L.KLEIN SA
PREMIUM STEEL & METALS
SINCE 1946

CHRONIFER® SPECIAL D 18/8

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

Distinctive feature and main attributes

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 δ (Delta) ferrite in all conditions and therefore displays traces of ferromagnetism. Plastic cold deformation lead to the formation of α (Alpha) martensite and increases considerably its ferromagnetism up to relative magnetic permeability >1.

Use and application range

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.

Norms

Material No.	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
max. 0.10	max. 1.00	max. 2.00	max. 0.045	0.15 – 0.35	17.0 – 19.0

Ni	Mo	Cu	N	Fe
8.00 – 10.00	≤0.70	max. 1.00	max. 0.10	balance

Dimensions and tolerances

Standard: bars 3 m (+ 50 / 0 mm), coils for Escomatic
Mechanical properties Rm: 650 – 950 MPa
- **Bars Ø < 0.8 – 18 mm:** ISO h8
- **Bars Ø ≥ 2.00 mm:** ISO h6 (h7)
- **Wires Ø ≥ 0.80 – 3.00 mm:** ISO fg7, coils for Escomatic
- **Out of roundness:** max. ½ diameter tolerance

Other tolerances on request

Executions and delivery conditions

Standard: bars 3 m (+ 50 / 0 mm), coils for Escomatic
- **Bars Ø ≥ 2.00 mm:** cold drawn, groundpolished, max. Ra 0.4 µm (N5), **Ends:** pointed and chamfered.
- **Bars < 2.00 mm: surface condition:** cold drawn
- **Wires Ø < 3.00 mm: surface condition:** cold drawn, coils for Escomatic

Other executions on request

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

L. Klein SA • Chemin du Long-Champ 110 • CH-2504 Biel / Bienne • Tél. +41 (0)32 341 73 73 • Fax +41 (0)32 341 97 20
info@kleinmetals.ch • www.kleinmetals.ch

CHRONIFER® SPECIAL D 18/8

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

Availability

Standards dimension on stock: see product range

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.

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® 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_{eq} und Ni_{eq} equivalent contents:
- $Cr_{eq} = 1.5\,Si + Cr + Mo + 2\,Ti + 0.5\,Nb$
- $Ni_{eq} = 30(C + N) + 0.5\,Mn + Ni + 0.5(Cu + Co)$
- Ferrite Number FN or $\%_{vol.}$ δ (Delta) Ferrite
  $FN = [\{1.375\,(Cr_{eq} - 16\} + 10] - Ni_{eq}]2.586$

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

Forming

Warm: forging: 950 – 1'100°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 2, p. 4. In this case, a solution anneal is recommended.

Cold: feasible, see Figure 1 p. 3

Annealing

Solution anneal: 1'030 – 1'060°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

- This steel cannot be hardened by heat treatment.

Strengthening

- This steel can be strengthened by cold deformation. See Figure 1, p. 3

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

CHRONIFER® SPECIAL D 18/8

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

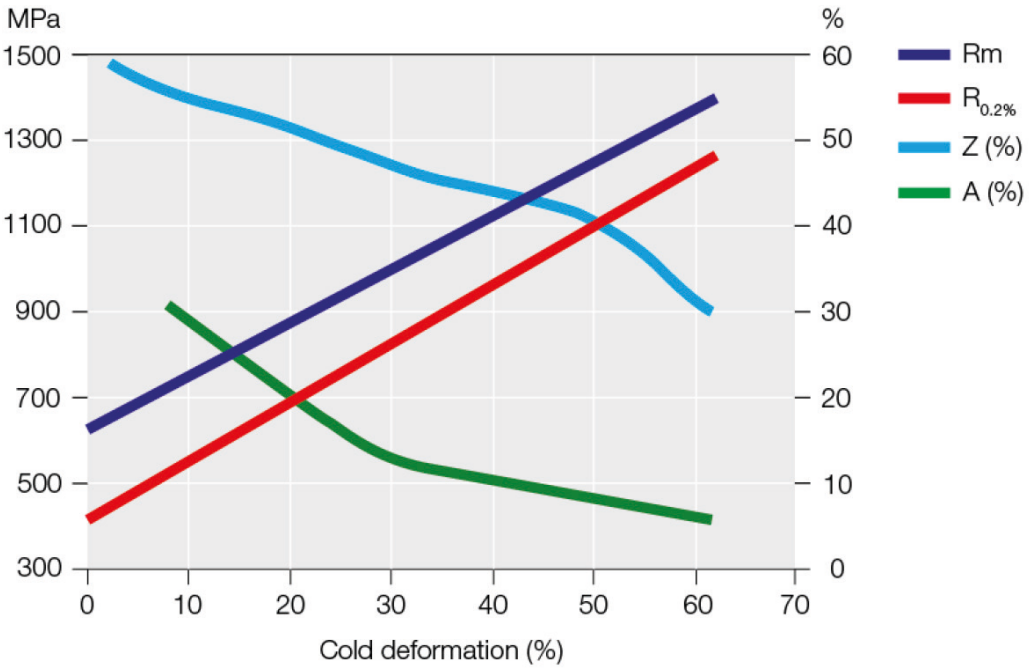
Microstructures **Delivery condition, hot worked:** Austenite in the annealed condition
For machining and polishing: Cold deformed bars and wires: Austenite in the annealed and cold worked condition

Polishing The presence of numerous MnS inclusions as well as of δ (Delta) Ferrite, may reduce significantly the steel aptitude to polishing.
Electropolishing: adapted, with restriction

- The traces of δ (Delta) Ferrite present in this steel are etched in relief by electropolishing.
- The presence of intergranular carbides after a sensitization below 850°C, requires a 1'030 – 1'060°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 electropolishing. more info

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

Figure 1
Strengthening curves

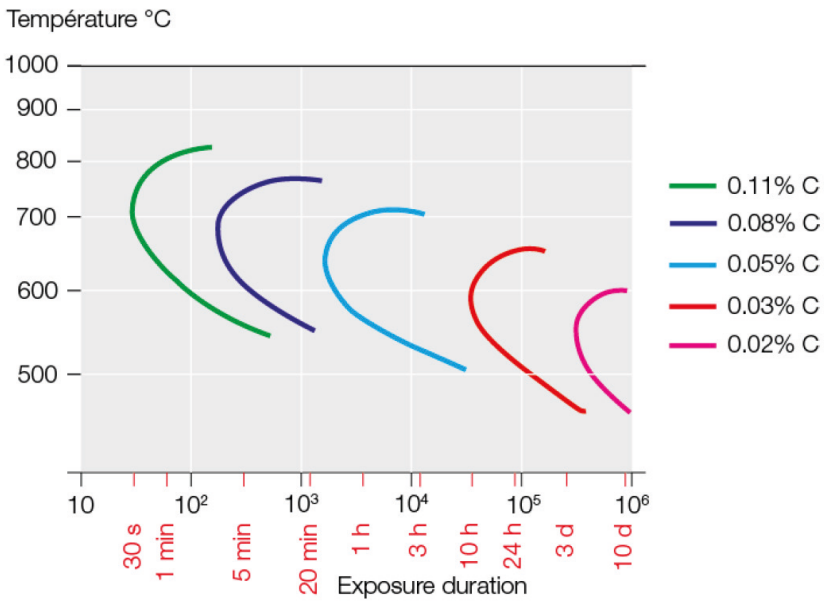


Modifications will not be adjusted automatically. Last update 08/2024

CHRONIFER® SPECIAL D 18/8

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

Figure 2
Sensitization TTS curves



Lasermarking The numerous MnS inclusions can make the lasermarking more difficult. The HAZ Zone (Heat Affected Zone) of the lasermarking can negatively influence its local microstructure. more info

Superficial oxidation A thermal oxidation forms colored oxides or scaling on the surface. These muss be eliminated, is it 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 and 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 electropolishing. 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® Special D 18/8 austenitic free machining stainless steel.

L.KLEIN SA
PREMIUM STEEL & METALS
SINCE 1946

CHRONIFER® SPECIAL D 18/8

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

Elementary precautions

- The most elementary protection is to always keep the surfaces very clean, polished and passivized.
- 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 δ (Delta) Ferrite:

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

Ferromagnetism due to the presence of α (Alpha) Martensite:

- This steel forms α (Alpha) ferromagnetic martensite during cold working. This ferromagnetism can exhibit relatively strong relative permeability values μr >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 ≤0.10% of the CHRONIFER® 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.

Physical properties

Properties	Units	Temperature (°C)				
		20	200	300	400	500
Density	g cm^{-3}	7.9				
Young modulus E	GPa	200	186	179	172	
Shear modulus G*	GPa	80				
Poisson coefficient ν		0.24	0.256			
Electrical resistance	Ω mm^2 m^{-1}	0.75				
Thermal expansion	m m^{-1} K^{-1} 10^{-6}	20 – 100°C 16.0	20 – 200°C 16.5	20 – 300°C 17.0	20 – 400°C 17.5	20 – 500°C 18.0
Thermal conductivity	W m^{-1} K^{-1}	15	16.3		15.2	
Specific heat	J kg^{-1} K^{-1}	500	510			
Melting Point	solidus 1'410 °C					
Magnetism	Annealed condition: Traces of ferromagnetic ∂ (Delta) Ferrite Cold worked condition: Traces of ferromagnetic ∂ (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.

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

L. Klein SA • Chemin du Long-Champ 110 • CH-2504 Biel / Bienne • Tél. +41 (0)32 341 73 73 • Fax +41 (0)32 341 97 20
info@kleinmetals.ch • www.kleinmetals.ch