



Standard Specification for Single- or Double-Welded Austenitic Stainless Steel Pipe¹

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^{ε1} NOTE—The Celsius conversion in 5.2.4 was added editorially in May 1996.

^{ε2} NOTE—The UNS designation N08367 was added to 5.2.1 in July 1996.

1. Scope

1.1 This specification covers two classes of fit-up and alignment quality straight-seam single- or double-welded austenitic steel pipe intended for high-temperature and general corrosive service.

NOTE 1—When the impact test criterion for a low-temperature service would be 15 ft-lbf [20 J] energy absorption or 15 mils [0.38 mm] lateral expansion, some of the austenitic stainless steel grades covered by this specification are accepted by certain pressure vessel or piping codes without the necessity of making the actual test. For example, Grades 304, 304L, and 347 are accepted by the ASME Pressure Vessel Code, Section VIII Division 1, and by the Chemical Plant and Refinery Piping Code, ANSI B31.3 for service at temperatures as low as -425°F [-250°C] without qualification by impact tests. Other AISI stainless steel grades are usually accepted for service temperatures as low as -325°F [-200°C] without impact testing. Impact testing may, under certain circumstances, be required. For example, materials with chromium or nickel content outside the AISI ranges, and for material with carbon content exceeding 0.10 %, are required to be impact tested under the rules of ASME Section VIII Division 1 when service temperatures are lower than -50°F [-45°C].

1.2 Grades TP304H, TP304N, TP316H, TP316N, TP321H, TP347H, and TP348H are modifications of Grades TP304, TP316, TP321, TP347, and TP348, and are intended for high-temperature service.

1.3 Two classes of pipe are covered as follows:

1.3.1 *Class SW*—Pipe, single-welded with no addition of filler metal and

1.3.2 *Class DW*—Pipe, double-welded with no addition of filler metal.

1.4 Optional supplementary requirements are provided for pipe where a greater degree of testing is desired. These supplementary requirements call for additional tests to be made and, when desired, one or more of these may be specified in the order.

1.5 Table 1 lists the dimensions of welded stainless steel pipe as shown in ANSI B36.19. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification.

1.6 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order.

2. Referenced Documents

2.1 ASTM Standards:

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels²

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²

A 530/A 530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe³

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products^{2,3}

E 381 Method of Macroetch Testing, Inspection, and Rating Steel Products, Comprising Bars, Billets, Blooms, and Forgings⁴

E 527 Practice for Numbering Metals and Alloys (UNS)³

2.2 ANSI Standards:

B1.20.1 Pipe Threads, General Purpose⁵

B36.10 Welded and Seamless Wrought Steel Pipe⁵

B36.19 Stainless Steel Pipe⁵

2.3 ASME Boiler and Pressure Vessel Code:

Section VIII Division 1, Pressure Vessels⁶

3. Ordering Information

3.1 Orders for material under this specification should include the following as required, to describe the desired material adequately:

3.1.1 Quantity (feet, centimetres, or number of lengths),

¹ This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.10 on Steel Tubing.

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² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 01.01.

⁴ Annual Book of ASTM Standards, Vol 03.03.

⁵ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

⁶ Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

TABLE 1 Dimensions of Welded and Seamless Stainless Steel Pipe^A

NOTE 1—Table 1 is based on Table 1 of the American National Standard for Stainless Steel Pipe (ANSI B36.19-1965).

NOTE 2—The decimal thickness listed for the respective pipe sizes represents their nominal or average wall dimensions.

NPS Designator	Outside Diameter		Nominal Wall Thickness							
	in.	mm	Schedule 5S ^B		Schedule 10S ^B		Schedule 40S		Schedule 80S	
			in.	mm	in.	mm	in.	mm	in.	mm
1/8	0.405	10.29	...	...	0.049 ^C	1.24	0.068	1.73	0.095	2.41
1/4	0.540	13.72	...	...	0.065 ^C	1.65	0.088	2.24	0.119	3.02
3/8	0.675	17.15	...	...	0.065 ^C	1.65	0.091	2.31	0.126	3.20
1/2	0.840	21.34	0.065 ^C	1.65	0.083 ^C	2.11	0.109	2.77	0.147	3.73
3/4	1.050	26.67	0.065 ^C	1.65	0.083 ^C	2.11	0.113	2.87	0.154	3.91
1.0	1.315	33.40	0.065 ^C	1.65	0.109 ^C	2.77	0.133	3.38	0.179	4.55
1 1/4	1.660	42.16	0.065 ^C	1.65	0.109 ^C	2.77	0.140	3.56	0.191	4.85
1 1/2	1.900	48.26	0.065 ^C	1.65	0.109 ^C	2.77	0.145	3.68	0.200	5.08
2	2.375	60.33	0.065 ^C	1.65	0.109 ^C	2.77	0.154	3.91	0.218	5.54
2 1/2	2.875	73.03	0.083	2.11	0.120 ^C	3.05	0.203	5.16	0.276	7.01
3	3.500	88.90	0.083	2.11	0.120 ^C	3.05	0.216	5.49	0.300	7.62
3 1/2	4.000	101.60	0.083	2.11	0.120 ^C	3.05	0.226	5.74	0.318	8.08
4	4.500	114.30	0.083	2.11	0.120 ^C	3.05	0.237	6.02	0.337	8.56
5	5.563	141.30	0.109 ^C	2.77	0.134 ^C	3.40	0.258	6.55	0.375	9.52
6	6.625	168.28	0.109	2.77	0.134 ^C	3.40	0.280	7.11	0.432	10.97
8	8.625	219.08	0.109 ^C	2.77	0.148 ^C	3.76	0.322	8.18	0.500	12.70
10	10.750	273.05	0.134 ^C	3.40	0.165 ^C	4.19	0.365	9.27	0.500 ^C	12.70 ^C
12	12.750	323.85	0.156 ^C	3.96	0.180 ^C	4.57	0.375 ^C	9.52 ^C	0.500 ^C	12.70 ^C
14	14.000	355.60	0.156 ^C	3.96	0.188	4.78	...	...	...	...
16	16.000	406.40	0.165 ^C	4.19	0.188	4.78	...	...	...	...
18	18.000	457.20	0.165 ^C	4.19	0.188	4.78	...	...	...	...
20	20.000	508.00	0.188 ^C	4.78	0.218 ^C	5.54	...	...	...	...
22	22.000	558.80	0.188 ^C	4.78	0.218 ^C	5.54	...	...	...	...
24	24.000	609.60	0.218 ^C	5.54	0.250	6.35	...	...	...	...
30	30.000	762.00	0.250	6.35	0.312	7.92	...	...	...	...

^AFor pipe sizes not listed, the dimensions and tolerances shall be by agreement between the purchaser and producer.

^BSchedules 5S and 10S wall thicknesses do not permit threading in accordance with the American National Standard for Pipe Threads (ANSI B1.20.1).

^CThese do not conform to the American National Standard for Welded and Seamless Wrought Steel Pipe (ANSI B36.10-1979).

- 3.1.2 Name of material (austenitic steel pipe),
- 3.1.3 Class (1.3). If not specified by the purchaser, the producer shall have the option to furnish either single-welded (SW) or double-welded (DW) pipe,
- 3.1.4 Grade (Table 2),
- 3.1.5 Size (NPS or outside diameter and schedule number or average wall thickness),
- 3.1.6 Length (specific or random), (Section 9),
- 3.1.7 End finish (section on Ends of Specification A 530/A 530M),
- 3.1.8 Optional requirements (Section 8), (Supplementary Requirements S1 to S8),
- 3.1.9 Test report required (Section on Certification of Specification A 530/A 530M),
- 3.1.10 Specification number, and
- 3.1.11 Special requirements or exceptions to the specification.

4. Materials and Manufacture

4.1 Manufacture:

- 4.1.1 The pipe shall be made by a machine-welding or an automatic-welding process, welding from one or both sides and producing full penetration welds with no addition of filler metal in the welding operation.
- 4.1.2 Weld repairs, with the addition of compatible filler metal, may be made to the weld joint in accordance with the requirements of the section on Repair by Welding of Specification A 530/A 530M.
- 4.1.3 The pipe shall be pickled free of scale. When bright

annealing is used, pickling is not necessary.

4.2 Heat Treatment:

4.2.1 Except as provided in 4.2.5 and 4.2.6, all pipe shall be furnished in the heat-treated condition, except pipe sizes over NPS 6 may be furnished in the unheat-treated condition when specified in the order. When the pipe is furnished without final heat treatment, each pipe shall be marked HT-O and when a material test report for such pipe is furnished to the purchaser, the report shall indicate that the pipe has not been heat-treated. The heat-treatment procedure, except for H grades, N08367, and S31254, shall consist of heating the pipe to a minimum temperature of 1900°F [1040°C] and quenching in water or rapidly cooling by other means.

4.2.2 All H grades shall be furnished in the solution-treated condition. If cold working is involved in processing, the minimum solution treating temperature for Grades TP321H, TP347H, and TP348H shall be 2000°F [1100°C] and for Grades TP304H and TP316H, 1900°F [1040°C]. If the H Grade is hot rolled, the minimum solution treating temperatures for Grades TP321H, TP347H, and TP348H shall be 1925°F [1050°C], and for Grades TP304H and TP316H, 1900°F [1040°C].

4.2.3 The heat-treatment procedure for S31254 shall consist of heating the pipe to a minimum temperature of 2100°F [1150°C] and quenching in water or rapidly cooling by other means.

4.2.4 UNS N08367 should be solution annealed from 2025°F [1107°C] minimum followed by rapid quenching.

TABLE 2 Chemical Requirements

Grade	UNS Designation ^A	Composition, %														
		Carbon, max ^B	Manganese, max ^B	Phosphorus, max	Sulfur, max	Silicon	Nickel	Chromium	Molybdenum	Titanium	Columbium plus Tantalum	Tantalum, max	Nitrogen ^C	Vanadium	Copper	Cerium
TP304	S30400	0.08	2.00	0.045	0.030	0.75 max	8.00–11.0	18.0–20.0	...	...	...	...	...	...	...	...
TP304H	S30409	0.04–0.10	2.00	0.045	0.030	0.75 max	8.00–11.0	18.0–20.0	...	...	...	...	...	...	...	...
TP304L	S30403	0.035 ^D	2.00	0.045	0.030	0.75 max	8.00–13.0	18.0–20.0	...	...	...	...	...	...	...	...
TP304N	S30451	0.08	2.00	0.045	0.030	0.75 max	8.00–11.0	18.0–20.0	...	...	...	0.10–0.16	...	...	...	...
TP304LN	S30453	0.035	2.00	0.045	0.030	0.75 max	8.00–11.0	18.0–20.0	...	...	...	0.10–0.16	...	...	...	...
TP309Cb	S30940	0.08	2.00	0.045	0.030	0.75 max	12.00–16.00	22.00–24.00	...	10 × C min, 1.10 max	...	...	...	0.75 max	...	...
TP309S	S30908	0.08	2.00	0.045	0.030	0.75 max	12.00–15.00	22.00–24.00	...	10 × C min, 1.10 max	...	...	...	0.75 max	...	...
TP310Cb	S31040	0.08	2.00	0.045	0.030	0.75 max	19.00–22.00	24.00–26.00	...	10 × C min, 1.10 max	...	...	...	0.75 max	...	...
TP310S	S31008	0.08	2.00	0.045	0.030	0.75 max	19.00–22.00	24.00–26.00	...	...	...	...	...	0.75 max	...	...
TP316	S31600	0.08	2.00	0.045	0.030	0.75 max	10.0–14.0	16.0–18.0	...	...	...	...	...	...	...	...
TP316H	S31609	0.04–0.10	2.00	0.045	0.030	0.75 max	10.0–14.0	16.0–18.0	...	...	...	...	...	...	...	...
TP316L	S31603	0.035 ^D	2.00	0.045	0.030	0.75 max	10.0–15.0	16.0–18.0	...	...	...	...	...	...	...	...
TP316N	S31651	0.08	2.00	0.045	0.030	0.75 max	10.0–14.0	16.0–18.0	...	...	...	0.10–0.16	...	...	...	...
TP316LN	S31653	0.035	2.00	0.045	0.030	0.75 max	10.0–14.0	16.0–18.0	...	...	...	0.10–0.16	...	...	...	...
TP317	S31700	0.08	2.00	0.045	0.030	0.75 max	11.0–14.0	18.0–20.0	...	...	...	...	...	...	...	...
TP317L	S31703	0.035	2.00	0.045	0.030	0.75 max	11.0–15.0	18.0–20.0	...	...	...	...	...	...	...	...
TP321	S32100	0.08	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	E	...	...	...	...	...	...
TP321H	S32109	0.04–0.10	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	F	...	...	...	...	...	...
TP347	S34700	0.08	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	G	...	...	...	...	...	...
TP347H	S34709	0.04–0.10	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	H	...	...	...	...	...	...
TP348	S34800	0.08	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	G	0.10	...	...	...	...	...
TP348H	S34809	0.04–0.10	2.00	0.045	0.030	0.75 max	9.00–13.0	17.0–20.0	...	H	0.10	...	...	...	...	...
TPXM-10	S21900	0.08	8.00–10.00	0.040	0.030	1.00 max	5.50–7.50	19.00–21.50	...	...	...	0.15–0.40	...	...	...	...
TPXM-11	S21903	0.04	8.00–10.00	0.040	0.030	1.00 max	5.50–7.50	19.00–21.50	...	...	...	0.15–0.40	...	...	...	...
TPXM-15	S38100	0.08	2.00	0.030	0.030	1.50–2.50	17.50–18.50	17.0–19.0	...	...	...	...	...	...	...	...
TPXM-19	S20910	0.060	4.00–6.00	0.040	0.030	1.00 max	11.50–13.50	20.50–23.50	...	...	0.10–0.30	...	0.10–0.30	...	...	...
TPXM-29	S24000	0.080	11.50–14.50	0.060	0.030	1.00 max	2.25–3.75	17.0–19.0	...	...	...	...	...	...	...	...
...	S31254	0.020	1.00	0.030	0.010	0.80 max	17.50–18.50	19.50–20.50	...	...	...	...	...	0.50–1.00	...	...
...	S30815	0.10	0.80	0.040	0.030	1.40–2.00	10.0–12.0	20.0–22.0	...	...	...	...	...	...	...	0.03–0.08
...	N08367	0.030	2.00	0.040	0.030	1.00 max	23.50–25.50	20.00–22.00	...	...	...	...	...	...	0.75 max	...

^ANew designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).
^BMaximum, unless otherwise indicated.
^CThe method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.
^DFor small diameter or thin walls or both, where many drawing passes are required, a carbon maximum of 0.040 % is necessary in grades TP304L and TP316L. Small outside diameter tubes are defined as those less than 0.500 in. [12.7 mm] in outside diameter and light wall tubes as those less than 0.049 in. [1.2 mm] in average wall thickness (0.044 in. [1.1 mm] in minimum wall thickness).
^EThe titanium content shall be not less than five times the carbon content and not more than 0.70 %.
^FThe titanium content shall be not less than four times the carbon content and not more than 0.60 %.
^GThe columbium plus tantalum content shall be not less than ten times the carbon content and not more than 1.00 %.
^HThe columbium plus tantalum content shall be not less than eight times the carbon content and not more than 1.0 %.