

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

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ICS 23.040.15; 77.150.30

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee NFE/34, Copper and copper alloys, to Subcommittee NFE/34/1, Wrought and unwrought copper and copper alloys, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 37 and a back cover.

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

Cuivre et alliages de cuivre — Tubes ronds sans soudure
pour usages généraux

Kupfer und Kupferlegierungen — Nahtlose Rundrohre zur
allgemeinen Verwendung

This European Standard was approved by CEN on 26 May 1999.

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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 Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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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of an identical text or by endorsement, at the latest by January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.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. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European 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 12449

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

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 12450

Copper and copper alloys – Seamless, round copper capillary tubes

EN 12451

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

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

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

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 general purposes supplied in the size range from 3 mm up to and including 450 mm outside diameter and from 0,3 mm up to and including 20 mm wall thickness.

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

NOTE: Tubes having an outside diameter less than 80 mm and/or a wall thickness greater than 2 mm in certain alloys are most frequently used for the free machining purposes which are specified in EN 12168.

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 10002-1

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

EN 10003-1

Metallic materials – Brinell hardness test – Part 1: Test method

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.

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 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 tables 1 to 8).

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:

M Material condition for the product as manufactured without specified mechanical properties;

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 material condition designation H... is the same for both hardness test methods.

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

NOTE 2: Products in the M, 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 the 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 12449);
- material designation, either symbol or number (see tables 1 to 8);
- material condition designation (see tables 9 to 15);
- nominal cross-sectional dimensions, either outside diameter (OD) and wall thickness or inside diameter (ID) and wall thickness (see 6.3).

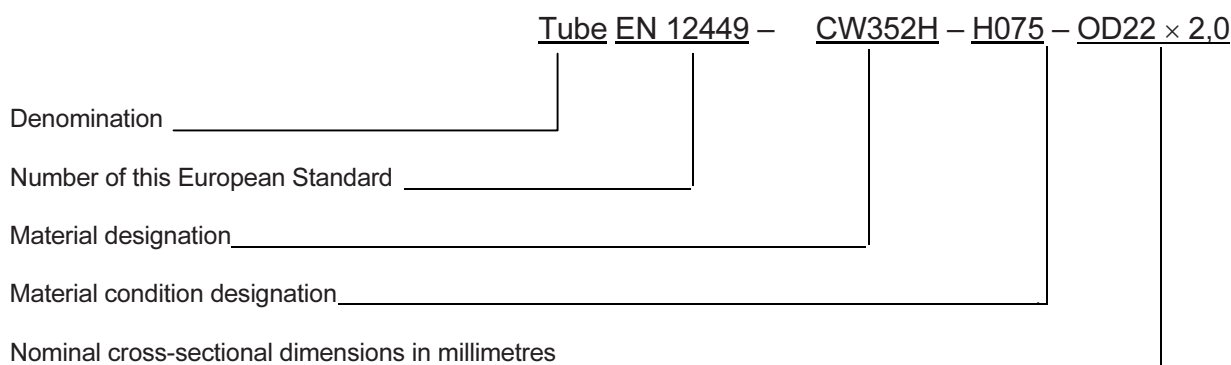
The derivation of a product designation is shown in example 1.

EXAMPLE 1:

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:

Tube EN 12449 – CuNi10Fe1Mn – H075 – OD22 × 2,0

or



EXAMPLE 2:

Tube conforming to this standard, in material designated either CuZn37 or CW508L, in material condition M, stress relieved, nominal inside diameter 30 mm, nominal wall thickness 2,5 mm, shall be designated as follows:

Tube EN 12449 – CuZn37 – MS – ID30 × 2,5

or

Tube EN 12449 – CW508L – MS – ID30 × 2,5

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 (number of pieces, length or mass);

- b) denomination (Tube);
- c) number of this European Standard (EN 12449);
- d) material designation (see tables 1 to 8);
- e) material condition designation (see 4.2 and tables 9 to 15) if it is other than M;
- f) nominal cross-sectional dimensions [either outside diameter (OD) and wall thickness or inside diameter (ID) and wall thickness] (see 6.3);
- g) length, either nominal together with tolerance required, or fixed length (see 6.3.4);

NOTE 1: 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 the tubes are for sea water application (see table 3). If so, the composition limits required;
- i) test method to be used for the measurement of hardness, i.e. Vickers or Brinell (see 8.3);
- j) where dimensional tolerances are to be applied, if not on the outside diameter and wall thickness (see 6.3.1);
- k) whether the tubes are required to pass a drift expanding test (see 6.5.1);
- l) whether the tubes are required to pass a stress corrosion resistance test (see 6.5.2);
- m) whether the tubes are required to meet a grain size requirement (see 6.5.3). If so, the grain size limits required;

NOTE 2: The grain size limits should be agreed between the purchaser and the supplier.

- n) 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;
- o) whether deburring is required (see 6.4);
- p) whether special surface quality is required (see 6.4);
- q) whether a declaration of conformity is required (see 9.1);
- r) whether an inspection document is required, and if so, which type (see 9.2);
- s) 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 12449, in material designated either CuNi10Fe1Mn or CW352H, in material condition H075, nominal outside diameter 22 mm, nominal wall thickness 2,0 mm, in 3 000 mm fixed lengths:

**1 000 m tube EN 12449 – CuNi10Fe1Mn – H075 – OD22 × 2,0
– fixed length 3 000 mm**

or

**1 000 m tube EN 12449 – CW352H – H075 – OD22 × 2,0
– fixed length 3 000 mm**

6 Requirements

6.1 Composition

The composition shall conform to the requirements for the appropriate material given in tables 1 to 8.

6.2 Mechanical properties

The properties shall conform to the appropriate requirements given in tables 9 to 15. 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 or inside diameter, wall thickness and length.

Normally, tolerances for cross-sectional dimensions are applied on the outside diameter (see 6.3.2) and wall thickness (see 6.3.3) but other possibilities may be agreed between the purchaser and the supplier at the time of the enquiry and order [see 5 j)].

Normally, tubes are supplied in lengths with tolerances agreed between the purchaser and the supplier at the time of the enquiry and order [see 5 g)] but tubes may be ordered as "fixed lengths" (see 6.3.4).

6.3.2 Outside or inside diameter

The diameter of the tubes shall conform to the tolerances given in table 16.

6.3.3 Wall thickness

The wall thickness, measured at any point, shall conform to the tolerances given in table 17.

6.3.4 Fixed lengths

Tubes in straight lengths ordered as "fixed lengths" shall conform to the tolerances given in table 18. Tubes in coiled form ordered as "fixed lengths" shall conform to the tolerances given in table 19.

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 tolerances on diameter given in table 16.

For coiled tubes with wall thicknesses up to and including 2 mm, except for tubes with ratios of outside diameter to wall thickness greater than 20, the deviation from circular form is included in the tolerances on diameter given in table 20.

6.3.5.2 Straightness

Tubes in straight lengths, except for those in the annealed condition (see tables 9 to 15) or with outside diameter equal to or less than 10 mm, shall conform to the tolerances given in table 21.

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 p)].

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

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 condition and outside diameter up to and including 100 mm and when agreed between the purchaser and the supplier [see 5 k)] 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 l)] are tested in accordance with 8.4.2.

6.5.3 Grain size

The average grain size of tubes in the annealed condition, when requested by the purchaser, [see 5 m)] shall conform to the limits agreed between the purchaser and the supplier. 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 n)] 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 22. 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 22. 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 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.

8.2 Tensile test

The tensile properties shall be determined in accordance with EN 10002-1 on the test pieces obtained in accordance with 7.3.

8.3 Hardness test

Hardness shall be determined on test pieces prepared from the test samples obtained in accordance with 7.3. The test shall be carried out in accordance with either EN 10003-1 or EN ISO 6507-1 and the impression/indentation made on the outside surface, unless otherwise agreed. For the Brinell test according to EN 10003-1 a 0,102 F/D^2 ratio of 10 shall be used.

8.4 Technological tests

8.4.1 Drift expanding test

When required, the drift expanding test shall be carried out in accordance with EN 10234. The outside diameter of the tube end shall be expanded by 30 % using a conical mandrel with an angle of 45°.

8.4.2 Stress corrosion resistance test

When required, the test method given in either EN ISO 196 or ISO 6957 shall be used on the test pieces prepared from the test samples obtained in accordance with 7.3. The choice of which of these tests is used shall be at the discretion of the supplier.

8.4.3 Average grain size determination

When required, the estimation of average grain size shall be carried out in accordance with EN ISO 2624.

8.5 Freedom from defects tests

When required, each tube shall be subjected to one of the following tests:

- Eddy current test;
- Hydrostatic test;
- Pneumatic test.

If not otherwise agreed between the purchaser and the supplier, the test method to be used and the method of testing shall be at the discretion of the manufacturer.