

CONFIRMED
DECEMBER 2007

Specification for

**Cartridge fuse-links
for use in
railway-signalling
circuits**

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:

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 Association of Supervising Electrical Engineers
 British Electrical and Allied Industries Research Association
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 British Electricity Authority and Area Boards
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 Public Transport Association (Incorporated)
 Radio Industry Council

The Government department 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:—

Crown Agents for the Colonies
 Federation of British Industries
 Ministry of Transport
 Office of the High Commissioner for India
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 Individual manufacturers of Railway Signalling Apparatus

This British Standard, having been approved by the Electrical Industry Standards Committee and endorsed by the chairman of the Engineering Divisional Council, was published under the authority of the General Council on 30 November 1950

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Foreword

This British Standard, first issued in 1936, has now been revised in order to bring the range of fuses concerned into line with modern developments in design and manufacture.

In other British Standards, current ratings have been assigned only to fuses and not to cartridge fuse-links, because cartridge fuse-links are not necessarily interchangeable in fuses of different types without alteration of the characteristics of the fuses. For the fuses dealt with in this standard, however, the influence of the surroundings of the cartridge fuse-links is small, the type of fuse holder being standard. This British Standard has therefore been drawn up to apply to cartridge fuse-links only.

Discrimination between fuse-links of different current rating has been dealt with as far as present experience permits, but the problem will continue to be investigated and any addition necessary to the standard will be made at a later date.

A wider range of fuses is dealt with in BS 88, "*Electric fuses, low-voltage and medium-voltage*", where more general information is given.

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 6 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 Scope

This British Standard covers fuse-links suitable for use in railway-signalling circuits in which the declared voltage does not exceed 250 volts between conductors or between conductor and earth.

The standard lays down standard current ratings and standard dimensions; it deals with manufacturing requirements, end caps, marking, performance and the type tests required. The information to be supplied by a purchaser is stated in the Appendix.

2 Definitions

For the purpose of this British Standard the following definitions shall apply: —

2.1

cartridge fuse-link, (hereinafter called a fuse)

a cartridge containing a fuse-element

2.2

cartridge

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

2.3

fuse-element

that part of a fuse which is designed to melt and thus open the circuit

2.4

current rating of a fuse

a current stated by the manufacturer as the current that the fuse will carry continuously without deterioration

2.5

prospective current of a circuit

the current (the r.m.s. value of the alternating component of an alternating current, or the direct 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

2.6

breaking-capacity rating of a fuse

the greatest prospective current in a circuit which the fuse is capable of opening under the prescribed conditions

2.7

minimum fusing current

the minimum current at which the fuse-element will melt in two hours, as determined from the time-current characteristic for the particular fuse rating

2.8

fusing factor of a fuse

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

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

2.9

voltage rating of a fuse

the voltage stated by the manufacturer as the highest declared voltage that may normally be associated with the fuse

2.10

pre-arcing time

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

2.11

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

2.12

total operating time

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

2.13

operation of a fuse

the process between the beginning of the pre-arcing time and the end of the arcing time; sometimes called "blowing"

3 Standard current ratings

The standard current ratings shall be 3, 5, 10, 15, 20 and 30 amperes.

4 Dimensions

The dimensions (see also Figure 1) shall be as follows: —

Overall length	2 ± 0.040 in.
Cap diameter	$\frac{9}{16} \pm 0.015$ in.
Length of cap	not less than $\frac{3}{8}$ in. and not greater than $\frac{7}{16}$ in.

The maximum diameter of the cartridge between the end caps shall be less than the diameter of the end cap.

5 Manufacture

The material used in manufacture shall be such as to have no deleterious action on any part of the fuse during its life, and this shall also apply under tropical conditions when the fuse is specified for use under such conditions.

All non-metallic parts of the fuse shall be constructed of non-ignitable, non-hygroscopic insulating material.

The joints between the fuse-element and the end caps shall be such that they shall not become disconnected before the fuse-element melts. The fuse-element shall be soldered or welded to the caps which make contact with the fuse clips.

6 End caps

The fuse shall be capped at both ends with copper caps, the thickness of metal being not less than 22 S.W.G. (0.028 in. nominal). The caps shall be securely and rigidly fixed to the body of the cartridge and the ends of the caps shall be reasonably flat. The sides of the two caps shall be in line, and parallel with the centre-line of the cartridge.

If tinning is required by the purchaser the caps shall be electro-tinned.

7 Marking

Each fuse shall be clearly and indelibly marked in the following manner:—

- a) By a band not less than ½ in. wide, of the appropriate colour indicating the rating of the fuse, applied round the fuse at one end adjacent to the cap. Colours corresponding to the standard current ratings shall be as follows:—

Current rating	Colour	British Standard colour No. ^a
3 amp.	Black	—
5	White	—
10	Sea green	17
15	Azure blue	4
20	Lemon	55
30	Signal red	37

^a See BS 381C, "Colours for ready mixed paints".

- b) The following information shall also be marked on the fuse in a manner which will not interfere with the colour marking:—

- i) Manufacturer's name.

- ii) Voltage rating.

- iii) Carrying capacity¹⁾ in amperes.

- iv) The number of this British Standard, viz. BS 714.

8 Type tests

- a) The purchaser shall accept, as evidence of compliance with this British Standard, certificates of type tests, as specified below, of not less than six representative fuses of each current rating (i.e., thirty-six fuses in all), identical in all essential respects with those purchased.

- b) *Accelerated life test.* The fuses shall each carry a current equal to 110 per cent of the current rating for 1 000 hours, and at no time during this period shall the temperature rise of the hottest accessible portion of the assembly exceed 40 centigrade degrees.

The fuses shall be mounted vertically in the standard test clips (see Figure 1) in an enclosure free from draughts, at normal room temperature not exceeding 20 °C. The cable connections to the clips shall be as specified in Figure 1, for the appropriate current rating of the fuse.

At the conclusion of this test, the fuses shall be mechanically sound and the exterior shall show no sign of deterioration.

- c) *Test for breaking capacity.* The fuses shall each be capable of opening satisfactorily a circuit adjusted for a current of 500 amperes, and any lower value down to the minimum fusing current.

The source of energy for the test shall be a secondary battery rated at not less than 100 ampere-hours on a one-hour rate of discharge, which shall be capable of giving the short-circuit current required, (i.e., 500 amperes).

The open circuit potential difference of the battery immediately prior to the test shall be 260 volts ± 2 per cent.

The fuses shall be mounted in a suitable carrier and connected as indicated in Figure 2. The resistance *R* shall be non-inductive, and shall be adjusted to suit the value of short-circuit current required in accordance with a previous calibration of the circuit, with the fuse replaced by a link of negligible impedance.

A fuse-link shall be deemed not to comply with this standard if, during the test, any of the following phenomena occur:—

- i) Holding of the arc for an appreciable length of time.

¹⁾ Appropriate current rating to be inserted.

- ii) Ignition of the fuse or attached apparatus.
- iii) Damage to the test clips sufficient to render them unserviceable without repair.

d) *Time-current characteristics.* When specified by the purchaser, the manufacturer shall submit time-current characteristics applicable to the complete range of fuses covered by this standard. The curves shall be plotted between time limits of 0.01 second and 1 000 minutes in one graph to logarithmic scales on paper as shown in Figure 3.

Tests may be carried out by the purchaser on a quantity of fuses as specified in a) above, and at points evenly distributed along the curves throughout the range of currents covered by the basic curves submitted.

The fuses shall be mounted as specified in b) above.

The fusing times shall be within the limits represented by lines drawn one-third of the linear distance on the current scale from the curve of the fuse concerned to the curves applicable to fuses with current ratings immediately above or below the current rating of the fuse concerned.

e) *Declared cold resistance.* When specified by the purchaser, the manufacturer shall submit declared cold resistance values at room temperature (20 °C.) applicable to the current rating of the fuses. The variation in initial declared cold resistance of a quantity of fuses as specified in a) above at the same temperature shall not exceed ± 5 per cent.

9 Acceptance tests

a) When required, facilities at the manufacturer's works shall be provided to enable one or all of the following tests to be carried out at the discretion of the purchaser. The number of fuses subjected to each test shall be as laid down in Clause 8 a) and the fuses for testing purposes shall be selected at random from the complete consignment.

b) For the purpose of these tests the fuses shall be mounted vertically in the standard test clips (see Figure 1) in an enclosure free from draughts, at normal room temperature not exceeding 20 °C. The cable connections to the clips shall be as shown in Figure 1, for the appropriate current rating.

c) *Potential-drop at current rating.* When a fuse is carrying its rated current, at room temperature (15–20 °C.), the potential-drop, measured between the end caps of the fuse, shall not exceed the values given in Table 1. The reading shall be taken when a steady value has been reached.

Table 1 — Potential-drop at current rating

Current rating	Potential-drop
amp.	mv.
3	400
5	300
10 and over	200

d) *Tests for operation.*

i) The fuse-element shall blow at a current equal to three times the current rating (see Clause 3) in a time not greater than that shown in Table 2 for the appropriate current rating.

ii) The fuse-element shall carry, for at least one minute, the current equal to that shown in Table 2 for the appropriate current rating.

Table 2 — Operational characteristics of fuses

Current rating	Time	Current
amp.	sec.	amp.
3	1	6
5	2	10
10	3	15
15	5	25
20	5	35
30	10	55

e) *General.*

i) The fuses selected for test purposes shall be inspected to ensure that they comply with the conditions specified in Clauses 4, 5, 6 and 7.

ii) If more than one of the six fuses selected for test purposes fails to satisfy the tests laid down, the consignment of fuses of the current rating concerned shall be liable to rejection as not complying with the standard.

If one of the six fuses of each current rating selected for test purposes fails to comply with the standard in any respect, another complete set of tests may be carried out on a further six fuses of the current rating concerned and unless all these are completely satisfactory the consignment of this rating shall be liable to rejection.

iii) The fusing factor, as defined in Clause 2.8, shall be not greater than 2.0.

Appendix Information to be supplied by the purchaser

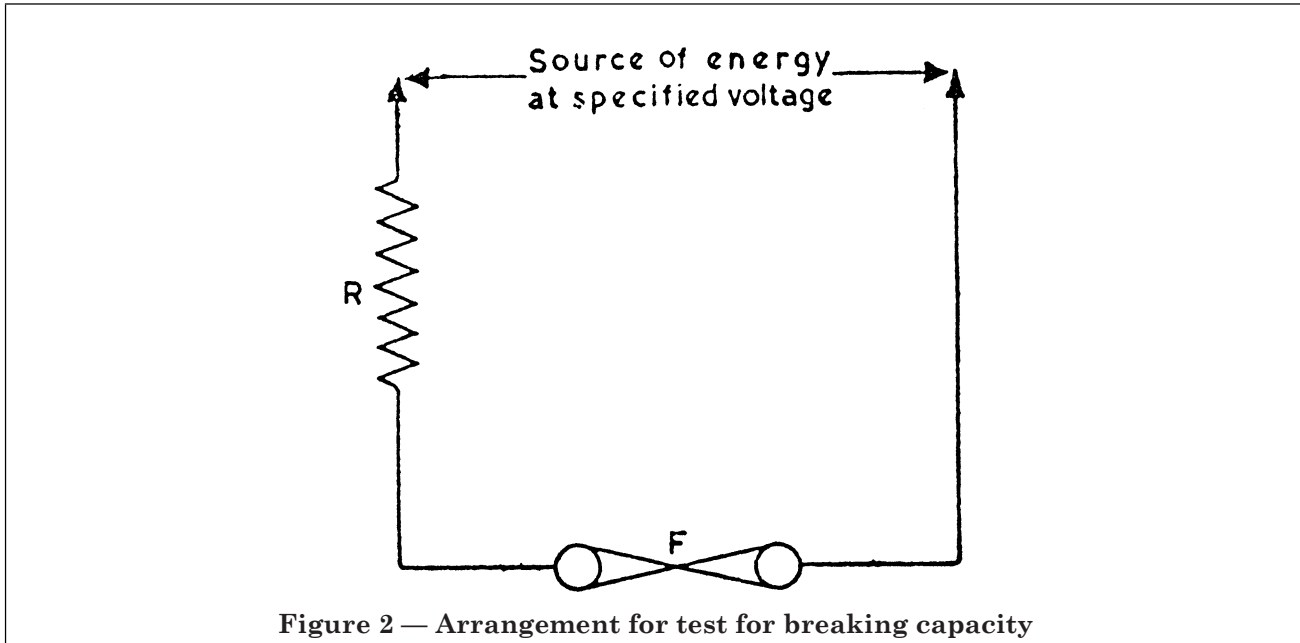
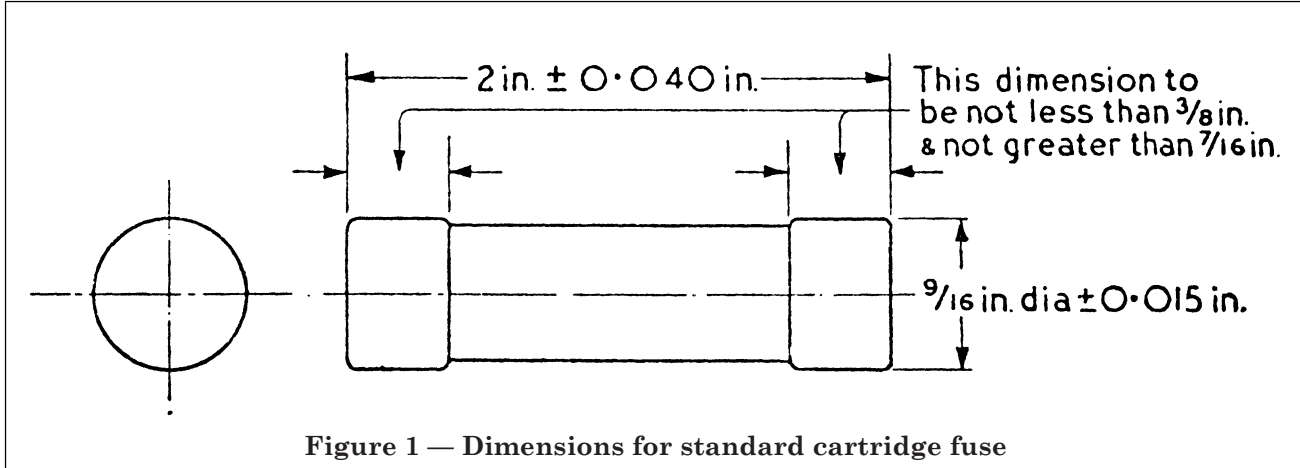
Whether the fuses are to be of the non-indicating or of the indicating type.

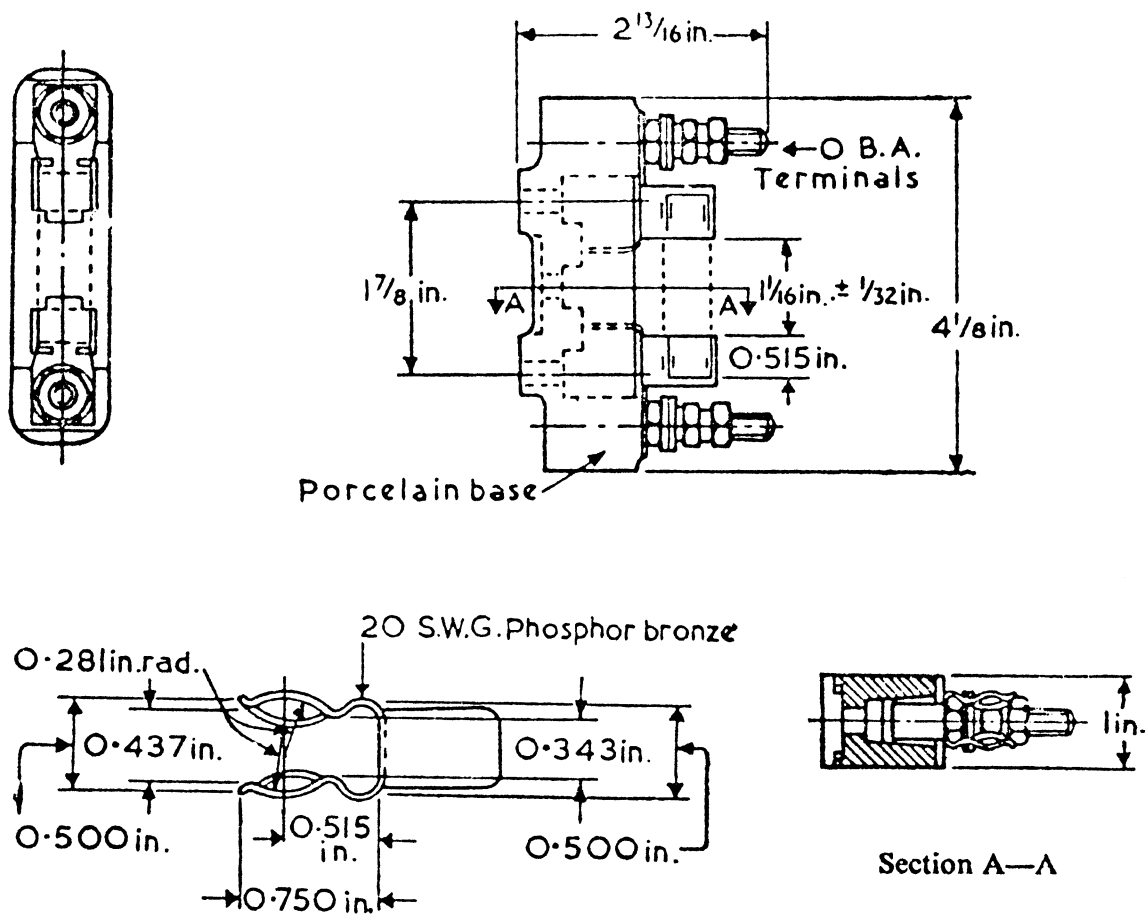
Whether end caps are to be electro-tinned (Clause 6).

Whether time-current characteristics are required [Clause 8 d].

Whether declared cold resistance values are required [Clause 8 e].

Whether facilities are required at the manufacturer's works for carrying out acceptance tests (Clause 9).





Details of clip

NOTE 1 Clips shall be cleaned and adjusted before use to ensure that the cold resistance between each clip and the end cap of the fuse shall be not greater than 0.000 5 ohms.

NOTE 2 The size of conductors used for connecting these test clips shall be as shown in the following table:

Current rating of fuse amps.	Size of V.I.R cable to be used
3	1/0.044
5	1/0.064
10	7/0.029
15	7/0.036
20	7/0.044
30	7/0.052

Figure 3 — Assembly of test clips

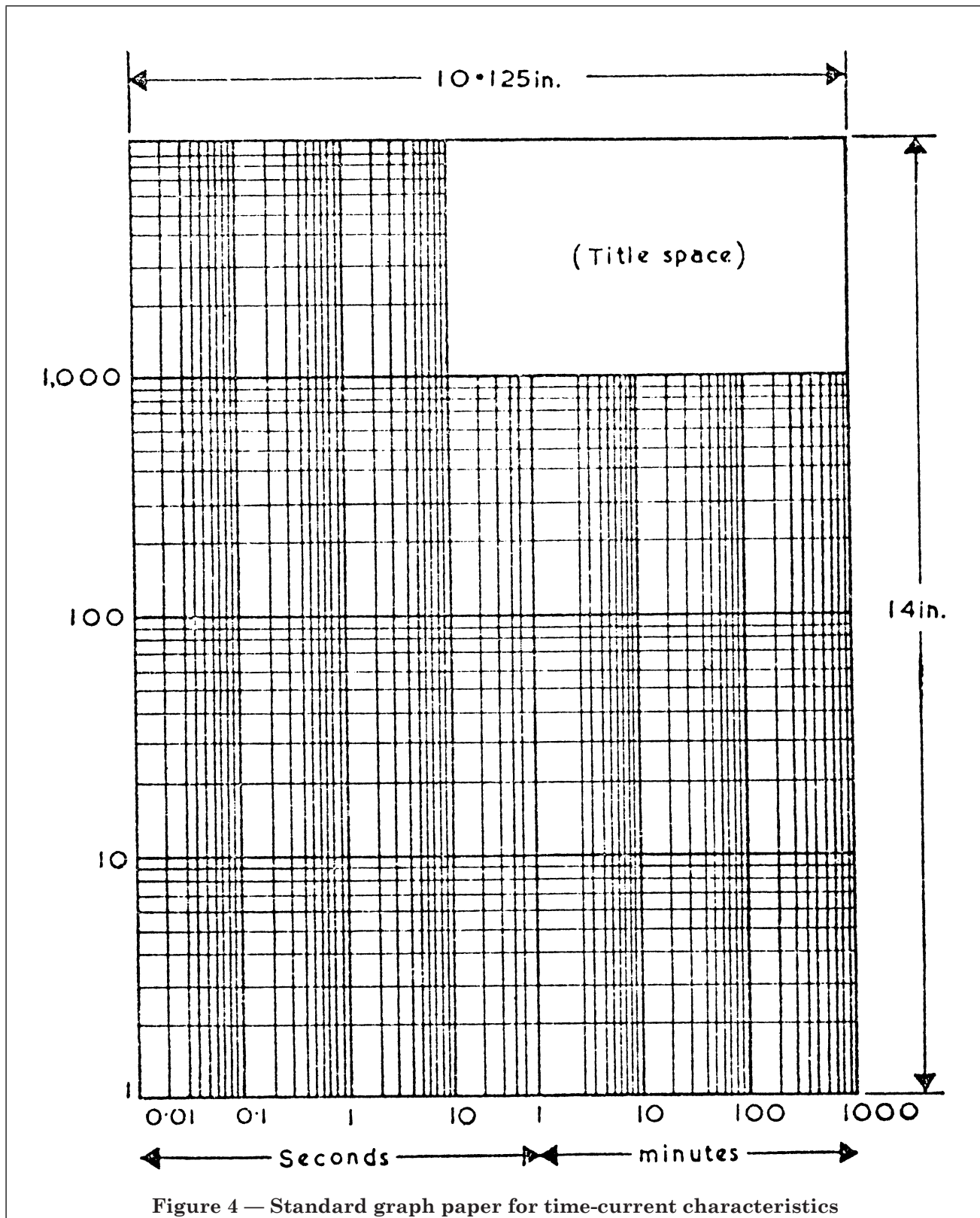


Figure 4 — Standard graph paper for time-current characteristics

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