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Specification

Semi-enclosed Electric fuses —

**Ratings up to 100 amperes and 240 volts
to earth**

UDC 621.316.923

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Foreword

Semi-enclosed fuses are used extensively and have given satisfactory service on low- and medium-voltage systems not exceeding 240 volts to earth at points where the breaking-capacity severity is limited. Such fuses are usually associated either with switches in composite units, or with distribution boards, used on two- or three-pole circuits, the fuses being enclosed within a single case, which is often of metal and is then connected to earth.

The semi-enclosed fuses covered by this standard are suitable for certain applications only. Where fuses are required for points in a system where the prospective short-circuit current exceeds the test values given in the standard, or higher breaking-capacity ratings are required, the appropriate Parts of BS 88 “*Cartridge fuses for voltages up to and including 1 000 V a.c. and 1 500 V d.c.*”, or with BS 1361 “*Cartridge fuses for a.c. circuits in domestic and similar premises*” should be used. BS 88, “*Electric fuses for circuits of voltage-ratings up to 660 volts*”, should be used.

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 22 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.

Section 1. General

1 Scope

This standard relates to low-voltage and medium-voltage semi-enclosed fuses, having ratings of 240 volts maximum to earth, and 100 amperes or less, intended for any of the a.c. categories of duty at 50 Hz included in Table 1 and for use under service conditions not more onerous than those described in Clause 2.

2 Service conditions

The service conditions for which fuses complying with this standard are suitable are as follows:¹⁾

- a) *Voltage.* Circuits in which the voltage between lines does not exceed the rated voltage of the fuse, and in which the voltage to earth does not exceed 240 volts.
- b) *Current.* Carrying currents from zero current to rated current and breaking currents from the minimum fusing current to the breaking-capacity rating at power factors not more severe than those corresponding to the relevant category of duty.
- c) *Ambient temperature.* The temperature of the air surrounding the fuse is assumed to have a peak value not exceeding 40 °C, with an average value not exceeding 35 °C over twenty-four-hour periods.
NOTE Under normal conditions of service, the available cooling air is subjected to natural atmospheric variations of temperature, and the peak temperature occurs only occasionally during the hot season; on those days when it does occur it does not continue for long periods. Meteorological records indicate that temperatures at least 10 degC below the peak temperature will occur within the twenty-four-hour period, and that the average temperature over any twenty-four-hour period that includes the peak temperature will be at least 5 degC below the peak value.
- d) *Altitude.* An altitude not exceeding 2 000 metres.
- e) *Atmosphere.* An atmosphere not subject to excessive pollution: for example, by pollution from smoke, chemical fumes and salt-laden spray. Such pollution occurs in some industrial areas and in some coastal districts.
- f) *Enclosure.* Enclosures similar to those specified for the tests in Section 3.

NOTE Where the fuses are mounted in an enclosure it should be established that the clearances between fuses and between each fuse and the wall of the enclosure are not less than those used for the test.

3 Definitions²⁾

For the purposes of this British Standard the following definitions apply:

3.1 fuse

a device for protecting a circuit against damage from an excessive current flowing in it by opening the circuit on the melting of a fuse element by such excessive current. The fuse comprises all the parts that form the complete device

3.2 semi-enclosed fuse

a fuse in which the fuse element is neither in free air (other than the air in any external containing case not forming part of the fuse) nor totally enclosed

3.3 fuse element

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

NOTE Semi-enclosed fuses have easily renewable fuse elements, usually of wire. It is normally left to the user to fit the elements according to the desired current rating.

3.4 fuse contact

a contact suitable for engaging with a fixed contact, and capable of having a fuse element attached to it

3.5 fuse carrier

a removable holder, fitted with fuse contacts, for carrying a fuse element

NOTE A container for a fuse element may form a fuse carrier or part of a fuse carrier.

3.6 fixed contact

a contact, connected to a fixed terminal, suitable for engaging with a fuse contact

3.7 fuse base

that part of a fuse which carries the fixed contacts

3.8 minimum fusing current

the minimum current at which a fuse element in a fuse will melt

3.9 current rating

a current, less than the minimum fusing current, stated by the manufacturer to be the current that the fuse will carry continuously without deterioration

¹⁾ Where service conditions differ appreciably from those specified, the manufacturer should be consulted in selecting fuses with appropriate ratings.

²⁾ See also further notes on terminology, given in Appendix A.

3.10 size

the maximum current rating (expressed in amperes) that a fuse may have when fitted with the appropriate fuse element

NOTE A fuse of one size (say 100-ampere) may be fitted with a fuse element to give it some smaller current rating (say 80-ampere). This matter is within the control of the user. Fuse contacts, fuse carriers, fixed contacts and fuse bases are usually described by stating the size of the fuse of which they are a part.

3.11 fusing factor

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

$$\text{Fusing factor} = \frac{\text{Minimum fusing current}}{\text{Current rating}}$$

(see Appendix A.2)

3.12 prospective current

the current (the r.m.s. value of the alternating component of an alternating current) that would flow, under any conditions, including test or fault conditions, 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. (See Appendix A.3)

3.13 loop

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

NOTE 1 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.

NOTE 2 As shown in Figure 9 and Figure 10, 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.

3.14 cut-off

if the melting of a fuse element prevents the current through the fuse reaching the otherwise attainable maximum (the peak current of the first major loop in an a.c. circuit), the fuse 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 (see Definition 3.12).

NOTE 2 A fuse only exhibits cut-off at prospective currents greater than a particular value; the transition point varies with different fuses, and may be at a prospective current greater than the breaking-capacity rating.

3.15 breaking-capacity rating

a prospective current stated by the manufacturer to be the greatest prospective current to which a fuse may be subjected under prescribed conditions of voltage and of power factor

3.16 voltage rating

a voltage stated by the manufacturer to be the highest declared voltage, and the highest voltage to earth, if less than 240 volts, that may be associated with the fuse

3.17 arc voltage

the voltage across a fuse during the arcing time

NOTE 1 The maximum value of the arc voltage may exceed the peak value of the a.c. recovery voltage.

NOTE 2 See Appendix A.6.

3.18 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

3.19 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

3.20 total operating time

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

3.21 recovery voltage

of a circuit opened by a fuse or fuses. The r.m.s. value of the normal-frequency a.c. voltage across the terminals of the fuse or fuses after the opening of the circuit

3.22 operation

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

3.23 discrimination

in a series circuit containing two or more current-interrupting devices: the operation, under over-current or short-circuit conditions, of only the current-interrupting device appropriate to the portion of the circuit affected. (See Appendix F.6)

3.24 duty

the satisfactory opening of a fuse, at voltages not higher than the voltage rating of the fuse, of the circuit or circuits protected by it under conditions that produce for the requisite length of time any prospective current greater than its minimum fusing current up to its breaking-capacity rating

Section 2. Requirements

4 Voltage ratings

The preferred a.c. rated voltages are 240 V single-phase and 415 V three-phase.

5 Sizes

The sizes of fuse for each category of duty (see Clause 9) shall be as stated in Table 1.

Table 1 — Sizes for each category of duty

Category of duty	Number of sizes	Standard sizes (Maximum current rating in amperes)
S1A	6	5, 15, 20 30, 45, 60
S2A	7	5, 15, 20, 30, 45, 60, 100
S4A	4	30, 45, 60, 100

6 Temperature rise at rated current

All parts of fuses shall be so designed and proportioned that when they are carrying their rated current continuously, in accordance with Clause 17, the temperature rise of the fuse contacts and of the fixed terminals³⁾ at the top of fuses mounted vertically, or at either end of fuses mounted horizontally, does not exceed 55 deg C.

7 Fusing factors

Fusing factors, which shall not exceed 2.0, shall be declared by the manufacturer. They shall be ascertained by calculating the ratio of the minimum fusing current, determined according to Clause 19, to the current rating.

8 Time/current characteristics

Time/current characteristics shall be prepared in accordance with Clause 18 and the manufacturer shall make copies available to the purchaser upon request.

The curves shall be prepared with both axes scaled logarithmically, and shall show prospective currents up to the breaking-capacity rating, plotted against pre-arcing times.

The curves shall be supplemented with information regarding arcing times and, if the manufacturer thinks it necessary, with data on the relationship between cut-off currents and prospective currents.

9 Performance

Fuses shall open circuits adjusted for any prospective current greater than their minimum fusing currents, up to their breaking-capacity ratings, and shall be tested for duty in accordance with Clauses 20 to 23.

One or more of the categories of duty given in the first column of Table 3 shall be assigned to each fuse.

NOTE The categories of duty are distinguished by the values of prospective current of the test circuit and are denoted by numerals prefixed by the letter "S" (indicating that the fuse is semi-enclosed).

The category of duty to which any fuse is assigned shall be one having a distinguishing value of prospective current not greater than the breaking-capacity rating of the fuse.

For example:

A fuse having a breaking-capacity rating greater than 2 000 amperes, but less than 4 000 amperes, is, for example, placed in category of duty S2A.

A fuse having a breaking-capacity rating less than 1 000 amperes is outside the scope of this standard.

The power-factor of the a.c. test circuits shall be of the appropriate values as stated in Table 3.

Reports of type tests of performance shall include the details given by Appendix G.

10 Contacts

Fuse contacts and fixed contacts shall be so constructed and of such materials that, when the fuse is properly installed and service conditions are not more severe than those given in Clause 2, adequate contact is maintained between the fuse contacts and the fixed contacts, even after repeated engagement and disengagement.

11 Spacing of fixed contacts

Fixed contacts and their terminals shall be so spaced and shielded that an arc cannot be maintained when the fuses are tested in accordance with Clauses 20 to 23.

12 Terminals

Terminals shall be so designed that they effectively contain all conductor strands of cables for which they are intended.

³⁾ Or cable sockets, when used.