Designation: A 949/A 949M – 00a

An American National Standard

Standard Specification for Spray-Formed Seamless Ferritic/Austenitic Stainless Steel Pipe[1]

This standard is issued under the fixed designation A 949/A 949M; 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 specification covers spray-formed seamless ferritic/austenitic stainless steel pipe intended for general corrosive service, with particular emphasis on resistance to stress corrosion cracking. These steels are susceptible to embrittlement if used for prolonged periods at elevated temperatures.

1.2 Optional supplementary requirements are provided for pipe where a greater degree of testing is desired. These supplementary requirements call for additional tests to be made and when desired, one or more of these may be specified in the order.

1.3 Appendix X1 of this specification lists the dimensions of seamless stainless steel pipe as shown in ANSI B 36.19. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification.

1.4 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.

NOTE 1—The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as "nominal diameter," "size," and "nominal size."

2. Referenced Documents

2.1 *ASTM Standards:*

A 450/A 450M Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes[2]

A 999/A 999M Specification for General Requirements for Alloy and Stainless Steel Pipe[2]

E 381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings[3]

E 527 Practice for Numbering Metals and Alloys (UNS)[2]

2.2 *ANSI/ASME Standards:*

B 1.20.1 Pipe Threads, General Purpose[4]

B 36.10M-1995 Welded and Seamless Wrought Steel Pipe[4]

B 36.19 Stainless Steel Pipe

2.3 *Other Standard:*

SAE J1086 Practice for Numbering Metals and Alloys (UNS)[5]

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 (ferritic/austenitic steel pipe),

3.1.3 Grade (Table 1),

3.1.4 Size (NPS designator or outside diameter and schedule number of average wall thickness, or other),

3.1.5 Length (specific or random) (Section 9),

3.1.6 End finish (section on Ends of Specification A 999/A 999M),

3.1.7 Optional requirements (Section 8), Supplementary Requirements S1 to S4,

3.1.8 Test report required (section on Certification of Specification A 999/A 999M),

3.1.9 Specification designation, and

3.1.10 Special requirements or exception to the specification.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 999/A 999M unless otherwise provided herein.

5. Materials and Manufacture

5.1 *Melting*—The steel shall be made by the electric-furnace process or other primary processes approved by the purchaser.

5.2 *Pipe Manufacture*:

5.2.1 The pipe shall be made by the spray forming process using the melt from the primary melting as noted in 6.1.

[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 01.01.

[3] *Annual Book of ASTM Standards*, Vol 03.01.

[4] Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036, and ASME International, Three Park Avenue, New York, NY 10016–5990.

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

TABLE 1 Heat Treatment

UNS Designation	Temperature	Quench
S31803	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
S31200	1920–2010°F [1050–1100°C]	rapid cooling in water
S32550	1900°F [1040°C] min	rapid cooling in air or 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
S32750	1880–2060°F [1025–1125°C]	rapid cooling in air or water
S32900	1700–1750°F [925–955°C]	rapid cooling in air or water
S32950	1820–1880°F [995–1025°C]	air cool

5.2.2 The pipe shall be made by spraying the melt on to a thin-walled collector tube. The as spray formed tube shall be machined on both the inner and outer surfaces. The remaining metal shall be homogeneous, sound, and meet the requirements of Section 10.

5.2.3 Unless specified by the purchaser, pipe may be furnished as spray formed or as spray-formed and cold-finished.

5.2.4 All pipe shall be furnished in the heat-treated condition as shown in Table 1.

5.2.5 All pipe shall be furnished in the descaled condition and be free of contaminating iron particles. Pickling, blasting or surface finishing is not mandatory when pipe is bright annealed. The purchaser may request that a passivating treatment be applied.

6. Chemical Composition

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

7. Product Analysis

7.1 At the request of the purchaser, an analysis of two pipes from each lot shall be made by the manufacturer. A lot of pipe shall consist of the following number of lengths of the same size and wall thickness from any one heat of stainless steel:

NPS Designator	Lengths of Pipe in Lot
Under 2	400 or fraction thereof
2 to 5, incl	200 or fraction thereof
6 and over	100 or fraction thereof

7.2 The results of these analyses shall be reported to the purchaser or the purchaser's representative, and shall conform to the requirements specified in Section 4.

7.3 If the analysis of one of the tests specified in 7.1 does not conform to the requirements specified in Section 4, an analysis of each pipe from the same heat or lot may be made, and all pipes conforming to the requirements shall be accepted.

8. Tensile and Hardness Properties

8.1 The material shall conform to the tensile and hardness properties prescribed in Table 3.

9. Lengths

9.1 Pipe lengths shall be in accordance with the following regular practice:

9.1.1 Unless otherwise agreed upon, all sizes from NPS ⅛ to and including NPS 8 are available in a length up to 24 ft (Note 2) with the permissible range of 15 to 24 ft (Note 2). Short lengths are acceptable and the number and minimum length shall be agreed upon between the manufacturer and the purchaser.

NOTE 2—This value applies when the inch-pound designation of this specification is the basis of purchase. When the "M" designation of this specification is the basis of purchase, the corresponding metric value(s) shall be agreed upon between the manufacturer and the purchaser.

9.1.2 If definite cut lengths are desired, the lengths required shall be specified in the order. No pipe shall be less than the specified length and no more than ¼ in. [6 mm] over it.

10. Workmanship, Finish, and Appearance

10.1 The finished pipes shall be reasonably straight and shall have a workmanlike finish. Imperfections may be removed by grinding, provided the wall thicknesses are not decreased to less than that permitted, in the Permissible Variations in Wall Thickness Section of Specification A 999/A 999M.

11. Mechanical Tests Required

11.1 *Transverse or Longitudinal Tension Test*—One tension test shall be made on a specimen for lots of not more than 100

TABLE 2 Chemical Requirements

UNS Designation[A]	C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu	Others
S31803	0.030 max	2.00 max	0.030 max	0.020 max	1.00 max	4.5–6.5	21.0–23.0	2.5–3.5	0.08–0.20	. . .	
S31500	0.030 max	1.20–2.00	0.030 max	0.030 max	1.40–2.00	4.3–5.2	18.0–19.0	2.50–3.00	0.05–0.10	. . .	
S32550	0.040 max	1.50 max	0.040 max	0.030 max	1.00 max	4.5–6.5	24.0–27.0	2.9–3.9	0.10–0.25	1.50–2.50	
S31200	0.030 max	2.00 max	0.045 max	0.030 max	1.00 max	5.5–6.5	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	5.5–7.5	24.0–26.0	2.5–3.5	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	1.00 max	3.0–5.5	21.5–24.5	0.05–0.60	0.05–0.20	0.05–0.60	
S32750	0.030 max	1.20 max	0.035 max	0.020 max	0.80 max	6.0–8.0	24.0–26.0	3.0–5.0	0.24–0.32	0.50 max	. . .
S32900	0.08 max	1.00 max	0.040 max	0.030 max	0.75 max	2.5–5.0	23.0–28.0	1.00–2.00	. . .	. . .	. . .
S32950	0.03 max	2.00 max	0.035 max	0.010 max	0.60 max	3.5–5.2	26.0–29.0	1.00–2.50	0.15–0.35	. . .	

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