



# Standard Specification for Austenitic Chromium-Nickel-Silicon Alloy Steel Seamless and Welded Pipe<sup>1</sup>

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## 1. Scope

1.1 This specification covers seamless and straight-seam welded austenitic steel pipe intended for high-temperature and general corrosive service, having a specified minimum chromium content of less than 10.50 %.

1.2 Appendix X1 lists the dimensions of welded and seamless stainless steel pipe as shown in ANSI B36.19. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification.

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. 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. Unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished in inch-pound units.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>2</sup>
- A 450/A450M Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes<sup>3</sup>
- A 530/A530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe<sup>3</sup>
- E 112 Test Methods for Determining the Average Grain Size<sup>4</sup>
- E 381 Method of Macroetch Testing, Inspection, and Rating Steel Products, Comprising Bars, Billets, Blooms, and Forgings<sup>4</sup>
- E 527 Practice for Numbering Metals and Alloys (UNS)<sup>5</sup>

### 2.2 ANSI Standards:<sup>5</sup>

- B1.20.1 Pipe Threads, General Purpose
- B36.10 Welded and Seamless Wrought Steel Pipe

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.10 on Steel Tubing.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.01.

<sup>4</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>5</sup> Available from American National Standards Institute, 11 W. 42nd St., 11th Floor, New York, NY 10036.

B36.19 Stainless Steel Pipe

2.3 AWS Standard.<sup>6</sup>

A5.9 Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Electrodes

2.4 SAE Standard.<sup>7</sup>

SAE J1086 Practice for Numbering Metals and Alloys (UNS)

## 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 (austenitic steel pipe),
- 3.1.3 Process (seamless or welded),
- 3.1.4 Grade (Table 1),
- 3.1.5 Size (NPS or outside diameter and schedule number or average wall thickness),
- 3.1.6 Length (specific or random) (Section 10),
- 3.1.7 End finish (Section on Ends of Specification A 530/A 530M),
- 3.1.8 Optional requirements,
- 3.1.9 Test report required (Certification Section of Specification A 530/A 530M),
- 3.1.10 Specification number, and
- 3.1.11 Special requirements or any supplementary requirements selected, or both.

## 4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 530/A 530M unless otherwise provided herein.

## 5. Materials and Manufacture

### 5.1 Manufacture:

5.1.1 The pipe shall be made by the seamless or an automatic welding process, without addition of filler metal in the welding operation.

5.1.2 Welded pipe NPS 14 and smaller shall have a single longitudinal weld. Welded pipe of a size larger than NPS 14

<sup>6</sup> Available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33135.

<sup>7</sup> Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

**TABLE 1 Chemical Requirements**

|                 |           |
|-----------------|-----------|
| Grade           | ...       |
| UNS Designation | S70003    |
| C max           | 0.020     |
| Mn max          | 2.00      |
| P max           | 0.025     |
| S max           | 0.010     |
| Si              | 6.5–8.0   |
| Ni              | 22.0–25.0 |
| Cr              | 8.0–11.0  |
| Mo max          | 0.50      |
| Fe              | Balance   |

may be produced by forming and welding two longitudinal sections of flat stock when approved by the purchaser. All weld tests, examinations, inspections, or treatments are to be performed on each weld seam.

5.1.3 At the manufacturer’s option, pipe may be either hot finished or cold finished.

5.1.4 The pipe shall be free of scale and 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.

**5.2 Heat Treatment:**

5.2.1 All pipe shall be furnished in the heat-treated condition. The heat-treatment procedure, shall consist of heating the pipe to a minimum temperature of 1900°F (1040°C) and quenching in water or rapidly cooling by other means.

5.2.2 S70003 shall be heat treated in the range of 1920°F (1050°C) to 2010°F (1100°C) followed by a water quench or rapid cooling by other means.

**6. Chemical Composition**

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

**7. Product Analysis**

7.1 At the request of the purchaser, an analysis of one billet or one length of flat-rolled stock from each heat, or 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 steel:

|                |                         |
|----------------|-------------------------|
| NPS Designator | Lengths of Pipe in Lot  |
| Under 2        | 400 or fraction thereof |
| 2 to 5         | 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 6.

7.3 If the analysis of one of the tests specified in 7.1 does not conform to the requirements specified in 6, an analysis of each billet or pipe from the same heat or lot may be made, and all billets or pipe conforming to the requirements shall be accepted.

**8. Tensile Requirements**

8.1 The tensile properties of the material shall conform to the requirements prescribed in Table 2.

**9. Mechanical Tests**

9.1 *Transverse or Longitudinal Tension Test*—One tension

**TABLE 2 Tensile Requirements**

| Grade | UNS Designation | Tensile Strength, min psi (MPa) | 0.2 Y.S. min psi (MPa) | Elongation 2 in. or 50 mm or 4D min, % |
|-------|-----------------|---------------------------------|------------------------|--|
| ...   | S70003          | 78 (540)                        | 35 (240)               | 40                                     |

test shall be made on a specimen for lots of not more than 100 pipes. Tension tests shall be made on specimens from two tubes for lots of more than 100 pipes.

NOTE 1—The term “lot,” for mechanical tests, applies to all pipe of the same diameter and wall thickness (or schedule) which are produced from the same heat of steel and subjected to the same finishing treatment: in a continuous heat-treatment furnace, or in a batch-type heat-treatment furnace, equipped with recording pyrometers and automatically controlled within a 50°F (30°C) range, the larger of each 200 ft (60 m) or fraction thereof or, that pipe heat treated in the same batch furnace charge.

9.2 *Flattening Test*—For material heat treated in a batch-type furnace, flattening tests shall be made on 5 % of the pipe from each heat-treated lot. For material heat treated by the continuous process, this test shall be made on a sufficient number of pipe to constitute 5 % of the lot, but in no case less than two lengths of pipe.

9.2.1 For welded pipe a transverse-guided face bend test of the weld may be conducted instead of a flattening test in accordance with the method outlined in the steel tubular product supplement of Test Methods and Definitions A 370. The ductility of the weld shall be considered acceptable when there is no evidence of cracks in the weld or between the weld and the base metal after bending. Test specimens from 5 % of the lot shall be taken from the pipe or test plates of the same material as the pipe, the test plates being attached to the end of the cylinder and welded as a prolongation of the pipe longitudinal seam.

9.3 *Hydrostatic Test*—Each length of finished pipe shall be subjected to the hydrostatic test in accordance with Specification A 530/A 530M, unless specifically exempted under the provisions of 9.4.

9.4 For pipe whose dimensions equal or exceed NPS10, the purchaser with the agreement of the manufacturer may waive the hydrostatic test requirement when in lieu of such test the purchaser performs a system test. Each length of pipe furnished without the completed manufacturer’s hydrostatic test shall include the letters “NH” with the mandatory markings.

**10. Lengths**

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

10.1.1 Unless otherwise agreed upon, all sizes from NPS 1/8 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(s) 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.

10.1.2 If definite cut lengths are desired, the lengths required shall be specified in the order. No pipe shall be under the

specified length and not more than ¼ in. (6 mm) over that specified.

10.1.3 No jointers are permitted unless otherwise specified.

### 11. Workmanship, Finish, and Appearance

11.1 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 Section 8 of Specification A 530/A 530M.

### 12. Repair by Welding

12.1 For welded pipe whose diameter equals or exceeds NPS 6, and whose nominal wall thickness equals or exceeds 0.200, weld repairs made with the addition of compatible filler metal may be made to the weld seam with the same procedures specified for plate defects in the section on Repair by Welding of Specification A 530/A 530M.

12.2 Weld repairs of the weld seam shall not exceed 20 % of the seam length.

12.3 Weld repairs shall be made only with the gas tungsten-arc welding process.

12.4 Pipes that have had weld seam repairs with filler metal shall be uniquely identified and shall be so stated and identified on the certificate of tests.

### 13. Product Marking

13.1 In addition to the marking specified in Specification A 530/A 530M, the marking shall include the manufacturer's private identifying mark, the marking requirement of 9.4, if applicable, and whether seamless or welded.

### 14. Keywords

14.1 pipe; steel

## APPENDIX

### (Nonmandatory Information)

#### X1. TABLE OF DIMENSIONS OF WELDED AND SEAMLESS STEEL PIPE

X1.1 See Table X1.1 for dimensions of welded and seamless steel pipe.

**TABLE X1.1 Dimensions of Welded and Seamless Stainless Steel Pipe<sup>A</sup>**

NOTE 1—The decimal thickness listed for the respective pipe sizes represents their nominal or average wall dimensions.

| NPS<br>Designator | Outside Diameter |        | Nominal Wall Thickness   |      |                           |                   |                    |                   |                    |                    |
|-------------------|------------------|--------|--------------------------|------|---------------------------|-------------------|--------------------|-------------------|--------------------|--------------------|
|                   |                  |        | Schedule 5S <sup>B</sup> |      | Schedule 10S <sup>B</sup> |                   | Schedule 40S       |                   | Schedule 80S       |                    |
|                   | in.              | mm     | in.                      | mm   | in.                       | mm                | in.                | mm                | in.                | mm                 |
| ⅛                 | 0.405            | 10.29  | ...                      | ...  | 0.049                     | 1.24              | 0.068              | 1.73              | 0.095              | 2.41               |
| ¼                 | 0.540            | 13.72  | ...                      | ...  | 0.065                     | 1.65              | 0.088              | 2.24              | 0.119              | 3.02               |
| ⅜                 | 0.675            | 17.15  | ...                      | ...  | 0.065                     | 1.65              | 0.091              | 2.31              | 0.126              | 3.20               |
| ½                 | 0.840            | 21.34  | 0.065                    | 1.65 | 0.083                     | 2.11              | 0.109              | 2.77              | 0.147              | 3.73               |
| ¾                 | 1.050            | 26.67  | 0.065                    | 1.65 | 0.083                     | 2.11              | 0.113              | 2.87              | 0.154              | 3.91               |
| 1.0               | 1.315            | 33.40  | 0.065                    | 1.65 | 0.109                     | 2.77              | 0.133              | 3.38              | 0.179              | 4.55               |
| 1¼                | 1.660            | 42.16  | 0.065                    | 1.65 | 0.109                     | 2.77              | 0.140              | 3.56              | 0.191              | 4.85               |
| 1½                | 1.900            | 48.26  | 0.065                    | 1.65 | 0.109                     | 2.77              | 0.145              | 3.68              | 0.200              | 5.08               |
| 2                 | 2.375            | 60.33  | 0.065                    | 1.65 | 0.109                     | 2.77              | 0.154              | 3.91              | 0.218              | 5.54               |
| 2½                | 2.875            | 73.03  | 0.083                    | 2.11 | 0.120                     | 3.05              | 0.203              | 5.16              | 0.276              | 7.01               |
| 3                 | 3.500            | 88.90  | 0.083                    | 2.11 | 0.120                     | 3.05              | 0.216              | 5.49              | 0.300              | 7.62               |
| 3½                | 4.000            | 101.60 | 0.083                    | 2.11 | 0.120                     | 3.05              | 0.226              | 5.74              | 0.318              | 8.08               |
| 4                 | 4.500            | 114.30 | 0.083                    | 2.11 | 0.120                     | 3.05              | 0.237              | 6.02              | 0.337              | 8.56               |
| 5                 | 5.563            | 141.30 | 0.109                    | 2.77 | 0.134                     | 3.40              | 0.258              | 6.55              | 0.375              | 9.52               |
| 6                 | 6.625            | 168.28 | 0.109                    | 2.77 | 0.134                     | 3.40              | 0.280              | 7.11              | 0.432              | 10.97              |
| 8                 | 8.625            | 219.08 | 0.109                    | 2.77 | 0.148                     | 3.76              | 0.322              | 8.18              | 0.500              | 12.70              |
| 10                | 10.750           | 273.05 | 0.134                    | 3.40 | 0.165                     | 4.19              | 0.365              | 9.27              | 0.500 <sup>A</sup> | 12.70 <sup>A</sup> |
| 12                | 12.750           | 323.85 | 0.156                    | 3.96 | 0.180                     | 4.57              | 0.375 <sup>A</sup> | 9.52 <sup>A</sup> | 0.500 <sup>A</sup> | 12.70 <sup>A</sup> |
| 14                | 14.000           | 355.60 | 0.156                    | 3.96 | 0.188 <sup>A</sup>        | 4.78 <sup>A</sup> | ...                | ...               | ...                | ...                |
| 16                | 16.000           | 406.40 | 0.165                    | 4.19 | 0.188 <sup>A</sup>        | 4.78 <sup>A</sup> | ...                | ...               | ...                | ...                |
| 18                | 18.000           | 457.20 | 0.165                    | 4.19 | 0.188 <sup>A</sup>        | 4.78 <sup>A</sup> | ...                | ...               | ...                | ...                |
| 20                | 20.000           | 508.00 | 0.188                    | 4.78 | 0.218 <sup>A</sup>        | 5.54 <sup>A</sup> | ...                | ...               | ...                | ...                |
| 22                | 22.000           | 558.80 | 0.188                    | 4.78 | 0.218 <sup>A</sup>        | 5.54 <sup>A</sup> | ...                | ...               | ...                | ...                |
| 24                | 24.000           | 609.60 | 0.218                    | 5.54 | 0.250                     | 6.35              | ...                | ...               | ...                | ...                |
| 30                | 30.000           | 762.00 | 0.250                    | 6.35 | 0.312                     | 7.92              | ...                | ...               | ...                | ...                |

<sup>A</sup> These do not conform to the American National Standard for Welded and Seamless Wrought Steel Pipe (ANSI B36.10-1979).

<sup>B</sup> Schedules 5S and 10S wall thicknesses do not permit threading in accordance with the American National Standard for Pipe Threads (ANSI B1.20.1).

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