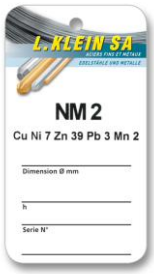

NICKEL SILVER NM2

Free machining nickel silver alloy with Pb addition

Particularities

This free machining nickel silver NM2 alloy contains 2.4-3.0% Pb. It has an excellent machinability. It can easily be warm extruded to produce shaped bars or warm form forged. However, its cold forming ability is somewhat restricted. High strengths can be reproducibly achieved. It has a gray silver color with a yellow touch.

Uses

Numerous applications such as: ball pen points, eye glass industry, watch industry, lock pins, mode accessories, etc.

Standards

Material number	CW400J
EN	CuNi7Zn39Pb3Mn2
DIN	CuNi7Zn39Mn5Pb3 (former DIN 2.0771)
UNS	no number
ASTM	no standard
NF	no standard
SNV	no standard

Chemical composition ($\%_{wt}$)

Cu	Ni	Pb	Mn	Zn
48.5	6.9	2.4	2.1	balance
49.7	7.6	3.0	2.8	

Dimensions and Tolerances

- Wires for Escomatic machines ø ≤ 3h9 mm
- Round cold drawn wires ø ≤ 5h9 mm
- Round cold drawn, ground wires ø ≤ 5h6 mm

Other tolerances on request

Executions and delivery conditions

- Round straightened bars Length 3 m +50/0
  - Bar ends pointed and chamfered
  - Straightness 0.5 mm/m
- Wires for Escomatic machines Rings

Other executions on request

Availability

Standard dimensions on stock, see Sale program

Mechanical properties

Wires and bars 0.5 – 5 mm

Designation	Condition	UTS/Rm (MPa)	$R_{0.2\%}$ (MPa)	A (%)	Hv hardness DPHN
soft	annealed	490	240	38	110
½ hard	20% cold reduction	600	500	12	175
hard	40% cold reduction	780	700	3	225

Cutting conditions

Machinability index:	95 (CuZn39Pb3 =100)
Tool life:	90 (CuZn39Pb3 =100)
Short, needlelike chips:	95 (CuZn39Pb3 =100)

- Cutting speed: $V_c \approx 60$ - 120 m/min.
- Cooling lubrication fluid, i.e.: INOX or ORTHO NFX
- This alloy can still be more efficiently machined in the ½ hard (UTS/Rm = 600 MPa) condition than in the soft one (UTS/Rm = 490 MPa).

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, as well as the tolerances and surface roughness to be produced.

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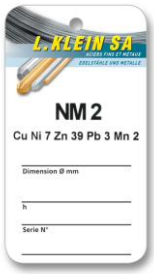


NICKEL SILVER NM2

Free machining nickel silver alloy with Pb addition

Microstructure

- The Pb addition amounts to approximately 1.5%$_{vol}$. It is not miscible into this alloy, where it is present as fine particles evenly distributed into the microstructure.
- The Pb addition improves massively its machinability.
- The Pb addition enhances a fine grain recrystallization.

Forming

Warm:	700 – 800 °C, can easily be formed
Cold:	cannot be easily formed

- Cold reduction before annealing is limited to approximately 40% reduction.

Welding

Gas-shielded welding:	moderately appropriate
Resistance welding:	well appropriate

- The Pb addition may render welding more difficult.
- Under given circumstances, welding may lead to a Zn loss by evaporation. This local Zn depletion can affect the corrosion resistance.

Brazing & Soldering

- The Pb addition may render brazing & soldering more difficult.

Hard soldering, brazing:	very well adapted
Soft soldering:	less adapted

Glueing

Very well adapted

Heat treatments

Soft anneal, recristallization:	600 – 700°C/1-3h
Thermal stress relieving:	300 – 400°C/1-3h

- A thermal stress relieving heat treatment may reduce or (negatively) influence the mechanical properties.

Polishing

Mechanical:	well adapted
Chemical:	moderately adapted
Electrolytic:	less adapted

Laser marking

Relatively difficult

- The Pb addition can make the laser marking somewhat more difficult. Appropriate precautions might be necessary.

Surface treatments

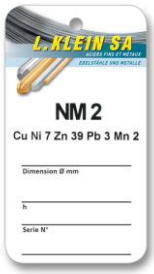
Electroplating:	well adapted

Corrosion resistance

This free machining nickel silver NM2 alloy has a better corrosion resistance than brass, such as Klein's Brass 58A (CuZn39Pb3).

Stress corrosion cracking

This free machining nickel silver NM2 alloy is less sensitive and prone to stress corrosion cracking.



NICKEL SILVER NM2

Free machining nickel silver alloy with Pb addition

Corrosion resistance

Atmospheres and Industrial atmospheres	Resistant	Medium	Passable	Insufficient
Agrar atmospheres	●			
Marine atmosphere	●			
Fresh water	●			
Sea water	●			
High humidity and temperature	●	●		
Vinegar		●		
Humid atmospheres containing chlorides			●	
				●

Galvanic corrosion

- Copper based alloys have a high standard corrosion potential. For this reason there exist a risk of galvanic corrosion in contact with other metals having a smaller potential not forming a protective passive oxide layer (passivation layer), such as for example non stainless steels containing less than 13%Cr.

Physical properties

Properties	Unit	Temperature (°C)			
		20	200	300	400
Density	g cm^{-3}	8.40			
Elastic Young modulus E	GPa	115			
Electrical resistance	Ω mm^2 m^{-1}				
Electrical conductivity	MS/m	4			
Electrical conductivity	%IACS	7			
Thermal expansion	m m^{-1} K^{-1}	20–100°C 19	20–200°C	20–300°C 19.5	20–400°C
Thermal conductivity	W m^{-1} K^{-1}	20°C 33			
Specific heat	J kg^{-1} K^{-1}	20°C 420	100 - 300°C 0.398		
Magnetism	non magnetic				
Melting range	910-925°C				

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