

AS 2005.10—1988

Australian Standard[®]

**LOW VOLTAGE FUSES—FUSES
WITH ENCLOSED FUSE—LINKS**

**Part 10— GENERAL
REQUIREMENTS**

This Australian Standard was prepared by Committee EL/6, Industrial Switchgear and Controlgear. It was approved on behalf of the Council of the Standards Association of Australia on 2 February 1988 and published on 9 May 1988.

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Australian Electrical and Electronic Manufacturers Association
Bureau of Steel Manufacturers of Australia
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AS 2005.10—1988

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LOW VOLTAGE FUSES—FUSES WITH ENCLOSED FUSE—LINKS

Part 10— GENERAL REQUIREMENTS

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PREFACE

This Standard was prepared by the Association's Committee on Industrial Switchgear and Controlgear as Part 10 in the AS 2005 series. This Standard and new Standards in the AS 2005 series* will progressively supersede AS 2005.1, AS 2005.2 and AS 2005.3.†

This Standard is published separately to enable readers to become familiar with new concepts before the publication of supplementary requirements for specific applications, which are in course of preparation.

It is based on the 1986 edition of IEC 269–1, *Low-voltage fuses*, Part 1: *General requirements*, and acknowledgement is made of the assistance received from this source.

To facilitate cross-references with IEC 269–1 and its subsequent Parts, the clause numbering of this Standard closely follows that of IEC 269–1.

Where this Standard deviates technically from IEC 269–1, by way of additional or different requirements, this fact is indicated by underlining or a rule in the margin against the clause, table or part thereof affected. A summary of such deviations including any omissions of IEC text and any significant editorial rearrangements is given in Appendix F.

For supplementary requirements according to the specific conditions of use or application, this Standard is intended to be read in conjunction with the appropriate Standards in the AS 2005 series.

Pending the publication of the new Standards in this series of Standards, AS 2005.2 and AS 2005.3 may be read in conjunction with this Standard.

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- * These further Parts are in course of preparation and are supplementary requirements for—
(a) fuses for use by authorized persons (fuses mainly for industrial application);
(b) fuses for use by unskilled persons (fuses mainly for household and similar applications); and
(c) fuse-links for the protection of semiconductor devices.
- † AS 2005 *Fuses with enclosed fuse-links (up to and including 1000 V a.c. and 1500 V d.c.)*
Part 1: *General requirements* (AS 2005.1)
Part 2: *Fuses for industrial applications* (AS 2005.2)
Part 3: *Fuses for household and similar applications* (AS 2005.3)

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard LOW VOLTAGE FUSES— FUSES WITH ENCLOSED FUSE-LINKS

PART 10: GENERAL REQUIREMENTS

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION.

1.1.1 Scope. 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 1000 V or d.c. circuits of nominal voltages not exceeding 1500 V.

Further Standards in the AS 2005 series cover supplementary requirements for such fuses intended for specific conditions of use or application. (See Note 4.)

NOTES:

1. The details of performance for 'a' fuse-links (see Clause 2.2.4) in d.c. circuits should be subject to agreement between the purchaser and the manufacturer.
2. Modifications of, and supplements to, this Standard required for certain types of fuses for particular applications, e.g. certain fuses for rolling stock or fuses for high-frequency circuits, will be covered, if necessary, by separate Standards.
3. This Standard does not apply to miniature fuses which are covered by IEC 127 and IEC 257.
4. Further Standards in the AS 2005 series are in course of preparation and will be based on IEC 269-2, IEC 269-3 and IEC 269-4.

1.1.2 Application. AS 2005.2 and AS 2005.3 may be read in conjunction with this Standard until superseded by the relevant new Standards in the AS 2005 series.

Fuses with enclosed fuse-links shall comply with the requirements of this Standard when other Standards in this series of Standards are published (see Preface).

Fuse-links intended to be included in fuse-switch combinations complying with AS 1775 should also comply with the requirements of this Standard.

1.2 OBJECT. 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:

- (a) Characteristics of fuses comprising their—
- (i) rated values;
 - (ii) insulation;
 - (iii) temperature rises in normal service;
 - (iv) power dissipation and acceptance;
 - (v) time/current characteristics;
 - (vi) breaking capacity;
 - (vii) cut-off current characteristics; and
 - (viii) I^2t characteristics.

(b) Type test for verification of the characteristics of fuses.

(c) The marking on fuses.

1.3 REFERENCED DOCUMENTS. The documents listed below are those referred to in this Standard.

AS

1104 Informative symbols for use on electrical and electronic equipment

1775 Low voltage switchgear and controlgear—Air-break switches, isolators and fuse combination units (up to and including 1000 V a.c. and 1200 V d.c.)

1852 (441) International electrotechnical vocabulary—Switchgear, controlgear and fuses

1939 Classification of degrees of protection provided by enclosures for electrical equipment

2005 Fuses with enclosed fuse-links (up to and including 1000 V a.c. and 1500 V d.c.)
Part 1: General requirements (AS 2005.1)
Part 2: Fuses for industrial applications (AS 2005.2)
Part 3: Fuses for household and similar applications (AS 2005.3)

2752 Preferred numbers and their use

2768 Electrical insulating materials—Evaluation and classification based on thermal endurance

3000 SAA Wiring Rules

IEC

127 Cartridge fuse-links for miniature fuses

257 Fuse-holders for miniature cartridge fuse-links

269 Low-voltage fuses

Part 1: General requirements (IEC 269-1)

Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) (IEC 269-2)

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

Part 4: Supplementary requirements for fuse-links for the protection of semiconductor devices (IEC 269-4).

291 Fuse definitions

584 Thermocouples

Part 1: Reference tables (IEC 584-1)

SECTION 2. DEFINITIONS

2.0 GENERAL. For the purpose of this Standard, the general fuse term definitions given in IEC 291, and AS 1852(441) apply. Additional terms used in this Standard are defined below.

For the convenience of the reader, terms used in this Standard which are defined in AS 1852(441) without amendment are repeated below, with the definitions replaced by their AS 1852(441) definition numbers, shown in parenthesis.

2.1 DEFINITIONS CONCERNING FUSES AND THEIR COMPONENTS.

2.1.1 Fuse—(441-18-01).

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—(441-18-13).

2.1.3 Fuse-link—(441-18-09).

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 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—(441-18-12).

2.2.2 Current-limiting fuse-link—(441-18-10).

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 5.2) and its rated breaking capacity.

NOTE: ‘a’ fuse-links are generally used to provide short-circuit protection only. Where protection is required against overcurrents less than $k_2 I_n$ in Figure 5.2, 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_c)—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_c 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_c is equal to T_a .

2.2.5.3 Fuse-component temperature (T)—temperature of the relevant part (contact, terminal, etc).

2.2.6 Overcurrent discrimination—coordination 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 or others do 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 contacts, 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 Clause 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 Tables 8.1(A) and 8.1(B)).

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 Clause 5.7.1).

NOTES:

1. A fuse-link with Utilization Category G complies with the gates specified in Table 5.2, is characterised by its rated current and is suitable for general applications (including motor starting).
2. A fuse-link with Utilization Category M complies with the gates specified in Table 5.2 and is suitable for the protection of circuits involving repeated short time overloads, e.g. motor circuits.

M fuse-links are usually characterised by smaller dimensions. The breaking current range is restricted in aM fuse-links. The rated current is less than I_{ch} in aM fuse-links.

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

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.

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 electrical protection.

2.2.14 Authorized persons—instructed or skilled persons.

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

2.2.14.2 Skilled persons—persons with technical knowledge or sufficient experience to enable them to avoid dangers which electricity may create (engineers and technicians).

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. For a.c., rated voltage and rated current are stated as r.m.s. symmetrical values; for 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 Clause 8.5.7).

2.3.3 Gate—limiting values within which the characteristics, e.g. time/current characteristics, shall be contained.

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—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—(441-17-14)

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 fuse-holder 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—(441-17-37)

2.3.11 Operating time; total clearing time—(441-18-22)

2.3.12 I^2t (joule integral)—(441-18-23)

2.3.13 I^2t characteristic—(441-18-24)

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 Currents.

2.3.15.1 Rated current of a fuse-link (I_n)—value of current that the fuse-link can carry continuously under the conditions specified in this Standard.

2.3.15.2 Characteristic current of a fuse-link (I_{ch})—current assigned to a fuse-link with Utilization Category M which defines current/time performance in accordance with this Standard.

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 characteristic and the maximum operating time/current characteristic, under specified conditions.

2.3.18 Conventional non-fusing current (I_{nf})—(441-18-27)

2.3.19 Conventional fusing current (I_f)—(441-18-28)

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 Clause 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 (Clause 2.3.23.1) followed by a second one during which only the power frequency or d.c. recovery voltage (Clause 2.3.23.2) exists.

2.3.23.1 *Transient recovery voltage (T.R.V.)—*(441-17-26)

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.

SECTION 3. CONDITIONS FOR OPERATION IN SERVICE

3.0 GENERAL. 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 Section 8.

3.1 AMBIENT AIR TEMPERATURE (T_a). The ambient air temperature T_a (see Clause 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.

NOTES:

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.
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 rises, etc. See Appendix D.

3.2 ALTITUDE. The altitude of the site of installation of the fuses does not exceed 2000 m above sea level.

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

Higher relative humidities are permitted at lower temperatures, e.g. 90 percent 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 Clauses 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 percent 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 percent above or 9 percent below the mean value of 110 percent of the rated voltage.

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 Clause 8.4.3.6).

3.5 CURRENT. The currents to be carried and to be broken are within the range specified in Clauses 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 8.6(A), appropriate to the value of prospective current.

3.6.3 Time constant. For d.c. the time constant corresponds to that shown in Table 8.6.(B).

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 Clause 5.7.1.

3.9 DISCRIMINATION OF 'gG' and 'gM' FUSES. Limits of discrimination for times greater than 0.1 s are given in Tables 5.1 and 5.2.

Pre-arcing I^2t values are given in Table 7.3, operating I^2t values will be given in other Standards of the AS 2005 series because they are dependent upon the system, the rated voltage and the application of the fuse.

SECTION 4. CLASSIFICATION

Fuses are classified in accordance with both Section 5 herein and other Standards in the AS 2005 series as appropriate.

SECTION 5. CHARACTERISTICS OF FUSES

5.1 SUMMARY OF CHARACTERISTICS.

5.1.0 General. The characteristics of a fuse shall be stated in accordance with properties listed in Clauses 5.1.1, 5.1.2 and 5.1.3 as applicable.

5.1.1 Fuse-holders .

- (a) Rated voltage (see Clause 5.2).
- (b) Rated current (see Clause 5.3.2).
- (c) Kind of current and rated frequency, if applicable (see Clause 5.4).
- (d) Rated power acceptance (see Clause 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 Clause 5.2).
- (b) Rated current (see Clause 5.3.1).
- (c) Kind of current, rated frequency, if applicable (see Clause 5.4).
- (d) Rated power dissipation (see Clause 5.5).
- (e) Time/current characteristics (see Clause 5.6).
- (f) Breaking range (see Clause 5.7.1).
- (g) Rated breaking capacity (see Clause 5.7.2).
- (h) Cut-off current characteristics (see Clause 5.8.1).
- (j) I^2t characteristics (see Clause 5.8.2).
- (k) Dimensions or size.

5.1.3 Complete fuses. Degree of protection according to AS 1939.

5.2 RATED VOLTAGE. For a.c., the preferred values of rated voltage are 240 V and 415 V.

NOTE: Other values, including those for d.c., may be specified in other Standards of the AS 2005 series.

The rated voltage of the fuse-link may have a different value to 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 voltage of its parts (fuse-base, fuse-carrier, 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	10	25	63	160	400	1000
4	12	32	80	200	500	1250
6	16	40	100	250	630	
8	20	50	125	315	800	

NOTES:

1. If higher or lower values are required, these should be selected from the R 10 series of preferred numbers, in accordance with AS 2752.
2. If, in exceptional cases, it is necessary to choose an intermediate value, this value should be selected from the R20 series of preferred numbers, in accordance with AS 2752.
3. Where fuse-links are provided having higher, lower or intermediate rated current values, the characteristics and test conditions are subject to agreement between the manufacturer and the testing authority.

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 other Standards of the AS 2005 series). 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 Clauses 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 other Standards of the AS 2005 series. 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 other Standards of the AS 2005 series. It is intended to be the maximum power dissipation that the fuse-holder can tolerate under specified test conditions without exceeding the specified temperature rise.

5.6 LIMITS OF TIME/CURRENT, CHARACTERISTICS.

5.6.0 Reference ambient air temperature. The limits of time/current characteristics are based on a reference ambient air temperature T_a of 20°C.

5.6.1 Time/current characteristics, time/current zones. The time/current characteristics and time/current zones depend on the design of the fuse-link, and, for a given fuse-link, on the ambient air temperature and the cooling conditions.

NOTES:

1. For ambient air temperatures deviating from the temperature range according to Clause 3.1, consultation with the manufacturer is necessary.
2. It should be noted that in service the characteristics of the fuse would be influenced by the fluid environment temperature T_e .

For fuse-links not complying with the standardized time/current zones, as specified in other Standards of the AS 2005 series, the manufacturer should provide on request (with tolerances)—

- (a) the pre-arcing and operating time/current characteristics; or
- (b) the time/current zone.

NOTE: For pre-arcing times smaller than 0.1 s the manufacturer should provide on request I^2t characteristics with their tolerances (see Clause 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 coordinate 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, a ratio of 1/1 is recognized as an alternative standard. The presentation shall be made on standard A3 or A4 paper.

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

20, 40, 80, 160 mm and 28, 56, 112 mm.

NOTE: It is recommended that, wherever possible, the preferred values 28 mm and 56 mm be used.

5.6.2 Conventional times and currents. The conventional times and currents are given in Table 5.1.

5.6.3 Gates. For 'gG' and 'gM' fuse-links, the gates given in Table 5.2 apply.

5.7 BREAKING RANGE AND BREAKING CAPACITY.

5.7.1 Breaking range and utilization category. The first letter shall indicate the breaking range as follows:

- (a) 'g' fuse-link—full range breaking capacity fuse-link.
- (b) 'a' fuse-link—partial range breaking capacity fuse-link.

TABLE 5.1
CONVENTIONAL TIME AND CURRENT FOR 'gG' AND 'gM' FUSE-LINKS

1 I_n (for gG) or I_{ch} (for gM*) A	2 Conventional time h	3 Conventional current (I_n)	4 Conventional current (I_f)
† ≤ I_n < 16 16 < I_n ≤ 63 63 < I_n ≤ 160 140 < I_n ≤ 400 400 < I_n	1 1 2 3 4	§ 1.25 I_n †	§ 1.6 I_n †

* For 'gM' fuse-links, see Clause 5.7.1.

† For 'gM' fuse-links, replace I_n in columns 1, 3 and 4 by I_{ch} .

TABLE 5.2
GATES FOR SPECIFIED PRE-ARCING AND OPERATING TIMES OF 'gG' AND 'gM' FUSE-LINKS

1 I_n of gG or I_{ch} for gM* A	2 Lower gate test current (pre-arcing time ≥ 10 s)† A	3 Upper gate test current (corresponding to operating time ≤ 5 s)† A	4 Lower gate test current (pre-arcing time ≥ 0.1 s)† A	5 Upper gate test current (corresponding to operating time ≤ 0.1 s)†‡ A
< 16	§	§	§	§
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

* For 'gM' fuse-links see Clause 5.7.1.

† See Figure 5.1.

‡ In Column 5 it is assumed that the operating time when the fuse-link is tested at reduced voltage in accordance with Clause 8.4.3.3(b) will approximate to the operating time at full voltage.

§ Values for fuses with rated current less than 16 A are under consideration.

The second letter shall indicate the utilization category; this letter defines with sufficient accuracy the time/current characteristics, conventional times and currents, gates, e.g. as follows:

- (i) 'gG' indicates fuse-links with a full-range breaking capacity for general application. At present 'gG' fuse-links are often used for the protection of motor circuits, which is possible when their characteristics are capable of withstanding the motor starting current.
- (ii) 'gM' indicates fuse-links with a full-range breaking capacity for the protection of motor circuits.

A 'gM' fuse-link, which has a dual rating is characterized by two current values. The first value I_n denotes both the rated current of the fuse-link and the minimum rated current of the fuse-holder; the second value I_{ch} denotes the time/current characteristic of the fuse-link as defined in Tables 5.1, 5.2 and 7.3.

These two ratings are separated by a letter which defines the applications. For example: $I_n M I_{ch}$ denotes a fuse intended to be used for protection of motor circuits. The first value I_n corresponds to the maximum continuous current for the whole fuse and the second value I_{ch} corresponds to the time/current characteristic of an 'aG' fuse-link (see Clause 8.4.3.3.(a)).

- (iii) 'aM' indicates fuse-links with a partial range breaking capacity for the protection of motor circuits.

An 'aM' fuse-link is characterized by one current value I_n and a time/current characteristic as defined in Clause 8.4.3.3.(a) and Figure 5.2.

5.7.2 Rated breaking capacity. The rated breaking capacity of a fuse-link shall be given by the manufacturer corresponding to the rated voltage. Values of minimum rated breaking capacity are given in other Standards of the AS 2005 series.

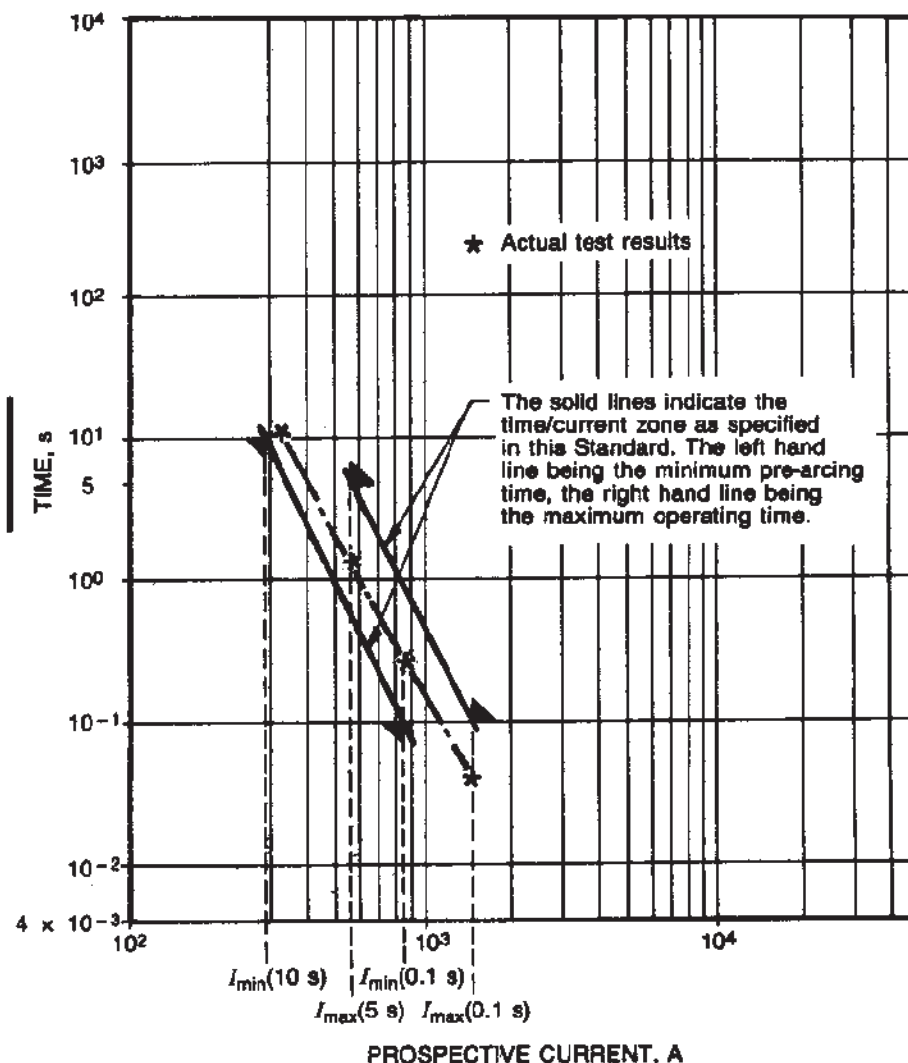
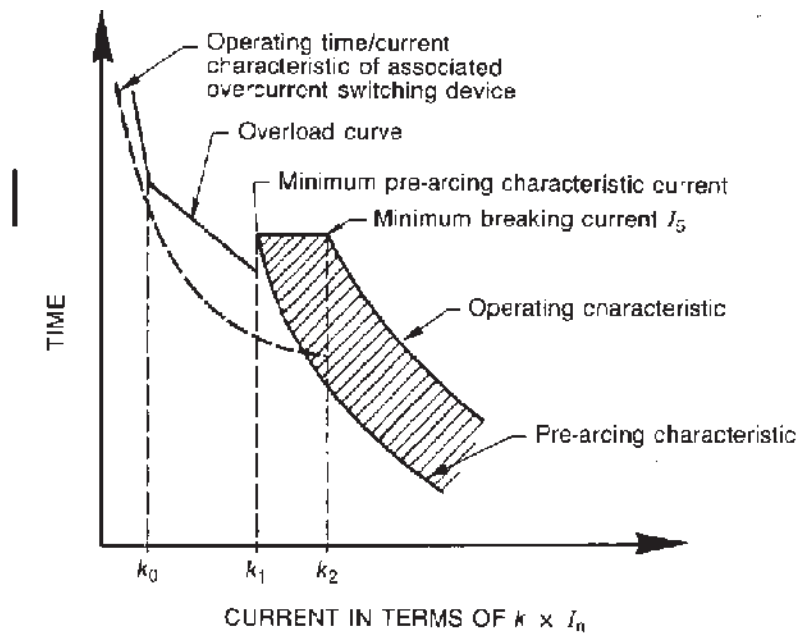
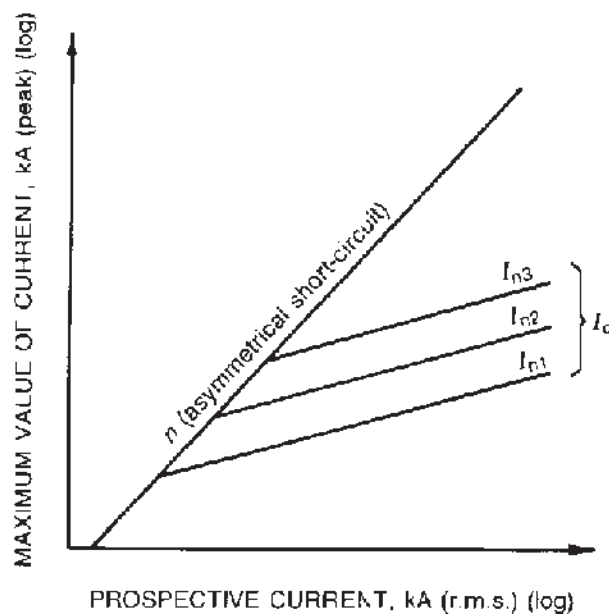


FIGURE 5.1 DIAGRAM ILLUSTRATING THE MEANS OF VERIFICATION OF THE TIME/CURRENT CHARACTERISTIC, USING THE RESULTS OF TESTS AT THE GATE CURRENTS (EXAMPLE)



The over load curve between $K_0 \times I_n$ and $K_1 \times I_n$ corresponds to a constant $I^2 t$ value.

FIGURE 5.2. OVERLOAD CURVE AND TIME/CURRENT CHARACTERISTIC FOR 'a' FUSE-LINKS



LEGEND:

I_{n1} , I_{n2} , I_{n3} = rate currents of fuse-links

I_c = maximum value of cut-off current

n = factor depending on the value of the power factor

FIGURE 5.3. GENERAL PRESENTATION OF THE CUT-OFF CHARACTERISTICS FOR A SERIES OF A.C. FUSE-LINKS