IEC 60127-8

Edition 1.0 2018-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Miniature fuses –
Part 8: Fuse resistors with particular overcurrent protection

Coupe-circuit miniatures –
Partie 8: Résistances de protection avec protection particulière contre les surintensités

IEC 60127-8:2018-06(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.120.50

ISBN 978-2-8322-6238-2

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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International Standard IEC 60127-8 has been prepared by subcommittee SC 32C: Miniature fuses, of IEC technical committee 32: Fuses

This bilingual version (2018-12) corresponds to the monolingual English version, published in 2018-06.

This first edition of IEC 60127-8 cancels and replaces IEC PAS 60127-8:2014.

This international standard is to be used in conjunction with IEC 60127-1.

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

FDIS	Report on voting
32C/542/FDIS	32C/546/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.

The French version of this standard has not been voted upon.

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

A list of all parts in the IEC 60127 series, published under the general title *Miniature 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- withdrawn,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.

INTRODUCTION

In recent years, so-called “fuse resistors” have increasingly been used in electrical and electronic applications. The term “fuse resistor”, however, which has become established in the market, is misleading. The actual function of a fuse resistor is that of a resistor in an electrical or electronic circuit. Only when an overload of multiple times the rated dissipation occurs can fuse resistors interrupt an electric current. In a wide range between the rated dissipation and the manufacturer’s specified breaking dissipation, fuse resistors provide poor or no overcurrent protection. Therefore if they are incorrectly rated and improperly used in an application, this may result in potential risk of fire.

Fuse resistors perform the function of a fuse only within a particular overcurrent range, and, from a technical point of view, must therefore be referred to as “fuse resistors with particular overcurrent protection”.

Fuse resistors with particular overcurrent protection can safely interrupt high short-circuit currents, but are not capable of interrupting overload currents.

For safety reasons, they are only used in combination with an accompanying overload current protection device, if overload currents cannot be excluded to occur in the respective application.

MINIATURE FUSES –

Part 8: Fuse resistors with particular overcurrent protection

1 Scope

This part of IEC 60127 relates to fuse resistors with particular overcurrent protection rated up to AC 500 V and/or DC 500 V for printed circuits and other substrate systems, used for the protection of electric appliances, electronic equipment and component parts thereof, normally intended to be used indoors.

It does not apply to fuse resistors with particular overcurrent protection for appliances intended to be used under special conditions, such as in a corrosive or explosive atmosphere.

The object of this part of IEC 60127 is

a) to establish uniform requirements for fuse resistors with particular overcurrent protection so as to protect appliances or parts of appliances in the most suitable way;

b) to define the performance of the fuse resistors with particular overcurrent protection, so as to give guidance to manufacturers of electrical appliances and electronic equipment and to ensure replacement of fuse resistors with particular overcurrent protection by those of similar dimensions and characteristics;

c) to establish uniform test methods for fuse resistors with particular overcurrent protection, so as to allow verification of the values (for example rated dissipation, functioning characteristic and rated breaking capacity values) specified by the manufacturer.

Manufacturers of fuse resistors with particular overcurrent protection shall ensure on their own responsibility that their products comply with the requirements of the resistor-related standards IEC 60115-1, IEC 60115-4-101 and IEC 60115-4-102[1].

This part of IEC 60127 applies in addition to the requirements of IEC 60127-1.

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 60063:2015, *Preferred number series for resistors and capacitors*

IEC 60068-2-21:2006, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60115-1:2008, *Fixed resistors for use in electronic equipment – Part 1: Generic specification*

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[1] This standard has been withdrawn.

IEC 60115-4-101:1995, *Fixed resistors for use in electronic equipment – Part 4: Detail specification: Fixed power wirewound resistors with solderable axial wire leads – Stability class 5%. Assessment level E*

IEC 60115-4-102:1995, *Fixed resistors for use in electronic equipment – Part 4: Detail specification: Fixed power wirewound resistors with solderable axial wire leads – Stability class 1 % – Assessment level E*

IEC 60127-1:2006, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*
IEC 60127-1:2006/AMD1:2011
IEC 60127-1:2006/AMD2:2015

IEC 60194:2015, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-12:2010, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability index (GWFI) test method for materials*

IEC 60695-2-13:2010, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignition temperature (GWIT) test method for materials*

IEC 60695-4:2012, *Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products*

IEC 61249-2-7:2002, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 3 of IEC 60127-1:2006 as well as IEC 60115-1, IEC 60115-4-101 and IEC 60115-4-102 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

3.1
fuse resistor with particular overcurrent protection
resistor with the added function of a fuse, characterized as being capable of continuously carrying currents up to at least the rated dissipation and of interrupting currents above a defined multiple of the rated dissipation up to its rated breaking capacity

Note 1 to entry: Fuse resistors with particular overcurrent protection can safely interrupt high short-circuit currents, but are not capable of interrupting overload currents. They are therefore allowed to be used only in combination with an accompanying overload current protection device such as a miniature fuse according to parts 2, 3, 4 and 7, if overload currents cannot be excluded to occur in the respective application.

3.2
fuse resistor with particular overcurrent protection for through-hole mounting
fuse resistor with particular overcurrent protection designed for soldering directly into a printed wiring board, with insertion of its leads in suitably designed holes

3.3
fuse resistor with particular overcurrent protection for surface mounting
fuse resistor with particular overcurrent protection designed for direct conductive attachment by solder or other means onto the surface of a substrate, without insertion of its leads in suitably designed holes or sockets

3.4
land
portion of a conductive pattern usually but not exclusively used for the connection and/or attachment of components

SEE: IEC 60194

Note 1 to entry: Further definitions which may be useful in the application of surface-mount fuse resistors with particular overcurrent protection may be found in IEC 60115-1 and IEC 60115-8.

3.5
critical resistance
resistance value at which the rated voltage is equal to the limiting element voltage

Note 1 to entry: At an ambient temperature of 70 °C, the maximum voltage which may be applied across the terminations of a fuse resistor with particular overcurrent protection is either the calculated rated voltage, if the resistance is less than the critical resistance, or the limiting element voltage, if the resistance is equal to or greater than the critical resistance. At temperatures other than 70 °C, it is important that account be taken of the derating curve and of the limiting element voltage in the calculation of any voltage to be applied

Note 2 to entry: Related terminology: Rated voltage, limiting element voltage.

3.6
limiting element voltage
U_{max}
maximum DC or AC r.m.s. voltage that may be continuously applied to the terminations of a fuse resistor with particular overcurrent protection (generally dependent upon size and manufacturing technology of the fuse resistor with particular overcurrent protection)

Note 1 to entry: Where the term "AC r.m.s. voltage" is used in this standard, the peak voltage should not exceed 1,42 times the r.m.s. value.

Note 2 to entry: This voltage can only be applied to fuse resistors with particular overcurrent protection when the resistance value is equal to or higher than the critical resistance value.

Note 3 to entry: Related terminology: rated voltage, critical resistance.

3.7
rated resistance
resistance value for which the fuse resistor with particular overcurrent protection has been designed, and which is generally used for denomination of the fuse resistor with particular overcurrent protection

3.8
rated dissipation
P_{70}
maximum permissible dissipation at an ambient temperature of 70 °C under the conditions of the respective acceptance criteria

Note 1 to entry: If the rated dissipation depends on special means supporting the abduction of the dissipation to the environment, for example, special circuit board material, special conductor dimensions, heat-sink, such means have to be identified whenever the rated dissipation is mentioned.

Note 2 to entry: Related terminology: rated temperature, rated voltage.

3.9
rated temperature
maximum ambient temperature at which the rated dissipation may be applied continuously

Note 1 to entry: The rated temperature has a value of 70 °C, unless otherwise prescribed in IEC 60115-1.

Note 2 to entry: Related terminology: rated dissipation.

3.10
rated voltage
U_r
DC or AC r.m.s. voltage calculated from the square root of the product of the rated resistance and the rated dissipation

Note 1 to entry: At high values of resistance, the rated voltage may not be applicable because of the size and the construction of the fuse resistor with particular overcurrent protection.

Note 2 to entry: Related terminology: rated dissipation, limiting element voltage.

3.11
minimum breaking dissipation
minimum value of the breaking dissipation which is equal to a multiple of the rated dissipation and at which the fuse resistor with particular overcurrent protection can still safely interrupt the circuit

Note 1 to entry: In this standard the minimum breaking dissipation is specified to be 16 times the rated dissipation. This value corresponds to the values given by most of the manufacturers.

4 General requirements

The requirements of IEC 60127-1:2006, Clause 4, are replaced as follows:

Fuse resistors with particular overcurrent protection shall be so constructed that their fuse function is reliable and safe and they are consistent in performance at the minimum breaking dissipation 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 resistor with particular overcurrent protection and within the conditions given in this standard, no permanent arc, nor external arcing, nor any flame that can endanger the surroundings, shall be produced. During testing and after operation, the fuse resistor with particular overcurrent protection shall not have suffered damage and the surroundings shall be unimpaired. Marking shall still be legible.

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

5 Standard ratings

The values of rated resistance shall be selected from the E12 or E24 series as given in IEC 60063.

6 Marking

The requirements of IEC 60127-1:2006, Clause 6, are replaced as follows:

6.1 Each fuse resistor with particular overcurrent protection shall be marked as follows:

a) Rated resistance in ohms (abbreviation Ω or mΩ).
b) The marking of the tolerance on rated resistance shall follow and be adjacent to the marking of the rated resistance.
c) Rated dissipation in watts (W).
d) Manufacturer's name or trade mark.
e) The symbol “F” shall precede and be adjacent to the marking of the rated resistance.

6.2 Marking shall be indelible and easily legible.

In the case of screen or pad printing, 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 For all other printing techniques, the above test is not applicable.

6.3 The marking according to 6.2 shall also be printed on the packing together with a reference to this standard. The marking of the rated resistance on the packing shall include the abbreviation Ω or mΩ. In addition, the marking of the rated voltage, rated dissipation P_{70} and minimum breaking dissipation shall be printed on the packing.

Compliance is checked by inspection.

6.4 For colour coding, no test or requirement is specified.

6.5 Where marking is impracticable due to space limitations, the relevant information should appear on the smallest packing unit and in the manufacturer’s technical literature.

7 General notes on tests

7.1 Atmospheric conditions for testing

See IEC 60127-1:2006, 7.1.

7.2 Type tests

7.2.1 General

The requirements of IEC 60127-1:2006, 7.2, are replaced as follows:

7.2.2 For fuse resistors with particular overcurrent protection designed and rated both for AC and DC, the number of fuse resistors with particular overcurrent protection required is 45.

For fuse resistors with particular overcurrent protection designed only for AC or DC, the number of fuse resistors with particular overcurrent protection required is 36.

18 fuse resistors with particular overcurrent protection are kept as spares.

The fuse resistors with particular overcurrent protection shall be tested or inspected in accordance with the following subclauses:

a) Marking (see 6.1);

b) Dimensions (see 8.1);

c) Construction (see 8.2);

d) Resistance (see 9.1);

with such additional tests as are specified in Subclauses 7.2.3 to 7.4.

7.2.3 Testing of the minimum and maximum rated resistance of the fuse resistors with particular overcurrent protection shall then be performed according to the testing schedule shown in Table 3.

In addition, any one rated resistance value per resistance decade shall be tested.

7.2.4

a) No failure is allowed in any of the tests covered by 8.1.1, 9.1, 9.2 and 9.3.

b) If in the test covered by Clause 6 and those tests described in 8.1 and 8.3, one failure occurs, the test shall be repeated on twice the number of fuse resistors with particular overcurrent protection, at the same breaking dissipation and a second failure shall be a cause for rejection.

   If two failures occur, but not both in the same test, the fuse resistors with particular overcurrent protection shall be deemed to comply provided that there are no further failures in repeat tests with twice the number of test samples.

   If more than two failures occur, the fuse resistors with particular overcurrent protection shall be deemed not to comply with this standard.

7.3 Fuse-bases for tests

7.3.1 General

The requirements of IEC 60127-1:2006, 7.3, are replaced as follows:

7.3.2 General requirements

The fuse resistors with particular overcurrent protection shall be mounted upon the appropriate test board (see 7.3.3 or 7.3.4 as appropriate) by soldering.

This test board shall then be mounted on the test fuse-base (Figure 3). The test board shall be made of epoxide woven glass fabric copper-clad laminated sheet, as defined in IEC 61249-2-7.

- The nominal sheet thickness shall be 1,6 mm.
- The nominal thickness of copper layer shall be 0,035 mm or 0,070 mm for rated dissipation values above 5 W.

Metal parts of the fuse-base shall be made of brass with a copper content between 58 % and 70 %. Contact parts shall be silver-plated.

When two or more fuse resistors with particular overcurrent protection are tested in series, the test fuse-bases shall be located so that there will be a spacing of not less than 50 mm between any two fuse resistors with particular overcurrent protection. The conductor connecting the test fuse-bases together, and connecting the test fuse-bases to the ammeter and the source of supply shall be insulated copper wire. The length of each conductor shall be 250 mm, and the cross-sectional area of the wire shall be approximately 1 mm^2.

7.3.3 Through-hole mounting of fuse resistors with particular overcurrent protection

For electrical tests, the fuse resistors with particular overcurrent protection shall be mounted on the test board as shown in Figure 1 in the pair of holes appropriate to the spacing of the terminations.

7.3.4 Surface mounting of fuse resistors with particular overcurrent protection

For electrical tests, the fuse resistors with particular overcurrent protection shall be mounted on the test board as shown in Figure 2.

7.4 Nature of supply

See IEC 60127-1:2006, 7.4.

8 Dimensions and construction

8.1 Dimensions

The requirements of IEC 60127-1:2006, 8.1, are replaced as follows:

- The dimensions of the fuse resistors with particular overcurrent protection shall be as specified by the manufacturer.
- Compliance is checked by measurement of length, width and height.

For through-hole mount fuse resistors with particular overcurrent protection the termination spacing is checked. In addition, the following applies:

- The termination shall also pass through a 1 mm hole.
- The length of the termination is not specified as this is subject to the method of packaging.

8.1.1 Creepage distances and clearances

The creepage distances and clearances between current-carrying parts (contacts together with their terminals) and the outside of the enclosure of the fuse resistor with particular overcurrent protection including insulated metal parts thereof, shall be not less than the values given in Table 1. The values indicated are absolute minimum values and inclusive of manufacturing tolerances.

These distances do not apply across the disconnection (between the open contacts) of the fuse resistors with particular overcurrent protection.

Compliance is checked by measuring the distances concerned.