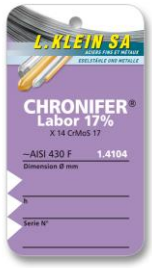


CHRONIFER® Labor 17%

1.4104/AISI ≈430F – Hardenable free machining ferritic stainless steel

Attributes and particularities

The free machining CHRONIFER® Labor 17% ferritic stainless steel has an increased S-content to enhance its machinability. Thus, one of its main features is its good to very good machinability. It is significantly better than those of non-free machining martensitic stainless steels. To obtain an optimal corrosion resistance in water and water steam, the parts must previously be heat treated, polished, and passivized.
This steel grade exhibits a fair corrosion resistance in weak alkaline solutions.

Uses

This free machining martensitic stainless steel is well adapted for the production of turned parts, such as bolts, nuts, screws and axles, as well as machined parts for general applications in the mechanical engineering.

Applicable standards

Material number	1.4104
ISO	X14CrMoS 17
EN	X14CrMoS 17 10088-3
DIN	X14CrMoS 17
AISI/SAE/ASTM	≈ AISI 430F
AFNOR	X14CrMoS 17
JIS	≈ SUS 430 F

Chemical composition (%wt)

C	Si	Mn	P	S	Cr	Mo	Ni	Fe
0.10 0.17	max. 1.00	max. 1.50	max. 0.04	0.15 0.35	15.50 17.50	0.20 0.60	max. 0.50	balance

Dimensions and tolerances

- Bars Ø < 2.00 mm: ISO h8
- Bars Ø ≥ 2.00 mm: ISO h7 (h6)
- Out of roundness: ½ diameter tolerance

Other tolerances on request

Executions and delivery conditions

Standard: ø in 3 m bars and coils for Escomatic:

- Bars ≥ 2.00 mm: cold drawn, ground, polished, Ra 0.4 µ (N5)
  pointed and chamfered
- Bars < 2.00 mm: cold drawn

Other executions on request

Availability

Dimensions on stock, see: Delivery program

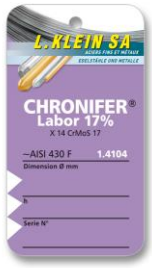
Mechanical properties

UTS strength:	depends on the diameter
Ø 1.00 - 4.40 mm:	700 – 900 MPa
Ø > 4.40 mm	650-850 MPa
• Hardening capacity:	up to 40 HRc

Machining conditions

Machinability:	good to very good build short chips
Cutting speed:	fine machining: V_c ≈ 50 - 60 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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Machining conditions CNC-turning

Condition	UTS (MPa)	Depth of cut (mm)	6	3	1
		Feed (mm/r)	0.5	0.4	0.2
Annealed	650-720°C	Cutting speed (m/min)	250	300	380

Machining conditions on automatic lathes Large diameters

Condition	UTS (MPa)	Depth of cut (mm)	6	3	1
		Feed (mm/r)	0.5	0.4	0.2
Annealed	650 – 720	Cutting speed (m/min)	140	155	165
Heat treated QT	750 – 700		125	140	165

Forming

Warm: forging: 1150 – 950°C (pre-heating at 1150 – 1230°C)
Not recommended below 930°C.
- The numerous inclusions of manganese sulfides (MnS) may lead to forging cracks.

Cold: Limited, not recommended.

Welding

Not recommended.
- The numerous manganese sulfides (MnS) inclusions can significantly hamper or even impede the welding process.

Annealing

Soft anneal: 800 – 820°C, UTS ≤ 730 MPa, $A_5 \geq 15\%$
- Because of the danger of carbide formation the annealing temperature should not exceed 825°C.

Stress relieving anneal (sub-critical): 650 – 760°C, air cooling

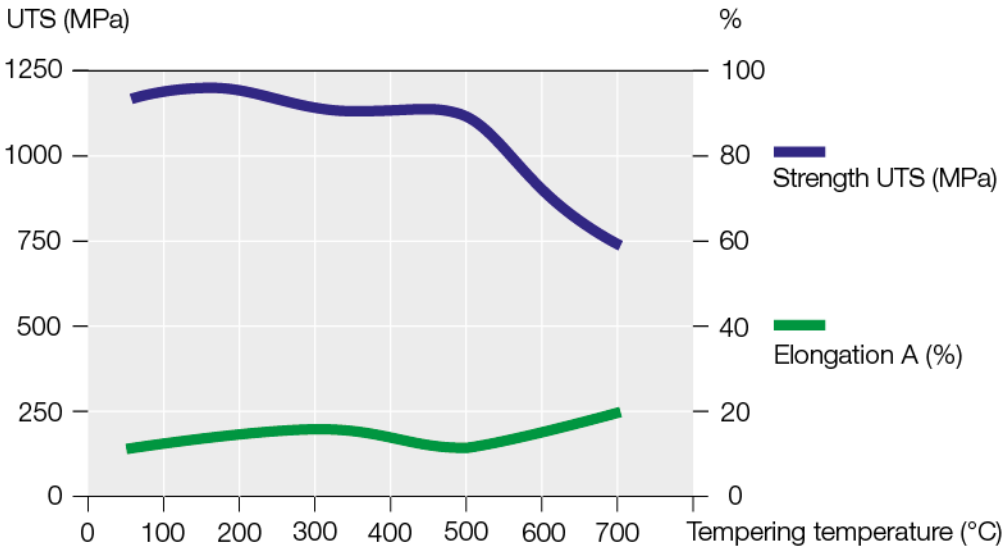
Heat treatments Quenching

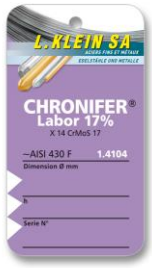
Primary quenching: 950 – 1050°C, oil quenching
Option: secondary quenching by sub-zero cooling
-20 or down to -80°C/12 – 48h, preferably -80°C/12 – 24h
or by cooling to cryo-temperature
-196°C/12 – 24h: low cooling rate to avoid thermal cracking
More info

Tempering

Tempering according to one's need. See diagram
- Because of a potential cracking risk the domain 400 – 580°C should be avoided.

Tempering diagram





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Microstructure

Delivery condition and “annealed + cold drawing” condition: ferrite + carbides
- Machining: ferrite + carbides

Quenched and tempered QT: martensite + carbides
- Hard machining: martensite + carbides
- Microstructure for an optimal polishing: stress relieved martensite

Polishing

Optimal: Quenched and tempered < 200°C
This steel grade is not amenable for mirror polish.
- The numerous inclusions of manganese sulfide (MnS) impair the polishing and decrease its material yield as well as the process economy.

Laser marking

- The numerous manganese sulfide (MnS) inclusions impair the laser marking.
- The Heat Affected Zone (HAZ) alters locally the microstructure and may reduce its corrosion resistance. More info

Passivation

The adequacy of the selected passivation process should be checked with respect to the numerous MnS inclusions of this martensitic free machining grade.
- The numerous manganese sulfide (MnS) inclusions may significantly impair the quality of the passivation process. A pickling prior to passivation is highly recommended. It should not be skipped over. More info

Corrosion resistance

Optimum: Clean, quenched, tempered, fine polished, and passivized surfaces.
- The numerous inclusions of manganese sulfide (MnS) of this steel increase its sensitivity to pitting corrosion.
- Conditions to avoid: “annealed“ and “annealed + cold deformed”. Because of their increased corrosion risk, they are not recommended as use conditions.
- The possible formation of oxides and scaling can strongly decrease the corrosion resistance. These oxidations should always be eliminated either mechanically by an abrasion process, or better, by pickling.

Elementary precautions

- The simplest and easiest precautions is always to keep the parts clean, free of working residues, polished, and correctly dried.
- Use only chlorine free disinfection, 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				
Electrical resistance	Ω mm^2 m^{-1}	0.70				
Thermal expansion	m m^{-1} K^{-1} 10^{-6}	20–100°C 10.5	20–200°C 10.5	20–300°C 10.5	20–400°C 10.5	20–500°C
Heat conductivity	W m^{-1} K^{-1}	25				28.7
Specific heat	J kg^{-1} K^{-1}	460				
Melting range	1510 – 1425 °C					
Magnetism us	Ferromagnetic, can be magnetized. More info					