



SLOVENSKI STANDARD
SIST EN 12451:2000
01-november-2000

Baker in bakrove zlitine - Nevarjene cevi z okroglim prerezom za toplotne izmenjevalnike

Copper and copper alloys - Seamless, round tubes for heat exchangers

Kupfer und Kupferlegierungen - Nahtlose Rundrohre für Wärmeaustauscher

Cuivre et alliages de cuivre - Tubes ronds sans soudure pour échangeurs thermiques

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Ta slovenski standard je istoveten z: EN 12451:1999

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ICS:

23.040.15

77.150.30

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en

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ICS 77.120.30; 77.140.90

English version

Copper and copper alloys - Seamless, round tubes for heat exchangers

Cuivre et alliages de cuivre - Tubes ronds sans soudure
pour échangeurs thermiques

Kupfer und Kupferlegierungen - Nahtlose Rundrohre für
Wärmeaustauscher

This European Standard was approved by CEN on 14 June 1999.

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 Central Secretariat 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 Central Secretariat 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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard 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 January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

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

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 3.2 "Tubes for general purposes" to prepare the following standard:

EN 12451

Copper and copper alloys – Seamless, round tubes for heat exchangers

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directives.

For relationship with EU Directives, see annex ZA (informative) which is an integral part of this standard.

This is one of a series of European Standards for copper and copper alloy tubes. Other products are, or will be, specified as follows:

EN 1057

Copper and copper alloys – Seamless, round copper tubes for water and gas in sanitary and heating applications

EN 12449

Copper and copper alloys – Seamless, round tubes for general purposes

EN 12450

Copper and copper alloys – Seamless, round copper capillary tubes

EN 12452

Copper and copper alloys – Rolled, finned, seamless tubes for heat exchangers

prEN 12735-1

Copper and copper alloys – Seamless, round copper tubes for air conditioning and refrigeration – Part 1: Tubes for piping systems

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prEN 12735-2

Copper and copper alloys – Seamless, round copper tubes for air conditioning and refrigeration – Part 2: Tubes for equipment

prEN 13348

Copper and copper alloys – Seamless, round copper tubes for medical gases

prEN 13349

Copper and copper alloys – Pre-insulated copper tubes with solid covering

prEN 13600

Copper and copper alloys – Seamless copper tubes for electrical purposes

According to CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard:

1 Scope

This European Standard specifies the composition, property requirements and tolerances on dimensions and form for seamless round drawn copper and copper alloy tubes for heat exchangers, condensers, evaporators and desalination equipment, supplied in the size range from 6 mm up to and including 76 mm outside diameter and from 0,5 mm up to and including 3 mm wall thickness.

The sampling procedures and the methods of test for verification of conformity to the requirements of this standard 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.

EN 1655

Copper and copper alloys – Declarations of conformity

EN 1971

Copper and copper alloys – Eddy current test for tubes

EN 10002-1

Metallic materials – Tensile testing – Part 1: Method of test (at ambient temperature)

EN 10204

Metallic products – Types of inspection documents

EN 10234

Metallic materials – Tube – Drift expanding test

EN ISO 196

Wrought copper and copper alloys – Detection of residual stress – Mercury(I) nitrate test (ISO 196 : 1978)

EN ISO 2624

Copper and copper alloys – Estimation of average grain size (ISO 2624 : 1990)

EN ISO 6507-1

Metallic materials – Vickers hardness test – Part 1: Test method (ISO 6507-1:1997)

ISO 6957

Copper alloys – Ammonia test for stress corrosion resistance

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

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3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 seamless round tube

Hollow semi-finished product, circular in cross-section, having a uniform wall thickness which at all stages of production has a continuous periphery.

3.2 mean wall thickness

Arithmetical mean of the maximum and minimum wall thicknesses 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 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:

- R... Material condition designated by the minimum value of tensile strength requirement for the product with mandatory tensile property requirements;
- H... Material condition designated by the minimum value of hardness requirement for the product with mandatory hardness requirements.

NOTE 1: Products in the H... condition can be specified to Vickers or Brinell hardness. The condition designation H... is the same for both hardness test methods.

S (suffix) Material condition for a product which is stress relieved.

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NOTE 2: Products in the R... or H... condition can be specially processed (i.e. mechanically or thermally stress relieved) in order to lower the residual stress level to improve the resistance to stress corrosion (see 6.5.2).

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

Except when the suffix S is used, 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.

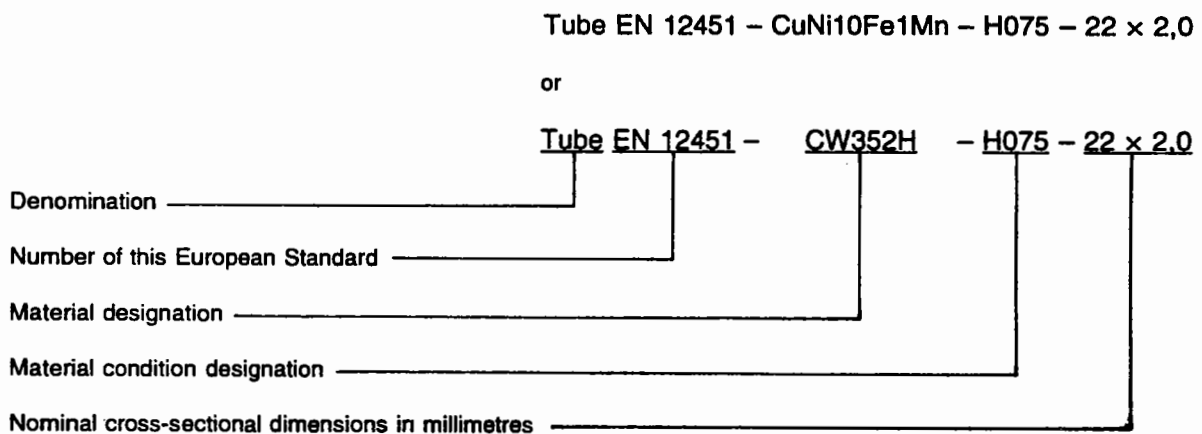
The product designation for products to this standard shall consist of:

- denomination (Tube);
- number of this European Standard (EN 12451);
- material designation, either symbol or number (see table 1);
- material condition designation (see table 2);
- nominal cross-sectional dimensions (outside diameter × wall thickness).

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

EXAMPLE:

Tube conforming to this standard, in material designated either CuNi10Fe1Mn or CW352H, in material condition H075, nominal outside diameter 22 mm, nominal wall thickness 2,0 mm, shall be designated as follows:



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:

NOTE 1: Heat exchanger tube can also be supplied as U-bend tube. For specific product and ordering information, see annex B.

- a) quantity of product required (number of pieces, length or mass);
- b) denomination (Tube);
- c) number of this European Standard (EN 12451);
- d) material designation (see table 1);
- e) material condition designation (see 4.2 and table 2);
- f) nominal cross-sectional dimensions (outside diameter × wall thickness);
- g) nominal length (see 6.3.4).

NOTE 2: 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:

- h) whether minimum wall thickness is required (see 6.3.3.2);
- i) whether the tubes in alloy CuNi10Fe1Mn (CW352H) are for sea water application (see table 1). If so, the composition limits required;

- j) whether the tubes are required to pass a stress corrosion resistance test (see 6.5.2);
- k) whether the tubes in hard condition are required with annealed ends;
- l) whether the tubes are required to pass freedom from defects tests (see 6.5.4). If so, which test method is to be used (see 8.5) if the choice is not to be left to the discretion of the supplier and the acceptance criteria if they are not to be left to the discretion of the supplier;
- m) whether the tubes are for subsequent welding application (see table 1);
- n) whether special surface quality is required (see 6.4);
- o) whether a declaration of conformity is required (see 9.1);
- p) whether an inspection document is required, and if so, which type (see 9.2);
- q) whether there are any special requirements for marking, packaging or labelling (see clause 10).

EXAMPLE:

Ordering details for 1 000 m tube conforming to EN 12451, in material designated either CuNi10Fe1Mn or CW352H, in material condition H075, nominal outside diameter 22 mm, nominal wall thickness 2,0 mm, nominal length 3 000 mm:

1 000 m Tube EN 12451 – CuNi10Fe1Mn – H075 – 22 × 2,0
– nominal length 3 000 mm

or

1 000 m Tube EN 12451 – CW352H – H075 – 22 × 2,0
– nominal length 3 000 mm

6 Requirements

6.1 Composition

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

6.2 Mechanical properties

The 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).

Products in stress relieved condition shall conform to the same mechanical property requirements as for non stress relieved material.

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6.3 Dimensions and tolerances

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6.3.1 General

The geometrical properties of the tubes are defined by outside diameter, wall thickness and length.

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

6.3.2 Outside diameter

The diameter of the tubes shall conform to the tolerances given in table 3.

6.3.3 Wall thickness

6.3.3.1 General

The wall thickness, measured at any point, shall conform to $\pm 10\%$ of the specified nominal wall thickness.

6.3.3.2 Minimum wall thickness

When minimum wall thickness is specified [see 5 h)], the wall thickness measured at any point shall be neither less than the nominal thickness nor more than 15 % greater than the nominal thickness and the mean wall thickness at any cross-section shall be not more than 10 % greater than the nominal thickness.

6.3.4 Length

Tubes ordered as "fixed lengths" shall conform to the tolerances given in table 4.

6.3.5 Tolerances of form

6.3.5.1 Deviation from circular form

For tubes in straight lengths the deviation from circular form is included in the tolerance on diameter given in table 3.

6.3.5.2 Straightness

The depth of arc measured in any one metre portion of length shall be not greater than 3 mm.

6.3.5.3 Squareness of cut

The deviation from squareness of the ends of the tubes shall not exceed the tolerances given in table 5.

6.4 Surface quality

The external and internal surfaces shall be clean and smooth.

The tubes may have a superficial film of drawing lubricant or, if annealed or thermally stress relieved, a superficial, dull, iridescent oxide film, securely adherent on both the internal and external surfaces.

Discontinuous irregularities on the external and internal surfaces of the tubes are permitted if they are within the dimensional tolerances.

Special requirements (e.g. pickling, degreasing, etc.) relating to the surface quality shall be agreed between the purchaser and the supplier [see 5 n)].

The cut ends of the tubes shall be deburred unless otherwise specified.

6.5 Technological requirements

6.5.1 Drift expanding

No crack shall be visible to the unaided eye, corrected for normal vision if necessary, when tubes in the annealed or end annealed condition are tested in accordance with 8.4.1.

6.5.2 Residual stress level

No crack shall be visible to the unaided eye, corrected for normal vision if necessary when tubes in the stress relieved condition and when requested by the purchaser [see 5 j)] are tested in accordance with 8.4.2.

6.5.3 Grain size

The average grain size of tubes in the annealed condition shall be in the range 0,010 mm to 0,050 mm. The test shall be carried out in accordance with 8.4.3.

6.5.4 Freedom from defects

When requested by the purchaser [see 5 l)], tubes shall be tested in accordance with 8.5 and the acceptance criteria, unless otherwise agreed between the purchaser and the supplier, shall be at the discretion of the supplier.

7 Sampling

7.1 General

When required (e.g. if necessary in accordance with specified procedures of a supplier's quality 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 table 6. 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.

Results may be used from analyses carried out at an earlier stage of manufacturing the product, e.g. at the casting stage, if the material identity is maintained and if the quality system of the manufacturer is certified as conforming to EN ISO 9001 or EN ISO 9002.

7.3 Mechanical tests and stress corrosion resistance test

The sampling rate shall be in accordance with table 6. 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.

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8 Test methods <https://standards.iteh.ai/catalog/standards/sist/66b8405c-4c9e-45cf-9049-a2da81d69e80/sist-en-12451-2000>

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 chemical or spectrographic according to ISO standards in force. For expression of results, the rounding rules given in 8.7 shall be used.

NOTE: In cases of dispute concerning the results of analysis, the method of analysis to be used should be chemical.