

URANUS® 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 oxydising nitric environments (oxydising 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.

Standards

EURONORM	1.4361 X1 Cr Ni Si 18-15-4
ASTM	UNS S30600

Chemical analysis

Typical values (weight %)

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

$$\text{PREN} [\text{Cr}\%] + 3.3 [\text{Mo}\%] + 16 [\text{N}\%] \geq 17$$

Mechanical properties

Tensile properties

C°	F°	Y.S. 0.2%		Y.S. 1%		UTS		EI%
		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	150	58	40

Minimum guaranteed values

Physical properties

Density : 7700 kg/m³

Interval temperature °C	Thermal expansion $\alpha \times 10^{-6} K^{-1}$	°C	°F	Resistivity $\mu\Omega \text{ cm}$	Thermal conductivity $W.m^{-1}.K^{-1}$	Specific heat $J.kg^{-1}.K^{-1}$	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

Fabrication

■ 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).

■ 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.

■ Cutting

All classical mechanical or thermal processes for stainless steels.

Corrosion performances

■ Pickling

This can be carried out using the following process : nitrohydrofluoric bath HNO₃ 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 HNO₃ 25 % in volume for 30 mins at 20° C (or 10 min. at 50°C) washing in water.

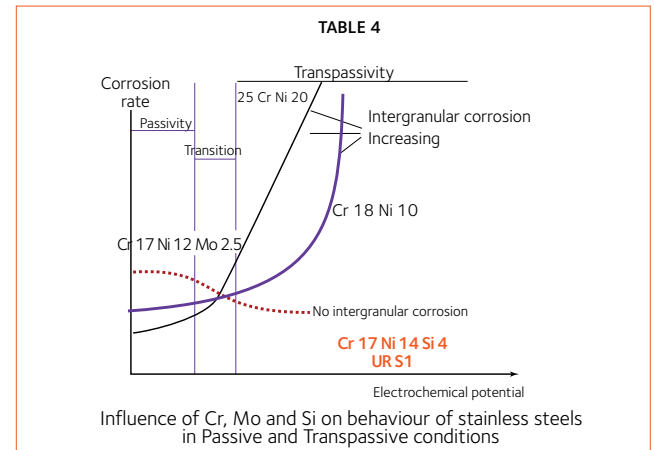
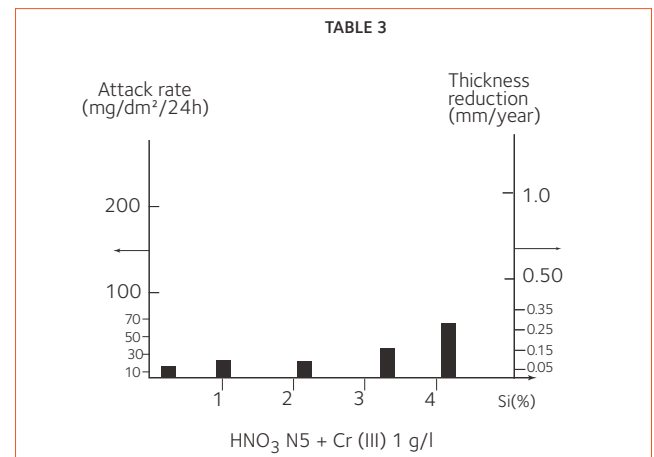
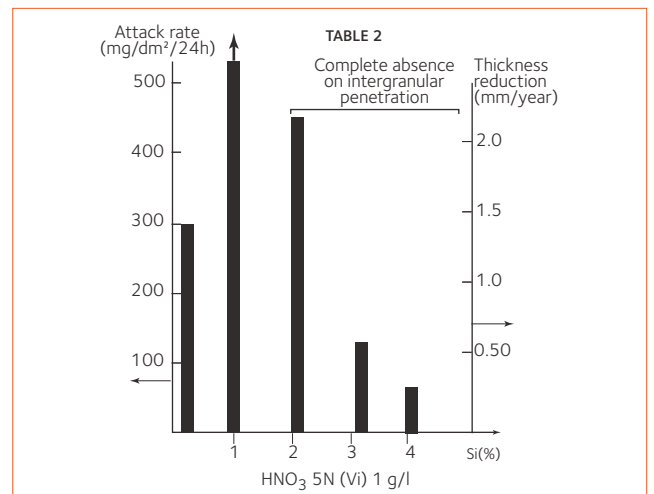
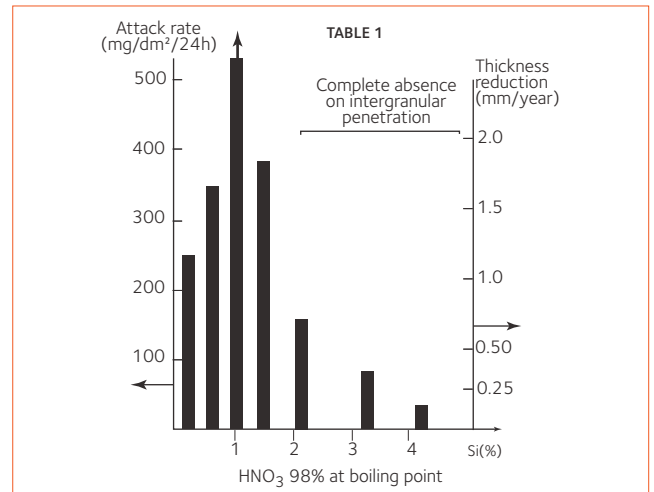
■ Resistance to corrosion

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	Pratically non existent
98% boiling	≤ 0.20mm/year (Table 1)
28% boiling + 1g/l of hexavalent chrome	≤ 0.30mm/year (Table 2)
28% boiling + 1g/l of tri-valent chrome	≤ 0.30mm/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.



Applications

Mineral chemistry

Production of concentrated HNO₃

Organic chemistry

Use of concentrated HNO₃ (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

Aerospatial industry rocket tanks

Galvanotechnology

Size range

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

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

For any information,
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This technical data and information represents our best knowledge at the time of printing. However, it may be subject to some slight variations due to our ongoing research programme on corrosion resistant grades.

We therefore suggest that information be verified at time of enquiry or order.

Furthemore, in service, real conditions are specific for each application. The data presented here is only for the purpose of description and may only be considered as guarantees when our company has given written formal approval.