

PD CEN/TS 13388:2015



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Copper and copper alloys — Compendium of compositions and products

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National foreword

This Published Document is the UK implementation of CEN/TS 13388:2015. It supersedes PD CEN/TS 13388:2013 which is withdrawn.

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

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

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Copper and copper alloys - Compendium of compositions and products

Cuivre et alliages de cuivre - Inventaire des compositions et des produits

Kupfer und Kupferlegierungen - Übersicht über Zusammensetzungen und Produkte

This Technical Specification (CEN/TS) was approved by CEN on 21 March 2015 for provisional application.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Table 12.3 — Ingots and castings — Copper-tin alloys — Composition and casting processes	41
Table 12.4 — Ingots and castings — Copper-tin-lead alloys — Composition and casting processes)	42
Table 12.5 — Ingots and castings — Copper-aluminium alloys — Composition and casting processes	44
Table 12.6 — Ingots and castings — Copper-manganese-aluminium alloys — Composition and casting processes	45
Table 12.7 — Ingots and castings — Copper-nickel alloys — Composition and casting processes	45
Table 13 — Scrap — Composition	46
Table 14 — Composition of copper alloy according to EN 50149:2012.....	50

Foreword

This document (CEN/TS 13388:2015) has been prepared by Technical Committee CEN/TC 133 “Copper and copper alloys”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 13388:2013.

In comparison with CEN/TS 13388:2013, the following changes were made:

- a) modifications regarding materials and compositions from EN 12420:2014, EN 13600:2013, EN 13601:2013 and EN 13602:2013 considered;
- b) last paragraph of the “Scope” deleted;
- c) 3.5 “Composition of filler metals” deleted;
- d) 4.4 “Filler metals” deleted;
- e) Clause 5 “Copper and copper alloys standardised by other CEN Technical Committees” deleted;
- f) Clause 6 “Copper and copper alloys registered by CEN/TC 133” deleted.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

CEN/TC 133 “Copper and copper alloys” was established in 1988 to prepare and maintain standards in the field of unwrought, wrought and cast products made from copper and copper alloys. Its responsibilities included developing, defining, specifying and giving guidance on, as appropriate, material compositions, designations, terminology, dimensions and tolerances, mechanical and physical characteristics, conditions of delivery and methods of testing peculiar to copper and copper alloys.

During the development of standards for copper and copper alloy products, the experts realized the necessity and seized the opportunity:

- a) to coordinate and in some cases also to rationalize the composition limits which already existed for the various product forms;
- b) to establish unique, new and identifiably European designations for copper and copper alloys, including a numerical option to be particularly convenient for computerized handling;
- c) to confirm, clarify and redefine where necessary, the terminology which already existed in common usage, at the international level or in customs nomenclature.

CEN/TC 133 decided, in view of the new form of presentation and new parameters for the description and provision of information on copper and copper alloy products, to prepare and publish the present consolidation and summary of essential details.

1 Scope

This Technical Specification provides a summary of material designations, compositions and the product forms in which they are available, for coppers and copper alloys standardized in European Standards by CEN/TC 133 “Copper and copper alloys”.

2 Normative references

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

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

EN 1982:2008, *Copper and copper alloys — Ingots and castings*

3 Compositions of coppers and copper alloys standardised by CEN/TC 133

3.1 Composition of coppers

The symbol and number designations and compositions of copper grades are given in the following tables:

- Table 1.1 — Composition of copper cathodes according to EN 1978:1998, Cu-CATH-1 (CR001A) and Cu-CATH-2 (CR002A)
- Table 1.2 — Composition of unalloyed copper grades made from Cu-CATH-1 (CR001A) according to EN 1978
- Table 1.3 — Composition of unalloyed copper grades, other than those made from Cu-CATH-1 (CR001A) according to EN 1978
- Table 1.4 — Composition of phosphorus-containing copper grades
- Table 1.5 — Composition of silver-containing copper grades (silver-bearing coppers)

3.2 Composition of copper alloys

The symbol and number designations and compositions of copper alloys are given in the following tables:

- Table 2 — Composition of copper alloys, low alloyed (less than 5 % alloying elements)
- Table 3 — Composition of copper-aluminium alloys
- Table 4 — Composition of copper-nickel alloys
- Table 5 — Composition of copper-nickel-zinc alloys
- Table 6 — Composition of copper-tin alloys
- Table 7 — Composition of copper-zinc alloys, binary
- Table 8 — Composition of copper-zinc-lead alloys
- Table 9 — Composition of copper-zinc alloys, complex

3.3 Composition of master alloys

The symbol and number designations and compositions of master alloys in accordance with EN 1981:2003 are given in Table 11.

3.4 Composition of ingots and castings

The symbol and number designations and compositions of ingots and castings in accordance with EN 1982:2008 are given in the following tables:

- Table 12.1 — Ingots and castings — Copper and copper-chromium alloys — Compositions and casting processes
- Table 12.2 — Ingots and castings — Copper-zinc alloys — Composition and casting processes
- Table 12.3 — Ingots and castings — Copper-tin alloys — Composition and casting processes
- Table 12.4 — Ingots and castings — Copper-tin-lead alloys — Composition and casting processes
- Table 12.5 — Ingots and castings — Copper-aluminium alloys — Composition and casting processes
- Table 12.6 — Ingots and castings — Copper-manganese-aluminium alloys — Composition and casting processes
- Table 12.7 — Ingots and castings — Copper-nickel alloys — Composition and casting processes

3.5 Composition of copper and copper alloy scrap

The symbol and number designations and compositions of copper and copper alloy scrap in accordance with EN 12861:1999 are given in Table 13.

4 Available product forms of copper and copper alloys

4.1 Wrought coppers and copper alloys

The product forms and applicable standards are given in Table 10.

4.2 Master alloys

The product forms are given in Table 11.

4.3 Ingots and castings

The product forms are given in Tables 12.1 to 12.7.

4.4 Scrap

The product forms are given in Table 13.

4.5 Copper and copper alloy grooved contact wires

The product forms are given in Table 14.

Table 1.1 — Composition of copper cathodes according to EN 1978:1998, Cu-CATH-1 (CR001A) and Cu-CATH-2 (CR002A)

Material designation		Composition in % (mass fraction)																				
		Element	Cu	Ag	As	Bi	Cd	Co	Cr	Fe	Mn	Ni	P	Pb	S	Sb	Se	Si	Sn	Te	Zn	Sum of elements listed in this table other than copper
Symbol	Number																					
Cu-CATH-1	CR001A	min.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		max.	—	0,002 5	0,000 5 ^a	0,000 20 ^b	— ^a	— ^c	— ^a	0,001 0 ^c	— ^a	— ^c	— ^a	0,000 5	0,001 5 ^d	0,000 4 ^a	0,000 20 ^b	— ^c	— ^c	0,000 20 ^b	— ^c	0,006 5
Cu-CATH-2	CR002A	min.	99,90 ^e	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		max.	—	—	—	0,000 5	—	—	—	—	—	—	—	0,005	—	—	—	—	—	—	—	0,03 excluding Ag
^a (As + Cd + Cr + Mn + P + Sb) maximum 0,001 5 %.																						
^b (Bi + Se + Te) maximum 0,000 3 %, of which (Se + Te) maximum 0,000 30 %.																						
^c (Co + Fe + Ni + Si + Sn + Zn) maximum 0,002 0 %.																						
^d The sulfur content shall be determined on a cast sample.																						
^e Including silver up to a maximum of 0,015 %.																						

Table 1.2 — Composition of unalloyed copper grades made from Cu-CATH-1 (CR001A) according to EN 1978

Material designation			Composition in % (mass fraction)													
Symbol	Number		Element	Cu	Ag	As	Bi	Cd	Co	Cr	Fe	Mn	Ni	O	P	Pb
	unwrought copper	wrought copper														
Cu-ETP1	CR003A	CW003A	min. max.	— —	— 0,002 5	— 0,000 5 ^a	— 0,000 20 ^b	— — ^a	— — ^c	— — ^a	— 0,001 0 ^c	— — ^a	— — ^c	— 0,040	— — ^a	— 0,000 5
Cu-OF1	CR007A	CW007A	min. max.	— —	— 0,002 5	— 0,000 5 ^a	— 0,000 20 ^b	— — ^a	— — ^c	— — ^a	— 0,001 0 ^c	— — ^a	— — ^c	— — ^d	— — ^a	— 0,000 5
Cu-OFE	CR009A	CW009A	min. max.	99,99 —	— 0,002 5	— 0,000 5	— 0,000 20	— 0,000 1	— —	— —	— 0,001 0	— 0,000 5	— 0,001 0	— — ^d	— 0,000 3	— 0,000 5
Cu-PHCE	CR022A	CW022A	min. max.	99,99 —	— 0,002 5	— 0,000 5	— 0,000 20	— 0,000 1	— —	— —	— 0,001 0	— 0,000 5	— 0,001 0	— — ^d	0,001 0,006	— 0,000 5

Material designation			Composition in % (mass fraction)									
Symbol	Number		Element	S	Sb	Se	Si	Sn	Te	Zn	Elements listed in this table other than copper	
	unwrought copper	wrought copper									total	excluding
Cu-ETP1	CR003A	CW003A	min. max.	— 0,001 5	— 0,000 4 ^a	— 0,000 20 ^b	— — ^c	— — ^c	— 0,000 20 ^b	— — ^c	— 0,006 5	O
Cu-OF1	CR007A	CW007A	min. max.	— 0,001 5	— 0,000 4 ^a	— 0,000 20 ^b	— — ^c	— — ^c	— 0,000 20 ^b	— — ^c	— 0,006 5	O
Cu-OFE	CR009A	CW009A	min. max.	— 0,001 5	— 0,000 4	— 0,000 20	— —	— 0,000 2	— 0,000 20	— 0,000 1	— —	—
Cu-PHCE	CR022A	CW022A	min. max.	— 0,001 5	— 0,000 4	— 0,000 20	— —	— 0,000 2	— 0,000 20	— 0,000 1	— —	—

^a (As + Cd + Cr + Mn + P + Sb) max. 0,001 5 %.

^b (Bi + Se + Te) max. 0,000 3 %, of which (Se + Te) max. 0,000 30 %.

^c (Co + Fe + Ni + Si + Sn + Zn) max. 0,002 0 %.

^d The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.

**Table 1.3 — Composition of unalloyed copper grades,
other than those made from Cu-CATH-1 (CR001A) according to EN 1978**

Material designation			Composition in % (mass fraction)						
Symbol	Number		Element	Cu ^a	Bi	O	Pb	Other elements (see note)	
	unwrought copper	wrought copper						total	excluding
Cu-ETP	CR004A	CW004A	min. max.	99,90 —	— 0,000 5	— 0,040 ^b	— 0,005	— 0,03	Ag, O
Cu-FRHC	CR005A	CW005A	min. max.	99,90 —	— —	— 0,040 ^b	— —	— 0,06 ^d	Ag, O
Cu-FRTP	CR006A	CW006A	min. max.	99,90 —	— —	— 0,100	— —	— 0,05	Ag, Ni, O
Cu-OF	CR008A	CW008A	min. max.	99,95 —	— 0,000 5	— — ^c	— 0,005	— 0,03	Ag
NOTE The total of other elements (than copper) is defined as the sum of Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.									
^a Including silver, up to a maximum of 0,015 %.									
^b Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.									
^c The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.									
^d Higher total impurities content is permitted, subject to agreement between the purchaser and the supplier.									

Table 1.4 — Composition of phosphorus-containing copper grades

Material designation			Composition in % (mass fraction)						
Symbol	Number		Element	Cu ^a	Bi	P	Pb	Other elements (see note)	
	unwrought copper	wrought copper						total	excluding
Cu-PHC	CR020A	CW020A	min. max.	99,95 —	— 0,000 5	0,001 0,006	— 0,005	— 0,03 ^b	Ag, P
Cu-HCP	CR021A	CW021A	min. max.	99,95 —	— 0,000 5	0,002 0,007	— 0,005	— 0,03 ^b	Ag, P
Cu-DLP	CR023A	CW023A	min. max.	99,90 —	— 0,000 5	0,005 0,013	— 0,005	— 0,03	Ag, Ni, P
Cu-DHP	CR024A	CW024A	min. max.	99,90 —	— —	0,015 0,040	— —	— — ^c	—
Cu-DXP	CR025A	—	min. max.	99,90 —	— 0,000 5	0,04 0,06	— 0,005	— 0,03	Ag, Ni, P
NOTE The total of other elements (than copper) is defined as the sum of Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.									
^a Including silver, up to a maximum of 0,015 %.									
^b The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.									
^c If required, the permitted total of elements, other than silver and phosphorus, should be agreed between the purchaser and the supplier.									

Table 1.5 — Composition of silver-containing copper grades (silver-bearing coppers)

Material designation			Composition in % (mass fraction)							
Symbol	Number		Element	Cu	Ag	Bi	O	P	Other elements (see note)	
	unwrought copper	wrought copper							total	excluding
CuAg0,04	CR011A	CW011A	min. max.	Rem. —	0,03 0,05	— 0,000 5	— 0,040	— —	— 0,03	Ag, O
CuAg0,07	CR012A	CW012A	min. max.	Rem. —	0,06 0,08	— 0,000 5	— 0,040	— —	— 0,03	Ag, O
CuAg0,10	CR013A	CW013A	min. max.	Rem. —	0,08 0,12	— 0,000 5	— 0,040	— —	— 0,03	Ag, O
CuAg0,04P	CR014A	CW014A	min. max.	Rem. —	0,03 0,05	— 0,000 5	— — ^a	0,001 0,007	— 0,03	Ag, P
CuAg0,07P	CR015A	CW015A	min. max.	Rem. —	0,06 0,08	— 0,000 5	— — ^a	0,001 0,007	— 0,03	Ag, P
CuAg0,10P	CR016A	CW016A	min. max.	Rem. —	0,08 0,12	— 0,000 5	— — ^a	0,001 0,007	— 0,03	Ag, P
CuAg0,04(OF)	CR017A	CW017A	min. max.	Rem. —	0,03 0,05	— 0,000 5	— — ^a	— —	— 0,006 5	Ag, O
CuAg0,07(OF)	CR018A	CW018A	min. max.	Rem. —	0,06 0,08	— 0,000 5	— — ^a	— —	— 0,006 5	Ag, O
CuAg0,10(OF)	CR019A	CW019A	min. max.	Rem. —	0,08 0,12	— 0,000 5	— — ^a	— —	— 0,006 5	Ag, O
NOTE The total of other elements (than copper) is defined as the sum of Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te and Zn, subject to the exclusion of any individual elements indicated.										
^a The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.										

Table 2 — Composition of copper alloys, low alloyed (less than 5 % alloying elements) (1 of 2)

Material designation		Composition in % (mass fraction)																		Density ^a g/cm ³ approx.
		Element	Cu	Al	Be	Co	Cr	Fe	Mn	Ni	P	Pb	S	Si	Sn	Te	Zn	Zr	Others total	
CuBe1,7	CW100C	min. max.	Rem. —	— —	1,6 1,8	— 0,3	— —	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— —	— —	— —	— 0,5	8,3
CuBe2	CW101C	min. max.	Rem. —	— —	1,8 2,1	— 0,3	— —	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— —	— —	— —	— 0,5	8,3
CuBe2Pb	CW102C	min. max.	Rem. —	— —	1,8 2,0	— 0,3	— —	— 0,2	— —	— 0,3	— —	0,2 0,6	— —	— —	— —	— —	— —	— —	— 0,5	8,3
CuCo1Ni1Be	CW103C	min. max.	Rem. —	— —	0,4 0,7	0,8 1,3	— —	— 0,2	— —	0,8 1,3	— —	— —	— —	— —	— —	— —	— —	— —	— 0,5	8,8
CuCo2Be	CW104C	min. max.	Rem. —	— —	0,4 0,7	2,0 2,8	— —	— 0,2	— —	— 0,3	— —	— —	— —	— —	— —	— —	— —	— —	— 0,5	8,8
CuCr1	CW105C	min. max.	Rem. —	— —	— —	— —	0,5 1,2	— 0,08	— —	— —	— —	— —	— —	— 0,1	— —	— —	— —	— —	— 0,2	8,9
CuCr1Zr	CW106C	min. max.	Rem. —	— —	— —	— —	0,5 1,2	— 0,08	— —	— —	— —	— —	— —	— 0,1	— —	— —	— —	0,03 0,3	— 0,2	8,9
CuFe2P	CW107C	min. max.	Rem. —	— —	— —	— —	— —	2,1 2,6	— —	— —	0,015 0,15	— 0,03	— —	— —	— —	— —	0,05 0,20	— —	— 0,2	8,8
CuNi1P	CW108C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	0,8 1,2	0,15 0,25	— —	— —	— —	— —	— —	— —	— —	— 0,1	8,9
CuNi1Si	CW109C	min. max.	Rem. —	— —	— —	— —	— —	— 0,2	— 0,1	1,0 1,6	— —	— 0,02	— —	0,4 0,7	— —	— —	— —	— —	— 0,3	8,8
CuNi2Be	CW110C	min. max.	Rem. —	— —	0,2 0,6	— 0,3	— —	— 0,2	— —	1,4 2,4	— —	— —	— —	— —	— —	— —	— —	— —	— 0,5	8,8
CuNi2Si	CW111C	min. max.	Rem. —	— —	— —	— —	— —	— 0,2	— 0,1	1,6 2,5	— —	— 0,02	— —	0,4 0,8	— —	— —	— —	— —	— 0,3	8,8

Table 2 (2 of 2)

Material designation		Composition in % (mass fraction)																		Density ^a g/cm ³ approx.
Symbol	Number	Element	Cu	Al	Be	Co	Cr	Fe	Mn	Ni	P	Pb	S	Si	Sn	Te	Zn	Zr	Others total	
CuNi3Si1	CW112C	min. max.	Rem. —	— —	— —	— —	— —	— 0,2	— 0,1	2,6 4,5	— —	— 0,02	— —	0,8 1,3	— —	— —	— —	— —	— 0,5	8,8
CuPb1P	CW113C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— —	0,003 0,012	0,7 1,5	— —	— —	— —	— —	— —	— —	— 0,1	8,9
CuSP	CW114C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— —	0,003 0,012	— —	0,2 0,7	— —	— —	— —	— —	— —	— 0,1	8,9
CuSi1	CW115C	min. max.	Rem. —	— 0,02	— —	— —	— —	— 0,8	— 0,7	— —	— 0,02	— 0,05	— —	0,8 2,0	— —	— —	— 1,5	— —	— 0,5	8,8
CuSi3Mn1	CW116C	min. max.	Rem. —	— 0,05	— —	— —	— —	— 0,2	0,7 1,3	— —	— 0,05	— 0,05	— —	2,7 3,2	— —	— —	— 0,4	— —	— 0,5	8,8
CuSn0,15	CW117C	min. max.	Rem. —	— —	— —	— —	— —	— 0,02	— —	— 0,02	— 0,015	— —	— —	— —	0,10 0,15	— —	— 0,10	— —	— 0,10	8,9
CuTeP	CW118C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— —	0,003 0,012	— —	— —	— —	— —	0,4 0,7	— —	— —	— 0,1	8,9
CuZn0,5	CW119C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— —	— 0,02	— —	— —	— —	— —	— —	0,1 1,0	— —	— 0,1	8,9
CuZr	CW120C	min. max.	Rem. —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	0,1 0,2	— 0,1	8,9
CuSi3Zn2P	CW121C	min. max.	Rem. —	— —	— —	— —	— —	— —	— 0,20	— 0,20	0,01 0,20	— 0,10	— —	2,5 3,5	— —	— —	1,0 3,0	— —	— 0,2	8,6

^a For information only.

Table 3 — Composition of copper-aluminium alloys

Material designation		Composition in % (mass fraction)													Density ^a g/cm ³ approx.
Symbol	Number	Element	Cu	Al	As	Fe	Mn	Ni	P	Pb	Si	Sn	Zn	Others total	
CuAl5As	CW300G	min. max.	Rem. —	4,0 6,5	0,1 0,4	— 0,2	— 0,2	— 0,2	— —	— 0,02	— —	— 0,05	— 0,3	— 0,3	8,2
CuAl6Si2Fe	CW301G	min. max.	Rem. —	6,0 6,4	— —	0,5 0,7	— 0,1	— 0,1	— —	— 0,05	2,0 2,4	— 0,1	— 0,4	— 0,2	7,7
CuAl7Si2	CW302G	min. max.	Rem. —	6,3 7,6	— —	— 0,3	— 0,2	— 0,2	— —	— 0,05	1,5 2,2	— 0,2	— 0,5	— 0,2	7,7
CuAl8Fe3	CW303G	min. max.	Rem. —	6,5 8,5	— —	1,5 3,5	— 1,0	— 1,0	— —	— 0,05	— 0,2	— 0,1	— 0,5	— 0,2	7,7
CuAl9Ni3Fe2	CW304G	min. max.	Rem. —	8,0 9,5	— —	1,0 3,0	— 2,5	2,0 4,0	— —	— 0,05	— 0,1	— 0,1	— 0,2	— 0,3	7,4
CuAl10Fe1	CW305G	min. max.	Rem. —	9,0 10,0	— —	0,5 1,5	— 0,5	— 1,0	— —	— 0,02	— 0,2	— 0,1	— 0,5	— 0,2	7,6
CuAl10Fe3Mn2	CW306G	min. max.	Rem. —	9,0 11,0	— —	2,0 4,0	1,5 3,5	— 1,0	— —	— 0,05	— 0,2	— 0,1	— 0,5	— 0,2	7,6
CuAl10Ni5Fe4	CW307G	min. max.	Rem. —	8,5 11,0	— —	3,0 5,0	— 1,0	4,0 6,0	— —	— 0,05	— 0,2	— 0,1	— 0,4	— 0,2	7,6
CuAl11Fe6Ni6	CW308G	min. max.	Rem. —	10,5 12,5	— —	5,0 7,0	— 1,5	5,0 7,0	— —	— 0,05	— 0,2	— 0,1	— 0,5	— 0,2	7,4
CuAl5Zn5Sn1	CW309G	min. max.	Rem. —	4,0 6,0	— —	0,15 —	— —	— —	— 0,05	— —	— —	0,3 1,5	4,0 6,0	— 0,5	8,2

^a For information only.

Table 4 — Composition of copper-nickel alloys

Material designation		Composition in % (mass fraction)													Density ^a g/cm ³ approx.
Symbol	Number	Element	Cu	C	Co	Fe	Mn	Ni	P	Pb	S	Sn	Zn	Others total	
CuNi25	CW350H	min. max.	Rem. —	— 0,05	— 0,1	— 0,3	— 0,5	24,0 26,0	— —	— 0,02	— 0,05	— 0,03	— 0,5	— 0,1	8,9
CuNi9Sn2	CW351H	min. max.	Rem. —	— —	— —	— 0,3	— 0,3	8,5 10,5	— —	— 0,03	— —	1,8 2,8	— 0,1	— 0,1	8,9
CuNi10Fe1Mn	CW352H	min. max.	Rem. —	— 0,05	— 0,1 ^b	1,0 2,0	0,5 1,0	9,0 11,0	— 0,02	— 0,02	— 0,05	— 0,03	— 0,5	— 0,2	8,9
CuNi30Fe2Mn2	CW353H	min. max.	Rem. —	— 0,05	— 0,1 ^b	1,5 2,5	1,5 2,5	29,0 32,0	— 0,02	— 0,02	— 0,05	— 0,05	— 0,5	— 0,2	8,9
CuNi30Mn1Fe	CW354H	min. max.	Rem. —	— 0,05	— 0,1 ^b	0,4 1,0	0,5 1,5	30,0 32,0	— 0,02	— 0,02	— 0,05	— 0,05	— 0,5	— 0,2	8,9

^a For information only.

^b Co max. 0,1 % is counted as Ni.

Table 5 — Composition of copper-nickel-zinc alloys

Material designation		Composition in % (mass fraction)									Density ^a g/cm ³ approx.
		Element	Cu	Fe	Mn	Ni	Pb	Sn	Zn	Others total	
CuNi7Zn39Pb3Mn2	CW400J	min. max.	47,0 50,0	— 0,3	1,5 3,0	6,0 8,0	2,3 3,3	— 0,2	Rem. —	— 0,2	8,5
CuNi10Zn27	CW401J	min. max.	61,0 64,0	— 0,3	— 0,5	9,0 11,0	— 0,05	— —	Rem. —	— 0,2	8,6
CuNi10Zn42Pb2	CW402J	min. max.	45,0 48,0	— 0,3	— 0,5	9,0 11,0	1,0 2,5	— 0,2	Rem. —	— 0,2	8,4
CuNi12Zn24	CW403J	min. max.	63,0 66,0	— 0,3	— 0,5	11,0 13,0	— 0,03	— 0,03	Rem. —	— 0,2	8,7
CuNi12Zn25Pb1	CW404J	min. max.	60,0 63,0	— 0,3	— 0,5	11,0 13,0	0,5 1,5	— 0,2	Rem. —	— 0,2	8,7
CuNi12Zn29	CW405J	min. max.	57,0 60,0	— 0,3	— 0,5	11,0 13,5	— 0,03	— 0,03	Rem. —	— 0,2	8,6
CuNi12Zn30Pb1	CW406J	min. max.	56,0 58,0	— 0,3	— 0,5	11,0 13,0	0,5 1,5	— 0,2	Rem. —	— 0,2	8,6
CuNi12Zn38Mn5Pb2	CW407J	min. max.	42,0 45,0	— 0,3	4,5 6,0	11,0 13,0	1,0 2,5	— 0,2	Rem. —	— 0,2	8,4
CuNi18Zn19Pb1	CW408J	min. max.	59,5 62,5	— 0,3	— 0,7	17,0 19,0	0,5 1,5	— 0,2	Rem. —	— 0,2	8,7
CuNi18Zn20	CW409J	min. max.	60,0 63,0	— 0,3	— 0,5	17,0 19,0	— 0,03	— 0,03	Rem. —	— 0,2	8,7
CuNi18Zn27	CW410J	min. max.	53,0 56,0	— 0,3	— 0,5	17,0 19,0	— 0,03	— 0,03	Rem. —	— 0,2	8,7

^a For information only.

Table 6 — Composition of copper-tin alloys

Material designation		Composition in % (mass fraction)										Density ^a g/cm ³ approx.
		Element	Cu	Fe	Ni	P	Pb	Sn	Te	Zn	Others total	
CuSn4	CW450K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	— 0,02	3,5 4,5	— —	— 0,2	— 0,2	8,9
CuSn5	CW451K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	— 0,02	4,5 5,5	— —	— 0,2	— 0,2	8,9
CuSn6	CW452K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	— 0,02	5,5 7,0	— —	— 0,2	— 0,2	8,8
CuSn8	CW453K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	— 0,02	7,5 8,5	— —	— 0,2	— 0,2	8,8
CuSn3Zn9	CW454K	min. max.	Rem. —	— 0,1	— 0,2	— 0,2	— 0,1	1,5 3,5	— —	7,5 10,0	— 0,2	8,8
CuSn4Pb2P	CW455K	min. max.	Rem. —	— 0,1	— 0,2	0,2 0,4	1,5 2,5	3,5 4,5	— —	— 0,3	— 0,2	8,9
CuSn4Pb4Zn4	CW456K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	3,5 4,5	3,5 4,5	— 0,2	3,5 4,5	— 0,2	8,9
CuSn4Te1P	CW457K	min. max.	Rem. —	— 0,1	— 0,2	0,1 0,4	— —	4,0 5,0	0,5 1,0	— 0,3	— 0,2	8,9
CuSn5Pb1	CW458K	min. max.	Rem. —	— 0,1	— 0,2	0,01 0,4	0,5 1,5	3,5 5,5	— —	— 0,3	— 0,2	8,8
CuSn8P	CW459K	min. max.	Rem. —	— 0,1	— 0,3	0,2 0,4	— 0,05	7,5 8,5	— —	— 0,3	— 0,2	8,8
CuSn8PbP	CW460K	min. max.	Rem. —	— 0,1	— 0,3	0,2 0,4	0,1 0,5	7,5 9,0	— —	— 0,3	— 0,2	8,8

^a For information only.