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Fusibles basse tension –

Partie 3-1:
Règles supplémentaires pour les fusibles destinés à être utilisés par des personnes non qualifiées (fusibles pour usages essentiellement domestiques et analogues) –
Sections I à IV

Low-voltage fuses –

Part 3-1:
Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) –
Sections I to IV

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- la CEI 417: *Symboles graphiques utilisables sur le matériel. Index, relevé et compilation des feuilles individuelles;*

- la CEI 617: *Symboles graphiques pour schémas;*

et pour les appareils électromédicaux.

- la CEI 878: *Symboles graphiques pour équipements électriques en pratique médicale.*

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Information on the revision work, the issue of revised editions and amendments may be obtained from IEC National Committees and from the following IEC sources:

- IEC Bulletin
- IEC Yearbook
  Published yearly
- Catalogue of IEC publications
  Published yearly with regular updates

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- IEC 27: *Letter symbols to be used in electrical technology;*

- IEC 417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets;*

- IEC 617: *Graphical symbols for diagrams;*

and for medical electrical equipment,

- IEC 878: *Graphical symbols for electromedical equipment in medical practice.*

The symbols and signs contained in the present publication have either been taken from IEC 27, IEC 417, IEC 617 and/or IEC 878, or have been specifically approved for the purpose of this publication.

IEC publications prepared by the same technical committee

The attention of readers is drawn to the end pages of this publication which list the IEC publications issued by the technical committee which has prepared the present publication.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE FUSES –

Part 3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) –

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FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

International Standard IEC 269-3-1 has been prepared by sub-committee 32B: Low-voltage fuses, of IEC technical committee 32: Fuses.

This edition cancels and replaces the first edition of IEC 269-3A published in 1978.

The text of this standard is based on the following documents:

Six Months' Rule/ DIS	Reports on voting	Two Months' Procedure/ Amendment to DIS	Reports on voting
32B(CO)69	32B(CO)71	32B(CO)74	32B(CO)82 and 82A
		32B(CO)75	32B(CO)83 and 83A
		32B(CO)76	32B(CO)84 and 84A
		32B(CO)77	32B(CO)85 and 85A
		32B(CO)78	32B(CO)86 and 86A
		32B(CO)79	32B(CO)87 and 87A
32B(CO)73	32B(CO)81	32B(CO)89	32B(CO)98
32B(CO)88 and 88A	32B(CO)97		
32B(CO)91	32B(CO)99		
32B(CO)92	32B(CO)100		
32B(CO)93	32B(CO)101		
32B(CO)96	32B(CO)104		

Full information on the voting for the approval of this standard can be found in the reports on voting indicated in the above table.

IEC 269 consists of the following parts, under the general title: *Low-voltage fuses*

Part 1: 1986, *General requirements*

Part 2: 1986, *Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)*

Part 3: 1987, *Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar application)*

Part 4: 1986, *Supplementary requirements for fuse-links for the protection of semi-conductor devices.*

LOW-VOLTAGE FUSES –

Part 3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) –

Sections I to IV

Explanatory note – In view of the fact that this standard should be read together with IEC 269-1 and 269-3, the numbering of its clauses and subclauses is made to correspond to the latter. Regarding the tables, their numbering also corresponds to that of IEC 269-1: however, when additional tables appear, they are referred to by capital letters: e.g. table A, table B, etc.

1 General

Fuses for use by unskilled persons according to the following sections shall comply with all subclauses of:

IEC 269-1: *Low-voltage fuses – Part 1: General requirements*

IEC 269-3: *Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications)*

and shall comply with the requirements laid down in the relevant sections.

This standard is divided into four sections, each dealing with a specific example of standardized fuses:

Section I: D-type fuses (fuse-links and fuse-holders)

Section II: Cylindrical fuses:
Type A
Type B
Type C

Section III: Pin-type fuses

Section IV: Cylindrical fuse-links (primarily used in plugs)

NOTES

1 Examples of standardized fuses complying with the requirements of IEC 269-1 and IEC 269-3 are listed in the present standard. Other examples may be added, provided that they comply with these requirements.

2 The following fuse-systems are standardized systems with respect to their safety aspects.

The National Committees may select from the examples of standardized fuses one or more systems for their own standards. Colour codes are not specified for each fuse-system. Where colour codes are indicated, they apply only to that particular fuse-system.

1.0 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 269. 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 269 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 529: 1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 664: *Insulation co-ordination for equipment within low-voltage systems*

IEC 898: 1987, *Circuit-breakers for overcurrent protection for household and similar installations*

IEC 999: 1990: *Connecting devices – Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors*

Section I – D-type fuses

1.1 Scope

The following additional requirements apply to D-type fuses. These fuses have rated currents up to and including 100 A and rated voltages of up to and including 500 V a.c. and 500 V d.c.

5 Characteristics of fuses

5.2 *Rated voltage*

For a.c., the standard values of rated voltages are 400 V for size DO1, DO2 and DO3* and 500 V for size DII, DIII and DIV.

For d.c., the rated voltages are 250 V for DO1, DO2 and DO3 and 500 V for DII, DIII and DIV.

5.3.1 *Rated current of the fuse-link*

The rated currents of the fuse-links are given in figure 6.

5.3.2 *Rated current of the fuse-holder*

The rated currents of the fuse-carriers are given in figure 7. The rated currents of the fuse-bases are given in figure 8.

5.5 *Rated power dissipation of a fuse-link and rated power acceptance of a fuse-holder*

The maximum values of power dissipation of D-type fuse-links are specified in table A.

5.6 *Limits of time-current characteristics*

5.6.1 *Time-current characteristics, time-current zones and overload curves*

In addition to the limits of pre-arcing time given by the gates and the conventional times and currents, time-current zones are stated in figure 1. The tolerance on time-current characteristics given by the manufacturer shall not deviate by more than ±10 % in terms of current.

The time-current zones given in figure 1, including manufacturing tolerances, shall be met for all pre-arcing and operating times measured at the test voltage according to 8.7.4.

* These three sizes are also applicable for 415 V networks.

Table A – Maximum values of power dissipation

Rated current I_n A	Maximum power dissipation W	
	DO1 - DO3	DII - DIV
2	2,5	3,3
4	1,8	2,3
6	1,8	2,3
10	2,0	2,6
16	2,5	3,2
20	3,0	3,5
25	3,5	4,5
35 *	4,0	5,2
50	5,0	6,5
63	5,5	7,0
80	6,5	8,0
100	7,0	9,0

* In some countries, the rating of 35 A is replaced by 32 A and 40 A.

5.6.2 *Conventional times and currents*

The conventional times and currents, in addition to the values of IEC 269-1, are given in table II.

Table II – Conventional time and current for "gG" fuse-links

Rated current I_n A	Conventional time h	Conventional current	
		I_{nf}	I_f
$I_n \leq 4$	1	1,5 I_n	2,1 I_n
$4 < I_n < 16$	1	1,5 I_n	1,9 I_n

5.6.3 *Gates*

For "gG" fuse-links, in addition to the gates of IEC 269-1, the gates given in table III apply.

Table III – Gates for specified pre-arcing times of "gG" fuse-links with rated currents 2 A, 4 A, 6 A, 10 A and 35 A

I_n A	$I_{min.}$ (10 s) A	$I_{max.}$ (5 s) A	$I_{min.}$ (0,1 s) A	$I_{max.}$ (0,1 s) A
2	3,7	9,2	6,0	23,0
4	7,8	18,5	14,0	47,0
6	11,0	28,0	26,0	72,0
10	22,0	46,5	58,0	111,0
35	89,0	175,0	255,0	445,0

5.7 *Breaking range and breaking capacity*

5.7.2 *Rated breaking capacity*

Table A of IEC 269-3 is replaced by the following values:

- not less than 50 kA a.c.
- not less than 8 kA d.c.

NOTE – D-type fuses are frequently used in a.c. installations with short-circuit currents higher than 20 kA, and also in d.c. installations. Therefore, all fuses have to comply with the requirements of this subclause.

6 Markings

Fuse-links and fuse-holders which meet the requirements and tests of this section may be marked with "IEC 269-3-1". For devices according to this standard, national approvals can be awarded by national test-houses. Such national approvals may be marked on the relevant parts of the fuse. The marking shall be durable. This durability shall be proved by appropriate tests.

7 Standard conditions for construction

7.1 *Mechanical design*

Deviations from the dimensions specified in the standard sheets may be made, but only if they provide a technical advantage and do not adversely affect the purpose and safety of fuses complying with the standard sheets, especially with regard to interchangeability and to non-interchangeability. Fuses with such deviations shall, however, comply with all other requirements of this specification as far as they reasonably apply.

7.1.2 *Connections including terminals*

The terminals shall be capable of accepting the cross-sections of conductors indicated in table B.

The largest cross-sectional areas specified in table B may be reduced to 6 mm^2 (size DII); 16 mm^2 (size DIII) and 35 mm^2 (size DIV), provided that the fuse-base terminals are connected to internal wiring of switchboards, fuse-boxes, etc. and external conductors are consequently fitted to separate supply terminals of a type-tested or partially type-tested assembly.

7.1.3 *Fuse-contacts*

The fuse-contacts shall be nickel plated or protected by other materials of at least similar protective properties.

Fuse-link contacts of rated currents 50 A and above shall be silver plated with a minimum thickness of the silver layer of 3 µm.

Table B – Cross-sections of rigid (solid or stranded) or flexible copper conductors

Fuse-base		Cross-section mm²
Size	I_n A	
DO1 DO2 DO3	16 63 100	1,5 to 4 1,5 to 25 10 to 50
DII DIII DIV	25 63 100	1,5 to 10 2,5 to 25 10 to 50
NOTE – This table is provisional, awaiting the results of subcommittees 17B and/or 23F.		

7.1.4 *Non-interchangeability*

For rated currents below 10 A non-interchangeability is not required.

7.1.5 *Construction of a fuse-base*

Current-carrying parts of solid copper alloy shall contain at least 50 % copper and those made from rolled material at least 62 % copper.

7.1.6 *Construction of a fuse-carrier*

The screwed shell shall be of solid copper alloy containing at least 50 % copper and those made from rolled sheet at least 62 % copper. The insulating parts shall be of ceramic or other sufficiently heat-resistant material.

7.1.7 *Construction of a fuse-link*

The fuse-link body shall be of ceramic material. Contact pieces shall be of copper or an alloy containing at least 62 % copper. The colour of the fuse-indicator shall be in accordance with figure 6b.

7.1.8 *Construction of a gauge-piece*

The contact pieces, if any, shall be in one piece and made of copper alloy containing at least 50 % copper. Their contact surfaces shall be flat and free from burrs.

The metal portion of gauge-pieces of sizes DII and DIII shall have smooth contact surfaces on both sides without burrs within the prescribed area, and both contact surfaces shall protrude from the adjacent ceramic material.

For DII, DIII and DIV-fuses, the part forming the calibration ring shall be of ceramic material. The colour of the face of the calibration ring shall be in accordance with the colour of the fuse indicator given in the table in figure 6b.

NOTE – Gauge-pieces ensure non-interchangeability. Therefore, they are so designed as to be insertable or replaceable only by special hand keys which are not available to unskilled persons.

Compliance with the requirements of the subclause is to be checked by inspection.

7.2 *Insulating properties*

The minimum creepage distances, clearances and distances through the insulation material or sealing compound shall comply with the values given in table C.

Table C – Creepage distances, clearances and distances through sealing compound

Creepage distance mm	DII - DIV	DO1 - DO3
Between metal parts, including contacts, which are of different polarity when the fuse-link has operated	5	4
Between live parts and accessible metal parts, including fuse-base fixing screws or metallic fixing means for rail mounting, with a fuse-carrier, a fuse-link and a gauge-piece in position	5	3
Between live parts and cover-fixing screws or metallic fixing means for rail mounting which are not earthed and not accessible to the standard test finger	3	2
Clearance mm	**DII – DIV**	**DO1 – DO3**
Between metal parts, including contacts, which are of different polarity when the fuse-link has operated	5	3
Between live parts and accessible metal parts, including fuse-base fixing screws or metallic fixing means for rail mounting, with a fuse-carrier, a fuse-link and a gauge-piece in position	5	3
Between live parts and cover-fixing screws or metallic fixing means for rail mounting which are not earthed and not accessible to the standard test finger	3	2
Distance mm	**DII – DIV**	**DO1 – DO3**
Between live parts and the surface on which a fuse-base for front connection is mounted	10	6
Through sealing compound between live parts covered with at least 2,5 mm of sealing compound and the surface on which a fuse-base for front connection is mounted	5	3

NOTES

1 The standard test finger referred to in the above table is that specified in IEC 529.

2 Pending the results of sub-committee 17B, technical committee 23 and sub-committee 28A, the table is provisional.

7.3 *Temperature rise, power dissipation of the fuse-link and power acceptance of the fuse-holder*

Instead of table IV of IEC 269-1, table IV of IEC 269-3 applies.

7.7 *I^2t characteristics*

7.7.1 *Pre-arcing I^2t values*

In addition to table VI of IEC 269-1, the following pre-arcing I^2t values apply:

Table VI – Pre-arcing I^2t values at 0,01 s for "gG" fuse-links

I_n A	$I^2t_{min.}$ A^2s	$I^2t_{max.}$ A^2s
2	1,0	23,0
4	6,2	90,2
6	24,0	225,0
10	100,0	676,0
35	2 250,0	8 000,0

7.7.2 *Operating I^2t values*

The maximum pre-arcing I^2t values given in table VI of this standard and of IEC 269-1 shall be taken as maximum operating I^2t values and shall be verified by the breaking capacity test specified in 8.7.1 of IEC 269-1.

7.8 *Overcurrent discrimination of "gG" fuse-links*

Fuse-links 16 A and above in series, with the rated current ratio of 1:1,6 have to operate selectively in the whole breaking range (see 8.7.4).

With regard to discrimination when circuit-breakers are used, the following I^2t values shall be followed:

I_n A	$I^2t_{min.}$ A^2s	at I_p A
16	250	500
20	450	670
25	810	900
35	2 000	1 410
50	4 000	2 000
63	6 300	2 510
80	10 000	3 160
100	16 000	4 000

7.9 *Protection against electric shock*

For D-type fuses, the operation of replacing a fuse-link is considered in two stages which are: "removing the fuse-link and the fuse-carrier" and "fuse-link and fuse-carrier removed". The first stage is considered to represent D-type fuses under normal service conditions. Only when the fuse-link and the fuse-carrier are removed, the degree of protection may temporarily be reduced to IP1X.

NOTE – The temporary suspension of the complete protection "IP2X" against electric shock (after many years of sufficiently safe application of the D-type fuse-system by unskilled users) need not be regarded as dangerous, as there is enough experience with interchanging of incandescent lamps, where comparable degrees of safety exist.

8 Tests

8.1.5.1 *Complete tests*

The following additional tests are required according to tables VII and D.

Table VII – Survey of tests on fuse-links

Test according to subclause		Number of test samples					
		3	4	1	1	2	1
8.4.3.2	Verification of rated current	x					
8.7.4	Overcurrent discrimination		x				
8.11.1	Mechanical strength			x	x		
8.11.2.4	Heat storage at elevated temperature					x	x
8.11.2.6	Dimensions and non-interchangeability	x	x				

Table D – Survey of tests on fuse-bases, fuse-carriers and gauge-pieces

Test according to subclause		Number of test samples: Fuse-bases				Fuse-carriers					Gauge-pieces	
		1	1	3	1	1	1	1	3	1	1	1
8.9	Verification of resistance to heat	x				x						
8.11.1	Mechanical strength		x				x	x			x	x
8.11.2.4	Heat storage at elevated temperature			x	x				x	x		
8.11.2.6	Dimensions and non-interchangeability										x	x

8.1.5.2 *Testing of fuse-links of a homogeneous series*

In addition to IEC 269-1, the following applies:

Fuse-links having different contact parts and different shapes of ceramic bodies only intended to provide non-interchangeability and not affecting the performance may be considered to meet the requirements of a homogeneous series.

8.2 *Verification of insulating properties*

8.2.1 *Arrangement of the fuse-holder*

The metal covering (can be aluminium foil) shall not be pressed on to the inspection window. For fuse-carriers, for example, a distance of 3 mm from the outer lower edge of the insulating part shall be left uncovered by metal covering.

8.2.4.1 This test shall be performed immediately after the humidity treatment described in 8.2.4.2 of IEC 269-1. The fuse-holder shall be submitted to the test voltage given in table IX of IEC 269-1.

8.2.6 *Creepage distances, clearances and distances through sealing compound*

8.2.6.1 *Test method*

Creepage distances, clearances and distances are measured on the complete fuse, first using conductors with the smallest cross-sectional areas specified in table B, and then the largest.

NOTE – The contribution to the creepage distance of any groove less than 1 mm wide is limited to its width. Any air gap less than 1 mm wide is ignored in computing the total clearance

8.2.6.2 *Acceptability of test results*

Creepage distances, clearances and distances shall not be less than the values in millimetres in table C.

8.3 *Verification of temperature rise and power dissipation*

8.3.1 *Arrangement of the fuse*

The fuse-carrier shall be inserted with a torque as indicated in table E.

Table E – Test torque for verification of temperature rise and power dissipation

Size	Torque Nm
DO1	1,0
DO2	1,0
DO3	1,7
DII	2,7
DIII	4,3
DIV	6,7

The torque applied to the screws of the terminals is two thirds of the values given in table C of IEC 269-3.

8.3.3 *Measurement of the power dissipation of the fuse-link*

The power dissipation shall be measured between the endcaps of the fuse-link (see figure 5b).

8.3.4.1 *Temperature rise of the fuse-holder*

The test shall be made with a dummy fuse-link as specified in figure 2 for the rated current of the fuse-holder (see figure 5b).

8.3.5 *Acceptability of test results*

For terminals, the temperature rise limits, when the fuse-base is fitted with conductors having a cross-section as indicated in table X, 8.3 of IEC 269-1 for the corresponding rated current of the fuse-base, shall comply with table IV of IEC 269-3.

The power dissipation of the fuse-link shall not exceed the values specified in table G.

8.4.3.1 *Verification of conventional non-fusing and fusing current*

This test will be performed using a test rig as shown in figure 3.

8.4.3.2 *Verification of rated current of fuse-links*

Three fuse-links are subjected to 100 operating cycles, each cycle comprising a period of 1 h during which the test current flows and a period of 15 min without the current flowing.

The test current of 1,2 I_n ± 2,5 % applies only for fuse-links with rated current < 16 A. For fuse links with rated current ≥ 16 A these requirements are deemed to be met by test of 8.4.3.2 of IEC 269-1, with the exception that three samples are tested.

During these cycles, the fuse-links shall not operate. They are allowed to cool down to approximately room temperature and are then loaded with a current equal to 0,9 times I_{nf} shown in table II of IEC 269-1 and this standard. The fuse-links shall not operate within the conventional time shown in tables II of IEC 269-1 and this standard.

After the fuses have been allowed to cool down to approximately room temperature, they are loaded with I_f. The fuse-links shall operate within the conventional time.

8.4.3.5 *Conventional cable overload protection*

The test procedure described under 8.4.3.5 of IEC 269-1 is not valid for fuses < 16 A.

8.4.3.6 *Operation of indicating devices and strikers, if any*

In addition to IEC 269-1 concerning indicating devices, the following applies:

If the test is performed at reduced voltages, the test circuit voltage shall be 100 V ± 5 V and the test current shall be 2 × $I_f\,^{+20}_{\ 0}$ %.

8.5.2 *Characteristics of the test circuit*

For the test with d.c. current, table XIIB of IEC 269-1 applies, with the following exception.

Test according to 8.5.5.1

	N° 1 N° 2	N° 3 N° 4 N° 5
Time constant	15 ms $^{+5}_{0}$ms *	≤ 3 ms
* The above-mentioned time-constant is within the limits given in IEC 269-1.		

8.5.8 *Acceptability of test results*

In addition to 8.5.8 of IEC 269-1, the following applies:

After this test, the endcaps of the fuse-links may have small holes, blisters, spots and localized bulging as long as the gauge-piece and the fuse-carrier are not damaged.

8.7.4 *Verification of overcurrent discrimination*

The samples are arranged as for breaking-capacity test according to 8.5 of IEC 269-1.

Two samples are tested at the current $I_{min.}$ and two others at the current $I_{max.}$. The current values are given in table F.

The a.c. test voltage is: $\dfrac{1{,}1 \times U_n}{\sqrt{3}}$

The other characteristics of the test circuit are the same as for the breaking-capacity test no. 2 (see table XIIA of IEC 269-1).

The evaluated I^2t values shall meet the I^2t limits specified in table F.

Table F – Test currents and I^2t limits for the discrimination test

Minimum pre-arcing I^2t value			Operating I^2t value		
I_n A	Prospective $I_{min.}$ kA r.m.s.	$I^2t_{min.}$ A^2s	Prospective $I_{max.}$ kA r.m.s.	$I^2t_{max.}$ A^2s	Selectivity ratio
2	0,013	0,67	0,064	16,4	
4	0,035	4,90	0,130	67,6	
6	0,064	16,40	0,220	193,6	
10	0,130	67,60	0,400	640,0	
16	0,270	291..00	0,550	1 210,0	
20	0,400	640,00	0,790	2 500,0	
25	0,550	1 210,00	1,000	4 000,0	
32	0,790	2 500,00	1,200	5 750,0	
35	0,870	3 030,00	1,300	6 750,0	
40	1,000	4 000,00	1,500	9 000,0	1:1,6
50	1,200	5 750,00	1,850	13 700,0	
63	1,500	9 000,00	2,300	21 200,0	
80	1,850	13 700,00	3,000	36 000,0	
100	2,300	21 200,00	4,000	64 000,0	

The pre-arcing I^2t values measured at the test current I_{min} shall be higher than the I^2t value, specified in column 3 of table F. The operating I^2t values measured at the test current I_{max} shall be lower than I^2t values specified in column 5 of table F.

8.9 *Verification of resistance to heat*

8.9.1 *Fuse-base*

The test is carried out only on fuse-bases of non-ceramic insulating material.

8.9.1.1 *Test arrangement*

The fuse-base to be tested is fitted with a dummy fuse-link according to figure 2, whose power dissipation at test current lies within the limits indicated in table G.

The torque applied to the fuse-carrier shall be two-thirds of the torque specified in table H. The cross-sectional area of the conductors connected depends on the maximum rated current of the largest fuse-link to be inserted in the fuse-base (see IEC 269-1, table X).

Table G – Power dissipation of a dummy fuse-link at rated and conventional fusing currents including tolerances

Size		DO1	DO2	DO3	DII	DIII	DIV
Power dissipation at I_n	W	2,5	5,5	7,0	4,0	7,0	9,0
Power dissipation at test current I_f*	W	6,7	14,1	17,9	10,3	17,9	23,0
Force applied to the dummy fuse-link	N	35,0	50,0	75,0	50,0	75,0	110,0

* For these values a tolerance of ±3 % applies.

The fuse is placed in a test arrangement according to figure 4 and placed in a heating chamber, the conductors emerging from the cabinet are sealed. The length of the connected conductors shall be at least 1 m outside the heating chamber. The heating chamber must be such that during the test, the air temperature is kept at 80 °C ± 5 °C, measured in the plane of the sample at a distance of approximately 15 cm.

8.9.1.2 *Test method*

The air temperature in the heating chamber is raised to 80 °C ± 5 °C and is maintained for 2 h. Immediately afterwards, but while maintaining the temperature of the heating chamber, the sample is loaded with a test current corresponding to approximately I_f. At this test current the power dissipation of the dummy fuse-link shall lie within the limits indicated in table G. The current shall be kept constant during the whole test duration of 2 h. At the end of the test, a weight is applied straight and not jerkily at position 4 (see figure 4), which (taking into account the lever-arm relations) generates along arrow G a force according to table G on the dummy fuse-link. For applying the force, the inspection window has to be removed. The sample may be connected to a reduced voltage source (≥42 V).

8.9.1.3 *Acceptability of test results*

After applying the force, a current shall continue to flow through the sample. The force is maintained for 15 min and the current shall continue to flow unchanged through the sample. Furthermore, after this test, the fuse-base shall not show any damage impairing its further use.

8.9.2 *Fuse-carrier*

8.9.2.1 *Test arrangement*

A fuse-base shall be mounted on a 15 mm thick plywood board. The arrangement shall be the same as in normal use. The fuse-base is fitted with a dummy fuse-link according to figure 2. The cross-sectional area of conductors depends on the rated current of the fuse-base (see IEC 269-1, table X). The length of the conductors shall be at least 1 m outside the heating chamber in which the test arrangement is to be placed.

The torque applied to the fuse-carrier shall correspond to table H. For tightening and later loosening of the fuse-carrier, a nut is used, the interior form of which enables a tight connection to the insulated part of the fuse-carrier. The nut is tightened with a torque wrench with a square-section shank – as is usual in service – (see figure 5a). The nut and the described test device shall be placed in the above-mentioned heating chamber.

8.9.2.2 *Test method*

The air temperature in the heating chamber is raised to 80 °C ± 5 °C and maintained for 2 h. Immediately afterwards, the fuse is loaded with a test current, corresponding to approximately I_f, for 2 h and the test current must be adjusted in such a way that the power dissipation of the dummy fuse-link lies within the limits indicated in table G.

The test current shall be kept constant during the 2 h test. Immediately after the opening of the test chamber, the nut heated up during the test is fitted to the torque wrench, and with this torque wrench, the fuse-carrier is loosened twice and tightened again.

8.9.2.3 *Acceptability of test results*

After this test, the fuse-carrier shall show no damage impairing its further use; especially, the insulating material shall not show any fissures or inadmissible shrinkage.

8.10 *Verification of non-deterioration of contacts*

Subclause 8.10 of IEC 269-1 applies.

8.10.1 *Arrangement of the fuse*

Subclause 8.10.1 of IEC 269-1 applies, with the following addition:

The dummy fuse-link is given in figure 2 of this standard.

Torques to be applied to the fuse carrier are equal to 40 % of the values given in table E.

8.10.2 *Test method*

The following wording is added after the first paragraph of 8.10.2 in IEC 269-1:

The test-current is the conventional non-fusing current.

The load period is 75 % of the conventional time.
The non-load period is 25 % of the conventional time.

The conventional time, as well as the non-fusing current, are stated in table II of IEC 269-1. A test voltage lower than the rated voltage may be used.

During the no-load period, the samples are cooled down to a temperature lower than 35 °C; additional cooling (e.g. a fan) is allowed.

The last sentence of the third paragraph of 8.10.2 in IEC 269-1 is replaced by the following wording:

The voltage drop of the contacts is measured after 50, 250 and 750 cycles at direct current of I_m = (0,05 to 0,30) I_n. However, the current I_m has so to be chosen as to give a voltage drop of at least 100 µV.

The tolerance of I_m during the measurement shall not be greater than $^{+1}_{0}$ %. The points between which the voltage drop is measured are marked A, B, C and D in figure 5b.

The resistance of the contact is then determined on the basis of the voltage drop. Before measurement, the sample has to be cooled down to room temperature. If the room temperature during the measurement deviates from 20 °C, the following formula may be applied:

$$R_{20} = \frac{R_T}{1 + \alpha_{20} \times (T - 20)}$$

where

R_{20} is the resistance at temperature 20 °C;

R_T is the resistance at temperature T;

α_{20} is the temperature coefficient.

8.10.3 *Acceptability of test results*

At the end of 250 cycles (equation 1) and at the end of 750 cycles (equation 2), the following limits shall not be exceeded:

$$\frac{R_{250} - R_{50}}{R_{50}} \leq 15\,\% \qquad (1)$$

$$\frac{R_{750} - R_{50}}{R_{50}} \leq 40\,\% \qquad (2)$$

Alternatively, the temperature measured according to figure 5b can be used for verification. As measuring points, the terminating lugs of the fuse-base (figure 5b) should be chosen. In this case, the following limits shall not be exceeded:

After 250 cycles, the measured temperature rise values shall not exceed the temperature at the beginning of the test by more than 15 K and after 750 cycles, the measured temperature rise values shall not exceed the values measured at the beginning of the tests by more than 20 K.

8.11 *Mechanical and miscellaneous tests*

8.11.1 *Mechanical strength*

8.11.1.1 *Mechanical strength of the gauge-piece*

The following tests refer only to gauge-pieces of sizes DII and DIII.

Gauge-pieces shall be so constructed that the current-carrying parts are in one piece and that they withstand the mechanical stress occurring in normal use.

Compliance is checked by inspection and by the following tests:

The gauge-piece is screwed into a fuse-base by applying a torque of 1 Nm for 1 min. It is then withdrawn with the aid of the appropriate hand-key. In addition, an axial force of 10 N is applied in both directions between the metal part and the ceramic part of the gauge-piece. The test is made on the gauge-piece as delivered. For gauge-pieces having parts which are cemented or glued together, the test is repeated after the samples have been immersed for 24 h in water at the temperature of 20 °C ± 5 °C, and again after the samples have been conditioned for 1 h at a temperature of 200 °C ± 5 °C.

After these tests, the samples shall show no change impairing their future use; in particular, the thread shall not be damaged and the ceramic parts still be securely fixed to each other and shall not be detached from the metal part.

8.11.1.2 *Mechanical strength of the fuse-carrier*

A force of 2,5 N (fuse-carrier DO1 and DO2) and 5 N (in all other cases) is applied gently to the inspection window from the inside, using a steel rod of 6 mm diameter. The inspection window shall neither break nor be displaced during the test.

A test mandrel, having the maximum diameter of the fuse-link d_3 or d_4 as specified in figure 6a or figure 6b is inserted five times in the fuse-carrier. After this test, a fuse-link (smooth ceramic surface) with a minimum outside diameter d_3 or d_4 according to figure 6 shall be retained in the fuse-carrier when this is turned upside down.

8.11.1.3 *Mechanical strength of the fuse-link*

The fuse-links shall have adequate mechanical strength and their contacts shall be securely fixed. For compliance they shall be tested as follows:

The fuse-link is placed in the appropriate fuse-carrier complying with figure 7 which is screwed into a fuse-base complying with figure 8, a gauge-piece complying with figure 9 being in position. The gauge-piece has a diameter d_1 equal to the minimum value specified for the relevant rated current.

The torque applied to the fuse-carrier is equal to that specified in table H and the fuse-carrier is then withdrawn. The fuse-carrier is screwed in and withdrawn five times. After this test, the fuse-link shall show no damage within the meaning of this standard. It shall not be possible to remove the fuse-link endcaps by hand.

8.11.1.4 *Mechanical strength of the fuse*

The fuse carrier fitted with a fuse-link complying with the standards is screwed five times into the fuse-base fitted with the gauge-piece by applying a torque as given in table H and withdrawn five times. After this test, the samples shall show no change impairing their further use.

NOTE – The tests specified in 8.11.1.3 and 8.11.1.4 may be performed at the same time.

Table H – Test-torque for mechanical strength

Size	Torque Nm
DO1 DO2 DO3	1,5 1,5 2,5
DII DIII DIV	4,0 6,5 10,0

8.11.2.4 *Resistance to storage at elevated temperature*

8.11.2.4.1 *Test arrangement*

Three each of the fuse-carriers and fuse-bases to be tested shall be placed in a heating chamber at the following temperatures for a period of 168 h: 180 °C ± 5 °C for moulded insulating, supporting and current-carrying parts.

Covers shall be placed in a heating chamber at the following temperature for a period of 168 h: 100 °C ± 5 °C.

A complete fuse shall be exposed for 1 h to the following temperature to meet the requirements for cemented parts, sealing compound and colour markings: 150 °C ± 5 °C for cemented parts, sealing compound and colour markings.

8.11.2.4.2 *Test method*

After cooling down to room temperature the following shall be tested:

One fuse-carrier and fuse-base shall be exposed to humid atmospheric conditions as described in 8.2.4.2 of IEC 269-1. Immediately after this treatment, the insulating properties shall be verified at a test voltage of 2,0 kV, according to 8.2.1, 8.2.2 and 8.2.4.1 of IEC 269-1, with the exception of table IX.

The other two fuse-carriers and fuse-bases shall be tested as follows:

The fuse-carriers fitted with a fuse-link complying with the standards are screwed five times into the fuse-bases fitted with gauge-pieces by applying a torque as given in table E and withdrawn five times.

8.11.2.4.3 *Acceptability of test results*

After this test, the test samples shall show no change impairing their further use. The mechanical strength, especially of the cemented parts, shall be maintained.

Sealing compound shall not have moved to such an extent that live parts are exposed. After this test, the identification colour shall not have changed appreciably.

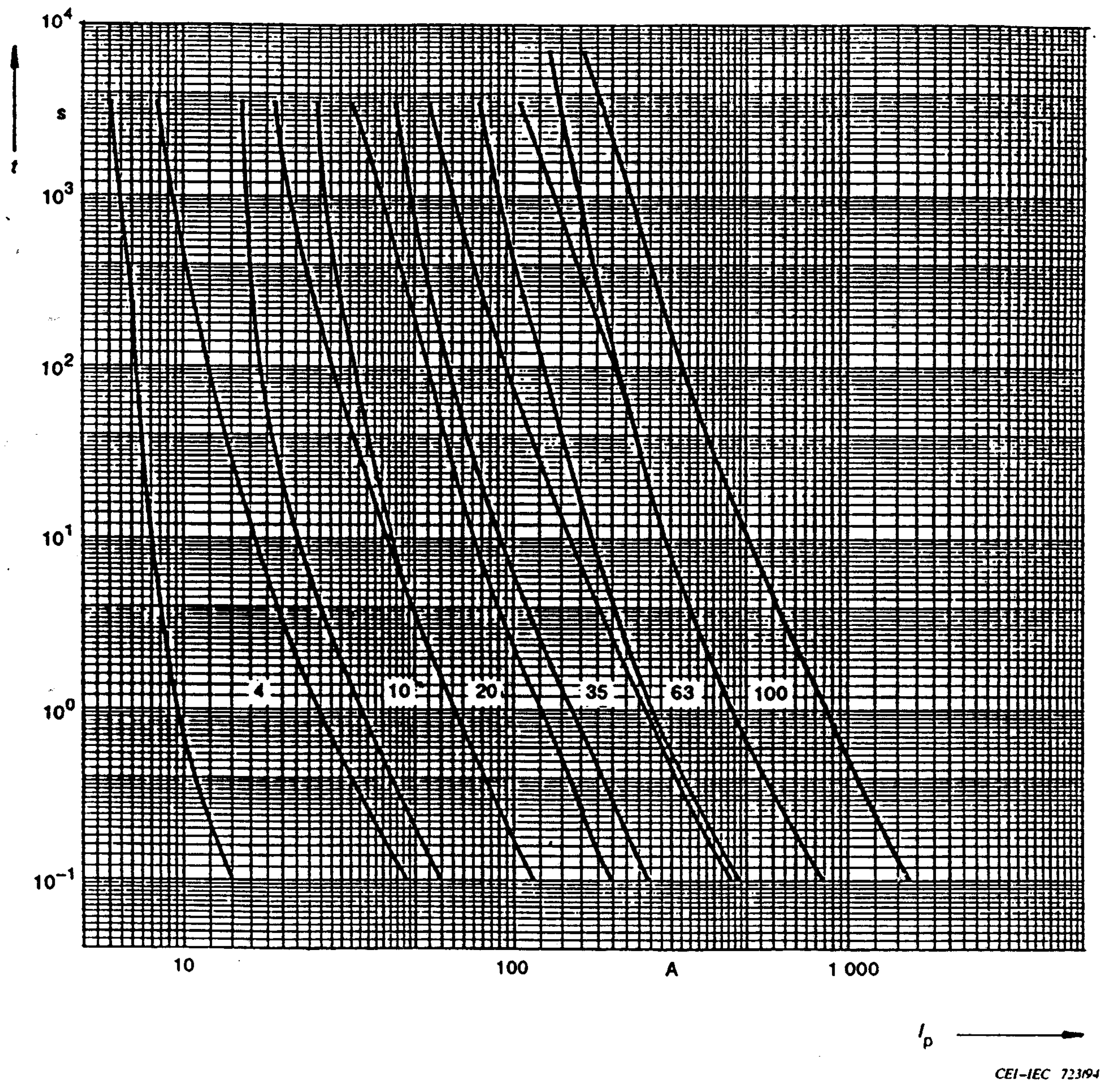
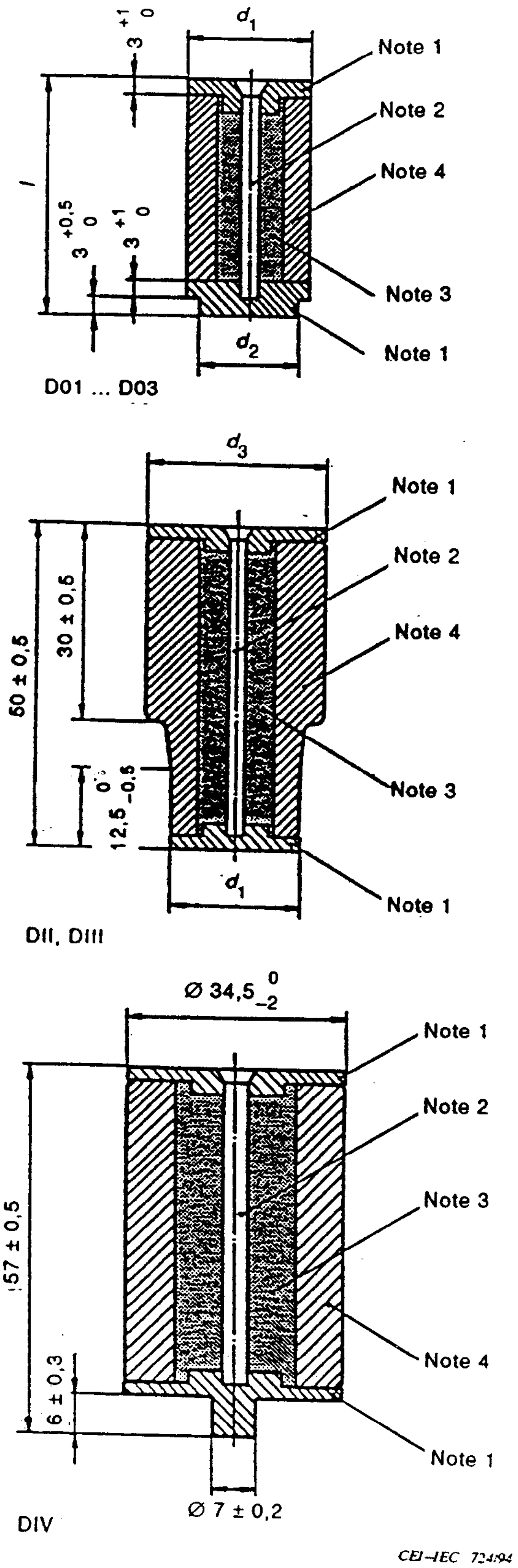


Figure 1b – Zones temps-courant pour éléments de remplacement «gG»
Time-current zones for "gG" fuse-links



Taille Size	$d_1{}^{0}_{-0,5}$	$d_2{}^{0}_{-0,5}$	$l \pm 0,5$
DO1	10,5	6	36
DO2	15	10	36
DO3	22	18	43

Taille Size	$d_1{}^{+0,2}_{-0,4}$	$d_3{}^{0}_{-1,5}$
DII	14	22,5
DIII	20	28

NOTES

1 Pièce de contact CuZn, argentée

2 CuNi 56/44 ou matériau équivalent présentant des valeurs similaires de la résistance spécifique et du coefficient de température.

3 Sable quartzeux.

4 Corps en matière céramique.

NOTES

1 Contact CuZn, silver plated.

2 CuNi 56/44 or an equivalent material with similar values of specific resistance and temperature coefficient.

3 Quartz sand.

4 Ceramic body.

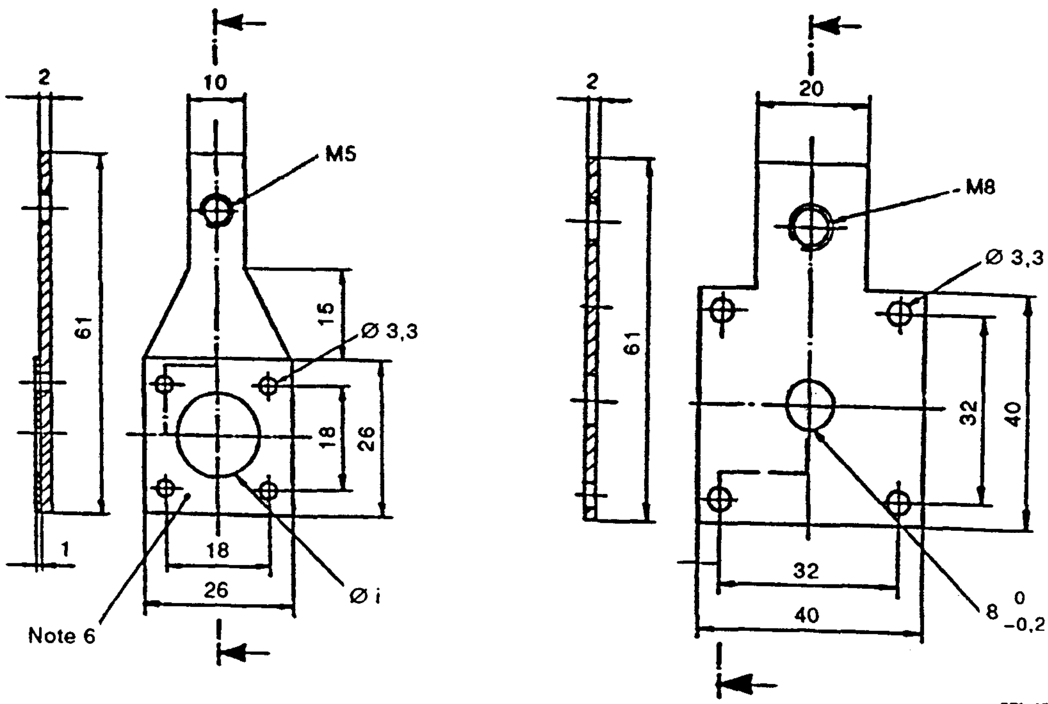
Dimensions en millimètres *Dimensions in millimetres*

Figure 2 – Eléments de remplacement conventionnels d'essai selon 8.3 et 8.9.1.1
Dummy fuse-links according to 8.3 and 8.9.1.1

Taille Size	Dimensions		Force de contact Contact force N
	a	Ø i	
DO1	35^{+2}_{0}	11,5	40 ± 10 %
DO2	35^{+2}_{0}	16,0	80 ± 10 %
DO3	42^{+2}_{0}	23,0	120 ± 10 %
DII	49^{+2}_{0}	14,5	200 ± 10 %
DIII	49^{+2}_{0}	20,5	320 ± 10 %
DIV	$56^{+2,5}_{0}$	–	550 ± 10 %

Dimensions en millimètres *Dimensions in millimetres*

Pièces de contact argentées (voir note 4 de la figure 3a)
Silver-plated contact pieces (see note 4 of figure 3a)



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Tailles DO1 à DO3 et DII, DIII
Sizes DO1 to DO3 and DII, DIII

Taille DIV
Size DIV

NOTE 6 – Plaque de centrage en matériau isolant.
Centring plate of insulating material.

Figure 3b – Dispositifs d'essai pour élément de remplacement
Test rigs for fuse-links

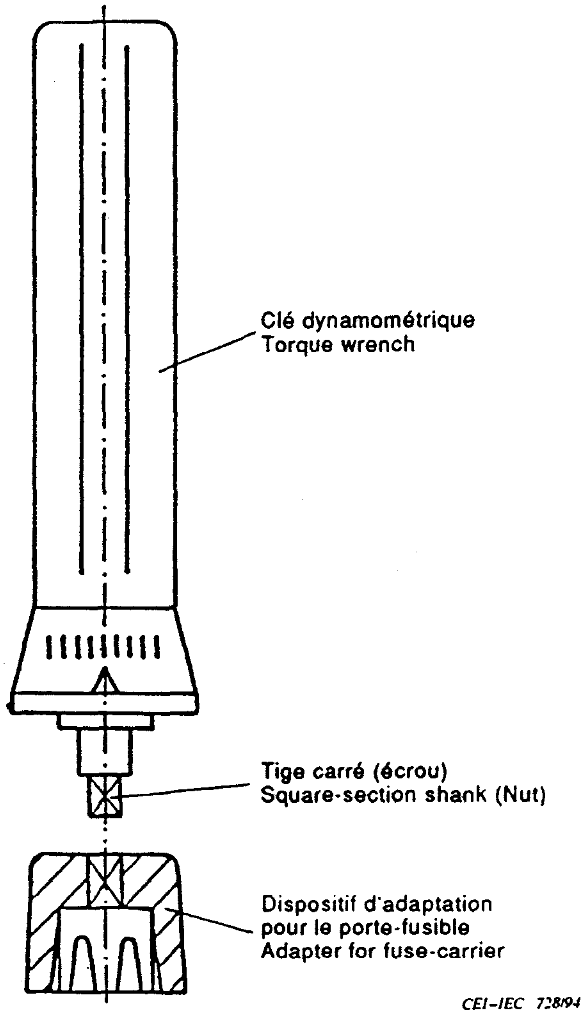
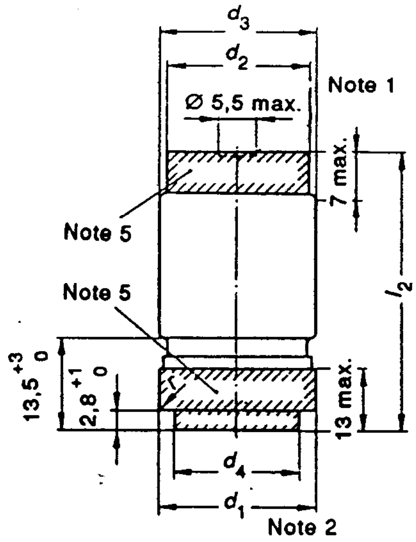
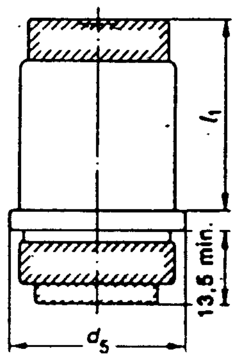


Figure 5a – Exemple de clé dynamométrique conforme à 8.9.2
Example of a torque wrench according to 8.9.2



Avec bourrelet (note 4)
With rim (note 4)



	I_n A	d_1 (note 2) ± 0,3	d_2 (min.)	d_3	d_4 (max.)	d_5 (Note 4)	l_1 (note 4)	$l_2 \pm 1$	r (max.)
DO1	2	7,3	9,8	$11\,^{0}_{-0,7}$	6	–	–	36	1
	4	7,3							
	6	7,3							
	10	8,5							
	16	9,7							
DO2	20	10,9	13,8	$15,3\,^{0}_{-0,8}$	10	16,7 (max.)	18,5	36	1
	25	12,1							
	35 (Note 3)	13,3							
	50 (Note 4)	14,5				$16,7\,^{0}_{-1,3}$			
	63	15,9				16,7 (max.)			
DO3	80 (Note 4)	22	20,6	$22,5\,^{0}_{-1}$	18	25,6 (max.)	22,5	43	1,6
	100	25							

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NOTES

1 Diamètre de l'indicateur de fusion

2 La valeur maximale de d_1 ne doit pas être dépassée sur la longueur de 13,5 mm

3 Dans certains pays, le courant assigné de 35 A est remplacé par 32 A et 40 A.

4 Choix du constructeur, obligatoire pour 50 A et 80 A. Le bourrelet est nécessaire pour ces valeurs afin d'assurer une insertion correcte. Le bourrelet peut être utilisé pour d'autres courants assignés dans les tailles DO2 et DO3.

5 Les parties hachurées précisent les zones de contact.

Corps de l'élément de remplacement en matière céramique.

Dimensions en millimètres

Les dessins ne sont pas destinés à imposer la conception, sauf en ce qui concerne les dimensions indiquées

NOTES

1 Diameter of fuse-indicator

2 The maximum value of d_1 shall not be exceeded within a range of 13,5 mm.

3 In some countries the rating of 35 A is replaced by 32 A and 40 A.

4 Choice of manufacturer, obligatory for 50 A and 80 A. The rim is necessary for the 50 A and 80 A rating to ensure correct insertion. The rim may be used for other ratings in sizes DO2 and DO3.

5 Hatched areas specify contact areas.

Body of the fuse link of ceramic material

Dimensions in millimetres

The sketches are not intended to govern the design except as regards the dimensions shown.

Figure 6a – Elément de remplacement, type D. Tailles DO1 à DO3
Fuse-link, D-type. Sizes DO1-DO3

I_n A	Couleur de l'indicateur de fusion Colour of fuse-indicator	
2	Rose	Pink
4	Brun	Brown
6	Vert	Green
10	Rouge	Red
16	Gris	Grey
20	Bleu	Blue
25	Jaune	Yellow
35 (Note 3)	Noir	Black
50	Blanc	White
63	Cuivre	Copper
80	Argent	Silver
100	Rouge	Red

NOTES

1 Diamètre de l'indicateur de fusion.

2 La valeur maximale de d_1 ne doit pas être dépassée sur la longueur de 10 mm pour les éléments de remplacement DII et DIII mesurée à partir de la face inférieure de contact.

3 Dans certains pays, la valeur nominale de 35 A est remplacée par 32 A et 40 A.

4 Forme facultative.

5 Enveloppe métallique facultative

6 La broche de calibrage n'est pas prescrite pour les éléments de remplacement ayant un courant assigné de 80A.

L'utilisation de ces couleurs est également obligatoire pour les tailles D01 à D03.

NOTES

1 Diameter of fuse-indicator.

2 The maximum value of d_1 shall not be exceeded within a range of 10 mm for fuse-links DII and DIII measured from the bottom contact.

3 In some countries, the rating of 35 A is replaced by 32 A and 40 A.

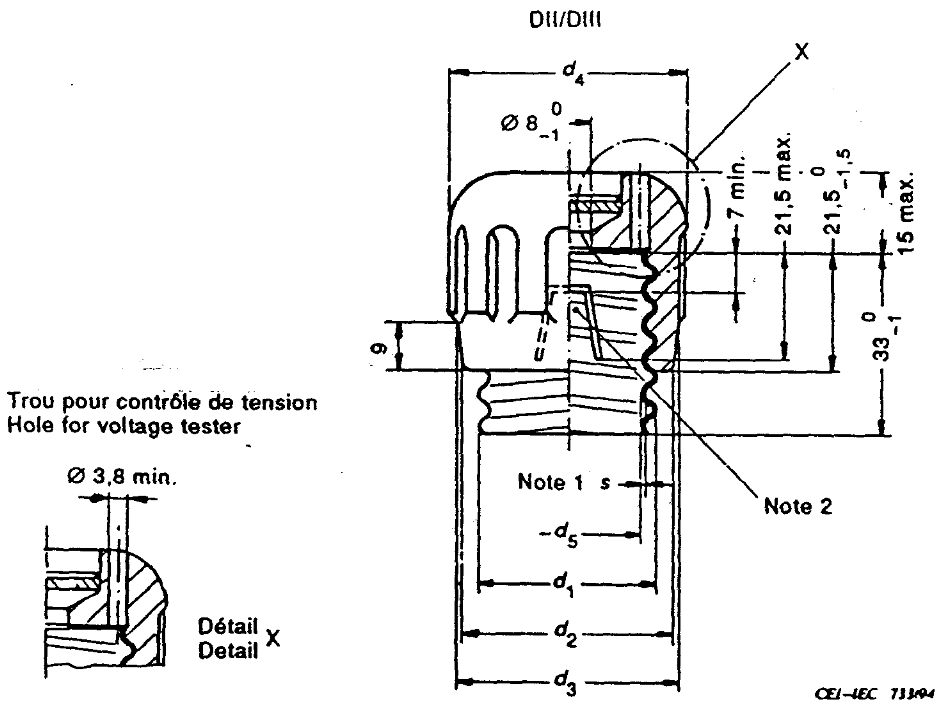
4 Alternative shape.

5 Optional metal cover.

6 The gauge-pin is not mandatory for fuse-links with rated current 80 A.

The use of these colours is mandatory also for sizes D01-D03.

Figure 6b – Elément de remplacement, type D. Tailles DII à DIV
Fuse-link, D-type. Sizes DII-DIV



Dimensions en millimètres

Les dessins ne sont pas destinés à imposer la conception, sauf en ce qui concerne les dimensions indiquées.

Les parties isolantes sont en matière céramique ou en une autre matière suffisamment résistante à la chaleur.

Dimensions in millimetres

The sketches are not intended to govern the design except as regards the dimensions shown.

Insulating parts of ceramic or other sufficiently heat-resistant material.

	I_n A	d_1	d_2 (min.)	d_3 (max.)	d_4 (max.)	d_5 (min.)	s (Note 1) (min.)
DII	25	E27	32	34	38	22,6	0,27
DIII	63	E33	40	43	48	28,1	0,37

NOTES

1 Valeur moyenne.

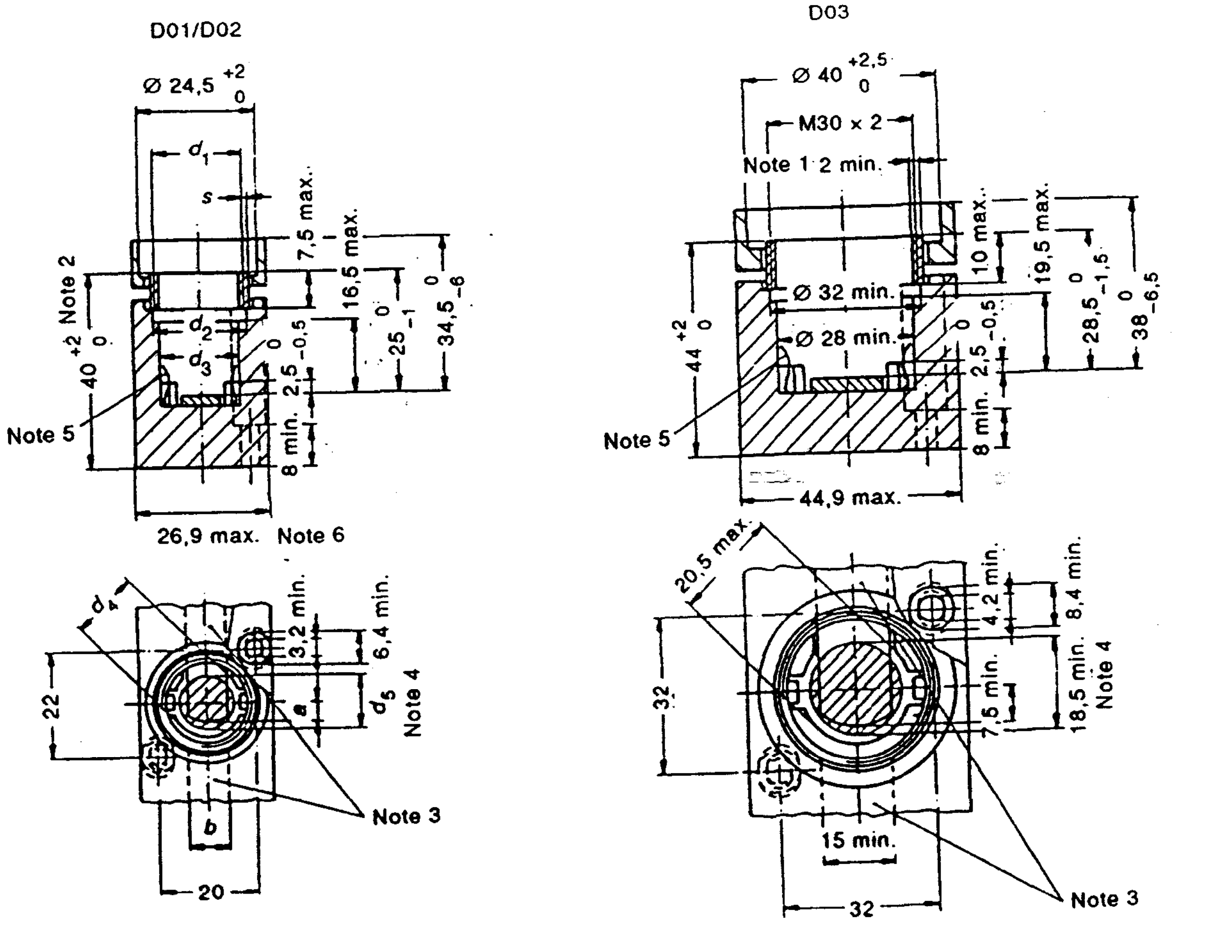
2 Clip de maintien; d'autres moyens de maintien sont autorisés.

NOTES

1 Mean value.

2 Retaining clip, other retaining means are allowed.

Figure 7b – Porte-fusibles, type D. Tailles DII à DIII
Fuse-carrier, D-type. Sizes DII-DIII



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	I_n A	a (min.)	b (min.)	d_1	d_2 (min.)	d_3 (min.)	d_4	d_5 (min.)	s (min.)	Toler. (Note 1)	Q (Note 3) (min.) mm²
DO1	16	2,5	5	E14	15	13	9,7 max.	6,5	0,3	–0,05	10
DO2	63	4	8	E18	19,5	17	13,7 max.	10,5	0,65	–0,15	30
DO3	100	Voir dessin – See sketch								–0,25	60

NOTES

1 Tolérance du premier pas du filetage.

2 Valeur préférentielle – pour les socles montés sur rail, cette valeur se réfère au bord supérieur du rail de montage.

3 Section des barrettes de connexion au moins Q mm².

4 A l'intérieur du cercle hachuré, aucune partie ne doit faire saillie par rapport à la surface.

5 Pince élastique pour l'élément de calibrage.

6 Pour des socles multiples, la valeur correspondante est multipliée.

Les parties isolantes sont en matière céramique ou en tout autre matière présentant une résistance à la chaleur suffisamment élevée.

Dimensions en millimètres
Les dessins ne sont pas destinés à imposer la conception, sauf en ce qui concerne les dimensions indiquées.

NOTES

1 Tolerance in first turn of the thread.

2 Preferred value – For fuse-bases for rail-mounting, this value refers to the top edge of the mounting rail.

3 Cross-sectional area of the connecting strips at least Q mm².

4 Within the hatched circle area no projection is allowed above the contact area.

5 Resilient grip for gauge-piece.

6 For multiple fuse-bases, the multiple value is relevant..

Insulating parts of ceramic or other sufficiently heat resistant material.

Dimensions in millimetres
The sketches are not intended to govern the design except as regards the dimensions shown.

Figure 8a – Socle, type D. Taille DO1 à DO3
Fuse-base, D-type. Sizes DO1-DO3

NOTES

1 Tolérance du premier pas du filetage.

2 Epaisseur de la barrette du fond de connexion seulement, longueur effective minimale de la partie taraudée dans la barrette: 2,2 mm (DII) et 3,2 mm (DIII) pour W3/16 in.

3 Section des barrettes de connexion: au moins Q mm². La section des barrettes de connexion peut être réduite près de leurs propres moyens de fixation et de leurs bornes. La section des barrettes de connexion est calculée pour un alliage, contenant au moins 62 % de cuivre. Les barrettes de connexion, faites de cuivre pur ou dans un autre matériau dont les conductivités électrique et thermique sont meilleures que celles calculées de l'alliage de cuivre peuvent avoir une section correspondante inférieure.

4 A l'intérieur du cercle hachuré, aucune partie ne doit faire saillie par rapport à la surface.

Pince élastique pour l'élément de calibrage.

6 Longueur effective du filetage au moins 7 mm à partir du sommet de la chemise filetée.

7 Quand des socles de taille DIII sont utilisés dans des ensembles (par exemple appareils d'utilisation) la tolérance du diamètre d_4 des couvercles de protection correspondants peut être réduite à 45 (0/–1,5).

NOTES

1 Tolerance in first turn of the thread.

2 Only thickness of bottom of connecting strip, minimum effective length of thread in connecting strip: 2,2 mm (DII) and 3,2 mm (DIII) for W3/16 in.

3 Cross-sectional area of the connecting strip at least Q mm². The cross-sectional area of the connecting strips may be reduced in the region of their own fixing means and in the region of terminals. The cross-sectional area of the connecting strips is calculated for an alloy, containing at least 62 % copper. Connecting strips, made of pure copper or other materials with improved electrical and thermal conductivity than the calculated copper alloy may have corresponding lower cross-sectional areas.

4 Within the hatched circle area no projection is allowed above the contact area.

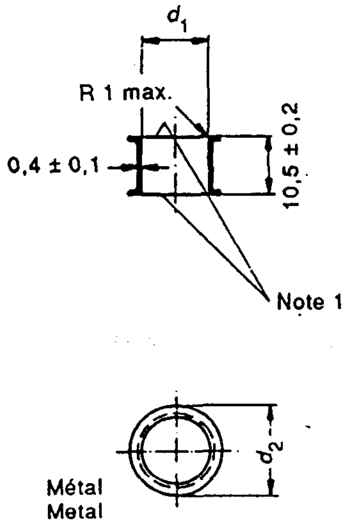
5 Resilient grip for gauge-piece.

6 Effective thread length at least 7 mm from the top of the screwed shell.

7 When fuse-bases of size DIII are used in assemblies (e.g. consumer units) the tolerance of the diameter d_4 of the corresponding protection covers may be reduced to 45 (0/–1,5).

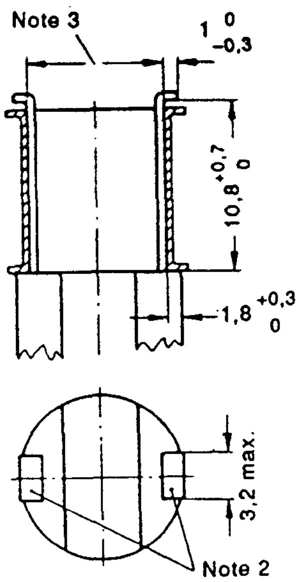
Figure 8b – Socle, type D. Taille DII à DIV
Fuse-base, D-type. Sizes DII-DIV

Eléments de calibrage D01/D02/D03
Gauge-pieces DO1/DO2/DO3



	I_n A	d_1 ± 0,1	d_2 ± 0,1
DO1	2 4 6 10 16	7,9 7,9 7,9 9,1 (Note 4)	 12 (Note 4)
DO2	20 25 35 50 63	11,5 12,7 13,9 15,1 (Note 4)	 16,6 (Note 4)
DO3	80 100	23 (Note 4)	27 (Note 4)

Partie de travail de la clé
Working head of hand-key



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NOTES

1 Surface colorée selon la figure 6b (tableau).

2 Manchon de la partie de travail.

3 Extension de 5 mm à 24 mm

4 Les éléments de calibrage ne s'appliquent pas aux caractéristiques assignées maximales.

NOTES

1 Coloured according to figure 6b (table).

2 Grip of the working head.

3 Resilient between 5 mm and 24 mm.

4 Gauge-pieces do not apply to the maximum rating.

Dimensions en millimètres

Les dessins ne sont pas destinés à imposer la conception, sauf en ce qui concerne les dimensions indiquées.

Dimensions in millimetres

The sketches are not intended to govern design except as regards the dimensions shown.

Figure 9a – Elément de calibrage et clé, type D. Tailles DO1 à DO3
Gauge-piece and hand-key, D-type. Sizes DO1-DO3

	I_n A	d_1	d_2 (min)	d_3 (min.)	d_4 0 −1,5	b_1 0 −1,5	b_2 (max.)
DII	2	6,5	4,5	6,5	24	20	19 (Note 7)
	4	6,5					
	6	6,5					
	10	8,5 (0 / +0,8)	6,5				
	16	10,5	8,5	8,5			
	20	12,5	9,5	9,5			
	25	14,5					
DIII	35 (Note 1)	16,5	15	15	30	26	25 (Note 8)
	50	18,5 (0 / +0,8)					
	63	20,5					
DIV	80	6 (±0,5)	–	–	–	–	–
	100	8 (±0,5)	–	–	–	–	–

NOTES

1 Dans certains pays, la valeur nominale de 35 A est remplacée par 32 A et 40 A.

2 Surface colorée selon la figure 6b (tableau).

3 Longueur effective du filetage au moins 2,5 mm.

4 Tolérance de 5 mm à 9 mm.

5 Matériau isolant.

6 Non nécessaire pour la taille DIV.

7 Tolérance de 18 mm à 20,5 mm.

8 Tolérance de 24 mm à 26,5 mm.

NOTES

1 In some countries, the rating of 35 A is replaced by 32 A and 40 A.

2 Coloured according to figure 6b (table).

3 Effective thread length at least 2,5 mm.

4 Resilient between 5 mm and 9 mm

5 Insulating material.

6 Not necessary for size DIV.

7 Resilient between 18 mm and 20,5 mm.

8 Resilient between 24 mm and 26,5 mm.

Figure 9b – Eléments de calibrage et clé, type D. Tailles DII à DIV
Gauge-piece and hand-key, D-type. Sizes DII-DIV

Section IIA – Cylindrical fuses type A

1.1 Scope

The following additional requirements apply to fuses having fuse-links, satisfying the dimensional requirements given in figure 10 of this section. Their rated current does not exceed 63 A and their rated voltages are 240 V or 380 V a.c.

2 Definitions

Definitions concerning terminals are given in IEC 999.

For the purpose of this section, the following definitions apply.

2.1.12 **screw-type terminal:** A terminal for the connection and subsequent disconnection of a conductor or the interconnection of the two or more conductors capable of being dismantled, the connection being made, directly or indirectly, by means of screws or nuts of any kind.

2.1.13 **pillar terminal:** A pillar terminal is a terminal with screw-clamping in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw(s). The clamping pressure may be applied directly by the shank of the screw or through an intermediate clamping member to which pressure is applied by the shank of the screw.

5 Characteristics of fuses

5.2 *Rated voltage*

The rated voltage shall be 240 V or 380 V a.c.

5.3.1 *Rated current of the fuse-link*

The rated currents of the fuse-links are given in the table of figure 10.

5.3.2 *Rated current of the fuse-holder*

The rated currents of the fuse-holders are the same as those of the fuse-links (see 5.3.1 of this section).

5.5 *Rated power dissipation of a fuse-link and rated power acceptance of a fuse-holder*

The maximum rated power dissipation of the fuse-links and the maximum rated power acceptance of the fuse-holders are given in table J.

Table J – Maximum values of power dissipation

Rated current I_n A	Rated voltage U_n V	Power dissipation/acceptance W
6	240	1,0
10	240	1,3
16	240	2,3
20	380	2,6
25	380	3,2
32	380	3,2
63	380	6,8

5.6.2 *Conventional times and currents*

The conventional times and currents, in addition to the values of IEC 269-1, are given in table II.

Table II – Conventional times and currents for "gG" fuse-links

Rated current I_n A	Conventional time h	Conventional current	
		I_{nf}	I_f
6	1	1,5 I_n	1,9 I_n
10	1	1,5 I_n	1,9 I_n

5.6.3 *Gates*

For "gG" fuse-links, in addition to the gates of IEC 269-1, the gates given in table III apply.

Table III – Gates for specified pre-arcing times of "gG" fuse-links with rating currents lower than 16 A

I_n A	$I_{min.}$ (10 s) A	$I_{max.}$ (5 s) A	$I_{min.}$ (0,1 s) A	$I_{max.}$ (0,1 s) A
6	11,0	28,0	26,0	72,0
10	22,0	46,5	58,0	111,0

7 Standard conditions for construction

7.1 *Mechanical design*

The dimensions of the cartridge must be in accordance with figure 10.

7.1.2 *Connections including terminals*

See IEC 269-1, and also IEC 999.

Within the framework of this standard, only those terminals intended for receiving copper conductors are included.

The base shall be fitted with terminals designed to receive copper conductors of cross-sectional area and current rating as in the following table.

Table J1 – Nominal section of copper conductors that the terminals must accept

Nominal current of fuse base A	Flexible conductors (Note 2) mm^2	Rigid conductors of solid core or cables mm^2
6	0,5 to 1	0,75 to 1,5
10	0,75 to 1,5	1 to 2,5
16	1 to 2,5	1,5 to 4
20	1,5 to 4	1,5 to 4
25	1,5 to 4	2,5 to 6
32	2,5 to 6 (Note 1)	4 to 10
63	6 to 16	10 to 25

NOTES

1 Attention is drawn to the fact that for certain applications, more space is necessary.

2 It is admitted that for conductors sizes 1 mm^2 to 6 mm^2, the terminals are intended only for clamping rigid solid conductors.

Verification is to be carried out by measurement and by the insertion of conductors of the smallest and largest section successively.

7.2 *Insulating properties*

As described in 7.2 of IEC 269-1 and pending the application of the requirements of IEC 664, the clearances and creepage distances given in table K shall be respected.

The verification of this prescription is made by measurements. The measurements are performed on a sample without conductors, or on a sample fitted with conductors of the maximum cross-sectional area specified in table J1.

The requirements stated above do not apply to metal covers and enclosures, if these are isolated with an internal insulating sheet.

If an enclosure of insulating material is covered internally by a metal sheet, this is in any case considered as an accessible metal part.

The thickness of the filling material exceeding a groove is not to be taken into account for evaluation of creepage distance.

The verification of this condition is made by examination.

Table K – Creepage distances and clearances

	mm
Minimum creepage distances and clearances	
1 Between live parts of the same polarity separated during breaking operation:	3
2 Between live parts of different polarities:	3
3 Between live parts and:	
a) metallic accessible parts not listed in 5, decorative parts and metallic covers, parts of mechanism, if these are isolated from live parts,	
b) screws of fixing means for surface mounting base of devices,	
c) screws or fixing means for the base of devices in flush-mounting housings,	
d) screws of covers or cover sheets,	
e) conduits entering the apparatus:	3
4 Between metallic parts of the mechanism and the accessible metallic parts, including frameworks used as support to flush-mounting device bases if an insulation is required:	3
5 Between live parts other than terminals for one part, and for the other part, metallic enclosures, or cases as well as the supporting surface of the bases:	4
6 Between terminals and the metallic enclosures or bases, as well as the supporting surface of the bases:	6
Shortest distance	
7 Between live parts covered by minimum 2 mm of sealing compound and the supporting surface of the bases:	3
NOTE – The contribution to the creepage distance of any groove less than 1 mm wide is limited to its width. Any air gap less than 1 mm is ignored in computing the total clearance.	

7.7 *I^2t characteristics*

7.7.1 *Pre-arcing I^2t values*

In addition to table VI of IEC 269-1, the pre-arcing I^2t values given in table VI of this section apply.

Table VI – Pre-arcing I^2t values at 0,01 s for "gG" fuse-links

I_n A	$I^2t_{min.}$ A^2s	$I^2t_{max.}$ A^2s
6	24,00	225,00
10	110,00	676,00

7.7.2 *Total I^2t values*

The maximum pre-arcing I^2t values given above are considered as the maximum operating I^2t values. For fuse-links with rated currents greater than 16 A, with the exception of 35 A, the maximum pre-arcing I^2t values of table VI of IEC 269-1 are considered as the maximum operating I^2t values.

7.8 *Overcurrent discrimination of "gG" fuse-links*

Fuse-links rated 16 A and above in series and with the rated current ratio of 1:1,6 have to operate selectively over the whole breaking range (see 8.7.4 of this section).

7.9 *Protection against electric shock*

As specified in 7.9 of IEC 269-1, the following details are given with regard to this clause:

a) The fuses shall be so designed that no contact can be made between different poles with fuse-carriers and fuse-links.

b) It shall be possible to replace easily a fuse-link without touching the live parts.

c) The live parts of devices protected against direct contact shall not be accessible when the fuse-base is installed and connected with conductors as in normal use, either fitted with its fuse-link or not, the fuse-carrier being in place.

NOTE – In case of a fuse unprotected against direct contact, and intended to be incorporated in appliances, this requirement does not apply to parts for which the protection shall be provided by screens or by construction in the appliance itself.

d) When the fuse-carrier is withdrawn, the accessibility to the live parts shall be possible only after a deliberate action.

These requirements are verified by the test according to 8.8 of this section.

8 Tests

8.1.5.1 *Complete tests*

The following additional test is required according to table VII.

Table VII – Survey of tests on fuse-link

Test according to subclause	Number of test samples			
	1	1	1	1
8.7.4 Verification of overcurrent discrimination	x	x	x	x

8.1.6 *Testing of fuse-holders*

The following additional test is required according to table VIII:

Table VIII – Survey of tests on fuse-holder and number of fuse-holders to be tested

Test according to subclause	Number of test samples
	1
8.12 Verification of the reliability of terminals	x

8.2.4.1 This test shall be performed immediately after the humidity treatment described in 8.2.4.2 of IEC 269-1.

The fuse-holder shall be submitted to the test voltage given in table IX of IEC 269-1.

8.3.1 *Arrangement of the fuse*

The screws of the screw terminals shall be tightened with a torque of two-thirds the torque given in table L.

Table L – Screw-thread diameters and applied torques

Nominal diameter of thread mm	Torque Nm		
	I	II	III
Up to and including 2,8	0,2	0,4	0,4
Over 2,8 up to and including 3,0	0,25	0,5	0,5
Over 3,0 up to and including 3,2	0,3	0,6	0,6
Over 3,2 up to and including 3,6	0,4	0,8	0,8
Over 3,6 up to and including 4,1	0,7	1,2	1,2
Over 4,1 up to and including 4,7	0,8	1,8	1,8
Over 4,7 up to and including 5,3	0,8	2,0	2,0
Over 5,3 up to and including 6,0	1,2	2,5	3,0
Over 6,0 up to and including 8,0	2,5	3,5	6,0
Over 8,0 up to and including 10,0	–	4,	10,0
Over 10,0 up to and including 12,0		(under consideration)	
Over 12,0 up to and including 15,0		(under consideration)	

Column I applies to screws without heads, if the screw, when tightened, does not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

Column II applies to other screws which are tightened by means of a screwdriver.

Column III applies to screws and nuts, which are tightened by means other than a screw-driver.

8.3.3 *Measurement of the power dissipation of the fuse-link*

The fuse-links are tested in open air, in a vertical position in one of the test rigs according to figures 12 and 13, according to the indications given in table M.

The sliding pin shall be well guided.

The ferrules and other parts of the fuse-base shall be made from brass with 58 % to 70 % copper, except springs, screws for connections, and the test piece used as specified in the following sub-clauses for measuring the contact resistance. Furthermore, the ferrules shall be silver plated.

After each test, it is necessary to verify the good condition of the contact surface.

Table M – Values concerning the choice and the adjustment of the test base

Cartridge Rated current A	No. of the base (see figure 12)	No. of the ferrule (see figure 12)	Distance *b* mm	Contact force N
6	1	1	48	6 to 8
10	1	2	48	6 to 8
16	2	3	56	14 to 17
20	2	3	62	14 to 17
25	2	3	62	14 to 17
32	2	3	68	18 to 22
63	3	4	80	38 to 42

8.3.4.1 *Temperature rise of the fuse-holder*

The dummy fuse-link shall have the maximum power dissipation given in table J and the dimensions in accordance with figure 11.

8.4 *Verification of operation*

8.4.1 *Arrangement of the fuse*

The fuse-links are tested in one of the test-rigs according to figure 12, chosen from the indications given in table M. The cartridge is placed under a housing in polyacryl resin according to figure 14. Before each test, it is necessary to verify the good condition of the ferrule surface.

8.4.3.6 *Operation of indicating devices and strikers, if any*

In addition to IEC 269-1, the following applies:

If the tests are performed at reduced voltages, the test circuit voltage shall be 100 V ± 5 V.

8.5 *Verification of the breaking capacity*

8.5.1 *Arrangement of the fuse*

The fuse-links are tested in a test-base according to figure 15 adjusted according to indications given in table N. The contact ferrules are of silver-plated brass.

Before beginning the test it is necessary to verify the good condition of the ferrule surfaces.

Table N – Values for adjustment of the test base

Cartridge Rated current A	No. of the ferrule	Distance *b* mm	Contact force N
6	5	70	8 to 10
10	5	70	8 to 10
16	6	73	14 to 16
20	5	79	14 to 16
25	6	79	14 to 16
32	6	85	22 to 24
63	7	85	38 to 42

8.5.8 *Acceptability of test results*

Subclause 8.5.8 of IEC 269-1 applies, under the following restrictions. The following is permissible:

- malfunction of the indicating device;
- any crack of the cartridge which does not prevent its withdrawal without a tool;
- small blisters, localized bumps on the ferrules also small holes, provided that these are not sufficient to damage the fuse-base or the fuse-carrier.

8.7.4 *Verification of overcurrent discrimination*

To verify the requirements specified in 7.7.1 and 7.7.2 of this section, four supplementary samples are tested, two to verify the minimum pre-arcing I^2t values and the other two to verify the total I^2t values.

The samples are arranged as for the breaking capacity test according to 8.5 of IEC 269-1.

The test voltage to verify the operating I^2t values shall be:

$$\frac{1{,}1 \times 380 \text{ V a.c.}}{\sqrt{3}}$$

for 380 V fuses and 1,1 × 240 V a.c. for 240 V fuses.

8.8 *Verification of the degree of protection of enclosures*

8.8.1 *Verification of protection against electric shock*

To verify the requirements given in 7.9, proceed as follows:

- the requirement b) is verified by examination;
- the requirement c) is verified by means of the test finger shown in figure 9 of IEC 898;
- the requirement d) is first verified by means of the test finger shown in figure 9 of IEC 898.

In case of the protecting screen or of parts intended to be knocked out, the test finger is applied with a 20 N force.

NOTE – It is recommended to use a lamp to detect the contact, the supply voltage being at least 40 V.

8.9 *Verification of resistance to heat*

The following two tests are performed:

Test in a heating cabinet

This test is performed with the specimen being kept in a heating cabinet at a temperature of 100 °C ± 5 °C for 1 h.

At the end of this test, significant deteriorations shall not be observed, and live parts protected with sealing compound shall not become exposed.

NOTE – Slight displacement of the sealing compound is permitted.

Ball pressure test

External parts of insulating material other than ceramic are, furthermore, submitted to a ball pressure test by means of the apparatus shown in figure 16 of IEC 898.

A steel ball of 5 mm diameter is pressed with a force of 20 N against one part of the external surface placed horizontally. The test is performed in a heating cabinet at a temperature of 125 °C ± 5 °C. After 1 h in the heating cabinet, the pressure is released, the ball is removed and after 5 min, the diameter of the impression is measured, which shall not exceed 2 mm.

Following these tests, the fuse-carrier is (without fuse-link) withdrawn and inserted by hand 50 times.

After this operation, it is verified that the force to withdraw the cover from the fuse-base, exerted in a direction perpendicular to the mounting plane of the fuse-base, is higher than 1,5 N.

The force is exerted without jerks by means of a mass of 150 g. The cover shall not be separated from the fuse-base.

8.10 *Verification of non-deterioration of contacts*

8.10.1 *Arrangement of the fuse*

A dummy fuse-link with its maximum power dissipation and its dimensions is given in 8.3.4.1 of this section and figure 11. A typical fuse-base with its spring-loaded contact pieces is given in figure 13.

Torques to be applied to the screws of the terminals are specified in 8.3.1 of this section.

In addition, 8.3.1 of IEC 269-1 and 7.3 of IEC 269-3 apply.

8.10.2 *Test method*

The load period is 75 % of the conventional time. The non-load period is 25 % of the conventional time.

The test current is the non-fusing current.

The conventional time, as well as the non-fusing current, are stated in table II of IEC 269-1.

A lower test voltage may be used.

8.10.3 *Acceptability of test results*

After 250 cycles, the measured temperature rise values of terminals shall not exceed the temperature rise measured at the beginning of the test (first cycle) by more than 15 K.

After 750 cycles, if necessary, the temperature rise values of terminals shall not exceed the values measured at the beginning of the tests (first cycle) by more than 20 K.

8.11.1.1 *Mechanical strength of the fuse-holder*

To verify that a fuse has satisfied the requirements of 7.11 of IEC 269-1 it is submitted to the following tests.

8.11.1.1.1 *Verification of resistance to shock*

The verification is made by means of the apparatus described in 8.11.1.1.1.1 of this section. The test conditions are given in 8.11.1.1.1.2 of this section.

8.11.1.1.1.1 *Test apparatus*

The test apparatus, according to figure 10 of IEC 898, consists of an arm swinging round an axis and fitted at its lower part with a hammer.

The arm is made with a steel tube of 9 mm external diameter and 8 mm internal diameter and includes:

- on its higher part, a device fitted with a swinging axis, the distance of which to the frame of the apparatus is adjustable, so that the pendulum can move only in a vertical plane perpendicular to the supporting side of the frame;
- on its lower part, a device designed to hold one of the hammers described below.

The length of the tube is such that the distance between the swinging axis of the pendulum and the hammer axis mounted on the pendulum arm is equal to 1 m.

The hammer has, as applicable, such a mass as, fixed on the tube by means of the device shown in figure 11 of IEC 898, the vertical force to apply in the axis of the hammer to maintain the pendulum arm horizontal, is:

- 2 N in case of type a, hammer so-called "of 150 g" shown in figure 11 of IEC 898.

According to dimensions, the apparatus is fixed on one of the supports shown in figure 12 of IEC 898.

The support is so arranged that it is possible:

- to place the apparatus so that the target is in the vertical plane passing by the pendulum swinging axis;
- to turn the apparatus round one vertical axis;
- to displace the apparatus horizontally, in parallel to the pendulum swinging axis.

8.11.1.1.1.2 *Test procedure*

The enclosure is fixed on the support as in normal use; the conductor apertures are left open and the cover screws are tightened with a torque equal to two-thirds of that given in table L of 8.3.1.

Enclosures intended for flush mounting are placed in the recessed portion of a block of plywood so that the edge of the enclosure box, if any, is flush with the surface of the block.

The enclosure box is tested separately and maintained against the support, its front side being directed towards the hammer.

By acting on the position of the support and that of the swinging axis of the pendulum, the enclosure is placed such as the target is in the vertical plane passing by the pendulum axis and the hammer is allowed to fall down from the prescribed height, measured vertically between the target on the enclosure and the strike point of the hammer at its free fall point.

NOTE – The blows are not applied to the knock-out holes.

The hammer to be used and the height of fall according to the enclosure classification with regard to the resistance to shocks are indicated in table P.

Table P – Hammer and height of fall for test for verification of resistance to shocks

Type of apparatus	Type of hammer	Height of fall cm
Ordinary enclosure	a	15

The apparatus is subjected to 10 blows, evenly distributed over the enclosure and if any, over the cover sheet.

The first series of five blows is applied as follows:

- in the case of flush-fitting enclosures, one blow on the centre, one blow on each end of the cover sheet and the two remaining at about half distance;

- in the case of other types, one blow on the centre, one blow on each lateral side and the two remaining blows on intermediary positions, the enclosure being turned after each blow, with the appropriate angle but not more than 60°, around a vertical axis.

The second series of five blows is then applied in the same way but after having turned the enclosure to 90° around its perpendicular axis to the support.

If there are cable entries, the two lines of targets on the specimens are chosen to be at the mid-way of the cable entries.

After the test, the enclosure shall show no damage that could decrease its protective function. It shall neither show any cracks nor deformations that could impair the operating characteristics, or alter the guaranteed qualities of the specimens.

Small cracks which do not alter the protection against direct contact may be neglected.

Fracture of the external cover sheet is permissible provided that this sheet is double and the second one satisfies the test, the live parts not being exposed.

8.11.1.1.2 *Verification of the constructional requirements*

The fuse-carriers shall comprise a device intended to maintain the fuse-link in place during the withdrawal of the fuse-carrier.

The efficiency of this device is verified by using a fuse-base corresponding to the fuse-carrier under test.

The fuse-carrier is equipped with a gauge-piece, the dimensions of which are in accordance with those given in figure 16 for the rated current of the fuse considered, and fitted together with the fuse-base as in normal use.

The fuse-carrier is then withdrawn from the fuse-base and, where an elastic device (e.g. spring clip) is used to hold the fuse-link, the fuse-carrier is kept in its most unfavourable position during about 10 s.

The test-piece shall not fall out from the fuse under the effect of its own weight.

In the case of the screw-type fuse-carrier, the threaded sleeve shall be fixed securely and shall not present a rough surface on the live surface of contact.

The verification of these conditions is made by examination and by the following test:

The fuse-carrier of a fuse-link having the maximum dimensions is screwed in fully and unscrewed 50 times consecutively as in normal use, by exerting during each screwing stroke a torque as indicated in table Q.

Table Q – Torque to be applied to the fuse-carrier

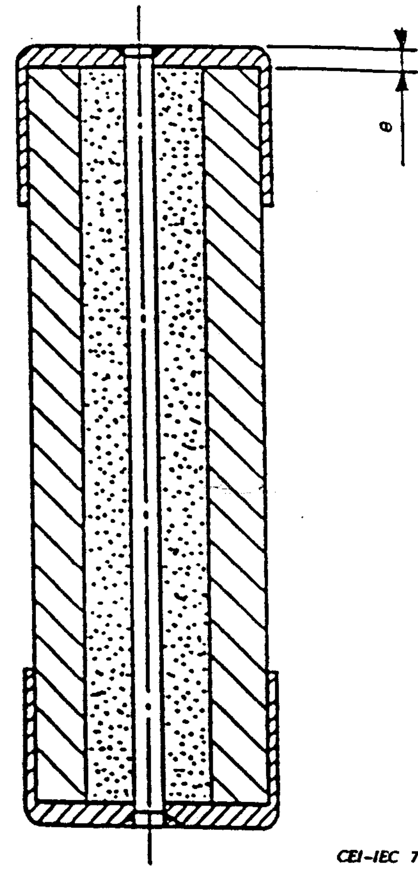
Rated current of the fuse-base A	Torque Nm
6	0,6
10	0,6
16	1,0
20	1,0
25	1,0
32	1,0
63	1,7

8.12 *Verification of the reliability of terminals*

Follow the tests described in IEC 999, clause 8.

Cote *e*
Dimension *e*

6 A	0,5 mm
10 A	1 mm
16 A	1,5 mm
20 A	1,5 mm
25 A	1,5 mm
32 A	2 mm
63 A	2 mm



Les capsules sont en cuivre nickelé argenté.

Le corps est en matériau céramique.

L'élément fusible est en alliage CuNi 56/44 ou en un matériau équivalent de valeurs de résistance spécifique et de coefficient de température similaires aux capsules par soudure ou brasure.

La matière de remplissage et d'extinction d'arc est identique à celle utilisée dans les éléments de remplacement d'usage courant.

Les autres dimensions sont indiquées à la figure 10.

Les valeurs de la puissance dissipée sont indiquées au tableau J.

Le dessin n'est pas destiné à imposer la conception, sauf en ce qui concerne les dimensions indiquées.

The endcaps are of nickel-plated and silver-plated copper.

The body is of ceramic material.

The fuse-element is of CuNi 56/44 alloy or of an equivalent material with similar values of specific resistance and temperature coefficient and is connected to the end caps by welding or brazing.

The filling and arc extinction material is identical to that commonly used in fuse-links.

The other dimensions are indicated in figure 10.

The values of power dissipation are indicated in table J.

The sketch is not intended to govern the design except as regards the dimensions shown.

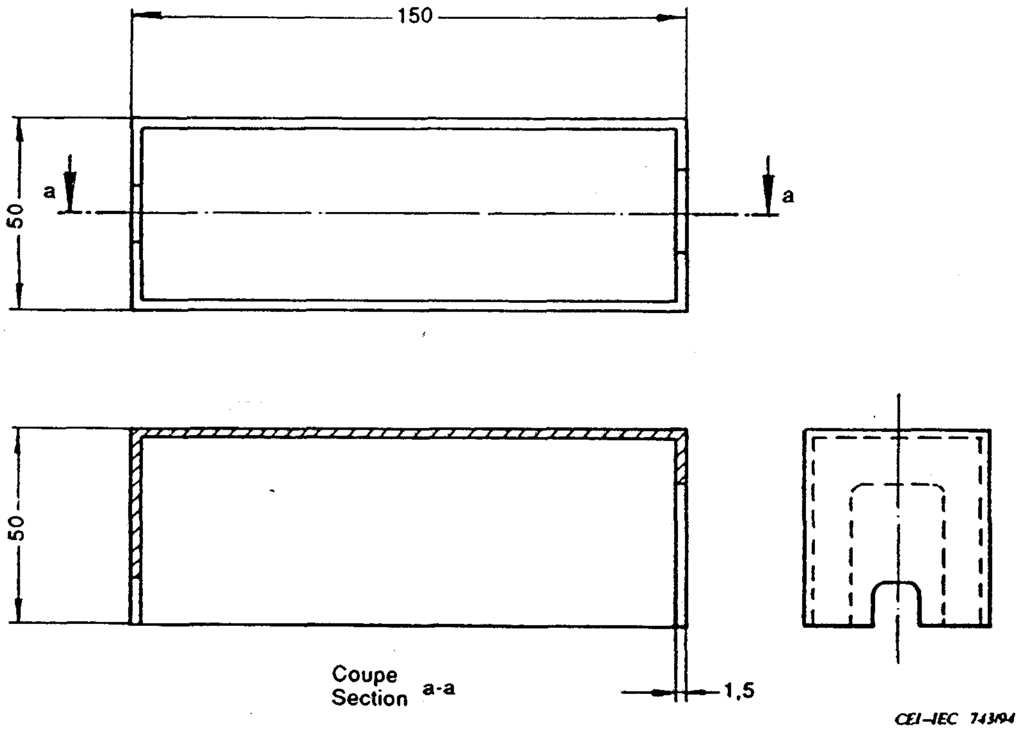
Figure 11 – Elément de remplacement conventionnel d'essai
Dummy fuse-link

Numéro du socle No. of test base	*a*	*b**	*c*	*d*	*e*	*f*	*l*	Ø 1	*s* mm²
1	8		10	12	17,5	8	50	5	4,6
2	12		10	17,5	24	15	65	6	13
3	20		10	30	40	20	75	12	30

* Cette dimension est donnée dans le tableau M.
This dimension is given in table M.

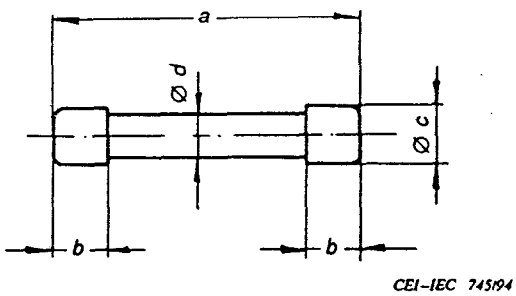
Numéro de l'embout No. of the ferrule	Ø 2	Ø 3	Ø 4	Ø 5	*g*	*i*	*l*	*k*
1	5	4	9	10	4	1	10	8
2	5	4	13	14	5	1	10	8
3	10	4	15	17	6	1,5	10	8
4	12	8	21,5	24	7	2	10	18

Figure 12 – Socle d'essai et embouts pour la mesure pour la chute de tension et la vérification des caractéristiques de fonctionnement des cartouches
Test-rig and ferrules for the measurement of the voltage drop and the verification of operating characteristics of the cartridge



Dimensions en millimètres *Dimensions in millimetres*

Figure 14 – Boîtier pour la vérification du fonctionnement des éléments de remplacement avec un socle conventionnel d'essai selon la figure 12
Housing for verification of operation of the fuse-links with a test rig according to figure 12



Matière: acier massif, les parties exposées à l'usure doivent être trempées.

Material: solid steel parts exposed to wear shall be hardened.

Courant assigné Rated current A	Tension assignée Rated voltage V	*a* mm	*b* mm	*c* mm	*d* mm
6	250	$22{,}2^{0}_{-0{,}1}$	$4{,}4^{+0{,}1}_{0}$	$6{,}2^{0}_{-0{,}02}$	$5{,}2^{0}_{-0{,}05}$
10	250	$22{,}2^{0}_{-0{,}1}$	$4{,}4^{+0{,}1}_{0}$	$8{,}4^{0}_{-0{,}02}$	$7{,}4^{0}_{-0{,}05}$
16	250	$25{,}4^{0}_{-0{,}1}$	$5{,}9^{+0{,}1}_{0}$	$10{,}2^{0}_{-0{,}02}$	$9{,}2^{0}_{-0{,}05}$
20	380	$31{,}0^{0}_{-0{,}1}$	$5{,}9^{+0{,}1}_{0}$	$8{,}4^{0}_{-0{,}02}$	$7{,}4^{0}_{-0{,}05}$
25	380	$31{,}0^{0}_{-0{,}1}$	$5{,}9^{+0{,}1}_{0}$	$10{,}2^{0}_{-0{,}02}$	$9{,}2^{0}_{-0{,}05}$
32	380	$37{,}4^{0}_{-0{,}1}$	$9{,}7^{+0{,}1}_{0}$	$10{,}2^{0}_{-0{,}02}$	$9{,}2^{0}_{-0{,}05}$
63	380	$34{,}9^{0}_{-0{,}1}$	$9{,}1^{+0{,}1}_{0}$	$16{,}6^{0}_{-0{,}02}$	$15{,}6^{0}_{-0{,}05}$

Figure 16 – Calibres pour vérifier le maintien de la cartouche dans le porte-fusible, lors de l'extraction
Gauge for verification of the upholding of the cartridge in the fuse-carrier during withdrawal

Section IIB – Cylindrical fuses type B

1.1 Scope

The following additional requirements apply to fuses having cylindrical fuse-links:

Type I: rated currents up to and equal 45 A a.c. and a rated voltage of 240 V a.c.

Type II: rated currents up to and equal 100 A a.c. and a rated voltage of 415 V a.c.

5 Characteristics of fuses

5.3 *Rated current*

5.3.1 *Rated current of the fuse-link*

The maximum rated currents are shown in figure 17.

5.3.2 *Rated current of the fuse-holder*

The rated currents of the fuse-holders are shown in figures 18 and 19.

5.5 *Rated power dissipation of a fuse-link and rated power acceptance of a fuse-holder*

The maximum power dissipation of the fuse-links is given in figure 17.

The power acceptance of the fuse-holders is given in figure 19.

5.6 *Limits of time-current characteristics*

5.6.1 *Time-current characteristics, time-current curves and overload curves*

In addition to the limits of the pre-arcing time given by the gates and the conventional time and currents, the time-current zones, excluding manufacturing tolerances, are given in figures 20a and 20b. The tolerances on individual time-current characteristics shall not deviate by more than ±10 % in terms of current.

5.6.2 *Conventional times and currents*

The conventional times and currents, in addition to the values of IEC 269-1, are given in table II.

Table II – Conventional time and current for "gG" fuse-links

Rated current I_n A	Conventional time h	Conventional currents	
		I_{nf}	I_f
$I_n < 16$	1	1,25 I_n	1,6 I_n

5.7 *Breaking range and breaking capacity*

5.7.2 *Rated breaking capacity*

The rated breaking capacity shall be 31,5 kA for 415 V fuse-links and 20 kA for 240 V fuse-links.

7 Standard conditions for construction

7.1 *Mechanical design*

7.1.2 *Connections including terminals*

Reference is made to IEC 999, clause 7.

7.9 *Protection against electric shock*

The degree of protection against electric shock shall be at least IP2X for all three stages.

8 Tests

8.1 *General*

8.1.4 *Arrangement of the fuse*

The dimensions of the fuse-links are given in figure 17 and the fuse-holders in figures 18 and 19.

8.3 *Verification of temperature rise and power dissipation*

8.3.1 *Arrangement of the fuse*

The test arrangement for fuse-links is given in figures 18 and 19. The test arrangement shall be mounted vertically. The connections to the test arrangements for the 100 A fuse-link shall be 25 mm^2 PVC-insulated copper conductors. The connectors for other current ratings shall be as specified in table X of IEC 269-1.

8.3.3 *Measurement of the power dissipation of the fuse-link*

The fuse-link shall be tested in the test rig shown in figure 21.

8.4 *Verification of operation*

8.4.1 *Arrangement of fuse*

The test arrangement for the fuse-link is specified in 8.3.1 of this section.

8.5 *Verification of breaking capacity*

8.5.1 *Arrangement of the fuse*

The test arrangement of the fuse-link is given in figure 22.

8.5.8 *Acceptability of test results*

The requirements of IEC 269-1 apply, and in addition, fuse-links shall operate without the melting of the fine wire fuse which indicates arcing to the metal enclosure and without mechanical damage to the test rig.

8.10 *Verification of non-deterioration of contacts*

8.10.1 *Arrangement of the fuse*

The test arrangement is given in 8.3.1 of this section.

The test shall be made in accordance with 8.3.4.1 of IEC 269-1 by using fuse-links as given in figure 17 as dummy fuse-links.

The dummy fuse-links shall have dimensions that comply with figure 17.

The power dissipation of the dummy fuse-links shall not be less than the maximum rated power dissipation given in figure 17 when tested in the standardized power-dissipation test rig according to figure 21.

The dummy fuse-links shall be so constructed that they do not operate during passage of the overload current I_{nf}.

8.10.2 *Test method*

The load period is 75 % of the conventional time.
The non-load period is 25 % of the conventional time.

The test current is the non-fusing current.

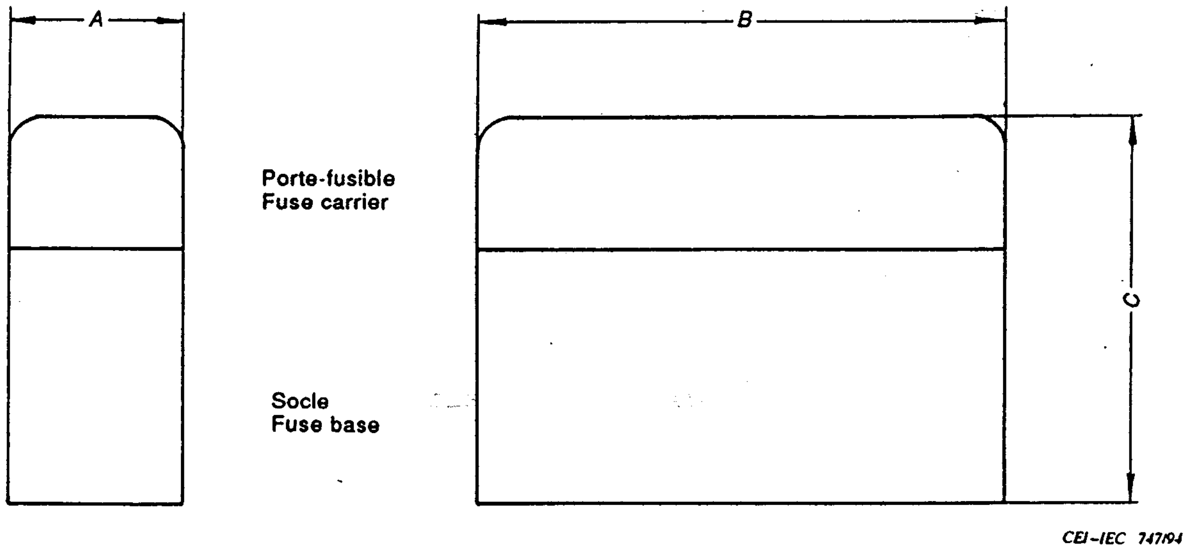
The conventional time, as well as the non-fusing current, are stated in table II of IEC 269-1.

A lower test voltage may be used.

8.10.3 *Acceptability of test results*

After 250 cycles, the measured temperature rise values of terminals shall not exceed the temperature rise measured at the beginning of the tests (1st cycle) by more than 15 K.

After 750 cycles, if necessary, the temperature rise values of terminals shall not exceed the values measured at the beginning of the tests (1st cycle) by more than 20 K.



Courant assigné Rated current A	Taille de l'élément de remplacement Fuse-link size	Puissance dissipable assignée Rated power acceptance W	*A* max. mm	*B* max. mm	*C* max. mm
20	Ia, Ib	2,5	25,4	77,0	56,0
32	Ic	3,0	28,0	77,0	56,0
45	Id	3,5	30,0	80,0	60,0

NOTE – Ce dessin n'est inclus qu'à titre d'illustration et n'empêche pas l'utilisation de formes différentes, à condition que les dimensions indiquées ci-dessus soient respectées.

This drawing is included by way of illustration only and does not prejudice the use of other shapes or forms, provided they fall within the dimensions listed above.

Figure 18 – Contours types et dimensions de porte-fusibles et socles pour élément de remplacement cylindriques de tension 240 V
Typical outline dimension of carriers and bases for 240 V cylindrical fuse-links

Courant assigné maximal Maximum rated current A	Taille de l'élément de remplacement Fuse-link size	Puissance dissipable assignée Rated power acceptance W	*A* mm
63	IIa	5,0	22,2
100	IIb	6,0	30,1

Figure 19 – Porte-fusible et socle types pour éléments de remplacement cylindriques de 415 V, de taille IIa et IIb
Typical carrier and base for 415 V cylindrical fuse-links, size IIa and IIb

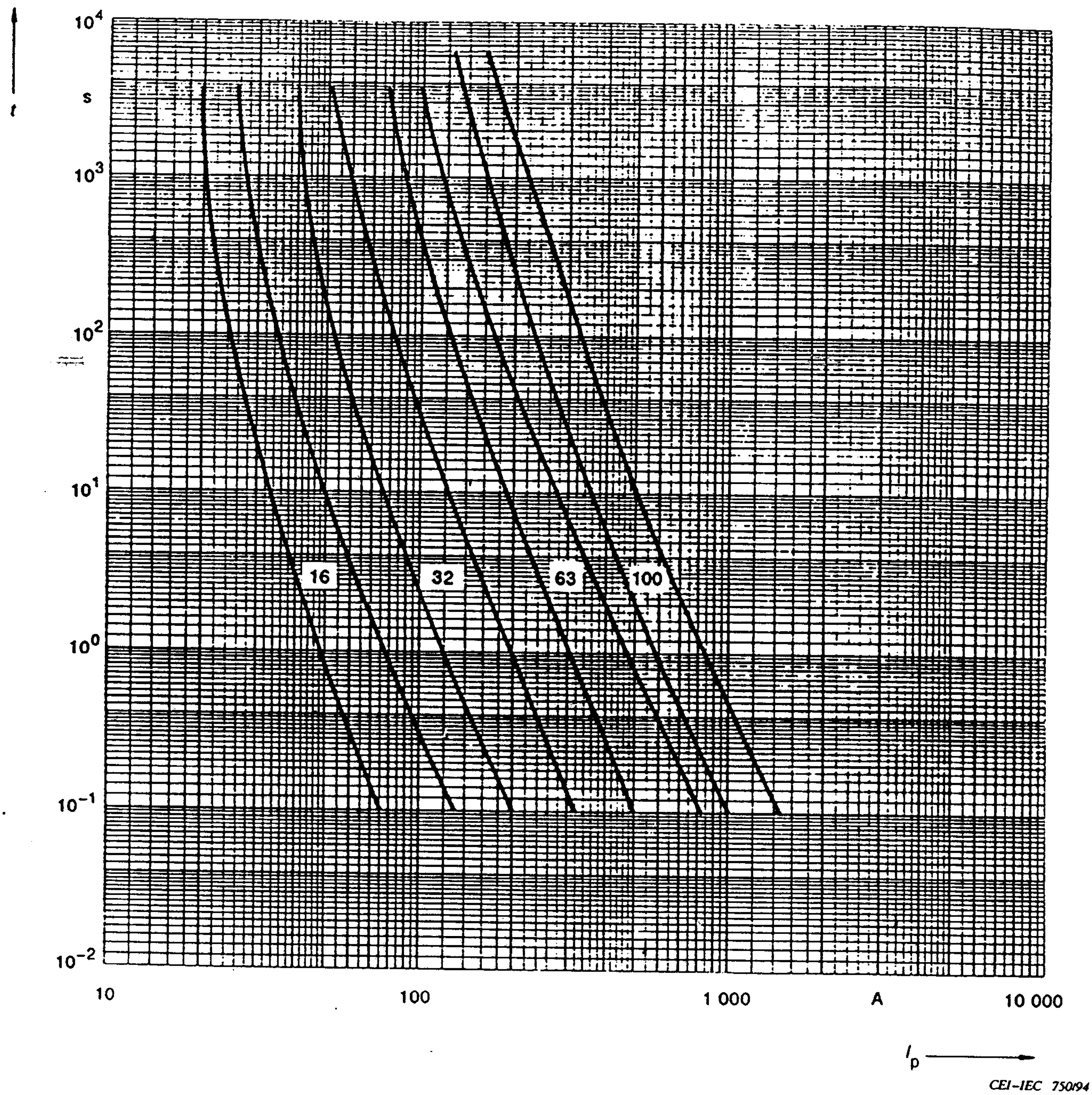


Figure 20b – Zones temps-courant pour éléments de remplacement «gG»
Time-current zones for "gG" fuse-link

A (max.)	Taille Size	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*	*L*	*M* *
100	IIb	63,5	38	47,7	41,3	19	8,7	16	1,2	30,1	M5	5,2	1,6
63	IIa	63,5	30	40	41,3	15	8,7	16	1,2	22,2	M5	5,2	1,6
45	Id	42	25	34	25,5	12,5	5	10	0,6	16,7	M3,5	4	1,6
32	Ic	42	25	34	25,5	12,5	5	10	0,6	12,7	M3,5	4	1,6
20	Ib	29	19	28	19	9,5	4	6,5	0,6	10,3	M3,5	4	1,6
5	Ia	29	19	28	19	9,5	4	6,5	0,6	6,3	M3,5	4	0,8

* Ces chiffres ne sont donnés qu'à titre d'indication. Il convient qu'ils soient ajustés de manière à assurer la pression de contact appropriée entre les clips et les capsules de la cartouche.

* These figures are for guidance only. They should be adjusted to give adequate contact pressure between the clips and the fuse endcaps.

Figure 21 – Socle conventionnel d'essai pour les essais de vérification de la puissance dissipée
Standard test rig for power-dissipation test

NOTES

1 Recouvrement amovible en tissu métallique, tôle en acier doux ou tôle perforée en acier doux suffisamment épaisse pour assurer une rigidité appropriée. La largeur des mailles du tissu ou des perforations de la tôle ne doit pas dépasser 8,5 mm^2 de surface. La courbure du recouvrement peut différer de celle indiquée dans les dessins, à condition que la ligne de fuite de 19 mm entre le recouvrement et les parties actives ne soit pas dépassée.

2 Boulons de raccordement en cuivre à conductivité élevée.

3 Adaptateurs en cuivre de section minimale de 25 mm × 6,3 mm et de longueur et centres de fixation appropriés à l'élément de remplacement en essai.

4 Clips de fusible de tailles appropriées aux éléments de remplacement en essai; les dimensions seront indiquées prochainement.

5 La disposition des connexions du coupe-circuit au-delà du socle conventionnel n'est pas spécifiée (le deuxième alinéa de 8.5.1 de la CEI 269-1 ne s'applique pas). La section des conducteurs en cuivre doit correspondre au pouvoir de coupure assigné.

6 Le socle doit être en matériau isolant; le socle conventionnel d'essai doit avoir une rigidité suffisante pour pouvoir supporter les efforts auxquels il est soumis sans les transmettre à l'élément de remplacement en essai.

7 Bande en cuivre.

8 Fusible en fil de cuivre de diamètre d'environ 0,1 mm avec une longueur libre d'au moins 75 mm, raccordé entre la borne et un pôle de la source d'essai.

9 Chanfrein.

10 Connexion amovible nécessaire pour l'essai du courant présumé. Elle peut être fendue pour faciliter la déconnexion.
La section de la connexion en cuivre doit correspondre au pouvoir de coupure assigné.

NOTES

1 Detachable cover fabricated from woven wire cloth, mild steel sheet or perforated mild steel sheet of such thickness as to ensure reasonable rigidity. Individual apertures in the wire cloth or perforated steel sheet shall not exceed 8,5 mm^2 in area. The cover may differ in section from that shown on the drawings, provided that the clearance of 19 mm between the cover and live metal parts is not exceeded.

2 Connecting studs of high conductivity copper.

3 Copper adaptor plates of minimum section 25 mm × 6,3 mm length and fixing centres appropriate to the fuse-link under test.

4 Fuse clips of a size appropriate to the fuse-links under test. Specific dimensions are pending.

5 The arrangement of the test connections beyond the test rig is not specified (the second paragraph of 8.5.1 of IEC 269-1 does not apply).

6 The base shall be made from insulating material and the test rig shall be of sufficient rigidity to withstand the forces encountered without applying external loads to the fuse-link under test.

7 Copper strip.

8 Fine wire fuse of copper wire approximately 0,1 mm diameter, with a free length of not less that 75 mm, connected between the terminal and one pole of the test supply.

9 Chamfer.

10 Short-circuiting link required for prospective current test. This may be slotted for easy disconnection. The size of the copper link shall be selected according to the rated breaking capacity.

Figure 22 – Socle conventionnel d'essai pour la vérification du pouvoir de coupure
Breaking-capacity test rig

Section IIC – Cylindrical fuses type C

1.1 Scope

The following additional requirements apply to fuses having fuse-links type C of rated currents up to and including 63 A and rated voltages up to and including 380 V a.c., whose dimensions are shown in figures 23 and 24.

5 Characteristics of fuses

5.3.1 *Rated current of the fuse-link*

The rated currents of the fuse-links, sizes and colours of indicating-devices (if any) are given in table R.

Table R – Fuse-links: rated currents, sizes and colours of indicating devices (if any)

Fuse size	Rated current A										
	2	4	6	10	16	20	25	32	40	50	63
0	x	x	x	x	x	x					
1	x	x	x	x	x	x	x				
2						x	x	x			
3								x	x	x	
4									x	x	x
Colours of indicating devices	pink	brown	green	red	grey	blue	yellow	black	brass	white	copper

5.3.2 *Rated current of the fuse-holder*

The rated currents for the fuse-holders are given in table S.

Table S – Rated currents of fuse-holders

Size	Rated current of fuse-holders A
0	20
1	25
2	32
3	50
4	63

5.5 *Rated power dissipation of a fuse-link and rated power acceptance of a fuse-holder*

The maximum values of the rated power dissipation of a fuse-link are given in table T.

Table T – Maximum rated power dissipation of fuse-links

Rated current of fuse-link A	2	4	6	10	16	20	25	32	40	50	63
Maximum power dissipation of fuse-link W	2,5	2,5	2,5	2,6	2,8	3,5	4,0	4,6	5,2	6,5	7

The rated values of power acceptance of fuse-holders are given in table U.

Table U – Rated power acceptance of fuse-holder

Size	Rated power acceptance of fuse-holders W
0	3,5
1	4,0
2	4,6
3	6,5
4	7,0

5.6 *Limits of time-current characteristics*

5.6.1 *Time-current characteristics, time-current zones and overload curves*

In addition to the limits of pre-arcing time given by the gates and the conventional currents, the time-current zones are shown in figure 25.

5.6.2 *Conventional times and currents*

The conventional currents for fuse-links having rated currents less than 16 A, in addition to IEC 269-1, are given in table II.

Table II – Conventional times and currents for fuse-links of I_n < 16 A

Rated current of the fuse-link A	Conventional time h	Conventional currents	
		I_{nf}	I_f
2 to 4	1	1,5 I_n	2,1 I_n
6 to 10	1	1,5 I_n	1,9 I_n

5.6.3 *Gates*

For fuse-links smaller than 16 A, in addition to the gates of IEC 269-1, the following gates in table III apply.

Table III – Gates for specified pre-arcing times of "gG" fuse-links with rated currents lower than 16 A

I_n A	$I_{min.}$ (10 s) A	$I_{max.}$ (5 s) A	$I_{min.}$ (0,1 s) A	$I_{max.}$ (0,1 s) A
2	3,7	8,5	6	23
4	8,0	18	14	45
6	12	26	28	75
10	22	38	50	85

7 Standard conditions for construction

7.1 *Mechanical design*

Fuse-links and fuse-bases shall be in accordance with figures 23 and 24.

7.1.2 *Connections including terminals*

The terminals shall be capable of accepting the cross-sectional areas of the conductors specified in table W.

Table W

Size	Cross-sectional areas of rigid conductors mm^2	Cross-sectional areas of flexible conductors mm^2
0	1,0 to 4	0,75 to 2,5
1	1,0 to 6	0,75 to 4
2	2,5 to 10	1,5 to 6
3	4,0 to 16	2,5 to 10
4	6,0 to 25	4,0 to 16

7.2 *Insulating properties*

The values of clearances and creepage distances shall not be less than those shown in table K.

7.3 *Temperature rise, power dissipation of the fuse-link and power acceptance of the fuse-holder*

Instead of table IV of IEC 269-1, table IV of IEC 269-3 applies.

7.7 *I^2t characteristics*

7.7.1 *Minimum pre-arcing I^2t values at 0,01 s*

The values are given in table Y.

Table Y – Minimum pre-arcing I^2t values at 0,01 s

I_n	A	2	4	6	10
$I^2t_{min.}$	A^2s	1	6,2	24	100

7.7.2 *Maximum operating I^2t values at 0,01 s*

The values are given in table Z.

Table Z – Maximum operating I^2t values at 0,01 s

I_n	A	2	4	6	10	16	20	25	32	40	50	63
$I^2t_{max.}$	A^2s	30	80	330	400	1 000	1 800	3 000	5 000	9 000	16 000	27 000

8 Tests

8.1.6 *Testing of the fuse-holder*

In addition to IEC 269-1, table VIII applies.

Table VIII – Survey of the complete tests on fuse-holders and number of fuse-holders to be tested

Test according to subclause		Number of fuse-holder tests			
		1	1	1	1
8.9.1	Test in heating cabinet	x			
8.9.2.1	Ball pressure test at 125 °C				x
8.9.2.2	Ball pressure test at 70 °C or $T + 40$ K			x	
8.11.1.6.1	Impact test		x		
8.11.1.6.2	Construction of the fuse-carrier		x		
8.11.1.6.3	Mechanical strength of the screw-type fuse-holder			x	

8.3 *Verification of temperature rise and power dissipation*

In addition to IEC 269-3, the following applies:

8.3.1 *Arrangement of the fuse*

The screws of screw terminals shall be tightened with a torque of two thirds of the torque specified in table C of IEC 269-3.

8.3.3 *Measurement of the power dissipation of the fuse-link*

The power dissipation shall be measured between the endcaps of the fuse-link.

This verification shall be carried out in the test rig shown in figure 26.

The contact forces for this test are specified in table AA.

Table AA – Contact forces of the test rig

Test rig	Fuse-link size	Contact force N
A	0	15 ± 10 %
	1	20 ± 10 %
	2	25 ± 10 %
B	3	40 ± 10 %
	4	50 ± 10 %

8.3.4.1 *Temperature rise of the fuse-holder*

This test shall be carried out with the dummy fuse-link shown in figure 27.

For screw-type fuse-holders, the relevant fuse-carrier shall be tightened with a torque equal to two-thirds the torque specified in table BB.

Table BB – Torque to be applied to the screw-type fuse carrier

Size	Torque Nm
0	1,0
1	1,2
2	1,4
3	1,8
4	3,0

8.4 *Verification of operation*

8.4.1 *Arrangement of the fuse*

In addition to IEC 269-1, the following applies:

The fuse-links are tested in test rigs as specified in figure 26. The fuse-link is placed under a housing of polyacryl resin according to figure 28.

The fuse shall be tested in a horizontal position. Before each test, it is necessary to verify the correct state of contact piece surfaces of the test rig.

8.5 *Verification of the breaking capacity*

8.5.1 *Arrangement of the fuse*

In addition to IEC 269-1, the following applies:

The fuse-links are tested in test rig according to figure 26. The contact forces to be applied are given in table AA. Before each test, it is necessary to verify the correct state of the contact piece surfaces of the test rigs.

8.5.8 *Acceptability of test results*

Small blisters, localized bumps and small holes on the contact pieces may be neglected.

8.7.4 *Verification of discrimination*

To verify the requirements specified in 7.7.1 and 7.7.2 of this section, the samples are arranged as for breaking capacity tests according to 8.5 of IEC 269-1. The test voltage to verify the operating I^2t values shall be:

$$\frac{1{,}1 \times 380 \text{ V a.c.}}{\sqrt{3}}$$

8.9 *Verification of resistance to heat*

8.9.1 *Test in heating cabinet*

The following test applies to fuse-holders.

The fuse-holder is kept for 1 h in a heating cabinet at a temperature of 100 °C ± 2 °C.

During the test, it shall not undergo any change impairing its further use, and sealing compound, if any, shall not flow to such an extent that live parts are exposed.

After the test, and after the fuse-holder has been allowed to cool down to approximately room temperature, there shall be no access to live parts which are normally non-accessible when the fuse-holder is mounted as in normal use, even if the standard test finger (see figure 9 of IEC 898) is applied with a force not exceeding 5 N.

After the test, markings shall still be legible. Discoloration, blisters or a slight displacement of the sealing compound may be disregarded, provided that safety is not impaired within the meaning of this standard.

8.9.2 *Ball pressure test*

The following test applies to fuse-holders.

8.9.2.1 Parts made of insulating material, necessary to retain current-carrying parts in position, are subjected to a ball pressure test by means of the apparatus as specified in 8.14.2 of IEC 898.

A protective conductor is not considered as a current-carrying part. The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface with a force of 20 N.

The test is made in a heating cabinet at a temperature of 125 °C ± 2 °C. After 1 h, the ball is removed from the sample, which is then cooled down within 10 s to approximately room temperature by immersion in cold water.

The diameter of the impression caused by the ball is measured, and shall not exceed 2 mm.

8.9.2.2 Parts of insulating material, not necessary to retain current-carrying parts in position even though they are in contact with them, and parts in contact with parts of the protective circuit, if ~~any~~, are subjected to a ball pressure test as specified above, but the test is made at a temperature of 70 °C ± 2 °C, or 40 °C ± 2 °C plus the highest temperature rise *T* determined for the relevant part during the test of 8.3 of this section, whichever is the higher. The test is not made on parts of ceramic material.

8.10 *Verification of non-deterioration of contacts*

8.10.1 *Arrangement of the fuse*

A dummy fuse-link, with its maximum power dissipation and its dimensions, is given in figure 27 of this standard. Subclause 8.3.4.1 of this section applies.

Torques to be applied to the screws of the terminals are specified in 8.3.1 of this section.

8.10.2 *Test method*

The load period is 75 % of the conventional time.
The non-load period is 25 % of the conventional time.

The test-current is the non-fusing current.

The conventional time, as well as the non-fusing current, are stated in table II of IEC 269-1. A lower test-voltage may be used.

8.10.3 *Acceptability of test results*

After 250 cycles, the measured temperature-rise values of terminals shall not exceed the temperature rise measured at the beginning of the test (1st cycle) by more than 15 K.

After 750 cycles, if necessary, the temperature-rise values of terminals shall not exceed the values measured at the beginning of the test (1st cycle) by more than 20 K.

8.11 *Mechanical and miscellaneous tests*

8.11.1.6 *Mechanical strength of the fuse-holder*

Fuse-holders shall have adequate mechanical behaviour so as to withstand stresses imposed during installation and use.

Compliance is checked by the tests specified in 8.11.1.6.1, 8.11.1.6.2 and 8.11.1.6.3 of this section.

8.11.1.6.1 Impact test

This test is performed on the fuse-holder fitted with its enclosure or cover-plate mounted as in normal use. The sample is subjected to impact by means of the test apparatus as shown in figures 10, 11 and 12 of IEC 898.

The striking element has a hemispherical face of 10 mm radius, made of polyamide having a Rockwell hardness of HR100, and has a mass of 150 g ± 1 g.

It is rigidly fixed to the lower end of a steel tube with an external diameter of 9 mm and a wall thickness of 0,5 mm, which is pivoted at its upper end in such a way that it swings only in a vertical plane.

The axis of the pivot is 1 000 mm ± 1 mm above the axis of a striking element.

The Rockwell hardness of the polyamide striking element is determined by using a ball having a diameter of 12,700 mm ± 0,0025 mm, with the initial load 500 N ± 2,5 N and the extra load 100 N ± 2 N.

Additional information concerning the determination of the Rockwell hardness of plastics is given in ASTM D 785-89*.

The design of the apparatus is such that a force between 1,9 N and 2,0 N has to be applied to the face of the striking element to maintain the tube in a horizontal position.

The sample is mounted on a sheet of plywood, 8 mm thick and 175 mm square, secured at its top and bottom edge to a rigid bracket, which is part of the mounting support.

The mounting support shall have a mass of 10 kg ± 1 kg and shall be mounted on a rigid frame by means of pivots. The frame is fixed to a solid wall.

The design of the mounting is such that:

- the sample can be so placed that the point of impact lies in the vertical plate through the axis of the pivot;
- the sample can be removed horizontally and turned about an axis perpendicular to the surface of the plywood;
- the plywood can be turned around a vertical axis.

For flush-type fuses, the sample is mounted in a suitable recess provided in a block of plywood or similar material, which is fixed to a sheet of plywood, and not in its relevant mounting box. If wood is used for the block, the direction of the wood-fibres shall be perpendicular to the direction of the impact. Flush-type fixing fuses shall be fixed by means of screws to lugs recessed in the plywood block.

Flush-type claw-fixing fuses shall be fixed to the block by means of the claws.

The sample is mounted so that the point of impact lies in the vertical plane through the axis of the pivot. The striking element is allowed to fall from a height of 10 cm.

The height of fall is the vertical distance between the position of a checking point, when the pendulum is released, and the position of that point at the moment of impact. The checking point is marked on the surface of the striking element where the line through the point of intersection of the axes of the steel tube of the pendulum and the striking element, and perpendicular to the plane through both axes, meets the surface.

Theoretically, the centre of gravity of the striking element should be the checking point. As the centre of gravity in practice is difficult to determine, the checking point is chosen as described above.

The sample is subjected to 10 blows, which are evenly distributed over the sample.

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* The American Society for Testing and Materials Standard Test Method for Rockwelll Hardness of Plastics and Electrical Insulating Materials.

In general, five blows are applied as follows:

– For flush-type fuses, one blow on the fuse-carrier; the other blows shall be distributed on the external surface as follows:

- one at each extremity of the area over the recess in the block; and
- the other two approximately midway between the previous blows, preferably on the ridge, if any, the sample being moved horizontally.

– For other fuses, one blow on the fuse-carrier, the other blows shall be distributed on the external surface as follows:

- one on each side of the sample after it has been turned as far as possible, but not through more than 60°, about a vertical axis; and
- the other two approximately midway between the previous blows, preferably on the ridge, if any.

The remaining blows are then applied in the same way, after the sample has been turned through 90° around its axis perpendicular to the plywood.

Cover-plates and other covers of multiple fuses are tested as though they were the corresponding number of separate covers, but only one blow is applied to any point.

After the test, the sample shall show no damage within the meaning of this standard. In particular, live parts shall not become accessible.

In case of doubt, it shall be verified that it is possible to remove and to replace external parts, such as boxes, enclosures, covers and cover-plates, without these parts or their insulating lining being broken.

If, however, a cover-plate, backed by an inner cover, is broken, the test is repeated on the inner cover, which shall remain unbroken.

Damage to the finish, small dents which do not reduce creepage distances or clearances below the value specified in 7.2 of this section and small chips which do not adversely affect the protection against electric shock may be neglected.

Cracks not visible to the naked eye and surface cracks in fibre-reinforced mouldings and the like may be ignored. Cracks or holes in the outer surface of any part of the fuse-holder may be ignored if the fuse-holder complies with this section, even if this part is omitted.

If a decorative cover is backed by an inner cover, fracture of the decorative cover may be neglected if the inner cover withstands the test after removal of the decorative cover.

8.11.1.6.2 Construction of the fuse-carrier

All fuse-carriers shall comprise a device intended to maintain the fuse-link in place during the withdrawal of the fuse-carrier from the fuse-base.

The efficiency of this device is verified by using a fuse-base corresponding to the fuse-carrier under test. The fuse-carrier is equipped with a gauge, having contact dimensions corresponding to the maximum contact dimensions of the relevant fuse-link specified in figure 23 for the rated current of the fuse considered and fitted together with the fuse-base as in normal use.

The fuse-carrier is then withdrawn from the fuse-base and the gauge is replaced by a new gauge, having contact dimensions corresponding to the minimum contact dimensions specified in figure 24.

The fuse-carrier is then kept in its most unfavourable position during about 10 s. The gauge shall not fall out from the fuse-carrier under the effect of its own weight.

The weight of the gauge used for this test should be as near as possible to the weight of the relevant fuse-link; moreover, the contact surfaces shall be made of polished steel.

8.11.1.6.3 Mechanical strength of the screw-type fuse-holder

This test applies only to screw-type fuses.

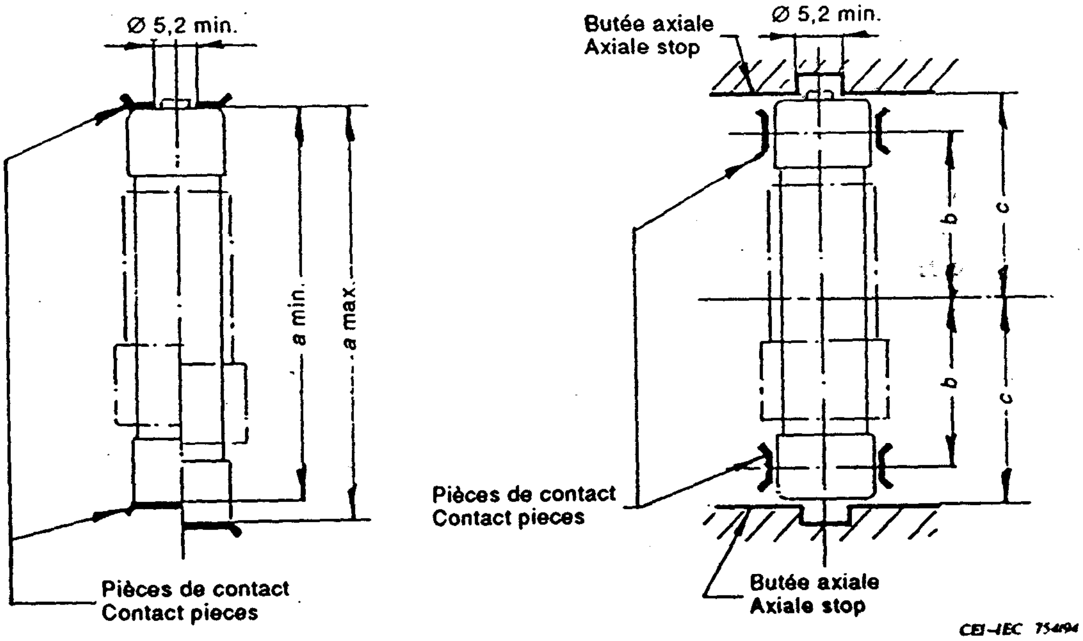
The fuse-carrier, with a relevant fuse-link complying with figure 23, is screwed and unscrewed five times into the fuse-base by applying a torque as given in table BB. After this test, the sample shall not show any change impairing its further use.

Contacts sur les extrémités de l'élément de remplacement

Contacts on fuse-link end surfaces

Contacts sur les surfaces cylindriques de l'élément de remplacement

Contacts on fuse-link cylindrical surfaces



NOTES

1 Les contacts doivent être assurés à l'intérieur des dimensions *a* min. et *a* max.

2 Les butées axiales et les pièces de contact doivent être construites de façon à ne pas gêner l'action des indicateurs de fusion, s'il en existe.

3 Des socles ayant un contact sur une extrémité et l'autre sur une surface cylindrique sont admis.

NOTES

1 The contacts shall be ensured within dimensions *a* min. and *a* max.

2 Axial stops and contact pieces shall be so constructed as not to interfere with the indicating devices, if any.

3 Bases having one contact on fuse-link end surface and the other on fuse-link cylindrical surface are allowed.

Taille Size	Contacts sur les extrémités Contacts on end surfaces		Contacts sur les surfaces cylindriques Contacts on cylindrical surfaces	
	a min.	a max.	$b^{+0,3}_{0}$	$c^{0}_{-0,3}$
0	30,8	32,2	13	16,5
1	35	37	14,5	18,9
2	37	39	15,5	19,9
3	49,8	51,2	21,5	25,5
4	49,8	51,2	21	25,5

Dimensions en millimètres

Dimensions in millimetres

Les dessins ne sont pas destinés à imposer la conception, sauf en ce qui concerne les dimensions indiquées.

The sketches are not intended to govern the design except as regards the dimensions shown.

Figure 24 – Socle
Fuse-base

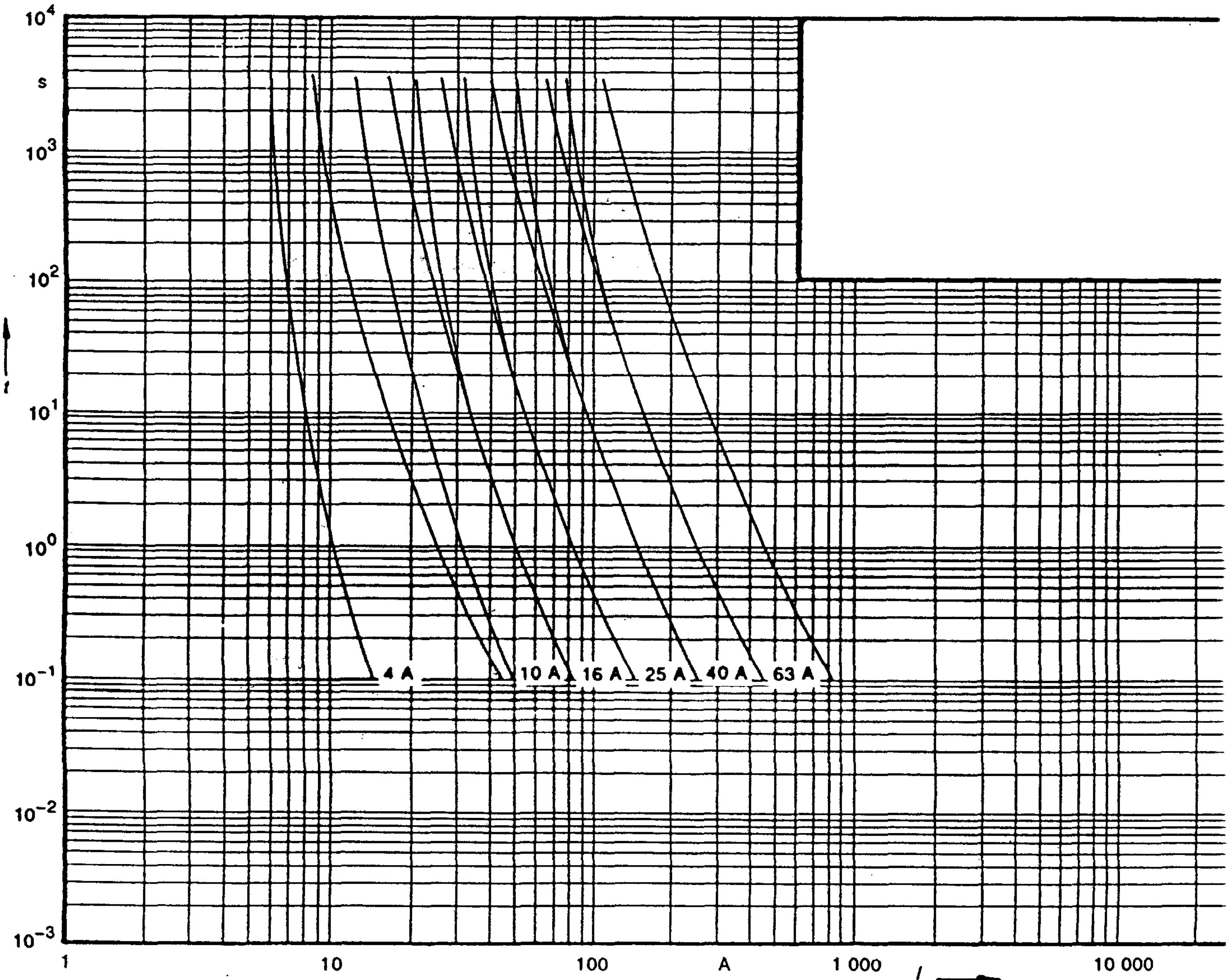


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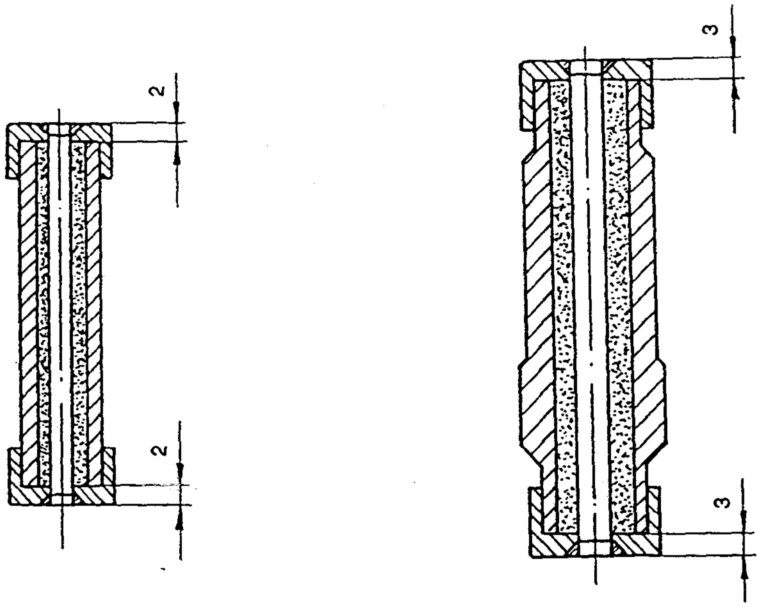
Figure 25b – Zones temps-courant
Time-current zones



NOTE – Les capsules sont en un alliage de cuivre et d'étain nickelé. Le corps est en matériau céramique. L'élément fusible est en un alliage de 56 % de cuivre et de 44 % de nickel ou en un matériau équivalent ayant des valeurs de résistance spécifique et de coefficient de température similaires (par exemple constantan), connecté aux capsules par soudure au cuivre. Les matières de remplissage et d'extinction d'arc sont identiques à celles utilisées dans les éléments de remplacement d'usage courant. Les autres dimensions correspondent aux valeurs indiquées à la figure 23.

Les valeurs de la puissance dissipée sont indiquées au tableau T.

NOTE – The end caps are made of copper tin alloy, nickel plated. The body is made of ceramic material. The fuse element is made of an alloy of 56 % copper and 44 % nickel or of an equivalent material with similar values of specific resistance and temperature coefficient (e.g. constantan), hard-soldered to the end caps. The arc-extinguishing medium and the filling are the same as those of the normal fuse-links. The other dimensions are those specified in figure 23.

The values of power dissipation are specified in table T.

Figure 27 – Elément de remplacement conventionnel d'essai
Dummy fuse-link

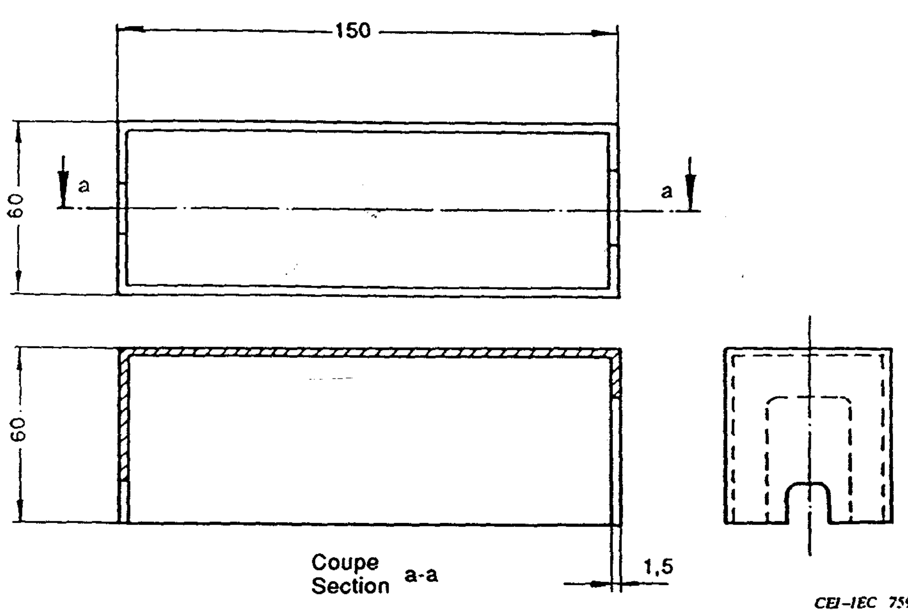


Figure 28 – Boîtier pour la vérification du fonctionnement des éléments de remplacement
Housing for verification of operation of the fuse-links

Section III – Pin-type fuses

1.1 Scope

The following additional requirements apply to pin-type fuses according to figures 29, 30 and 31.

These fuses have rated currents up to and including 50 A and a rated voltage of 230 V a.c.

2 Definitions

2.3 *Characteristic quantities*

2.3.25 **equivalent section of a fuse-base:** The minimum section of the copper wire to be protected when the fuse-base is fitted with a fuse-link of the maximum current rating which the fuse-base can accommodate.

2.3.26 **size of the fuse-base:** Conventional Roman figure by which the type of the fuse-base is defined with regard both to its equivalent section and to the maximum rated current of the fuse-link the fuse-base can accommodate.

5 Characteristics of fuses

5.5 *Rated power dissipation of the fuse-link*

The maximum values of the power dissipation of fuse-links are given in table CC.

Table CC – Maximum values of power dissipation

Rated current fuse-link A	2-4-6	10	16	20	25	32	40	50
Maximum power dissipation of fuse-link W	1,0	1,3	2,2	2,5	3,0	3,2	4,0	5,0

5.6 *Limits of time-current characteristics*

5.6.2 *Conventional times and currents*

In addition to IEC 269-1, the following values apply:

Table II

Rated current of the fuse-link I_n A	Conventional time h	Conventional currents	
		I_{nf}	I_f
$2 \leq I_n \leq 4$	1	1,5 I_n	2,1 I_n
$6 \leq I_n \leq 10$	1	1,5 I_n	1,9 I_n

5.6.3 *Gates*

In addition to IEC 269-1, the gates in the following table apply:

Table III

Rated current I_n A	Current	Pre-arcing time s	Current	Pre-arcing time s
$2 \leq I_n \leq 4$	5 I_n	≤ 0,05	1,75 I_n	≥ 10
$6 \leq I_n \leq 10$	7 I_n	≤ 0,1		

6 Markings

6.1 *Markings of fuse-holders*

Add the following information according to figure 30 to the list of general markings:

– the equivalent section in square millimetres followed by the symbol "mm^2".

6.2 *Markings of fuse-links*

Add the following information according to figure 29 to the list of general markings:

– the minimum section of the protected copper wire in mm^2;

– the marking shall include an identification colour code as a function of the protected minimum section.

6.4 *Markings of the gauge-pieces*

The following information, according to figure 31, shall be marked on the gauge-piece:

– the equivalent section in square millimetres, followed by the symbol "mm^2".

7 Standard conditions for construction

7.1 *Mechanical design*

7.1.8 *Construction of the gauge-piece*

7.1.8.1 A gauge-piece shall be in one piece (in accordance with figure 31).

7.1.8.2 A gauge-piece shall be so constructed that it can be secured home in the fuse-base when the latter is installed and fitted with wire as in normal use.

7.1.8.3 A gauge-piece shall be such that it cannot readily be removed once the fuse-base is installed and fitted with conductors as in normal use. Removing a gauge-piece shall only be possible from the rear of the fuse-base. Removal of a gauge-piece from the front end of the fuse-base shall cause its destruction.

7.3 *Temperature rise, power dissipation of the fuse-link and power acceptance of the fuse-holder*

The temperature rise of the terminals, measured on the outgoing side, shall not exceed the value specified in 7.3 of IEC 269-3 when the fuse-base is fitted with conductors having a cross-section as indicated in table EE of this standard (see 8.3.3).

8 Tests

8.3 *Verification of temperature rise and power dissipation*

8.3.1 *Arrangement of the fuse*

For the test, terminal screws or nuts are tightened with a torque equal to two-thirds of that specified in table DD.

Table DD

Nominal diameter of screw or bolt mm	Torque Nm
2,6	0,4
3,0	0,5
3,5	0,8
4,0	1,2
5,0	2,0
6,0	2,5
8,0	5,5
10,0	7,5

8.3.3 *Measurement of the power dissipation of the fuse-link*

The fuse-link shall be mounted in the fuse-holder specified in table EE and connected with wires of the corresponding cross-sectional area.

Table EE

Rated current of the fuse-link A	Size of fuse-holder	Cross-sectional area mm^2
≤ 10 16	I II	1,5 2,5
20	II	4
25 to 32	III	6
40 to 50	IV	10

For the measurement of the power dissipation, the voltage drop across the fuse-link contacts is measured between the points marked "S" shown in figure 32.

8.3.4 *Test method*

The measurement of the temperature rise of the fuse-base and power dissipation of the fuse-link shall be made after 1 h of application of the rated current.

8.3.4.1 *Temperature rise of the fuse-holder*

The test for the temperature rise shall be made with a.c. by using a dummy fuse-link according to figure 29, whose power dissipation corresponds with the size of the fuse-base, as shown in table FF.

Table FF

Size of fuse-holder	Maximum rated current of fuse-link A	Power dissipation of the dummy fuse-link W
I	16	$2{,}2^{\ 0}_{-5}$ %
II	20	$2{,}5^{\ 0}_{-5}$ %
III	32	$3{,}2^{\ 0}_{-5}$ %
IV	50	$5{,}0^{\ 0}_{-5}$ %

The envelope of the dummy fuse-link is made of insulating material, totally enclosed and painted matt black.

The filling material consists of quartz sand, SiO_2, homogeneously granulated 180 µm-350 µm.

The heating element consists of a constantan wire (54 % Fe, 45 % Ni, 1 % Mn, ρ = 0,50 $\Omega \cdot mm^2/mm$) with a total length of 30 mm and a diameter as shown in table GG. This wire is soldered to the two contact pins inside the groove provided for that purpose (see figure 32).

The dimension *b* of both contact pins is free in order to adjust the necessary free length (*a*) for the constantan wire. The pins are made of brass, containing 58 % copper, 3 % lead, the rest consisting of zinc. Pins are coated with a silver facing of at least 10 µm. This facing is hardened by polishing.

The heat element is placed at 20 mm above the bottom of the casing. Its temperature rise shall not exceed 120 K at rated current.

The points between which the measurement of the power dissipation of each dummy fuse-link is taken are indicated by an "S" in figure 32.

Prior to each test, the contact pins are calibrated to a diameter of $7^{+0,15}_{-0,10}$ mm.

Table GG

Size of fuse-base	Resistance wire		Contact pins	
	Ø mm	*a* mm	*b* mm	*c* mm
I	0,9	11,0	9,5	0,9
II	1,1	11,8	9,1	1,1
III	1,5	10,7	9,6	1,5
IV	2,2	14,3	7,9	2,2

8.10 *Verification of non-deterioration of contacts*

Subclause 8.10 of IEC 269-1 applies.

8.10.1 *Arrangement of the fuse*

Subclause 8.10.1 of IEC 269-1 applies, with the following addition:

The dummy fuse-link is shown in figure 32 and features the power dissipation given in table FF.

8.10.2 *Test method*

The following wording is added after the first paragraph of 8.10.2 in IEC 269-1:

The test current is the non-fusing current.

The load period is 75 % of the conventional time.
The non-load period is 25 % of the conventional time.

The conventional time, as well as the non-fusing current, are stated in table II of IEC 269-1, and table II of this section. A test voltage lower than the rated voltage may be used.

During the non-load period, the samples are cooled down to a temperature lower than 35 °C. Additional cooling (e.g. a fan) is allowed.

The last sentence of the third paragraph of 8.10.2 in IEC 269-1 is replaced by the following wording:

The voltage drop of the contacts is measured after 50 and 250 cycles and, if necessary, after 500 and 750 cycles at a direct current of I_m = (0,05 to 0,20) I_n. However, the current I_m has to be chosen in such a way as to give a voltage drop of at least 100 μV.

The tolerance of I_m during the measurement must not be greater than $^{+1}_{0}$ %. The points between which the voltage drop is measured are marked "S" in figure 32. The voltage drop has to be converted into resistance. Before measurement, the samples have to be cooled down to room temperature. If the room temperature during the measurement deviates from 20 °C, the following formula may be applied:

$$R_{20} = \frac{R_T}{1 + \alpha_{20} \times (T - 20)}$$

where

R_{20} is the resistance at temperature 20 °C;

R_T is the resistance at temperature T;

α_{20} is the temperature coefficient.

8.10.3 *Acceptability of test results*

The following limits shall not be exceeded:

$$\frac{R_{250} - R_{50}}{R_{50}} \leq 15\ \%$$

At the end of the 750 cycles, the following limit shall not be exceeded:

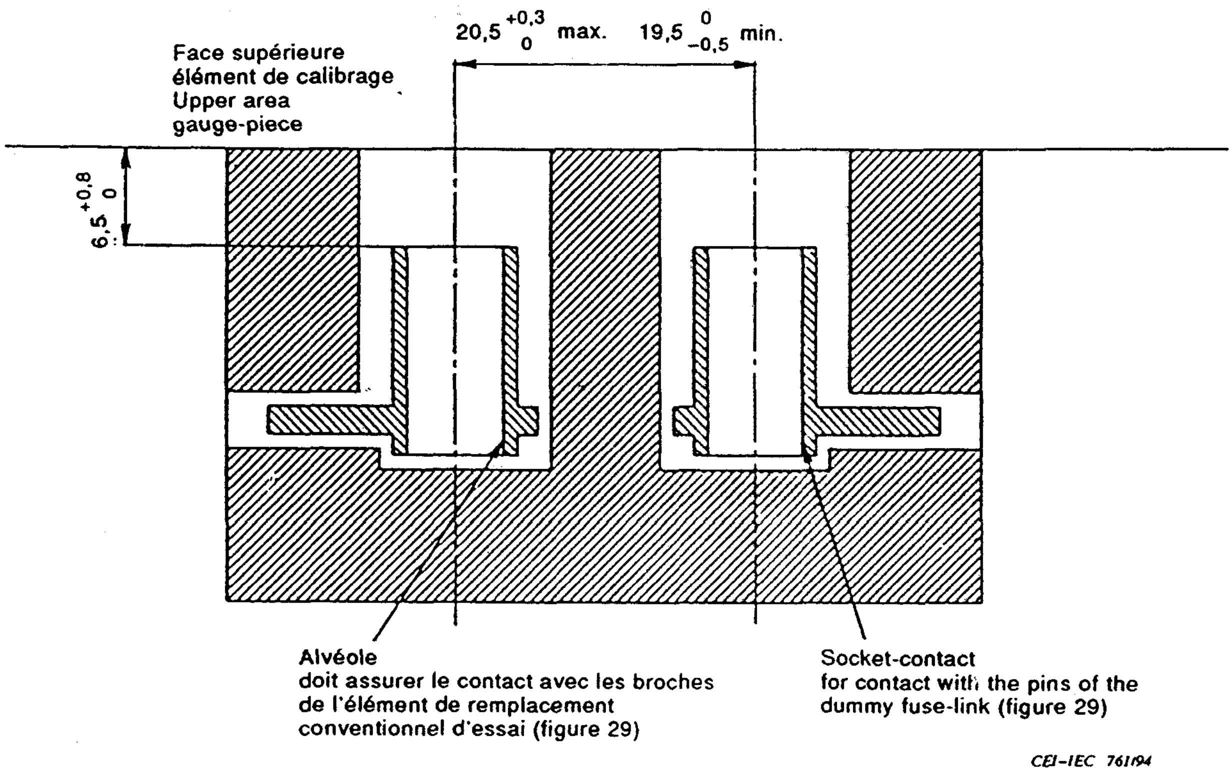
$$\frac{R_{750} - R_{50}}{R_{50}} \leq 40\ \%$$

Alternatively, the temperature measured can be used for verification. As measuring points the terminals of the fuse-base should be chosen. In this case, the following limits shall not be exceeded:

After 250 cycles, the measured temperature rise values shall not exceed the temperature at the beginning of the tests by more than 15 K.

After 750 cycles, the measured temperature rise values shall not exceed the values measured at the beginning of the tests by more than 20 K.

Taille du socle Size of fuse-holder	Section équivalente Equivalent section mm^2	Courant assigné maximal de l'élément de remplacement Maximum rated current of fuse-link A
I	2,5	16
II	4,0	20
III	6,0	32
IV	10	50



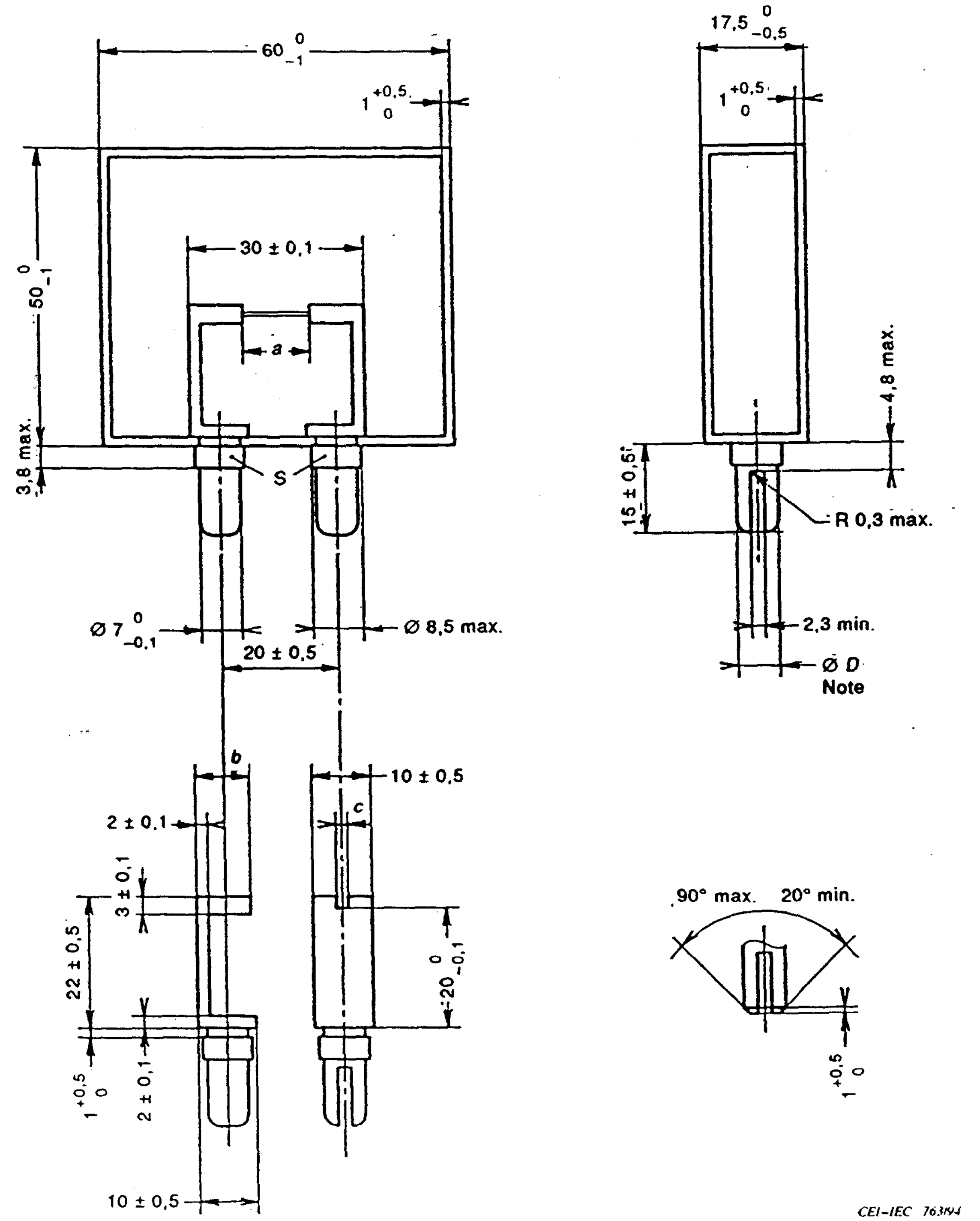
Dimensions en millimètres

Les dessins ne sont pas destinés à imposer la conception sauf en ce qui concerne les dimensions indiquées.

Dimensions in millimetres

The drawings are not intended to govern design except as regards the dimensions shown.

Figure 30 – Coupe-circuit à broches – Socle
Pin-type fuses – Fuse-holder



Dimensions en millimètres

Dimensions en millimètres

NOTE – A ouvrir après fendage à Ø $7^{+0,15}_{+0,10}$

NOTE – After splitting open to Ø $7^{+0,15}_{+0,10}$

Figure 32 – Elément de remplacement standard pour l'essai d'échauffement
Dummy fuse-link for the temperature rise test

Section IV – Cylindrical fuse-links for use in plugs

1.1 Scope

Special requirements for "gG" fuse-links primarily for use in plugs. Dimensions of these fuse-links are given in figure 33.

5 Characteristics of fuses

5.2 *Rated voltage*

The rated voltage shall be 240 V a.c.

5.3.1 *Rated current of the fuse-link*

For adequate protection of flexible conductors, the preferred ratings are 3 A and 13 A. Other ratings must be below 13 A and selected from the R10 and R20 series.

5.5 *Rated power dissipation of the fuse-link and rated power acceptance of a fuse-holder*

To ensure that the plug is maintained within acceptable temperature rise limits, the rated power dissipation of the fuse-links shall not exceed 1 W when carrying rated current under specified conditions of test.

5.6.1 *Time-current characteristics, time-current zones and overload curves*

The time-current zones are given in figure 34.

5.6.2 *Conventional times and currents*

Conventional times and currents are given in table II.

Table II – Conventional times and conventional currents

Rated current for fuse-link I_n A	Conventional time h	Conventional currents	
		I_{nf}	I_f
13	0,5	1,6 I_n	1,9 I_n

5.6.3 *Gates*

Gates for specified pre-arcing times are given in table III.

Table III – Gates for specified pre-arcing times of "gG" fuse-links for use in plugs

I_n A	$I_{min.}$ (10 s) A	$I_{max.}$ (5 s) A	$I_{min.}$ (0,1 s) A	$I_{max.}$ (0,1 s) A
3	5,5	9,5	6	19
13	30	55	60	140

7 Standard conditions for construction

7.7 *I^2t characteristics*

7.7.1 *Pre-arcing I^2t values*

Limits are standardized for fuse-links rated at 3 A and 13 A as in table VI.

Table VI – Pre-arcing I^2t values at 0,01 s for "gG" fuse-links

I_n A	I^2t_{min} A^2s	I^2t_{max} A^2s
3	2	19
13	250	850

8 Tests

8.1.4 *Arrangement of the fuse-link for tests*

For all electrical tests, the fuse-links shall be mounted in the test fuse-base shown in figure 35 with the axis of the fuse-link vertical.

8.1.5 *Testing of fuse-links*

For the complete tests, 45 samples shall be tested. If the fuse-links constitute a homogeneous series (see 8.1.5.2 of IEC 269-1) 24 samples are required of the lowest current rating and 21 samples of any intermediate current rating. The tests to be made in each case are given in table VIIA of this section.

Table VIIA – Survey of tests on fuse-links

		Sample numbers to be tested															
Complete tests on maximum rated current		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Tests on intermediate rated current		3	3	3				3	3	3						3	
Tests on lowest rated current in a series		3	3	3				3	3	3		3				3	
Test according to subclause																	
8.3	Verification of temperature rise and power dissipation	x															
8.4.3.1	Conventional non-fusing current a)			x													
	Conventional fusing current b)		x	x													
8.4.3.3.2	Time-current gates * a) c)				x	x											
	b) d)														x	x	
8.4.3.4	Overload	x															
8.5	Breaking capacity No. 5							x									
8.5	Breaking capacity No. 4								x								
8.5	Breaking capacity No. 3									x							
8.5	Breaking capacity No. 2										x						
8.5	Breaking capacity No.1											x					
8.7.2 *	I^2t tests a)						x										
	b)												x				
8.11.1	Mechanical strength																x

* Notwithstanding the range submitted by a manufacturer, these tests are mandatory for 3 A and 13 A fuse-links.

The initial cold resistance of the appropriate number of samples shall be measured when carrying not more than 10 % of the rated current. They shall then be sorted and numbered consecutively in descending order of cold resistance. These numbers are then used to determine which samples shall be used to the various tests, as indicated in table VIIA.

NOTES

1 If the test has to be repeated for reasons other than the failure of the fuse-link, spare fuse-links, having approximately the same initial resistance as the original samples, should be used for the repeated test.

2 It should be noted that the grain size may vary between different rated currents of a homogeneous series.

8.2.5 *Acceptability of test results*

There shall be no failure in any of the tests.

8.3 *Verification of temperature rise and power dissipation*

8.3.1 *Arrangement of the fuse*

The connections of the test base (see 8.1.4 of this section) shall be by means of single-core copper cables with PVC or similar insulation, 0,3 m ± 0,05 m in length and 2,5 mm^2 cross-section. The surroundings shall be free from draughts and the ambient air temperature, measured by a suitable thermocouple or thermometer at a horizontal distance of 1 m to 2 m from the fuse-link, shall be within the range of 15 °C to 25 °C.

8.3.4 *Test method*

Three fuse-links, selected in accordance with table VIIA, shall be tested. After carrying rated current continuously for 1 h, the cover of the test base shall be removed. The millivolt drop shall then be measured between the end surfaces of the endcaps of the fuse-links whilst carrying rated current. Direct current is recommended for this test, but if a.c. is used, care should be taken to avoid errors, e.g. by distorted waveform.

8.3.5 *Acceptability of test results*

The product of the measured millivolt drop, multiplied by the rated current, shall not exceed 1 W for any rated current.

8.4 *Verification of operation*

8.4.1 *Arrangement of the fuse*

This shall be as specified in 8.3.1 of this section. The tests shall be made using a.c. of substantially sinusoidal waveform.

8.4.3.1 *Verification of conventional non-fusing and fusing current*

Six fuse-links, selected in accordance with table VIIA, shall carry the conventional non-fusing current (1,6 I_n) for a conventional time of 30 min and shall not operate during this time.

Three fuse-links, selected in accordance with table VIIA, shall be subjected to the conventional fusing current (1,9 I_n). They shall operate satisfactorily within the conventional time of 30 min. The recorded time to operate can be used to verify the time-current characteristics.

8.4.3.2 *Verification of rated current of "gG" fuse-links*

During the following tests, the current shall be maintained within ±2,5 % of the adjusted value.

Three fuse-links, selected from those used for the power-loss test of 8.3, having being allowed to cool down to approximately ambient temperature, shall be subjected to

100 cycles of the current. Each cycle shall comprise an on-period of 1 h at 1,2 I_n, followed by an off-period of 15 min. This test should be run continuously but, where unavoidable, a single interruption is permitted.

Following this, a current of 1,4 I_n shall be passed through the fuse-link for a period of 1 h.

Finally, the millivolt drop at rated current shall again be measured as in 8.4 and the values obtained shall not exceed those recorded in the original test by more than 10 % and the marking of the fuse-link shall still be legible.

8.5 *Breaking-capacity tests*

8.5.1 *Arrangement of the fuse*

The fuse-links shall be mounted in the enclosed fuse-base shown in figure 35. However, the cable soldering sockets shown in this figure shall be removed and the fuse-base bolted directly to two copper bars of cross-section approximately 25 mm x 3 mm by means of the test terminals.

Substantial terminals shall be provided in these copper bars adjacent to the mounting terminals, so that the fuse-base can be shorted by a copper-link of negligible impedance during the calibration test.

A typical arrangement for the test-circuit connections is shown in figure 36. The metal enclosure of the test fuse-base shall be connected to one pole of the supply through a fine wire fuse (FW) wired with a copper wire of diameter not greater than 0,1 mm and having a free length of not less than 75 mm.

8.5.2 *Characteristics of the test circuit*

Subclause 8.5.2 of IEC 269-1 applies, with the exception that table XIIA is to be replaced by the following table:

Table XIIA – Values for breaking-capacity tests

Breaking-capacity test No.	1	2	3	4	5
Prospective current	6 000 A	Depends on rated current	$I_3 = 6{,}3\ I_n$	$I_4 = 4\ I_n$	$I_5 = 2{,}5\ I_n$
Tolerance on test current	$^{+10}_{-0}$ %**	± 10 %			
Power factor	0,3** – 0,4	Not specified (see 8.5.4)			
Making angle after voltage zero	70° ± 10°	$0^{+20°}_{-0}$	Not specified		
Power frequency recovery voltage (r.m.s.)	10 $\%^{+5}_{-0}$ % ** of the rated voltage				

* See table B of IEC 269-3.

** By agreement with the manufacturer, this tolerance may be exceeded.

8.5.4 *Calibration of the test circuit*

The power factor shall be determined as described in appendix A of IEC 269-1, preferably by using method 1.

The required current values for tests 2-5 (see table XIIA) shall be obtained by adjustment of the series resistance only, the air-cored reactor remaining as adjusted for test 1.

8.5.8 *Acceptability of test results*

The fuse-links shall operate without external effects and damage beyond those specified below.

In addition to IEC 269-1, the following applies:

There shall be neither permanent arcing, ejection of flames nor flashover, sufficient to cause the fine wire fuse to melt.

8.7 *Verification of I^2t characteristics and overcurrent discrimination*

Six fuse-links shall be submitted for I^2t testing.

8.7.2 Three samples shall be subjected individually to a pulse of 0,01 s corresponding to the I^2t_{min} value in table VI.

No fuse-link shall operate.

8.10 *Verification of non-deterioration of contacts*

The fuse-links produced to this standard are intended to be mounted directly within plugs, and not in conventional fuse-bases. Appropriate tests on contacts in the plugs are made by the plug manufacturers.

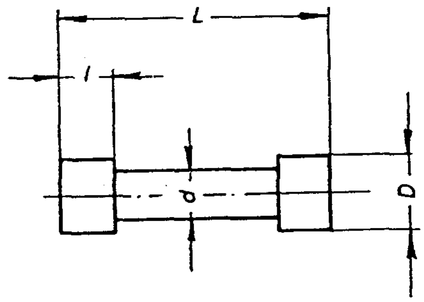
Consequently, no test for the non-deterioration of contacts is appropriate for inclusion in this specification for fuse-links.

8.11.1 *Mechanical strength*

Three fuse-links, selected as shown in table VIIA, shall be tested in a tumbling barrel according to IEC 68-2-32 but with 20 mm thick hardwood (hornbeam) ends and a height of fall of 350 mm. Alternatively, with the consent of the manufacturer, a tumbling barrel with a steel base which has a greater dropping distance may be used (i.e. that used for testing plugs).

Only one fuse-link is tested at a time. The barrel is rotated at five revolutions per minute and the fuse-link subjected to 50 falls, i.e. 25 revolutions of the barrel.

After the test, the body shall not be broken, filling shall not have come out, and the end-caps shall remain tight when tested by hand.



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Longueur L Length L mm	Dimension l de la capsule Dimension l of endcap mm	Diamètre D de la capsule Diameter D of endcap mm
$25,4^{+0,8}_{-0,4}$	5,5 ± 0,8	$6,3^{+0,2}_{-0,05}$

Le diamètre maximal d de la cartouche entre les capsules doit être inférieur au diamètre D des capsules.

The maximum diameter d of the cartridge between the endcaps shall be less than the diameter D of the endcaps.

Figure 33 – Dimensions des éléments de remplacement cylindriques (destinés à être utilisés principalement dans les fiches de prises de courant)
Dimensions for cylindrical fuse links (primarily used in plugs)

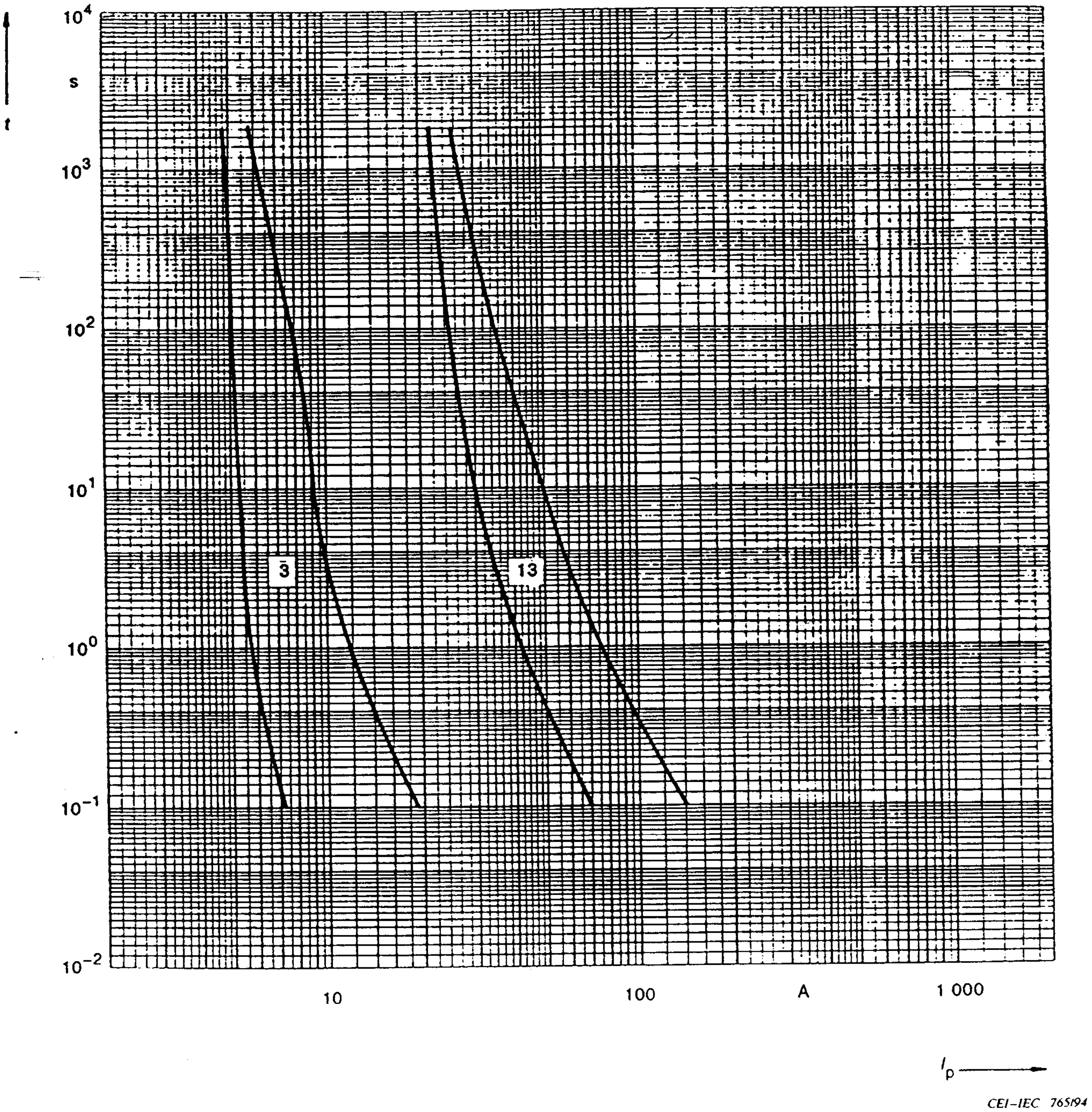
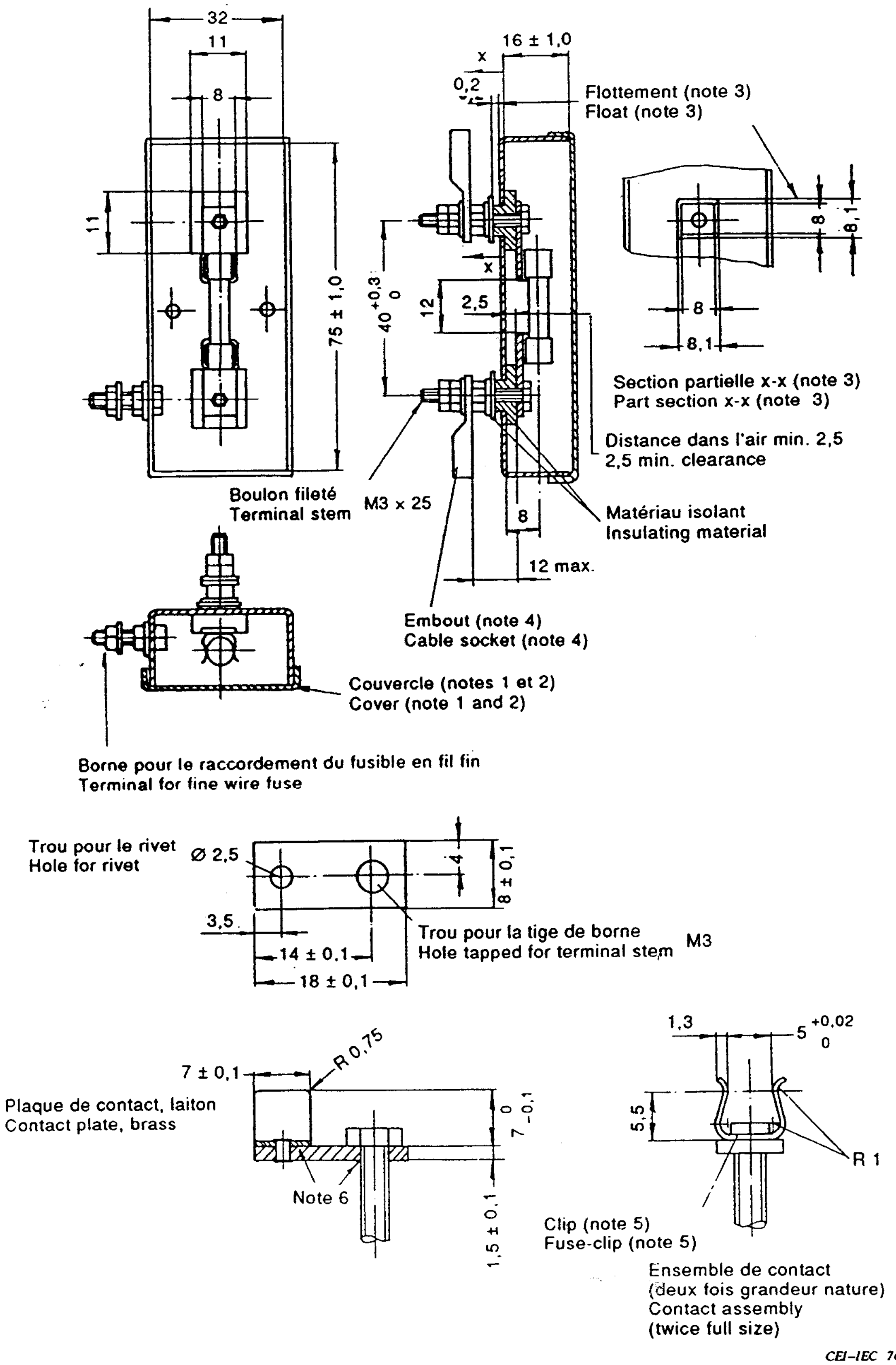


Figure 34 – Zones temps-courant pour éléments de remplacement «gG»
Time-current zones for "gG" fuse-links



Dimensions en millimètres

Dimensions in millimetres

NOTES

1 Boîte et couvercle en tôle de laiton de 1,25 mm d'épaisseur, surface propre non traitée.

2 Le couvercle devrait être ajusté par poussée sur la boîte; il ne doit pas être fixé rigidement.

3 Le flottement et la distance dans l'air entre l'isolation et la boîte permettent aux contacts de s'aligner.

4 Embout pour câble de 2,5 mm^2 de section pour l'essai de vérification de la puissance dissipée (remplacé par une barre de cuivre pour l'essai de vérification du pouvoir de coupure, voir 8.5.1.)

5 Clip du fusible en cuivre au béryllium de 0,45 mm d'épaisseur, trempé (valeur thermique au moins 170). Base du clip plate; surface argentée.

6 Les joints entre clip, plaque de contact et tige de borne doivent être soudés.

NOTES

1 Box and cover made from 1,25 mm brass sheet, clean natural finish.

2 Cover should be a push fit on box and must not be rigidly attached.

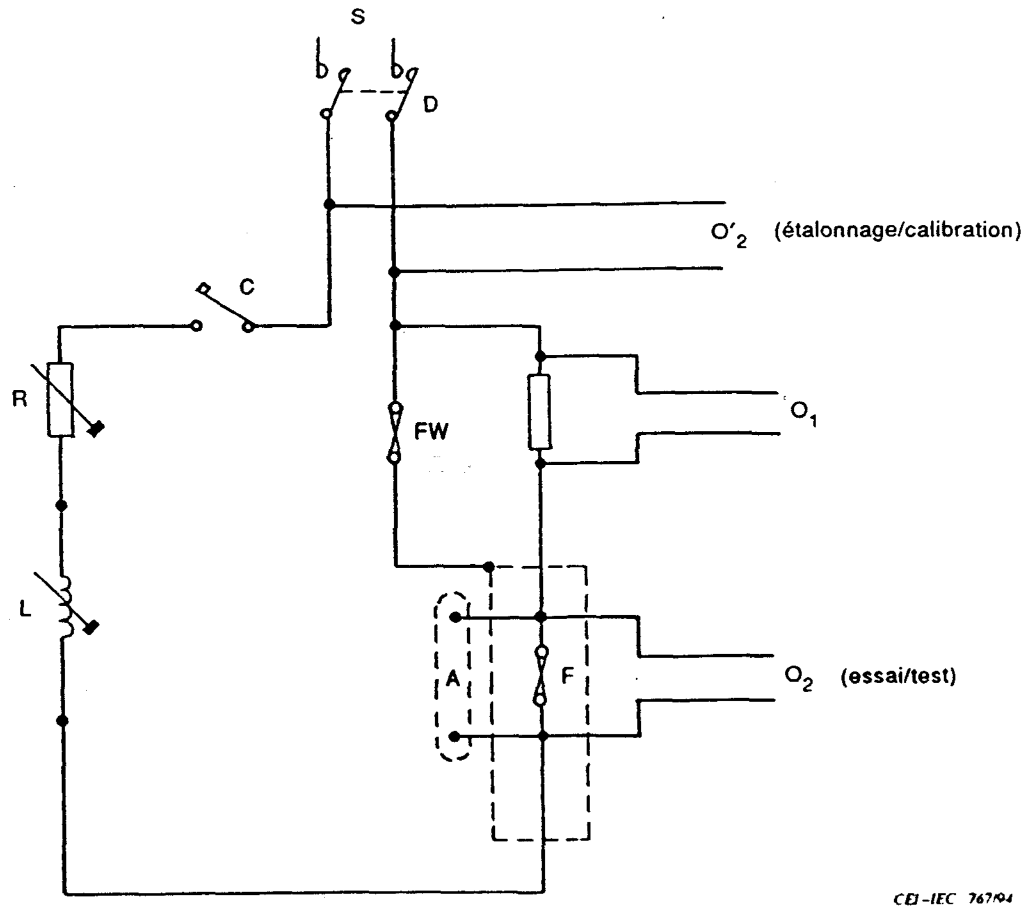
3 The end float and clearance between the insulation and the box is to allow the contacts to be self-aligning.

4 Cable sockets for 2,5 mm^2 cable for power-loss test. (Replaced by copper bar for breaking-capacity test, see 8.5.1.)

5 Fuse-clip. Made from beryllium copper 0,45 mm thick and heat treated (170 HV minimum). Base of clip to be flat; finish, silver plated.

6 Joints between clip, contact plate and terminal stem to be soldered.

Figure 35 – Socle conventionnel d'essai
Test fuse-base



A	=	connexion amovible établie pour l'étalonnage removable link used for the calibration test
C	=	appareil fermant le circuit apparatus for closing the circuit
D	=	disjoncteur ou autre appareil protégeant la source circuit-breaker or other apparatus for the protection of the source
F	=	fusible en essai fuse on test
FW	=	fusible en fil fin fine wire fuse
L	=	inductance réglable adjustable inductor
O_1	=	circuit de mesure enregistrant le courant measuring circuit for recording the current
O_2	=	circuit de mesure enregistrant la tension lors de l'essai measuring circuit for recording the voltage during the test
O'_2	=	circuit de mesure enregistrant la tension lors de l'étalonnage measuring circuit for recording the voltage during calibration
R	=	résistance réglable adjustable resistor
S	=	source de puissance source of energy

Figure 36 – Schéma type du circuit utilisé pour les essais du pouvoir de coupure
Typical diagram of the circuit used for breaking-capacity tests

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269-3 (1987) Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications).

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Modification n° 1 (1985).

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787 (1983) Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit applications.

Amendment No. 1 (1985)

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