CHRONIFER® M-4122

1.4122/EN X39CrMo17-1 - Martensitic Stainless Steel

Features and peculiarities

The CHRONIFER M-4122 Martensitic Stainless Steel is ESR remelted. Its 16.5±0.5% Cr-content ensures its good basic corrosion resistance. Together with its 1.05±0.25% Mo addition, good fretting characteristics and behaviors as well as wear resistance can be achieved. This steel can be mirror polished.

Uses

This steel is well adapted for the production of cutting tools, axes, parts for the mechanical engineering and further usages. It is used in the micro-mechanical engineering as well as for parts for watch movements in the watch making industry.

Standards

Material Nr.	1.4122
EN 10088-3	X39CrMo17-1
DIN	X39CrMo17
ASTM, AISI or SAE	The use of this 1.4122 steel for medical instruments should be checked by the user, because it does not correspond to a registered US-equivalent grade.

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

C	Si	Mn	P	S	Cr	Mo	Ni	Fe
0.33	max.	max.	max.	max.	15.5	0.80	max.	Balance
0.45	1.00	1.50	0.040	0.030	17.5	1.30	1.00	

Dimensions and tolerances

Standard: 3 m (+30/0 mm) bars

- Bars Ø 4.50-16.00 mm: ISO h6, heat treated QT 750 and ground
- Bars Ø ≤ 3.00 mm: ISO h4-5, cold drawn
- Out of roundness: max ½ Diameter tolerance

Other tolerances on request

Executions and delivery condition

Bars: pointed and chamfered
Cracking check:
Eddy current according to EN10277-1, Table 1, cl. 4

- Bars Ø > 10.00 mm: Rm = 750-950 MPa, $Rp_{0.2}$ ≥550 MPa, A5 ≥ 12%
- Bars Ø 5.00-10.00 mm: Rm = 800-1050 MPa, $Rp_{0.2}$ ≥650 MPa, A5 ≥ 8%
- Bars Ø < 5.00 mm: Rm = 800-1050 MPa, $Rp_{0.2}$ ≥650 MPa, A5 on request

Other executions on request

Availability

Standard dimensions on stock: see sales program

Hardening capability

up to ≈51 HRc

Cutting conditions

Machinability: From difficult to sufficient
tendency to produce long chips
Cutting speed: V_c ≈ up to 150 m/min, see Table 1, page 2
Lubricant-coolant: individual choice

- The optimal cutting conditions depend on the machine tool, cutting tools, chip dimensions, lubricant-cooling fluid, as well as the tolerances and surface roughness to be achieved.

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Table 1
Indicative machining conditions

Machining 1.4122 – annealed 700-850 MPa

Cutting speed (m/min)	100	125	150
Chip thickness (mm)	4 – 6	2 – 3	0.5 – 1
Feed (mm/Rev)	0.4 – 0.6	0.3 – 0.4	0.15 – 0.2

Forming

Warm: Forging: 950-1180°C, slow furnace cooling
Slow heating up to 800°C, then fast up to the forming temperature of preferably 1150-1180°C
Cold: difficult, feasible after annealing at 750 – 820°C/slow cooling

Annealing

Soft annealing: (720 – 850°C) 750-820°C/ low furnace cooling
- UTS/Rm after annealing: ≤ 900 MPa
- Intermediate anneal during cold working: < 740°C/slow furnace cooling to 550°C or air cooling

Stress relieving: 600-650°C/slow furnace cooling

Quenching Subzero and Deep temperature treatment

Quenching: Primary quenching
(980 – 1060°C) 1000-1040°C / oil or fat air or gas cooling/quenching
Secondary quenching – Subzero cooling/quenching
from -20 to -80°C °C/12-24h, preferably 12h.
Deep cooling (Cryo)-treatment:
from -80 to -196°C/6-12h, progressive or step by step cooling to prevent any potential thermal shock cracking.
- Secondary quenching and Subzero or Deep temperature treatments should always be made as soon as feasible after the primary quenching.
- Secondary quenching and Subzero or Deep temperature treatments even out the internal stresses and may cause a supplementary hardening. More information

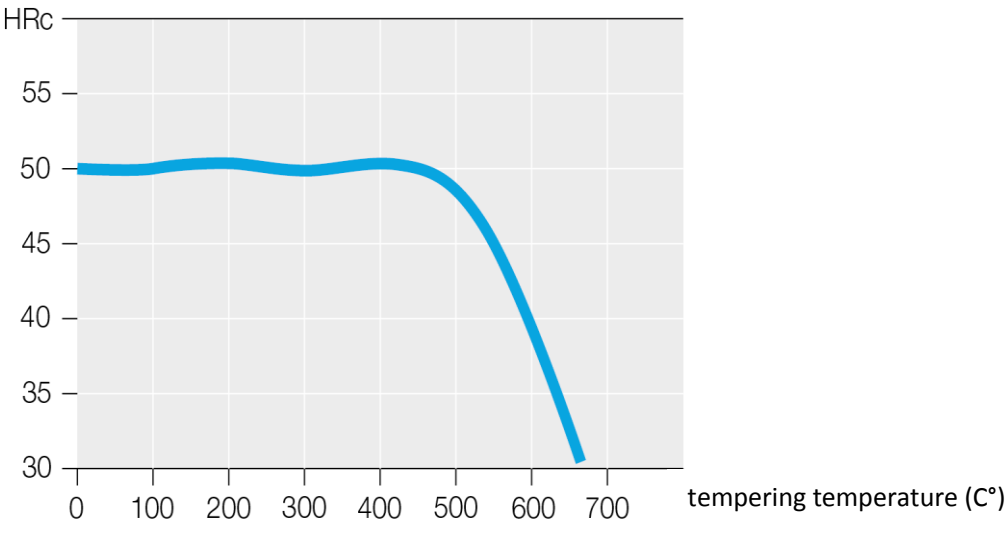
Tempering

Tempering according to needs, see Figure 1, Tempering diagram
- The temperature range of 400 – 600°C should be avoided because it may lead to brittleness and reduction of the corrosion resistance.

Welding

Difficult, not recommended

Figure 1
Tempering diagram
Quenching: 1030°C/oil
Product: ø 25 mm



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Microstructures

Microstructure for machining: Ferrite + carbides
Microstructure for hard machining: Martensite(possibly tempered Martensite) + carbides
Hardened condition (QT condition): Martensite + carbides
Microstructure for hard machining: <200°C tempered Martensite + carbides
Optimal microstructure for polishing: Tempered Martensite + carbides

Polishing

Very well adapted for mirror polishing
- Optimal in QT condition, tempering < 200°C

Laser marking

- Under normal laser marking conditions the Heat Affected Zone (HAZ) should not be modified and induces alteration of the strength and corrosion resistance should take place. More information

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 information

Corrosion resistance

Optimal: Clean surface in the heat treated condition, fine polished and passivized

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 information

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. More information

Physical properties

Property	Unit	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.7				
Young Modulus E	GPa	215	205		190	
Electrical resistance	Ω mm^2 m^{-1}	0.80				
Thermal expansion	m m^{-1} K^{-1} 10^{-6}	20–100°C 10.4	20–200°C 10.8	20–300°C 11.2	20–400°C 11.6	20–500°C
Thermal conductivity	W m^{-1} K^{-1}	15-30				
Specific heat	J kg^{-1} K^{-1}	430	505	530	550	580
Relative magnetic permeability µr		≥400				
Magnetism	Ferromagnetic, can be magnetized More information					

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