



# SLOVENSKI STANDARD

## SIST EN 12451:2012

01-september-2012

Nadomešča:  
SIST EN 12451:2000

---

**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

**Ta slovenski standard je istoveten z: EN 12451:2012**

**ICS:**

23.040.15	Cevi iz neželeznih kovin	Non-ferrous metal pipes
77.150.30	Bakreni izdelki	Copper products

**SIST EN 12451:2012**

**en,de**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 12451:2012](#)

<https://standards.iteh.ai/catalog/standards/sist/079f0eb3-e3f1-4519-97ba-fdec48571f71/sist-en-12451-2012>

EUROPEAN STANDARD

**EN 12451**

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2012

ICS 23.040.15; 77.150.30

Supersedes EN 12451:1999

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 20 April 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, 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.

SIST EN 12451:2012

<https://standards.iteh.ai/catalog/standards/sist/079f0eb3-e3f1-4519-97ba-f1ec48571f71/sist-en-12451-2012>



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

## Contents

Page

Foreword.....	3
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Designations .....	6
4.1 Material .....	6
4.2 Material condition .....	6
4.3 Product .....	6
5 Ordering information .....	7
6 Requirements .....	8
6.1 Composition .....	8
6.2 Mechanical properties .....	8
6.3 Dimensions and tolerances .....	9
6.4 Surface quality .....	9
6.5 Technological requirements .....	10
7 Sampling .....	10
7.1 General.....	10
7.2 Analysis .....	10
7.3 Mechanical tests and stress corrosion resistance test .....	11
8 Test methods.....	11
8.1 Analysis .....	11
8.2 Tensile test .....	11
8.3 Hardness test .....	11
8.4 Technological tests .....	11
8.5 Freedom from defects tests .....	11
8.6 Retests .....	13
8.7 Rounding of results .....	13
9 Declaration of conformity and inspection documentation.....	13
9.1 Declaration of conformity .....	13
9.2 Inspection documentation .....	13
10 Marking, packaging, labelling.....	14
Annex A (normative) U-bend seamless copper and copper alloy heat exchanger tubes .....	19
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Pressure Equipment Directive (PED) 97/23/EC .....	21
Bibliography .....	22
Tables	
Table 1 — Composition of copper and copper alloys.....	15
Table 2 — Mechanical properties of copper and copper alloys .....	16
Table 3 — Tolerances on diameter .....	17
Table 4 — Tolerances on length.....	17
Table 5 — Tolerances on squareness of cut .....	17
Table 6 — Sampling rate .....	18
Table 7 — Drill sizes for production of reference standard tubes.....	18
Table ZA.1 — Correspondence between this European Standard and Directive 97/23/EC .....	21

## Foreword

This document (EN 12451:2012) 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 November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

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 12451:1999.

This document 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 97/23/EC Pressure Equipment Directive (PED).

For relationship with EU Directive 97/23/EU, see informative Annex ZA, which is an integral part of this document.

In comparison with EN 12451:1999, the following significant technical changes were made:

a) for Cu-DHP (CW024A):

- 1) the material condition R220 in Table 2 was added;
- 2) elongation values were modified for R250 and R290.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 3 "Copper tubes (installation and industrial)" to revise the following standard:

EN 12451:1999, *Copper and copper alloys — Seamless, round tubes for heat exchangers*

This is one of a series of European Standards for copper and copper alloy tubes. Other products are 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*

EN 12735-1, *Copper and copper alloys — Seamless, round copper tubes for air conditioning and refrigeration — Part 1: Tubes for piping systems*

EN 12735-2, *Copper and copper alloys — Seamless, round copper tubes for air conditioning and refrigeration — Part 2: Tubes for equipment*

EN 13348, *Copper and copper alloys — Seamless, round copper tubes for medical gases or vacuum*

EN 13349, *Copper and copper alloys — Pre-insulated copper tubes with solid covering*

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

**EN 12451:2012 (E)**

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, 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.

## **iTeh STANDARD PREVIEW (standards.iteh.ai)**

[SIST EN 12451:2012](https://standards.iteh.ai/catalog/standards/sist/079f0eb3-e3f1-4519-97ba-fdec48571f71/sist-en-12451-2012)

<https://standards.iteh.ai/catalog/standards/sist/079f0eb3-e3f1-4519-97ba-fdec48571f71/sist-en-12451-2012>

## 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. It is applicable to copper and copper alloy tubes 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 European Standard are also specified.

## 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 1971-1, *Copper and copper alloys — Eddy current test for measuring defects on seamless round copper and copper alloy tubes — Part 1: Test with an encircling test coil on the outer surface*

EN 1971-2, *Copper and copper alloys — Eddy current test for measuring defects on seamless round copper and copper alloy tubes — Part 2: Test with an internal probe on the inner surface*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 16090, *Copper and copper alloys — Estimation of average grain size by ultrasound*

EN ISO 196, *Wrought copper and copper alloys — Detection of residual stress — Mercury (I) nitrate test (ISO 196)*

EN ISO 2624, *Copper and copper alloys — Estimation of average grain size (ISO 2624)*

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

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

EN ISO 8493, *Metallic materials — Tube — Drift-expanding test (ISO 8493)*

ISO 6957, *Copper alloys — Ammonia test for stress corrosion resistance*

## 3 Terms and definitions

For the purposes of this document, the following terms and 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

**EN 12451:2012 (E)**

**3.3 deviation from circular form**  
 difference between the maximum and minimum outside diameters measured at any one cross-section of the tube

[SOURCE: EN 1057:2006+A1:2010, 3.6]

**4 Designations****4.1 Material****4.1.1 General**

The material is designated either by symbol or by 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 European 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 European 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.                 |
| S (suffix) | Material condition for a product which is stress relieved.   |

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.

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).

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

Except when the suffix S is used, the 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 can be 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.

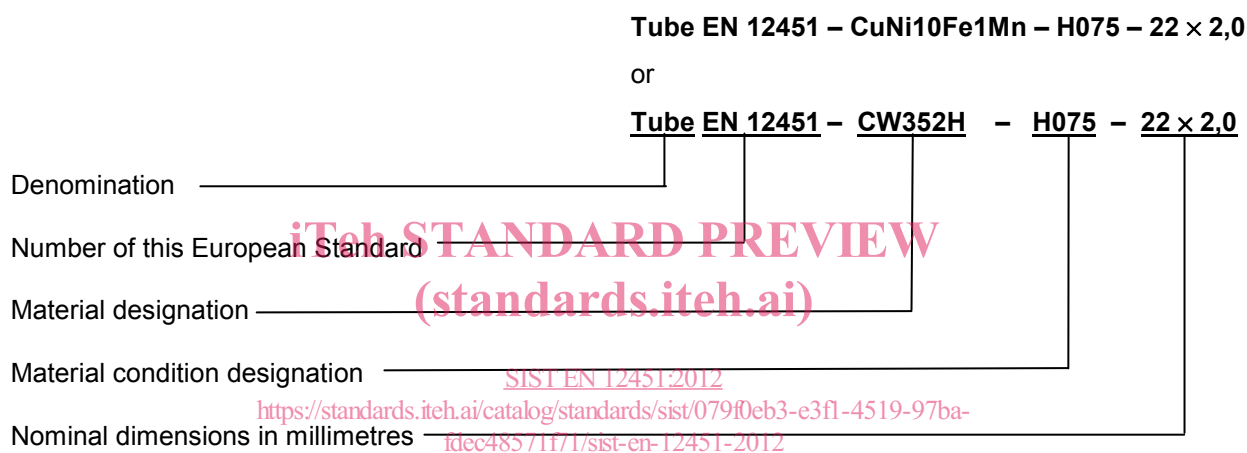


The product designation for products to this European Standard shall consist of:

- denomination (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 European Standard, in material designated either CuNi10Fe1Mn or CW352H, in material condition H075, with nominal outside diameter 22 mm and 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 A.

- 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).

**EN 12451:2012 (E)**

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), and 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), and if so, which test method is to be used (see 8.5) if the choice and/or the acceptance criteria is (are) not to be left to the discretion of the supplier;
- m) whether the tubes are for subsequent welding applications (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, with nominal outside diameter 22 mm, nominal wall thickness 2,0 mm and nominal length 3 000 mm:

**1 000 m Tube EN 12451 – CuNi10Fe1Mn – H075 – 22 × 2,0**

<https://standards.iteh.ai/catalog/standards/sist/079f0eb3-e3f1-4519-97ba-fdec48571171/sist-en-12451-2012>  
**– 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.

## 6.3 Dimensions and tolerances

### 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 Clause 5, list entry 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 on 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 1 m 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 adhered to 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.