

Specification for

Copper and copper alloy rods and sections (other than forging stock)

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- British Non-ferrous Metals Federation
- Copper Development Association
- London Metal Exchange
- Non-ferrous Metal Stockists
- Society of British Aerospace Companies Limited
- Coopted members

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

- British Malleable Tube Fittings Association
- British Telecommunications plc
- Copper Smelters' and Refiners' Association
- Electronic Engineering Association
- Fasteners and Turned Parts Institute
- Spring Research and Manufacturers' Association
- Telecommunication Engineering and Manufacturing Association (TEAMA)

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Foreword

This British Standard has been prepared under the direction of the Non-ferrous Metals Standards Committee. It is the second metric revision of BS 2874, which was originally published in 1962 and subsequently revised in 1969 and it supersedes the 1969 edition, which is withdrawn. It is one in a series of standards for copper and copper alloys in various wrought forms, intended for general engineering purposes. The others in the series are:

BS 2870, *Specification for rolled copper and copper alloys: sheet, strip and foil.*

BS 2871, *Copper and copper alloys. Tubes.*

BS 2872, *Copper and copper alloys. Forging stock and forgings.*

BS 2873, *Copper and copper alloys. Wire.*

BS 2875, *Copper and copper alloys. Plate.*

In this revision, due regard has been given to the work of the International Organization for Standardization (ISO) and in particular to Technical Committee ISO/TC 26, Copper and copper alloys, in respect of chemical compositions, testing requirements, properties and dimensional tolerances. Whenever possible and appropriate, the requirements of this standard have been aligned with those of corresponding international standards.

Certain alloys that are considered to be in sufficient demand to warrant inclusion have been added. The additions are:

C 112, *copper-cobalt-beryllium.*

C 113, *copper-nickel-phosphorus.*

CA 107, *6 % aluminium-silicon bronze.*

CC 101, *copper-chromium.*

CC 102, *copper-chromium-zirconium.*

CN 102, *90/10 copper-nickel-iron.*

CN 107, *70/30 copper-nickel.*

CZ 133, *naval brass, uninhibited (a modified version of CZ 113, now withdrawn).*

CZ 134, *naval brass, high leaded.*

CZ 135, *high tensile brass, with silicon.*

CZ 136, *manganese brass.*

PB 104, *8 % phosphor bronze.*

The alloy previously known as CZ 123 in BS 2874 has been redesignated CZ 137 to avoid confusion with the similar but purer alloy CZ 123 which is included in BS 2870 and BS 2875.

The demand for nine of the alloys included in the last edition of this standard is considered to be insufficient to warrant their retention and they have consequently been withdrawn. The alloys withdrawn are CA 103, CA 106, CZ 103, CZ 106, CZ 113, NS 102, NS 111, NS 112 and NS 113.

In this revision, and for the purposes of this standard only, each of the alloys has been placed in one of three material groups, designated I, II and III, used to specify the dimensional tolerances in Table 5 to Table 9. The tolerances specified have been reviewed in the light of current demand and practice. Account has been taken of ISO work when revising the tolerances and the break-points.

All mechanical properties have been reviewed and revised where appropriate. All bend test requirements have been deleted.

In previous editions of this standard, clauses have been included entitled "Inspection" and "Facilities for testing". As these clauses are contractual and not relevant to the standard for the product, they have been omitted from this revision.

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 18, 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 requirements for copper and copper alloy rods and sections intended for machining and general engineering purposes (other than forging) having a diameter or thickness greater than 1.6 mm. It applies to rods and sections supplied in the coppers and copper alloys listed and in the material conditions given in Table 1 to Table 4.

NOTE 1 Table 11 in appendix A indicates the alloys included in the whole series of copper and copper alloy standards, BS 2870 to BS 2875. This gives nominal compositions, product forms specified and related ISO designations.

NOTE 2 For the convenience of users of this standard, Table 12 in appendix B gives conversion factors for stress values in SI and imperial units. Throughout this standard, values for the tensile strength and proof stress requirements are stated in newtons per square millimetre (N/mm²), this unit now being in common use in the industry.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1 rod

a solid product of round, square, rectangular or regular polygonal cross section, uniform throughout its length, usually supplied in straight lengths, and which if rectangular in cross section has a thickness that exceeds one tenth of the width

2.2 section

a product of uniform cross section along its whole length (other than round, square, rectangular or regular polygonal), usually supplied in straight lengths

NOTE 1 The term "profile" is synonymous with "section".

NOTE 2 The term "bar" is often used to denote a rod of comparatively large cross section and especially heavy rectangular cross section.

3 Designations for material conditions

For the purposes of this British Standard, the following designations apply for the material conditions:

M	as manufactured
O	annealed (soft)
½H	cold worked (half-hard)
H	cold worked (hard)
HS	cold worked (hard) and stress relieved
TH	solution treated, cold worked and precipitation hardened at an elevated temperature.

4 Information to be supplied by the purchaser

The following information shall be supplied by the purchaser at the time of the enquiry and order:

- the designation of the material required (see Table 1 to Table 4);
- the material condition required (see clause 3 and Table 1 to Table 4);
- the nominal dimensions and quantity of material required;
- for sections, the required dimensional tolerances (or a toleranced drawing).

NOTE 1 The purchaser should also be aware of the importance of including in the enquiry and order the following information, as appropriate:

- for rod within the size ranges given in Table 5 to Table 7 and Table 9, whether closer than normal tolerances are required, and for rod outside the size ranges given in Table 5 to Table 9, the tolerances agreed between the purchaser and the supplier (see clause 10 and Table 5 to Table 9);
- whether the material is required to pass the mercurous nitrate test for the detection of residual (internal) stress (see clause 7);
- whether tensile tests are required (see clause 6);
- whether special tests are required (see clauses 7, 8 and 9) and, if hydrogen embrittlement testing of C 103 or testing for dezincification resistance of CZ 132 is required, the batch size, the method of selection of samples and the provisions for retests for these tests;
- whether a statement of compliance, or a certificate of conformity of the material, to the requirements of the standard is required (see note 2).

NOTE 2 In normal commercial practice, two levels of certification of the quality of the product are available at the request of the purchaser, as follows.

a) **Statement of compliance.** This is usually available from the supplier when traceability of the product is not a requirement. The goods will have been manufactured to comply with the conditions and requirements of the purchaser in accordance with the supplier's quality control procedures. The goods may not themselves have been tested before delivery.

b) **Certificate of conformity.** This is normally supplied with material for which the purchaser has requested traceability to a manufacturing batch. The certificate is issued on the basis of tests, requested by the purchaser, having been carried out on the manufacturing batch from which the material supplied has been taken.

5 Chemical composition

The chemical composition of the rods and sections shall be as given for the appropriate material in Table 1 to Table 4.

NOTE Table 13 in appendix D gives cross-references for the wrought copper designations in both this standard and BS 1433 to the equivalent raw material designations in BS 6017 for copper refinery shapes.

6 Tensile properties

The tensile properties of the rods and sections shall be as given in Table 1 to Table 4 when tested in accordance with appendix E.

NOTE Rods and sections in the copper alloys C 112, C 113, CC 101 and CC 102 are supplied in the TH condition only. To achieve the properties given in Table 2, the rods and sections are normally cold worked after solution treatment and before precipitation hardening. The cold working may exceptionally follow the precipitation hardening or may even be omitted, at the discretion of the manufacturer.

During subsequent processing operations, including final assembly of finished components, the purchaser should avoid heating these rods and sections above the following temperatures:

C 112	copper-cobalt-beryllium	500 °C
C 113	copper-nickel-phosphorus	475 °C
CC 101	copper-chromium	500 °C
CC 102	copper-chromium-zirconium	525 °C.

These temperature maxima are given for information only; they are based on the lowest temperature that, if maintained for 2 h, would give a reduction in hardness equivalent to 20 % of the difference between the hardest condition, as received, and the softest possible condition of the alloy.

7 Residual stress level

The rods and sections shall be supplied as either a) or b) as follows.

- a) Specially processed to achieve a residual (internal) stress level which is sufficiently low to pass the mercurous nitrate test (see appendix F). When samples of such rods or sections are tested in accordance with appendix F they shall show no evidence of cracking upon immediate examination with the unaided eye, corrected for normal vision if necessary.
- b) Not specially processed or tested as in a).

If no option is expressed by the purchaser, material of type b) shall be supplied.

NOTE 1 When material of type a) is required, this should be clearly stated in the enquiry and order (see b) of note 1 to clause 4).

NOTE 2 Care should be taken that subsequent fabrication operations carried out in producing components, or assemblies, from material that has passed this test do not introduce levels of internal stress which could cause failure.

8 Resistance to dezincification (applicable to alloy CZ 132 only)

When tested in accordance with appendix G, the maximum depth of dezincification of CZ 132 brass rod and section in the M or O condition shall be 100 µm in the direction perpendicular to the extrusion or rolling direction and 200 µm in the direction parallel to the extrusion or rolling direction.

NOTE Rods and sections of brass CZ 132 supplied in the M or O condition are subjected to heat treatment in the range 450 °C to 550 °C during manufacture. Should the user need to heat the rods or sections to a temperature exceeding 525 °C during subsequent processing operations, including final assembly of finished components, advice should be sought from the supplier.

9 Freedom from hydrogen embrittlement (applicable to copper C 103 only)

When tested in accordance with BS 5899, rods and sections in copper C 103 shall show no evidence of cracking when the stressed surface is examined with the unaided eye, corrected for normal vision if necessary, thus indicating freedom from hydrogen embrittlement.

The test pieces shall be of a convenient length and of either the full cross section of the material or a convenient thickness or diameter not greater than 12 mm. Any edges shall be rounded or smoothed. Test pieces not of the full cross section shall contain part of the original surface of the material.

At the conclusion of the hydrogen embrittlement test the sample(s) shall be subjected to the close bend test described in BS 5899.

10 Tolerances on dimensions for rods

The diameter, width across flats and thickness for rods shall be within the tolerances given in Table 5 to Table 9 for the appropriate material group, size and shape. The “normal” tolerances shall apply, unless the purchaser has expressed an option for “close” tolerance material in the order (see a) of note 1 to clause 4).

NOTE The dimensional tolerances for rods larger than the size ranges given in Table 5 to Table 9 should be agreed between the supplier and the purchaser.

11 Selection of test samples

11.1 General

When tests are required to be carried out to verify that a batch of rods or sections complies with this standard (see b), c) and d) of note 1 to clause 4), samples for analysis, tensile and mercurous nitrate tests shall be taken in accordance with 11.2.

NOTE No sampling requirements are specified in this standard for the hydrogen embrittlement test (copper C 103 only) or the dezincification resistance test (alloy CZ 132 only). When the purchaser requires either of these tests to be carried out, the sampling requirements, including provisions for retests, should be agreed with the supplier at the time of the enquiry and order (see d) of note 1 to clause 4).

11.2 Samples for analysis, tensile and mercurous nitrate tests

For sampling, the rods or sections shall be grouped into the batch sizes (masses) given in Table 10.

For each test (i.e. analysis, tensile or mercurous nitrate) one sample shall be taken at random from each batch and from any remaining part of a batch. The samples shall be cut off cold and shall not be subjected to any further treatment (other than machining, as necessary) before testing.