

Specification for

Conductors in insulated cables and cords

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 United Kingdom
- 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 Supervisory and Executive Engineers
- British Non-Ferrous Metals Federation
- Ministry of Defence

This British Standard, having been prepared under the direction of the Cables and Insulation Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 30 April 1991

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Foreword

This edition of BS 6360 has been prepared under the direction of the Cables and Insulation Standards Policy Committee and it supersedes BS 6360:1981, which is withdrawn.

This edition includes alterations introduced by Amendment Nos 1 and 2 to BS 6360:1981 (published in September 1983 and March 1985 respectively) together with some further technical changes to bring the standard up to date but it does not reflect a full review of the standard which will be undertaken in due course.

The 1981 edition revised the requirements for copper conductors in insulated cables and cords included in the first edition of this standard and it also included and revised the requirements for aluminium conductors in insulated cables and copper-clad aluminium conductors in insulated cables previously given in BS 6791:1969 and BS 4990:1973 respectively.

This edition does not include the specification for copper-clad aluminium conductors.

This standard is intended for use in the preparation of standards for electric cables so that the cable specification can either cross refer to this standard or include the appropriate information.

For conductors of the types used in cables and cords covered by CENELEC¹⁾ Harmonization Documents HD 21 and HD 22 and their supplements, this standard implements CENELEC Harmonization Document HD 383 for which the reference document is IEC²⁾ Publication 228:1978 "Conductors of insulated cables".

The content of this standard differs from that of IEC Publication 228 as follows:

- a) The requirements for metal-coated aluminium and plain or metal-coated aluminium alloy have not been included as these types of material are not in general use in the United Kingdom.
- b) Additional requirements have been included covering the following items as these are necessary for other British Standards:
 - 1) materials for aluminium conductors;
 - 2) hard-drawn copper conductors;
 - 3) tests for tinning and mechanical properties of wires when these are specifically required for cable specifications;
 - 4) sectoral solid aluminium conductors previously covered in BS 6791;
 - 5) three nominal cross-sectional areas of flexible copper conductors, 0.22 mm², 1.25 mm² and 1.35 mm².

The most notable differences in requirements in this standard from those in the British Standards it replaces are as follows.

- a) For conductors in cables for fixed installations the maximum resistance specified for each cross-sectional area of the same metal (i.e. copper or aluminium) is the same for single and multicore cables and for solid and stranded conductors, whatever the number of wires.

However the differences between plain and metal-coated copper conductors is maintained.

- b) For the nominal cross-sectional areas up to and including 10 mm², the specified maximum resistance of aluminium conductor is the same as for the next smaller standard nominal cross-sectional area of copper conductor.

Consistent with IEC Publication 228, the smallest nominal cross-sectional area of shaped cross section is now 25 mm², and the designations by the classes 1, 2, 5 and 6 follow the nomenclature of IEC Publication 228.

¹⁾ European Committee for Electrotechnical Standardization.

²⁾ International Electrotechnical Commission.

Appendix E constitutes a guide to dimensional limits of circular conductors and includes other subsidiary information.

This edition includes the necessary amendment to align with Amendment 1 to HD 383 S2 being the endorsement of IEC 228 and IEC 228A.

Differences in the text between this edition and BS 6360:1981 are indicated by a sideline in the margin.

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.

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 to iv, pages 1 to 16, 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 British Standard specifies the nominal cross-sectional areas and requirements, including numbers and sizes of wires and resistance values, for conductors in electric cables and cords of a wide range of types. These conductors include solid and stranded copper and aluminium conductors in cables for fixed installations and flexible copper conductors.

The applicability of this standard to a particular type of cable is as specified in the standard for the type of cable. It does not apply, for example, to conductors for telecommunication purposes, and for some cables, for example flexible cables having the cores twisted together with unusually short lays, where the requirements specified for the class of conductors apply only in part.

2 References

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

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1

metal-coated

coated with a thin layer of metal, such as tin, tin alloy or lead alloy

4 Classification

The conductors have been divided into four classes, 1, 2, 5 and 6. Those in classes 1 and 2 are intended for use in cables for fixed installations, class 1 being solid conductors and class 2 stranded conductors. Classes 5 and 6 are intended for use in flexible cables and cords, class 6 being more flexible than class 5.

5 Materials

5.1 Introduction. The conductors shall consist of one of the following:

- plain or metal-coated annealed copper
- plain or metal-coated hard-drawn copper
- aluminium or aluminium alloy

as specified for the different types of conductors in **5.2** and **5.3** and in clauses **6** and **7**.

NOTE To avoid a proliferation of different resistance values for aluminium and aluminium alloy conductors, the same values are quoted for all types. To achieve this standardization of resistance, there may be a variation in wire sizes used for the same nominal cross-sectional areas according to the particular material used.

5.2 Solid aluminium conductors. Circular and shaped solid aluminium conductors of nominal cross-sectional area 50 mm^2 and above, and all sectoral circular aluminium conductors, shall be made from aluminium of material 1350 as specified in BS 3988.

Circular and shaped solid aluminium conductors of nominal cross-sectional area 35 mm^2 and below shall be made from aluminium of material 1350 as specified in BS 3988 or, at the option of the manufacturer, from material 1350 as specified in BS 2627, the tensile strength of which shall not exceed the maximum specified for materials in the conditions as follows:

up to and including 16 mm^2	H6
25 mm^2 and 35 mm^2	H4

5.3 Stranded aluminium conductors. Stranded aluminium conductors shall be made from aluminium of material 1350 as specified in BS 2627. For nominal cross-sectional areas 16 mm^2 and above the material shall be in the H68 condition; for nominal cross-sectional areas 10 mm^2 and below the tensile strength shall not exceed the maximum specified for material in the H68 condition.

6 Conductors for fixed installations

6.1 Solid conductors (class 1)

6.1.1 Solid conductors (class 1) shall consist of one of the following:

- plain or metal-coated annealed copper
- plain or metal-coated hard-drawn copper
- aluminium or aluminium alloy

6.1.2 Solid copper conductors shall be of circular cross section.

NOTE The solid copper conductors having nominal cross-sectional areas of 25 mm^2 and above are examples of conductors for particular types of cable and not for general purposes.

6.1.3 Solid aluminium conductors of sizes up to and including 16 mm^2 shall be of circular cross section. Sizes from 25 mm^2 up to 300 mm^2 shall be of circular cross section for single-core cables and shall be of either circular or shaped cross section for multicore cables.

Sizes above 300 mm^2 for single-core cables shall be circular sectoral comprising four solid sectors, each of the shape appropriate for a four-core cable, laid-up together and suitably bound.

NOTE These conductors are known as sectoral conductors and are available in the conductor sizes of 380 mm^2 and above shown in Table 1.

6.1.4 The resistance of each conductor at 20 °C when determined in accordance with clause 8 shall not exceed the appropriate maximum value given in Table 1.

6.2 Stranded circular non-compacted conductors (class 2)

6.2.1 Stranded circular non-compacted conductors (class 2) shall consist of one of the following:

- plain or metal-coated annealed copper
- plain or metal-coated hard-drawn copper
- aluminium or aluminium alloy

Stranded aluminium conductors shall normally have a cross-sectional area not less than 10 mm², but 4 mm² and 6 mm² may be used subject to the special consideration of the suitability of the conductor for the type of cable and its applications.

6.2.2 The wires in each conductor shall all have the same nominal diameter.

6.2.3 The number of wires in each conductor shall be not less than the appropriate minimum number given in Table 2. The minimum numbers of wires are not specified for cross-sectional areas from 1 200 mm² to 2 000 mm².

6.2.4 The resistance of each conductor at 20 °C when determined in accordance with clause 8 shall not exceed the appropriate maximum value given in Table 2.

6.3 Stranded compacted circular conductors and stranded shaped conductors (class 2)

6.3.1 Stranded compacted circular conductors and stranded shaped conductors (class 2) shall consist of:

- plain or metal-coated annealed copper, or
- plain aluminium.

Stranded compacted circular aluminium conductors shall have a nominal cross-sectional area not less than 16 mm². Stranded shaped copper or aluminium conductors shall have a nominal cross-sectional area not less than 25 mm².

6.3.2 The ratio of the diameters of two different wires in the same conductor shall not exceed 2.

6.3.3 The number of wires in each conductor, for nominal cross-sectional areas up to and including 1 000 mm², shall be not less than the appropriate minimum given in Table 2.

NOTE This requirement applies to conductors made with wires of circular cross section before compaction and not to conductors of non-harmonized cables made with preshaped wires.

6.3.4 The 960 mm² conductor shall be either of Milliken construction or comprise four stranded sector shaped sections laid up together; sizes 1 200 mm² and above shall be of Milliken construction or comprise a number of stranded shaped sections laid up together or be of concentric stranded construction.

Milliken conductors shall consist of a number of stranded shaped sections, with adjacent sections lightly insulated from one another, laid-up to give a substantially circular profile.

6.3.5 The resistance of each conductor at 20 °C when determined in accordance with clause 8 shall not exceed the appropriate maximum value given in Table 2.

7 Flexible conductors (classes 5 and 6)

7.1 Flexible conductors (classes 5 and 6) shall consist of plain or metal-coated annealed copper.

7.2 The wires in each conductor shall all have the same nominal diameter.

7.3 The diameter of the wires in each conductor shall not exceed the appropriate maximum value given in Table 3 or Table 4.

7.4 The resistance of each conductor at 20 °C when determined in accordance with clause 8 shall not exceed the appropriate maximum value given in Table 3 or Table 4.

8 Check of compliance with clauses 6 and 7

Compliance with the requirements of **6.1.1** to **6.1.3**, **6.2.1** to **6.2.3**, **6.3.1** to **6.3.4** and **7.1** to **7.3** shall be checked on the completed cable by inspection and measurement where practicable.

Compliance with the requirements for resistance given in **6.1.4**, **6.2.4**, **6.3.5** and **7.4** shall be checked by measurement in accordance with Appendix A and correction for temperature by the factors in Table 5.

9 Tests for particular types of conductor

When specifically required by the standard for the type of cable, the types of conductor designated in **9.1**, **9.2** and **9.3** shall comply with the requirements specified therein.

9.1 Tinning test for tinned copper conductors.

When wires taken from circular tinned annealed or hard-drawn copper conductors are tested by the method specified in Appendix B, the mass of copper dissolved shall not exceed the appropriate value specified in Table 6.