BRASS 58A (CuZn39Pb3)

Pb alloyed free machining brass

Particularities

The brass 58A (CuZn39Pb3) is the most used brass for machining on automatic machines/lathes. It has an excellent machinability.
Furthermore, it can be easily warm formed.

Applications and uses

Many different applications

Standards

Material number	CW614N (former DIN 2.0401)
EN	CuZn39Pb3
ISO	CuZn38Pb3
UNS / ASTM	C38500
NF	CuZn40Pb3
SNV	CuZn39Pb3
UNI	P-CuZn40Pb2
JIS	C3603

Chemical composition (%wt)

Cu	Pb	Ni	Fe	Sn	Al	others	Zn
57	2.5	max.	max.	max.	max.	max.	balance
59	3.5	0.30	0.5	0.3	0.005	0.2	

Dimensions and tolerances

- Round bars and cold drawn: 1 – 22 mm ISO h8 (h9)

Closer tolerances on request.

Executions and Delivery condition

Standard delivery condition:	thermally stress relieved
• Round bars and shaped bars:	in length of 3 m +50/0
bar ends:	pointed, chamfered
Straightness:	0.5 mm/m

Other executions on request

Availability

Standard dimensions on stock, see: Sale program

Mechanical properties

Standard delivery condition: thermally stress relieved
According to DIN 12164 Bars: condition: cold drawn (not stress relieved!)

	Designation	Rm (MPa)	$R_{0.2\%}$ (MPa)	A (%)	Hardness Hv/HB
Ø 2 – 6 mm:	R550	550	(440)	--	(150)
Ø 2 – 14 mm:	R500	500	(390)	8	(150)
Ø 2 – 40 mm:	R430	430	(250)	10	(120)

Cutting conditions

Machining index: 100 (Europe: CuZn39Pb3 = 100; USA: CuZn36Pb3 = 100)
Machinability: very good
forms short acicular, needle like chips

- The brass 58A in the R550 (Rm = 550 MPa) hard condition can still be more easily machined than in the semi-hard R400 (Rm = 400 MPa) condition.
- Cutting speed: $V_c \approx 60$ - 120 m/min.

The optimal cutting conditions depend on the machine tool, the cutting tools, the chip dimensions (cutting depth and feed), the cutting speed, the lubricant-cooling fluid, the tolerances and surface roughness to be produced, and, obviously, the experience of the machinist.

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Microstructure

The CuZn39Pb3 brass A58 is a two phases alloy Alpha-Beta in solid solutions. The Alpha phase is cubic face centered, the Beta phase, richer in Zn, is cubic centered.

- The alloyed Pb addition is not soluble. Pb is present as fine particles uniformly distributed, predominantly at the grain boundaries.
- The Pb addition permits a better control of the grain size during annealing.
- The volume Pb concentration is approximately 1.5%$_{vol}$.
- Pb strongly favors the machinability by forming small acicular chips.

Forming

Warm:	625 – 725°C, good formability
Cold:	limited

- The cold reduction before annealing is limited to 20%.

Welding

Gas, arc, WIG and MIG:	difficult, not recommended
Resistance welding:	average

- A not fully controlled welding operation can lead to Zn loss by dezincification of the surface zone. The temperature of evaporation of Zn is 906°C only.
- The high Pb content of the Brass 58A renders its welding particularly challenging, because the solidification shrinkage of the weld pools favors the formation of tensile internal stresses in the assembled components.

Brazing

Average

Soldering

Very well adapted to soldering

Gluing

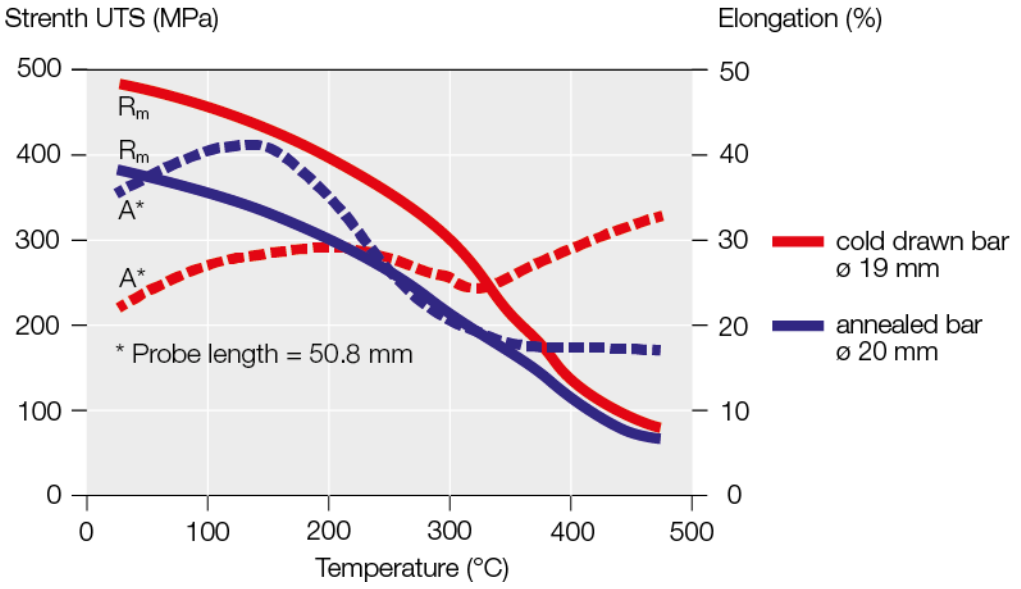
Well adapted to gluing

Heat treatments

Soft anneal:	450 – 600 °C
Thermal stress relief:	250 – 350 °C

- A stress relieving anneal may reduce the strength of the heat-treated material.

Diagram of the mechanical properties



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Polishing

Mechanical: very well adapted
Chemical: less adapted
Electrolytic: less to poorly adapted

Laser marking

Fairly difficult

- The presence of Pb makes the laser marking more difficult, requiring additional attention and precautions.

Electroplating

Very well adapted

Corrosion resistance

- The corrosion resistance of the Brass 58A (CuZn39Pb3) in water, saline and organic solutions is not as good as with the single phase, homogeneous Alpha brass. Its Beta phase richer in Zn is more sensitive to corrosion.
- Under given circumstances, a “dezincification“ of the surface zone may take place in soft water having a high Cl content and low carbonates content.

Stress Corrosion Cracking (SSC):

- Under the influence of internal, external or of both tensile stresses, the Brass 58A (CuZn39Pb3) exposed to ammoniac, amines, or ammonium salts, can crack, or even break catastrophically by SSC.
- The tensile stresses prevalent in operation, or build in during assembly of the parts, may significantly increase the SSC risk.
- SSC can also be prevented, by submitting the finished machined parts, or assemblies, to a stress relieving treatment before their final use.
- The usage of thermally stress-relieved bars, as those supplied by L. Klein SA, contribute to reduce – eliminate this risk.

Physical properties

Properties	Units	Temperature (°C)			
		20	200	300	400
Density	g cm^{-3}	8.47			
Young modulus of elasticity E	GPa	97			
Electrical resistance	Ω mm^2 m^{-1}	0.066	0.083		
Thermal coefficient of the electrical resistance	K^{-1}	$1.7*10^{-2}$			
Specific thermal conductivity	MS/m	15	12		
Thermal expansion	m m^{-1} K^{-1} 10^{-6}	20–100°C 19.3	20–200°C 21.0	20–300°C 21.4	20–800°C 24.7
Thermal conductivity	W m^{-1} K^{-1}	-200°C 50	20°C 123		
Specific heat	J kg^{-1} K^{-1}	20°C 0.377	100 - 300°C 0.398		
Magnetism	diamagnetic: in the absence of free Fe only				
Magnetic susceptibility	cm^3/g	-0.173 $1.39*10^{-4}$ with 0,15% free Fe present			
Melting range	875-890°C				

Disclaimer: The information and data of this informative “Data sheet“ are indicative only. They are not use instructions. The users must define and endorse them in each case.

Modifications will not be adjusted automatically.
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