Designation: ~~A269 – 10~~ A269 – 13

Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service[1]

This standard is issued under the fixed designation A269; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers grades of nominal-wall-thickness, stainless steel tubing for general corrosion-resisting and low- or high-temperature service, as designated in Table 1.

1.2 The tubing sizes and thicknesses usually furnished to this specification are ¼ in. (6.4 mm) in inside diameter and larger and 0.020 in. (0.51 mm) in nominal wall-thickness and heavier.

1.3 Mechanical property requirements do not apply to tubing smaller than ⅛ in. (3.2 mm) in inside diameter or 0.015 in. (0.38 mm) in thickness.

NOTE 1—Additional testing requirements may apply for use in ASME B31.3 applications.

1.4 Optional supplementary requirements are provided and, when one or more of these are desired, each shall be so stated in the order.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A480/A480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A632 Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service

A1016/A1016M Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *ASME Piping Code:*

ASME B31.3 Process Piping[3]

2.3 *Other Standard:*

SAE J1086 Practice for Numbering Metals and Alloys (UNS)[4]

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, metres, or number of lengths),

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[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.10 on Stainless and Alloy Steel Tubular Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

***A Summary of Changes section appears at the end of this standard**

TABLE 1 Chemical Requirements %

Grade	Composition, %															
	TP 201	TP 201LN	TP 304	TP 304L	TP 304LN	TP 316	TP 316L	TP 316LN	TP 317	TP 321	TP 347	TP 348	TP XM-10	TP XM-11	TP XM-15	TP XM-19
UNS Designation[A]	S20100	S20153	S30400	S30403	S30453	S31600	31603	S31653	S31700	S32100	S34700	S34800	S21900	S21904	S38100	S20910
Carbon	0.15 max	0.03 max	0.08 max	0.035 max[B]	0.035 max[B]	0.08 max	0.035 max[B]	0.035 max[B]	0.08 max	0.08 max	0.08 max	0.08 max	0.08 max	0.04 max	0.08 max	0.06 max
Manganese, max[C]	5.5–7.5	6.4–7.5	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	8.00–10.00	8.00–10.00	2.00	4.0–6.0
Phosphorus, max.	0.060	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.030	0.045
Sulfur, max.	0.030	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Silicon[C]	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.50–2.50	1.00
Nickel	3.5–5.5	4.0–5.0	8.0–11.0	8.0–12.0	8.0–11.0	10.0–14.0	10.0–15.0	10.0–13.0	11.0–15.0	9.0–12.0	9.0–12.0	9.0–12.0	5.5–7.5	5.5–7.5	17.5–18.5	11.5–13.5
Chromium	16.0–18.0	16.0–17.5	18.0–20.0	18.0–20.0	18.0–20.0	16.0–18.0	16.0–18.0	16.0–18.0	18.0–20.0	17.0–19.0	17.0–19.0	17.0–19.0	19.0–21.5	19.0–21.5	17.0–19.0	20.5–23.5
Molybdenum	. . .	. . .	. . .	. . .	. . .	2.00–3.00	2.00–3.00	2.00–3.00	3.0–4.0	. . .	. . .	. . .	. . .	. . .	. . .	1.50–3.00
Titanium	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	[D]	. . .	. . .	. . .	. . .	. . .	. . .
Columbium	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	10 × C min 1.10 max	[E]	. . .	. . .	. . .	0.10–0.30
Tantalum, max	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.10	. . .	. . .	. . .	. . .
Nitrogen[F]	0.25	0.10–0.25	. . .	. . .	0.10–0.16	. . .	. . .	0.10–0.16	. . .	. . .	. . .	. . .	0.15–0.40	0.15–0.40	. . .	0.20–0.40
Vanadium	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .			. . .	0.10–0.30
Copper	. . .	1.00	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Others	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	Co 0.20 max	. . .	. . .	. . .	. . .

Grade	Composition, %												
	TP XM-29	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
UNS Designation[A]	S24000	S31254	S31725	S31726	S31727	S32053	S30600[A]	S32654	S34565	S35045	N08367	N08926	N08904
Carbon	0.08 max	0.020 max	0.035 max	0.035 max	0.030 max	0.030 max	0.018 max	0.020 max	0.030 max	0.06–0.10	0.030 max	0.020 max	0.020 max
Manganese, max[C]	11.5–14.5	1.00	2.00	2.00	1.00	1.00	2.0	2.0–4.0	5.0–7.0	1.50	2.00	2.00	2.00
Phosphorus, max.	0.060	0.030	0.045	0.045	0.030	0.030	0.020	0.030	0.030	0.045	0.040	0.030	0.040
Sulfur, max.	0.030	0.015	0.030	0.030	0.030	0.010	0.020	0.005	0.010	0.015	0.030	0.010	0.030
Silicon[C]	1.00	0.80	1.00	1.00	1.00	1.00	3.7–4.3	0.50	1.00	1.00	1.00	0.50	1.00
Nickel	2.3–3.7	17.5–18.5	13.5–17.5	14.5–17.5	14.5–16.5	24.0–26.0	14.0–15.5	21.0–23.0	16.0–18.0	32.0–37.0	23.5–25.5	24.0–26.0	23.0–28.0
Chromium	17.0–19.0	19.5–20.5	18.0–20.0	17.0–20.0	17.5–19.0	22.0–24.0	17.0–18.5	24.0–25.0	23.0–25.0	25.0–29.0	20.0–22.0	19.0–21.0	19.0–23.0
Molybdenum	...	6.0–6.5	4.0–5.0	4.0–5.0	3.8–4.5	5.0–6.0	0.20 max	7.0–8.0	4.0–5.0		6.0–7.0	6.0–7.0	4.0–5.0
Titanium	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.15–0.60	. . .	. . .	. . .
Columbium	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	0.10 max	. . .	. . .	. . .	. . .
Tantalum, max	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
~~Nitrogen[E]~~	~~0.20–0.40~~	~~0.18–0.22~~	~~0.20 max~~	~~0.10–0.20~~	~~0.15–0.21~~	~~0.17–0.22~~		~~0.45–0.55~~	~~0.40–0.60~~	~~. . .~~	~~0.18–0.25~~	~~0.15–0.25~~	~~0.10 max~~
Nitrogen[F]	0.20–0.40	0.18–0.25	0.20 max	0.10–0.20	0.15–0.21	0.17–0.22		0.45–0.55	0.40–0.60	. . .	0.18–0.25	0.15–0.25	0.10 max
Vanadium	. . .		. . .	. . .	. . .	. . .		. . .		. . .	. . .	. . .	. . .
Copper	. . .	0.50–1.00	. . .	. . .	2.8–4.0	. . .	0.50 max	0.30–0.60	. . .	0.75	0.75 max	0.50–1.50	1.00–2.00
Others	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	Al 0.15–0.60	. . .	. . .	. . .

[A] New designation established in accordance with Practice E527 and SAE J1086.
[B] For small diameter or thin walls, or both, where many drawing passes are required, a carbon maximum of 0.040 % is necessary in grades TP 304L, TP 304LN, 316L and 316LN. Small outside diameter tubes are defined as those with less than 0.500 in. [12.7 mm] in outside diameter and light walls are those less than 0.049 in. [1.2 mm] in minimum wall thickness.
[C] Maximum, unless otherwise indicated.
[D] Grade TP 321 shall have a titanium content of not less than five times the sum of the carbon and nitrogen content and not more than 0.70 %.
[E] Grade TP 348 shall have a columbium plus tantalum content of not less than ten times the carbon content and not more than 1.10 %.
[F] The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.

3.1.2 Name of material (seamless or welded tubes),
3.1.3 Grade (Table 1),
3.1.4 Size (outside diameter and nominal wall thickness),
3.1.5 Length (specific or random),
3.1.6 Optional requirements (heat treatment, see Section 6; hydrostatic or nondestructive electric test, see Section 10),
3.1.7 Test report required (see Section on Inspection of Specification A1016/A1016M),
3.1.8 Specification designation, and
3.1.9 Special requirements and any supplementary requirements selected.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A1016/A1016M, unless otherwise provided herein.

5. Manufacture

5.1 The tubes shall be made by the seamless or welded process.

5.2 At the manufacturer's option, tubing may be furnished either hot finished or cold finished.

6. Heat Treatment

6.1 All material shall be furnished in the heat-treated condition. Except as provided in 6.2, the heat-treatment procedure shall, except for S31254 and S32654 (see 6.3), S34565 (see 6.4), N08367 (see 6.8), N08904 (see 6.5) and N08926 (see 6.7), consist of heating the material to a minimum temperature of 1900 °F (1040 °C) and quenching in water or rapidly cooling by other means. Alternatively, for seamless tubes, immediately following hot forming while the temperature of the tubes is not less than the specified minimum solution treatment temperature, tubes may be individually quenched in water or rapidly cooled by other means.

6.2 Controlled structural or special service characteristics shall be specified as a guide for the most suitable heat treatment. If the final heat treatment is at a temperature under 1900 °F and is so specified on the order, each tube shall be stenciled with the final heat treatment temperature in degrees Fahrenheit after the suffix "HT".

6.3 S31254 and S32654 shall be heat-treated to a minimum temperature of 2100 °F (1150 °C) followed by quenching in water or rapidly cooling by other means.

6.4 S34565 shall be heat-treated in the range 2050 °F (1120 °C) to 2140 °F (1170 °C) followed by quenching in water or rapidly cooling by other means.

6.5 N08904 shall be heat treated to a minimum temperature of 2000 °F (1100 °C) followed by quenching in water or rapidly cooling by other means.

6.6 A solution annealing temperature above 1950 °F (1065 °C) may impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in TP321, TP347, and TP348. When specified by the purchaser, a lower temperature stabilization or re-solution anneal shall be used subsequent to the initial high temperature solution anneal (see Supplementary Requirement S3).

6.7 N08926 shall be heat-treated to a minimum temperature of 2010 °F (1100 °C) followed by quenching in water or rapidly cooling by other means.

6.8 UNS N08367 should be solution annealed from 2025 °F (1107 °C) minimum followed by rapid quenching.

6.9 Solution annealing of S35045 shall consist of heating the material to a temperature of 2000 °F (1093 °C) minimum for an appropriate time, followed by cooling in still air or at a faster rate.

6.10 S31727 and S32053 shall be solution annealed in the range 1975 to 2155 °F (1080 to 1180 °C) followed by quenching in water or rapidly cooling by other means.

7. Chemical Composition

7.1 The steel shall conform to the requirements as to chemical composition as prescribed in Table 1.

8. Product Analysis

8.1 An analysis of either one billet or one length of flat-rolled stock or one tube shall be made from each heat. The chemical composition thus determined shall conform to the requirements specified.

8.2 A product analysis tolerance of Table number A1.1 in Specification A480/A480M shall apply. The product analysis tolerance is not applicable to the carbon content for material with a specified maximum carbon of .04 % or less.

8.3 If the original test for product analysis fails, retests of two additional billets, lengths of flat-rolled stock, or tubes shall be made. Both retests for the elements in question shall meet the requirements of the specification; otherwise all remaining material