BRITISH STANDARD

BS EN 60127-4:1998

Incorporating Amendments Nos. 1 and 2

Miniature fuses —

Part 4: Universal Modular Fuse-links (UMF)

The European Standard EN 60127-4:1996, with the incorporation of amendments A1:2002 and A2:2003, has the status of a British Standard

ICS 29.120.50

BSI British Standards

National foreword

This British Standard is the English language version of EN 60127-4:1996, including amendments A1:2002 and A2:2003. It is identical with IEC 60127-4:1996, including amendments 1:2002 and 2:2003.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] ⟨A1⟩. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1] ⟨A1⟩.

The UK participation in its preparation was entrusted by Technical Committee PEL/32, Fuses, to Subcommittee PEL/32/3, Miniature fuses, which has the responsibility to:

— aid enquirers to understand the text;
— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Descriptors: Universal modular fuse-links (UMF), definitions, additional requirements, standard ratings, marking, test equipment, dimensions and construction, standard sheets

English version

Miniature fuses — Part 4: Universal Modular Fuse-links (UMF)

(includes amendments A1:2002 and A2:2003)
(IEC 60127-4:1996 + A1:2002 + A2:2003)

Coupe-circuit miniatures —
Partie 4: Eléments de remplacement modulaires universels (UMF)
(inclut les amendements A1:2002 et A2:2003)
(CEI 60127-4:1996 + A1:2002 + A2:2003)

Geräteschutzsicherungen
Teil 4: Welteinheitliche Modular-Sicherungseinsätze (UMF)
(enthält Änderungen A1:2002 und A2:2003)
(IEC 60127-4:1996 + A1:2002 + A2:2003)

This European Standard was approved by CENELEC on 1996-10-01. Amendment A1 was approved by CENELEC on 2002-07-01, amendment A2 was approved by CENELEC on 2003-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 32C/155/FDIS, future edition 2 of IEC 60127-4, prepared by SC 32C, Miniature fuses, of IEC TC 32, Fuses, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60127-4 on 1996-10-01.

The following dates were fixed:

— latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop) 1997-07-01
— latest date by which the national standards conflicting with the EN have to be withdrawn	(dow) 1997-07-01

For products which have complied with the relevant national standard before 1997-07-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-07-01.

Annexes designated "normative" are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60127-4:1996 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 32C/304/FDIS, future amendment 1 to IEC 60127-4:1996, prepared by SC 32C, Miniature fuses, of IEC TC 32, Fuses, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60127-4:1996 on 2002-07-01.

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— latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop) 2003-04-01
— latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow) 2005-07-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, Annex ZA is normative and Annex A is informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of amendment 1:2002 to the International Standard IEC 60127-4:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61191-2	NOTE Harmonized as EN 61191-2:1998 (not modified).
ISO 9453	NOTE Harmonized as EN 29453:1993 (not modified).

Foreword to amendment A2

The text of document 32C/336/FDIS, future amendment 2 to IEC 60127-4:1996, prepared by SC 32C, Miniature fuses, of IEC TC 32, Fuses, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60127-4:1996 on 2003-10-01.

The following dates were fixed:

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Endorsement notice

The text of amendment 2:2003 to the International Standard IEC 60127-4:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

Contents

Introduction

The trend towards miniaturization of electronic equipment has caused users to require fuse-links of small dimensions, and of appropriate design for application to printed circuit boards or other substrate systems, possibly by automatic means. These fuse-links should be designed to incorporate a degree of non-interchangeability.

Rated voltages of 32 V, 63 V, 125 V, and 250 V are specified together with the following characteristics: very quick acting (FF), quick acting (F), time-lag (T) and long time-lag (TT).

Because of the increasing importance of limitation of transient overvoltages in new technology, recommendations are included for limits to the overvoltages produced by these fuses under specified test conditions related to typical circuit configurations.

The option is given to specify the breaking capacity with alternating current or direct current; it is considered that fuses that meet the d.c. requirement will meet the a.c. requirement; however, testing is required to validate this. Fuses may be dual rated, in which case the manufacturer's literature should be referred to.

The users of miniature fuses express the wish that 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 fuselinks.*

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).*

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

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

IEC 60127-7, *(Free for further documents).*

IEC 60127-8, *(Free for further documents).*

IEC 60127-9, *Part 9: Test-holders and test-circuits.*

IEC 60127-10, *Part 10: User guide.*

The fourth part of this standard covers additional requirements, test equipment and standard sheets for UMFs.

It should be read in conjunction with other parts of the IEC 60127 series.

Section 1. Additional requirements and test equipment

1 Scope and object

1.1 This part of IEC 60127 relates to Universal Modular Fuse-links (UMF) 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-links for appliances intended to be used under special conditions, such as in a corrosive or explosive atmosphere.

These fuses are normally intended to be mounted or replaced only by appropriately skilled persons using specialized equipment.

Fuse-links for use in fuse-holders are under consideration.

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

1.2 The objects of this part of IEC 60127 are as given in IEC 60127-1, with the additional requirement of a degree of non-interchangeability.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60127. At the time of publication, the editions indicated were valid. All normative documents are subject to revision and parties to agreements based on this part of IEC 60127 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068-2-20:1979, *Environmental testing — Part 2: Tests — Test T: Soldering.*

〈A1〉 IEC 60068-2-21:1999, *Environmental testing — Part 2-21: Tests — Test U: Robustness of terminations and integral mounting devices.* 〈A1〉

IEC 60068-2-58:1989, *Environmental testing — Part 2: Tests — Test Td: Solderability, resistance to dissolution of metallization and to soldering heat of Surface Mounting Devices (SMD).*

IEC 60115-1:1982, *Fixed resistors for use in electronic equipment — Part 1: Generic specification.*
Amendment 2 (1987)
Amendment 3 (1989)
Amendment 4 (1993)

IEC 60115-8:1989, *Fixed resistors for use in electronic equipment — Part 8: Sectional specification: Fixed chip resistors.*

IEC 60127-1:1988, *Miniature fuses — Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links.*

IEC 60194:1988, *Terms and definitions for printed circuits.*

IEC 60249-2-5:1987, *Base materials for printed circuits — Part 2: Specifications — Specification No. 5: Epoxide woven glass fabric copper-clad laminated sheet, of defined flammability* (vertical burning test).

IEC 60326-3:1991, *Printed boards — Part 3: Design and use of printed boards.*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests.*

ISO 3:1973, *Preferred numbers — Series of preferred numbers.*

3 Definitions

The definitions given in Clause **3** of IEC 60127-1 apply for the purpose of this part of IEC 60127, with the addition of the following:

3.7.1
through-hole fuse-link
a through-hole fuse-link is a UMF designed for soldering directly into a printed wiring board, with insertion of its leads in suitably designed holes

3.7.2
surface mount fuse-link
a surface mount fuse-link is a UMF designed for direct conductive attachment by solder or other means on to the surface of a substrate, without insertion of its leads in suitably designed holes or sockets

3.28
land
portion of a conductive pattern usually but not exclusively used for the connection and/or attachment of components (see IEC 60194)

NOTE Further definitions which may be useful in the application of surface mount fuse-links may be found in IEC 60115-1 and IEC 60115-8.

4 General requirements (see IEC 60127-1)

5 Standard ratings

5.1 Rated voltage

See standard sheets.

5.2 Rated current

See Table 2 for preferred ratings.

5.3 Rated breaking capacity

See standard sheets.

6 Marking

In addition to the requirements of Clause **6** in IEC 60127-1, the following criteria are to be observed:

6.1 In addition to the requirements of **6.1** in IEC 60127-1, each UMF shall be marked with the following:

e) for fuse-links rated at 250 V, a symbol denoting the breaking capacity. This symbol shall be placed between the marking for rated current and the marking for rated voltage.

These symbols are:

H: denoting high-breaking capacity;

I: denoting intermediate-breaking capacity;

L: denoting low-breaking capacity.

f) the distinctive symbol shown in Figure 1;

g) the letters a.c. before the voltage for devices designed solely for alternating current application.

6.4 Colour coding for Universal Modular Fuse-links

Under consideration.

6.5 For fuse-links rated at 125 V or less, where marking is impractical due to space limitations, the relevant information should appear on the smallest pack size, and in the manufacturer's technical literature.

7 General notes on tests

In addition to the requirements of Clause **7** in IEC 60127-1, the following criteria are to be observed:

7.2 Type tests

7.2.1 [A2] For testing of individual fuse ratings according to standard sheets 1 and 2 see Table 1. For fuse-links, designed and rated both for a.c. and d.c., the number of fuse-links required is 63. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are 9 spares.

For the maximum ampere rating of a homogeneous series according to standard sheets 1 and 2 see Table 3. For fuse-links, designed and rated both for a.c. and d.c., the number of fuse-links required is 53. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are 19 spares.

For the minimum ampere rating of a homogeneous series according to standard sheets 1 and 2 see Table 4. For fuse-links, designed and rated both for a.c. and d.c., the number of fuse-links required is 38. For fuse-links designed only for a.c., the number of fuse-links required is 33. There are 16 spares. [/A2]

7.3 Fuse-bases for tests

7.3.1 *General requirements*

Fuse-links shall be mounted upon the appropriate test board (see [A1] **7.3.2** or **7.3.3** [/A1] as appropriate) by soldering.

This test board shall then be mounted on the test fuse-base (Figure 4). The test board shall be made of epoxide woven glass fabric copper-clad laminated sheet, as defined in IEC 60249-2-5.

— The nominal sheet thickness shall be 1,6 mm.

— The nominal thickness of copper layer shall be 0,035 mm.

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-links 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-links under test. 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.

7.3.2 *Through-hole fuse-links (standard sheet 1)*

For electrical tests upon fuse-links covered by standard sheet 1, the fuse-link shall be mounted on the test board shown in Figure 2 in the pair of holes appropriate to the spacing of the terminations.

7.3.3 *Surface mount fuse-links (standard sheet 2)*

For electrical tests upon fuse-links covered by standard sheet 2, the fuse-link shall be mounted on the test board shown in Figure 3. Mounting shall be carried out as specified in **8.8**.

8 Dimensions and construction

8.1 Dimensions

The dimensions of the UMFs shall comply with the relevant standard sheets.

Compliance is checked by measurement of length, width and height.

For fuse-links to standard sheet 1, the termination spacing is checked. 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.

8.2 Construction

The fuse element shall be completely enclosed.

The UMF shall withstand the heat and chemical exposure of a printed circuit board or other substrate assembly operations with its performance unimpaired.

Compliance is checked by the resistance to soldering heat test as specified in **8.7**.

8.3 Terminations

8.3.1 *Through-hole fuse-links*

Terminations shall be firmly attached so that it is not possible to remove them without damaging the UMF.

Compliance is checked by carrying out the following test:

The samples are preconditioned by immersion in water for 24 h at a temperature between 15 °C and 35 °C.

The tests are carried out in accordance with IEC 60068-2-21.

The following tests shall be applied:

— tensile test Ua_1, applied force 10 N;

— thrust test Ua_2, applied force 2 N;

— bending test Ub, applied force 5 N, number of bends shall be one.

The sample size is two for each test. After testing, the terminations shall remain firmly attached. The voltage drop shall be measured in accordance with **9.1**, and shall not exceed the maximum allowed in Table 2. Bending test Ub is omitted if the terminations are less than 5 mm.

8.3.2 *Surface mount fuse-links*

The fuse-links shall be mounted on the test board shown in Figure 3. The test board, with the fuse-links on the underside, shall be placed in the bending jig as shown in Figure 5. The board shall then be bent by 1 mm at a rate of 1 mm/s. The test board shall be allowed to recover from the bent position, and then be removed from the test jig.

After the test, the terminations shall remain firmly attached, and voltage drop shall be measured in accordance with **9.1**, and shall not exceed the maximum allowed in Table 2.

8.4 Alignment and configuration of terminations

The termination configuration and spacing shall be as specified in the standard sheets.

NOTE 1 Through-hole fuse-links

For through-hole mounting of UMFs (standard sheet 1), the dimensions shown on the standard sheets are such as to permit installation on printed circuit boards having a grid system of holes located on centres of distance e = 2,5 mm. Attention is drawn to the fact that in some parts of the world, the value e = 2,54 mm is still in use by printed circuit designers.

Electrical and electronic circuit designers are advised to apply the requirements of IEC 60326-3.

NOTE 2 Surface mount fuse-links

For surface mounting of UMFs, electrical and electronic circuit designers are advised to design substrate land areas to receive UMFs with due consideration for achieving the maximum area of contact in the application, taking into account the tolerance applied to mechanical placing of the component, and the dimensions and tolerances for terminals in this standard.

8.5 Soldered joints (see IEC 60127-1)

8.6 Solderability of terminations

8.6.1 ***Through-hole fuse-links***

The fuse-links shall be subjected to Test Ta of IEC 60068-2-20, using Method 1, with the following conditions:

Ageing:	None (as received)
Immersion conditions:	235 °C ± 5 °C, 2 s ± 0,5 s
Depth of immersion:	2,0 mm ± 0,5 mm (from seating plane)
Flux type:	Non-activated
Screen:	A screen should be used.

After the test, the dipped surface shall be covered with a smooth and bright solder coating, with no more than small amounts of scattered imperfections such as pin-holes or unwetted or dewetted areas. These imperfections shall not be concentrated in one area. 10 x magnification should be used.

8.6.2 ***Surface mount fuse-links***

The fuse-links shall be subjected to Test Td of IEC 60068-2-58, with the following conditions:

Ageing:	None (as received)
Immersion conditions:	235 °C ± 5 °C, 2 s ± 0,2 s for wave soldering application 215 °C ± 3 °C, 3 s ± 0,3 s for reflow soldering application
Depth of immersion:	The terminations shall be immersed successively in such a way that the entire metal surfaces are covered by the solder bath
Flux type:	Non-activated

After the test, the contact areas shall be covered with a smooth and bright solder coating, with no more than small amounts of scattered imperfections such as pin-holes or unwetted or de-wetted areas. These imperfections shall not be concentrated in one area. 10 x magnification should be used.

8.7 Resistance to soldering heat

8.7.1 ***Through-hole fuse-links***

The fuse-links shall be subjected to Test Tb of IEC 60068-2-20, Method 1A, with the following conditions:

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	2,0 mm ± 0,5 mm (from seating plane)
Flux type:	Activated
Screen:	A screen should be used.

After the test, the fuse-link shall not be cracked. Marking shall be readable, and colour coding, if used, shall not have changed colour.

The voltage drop is measured as specified in **9.1**, and shall not exceed the maximum values specified in Table 2.

8.7.2 ***Surface mount fuse-links***

The fuse-links shall be subjected to Test Td of IEC 60068-2-58.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	10 mm
Flux type:	Activated

After the test, the fuse-link shall not be cracked. Marking shall be readable, and colour coding, if used, shall not have changed colour.

The voltage drop is measured as specified in **9.1**, and shall not exceed the maximum values specified in Table 2.

NOTE For some designs, it may be necessary to use a less severe test. This should be in accordance with the manufacturer's recommendations, and should be recorded in the test report.

8.8 Mounting for surface mount fuse-links

The surface mount fuse-links are mounted on test boards as shown in Figure 3. [A1] See Annex A for guidance. [A1]

These mounted test boards shall be used for the electrical tests listed in [A1] Table 1 [A1].

8.8.1 [A1] *Text deleted* [A1]

8.8.2 [A1] *Text deleted* [A1]

9 Electrical requirements

9.1 Voltage drop

For measurement of voltage drop, see IEC 60127-1.

[A2] The voltage drop shall be measured at the points marked *U* in Figure 2 for through-hole fuse-links and in Figure 3 for surface mount fuse-links, using the test fuse-base shown in Figure 4 (see **7.3**). [A2]

Values given in Table 2 apply.

9.2 Time/current characteristics

9.2.1 *Time/current characteristics at normal ambient temperature*

At 1,25 times rated current not less than 1 h (after completing endurance test).

At 2 times rated current not exceeding 2 min.

[A1] *Pre-arcing time* [A1] *at 10 times rated current according to the following types*:

Type FF: less than 0,001 s
Type F: from 0,001 s to 0,01 s
Type T: greater than 0,01 s to 0,1 s
Type TT: greater than 0,100 s to 1,00 s

9.2.2 *Test at elevated temperature*

None specified.

9.2.3 ***Test procedure*** (see IEC 60127-1)

9.2.4 ***Presentation of results*** (see IEC 60127-1)

9.3 Breaking capacity

9.3.1 In addition to the requirements of **9.3.1** of IEC 60127-1, the following shall be observed:

In the case of fuse-links in which any component is organic (such as with a moulded body), the recovery voltage shall be maintained for 5 min after the fuse has operated.

Typical test circuits for a.c. and d.c. are given in Figure 6a and Figure 6b.

For low-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be greater than 0,95. To obtain this result, the circuit current shall be adjusted by the use of resistors of negligible inductance.

For intermediate-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be between 0,8 and 0,9.

For high-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be between 0,7 and 0,8.

The time constant of the d.c. test circuit for low-breaking capacity fuse-links shall be less than 1 ms. To obtain this result, the circuit current shall be adjusted by the use of resistors of negligible inductance; additionally, the total inductance of the test circuit and source of supply shall be less than 1 mH.

The time constant for the d.c. test circuit for intermediate-breaking capacity fuses shall be 1,5 ms $^{+10}_{0}$ % and for high-breaking capacity it shall be 2,3 ms $^{+10}_{0}$ %.

Where difficulties in testing arise, these limits may be exceeded with the permission of the manufacturer. For tests at lower prospective currents, the inductance of the circuit shall remain constant, and the current shall be adjusted by changing the resistance only.

9.3.2 In addition to the criteria given in **9.3.2** of IEC 60127-1, the UMF shall operate satisfactorily without any of the following phenomena:

— illegibility of marking after test.

— [A1] *Text deleted* [A1]

The following phenomena are neglected:

— black spots or other marks on the fuse-link terminations.

9.3.3 In place of the requirements of IEC 60127-1, the following shall be observed:

After the breaking capacity test, the insulation resistance shall be measured with a d.c. voltage equal to twice the rated voltage of the fuse-link. The resistance shall not be less than 0,1 MΩ.

9.4 Endurance test (see IEC 60127-1)

9.5 Maximum sustained dissipation (see IEC 60127-1)

9.6 Pulse tests

None specified.

9.7 Fuse-link temperature

In place of the test in **9.7** of IEC 60127-1, the following test is performed during the final 5 min of the endurance test at 1,25 I_N:

The temperature rise above ambient temperature shall be measured at the hottest spot found on the surface of the fuse-link, using a fine wire thermocouple (or other measuring methods that do not appreciably affect the temperature). The temperature rise shall not exceed 70 K.

9.8 Operating overvoltage

During the breaking capacity tests, the voltage across the fuse shall be monitored by a suitable oscilloscope and probe system, operated in such a way as to indicate and record the voltage for a time which includes the interval from the moment of closure of the contactor until current through the fuse-link is extinguished to a value of less than 10 mA (a suitable oscilloscope should be capable of recording any overvoltage that persists for 1 μs or longer).

The maximum voltage in the interval shall be recorded. In no case shall it be higher than the value of maximum operating overvoltage given on the standard sheet.

A2

Table 1 — Testing schedule for individual ampere rating

Subclause	Description		Universal modular fuse-link number																			
			1	4	7	10	13	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61
			2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59	62
			3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
9.7	Temperature rise						X	X															
9.5	Maximum sustained dissipation						X	X															
9.4	Endurance test						X	X															
9.2.1	Time/current characteristic	10 I_N												X									
		2 I_N																					X
		1,25 I_N					X	X															
9.3	Breaking capacity																						
	Rated breaking capacity	a.c.								X													
		d.c.									X												
	5 times the rated current	a.c.										X											
		d.c.											X										
	10 times the rated current	a.c.														X							
		d.c.															X						
	50 times the rated current	a.c.																X					
		d.c.																	X				
	250 times the rated current	a.c.																			X		
		d.c.																				X	
9.3.3	Insulation resistance									X	X	X	X			X	X	X	X		X	X	
8.3	Fuse-link terminations		X	X																			
8.5	Soldered joints						X	X						X									X
6.2	Legibility and indelibility of marking						X	X						X									X
8.6	Solderability				X																		
8.7	Resistance to soldering heat					X																	

A total of 63 fuse-links (48 for a.c. use only, omit d.c. breaking capacity samples) of which nine are kept as spares. Samples 1 to 12 are chosen at random.

Samples 13 to 63 (48) are soldered to the appropriate test board and sorted in descending order of voltage drop.

A2

Table 2 — Maximum values of voltage drop and sustained dissipation

Rated current	Maximum voltage drop mV	Maximum sustained dissipation mW
32 mA	Under consideration	Under consideration
50 mA	Under consideration	Under consideration
63 mA	Under consideration	Under consideration
80 mA	Under consideration	Under consideration
100 mA	1 300	[A1] 200
125 mA	1 000	200
160 mA	1 000	240 [A1]
200 mA	1 000	500
250 mA	800	500
315 mA	750	500
400 mA	700	500
500 mA	600	500
630 mA	500	500
800 mA	400	500
1 A	300	500
1,25 A	300	1 000
1,6 A	300	1 000
2 A	300	1 000
2,5 A	300	[A1] 1 200
3,15 A	300	1 500
4 A	300	2 000
5 A	300	2 500 [A1]
6,3 A	300	Under consideration

NOTE 1 The values indicated in the table apply to low-breaking capacity only. Values for intermediate-breaking capacity and high-breaking capacity are under consideration.

NOTE 2 If intermediate rated currents are required, they shall be chosen from the series R20 or R40 according to ISO 3.

A2

Table 3 — Testing schedule for maximum ampere rating of a homogeneous series

Subclause	Description		Fuse-link numbers											
			1-6	7 8 9	10 11 12	13-18	19 20 21	22-26	27-31	32-41	42 43 44	45 46 47	48 49 50	51 52 53
9.7	Temperature rise					X								
9.5	Maximum sustained dissipation					X								
9.4	Endurance test					X								
9.2.1	Time/current characteristics	10 I_N									X			
		2 I_N											X	
		1,25 I_N				X								
9.3	Rated breaking capacity	a.c.						X						
		d.c.							X					
9.3.3	Insulation resistance							X	X					
8.3	Fuse-link terminations		X											
8.5	Soldered joints					X					X		X	
6.2[a]	Legibility and indelibility of marking					X					X		X	
8.6	Solderability			X										
8.7	Resistance to soldering heat				X									

A total of 53 fuse-links (48 for a.c. use only, omit d.c. breaking capacity samples) of which 19 are kept as spares. Samples 1 to 12 are chosen at random.
Samples 13 to 53 (48) are soldered to the test board and sorted in descending order of voltage drop.

[a] This subclause is to be found in IEC 60127-1.

A2

A2

Table 4 — Testing schedule for minimum ampere rating of a homogeneous series

Subclause	Description		Fuse-link numbers in decreasing value of voltage drop							
			1-6	7 8 9	10 11 12	13-17	18-22	23-32	33 34 35	36 37 38
9.4	Endurance test		X							
9.2.1	Time/current characteristics	10 I_N		X						
		2 I_N							X	
9.3	Rated breaking capacity	a.c.				X				
		d.c. (if applicable)					X			
A total of 38 fuse-links (33 for a.c. use only, omit d.c. breaking capacity samples) of which 16 are kept as spares. The samples are soldered to the test board and sorted in descending order of voltage drop.										

A2

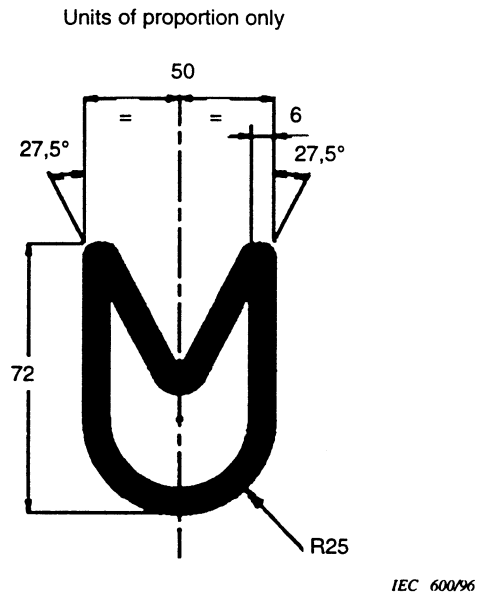
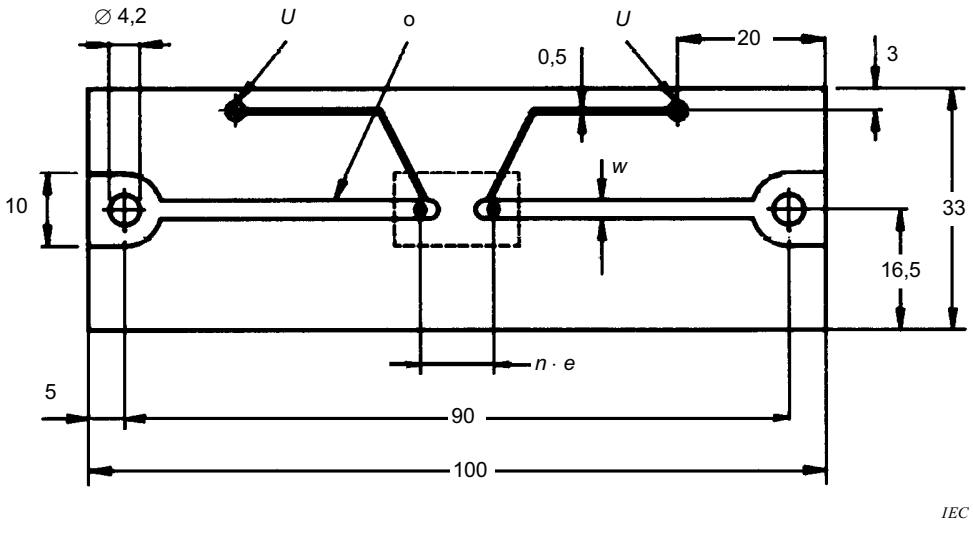


Figure 1 — Unique identifying symbol for UMFs

A1



A1

o = copper layer, 35 µm

U = connection for voltage drop measurement

n = 1, 2, 3, 4 or 5

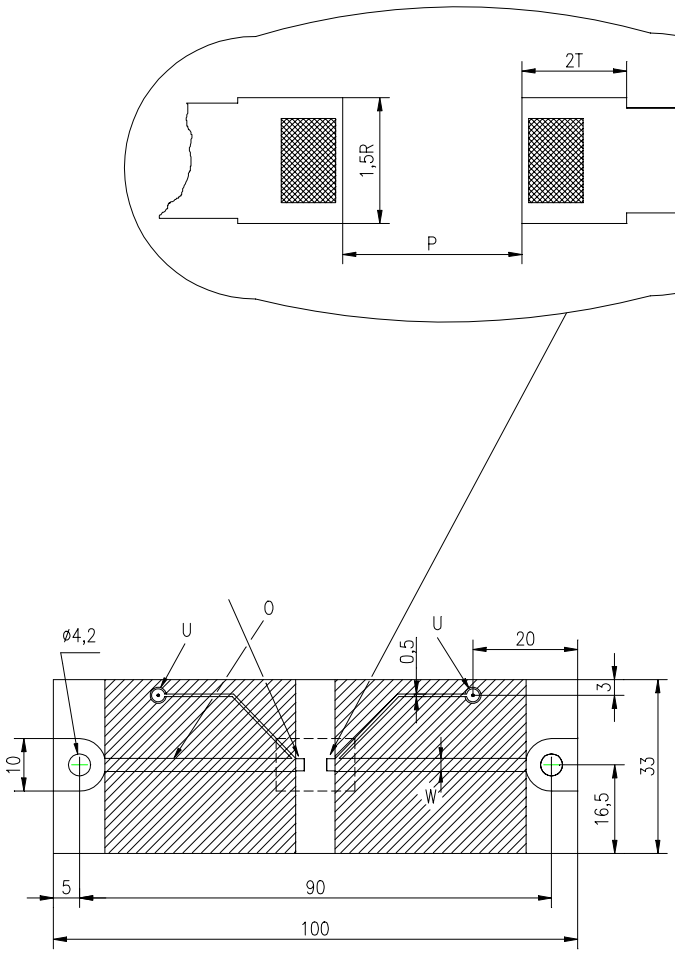
w = 5,0 mm

e = 2,50 mm

NOTE A mechanical device can be used as long as it is demonstrated that the results are the same.

Figure 2 — Test board for through-hole fuse-links

A1



Dimensions in millimetres

O = copper layer, 35 µm

U = connection for voltage drop measurement

W = 5,0 mm. For small devices, it may be necessary to use reduced track widths, representing normal use of these devices. This should be recorded in the test report and in the manufacturer's literature.

P = terminal spacing

R = refer to standard sheet 2, page 1

T = refer to standard sheet 2, page 1

NOTE 1 Solder resist to be applied in hatched areas.

NOTE 2 The land areas should be suitably prepared for soldering.

NOTE 3 A mechanical device can be used as long as it is demonstrated that the results are the same (not applicable to **8.7**).

A1

Figure 3 — Test board for surface mount fuse-links

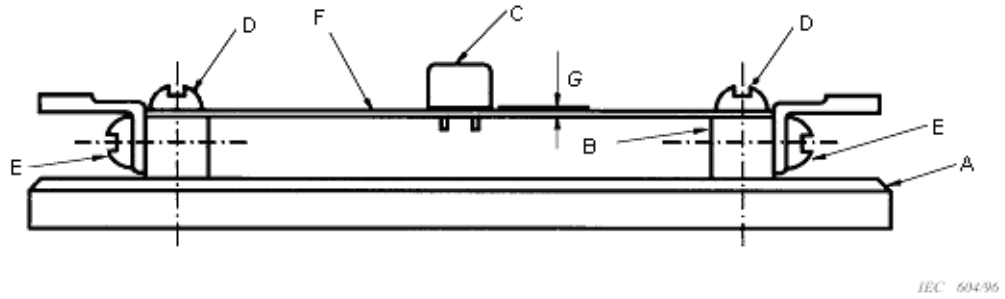


Figure 4a — Through-hole fuse-link (printed circuit track underneath)

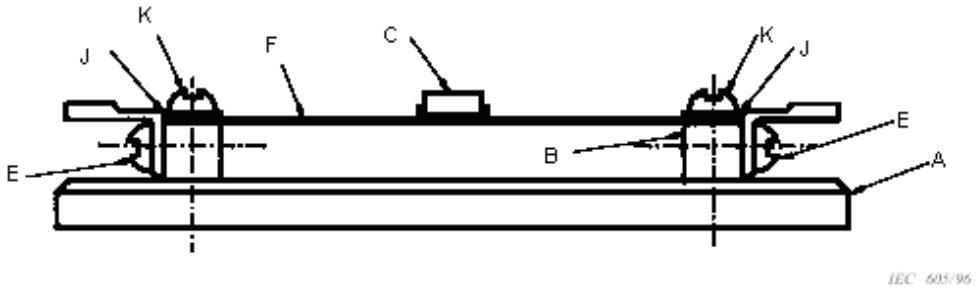
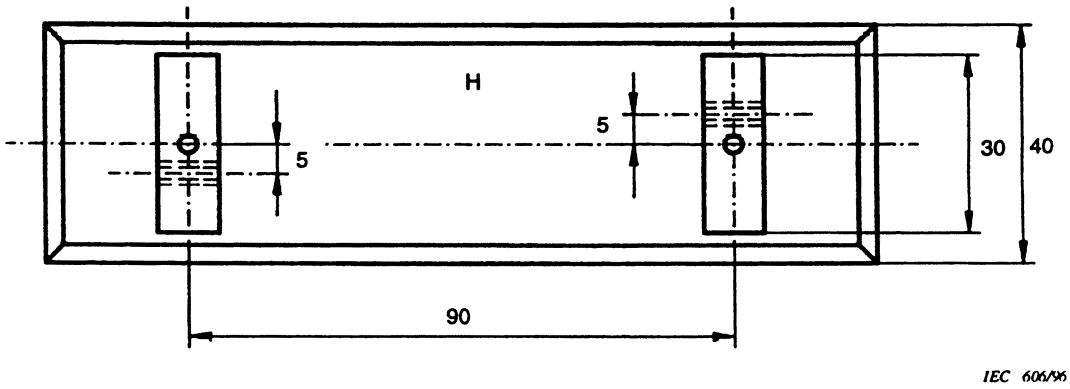


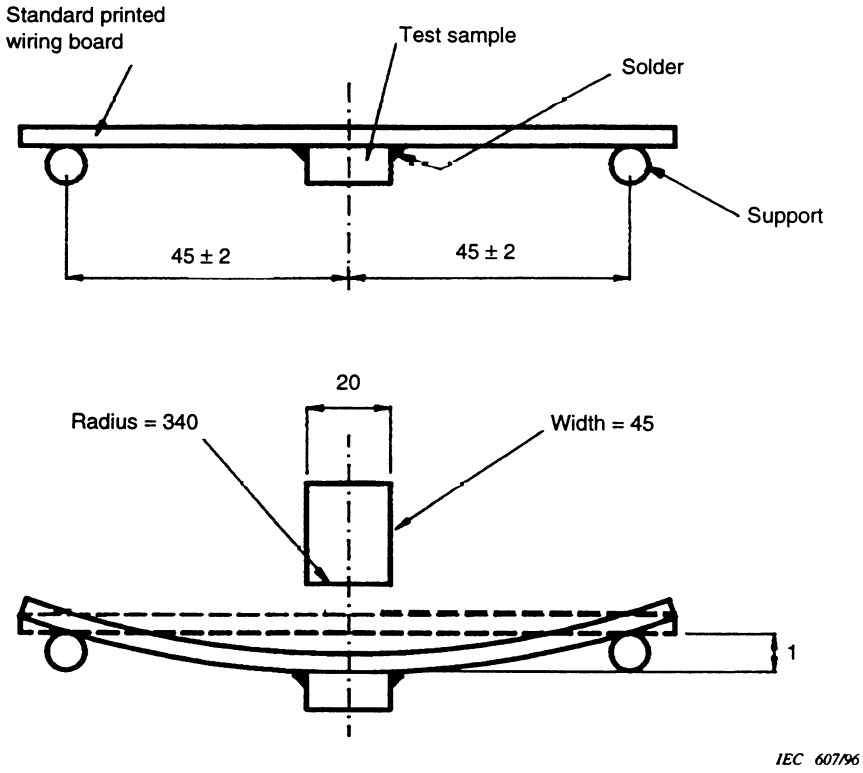
Figure 4b — Surface mount fuse-link (printed circuit track on top)



Dimensions in millimetres

A	=	base of low heat conducting material, thickness 10 mm	F	=	printed circuit board (see Figure 2 and Figure 3)
B	=	brass electrodes 10 mm^2	G	=	space between UMF body and board equals (0,5 ± 0,25) mm
C	=	UMF soldered in place	H	=	top view of base with 10 mm^2 brass electrodes
D	=	fixing screws	J	=	silver-plated brass washer (two places)
E	=	contact screws holder solder terminal	K	=	silver-plated brass screw to make contact with the conducting surface on top of the printed circuit board (two places)

Figure 4 — Test fuse base



Dimensions in millimetres

Figure 5 — Bending jig for surface mount fuse-links

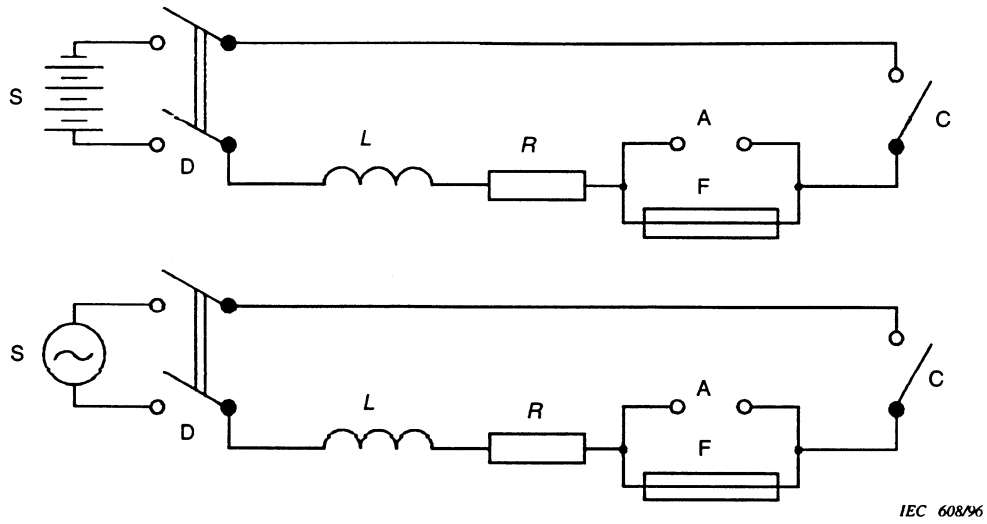


Figure 6a – Typical test circuit for breaking capacity tests for high-breaking capacity and intermediate-breaking capacity fuse-links

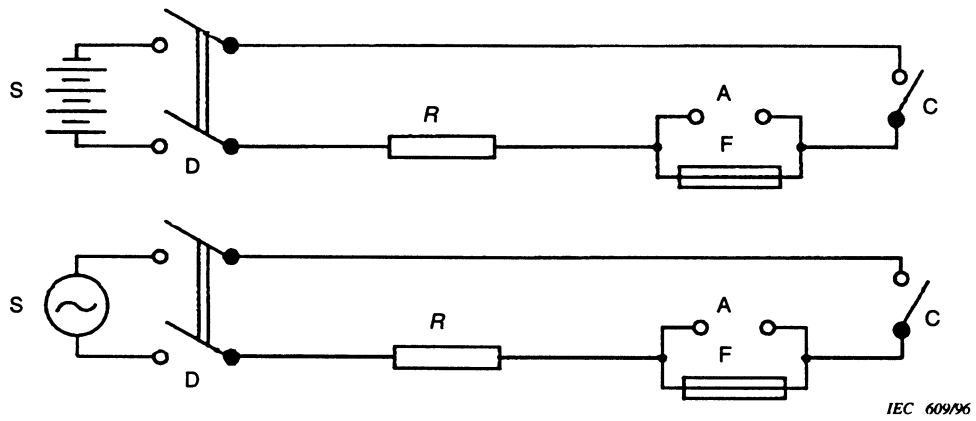


Figure 6b – Typical test circuit for breaking capacity tests for low-breaking capacity fuse-links

A	=	removable link used for calibration	S	=	source of supply, impedance less than 10 % of the total impedance of the circuit
C	=	contactor that makes the circuit	L	=	air-cored inductance
D	=	switch to disconnect the source of supply	R	=	series resistor, adjusted to obtain correct prospective current
F	=	fuse under test			

Figure 6 — Test circuit for breaking capacity tests

A1 Annex A (informative)
Mounting for surface mount fuse-links

The test fuse-links may be submitted to the test house already soldered to the test boards; however, some tests require fuses to be loose, e.g. "solderability" and "resistance to soldering heat" tests, while through-hole type "bend testing" has to be carried out before soldering. While it is considered acceptable for the test house to be able to solder the through-hole types to the test board for subsequent measurement of voltage drop, there is a difficulty with soldering the SMD fuse-links that have been subjected to resistance to soldering heat onto a test board so that the voltage drop can be tested.

The following is taken from **8.3.3** "Mounting method for pull-off, push-off and shear" of IEC 60068-2-21:

When the details of mounting are not prescribed by the relevant specification, the method of mounting shall be as follows:

a) Choice of solder paste

1) A solder paste, made from solder as specified in Annex B of IEC 60068-2-20 (see Note 1 below) or 63 % tin and 37 % lead may be used and mildly activated flux (see Note 2 below) as specified in Annex C of IEC 60068-2-20. Silver (2 weight % or more) can be added in accordance with the relevant specification. The contamination limits of the solder shall comply with ISO 9453.

NOTE 1 The solder has the following composition: tin 59 % to 61%; antimony 0,5 % maximum; copper 0,1 % maximum; arsenic 0,05 % maximum; iron 0,02 % maximum; remainder lead.

NOTE 2 The activated flux has the following composition: colophony 25 g; 2 propanol (iso-propanol) or ethyl alcohol 75 g; diethylammonium chloride 0,39 g.

2) The viscosity of the solder paste shall be in accordance with the relevant specification.

3) The particle mesh size of the solder paste shall be 160 or finer.

4) The footprints shall be covered with solder deposit. The thickness of the solder deposit shall be between 100 µm and 250 µm; the thickness shall be specified in the relevant specification.

b) Preparation of the specimen

1) The specimen surface to be tested shall be in the "as received" condition and shall not be touched by fingers or otherwise contaminated.

2) The specimen, shall not be cleaned prior to test. If required by the relevant specification, the specimen may be immersed in an organic solvent at room temperature for preconditioning.

3) Preconditioning

Specimens, which need preconditioning, shall be pre-treated in accordance with the relevant specification.

c) Positioning of the specimen

The specimen shall be placed symmetrically on its footprint.

d) Preheating

The substrate with the mounted specimen shall be preheated for 60 s to 120 s at 150 °C ± 10 °C, unless otherwise specified.

e) Soldering

1) Soldering shall be performed immediately after preheating.

2) As long as the soldering conditions do not lead to a thermal load, which exceeds the SMD specification, any kind of reflow oven or vapour phase soldering oven may be used.

3) The solder temperature shall be between 215 °C and 235 °C and the time at the peak temperature shall not exceed 10 s. During soldering the total time above 185 °C shall be 45 s minimum.

4) Care shall be taken that complete wetting is achieved.

5) The soldered area of the substrate shall be cleaned using 2-propanol (iso-propanol) or water to remove surplus flux. If necessary, the details of the cleaning method shall be specified in the relevant specification.

6) The solder fillet shall comply with the minimum requirements for the relevant joint given in IEC 61191-2. A1

Bibliography

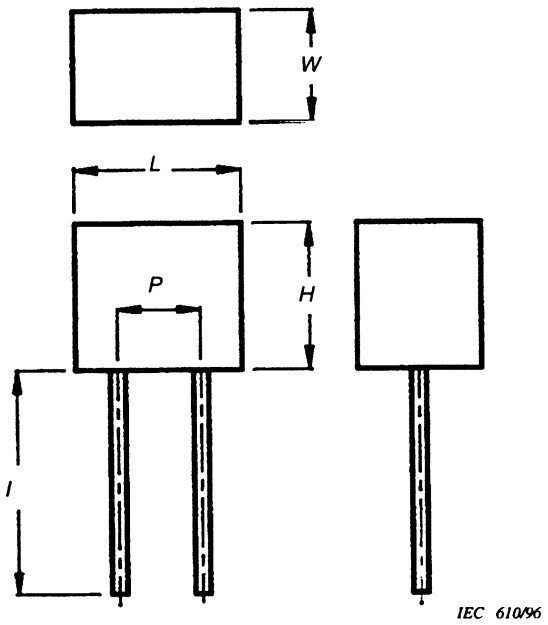
IEC 61191-2:1998, *Printed board assemblies — Part 2: Sectional specification — Requirements for surface mount soldered assemblies.*

ISO 9453:1990, *Soft solder alloys — Chemical compositions and forms.*

Section 2. Standard sheets

	Through-hole fuse-links	Standard sheet 1 Page 1

Dimensions



Rated voltage V	Terminal spacing *P* mm	Maximum dimensions mm		
		W (width)	*H* (height)	*L* (length)
32	2,5 ± 0,1			8
63	2,5 ± 0,1			8
125	5 ± 0,1			10,5
250 (low-breaking capacity)	7,5 ± 0,15	7,5	10	12,5
250 (intermediate-breaking capacity)	10 ± 0,15			15,0
250 (high-breaking capacity)	12,5 ± 0,15			18

1) The termination must go through a hole 1 mm diameter.
The geometry of the cross-section is optional.

2) Any shape is allowed, as long as the terminations are within tolerance limits for *P* and emerge from the same side of the body.

3) The length "*l*" of the terminations may be adapted for a lead taping type of packaging.

Maximum voltage drop and maximum sustained dissipation: see Table 2.

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	Through-hole fuse-links	Standard sheet 1 Page 2

Marking

Fuse-links shall be marked according to the requirements of Clause **6**.

Pre-arcing time/current characteristic

The pre-arcing time shall lie within the gates appropriate to the characteristic symbol as specified in **9.2.1**.

Breaking capacity

Fuse-links shall be tested as appropriate to their a.c. or a.c./d.c. rating at rated voltage as specified in **9.3**.

Rated voltage V	Test current	Overvoltage** V
32	35 A or 10 I_N*	330
63	35 A or 10 I_N*	500
125	50 A or 10 I_N*	800
250 (low-breaking capacity)	100 A	1 500
250 (intermediate-breaking capacity)	500 A	2 500
250 (high-breaking capacity)	1 500 A	4 000

* Whichever is greater.
** These values are maximum values to comply with IEC 60664-1.

Endurance test

100 cycles at 1,05 times the rated current according to **9.4** of IEC 60127-1, followed by 1 h at 1,25 times the rated current.

Maximum sustained dissipation

The maximum sustained dissipation shall be measured at 1,25 times the rated current during the last 10 minutes of the endurance test and shall not exceed the values specified in Table 2.

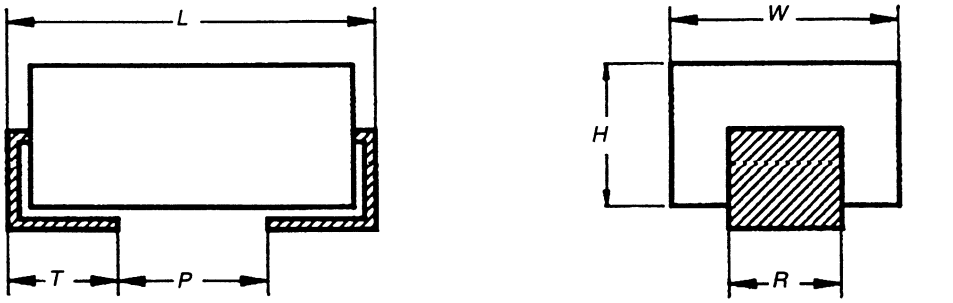
Terminations

Terminations shall be tested in accordance with **8.3.1**.
If the length of the terminations does not exceed 5 mm, the bend test of Ub of **8.3.1** is omitted.

127-4-IEC

	Surface mount fuse-links	**Standard sheet 2** **Page 1**

Dimensions

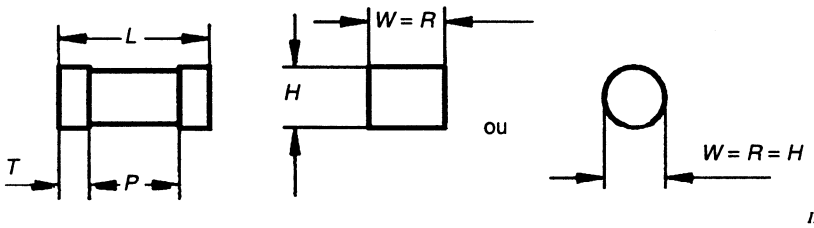


IEC 611/96

Rated voltage V	**Minimum terminal spacing** *P* mm	**Maximum dimensions** mm		
		W (width)	*H* (height)	*L* (length)
32	1,5			6
63	2	6	5	8
125	2,5			10
250 (low-breaking capacity)	4			12,5
250 (intermediate-breaking capacity)	4	Under consideration	Under consideration	15,8
250 (high-breaking capacity)	4			18

1) Any shape is allowed, the point at which the terminations protrude from the body is optional, and the termination may vary.

Some alternative shapes are shown below:



IEC 612/96

2) Dimensions *T* and *R* are not specified, but are required to calculate the land sizes for the test board in Figure 3.

3) The clearance from the underside of the fuse-link to the surface of the printed circuit board shall not be less than 0,05 mm and shall not exceed 0,3 mm.

Maximum voltage drop and maximum sustained dissipation: see Table 2.

127-4-IEC

	Surface mount fuse-links	Standard sheet 2 Page 2

Marking

Fuse-links shall be marked according to the requirements of Clause **6**.

Pre-arcing time/current characteristic

The pre-arcing time shall lie within the gates appropriate to the characteristic symbol as specified in **9.2.1**.

Breaking capacity

Fuse-links shall be tested as appropriate to their a.c. or a.c./d.c. rating at rated voltage as specified in **9.3**.

Rated voltage V	Test current	Overvoltage** V
32	35 A or 10 I_N*	330
63	35 A or 10 I_N*	500
125	50 A or 10 I_N*	800
250 (low-breaking capacity)	100 A	1 500
250 (intermediate-breaking capacity)	500 A	2 500
250 (high-breaking capacity)	1 500 A	4 000

* Whichever is greater.
** These values are maximum values to comply with IEC 60664-1.

Endurance test

100 cycles at 1,05 times the rated current according to **9.4** of IEC 60127-1, followed by 1 h at 1,25 times the rated current.

Maximum sustained dissipation

The maximum sustained dissipation shall be measured at 1,25 times the rated current during the last 10 min of the endurance test and shall not exceed the values specified in Table 2.

Terminations

Terminations shall be tested in accordance with **8.3.2**.

127-4-IEC

Annex ZA (normative)
Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

Publication	Year	Title	EN/HD	Year
IEC 60068-2-20	1979	*Basic environmental testing procedures — Part 2: Tests — Test T: Soldering*	HD 323.2.20 S3[1)]	1988
IEC 60068-2-21	1983	*Part 2: Tests — Test U: Robustness of terminations and integral mounting devices*	HD 323.2.21 S3[2)]	1988
IEC 60068-2-58	1989	*Part 2: Tests — Test Td: Solderability, resistance to dissolution of metallization and to soldering heat of Surface Mounting Devices (SMD)*	HD 323.2.58 S1	1991
IEC 60115-1	1982	*Fixed resistors for use in electronic equipment — Part 1: Generic specification*	—	—
A2	1987		—	—
A3	1989		—	—
A4	1993		—	—
IEC 60115-8	1989	*Part 8: Sectional specification: Fixed chip resistors*	—	—
IEC 60127-1	1988	*Miniature fuses — Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*	EN 60127-1[3)]	1991
IEC 60194	1988	*Terms and definitions for printed circuits*	HD 142 S3	1991
IEC 60249-2-5	1987	*Base materials for printed circuits — Part 2: Specifications — Specification No. 5: Epoxide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)*	EN 60249-2-5[4)] + corr. March	1994 1994
IEC 60326-3	1991	*Printed boards — Part 3: Design and use of printed boards*	—	—
IEC 60664-1 (mod)	1992	*Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*	HD 625.1 S1	1996
ISO 3	1973	*Preferred numbers — Series of preferred numbers*	—	—

[1)] HD 323.2.20 S3 includes A2:1987 to IEC 60068-2-20.
[2)] HD 323.2.21 S3 includes A1:1985 to IEC 60068-2-21.
[3)] EN 60127-1 includes the corrigendum March 1990 to IEC 60127-1.
[4)] EN 60249-2-5 includes A2:1992 to IEC 60249-2-5.

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