

# C51100

## CuSn4




## Industrial Rolled

Alloy Designation	
EN	CuSn4
DIN CEN/TS 13388	CW450K
JIS	C 5111
BS	PB 101
UNS	C51100

Chemical Composition	
Weight percentage	
Cu	Rest
Sn	4 %
P	0.1 %

This alloy is in accordance with RoHS 2002/96/CE for electric & electronic equipments and 2002/53/CE for automotive industry

### Bronze Rolled Products



KME provides highest quality bronze strips for an extremely wide range of industrial applications: from connectors to electrical contacts, from membranes to spring elements and switches.

### Characteristics

CuSn4 provides an excellent combination of strength, excellent formability and hardness. It has a good electrical conductivity and corrosion resistance. Soldering and brazing properties are excellent. We offer exceptionally narrow tolerances with regard to chemical composition, dimensional precision and mechanical properties. Special characteristics such as superfine particle size or thermal-mechanical stress relieving improve mechanical properties and provide increased strength and greater malleability.

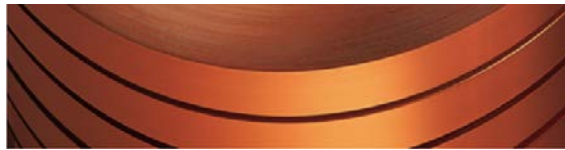
### Main Applications

**Architecture:** Bridge Bearing Plates.  
**Electrical:** Miniaturized Connectors, Contact Springs, Relais Springs, Terminals, Switch Parts Fuse Clips, Electronic Connectors  
**Fasteners:** Lock Washers, Fasteners.  
**Industrial:** Bellows, Textile Machinery, Perforated Sheets, Springs, Sleeve Bushing, Clutch Disks, Beater Bar, Chemical Hardware  
**General:** Stamped parts, Connectors, Contact springs, Spring elements, Ultra high strength spring elements, Membranes, Switch elements, Fixed contacts.

Preferred Applications					
Spring Contact	Pin Contact	Fuse; Relay Box; Pushed Screen	Switches; Relays	Low Temperature Range $\leq 130^{\circ}\text{C}$	Current Carrying Capacity
x	x		x	x	

x = well suited    xx = particularly well suited

Physical Properties			
Typical values in annealed temper at 20 °C			
Density		8.85	g/cm <sup>3</sup>
Thermal expansion coefficient	-191 .. 16 °C	17.8	10 <sup>-6</sup> /K
	20 .. 300 °C	18.1	10 <sup>-6</sup> /K
Specific heat capacity		0.377	J/(g·K)
Thermal conductivity		100	W/(m·K)
Electrical conductivity	(1 MS/m = 1 m/(Ω mm <sup>2</sup> ))	≥ 12	MS/m
Electrical conductivity	(IACS)	≥ 21	%
Thermal coefficient of electrical resistance	(0 .. 200 °C)	0,1	10 <sup>-3</sup> /K
Modulus of elasticity	(1 GPa = 1 kN/mm <sup>2</sup> ) cold formed	110	GPa
	annealed	120	GPa



**Mechanical Properties (EN 1652)**

Temper	Tensile Strength	Yield Strength Standard	Elongation Standard	Yield Strength Bending optimized	Elongation Thermal Stress Relieved	Hard-ness
	MPa	MPa	%		%	HV
<b>R290</b> annealed	290 .. 390	≤ 190*	40		40	70 .. 105
<b>R390</b>	390 .. 490	≥ 320	17	≥ 250	20	115 .. 155
<b>R480</b>	480 .. 570	≥ 440	8	≥ 400	13	150 .. 180
<b>R540</b>	540 .. 630	≥ 480	6	≥ 450	12	160 .. 200
<b>R600</b>	600 .. 660	≥ 560	5	≥ 530	12	> 180
<b>R660</b>	660 .. 760	≥ 620	-	≥ 590	7	> 180
<b>R700</b>	700 .. 800	-	-	≥ 640	3	> 190

\* only for information

**Fabrication Properties\***

Cold Forming Properties	Excellent
Hot Forming Properties at 750 .. 850°C	Limited
Machinability (Rating 20)	Less suitable
Electroplating Properties	Excellent
Hot Tinning Properties	Excellent
Soft soldering, Brazing	Excellent
Resistance Welding	Good
Gas Shielded Arc Welding	Good
Laser Welding	Good
Soft Annealing	450 .. 700°C
Stress Relieving Annealing	200 .. 350°C

\* For more details call our technical service

**Corrosion Resistance\***

Resistant to:

CuSn4 has a good resistance to seawater, different agents and industrial atmosphere.

It is in a large extend resistant to pitting corrosion. Even in seawater the laminar attack is higher than localized corrosion.

Largely insensitive to stress corrosion cracking

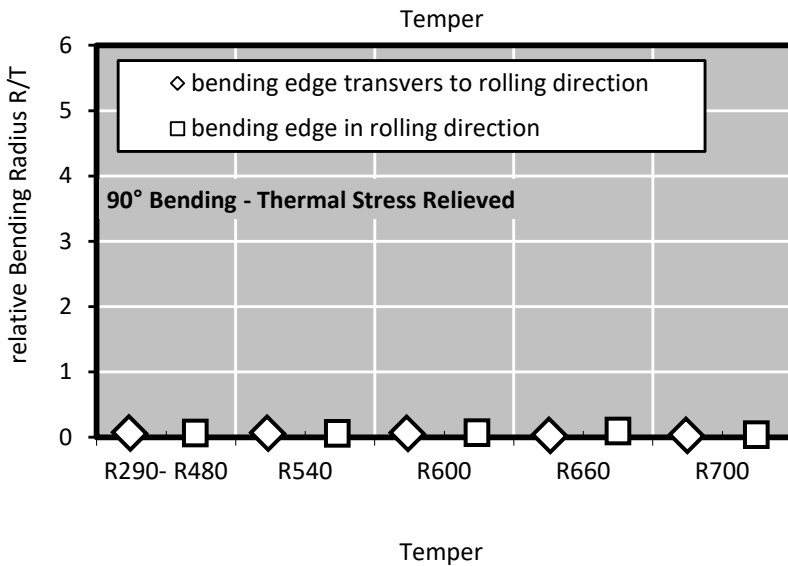
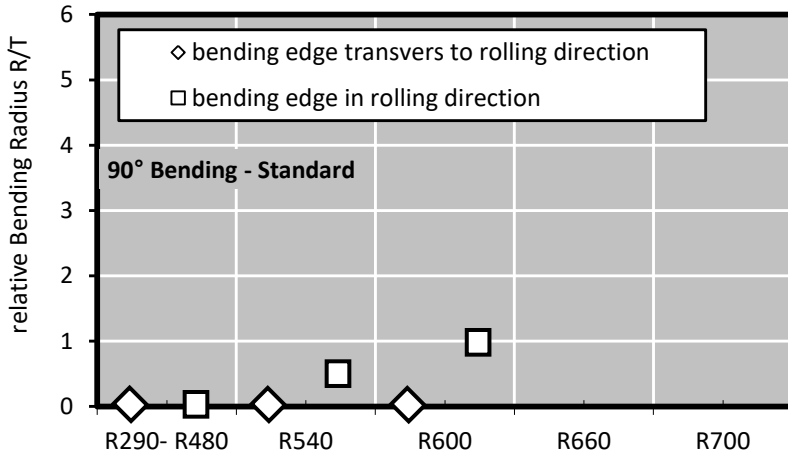
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**Bend Fatigue** (at room temperature)

The fatigue strength gives an indication about the resistance to variations in applied tension. It is measured under symmetrical alternating load. The maximum bending load for 10<sup>7</sup> load cycles without crack is measured. Dependent on the temper class it is approximately 1/3 of the tensile strength R<sub>m</sub>.



**Bending Properties** Standard & Thermal Stress Relieved Thickness: ≤ 0.5 mm

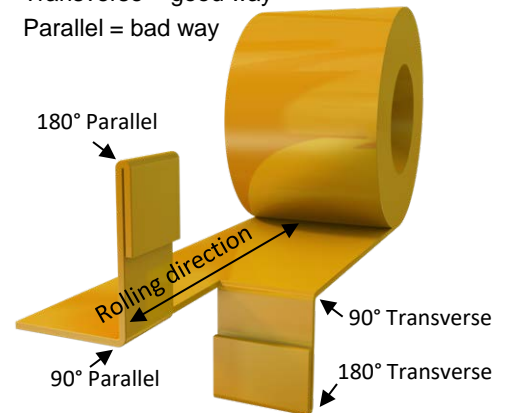


Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

Please take care when comparing with ASTM E 290 results, there the bend definition direction is contradictory.

**Bending Definition**

Transverse = good way  
Parallel = bad way



**Minimum Bending Radius Calculation**

To find out the minimum possible bending radius take the R/T value from the list.  
Example: R/T = 0.5 and thickness 0.3 mm  
Minimum radius = (R/T) x thickness  
= 0.5 x 0.3 mm = 0.15 mm

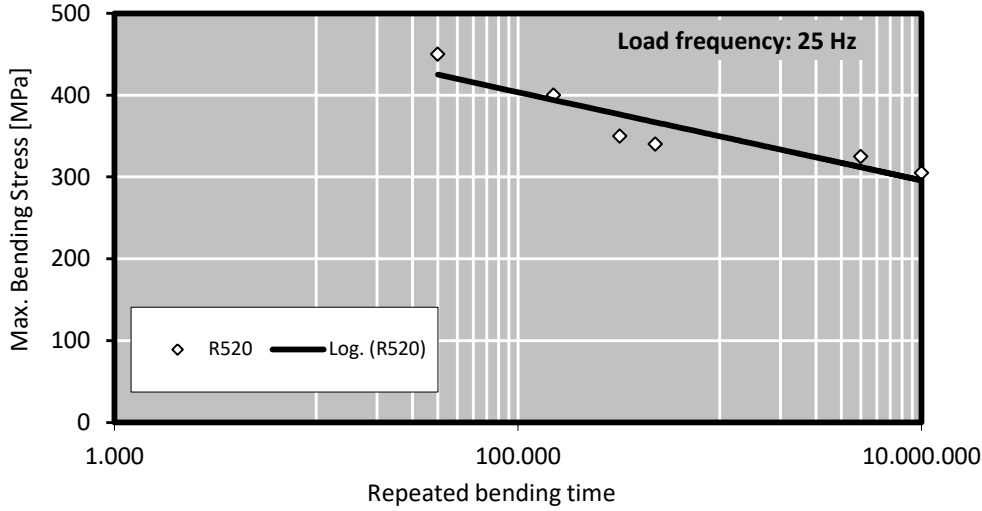
**Bending Properties\*** (Thickness t ≤ 0.5 mm)

Temper	Standard		Thermal Stress Relieved	
	Bending 90°		Bending 90°	
	Transverse	Parallel	Transverse	Parallel
	R/T	R/T	R/T	R/T
R290	0	0	0	0
R390	0	0	0	0
R480	0	0	0	0
R540	0	0,5	0	0
R600	0	1	0	0
R660	-	-	0	0
R700	-	-	0	0

\* Measured at sample width 10 mm. according EN 1654; Possible bending radius = (R/T) x thickness

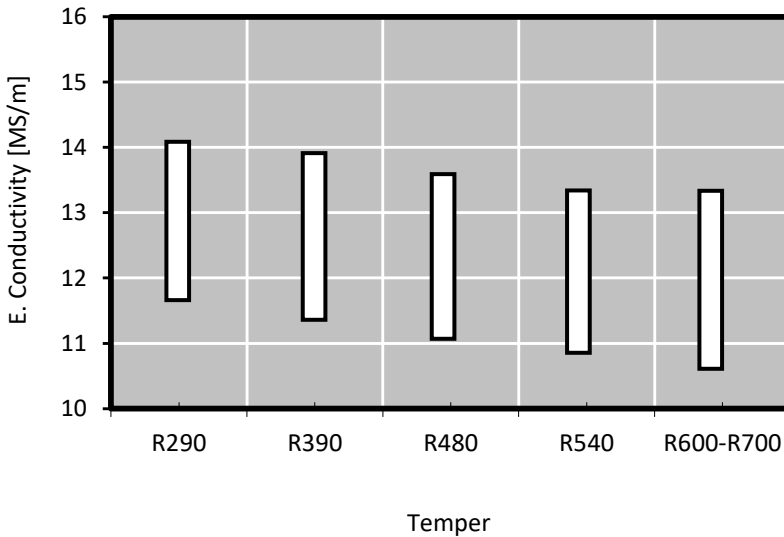


**Bend Fatigue** (at room temperature)



The fatigue strength gives an indication about the resistance to variations in applied tension. It is measured under symmetrical alternating load. The maximum bending load for  $10^7$  load cycles without crack is measured. Dependent on the temper class it is approximately 1/3 of the tensile strength  $R_m$ .

**Electrical Conductivity**

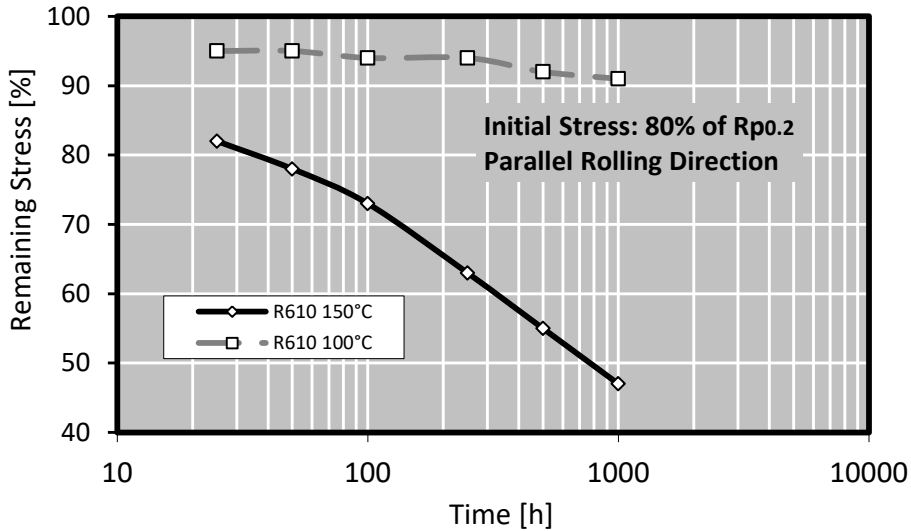
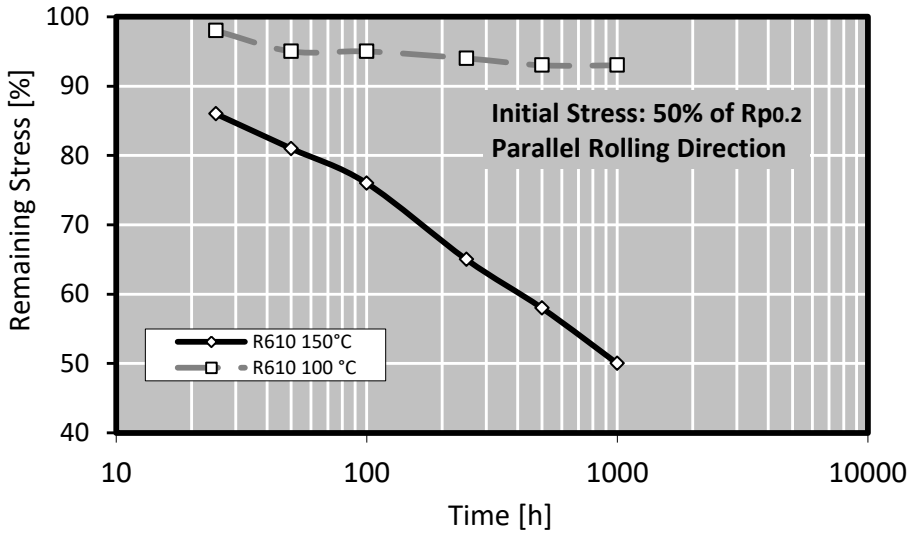


Electrical conductivity is strongly influenced by chemical composition. A high level of cold deformation and small grain size decrease the electrical conductivity moderately. Minimum conductivity level can be specified.



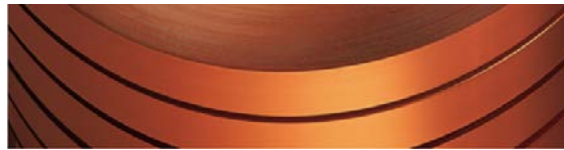
Relaxation Properties

Thermal stress relieved

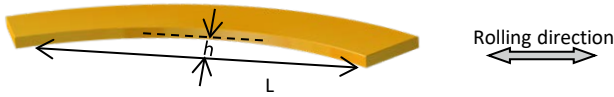


Stress relaxation is tested with cantilever bending test equipment. This method is taking short time relaxation into account, so that the values achieved are very realistic, while other test methods like tube test pretend better properties from the achieved values. Relaxation values give an indication about stress relieve of strip under tension for a certain time and temperature. As it is measured on plain strip, the behaviour of deformed parts may differ, nevertheless the ratio between the different tempers remains the same.

Typical test sample thickness is 0.3 – 0.6 mm.



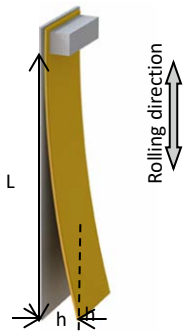
**Camber**



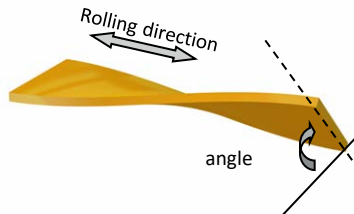
**Evenness**



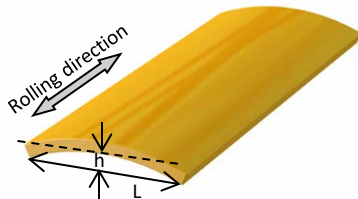
**Coil set**



**Twist**



**Transverse Flatness**



**Evenness Tolerance**

Thickness Range [mm]	Width Range [mm]		
	7 .. 20	21 .. 50	51 .. 100
0.10 .. 0.50	+0.10	+0.20	+0.30
0.50 .. 1.00	+0.15	+0.25	+0.35

**Width Tolerance** Standard / Precision

Thickness Range [mm]	Width Range [mm]				
	10 .. 50	51 .. 100	101 .. 200	201 .. 350	351 .. 700
0.10 .. 1.00	+0.2 / +0.1	+0.3 / +0.2	+0.4 / +0.3	+0.6 / +0.4	+1.0 / +0.5
0.20 .. 1.00	+0.2 / +0.1	+0.3 / +0.2	+0.4 / +0.3	+0.6 / +0.4	+1.0 / +0.5
1.01 .. 2.00	+0.3 / +0.2	+0.4 / +0.2	+0.5 / +0.4	+1.0 / +0.6	+1.5 / +0.7
2.01 .. 3.00	+0.5 / +0.3	+0.6 / +0.3	+0.7 / +0.5	+1.2 / +0.7	+2.0 / +0.9
3.01 .. 6.00	+2.0 / -	+2.3 / -	+2.5 / -	+3.0 / -	+4.0 / -

**Customized Tolerances**

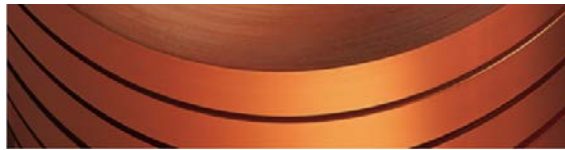
Our products are produced in accordance with relevant norms EN 1652 / EN 1654. Customer specific tolerances for Thickness, Width, Camber, Transverse Flatness, Evenness, Twist and Coil set can be defined. We will be happy to meet your demands. EN 1652 defines only camber.

**Thickness Tolerance**

Thickness Range [mm]	EN 1652 ≤350 mm [mm]	KME Standard [mm]	KME Precision [mm]
0.10 .. 0.20	± 0.018	± 0.005	± 0.004
0.21 .. 0.30	± 0.022	± 0.007	± 0.005
0.31 .. 0.40	± 0.025	± 0.015	± 0.006
0.41 .. 0.50	± 0.030	± 0.015	± 0.008
0.51 .. 0.60	± 0.040	± 0.017	± 0.010
0.61 .. 0.70	± 0.040	± 0.020	± 0.010
0.71 .. 0.85	± 0.040	± 0.022	± 0.012
0.86 .. 1.30	± 0.050	± 0.025	± 0.015
1.31 .. 2.00	± 0.060	± 0.030	± 0.020
2.01 .. 3.00	± 0.070	± 0.045	± 0.025
3.00 .. 4.00	± 0.100	± 0.050	± 0.025
4.00 .. 6.00	± 0.120	± 0.060	± 0.030

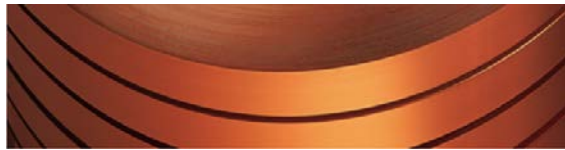
**Roughness**

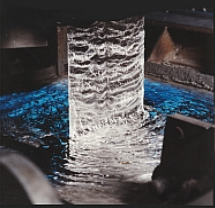



Ra [μm]	Thickness [mm]
0.13 .. 0.18	0.1 .. 2.0
0.20 .. 0.30	0.1 .. 2.0
0.35 .. 0.46	0.1 .. 2.0
On request	> 2.0



Formats	Dimension			
	Coil	Strip thickness (other thicknesses on request)	≥ 0.08 .. 4.00	mm
		Strip width	≥ 3 .. 700	mm
		Outside diameter	≤ 1,400	mm
		Weight (Standard)	≤ 9,000	kg
		Weight per mm	≤ 13.5	kg
	Traverse wound strip	Thickness	≥ 0.2 .. ≤ 1.50	mm
		Width	≥ 8 .. ≤ 60.0	mm
		Weight	300 .. 1,500	kg
		Drums: wood, plastic, metal, flangeless		
	<b>TECSTRIP®</b> _multicoil	Thickness	0.18 .. 0.80	mm
		Width	15 .. 50	mm
		Inner diameter 300 mm for thickness	0.15 .. 0.80	mm
		Inner diameter 400 mm for thickness	0.41 .. 0.80	mm
		Maximum weight	5,000	kg
		Outer diameter maximum	1,600	mm
	Sheet	On request		
	Plate	On request		
	Disc	On request		

\* Some combinations might not be possible



Surface coatings & Special Treatments *		Dimension	
	Hot-Dip tinned and STOL®28M Tin-Silver	Width	≤ 330 mm
	STOL®13 Thermic Sn	Thickness	≤ 1.5 mm
		Tin Layer Thickness	0.4 .. 20 μm
Different thickness per side possible			
	Electroplating	Width	≤ 400 mm
		Thickness	≤ 2.5 mm
	Tin, Silver, Gold, Cu-Flash, Ni-Flash, Selective plating	Other coatings on request	
	Profiled strips: STOL®Multigauge	Width	15 .. 90 mm
		Thickness	0.23 .. 1 mm
	Other width on request		
	Surface protection with oil or adhesive foil on request		

\* Further details you find at [www.kme.com](http://www.kme.com)

**Standards for copper and copper alloys**

EN 1652	Plate, sheet, strip and circles for general purposes
EN 1654	Strip for springs and connectors
EN 1758	Strip for lead frames
EN 13148	Hot-dip tinned strip
EN 13599	Copper plate, sheet and strip for electrical purposes
EN 14436	Electrolytically tinned strip