BRITISH STANDARD

BS EN 1652:1998

Incorporating Corrigendum No. 1

Copper and copper alloys —

Plate, sheet, strip and circles for general purposes

The European Standard EN 1652:1997 has the status of a British Standard

ICS 77.150.30

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

National foreword

This British Standard is the English language version of EN 1652:1997. Together with BS EN 1653:1998 and BS EN 1654:1998 it supersedes BS 2870:1980 and BS 2875:1969 which are withdrawn.

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 committee 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.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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 April 1998

© BSI 1998

ISBN 0 580 29464 1

Amendments issued since publication

Amd. No.	Date	Text affected
10198 Corr. No. 1	September 1998	Indicated by a sideline in the margin

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1652

December 1997

ICS 77.150.30

Descriptors: Copper, copper alloys, rolled products, metal plates, steel strips, blank, designation, chemical composition, mechanical properties, dimensions, dimensional tolerances, sampling, tests, verification

English version

Copper and copper alloys — Plate, sheet, strip and circles for general purposes

Cuivre et alliages de cuivre — Plaques, tôles, bandes et disques pour usages généraux

Kupfer und Kupferlegierungen — Platten, Bleche, Bänder, Streifen und Ronden zur allgemeinen Verwendung

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

© 1997 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 1652:1997 E

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 1652, *Copper and copper alloys — Plate, sheet, strip and circles for general purposes*

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 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*

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

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

© BSI 1998

1 Scope

This European Standard specifies the composition, property requirements and tolerances on dimensions and form for copper and copper alloy plate, sheet, strip and circles for general purposes.

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.*

prEN 1976, *Copper and copper alloys — Cast unwrought copper products.*

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

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

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

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

ISO 6507-1, *Metallic materials — Hardness test — Vickers test — Part 1: HV 5 to HV 100.*

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

ISO 7438, *Metallic materials — Bend test.*

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

ISO 8490, *Metallic materials — Sheet and strip — Modified Erichsen cupping test.*

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

3 Definitions

For the purposes of this standard, the following definitions, based on ISO 197-3, apply:

3.1

plate

flat rolled product of rectangular cross-section with uniform thickness greater than 10 mm

3.2

sheet

flat rolled product of rectangular cross-section with uniform thickness from 0,2 mm up to and including 10 mm, supplied in straight lengths, usually with sheared or sawn edges. The thickness does not exceed one tenth of the width

3.3

strip

flat rolled product of rectangular cross-section with uniform thickness from 0,1 mm up to and including 5,0 mm manufactured in coil and supplied in as sheared coils, traverse wound coils or cut to length, usually with slit edges. The thickness does not exceed one tenth of the width

3.4

circle

circular blank

4 Designations

4.1 Material

4.1.1 *General*

The material is designated either by a symbol or a 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 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;

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.

© BSI 1998

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:

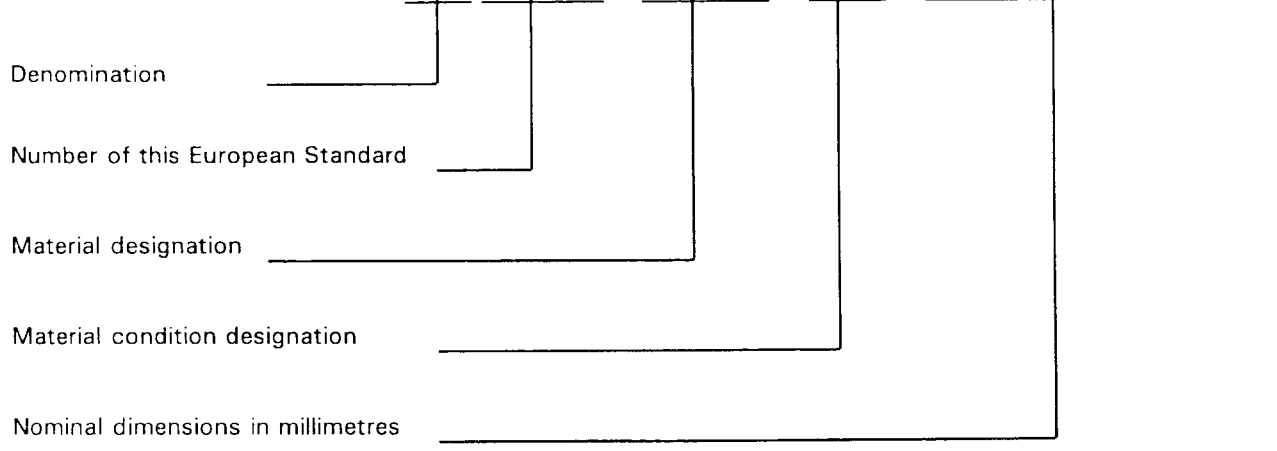
- denomination (plate, sheet, strip or circle);
- number of this European Standard (EN 1652);
- material designation, either symbol or number (see Tables 1 and 2);
- material condition designation (see Table 3);
- nominal dimensions:
  - plate: thickness × width × length [either "as manufactured" (M) or "fixed" (F) length] (see example 1);
  - sheet: thickness × width × length [either "as manufactured" (M) or "fixed" (F) length];
  - strip (in coils or on spools): thickness × width;
  - strip (cut to length): thickness × width × length [either "as manufactured" (M) or "fixed" (F) length];
  - circles: thickness × diameter (see example 2).

The derivation of a product designation is shown for plate in example 1 and another typical product designation is shown in example 2.

EXAMPLE 1:

Plate conforming to this standard, in material designated either Cu-OF or CW008A, in material condition H065, nominal thickness 14,25 mm, nominal width 350,5 mm, as manufactured length 1 200 mm, shall be designated as follows:

Plate EN 1652 – Cu-OF – H065 – 14,25 × 350,5 × 1 200M
or
Plate EN 1652 – CW008A – H065 – 14,25 × 350,5 × 1 200M



EXAMPLE 2:

Circle conforming to this standard, in material designated either CuNi12Zn24 or CW403J, in material condition R550, nominal thickness 1,115 mm, nominal diameter 345,5 mm, shall be designated as follows:

Circle EN 1652 — CuNi12Zn24 — R550 — 1,115 × 345,5

or

Circle EN 1652 — CW403J — R550 — 1,115 × 345,5

© BSI 1998

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:

– plate: number of pieces or mass;

– sheet: number of pieces or mass;

– strip (in coils or on spools): mass;

– strip (cut to length): mass or number of pieces;

– circle: number of pieces or mass;

b) denomination (plate, sheet, strip or circle);

c) number of this European standard (EN 1652);

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

e) material condition designation (see **4.2** and Table 3) if the choice is not to be left to the discretion of the supplier;

f) nominal dimensions:

– plate, sheet, strip (cut to length): thickness × width × length (either "as manufactured" or "fixed" length);

– strip (in coils or on spools): thickness × width;

– circles: thickness × diameter;

g) coil size (strip) 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;

h) spool size (strip): type or dimensions.

NOTE 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:

i) thickness tolerance required for hot rolled plate or circles with width or diameter over 1 500 mm (see Table 4);

j) width tolerance required for plate or sheet with width over 1 250 mm (see Table 7);

k) squareness requirement for cut plate or sheet with width over 1 250 mm (see Table 9);

l) tolerance on diameter required for circles with diameter over 2 000 mm and thickness over 2,5 mm up to and including 5,0 mm (see Table 10);

m) whether one or more technological tests are required, and if so, the test method(s) and test(s) acceptance criteria (see **8.5**);

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

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

p) 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 1652, in material designated either CuZn37 or CW508L, in material condition R480, nominal thickness 0,543 mm, nominal width 219,25 mm, nominal inside diameter of coil 300 mm, maximum outside diameter of coil 950 mm, approximate specific coil weight (mass per width) 4,5 kg/mm:

1 500 kg Strip – CuZn37 – R480 – 0,543 × 219,25
EN 1652 – nominal inside diameter of coil 300 mm
– maximum outside diameter of coil 950 mm
– approximate specific coil weight 4,5 kg/mm

or

1 500 kg Strip – CW508L – R480 – 0,543 × 219,25
EN 1652 – nominal inside diameter of coil 300 mm
– maximum outside diameter of coil 950 mm
– approximate specific coil weight 4,5 kg/mm

6 Requirements

6.1 Composition

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

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

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 **8.2** and **8.3**.

6.3 Grain size

The grain size of G… condition material shall conform to the appropriate requirements given in Table 3. The test shall be carried out in accordance with **8.4**.

6.4 Dimensions and tolerances

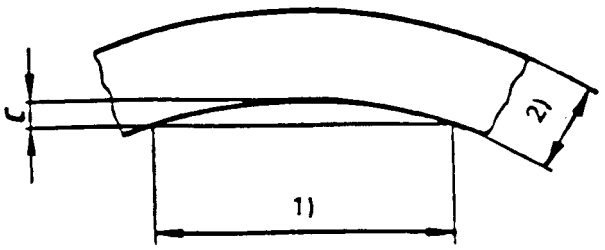
Plate, sheet, strip and circles shall conform to the appropriate tolerances on dimensions and form given in Tables 4 to 10. Plate, sheet and strip up to 5 000 mm in length may be supplied in "as manufactured" or "fixed" lengths (see Table 8).

6.5 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 11.

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 11 multiplied by 4.

© BSI 1998



1) measuring length
2) strip width

Figure 1 — Edgewise curvature *c*

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

7 Sampling

7.1 General

When required (e.g. if necessary in accordance with specified procedures of a supplier's quality system, or when the purchaser requests inspection documents with test results, or for use in cases of dispute), an inspection lot shall be sampled in accordance with **7.2** and **7.3**.

7.2 Analysis

The sampling rate shall be in accordance with 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 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 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 **8.7** 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 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**, except that the gauge length for determining elongation shall be:

a) for thickness over 2,5 mm, gauge length $l_0 = 5{,}65\sqrt{S_0}$ (Elongation A);

b) for thickness from 0,10 mm up to and including 2,5 mm, a fixed gauge length of 50 mm (Elongation $A_{50\,mm}$).

8.3 Hardness test

The Vickers hardness shall be determined in accordance with ISO 6507-1 or ISO 6507-2 as appropriate, on the test pieces prepared from the test samples obtained in accordance with **7.3**.

For the Vickers test according to ISO 6507-1 a test force selected from one of those given in ISO 6507-1 shall be used.

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.

8.4 Estimation of average grain size

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 Technological tests

The technological tests shall be agreed between the purchaser and the supplier [see 5 m)], e.g.:

a) bend test, in accordance with ISO 7438;

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

c) Erichsen cupping test, in accordance with ISO 8490.

8.6 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.

© BSI 1998

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.

8.7 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 five, 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 five, 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 n)] 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 o)] 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 p)].

Table 1 — Composition of copper

Material designation		Composition in % (m/m)								Density[2] g/cm^3
		Element	Cu[1]	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[3]	—	0,005	0,03		
Cu-FRTP	CW006A	min.	99,90	—	—	—	—	—	Ag, Ni, O	8,9
		max.	—	—	0,100	—	—	0,05		
Cu-OF	CW008A	min.	99,95	—	—	—	—	—	Ag	8,9
		max.	—	0,000 5	—[4]	—	0,005	0,03		
Cu-DLP	CW023A	min.	99,90	—	—	0,005	—	—	Ag, Ni, P	8,9
		max.	—	0,000 5	—	0,013	0,005	0,03		
Cu-DHP	CW024A	min.	99,90	—	—	0,015	—	—	—	8,9
		max.	—	—	—	0,040	—	—		

[1] Including Ag, up to a maximum of 0,015 %.
[2] For information only.
[3] Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.
[4] The oxygen content shall be such that the material conforms to the hydrogen embrittlement requirements of prEN 1976.

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.

© BSI 1998

Table 2 — Composition of copper alloys

Material designation		Composition in % (m/m)																Density[1] g/cm³
Symbol	Number	Element	Cu	Al	As	Be	C	Co	Fe	Mn	Ni	P	Pb	S	Si	Sn	Zn	Others total	approx.
CuBe2	CW101C	min.	Rem.	—	—	1,8	—	—	—	—	—	—	—	—	—	—	—	—	8,3
		max.	—	—	—	2,1	—	0,3	0,2	—	0,3	—	—	—	—	—	—	0,5	
CuCo1Ni1Be	CW103C	min.	Rem.	—	—	0,4	—	0,8	—	—	0,8	—	—	—	—	—	—	—	8,8
		max.	—	—	—	0,7	—	1,3	0,2	—	1,3	—	—	—	—	—	—	0,5	
CuCo2Be	CW104C	min.	Rem.	—	—	0,4	—	2,0	—	—	—	—	—	—	—	—	—	—	8,8
		max.	—	—	—	0,7	—	2,8	0,2	—	0,3	—	—	—	—	—	—	0,5	
CuNi2Be	CW110C	min.	Rem.	—	—	0,2	—	—	—	—	1,4	—	—	—	—	—	—	—	8,8
		max.	—	—	—	0,6	—	0,3	0,2	—	2,2	—	—	—	—	—	—	0,5	
CuNi2Si	CW111C	min.	Rem.	—	—	—	—	—	—	—	1,6	—	—	—	0,4	—	—	—	8,8
		max.	—	—	—	—	—	—	0,2	0,1	2,5	—	0,02	—	0,8	—	—	0,3	
CuZn0,5	CW119C	min.	Rem.	—	—	—	—	—	—	—	—	—	—	—	—	—	0,1	—	8,9
		max.	—	—	—	—	—	—	—	—	—	0,02	—	—	—	—	1,0	0,1	
CuAl8Fe3	CW303G	min.	Rem.	6,5	—	—	—	—	1,5	—	—	—	—	—	—	—	—	—	7,7
		max.	—	8,5	—	—	—	—	3,5	1,0	1,0	—	0,05	—	0,2	0,1	0,5	0,2	
CuNi25	CW350H	min.	Rem.	—	—	—	—	—	—	—	24,0	—	—	—	—	—	—	—	8,9
		max.	—	—	—	—	0,05	0,1	0,3	0,5	26,0	—	0,02	0,05	—	0,03	0,5	0,1	
CuNi9Sn2	CW351H	min.	Rem.	—	—	—	—	—	—	—	8,5	—	—	—	—	1,8	—	—	8,9
		max.	—	—	—	—	—	—	0,3	0,3	10,5	—	0,03	—	—	2,8	0,1	0,1	
CuNi10Fe1Mn	CW352H	min.	Rem.	—	—	—	—	—	1,0	0,5	9,0	—	—	—	—	—	—	—	8,9
		max.	—	—	—	—	0,05	0,1[2]	2,0	1,0	11,0	0,02	0,02	0,05	—	0,03	0,5	0,2	
CuNi30Mn1Fe	CW354H	min.	Rem.	—	—	—	—	—	0,4	0,5	30,0	—	—	—	—	—	—	—	8,9
		max.	—	—	—	—	0,05	0,1[2]	1,0	1,5	32,0	0,02	0,02	0,05	—	0,05	0,5	0,2	
CuNi10Zn27	CW401J	min.	61,0	—	—	—	—	—	—	—	9,0	—	—	—	—	—	Rem.	—	8,6
		max.	64,0	—	—	—	—	—	0,3	0,5	11,0	—	0,05	—	—	—	—	0,2	
CuNi12Zn24	CW403J	min.	63,0	—	—	—	—	—	—	—	11,0	—	—	—	—	—	Rem.	—	8,7
		max.	66,0	—	—	—	—	—	0,3	0,5	13,0	—	0,03	—	—	0,03	—	0,2	
CuNi12Zn25Pb1	CW404J	min.	60,0	—	—	—	—	—	—	—	11,0	—	0,5	—	—	—	Rem.	—	8,7
		max.	63,0	—	—	—	—	—	0,3	0,5	13,0	—	1,5	—	—	0,2	—	0,2	

© BSI 1998

© BSI 1998

Table 2 — Composition of copper alloys *(continued)*

Material designation		Composition in % (m/m)																Density[1] g/cm³
Symbol	**Number**	**Element**	**Cu**	**Al**	**As**	**Be**	**C**	**Co**	**Fe**	**Mn**	**Ni**	**P**	**Pb**	**S**	**Si**	**Sn**	**Zn**	**Others total**	approx.
CuNi18Zn20	CW409J	min.	60,0	—	—	—	—	—	—	—	17,0	—	—	—	—	—	Rem.	—	8,7
		max.	63,0	—	—	—	—	—	0,3	0,5	19,0	—	0,03	—	—	0,03	—	0,2	
CuNi18Zn27	CW410J	min.	53,0	—	—	—	—	—	—	—	17,0	—	—	—	—	—	Rem.	—	8,7
		max.	56,0	—	—	—	—	—	0,3	0,5	19,0	—	0,03	—	—	0,03	—	0,2	
CuSn4	CW450K	min.	Rem.	—	—	—	—	—	—	—	—	0,01	—	—	—	3,5	—	—	8,9
		max.	—	—	—	—	—	—	0,1	—	0,2	0,4	0,02	—	—	4,5	0,2	0,2	
CuSn5	CW451K	min.	Rem.	—	—	—	—	—	—	—		0,01	—	—	—	4,5	—	—	8,9
		max.	—	—	—	—	—	—	0,1	—	0,2	0,4	0,02	—	—	5,5	0,2	0,2	
CuSn6	CW452K	min.	Rem.	—	—	—	—	—	—	—	—	0,01	—	—	—	5,5	—	—	8,8
		max.	—	—	—	—	—	—	0,1	—	0,2	0,4	0,02	—	—	7,0	0,2	0,2	
CuSn8	CW453K	min.	Rem.	—	—	—	—	—	—	—	—	0,01	—	—	—	7,5	—	—	8,8
		max.	—	—	—	—	—	—	0,1	—	0,2	0,4	0,02	—	—	8,5	0,2	0,2	
CuSn3Zn9	CW454K	min.	Rem.	—	—	—	—	—	—	—	—	—	—	—	—	1,5	7,5	—	8,8
		max.	—	—	—	—	—	—	0,1	—	0,2	0,2	0,1	—	—	3,5	10,0	0,2	
CuZn5	CW500L	min.	94,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,9
		max.	96,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn10	CW501L	min.	89,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,8
		max.	91,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn15	CW502L	min.	84,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,8
		max.	86,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn20	CW503L	min.	79,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,7
		max.	81,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn30	CW505L	min.	69,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,5
		max.	71,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn33	CW506L	min.	66,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,5
		max.	68,0	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	
CuZn36	CW507L	min.	63,5	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,4
		max.	65,5	0,02	—	—	—	—	0,05	—	0,3	—	0,05	—	—	0,1	—	0,1	

Table 2 — Composition of copper alloys *(continued)*

Material designation		Composition in % (m/m)																Density[1] g/cm³
Symbol	**Number**	**Element**	**Cu**	**Al**	**As**	**Be**	**C**	**Co**	**Fe**	**Mn**	**Ni**	**P**	**Pb**	**S**	**Si**	**Sn**	**Zn**	**Others total**	approx.
CuZn37	CW508L	min.	62,0	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,4
		max.	64,0	0,05	—	—	—	—	0,1	—	0,3	—	0,1	—	—	0,1	—	0,1	
CuZn40	CW509L	min.	59,5	—	—	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,4
		max.	61,5	0,05	—	—	—	—	0,2	—	0,3	—	0,3	—	—	0,2	—	0,2	
CuZn35Pb1	CW600N	min.	62,5	—	—	—	—	—	—	—	—	—	0,8	—	—	—	Rem.	—	8,5
		max.	64,0	0,05	—	—	—	—	0,1	—	0,3	—	1,6	—	—	0,1	—	0,1	
CuZn37Pb0,5	CW604N	min.	62,0	—	—	—	—	—	—	—	—	—	0,1	—	—	—	Rem.	—	8,4
		max.	64,0	0,05	—	—	—	—	0,1	—	0,3	—	0,8	—	—	0,2	—	0,2	
CuZn37Pb2	CW606N	min.	61,0	—	—	—	—	—	—	—	—	—	1,6	—	—	—	Rem.	—	8,4
		max.	62,0	0,05	—	—	—	—	0,2	—	0,3	—	2,5	—	—	0,2	—	0,2	
CuZn38Pb2	CW608N	min.	60,0	—	—	—	—	—	—	—	—	—	1,6	—	—	—	Rem.	—	8,4
		max.	61,0	0,05	—	—	—	—	0,2	—	0,3	—	2,5	—	—	0,2	—	0,2	
CuZn39Pb0,5	CW610N	min.	59,0	—	—	—	—	—	—	—	—	—	0,2	—	—	—	Rem.	—	8,4
		max.	60,5	0,05	—	—	—	—	0,2	—	0,3	—	0,8	—	—	0,2	—	0,2	
CuZn39Pb2	CW612N	min.	59,0	—	—	—	—	—	—	—	—	—	1,6	—	—	—	Rem.	—	8,4
		max.	60,0	0,05	—	—	—	—	0,3	—	0,3	—	2,5	—	—	0,3	—	0,2	
CuZn20Al2As	CW702R	min.	76,0	1,8	0,02	—	—	—	—	—	—	—	—	—	—	—	Rem.	—	8,4
		max.	79,0	2,3	0,06	—	—	—	0,07	0,1	0,1	0,01	0,05	—	—	—	—	0,3	

[1] For information only.

[2] Co max. 0,1 is counted as Ni.

© BSI 1998

© BSI 1998

Table 3 — Mechanical properties

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
Cu-ETP Cu-FRTP Cu-OF Cu-DLP Cu-DHP	CW004A CW006A CW008A CW023A CW024A	R200	over 5		200	250	(max. 100)	—	42	—	—	—	—
		H040			—	—	—	—	—	40	65	—	—
		R220	0,2	5	220	260	(max. 140)	33	42	—	—	—	—
		H040			—	—	—	—	—	40	65	—	—
		R240	0,2	15	240	300	(min. 180)	8	15	—	—	—	—
		H065			—	—	—	—	—	65	95	—	—
		R290	0,2	15	290	360	(min. 250)	4	6	—	—	—	—
		H090			—	—	—	—	—	90	110	—	—
		R360	0,2	2	360	—	(min. 320)	2	—	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuBe2	CW101C	R410[1)]	1	15	410	—	(max. 250)	20	20	—	—	—	—
		H090[1)]			—	—	—	—	—	90	150	—	—
		R1130[2)]	1	15	1 130	—	(min. 890)	3	3	—	—	—	—
		H340[2)]			—	—	—	—	—	340	410	—	—
		R580[1)]	1	15	580	—	(min. 510)	8	8	—	—	—	—
		H180[1)]			—	—	—	—	—	180	250	—	—
		R1200[2)]	1	15	1 200	—	(min. 980)	2	2	—	—	—	—
		H360[2)]			—	—	—	—	—	360	420	—	—
CuCo1Ni1Be CuCo2Be CuNi2Be	CW103C CW104C CW110C	R240[1)]	1	15	240	—	(max. 220)	20	20	—	—	—	—
		H060[1)]			—	—	—	—	—	60	130	—	—
		R480[1)]	1	15	480	—	(min. 370)	2	2	—	—	—	—
		H140[1)]			—	—	—	—	—	140	180	—	—
		R650[2)]	1	15	650	—	(min. 500)	8	8	—	—	—	—
		H200[2)]			—	—	—	—	—	200	280	—	—
		R750[2)]	1	15	750	—	(min. 650)	5	5	—	—	—	—
		H210[2)]			—	—	—	—	—	210	290	—	—

© BSI 1998

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi2Si	CW111C	R260[3]	1	10	260	—	(min. 60)	28	—	—	—	—	—
		H070[3]			—	—	—	—	—	70	100	—	—
		R490[4]	1	10	490	—	(min. 340)	11	—	—	—	—	—
		H140[4]			—	—	—	—	—	140	190	—	—
		R450[1]	0,6	3	450	—	(min. 360)	2	—	—	—	—	—
		H130[1]			—	—	—	—	—	130	180	—	—
		R640[2]	0,6	3	640	—	(min. 590)	8	—	—	—	—	—
		H170[2]			—	—	—	—	—	170	220	—	—

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn0,5	CW119C	R220	0,2	5	220	260	(max. 140)	33	42	—	—	—	—
		H040			—	—	—	—	—	40	65	—	—
		R240	0,2	5	240	300	(min. 180)	8	15	—	—	—	—
		H065			—	—	—	—	—	65	95	—	—
		R290	0,2	5	290	360	(min. 250)	—	6	—	—	—	—
		H085			—	—	—	—	—	85	115	—	—
		R360	0,2	1,5	360	—	(min. 320)	—	—	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—
CuAl8Fe3	CW303G	R480	3	15	480	—	(min. 210)	—	30	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi25	CW350H	R290	0,3	15	290	—	(min. 100)	—	—	—	—	—	—
		H070			—	—	—	—	—	70	100	—	—
CuNi9Sn2	CW351H	R340	0,2	5	340	410	(max. 250)	30	40	—	—	—	—
		H075			—	—	—	—	—	75	110	—	—
		R380	0,2	5	380	470	(min. 200)	8	10	—	—	—	—
		H110			—	—	—	—	—	110	150	—	—
		R450	0,2	2	450	530	(min. 370)	4	—	—	—	—	—
		H140			—	—	—	—	—	140	170	—	—
		R500	0,2	2	500	580	(min. 450)	2	—	—	—	—	—
		H160			—	—	—	—	—	160	190	—	—
		R560	0,2	2	560	650	(min. 520)	—	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi10Fe1Mn	CW352H	R300	0,3	15	300	—	(min. 100)	20	30	—	—	—	—
		H070			—	—	—	—	—	70	120	—	—
		R320	0,3	15	320	—	(min. 200)	—	15	—	—	—	—
		H100			—	—	—	—	—	100	—	—	—
CuNi30Mn1Fe	CW354H	R350	0,3	15	350	420	(min. 120)	—	35	—	—	—	—
		H080			—	—	—	—	—	80	120	—	—
		R410	0,3	15	410	—	(min. 300)	—	14	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi10Zn27 CuNi12Zn24	CW401J CW403J	R360	0,1	5	360	430	(max. 230)	35	45	—	—	—	—
		H080			—	—	—	—	—	80	110	—	—
		G020	0,2	2	—	—	—	—	—	—	110	0,015	0,030
		G035			—	—	—	—	—	—	100	0,025	0,050
		R430	0,1	5	430	510	(min. 230)	8	15	—	—	—	—
		H110			—	—	—	—	—	110	150	—	—
		R490	0,1	5	490	580	(min. 400)	—	8	—	—	—	—
		H150			—	—	—	—	—	150	180	—	—
		R550	0,1	2	550	640	(min. 480)	—	—	—	—	—	—
		H170			—	—	—	—	—	170	200	—	—
		R620	0,1	2	620	—	(min. 580)	—	—	—	—	—	—
		H190			—	—	—	—	—	190	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi12Zn25Pb1	CW404J	R380	0,5	4	380	470	(min. 260)	15	—	—	—	—	—
		H110			—	—	—	—	—	110	140	—	—
		R460	0,5	4	460	540	(min. 320)	6	—	—	—	—	—
		H130			—	—	—	—	—	130	160	—	—
		R530	0,5	4	530	610	(min. 420)	3	—	—	—	—	—
		H155			—	—	—	—	—	155	185	—	—
		R620	0,5	4	620	700	(min. 530)	—	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—
		R700	0,5	4	700	—	(min. 630)	—	—	—	—	—	—
		H200			—	—	—	—	—	200	—	—	—

© BSI 1998

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi18Zn20	CW409J	R380	0,1	5	380	450	(max. 250)	27	37	—	—	—	—
		H085			—	—	—	—	—	85	115	—	—
		G020	0,2	2	—	—	—	—	—	—	120	0,015	0,030
		G035			—	—	—	—	—	—	110	0,025	0,050
		R450	0,1	5	450	520	(min. 250)	9	18	—	—	—	—
		H115			—	—	—	—	—	115	160	—	—
		R500	0,1	2	500	590	(min. 410)	3	—	—	—	—	—
		H160			—	—	—	—	—	160	190	—	—
		R580	0,1	2	580	670	(min. 510)	—	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—
		R640	0,1	2	640	730	(min. 600)	—	—	—	—	—	—
		H200			—	—	—	—	—	200	230	—	—

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuNi18Zn27	CW410J	R390	0,1	5	390	470	(max. 280)	30	40	—	—	—	—
		H090			—	—	—	—	—	90	120	—	—
		R470	0,1	5	470	540	(min. 280)	11	20	—	—	—	—
		H120			—	—	—	—	—	120	170	—	—
		R540	0,1	2	540	630	(min. 450)	3	—	—	—	—	—
		H170			—	—	—	—	—	170	200	—	—
		R600	0,1	2	600	700	(min. 550)	—	—	—	—	—	—
		H190			—	—	—	—	—	190	220	—	—
		R700	0,1	2	700	800	(min. 660)	—	—	—	—	—	—
		H220			—	—	—	—	—	220	250	—	—

© BSI 1998

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuSn4	CW450K	R290	0,1	5	290	390	(max. 190)	40	50	—	—	—	—
		H070			—	—	—	—	—	70	100	—	—
		R390	0,1	5	390	490	(min. 210)	11	13	—	—	—	—
		H115			—	—	—	—	—	115	155	—	—
		R480	0,1	5	480	570	(min. 420)	4	5	—	—	—	—
		H150			—	—	—	—	—	150	180	—	—
		R540	0,1	2	540	630	(min. 490)	3	—	—	—	—	—
		H170			—	—	—	—	—	170	200	—	—
		R610	0,1	2	610	—	(min. 540)	—	—	—	—	—	—
		H190			—	—	—	—	—	190	—	—	—

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuSn5	CW451K	R310	0,1	5	310	390	(max. 250)	45	55	—	—	—	—
		H075			—	—	—	—	—	75	105	—	—
		R400	0,1	5	400	500	(min. 240)	14	17	—	—	—	—
		H120			—	—	—	—	—	120	160	—	—
		R490	0,1	5	490	580	(min. 430)	8	10	—	—	—	—
		H160			—	—	—	—	—	160	190	—	—
		R550	0,1	2	550	640	(min. 510)	4	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—
		R630	0,1	2	630	720	(min. 600)	2	—	—	—	—	—
		H200			—	—	—	—	—	200	230	—	—
		R690	0,1	2	690	—	(min. 670)	—	—	—	—	—	—
		H220			—	—	—	—	—	220	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuSn6	CW452K	R350	0,1	5	350	420	(max. 300)	45	55	—	—	—	—
		H080			—	—	—	—	—	80	110	—	—
		R420	0,1	5	420	520	(min. 260)	17	20	—	—	—	—
		H125			—	—	—	—	—	125	165	—	—
		R500	0,1	5	500	590	(min. 450)	8	10	—	—	—	—
		H160			—	—	—	—	—	160	190	—	—
		R560	0,1	2	560	650	(min. 500)	5	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—
		R640	0,1	2	640	730	(min. 600)	3	—	—	—	—	—
		H200			—	—	—	—	—	200	230	—	—
		R720	0,1	2	720	—	(min. 690)	—	—	—	—	—	—
		H220			—	—	—	—	—	220	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuSn8	CW453K	R370	0,1	5	370	450	(max. 300)	50	60	—	—	—	—
		H090			—	—	—	—	—	90	120	—	—
		R450	0,1	5	450	550	(min. 280)	20	23	—	—	—	—
		H135			—	—	—	—	—	135	175	—	—
		R540	0,1	5	540	630	(min. 460)	13	15	—	—	—	—
		H170			—	—	—	—	—	170	200	—	—
		R600	0,1	5	600	690	(min. 530)	5	7	—	—	—	—
		H190			—	—	—	—	—	190	220	—	—
		R660	0,1	2	660	750	(min. 620)	3	—	—	—	—	—
		H210			—	—	—	—	—	210	240	—	—
		R740	0,1	2	740	—	(min. 700)	2	—	—	—	—	—
		H230			—	—	—	—	—	230	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuSn3Zn9	CW454K	R320	0,1	5	320	380	(max. 230)	25	30	—	—	—	—
		H080			—	—	—	—	—	80	110	—	—
		R380	0,1	5	380	430	(min. 200)	16	22	—	—	—	—
		H110			—	—	—	—	—	110	140	—	—
		R430	0,1	5	430	520	(min. 330)	6	8	—	—	—	—
		H140			—	—	—	—	—	140	170	—	—
		R510	0,1	2	510	600	(min. 430)	3	—	—	—	—	—
		H160			—	—	—	—	—	160	190	—	—
		R580	0,1	2	580	690	(min. 520)	—	—	—	—	—	—
		H180			—	—	—	—	—	180	210	—	—
		R660	0,1	2	660	—	(min. 610)	—	—	—	—	—	—
		H200			—	—	—	—	—	200	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn5	CW500L	R230	0,2	5	230	280	(max. 130)	36	45	—	—	—	—
		H045			—	—	—	—	—	45	75	—	—
		R270	0,2	5	270	350	(min. 200)	12	19	—	—	—	—
		H075			—	—	—	—	—	75	110	—	—
		R340	0,2	5	340	—	(min. 280)	4	8	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—
CuZn10	CW501L	R240	0,2	5	240	290	(max. 140)	36	45	—	—	—	—
		H050			—	—	—	—	—	50	80	—	—
		R280	0,2	5	280	360	(min. 200)	13	20	—	—	—	—
		H080			—	—	—	—	—	80	110	—	—
		R350	0,2	5	350	—	(min. 290)	4	8	—	—	—	—
		H110			—	—	—	—	—	110	—	—	—

© BSI 1998

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn15	CW502L	R260	0,2	5	260	310	(max. 170)	36	45	—	—	—	—
		H055			—	—	—	—	—	55	85	—	—
		G010	0,2	1	(340)		(190)	(50)	—	—	105	—	0,015
		G020	0,2	2	(300)		(125)	(50)	—	—	85	0,015	0,030
		G035			(290)		(110)	(50)	—	—	75	0,025	0,050
		R300	0,2	5	300	370	(min. 150)	16	25	—	—	—	—
		H085			—	—	—	—	—	85	115	—	—
		R350	0,2	5	350	420	(min. 250)	4	12	—	—	—	—
		H105			—	—	—	—	—	105	135	—	—
		R410	0,2	5	410	—	(min. 360)	—	—	—	—	—	—
		H125			—	—	—	—	—	125	—	—	—

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn20	CW503L	R270	0,2	5	270	320	(max. 150)	38	48	—	—	—	—
		H055			—	—	—	—	—	55	85	—	—
		G010	0,2	1	(340)		(190)	(50)	—	—	105	—	0,015
		G020	0,2	2	(300)		(125)	(50)	—	—	85	0,015	0,030
		G035			(290)		(110)	(50)	—	—	75	0,025	0,050
		R320	0,2	5	320	400	(min. 200)	20	28	—	—	—	—
		H085			—	—	—	—	—	85	120	—	—
		R400	0,2	5	400	480	(min. 320)	5	12	—	—	—	—
		H120			—	—	—	—	—	120	155	—	—
		R480	0,2	2	480	—	(min. 440)	—	—	—	—	—	—
		H155			—	—	—	—	—	155	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn30	CW505L	R270	0,2	5	270	350	(max. 160)	40	50	—	—	—	—
		H055			—	—	—	—	—	55	90	—	—
		G010	0,2	1	(410)		(210)	(40)	—	—	120	—	0,015
		G020	0,2	2	(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	5	350	430	(min. 170)	21	33	—	—	—	—
		H095			—	—	—	—	—	95	125	—	—
		R410	0,2	5	410	490	(min. 260)	9	15	—	—	—	—
		H120			—	—	—	—	—	120	155	—	—
		R480	0,2	2	480	—	(min. 430)	—	—	—	—	—	—
		H150			—	—	—	—	—	150	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn33	CW506L	R280	0,2	5	280	380	(max. 170)	40	50	—	—	—	—
		H055			—	—	—	—	—	55	90	—	—
		G010	0,2	1	(410)		(210)	(40)	—	—	120	—	0,015
		G020	0,2	2	(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	5	350	430	(min. 170)	23	31	—	—	—	—
		H095			—	—	—	—	—	95	125	—	—
		R420	0,2	5	420	500	(min. 300)	6	13	—	—	—	—
		H125			—	—	—	—	—	125	155	—	—
		R500	0,2	2	500	—	(min. 450)	—	—	—	—	—	—
		H155			—	—	—	—	—	155	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn36 CuZn37	CW507L CW508L	R300	0,2	5	300	370	(max. 180)	38	48	—	—	—	—
		H055			—	—	—	—	—	55	95	—	—
		G010	0,2	1	(410)		(210)	(30)	—	—	120	—	0,015
		G020	0,2	2	(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	5	350	440	(min. 170)	19	28	—	—	—	—
		H095			—	—	—	—	—	95	125	—	—
		R410	0,2	5	410	490	(min. 300)	8	12	—	—	—	—
		H120			—	—	—	—	—	120	155	—	—
		R480	0,2	2	480	560	(min. 430)	3	—	—	—	—	—
		H150			—	—	—	—	—	150	180	—	—
		R550	0,2	2	550	—	(min. 500)	—	—	—	—	—	—
		H170			—	—	—	—	—	170	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn40	CW509L	R340	0,3	10	340	420	(max. 240)	33	43	—	—	—	—
		H085			—	—	—	—	—	85	115	—	—
		R400	0,3	10	400	480	(min. 200)	15	23	—	—	—	—
		H110			—	—	—	—	—	110	140	—	—
		R470	0,3	5	470	—	(min. 390)	6	12	—	—	—	—
		H140			—	—	—	—	—	140	—	—	—
CuZn35Pb1 CuZn37Pb0,5 CuZn37Pb2	CW600N CW604N CW606N	R290	0,3	5	290	370	(max. 200)	40	50	—	—	—	—
		H060			—	—	—	—	—	60	110	—	—
		R370	0,3	5	370	440	(min. 200)	19	28	—	—	—	—
		H110			—	—	—	—	—	110	140	—	—
		R440	0,3	5	440	540	(min. 370)	5	12	—	—	—	—
		H140			—	—	—	—	—	140	170	—	—
		R540	0,3	2	540	—	(min. 490)	—	—	—	—	—	—
		H170			—	—	—	—	—	170	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn38Pb2 CuZn39Pb0,5	CW608N CW610N	R340	0,3	10	340	420	(max. 240)	33	43	—	—	—	—
		H075			—	—	—	—	—	75	110	—	—
		R400	0,3	10	400	480	(min. 200)	14	23	—	—	—	—
		H110			—	—	—	—	—	110	140	—	—
		R470	0,3	5	470	550	(min. 390)	5	12	—	—	—	—
		H140			—	—	—	—	—	140	170	—	—
		R540	0,3	2	540	—	(min. 490)	—	—	—	—	—	—
		H165			—	—	—	—	—	165	—	—	—

© BSI 1998

Table 3 — Mechanical properties *(continued)*

Designations			Nominal thickness		Tensile strength		0,2 % proof strength	Elongation		Hardness		Grain size	
					R_m		$R_{p0,2}$	A_{50mm} for thicknesses up to and including 2,5 mm	A for thicknesses over 2,5 mm	HV			
Material		Material condition	mm		N/mm^2		N/mm^2	%	%			mm	
Symbol	Number		from	up to and including	min.	max.		min.	min.	min.	max.	min.	max.
CuZn39Pb2	CW612N	R360	0,3	5	360	440	(max. 270)	30	40	—	—	—	—
		H090			—	—	—	—	—	90	120	—	—
		R420	0,3	5	420	500	(min. 270)	12	20	—	—	—	—
		H120			—	—	—	—	—	120	150	—	—
		R490	0,3	5	490	570	(min. 420)	—	9	—	—	—	—
		H150			—	—	—	—	—	150	180	—	—
		R560	0,3	2	560	—	(min. 510)	—	—	—	—	—	—
		H175			—	—	—	—	—	175	—	—	—
CuZn20A12As	CW702R	R330	3	15	330	—	(min. 90)	—	30	—	—	—	—
		H070			—	—	—	—	—	70	105	—	—
		R390	3	15	390	—	(min. 240)	—	25	—	—	—	—
		H100			—	—	—	—	—	100	—	—	—

[1] Solution heat treated and cold rolled.

[2] Solution heat treated, cold rolled and precipitation hardened at mill.

[3] Solution heat treated.

[4] Solution heat treated and precipitation hardened.

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

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

© BSI 1998

Table 4 — Tolerances on thickness of hot rolled products (plate, sheet, strip and circles)

Values in millimetres

Nominal thickness		Tolerance on thickness for nominal widths						
		up to and including 700		over 700 up to and including 1 000		over 1 000 up to and including 1 500		over 1 500
over	up to and including	1)	2)	1)	2)	1)	2)	
—	2,5	by agreement		by agreement		by agreement		by agreement
2,5	5,0	± 0,25	± 0,30	± 0,30	± 0,35	± 0,35	± 0,45	
5,0	7,5	± 0,35	± 0,45	± 0,40	± 0,50	± 0,45	± 0,55	
7,5	10	± 0,45	± 0,60	± 0,50	± 0,65	± 0,55	± 0,75	
10	15	± 0,75	± 0,95	± 0,80	± 1,00	± 0,90	± 1,10	
15	25	± 0,95	± 1,20	± 1,05	± 1,30	± 1,30	± 1,60	
25	50	± 1,30	± 1,60	± 1,40	± 1,75	± 1,50	± 1,90	
50	—	± 1,50	± 1,90	± 1,65	± 2,05	± 1,80	± 2,20	

1) For all materials except for CuAl8Fe3 (CW303G), CuNi10Fe1Mn (CW352H), CuNi30Mn1Fe (CW354H) and CuZn20Al2As (CW702R).

2) For alloys CuAl8Fe3 (CW303G), CuNi10Fe1Mn (CW352H), CuNi30Mn1Fe (CW354H) and CuZn20Al2As (CW702R).

Table 5 — Tolerances on thickness of cold rolled products (sheet, strip and circles)

Values in millimetres

Nominal thickness		Tolerance on thickness for nominal widths[1]			
			over 350	over 700	over 1 000
over	up to and including	up to and including 350	up to and including 700	up to and including 1 000	up to and including 1 250
0,1[2]	0,2	± 0,018	—	—	—
0,2	0,3	± 0,022	± 0,03	± 0,04	—
0,3	0,4	± 0,025	± 0,04	± 0,05	± 0,07
0,4	0,5	± 0,030	± 0,05	± 0,06	± 0,08
0,5	0,8	± 0,040	± 0,06	± 0,07	± 0,09
0,8	1,2	± 0,050	± 0,07	± 0,09	± 0,10
1,2	1,8	± 0,060	± 0,08	± 0,10	± 0,11
1,8	2,5	± 0,070	± 0,09	± 0,11	± 0,13
2,5	3,2	± 0,080	± 0,10	± 0,13	± 0,17
3,2	4,0	± 0,10	± 0,12	± 0,15	± 0,20
4,0	5,0	± 0,12	± 0,14	± 0,17	± 0,23
5,0	6,0	± 0,14	± 0,16	± 0,20	± 0,26
6,0	7,0	± 0,16	± 0,19	± 0,23	± 0,29
7,0	8,0	± 0,18	± 0,22	± 0,26	± 0,32
8,0	9,0	± 0,20	± 0,25	± 0,29	± 0,35
9,0	10,0	± 0,22	± 0,28	± 0,32	± 0,38

1) For alloys CuAl8Fe3 (CW303G), CuNi10Fe1Mn (CW352H), CuNi30Mn1Fe (CW354H) and CuZn20Al2As (CW702R) the thickness tolerances shall be multiplied by 1,25, and the results rounded to the nearest 0,01 mm.

2) Including 0,1.

NOTE Thicknesses greater than 10 mm are covered by EN 1653.

© BSI 1998

Table 6 — Tolerances on width of cold rolled strip

Values in millimetres

Nominal thickness		Tolerance on width for nominal widths						
			over 50	over 100	over 200	over 350	over 500	over 700
		up to and including	up to and including	up to and including	up to and including	up to and including	up to and including	up to and including
over	up to and including	50	100	200	350	500	700	1 250
0,1[1)]	1,0	+0,20 0	+0,30 0	+0,40 0	+0,60 0	+1,0 0	+1,5 0	+2,0 0
1,0	2,0	+0,30 0	+0,40 0	+0,50 0	+1,0 0	+1,2 0	+1,5 0	+2,0 0
2,0	2,5	+0,50 0	+0,60 0	+0,70 0	+1,2 0	+1,5 0	+2,0 0	+2,5 0
2,5	3,0	+1,0 0	+1,10 0	+1,20 0	+1,5 0	+2,0 0	+2,5 0	+3,0 0
3,0	4,0	+2,0 0	+2,30 0	+2,50 0	+3,0 0	+4,0 0	+5,0 0	+6,0 0

[1)] Including 0,1.

Table 7 — Tolerances on width of plate and sheet

Values in millimetres

Nominal thickness		Tolerance on width for nominal widths		
			over 350	over 1 250
over	up to and including	up to and including 350	up to and including 1 250	
—	2	+2,0 0	+6,0 0	by agreement
2	5	+4,0 0	+8,0 0	
5	—	+8,0 0	+10,0 0	

Table 8 — Tolerances on length of plate, sheet and strip cut to length for lengths up to 5 000 mm

Values in millimetres

Length	Nominal thickness	Tolerance on length
as manufactured (M)	up to and including 15	± 50
fixed length (F)	up to and including 5	+10 0
	over 5	+15 0

Table 9 — Squareness of cut plate and sheet

Dimensions in millimetres

Nominal width		Maximum allowable differences between diagonals, for lengths		
		over 1 000	over 2 000	over 3 000
over	up to and including	up to and including 2 000	up to and including 3 000	
350	700	6	7	8
700	1 250	8	9	10
1 250	—	by agreement		

© BSI 1998

Table 10 — Tolerances on diameter for circles

Values in millimetres

Nominal diameter		Tolerances on diameter for nominal thicknesses		
		over 0,3	over 1,0	over 2,5
over	up to and including	up to and including 1,0	up to and including 2,5	up to and including 5,0
—	500	± 1	± 1,5	± 2
500	1 000	± 2	± 2,5	± 3
1 000	2 000	± 3	± 3,5	± 4
2 000	—	—	—	by agreement

Table 11 — Edgewise curvature *c*

Dimensions in millimetres

Nominal width		Maximum edgewise curvature *c* for nominal thicknesses	
			over 1,0
over	up to and including	up to and including 1,0	up to and including 4,0
3[1)]	8	12	—
8	15	8	10
15	—	4	6

[1)] Including 3.

© BSI 1998

Annex A (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 1653, *Copper and copper alloys — Plate, sheet and circles for boilers, pressure vessels and hot water storage units.*

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.*

© BSI 1998

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.

BSI
389 Chiswick High Road
London
W4 4AL