

1. Scope *

1.1 This specification covers seamless austenitic steel pipe intended for high-temperature central-station service. Among the grades covered are five H grades and two nitrogen grades (304N and 316N) that are specifically intended for high temperature service.

1.2 Optional supplementary requirements (S1 through S10) are provided. These supplementary requirements specify additional tests that will be made only when stated in the order, together with the number of such tests required.

1.3 Grades TP321 and TP321H have lower strength requirements for nominal wall thicknesses greater than 3/8 in. [9.5mm].

1.4 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.

NOTE 1—The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as "nominal diameter," "size," and "nominal size."

2. Referenced Documents

2.1 ASTM Standards:

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels³

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys⁴

A 999/A 999M Specification for General Requirements for Alloy and Stainless Steel Pipe⁴

E 112 Test Methods for Determining Average Grain Size⁵

E 213 Practice for Ultrasonic Examination of Metal Pipe and Tubing⁶

E 381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings⁵

E 426 Practice for Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel, and Similar Alloys⁶

2.2 ASME Boiler and Pressure Vessel Code: Section IX Welding Qualifications⁷

2.3 Other Standards:

SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing⁸

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology A 941.

4. Ordering Information

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

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

4.1.2 Name of material (seamless austenitic steel pipe),

4.1.3 Grade (Table 1),

4.1.4 Size (nominal size, or outside diameter and schedule number or average wall thickness),

4.1.5 Lengths (specific or random), (Permissible Variations in Length Section of Specification A 999/A 999M),

4.1.6 End finish (Ends Section of Specification A 999/A 999M),

4.1.7 Optional requirements (Section 9) (see Hydrostatic Test Requirements Section and the Permissible Variation in Weight for Seamless Pipe Section for weighing individual lengths, of Specification A 999/A 999M), (see 10.6, repairing by welding; 14.3, die stamping),

TABLE 1 Chemical Requirements

Grade	UNS	Carbon	Manganese,max	Phosphorus,max	Sulfur,max	Silicon,max	Nickel	Chromium	Molybdenum	Titanium	Columbium	Tantalum	Nitrogen ^A	Others
TP304	S30400	0.08max	2.00	0.045	0.030	0.75	8.0–11.0	18.0–20.0	...	....	....	...	...	...
TP304H	S30409	0.04–0.10	2.00	0.045	0.030	0.75	8.0–11.0	18.0–20.0	...	...	...	....	...	..
TP304N	S30451	0.08 max	2.00	0.045	0.030	0.75	8.0–11.0	18.0–20.0	...	...	...	...	0.10–0.16	...
TP304LN	S30453	0.035 max	2.00	0.045	0.030	0.75	8.0–11.0	18.0–20.0	...	...	...	0.10–0.16	...	...
TP316	S31600	0.08 max	2.00	0.045	0.030	0.75	11.0–14.0	16.0–18.0	2.00–3.00	...	...	...	...	...
TP316H	S31609	0.04–0.10	2.00	0.045	0.030	0.75	11.0–14.0	16.0–18.0	2.00–3.00	...	...	...	...	...
TP316N	S31651	0.08 max	2.00	0.045	0.030	0.75	11.0–14.0	16.0–18.0	2.00–3.00	...	...	...	0.10–0.16	...
TP316LN	S31653	0.035 max	2.00	0.045	0.030	0.75	11.0–14.0	16.0–18.0	2.00–3.00	...	...	...	0.10–0.16	...
TP321	S32100	0.08 max	2.00	0.045	0.030	0.75	9.0–13.0	17.0–19.0	...	B	...	....	....	...
TP321H	S32109	0.04–0.10	2.00	0.045	0.030	0.75	9.0–13.0	17.0–19.0	...	C	...	...	...	...
TP347	S34700	0.08 max	2.00	0.045	0.030	0.75	9.0–13.0	17.0–19.0	...	...	D	...	...	...
TP347H	S34709	0.04–0.10	2.00	0.045	0.030	0.75	9.0–13.0	17.0–19.0	...	...	E	...	...	...
TP348F	S34800	0.08 max	2.00	0.045	0.030	0.75	9.0–13.0	17.0–19.0	...	...	D	0.10	... Co 0.20 max	...
16-8-2H	S16800	0.05–0.10	2.00	0.045	0.030	0.75	7.5–9.5	14.5–16.5	1.50–2.00	...	...	...	...	....
...	S31725	0.030 max	2.00	0.045	0.030	0.75	13.5–17.5	18.0–20.0	4.0–5.0	...	....	0.20 max	Cu 0.75 max	...
...	S31726	0.030 max	2.00	0.045	0.030	0.75	14.5–17.5	17.0–20.0	4.0–5.0	...	...	...	0.10–0.20	Cu 0.75 max
...	S34565	0.030 max	5.0–7.0	0.030	0.010	1.0	16.0–18.0	23.0–25.0	4.0–5.0	...	...	...	0.040–0.060	Cb 0.10 max

A The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.

B The titanium content shall be not less than five times the carbon content and not more than 0.70 %.

C The titanium content shall be not less than four times the carbon content and not more than 0.70 %.

D The columbium content shall be not less than ten times the carbon content and not more than 1.10 %.

E The columbium content shall be not less than eight times the carbon content and not more than 1.10 %.

F This grade is intended for special purpose applications.

Tensile and Hardness Requirements

Grade	Tensile Strength min, ksi (MPa)	Yield Strength min, ksi (MPa)	Elongation in 2 in. or 50 mm (or 4D) min, %	
			Longitudinal	Transverse
TP304, TP304H, TP304LN, TP316, TP316H, TP316LN, TP347, TP347H, TP348, 16-8-2H, S31725	75 (515)	30 (205)	35	25
TP304N, TP316N, S31726	80(550)	35(240)	35	25
S34565	115(790)	60(415)	35	30
TP321, 321H #3/89	75(515)	30(205)	35	25
>3/89B	70(480)	25(170)	25	25

A † For grade TP304, NPS8 or larger, and in schedules 140 and heavier, the required minimum tensile strength shall be 70 ksi [480 MPa].

B Prior to the issuance of A 376/A 376M – 88, the tensile and yield strength values were 75 [520] and 30 [210] respectively, for nominal wall greater than 3/8 in. [9.5 mm].

† Editorially corrected.