BRITISH STANDARD

BS EN 60127-2:2003
Incorporating Amendment No. 1

Miniature fuses —

Part 2: Cartridge fuse-links

The European Standard EN 60127-2:2003, incorporating amendment A1:2003, has the status of a British Standard

ICS 29.120.50

BSI British Standards

National foreword

This British Standard is the official English language version of EN 60127-2:2003, including amendment A1:2003. It is identical with IEC 30127-2:2003, including amendment 1:2003. It supersedes BS EN 60127-2:1991 which is withdrawn.

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

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 33 and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments
14903	14 January 2004	Change to fourth and fifth paragraph in **7.3.1**, title change to Figure 1, Figure 2 replaced, Standard Sheet 4 figure replaced and replacement of Standard Sheets 1, 2, 3, 5 and 6

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English version

Minature fuses — Part 2: Cartridge fuse-links

(including amendment A1:2003)
(IEC 60127-2:2003 + A1:2003, modified)

Coupe-circuit miniatures —
Partie 2: Cartouches
(inclut l'amendement A1:2003)
(CEI 60127-2:2003 + A1:2003, modifiée)

Geräteschutzsicherungen —
Teil 2: Sicherungseinsätze
(enthält Änderung A1:2003)
(IEC 60127-2:2003 + A1:2003, mofifiziert)

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 32C/326/FDIS, future edition 2 of IEC 60127-2, 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 60127-2 on 2003-03-18.

This European Standard should be read in conjuction with EN 60127-1:1991.

This European Standard supersedes EN 60127-2:1991 + A1:1995 + corrigendum May 1996 + A2:2000.

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) 2003-12-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-03-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annexes A and ZA are normative.
Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 60127-2:2003 was approved by CENELEC as a European Standard without any modification.

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Foreword to amendment A1

The text of document 32C/338/FDIS, future amendment 1 to IEC 60127-2:2003, 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 60127-2:2003 on 2003-10-01.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-07-01

– latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2006-10-01

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Endorsement notice

The text of amendment 1:2003 to the International Standard IEC 60127-2:2003 was approved by CENELEC as an amendment to the European Standard without any modification.

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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 containing general requirements need not be repeated.

The new IEC 60127 series, under the general heading *Miniature fuses*, is thus subdivided as follows:

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

IEC 60127-2:2002, *Miniature fuses – Part 2: Cartridge fuse-links*

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

IEC 60127-4, *Miniature fuses – Part 4: Universal modular fuse-links*

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

IEC 60127-6, *Miniature fuses – 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, (Free for further documents)

IEC 60127-10, *Miniature fuses – Part 10: User guide*

This Part 2 covers additional requirements, test equipment and standard sheets.

The SI system of units is used throughout this standard.

MINIATURE FUSES –

Part 2: Cartridge fuse-links

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*[1]
Amendement 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.

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[1] 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 mm ± 0,2 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^2; 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^2; 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 [a]	Endurance test		X														
9.2.2 [a]	Test at elevated temperature [b]						X										
9.2.1 [a]	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 [a]	Soldered joints		X	X			X		X				X			X	
6.2 [a]	Legibility and indelibility of marking			X					X				X			X	

[a] These subclauses are to be found in Part 1.

[b] 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 [a]	Endurance test		X											
9.2.2 [a]	Test at elevated temperature [b]							X						
9.2.1 [a]	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 [a]	Soldered joints		X	X				X	X		X		X	
6.2 [a]	Legibility and indelibility of marking			X					X		X		X	

[a] These subclauses are to be found in IEC 60127-1.

[b] 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 [a]	Endurance test		X						
9.2.1 [a]	Time/current characteristics	10 I_N		X					
		2,0 I_N or 2,1 I_N						X	
9.3	Rated breaking capacity					X			

[a] 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

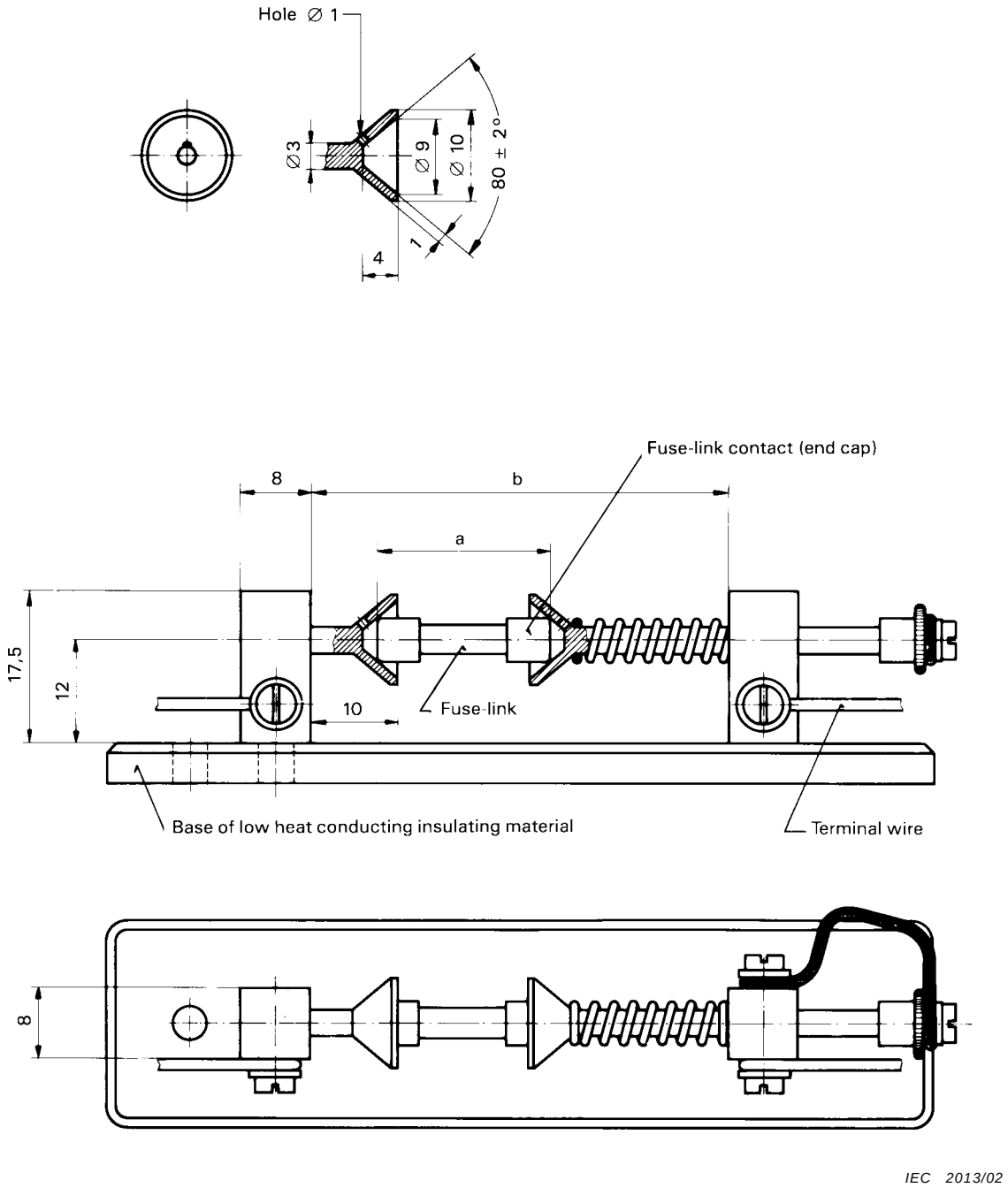
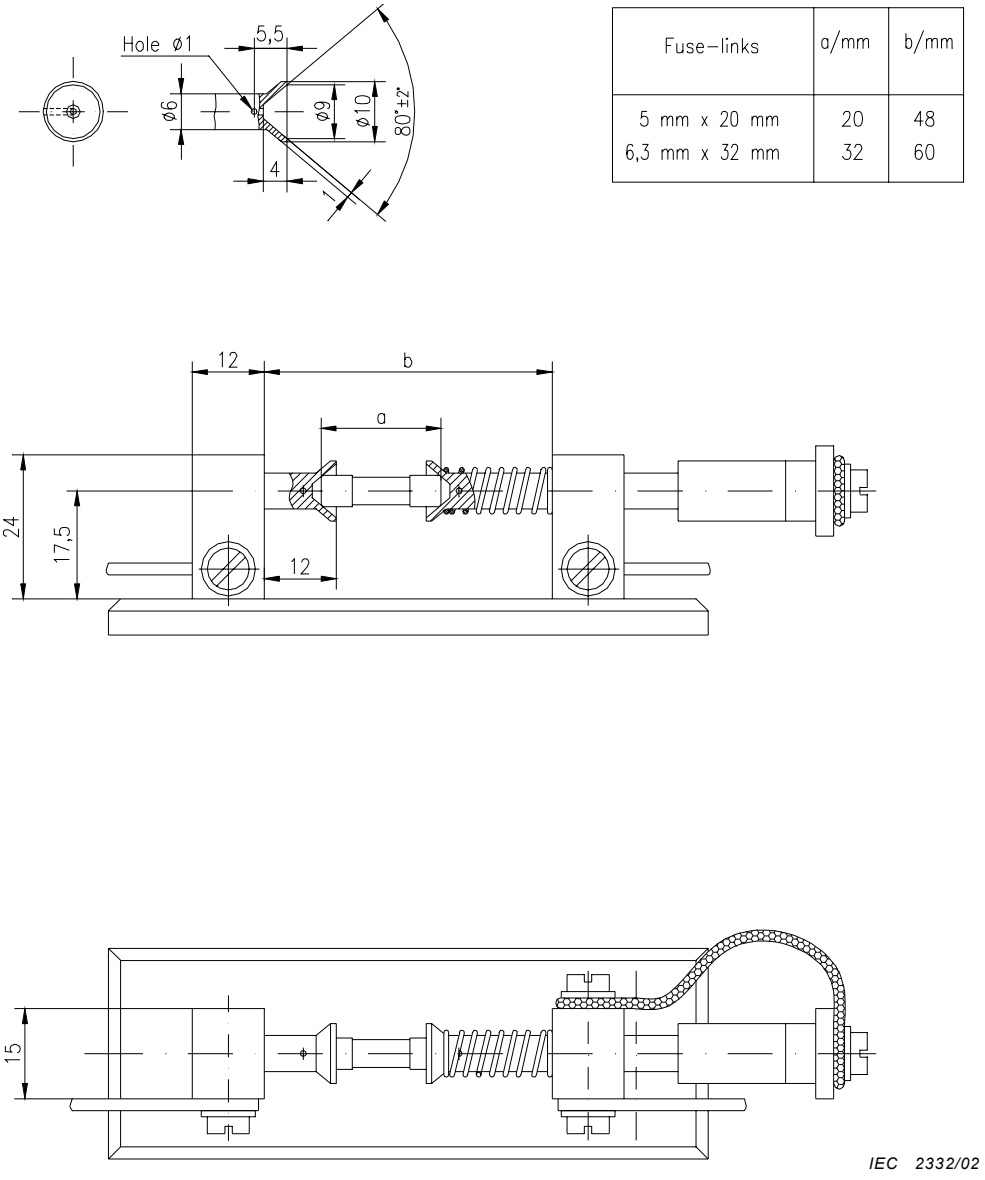


Figure 1 – Test fuse-base for 5 mm × 20 mm and 6,3 mm × 32 mm fuse-links – Rated currents up to and including 6,3 A (see 7.3.1)

Dimensions in millimetres with tolerance of 0,1 mm



Fuse–links	a/mm	b/mm
5 mm x 20 mm	20	48
6,3 mm x 32 mm	32	60

Figure 2 – Test fuse-base for 5 mm × 20 mm and 6,3 mm × 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 × 20 mm	20	67
6,3 mm × 32 mm	32	79

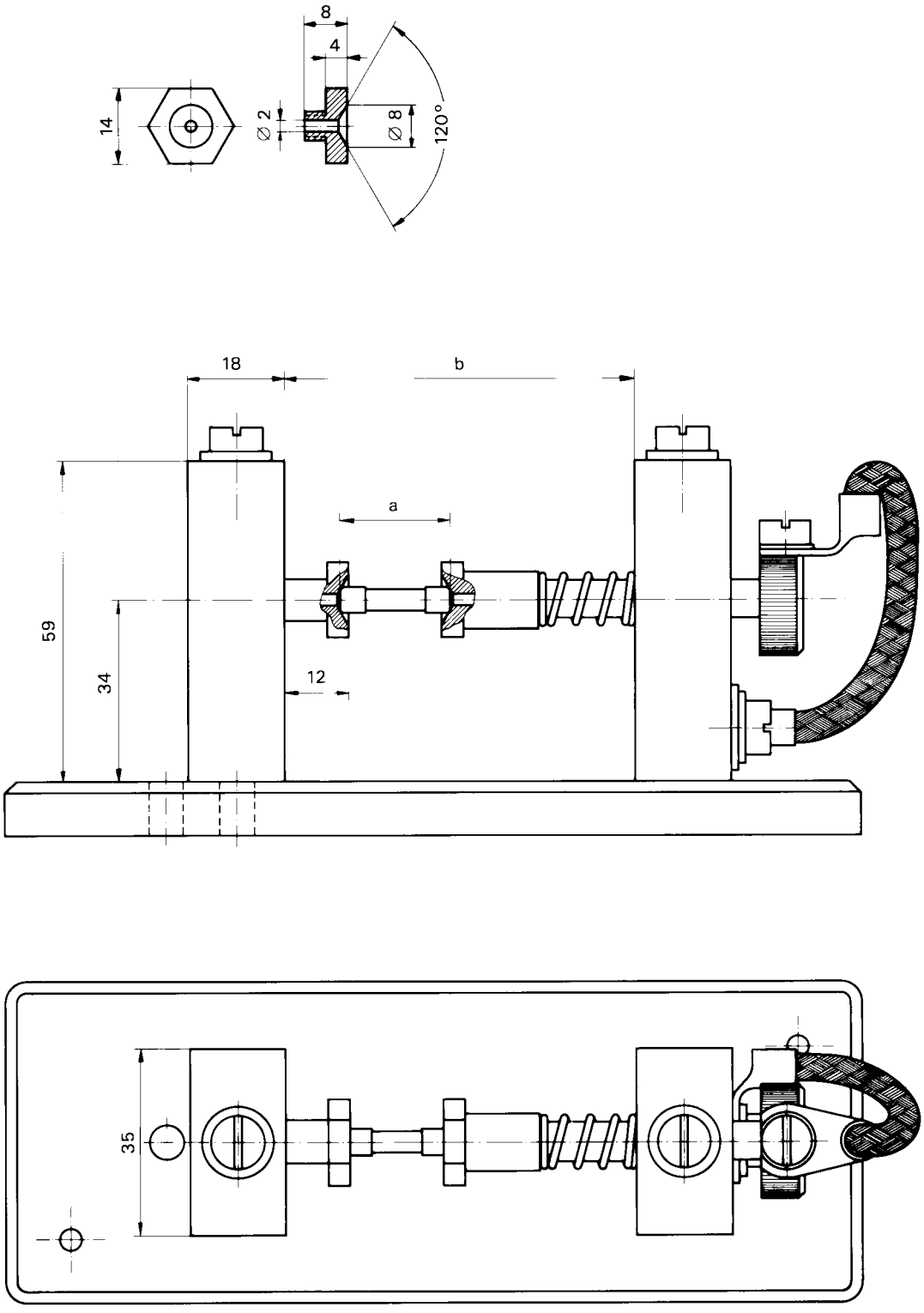


Figure 3 – Test fuse-base for breaking capacity tests (see 7.3.1)

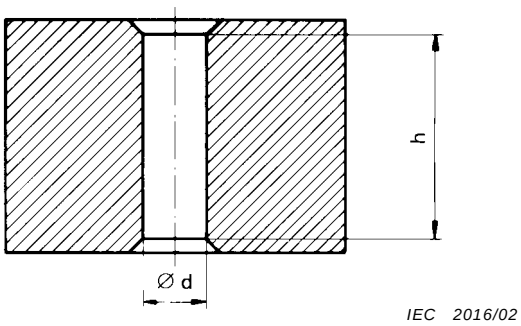


Figure 4 – Alignment gauge (see 8.4)

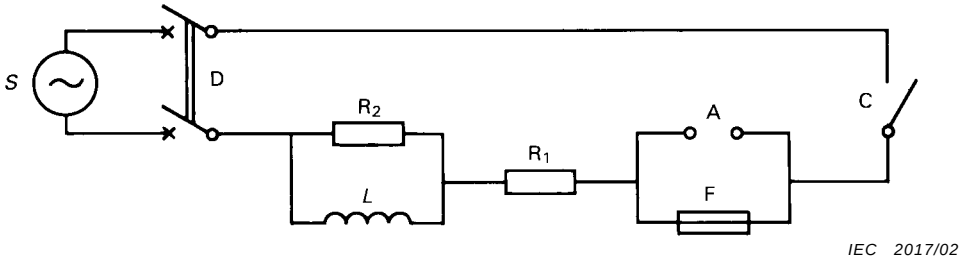
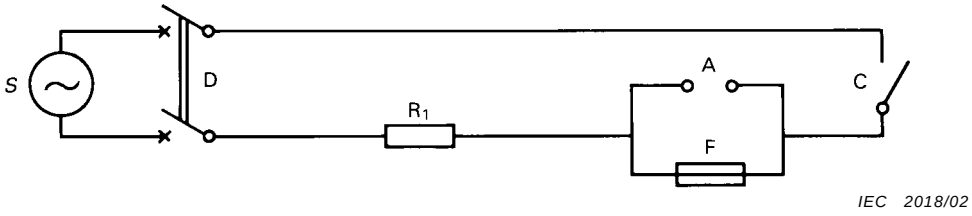


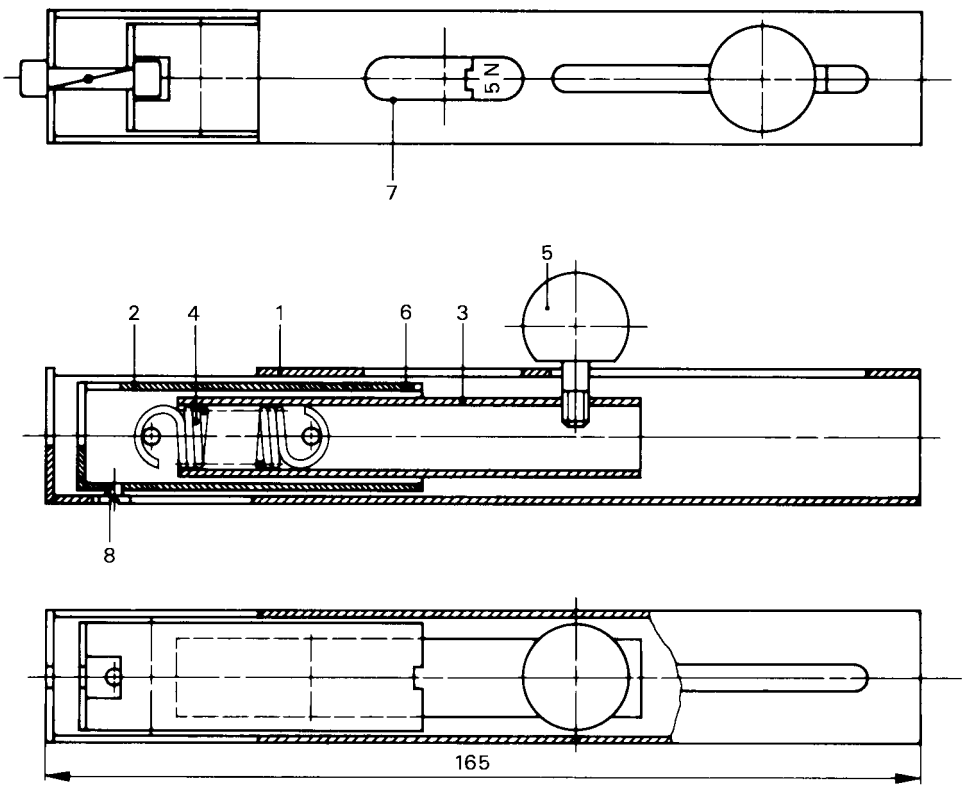
Figure 5 – Typical test circuit for breaking-capacity tests for high-breaking capacity fuse-links (see 9.3)



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 mH ± 3 %
R_1 Series resistor, adjusted to obtain correct prospective current
R_2 Parallel resistor of 40 Ω ± 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 × 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 × 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 Ua_1: tensile

   With the termination in its normal position and the fuse-link held by its body, a force of (10 ± 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 ± 1) s.

b) Test Ub: bending (applicable to pliable terminations only)

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

   – (5 ± 0,5) N for wire diameters of 0,5 mm to 0,8 mm;

   – (10 ± 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.

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

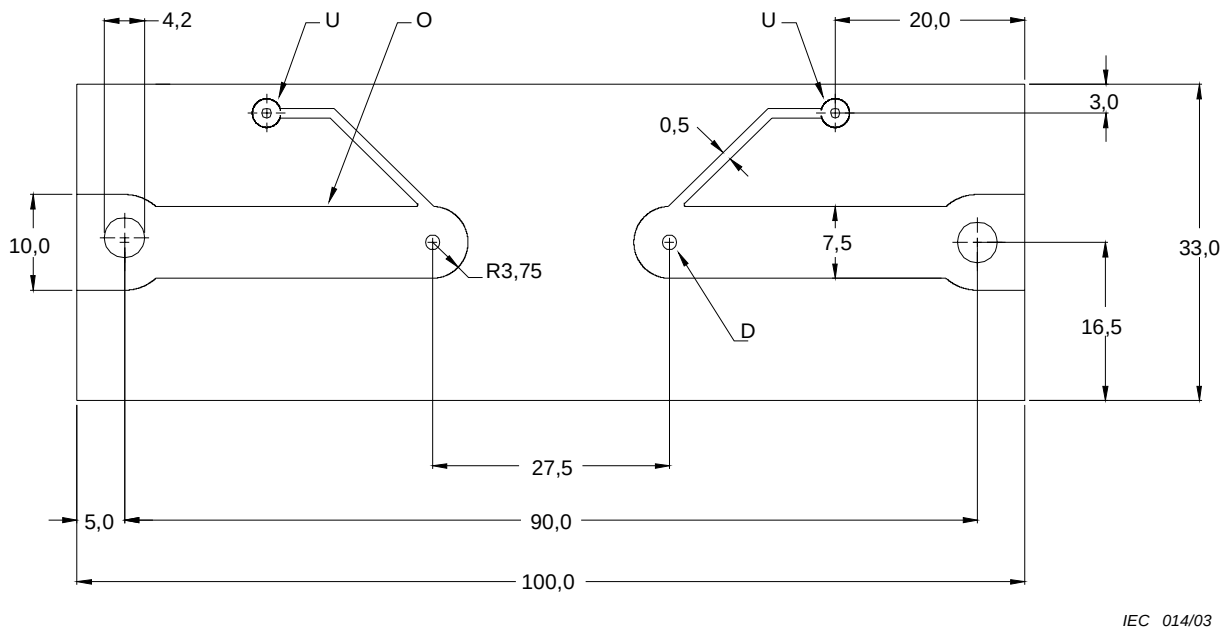
Time/current characteristic at 2,1 I_N shall be checked in accordance with the relevant standard sheet.

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 2 3	4 5 6	7 to 12	13 14 15	16 17 18	19 20 21
A.3.1	Dimensions	X	X	X	X	X	
A.4.1	Voltage drop	X	X				
A.4.2	2,1 I_N	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

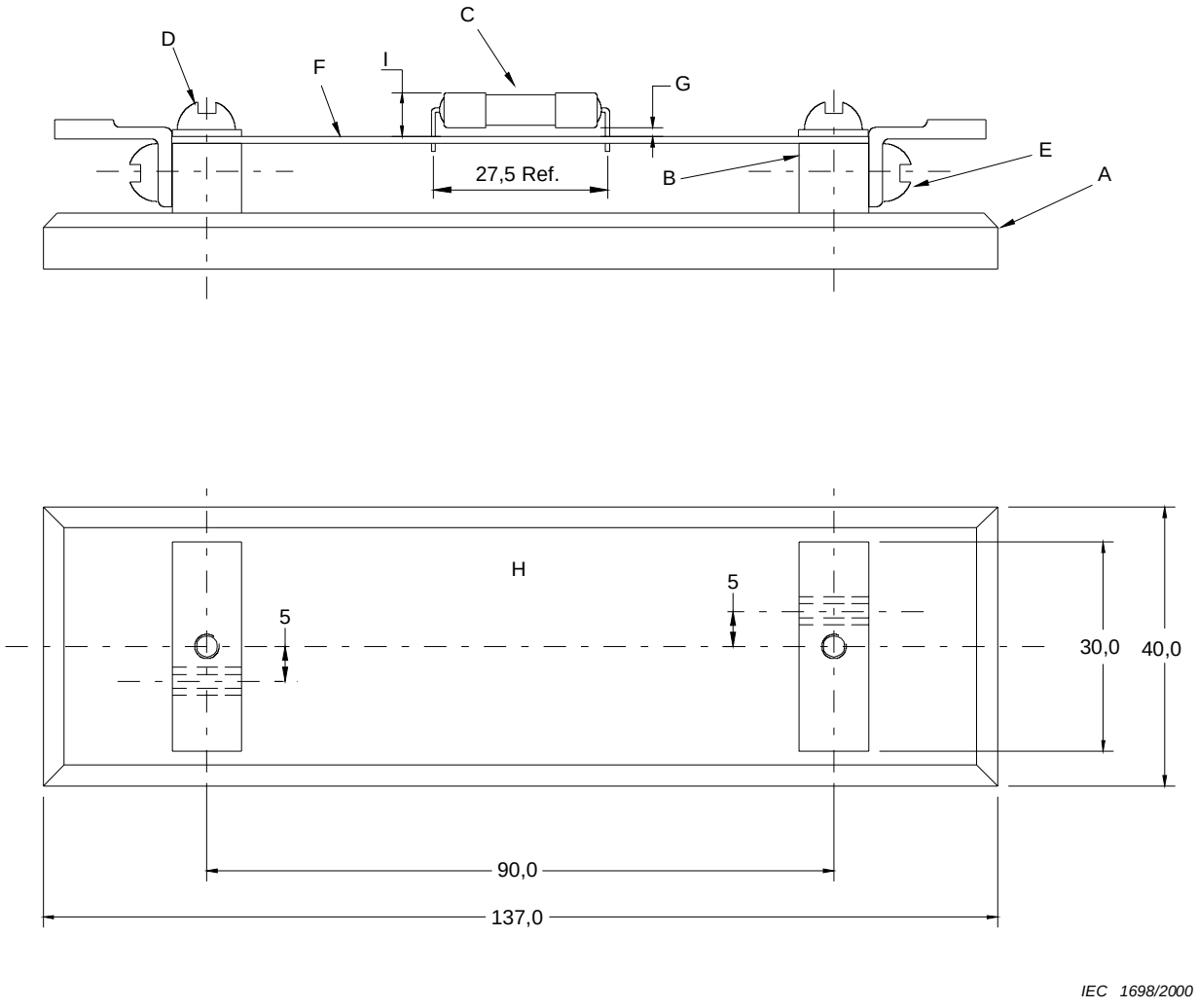
O copper layer: 0,035 mm for rated current up to and including 6,3 A;
0,070 mm for rated current above 6,3 A.
Hot tin dipping is optional.

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



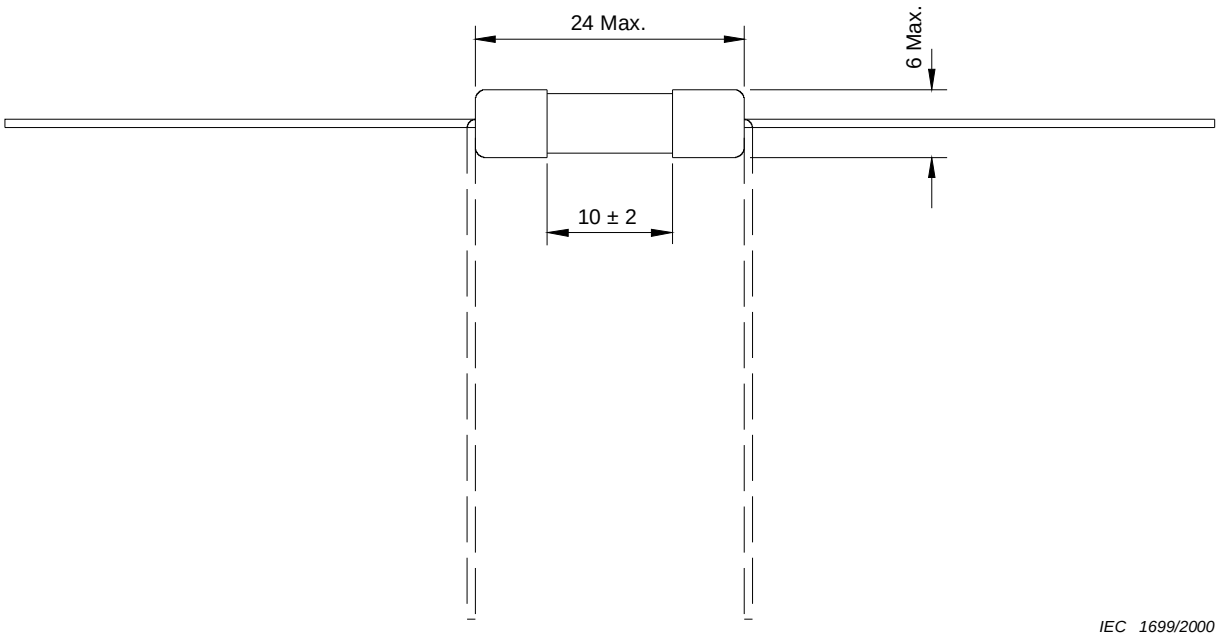
Not to scale *Dimensions in millimetres*

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

a) The length of the terminations is not specified.

b) The cross-sectional shape of the wire termination is optional.

c) 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.

d) The orientation of the terminations is not specified (alternative shown above).

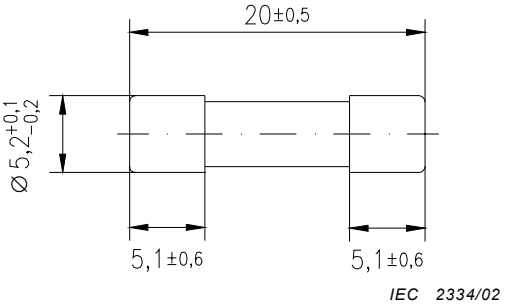
e) The method of fixing the terminations is not specified.

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

10 Standard sheets

	Fuse-links 5 mm x 20 mm Quick-acting High-breaking capacity	**Standard sheet 1** Page 1

Dimensions in millimetres



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

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

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

[a] Intermediate values shall be chosen from the R 20 series according to ISO 3.

[b] 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:

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 x 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.

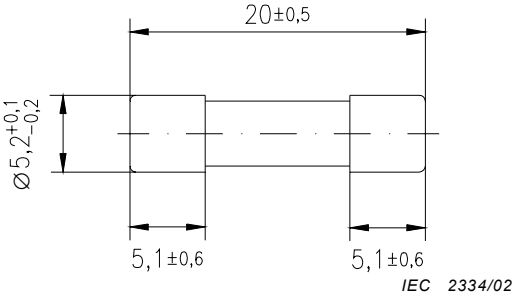
Endurance test

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.

	Fuse-links 5 mm x 20 mm Quick-acting Low-breaking capacity	**Standard sheet 2** 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 ± 0,01 mm (see 8.4).

Construction: The fuse-link shall be transparent.

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

[a] Intermediate values shall be chosen from the R 20 series according to ISO 3.

[b] 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:

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 x 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.

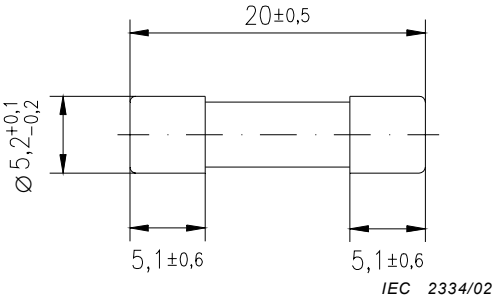
Endurance test

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 ± 0,01 mm (see 8.4).

Construction: The fuse-link shall be transparent.

Rated current [a]	**Rated voltage** V	**Maximum voltage drop** mV	**Maximum sustained power dissipation** W [b]
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	

[a] Intermediate values shall be chosen from the R 20 series according to ISO 3.

[b] 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:

a) rated current;
b) rated voltage;
c) manufacturer's name or trade mark;
d) characteristic symbol T;
e) breaking capacity symbol L.

	Fuse-links 5 mm x 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 ± 2) °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

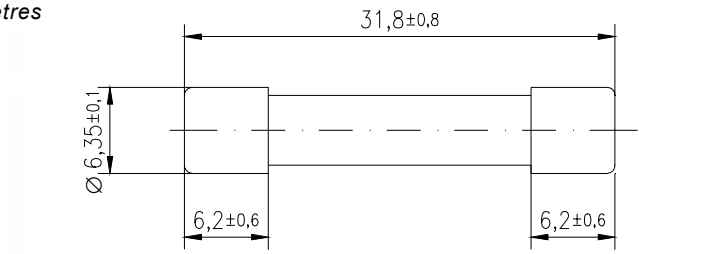
100 cycles at 1,2 times the rated current according to 9.4 a) of IEC 60127-1, followed by 1 h (for ratings above 6,3 A 30 min) at 1,5 times the rated current according to 9.4 b) of IEC 60127-1.

	Fuse-links 6,3 mm × 32 mm Quick-acting Low-breaking capacity	**Standard Sheet 4**

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



IEC 2333/02

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:

a) rated current;
b) rated voltage;
c) maker's name or trade mark;
d) characteristic symbol F;
e) 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

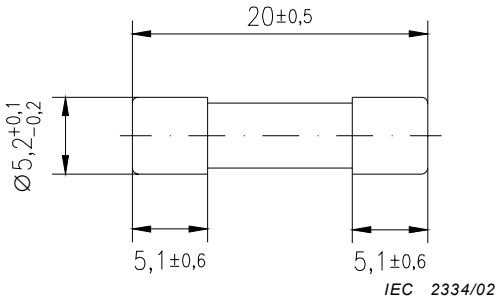
Rated breaking capacity: 35 A or 10 I_N whichever is greater, tested with a.c. and using the circuit given in Figure 6, for the low-breaking capacity test.

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.

	Fuse-links 5 mm x 20 mm Time-lag (surge-proof) High-breaking capacity	**Standard sheet 5** Page 1

Dimensions in millimetres



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

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

Rated current [a]	**Rated voltage** V	**Maximum voltage drop** mV	**Maximum sustained power dissipation** W [b]
100 mA	250	2 800	1,6
125 mA		2 600	
160 mA		2 400	
200 mA		2 100	
250 mA		1 500	
315 mA		1 100	
400 mA		1 000	
500 mA		850	
630 mA		650	
800 mA		500	
1 A		350	2,5
1,25 A		300	
1,6 A		200	
2 A		190	
2,5 A		180	
3,15 A		140	4
4 A		100	
5 A		100	
6,3 A		100	
8 A		100	
10 A		100	

[a] Intermediate values shall be chosen from the R 20 series according to ISO 3.

[b] 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:

a) rated current;
b) rated voltage;
c) manufacturer's name or trade mark;
d) characteristic symbol T;
e) breaking capacity symbol H.

	Fuse-links 5 mm x 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 ± 2) °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.

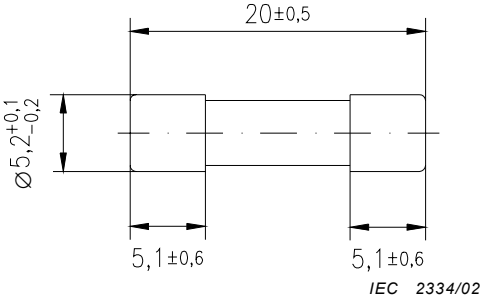
Endurance test

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 x 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 ± 0,01 mm (see 8.4).

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

Rated current [a]	**Rated voltage** V	**Maximum voltage drop** mV	**Maximum sustained power dissipation** W [b]
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		100	4
10 A		100	

[a] Intermediate values shall be chosen from the R 20 series according to ISO 3.

[b] 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:

a) rated current;
b) rated voltage;
c) manufacturer's name or trade mark;
d) characteristic symbol T;
e) breaking capacity symbol E.

	Fuse-links 5 mm x 20 mm Time-lag (surge-proof) Enhanced breaking capacity	**Standard sheet 6** 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 ± 2) °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.

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	1999	Environmental testing Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	1999
IEC 60127-1 + corr. March	1988 1990	Miniature fuses Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links	EN 60127-1	1991
A1	1999		A1	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)	EN 60249-2-5 [2)] + corr. March	1994 1994
ISO 3	1973	Preferred numbers - Series of preferred numbers	-	-

[1)] HD 323.2.20 S3 includes A2:1987 to IEC 60068-2-20.

[2)] EN 60249-2-5 includes A2:1992 to IEC 60249-2-5.

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