



KME ENGINEERING COPPER SOLUTIONS

Connector Strip Materials

Strips of copper and copper alloys

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slight difference in chem. composition

KME Germany GmbH & Co. KG with its production sites in Osnabrück, Berlin and Menden manufactures standard products for the building and rolled industry and also in Osnabrück special products for industrial applications.

Value adding at KME covers all the stages of processing the basic material copper into semi-finished and finished products.

At KME, copper and copper-alloy rolled material is tailor-made in any quantity/size to customer specifications.

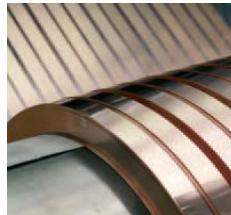
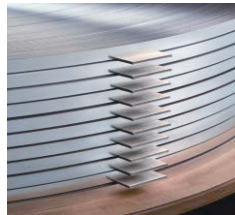
When innovative products are being developed we lend our customers our comprehensive support in the shape of our KME research and development departments and process technology customer assistance.

KME supply their products with the great advantage that they are all from a “one-stop shop”.

Divisions

Rolled products

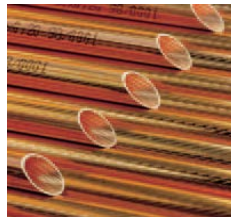
Products



Main uses

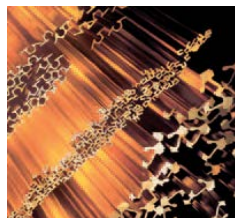
Building and architecture; roof coverings, facades and rainwater draining systems; interior/exterior decorations; electrical and mechanical industry, connectors, boilers, minting, solar collectors, gifts and fancy goods.

Copper tubes



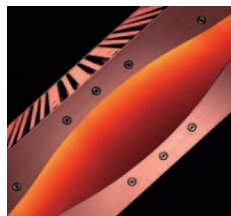
Air conditioning and cooling systems, connectors and pipe fittings, plumbing and heating systems, piping boilers rods systems, gas piping, boilers, electrical applications, solar thermal systems, medical industry.

Brass and copper rods



Tabs, valves and fittings, precision mechanical parts, car components, electrical and electronic equipment, door locks, profiles for architectural use and for window and door fittings.

Special products



Shipbuilding, offshore installations, chemical industry, energy, metallurgy and steel industry.

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1.3. Production and sales location



Production and Sales location

- Brass
- Building Products
- Industrial Products
- Special Products
- Research & Development
- Sales location

■ **bare strips**

■ **pre tinned strips**

hot dip tinned
electrolytical tinned

■ **special qualities**

narrow tolerances
stress levelled
stress annealed

■ **traverse wound strips**

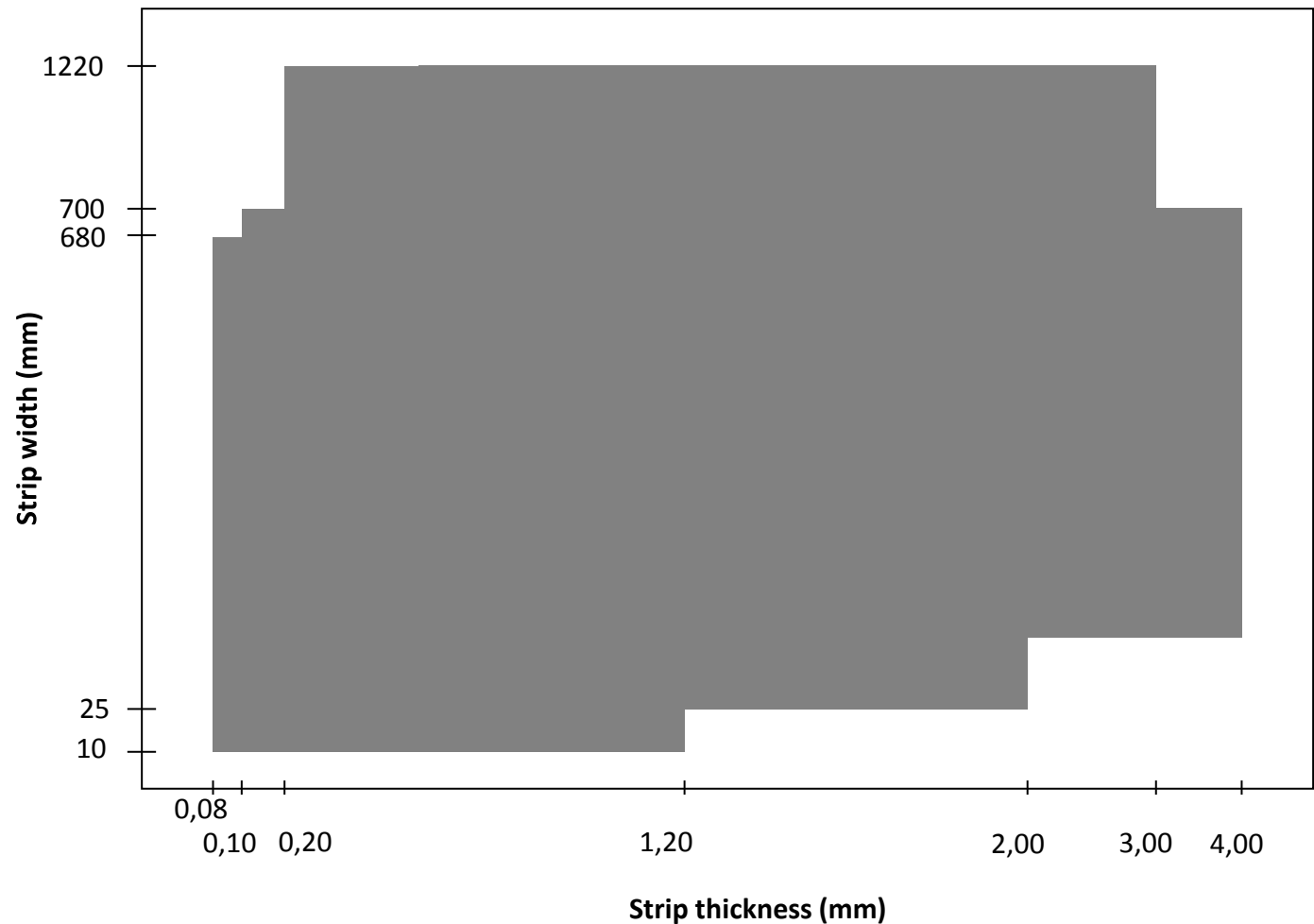
drum weights: 300 - 1.500 kg
wooden, plastic and metal drums
flange less

■ **TECSTRIP®_multicoil**

thickness: 0,15 - 0,80 mm
width: 15 - 50 mm
max. pallet weights: 2.500 kg *

*) higher pallet weights on request

■ **pre stamped - and finish parts**



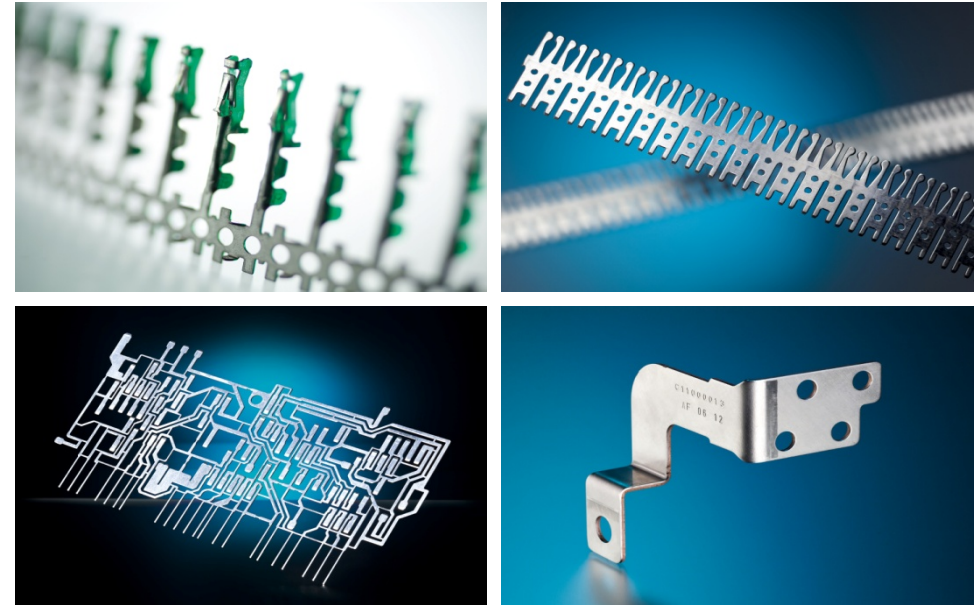
thickness mm	width tolerance standard (mm)				
	10 - 50	51 - 100	101 - 200	201 - 350	351 - 600
0,08 - 1,00	+ 0,20	+ 0,30	+ 0,40	+ 0,60	+ 1,00
1,01 - 2,00	+ 0,30	+ 0,40	+ 0,50	+ 1,00	+ 1,50
2,01 - 4,00	+ 0,50	+ 0,60	+ 0,70	+ 1,20	+ 2,00

thickness mm	width tolerance precision (mm)				
	10 - 50	51 - 100	101 - 200	201 - 350	351 - 600
0,08 - 1,00	+ 0,10	+ 0,20	+ 0,30	+ 0,40	+ 0,50
1,01 - 2,00	+ 0,20	+ 0,20	+ 0,40	+ 0,60	+ 0,70
2,01 - 4,00	+ 0,30	+ 0,30	+ 0,50	+ 0,70	+ 0,90

thickness mm	thickness tolerance	
	standard	precision
0,08 - 0,20	± 0,005	± 0,004
0,21 - 0,30	± 0,007	± 0,005
0,31 - 0,40	± 0,015	± 0,006
0,41 - 0,50	± 0,015	± 0,008
0,51 - 0,60	± 0,017	± 0,010
0,61 - 0,70	± 0,020	± 0,010
0,71 - 0,85	± 0,022	± 0,012
0,86 - 1,30	± 0,025	± 0,015
1,31 - 2,00	± 0,030	± 0,020
2,01 - 4,00	± 0,045	± 0,025

other tolerances on request

- When it comes to high-quality stamped and formed parts with maximum precision at a high technical level, we are your partner.
- We offer fully integrated manufacturing chain
 - Advice on materials
 - Strip production
 - Hot-dip tinning, electroplating and coating of stamped strips
 - Manufacturing of stamped parts especially for material-intensive products
 - Recycling of stamping parts
 - Metal management
- We will send you an overall concept tailored to your needs



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2.2.2. Stamping - Center Osnabrück

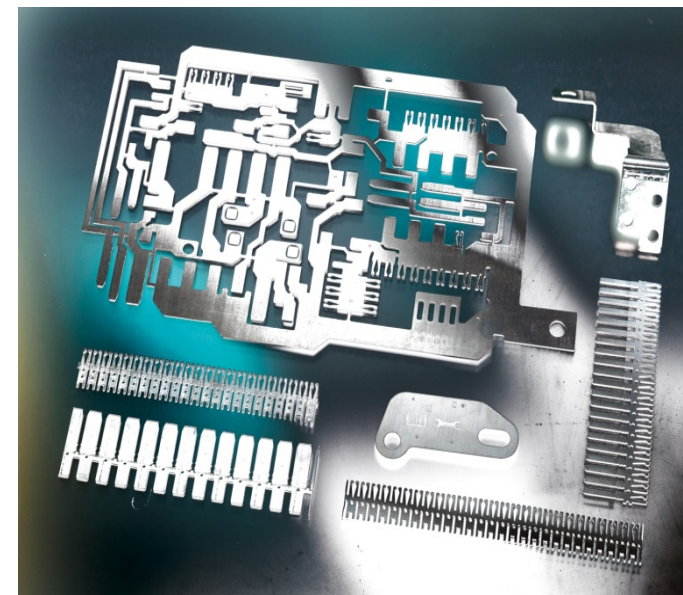
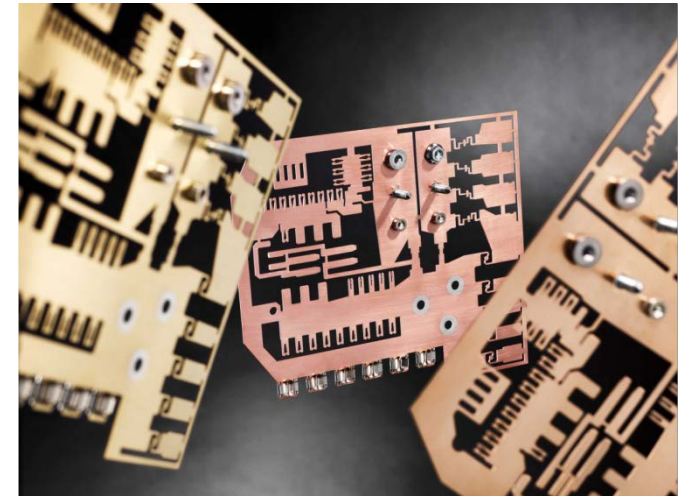


- Stampingmaschinen with 50 – 300t press force
- Strip thickness up to 4 mm (according press and base material)
> 4 mm on request
- Tool size up to 2,5m
- Integrated processes a.e.
 - press in from bolts and nuts
 - joining of components
- Small and large batch production
- Customised packaging
- Tool construction and tool maintenance
- Stamping of all common metals
- Technical and sales support for customers
- Project management
- Quality management system accredited to TS 16949

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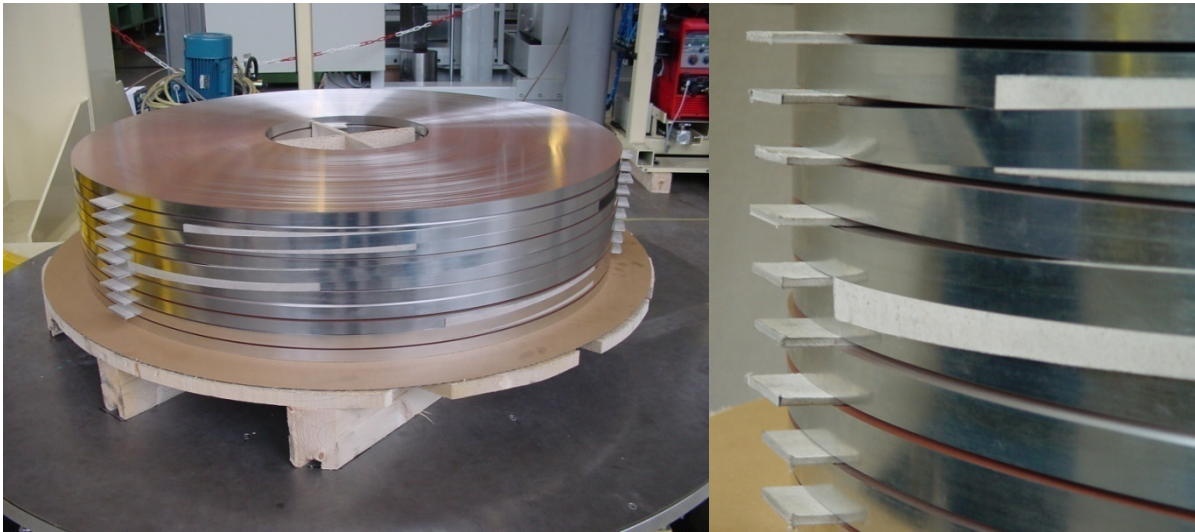
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2.3.1. TECSTRIP®_multicoil



The economical coil of Copper, Bronze and High Performance STOL® alloys. **TECSTRIP®_multicoil** is a system where several large pancake coils are joined together by resistance welding and supplied palletized for use on pallet de-coilers.

Your advantage: Increased efficiency = increase of the productivity = cost savings when processing KME alloys.



Standard thickness: 15 - 50 mm
Standard width: 0,15 - 0,80 mm

Warehouse requirements:

- Height of pallet: max. 490 mm
- Circular pallet ø: max. 1.600 mm
- Pallet weight: max. 2.500 kg *)
- Outer diameter ø: max. 1.600 mm

*) higher pallet weights on request

Inner diameter ø 300 mm for thickness:
0,15 - 0,40 mm

Inner diameter ø 400 mm für thickness:
> 0,40 - 0,80 mm

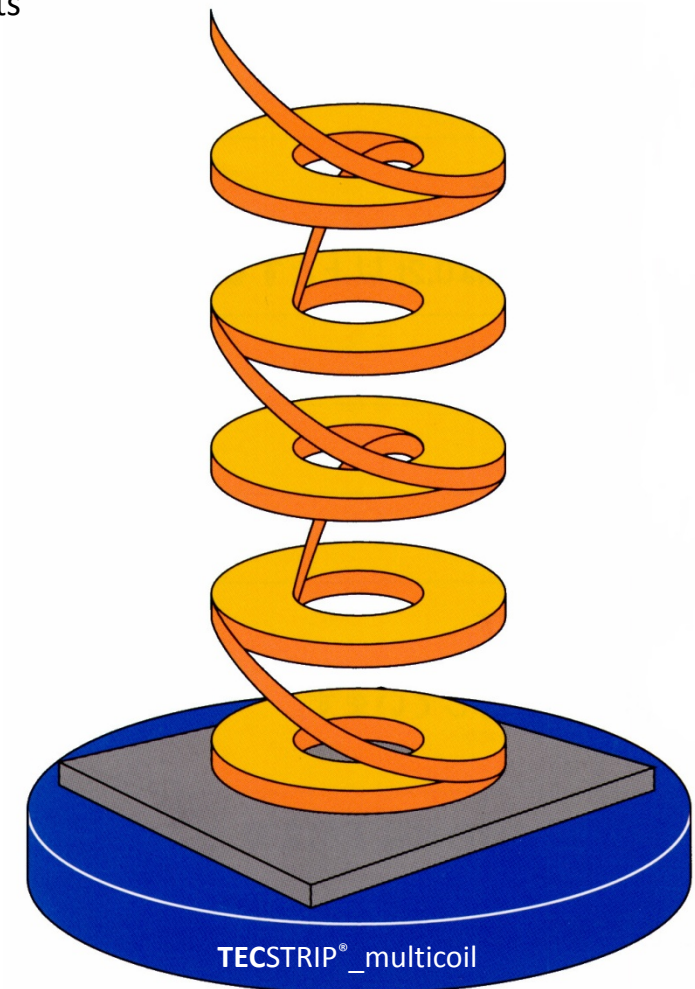
The coils ends are joined by welding the outer to outer and inner to inner ends, forming one continuous length. The **TECSTRIP®_multicoil** is then unreeled in the opposite direction during processing.

Potential savings using TECSTRIP®_multicoil

The use of TECSTRIP®_multicoil optimises production, reduces coil changes and labour costs and keeps scrap to the minimum.

(Example for strip dimension: 0,25 x 25 mm = 12 single coils)

- Saving of materials
 - up to 44 m strip material = minimizes scrap.
- Reduction of tooling time
 - up to 165 minutes longer machine running capacity through TECSTRIP®_multicoil
 - in comparison to 12 single coils without stamping starts of
 - single coils = productivity increase of approx. 13 %.
- Tooling – capacity
 - up to 25 % less tooling breaks starting single coils.
- De-coiler system of KME own machinery manufacture
 - customer designed conception
 - reduction of investment spending by customer-orientated cost absorptions.



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3.1. Survey standard - alloys



ASTM	DIN EN	CEN	Applications
C11000 C10300 C10300 C12000 C12200 C10200 C10100	Cu-ETP Cu-HCP Cu-PHC Cu-DLP Cu-DHP Cu-OF Cu-OFE	CW004A CW021A CW020A CW023A CW024A CW009A	Base material for electrical parts.
C22000 C23000 C26000 C26800 C27000 C27200	CuZn10 CuZn15 CuZn30 CuZn33 CuZn36 CuZn37	CW501L CW502L CW505L CW506L CW507L CW508L	Basis elements for electrical parts, installation parts and fittings for the electrical industry. Cost reduction by higher zinc content.
C51100 C51000 C51900 C52100	CuSn4 CuSn5 CuSn6 CuSn8	CW450K CW451K CW452K CW453K	Contact springs, connectors, membranes, spring elements, switch elements, fixed contacts. Ultra-high strength spring elements.
C 14415 [#]	CuSn0,15	CW117C	Male connectors, junction boxes.
C15100	CuZr0,1		Connectors, relays, springs, high voltage contacts.
C15500	CuMgAgP		Electrical contacts, electronic components, soldered connection
C19210	CuFe0,1P		Connectors, relays, springs
	CuSn3Zn9	CW454K	Good compromise between alloy properties, low metal price and better price formation.
C42500	CuSn2Zn10		Connectors
C50710	CuSn2Fe0,1P		Connectors
C50725	CuSn2Zn2Fe0,1P		Connectors, bend parts, relays.
C70250	CuNi3Si		High corrosion resistance against oil + seawater (seawater spray test), resistance against relaxation.
C70600	CuNi10Fe1Mn	CW352H	

The KME alloys are conforming to RoHS. [#] slight difference in chem. composition

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3.2. C11000 - Cu-ETP _(E-Cu) - CW004A



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	180	8	65 - 95	0	0
R290	290 - 360	250	4	90 - 110	0	0,5
R360	min. 360	320	2	min. 110	1	2
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,90
O	$\leq 0,040$

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	394
Electr. conductivity ***	MS/m	58
Electr. conductivity ***	IACS	100
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,7
Modulus of elasticity *	GPa	127
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.3. C10300 - Cu-HCP (SE-Cu) - CW021A



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	180	8	65 - 95	0	0
R290	290 - 360	250	4	90 - 110	0	0
R360	min. 360	320	2	min. 110	0	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,95
P	0,003

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	385
Electr. conductivity ***	MS/m	57
Electr. conductivity ***	IACS	98
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,7
Modulus of elasticity *	GPa	132
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.4. C10300 - Cu-PHC (SE-Cu) - CW020A



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	180	8	65 - 95	0	0
R290	290 - 360	250	4	90 - 110	0	0
R360	min. 360	320	2	min. 110	0	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,95
P	0,001 - 0,005

Physical properties		
Density *	g/cm ³	8,94
Thermal conductivity *	W/(m·K)	385
Electr. conductivity ***	MS/m	58
Electr. conductivity ***	IACS	100
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,7
Modulus of elasticity *	GPa	132
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.5. C12000 - Cu-DLP (SW-Cu) - CW023A



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	180	8	65 - 95	0	0
R290	290 - 360	250	4	90 - 110	0	0
R360	min. 360	320	2	min. 110	0	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,90
P	0,005 - 0,013

Physical properties		
Density *	g/cm ³	8,94
Thermal conductivity *	W/(m·K)	375
Electr. conductivity ***	MS/m	55
Electr. conductivity ***	IACS	95
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,3
Modulus of elasticity *	GPa	132
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.6. C12200 - Cu-DHP (SF-Cu) - CW024A



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	180	8	65 - 95	0	0
R290	290 - 360	250	4	90 - 110	0	0
R360	min. 360	320	2	min. 110	0	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,90
P	0,015 - 0,040

Physical properties		
Density *	g/cm ³	8,90
Thermal conductivity *	W/(m·K)	330
Electr. conductivity ***	MS/m	47
Electr. conductivity ***	IACS	81
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,6
Modulus of elasticity *	GPa	132
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
R220	220 - 260	(max. 140)	33	40 - 65	0	0
R240	240 - 300	(180)	8	65 - 95	0	0
R290	290 - 360	(250)	4	90 - 110	0	0
R360	min. 360	(320)	2	min. 110	0	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	99,90
P	0,015 - 0,040
O	0,0005

Physical properties		
Density *	g/cm ³	8,94
Thermal conductivity *	W/(m·K)	394
Electr. conductivity ***	MS/m	58,6
Electr. conductivity ***	IACS	101
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,7
Modulus of elasticity *	GPa	132
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.8. C22000 - CuZn10 - CW501L



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R240	240 - 290	(max. 140)	36	50 - 100	0	0
R280	280 - 360	(200)	13	80 - 130	0	0
R350	350 - 450	(290)	4	110 - 160	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	89,0 - 91,0
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,8
Thermal conductivity *	W/(m·K)	184
Electr. conductivity ***	MS/m	25
Electr. conductivity ***	IACS	43
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,2
Modulus of elasticity *	GPa	124
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.9. C23000 - CuZn15 - CW502L



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R300	300 - 370	(max. 170)	16	85 - 120	0	0
R350	350 - 420	(270)	8	100 - 150	0	0
R410	410 - 490	(360)	3	125 - 155	0	1
R480	480 - 560	(420)	1	150 - 180	1	3
R550	min. 550	(480)	-	min. 170	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	84,0 - 86,0
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,75
Thermal conductivity *	W/(m·K)	159
Electr. conductivity ***	MS/m	20
Electr. conductivity ***	IACS	34
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,5
Modulus of elasticity *	GPa	122
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R270	270 - 350	(max. 170)	40	55 - 105	0	0
R350	350 - 430	(270)	21	95 - 155	0	0
R410	410 - 490	(350)	9	120 - 180	0	1
R480	480 - 570	(430)	4	150 - 190	0,5	2
R550	550 - 640	(480)	2	170 - 210	1	3
R630	min. 630	(560)	-	min. 190	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	69,0 - 71,0
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,5
Thermal conductivity *	W/(m·K)	126
Electr. conductivity ***	MS/m	16
Electr. conductivity ***	IACS	28
Coefficient of thermal expansion **	10 ⁻⁶ /K	19,7
Modulus of elasticity *	GPa	115
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

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3.11. C26800 - CuZn33 - CW506L



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R280	280 - 380	(max. 170)	44	55 - 95	0	0
R350	350 - 430	(170)	23	95 - 125	0	0
R420	420 - 500	(300)	6	125 - 155	0	0
R500	min. 500	(450)	3	min. 155	0,5	0,5
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	66,0 - 68,0
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,5
Thermal conductivity *	W/(m·K)	121
Electr. conductivity ***	MS/m	15
Electr. conductivity ***	IACS	26
Coefficient of thermal expansion **	10 ⁻⁶ /K	19,9
Modulus of elasticity *	GPa	112
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.12. C27000 - CuZn36 - CW507L



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R300	300 - 370	(max. 180)	38	55 - 105	0	0
R350	350 - 430	(170)	19	95 - 125	0	0
R410	410 - 490	(300)	8	120 - 155	0	0
R480	480 - 560	(430)	3	150 - 180	0,5	2
R550	min. 550	(500)	-	min. 170	1	3
R630	min. 630	(600)	-	min. 190	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	63,5 - 65,5
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,45
Thermal conductivity *	W/(m·K)	121
Electr. conductivity ***	MS/m	14
Electr. conductivity ***	IACS	24
Coefficient of thermal expansion **	10 ⁻⁶ /K	20,2
Modulus of elasticity *	GPa	110
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.13. C27200 - CuZn37 - CW508L



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R300	300 - 370	(max. 180)	38	55 - 105	0	0
R350	350 - 430	(170)	19	95 - 125	0	0
R410	410 - 490	(300)	8	120 - 155	0	0
R480	480 - 560	(430)	3	150 - 180	0,5	2
R550	min. 550	(500)	-	min. 170	1	3
R630	min. 630	(600)	-	min. 190	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	62,0 - 64,0
Zn	Rest
Ni	max. 0,3
Sn	max. 0,1
Fe	max. 0,05

Physical properties		
Density *	g/cm ³	8,45
Thermal conductivity *	W/(m·K)	121
Electr. conductivity ***	MS/m	14
Electr. conductivity ***	IACS	24
Coefficient of thermal expansion **	10 ⁻⁶ /K	20,2
Modulus of elasticity *	GPa	110
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.14. C51100 - CuSn4 - CW450K



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa		Elongation A50 min. %		Hardness (reference) HV	Bendability 90° gw 1) 2)		Bendability 90° bw 1) 2)	
		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling
R290	290 - 390	max. 190		40		70 - 105	0	0	0	0
R390	390 - 490	320	250	17	20	115 - 155	0	0	0	0
R480	480 - 570	440	400	8	13	150 - 180	0	0	0	0
R540	540 - 630	480	450	6	12	160 - 200	0	0	0,5	0
R600	600 - 660	560	530	5	12	min. 180	0	0	1	0
R660	660 - 720	620	590	-	7	min. 180	-	0	-	0
R700	700 - 800	-	640	-	3	min. 180	-	0	-	0

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) Sample width = 10 mm / Bendability for width of smaller samples on request
(scale acc. bending cross reference list)

Chemical composition (reference) %	
Cu	Rest
Sn	3,5 - 4,5
Fe	max. 0,1
Ni	max. 0,2
P	0,01 - 0,4
Zn	max. 0,2
Pb	max. 0,02
Other	max. 0,2

Physical properties		
Density *	g/cm ³	8,85
Thermal conductivity *	W/(m·K)	100
Electr. conductivity ***	MS/m	12
Electr. conductivity ***	IACS	21
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,8
Modulus of elasticity *	GPa	120

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.15. C51000 - CuSn5 - CW451K



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa		Elongation A50 min. %		Hardness (reference) HV	Bendability 90° gw 1) 2)		Bendability 90° bw 1) 2)	
		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling
R310	310 - 390	max. 250		45		70 - 105	0	0	0	0
R400	400 - 500	340	-	17	-	120 - 160	0	0	0	0
R490	490 - 580	450	440	12	19	160 - 190	0	0	0	0
R550	550 - 640	500	480	5	13	180 - 210	0	0	1	0,5
R630	630 - 720	570	560	3	7	200 - 230	1	0	2	1
R690	min. 690	630	600	2	4	min. 220	2,5	2	3,5	3

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) Sample width = 10 mm / Bendability for width of smaller samples on request
(scale acc. bending cross reference list)

Chemical composition (reference) %	
Cu	Rest
Sn	4,5 - 5,5
Fe	max. 0,1
Ni	max. 0,2
P	0,01 - 0,4
Zn	max. 0,2
Pb	max. 0,02
Other	max. 0,2

Physical properties		
Density *	g/cm ³	8,85
Thermal conductivity *	W/(m·K)	96
Electr. conductivity ***	MS/m	89
Electr. conductivity ***	IACS	15
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,8
Modulus of elasticity *	GPa	120

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.16. C51900 - CuSn6 - CW452K



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa		Elongation A50 min. %		Hardness (reference) HV	Bendability 90° gw 1) 2)		Bendability 90° bw 1) 2)	
		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling		mech. stress- levelling	thermal stress- levelling	mech. stress- levelling	thermal stress- levelling
R350	350 - 420	max. 300		45		80 - 120	0	0	0	0
R420	420 - 520	350	340	15	22	120 - 170	0	0	0	0
R500	500 - 590	450	410	15	22	160 - 190	0	0	0	0
R560	560 - 650	520	490	10	15	180 - 210	0	0	0	0
R640	640 - 730	590	570	5	12	200 - 230	0	0	1	0,5
R720	min. 720	650	620	-	4	min. 210	-	1	-	-
R850 ³⁾	min. 850	-	800	-	1,5	min. 240	-	1	-	-

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)
3) thicknesses: 0,15 - 0,60 mm

Chemical composition (reference) %	
Cu	Rest
Sn	5,5 - 7,0
Fe	max. 0,1
Ni	max. 0,2
P	0,01 - 0,4
Zn	max. 0,2
Pb	max. 0,02
Other	max. 0,2

Physical properties		
Density *	g/cm ³	8,80
Thermal conductivity *	W/(m·K)	75
Electr. conductivity ***	MS/m	8
Electr. conductivity ***	IACS	13
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,5
Modulus of elasticity *	GPa	118

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.17. C52100 - CuSn8 - CW453K



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa		Elongation A50 min. %		Hardness (reference) HV	Bendability 90° gw 1) 2)		Bendability 90° bw 1) 2)	
		mech. stress-levelling	thermal stress-levelling	mech. stress-levelling	thermal stress-levelling		mech. stress-levelling	thermal stress-levelling	mech. stress-levelling	thermal stress-levelling
R370	370 - 450	max. 300		50		80 - 120	0	0	0	0
R450	450 - 550	370 350	28	35	22	120 - 175	0	0	0	0
R540	540 - 630	460	440	22	27	170 - 200	0	0	0	0
R600	600 - 690	520	480	16	20	180 - 210	0	0	1	0
R660	660 - 750	600	580	10	14	210 - 240	0	0	3	2
R740	740 - 810	680	660	5	8	210 - 260	-	2	-	3
R800 ³⁾	800 - 930	720	700	-	4	230 - 290	-	-	-	-
R850 ³⁾	min. 850	-	800	-	1,5	min. 240	-	-	-	-

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)
3) thicknesses: 0,15 - 0,60 mm

Chemical composition (reference) %	
Cu	Rest
Sn	7,5 - 8,5
Fe	max. 0,1
Ni	max. 0,2
P	0,01 - 0,4
Zn	max. 0,2
Pb	max. 0,02
Other	max. 0,2

Physical properties		
Density *	g/cm ³	8,80
Thermal conductivity *	W/(m·K)	67
Electr. conductivity ***	MS/m	6,5
Electr. conductivity ***	IACS	11
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,5
Modulus of elasticity *	GPa	115

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.18. C70600 - CuNi10Fe1Mn - CW352K



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2) 3)} bw	
R300	min. 300	(100)	20	min. 70	0	0
R320	min. 320	(180)	12	min. 100	0	0
R420	420 - 510	(370)	3	min. 120	0	0,5
R520	520 - 610	(480)	2	min. 150	1	2
R620	min. 620	(590)	-	min. 170	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	Rest
Ni	9,0 - 11,0
Fe	1,0 - 2,0
Mn	0,5 - 1,0

Physical properties		
Density *	g/cm ³	8,80
Thermal conductivity *	W/(m·K)	67
Electr. conductivity ***	MS/m	6,5
Electr. conductivity ***	IACS	11
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,5
Modulus of elasticity *	GPa	115
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.19. C70250 - CuNi3Si



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa () only Information	Elongation A50 min. %	Hardness (reference) HV	Bendability 90° gw _{1) 2)} bw	
age hardened						
R620	620 - 760	500	10	180 - 240	0	0
R650	650 - 800	585	7	190 - 250	1	1
R690	690 - 820	655	5	210 - 250	1,5	1,5
R760	760 - 840	720	3	220 - 260	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu	min. 96,2
Ni	2,2 - 4,2
Si	0,25 - 1,2
Mg	0,05 - 0,30
Other	Rest

Physical properties		
Density *	g/cm ³	8,80
Thermal conductivity *	W/(m·K)	190
Electr. conductivity ***	MS/m	23
Electr. conductivity ***	IACS	40
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,6
Modulus of elasticity *	GPa	130
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)		Hardness (reference) HV	Bendability 90°		Bendability 180°	
						1) 2) 3)		1) 2) 3)	
						gw	bw	gw	bw
R320	320 - 380	max. 250	25		80 - 110	0	0	0	0
R380	380 - 430	(200)	16	20	110 - 140	0	0	0,5	1
R430	430 - 520	(330)	6	10	140 - 170	0	0	1	1,5
R510	510 - 600	(430)	3	8	160 - 190	0	1	2	2,5
R580	580 - 690	(520)	-		180 - 210	1	2	2,5	4
R660	min. 660	(610)	-		min. 200	-	-	-	-

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request
(scale acc. bending cross reference list)

Chemical composition % (reference) CuSn3Zn9 - CW454K		
Cu	Rest	
Sn	1,5 - 3,5	
Zn	7,5 - 10,0	

Chemical composition % (reference) CuSn3Zn9 - CW454K		
Cu	87 - 90	
Sn	1,5 - 3,0	
Zn	Rest	

Physical properties		
Density *	g/cm ³	8,75
Thermal conductivity *	W/(m·K)	120
Electr. conductivity ***	MS/m	15
Electr. conductivity ***	IACS	25
Coefficient of thermal expansion **	10 ⁻⁶ /K	18,4
Modulus of elasticity *	GPa	126

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.21. C15100 - CuZr0,1



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R280	280 - 310	190	13	80 - 100	0	0	0	0
R300	300 - 350	280	6	95 - 115	0	0	-	-
R320	320 - 390	310	5	100 - 125	-	-	-	-
R360	360 - 430	350	4	120 - 145	-	-	-	-
R400	400 - 450	390	3	125 - 150	-	-	-	-
R440	440 - 490	430	2	min. 135	-	-	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)								

Chemical composition (reference) %		
Cu		$\geq 99,80$
Zr		0,05 - 0,15
Fe + Al + Mn		$\leq 0,01$
Physical properties		
Density *		g/cm ³ 8,94
Thermal conductivity *		W/(m·K) 360
Electr. conductivity ***		MS/m 55
Electr. conductivity ***		IACS 95
Coefficient of thermal expansion **		10 ⁻⁶ /K 17,6
Modulus of elasticity *		GPa 121
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.22. C19210 - CuFe0,1P



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R300	300 - 380	max. 300	10	80 - 110	0	0	0	0
R360	360 - 440	260	3	100 - 130	0	0	-	-
R420	420 - 500	350	2	120 - 150	-	-	-	-
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) values for stress relieved qualities 3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)								

Chemical composition (reference) %	
Cu	Rest
Fe	0,05 - 0,15
P	0,025 - 0,04
Other	max. 0,5

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	350
Electr. conductivity ***	MS/m	50
Electr. conductivity ***	IACS	86
Coefficient of thermal expansion **	10 ⁻⁶ /K	17
Modulus of elasticity *	GPa	125
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

KME Germany GmbH & Co. KG

3.23. C50715 - CuSn2Fe0,1P



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R390	390 - 500	290	16	min. 130	0	0	0	0
R510	510 - 600	440	6	min. 165	0	0	0	1
R550	550 - 630	490	5	min. 175	0	0,5	1	1,5
R600	600 - 670	550	3	min. 190	1	1,5	2	2,5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)

Chemical composition (reference) %	
Cu	Rest
Sn	1,7 - 2,3
Fe	0,05 - 0,15
P	0,025 - 0,04
Other	max. 0,5

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	140
Electr. conductivity ***	MS/m	22
Electr. conductivity ***	IACS	38
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,6
Modulus of elasticity *	GPa	121

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

KME Germany GmbH & Co. KG

3.24. C50725 - CuSn2Zn2Fe0,1P



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R390	390 - 500	280	20	min. 130	0	0	0	0
R510	510 - 600	470	6	min. 165	0	0	0	1
R550	550 - 630	510	5	min. 175	0	0,5	1	1,5
R600	600 - 670	575	3	min. 190	1	1,5	2	2,5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
 2) values for stress relieved qualities
 3) Sample width = 10 mm / Bendability for width of smaller samples on request
 (scale acc. bending cross reference list)

Chemical composition (reference) %	
Cu	Rest
Sn	1,5 - 2,5
Zn	1,5 - 3,0
Fe	0,05 - 0,20
P	0,02 - 0,06
Other	max. 0,5

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	150
Electr. conductivity ***	MS/m	19
Electr. conductivity ***	IACS	33
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,5
Modulus of elasticity *	GPa	113

* Reference values at room temperature
 ** Between 20 up to 300 °C
 *** Values for the lowest temper class

Temper class	Tensile strength R _m min. - max. MPa	Yield strength R _{p0,2} min. MPa	Elongation A ₅₀ min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2)	
					gw	bw
R250	250 - 320	200	9	60 - 90	0	0
R300	300 - 370	250	4	85 - 110	0	0
R360	360 - 430	300	3	105 - 130	0	0
R420	420 - 490	350	2	120 - 140	1	1
1) $r = x \cdot t$ thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (reference) %	
Cu (incl. Ag + Sn)	$\geq 99,96$
Sn	0,10 - 0,15

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	350
Electr. conductivity ***	MS/m	47
Electr. conductivity ***	IACS	81
Coefficient of thermal expansion **	10 ⁻⁶ /K	18
Modulus of elasticity *	GPa	120
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

slight difference in chem. composition

KME Germany GmbH & Co. KG

3.26. C15500 - CuMgAgP



Temper class		Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. %	Bendability	
					90° 1) 2)	
					gw	bw
R235	O61 annealed	235 - 295	105	30	0	0
R310	H02 ½ hard	310 - 380	260	13	0	0
R385	H04 hard	385 - 440	345	6	0	0,5
R435	H06 extra hard	435 - 495	385	5	0,5	1
R450	H08 spring	450 - 505	415	4	0,5	1
R470	H10 extra spring	470 - 515	435	3	1	2
1) $r = x \cdot t$ (thickness $\leq 0,50$ mm) 2) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)						

Chemical composition (%) (reference)	
Cu (incl. Ag)	99,75
Mg	0,08 - 0,13
P	0,04 - 0,08
Ag	0,027 - 0,10

Main characteristics
Medium performance, automotive and soldered terminals. Maximum conductivity combined with medium strength, high thermal and oxidation stability, junction boxes and terminals.

Physical properties		
Density *	g/cm ³	8,91
Thermal conductivity *	W/(m·K)	346
Electr. conductivity ***	MS/m	50
Electr. conductivity ***	IACS	86
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,8
Modulus of elasticity *	GPa	115
* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class		

4.1. STOL® alloys



KME Brand name	CEN	ASTM	Main characteristics
STOL®76	-	C19010	Basic elements for automotive and electrical connectors for high currents and high temperature. Excellent conductivity combined with high strength and good resistance to relaxation; strengthening by age hardening. STOL®76 is the most important alloy in our program.
STOL®76M	-	C19002#	Upgraded STOL®76. High tensile strength with best bendability and electrical conductivity. Good resistance against relaxation; strengthening by age hardening. No peeling at long term-charge up to 130 °C and higher.
STOL®78	-	C18665	Automotive, electrical and electronic connectors; for relays; current carrying springs and junction boxes; excellent formability at medium strength.
STOL®80	-	C14410	Low cost special alloy, highest conductivity, preferred for male connectors, junction boxes, pre-tinned a substitution of brass at nearly the same costs.
STOL®94	-	C70310	Maximum strength combined with good bendability and good electrical conductivity, resistance against relaxation and electro-chemical migration. No peeling at long-term charge up to 130 °C and higher. Partial substitute for beryllium alloys.
STOL®95	-	-	Alloy for high current applications e.g. hybrid-cars or photovoltaic. The electrical and thermal conductivity is excellent. Due to the CrZr-precipitations the relaxation properties, even at temperatures up to 200 °C are excellent (remaining stress 80% / 200°C / 1000h): As strip (0,2 – 3,0 mm) and round wire (up to 1,0 mm) available.
STOL®194	CW 107 C	C19400	Medium performing alloy, the oldest worldwide available special alloy.

slight difference in chem.composition

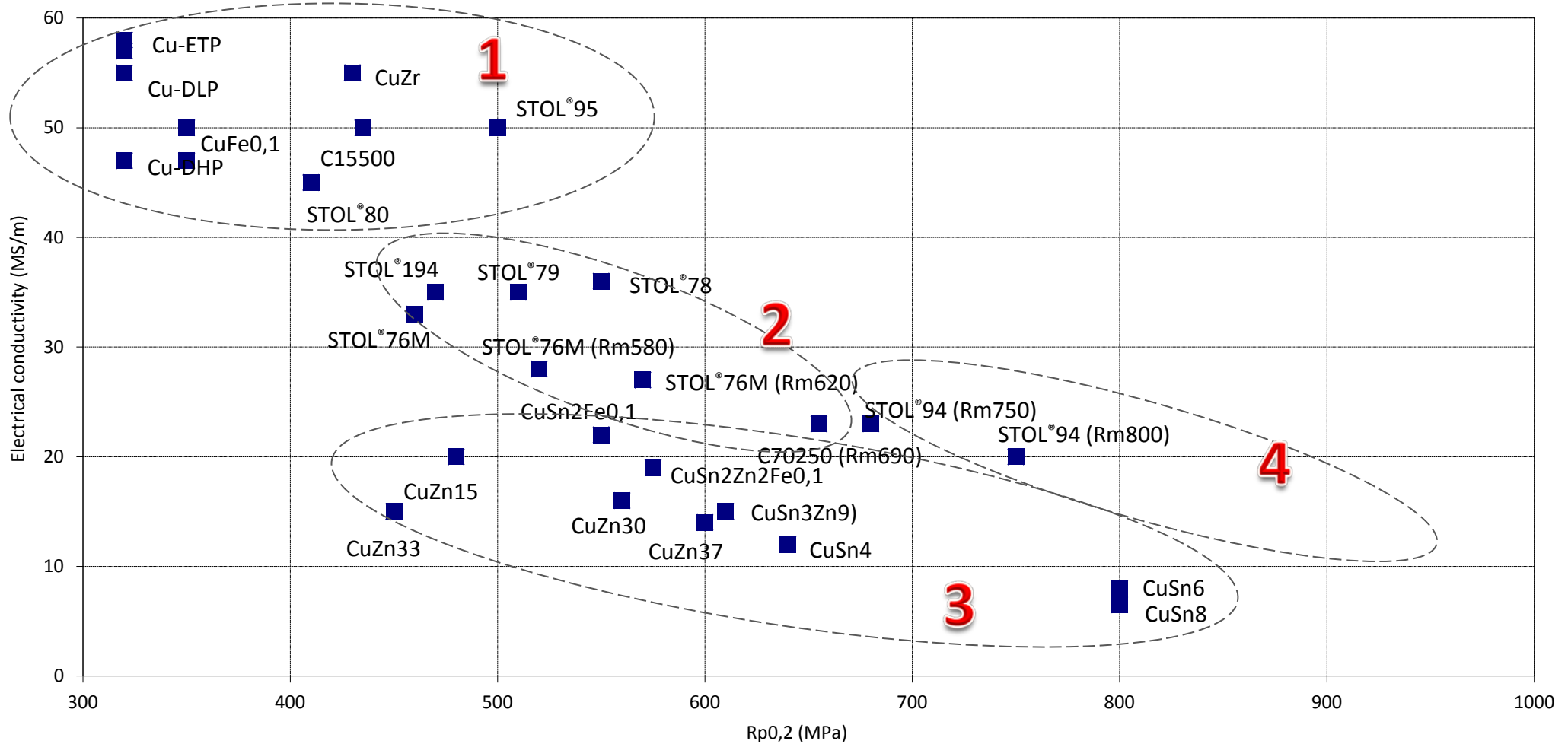
4.2. STOL[®] alloys (Chemical composition)

Alloy	Cu %	Cr %	Fe %	Mg %	Ni %	Sn %	Si %	Zn %	Zr %	Other %
STOL [®] 76	Rest				0,8 – 1,8		0,15 – 0,35			max. 0,8
STOL [®] 76M	Rest				1,4 – 1,7	0,2 – 0,3	0,2 – 0,35	0,35 – 0,5		max. 0,5
STOL [®] 78	min. 99,0			0,4 – 0,9						
STOL [®] 80	min. 99,90 incl. Ag + Sn					0,15 – 0,20				max. 0,1
STOL [®] 94	Rest				2,0 – 3,2	0,1 – 0,7	0,3 – 0,9	0,3 – 1,3		max. 0,5
STOL [®] 95	Rest	0,3 – 1,2							0,03 – 0,3	max. 0,2
STOL [®] 194	Rest		2,1 – 2,6					0,05 – 0,20		max. 0,2

	Density*	Coefficient of thermal conductivity**	Thermal conductivity *	Electrical conductivity***	Electrical conductivity***	Modulus of elasticity *
	kg/cm ³	10 ⁻⁶ K	W/ (m K)	MS/m	IACS	GPa
STOL [®] 76	8,9	16,8	260	29 / 35	50 / 60	135
STOL [®] 76M	8,9	16,8	260	27 / 33	47 / 57	135
STOL [®] 78	8,8	17,3	270	36	62	130
STOL [®] 80	8,9	17,3	330	44	76	120
STOL [®] 94	8,85	17	185	23 / 25	40 / 43	132
STOL [®] 95	8,9	18	330	50	86	137
STOL [®] 194	8,9	16,3	260	35	60	125
* Reference values at room temperature		** between 20 and 300 °C		*** Value for the age hardened / lowest cold rolled worked temper class		

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4.4. Segmentation of selected alloys



1. Moderate-low strength, high conductivity
2. Moderate strength, improved conductivity
3. Low conductivity, moderate strength
4. Medium conductivity, high strength

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4.5. STOL®76 - C19010



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)		Hardness (reference) HV	Bendability		Bendability	
						90°		180°	
						1) 2) 3)		1) 2) 3)	
						gw	bw	gw	bw
cold worked R360	360 - 430	300	12	14	100 - 130	0	0	0	0
R410	410 - 470	360	9	11	125 - 155	0	0	0,5	1
R460	460 - 520	410	7	9	135 - 165	0,5	1	1,5	3
R520	520 - 580	460	5	7	145 - 175	1	2	2,5	4
age hardened R580	580 - 650	520	9		160 - 210	1	1	3	5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu	Rest
Ni	0,8 - 1,8
Si	0,15 - 0,35
Other	max. 0,8

Main characteristics
Basic elements for automotive and electrical connectors for high current and high temperature. Excellent conductivity combined with high strength and good resistance to relaxation; strengthening by age hardening.

Physical properties		
Density *	g/cm³	8,9
Thermal conductivity *	W/(m·K)	260
Electr. conductivity ***	MS/m	35 (cold worked) 29 (age hardened)
Electr. conductivity ***	IACS	60 (cold worked) 50 (age hardened)
Coefficient of thermal expansion **	10 ⁻⁶ /K	16,8
Modulus of elasticity *	GPa	135

* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class

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4.6. STOL®76M - C19002[#]



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)		Hardness (reference) HV	Bendability		Bendability	
						90°		180°	
						1) 2) 3)		1) 2) 3)	
						gw	bw	gw	bw
cold worked R360	360 - 430	300	12	14	100 - 130	0	0	0	0
R410	410 - 470	360	9	11	125 - 155	0	0	0,5	1
R460	460 - 520	410	7	9	135 - 165	0,5	1	1,5	3
R520	520 - 580	460	5	7	145 - 175	1	2	2,5	4
age hardened R530	530 - 630	430	14		150 - 190	0	0	1	2
R580	580 - 650	540	8		170 - 200	1	1	3	5
R580S	580 - 650	520	9		170 - 200	0,5	0,5	1,5	2
R620S	620 - 700	560	7		180 - 210	1	1,5	3	5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)

2) values for stress relieved qualities

3) Sample width = 10 mm / Bendability for width of smaller samples on request
(scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu	Rest
Ni	1,4 - 1,7
Si	0,2 - 0,35
Sn	0,02 - 0,3
Zn	0,35 - 0,5
Other	max. 0,50

Main characteristics
CuNiSi-alloy with high tensile strength, best bendability and electrical conductivity. Good resistance against relaxation; strengthening by age hardening.

Physical properties		
Density *	g/cm³	8,9
Thermal conductivity *	W/(m·K)	260
Electr. conductivity ***	MS/m	33 (cold worked)
		27 (age hardened)
Electr. conductivity ***	IACS	57 (cold worked)
		47 (age hardened)
Coefficient of thermal expansion **	10 ⁻⁶ /K	16,8
Modulus of elasticity *	GPa	135

* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class

slight difference in chemical composition

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4.7. STOL®78 - C18665



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)		Hardness (reference) HV	Bendability 90°		Bendability 180°	
						1) 2) 3)		1) 2) 3)	
						gw	bw	gw	bw
R380	380 - 460	330	14	17	115 - 145	0	0	0	0,5
R460	460 - 520	410	10	12	140 - 165	0,5	1	1,5	3
R520	520 - 570	460	8	10	160 - 180	1	2,5	2	5
R570	570 - 620	500	6	8	175 - 195	2,5	5	3,5	8
R620 4)	min. 620	550	3	4	min. 190	3	6	5	10

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)
4) Thickness max. 0,50 mm

Chemical composition % (reference)	
Cu	min. 99,0
Mg	0,4 - 0,9
P	0,002 - 0,04

Main characteristics
Automotive, electrical and electronic connectors; for relays; current carrying springs and junction boxes; excellent formability at medium strength.

Physical properties		
Density *	g/cm ³	8,8
Thermal conductivity *	W/(m·K)	270
Electr. conductivity ***	MS/m	36
Electr. conductivity ***	IACS	62
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,3
Modulus of elasticity *	GPa	130

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

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4.8. STOL®80 - C14410



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R250	min. 250	max. 140	20	60 - 85	0	0	0	0
R300	300 - 370	270	10	80 - 110	0	0	0	0
R360	360 - 430	310	7	110 - 130	0	0	0,5	1
R420	420 - 490	370	5	120 - 150	1	1	2	2,5
R460	min. 460	410	4	min. 135	1	1,5	2,5	3

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu (incl. Ag + Sn)	99,9
Sn	0,10 - 0,20
Other	max. 0,10

Main characteristics
Low cost special alloy, highest conductivity, preferred for male connectors, junction boxes, and with a pre-tinned surface all scrap materials has a higher value than standard tinned brass. The total cost for finsh products are being equal to brass made one.

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	330
Electr. conductivity ***	MS/m	44
Electr. conductivity ***	IACS	76
Coefficient of thermal expansion **	10 ⁻⁶ /K	17,3
Modulus of elasticity *	GPa	120

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

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4.9. STOL®94 - C70310



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)		Hardness (reference) HV	Bendability		Bendability	
						90°		180°	
						1) 2) 3)		1) 2) 3)	
						gw	bw	gw	bw
cold rolled R360	360 - 430	250	14	16	100 - 130	0	0	0	0,5
R410	410 - 470	360	9	12	125 - 155	0	0,5	0,5	1
R460	460 - 520	410	7	10	135 - 165	0,5	1	1,5	3
R520	520 - 580	460	5	8	145 - 175	1	2	2,5	3,5
R580	580 - 650	520	4	6	170 - 200	1	2,5	3	5
age hardened R620	620 - 720	540	16		180 - 240	0	0	1	1,5
R660	660 - 750	590	10		200 - 250	1	1	1,5	2
R750	750 - 830	680	8		210 - 260	2	2	3	4
R800	min. 800	750	5		min. 210	2	3	4	5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request
(scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu	Rest
Ni	2,0 - 3,2
Si	0,3 - 0,9
Sn	0,1 - 0,7
Zn	0,3 - 1,3
Other	max. 0,50

Main characteristics
CuNiSi-alloy with highest tensile strength, best bendability and good electrical conductivity. Good resistance against relaxation; strengthening by age hardening.

Physical properties		
Density *	g/cm³	8,85
Thermal conductivity *	W/(m·K)	185
Electr. conductivity ***	MS/m	25 (cold worked) 23 (age hardened)
Electr. conductivity ***	IACS	43 (cold worked) 40 (age hardened)
Coefficient of thermal expansion **	10 ⁻⁶ /K	17
Modulus of elasticity *	GPa	132

* Reference values at room temperature ** Between 20 up to 300 °C *** Values for the lowest temper class

Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
age hardened R480	480 - 560	450	8	150 - 190	1,5	1,5	2	2
R540	540 - 630	500	4	160 - 200	2	2	2,5	3
R540S	540 - 620	500	8	160 - 190	1,5	1,5	2	2,5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu	Rest
Cr	0,3 - 1,2
Zr	0,03 - 0,3
Other	max. 0,2

Main characteristics
Alloy for high voltage applications, as Hybrid cars or Photovoltaic. Very high electrical conductivity at excellence relaxation behavior (remaining contact force min. 80 %, at 200 °C./1000h). As strip (0,2 up to 3,0 mm) and round wire (up to 1,0 mm) available.

Physical properties		
Density *	g/cm ³	8,9
Thermal conductivity *	W/(m·K)	330
Electr. conductivity ***	MS/m	50
Electr. conductivity ***	IACS	86
Coefficient of thermal expansion **	10 ⁻⁶ /K	18
Modulus of elasticity *	GPa	137

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

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4.11. STOL®194 - C19400



Temper class	Tensile strength Rm min. - max. MPa	Yield strength Rp0,2 min. MPa	Elongation A50 min. % 2)	Hardness (reference) HV	Bendability 90° 1) 2) 3)		Bendability 180° 1) 2) 3)	
					gw	bw	gw	bw
R300	300 - 360	max. 240	18	80 - 100	0	0	0	0
R360	360 - 430	270	15	110 - 135	0	0	0	0,5
R420	420 - 480	380	10	130 - 150	0,5	0,5	1	1
R480	480 - 540	430	7	140 - 160	0,5	0,5	1	1,5
R520	520 - 580	470	4	min. 140	2,5	3,5	3	4,5

1) $r = x \cdot t$ thickness $\leq 0,50$ mm)
2) values for stress relieved qualities
3) Sample width = 10 mm / Bendability for width of smaller samples on request (scale acc. bending cross reference list)

Chemical composition % (reference)	
Cu	Rest
Fe	2,1 - 2,6
Zn	0,05 - 0,2
Other	max. 0,2

Main characteristics
Alloy for electrical contacts; good electrical conductivity, moderate strength and good resistance against relaxation.

Physical properties		
Density *	g/cm ³	8,8
Thermal conductivity *	W/(m·K)	260
Electr. conductivity ***	MS/m	35
Electr. conductivity ***	IACS	60
Coefficient of thermal expansion **	10 ⁻⁶ /K	16,3
Modulus of elasticity *	GPa	125

* Reference values at room temperature
** Between 20 up to 300 °C
*** Values for the lowest temper class

5.1.1. Relaxation (test methods and conditions)

■ Definition

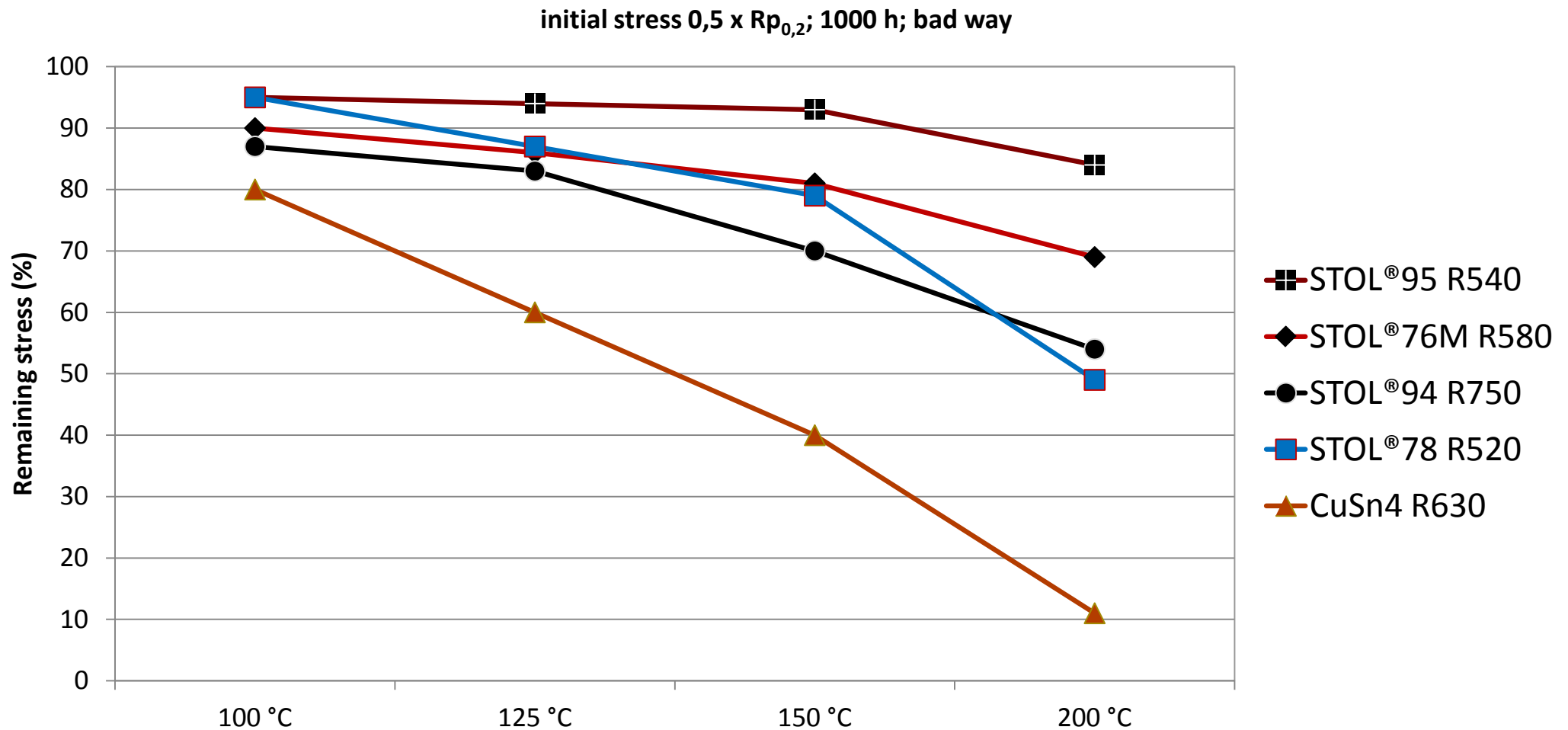
- Relaxation sample is deformed elastic (e.g. bended around a tube), causing an initial stress level (of e.g. 50 % $R_{p0.2}$).
- After a storage time (e.g. 1,000 h) at elevated temperature (e.g. 150 °C) the remaining stress under this deformation is measured.
- As the stress/ temperature combination leads to a reduction of the dislocation density, the yield strength of the material drops.
- Percentage of loss compared to initial yield strength is indicated as relaxation.

■ Methods

- Three point bending test
- Four point bending test
- Tube test
- Cantilever - bending test (discontinuous / continuous) - KME testing method

■ Test conditions (standard practice)

- Temperatures (100° C. / 125° C. / 150° C. / 200° C.)
- times (50 h / 100 h / 250 h / 500 h / 1000 h) // Long term view with Larson-Miller Methode
- Initial stress (50 % oder 80 % of yield strength ($R_{p0.2}$))

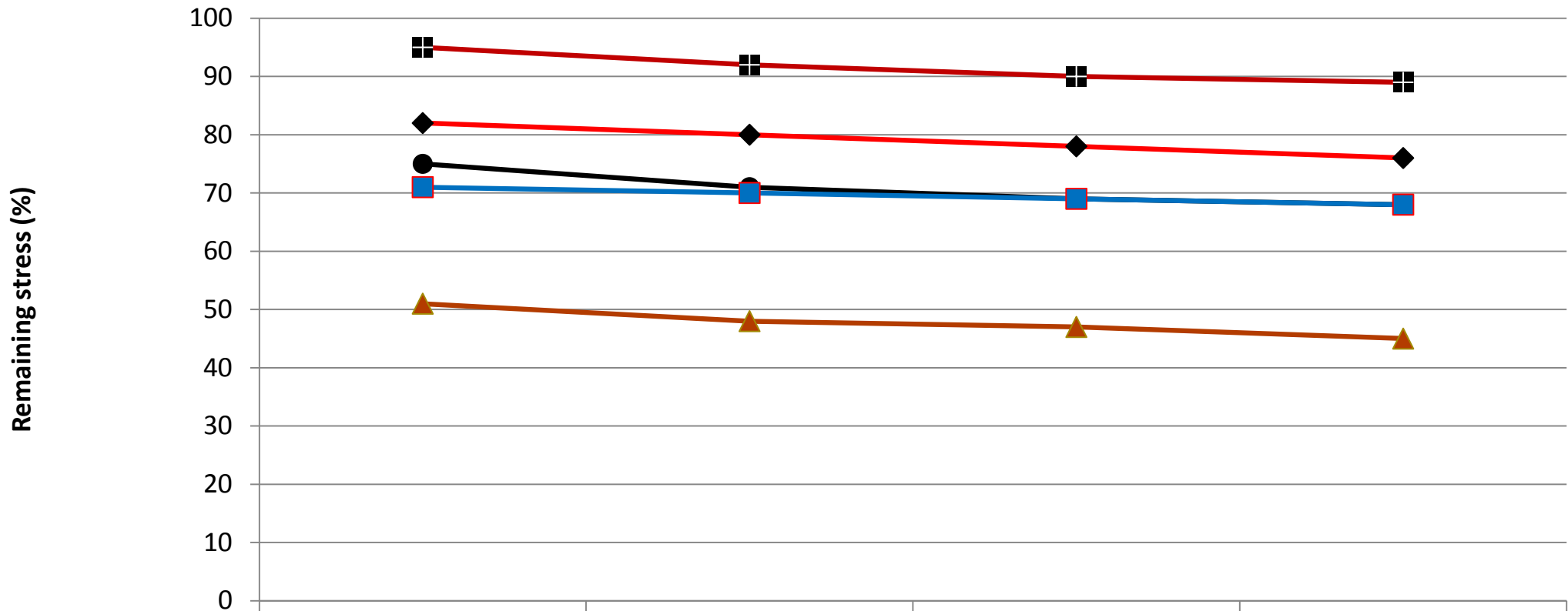


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5.1.3. Relaxation (difference initial stress)

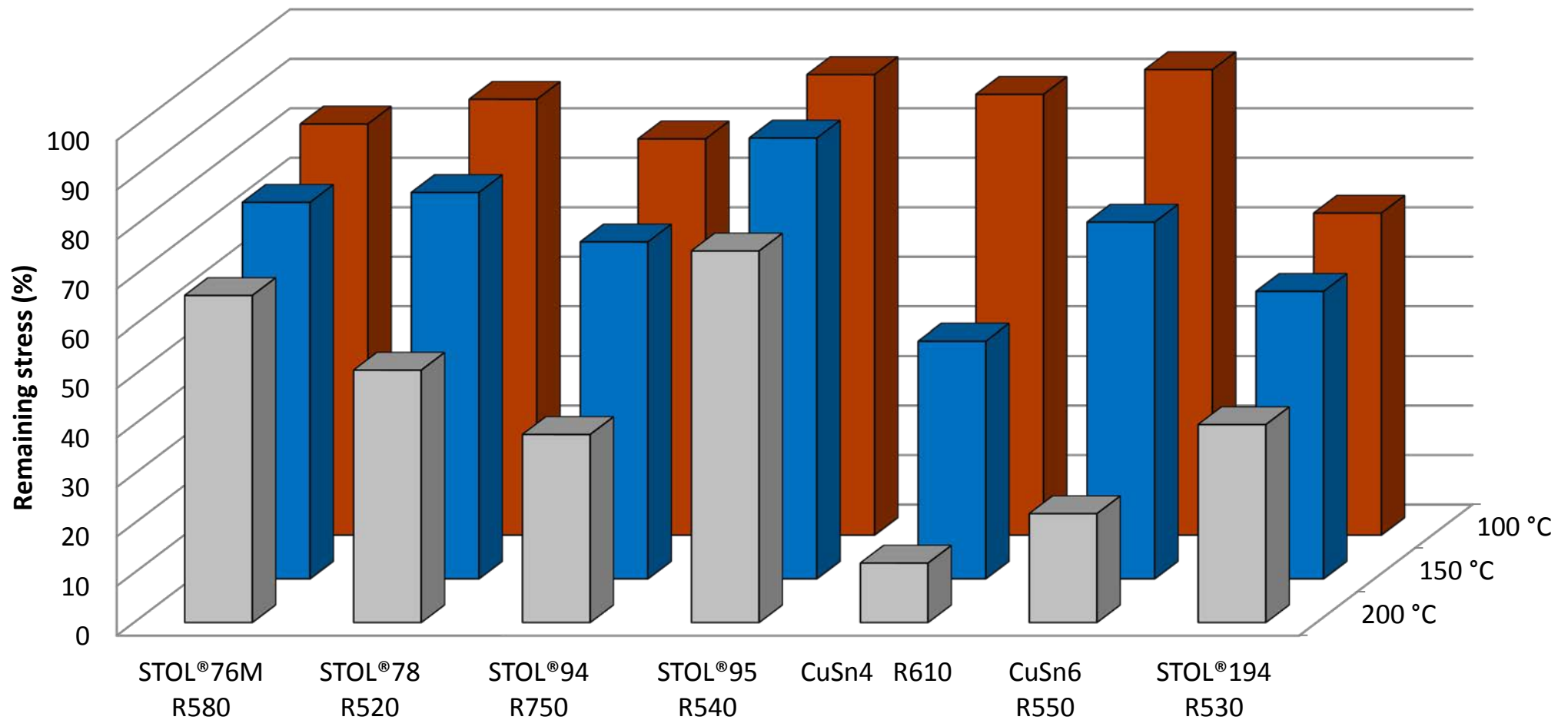


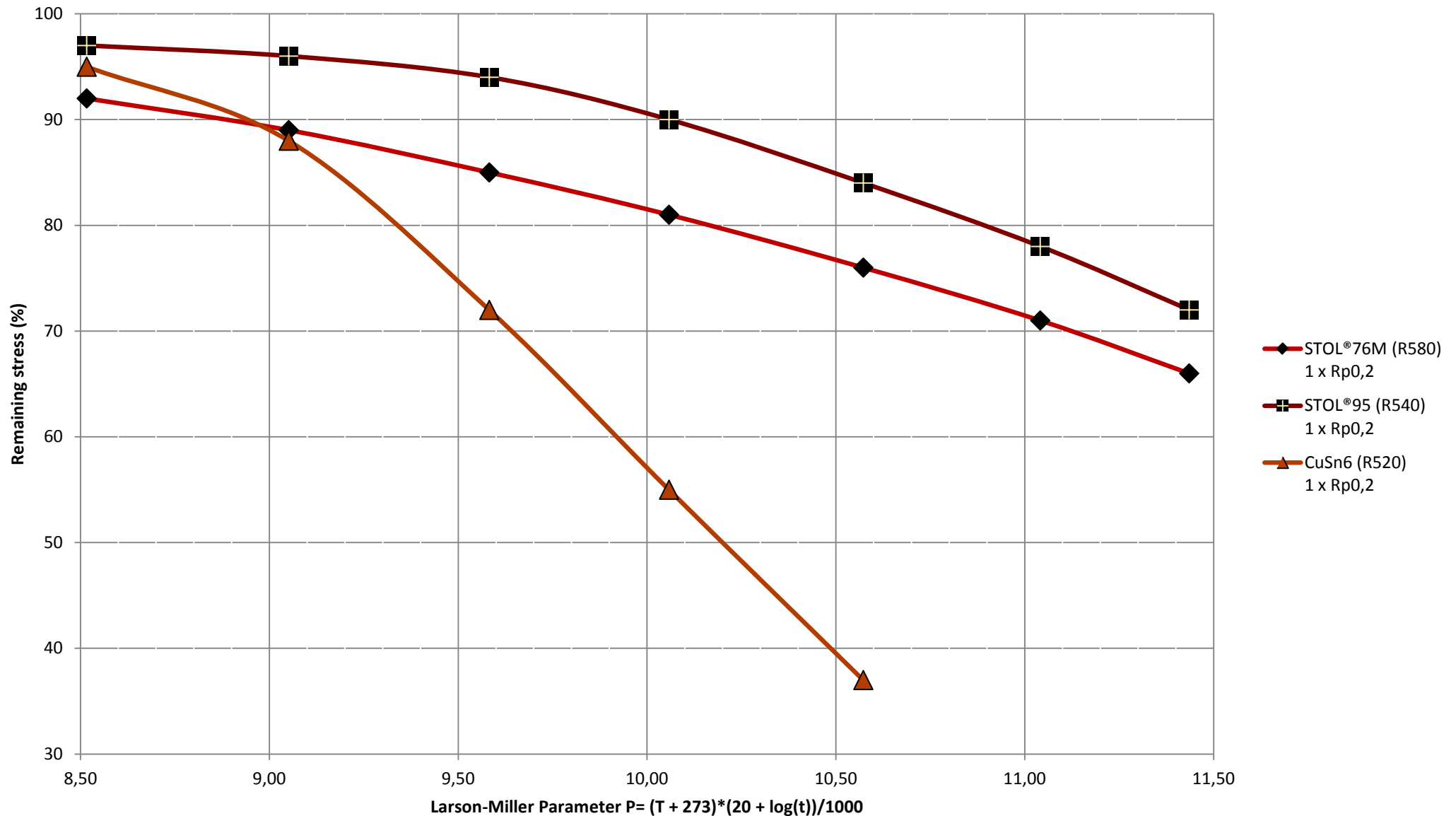
1000 h; 150 °C; bad way



	200 MPa	300 MPa	400 MPa	500 MPa
STOL®95 R540	95	92	90	89
STOL®76M R580	82	80	78	76
STOL®94 R750	75	71	69	68
STOL®78 R570	71	70	69	68
CuSn4 R630	51	48	47	45

5.1.4. Relaxation (comparison at 500 MPa initial stress)





5.2. Comparison of alloys (physical data's)

Alloys	Density * g/cm ³	Coefficient of thermal expansion** 10 ⁻⁶ K	Thermal conductivity* W / (m K)	Electrical conductivity*** MS/m	electrical conductivity*** IACS	Modulus of elasticity * GPa
STOL°76	8,9	16,8	260	35 / 29	60 / 50	135
STOL°76M	8,9	16,8	260	33 / 27	57 / 47	135
STOL°78	8,9	17,3	270	36	62	130
STOL°80	8,9	17,3	330	44	76	120
STOL°94	8,85	17	185	25 / 23	43 / 40	132
STOL°95	8,9	18	330	50	86	137
STOL°194	8,8	16,3	260	35	60	125
C14415 / CuSn0,15	8,9	18	350	47	81	120
C15100 / CuZr	8,94	17,6	360	55	95	121
C15500	8,91	17,8	346	50	86	115
C19210 / CuFe0,1P	8,9	17	350	50	86	125
C42500	8,75	18,4	120	15	25	126
C50715 / CuSn2Fe0,1P	8,9	17,6	140	22	38	121
C50725 / CuSn2Zn2Fe0,1P	8,9	17,5	150	19	33	113
C70250 / CuNi3Si	8,8	17,6	170	23	40	130
C70600 / CuNi10Fe1Mn	8,9	17	46	4	6,9	130
CuSn4	8,85	17,8	100	10	18	120
CuSn5	8,85	18	96	9	15	120
CuSn6	8,8	18,5	75	8	13	118
CuSn8	8,8	18,5	67	6,5	11	115
CuZn10	8,8	18,2	184	25	43	124
CuZn15	8,75	18,5	159	20	34	122
CuZn30	8,5	19,7	126	16	28	115
CuZn33	8,5	19,9	121	15	26	112
CuZn37	8,45	20,2	121	14	24	110
Cu-ETP	8,9	17,7	394	58	100	127
Cu-HCP	8,9	17,7	385	57	98	127
Cu-PHC	8,9	17,7	385	58	100	132
Cu-DLP	8,9	17,7	375	55	95	132
Cu-DHP	8,9	17,6	330	47	81	132
Cu-OFE	8,9	17,7	394	58,6	101	132

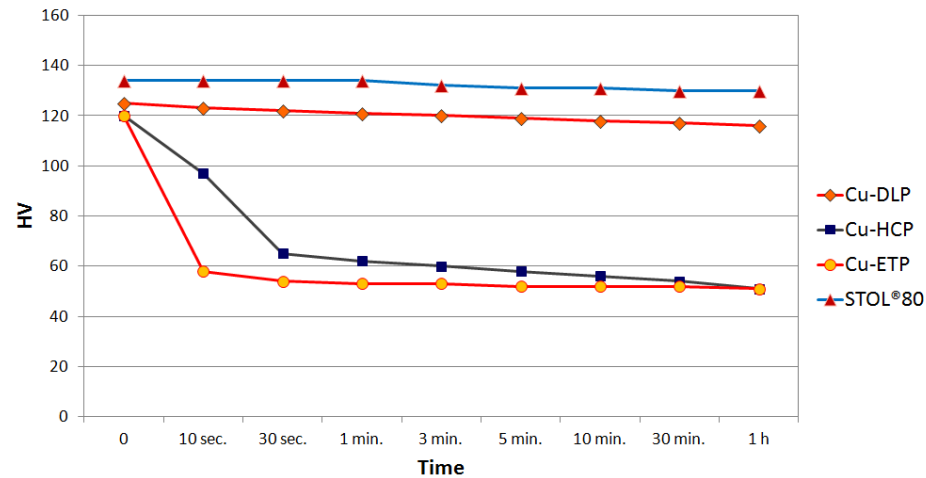
* Reference values at room temperature ** between 20 and 300 °C *** Value for the lowest temper / age hardened class

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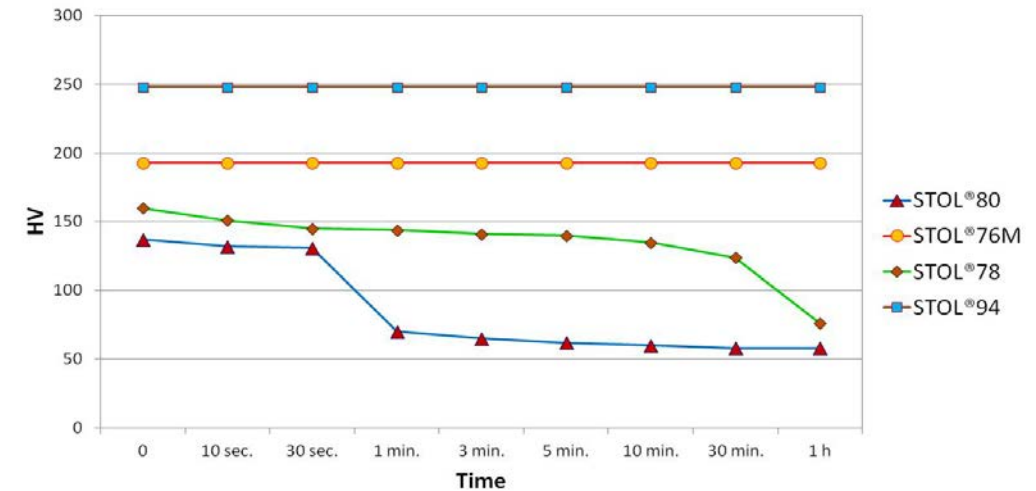
5.3. Softening characteristic



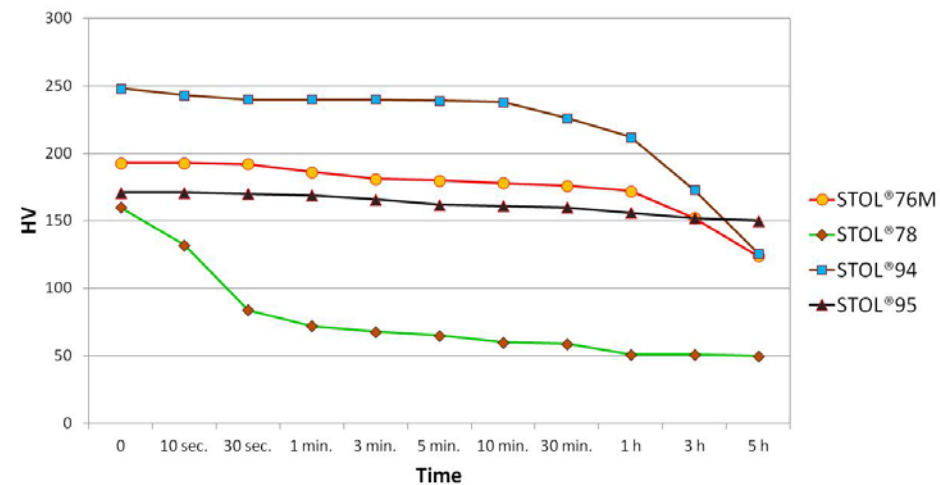
300 °C



400 °C

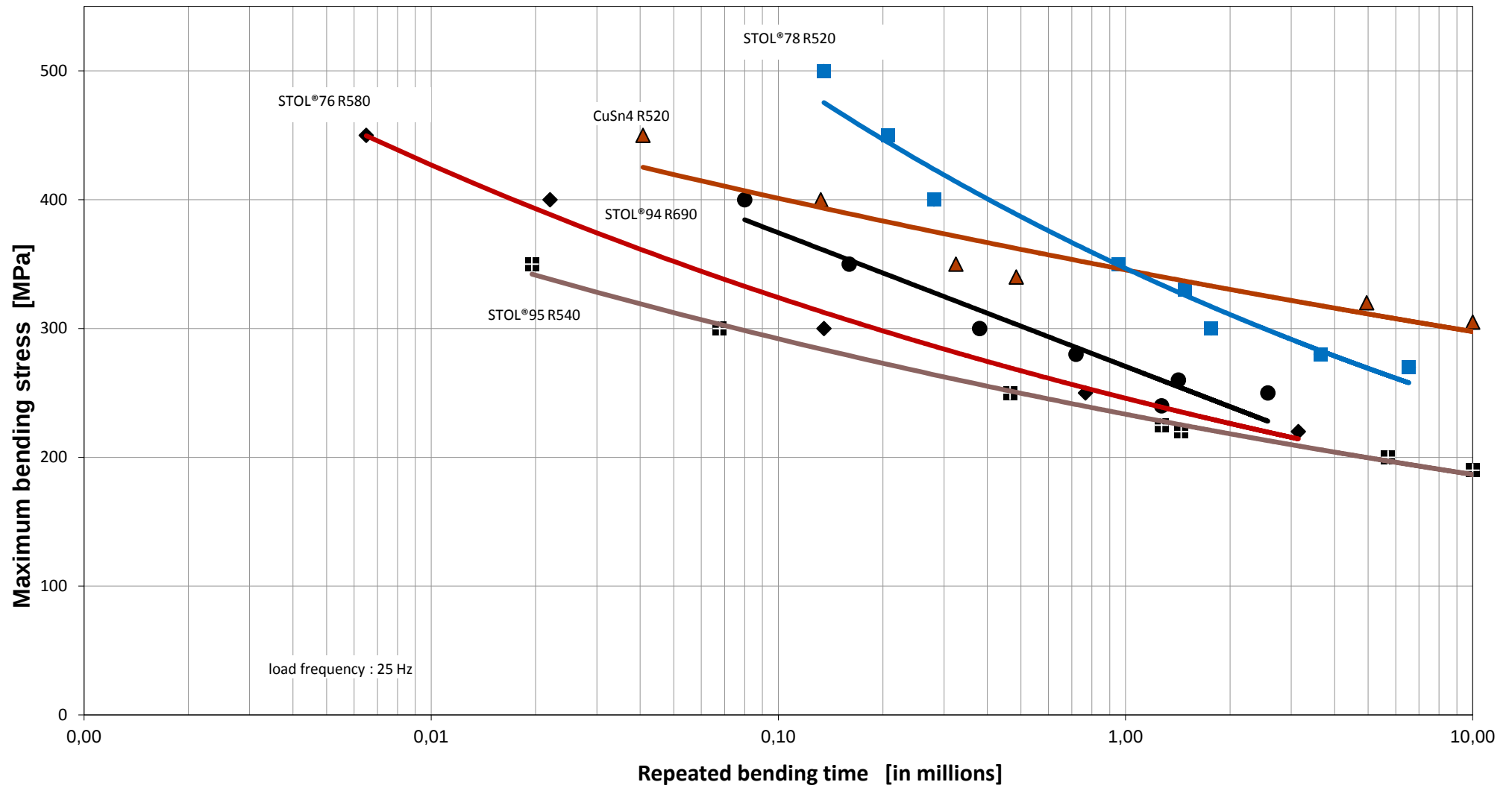


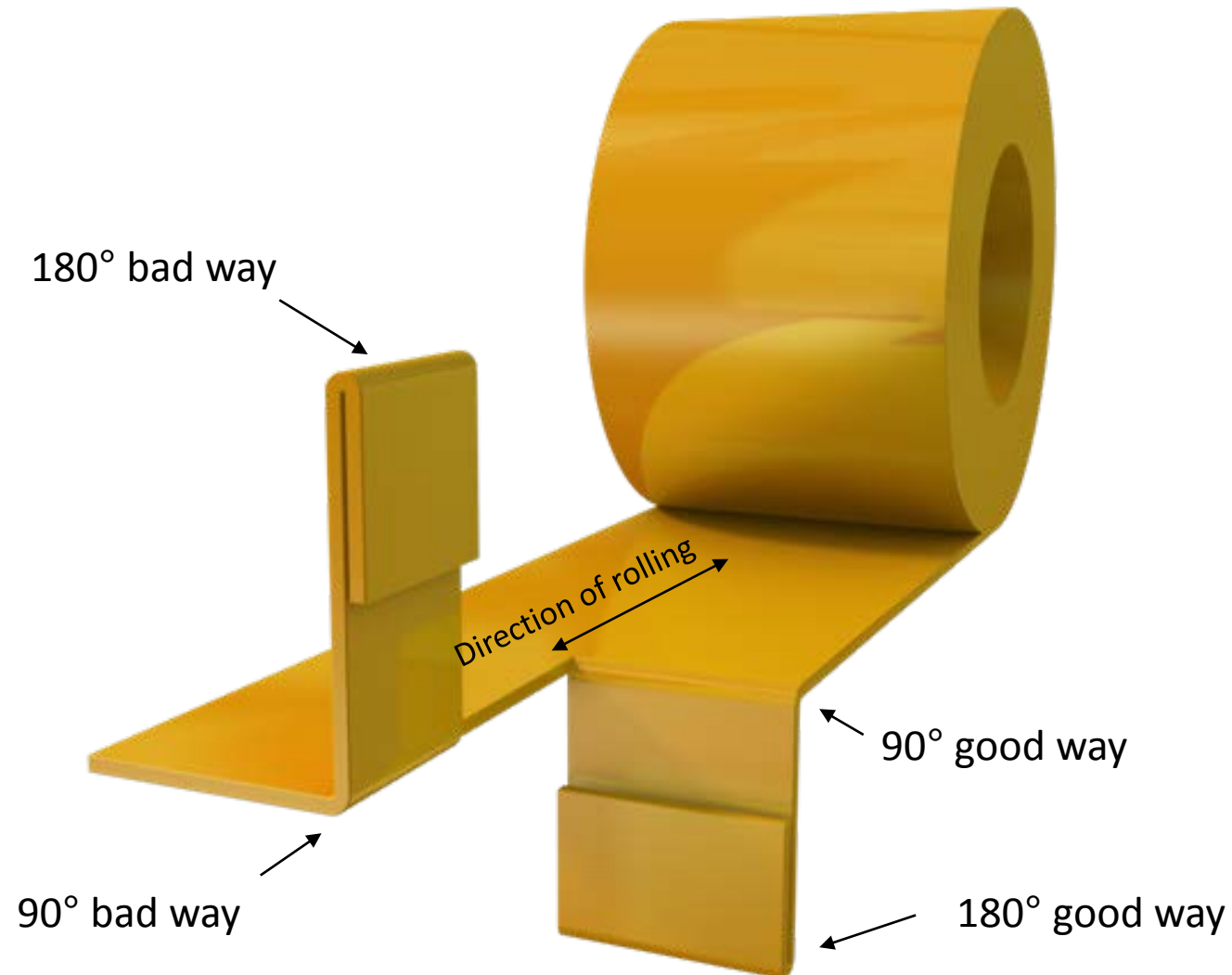
500 °C



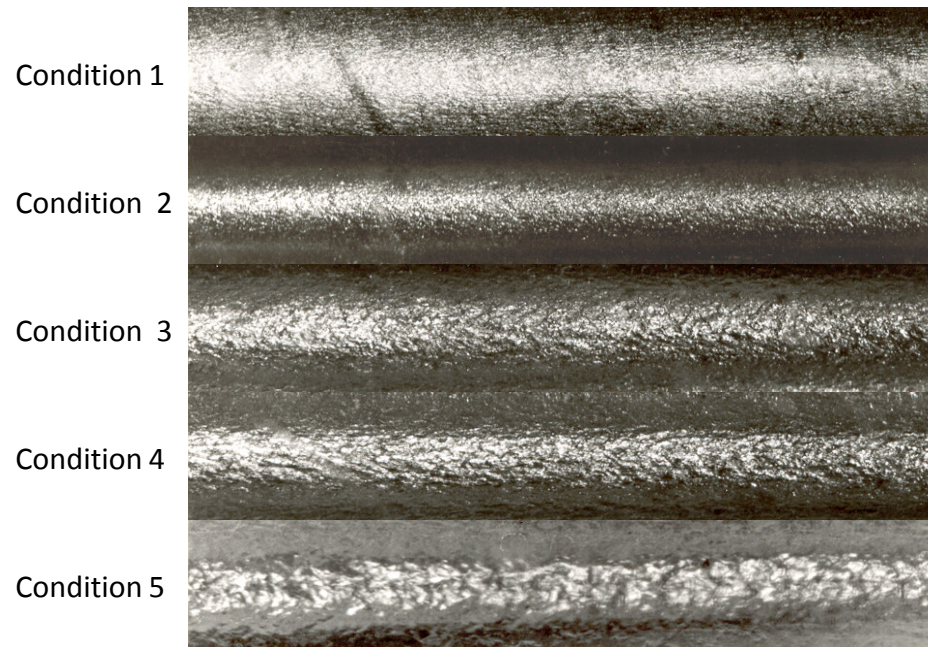
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5.4. Bend fatigue at room temperature

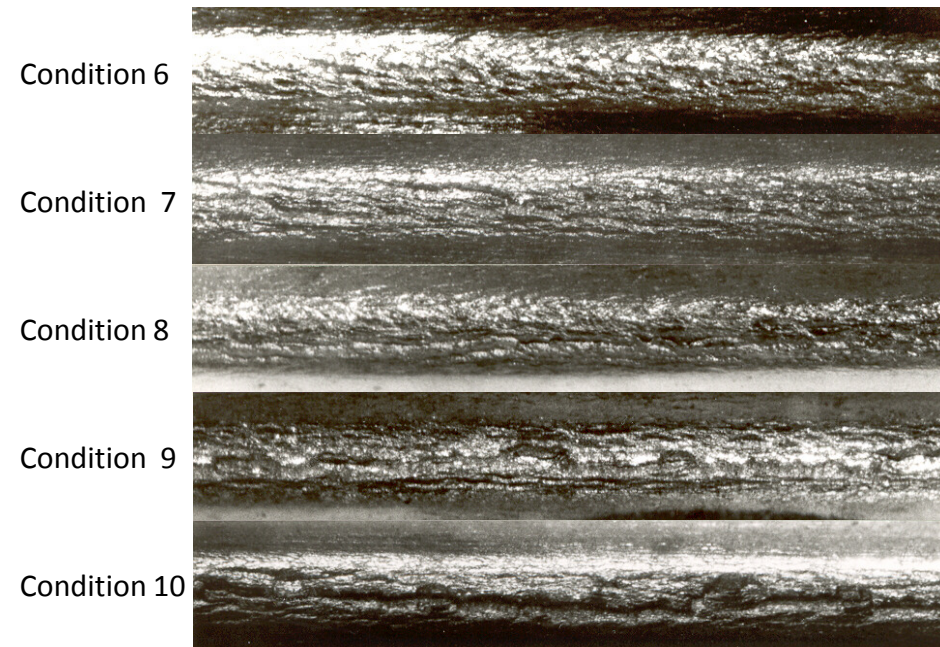




5.5.2. Evaluation of bending (based on bending picture gallery)



- Condition 1 smooth, no cracks (no orange skin, no rough grain)
- Condition 2 rough, no cracks (no orange skin, no rough grain)
- Condition 3 slight orange skin, no cracks
- Condition 4 orange skin, no cracks
- Condition 5 strong orange skin, no cracks



- Condition 6 very slight cracks
- Condition 7 slight cracks
- Condition 8 cracks
- Condition 9 strong cracks
- Condition 10 very strong cracks, nearly broken

test condition, in accordance with DIN ISO 7438, scale in accordance with DIN EN 1654 plus additionally valid for 180° bending.
(sample width = 10 mm, 90° test method with V-block and punch, 180 ° test method with 180 ° bend test machine.)

Hot dip tinning acc. DIN EN 13148 (RoHS conform)

Strip thickness: 0,15 – 1,20 mm (Coating thickness for the strip thickness >1,2 mm on request)

Strip width: up to 330 mm

Coatings: pure tin, tin-silver*, Thermic tin

Coating thickness: 0,5 - 1,2 µm

0,8 - 2,0 µm

1,0 - 3,0 µm

2,0 - 5,0 µm

4,0 - 10,0 µm

10,0 - 20,0 µm

* Coating thickness $\leq$ 2,0 µm on request

Electroplating acc. DIN EN 14436 (RoHS conform)

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Strip thickness : 0,4 - 2,00 mm

Strip width : up to 170 mm

Coatings : Sn/Cu and Sn/Ni, holohedral, matt, gloss, reflow

external source

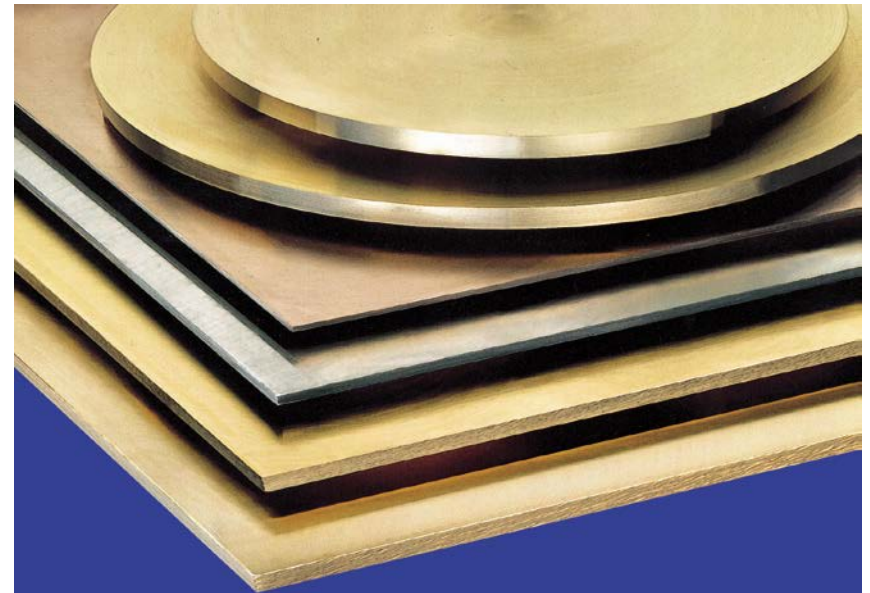
Strip width up to 400 mm with and without reflow

Coatings: Sn/Cu or Ni/Ag // Ni/Cu / matt, gloss

7.1. Sheets, Plates and Discs of Copper and Copper alloys

KME is an industrial group playing a major role in the global copper processing industry. With its headquarters in Florence, approx. 6,500 staff and a manufacturing base strategically located in the five largest European markets and in China, KME is a Group with a strong international vocation spread across all the continents. With an unique and complete product portfolio, KME is one of the world leading suppliers of copper and copper-alloy industrial rolled products that are used in a wide range of today's modern industries:

- Electrical engineering and electronics
- Mechanics
- Automotive industry
- Minting
- Solar-energy technology
- Telecommunications
- Household consumer products
- Decoration, objects and bathroom accessories.



7.2. Sheets, Plates and Discs of Copper and Copper alloys

Copper				Brass			
<u>DIN EN</u>	<u>CEN</u>	<u>ASTM</u>	<u>DIN</u>	<u>DIN EN</u>	<u>CEN</u>	<u>ASTM</u>	<u>DIN</u>
Cu-ETP	CW004A	C11000		CuZn10	CW501L	C22000	2.0230
Cu-HCP	CW021A	C10300		CuZn15	CW502L	C23000	2.0240
Cu-DLP	CW023A	C12000		CuZn30	CW505L	C26000	2.0265
Cu-DHP	CW024A	C12200		CuZn37	CW508L	C27200	2.0321
Cu-OFE		C10100		CuZn40	CW509L	C28000	2.0360
Cu-OF	CW008A	C10200		CuZn38Sn1As	CW717R	C46500	2.0530
Cu-Ag0,1	CW016A	C10700*		CuZn38AlFeNiPbSn	CW715R		
Low alloyed Copper				CuZn39Sn1	CW719R	C46400	
CuCrZr	CW106C	C18150	2.1293	CuZn39Pb0,5	CW610N	C36500	2.0372
Bronze				CuZn39Pb2	CW612N	C37700	2.0380
CuSn4	CW450K	C51100	2.1016	Aluminium-Bronze			
CuSn6	CW452K	C51900	2.1010	CuAl8Fe3	CA106	C61400	2.0932
CuSn8	CW453K	C52100	2.1030	CuAl10Ni5Fe4	CW307G	C63000	2.0966
Copper-Nickel							
CuNi10Fe1Mn	CW352H	C70600	2.0872				
CuNi30Mn1Fe	CW354H	C71500	2.0882				

* Difference in composition

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