

Alloy Designation	
EN	Cu-ETP (E-Cu, E-Cu58)
DIN CEN/TS 13388	CW004A
JIS	C 1100
UNS	C11000

Copper Rolled Products



We produce a vast assortment of copper rolled products with highest purity in various in chemical compositions, sizes and formats, all suited to many types of final processing.

Chemical Composition		
Weight percentage		
Cu	≥ 99.90	%
O	≤ 0.040	%

Characteristics

Cu-ETP is an oxygen containing copper which has a very high electrical and thermal conductivity. It has excellent forming properties. Due to its oxygen content soldering and welding properties are limited.

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

Main Applications

- Automotive** Radiators, Gaskets
- Builders Hardware** Cotter Pins, Butts, Ball Floats, Nails, Tacks, Soldering Copper, Rivets
- Consumer** Christmas Ornaments
- Electrical** Transformer Coils, Switches, Terminals, Contacts, Radio Parts, Busbars, Terminal Connectors, Conductors, Stranded Conductors, Cable Strip
- Fasteners** Fasteners
- Industrial** Printed circuit boards, Stamped parts, Pressure Vessels, Chemical Process Equipment, Chlorine Cells, Chimney Cap Screens, Heat Exchangers, Printing Rolls, Anodes, Rotating Bands, Kettles, Pans, Vats, Heat sinks

Preferred Applications			
Transformer	Fuse; Relay Box; Pushed Screen	Cable Strip	Current Carrying Capacity
xx	xx	xx	xx

x = well suited xx = particularly well suited

Physical Properties			
Typical values in annealed temper at 20 °C			
Density		8.9	g/cm ³
Thermal expansion coefficient	-191 .. 16 °C	14.1	10 ⁻⁶ /K
	20 .. 300 °C	17.7	10 ⁻⁶ /K
Specific heat capacity		0.386	J/(g·K)
Thermal conductivity		394	W/(m·K)
Electrical conductivity	(1 MS/m = 1 m/(Ω mm ²))	≥ 58	MS/m
Electrical conductivity	(IACS)	100	%
Thermal coefficient of electrical resistance	(0 .. 200 °C)	3.7	10 ⁻³ /K
Modulus of elasticity	(1 GPa = 1 kN/mm ²) cold formed	130	GPa
	annealed	110	GPa

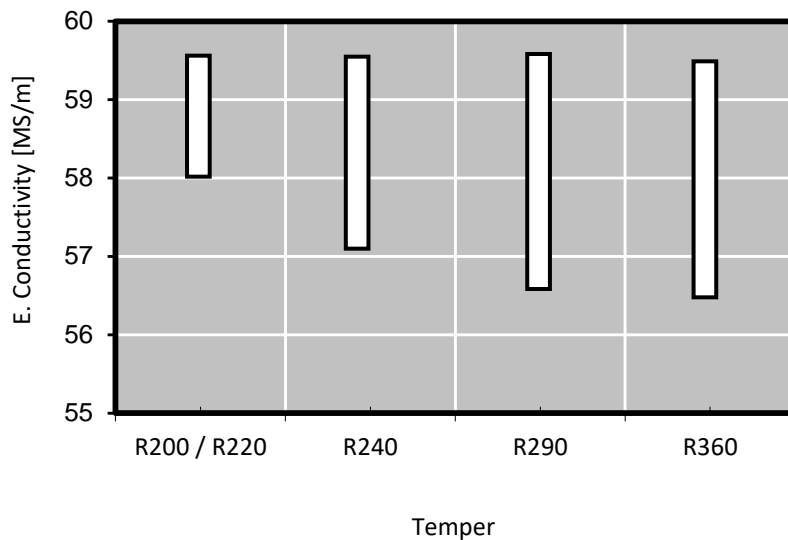


Mechanical Properties (EN 1652)

Temper		Tensile Strength	Yield Strength	Elongation Minimum	Hardness
		R _m	R _{p0.2}	A _{50mm}	HV *
		MPa	MPa	%	HV
R200	annealed	200 .. 250	≤ 100*	(≥ 2,5 mm) 42	40 .. 65
R220	annealed	220 .. 260	< 140*	33	40 .. 65
R240		240 .. 300	≥ 180	8	65 .. 95
R290		290 .. 360	≥ 250	4	90 .. 110
R360		≥ 360	≥ 320	2	≥ 110

* only for information

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.

Fabrication Properties*

Cold Forming Properties	Excellent
Hot Forming Properties at 750 .. 950°C	Good
Machinability (Rating 20)	Less suitable
Electroplating Properties	Excellent
Hot Tinning Properties	Excellent
Soft soldering	Excellent
Resistance Welding	Less suitable
Gas Shielded Arc Welding	Less suitable
Laser Welding	Less suitable
Soft Annealing	250 .. 500°C
Stress Relieving Annealing	150 .. 200°C

During heating in reducing atmosphere hydrogen can penetrate inside the copper and react with Cu-Oxide to water vapour. Its pressure can cause embrittlement.

Corrosion Resistance*

Resistant to:

Atmospheric corrosion: formation of the a greenish protective patina due to the formation of copper basic salts (such sulphates, chlorides in marine environment, nitrates and carbonates). Cu-ETP is showing a good resistance in in natural atmosphere.

Industrial and drinking water, aqueous and alkaline solutions (excluding aqueous solutions containing cyanides, halgens, ammonia), pure water vapour (steam), non oxidizing acids (without oxygen in solution), neutral saline solutions.

Material can be heat-treated in reducing atmosphere.

Practically resistant against stress corrosion cracking

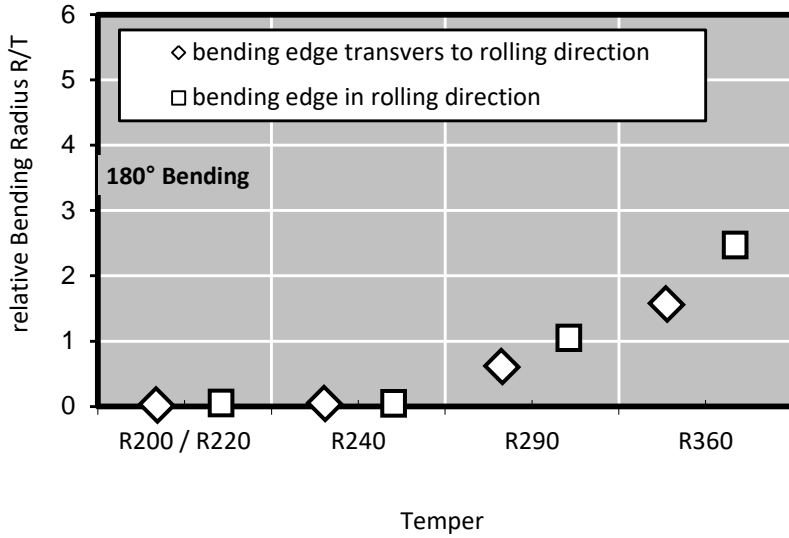
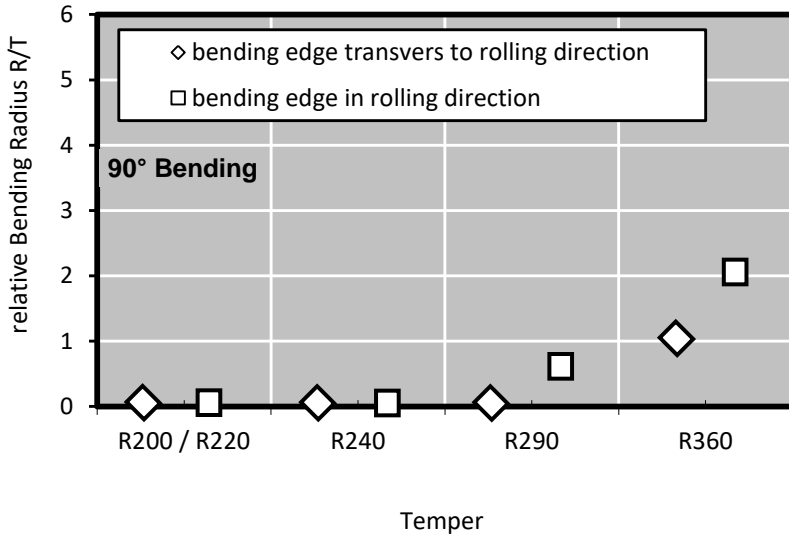
Not resistant to:

Oxidising acids, solutions containing cyanides, ammonia or halogens, hydrosulfide, seawater.

* For more details call our technical service



Bending Properties Thickness: ≤ 0.5 mm

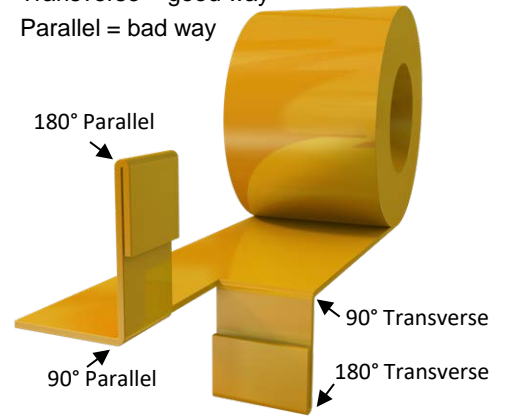


Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

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

$$\text{Minimum radius} = (R/T) \times \text{thickness} \\ = 0.5 \times 0.3 \text{ mm} = 0.15 \text{ mm}$$

Bending Properties*

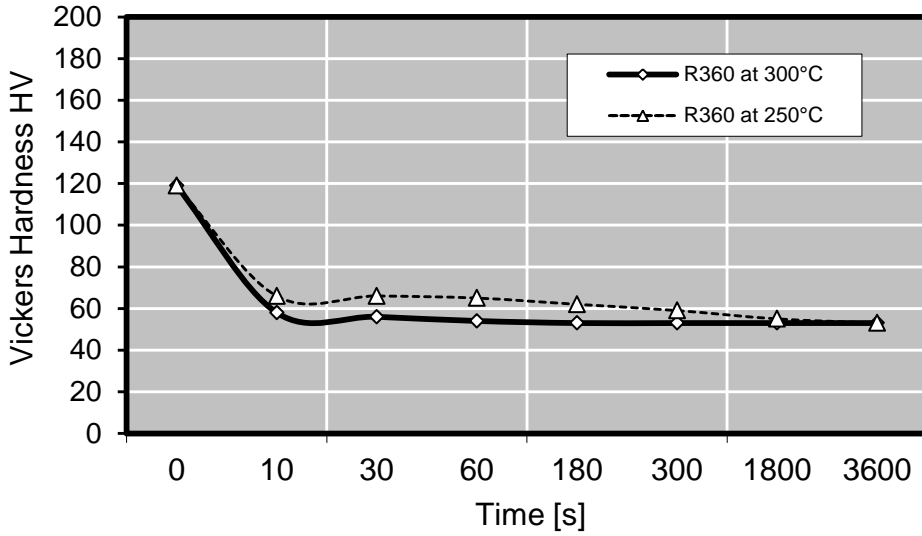
Temper	Thickness Range	Bending 90°		Bending 180°	
		Trans-vers	Parallel	Trans-vers	Parallel
	mm	R/T	R/T	R/T	R/T
R220	≤ 0.5	0	0	0	0
R240	≤ 0.5	0	0	0	0
R290	≤ 0.5	0	0.5	0.5	1
R360	≤ 0.5	1	2	1.5	2.5

* Measured at sample width 10 mm according to EN 1654

Possible bending radius = (R/T) x thickness



Softening Resistance



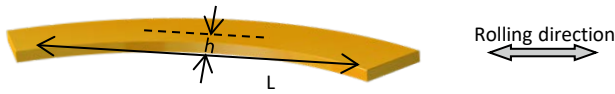
After short time heat treatment Vickers Hardness is measured. The diagram shows typical values.

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 .



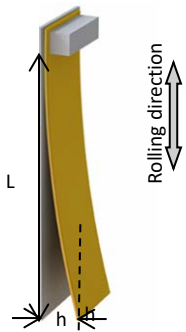
Camber



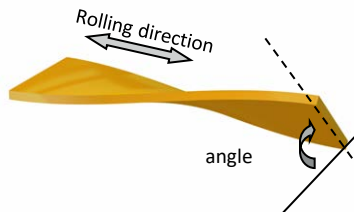
Evenness



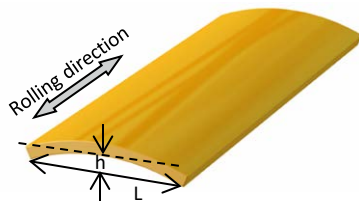
Coil set



Twist



Transverse Flatness



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

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

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

Width Tolerance Standard / Precision

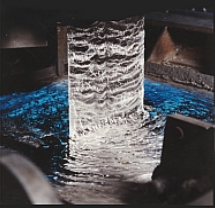




Thickness Range [mm]	Width Range [mm]						* Only R200 and R220
	10 .. 50	51 .. 100	101 .. 200	201 .. 350	351 .. 700	700 .. 1.250	
0.10 .. 1.00	+0.2 / +0.1	+0.3 / +0.2	+0.4 / +0.3	+0.6 / +0.4	+1.0 / +0.5	-	
0.20 .. 1.00	+0.2 / +0.1	+0.3 / +0.2	+0.4 / +0.3	+0.6 / +0.4	+1.0 / +0.5	+2.0	
1.01 .. 2.00	+0.3 / +0.2	+0.4 / +0.2	+0.5 / +0.4	+1.0 / +0.6	+1.5 / +0.7	+2.0	
2.01 .. 3.00	+0.5 / +0.3	+0.6 / +0.3	+0.7 / +0.5	+1.2 / +0.7	+2.0 / +0.9	+3.0	
3.01 .. 6.00	+2.0 / -	+2.3 / -	+2.5 / -	+3.0 / -	+4.0 / -	+6.0	



Formats	Dimension*			
	Coil	Strip thickness (other thicknesses on request)	≥ 0.1 .. 6.00	mm
		Strip width	≥ 3 .. 1,250	mm
		Outside diameter	≤ 1,400	mm
		Weight (Standard)	≤ 8,400	kg
		Weight (Deep-Drawing Quality)	≤ 8,000	kg
		Weight per mm	≤ 12.0	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		
	TECSTRIP® _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 ≤ 6.35 mm	Thickness	0.3 .. 6.35	mm
		Width	50 .. 1,250	mm
		Length	200 .. 6,500	mm
		Weight	2,800 .. 8,000	kg
		Sheets in standard dimensions e.g. 1,000 x 2,000 mm on stock		
	Sheet > 6.35 mm	Thickness	6.35 .. 9.50	mm
		Width	50 .. 2,450	mm
		Length	200 .. 7,500	mm
		Weight	≤ 10,000	kg
		Sheets in standard dimensions e.g. 1,000 x 2,000 mm		
	Plate	Thickness	9.5 .. 150	mm
		Width	≤ 4,500	mm
		Length	≤ 15,000	mm
		Weight	≤ 8,000	kg
	Disc	Thickness	0.3 .. 150	mm
		Diameter	20 .. 3,100	mm
		Weight	≤ 10,000	kg

* 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	R360 on request	
	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	
	Deburred and rounded edges	Width	≥ 200 .. 1,250* mm
		Thickness	0.3 .. 2.0* mm
	(e.g. for Transformer Strips)	* 0.3 - 2.0 mm Width ≤ 700 mm and 0.4 - 2.0 mm Width ≥ 700 mm	
	Surface with extra low residual carbon content possible.		
	Protection with oil or adhesive foil on request		

* Further details you find at our website.

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