

INTERNATIONAL STANDARD

IEC
60127-1

Second edition
2006-06

Miniature fuses –

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 60127-1:2006

<https://standards.iteh.ai/catalog/standards/sist/757c4c96-7098-4dd0-8502-8dbf8effe8be/iec-60127-1-2006>



Reference number
IEC 60127-1:2006(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**
- **Catalogue of IEC publications**
The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.
- **IEC Just Published (standards.iteh.ai)**
This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information. <https://standards.iteh.ai/catalog/standards/sist/757c4c96-7098-4dd0-8502-8db18effe8be/iec-60127-1-2006>
- **Customer Service Centre**
If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC
60127-1

Second edition
2006-06

Miniature fuses –

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60127-1:2006](https://standards.iteh.ai/catalog/standards/sist/757c4c96-7098-4dd0-8502-8dbf8effe8be/iec-60127-1-2006)

<https://standards.iteh.ai/catalog/standards/sist/757c4c96-7098-4dd0-8502-8dbf8effe8be/iec-60127-1-2006>

© IEC 2006 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

U

For price, see current catalogue

CONTENTS

FOREWORD.....	3
1 Scope and object.....	5
2 Normative references	5
3 Terms and definitions	5
4 General requirements	9
5 Standard ratings	9
6 Marking	9
7 General notes on tests	10
7.1 Atmospheric conditions for testing.....	10
7.2 Type tests	11
7.3 Fuse-bases for tests.....	11
7.4 Nature of supply	11
8 Dimensions and construction	12
8.1 Dimensions	12
8.2 Construction.....	12
8.3 Terminations	12
8.4 Alignment and configuration of terminations	12
8.5 Soldered joints	12
9 Electrical requirements	12
9.1 Voltage drop.....	12
9.2 Time/current characteristic	13
9.3 Breaking capacity	14
9.4 Endurance tests	15
9.5 Maximum sustained dissipation	16
9.6 Pulse tests	16
9.7 Fuse-link temperature	16
Annex A (informative) Colour coding for miniature fuse-links	17
Annex B (informative) Example presentations of time/current characteristic	
Annex C (informative) Audit testing and surveillance – Guidelines for the application of the principles of IEC 60303 (CB-FCS) to miniature fuse-links	21
Bibliography.....	27
Figure A.1– Layout of colour bands.....	17
Figure B.1 – Example presentation of time/current characteristic, ratio 2:1	19
Figure B.2 – Example presentation of time/current characteristic, ratio 3:1	20
Figure C.1 – Example of a fuse-link description	22
Table A.1 – Colour coding for miniature fuse-links	18
Table C.1 – Audit testing for option 3	25
Table C.2 – Audit testing for option 4	26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MINIATURE FUSES –

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This second edition cancels and replaces the first edition (1988), together with amendment 1 (1999) and amendment 2 (2002), and constitutes a technical revision.

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.

The text of this standard is based on the following documents:

FDIS	Report on voting
32C/387/FDIS	32C/390/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 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) [IEC 60127-1:2006](http://standards.iteh.ai/iec-60127-1-2006)
- Part 9: (Free for further documents) <http://standards.iteh.ai/iec-60127-1-2006>
- Part 10: User guide for miniature fuses

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

A bilingual version of this publication may be issued at a later date.

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.

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

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

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^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 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 1Ω 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

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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 $8,6 \times 10^4$ Pa and $1,06 \times 10^5$ 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 $23 \text{ °C} \pm 1 \text{ °C}$.

7.1.2 In every test report, the ambient temperature shall be stated. If the standard conditions for relative humidity or pressure are not fulfilled during tests, a note to this effect shall be added to the report.

Where tests are required at elevated temperatures, these tests shall be carried out at an ambient temperature of $70 \text{ °C} \pm 2 \text{ °C}$, unless otherwise specified.