BS EN 13148:2010

BSI Standards Publication

Copper and copper alloys — Hot-dip tinned strip

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National foreword

This British Standard is the UK implementation of EN 13148:2010. It supersedes BS EN 13148:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NFE/34/1, Wrought and unwrought copper and copper alloys.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Copper and copper alloys - Hot-dip tinned strip

Cuivres et alliages de cuivre - Bandes étamées à chaud

Kupfer und Kupferlegierungen - Feuerverzinnte Bänder

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Foreword

This document (EN 13148:2010) 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of an identical text or by endorsement, at the latest by March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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 13148:2001.

Within its programme of work, Technical Committee CEN/TC 133 requested CEN/TC 133/WG 2 "Rolled flat products" to revise the following standard:

EN 13148, *Copper and copper alloys — Hot-dip tinned strip*

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

- EN 1172, *Copper and copper alloys — Sheet and strip for building purposes;*
- EN 1652, *Copper and copper alloys — Plate, sheet, strip and circles for general purposes;*
- EN 1653, *Copper and copper alloys — Plate, sheet and circles for boilers, pressure vessels and hot water storage units;*
- EN 1654, *Copper and copper alloys — Strip for springs and connectors;*
- EN 1758, *Copper and copper alloys — Strip for lead frames;*
- EN 13599, *Copper and copper alloys — Copper plate, sheet and strip for electrical purposes;*
- EN 14436, *Copper and copper alloys — Electrolytically tinned strip.*

In comparison with EN 13148:2001, the following significant technical changes were made:

a) Table 3:

   1) composition of Sn, increasing of the upper limits: Cu from 0,030 % to 2,0 %, Pb from 0,03 % to 0,1 % and Zn from 0,0010 % to 0,7 %;
   2) column "Material designation" and reference to "EN 610 and EN 29453" are deleted;

b) Table 4: column 0,2 % proof strength, at the 1st line (R220), the value "(min. 140)" where corrected in "(max. 140)".

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 and the United Kingdom.

Introduction

Hot-dip tinned strip is manufactured by passing strip through a molten bath of tin, tin-lead alloy or other tin alloys. By this process a solid bond is created between the metallic coating and the strip by formation of a layer of an intermetallic phase and a diffusion zone.

The base metal is hot-dip tinned to protect it against corrosion, to facilitate soldering operations, to improve insertion and withdrawal forces of connectors, to reduce contact resistance at electrical junctions and to avoid whisker growth on components. The properties of coatings can be modified by mechanical and/or thermal treatments.

When the strip is emerging from the bath the thickness of the coating is adjusted by partially wiping off the molten film, either by stationary wiping devices or by a flat air jet. The thickness of the coating can be continously measured and regulated on both sides of the strip during or after the tinning process. Usually strips are tinned in larger widths and slit to narrower width specified by the customer. In this case, the final slit product has untinned edges.

1 Scope

This European Standard specifies:

— the composition and tolerances on dimensions of strip produced by rolling in the thickness range from 0,10 mm up to and including 1,50 mm of copper and copper alloys to be tinned, with tin, a tin-lead alloy or other tin alloys;

— the composition of material normally used for the melt;

— the properties of strip before tinning;

— the properties of hot-dip tinned strip;

— the preferred thicknesses (mean values) and thickness ranges of coatings;

— the edgewise curvature of hot-dip tinned strip;

— the sampling procedure;

— the methods of test to be used for verification of conformity to the requirements of this European Standard;

— the delivery conditions.

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 1655, *Copper and copper alloys — Declarations of conformity*

EN 1976, *Copper and copper alloys — Cast unwrought copper products*

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

EN ISO 2624, *Copper and copper alloys — Estimation of average grain size (ISO 2624:1990)*

EN ISO 3497, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods (ISO 3497:2000)*

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

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

EN ISO 7438:2005, *Metallic materials — Bend test (ISO 7438:2005)*

ISO 1811-2, *Copper and copper alloys — Selection and preparation of samples for chemical analysis — Part 2: Sampling of wrought products and castings*

ISO 80000-1, *Quantities and units — Part 1: General*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
strip
flat rolled product of rectangular cross-section with uniform thickness manufactured in coils and supplied in as sheared coils or traverse wound coils, usually with slit edges

NOTE The thickness does not exceed one tenth of the width.

3.2
hot-dip tinned strip
strip which is tinned with coatings on each face of equal thickness by drawing in an appropriate manner through a bath of any molten tin or tin-lead alloy or other tin alloy

3.3
differentially hot-dip tinned strip
hot-dip tinned strip with coatings on each face of different thicknesses

3.4
partially hot-dip tinned strip
hot-dip tinned strip with coatings on each face of equal thickness, but covering only part of the strip in the longitudinal direction

3.5
base material (of a tinned strip)
part of the strip which, after the tinning process, belongs neither to the metallic coating nor to an intermetallic phase and diffusion zone

4 Designations

4.1 Material of the strip to be tinned

4.1.1 General

The material is designated either by symbol or number (see Tables 1 and 2).

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 for the coating

The coating is designated by the coating type (see Table 3) or for non-standardized coatings, by the supplier's designation.

NOTE Due to solution and/or diffusion processes the composition of the coating can differ from that of the melt.

4.3 Material condition of the hot-dip tinned strip

For the purposes of this European Standard, the following designations, which are in accordance with the system given in EN 1173, apply to the hot-dip tinned strip but are actually the material condition designations of the strip before tinning.

- R... Material condition designated by the minimum value of tensile strength requirement for the product with mandatory tensile strength and elongation requirements;
- H... Material condition designated by the minimum value of hardness requirement for the product with mandatory hardness requirements;
- G... Material condition designated by the mid-range value of grain size requirement for the product with mandatory grain size and hardness requirements.

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

Material condition is designated by only one of the above designations.

4.4 Product

The product designation provides a standardized pattern of designation from which a rapid and unequivocal description of a product is communicated. 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 (hot-dip tinned strip or differentially hot-dip tinned strip or partially hot-dip tinned strip);

— number of this European Standard (EN 13148);

— material designation of the strip to be tinned, either symbol or number (see Tables 1 and 2);

— material condition designation of the hot-dip tinned strip (see Table 4);

— nominal dimensions of the strip before tinning (thickness × width);

— tolerance class for the thickness of the strip before tinning (see Table 6);

— coating type, Sn or Sn60Pb (see Table 3) or for non-standardized coatings the supplier's designation;

— for hot-dip tinned strip, the preferred thickness or thickness range of the coating (see Table 5);

— for differentially hot-dip tinned strip, the preferred thicknesses or the thickness ranges of the coatings on each face (see Table 5), which shall be identified by marking one face A and the other B;

— for partially hot-dip tinned strip, the number of a dimensioned drawing including the preferred thicknesses or the thickness ranges of the coating (see Table 5).

The derivation of a product designation is shown in the following examples:

EXAMPLE 1 Hot-dip tinned strip conforming to this European Standard, in material of the strip to be tinned designated either CuSn6 or CW452K, in material condition H180, nominal thickness 0,50 mm, tolerance Class A, nominal width 200,00 mm, coating type Sn60Pb, thickness range 2 µm to 5 µm, is designated as follows:

Hot-dip tinned strip EN 13148 — CuSn6 — H180 — 0,50A × 200,00 — Sn60Pb — 2-5

or

Hot-dip tinned strip EN 13148 — CW452K — H180 — 0,50A × 200,00 — Sn60Pb — 2-5

Denomination

Number of this European Standard

Material designation of the strip to be tinned

Material condition designation

Nominal dimensions in millimetres and tolerance class for thickness

Material designation of the coating

Thickness range of the coating in micrometres

EXAMPLE 2 Differentially hot-dip tinned strip conforming to this European Standard, in material of the strip to be tinned designated either CuZn30 or CW505L, in material condition R350, nominal thickness 1,20 mm, tolerance Class B, nominal width 125,00 mm, coating type Sn, thickness (mean value) surface A 1,45 µm, thickness (mean value) surface B 3,5 µm, is designated as follows:

Differentially hot dip tinned strip EN 13148 — CuZn30 — R350 — 1,20B × 125,00 — Sn — A1,45 — B3,5

or

Differentially hot-dip tinned strip EN 13148 — CW505L — R350 — 1,20B × 125,00 — Sn — A1,45 — B3,5

Denomination

Number of this European Standard

Material designation of the strip to be tinned

Material condition designation

Nominal dimensions in millimetres and tolerance class for thickness

Material designation of the coating

Thickness of the coating surface A in micrometres

Thickness of the coating surface B in micrometres

EXAMPLE 3 Partially hot-dip tinned strip, conforming to this European Standard, in material of the strip to be tinned designated either CuSn4 or CW450K, in material condition R610, nominal thickness 0,60 mm, tolerance Class A, nominal width 54,00 mm, coating type Sn60Pb, drawing number W38501, is designated as follows:

Partially
hot dip
tinned strip EN 13148 — CuSn4 — R610 — 0,60A × 54,00 — Sn60Pb — W38501

or

Partially
hot dip
tinned strip EN 13148 — CW450K — R610 — 0,60A × 54,00 — Sn60Pb — W38501

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 (mass);

b) denomination (hot-dip tinned strip or differentially hot-dip tinned strip or partially hot-dip tinned strip);

c) number of this European Standard (EN 13148);

d) material designation of the strip to be tinned (see Tables 1 and 2);

e) material condition designation of the hot-dip tinned strip (see 4.3 and Table 4);

f) nominal thickness of the strip before tinning. If nominal thickness of the tinned strip is required, it shall be subject to agreement between the purchaser and the supplier;

g) tolerance class for the thickness of the strip before tinning (see Table 6);

h) nominal width of the hot-dip tinned strip;

i) coating type, Sn or Sn60Pb (see Table 3) or for non-standardized coatings the supplier's designation;

j) thickness of the coating:

   1) hot-dip tinned strip (see 3.2): mean value of coating thickness or thickness range (see Table 5);

   2) differentially hot-dip tinned strip (see 3.3): mean value of coating thickness or thickness range (see Table 5) of each face, identified A and B, and the positions of those faces relative to the coil or spool;

   3) partially hot-dip tinned strip (see 3.4): the number of a fully dimensioned and toleranced drawing which shall accompany the order.

NOTE 1 It is recommended that the product designation, as described in 4.4, is used for items b) to j).

In addition, the purchaser shall also state on the enquiry and order any of the following, if required:

k) whether tinned edges are required (see 6.3.2) and if so, tolerances on width shall be agreed between the purchaser and the supplier;

l) whether the strip shall meet edgewise curvature requirements (see 6.4 and Table 8);

m) whether special requirements for appearance of the surface shall be met (bright, dull) (see 6.5.2);

n) whether requirements for solderability shall be met (see 6.5.3) and if so, the acceptance criteria shall be agreed between the purchaser and the supplier;

o) whether special requirements for adhesion of the coating shall be met (see 6.5.4) and if so, the acceptance criteria shall be agreed between the purchaser and the supplier;

p) coil size requirements: nominal inside diameter in millimetres and maximum outside diameter in millimetres and either maximum mass in kilograms or approximate specific coil mass (mass per width) in kilogram per millimetre;

q) spool size: type or dimensions;

r) whether a declaration of conformity is required (see 9.1);

s) whether an inspection document is required, and if so, which type (see 9.2);

t) whether there are any special requirements for marking, packaging or labelling (see Clause 10).

NOTE 2 To facilitate recycling it is recommended to use coating type Sn for the coating.

EXAMPLE Ordering details for 1 200 kg hot-dip tinned strip conforming to EN 13148, in material of the strip to be tinned designated either CuZn37 or CW508L, in material condition R480, nominal thickness 0,40 mm, tolerance Class C, nominal width 160,00 mm, coating type Sn, mean value of thickness of the coating 1,45 µm, untinned edges, nominal inside diameter of coil 400 mm, maximum outside diameter of coil 950 mm, approximate specific coil mass (mass per width) 4,5 kg/mm:

1 200 kg Hot-dip tinned strip EN 13148 — CuZn37 — R480 — 0,40C × 160,00 — Sn — 1,45
— nominal inside diameter of coil 400 mm
— maximum outside diameter of coil 950 mm
— approximate specific coil mass 4,5 kg/mm

or

1 200 kg Hot-dip tinned strip EN 13148 — CW508L — R480 — 0,40C × 160,00 — Sn — 1,45
— nominal inside diameter of coil 400 mm
— maximum outside diameter of coil 950 mm
— approximate specific coil mass 4,5 kg/mm

6 Requirements

6.1 Composition

6.1.1 Strip to be tinned

The composition of the strip shall conform to the requirements for the appropriate material given in Tables 1 and 2.

Percentage content of the elements shown as "remainder" (Rem.) is usually calculated by difference from 100 %.

6.1.2 Material for the coating

Unless otherwise specified, the composition of the material for the coating shall conform to the requirements for the appropriate material given in Table 3. Other material for the coating shall conform to the requirements agreed between the purchaser and the supplier [see 5 i)].

6.2 Mechanical properties and grain size of the base material

The mechanical properties and the grain size, if required, shall conform to the appropriate requirements given in Table 4. The tests shall be carried out in accordance with 8.2 to 8.4.

6.3 Dimensions and tolerances

6.3.1 Tolerances on thickness

The thickness of strip before tinning shall conform to the appropriate tolerances given in Table 6. The thickness of tinned strip shall conform to the appropriate combination of tolerances for the thickness of the strip given in Table 6 and the thickness range of the coatings ordered, for both faces, given in Table 5.

NOTE The minimum thickness of the tinned strip is equal to the minimum thickness of the strip before tinning plus the minimum thickness of the coating on each face. The maximum thickness of the tinned strip is equal to the maximum thickness of the strip before tinning plus the maximum thickness of the coating on each face.

For partially hot-dip tinned strip it can be the case that in the non-coated parts max. 0,03 mm of the base material is removed.

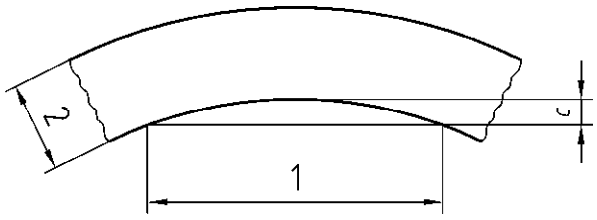
6.3.2 Tolerances on widths

Generally the edges of a supplied strip are not tinned, because a strip is normally tinned in a larger width and slit to the ordered width after hot-dip tinning. In this case the same tolerances as for strip before tinning shall apply as given in Table 7. When strip with coated edges is ordered, the tolerance on width shall be agreed between the purchaser and the supplier.

6.4 Edgewise curvature c

For the straightness of the longitudinal edge, which unless otherwise agreed between the purchaser and the supplier shall be based on a measuring length of 1 000 mm, the edgewise curvature c (see Figure 1) shall not exceed the values given in Table 8.

If the purchaser and the supplier agree on a measuring length of 2 000 mm, the edgewise curvature c shall not exceed the values given in Table 8 multiplied by 4.



Key
1 measuring length
2 strip width

c edgewise curvature

Figure 1 — Edgewise curvature c

6.5 Properties of the coating

6.5.1 Condition

The products shall be clean and free from injurious defects which shall be specified by agreement between the purchaser and the supplier at the time of enquiry and order. A thin film of lubricant or interleaved paper may be present to avoid surface damage.

6.5.2 Appearance

The appearance depends on the cooling condition of the liquid film, the coating type and the technique used to remove the excess molten metal. The appearance of the surface may be either bright or dull or a combination of both. The appearance of the coating does not affect the suitability of the coating. If there are special requirements for appearance of the coating, they shall be agreed between the purchaser and the supplier.

6.5.3 Solderability

If solderability is required, the acceptance criteria shall be agreed between the purchaser and the supplier. The test shall be carried out in accordance with Annex A.

6.5.4 Adhesion

If verification of the coating adhesion is required, the acceptance criteria shall be agreed between the purchaser and the supplier. The tests shall be carried out in accordance with 8.7.

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 of the base material

The sampling rate shall be in accordance with ISO 1811-2. 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.

NOTE 3 Results may be used from analyses carried out at an earlier stage of manufacturing the product, e.g. at the casting or master coil stage, if the material identity is maintained and if the quality system of the manufacturer is certified as conforming to EN ISO 9001 or equivalent.

7.3 Tensile, hardness, grain size and technological tests

The sampling rate shall be one test sample per master coil. Sampling units shall be selected from the hot-dip tinned 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, except in the case of tensile or hardness tests when the coating and any intermetallic layers and diffusion zone shall be removed without deleteriously affecting the base material, e.g. etching is recommended.

8 Test methods

8.1 Analysis of the base material

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 at the discretion of the supplier. For expression of results, the rounding rules given in 8.10 shall be used.

NOTE In cases of dispute concerning the results of analysis, the methods of analysis to be used should be in accordance with the appropriate ISO standards.

8.2 Tensile test of the base material

The tensile properties shall be determined in accordance with EN ISO 6892-1 on the test pieces prepared from the test samples obtained in accordance with 7.3.

8.3 Hardness test of the base material

The Vickers hardness shall be determined in accordance with EN ISO 6507-1 using a suitable test force selected from those given, on the test pieces prepared from the test samples obtained in accordance with 7.3.

8.4 Estimation of average grain size of the base material

The average grain size shall be estimated in accordance with EN ISO 2624 on the test pieces prepared from the test samples obtained in accordance with 7.3.

8.5 Edgewise curvature c

The edgewise curvature c shall be measured by appropriate devices.

8.6 Solderability

The solderability shall be determined as described in Annex A.

8.7 Adhesion

The adhesion of the coating shall be tested in accordance with EN ISO 7438:2005, 4.3 (bending device with a V-block).

8.8 Measurement of coating thickness

The method of thickness testing is left to the discretion of the supplier.

In cases of dispute the X-ray spectrometric method in accordance with EN ISO 3497 shall be applied, where the total thickness of the coating (both of the intermetallic phases and of the metallic tin or metallic tin alloy) is measured. Details of test essentials are given in Annex B.

8.9 Retests

If there is a failure of one, or more than one, of the tests in 8.1 to 8.5, two test samples from the same inspection lot shall be permitted to be selected for retesting the failed property (properties). One of these test samples shall be taken from the same sampling unit as that from which the original failed test piece was taken, unless that sampling unit is no longer available, or has been withdrawn by the supplier.

If the test pieces from both test samples pass the appropriate test(s), then the inspection lot represented shall be deemed to conform to the particular requirement(s) of this European Standard. If a test piece fails a test, the inspection lot represented shall be deemed not to conform to this European Standard.

8.10 Rounding of results

For the purpose of determining conformity to the limits specified in this European Standard, an observed or a calculated value obtained from a test shall be rounded in accordance with the following procedure. This procedure is based upon ISO 80000-1. It shall be rounded in one step to the same number of figures used to express the specified limit in this standard, except that for tensile strength the rounding interval shall be 10 N/mm^2 and for elongation the value shall be rounded to the nearest 1 %.

The following rules shall be used for rounding:

a) if the figure immediately after the last figure to be retained is less than 5, the last figure to be retained shall be kept unchanged;

b) if the figure immediately after the last figure to be retained is equal to or greater than 5, the last figure to be retained shall be increased by one.

9 Declaration of conformity and inspection documentation

9.1 Declaration of conformity

When requested by the purchaser [see 5 r)] and agreed with the supplier, the supplier shall issue for the products the appropriate declaration of conformity in accordance with EN 1655.

9.2 Inspection documentation

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

10 Marking, packaging, labelling

Unless otherwise specified by the purchaser and agreed by the supplier, the marking, packaging and labelling shall be left to the discretion of the supplier [see 5 t)].

Table 1 — Composition of copper

Material designation		Composition % (mass fraction)								Density [b] g/cm³
		Element	Cu [a]	Bi	O	P	Pb	Other elements (see note)		
Symbol	Number							total	excluding	approx.
Cu-ETP	CW004A	min.	99,90	—	—	—	—	—	Ag, O	8,9
		max.	—	0,000 5	0,040 [c]	—	0,005	0,03		
Cu-OF	CW008A	min.	99,95	—	—	—	—	—	Ag	8,9
		max.	—	0,000 5	— [d]	—	0,005	0,03		
Cu-PHC	CW020A	min.	99,95	—	—	0,001	—	—	Ag, P	8,9
		max.	—	0,000 5	— [d]	0,006	0,005	0,03		
Cu-DLP	CW023A	min.	99,90	—	—	0,005	—	—	Ag, Ni, P	8,9
		max.	—	0,000 5	— [d]	0,013	0,005	0,03		
Cu-DHP	CW024A	min.	99,90	—	—	0,015	—	—	—	8,9
		max.	—	—	—	0,040	—	—		

NOTE The Total of other elements (than copper) is defined as the sum of Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.

[a] Including Ag, up to a maximum of 0,015 %.

[b] For information only.

[c] Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.

[d] The oxygen content shall be such that the material conforms to the hydrogen embrittlement requirements of EN 1976.

Table 2 — Composition of copper alloys

Material designation		Composition % (mass fraction)													Density [a] g/cm³
Symbol	Number	Element	Cu	Al	Be	Co	Fe	Mn	Ni	P	Pb	Si	Sn	Zn	Others total	approx.
CuBe1,7	CW100C	min. max.	Rem. —	— —	1,6 1,8	— 0,3	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— 0,5	8,3
CuBe2	CW101C	min. max.	Rem. —	— —	1,8 2,1	— 0,3	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— 0,5	8,3
CuCo2Be	CW104C	min. max.	Rem. —	— —	0,4 0,7	2,0 2,8	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— 0,5	8,8
CuFe2P	CW107C	min. max.	Rem. —	— —	— —	— —	2,1 2,6	— —	— —	0,015 0,15	— 0,03	— —	— —	0,05 0,20	— 0,2	8,8
CuNi2Be	CW110C	min. max.	Rem. —	— —	0,2 0,6	— 0,3	— 0,2	— —	1,4 2,4	— —	— —	— —	— —	— —	— 0,5	8,8
CuNi2Si	CW111C	min. max.	Rem. —	— —	— —	— —	— 0,2	— 0,1	1,6 2,5	— —	— 0,02	0,4 0,8	— —	— —	— 0,3	8,8
CuSn0,15	CW117C	min. max.	Rem. —	— —	— —	— —	— 0,02	— —	— 0,02	— 0,015	— —	— —	0,10 0,15	— 0,10	— 0,10	8,9
CuZn0,5	CW119C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— 0,02	— —	— —	— —	0,1 1,0	— 0,1	8,9
CuNi9Sn2	CW351H	min. max.	Rem. —	— —	— —	— —	— 0,3	— 0,3	8,5 10,5	— —	— 0,03	— —	1,8 2,8	— 0,1	— 0,1	8,9
CuSn4	CW450K	min. max.	Rem. —	— —	— —	— —	— 0,1	— —	— 0,2	0,01 0,4	— 0,02	— —	3,5 4,5	— 0,2	— 0,2	8,9
CuSn5	CW451K	min. max.	Rem. —	— —	— —	— —	— 0,1	— —	 0,2	0,01 0,4	— 0,02	— —	4,5 5,5	— 0,2	— 0,2	8,9
CuSn6	CW452K	min. max.	Rem. —	— —	— —	— —	— 0,1	— —	— 0,2	0,01 0,4	— 0,02	— —	5,5 7,0	— 0,2	— 0,2	8,8
CuSn8	CW453K	min. max.	Rem. —	— —	— —	— —	— 0,1	— —	— 0,2	0,01 0,4	— 0,02	— —	7,5 8,5	— 0,2	— 0,2	8,8
CuSn3Zn9	CW454K	min. max.	Rem. —	— —	— —	— —	— 0,1	— —	— 0,2	— 0,2	— 0,1	— —	1,5 3,5	7,5 10,0	— 0,2	8,8
CuZn5	CW500L	min. max.	94,0 96,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,9
CuZn10	CW501L	min. max.	89,0 91,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,8

Table 2 (*continued*)

Material designation		Composition % (mass fraction)													Density [a] g/cm³
Symbol	Number	Element	Cu	Al	Be	Co	Fe	Mn	Ni	P	Pb	Si	Sn	Zn	Others total	approx.
CuZn15	CW502L	min. max.	84,0 86,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,8
CuZn20	CW503L	min. max.	79,0 81,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,7
CuZn30	CW505L	min. max.	69,0 71,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,5
CuZn33	CW506L	min. max.	66,0 68,0	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,5
CuZn36	CW507L	min. max.	63,5 65,5	— 0,02	— —	— —	— 0,05	— —	— 0,3	— —	— 0,05	— —	— 0,1	Rem. —	— 0,1	8,4
CuZn37	CW508L	min. max.	62,0 64,0	— 0,05	— —	— —	— 0,1	— —	— 0,3	— —	— 0,1	— —	— 0,1	Rem. —	— 0,1	8,4

[a] For information only.

Table 3 — Composition of Sn and Sn60Pb

Coating type	Composition % (mass fraction)												Density [a] g/cm³
	Element	Sn	Al	As	Bi	Cd	Cu	Fe	Pb	Sb	Zn	Others total excl. Sb, Bi, Cu	
													approx.
Sn	min.	99,90	—	—	—	—	—	—	—	—	—	—	7,3
	max.	—	0,001 0	0,030	0,010	0,001 0	2,0	0,005	0,1	0,040	0,7	0,100	
Sn60Pb	min.	59,5	—	—	—	—	—	—	Rem.	—	—	—	—
	max.	60,5	0,001 [b]	0,03	0,10	0,002 [b]	0,05	0,02	—	0,12	0,001 [b]	0,08	

[a] For information only.

[b] Sum of Al, Cd and Zn: max. 0,002 %.

Table 4 — Mechanical properties and grain size of strip before tinning or base material

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
Cu-ETP Cu-OF Cu-PHC Cu-DLP Cu-DHP	CW004A CW008A CW020A CW023A CW024A	R220	0,2	1,5	220	260	(max. 140)	33	—	—	—	—
		H040			—	—	—	—	40	65	—	—
		R240	0,2	1,5	240	300	(min. 180)	8	—	—	—	—
		H065			—	—	—	—	65	95	—	—
		R290	0,2	1,5	290	360	(min. 250)	4	—	—	—	—
		H090			—	—	—	—	90	110	—	—
		R360 [a]	0,2	1,5	360	—	(min. 320)	2	—	—	—	—
		H110 [a]			—	—	—	—	110	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuBe1,7	CW100C	R410 [b]	0,2	1,5	410	530	(min. 190)	35	—	—	—	—
		H080 [b]			—	—	—	—	80	150	—	—
		R1030 [c]	0,2	1,5	1 030	1 250	(min. 890)	3	—	—	—	—
		H330 [c]			—	—	—	—	330	380	—	—
		R510 [b]	0,2	1,5	510	610	(min. 410)	15	—	—	—	—
		H120 [b]			—	—	—	—	120	190	—	—
		R1100 [c]	0,2	1,5	1 100	1 320	(min. 930)	3	—	—	—	—
		H340 [c]			—	—	—	—	340	390	—	—
		R580 [b]	0,2	1,5	580	690	(min. 510)	8	—	—	—	—
		H180 [b]			—	—	—	—	180	220	—	—
		R1170 [c]	0,2	1,5	1 170	1 380	(min. 1 030)	—	—	—	—	—
		H360 [c]			—	—	—	—	360	410	—	—
		R680 [b]	0,2	1,5	680	830	(min. 620)	2	—	—	—	—
		H210 [b]			—	—	—	—	210	290	—	—
		R1240 [c]	0,2	1,5	1 240	1 450	(min. 1 060)	—	—	—	—	—
		H370 [c]			—	—	—	—	370	440	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuBe2	CW101C	R410 [b]	0,2	1,5	410	—	(max. 250)	20	—	—	—	—
		H090 [b]			—	—	—	—	90	150	—	—
		R1130 [c]	0,2	1,5	1 130	—	(min. 890)	3	—	—	—	—
		H340 [c]			—	—	—	—	340	410	—	—
		R580 [b]	0,2	1,5	580	—	(min. 510)	8	—	—	—	—
		H180 [b]			—	—	—	—	180	250	—	—
		R1200 [c]	0,2	1,5	1 200	—	(min. 980)	2	—	—	—	—
		H360 [c]			—	—	—	—	360	420	—	—
CuCo2Be	CW104C	R240 [b]	0,2	1,5	240	—	(max. 220)	20	—	—	—	—
		H060 [b]			—	—	—	—	60	130	—	—
		R480 [b]	0,2	1,5	480	—	(min. 370)	2	—	—	—	—
		H140 [b]			—	—	—	—	140	180	—	—
		R650 [c]	0,2	1,5	650	—	(min. 500)	8	—	—	—	—
		H200 [c]			—	—	—	—	200	280	—	—
		R750 [c]	0,2	1,5	750	—	(min. 650)	5	—	—	—	—
		H210 [c]			—	—	—	—	210	290	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuFe2P	CW107C	R340	0,2	1,5	340	390	(min. 240)	8	—	—	—	—
		H100			—	—	—	—	100	120	—	—
		R370	0,1	1,5	370	430	(min. 330)	4	—	—	—	—
		H120			—	—	—	—	120	140	—	—
		R420	0,1	1,5	420	480	(min. 380)	—	—	—	—	—
		H130			—	—	—	—	130	150	—	—
		R470	0,1	1,5	470	—	(min. 440)	—	—	—	—	—
		H140			—	—	—	—	140	—	—	—
CuNi2Be	CW110C	R240 [b]	0,2	1,5	240	—	(max. 220)	20	—	—	—	—
		H060 [b]			—	—	—	—	60	130	—	—
		R480 [b]	0,2	1,5	480	—	(min. 370)	2	—	—	—	—
		H140 [b]			—	—	—	—	140	180	—	—
		R650 [c]	0,2	1,5	650	—	(min. 500)	8	—	—	—	—
		H200 [c]			—	—	—	—	200	280	—	—
		R750 [c]	0,2	1,5	750	—	(min. 650)	5	—	—	—	—
		H210 [c]			—	—	—	—	210	290	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuNi2Si	CW111C	R260	0,2	1,5	260	—	(min. 60)	30	—	—	—	—
		H070			—	—	—	—	70	100	—	—
		R490	0,1	1,5	490	—	(min. 340)	11	—	—	—	—
		H140			—	—	—	—	140	190	—	—
		R450	0,1	1,5	450	—	(min. 360)	5	—	—	—	—
		H130			—	—	—	—	130	180	—	—
		R640	0,1	1,5	640	—	(min. 590)	8	—	—	—	—
		H170			—	—	—	—	170	220	—	—
CuSn0,15	CW117C	R250	0,2	1,5	250	320	—	9	—	—	—	—
		H060			—	—	—	—	60	90	—	—
		R300	0,1	1,5	300	370	—	4	—	—	—	—
		H085			—	—	—	—	85	110	—	—
		R360	0,1	1,5	360	430	—	3	—	—	—	—
		H105			—	—	—	—	105	130	—	—
		R420	0,1	1,5	420	490	—	2	—	—	—	—
		H120			—	—	—	—	120	140	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn0,5	CW119C	R220	0,2	1,5	220	260	(max. 140)	33	—	—	—	—
		H040			—	—	—	—	40	65	—	—
		R240	0,2	1,5	240	300	(min. 180)	8	—	—	—	—
		H065			—	—	—	—	65	95	—	—
		R290	0,2	1,5	290	360	(min. 250)	—	—	—	—	—
		H085			—	—	—	—	85	115	—	—
		R360	0,2	1,5	360	—	(min. 320)	—	—	—	—	—
		H110			—	—	—	—	110	—	—	—
CuNi9Sn2	CW351H	R340	0,2	1,5	340	410	(max. 250)	30	—	—	—	—
		H075			—	—	—	—	75	110	—	—
		R380	0,2	1,5	380	470	(min. 200)	8	—	—	—	—
		H110			—	—	—	—	110	150	—	—
		R450	0,2	1,5	450	530	(min. 370)	4	—	—	—	—
		H140			—	—	—	—	140	170	—	—
		R500	0,2	1,5	500	580	(min. 450)	2	—	—	—	—
		H160			—	—	—	—	160	190	—	—
		R560	0,2	1,5	560	—	(min. 520)	—	—	—	—	—
		H160			—	—	—	—	180	210	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuSn4	CW450K	R290	0,2	1,5	290	390	(max. 190)	40	—	—	—	—
		H070			—	—	—	—	70	100	—	—
		R390	0,1	1,5	390	490	(min. 210)	11	—	—	—	—
		H115			—	—	—	—	115	155	—	—
		R480	0,1	1,5	480	570	(min. 420)	4	—	—	—	—
		H150			—	—	—	—	150	180	—	—
		R540	0,1	1,5	540	630	(min. 490)	3	—	—	—	—
		H170			—	—	—	—	170	200	—	—
		R610	0,1	1,5	610	—	(min. 540)	—	—	—	—	—
		H190			—	—	—	—	190	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm²		$R_{p0,2}$ N/mm²	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuSn5	CW451K	R310	0,1	1,5	310	390	(max. 250)	45	—	—	—	—
		H075			—	—	—	—	75	105	—	—
		R400	0,1	1,5	400	500	(min. 240)	14	—	—	—	—
		H120			—	—	—	—	120	160	—	—
		R490	0,1	1,5	490	580	(min. 430)	8	—	—	—	—
		H160			—	—	—	—	160	190	—	—
		R550	0,1	1,5	550	640	(min. 510)	4	—	—	—	—
		H180			—	—	—	—	180	210	—	—
		R630	0,1	1,5	630	720	(min. 600)	2	—	—	—	—
		H200			—	—	—	—	200	230	—	—
		R690	0,1	1,5	690	—	(min. 670)	—	—	—	—	—
		H220			—	—	—	—	220	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
					R_m		$R_{p0,2}$	$A_{50\ mm}$	HV			
Material		Material condition	mm		N/mm²		N/mm²	%			mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuSn6	CW452K	R350	0,1	1,5	350	420	(max. 300)	45	—	—	—	—
		H080			—	—	—	—	80	110	—	—
		R420	0,1	1,5	420	520	(min. 260)	17	—	—	—	—
		H125			—	—	—	—	125	165	—	—
		R500	0,1	1,5	500	590	(min. 450)	8	—	—	—	—
		H160			—	—	—	—	160	190	—	—
		R560	0,1	1,5	560	650	(min. 500)	5	—	—	—	—
		H180			—	—	—	—	180	210	—	—
		R640	0,1	1,5	640	730	(min. 600)	3	—	—	—	—
		H200			—	—	—	—	200	230	—	—
		R720	0,1	1,5	720	—	(min. 690)	—	—	—	—	—
		H220			—	—	—	—	220	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min	up to		min.	min.	max.	min.	max.
CuSn8	CW453K	R370	0,2	1,5	370	450	(max. 300)	50	—	—	—	—
		H090			—	—	—	—	90	120	—	—
		R450	0,1	1,5	450	550	(min. 280)	20	—	—	—	—
		H135			—	—	—	—	135	175	—	—
		R540	0,1	1,5	540	630	(min. 460)	13	—	—	—	—
		H170			—	—	—	—	170	200	—	—
		R600	0,1	1,5	600	690	(min. 530)	5	—	—	—	—
		H190			—	—	—	—	190	220	—	—
		R660	0,1	1,5	660	750	(min. 620)	3	—	—	—	—
		H210			—	—	—	—	210	240	—	—
		R740	0,1	1,5	740	—	(min. 700)	2	—	—	—	—
		H230			—	—	—	—	230	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuSn3Zn9	CW454K	R320	0,2	1,5	320	380	(max. 230)	25	—	—	—	—
		H080			—	—	—	—	80	110	—	—
		R380	0,1	1,5	380	430	(min. 200)	18	—	—	—	—
		H110			—	—	—	—	110	140	—	—
		R430	0,1	1,5	430	520	(min. 330)	6	—	—	—	—
		H140			—	—	—	—	140	170	—	—
		R510	0,1	1,5	510	600	(min. 430)	3	—	—	—	—
		H160			—	—	—	—	160	190	—	—
		R580	0,1	1,5	580	690	(min. 520)	—	—	—	—	—
		H180			—	—	—	—	180	210	—	—
		R660	0,1	1,5	660	—	(min. 610)	—	—	—	—	—
		H200			—	—	—	—	200	—	—	—
CuZn5	CW500L	R230	0,2	1,5	230	280	(max. 130)	36	—	—	—	—
		H045			—	—	—	—	45	75	—	—
		R270	0,2	1,5	270	350	(min. 300)	12	—	—	—	—
		H075			—	—	—	—	75	110	—	—
		R340	0,2	1,5	340	—	(min. 280)	4	—	—	—	—
		H110			—	—	—	—	110	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
					R_m		$R_{p0,2}$	$A_{50\ mm}$	HV			
Material		Material condition	mm		N/mm²		N/mm²	%			mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn10	CW501L	R240	0,2	1,5	240	290	(max. 140)	36	—	—	—	—
		H050			—	—	—	—	50	80	—	—
		R280	0,2	1,5	280	360	(min. 200)	13	—	—	—	—
		H080			—	—	—	—	80	110	—	—
		R350	0,2	1,5	350	—	(min. 290)	4	—	—	—	—
		H110			—	—	—	—	110	—	—	—
CuZn15	CW502L	R260	0,2	1,5	260	310	(max. 140)	36	—	—	—	—
		H055			—	—	—	—	55	85	—	—
		G010	0,2	1	(340)		(190)	(50)	—	105	—	0,015
		G020	0,2	1,5	(300)		(125)	(50)	—	85	0,015	0,030
		G035			(290)		(110)	(50)	—	75	0,025	0,050
		R300	0,2	1,5	300	370	(min. 150)	16	—	—	—	—
		H085			—	—	—	—	85	115	—	—
		R350	0,2	1,5	350	420	(min. 250)	4	—	—	—	—
		H105			—	—	—	—	105	135	—	—
		R410	0,2	1,5	410	—	(min. 360)	—	—	—	—	—
		H125			—	—	—	—	125	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn20	CW503L	R270	0,2	1,5	270	320	(max. 150)	38	—	—	—	—
		H055			—	—	—	—	55	85	—	—
		G010	0,2	1	(340)		(190)	(50)	—	105	—	0,015
		G020	0,2	1,5	(300)		(125)	(50)	—	85	0,015	0,030
		G035			(290)		(110)	(50)	—	75	0,025	0,050
		R320	0,2	1,5	320	400	(min. 200)	20	—	—	—	—
		H085			—	—	—	—	85	115	—	—
		R400	0,2	1,5	400	480	(min. 320)	5	—	—	—	—
		H120			—	—	—	—	120	155	—	—
		R480	0,2	1,5	480	—	(min. 440)	—	—	—	—	—
		H155			—	—	—	—	155	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn30	CW505L	R270	0,2	1,5	270	350	(max. 160)	40	—	—	—	—
		H055			—	—	—	—	55	90	—	—
		G010	0,2	1	(410)		(210)	(40)	—	120	—	0,015
		G020	0,2	1,5	(360)		(150)	(40)	—	95	0,015	0,030
		G030			(340)		(130)	(40)	—	90	0,020	0,040
		G050			(330)		(110)	(40)	—	80	0,035	0,070
		G075			(310)		(90)	(50)	—	70	0,050	0,100
		R350	0,2	1,5	350	430	(min. 170)	21	—	—	—	—
		H095			—	—	—	—	95	125	—	—
		R410	0,2	1,5	410	490	(min. 260)	9	—	—	—	—
		H120			—	—	—	—	120	155	—	—
		R480	0,2	1,5	480	—	(min. 430)	—	—	—	—	—
		H150			—	—	—	—	150	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$	$A_{50\ mm}$	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn33	CW506L	R280	0,2	1,5	280	310	(max. 170)	40	—	—	—	—
		H055			—	—	—	—	55	90	—	—
		G010	0,2	1	(410)		(210)	(40)	—	120	—	0,015
		G020	0,2	1,5	(360)		(150)	(40)	—	95	0,015	0,030
		G030			(340)		(130)	(40)	—	90	0,020	0,040
		G050			(330)		(110)	(40)	—	80	0,035	0,070
		R350	0,2	1,5	350	430	(min. 170)	23	—	—	—	—
		H095			—	—	—	—	95	125	—	—
		R420	0,2	1,5	420	500	(min. 300)	6	—	—	—	—
		H125			—	—	—	—	125	155	—	—
		R500	0,2	1,5	500	—	(min. 450)	—	—	—	—	—
		H155			—	—	—	—	155	—	—	—

Table 4 *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation	Hardness		Grain size	
Material		Material condition	mm		R_m N/mm^2		$R_{p0,2}$ N/mm^2	$A_{50\ mm}$ %	HV		mm	
Symbol	Number		from	up to	min.	max.		min.	min.	max.	min.	max.
CuZn36 CuZn37	CW507L CW508L	R300	0,2	1,5	300	370	(max. 180)	38	—	—	—	—
		H055			—	—	—	—	55	95	—	—
		G010	0,2	1	(410)		(210)	(30)	—	120	—	0,015
		G020	0,2	1,5	(360)		(150)	(40)	—	95	0,015	0,030
		G030			(340)		(130)	(40)	—	90	0,020	0,040
		G050			(330)		(110)	(40)	—	80	0,035	0,070
		R350	0,2	1,5	350	440	(min. 170)	19	—	—	—	—
		H095			—	—	—	—	95	125	—	—
		R410	0,2	1,5	410	490	(min. 300)	8	—	—	—	—
		H120			—	—	—	—	120	155	—	—
		R480	0,2	1,5	480	560	(min. 430)	3	—	—	—	—
		H150			—	—	—	—	150	180	—	—
		R550	0,2	1,5	550	—	(min.500)	—	—	—	—	—
		H170			—	—	—	—	170	—	—	—

NOTE 1 Figures in parentheses are not requirements of this European Standard, but are given for information only.

NOTE 2 1 N/mm^2 is equivalent to 1 MPa.

[a] For Cu-ETP the material condition designated either R360 or H110 is not available.

[b] Solution heat treated and cold rolled.

[c] Solution heat treated, cold rolled and precipitation hardened.

Table 5 — Preferred thickness (mean values) and thickness ranges of coatings

Thickness µm mean value	Thickness range µm from	 up to	Application
1,45	0,7	2,2	Tarnish prevention, decorative appearance, lowering of frictional forces
2,0	1,0	3,0	
3,5	2,0	5,0	Corrosion protection
5,0	3,0	7,0	Improved shelf life
7,5	5,0	10,0	Soldering aid
10,0	7,0	13,0	Soldering aid

Table 6 — Tolerance on thickness for strip before tinning

Values in millimetres

Nominal thickness		Tolerances on thickness for nominal widths up to 200		Tolerance on thickness for nominal widths up to 300
over	up to	Class A	Class B	Class C
0,1 [a]	0,2	± 0,010	± 0,007	± 0,018
0,2	0,3	± 0,015	± 0,010	± 0,022
0,3	0,4	± 0,018	± 0,012	± 0,025
0,4	0,5	± 0,020	± 0,015	± 0,030
0,5	0,8	± 0,025	± 0,018	± 0,040
0,8	1,2	± 0,030	± 0,022	± 0,050
1,2	1,5	—	—	± 0,060

NOTE These values for tolerances on thickness for nominal widths
– up to 200: are equivalent to those of EN 1654:1997, Table 3 up to 1,0 mm nominal thickness only;
– up to 300: are equivalent to those of EN 1652:1997, Table 5.

[a] Including 0,1.

Table 7 — Tolerances on width for hot-dip tinned strip

Values in millimetres

Nominal thickness		Tolerances on widths for nominal widths			
over	up to	up to 50	over 50 up to 100	over 100 up to 200	over 200 up to 350
0,1 [a]	1,0	+ 0,20 0	+ 0,30 0	+ 0,40 0	+ 0,60 0
1,0	1,5	+ 0,30 0	+ 0,40 0	+ 0,50 0	+ 1,0 0

[a] Including 0,1.

Table 8 — Edgewise curvature c for hot-dip tinned strip

Dimensions in millimetres

Nominal width		Maximum edgewise curvature c for nominal thickness		
over	up to	up to 0,5	over 0,5 up to 1,2	over 1,2
10 [a]	15	7	10	—
15	30	4	6	8
30	50	3	4	6
50	—	2	3	4

[a] Including 10.

Annex A
(normative)

Testing of solderability of hot-dip tinned strip by means of vertical dipping test

A.1 Introduction

This annex specifies a test method and acceptance criteria for solderability for soft soldering of hot-dip tinned strip with coatings of the type Sn or Sn60Pb in accordance with this European Standard.

A.2 Method

The test sample shall be immersed vertically in a soldering bath at a speed of 3 mm/s and removed again at the same speed after a dwell time of 5 s.

Wetting shall be assessed by visual comparison with wetted reference samples.

A.3 Test samples

Preferably, sections of approximately 10 mm $\times$ 40 mm shall be provided. Smaller dimensions are permitted, but the minimum width should not be less than 2 mm.

At least three test samples shall be taken. The test samples shall be free from corrosive residues. Care shall be taken that the surface to be tested is not contaminated in any way, in particular by contact with bare fingers during sampling and test piece preparation. The test pieces shall be cleaned to remove any protective grease coatings by immersion in a neutral organic solvent at room temperature of 15 °C to 35 °C.

If it is intended that this test shall be applied for testing on receipt, this shall be agreed at the time of ordering. Sampling and testing shall be carried out at the latest 14 days after arrival of the shipment, in the condition as delivered.

The first 200 mm of strip from the coil or spool shall not be used for the solderability test; in cases of insufficient solderability the first winding of the coil shall be removed and the test shall be repeated.

If an ageing test has been agreed between purchaser and supplier, the test samples shall be aged for 16 h in an oven at (155 $\pm$ 3) °C.

A.4 Test arrangement

The test arrangement consists of a stationary soldering bath and a device enabling the test sample to be immersed at a defined constant speed, with a defined stroke, and to be removed again after a defined dwell time.

The amount of solder shall be at least 0,5 kg and the depth of the soldering bath at least 40 mm.

A.5 Test procedure

Depth of immersion: 25 mm, other depths of immersion shall be agreed between the purchaser and the supplier.

Solder: S-Sn60Pb40 in accordance with EN ISO 9453.

Bath temperature: (250 ± 5) °C.

Flux: 600 g of pure colophonium, free from halogen ($< 5 \times 10^{-6}$) based on natural resins without additions, dissolved in 1 l of ethylalcohol, completely denatured with methylethylketone (96,4 % by mass) of alcohol or 1 l of anhydrous isopropylalcohol.

The alcohol to be used shall be agreed between the purchaser and the supplier.

The test sample shall be immersed in the flux beyond the defined depth of immersion. It shall then be checked after the flux has dried (at least for 1 min at room temperature to allow the solvent to evaporate). Immediately before testing, the surface of the soldering bath shall be cleaned by skimming.

Speed of immersion: 3 mm/s

Speed of immersion equals speed of removal

Dwell time in the bath: 5 s

A.6 Assessment

Test samples prepared in accordance with A.3 and A.5 shall be cleaned of flux and assessed in respect of their wetting by comparison with the reference samples in Figures A.1 to A.5.

For test samples differing in shape and dimensions from those in accordance with A.3 the evaluation criteria illustrated in Figures A.1 to A.5 shall be applied appropriately. The smaller the test samples the more difficult is the assessment.

These requirements do not apply to untinned cut edges, untinned areas of partially tinned strips and components manufactured from them.

A.7 Illustrations of reference samples

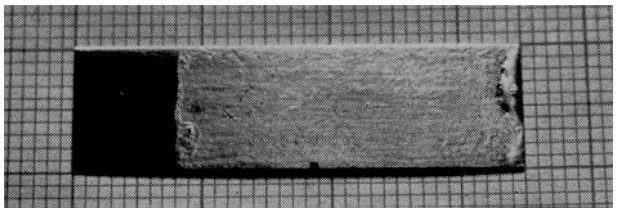


Figure A.1 — Acceptable

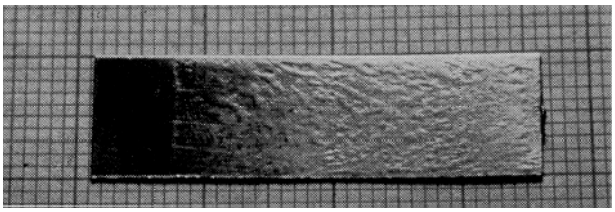


Figure A.2 — Borderline sample, acceptable

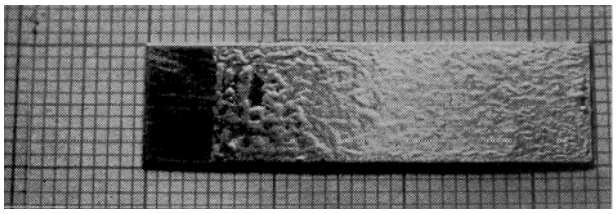


Figure A.3 — Borderline sample, unacceptable

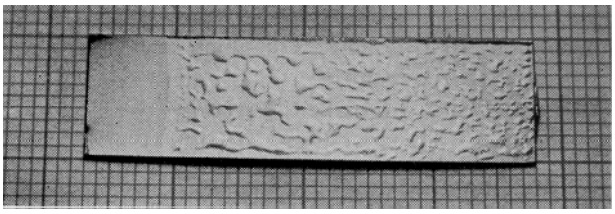


Figure A.4 — Unacceptable

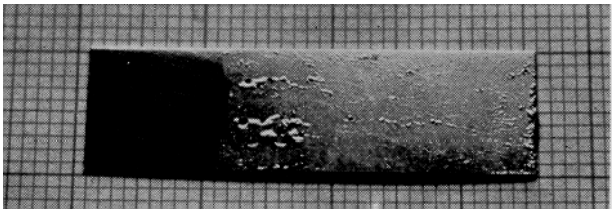


Figure A.5 — Unacceptable, no adequate coating

Annex B
(normative)

Measuring of coating thickness with X-ray spectrometric method according to EN ISO 3497

B.1 Introduction

This annex contains some test essentials which shall be respected when measurements in accordance with EN ISO 3497 are made.

B.2 Test essentials

B.2.1 Coating thickness

The coating thickness is the thickness of a coating material on a substrate. The coating thickness shall be reported in micrometres or in grams per square metre as mass referred to a specific area.

B.2.2 Essential area

The essential area is that area of the surface of the copper material strip on which the specified coating thickness shall be fulfilled. It can be the total area of the strip surface or a special part of the strip surface. Generally the total area refers to one production lot.

B.2.3 Reference area

Reference areas are those areas of the essential area where an agreed number of single measurements shall be performed, i.e. strip samples 50 cm long multiplied by the width of the strip.

The number of samples, the geometry of samples and the number of single measurements shall be agreed between the purchaser and the supplier.

B.2.4 Measurement point

The measurement point is that area inside a reference area which is necessary for a single measurement and gives a measurement value. This point shall be determined combined with the measurement method and the reference area.

B.2.5 Local coating thickness

The local coating thickness x_i is the arithmetic mean value calculated from the single measurements (x_1, x_2, ... x_n) which are performed inside the reference area, in accordance with the agreed measurement method.

At least three single measurements shall be made on each side of the essential area and the local coating thickness for each side shall be calculated as follows:

$$x_i = \frac{(x_1 + x_2 + \ldots . x_n}{n} 1 \quad \text{(B.1)}$$

where

n is the number of single measurements inside a reference area.

B.2.6 Accepted quality level

The local coating thicknesses shall be within the specified tolerance although, single measurement values may deviate from this tolerance. Rounding of results and, if required, standard deviations shall be agreed between the purchaser and the supplier.

Bibliography

[1] EN 1173, *Copper and copper alloys — Material condition designation*

[2] EN 1412, *Copper and copper alloys — European numbering system*

[3] EN 1652:1997, *Copper and copper alloys — Plate, sheet, strip and circles for general purposes*

[4] EN 1654:1997, *Copper and copper alloys — Strip for springs and connectors*

[5] EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2008)*

[6] EN ISO 9453, *Soft solder alloys — Chemical compositions and forms (ISO 9453:2006)*

[7] ISO 1190-1, Copper and copper alloys — Code of designation — Part 1: Designation of materials

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