Industeel

ArcelorMittal

UR™ 317L

UR™ 317L: A 3%Mo minimum austenitic stainless steel (317L grade)

UR™ 317L (317L) is an austenitic stainless steel with a 3% molybdenum addition. Alloy UR™ 317L (317L) exhibits an austenitic microstructure, free of chromium carbide precipitations at grain boundaries. The grade contains some residual ferrite (after solution annealing (1100 - 1150°C / 2012 - 2102°F)) and water quenching.
The high molybdenum content gives this steel a higher resistance to corrosion in sulfuric media than standard grades (UR™ 316 m / 316L).
Its main properties are:

> high ductility,

> weldability and improved corrosion resistance.

The main application are refining, chemical industries, pulp and paper industry.

PROPERTIES

STANDARDS

> EURONORM: **EN 1.4438** **X2CrNiMo18 - 15 - 4**

> ASTM: **A 240 TP 317L - UNS S31703**

CHEMICAL ANALYSIS - WEIGHT %

Typical values

C	Cr	Ni	Mo	Others
0.030	18.5	12[(1)(2)]	> 3.0	-

PREN (% Cr + 3.3%Mo +16%N) ≥ 29

[(1)] Ni = 11.5% for 317L

[(2)] Ni = 13% for 1.4438

PHYSICAL PROPERTIES

Density: 7900 kg/m³

Interval temperature (°C)	Thermal expansion $\alpha \times 10^{-6} K^{-1}$	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)	75	14	500	200	77
20 - 200	16.5	100 (212)	77	15	500	194	75
20 - 300	17	200 (392)	84	16.5	520	186	71
20 - 400	17.5	300 (572)	91	18	530	179	68
20 - 500	18	400 (752)	97	19.5	540	172	65
		500 (932)	102	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	210	31	250	36	515	75	40
100	212	170	25	203	30	460	67	40
200	392	144	21	176	26	420	61	30
300	572	126	18	155	23	410	60	30
400	752	115	17	144	21	410	60	25
500	932	110	16	138	20	400	58	25

** Minimum guaranteed values following EN 10088 hot rolled plates. The EN guaranteed values are valid for a thickness from 5 up to 75 mm (.20" up to 2.95")*

IN SERVICE CONDITIONS

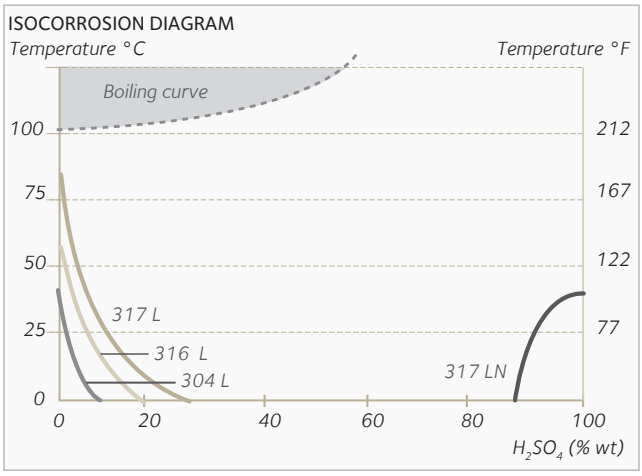
CORROSION RESISTANCE

Standardized corrosion tests (special request may be discussed)

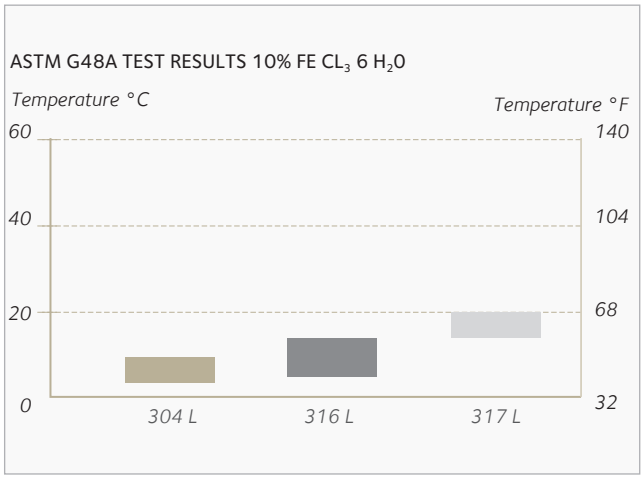
TEST	OTHER NAME	CORROSION(1)	RESULTS
ASTM A262 A	-	Intergranular	Step or dual structure
ASTM A262 B	STREICHER	Intergranular	< 1.5 mm/year
ASTM A262 C	HUEY	Intergranular	< 1. 5 mm/year
ASTM A262 E DIN 50914 RCCM	STRAUSS	Intergranular	No cracking after bending
ASTM G48A		Pitting	CPT ≥ 15 °C (59 °F)
ASTM G48B	ASTM G78	Crevice	CPT ≥ 5 °C (41 °F)

(1) kind of corrosion mechanism investigated

General corrosion in sulfuric acid



Pitting resistance



DELIVERY CONDITIONS

SIZE RANGE

	Quarto plates	Clad plates
Thickness	5 up to 150 mm 3/16" to 6"	6 up 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.*
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

The alloy can be cold formed without any problem. The cold hardening of the steel explains that it may require more powerfull equipments than structural steel. Molybdenum and Nitrogen bearing implie also some more powerfull equipments than Cr - Ni austenitic stainless steels.

PICKLING

A nitric hydrofluoric acid bath (10 - 20% HNO_3 - 1.5 - 5% HF) at 20 - 60°C (68 - 140°F) is used for the pickling treatment. A 10 - 20% H_2SO_4 - 1.5 - 5% HF pickling bath may also be used. Passivation - decontamination treatments may be performed with a 10 - 20% nitric acid solution.

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

The alloy, stabilized by Nitrogen addition, can be welded without hot cracking, using an adequate filler metal. The alloy is not sensitive to cold cracking phenomenon. All welding processes can be used. The fillerless processes may be used after checking out the no hot cracking of the weld metal and the lack of porosities.

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 and giving a fully austenitic weld metal should be used to improve the pitting corrosion resistance. 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™ 317L presents an austenitic microstructure with some residual ferrite. It must be annealed at 1100 - 1150°C (2012 - 2102°F) and water quenched in order to avoid intermetallic phase precipitations which reduce its ductility and its corrosion resistance properties.

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 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)	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 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)	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 mm/t (inch/t)	Speed m/min (feet/min)
Milling profiling	High speed steel	Cutting oil		0.05 - 0.10 (0.002 - 0.004)	10 - 20 (33 - 66)

APPLICATIONS

The main applications are:

- > Refineries
- > Chemical and petrochemical processing equipments
- > Food and beverage industry
- > Explosives industry
- > Pollution control equipments
- > Pulp and paper plants

YOUR CONTACTS

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