



SLOVENSKI STANDARD

SIST EN 13601:2004

01-januar-2004

Baker in bakrove zlitine – Drogovi, palice in žice za splošno uporabo v elektrotehniki

Copper and copper alloys - Copper rod, bar and wire for general electrical purposes

Kupfer und Kupferlegierungen - Stangen und Drähte aus Kupfer für die allgemeine Anwendung in der Elektrotechnik

Cuivre et alliages de cuivre - Barres et fils en cuivre pour usages électriques généraux

Ta slovenski standard je istoveten z: EN 13601:2002

SIST EN 13601:2004
<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>

ICS:

77.150.30 Bakreni izdelki Copper products

SIST EN 13601:2004 en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 13601:2004](#)

<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>

EUROPEAN STANDARD

EN 13601

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2002

ICS 77.150.30

English version

Copper and copper alloys - Copper rod, bar and wire for general electrical purposes

Cuivre et alliages de cuivre - Barres et fils en cuivre pour usages électriques généraux

Kupfer und Kupferlegierungen - Stangen und Drähte aus Kupfer für die allgemeine Anwendung in der Elektrotechnik

This European Standard was approved by CEN on 22 February 2002.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

[SIST EN 13601:2004](https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004)

<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page		page
Foreword	3	10 Marking, packaging, labelling	16
1 Scope	4	Annex A (informative) Characteristics of coppers for electrical purposes	23
2 Normative references	4	Bibliography	25
3 Terms and definitions	5	Tables	
4 Designations	5	Table 1 — Composition of copper	16
4.1 Material	5	Table 2 — Mechanical properties	17
4.2 Material condition	5	Table 3 — Electrical properties (at 20 °C) ..	18
4.3 Product	6	Table 4 — Dimensional tolerances for round, square and hexagonal rod and wire	19
5 Ordering information	7	Table 5 — Tolerances on width and thickness of rectangular bar and wire ...	19
6 Requirements	8	Table 6 — Maximum radii for sharp corners of rod, bar and wire	20
6.1 Composition	8	Table 7 — Radii for rounded corners of rod, bar and wire	20
6.2 Mechanical properties	8	Table 8 — Tolerances on "as manufactured" lengths	20
6.3 Bending characteristics	8	Table 9 — Tolerances on "fixed lengths" ..	21
6.4 Electrical properties	8	Table 10 — Maximum twist of square or hexagonal rod or rectangular bar	21
6.5 Freedom from hydrogen embrittlement ..	8	Table 11 — Straightness of rod and bar	21
6.6 Dimensions and tolerances	8	Table 12 — Flatness of rectangular bar	22
6.7 Form tolerances	10	Table 13 — Mass tolerances	22
6.8 Wire in coils	13	Table 14 — Sampling rate	22
6.9 Mass tolerances	13	Table A.1 — Particular characteristics of copper for electrical purposes	24
6.10 Surface condition	13		
7 Sampling	14		
7.1 General	14		
7.2 Analysis	14		
7.3 Mechanical and electrical tests	14		
8 Test methods	14		
8.1 Analysis	14		
8.2 Tensile test	14		
8.3 Hardness test	14		
8.4 Bend test	15		
8.5 Electrical resistivity test	15		
8.6 Hydrogen embrittlement test	15		
8.7 Retests	15		
8.8 Rounding of results	15		
9 Declaration of conformity and inspection documentation	15		
9.1 Declaration of conformity	15		
9.2 Inspection documentation	16		

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 13601:2004

<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>

Foreword

This document EN 13601:2002 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 September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 5 "Copper for electrical purposes" to prepare the following standard:

EN 13601, *Copper and copper alloys – Copper rod, bar and wire for general electrical purposes.*

The products specified in this European Standard are those which are especially suitable for electrical purposes, i.e. with specified electrical properties. Copper rod, bar and wire for general purposes are specified in EN 12163, EN 12166 and EN 12167.

Annex A (informative) gives guidance on the characteristics of coppers for electrical purposes.

This is one of a series of European Standards for copper products for electrical purposes. Other copper products are specified as follows:

EN 13599, *Copper and copper alloys — Copper plate, sheet and strip for electrical purposes.*

EN 13600, *Copper and copper alloys — Seamless copper tubes for electrical purposes.*

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

EN 13604, *Copper and copper alloys — Products of high conductivity copper for electronic tubes, semiconductor devices and vacuum applications.*

EN 13605, *Copper and copper alloys — Copper profiles and profiled wire for electrical purposes.*

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EN 13601:2002 (E)**1 Scope**

This European Standard specifies the composition, property requirements including electrical properties, and tolerances on dimensions and form for copper rod, bar and wire for general electrical purposes. Cross-sections and size ranges are:

- round, square and hexagonal rod with diameters or widths across-flats from 2 mm up to and including 80 mm;
- rectangular bar with thicknesses from 2 mm up to and including 40 mm and widths from 3 mm up to and including 200 mm;
- round, square, hexagonal and rectangular wire with diameters or widths across-flats from 2 mm up to and including 25 mm, as well as thicknesses from 0,5 mm up to and including 12 mm with widths from 1 mm up to and including 200 mm.

The sampling procedures, the methods of test for verification of conformity to the requirements of this standard and the delivery conditions are also specified.

NOTE Drawn, round copper wire — plain or tinned, single or multiline — for the manufacture of electrical conductors is specified in EN 13602.

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 (including amendments).

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

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

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature)*.

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

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

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:1999)*.

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1:1997)*.

EN ISO 7438, *Metallic materials — Bend test (ISO 7438:1985)*.

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

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

3 Terms and definitions

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

3.1

rod/bar

solid wrought product of uniform cross-section along its whole length, supplied in straight lengths. The cross-sections are round, square, hexagonal or rectangular. Square, hexagonal and rectangular cross-sections may have corners rounded along their whole length

3.2

wire

solid wrought product of uniform cross-section along its whole length, supplied in coiled form. The cross-sections are round, square, hexagonal and rectangular. Square, hexagonal and rectangular cross-sections may have corners rounded along their whole length

3.3

circularity (round rod or wire)

difference between the maximum and the minimum diameters measured at any one cross-section

4 Designations

4.1 Material

4.1.1 General

The material is designated either by symbol or number (see Table 1).

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 Material condition

For the purposes of this standard, the following designations, which are in accordance with the system given in EN 1173, apply for the material condition:

- D Material condition for the product as cold worked without specified mechanical properties;
- H... Material condition designated by the minimum value of hardness requirement for the product with mandatory hardness requirements;
- R... Material condition designated by the minimum value of tensile strength requirement for the product with mandatory tensile strength, 0,2% proof strength and elongation requirements.

NOTE Products in the H... condition may be specified to Vickers or Brinell hardness. The material condition designation H... is the same for both hardness test methods.

Exact conversion between the material conditions designated H... and R... is not possible.

Material condition is designated by only one of the above designations.

EN 13601:2002 (E)

4.3 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.

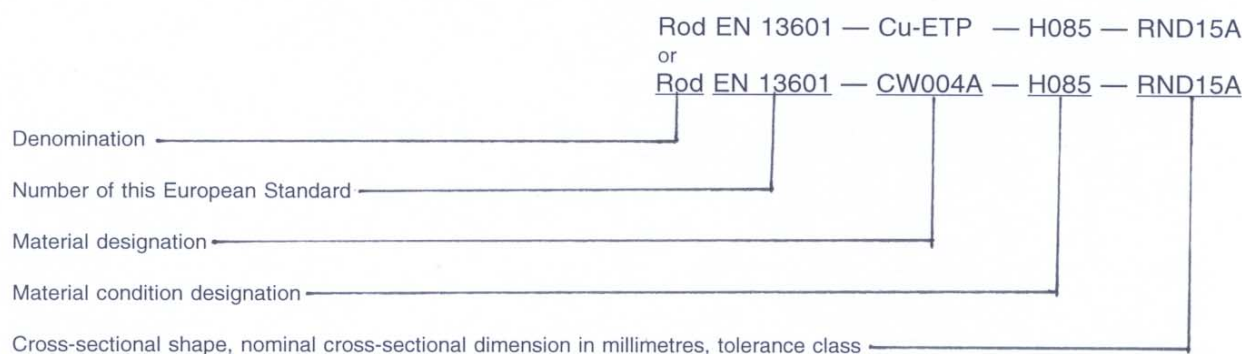
The product designation for products to this standard shall consist of:

- denomination (Rod, Bar or Wire);
- number of this European Standard (EN 13601);
- material designation, either symbol or number (see Table 1);
- material condition designation (see Table 2);
- cross-sectional shape (the following designations shall be used as appropriate: RND for round, SQR for square, HEX for hexagonal);
- nominal cross-sectional dimensions;
 - round rod or wire: diameter;
 - square or hexagonal rod or wire: width across-flats;
 - rectangular bar or wire: thickness x width;
- tolerance class for round, square or hexagonal rod or wire (see Table 4);
- corner type for square or hexagonal rod, rectangular bar or wire (the following designations shall be used as appropriate: SH for sharp, RD for rounded, CE for semi-circular edges) (see 6.6.2).

The derivation of a product designation is shown in example 1 and other typical product designations are shown in examples 2 and 3.

<https://standards.itech.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32734292ba0/sist-en-13601-2004>

EXAMPLE 1 Rod for electrical purposes conforming to this standard, in material designated either Cu-ETP or CW004A, in material condition H085, round, nominal diameter 15 mm, tolerance class A, shall be designated as follows:



EXAMPLE 2 Bar for electrical purposes conforming to this standard, in material designated either CuAg0,10 or CW013A, in material condition R280, rectangular, nominal thickness 15 mm, nominal width 100 mm, semi-circular edge, shall be designated as follows:

Bar EN 13601 — CuAg0,10 — R280 — 15 x 100 — CE
or
Bar EN 13601 — CW013A — R280 — 15 x 100 — CE

EXAMPLE 3 Wire for electrical purposes conforming to this standard, in material designated either Cu-OF or CW008A, in material condition H035, hexagonal, nominal width across-flats 8 mm, tolerance class B, sharp corners, shall be designated as follows:

Wire EN 13601 — Cu-OF — H035 — HEX8B — SH
or
Wire EN 13601 — CW008A — H035 — HEX8B — SH

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, number of rods or bars or coils of wire);
- b) denomination (Rod, Bar or Wire);
- c) number of this European Standard (EN 13601);
- d) material designation (see Table 1);
- e) material condition designation (see 4.2 and Table 2);
- f) cross-sectional shape (round, square, hexagonal or rectangular);
- g) nominal dimensions (diameter, width across-flats or thickness × width);
- h) tolerance class for round, square or hexagonal rod or wire: either class A (minus tolerance only) or class B (plus/minus tolerance) (see Table 4);
- i) type of corner (see 6.6.2);
- j) for rod or bar, the length required (see 6.6.3);
- k) for wire, the coil type: pancake, traverse wound, bunch or on drums (see 6.8);
- l) coil size requirements: inside and/or outside diameter and width or mass.

NOTE It is recommended that the product designation, as described in 4.3, is used for b) to i).

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

- m) test method to be used for measurement of hardness, i.e. Brinell or Vickers (see 8.3) unless the test method is to be left to the discretion of the supplier;
- n) whether sawn or sheared ends are required (see 6.6.3);
- o) whether special surface conditions are required (see 6.10);
- p) whether a bend test is required (see 6.3);
- q) whether form tolerances for wire are required (see 6.7.1);
- r) whether length of wire is required (see 6.6.3);
- s) whether sampling is required (see clause 7);
- t) whether a declaration of conformity is required (see 9.1);
- u) whether an inspection document is required, and if so, which type (see 9.2);
- v) whether there are any special requirements for marking, packaging or labelling (see clause 10).

EN 13601:2002 (E)

EXAMPLE 1 Ordering details for 250 pieces bar for general electrical purposes conforming to EN 13601, in material designated either CuAg0,10 or CW013A, in material condition R280, rectangular, nominal thickness 15 mm, nominal width 100 mm, semi-circular edge, fixed length 4 500 mm:

250 pieces Bar EN 13601 — CuAg0,10 — R280 — 15 x 100 — CE
— fixed length 4 500 mm

or

250 pieces Bar EN 13601 — CW013A — R280 — 15 x 100 — CE
— fixed length 4 500 mm

EXAMPLE 2 Ordering details for 1 000 kg wire for general electrical purposes conforming to EN 13601, in material designated either Cu-OF or CW008A, in material condition H035, hexagonal, nominal width across flats 8 mm, tolerance class B, with sharp corners, nominal inside diameter of coil 500 mm:

1 000 kg Wire EN 13601 — Cu-OF — H035 — HEX8B — SH
— nominal inside diameter of coil 500 mm

or

1 000 kg Wire EN 13601 — CW008A — H035 — HEX8B — SH
— nominal inside diameter of coil 500 mm

6 Requirements**6.1 Composition**

The composition shall conform to the requirements for the appropriate material given in Table 1.

NOTE For characteristics of coppers for electrical purposes, see annex A.

6.2 Mechanical properties

The mechanical properties shall conform to the appropriate requirements given in Table 2. The tests shall be carried out in accordance with either 8.2 (tensile test) or 8.3 (hardness test).

<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>

6.3 Bending characteristics

If required, bending characteristics shall be agreed between the purchaser and the supplier at the time of enquiry and order. The test shall be carried out in accordance with 8.4.

6.4 Electrical properties

The electrical properties shall conform to the appropriate requirements given in Table 3. The test shall be carried out in accordance with 8.5.

6.5 Freedom from hydrogen embrittlement

Rod, bar and wire in copper grades Cu-OF (CW008A), CuAg0,04P (CW014A), CuAg0,07P (CW015A), CuAg0,10P (CW016A), CuAg0,04(OF) (CW017A), CuAg0,07(OF) (CW018A), CuAg0,10(OF) (CW019A), Cu-PHC (CW020A) and Cu-HCP (CW021A) shall show no evidence of cracking, when tested and visually examined in accordance with 8.6.

6.6 Dimensions and tolerances**6.6.1 Diameter or width across-flats**

The diameter or width across-flats of round, square, hexagonal or rectangular rod, bar or wire shall conform to the appropriate tolerances given in Tables 4 and 5.

6.6.2 Corner configuration

6.6.2.1 General

Rod, bar and wire may be supplied with sharp corners, rounded corners or semi-circular edges. The type of corner shall be specified at the time of order [see 5 i)].

6.6.2.2 Sharp corners

Sharp corners (SH) of square, hexagonal and rectangular rod, bar and wire (see Figure 1) shall conform to Table 6.

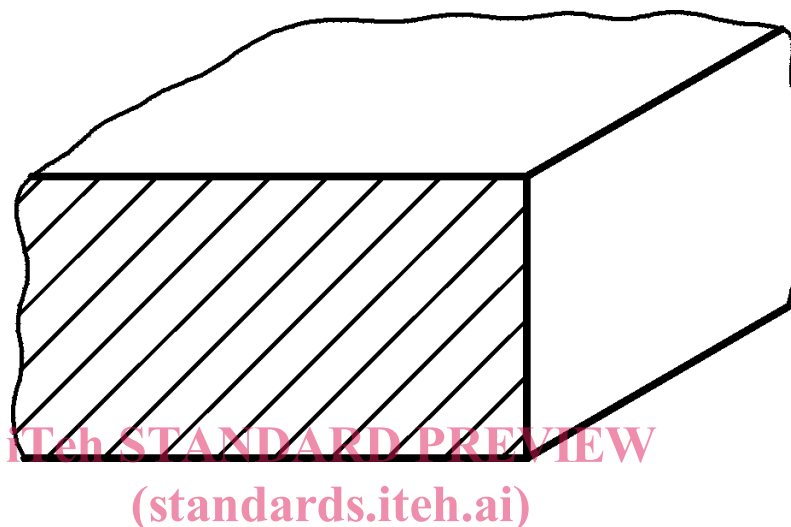


Figure 1 — Sharp corner

[SIST EN 13601:2004](https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004)

<https://standards.iteh.ai/catalog/standards/sist/1eb076c4-dcf0-467b-bc72-d32724292ba0/sist-en-13601-2004>

6.6.2.3 Rounded corners

Rounded corners (RD) of square, hexagonal and rectangular rod, bar and wire (see Figure 2) shall conform to Table 7.

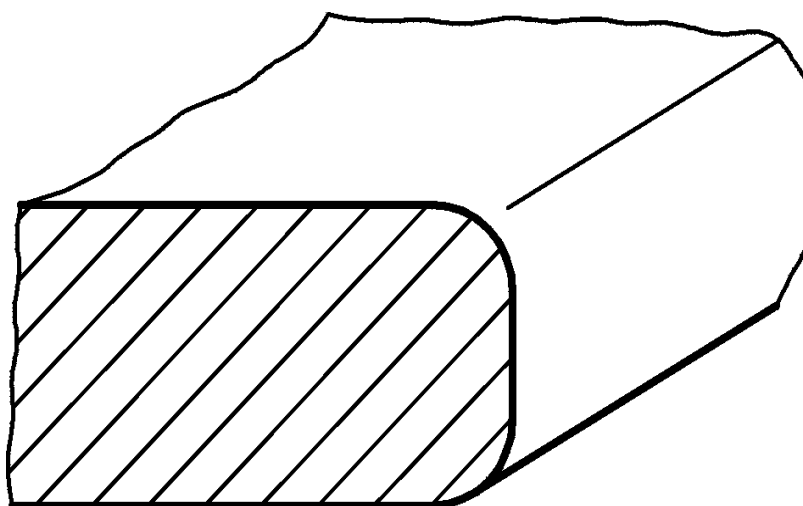


Figure 2 — Rounded corner