



Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service¹

This standard is issued under the fixed designation A 789/A 789M; 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.

1. Scope

1.1 This specification² covers grades of nominal wall thickness, stainless steel tubing for services requiring general corrosion resistance, with particular emphasis on resistance to stress corrosion cracking. These steels are susceptible to embrittlement if used for prolonged periods at elevated temperatures.

NOTE 1—For tubing smaller than 1/2 in. [12.7 mm] in outside diameter, the elongation values given for strip specimens in Table 1 shall apply. Mechanical property requirements do not apply to tubing smaller than 1/8 in. [3.2 mm] in outside diameter or with walls thinner than 0.015 in. [0.4 mm].

1.2 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.

2. Referenced Documents

2.1 ASTM Standards:

- A 450/A 450M Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes³
- A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip⁴
- E 527 Practice for Numbering Metals and Alloys (UNS)³
- 2.2 SAE Standard:⁵
- SAE J 1086

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 ASME Boiler and Pressure Vessel Code applications see related Specification SA-789 in Section II of that Code.

³ Annual Book of ASTM Standards, Vol 01.01.

⁴ Annual Book of ASTM Standards, Vol 01.03.

⁵ Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

TABLE 1 Tensile and Hardness Requirements

UNS Designation	Tensile Strength, min, ksi [MPa]	Yield Strength, min, ksi [MPa]	Elongation in 2 in. or 50 mm, min, %	Hardness, max	
				Brinell	Rockwell C
S31803	90 [620]	65 [450]	25	290	30.5
S32205	90 [620]	65 [450]	25	290	30.5
S32205	90 [620]	65 [450]	25	290	30.5
S32205	95 [655]	70 [485]	25	290	30.5
S31500	92 [630]	64 [440]	30	290	30.5
S32550	110 [760]	80 [550]	15	297	31.5
S31200	100 [690]	65 [450]	25	280	...
S31260 ^A	100 [690]	65 [450]	25	290	30.5
S32304					
OD 1 in. [25 mm] and Under	100 [690]	65 [450]	25	...	...
OD over 1 in. [25 mm]	87 [600]	58 [400]	25	290	30.5
S39274	116 [800]	80 [550]	15	310	...
S32750	116 [800]	80 [550]	15	310	32
S32760	109 [750]	80 [550]	25	300	...
S32900	90 [620]	70 [485]	20	271	28
S32950 ^B	100 [690]	70 [480]	20	290	30.5
S39277	120 [825]	90 [620]	25	290	30
S32520	112 [770]	80 [550]	25	310	...

^A Prior to A 789/A 789M – 87, the values for S31260 were: 92 ksi tensile strength, 54 ksi yield strength, and 30 % elongation.

^B Prior to A 789/A 789M – 89, the tensile strength value was 90 ksi for UNS S32950.

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 (see Table 2),
- 3.1.4 Size (outside diameter and nominal wall thickness),
- 3.1.5 Length (specific or random),
- 3.1.6 Optional requirements (product analysis for welded tubes, Section 8; hydrostatic test or nondestructive electric test, Section 10),
- 3.1.7 Test report required (section on inspection of Specification A 450/A 450M),
- 3.1.8 Specification designation, and
- 3.1.9 Special requirements.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of Specification A 450/

TABLE 2 Chemical Requirements

UNS Designation ^A	C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu	Others
S31803	0.030 max	2.0 max	0.030 max	0.020 max	1.0 max	4.50–6.50	21.0–23.0	2.50–3.50	0.08–0.20	...	...
S32205	0.030 max	2.00 max	0.030 max	0.020 max	1.00 max	4.5–6.5	22.0–23.0	3.0–3.5	0.14–0.20	...	...
S31500	0.030 max	1.20–2.00	0.030 max	0.030 max	1.40–2.00	4.25–5.25	18.0–19.0	2.50–3.00	0.05–0.1	...	...
S32550	0.040	1.5 max	0.040 max	0.030 max	1.0 max	4.50–6.50	24.0–27.0	2.90–3.90	0.10–0.25	1.5–2.5	...
S31200	0.030 max	2.0 max	0.045 max	0.030 max	1.0 max	5.50–6.50	24.0–26.0	1.20–2.00	0.14–0.20	...	...
S31260	0.030 max	1.00 max	0.030 max	0.030 max	0.75 max	5.50–7.50	24.0–26.0	2.50–3.50	0.10–0.30	0.20–0.80	W 0.10–0.50
S32304	0.030 max	2.50 max	0.040 max	0.040 max	1.0 max	3.0–5.5	21.5–24.5	0.05–0.60	0.05–0.20	0.05–0.60	...
S39274	0.030 max	1.0 max	0.030 max	0.020 max	0.80 max	6.0–8.0	24.0–26.0	2.50–3.50	0.24–0.32	0.20–0.80	W 1.50–2.50
S32750	0.030 max	1.2 max	0.035 max	0.020 max	0.8 max	6.0–8.0	24.0–26.0	3.0–5.0	0.24–0.32	0.5 max	...
S32760	0.05 max	1.00 max	0.030 max	0.010 max	1.00 max	6.00–8.00	24.00–26.00	3.00–4.00	0.20–0.30	0.50–1.00	W 0.50–1.00 40 min ^B
S32900	0.08 max	1.00 max	0.040 max	0.030 max	0.75 max	2.50–5.00	23.00–28.00	1.00–2.00	...	...	...
S32950	0.03 max	2.00 max	0.035 max	0.010 max	0.60 max	3.50–5.20	26.00–29.00	1.00–2.50	0.15–0.35	...	...
S39277	0.025 max	0.80 max	0.025 max	0.002 max	0.80 max	6.50–8.00	24.00–26.00	3.00–4.00	0.23–0.33	1.2–2.0	W 0.8–1.2
S32520	0.030 max	1.50 max	0.035 max	0.020 max	0.80 max	5.5–8.0	23.0–25.0	3.0–5.0	0.20–0.35	0.50–3.00	...

^A New designation established in accordance with Practice E 527 and SAE J1086.

^B % Cr + 3.3 × % Mo + 16 × % N.

A 450M, unless otherwise provided herein.

5. Manufacture

5.1 The tubes shall be made by the seamless or welded process with no filler metal added.

6. Heat Treatment

6.1 All tubes shall be furnished in the heat-treated condition in accordance with the procedures shown in Table 3. For seamless tubes, as an alternate to final heat treatment in a continuous furnace or batch-type furnace, 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.

TABLE 3 Heat Treatment

UNS Designation	Temperature	Quench
S31803	1870–2010°F [1020–1100°C]	rapid cooling in air or water
S32205	1870–2010°F [1020–1100°C]	rapid cooling in air or water
S31500	1800–1900°F [980–1040°C]	rapid cooling in air or water
S32550	1900°F [1040°C] min	rapid cooling in air or water
S31200	1920–2010°F [1050–1100°C]	rapid cooling in water
S31260	1870–2010°F [1020–1100°C]	rapid cooling in water
S32304	1700–1920°F [925–1050°C]	rapid cooling in air or water
S39274	1920–2060°F [1025–1125°C]	rapid cooling in air or water
S32750	1880–2060°F [1025–1125°C]	rapid cooling in air or water
S32760	2010–2085°F [1100–1140°C]	rapid cooling in air or water
S32900	1700–1750°F [925–955°C]	rapid cooling in air or water
S32950	1820–1880°F [990–1025°C]	air cool
S39277	1975–2155°F [1080–1180°C]	rapid cooling in air or water
S32520	1975–2050°F [1080–1120°C]	rapid cooling in air or water

7. Chemical Composition

7.1 The steel shall conform to the chemical requirements prescribed in Table 2.

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 labeled A1.1 in Specification A 480/A 480M shall apply. The product analysis tolerance is not applicable to the carbon content for material with a specified maximum carbon of 0.04 % 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 this specification; otherwise, all remaining material in the heat or lot (see Note 2) shall be rejected or, at the option of the producer, each billet or tube may be individually tested for acceptance. Billets, lengths of flat-rolled stock, or tubes that do not meet the requirements of this specification shall be rejected.

NOTE 2—For flange and flaring requirements, the term *lot* applies to all tubes prior to cutting of the same nominal size and wall thickness that are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and from the same heat that are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, or when heat treated condition is obtained directly by quenching after hot forming, the number of tubes of the same size and from the same heat in a lot shall be determined from the size of the tubes as prescribed in Table 4.

NOTE 3—For tension and hardness test requirements, the term *lot* applies to all tubes prior to cutting, of the same nominal diameter and wall thickness that are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and the same heat that are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, or when heat treated condition is obtained directly by quenching after hot forming, a lot shall include all tubes of the same size and heat, heat treated in the same furnace at the same temperature, time at heat, and furnace speed, or all tubes of the same size and heat, hot formed and quenched in the same production run.