



SLOVENSKI STANDARD
SIST-TS CEN/TS 13388:2004
01-september-2004

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SIST CR 13388:1999

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Copper and copper alloys - Compendium of compositions and products

Kupfer und Kupferlegierungen - Übersicht über Zusammensetzungen und Produkte

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Cuivre et alliages de cuivre - Inventaire des compositions chimiques et des produits
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ICS:

77.120.30	Baker in bakrove zlitine	Copper and copper alloys
77.150.30	Bakreni izdelki	Copper products

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English version

Copper and copper alloys - Compendium of compositions and products

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

Kupfer und Kupferlegierungen - Übersicht über Zusammensetzungen und Produkte

This Technical Specification (CEN/TS) was approved by CEN on 25 January 2004 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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

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Foreword

This document CEN/TS 13388:2004 has been prepared by Technical Committee CEN/TC 133 “Copper and copper alloys”, the secretariat of which is held by DIN.

This document supersedes CR 13388:1998.

In comparison with the first edition of CR 13388:1998, the following significant technical changes were made:

- a) In view of the changes introduced by CEN to their range of deliverables this edition of the compendium is published as a Technical Specification in place of the previous CEN Report.
- b) Since publication of the 1998 edition of the compendium, several TC 133 standards have progressed to final publication, a revision of EN 1981 has been published and other amendments and 3 corrigenda have been issued. Tables 1.1 and 16 have been added. These changes are reflected in this current edition.

This document includes a Bibliography.

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

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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 co-ordinate 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 re-define 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.

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1 Scope

This document 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".

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It also includes copper alloys which are not standardized by CEN/TC 133 but by other CEN Technical Committees responsible for products in copper alloys, and other copper alloys not yet standardized. These alloys have been registered by CEN/TC 133 in accordance with the procedures laid down in CEN Report CR 12776.

2 Compositions of coppers and copper alloys standardized by CEN/TC 133

2.1 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, Cu-CATH-1 (CR001A) and Cu-CATH-2 (CR002A)

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

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

Table 1.4 — Composition of phosphorus-containing copper grades

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

2.2 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

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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

2.3 Composition of master alloys

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

2.4 Composition of ingots and castings

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

Table 12.1 — Ingots and castings — Composition of copper and copper-chromium alloys and casting processes

Table 12.2 — Ingots and castings — Composition of copper-zinc alloys and casting processes

Table 12.3 — Ingots and castings — Composition of copper-tin alloys and casting processes

Table 12.4 — Ingots and castings — Composition of copper-tin-lead alloys and casting processes

Table 12.5 — Ingots and castings — Composition of copper-aluminium alloys and casting processes

Table 12.6 — Ingots and castings — Composition of copper-manganese-aluminium alloys and casting processes

Table 12.7 — Ingots and castings — Composition of copper-nickel alloys and casting processes

2.5 Composition of filler metals

The symbol and number designations and compositions of filler metals in accordance with EN 13347 are given in the following tables:

Table 13.1 — Filler metals — Composition of copper

Table 13.2 — Filler metals — Composition of miscellaneous copper alloys

Table 13.3 — Filler metals — Composition of copper-zinc alloys

Table 13.4 — Filler metals — Composition of copper-tin alloys

Table 13.5 — Filler metals — Composition of copper-aluminium alloys

Table 13.6 — Filler metals — Composition of copper-nickel-zinc alloys

2.6 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 are given in Table 14.

3 Available product forms of copper and copper alloys standardized by CEN/TC 133

3.1 Wrought coppers and copper alloys

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

3.2 Master alloys

The product forms are given in Table 11.

3.3 Ingots and castings

The product forms are given in Tables 12.1 to 12.7.

3.4 Filler metals

The product forms are given in Tables 13.1 to 13.6.

3.5 Scrap

The product forms are given in Table 14.

4 Copper and copper alloys standardized by other CEN Technical Committees

The symbol and number designations of copper alloys standardized by other CEN Technical Committees but allocated by CEN/TC 133 Secretariat, in accordance with the procedures laid down in CR 12776, are given in Tables 15.1, 15.2, 15.3, 15.4 and 16.

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5 Copper and copper alloys registered by CEN/TC 133

The symbol and number designations of copper grades and copper alloys registered by CEN/TC 133 in accordance with the procedures laid down in CR 12776 will be given in Table 17.

NOTE At the time of publication of this Technical Specification, no requests for registration of copper grades or copper alloys had been received.

Table 1.1 — Composition of copper cathodes according to EN 1978, 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 %

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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)										Elements listed in this table other than copper	
Symbol	Number		Element	S	Sb	Se	Si	Sn	Te	Zn	total	excluding		
	unwrought copper	wrought copper												
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	— —	— 0,04	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.

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(O.F)	CR017A	CW017A	min. max.	Rem. —	0,03 0,05	— 0,000 5	— — ^a	— —	— 0,006 5	Ag, O
CuAg0,07(O.F)	CR018A	CW018A	min. max.	Rem. —	0,06 0,08	— 0,000 5	— — ^a	— —	— 0,006 5	Ag, O
CuAg0,10(O.F)	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)

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. —	— —	— 0,6	— 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 (continued)

Material designation		Composition in % (mass fraction)																		Density ^a g/cm ³
Symbol	Number	Element	Cu	Al	Be	Co	Cr	Fe	Mn	Ni	P	Pb	S	Si	Sn	Te	Zn	Zr	Others total	approx.
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

^a For information only

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