

CHRONIFER® Supra

1.4301-1.4306-1.4307/AISI 304-304L – 18/8 Austenitic Stainless Steel

Features and Particularities

The composition of this austenitic stainless steel satisfies simultaneously the composition requirements of the 1.4301 and 1.4306-1.4307 grades. Its low C-content reduces significantly its sensitization risk in the 450-800°C temperature range with formation of grain boundaries precipitates leading to intergranular corrosion reactions. This stainless steel grade forms δ (Delta) ferrite during solidification. Its relative magnetic permeability μ_r in the annealed condition is up to <1.02 . However, its austenitic matrix transforms progressively into a ferromagnetic martensitic microstructure during cold working. Thereby, its relative magnetic permeability μ_r can rapidly increase to high values, like 2 or more. Its corrosion resistance in chloride free salt solutions is satisfactory. This steel can continuously be used up to 400°C.

Uses

This steel grade it's the most used stainless steel. Its typical uses are the production, stocking and transportation in the beverage, nutritional and chemical industries. However, its corrosion resistance depends partly on its strength, surface condition, cleanliness and roughness.

Standards

Material Number	1.4301 / 1.4306 / 1.4307
ISO	X5CrNi 18-10 / X2CrNi 19-11 / X2CrNi 18-9
EN/DIN	X5CrNi 18-10 / X5CrNi 19-11 / X2CrNi 18-9
AFNOR	X10CrNi 18-10 (former Z 7 CN 18-09)
AISI/SAE	≈ 304 / 304L
ASTM	F899
UNS	S30400
JIS	SUS 304 / JUS 304 L

Chemical composition (%wt.)

C	Si	Mn	P	S	Cr	Ni	N	Fe
max.	max.	max.	max.	max.	18.0	8.00	max.	Balance
0.03	1.00	2.00	0.045	0.03	19.0	10.50	0.10	

Dimensions and tolerances

Standard: Bars 3 m (+50/0 mm), coils for Escomatic

- Bars $\varnothing < 2.00$ mm: ISO h8 (h7)
- Bars $\varnothing \geq 2.00$ mm: ISO h6
- Wires $\varnothing \geq 0.80$ - max. 3.00 mm: ISO fg7, coils for Escomatic
- Out of roundness max.: $\frac{1}{2}$ diameter tolerance

Other tolerances on request

Mechanical properties

Diameter (mm)	<13.0	≥ 13.0 - ≤ 16.0	>16.0
Mechanical strength UTS (MPa)	700-950	600-950	500-700

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 μm (N5)
Bar ends: pointed and chamfered
- Bars < 2.00 mm: Surface condition: cold drawn

Other executions on request

Availability

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

Cutting conditions

Machinability: relatively difficult
Cutting speed: $V_c \approx > 25-40$ m/min, annealed: Rm 500-700 MPa
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.



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δ (Delta) Ferrite This CHRONIFER® Supra stainless 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 Creq und Nieq equivalent contents:

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

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

- PREN**
- $PREN = \%Cr + 3.3\%Mo + 18\%N$
 - Computed basic parameters: min. ≥ 18 / max. 19.8

- Forming**
- Warm: forging: 950 – 1150°C, rapid cooling
- The temperature range 450-800°C should be avoided.
- Cold: no limitation

- Annealing**
- Solution anneal: 1010-1090°C, quenching, rapid cooling
- Stress relieving anneal: T max. 420°C / < 5h

- Hardening Strengthening**
- This steel cannot be hardened by heat treatment.
 - This steel can be strengthened by cold deformation/straining.

Microstructures For machining and polishing: annealed or cold deformed austenite

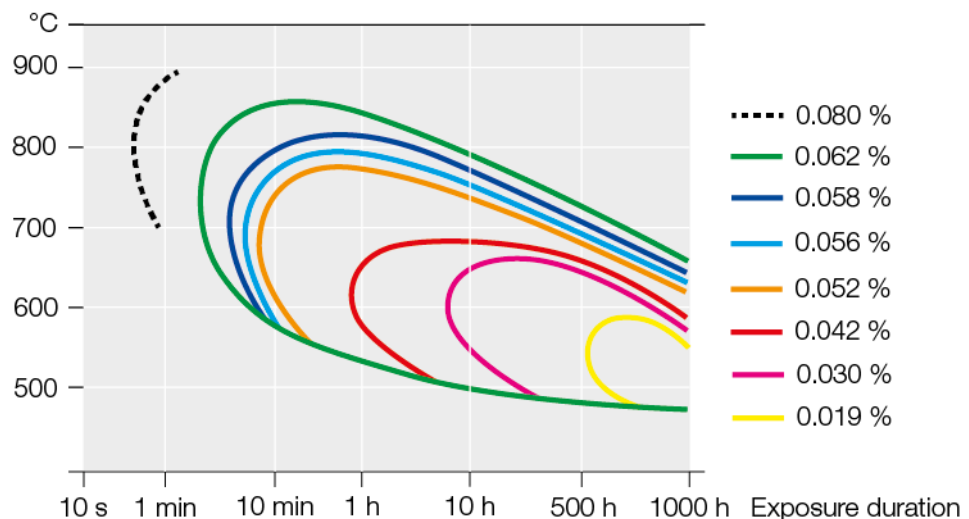
- Polishing**
- Mechanical or electrolytic: adapted
- The presence of δ (Delta) Ferrite restricts its adequacy for mirror polishing.

Welding Good for welding

Laser marking The HAZ Zone (Heat Affected Zone) of the laser marking can influence negatively its local microstructure. [More info](#)

- Sensitization**
- Sensitization in the 450-800°C temperature range should be avoided, to prevent any intergranular carbide precipitations which can lead to brittleness and a reduction of the corrosion resistance. [More info.](#)

Sensitization TTS - curves





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Surface oxidation

A thermal oxidation forms colored oxides or scaling on the surface. These must 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.

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 austenitic stainless steels. [More info.](#)

- Potential “Flash back” reactions staining the surface can always be avoided by applying a pickling process prior to passivation.
- An additional passivation treatment is not needed after electro polishing.

Corrosion resistance

- Optimal surface condition: Very clean, polished and passivized. [More info.](#)

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.

Magnetism

Ferromagnetism due to the presence of δ (Delta) Ferrite:

- In the annealed condition this steel can contain δ (Delta) Ferrite and exhibit a relative magnetic permeability μ_r up to 1.02.

Ferromagnetism due to the formation of ferromagnetic martensite by cold deformation:

- This steel can exhibit a relative permeability μ_r up to > 2 in the cold deformed, plastically strained condition. [More info.](#)

Physical properties

Properties	Unit	Temperature (°C)				
		20	200	300	400	500
Density	g cm ⁻³	7.9				
Young modulus E	GPa	200	186	179	172	165
Poisson coefficient		0.30	0.31	0.31	0.32	
Electrical resistance	Ω.mm ² .m ⁻¹	0.73				
Thermal expansion	m m ⁻¹ K ⁻¹	20–100°C	20–200°C	20–300°C	20–400°C	20–500°C
	10 ⁻⁶	16.0	16.5	17.0	17.5	18.0
Thermal conductivity	W.m ⁻¹ .K ⁻¹	15				
Specific heat	J.kg ⁻¹ .K ⁻¹	500				
Solidus	°C	1420				
Magnetism	from weak magnetic in the annealed condition, to strong magnetic in the cold deformed condition					
Relative Permeability μ_r	≤ 1.02 in the annealed condition					
	> 2 in a strong cold deformed condition (i.e. spring material)					

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