C10300
Cu-PHC

KME

Industrial Rolled

Alloy Designation	
EN	Cu-PHC (SE-Cu)
DIN CEN/TS 13388	CW020A
JIS	-
UNS	C10300 OFXLP-Cu

Copper Rolled Products

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

Chemical Composition Weight percentage in %		
Cu	≥ 99.95	%
P	≈ 0.003	%

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

Characteristics

Cu-PHC is a high purity, low level residual phosphorus, deoxidized copper. It has a very high electrical and thermal conductivity, good welding and soldering properties as well as resistance to hydrogen. It has excellent hot and cold forming properties, and a good corrosion resistance in water and especially in atmosphere (including industrial atmosphere). Cu-PHC has a higher conductivity than Cu-HPC.

Main Applications

Electrical
High Frequency Cable, Submarine Cable Strips, Wave Guide Tubing, Commutators, Applications Requiring High Conductivity, Tubular Bus, Electrical Conductors, Clad Products, Busbars, Terminals, Thermostatic Control Tubing
Industrial
Applications Requiring Good Brazing, Applications Requiring Good Weldability, Pressure Vessels, Billet Mold Tube, Extrusion Cans for Powder Metallurgy

Preferred Applications

Electrical Engineering	Electronics	High Frequency Cable	Submarine Cable	Cladding
xx	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/cm³
Thermal expansion coefficient	-191 .. 16 °C 20 .. 300 °C	19.9 17.7	10^{-6}/K 10^{-6}/K
Specific heat capacity		0.385	J/(g·K)
Thermal conductivity		385	W/(m·K)
Electrical conductivity	(1 MS/m = 1 m/(Ω mm²))	≥ 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/mm²) cold formed annealed	130 115	GPa GPa

C10300
Cu-PHC

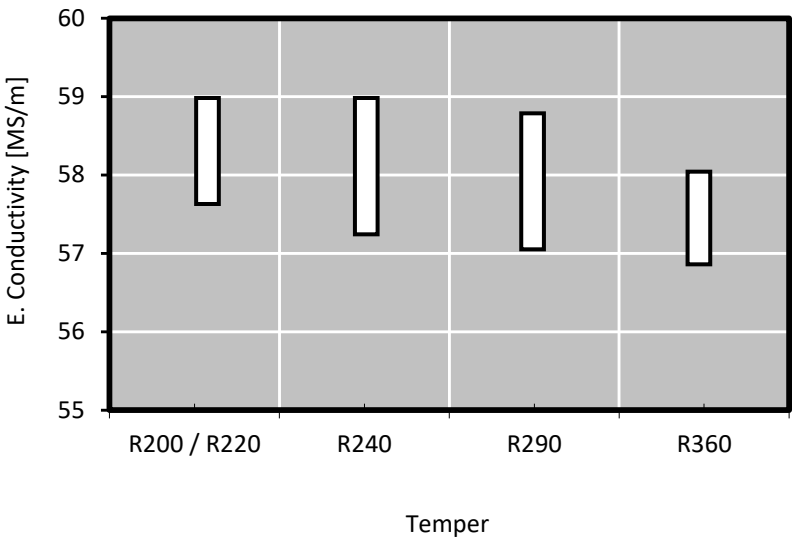
KME

Industrial Rolled

Mechanical Properties (EN 13599)					
Temper		**Tensile Strength Rm**	**Yield Strength $Rp_{0.2}$**	**Elongation Minimum A_{50mm}**	**Hardness HV ***
		MPa	MPa	%	HV
R200	annealed	200 .. 250	≤ 100*	-	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	Excellent
Machinability (Rating 20)	Less suitable
Electroplating Properties	Excellent
Hot Tinning Properties	Excellent
Soft soldering, Brazing	Excellent
Resistance Welding Spot Butt	Less suitable Good
Gas Shielded Arc Welding	Excellent
Laser Welding	Fair
Soft Annealing, protective gas or hydrogen containing atmosphere	250 .. 650°C
Stress Relieving Annealing	150 .. 200°C

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)

Water (industrial and drinking). Aqueous and alkaline solutions (not oxidizing), pure water vapour (steam), non oxidizing acids (without oxygen in solution), neutral saline solutions.

Material can be heat-treated in reducing atmosphere.

Insensible to stress corrosion cracking

Not resistant to:

Oxidising acids, solutions containing cyanides, ammonia or halogens, hydrous ammonia and halogenated gases, hydrogen sulfide, seawater.

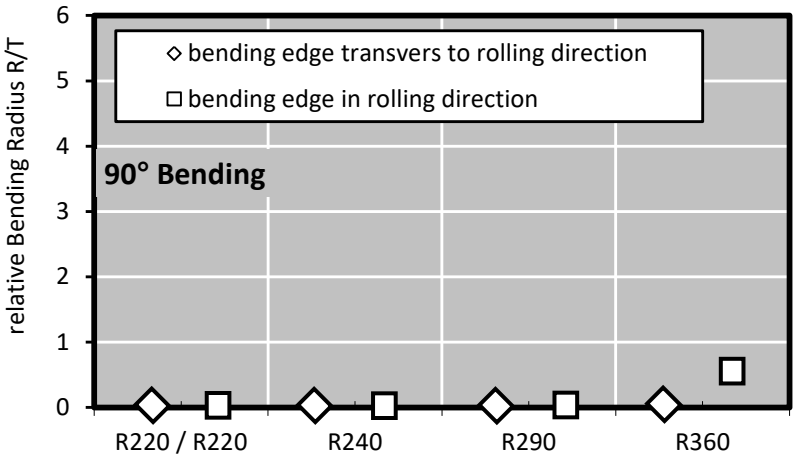
* For more details call our technical service

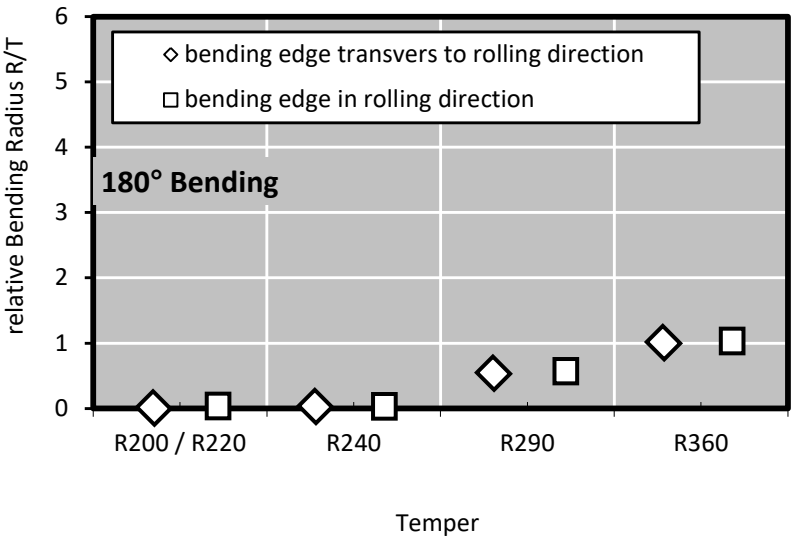
C10300
Cu-PHC

KME

Industrial Rolled

Bending Properties Thickness: ≤ 0.5 mm





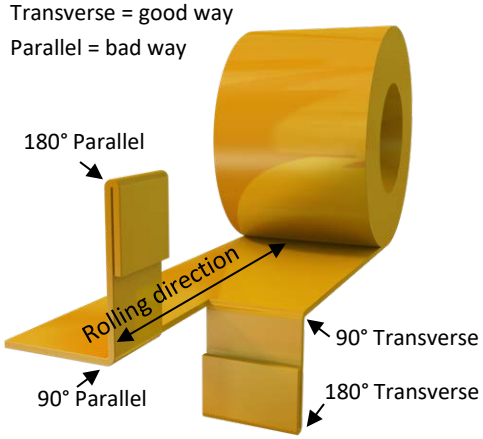
Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

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

Minimum radius = (R/T) x thickness

= 0.5 x 0.3 mm = 0.15 mm

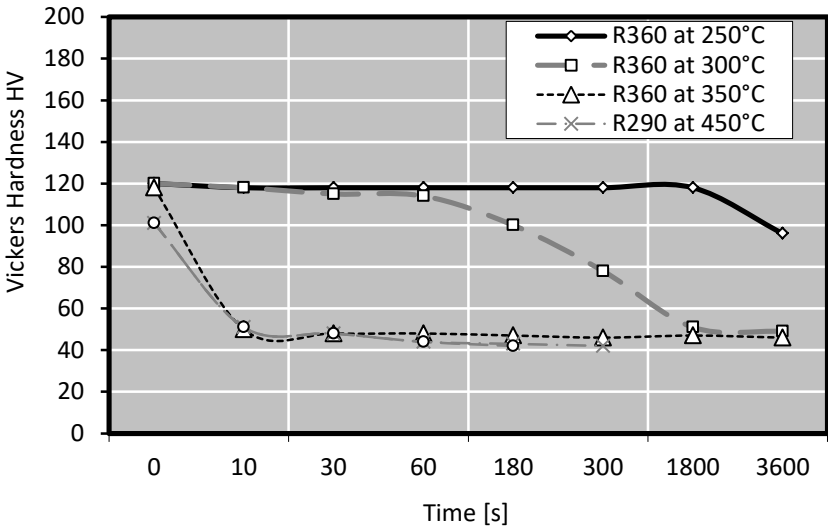
Bending Properties*

Temper	Thickness Range	Bending 90°		Bending 180°	
		Trans-vers	Parallel	Trans-vers	Parallel
	mm	R/T	R/T	R/T	R/T
R200	≤ 0.5	0	0	0	0
R220	≤ 0.5	0	0	0	0
R240	≤ 0.5	0	0	0	0
R290	≤ 0.5	0	0	0.5	0.5
R360	≤ 0.5	0	0.5	1	1

* 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)

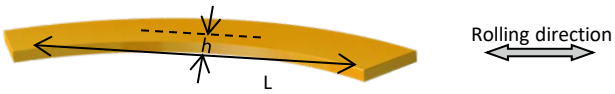
The fatigue strength gives an indication about the resistance to variations in applied tension. It is measured under symmetrical alternating load. The maximum bending load for 10^7 load cycles without crack is measured. Dependent on the temper class it is approximately 1/3 of the tensile strength R_m.

C10300
Cu-PHC

KME

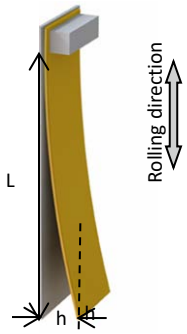
Industrial Rolled

Camber

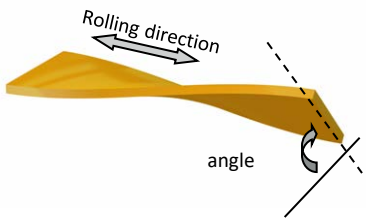


Evenness

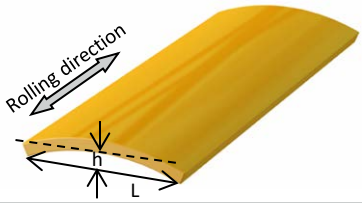
Coil set



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

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

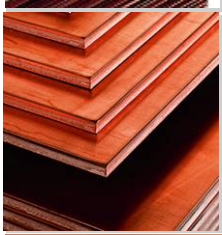
Width Tolerance Standard / Precision

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

C10300
Cu-PHC

KME

Industrial Rolled

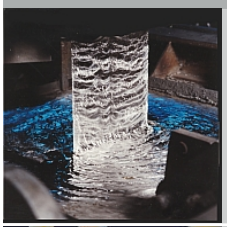
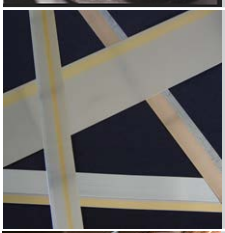
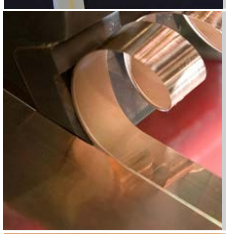
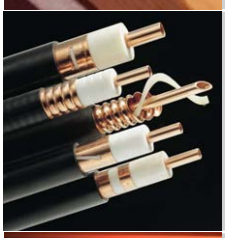
Formats		Dimension*		
	Coil	Strip thickness (other thicknesses on request)	≥ 0.1 .. 6.00	mm
		Strip width	≥ 3 .. 1,250	mm
		Outside diameter	≤ 1,400	mm
		Weight (Standard)	≤ 8,400	kg
		Weight (Deep-Drawing Quality)	≤ 8,000	kg
		Weight per mm	≤ 12.0	kg
	Traverse wound strip	Thickness	≥ 0.2 .. ≤ 1.50	mm
		Width	≥ 8 .. ≤ 60.0	mm
		Weight	300 .. 1,500	kg
		Drums: wood, plastic, metal, flangeless		
	**TEC**STRIP® _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

C10300
Cu-PHC

KME

Industrial Rolled

Surface coatings & Special Treatments *		Dimension		
	Hot-Dip tinned and STOL®28M Tin-Silver STOL®13 Thermic Sn Different thickness per side possible	Width Thickness Tin Layer Thickness R360 on request	≤ 330 ≤ 1.5 0.4 .. 20	mm mm µm
	Electroplating Tin, Silver, Gold, Cu-Flash, Ni-Flash, Selective plating	Width Thickness Other coatings on request	≤ 400 ≤ 2.5	mm mm
	Profiled strips STOL®Multigauge	Width Thickness Other width on request	15 .. 90 0.23 .. 1	mm mm
	Deburred and rounded edges (e.g. for Transformer Strips)	Width Thickness * 0.3 - 2.0 mm Width ≤ 700 mm and 0.4 - 2.0 mm Width ≥ 700 mm	≥ 200 .. 1,250* 0.3 .. 2.0*	mm mm
	Precision Strip With low periodic thickness variation for e.g. High Frequency Cable Applications	Fully Integrated Fast Fourier Transformation (FFT) Analysis per coil		
	Surface with extra low residual carbon content possible. Protection with oil or adhesive foil on request			

* Further details you find at 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