BRITISH STANDARD

BS 6182-3: 1982

Incorporating Amendment Nos. 1, 2 and 3

Intrinsically safe power supplies for use in coal mines —

Part 3: Specification for rechargeable battery units

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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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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 which 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.

The address of the recognized certification authority in the United Kingdom for intrinsic safety aspects is given on the inside back cover of this standard.

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 nickel cadmium rechargeable battery units intended to be certified intrinsically safe for use in coal mines and which provide an intrinsically safe output. These battery units are rechargeable from the power supplies specified in Parts 1 and 2 of 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.

rechargeable battery unit

an assembly of cells and related components mounted within an enclosure

3 Design and construction

3.1 General. The rechargeable battery unit shall comply with the requirements of BS 5501-7 for group I category "ia" apparatus.

Each rechargeable battery unit shall consist of sealed nickel-cadmium cells, together with a charging and regulating circuit and an enclosure, and be suitable for use in any attitude.

NOTE Requirements for enclosures are not given in this standard.

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

3.3 Charging and regulating circuit

3.3.1 Each rechargeable battery unit shall incorporate a charging and regulating circuit such that:

a) the configuration of components is as shown in Figure 1;

b) there shall be no interruption of the battery supply to the load when the charging supply is disconnected;

c) the battery is protected from damage due to overcharging;

d) an externally visible green indicator light is continuously illuminated when the externally connected power supply is energized;

e) an externally available connection allows battery charging not limited by the charging and regulating circuit;

f) the facilities provided in items d) and e) shall be clearly identified together with the input and output connections;

g) the normal shelf life of the battery cells is not degraded;

h) the intrinsic safety at the output terminals of the battery unit is not adversely affected by the charging source.

3.3.2 Each rechargeable battery unit designed to be charged from a 12 DC or 18 DC power supply shall comply with the following requirements.

a) The battery charging and regulating circuit shall be such that, according to the load requirement, the battery either supplies current additional to that available from the incoming power supply or is charged from the residue of the incoming power supply.

b) Irrespective of the state of charge of the battery, at least 50 % of the current derived from the incoming power supply shall be available to the external load.

c) The current required by the regulating circuit shall not exceed 10 mA.

Table 1 — Battery unit characteristics

1	2	3	4	5	6
Battery unit type	**Nominal output voltage**	**Minimum nominal capacity of battery**[a]	**Number of cells**	**Maximum output voltage** (see **3.4.3**)	**Type of power supply unit source suitable for recharging**
	V	A h		V	
8/NC/10	8	10	6	8.4	12 DC
14/NC/7	14	7	11	15.4	18 DC
14/NC/2	14	2	11	15.4	18 DC
14/NC/2/AC	14	2	11	15.4	15 AC

[a] It is important to understand that the minimum nominal capacity of the batteries may not be realised in practice when charged from the designated power supplies.

3.3.3 The assembly of cells and the associated charging and regulating circuit shall be infallibly separated from earthed parts and any outer metallic enclosure by the appropriate creepage and clearance distances specified in BS 5501-7.

3.3.4 In addition to the requirements of BS 5501-7, the insulation resistance between all parts of the circuit and any outer metal enclosure or earth as appropriate, shall not be less than 1 MΩ when tested at 500 V d.c.

3.4 Output circuit

3.4.1 The value of the current limiting resistance shall be as given in Table 2.

NOTE The resistance may be made up from more than one resistor provided that the combination complies with value given in Table 2.

The resistance shall be capable of dissipating the power given in Table 2 without exceeding the manufacturer's rated hot spot temperature when the battery is mounted in its enclosure.

3.4.2 The fuse shall have the value given in Table 2 and shall be connected in series with the resistance so as to limit power dissipation.

3.4.3 When the unit is on charge the voltage at the output terminals, with any two faults applied, as defined in BS 5501-7, shall not exceed the value as given in column 5 of Table 1.

3.5 Working temperature. Each rechargeable battery unit shall be designed for continuous operation in an ambient temperature range of – 5 °C to + 40 °C.

3.6 Cable connections. Cable connection arrangements shall be either:

a) a terminal box or boxes with provision for armoured cable glands fitted for incoming and outgoing cables, with incoming and outgoing circuits adequately segregated; or

b) plug and socket connectors fitted subject to a suitable type being agreed between purchaser and manufacturer.

Table 2 — Component specifications

Battery nominal voltage	Current limiting resistance		Rated current of fuse
	Resistance	Power rating[a]	
V	Ω	W	A
8	1.8 ± 1 %	64	No fuse
14	4.7 ± 5 %	22	1.0

[a] The values shown include a derating factor of two-thirds as required by BS 5501-7.

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 derating factor of two-thirds as required by BS 5501-7.

4 Marking

In addition to the marking prescribed in BS 5501-7, each rechargeable battery unit shall be marked with:

a) rechargeable battery type (see Table 1) and the number of this standard, i.e. BS 6182-3[1)];

b) manufacturer's serial number.

5 Routine tests

The rechargeable battery unit supplier shall subject each battery unit to charge/discharge cycles in an ambient temperature of 20 °C until the rated capacity in Table 1 is confirmed.

[1)] Marking BS 6182-3 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 HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

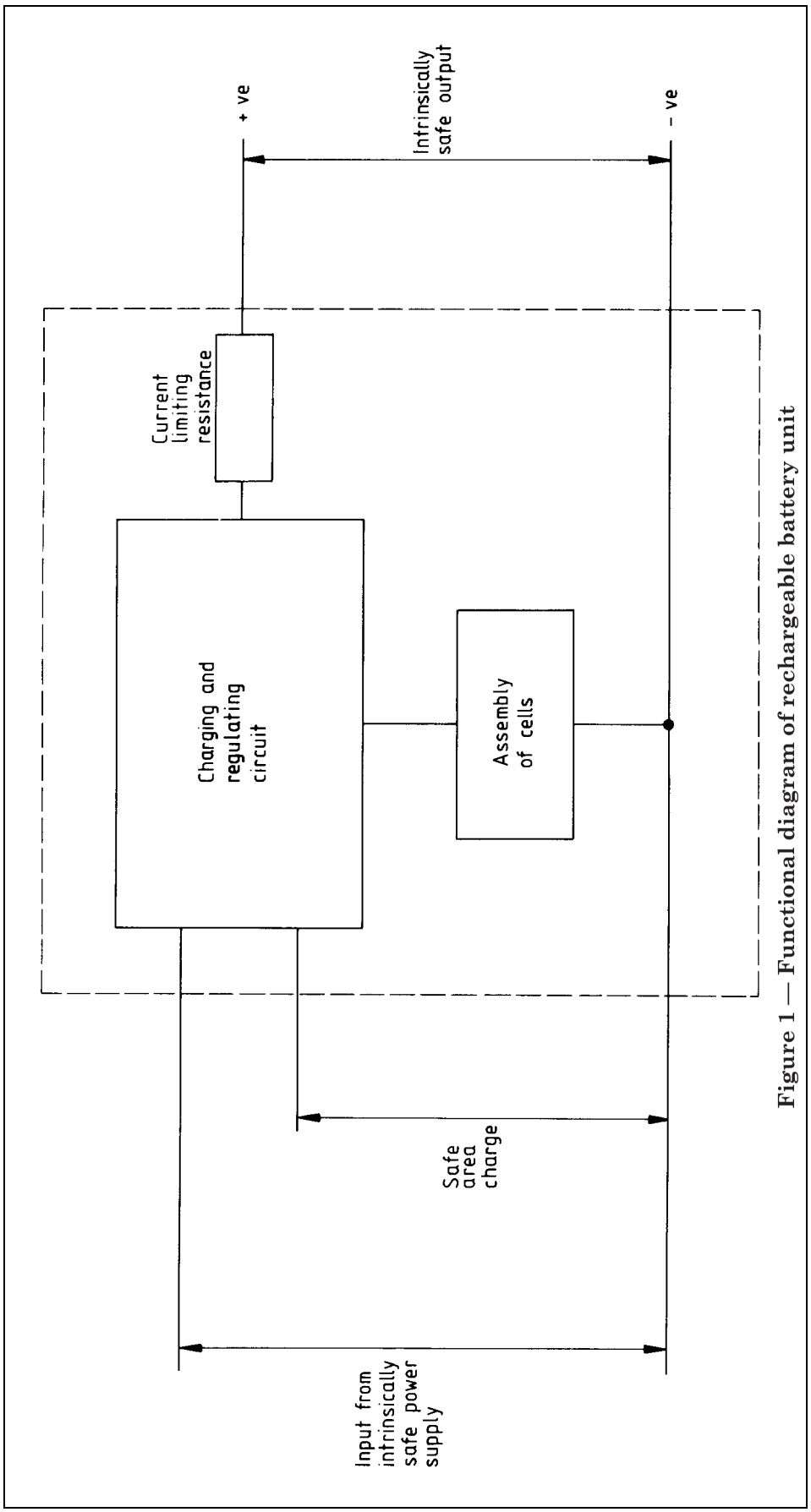

Figure 1 — Functional diagram of rechargeable battery unit

Appendix A Guidance on interconnection with other equipment

The design of the battery unit is such that when it is connected to a load there are limiting electrical parameters that dictate the arrangement permitted by the certifying authority. Table 3 provides guidance on this subject for the user.

Table 3 — Maximum inductance of cables and load for connection to the output of the power supply

a) Values extrapolated from ignition curves in BS 5501-7

Power supply	Maximum inductance per ohm	Maximum inductance
	µH/Ω	mH
8/NC/10	44	0.02
14/NC/7 14/NC/2 14/NC/2/AC	31	0.037

b) Values calculated with reference to ignition curves in IEC 79-11

Power supply	Maximum inductance per ohm	Maximum inductance
	µH/Ω	mH
8/NC/10	78	0.041
14/NC/7 14/NC/2 14/NC/2/AC	44	0.056

Publications referred to

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 6182-2, *Specification for a.c. power supplies.*

IEC 79-11, *Electrical apparatus for explosive gas atmospheres — Part 11 Construction and test of intrinsically safe and associated apparatus.*

[2)] Referred to in the foreword only.

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