

Type 317LMN UNS S31726

A low-carbon, higher molybdenum austenitic stainless steel frequently used for flue gas desulfurization service.

Description

Type 317LMN is a higher molybdenum austenitic stainless steel further alloyed with nitrogen to provide improved corrosion resistance relative to 316L and 317L, especially in acidic chloride-containing environments. As a low carbon grade, 317LMN may be welded without sensitization to intergranular corrosion resulting from chromium carbide precipitation on the grain boundaries.

Type 317LMN is non-magnetic in the annealed condition.

Dual Certification

When the chromium content of Type 317LMN (S31726) is equal to or greater than 18.0%, it is possible to certify the steel also as 317LM (S31725). 317LMN is stronger than 317LM and more corrosion resistant, so this substitution is conservative. The ASTM specification was changed for 317LM to permit greater flexibility to the end user who seeks to obtain small quantities of 317LM. The producer of the steel must certify the material as S31725 if it is to be used as S31725 instead of S31726.

Product Forms Available

Plate
Sheet
Tubular Products
Fittings

Corrosion Resistance

The combination of high molybdenum and nitrogen gives Type 317LMN excellent resistance to chloride pitting and crevice corrosion. It has been applied for many years in the bodies, structural members, and internals for scrubbers for flue gas desulfurization. It is also a versatile and cost effective material in a

wide range of chemical processing applications requiring a stainless steel with corrosion resistance better than that of 316L and 317L.

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 *0.375 inch plate	80	95 max

Chemical Composition, wt. pct.

Table 2

	317LMN
Carbon	0.030 max
Manganese	2.00 max
Phosphorus	0.045 max
Sulfur	0.030 max
Silicon	0.75 max
Chromium	17.0-20.0
Nickel	13.5-17.5
Molybdenum	4.0-5.0
Nitrogen*	0.10-0.20
*flat-rolled products only	

Physical Properties

Table 3

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

Specifications

Type 317LMN can be supplied to ASTM and ASME specifications.

Heat Treatment

Type 317LMN is solution annealed by heating to 1900°F minimum and followed by water quenching or rapidly cooling by other means. 317LMN should not be “stress relieved” by heat treatment other than a full solution anneal. 317LMN cannot be hardened by heat treatment.

Workability Cold Working

Type 317LMN is readily formed and fabricated through the full range of cold working operations

typically applied to the common austenitic stainless steels. It can be used in heading, drawing, bending, and upsetting. Because of its nitrogen content, 317LMN will be slightly stronger and work harden slightly faster than 316L.

Hot Working

Type 317LMN can be hot formed in the 1700-2200°F range. For maximum corrosion resistance, parts that have been hot formed should be subsequently annealed at 1900°F minimum and water quenched or rapidly cooled by other means.

Welding

Type 317LMN is readily welded by a full range of conventional welding procedures (except oxyacetylene). To produce a fusion zone with corrosion resistance

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	Outokumpu 2507	2205 Code Plus Two®	Outokumpu 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 ⁻ + N ₂	149	104	131	77	—	122	95	<55
10% Sulfuric Acid + 2000ppm Cl ⁻ + SO ₂	167	140	122	<<59p	—	104	<59	<<50
WPA1, High Cl ⁻ Content	203	176	122	≤50	<<50	203	113	86
WPA2, High F ⁻ Content	176	140	95	≤50	<<50	167	140	95

ps = pitting can occur

ps = pitting/crevice corrosion can occur

WPA	P ₂ O ₅	Cl ⁻	F ⁻	H ₂ SO ₄	Fe ₂ O ₃	Al ₂ O ₃	SiO ₂	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

similar to that of the base metal, filler metals of Alloy 625 (AWS ERNiCrMo-3) or its lower carbon version, ERNiCrMo-12, are commonly used with 317LMN.

Machinability

Type 317LMN is a very tough austenitic stainless steel subject to work hardening during deformation and is resistant to chip breaking. The higher molybdenum and the nitrogen make 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

The corrosion resistance of Type 317LMN is only slightly below that of the 904L stainless steel. Type 317LMN has a long service history in flue gas scrubbing applications but has not been fully evaluated for chemical applications. However, it would be conservative to use Table 4 as a guide, considering 317LMN to be intermediate to 316L and 904L.

This 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).

Technical Support

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

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

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

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Outokumpu is a global leader in stainless steel. Our vision is to be the undisputed number one in stainless, with success based on operational excellence. Customers in a wide range of industries use our stainless steel and services worldwide. Being fully recyclable, maintenance-free, as well as very strong and durable material, stainless steel is one of the key building blocks for sustainable future.

What makes Outokumpu special is total customer focus – all the way, from R&D to delivery. You have the idea. We offer world-class stainless steel, technical know-how and support. We activate your ideas.



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