

Copper

Chemical Composition

Designation of the material			Composition in % (mass fraction)																		Other elements	
Classification of symbols	Numerical classification	European Standard (EN)	Min. Cu	Max. Bi	Max. O	Min. P	Max. P	Min. Be	Max. Be	Max. Co	Min. Fe	Max. Fe	Max. Ni	Min. Mn	Max. Mn	Max. Pb	Min. Sn	Max. Sn	Min. Zn	Max. Zn	total max.	excluding
Cu-ETP	CW004 A	EN 1652	99.90	0.0005	0.04	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	0.03	Ag, O
Cu-OF	CW008 A	EN 1652	99.95	0.0005	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	0.03	Ag
Cu-PHC	CW020 A	EN 13599	99.95	0.0005	-	-	0.001	0.006	-	-	-	-	-	-	-	0.0	-	-	-	-	0.03	Ag, P
Cu-DHP	CW024 A	EN 1652	99.90	-	-	0.015	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CuFe2P	CW107 C	EN 1654	Rest	-	-	0.015	0.15	-	-	-	2.1	2.6	-	-	-	C	-	-	0.05	0.20	0.2	-
CuNi2Si	CW111 C	EN 1654	Rest	-	-	-	-	-	-	-	-	0.2	-	0.1	1.6	0.02	0.4	0.8	-	-	0.3	-
CuBe2	CW101 C	EN 1654	Rest	-	-	-	-	1.8	2.1	0.3	-	0.2	0.3	-	-	-	-	-	-	-	0.5	-

Equivalents

Classification of symbols	Numerical classification	European Standard (EN)	Approximate international equivalents		
			US (AISI)	Japan (JIS)	China (GB)
Cu-ETP	CW004A	EN 1652	C11000	C	1100
Cu-OF	CW008A	EN 1652			
Cu-PHC	CW020A	EN 13599			
Cu-DHP	CW024A	EN 1652			
CuFe2P	CW107C	EN 1654			
CuNi2Si	CW111C	EN 1654	C64700	-	
CuBe2	CW101C	EN 1654			

Mechanical properties

MECHANICAL PROPERTIES EN 1652

Designations		Tensile strength Rm	Conventional yield strength at 0.2% Rp _{0,2}		Elongation		HV hardness		
					N/mm ²				A _{50mm} for thicknesses up to 2.5 mm
Material		Metallurgical condition	min.	max.	N/mm ²	min.	min.	min.	max.
Classification of symbols	Numerical classification								
Cu-DHP	CW024A	R200	200	250	(max. 100)	-	42	-	-
		H040	-	-	-	-	-	40	65
		R220	220	260	(max. 140)	33	42	-	-
		H040	-	-	-	-	-	40	65
		R240	240	300	(max. 180)	8	15	-	-
		H065	-	-	-	-	-	65	95
		R290	290	360	(max. 250)	4	6	-	-
		H090	-	-	-	-	-	90	110
		R360	360	-	(max. 320)	2	-	-	-
		H110	-	-	-	-	-	110	-

NOTE 2- The numbers in brackets are not standard requirements, they are given for information purposes only.

MECHANICAL PROPERTIES EN 1654

Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp _{0.2}		Elongation		HV hardness		Minimum bend radius according to bend edge				
		N/mm ²		N/mm ²		A _{50mm}				Parallel to the direction of rolling for thicknesses		Perpendicular to the direction of rolling for thicknesses		
Material	Metallurgical condition	min.	max.	min.	max.	% for thicknesses from 0.1 mm to 0.25 mm inclusive	% for thicknesses above 0.25 mm to 1.0 mm inclusive	min.	max.	up to 0.25 mm inclusive	over 0.25 mm	up to 0.25 mm inclusive	over 0.25 mm	
		Symbolic	Numerical			min.	min.							
CuFe2P	CW107C	R340	340	390	(240)	-	8	10	-	-	-	-	-	-
		H100	-	-	-	-	-	-	100	120	0 x t	0 x t	0 x t	0 x t
		R370	370	430	(330)	-	4	6	-	-	-	-	-	-
		H120	-	-	-	-	-	-	120	140	0 x t	1 x t	0 x t	1 x t
		R420	420	480	(380)	-	-	3	-	-	-	-	-	-
		H130	-	-	-	-	-	-	130	150	1 x t	2 x t	1 x t	2 x t
		R470	470	-	(440)	-	-	-	-	-	-	-	-	-
		H140	-	-	-	-	-	-	140	-	-	-	-	-
		R430	430	520	(330)	-	10	13	-	-	-	-	-	-
		H125	-	-	-	-	-	-	125	155	0 x t	1.5 x t	0 x t	1 x t
CuNi2Si	CW111C	R450	450	600	(360)	-	3	5	-	-	-	-	-	
		H130	-	-	-	-	-	-	130	180	1.5 x t	2.5 x t	0 x t	1.5 x t
		R510	510	600	(450)	-	7	10	-	-	-	-	-	-
		H130	-	-	-	-	-	-	130	180	1.5 x t	2.5 x t	0 x t	1.5 x t

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2		Elongation		HV hardness		Minimum bend radius according to bend edge			
		N/mm ²		N/mm ²		A ₅₀ mm				Parallel to the direction of rolling for thicknesses		Perpendicular to the direction of rolling for thicknesses	
Material	Metallurgical condition	min.	max.	min.	max.	% for thicknesses from 0.1 mm to 0.25 mm inclusive	% for thicknesses above 0.25 mm to 1.0 mm inclusive	min.	max.	up to 0.25 mm inclusive	over 0.25 mm	up to 0.25 mm inclusive	over 0.25 mm
		Symbolic	Numerical			min.	min.						
		H150	-	-	-	-	-	150	180	1.5 x t	2.5 x t	0 x t	1.5 x t
		R600	600	-	(550)	-	5	8	-	-	-	-	-
		H180	-	-	-	-	-	180	-	2 x t	-	0 x t	-
		R410	410	530	-	-	35	35	-	-	-	-	-
		H090	-	-	-	-	-	90	150	0 x t	0 x t	0 x t	0 x t
		Y190	-	-	190	(380)	35	35	-	-	-	-	-
		R1130	1130	1350	-	-	3	3	-	-	-	-	-
		H350	-	-	-	-	-	350	410	-	-	-	-
		Y960	-	-	960	(1210)	3	3	-	-	-	-	-
		B770	-	-	-	-	-	(350)	(410)	-	-	-	-
		R510	510	610	-	-	15	15	-	-	-	-	-
		H120	-	-	-	-	-	120	190	1 x t	1 x t	0 x t	0 x t
		Y410	-	-	410	(560)	15	15	-	-	-	-	-
		R1190	1190	1420	-	-	3	3	-	-	-	-	-
		H360	-	-	-	-	-	360	430	-	-	-	-
		Y1020	-	-	1020	(1280)	3	3	-	-	-	-	-
		B820	-	-	-	-	-	(360)	(430)	-	-	-	-

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2		Elongation		HV hardness		Minimum bend radius according to bend edge				
		N/mm ²		N/mm ²		A ₅₀ mm				Parallel to the direction of rolling for thicknesses		Perpendicular to the direction of rolling for thicknesses		
Material	Metallurgical condition	min.	max.	min.	max.	% for thicknesses from 0.1 mm to 0.25 mm inclusive	% for thicknesses above 0.25 mm to 1.0 mm inclusive	min.	max.	up to 0.25 mm inclusive	over 0.25 mm	up to 0.25 mm inclusive	over 0.25 mm	
						min.	min.							
Symbolic	Numerical													
CuBe2	CW101C	R580	580	690	-	-	8	8	-	-	-	-	-	-
		H170	-	-	-	-	-	-	170	220	2 x t	2 x t	1 x t	1 x t
		Y510	-	-	510	(660)	8	8	-	-	-	-	-	-
		R1270	1270	1490	-	-	-	-	-	-	-	-	-	-
		H370	-	-	-	-	-	-	370	440	-	-	-	-
		Y1100	-	-	1100	(1350)	-	-	-	-	-	-	-	-
		B880	-	-	-	-	-	-	(370)	(440)	-	-	-	-
		R680	680	830	-	-	2	2	-	-	-	-	-	-
		H220	-	-	-	-	-	-	220	290	3 x t	3 x t	1.5 x t	1.5 x t
		Y620	-	-	620	(800)	2	2	-	-	-	-	-	-
		R1310	1310	1520	-	-	-	-	-	-	-	-	-	-
		H380	-	-	-	-	-	-	380	450	-	-	-	-
		Y1130	-	-	1130	(1420)	-	-	-	-	-	-	-	-
		B920	-	-	-	-	-	-	(380)	(450)	-	-	-	-
		R690	690	760	-	-	16	16	-	-	-	-	-	-
		H210	-	-	-	-	-	-	210	250	0.8 x t	0.8 x t	0.8 x t	0.8 x t

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2		Elongation		HV hardness		Minimum bend radius according to bend edge				
		N/mm ²		N/mm ²		A ₅₀ mm				Parallel to the direction of rolling for thicknesses		Perpendicular to the direction of rolling for thicknesses		
Material	Metallurgical condition	min.	max.	min.	max.	% for thicknesses from 0.1 mm to 0.25 mm inclusive	% for thicknesses above 0.25 mm to 1.0 mm inclusive	min.	max.	up to 0.25 mm inclusive	over 0.25 mm	up to 0.25 mm inclusive	over 0.25 mm	
						min.	min.							
Symbolic	Numerical													
		Y480	-	-	480	(660)	16	16	-	-	-	-	-	-
		B400	-	-	-	-	-	-	(210)	(250)	0.8 x t	0.8 x t	0.8 x t	0.8 x t
		R750	750	830	-	-	15	15	-	-	-	-	-	-
		H230	-	-	-	-	-	-	230	280	1 x t	1 x t	1 x t	1 x t
		Y550	-	-	550	(760)	15	15	-	-	-	-	-	-
		B500	-	-	-	-	-	-	(230)	(280)	1 x t	1 x t	1 x t	1 x t
		R820	820	930	-	-	12	12	-	-	-	-	-	-
		H250	-	-	-	-	-	-	250	310	1.3 x t	1.3 x t	1.3 x t	1.3 x t
		Y650	-	-	650	(870)	12	12	-	-	-	-	-	-
		B530	-	-	-	-	-	-	(250)	(310)	1.3 x t	1.3 x t	1.3 x t	1.3 x t
		R930	930	1040	-	-	9	9	-	-	-	-	-	-
		H280	-	-	-	-	-	-	280	350	2.5 x t	2.5 x t	2.5 x t	2.5 x t
		Y750	-	-	750	(940)	9	9	-	-	-	-	-	-
		B600	-	-	-	-	-	-	(280)	(350)	2.5 x t	2.5 x t	2.5 x t	2.5 x t
		R1060	1060	1250	-	-	4	4	-	-	-	-	-	-
		H310	-	-	-	-	-	-	310	400	4 x t	4 x t	3 x t	3 x t
		Y930	-	-	930	(1180)	4	4	-	-	-	-	-	-

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2		Elongation		HV hardness		Minimum bend radius according to bend edge			
		N/mm ²		N/mm ²		A ₅₀ mm				Parallel to the direction of rolling for thicknesses		Perpendicular to the direction of rolling for thicknesses	
Material	Metallurgical condition	min.	max.	min.	max.	% for thicknesses from 0.1 mm to 0.25 mm inclusive	% for thicknesses above 0.25 mm to 1.0 mm inclusive	min.	max.	up to 0.25 mm inclusive	over 0.25 mm	up to 0.25 mm inclusive	over 0.25 mm
		Symbolic	Numerical			min.	min.						
		B760	-	-	-	-	-	(310)	(400)	4 x t	4 x t	3 x t	3 x t
		R1200	1200	1320	-	-	3	3	-	-	-	-	-
		H360	-	-	-	-	-	360	420	6 x t	6 x t	4 x t	4 x t
		Y1030	-	-	1030	(1250)	3	3	-	-	-	-	-
		B780	-	-	-	-	-	(360)	(420)	6 x t	6 x t	4 x t	4 x t

NOTE 2- The numbers in brackets are not standard requirements, they are given for information purposes only.

MECHANICAL PROPERTIES EN 13599

Designations		Nominal thickness t ^{a)}		HV hardness		Tensile strength Rm		Conventional yield strength of 0.2% Rp _{0.2}		Elongation			
		mm				N/mm ²		N/mm ²		A _{50mm} for thicknesses from 0.1 to 2.5 mm inclusive %	A for thicknesses above 2.5 mm %		
Material		Metallurgical condition	from	up to & including	min.	max.	min.	max.	min.			max.	min.
Symbolic	Numerical												
Cu-ETP b) Cu-OF Cu-PHC	CW004A CW008A CW020A	H040	0.10	5	40	65	-	-	-	-	-	-	
		R220	-	-	-	-	-	220	260	-	(140)	33	42
		H040	0.20	10	40	65	-	-	-	-	-	-	-
		R200	-	-	-	-	-	200	250	-	(100)	-	42
		H065	0.10	10	65	95	-	-	-	-	-	-	-
		R240	-	-	-	-	-	240	300	180	-	8	15
		H090	0.10	10	90	110	-	-	-	-	-	-	-
		R290	-	-	-	-	-	290	360	250	-	4	6
		H110	0.10	2	110	-	-	-	-	-	-	-	-
		R360	-	-	-	-	-	360	-	320	-	2	-

NOTE 2- The numbers in brackets are not standard requirements, they are given for information purposes only.

a) For thicknesses below 0.10 mm the mechanical properties must be agreed between the customer and the supplier..

b) For CU-ETP (CW004A) with thicknesses between 0.10mm and 0.20mm, both inclusive, the following values must be applied: Rm min. 200 N/mm² and A_{50mm} min 28%

Finishes

BARE MATERIAL

The strips must be clean and free of detrimental defects, which must be specified by agreement between the customer and the supplier when requesting the quote and in the order. Normally, a small residual layer of lubricant is left on cold-rolled products, which is authorised unless otherwise specified.

ROUGHNESS EN 1654

This must be agreed between the customer and the supplier when requesting the quote and confirming the order.

SURFACE CONDITION EN 13599

The strips must be clean and free of detrimental defects, which must be specified by agreement between the customer and the supplier in the request for quotes and in the order. Normally, a small residual layer of lubricant is left on cold-drawn products, and this is acceptable unless otherwise specified. Discolouration is acceptable, provided that it is not detrimental to the use of the product .

TIN COATINGS

Tin coatings for strips and copper strips and copper alloys:

Type of coating	Standard
Electrolytic	EN 14436
Hot dip	EN 13148

ELECTROLYTIC TINNING EN 14436

ELECTROLYTIC TIN PROCESS TYPES AND TYPES OF TIN COATINGS AND TIN ALLOYS EN 14436

Process	Description
Process for matt electrolytic coatings.	This is the standard finish of a traditional electrolytic bath.
Process for bright electrolytic coatings.	Coatings with a bright appearance are obtained using baths that contain one or more suitable brightening agents (brighteners). Their presence may not be desirable in subsequent melting or soft soldering processes. Furthermore, they may be beneficial for frictional properties (low friction or sliding contacts).
Process for flow-brightened electrolytic coatings.	Flow-brightened electrolytic coatings are obtained by heating a matt electrolytic coating above its melting point for a few seconds and then cooling it. The coatings preserve their sheen after cooling. In practice, flow brightening is not used for coatings with thicknesses above 5 µm (slip risk) or for coatings that are already bright.

NOTE - Tin electrolytic coatings may experience a spontaneous growth of metallic filaments (the combined effect of humidity and mechanical stresses, for example). This phenomenon is highly undesirable for electrotechnical applications (risk of short circuit). The risk of this happening can be reduced by flow brightening, using tin-lead alloy coatings or inserting a suitable sublayer.

TYPES OF STEEL ELECTROLYTIC COATINGS AND TIN ALLOYS ACCORDING TO APPLICABLE EN 14436

Coating thickness μm		Types of coatings		
min.	max.	Sn bright (Snb)	Sn matt (Snm)	Sn flow-brightened (Snf)
	1	As	N/A	As
0.8	1.2	As	N/A	*
1.5	2.5	B	As	B - R
2	4	B - C	R	B - R
3	6	B - C	R	N/A
5		B - C	R - C	N/A

NOTE 1: Applications:

- N/A: not applicable
- B: improves the suitability for soft soldering
- *: reduction of frictional forces
- C: corrosion resistance
- R: reduction of electrical resistance on a contact
- As: improved appearance

NOTE 2: These typical values are for information purposes and can be replaced by agreement between the customer and the supplier.

COMPOSITION OF THE TIN AND TIN ALLOYS EN 14436

Type of coating	Designation of the material	Composition in % (mass fraction)	
		Min. Sn	Others, total
Sn bright (Snb)	Sn99	99	Remainder
Sn matt (Snm) or Sn flow-brightened (Snf)	Sn99.50	99.5	Remainder

HOT DIP EN 13148

APPEARANCE EN 13148. HOT DIP TINNING

Thicknesses (average values) and preferred thickness ranges for coatings:

Thickness µm	Thickness range		Application
	µm		
	from	up to and included	
1.45	0.7	2.2	Preventing surface oxidation, decorative appearance, reducing frictional forces.
2	1	3	Preventing surface oxidation, decorative appearance, reducing frictional forces.
3.5	2	5	Preventing corrosion
5	3	7	Extending the useful life
7.5	5	10	To aid soft soldering
10	7	13	To aid soft soldering

The appearance depends on the type of liquid film cooling, the type of coating and the technique used to remove excess molten metal. The surface may have a bright or matt appearance, or a combination of both. The appearance of the coating does not affect its suitability. If there are special requirements for the appearance of the coating, these requirements must be agreed at the time of the quote and/or order.

Tolerances

THICKNESS TOLERANCES EN 13599 / EN 1652

Nominal thickness		Thickness tolerance for nominal widths according to EN 13599/ EN 1652					
>	≤	10 < and ≤ 200		200 < and ≤ 350	350 < and ≤ 700	700 < and ≤ 1000	1000 < and ≤ 1250
		normal (Class A)	special (Class B)				
0.05 ¹⁾	0.1	± 10% ²⁾	-	-	-	-	-
0.1	0.2	± 0.010	± 0.007	± 0.015	-	-	-
0.2	0.3	± 0.015	± 0.010	± 0.020	± 0.03	± 0.04	-
0.3	0.4	± 0.018	± 0.012	± 0.022	± 0.04	± 0.05	± 0.07
0.4	0.5	± 0.020	± 0.015	± 0.025	± 0.05	± 0.06	± 0.08
0.5	0.8	± 0.025	± 0.018	± 0.030	± 0.06	± 0.07	± 0.09
0.8	1.2	± 0.030	± 0.022	± 0.040	± 0.07	± 0.09	± 0.10
1.2	1.8	± 0.035	± 0.028	± 0.06	± 0.08	± 0.10	± 0.11
1.8	2.5	± 0.045	± 0.035	± 0.07	± 0.09	± 0.11	± 0.13
2.5	3.2	± 0.055	± 0.040	± 0.08	± 0.10	± 0.13	± 0.17
3.2	4.0	-	-	± 0.10	± 0.12	± 0.15	± 0.20
4.0	5.0	-	-	± 0.12	± 0.14	± 0.17	± 0.23
5.0	6.0	-	-	± 0.14	± 0.16	± 0.20	± 0.26

Measurements in mm.

1) Including the value 0.05.

2) ± 10% of the nominal thickness

Nominal thickness t		Standard slitting tolerances for Metalle Schmidt ²⁾				Width tolerances for nominal widths according to EN 13599/ EN 1654																				
<	≤	3-15	15-50	50-150	>150	up to & including 50	over 50 and up to 100 inclusive	over 100 and up to 200 inclusive	over 200 and up to 350 inclusive	over 350 and up to 500 inclusive	over 500 and up to 700 inclusive	over 700 and up to 1250 inclusive	2,5	3	on request	on request	0;+0,3 2	0;+0,3 5	0;+1,0	0;+1,1	0;+1,2	0;+1,5	0;+2,0	0;+2,5	0;+3,0	
3	5	on request	on request	0;+0,3 2	0;+0,3 5	0;+2,0	0;+2,3	0;+2,5	0;+3,0	0;+4,0	0;+5,0	0;+6,0														

Measurements in mm.

1) Including the value t=0.05

2) Other, closer dimensional tolerances are possible under a commercial agreement .

3) Including the value t=0,1

LENGTH TOLERANCES 13599

Length tolerances of thick sheets, thin sheets and strips in cut lengths of up to 5000mm.

Length	Nominal thickness	Length tolerance
Without rolling (M)	up to & including 25	±50
	5 and above	0; +10
Fixed length (F)	over 5 and up to 10 inclusive	0; +15

Measurements in mm.

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EDGE CAMBER TOLERANCES

Nominal width (W)	Edge curve tolerances under commercial agreement		Edge curve tolerances according to the EN 13599 Standard				
	Maximum deviation 1000 mm Thickness (t)		Maximum deviation 1000 mm Thickness (t)				
	t ≤ 1.20 mm	t > 1.20 mm	t ≤ 0.5 mm	0.5 < t ≤ 1.20 mm	1.20 < t ≤ 2.50 mm	2.50 < t ≤ 3.20 mm	3.20 < t ≤ 5.00 mm
3 ≤ W < 6	2.50	4.00	-	-	-	-	-
6 < W ≤ 10	2.00	3.00	-	-	-	-	-
10 < W ≤ 15	1.00	1.50	7.00 ¹⁾	10.00	-	-	-
15 < W ≤ 20	1.00	1.50	4.00	6.00	8.00	-	-
20 < W ≤ 30	0.50	1.00	4.00	6.00	8.00	-	-
30 < W ≤ 50	0.50	1.00	3.00	4.00	6.00	7.00	*under a commercial agreement
50 < W ≤ 350	0.50	1.00	2.00	3.00	4.00	5.00	
350 < W ≤ 1250	-	-	2.00	3.00	4.00	5.00	

Measurements in mm.

1) Including nominal width 10mm.