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Solid metals. Fine solutions.

Wrought copper-nickel-silicon alloy **NSB** alloy 1110 (Manganese-free = alloy 1115)

NSB = 2.0855 is a precipitation-hardenable, low-alloy material with high strength, medium electrical and thermal conductivity. The material NSB is insensitive to stress corrosion cracking and to atmospheric corrosion. It does not become brittle at low temperatures. Yield strength, strength and also elongation increase with falling temperatures. Therefore NSB is also suitable for use in low-temperature technology. NSB can be easily thermoformed and cold-formed.

ZOLLERN brand	NSB
EN designation	CuNi2Si
EN material no:	CW111C (1115-0)

EN 12420:1999 Forgings
EN 12163:2016 Bars drawn
EN 12167:2016 Profiles drawn
Mn content, see composition

// National designations / ISO

DIN	CuNi2Si
DIN	2.0855 (1110-0)
ISO	≈ CuNi2Si
USA	C64700 (1115-0)
GB	-
F	≈ U - N3S

≈ (substantial coherence)

// **Composition** according to DIN 1.7666 2.0855 (weight by per cent in %)

Cu	Ni	Si	Mn	Other
Rest	1.6 – 2.5	0.5 – 0.8	max. 0.8	max. 0.3

NSB = 2.0855 alloyed with Mn to improve forgeability.
Also available without manganese additive = CW111C or C64700 (1115-0)

// **Strength properties** at room temperature

	(minimum values)			
[1] EN 12420:1999 [2] EN 12163:2016 min. 200 Kg [3] EN 12167:2016 min. 200 Kg [3] ASTM B411 C64700 min. 200 Kg	$R_{p0.2}$ N/mm²	R_m N/mm²	A_5 %	HB
[1] Forgings and die-forged parts up to 80 mm thickness	340 430[1)]	490 550[1)]	12	150
[1] Forgings over 80 mm thickness	320 430[1)]	470 550[1)]	12	140
[2] Rods, drawn up to 30 mm Ø [3] Profiles, drawn up to 10 mm thickness	590	640	10 [2] 8 [3]	180
[3] Profiles, drawn up to 30 mm thickness	520	600	10	165
[4] Profiles, drawn up to 38 mm thickness	515	620	8	-

[1)] Higher strength on request

// **Strength properties** at elevated temperatures (reference values) (drawn bar, 22 mm Ø)

Temperature	°C	20	200	300	400	500
0.2% limit	$R_{p0.2}$ N/mm²	560	525	490	450	300
Tensile strength	R_m N/mm²	590	575	550	480	330
Elongation	A_5 %	13	8	2	2	2

// 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	11 - 16 MS/m 18 - 27 % IACS (without manganese min. 18 MS/m, min. 31 % IACS)
Electr. resistance at 20°C	0.0625 - 0.0909 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 x 10^6 load cycles, 30 % cold formed	180 N/mm²
Notched impact energy (ISO - V/KV)	80 joules

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Areas of application

Due to the favourable combination of properties, NSB is suitable

- for many areas of technology, also with seawater contact.
- In addition to amagnetic screws, bolts, contact wire clamps in overhead line construction, NSB is used, among other things, as a rotor burs and rotor wedge gibs in electric motors and generators.

A fine-grained microstructure with finely distributed nickel silicides results in excellent running behaviour with the carbon brushes in slip rings for electric motors and current transformers. Mechanically and electrically stressed parts in resistance welding machines e.g. lower copper, electrode holders are possible in NSB.

Machinability

NSB has good hot forming properties and can also be cold-formed well in the solution-annealed condition. NSB 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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