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IS/IEC 60127-2 (2003): Miniature fuses, Part 2: Cartridge fuse-links [ETD 39: Fuses]



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भाग 2 कार्ट्रिज फ्यूज-लिंक

( पहला पुनरीक्षण )

*Indian Standard*

**MINIATURE FUSES**

**PART 2 CARTRIDGE FUSE-LINKS**

*( First Revision )*

ICS 29.120.50

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

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Price Group 10



## NATIONAL FOREWORD

This Indian Standard (Part 2) (First Revision) which is identical with IEC 60127-2 : 2003 'Miniature fuse Part 2: Cartridge fuse-links' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Fuses Sectional Committee and approved by the Electrotechnical Division Council.

This standard is the first revision of IS/IEC 127-2 : 1989 'Miniature fuses — Part 2: Cartridge fuse-links Specification'. The revision has been undertaken to align it with the latest IEC Standard.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard with deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- Wherever the words 'International Standard' appear referring to this standard, they should be read 'Indian Standard'.
- Comma (,) has been used as a decimal marker in the International Standard while in Indian Standard the current practice is to use a point (.) as the decimal marker.

This standard should be read in conjunction with IS/IEC 60127-1.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
IEC 60068-2-20 : 1979 Basic environmental testing procedures — Part 2: Tests — Test T: Soldering	IS 9000 (Part XVIII/Sec 1 to 3) : 1981 Basic environmental testing procedures for electronic and electrical items: Part XVIII Solderability test	Technically Equivalent
IEC 60068-2-21 : 1999 Environmental testing — Part 2-21: Tests — Test U: Robustness of terminations and integral mounting devices	IS 9000 (Part 19/Sec 1 to 5) : 1986 Basic environmental testing procedures for electronic and electrical items: Part 19 Test U: Robustness of terminations and integral mounting devices ( <i>first revision</i> )	do
IEC 60127-1 : 1988 <sup>1)</sup> Miniature fuses — Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links	IS/IEC 60127-1 : 2006 Miniature fuses: Part 1 Definitions for miniature fuses and general requirements for miniature fuse-links ( <i>first revision</i> )	do
ISO 3 : 1973 Preferred numbers — Series of preferred numbers	IS 1076 (Part 1) : 1985 Preferred numbers: Part 1 Series of preferred numbers ( <i>second revision</i> )	Identical

The technical committee has reviewed the provisions of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

<sup>1)</sup> Since revised in 2006 and adopted as IS/IEC 60127-1 : 2006.

(Continued on third cover)

# Indian Standard

## MINIATURE FUSES

### PART 2 CARTRIDGE FUSE-LINKS

( *First Revision* )

#### 1 Scope and object

This part of IEC 60127 relates to special requirements applicable to cartridge fuse-links for miniature fuses with dimensions measuring 5 mm × 20 mm and 6,3 mm × 32 mm for the protection of electric appliances, electronic equipment and component parts thereof, normally intended for use indoors.

It does not apply to fuses for appliances intended to be used under special conditions, such as in corrosive or explosive atmospheres.

This standard applies in addition to the requirements of Part 1.

The object of this standard is to define special and additional test methods for cartridge fuse-links applying in addition to the requirements of Part 1.

#### 2 Normative references

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

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

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60127-1:1988, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*<sup>1</sup>  
Amendment 1 (1999)

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)*

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

#### 3 Definitions

For the purposes of this part of IEC 60127, the definitions contained in Clause 3 of Part 1 apply.

<sup>1</sup> There is a consolidated edition 1.1 (1999) including IEC 60127-1 (1988) and Amendment 1 (1999).

#### 4 General requirements

Clause 4 of Part 1 applies.

#### 5 Standard ratings

Clause 5 of Part 1 applies:

#### 6 Marking

In addition to the requirements of Clause 6, Part 1, the following criterion shall be observed:

6.1 In addition to the requirements of 6.1 in Part 1 each fuse-link shall be marked with:

- e) A symbol denoting the rated breaking capacity. This symbol shall be placed between the marking for the rated current and the marking for the rated voltage.

These symbols are

H denoting high breaking capacity,

L denoting low breaking capacity,

E denoting enhanced breaking capacity.

EXAMPLES of marking:

T	3	1	5	L	2	5	0	V
---	---	---	---	---	---	---	---	---

		F	4	H	2	5	0	V
--	--	---	---	---	---	---	---	---

T	3	1	5	E	2	5	0	V
---	---	---	---	---	---	---	---	---

6.4 The values for "d" and "s" shall be  $0,8 \text{ mm} \pm 0,2 \text{ mm}$ .

#### 7 General notes on tests

In addition to the requirements of Clause 7 in Part 1, the following criteria are to be observed:

7.2.1 For testing individual fuse ratings, the number of fuse-links required is 48, of which 12 are kept as spares. The testing schedule is shown in Table 1.

For the maximum ampere rating of a homogeneous series, the number of fuse-links required is 48, of which 22 are kept as spares. The testing schedule is shown in Table 2.

For the minimum ampere rating of a homogeneous series the number of fuse-links required is 33, of which 16 are kept as spares. The testing schedule is shown in Table 3.

### 7.3.1 Fuse-bases for tests

For tests that require a fuse-base for mounting the fuse-links, bases according to Figures 1, 2 or 3, shall be used as appropriate.

The contact resistance between each contact and a silvered brass piece having the same nominal dimensions and shape as the fuse-link to be tested shall not exceed 3 mΩ and is measured under the following conditions:

- a) in order to prevent the breakdown of thin insulating layers on the contacts, the e.m.f. of the circuit shall not exceed 20 mV (d.c. or a.c. peak);
- b) in order to prevent undue heating of the contacts, the current flowing shall not exceed 1 A.

Metal parts of the fuse-base, except the spring and connections, shall be made of brass. Brass parts of the fuse-base and of the gauge for measuring contact resistance shall have a copper content of between 58 % and 70 %. Contacts shall be silver-plated.

For fuse-links with rated currents up to and including 6,3 A, a fuse-base according to Figure 1 shall be used. The contact force shall be between 4 N and 6 N. The flexible lead and terminal wires shall be of copper and shall have a cross-sectional area of 1 mm<sup>2</sup>; the length of each of the terminal wires being approximately 500 mm.

For fuse-links with rated currents exceeding 6,3 A, a fuse-base according to Figure 2 shall be used. The contact force shall be between 8 N and 12 N. The flexible lead and terminal wires shall be of copper and shall have a cross-sectional area of 6 mm<sup>2</sup>; the length of each of the terminal wires being approximately 500 mm.

For breaking capacity tests, a fuse-base according to Figure 3, with the same contact force and conductor cross-sectional area as for the base in Figure 2, shall be used.

## 8 Dimensions and construction

In addition to the requirements of Clause 8 in Part 1, the following criteria and tests shall be observed:

### 8.2 Construction

Where a "non-transparent" fuse-link is specified, a transparent case (body) may be used provided that there is an opaque filler.

Compliance is checked by inspection.

This standard is based on the assumption that the case (body) is made of glass, ceramic or similar non-combustible material.

For other materials, additional tests may be necessary.

### 8.3 Terminations

Fuse-links shall have at each end a metallic cap of cylindrical form.

The outer ends of the cylindrical caps shall be substantially flat and at right angles to the axis.

The end caps shall be firmly attached so that it is not possible to remove them without damaging the fuse-link.

Compliance is checked by inspection and by the following test:

The samples are immersed in water for 24 h at a temperature of between 15 °C and 35 °C. After removal from the water, and axial pull steadily increasing to 5 N is applied to each cap for 1 min.

The caps shall remain firmly attached.

A suitable test apparatus for this purpose is given in Figure 7 and shall be used in cases of dispute. By using this apparatus, the test can be performed without distorting the end caps.

#### **8.4 Alignment and configuration of terminations**

The end caps and the body of the fuse-link shall be in reasonable alignment.

Compliance is checked by means of the gauge shown in Figure 4.

The entire length of the fuse-link shall pass through the gauge by the fuse-link's own weight.

### **9 Electrical requirements**

In addition to the requirements of Clause 9 in Part 1, the following criteria and tests are to be observed:

#### **9.3 Breaking capacity**

**9.3.1** In addition to the requirements of 9.3.1 in Part 1, the following shall be observed:

AC shall be used for this test.

A typical test circuit for the rated high-breaking capacity test is given in Figure 5, and for the rated low-breaking capacity test, a typical test circuit is given in Figure 6. A test base according to Figure 3 shall be used.

The power factor of the test circuit at rated high-breaking capacity shall be between 0,7 and 0,8. For tests at lower prospective currents, the inductance in the circuit shall remain constant and the current shall be adjusted by changing only the resistance.

**9.3.2** In addition to the criteria of failure prescribed in Part 1, in each of the tests the fuse-link shall operate satisfactorily without any of the following phenomena:

- fusing together of the contacts;
- illegibility of marking after test;
- piercing of the external surfaces of the end caps, visible to the naked eye.

The following phenomena are neglected:

- black spots on the end caps;
- small deformation of the end caps;
- cracking of the fuse-link.

Table 1 – Testing schedule for individual ampere ratings

Sub-clause	Description	Fuse-link no.															
		1-6	7 9 11	8 10 13	12 14 15	16 17 18	19 20 21	22 24 26	23 25 27	28 29 30	31 32 33	34 36 38	35 37 39	40 41 42	43 44 45	46 47 48	
9.4 <sup>a</sup>	Endurance test	X															
9.2.2 <sup>a</sup>	Test at elevated temperature <sup>b</sup>					X											
9.2.1 <sup>a</sup>	Time/current characteristics	10 $I_N$	X														
		4 $I_N$						X									
		2,75 $I_N$										X					
		2,0 $I_N$ or 2,1 $I_N$														X	
9.3	Breaking capacity test: Rated breaking capacity				X												
	5 times the rated current						X										
	10 times the rated current								X								
	50 times the rated current									X							
	250 times the rated current													X			
8.3	Terminations (end cap test)		X					X			X				X		
8.5 <sup>a</sup>	Soldered joints	X	X			X		X			X				X		
6.2 <sup>a</sup>	Legibility and indelibility of marking		X					X			X				X		
<sup>a</sup> These subclauses are to be found in Part 1.																	
<sup>b</sup> Applicable only when specified on the standard sheet.																	



Table 2 – Testing schedule for maximum ampere rating of a homogeneous series

Sub-clause	Description	Fuse-link numbers in decreasing value of voltage drop											
		1-6	7 8 9	10 11 12	13-17	18-27	28 29 30	31 32 33	34 35 36	37 38 39	40 41 42	43 44 45	46 47 48
9.4 <sup>a</sup>	Endurance test	X											
9.2.2 <sup>a</sup>	Test at elevated temperature <sup>b</sup>						X						
9.2.1 <sup>a</sup>	Time/current characteristics												
	10 $I_N$		X										
	4 $I_N$							X					
	2,75 $I_N$									X			
	2,0 $I_N$ or 2,1 $I_N$											X	
9.3	Rated breaking capacity				X								
8.3	Terminations (end cap test)		X					X		X		X	
8.5 <sup>a</sup>	Soldered joints	X	X				X	X		X		X	
6.2 <sup>a</sup>	Legibility and indelibility of marking		X					X		X		X	
<sup>a</sup> These subclauses are to be found in IEC 60127-1.													
<sup>b</sup> Applicable only when specified on the standard sheet.													

Table 3 – 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	18-27	28 29 30	31 32 33
9.4 <sup>a</sup>	Endurance test	X						
9.2.1 <sup>a</sup>	Time/current characteristics							
	10 $I_N$		X					
	2,0 $I_N$ or 2,1 $I_N$						X	
9.3	Rated breaking capacity				X			
<sup>a</sup> These subclauses are to be found in IEC 60127-1.								

Dimensions in millimetres with tolerance of 0,1 mm

Fuse-links	a mm	b mm
5 mm × 20 mm	20	48
6,3 mm × 32 mm	32	60

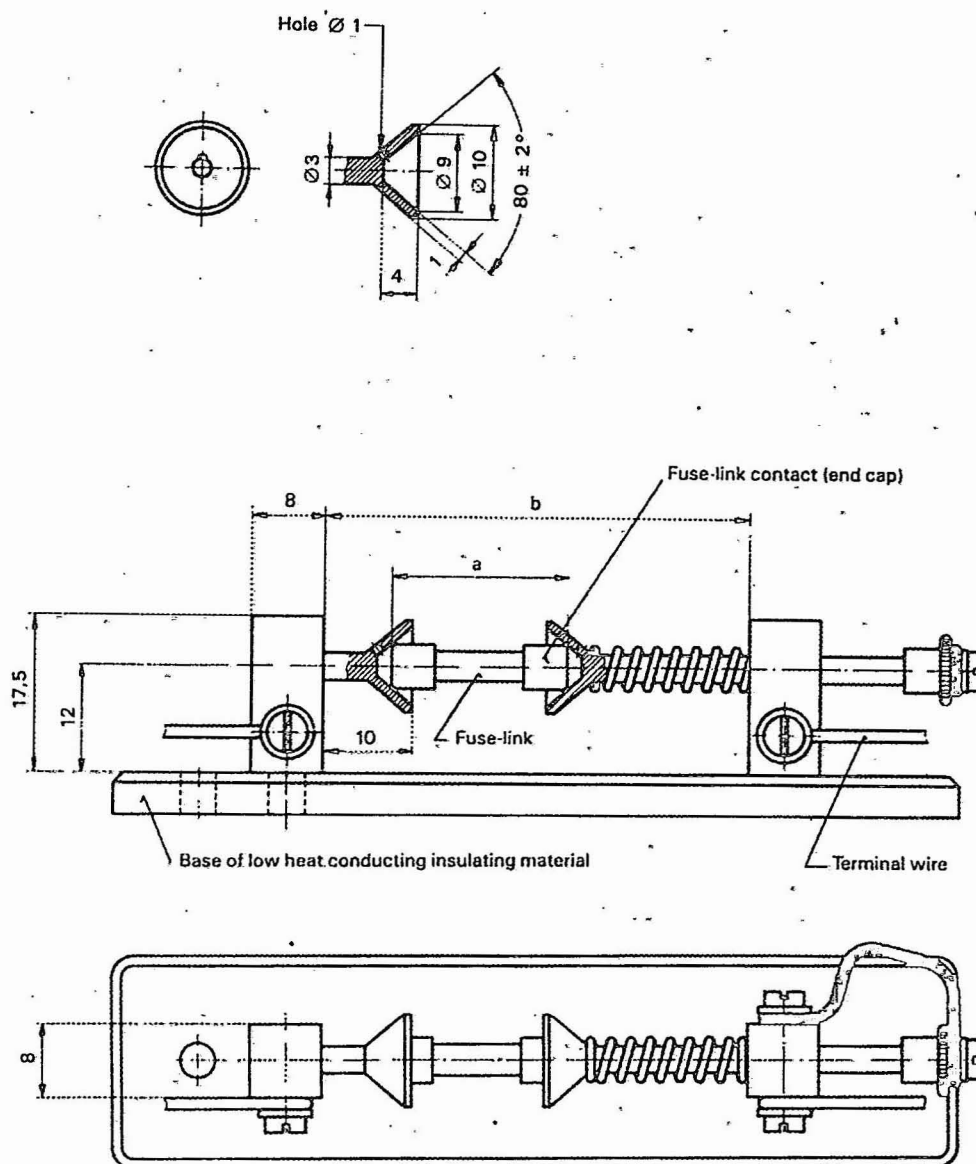


Figure 1 – Test fuse-base for 5 mm × 20 mm and 6,3 mm × 32 mm fuse-links –  
Rated currents up to and including 6,3 A (see 7.3.1)

Dimensions in millimetres with tolerances of 0,1 mm

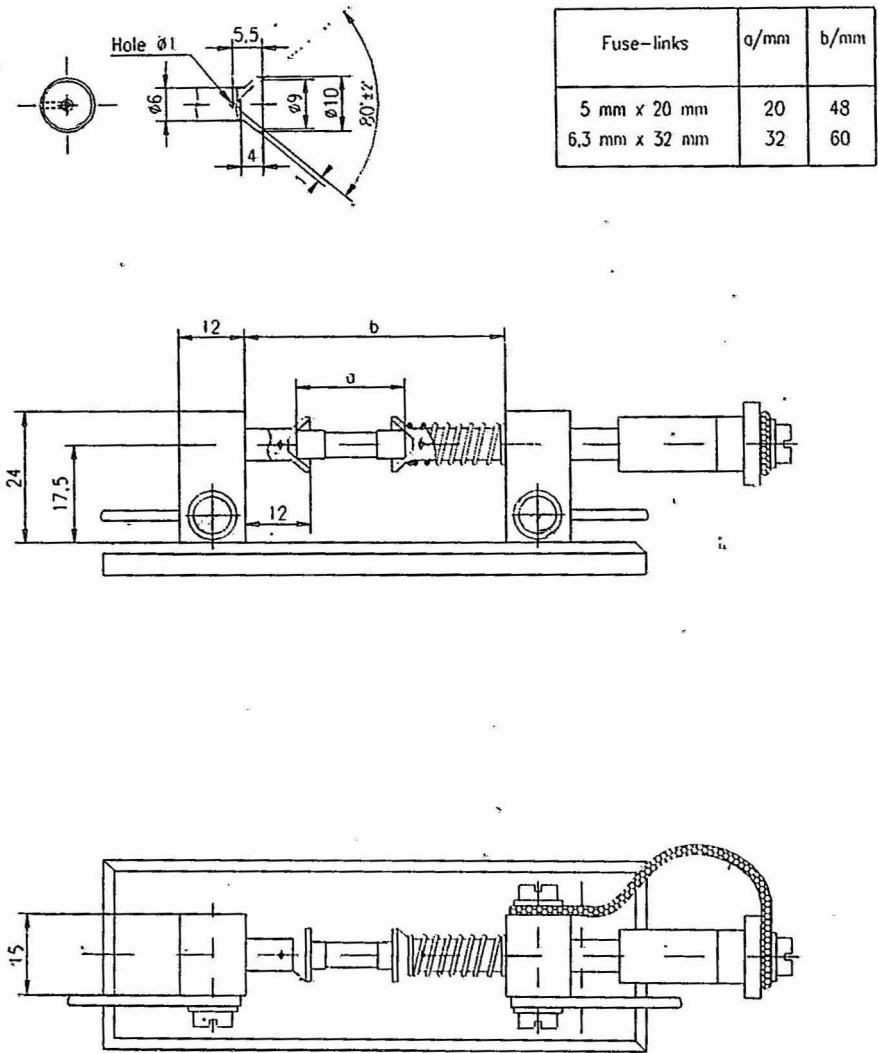


Figure 2 – Test fuse-base for 5 mm x 20 mm and 6,3 mm x 32 mm fuse-links –  
Rated currents exceeding 6,3 A (see 7.3.1)

Dimensions in millimetres with tolerance of 0,1 mm

Fuse-links	a mm	b mm
5 mm x 20 mm	20	67
6,3 mm x 32 mm	32	79

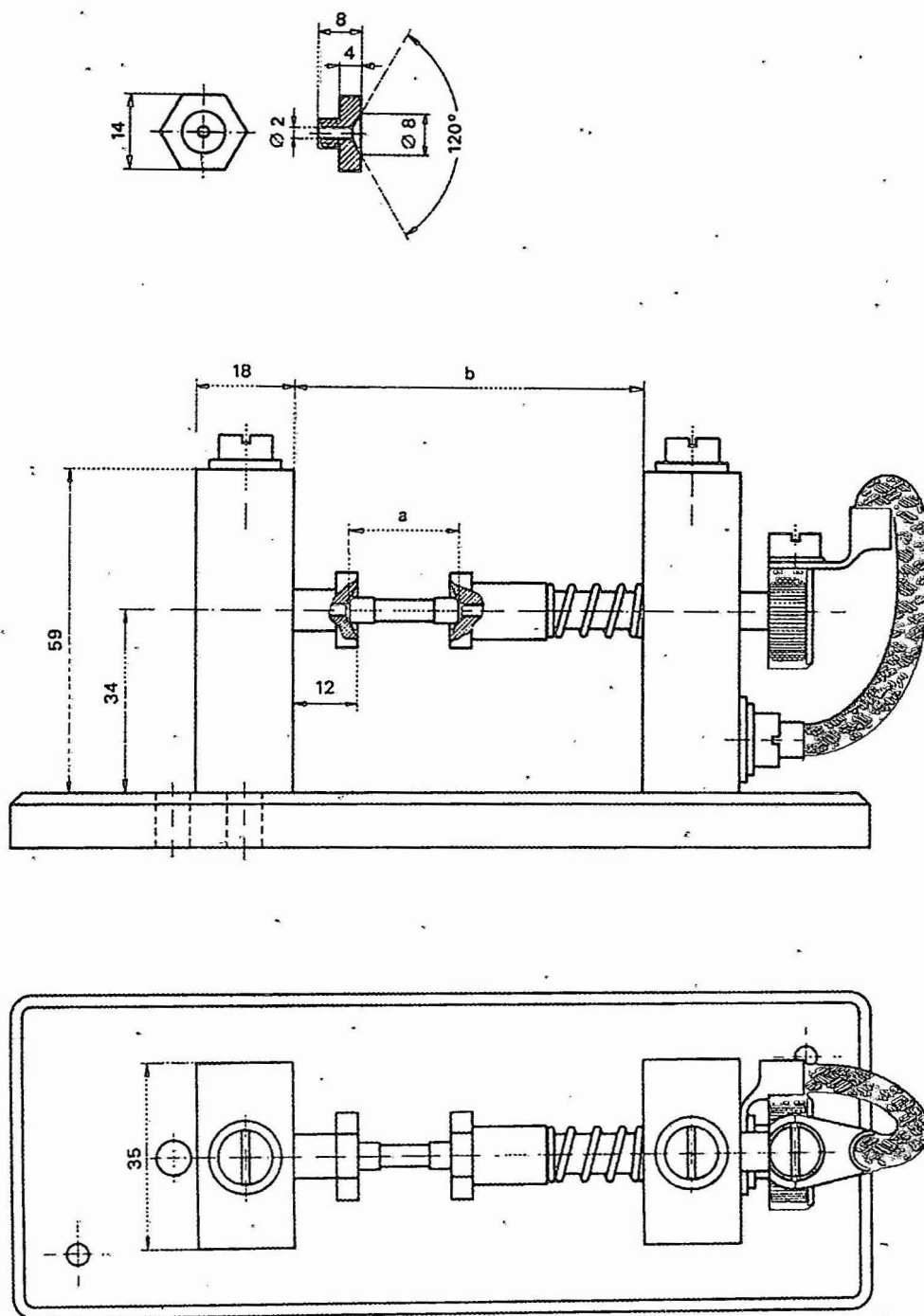


Figure 3 – Test fuse-base for breaking capacity tests (see 7.3.1)

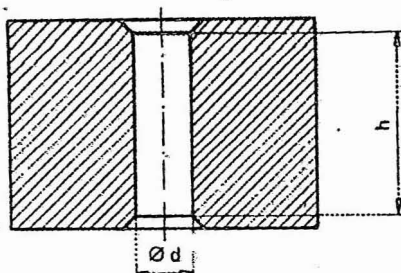


Figure 4 – Alignment gauge (see 8.4)

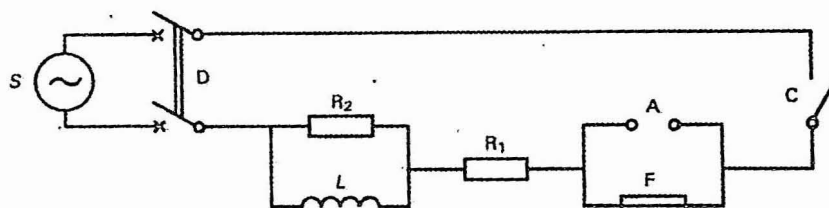
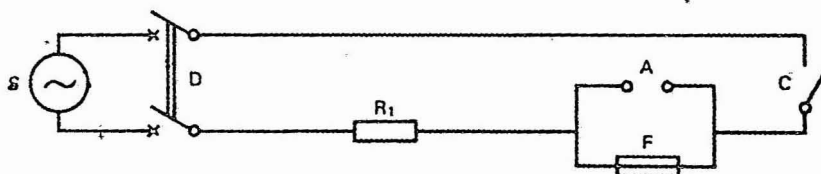


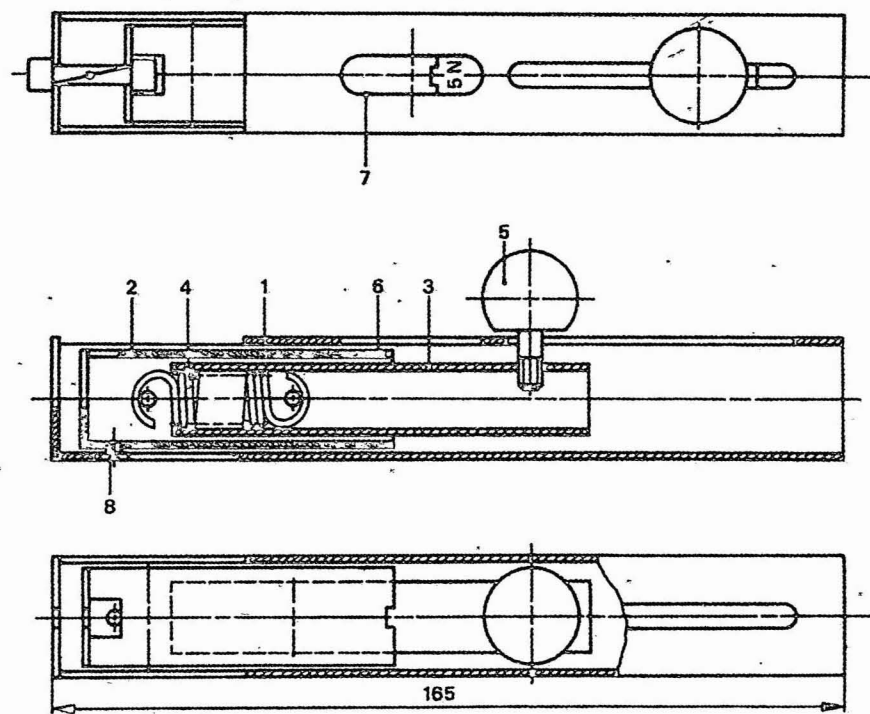
Figure 5 – Typical test circuit for breaking-capacity tests for high-breaking capacity fuse-links (see 9.3)



**Key for Figures 5 and 6**

- A Removable link used for calibration
- C Contactor that makes the circuit
- D Switch to disconnect the source of supply
- F Fuse under test
- S Source of supply, impedance less than 10 % of the total impedance of the circuit
- L Air-cored inductance of  $0,30 \text{ mH} \pm 3 \%$
- $R_1$  Series resistor, adjusted to obtain correct prospective current
- $R_2$  Parallel resistor of  $40 \Omega \pm 10 \%$  acting as a damping resistor

Figure 6 – Typical test circuit for breaking-capacity tests for low-breaking capacity fuse-links (see 9.3)



*Dimensions in millimetres*

The device has 3 tubes (1, 2, 3) sliding within each other.

The outer tube (1) has an opening at its upper end and a fixture receiving one end of the test sample.

The intermediate tube (2) similarly has a recess at its upper end and a fixture receiving the other end of the test sample.

The inner tube (3) is connected with tube (2) by means of a spring (4).

Moving downward tube (3) by pulling with knob (5) extends spring (4) and thus applies a steadily increasing axial force to tube (2) and to the test specimen.

The varying length of fuse cap and total link will be compensated by the sliding tube (2). Its lower end (6) appears within the observation window (7) and serves as a reference mark. The other mark (dashed line) together with the indication "5 N" is printed on tube (3). Coincidence of both marks is attained by adequately moving down knob (5), which can be screwed tight in this position.

Screw (8) ensures alignment of tubes (1) and (2).

The testing device is to be used and calibrated in the vertical position with the fuse under test at the top.

**Figure 7 – Axial pull test apparatus**



**Annex A**  
**(normative)**

**Miniature fuse-links with wire terminations**

**Introduction**

The automatic assembly of electrical and electronic circuits on printed boards has led to a requirement for miniature cartridge fuse-links which have the performance level of existing 5 mm x 20 mm types and are of a form suitable for automatic insertion into printed boards.

This annex supplements the requirements of this standard and is to be applied to already tested and approved 5 mm x 20 mm fuse-links which are available without wire terminations.

**A.1 Scope**

This annex relates to special requirements applicable to miniature fuse-links adapted to printed circuits and used for the protection of electric appliances, electronic equipment and component parts thereof, normally intended to be used indoors.

The following details of the terminations are not specified: the method of fixing, the orientation, the geometry of the cross section and the length.

The object of this annex is to define additional test methods for miniature fuse-links with wire terminations.

**A.2 General notes on tests**

In addition to the requirements of Clause 7 in Part 1, the following criteria shall be observed.

**A.2.1 Type tests**

The number of miniature fuse-links required is 21, of which 3 (fuse-links numbered 19 to 21) are kept as spares in case some of the tests have to be repeated.

The requirements of 7.2.2 in IEC 60127-1 are not applicable.

No failure is allowed in any of the additional tests specified in this annex.

**A.2.2 Testing schedule**

The schedule for testing miniature fuse-links with wire terminations shall be according to Table A.1.

**A.2.3 Test bases for tests**

Miniature fuse-links with wire terminations shall be tested in a test board as shown in Figure A.1. The fuse-link under test shall be soldered to the test board, using the minimum amount of heat to produce a satisfactory soldered joint, and excess wire shall be removed. The test board shall then be mounted on the test base of Figure A.2.

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 including the metal foil shall be 1,6 mm.

The nominal thickness of the copper layer shall be 0,035 mm for fuse-links rated up to and including 6,3 A and 0,070 mm for fuse-links above 6,3 A.

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

### A.3 Dimensions and construction

In addition to the requirements of Clause 8 of IEC 60127-1, the following criteria are to be observed.

#### A.3.1 Dimensions

The dimensions of the miniature fuse-link shall comply with Figure A.3. Compliance is checked by measurement.

#### A.3.2 Mechanical tests on terminations

Terminations shall withstand the mechanical forces likely to be encountered during normal use. Compliance is checked by the following tests which are to be performed in accordance with IEC 60068-2-21.

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

With the miniature fuse-link held in a fixed position, each terminal in turn is subjected to the forces laid down in items a) and b). Test sample groups shall be equally divided between the following termination tests.

##### a) Test $U_{a1}$ : tensile

With the termination in its normal position and the fuse-link held by its body, a force of  $(10 \pm 1)$  N is applied in the direction of axis and acting in a direction away from the body of the component. The force shall be applied progressively (without any shock) and then maintained for a period of  $(10 \pm 1)$  s.

##### b) Test $U_b$ : bending (applicable to pliable terminations only)

For the bending test according to IEC 60068-2-21, the force applied shall be:

- $(5 \pm 0,5)$  N for wire diameters of 0,5 mm to 0,8 mm;
- $(10 \pm 0,5)$  N for wire diameters of above 0,8 mm to 1,25 mm;

and the number of bends shall be two. The bending can be done according to Method 1 (two bends in opposite directions) or Method 2 (two bends in the same direction).

NOTE The value of the force to be applied for wire diameters above 1,25 mm and for strip terminations can be found in Table 4 of IEC 60068-2-21.

At the conclusion of testing, the miniature fuse-link terminations shall remain firmly attached and the voltage drop shall not exceed the maximum permissible values in the relevant standard sheet.

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### A.3.3 Solderability of terminations

The fuse-links shall be subjected to Test Ta of IEC 60068-2-20, using Method 1 (solder bath at 235 °C), with the following conditions:

Ageing:	None (as received)
Immersion conditions:	(235 ± 5) °C, (2 ± 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.

Inspection shall be carried out under adequate light with the naked eye or with the assistance of a magnifier capable of giving a magnification of 4 to 10.

The dipped surface shall be covered with a smooth and bright solder coating, with no more than small amounts (less than 10 % of the tested area) of scattered imperfections such as pin-holes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.

### A.3.4 Resistance to soldering heat

The fuse-links shall be subjected to Test Tb of IEC 60068-2-20, using Method 1A (solder bath at 260 °C), with the following conditions:

Ageing:	None (as received)
Immersion conditions:	(260 ± 5) °C, (10 ± 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 have cracked, marking shall be readable and colour coding, if used, shall not have changed colour.

The voltage drop is measured as specified in A.4.1 and shall not exceed the maximum values specified in the relevant standard sheet.

## A.4 Electrical requirements

In addition to the requirements of Clause 9, the following criteria shall be observed.

### A.4.1 Voltage drop

The use of a high impedance voltmeter is recommended for measuring the voltage drop. Voltage drop shall be measured at the points marked with U in Figure A.1.

### A.4.2 Time/current characteristic at normal ambient temperature

Time/current characteristic at 2,1 I<sub>N</sub> shall be checked in accordance with the relevant standard sheet.

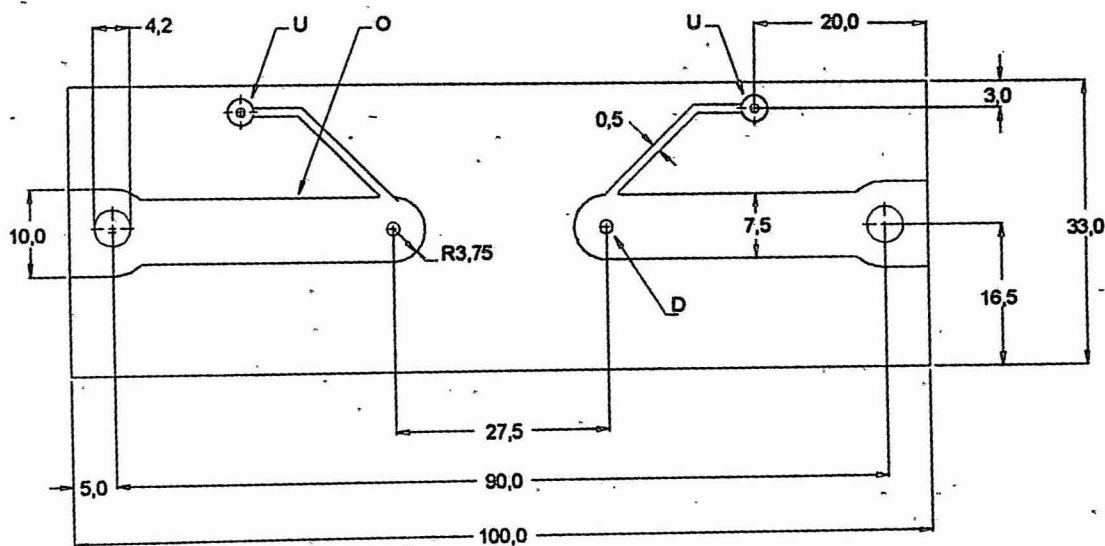
### A.4.3 Breaking capacity

Rated breaking capacity shall be checked as specified in the relevant standard sheet.

**Table A.1 – Testing schedule**

Subclause	Description	Fuse-link number					
		1	4	7 to 12	13	16	19
		2 3	5 6		14 15	17 18	20 21
A.3.1	Dimensions	X	X	X	X	X	
A.4.1	Voltage drop	X	X				
A.4.2	2,1 I <sub>N</sub>	X					
A.4.3	Rated breaking capacity		X				
A.3.2	Mechanical tests on terminations			X			
A.3.3	Solderability				X		
A.3.4	Resistance to soldering heat					X	
A.4.1	Voltage drop			X		X	

NOTE Fuse-links numbered 7 to 12 and 16 to 18 are tested before soldering to the test board for the measurement of voltage drop. Fuse-links 13 to 15 are not soldered to the test board.



**Not to scale**

**Dimensions in millimetres**

### Key

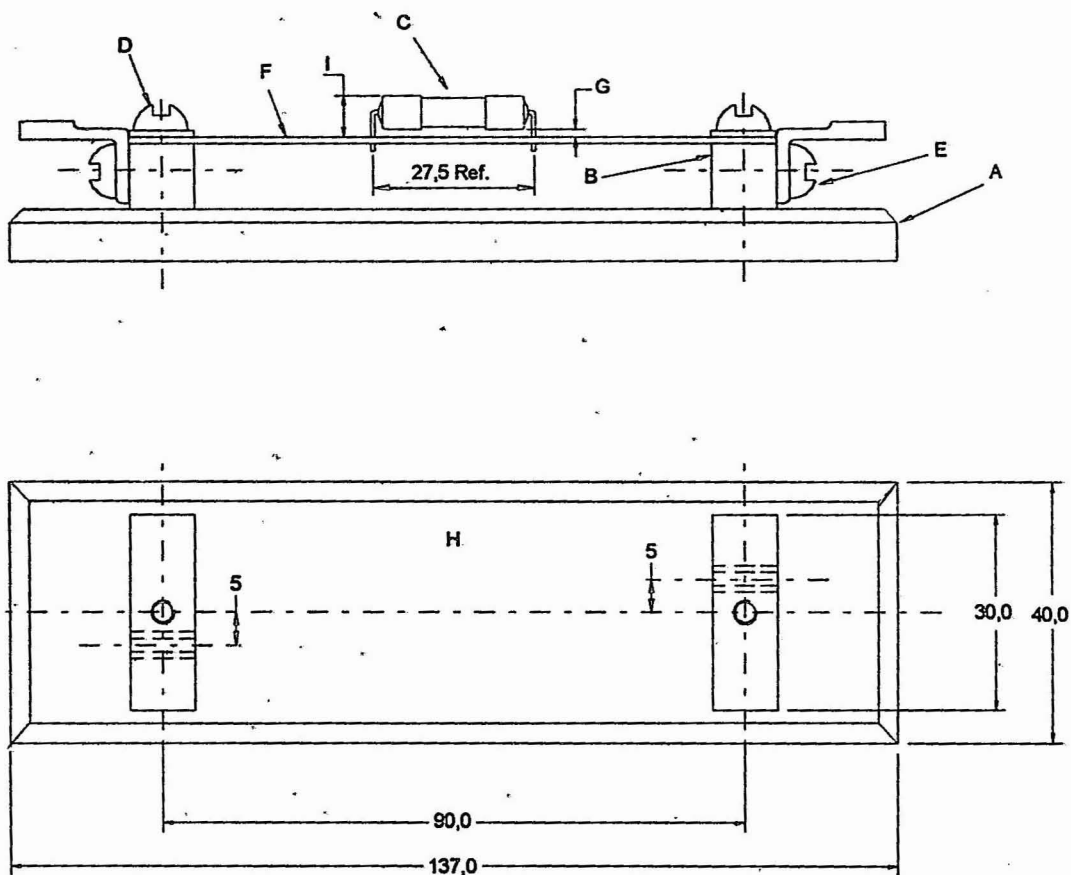
- O** copper layer: 0,035 mm for rated current up to and including 6,3 A;  
0,070 mm for rated current above 6,3 A.

Hot tin dipping is optional.

- U connection for voltage drop measurement  
D diameter of 1 mm for rated current up to and including 6,3 A:  
diameter of 1,5 mm for rated current above 6,3 A.

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

**Figure A.1 – Test board**



*Not to scale*

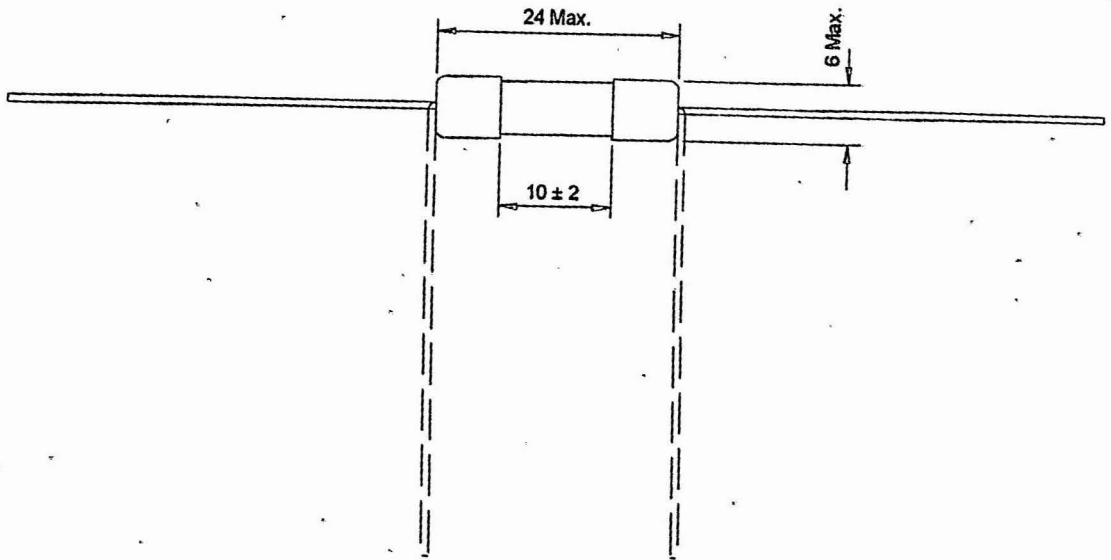
*Dimensions in millimetres*

**Key**

- A base of low heat conducting material, thickness 10 mm
- B brass electrodes 10 mm × 10 mm
- C fuse-link soldered in place
- D fixing screws
- E contact screws holding solder terminal
- F test board (see Figure A.1)
- G space between end-caps of fuse-link and test board: 0,25 mm minimum
- H top view of test base with 10 mm × 10 mm brass electrodes
- I 10 mm maximum above test board

**NOTE** The terminations of the fuse-link may be bent as required to fit the test board.

**Figure A.2 – Test base**



*Not to scale*

*Dimensions in millimetres*

#### Terminations

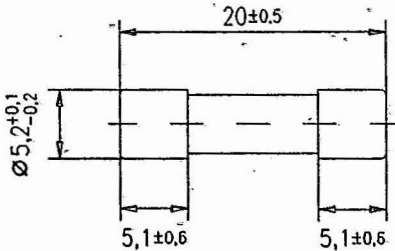
- The length of the terminations is not specified.
- The cross-sectional shape of the wire termination is optional.
- The termination must go through a hole of:
  - 1 mm diameter for rated currents up to and including 6,3 A;
  - 1,5 mm diameter for rated currents above 6,3 A.
- The orientation of the terminations is not specified (alternative shown above).
- The method of fixing the terminations is not specified.

**Figure A.3 – Dimensions of fuse-link with wire terminations**



	<b>Fuse-links 5 mm × 20 mm</b> <b>Quick-acting</b> <b>High-breaking capacity</b>	<b>Standard sheet</b> <b>1</b> Page 1
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Dimensions in millimetres



**Alignment:** The dimensions of the gauge are as follows:  $h = 30\text{ mm}$ ;  $d = 5,38\text{ mm} \pm 0,01\text{ mm}$  (see 8.4).

**Construction:** The fuse-link shall be non-transparent.

Rated current <sup>a</sup>	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W <sup>b</sup>
50 mA 63 mA 80 mA 100 mA 125 mA 160 mA 200 mA	250	10000 8800 7600 7000 5000 4300 3500	1,6
250 mA 315 mA 400 mA 500 mA 630 mA 800 mA 1 A		2800 2500 2000 1800 1500 1200 1000	2,5
1,25 A 1,6 A 2 A 2,5 A 3,15 A 4 A 5 A 6,3 A 8 A 10 A		800 600 500 400 350 300 250 200 200 200	4

<sup>a</sup> Intermediate values shall be chosen from the R 20 series according to ISO 3.

<sup>b</sup> Measured after 1 h (for ratings above 6,3 A after 30 min) at 1,5 I<sub>N</sub>.

**Marking**

Fuse-links shall be marked with the following:

- a) rated current;
- b) rated voltage;
- c) manufacturer's name or trade mark;
- d) characteristic symbol F;
- e) breaking capacity symbol H.

**Fuse-links 5 mm × 20 mm**  
**Quick-acting**  
**High-breaking capacity**

**Standard sheet**  
**1**

Page 2

**Pre-arcing time/current characteristic**

The pre-arcing time shall be within the following limits:

Rated current	2,1 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$
	Maximum	Minimum	Maximum	Minimum	Maximum	Maximum
50 mA to 4 A	30 min	10 ms	2 s	3 ms	300 ms	20 ms
Above 4 A to 6,3 A	30 min	10 ms	3 s	3 ms	300 ms	20 ms
Above 6,3 A to 10 A	30 min	40 ms	20 s	10 ms	1 s	30 ms

**Breaking capacity**

Rated breaking capacity: 1500 A, tested with a.c. and using the circuit given in Figure 5 for the high-breaking capacity test.

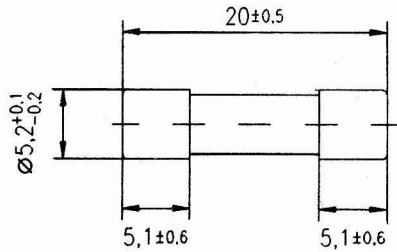
**Endurance test**

100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

	<b>Fuse-links 5 mm × 20 mm</b> <b>Quick-acting</b> <b>Low-breaking capacity</b>	<b>Standard sheet</b> <b>2</b>  Page 1
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This type of fuse-link is recommended for the protection of circuits in telecommunication equipment or similar circuits with limited short-circuit current.

Dimensions in millimetres



Alignment: The dimensions of the gauge are as follows:  $h = 30\text{ mm}$ ;  $d = 5,38\text{ mm} \pm 0,01\text{ mm}$  (see 8.4).

Construction: The fuse-link shall be transparent.

Rated current <sup>a</sup>	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W <sup>b</sup>		
32 mA 40 mA 50 mA 63 mA 80 mA 100 mA 125 mA 160 mA 200 mA 250 mA 315 mA 400 mA 500 mA 630 mA 800 mA 1 A 1,25 A 1,6 A 2 A 2,5 A	250	10000 8000 7000 5000 4000 3500 2000 2000 1700 1400 1300 1200 1000 650 240 200 200 190 170 170	1,6		
3,15 A 4 A 5 A 6,3 A		150 130 130 130		2,5	
8 A 10 A		130 130			
		125		130 130	4

<sup>a</sup> Intermediate values shall be chosen from the R 20 series according to ISO 3.

<sup>b</sup> Measured after 1 h (for ratings above 6,3 A after 30 min) at 1,5 I<sub>N</sub>.

Marking

Fuse-links shall be marked with the following:

- a) rated current;
- b) rated voltage;
- c) manufacturer's name or trade mark;
- d) characteristic symbol F;
- e) breaking capacity symbol L.

**Fuse-links 5 mm × 20 mm**  
**Quick-acting**  
**Low-breaking capacity**

**Standard sheet**  
**2**  
 Page 2

**Pre-arcing time/current characteristic**

The pre-arcing time shall be within the following limits:

Rated current	2,1 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$
	Maximum	Minimum	Maximum	Minimum	Maximum	Maximum
32 mA to 100 mA	30 min	10 ms	500 ms	3 ms	100 ms	20 ms
Above 100 mA to 6,3 A	30 min	50 ms	2 s	10 ms	300 ms	20 ms
Above 6,3 A to 10 A	30 min	50 ms	2 s	10 ms	400 ms	40 ms

**Breaking capacity**

Rated breaking capacity: 35 A or 10  $I_N$  whichever is greater, tested with a.c. and using the circuit given in Figure 6 for the low-breaking capacity test.

For breaking capacity rated currents above 6,3 A shall be tested at 125 V.

**NOTE** Care should be taken that the prospective fault currents of the circuit are within these limits.

**Endurance test**

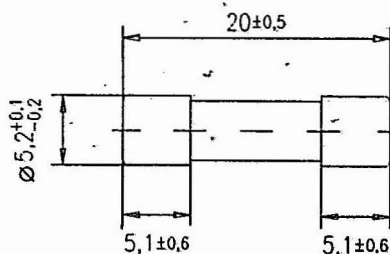
100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

**Fuse-links 5 mm x 20 mm**  
**Time-lag (surge proof)**  
**Low-breaking capacity**

**Standard sheet**  
**3**  
 Page 1

This type of fuse-link is recommended for the protection of circuits in telecommunication equipment or similar circuits with limited short-circuit current.

Dimensions in millimetres



**Alignment:** The dimensions of the gauge are as follows:  $h = 30$  mm;  $d = 5.38$  mm  $\pm 0.01$  mm (see 8.4).

**Construction:** The fuse-link shall be transparent.

Rated current <sup>a</sup>	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W <sup>b</sup>
32 mA	250	5000	1.6
40 mA		4000	
50 mA		3500	
63 mA		3000	
80 mA		3000	
100 mA		2500	
125 mA		2000	
160 mA		1900	
200 mA		1500	
250 mA		1300	
315 mA		1100	
400 mA		1000	
500 mA		900	
630 mA		300	
800 mA		250	
1 A		150	
1.25 A		150	
1.6 A		150	
2 A		150	
2.5 A		120	
3.15 A		100	
4 A		100	
5 A		100	
6.3 A		100	
8 A	125	100	4
10 A		100	

<sup>a</sup> Intermediate values shall be chosen from the R 20 series according to ISO 3.

<sup>b</sup> Measured after 1 h (for ratings above 6.3 A after 30 min) at 1.5  $I_N$ .

#### Marking

Fuse-links shall be marked with the following:

- rated current;
- rated voltage;
- manufacturer's name or trade mark;
- characteristic symbol T;
- breaking capacity symbol L.

**Fuse-links 5 mm × 20 mm**  
**Time-lag (surge-proof)**  
**Low-breaking capacity**

Standard sheet

3

Page 2

**Pre-arcing time/current characteristic**

The pre-arcing time shall be within the following limits:

Rated current	2,1 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
32 mA to 100 mA	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 10 A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

**Test at a temperature of  $(70 \pm 2) ^\circ\text{C}$** 

A current of 1,1  $I_N$  shall be passed through the fuse-links for 1 h and they shall not operate.

**Breaking capacity**

Rated breaking capacity: 35 A or 10  $I_N$ , whichever is greater, tested with a.c. and using the circuit given in Figure 6 for the low-breaking capacity test.

For breaking capacity rated currents above 6,3 A shall be tested at 125 V.

NOTE Care should be taken that the prospective fault currents of the circuit are within these limits.

**Endurance test**

100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

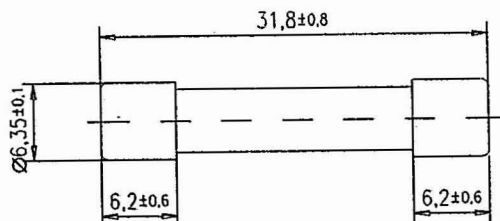


<b>Fuse-links 6,3 mm x 32 mm</b> <b>Quick-acting</b> <b>Low-breaking capacity</b>			<b>Standard</b> <b>Sheet</b> <b>4</b>
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This type of fuse-link is recommended for the protection of circuits in telecommunication equipment or similar circuits with limited short-circuit current.

Note This sheet is issued on the basis of actual needs in several countries. Modifications may be necessary for future use in more countries.

Dimensions in millimetres



Alignment: The dimensions of the gauge are: h = 38 mm; d = 6,65 mm ± 0,01 mm (see 8.4).

Construction: The fuse-link shall be transparent.

Rated current	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W*
50 mA	250	10 000	1,6
63 mA		8 000	
80 mA		7 000	
100 mA		6 000	
125 mA		5 500	
160 mA		5 000	
200 mA		4 000	
250 mA		3 500	
315 mA		3 000	
400 mA		2 500	
500 mA		2 000	
630 mA		1 800	
800 mA		1 500	
1 A		500	
1,25 A	150	400	2,5
1,6 A		400	
2 A		300	
2,5 A		250	
3,15 A	150	250	4
4 A	150	250	
5 A	60	200	
6,3 A	60	200	
8 A	60	200	
10 A	60	200	

\* Measured after 1 h at 1,15  $I_N$ .

#### Marking

Fuse-links shall be marked with:

- rated current;
- rated voltage;
- maker's name or trade mark;
- characteristic symbol F;
- breaking capacity symbol L.

#### Pre-arcing time/current characteristic

The pre-arcing time shall be within the following limits:

Rated current	2 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$
	Maximum	Minimum	Maximum	Minimum	Maximum	Maximum
50 mA to 100 mA inclusive	20 s	2 ms	200 ms	1 ms	30 ms	5 ms
Above 100 mA to 10 A	20 s	20 ms	1 500 ms	8 ms	400 ms	80 ms

#### Breaking capacity

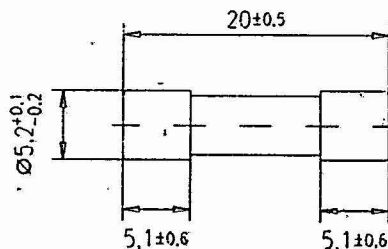
Rated breaking capacity: 35 A or 10  $I_N$  whichever is greater, tested with a.c. and using the circuit given in Figure 6, for the low-breaking capacity test.

#### Endurance test

100 cycles at 1,05 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h 1,15 times the rated current according to 9.4 b) of IEC 60127-1.

	<b>Fuse-links 5 mm x 20 mm</b> <b>Time-lag (surge-proof)</b> <b>High-breaking capacity</b>	<b>Standard sheet</b> <b>5</b>  <b>Page 1</b>
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Dimensions in millimetres



**Alignment:** The dimensions of the gauge are as follows:  $h = 30$  mm;  $d = 5.38$  mm  $\pm 0.01$  mm (see 8.4).

**Construction:** The fuse-link shall be non-transparent.

Rated current <sup>a</sup>	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W <sup>b</sup>
100 mA 125 mA 160 mA 200 mA 250 mA 315 mA 400 mA 500 mA 630 mA 800 mA	250	2 800 2 600 2 400 2 100 1 500 1 100 1 000 850 650 500	1,6
1 A 1,25 A 1,6 A 2 A 2,5 A		350 300 200 190 180	2,5
3,15 A 4 A 5 A 6,3 A 8 A 10 A		140 100 100 100 100 100	4
<sup>a</sup> Intermediate values shall be chosen from the R 20 series according to ISO 3.			
<sup>b</sup> Measured after 1 h (for ratings above 6,3 A after 30 min) at 1,5 I <sub>N</sub> .			

#### Marking

Fuse-links shall be marked with the following:

- rated current;
- rated voltage;
- manufacturer's name or trade mark;
- characteristic symbol T;
- breaking capacity symbol H.

**Fuse-links 5 mm × 20 mm**  
**Time-lag (surge-proof)**  
**High-breaking capacity**

**Standard sheet**  
**5**  
 Page 2

**Pre-arcing time/current characteristic**

The pre-arcing time shall be within the following limits:

Rated current	2,1 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
100 mA to 800 mA	30 min	250 ms	80 s	50 ms	5 s	5 ms	150 ms
Above 800 mA to 3,15 A	30 min	750 ms	80 s	95 ms	5 s	10 ms	150 ms
Above 3,15 A to 10 A	30 min	750 ms	80 s	150 ms	5 s	10 ms	150 ms

**Test at a temperature of  $(70 \pm 2) ^\circ\text{C}$**

A current of 1,1  $I_N$  shall be passed through the fuse-links for 1 h and they shall not operate.

**Breaking capacity**

Rated breaking capacity: 1 500 A, tested with a.c. and using the circuit given in Figure 5 for the high-breaking capacity test.

**Endurance test**

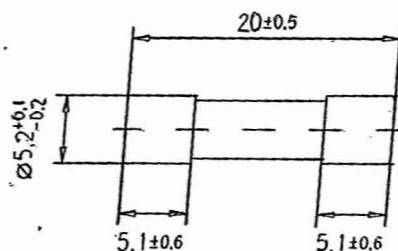
100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

**Fuse-links 5 mm × 20 mm**  
**Time-lag (surge proof)**  
**Enhanced breaking capacity**

**Standard sheet**  
**6**  
 Page 1

This type of fuse-link is recommended for the protection of circuits in equipment such as television sets having a prospective short-circuit current above 35 A, but not exceeding 150 A.

Dimensions in millimetres



**Alignment:** The dimensions of the gauge are as follows:  $h = 30$  mm;  $d = 5,38$  mm  $\pm$  0,01 mm (see 8.4).

**Construction:** The fuse-link may be transparent or non-transparent.

Rated current <sup>a</sup>	Rated voltage V	Maximum voltage drop mV	Maximum sustained power dissipation W <sup>b</sup>
32 mA	250	5000	1,6
40 mA		4000	
50 mA		3500	
63 mA		3000	
80 mA		3000	
100 mA		2500	
125 mA		2000	
160 mA		1900	
200 mA		1500	
250 mA		1300	
315 mA		1100	
400 mA		1000	
500 mA		900	
630 mA		300	
800 mA		250	
1 A		150	
1,25 A		150	
1,6 A		150	
2 A		150	
2,5 A		120	
3,15 A		100	
4 A		100	
5 A		100	
6,3 A		100	
8 A	10	100	4
10 A		100	

<sup>a</sup> Intermediate values shall be chosen from the R 20 series according to ISO 3.

<sup>b</sup> Measured after 1 h (for ratings above 6,3 A after 30 min) at 1,5  $I_N$ .

#### Marking

Fuse-links shall be marked with the following:

- rated current;
- rated voltage;
- manufacturer's name or trade mark;
- characteristic symbol T;
- breaking capacity symbol E.

	<b>Fuse-links 5 mm × 20 mm</b> <b>Time-lag (surge-proof)</b> <b>Enhanced breaking capacity</b>	<b>Standard sheet</b> <b>6</b>  <b>Page 2</b>
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**Pre-arcing time/current characteristic**  
The pre-arcing time shall be within the following limits:

Rated current	2,1 $I_N$	2,75 $I_N$		4 $I_N$		10 $I_N$	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
32 mA to 100 mA	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 10 A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

**Test at a temperature of  $(70 \pm 2)^\circ\text{C}$**   
A current of 1,1  $I_N$  shall be passed through the fuse-links for 1 h and they shall not operate.

**Breaking capacity**  
Rated breaking capacity: 150 A, tested with a.c. and using the circuit given in Figure 6 for the low-breaking capacity test.

**Endurance test**  
100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

(Continued from second cover)

*International Standard*

*Title*

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)

Only the English language text has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the IEC Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: ETD 39 (5825).

#### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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