Specification Sheet: Alloy 317L
(UNS S31703) W. Nr. 1.4438

An Austenitic Stainless Steel with High Levels of Chromium, Nickel and Molybdenum for Enhanced Corrosion Resistance When Compared with 304/304L and 316/316L

Alloy 317L (UNS S31703) is a low-carbon corrosion resistant austenitic chromium-nickel-molybdenum stainless steel. The high levels of these elements assure the alloy has superior chloride pitting and general corrosion resistance to the conventional 304/304L and 316/316L grades. The alloy provides improved resistance relative to 316L in strongly corrosive environments containing sulfurous media, chlorides, and other halides.

The low carbon content of Alloy 317L enables it to be welded without intergranular corrosion resulting from chromium carbide precipitation enabling it to be used in the as-welded condition. With the addition of nitrogen as a strengthening agent, the alloy can be dual certified as Alloy 317 (UNS S31700).

Alloy 317L is non-magnetic in the annealed condition. It cannot be hardened by heat treatment, however the material will harden due to cold working. Alloy 317L can be easily welded and processed by standard shop fabrication practices.

Applications

- Air Pollution Control — flue gas desulfurization systems (FGD)
- Chemical and Petrochemical Processing
- Explosives
- Food and Beverage Processing
- Petroleum Refining
- Power Generation — condensers
- Pulp and Paper

Standards

ASTM ..... A 240

ASME ..... SA 240

Chemical Analysis

Weight % (all values are maximum unless a range is otherwise indicated)

Chromium	18.0 min.–20.0 max.	**Phosphorus**	0.045
Nickel	11.0 min.–15.0 max.	**Sulfur**	0.030
Molybdenum	3.0 min.–4.0 max.	**Silicon**	0.75
Carbon	0.030	**Nitrogen**	0.10
Manganese	2.00	**Iron**	Balance

Physical Properties

Density
0.285 lbs/in^3
7.89 g/cm^3

Specific Heat
0.12 BTU/lb-°F (32–212°F)
502 J/kg-°K (0–100°C)

Modulus of Elasticity
29.0 x 10^6 psi
200 GPa

Thermal Conductivity 68°F (20°C)
8.1 BTU/(hr x ft x °F)
14 W/(m x K)

Melting Range
2540–2630°F
1390–1440°C

Electrical Resistivity
33.5 Microhm-in at 68°F
85.1 Microhm-cm at 20°C

Mean Coefficient of Thermal Expansion

Temperature Range			
°F	°C	in/in °F	cm/cm °C
68–212	20–100	8.9 x 10^{-6}	16.02 x 10^{-6}

Mechanical Properties

Values at 68°F (20°C) (minimum values, unless specified)

Yield Strength 0.2% Offset		Ultimate Tensile Strength		Elongation in 2 in.	Hardness
psi	(MPa)	psi	(MPa)	%	(max.)
30,000	205	75,000	515	40	95 Rockwell B

Corrosion Resistance

The higher molybdenum content of Alloy 317L assures superior general and localized corrosion resistance in most media when compared with 304/304L and 316/316L stainless steels. Environments that don't attack 304/304L stainless steel will normally not corrode 317L. One exception, however, are strongly oxidizing acids such as nitric acid. Alloys that contain molybdenum generally do not perform as well in these environments.

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Providing Solutions, With Materials and Value Added Products, for Process Industries

Alloy 317L has excellent corrosion resistance in a wide range of chemicals. It resists attack in sulfuric acid, acidic chlorine and phosphoric acid. It is used in handling hot organic and fatty acids often present in food and pharmaceutical processing applications.

The corrosion resistance of 317 and 317L should be the same in any given environment. The one exception is where the alloy will be exposed to temperatures in the chromium carbide precipitation range of 800–1500°F (427–816°C). Because of its low carbon content, 317L is the preferred material in this service to guard against intergranular corrosion.

In general, austenitic stainless steels are subject to chloride stress corrosion cracking in halide service. Although 317L is somewhat more resistant to stress corrosion cracking than 304/304L stainless steels, because of its higher molybdenum content, it is still susceptible.

The higher chromium, molybdenum and nitrogen content of 317L enhance its ability to resist pitting and crevice corrosion in the presence of chlorides and other halides. The Pitting Resistance Equivalent including Nitrogen number (PREN) is a relative measure of pitting resistance. The following chart offers a comparison Alloy 317L and other austenitic stainless steels.

ALLOY	Composition (Weight Percent)			PRE_N[1]
	Cr	Mo	N	
304 Stainless Steel	18.0	—	0.06	19.0
316 Stainless Steel	16.5	2.1	0.05	24.2
317L Stainless Steel	18.5	3.1	0.06	29.7
SSC-6MO	20.5	6.2	0.22	44.5

[1]*Pitting Resistance Equivalent, including Nitrogen, PREN = Cr + 3.3Mo + 16N*

Fabrication Data

Alloy 317L can be easily welded and processed by standard shop fabrication practices.

Machining

The cold work hardening rate of Alloy 317L makes it less machinable than 410 stainless steel. The table below provides relevant machining data.

Operation	Tool	Lubrication	CONDITIONS					
			Depth-mm	Depth-in	Feed-mm/t	Feed-in/t	Speed-m/min	Speed-ft/min
Turning	High Speed Steel	Cutting Oil	6	.23	0.5	.019	11–16	36–52
			3	.11	0.4	.016	18–23	59–75
			1	.04	0.2	.008	24–30	82–98
	Carbide	Dry or Cutting Oil	6	.23	0.5	.019	70–80	230–262
			3	.11	0.4	.016	85–95	279–313
			1	.04	0.2	.008	100–110	328–361
			Depth of cut-mm	Depth of cut-in	Feed-mm/t	Feed-in/t	Speed-m/min	Speed-ft/min
Cutting	High Speed Steel	Cutting Oil	1.5	.06	0.03–0.05	.0012–.0020	16–21	52–69
			3	.11	0.04–0.06	.0016–.0024	17–22	56–72
			6	.23	0.05–0.07	.0020–.0027	18–23	59–75
			Drill ø mm	Drill ø in	Feed-mm/t	Feed-in/t	Speed-m/min	Speed-ft/min
Drilling	High Speed Steel	Cutting Oil	1.5	.06	0.02–0.03	.0007–.0012	10–14	33–46
			3	.11	0.05–0.06	.0020–.0024	12–16	39–52
			6	.23	0.08–0.09	.0031–.0035	12–16	39–52
			12	.48	0.09–0.10	.0035–.0039	12–16	39–52
					Feed-mm/t	Feed-in/t	Speed-m/min	Speed-ft/min
Milling Profiling	High Speed Steel	Cutting Oil			0.05–0.10	.002–.004	10–20	33–66

Hot Forming

Working temperatures of 1652–2102°F (900–1150°C) are recommended for hot working processes. Do not work this alloy below 1742°F (950°C). If the final forming temperature falls below this threshold, a solution anneal of 1976–2156°F (1080–1180°C) is necessary. Rapid quenching is required.

Cold Forming

The alloy is quite ductile and forms easily. The addition of molybdenum and nitrogen implies more powerful processing equipment may be necessary when compared with the standard 304/304L grades.

Welding

Alloy 317L can be readily welded by most standard processes. A post weld heat treatment is not necessary.

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