



SLOVENSKI STANDARD
SIST EN 13600:2004

01-januar-2004

Baker in bakrove zlitine – Nevarjene bakrene cevi za uporabo v elektrotehnik

Copper and copper alloys - Seamless copper tubes for electrical purposes

Kupfer und Kupferlegierungen - Nahtlose Rohre aus Kupfer für die Anwendung in der Elektrotechnik

Cuivre et alliages de cuivre - Tubes sans soudure en cuivre pour usages électriques

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Ta slovenski standard je istoveten z: EN 13600:2002

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77.150.30 Bakreni izdelki Copper products

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EUROPEAN STANDARD

EN 13600

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2002

ICS 77.150.30

English version

Copper and copper alloys - Seamless copper tubes for electrical purposes

Cuivre et alliages de cuivre - Tubes sans soudure en cuivre
pour usages électriques

Kupfer und Kupferlegierungen - Nahtlose Rohre aus Kupfer
für die 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.

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

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

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Foreword

This document EN 13600:2002 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of an identical text or by endorsement, at the latest by September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.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 13600, *Copper and copper alloys — Seamless copper tubes for 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 tubes for general purposes are specified in EN 12449.

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 13601, *Copper and copper alloys — Copper rod, bar and wire for general 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 13600:2002 (E)

1 Scope

This European Standard specifies the composition, property requirements including electrical properties, and tolerances on dimensions and form for seamless drawn copper tubes for electrical purposes, delivered in straight lengths with the cross-sections and size ranges below:

- for round tubes with outside diameters from 5 mm up to and including 150 mm and wall thicknesses from 0,5 mm up to and including 20 mm;
- for square and rectangular tubes with major outside dimension from 5 mm up to and including 150 mm and wall thicknesses from 0,5 mm up to and including 10 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.

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).*

ISO 1811-2, *Copper and copper alloys — Selection and preparation of samples for chemical analysis — Part 2: Sampling of wrought products and castings.*

ISO 8491, *Metallic materials — Tube (in full section) — Bend 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 the Bibliography.

3 Terms and definitions

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

3.1

seamless tube

hollow semi-finished product, circular, square or rectangular in cross-section, having a uniform wall thickness, which at all stages of production has a continuous periphery. Tubes with a square or rectangular cross-section may have corners rounded along their whole length

3.2

mean diameter

arithmetical mean of any two diameters normal to each other at the same cross-section of the tube

3.3

deviation from circular form

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

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 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 Material condition

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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.

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.

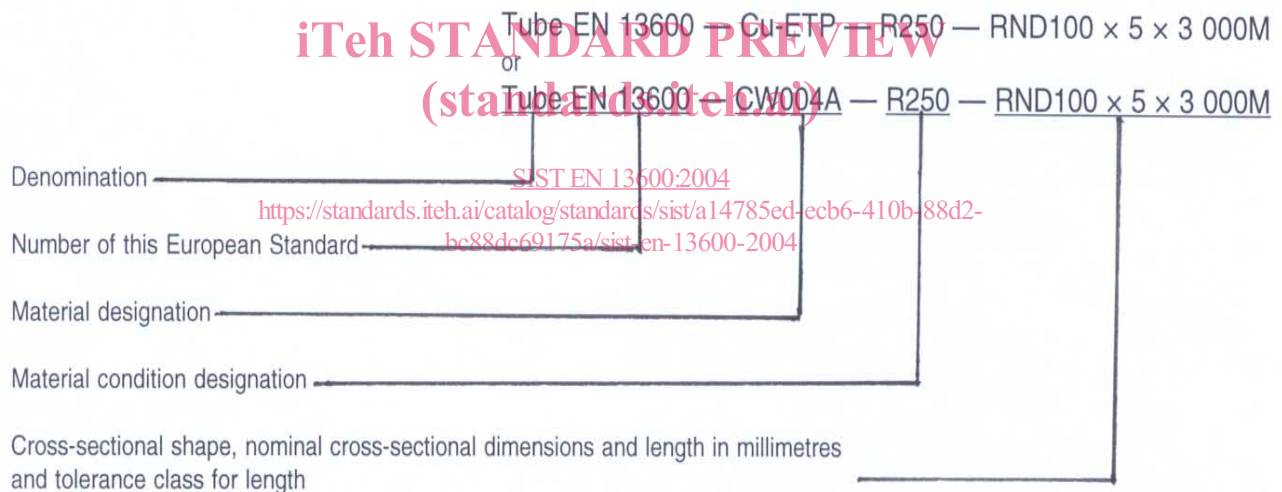
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The product designation for products to this standard shall consist of:

- denomination (Tube);
- number of this European Standard (EN 13600);
- 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, RCT for rectangular);
- nominal dimensions;
 - round tube: outside diameter × wall thickness × length [either "as manufactured" (M) or "fixed" (F) length (see 6.5.4)];
 - square or rectangular tube: across-flats dimension(s) × wall thickness × length [either "as manufactured" (M) or "fixed" (F) length (see 6.5.4)].

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

EXAMPLE 1 Tube for electrical purposes conforming to this standard, in material designated either Cu-ETP or CW004A, in material condition R250, round, nominal outside diameter 100 mm, nominal wall thickness 5 mm, as manufactured length 3 000 mm, shall be designated as follows:



EXAMPLE 2 Tube for electrical purposes conforming to this standard, in material designated either Cu-0F or CW008A, in material condition H065, square, nominal width across-flats 120 mm, nominal wall thickness 10 mm, fixed length 4 500 mm, shall be designated as follows:

Tube EN 13600 — Cu-0F — H065 — SQR120 × 10 × 4 500F
or
Tube EN 13600 — CW008A — H065 — SQR120 × 10 × 4 500F

EXAMPLE 3 Tube for electrical purposes conforming to this standard, in material designated either CuAg0,10 or CW013A, in material condition R290, rectangular, nominal widths across-flats 140 mm and 80 mm, nominal wall thickness 5 mm, fixed length 3 500 mm, shall be designated as follows:

Tube EN 13600 — CuAg0,10 — R290 — RCT140 × 80 × 5 × 3 500F
 or
 Tube EN 13600 — CW013A — R290 — RCT140 × 80 × 5 × 3 500F

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 tubes);
- b) denomination (Tube);
- c) number of this European Standard (EN 13600);
- d) material designation (see Table 1);
- e) material condition designation (see 4.2 and Table 2);
- f) nominal dimensions:
 - round tubes: outside diameter × wall thickness × length [either "as manufactured" (M) or "fixed" (F) length (see 6.5.4)];
 - square or rectangular tubes: across-flats dimension(s) × wall thickness × length [either "as manufactured" (M) or "fixed" (F) length (see 6.5.4)].

NOTE It is recommended that the product designation, as described in 4.3, 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) test method to be used for the measurement of hardness, i.e. Vickers or Brinell (see 8.3);
- h) whether special tolerances on dimensions and form are required;
- i) whether special surface conditions are required (see 6.7);
- j) whether deburring is required (see 6.5.4.1);
- 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);
- m) whether there are any special requirements for marking, packaging or labelling (see clause 10).

EXAMPLE Ordering details for 1 000 pieces tube for electrical purposes conforming to EN 13600, in material designated either Cu-ETP or CW004A, in material condition R250, round, nominal outside diameter 100 mm, nominal wall thickness 5 mm, as manufactured length 3 000 mm:

1 000 pieces Tube EN 13600 — Cu-ETP — R250 — RND100 × 5 × 3 000M
 or
1 000 pieces Tube EN 13600 — CW004A — R250 — RND100 × 5 × 3 000M

EN 13600:2002 (E)**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).

6.3 Electrical properties

The electrical properties shall conform to the appropriate requirements given in Table 3. The test shall be carried out in accordance with 8.4.

6.4 Freedom from hydrogen embrittlement

Tubes in copper grades Cu-OF (CW008A), CuAg0,10P (CW016A), 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 8.5.

6.5 Dimensions and tolerances

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6.5.1 Outside dimensions

The dimensional tolerances are applied on the outside dimensions and wall thickness, if not otherwise agreed between the purchaser and the supplier.

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For round tubes the diameter shall conform to the tolerances given in Table 4.

For square and rectangular tubes the outside dimensions shall conform to the tolerances given in Table 5.

6.5.2 Corner radii

The corner radii of square and rectangular tubes shall conform to the requirements given in Table 6.

6.5.3 Wall thickness

The wall thickness of round, square and rectangular tubes, measured at any one point, shall conform to the tolerances given in Table 7.

6.5.4 Length**6.5.4.1 General**

Tubes shall be supplied either in "as manufactured" or "fixed" lengths, with ends either sawn or sheared.

If deburring of the cut ends of the tubes is required it shall be agreed between the purchaser and the supplier [see 5 j)].

6.5.4.2 As manufactured lengths

As manufactured lengths (M) shall be supplied in the nominal lengths and with the tolerances given in Table 8.

It is permissible for 10 % of the number of tubes in a consignment to be shorter, but not less than 50 % of the nominal length.

6.5.4.3 Fixed lengths

Tubes supplied as fixed lengths (F) shall conform to the tolerances given in Table 9.

The deviation from squareness of the cut shall be a maximum of 2 % of the diameter or major across-flats dimension of the tube and is included in the fixed length tolerance.

6.5.5 Form tolerances

6.5.5.1 General

The form tolerances given in 6.5.5.2 and 6.5.5.3 apply to:

- outside dimensions equal to or greater than 10 mm;
- all material conditions except D, H040 and R200.

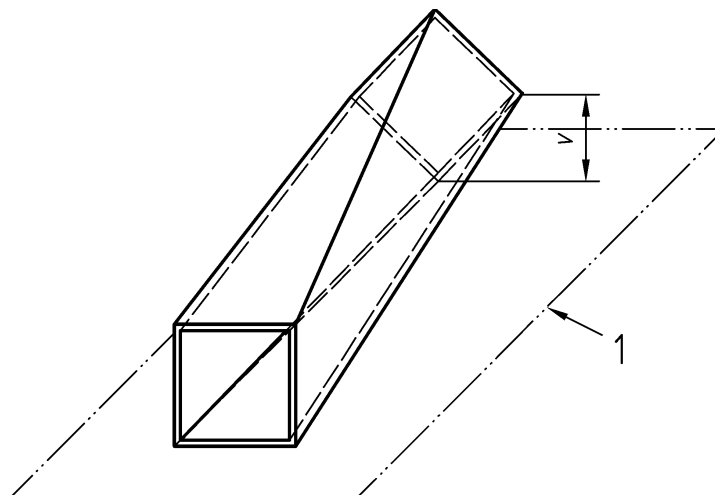
The deviation shall be measured with the tube supported on a horizontal base plate such that the deviation is minimized by the mass of the tube.

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6.5.5.2 Twist

Square and rectangular tubes shall conform to the tolerances given in Table 10. The twist v shall be measured as indicated in Figure 1.

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Key

- 1 Reference plane
v Twist

Figure 1 - Measurement of twist