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(AMD 6692)*

Specification for

Cartridge fuses for a.c. circuits —

In domestic and similar premises

Co-operating organizations

The Electrical Industry Standards Committee, under whose supervision this British Standard was prepared consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices' Technical Committee	Electricity Council, the Central Electricity
Association of Consulting Engineers*	Generating Board and the Area Boards in
Association of Manufacturers of Domestic	England and Wales*
Electrical Appliances	Electronic Engineering Association
Association of Mining Electrical and	Engineering Equipment Users' Association*
Mechanical Engineers	Institution of Electrical Engineers*
Association of Supervisory and Executive	Lighting Industry Federation Limited
Engineers	Ministry of Defence
British Electrical and Allied Manufacturers'	Ministry of Defence, Army Department
Association*	Ministry of Defence, Navy Department*
British Radio Equipment Manufacturers'	Ministry of Public Building and Works
Association	Ministry of Technology*
British Railways Board	Municipal Passenger Transport Association
Crown Agents for Oversea Governments and	(Incorporated)
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Department of Employment and	Installation Contracting
Productivity*	National Physical Laboratory (Ministry of
Electric Cable Makers' Confederation	Technology)
Electrical Contractors' Association	Oil Companies Materials Association*
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Electrical Contractors' Association of	Public Transport Association (Incorporated)
Scotland	South of Scotland Electricity Board
Electrical Research Association*	

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Association of Short-circuit Testing	Lloyd's Register of Shipping
Authorities	London Transport Board
Electrical Power Engineers' Association	

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Foreword

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

BS 88, *Cartridge fuses of voltage ratings up to 660 volts — Part 1: Performance and dimensions of fuse links.*

BS 1454, *Consumers' electricity control units. Fuse and miniature circuit breaker types principally for use in domestic premises.*

BS 4000, *Sizes of paper and board.*

The principal changes in this revision of BS 1361 are the introduction of standard time/current zones and metric dimensions, and the subdivision of the fuse links into two types, as follows:

Type I fuse links, rated at 240 V and 5 – 45 A, which are intended for use in distribution boards where the fuses are replaced by the consumer.

Type II fuse links, rated at 415 V and having preferred current ratings of 60, 80 and 100 A, primarily intended for use by the supply authority in the incoming service unit of domestic and similar premises.

In addition, the specification has been split into three sections: the first containing definitions and general clauses; the second dealing with fuse links; and the third with fuse carriers and bases. Details are also given of standard test rigs for performing power loss and breaking capacity tests on fuse links.

The dimensions in this standard are now given in metric units. However, the dimensions of the actual fuse links are direct equivalents of the original inch dimensions given in the earlier edition of this standard. This was considered essential in order to maintain interchangeability with the existing fuse links already in use in a large number of installations.

Fuses within the scope of this standard are not sensitive to normal electromagnetic disturbances, and therefore no immunity tests are required. Significant electromagnetic disturbance generated by a fuse is limited to the instant of its operation. Provided that the maximum arc voltages during operation in the type test comply with the requirements of the clause in this standard specifying maximum arc voltage, the requirements for electromagnetic compatibility are deemed to be satisfied.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 General

1.1 Scope

This British Standard specifies requirements for fuses for a.c. circuits of 240 V and current ratings of up to 45 A which are intended for use in consumers' distribution boards, including electricity control units complying with BS 1454¹⁾, in dwelling houses, blocks of flats and office buildings. It also covers fuses of 415 V rating and current ratings of up to 100 A for use by the supply authority in the incoming service units of such premises.

It specifies performance and as many of the dimensions and constructional details as are necessary to ensure interchangeability of fuse links of the same current rating and to prevent unintended interchangeability of fuse links and carriers not of the same current rating.

The dimensions and performance of fuse links are dealt with in Section 2, whilst fuse carriers and bases to accommodate these fuse links are dealt with in Section 3.

1.2 Service conditions

The service conditions for which fuses, fuse links, fuse carriers and bases complying with the requirements of this standard are suitable are as follows. (Attention is also drawn to Appendix J, dealing with the application of fuse links).

- 1) *Voltage*. An a.c. system having a maximum voltage not exceeding 1.1 times the rated voltage of the fuse.
- 2) *Current*
 - a) *Fuse links*. Carrying continuously any current not exceeding the current rating and breaking currents from the minimum fusing current up to the breaking capacity rating at power factors not lower than 0.3.
 - b) *Fuse carriers and bases*. Carrying any current not exceeding the rated current continuously, and the peak currents associated with the operation under fault conditions of any fuse link which the fuse carriers and bases are to accommodate.
- 3) *Frequency of alternating current*. A frequency of 45 – 62 Hz.

4) *Ambient air temperature*. The temperature of the surrounding air having a peak value not exceeding 35 °C, with an average value not exceeding 30 °C over 24 h periods. For fuses installed within an enclosure it is the temperature outside the enclosure.

5) *Temperature inside an enclosure*. Since most fuses are used inside an enclosure, this specification is based on a temperature of the air surrounding the fuse inside the enclosure which is 15 °C above the ambient air temperature.

In cases where the temperature conditions vary significantly from this value, e.g. in small or congested enclosures, this should be taken into consideration from the points of view of both operation and temperature rise.

6) *Altitude*. An altitude not exceeding 1 000 m above sea level.

7) *Atmosphere*. An atmosphere not subject to excessive pollution, e.g. pollution from smoke, chemical fumes, or salt-laden spray; such pollution occurs in some industrial areas and in some coastal districts.

1.3 Definitions

For the purposes of this British Standard the following definitions apply. (Further explanation of some of the terms defined in this clause is given in Appendix A).

1.3.1 fuse

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

1.3.2 fuse

element an individual current-carrying component extending between end connections within a cartridge and designed to melt in total or in part upon the operation of the fuse

1.3.3 form of fuse element

the shape and the material of the fuse element, the variations (increase or decrease) of cross-sectional dimensions and the changes, if any, in the material along the length of the fuse element, including the material of joints and/or time lag devices

¹⁾ BS 1454, "Consumers" electricity control units. Fuse and miniature circuit breaker types principally for use in domestic premises'.

1.3.4 cartridge

a totally enclosing fuse element container consisting of insulating material, tubular in form, and having its ends closed by metallic caps

1.3.5 cartridge fuse link

(hereinafter referred to as fuse link) a device comprising a fuse element or several fuse elements connected in parallel, enclosed in a cartridge usually filled with arc-extinguishing media and connected to terminations

1.3.6 fuse contact

a contact suitable for engaging with a fixed contact and capable of having a fuse link attached to it or forming an integral part of a fuse link

1.3.7 fuse carrier

a removable holder serving to carry a fuse link and fitted with fuse contacts, if necessary, for this purpose. A cartridge or other container of a fuse element, if suitable, may form a fuse carrier or part of a fuse carrier

1.3.8 fixed contact

a contact for engaging with a fuse contact and connected to a fixed terminal

1.3.9 fuse base

that part of the fuse which carries the fixed contacts

1.3.10 rated minimum fusing current

the current stated as being that current which will cause the fuse link to operate in the specified time under the prescribed conditions

1.3.11 current rating

a current stated by the manufacturer as the current that the fuse link, fuse carrier and base will carry continuously without deterioration, in accordance with the relevant clauses of this specification

1.3.12 fusing factor

the ratio, greater than unity, of the minimum fusing current to the current rating, namely:

$$\text{fusing factor} = \frac{\text{rated minimum fusing current}}{\text{current rating}}$$

1.3.13 prospective current (of a circuit)

the current (the r.m.s. value of the alternating component of an alternating current) that would flow on the making of the circuit when the circuit is equipped for the insertion of a fuse but the fuse is replaced by a link of negligible impedance

1.3.14 loop

that part of an alternating wave which extends from one zero to the next

NOTE 1 As Figure 6 and Figure 7 show, successive loops may have different durations and amplitudes in the region of initiation of current. The larger loops are called major loops, and the smaller loops are called minor loops.

NOTE 2 For the purpose of indicating the number of current zeros during arcing time arcing time may be referred to as including a stated number of loops.

1.3.15 cut-off

if the melting of the fuse element(s) prevents the current through the fuse link from reaching the otherwise attainable maximum (the peak current of the first major loop in an a.c. circuit), the fuse link is said to cut off and the instantaneous maximum current attained is called the cut-off current

NOTE 1 In an a.c. circuit the numerical value of the cut-off current may be greater than the numerical value of the prospective current.

NOTE 2 A fuse link only exhibits cut-off at prospective currents greater than a particular value; the transition point varies with different fuse links.

1.3.16 breaking capacity rating

a prospective current stated by the manufacturer as the greatest prospective current that may be associated with the fuse link under prescribed conditions of voltage and of power factor

1.3.17 rated voltage

the voltage assigned by the manufacturer to indicate the nominal system voltage with which the fuse or fuse link may normally be associated

1.3.18 arc voltage

the voltage that exists across a fuse link during the arcing time

NOTE The maximum value of the arc voltage may exceed the peak value of the a.c. recovery voltage.

1.3.19 pre-arcing time

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

NOTE In practice the instant of arc initiation is marked by sudden rise in voltage across the fuse link.

1.3.20**arcing time**

the time between the end of the pre-arcing time and the instant when the circuit is broken and the current becomes permanently zero

1.3.21**total operating time**

the sum of the pre-arcing time and the arcing time

1.3.22**recovery voltage (of a circuit opened by a fuse link)**

the r.m.s. value of the normal frequency alternating voltage that exists across the fuse link after opening of the circuit

1.3.23**operation (of a fuse link)**

the process in the fuse link between the beginning of the pre-arcing time and the end of the arcing time. Operation is sometimes called blowing

1.3.24**discrimination**

discrimination between two or more circuit interrupting devices in series is said to occur when, on the incidence of a short circuit or an overcurrent, only the device which is required to operate does so, and the other remains unimpaired

1.3.25**duty of a fuse link**

the satisfactory opening of the circuit or circuits protected by the fuse link at system voltages having maximum values not exceeding 1.1 times its rated voltage, under conditions which produce for the requisite length of time any prospective current greater than its minimum fusing current, but which does not exceed its breaking capacity rating

1.3.26**total I^2t (let through)**

the specific energy to which a protected circuit is subjected during the operation of a fuse link

1.3.27**pre-arcing I^2t**

the specific energy to which a protected circuit is subjected during the pre-arcing time

1.3.28**arcing I^2t**

the specific energy to which a protected circuit is subjected during the arcing time

NOTE For the above three definitions, the specific energy is that energy which would be produced in a unit resistance by a current flowing for an interval of time. This energy is given by the time integral of the square of the instantaneous current for the interval of time t and is referred to as I^2t , where I is the r.m.s. value of the current during the interval of time t .

1.3.29**time/current zone**

the zone contained by the minimum pre-arcing characteristic and the maximum operating characteristic applying to specified conditions

2 Fuse links**2.1 Ratings**

2.1.1 Rating of fuse link. The fuse link shall be rated in terms of:

- 1) voltage,
- 2) breaking capacity,
- 3) current,
- 4) fusing factor,
- 5) type reference.

2.1.2 Rated voltages. The rated voltages are 240 V a.c. for Type I fuse links and 415 V a.c. for Type II fuse links.

2.1.3 Breaking capacity rating. The breaking capacity rating of the fuse link shall be the appropriate value given in Column 2 of Table 1.

Table 1 — Breaking capacity and power factor

Type	Breaking capacity rating	Power factor lagging (nominal)
	A	
I	16 500	0.3
II	33 000	0.3

The power factor associated with breaking capacity rating shall be the corresponding nominal value given in Column 3 of Table 1. Tolerances for test purposes are given in 2.5.5.

2.1.4 Current rating. The current ratings of Type I fuse links shall be as given in Table 2.

Table 2 — Current ratings

Type	Current rating
	A
I	5
	15
	20
	30
	45
IIa	60
	80
IIb	80
	100

The current ratings for Type II fuse links given in Table 2 are preferred values; other current ratings shall not exceed 80 A for Type IIa, or 100 A for Type IIb.

2.1.5 Fusing factor. The fusing factor shall be not greater than 1.5 and shall be determined in accordance with the requirements of 2.2.4.

2.2 Performance

2.2.1 Power loss. Fuse links shall be so designed that when they are tested for power loss in accordance with the method described in 2.5.2, the loss in watts shall not exceed the values given in Table 3.

2.2.2 Time/current zones. The standard time/current zones for fuse links below 60 A rating are indicated in Figure 5a and Figure 5b.

The standard time/current zones for fuse links of 60 A rating and above are indicated in Figure 5c and Figure 5d.

2.2.3 Time/current characteristic. The manufacturer shall hold available time/current characteristic curves which shall be supplied on request. These shall be prepared with logarithmic scales on both axes (see Appendix B) and shall give current values for pre-arcing times down to 0.01 s. These nominal time/current characteristic curves, together with a tolerance of $\pm 10\%$ in terms of current, shall lie wholly within the appropriate time/current zone shown in Figure 5a, Figure 5b or Figure 5c. For any pre-arcing time of less than 0.01 s, the manufacturers shall supplement the time/current characteristics with information on both pre-arcing I^2t and total operating I^2t values.

2.2.4 Fusing factor. When determining the fusing factor, as defined in 1.3 12), the rated minimum fusing current shall be that current corresponding to a time of 4 h on the time/current characteristic curve specified in 2.2.3.

2.2.5 Breaking performance. Fuse links shall be capable of opening any circuit in which:

- 1) the maximum voltage does not exceed 1.1 times the rated voltage of the fuse link;
- 2) the prospective current is greater than the minimum fusing current but does not exceed the breaking capacity rating (Table 1);
- 3) the power factor is not lower than 0.3 lagging.

2.2.6 Discrimination. Type I fuse links of 5, 15, 20 or 30 A ratings shall discriminate with Type II fuse links of 60, 80 or 100 A and Type I 45 A fuse links shall discriminate with Type IIb fuse links of 100 A. To comply with these requirements, the total I^2t values of Type I fuse links and the pre-arcing I^2t values for Type II fuse links shall be in accordance with the values given in Table 6A and Table 6B.

Table 3 — Test conductor sizes and maximum power loss

Type	Current rating	Maximum power loss	Test conductor sizes (copper conductors)
I	A	W	mm ²
	5	1.1	1
	15	2.0	1.5
	20	2.5	2.5
	50	3.0	6
	45	3.5	10
II	Less than 60	5.5	As for equivalent Type I
	60	5.5	16
	80	6.0	25
	100	6.0	35

2.3 Construction

2.3.1 Dimensions. The dimensions of the fuse link shall be as specified in Table 4 and Figure 1.

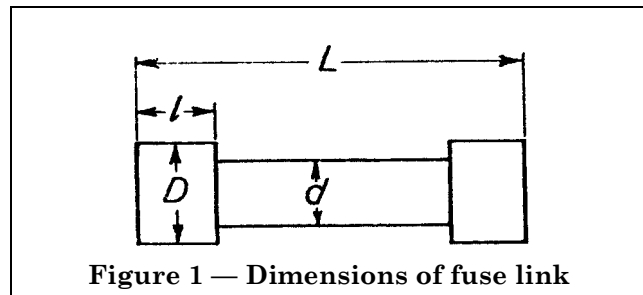


Figure 1 — Dimensions of fuse link

The maximum diameter (d) of the cartridge between the end caps shall be less than the diameter, D , of the end caps.

2.3.2 End caps. Fuse links shall have at each end an end cap with a cylindrical contact surface which shall be substantially co-axial with the body of the fuse. End caps shall be either of non-corroding metal or of a metal suitably protected against corrosion.

2.4 Marking

Every fuse link shall be clearly and indelibly marked with the following:

- 1) the manufacturer's name or identifying mark,
- 2) the number of this British Standard,
- 3) the rated current and, for Type I, the identifying colour as given in Table 5, and
- 4) for Type II only, the rated voltage.

Table 4 — Dimensions of fuse links

Type	Current rating	Dimensions		
		Length L	Length l of end cap	Diameter D of end cap
I	A	mm	mm	mm
	5	$23^{+0}_{-0.8}$	4.8 ± 0.5	6.35 ± 0.1
	15 and 20	$26^{+0.2}_{-0.6}$	6.4 ± 0.5	10.32 ± 0.1
	30	29 ± 0.4	8.0 ± 0.5	12.7 ± 0.1
	45	$35^{+0.8}_{-0.1}$	9.5 ± 0.5	16.67 ± 0.1
IIa	≥ 80	57 ± 1.0	16 ± 0.5	22.23 ± 0.1
IIb	≥ 100	57 ± 1.0	16 ± 0.5	30.16 ± 0.1

Table 5 — Colour coding for type I fuse links

Current rating	Colour
A	
5	White
15	Blue
20	Yellow
30	Red
45	Green

2.5 Type tests

The manufacturer shall hold available evidence of type tests proving compliance with the requirements of this clause, together with detail drawings of the fuse links and a record of any alterations that have been made in the fuse links subsequent to the type tests.

Fuse links supplied by the manufacturer shall be regarded as complying with the requirements of this specification, provided that in the following respects they are identical with those tested in the type tests:

- 1) the cartridge bodies have the same dimensions, material and method of manufacture;
- 2) the caps or other end closure of the cartridges have the same dimensions, materials and method of attachment and sealing;
- 3) the granular filler of the cartridge is of the same material, grain size and completeness of filling;
- 4) the fuse elements and their arrangement are the same in every respect.

2.5.1 Type II fuse links of lower current rating.

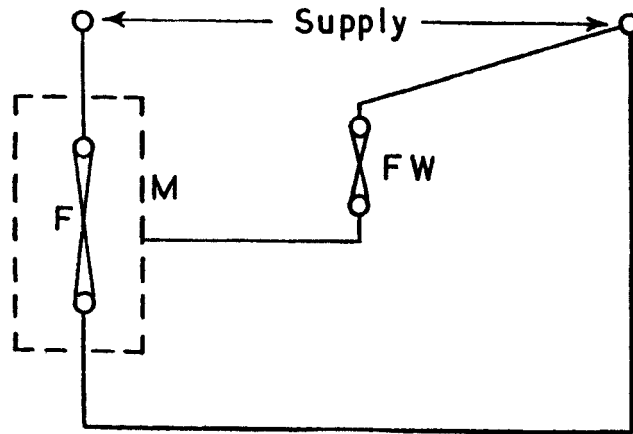
In the case of Type II fuse links it is not necessary to perform full breaking capacity tests on fuse links of all current ratings when, in a given body size, the fuse links of lower current rating are identical in design to those of the higher current rating.

Provided that a breaking capacity Test 1 of 2.5.5 is performed on the fuse links of lowest current rating, then the full breaking capacity tests on the largest current rating are considered to cover also those of the lower current ratings.

The fuse links of lower current ratings shall comply in all respects with the requirements 1) to 3) of 2.5 and the fuse elements shall be identical in form but may be less in number or reduced in cross section dimensions. Any changes in the disposition of fuse elements shall not be such as to reduce the minimum distance between adjacent elements or between the elements and the inner surface of the cartridge body.

2.5.2 Power loss tests. Fuse links shall be mounted in a vertical position, using a test rig as described in Appendix D, in surroundings free from external draughts. If the ambient temperature is not in the preferred range of 15 – 30 °C, the actual temperature at the time of the test shall be recorded in the test report. The test conductors shall have elastomer or plastic insulation and dimensions as given in Column 4 of Table 3. They shall be at least 1 m long and be terminated with cable lugs of the appropriate size. The frequency of the supply shall be 45 – 62 Hz.

The rated current shall be passed through the fuse links for a time sufficient for the power loss value to become steady and these values, measured in accordance with the method described in Appendix M, shall not exceed those given in Table 3.



F. Fuse link on test
M. Metal enclosure
FW. Fine wire fuse

Figure 2 — Diagram of connections for tests for duty

2.5.3 Tests for time/current characteristics and fusing factor. A sufficient number of tests shall be made under the conditions specified in 2.5.2 to enable a time/current characteristic curve to be plotted within the tolerances stated in 2.2.3. At the beginning of each test the fuse links and conductors connected to them shall be approximately at ambient temperature. Tests shall include currents such as to indicate the value of the current for a fusing time of 4 h in order to determine the fusing factor.

When independent verification of a manufacturer's time/current characteristic curves is required, the following tests shall be made on the maximum current rating of each form of fuse element within a given body size.

One test shall be performed at each of three values of current, so that the time/current curve is verified at times of approximately 1 s, 10 s and 100 s (or at such other times as may seem more appropriate to the shape of the curves). The results obtained shall lie within $\pm 10\%$, in terms of current, of the time/current curve at the operating times obtained in the tests.

2.5.4 Preparation of fuses for breaking capacity tests. Fuse links shall be mounted vertically for test and shall be tested singly in a test rig as shown in Figure 4 and as described in Appendix C. The connections of the fuse link and of the test rig shall be as indicated in Figure 2. The metal enclosure of Figure 4 shall be connected to one pole of the supply through a fine wire fuse, wired with copper wire not greater than 0.1 mm in diameter with a free length of not less than 75 mm.

If, from inspection, it appears that one terminal of the fuse is more likely to arc to the enclosure, that terminal shall be connected to the pole of the supply to which the fine wire fuse is not connected.

2.5.5 Breaking capacity tests. The supply shall be single phase with a frequency of 45 – 62 Hz.

The applied voltage and recovery voltage (measured as in Appendix G) shall be 1.1 times the voltage rating of the fuse link (see 2.1.2) with a tolerance of $-0\% + 5\%$. The positive tolerance may be exceeded with the consent of the manufacturer.

The prospective current of the circuit shall be determined by the method given in Appendix E and the power factor during this test (computed as in Appendix F) shall be within ± 0.05 of the value given in Table 1. With the consent of the manufacturer the power factor may be less than that specified.

Fuse links of each current rating (except as provided in 2.5.1) shall be subjected to the following tests. During each test arcing shall commence between 60° and 90° after voltage zero.

TEST 1. One test shall be made at a prospective current of not less than the rated breaking capacity given in Table 1. The prospective current shall not exceed 115% of this value unless agreed by the manufacturer.

TEST 2. Three tests shall be made at some lower prospective current chosen to ensure that cut off occurs at a level not lower than the numerical (r.m.s. symmetrical) value of the prospective current.

This lower prospective current can be calculated with sufficient accuracy from the formula:

$$I_2 = 0.7 I_{co}^{1.5} / I_1^{0.5},$$

where: I_1 = prospective current in Test 1,

I_2 = prospective current in Test 2,

I_{co} = instantaneous cut-off current in Test 1.

The voltage shall be maintained for 30 s after operation of the fuse link, and during the three minutes following these 30 s the insulation resistance between the terminals of the fuse link shall be measured, using a direct voltage of approximately 500 V.

A summary of the information to be included in a report of type tests for breaking capacity is given in Appendix L.

2.5.6 Criteria of failure in breaking capacity tests.

If, during the breaking capacity tests, any of the following occur this shall be regarded as a failure to pass the test:

- 1) melting of the fine wire fuse, indicating arcing to the metal enclosure;
- 2) mechanical damage to the test rig;
- 3) ignition of the fuse link, excluding any paper labels;
- 4) bursting (as distinct from cracking) of the cartridge;
- 5) puncture or significant movement of the end caps (exceeding 1 mm per cap);
- 6) an insulation resistance of less than 100 000 Ω between the fuse link contacts at the conclusion of the test;
- 7) a maximum arc voltage in excess of the following values during breaking capacity Test 1:
 - 3 kV for a 5 A fuse link,
 - 2.5 kV for fuse links of 15 A and above.

2.5.7 Verification of discrimination. Compliance with the requirements of 2.2.6 regarding discrimination is checked by measurement of the oscillograms obtained during the breaking capacity tests of 2.5.5, as follows:

Type I. Total I^2t during Test 1 shall not exceed the values in Table 6A.

Type II. Pre-arcing I^2t during Test 2 shall not be less than the minimum values in Table 6B and shall not exceed the maximum values in Table 6B.

Table 6A — Values for pre-arcing and total I^2t of type I fuse links

Current rating	Maximum total I^2t	Minimum pre-arcing I^2t
A	A ² s	A ² s
Not exceeding 20	5 000	—
30	5 000	800
45	20 000	800

Table 6B — Values for pre-arcing I^2t of type II fuse links

Current rating	Minimum pre-arcing I^2t	Maximum pre-arcing I^2t
A	A ² s	A ² s
Not exceeding 60	7 000	27 000
80	12 000	42 000
100	22 000	42 000

3 Fuse carriers and bases

3.1 Ratings

3.1.1 Ratings of fuse carriers and bases. The fuse carrier and base shall be rated in terms of:

- 1) voltage,
- 2) current.

3.1.2 Voltage rating. The following are the voltage ratings:

- 240 V for accommodating Type I fuse links
- 415 V for accommodating Type II fuse links.

3.1.3 Current rating. Fuse carriers and bases shall be designed to accommodate fuse links of the dimensions specified in Section 2 and shall have one of the following ratings:

- 5, 15/20, 30, 45, 60/80 or 80/100 A.

NOTE The above current ratings apply only when the fuse links and carriers and bases are used under the specified conditions (see Appendix J).

3.2 Performance

3.2.1 Temperature rise at current rating. All parts of fuse carriers and bases shall be so designed and proportioned that when carrying the appropriate current rating continuously and tested in accordance with the requirements of 3.4.3, the temperature rise of the fuse contacts and of the fixed terminals, or cable sockets when used, shall not exceed the following values:

- fuse contacts 55 °C
- fixed terminals or cable sockets when used 45 °C.

3.3 Construction

3.3.1 Dimensions. Fuse carriers and bases shall only be capable of accommodating cartridge fuse links of the ratings and dimensions specified in Section 2.

3.3.2 Mechanical strength. Fuse carriers and bases shall be suitable for supporting the fuse links for which they are designed during the operation of the fuse links.

Carriers and bases for accommodating Type II fuse links shall be tested for mechanical strength in accordance with 3.4.5.

3.3.3 Contacts. Fuse contacts and fixed contacts shall be so constructed and of such material that when the fuse link is properly installed and service conditions are normal, adequate contact is maintained between the fuse contacts and the fixed contacts after repeated engagement and disengagement, or after the fuse has been left untouched for a long period.

3.3.4 Terminals. Cable terminals, or cable sockets where these are used, shall be suitable for accommodating the conductor specified in Columns 3 and 4 of Table 7.

Where the conductor is to be fitted into a round hole in a terminal, the hole diameter shall be not less than that given in Column 5 of Table 7.

If conductors are intended to be secured in the terminals by pinching screws, the ends of the pinching screws shall be so shaped as to minimize damage to the conductors. Each terminal shall also be capable of satisfactorily clamping a conductor of a diameter equal to 0.3 times the equivalent diameter of the conductor given in Column 3.

NOTE Due to the fact that standard means for the termination of aluminium conductor cables have yet to be established, arrangements for the accommodation of such cables have not been included in this specification.

3.3.5 Non-metallic parts. All non-metallic parts of fuse carriers and bases shall be constructed of non-hygroscopic insulating material which shall be non-ignitable under service conditions.

3.3.6 Non-interchangeability. Fuse carriers and bases intended for use with Type I fuse links as specified in Section 2 shall accommodate only fuse links of dimensions for which they are designed, and of current rating equal to or less than the rating indicated by the marking on the carrier or base.

3.3.7 Shielding. Fuse carriers shall be of such form and material as to protect persons from shock or burns. In all fuses designed for accommodating Type I fuse links and Type II fuse links not intended for use as supply authority fuses, the fuse contacts and the fixed contacts shall be so shielded as to protect persons from inadvertent contact with live metal whilst the fuse carrier is being inserted or withdrawn.

3.4 Type tests

3.4.1 General. The manufacturer shall hold available evidence of compliance with the requirements of this clause of this standard, together with detailed drawings of the fuse carriers and bases and a record of any alterations that have been made in the fuse carrier and base subsequent to the type tests.

3.4.2 Tests for insulation resistance. Fuse carriers and bases shall be in clean new condition and shall have been exposed to the normal atmosphere in the manufacturer's works for at least 24 h prior to the test.

The fuses shall be mounted in the manner intended or specified by the manufacturer for use in service, particularly as regards the proximity of any earthed metal of the mounting or the enclosing case.

The insulation resistance shall be measured using a nominal direct voltage of not less than 500 V which may be generated in the instrument or obtained from an external source. The voltage shall be applied for sufficient time for the reading of the indicator to become practically steady. Two tests shall be made, as follows:

- 1) between the fixed terminals (or cable sockets) without a fuse link fitted;
- 2) between a fixed terminal (or cable socket) and any earthed metal of the mounting or enclosure, with a fuse link fitted.

The insulation resistance shall be not less than 50 M Ω .

3.4.3 Tests for temperature rise at current rating. Fuse carriers and bases for the temperature rise test shall be mounted in an enclosing case, preferably of a type in which they may be used in service, and, unless the case only allows horizontal mounting of the fuses, they shall be mounted vertically for the test. The surroundings shall be free from external draughts.

Copper test conductors with elastomer or plastic insulation and of the appropriate size as shown in Table 7, shall be connected to the terminals which are to be used in service. At least 1 m of each conductor shall project in a vertical plane from the fuse terminal.

A dummy fuse link having a power loss of the appropriate value shown in Table 3 shall be fitted in the fuse and rated current, at a frequency of 45 – 62 Hz, shall then be passed through the complete fuse for sufficient time for the temperatures to become steady.

Table 7 — Sizes of test conductors and terminal bores

Type	Rating	Test conductor size		Minimum diameter of bore
		Area	Stranding	
I	A	mm ²	No./mm	mm
	5	1	1/1.13	3.2
	15	1.5	1/1.38	5.2
	20	2.5	1/1.78	5.2
	30	6	7/1.04	4.0
IIa	45	10	7/1.35	5.0
	60	16	7/1.7	6.0
IIb	80	25	7/2.14	7.5
	100	35	19/1.53	8.5

If mounted vertically, temperatures shall be measured at the top of the fuse; if mounted horizontally, at either end of the fuse. They shall be measured by thermocouples which may be attached by low melting point alloy or other equally effective means. The points at which the temperatures are measured shall be:

- 1) for contacts: the point at which, from the design, the maximum temperature rise may be expected to occur;
- 2) for fixed terminals (or, when used, cable sockets): the nearest accessible point to the external connection.

The temperature rises above ambient air temperature shall not exceed the values given in 3.2.1. No correction is required if the ambient temperature during the test is different from the service ambient temperature.

NOTE Base metal thermocouples attached by low melting point alloy of equal parts of lead, tin and bismuth are suitable.

3.4.4 High voltage test. A representative sample of each design and rating of fuse carrier and base shall be tested to withstand the high voltage test when in a clean new condition after having been exposed to ordinary atmosphere at the manufacturer's works for at least 24 h. The test shall be performed with all parts of the fuse carrier and base in position.

The test shall be at 2.5 kV a.c. at a frequency of between 25 Hz and 100 Hz. The test shall be performed:

- 1) between the fixed terminals or cable sockets without the fuse link in position, and
- 2) between the fixed terminals or cable sockets and any metal parts associated with the mounting, with the fuse link fitted.

During test 2) the pole of the testing transformer connected to the mounting shall be earthed.

The test voltage shall not be applied suddenly. The voltage shall be applied at a relatively low value and shall be brought up to the full value as rapidly as is consistent with its value being indicated by the measuring instrument. The full test voltage shall be maintained at the steady value for 1 minute and may then be rapidly diminished before switching off.

If the voltage cannot be maintained at the specified value, or if there is visible evidence of sparking or tracking, this shall be regarded as failure of the test.

3.4.5 Tests for mechanical strength. One test shall be performed on each current rating of fuse carrier and fuse base for accommodating Type II fuse links at any convenient value of voltage but with the fuse link replaced by a copper link.

The value of test current shall be such that the peak value caused to flow through the fuse carrier and base shall be not less than the appropriate value in Table 8, with a positive tolerance of 20 % which should not be exceeded without the consent of the manufacturer.

The duration of the test current shall not exceed 20 ms without the consent of the manufacturer. During the test the fuse carrier shall not be ejected.

Table 8 — Test currents for mechanical strength of type II fuses

Current rating	Peak test current
A	kA
80	15
100	18

3.5 Marking

Fuse carriers shall be clearly and indelibly marked with:

- 1) the manufacturer's name or identification mark,
- 2) current rating,
- 3) voltage rating,
- 4) type reference of fuse links for which it is suitable,
- 5) the number of this British Standard.

Fuse bases, or any part designed to ensure non-interchangeability, shall be marked with the current rating. If fuse carriers or bases are colour coded, the colour shall agree with that given in Table 5.

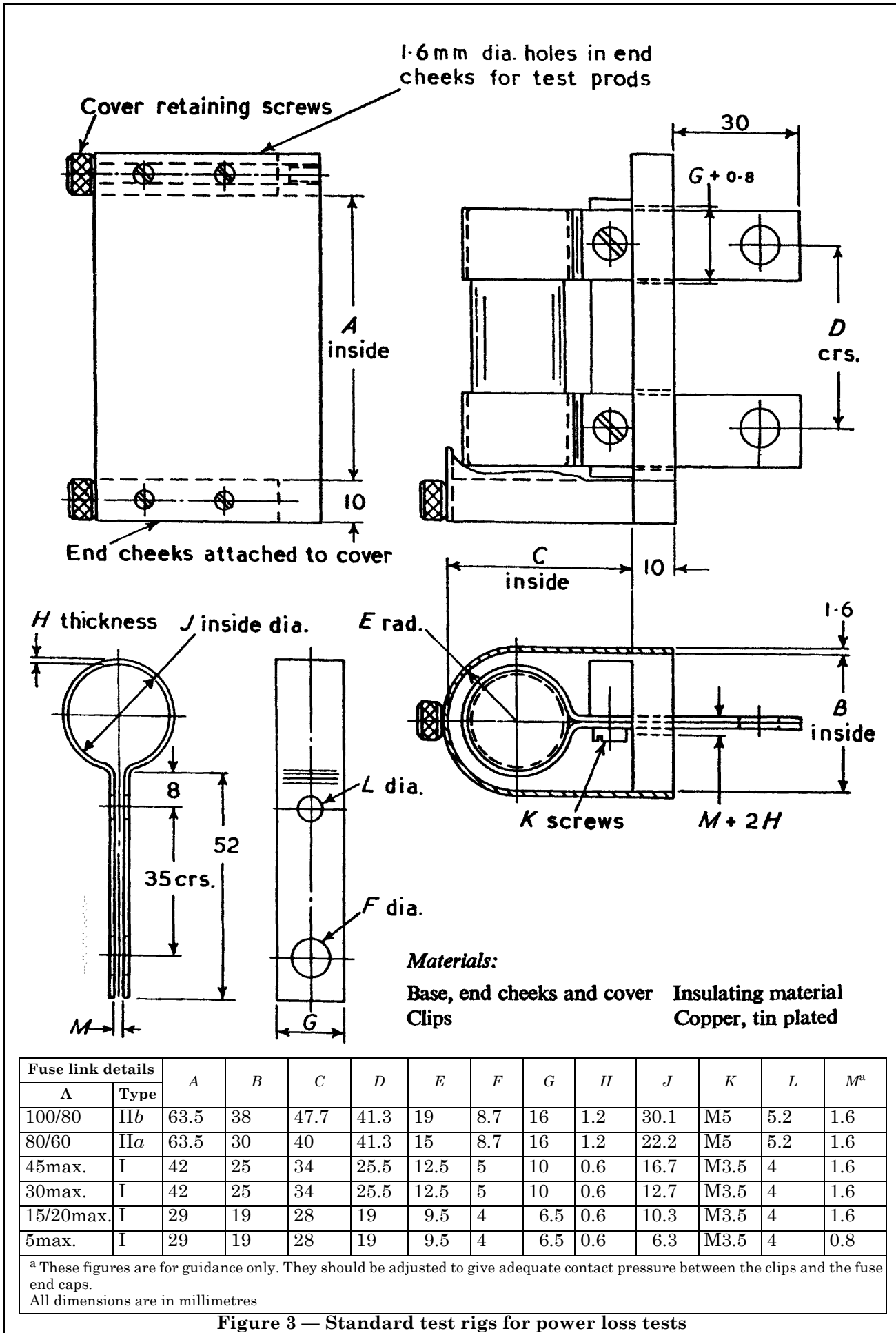
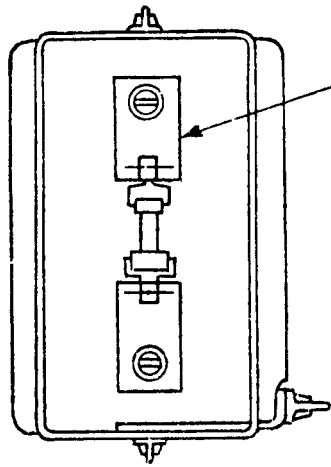
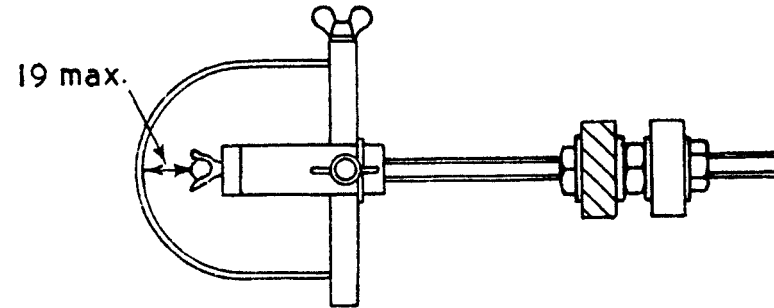
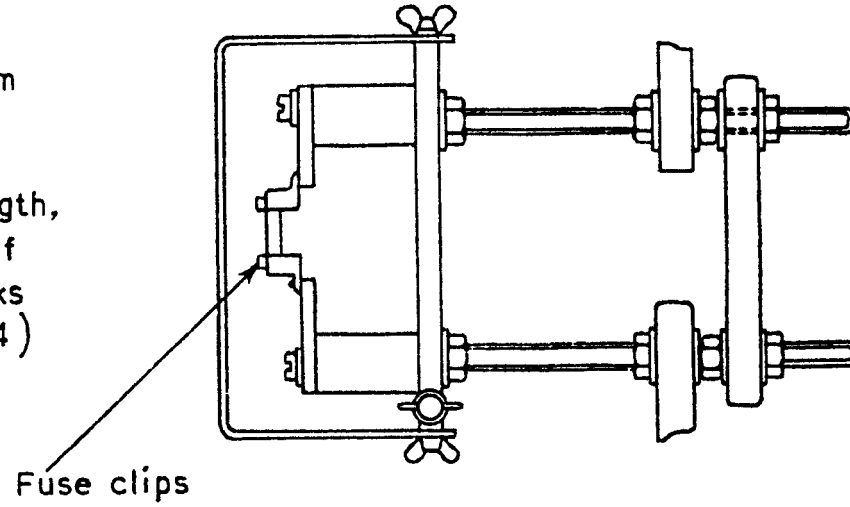


Figure 3 — Standard test rigs for power loss tests



Adaptor plates of minimum section 25.4 x 6.3
Adaptor plates should be modified in respect of length, fixing centres and size of fuse clips to suit fuse links (see Table 4)



Dimensions are in millimetres

NOTE Other details of test rig to be as Figure 7 of BS 88-1:1967.

Figure 4 — Arrangement of test rig for breaking capacity test

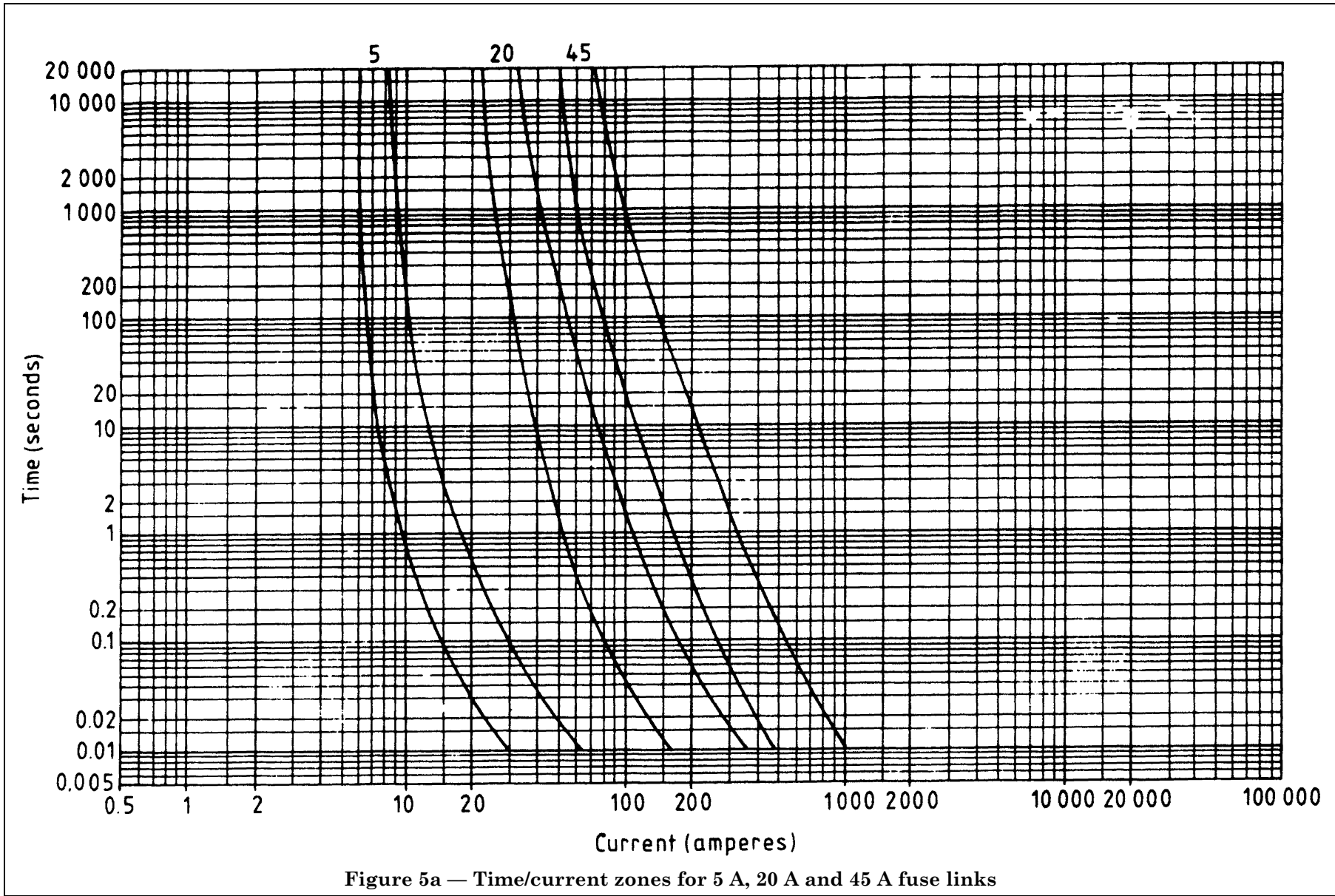


Figure 5a — Time/current zones for 5 A, 20 A and 45 A fuse links

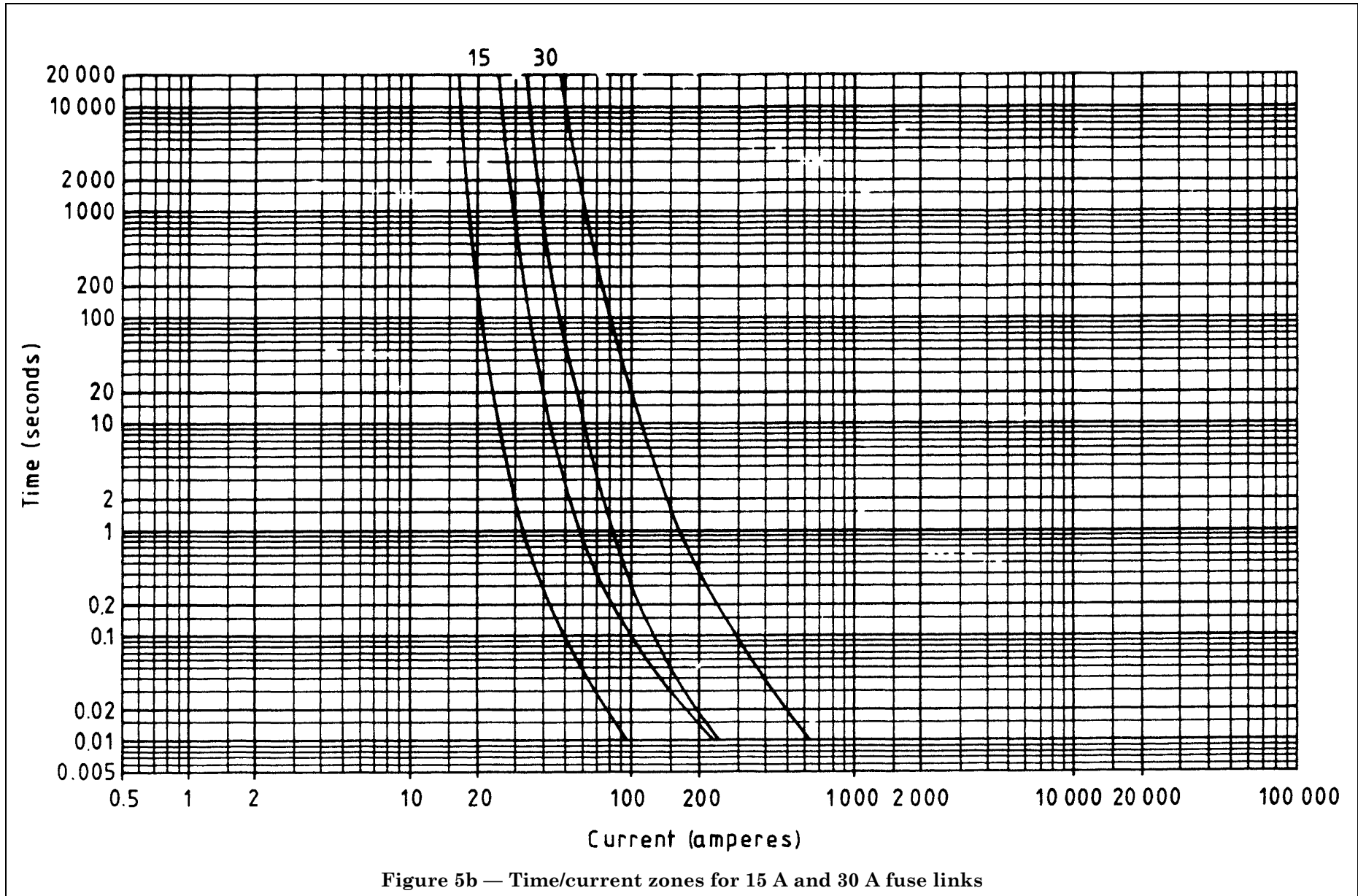


Figure 5b — Time/current zones for 15 A and 30 A fuse links

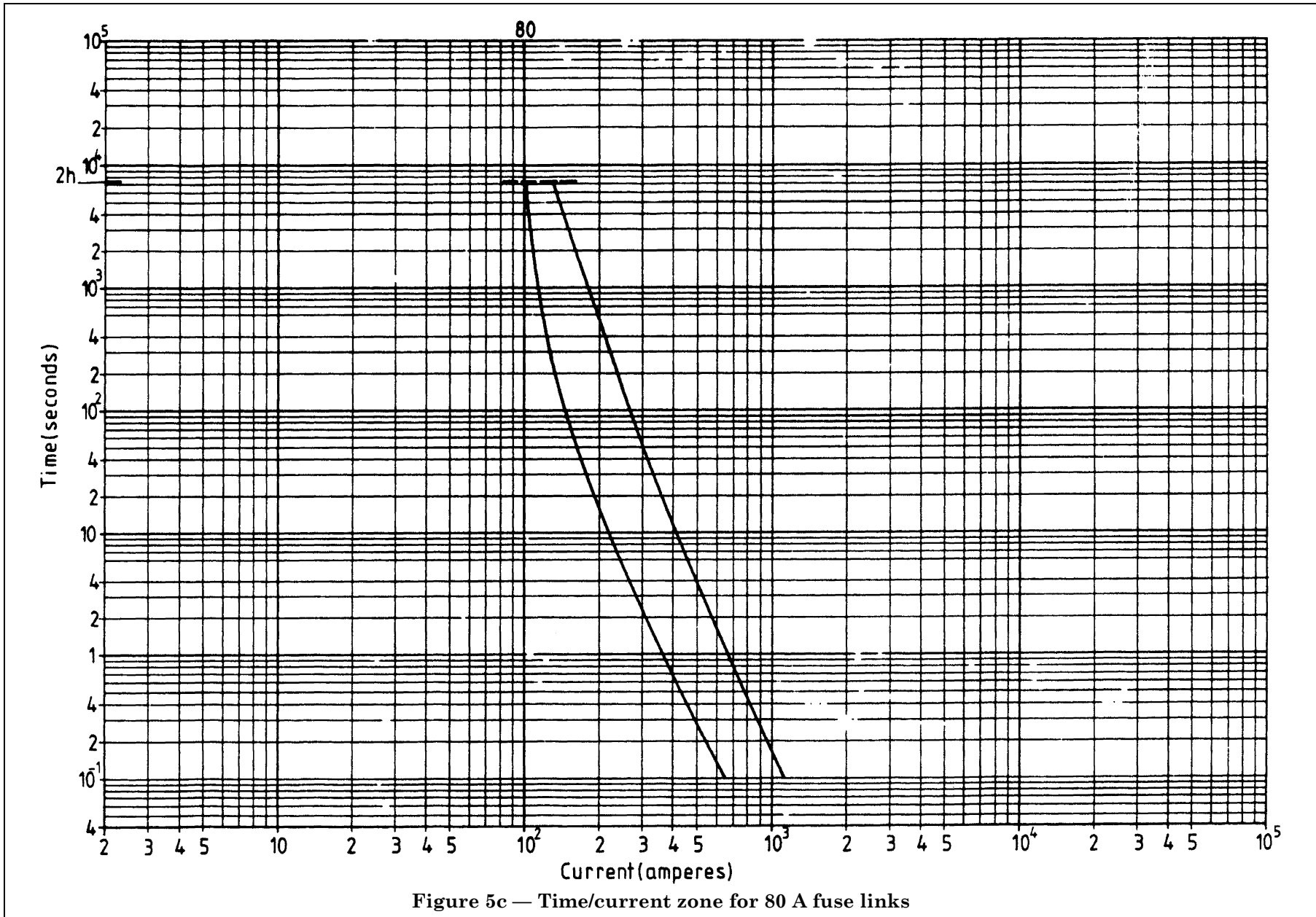


Figure 5c — Time/current zone for 80 A fuse links

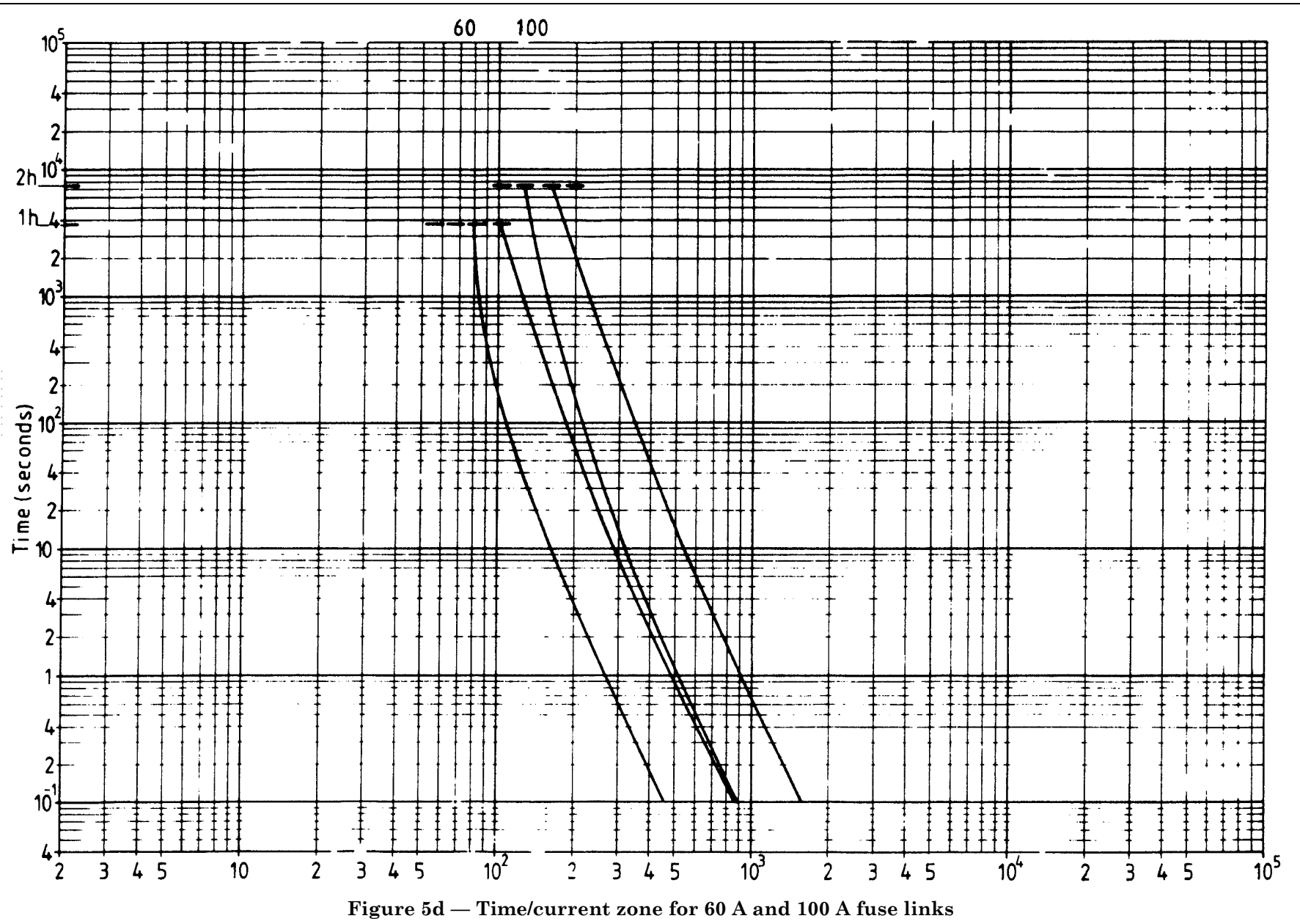


Figure 5d — Time/current zone for 60 A and 100 A fuse links

Appendix A Notes on terms

A.1 Time/current characteristic, rated minimum fusing current, current rating and fusing factor. The time/current characteristics of fuse links are illustrated typically in Figure 9. In the determination of time/current characteristics, the fuse links start from approximately the ambient temperature (i.e. a temperature generally less than 25 °C) and have not been carrying current prior to the test.

When a fuse link that has been carrying a current less than its minimum fusing current for some time blows at some greater current, the pre-arcing time is, in general, less than that shown by the time/current characteristics.

At currents smaller than the rated minimum fusing current a fuse link does not give protection, because it does not blow (or blows only after an indeterminately long time). It may, however, deteriorate if it carries currents greater than its current rating continuously.

The term “current rating” applied to a fuse link is synonymous with the terms “normal current”, “current-carrying capacity”, and so on, used for other electrical apparatus. Current rating (which, as the definition in 1.3 indicates, is less than rated minimum fusing current) is assigned by the manufacturer from the results of tests made in accordance with the requirements of 2.5.3.

Compliance with this British Standard is not necessarily complete proof that fuse links will carry their current ratings for long periods without deterioration.

Fusing factor forms a ready means of stating the range of currents, between current rating and rated minimum fusing current, at which a fuse link does not give protection, and within which it may not be used without the possibility of deterioration or of a temperature rise greater than is permitted by 3.2.1.

A.2 Oscillograms, prospective current and cut-off. In tests for duty, currents and voltages are usually measured on an oscillograph. A typical oscillogram such as that in Figure 6, shows that the circuit was opened by the fuse link before the current could reach the first major peak.

Because of this kind of operation it has become necessary to introduce the terms “cut-off” and “prospective current”, as defined in 1.3. Although it is true that the impedance of a fuse link may reduce the greatest possible current in a circuit to a value somewhat less than that of the greatest prospective current of the circuit, the limitation of current from this cause is not what is understood by cut-off; cut-off is produced by the inherent mode of action of the fuse link which causes the fuse element to melt before the prospective current can be fully developed.

Prospective current may have any value from zero upwards according to circuit conditions. It is sometimes confused with short circuit current, but short circuit current as commonly understood is one particular value of the prospective current of a circuit, namely the greatest.

Some fuse links would cut off only at currents greater than their breaking capacity rating, and no fuse link cuts off at all prospective currents. This means that the current oscillogram of all fuse links is, at some prospective current, of the general type shown in Figure 7.

In an a.c. circuit, the prospective current is defined as the r.m.s. value of the alternating component of the current that flows in a prospective current test, because the alternating component alone affords the possibility of a common term of reference. The actual form of the current as a whole depends on the power factor of the circuit and the point on the voltage wave at which the circuit is made; i.e. there are varying degrees of asymmetry, implying that the first major loop of current may have a peak value anywhere between I and nearly $2 \times I$, where I is the peak current corresponding to the (r.m.s.) prospective current. To avoid possible complication of statement, therefore, the definition in 1.3 has been adopted, though it often enough allows the numerical value of the cut-off current to be greater than the numerical value of the corresponding prospective current [see Note 1 to 1.3 15)].

A.3 Pre-arcing time, arcing time and total operating time. The pre-arcing time, the arcing time and the total operating time alter with prospective current, in general as indicated by Figure 6 and Figure 7. The arcing time usually becomes a greater proportion of the total operating time as the prospective current increases. This fact is important in connection with discrimination.

A.4 Breaking capacity rating. In switchgear practice it is common to refer to breaking capacity in terms of MV A and it has also been found necessary to introduce such terms as “making capacity”, “breaking current” and “making current”. For the purposes of this British Standard, however, only the term “breaking capacity” is necessary. It is defined in terms of prospective current, voltage and power factor, and these three quantities (or alternatively the category of duty and the voltage rating) are essential in a statement of the breaking capacity rating of a fuse. MV A may be used, instead of amperes, in a statement of breaking capacity rating; but here, too, such a statement is incomplete unless it includes also a statement of the voltage and power factor with which the MV A ratings are associated. The terms H.R.C. (high-rupturing capacity) and H.B.C. (high-breaking capacity) fuse links have come into fairly general use to denote fuse links in the categories of duty covered by this standard. These are convenient terms but should not be taken to have exact definition which applies when the breaking capacity is known and stated.

A.5 Arc voltage and recovery voltage. The voltage drop across a fuse link during most of its pre-arcing time is relatively small, and in oscillograms taken during normal type tests it appears to be approximately a continuation of the zero-voltage trace. It is shown as the voltage appearing across the fuse link between times *a* and *b* in Figure 6 and Figure 7.

When arcing starts, there is an immediate increase of voltage across the fuse link and the amount of the increase depends on the type of fuse link and on the prospective current. With large prospective currents, the arc voltage may quickly reach a relatively high value, as shown in Figure 6, and it then decreases to the initial recovery voltage, as shown between *b* and *c* in this figure. With smaller prospective currents the initial arc voltage is smaller and, if it is less than the recovery voltage, it increases to the higher value represented by the initial recovery voltage as shown between *b* and *c* in Figure 7.

The recovery voltage is the voltage that exists across a fuse link at any time after the opening of the circuit by the fuse link and a statement of its value must be accompanied by a statement of when it was measured (see Appendix G). Because of characteristics that may be inherent in the source of power the recovery voltage may not become equal to the normal open-circuit voltage of the source of power until some time after the circuit has been opened by the fuse link.

A.6 Operation and duty. The term “melting” (or “fusing”) is sometimes used in the sense of “operation” as defined, but “melting” (or “fusing”) can only be properly used to describe what goes on in a fuse link during part of the pre-arcing time. Operation includes all that happens in a fuse link, during both pre-arcing time and arcing time. The term “failed” is also used occasionally in connection with “operation” (or “blowing”); the only correct implication then is that the fuse link has, for example, shown one or more of the phenomena described in 2.5.6, but in fact the intention often is, wrongly, to imply just the opposite, and the word should therefore be used with care.

Some fuse links which operate satisfactorily at the prospective current of its breaking capacity rating may not do so at all smaller prospective currents; and therefore, since it is the duty of a fuse link to operate satisfactorily at all prospective currents greater than its minimum fusing current up to its breaking capacity rating, the tests specified in 2.5.5 have been chosen to ensure as far as is practicable that standard fuse links are capable of doing this.

A.7 Specific energy. The general conception of “specific energy” together with its particular values “let-through I^2t ”, “pre-arcing I^2t ” and “arcing I^2t ”, is useful in view of the fast operation of cartridge fuse links at high prospective currents. In these circumstances heat loss from fuse elements is not significant during the pre-arcing time. The energy produced in a given fuse link over this time when operating from the same starting conditions tends to be independent of circuit characteristics including, for a.c., the point-on-wave of voltage at which fault current flow commences. This argument applies similarly to specific energy and the corresponding value of “pre-arcing I^2t ” tends to be a constant for short times.

Arcing I^2t and therefore let-through I^2t are not constants in the same manner; however, typical values can be obtained during tests for duty.

Information on specific energy allows assessment of the energy expended during a fault in parts of the protected circuit of known resistance and helps in the consideration of discrimination.

Appendix B Standard graph sheet for the presentation of time/current characteristics

In order to achieve international standardization of the presentation of time/current characteristics for protective devices, the International Electrotechnical Commission has recommended that these should be plotted on log/log graph paper, using standard dimensions for the decades on each axis.

When plotting time/current characteristics of fuse links it is therefore recommended that the graph paper used should comply with the following requirements:

- 1) logarithmic scales should be used on both axes with time as the vertical axis (ordinate) and current as the horizontal axis (abscissa);
- 2) the ratio of the dimensions of one decade on the two axes shall be 1 : 2 with the longer dimension on the abscissa;
- 3) the preferred dimensions for one decade are 28 mm on the time axis and 56 mm on the current axis;
- 4) it is recommended that the international size A4 (210 mm × 297 mm) should be used for the graph paper (see BS 4000²⁾).

Examples of this form of presentation are given in Figure 5a, Figure 5b, and Figure 5c.

Appendix C Test rig for tests for breaking capacity

C.1 Use of test rig. The test rig shown in Figure 4 is intended for the accommodation of fuse links conforming to the dimensions laid down in Table 4. The method of use is described in 2.5.4 and 2.5.5.

C.2 Design of test rig. The main factors taken into account and which are inherent in the design of the test rig are as follows.

- 1) The fuse links are screened by metal, having specified clearances from live parts, to simulate the use of fuse links in unlined metal cases.

- 2) The test rig provides a rigid structure onto which the fuse links are mounted, ensuring a uniformity of connections for fuse links. The mechanical design of the insulating base and connections is rigid enough to prevent undue stress being transmitted to the fuse link due to the flexing of conductors under short-circuit conditions. Conversely, the contact blocks and adaptors are so designed that the fuse link derives no mechanical support, other than that provided through the medium of the circumferential support of the end caps only.
- 3) The connecting stems projecting from the contacts through the back of the insulating base are of a length sufficient to produce electromagnetic forces, which may be considered to be representative of onerous service conditions.

Subject to the overriding requirements of proving technical performance, the design of the test rig has been chosen to be simple and economical so as to ensure standardization of test conditions between tests carried out in different locations. Attention is drawn to the importance of maintaining the correct air clearance in respect of each fuse link.

Appendix D Standard test rig for power loss tests

The standard test rigs for power loss tests shall be as shown in Figure 3.

These test rigs are designed to provide a common basis of comparison for temperature rise between different designs or makes of fuse link.

Appendix E Measurement of prospective current and cut-off current

Prospective current is measured in a test (made as a preliminary to a test for duty) for which a link of negligible impedance is used in place of the fuse link.

In an a.c. circuit, current is usually measured as the r.m.s. value of the symmetrical constant-amplitude waveform it reaches shortly after the circuit is made. The time between the making of the circuit and the reaching of the measured value usually depends only on the time-constant of the d.c. component of the transient asymmetrical current.

The degree of asymmetry in any a.c. circuit is dependent on the power factor of the circuit and on the point on the voltage wave at which the circuit is made.

²⁾ BS 4000, "Sizes of paper and board".

The current obtained in an a.c. prospective current test may or may not reach a constant-amplitude waveform. If it does so in a time comparable with the time constant of the d.c. component of the transient asymmetrical current, the r.m.s. value of the constant-amplitude waveform, measured by an ammeter or otherwise, is the prospective current of the test circuit. Prospective current can sometimes be measured in this way as a preliminary to Test 2 of 2.5.5.

If the required current is large it is usually not possible to obtain a constant-amplitude waveform in the prospective current test, because of characteristics inherent in the source of power for the test or because of limitations imposed on the operation of large-current a.c. testing equipment. Under these circumstances the prospective current is measured as the r.m.s. value of the alternating component of the current over a stated period of time; the arbitrary period usually taken is the first 0.02 s after the making of the circuit. In practice it is usually sufficiently accurate to make this measurement in the way indicated in the next paragraph.

An oscillogram of the current is taken, and on this oscillogram (see Figure 8) AA₁ and BB₁ are drawn as the envelope of the current wave.

The point O corresponding to the current when the circuit is made, is marked, and the current zero line is produced from O to F, where F corresponds to a time 0.01 s after O (i.e. midway between 0 s and 0.02 s after the circuit is made).

GH is drawn through F perpendicular to the current zero line to intersect AA₁ and BB₁ at G and H respectively.

The prospective current during the first 0.02 s after the making of the circuit is deemed to be given by $GH/2\sqrt{2}$.

If cut-off occurs in a test for duty, a constant-amplitude waveform is not reached in the circuit (see Figure 6). Hence it is difficult to refer to cut-off current in terms of an r.m.s. value and it is therefore measured as the instantaneous value of the maximum current reached when a fuse link cuts off.

Because cut-off current is measured as an instantaneous value and prospective current as an r.m.s. value, the numerical value of the cut-off current may be greater than the numerical value of the corresponding prospective current [see Note 1 to 1.3 15)].

Appendix F Computation of power factor from oscillograms

F.1 Power factor. The power factor of an a.c. circuit is computed from oscillograms in accordance with the following methods.

F.1.1 If the asymmetry of the prospective current is sufficient, the angle \tilde{A} may be determined from the curve of the d.c. component of the prospective current wave as follows.

Determine the time constant T of the d.c. component, which has the general form of

$$i_d = I_{do}e^{-t/T}$$

where i_d is the value of the d.c. component at any instant, I_{do} is the initial value of the d.c. component, T is the time constant in seconds of the test circuit, t is the time interval in seconds between i_d and I_{do} , and e is the base of Napierian logarithms.

This can readily be done as follows.

Measure the value of I_{do} (i.e. the initial value) and the value of i_d at any other time t .

Determine the value $e^{-t/T}$ by dividing i_d by I_{do} .

From a table of e^{-x} determine the value of $-x$ corresponding to the ratio i_d/I_{do} . (The value of e^{-x} can be obtained readily from a table of Napierian logarithms by taking the reciprocal of the number of which x is the logarithm.)

The value x represents t/T , and so T can be determined by dividing t by x . Determine the angle ϕ from

$$\phi = \arctan \omega T$$

where ω is the actual frequency multiplied by 2π . The power factor is then $\cos \phi$.

F.1.2 For the higher values of power factor in the specification, the asymmetry is likely to be insufficient for an accurate determination of T and this alternative method should then be used; it requires a voltage trace in addition to a prospective current trace, as shown in Figure 11. The part of the current wave at which the asymmetry, if any, has disappeared is determined by comparison of the duration of the current loops. Thus asymmetry has disappeared at A, since $AB = BC$.

A distance AD is then stepped back along the current zero, making AD equal to AB; it may be necessary to do this more than once. A projection E on the current-zero is then made from the point F, which represents the last voltage zero before the initiation of the current.

Then ED, to the appropriate scale, is the angle \tilde{A} , and the power factor is $\cos \tilde{A}$.

Appendix G Measurement of recovery voltage and arc voltage

Recovery voltage is measured as an r.m.s. value in an a.c. circuit, but arc voltage is measured as an instantaneous value.

The measurement of the maximum instantaneous value of arc voltage should be made with recording equipment capable of responding to short time duration transients. This requirement is met by the use of a cathode ray oscillograph or other equipment having the required frequency response and voltage accuracy.

In tests for duty when the operating time is short and recovery voltage is not of constant value it is usual to state the recovery voltage during a period of 0.02 s (generally the first 0.02 s after the opening of the circuit by the fuse link). In practice it is usually sufficiently accurate to measure the a.c. recovery voltage during the first 0.02 s after the opening of the circuit in a way similar to that by which prospective current is measured, i.e. referring to Figure 10, AA₁ and BB₁ are drawn as the envelope of the recovery voltage wave; the point O corresponds to the end of the arcing time and the voltage zero line is produced through O to F, where F corresponds to a time 0.01 s after O (i.e. midway between O and 0.02 s after the circuit is opened by the fuse link): a perpendicular GH drawn through F intersects AA₁ and BB₁ at G and H respectively; the recovery voltage during the first 0.02 s after the opening of the circuit is deemed to be given (to the correct scale) by $GH/2\sqrt{2}$.

Appendix J Application of fuse links

The performance of fuse links may be affected by the proximity of other current carrying parts, and the performance and characteristics of fuses published by manufacturers relate to the conditions laid down in this specification. The manufacturers of equipment using these fuse links generally provide guidance on the ratings of the equipment when fitted with fuse links. If fuse links are used in conditions differing widely from those laid down in this specification then the manufacturer's advice should be sought. This applies particularly to changes in the size or material of the conductors used for connections.

Appendix L Information to be included in a report of type tests for breaking capacity on cartridge fuse links

L.1 General. The following general information should be included:

- 1) testing authority,
- 2) date of tests,
- 3) reference or report number,
- 4) tests made in accordance with BS 1361:1971.

L.2 Apparatus tested. The following information should be given regarding the apparatus which was tested:

- 1) manufacturer,
- 2) description (ferrule-type cartridge fuse link, etc.),
- 3) manufacturer's list number or reference,
- 4) type (see 2.1.4),
- 5) photograph number(s),
- 6) drawing number(s),
- 7) number of drawing of test rig, including adaptors.

L.3 Ratings. The electrical rating of the fuse links should be stated in the following terms:

- 1) current rating,
- 2) voltage rating,
- 3) breaking capacity rating (see 2.1.3).

L.4 Record of proving tests. The record of the proving tests should include the following items:

- 1) test number,
- 2) oscillogram number,
- 3) applied voltage,
- 4) prospective current,
- 5) power factor,
- 6) point on voltage wave at which arcing commences,
- 7) cut-off current,
- 8) recovery voltage,
- 9) Pre-arcing time,
- 10) arcing time,
- 11) total operating time,
- 12) statement that the following requirements of the specification have been met:
 - time for which recovery voltage has been maintained,
 - frequency of supply,
 - maximum arc voltage.

L.5 Physical condition and behaviour during and after test. The behaviour during and after the tests shall be stated as follows:

- 1) behaviour during test,
- 2) condition after test,
- 3) condition of fine-wire fuse,
- 4) resistance at conclusion of test.

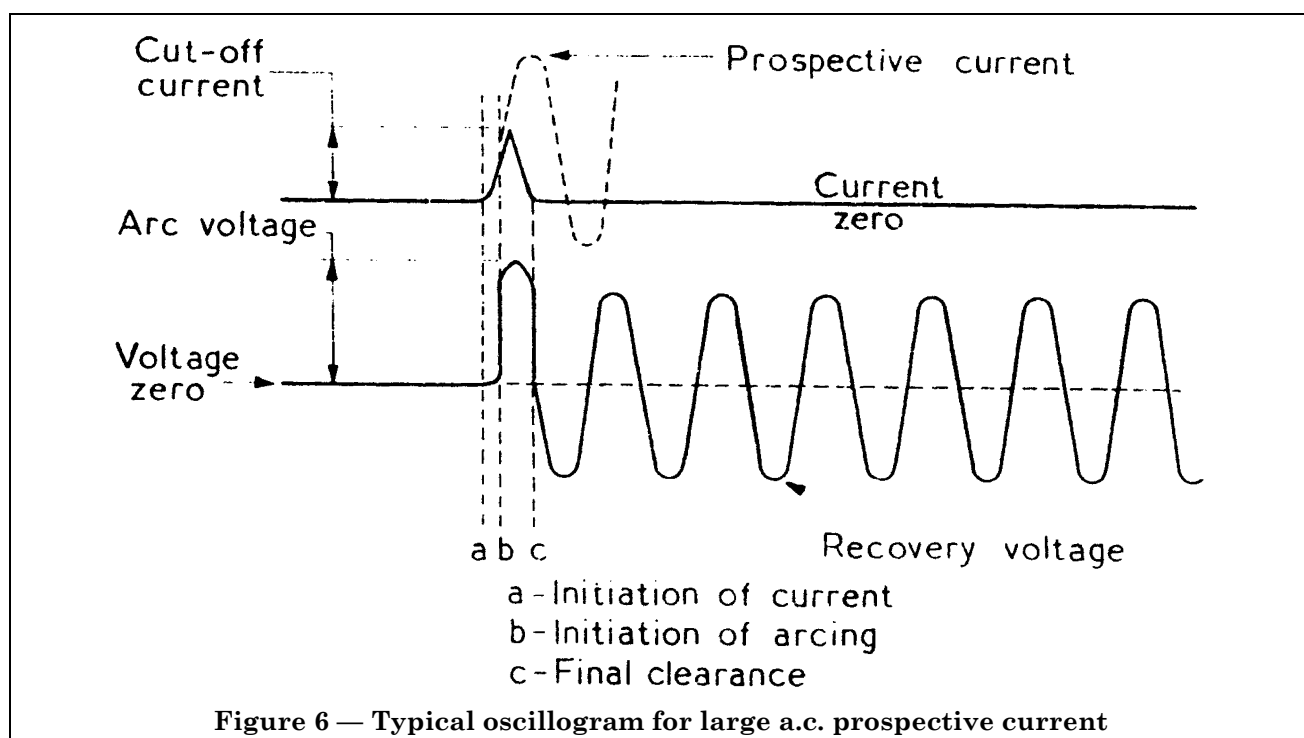
L.6 Oscillograms

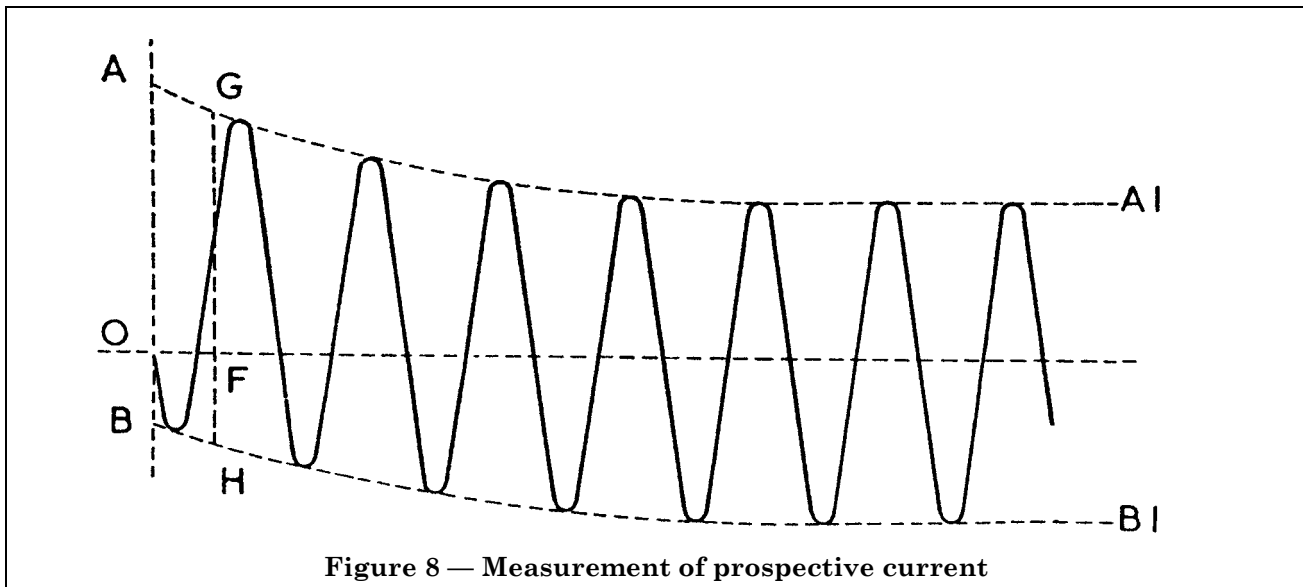
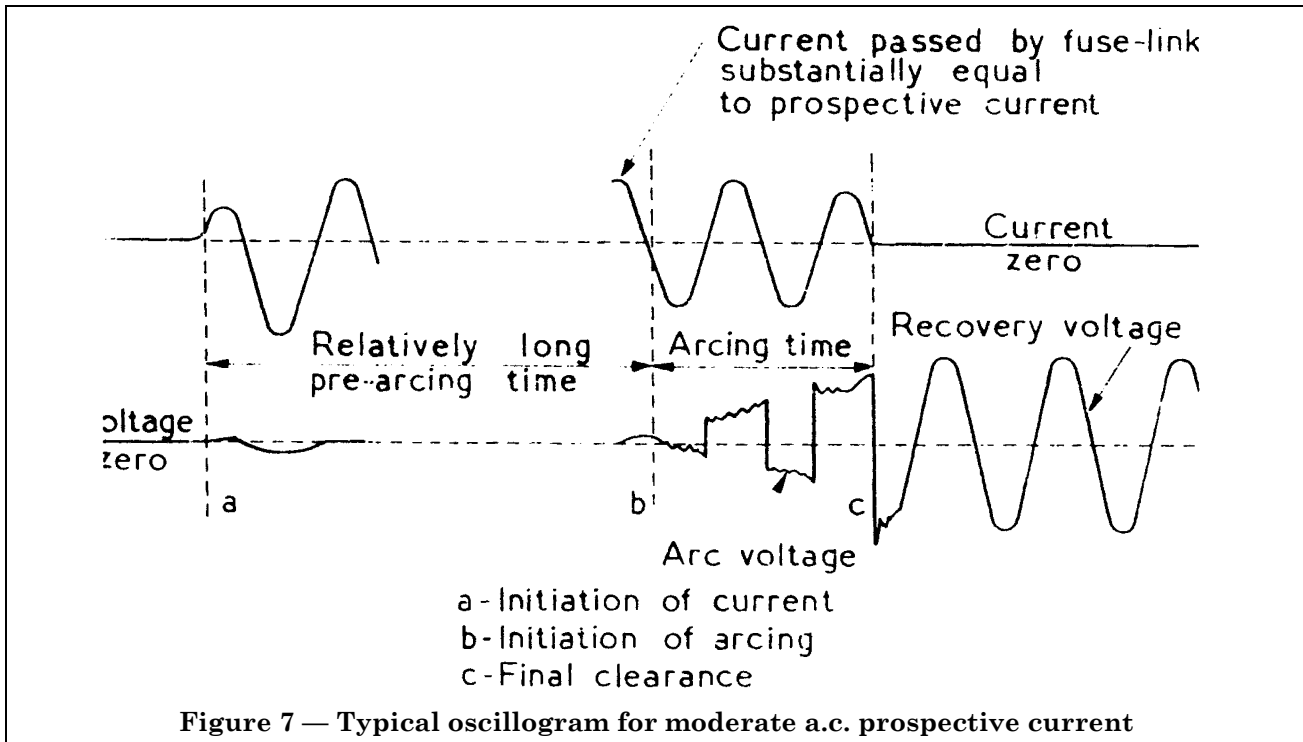
L.7 Drawings

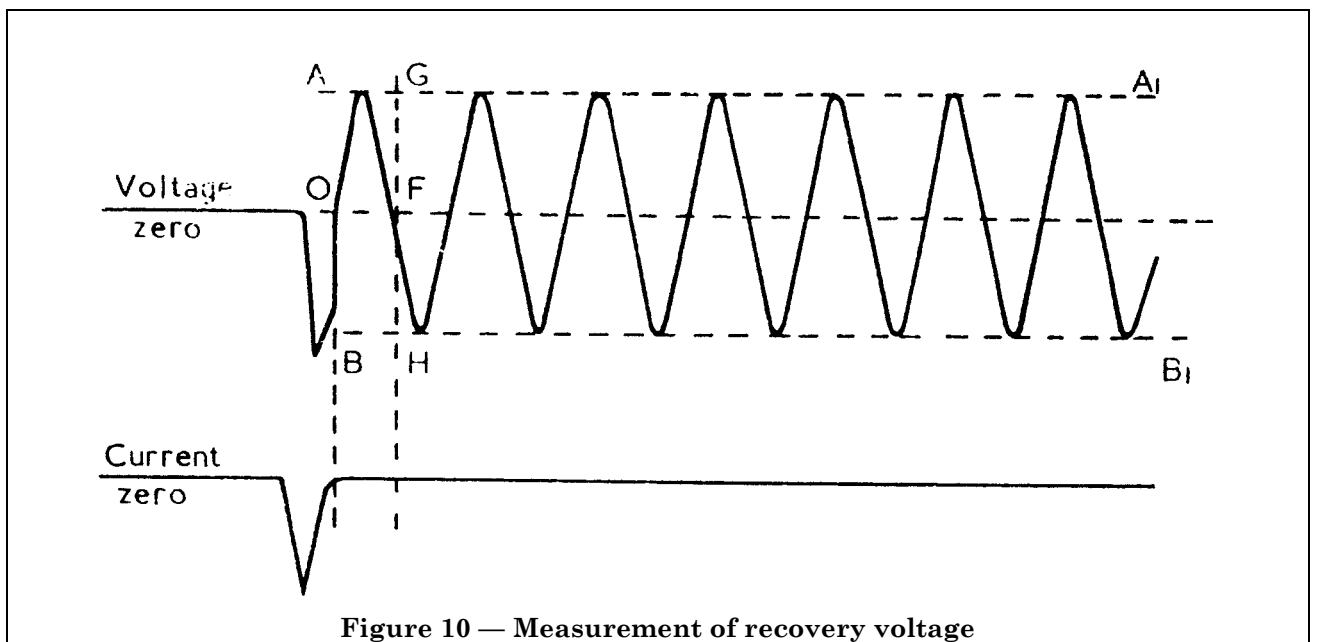
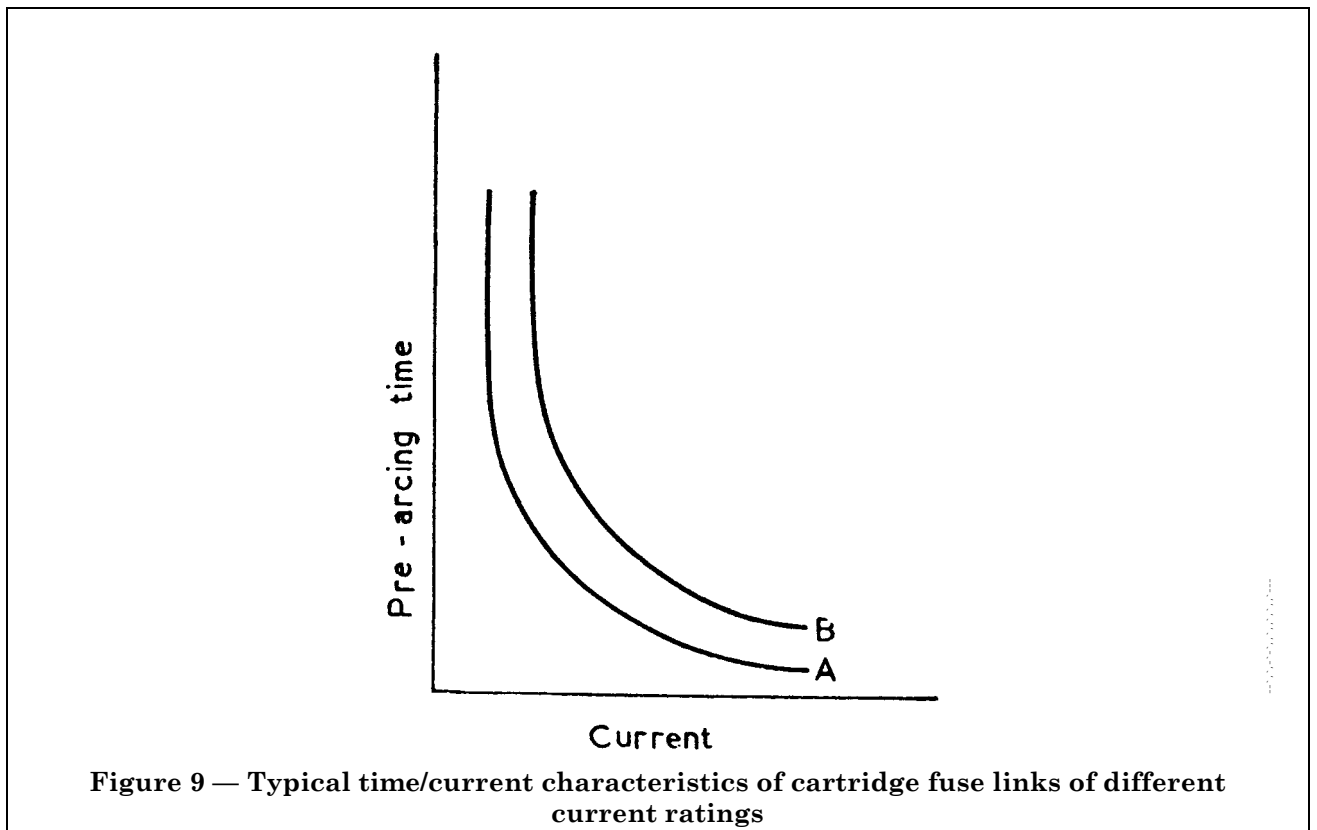
L.8 Photographs

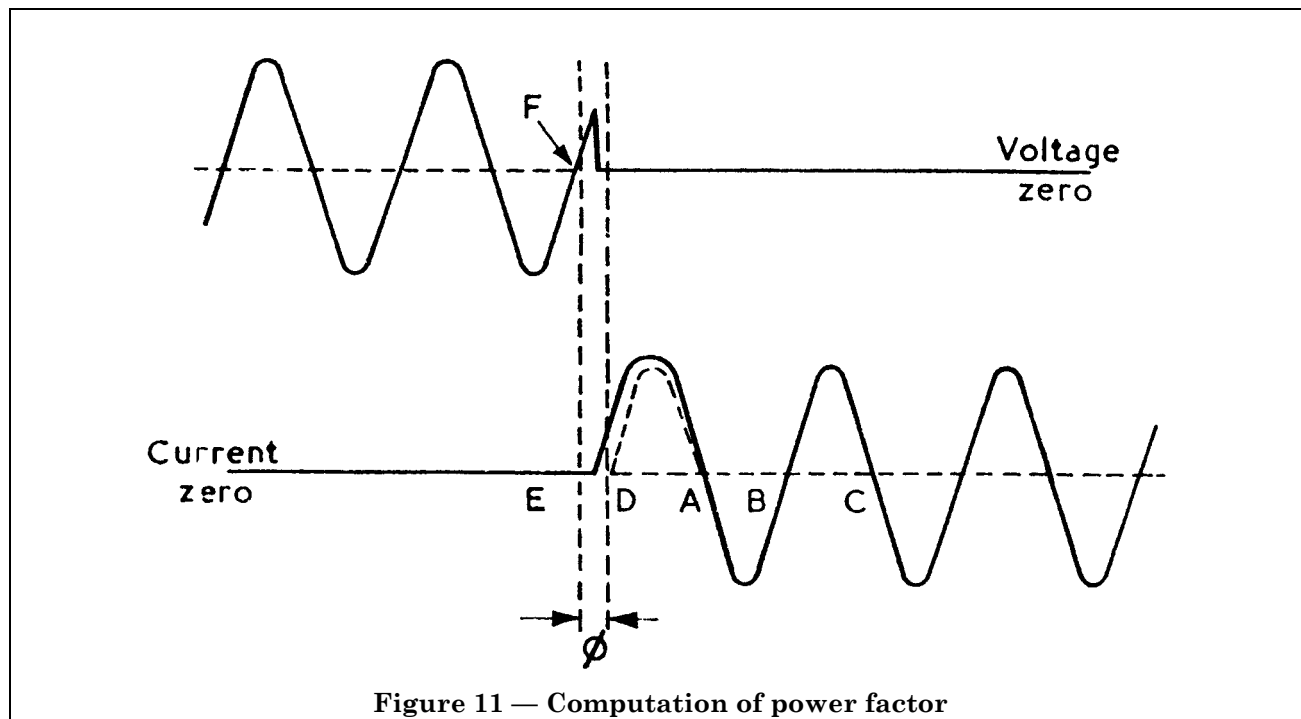
Appendix M Power loss

During the period of the tests for power loss, in accordance with the requirements of 2.5.2, the millivolt drop across the end faces of the fuse link end caps shall be periodically measured until three sensibly constant readings, measured at 15 min intervals, are obtained. The power loss of the fuse link shall then be calculated by multiplying this final millivolt value by the rated current of the fuse link.









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