IEC 60282-1

Edition 8.0 2020-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

High-voltage fuses –
Part 1: Current-limiting fuses

Fusibles à haute tension –
Partie 1: Fusibles limiteurs de courant

IEC 60282-1:2020-04(en-fr)

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High-voltage fuses – Part 1: Current-limiting fuses

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Part 1: Current-limiting fuses

FOREWORD

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International Standard IEC 60282-1 has been prepared by subcommittee 32A: High-voltage fuses, of IEC technical committee 32: Fuses.

This eighth edition cancels and replaces the seventh edition published in 2009.

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

– additional information concerning thermally operated strikers;
– the division of ratings, characteristics and type tests into those applicable to all fuses and those applicable to particular fuse-link types and applications;
– adjustment of Series II voltages and tests to meet present North American standard system voltages and applications;
– clarification of requirements for fuse-links used in surrounding temperatures above 40 °C; and

– clarification of homogeneous requirements for fuse-links containing one element.

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

FDIS	Report on voting
32A/347/FDIS	32A/349/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 60282 series, published under the general title *High-voltage fuses*, 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- withdrawn,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.

HIGH-VOLTAGE FUSES –

Part 1: Current-limiting fuses

1 Scope

This part of IEC 60282 applies to all types of high-voltage current-limiting fuses designed for use outdoors or indoors on alternating current systems of 50 Hz and 60 Hz and of rated voltages exceeding 1 000 V.

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 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

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

IEC 60549, *High-voltage fuses for the external protection of shunt capacitors*

IEC 60644, *Specification for high-voltage fuse-links for motor circuit applications*

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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 Electrical characteristics

3.1.1
rated value
value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

Note 1 to entry: Examples of rated value usually stated for fuses: voltage, current and breaking current.

[SOURCE: IEC 60050-441:2000, 441-18-35, modified – "used for specification purposes" and "system" added, "assigned, generally by the manufacturer" deleted.]

3.1.2
rating
set of rated values and operating conditions

[SOURCE: IEC 60050-441:2000, 441-18-36]

3.1.3
prospective current (of a circuit and with respect to a fuse)
current that would flow in the circuit if the fuse were replaced by a conductor of negligible impedance

Note 1 to entry: For the method to evaluate and to express the prospective current, see 7.6.2.1 and 7.6.2.2.

[SOURCE: IEC 60050-441:2000, 441-17-01, modified – deletion of "a switching device or", "each pole of the switching device or" and "is to be specified in the relevant publications" and addition of "see 7.6.2.1 and 7.6.2.2".]

3.1.4
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, for example 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]

3.1.5
prospective breaking current
RMS value of the AC component of the prospective current, evaluated at a specified time

Note 1 to entry: This specified time is given in 7.6.2.3.

3.1.6
breaking capacity
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, 441-17-08, modified – "switching device or a fuse" replaced with "fuse-link" and Notes removed.]

3.1.7
cut-off current
let-through current
maximum instantaneous value of current attained during the breaking operation of a fuse

Note 1 to entry: This concept is of particular importance when the fuse operates in such a manner that the prospective peak current of the circuit is not reached due to a current-limiting effect.

[SOURCE: IEC 60050-441:2000, 441-17-12, modified – "a switching device or" deleted, "due to a current limiting effect" added to Note 1 to entry.]

3.1.8
pre-arcing time
melting time
interval of time between the beginning of a current large enough to cause a break in the fuse-element(s) and the instant when an arc is initiated

[SOURCE: IEC 60050-441:2000, 441-18-21]

3.1.9
arcing time
interval of time between the instant of the initiation of the arc in a fuse and the instant of final arc extinction in that fuse

[SOURCE: IEC 60050-441:2000, 441-17-37, modified – references to "poles" removed.]

3.1.10
operating time
clearing time
sum of the pre-arcing time and the arcing time

[SOURCE: IEC 60050-441:2000, 441-18-22]

3.1.11
I*²*t
Joule integral
integral of the square of the current over a given time interval $t_0 - t_1$

$$I^2t = \int_{t_0}^{t_1} i^2 \mathrm{d}t$$

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 1 Ω of resistance in a circuit protected by a fuse is equal to the value of the operating I^2t expressed in $A^2 \times s$.

[SOURCE: IEC 60050-441:2000, 441-18-23]

3.1.12
virtual time
value of Joule integral divided by the square of the value of the prospective current

Note 1 to entry: The values of virtual times usually stated for a fuse-link are the values of pre-arcing time and of operating time.

[SOURCE: IEC 60050-441:2000, 441-18-37]

3.1.13
time-current characteristic
curve giving the virtual time, for example pre-arcing time or operating time, as a function of the prospective current under stated conditions of operation

[SOURCE: IEC 60050-441:2000, 441-17-13, modified – "virtual" added.]

3.1.14
cut-off (current) characteristic
let-through (current) characteristic
curve giving the cut-off current as a function of the RMS prospective current, under stated conditions of operation

Note 1 to entry: The values of the cut-off currents are the maximum values that can be reached whatever the degree of asymmetry.

[SOURCE: IEC 60050-441:2000, 441-17-14, modified – "RMS" added, and references relating to direct currents removed from the note to entry.]

3.1.15
recovery voltage
voltage which appears across the terminals of 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 recovery voltage alone exists.

[SOURCE: IEC 60050-441:2000, 441-17-25, modified – "a pole of a switching device or" removed and "or the steady-state" removed from the Note to entry.]

3.1.16
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 fuse. It includes the voltage shift of the neutral point of a polyphase circuit.

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

[SOURCE: IEC 60050-441:2000, 441-17-26, modified – "switching device" and "pole" replaced by "fuse" in the Notes to entry.]

3.1.17
power-frequency recovery voltage
recovery voltage after the transient voltage phenomena have subsided

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

3.1.18
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 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, for example 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, modified – "switching device or" removed from note to entry.]

3.1.19
switching voltage
maximum instantaneous value of voltage which appears across the terminals of a fuse during its operation

Note 1 to entry: The switching voltage may be the arc voltage or may occur during the time of transient recovery voltage.

[SOURCE: IEC 60050-441:2000, 441-18-31]

3.1.20
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]

3.1.21
power dissipation (in a fuse-link)
power released in a fuse-link carrying a stated value of electric current under prescribed conditions of use and behaviour

Note 1 to entry: Prescribed conditions of use and behaviour generally include a constant RMS value of the electric current after steady-state temperature conditions are reached.

[SOURCE: IEC 60050-441:2000, 441-18-38]

3.1.22
maximum breaking current
maximum value of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

3.1.23
lightning impulse
voltage pulse of a specified shape applied during dielectric tests with a virtual front duration of the order of 1 µs and a time to half value of the order of 50 µs

Note 1 to entry: The lightning impulse is defined by the two figures giving these durations in microseconds; in particular the standard lightning impulse is 1,2/50 µs.

[SOURCE: IEC 60050-614:2016, 641-03-28]

3.1.24
rated lightning impulse withstand voltage
designated maximum peak withstand-voltage value, of a lightning impulse voltage wave, that is assigned to the device regarding its ability to withstand a lightning impulse voltage

Note 1 to entry: The term previously used is "basic impulse insulation level (BIL)" (still in common usage).

3.2 Fuses and their component parts

3.2.1
fuse
device that by the fusing of one or more of its specially designed and proportioned components, opens the circuit to which it is connected by breaking the current when this exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device

[SOURCE: IEC 60050-441:2000, 441-18-01, modified – "in which it is inserted" changed to "to which it is connected".]

3.2.2
terminal
conducting part of a fuse provided for an electric connection to external circuits

Note 1 to entry: Terminals may be distinguished according to the kind of circuits for which they are intended (for example, main terminal, earth terminal, etc.), but also according to their design (for example, screw terminal, plug terminal, etc.).

3.2.3
fuse-base
fuse-mount
fixed part of a fuse provided with contacts and terminals

Note 1 to entry: The fuse-base comprises all the parts necessary for insulation (see Figure 1).

[SOURCE: IEC 60050-441:2000, 441-18-02, modified – Note 1 to entry added.]

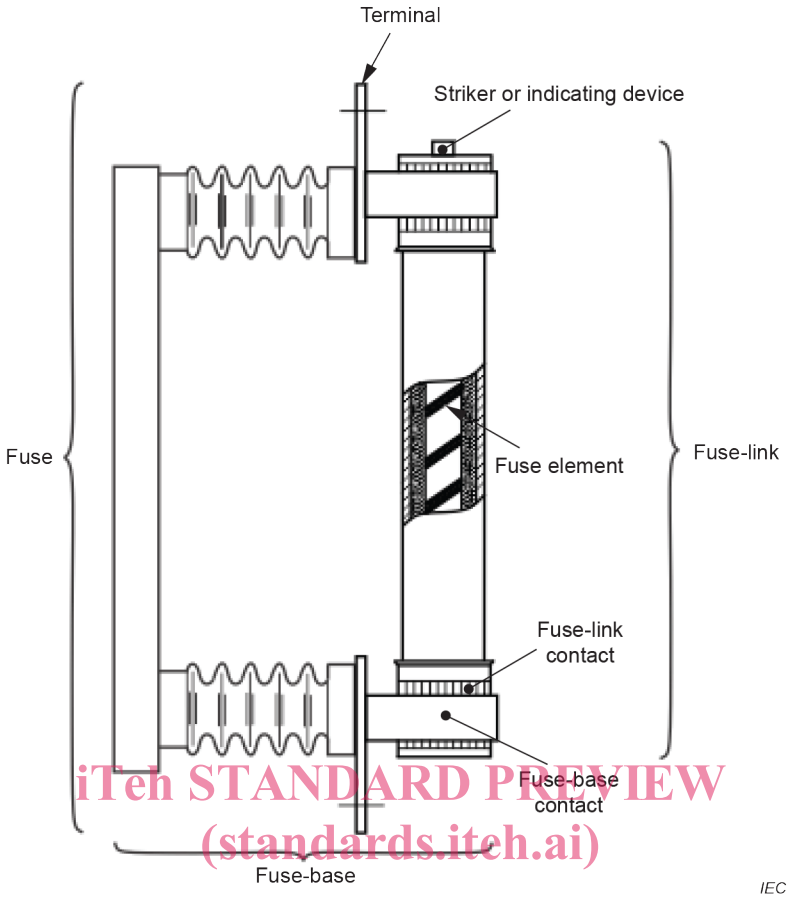

Figure 1 – Terminology

3.2.4
fuse-base contact
contact piece of a fuse-base designed to engage with a fuse-link contact (see Figure 1)

[SOURCE: IEC 60050-441:2000, 441-18-03, modified – "corresponding part of the fuse" replaced with "fuse-link contact (see Figure 1)".]

3.2.5
fuse-link
part of a fuse (including the fuse element(s)) intended to be replaced after the fuse has operated (see Figure 1)

[SOURCE: IEC 60050-441:2000, 441-18-09, modified – "see Figure 1" added.]

3.2.6
fuse-link contact
contact piece of a fuse-link designed to engage with a fuse-base contact (see Figure 1)

[SOURCE: IEC 60050-441:2000, 441-18-04, modified – "corresponding part of the fuse" replaced with "fuse-base contact (see Figure 1)".]

3.2.7
fuse-element
part of the fuse-link designed to melt under the action of current exceeding some definite value for a definite period of time (see Figure 1)