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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Wrought copper and copper alloy plate, sheet and strip

Part 1: Technical conditions of delivery for plate, sheet and strip for general purposes

Plaques, tôles et bandes en cuivre et en alliages de cuivre corroyés —

Partie 1: Conditions techniques de livraison des plaques, tôles et bandes pour usages généraux

Reference number
ISO 1634-1:1987 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1634-1 was prepared by Technical Committee ISO/TC 26, *Copper and copper alloys*.

With ISO 1634-2, it cancels and replaces ISO 1634 : 1974, of which they constitute a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Wrought copper and copper alloy plate, sheet and strip —

Part 1:

Technical conditions of delivery for plate, sheet and strip for general purposes

1 Scope and field of application

This part of ISO 1634 specifies the technical conditions of delivery for wrought copper and copper alloy plate, sheet and strip for general purposes currently available in commercial quantities.

For the purpose of this part of ISO 1634, the definitions for copper and copper alloys in ISO 197-1 and for plate, sheet and strip in ISO 197-3 as well as the principles for designation in ISO 1190-1 and ISO 1190-2 apply.

For technical conditions of delivery for plate, sheet and strip

- for boilers, pressure vessels and heat-exchangers, see ISO 1634-2;
- for strip for springs, see ISO 1634-3.

2 References

2.1 Definitions

ISO 197, *Copper and copper alloys — Terms and definitions*

- Part 1: *Materials.*
- Part 3: *Wrought products.*

2.2 Designations

ISO 1190, *Copper and copper alloys — Code of designation*

- Part 1: *Designation of materials.*
- Part 2: *Designation of tempers.*

2.3 Chemical composition

ISO 426, *Wrought copper-zinc alloys — Chemical composition and forms of wrought products*

- Part 1: *Non-leaded and special copper-zinc alloys.*
- Part 2: *Leaded copper-zinc alloys.*

ISO 427, *Wrought copper-tin alloys — Chemical composition and forms of wrought products.*

ISO 429, *Wrought copper-nickel alloys — Chemical composition and forms of wrought products.*

ISO 430, *Wrought copper-nickel-zinc alloys — Chemical composition and forms of wrought products.*

ISO 1187, *Special wrought copper alloys — Chemical composition and forms of wrought products.*

ISO 1336, *Wrought coppers (having minimum copper content of 97,5 %) — Chemical composition and forms of wrought products.*

ISO 1337, *Wrought coppers (having a minimum copper content of 99,85 %) — Chemical composition and forms of wrought products.*

2.4 Technical conditions of delivery

ISO 1634, *Wrought copper and copper alloy plate, sheet and strip*

- Part 2: *Technical conditions of delivery for plate and sheet for boilers, pressure vessels and heat-exchangers.*
- Part 3: *Technical conditions of delivery for strip for springs.*

2.5 Methods of test

2.5.1 Sampling

ISO 4739, *Wrought copper and copper alloy products — Selection and preparation of specimens and test pieces for mechanical testing.*

2.5.2 Tensile testing

ISO 6892, *Metallic materials — Tensile testing.*

2.5.3 Hardness testing

ISO 2712, *Copper and copper alloys — Rockwell superficial hardness test (N and T scales).*

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ISO 6507, *Metallic materials — Hardness test — Vickers test*

- Part 1: HV 5 to HV 100.
- Part 2: HV 0,2 to less than HV 5.

ISO 6508, *Metallic materials — Hardness test — Rockwell test (scales A — B — C — D — E — F — G — H — K).*

2.5.4 Estimation of grain size

ISO 2624, *Copper and copper alloys — Estimation of average grain size.*

2.5.5 Technological testing

ISO 7438, *Metallic materials — Bend test.*

ISO 7799, *Metallic materials — Sheet and strip 3 mm thick or less — Reverse bend test.*

ISO 8490, *Metallic materials — Sheet and strip — Modified Erichsen cupping test.*

2.5.6 Stress corrosion testing

ISO 196, *Wrought copper and copper alloys — Detection of residual stress — Mercury(I) nitrate test.*

ISO 6957, *Copper and copper alloys — Ammonia test for stress corrosion resistance.*¹⁾

2.6 Dimensional tolerances

ISO 3486, *Wrought copper and copper alloys — Cold rolled flat products delivered in lengths (sheet) — Dimensions and tolerances.*

ISO 3487, *Wrought copper and copper alloys — Cold-rolled flat products in coils or on reels (strip) — Dimensions and tolerances.*

3 Ordering information

The purchaser shall state on his inquiry and order the following information:

- a) quantity;
- b) designation of the material and temper required (see table 2);
- c) dimensions: thickness, width, length and — if necessary — the tolerances, as appropriate;
- d) the mandatory mechanical properties: hardness, tensile strength, grain size (see 4.2);
- e) in case of hardness, whether Vickers or Rockwell hardness is mandatory;

f) the tests to be carried out, including the details to be agreed upon, for example lot size, technological tests, stress corrosion tests (see clause 5).

4 Requirements

4.1 Chemical composition

The chemical composition shall comply with the requirements as specified in the International Standards referred to in table 1.

Table 1 — Chemical composition

Materials	Chemical composition in accordance with
Coppers	ISO 1336, ISO 1337
Copper-zinc alloys	ISO 426-1
Copper-tin alloys	ISO 427
Copper-nickel alloys	ISO 429
Copper-nickel-zinc alloys	ISO 430
Special copper alloys	ISO 1187

4.2 Mandatory mechanical properties

4.2.1 This part of ISO 1634 embodies the principle that either

- hardness or
- tensile strength and elongation

are generally sufficient to define the condition of the material. Exact conversion between tensile strength and hardness is not possible.

At the option of the purchaser, mandatory properties of the material may be either

- hardness or
- tensile strength and elongation,

but not both.

In case of hardness, it shall be indicated whether the Vickers or the Rockwell hardness test method is mandatory.

If mandatory properties are not specified by the purchaser, the supplier may choose to meet either

- hardness or
- tensile strength and elongation.

Mechanical properties are given in table 2.

Values shown in brackets are given for information only.

1) At present at the stage of draft.

Dimensional limitations which can have an effect on the properties are indicated. Plate, sheet and strip having thicknesses outside these ranges may not comply with the properties given in table 2.

4.2.2 Subject to agreement between the purchaser and the supplier, copper-zinc alloy plate, sheet and strip may be supplied in the stress-relieved condition and be subject to the stress corrosion test. The pieces subjected to this test shall not crack.

Should a lot of material fail the test, then the supplier shall have the option to restress relieve the lot and to resubmit it to all the relevant tests.

4.2.3 The elongation values listed are valid:

- a) for thickness over 2,5 mm based on gauge length $5,65 \sqrt{S_0} \cong A_{50}$;
- b) for thickness from 0,10 up to 2,5 mm based on
 - either a gauge length $11,3 \sqrt{S_0} \cong A_{10}$,
 - or a fixed gauge length of 50 mm $\cong A_{50}$.

The A_{50} values depend upon thickness. The given values are valid for a thickness range of 0,10 to 0,4 mm. The values increase slightly with increasing thickness. With a thickness equal to 2,5 mm, they are identical with those of A_{10} . For thickness over 2,5 mm, the A_{50} values are somewhat higher than the A_{10} values.

4.3 Dimensions and tolerances

For cold-rolled sheet and strip, the tolerances for thickness, width and length specified in ISO 3486 and ISO 3487 apply.

4.4 Surface quality

The plates, sheets and strips shall be clean, sound and free from injurious defects. Discoloration which is characteristic of proper heat treatment shall not be cause for rejection. A superficial film of residual light lubricant is normally present and is permissible, unless otherwise specified.

5 Methods of test

5.1 Sampling

Selection and preparation of test specimens and test pieces for mechanical testing shall be carried out in accordance with ISO 4739.

The lot size shall be subject to the agreement between supplier and purchaser.

If not otherwise specified, the rate of sampling for plate, sheet and strip shall be one test piece per lot for each of the tests referred to in 5.2 to 5.7, as appropriate.

5.2 Tensile testing

The test shall be carried out in accordance with ISO 6892.

5.3 Hardness testing

5.3.1 Vickers hardness

The test shall be carried out in accordance with ISO 6507-1 and ISO 6507-2, as appropriate.

5.3.2 Rockwell hardness

The test shall be carried out in accordance with ISO 2712 and ISO 6508, as appropriate.

5.4 Estimation of average grain size

The estimation shall be carried out in accordance with ISO 2624.

5.5 Technological testing

The technological tests and their requirements shall be agreed upon between supplier and purchaser, for example

- a) the bend test in accordance with ISO 7438;
- b) the reverse bend test in accordance with ISO 7799;
- c) the Erichsen cupping test in accordance with ISO 8490.

5.6 Stress corrosion test

If required, the test is only carried out on copper-zinc alloys as listed in table 2.

The method shall be the mercury(I) nitrate test according to ISO 196. Test pieces subjected to this test shall not crack. By agreement between supplier and purchaser, an ammonia test according to ISO 6957 may be specified instead of the mercury(I) nitrate test.

5.7 Retests

5.7.1 If both of the two test pieces which were originally taken from a lot fail to meet the specification for any reason, the lot shall be deemed not to comply with this part of ISO 1634.

5.7.2 If one of the two test pieces taken originally from the lot fails to meet the specification, for any reason, two further test pieces shall be taken. One of these two test pieces shall be taken from the plate, sheet or strip from which the failed test piece was originally taken, unless that plate, sheet or strip has been withdrawn from the lot by the supplier. The other test piece shall be taken from another sample from the same lot. All appropriate tests shall be carried out.

5.7.3 Should both of the new test pieces pass the tests, the lot represented by the test pieces shall be deemed to comply with this part of ISO 1634. Should either of the additional test pieces fail, then the lot represented by the test pieces shall be deemed not to comply with this part of ISO 1634.

Table 2 – Mandatory mechanical properties

Temper	Thickness mm	Mechanical properties					Hardness				Grain size
		Tensile strength R_m N/mm ²	0,2 Proof stress $R_{p0,2}$ N/mm ²	Elongation ¹⁾			Vickers HV	Rockwell ²⁾			
				A_5 % min.	A_{10} % min.	A_{50} % min.		F scale	B scale	Superficial 30 T	
Coppers (except CuCd1, CuCr1, CuCr1Zr)											
M ³⁾	min. 3	– 220	(– 80)	35	30	25	max. 82	max. 75	–	max. 41	–
O ³⁾	0,15 to 10	– 210	(– 80)	45	40	35	max. 70	max. 65	–	max. 31	–
HA	0,15 to 10	240 to 290	(min. 170)	15	12	8	70 to 100	64 to 87	–	18 to 51	–
HB	0,15 to 6	280 to 330	(min. 250)	8	5	–	85 to 115	80 to 89	–	44 to 57	–
HC	0,15 to 3	320 to 380	(min. 280)	–	–	–	100 to 130	87 to 95	–	55 to 64	–
HD	0,15 to 2	min. 350	(min. 320)	–	–	–	min. 110	min. 91	–	min. 60	–
CuZn5											
O	0,15 to 10	– 250	(– 85)	48	43	38	max. 70	max. 68	–	max. 23	–
OS25	0,15 to 10	– 250	(– 80)	48	43	38	max. 65	max. 61	–	max. 17	0,015 to 0,035
HA	0,15 to 5	250 to 320	(min. 140)	19	16	12	75 to 105	–	20 to 52	37 to 56	–
HB	0,15 to 5	310 to 370	(min. 280)	12	9	–	95 to 125	–	48 to 64	51 to 63	–
HC	0,15 to 3	350 to 410	(min. 330)	5	–	–	115 to 140	–	57 to 69	57 to 66	–
HD	0,15 to 2	min. 400	(min. 385)	–	–	–	min. 130	–	min. 67	min. 65	–
CuZn10											
O	0,15 to 10	– 290	(– 100)	48	43	38	max. 75	max. 75	–	max. 39	–
OS25	0,15 to 5	– 290	(– 100)	48	43	38	max. 70	max. 70	–	max. 31	0,015 to 0,035
OS35	0,15 to 5	– 290	(– 85)	50	45	40	max. 65	max. 64	–	max. 21	0,025 to 0,050
HA	0,15 to 5	280 to 350	(min. 200)	20	17	13	75 to 110	–	30 to 58	37 to 58	–
HB	0,15 to 5	330 to 400	(min. 260)	10	7	5	105 to 130	–	52 to 68	53 to 64	–
HC	0,15 to 3	390 to 450	(min. 350)	5	–	–	125 to 150	–	65 to 75	63 to 69	–
HD	0,15 to 2	min. 440	(min. 400)	–	–	–	min. 145	–	min. 72	min. 67	–
CuZn15											
O	0,15 to 10	– 320	(– 130)	48	43	38	max. 85	max. 79	–	max. 48	–
OS25	0,15 to 5	– 320	(– 130)	48	43	38	max. 75	max. 72	–	max. 34	0,015 to 0,035
OS35	0,15 to 5	– 300	(– 90)	50	45	40	max. 70	max. 66	–	max. 24	0,025 to 0,050
HA	0,15 to 5	305 to 370	(min. 190)	25	22	18	85 to 115	–	33 to 62	42 to 60	–
HB	0,15 to 5	350 to 420	(min. 290)	12	8	5	105 to 135	–	54 to 71	56 to 66	–
HC	0,15 to 3	410 to 490	(min. 360)	7	–	–	125 to 155	–	68 to 80	64 to 71	–
HD	0,15 to 2	480 to 560	(min. 430)	–	–	–	150 to 180	–	76 to 86	69,5 to 75	–
HE	0,15 to 2	min. 550	(min. 500)	–	–	–	min. 170	–	min. 84	min. 73	–
CuZn20											
O	0,15 to 10	– 320	(– 150)	50	45	40	max. 90	max. 83	–	max. 50	–
OS25	0,15 to 5	– 320	(– 150)	50	45	40	max. 80	max. 77	–	max. 42	0,015 to 0,035
OS35	0,15 to 5	– 315	(– 110)	55	50	45	max. 75	max. 72	–	max. 35	0,025 to 0,050
HA	0,15 to 5	320 to 390	(min. 170)	28	25	20	85 to 120	–	33 to 65	42 to 60	–
HB	0,15 to 5	380 to 450	(min. 290)	14	10	7	110 to 140	–	56 to 73	58 to 66	–
HC	0,15 to 3	440 to 500	(min. 360)	9	5	–	130 to 160	–	70 to 83	63 to 71	–
HD	0,15 to 2	min. 490	(min. 440)	–	–	–	min. 150	–	min. 80	min. 70	–

Table 2 — Mandatory mechanical properties (continued)

Temper	Thickness mm	Mechanical properties					Hardness				Grain size
		Tensile strength R_m N/mm ²	0,2 Proof stress $R_{p0,2}$ N/mm ²	Elongation ¹⁾			Vickers HV	Rockwell ²⁾			
				A_5 % min.	A_{10} % min.	A_{50} % min.		F scale	B scale	Superficial 30 T	
CuZn30											
O	0,15 to 10	— 360	(— 150)	55	50	45	max. 95	max. 85	—	max. 50	—
OS10	0,15 to 2	— 400	(— 200)	50	45	40	max. 95	max. 85	—	max. 50	max. 0,015
OS25	0,15 to 3	— 355	(— 145)	58	53	48	max. 82	max. 79	—	max. 42	0,015 to 0,035
OS35	0,15 to 5	— 325	(— 115)	60	55	50	max. 75	max. 76	—	max. 38	0,025 to 0,050
OS50	0,15 to 5	— 315	(— 105)	65	60	54	max. 70	max. 73	—	max. 35	0,035 to 0,070
OS70	0,15 to 5	— 310	(— 95)	69	64	58	max. 65	max. 67	—	max. 27	0,50 to 0,090
HA	0,15 to 5	350 to 420	(min. 200)	33	30	25	95 to 125	—	45 to 70	45 to 63	—
HB	0,15 to 5	410 to 490	(min. 300)	20	16	12	120 to 155	—	65 to 79	60 to 70	—
HC	0,15 to 3	480 to 560	(min. 430)	13	9	6	150 to 180	—	78 to 87	69 to 74	—
HD	0,15 to 3	550 to 640	(min. 500)	—	—	—	170 to 200	—	84 to 91	73 to 78	—
HE	0,15 to 2	min. 630	(min. 560)	—	—	—	min. 190	—	min. 89	min. 76	—
CuZn35/CuZn37											
O	0,15 to 10	— 360	(— 150)	53	48	43	max. 95	max. 85	—	max. 50	—
OS10	0,15 to 2	— 400	(— 200)	48	43	38	max. 95	max. 85	—	max. 50	max. 0,015
OS25	0,15 to 3	— 355	(— 145)	55	50	45	max. 82	max. 79	—	max. 42	0,015 to 0,035
OS35	0,15 to 5	— 325	(— 115)	58	53	48	max. 75	max. 76	—	max. 38	0,025 to 0,050
OS50	0,15 to 5	— 315	(— 105)	63	58	52	max. 70	max. 67	—	max. 30	0,035 to 0,070
HA	0,15 to 5	350 to 420	(min. 200)	31	28	23	95 to 125	—	45 to 70	45 to 63	—
HB	0,15 to 5	410 to 490	(min. 300)	18	14	10	120 to 155	—	65 to 79	60 to 70	—
HC	0,15 to 3	480 to 560	(min. 430)	11	7	5	150 to 180	—	78 to 87	69 to 74	—
HD	0,15 to 3	550 to 640	(min. 500)	—	—	—	170 to 200	—	84 to 91	73 to 78	—
HE	0,15 to 2	min. 630	(min. 560)	—	—	—	min. 190	—	min. 89	min. 76	—
CuSn4											
O	0,15 to 5	— 370	(— 190)	55	50	45	max. 100	max. 82	—	max. 55	—
HA	0,15 to 5	360 to 430	(min. 200)	30	25	20	95 to 135	—	45 to 71	48 to 65	—
HB	0,15 to 5	420 to 490	(min. 310)	21	16	12	130 to 160	—	67 to 81	63 to 70	—
HC	0,15 to 3	470 to 570	(min. 440)	12	9	6	150 to 180	—	77 to 89	67 to 76	—
HD	0,15 to 2	540 to 630	(min. 520)	7	5	—	170 to 200	—	85 to 92	74 to 78	—
HE	0,15 to 2	590 to 690	(min. 570)	—	—	—	190 to 220	—	91 to 97	77 to 81	—
HF	0,15 to 2	min. 670	(min. 640)	—	—	—	min. 210	—	min. 94	min. 80	—
CuSn5											
O	0,15 to 5	— 380	(— 200)	55	50	45	max. 105	max. 85	—	max. 57	—
HA	0,15 to 5	390 to 490	(min. 320)	23	18	14	110 to 165	—	57 to 83	59 to 72	—
HB	0,15 to 5	480 to 580	(min. 450)	15	12	9	160 to 190	—	81 to 91	70 to 77	—
HC	0,15 to 3	550 to 650	(min. 510)	7	5	—	180 to 210	—	89 to 94	76 to 80	—
HD	0,15 to 2	630 to 730	(min. 600)	—	—	—	200 to 230	—	92 to 98	78 to 82	—
HE	0,15 to 2	min. 700	(min. 670)	—	—	—	min. 220	—	min. 97	min. 81	—

Table 2 – Mandatory mechanical properties (continued)

Temper	Thickness mm	Mechanical properties					Hardness				Grain size
		Tensile strength R_m N/mm ²	0,2 Proof stress $R_{p0,2}$ N/mm ²	Elongation ¹⁾			Vickers HV	Rockwell ²⁾			
				A_5 % min.	A_{10} % min.	A_{50} % min.		F scale	B scale	Superficial 30 T	
CuSn6											
O	0,15 to 5	– 390	(– 210)	60	55	50	max. 110	max. 88	–	max. 59	–
HA	0,15 to 5	410 to 500	(min. 300)	30	25	22	110 to 165	–	57 to 83	59 to 72	–
HB	0,15 to 5	480 to 580	(min. 450)	20	15	11	160 to 190	–	81 to 91	70 to 77	–
HC	0,15 to 3	550 to 650	(min. 510)	10	8	5	180 to 210	–	89 to 94	76 to 80	–
HD	0,15 to 2	630 to 740	(min. 600)	6	–	–	200 to 230	–	92 to 98	78 to 82	–
HE	0,15 to 2	min. 720	(min. 690)	–	–	–	min. 220	–	min. 97	min. 81	–
CuSn8											
O	0,15 to 5	– 410	(– 250)	65	60	55	max. 115	max. 90	–	max. 61	–
HA	0,15 to 5	450 to 540	(min. 320)	33	28	22	120 to 170	–	64 to 85	62 to 74	–
HB	0,15 to 5	540 to 630	(min. 470)	20	15	11	170 to 200	–	85 to 94	74 to 78	–
HC	0,15 to 3	590 to 690	(min. 550)	10	7	–	190 to 220	–	91 to 97	77 to 81	–
HD	0,15 to 2	660 to 760	(min. 600)	–	–	–	210 to 240	–	94 to 99	80 to 84	–
HE	0,15 to 2	min. 740	(min. 680)	–	–	–	min. 230	–	min. 98	min. 82	–
CuNi9Sn2											
O	0,15 to 5	– 380	(– 170)	42	37	30	max. 115	max. 92	–	max. 58	–
HA	0,15 to 5	380 to 480	(min. 220)	17	12	8	100 to 150	–	55 to 79	52 to 68	–
HB	0,15 to 5	440 to 540	(min. 370)	6	–	–	140 to 180	–	73 to 84	64 to 72	–
HC	0,15 to 3	500 to 600	(min. 450)	–	–	–	160 to 190	–	81 to 88	70 to 75	–
HD	0,15 to 2	560 to 660	(min. 510)	–	–	–	180 to 210	–	84 to 92	72 to 77	–
HE	0,15 to 2	min. 610	(min. 560)	–	–	–	min. 195	–	min. 90	min. 75	–
CuNi25											
O	0,15 to 5	– 360	(– 200)	40	35	–	max. 100	max. 88	–	max. 54	–
CuNi18Zn20											
O	0,15 to 5	– 430	(– 190)	40	35	30	max. 115	max. 93	–	max. 64	–
OS15	0,15 to 5	– 430	(– 200)	40	35	30	max. 115	max. 93	–	max. 64	0,005 to 0,025
OS35	0,15 to 5	– 420	(– 170)	45	40	35	max. 105	max. 88	–	max. 53	0,025 to 0,050
HA	0,15 to 5	410 to 490	(min. 200)	24	19	15	105 to 155	–	55 to 76	53 to 68	–
HB	0,15 to 5	470 to 540	(min. 330)	15	11	7	140 to 170	–	72 to 83	64 to 72	–
HC	0,15 to 3	500 to 600	(min. 410)	7	–	–	160 to 190	–	79 to 88	69 to 76	–
HD	0,15 to 2	min. 560	(min. 510)	–	–	–	min. 180	–	min. 86	min. 73	–
CuNi18Zn27											
O	0,15 to 5	– 450	(– 200)	43	38	33	max. 120	max. 98	–	max. 65	–
OS15	0,15 to 5	– 450	(– 220)	43	38	33	max. 120	max. 98	–	max. 65	0,005 to 0,025
OS35	0,15 to 5	– 430	(– 180)	45	40	35	max. 115	max. 91	–	max. 57	0,025 to 0,050
HA	0,15 to 5	470 to 570	(min. 210)	20	15	11	120 to 180	–	65 to 85	60 to 73	–
HB	0,15 to 5	540 to 620	(min. 440)	13	8	5	170 to 220	–	81 to 90	72 to 77	–
HC	0,15 to 3	600 to 700	(min. 540)	–	–	–	190 to 220	–	88 to 95	76 to 79	–
HD	0,15 to 2	700 to 820	(min. 650)	–	–	–	220 to 250	–	95 to 99	79 to 82	–
HE	0,15 to 2	min. 750	(min. 700)	–	–	–	min. 230	–	min. 97	min. 80	–

Table 2 — Mandatory mechanical properties (continued)

Temper	Thickness mm	Mechanical properties					Hardness				Grain size
		Tensile strength R_m N/mm ²	0,2 Proof stress $R_{p0,2}$ N/mm ²	Elongation ¹⁾			Vickers HV	Rockwell ²⁾			
				A_5 % min.	A_{10} % min.	A_{50} % min.		F scale	B scale	Superficial 30 T	
CuNi15Zn21											
O	0,15 to 5	— 420	(— 160)	44	39	34	max. 110	max. 89	—	max. 55	—
OS15	0,15 to 5	— 420	(— 160)	44	39	34	max. 110	max. 89	—	max. 55	0,005 to 0,025
OS35	0,15 to 5	— 380	(— 140)	46	41	36	max. 90	max. 79	—	max. 43	0,025 to 0,050
HA	0,15 to 5	430 to 510	(min. 260)	20	15	11	110 to 150	—	58 to 75	56 to 67	—
HB	0,15 to 5	500 to 590	(min. 390)	10	5	—	140 to 180	—	72 to 86	64 to 73	—
HC	0,15 to 3	580 to 660	(min. 500)	—	—	—	170 to 210	—	83 to 93	72 to 78	—
HD	0,15 to 2	min. 650	(min. 610)	—	—	—	min. 200	—	min. 91	min. 77	—
CuNi12Zn24											
O	0,15 to 5	— 400	(— 180)	45	40	35	max. 110	max. 90	—	max. 56	—
OS15	0,15 to 5	— 400	(— 190)	45	40	35	max. 110	max. 90	—	max. 56	0,005 to 0,025
OS35	0,15 to 5	— 390	(— 160)	50	45	40	max. 90	max. 80	—	max. 44	0,025 to 0,050
HA	0,15 to 5	400 to 470	(min. 180)	27	22	18	100 to 150	—	53 to 75	50 to 67	—
HB	0,15 to 5	450 to 520	(min. 310)	18	13	9	140 to 170	—	72 to 83	64 to 72	—
HC	0,15 to 3	490 to 580	(min. 390)	8	5	—	160 to 190	—	79 to 88	69 to 76	—
HD	0,15 to 2	550 to 650	(min. 480)	—	—	—	180 to 210	—	86 to 93	73 to 78	—
HE	0,15 to 2	min. 620	(min. 550)	—	—	—	min. 200	—	min. 91	min. 77	—
CuNi12Zn29											
O	0,15 to 5	— 440	(— 170)	45	40	35	max. 115	max. 90	—	max. 58	—
OS15	0,15 to 5	— 440	(— 180)	45	40	35	max. 115	max. 90	—	max. 58	0,05 to 0,025
OS35	0,15 to 5	— 410	(— 150)	50	45	40	max. 90	max. 80	—	max. 44	0,025 to 0,050
HA	0,15 to 5	450 to 550	(min. 245)	16	10	7	130 to 180	—	68 to 86	62 to 73	—
HB	0,15 to 5	510 to 620	(min. 245)	8	5	—	170 to 200	—	83 to 91	72 to 77	—
HC	0,15 to 3	600 to 720	(min. 530)	—	—	—	190 to 220	—	88 to 95	76 to 79	—
HD	0,15 to 2	670 to 790	(min. 620)	—	—	—	210 to 240	—	93 to 98	78 to 81	—
HE	0,15 to 2	min. 720	(min. 660)	—	—	—	min. 230	—	min. 97	min. 80	—

Table 2 — Mandatory mechanical properties (concluded)

Temper ⁴⁾	Thickness mm	Mechanical properties			Hardness				
		Tensile strength R_m N/mm ²	0,2 Proof stress $R_{p0,2}$ N/mm ²	Elongation ⁵⁾ A_{50} % min.	Vickers HV	Rockwell ⁶⁾			Superficial 30 N
						B scale	C scale	Superficial 30 T	
CuBe1,7									
TB 00	0,1 to 2,0	390 to 540	180	35	80 to 140	45 to 78	—	46 to 69	—
TF 00	0,1 to 2,0	1 030 to 1 240	900	3	330 to 380	—	33 to 38	—	53 to 58
TD 01	0,1 to 2,0	500 to 600	350	10	120 to 180	68 to 90	—	62 to 75	—
TH 01	0,1 to 2,0	1 100 to 1 310	930	2	340 to 390	—	35 to 40	—	55 to 59
TD 02	0,1 to 2,0	580 to 690	450	5	180 to 225	88 to 96	—	74 to 79	—
TH 02	0,1 to 2,0	1 170 to 1 380	1 000	1	350 to 410	—	37 to 42	—	56 to 60
TD 04	0,1 to 2,0	680 to 830	650	2	215 to 260	96 to 102	—	79 to 83	—
TH 04	0,1 to 2,0	1 240 to 1 450	1 070	1	360 to 430	—	39 to 44	—	58 to 63
CuBe2									
TB 00	0,1 to 2,0	410 to 540	190	35	90 to 140	45 to 78	—	45 to 67	—
TF 00	0,1 to 2,0	1 140 to 1 340	970	3	350 to 400	—	36 to 41	—	56 to 61
TD 01	0,1 to 2,0	520 to 610	410	10	120 to 180	69 to 90	—	62 to 75	—
TH 01	0,1 to 2,0	1 210 to 1 410	1 030	2	360 to 410	—	38 to 43	—	58 to 63
TD 02	0,1 to 2,0	590 to 690	520	5	180 to 225	88 to 96	—	74 to 79	—
TH 02	0,1 to 2,0	1 270 to 1 480	1 100	1	370 to 430	—	39 to 44	—	59 to 63
TD 04	0,1 to 2,0	690 to 830	620	2	215 to 260	96 to 102	—	79 to 83	—
TH 04	0,1 to 2,0	1 310 to 1 500	1 140	1	380 to 450	—	40 to 45	—	60 to 65
TM 04	0,1 to 1,0	930 to 1 040	790	8	300 to 345	—	30 to 35	—	50 to 55
TM 06	0,1 to 1,0	1 100 to 1 250	1 000	3	345 to 390	—	32 to 38	—	52 to 58
CuCo2Be									
TB 00	0,1 to 2,0	250 to 380	140	20	60 to 95	20 to 50	—	35 to 50	—
TF 00	0,1 to 2,0	650 to 830	500	8	195 to 230	92 to 100	—	77 to 82	—
TD 04	0,1 to 2,0	480 to 590	400	2	145 to 185	70 to 80	—	69 to 75	—
TF 04	0,1 to 2,0	750 to 900	650	6	220 to 270	96 to 102	—	79 to 82	—

- 1) For relation between gauge length and thickness, see clause 4.2.3.
- 2) The Rockwell hardness values listed are valid
 - for thickness from 0,3 up to and including 0,7 mm: superficial 30 T;
 - for thickness over 0,5 mm: B scale;
 - for temper M, O and OS: F scale.
- 3) Not for CuAg.
- 4) Temporary temper designations
 - TB: Solution heat treated
 - TD: Solution heat treated and cold worked
 - TF: Solution heat treated and precipitation heat treated
 - TH: Solution heat treated, cold worked and precipitation heat treated
 - TM: Mill hardened
 - Suffixes to TD, TH, TM: 01 = 1/4 hard, 02 = 1/2 hard, 04 = hard, 06 = extrahard.
- 5) The elongation values listed are based on a fixed gauge length of 50 mm: A_{50} .
- 6) The Rockwell hardness values listed are valid
 - for thickness from 0,4 up to and including 0,8 mm: superficial 30 T or 30 N;
 - for thickness over 0,8 mm: B scale or C scale.

UDC 669.3-41

Descriptors : wrought products, copper products, metal plates, sheet metal, strips, specifications.

Price based on 8 pages
