

UGINOX

R20-12

Heat resisting austenitic stainless steel

European designation ⁽¹⁾
X15CrNiSi20-12
1.4828

(1) Selon NF EN 10095

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
%	0.04	1.60	1.30	19.3	11.40

General characteristics

The principal features of **UGINOX R20-12** are:

- maximum temperature in service in the air of 1000°C: this grade has a particularly good resistance to carburizing
- good weldability and formability
- excellent resistance to corrosion and oxidation.

For use in sulfiding atmospheres at temperatures exceeding 850°C, the UGINOX R24-13S grade should be preferred.

Typical applications

- Industrial furnace and boiler components
- Tubes and expansion bellows
- Electrical heating elements
- Aeronautical engineering
- Automotive exhaust systems

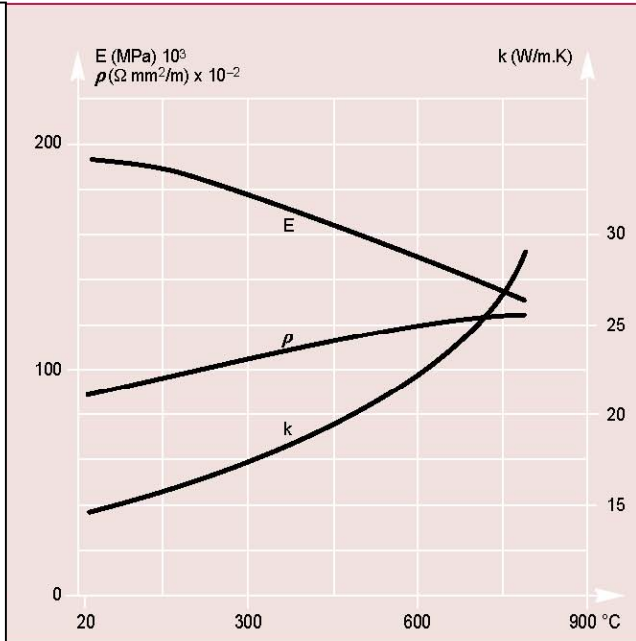
Product range

Forms: sheets, blanks, coils, strips, circles
Thicknesses: 0.40 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		1380
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C 500 °C	15 21
Mean coefficient of Thermal expansion	α	$10^{-6}/K$	20 - 200 °C 20 - 400 °C 20 - 600 °C 20 - 800 °C 20 - 1000 °C	16.5 17.5 18.0 18.5 19.5
Electric resistivity	ρ	$\Omega \cdot \text{mm}^2/\text{m}$	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

Poisson's ratio: 0.28



Tensile properties

Annealed condition

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

Specimen

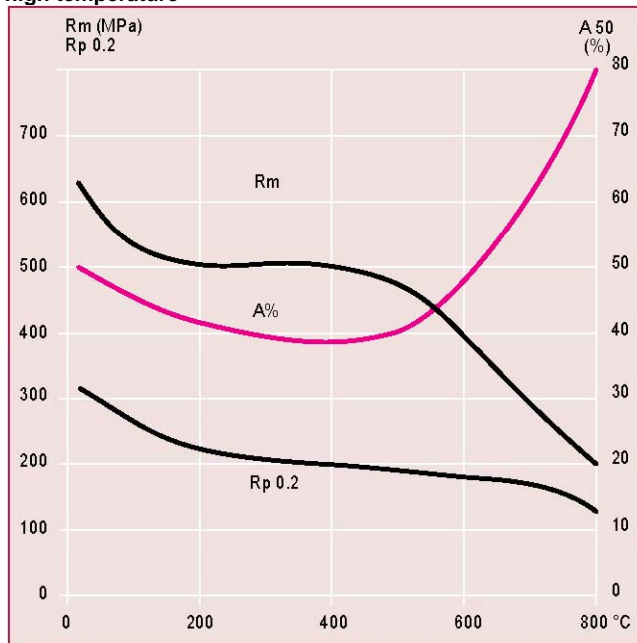
Lo = 80 mm (thickness < 3 mm)
Lo = 5,65 \sqrt{So} (thickness \geq 3 mm)

1 MPa = 1 N/mm²

	R _m ⁽¹⁾ (MPa)	R _{p0.2} ⁽²⁾ (MPa)	A ⁽³⁾ (%)*
Cold rolled	610	290	50

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	190	120	65
700	75	36	16
800	35	18	7,5
900	15	8,5	3

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

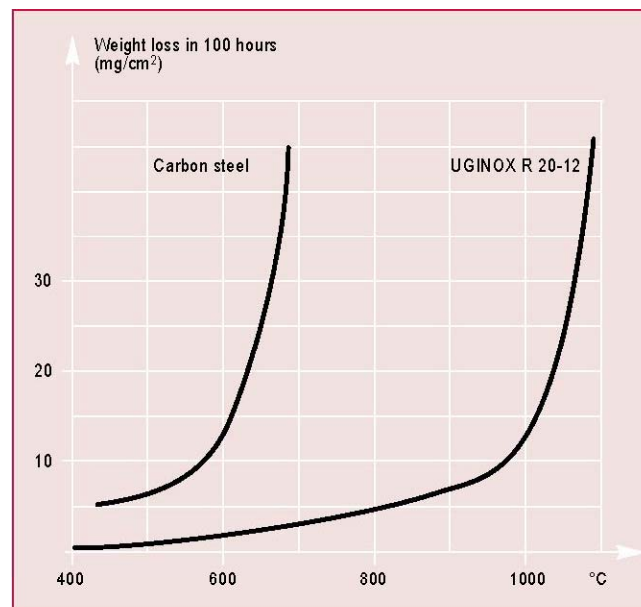
Temperature (°C)	1 000 h	10 000 h	100 000 h
600	120	80	50
700	50	25	17
800	20	10	4
900	8	4	1

Prolonged holding between 650 and 850°C decrease the low temperature ductility, which can be regenerated by annealing at 1000°C.

Corrosion resistance

UGINOX F20-12 has a very good general resistance to wet corrosion and excellent hot corrosion resistance. The maximum temperature for continuous service with respect to oxidation is 1000°C. In practice, the maximum operating temperature is determined by the exact composition of the atmosphere, together with the mechanical loading conditions. For use in sulfiding or carburizing atmospheres at temperatures exceeding 850°C, the **UGINOX R24-13S** grade should be preferred.

High temperature oxidation



Welding

Welding process	No filler metal	With filler metal		Shielding gas	
	Typical thicknesses	Epaisseurs	Filler metal		
			Rod	Wire	
Resistance spot seam	≤ 2 mm ≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 309 L (Si) ER 308 L (Si) ⁽¹⁾ W.N° 1.4370 ⁽¹⁾ ER Ni Cr 3 ⁽¹⁾	ER 309 L (Si) ER 308 L (Si) ⁽¹⁾ W.N° 1.4370 ⁽¹⁾ ER Ni Cr 3 ⁽¹⁾	Argon Argon + 5% H ₂ Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 309 L (Si) ER 308 L (Si) ⁽¹⁾ W.N° 1.4370 ⁽¹⁾ ER Ni Cr 3 ⁽¹⁾	Argon Argon + 5% H ₂ Argon + Helium
MIG		> 0.8 mm		ER 309 L (Si) ER 308 L (Si) ⁽¹⁾ W.N° 1.4370 ⁽¹⁾ 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 309 L ER 308 L W.N° 1.4370 ⁽¹⁾ ER Ni Cr 3 ⁽¹⁾	
Electrode		Repairs	E 309 L E 316 L		
Laser	< 5 mm				Helium Possibly argon and nitrogen

(1) For service temperature between 550 and 900°C

No heat treatment is necessary after welding.
The welds must be mechanically or chemically descaled, then passivated.

Forming

In the annealed condition, **UGINOX R20-12** can be readily formed by all standard processes (bending, contour forming, drawing, etc)

Heat treatment and finishing

Annealing

Water quench or air cool from 1075°C ±25°C.
Parts must be degreased before any heat treatment operation

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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