CuNi2,5SiZn
C70315
STOL® 94

Industrial Rolled

Alloy Designation	STOL® 94
EN	CuNi2,5SiZn
DIN CEN/TS 13388	
UNS	C70315

Chemical Composition Weight percentage		
Cu#	Rest	%
Ni	1.0 .. 4.0	%
Si	0.08 .. 1.0	%
Zn	max. 2.0	%
Sn	max. 1.0	%
Ag	max. 0.50	%
Mg	max. 0.20	%
Fe	max. 0.10	%
Pb	max. 0.50	%

Cu + sum of named elements min. 99.5 %

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, bendability and relaxation properties. STOL® alloys are the first choice materials for high-end applications and products.

Characteristics

STOL® 94 is a NiSi alloy that is available in cold worked and precipitation hardened tempers. It combines maximum strength with excellent bend ability, good electrical conductivity, excellent resistance against relaxation.

No peeling at long-term up to 130°C. and higher.

Partial substitute for copper-beryllium alloys.

Main Applications

Automotive: Switches and Relays, Terminals, Contacts, Connectors
Electrical: Switches and Relays, Terminals, Contacts, Connectors

Preferred Applications

Spring Contact	Fuse Box Leadframe	Current carrying Capacity	High temperatures ≥130°C
xx	xx	xx	xx

x = well suited xx = particularly well suited

Physical Properties Typical values in annealed temper at 20 °C		
Density	8.85	g/cm³
Thermal expansion coefficient 20 .. 300 °C	17	10^{-6}/K
Specific heat capacity	0.399	J/(g·K)
Thermal conductivity	185	W/(m·K)
Electrical conductivity (1 MS/m = 1 m/(Ω mm²)	25	MS/m
Electrical conductivity (IACS)	43	%
Thermal coefficient of electrical resistance (0 .. 100 °C)		10^{-3}/K
Modulus of elasticity (1 GPa = 1 kN/mm²) cold formed	132	GPa

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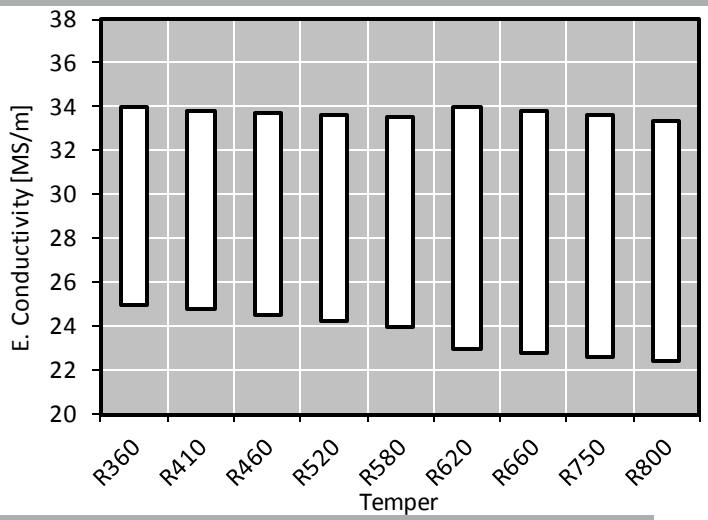
Mechanical Properties				
Temper - US Temper - Code	**Tensile Strength Rm**	**Yield Strength Minimum $Rp_{0.2}$**	**Elongation Minimum A_{50mm}**	**Hardness HV ***
	MPa	MPa	%	HV
R360 - 1/8 Hard - H00	360 .. 430	250	14	100 .. 130
R410 - 1/4 Hard - H01	410 .. 470	360	9	125 .. 155
R460 - 1/2 Hard - H02	460 .. 520	410	7	135 .. 165
R520 - 3/4 Hard - H03	520 .. 580	460	5	145 .. 175
R580 - Extra Hard - H06	580 .. 650	520	4	170 .. 200
R620 - 1/2 Hard - TM01	620 .. 720	540	16	180 .. 240
R660 - 1/2 Hard - TM02	660 ..750	590	10	200 .. 250
R750 - Hard - TM04	750 .. 830	680	8	210 .. 260
R800 - SHM - TM05	> 800	750	5	> 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	Good
Hot Forming Properties at 750 .. 950°C	Excellent
Machinability (Rating 20)	Less suitable
Electroplating Properties	Good
Hot Tinning Properties	Good
Soft Soldering, Brazing	Good
Resistance Welding	Fair
Gas Shielded Arc Welding	Good
Laser Welding	Less suitable
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:
CuNi2,5SiSn has a good resistance in in natural and industrial atmosphere.

Practically resistant against stress corrosion cracking

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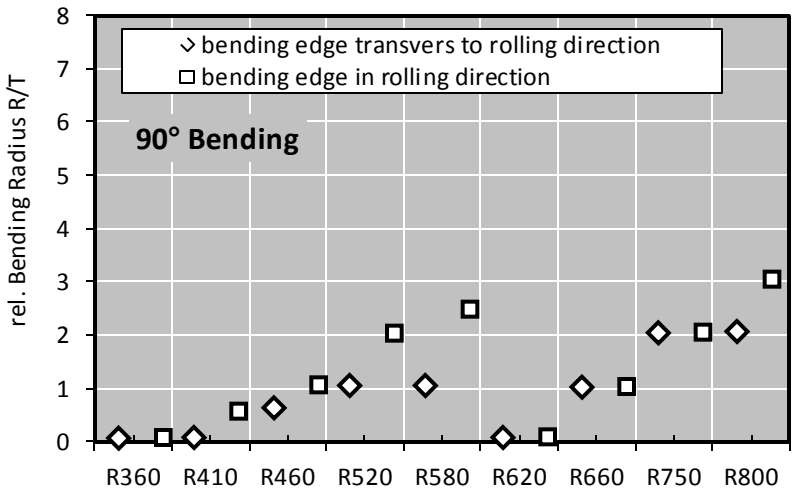
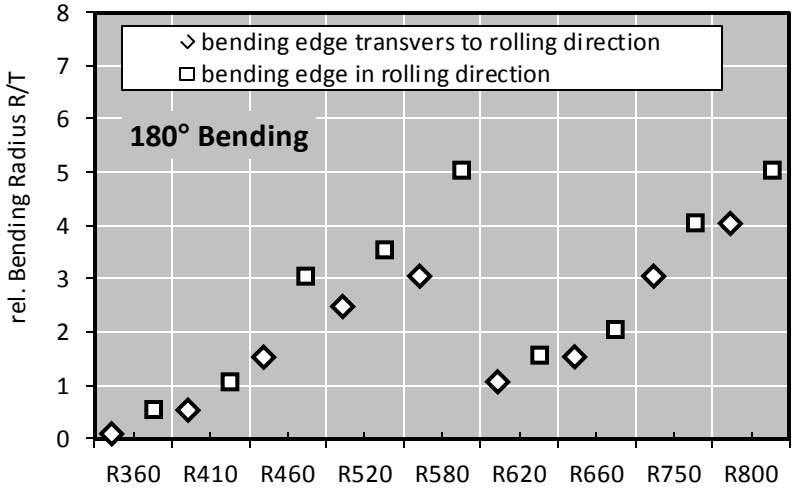
Bending Properties Thickness: ≤ 0.5 mm

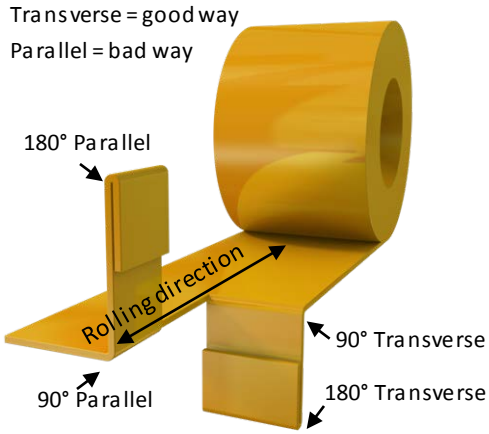




Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

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

Bending Definition



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
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	3.5
R580	≤ 0.5	1	2.5	3	5
R620	≤ 0.5	0	0	1	1.5
R660	≤ 0.5	1	1	1.5	2
R750	≤ 0.5	2	2	3	4
R800	≤ 0.5	2	3	4	5

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

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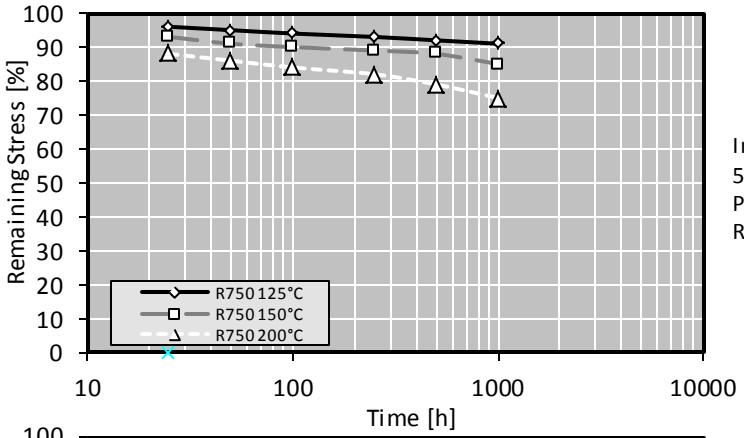
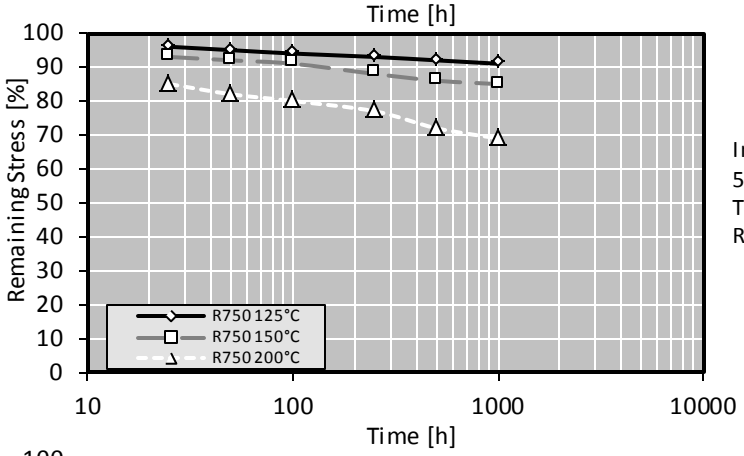
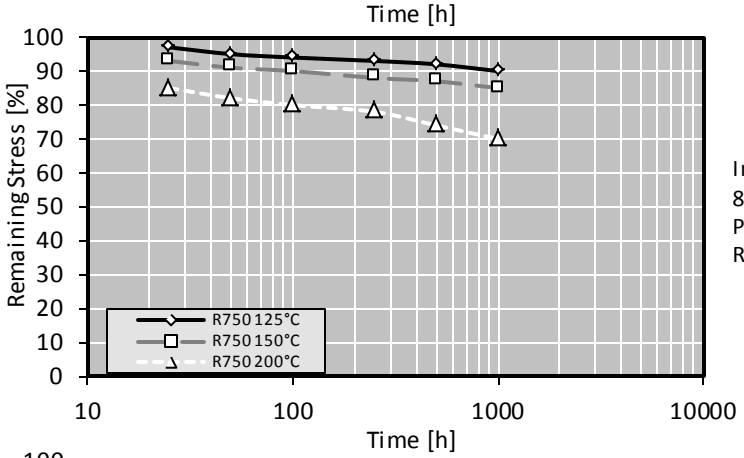
Relaxation Properties



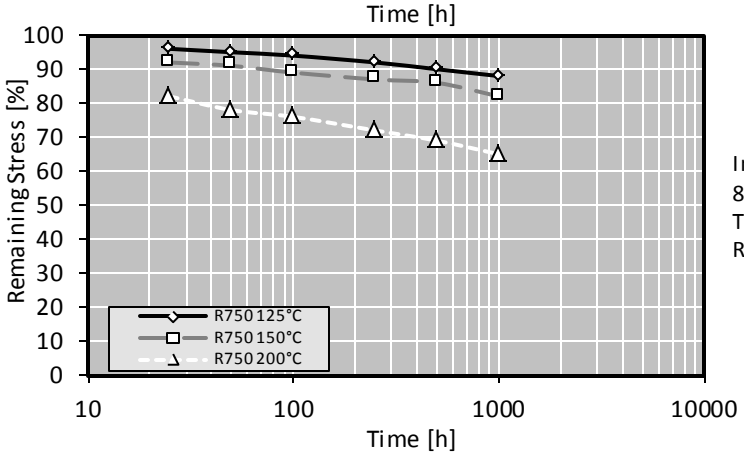
Initial Stress:
50% of Rp0.2
Parallel
Rolling Direction



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

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.

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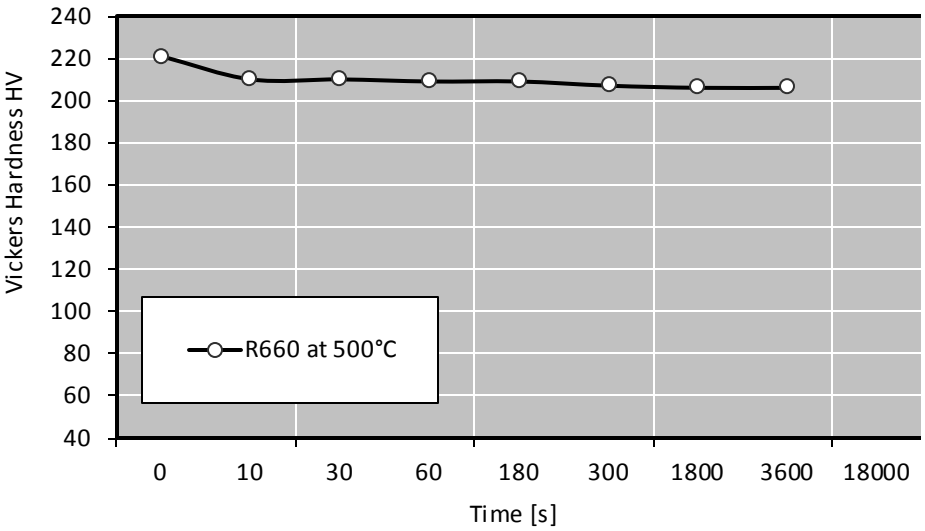
Softening Resistance



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.

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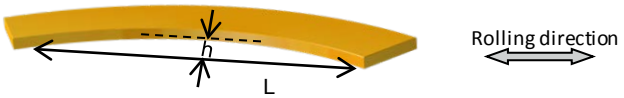
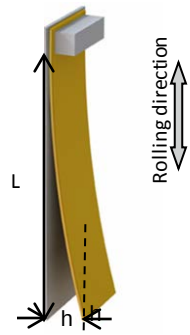
Camber

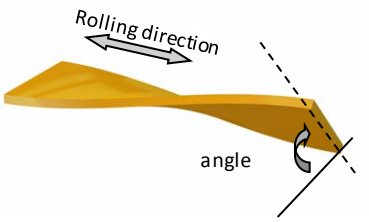


Evenness

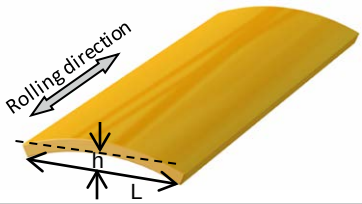
Coil set



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]					
	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

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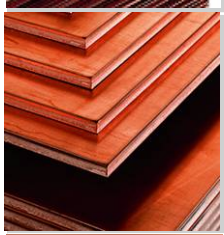
Formats		Dimension*		
	Coil	Strip thickness (other thicknesses on request)	≥ 0.1 .. 6.00	mm
		Strip width	≥ 3 .. 1.250	mm
		Outside diameter	≤ 1.400	mm
		Weight (Standard)	≤ 8.400	kg
		Weight (Deep-Drawing Quality)	≤ 8.000	kg
		Weight per mm	≤ 12.0	kg
	Traverse wound strip	Thickness	≥ 0.2 .. ≤ 1.50	mm
		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

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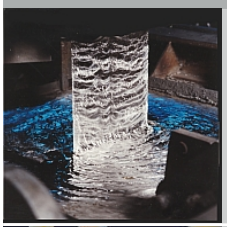
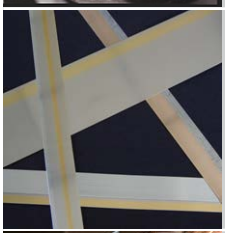
Surface coatings & Special Treatments *		Dimension		
	Hot-Dip tinned and STOL®28M Tin-Silver STOL®13 Thermic Sn Different thickness per side possible	Width Thickness Tin Layer Thickness	≤ 330 ≤ 1.5 0.4 .. 20	mm mm µm
	Electroplating Tin, Silver, Gold, Cu-Flash, Ni-Flash, Selective plating	Width Thickness 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
	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

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