



# SLOVENSKI STANDARD SIST-TS CEN/TS 13388:2020

01-maj-2020

Nadomešča:

SIST-TS CEN/TS 13388:2015

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## Baker in bakrove zlitine - Zbirka kemijskih sestav in izdelkov

Copper and copper alloys - Compendium of compositions and products

Kupfer und Kupferlegierungen - Übersicht über Zusammensetzungen und Produkte

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

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

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
TECHNISCHE SPEZIFIKATION

**CEN/TS 13388**

April 2020

ICS 77.120.30; 77.150.30

Supersedes CEN/TS 13388:2015

English Version

**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 October 2019 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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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**CEN/TS 13388:2020 (E)****European foreword**

This document (CEN/TS 13388:2020) 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 shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 13388:2015.

In comparison with CEN/TS 13388:2015, the following changes were made:

- a) modifications regarding materials and compositions from EN 1982:2017, EN 12164:2016, EN 12165:2016, EN 12167:2016, EN 12168:2016, EN 12449:2016+A1:2019, EN 12735-1:2016 and EN 12861:2018 considered.

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

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**CEN/TS 13388:2020 (E)****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”.

**2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 1982:2017, *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 1982:2017 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-zinc-aluminium alloys — Composition and casting processes

Table 12.4 — Ingots and castings — Copper-zinc-lead alloys — Composition and casting processes

Table 12.5 — Ingots and castings — Copper-zinc-silicon alloys — Composition and casting processes

Table 12.6 — Ingots and castings — Other copper-zinc alloys — Composition and casting processes

Table 12.7 — Ingots and castings — Copper-tin alloys — Composition and casting processes

Table 12.8 — Ingots and castings — Copper-tin-zinc-lead alloys — Composition and casting processes

Table 12.9 — Ingots and castings — Copper-tin-lead alloys — Composition and casting processes

Table 12.10 — Ingots and castings — Copper-aluminium alloys — Composition and casting processes

Table 12.11 — Ingots and castings — Copper-manganese alloys — Composition and casting processes

Table 12.12 — Ingots and castings — Copper-nickel alloys — Composition and casting processes

Table 12.13 — Ingots and castings — Copper-silicon-zinc 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 12861:2018 are given in Table 13.

**CEN/TS 13388:2020 (E)****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 12.13.

**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.

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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) |            |         |              |               |        |        |        |              |        |        |        |         |              |              |               |        |        |               | Sum of elements listed in this table other than copper |         |
|----------------------|--------|----------------------------------|------------|---------|--------------|---------------|--------|--------|--------|--------------|--------|--------|--------|---------|--------------|--------------|---------------|--------|--------|---------------|--|---------|
|                      |        | Element                          | Cu         | Ag      | As           | Bi            | Cd     | Co     | Cr     | Fe           | Mn     | Ni     | P      | Pb      | S            | Sb           | Se            | Si     | Sn     | Te            |  | Zn      |
| Symbol               | Number |                                  |            |         |              |               |        |        |        |              |        |        |        |         |              |              |               |        |        |               |  |         |
| Cu-CATH-1            | CR001A | min.                             | —          | —       | —            | —             | —      | —      | —      | —            | —      | —      | —      | —       | —            | —            | —             | —      | —      | —             | —  |         |
|                      |        | max.                             | —          | 0,002 5 | 0,000 5<br>a | 0,000 20<br>b | —<br>a | —<br>c | —<br>a | 0,001 0<br>c | —<br>a | —<br>c | —<br>a | 0,000 5 | 0,001 5<br>d | 0,000 4<br>a | 0,000 20<br>b | —<br>c | —<br>c | 0,000 20<br>b | —<br>c   | 0,006 5 |
| Cu-CATH-2            | CR002A | min.                             | 99,90<br>e | —       | —            | —             | —      | —      | —      | —            | —      | —      | —      | —       | —            | —            | —             | —      | —      | —             | —  | —       |
|                      |        | max.                             | —          | —       | —            | 0,000 5       | —      | —      | —      | —            | —      | —      | —      | 0,005   | —            | —            | —             | —      | —      | —             | —  | —       |

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.<br>max.                     | —<br>—     | —<br>0,002 5 | —<br>0,000 5 a | —<br>0,000 20 b | —<br>— a     | —<br>— c | —<br>— a | —<br>0,001 0 c | —<br>— a     | —<br>— c     | —<br>0,040 | —<br>— a       | —<br>0,000 5 |
| Cu-OF1               | CR007A           | CW007A         | min.<br>max.                     | —<br>—     | —<br>0,002 5 | —<br>0,000 5 a | —<br>0,000 20 b | —<br>— a     | —<br>— c | —<br>— a | —<br>0,001 0 c | —<br>— a     | —<br>— c     | —<br>— d   | —<br>— a       | —<br>0,000 5 |
| Cu-OFE               | CR009A           | CW009A         | min.<br>max.                     | 99,99<br>— | —<br>0,002 5 | —<br>0,000 5   | —<br>0,000 20   | —<br>0,000 1 | —<br>—   | —<br>—   | —<br>0,001 0   | —<br>0,000 5 | —<br>0,001 0 | —<br>— d   | —<br>0,000 3   | —<br>0,000 5 |
| Cu-PHCE              | CR022A           | CW022A         | min.<br>max.                     | 99,99<br>— | —<br>0,002 5 | —<br>0,000 5   | —<br>0,000 20   | —<br>0,000 1 | —<br>—   | —<br>—   | —<br>0,001 0   | —<br>0,000 5 | —<br>0,001 0 | —<br>— d   | 0,001<br>0,006 | —<br>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.<br>max.                     | —<br>0,001 5 | —<br>0,000 4 a | —<br>0,000 20 b | —<br>— c | —<br>— c | —<br>0,000 20 b | —<br>— c | —<br>0,006 5 | 0         |   |  |
| Cu-OF1               | CR007A           | CW007A         | min.<br>max.                     | —<br>0,001 5 | —<br>0,000 4 a | —<br>0,000 20 b | —<br>— c | —<br>— c | —<br>0,000 20 b | —<br>— c | —<br>0,006 5 | 0         |   |  |
| Cu-OFE               | CR009A           | CW009A         | min.                             | —            | —              | —               | —        | —        | —               | —        | —            | —         |   |  |

| 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 |
|   |                  |                | max.                             | 0,001 5      | 0,000 4      | 0,000 20      | —      | 0,000 2      | 0,000 20      | 0,000 1      | —   | —         |
| <b>Cu-PHCE</b>  | <b>CR022A</b>    | <b>CW022A</b>  | min.<br>max.                     | —<br>0,001 5 | —<br>0,000 4 | —<br>0,000 20 | —<br>— | —<br>0,000 2 | —<br>0,000 20 | —<br>0,000 1 | —<br>—  | —<br>—    |
| <p><sup>a</sup> (As + Cd + Cr + Mn + P + Sb) max. 0,001 5 %.</p> <p><sup>b</sup> (Bi + Se + Te) max. 0,000 3 %, of which (Se + Te) max. 0,000 30 %.</p> <p><sup>c</sup> (Co + Fe + Ni + Si + Sn + Zn) max. 0,002 0 %.</p> <p><sup>d</sup> The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.</p> |                  |                |                                  |              |              |               |        |              |               |              |   |           |

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**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 <sup>a</sup> | Bi           | O                       | Pb         | Other elements<br>(see note) |           |
|                      | unwrought<br>copper | wrought<br>copper |                                  |                 |              |                         |            | total                        | excluding |
| <b>Cu-ETP</b>        | <b>CR004A</b>       | <b>CW004A</b>     | min.<br>max.                     | 99,90<br>—      | —<br>0,000 5 | —<br>0,040 <sup>b</sup> | —<br>0,005 | —<br>0,03                    | Ag, O     |
| <b>Cu-FRHC</b>       | <b>CR005A</b>       | <b>CW005A</b>     | min.<br>max.                     | 99,90<br>—      | —<br>—       | —<br>0,040 <sup>b</sup> | —<br>—     | —<br>0,06 <sup>d</sup>       | Ag, O     |
| <b>Cu-FRTP</b>       | <b>CR006A</b>       | <b>CW006A</b>     | min.<br>max.                     | 99,90<br>—      | —<br>—       | —<br>0,100              | —<br>—     | —<br>0,05                    | Ag, Ni, O |
| <b>Cu-OF</b>         | <b>CR008A</b>       | <b>CW008A</b>     | min.<br>max.                     | 99,95<br>—      | —<br>0,000 5 | —<br>— <sup>c</sup>     | —<br>0,005 | —<br>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.

<sup>a</sup> Including silver, up to a maximum of 0,015 %.

<sup>b</sup> Oxygen content up to 0,060 % is permitted, subject to agreement between the purchaser and the supplier.

<sup>c</sup> The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.

<sup>d</sup> 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 <sup>a</sup> | Bi           | P              | Pb         | Other elements<br>(see note) |           |
|                      | unwrought<br>copper | wrought<br>copper |                                  |                 |              |                |            | total                        | excluding |
| <b>Cu-PHC</b>        | <b>CR020A</b>       | <b>CW020A</b>     | min.<br>max.                     | 99,95<br>—      | —<br>0,000 5 | 0,001<br>0,006 | —<br>0,005 | —<br>0,03 <sup>b</sup>       | Ag, P     |
| <b>Cu-HCP</b>        | <b>CR021A</b>       | <b>CW021A</b>     | min.<br>max.                     | 99,95<br>—      | —<br>0,000 5 | 0,002<br>0,007 | —<br>0,005 | —<br>0,03 <sup>b</sup>       | Ag, P     |
| <b>Cu-DLP</b>        | <b>CR023A</b>       | <b>CW023A</b>     | min.<br>max.                     | 99,90<br>—      | —<br>0,000 5 | 0,005<br>0,013 | —<br>0,005 | —<br>0,03                    | Ag, Ni, P |
| <b>Cu-DHP</b>        | <b>CR024A</b>       | <b>CW024A</b>     | min.<br>max.                     | 99,90<br>—      | —<br>—       | 0,015<br>0,040 | —<br>—     | —<br>— <sup>c</sup>          | —         |
| <b>Cu-DXP</b>        | <b>CR025A</b>       | —                 | min.<br>max.                     | 99,90<br>—      | —<br>0,000 5 | 0,04<br>0,06   | —<br>0,005 | —<br>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.

<sup>a</sup> Including silver, up to a maximum of 0,015 %.

<sup>b</sup> The oxygen content shall be controlled by the manufacturer so that the material conforms to the hydrogen embrittlement requirements of EN 1976.

<sup>c</sup> If required, the permitted total of elements, other than silver and phosphorus, should be agreed between the purchaser and the supplier.