

UGINOX

18-10T

Titanium stabilized austenitic stainless steel

European designation ⁽¹⁾
X6CrNiTi18-10
1.4541
American designation ⁽²⁾
AISI 321

(1) According to NF EN 10088-2
(2) According to ASTM A 240

This grade is in accordance with:

- UGINE & ALZ Material Safety Data Sheet n°1: stainless steels (European Directive 2001/58/EC).
- European Commission Directive 2000/53/EC for end-of-life vehicles, and to Annex II dated 27 June 2002.
- PED (Pressure Equipment Directive) according to EN 10028-7 and AD2000W2 according to VD TÜV W494.
- Lloyd's Register of Shipping.
- NFA 36 711 Standard «Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption» (non packaging steel).

Chemical composition

Mean values

Éléments	C	Si	Mn	Cr	Ni	Ti
%	0.03	0.50	1.30	17.50	9.20	0.300

General characteristics

The principal features of **UGINOX 18-10T** are:

- very good general resistance to corrosion
- excellent resistance to intergranular corrosion
- excellent weldability
- good resistance to creep and oxidation at high temperatures.

Typical applications

- Chemicals and agrofood industries
- Tubes and expansion bellows
- Electrical heating elements
- Aeronautical engineering
- Automotive exhaust systems
- Cryogeny

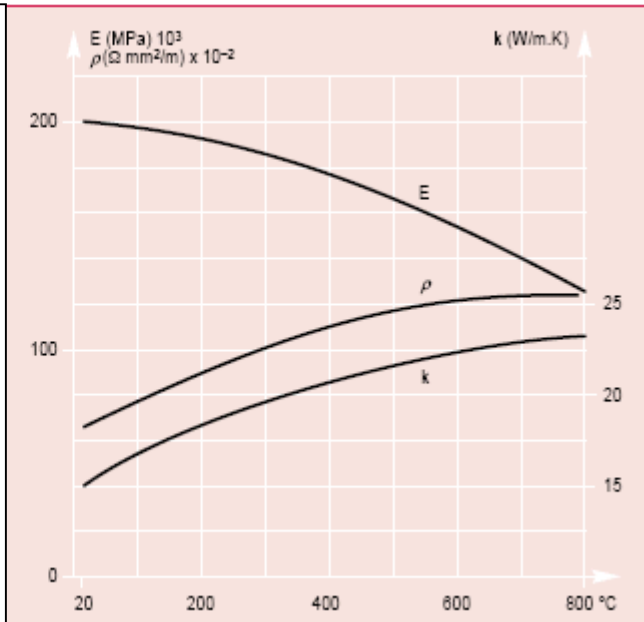
Product range

Forms: sheets, blanks, coils, strips, circles
Thicknesses: 0.3 to 14 mm
Width: according to thickness, consult us
Finish: cold rolled or hot rolled, depending on the thickness

Physical properties (cold rolled sheet - annealed)

Density	d	–	4 °C	7,9
Melting temperature		°C		1420
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	15
Mean coefficient of Thermal expansion	α	$10^{-6}/K$	20 - 100 °C 20 - 200 °C 20 - 400 °C 20 - 500 °C	16,0 16,5 17,5 18,0
Electric resistivity	ρ	$\Omega \cdot \text{mm}^2/\text{m}$	20 °C	0,73
Magnetic permeability	μ	at 0.8 kA/m DC or top AC	20 °C	1,01
Young's modulus	E	$\text{Mpa} \cdot 10^3$	20 °C	200

Ferrite content (Delon diagram): $\leq 7\%$
Poisson's ratio: 0.28



Tensile properties

Annealed condition
According to NF EN 10002-1 (July 2001),
specimen perpendicular to the rolling direction

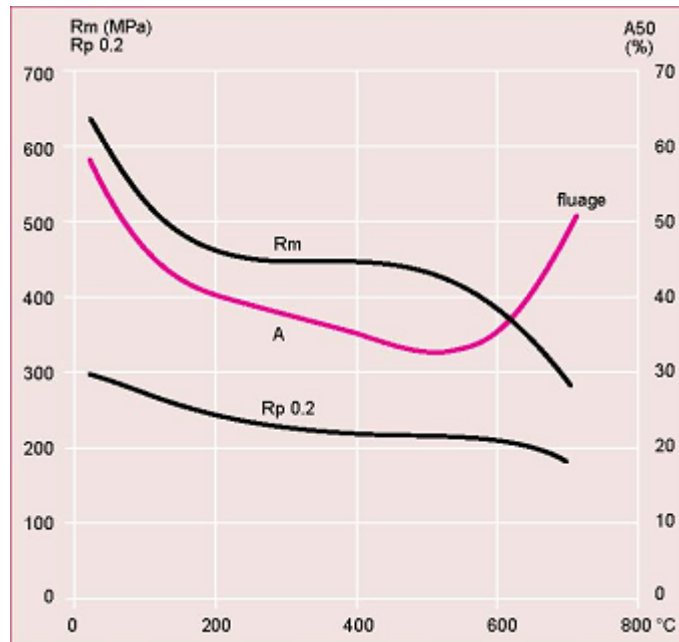
Specimen
Lo = 80 mm (thickness < 3 mm)
Lo = $5,65 \sqrt{S_0}$ (thickness ≥ 3 mm)

1 MPa = 1 N/mm²

Annealed condition	$R_m^{(1)}$ (MPa)	$R_{p0,2}^{(2)}$ (MPa)	A ⁽³⁾ (%)
Mean value	610	280	48

(1) Ultimate Tensile Strength (UTS) (2) Yield Strength (YS) (3) Elongation (A)

At high temperature



Typical values

Creep properties (MPa)

(typical values)

Mean stresses (MPa) for different rupture lives as a function of temperature

Temperature (°C)	100 h	10 000 h	100 000 h
600	270	210	150
650	185	125	80
700	125	75	-

Mean stresses (Mpa) for 1% elongation in different times as a function of temperature

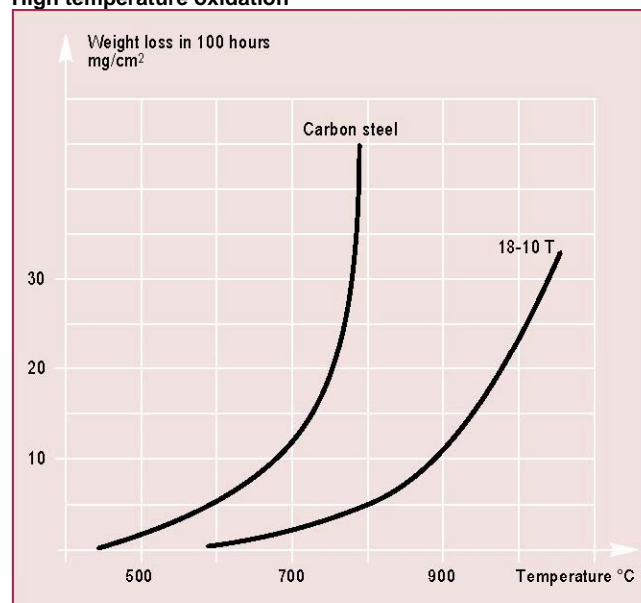
Temperature (°C)	100 h	10 000 h	100 000 h
600	175	140	100
650	140	95	65
700	80	50	-

Corrosion resistance

UGINOX 18-10T has a very good general resistance to wet corrosion and is especially recommended where there is a risk of intergranular corrosion. In particular, it meets the requirements of the standard tests defined by EN ISO 3651-2 (sensitizing treatments T1 and T2). It shows excellent behavior in urban and rural atmospheres and in fresh waters.

The limiting temperature for continuous service in terms of oxidation is 900°C. In practice, the maximum permissible temperature depends on the exact composition of the atmosphere and the mechanical loading conditions.

High temperature oxidation



Forming

In the annealed condition, **UGINOX 18-10T** can be readily cold formed by all standard processes (bending, contour forming, drawing, etc.).

Grade	European designation	AISI	Erichsen deflection* (expansion test)
UGINOX 18-10T	1.4541	321	12 mm

* 0.8 mm thick sheet

Welding

Thin **UGINOX 18-10T** sheets can be joined by spot or seam resistance welding, by TIG welding in argon, or by plasma welding, without filler metal.

For larger thicknesses, the recommended welding conditions are as follows:

Welding process	No filler metal	With filler metal		Shielding gas*	
	Typical thicknesses	Thickness	Filler metal		
			Rod	Wire	
Resistance Spot Seam	≤ 2 mm ≤ 2 mm				*Hydrogen and nitrogen forbidden in all cases
TIG	< 1.5 mm	> 0.5 mm	ER 347 (Si) ER 308 L (Si)	ER 347 (Si) ER 308 L (Si)	Argon Argon + 5% hydrogen Argon + helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 347 (Si) ER 308 L (Si)	Argon Argon + 5% hydrogen Argon + helium
MIG		> 0.8 mm		ER 347 (Si) ER 308 L (Si)	Argon + 2% CO ₂ Argon + 2% O ₂ Argon + 2% CO ₂ + 1% H ₂ Argon + helium
S.A.W		> 2 mm		ER 347 ER 308 L	
Electrode		Repairs		ER 347 ER 308 L	
Laser	< 5 mm				helium In certain conditions: argon

No heat treatment is necessary after welding.

The welds must be mechanically or chemically descaled, then passivated.

For applications at temperatures above 500°C, the filler metal must be chosen to ensure that the ferrite content of the weld does not exceed 8%.

Heat treatment and finishing

Annealing

Water quench or air cool from 1050°C ±25°C.

Polishing – brushing – buffing - satin finishing

Due to the presence of titanium, it is not possible to obtain a mirror finish.

Pickling

Nitric-hydrofluoric acid mixture (10% HNO₃ + 2% HF), at RT or 60°C.

Sulphuric-nitric acid mixture (10% H₂SO₄ + 0,5% HNO₃) at 60°C.

Descaling pastes for weld zones.

Passivation

20-25 % HNO₃ solution at 20°C.

Passivating pastes for weld zones.

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