

## **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. <sup>(A)</sup> For applications at temperatures up to 250 °C the required wall thickness of the tube shall be calculated in accordance with the valid design stress. <sup>(A)</sup>

### **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 % ≤ P ≤ 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.

**BS EN 1057:2006+A1:2010**  
**EN 1057:2006+A1:2010 (E)**

**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<sub>m</sub></i> MPa	<i>A</i> %	HV 5
		min.	max.	min.	min.	
R220	annealed	6	54	220	40	(40 to 70)
R250 <sup>a</sup>	half hard <sup>a</sup>	6	66,7	250	30 <sup>a</sup>	(75 to 100)
		6	159		20 <sup>a</sup>	
R290	hard	6	267	290	3	(min. 100)
NOTE 1 Hardness figures in parentheses are not requirements of this European Standard but are given for guidance purposes only.						
NOTE 2 1 MPa is equivalent to 1 N/mm <sup>2</sup> .						
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.						
<sup>a</sup> 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.

## **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.

