



## Designation: ~~A269/A269M—15a (Reapproved 2019)~~ A269/A269M – 22

# Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service<sup>1</sup>

This standard is issued under the fixed designation A269/A269M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. ~~Scope~~ 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  $\frac{1}{4}$  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  $\frac{1}{8}$  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 either SI units or inch-pound units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. The inch-pound units shall apply unless the “M” designation of this specification is specified in the order.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 *ASTM Standards:*<sup>2</sup>

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

**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

<sup>1</sup> 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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<sup>2</sup> 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.

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



TABLE 1 Chemical Requirements<sup>C</sup> %

Grade	Composition, %																
	TP 201	TP 201LN	TP 304	TP 304L	TP 304LN	TP 316	TP 316L	TP 316LN	TP 317	TP 31730	TP 321	TP 347	TP 348	TP XM-10	TP XM-11	TP XM-15	TP XM-19
UNS Designation <sup>A</sup>	S20100	S20153	S30400	S30403	S30453	S31600	31603	S31653	S31700	S31730	S32100	S34700	S34800	S21900	S21904	S38100	S20910
Carbon	0.15	0.03	0.08	0.035 <sup>B</sup>	0.035 <sup>B</sup>	0.08	0.035 <sup>B</sup>	0.035 <sup>B</sup>	0.030	0.030	0.08	0.08	0.08	0.08	0.04	0.08	0.06
Manganese	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	2.00	8.00–10.00	8.00–10.00	2.00	4.0–6.0
Phosphorus	0.060	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.040	0.045	0.045	0.045	0.045	0.045	0.030	0.045
Sulfur	0.030	0.015	0.030	0.030	0.030	0.030	0.030	0.030	0.015	0.010	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Silicon	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	1.00	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	8.0–9.5	15.0–16.5	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	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	0.5–1.5	3.0–4.0	...	...	...	...	...	...	1.50–3.00
Titanium	...	...	...	...	...	...	...	...	...	...	<i>D</i>	...	...	...	...	...	...
Columbium	...	...	...	...	...	...	...	...	...	...	...	10 x C min 1.10 max	<i>E</i>	...	...	...	0.10–0.30
Tantalum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nitrogen <sup>F</sup>	0.25	0.10–0.25	...	0.10–0.16	...	...	...	0.10–0.16	0.14–0.25	0.45	...	...	...	0.15–0.40	0.15–0.40	...	0.20–0.40
Vanadium	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.10–0.30
Copper	...	1.00	...	...	...	...	...	...	1.00	4.0–5.0	...	...	Co 0.20 max	...	...	...	...
Others	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...



Grade	Composition, %															
	TP XM-29	S31254	S31266	S31725	S31726	S31727	S32053	S30600 <sup>A</sup>	S32654	S34565	S35045	S35090	N08367	N08925	N08926	N08904
UNS Designation <sup>A</sup>	S24000	S31254	S31266	S31725	S31726	S31727	S32053	S30600 <sup>A</sup>	S32654	S34565	S35045	S35090	N08367	N08925	N08926	N08904
Carbon	0.08	0.020	0.030 max	0.035	0.035	0.030	0.030	0.018	0.020	0.030	0.06– 0.10	0.05–0.10	0.030	0.020	0.020	0.020
Manganese	11.5– 14.5	1.00	2.00–4.00	2.00	2.00	1.00	1.00	2.0	2.0– 4.0	5.0– 7.0	1.50	1.50	2.00	1.00	2.00	2.00
Phosphorus	0.060	0.030	0.035	0.045	0.045	0.030	0.030	0.020	0.030	0.030	0.045	0.030	0.040	0.045	0.030	0.040
Sulfur	0.030	0.015	0.020	0.030	0.030	0.030	0.010	0.020	0.005	0.010	0.015	0.015	0.030	0.030	0.010	0.030
Silicon	1.00	0.80	1.00	1.00	1.00	1.00	1.00	3.7–4.3	0.50	1.00	1.00	0.50–2.0	1.00	0.50	0.50	1.00
Nickel	2.3– 3.7	17.5– 18.5	21.0–24.0	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	22.5– 27.5	23.5– 25.5	24.0–26.0	24.0– 26.0	23.0– 28.0
Chromium	17.0– 19.0	19.5– 20.5	23.0–25.0	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	18.5–22.5	20.0– 22.0	19.0–21.0	19.0– 21.0	19.0– 23.0
Molybdenum	...	6.0– 6.5	5.2–6.2	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	6.0– 7.0	4.0– 5.0
Titanium	...	...	...	...	...	...	...	...	...	...	0.15– 0.60	...	...	...	...	...
Columbium	...	...	...	...	...	...	...	...	...	0.10 max	...	0.25–0.75	...	...	...	...
Tantalum Nitrogen <sup>F</sup>	0.20– 0.40	0.18– 0.25	0.35–0.60	0.20 max	0.10– 0.20	0.15– 0.21	0.17– 0.22	...	0.45– 0.55	0.40– 0.60	...	0.05–0.15	0.18– 0.25	0.10–0.20	0.15– 0.25	0.10 max
Vanadium	...	0.50– 1.00	1.00–2.50	...	...	2.8– 4.0	...	0.50 max	0.30– 0.60	...	0.75	2.5–3.5	0.75 max	0.80–1.50	0.50– 1.50	1.00– 2.00
Copper	...	...	W	...	...	...	...	...	...	...	Al	...	...	...	...	...
Others	...	...	1.50–2.50	...	...	...	...	...	...	...	0.15– 0.60	...	...	...	...	...

<sup>A</sup> New designation established in accordance with Practice E527 and SAE J1086.  
<sup>B</sup> 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.  
<sup>C</sup> Maximum, unless otherwise indicated. Where ellipses (...) appear in this table, there are no requirements and analysis for the element need not be determined or reported.  
<sup>D</sup> 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 %.  
<sup>E</sup> 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 %.  
<sup>F</sup> The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.

**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<sup>3</sup>

2.3 *Other Standard:*

**SAE J1086** Practice for Numbering Metals and Alloys (UNS)<sup>4</sup>

### 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),

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 solution heat-treated condition. Except as provided in 6.2, the heat-treatment procedure shall consist of heating the material to a minimum temperature or temperature range as specified for the grade in **Table 2**, followed by 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 [1040 °C] and is so specified on the order, each tube shall be stenciled with the final heat treatment temperature in degrees Fahrenheit [degrees Celsius] after the suffix "HT".

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

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



TABLE 2 Heat Treatment and Hardness Requirements

Grade	UNS Number	Austenitizing Temperature, min or range °F [°C]	Hardness, max
TP201	S20100	1900 [1040]	220 HBW/230 HV or 96 HRB
TP201LN	S20153	1900 [1040]	250 HBW/263 HV or 100 HRB
TP304	S30400	1900 [1040]	192 HBW/200 HV or 90 HRB
TP304L	S30403	1900 [1040]	192 HBW/200 HV or 90 HRB
TP304LN	S30453	1900 [1040]	192 HBW/200 HV or 90 HRB
TP316	S31600	1900 [1040]	192 HBW/200 HV or 90 HRB
TP316L	S31603	1900 [1040]	192 HBW/200 HV or 90 HRB
TP316N	S31653	1900 [1040]	192 HBW/200 HV or 90 HRB
...	S31655	1900 [1040]	256 HBW or 100 HRB
TP317	S31700	1900 [1040]	192 HBW/200 HV or 90 HRB
...	S31730	1900 [1040]	192 HBW/200 HV or 90 HRB
TP321	S32100	1900 [1040]	192 HBW/200 HV or 90 HRB
TP347	S34700	1900 [1040]	192 HBW/200 HV or 90 HRB
TP348	S34800	1900 [1040]	192 HBW/200 HV or 90 HRB
TPXM-10	S21900	1900 [1040]	269 HBW/285 HV or 25 HRC
TPXM-11	S21904	1900 [1040]	269 HBW/285 HV or 25 HRC
TPXM-15	S38100	1900 [1040]	192 HBW/200 HV or 90 HRB
TPXM-19	S20910	1900 [1040]	269 HBW/25 HV or 25 HRC
TPXM-29	S24000	1900 [1040]	265 HBW/270 HV or 100 HRB
...	SS31254	2100 [1150]	220 HBW/230 HV or 96 HRB
...	S31266	2100 [1150]	250 HBW/263 HV or 100 HRB
...	S31725	1900 [1040]	192 HBW/200 HV or 90 HRB
...	S31726	1900 [1040]	192 HBW/200 HV or 90 HRB
...	S31727	1975–2155 [1080–1180]	192 HBW/200 HV or 90 HRB
...	S32053	1975–2155 [1080–1180]	192 HBW/200 HV or 90 HRB
...	S30600	1900 [1040]	192 HBW/200 HV or 90 HRB
...	S32654	2100 [1150]	250 HBW/263 HV or 100 HRB
...	S34565	2050–2140 [1120–1070]	265 HBW/270 HV or 100 HRB
...	S35045	2000 [1095]	192 HBW/200 HV or 90 HRB
...	<u>S35030</u>	<u>1900 [1040]</u>	<u>192 HBW/200 HV or 90 HRB</u>
...	N08367	2025 [1110]	265 HBW/270 HV or 100 HRB
...	N08925	2010–2100 [1100–1150]	217 HBW or 95 HRB
...	N08926	2010 [1100]	265 HBW/270 HV or 100 HRB
...	N08904	2000 [1100]	192 HBW/200 HV or 90 HRB

6.3 A solution annealing temperature above 1950 °F [1065 °C] may impair the resistance to intergranular corrosion after