

# INTERNATIONAL STANDARD



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

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## MINIATURE FUSES –

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

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**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60127-1:2006+AMD1:2011+AMD2:2015 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

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

This third edition cancels and replaces the second edition published in 2006, Amendment 1:2011 and Amendment 2:2015. This edition constitutes a technical revision.

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

- a) modification of 6.3 to clarify the marking items;
- b) modification of 9.3.1 to introduce a tolerance for the prospective current for the breaking capacity test;
- c) deletion of contents of 9.6, Pulse test;
- d) deletion of Annex C;
- e) addition of new Annex C user guide for miniature fuse-links.

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

Draft	Report on voting
32C/615/FDIS	32C/624/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

A list of all parts in the IEC 60127 series, published under the general title *Miniature fuses*, can be found on the IEC website.

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, universal modular fuse-links and miniature fuse-links for special applications). All subsequent parts of the complete series are to be read in conjunction with this Part 1.

IEC 60127 consists of the following parts:

IEC 60127-1, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

IEC 60127-2, *Miniature fuses – Part 2: Cartridge fuse-links*

IEC 60127-3, *Miniature fuses – Part 3: Sub-miniature fuse-links*

IEC 60127-4, *Miniature fuses – Part 4: Universal modular fuse-links (UMF) – Through-hole and surface mount types*

IEC 60127-5, *Miniature fuses – Part 5: Guidelines for quality assessment of miniature fuse-links*

IEC 60127-6, *Miniature fuses – Part 6: Fuse-holders for miniature fuse-links*

IEC 60127-7, *Miniature fuses – Part 7: Miniature fuse-links for special applications*

IEC 60127-8, *Miniature fuses – Part 8: Fuse resistors with particular overcurrent protection*

IEC 60127-9, (free for further documents)

IEC 60127-10, Moved to IEC 60127-1 as Annex C.

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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, universal modular fuse-links and miniature fuse-links for special applications) for the protection of electric appliances, electronic equipment and component parts thereof normally intended to be used indoors.

This document 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 document 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 document 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 document (see IEC 60127-6).

#### 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 60038, *IEC standard voltages*

IEC 60127-6:1994/2014, *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 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

##### **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 1 to entry: 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 for the protection of electric appliances, electronic equipment and component parts thereof normally intended to be used indoors

##### 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 1 to entry: 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

##### 3.5.3

##### **sub-miniature fuse-link**

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

Note 1 to entry: Principal dimensions are length, width, height and diameter.

**3.5.4****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

**3.6****fuse-link contact**

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

**3.7****fuse-holder**

combination of a fuse-base with its fuse-carrier

**3.8****fuse-base**

fuse-mount

fixed part of a fuse provided with contacts and terminals for connection to the system

**3.9****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

**3.10****fuse-carrier**

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

**3.11****fuse-carrier contact**

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

**3.12****fuse-element**

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

**3.13****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 1 to entry: 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.

### **3.14 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.

### **3.15 time/current characteristics (of a fuse-link) for AC**

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 RMS value

Note 1 to entry: Time/current characteristics usually stated for a fuse-link relate to the pre-arcing time and the operating time.

#### **3.15.1 time/current characteristics (of a fuse-link) for DC**

curve giving, under stated conditions of operation, the value of time expressed as actual time as a function of the DC prospective current

Note 1 to entry: Time/current characteristics usually stated for a fuse-link relate to the pre-arcing time and the operating time.

### **3.16 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

### **3.17 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

### **3.18 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

### **3.19 arcing time**

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

### **3.20 operating time (total clearing time)**

sum of the pre-arcing time and the arcing time

### **3.21 virtual time**

value of  $I^2t$  divided by the value of the square of the value of the prospective current

Note 1 to entry: 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.

### 3.22

#### **$I^2t$ (joule integral)**

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

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

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 released in 1  $\Omega$  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.

### 3.23

#### **breaking capacity of a fuse-link**

value (RMS for AC) of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

### 3.24

#### **recovery voltage**

voltage which appears across the terminals of a fuse after 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 exists.

### 3.25

#### **maximum sustained power 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 to entry: 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 to entry: 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 document.

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

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

Each fuse-link shall be marked with the below in the order given:

- a) 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.

- b) Rated current in milliamperes (mA) for rated currents below 1 A, and in amperes (A) 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.

- c) Rated voltage in volts (V).

- d) ~~Maker's~~ Manufacturer's name or trade mark (does not need to follow order of marking). ~~-1-2023~~

**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 label along with a reference to the subsequent IEC 60127 standard and appropriate standard sheet. It is optional to indicate IEC 60127-1 on the packing label. The marking on the packing label shall include the abbreviation A ~~and~~ or mA for the current rating of the fuse-link.

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.