Industeel

ArcelorMittal

UR™ 317LN

UR™ 317LN : A 3% Mo austenitic stainless steel with Nitrogen addition (317LN grade)

UR™ 317LN is a nitrogen alloyed austenitic stainless steel with a 3% Mo addition. Its austenitic microstructure is free of deleterious carbide precipitations at grain boundaries. The grade contains some residual ferrite after solution annealing (1100 - 1150°C / 2012 - 2102°F) and water quenching. This steel has a higher resistance to corrosion in chlorides environments than standard grades (UR™ 316L/ 316L).
Nitrogen additions improves sructure stability, increases the yield strength and improves its pitting corrosion resistance. Its main properties are: good mechanical properties, high ductility and improved corrosion resistance.
The main applications are chemical and petrochemical applications and chemical tankers.

PROPERTIES

STANDARDS

> EURONORM: EN 1.4434 X2CrNiMoN18.12.4

> ASTM: UNS S31753

CHEMICAL ANALYSIS - WEIGHT %

Typical values

C	Cr	Ni	Mo	N	Others
< .030	18.2	13	> 3.0	0.15	-

PREN (% Cr + 3.3 mo +16N) ≥ 32

PHYSICAL PROPERTIES

Density: 7900 kg/m^3

interval temperature (°C)	Thermal expansion $\alpha x10^{-6} K^{-1}$	T °C (°F)	Resistivity (µΩ.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	20 (68)	80	14	500	200	77
20 - 200	16.5	100 (212)	87	15	500	194	75
20 - 300	17	200 (392)	94	16.5	520	186	71
20 - 400	17.5	300 (572)	100	18	530	179	68
20 - 500	18	400 (752)	105	19.5	540	172	65
		500 (932)	110	21	540	165	62

The alloy is non magnetic in the solution treated condition, very slightly ferromagnetic after cold work.

MECHANICAL PROPERTIES

Tensile properties - After solution annealing heat treatment

°C	°F	YS 0.2%		YS 1%		UTS		Elongation
		MPa	ksi	MPa	ksi	MPa	ksi	%
20	68	290	43	31 5	46	590	86	40
100	212	225	33	255	37	525	76	40
200	392	185	27	210	31	490	77	40
300	572	165	24	190	28	460	67	35
400	752	150	22	175	25	450	65	30
500	932	135	20	160	23	440	64	25

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

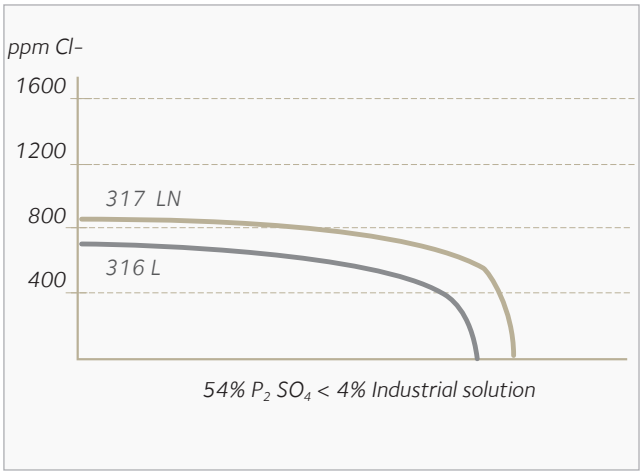
IN SERVICE CONDITIONS

CORROSION RESISTANCE

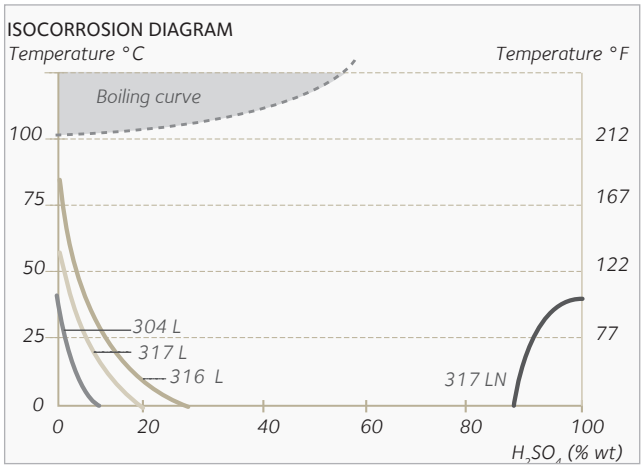
Standardized corrosion tests (special request may be discussed)

TEST	OTHER NAME	CORROSION	RESULTS
ASTM A262 A	-	Intergranular	Step or dual structure
ASTM A262 B	STREICHER	Intergranular	< 1 mm/year
ASTM A262 C	HUEY	Intergranular	< 1.5 mm/year
ASTM A262 E DIN 50914 RCCM	STRAUSS	Intergranular	No cracking after bending
ASTM G48A	-	Pitting	CPT ≥ 20°C (68°F)
ASTM G48B - ASTM G78	-	Crevice	CPT ≥ 10°C (50°F)

Pitting resistance



General corrosion in sulfuric acid



DELIVERY CONDITIONS

SIZE RANGE

	Quarto plates	Plates cut to length	Clad plates
Thickness	5 up to 150 mm 3/16" to 6"	2 up to 12 mm 5/64" up to 1/2"	6 up to 150 mm 1/4" to 6"
Width	Up to 3800 mm* Up to 150"	Up to 2000 mm* Up to 79"	Up to 3900 mm Up to 154"
Length	Up to 16000 mm Up to 52.5 ft	Up to 12000 mm Up to 39 ft	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 available from Aperam.

PLATE PROCESSING

HOT FORMING

Hot forming should be carried out in a temperature range of 900 - 1150°C (1652 - 2102°F).If the final forming temperature falls below 950°C (1742°F) a solution annealing (1080 - 1180°C / 1976 - 2156°F) is necessary. The cleanliness of the surface is very important (avoid oil contamination). A neutral or slightly oxidising atmosphere is required. Due to the low thermal conductivity, the holding time of temperature may be longer than for carbon steel (about 50%). Quenching must be fast after forming.

COLD FORMING

Because of its high nitrogen content and of its work hardening properties, cold forming requires more power than structural steels or standard austenitic grades. UR™ 317LN has excellent ductility and can be cold formed without problem.

PICKLING

UR™ 317LN can be pickled in a standard pickling solution (10 - 20% HNO_3 + 1,5 - 5% HF) at 20°C - 60°C. Increasing the temperature will reduce the pickling time. A 10 - 20% H_2SO_4 + 1,5 - 5% HF solution can also be used. Rinse carefully after pickling.

CUTTING

> Thermal cutting (plasma, thermal sawing...)

> Mechanical cutting (shearing, stamping, cold sawing...)

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

WELDING

UR™ 317LN can be welded by TIG/GTAW, MIG/GMAW, MMAW, SAW and other current processes. It has a good resistance to hot cracking but care must be exercised when using processes without filler, high energy processes or fully austenitic fillers.

Filler materials

Electrode	E317L - 15 or E317L - 16 (ASME Sect II - Part C SFA5 - 4)
Wire	ER 317L (ASME Sect II - Part C SFA 5 - 9)

18 - 16 - 5L filler materials with a higher Molybdenum content should be used to improve the corrosion resistance of the welded area. Overalloyed 904L or Cr - Ni - Mo alloys can also be used. Preheating and post weld heat treatment are not necessary. 120°C (248°F) is the maximum interpass temperature. Post weld pickling and passivation treatment are necessary.

HEAT TREATMENT

UR™ 317LN (317LN) grade exibits an austenitic microstructure with about 1 - 2% ferrite. The grade must be annealed at 1100 - 1150°C (2012 - 2102°F) and water quenched in order to avoid intermetallic phase precipitations which reduce ductility and corrosion resistance. Nitrogen additions also improve structure stability.

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)	11 - 16 (36 - 52)
			3 (0.11)	0.4 (0.016)	18 - 23 (59 - 75)
			1 (0.04)	0.2 (0.008)	25 - 30 (82 - 98)
	Carbide	Dry or cutting oil	6 (0.23)	0.5 (0.019)	70 - 80 (230 - 262)
			3 (0.11)	0.4 (0.016)	85 - 95 (279 - 313)
			1 (0.04)	0.2 (0.008)	100 - 110 (328 - 361)
			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)
			Drill Ø mm (inch)	Feed	Speed
Drilling	High speed steel	Cutting oil	1.5 (0.06)	0.02 - 0.03 (0.0008 - 0.0012)	10 - 14 (33 - 46)
			3 (0.11)	0.05 - 0.06 (0.0020 - 0.0024)	12 - 16 (39 - 52)
			6 (0.23)	0.08 - 0.09 (0.0031 - 0.0035)	12 - 16 (39 - 52)
			12 (0.48)	0.09 - 0.10 (0.0035 - 0.0039)	12 - 16 (39 - 52)
				Feed	Speed
Milling profiling	High speed steel	Cutting oil		0.05 - 0.10 (0.002 - 0.004)	10 - 20 (33 - 66)

APPLICATIONS

The alloy is corrosion resistant in:

> Diluted sulfuric solutions at moderate temperature

> Very diluted hydrochloric acid solutions at moderate temperature

> Industrial phosphoric acid (pure phosphoric acid up to 100°C/212°F)

> Sulphurous acid solutions of sulphites and bisulphites at high temperature

> Hot organic acid solutions (acetic, formic, citric)

Please consult for more data.
The main applications are:

> Chemical tankers

> Petrochemical industry

> Chemical and pharmaceutical industries

> Oil and gas industry

> Food and beverage industry

> Pollution control equipments

YOUR CONTACTS

Didier Paul
Tel. + 33 6 19 28 29 31
didier.r.paul@arcelormittal.com

http://industeel.arcelormittal.com

Industeel Belgium
266 rue de Châtelet
B - 6030 Marchiennne-au-Pont