BRITISH STANDARD

BS 88-5:1988

Incorporating Amendment No. 1

Cartridge fuses for voltages up to and including 1 000 V a.c. and 1 500 V d.c. —

Part 5: Specification of supplementary requirements for fuse-links for use in a.c. electricity supply networks

UDC 621.316.923.2.027.2/.5

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Committee (PEL/-) to Technical Committee PEL/78, upon which the following bodies were represented:

Association of Supervisory and Executive Engineers
Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
Electrical Power Engineers' Association
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users' Association
ERA Technology Ltd.
London Regional Transport

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Association of Consulting Engineers
ASTA Certification Services
Electrical Contractors' Association
Institution of Electrical Engineers
Ministry of Defence

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on
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The following BSI references relate to the work on this standard:
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Amendments issued since publication

Amd. No.	Date of issue	Comments
6695	April 1991	Indicated by a sideline in the margin

Contents

Foreword

This Part of BS 88 has been prepared under the direction of the Power Electrical Engineering Standards Committee on the basis of proposals by the Electrical Installation Equipment Manufacturers' Association Ltd. It should be read in conjunction with BS 88-1, and its clauses and tables have been numbered to correspond with the relevant clauses and tables of Part 1. It supersedes BS 88-5:1980 which is withdrawn. The purpose of this revision is to incorporate the changes made by the 1988 edition of BS 88-1, and to this end some rewording has been necessary; however, except for these changes the requirements of this Part of BS 88 are similar to those of the previous edition.

Fuse-links in accordance with this standard are intended to form part of a system of providing fuse protection for 415 V distribution networks that have been transformed from 11 kV and 6.6 kV and will give satisfactory co-ordination between high voltage and medium voltage fuse-links and an adequate degree of protection.

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 and ii, pages 1 to 10, 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 Part of BS 88 is applicable to general purpose fuse-links of standardized dimensions and performance, intended for use in a.c. electricity supply networks, where they are accessible to, and may be replaced by, suitably authorized persons only. Requirements for fuse-links for use in d.c. networks and fuses incorporating integral indicating devices are not covered by this Part.

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

NOTE 2 In most cases, a part of the associated equipment serves the purpose of a fuse base. Owing to the great variety of equipment, no general rules can be given; the suitability of the associated equipment to serve as a fuse base should be subject to agreement between the manufacturer and the user. However, if separate fuse bases or fuse holders are used, they should comply with the appropriate requirements of BS 88-1.

NOTE 3 The titles of publications referred to in this standard are listed on the inside back cover.

1.2 Object

The object of this standard is to specify standard values for:

the time/current zones and conventional currents;

the rated voltage;

the rated breaking capacity;

the maximum power dissipations;

the dimensions.

1.3 Compliance

Fuse-links for use in electricity supply networks shall comply with all the requirements of BS 88-1, unless otherwise specified in this standard.

2 Definitions

For the purposes of this Part of BS 88 the definitions given in BS 88-1 apply with the exception of the following.

2.3 Characteristic quantities

2.3.13
$I^2 t$ characteristic

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

it is also a representation of $I^2 t$ values plotted as a function of rated current under stated conditions

3 Conditions for operation in service

3.9 Discrimination of "gG" and "gM" fuses

Subclause **3.9** of Part 1 does not apply. In the case of these fuse-links, correct discrimination is ensured by adherence to the standard zones for time/current characteristics as specified in **5.6.1.3** and given in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d).

5 Characteristics of fuses

5.2 Rated voltage

The standard rated voltage is 415 V a.c.

NOTE Whilst the designed open-circuit voltage of the associated distribution transformers is 433 V a.c.. the desired "on-load" voltage is 415 V a.c. and fuse-links to this Part are rated at this latter voltage. The fuse-links are tested at a minimum voltage of 457 V a.c., i.e. 415 V a.c. + 10 %.

5.3 Rated current

The current ratings for the fuse-links shall be as given in Table 1

Table 1 — Rated current values of fuse-links

Fuse-links[a] with fixing centres at 82 mm	Fuse-links[a] with fixing centres at 92 mm
A	A
100	100
160	160
200	200
250	250
315	315
355	355
400	400
	500
	630

[a] For dimensions of fuse-links see Figure 2.

5.5 Rated power dissipation

5.5.1 *Power dissipation of fuse-links.* The maximum values of power dissipation for fuse-links, when tested in accordance with **8.3.1**, are specified in Table 2, when measured on the standard test rig shown in Figure 3.

Table 2 — Maximum power dissipation values of fuse-links

Preferred current rating (A)	100	160	200	250	315	355	400	500	630
Power dissipation (W)	10	14	18	22	29	29	33	38	46

5.6 Time and current dependent characteristics

5.6.1 *Time/current characteristics.* This subclause of Part 1 applies with the following addition.

Fuse-links shall be such that values derived from the specified tests do not deviate by more than 10 %, in terms of current, from the manufacturer's published curves.

5.6.1.3 *Time/current zones.* The standard zones for time/current characteristics based on an ambient air temperature of 20 °C and at a rated voltage of 415 V a.c. are as given in the graphs in Figure 1(a), Figure 1(b), Figure 1(c) and Figure 1(d).

5.6.3 *Gates*

Subclause **5.6.3** of Part 1 does not apply to these fuse-links, because these fuse-links need to be faster than the standardized "gG" types in order to secure good discrimination with h.v. fuse-links on the primary side of the transformer.

Correct discrimination is ensured by adherence to the standard zones for time/current characteristics as specified in **5.6.1.3** and given in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d).

5.7 Rated breaking capacity

The rated breaking capacity shall be a minimum of 46 kA a.c.

5.8 Cut-off current and $I^2 t$ characteristics

This clause of Part 1 applies. $I^2 t$ characteristics may alternatively be represented as a graph showing pre-arcing and total operating values as a function of rated current.

5.9 Dimensions

Standardized dimensions for fuse-links are given in Figure 2.

7 Standard conditions for construction

7.5 Breaking capacity

The maximum arc voltages specified in Table V of Part 1 apply, with the following additional note.

NOTE 2 For a.c., the arc voltage may reach up to $\sqrt{2}$ times the values given, provided that the period of such excess does not exceed 1 ms.

7.6 Cut-off characteristics

Cut-off characteristic values shall be made available to the user on request.

7.7 $I^2 t$ Characteristics

$I^2 t$ values shall be made available to the user on request.

7.8 Overcurrent discrimination

Subclause **7.8** of Part 1 does not apply to these fuse-links, because these fuse-links need to be faster than the standardized "gG" types, in order to secure good discrimination with h.v. fuse-links on the primary side of the transformer.

Correct discrimination is ensured by adherence to the standard zones for time/current characteristics as specified in **5.6.1.3** and given in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d).
and Figure 1(d).

8 Tests

8.1 General

8.1.1 *Kind of test.* The requirements of Part 1 of this standard apply, but where fuse-links of standardized dimension and performance have been tested in accordance with this Part, the results of such tests shall also be regarded as comprising fuse-links of identical construction but having different contact dimensions and fixing centres; provided that the changes are not likely to result in inferior performance.

8.3 Verification of temperature-rise limit, power dissipation and acceptance

8.3.1 *Arrangement of the fuse.* Fuse-links shall be mounted in an appropriate carrier and tested in the test rig shown in Figure 3.

The connections on either side of the test rig shall be copper bars not less than one metre in length selected in accordance with Table 3.

Table 3 — Cross-sectional area of conductors for power dissipation and temperature-rise tests

Rated current of fuse-link	Cross section[a] of conductors
A	mm
100	20 × 1.6
160	20 × 2.5
200	20 × 3.15
250	20 × 5
315	25 × 5
355	25 × 6
400	25 × 8
500	40 × 6
630	40 × 10

[a] Approximate imperial equivalents for the conductor sizes recommended are acceptable.

8.3.3 *Measurement of the power dissipation of a fuse-link.* This subclause of Part 1 applies, except that the points between which power dissipation measurement is to be taken are indicated in Figure 3.

8.4 Verification of operation

8.4.1 *Arrangement of the fuse.* Fuse-links shall be mounted in an appropriate carrier and tested for time/current characteristics in the test rig shown in Figure 3.

8.4.3.3.2 *Verification of gates.* Subclause **8.4.3.3.2** of Part 1 does not apply to these fuse-links, because these fuse-links need to be faster than the standardized "gG" types, in order to secure good discrimination with h.v. fuse-links on the primary side of the transformer.

Correct discrimination is ensured by adherence to the standard zones for time/current characteristics as specified in **5.6.1.3** and given in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d), verified as in **8.4.3.3.1** of Part 1.

8.4.3.4 *Overload test.* Not applicable.

8.4.3.5 *Conventional cable overload protection.* Not applicable.

8.5 Verification of breaking capacity

8.5.1 *Arrangement of the fuse.* Fuse-links shall be tested for breaking capacity in the test rig shown in Figure 4. The disposition of the test connections beyond the test rig is not specified.

8.5.2 *Characteristics of the test circuit.* This subclause of Part 1 applies except that test no. 3 and the d.c. tests are omitted.

8.5.5 ***Test method***

8.5.5.1 This subclause of Part 1 applies except that test no. 3 and all tests for d.c. shall be omitted and that tests nos. 4 and 5 shall be carried out at a power factor of 0.8 to 0.9. With the consent of the manufacturer a lower power factor may be employed in these tests. Where testing facilities do not permit direct testing (e.g. for $I_n \geqslant 200$ A) two-part testing may be used.

8.5.5.2 This subclause of Part 1 applies except that both tests for d.c. shall be omitted.

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

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

8.7.3 ***Verification of compliance at 0.01 s***

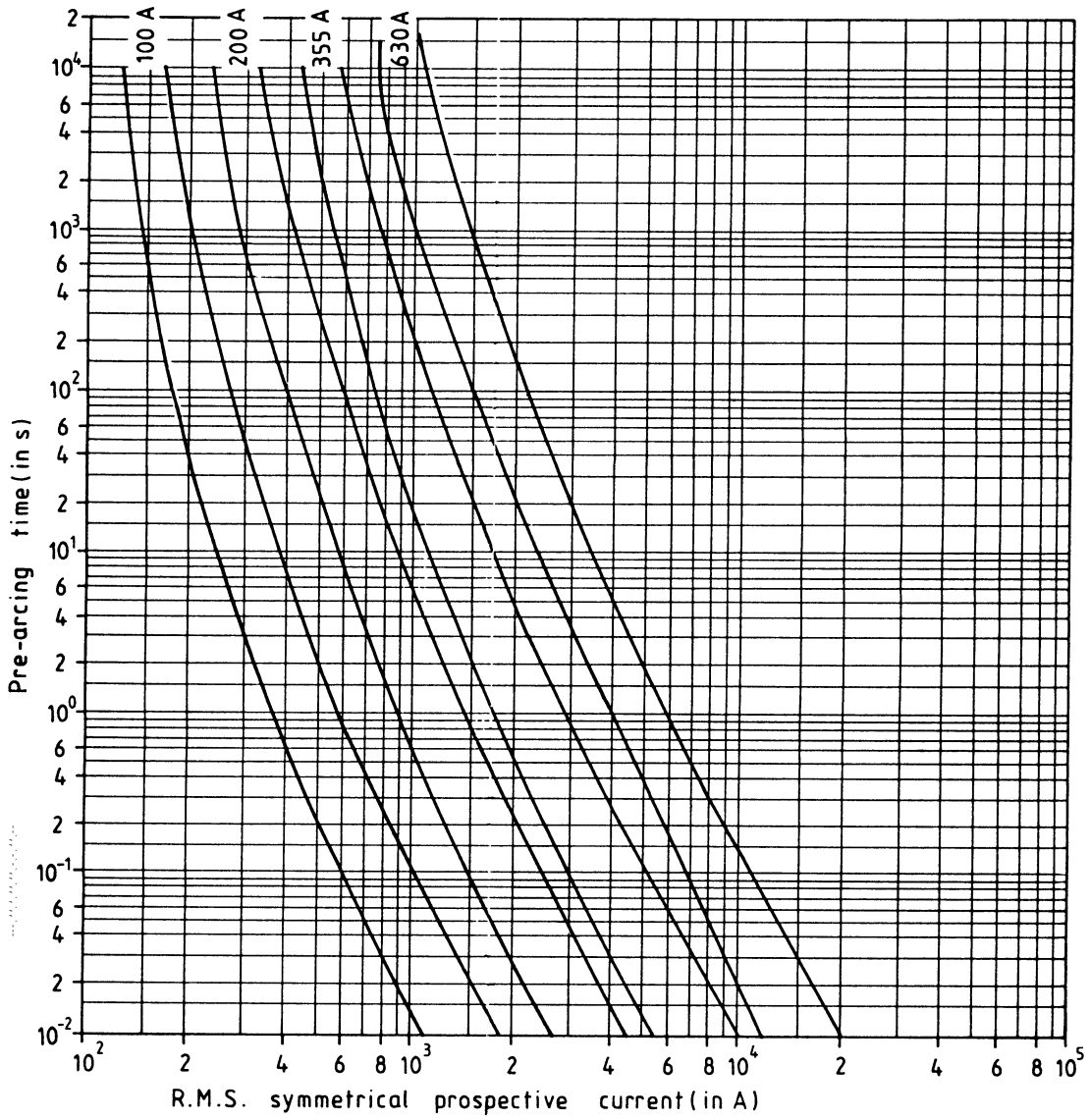
Compliance at 0.01 s is confirmed by adherence to the standard zones for time/current characteristics as specified in **5.6.1.3** and given in Figure 1(a), Figure 1(b), Figure 1(c), and Figure 1(d), and verified as in **8.4.3.3.1** of Part 1.

8.10 Verification of non-deterioration of contacts

Not applicable.

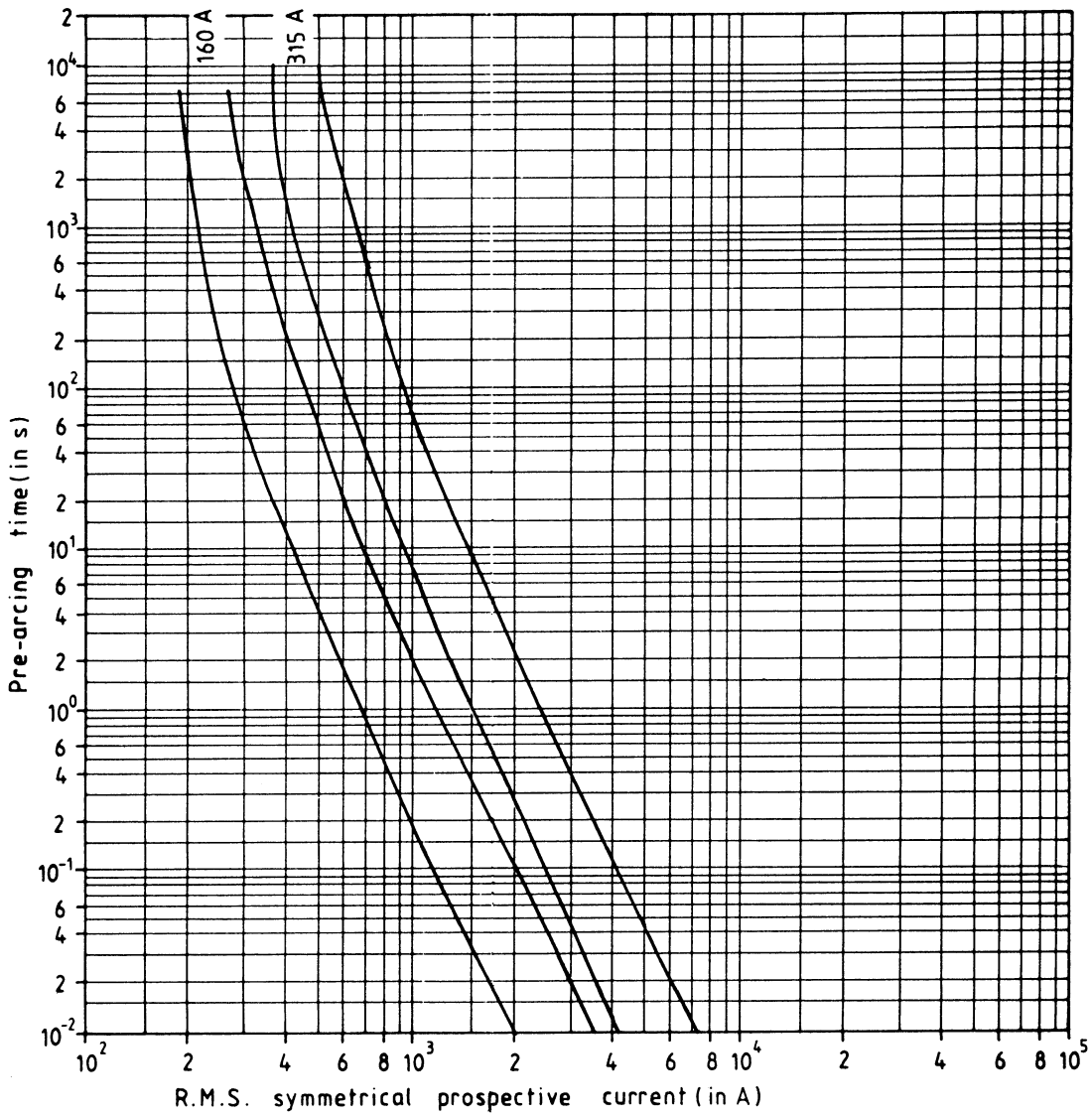
8.11 Mechanical and miscellaneous tests

Not applicable.



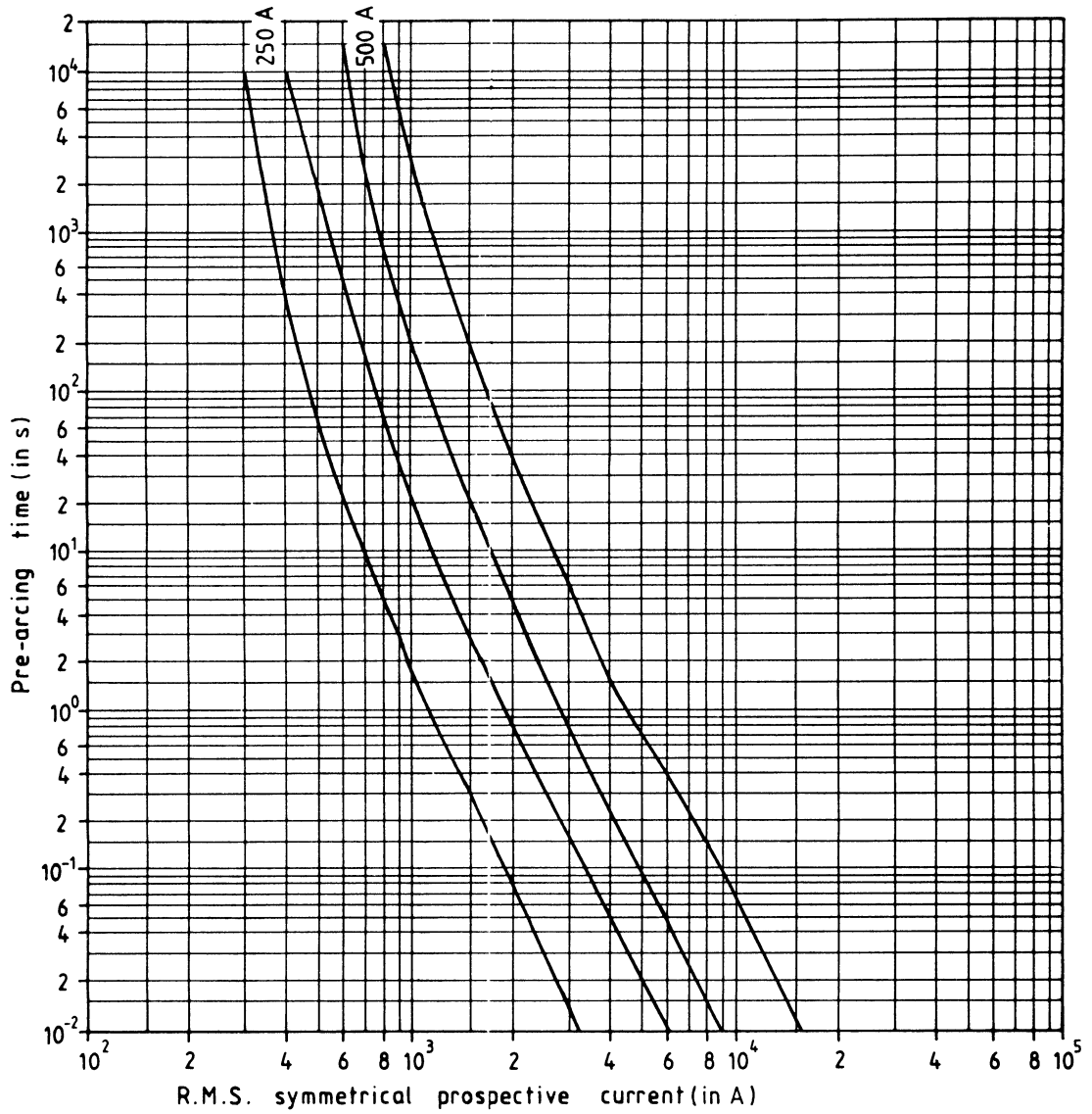
(a) For current ratings 100 A, 200 A, 355 A and 630 A

Figure 1 — Time/current zones



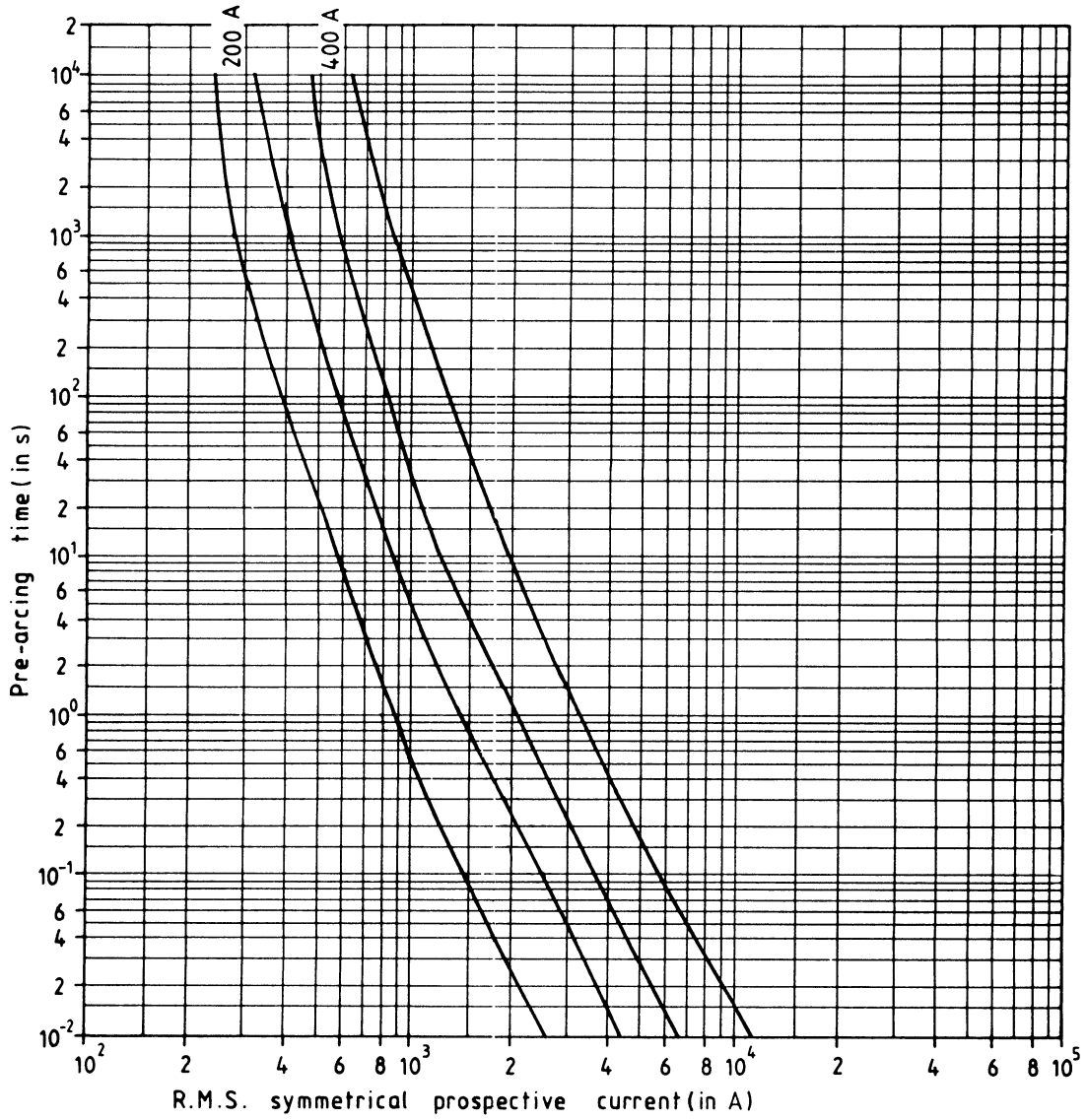
(b) For current ratings 160 A and 315 A

Figure 1 — Time/current zones *(continued)*



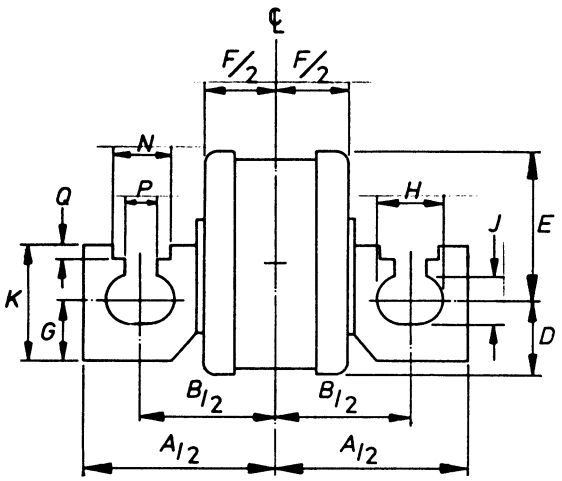
(c) For current ratings 250 A and 500 A

Figure 1 — Time/current zones *(continued)*

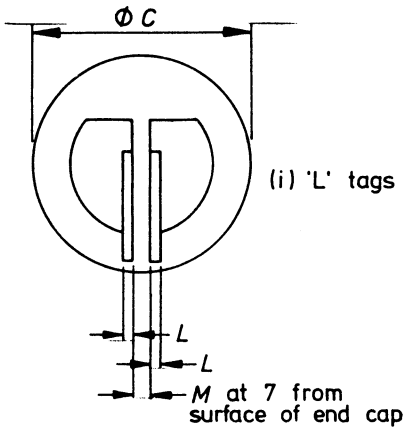


(d) For current ratings 200 A and 400 A

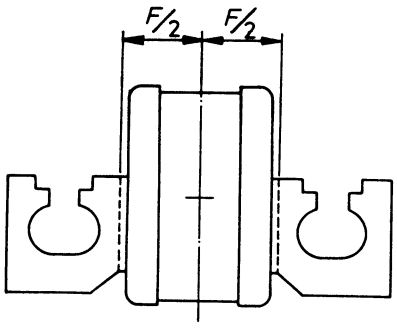
Figure 1 — Time/current zones *(concluded)*



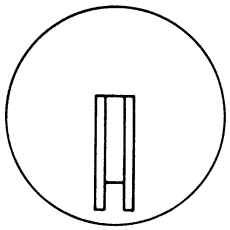
Fuse-links with 'L' type tags



Typical forms of tag construction



Fuse-links with 'U' type tags



The tags should be of the form shown to ensure compliance with the note below relating to dimension *F*

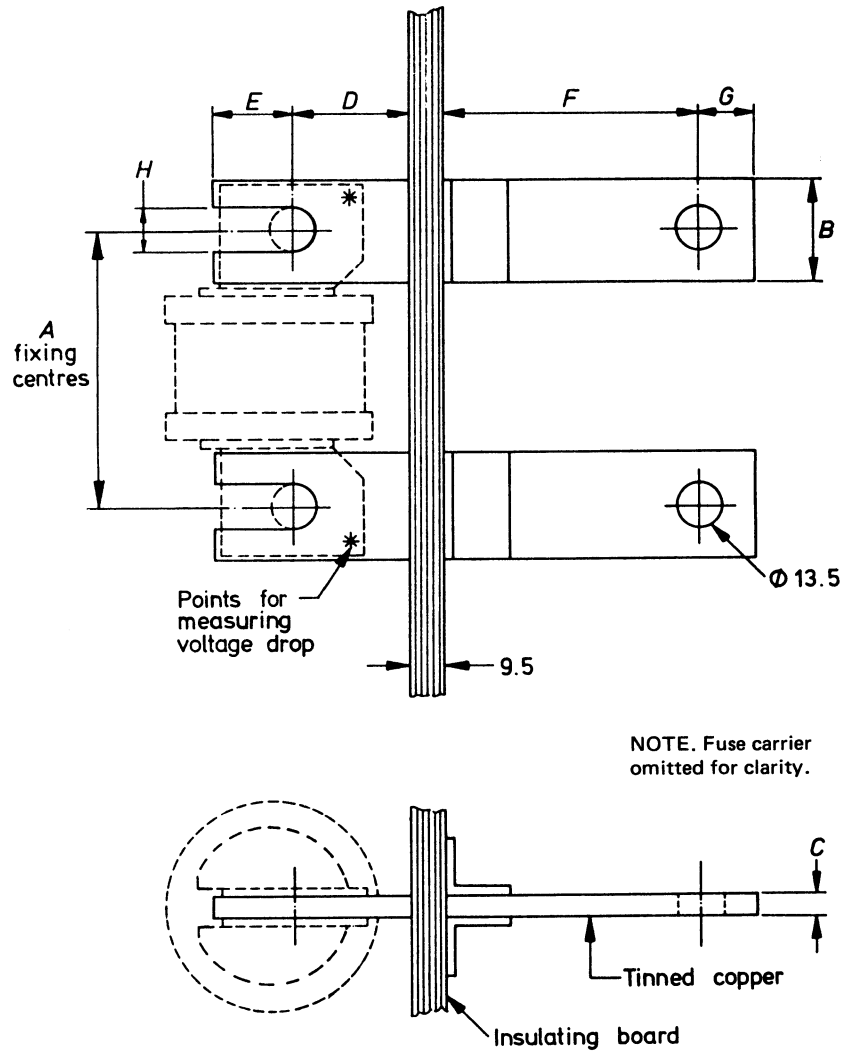
All dimensions are in millimetres.

Max. current rating, A	Fixing centres at 82														
	A max.	*B* nom.	*C* max.	*D* max.	*E* max.	*F** max.	*G* nom.	*H* nom.	*J* nom.	*K* max.	*L* nom.	*M*†	*N* nom.	*P* nom.	*O* nom.
400	112	82	61	25	36	48	19	17	14	35	2.4	6.53 6.45	13	10	3

Max. current rating, A	Fixing centres at 92														
	A max.	*B* nom.	*C* max.	*D* max.	*E* max.	*F** max.	*G* nom.	*H* nom.	*J* nom.	*K* max.	*L* nom.	*M*†	*N* nom.	*P* nom.	*O* nom.
630	132	92	75	25	50	48	24	20	17	42	3.2	8.13 8.05	16	11	3

**F* represents the maximum dimension of the effective body length including rivet heads.
†*M* maximum and minimum dimensions.

Figure 2 — Dimensions for fuse-links with L type and U type tags

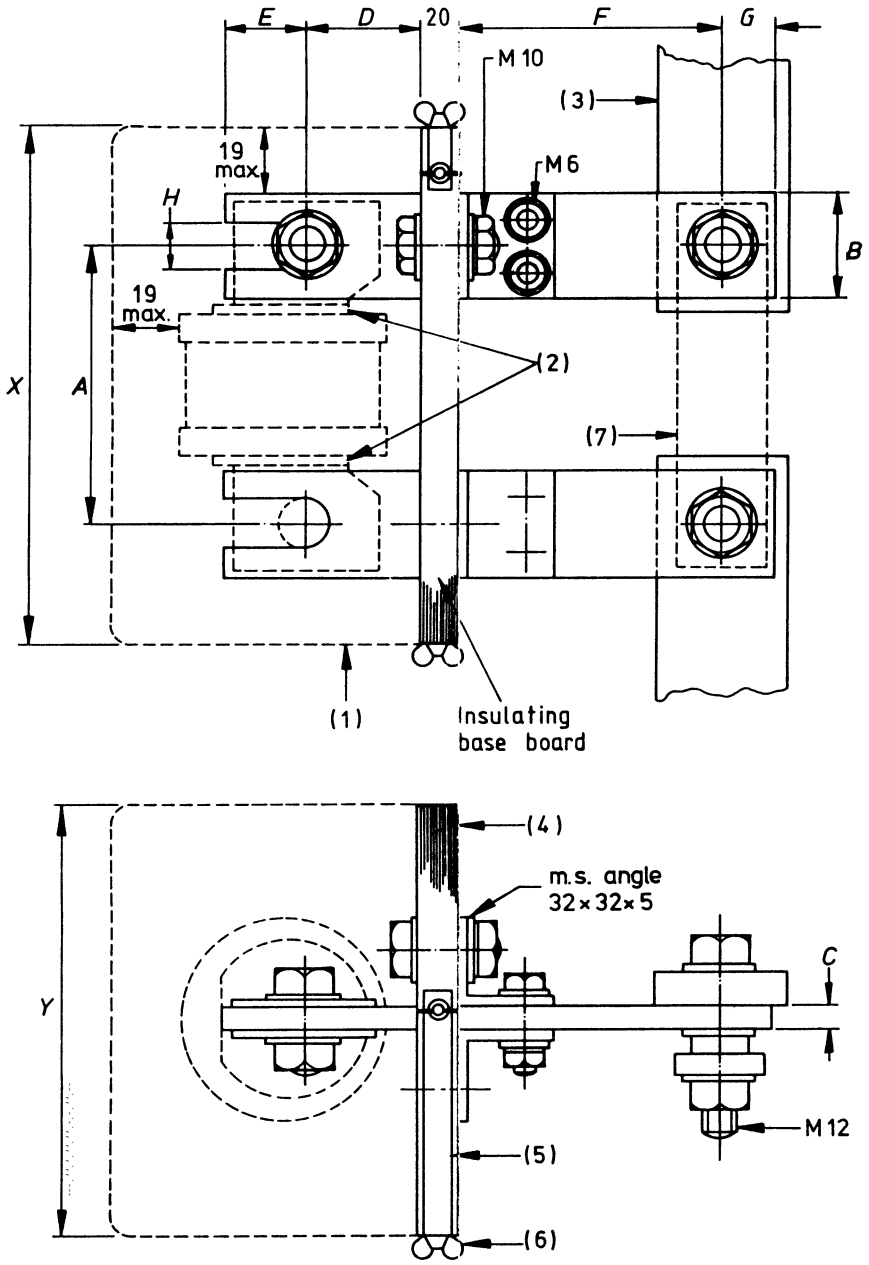


NOTE. Fixing bolts for external conductors as appropriate.

All dimensions are in millimetres.

Max. current rating, A	A	B	C	D	E	F	G	H
400	82.0	31.5	6.3	35.0	24.0	76.2	16.0	13.5
630	92.0	40.0	8.0	41.3	28.6	76.2	22.3	17.5

Figure 3 — Power dissipation test rig



Explanations and notes applying to figure 4: breaking capacity test rig

(1) Detachable cover fabricated from woven wire cloth, mild sheet, or perforated mild steel sheet of such thicknesses as to ensure reasonable rigidity. Individual apertures in the wire cloth or perforated steel sheet not to exceed 8.5 mm^2 in area. The section of cover shown on the drawing is included by way of illustration only, and does not prejudice the use of other shapes or forms, provided that the minimum clearance between the cover and any live metal parts does not exceed 19 mm.

(2) A visible gap at this position is essential to ensure that the end caps are not supported by the test rig contacts.

(3) The size of the copper conductors is to be chosen by the testing laboratory and to be appropriate to the breaking capacity.

(4) The base, and the fixing of the test contacts to it, shall be of sufficient rigidity to withstand the forces encountered without applying external load to the fuse-link under test. A suitable material for the base is phenolic resin bonded paper laminated sheet complying with type 1 of BS 5102.

(5) *Copper strip.*

(6) *Terminal for fine wire fuse.* Fine wire fuse of copper wire approximately 0.1 mm diameter, with a free length not less than 75 mm long connected between this terminal and one pole of the test supply.

(7) *Short-circuit link required for prospective current test.* This may be slotted for easy disconnection. The size of the copper link is to be chosen by the test laboratory and to be appropriate to the breaking capacity.

(8) Approximate imperial equivalents are acceptable.

All dimensions are in millimetres.

Max. current rating, A	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*X*	*Y*	Fuse link fixing bolts
400	82.0	31.5	6.3	35.0	24.0	76.2	16.0	13.5	152	124	M12
630	92.0	40.0	8.0	41.3	28.6	76.2	22.3	17.5	170	138	M16

Figure 4 — Breaking capacity test rig

Publications referred to

BS 88, *Cartridge fuses for voltages up to and including 1 000 V a.c. and 1 500 V d.c.*.
BS 88-1, *Specification of general requirements.*
BS 5102, *Specification for phenolic resin bonded paper laminated sheets for electrical applications.*

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