UGINOX
R25-20

Heat resisting austenitic stainless steel

European designation (1)
X8CrNi25-21
1.4845

American designation (2)
AISI 310S

(1) According to NF EN 10095
(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.

Chemical composition
Mean values

Elements	C	Si	Mn	Cr	Ni
%	0.05	0.50	1.30	25.80	19.20

General characteristics

The principal features of **UGINOX R25-20** are:
- excellent resistance to oxidation and corrosion at temperatures up to about 1050 °C
- good mechanical strength up to 1000 °C
- good weldability and formability

For use in sulfur-containing reducing atmospheres, the UGINOX R25-20 grade should be preferred.

Typical applications

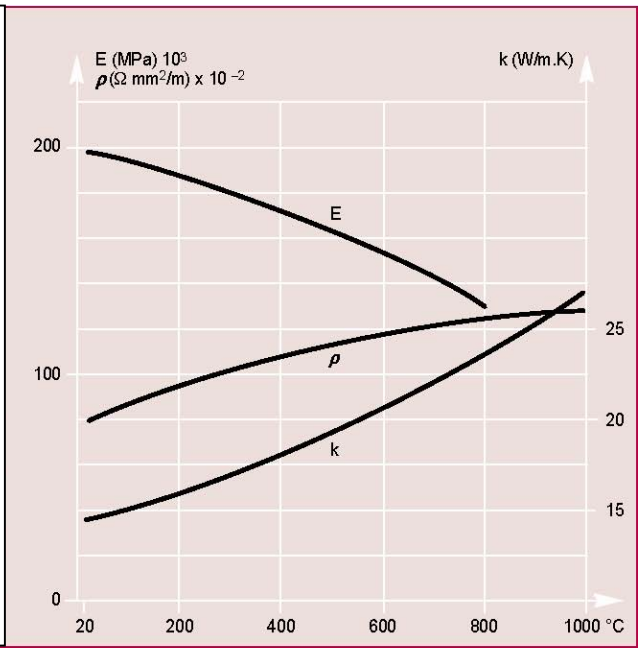
- Industrial furnace and boiler components
- Annealing bells
- Heat exchangers
- Salt bath heat treatment systems

Product range

Forms: sheets, blanks, coils, strips, circles
Thicknesses: 0.60 à 13 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 500 °C	15 19
Mean coefficient of Thermal expansion	α	10^{-6}/K	20 - 200 °C 20 - 400 °C 20 - 600 °C 20 - 800 °C 20 - 1000 °C	15.5 17.0 17.5 18.5 19.0
Electric resistivity	ρ	Ω.mm²/m	20 °C	0.85
Magnetic permeability	μ	at 0.8 kA/m DC or AC	20 °C	1.05
Young's modulus	E	MPa.10^3	20 °C	195



Tensile properties

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

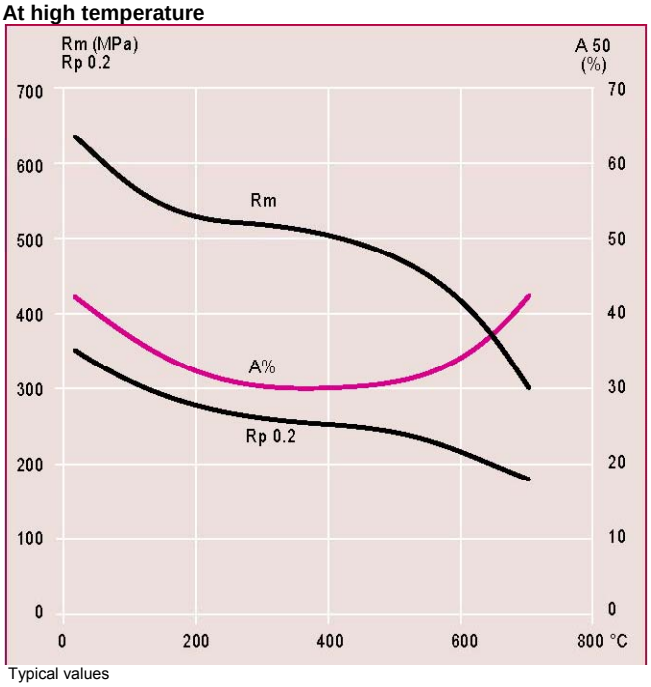
Specimen
Lo = 80 mm (thickness < 3 mm)
Lo = 5.65 √ So (thickness ≥ 3 mm)

1 MPa = 1 N/mm²

	R_m (1) (MPa)	$Rp_{0,2}$ (2) (MPa)	A (3) (%)
Cold rolled	590	310	42

Mean values
(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)	1 000 h	10 000 h	100 000 h
600	170	130	80
700	80	40	18
800	35	18	7
900	15	8.5	3
1000	9	4.5	2

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

Temperature (°C)	1 000 h	10 000 h	100 000 h
600	100	90	70
700	45	30	25
800	18	10	8
900	10	4	3
1000	5.5	3	1.5

Note: Prolonged holding between 650 and 850°C decreases the low temperature ductibility of UGINOX R25-20.

High temperature oxidation and corrosion resistance

In general, depending on the type of atmosphere, the maximum temperatures for the use of **UGINOX R25-20** in continuous service are as follows:

Atmosphere	
Oxidizing	1 100°C
Oxidizing, sulfur-containing	1 000°C
Reducing, carburizing	1 000°C
Reducing, sulfidizing	750°C

When the atmosphere is not continuously oxidizing, the limiting service temperatures are lower than those indicated above, and depend on the frequency of the cycles. In no circumstances must temperatures then exceed 950°C.
UGINOX R25-20 resists temperature cycling better than UGINOX R24-13S and can withstand relatively severe thermal shocks.
UGINOX R25-20 behaves well in carburizing atmospheres (better than the R24-13 S grade). It is also used in contact with molten salt baths, even in certain cases where the salt is contamined with fuel ash.

Note:
These indications are general in nature and usually refer to the behavior in impurity-free media. They must therefore be used only as rough guidelines for material selection purposes.

Welding

Welding process	No filler metal	With filler metal			Shielding gas
	Typical thicknesses	Thickness	Filler metal		
			Rod	Wire	
Resistance Sport Seam	 ≤ 2 mm ≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 310 ER Ni Cr 3 (1)	ER 310 (Si) ER Ni Cr 3 (1)	Argon Argon + 5% H_2 Argon + Helium
PLASMA	< 1,5 mm	> 0.5 mm		ER 310 (Si) ER Ni Cr 3 (1)	Argon Argon + 5% H_2 Argon + Helium
MIG		> 0.8 mm		ER 310 (Si) ER Ni Cr 3 (1)	Argon + 2% CO_2 Argon + 2% O_2 Argon + 3% CO_2 + 1%H_2 Argon + 2% CO_2 + Helium
S.A.W		> 2 mm		ER 310 ER Ni Cr 3 (1)	
Electrode		Repairs	E 310 E Nl Cr Fe 2 (1)		
Laser	< 5 mm				Helium Possibly argon or nitrogen

(1) For service temperatures (not commended) between 550 and 900°C

In general, **UGINOX R 25-20** is slightly more difficult to weld than UGINOX 18-8 type austenitic grades. It is recommended to reduce the welding power, and where necessary to increase the number of passes, limiting the interpass temperature to a maximum of 150°C.

It can be useful to preheat the parts to be joined for large thicknesses or complex assemblies. No post-weld heat treatment is required.

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

Forming

UGINOX R25-20 can be drawn and can be readily cold and hot formed

Heat treatment and finishing operations

Annealing
Water quench or air cool from 1075°C ± 25°C.

Polishing – brushing – buffing – satin finishing
No particular difficulty.

Pickling
Nitric-hydrofluoric acid mixture
(10% HNO_3 + 2% HF) at RT or 60°C.
Sulphuric-nitric acid mixture
(10% H_2SO_4 + 0,5% HNO_3) at 60°C.
Descaling pastes for weld zones.

Note:
For high temperature applications, pickling is generally of no utility.

Passivation
20- 25 % HNO_3 solution at 20 °C.
Passivating pastes for weld zones.

Head office:
UGINE & ALZ
5 rue Luigi CHERUBINI
F - 93210 LA PLAINE SAINT-DENIS CEDEX
www.ugine-alz.com

Sales information:
Tel: (33) 1 71 92 00 00
Technical information:
Tel: (33) 1 71 92 06 52
Fax: (33) 1 71 92 07 97