Industeel

ArcelorMittal

UR™ 304L

UR™ 304L: General purpose 18Cr - 9Ni austenitic stainless steel

UR™ 304L is an austenitic stainless steel with the following properties:

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

This grade is austenitic in the solution annealed condition (1000 - 1100°C / 1832 - 2012°F) and water quenching. It contains a small amount of ferrite.

PROPERTIES

STANDARDS

> EURONORM: **EN 1.4307 X2CrNi 18 - 11**

> ASTM: **A 240 - TP 304L - UNS S30403**

CHEMICAL ANALYSIS - WEIGHT %

Typical values

C	Cr	Ni	Mo	N	Others
.02	18	8.5	-	.07	-

Ni content may be modified to be conform to 1.4306 grade (UR™ 304L).
Please consult for specific requirements such as
- low ferrite contents or non magnetic properties
- nitric acid service.

PHYSICAL PROPERTIES

Density: 7900 kg/m^3

Interval temperature (°C)	Thermal expansion α 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)	73	15	500	200	77
20 - 200	17	100 (212)	77	16	500	194	75
20 - 300	17	200 (392)	84	17.5	520	186	71
20 - 400	18	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

°C	°F	Minimum guaranteed values*						Typical values (10 mm plates)						
		YS 0.2%		YS 1%		UTS		YS 0.2%		YS 1%		UTS		Elongation
		MPa	ksi	MPa	ksi	MPa	ksi	MPa	ksi	MPa	ksi	MPa	ksi	%
20	68	200	29	240	35	520/650	75/95	265	38	305	44	570	83	45
100	212	147	21	181	26	410	60	240	34	280	40	480	70	40
200	392	118	17	147	21	360	52	220	32	240	34	440	63	35
300	572	100	15	127	19	340	50	170	25	190	27	420	62	35
400	752	89	13	116	17	330	48	150	22	165	24	400	58	30
500	932	81	12	109	16	320	47	130	20	145	21	380	56	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 - KCV ≥ 120 K/cm² (room temperature)

°C	- 196	- 20	+20
°F	- 321	- 4	68
KCV (J/cm²) minimum	125	185	185

High toughness values at - 269°C (- 452°F) Can be achieved with a specially melted low ferrite grade. Please, consult

IN SERVICE CONDITIONS

CORROSION RESISTANCE

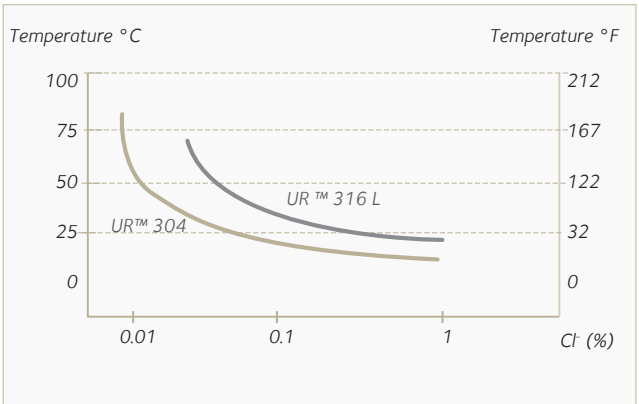
Standardized corrosion tests (special request may be discussed)

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	< 0.6 mm/year*
ASTM A262 E DIN 50914	STRAUSS	Intergranular	No cracking after bending

** using low ferrite grade*

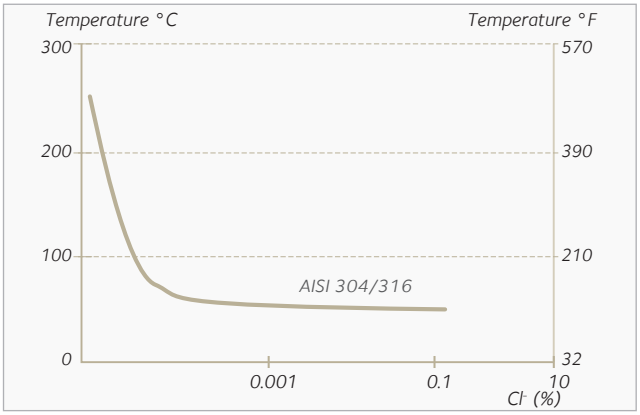
The alloy has only limited resistance to localized corrosion in chloride containing solutions. Pitting may occur even at low temperature (5 - 10°C / 41 - 50°F). The alloy may suffer from stress corrosion cracking in chloride containing solution when temperature is higher than 50°C (122°F).

Sensivity to pitting corrosion



Effect of temperature and chloride contents

Stress corrosion cracking resistance.



Constant strain tests in autoclave – Above the curve, SCC occurs

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. Cut to length plates are available from Aperam.*

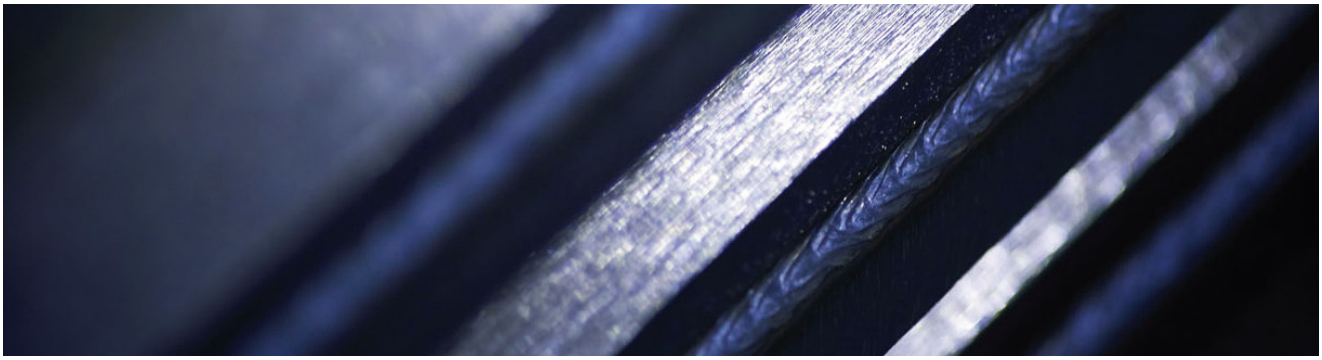


PLATE PROCESSING

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 may be faster 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 nitro - hydrofluoric acid bath (10 - 20% HNO_3 - 1,5 - 5% HF) at 20 - 60 °C (68 - 142 °F) is used for the pickling treatment. A 10 - 20% H_2SO_4 - 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.

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 can be easy 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	E308L - 15 or E308L - 16 (ASME Sect II - Part C SFA5 - 4)
Wire	ER 308L or ER 308L.Si (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 is necessary to restore the corrosion resistance of the welded joint.

MACHINING

Due to its cold work hardening, the alloy is less machinable than a 13% Cr martensitic stainless steel. To improve the machinability, Industeel has developed a grade called FASTINOX 18 - 9L (please, consult).

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)	13 - 18 (42.6 - 59)
			3 (0.11)	0.4 (0.016)	20 - 25 (65.6 - 82)
			1 (0.04)	0.2 (0.008)	26 - 31 (85.3 - 101.7)
	Carbide	Dry or cutting oil	6 (0.23)	0.5 (0.019)	75 - 85 (246 - 278.9)
			3 (0.11)	0.4 (0.016)	90 - 100 (295.3 - 328.1)
			1 (0.04)	0.2 (0.008)	110 - 120 (360.8 - 393.7)
			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)	18 - 23 (59 - 75.5)
			3 (0.11)	0.04 - 0.06 (0.0016 - 0.0024)	19 - 24 (62.3 - 78.7)
			6 (0.23)	0.05 - 0.07 (0.0020 - 0.0027)	20 - 25 (65.6 - 82)
			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 (32.8 - 45.9)
			3 (0.11)	0.05 - 0.06 (0.0020 - 0.0024)	12 - 16 (39.3 - 52.5)
			6 (0.23)	0.08 - 0.09 (0.0031 - 0.0035)	12 - 16 (39.3 - 52.5)
			12 (0.48)	0.09 - 0.10 (0.0035 - 0.0039)	12 - 16 (39.3 - 52.5)
				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)	12 - 22 (39.4 - 72.2)

APPLICATIONS

UR™ 304L is corrosion resistant in

> Urban atmospheric applications

> Nitric solution, up to 55% weight, up to 80°C (176°F) (low ferrite)

> 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

> Food processing industry (excluding Cl^- containing media),

> Nuclear industry (special melts - please consult)

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