



Designation: A409/A409M – 24

Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service¹

This standard is issued under the fixed designation A409/A409M; 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 straight seam or spiral seam electric-fusion-welded, light-wall, austenitic chromium-nickel alloy steel pipe for corrosive or high-temperature service. The sizes covered are NPS 14 to 30 with extra light (Schedule 5S) and light (Schedule 10S) wall thicknesses. **Table X1.1** shows the wall thickness of Schedule 5S and 10S pipe. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification.

1.2 Several grades of alloy steel are covered as indicated in **Table 1**.

1.3 Optional supplementary requirements are provided. These call for additional tests to be made, and when desired shall be stated in the order, together with the number of such tests required.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the 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.

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*.

1.5 *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.*

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-409 in Section II of that Code.

2. Referenced Documents

2.1 ASTM Standards:³

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

A999/A999M Specification for General Requirements for Alloy and Stainless Steel Pipe

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 ASME Boiler and Pressure Vessel Code:⁴

Section III

Section VIII, Division 1

Section IX

2.3 AWS Standards:⁵

A 5.22 Flux Cored Arc Welding

A 5.30 Consumable Weld Inserts for Gas Tungsten Arc Welding

A 5.4 Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes

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

A 5.11 Nickel and Nickel-Alloy Covered Welding Electrodes

A 5.14 Nickel and Nickel-Alloy Bare Welding Rods and Electrodes

2.4 Other Standard:

SAE J1086 Practice for Numbering Metals and Alloys (UNS)⁶

³ 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.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁵ Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, <http://www.aws.org>.

⁶ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

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



TABLE 1 Chemical Requirements

	UNS Designations ^A	Composition, %											Other Elements
		Carbon, max	Manganese, max	Phosphorus, max	Sulfur, max	Silicon	Nickel	Chromium	Molybdenum	Titanium	Columbium	Cerium	
TP201	S20100	0.15	5.5–7.5	0.060	0.030	1.00	3.5–5.5	16.0–18.0	...	...	...	...	N 0.25
TP201LN	S20153	0.03	6.4–7.5	0.045	0.015	0.75	4.0–5.0	16.0–17.5	...	...	...	...	N 0.10–0.25, Cu 1.00
TP304	S30400	0.08	2.00	0.045	0.030	1.00 max	8.0–11.0	18.0–20.0	...	...	...	...	...
TP304L	S30403	0.035	2.00	0.045	0.030	1.00 max	8.0–12.0	18.0–20.0	...	...	...	...	...
...	S30416	0.030	2.00	0.045	0.015	0.80–2.00	9.0–11.0	17.5–19.5	0.40–0.80	...	...	...	N 0.10 max
TP309Cb	S30940	0.08	2.00	0.045	0.030	1.00 max	12.0–16.0	22.0–24.0	...	...	...	...	Cb 10 × C min, 1.10 max
TP309S	S30908	0.08	2.00	0.045	0.030	1.00 max	12.0–15.0	22.0–24.0	...	...	...	...	...
TP310Cb	S31040	0.08	2.00	0.045	0.030	1.00 max	19.0–22.0	24.0–26.0	...	...	...	...	Cb 10 × C min, 1.10 max
TP310S	S31008	0.08	2.00	0.045	0.030	1.00 max	19.0–22.0	24.0–26.0	...	...	...	...	...
TP316	S31600	0.08	2.00	0.045	0.030	1.00 max	10.0–14.0	16.0–18.0	2.00–3.00	...	...	...	...
TP316L	S31603	0.035	2.00	0.045	0.030	1.00 max	10.0–14.0	16.0–18.0	2.00–3.00	...	...	...	...
TP317	S31700	0.08	2.00	0.045	0.030	1.00 max	11.0–15.0	18.0–20.0	3.0–4.0	...	...	...	...
...	S31727	0.030	1.00	0.030	0.030	1.00 max	14.5–16.5	17.5–19.0	3.8–4.5	...	...	...	N 0.15–0.21, Cu 2.8–4.0
...	S32053	0.030	1.00	0.030	0.010	1.00 max	24.0–26.0	22.0–24.0	5.0–6.0	...	...	...	N 0.17–0.22
TP321	S32100	0.08	2.00	0.045	0.030	1.00 max	9.00–12.0	17.0–20.0	...	^B	...	...	...
TP347	S34700	0.08	2.00	0.045	0.030	1.00 max	9.00–12.0	17.0–19.0	...	...	^C	...	...
TP348	S34800	0.08	2.00	0.045	0.030	1.00 max	9.00–12.0	17.0–19.0	...	...	^D	...	...
...	S31254	0.020	1.00	0.030	0.010	0.80 max	17.5–18.5	19.5–19.5	6.0–6.5	...	...	...	Cu 0.50–1.00, N 0.18–0.25
...	S30815	0.05–0.10	0.80	0.040	0.030	1.40–2.00	10.0–12.0	20.0–22.0	...	...	...	0.03–0.08	N 0.14–0.20
...	S31725	0.030	2.00	0.045	0.030	1.00 max	13.5–17.5	18.0–20.0	4.0–5.0	...	...	...	N 0.020 max
...	S31726	0.030	2.00	0.045	0.030	1.00 max	14.5–17.5	17.0–20.0	4.0–5.0	...	...	...	N 0.10–0.20
...	S34565	0.030	5.0–7.0	0.030	0.010	1.00 max	16.0–18.0	23.0–25.0	4.0–5.0	...	0.10 max	...	N 0.40–0.60
...	N08367	0.030	2.00	0.040	0.030	1.00 max	23.5–25.5	20.0–22.0	6.0–7.0	...	...	...	Cu 0.75 max, Ni 0.18–0.25
...	S20400	0.030	7.0–9.0	0.45	0.030	1.00 max	1.50–3.00	15.0–17.0	...	...	...	...	N 0.15–0.30
...	S31266	0.030	2.00–4.00	0.035	0.020	1.00 max	21.0–24.0	23.0–25.0	5.2–6.2	...	...	...	Cu 1.00–2.50, W 1.50–2.50, N 0.35–0.60

^A New designation established in accordance with ASTM E527 and SAE J1086.

^B The titanium content shall be not less than 5 times the carbon content and not more than 0.70 %.

^C The columbium plus tantalum content shall be not less than 10 times the carbon content and not more than 1.10 %.

^D The columbium plus tantalum content shall be not less than 10 times the carbon content and not more than 1.10 %. The tantalum content shall be 0.10 % maximum, CO 0.20 % maximum.

3. Ordering Information

3.1 Orders for material to this specification should include the following, as required, to describe the desired material adequately:

- 3.1.1 Quantity (feet, centimetres, or number of lengths),
- 3.1.2 Name of material (straight seam or spiral seam electric-fusion-welded austenitic steel pipe),
- 3.1.3 Grade (Table 1),
- 3.1.4 Size (outside diameter and schedule number, or wall thickness).
- 3.1.5 Length (specific or random) (Section 11),
- 3.1.6 End finish (Section on Ends of Specification A999/A999M),
- 3.1.7 Optional requirements (5.2.1 – 5.2.3 removal of weld bead; 5.3.2, special heat treatment; 15.2, nondestructive test; 10.1.1, outside diameter tolerance; 11.2, length circumferentially welded; 12.3, repair by welding and heat treatment subsequent to repair welding; 12.4, sand blasted or pickled; 17.1 Certification; Supplementary Requirements S1 to S6).

3.1.8 Specification designation, and

3.1.9 Special requirements.

4. General Requirements

4.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A999/A999M, unless otherwise provided herein.

5. Materials and Manufacture

5.1 If a specific type of melting is required by the purchaser it shall be stated on the order.

5.2 Welding:

5.2.1 The welds shall be made by the manual or automatic electric-welding process. For manual welding, the operator and procedure shall be qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX. Unless otherwise specified on the purchase order, the pipe may be welded with or without filler metal when the automatic electric-welding process is used.