UGINOX

17-7C

17-7E

Austenitic stainless steels with low chrome and nickel contents for cold work hardening

European designation[1]
X10CrNi18-8
1.4310

American designation[2]
AISI 301

(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.
- 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

Elements (%)	C	Si	Mn	Cr	Ni	Mo
UGINOX 17-7C	< 0.1	0.60	1.20	17.0	7.5	-
UGINOX 17-7E	< 0.12	1.20	1.20	17.0	6.5	0.7

General characteristics

UGINOX 17-7C and UGINOX 17-7E are austenitic stainless steels capable of attaining elevated mechanical properties by cold work hardening (effect of lower Cr and Ni contents and higher C content than UGINOX 18-9-E - 1.4301).
These 2 grades can also be supplied directly in the strain-hardened condition in accordance with 7 classes of mechanical properties (according to thickness).
UGINOX 17-7C and UGINOX 17-7E exhibit good resistance to atmospheric, urban and freshwater corrosion, but should not be used for long periods in the 400-800°C temperature range (intergranular corrosion following precipitation of chromium carbides).

Typical applications

- Sink drainers
- Catering equipment
- Conveyor belts
- Mechanical components, springs (for T<300°C)
- Railway rolling stock
- Lorry structures
- Hubcaps
- Medical and safety equipment

Product range

Annealed condition (2B/2D) :

UGINOX 17-7C
0.4 ≤ thickness < 2 mm - Width 11 to 1250 mm
2 ≤ thickness ≤ 4 mm - Width 40 to 1250 mm

UGINOX 17-7E
0.4 ≤ thickness < 0,8 mm - Width 100 to 1250 mm
0.8 ≤ thickness ≤ 4 mm - Width 100 to 1500 mm

Tempered condition: consult us.

Physical properties

(cold rolled sheet - annealed)

Density	d	–	20 °C	7.90
Melting temperature		°C		1410
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	16
Mean coefficient of thermal expansion	α	10^{-6}/K	20 - 100 °C 20 - 200 °C	16.6 17.0
Electric resistivity	ρ	Ω.mm^2/m	20 °C	0.73
Magnetic permeability*	μ	at 0.8 kA/m DC or top AC	20 °C	1.02
Young's modulus**	E	Mpa.10^3	20 °C	195

* Magnetic permeability increases significantly with cold forming and the degree of work hardening.
** Young's modulus reduces with cold forming and the degree of work hardening.

Tensile properties

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

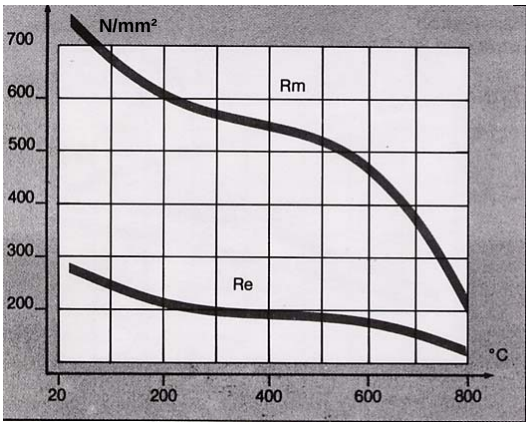
Specimen
Lo = 80 mm (thickness < 3 mm)
Lo = 5,65 √ So (thickness ≥ 3 mm)

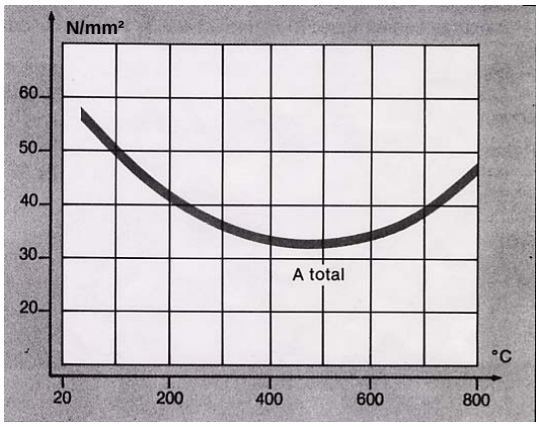
1 MPa = 1 N/mm^2

	R_m (1) (MPa)	$Rp_{0,2}$ (2) (MPa)	A (3) (%)
UGINOX 17-7C / 17-7E	600-950	250	40

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

At high temperature





Mechanical properties as a function of degree of work hardening at ambient temperature

UGINOX 17-7C	R_m * (MPa)	$Rp_{0,2}$ * (MPa)	A* (%)
20%	900	780	26
40%	1250	1100	8
60%	1750	1450	2
80%	1800	1700	0

* Typical values

UGINOX 17-7E	R_m * (MPa)	$Rp_{0,2}$ * (MPa)	A* (%)
20%	1160	900	30
40%	1460	1300	12
60%	1800	1680	4
80%	2100	2000	1

* Typical values

Mechanical properties in the cold-work-hardened condition

Strain- hardening class	UGINOX 17-7C			UGINOX 17-7E		
	R_m * (MPa)	$Rp_{0,2}$ * (MPa)	A* (%)	R_m * (MPa)	$Rp_{0,2}$ * (MPa)	A* (%)
C850	850 1000	520 780	43 30	850 1000	360 640	50 38
C1000	1000 1150	780 1020	30 18	1000 1150	640 900	38 26
C1150	1150 1300	1020 1180	18 11	1150 1300	900 1120	26 18
C1300	1300 1500	1180 1400	11 5	1300 1500	1120 1360	18 10
C1500	1500 1700	1400 1600	5 2	1500 1700	1360 1580	10 5
C1700				1700 1900	1580 1800	5 2
C1900				≥ 1900	≥ 1800	< 2

* Typical values

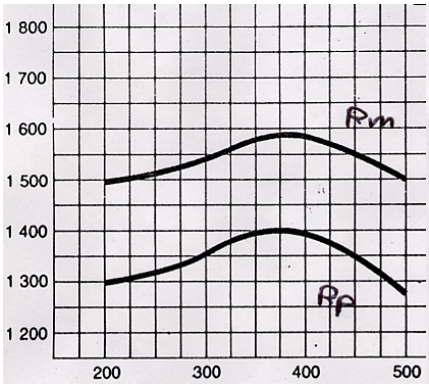
NB: The elevated mechanical properties of UGINOX 17-7C and UGINOX 17-7E obtained by cold work hardening impart these 2 grades with excellent fatigue resistance.

Secondary hardening capability

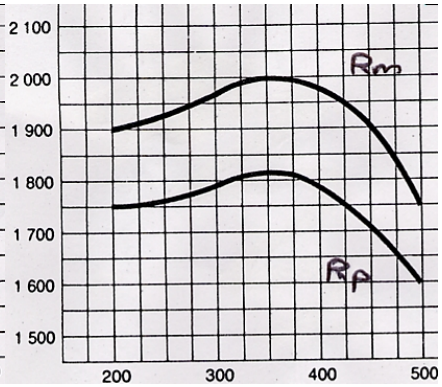
In addition to their high cold-work-hardenability, UGINOX 17-7C and especially UGINOX 17-7E exhibit a “bake-hardening” or secondary hardening effect that can be obtained by post-forming heat treatment of components. This hardening effect is directly related to the degree of prior cold forming.

UGINOX 17-7C :
Typical graphs after treatment for 3 hours

UGINOX 17-7C : C1500

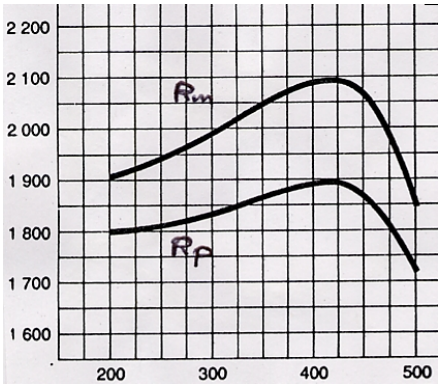


UGINOX 17-7C : C1900



UGINOX 17-7E :
Typical graphs after treatment for 4 hours

UGINOX 17-7E : C1900

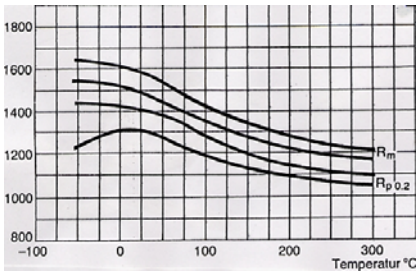


Influence of temperature on strain-hardened conditions

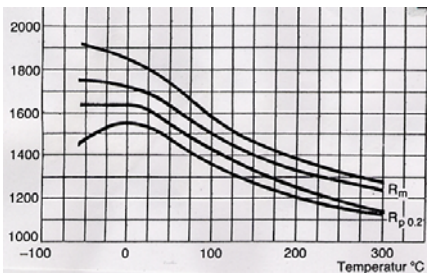
When UGINOX 17-7C and UGINOX 17-7E are exposed to temperatures below 0°C, a slight increase in Rm and Rp0.2 is observed, accompanied by a reduction in A%. Conversely, exposure to high temperatures brings about a rapid reduction in Rm and Rp0.2 accompanied by an appreciable increase in A% (cf. typical graphs below for UGINOX 17-7C)

N.B.: It should also be noted that these 2 grades are highly susceptible to intergranular corrosion caused by the precipitation of chromium carbides when they are exposed to temperatures in the range 400-800°C.

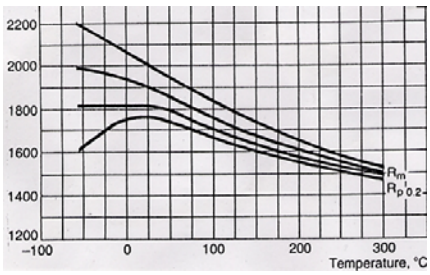
C1500



C1700



C1900



Corrosion resistance

UGINOX 17-7C and **UGINOX 17-7E** are slightly less resistant than UGINOX 18-9-D (1.4301) and are prone to intergranular corrosion.
They are well suited to fresh water, urban atmospheres and foodstuffs.

Forming

In the strain-hardened condition, **UGINOX 17-7C** and **UGINOX 17-7E** stainless steels respond well to common cold forming operations (bending, profiling, curving, drawing, metal spinning…). They are also well-suited to ironing but their drawability is less than that of UGINOX 18-9D and 18-9E.
Cold work-hardening absorbs considerable power on the forming tools.
When designing components, it is necessary to take account of springback, which increases as higher classes of strain hardening are employed.

Welding

UGINOX 17-7C and **UGINOX 17-7E** are weldable in thin gauges by resistance spot or seam welding.
For other processes, refer to us, particularly in the case of heavy gauges and/or strain-hardened condition because welding operations can significantly reduce mechanical properties in the heat affected zones and lead to risks of intergranular corrosion.

Welding process	No filler metal	With filler metal			Shielding gas*
	Typical thicknesses	Thickness	Filler metal		
			Rod	Wire	
Resistance Spot Seam	 ≤ 2 mm ≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 308 L (Si) ER 308	ER 308 L (Si) ER 308	Argon Argon + 5% hydrogen Argon + helium Argon + 5% nitrogen
PLASMA	< 1.5 mm	> 0.5 mm		ER 308 L (Si) ER 308	Argon Argon + 5% hydrogen Argon + helium Argon + 5% nitrogen
MIG		> 0.8 mm		ER 308 L (Si) ER 308	Argon + 2% CO_2 Argon + 2% O_2 Argon + 3% CO_2 + 1% H_2 Argon + 2% CO_2 + 5% nitrogen
S.A.W		> 2 mm		ER 308 L ER 308	
Electrode		Repairs	E 308		
Laser	< 5 mm				Helium Helium + nitrogen

No heat treatment is necessary after welding.
In order to fully restore the corrosion resistance of the metal, the welds must be mechanically or chemically pickled, then passivated. However, depending on the application, this operation may not be essential.

Heat treatment and finishing

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

Polishing - brushing - buffing - satin finishing
No particular difficulty.
Good lustre (low roughness) in strain-hardened condition

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.

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