

Specification for

PVC-insulated cables for switchgear and controlgear wiring

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cables and Insulation Standards Policy Committee (CIL/-) to Technical Committee CIL/20, upon which the following bodies were represented:

- Aluminium Federation
- Association of Consulting Engineers
- Association of Manufacturers of Domestic Electrical Appliances
- British Approvals Service for Cables
- British Cable Makers Confederation
- British Plastics Federation
- British Railways Board
- British Steel Industry
- British Telecommunications plc
- Department of the Environment (Property Services Agency)
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- ERA Technology Ltd.
- Electricity Supply Industry in England and Wales
- Engineering Equipment and Materials Users Association
- Institution of Electrical Engineers
- London Regional Transport

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- Association of Supervisory and Executive Engineers
- British Electrical Systems Association (BEAMA Ltd.)
- British Non-Ferrous Metals Federation
- Chartered Institution of Building Services Engineers
- Electrical Contractors Association
- Electrical Installation Equipment Manufacturers Association (BEAMA Ltd.)
- Engineering Industries Association GAMBICA (BEAMA Ltd.)
- Lighting Industry Federation Ltd.
- National Association of Lift Makers
- Portable Tool Manufacturers Association
- Transmission and Distribution Association (BEAMA Ltd.)

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Foreword

This new edition of BS 6231 has been prepared under the direction of the Cables and Insulation Standards Policy Committee and supersedes BS 6231:1981 which is withdrawn. It introduces technical changes but does not reflect a full review or revision of this standard, which will be undertaken in due course.

As specified in the previous edition, this standard follows the voltage designation for some types of harmonized single-core PVC-insulated cables in CENELEC¹⁾ Harmonization Document HD 21.

Despite the fact that CENELEC has now agreed to a 600/1 000 V rating for some cables of the types specified in BS 6004 when installed inside equipment in protected conditions, the electrical control gear industry has requested continuation and revision of BS 6231, rather than its withdrawal, because some requirements cannot always be fulfilled by the use of cables complying with other British Standards.

To meet the requirements of the electrical switchgear and controlgear industry, a new range of cables, types CR, CU and CK, has been introduced for operation at a designated temperature of 85 °C. These cables are dimensionally similar to the existing types BR, BU and BK.

Amendment No. 1 upgrades the type 5 hard insulation currently specified for cables type CR, CU, and CK to type TI 3 with a higher designated temperature for these types of cable.

The opportunity has also been taken to align types AU and AK cables contained in this standard with those of BS 4808-2.

Appendix A gives guidance on installation and operating temperatures.

Cables complying with this standard also comply, for corresponding sizes, with the requirements of the corresponding classes of BS 4808, BS 6004 and BS 6500. Because of the more stringent requirements of this standard, the converse is not necessarily true.

Differences in the text between this edition and BS 6231:1981 are indicated by a vertical line in the margin.

Certification. Attention is drawn to the certification facilities described on page 9 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 12, 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⁾ European Committee for Electrotechnical Standardization

1 Scope

This British Standard specifies requirements for single-core non-sheathed cables, including flexible cables, used for the wiring of switch, control, metering, relay and instrument panels of power switchgear, and for such purposes as internal connections in rectifier equipment and in motor starters and controllers.

Attention is drawn to the ranges of cables in Table 1 and Table 3 of BS 6004:1990, in Table 17 of BS 6500:1990 and also in BS 4808-2. The revised voltage rating of cables in Table 1 of BS 6004 when installed inside equipment in protected conditions should be noted. When appropriate, these cables may be used in place of cables complying with the specifications of this standard, but their less stringent dielectric and other test requirements should be noted.

The types of cable specified in this standard are as follows.

Type	Form of conductor	Designated temperature	Rated Voltage
AU	Rigid, round, solid	70 °C	60 V
AK	Flexible	70 °C	60 V
BR	Rigid, round, stranded	70 °C	600/1 000 V
BU	Rigid, round, solid	70 °C	600/1 000 V
BK	Flexible	70 °C	600/1 000 V
CR	Rigid, round, stranded	90 °C	600/1 000 V
CU	Rigid, round, solid	90 °C	600/1 000 V
CK	Flexible	90 °C	600/1 000 V

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 definitions relating to electric cables given in BS 4727 apply.

4 Temperature ratings

The designated temperatures quoted are the temperatures already assigned to the same materials in BS 6004, BS 6141, BS 6500 and BS 6746. Under service conditions the materials are within thermal limits provided the combination of ambient temperature and temperature rise due to load results in a conductor temperature not exceeding the designated temperature.

NOTE Attention is drawn to appendix A which gives guidance on installation and operating temperatures.

5 Voltage designations

5.1 Types AU and AK cables shall be designated by the rated voltage which is 60 V. They are intended for use where the operating voltage to earth does not exceed 60 V. They are suitable for wiring circuits which are tested with direct current at a voltage not exceeding 500 V.

NOTE Where the fault power is low and adequate mechanical protection is provided, these types may be used at voltages higher than 60 V by agreement between the purchaser and the manufacturer.

5.2 Types BU, BR, BK, CU, CR and CK cables shall be designated by the rated voltages U_0 and U expressed in the form U_0/U , where U_0 is the power-frequency voltage to earth for which the cable is designed, and U is the power-frequency voltage between phase conductors for which the cable is designed.

The rated voltage for these cables is 600/1 000 V. These cables are intended for use at alternating voltages not exceeding 600 V to earth, and direct voltages not exceeding 1 000 V to earth. They are suitable for wiring circuits for which the prescribed alternating test voltage, when installed in the equipment, does not exceed 4 kV r.m.s. for 1 min.

6 Identification

6.1 All cables shall be identified by colour as listed in Table 5, Table 6, Table 7, Table 8 and Table 9. The colour shall be either throughout the whole of the insulation or on its surface.

6.2 For types AU and AK cables, the colours of bi-colour combinations shall be uniform and the form shall be either continuous helical marking or ring marking which, when viewed from any side, shall be readily identifiable within every 15 mm of length.

6.3 On types BU, BR, BK, CU, CR and CK cables marked with the bi-colour combination green/yellow, the distribution of these colours shall comply with the following condition.

For every 15 mm length of core, one of the colours shall cover at least 30 % and not more than 70 % of the surface of the core, the other colour covering the remainder.

NOTE The green and yellow colours, when combined as specified above, are exclusively recognized as a means of identification of cables intended to be used for earthing or similar protection.

6.4 The colours of the cables shall be durable and easily discernible.
Compliance shall be checked by the test described in clause 13.

7 Marking (not applicable to types AU and AK)

7.1 Types BU, BR, BK, CU, CR and CK cables shall be provided with an indication of origin consisting of either an identification thread or the continuous marking of the manufacturer's name or trade mark. This marking may be by printing, indenting or embossing.

7.2 If coloured threads are used, the colours shall be in accordance with those registered in PD 2379.

The colours of identification threads shall be easy to recognize or shall become recognizable by cleaning with petrol or any other suitable solvent, if necessary.

7.3 The designated temperature shall be indicated on types CU, CR and CK cables in the following form:

HEAT RESISTING 90.

The marking shall be by printing, indenting or embossing, and shall be legible and easily discernible.

This marking may be combined with the marking specified in 7.1.

7.4 Marking shall be regarded as continuous if the gap between the end of one complete inscription and the beginning of the next does not exceed 200 mm.

7.5 Any marking by printing shall be durable.
Compliance shall be checked by the test described in clause 13.

8 Conductors

8.1 The conductors shall be circular, plain or tinned, annealed copper conductors as specified in 8.2 to 8.6.

8.2 For type AU cables, the conductors shall be tinned annealed copper conductors. The number and nominal diameter of wires and the maximum resistance at 20 °C shall comply with the appropriate requirements given in Table 1.

Table 1 — Constructional details and maximum resistance for small circular tinned annealed copper conductors not included in BS 6360

Nominal cross-sectional area	Number and nominal diameter of wires	Maximum resistance of conductor at 20 °C
mm ²	mm	Ω/km
0.2	1/0.50	92.2
0.28	1/0.60	64.1
0.5	1/0.80	36.0

8.3 For type AK cables, the conductors shall be tinned annealed copper conductors. They shall comply with the appropriate requirements of BS 6360 for class 5 conductors.

8.4 For types BK and CK cables, the conductors shall be either plain annealed or tinned annealed copper conductors. They shall comply with the appropriate requirements of BS 6360 for class 5 conductors.

8.5 The conductors of types AU and AK cables, and of types BK and CK when tinned annealed copper conductors are used, shall comply with the requirements for solderability when tested in accordance with Test Ta, Method 1: Solder bath at 235° C, of BS 2011-2.1T:1981.

8.6 For all other types of cable the conductors shall be plain annealed copper complying with the appropriate requirements of BS 6360 for class 1 or class 2 conductors.

9 Insulation

9.1 The insulation shall be PVC compound of the following types as designated in BS 6746 and shall comply with the appropriate requirements of that standard.

Types AU and AK cables: type 2 hard insulation, or type TI 1 general-purpose insulation.

Types BU, BR and BK cables: type TI 1 general-purpose insulation.

Types CR, CU and CK cables, type TI 3 insulation.

Compliance shall be checked by carrying out the tests indicated in the appropriate column of Table 10.