BS EN 60127-6:2014

BSI Standards Publication

Miniature fuses

Part 6: Fuse-holders for miniature fuse-links

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National foreword

This British Standard is the UK implementation of EN 60127-6:2014. It is identical to IEC 60127-6:2014. It supersedes BS EN 60127-6:1994, which will be withdrawn on 8 October 2017.

The UK participation in its preparation was entrusted to Technical Committee PEL/32, Fuses.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Miniature fuses - Part 6: Fuse-holders for miniature fuse-links (IEC 60127-6:2014)

Coupe-circuits miniatures - Partie 6: Ensembles-porteurs pour cartouches de coupe-circuits miniatures (CEI 60127-6:2014)

Geräteschutzsicherungen - Teil 6: G-Sicherungshalter für G-Sicherungseinsätze (IEC 60127-6:2014)

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European Committee for Electrotechnical Standardization
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Foreword

The text of document 32C/491/FDIS, future edition 2 of IEC 60127-6, prepared by SC 32C "Miniature fuses" of IEC/TC 32 "Fuses" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60127-6:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-07-08
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-10-08

This document supersedes EN 60127-6:1994.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60127-6:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60060-1:2010	NOTE	Harmonized as EN 60060-1:2010 (not modified).
IEC 60060-3:2006	NOTE	Harmonized as EN 60060-3:2006 (not modified).
IEC 60364-4-44:2007	NOTE	Harmonized as HD 60364-4-444:2010 and HD 60364-4-442:2012 (modified).
ISO 1302:2002	NOTE	Harmonized as EN ISO 1302:2002 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 60050	Series	International Electrotechnical Vocabulary	-	-
IEC 60068-1	2013	Environmental testing - Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-1	2007	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	2007
IEC 60068-2-2	2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-6	2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-20	2008	Environmental testing - Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads	EN 60068-2-20	2008
IEC 60068-2-21	2006	Environmental testing - Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	2006
IEC 60068-2-27	2008	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-45 + A1	1980 1993	Basic environmental testing procedures - Part 2-45: Tests - Test XA and guidance: Immersion in cleaning solvents	EN 60068-2-45 + A1	1992 1993
IEC 60068-2-47	2005	Environmental testing - Part 2-47: Tests - Mounting of specimens for vibration, impact and similar dynamic tests	EN 60068-2-47	2005
IEC 60068-2-75	1997	Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	1997 [1)]
IEC 60068-2-78	2012	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2013

[1)] Superseded by EN 60068-2-75:2014 (IEC 60068-2-75:2014).

Publication	Year	Title	EN/HD	Year
IEC 60068-3-4	2001	Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests	EN 60068-3-4	2002
IEC 60112	2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003
+ A1	2009		+ A1	2009
IEC 60127-1	2006	Miniature fuses - Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links	EN 60127-1	2006
+A1	2011		+A1	2011
IEC 60127-2	2003	Miniature fuses - Part 2: Cartridge fuse-links	EN 60127-2	2003
+A1	2003		+A1	2003
+A2	2010		+A2	2010
IEC 60127-3	1988	Miniature fuses - Part 3: Sub-miniature fuse-links	EN 60127-3	1996
			+ corr. June	1996
+A1	1991		-	-
+A2	2002		+A2	2003
IEC 60216-1	2013	Electrical insulating materials - Thermal endurance properties - Part 1: Ageing procedures and evaluation of test results	EN 60216-1	2013
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
			+corr. May	1993
+A1	1999		+A1	2000
+A2	2013		+A2	2013
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC 60695-11-5	2004	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	2005
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	EN 60695-2-12	2010
+A1	2014		+A1	2014
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	EN 60695-2-13	2010
+A1	2014		+A1	2014
IEC 60999-1	1999	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)	EN 60999-1	2000

Publication	Year	Title	EN/HD	Year
IEC 61140	2001	Protection against electric shock - Common aspects for installation and equipment	EN 61140	2002
+A1 (mod)	2004		+A1	2006
IEC 61210 (mod)	2010	Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements	EN 61210	2010
ISO 3	1973	Preferred numbers; Series of preferred numbers	-	-

CONTENTS

INTRODUCTION

According to the wish expressed by the users of miniature fuses, all standards, recommendations and other documents relating to miniature fuses should have the same publication number in order to facilitate reference to fuses in other specifications, for example, equipment specifications.

Furthermore, a single publication number and subdivision into parts would facilitate the establishment of new standards, because clauses and subclauses containing general requirements need not be repeated.

The new IEC 60127 series is thus subdivided as follows:

IEC 60127, *Miniature fuses* (general title)

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

IEC 60127-2, *Part 2: Cartridge fuse-links*

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

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

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

IEC 60127-6, *Part 6: Fuse-holders for miniature cartridge fuse-links*

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

IEC 60127-8 (free for further documents)

IEC 60127-9 (free for further documents).

IEC 60127-10, *Part 10: User guide for miniature fuses*

This part of IEC 60127 covers requirements, test equipment and test methods for fuse-holders. It is a self-standing document, which refers back to Part 1 with regard to certain definitions and the atmospheric conditions for test. It also makes reference to other parts of IEC 60127 with regard to dimensions and maximum power losses of fuse-links.

MINIATURE FUSES –

Part 6: Fuse-holders for miniature fuse-links

1 Scope

This part of IEC 60127 is applicable to fuse-holders for miniature cartridge fuse-links according to IEC 60127-2 and sub-miniature fuse-links according to IEC 60127-3 for the protection of electric appliances, electronic equipment and component parts thereof, normally intended for use indoors.

Examples of fuse-holder types with different features are given in Table 1.

Table 1 – Features of unexposed or exposed fuse-holders

1	*Types of mounting*
1.1	Panel and base mounting
1.2	Printed circuit board mounting
2	*Methods of fastening*
2.1	Methods of fastening on panel:
2.1.1	Fixing nut fastening (threaded nut)
2.1.2	Snap-in fastening:
2.1.2.1	Fuse-base with an integral spring system
2.1.2.2	Fuse-base with a separate spring-nut (a nut fabricated, e.g. from thin spring steel having an impression designed to accommodate the mating part)
2.2	Methods of fastening on printed circuit (PC) board:
2.2.1	Solder fastening
2.2.2	Plug-in fastening
3	*Methods of insertion of the fuse-carrier into the fuse base*
3.1	Screw insertion
3.2	Bayonet insertion
3.3	Plug-in insertion
4	*Types of terminals*
4.1	Screw terminals
4.2	Solder terminals
4.3	Quick connect terminals
4.4	Other solderless terminals: – crimp terminals
	– wire wrap terminals
5	*Protection against electric shock*
5.1	Fuse-holder without integral protection against electric shock
5.2	Fuse-holder with integral protection against electric shock
5.3	Fuse-holder with enhanced integral protection against electric shock

NOTE This list is not intended to be comprehensive and fuse-holders which are not listed are not necessarily excluded from the scope.

This part of IEC 60127 applies to fuse-holders with:

– a maximum rated current of 16 A; and
– a maximum rated voltage of 1 500 V d.c. or 1 000 V a.c.; and
– for use up to 2 000 m above sea-level, unless otherwise specified.

The object of this standard is to establish uniform requirements for safety and the assessment of electrical, mechanical, thermal and climatic properties of fuse-holders and the compatibility between fuse-holders and fuse-links.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 60068-1:2013, *Environmental testing - Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing - Part 2-1: Tests - Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing - Part 2-2: Tests - Test B: Dry heat*

IEC 60068-2-6:2007, *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*

IEC 60068-2-20:2008, *Environmental testing - Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

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

IEC 60068-2-27:2008, *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock*

IEC 60068-2-45:1980, *Basic environmental testing procedures - Part 2-45: Tests - Test XA and guidance: Immersion in cleaning solvents*
IEC 60068-2-45:1980/AMD1:1993

IEC 60068-2-47:2005, *Environmental testing - Part 2-47: Test - Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-75:1997, *Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests*

IEC 60068-2-78:2012, *Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state*

IEC 60068-3-4:2001, *Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
IEC 60112:2003/AMD1:2009

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 60127-2:2003, *Miniature fuses - Part 2: Cartridge fuse-links*
IEC 60127-2:2003/AMD1:2003
IEC 60127-2:2003/AMD2:2010

IEC 60127-3:1988, *Miniature fuses - Part 3: Sub-miniature fuse-links*
IEC 60127-3:1988/AMD1:1991
IEC 60127-3:1988/AMD2:2002

IEC 60216-1:2013, *Electrical insulating materials - Thermal endurance properties - Part 1: Ageing procedures and evaluation of test results*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

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

IEC 60695-11-5:2004, *Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance*

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 60695-2-12:2010/AMD1:2014

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 60695-2-13:2010/AMD1:2014

IEC 60999-1:1999, *Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)*

IEC 61140:2001, *Protection against electric shock - Common aspects for installation and equipment*
IEC 61140:2001/AMD1:2004

IEC 61210:2010, *Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

3 Terms and definitions

For the definitions of general terms used in this standard, reference should be made to IEC 60050-441, IEC 60050-581 and IEC 60664-1.

For definitions of terms relating to fuse-links, reference is made to IEC 60127-1:2006.

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

3.1 Fuse-holders

3.1.1
fuse-base
fuse-mount
fixed part of a fuse provided with contacts and terminals for connection to the system

[SOURCE: IEC 60127-1:2006, 3.10]

3.1.2
fuse-carrier
movable part of a fuse designed to carry a fuse-link

[SOURCE: IEC 60127-1:2006, 3.12]

3.1.3
fuse-holder
combination of a fuse-base with its fuse-carrier

Note 1 to entry: In some fuse-holder constructions where the fuse-base and the fuse-carrier are not spearate parts the fuse-holder may consist of only the fuse-base and no fuse-carrier.

3.1.4
unexposed fuse-holder
fuse-holder with enclosed contacts

3.1.5
exposed fuse-holder
fuse-holder with exposed contacts (e.g. clips)

3.2
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

EXAMPLE Examples of rated values usually stated for fuses:

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

[SOURCE: IEC 60127-1:2006, 3.16]

3.3
rated power acceptance
value of power acceptance of a fuse-holder assigned by the manufacturer

Note 1 to entry: This value is the maximum power dissipation produced by the inserted dummy fuse-link during testing, at the rated current tolerated by the fuse-holder without exceeding the specified temperatures.

Note 2 to entry: The rated power acceptance is referred to an ambient temperature of 23 °C.

3.4
rated current
value of current of a fuse-holder assigned by the manufacturer and to which the rated power acceptance is referred

3.5
rated voltage
value of voltage of a fuse-holder assigned by the manufacturer and to which operation and performance characteristics are referred

3.6
insulation coordination
mutual correlation of insulation characteristics of electrical equipment taking into account the expected micro-environment and other influencing stresses

[SOURCE: IEC 60664-1:2007, 3.1]

3.7
impulse withstand voltage
highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions

[SOURCE: IEC 60664-1:2007, 3.8.1]

3.8
overvoltage category
numeral defining a transient overvoltage condition

specified categories, see C.1

[SOURCE: IEC 60664-1:2007, 3.10, modified by addition of “specified categories”]

3.9
pollution
any addition of foreign matter, solid, liquid, or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation

[SOURCE: IEC 60664-1:2007, 3.11]

3.10
pollution degree
numeral characterizing the expected pollution of the micro-environment

specified degrees, see C.2

[SOURCE: IEC 60664-1:2007, 3.13, modified by addition of “specified categories”]

3.11
micro-environment
immediate environment of the insulation which particularly influences the dimensioning of the creepage distances

[SOURCE: IEC 60664-1:2007, 3.12.2]

3.12
clearance
shortest distance in air between two conductive parts

[SOURCE: IEC 60664-1:2007, 3.2]

3.13
creepage distance
shortest distance along the surface of a solid insulating material between two conductive parts

[SOURCE: IEC 60050-151:2001, 151-15-50]

3.14
solid insulation
solid insulating material interposed between two conductive parts

[SOURCE: IEC 60664-1:2007, 3.4]

3.15
comparative tracking index
CTI
numerical value of the maximum voltage in volts which a material can withstand without tracking and without a persistent flame occurring under specified test conditions

Note 1 to entry: the test for comparative tracking index in accordance with IEC 60112 is designed to compare the performance of various insulating materials under test conditions, namely drops of an aqueous contaminant falling on a horizontal surface leading to electrolytic conduction material groups and their CTI values, see C.3.

[SOURCE: IEC 60050-212:2010, 212-11-59, modified by addition of Note to entry]

3.16
live part
conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention, not a PEN conductor or PEM conductor or PEL conductor

[SOURCE: IEC 60050-826:2004, 826-12-08]

3.17
fuse-holder electric shock protection categories
a designation characterizing the level of the protection against electric shock of a fuse-holder

3.18
maximum ambient air temperature
the highest air temperature that a fuse-holder can endure at a power acceptance assigned by the manufacturer of the fuse-holder without exceeding the maximum allowable temperatures on the accessible and inaccessible surfaces of the fuse-holder

3.19
relative temperature Index
based on IEC 60216-1, the temperature index of a test material obtained from the time which corresponds to the known temperature index of a reference material when both materials are subjected to the same ageing and diagnostic procedures in comparative test

3.20
insulation
that part of an electrotechnical product which separates the conducting parts at different electrical potentials

Note 1 to entry: For detailed information, see IEC 61140 and IEC 60664-1.

[SOURCE: IEC 60050-212:2010, 212-01-05]

3.20.1
functional insulation
insulation between conductive parts which is necessary only for the proper functioning of the equipment

[SOURCE: IEC 60664-1:2007, 3.17.1]

3.20.2
basic insulation
insulation of hazardous-live-parts which provides basic protection

Note 1 to entry: The concept does not apply to insulation used exclusively for functional purposes.

[SOURCE: IEC 60050-826:2004, 826-12-14]

3.20.3
supplementary insulation
independent insulation applied in addition to basic insulation for fault protection

[SOURCE: IEC 60050-826:2004, 826-12-15]

3.20.4
double insulation
insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-826:2004, 826-12-16]

3.20.5
reinforced insulation
insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[SOURCE: IEC 60050-826:2004, 826-12-17]

3.21
inaccessible part (inaccessible surface)
part or surface inside the equipment and which cannot be touched by means of the standard test finger according to IEC 60529

3.22
accessible part (accessible surface)
part or surface which can be touched by means of the standard test finger according to IEC 60529, when the fuse-holder is installed and operated as in normal use, e.g. on the front panel of equipment

4 General requirements

Fuse-holders shall be so designed and constructed that in normal use, installed according to the manufacturer's instructions, their performance is reliable and without danger to the user or surroundings.

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

5 Preferred standard ratings and classifications for fuse-holders

Table 2 gives the values for standard ratings and classifications.

Table 2 – Values for standard ratings and classifications

No.	Preferred ratings and classifications for fuse-holders	For fuse-links according to	
		IEC 60127-2	IEC 60127-3
5.1	Rated voltage	250 V	125 V and 250 V
5.2	Rated current	6,3 A / 10 A	5 A
5.3	Rated power acceptance at an ambient temperature T_{A1} of 23 °C	1,6 W / 2,5 W / 4 W	1,6 W / 2,5 W
5.4	Protection against electric shock referring to fuse-holder	Category PC1 Category PC2 Category PC3	
5.5	Protection against electric shock referring to equipment, according to IEC 61140	Class I or II	
5.6	Insulation coordination according to IEC 60664-1: a) Overvoltage category b) Pollution degree c) Comparative tracking index CTI	 II or III 2 or 3 CTI ≥ 150	

In reference to ratings (voltage, current, power acceptance), if other values are required, these values should be selected from the R10 series according to ISO 3. For classifications (No. 5.6), other values may be specified.

Complete information on ratings and classifications is given by the manufacturer according to Annex E.

6 Marking

Fuse-holders shall be marked with the name or trade mark of the manufacturer together with the catalogue or type reference.

The manufacturer may provide additional markings for the rated voltage in volts, the power acceptance in watts together with the rated current in amperes (. ./. .), e.g. 250 V (4 W/6,3 A).

The additional marking shall not be placed on the front of the fuse-holder.

NOTE This is to prevent installation of a replacement fuse-link with the wrong rating.

The marking shall be indelible and easily legible.

Compliance is checked by inspection and by the test according to 6.2 of IEC 60127-1:2006.

7 Clause deleted

8 General notes on tests

8.1 Nature of 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.

8.2 Standard atmospheric conditions for measurement and tests

Unless otherwise specified, all tests shall be carried out under the atmospheric conditions according to 7.1 of IEC 60127-1:2006.

8.3 Preconditioning of test samples

Unless otherwise specified, the test samples shall be maintained at standard atmospheric conditions for not less than 4 h before measurements are performed.

8.4 Nature of supply

For a.c., the test voltage shall be of substantially sinusoidal form with a frequency between 45 Hz and 62 Hz.

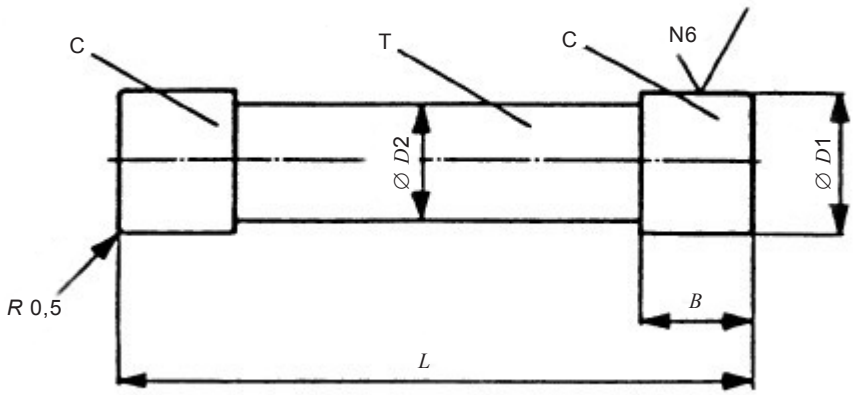
8.5 Gauges and dummy fuse-links for tests

8.5.1 Gauges and dummy fuse-links according to IEC 60127-2

For tests that require gauges (Figure 1), the appropriate gauges mentioned in Table 3 shall be used. The gauges or parts thereof made of brass shall be provided with 8 μm of nickel plating plus 4,5 μm of gold plating.

There shall be no holes in the ends of the gauges.

The gauges shall have a homogeneous composition, except for gauge Nos. 3 and 6.



NOTE The symbol for roughness is in accordance with ISO 1302.

Figure 1 – Outline of gauges and dummy fuse-links according to IEC 60127-2

Table 3 gives the dimensions and materials for gauges according to IEC 60127-2.

Table 3 – Dimensions and materials for gauges according to IEC 60127-2

Type of cartridge			*L* mm	*D*1 mm	*D*2 mm	*B* mm	Weight Approximately g	Materials of part	
Fuse-link mm	Gauge No.	Size						C	T
5 × 20	1	max.	$20{,}54\ ^{0}_{-0{,}04}$	$5{,}3\ ^{+0{,}01}_{0}$	4,2±0,1	$5\ ^{+0{,}1}_{0}$	–	Steel [a]	
	2	min.	$19{,}46\ ^{+0{,}04}_{0}$	$5{,}0\ ^{0}_{-0{,}01}$	4,2±0,1	$5\ ^{+0{,}1}_{0}$	2,5	Brass[b]	
	3	–	$20{,}54\ ^{0}_{-0{,}04}$	$5{,}3\ ^{+0{,}01}_{0}$	4,2	$6{,}2\ ^{+0{,}1}_{0}$	–	Brass end caps[b]	Glass or ceramic tube
6,3 × 32	4	max.	$32{,}64\ ^{0}_{-0{,}04}$	$6{,}45\ ^{+0{,}01}_{0}$	5,5±0,1	$6\ ^{+0{,}1}_{0}$	–	Steel [a]	
	5	min.	$30{,}96\ ^{+0{,}04}_{0}$	$6{,}25\ ^{0}_{-0{,}01}$	5,5±0,1	$6\ ^{+0{,}1}_{0}$	6	Brass[b]	
	6	–	$32{,}64\ ^{0}_{-0{,}04}$	$6{,}45\ ^{+0{,}01}_{0}$	5,5	$8{,}3\ ^{+0{,}1}_{0}$	–	Brass end caps[b]	Glass or ceramic tube

NOTE All test gauges are without a melting element.

[a] Hardened.

[b] Copper content from 58 % to 70 %.

For tests that require dummy fuse-links (Figure 1), the appropriate dummy fuse-link mentioned in Table 4 shall be used.

Table 4 – Dimensions and materials for dummy fuse-links according to IEC 60127-2

Dummy fuse-link for cartridge fuse-links	*L* mm	*D*1 mm	*D*2 mm	*B* mm	Mass (approximately) g	Materials of part	
						C	T
5 mm × 20 mm	$19{,}46\ ^{+0{,}08}_{0}$	5,0 ± 0,2	4,2 ± 0,1	5,0 ± 0,1	2	Brass end caps[a]	Ceramic tube
6,3 mm × 32 mm	$30{,}96\ ^{+0{,}08}_{0}$	6,25 ± 0,2	5,5 ± 0,1	6,0 ± 0,1	3	Brass end caps[a]	Ceramic tube

[a] Brass with copper content from 58 % to 70 %, surface with 2 μm (minimum) nickel plating (galvanic).

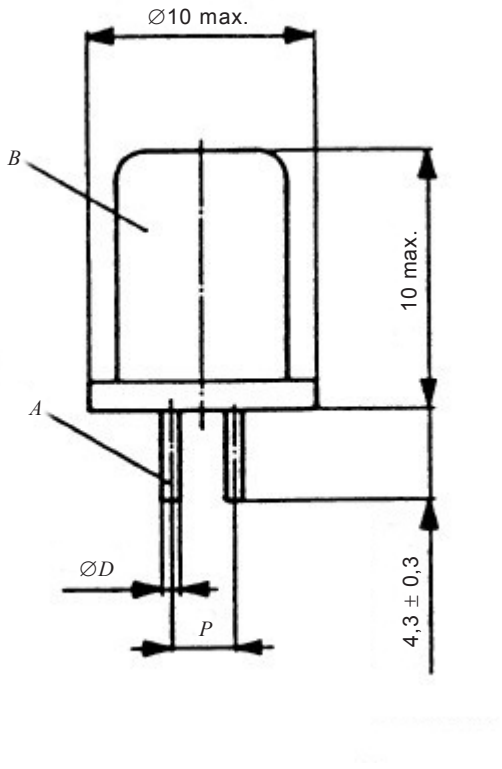
There shall be no holes in the ends of the dummy fuse-links.

8.5.2 Gauges and dummy fuse-links according to IEC 60127-3

For tests that require gauges (Figure 2 and Figure 3), the appropriate gauges mentioned in Table 5 shall be used.

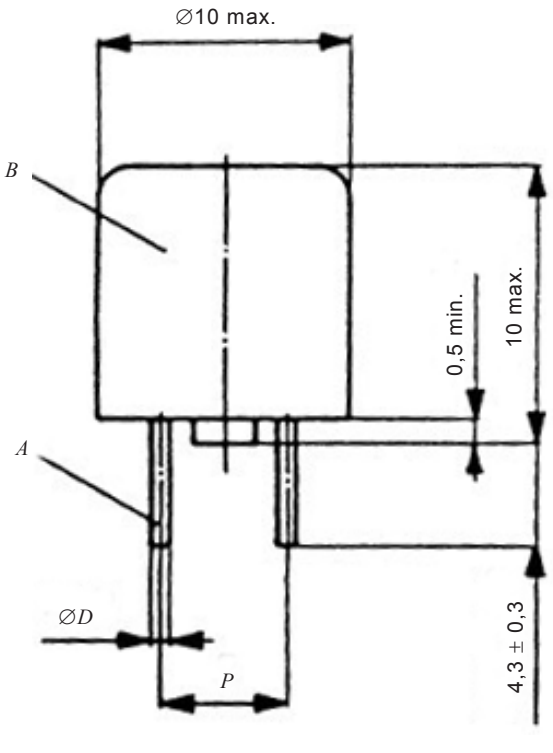
The gauges or parts thereof made of brass shall be provided with 8 μm of nickel plating plus 4,5 μm of gold plating.

The gauges shall have a homogeneous composition, except for gauge Nos. 3 and 6.



Dimensions in millimetres

Figure 2 – Outline of gauges and dummy fuse-links according to IEC 60127-3 standard sheet 1



Dimensions in millimetres

Figure 3 – Outline of gauges and dummy fuse-links according to IEC 60127-3 standard sheets 3 and 4

Table 5 – Dimensions and materials for gauges according to IEC 60127-3

Type of			*D* mm	*P* mm	Materials of part	
Sub-miniature fuse-link	Gauge No.	Size			A	B
Standard sheet 1	1	max.	$0{,}70\ ^{0}_{-0{,}02}$	$2{,}54\ ^{+0{,}17}_{-0{,}09}$	Steel[a]	
	2	min.	$0{,}55\ ^{0}_{-0{,}02}$		Brass[b]	
	3	–	$0{,}70\ ^{0}_{-0{,}02}$		Brass[b]	Insulating material
Standard sheets 3 and 4	4	max.	$0{,}63\ ^{0}_{-0{,}02}$	$5{,}08 \pm 0{,}1$	Steel[a]	
	5	min.	$0{,}56\ ^{0}_{-0{,}02}$		Brass[b]	
	6	–	$0{,}70\ ^{0}_{-0{,}02}$		Brass end caps[b]	Insulating material
NOTE All test gauges are without a melting element.						
[a] Hardened. [b] Copper content from 58 % to 70 %.						

For tests that require dummy fuse-links (Figure 2 and Figure 3), the appropriate dummy fuse-link mentioned in Table 6 shall be used.

Table 6 – Dimensions and materials for dummy fuse-links according to IEC 60127-3

Dummy fuse-link for sub-miniature fuse-links	*D* mm	*P* mm	Materials of part	
			A	B
Standard sheet 1	$0{,}55\ ^{0}_{-0{,}02}$	$2{,}54\ ^{+0{,}17}_{-0{,}09}$	Brass[a]	Brass[a]
Standard sheets 3 and 4	$0{,}56\ ^{0}_{-0{,}02}$	$5{,}08 \pm 0{,}1$	Brass[a]	Brass[a]
[a] Copper content from 58 % to 70 %.				

8.6 Type tests

The compliance of the fuse-holder with this standard shall be verified by means of type tests.

The type tests required, the test sequences and the number of samples to be submitted are stated in Annex B.

9 Protection against electric shock

9.1 Category PC1: Fuse-holders without integral protection against electric shock

Fuse-holders of category PC1 are only suitable for applications where corresponding additional means are provided to protect against electric shock.

9.2 Category PC2: Fuse-holders with integral protection against electric shock

9.2.1 The fuse-holder shall be so designed that:

– live parts are not accessible when the fuse-holder is properly assembled and correctly installed on the front panel of equipment with fuse-carrier and gauge No. 3 or No. 6 according to Table 3 or Table 5 inserted into the fuse-base;

– live parts do not become accessible, either during insertion or removal of the fuse-carrier by hand or with the aid of a tool or after the fuse-carrier has been removed.

9.2.2 Compliance is checked by using the standard test finger specified in IEC 60529. This test finger is applied without appreciable force in every possible position. Where the fuse-holder has a fuse-carrier, gauge No. 3 or No. 6 according to Table 3 or Table 5 shall be placed in the fuse-carrier during testing. It is recommended that an electrical indicator with a voltage of approximately 40 V is used for the indication of contact with the relevant part.

9.3 Category PC3: Fuse-holders with enhanced integral protection against electric shock

The requirements for this category are the same as those for 9.2 (Category PC2) with the exception that the testing is carried out with a rigid test wire of 1 mm diameter according to IEC 60529, Table VI, instead of the standard test finger.

10 Clearances and creepage distances

10.1 General

Clearances and creepage distances shall be checked for a fuse-holder properly assembled and installed as in normal use, and fitted with gauge No. 3 or No. 6 according to Table 3 or Table 5.

Compliance is checked by measurement.

10.2 Minimum requirements for fuse-holders in respect to the grade of insulation

10.2.1 Table 7 shows the types of insulation between different live parts and accessible parts.

Table 7 – Types of insulation between different live parts and accessible parts

Type of insulation / Insulation between:	Functional	Basic	Supplementary	Reinforced	Double
a) Live parts of different potential	X				
b) Live parts and a metal mounting-plate or any other metal parts which may be in contact with the mounting-plate e.g. base-fixing devices.					
Thickness of the mounting-plate according to 11.1					
– fuse-holders according to 10.1.1		X	(X)[a]		
– fuse-holders according to 10.1.2				X	X
c) Live parts and all parts which may be touched with the test finger (accessible parts)					
– fuse-holders according to 10.1.1		X	(X)[a]		
– fuse-holders according to 10.1.2				X	X

[a] Supplementary insulation is only applied in addition to basic insulation, whereas basic insulation can be applied without supplementary insulation.

10.2.2 Fuse-holders intended for class I equipment shall have at least basic insulation between live parts and accessible metal parts. These metal parts shall be provided with means enabling a reliable connection to the protective earthing circuit of the equipment in which it is intended to be used.

10.2.3 Fuse-holders intended for class II equipment shall have double or reinforced insulation between live parts and accessible parts.

10.3 Clearances

Clearances shall be dimensioned in such a way that the fuse-holder withstands the overvoltages expected to occur during normal use. The clearances shall be verified by measurement of dimensions and the impulse withstand voltage test according to 11.1.5, where this test is required.

Clearances equal to those specified in Table 9 or Table 10 shall be deemed to comply with this requirement. In this case the impulse withstand voltage test according to 11.1.5 is not required.

Clearances may be smaller than the values specified in Table 9 and Table 10 but not smaller than the values determined for the homogeneous field conditions according to Table F.2 of IEC 60664-1:2007. In this case, the clearances shall be deemed to comply with this requirement as long as no non-compliance occurs in the impulse withstand voltage test according to 11.1.5.

Clearances smaller than the values determined for the homogeneous field conditions according to Table F.2 of IEC 60664-1:2007 shall be deemed not to comply with this requirement.

Table 8 – Required impulse withstand voltage for clearances

Rated voltage V		**Required impulse withstand voltage** $\hat{U}$ 1,2/50[1)] kV	
Overvoltage category		**Functional, basic or supplementary insulation**	**Reinforced or double insulation**
α	β		
32	-	0,5	0,8
63	-	0,8	1,5
125	-	1,5	2,5
250	125	2,5	4,0
-	250	4,0	6,0

[1)] According to IEC 60060-1. $\hat{U}$ 1,2/50 defines the impulse wave shape: 1,2 4s rise time and 50 4s half-value decay time.

There is increasing use of equipment operating at voltages below 125 V. In order to conform with IEC 60664-1, fuse-holders specifically designed for these lower voltages should meet the prescriptions in Table 8.

NOTE Attention is drawn to the fact that appliance specifications might contain requirements additional to or deviating from those specified in Table 8, Table 9, Table 10 and Table 11.

Tables 9 and 10 show minimum clearances in air with regard to the rated voltage, the overvoltage category and the specified degree of pollution

NOTE Minimum clearances in air in millimetres up to 2 000 m above sea-level for inhomogeneous field conditions corresponding to IEC 60664-1:2007, Table F.2.

Table 9 – Overvoltage category II

Rated voltage V		Clearances in air mm	
Functional, basic or supplementary insulation	Reinforced or double insulation	Pollution degree	
		2	3
32	32	0,2	0,8
63	–	0,2	0,8
125	63	0,5	0,8
250	125	1,5	1,5
–	250	3,0	3,0

Table 10 – Overvoltage category III

Rated voltage V		Clearances in air mm	
Functional, basic or supplementary insulation	Reinforced or double insulation	Pollution degree	
		2	3
125	–	1,5	1,5
250	125	3,0	3,0
–	250	5,5	5,5

10.4 Creepage distances

10.4.1 Creepage distances for basic or supplementary insulation, based on the rated voltage shall be selected from Table 11. The following influencing factors shall be taken into account:

– rated voltage;
– pollution degree;
– shape of insulating surface;
– comparative tracking index (CTI).

10.4.2 Measurement of creepage distances and clearances, shape of insulating surface: requirements according to 6.2 of IEC 60664-1:2007.

10.4.3 Creepage distances for reinforced or double insulation: twice the value as specified in Table 11.

10.4.4 A creepage distance cannot be less than the associated clearance so that the shortest creepage distance possible is equal to the required clearance.

Table 11 – Minimum creepage distances in millimetres for a micro-environmentdependent on rated voltage, pollution degree, insulating material,corresponding to IEC 60664-1:2007, Table F.4

Rated voltage V	Creepage distances mm							
	Pollution degree 2				Pollution degree 3			
	Material group[1)]				Material group[1)]			
	I	II	IIIa	IIIb	I	II	IIIa	IIIb
32	0,53	0,53	0,53		1,3	1,3	1,3	
63	0,63	0,9	1,25		1,6	1,8	2,0	
125	0,75	1,05	1,5		1,9	2,1	2,4	
250	1,25	1,8	2,5		3,2	3,6	4,0	

[1)] See Annex C.

There is increasing use of equipment operating at voltages below 125 V. In order to conform with IEC 60664-1, fuseholders specifically designed for these lower voltages should meet the prescriptions in Table 11.

11 Electrical requirements

11.1 Insulation resistance, dielectric strength and impulse withstand voltage

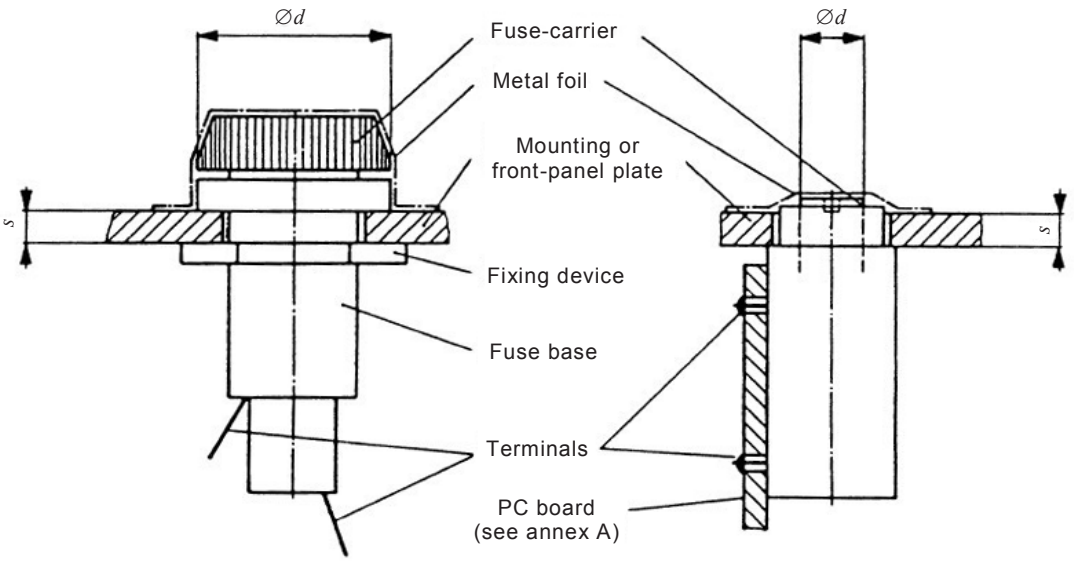
11.1.1 Mounting

a) Fuse-holders designed for panel or base mounting, shall be mounted on a metal plate, with a thickness s (Figure 4) specified by the manufacturer. A test gauge according to Table 12 and with or without the fuse-carrier shall be inserted into the fuse-base.

   For fuse-holders having screw-in fuse-carriers, these carriers shall be fitted in the normal way for each operation with a torque equal to two-thirds of the value specified in Table 13.

b) Fuse-holders designed for PC board mounting shall be mounted on a test PC board according to Annex A and, if adapted to such use, with a front-panel metal plate of a thickness s (Figure 5). A test gauge according to Table 12 and with or without the fuse-carrier shall be inserted into the fuse-base.

Fuse-holders for PC board mounting by soldering (through-hole types) should have a pin-spacing of $n \times e$ where n is an integer from 1 to 6 and e = 2,54 mm.



NOTE Thickness s to be specified by the manufacturer.

Figure 4 – Panel mounting **Figure 5 – PC board mounting**

11.1.2 Humidity preconditioning

Mounted fuse-bases according to 11.1.1 and separate, not inserted fuse-carriers are submitted to the humidity preconditioning.

The humidity preconditioning is carried out in a humidity chamber containing air with a relative humidity maintained between 91 % and 95 %.

The air in the chamber where test samples are located shall be maintained at a temperature t = (40 ± 2) °C, uniformly distributed throughout the chamber.

The air in the chamber shall be stirred and the chamber shall be designed so that mist of condensed water will not precipitate on the test samples. Temperature variations shall not allow any part of the test samples to reach a dew-point condition. Some methods of achieving the specified relative humidity are described in IEC 60068-3-4.

The test samples are kept in the chamber for 48 h.

Immediately after the humidity preconditioning, with the samples still in the humidity chamber or in the room in which the samples were brought to the prescribed temperature, the measurement of the insulation resistance and dielectric strength are made, after reassembly of those parts which were separated before the humidity preconditioning. Parts of insulating material shall be wrapped in metal foil as shown in Figure 4 and Figure 5.

11.1.3 Measurement of insulation resistance

The insulation resistance shall be measured between the points as specified in Table 12.

D.C. voltage according to Table 12 shall be applied. The measurement is made 1 min after application of the test-voltage.

The insulation resistance shall be not less than the values shown in Table 12.

There is increasing use of equipment operating at voltages below 125 V. In order to conform with IEC 60664-1, the fuse-holders specifically designed for these lower voltages should meet the requirements of the insulation resistance in Table 12.

11.1.4 Dielectric strength test

Immediately after the measurement of the insulation resistance, with the samples still in the humidity chamber or in the room in which the samples were brought to the prescribed temperature, an a.c. voltage according to Table 12 is applied for 1 min between the points specified in Table 12.

Initially, not more than half the prescribed voltage is applied, then it is raised rapidly to the full value.

There is increasing use of equipment operating at voltages below 125 V. In order to conform with IEC 60664-1, the dielectric strength test for fuse-holders specifically designed for these lower voltages should be as specified in Table 12.

No flashover or breakdown shall occur during the test.

11.1.5 Impulse withstand voltage test

After the test in 11.1.4 the impulse withstand voltage shall be tested between the points as specified in Table 12.

The required impulse withstand voltage according to Table 8 shall be applied.

Form and numbers of impulses:

The 1,2/50 μs impulse voltage shall be applied three times for each polarity at intervals of 1 s minimum.

Unless otherwise specified, the output impedance of the impulse generator should not be higher than 500 Ω.

NOTE For description of test equipment, see IEC 60060-1 and IEC 60060-3.

During this voltage test, no breakdown or flashover shall occur.

Corona effects and similar phenomena are disregarded.

There is increasing use of equipment operating at voltages below 125 V. In order to conform with IEC 60664-1, the impulse withstand voltage test for fuse-holders specifically designed for these lower voltages should be as specified in Table 12.

11.2 Contact resistance

11.2.1 General measuring requirements

Measurements may be carried out with direct current or alternating current. For a.c. measurements the frequency shall not exceed 1 kHz. In the case of dispute, the d.c. measurements shall govern.

The accuracy of the measuring apparatus shall be within ±3 %.

For fuse-holders having screw-in fuse-carriers these carriers shall be fitted in the normal way for each operation with a torque equal to two-thirds of the value specified in Table 13.

The contact resistance shall be measured between the terminals after the fuse-holder has been equipped with a gauge No. 2 or No. 5 according to Table 3 or Table 5.

Contact resistance of fuse-holders intended for PC board mounting shall be measured on a fuse-holder mounted (soldered) on a test PC board according to Annex A. The voltage drop shall be measured between points P and O of the figure in Annex A.

The contact resistance shall normally be calculated from the voltage drop measured between the terminals.

The measurement is carried out under the following conditions.

a) Test voltage: the electromotive force of the source shall not exceed 60 V d.c. or a.c. (peak), but shall be at least 10 V.
b) Test current: 0,1 A
c) Measurement shall be made within 1 min after the application of the test current.
d) Care shall be taken during the measurement to avoid exerting abnormal pressure on the contacts under test and to avoid movement of the test cable.

11.2.2 Measuring cycle

11.2.2.1 Measuring cycle with d.c.

One measuring cycle consists of:

a) insertion of the gauge in the fuse-holder;
b) measurement with current flowing in one direction;
c) measurement with current flowing in opposite direction;
d) removal of the gauge from the fuse-holder.

11.2.2.2 Measuring cycle with a.c.

One measuring cycle consists of:

a) insertion of the gauge in the fuse-holder;
b) measurement;
c) removal of the gauge from the fuse-holder.

11.2.3 Measurement and requirements

The complete measurement shall consist of five measuring cycles, which shall be carried out in immediate succession.

For fuse-holders for fuse-links in accordance with IEC 60127-2 the average values shall not exceed 5 mΩ. The value of any individual measurement shall not exceed 10 mΩ.

For fuse-holders for fuse-links in accordance with IEC 60127-3 the average values shall not exceed 10 mΩ. The value of any individual measurement shall not exceed 15 mΩ.

Table 12 – Values for insulation resistance, dielectric strength and impulse withstand voltage

Insulation resistance, dielectric strength and impulse withstand voltage measured between:	Number of test gauges according to table 3 or 5	Rated voltage V	Insulation resistance: DC test voltage V — functional, basic or supplementary insulation	Insulation resistance: DC test voltage V — Reinforced or double insulation	Insulation resistance MΩ	Dielectric strength: AC test voltage V — functional, basic or supplementary insulation	Dielectric strength: AC test voltage V — Reinforced or double insulation	Impulse withstand voltage: Impulse test voltage V — functional, basic or supplementary insulation	Impulse withstand voltage: Impulse test voltage V — Reinforced or double insulation
1 Unexposed fuse-holder	3 / 6	32	Twice rated voltage but at least 100 V		≥10 for functional, basic or supplementary insulation ≥20 for reinforced or double insulation	500	1 000	Required impulse withstand voltage values according to Table 8	
1.1 The terminals		63							
1.2 The terminals and the metal mounting or front-panel plate	1 / 4					Twice rated voltage +1 000 V	Twice the value for functional, basic or supplementary insulation		
1.3 The terminals and any other metal parts which may be in contact with the mounting plate, e. g. base fixing devices		125							
1.4 The terminals and a metal foil covering the whole of the accessible surface (see figures 4 and 5)		250							
2 Exposed fuse-holders	3 / 6								
2.1 The terminals									
2.2 The terminals and the mounting plate	1 / 4								

12 Mechanical requirements

12.1 General

Fuse-holders shall have adequate mechanical strength to withstand the stresses imposed during installation and use.

Compliance is checked by the appropriate tests of 12.2 to 12.8.

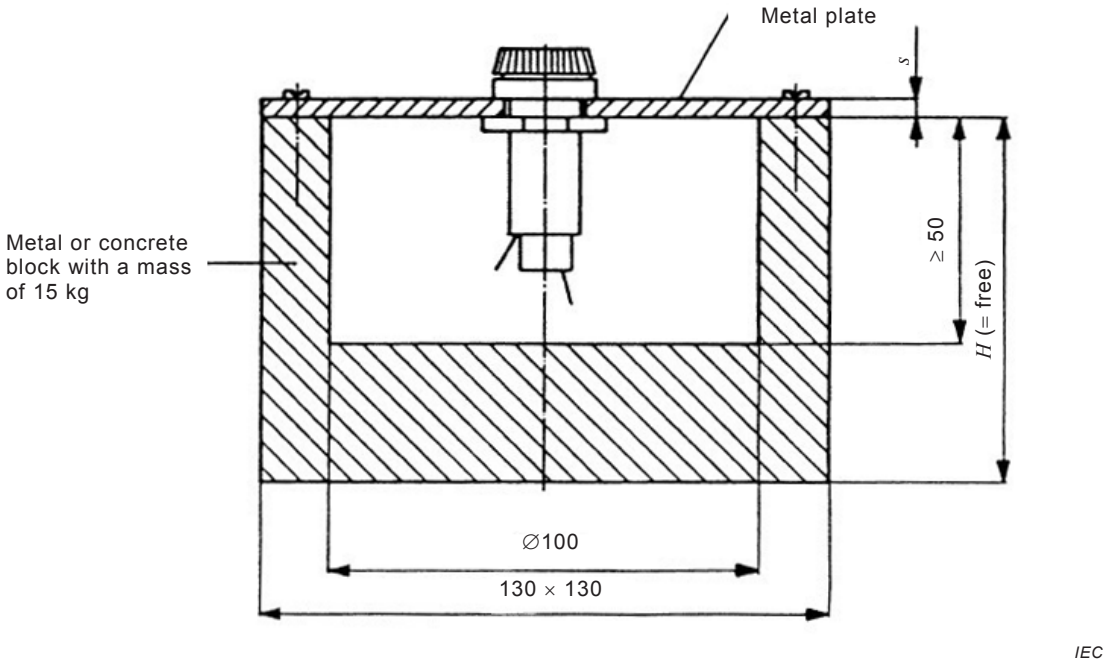
12.2 Mounting

For the tests of 12.3 to 12.5 the fuse-holders are mounted as follows.

a) Fuse-holders designed for front-panel mounting shall be mounted with their fixing elements, if any, in the centre of a metal plate 130 mm × 130 mm having a maximum thickness s as specified by the manufacturer.

The specimen as a whole is then fixed to a rigid plane support having a free space with a diameter of 100 mm for the base of a panel-mounted fuse-holder. To ensure that the specimen is rigidly supported, a block of metal or concrete having a mass of 15 kg shall be used (Figure 6).

Any fixing nut or fixing screw is screwed on with two-thirds of the torque specified in Table 14 or Table 15 as applicable.



Dimensions in millimetres

Figure 6 – Test device for mechanical test

b) Fuse-holders for PC board mounting shall be soldered to the test PC board according to Annex A and, by means of screws, this test PC board shall be fixed to the metal or concrete block of Figure 6 using a suitably adapted metal plate.

12.3 Compatibility between fuse-holder and fuse-link

The maximum gauge No. 1 or No. 4 according to Table 3 or Table 5 shall be inserted in and withdrawn from the fuse-holder and fuse-carrier, if any, 10 times.

For fuse-holders having screw-in fuse-carriers, these carriers shall be fitted in the normal way for each operation with a torque equal to two-thirds of the value specified in Table 13.

For fuse-holders having bayonet fuse-carriers there are no special torque requirements.

There shall be no visible damage or loosening of parts. In the most unfavourable position, the minimum gauge No. 2 or No. 5 according to Table 3 or Table 5 shall not fall from the fuse-carrier.

The minimum gauge No. 2 or No. 5 according to Table 3 or Table 5 shall then be inserted in the holder and the contact resistance shall be measured according to 11.2 with the same requirements.

12.4 Mechanical strength of the connection between fuse-base and fuse-carrier

12.4.1 Screw and bayonet connections

For the following tests, the fuse-carrier is fitted with the maximum gauge No. 1 or No. 4 according to Table 3 and inserted in the fuse-base mounted according to 12.2.

a) Torque test on fuse-carriers

   The fuse-carrier shall be subjected five times to the appropriate torque specified in Table 13.

b) Tensile test on fuse-carriers

   The screw-in fuse-carrier is screwed in with a torque of two-thirds of the value as specified in Table 13.

The screw-in or bayonet fuse-carrier shall then be subjected for 1 min to an axial pull as specified in Table 13.

Table 13 – Values for torque and axial pull

Diameter of fuse-carrier (Φ *d* in Figure 4 and Figure 5)	**Torque** Nm	**Axial pull** N
Up to and including 16 mm	0,4	25
Over 16 mm, up to and including 25 mm	0,6	50

During and after the tests, the fuse-carrier must be securely held in the fuse-base and shall not show any change impairing its further use.

For fuse-holders where fuse-carriers are flush with the fuse-base, the axial pull test is not required.

12.4.2 Plug-in connection

Insertion and withdrawal forces:

The fuse-carrier together with the maximum gauge No. 1 or No. 4 according to Table 3 shall be inserted in and withdrawn from the fuse-base. The forces have to be measured with suitable measuring devices. This test has to be repeated 10 times. The value of any individual measurement, insertion and withdrawal forces, shall be within limits assigned by the manufacturer.

After the test the contact resistance shall be measured according to 11.2 with the same requirements.

12.5 Impact test

This test shall only be applied to panel-mounted fuse-holders. The fuse-carrier with the maximum gauge No. 1 or No. 4 according to Table 3 shall be inserted in the fuse-holder.

The front of the fuse-holder is then subjected to three blows with a spring-operated impact-hammer according to IEC 60068-2-75, applied to points equally distributed over the front of the fuse-holder.

The adjusted value of the kinetic energy just before impact shall be (0,35 ± 0,03) J.

After the test, the sample shall show no serious damage. In particular, live parts shall not have become exposed so as to impair compliance with Clause 9 and there shall not have been such distortion as to impair compliance with Clause 10.

Compliance is checked by visual inspection and measurement of dimensions. If there is any doubt, compliance is additionally checked by the impulse withstand voltage test according to 11.1.5.

12.6 Mechanical strength of the fuse-holder fastening on panels

12.6.1 Fixing nut fastening

The fuse-base shall be mounted with supplied fixing elements, including gasket, on a steel plate according to the manufacturer's instructions.

The fixing nut of a one-hole mounted fuse-base shall be screwed on and off five times with a torque as specified in Table 14.

Table 14 – Torque values

Thread diameter mm	**Torque** Nm
Up to and including 12	0,6
Greater than 12, up to and including 18	1,2
Greater than 18, up to and including 30	2,4

After the test the fuse-base shall not show any change impairing its further use.

12.6.2 Fixing screw fastening

Fixing screws, bolts or nuts of a multi-hole mounted fuse-base shall be screwed on and off five times with a torque as specified in Table 15.

Table 15 – Torque values

Thread diameter mm	Torque Nm
2	0,25
2,5	0,4
3	0,5
3,5	0,8
4	1,2
5	2,0
6	2,5
≥8	3,5

After the test the fuse-base shall not show any change impairing its further use.

12.6.3 Snap-in fastening

12.6.3.1 General

The following types belong to this group of fuse-holders:

– fuse-base with integral spring-system;

– fuse-base with a separate spring-nut (a nut fabricated e.g. from thin spring steel having an impression designed to accomodate the mating part).

12.6.3.2 Tests and requirements

12.6.3.2.1 Test procedures

The mechanical strength of the fuse-holder fastening on panels (see Figure 7) shall be verified by the following tests.

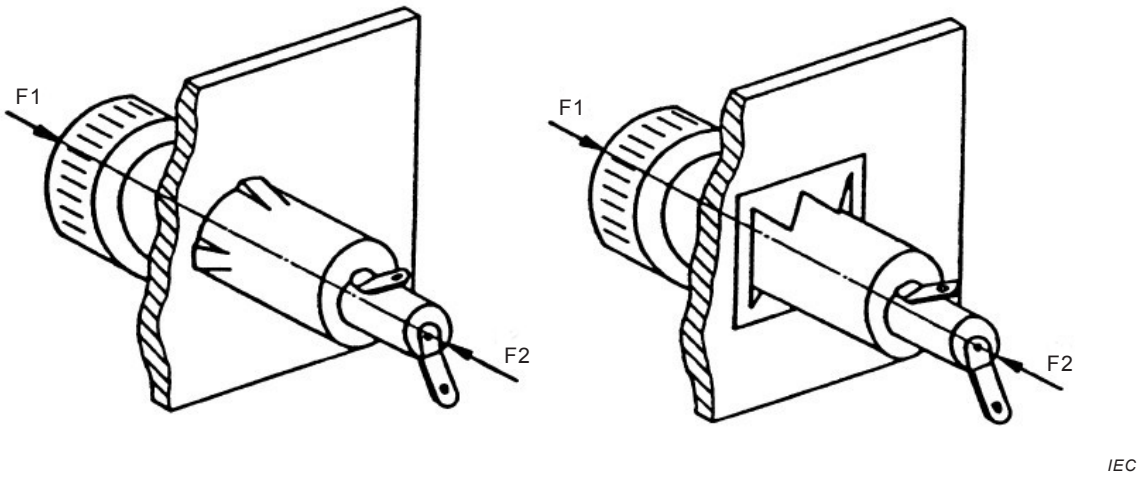


Figure 7 – Fuse-holder fastening on panels

They shall be performed with an engaged snap-in fastening and the fuse-holder shall lie flat on the surface of the mounting plate.

The specimens shall be divided into two mounting groups according to Table 16.

Table 16 – Mounting groups

	Group 1	Group 2
Mounting plate	Maximum panel thickness and mounting hole with smallest dimension	Minimum panel thickness and mounting hole with largest dimension
Testing force	Insertion force F1	Withdrawal force F2

Preparation of the specimen:

The thickness of the mounting plate and the diameter of the mounting hole shall be according to the specifications of the manufacturer.

The mounting plate may be positioned in any convenient orientation during the test procedures.

12.6.3.2.2 Insertion force F1

The insertion force F1 shall be ≤ 20 N or as specified by the manufacturer, and centered in the middle of the socket base of the fuse-holder (see Figure 7).

The insertion force F1 shall be so applied that the force on the whole surface is continuously increased in a monotonous manner without jogging.

The pressure device shall cover the flange completely.

12.6.3.2.3 Withdrawal force F2

The withdrawal force F2 (see Figure 7) shall be applied axially to the rear of the fuse-holder. The force shall be increased monotonously from 0 N to 50 N.

The snap-in fastening of the fuse-holder shall not be permanently distorted and the fuse-holder shall not be ejected by the maximum force.

12.6.3.2.4 Acceptance criteria in the above tests

– Cracks, chipping and breakage of the fuse-holder base due to the mechanical stress of F1 and F2 are not acceptable.
– Ridges and wear of the insulating body are acceptable.

12.7 Terminals of fuse-bases

12.7.1 Terminals with screw-type clamping or screwless-type clamping

Tests and requirements for terminals with screw-type and screwless-type clamping units for electrical copper conductors, according to IEC 60999-1.

12.7.2 Terminals for soldering

12.7.2.1 Tag terminals

12.7.2.1.1 General

Designed for being soldered with a soldering iron.

12.7.2.1.2 Size

Terminals of fuse-bases shall allow the connection of rigid conductors, solid or stranded and flexible conductors of the size shown in Table 17.

Table 17 – Cross-sections of conductors

Fuse-holder with a maximum rated current of:	Minimum hole diameter mm	Maximum cross-section of the conductor mm^2
Up to and including 6,3 A	1,2	1
More than 6,3 A, and up to and including 10 A	1,4	1,5
More than 10 A, and up to and including 16 A	1,8	2,5

For soldering terminals there shall be a means such as a hole through which the conductor, or all strands of a multi-strand conductor, will pass so that the conductor may be held independently of the solder.

12.7.2.1.3 Tests

a) Robustness of termination

The terminals shall be subjected to the following tensile and bending tests.

– Tensile test according to Test Ua_1 of IEC 60068-2-21:2006.

An axial force of 20 N shall be applied.

Requirements: there shall be no damage which would impair normal operation.

– Bending test according to Test Ub of IEC 60068-2-21:2006.

Where applicable, method 1 shall be used, otherwise method 2.

Requirements: there shall be no damage which would impair normal operation.

b) Solderability, wetting, soldering iron method

The test shall be performed in accordance with Test Ta of IEC 60068-2-20:2008 after the accelerated ageing 4.1.4.3 detailed in 4.1.4 of IEC 60068-2-20:2008.

– Method 2.

– “B” size soldering iron.

Requirements: The solder shall have wetted the test area and there shall be no droplets.

c) Resistance to soldering heat, soldering iron method

The test shall be performed in accordance with Test Tb of IEC 60068-2-20:2008.

– Method 2.

– “B” size soldering iron.

Requirements: there shall be no damage that would impair normal operation.

12.7.2.2 Wire and pin terminals

12.7.2.2.1 General

Designed for use with printed boards or other applications using similar soldering techniques.

12.7.2.2.2 Size

Dimensions: no special requirements

12.7.2.2.3 Tests

a) Robustness of termination: see 12.7.2.1.3 a).

b) Solderability, wetting, solder bath method.

The test shall be performed in accordance with Test Ta of IEC 60068-2-20 after the accelerated ageing 4.1.4.3 detailed in 4.1.4 of IEC 60068-2-20:2008

– Method 1.

– A thermal screen shall be used: e.g. a PC board.

Requirements: the dipped surface shall be covered with a solder coating with no more than small amounts of scattered imperfections such as pin-holes or unwetted areas. These imperfections shall not be concentrated in one area.

c) Resistance to soldering heat, solder bath method.

The test shall be performed in accordance with Test Tb of IEC 60068-2-20:2008.

– Method 1.

– A thermal screen shall be used: e.g. a PC board.

– Immersion temperature: 260 °C ± 3 °C

– Immersion time: (5 ± 1) s.

Requirements: there shall be no damage that would impair normal operation.

12.7.3 Quick-connect male tab terminals

12.7.3.1 General

A quick-connect termination consists of a male tab with hole or dimple detent and the mating female connectors. The fuse-base is provided with the male tab.

12.7.3.2 Size

Dimensions, classified types of male tabs: according to IEC 61210.

12.7.3.3 Tests

Robustness of terminations

The terminals shall be subjected to the following tensile and compressive strength tests:

– tensile test according to test Ua1 of IEC 60068-2-21:2006. A tensile force F1 according to Table 18 shall be applied to the fixed male tab as shown in Figure 8;

– compressive test analogous to the tensile test. A compressive force F2 according to Table 18 shall be applied to the fixed male tab as shown in Figure 9.

Separate specimens shall be used for tensile and compressive testing. Care shall be taken to ensure correct alignment and direction of forces.

Requirements: there shall be no damage which would impair normal operation.

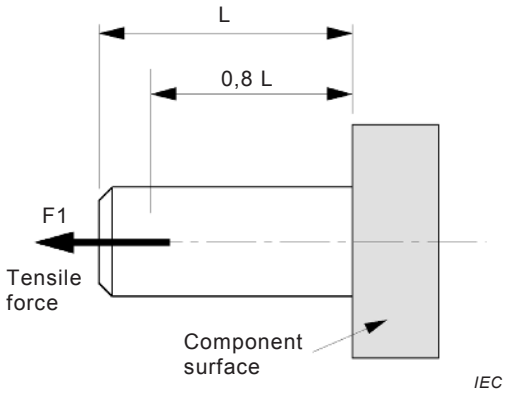


Figure 8 – Tensile force test

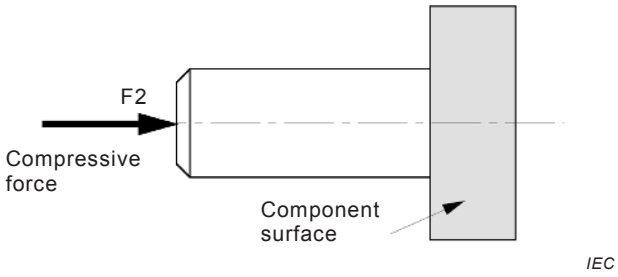


Figure 9 – Compressive force test

Table 18 – Tensile and compressive forces

Tab size mm	Tensile force F1 and compressive force F2 N
2,8	53
4,8	67
5,2	67
6,3	80
9,5	100

12.7.4 Quick-connect male tab terminals combined with solder tag terminals

Combined versions are tested according to 12.7.2.1 and 12.7.3 as applicable.

12.8 Resistance to vibration

12.8.1 General

The resistance to vibration of fuse-holders shall be adequate.

Compliance is checked by submitting the fuse-holder to the test in accordance with IEC 60068-2-6:2007, Test Fc, with the following general measuring requirements.

12.8.2 Mounting

The fuse-holder shall be mechanically connected to the test apparatus according to IEC 60068-2-47 by its normal mounting method.

The fixing nut of one-hole mounted fuse-bases shall be screwed on with a torque as specified in 12.6.1.

The fixing screws, bolts or nuts of multi-hole mounted fuse-bases shall be screwed on with a torque as specified in 12.6.2.

The snap-in fastening fuse-bases shall be mounted as specified in 12.6.3.

The minimum gauge No. 2 or No. 5 according to Table 3 or Table 5 shall be inserted in the fuse-holder.

For fuse-holders having screw-in fuse-carriers, these carriers shall be fitted in the normal way with a torque equal to two-thirds of the maximum allowable value specified in Table 13.

12.8.3 Measurement and requirements

12.8.3.1 Severity (minimum level)

– Frequency range: 10 Hz to 55 Hz.

– Displacement amplitude 0,35 mm or acceleration amplitude 5 g (see 5.2 of IEC 60068-2-:2007, Table IV).

– Number of sweep cycles: five in each axis.

12.8.3.2 Axis of vibration

The fuse-holder shall be vibrated in three mutually perpendicular axes in turn which should be chosen in such a way that one axis is the main fuse-link axis.

12.8.3.3 Functional checks

During vibration, it shall be checked whether or not the electrical continuity between the contacts is interrupted. Interruption of 1 ms or less shall be ignored.

12.8.3.4 Final measurements

After the test the contact resistance shall be in accordance with 11.2, and the fuse-holder shall show no serious damage in the sense of this standard.

13 Thermal requirements

13.1 Rated power acceptance test

13.1.1 General

A fuse-holder shall be so designed to carry continuously the rated current at the rated power acceptance and at an ambient air temperature T_{A1} of 23 °C without exceeding the allowable temperatures on the fuse-holder specified in 13.1.4.

Compliance is checked by the tests of 13.1.2 to 13.1.7.

13.1.2 Mounting

Fuse-holders designed for panel or base mounting shall be mounted in the centre of an insulating plate, e.g. laminated phenolic cellulose paper with the dimensions (100 × 100 × 3) mm.

Fuse-holders designed for PC board mounting shall be mounted on a test PC board according to Annex A.

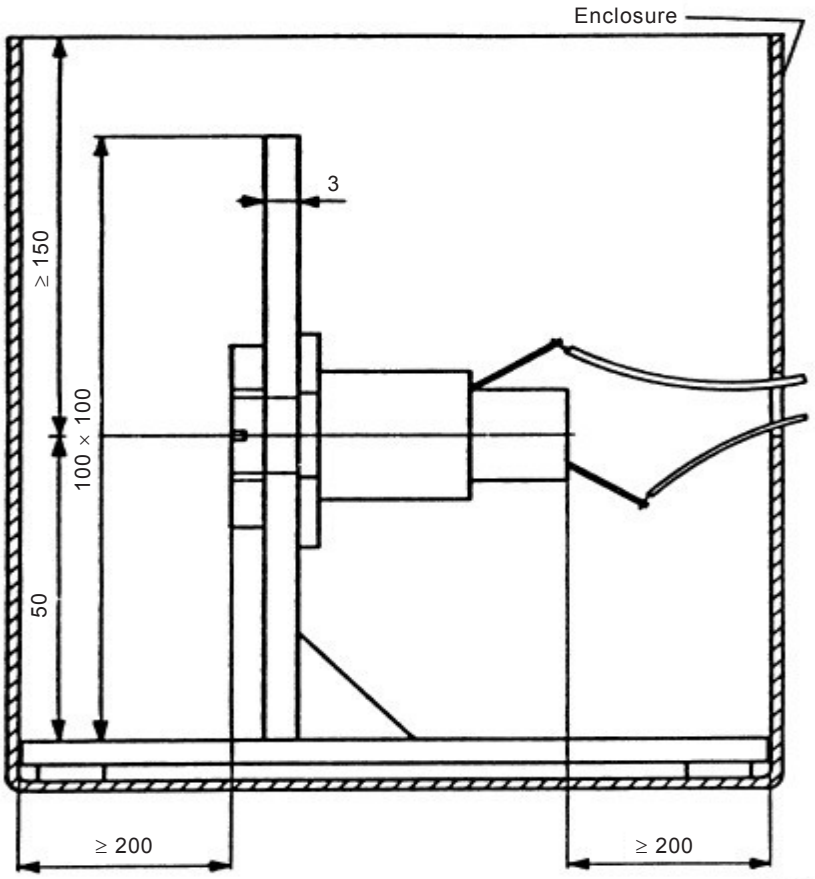
For fuse-holders having screw-in fuse-carriers, these carriers shall be fitted in the normal way with a torque equal to two-thirds of the maximum allowable value specified in Table 13.

The temperature measurements shall be carried out in air as undisturbed as possible. Therefore the fuse-holder, mounted on the corresponding plate, shall be placed in an enclosure which protects the immediate environment from external movements of air. The enclosure should be made of negligible reflective materials.

The enclosure sides shall not be closer than 200 mm from the edges of the fuse-holder. The enclosure shall not have a cover.

The fuse-holder samples shall be arranged in three different positions, one in the horizontal plane (Figure 10) and two in the vertical plane (upright and downwards).

The arrangement in the other planes has to be made in a similar way.



Dimensions in millimetres

Figure 10 – Test device

The insulated conductors fitted to the fuse-holder or test PC board terminals shall have the following dimensions:

a) Length: 1 m.

b) Cross-sectional area of a single-core copper conductor:
   - 0,5 mm^2 for fuse-holders rated up to and including 1 A;
   - 1 mm^2 for fuse-holders rated more than 1 A but less than or equal to 6,3 A;
   - 1,5 mm^2 for fuse-holders rated more than 6,3 A but less than or equal to 10 A;
   - 2,5 mm^2 for fuse-holders rated more than 10 A but less than or equal to 16 A.

13.1.3 Dummy fuse-links

13.1.3.1 Dummy fuse-links for cartridge fuse-links

A dummy fuse-link is a test fuse-link with defined resistance according to Table 19.

The material of the resistance wire used in the dummy fuse-link shall be of CuNi44 or any similar material having a temperature coefficient of resistance of less than $\pm 8{,}0 \times 10^{-5}$ K^{-1} within the temperature range of 20 °C to 200 °C.

The dimensiuons of the dummy fuse-links are specified in Table 4. These dimensions are equivalent to the dimensions of the minimum gauges No. 2 or No. 5, except for the permissible tolerances.

Material of the end cap: brass, nickel plated; minimum thickness of nickel plating: 2 μm.

Table 19 – Dummy fuse-links according to IEC 60127-2

Dummy No.		Nominal power dissipation of the dummy fuse-link	Current	Resistance[a] ± 10 %
Dummy fuse-link for fuse-links				
5 mm × 20 mm	6,3 mm × 32 mm	P W	I A	R mΩ
A1/1625	A2/1625	1,6	2,5	256
A1/1663	A2/1663		6,3	40
A1/2525	A2/2525	2,5	2,5	400
A1/2563	A2/2563		6,3	63
A1/2510	A2/2510		10	25
A1/3263	A2/3263	3,2	6,3	81
A1/4063	A2/4063	4,0	6,3	101
A1/4010	A2/4010		10	40

[a] The resistance of the dummy fuse-link is calculated as follows: $R = P/I^2$.

In reference to ratings (current, power dissipation), if other values are required, these values should be selected from the R10 series according to ISO 3.

In case of doubt concerning the behaviour of the used dummy fuse-links, these should be tested at rated current in the fuse-base shown in Figure 1 of IEC 60127-2:2010, and they should show no special effects such as thermoelectrical voltage.

13.1.3.2 Dummy fuse-links for sub-miniature fuse-links

Requirements:

a) Defined resistance according to Table 20. The material should be of low temperature coefficient of resistance.
b) Dimensions of the minimum gauge in Table 6.
c) Materials of parts A and B according to Table 5:
   – part A: brass or copper, nickel- or tin-plated;
   – part B: insulating material.

The type of material shall be assigned by the manufacturer.

Table 20 – Dummy fuse-links according to IEC 60127-3

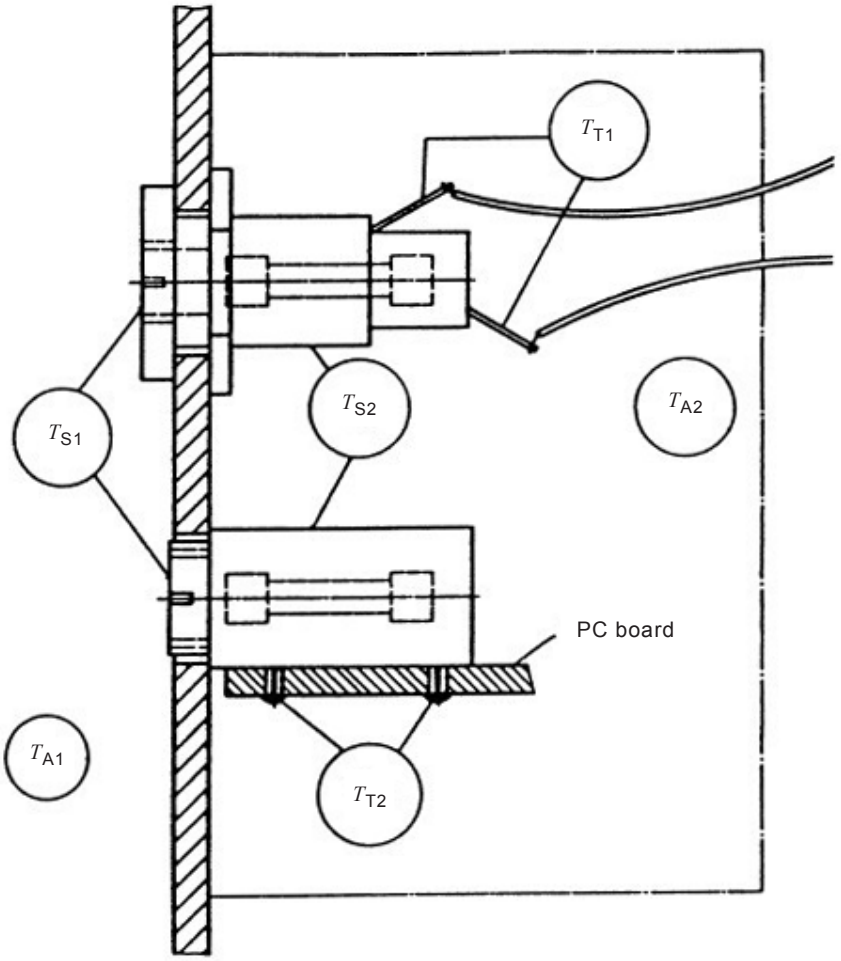
Dummy No.		Nominal power dissipation of the dummy fuse-link	Current	Resistance[a] ± 10 %
Dummy fuse-link for sub-miniature fuse-links according to				
Standard sheet 1	Standard sheets 3 and 4	*P* W	*I* A	*R* mΩ
B1/1650		1,6	5,0	64
	B2/1620	1,6	2,0	400
	B2/1650		5,0	64
	B2/2550	2,5	5,0	100

[a] The resistance of the dummy fuse-link is calculated as follows: $R = P/I^2$.

In reference to ratings (current, power dissipation), if other values are required, these values should be selected from the R10 series according to ISO 3.

13.1.4 Measurement of maximum allowable temperatures on fuse-holders

The locations where the relevant temperatures shall be measured are illustrated in Figure 11.



Key:

T_{A1} = ambient air temperature, surrounding the equipment
T_{A2}= ambient air temperature, in the equipment
T_{S1}= temperature of accessible part on fuse-holder surface
T_{S2}= temperature of inaccessible part on fuse-holder surface
T_{T1} = temperature on the tag-terminal of panel fuse-holder
T_{T2} = temperature on the pin-terminal of PC-board fuse-holder

Figure 11 – Illustration of temperatures experienced in practice

A thermocouple or other temperature measuring device that does not appreciably affect the result shall be used.

Remarks on the individual measuring points:

T_{A1} denotes the ambient temperature surrounding the equipment. It is measured at a distance of approximately 100 mm from the enclosure of the test device.

The rated power acceptance is referred to an ambient temperature T_{A1} of 23 °C.

The power acceptance at higher ambient temperatures T_{A1} shall be assigned by the manufacturer.

Preferred ratings at ambient temperatures T_{A1} are given in Table 2. See also Annex E.

T_{A2} denotes the ambient temperature inside the equipment. It is measured at a distance of approximately 50 mm from the fuse-holder under test.

T_{S1} denotes the temperature of accessible parts on the fuse-holder surface which can be touched by means of the standard test finger according to IEC 60529, when the fuse-holder is installed and operated as in normal use, e.g. on the front panel of equipment (see 3.17).

T_{S2} denotes the temperature of inaccessible parts on the fuse-holder surface. It is measured on the insulating parts of the fuse-holder which are located inside the equipment. The measuring point on the surface of the fuse-holder shall be accessible by means of a test wire of 1 mm diameter according to IEC 60529.

T_{S1} and T_{S2} shall be measured on the hottest point of the fuse-holder surface area. The temperature measuring points shall be chosen by performing a plot test to determine the approximate location of the hottest point.

T_{T1} denotes the temperature on the tag-terminals of panel fuse-holders. It is measured on the centre point of the tag-terminal surface.

T_{T2} denotes the temperature on the pin-terminals of PC-board fuse-holders. It is measured underneath the PC board on the centre point of the fillet formed by the meniscus of the solder.

Table 21 – Maximum allowable temperatures

Fuse-holder surface area		Maximum allowable temperatures °C	
1	Accessible parts[a]	T_{S1}[b]	85
2	Inaccessible parts[a]		
2.1	Insulating parts	T_{S2}[b]	see[c]
2.2	Terminals:		
2.2.1	of fuse-holder for panel or base mounting: (area around the fitted conductor)	T_{T1}[b]	see[d]
2.2.2	of fuse-holder for PC board mounting: (soldered points on PC board)	T_{T2}[b]	see[d]

[a] When the fuse-holder is properly assembled, installed and operated as in normal use, e.g. on the front panel of equipment.

[b] See Figure 11.

[c] The maximum allowable temperature of the fuse-holder's insulating materials corresponds to the relative temperature index (RTI) or temperature index (TI) according to IEC 60216-1, which is based on test conditions of 20 000 h – electrical, without impact – if the insulating material is inaccessible after normal installation of the fuse-holder in the equipment. If there are no relevant IEC values available, as an alternative, comparable RTI values may be chosen from an equivalent standard.

The RTI value shall be assigned by the manufacturer.

[d] The maximum allowable temperature shall be assigned by the manufacturer.

13.1.5 Correlation between ambient air temperature T_{A1} and the power acceptance of a fuse-holder

The rated power acceptance of a fuse-holder is determined at an ambient temperature T_{A1} of 23 °C (see 3.3).

The power acceptance at higher ambient temperatures T_{A1} shall be assigned by the manufacturer. See also Annex E.

13.1.6 Temperature measuring point for ambient air temperature T_{A1}

The measuring point for measuring the ambient air temperatures T_{A1} shall be located outside the enclosure in Figure 10.

13.1.7 Test method

The fuse-holder shall be mounted according to 13.1.2.

The dummy fuse-link corresponding to the fuse-holder to be tested shall be chosen from Table 19 or Table 20 and inserted in the holder.

NOTE 1 For example, for a fuse-holder designed for fuse-links 5 mm × 20 mm and a rated power acceptance of 4 W at a rated current of 6,3 A, the dummy fuse-link No. A1/4063 with a resistance of 101 mΩ ± 10 % should be used.

The rated power acceptance test shall be carried out at an ambient temperature of not less than 23 °C and the result is corrected to a reference temperature of T_{A1} = 23 °C.

A test current equal to the rated current, a.c. or d.c., shall be passed through the fuse-holder. It is permissible for the test voltage to be less than the rated voltage of the fuse-holder.

Based on the dummy fuse-link resistance, the test current of the fuse-holder is adjusted within a tolerance of $^{+5}_{0}$ % of the rated current to give the nominal power dissipation P of the inserted dummy fuse-link.

NOTE 2 For the above example the tolerances of the 101 m7 dummy fuse-link are:

R_{min} = 90,9 mΩ, adjusted current: 6,63 A;

R_{max} = 111 mΩ, adjusted current: 6,00 A.

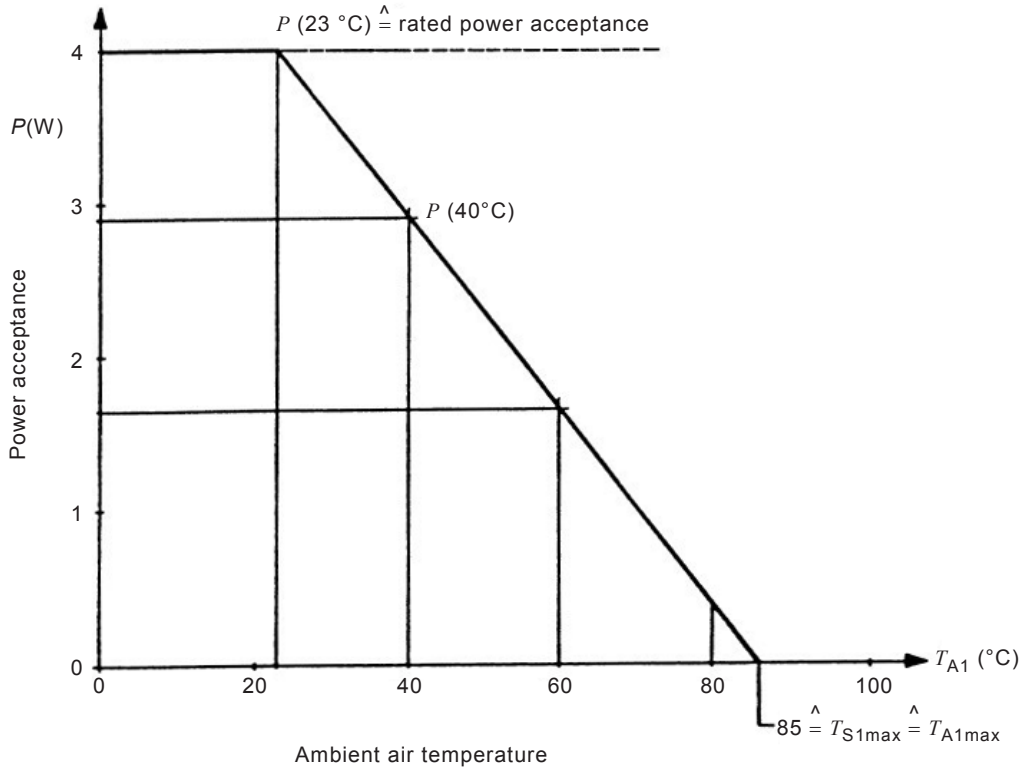
The test shall be continued until temperature stability has been reached.

Temperature stability shall be considered to have been reached when three (3) successive readings, at least 10 min apart, indicate no further temperature rise.

After temperature stability has been reached, the endurance test, according to Clause 14, shall be carried out with the same fuse-holder.

To obtain power acceptance values at higher ambient temperatures T_{A1}, tests shall be carried out at these higher temperatures following the test described above. The results can then be represented by means of a derating curve similar to the example shown in Figure 12.

Because of the maximum allowable temperature T_{S1max} = 85 °C for accessible parts, the derating curve should intersect the x-axis at the point T_{A1} = 85 °C.



NOTE Attention is drawn to the fact that this figure is an example of a derating curve. The relevant derating curve for any individual fuse-holder is assigned by the manufacturer.

Figure 12 – Example of a derating curve

13.2 Resistance to abnormal heat and fire

13.2.1 Needle-flame test

Insulation materials of fuse-holders which might be exposed to thermal stress due to electric effects and the deterioration of which might impair the safety of the equipment shall not be unduly affected by heat and by fire generated within the fuse-holder.

Compliance is checked by subjecting the fuse-holder to the needle-flame test according to IEC 60695-11-5:2004, with the following modifications:

Clause 7: Severities

The duration of application of the test flame is (10 ± 1) s.

Clause 9: Test procedure

The fuse-holder shall be positioned as in normal use and, at the beginning of the test, the flame is applied so that the tip of the flame is in contact with the surface of the fuse-holder. During the test, the burner shall not be moved.

Clause 11: Evaluation of test results

Add the following:

There shall be no ignition of the tissue paper or scorching of the white pine board, a slight discoloration, if any, of the white pine board being neglected.

13.2.2 Glow-wire ignition test

For fuse-holders made of plastic material or of material containing organic substances the following minimum requirements apply.

Glow-wire ignition temperature (GWIT) = 775 °C

Glow-wire flammability index (GWFI) = 850 °C

For GWFI and GWIT, reference should be made to IEC 60695-2-12 and IEC 60695-2-13 respectively. For the glow wire test it is necessary to use material plates with the dimensions according to 4.2 of IEC 60695-2-12:2010 or IEC 60695-2-13.

14 Endurance

14.1 General

Fuse-holders shall be sufficiently resistant to heat and to mechanical stresses which may occur in normal use.

Compliance is checked by the following test.

14.2 Endurance test

The fuse-holder shall be subjected to the rated power acceptance test according to 13.2. The test together with measurements of temperature and voltage drop shall go on continuously for a period of 500 h.

14.3 Requirements

After the test the fuse-holder shall be in a satisfactory condition. It shall not have suffered any deformation that would impair its correct operation. The requirements according to the following subclauses shall be fulfilled:

11.1.3 Insulating resistance.

11.1.4 Dielectric strength.

12.2 Compatibility between fuse-holder and fuse-link. For this test the requirements in the second paragraph of 11.2.3 shall be replaced by the following: “The average of the values of the contact resistance shall not exceed 10 mΩ. The value of any individual measurement shall not exceed 15 mΩ.”

The maximum allowable temperatures according to Table 21 shall not be exceeded.

15 Additional requirements

15.1 Resistance to rusting

Ferrous parts shall be adequately protected against rusting. Compliance is checked by the following test.

All grease is removed from the parts to be tested by immersion in trichloroethane or an equivalent degreasing agent, for 10 min. The parts are then immersed for 10 min in a 10 % solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of (20 ± 5) °C.

After the parts have been dried for 10 min in a heating cabinet at a temperature of (100 ± 5) °C, their surface shall show no signs of rust.

Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

For small springs and for inaccessible parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are subjected to the test only if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.

15.2 Resistance to cleaning solvents

This test shall be applied to fuse-holders designed for PC board mounting.

The cleaning solvent to be used shall be propan-2-ol (isopropyl alcohol) or any similar solvent, except for solvent containing freon.

Compliance is checked by the test according to IEC 60068-2-45, with the following conditions:

Solvent temperature: (23 ± 5) °C

Duration of immersion: (5 ± 0,5) min.

Conditioning: Method 2 (without rubbing)

Recovery time: not less than 1 h

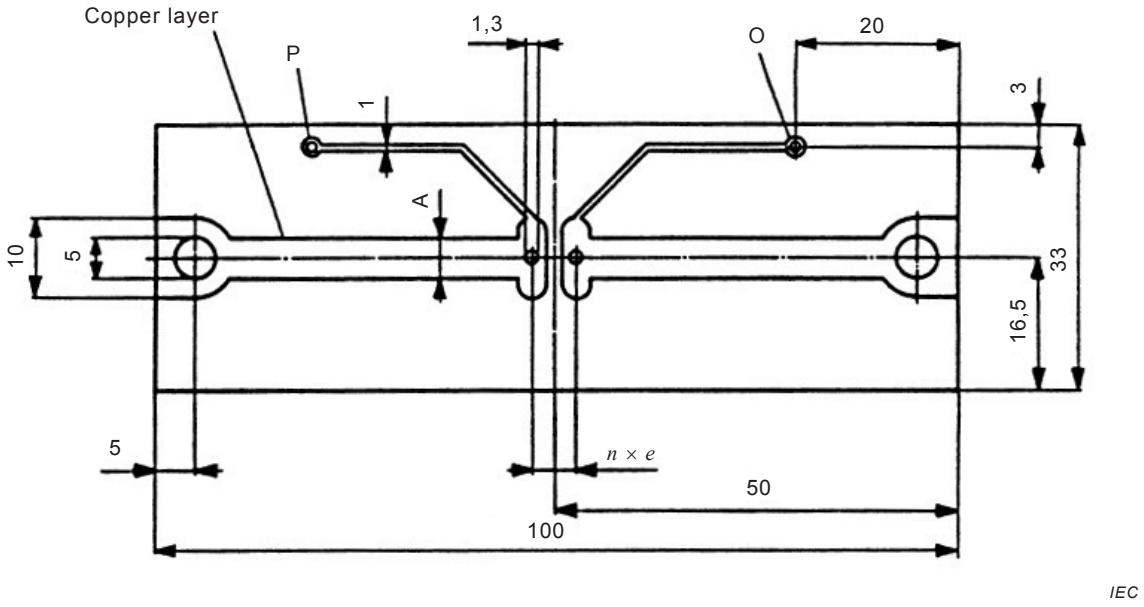
Final measurement:

– visual inspection and
– dielectric strength test according to Table 12

Annex A
(normative)

Test PC board for fuse-holders of rated currents up to 10 A

Figure A.1 shows an example of a test board. The number and alignment of the holes for the solder terminal of the fuse-holder may be chosen to suit the relevant fuse-holder. The dimensions of the copper layer (nominal width A, nominal thickness) and the overall dimensions (approximately 100 mm × 33 mm) shall be met. Table A.1 gives nominal width and nominal thickness of copper layer for test board.



Dimensions in millimetres

Figure A.1 – Example of a test board

Base material:

– glass-fibre reinforced epoxy, temperature strength ≥150 °C;
– nominal thickness shall be 1,6 mm;
– copper layer:

Table A.1 – Copper layer for test board

Rated current of fuse-holder	Copper layer	
	Nominal width *A* mm	Nominal thickness mm
<6,3 A	2,5	0,035
6,3 A to ≤10 A	5,0	0,070
≤16 A	Under consideration	Under consideration

Connection for voltage drop measurement: P/O

e = 2,54 mm

n = 1 to 6

Annex B
(normative)

Type tests, test sequences and number of samples

Table B.1 gives type tests, test sequences and number of samples. Care shall be taken that 12 spares are available.

Table B.1 – Type tests, test sequences and number of samples

Test		Number of samples	Parameters	Sub-clause
group	no.			
		1 to 15 (15 samples)	Marking	6
1	1.1	1 to 3 (3 samples)	Protection against electric shock	9
	1.2		Clearance, creepage distances	10
	1.3		Insulation resistance, dielectric strength, impulse withstand voltage	11.1
	1.4		Mechanical strength of the fuse-holder fastening on panels	12.5
2	2.1	4 to 6 (3 samples)	Contact resistance	11.2
	2.2		Compatibility between fuse-holder and fuse-link	12.2
	2.3		Mechanical strength of the connection between fuse-base and fuse-carrier	12.3
	2.4		Impact test	12.4
	2.5		Terminals of fuse-bases	12.6
3	3.1	7 to 9 (3 samples)	Rated power acceptance test including endurance test	13.1 14
4	4.1	10 to 12 (3 samples)	Resistance to abnormal heat and fire	13.2
5	5.1	13 to 15 (3 samples)	Resistance to vibration	12.7
	5.2		Resistance to rusting	15.1
	5.3		Resistance to cleaning solvents	15.2

All 15 samples in Table B.1 shall comply with the requirements of Clause 6.

All 3 samples in Group 1 in Table B.1 shall comply with the requirements of Clause and sub-clause 9, 10, 11.1 and 12.5.

If one instance of non-compliance occurs in Group 2, 3, 4 and 5 in Table B.1, then the test shall be repeated on this parameter using the original sample size. Providing that no further instances of non-compliance occur, the fuse-holder shall be deemed to comply with this standard.

If a total of two or more instances of non-compliance occur, not necessarily for the same parameter of this group, then the fuse-holder is deemed not to comply with this standard.

Annex C
(informative)

Insulation coordination[1]

C.1 Overvoltage categories

The concept of overvoltage categories is used for equipment energized directly from the low-voltage mains.

NOTE 1 This concept of overvoltage categories is used in IEC 60364-4-44.

– Equipment of *overvoltage category IV* is for use at the origin of the installation.

NOTE 2 Examples of such equipment are electricity meters and primary overcurrent protection equipment.

– Equipment of *overvoltage category III* is equipment in fixed installations, and for cases where the reliability and the availability of the equipment is subject to special requirements.

NOTE 3 Examples of such equipment are switches in the fixed installation and equipment for industrial use with permanent connection to the fixed installation.

– Equipment of *overvoltage category II* is energy-consuming equipment to be supplied from the fixed installation.

NOTE 4 Examples of such equipment are appliances, portable tools, and other household and similar loads.

If such equipment is subjected to special requirements with regard to reliability and availability, overvoltage category III applies.

– Equipment of *overvoltage category I* is equipment for connection to circuits in which measures are taken to limit transient overvoltages to an appropriately low level.

NOTE 5 Examples are protected electronic circuits.

C.2 Degrees of pollution in the micro-environment

Pollution degree 1

No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

Pollution degree 2

Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

Pollution degree 3

Conductive pollution occurs or dry non-conductive pollution occurs which becomes conductive due to condensation which is to be expected.

Pollution degree 4

The pollution generates persistent conductivity caused by conductive dust, or by rain or snow.

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1 See IEC 60664-1.

C.3 Comparative tracking index CTI

Material groups and their CTI value as follows:

Material group I 600 ≤ CTI

Material group II 400 ≤ CTI < 600

Material group IIIa 175 ≤ CTI < 400

Material group IIIb 100≤ CTI < 175

The CTI values above refer to values obtained, in accordance with IEC 60112, on samples specifically made for the purpose and tested with solution A.

The proof-tracking index (PTI) is also used to identify the tracking characteristics of materials. A material may be included in one of the four groups given above on the basis that its PTI, established by the methods of IEC 60112 using solution A, is equal to or greater than the lower value specified for the group.

Annex D
(informative)

Additional tests and requirements

D.1 General

The tests mentioned in this annex are optional. However, if they are carried out, the following requirements shall be met.

It shall also be indicated in which lot for a type test this test shall be included.

D.2 Resistance to shock

D.2.1 General

The resistance to shock of fuse-holders shall be adequate. Compliance is checked by submitting the fuse-holder to the test in accordance with IEC 60068-2-27, test Ea, with the following general measuring requirements.

D.2.2 Mounting

According to 12.8.2.

D.2.3 Measurement and requirements

D.2.3.1 Severity (minimum level)

– Acceleration amplitude: 50 g
– Pulse duration: 11 ms

(see 4.1 of IEC 60068-2-27:2008, Table 1)

D.2.3.2 Axes of shocks

According to 12.8.3.2.

D.2.3.3 Final measurements

According to 12.8.3.4.

D.3 Verification of the degree of protection of enclosures

If the fuse-holder is qualified equipment with a degree of protection provided by enclosure according to IEC 60529, as declared by the manufacturer, the verification of the degree of protection shall be carried out according to IEC 60529.

IEC 60529 gives test conditions for each degree of protection. The conditions appropriate to the stated degree of protection should be applied, immediately followed by the dielectric strength test on the fuseholder as specified in 11.1.4.

Preferred degree of protection: Minimum IP 40.

D.4 Climatic category

D.4.1 General

The climatic category assigned to the fuse-holder by the manufacturer shall be in accordance with IEC 60068-1, as shown in Table D.1.

Table D.1 – Examples of climatic categories

Category	Temperature limits °C		Damp heat, steady state: number of days	Designation[a] of the test according to IEC 60068-2
55/125/56	-55	+125	56	A (Cold, IEC 60068-2-1) B (Dry heat, IEC 60068-2-2) C (Damp heat, steady state, IEC 60068-2-78
40/85/56	-40	+85	56	
25/70/21	-25	+70	21	
10/55/04	-10	+55	4	
[a] Introduction of IEC 60068-1:1998.				

D.4.2 Test conditions and requirements

The verification of the stated climatic category shall be carried out under the conditions in the relevant IEC 60068-1 and IEC 60068-2.

The fuse-holder shall be mounted as specified in 11.1.1.

Immediately after these tests the parts of insulating material, normally accessible when in use, shall be wrapped with metal foil as shown in Figure 4 and Figure 5. After this treatment the requirements shall be in accordance with:

11.1.3 Insulation resistance.

11.1.4 Dielectric strength.

12.2 Compatibility between fuse-holder and fuse-link. For this test the requirements in the second paragraph of 11.2.3 shall be replaced by the following: “The average of the values of the contact resistance shall not exceed 10 mΩ. The value of any individual measurement shall not exceed 15 mΩ.”

Annex E
(informative)

Information for the correct application of the fuse-holder

Manufacturers shall hold available the minimum information given in Table E.1 which is necessary for the correct application of the fuse-holder.

Table E.1 – Information for the correct application of the fuse-holder

		Ratings, characteristics	According to clauses and subclauses
1	Rated voltage		3.5 / 5.1
2	Rated current		3.4 / 5.2
3	Rated power acceptance at ambient temperature T_{A1} of 23 °C		3.3 / 5.3 / 13.1
4	Maximum allowable ambient temperature:		3.19 /13.1.3 / 13.1.4
4.1	for accessible parts (T_{A1})		
4.2	for inaccessible parts (T_{A2})		
5	Protection against electric shock Category PC1 or PC2 or PC3		5.4 / 9
6	Protection class I or II of electrical equipment for which the fuse-holder is suitable, regarding protection against electric shock according to IEC 61140		5.5 / 9
7	Overvoltage category and degree of pollution		3.8 / 3.10 / 5.6
8	Comparative tracking index CTI of insulation materials		3.15 / 5.6

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