

UR™ 347

UR™ 347: A Nb stabilized 18Cr – 10Ni austenitic stainless steel

UR™ 347 is an austenitic stainless steel with a stabilizing niobium/columbium addition.

The properties of UR™ 347 are:

- > Good general corrosion resistance
- > Excellent resistance to intergranular corrosion in the as - welded condition
- > Easy to weld and form
- > Good low temperature toughness

This grade is austenitic in the solution annealed condition (1000 – 1100°C / 1832 – 2012°F) and rapid cooling by air or water. It contains a small amount of ferrite and niobium/columbium carbonitrides.

347H also available upon request. A special 1.4550 version for nuclear applications is also available (NUCL™ 347).

PROPERTIES

STANDARDS

> EURONORM: EN 1.4550 X6CrNiNb 18 – 10

> ASTM: A 240 – TP 347 – UNS S34700

CHEMICAL ANALYSIS – WEIGHT %

Typical values

C	Cr	Ni	Mo	N	Nb/Cb
.04	17.5	9.5	-	-	10 x%C up to 1.0

PHYSICAL PROPERTIES

Density: 7900 kg/m³

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	20 (68)	73	15	500	200	77
20 – 200	16.5	100 (212)	77	16	500	194	75
20 – 300	17	200 (392)	84	17.5	520	186	71
20 – 400	17.5	300 (572)	91	19	530	179	68
20 – 500	18	400 (752)	97	20.5	540	172	65
		500 (932)	102	22	540	165	62

PROPERTIES

MECHANICAL PROPERTIES

Tensile properties

°C	°F	YS 0.2%		YS 1%		UTS		Elongation
		MPa	ksi	MPa	ksi	MPa	ksi	%
20	68	200	29	240	35	520	76	40
100	212	175	25	210	31	460	67	40
200	392	155	22	185	27	410	60	35
300	572	135	19	165	24	390	57	35
400	752	125	18	155	23	390	57	30
500	932	120	17	150	22	310	45	30

* As per EN 10088 hot rolled plates. The EN guaranteed values are valid for a thickness from 5 up to 75 mm (0.20" up to 2.95")

Impact values

°C (°F)	- 196 (- 321)	+20 (68)
KCV (J/cm ²) typical	175	225
KCV (J/cm ²) minimum	100	150

Typical creep strength values

Temperature °C (°F)	600 (1112)		650 (1202)		700 (1292)	
Ageing (H)	10 ³	10 ⁴	10 ³	10 ⁴	10 ³	10 ⁴
σR (MPa)	210	165	155	100	110	65



IN SERVICE CONDITIONS

CORROSION RESISTANCE

Standardized corrosion tests (special request may be discussed)

TEST	OTHER NAME	CORROSION	RESULTS
ASTM A262 A	-	Intergranular	Step or dual structure
ASTM A262 B	STREICHER	Intergranular	Not recommended
ASTM A262 C	HUEY	Intergranular	Not recommended
ASTM A262 E DIN 50914 RCCM	STRAUSS	Intergranular	No cracking after bending

DELIVERY CONDITIONS

SIZE RANGE

	Quarto plates	Clad plate
Thickness	5 to 150 mm 3/16" to 6"	6 to 150 mm 1/4" to 6"
Width	Up to 3800 mm* Up to 150"	Up to 3900 mm Up to 154"
Length	Up to 16000 mm Up to 52.5 ft	Up to 16000 mm Up to 52.5 ft

Indicative dimensional programme. * Width related to thickness; please consult for specific request.

HOT FORMING

Hot forming should be carried out in a temperature range of 1150 - 750°C (2102 - 1652°F). Due to the low thermal conductivity, the holding time of temperature may be longer (about 50%) than for C.Mn steels. The quenching must be fast after forming. The cleanliness of the surface is very important (avoid oil contamination). A neutral or slightly oxidizing atmosphere is required.

COLD FORMING

The alloy can be cold formed without problem. The cold hardening behaviour of the steel explains why it may require more powerful equipments than for a structural steel.

PICKLING

A nitric hydrofluoric acid bath (10 - 20% HNO₃ - 1,5 - 5% HF) at 20 - 60°C (68 - 142°F) is used for the pickling treatment. A 10 - 20% H₂SO₄ - 1,5 - 5% HF pickling bath may also be used. Decontamination treatment may be performed with a 10 - 20% weight nitric acid solution. Rinsing is necessary after pickling.

CUTTING

- > **Thermal cutting (plasma, thermal sawing...)**
After cutting, pickling or grinding are necessary to eliminate the oxide formed layer.
- > **Mechanical cutting (shearing, stamping, cold sawing...)**

WELDING

The alloy can be easily welded without hot cracking, using an adequate filler metal (5 to 15% δ ferrite). The alloy is not sensitive to cold cracking. All welding processes can be used, including filler processes.

Filler materials

Electrode	E347 - 15 or E347 - 16 (ASME Sect II - Part C SFA5 - 4)
Wire	ER 347 (ASME Sect II - Part C SFA 5 - 9)

A post - weld heat treatment is not necessary. Preheating and postheating are not necessary. 200°C (392°F) is the maximum interpass temperature. Post - weld pickling and rinsing are necessary to restore the corrosion resistance of the joints.



MACHINING

Due to its cold work hardening, the alloy is less machinable than a 13% Cr martensitic stainless steel.

Operation	Tool	Lubrication	CONDITIONS		
			Depth mm (inch)	Feed mm/t (inch/t)	Speed m/min (feet/min)
Turning	High speed steel	Cutting oil	6 (0.23)	0.5 (0.019)	12 - 16 (39 - 52)
			3 (0.11)	0.4 (0.016)	18 - 23 (59 - 75)
			1 (0.04)	0.2 (0.008)	23 - 28 (75 - 92)
	Carbide	Dry or cutting oil	6 (0.23)	0.5 (0.019)	67 - 76 (220 - 249)
			3 (0.11)	0.4 (0.016)	81 - 90 (266 - 295)
			1 (0.04)	0.2 (0.008)	99 - 108 (325 - 354)
			Depth of cut mm (inch)	Feed	Speed
Cutting	High speed steel	Cutting oil	1.5 (0.06)	0.03 - 0.05 (0.0012 - 0.0020)	16 - 21 (52 - 69)
			3 (0.11)	0.04 - 0.06 (0.0016 - 0.0024)	17 - 22 (56 - 72)
			6 (0.23)	0.05 - 0.07 (0.0020 - 0.0027)	18 - 23 (59 - 75)

PLATE PROCESSING

			Drill Ø mm (inch)	Feed mm/t (inch/t)	Speed m/min (feet/min)
Drilling	High speed steel	Cutting oil	1.5 (0.06)	0.02 - 0.03 (0.0008 - 0.0012)	9 - 13 (29 - 42)
			3 (0.11)	0.05 - 0.06 (0.0020 - 0.0024)	11 - 15 (36 - 49)
			6 (0.23)	0.08 - 0.09 (0.0031 - 0.0035)	11 - 15 (36 - 49)
			12 (0.48)	0.09 - 0.10 (0.0035 - 0.0039)	11 - 15 (36 - 49)
			Feed	Speed	
Milling profiling	High speed steel	Cutting oil		0.05 - 0.10 (0.002 - 0.004)	11 - 21 (36 - 69)

APPLICATIONS

UR™ 347 is corrosion resistant in:

- > Nitric solution, up to 55% weight, up to 80°C (176°F)
- > Most of diluted organic acids at moderate temperatures
- > Most of food and pharmaceutical products
- > Pure phosphoric acid
 - whatever concentration in cold solution
 - up to 10% diluted hot solution
- > Sulphuric or fluoridric acid traces increase the corrosion
- > Caustic solutions free of chlorides or fluorides at medium temperatures

It has only limited corrosion resistance in chloride containing solutions, even diluted, and in sulphuric acid media.

The creep resistant version of the grade (**347H**) is also available on request.

A special grade: **NUCL™ 347** has been developed for nuclear applications.

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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.