

Copper and copper alloys — Cast unwrought copper products

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British Standard

ICS 77.150.30

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National foreword

This British Standard is the English language version of EN 1976:1998. Together with BS EN 1978:1998 it supersedes BS 6017:1981 which is withdrawn.

The great majority of user requirements across Europe for silver-bearing copper grades are satisfied by just three levels of silver content. The demand for two of the five levels of silver in the grades included in the previous British Standard was considered to be insufficient to warrant their retention and consequently there are no equivalents for Cu-Ag-1 and Cu-Ag-5 standardized in BS EN 1976.

The UK participation in its preparation was entrusted by Technical Committee NFE/34, Copper and copper alloys, to Subcommittee NFE/34/1, Wrought and unwrought copper and copper alloys, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 14, an inside back cover and a back cover.

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English version

Copper and copper alloys — Cast unwrought copper products

Cuivre et alliages de cuivre — Formes brutes de
coulée en cuivre

Kupfer und Kupferlegierungen — Gegossene
Rohformen aus Kupfer

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CEN

European Committee for Standardization
Comité Européen de Normalisation
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 133, Copper and copper alloys, the secretariat of which is held by DIN.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 1, Unwrought copper products, to prepare the following standard:

EN 1976, *Copper and copper alloys — Cast unwrought copper products*.

This is one of a series of European Standards for products manufactured from refined copper grades. Other products are specified as follows:

EN 1977, *Copper and copper alloys — Copper drawing stock (wire rod)*.

EN 1978, *Copper and copper alloys — Copper cathodes*.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1998, and conflicting national standards shall be withdrawn at the latest by September 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Standard specifies the composition and physical properties of cast unwrought copper products (refinery shapes) in thirteen grades of copper and nine silver-bearing copper grades. The refinery shapes included are horizontally, vertically and continuously cast wire bars, cakes, billets and ingots. Wire bars, cakes and billets are intended for fabricating into wrought products; ingots are intended for alloying in wrought and cast copper alloys.

A table indicating the refinery shapes in which each copper grade is normally available is given in annex A (informative). Annex B (informative) gives information on the relationships between electrical resistivity and conductivity of copper.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 1655, *Copper and copper alloys — Declarations of conformity*.

EN 10204, *Metallic products — Types of inspection documents*.

EN ISO 2626, *Copper — Hydrogen embrittlement test*. (ISO 2626:1973).

IEC 468, *Methods of measurement of resistivity of metallic materials*.

ISO 197-2, *Copper and copper alloys — Terms and definitions — Part 2: Unwrought products (refinery shapes)*.

ISO 4746, *Oxygen-free copper — Scale adhesion test*.

NOTE Informative references to documents used in the preparation of this standard, and cited at the appropriate places in the text, are listed in a bibliography, see annex C.

3 Definitions

For the purposes of this standard, the definitions for the various refinery shapes given in ISO 197-2 apply.

4 Designations

4.1 Material

4.1.1 General

The material is designated either by symbol or number (see Tables 1 to 4).

4.1.2 Symbol

The material symbol designation is based on the designation system given in ISO 1190-1.

NOTE Although material symbol designations used in this standard might be the same as those in other standards using the designation system given in ISO 1190-1, the detailed composition requirements are not necessarily the same.

4.1.3 Number

The material number designation is in accordance with the system given in EN 1412.

4.2 Product

The product designation provides a standardized pattern of designation from which a rapid and unequivocal description of a product is conveyed in communication. It provides mutual comprehension at the international level with regard to products which meet the requirements of the relevant European Standard.

The product designation is no substitute for the full content of the standard.

The product designation for products to this standard shall consist of:

- denomination (billet, wire bar, cake or ingot);
- number of this European Standard (EN 1976);
- material designation, either symbol or number (see Tables 1 to 4);
- cross-sectional shape (the following designations shall be used as appropriate: RND for round, SQR for square, RCT for rectangular);
- nominal dimensions (diameter, or width × thickness, and length);
- nominal unit mass, (if appropriate).

The derivation of a product designation is shown in the following example.

EXAMPLE

Billets conforming to this standard, in material designated either Cu-ETP or CR004A, round cross-section, nominal diameter 250 mm × nominal length 1 000 mm, shall be designated as follows:

	Billet EN 1976 – Cu-ETP –	RND250 × 1 000; or
	Billet EN 1976 – CR004A –	RND250 × 1 000
Denomination		
Number of this European Standard		
Material designation		
Cross-sectional shape and nominal dimensions in millimetres		

5 Ordering information

In order to facilitate the enquiry, order and confirmation of order procedures between the purchaser and the supplier, the purchaser shall state on his enquiry and order the following information:

- a) quantity of product required (mass);
- b) denomination (billet, wire bar, cake or ingot);
- c) number of this European Standard (EN 1976);
- d) material designation (see Tables 1 to 4);
- e) cross-sectional shape required;
- f) nominal dimensions (i.e. diameter, or width $\times$ thickness, and length) and nominal mass, where appropriate (see Table 7 for wire bar dimensions).

NOTE It is recommended that the product designation, as described in 4.2, is used for items b) to f).

In addition, the purchaser shall also state on the enquiry and order any of the following, if required:

- g) for ingots only, whether they are to be marked with a furnace charge mark;
- h) the tests, if any, which the purchaser requires to be carried out by the manufacturer on the material, selected from the tests appropriate to each copper grade given in Table 6;
- i) whether a declaration of conformity is required (see 9.1);
- j) whether an inspection document is required, and if so, which type (see 9.2).

6 Requirements

6.1 Composition

The composition of the refinery shapes shall conform to the requirements for the appropriate grade given in Tables 1 to 4.

6.2 Electrical properties

The maximum mass resistivity at 20 °C of each refinery shape shall conform to the appropriate requirements given in Table 5. The test shall be carried out in accordance with 8.2.

6.3 Hydrogen embrittlement

Samples taken from refinery shapes in copper grades Cu-OF (CR008A), Cu-OF1 (CR007A), Cu-OFE (CR009A), Cu-HCP (CR021A), Cu-PHC (CR020A), Cu-PHCE (CR022A), Cu-DLP (CR023A), Cu-DHP (CR024A), Cu-DXP (CR025A), CuAg0,04(OF) (CR017A), CuAg0,07(OF) (CR018A), CuAg0,10(OF) (CR019A), CuAg0,04P (CR014A), CuAg0,07P (CR015A) and CuAg0,10P (CR016A) shall show no evidence of cracking, when tested. The test shall be carried out in accordance with 8.2.2.

6.4 Scale adhesion

Samples taken from refinery shapes in copper grade Cu-OFE (CR009A) shall meet the requirements of the scale adhesion test. The test shall be carried out in accordance with 8.2.3.

6.5 Dimensions, mass and tolerances

6.5.1 Horizontally cast wire bars

Horizontally cast wire bars, of various nominal masses, shall conform to the appropriate dimensions and tolerances given in Table 7 and Figure 1.

6.5.2 Billets

Billets shall be of a cylindrical shape with both ends flat.

The mass, diameter and length and the maximum deviation from straightness shall conform to the tolerances given in Table 8.

6.5.3 Other shapes

The mass, dimensions and straightness of vertically (either statically or continuously) cast wire bars, vertically and horizontally cast cakes and ingots, shall conform to the tolerances given in Table 8.

6.6 Physical condition of refinery shapes

Cakes, billets and wire bars shall be substantially free from shrinkage defects, gas holes, cracks, cold sets, pits, concave tops and other similar defects in set or casting.

NOTE No physical condition requirements are specified for ingots, as physical defects are generally of minor consequence.

7 Sampling

7.1 Arrangement of lots for sampling purposes

For refinery shapes produced in a batch process, the manufacturer shall arrange lots for sampling purposes so that, as far as possible, each lot contains pieces from one furnace charge or production batch only.

For refinery shapes produced in a continuous process, the manufacturer shall arrange lots so that, as far as possible, each lot contains pieces produced consecutively from the process.

NOTE A lot is the number of, or aggregate mass of, individual refinery shapes, appropriate to the total amount ordered and to the means of shipment, which constitutes a unit for sampling purposes.

7.2 Inspection lots for analysis and physical testing

For the routine sampling of refinery shapes for analysis or for the routine determination of physical properties, the method and rate of sampling each inspection lot shall be at the discretion of the sampler, unless otherwise specified by the purchaser.

In cases of dispute concerning the analysis or physical properties, the method and rate of sampling each inspection lot shall be agreed between the supplier, the purchaser, and if necessary, any mutually accepted arbitrator.