

# Bronze

## Chemical Composition

Designation			Chemical composition in % (mm)										
			Min. Cu	Max. Fe	Max. Ni	Min. P	Max. P	Max. Pb	Min. Sn	Max. Sn	Min. Zn	Max. Zn	Others total max.
Classification of symbols	Numerical classification	European Standard (EN)											
CuSn4	CW450K	EN 1652/1654	Rest	0.1	0.2	0.01	0.4	0.02	3.5	4.5	-	0.2	0.2
CuSn6	CW452K	EN 1652/1654	Rest	0.1	0.2	0.01	0.4	0.02	5.5	7.0	-	0.2	0.2
CuSn8	CW453K	EN 1652/1654	Rest	0.1	0.2	0.01	0.4	0.02	7.5	8.5	-	0.2	0.2
CuSn3Zn9	CW454K	EN 1654	Rest	0.1	0.2	-	0.2	0.10	1.5	3.5	7.5	10.0	0.2

## Equivalents

Classification of symbols	Numerical classification	European Standard (EN)	APPROXIMATE INTERNATIONAL EQUIVALENTS		
			US (AISI)	Japan (JIS)	China (GB)
CuSn4	CW450K	EN 1652/1654			
CuSn6	CW452K	EN 1652/1654	C51900	C 5191	
CuSn8	CW453K	EN 1652/1654			
CuSn3Zn9	CW454K	EN 1654	C42500		

## Mechanical properties

**MECHANICAL PROPERTIES EN 1652 / EN 1654**

Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp <sub>0.2</sub>	Elongation		HV hardness			
		N/mm <sup>2</sup>			A <sub>50mm</sub> for thicknesses up to 2.5 mm (inclusive) %	A for thicknesses above 2.5 mm %				
Material		Metallurgical condition	min.	max.	N/mm <sup>2</sup>	min.	min.	min.	max.	
Classification of symbols	Numerical classification									
CuSn4	CW450K	R290	290	390	(max. 190)	40	50	-	-	
		H070	-	-	-	-	-	-	70	100
		R390	390	490	(min. 210)	11	13	-	-	
		H115	-	-	-	-	-	-	115	155
		R480	480	570	(min. 420)	4	5	-	-	
		H150	-	-	-	-	-	-	150	180
		R540	540	930	(min. 490)	3	-	-	-	
		H170	-	-	-	-	-	-	170	200
		R610	610	-	(min. 540)	-	-	-	-	
		H190	-	-	-	-	-	-	190	-
		H350	350	420	(max. 300)	45	55	-	-	
		H080	-	-	-	-	-	-	80	110
R420	420	520	(min. 260)	17	20	-	-			
H125	-	-	-	-	-	-	125	165		

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2	Elongation		HV hardness		
		N/mm <sup>2</sup>			A <sub>50mm</sub> for thicknesses up to 2.5 mm (inclusive) %	A for thicknesses above 2.5 mm %			
Material		Metallurgical condition	min.	max.	N/mm <sup>2</sup>	min.	min.	min.	max.
Classification of symbols	Numerical classification								
CuSn6	CW452K	R500	500	590	(min. 450)	8	10	-	-
		H160	-	-	-	-	-	160	190
		R560	560	650	(min. 500)	5	-	-	-
		H180	-	-	-	-	-	180	210
		R640	640	730	(min. 600)	3	-	-	-
		H200	-	-	-	-	-	200	230
		R720	720	-	(min. 690)	-	-	-	-
		H220	-	-	-	-	-	220	-
		R370	370	450	(max. 300)	50	60	-	-
		H90	-	-	-	-	-	90	120
CuSn8	CW453K	R450	450	550	(min. 280)	20	23	-	-
		H135	-	-	-	-	-	136	175
		R640	540	630	(min. 460)	13	16	-	-
		H170	-	-	-	-	-	170	200
		R600	600	690	(min. 530)	5	7	-	-
		H190	-	-	-	-	-	190	220
		R660	660	750	(min. 620)	3	-	-	-
		H210	-	-	-	-	-	210	240

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Designations		Tensile strength Rm		Conventional yield strength at 0.2% Rp0.2	Elongation		HV hardness			
		N/mm <sup>2</sup>			A <sub>50</sub> mm for thicknesses up to 2.5 mm (inclusive) %	A for thicknesses above 2.5 mm %				
Material		Metallurgical condition	min.	max.	N/mm <sup>2</sup>	min.	min.	min.	max.	
Classification of symbols	Numerical classification									
		R740	740	-	(min. 700)	2	-	-	-	
		H230	-	-	-	-	-	230	-	
CuSn3Zn9	CW454K	R430	430	520	(330)	6	8	-	-	
		H140	-	-	-	-	-	140	170	
		R510	510	600	(430)	3	5	-	-	
		H160	-	-	-	-	-	-	160	190
		R580	580	690	(520)	-	2	-	-	
		H180	-	-	-	-	-	-	180	210
		R660	660	-	(610)	-	-	-	-	
		H200	-	-	-	-	-	-	200	8

NOTE 1- The numbers in brackets are not requirements of the standard and are given for information purposes only.

## 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 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 occurring 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 $\mu\text{m}$		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
- \*: reduces 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	Thickness range		Application
µm	µm		
average value	from	up to & including	
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 <sup>1)</sup>	0.1	± 10% <sup>2)</sup>	-	-	-	-	-
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

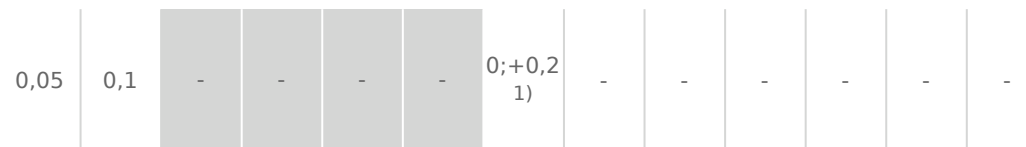
## THICKNESS TOLERANCE FOR COATED MATERIAL

EN 13148. The thickness of the tinned strip must meet the required combination of tolerances for the thickness of the strip (table above) and the range of thicknesses of the coatings ordered, for both sides.

EN 14436. The thickness of the strip prior to tinning must be in accordance with the approximate tolerances given in the table above. The thickness tolerance of the tinned strip must take into account the minimum and maximum thicknesses of the coating.

## WIDTH TOLERANCES OF THE STRIPS

Nominal thickness t		Standard slitting tolerances for Metalle Schmidt <sup>2)</sup>				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
0,1	0,2	0;+0,1 5 <sup>3)</sup>	0;+0,1 5 <sup>3)</sup>	0;+0,1 5 <sup>3)</sup>	0;+0,2 3)	0;+0,2	0;+0,3	0;+0,4	0;+0,6	0;+1,0	0;+1,5	0;+2,0
0,2	0,4	0;+0,1 5	0;+0,1 5	0;+0,1 5	0;+0,2	0;+0,2	0;+0,3	0;+0,4	0;+0,6	0;+1,0	0;+1,5	0;+2,0
0,4	1	0;+0,1 7	0;+0,1 8	0;+0,2	0;+0,2 4	0;+0,2	0;+0,3	0;+0,4	0;+0,6	0;+1,0	0;+1,5	0;+2,0
1	1,5	0;+0,2	0;+0,2	0;+0,2	0;+0,3	0;+0,3	0;+0,4	0;+0,5	0;+1,0	0;+1,2	0;+1,5	0;+2,0
1,5	2	on request	0;+0,2 6	0;+0,3	0;+0,3 2	0;+0,3	0;+0,4	0;+0,5	0;+1,0	0;+1,2	0;+1,5	0;+2,0
2	2,5	on request	0;+0,2 6	0;+0,3	0;+0,3 2	0;+0,5	0;+0,6	0;+0,7	0;+1,2	0;+1,5	0;+2,0	0;+2,5



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Nominal thickness t		Standard slitting tolerances for Metalle Schmidt <sup>2)</sup>				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 <sup>1)</sup>	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.