CHRONIFER® M-17C

1.4125/AISI 440C - Martensitic stainless steel

Attributes and particularities

This steel is ESR remelted and therefore has a low S content. The high C-content favors its high hardening capability up to 60 HRc. As a consequence, it has a remarkably high wear resistance associated to a good bluntness resistance as well. The presence of numerous primary carbides reduces its machinability, which is fair only. Its corrosion resistance in water and water steam is satisfactory only if the parts are previously hardened (quenched and tempered), polished and passivized.

Uses and Applications

This steel is well indicated for the production of bearings; medical, surgical, and dental instruments; cutting tools, including those for the paper industry, as well as nozzles for various applications.

Applicable standards

Material Number	1.4125
EN 10088-3 / DIN	X105CrMo17
AFNOR	X105CrMo17 (formerly Z 100 CD 17)
AISI/SAE/ASTM	AISI 440C, ASTM F899, A 276, A 959, AMS5630J, AMS 5880C (chemical composition)
NF	S 94-090
JIS	≈ SUS 440C
UNS	S 44004

Chemical composition (%wt

C	Si	Mn	P	S	Cr	Mo	Fe
0.95	max.	max.	max.	max.	16.0	0.40	balance
1.20	1.00	1.00	0.04	0.03	18.0	0.75	

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

Executions and Delivery conditions

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

Bars Ø ≥ 2.00 mm: cold drawn, ground polished, Ra max. 0.4 µm (N5)
eddy-current check according to EN10277-1, Table 1
pointed and chamfered

- Bars < 2.00 mm: cold drawn surface
- Wires Ø < 6.00 mm: cold drawn surface, coils for Escomatic

Other executions on request

Availability

Standard dimensions on stock, see: Sale program

Mechanical properties

Standard delivery condition: annealed

- Ø < 14.00 mm: max. 950 MPa
- Ø ≥ 14.00 mm: max. 285 HB
- Hardening capability: up to 60 HRc

Cutting conditions

Machinability: difficult to fair
build long chips

Cutting speed: V_c ≈ 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.

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Forming

Warm: forging: 950 – 1100 °C, preferably > 1020°C, slow cooling
Slow heating up to 850°C, then faster up to the forming temperature
Cold: Feasible after anneal at 750 – 825 °C, slow cooling
UTS/Rm after annealing: max 760 MPa

Welding

Difficult, not recommended

Annealing

Soft anneal: 780 – 840°C / 2-4h / slow furnace cooling 30°C/h to 600°C
Intermediary soft anneal during cold deformation: 600 – 680°C, air cooling
- Minimum reduction: ≥ 10 – 15%, to avoid an excessive grain growth

Quenching

Primary quench: 1000-1050°C / oil, or rapid cooling in air or gas
Optional: secondary quench by sub-zero cooling
Recommendation: To obtain the best sub-zero heat treatment efficiency, this secondary quench must be made without delay after the primary one.
- -20 down to -80°C/12 – 48h, preferably -80°C/12 – 24

Or cryo-treatment (deep cryo-cooling):
- -196°C/6 – 12h; progressive or step by step cooling to avoid a possible cracking.

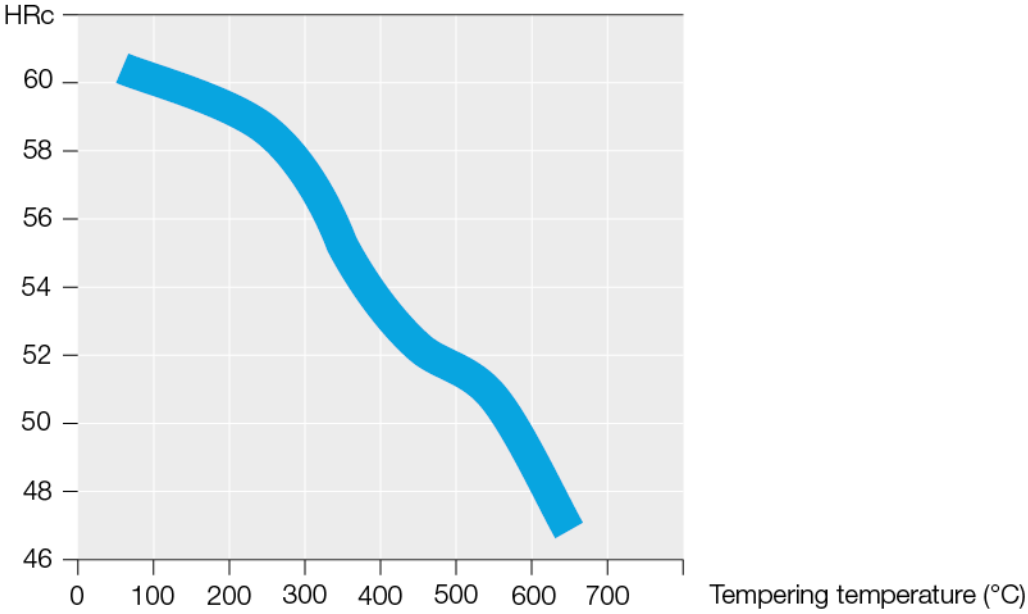
More info.

Tempering

According to needs, see Tempering diagram
- Not recommended temperature range: 400 – 580°C (brittleness range)

Not advisable because of the increased risk of inter-granular corrosion.

Tempering diagram



Microstructural cleanliness

Microstructural cleanliness: max. K2 DIN 50602 (Oxide)

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Microstructures

Delivery conditions: “annealed” and “annealed + cold drawn”: Ferrite + carbides
- Machining microstructure: Ferrite + carbides

Microstructure quenched and tempered: Martensite + carbides
- Hard machining microstructure: Ferrite + carbides

Microstructure for optimal polishing: Stress relieved martensite
- Microstructure for polishing: Stress relieved martensite - Martensite + carbides

Microstructural cleanliness: max. K2 DIN 50602 (Oxide)

Polishing

The adequacy of the CHRONIFER® M-17C steel for a mirror polish is strongly dependent on the presence of primary carbides, their size and distribution. They can strongly affect the quality of the polishing operations, their yields and economy.
- Optimal hardness: After quenching and tempering < 200°C

Laser marking

- The laser marking heat in the Heat Affected Zone (HAZ) may modify the local microstructure and affect negatively its corrosion resistance. More info.

Pickling and passivation

It is strongly recommended to use pickling and passivation procedures and products really adapted to the treatment of martensitic stainless steels.
- To avoid a possible staining by a “flash back“ reaction, it is also strongly recommended to always pickle the surfaces before passivation. More info.

Corrosion resistance

Optimum: Clean, quenched, tempered, fine polished, and passivized surfaces.
- Conditions to avoid: “annealed” and “annealed + cold deformed“. These conditions should be avoided because of the increased risk of inter-granular corrosion. These two conditions are definitively not recommended for the permanent use of parts.
- The possible formation of oxides and scaling can strongly decrease the corrosion resistance. Pickling should always eliminate these oxidations, either mechanically, or chemically by pickling.

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. More info.

Physical properties

Properties	Units	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.70				
Young Modulus E	GPa	215			190	
Electrical resistance	Ω mm^2 m^{-1}	0.70				
Thermal expansion	m m^{-1} K^{-1}	20–100°C	20–200°C	20–300°C	20–400°C	20–500°C
	10^{-6}	10.4	10.8	11.2	11.6	
Thermal conductivity	W m^{-1} K^{-1}	15.5				
Specific heat	J kg^{-1} K^{-1}	460				
Melting range	1500 – 1430 °C					
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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