

# Type 317L UNS S31703

A low-carbon, molybdenum-containing austenitic stainless steel with improved resistance to chlorides relative to Type 304L and Type 316L stainless steels.

## Description

Type 317L is a molybdenum-containing austenitic stainless steel intended to provide improved corrosion resistance relative to Type 316L in strongly corrosive process environments, particularly those containing chlorides or other halides. The low carbon permits Type 317L to be welded without sensitization to intergranular corrosion resulting from chromium carbide precipitation in the grain boundaries.

Type 317L is non-magnetic in the annealed condition but may become slightly magnetic as a result of welding.

## Dual Certification

It is common for 317L to be dual certified as 317 and 317L when the material meets the lower carbon limit of Type 317L. The producer of the steel must certify the material as Type 317 if it is to be used as Type 317 instead of Type 317L.

## Product Forms Available

Plate  
Sheet  
Tubular Products  
Bar  
Angle  
Wire Rod  
Billet  
Welding Consumables

## Corrosion Resistance

Type 317L has excellent corrosion resistance in a wide range of chemicals, especially in acidic chloride environments such as those encountered in pulp and paper mills.

## Specifications

Type 317L can be supplied to meet AMS, ASTM, ASME, QQS, and MIL-S specifications.

## Mechanical Properties at Room Temperature

Table 1

	Typical*	ASTM
Ultimate Tensile Strength, ksi	89	75 min
0.2% Offset Yield Strength, ksi	46	30 min
Elongation in 2 inches, %	53	40 min
Reduction in Area, %	69	—
Hardness, Rockwell B	80	95 max

\*0.375 inch plate

## Chemical Composition, wt. pct.

Table 2

	317L
Carbon	0.030 max
Manganese	2.00 max
Phosphorus	0.045 max
Sulfur	0.030 max
Silicon	0.75 max
Chromium	18.0-20.0
Nickel	11.0-15.0
Molybdenum	3.0-4.0
Nitrogen*	0.10 max

\*flat-rolled products only

## Physical Properties

Table 3

Density, lb/in <sup>3</sup>	0.285
Modulus of Elasticity, psi	29 x 10 <sup>6</sup>
Coefficient of Thermal Expansion, 68-212°F, /°F	8.9 x 10 <sup>-6</sup>
Thermal Conductivity, Btu/ft hr°F	8.7
Heat Capacity, Btu/lb°F	0.12
Electrical Resistivity, Ω-inch	33.5 x 10 <sup>-6</sup>

### Heat Treatment Annealing

Type 317L should be heated to 1900°F minimum and water quenched or rapidly cooled by other means.

### Hardening

Type 317L cannot be hardened by heat treatment. However, Type 317L can be hardened by cold working.

### Workability Cold Working

Type 317L may be formed and fabricated through a full range of cold working operations. It can be used in heading, drawing, bending, and upsetting. Any cold working operations will increase the strength and hardness of the material.

### Hot Working

Type 317L can be forged in the 1700-2200°F range. For maximum corrosion resistance, forgings should be annealed at 1900°F minimum and water quenched or rapidly cooled by other means after hot working operations.

### Welding

Type 317L is readily welded by a full range of conventional welding procedures (except oxyacetylene). AWS E317L/ER317L filler metal or austenitic, low carbon filler metals with molybdenum content higher than that of Type 317L, or a nickel-base filler metal with sufficient chromium and molybdenum content to exceed the corrosion resistance of Type 317L should be used to weld Type 317L steel.

### Lowest Temperature (°F) at Which the Corrosion Rate Exceeds 5 mpy

Table 4

Corrosion Environment	654 SMO®	254 SMO®	904L	Type 316L (2.7 Mo)	Type 304	2507	2205 Code Plus Two®	2304
0.2% Hydrochloric Acid	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling
1% Hydrochloric Acid	203	158	122	86	86p	>Boiling	185	131
10% Sulfuric Acid	158	140	140	122	—	167	140	149
60% Sulfuric Acid	104	104	185	<54	—	<57	<59	<<55
96% Sulfuric Acid	86	68	95	113	—	86	77	59
85% Phosphoric Acid	194	230	248	203	176	203	194	203
10% Nitric Acid	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling	>Boiling
65% Nitric Acid	221	212	212	212	212	230	221	203
80% Acetic Acid	>Boiling	>Boiling	>Boiling	>Boiling	212p	>Boiling	>Boiling	>Boiling
50% Formic Acid	158	212	212p	104	≤50	194	194	59
50% Sodium Hydroxide	275	239	Boiling	194	185	230	194	203
83% Phosphoric Acid + 2% Hydrofluoric Acid	185	194	248	149	113	140	122	95
60% Nitric Acid + 2% Hydrochloric Acid	>140	140	>140	>140	>140	>140	>140	>140
50% Acetic Acid + 50% Acetic Anhydride	>Boiling	>Boiling	>Boiling	248	>Boiling	230	212	194
1% Hydrochloric Acid + 0.3% Ferric Chloride	>Boiling, p	203ps	140ps	77p	68p	203ps	113ps	68p
10% Sulfuric Acid + 2000ppm Cl <sup>-</sup> + N <sub>2</sub>	149	104	131	77	—	122	95	<55
10% Sulfuric Acid + 2000ppm Cl <sup>-</sup> + SO <sub>2</sub>	167	140	122	<<59p	—	104	<59	<<50
WPA1, High Cl <sup>-</sup> Content	203	176	122	≤50	<<50	203	113	86
WPA2, High F <sup>-</sup> Content	176	140	95	≤50	<<50	167	140	95

ps = pitting can occur  
ps = pitting/crevice corrosion can occur

WPA	P <sub>2</sub> O <sub>5</sub>	Cl <sup>-</sup>	F <sup>-</sup>	H <sub>2</sub> SO <sub>4</sub>	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	CaO	MgO
1	54	0.20	0.50	4.0	0.30	0.20	0.10	0.20	0.70
2	54	0.02	2.0	4.0	0.30	0.20	0.10	0.20	0.70

### **Machinability**

Type 317L is a tough austenitic stainless steel subject to work hardening during deformation and resistant to chip breaking. The higher molybdenum makes the chip abrasive, increasing tool wear. The best machining results are achieved with slower speeds, heavier feeds, excellent lubrication, sharp tooling, and powerful, rigid equipment.

### **Corrosion Performance of Stainless Steels**

Table 4 compares stainless steels in a variety of common corrosive environments. The table shows the lowest temperature at which the corrosion rate exceeds 5 mpy. All testing was done in accordance with the requirements of the Materials Technology Institute of the Chemical Process Industries (MTI). Performance of 317L in these tests will be slightly superior to that of 316L (2.7Mo) as shown in Table 4.

### **Technical Support**

Outokumpu Stainless, Inc. assists users and fabricators in the selection, qualification, installation, operation, and maintenance of Type 317L stainless steel. Technical personnel, supported by the research laboratory of Outokumpu Stainless can draw on years of field experience with Type 317L to help you make the technically and economically correct materials decision.

Outokumpu Stainless is prepared to discuss individual applications and to provide data and experience as a basis for selection and application of Type 317L.

Outokumpu Stainless works closely with its distributors to ensure timely availability of Type 317L in the forms, sizes, and quantities required by the user. For assistance with technical questions and to obtain top quality Type 317L, call Outokumpu Stainless, Inc. at 1-800-833-8703.

## 4 Type 317L

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