SLOVENSKI STANDARD

SIST EN 13599:2004

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Copper and copper alloys - Copper plate, sheet and strip for electrical purposes

Kupfer und Kupferlegierungen - Platten, Bleche und Bänder aus Kupfer für die Anwendung in der Elektrotechnik

Cuivre et alliages de cuivre - Plaques, tôles et bandes en cuivre pour usages électriques

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English version

Copper and copper alloys - Copper plate, sheet and strip for electrical purposes

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

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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 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.

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

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Contents

Foreword

This document EN 13599:2002 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of an identical text or by endorsement, at the latest by September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.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 13599, *Copper and copper alloys — Copper plate, sheet and strip 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 plate, sheet and strip for general purposes are specified in EN 1652.

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 13600, *Copper and copper alloys — Seamless copper tubes 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.

1 Scope

This European Standard specifies the composition, property requirements including electrical properties, and tolerances on dimensions and form for copper plate, sheet and strip for electrical purposes with thicknesses from 0,05 mm up to and including 25 mm and widths from 10 mm up to and including 1 250 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 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.*

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
plate
flat rolled product of rectangular cross-section with uniform thickness greater than 10 mm

3.2
sheet
flat rolled product of rectangular cross-section with uniform thickness from 0,2 mm up to and including 10 mm, supplied in straight lengths, usually with sheared or sawn edges. The thickness does not exceed one tenth of the width

3.3
strip
flat rolled product of rectangular cross-section with uniform thickness from 0,05 mm up to and including 5,0 mm manufactured in coil and supplied in as sheared coils, traverse wound coils or cut to length, usually with slit edges. The thickness does not exceed one tenth of the width

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.

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:

M Material condition for the product as manufactured 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 and elongation requirements.

NOTE Some R... material conditions in this standard apply to products which also have mandatory 0,2% proof strength requirements.

Exact conversion between 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.

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

– denomination (Plate, Sheet or Strip);

– number of this European Standard (EN 13599);

– material designation, either symbol or number (see Table 1);

– material condition designation (see Table 2);

– nominal dimensions;

– plate: thickness × width × length [either "as manufactured" (M) or "fixed" (F) length];
– sheet: thickness × width × length [either "as manufactured" (M) or "fixed" (F) length] (see example 1);
– strip (in coils or on spools): thickness × width (see example 2);
– strip (cut to length): thickness × width × length [either "as manufactured" (M) or "fixed" (F) length].

The derivation of a product designation is shown in example 1.

EXAMPLE 1 Sheet for electrical purposes conforming to this standard, in material designated either Cu-ETP or CW004A, in material condition H040, nominal thickness 6,0 mm, nominal width 600 mm, as manufactured length 2 000 mm, shall be designated as follows:

EXAMPLE 2 Strip for electrical purposes conforming to this standard, in material designated either CuAg0,10 or CW013A, in material condition R290, nominal thickness 2,0 mm, nominal width 1 000 mm, shall be designated as follows:

Strip EN 13599 — CuAg0,10 — R290 — 2,0 × 1 000
or
Strip EN 13599 — CW013A — R290 — 2,0 × 1 000

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:

– plate: number of pieces or mass;
– sheet: number of pieces or mass;
– strip (in coils or on spools): mass;
– strip (cut to length): mass or number of pieces;

b) denomination (Plate, Sheet or Strip);

c) number of this European Standard (EN 13599);

d) material designation (see Table 1);

e) material condition designation (see 4.2 and Table 2);

f) nominal dimensions:

- plate, sheet, strip (cut to length): thickness [for thicknesses from 0,05 up to and including 3,2 mm and with widths from 10 mm up to and including 200 mm, thickness tolerance either "normal" (N) or "special" (S)] × width × length (either "as manufactured" or "fixed" length);
- strip (in coils or on spools): thickness [for thicknesses from 0,05 up to and including 3,2 mm and with widths from 10 mm up to and including 200 mm, thickness tolerance either "normal" (N) or "special" (S)] × width;

g) coil size (strip) requirements: nominal inside diameter in millimetres and maximum outside diameter in millimetres and either maximum mass in kilograms or approximate specific coil weight (mass per width) in kilograms per millimetre;

h) spool size (strip): type or dimensions.

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:

i) maximum edgewise curvature values for strip over 3,2 mm up to and including 5,0 mm thickness and width over 30 mm (see Table 9);

j) whether special surface conditions are required (see 6.8);

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 1 Ordering details for 100 sheets for electrical purposes conforming to EN 13599, in material designated either Cu-ETP or CW004A, in material condition H040, nominal thickness 6,0 mm, nominal width 600 mm, as manufactured length 2 000 mm:

100 pieces Sheet EN 13599 — Cu-ETP — H040 — 6,0 × 600 × 2 000M

or

100 pieces Sheet EN 13599 — CW004A — H040 — 6,0 × 600 × 2 000M

EXAMPLE 2 Ordering details for 5 000 kg strip for electrical purposes conforming to EN 13599, in material designated either CuAg0,10 or CW013A, in material condition R290, nominal thickness 0,4 mm, normal thickness tolerance, nominal width 60 mm, nominal inside diameter of coil 400 mm, maximum outside diameter of coil 960 mm and approximate specific coil weight (mass per width) 4,5 kg/mm:

5 000 kg Strip EN 13599 — CuAg0,10 — R290 — 0,4N × 60
— nominal inside diameter of coil 400 mm
— maximum outside diameter of coil 960 mm
— approximate specific coil weight 4,5 kg/mm

or

5 000 kg Strip EN 13599 — CW013A — R290 — 0,4N × 60
— nominal inside diameter of coil 400 mm
— maximum outside diameter of coil 960 mm
— approximate specific coil weight 4,5 kg/mm

6 Requirements

6.1 Composition

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

Percentage content of the element shown as "remainder" (Rem.) is usually calculated by difference from 100 %.

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 Bending characteristics

The bending edge shall show no evidence of cracks on the tension side, when tested and examined with the unaided eye, corrected to normal vision if necessary, 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

Sheet and strip 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 8.6.

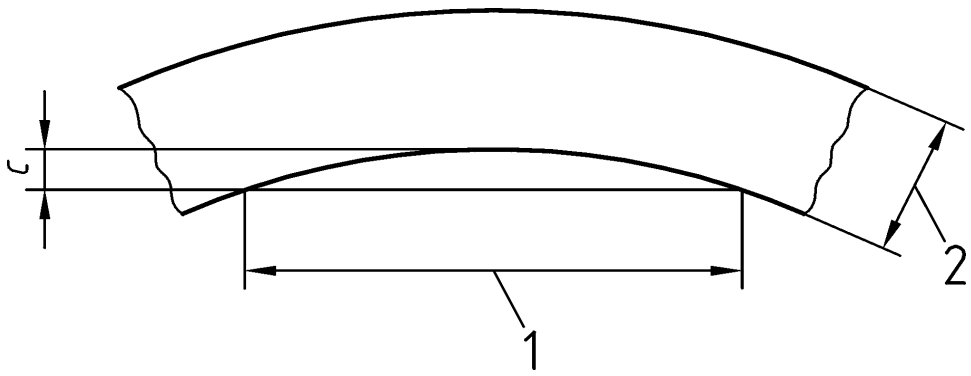
6.6 Dimensions and tolerances

Plate, sheet and strip shall conform to the appropriate tolerances on dimensions and form given in Tables 4 to 8. Plate, sheet and strip up to 5 000 mm in length may be supplied in "as manufactured" or "fixed lengths" (see Table 7).

6.7 Edgewise curvature *c*

For the straightness of the longitudinal edge of strip, which unless otherwise agreed between the purchaser and the supplier shall be based on a measuring length of 1 000 mm, the edgewise curvature *c* (see Figure 1) shall not exceed the values given in Table 9.

If the purchaser and the supplier agree on a measuring length of 2 000 mm, the edgewise curvature *c* shall not exceed the values given in Table 9 multiplied by 4.



Key
1 Measuring length
2 Strip width
c Edgewise curvature

Figure 1 — Edgewise curvature *c*

6.8 Surface condition

The products shall be clean and free from injurious defects which shall be specified by agreement between the purchaser and the supplier at the time of enquiry and order. A superficial film of residual lubricant is normally present on cold rolled products and is permissible unless otherwise specified. Discoloration is permissible as long as it does not impair utilisation.

Special requirements, for the application, e.g. contact area, surface coating, shall be agreed between the purchaser and the supplier [see 5 j)]. The dimensions, mechanical and electrical properties of plate, sheet and strip with surface coatings shall be agreed between the purchaser and the supplier.

7 Sampling

7.1 General

When required, (e.g. if necessary in accordance with specified procedures of a supplier's quality management system, or when the purchaser requests inspection documents with test results, or for use in cases of dispute), an inspection lot shall be sampled in accordance with 7.2 and 7.3.

7.2 Analysis

The sampling rate shall be in accordance with ISO 1811-2. A test sample, depending on the analytical technique to be employed, shall be prepared from each sampling unit and used for the determination of the composition.

NOTE 1 When preparing the test sample, care should be taken to avoid contaminating or overheating the test sample. Carbide tipped tools are recommended; steel tools, if used, should be made of magnetic material to assist in the subsequent removal of extraneous iron. If the test samples are in finely divided form (e.g. drillings, millings), they should be treated carefully with a strong magnet to remove any particles of iron introduced during preparation.

NOTE 2 In cases of dispute concerning the results of analysis, the full procedure given in ISO 1811-2 should be followed.

NOTE 3 Results may be used from analyses carried out at an earlier stage of manufacturing the product, e.g. at the casting or master coil stage, if the material identity is maintained and if the quality management system of the manufacturer is certified as conforming to EN ISO 9001.

7.3 Mechanical and electrical tests

The sampling rate shall be one test sample per master coil. Sampling units shall be selected from the finished products. The test samples shall be cut from the sampling units. Test samples, and test pieces prepared from them, shall not be subjected to any further treatment, other than any machining operations necessary in the preparation of the test pieces.

8 Test methods

8.1 Analysis

Analysis shall be carried out on the test pieces, or test portions, prepared from the test samples obtained in accordance with 7.2. Except in cases of dispute, the analytical methods used shall be at the discretion of the supplier. In cases of dispute, the methods of analysis to be used shall be in accordance with the appropriate ISO standards agreed between the disputing parties. For expression of results, the rounding rules given in 8.8 shall be used.