SLOVENSKI STANDARD
SIST EN 1977:2013

01-julij-2013

Nadomešča:
SIST EN 1977:1999

Baker in bakrove zlitine - Polizdelki za bakreno žico

Copper and copper alloys - Cast drawing stock (wire rod)

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Ta slovenski standard je istoveten z: EN 1977:2013

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ICS:

77.150.30	Bakreni izdelki	Copper products

SIST EN 1977:2013 **en,fr,de**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1977

January 2013

ICS 77.150.30

Supersedes EN 1977:1998

English Version

Copper and copper alloys - Copper drawing stock (wire rod)

Cuivre et alliages de cuivre - Fil machine en cuivre

Kupfer und Kupferlegierungen - Vordraht aus Kupfer

This European Standard was approved by CEN on 24 November 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of 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 United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 1977:2013) 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 July 2013, and conflicting national standards shall be withdrawn at the latest by July 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 1977:1998.

This document is one of a series of European Standards for products manufactured from refined copper grades.

Other products are specified as follows:

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

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

— EN 13602, *Copper and copper alloys — Drawn, round copper wire for the manufacture of electrical conductors*

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In comparison with EN 1977:1998, the following significant technical changes were made:

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a) Table 2, Cu-FRHC, Other elements: content has been modified and a new footnote “d” has been added;

b) 6.4 and 8.4 “Annealability” have been modified;

c) A.2 “Standard annealed copper (IACS)” has been modified;

d) Annex B (normative) “Rapid Elongation Test method (AR-Test) for diameter 8 mm Cu-ETP1 wire rod” has been added.

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.

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Introduction

Copper drawing stock (wire rod) is normally manufactured by one of the following process routes:

— continuous casting and hot rolling in tandem;

— continuous or semi-continuous casting and cold rolling;

— rolling of wire bar or billets; or

— extrusion.

Annex A (informative) gives information on the relationships between electrical resistivity and conductivity (of copper).

Annex B (normative) describes the rapid elongation test method (AR-Test) for diameter 8 mm Cu-ETP1 wire rod.

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1 Scope

This European Standard specifies the composition, mechanical, electrical and physical properties for high conductivity copper drawing stock (wire rod) suitable for fabrication into wire by cold drawing, principally for the manufacture of electrical conductors. This European Standard covers drawing stock (wire rod), in nine grades of copper and nine silver-bearing copper grades. Normally, the cross-section is approximately circular, in a range of diameters from 6 mm.

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 12893, *Copper and copper alloys — Determination of spiral elongation number*

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

EN ISO 6892-1:2009, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

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
drawing stock
wire rod
intermediate solid wrought product, of uniform cross-section along its whole length, supplied in coils

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.

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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 European Standard shall consist of:

— denomination (copper drawing stock);

— number of this European Standard (EN 1977);

— material designation, either symbol or number (see Tables 1 to 4);

— nominal diameter;

— nominal coil mass;

— surface condition (the following designations shall be used, as appropriate: M for as manufactured, CL for cleaned).

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

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EXAMPLE

Drawing stock (wire rod) conforming to this standard, in material designated either Cu-ETP or CW004A, nominal diameter 8 mm, in 1 000 kg coils, cleaned surface condition, shall be designated as follows:

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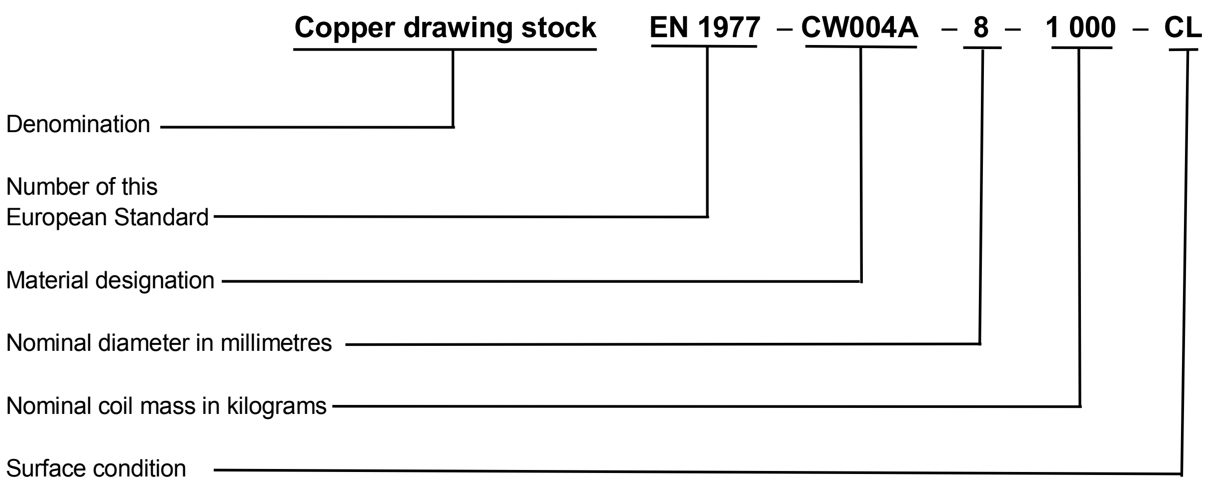
Copper drawing stock EN 1977 – Cu-ETP – 8 – 1 000 – CL

or



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5 Ordering information

In order to facilitate the enquiry, order and information 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 or number of coils);

b) denomination (copper drawing stock);

c) number of this European Standard (EN 1977);

d) material designation (see Tables 1 to 4);

e) nominal diameter;

f) nominal coil mass;

g) surface condition (see 6.8).

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

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

h) whether joins are permitted in the coils (see 6.9);

i) additional 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 5;

j) whether a declaration of conformity is required (see 9.1);

k) whether an inspection document is required, and if so which type (see 9.2).

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EXAMPLE

Ordering details for 5 000 kg of drawing stock conforming to EN 1977, in material designated either Cu-ETP or CW004A, nominal diameter 8 mm, in 1 000 kg coils, cleaned surface condition:

5 000 kg Copper drawing stock EN 1977 – Cu-ETP – 8 – 1 000 – CL

or

5 000 kg Copper drawing stock EN 1977 – CW004A – 8 – 1 000 – CL

6 Requirements

6.1 Composition

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

6.2 Elongation

Hot-finished drawing stock shall have a minimum elongation of 30 %. The test shall be carried out in accordance with 8.2.

No elongation requirements are specified for cold-finished drawing stock. If such requirements are necessary, they should be agreed between the purchaser and the supplier.

6.3 Electrical properties

The maximum volume resistivity at 20 °C of hot-finished drawing stock shall conform to the appropriate requirements given in Table 6. The test shall be carried out in accordance with 8.3.

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

Material designation		Composition % (mass fraction)																					
Symbol	Number	Element	Cu	Ag	As	Bi	Cd	Co	Cr	Fe	Mn	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Te	Zn	Elements listed in this table other than copper: total	Elements listed in this table other than copper: excluding
Cu-ETP1	CW003A	min.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
		max.	–	0,002 5	0,000 5[a]	0,000 20[b]	_a	_c	_a	0,001 0[c]	_a	_c	0,040	_a	0,000 5	0,001 5	0,000 4[a]	0,000 20[b]	_c	_c	0,000 20[b]	_c	0,006 5	O
Cu-OF1	CW007A	min.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
		max.	–	0,002 5	0,000 5[a]	0,000 20[b]	_a	_c	_a	0,001 0[c]	_a	_c	_d	_a	0,000 5	0,001 5	0,000 4[a]	0,000 20[b]	_c	_c	0,000 20[b]	_c	0,006 5	O
Cu-OFE	CW009A	min.	99,99	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
		max.	–	0,002 5	0,000 5	0,000 20	0,000 1	–	–	0,001 0	0,0005	0,0010	_d	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	CW022A	min.	99,99	–	–	–	–	–	–	–	–	–	–	0,001	–	–	–	–	–	–	–	–	–	
		max.	–	0,002 5	0,000 5	0,000 20	0,000 1	–	–	0,001 0	0,0005	0,0010	_d	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) max. 0,001 5 %.

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

c (Co + Fe + Ni + Si + Sn + Zn) max. 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 copper grades, other than those made from Cu-CATH-1 (CR001A)

Material designation		Composition % (mass fraction)						
		Element	Cu [a]	Bi	O	Pb	other elements (see Note)	
Symbol	Number						total	excluding
Cu-ETP	CW004A	min.	99,90	—	—	—	—	Ag, O
		max.	—	0,000 5	0,040 [b]	0,005	0,03	
Cu-FRHC	CW005A	min.	99,90	—	—	—	—	Ag, O
		max.	—	—	0,040 [b]	—	0,06 [d]	
Cu-OF	CW008A	min.	99,95	–	—	—	—	Ag
		max.	—	0,000 5	— [c]	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.

[a] Including silver, up to a maximum of 0,015 %.

[b] Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.

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

[d] Higher total impurities content is permitted, subject to agreement between the purchaser and the supplier.

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Table 3 — Composition of phosphorus-containing copper grades

Material designation		Composition % (mass fraction)						
		Element	Cu [a]	Bi	P	Pb	other elements (see Note)	
Symbol	Number						total	excluding
Cu-PHC	CW020A	min.	99,95	–	0,001	–	–	Ag, P
		max.	–	0,000 5	0,006	0,005	0,03 [b]	
Cu-HCP	CW021A	min.	99,95	–	0,002	–	–	Ag, P
		max	–	0,000 5	0,007	0,005	0,03 [b]	

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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.

[a] Including silver, up to a maximum of 0,015 %.

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