ZOLLERN

Solid metals. Fine solutions.

Wrought copper-nickel-silicon alloy **NSB-CrZr** alloy 1117

NSB-CrZr corresponds to different customer specifications. The material was specially developed for electrical engineering and is mainly used for rotor wedges / slot wedges in large generators.

ZOLLERN brand	NSB-CrZr

(C18000 Ni 1.8-3.0 Si 0.4-0.8 ≈ Cr 0.10-0.80)

// National designations

USA	≈ C18000

≈ (substantial coherence)

// Composition (not standardised)

Cu	Ni	Si	Cr	Zr
Rest	1.6 – 2.5	0.5 – 0.8	0.05–0.10	0.15-0.20

Other	Mn	Zn	Fe	Sn
max. 0.3	max 0.1	max 0.2	max 0.2	max 0.2

Mg	Al	Pb	P
max 0.05	max 0.04	max 0.01	max 0.005

// Strength properties at room temperature

	(minimum values)			
[1] Customer specifications [2] Zollern values for rings	$R_{p0.2}$ N/mm²	R_m N/mm²	A_5 %	HB
[1] Profiles, bars	540	600	10	180
[2] Forged pieces, rings	450	550	15	160

// Physical properties

Density at 20 °C	8.8 kg/dm³
Melting temperature/range	1040 – 1060°C
Coefficient of linear expansion	
from 20° to 200°C	16 x 10^{-6} °C^{-1}
from 20° to 300°C	18 x 10^{-6} °C^{-1}
Specific heat at 20°C	0.381 J/g x °C
Thermal conductivity at 20°C	1.51 W/cm x°C
Electr. conductivity at 20°C	18 - 23 MS/m 31 - 40 % IACS
Electr. resistance at 20°C	0.0435 - 0.05555 Ω mm²/m
Temperature coefficient of the electrical resistance (0 - 100°C)	0.0020 °C^{-1}
Permeability	< 1.01
Young's modulus	130 KN/mm²

// Dynamic strength values at room temperature (reference values)

Rotational bending fatigue strength R_{bw} at 20 x10^6 load cycles, 30% cold-formed	180 N/mm²
Notched impact energy (ISO - V/KV)	80 joules

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Areas of application
- Rotor wedges / slot wedges for generators
- Short circuit rings for electric motors

Machinability
NSB-CrZr has good hot forming properties and can also be cold-formed well in the solution-annealed condition. NSB-CrZr behaves better during machining than pure copper. Flow chips do not form as long. The cutting index is approx. 30 where CuZn39Pb3 = 100.

Relaxation annealing	250 – 400°C
Soft annealing	soft, solution-annealed condition is achieved by annealing 750 – 880°C with subsequent water quenching
Soft soldering	good
Brazing	not recommended due to softening
Welding	not recommended due to softening, preheating is necessary for large parts. A filler material of the same type is not available
Surface treatment	polishing and chemical structuring are possible, as well as galvanic coatings

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