuses can be combined with one type of switch, which give several combinations with different characteristics, in particular concerning the rated continuous currents.

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

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 can be fitted with either an over-current release or a shunt release.

NOTE In this document 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.

Fuses are in accordance with IEC 60282-1:2020.

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

Switches, including their specific mechanism, are in accordance with IEC 62271-103 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.

In addition, switches which include other functions (not covered by IEC 62271-103) are covered by their relevant standards (e.g. IEC 62271-102 for disconnectors and earthing switches).

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.

Clause 2 of IEC 62271-1:2017 applies with the following additions:

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

IEC 60282-1:2020*, High-voltage fuses – Part 1: Current-limiting fuses*

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

IEC 62271-100:2021*, High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

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

IEC 62271-103:2021, *High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-441 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Some of the terms given in IEC 60050-441 are listed hereunder.

3.1 General terms and definitions

Subclause 3.1 of IEC 62271-1:2017 applies.

3.2 Assemblies of switchgear and controlgear

Subclause 3.2 of IEC 62271-1:2017 applies.

3.3 Parts of assemblies

Subclause 3.3 of IEC 62271-1:2017 applies.

3.4 Switching devices

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

3.4.101
switch-fuse combination
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

Note 1 to entry: The switch-fuse combination includes the fuse-switch combination.

3.4.102
switch-fuse combination base
combination base
switch-fuse combination without fuse-links mounted

3.4.103
switch-fuse
switch in which one or more poles have a fuse in series in a composite unit

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

3.4.104
fuse-switch
switch in which a fuse-link or a fuse-carrier with fuse-link forms the moving contact

[SOURCE: IEC 60050-441:2000, 441-14-17]

3.4.105
switch-disconnector
switch which, in the open position, satisfies the isolating requirements specified for a disconnector

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

3.4.106
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 switchgear and controlgear

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

3.5.101
release
<of a mechanical switching device> 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 60050-441:2000, 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

Note 1 to entry: This value can in some cases depend upon the rate-of-rise of current.

[SOURCE: IEC 60050-441:2000, 441-16-33]

3.5.103
shunt release
release energized by a source of voltage

Note 1 to entry: The source of voltage may be independent of the voltage of the main circuit.

[SOURCE: IEC 60050-441:2000, 441-16-41]

3.6 Operational characteristics of switchgear and controlgear

Subclause 3.6 of IEC 62271-1:2017 applies.

3.7 Characteristic quantities

Subclause 3.7 of IEC 62271-1:2017 applies, 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

Note 1 to entry: The method to be used to evaluate and to express the prospective current is to be specified in the relevant publications.

[SOURCE: IEC 60050-441:2000, 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 60050-441:2000, 441-17-02]

3.7.103
maximum prospective peak current
<of an AC circuit> 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 60050-441:2000, 441-17-04]

3.7.104
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

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

3.7.105
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 60050-441:2000, 441-18-29]

3.7.106
short-circuit making capacity
making capacity for which the prescribed conditions include a short circuit at the terminals of the switching device

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

3.7.107
cut-off current
let-through 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 60050-441:2000, 441-17-12]

3.7.108
transfer current
$I_{transfer}$
<striker operation> value of the three-phase symmetrical current at which the fuses and the switch exchange breaking duties

Note 1 to entry: Above this value the three-phase current is interrupted by the fuses 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.

3.7.109
take-over current
current co-ordinate of the intersection between the time-current characteristics of two over-current protective devices

[SOURCE: IEC 60050-441:2000, 441-17-16]

3.7.110
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

3.7.111
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 corresponding to:

a) the minimum opening time plus, where applicable, the minimum operating time of an external over-current or earth-fault relay,

b) the maximum operating time of the fuse

3.7.112
applied voltage
<for a switching device> voltage which exists across the terminals of a pole of a switching device just before the making of the current

[SOURCE: IEC 60050-441:2000, 441-17-24]

3.7.113
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 60050-441:2000, 441-17-25]

3.7.114
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 60050-441:2000, 441-17-26]

3.7.115
power-frequency recovery voltage
recovery voltage after the transient voltage phenomena have subsided

[SOURCE: IEC 60050-441:2000, 441-17-27]

3.7.116
prospective transient recovery voltage
<of a circuit> 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 60050-441:2000, 441-17-29]

3.7.117
fuse-initiated opening time
<of the switch-fuse combination> time taken from the instant at which arcing in the fuse commences to the instant when the arcing contacts of the switch of the combination have separated in all poles (including all elements influencing this time)

3.7.118
release-initiated opening time
<of the switch-fuse combination> 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

3.7.119
minimum release-initiated opening time
<of the switch-fuse combination> release-initiated opening time when the specified setting of any time-delay device forming an integral part of the switch is its minimum setting

3.7.120
maximum release-initiated opening time
<of the switch-fuse combination> release-initiated opening time when the specified setting of any time-delay device forming an integral part of the switch is its maximum setting

3.7.121
break-time
interval of time between the beginning of the opening time of a mechanical switching device (or the pre-arcing time of a fuse) and the end of the arcing time

[SOURCE: IEC 60050-441:2000, 441-17-39]

3.7.122
arcing time
<of a pole or a fuse> interval of time between the instant of the initiation of the arc in a pole or a fuse and the instant of final arc extinction in that pole or that fuse

[SOURCE: IEC 60050-441:2000, 441-17-37]

3.101 Fuses

3.101.1
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 document of all corresponding switch-fuse combinations is assessed

Note 1 to entry: Conditions for extending the validity of the type tests are given in 7.105 and 9.102.

3.101.2
fuse-base
fuse mount
fixed part of a fuse provided with contacts and terminals

[SOURCE: IEC 60050-441:2000, 441-18-02]