

UR™ 304LN – UR™ 304N

UR™ 304LN – UR™ 304N: A nitrogen containing 18Cr – 10Ni – 2Mo austenitic stainless steel

UR™ 304LN – UR™ 304N are nitrogen alloyed austenitic stainless steels. Nitrogen increases the yield strength of austenitic grades without impairing their ductility. The properties of UR™ 304LN – UR™ 304N are:

- > high strength and excellent ductility
- > good resistance to intergranular corrosion in the aswelded condition
- > excellent fabrication properties
- > low temperature toughness

UR™ 304LN – UR™ 304N are austenitic in the solution annealed condition (1000°C – 1100°C/1832°F – 2012°F) and rapid cooling in air or water. They contain a small amount of ferrite. UR™ 304LN – UR™ 304N are more stable than standard 304L grades against martensitic transformations induced by deformation at low temperature. The use of UR™ 304LN – UR™ 304N will usually result in notable weight savings in most structural or pressure retaining applications.

PROPERTIES

STANDARDS

- > EURONORM: UR™ 304LN: 1.4311 X2CrNiN18 – 10
UR™ 304N: 1.4315 X5CrNiN19 – 9
- > ASTM: UR™ 304LN: A 240 – TP 304LN – UNS S30453
UR™ 304N: A 240 – TP 304N – UNS S30451

CHEMICAL ANALYSIS – WEIGHT %

Typical values

C	Cr	Ni	Mo	N	Others
.02	18.5	8.5	–	.15	–

* High carbon content can be available on request

PROPERTIES

PHYSICAL PROPERTIES

Density: 7900 kg/m³

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

MECHANICAL PROPERTIES

Tensile properties after solution annealing heat treatment - Minimum guaranteed values as per EN10088 - 2 hot rolled plates

°C	°F	YS 0.2%		YS 1%		UTS		Elongation
		MPa	Ksi	MPa	Ksi	MPa	Ksi	%
20	68	270	40	310	43	570	83	40
100	212	205	30	240	32	490	71	35
200	392	157	23	187	26	430	63	30
300	572	136	20	167	23	410	60	30
400	752	125	19	156	21	400	58	25
500	932	119	18	149	20	390	57	25

The EN guaranteed values are valid for thicknesses from 5 up to 75 mm. Typical Y.S. values may be 20% higher than minimum values of Standards.

Guaranteed Impact values

°C	- 253	- 196	+20
°F	- 423	- 320	+ 68
KCV (J/cm ²)	62	85	180

Typical creep strength values

Temperature	600°C (1112°F)		650°C (1202°F)	
Time to rupture (H)	10 ³	10 ⁴	10 ³	10 ⁴
σ_R (MPa)	205	160	150	100

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	$\leq 0.6 \text{ mm/year}^*$
ASTM A262 E DIN 50914 RCCM	STRAUSS	Intergranular	No cracking after bending

*non sensitized sample

DELIVERY CONDITIONS

SIZE RANGE

	Quarto plates	Clad plates
Thickness	5 up to 150 mm 3/16" to 6"	Consult Industeel
Width	Up to 3800 mm* Up to 150"	
Length	Up to 16000 mm Up to 52.5 ft	

Indicative dimensional programme * Width related to thickness; please consult for specific request.
Cut to length plates are available from Aperam.

PLATE PROCESSING

HOT FORMING

Hot forming should be carried out at temperatures between 1150 and 750 °C (2102 – 1382 °F). Solution annealing is not required if hot forming has been performed above 900 °C (1652 °F) followed by rapid cooling in air or water. The cleanliness of the surface is very important (avoid contaminations). A neutral or slightly oxidizing atmosphere is required. Due to the low thermal conductivity, the holding time of temperature may be longer than for carbon steel (about 50%).

COLD FORMING

UR™ 304LN – UR™ 304N can be cold formed without problem. Due to the nitrogen addition, it is less susceptible to martensitic transformation than cold formed UR™ 304L or UR™ 316Ti. UR™ 304LN – UR™ 304N may require more powerful equipments than structural steel because of their work hardening properties.

MACHINING

Due to its cold work hardening, the alloy is less machinable than structural steel or 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)	10 - 15 (33 - 49)
			3 (0.11)	0.4 (0.016)	16 - 21 (52 - 69)
			1 (0.04)	0.2 (0.008)	21 - 26 (69 - 85)
	Carbide	Dry or cutting oil	6 (0.23)	0.5 (0.019)	60 - 70 (197 - 229)
			3 (0.11)	0.4 (0.016)	75 - 85 (246 - 279)
			1 (0.04)	0.2 (0.008)	90 - 100 (295 - 328)
			Depth of cut (mm) (inch)	Feed (mm/t) (inch/t)	Speed (m/min) (feet/min)
Cutting	High speed steel	Cutting oil	1.5 (0.06)	0.03 - 0.05 (0.0012 - 0.0020)	14 - 19 (46 - 62)
			3 (0.11)	0.04 - 0.06 (0.0016 - 0.0024)	16 - 21 (52 - 69)
			6 (0.23)	0.05 - 0.07 (0.0020 - 0.0027)	18 - 23 (59 - 75)
			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)	8 - 12 (26 - 39)
			3 (0.11)	0.05 - 0.06 (0.0020 - 0.0024)	10 - 24 (33 - 46)
			6 (0.23)	0.08 - 0.09 (0.0031 - 0.0035)	10 - 14 (33 - 46)
			12 (0.48)	0.09 - 0.10 (0.0035 - 0.0039)	10 - 14 (33 - 46)
				Feed (mm/t) (inch/t)	Speed (m/min) (feet/min)
Milling profiling	High speed steel	Cutting oil		0.05 - 0.10 (0.002 - 0.004)	9 - 19 (29 - 62)

PICKLING

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

CUTTING

- > Thermal cutting (plasma, thermal sawing...)
- > Mechanical cutting (shearing, stamping, cold sawing...)

After cutting, pickling or grinding are necessary to eliminate the oxide formed layer.

WELDING

URTM 304LN – URTM 304N are readily welded using the same methods as 304L. The alloy is not sensitive to cold cracking phenomenon. All welding processes can be used, including filler less processes.

Filler materials

Electrode	E308L – 15 or E308L – 16 (ASME Sect II – Part C SFA 5 – 4)
Wire	ER 308L or ER 308Si (ASME Sect II – Part C SFA 5 – 9)

Welds using 308L filler material are generally sufficient to guarantee the same mechanical properties as the base metal. Consult us in case of doubt. A post weld heat treatment is not necessary. 200°C (392°F) is the maximum interpass temperature. Post weld pickling is necessary to restore the corrosion resistance properties of the joints.

Nota: In case of low temperature (down to – 269°C) properties requirements, 308L fillers are not adapted. Please consult us for technical support.

APPLICATIONS

The main applications are:

- > Chemical industry
- > Natural gas denitrogenation and decarburization columns
- > Petrochemical industry
- > Liquid gas production and storage
- > Space equipment testing facilities
- > Tanks and containers for rail or road transportation (higher mechanical properties than 304L)
- > Building infrastructures

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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.