

# CuMg C18665 STOL® 78



## Industrial Rolled

<b>Alloy Designation</b>	STOL® 78
<b>EN</b>	
<b>DIN CEN/TS 13388</b>	
<b>UNS</b>	C18665

<b>Chemical Composition</b>		
Weight percentage		
<b>Cu</b>	≥ 99.0	%
<b>Mg</b>	0.4 .. 0.9	%
<b>P</b>	0.002 .. 0.04	%

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



### High Performance STOL® Alloys

We have developed a wide range of high performance alloys with excellent properties regarding conductivity, strength, corrosion behaviour, bend ability and relaxation properties. STOL® alloys are the first choice materials for high-end applications and products.

<b>Characteristics</b>
STOL® 78 is a high Magnesium (Mg) alloyed material with excellent formability at medium strength and good conductivity. Typical applications are automotive, electrical and electronic connectors, relays, current carrying springs and junction boxes.

<b>Main Applications</b>
<b>Automotive</b> Switches and Relays, Contacts, Connectors, Terminals
<b>Electrical</b> Switches and Relays, Contacts, Connectors, Terminals, Components for the electrical industry, Stamped parts, Semiconductor Components,

<b>Preferred Applications</b>			
Spring Contact	Switches and Relays	Junction Box	Current Carrying Capacity
xx	xx	xx	xx

x = well suited    xx = particularly well suited

<b>Physical Properties</b>		
Typical values in annealed temper at 20 °C		
Density	8.8	g/cm <sup>3</sup>
Thermal expansion coefficient 20 .. 300 °C	17.3	10 <sup>-6</sup> /K
Specific heat capacity	0,320	J/(g·K)
Thermal conductivity	270	W/(m·K)
Electrical conductivity (1 MS/m = 1 m/(Ω mm <sup>2</sup> ))	36	MS/m
Electrical conductivity (IACS)	62	%
Thermal coefficient of electrical resistance (0 .. 100 °C)	2.5	10 <sup>-3</sup> /K
Modulus of elasticity ( 1 GPa = 1 kN/mm <sup>2</sup> ) cold formed	130	GPa

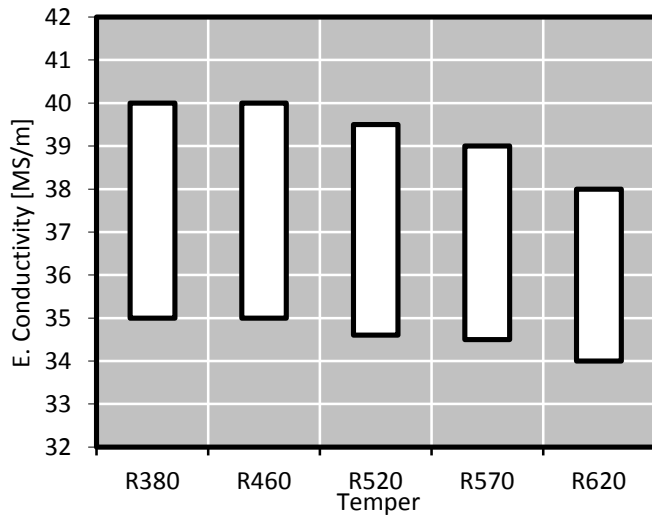


**Mechanical Properties (EN 1652)**

Temper	Tensile Strength	Yield Strength Minimum	Elongation Minimum	Hardness
	Rm	Rp <sub>0.2</sub>	A <sub>50mm</sub>	HV *
	MPa	MPa	%	HV
<b>R380</b>	380 .. 460	330	14	115 .. 145
<b>R460</b>	460 .. 520	410	10	140 .. 165
<b>R520</b>	520 .. 570	460	8	160 .. 180
<b>R570</b>	570 .. 620	500	6	175 .. 195
<b>R620</b>	> 620	550	3	> 190

\*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	Excellent
Machinability (Rating 20)	Less suitable
Electroplating Properties	Excellent
Hot Tinning Properties	Excellent
Soft Soldering, Brazing	Excellent
Resistance Welding	Less suitable
Gas Shielded Arc Welding	Excellent
Laser Welding	Fair
Soft Annealing	250 .. 650°C, 1 .. 3h
Stress Relieving Annealing	150 .. 200°C, 1 .. 3h

\* For more details call our technical service

**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). CuMg has a good resistance in in natural and industrial atmosphere (maritime air too).

Industrial and drinking water, aqueous and alkaline solutions (not oxidizing), pure water vapour (steam), non oxidizing acids (without oxygen in solution) and salts, neutral saline solutions.

Material can be heat-treated in reducing atmosphere.

Practically resistant against stress corrosion cracking

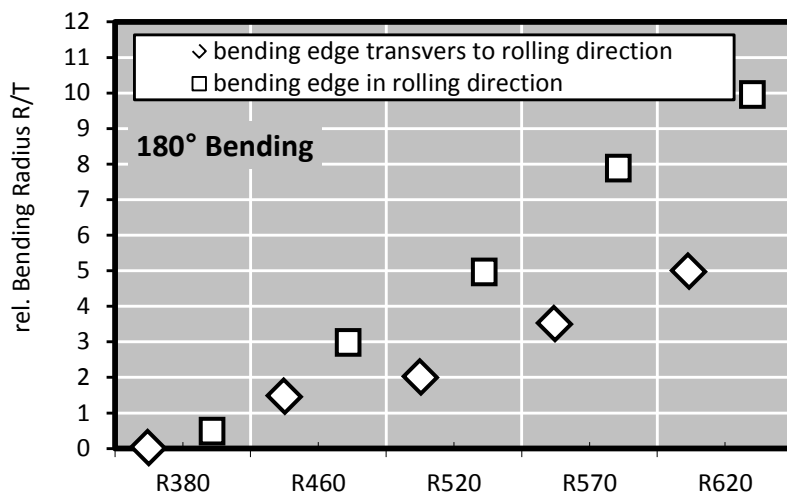
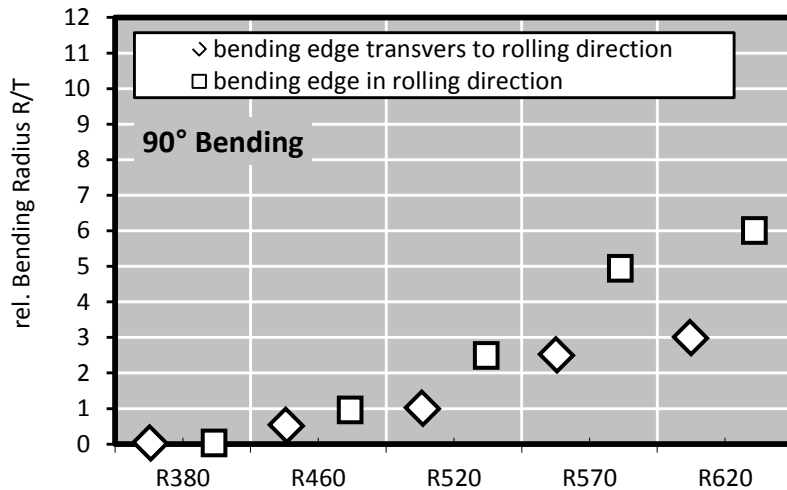
Not resistant to:

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

\* For more details call our technical service



Bending Properties Thickness: ≤ 0.5 mm stress relieved

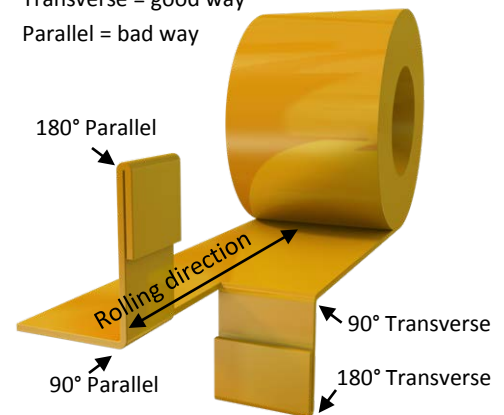


Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

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

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

**Bending Properties\***

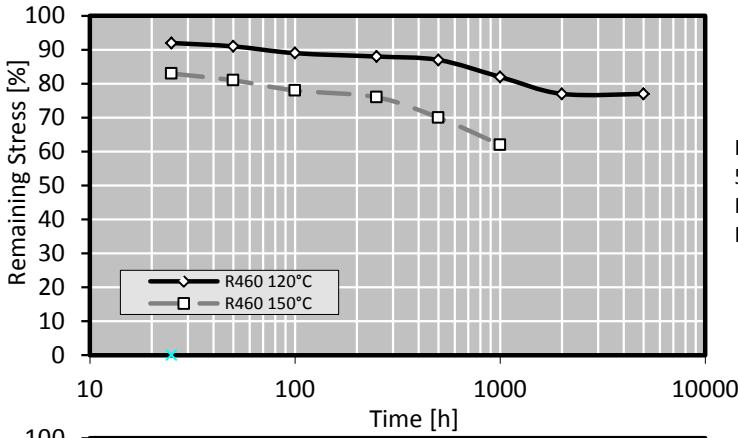
Temper	Thickness Range	Bending 90°		Bending 180°	
		Transversers	Parallel	Transversers	Parallel
	mm	R/T	R/T	R/T	R/T
R380	≤ 0.5	0	0	0	0.5
R460	≤ 0.5	0.5	1	1.5	3
R520	≤ 0.5	1	2.5	2	5
R570	≤ 0.5	2.5	5	3.5	8
R620	≤ 0.5	3	6	5	10

\* Measured at sample width 10 mm according to EN 1654

Possible bending radius = (R/T) x thickness



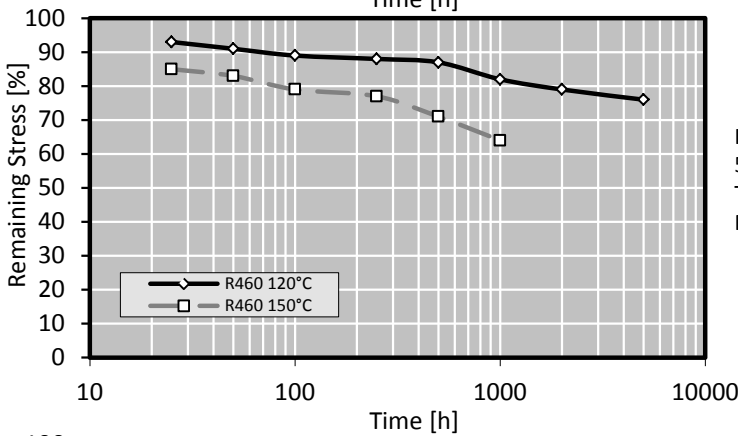
Relaxation Properties



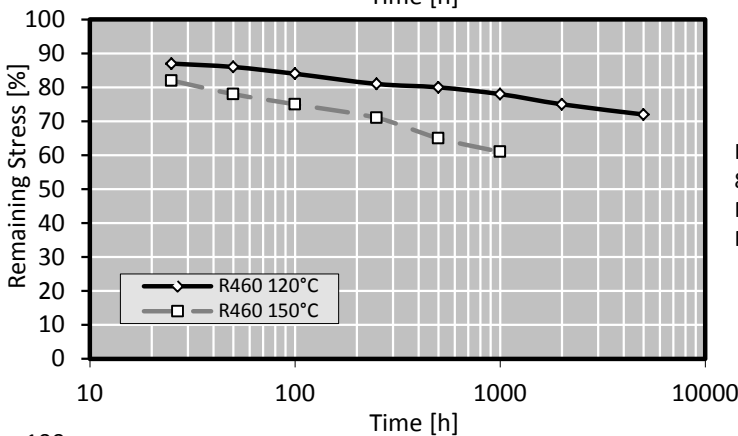
Initial Stress:  
50% of Rp0.2  
Parallel  
Rolling Direction

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.

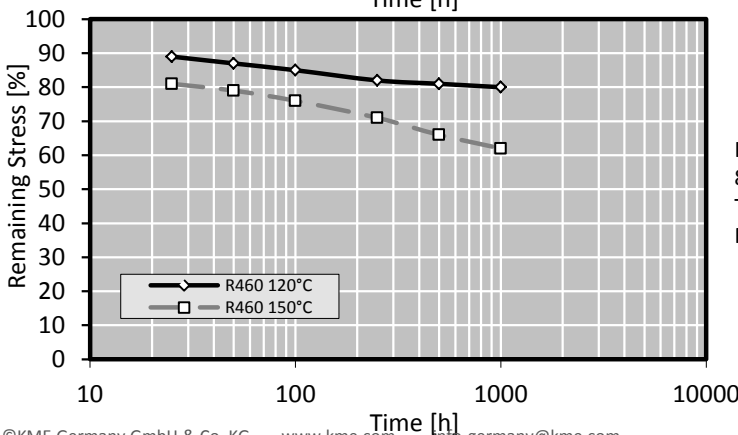
Typical test sample thickness is 0.3 – 0.6 mm.



Initial Stress:  
50% of Rp0.2  
Transverse  
Rolling Direction



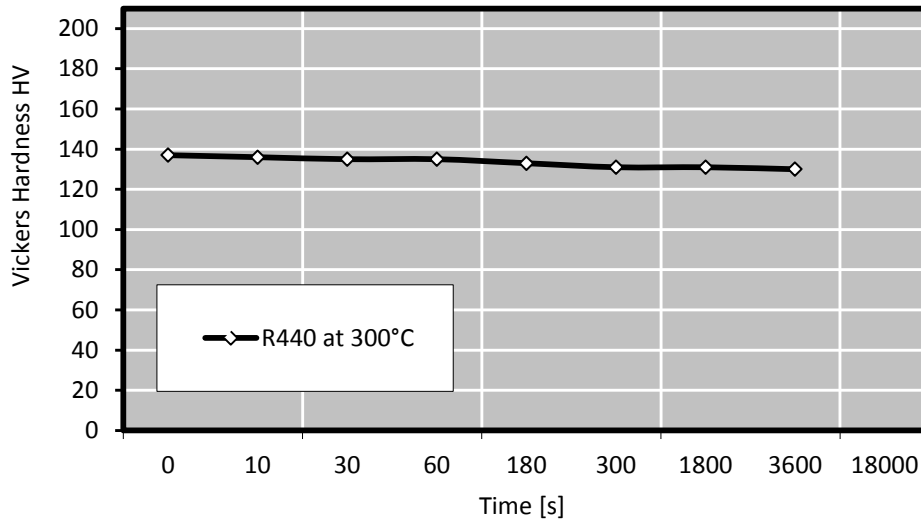
Initial Stress:  
80% of Rp0.2  
Parallel  
Rolling Direction



Initial Stress:  
80% of Rp0.2  
Transverse  
Rolling Direction



Softening Resistance



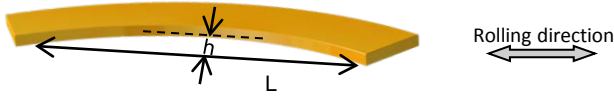
After short time heat treatment Vickers Hardness is measured. The diagram shows typical values.

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  $R_m$ .



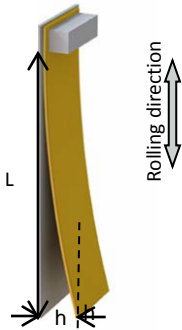
**Camber**



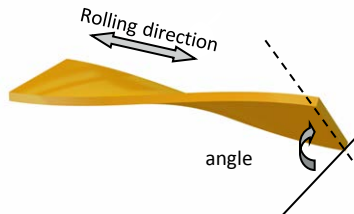
**Evenness**



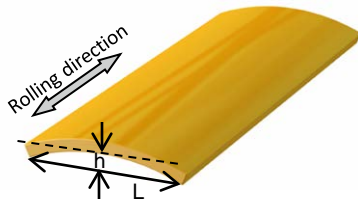
**Coil set**



**Twist**



**Transverse Flatness**



**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	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

**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**

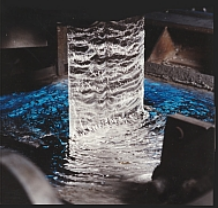



Ra [µm]	Thickness [mm]
0.13 .. 0.18	0.1 .. 2.0
0.20 .. 0.30	0.1 .. 2.0
0.35 .. 0.46	0.1 .. 2.0
On request	> 2.0



Formats	Dimension*			
	Coil	Strip thickness (other thicknesses on request)	≥ 0.1 .. 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		
	<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 ≤ 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			
	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 with extra low residual carbon content possible.		
	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