CHRONIFER® M-4108

1.4108 - Martensitic stainless steel with a high N content

Features

The CHRONIFER® M-4108 is a PESR (Pressure-ESR) remelted steel with a high N-content. The partial substitution of C with N leads to significantly better corrosion and wear resistances than achievable with current martensitic stainless steels such as those of the AISI 420 and 440 series. Besides its high corrosion resistance, this steel is also exceptionally tough. It can be hardened up to HRc 60. The PESR remelting provides a clean microstructure making it well adapted for mirror polishing. Its custom warm forging gives it a fine and uniform microstructure and a superior machinability.

Uses

This steel is especially well indicated for the production of medical, surgical and dental instruments, like cutting instruments such as drill bits, taps and saw blades, as well as other instruments like screw drivers requiring toughness and a good fatigue resistance in corrosive mediums. These same features are also favorable for industrial uses and applications operating under similar conditions.

Standards

Material number	1.4108
DIN	X30CrMoN 15-1
ASTM	F899
AISI/SAE	AMS 5898
UNS	S42027

Chemical composition (%wt)

C	Si	Mn	P	S	Cr	Mo	Ni	N	Fe
0.28	0.30	0.30	max.	max.	14.5	0.95	max.	0.35	balance
0.34	0.80	0.60	0.020	0.010	16.0	1.10	0.30	0.44	

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 executions on request

Executions and Delivery conditions

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

- Bars Ø ≥ 2.00 mm: cold drawn, ground polished, max Ra 0.4 µm (N5)
  Eddy-current checked according to EN10277-1, Tab. 1
  pointed and chamfered
- Bars Ø < 2.00 mm: cold drawn execution
- Wires Ø ≤ 6.00 mm: cold drawn execution, coils for Escomatic
- Bars Ø ≥ 6.00 mm: SWISSLINE execution

Other executions on request

Availability

Standard dimensions on stock: see Sale program

Mechanical properties

Standard delivery condition:

- Strength UTS/Rm: max 900 MPa, dependent on diameter
- Hardening capability: up to 60 HRc

Cutting conditions

Machinability:	fair to good build long chips
Cutting speed:	$V_c \approx 20 - 25$ 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.

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Cleanliness

Testing according to DIN 50602, Table 1:
- Sulfides: 0.1 respectively 1.1
- Aluminates: 2.2 respectively 3.1
- Silicates: 5.2 respectively 6.1
- Globular Oxides: 8.2 respectively 9.3

Microstructure

Grain size according to ASTM E112: Nr ≥ 7 after the last anneal

Carbonitrides:	tolerated < 25 µm
Segregations:	not tolerated
Inhomogeneities:	not tolerated
Porosity:	not tolerated

Forming

Warm:	forging:	1000 – 1220°C
Cold:	feasible	fast and strong strain hardening

Welding

Not recommended.
- The high N-content renders the welding very difficult

Thermal heat treatments
- Soft anneal: 780 – 820°C / 7h / furnace or air cooling
- Stress relieving: 150 – 220°C / 2 x 2h / air cooling

Primary quenching

Primary quenching: 1000 – 1050°C / 30 min / Oil
- Pay great attention to a possible N-loss

Secondary quenching

Secondary quenching or subzero treatment: from -80 to -196°C / 6-12h
- This treatment should be made as soon as possible after the primary quenching.

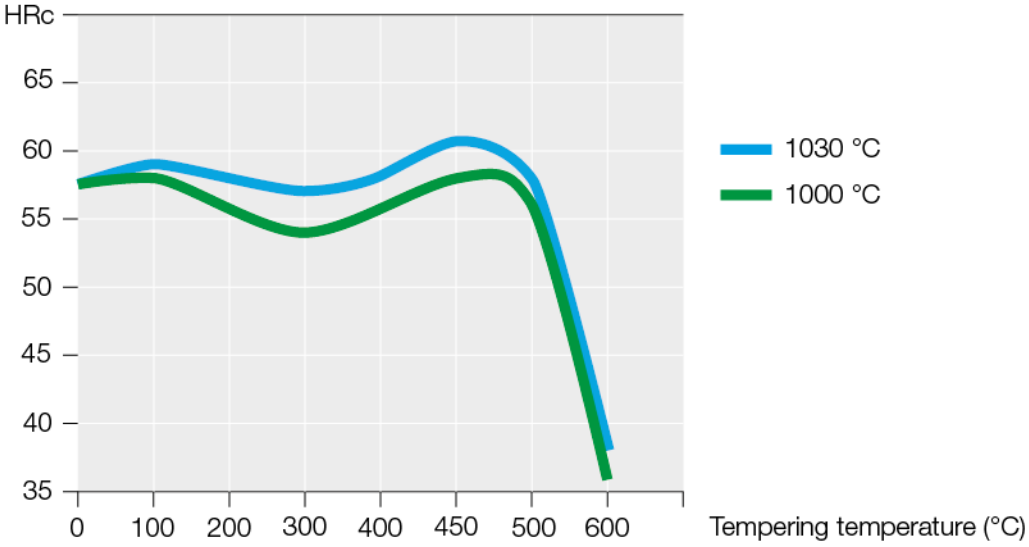
Tempering

Tempering diagram: 100 – 475°C / 2 x 2h / air (medical ≥ 150°C)

Induction Hardening

Feasible.
- Prior condition: 35 – 40 HRc

Tempering diagram



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Polishing

Well adapted to mirror polishing.

Laser Marking

Feasible

- The high N-content makes the laser marking more astute and critical.
- Avoid the formation of bubbles, because they are the cause of N-losses, which reduce the corrosion as well as the mechanical properties, especially the fatigue resistance.
- The localized heating in the HAZ (Heat Affected Zone) can possibly sensitize the microstructure, and, as a consequence, affect negatively the corrosion resistance and the mechanical properties. More info.

Oxidation of the surface

The formation of oxides on the surface (colored oxidation or scaling) can strongly impair the corrosion resistance. These oxides muss be eliminated, is it mechanically or chemically by pickling.

Pickling and passivation

It is strongly recommended to only use proven pickling and passivation procedures and products, adapted to the treatment of high N-containing martensitic stainless steels. More info.

Corrosion resistance

The optimal corrosion resistance can only be reproducibly obtained with clean, fine polished passivized surfaces. More info.

Elementary precautions

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

Physical properties

Properties	Units	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.80				
Young Modulus E	GPa	197				
Electrical resistance	Ω mm^2 m^{-1}	0.71				
Thermal expansion	m m^{-1} K^{-1}	20–100°C	20–200°C	20–300°C	20–400°C	20–500°C
	10^{-6}	10.9		11.1		
Thermal conductivity	W m^{-1} K^{-1}	16-17				
Specific heat	J kg^{-1} K^{-1}	500				
Melting range						
Magnetism	ferromagnetic, can be magnetized. More info.					