



# CHRONIFER<sup>®</sup> Special D 18/8

1.4305/AISI 303 – Free machining 18/8 austenitic stainless steel

## Features and particularities

This steel belongs to the free machining austenitic stainless steels group. It contains 0.15-0.35% S and up to 1% Cu. It is the reference free machining austenitic stainless steel. But its high S-content reduces markedly its aptitude to welding, high quality polishing and corrosion resistance. Its high Cu-content can render it sensitive to stress corrosion cracking, and its high C-content to intergranular corrosion, after exposure in the critical sensitization range 450-850°C. It can retain traces of  $\delta$  (Delta) ferrite in all conditions and therefore displays traces of ferromagnetism. Plastic cold deformation lead to the formation of  $\alpha$  (Alpha) martensite and increases considerably its ferromagnetism up to relative magnetic permeability >1.

## Uses

This steel is the classical free machining austenitic stainless steel. Its uses are numerous, from sanitary wares to beverage, food and chemical industries as well as components in micro-mechanical engineering and equipment.

## Standards

Material Number	1.4305
ISO	7153-1 (N)
EN 10088-3	X8CrNiS 18-9
UNS	S30300
DIN   AFNOR	X8CrNiS 18-9
AISI/SAE	303
ASTM	F 899   A 582
JIS	SUS 303

## Chemical composition (%wt.)

C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N	Fe
max.	max.	max.	max.	0.15	17.0	8.00	≤ 0.70	max.	max.	balance
0.10	1.00	2.00	0.045	0.35	19.0	10.00		1.00	0.10	

## Dimensions and tolerances

Standard: bars 3 m (+50/0 mm), coils for Escomatic  
 Mechanical properties: Rm 650-950 MPa  
 • Bars  $\varnothing < 0.8-18$  mm: ISO h8  
 • Bars  $\varnothing \geq 2.00$  mm: ISO h6 (h7)  
 • Wires  $\varnothing \geq 0.80 - 3.00$  mm: ISO fg7, coils for Escomatic  
 • Out of roundness max: 1/2 diameter tolerance  
 Other tolerances on request

## Executions and Delivery conditions

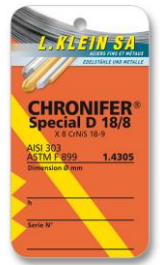
Standard: bars 3 m (+50/0 mm), coils for Escomatic  
 • Bars  $\varnothing \geq 2.00$  mm: cold drawn, ground, polished, Ra max 0.4  $\mu$ m (N5)  
 Ends: pointed and chamfered  
 • Bars < 2.00 mm: surface condition: cold drawn  
 • Wires  $\varnothing < 3.00$  mm: surface condition: cold drawn, coils for Escomatic  
 Other executions on request

## Availability

Standards dimension on stock, see: [Sale program](#)

## Cutting conditions

Machinability: very good, reference  
 Cutting speed:  $V_c \approx 40 - 100$  m/min.  
 Well adapted to high cutting speeds  
 Lubricant-coolant fluid: 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.



# CHRONIFER<sup>®</sup> Special D 18/8

1.4305/AISI 303 – Free machining 18/8 austenitic stainless steel

**Grain size** According to ASTM E47:

- Hot rolled bars: ASTM Nr. ≥ 6-7, individual grains > 5
- Cold drawn wires: ASTM Nr. ≥ 7-8

**δ (Delta) Ferrite**

The CHRONIFER<sup>®</sup> Special D 18/8 steel contains δ (Delta) Ferrite. Its Ferrite content can be determined graphically with the Schaeffler-De Long Diagram modified by Outokumpu, or computed with the aid of the Cr<sub>eq</sub> und Ni<sub>eq</sub> equivalent contents:

- Cr<sub>eq</sub> = 1.5Si + Cr + Mo + 2Ti + 0.5Nb
- Ni<sub>eq</sub> = 30(C + N) + 0.5Mn + Ni + 0.5(Cu + Co)
- Ferrite Number FN or %<sub>vol.</sub> δ (Delta) Ferrite  
FN = (({1.375 (Cr<sub>ew</sub> - 16)} + 10) - Ni<sub>eq</sub>) 2.586

Negative values of FN indicate the absence of δ (Delta) Ferrite.

**Forming**

Warm, forging 950 – 1100°C, quenching/rapid cooling

- The numerous MnS inclusions increase the hot cracking risk and restrict the hot forming capability.
- In case that the temperature should drop below 900°C, the risk of sensitization increases strongly, see Figure p. 3. In this case, a solution anneal is recommended.

Cold: feasible, see Figure 1 p. 3.

**Solution anneal**

1030-1060°C, quenching/rapid cooling

- To restrict the risk of a rapid and intensive grain growth, a minimum cold deformation of 10 – 15% is recommended.
- Temperature below 900°C should be avoided as they may lead to sensitization and to the precipitation of intergranular carbides. In this case, a 1030-1060°C solution anneal is recommended.

**Stress relieving**

- Stress relieving treatments above 150°C may lead to a drop of the mechanical properties obtained by cold deformation.

**Hardening  
Strengthening**

- This steel cannot be hardened by heat treatment.
- This steel can be strengthened by cold deformation.

**Microstructures**

Delivery condition, hot worked: Austenite in the annealed condition  
For machining and polishing: Cold deformed bars and wires:  
Austenite in the annealed and cold worked condition

**Polishing**

- The presence of numerous MnS inclusions as well as of δ (Delta) Ferrite, may reduce significantly the steel aptitude to polishing.
- Electro-polishing: adapted, with restriction
- The traces of δ (Delta) Ferrite present in this steel are etched in relief by electro-polishing.
  - The presence of intergranular carbides after a sensitization below 850°C, requires a 1030-1060°C solution anneal treatment in order to not jeopardize the polishing abilities and corrosion resistance of this steel.
  - The intergranular carbides precipitated during a sensitization exposure appears in relief after electro-polishing.

[More info.](#)

**Welding**

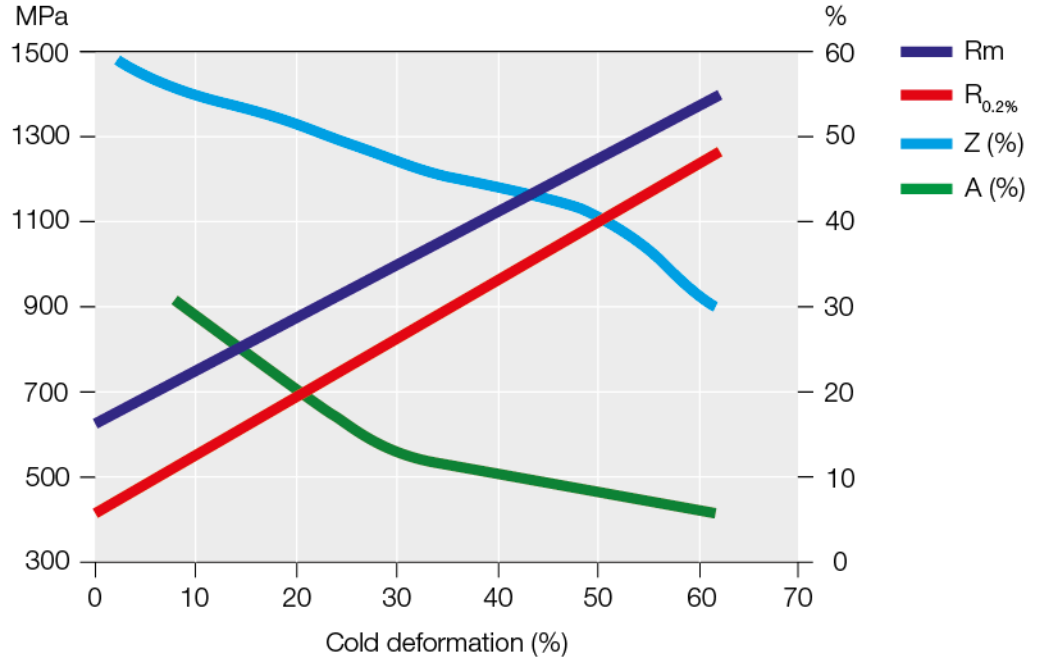
- Not recommended. The presence of numerous MnS inclusions in this steel restrict its welding.



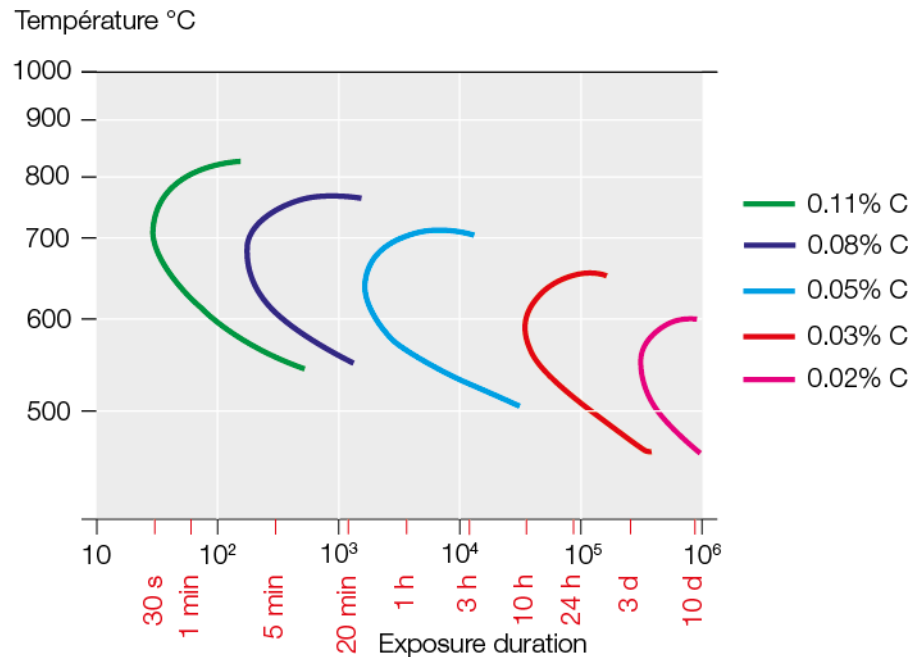
# CHRONIFER<sup>®</sup> Special D 18/8

1.4305/AISI 303 – Free machining 18/8 austenitic stainless steel

**Figure 1**  
Strengthening curves



**Figure 2**  
Sensitization  
TTS curves





# CHRONIFER<sup>®</sup> Special D 18/8

1.4305/AISI 303 – Free machining 18/8 austenitic stainless steel

## Laser marking

- The numerous MnS inclusions can make the laser marking more difficult.
- The HAZ Zone (Heat Affected Zone) of the laser marking can negatively influence its local microstructure.

Laser marking: [More info.](#)

## Surface oxidation

A thermal oxidation forms colored oxides or scaling on the surface. These must be eliminated, either chemically by pickling or by mechanical means like grinding.

- Colored surface oxidation and/or scaling can massively reduce the corrosion resistance and jeopardize it.
- Colored surface oxidation and/or scaling can jeopardize the corrosion resistance.

## Pickling - Passivation

The pickling and passivation processes and the products used therefore, should always be adapted to the requirements of the pickling and passivation of free machining austenitic stainless steels.

- Potential “Flash back” reactions staining the surface can always be avoided by pickling the surfaces prior to passivation.
- The ferromagnetism of this steel in the cold worked condition can enhance the tendency to form flash back reactions. A pickling should always be preventively be made.
- An additional passivation treatment is not needed after electro-polishing.

[More info.](#)

## PREN

- The use of computed PREN (Pitting Resistance Equivalent Number) as indicators of the pitting corrosion resistance of free machining stainless steels containing S additions are not valid, as is the case of this CHRONIFER<sup>®</sup> Special D 18/8 austenitic free machining stainless steel.

## Elementary precautions

- The most elementary protection is to always keep the surfaces very clean, polished and passivated.
- The parts should always be very well cleaned (no usage residual) and dried.
- Only use adapted chlorine free disinfection, cleaning and washing products.

[More info.](#)

## Magnetism

Ferromagnetism due to the presence of  $\delta$  (Delta) Ferrite:

- This steel can contain traces of  $\delta$  (Delta) Ferrite and exhibit in the annealed condition values of its magnetic relative permeability  $\mu > 1.003$ .

Ferromagnetism due to the presence of  $\alpha$  (Alpha) Martensite:

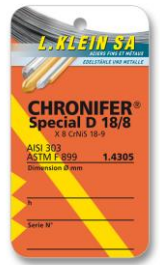
- This steel forms  $\alpha$  (Alpha) ferromagnetic martensite during cold working. This ferromagnetism can exhibit relatively strong relative permeability values  $\mu > 1$ .

[More info.](#)

## Use limits

Figure 2 shows the TTT sensitization curves applying for this austenitic stainless steel class. This steel can during exposure in the 450 et 850°C temperature range precipitates grain boundary carbides - intergranular carbides. This carbide precipitation reduce its corrosion resistance and increase its brittleness.

- The high C content of  $\leq 0.10\%$  of the CHRONIFER<sup>®</sup> Special D 18/8 steel renders it sensitive to this type of precipitation in the temperature range of 450-850°C, and limit its continuous use to temperature of max. 400°C.



# CHRONIFER<sup>®</sup> Special D 18/8

1.4305/AISI 303 – Free machining 18/8 austenitic stainless steel

**Physical properties**

Properties	Unité	Température (°C)				
		20	200	300	400	500
Density	g cm <sup>-3</sup>	7.90				
Young modulus E	GPa	200	186	179	172	
Shear modulus G*	GPa	80				
Poisson coefficient V		0.24	0.256			
Electrical resistance	Ω.mm <sup>2</sup> .m <sup>-1</sup>	0.75				
Thermal expansion	m m <sup>-1</sup> K <sup>-1</sup> 10 <sup>-6</sup>	20–100°C	20–200°C	20–300°C	20–400°C	20–500°C
		16	16.5	17	17.5	18
Thermal conductivity	W.m <sup>-1</sup> .K <sup>-1</sup>	15	16.3		15.2	
Specific heat	J.kg <sup>-1</sup> .K <sup>-1</sup>	500	510			
Liquidus	°C		1410			
Magnetism	Annealed condition: Traces of ferromagnetic δ (Delta) Ferrite Cold worked condition: Traces of ferromagnetic δ (Delta) Ferrite and α (Alpha) martensite					

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.