



## UR™ S1

## UR™ S1: A 4% Si, austenitic stainless steel resistant to nitric acid solutions

Research carried out in about the last 20 years in Industeel Research Center shows that a strong addition of silicon to austenitic stainless steels of the 18/10 type has a favourable influence on resistance to transpassive intergranular corrosion. This type of corrosion develops particularly in very concentrated nitric environments (> 90%) up to boiling point, also in strongly oxidizing nitric environments (oxidizing ions present such as: hexavalent chromium, pentavalent vanadium - ferritic salts etc...). Our UR™ S1 steel grade puts in a concrete form the results of our research in this domain.

## PROPERTIES

## STANDARDS

> EURONORM: EN 1.4361 X1 Cr Ni Si 18 - 15 - 4

> ASTM: UNS S30600

## CHEMICAL ANALYSIS - WEIGHT %

Typical values

C	Cr	Ni	Mo	N	Others
≤ .015	17	14.5		-	Si = 4

PREN [Cr%] + 3.3 [Mo%] + 16 [N%] ≥ 17

## PHYSICAL PROPERTIES

Density: 7.7 kg/dm<sup>3</sup>

Interval temperature (°C)	Thermal expansion ( $\alpha \times 10^{-6} K^{-1}$ )	T °C (°F)	Resistivity ( $\mu\Omega \cdot cm$ )	Thermal conductivity ( $W \cdot m^{-1} \cdot K^{-1}$ )	Specific heat ( $J \cdot kg^{-1} \cdot K^{-1}$ )	Young modulus E (GPa)	Shear modulus G (GPa)
20 - 100	16.5	20 (68)	75	15.1	500	200	77
20 - 300	18	200 (392)	-	-	520	186	71
20 - 500	19	400 (752)			540	172	65

## MECHANICAL PROPERTIES

Tensile properties

°C	°F	Y.S. 0.2%		Y.S. 1%		UTS		Elongation %
		MPa	ksi	MPa	ksi	MPa	ksi	
20	68	240	35	260	38	540	78	45
100	212	185	27	210	31	490	71	45
200	392	140	21	175	25	450	65	45
300	572	125	18	155	22	420	61	40
400	752	115	17	150	22	400	58	40

Minimum guaranteed values.

**CORROSION PERFORMANCES**

**Pickling**

This can be carried out using the following process: nitrohydrofluoric bath HNO<sub>3</sub> 15% (volume) HF (3%) volume water immersion for a few hours at 20°C - 30 mins at 60° C careful rinsing in water.

**Decontamination - Passivation**

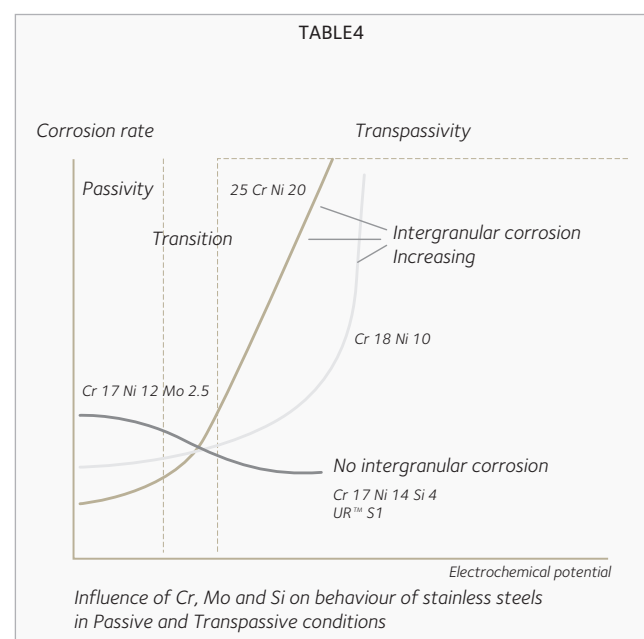
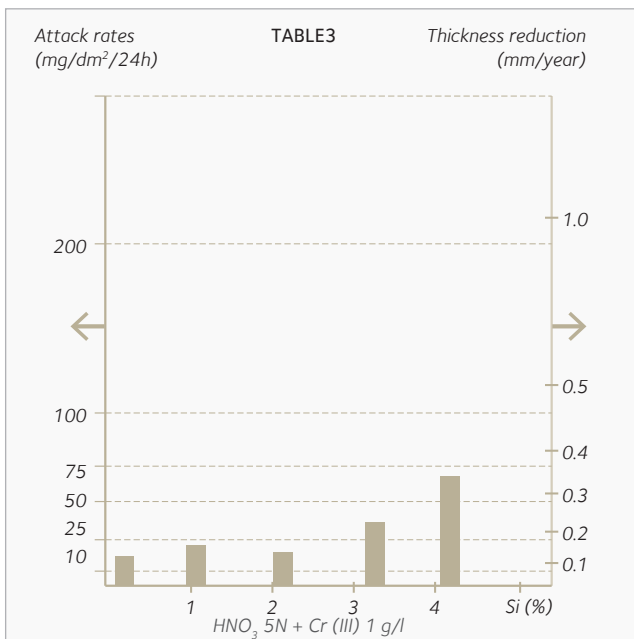
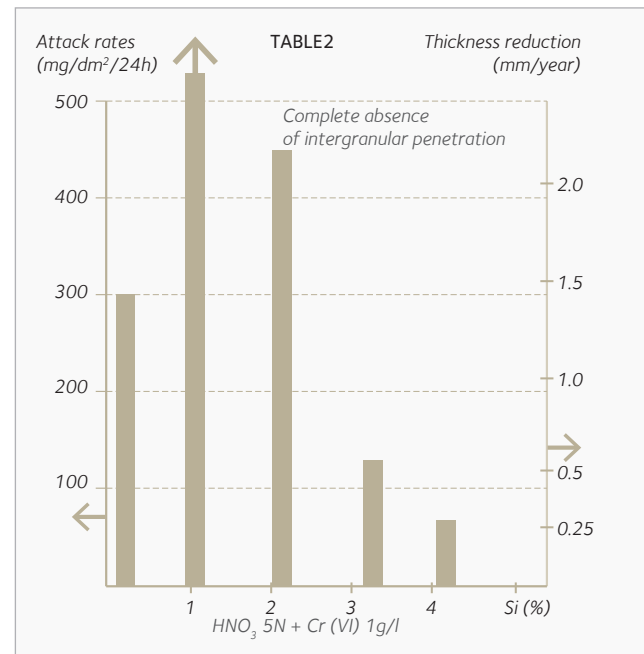
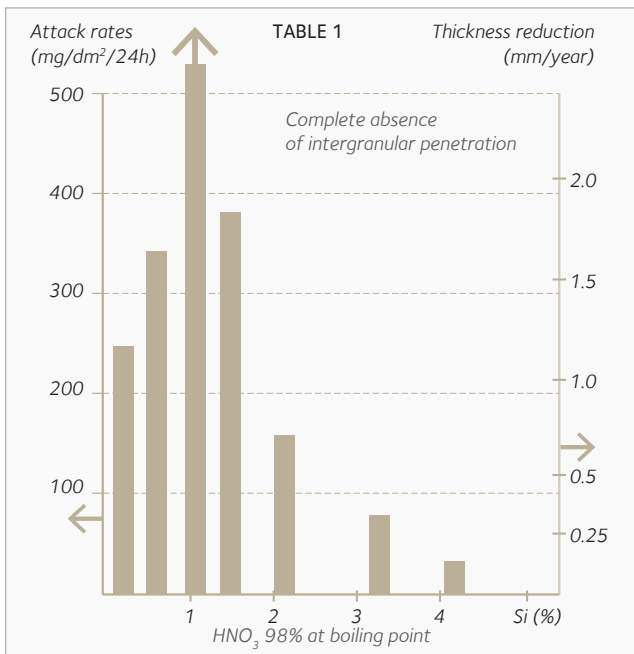
Nitric bath HNO<sub>3</sub> 25% in volume for 30 mins at 20° C (or 10 min. at 50°C) washing in water.

**Resistance to corrosion**

UR™ S1 has a chemical composition adapted to work in the transpassive zone. It resists perfectly to intergranular corrosion.

Acid nitric	General corrosion rate
98% at room temperature	Practically non existent
98% boiling	≤ 0.20 mm/year (Table 1)
28% boiling + 1 g/l of hexavalent chrome	≤ 0.30 mm/year (Table 2)
28% boiling + 1 g/l of trivalent chrome	< 0.30 mm/year (Table 3) with no trace of intergranular corrosion

The graphs beside (Tables 1 to 3) show the influence of silicon content for a Cr 16% Ni, the content increasing from 0.1 to 4.2%. Table 4 schematizes UR™ S1 behaviour in passive and transpassive conditions compared to some other grades.



## DELIVERY CONDITIONS

### SIZE RANGE

	Hot rolled plates	Clad plates
Thickness	5 to 150 mm 3/16" to 6"	6 to 150 mm 1/4" to 6"
Width	Up to 3300 mm Up to 130"	Up to 3300 mm Up to 130"
Length	Up to 12000 mm Up to 39 ft	Up to 14000 mm Up to 46 ft

*Other sizes are available on request, including 4100 mm (161,4") width plates*

## PLATE PROCESSING

### HOT FORMING

Forming temperature 1150 - 900°C (2100 - 1650°F)  
(removal of grease in oxidising environment necessary)  
in order to avoid all risks of recarburation.

### COLD FORMING

Easy with all current methods: bending, profiling,  
stamping.

### HEAT TREATMENT

Solution annealing at 1100 - 1150°C (2010 - 2100°F)  
- cooling in water (holding time 1 to 2 min. per mm of  
plate thickness oxidising environment).

### CUTTING

All classical mechanical or thermal processes for  
stainless steels.

### WELDING

Welding UR™ S1 requires well qualified welders. It is carried out both TIG and MIG processes (recommended technique) with our welding filler metal Soudinox S1) and under inert gas protection. Arc extinguishers are indispensable to avoid craters. It is also necessary to adapt speed and compatible amperage in order to limit the temperature between passes. Heat treatment after welding is not necessary. For very severe conditions of use, it could be advisable. However, pickling after welding is necessary and then continue immediately with a passivation treatment. For any further information, please contact our technical assistance specialists.



## APPLICATIONS

- > Mineral chemistry  
Production of concentrated  $\text{HNO}_3$
- > Organic chemistry  
Use of concentrated  $\text{HNO}_3$  (nitration)
- > Nuclear industry  
Evaporator working in nitric environment, to concentrate products of fusion
- > Metallurgical industry  
Tanks - equipment destined for nitrogen sulphite mixtures
- > Chemical industry  
Chrome sulphite mixtures, very oxyding solutions
- > Explosive industry
- > Aerspatial industry  
Rocket tanks
- > Galvanotechnology



## YOUR CONTACTS

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*Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research programme on steels. Therefore, we suggest that information be verified at time of enquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company. Further information may be obtained from the address opposite.*