



Designation: A 778 – 01

Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products¹

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1. Scope

1.1 This specification covers straight seam and spiral butt seam welded unannealed austenitic stainless steel tubular products intended for low and moderate temperatures and corrosive service where heat treatment is not necessary for corrosion resistance. **Table 1** lists the five grades covered by this specification. The user of this specification should be aware that a minimum amount of testing and examination is required of the basic product. The user requiring additional testing or examination is referred to the supplemental requirements or Ordering Information, or both. Users requiring a tubular product with post-weld heat treatment or with radiographic examination are referred to Specification **A 312/A 312M**, **A 358/A 358M**, or **A 409/A 409M**, as applicable.

1.2 This specification covers welded unannealed tubular products 3 in. (75 mm) through 48 in. (1200 mm) in outside diameter and in nominal wall thicknesses of 0.062 in. (1.5 mm) through 0.500 in. (12.5 mm) produced to this specification. Tubular products having other diameters or wall thickness, or both, may be furnished provided it complies with all other requirements of this specification.

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

A 240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels²

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

A 312/A 312M Specification for Seamless and Welded Austenitic Stainless Steel Pipes³

A 358/A 358M Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service³

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

A 409/A 409M Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service³

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment⁴

A 941 Terminology Relating to Steel, Related Alloys, and Ferroalloys³

A 999/A 999M Specification for General Requirements for Alloy and Stainless Steel Pipe³

E 340 Test Method for Macroetching Metals and Alloys⁵

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

2.2 AWS Standards:

A 5.4 Corrosion—Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes⁶

A 5.9 Corrosion—Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes⁶

2.3 SAE Standard:

SAE J1086 Practice for Numbering Metals and Alloys (UNS)⁷

3. Terminology

3.1 Definitions:

3.2 The definitions in Specification **A 999/A 999M** and Terminology **A 941** are applicable to this specification.

4. Ordering Information

4.1 Orders for material to this specification should include the following:

4.1.1 Quantity (feet, metres, or number of pieces),

4.1.2 Name of material (welded unannealed austenitic stainless steel tubular products),

4.1.3 Straight seam or spiral butt seam,

4.1.4 Grade (see **Table 1**),

4.1.5 Size (outside diameter and specified wall thickness) (see **10.3** and **10.4**),

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 *Annual Book of ASTM Standards*, Vol 01.03.

³ *Annual Book of ASTM Standards*, Vol 01.01.

⁴ *Annual Book of ASTM Standards*, Vol 01.05.

⁵ *Annual Book of ASTM Standards*, Vol 03.01.

⁶ Available from American Welding Society, 2501 N.W. 7th St., Miami, FL 33125.

⁷ Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

TABLE 1 Chemical Requirements

Grade	UNS Designation ^A	Carbon max ^B	Manganese, max	Phosphorus, max	Composition, %					Titanium	Columbium Plus Tantalus	Nitrogen, max
					Sulfur, max	Silicon, max	Chromium	Nickel				
TP 304L	S30403	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–13.0	...	...	...	0.10
TP 316L	S31603	0.030	2.00	0.045	0.030	1.00	16.0–18.0	10.0–14.0	2.00	...	...	0.10
TP 317L	S31703	0.030	2.00	0.045	0.030	1.00	18.0–20.0	11.0–15.0	3.00	...	...	0.10
									3.0			
TP 321	S32100	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	4.0	C	...	...
									...			
TP 347	S34700	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	...	...	D	...

^A New designation established in accordance with Practice E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

^B The carbon analysis shall be reported to the nearest 0.01 %, except for the low carbon (0.030) types, which shall be reported to the nearest 0.001 %.

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

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

4.1.6 Length (mill standard lengths, or specify cut lengths) (see 10.1),

4.1.7 Optional requirements (Supplementary Requirements S1 to S5),

4.1.8 Certification requirements,

4.1.9 Specification designation, and

4.1.10 Special requirements.

5. Significance and Use

5.1 It is anticipated that the ASTM Subcommittees A01.06, A01.10, A01.17, A01.22, and A01.28 will use the standard composition limits listed in this specification for the grades identified by the corresponding UNS designation in the product specification unless there is a specific technical justification for doing otherwise. The compositions in this specification shall not be considered as chemical requirements for any particular product until adopted by the subcommittee overseeing that product.

6. Manufacture

6.1 The tubular products shall be made from flat-rolled steel sheet, coil, or plate by a shielded arc-welding process. The material used for manufacture shall conform to the requirements of one of the grades of Specification A 240 listed in Table 1. At the manufacturer's option, filler metal may be used.

6.2 Tubular products 14 in. (350 mm) in diameter and smaller shall have a single longitudinal weld or a spiral butt weld seam. Tubular products of larger diameter may have a maximum of three longitudinal welds. All weld tests, examinations, inspections, or treatments are to be performed on each weld seam.

6.3 Circumferentially welded joints of the same quality as the longitudinal or spiral joints shall be permitted by agreement between the manufacturer and the purchaser.

6.4 All tubular products shall be furnished clean and free of scale.

6.5 Welding:

6.5.1 The welds shall be made by the manual or automatic electric-welding process.

6.5.2 The welded joints may show a reinforcing bead no greater than 1/16 in. (1.6 mm) on either surface of the tubular product. At no place shall the thickness of the weld section be less than the minimum wall thickness permitted by the toler-

ances of 10.4. The weld bead may be removed at the option of the manufacturer or upon agreement between the manufacturer and purchaser.

6.5.3 Injurious weld defects shall be repaired by removal to sound metal and rewelding.

6.5.4 The alloy content (chromium, nickel, molybdenum, columbium, and carbon) of the filler metal shall conform to that required for the plate or the welding electrodes as shown in Table II of Specification AWS A5.4 or in Table I of Specification AWS A5.9, except that when welding on Type 321 base metal, the deposited weld metal may correspond to Type 347.

7. Mechanical Test Requirements

7.1 Each lot shall be subjected to one transverse tension test and two transverse guided bend tests.

NOTE 1—The term *lot* applies to all pipe of the same grade, of the same thickness, produced from the same heat with the same weld procedure.

7.2 The maximum lot size shall be in accordance with the following table:

Diameter Range	Lot Size (lengths)
up to 3 in. exclusive	400
3–8 in. exclusive	300
8–14 in. exclusive	200
14 in. and over	100

7.3 Specimen Preparation:

7.3.1 Transverse tension and bend test specimens shall be taken from the end of a length and shall be flattened cold before final machining to size.

7.3.2 As an alternative to the requirements of 7.3.1, the test specimens may be taken from test plates of the same material as the tube, which are attached to the end of the cylinder and welded as a prolongation of the tube longitudinal weld.

7.3.3 Tension test specimens shall be made in accordance with Test Methods and Definitions A 370.

7.4 Transverse Tension Test:

7.4.1 Transverse tension tests taken transversely across the welded joint shall meet the same minimum tensile strength as the base material (Table 2).

7.4.2 When diameters below 8-in. (200 mm) make it impractical to perform a transverse tension test, an alternative test may be permitted by agreement between the manufacturer and the purchaser.

7.5 Transverse Guided—Bend Weld Test: