

# UGINOX

## 18-9E 18-9D

## 18-9DDQ

### Austenitic stainless steels

European designation <sup>(1)</sup>
X5CrNi18-10
1.4301
American designation <sup>(2)</sup>
AISI 304

(1) According to NF EN 10095

(2) According to ASTM A 240

<b>18-9E</b>	Basic grade
<b>18-9D</b>	Deep drawing grade
<b>18-9DDQ</b>	Severe deep drawing grade

These grades are 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  
(weight %)

Elements	C	Si	Mn	Cr	Ni
UGINOX 18-9E	0.05	0.50	1.10	18.20	8.30
UGINOX 18-9D	0.04	0.50	1.10	18.20	8.60
UGINOX 18-9DDQ	0.04	0.50	1.50	18.30	9.20

#### General characteristics

The principal features of the **UGINOX 18-9** stainless steels are:

- good general resistance to corrosion
- good ductility
- excellent weldability
- good polishability
- very good drawability for the **UGINOX 18-9D** and **UGINOX 18-9DDQ** grades.

#### Typical applications

- Domestic appliances
- Sinks units
- Metallic frames for the building industry
- Platters and cutlery
- Domestic cooking and collective catering equipment
- Dairy equipment, welded structures
- Tubes

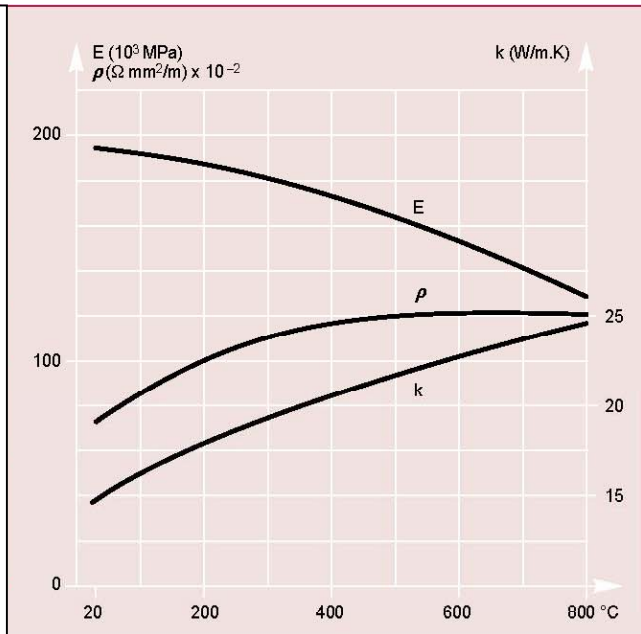
#### Product range

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

## Physical properties (cold rolled sheet - annealed)

Density	d	–	20 °C	7.90
Melting temperature		°C		1450
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	15
Mean coefficient of Thermal expansion	$\alpha$	$10^{-6}/K$	20 - 100 °C 20 - 200 °C 20 - 300 °C 20 - 400 °C 20 - 500 °C	16.0 16.5 17.0 17.5 18.0
Electric resistivity	$\rho$	$\Omega \cdot \text{mm}^2/\text{m}$	20 °C	0.73
Magnetic permeability	$\mu$	at 0.8 kA/m DC or AC	20 °C	1.02
Young's modulus	E	$\text{Mpa} \cdot 10^3$	20 °C	200

Poisson's ratio: 0.30



## 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)

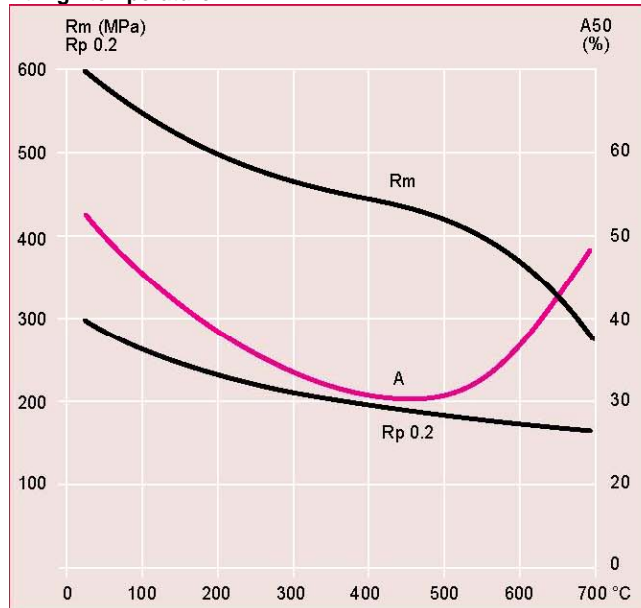
1 MPa = 1 N/mm²

Condition		R <sub>m</sub> <sup>(1)</sup> (MPa)	Rp <sub>0.2</sub> <sup>(2)</sup> (MPa)	A <sup>(3)</sup> (%)
Annealed	UGINOX 18-9E	670	320	50
	UGINOX 18-9D	630	300	54
	UGINOX 18-9DDQ	610	270	55

Mean values

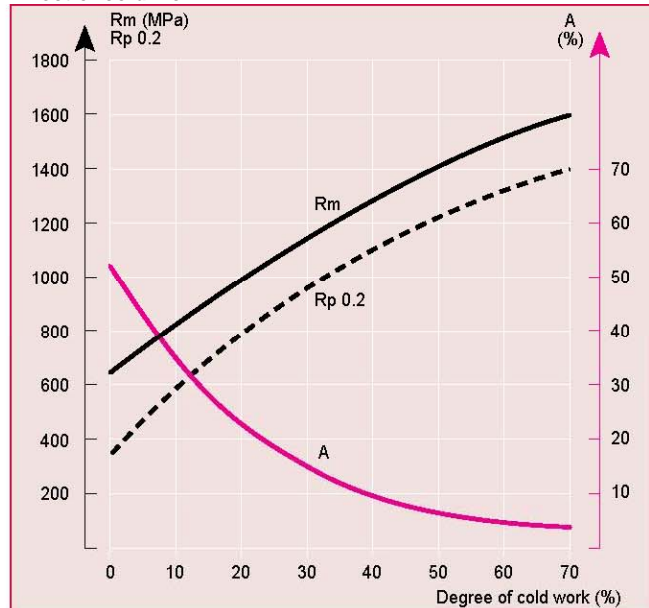
(1) Ultimate Tensile Strength (UTS) (2) Yield Strength (YS) (3) Elongation (A)

### At high temperature



Typical values

### Effect of cold work



## Creep properties (MPa)

(typical values)

Mean stresses (MPa) for different rupture lives as a function of temperature for **UGINOX 18-9**.

Temperature (°C)	100 h	10 000 h	100 000 h
550	240	185	135
500	185	130	90
650	125	85	55

## Corrosion resistance

The **UGINOX 18-9** steels have good resistance to the common corrosive media, but are not recommended where there is a risk of intergranular corrosion. They are well adapted for exposure in fresh water and urban and rural atmospheres.

In all cases, regular cleaning of exposed external surfaces is necessary to conserve their original appearance.

The UGINOX 18-9 grades have good resistance to various acids:

- phosphoric acid in all concentrations at ambient temperature
- nitric acid up to 65% (40° Baumé), between 20 and 50°C
- formic and lactic acids at room temperature
- acetic acid between 20 and 50°C.

They are recommended for use in contact with cold or hot foodstuffs, such as wine, beer, milk (curdled or otherwise), natural fruit juices, syrups, molasses, etc..

## Welding

Welding process	No filler metal	With filler metal		Shielding gas*	
	Typical thicknesses	Thickness	Filler metal		*Hydrogen and nitrogen forbidden in all cases
			Rod	Wire	
Resistance Spot Seam	≤ 2 mm ≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	Argon
PLASMA	< 1.5 mm	> 0.5 mm		W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	Argon
MIG		> 0.8 mm		W.N° 1.4370 ER 309 L Si ER 316 L Si	Argon + 2% CO <sub>2</sub> Argon + 2% O <sub>2</sub>
S.A.W		> 2 mm		ER 309 L ER 316 L	
Electrode		Repairs	E 309 L E 316 L		
Laser	< 5 mm				Helium

No heat treatment is normally necessary after welding.

However, where there is a risk of intergranular corrosion, annealing should be performed at 1050-1100°C. An UGINOX 18-9L low carbon grade or an UGINOX 18-10T stabilized grade is to be preferred in this case.

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

## Forming

The **UGINOX 18-9E** and **UGINOX18-9D** grades can be readily cold formed by all standard processes (bending, contour forming, drawing, flow turning etc.). The **UGINOX 18-9DDQ** grade is to be preferred for severe forming operations.

Some forming operations, such as bending, drawing and flow turning, are more readily performed hot. Subsequent pickling is then necessary.

### Erichsen test (expansion)

Grade	European designation	AISI	Erichsen deflection* (mm)
UGINOX 18-9E	1.4301	304	11.5
UGINOX 18-9D	1.4301	304	11.8
UGINOX 18-9DDQ	1.4301	304	12

\* 0.8 mm thick sheet

### Swift test (drawing)

Grade	European designation	AISI	LDR* (mm)
UGINOX 18-9E	1.4301	304	1.95-2.00
UGINOX 18-9D	1.4301	304	1.95-2.00
UGINOX 18-9DDQ	1.4301	304	2.00-2.05

\* Limiting Drawing Ratio - 0.8 mm thick sheet

### Bending

Good 180° bendability, with very small bending radii for thicknesses less than 0.8 mm, whereas a radius not less than half the thickness is recommended for thicker sheets.

### Flow turning

The **UGINOX 18-9DDQ** grade is best suited for this application.

## Heat treatment and finishing

### Annealing

Annealing for a few minutes at 1075°C ± 25°C, followed by air cooling, to regenerate the microstructure by recrystallization and solutioning of carbides and to relieve internal stresses, should be carried out after cold forming operations and after welding (risk of intergranular corrosion in the weld).

After annealing, pickling and passivation treatments are necessary.

### Pickling

Nitric-hydrofluoric acid mixture (10% HNO<sub>3</sub> + 2% HF), at RT or 60°C.  
Sulphuric-nitric acid mixture (10% H<sub>2</sub>SO<sub>4</sub> + 0,5% HNO<sub>3</sub>) at 60°C.  
Descaling pastes for weld zones.

### Passivation

20-25 % HNO<sub>3</sub> solution (36° Baumé) at 20°C  
Passivating pastes for weld zones.

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