

Specification for

PVC-insulated cables for switchgear and controlgear wiring

ICS 29.060.20

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Committees responsible for this British Standard

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- Association of Consulting Engineers
- Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd)
- British Approvals Service for Cables
- British Cable Makers Confederation
- British Plastics Federation
- British Retail Consortium
- Chartered Institution of Building Services Engineers
- Department of Trade and Industry — Consumer Safety Unit, C A Division
- Electricity Association
- ERA Technology Ltd.
- Electrical Installation Equipment Manufacturers Association (BEAMA Ltd.)
- Engineering Industries Association
- Institution of Incorporated Executive Engineers
- Lift and Escalator Industries Association
- London Underground Ltd.
- Portable Electric Tool Manufacturers Association
- Transmission and Distribution Association (BEAMA Ltd.)

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Foreword

This new edition of BS 6231 has been prepared by Technical Subcommittee GEL/20/1 and supersedes BS 6231:1990 which is withdrawn.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 adopts the voltage designation for some types of harmonized single-core PVC-insulated cables in CENELEC Harmonization Document HD 21.

Although 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 controlgear 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 conforming to 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.

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

Annex A (informative) gives guidance on installation and operating temperatures.

Cables conforming to this standard are deemed also to conform, for corresponding sizes, to 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.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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Summary of pages

This document comprises a front cover, an inside front cover, page i and ii, pages 1 to 12 and a back cover.

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.

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 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 2011:1981, *Environmental testing — Part 2.1T: Test T Soldering*.

BS 4066-1, *Tests on electric cables under fire conditions — Part 1: Method of test on a single vertical insulated wire or cable*.

BS 4066-2, *Tests on electric cables under fire conditions — Part 2: Method of test on a single small insulated wire or cable*.

BS 4727, *Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms — Part 2: Terms particular to power engineering Group 08 Electric cables*.

BS 5099, *Spark testing of electric cables*.

BS 6360, *Specification for conductors in insulated cables and cords*.

BS 7655-3.1, *Specification for insulating and sheathing materials for cables — Part 3: PVC insulating compounds — Section 3.1: Harmonized types*.

BS 7655-3.2, *Specification for insulating and sheathing materials for cables — Part 3: PVC insulating compounds — Section 3.2: Hard grade types*.

BS EN 60811-1-1:1995, *Insulating and sheathing materials for electric cables. Common test methods — Part 1-1: General application — Measurement of thickness and overall dimensions. Tests for determining the mechanical properties*.

PD 2379, *Register of colours of manufacturers' identification threads for electric cables and cords*.

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 assigned to the same materials in BS 6004, BS 6500 and BS 7655. The combination of ambient temperature and temperature rise due to load should not result in a conductor temperature exceeding the designated temperature.

NOTE Attention is drawn to annex 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 d.c. 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 Tables 5, 6, 7, 8 and 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 conform to the following condition.

On the core marked with the bi-colour combination green/yellow, the distribution of the colours shall be such that for every 15 mm length of core, one of these colours shall cover at least 30 % and at most 70 % of the surface of the core, while the other colour covers the remainder of the surface.

NOTE 1 In cases of dispute and where appropriate to the method of colour marking of the insulation, a suitable test for checking conformity is given in BS 6469-99.1:1992, clause 8.

NOTE 2 Information on the use of the colours green/yellow. It is understood that the colours green and yellow when they are combined as specified above are recognized exclusively as a means of identification of the core intended for use as earth connection or similar protection.

6.4 The colours of the cables shall be durable and easily discernible.

Conformity 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.

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

7.4 Each specified mark shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed 275 mm.

7.5 Any marking by printing shall be durable.

Conformity shall be checked by the test prescribed 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 conform to the appropriate requirements given in Table 1.

8.3 For type AK cables, the conductors shall be tinned annealed copper conductors. They shall conform to 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 conform to 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 conform to the requirements for solderability when tested in accordance with Test Ta, Method 1 : Solder bath at 235 °C, given in BS 2011-2.1T:1981.

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

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

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