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Standard Specification for Seamless Carbon Steel Pipe for Atmospheric and Lower Temperatures[1]

This standard is issued under the fixed designation A524; 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[2] covers seamless carbon steel pipe intended primarily for service at atmospheric and lower temperatures, NPS ⅛ to 26 inclusive, with nominal (average) wall thickness as given in ANSI B36.10. Pipe having other dimensions may be furnished, provided such pipe complies with all other requirements of this specification. Pipe ordered to this specification shall be suitable both for welding, and for bending, flanging, and similar forming operations.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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."

1.3 The following hazard caveat applies to the test methods portion, Section 16, only.*This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A530/A530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *American National Standards Institute Standard:*

B36.10 Welded and Seamless Wrought Steel Pipe[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 or number of lengths),

3.1.2 Name of material (seamless carbon steel pipe),

3.1.3 Grade (Table 1 and Table 2),

3.1.4 Manufacture (hot finished or cold drawn),

3.1.5 Size (either nominal wall thickness and weight class or schedule number, or both, or outside diameter and nominal wall thickness, ANSI B36.10),

3.1.6 Length (17),

3.1.7 Optional requirements (Section 8 and Section 11 of Specification A530/A530M),

3.1.8 Test report required (Certification Section of Specification A530/A530M),

3.1.9 Specification designation,

3.1.10 End use of material, and

3.1.11 Special requirements.

4. General Requirements

4.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A530/A530M unless otherwise provided herein.

5. Materials and Manufacture

5.1 *Process:*

5.1.1 The steel shall be killed steel made by one or more of the following processes: open-hearth, electric-furnace, or basic-oxygen.

5.1.2 The steel shall be made to fine grain practice.

5.1.3 Steel may be cast in ingots or may be strand cast. When steel of different grades are sequentially strand cast, identification of the resultant transition material is required. The producer shall remove the transition material by any established procedure that positively separates the grades.

[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 A01.09 on Carbon Steel Tubular Products.

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[2] For ASME Boiler and Pressure Vessel Code Applications see related Specification SA-524 in Section II of that Code.

[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 National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

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TABLE 1 Chemical Requirements

Element	Grades I and II, Composition, %
Carbon, max	0.21
Manganese	0.90–1.35
Phosphorus, max	0.035
Sulfur, max	0.035
Silicon	0.10–0.40

5.1.4 Pipe NPS 1½ and under may be either hot finished or cold drawn.

5.1.5 Unless otherwise specified, pipe NPS 2 and over shall be furnished hot finished. When agreed upon between the manufacturer and purchaser, cold-drawn pipe may be furnished.

5.2 *Heat Treatment*—All hot-finished and cold-drawn pipe shall be reheated to a temperature above 1550 °F (845°C) and followed by cooling in air or in the cooling chamber of a controlled atmosphere furnace.

6. Chemical Composition

6.1 The steel shall conform to the chemical requirements prescribed in Table 1.

7. Heat Analysis

7.1 An analysis of each heat of steel shall be made by the steel manufacturer to determine the percentages of the elements specified in Section 6. The chemical composition thus determined, or that determined from a product analysis made by the manufacturer, if the latter has not manufactured the steel, shall be reported to the purchaser or the purchaser's representative, and shall conform to the requirements specified in Section 6.

8. Product Analysis

8.1 At the request of the purchaser, analyses of two pipes from each lot (Note 2) shall be made by the manufacturer from the finished pipe. The chemical composition thus determined shall conform to the requirements specified in Section 6.

NOTE 2—A lot shall consist of 400 lengths, or fraction thereof, for each size NPS 2 up to but not including NPS 6, and of 200 lengths, or fraction thereof, for each size NPS 6 and over.

8.2 If the analysis of one of the tests specified in 8.1 does not conform to the requirements specified in 6, analyses shall be made on additional pipe of double the original number from the same lot, each of which shall conform to requirements specified.

9. Physical Properties

9.1 *Tensile Properties*—The material shall conform to the requirements as to tensile properties prescribed in Table 2.

9.2 *Bending Properties:*

9.2.1 For pipe NPS 2 and under, a sufficient length of pipe shall stand being bent cold through 90° around a cylindrical mandrel, the diameter of which is twelve times the nominal diameter of the pipe, without developing cracks. When ordered for close coiling, the pipe shall stand being bent cold through 180° around a cylindrical mandrel, the diameter of which is eight times the nominal diameter of the pipe, without failure.

9.2.2 For pipe whose diameter exceeds 25 in. (635 mm) and whose diameter to wall thickness ratio is 7.0 or less, bend test specimens shall be bent at room temperature through 180° without cracking on the outside of the bent portion. The inside diameter of the bend shall be 1 in. (25.4 mm). This test shall be in place of Section 10.

NOTE 3—Diameter to wall thickness ratio = specified outside diameter/nominal wall thickness.
Example: For 28 in. diameter 5.000 in. thick pipe the diameter to wall thickness ratio = 28/5 = 5.6.

10. Flattening Test Requirements

10.1 For pipe over NPS 2, a section of pipe not less than 2½ in. (63.5 mm) in length shall be flattened cold between parallel plates until the opposite walls of the pipe meet. Flattening tests shall be in accordance with Specification A530/A530M, except that in the equation used to calculate the *H* value, the following *e* constants shall be used:

0.07 for Grade I
0.08 for Grade II

10.2 When low *D*-to-*t* ratio tubulars are tested, because the strain imposed due to geometry is unreasonably high on the inside surface at the 6 and 12 o'clock locations, cracks at these locations shall not be cause for rejection if the *D*-to-*t* ratio is less than ten.

11. Hydrostatic Test Requirements

11.1 Each length of pipe shall be subjected to the hydrostatic pressure, except as provided in 11.2.

11.2 When specified in the order, pipe may be furnished without hydrostatic testing and each length so furnished shall include with the mandatory marking the letters "NH."

11.3 When certification is required by the purchaser and the hydrostatic test has been omitted, the certification shall clearly state "Not Hydrostatically Tested," and the specification number and grade designation, as shown on the certification, shall be followed by the letters "NH."

12. Dimensions and Weights

12.1 The dimensions and weights of plain-end pipe are included in ANSI B36.10. Sizes and wall thicknesses most generally available are listed in Appendix X1.

13. Dimensions, Weight, and Permissible Variations

13.1 *Weight*—The weight of any length of pipe shall not vary more than 6.5 % over and 3.5 % under that specified for pipe of Schedule 120 and lighter nor more than 10 % over and 3.5 % under that specified for pipe heavier than Schedule 120. Unless otherwise agreed upon between the manufacturer and purchaser, pipe in sizes NPS 4 and smaller may be weighed in convenient lots; pipe in sizes larger than NPS 4 shall be weighed separately.

13.2 *Diameter*—Variations in outside diameter shall not exceed those specified in Table 3.

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TABLE 2 Tensile Requirements

	Wall Thicknesses			
	Grade I, 0.375 in. (9.52 mm) and under		Grade II, greater than 0.375 in. (9.52 mm)	
Tensile strength, psi (MPa)	60 000–85 000 (414–586)		55 000–80 000 (380–550)	
Yield strength, min, psi (MPa)	35 000 (240)		30 000 (205)	
	Longitudinal	Transverse	Longitudinal	Transverse
Elongation in 2 in. or 50 mm, min %:				
Basic minimum elongation for walls 5/16 in. (7.9 mm) and over in thickness, strip tests, and for all small sizes tested in full section	30	16.5	35	25
When standard round 2 in. or 50 mm gauge length test specimen is used for strip tests, a deduction for each 1/32 in. (0.8 mm) decrease in wall thickness below 5/16 in. (7.9 mm) from the basic minimum elongation of the following percentage	22 1.50[A]	12 1.00[A]	28 ...	20 ...

[A] The following table gives the computed minimum values:

Wall Thickness		Elongation in 2 in. or 50 mm, min, %	
		Grade I	
in.	mm	Longitudinal	Transverse
5/16 (0.312)	7.94	30.0	16.5
9/32 (0.281)	7.14	28.5	15.5
1/4 (0.250)	6.35	27.0	14.5
7/32 (0.219)	5.56	25.5	. . .
3/16 (0.188)	4.76	24.0	. . .
5/32 (0.156)	3.97	22.5	. . .
1/8 (0.125)	3.18	21.0	. . .
3/32 (0.094)	2.38	19.5	. . .
1/16 (0.062)	1.59	18.0	. . .

Note—The above table gives the computed minimum elongation values for each 1/32-in. (0.79-mm) decrease in wall thickness. Where the wall thickness lies between two values shown above, the minimum elongation value is determined by the following equation:

Grade	Direction of Test	Equation
I	transverse	E = 32t + 6.50
I	longitudinal	E = 48t + 15.00

where:

E = elongation in 2 in. or 50 mm in % and
t = actual thickness of specimen, in. (mm).

TABLE 3 Variations in Outside Diameter

NPS Designator	Permissible Variations in Outside Diameter, in. (mm)	
	Over	Under
1/8 to 1 1/2, incl	1/64 (0.4)	1/32 (0.8)
Over 1 1/2 to 4, incl	1/32 (0.8)	1/32 (0.8)
Over 4 to 8, incl	1/16 (1.6)	1/32 (0.8)
Over 8 to 18, incl	3/32 (2.4)	1/32 (0.8)
Over 18	1/8 (3.2)	1/32 (0.8)

13.3 *Thickness*—The minimum wall thickness at any point shall not be more than 12.5 % under the nominal wall thickness specified.

NOTE 4—The minimum wall thickness on inspection is shown in Appendix X1.

14. Workmanship, Finish, and Appearance

14.1 The pipe manufacturer shall explore a sufficient number of visual surface imperfections to provide reasonable assurance that they have been properly evaluated with respect to depth. Exploration of all surface imperfections is not required but may be necessary to assure compliance with 14.2.

14.2 Surface imperfections that penetrate more than 12½ % of the nominal wall thickness or encroach on the minimum wall thickness shall be considered defects. Pipe with such defects shall be given one of the following dispositions:

14.2.1 The defect may be removed by grinding provided that the remaining wall thickness is within specified limits.

14.2.2 Repaired in accordance with the repair welding provisions of 14.6.

14.2.3 The section of pipe containing the defect may be cut off within the limits of requirements on length.

14.2.4 Rejected.

14.3 To provide a workmanlike finish and basis for evaluating conformance with 14.2, the pipe manufacturer shall remove by grinding the following noninjurious imperfections:

14.3.1 Mechanical marks, abrasions (Note 5), and pits, any of which imperfections are deeper than 1/16 in. (1.58 mm).

NOTE 5—Marks and abrasions are defined as cable marks, dinges, guide marks, roll marks, ball scratches, scores, die marks, and the like.

14.3.2 Visual imperfections, commonly referred to as scabs, seams, laps, tears, or slivers, found by exploration in accordance with 14.1 to be deeper than 5 % of the nominal wall thickness.

14.4 At the purchaser's discretion, pipe shall be subject to rejection if surface imperfections acceptable under 14.2 are not

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