L.KLEIN SA
PREMIUM STEEL & METALS
SINCE 1946

CHRONIFER® M-17C

1.4125 / AISI 440C – Martensitic stainless steel

Distinctive feature and main attributes

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.

Use and application range

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.

Norms

Material Number	1.4125
EN	10088-3
DIN	X105CrMo17
AFNOR	X105CrMo17
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 – 1.20	max. 1.00	max. 1.00	max. 0.04	max. 0.03	16.0 – 18.0	0.40 – 0.75	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:** cold drawn, groundpolished, 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 product range

Standard delivery condition: annealed

- Ø < 14.00 mm: max. 950 MPa
- Ø ≥ 14.00 mm: max. 285 HB

Hardenability: up to 60 HRc

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

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Mechanical properties
Machinability: difficult to fair, build long chips

Cutting conditions
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.

Forming
Warm: forging: 950 – 1'100 °C, preferably >1'020°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 – 4 h / 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: 1'000 – 1'050°C / oil, or rapid cooling in air or gas
Optional: Secondary quench by sub-zero cooling:
- - 20 down to - 80°C / 12 – 48 h, preferably - 80°C / 12 – 24 h

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

Recommendation: To obtain the best sub-zero heat treatment efficiency, this secondary quench must be made without delay after the primary one. 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.

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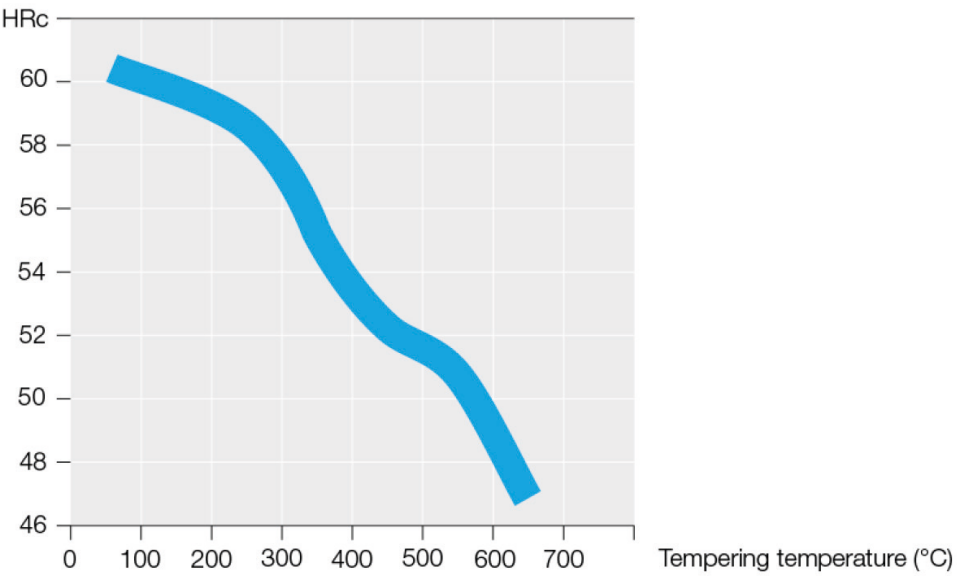
Tempering diagram



Microstructural cleanliness

Microstructural cleanliness: max. K2 DIN 50602 (Oxide)

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

Polishing

The adequacy of the CHRONIFER® M-17C steel for a mirrorpolish 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
Optimum: Clean, quenched, tempered, finepolished, and passivized surfaces.

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Corrosion resistance

- **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} 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}	15.5				
Specific heat	J kg^{-1} K^{-1}	460				
Melting range	1'500 – 1'430°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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