



# SLOVENSKI STANDARD

## SIST EN 1976:2014

01-julij-2014

Nadomešča:

SIST EN 1976:1999

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**Baker in bakrove zlitine - Uliti negneteni polizdelki iz bakra**

Copper and copper alloys - Cast unwrought copper products

Kupfer und Kupferlegierungen - Gegossene Rohformen aus Kupfer

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

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**Ta slovenski standard je istoveten z: ~~SIST EN 1976:2012~~ EN 1976:2012**

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**ICS:**

77.150.30

Bakreni izdelki

Copper products

**SIST EN 1976:2014**

**en,fr,de**

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EUROPEAN STANDARD

EN 1976

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2012

ICS 77.150.30

Supersedes EN 1976:1998

English Version

## Copper and copper alloys - Cast unwrought copper products

Cuivre et alliages de cuivre - Formes brutes de coulée en  
cuivreKupfer und Kupferlegierungen - Gegossene Rohformen aus  
Kupfer

This European Standard was approved by CEN on 18 August 2012.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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## Foreword

This document (EN 1976:2012) has been prepared by Technical Committee CEN/TC 133 "Copper and copper alloys", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1976:1998.

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*.

In comparison with the first edition of EN 1976:1998, the following significant changes were made:

- a) Clause 3, Terms and definitions for the various refinery shapes have been added from ISO 197-2;
- b) Table 2, Cu-FRHC, Other elements – content has been modified and a new footnote "d" has been added.

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

EN 1976:1998, *Copper and copper alloys — Cast unwrought copper products*.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**EN 1976:2012 (E)****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. Annex B gives information on the relationships between electrical resistivity and conductivity of copper.

**2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) 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)*

IEC 60468, *Method of measurement of resistivity of metallic materials*

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

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**3 Terms and definitions**

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For the purposes of this document, the following terms and definitions apply.

**3.1****unwrought product  
refinery shape**

general term for unwrought products obtained by refining or melting and casting processes, intended for further processing

EXAMPLE Examples of unwrought products are cathodes, wire bars, cakes, billets, ingots.

[SOURCE: ISO 197-2:1983, 2.1]

**3.2****wire bar**

cast unwrought product normally of approximately square cross-section, with or without tapered ends, principally used for rolling into drawing stock or flat products for subsequent processing into wire, strip or profile

[SOURCE: ISO 197-2:1983, 2.3]

**3.3****cake**

cast unwrought product of rectangular cross-section, generally used for rolling into plate, sheet, strip or profiles

[SOURCE: ISO 197-2:1983, 2.4]

### 3.4

#### **billet**

cast unwrought product of circular cross-section used for the production of tube, rod, bar, profiles or forgings

[SOURCE: ISO 197-2:1983, 2.5]

### 3.5

#### **ingot**

#### **ingot bar**

cast unwrought product in a form suitable only for remelting primarily for the production of copper and copper alloys

[SOURCE: ISO 197-2:1983, 2.6]

## 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 x thickness, and length);
- nominal unit mass, (if appropriate).

**EN 1976:2012 (E)**

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, are designated as follows:

	Billet EN 1976 — Cu-ETP — RND 250 × 1 000
	or
	Billet EN 1976 — CR004A — RND 250 × 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 × thickness, and length) and nominal mass, where appropriate (see Table 7 for wire bar dimensions).

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 Cu-ETP and Cu-FRHC only: if oxygen content is higher than 0,040 % (see Table 2, Footnote b);
- h) for Cu-FRHC only: if the total impurities content is higher than 0,06 % (see Table 2, Footnote d);
- i) for ingots only: whether they are to be marked with a furnace charge mark;
- j) the tests, if any, which the purchaser requires to be carried out by the manufacturer on the product, selected from the tests appropriate to each copper grade given in Table 6;
- k) whether a declaration of conformity is required (see 9.1);
- l) 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.

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Table 1 — Composition of unalloyed copper grades made from Cu-CATH-1 (CR001A)

Material designation		Composition % (mass fraction)																					Elements listed in this table other than copper	
		Element	Cu	Ag	As	Bi	Cd	Co	Cr	Fe	Mn	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Te	Zn	total	excl.
Symbol	Number																							
Cu-ETP1	CR003A	min.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		max.	—	0,002 5	0,000 5 <sup>a</sup>	0,000 20 <sup>b</sup>	— <sup>a</sup>	— <sup>c</sup>	— <sup>a</sup>	0,001 0 <sup>c</sup>	— <sup>a</sup>	— <sup>c</sup>	0,040	— <sup>a</sup>	0,000 5	0,001 5	0,000 4 <sup>a</sup>	0,000 20 <sup>b</sup>	— <sup>c</sup>	— <sup>c</sup>	0,000 20 <sup>b</sup>	— <sup>c</sup>	0,006 5	0
Cu-OF1	CR007A	min.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		max.	—	0,002 5	0,000 5 <sup>a</sup>	0,000 20 <sup>b</sup>	— <sup>a</sup>	— <sup>c</sup>	— <sup>a</sup>	0,001 0 <sup>c</sup>	— <sup>a</sup>	— <sup>c</sup>	— <sup>d</sup>	— <sup>a</sup>	0,000 5	0,001 5	0,000 4 <sup>a</sup>	0,000 20 <sup>b</sup>	— <sup>c</sup>	— <sup>c</sup>	0,000 20 <sup>b</sup>	— <sup>c</sup>	0,006 5	0
Cu-OFE	CR009A	min.	99,99	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		max.	—	0,002 5	0,000 5	0,000 20	0,000 1	—	—	0,001 0	0,000 5	0,001 0	— <sup>d</sup>	0,000 3	0,000 5	0,001 5	0,000 4	0,000 20	—	0,000 2	0,000 20	0,000 1	—	—
Cu-PHCE	CR022A	min.	99,99	—	—	—	—	—	—	—	—	—	0,001	—	—	—	—	—	—	—	—	—	—	—
		max.	—	0,002 5	0,000 5	0,000 20	0,000 1	—	—	0,001 0	0,000 5	0,001 0	— <sup>d</sup>	0,006	0,000 5	0,001 5	0,000 4	0,000 20	—	0,000 2	0,000 20	0,000 1	—	—

a (As + Cd + Cr + Mn + P + Sb) maximum 0,001 5 %.

b (Bi + Se + Te) maximum 0,000 3 %, of which (Se + Te) maximum 0,000 30 %.

c (Co + Fe + Ni + Si + Sn + Zn) maximum 0,002 0 %.

d The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements.

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Table 2 — Composition of unalloyed copper grades, other than those made from Cu-CATH-1 (CR001A)

Material designation		Composition % (mass fraction)						
		Element	Cu <sup>a</sup>	Bi	O	Pb	Other elements (see note)	
Symbol	Number						total	excluding
Cu-ETP	CR004A	min.	99,90	—	—	—	—	Ag, O
		max.	—	0,000 5	0,040 <sup>b</sup>	0,005	0,03	
Cu-FRHC	CR005A	min.	99,90	—	—	—	—	Ag, O
		max.	—	—	0,040 <sup>b</sup>	—	0,06 <sup>d</sup>	
Cu-FRTP	CR006A	min.	99,90	—	—	—	—	Ag, Ni, O
		max.	—	—	0,100	—	0,05	
Cu-OF	CR008A	min.	99,95	—	—	—	—	Ag
		max.	—	0,000 5	— <sup>c</sup>	0,005	0,03	

NOTE The total of other elements (than copper) is defined as the sum of Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.

<sup>a</sup> Including silver, up to a maximum of 0,015 %.

<sup>b</sup> Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.

<sup>c</sup> The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements.

<sup>d</sup> Higher total impurities content is permitted, subject to agreement between the purchaser and the supplier.

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