INTERNATIONAL STANDARD

**ISO 24373**

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# Welding consumables — Solid wires and rods for fusion welding of copper and copper alloys — Classification

*Produits consommables pour le soudage — Fils pleins et baguettes pleines pour le soudage par fusion du cuivre et des alliages de cuivre — Classification*

Reference number
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# Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 24373 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

Requests for official interpretations of any aspect of this International Standard should be directed to the Secretariat of ISO/TC 44/SC 3 via your national standards body, a complete listing of which can be found at www.iso.org.

# Introduction

For copper-welding consumables, there is no unique relationship between the product form (solid wire or rod) and the welding process used (e.g. gas-shielded metal arc welding, gas tungsten arc welding, plasma arc or other welding processes). For this reason, the solid wires or rods may be classified on the basis of any of the above product forms and can be used, as appropriate, for more than one of the above processes.

ISO 24373 is based on EN 14640:2005.

# Welding consumables — Solid wires and rods for fusion welding of copper and copper alloys — Classification

## 1 Scope

This International Standard specifies requirements for classification of solid wires and rods for fusion welding of copper and copper alloys. The classification of the solid wires and rods is based on their chemical composition.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

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

ISO 544, *Welding consumables — Technical delivery conditions for welding filler materials — Type of product, dimensions, tolerances and markings*

ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

ISO 14344, *Welding and allied processes — Flux and gas shielded electrical welding processes — Procurement guidelines for consumables*

## 3 Classification

The classification is divided into two parts:

a) the first part indicates the product form, solid wires or rods (see 4.1);

b) the second part gives a numerical symbol indicating the chemical composition of the solid wire or rod (see Table 1).

## 4 Symbols

### 4.1 Symbol for the product form

The symbol for the solid wire and rod shall be S.

NOTE One product form may be used for more than one welding process.

### 4.2 Symbol for the chemical composition

The numerical symbol in Table 1 indicates the chemical composition of a solid wire or rod, determined under conditions given in Clause 6.

NOTE 1 In addition the chemical symbol may be used.

NOTE 2 Corresponding national classifications are shown in Annex A.

## 5 Mechanical properties of the weld metal

The mechanical properties of the weld metal are not part of the classification.

## 6 Chemical analysis

Chemical analysis shall be performed on specimens of the product or the stock from which it is made. Any analytical technique can be used; but, in case of dispute, reference shall be made to established published methods, agreed between the contracting parties.

## 7 Rounding-off procedure

For purposes of determining compliance with the requirements of this International Standard, the actual test values obtained shall be subjected to the rounding-off rules of ISO 31-0:1992, Annex B, Rule A. If the measured values are obtained by equipment calibrated in units other than those of this International Standard, the measured values shall be converted to the units of this International Standard before rounding off. If an average value is to be compared to the requirements of this International Standard, rounding off shall be done only after calculating the average. In the case where the testing standard cited in the normative references of this International Standard contains instructions for rounding off that conflict with the instructions of this International Standard, the rounding off requirements of the testing standard shall apply. The rounded-off results shall fulfil the requirements of the appropriate table for the classification under test.

## 8 Retest

If any test fails to meet a requirement, that test shall be repeated twice. The results of both retests shall meet the requirement. Specimens for the retest may be taken from the original test sample or from a new test sample. For chemical analysis, retests need only be for those specific elements that failed to meet their test requirement. If the results of one or both retests fail to meet the requirement, the material under test shall be considered as not meeting the requirements of this International Standard for that classification.

In the event that, during preparation or after completion of any test, it is clearly determined that prescribed or proper procedures were not followed in preparing the sample or test specimen(s), or in conducting the tests, the test shall be considered invalid, without regard to whether the test was actually completed, or whether the test results met, or failed to meet, the requirement. That test shall be repeated, following proper prescribed procedures. In this case, the requirement for doubling the number of test specimens does not apply.

## 9 Technical delivery conditions

Technical delivery conditions shall meet the requirements in ISO 544 and ISO 14344.

## Table 1 — Symbol for the chemical composition of solid wires and rods

| **Alloy symbols** | | **Chemical composition,** % mass fraction[a, b] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Numerical** | **Chemical** | Cu | Al | Fe | Mn | Ni incl. Co | P | Pb | Si | Sn | Zn | As | C | Ti | S | Others total |
| COPPER-LOW ALLOYED | | | | | | | | | | | | | | | | |
| Cu 1897 | CuAg1 | min. 99,5 incl. Ag | 0,01 | 0,05 | 0,2 | 0,3 | 0,01 to 0,05 | 0,01 | 0,1 | — | — | 0,05 | — | — | — | 0,2 Ag:0,8 to 1,2 |
| Cu 1898 | CuSn1 | min. 98,0 | 0,01 | — | 0,50 | — | 0,15 | 0,02 | 0,5 | 1,0 | — | — | — | — | — | 0,50 |
| Cu 1898A | CuSn1MnSi | bal. | 0,01 | 0,03 | 0,1 to 0,4 | 0,1 | 0,015 | 0,01 | 0,1 to 0,4 | 0,5 to 1,0 | — | — | — | — | — | 0,2 |
| COPPER-SILICON (SILICON BRONZE) | | | | | | | | | | | | | | | | |
| Cu 6511 | CuSi2Mn1 | bal. | 0,01 | 0,1 | 0,5 to 1,5 | — | 0,02 | 0,02 | 1,5 to 2,0 | 0,1 to 0,3 | 0,2 | — | — | — | — | 0,5 |
| Cu 6560 | CuSi3Mn1 | bal. | 0,02 | 0,5 | 0,5 to 1,5 | — | 0,05 | 0,02 | 2,8 to 4,0 | 0,2 | 0,4 | — | — | — | — | 0,5 |
| Cu 6561 | CuSi2Mn1Sn1Zn1 | bal. | — | 0,5 | 1,5 | — | — | 0,02 | 2,0 to 2,8 | 1,5 | 1,5 | — | — | — | — | 0,5 |
| COPPER-TIN (INCL. PHOSPHOR BRONZE) | | | | | | | | | | | | | | | | |
| Cu 5180 | CuSn5P | bal. | 0,01 | — | — | — | 0,1 to 0,4 | 0,02 | — | 4,0 to 6,0 | — | — | — | — | — | 0,5 |
| Cu 5180A | CuSn6P | bal. | 0,01 | 0,1 | — | — | 0,01 to 0,4 | 0,02 | — | 4,0 to 7,0 | 0,1 | — | — | — | — | 0,2 |
| Cu 5210 | CuSn8P | bal. | — | 0,1 | — | 0,2 | 0,01 to 0,4 | 0,02 | — | 7,5 to 8,5 | 0,2 | — | — | — | — | 0,2 |
| Cu 5211 | CuSn10MnSi | bal. | 0,01 | 0,1 | 0,1 to 0,5 | — | 0,1 | 0,02 | 0,1 to 0,5 | 9,0 to 10,0 | 0,1 | — | — | — | — | 0,5 |
| Cu 5410 | CuSn12P | bal. | 0,005 | — | — | — | 0,01 to 0,4 | 0,02 | — | 11,0 to 13,0 | 0,05 | — | — | — | — | 0,4 |
| COPPER-ZINC (BRASS) | | | | | | | | | | | | | | | | |
| Cu 4641 | CuZn40SnSi | 58,0 to 62,0 | 0,01 | 0,2 | 0,3 | — | — | 0,03 | 0,1 to 0,5 | 1,0 | bal. | — | — | — | — | 0,2 |
| Cu 4700 | CuZn40Sn | 57,0 to 61,0 | 0,01* | * | * | — | — | 0,05* | * | 0,25 to 1,00 | bal. | — | — | — | — | 0,5[c] |
| Cu 4701 | CuZn40SnSiMn | 58,5 to 61,5 | 0,01 | 0,25 | 0,05 to 0,25 | — | — | 0,02 | 0,15 to 0,4 | 0,2 to 0,5 | bal. | — | — | — | — | 0,2 |
| Cu 6800 | CuZn40Ni | 56,0 to 60,0 | 0,01* | 0,25 to 1,20 | 0,01 to 0,50 | 0,2 to 0,8 | — | 0,05* | 0,04 to 0,20 | 0,8 to 1,1 | bal. | — | — | — | — | 0,5[c] |

**Table 1** (*continued*)

| Alloy symbols | | Chemical composition, % mass fraction[a, b] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Numerical** | **Chemical** | Cu | Al | Fe | Mn | Ni incl. Co | P | Pb | Si | Sn | Zn | As | C | Ti | S | Others total |
| Cu 6810 | CuZn40Fe1Sn1 | 56,0 to 60,0 | 0,01* | 0,25 to 1,20 | 0,01 to 0,50 | — | — | 0,05* | 0,04 to 0,15 | 0,8 to 1,1 | bal. | — | — | — | — | 0,5[c] |
| Cu 7730 | CuZn40Ni10 | 46,0 to 50,0 | 0,01* | — | — | 9,0 to 11,0 | 0,25 | 0,05* | 0,04 to 0,25 | — | bal. | — | — | — | — | 0,5[c] |
| COPPER-ALUMINIUM (ALUMINIUM BRONZE) | | | | | | | | | | | | | | | | |
| Cu 6061 | CuAl5Ni2Mn | bal. | 4,5 to 5,5 | 0,5 | 0,1 to 1,0 | 1,0 to 2,5 | — | 0,02 | 0,1 | — | 0,2 | — | — | — | — | 0,5 |
| Cu 6100 | CuAl7 | bal. | 6,0 to 8,5 | * | 0,5 | * | — | 0,02 | 0,2 | * | 0,2 | — | — | — | — | 0,4[c] |
| Cu 6180 | CuAl10Fe | bal. | 8,5 to 11,0 | 1,5 | — | — | — | 0,02 | 0,1 | — | 0,02 | — | — | — | — | 0,5 |
| Cu 6240 | CuAl11Fe3 | bal. | 10,0 to 11,5 | 2,0 to 4,5 | — | — | — | 0,02 | 0,1 | — | 0,1 | — | — | — | — | 0,5 |
| Cu 6325 | CuAl8Fe4Mn2Ni2 | bal. | 7,0 to 9,0 | 1,8 to 5,0 | 0,5 to 3,0 | 0,5 to 3,0 | — | 0,02 | 0,1 | — | 0,1 | — | — | — | — | 0,4 |
| Cu 6327 | CuAl8Ni2Fe2Mn2 | bal. | 7,0 to 9,5 | 0,5 to 2,5 | 0,5 to 2,5 | 0,5 to 3,0 | — | 0,02 | 0,2 | — | 0,2 | — | — | — | — | 0,4 |
| Cu 6328 | CuAl9Ni5Fe3Mn2 | bal. | 8,5 to 9,5 | 3,0 to 5,0 | 0,6 to 3,5 | 4,0 to 5,5 | — | 0,02 | 0,1 | — | 0,1 | — | — | — | — | 0,5 |
| COPPER-MANGANESE | | | | | | | | | | | | | | | | |
| Cu 6338 | CuMn13Al8Fe3Ni2 | bal. | 7,0 to 8,5 | 2,0 to 4,0 | 11,0 to 14,0 | 1,5 to 3,0 | — | 0,02 | 0,1 | — | 0,15 | — | — | — | — | 0,5 |
| COPPER-NICKEL | | | | | | | | | | | | | | | | |
| Cu 7061 | CuNi10 | bal. | — | 0,5 to 2,0 | 0,5 to 1,5 | 9,0 to 11,0 | 0,02 | 0,02 | 0,2 | — | — | — | 0,05 | 0,1 to 0,5 | 0,02 | 0,4 |
| Cu 7158 | CuNi30Mn1FeTi | bal. | — | 0,4 to 0,7 | 0,5 to 1,5 | 29,0 to 32,0 | 0,02 | 0,02 | 0,25 | — | — | — | 0,04 | 0,2 to 0,5 | 0,01 | 0,5 |

[a] Analysis shall be made for the elements for which specific values are shown in this table. If, however, the presence of other elements is indicated in the course of routine analysis, further analyses shall be carried out to determine that the total of these other elements does not exceed the given maximum level.

[b] Single values shown are maxima, unless otherwise noted.

[c] (and *) The total of all other elements, including those for which the maximum value or an asterisk (*) is shown, shall not exceed the value specified in "Others total".

NOTE Consumables not listed in the table can be symbolized by Cu Z. The chemical symbol established by the manufacturer may be added in brackets.

## 10 Designation

The designation of solid wires and rods shall follow the principle given in the example below.

EXAMPLE A solid wire (S) for fusion welding that has a chemical composition within the limits for the alloy symbol Cu 6560 (CuSi3Mn1) of Table 1 is designated:

**Solid wire ISO 24373 - S Cu 6560**

or

**Solid wire ISO 24373 - S Cu 6560 (CuSi3Mn1)**

where:

ISO 24373 is the number of this International Standard;

S is the product form (see 4.1);

Cu 6560 is the chemical composition of welding consumable (see Table 1);

CuSi3Mn1 is the optional chemical composition of welding consumable (see Table 1).

# Annex A
(informative)

# Corresponding national classifications

**Table A.1 — Corresponding national classifications**

| Numerical symbol | Chemical symbol | USA | | Japan | Europe | | Germany |
|---|---|---|---|---|---|---|---|
| | | AWS A5.7/A5.7M:2007<br>AWS A5.8/A5.8M:2004 | UNS | JIS Z3341:1999<br>JIS Z3202:1999 | EN 13347:2002 | EN 14640:2005 | DIN 1733-1:1998 |
| **COPPER-(LOW ALLOYED)** | | | | | | | |
| Cu 1897 | CuAg1 | — | — | — | — | CuAg1 | 2.1211 |
| Cu 1898 | CuSn1 | ERCu | C18980 | YCu | — | — | — |
| Cu 1898A | CuSn1MnSi | — | — | — | CuSn1MnSi | CuSn1 | 2.1006 |
| **COPPER-SILICON** (silicon bronze) | | | | | | | |
| Cu 6511 | CuSi2Mn1 | — | — | — | — | CuSi2Mn1 | — |
| Cu 6560 | CuSi3Mn1 | ERCuSi-A | C65600 | YCuSi B | CuSi3Mn1 | CuSi3Mn1 | 2.1461 |
| Cu 6561 | CuSi2Mn1Sn1Zn1 | — | — | YCuSi A | — | CuSi2Mn1Sn | — |
| **COPPER-TIN** (incl. phosphor bronze) | | | | | | | |
| Cu 5180 | CuSn5P | ERCuSn-A | C51800 | YCuSn A | CuSn5, CuSn6 | — | 2.1022 |
| Cu 5180A | CuSn6P | ERCuSn-A | C51800 | — | CuSn5, CuSn6 | CuSn6P | 2.1022 |
| Cu 5210 | CuSn8P | — | — | YCuSn B | CuSn8 | CuSn9P | — |
| Cu 5211 | CuSn10MnSi | — | — | — | — | CuSn10 | — |
| Cu 5410 | CuSn12P | — | — | — | CuSn12 | CuSn12P | 2.1056 |
| **COPPER-ZINC** (brass) | | | | | | | |
| Cu 4641 | CuZn40SnSi | — | — | — | CuZn40FeSiSn | CuZn40SnSi | — |
| Cu 4700 | CuZn40Sn | RBCuZn-A | C47000 | GCuZnSn | CuZn40Sn1 | CuZn40 | — |
| Cu 4701 | CuZn40SnSiMn | — | — | — | CuZn40MnSiSn | CuZn40SnSiMn | — |
| Cu 6800 | CuZn40Ni | RBCuZn-B | C68000 | — | CuZn39Fe1Sn1MnNiSi | CuZn40Ni | — |
| Cu 6810 | CuZn40Fe1Sn1 | RBCuZn-C | C68100 | — | CuZn40FeSiSn | CuZn40SnSi | 2.0366 |
| Cu 7730 | CuZn40Ni10Sn1 | RBCuZn-D | C77300 | GCuZnNi | — | CuZn40Ni10 | — |

**Table A.1** (*continued*)

| Numerical symbol | Chemical symbol | USA | | Japan | Europe | | Germany |
|---|---|---|---|---|---|---|---|
| | | AWS A5.7/A5.7M:2007<br>AWS A5.8/A5.8M:2004 | UNS | JIS Z3341:1999<br>JIS Z3202:1999 | EN 13347:2002 | EN 14640:2005 | DIN 1733-1:1998 |
| **COPPER-ALUMINIUM** (aluminium bronze) | | | | | | | |
| Cu 6061 | CuAl5Ni2Mn | — | — | — | — | CuAl5Mn1Ni1 | — |
| Cu 6100 | CuAl7 | ERCuAl-A1 | C61000 | — | CuAl8 | CuAl8 | 2.0921 |
| Cu 6180 | CuAl10Fe1 | ERCuAl-A2 | C61800 | YCuAl | CuAl10Fe1 | CuAl10 | 2.0937 |
| Cu 6240 | CuAl11Fe3 | ERCuAl-A3 | C62400 | — | — | CuAl11Fe | — |
| Cu 6325 | CuAl8Fe4Mn2Ni2 | — | — | YCuAlNi B | — | CuAl8Fe4Ni2 | — |
| Cu 6327 | CuAl8Ni2Fe2Mn2 | — | — | YCuAlNi A | — | CuAl8Ni2 | 2.0922 |
| Cu 6328 | CuAl9Ni5Fe3Mn2 | ERCuAlNi | C63280 | YCuAlNi C | CuAl9Ni4Fe3Mn2 | CuAl9Ni5 | 2.0923 |
| **COPPER-MANGANESE** | | | | | | | |
| Cu 6338 | CuMn13Al8Fe3Ni2 | ERCuMnNiAl | C63380 | — | — | CuMn13Al7 | 2.1367 |
| **COPPER-NICKEL** | | | | | | | |
| Cu 7061 | CuNi10 | — | — | YCuNi-1 | — | CuNi10 | 2.0873 |
| Cu 7158 | CuNi30Mn1FeTi | ERCuNi | C71581 | YCuNi-3 | — | CuNi30 | 2.0837 |

# Annex B
(informative)

# Process considerations

## B.1 **Oxyfuel gas welding** (process 31 in accordance with ISO 4063)

For alloy Cu 1897, a phosphorus content, as a mass fraction, of 0,02 % to 0,05 % is recommended.

For alloy Cu 5180A, Cu 5210 and Cu 5410, a phosphorus content, as a mass fraction, of 0,1 % to 0,4 % is recommended.

## B.2 **Gas-shielded metal arc welding** (process 131 in accordance with ISO 4063)

For alloy Cu 1897, a phosphorus content, as a mass fraction, of 0,01 % to 0,02 % is recommended.

For alloys Cu 5180A, Cu 5210 and Cu 5410, a phosphorus content, as a mass fraction, of 0,01 % to 0,10 % is recommended.

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[3] CR 10261, *ECISS Information Circular 11 — Iron and steel — Review of available methods of chemical analysis*

[4] AWS A5.7/A5.7M:2007, *Specification for copper and copper-alloy bare welding rods and electrodes*

[5] AWS A5.8/A5.8M:2004, *Specification for filler metals for brazing and braze welding*

[6] JIS Z 3341:1999, *Copper and copper alloy rods and solid wires for inert gas shielded arc welding*

[7] JIS Z 3202:1999, *Copper and copper alloy gas welding rods*

[8] EN 13347:2002, *Copper and copper alloys — Rod and wire for welding and braze welding*

[9] EN 14640:2005, *Welding consumables — Solid wires and rods for fusion welding of copper and copper alloys — Classification*

[10] DIN 1733-1:1988, *Filler metals for welding copper and copper alloys; composition, application and technical delivery conditions*[1)]

1) Withdrawn.

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