

# CuNiSi

## C19005

### STOL® 76M



## Industrial Rolled

<b>Alloy Designation</b>	<b>STOL® 76M</b>
<b>EN</b>	-
<b>DIN CEN/TS 13388</b>	-
<b>UNS</b>	C19005

<b>Chemical Composition</b>		
Weight percentage		
<b>Cu</b>	Rest	%
<b>Ni</b>	1.4 .. 1.7	%
<b>Si</b>	0.2 .. 0.35	%
<b>Sn</b>	0.02 .. 0.3	%
<b>Zn</b>	0.20 .. 0.7	%
<b>Others</b>	≤ 0.50	%

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

\* slight difference in chemical composition



### High Performance STOL® Alloys

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

### Characteristics

STOL® 76M is an optimized CuNiSi alloy that can be hardened by cold forming and by precipitation of NiSi-phases during a heat treatment. It has excellent bendability, excellent hot and cold forming properties, a high strength and a good corrosion resistance.

Due to the NiSi-precipitations the relaxation properties, even at temperatures up to 150°C are excellent. In combination with a tin coating even at temperatures around 150°C (3.000h) the tin coating does not peel off. The electrical and thermal conductivity is good. Welding, soldering and brazing properties are good too.

### Main Applications

**Automotive** Switches and Relays, Contacts, Connectors, Terminals , Press fits

**Electrical** Switches and Relays, Contacts, Connectors, Terminals, Press fits, Components for the electrical industry, Stamped parts, Semiconductor Components,

### Preferred Applications

Spring Contact	Switches and Relays	High Temperature Ranges ≥ 130°C	Current Carrying Capacity	Press fits
xx	x	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 <sup>3</sup>
Thermal expansion coefficient	-191 .. 16 °C	14.1	10 <sup>-6</sup> /K
	20 .. 300 °C	16,8	10 <sup>-6</sup> /K
Specific heat capacity		0.377	J/(g·K)
Thermal conductivity		260	W/(m·K)
Electrical conductivity (1 MS/m = 1 m/(Ω mm <sup>2</sup> ))		33	MS/m
Electrical conductivity (IACS)		57	%
Thermal coefficient of electrical resistance (0 .. 100 °C)		2.0	10 <sup>-3</sup> /K
Modulus of elasticity ( 1 GPa = 1 kN/mm <sup>2</sup> )	cold formed	135	GPa
	annealed	118	GPa

CuNiSi  
C19005  
STOL® 76M

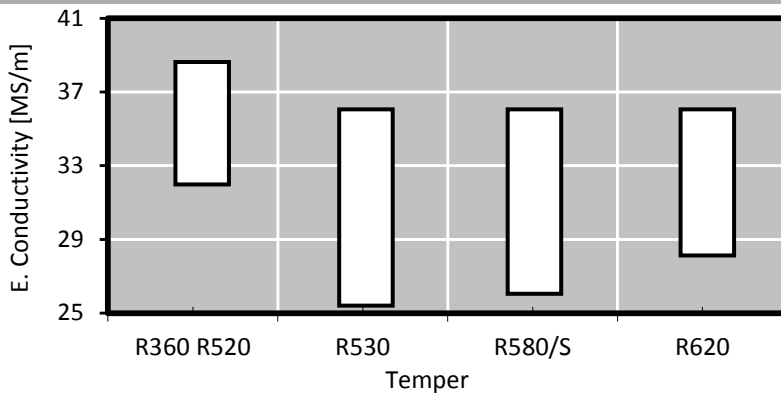


Industrial Rolled

Mechanical Properties					
Temper	Tensile Strength Rm	Yield Strength min. Rp0.2	Elongation min. A <sub>50mm</sub>	Elongation Thermal Stress Relieved min. A <sub>50mm</sub>	Hardness HV *
	MPa	MPa	%		HV
R360	360 ... 430	300	12	14	100 ... 130
R410	410 ... 470	360	9	11	125 ... 155
R460	460 ... 520	410	7	9	135 ... 165
R520	520 ... 580	460	5	7	145 ... 175
R530	age hardened	530 ... 630	430	14	150 ... 190
R580 / R580S	age hardened	580 ... 650	540 / 520	8 / 9	170 ... 200
R620S	age hardened	620 ... 700	560	7	180 ... 210

\* 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	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

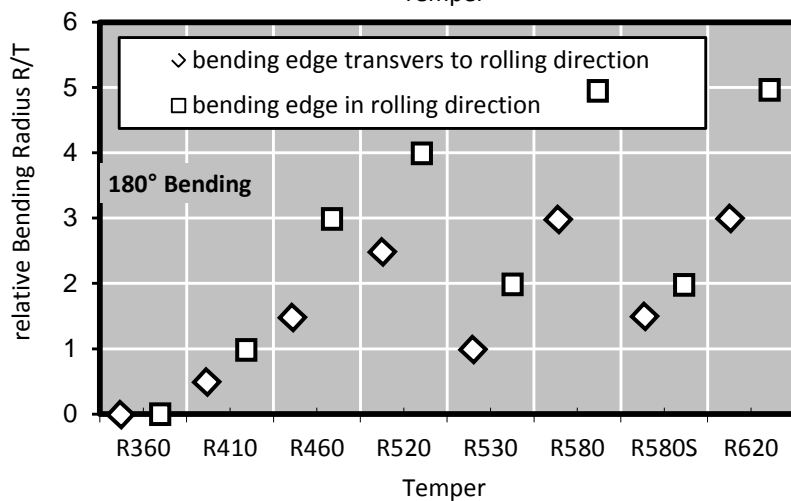
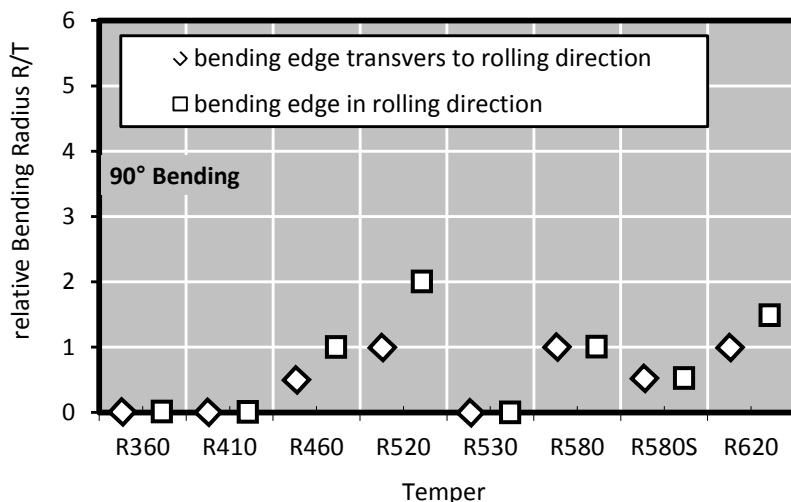
\* For more details call our technical service

Corrosion Resistance*
STOL® 76M has good corrosion resistance.
The alloy is insensitive to stress corrosion cracking

\* For more details call our technical service



Bending Properties Thickness: ≤ 0.5 mm stress relieved

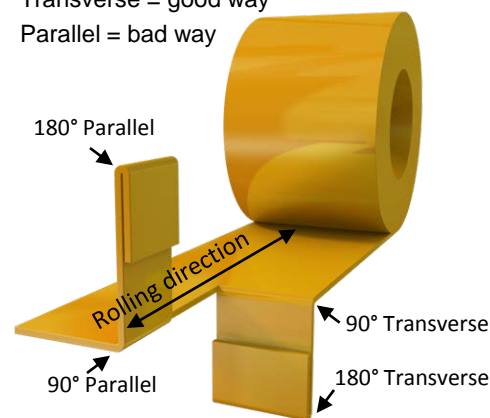


Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

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

$$\text{Minimum radius} = (R/T) \times \text{thickness}$$

$$= 0.5 \times 0.3 \text{ mm} = 0.15 \text{ mm}$$

**Bending Properties\***

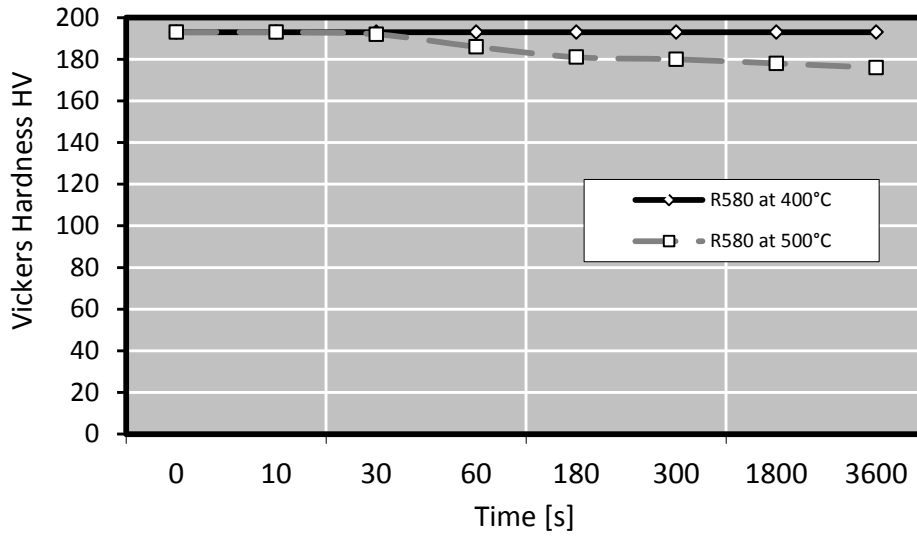
Temper	Thickness Range	Bending 90°		Bending 180°	
		Transvers	Parallel	Transvers	Parallel
	mm	R/T	R/T	R/T	R/T
R360	≤ 0.5	0	0	0	0,5
R410	≤ 0.5	0	0,5	0,5	1
R460	≤ 0.5	0,5	1	1,5	3
R520	≤ 0.5	1	2	2,5	4
R530	≤ 0.5	0	0	1	2
R580	≤ 0.5	1	1	3	5
R580S	≤ 0.5	0,5	0,5	1,5	2
R620	≤ 0.5	1	1,5	3	5

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

Possible bending radius = (R/T) x thickness



Softening Resistance



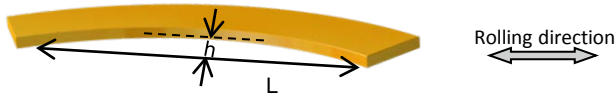
After short time heat treatment Vickers Hardness is measured. The diagram shows typical values.

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  $R_m$ .



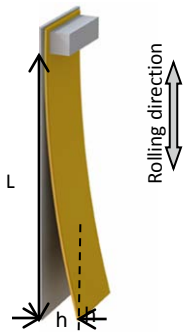
**Camber**



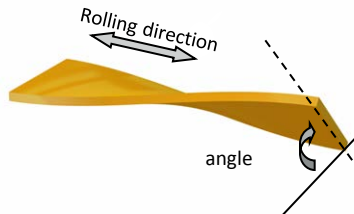
**Evenness**



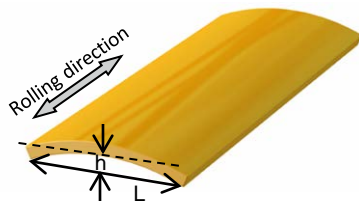
**Coil set**



**Twist**



**Transverse Flatness**



**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* (General Information)			
	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 (General Information)	
	Hot-Dip tinned and STOL®28M Tin-Silver STOL®13 Thermic Sn	Width Thickness Tin Layer Thickness	≤ 330 mm ≤ 1.5 mm 0.4 .. 20 µm
	Different thickness per side possible	R360 on request	
	Electroplating	Width Thickness	≤ 400 mm ≤ 2.5 mm
	Tin, Silver, Gold, Cu-Flash, Ni-Flash, Selective plating	Other coatings on request	
	Profiled strips STOL®Multigauge	Width Thickness	15 .. 90 mm 0.23 .. 1 mm
		Other width on request	
	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* mm 0.3 .. 2.0* 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 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