

English Version

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

Cuivre et alliages de cuivre - Tubes ronds sans soudure en cuivre pour l'eau et le gaz dans les applications sanitaires et de chauffage

Kupfer und Kupferlegierungen - Nahtlose Rundrohre aus Kupfer für Wasser- und Gasleitungen für Sanitärinstallationen und Heizungsanlagen

This European Standard was approved by CEN on 23 March 2006.

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Contents

Page

Foreword.....	4
Introduction	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 Designations	9
4.1 Material	9
4.1.1 General.....	9
4.1.2 Symbol	9
4.1.3 Number	9
4.2 Material condition	9
4.3 Product	9
5 Ordering information	10
6 Material characteristics.....	11
6.1 Safety in case of fire – Reaction to fire	11
6.2 Properties at high temperature	11
6.3 Weldability	11
7 Requirements	11
7.1 Composition.....	11
7.2 Mechanical properties.....	11
7.3 Dimensions and tolerances	14
7.3.1 General.....	14
7.3.2 Nominal dimensions.....	14
7.3.3 Tolerances on outside diameter.....	15
7.3.4 Tolerances on wall thickness	16
7.3.5 Tolerances on length.....	16
7.4 Freedom from defects	17
7.5 Surface quality	17
7.6 Bending.....	17
7.7 Drift expanding.....	17
7.8 Flanging	17
8 Evaluation of conformity.....	18
8.1 General.....	18
8.2 Type testing	18
8.2.1 Initial type testing	18
8.2.2 Sampling, testing and conformity criteria.....	19
8.3 Factory production control (FPC)	19
8.3.1 General.....	19
8.3.2 General FPC requirements	20
8.3.3 Manufacturer-specific FPC system requirements.....	20
9 Sampling.....	21
10 Test methods.....	22
10.1 Analysis	22
10.2 Tensile test	22
10.3 Hardness test	22
10.4 Carbon content test	22
10.5 Carbon film test.....	22
10.6 Bending test	22
10.7 Drift-expanding test	23
10.8 Flanging test.....	23
10.9 Freedom from defects tests.....	24
10.10 Retests	24

11	Inspection documentation	24
12	Marking and form of delivery	24
12.1	Marking	24
12.2	Form of delivery	25
Annex A (normative) Standardized dimensions for reconsideration at a future revision.....		26
Annex B (normative) Carbon film test		27
B.1	Preparation of the test piece	27
B.2	Procedure	27
B.3	Detection and assessment of films.....	27
Annex C (normative) Freedom from defects tests		28
C.1	Eddy current test	28
C.2	Hydrostatic test.....	28
C.3	Pneumatic test	28
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive (CPD) 89/106/EEC.....		30
ZA.1	Scope and relevant characteristics	30
ZA.2	Procedure(s) for attestation of conformity of pipes	32
ZA.2.1	System(s) of attestation of conformity	32
ZA.2.2	EC Certificate and Declaration of conformity	33
ZA.3	CE marking and labelling.....	34
Annex ZB (informative) Relationship between this European Standard and the Essential Requirements of the EU Pressure Equipment Directive (PED) 97/23/EC.....		36
Bibliography		37

Tables

Table 1	— Mechanical properties.....	12
Table 2	— Minimal elongation values for R250 (half hard) material condition tubes.....	13
Table 3	— Standardized dimensions	15
Table 4	— Tolerances on outside diameter	16
Table 5	— Tolerances on wall thickness.....	16
Table 6	— Quantitative and qualitative specification for carbon residues.....	17
Table 7	— Testing of bending, drift expanding and flanging.....	18
Table 8	— Sampling rate	21
Table 9	— Minimum radius of curvature	23
Table 10	— Recommended form of delivery.....	25
Table A.1	— Standardized dimensions for reconsideration at a future revision	26
Table C.1	— Maximum drill diameters for the reference standard tube	28
Table C.2	— Hydraulic pressure test	28
Table ZA.1	— Relevant clauses.....	31
Table ZA.2	— Systems of attestation of conformity	32
Table ZA.3.1	— Assignment of evaluation of conformity tasks for pipes under system 3 — 1/5	33
Table ZA.3.2	— Assignment of evaluation of conformity tasks for pipes under system 4 — 2/5	33
Table ZB.1	— Correspondence between this European Standard and Directive 97/23/EC	36

Foreword

This document (EN 1057:2006) 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 2006, and conflicting national standards shall be withdrawn at the latest by February 2008.

This document supersedes EN 1057:1996.

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

EN 1057:1996, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*

This document has been prepared within the framework of two mandates given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the EU Construction Products Directive (CPD) 89/106/EEC and the EU Pressure Equipment Directive (PED) 97/23/EC.

For relationship with EU Directives, see informative Annexes ZA and ZB, which are integral parts of this document.

In comparison with the first edition of EN 1057:1996, the following significant technical changes were made:

- harmonization of the standard to the Construction Product Directive (CPD) and to the Pressure Equipment Directive (PED);
- introduction of two new definitions: "permanently marked" and "durably marked";
- updating of the definitions regarding soldering, brazing, fusion welding, braze welding and mean diameter;
- introduction of five new items in Clause 5 "Ordering information" regarding options on tests and documents;
- due to the process of harmonization to the CPD, introduction of three new characteristics in Clause 6 "Material characteristics" inherent to copper material which are not to be tested;
- modification of Table 3 "Standardized dimensions";
- simplification of Table 6 "Quantitative and qualitative specification for carbon residues": Suppression of the residual and potential carbon and application of the thresholds to the total carbon;
- text in Clause 8 "Evaluation of conformity" added due to the process of harmonization to the CPD;
- for permanent and durable markings, specification of their applicability in 12.1 "Marking";
- modification of the table in Annex A, introduction of new diameters and wall thicknesses;
- due to the process of harmonization to the CPD and PED introduction of Annexes ZA and ZB.

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

EN 12449, *Copper and copper alloys — Seamless, round tubes for general purposes*

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*

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*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 and United Kingdom.

Introduction

Products in conformity with this European Standard are considered suitable for drinking water applications subject to either

- a) compliance with any national regulations in the country of intended destination; or
- b) compliance in due course with the proposed European Acceptance Scheme (EAS) that will introduce common EU requirements for testing for fitness for contact with drinking water. When the EAS is implemented, this European Standard will have added to it a special Annex (Z/EAS) to incorporate the provisions of the EC mandate M/136 and a) will no longer be applicable.

This European Standard provides the basis for the assessment of a manufacturer's production process for products manufactured in accordance with this European Standard. The assessment could be based on initial and continuing surveillance of the factory production control system which could be concurrent with an assessment of the manufacturer's quality management system against EN ISO 9001.

Regulatory marking and the means by which regulatory marking is applied, is dealt with in Annex ZA.

Tubes having an outside diameter of not more than 108 mm are suitable for soldering, brazing or assembling by mechanical compression, collared, push-fit or press fittings. For tubes having an outside diameter of more than 108 mm, assembly should preferably be performed by welding or braze welding.

Reference can be made to this European Standard for tubes intended for other applications or for the transportation of other fluids. In such cases special requirements (for specifications, conditioning or delivery conditions) can be agreed between the purchaser and the supplier.

NOTE Appropriate precautions should be taken if applying insulating/protecting material because it could be detrimental to the copper tube.

1 Scope

This European Standard specifies the requirements, sampling, test methods and conditions of delivery for seamless round copper tubes.

It is applicable to tubes having an outside diameter from 6 mm up to and including 267 mm for:

- distributing networks for hot water and cold water;
- hot water heating systems, including panel heating systems (under-floor, wall, overhead);
- domestic gas and liquid fuel distribution;
- waste water sanitation.

It is also applicable to seamless round copper tubes intended to be pre-insulated before use for any of the above purposes.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 723, *Copper and copper alloys — Combustion method for determination of carbon on the inner surface of copper tubes or fittings*

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

EN ISO 8491, *Metallic materials — Tube (in full section) — Bend test (ISO 8491:1998)*

EN ISO 8493, *Metallic materials — Tube — Drift-expanding test (ISO 8493:1998)*

EN ISO 8494, *Metallic materials — Tube — Flanging test (ISO 8494:1998)*

EN ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1:2005)*

EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*

ISO 1553, *Unalloyed copper containing not less than 99,90 % of copper — Determination of copper content — Electrolytic method*

ISO 4741, *Copper and copper alloys — Determination of phosphorus content — Molybdovanadate spectrometric method*

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 document, the following terms and definitions apply.

3.1

seamless round copper tube

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

3.2

soldering/brazing

joining process in which, during or after heating, molten filler metal is drawn into or retained in the space between closely adjacent surfaces of the parts to be joined by capillary attraction

3.2.1

soldering

soft soldering

joining process using filler metal with a liquidus temperature of 450 °C or less

[ISO 857-2:2005]

3.2.2

brazing

hard soldering

joining process using filler metal with a liquidus temperature above 450 °C

[ISO 857-2:2005]

3.3

fusion welding

welding without application of outer force in which the facing surface(s) has (have) to be molten; usually, but not necessarily, molten filler metal is added

[ISO 857-1:1998]

3.4

braze welding

method of welding by using a filler metal that liquefies above 450 °C and below the solid state of the base metals. Unlike brazing, in braze welding, the filler metal is not distributed in the joint by capillary action

3.5

mean diameter

arithmetical mean of the maximum and minimum outside diameters through the same cross-section of the tube

3.6

deviation from circular form

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

3.7

deviation from concentricity

half of the difference between the maximum and minimum wall thicknesses at the same cross-section of the tube

3.8

production batch

definite quantity of products of the same form, the same material condition and the same cross-sectional dimensions manufactured during the same production sequence under uniform conditions

3.9**permanently marked**

marked in such a way that the marking will remain readable up to the end of the life of the installation, e.g. by stamping, etching or engraving

3.10**durably marked**

marked in such a way that the marking will remain readable up to the time of commissioning of the installation

EXAMPLE ink marking

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

The material is designated either by symbol or number (see 7.1).

4.1.2 Symbol

The material symbol designation is based on the designation system given in ISO 1190-1.

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 designation, which is in accordance with the system given in EN 1173, applies for the material condition (see Table 1):

R... Material condition designated by the minimum value of tensile strength requirement for the product with mandatory tensile strength and elongation requirements.

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 European Standard shall consist of:

- denomination (Copper tube);
- number of this European Standard (EN 1057);
- material condition designation (see Table 1);
- nominal cross-sectional dimensions in millimetres: outside diameter × wall thickness.

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

EXAMPLE Copper tube conforming to this European Standard, material condition R220 (annealed), nominal outside diameter 12 mm, nominal wall thickness 1,0 mm, shall be designated as follows:

6 Material characteristics

6.1 Safety in case of fire – Reaction to fire

Copper tubes according to this European Standard, i.e. without plastics covering, do not require to be tested for reaction to fire (i.e. products/materials of class A.1 according to Commission Decision 96/603/EC, as amended 2000/605/EC).

6.2 Properties at high temperature

The mechanical properties of copper at temperatures encountered in heating networks are not reduced significantly; for example, from ambient temperature up to 120 °C, it is not necessary to include the maximum admissible stress in pressure calculations.

6.3 Weldability

The suitability for welding is characteristic of the copper grade used for products in accordance with this European Standard, which is assured by control of the material composition.

NOTE Cu-DHP copper can be readily welded to produce a strong, homogeneous structure. Nevertheless, the advice of the manufacturer and welding professionals should be sought in order to ensure the correct selection of welding process, design and workmanship, taking into account thermal conductivity and coefficient of thermal expansion, to achieve the highest quality results.

7 Requirements

7.1 Composition

The composition shall conform to the following requirements:

Cu + Ag: min. 99,90 %;

$0,015 \% \leq P \leq 0,040 \%$.

This copper grade is designated either Cu-DHP or CW024A.

7.2 Mechanical properties

The tensile strength and elongation shall conform to the requirements given in Table 1. The test shall be carried out in accordance with 10.2.

Table 1 — Mechanical properties

Material condition		Nominal outside diameter		Tensile strength	Elongation	Hardness (indicative)
designation in accordance with EN 1173	common term	<i>d</i> mm		<i>R_m</i> MPa	<i>A</i> %	HV 5
		min.	max.	min.	min.	
R220	annealed	6	54	220	40	(40 to 70)
R250 ^a	half hard ^a	6	66,7	250	30 ^a	(75 to 100)
		6	159		20 ^a	
R290	hard	6	267	290	3	(min. 100)
<p>NOTE 1 Hardness figures in parentheses are not requirements of this European Standard but are given for guidance purposes only.</p> <p>NOTE 2 1 MPa is equivalent to 1 N/mm².</p> <p>NOTE 3 Brittle fracture prevention: Copper, having a face-centred cubic crystal structure, does not suffer a transition from ductile to brittle failure like some other materials.</p>						
^a See Table 2 for relationship between tube dimensions and elongation for R250 (half hard) tubes.						

The size range for values of elongation of R250 (half hard) tube is dependent on the relationship between diameter and wall thickness as shown in Table 2.

Table 2 — Minimal elongation values for R250 (half hard) material condition tubes

Values in millimetres

Nominal outside diameter ^a <i>d</i>	Nominal wall thickness <i>e</i>												
	0,5	0,6	0,7	0,75	0,8	0,9	1,0	1,1	1,2	1,5	2,0	2,5	3,0
6													
8													
10													
12													
14													
15													
16													
18													
22													
28													
35													
40		A ≥ 30 %											
42													
54													
64													
66,7													
70													
76,1													
80													
88,9										A ≥ 20 %			
108													
133													
159													
219													
267													

^a For remaining non-metric dimensions in Annex A, the rounded nearest diameter applies.

Elongation ≥ 30 % when $d \leq 66,7$ mm; and either $e < 1$ mm or $\frac{d}{e^2} > 24$;

Elongation ≥ 20 % when $d > 66,7$ mm; or $e \geq 1$ mm and also $\frac{d}{e^2} \leq 24$.

where

d is the nominal outside diameter in millimetres;

e is the nominal wall thickness in millimetres.

7.3 Dimensions and tolerances

7.3.1 General

The geometrical properties of the tube are defined by outside diameter, wall thickness and length. The outside diameter and wall thickness shall conform to the requirements given in Table 3 (or Table A.1), Table 4 and Table 5.

In cases of dispute these dimensions shall be measured at a temperature of $(23 \pm 5) ^\circ\text{C}$.

7.3.2 Nominal dimensions

The standardized nominal outside diameters and nominal wall thicknesses are given in Table 3 (or Table A.1). The lengths recommended are indicated in Table 10.

NOTE 1 These standardized dimensions have been selected from those used on the European market at the time of establishment of the present European Standard.

NOTE 2 A limited number of other dimensions have been listed in Annex A for reconsideration at a future revision of this European Standard.

NOTE 3 CEN/TC 133 has defined the recommended R marked dimensions as a step towards rationalization aiming for not more than three wall thickness for each diameter, and a restricted number of diameters.

NOTE 4 For reference purposes, if DN designation of size for components of a piping system is required, it can be calculated for tubes to this European Standard by: Nominal outside diameter (d) — $2 \times$ nominal wall thickness (e). DN is a numerical designation of size, which is common to all components in a piping system. It is a convenient round number for reference purposes and is only loosely related to the manufacturing dimensions (see EN ISO 6708).

Table 3 — Standardized dimensions

Values in millimetres

Nominal outside diameter <i>d</i>	Nominal wall thickness <i>e</i>											
	0,5	0,6	0,7	0,8	0,9	1,0	1,1	1,2	1,5	2,0	2,5	3,0
6		R		R		R						
8		R		R		R						
10		R	R	R		R						
12		R	R	R		R						
14				R		R						
15			R	R		R						
16						R						
18				R		R						
22					R	R	R	R	R			
28					R	R		R	R			
35						R		R	R			
40						R						
42						R		R	R			
54						R		R	R	R		
64										R		
66,7								R		R		
76,1									R	R		
88,9										R		
108									R		R	
133									R			R
159										R		R
219												R
267												R

R Indicates the dimensions recommended for consideration in national codes of practice. See also Annex A.

7.3.3 Tolerances on outside diameter

The outside diameter shall conform to the tolerances given in Table 4.

Table 4 — Tolerances on outside diameter

Values in millimetres

Nominal outside diameter		Tolerances on nominal diameter		
<i>d</i>		applicable to mean diameter all material conditions	applicable to any diameter ^a	
over	up to and including		R290 (hard) material condition	R250 (half hard) material condition
6 ^b	18	± 0,04	± 0,04	± 0,09
18	28	± 0,05	± 0,06	± 0,10
28	54	± 0,06	± 0,07	± 0,11
54	76,1	± 0,07	± 0,10	± 0,15
76,1	88,9	± 0,07	± 0,15	± 0,20
88,9	108	± 0,07	± 0,20	± 0,30
108	159	± 0,2	± 0,7	± 0,4
159	267	± 0,6	± 1,5	—

NOTE 1 Tolerances for tubes in R220 (annealed) material condition are applicable only to mean diameter.

NOTE 2 In case of dispute, to improve the accuracy when determining the mean diameter, the tube may be re-rounded before measurement.

^a Including deviation from circular form

^b Including 6

7.3.4 Tolerances on wall thickness

The tolerances on wall thickness expressed in percentage of the nominal thickness as measured at any point shall conform to the requirements given in Table 5.

Table 5 — Tolerances on wall thickness

Nominal outside diameter <i>d</i> mm	Tolerances on wall thickness <i>e</i> ^a	
	<i>e</i> < 1 mm %	<i>e</i> ≥ 1 mm %
< 18	± 10	± 13
≥ 18	± 10	± 15 ^b

NOTE Concentricity (uniformity of wall thickness) is controlled by tolerance on wall thickness.

^a Including deviation from concentricity

^b ± 10 % for R250 (half hard) tubes of 35 mm, 42 mm and 54 mm diameters with a wall thickness of 1,2 mm

7.3.5 Tolerances on length

The lengths shall be equal to or greater than those ordered.

7.4 Freedom from defects

The tubes shall be free from defects that could be detrimental to their use. Each tube shall be subjected to one of the freedom from defects tests described in 10.9.

7.5 Surface quality

The outer and inner surfaces of the tubes shall be clean and smooth.

The inner surface shall neither contain any detrimental film nor present a carbon level high enough to allow the formation of such a film during installation. When tested in accordance with 10.4 and 10.5 as appropriate the tube shall conform to the appropriate requirements given in Table 6. The results of the tests shall be documented and presented to the purchaser, or his representative, upon request using the quantitative method in accordance with 10.4.

NOTE For routine quality control, it is at the discretion of the manufacturer to choose between quantitative analysis of carbon content or the carbon film test.

Table 6 — Quantitative and qualitative specification for carbon residues

Nominal outside diameter <i>d</i> mm	Material condition	Quantitative method — Total carbon ^a max. mg/dm ²	Qualitative method — Carbon film test
from 10 up to and including 54	R220 (annealed)	0,20	yes
	R250 (half hard)	0,20	yes
	R290 (hard)	0,20	yes
over 54	R250 (half hard)	0,20	yes
	R290 (hard)	1,0	no
NOTE To establish the inspection and control documents, only the quantitative method shall be used (see EN 723).			
^a Definition according to EN 723.			

7.6 Bending

No tear shall be visible to the unaided eye, corrected for normal vision, if necessary, when tubes of the sizes and material condition given in Table 7 are tested in accordance with 10.6. Strain bending (Lüders lines) shall be accepted.

7.7 Drift expanding

No crack, break or tearing of the metal shall be visible to the unaided eye, corrected for normal vision, if necessary, when tubes of the sizes and material conditions given in Table 7 (and agreed between the purchaser and the supplier, where necessary) are tested in accordance with 10.7.

7.8 Flanging

No crack on the tube edge shall be visible to the unaided eye, corrected for normal vision, if necessary, when tubes of the sizes and material condition given in Table 7 (and agreed between the purchaser and the supplier, where necessary) are tested in accordance with 10.8.

Table 7 — Testing of bending, drift expanding and flanging

Nominal outside diameter <i>d</i> mm		Material condition	Technological tests		
over	up to and including		bending ^a	drift expanding	flanging
6 ^b	18	R220 (annealed)	—	M	A
		R250 (half hard)	—	M	—
		R290 (hard)	M	—	—
18	54	R220 (annealed)	—	A	A
		R250 (half hard)	—	A	—
		R290 (hard)	—	—	—
54	267	R220 (annealed)	—	—	—
		R250 (half hard)	—	—	—
		R290 (hard)	—	—	—
M Mandatory					
A To be agreed upon by the purchaser and the supplier					
^a For nominal wall thickness not less than 1 mm.					
^b Including 6.					

8 Evaluation of conformity

8.1 General

The conformity of copper tube to the requirements of this standard and with the stated values shall be demonstrated by:

- initial type testing;
- factory production control by the manufacturer, including product assessment.

8.2 Type testing

8.2.1 Initial type testing

An initial type test is the complete set of tests or other procedures, determining the performance of samples of products representative of the product type.

Initial type testing shall be performed to show conformity with this European Standard.

Tests previously performed in accordance with the provisions of this European Standard (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity etc.) may be taken into account. In addition, initial type testing shall be performed at the beginning of a new method of production (where this may affect the stated properties).

All requirements in Clause 7 shall be subject to initial type testing. The material characteristics in Clause 6, which may be assessed by control of the material, do not need testing because:

- reaction to fire — copper and copper alloys are classified as class A.1 according to Commission Decision 96/603/EC;
- properties at high temperature — mechanical properties are not reduced significantly at temperatures concerned;
- weldability — copper grade Cu-DHP can be readily welded.

8.2.2 Sampling, testing and conformity criteria

8.2.2.1 Sampling

Initial type testing shall be performed on representative samples of the copper tube production to be placed on the market.

8.2.2.2 Testing and conformity criteria

Copper tubes shall be tested for conformity to the requirements listed in Clause 7 in accordance with the relevant methods given in Clause 10.

The results of all type tests shall be recorded and held by the manufacturer for at least 5 years after the end of production of the product for which the ITT is representative.

8.3 Factory production control (FPC)

8.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the declared performance characteristics. The FPC system shall consist of written procedures (works' manual), regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials, equipment, the production process and the product.

All elements, requirements and provisions of FPC adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required component characteristics and the effective operation of the production control system to be checked.

Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the conformity of the product with its technical specifications. Its implementation may be achieved by controls and tests on measuring equipment, raw materials, processes, machines and manufacturing equipment and finished products, including material properties of the products, and by making use of the results thus obtained.

An FPC system conforming with the requirements of EN ISO 9001, and made specific to the requirements of this standard, is considered to satisfy the above requirements.

8.3.2 General FPC requirements

The FPC system shall fulfil the requirements as described in the following clauses of EN ISO 9001:2000, where applicable:

- 4.2 except 4.2.1 a);
- 5.1 e), 5.5.1, 5.5.2;
- Clause 6;
- 7.1 except 7.1 a), 7.2.3 c), 7.4, 7.5, 7.6;
- 8.2.3, 8.2.4, 8.3, 8.5.2.

NOTE The FPC system may be part of a Quality Management system, e.g. in accordance with EN ISO 9001:2000.

The manufacturer shall establish procedures to ensure that the production tolerances allow for the copper tube performances to be in conformity with the declared values derived from initial type testing.

The characteristics and the means of verification are given in Clauses 7 and 10 and the minimum frequency of testing is given in Table 8.

The manufacturer shall record the results of the tests specified above. These records shall at least include the following information:

- identification of the copper tube tested;
- date of testing;
- test results.

8.3.3 Manufacturer-specific FPC system requirements

8.3.3.1 Personnel

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that needs to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems.

8.3.3.2 Equipment

All weighing, measuring and testing equipment necessary to achieve, or produce evidence of, conformity shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria. Control of monitoring and measuring devices shall conform to the appropriate clause of EN ISO 9001:2000.

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process.

8.3.3.3 Raw materials

The specifications of all incoming raw materials shall be documented, as shall be the inspection scheme for ensuring their conformity. The verification of conformity of the raw material with the specification shall be in accordance with EN ISO 9001:2000, 7.4.3.

8.3.3.4 In-process control

The manufacturer shall plan and carry out production under controlled conditions. Compliance with EN ISO 9001:2000, 7.5.1 and 7.5.2 shall be deemed to satisfy the requirements of this clause.

8.3.3.5 Traceability and marking

Individual copper tubes, batches or packages shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings (see Clause 12) are inspected regularly. Compliance with EN ISO 9001:2000, 7.5.3 shall be deemed to satisfy the requirements of this clause.

8.3.3.6 Non-conforming products

The manufacturer shall have written procedures which specify how non-conforming products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures. Compliance with EN ISO 9001:2000, 8.3 shall be deemed to satisfy the requirements of this clause.

8.3.3.7 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence. Compliance with EN ISO 9001:2000, 8.5.2 shall be deemed to satisfy the requirements of this clause.

8.3.3.8 Handling, storage, packaging

The manufacturer shall have written procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

9 Sampling

For the purpose of quality assurance during production, the number of sampling units to be taken at random shall be in accordance with Table 8.

Table 8 — Sampling rate

Tube mass per meter	Quantity for one sampling unit at predicted monthly meterage ^a	
	< 100 000 m	≥ 100 000 m
kg/m	kg	kg
≤ 0,25	1 500	3 000
> 0,25	2 500	5 000

^a At least one sampling unit shall be taken per production batch.

These sampling rates shall apply when testing for dimensional controls; controls of other mandatory properties shall be carried out on each second sampling unit.

Results may be used from analyses carried out at an earlier stage of manufacturing the product, e.g. at the casting or billets inward stage, if product identity is maintained and if the quality management system of the manufacturer conforms to the relevant requirements of EN ISO 9001.

10 Test methods

10.1 Analysis

For composition, analysis shall be carried out on the test samples obtained in accordance with Clause 9. The analytical methods used shall be chemical or spectrographic in accordance with appropriate European or International Standards. In cases of dispute the reference method shall be by chemical analysis according to ISO 1553 and ISO 4741.

10.2 Tensile test

The tensile test shall be carried out in accordance with the method given in EN 10002-1 on test pieces prepared from the samples obtained in accordance with Clause 9.

10.3 Hardness test

When required and after agreement between the purchaser and the supplier, the Vickers hardness test shall be carried out in accordance with EN ISO 6507-1.

10.4 Carbon content test

The determination of carbon content shall be carried out on the samples obtained in accordance with Clause 9 using the reference method described in EN 723.

NOTE For factory production control, it is at the discretion of the manufacturer to choose between quantitative analysis of carbon content and the carbon film test.

10.5 Carbon film test

The detection and assessment of carbon film shall be carried out on the samples obtained in accordance with Clause 9 using the method described in Annex B.

10.6 Bending test

When required, the bending test shall be carried out under current operating conditions using appropriate bending machines without internal mandrel in accordance with EN ISO 8491. The test piece shall be bent to an angle of 90° and to the appropriate minimum radius of curvature given in Table 9.

NOTE The result of bending on site may be different from the result of the bending test carried out under laboratory conditions due to tooling variations.

Table 9 — Minimum radius of curvature

Dimensions in millimetres

Nominal outside diameter <i>d</i>	Minimum radius of curvature	
	internal radius	neutral axis radius
6	27	30
8	31	35
10	35	40
12	39	45
14	43	50
15	48	55
16	52	60
18	61	70

10.7 Drift-expanding test

When required, the drift-expanding test shall be carried out in accordance with EN ISO 8493. The outside diameter of the tube end shall be expanded by 30 % using a conical mandrel having an angle of 45°.

10.8 Flanging test

When required, the flanging test shall be carried out in accordance with EN ISO 8494. After testing, the outside diameter of the flange shall be at least 30 % greater than the nominal tube diameter when the tube was formed on a flanging tool with a corner radius of approximately 1 mm.

10.9 Freedom from defects tests

Each tube shall be subjected to one of the following tests:

- eddy current test for detection of local defects, in accordance with EN 1971 and the requirements in C.1;
- hydrostatic test in accordance with the method in C.2;
- pneumatic test in accordance with the method in C.3.

Except for initial type testing, when only the eddy current test shall be used, the choice of the method, selected from the above, is at the discretion of the manufacturer.

10.10 Retests

In the event that the sample fails to meet the test requirements the batch represented by the sample or, in the case of continuous production all tubes manufactured since the previous check, shall be placed in a bond.

Further samples shall be taken from the bonded tubes at a sampling rate four times more frequent than specified in Clause 9. If any of the retest samples fail to meet the specification requirements the tubes represented by the samples shall be deemed not to meet the requirements of this European Standard and shall be rejected. If all the retest samples meet the requirements, the tubes represented by the samples shall be deemed to meet the requirements of this European Standard.

11 Inspection documentation

When requested by the purchaser [see 5 k]) and agreed with the supplier, the supplier shall issue for the products the appropriate inspection document in accordance with EN 10204.

NOTE When ordering material for pressure equipment applications, the equipment manufacturer has the obligation to request appropriate inspection documentation according to EN 10204:2004, Annex ZA.

12 Marking and form of delivery

12.1 Marking

Tubes from 10 mm up to and including 54 mm diameter shall be permanently marked at repeated distances along their length of not greater than 600 mm, with at least the following:

Permanent marking:

- number of this European Standard (EN 1057);
- manufacturer's identification mark;
- date of production: year and quarter (I to IV) or year and month (1 to 12).

The marking shall not be detrimental to the use of the tube.

Durable or permanent marking:

- nominal cross-sectional dimensions: outside diameter × wall thickness;
- identification for R250 (half hard) material condition by the following symbol: I-I-I.

Tubes from 6 mm but less than 10 mm, or greater than 54 mm diameter shall be at least similarly marked legibly at both ends.

The marking shall do nothing to either obscure or cause confusion with any regulatory marking, e.g. CE marking.

12.2 Form of delivery

The recommended form of delivery of tubes is given in Table 10.

Table 10 — Recommended form of delivery

Form of delivery	Nominal outside diameter <i>d</i> mm		Nominal length m	Material condition
	from	up to and including		
Coils	6	28	25; 50	R220 (annealed)
Straight lengths	6	267	3; 5	R250 (half hard)
				R290 (hard)

Annex A (normative)

Standardized dimensions for reconsideration at a future revision

Table A.1 — Standardized dimensions for reconsideration at a future revision

Dimensions in millimetres

Nominal outside diameter <i>d</i>	Nominal wall thickness <i>e</i>												
	0,5	0,6	0,7	0,75	0,8	0,9	1,0	1,1	1,2	1,5	2,0	2,5	3,0
6	X												
8	X												
10	X												
12	X												
14,68 (14,7 ^a)			X										
15	X			X					X	X			
16					X				X				
18		X		X					X	X			
21,03 (21 ^a)		X				X				X			
22		X											
27,38 (27,4 ^a)						X							
28		X								X			
34,13 (34 ^a)								X					
35											X		
40,48 (40,5 ^a)								X					
42											X		
53,59 (53,6 ^a)									X				
64										X		X	
66,7							X			X		X	
70											X	X	
76,1									X			X	
80							X				X		
88,9												X	X
108									X		X		X
133											X		
159										X			

^a Designated outside diameter for the Irish market

Annex B (normative)

Carbon film test

B.1 Preparation of the test piece

The sample of tube to be tested shall be cleaned on its outside surface either abrasively by filing or turning in order to remove all traces of the original surface finish or chemically by sealing one end with an acid resistant plug and then immersing in concentrated nitric acid to pickle the outside surface and then rinsing with de-ionized water and drying.

A sample, at least 25 mm long, shall be then cut from the cleaned section, using a clean saw blade and cut in half longitudinally to make two test pieces. One test piece shall be degreased by dipping in acetone.

For tube dimensions exceeding 22 mm × 1 mm a sample of comparable surface area shall be taken, the preparation of which shall correspond to the procedure described above.

B.2 Procedure

The degreased test piece shall be placed, with its internal surface upwards, in a small, flat-bottomed white porcelain or glass dish and covered with 25 % (mass fraction) nitric acid at ambient temperature.

The acid causes loosening of surface deposits which will float to the surface. When the acid turns blue in colour the test piece shall be removed and rinsed with de-ionized water to wash back into the acid any particles adhering to the test piece.

B.3 Detection and assessment of films

The reaction of the test piece in the acid shall be observed with a microscope of × 10 magnification.

The initial observation will assess whether a material released by the acid is in the form of a film or particulate. If nothing is detected, or particles are found, the test is passed.

If clearly visible films are seen floating to the surface these may be of carbon or oxide.

To distinguish between carbon and oxide, the porcelain or glass dish shall be gently heated and the acid allowed to boil for about 5 min to dissolve any oxide films.

If on re-examination the films have been eliminated or only particles remain, the test is passed. If there is no reduction in the film element, then it is carbon and the test is failed.

Annex C (normative)

Freedom from defects tests

C.1 Eddy current test

Maximum drill diameters for the reference standard tube, which is defined in EN 1971, are given in Table C.1.

Table C.1 — Maximum drill diameters for the reference standard tube

Dimensions in millimetres

Nominal outside diameter <i>d</i>		Drill diameter
over	up to and including	max.
6 ^a	28	1,2
28	267	2,0
^a Including 6.		

Signals produced by reference standard tubes set the sorting limits for acceptance or rejection. Tubes containing defects which produce signals equal to or greater than the sorting limit shall be rejected.

C.2 Hydrostatic test

The tube under test shall be connected to a source of pressurized water. Water pressure as specified in Table C.2 shall be maintained in the tube for a minimum period of 10 s without evidence of leaking. If one or more leaks are observed, the tube shall be rejected. If no leak is observed, the tube shall be accepted.

Table C.2 — Hydraulic pressure test

Nominal outside diameter <i>d</i> mm		Hydraulic pressure
over	up to and including	bar min.
6 ^a	54	35
54	108	25
108	159	15
159	267	10
NOTE 1 bar is equivalent to 0,1 MPa.		
^a Including 6.		

C.3 Pneumatic test

The tube under test shall be connected to a source of pressurized air. Air pressure at 4 bar (0,4 MPa) shall be maintained in the tube.

The tube shall be completely immersed in water for a minimum period of 10 s and inspected for the issue of bubbles from the tube. Should any bubbles be observed then the tube shall be rejected. If no bubbles are observed then the tube shall be accepted.

Annex ZA (informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive (CPD) 89/106/EEC

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/131 “Pipes, tanks and ancillaries not in contact with water for human consumption” given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this Annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction products covered by this Annex for their intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended use, may be applicable to the construction products falling within the scope of this standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through <http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm>).

This Annex has the same scope as Clause 1 of this standard with regard to the products covered. It establishes the conditions for the CE marking of seamless, round copper tubes for water and gas in heating and sanitary applications intended for the uses indicated below and shows the relevant clauses applicable (see Table ZA.1).

Construction product:	Pipes
Intended uses:	18/33 Drainage, and disposal of other liquids and gaseous waste; 20/33 Supply of fuels, oil and other liquids; 21/33 Fire suppression and extinguishing systems; 22/33 Supply of gases, pressure and vacuum systems; 33/33 Storage fixtures.

NOTE Hot water heating systems, including under-floor heating systems, are included in intended use 20/33.

The requirement on a certain characteristic is not applicable in those Member States where there are no regulatory requirements on that characteristic for the intended end use of the product. In this case, manufacturers placing their products on the market of these Member States are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

Table ZA.1 — Relevant clauses

Essential characteristics	Requirement clause(s) in this (or another) EN	Notes
Reaction to fire	6.1 Safety in case of fire – Reaction to fire	Class A.1
Crushing strength	Derives from Wall thickness, 7.3.2 and Mechanical properties, 7.2	pass/fail
Internal pressure	Derives from Wall thickness, 7.3.2 and Mechanical properties, 7.2	pass/fail
Dimensional tolerances	7.3 Dimensions and tolerances	pass/fail
Resistance to high temperature (for heating networks)	6.2 Properties at high temperature	threshold
Weldability (for gas networks)	6.3 Weldability	pass/fail
Tightness: gas and liquid	10.9 Freedom from defects tests	pass/fail
Durability of crushing strength, internal pressure and tightness	7.5 Surface quality	pass/fail

ZA.2 Procedure(s) for attestation of conformity of pipes

ZA.2.1 System(s) of attestation of conformity

The systems of attestation of conformity of pipes indicated in Table ZA.1, in accordance with the Decision of the Commission 99/472/EC of 1999-07-01 as given in Annex III of the mandate for "Pipes, tanks and ancillaries not in contact with water for human consumption", are shown in Table ZA.2 for the indicated intended uses.

Table ZA.2 — Systems of attestation of conformity

Product	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Pipes — Mandate, Annex III (1/5)	In installations for the transport/distribution/storage of gas/fuel intended for the supply of building heating/cooling systems, from the external storage reservoir or the last pressure reduction unit of the network to the inlet of the boiler/heater/cooler system(s) of the building(s).	—	3
Pipes — Mandate, Annex III (4/5)	<i>In installations in areas subject to reaction to fire regulations, used for the transport/distribution/storage of gas/fuel intended for the supply of building heating/cooling systems, from the external storage reservoir or the last pressure reduction unit of the network to the inlet of the boiler/heater/cooler system(s) of the building(s).</i>	A.1 (reaction to fire)	1
Pipes — Mandate, Annex III (2/5)	In installations for the transport/disposal/storage of water not intended for human consumption.	—	4
Pipes — Mandate, Annex III (4/5)	In installations in areas subject to reaction to fire regulations, used for the transport/disposal/storage of water not intended for human consumption.	A***	4
<p>System 1: See Directive 89/106/EEC (CPD) Annex III.2(i), without audit-testing of samples.</p> <p>System 3: See Directive 89/106/EEC (CPD) Annex III.2(ii), second possibility.</p> <p>System 4: See Directive 89/106/EEC (CPD) Annex III.2(ii), third possibility.</p> <p>NOTE In the mandate the above intended use in areas subject to reaction to fire regulations [Mandate, Annex III (4/5)] is system 1. However, since copper tube is deemed Class A.1 without further testing (Commission Decision 96/603/EC) the involvement of a notified laboratory for reaction to fire is not necessary and the manufacturer may provide the appropriate declaration for reaction to fire as under system 4.</p>			
<p>*** Materials for Class A that according to the Decision 96/603/EC do not require to be tested for reaction to fire.</p>			

The attestation of conformity of the pipes with the essential characteristics in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Tables ZA.3.1 or ZA.3.2 resulting from application of the clauses of this or other European Standard indicated therein.

Table ZA.3.1 — Assignment of evaluation of conformity tasks for pipes under system 3 — 1/5

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all relevant characteristics of Table ZA.1	8.3
	Initial type testing by the manufacturer	Reaction to fire	8.2
	Initial type testing by a notified test laboratory	Crushing strength Internal pressure Dimensional tolerances Tightness: gas and liquid Durability of crushing strength, internal pressure and tightness	8.2

Table ZA.3.2 — Assignment of evaluation of conformity tasks for pipes under system 4 — 2/5

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all relevant characteristics of Table ZA.1	8.3
	Initial type testing by the manufacturer	All characteristics of Table ZA.1.	8.2

ZA.2.2 EC Certificate and Declaration of conformity

ZA.2.2.1 Products under system 3

When compliance with the conditions of this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (i.e. Annex ZA of this EN);
- particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions);
- name and address of the notified laboratory(ies);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

ZA.2.2.2 Products under system 4

When compliance with this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (i.e. Annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned declaration and certificate shall be presented in the official language(s) acceptable to the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the pipes (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note). The following information shall accompany the CE marking symbol:

- name or identifying mark and registered address of the producer;
- last two digits of the year in which the marking is affixed;
- reference to this European Standard (EN 1057);
- description of the product: generic name, material, dimensions, ... and intended use;
- information on the essential characteristics listed in Table ZA.1 which are to be declared:
 - values and, where relevant, level or class (including "pass" for pass/fail requirements, where necessary) for each essential characteristic as indicated in "Notes" in Table ZA.1;
 - "No performance determined" for essential characteristics, where this is relevant;
 - as an alternative, a product designation which shows some or all of the essential characteristics (where the product designation covers only some essential characteristics, it will need to be supplemented with declared values for other essential characteristics, as above).

The "No performance determined" (NPD) option may not be used where the essential characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the essential characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.


	<p>CE conformity marking, consisting of the “CE”-symbol given in Directive 93/68/EEC.</p>																
<p>AnyCo Ltd, PO Box 21, B-1050</p> <p>06</p>	<p><i>Name or identifying mark and registered address of the producer</i></p> <p><i>Last two digits of the year in which the marking was affixed</i></p>																
<p style="text-align: center;">EN 1057</p> <p style="text-align: center;">Seamless, round copper tubes for water and gas in sanitary and heating applications</p> <p>intended to be used in:</p> <ul style="list-style-type: none"> — Drainage, and disposal of other liquids and gaseous waste; — Supply of fuels, oil and other liquids (including hot water heating systems); — Fire suppression and extinguishing systems; — Supply of gases, pressure and vacuum systems; — Storage fixtures. <p>Product designation: Copper tube EN 1057 – R220 – 12 x 1,0</p> <table border="0"> <tr> <td>Reaction to fire:</td> <td>Class A.1</td> </tr> <tr> <td>Crushing strength:</td> <td>NPD</td> </tr> <tr> <td>Internal pressure:</td> <td>NPD</td> </tr> <tr> <td>Dimensional tolerances:</td> <td>pass</td> </tr> <tr> <td>Resistance to high temperature:</td> <td>Suitable for use up to 120 °C</td> </tr> <tr> <td>Weldability:</td> <td>pass</td> </tr> <tr> <td>Tightness: gas and liquid:</td> <td>pass</td> </tr> <tr> <td>Durability of crushing strength, internal pressure and tightness:</td> <td>pass</td> </tr> </table>	Reaction to fire:	Class A.1	Crushing strength:	NPD	Internal pressure:	NPD	Dimensional tolerances:	pass	Resistance to high temperature:	Suitable for use up to 120 °C	Weldability:	pass	Tightness: gas and liquid:	pass	Durability of crushing strength, internal pressure and tightness:	pass	<p>No. of European Standard</p> <p>Description of product</p> <p style="text-align: center;">and</p> <p>information on regulated characteristics</p>
Reaction to fire:	Class A.1																
Crushing strength:	NPD																
Internal pressure:	NPD																
Dimensional tolerances:	pass																
Resistance to high temperature:	Suitable for use up to 120 °C																
Weldability:	pass																
Tightness: gas and liquid:	pass																
Durability of crushing strength, internal pressure and tightness:	pass																

Figure ZA.1 — Example CE marking information

Annex ZB (informative)

Relationship between this European Standard and the Essential Requirements of the EU Pressure Equipment Directive (PED) 97/23/EC

This European Standard has been prepared under a Mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

For this harmonised supporting standard for materials, presumption of conformity to the Essential Requirements of the Directive is limited to technical data of the material in the standard and does not presume adequacy of the material to specific equipment. Consequently the technical data stated in the material standard should be assessed against the design requirements of the specific equipment to verify that the Essential Requirements of the Pressure Equipment Directive (PED) are satisfied.

Table ZB.1 — Correspondence between this European Standard and Directive 97/23/EC

Clause(s)/ subclause(s) of this EN	Subject	Qualifying remarks/Notes
7.2	Material properties	Annex I, 4.1(a) of the Directive
11	Conformity of material and manufacturer's certified documentation	Annex I, 4.3 of the Directive

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

In the preparation of this European Standard, use was made of a number of documents for reference purposes. These informative references are cited at the appropriate places in the text and the publications are listed hereafter.

- [1] EN 1173, *Copper and copper alloys — Material condition or temper designation*
- [2] EN 1412, *Copper and copper alloys — European numbering system*
- [3] EN ISO 6708, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708:1995)*
- [4] ISO 857-1, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*
- [5] ISO 857-2:2005, *Welding and allied processes — Vocabulary — Part 2: Soldering and brazing processes and related terms*
- [6] ISO 1190-1, *Copper and copper alloys — Code of designation — Part 1: Designation of materials*