

Low-voltage fuses —

Part 1: General requirements

The European Standard EN 60269-1:1998, with the incorporation of amendment A1:2005, has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 480-5:2005, including amendment A1:2005. It supersedes BS EN 480-5:1997 which is withdrawn.

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English version

Low-voltage fuses —
Part 1: General requirements
(IEC 60269-1:1998)
(includes amendment A1:2005)

Fusibles basse tension —
Partie 1: Règles générales
(CEI 60269-1:1998)
(inclut l'amendement A1:2005)

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CENELEC

European Committee for Electrotechnical Standardization
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Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of document 32B/308/FDIS, future amendment to IEC 60269-1:1986, prepared by SC 32B, Low-voltage fuses, of IEC TC 32, Fuses, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A3 to EN 60269-1:1989 on 1998-10-01.

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This European Standard supersedes EN 60269-1:1989 + A1:1994 + A2:1998.

The following dates were fixed:

- latest date by which the (dop) 1999-07-01
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at national level by
publication of an identical
national standard or by
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conflicting with the EN
have to be withdrawn

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex ZA is normative and Annex A, Annex B, Annex C and Annex D are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60269-1:1998 was approved by CENELEC as a European Standard without any modification.

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1 General

1.1 Scope and object

This standard is applicable to fuses incorporating enclosed current-limiting fuse-links with rated breaking capacities of not less than 6 kA, intended for protecting power-frequency a.c. circuits of nominal voltages not exceeding 1 000 V or d.c. circuits of nominal voltages not exceeding 1 500 V.

Subsequent parts of this standard, referred to herein, cover supplementary requirements for such fuses intended for specific conditions of use or applications.

Fuse-links intended to be included in, fuse-switch combinations according to IEC 60947-3 should also comply with the following requirements.

NOTE 1 For “a” fuse-links, details of performance (see 2.2.4) on d.c. circuits should be subject to agreement between user and manufacturer.

NOTE 2 Modifications of, and supplements to, this standard required for certain types of fuses for particular applications — for example certain fuses for rolling stock, or fuses for high-frequency circuits — will be covered, if necessary, by separate standards.

NOTE 3 This standard does not apply to miniature fuses, these being covered by IEC 60127.

The object of this standard is to establish the characteristics of fuses or parts of fuses (fuse-base, fuse-carrier, fuse-link) in such a way that they can be replaced by other fuses or parts of fuses having the same characteristics provided that they are interchangeable as far as their dimensions are concerned. For this purpose, this standard refers in particular to:

- the following characteristics of fuses:
 - a) their rated values;
 - b) their insulation;
 - c) their temperature rise in normal service;
 - d) their power dissipation and acceptance;
 - e) their time/current characteristics;
 - f) their breaking capacity;
 - g) their cut-off current characteristics and their I^2t characteristics.
- type test for verification of the characteristics of fuses;
- the marking of fuses.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60269. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60269 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60038:1983, *IEC standard voltages*.

IEC 60050(411):1984, *International Electrotechnical Vocabulary (IEV) — Chapter 441: Switchgear, controlgear and fuses*.

IEC 60127, *Cartridge fuse-links for miniature fuses*.

IEC 60269-2:1986, *Low-voltage fuses — Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)*.

IEC 60291:1969, *Fuse definitions*.

IEC 60291A:1974, First supplement.

IEC 60364-3:1993, *Electrical installations of buildings — Part 3: Assessment of general characteristics*.

IEC 60364-5-523:1983, *Electrical installations of buildings — Part 5: Selection and erection of electrical equipment — Chapter 52: Wiring system — Section 523: Current-carrying capacities*.

IEC 60947-3:1998, *Low-voltage switchgear and controlgear — Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*.

IEC 60417:1973, *Graphical symbols for use on equipment — Index, survey and compilation of the single sheets.*

IEC 60529:1989, *Degrees of protection provided by enclosures (Code IP).*

IEC 60584-1:1995, *Thermocouples — Part 1: Reference tables.*

IEC 60695-2-1/0:1994, *Fire hazard testing — Part 2: Test methods — Section 1/sheet 0: Glow-wire test methods — General.*

IEC 60695-2-1/1:1994, *Fire hazard testing — Part 2: Test methods — Section 1/sheet 1: Glow-wire end-product test and guidance.*

IEC 60695-2-1/2:1994, *Fire hazard testing — Part 2: Test methods — Section 1/sheet 2: Glow-wire flammability test on materials.*

IEC 60692-2-1/3:1994, *Fire hazard testing — Part 2: Test methods — Section 1/sheet 3: Glow-wire ignitability test on materials.*

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

ISO 478:1974, *Paper — Untrimmed stock sizes for the ISO-A series — ISO primary range.*

ISO 593:1974, *Paper — Untrimmed stock size for the ISO-A series — ISO supplementary range.*

ISO 4046:1978, *Paper, board, pulp and related terms — Vocabulary — Bilingual edition.*

2 Definitions

NOTE For general definitions concerning fuses, see also IEC 60291 and IEC 60050-441.

For the purpose of this standard, the following definitions shall apply.

2.1 Fuses and their component parts

2.1.1

fuse

device that by the fusing of one or more of its specially designed and proportioned components opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time the fuse comprises all the parts that form the complete device.

2.1.2

Fuse-holder

combination of the fuse-base with its fuse-carrier. (Where in this standard the term “fuse-holder” is used, it covers fuse-bases and/or fuse-carriers, if no clearer distinction is necessary)

2.1.2.1

fuse-base (fuse-mount)

fixed part of a fuse provided with contacts, terminals and covers, where applicable

2.1.2.2

fuse-carrier

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

2.1.3

fuse-link

part of a fuse including the fuse-element(s), intended to be replaced after the fuse has operated

2.1.4

fuse-contact

two or more conductive parts designed to ensure circuit continuity between a fuse-link and the corresponding fuse-holder

2.1.5

fuse-element

part of a fuse-link designed to melt when the fuse operates

the fuse-link may comprise several fuse-elements in parallel.

2.1.6**indicating device (indicator)**

device provided to indicate whether the fuse has operated

2.1.7**striker**

mechanical device forming part of a fuse-link which, when the fuse operates, releases the energy required to cause operation of other apparatus or indicators or to provide interlocking

2.1.8**terminal**

conductive part of a fuse provided for electric connection to external circuits

NOTE Terminals may be distinguished according to the kind of circuits for which they are intended (e.g. main terminal, earth terminal, etc.) and also according to their design (e.g. screw terminal, plug terminal, etc.).

2.1.9**dummy fuse-link**

test fuse-link with defined power dissipation and dimensions

2.1.10**test rig**

defined test fuse-base

2.1.11**gauge-piece**

additional part of a fuse-base intended to achieve a degree of non-interchangeability

2.2 General terms**2.2.1****enclosed fuse-link**

fuse-link in which the fuse-element(s) is (are) totally enclosed, so that during operation within its rating it cannot produce any harmful external effects, e.g. due to development of an arc, the release of gas or the ejection of flame or metallic particles

2.2.2**current-limiting fuse-link**

fuse-link that during and by its operation in a specified current range, limits the current to a substantially lower value than the peak value of the prospective current

2.2.3**“g” fuse-link (formerly general purpose fuse-link)**

current-limiting fuse-link capable of breaking under specified conditions all currents which cause melting of the fuse-element up to its rated breaking capacity

2.2.4**“a” fuse-link (formerly back-up fuse-link)**

current-limiting fuse-link capable of breaking under specified conditions all currents between the lowest current indicated on its operating time-current characteristic ($k_2 I_n$ in Figure 2) and its rated breaking capacity

NOTE “a” fuse-links are generally used to provide short-circuit protection. Where protection is required against over currents less than $k_2 I_n$ in Figure 2, they are used in conjunction with another suitable switching device designed to interrupt such small overcurrents.

2.2.5**temperatures****2.2.5.1****ambient air temperature (T_a)**

temperature of the air surrounding the fuse (at a distance of about 1 m from the fuse or its enclosure, if any)

2.2.5.2**fluid environment temperature (T_e)**

temperature of the fluid cooling the fuse-components (contact, terminal, etc.)

it is the sum of the ambient air temperature T_a and the temperature rise ΔT_e with respect to the ambient temperature of the internal fluid in contact with the fuse-components (contact, terminal, etc.) if the latter is in an enclosure.

if it is not in an enclosure, it is assumed that T_e is equal to T_a .

2.2.5.3**fuse-component temperature (T)**

fuse-component (contact, terminal, etc.) temperature T is that of the relevant part

2.2.6**overcurrent discrimination**

co-ordination of the relevant characteristics of two or more overcurrent protective devices such that, on the occurrence of overcurrents within stated limits, the device intended to operate within these limits does so, while the other(s) do(es) not

2.2.7**fuse-system**

family of fuses following the same physical design principles with respect to the shape of the fuse-links, type of contact, etc.

2.2.8**size**

specified set of dimensions of fuses within a fuse-system

each individual size covers a given range of rated currents for which the specified dimensions of the fuses remain unchanged.

2.2.9**homogeneous series of fuse-links**

series of fuse-links, within a given size, differing from each other only in such characteristics that for a given test, the testing of one or a reduced number of particular fuse-links of that series may be taken as representative for all the fuse-links of the series itself (see 8.1.5.2)

NOTE The characteristics by which the fuse-links of a homogeneous series may differ and details on which of the fuse-links shall be tested are specified in association with the tests concerned (see Table 7B and Table 7C).

2.2.10**utilization category (of a fuse link)**

combination of specified requirements related to the conditions in which the fuse-link fulfils its purpose, selected to represent a characteristic group of practical applications (see 5.7.1)

2.2.11**fuses for use by authorized persons (formerly called fuses for industrial application)**

fuses intended to be used in installations where the fuse-links are accessible to and intended to be replaced by authorized persons only

NOTE 1 Non-interchangeability and protection against accidental contact with live parts need not necessarily be ensured by constructional means.

NOTE 2 Authorized person is understood to have the meaning defined for categories BA4 "Instructed"¹⁾ and BA5 "Skilled"²⁾ in IEC 60364-3.

2.2.12**fuses for use by unskilled persons (formerly called fuses for domestic and similar applications)**

fuses intended to be used in installations where the fuse-links are accessible to and can be replaced by unskilled persons

NOTE For these fuses protection against direct contact with live parts is recommended and non-interchangeability may be required, if necessary

¹⁾ Instructed: Persons adequately advised or supervised by skilled persons to enable them to avoid dangers which electricity may create (operating and maintenance staff).

²⁾ Skilled: Persons with technical knowledge or sufficient experience to enable them to avoid dangers which electricity may create (engineers and technicians).

2.2.13**non-interchangeability**

limitations on shape and/or dimensions with the object of avoiding in a specific fuse-base the inadvertent use of fuse-links having electrical characteristics other than those ensuring the desired degree of protection

2.3 Characteristic quantities**2.3.1****rating**

general term employed to designate the characteristic values that together define the working conditions upon which the tests are based and for which the equipment is designed

NOTE Rated values usually stated for low-voltage fuses are: voltage, current, breaking capacity, power dissipation and acceptance and frequency, where applicable. In the case of a.c., rated voltage and rated current are stated as r.m.s. symmetrical values; in the case of d.c., when ripple is present, the rated voltage is stated as a mean value, the rated current as an r.m.s. value. The above applies to any value of voltage and current, if not indicated otherwise.

2.3.2**prospective current of a circuit** (with respect to a fuse)

current that would flow in a circuit if a fuse situated therein were replaced by a link of negligible impedance

the prospective current is the quantity to which the breaking capacity and characteristics of the fuse are normally referred, e.g. I^2t and cut-off current characteristics (see 8.5.7).

2.3.3**gate**

limiting values within which the characteristics, for example time-current characteristics, shall be obtained

2.3.4**breaking capacity of a fuse-link**

value (for a.c. the r.m.s. value of the a.c. component) of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour

2.3.5**breaking range**

breaking range is a range of prospective currents within which the breaking capacity of a fuse-link is assured

2.3.6**cut-off current**

maximum instantaneous value reached by the current during the breaking operation of a fuse-link when it operates in such a manner as to prevent the current from reaching the otherwise attainable maximum

2.3.7**cut-off current characteristic**

curve giving the cut-off current as a function of the prospective current under stated conditions of operation

NOTE In the case of a.c., the value of the cut-off currents are the maximum values reached whatever the degree of asymmetry. In the case of d.c., the values of the cut-off currents are the maximum values reached related to the time constants as specified.

2.3.8**peak withstand current** (of a fuse-holder)

value of cut-off current that the fuse-holder can withstand

NOTE The peak withstand current is not less than the highest cut-off current of any fuse-link with which the fuseholder is intended to be associated.

2.3.9**pre-arcing time**

time between the commencement of a current large enough to cause the fuse-element(s) to melt and the instant when an arc is initiated

2.3.10**arcing time**

interval of time between the instant of the initiation of the arc and the instant of final arc extinction

2.3.11**operating time**

sum of the pre-arcing time and the arcing time

2.3.12 **I^2t (Joule integral)**

integral of the square of the current over a given time:

$$I^2t = \int_{t_0}^{t_1} i^2 dt$$

NOTE 1 The pre-arcing I^2t is the I^2t integral extended over the pre-arcing time of the fuse.

NOTE 2 The operating I^2t is the I^2t integral extended over the operating time of the fuse.

NOTE 3 The energy in joules released in 1 Ω of resistance in a circuit protected by a fuse is equal to the value of the operating I^2t expressed in A²s.

2.3.13 **I^2t characteristic**

curve giving I^2t values (pre-arcing I^2t and/or operating I^2t) as a function of prospective current under stated conditions of operation

2.3.14 **I^2t zone**

range contained by the minimum pre-arcing I^2t characteristic and the maximum operating I^2t characteristic, under specified conditions

2.3.15**rated current of a fuse-link (I_n)**

value of current that the fuse-link can carry continuously without deterioration under specified conditions

2.3.16**time-current characteristic**

curve giving the pre-arcing time or operating time as a function of the prospective current under stated conditions of operation

NOTE For times longer than 0,1 s, for practical purposes the difference between pre-arcing and operating time is negligible.

2.3.17**time-current zone**

range contained by the minimum pre-arcing time-current characteristics and the maximum operating time-current characteristic, under specified conditions

2.3.18**conventional non-fusing current (I_{nf})**

value of current specified as that which the fuse-link is capable of carrying for a specified time (conventional time) without melting

2.3.19**conventional fusing current (I_f)**

value of current specified as that which causes operation of the fuse-link within a specified time (conventional time)

2.3.20**overload curve of an “a” fuse-link**

curve showing the time for which an “a” fuse-link shall be able to carry the current without deterioration (see 8.4.3.4 and Figure 2)

2.3.21**power dissipation of a fuse-link**

power released in a fuse-link carrying rated current under specified conditions

2.3.22**power acceptance of a fuse-holder**

maximum value of power released in a fuse-link which a fuse-holder is designed to tolerate under specified conditions

2.3.23**recovery voltage**

voltage which appears across the terminals of a fuse after the breaking of the current

NOTE This voltage may be considered in two successive intervals of time, one during which a transient voltage exists (see 2.3.23.1) followed by a second one during which only the power frequency or d.c. recovery voltage (see 2.3.23.2) exists.

2.3.23.1**transient recovery voltage**

recovery voltage during the time in which it has a significant transient character

NOTE 1 The transient voltage may be oscillatory or non-oscillatory or a combination of both, depending on the characteristics of the circuit and the fuse. It includes the voltage shift of the neutral of a polyphase circuit.

NOTE 2 The transient recovery voltage in three-phase circuits is, unless otherwise stated, that which appears across the first pole to clear, because this voltage is generally higher than that which appears across each of the other two poles.

2.3.23.2**power-frequency or d.c. recovery voltage**

recovery voltage after the transient voltage phenomena have subsided

NOTE The power frequency or d.c. recovery voltage may be referred to as a percentage of the rated voltage.

2.3.24**arc voltage**

instantaneous value of the voltage which appears across the terminals of a fuse during the arcing time

3 Conditions for operation in service

Where the following conditions apply, fuses complying with this standard are deemed capable of operating satisfactorily without further qualification. These conditions also apply for tests except those otherwise specified in clause 8.

3.1 Ambient air temperature (T_a)

The ambient air temperature T_a (see 2.2.5.1) does not exceed 40 °C, its mean value measured over a period of 24 h does not exceed 35 °C, and its mean value measured over a period of one year is lower.

The minimum value of the ambient air temperature is – 5 °C.

NOTE 1 The time-current characteristics given are related to a reference ambient air temperature of 20 °C. These time-current characteristics also approximately apply to a temperature of 30 °C.

NOTE 2 In cases where the temperature conditions vary significantly from these values, this should be taken into consideration from the points of view of operation, temperature rise, etc. See Annex D.

3.2 Altitude

The altitude of the site of installation of the fuses does not exceed 2 000 m above sea level.

3.3 Atmospheric conditions

The air is clean and its relative humidity does not exceed 50 % at the maximum temperature of 40 °C.

Higher relative humidities are permitted at lower temperatures, e.g. 90 % at 20 °C.

Under these conditions, moderate condensation may occasionally occur due to variation in temperature.

NOTE Where fuses are to be used under conditions different from those mentioned in 3.1, 3.2 and 3.3, in particular outdoors without protection, the manufacturer should be consulted. This applies also in cases where deposits of sea salt or abnormal deposits of industrial origin may occur.

3.4 Voltage

The system voltage has a maximum value not exceeding 110 % of the rated voltage of the fuse. For d.c. when obtained by rectifying a.c., the ripple shall not cause a variation of more than 5 % above or 9 % below the mean value of 110 % of the rated voltage.

For fuses rated 690 V the maximum system voltage shall not exceed 105 % of the rated voltage of the fuse.

NOTE Attention is drawn to the fact that the indicating device or striker of a fuse may not operate if the fuse-link operates at a voltage which is considerably lower than its rated voltage (see 8.4.3.6).

3.5 Current

The currents to be carried and to be broken are within the range specified in 7.4 and 7.5.

3.6 Frequency, power factor and time constant

3.6.1 Frequency

For a.c. the frequency is the rated frequency of the fuse-link.

3.6.2 Power factor

For a.c. the power factor is not lower than that shown in Table 12A, appropriate to the value of prospective current.

3.6.3 Time constant

For d.c. the time constant corresponds to that shown in Table 12B.

Some service duties may be found which exceed the limits shown in the table as regards time constant. For such an application, a fuse-link which has been tested to verify that it meets the required time constant and is marked accordingly shall be used.

3.7 Conditions of installation

The fuse is installed in accordance with the manufacturer's instructions.

If the fuse is likely to be exposed in service to abnormal vibrations or shocks, the manufacturer should be consulted.

3.8 Utilization category

Utilization categories (e.g. "gG") are specified according to 5.7.1.

3.9 Discrimination of fuse-links

Limits of discrimination for times greater than 0,1 s are given in Table 2 and Table 3.

Pre-arcing I^2t values are given in Table 6; operating I^2t values will be given in subsequent parts, because they are dependent upon the system, the rated voltage and the application of the fuse.

4 Classification

Fuses are classified according to clause 5 and the subsequent parts.

5 Characteristics of fuses

5.1 Summary of characteristics

The characteristics of a fuse shall be stated in the following terms, where such terms are applicable.

5.1.1 Fuse-holders

- a) Rated voltage (see 5.2).
- b) Rated current (see 5.3.2).
- c) Kind of current and rated frequency, if applicable (see 5.4).
- d) Rated power acceptance (see 5.5).
- e) Dimensions or size.
- f) Number of poles, if more than one.
- g) Peak withstand current.

5.1.2 Fuse-links

- a) Rated voltage (see 5.2).
- b) Rated current (see 5.3.1).
- c) Kind of current and rated frequency, if applicable (see 5.4).
- d) Rated power dissipation (see 5.5).
- e) Time-current characteristics (see 5.6).
- f) Breaking range (see 5.7.1).
- g) Rated breaking capacity (see 5.7.2).
- h) Cut-off current characteristics (see 5.8.1).
- i) $I^2 t$ characteristics (see 5.8.2).
- j) Dimensions or size.

5.1.3 Complete fuses

Degree of protection according to IEC 60529.

5.2 Rated voltage

For a.c. the standard values of rated voltages are given in Table 1.

Table 1 — Standard values of a.c. rated voltages for fuses

Series I V	Series II V
230*	120*
	208
	240
	277*
400*	415
500	480*
690*	600

The values marked with an asterisk are standardized values according to IEC 60038. In the meantime, the other values of the table will also be used.

For d.c., the preferred values for rated voltages are given as follows:

110* – 125* – 220* – 250* – 440* – 460 – 500 – 600* – 750 V.

NOTE The rated voltage of the fuse-link may be a value other than the rated voltage of the fuse-holder in which the fuse-link is to be used. The rated voltage of the fuse is the lowest value of the rated voltages of its parts (fuse-holder, fuse-link).

5.3 Rated current

5.3.1 Rated current of the fuse-link

The rated current for the fuse-link, expressed in amperes, should be selected from the following values:

2 – 4 – 6 – 8 – 10 – 12 – 16 – 20 – 25 – 32 – 40 – 50 – 63 – 80 – 100 – 125 – 160 – 200 – 250 – 315 – 400 – 500 – 630 – 800 – 1 000 – 1 250

NOTE 1 If higher or lower values are required, these values should be selected from the series R10 of ISO 3.

NOTE 2 If, in exceptional cases, it is necessary to choose an intermediate value, this value should be selected from the series R20 of ISO 3.

5.3.2 Rated current of the fuse-holder

The rated current of the fuse-holder, expressed in amperes, should be selected from the series of rated currents of fuse-links if not otherwise specified in subsequent parts. For “gG” and “aM” fuses, the rated current of the fuse-holder represents the highest rated current of the fuse-link with which it is intended to be used.

5.4 Rated frequency (see 6.1 and 6.2)

The absence of any marking regarding rated frequency shall imply that the fuse meets the conditions laid down in this standard for frequencies between 45 Hz and 62 Hz only.

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

The rated power dissipation of a fuse-link is stated by the manufacturer if not otherwise specified in subsequent parts. That value shall not be exceeded under specified test conditions.

The rated power acceptance of a fuse-holder is stated by the manufacturer if not otherwise specified in the subsequent parts. It is intended to be the maximum power dissipation the fuse-holder can tolerate under specified test conditions without exceeding the specified temperature rise.

5.6 Limits of time-current characteristics

The limits are based on a reference ambient air temperature T_a of + 20 °C.

5.6.1 Time-current characteristics, time-current zones

They depend on the design of the fuse-link, and, for a given fuse-link, on the ambient air temperature and the cooling conditions.

NOTE For ambient air temperatures deviating from the temperature range according to 3.1, consultation with the manufacturer is necessary.

For fuse-links not complying with the standardized time-current zones as specified in the subsequent parts, the manufacturer should keep available (with their tolerances):

— the pre-arcing and operating time-current characteristics

or

— the time-current zone.

NOTE For pre-arcing times smaller than 0,1 s the manufacturer should keep available I^2t characteristics with their tolerances (see 5.8.2).

When the time-current characteristics are presented for pre-arcing times exceeding 0,1 s, they should be given with current as abscissa and time as ordinate. Logarithmic scales shall be used on both co-ordinate axes.

The basis of the logarithmic scales (the dimensions of one decade) shall be in the ratio 2/1 with the longer dimensions on the abscissa. However, because of long established practice in the United States of America, a ratio of 1/1 is recognized as an alternative standard. The presentation shall be made on standardized paper A3 or A4, according to ISO 478 or ISO 593.

The dimensions of the decades shall be selected from the following series:

2 cm, 4 cm, 8 cm, 16 cm, and 2,8 cm, 5,6 cm, 11,2 cm.

NOTE It is recommended that, whenever possible, the preferred values 2,8 cm (ordinate) and 5,6 cm (abscissa) should be used.

5.6.2 Conventional times and currents

The conventional times and currents are given in Table 2. For “gD” and “gN” fuse-links, conventional times and currents are given in IEC 60269-2-1, section V.

Table 2 — Conventional time and current for “gG” and “gM” fuse-links

Rated current I_n for “gG” Characteristic current I_{ch} for “gM” ^b A	Conventional time h	Conventional current	
		I_{nf}	I_f
$I_n < 16$	1	^a	^a
$16 \leq I_n \leq 63$	1	1,25 I_n	1,6 I_n
$63 < I_n \leq 160$	2		
$160 < I_n \leq 400$	3		
$400 < I_n$	4		
^a Under consideration.			
^b For “gM” fuse links, see 5.7.1.			

5.6.3 Gates

For “gG” and “gM” fuse-links, the gates given in Table 3 apply.

Table 3 — Gates for specified pre-arcing times of “gG” and “gM” fuse-links

1	2	3	4	5
I_n for “gG” I_{ch} for “gM” A	I_{min} (10 s) ^c A	I_{max} (5 s) ^c A	I_{min} (0,1 s) A	I_{max} (0,1 s) A
16	33	65	85	150
20	42	85	110	200
25	52	110	150	260
32	75	150	200	350
40	95	190	260	450
50	125	250	350	610
63	160	320	450	820
80	215	425	610	1 100
100	290	580	820	1 450
125	355	715	1 100	1 910
160	460	950	1 450	2 590
200	610	1 250	1 910	3 420
250	750	1 650	2 590	4 500
315	1 050	2 200	3 420	6 000
400	1 420	2 840	4 500	8 060
500	1 780	3 800	6 000	10 600
630	2 200	5 100	8 060	14 140
800	3 060	7 000	10 600	19 000
1 000	4 000	9 500	14 140	24 000
1 250	5 000	13 000	19 000	35 000

^a Values for fuses with rated current less than 16 A are under consideration.
^b For “gM” fuse-links see 5.7.1.
^c I_{min} (10 s) is the minimum value of current for which the pre-arcing time is not less than 10 s.
 I_{max} (5 s) is the maximum value of current for which the operating time is not more than 5 s (see Figure 1).

For “gD” and “gN” fuse-links, gates are given in IEC 60269-2-1, section V.

5.7 Breaking range and breaking capacity

5.7.1 Breaking range and utilization category

The first letter shall indicate the breaking range:

- “g” fuse-links (full-range breaking-capacity fuse-link);
- “a” fuse-links (partial-range breaking-capacity fuse-link).

The second letter shall indicate the utilization category; this letter defines with accuracy the time-current characteristics, conventional times and currents, gates:

For example

- “gG” indicates fuse-links with a full-range breaking capacity for general application;
- “gM” indicates fuse-links with a full-range breaking capacity for the protection of motor circuits;
- “aM” indicates fuse-links with a partial range breaking capacity for the protection of motor circuits;
- “gD” indicates time-delay fuse-links with a full range breaking capacity;
- “gN” indicates non-time-delay fuse-links with a full range breaking capacity.

NOTE 1 At present “gG” fuse-links are often used for the protection of motor circuits, which is possible when their characteristics are suitable to be capable of withstanding the motor starting current.