

# CHRONIFER® L 18 SOLENOID

**1.4105/AISI 430F – Free machining ferritic stainless steel for solenoids**

### Distinctive feature and main attributes

The CHRONIFER® L 18 is a soft magnetic free machining ferritic stainless steel for solenoids. It contains an addition of S to improve its machinability. The soft magnetic properties are directly set by a specific heat treatment made by the steel producer. The high C content permits to adjust the mechanical properties by heat treatment. But, its high S content limits its corrosion resistance in chloride containing mediums.

### Use and application range

The soft magnetic properties of the CHRONIFER® L 18 steel are of primary interest for the producers and users of solenoid parts. This steel is also widely used in numerous industrial segments for the production of general mechanical engineering parts not requiring specific magnetic properties.

### Norms

Material No.	1.4105
DIN	X6CrMoS 17
AFNOR	Z8CF17
AISI	430F; ≈ 430FR; ASTM F899
EN	X6CrMoS 17 10088-3
JIS	≈ SUS 430 F
UNS	S43020

### Chemical composition [% wt]

C	Si	Mn	P	S
max. 0.08	max. 1.50	max. 1.00	max. 0.04	0.15 – 0.35

Cr	Mo	Ni	Fe
16.00 – 18.00	0.20 – 0.60	max. 1.00	balance

### Execution, delivery conditions and standard sizes

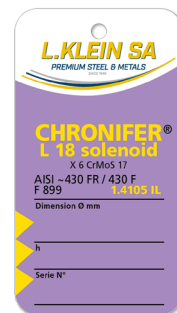
Round bars: 3 m length, 2 m on request, delivery condition: cold drawn  
square or hexagonal bars: cold drawn, available on request

### Availability

Standard dimensions on stock: see [product range](#)

### Magnetic properties

In delivery condition: heat treated for specific soft magnetic properties  
The adjustment of the soft magnetic properties requires a particular heat treatment made directly by the steel producer.



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### Set soft magnetic properties

Properties	symbol	value	unit
Saturation flux density	Bs	1.6	T
Remanence	Br	0.5 – 0.8	T
Specific electrical resistance		0.85	$\mu\Omega\text{m}$
Magnetic conductivity – permeability	$\mu_r$	$\geq 1'000$	
Coercive field strength	$\mu\text{Hc}$	< 240	A/m

### Cutting conditions

Machining: from good to very good, forms short chips

Cutting speed:  $V_c \approx 50 - 100 \text{ m/min}$ , fine Swiss machining

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.
- Under given circumstances the used cutting conditions may lead to a build up of surface internal stress patterns that may influence negatively the set magnetic properties. In such cases, a low temperature stress relieving treatment < 250°C, can be considered.

### 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	Cutting speed [m/min]	250	300	380

### Swiss machining 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

### Warm forming

Forging: 1'150 – 950°C (pre-warming 1'150 – 1'230°C), not recommended below 930°C.

The numerous complex sulfide inclusions may lead to hot cracking during forming-forging.

### Cold forming

Limited. Not recommended.

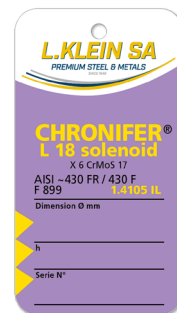
Cold forming can be made up to approximately 35% cold reduction, but is not usually made.

Cold forming may lead to the loss of the soft magnetic properties set by the steel producer.

### Welding

Not recommended.

The numerous complex sulfide inclusions render the welding very difficult and lead to the loss of the specific soft magnetic properties set by the steel producer.



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- Annealing** Soft anneal: 800 – 820°C, UTS / Rm ≤ 730 MPa, A<sub>5</sub> ≥ 15%
- The annealing temperature should not exceed 825°C. Above it there is a significant risk of carbide formation.
  - Above 800 – 820°C this steel develops rapidly coarse grains.
  - A coarse grain microstructure influences negatively the soft magnetic properties.

- Stress relieving** Appropriate stress relieving: ≤ 250°C.  
Annealing > 250°C modify the soft magnetic properties set by the steel producer.

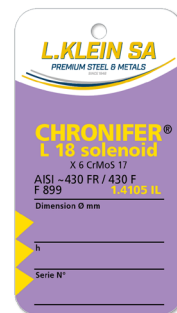
- Polishing** Optimal: quenching + annealing at < 200°C to obtain a stress relieved martensite.
- This steel is not adapted for mirror polishing.
  - The numerous complex sulfide inclusions render the polishing more difficult and lowers its efficiency and economy.

- Laser marking**
- The numerous complex sulfide inclusions render the laser marking process more difficult.
  - The HAZ (Heat Affected Zone) of the laser markings affects negatively and irreversibly the microstructure, its corrosion resistance and the soft magnetic properties set by the steel producer. [more info](#)

- Passivation** The adequacy of the passivation process and of the chemical solutions to be used for the passivation of this S alloyed free machining ferritic stainless steel, should always be checked before their application.
- The numerous complex sulfide inclusions may render the passivation significantly more difficult.
  - The pickling before passivation is highly recommended. It should not be omitted. [more info](#)

- Corrosion resistance** Optimal: clean surface, hardened and tempered, fine polished and passivized
- The numerous complex sulfide inclusions may increase the pitting corrosion sensitivity.
  - A possible surface and scaling oxidation can induce a massive increase of corrosion sensitivity lowering the corrosion resistance. These oxides must be eliminated either by mechanical or chemical (pickling) means.
  - The microstructure of the soft magnetic properties of this steel, set by the steel producer, have a stable microstructure exhibiting the best achievable corrosion resistance.

- Elementary precautions**
- The simplest protection is to always keep the parts clean, polished and passivized.
  - Keep the parts properly cleaned and dry (no residuals adhering on the surface).
  - Use only chloride free cleaning and washing agents. [more info](#)



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### Physical properties

Properties	Units	Temperature [°C]				
		20	200	300	400	500
Density	g cm <sup>-3</sup>	7.7				
Young modulus E	GPa	215				
Electrical resistance	Ω mm <sup>2</sup> m <sup>-1</sup>	0.70				
Thermal expansion	m m <sup>-1</sup> K <sup>-1</sup> 10 <sup>-6</sup>	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 <sup>-1</sup> K <sup>-1</sup>	25				28.7
Specific heat	J kg <sup>-1</sup> K <sup>-1</sup>	460				
Melting range		1'510 – 1'425 °C				
Magnetism		Ferromagnetic, can be magnetized. <a href="#">more info</a>				

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