

Wrought copper-nickel-silicon alloy **NSB 4** alloy 1250

NSB 4 is a construction material with high strength and medium electrical conductivity. The thermal conductivity is relatively high. It is to be seen as an alternative material to some materials that contain beryllium. Good sliding properties and high wear resistance result in many replacement possibilities with a simultaneous requirement for electrical or thermal conductivity.

ZOLLERN brand	NSB 4
EN designation	CuNi3Si1
EN material no:	CW112C

EN 12420:1999 Forgings only composition, no values
(not included in 2014 edition)
EN 12163:1998 bars drawn (not included from 2011 edition)

// National designations / ISO	
DIN	CuNi3Si
DIN	2.0857
ISO	-
USA	≈ C 64710
GB	-
F	≈ U - N3S

≈ (substantial coherence)

// Composition (weight by per cent in %)

Cu	Ni	Si	Fe	Mn
Rest	2.6 – 4.5	0.8 – 1.3	< 0.2	< 0.1
Pb	Other			
< 0.02	< 0.5			

// Strength properties at room temperature

	(minimum values)			
	R _{p0.2} N/mm ²	R _m N/mm ²	A ₅ %	HB ¹⁾
[1] as DIN 17672:1982 F69 [2] EN 12163:1998 min. 200 Kg				
[1] Forgings and die-forged parts up to 80 mm thickness	540	690	8	180
[-] Forgings over 80 mm thickness (values not standardised)	500	600	8	180
[2] Rods, profiles drawn up to 30 mm Ø thickness or SW	570	690	10	180

¹⁾ On request hardness also greater than 200 HB

// Physical properties

Density at 20 °C	8.8 kg/dm ³
Melting temperature/range	1040 – 1065°C
Coefficient of linear expansion from 20° to 100°C	16 x 10 ⁻⁶ °C ⁻¹
Specific heat at 20°C	0.381 J/g x °C
Thermal conductivity at 20°C	approx. 1.8 - 2.0 W/cm x °C
Electr. conductivity at 20°C	18 - 25 MS/m 30 - 43 % IACS
Electr. resistance at 20°C	0.040 - 0.056 Ω mm ² /m
Permeability	< 1.01
Young's modulus	130 KN/mm ²

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

Rotational bending fatigue strength R _{bw} at 20 x 10 ⁶ load cycles	270 N/mm ²
Notched impact energy (ISO - V/KV)	60 joules

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Areas of application

NSB 4 is suitable for conductors because of its high strength values, hardness and wear resistance in combination with the good electrical and thermal conductivity for conductive parts. For example

- electrode holders and copper backup bars for resistance welding machines.
- In mould making for plastic injection moulded parts, moulded parts, cores and inserts allow a notable reduction of cycle times due to the rapid dissipation of heat.
- Injection nozzles in plastic injection moulds are used.
- Die-cast pistons of all designs - solid pistons or piston liners - are used in the die casting of aluminium parts.

Machinability

NSB 4 has good thermoforming properties. During machining, the material behaves better than pure copper. The cutting index is approx. 30 where $CuZn39Pb3 = 100$. EDM is easily possible. In the case of die-sinking, increased electrode wear is to be expected with copper electrodes.

Relaxation annealing	250 – 400°C
Soft annealing	soft, solution-annealed state is achieved by annealing 800 – 880°C with subsequent water quenching
Soft soldering	good
Brazing	not recommended due to softening
Welding	possible, softening must be observed, large parts may have to be preheated. A filler material of the same type is not available
Surface treatment	Polishing and chemical structuring (etching, graining) is possible, as well as galvanic coatings

