
Specification for
200 A flameproof restrained and bolted
plugs and sockets for voltages not exceeding
1100 V, primarily for use in mining

Spécification des prises de courant de 200 A à bridage ou à boulonnage et
à l'épreuve de feu pour des tensions jusqu'à 1100 V, utilisées
principalement dans les mines

Spezifikation für flammenbeständige, durch einen Bügel verbundene bzw.
verschraubte Steckvorrichtungen von 200 A für Spannungen bis auf
1100 V, mit Hauptverwendung im Bergbau

Contents	Page		Page
Foreword	Inside front cover	Tables	
Cooperating organizations	Back cover	1. Requirements for insulation materials	2
Specification		2. Parameters for cable gland slip test	4
1. Scope	1	3. Parameters for contact pressure testing of contact tubes	5
2. References	1	Figures	
3. Definitions	1	1. Restrained plug showing essential dimensions for function and interchangeability (650 V mode)	7
4. Metallic components	1	2. Bolted plug showing essential dimensions for function and interchangeability (650 V mode)	8
5. Insulation	1	3. Restrained socket showing essential dimensions for function and interchangeability (650 V mode)	9
6. Contacts	2	4. Bolted socket showing essential dimensions for function and interchangeability (650 V mode)	10
7. Terminals	2	5. Contact dispositions for alternative voltage modes	11
8. Plug	2	6. Flameproof closure cap for restrained sockets showing essential dimensions for function and interchangeability	11
9. Socket	3	7. Flameproof closure cap for bolted sockets showing essential dimensions for function and interchangeability	12
10. Plug and socket assembly	3		
11. Plug coupling unit	3		
12. Dimensions	3		
13. Flameproof enclosure	3		
14. Tests	3		
15. Marking	5		
Appendices			
A. Information to be provided with enquiry and order	6		
B. Mechanical interlocking	6		

Foreword

This British Standard has been prepared, under the direction of the Mining and Quarrying Requisites Standards Committee, in order to rationalize the principal features of 200 A restrained and bolted types of plug and socket designed primarily for equipment used in mining; due cognizance has been taken of the relevant requirements of BS 4683 : Part 2.

This standard replaces BS 4673 : 1971 and that standard is therefore now withdrawn. Whereas BS 4673 made provision for plugs and sockets for Groups I and II, it should be noted that plugs and sockets to this standard are dimensioned as Group I enclosures only. In recognizing systems of 1100 V nominal working voltage, this standard introduces a plug and socket which is suitable for use on either a 650 V or 1100 V system. The standard is designed to ensure interchangeability of plugs in sockets of different

makes and to standardize the fixing dimensions of sockets; it specifies some electrical and mechanical requirements but does not purport to provide a fully detailed design.

Certification. Attention is drawn to the Health and Safety at Work etc Act 1974, the Factories Act 1961, the Mines & 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 specific safety requirements on the manufacturer and the user. The usual way of demonstrating compliance with certain of these requirements relating to the protection of electrical apparatus for use in potentially explosive atmospheres, is the production of a certificate issued by a recognized certification authority. Further information is provided in BS 5345 and CP 1003. The addresses of the recognized certification authorities in the United Kingdom are given on the inside back cover of this standard.

British Standard Specification for

200 A flameproof restrained and bolted plugs and sockets for voltages not exceeding 1100 V, primarily for use in mining

1. Scope

This British Standard specifies the dimensional and test requirements for flameproof restrained and bolted plugs and sockets (incorporating three power contacts, one pilot contact for electrical interlocking and a scraping earthing contact) primarily intended for use with mining apparatus which is connected to its power supply by means of a flexible cable. Provision is also made for plug coupling units, to enable lengths of flexible cable to be coupled together.

The standard specifies requirements for 200 A, 650 V plugs and sockets (single voltage) and requirements for 200 A, 650/1100 V plugs and sockets (dual voltage).

The dual voltage plugs and sockets are designed to be suitable for use either on a 650 V or 1100 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.

Information to be supplied by the purchaser with his enquiry or order is given in appendix A.

2. References

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

3. Definitions

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

3.1 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.

3.2 flameproof plug and socket. A plug and socket which, when its parts are properly assembled together with the cable attached, complies with the relevant requirements of BS 4683 : Part 2.

3.3 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.

3.4 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.

3.5 plug coupling unit. An assembly incorporating two socket entries providing for the insertion and engagement of plugs.

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

3.7 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.

3.8 scraping earthing contact. A device to ensure electrical continuity of the earthing connection between a plug and socket.

3.9 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. Metallic components

No part of any plug, socket, or plug coupling unit shall be made of aluminium, magnesium or titanium and of alloys containing by mass

(a) more than 15 % in total of aluminium, titanium and magnesium, and

(b) more than 6 % in total of magnesium and titanium.

No component part shall be painted or coated with preparations containing, in metallic form, aluminium, magnesium or titanium.

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

5. Insulation

5.1 Insulation materials. The material used for insulating the contact tubes and pins shall comply with the requirements listed in table 1.

Preparatory to testing insulation materials for the properties 'water absorption' and 'comparative tracking index', not less than 0.5 mm shall be removed from all the surfaces by machining and the faces shall be smoothly finished with grade no. 0 glass paper (see BS 871).

5.2 Insulators. Insulators shall be free from voids, cracks and deleterious inclusions and shall be capable of withstanding the test specified in 14.1.6.

5.3 Additional requirements for 650/1100 V (dual voltage) plugs and sockets. In addition to compliance with all requirements for 650 V (single voltage) plugs and sockets, the following requirements shall also be met.

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 10 mm.

Table 1. Requirements for insulation materials

Property	Value	Units	Test specification and method
Electric strength (90 °C)	8 (min.)	kV/mm	Method 201A or 201G (as appropriate) of BS 2782 : 1970
Volume resistivity	13 (min.)	$\log_{10} \Omega \text{ cm}$	Method 202A of BS 2782 : 1970
Tensile strength	34.5 (min.)	MPa	Method 320B of BS 2782 : Part 3 : Methods 320A to 320F
Cross breaking strength	60 (min.)	MPa	BS 2782 : Part 3 : Method 335A
Impact strength	10 (min.)	kJ/m^2	BS 2782 : Part 3 : Method 351A
Water absorption	50 (max.)	mg	Method 502G of BS 2782 : 1970
Comparative tracking index	250 (min.)	—	Test to BS 3781
Burning properties of a small specimen	Not inferior to classification X ₂	—	Appendix F of BS 3840 : 1965*

*Although it is appreciated that BS 3840 relates specifically to dough moulding compounds, the test method is to be applied to any insulation material for the purposes of this standard.

There shall be visible indication at the front of the insulator that a separator has been incorporated.

Provision shall be made for bonding the separator to the body of the plug or socket.

6. Contacts

Each plug and socket, or plug coupling unit, shall be provided with three power contacts and one pilot contact (contact tubes or contact pins, as may be appropriate) arranged as in figure 5 for the appropriate voltage mode.

7. Terminals

7.1 Power and pilot. Power terminals shall be bored to a diameter of 6 mm and be capable of being bored to a diameter of 13 mm. Pilot terminals shall be bored to a diameter of 4 mm and be capable of being bored to a diameter of 10 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 the requirements of BS 4168.

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.

7.2 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 screens in the associated cables.

8. Plug

8.1 Case. The general dimensions of the case of the plug shall be as given in figures 1 and 2. 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 MPa when determined in accordance with BS 18 : Part 1 or Part 2. If of ferrous metal, it shall be substantially non-corrodible.

The remaining part of the case shall be of any suitable metal having a tensile strength of not less than 225 MPa.

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 9.3).

8.2 Contact tubes (power and pilot). Contact tubes shall be of any suitable metal having:

- (a) a hardness of not less than 70 HB when determined in accordance with BS 240 : Part 1, and
- (b) a volume resistivity of not more than 11 $\mu\Omega \text{ cm}$ at a temperature of 20 °C.

Contact tubes shall make good electrical contact with the pins when the plug is inserted fully in the socket. Contact tubes shall conform to the dimensions given in figures 1 and 2.

When assembled, the contact tubes shall be self-adjusting to the extent necessary to accommodate at least the permitted tolerance on position.

8.3 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 the compression type and shall be provided with means to:

- (a) secure the cable,
- (b) seal the assembly against ingress of moisture, and
- (c) satisfy the relevant requirements of BS 6121 for flameproof glands.

Where a pliable wire armoured cable is to be accommodated in the plug, 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. This device may be located within the cable gland and may also incorporate means to secure and earth any protective metallic screen in the associated cable.

NOTE. The following types of cable are normally employed:

- (a) flexible cable with individually screened power cores;
- (b) flexible cable with collectively screened cores;
- (c) pliable armoured flexible cable with or without individually screened power cores.

Glands suitable for flexible cable of a type other than mentioned in the foregoing note, provided they comply with all other requirements specified herein, shall be

deemed as standard subject to agreement between the purchaser and the supplier.

9. Socket

NOTE. The socket may be provided with a mechanical interlock (see appendix B).

9.1 Case. The case of the socket shall be of any suitable metal having a tensile strength of not less than 225 MPa when determined in accordance with the test methods given in BS 18 : Part 1 or Part 2 and shall have the general dimensions shown in figures 3 and 4. If of ferrous metal it shall be substantially non-corrodible.

9.2 Contact pins (power and pilot). Contact pins shall be solid and of any suitable metal having:

- (a) a hardness of not less than 70 HB determined in accordance with BS 240 : Part 1, and
- (b) a volume resistivity of not more than $11 \mu\Omega \text{ cm}$ at a temperature of 20°C .

Contact pins shall conform to the dimensions given in figures 3 and 4.

9.3 Scraping earthing contact. The earth continuity circuit between a plug and socket shall be made by contact between the external surface of the engaging portion of the plug casing and the internal surface of scraping contacts mechanically attached and electrically connected to the socket casing.

The effectiveness of contact shall be proved by compliance with 14.2.3.

The design shall be such that the earthing contact shall be made before the power contact pins and tubes come into contact, and shall not be broken until the contact pins and tubes have separated.

9.4 Closure cap. When it is required to blank off the socket in a flameproof manner, a closure cap conforming to the dimensions given in figure 6 (restrained type) or figure 7 (bolted type) shall be provided.

9.5 Padlocking facilities for restrained socket. The socket shall be provided with two (optionally three) 9 mm diameter holes, as shown in figure 3, to enable a padlock to be fitted when required.

10. Plug and socket assembly

10.1 Creepage distance for 650/1100 V (dual voltage) plugs and sockets. With the plug and socket fully engaged, the creepage distance between any power contact and earth shall be not less than 19 mm in the interface between plug and socket. The creepage distance between any other power contact terminal and earth, whether in plug or socket, shall be not less than 24 mm.

Where insulation of the contact pins is required to maintain these creepages, the dimensions of the insulation shall conform to figures 3 and 4.

10.2 Interchangeability of insulators

10.2.1 650 V (single voltage). The design of plug and socket shall be such as to allow the insulator to be fitted only in the 650 V mode (see figure 5) and to ensure non-interchangeability of insulators with those specified in 10.2.2.

10.2.2 650/1100 V (dual voltage). The design of the plug and socket shall be such as to allow each insulator to be orientated in either the 650 V or 1100 V mode, i.e. with two keyways.

10.3 Retaining arrangements

10.3.1 Restrained type. The socket shall incorporate a device which provides means for engaging, retaining and disengaging the two portions by locating a lug in a corresponding slot in the plug and moving the plug axially relative to the socket. These operations shall be capable of being accomplished solely by means of this device which shall operate positively on the plug.

The overall dimensions of the device shall be such that no part extends beyond the profile line shown in figure 3.

The actual details, construction and dimensions of the operating device do not form part of this specification. The features standardized embrace the lug and the axial movement, the dimensions of which shall conform to figure 3.

NOTE. The device may be in the form of a screw with a square head wing-nut, or it may be a rack, or combination lever, or similar device.

10.3.2 Bolted type. Both plug and socket shall be provided with an external flange, the plug portion having clearance holes, and the socket portion tapped holes suitable for taking securing screws. The external flange of the plug portion shall be provided with means for shrouding the socket heads of the securing screws. The dimensions of the coupling screws, also the dimensions and positions of the holes and means of shrouding, are shown in figures 2 and 4.

11. Plug coupling unit

Socket entries of plug coupling units shall be designed to accept plugs of a type specified in this standard and shall meet the relevant material and dimensional requirements of this standard.

12. Dimensions

Dimensions shall conform to those given in figures 1, 2, 3, 4, 5, 6 and 7 as applicable.

13. Flameproof enclosure

All plugs and sockets purporting to comply with the requirements of this standard shall be of a type which has been certified, by the appropriate certifying authority, as flameproof in accordance with the requirements of BS 4683 : Part 2 for Group I enclosures.

NOTE. A socket of a plug and socket assembly certified to BS 4683 : Part 2 will have the necessary internal flame paths so that, when mounted on associated apparatus, it will serve to complete the flameproof enclosure of such apparatus even when the plug is withdrawn.

14. Tests

Two categories of tests are recognized, as follows:

- (a) type tests, the purpose of which is to establish that the design complies with the requirements of this standard, and
- (b) routine tests, on certain components and on each plug and each socket, at the manufacturer's works.

14.1 Type tests. Type tests shall be carried out on a plug and socket which is representative in all respects of the items intended for supply against this standard.

14.1.1 Temperature rise test. The temperature rise test shall be conducted under reasonably draught free conditions, as follows.

The socket shall be mounted on the outside of a non-metallic enclosure, the volume of which does not exceed