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Welding consumables — Covered electrodes for manual metal arc welding of copper and copper alloys — Classification

Produits consommables pour le soudage — Électrodes enrobées pour le soudage manuel à l'arc du cuivre et des alliages de cuivre — Classification

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is 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 these bodies can be found at www.iso.org.

Welding consumables — Covered electrodes for manual metal arc welding of copper and copper alloys — Classification

1 Scope

This International Standard prescribes requirements for the classification of covered electrodes for manual metal arc welding of copper and copper alloys. It includes those chemical compositions in which the copper content exceeds that of any other element.

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.

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

ISO 6847, *Welding consumables — Deposition of a weld metal pad for chemical analysis*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*

ISO 80000-1:2009, *Quantities and units — Part 1: General*. Corrected by ISO 80000-1:2009/Cor 1:2011

3 Classification

A covered electrode shall be classified according to the chemical composition of the all-weld metal as given in Table 1. The symbol for the classification is divided into two parts:

a) the first part gives a symbol indicating the product/process to be used;

b) the second part gives a symbol indicating the chemical composition of the all-weld metal.

Table 1 — Symbols and all-weld metal chemical composition of covered electrodes

Alloy symbols		Chemical composition, % (by mass)[a]													
Numerical	Chemical	Cu	Al	Fe	Mn	Ni incl. Co	P	Pb	Si	Sn	Zn	As	Ti	S	Others total
COPPER LOW ALLOYED															
Cu 1892	Cu	Bal.	0,10	0,20	0,10	—	—	0,01	0,10	—	—	—	—	—	0,50
Cu 1893	CuMn2	≥95	—	1,0	1,0 to 3,0	0,3	0,10	0,01	0,8	1,0	—	0,05	—	—	0,5
Cu 1893A	CuMn2(A)	≥95	—	—	3,0	—	0,30	0,02	0,5	—	—	—	—	—	0,50
COPPER–TIN															
Cu 5180	CuSn5P	Bal.	0,01	0,25	—	—	0,05 to 0,35	0,02	—	4,0 to 6,0	—	—	—	—	0,50
Cu 5180A	CuSn6P	Bal.	—	—	—	—	0,30	0,02	—	5,0 to 7,0	—	—	—	—	0,50
Cu 5180B	CuSn7	Bal.	0,1	0,2	1,0	—	0,10	0,02	0,5	5,0 to 8,0	0,1	—	—	—	0,5
Cu 5410	CuSn13	Bal.	0,1	0,2	1,0	—	0,10	0,02	0,5	11,0 to 13,0	0,1	—	—	—	0,2
Cu 5210	CuSn8P	Bal.	0,01	0,25	—	—	0,05 to 0,35	0,02	—	7,0 to 9,0	—	—	—	—	0,50
Cu 5210A	CuSn8P(A)	Bal.	—	—	—	—	0,30	0,02	—	7,0 to 9,0	—	—	—	—	0,50
COPPER–ALUMINIUM															
Cu 6100	CuAl8Fe3	Bal.	6,5 to 9,5	0,5 to 5,0	—	—		0,02	1,5	—	—	—	—	—	0,50
Cu 6100A	CuAl9	Bal.	6,5 to 8,5	1,0	2,0	0,8	—	0,02	0,7	—	—	—	—	—	0,5
Cu 6325	CuAl9Ni2Fe	Bal.	6,5 to 8,5	1,5 to 2,5	1,5 to 3,0	1,8 to 3,0	—	0,02	0,7	—	—	—	—	—	0,5
Cu 6327	CuAl9MnFe	Bal.	7,0 to 10,0	1,5	2,0	0,5	—	0,02	1,0	—	—	—	—	—	0,50
Cu 6328	CuAl9Ni5Fe4Mn2	Bal.	8,0 to 9,5	3,0 to 6,0	0,5 to 3,5	4,0 to 6,0	—	0,02	1,5	—	—	—	—	—	0,50
Cu 6240	CuAl10Fe4	Bal.	9,5 to 11,5	2,5 to 5,0	—	—	—	0,02	1,5	—	—	—	—	—	0,50

[a] Single values for all elements except for Cu shown are maxima.

[b] Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and, therefore, it is possible that two electrodes with the same Z classification are not interchangeable.

Table 1 *(continued)*

Alloy symbols		Chemical composition, % (by mass)[a]													
Numerical	**Chemical**	Cu	Al	Fe	Mn	Ni incl. Co	P	Pb	Si	Sn	Zn	As	Ti	S	Others total
Cu 6240A	CuAl9Fe5	Bal.	7,0 to 10,0	2,0 to 6,0	2,0	2,0	—	0,02	1,0	—	—	—	—	—	0,50
COPPER–MANGANESE															
Cu 6338	CuMn13Al7Fe3Ni2	Bal.	6,0 to 8,5	2,0 to 4,0	11,0 to 14,0	1,5 to 3,0	—	0,02	1,5	—	—	—	—	—	0,50
COPPER–NICKEL															
Cu 7061	CuNi10Mn	Bal.	—	2,5	2,5	9,0 to 11,0	0,020	0,02	0,5	—	—	—	0,5	0,015	0,50
Cu 7158	CuNi30Mn2FeTi	Bal.	—	0,40 to 0,75	1,00 to 2,50	29,0 to 33,0	0,020	0,02	0,50	—	—	—	0,50	0,015	0,50
Cu 7158A	CuNi30Mn1Fe2Ti	Bal.	—	2,5	2,5	29,0 to 33,0	0,020	0,02	0,5	—	—	—	0,5	0,015	0,50
COPPER–SILICON															
Cu 6511	CuSi2Mn	≥93	—	—	3,0	—	0,30	0,02	1,0 to 2,0	—	—	—	—	—	0,50
Cu 6560	CuSi3Mn	≥92	—	—	3,0	—	0,30	0,02	2,5 to 4,0	—	—	—	—	—	0,50
Cu 6561	CuSi3	Bal.	0,01	0,50	1,5	—	—	0,02	2,4 to 4,0	1,5	—	—	—	—	0,50
Z[b]		Any other agreed composition													

[a] Single values for all elements except for Cu shown are maxima.

[b] Consumables for which the chemical composition is not listed in this table shall be symbolized similarly and prefixed by the letter Z. The chemical composition ranges are not specified and, therefore, it is possible that two electrodes with the same Z classification are not interchangeable.

4 Symbols

4.1 Symbol for the product/process

The symbol for covered electrodes shall be the letter E.

4.2 Symbol for the chemical composition of the all-weld metal

The numerical symbol for the chemical composition of the all-weld metal shall comprise “Cu” plus four digits, as shown in Table 1.

In addition, the chemical symbol may be used.

5 Chemical analysis

Chemical analysis shall be performed on any suitable all-weld metal test specimen. In case of dispute, the test specimen specified in ISO 6847 shall be used. Any analytical technique may be used, but in case of dispute, reference shall be made to established published methods.

6 Rounding procedure

For purposes of determining compliance with the requirements of this International Standard, the actual test values obtained shall be subject to ISO 80000-1:2009, B.3, 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. If an arithmetic average value is to be compared with the requirements of this International Standard, rounding shall be done only after calculating the arithmetic average. The rounded results shall fulfil the requirements of the appropriate table for the classification under test.

7 Retests

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 the 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.

8 Technical delivery conditions

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

9 Designation examples

The designation of covered electrodes shall follow the principle given in the examples below.

EXAMPLE 1 A covered electrode (E) for manual metal arc welding depositing a copper-base alloy weld metal within the chemical composition limits for the alloy Cu 6100 (CuAl8Fe3) according to Table 1 is designated:

ISO 17777 - E Cu 6100

or

ISO 17777 - E Cu 6100 (CuAl8Fe3)

where

ISO 17777 indicates the number of this International Standard;

E indicates the symbol for covered electrode/manual metal-arc welding (see 4.1);

Cu 6100 indicates the chemical composition of all-weld metal (see Table 1);

CuAl8Fe3 indicates the optional chemical symbol of covered electrode (see Table 1).

EXAMPLE 2 A covered electrode (E) for manual metal arc welding depositing a copper-tin-base alloy weld metal with a chemical composition 9Sn base copper, not listed in Table 1:

ISO 17777 - E Cu Z (CuSn9)

where

ISO 17777 indicates the number of this International Standard;

E indicates the symbol for covered electrode/manual metal-arc welding (see 4.1);

Z indicates the chemical composition is agreed between manufacturer and customer;

CuSn9 indicates the chemical composition of the all-weld metal.

EXAMPLE 3 A covered electrode (E) for manual metal arc welding has a chemical composition of Sn 8,5 % to 9,5 % and Cu rem. for the alloy symbol Z of Table 1 is designated:

ISO 17777 - E Cu Z (CuSn9)

where

ISO 17777 indicates the number of this International Standard;

E indicates the symbol for covered electrode/manual metal-arc welding (see 4.1);

Cu Z indicates the chemical composition is agreed between manufacturer and customer;

CuSn9 indicates the chemical composition of the all-weld metal.

Annex A
(informative)

Corresponding national classifications

Table A.1 — Symbols, corresponding national classifications

Numerical	Germany DIN 1733–1 Material number	USA AWS A 5.6 M Symbol	Japan[a] JIS Z 3231 Symbol	China[a] GB/T 3670
Cu 1892		ECu W60189		
Cu 1893	2.1363			
Cu 1893A			DCu	ECu
Cu 5180		ECuSn-A W60518		
Cu 5180A			DCuSnA	ECuSn-A
Cu 5180B	2.1025			
Cu 5410	2.1027			
Cu 5210		ECuSnC W60521		
Cu 5210A			DCuSnB	ECuSnB
Cu 6100		ECuAl-A2 W60614		ECuAl-A2
Cu 6100A	2.0926			
Cu 6325	2.0930			
Cu 6327			DCuAl	ECuAl-C
Cu 6328		ECuNiAl W60632		
Cu 6240		ECuAl-B W60619		ECuAl-B
Cu 6240A			DCuAlNi	ECuAlNi
Cu 6338		ECuMnNiAl W60633		ECuMnAlNi
Cu 7061			DCuNi-1	ECuNi-A
Cu 7158		ECuNi W60715		
Cu 7158A			DCuNi-3	ECuNi-B
Cu 6511			DCuSiA	ECuSi-A
Cu 6560			DCuSiB	ECuSi-B
Cu 6561		ECuSi W60656		

[a] These alloys are the nearest equivalent of the relevant national standards.

Annex B
(informative)

Physical properties and examples for the use of copper alloy covered electrodes

Table B.1 — Physical properties and examples for the use of copper alloy covered electrodes

Chemical/ numerical	Physical properties				Examples for the application of base materials (cast or wrought alloys)
	Melting range °C	Density g/cm³	Electrical conductivity κ at 20 °C MS/m	Thermal conductivity λ at 20 °C W/m·K	
Cu 1893	1 000 to 1 050	8,9	15 to 20	120 to 145	Oxygen-free copper
Cu 5180	910 to 1 040	8,7	7	75	Copper-tin alloys and copper-tin-zinc-lead-alloys
Cu 5410	825 to 990	8,6	3 to 5	40 to 50	Copper-tin alloys and copper-tin-zinc-lead-alloys with Sn > 8 % (by mass)
Cu 6100	1 020 to 1 050	7,7	6	70	Copper-Aluminium alloys and copper-zinc-alloys, Overlay welding on ferritic-pearlitic steels
Cu 6327	1 030 to 1 050	7,5	5	30 to 50	Copper-Aluminium alloys
Cu 6338	940 to 980	7,4	3	30	Copper-Aluminium-Tin-alloys containing manganese and nickel
Cu 6561	970 to 1 025	8,5	3 to 4	38	Primarily for welding copper silicon alloys and often for surfaces subject to corrosion
Cu 7061	1 100 to 1 145	8,9	4 to 5	45	Copper-Nickel-alloys CuNi10Fe1Mn
Cu 7158	1 180 to 1 240	8,9	3	30	Copper-Nickel-alloys CuNi10Fe1Mn and CuNi30Mn1Fe