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INTERNATIONAL STANDARD

colour inside

Miniature fuses –
Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 60127-1 edition 2.2 contains the second edition (2006-06) [documents 32C/387/FDIS and 32C/390/RVD], its amendment 1 (2011-04) [documents 32C/436/CDV and 32C/438/RVC] and its amendment 2 (2015-02) [documents 32C/490/CDV and 32C/505/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60127-1 has been prepared by subcommittee 32C: Miniature fuses, of IEC technical committee 32: Fuses.

The major technical changes with regard to the first edition concern subclause 9.2.3 where the nature of the current source has been clarified; in addition, IEC 60038: *IEC standard voltages*, has been added to the list of normative references.

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

This Part 1 of the IEC 60127 series covers definitions, general requirements and tests applicable to all types of miniature fuses (e.g. cartridge fuse-links, sub-miniature fuse-links and universal modular fuse-links). All subsequent parts of the complete series should be read in conjunction with this Part 1.

IEC 60127 consists of the following parts, under the general heading *Miniature fuses*:

Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links
Part 2: Cartridge fuse-links
Part 3: Sub-miniature fuse-links
Part 4: Universal modular fuse-links (UMF) – Through-hole and surface mount types
Part 5: Guidelines for quality assessment of miniature fuse-links
Part 6: Fuse-holders for miniature fuse-links
Part 7: (Free for further documents)
Part 8: (Free for further documents)
Part 9: (Free for further documents)
Part 10: User guide for miniature fuses

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability 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,
- withdrawn,
- replaced by a revised edition, or
- amended.

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MINIATURE FUSES –

Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links

1 Scope and object

This part of IEC 60127 covers the general requirements and tests applicable to all types of miniature fuse-links (e.g. cartridge fuse-links, sub-miniature fuse-links and universal modular fuse-links) for the protection of electric appliances, electronic equipment and component parts thereof normally intended to be used indoors.

This standard does not apply to fuses intended for the protection of low-voltage electrical installations. These are covered by IEC 60269, *Low Voltage Fuses*.

Specific details covering each major subdivision are given in subsequent parts.

This standard does not apply to fuses for appliances intended to be used under special conditions, such as in a corrosive or explosive atmosphere.

The object of this standard is

a) to establish uniform requirements for miniature fuses so as to protect appliances or parts of appliances in the most suitable way,
b) to define the performance of the fuses, so as to give guidance to designers of electrical appliances and electronic equipment and to ensure replacement of fuse-links by those of similar dimensions and characteristics,
c) to define methods of testing,
d) to define maximum sustained dissipation of fuse-links to ensure good compatibility of stated power acceptance when used with fuse-holders according to this standard (see IEC 60127-6).

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 60038, *IEC standard voltages*

IEC 60127-6:1994, *Miniature fuses – Part 6: Fuse-holders for miniature fuse-links*
Amendment 1 (1996)
Amendment 2 (2003)

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1
fuse
device that, by the fusing of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time

NOTE The fuse comprises all the parts that form the complete device.

3.2
miniature fuse
fuse in which the fuse-link is a miniature fuse-link

3.3
fuse-link
part of a fuse including the fuse-element(s) intended to be replaced after the fuse has operated

3.4
enclosed fuse-link
fuse-link in which the fuse-element is totally enclosed, so that during operation within its rating it cannot produce any harmful external effects, e.g. due to development of an arc, the release of gas or the ejection of flame or metallic particles

3.5
miniature fuse-link
enclosed fuse-link ~~of rated breaking capacity not exceeding 2 kA and which has at least one of its principal dimensions not exceeding 10 mm~~ for the protection of electric appliances, electronic equipment and component parts thereof normally intended to be used indoors

~~NOTE Principal dimensions are length, width, height and diameter.~~

3.5.1
cartridge fuse-link
enclosed miniature fuse-link of rated breaking capacity not exceeding 2 kA and which has at least one of its principle dimensions not exceeding 10 mm

NOTE Principle dimensions are length, width, height and diameter.

3.5.2
miniature fuse-link for special applications
enclosed miniature fuse-link which is not covered in IEC 60127-2, IEC 60127-3 or IEC 60127-4 and of rated breaking capacity not exceeding 50 kA and having a width and height not exceeding 12 mm and a length not exceeding 50 mm

3.6
sub-miniature fuse-link
miniature fuse-link of which the case (body) has no principal dimension exceeding 10 mm

NOTE Principal dimensions are length, width, height and diameter.

3.7
universal modular fuse-link
miniature fuse-link primarily adapted for direct electrical connection to printed circuit boards or other conductive substrates, incorporating features designed to provide a degree of non-interchangeability where necessary

3.8
fuse-link contact
conductive part of a fuse-link designed to engage with a fuse-base contact or with a fuse-carrier contact

3.9
fuse-holder
combination of a fuse-base with its fuse-carrier

3.10
fuse-base
fuse-mount
fixed part of a fuse provided with contacts and terminals for connection to the system

3.11
fuse-base contact
fuse-mount contact
conductive part of a fuse-base, connected to a terminal designed to engage with a fuse-carrier contact or with a fuse-link contact

3.12
fuse-carrier
movable part of a fuse designed to carry a fuse-link

3.13
fuse-carrier contact
conductive part of a fuse-carrier connected to a fuse-link contact and designed to engage with a fuse-base contact

3.14
fuse-element
part of the fuse-link designed to melt when the fuse operates

3.15
homogeneous series (of fuse-links)
series of fuse-links, deviating from each other only in such characteristics that, for a given test, the testing of one or a reduced number of particular fuse-links of the series may be taken as representative of all the fuse-links of the series

NOTE Fuse-links are considered as forming a homogeneous series when the characteristics comply with the following:

- the bodies have the same dimensions, material and method of manufacture;
- the caps or other end closures of the body have the same dimensions, materials and method of attachment and sealing;
- the granular filler, if any, of the body is of the same material and completeness of filling. It should be of the same size or any variation of the grain size with current rating should be monotonous;
- the fuse-elements are of the same material with the same principles of design and construction; any changes of fuse-element dimensions with current rating should be monotonous;
- the rated voltage is the same;
- for low-breaking capacity fuse-links it is only necessary to test the highest rated breaking capacity in a homogeneous series.

3.16
rating
general term employed to designate the characteristic values that together define the working conditions upon which the tests are based and for which the fuse is designed

Examples of rated values usually stated for fuses:

- voltage (U_N);
- current (I_N);
- breaking capacity.

3.17
time/current characteristics (of a fuse-link)
a) For a.c.: curve giving, under stated conditions of operation, the value of time expressed as virtual time as a function of the prospective symmetrical current, expressed as the r.m.s. value

b) For d.c.: curve giving, under stated conditions of operation, the value of time expressed as actual time as a function of the d.c. prospective current

NOTE Time/current characteristics usually stated for a fuse-link relate to the pre-arcing time and the operating time.

3.18
conventional non-fusing current
value of current specified as that which the fuse-link is capable of carrying for a specified time (conventional time) without melting

3.19
prospective current (of a circuit and with respect to a fuse)
current that would flow in a circuit, if a fuse situated therein were replaced by a link of negligible impedance

3.20
pre-arcing time (melting time)
interval of time between the beginning of a current large enough to cause a break in the fuse-element and the instant when an arc is initiated

3.21
arcing time
interval of time between the instant of the initiation of the arc and the instant of final arc extinction

3.22
operating time (total clearing time)
sum of the pre-arcing time and the arcing time

3.23
virtual time
value of I^2t divided by the value of the square of the value of the prospective current

NOTE The values of the virtual times, usually stated for a fuse-link, are the values of the pre-arcing time and of the operating time.

3.24
***I*²*t* (joule integral)**
integral of the square of the current over a given time interval:

$$I^2t = \int_{t=0}^{t} i^2 \mathrm{d}t$$

NOTE 1 The pre-arcing I^2t is the I^2t integral extended over the pre-arcing time of the fuse.

NOTE 2 The operating I^2t is the I^2t integral extended over the operating time of the fuse.

NOTE 3 The energy in joules released 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^2s.

3.25
breaking capacity of a fuse-link
value (r.m.s. for a.c.) of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

3.26
recovery voltage
voltage which appears across the terminals of a fuse after breaking of the current

NOTE 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 exists.

3.27
maximum sustained dissipation
power dissipation of a fuse-link measured under prescribed conditions of measurement at the maximum current level that can be sustained for a minimum of 1 h or, as specified in the standard sheet for ratings above 6,3 A

NOTE 1 The figure for maximum sustained dissipation is used in connection with the maximum power acceptance of fuse-holders for miniature fuse-links in accordance with IEC 60127-6.

NOTE 2 These values are often exceeded for short periods of time immediately before the fuse-element melts. Values as high as twice the maximum sustained dissipation have been recorded.

4 General requirements

Fuse-links shall be so constructed that they are reliable and safe in operation and consistent in performance at any current up to and including the breaking capacity rating and at any voltage up to the rated voltage, when used within the limits of this standard.

During normal use of the fuse-link and within the conditions given in this standard, no permanent arc, no external arcing, nor any flame that can endanger the surroundings, shall be produced. During the test for establishing the maximum sustained dissipation and after operation, the fuse-link shall not have suffered damage hindering its replacement and the marking shall still be legible.

In general, compliance is checked by carrying out all the tests specified.

5 Standard ratings

In the relevant standard sheets, values are given for

– rated voltage,
– rated current,
– rated breaking capacity.

6 Marking

Unless otherwise stated in subsequent parts, the requirements for marking are as follows:

6.1 Each fuse-link shall be marked with:

a) Rated current in milliamperes for rated currents below 1 A, and in amperes for rated currents of 1 A or more. The marking of the rated current shall precede and be adjacent to the marking of the rated voltage.

   To accommodate existing practice in some countries, for the time being, the current may also be indicated in fractions of ampere.

b) Rated voltage in volts (V).

c) Maker's name or trade mark.

d) A symbol denoting the relative pre-arcing time/current characteristic as given in the relevant standard sheet. This symbol shall be placed before and adjacent to the rated current.

These symbols read as follows:

FF: denoting very quick acting

F: denoting quick acting

M: denoting medium time-lag

T: denoting time-lag

TT: denoting long time-lag.

6.2 Marking shall be indelible and easily legible.

Compliance is checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

NOTE 1 For petroleum spirit the use of an aliphatic solvent hexane, with an aromatics content of maximum 0,1 % volume, a kauri-butanol value of 29, initial boiling point approximately 65 °C, dry-point approximately 69 °C and specific gravity of approximately 0,68 is recommended.

NOTE 2 In the case of colour coding, the test for indelibility need not be applied.

6.3 The marking according to 6.1 shall be printed on the packing together with a reference to this standard and an indication of the appropriate standard sheet. The marking on the packing shall include the abbreviation A and mA.

Compliance is checked by inspection.

6.4 Further identification of the current rating and the time/current characteristics by means of colour bands may be used.

Such an additional marking shall be in accordance with Annex A.

7 General notes on tests

Tests according to this standard are type tests.

It is recommended that where acceptance tests are required, they are chosen from the type tests in this standard.

7.1 Atmospheric conditions for testing

7.1.1 Unless otherwise specified in subsequent parts, all tests shall be carried out under the following atmospheric conditions:

– temperature between 15 °C and 35 °C;

– relative humidity between 45 % and 75 %;

– air pressure between 8,6 × 10^4 Pa and 1,06 × 10^5 Pa.

Where the above-mentioned conditions have a significant influence, they shall be kept substantially constant during the tests.

Fuse-links shall be tested in the specified bases in free air, and be protected from draughts and direct heat radiation. The position of the fuse-holder shall be horizontal.

If temperature has a marked effect on the results of the tests, these shall be performed at a temperature of 23 °C ± 1 °C.