

Please be aware that this PDF has been created from the original hardcopy document, which might not be in good condition and so the PDF might reflect this.

SPECIFICATION FOR
COPPER FOR
ELECTRICAL PURPOSES

STRIP WITH DRAWN OR ROLLED EDGES

BS 1432 : 1970
inc. AMD 2311 (Nov) JULY 1977-A



Amendment Slip No. 1, published 29 July 1977
to BS 1432 : 1970

Copper for electrical purposes
Strip with drawn or rolled edges

NOTE. This amendment slip includes dimensions and areas of bare, rectangular annealed copper conductors suitable for insulation for winding purposes, including conductors of controlled proof stress and half-hard temper on which agreement had still to be reached when the revision of BS 1432 was published in 1970.

In order to clarify the ranges of dimensions of bare, rectangular copper conductors specified in this standard and in BS 1433, it has been decided to include (for information only) the dimensions and cross-sectional areas of bare, rectangular, half-hard and hard copper conductors suitable for busbar, switchgear and similar applications.

In view of the long service life of certain telecommunication installations, it is recognized that there will continue to be a need for material in alternative dimensions to be used for extension work, although new installations are being designed using dimensions specified in this standard.

BS 1432 : 1970

THIS BRITISH STANDARD, having been approved by the Non-ferrous Metals Industry Standards Committee, was published under the authority of the Executive Board on 25th June, 1970.

First published February, 1948
First revision February, 1953
Second revision November, 1961
Third revision June, 1970

SBN: 580 06490 5

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A complete list of British Standards, numbering over 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook, price £1. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 18. Methods for tensile testing of metals.
Part 1 Non-ferrous metals.
- BS 1036. Electrolytic tough pitch high conductivity copper.
- BS 1037. Fire refined tough pitch high conductivity copper.
- BS 1433. Copper for electrical purposes. Rod and bar.
- BS 1639. Methods for bend testing of metals.
- BS 1861. Oxygen-free high conductivity copper.
- BS 3239. Determination of resistivity of metallic electrical conductor materials.
- BS 4391. Recommendations for metric basic sizes for metal wire, sheet and strip.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BS1 references relate to the work on this standard:
Committee reference NFE/12 Draft for comment 69/11305

CONTENTS

Co-operating organizations	Page 5
Foreword	6

SPECIFICATION

1. Scope	6
2. General	7
3. Information to be supplied by the purchaser	7
4. Freedom from defects	7
5. Chemical composition	7
6. Condition	8
7. Dimensions and tolerances	8
8. Selection of test samples	8
9. Mechanical tests (including preparation of test pieces)	9
10. Electrical resistivity test	11
11. Hydrogen embrittlement test	12
12. Retests	12
13. Certificate of compliance	12
14. Inspection	12
15. Facilities for testing	13

APPENDICES

A. Conversion of stress values	17
B. Factors for correcting resistance at various temperatures	18
~~C. Table of recommended sizes (and related cross-sectional areas) for rectangular section copper~~	~~21~~

TABLES

1. Width of test piece	10
2. Resistivity values	11
3. Tolerances on thickness and width of strip	13
4. Tolerances on length of strip ordered to exact length	14
5. Radius on edges or corners of strip	14
6. Mechanical properties of copper strip	15

	7. Controlled proof stress copper strip	Page 15
8A.	Dimensions and areas of bare, rectangular annealed copper conductors suitable for insulation for winding purposes and including conductors of controlled proof stress and half-hard temper	16
8B.	Dimensions and areas of bare, rectangular, half-hard and hard copper conductors, suitable for busbar, switchgear and similar applications.	16 A
9.	Factors for correcting resistance. Hard-drawn high conductivity copper of conductivity 97 % I.A.C.S.	19
10.	Factors for correcting resistance. Annealed high conductivity copper of conductivity 100 % I.A.C.S.	20

FIGURES

1. Bend test	10
2. Test piece	12

BS 1432 : 1970

CO-OPERATING ORGANIZATIONS

The Non-ferrous Metals Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments, and scientific and industrial organizations:

Aluminium Federation
Association of Bronze and Brass Founders
Association of Consulting Engineers, Incorporated
Board of Trade
British Bronze and Brass Ingot Manufacturers' Association
*British Electrical and Allied Manufacturers' Association
British Lead Manufacturers' Association
*British Non-ferrous Metals Federation
*British Non-ferrous Metals Research Association
*Copper Development Association
Crown Agents for Oversea Governments and Administrations
*Electric Cable Makers' Confederation
Institute of British Foundrymen
*Institute of Metals
Institution of Mechanical Engineers (Automobile Division)
Institution of Mining and Metallurgy
Institution of Production Engineers
Institution of Structural Engineers
Lead Development Association
Light Metal Founders' Association
London Metal Exchange
Magnesium Industry Council
Ministry of Defence (Army Dept)
Ministry of Defence (Navy Dept)
National Brassfoundry Association
*Non-ferrous Metal Stockists
*Post Office
Royal Institute of British Architects
Society of Motor Manufacturers and Traders Limited
Tin Research Institute
Zinc Development Association
Individual manufacturers

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Railways Board
Electricity Supply Industry in England and Wales
Institute of Sheet Metal Engineering
Ministry of Technology
Ministry of Technology (National Physical Laboratory)

BS 1432 : 1970

BRITISH STANDARD SPECIFICATION FOR
COPPER FOR ELECTRICAL PURPOSES
STRIP WITH DRAWN OR ROLLED EDGES

FOREWORD

This British Standard is the first revision in metric terms of a standard originally published in 1948 and revised in 1953 and 1961. It is one of a series of standards for copper for electrical purposes, the others in the series being as follows:

- BS 1433. Copper for electrical purposes. Rod and bar.
- BS 1434. Copper for electrical purposes. Commutator bars.
- BS 1977. Copper for electrical purposes. Tubes.
- BS 4109. Copper for electrical purposes. Wire for general electrical purposes and for insulated cables and flexible cords.
- BS 4608. Copper for electrical purposes. Rolled sheet, strip and foil.

In this revision due regard has been given to the work of the International Organization for Standardization (ISO) on testing requirements, properties, etc., and wherever possible and appropriate their recommendations or expected recommendations have been followed.

 ~~Tables of recommended sizes and areas have not been included for the whole range covered by this standard, but only for the middle of the range. For sizes less than 20 mm wide and less than 6.3 mm thick it has not been possible to reach agreement on preferred sizes in time for publication, but it is anticipated that an amendment slip covering this range will follow. Recommended sizes of larger rectangular sections are included in Appendix C.~~

NOTE. Attention is drawn to certification facilities offered by BSI; see the back cover of this standard.

SPECIFICATION

1. SCOPE

 This British Standard specifies requirements for copper strip for electrical purposes, in coil or straight lengths, in the annealed, half-hard and hard conditions in widths from 0.50 mm up to and including 160 mm, and in thickness from 0.50 mm up to and including 10.0 mm. It includes requirements for both square and radiused ~~* for~~ corners.

 The standard also specifies requirements for the supply of strip ~~in the half-hard or hard condition~~ to controlled values of proof stress in thicknesses from  0.8 mm up to and including 10.0 mm.

6

 *BS 1420, 'Glossary of terms applicable to wrought products in copper, zinc and their alloys'.

ti A9

V69 2356

Documents
Document Sharing Hub

2. GENERAL

The strip shall comply with the general requirements specified in Clauses 4 to 12 and with the appropriate requirements given in Tables 1 to 6. ~~SA-82f~~ If ordered to controlled values of proof stress the strip shall comply with the requirements given in Table 7.

3. INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser shall supply the following information when placing the order:

- (1) The designation of the material and whether a silver content is required (see Clause 5).
- (2) The condition of the material (selected from Table 6), or the designation of controlled proof stress strip (selected from Table 7).
- (3) Whether corner radii other than those given in Table 5 are required (see 7.3).
- (4) The test requirements for edgewise bending when strip other than annealed is to be subjected to severe edgewise bending (see 9.3).
- (5) Whether mechanical tests are required (see 8.1).
- (6) Whether electrical resistivity tests are required (see 8.2).
- (7) In the case of oxygen-free material whether a hydrogen embrittlement test is required (see 8.3).
- (8) Whether a certificate of compliance is required (see Clause 13).
- (9) Whether it is the purchaser's intention to inspect the material at the supplier's works (see Clause 14).

4. FREEDOM FROM DEFECTS

The material shall be clean, smooth and free from harmful defects.

5. CHEMICAL COMPOSITION

The strip shall be manufactured from copper complying with the requirements of BS 1036* (designated C101), BS 1037† (designated C102) or BS 1861‡ (designated C103) as specified by the purchaser.

If silver is to be present as an alloying element the purchaser should specify the silver percentage he requires at the time of the enquiry or order.

If no British Standard is stipulated by the purchaser, the supplier shall be at liberty to supply at his discretion material complying with the requirements of any one of the above standards.

* BS 1036, 'Electrolytic tough pitch high conductivity copper'.

† BS 1037, 'Fire refined tough pitch high conductivity copper'.

‡ BS 1861, 'Oxygen-free high conductivity copper'.

BS 1432 : 1970

6. CONDITION

The strip shall be supplied in one of the following conditions as specified by the purchaser and selected from Table 6 or Table 7:

- O material in the annealed condition
- $\frac{1}{2}$ H, H the various harder tempers produced by cold working
- CPR1-4 the various controlled proof stress designations

7. DIMENSIONS AND TOLERANCES

7.1 Thickness, width and length. The thickness, width and length shall be as ordered, within the tolerances specified in Tables 3 and 4 as appropriate.

7.2 Straightness (edgewise curvature). Edges of strip in the half-hard and hard condition cut to length shall not vary from a straight line joining two points on the edge of the strip 2 m apart by more than 10 mm.

Edges of strip in the annealed condition and of material of any temper supplied in coil shall not vary from a straight line joining two points on the edge of the strip 2 m apart by more than 20 mm.

Alternatively, in the interests of economy, test lengths of 1 m may be taken with a permitted bow of 5 mm for annealed material and 3 mm for half-hard and hard material.

7.3 Corner radius. Annealed or controlled proof stress strip shall be supplied with radiused supplied corners* in accordance with Table 5. Semi-circular edges* may be supplied semi-ci for sizes in excess of 1 mm thickness if so specified by the purchaser.

Unless otherwise specified by the purchaser, half-hard and hard strip shall be supplied with square corners. If the strip is required with radiused corners ~~edges~~, the radius of curvature and tolerances shall be as specified in Table 5.

The arc shall merge smoothly into the flat and the strip shall be free from sharp, rough and projecting ~~edges~~ corners.

8. SELECTION OF TEST SAMPLES

8.1 Mechanical tests. When tests are specifically called for by the purchaser, strip of the same width and thickness, and of the same temper shall be batched together, and for each batch the number of samples taken shall be as given below. The samples shall be cut off cold and shall receive no further treatment (except that they may be machined to the shape of the test pieces) before being tested.

- (1) From batches weighing less than 200 kg, one sample shall be taken to provide the necessary test pieces.
- (2) From batches weighing 200 kg or more, but not more than 1000 kg the number of samples taken shall be in the proportion of one per 200 kg of

~~* Attention is drawn to BS 4394, 'Recommendations for metric basic sizes for metal wire, sheet and strip'.~~



*BS 1420, 'Glossary of terms applicable to wrought products in copper, zinc and their alloys'.

material submitted, any fractional remainder being considered as 200 kg. Where strip is supplied in coils weighing more than 200 kg one sample shall be taken from each coil to provide the necessary test pieces.

If the purchaser requires more than one sample to be taken from any coil, the method of taking the additional sample or samples shall be agreed between the supplier and the purchaser.

- (3) Batches exceeding 1000 kg shall be subdivided into smaller batches of not less than 200 kg and not more than 1000 kg, to which the provisions of (2) shall apply.

For strip cut to length, the test samples shall, at the option of the purchaser, be obtained either by leaving, during manufacture, extra material of appropriate size upon a sufficient number of strips in the batch, or by taking them from the body of the strip at random. In the latter case the material from which test samples have been taken shall be accepted as good delivery, notwithstanding its consequent non-compliance with the ordered length or width, provided it is otherwise deemed to comply with the requirements of this standard.

8.2 Electrical resistivity test. When this test is required the selection of test samples and the number of tests to be made shall be agreed between the supplier and the purchaser.

For the purpose of the electrical resistance per unit length in material supplied to a controlled range of 0.1% proof stress the material shall be deemed to be in the hard or half hard condition. A

8.3 Hydrogen embrittlement test. When this test is required the selection of test samples and the number of tests to be made shall be agreed between the supplier and the purchaser.

9. MECHANICAL TESTS (INCLUDING PREPARATION OF TEST PIECES)

The following tests shall be made on test pieces prepared from samples selected as specified in Clause 8.

9.1 Tensile test. Whenever practicable tensile tests shall be made on the full section of the material. Alternatively a test piece of the full thickness of the material and machined to the dimensions of the 12.5 mm wide rectangular test piece specified in BS 18, Part 1*, shall be used. The longitudinal axis of symmetry of the test piece shall be in the direction of working. The elongation shall be measured on a gauge length of 50 mm, or $5.65 \sqrt{S_0}$ (where S_0 = cross sectional area), as specified in Tables 6 and 7.

* BS 18, 'Methods for tensile testing of metals', Part 1. 'Non-ferrous metals'.