

Mining type flameproof supply and control units for use systems up to 1100 V —

**Part 4: Specification for air-cooled
transformers to power drilling
machines**

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Committees responsible for this British Standard

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- Association of British Mining Equipment Companies
- British Coal Corporation
- Health and Safety Executive

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 References	1
3 Definitions	1
4 Information and requirements to be agreed and to be documented	2
5 Service conditions	2
6 Rated values	3
7 Design and construction	3
8 Verification and tests	9
9 Marking	10
Figure 1 — Outline of enclosures showing arrangements for earthing terminals and skid couplings	11
Figure 2 — Busbar chamber end flange	12
Figure 3 — Busbar interconnecting trunk with cover plate	13
Figure 4 — 650/1 100 V busbar interconnecting adaptor trunk	14
Figure 5 — 650/1 100 V skid coupling plate	15
Figure 6 — End cover for busbar chamber	16
Figure 7 — Example of outgoing cable fittings	17
Figure 8 — Envelope dimensions for padlocks	18
Table 1 — Creepage distance and clearance	8
List of references	20

Foreword

This Part of BS 5126 has been prepared under the direction of the Mining Requisites Standards Committee. It supersedes BS 5126-4:1982, which is withdrawn. This revision updates the standard to reflect today's usage for 1 100 V mining type flameproof supply and control units (commonly known in the UK as "gate-end boxes") and takes account of expected future development.

This Part of BS 5126 covers units in which the essential apparatus are air-cooled transformers to power drilling machines, whilst Parts 1, 2 and 3 cover direct-on-line motor starter units, circuit breaker units, and lighting transformer units, respectively. All have standard busbar and other fixing dimensions, enabling the different units to be fastened together to form a switchboard.

This standard is arranged to be in close alignment with IEC (International Electrotechnical Commission) criteria for various electrical features.

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 [1], the Mines and Quarries Act 1954 [2], the Regulations made under these Acts, and also any other appropriate statutory requirements or byelaws. 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 United Kingdom for Group I (Mines susceptible to firedamp) apparatus are:

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 20, 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 BS 5126 specifies requirements for flameproof supply and control units designed primarily for use in the coal mining industry on 1 100 V three-phase a.c. circuits containing three-phase transformers intended for supplying electrically operated drilling machines. Provision is also made for operation on other voltages, where required.

In addition to the definitive requirements, this standard also requires the items detailed in clause 4 to be documented. For compliance with this standard, both the definitive requirements and the documented items have to be satisfied.

NOTE 1 To facilitate cross-reference and subject location recall between the Parts of this standard, a uniformity of clause arrangements is maintained. At subclause level, because of the different purposes and individual technical features of the four types of control unit, some differences in title and/or subclause arrangements have been unavoidable, but have been made without disturbing the general pattern.

NOTE 2 The figures in this standard show only those features and dimensions essential for function and interchangeability. Dimensions are in millimetres. Untoleranced values less than 100 mm are ± 0.15 mm and those greater than 100 mm are ± 0.25 mm.

2 References

2.1 Normative references

This Part of BS 5126 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on page 20. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 5126 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 5126 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 Definitions

For the purposes of this Part of BS 5126, the following definitions apply¹⁾.

3.1

supply and control unit (gate-end box)

a flameproof enclosure containing electrical apparatus, such as transformer, control gear, switchgear and or protective gear, designed primarily for use underground

NOTE 1 In this Part of BS 5126, the term “unit” has in many instances been used in abbreviation of “supply and control unit”.

NOTE 2 For the purposes of this Part of BS 5126, the enclosed apparatus is essentially a three-phase air-cooled transformer with associated equipment to provide a supply for drilling and other similar low voltage machines.

3.2

switch disconnecter (isolating switch)

a switch which isolates a circuit and is capable of breaking not less than its rated current at rated voltage

3.3

cable half coupler (flit plug)

a detachable cable sealing box utilizing contact tubes and pins to facilitate ready connection to, or disconnection from, a similar unit or other apparatus

3.4

cable coupler adaptor

a device used to connect either a cable half coupler or other type of cable termination to apparatus. If used to connect a cable half coupler it may either be separate from, or be integral with, the enclosure of the apparatus

3.5

cable sealing box

a device designed to receive and protect the end of the cable, with provision for sealing the conductors and the insulating material of the cable with a filling compound and having a cable gland for attaching the cable to the box, together with any terminals provided for connection to the conductors of the cable within the box. The box may form part of, or be detachable from, the apparatus with which it is associated

3.6

detachable cable sealing box

a cable sealing box which can be detached from associated apparatus without disturbing the sealing of the cable

3.7

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

3.8

bolted cable 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 cannot be disengaged from the socket without the use of a tool

¹⁾ The terms in brackets are those commonly used in practice.

3.9

overcurrent protection

a device that causes the circuit being protected to be automatically disconnected from the supply when the current exceeds a predetermined value

NOTE The preferred term “overcurrent” is used throughout this standard, but in certain other British Standards to which reference is made the term “overload” may be used when referring to these devices.

3.10

instantaneous short circuit protection

a device that causes the circuit being protected to be automatically disconnected from the supply without intentional time delay when the current exceeds a predetermined value

4 Information and requirements to be agreed and to be documented

4.1 Information to be supplied by the purchaser

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 5126-4:1993;
- b) the service conditions, if other than those specified in clause 5;
- c) information relating to the drill/motor to be controlled, where known:
 - 1) full load current or rated output of the drill/motor in kilowatts;
 - 2) any information concerning special conditions likely to affect the performance of the transformer and contactor;
- d) any information concerning special conditions likely to affect the performance of the unit;
- e) the voltage, if less than 1 100 V (see 6.1);
- f) the rated frequency of the supply system and its deviation if greater than ± 2 Hz (see 6.2);
- g) the no-load output voltage (see 6.3);
- h) the rated kilovolt-ampere output (see 6.4);
- i) the rated thermal current of busbars (see 6.5);
- j) whether two or more units are to be coupled together (see 7.4);
- k) whether provision for incoming and throughgoing cable fittings is required at one or both ends of the unit, and the type of fitting required (see 7.6.1);

l) the type of outgoing cable fittings, together with the number, if any, of the auxiliary cable fittings needed; the control and interlock circuit for the restrained plug and socket of the outgoing cable, if other than one conforming to BS 3101:1986 and BS 7202:1989 (see 7.6.2);

m) whether secondary means of isolation are to be fitted (see 7.8.2);

n) whether any auxiliary circuits are to be connected across the power circuit (see 7.10.4);

o) live compartment indication in the switch disconnector chamber (see 7.14);

p) whether voltage-free auxiliary contacts are to be fitted and whether they are to be used for control (see 7.21);

q) the testing authority for type tests, if other than the manufacturer (see 8.1.2);

r) the certifying authority, if other than a UK authority (see foreword).

4.2 Items to be agreed between the contracting parties

The following items to be agreed between the contracting parties, which are specified in the clauses referred to, 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) additional protection to take account of overloading (see 7.10.1.1 and 7.10.1.3);
- b) whether earth fault electrical lockout is to be fitted (see 7.10.3);
- c) pilot-to-earth test facility (see 7.10.6);
- d) the form of control, if other than specified in 7.11;
- e) provision of a test feature (see 7.14.2);
- f) the terminals to be marked and the information to be displayed (see 9.2);
- g) the form of the diagrams (see 9.5).

5 Service conditions

Within the limits of their ratings, units shall be suitable for use in installations operating under the intended service conditions. Unless otherwise specified by the purchaser [see 4.1 b)], these service conditions shall be not more severe than the following.

- a) *Ambient temperature*: a peak value not exceeding 40 °C with an average value not exceeding 35 °C over 24 h periods. The lower limit of the ambient temperature is – 5 °C.
- b) *Altitude*: an altitude at the site of installation not exceeding 2 000 m (6 600 ft.) above sea-level.

6 Rated values

6.1 Supply voltage

The maximum rated supply voltage shall be 1 100 V. Units shall operate normally within the limits -10% and $+6\%$ of the declared rated supply voltage.

Voltages less than 1 100 V shall be specified by the purchaser [see 4.1 e)].

6.2 Supply frequency

Units shall have a rated supply frequency within the range 40 Hz to 62 Hz.

The purchaser shall state the supply frequency required, and its deviation if greater than ± 2 Hz, on the enquiry and/or order [see 4.1 f)].

NOTE The standard frequency is 50 Hz. The normal deviation is not greater than ± 2 Hz.

6.3 Output voltage

Unless otherwise specified by the purchaser [see 4.1 g)], the rated no-load output voltage shall be 125 V.

6.4 Kilovolt-ampere output

Unless otherwise specified by the purchaser [see 4.1 h)], the rated kilovolt-ampere output shall be one of the following:

- a) 1.25 kV A for single circuit units;
- b) 2.5 kV A for double circuit units.

6.5 Thermal current of busbars

Unless otherwise specified by the purchaser [see 4.1 i)], the rated thermal current of busbars shall be one of the following:

- a) 300 A;
- b) 400 A.

7 Design and construction

7.1 General

The flameproof parts of a unit supplied in accordance with this standard shall conform to one of the following standards:

- a) BS 4683-2:1971;
- b) BS 5501-5:1977;
- c) BS 6709:1986;

for Group I enclosures, with fittings in accordance with 7.4, 7.5 and 7.6. However, units designed and certified before the date of publication of this standard, which have been certified as flameproof in accordance with BS 229 for Group I gas (methane/firedamp), shall be deemed to conform to this standard provided that the requirements of all other clauses are met.

The design and construction of units shall minimize the risk of inadvertent closure of relays or contactors arising from either:

- 1) pressure changes within the enclosure; or
- 2) changes in the parameters of electronic components or programmable electronic systems due to variations in temperature or electrical interference.

Any circuits required to be intrinsically safe shall conform to BS 1259:1958 appropriate to Class 1, or BS 5501-7:1977 appropriate to Group I.

NOTE 1 Where a unit conforming to this standard and to BS 5501 is to be directly connected to apparatus conforming to BS 229 or BS 1259 or BS 4683, it may be necessary to construct the unit such that it conforms to BS 6709.

NOTE 2 Where a unit is not to be connected as in note 1, in order to promote the increasing use of BS 5501 in parallel with the progressive phasing out of Group I apparatus conforming to earlier standards, such a unit should conform to BS 5501.

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, titanium, either singly or in combinations, providing that the total content of these three constituents does not exceed 15% (m/m) of the alloy and the combined content of magnesium and titanium does not exceed 6% (m/m) of the alloy.

NOTE 3 These limitations have been imposed to avoid the hazards of incendive sparking due to friction between rusted steel or iron and the metals listed.

7.2 Supply and control unit assembly

NOTE A supply and control unit comprises a basic unit together with optional features.

The basic unit shall conform to the following:

- 7.3 for the enclosing case
- 7.6.2 for the fittings for the outgoing cable
- 7.7 for busbars
- 7.8.1 for the means of isolation (primary)
- 7.8.3 for the means of reversing
- 7.9 for the transformer
- 7.10.1 for overcurrent and short circuit protection
- 7.10.2 for earth fault protection for main outgoing conductors
- 7.10.5 for undervoltage protection
- 7.11 for provision for control
- 7.12 for external control devices
- 7.13 for provision for earthing
- 7.14 for contactors
- 7.16 for live compartment indication in the main chamber
- 7.18 for internal protective cover

Where supplied, the optional features shall conform to the following:

- 7.4** for coupling of units
- 7.5** for busbar end cover
- 7.6.1** for the fittings for the incoming and throughgoing cables
- 7.8.2** for the means of isolation (secondary)
- 7.10.1.3** for outgoing circuit protection
- 7.10.3** for the earth fault electrical lockout for outgoing main conductors
- 7.10.4** for auxiliary circuit protection
- 7.10.6** pilot-to-earth fault protection and test facility
- 7.14.2** for the test feature
- 7.15** for selection and indication of secondary voltage
- 7.16** for live compartment indication in the switch disconnecter chamber
- 7.21** for voltage-free auxiliary contact

The supply and control unit, i.e. the basic unit plus the optional features, shall conform to the following:

- 7.17** for temperature limits
- 7.19** for creepage distance and clearance
- 7.20** for insulating material

7.3 Enclosing case

The enclosing case shall comprise a main chamber and a switch disconnecter busbar chamber, each with access covers. It shall be equipped with lifting points and shall incorporate, or be adapted for mounting on, skids to facilitate transport (see Figure 1).

The design shall include such provision as will permit, without structural alteration, the attachment of adaptors, cable fittings, interconnecting trunks, etc. as specified in **7.4**, **7.5** and **7.6**, in any combination that may be required for normal installation and operation of the unit. The busbar coupling flange shall conform to the dimensions and tolerances shown in Figure 2.

7.4 Coupling of units

The purchaser shall state on the enquiry and/or order [see 4.1 j)] whether two or more units are to be coupled together. When this is required interconnecting busbar trunking shall be fitted. The interconnecting busbar trunk shall conform to Figure 3.

Where an 1 100 V unit having a busbar chamber end flange as shown in Figure 1 is to be used for operation on a system voltage of up to 650 V, and is to be coupled to a unit having a busbar chamber end flange as shown in Figure 1 of BS 787-1:1969, a busbar interconnecting adaptor trunk as shown in Figure 4 shall be fitted.

Where busbar trunking is used to connect two units together, means shall be provided as shown in Figure 1. Where a trunk as shown in Figure 4 is used, the coupling plate shown in Figure 5 shall be used.

NOTE 1 The coupling arrangements need to be sufficiently robust to prevent, in normal use, undue strain being placed on the flanges of the unit or those of the interconnecting busbar trunking.

NOTE 2 Where skids are provided, it is usual either for the skids to be continuous or, where individual skids are fitted, for coupling plates to be bolted between the skids.

NOTE 3 In some designs the bottom of the enclosing case can be utilized as an individual skid.

7.5 Busbar end cover

Where cable attachments conforming to **7.6.1** or couplings conforming to **7.4** are not used, an end cover as shown in Figure 6 shall be fitted to complete the enclosure.

7.6 Fittings for cables

7.6.1 Incoming and throughgoing cable

The busbar chamber shall be fitted with a means of attaching incoming or throughgoing cables. The purchaser shall state on the enquiry and/or order whether provision for the fittings is required at one or both ends of the unit and which of the following types is to be used [see 4.1 k)]:

- a) an adaptor for the reception of a cable half coupler, e.g. as specified in BS 3454;
- b) a compound filled detachable cable sealing and dividing box;

NOTE A suitable compound should conform to BS 7383.

- c) any other fitting which is acceptable to the certifying authority²⁾.

The cable details shall be given by the purchaser in accordance with the appropriate British Standard.

7.6.2 Outgoing cable

For the attachment of the outgoing cable, the case of the unit shall be fitted with sockets for the reception of suitable plugs which, when combined, form plug and socket couplings.

²⁾ See foreword.