L.KLEIN SA
PREMIUM STEEL & METALS
SINCE 1946

CHRONIFER® M-15 KL

1.4123 / AISI 420Mod – Martensitic stainless steel

Distinctive feature and main attributes

This steel is alloyed with Mo, V und N, and has a low S-content. It is ESR remelted. Its good corrosion resistance, which is better than these of the 1.4112 and 1.4125 grades, characterizes it. It features good wear and bluntness resistances as well. This steel is amenable to high quality mirrorpolishing.

Use and application range

This steel is most suitable for the production of bearings, drills, taps, milling cutters and other tools, as well as for medical, surgical and dental instruments and general-purpose instruments in the medical field.

Norms

Material No.	1.4123
EN 10088-3	X40CrMoVN16-2
DIN	X40CrMoVN16-2
AFNOR	X40CrMoVN16.02 (formerly Z40 CDV 16.02)
ASTM	ASTM F899
AISI / SAE	420 Mod, AMS5925 (chemical composition)
NF	S 94-090 (chemical composition)
UNS	S42025 (chemical composition)

Chemical composition (% wt)

C	Si	Mn	P	S	Cr
0.37 – 0.45	max. 0.60	max. 0.60	max. 0.02	max. 0.005	15.0 – 16.0

Mo	Ni	V	N	Fe
1.50 – 1.90	max. 0.50	0.20 – 0.40	0.15 – 0.25	balance

Dimensions and tolerances

- **Bars Ø < 2.00 mm:** ISO h8
- **Bars Ø ≥ 2.00 mm:** ISO h6
- **Wires Ø ≥ 0.80 mm:** ISO fg7, coils for Escomatic
- **Out of roundness:** max. ½ of tolerance

Other tolerances on request

Execution, delivery conditions and standard sizes

Standard: in bars 3 m (+ 50 / 0 mm), coils for Escomatic

- **Bars Ø ≥ 2.00 mm:** annealed, groundpolished, max. Ra 0.4 µm (N5), eddy-current check according to EN10277-1, Table 1, pointed and chamfered
- **Bars < 2.00 mm: surface condition:** cold drawn executione
- **Wires Ø ≤ 6.00 mm: surface condition:** cold drawn, coils for Escomatic

Other executions on request

Availability

Standard dimensions on stock: see product range

Modifications will not be adjusted automatically. Last update 08 / 2024

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Mechanical properties

Delivery condition: annealed groundpolished
- Ø < 14.0 mm: UTS / Rm ≈ 900 MPa
- Ø > 14.0 mm: 265 HB, (converted to UTS ≈ 865 MPa)

Hardening capability: up to 58 HRc

Cutting conditions

Machinability: difficult to acceptable, build long chips
Cutting speed: $V_c \approx 20 - 30$ m / min
Lubricant-coolant: individual choice
The optimal cutting conditions depend on the machine tool, the cutting tools, the chip dimensions, the lubricant-cooling fluid, as well as the tolerances and surface the roughness to be achieved.

Machining

Parameter	Turning	Fine turning	Milling	Fine milling
Cutting speed V_c (m / min)	65	70	65	70
Feed rate (mm / rev.)	0.50	0.10 – 0.30		
Feed rate (mm / tooth)			0.15	0.12
Depth (mm)	2 – 5	0.3 – 0.5	2 – 5	0.3 – 1.5

Forming

Warm: forging: 1'000 – 1'100°C / slow cooling, Slow heating up to 800°C, then fast up to the forming temperature
- Microstructure at the forming temperature: Austenite + carbides

Cold: Difficult, feasible after annealing at 740 – 840°C / slow cooling.

Welding

Difficult, not recommended.

Annealing

Soft anneal: 740 – 840°C / 2 – 4 h / slow furnace cooling down to 600°C
UTS / Rm after annealing: ≈ 865 MPa, about 265 HB or Hv
Intermediary annealing during cold forming: < 740°C, air cooling
Take care to either pickup or loose N content during the heat treatment procedures.
The recommended minimum amount of cold work before anneal is ≥ 10 – 15%, this to prevent an excessive grain growth.

Quenching
Subzero treatment

Primary quenching: 950 – 1'050°C / oil, or fast air cooling or gas
Options: Secondary quenching by sub-zero treatment:
- - 20°C / 12 – 48 h, preferably - 80°C / 12 h

Or Cryo-treatment (deep cooling):
- - 196°C / 6 – 12 h, progressive or step-by-step cooling to prevent any cracking.

The sub-zero treatment should always be made as quickly as feasible after the primary quenching.
A sub-zero treatment can lead to an additional hardening. It equalizes the internal stresses of the quenched martensite. more Info

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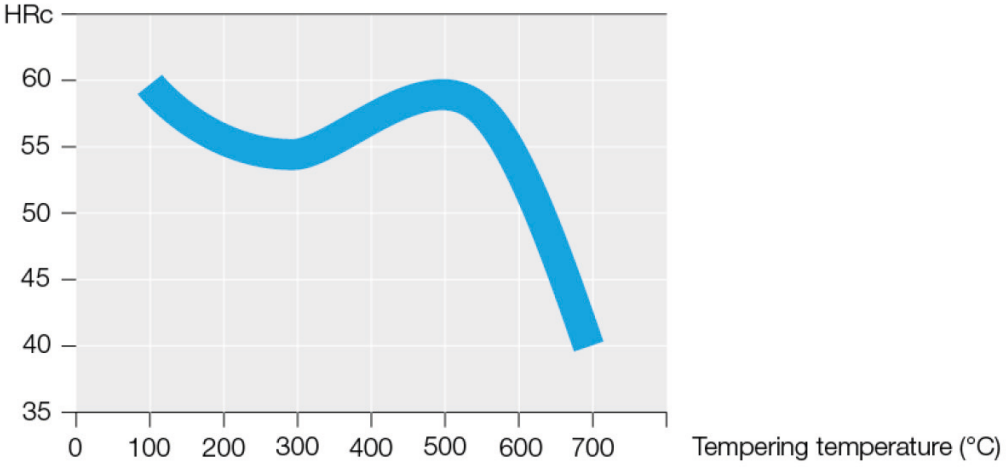
Tempering **Tempering:** according to requirements, see Tempering diagram.
Not recommended temperature range: 400 – 580°C, Tempering in this temperature range can lead to brittleness, and to a reduction of the corrosion resistance.

Tempering diagram



Microstructures Delivery conditions: "annealed" and "annealed + cold formed": Ferrite + carbides

- **Microstructure in the cold worked condition:** Ferrite + carbides
- **Microstructure for machining:** Cold worked ferrite + carbides
- **Microstructure for hard machining:** Martensite or Tempered martensite
- **Optimal condition for mirrorpolishing:** Stress relieved martensite
- **Condition for polishing:** Stress relieved martensite or Tempered martensite

Polishing Well adapted to mirrorpolishing.
Optimal when tempered at temperature < 200°C.

Laser marking The heating of the Heat Affected Zone (HAZ) can locally affect the microstructure by depleting partially its N content, and thereby reduce its corrosion resistance and strength. more info

Pickling and passivation It is strongly recommended to select adequate pickling and passivation procedures and products, adapted to the treatment of martensitic stainless steels.
In order to avoid any "flash back" phenomena, it is strongly recommended to always pickle the surface prior to its passivation. more info

Corrosion resistance **Optimal:** Clean surface in the heat treated condition + finepolished + passivized

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Superficial oxidation

- The formation of a colored oxidation or scaling on the surface during heat treatment can significantly reduce the corrosion resistance.
- These oxidations or scales must always be eliminated, is it mechanically, or chemically by pickling. more info

Elementary precautions

- The simplest and elementary precautions is to always keep the parts clean, free of working residues, polished, and correctly dried.
- Use only chlorine free disinfection, cleaning and washing solutions and products.

Physical properties

Property	Unit	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.70				
Young modulus E	GPa	195				
Electrical resistance	Ω mm^2 m^{-1}	0.8				
Thermal expansion	m m^{-1} K^{-1} 10^{-6}	20 – 100°C 10.4	20 – 200°C	20 – 300°C 10.5	20 – 400°C	20 – 500°C 10.8
Thermal conductivity	W m^{-1} K^{-1}	30				
Specific heat	J kg^{-1} K^{-1}	460				
Melting range	–					
Magnetism	Ferromagnetic, can be magnetized. more info					

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.

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