

Specification for

200 A 1100 V flameproof restrained and bolted plugs and sockets for use in coal mines

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mining Requisites Standards Policy Committee (MRE/-) to Technical Committee MRE/14, upon which the following bodies were represented:

- Association of British Mining Equipment Companies
- British Cable Makers' Confederation
- British Coal Corporation
- Council for Electrical Equipment for Flammable Atmospheres (BEAMA Ltd.)
- Health and Safety Executive

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 References	1
3 Information and requirements to be agreed and documented	1
4 Definitions	1
5 Metallic components	2
6 Insulation	2
7 Contacts	3
8 Terminals	3
9 Plug	3
10 Socket	3
11 Closer caps for sockets	4
12 Plug and socket assembly	4
13 Plug coupling unit	4
14 Dimensions	5
15 Flameproof enclosure	5
16 Type tests	5
17 Routine tests	6
18 Marking	7
Figure 1 — Contact dispositions for alternative voltage modes	8
Figure 2 — Type 1 restrained plug (650 V mode)	9
Figure 3 — Type 1 bolted plug (650 V mode)	10
Figure 4 — Type 2 restrained plug	11
Figure 5 — Type 1 restrained socket (650 V mode)	12
Figure 6 — Type 1 bolted socket (650 V mode)	13
Figure 7 — Type 2 restrained socket	14
Figure 8 — Type 1 flameproof closure cap for restrained sockets	15
Figure 9 — Type 1 flameproof closure cap for bolted sockets	15
Figure 10 — Type 2 flameproof closure cap for restrained sockets	16
Table 1 — Properties of electrical insulating materials	2
Table 2 — Test mandrel dimensions	6
Table 3 — Contact tube conditioning data	7
List of references	Inside back cover

Foreword

This British Standard has been prepared under the direction of the Mining Requisites Standards Policy Committee. It supersedes BS 5620:1979 which is withdrawn.

BS 5620:1979 specified requirements for 650 V single voltage units and for 650/1 100 V dual voltage units. This revision also specifies requirements for 1 100 V single voltage units. Due cognizance is taken of the relevant requirements of BS 4683-2, BS 5501-1 and BS 5501-5.

The standard continues to ensure interchangeability of plugs in sockets of different makes and to standardize the fixing dimensions of sockets.

Whilst specifying some electrical and mechanical requirements, the standard does not purport to provide a fully detailed design.

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. Attention is drawn to the Health and Safety at Work etc. Act 1974, the Mines and Quarries Act 1954, the Regulations made under these Acts, and also any other appropriate statutory requirements or bye-laws. These place responsibility for complying with certain specific safety requirements on the manufacturer and the user. The addresses of the recognized certification authorities in the UK for Group I (coal mining) apparatus for flameproof safety purposes are as follows:

Health and Safety Executive
Mining Equipment Certification Service
Harpur Hill
Buxton
Derbyshire
SK17 9JN

SIRA Certification Service
Saighton Lane
Saighton
Chester CH3 6EG

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, 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 Scope

This British Standard specifies the constructional and test requirements for 200 A flameproof restrained and bolted plugs, sockets and plug coupling units suitable for single voltages of 650 V and 1 100 V and dual voltage of 650/1 100 V. They are primarily intended for use with mining apparatus which is connected to its power supply by means of a flexible cable.

Three types are covered and designated as:

- type 1S: 200 A, 650 V single voltage, restrained and bolted;
- type 1D: 200 A, 650/1 100 V dual voltage, restrained and bolted;
- type 2: 200 A, 1 100 V single voltage, restrained only.

Type 1 and 2 configurations are not interchangeable.

The plugs, sockets and plug coupling units incorporate three power contacts, a pilot contact for electrical interlocking and a scraping earth contact.

The dual voltage plugs and sockets are intended for use either on a 650 V or 1 100 V supply, the appropriate arrangements including selection of voltage by orientation of insulator and pins to ensure non-interchangeability for other than the appropriate voltage.

In addition to the definitive requirements, this standard also requires the items detailed in clause 3 to be documented. For compliance with this standard, both the definitive requirements and the documented items have to be satisfied.

NOTE The figures in this standard show only those features and dimensions essential for function interchangeability.

2 References

2.1 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies: any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Information and requirements to be agreed and to be documented

The following information to be supplied by the purchaser shall be fully documented. Both the definitive requirements specified throughout the standard and the following documented items shall be satisfied before a claim of compliance with the standard can be made and verified.

- a) The number and date of this British Standard, i.e. BS 5620:1994.
- b) Type of plugs and/or sockets required, i.e. restrained or bolted types 1S, 1D or 2 and, for sockets, whether of the fixed or coupler variety.
- c) Nominal size of cable conductors (in mm²).
- d) Type of cable, if made to a British Standard or other recognized standard specification, the appropriate standard number; for non-standard cables, complete details of the cable construction and dimensions should be given.

4 Definitions

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

4.1

plug and socket

a device consisting of two portions having metallic contacts and arranged to engage with each other, so forming a ready means of connecting or disconnecting current-using apparatus to or from the source of electrical supply

4.2

flameproof plug and socket

a plug and socket which, when its parts are properly assembled together with the cable attached, conforms to the relevant flameproof requirements

4.3

restrained plug and socket

a plug and socket in which the two portions are engaged, retained and disengaged by means of a manually operated device

4.4

bolted plug and socket

a plug and socket designed to be held together by two or more bolts or screws, or studs and nuts, in such a way that the plug and socket cannot be disengaged without the use of a tool

4.5

plug coupling unit

an assembly incorporating two socket entries providing for the insertion and engagement of plugs

4.6**plug**

that portion of a plug and socket having contacts consisting of tubes and which is attached to a flexible cable

4.7**socket**

that portion of a plug and socket having contacts consisting of pins and which is designed for the insertion and engagement of a plug

4.8**scraping earthing contact**

a device to ensure electrical continuity of the earthing connection between a plug and socket

4.9**cable gland**

a device designed to secure the end of a cable, by means appropriate to the type of cable, and which may include provision for making electrical connection to any screen or metallic covering

4.10**closer cap**

a cap primarily intended for blanking off motor sockets (see note to clause 11)

5 Metallic components

The material for external components and enclosures shall be one of the following:

- a) a corrosion resistant ferrous alloy; or
- b) a non-ferrous metal, other than aluminium, magnesium, or titanium; or

- c) an alloy containing the metals aluminium, magnesium and titanium, either singly or in combination, providing that the total content of these constituents does not exceed 15 % by mass of the alloy and the combined content of magnesium and titanium does not exceed 6 % by mass of the alloy.

NOTE These limits have been imposed to avoid the hazards of incendiary sparking due to friction between rusted steel or iron and the metals in question.

6 Insulation**6.1 Insulation materials**

The material used for insulating the contact tubes and pins shall conform to Table 1.

6.2 Insulators

Insulators shall be free from voids, cracks and deleterious inclusions and shall be capable of withstanding the test specified in 16.8.

6.3 Additional requirements for type 1D and type 2 plugs and sockets

The insulator, whether for plug or for socket, shall incorporate a metal separator between each of the contact housings. The separator shall be of cruciform section moulded integrally with the insulator such that the fins are located midway between the respective contact housings.

The separator shall extend as near as is practicable to the ends of the insulator, and the radial length of each fin shall be such that the radial distance between the tip of the fin and the outer surface of the insulator is not greater than 13 mm.

There shall be visible indication at the front of the insulator that a separator has been incorporated. Part of the separator shall be exposed at the front end for electrical test.

The separator shall be bonded to the case of the plug or socket.

Table 1 — Properties of electrical insulating materials

Property	Value	Test method
Electric strength (90 °C)	8 kV/mm (min.)	BS 2782:Method 220 or 221 ^a
Volume resistivity	$1 \times 10^{13} \Omega \text{ cm}$ (min.)	BS 2782:Method 230A ^b
Tensile strength	34.5 N/mm ² (min.)	BS 2782:Method 320D
Flexural strength	60 N/mm ² (min.)	BS 2782:Method 335A
Impact strength	10 kJ/m ² (min.)	BS 2782:Method 359
Water absorption ^c	50 mg (max.)	BS 2782:Method 430A
Comparative tracking index ^c	CTI 400 (min.)	BS 5901
Oxygen index ^d	28 % (min.)	BS 2782:Method 141

NOTE 1 N/mm² = 1 MPa.

^a Also numbered BS 903-C4.

^b Also numbered BS 903-C2.

^c Preparatory to any testing for these properties, remove not less than 0.5 mm by machining from all the surfaces of the test specimen and then smoothly finish.

^d This is a minimum requirement. Insulation forming a part of the flameproof path will additionally need to satisfy the requirements of BS 5501-5 with respect to flammability.

7 Contacts

Each plug and socket shall be provided with three power contacts and one pilot contact (contact tubes or contact pins, as may be appropriate) arranged for the appropriate voltage mode as in Figure 1.

8 Terminals

8.1 Power and pilot

Terminals of power contact tubes and pins shall be capable of being bored to a diameter from 6 mm up to 13 mm. Unless otherwise specified by the purchaser they shall be supplied bored to a diameter of 6 mm. Terminals of pilot contact tubes and pins shall be capable of being bored to a diameter from 4 mm up to 10 mm. Unless otherwise specified by the purchaser they shall be supplied bored to a diameter of 4 mm. Terminals shall be integral with contact tubes and contact pins; this does not preclude the use of dissimilar metals for contacts and terminals.

Where screws are used as a clamping device on a terminal, not less than two such screws shall be provided and they shall be flat point hexagon socket set screws conforming to BS 4168-2.

Each plug terminal shall provide for the entry of the conductor to a depth of at least 25 mm. Each socket terminal shall provide for the entry of the conductor to a depth of at least 18 mm.

8.2 Earthing

Earthing terminals shall be provided in the plugs and shall be capable of securely accommodating conductors of 6 mm² to 50 mm² cross-sectional area. Additional terminals shall be provided to accommodate securely any metallic cable screens.

9 Plug

9.1 Case

The general dimensions of the case of the type 1S and 1D plug shall be as given in Figure 2 and Figure 3 and for the type 2 as given in Figure 4. The engaging portion of the case of the plug which protects the contact tubes shall be of metal having a tensile strength of not less than 450 N/mm² when determined in accordance with the test methods given in BS EN 10002-1.

The remaining part of the case shall be of metal having a tensile strength of not less than 225 N/mm².

The external surface of the engaging portion of the plug casing shall form part of a scraping earthing contact and shall be electrically continuous with the remainder of the plug casing (see 10.3).

9.2 Contact tubes (power and pilot)

The dimensions of the tubes shall be as shown in Figure 2 or Figure 3 as appropriate, for types 1S and 1D and in Figure 4 for type 2. When assembled they shall be self-adjusting to the extent necessary to accommodate at least the permitted tolerances on position. The tubes shall be of any suitable metal having both a hardness of not less than 70 HB when determined in accordance with BS 240, and a volume resistivity of not more than 11 µΩ cm at a temperature of 20 °C.

Contact tubes shall make good electrical contact with the pins when the plug is inserted in the socket. The effectiveness of contact shall be proved by conformity to the requirements of 16.1 to 16.4 and 16.6.

9.3 Cable glands

A cable gland shall be provided, suitable for the size and type of cable to be accommodated, up to a maximum overall diameter of 60 mm. Cable glands shall be of a compression type and shall be provided with means:

- a) to satisfy the relevant requirements of BS 5501-1 and BS 5501-5 for cable entries for Group I apparatus;
- b) to secure the cable; and
- c) to seal the assembly against ingress of moisture.

Where a pliable wire armoured cable is to be accommodated in the gland, a device shall be provided to clamp the armour wires in such a way that a good electrical connection is made to the plug casing.

NOTE Types of cable normally employed in coal mines are:

- 1) flexible cable with individually screened power cores;
- 2) flexible cable with collectively screened cores;
- 3) pliable armoured flexible cable with or without individually screened power cores.

10 Socket

NOTE When associated with a circuit breaker, switch or isolator, the socket, may be provided with a mechanical interlock to ensure that the plug cannot be inserted or withdrawn without first opening such circuit breaker, switch or isolator. Any such interlocking device should be so arranged that interchangeability of plugs of different makes is not prevented.

10.1 Case

The case of the socket shall be of metal having a tensile strength of not less than 225 N/mm² when determined in accordance with the test methods given in BS EN 10002-1 and shall have the general dimensions given in Figure 5 and Figure 6 for types 1S and 1D and in Figure 7 for type 2.