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BRITISH STANDARD

BS EN 1758:1998

Incorporating Corrigendum No. 1

Copper and copper alloys — Strip for lead frames

The European Standard EN 1758:1997 has the status of a British Standard

ICS 77.150.30

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National foreword

This British Standard is the English language version of EN 1758:1997 published by the European Committee for Standardization (CEN).

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

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 May 1998

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Amd. No.	Date	Text affected
10197 Corr. No. 1	September 1998	Indicated by a sideline in the margin

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1758

December 1997

ICS 77.150.30

Descriptors: Copper, copper alloys, rolled products, steel strips, integrated circuits, electronic components, designation, materials, dimensions, dimensional tolerances, mechanical properties, surface properties, chemical composition, roughness, marking

English version

Copper and copper alloys — Strip for lead frames

Cuivre et alliages de cuivre — Bandes pour grilles de composants (lead frames)

Kupfer und Kupferlegierungen — Bänder für Systemträger

This European Standard was approved by CEN on 6 November 1997.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

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Ref. No. EN 1758:1997 E

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 133, Copper and copper alloys, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 1998, and conflicting national standards shall be withdrawn at the latest by June 1998.

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

EN 1758, *Copper and copper alloys — Strip for lead frames.*

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.*

Copper and copper alloys — Copper plate, sheet and strip for electrical purposes. (WI: 00133022)

This standard gives information, which might be useful to the user, on physical properties of the product contained in annex A.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

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1 Scope

This European Standard specifies the composition, property requirements and tolerances on dimensions and form for copper and copper alloy strip for lead frame material, with widths up to and including 100 mm. Thicknesses from 0,1 mm up to and including 1,0 mm are generally used for stamped lead frames for integrated circuits and low power devices and thicknesses from 1,0 mm up to and including 2,0 mm are generally used for stamped lead frames for high power devices.

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

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

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

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature).*

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

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

ISO 4287-1, *Surface roughness — Terminology — Part 1: Surface and its parameters.*

ISO 6507-2, *Metallic materials — Hardness test — Vickers test — Part 2: HV 0,2 to less than HV 5.*

ISO 6507-3, *Metallic materials — Hardness test — Vickers test — Part 3: Less than HV 0,2.*

ISO 7438, *Metallic materials — Bend test.*

ISO 7799, *Metallic materials — Sheet and strip 3 mm thick or less — Reverse bend test.*

HD 323.2.20 S3, *Environmental testing — Part 2: Tests — Test T: Soldering.*

NOTE Informative references to documents used in the preparation of this standard, and cited at the appropriate places in the text, are listed in a bibliography, see annex B.

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1
strip
flat rolled product of rectangular cross-section with uniform thickness from at least 0,10 mm, supplied as level wound coils usually with slit edges; the thickness does not exceed one tenth of the width

3.2
lead frame
part which has been stamped or etched from a strip for assembling, carrying and effecting the electrical connections of semi-conductor components

4 Designations

4.1 Material

4.1.1 *General*

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

Table 1 — Composition of copper

Material designation		Composition % (*m/m*)						
		Element	Cu[1)]	Bi	P	Pb	Other elements (see note)	
Symbol	Number						Total	Excluding
Cu-DLP	CW023A	min.	99,90	—	0,005	—	—	Ag, Ni, P
		max.	—	0,0005	0,013	0,005	0,03	

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

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.

Table 2 — Composition of low alloyed copper alloys

Material designation		Composition in % (*m/m*)								
Symbol	Number	Element	Cu	Fe	Ni	P	Pb	Sn	Zn	Others Total
CuFe2P	CW107C	min.	Rem	2,1	—	0,015	—	—	0,05	—
		max.	—	2,6	—	0,15	0,03	—	0,20	0,2
CuSn0,15	CW117C	min.	Rem.	—	—	—	—	0,10	—	—
		max.	—	0,02	0,02	0,015	—	0,15	0,10	0,10

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4.1.2 *Symbol*

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

NOTE Although material symbol designations used in this standard might be the same as those in other standards using the designation system given in ISO 1190-1, the detailed composition requirements are not necessarily the same.

4.1.3 *Number*

The material number designation is in accordance with the system given in EN 1412.

4.2 Material condition

For the purposes of this standard, the following designations, which are in accordance with the system given in EN 1173, apply for the material condition.

– 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.

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

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

4.3 Product

The product designation provides a standardized pattern of designation from which a rapid and unequivocal description of a product is conveyed in communication. It provides mutual comprehension at the international level with regard to products which meet the requirements of the relevant European Standard.

The product designation is no substitute for the full content of the standard.

The product designation for products to this standard shall consist of:

– denomination (strip);

– number of this European Standard (EN 1758);

– material designation, either symbol or number (see Tables 1 and 2);

– material condition designation (see Table 3);

– nominal dimensions (thickness × width).

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

Table 3 — Mechanical properties

Designation			Nominal thickness		Tensile strength R_m		Elongation $A_{50\,mm}$	Hardness	
Material		Material condition	mm		N/mm^2		%	HV	
Symbol	Number		From	Up to and including	min.	max.	min.	min.	max.
Cu-DLP	CW023A	R240[*)]	0,10	2,0	240	300	8	—	—
		H065[*)]			—	—	—	65	95
		R290	0,10	2,0	290	360	4	—	—
		H090			—	—	—	90	110
		R360	0,10	1,0	360	—	2	—	—
		H110			—	—	—	110	—
CuFe2P	CW107C	R370[*)]	0,10	2,0	370	430	6	—	—
		H120[*)]			—	—	—	120	140
		R420	0,10	2,0	420	480	3	—	—
		H130			—	—	—	130	150
		R470	0,10	1,0	470	530	—	—	—
		H140			—	—	—	140	160
		R520	0,10	1,0	520	580	—	—	—
		H150			—	—	—	150	170
CuSn0,15	CW117C	R250[*)]	0,10	2,0	250	320	9	—	—
		H060[*)]			—	—	—	60	90
		R300	0,10	2,0	300	370	4	—	—
		H085			—	—	—	85	110
		R360	0,10	2,0	360	430	3	—	—
		H105			—	—	—	105	130
		R420	0,10	1,0	420	490	2	—	—
		H120			—	—	—	120	140

[*)] See Table 8.

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

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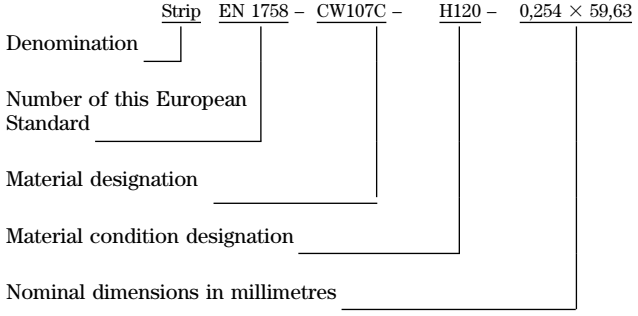
EXAMPLE:

Strip conforming to this standard, in material designated either CuFe2P or CW107C, in material condition H120, nominal thickness 0,254 mm, nominal width 59,63 mm, shall be designated as follows:

Strip EN 1758 – CuFe2P – H120 – 0,254 × 59,63;

or

Strip EN 1758 – CW107C – H120 – 0,254 × 59,63



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 (strip);

c) number of this European Standard (EN 1758);

d) material designation (see Tables 1 and 2);

e) material condition designation (see **4.2** and Table 3);

f) nominal dimensions (thickness × width);

g) coil size requirements: nominal inside diameter, in millimetres, and maximum outside diameter, in millimetres, and either maximum mass, in kilograms, or approximate specific coil weight (mass per width) in kilograms per millimetre.

NOTE 1 It is recommended that the product designation as described in **4.3**, is used for items b) to f).

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

h) whether a 90° bend test according to ISO 7438 is required (see **6.3**); if so, the acceptance criteria required;

i) whether a reverse bend test according to ISO 7799 is required (see **6.3**); if so, the dimensions, alignment of the test piece to the rolling direction of the strip, the tensile load and the acceptance criteria required;

j) whether a lead fatigue test according to annex C is required (see **6.3**); if so, the acceptance criteria required;

k) whether edgewise curvature shall be measured over a length of 2 000 mm (see **6.5.1**);

l) whether there is a requirement for limitation of coil set for strip thicknesses over 0,5 mm (see **6.5.3.1**);

m) whether there is a requirement for limitation of twist (see **6.5.3.3**);

n) which measuring device is to be used for the determination of transverse cross bow (see **8.7**);

o) whether the solderability test according to HD 323.2.20 S3 is required (see **6.6.3**);

p) whether there is a requirement for limitation of edge stress (see **6.7**); if so, the acceptance criteria required;

NOTE 2 The details of the test method and the acceptance criteria should be agreed between the purchaser and the supplier.

q) whether there is a requirement for minimum electrical conductivity (see **6.8**); if so, the acceptance criteria required and the test method if it is not to be left to the discretion of the supplier;

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**).

EXAMPLE

Ordering details for 1 500 kg strip conforming to EN 1758, in material designated either CuFe2P or CW107C, in material condition H120, nominal thickness, 0,254 mm, nominal width, 59,63 mm, with nominal inside diameter of coil, 400 mm, maximum outside diameter of coil, 915 mm, approximate specific coil weight (mass per width), 4,0 kg/mm:

1 500 kg strip EN 1758 – CuFe2P – H120 – 0,254 × 59,63;
– nominal inside diameter of coil: 400 mm;
– maximum outside diameter of coil: 915 mm;
– approximate specific coil weight: 4,0 kg/mm;

or

1 500 kg strip EN 1758 – CW107C – H120 – 0,254 × 59,63;
– nominal inside diameter of coil: 400 mm;
– maximum outside diameter of coil: 915 mm;
– approximate specific coil weight: 4,0 kg/mm.

6 Requirements

6.1 Composition

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

NOTE These materials have been taken into account as being the most common materials in Europe and meeting the guidelines of CEN/TC 133 for the standardization of materials.

6.2 Mechanical properties

The mechanical properties shall conform to the appropriate requirements given in Table 3. The tests shall be carried out in accordance with either **8.2** (tensile) or **8.3** (hardness).

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6.3 Technological properties

Strip shall be tested in accordance with the method(s) selected from those given in **8.4** when requested by the purchaser [see **5**h), **5**i) and **5**j)] and shall meet the acceptance criteria agreed between the purchaser and the supplier.

6.4 Dimensions and tolerances

Strip shall conform to the tolerances given in Tables 4 and 5.

6.5 Form tolerances

6.5.1 *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 6.

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 6 multiplied by 4.

6.5.2 *Edge burr* b

The height of edge burrs (see Figure 2) shall not exceed the values given in Table 7.

Height of edge burr $b = x - t$

where:

x is the height of edge burr measured from the opposite side of the strip;

t is the thickness.

Table 4 — Tolerances on thickness

Dimensions in millimetres

Nominal thickness		Tolerance on thickness
Over	Up to and including	
0,1[1)]	0,3	±0,008
0,3	0,5	±0,010
0,5	0,8	±0,013
0,8	1,0	±0,015
1,0	1,5	±0,020
1,5	2,0	±0,025

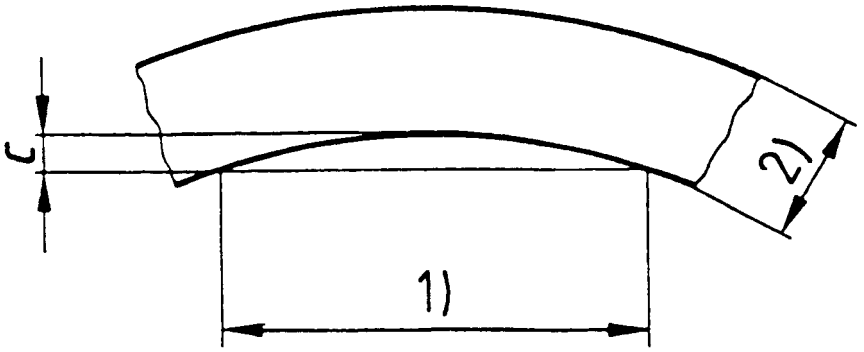
[1)] Including 0,1.

Table 5 — Tolerances on width

Dimensions in millimetres

Nominal thickness		Tolerance on width for nominal widths	
Over	Up to and including	From 15 up to and including 55	Over 55 up to and including 100
0,1[1)]	0,5	+0,10 0	+0,15 0
0,5	1,0	+0,15 0	+0,20 0
1,0	2,0	+0,30 0	+0,40 0

[1)] Including 0,1.



1) measuring length
2) strip width

Figure 1 — Edgewise curvature c

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Table 6 — Edgewise curvature *c*

Dimensions in millimetres

Nominal width		Edgewise curvature *c* for nominal thicknesses[1)]		
Over	Up to and including	From 0,1 up to and including 0,3 max.	Over 0,3 up to and including 1,0 max.	Over 1,0 up to and including 2,0 max.
15[2)]	24	1,8	2,5	4,0
24	55	1,3	2,0	3,0
55	100	1,0	1,5	2,5

[1)] Measuring length 1 000.

[2)] Including 15.

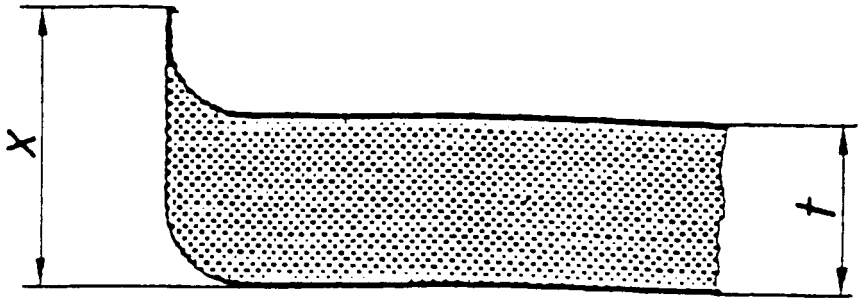

Figure 2 — Edge burr *b*

Table 7 — Edge burr *b*

Dimensions in millimetres

Nominal thickness		Height of edge burr *b*
Over	Up to and including	max.
0,1[1)]	0,5	0,02
0,5	1,0	0,03
1,0	2,0	0,04

[1)] Including 0,1.

6.5.3 *Flatness*

6.5.3.1 *Coil set*

The coil set is measured as the deflection a from the vertical of a 300 mm long portion of a strip (see Figure 3), for thicknesses up to and including 0,5 mm, and with widths equal to or greater than 15 mm, coiled with an inside diameter equal to or greater than 400 mm. The test shall be carried out in accordance with **8.6**. The deflection shall not exceed the values given in Table 8.

If a limitation of coil set is required for strip over 0,5 mm thickness, the acceptance criteria shall be agreed between the purchaser and the supplier.

6.5.3.2 *Transverse cross bow q*

The transverse cross bow q (see Figure 4) including edge burr (see **6.5.2**) for strips with widths up to and including 100 mm shall not exceed the values given in Table 9.

transverse cross bow $q = d - t$

where:

d is the distance of the upper point of the cross-section from the reference plane;

t is the thickness;

$\overline{w}$ is the width.

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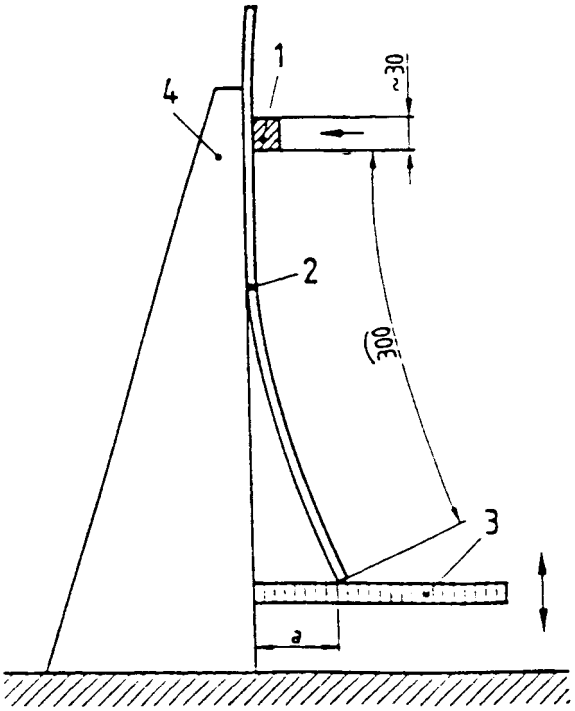

1 holder
2 strip
3 scale
4 stand

Dimensions in millimetres

Figure 3 — Coil set as measured by deflection *a*

Table 8 — Coil set

Dimensions in millimetres

Nominal width		**Deflection *a* for nominal thicknesses[1), 2)] for coil inside diameters equal to or greater than 400[3)]**	
Over	**Up to and including**	**From 0,1 up to and including 0,3 max.**	**Over 0,3 up to and including 0,5 max.**
15[4)]	24	50	60
24	55	45	55
55	100	40	50

[1)] With the exception of material conditions marked with [*)] in Table 3.

[2)] Measuring length 300.

[3)] For thicknesses from 0,1 up to and including 0,2, coil inside diameters equal to or smaller than 400 are permitted. The relevant values for deflection *a* shall be agreed between the purchaser and the supplier.

[4)] Including 15.

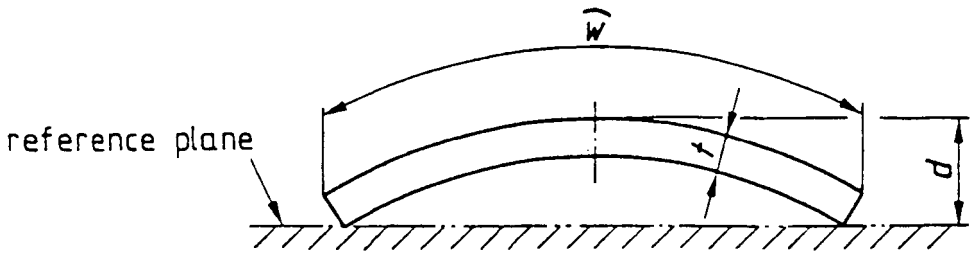

Figure 4 — Transverse cross bow *q*

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Table 9 — Transverse cross bow q

Dimensions in millimetres

Nominal width		Transverse cross bow q for nominal thicknesses		
Over	Up to and including	From 0,1 up to and including 0,3 max.	Over 0,3 up to and including 1,0 max.	Over 1,0 up to and including 2,0 max.
15[1)]	24	0,10	0,15	0,20
24	55	0,15	0,20	0,25
55	100	0,25	0,30	0,35

[1)] Including 15.

6.5.3.3 *Twist*

If required, maximum values for angle of twist α (see Figure 5) shall be agreed between the purchaser and the supplier. The test shall be carried out in accordance with **8.8**.

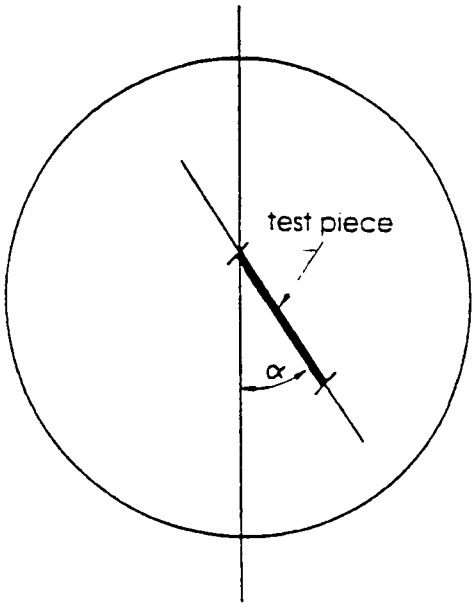

Figure 5 — Angle of twist α

6.6 Surface properties

6.6.1 *Condition*

Strip 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 superficial film of residual lubricant is normally present on cold rolled products and is permissible unless otherwise specified.

Visual inspection of the strip shall be carried out by the purchaser within two weeks of receiving the products. They shall have been stored until then under dry conditions in a closed storeroom.

6.6.2 *Roughness*

The surface roughness, R_a, of both sides of the strip shall conform to the appropriate requirements given in Table 10. The test shall be carried out in accordance with **8.9**.

6.6.3 *Solderability*

If solderability is required, the acceptance criteria agreed between the purchaser and the supplier shall be met. The test shall be carried out in accordance with **8.10**.

6.7 Edge stress

If a limitation of edge stress is required, the acceptance criteria shall be agreed between the purchaser and the supplier. The test shall be carried out in accordance with **8.11**.

6.8 Electrical conductivity

If required, the minimum value of the electrical conductivity shall be agreed between the purchaser and the supplier. The test shall be carried out in accordance with **8.12**.

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**.

Table 10 — Roughness

Nominal thickness mm		Surface roughness R_a μm
Over	Up to and including	max.
0,1[1)]	1,0	0,15
1,0	2,0	0,25

[1)] Including 0,1.

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7.2 Analysis

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.

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 EN ISO 9002.

7.3 Mechanical and other tests

The sampling rate shall be one test sample per master coil. Sampling units shall be selected from the finished products. The test samples shall be cut from the sampling units. Test samples, and test pieces prepared from them, shall not be subjected to any further treatment, other than any machining operations necessary in the preparation of the test pieces.

8 Test methods

8.1 Analysis

Analysis shall be carried out on the test pieces, or test portions, prepared from the test samples obtained in accordance with **7.2**. Except in cases of dispute, the analytical methods used shall be at the discretion of the supplier. For expression of results, the rounding rules given in **8.14** shall be used.

NOTE In cases of dispute concerning the results of analysis, the method of analysis to be used should be in accordance with the appropriate ISO standards, as agreed between the disputing parties.

8.2 Tensile test

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

8.3 Hardness test

The Vickers hardness shall be determined in accordance with ISO 6507-2 or ISO 6507-3, as appropriate, on the test pieces prepared from the test samples obtained in accordance with **7.3**.

For the Vickers test, according to ISO 6507-2, a test force selected from one of those given in ISO 6507-2 shall be used.

For the Vickers test, according to ISO 6507-3, a test force selected from one of those given in ISO 6507-3 shall be used.

8.4 Bend test

The bend tests shall be agreed between the purchaser and the supplier, e.g.:

a) bend test, in accordance with ISO 7438;

b) reverse bend test, in accordance with ISO 7799;

c) lead fatigue test, in accordance with annex C; the dimensions and shape of the test piece shall be defined by agreement between the purchaser and the supplier.

The bending properties shall be determined on test pieces prepared from the test samples obtained in accordance with **7.3**.

8.5 Edge burr b

The edge burr b is the difference between x and t (see Figure 2). The thickness t of the strip and the distance x shall be measured by appropriate devices, as agreed between the purchaser and the supplier.

8.6 Coil set

A test piece with a length greater than 300 mm shall be fixed in the apparatus shown diagrammatically in Figure 3. From the holder the strip shall hang vertically above the base plate of the test equipment. The scale shows the coil set as the shortest distance between the holder and the middle of the lower end of the test piece.

8.7 Transverse cross bow q

The transverse cross bow q is the difference between d and t. The thickness t of the strip and the distance d shall be measured by appropriate measuring devices, as agreed between the purchaser and the supplier.

8.8 Twist α

Twist α shall be directly measured, e.g. by the same apparatus used to determine coil set (see Figure 5). It is measured by the projection of the lower end of the strip on to a scale.

8.9 Roughness

Roughness shall be determined in accordance with ISO 4287-1, perpendicular to the rolling direction.

8.10 Solderability

Solderability shall be determined in accordance with HD 323.2.20 S3.

8.11 Edge stress

This method is used to evaluate edge stresses caused by slitting, for strip thickness between 0,1 mm and 0,3 mm.

Edge stress is characterized by the residual stresses in the area adjacent to slit edges of rolled strip and measured as sideways curvature δ, longitudinal curvature λ and edge twist β. These components of the edge stresses are measured as the displacement of the outer portions relative to the plane of the test piece shown in Figure 6.

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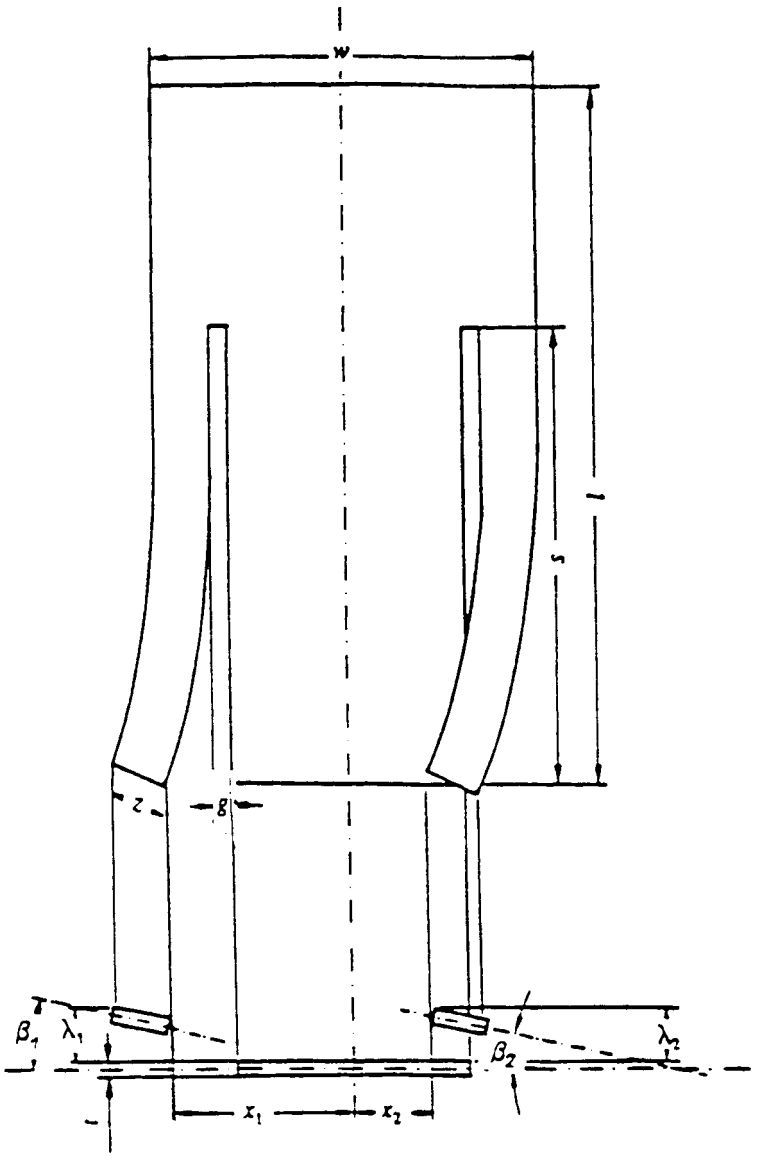

Figure 6 — Determination of sideways curvature δ, longitudinal curvature λ and edge twist β

In a test piece of thickness, t, of length, l, approximately 200 mm, cuts of width g, 0,20 mm to 1,5 mm are made over a length s, 100 mm to 150 mm, parallel to the rolling direction and a distance z, 2 mm to 5 mm from each edge of the strip, by sawing, stamping, etching or wire eroding (see Figure 6).

The details of the test method and the maximum permissible values of δ, λ and β shall be agreed between the purchaser and the supplier.

$$\text{Sideways curvature } \delta_1 = x_1 - \left(\frac{w}{2} - z\right)$$

$$\text{Sideways curvature } \delta_2 = x_2 - \left(\frac{w}{2} - z\right)$$

where:

w is the width of the strip;

x_1, x_2 is the sideways displacement measured from the centre line of the test piece;

z is the width of the outer portions of the test piece.

NOTE It is to be expected that the values of δ_1 and δ_2, of β_1 and β_2 and of λ_1 and λ_2 will be slightly different from each other due to local variations of residual stress and to measuring inaccuracies.

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8.12 Electrical resistivity or conductivity test

The electrical resistivity or conductivity shall be determined by direct measurement on the product in the as delivered condition.

Unless otherwise specified, except for alloys which contain Fe as an alloying element, the test method to be used is left to the discretion of the supplier. For alloys which contain Fe as an alloying element, the resistance bridge method shall be used.

8.13 Retests

If there is a failure of one, or more than one, of the tests in **8.1** to **8.12**, 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 standard. If a test piece fails a test, the inspection lot represented shall be deemed not to conform to this standard.

8.14 Rounding of results

For the purpose of determining conformity to the limits specified in this standard, an observed or a calculated value obtained from a test shall be rounded in accordance with the following procedure, which is based upon the guidance given in annex B of ISO 31-0:1992. 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)].

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Annex A (informative)
Physical properties

The values given in Table A.1 are approximate and for information only.

Table A.1 — Physical properties

Material designation		Linear coefficient of thermal expansion	Electrical conductivity[1]		Thermal conductivity[2]	Density
Symbol	Number	K^{-1}	MS/m[3]	% IACS[4]	W/(m·K)	g/cm^3
Cu-DLP	CW023A	$17{,}3 \times 10^{-6}$	52	90	370	8,9
CuFe2P	CW107C	$16{,}3 \times 10^{-6}$	35	60	260	8,8
CuSn0,15	CW117C	$17{,}3 \times 10^{-6}$	47	80	340	8,9

[1] For some specific applications a minimum electrical conductivity may be required.
[2] Thermal conductivity is calculated from the electrical conductivity.
[3] 1 MS/m is equivalent to 1 m/(Ω·mm^2).
[4] IACS = International Annealed Copper Standard.

Annex B (informative)
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.

EN 1173, *Copper and copper alloys — Material condition or temper designation.*

EN 1412, *Copper and copper alloys — European numbering system.*

EN ISO 9001, *Quality systems — Model for quality assurance in design, development, production, installation and servicing.* [ISO 9001:1994]

EN ISO 9002, *Quality systems — Model for quality assurance in production, installation and servicing.* [ISO 9002:1994]

ISO 31-0:1992, *Quantities and units — Part 0: General principles.*

ISO 197-3, *Copper and copper alloys — Terms and definitions — Part 3: Wrought products.*

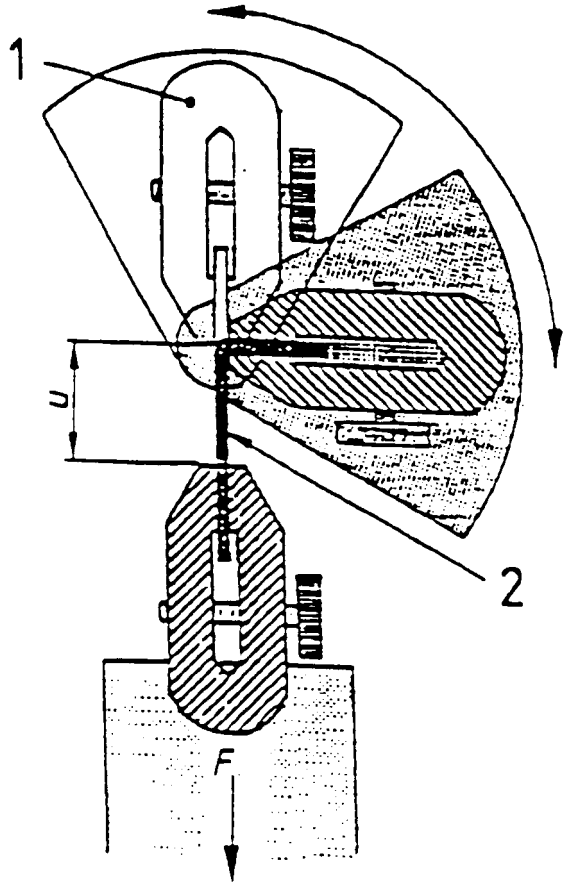
ISO 1190-1, *Copper and copper alloys — Code of designation — Part 1: Designation of materials.*

Annex C (normative)
Lead fatigue test

An alternating bending test with simultaneous tensile stress shall be used to evaluate the bending performance of the leads of semi-conductor lead frames having a thickness of 0,10 mm to 0,30 mm. The dimensions, shape and the alignment of the test piece to the rolling direction of the strip, the tensile load and the number of alternate bends to be achieved shall be agreed between the purchaser and the supplier.

The number of alternate bends shall be determined as follows.

The test piece shall be clamped between two opposing, horizontal grips. The unsupported length shall be 10 mm. One grip shall be linearly moveable and shall be loaded with tensile stress; the other grip shall be such as to enable a 90° rotation (see Figure C.1). The number of complete 90° alternate bends, with bending rate approximately 8/min, until failure of the test piece shall be recorded.



1 grip
2 test piece
where:
U is the unsupported length 10 mm;
F is the load.

Figure C.1

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