

ASTM A312 / A312M

Seamless & Welded Austenitic Stainless Steel Pipes — High-Temperature & General Corrosive Service

Seamless (SML)

Welded (WLD)

Heavy Cold-Worked (HCW)

NPS 1/8" – 30"

1 Scope & Application

What this standard covers and where these pipes are used.

Product Coverage

Seamless, straight-seam welded, and heavily cold-worked welded austenitic stainless steel pipes.

Service Conditions

High-temperature service and general corrosive environments. Accepted by ASME Pressure Vessel Code, Section VIII and ANSI B31.3.

Low-Temperature Use

Grades TP304, TP304L, TP347 are accepted for service as low as -425°F [-250°C] without impact testing per ASME codes.

Dual Units

Values in inch-pound and SI units. Each system is used independently. Use the "M" designation for metric-governed orders.

Size Range

NPS 1/8" through 30" in schedules 5S, 10S, 40S, and 80S per ANSI B36.19. Custom sizes available upon agreement.

High-Temp Grades

"H" grades (TP304H, TP316H, TP321H, TP347H, etc.) are specifically modified for elevated-temperature service.

Grade Overview

Major austenitic stainless steel grades covered by ASTM A312 — chemical families, key properties, and typical applications.

TP304 / TP304L

MOST POPULAR

UNS S30400 / S30403

18Cr-8Ni

General Purpose

Good Weldability

The workhorse austenitic grade. Excellent corrosion resistance in most environments. TP304L (low carbon) eliminates sensitization during welding. Widely used in food processing, chemical equipment, and architectural applications.

TP304H

HIGH TEMP

UNS S30409

C 0.04–0.10

Elevated Temperature

Higher Creep Strength

High-carbon modification of TP304 for improved high-temperature strength. Used in boilers, superheaters, and refinery piping above 1000°F [540°C].

TP316 / TP316L

MOST POPULAR

UNS S31600 / S31603

16Cr-10Ni-2Mo

Enhanced Pitting Resistance

Marine Grade

Molybdenum-bearing grade with superior pitting and crevice corrosion resistance. TP316L (low carbon) is preferred for welded structures. Ideal for marine environments, chemical processing, and pharmaceutical equipment.

TP316H

HIGH TEMP

UNS S31609

C 0.04–0.10

Elevated Temperature

Mo-Bearing High Temp

High-carbon 316 for superior creep strength at elevated temperatures. Common in petrochemical and power generation heat exchangers.

TP321 / TP321H

STABILIZED

UNS S32100 / S32109

Ti-Stabilized

Intergranular Corrosion Resistant

High Temp

Titanium-stabilized for resistance to intergranular corrosion after welding or heating in the 800–1500°F [425–815°C] range. Common in aerospace and chemical plants.

TP347 / TP347H

STABILIZED

UNS S34700 / S34709

Nb-Stabilized

Superior Weldability

High Temp Strength

Niobium (columbium) stabilized. Excellent resistance to sensitization. Preferred over TP321 for heavy-section welding. Widely used in refinery and power plant piping.

TP309S / TP310S

HIGH TEMP

UNS S30908 / S31008

22–25Cr

Oxidation Resistant

Up to 2000°F

High chromium and nickel content for superior oxidation resistance. TP310S withstands continuous service up to 2000°F [1095°C]. Used in furnace parts, heat exchangers, and thermal processing equipment.

TP317 / TP317L

PREMIUM

UNS S31700 / S31703

18Cr-13Ni-3.5Mo

Superior Corrosion Resistance

Chemical Processing

Higher molybdenum content than 316 for enhanced resistance to sulfurous acid, phosphoric acid, and other aggressive chemicals. Common in FGD systems and pulp & paper.

S31254 (254 SMO)

SUPER AUSTENITIC

UNS S31254

20Cr-18Ni-6Mo

PREN ≥43

Seawater Resistant

High-performance super austenitic with excellent resistance to pitting and crevice corrosion in chloride-rich environments. Suitable for seawater cooling, bleach plants, and FGD scrubbers.

N08367 (AL-6XN)

SUPER AUSTENITIC

UNS N08367

21Cr-24Ni-6Mo

PREN ≥43

Offshore / Chemical

Superior corrosion resistance in chloride environments. Higher nickel content than S31254 for better stress corrosion cracking resistance. Used in offshore platforms and chemical tankers.

N08904 (904L)

PREMIUM

UNS N08904

20Cr-25Ni-4.5Mo

Acid Resistant

Cu 1.5%

High nickel and molybdenum with copper addition for excellent resistance to reducing acids like sulfuric, phosphoric, and acetic acids. Ideal for chemical and pharmaceutical industries.

Key alloying elements for the most commonly ordered grades. Values are weight percent maximum unless a range is given.

Grade	UNS	C max	Mn max	Si max	Cr	Ni	Mo	Others
TP304	S30400	0.08	2.00	0.75	18.0–20.0	8.0–11.0	—	—
TP304L	S30403	0.035	2.00	0.75	18.0–20.0	8.0–12.0	—	—
TP304H	S30409	0.04–0.10	2.00	0.75	18.0–20.0	8.0–11.0	—	—
TP316	S31600	0.08	2.00	0.75	16.0–18.0	10.0–14.0	2.00–3.00	—
TP316L	S31603	0.035	2.00	0.75	16.0–18.0	10.0–14.0	2.00–3.00	—
TP316H	S31609	0.04–0.10	2.00	0.75	16.0–18.0	10.0–14.0	2.00–3.00	—
TP317	S31700	0.08	2.00	0.75	18.0–20.0	11.0–15.0	3.0–4.0	—
TP317L	S31703	0.035	2.00	0.75	18.0–20.0	11.0–15.0	3.0–4.0	—
TP321	S32100	0.08	2.00	0.75	17.0–19.0	9.0–12.0	—	Ti 5×C–0.70
TP347	S34700	0.08	2.00	0.75	17.0–19.0	9.0–12.0	—	Cb+Ta 10×C–1.00
TP309S	S30908	0.08	2.00	0.75	22.0–24.0	12.0–15.0	—	—
TP310S	S31008	0.08	2.00	0.75	24.0–26.0	19.0–22.0	—	—
S31254	S31254	0.020	1.00	0.80	19.5–20.5	17.5–18.5	6.0–6.5	N 0.18–0.22, Cu 0.50–1.00
N08367	N08367	0.030	2.00	1.00	20.0–22.0	23.5–25.5	6.0–7.0	N 0.18–0.25, Cu 0.75
N08904	N08904	0.020	2.00	1.00	19.0–23.0	23.0–28.0	4.0–5.0	Cu 1.0–2.0

P max: 0.045% (0.030% for S31254/N08926); S max: 0.030% (0.010% for S31254/N08926). All values in weight percent.

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Mechanical Properties

Room-temperature tensile requirements per ASTM A312. Elongation minimum is 35% (longitudinal) / 25% (transverse) for most grades.

Grade	UNS	Tensile Strength min ksi	Tensile Strength min MPa	Yield Strength min ksi	Yield Strength min MPa
TP304	S30400	75	515	30	205
TP304L	S30403	70	485	25	170
TP304H	S30409	75	515	30	205
TP316	S31600	75	515	30	205
TP316L	S31603	70	485	25	170
TP316H	S31609	75	515	30	205
TP317	S31700	75	515	30	205
TP317L	S31703	75	515	30	205
TP321	S32100	75	515	30	205
TP321H	S32109	75	515	30	205
TP347	S34700	75	515	30	205
TP347H	S34709	75	515	30	205
TP309S	S30908	75	515	30	205
TP310S	S31008	75	515	30	205
S31254	S31254	95–98	655–675	45	310
N08367	N08367	95–100	655–690	45	310
N08904	N08904	71	490	31	215

Important Notes on Tensile Requirements

- ✓ TP321 and TP321H seamless pipe with wall thickness > 3/8" [9.5 mm]: reduced yield to 25 ksi [170 MPa] and tensile to 70 ksi [485 MPa]
- ✓ S31254 and N08367 tensile values are thickness-dependent; thinner walls (≤0.187") have higher tensile requirements
- ✓ S31050 tensile properties also vary with wall thickness

✓ Transverse elongation minimum is 25% for all grades except S31050, S32615 (25%) and N08367 (no transverse requirement)

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Heat Treatment

Solution annealing requirements — all pipe must be furnished in the heat-treated condition. Quenching in water or rapid cooling is mandatory.

Grade(s)	Temperature	Cooling Method
TP304, TP304L, TP316, TP316L TP317, TP321, TP347, TP309S, TP310S	1900°F [1040°C] min	Water quench or rapid cool
TP304H, TP316H	1900°F [1040°C] min	Water quench or rapid cool
TP321H, TP347H, TP348H Cold finished	2000°F [1100°C] min	Water quench or rapid cool
TP321H, TP347H, TP348H Hot finished	1925°F [1050°C] min	Water quench or rapid cool
TP309H, TP309HCb, TP310H, TP310HCb	1900°F [1040°C] min	Water quench or rapid cool
S31254, S32654	2100°F [1150°C] min	Water quench or rapid cool
N08367	2025°F [1110°C] min	Water quench or rapid cool
N08904	2000°F [1100°C] min	Water quench or rapid cool
S30815, S31272	1920°F [1050°C] min	Water quench or rapid cool
S30600	2010–2140°F [1100–1170°C]	Water quench or rapid cool

Key Heat Treatment Notes

- ✓ Quenching must be sufficiently rapid to prevent re-precipitation of carbides
- ✓ For low-carbon (L) and stabilized grades (321/347), the ability to pass intergranular corrosion testing (ASTM A262 Practice E) demonstrates proper heat treatment
- ✓ Stabilization heat treatment (per Supplementary Requirement S6) may be applied to Ti/Nb-stabilized grades after solution annealing

Standard Pipe Dimensions

Per ANSI B36.19 — the standardized dimension table for welded and seamless stainless steel pipe. Schedules 5S, 10S, 40S, and 80S.

NPS	OD in	OD mm	Sch 5S in / mm	Sch 10S in / mm	Sch 40S in / mm	Sch 80S in / mm
1/8	0.405	10.3	—	0.049 / 1.24	0.068 / 1.73	0.095 / 2.41
1/4	0.540	13.7	—	0.065 / 1.65	0.088 / 2.24	0.119 / 3.02
1/2	0.840	21.3	0.065 / 1.65	0.083 / 2.11	0.109 / 2.77	0.147 / 3.73
1	1.315	33.4	0.065 / 1.65	0.109 / 2.77	0.133 / 3.38	0.179 / 4.55
1 1/2	1.900	48.3	0.065 / 1.65	0.109 / 2.77	0.145 / 3.68	0.200 / 5.08
2	2.375	60.3	0.065 / 1.65	0.109 / 2.77	0.154 / 3.91	0.218 / 5.54
3	3.500	88.9	0.083 / 2.11	0.120 / 3.05	0.216 / 5.49	0.300 / 7.62
4	4.500	114.3	0.083 / 2.11	0.120 / 3.05	0.237 / 6.02	0.337 / 8.56
6	6.625	168.3	0.109 / 2.77	0.134 / 3.40	0.280 / 7.11	0.432 / 10.97
8	8.625	219.1	0.109 / 2.77	0.148 / 3.76	0.322 / 8.18	0.500 / 12.70
10	10.750	273.1	0.134 / 3.40	0.165 / 4.19	0.365 / 9.27	0.500 / 12.70
12	12.750	323.9	0.156 / 3.96	0.180 / 4.57	0.375 / 9.52	0.500 / 12.70
16	16.000	406.4	0.165 / 4.19	0.188 / 4.78	—	—
20	20.000	508.0	0.188 / 4.78	0.218 / 5.54	—	—
24	24.000	609.6	0.218 / 5.54	0.250 / 6.35	—	—

Wall Thickness Tolerances

- ✓ NPS 1/8"–2 1/2": –12.5% / +20.0% from nominal
- ✓ NPS 3"–18" (t/D ≤ 5%): –12.5% / +22.5%
- ✓ NPS 3"–18" (t/D > 5%): –12.5% / +15.0%
- ✓ NPS 20"+ welded: –12.5% / +17.5%

✓ For minimum-wall orders (Supplementary S8), the wall shall not fall below the specified thickness

7 Testing & Inspection

Mandatory and optional test requirements to ensure product quality and conformance.

Test	Scope	Frequency	Details
Hydrostatic / NDE	Each pipe	100%	Hydrostatic or nondestructive electric test (eddy-current or ultrasonic). Manufacturer's option unless specified. NPS ≥10 may waive hydrotest per purchaser agreement (mark "NH").
Tensile Test	Per lot	1 per 100 pipes	Transverse or longitudinal. Lots >100 pipes: test 2 tubes. Lot = same diameter, wall, heat, and finishing treatment.
Flattening Test	Per lot	5% of batch; min 2	Required for batch furnace heat-treated material. Not required for continuous furnace or direct-quenched material.
Grain Size	H-grade + S32615	Same as flattening	Required for TP309H, TP309HCb, TP310H, TP310HCb, and UNS S32615. Coarse grain ensures high-temperature creep strength.
Weld Decay Test	HCW pipe (optional)	1 per lot (S9)	Boiling 50% HCl test. Weld/base metal corrosion ratio 0.90–1.1. Only when Supplementary S9 is specified.
Intergranular Corrosion	Optional	Per order (S7)	ASTM A262 Practice E. Sensitized condition for low-carbon/stabilized grades; as-shipped for others.

Optional Supplementary Tests

- ✓ **S1:** Product Analysis — chemical check on finished pipe (one per 10 lengths or 10% of heat)
- ✓ **S2:** Transverse Tension — one per 10% of lengths, NPS 8" + only
- ✓ **S3:** Flattening Test — 100% of pipes (one or both ends)
- ✓ **S4:** Etching Tests — macroetch per ASTM E381 to verify homogeneity
- ✓ **S5:** Radiographic Examination — X-ray of entire weld seam (double-welded pipe) per ASME Section VIII UW-51
- ✓ **S6:** Stabilizing Heat Treatment — additional stabilization anneal for Ti/Nb grades
- ✓ **S8:** Minimum Wall Pipe — guaranteed wall not below specified thickness

Ordering Information

Essential information to include when placing an order for ASTM A312 pipe. Clear specifications ensure you get exactly what you need.

Required Information (Must Specify)

- ✓ **Quantity:** Total footage or number of lengths
- ✓ **Material:** Grade (e.g., TP304, TP316L, S31254)
- ✓ **Manufacturing Process:** Seamless (SML) or Welded (WLD) or HCW
- ✓ **Size:** NPS designation and schedule number (e.g., NPS 4 SCH 40S) or OD × wall thickness
- ✓ **Length:** Specific cut lengths or standard random (15–24 ft for NPS 1/8"–8")
- ✓ **Unit System:** Specify "A312" (inch-pound) or "A312M" (metric)

Optional Requirements (Specify If Needed)

- ✓ Supplementary requirements S1 through S9
- ✓ Hydrostatic vs. NDE test preference (eddy-current "ET" or ultrasonic "UT")
- ✓ Intergranular corrosion testing (ASTM A262 Practice E)
- ✓ Specific marking requirements (e.g., weight marking for NPS >4)
- ✓ End finish / bevel requirements
- ✓ Level of preservation and packing
- ✓ Certification and test report requirements

Example Order Description

ASTM A312/A312M Pipe – TP316L – NPS 6 – SCH 40S – SMLS

Quantity: 500 ft – Random lengths 15–24 ft – With MTR Certification

Key Takeaways

Standard Pipe Sizes

Available NPS 1/8" through 30" in Schedules 5S/10S/40S/80S per ANSI B36.19. Seamless typically stocked to 12" NPS.

"L" vs "H" Grades

L = Low Carbon ($\leq 0.035\%$ C): prevents weld sensitization.

H = High Carbon (0.04–0.10% C): enhanced high-temperature creep strength.

Stabilized Grades

TP321 (Ti-stabilized) and TP347 (Nb-stabilized) resist intergranular corrosion after welding. Preferred for service in the 800–1500°F sensitization range.

Marking

Each pipe marked with: NPS/schedule, grade, heat number, SML/WLD/HCW, manufacturer ID, and test method (NH/ET/UT).

Important Disclaimer

This guide is a condensed summary for customer reference only. It does not replace the full ASTM A312/A312M standard. Always refer to the latest official ASTM standard for complete requirements, detailed testing procedures, and regulatory compliance. For specific applications, consult with your engineering team and material supplier.

Reference: ASTM A312/A312M — Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes

This guide is for informational purposes. Always consult the latest official ASTM standard.