

1. Scope*

- 1.1 This specification covers grades of nominal-wallthickness, 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 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 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 inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards: 2

- A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products
- A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
- A 632 Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
- A 1016/A 1016M Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes
- E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 ASME Piping Code: ASME B31.3 Process Piping³

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, meters, 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 A 1016/A 1016M),
- 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 A 1016/A 1016M, 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), S24565 (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 S24565 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.

**Number of Tubes in a Lot Heat Treated by the
Continuous Process or by Direct Quench After Hot Forming**

Size of Tube	Size of Lot
2 in. and over in outside diameter and 0.200 in.(5.08 mm) and over in wall thickness	not more than 50 tubes
Less than 2 in. but over 1 in. in outside diameter or over 1 in. in outside diameter and under 0.200 in. (5.08 mm) in wall thickness	not more than 75 tubes
1 in. or less in outside diameter	not more than 125Tubes

Permissible Variations in Dimensions						
Group	Size, OD, in.	Permissible Variations in OD, in. (mm)	Permissible Variations in Wall Thickness,A %	Permissible Variations in Cut Length in. (mm)B		Thin Walled TubesC
				Over	Under	
1	Up to 1/2.	±.005 (0.13)	±15	1/8 (3.2)	0
2	1/2 to 1 1/2 , excl	±.005 (0.13)	±10	1/8 (3.2)	0	less than 0.065 in. (1.65 mm) nominal
3	1 1/2 to 3 1/2 , excl	±.010 (0.25)	±10	3/16 (4.8)	0	less than(2.41 mm) nominal
4	3 1/2 to 5 1/2 , excl	±.015 (0.38)	±10	3/16 (4.8)	0	less than (3.81 mm) nominal
5	5 1/2 to 8, excl	±.030 (0.76)	±10	3/16 (4.8)	0	less than 0.150 in. (3.81 mm) nominal
6	8 to 12, excl	±.040 (1.01)	±10	3/16 (4.8)	0	less than 0.200 in. (5.08 mm) nominal
7	12 to 14, excl	±.050 (1.26)	±10	3/16 (4.8)	0	less than 0.220 in. (5.59 mm) nominal

A When tubes as ordered require wall thicknesses 3/4 in. (19.0 mm) or over, or an inside diameter 60 % or less of the outside diameter, a wider variation in wall thickness is required. On such sizes a variation in wall thickness of 12.5 % over or under will be permitted.

For tubes less than 1/2 in. (12.7 mm) in inside diameter which cannot be successfully drawn over a mandrel, the wall thickness may vary 615 % from that specified.

B These tolerances apply to cut lengths up to and including 24 ft (7.3 m). For lengths greater than 24 ft (7.3 m), the above over tolerances shall be increased by 1/8 in. (3 mm) for each 10 ft (3 m) or fraction thereof over 24 ft, or 1/2 in. (13 mm), whichever is lesser.

C Ovality provisions of 11.2 apply