BRITISH STANDARD

BS 6182-2: 1982

Incorporating Amendment No. 1

Intrinsically safe power supplies for use in coal mines —

Part 2: Specification for a.c. power supplies

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Cooperating organizations

The Mining and Quarrying Requisites Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

Association of British Mining Equipment Companies*
Association of Mining Electrical and Mechanical Engineers
British Electrical and Allied Manufacturers' Association (BEAMA)*
British Quarrying and Slag Federation
Council for Electrical Equipment for Flammable Atmospheres (BEAMA)*
Engineering Equipment Users Association
Health and Safety Executive*
Institute of Quarrying
Institution of Mechanical Engineers
Institution of Mining and Metallurgy
Institution of Mining Engineers
Mechanical Handling Engineers Association
National Coal Board*
National Union of Mineworkers*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

National Association of Colliery Overmen, Deputies and Shotfirers (NACODS)
Coopted member

This British Standard, having been prepared under the direction of the Mining and Quarrying Requisites Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 September 1982

The following BSI references relate to the work on this standard:
Committee reference MQE/25
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Amendments issued since publication

Amd. No.	Date of issue	Comments
4784	February 1985	Indicated by a sideline in the margin

Contents

Foreword

This British Standard has been prepared under the direction of the Mining and Quarrying Requisites Standards Committee and specifies requirements for mains fed power supplies that provide intrinsically safe outputs suitable for use in coal mines. A range of d.c. and a.c. power supplies and rechargeable battery units is specified to give a power output ensuring both a minimum acceptable performance with connected apparatus and a maximum power output dictated by the requirements of intrinsic safety.

This standard is published in three Parts.

— *Part 1: specifies requirements for power supplies providing d.c. outputs of the following voltages:*

a) an 18 V power supply that may be used, for example, to float charge an intrinsically safe battery with a nominal discharge end-point voltage of 12 V;

b) a 12 V power supply for use where battery standby is not required, or to float charge an intrinsically safe battery with a nominal discharge end-point voltage of 7.5 V;

c) a 7.5 V power supply that may be used, for example, with equipment using logic circuits requiring 5 V for operation.

— *Part 2: specifies requirements for power supplies providing a.c. outputs. Two output voltages are specified for the following purposes:*

a) a 12 V r.m.s. output to supply intrinsically safe apparatus where maximum power availability is the predominant requirement;

b) a 15 V r.m.s. output to supply intrinsically safe apparatus where a higher operating voltage is more important than available power.

— *Part 3: specifies requirements for a range of rechargeable battery units that are to be charged from the power supplies specified in Parts 1 and 2.*

Certification. Attention is drawn to the Health and Safety at Work etc. Act 1974, 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.

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 4, 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 Part of this standard specifies requirements for the construction and testing of a range of mains fed power supply units intended to be certified intrinsically safe for use in coal mines and which provide an intrinsically safe a.c. output of the following voltages:

a) a 12 V r.m.s. output to supply intrinsically safe apparatus where maximum power availability is the predominant requirement;

b) a 15 V r.m.s. output to supply intrinsically safe apparatus where a higher operating voltage is more important than available power.

It is intended that the components forming the power supply circuit be assembled on to a chassis that may be incorporated within either a flameproof enclosure or, where the power supply unit is located outside a potentially explosive atmosphere, within some other suitable enclosure. Requirements for these enclosures are not given in this standard.

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

2 Definition

For the purposes of this standard the following definition applies.

power supply unit

an assembly of components forming a power supply circuit mounted on a metal chassis

3 Design and construction

3.1 General. The power supply shall comply with the requirements of either:

a) BS 5501-7 for group I category "ia" apparatus; or

b) BS 1259 class 1.

NOTE 1 Since the issue of BS 1259 in 1958, the certification authority in the United Kingdom, using its discretionary powers, has established in the interim more detailed requirements. Manufacturers intending to obtain certification to BS 1259 should therefore seek guidance from the certifying authority before commencing manufacture to this standard.

The power supply unit shall be designed for incorporation within one of the following:

1) a purpose designed flameproof enclosure housing only a power supply unit(s); or

2) a flameproof enclosure of other mains supplied apparatus, in which case the power supply unit shall be fitted with covers to give a degree of protection not less than IP20 as defined in BS 5490; or

3) a non-flameproof enclosure where the power supply unit is located outside a potentially explosive atmosphere.

NOTE 2 It is intended in each case that power supply units will be separately certified.

3.2 Type of power supply unit. Each type of power supply unit shall comply with the appropriate values given in Table 1.

3.3 Mains input voltage. Each power supply unit shall be designed to operate from single-phase a.c. voltages at mains frequency.

NOTE The value of the voltage is not specified as a requirement of this standard. The preferred values are 120 V and/or 240 V, or 550 V and/or 1 100 V.

3.4 Working temperature. When enclosed in the manner of **3.1** 1) or **3.1** 3), the power supply unit shall be capable of operating continuously when the enclosure is subject to ambient temperature in the range of – 5 °C to + 40 °C.

NOTE When the power supply unit is intended for enclosure in the manner of **3.1** 2), the operating temperature range should be agreed between the purchaser and the manufacturer. The preferred range is – 5 °C to + 70 °C.

3.5 Power supply circuit

3.5.1 *General.* The power supply circuit shall be as shown in Figure 1. Circuit components shall be mounted on a metal chassis having facilities for making a connection to earth. Any covers required by **3.1** 2) shall be fixed in a manner to prevent unauthorized interference and if made of metal shall be electrically connected to the metal chassis.

3.5.2 *Creepage distances and clearances to earth.* The secondary winding of the transformer and the current limiting resistance shall be mounted so that any conducting part of the circuit shall be infallibly separated from earthed metal parts by the appropriate creepage and clearance distances specified in BS 5501-7.

3.5.3 *Insulation from earth.* In addition to the requirements of BS 5501-7, the insulation resistance between all parts of the circuit connected to the secondary side of the transformer and earth shall not be less than 1 MΩ when tested at 500 V d.c.

3.6 Circuit components

3.6.1 *General.* All components shall meet the relevant requirements specified in BS 5501-7, and also Table 1 of this Part, and shall also comply with the requirements of **3.6.2** and **3.6.3**.

3.6.2 Transformer. When tested by the method given in Appendix B, the leakage inductance referred to the output winding shall not exceed 200 μH for the 12 AC power supply and 300 μH for the 15 AC power supply.

Table 1 — Output characteristics and component specifications

Type of power supply unit	Fuse rating, FS1 and FS2	Current limiting resistance R		Transformer		Minimum power supply output current
		Resistance (see note 1)	Power rating (see note 2)	Primary	Open circuit output at nominal input	
	A	Ω	W	V	V r.m.s.	
12 AC	2	16 ± 2 %	17	See note to **3.3**	11.7 to 12	200 mA at 8 V
15 AC	2	34 ± 2 %	13		14.5 to 15	125 mA at 10 V

NOTE 1 This value is calculated under the terms of paragraph 2 of clause **9** of BS 5501-7:1977.
NOTE 2 The values shown include a two-thirds derating factor as required by BS 5501-7.

Effective means shall be provided to prevent mains input connections to any adjustable voltage tappings on the transformer being easily changed, for example, soldered connections are acceptable. The primary input connections shall be clearly and unambiguously identified so that incorrect connection is improbable.

3.6.3 *Current limiting resistance.* The current limiting resistance R shall be of the value given in Table 1.

NOTE The resistance may be made up from more than one resistor providing that the combination complies with the value given in Table 1.

The inductance of the current limiting resistance shall not exceed 5 μH.

The resistance shall be capable of dissipating the power given in Table 1 without exceeding the manufacturer's maximum rated hotspot temperature when the power supply is mounted in its enclosure.

4 Marking

In addition to the marking prescribed in BS 5501-7 or BS 1259, as appropriate, the power supply chassis shall be marked with:

a) power supply type (see Table 1) and the number of this standard, i.e. BS 6182-2[1)];

b) manufacturer's serial number;

c) rated input voltage and frequency on a separate label.

In addition, when the power supply unit is intended for enclosure in the manner of **3.1** 2), the marking shall include the maximum ambient temperature as agreed between manufacturer and purchaser (see note to **3.4**). If the chassis marking is not visible with the cover fitted then the cover shall also be marked.

5 Routine tests

In addition to any tests required by BS 5501-7, the following tests shall be applied to every power supply unit in an ambient temperature of 20 °C:

a) measurement of leakage inductance for compliance with **3.6.2**;

b) measurement of the values of voltage and current for compliance with the figures given in Table 1;

c) measurement of the insulation resistance for compliance with **3.5.3**.

[1)] Marking BS 6182-2 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, Quality Assurance Division, BSI, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

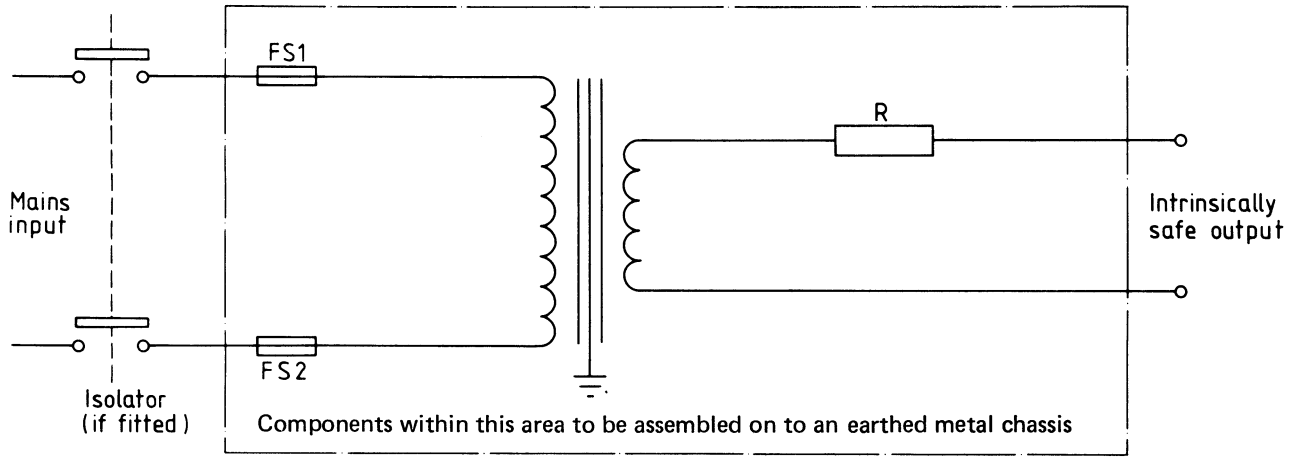

Figure 1 — Circuit arrangement for intrinsically safe a.c. power supply

Appendix A Guidance on interconnection with other equipment

The design of the power supply circuit is such that when the power supply unit is connected to a load there are limiting electrical parameters that dictate the arrangement permitted by the certifying authority. Table 2 provides guidance on this subject for the user.

Table 2 — Maximum inductance of cables and load for connection to the output of the power supply

Power supply	Maximum inductance per ohm	Maximum inductance
	μH/Ω	mH
12 AC	65	0.1
15 AC	100	0.6
NOTE The values are given extrapolated from ignition curves in BS 5501-7.		

Appendix B Measurement of leakage inductance

The primary winding shall be short-circuited and the inductance of the secondary winding measured by a suitable bridge method. If a frequency other than mains frequency is used to energize the bridge it shall be established that this does not introduce significant errors. This can be achieved by relating the method to the results obtained in a type test.

Publications referred to

BS 1259, *Intrinsically safe electrical apparatus and circuits for use in explosive atmospheres.*
BS 5490, *Specification for degrees of protection provided by enclosures.*
BS 5501, *Electrical apparatus for potentially explosive atmospheres.*
BS 5501-7, *Intrinsic safety "i".*
BS 6182, *Intrinsically safe power supplies for use in coal mines.*
BS 6182-1, *Specification for d.c. power supplies*[2)].
BS 6182-3, *Specification for rechargeable battery units*[2)].

[2)] Referred to in the foreword only.

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London
W4 4AL