



Designation: A53/A53M – 18

Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless¹

This standard is issued under the fixed designation A53/A53M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification² covers seamless and welded black and hot-dipped galvanized steel pipe in NPS 1/8 to NPS 26 [DN 6 to DN 650] (Note 1), inclusive, with nominal wall thickness (Note 2) as given in Table X2.2 and Table X2.3. It shall be permissible to furnish pipe having other dimensions provided that such pipe complies with all other requirements of this specification. Supplementary requirements of an optional nature are provided and shall apply only when specified by the purchaser.

NOTE 1—The dimensionless designators NPS (nominal pipe size) [DN (diameter nominal)] have been substituted in this specification for such traditional terms as “nominal diameter,” “size,” and “nominal size.”

NOTE 2—The term nominal wall thickness has been assigned for the purpose of convenient designation, existing in name only, and is used to distinguish it from the actual wall thickness, which may vary over or under the nominal wall thickness.

1.2 This specification covers the following types and grades:

1.2.1 *Type F*—Furnace-butt-welded, continuous welded Grade A,

1.2.2 *Type E*—Electric-resistance-welded, Grades A and B, and

1.2.3 *Type S*—Seamless, Grades A and B.

NOTE 3—See Appendix X1 for definitions of types of pipe.

1.3 Pipe ordered under this specification is intended for mechanical and pressure applications and is also acceptable for ordinary uses in steam, water, gas, and air lines. It is suitable for welding, and suitable for forming operations involving coiling, bending, and flanging, subject to the following qualifications:

1.3.1 Type F is not intended for flanging.

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-53 in Section II of that code.

1.3.2 If Type S or Type E is required for close coiling or cold bending, Grade A is the preferred grade; however, this is not intended to prohibit the cold bending of Grade B pipe.

1.3.3 Type E is furnished either nonexpanded or cold expanded at the option of the manufacturer.

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

1.5 The following precautionary caveat pertains only to the test method portion, Sections 7, 8, 9, 13, 14, and 15 of this specification: *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, health, and environmental practices and determine the applicability of regulatory requirements prior to use.*

1.6 The text of this specification contains notes or footnotes, or both, that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.7 *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.*

2. Referenced Documents

2.1 *ASTM Standards*:³

A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
A370 Test Methods and Definitions for Mechanical Testing of Steel Products

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.

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

A530/A530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe
A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment
A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
A865/A865M Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints
B6 Specification for Zinc
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E213 Practice for Ultrasonic Testing of Metal Pipe and Tubing
E273 Practice for Ultrasonic Testing of the Weld Zone of Welded Pipe and Tubing
E309 Practice for Eddy Current Examination of Steel Tubular Products Using Magnetic Saturation
E570 Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products
E1806 Practice for Sampling Steel and Iron for Determination of Chemical Composition

2.2 ANSI Standards:

ASC X12⁴

B1.20.1 Pipe Threads, General Purpose⁴

2.3 ASME Standard:

B36.10M Welded and Seamless Wrought Steel Pipe⁵

2.4 Military Standards:

MIL-STD-129 Marking for Shipment and Storage⁶

MIL-STD-163 Steel Mill Products Preparation for Shipment and Storage⁶

2.5 Federal Standards:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁷

Fed. Std. No. 183 Continuous Identification Marking of Iron and Steel Products⁷

2.6 API Standard:

5B Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads⁸

3. Ordering Information

3.1 Information items to be considered, if appropriate, for inclusion in the purchase order are as follows:

3.1.1 Specification designation (A53 or A53M, including year-date),

3.1.2 Quantity (feet, metres, or number of lengths),

3.1.3 Grade (A or B),

3.1.4 Type (F, E, or S; see 1.2),

3.1.5 Finish (black or galvanized),

3.1.6 Size (either nominal (NPS) [DN] and weight class or schedule number, or both; or outside diameter and wall thickness, see **Table X2.2** and **Table X2.3**),

3.1.7 Length (specific or random, see Section 16),

3.1.8 End finish (plain end or threaded, Section 11),

3.1.8.1 Threaded and coupled, if desired,

3.1.8.2 Threads only (no couplings), if desired,

3.1.8.3 Plain end, if desired,

3.1.8.4 Couplings power tight, if desired,

3.1.8.5 Taper-tapped couplings for NPS 2 [DN 50] and smaller, if desired,

3.1.9 Close coiling, if desired (see 7.2.2),

3.1.10 Nondestructive electric test for seamless pipe (see 9.2),

3.1.11 Certification (see Section 20),

3.1.12 Report of the length of the end effect, if desired (see 9.2.7),

3.1.13 Marking (see Section 21),

3.1.14 End use of pipe,

3.1.15 Special requirements,

3.1.16 Supplementary requirements, if any,

3.1.17 Selection of applicable level of preservation and packaging and level of packing required, if other than as specified or if MIL-STD-163 applies (see 22.1), and

3.1.18 Packaging and package marking, if desired (see 23.1).

4. Materials and Manufacture

4.1 The steel for both seamless and welded pipe shall be made by one or more of the following processes: open-hearth, electric-furnace, or basic-oxygen.

4.2 If steels of different grades are sequentially strand cast, identification of the resultant transition material is required. The steel producer shall remove the transition material by any established procedure that positively separates the grades.

4.3 The weld seam of electric-resistance welded pipe in Grade B shall be heat treated after welding to a minimum of 1000 °F [540 °C] so that no untempered martensite remains, or otherwise processed in such a manner that no untempered martensite remains.

4.4 When pipe is cold expanded, the amount of expansion shall not exceed 1½ % of the specified outside diameter of the pipe.

5. Chemical Composition

5.1 The steel shall conform to the requirements as to chemical composition given in **Table 1** and the chemical analysis shall be in accordance with Test Methods, Practices, and Terminology **A751**.

6. Product Analysis

6.1 The purchaser is permitted to perform an analysis of two pipes from each lot of 500 lengths, or fraction thereof. Samples for chemical analysis, except for spectrographic analysis, shall be taken in accordance with Practice **E1806**. The chemical composition thus determined shall conform to the requirements given in **Table 1**.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁶ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

⁷ Available from General Services Administration, Washington, DC 20405.

⁸ Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://api-ec.api.org>.

TABLE 1 Chemical Requirements

	Composition, max, %								
	Carbon	Manganese	Phosphorus	Sulfur	Copper ^A	Nickel ^A	Chromium ^A	Molybdenum ^A	Vanadium ^A
	Type S (seamless pipe)								
Grade A	0.25 ^B	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30 ^C	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
	Type E (electric-resistance-welded)								
Grade A	0.25 ^B	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30 ^C	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
	Type F (furnace-welded pipe)								
Grade A	0.30 ^B	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08

^A The total composition for these five elements shall not exceed 1.00 %.

^B For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted up to a maximum of 1.35 %.

^C For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted up to a maximum of 1.65 %.

6.2 If the analysis of either pipe does not conform to the requirements given in **Table 1**, analyses shall be made on additional pipes of double the original number from the same lot, each of which shall conform to the specified requirements.

7. Mechanical Properties

7.1 Tension Test:

7.1.1 For tension tests other than transverse weld tension tests, the yield strength corresponding to a permanent offset of 0.2 % of the gage length or to an extension of 0.5 % of the gage length under load, the tensile strength, and the elongation in 2 in. or 50 mm shall be determined, and the tension test results shall conform to the applicable tensile property requirements given in **Table 2**.

7.1.2 For transverse weld tension tests, the tensile strength shall be determined, and the tension test results shall conform to the applicable tensile strength requirement given in **Table 2**.

7.1.3 Electric-resistance-welded pipe NPS 8 [DN 200] or larger shall be tested using two transverse test specimens, one taken across the weld and one taken opposite the weld.

7.1.4 Transverse tension test specimens shall be approximately 1½ in. [38 mm] wide in the gage length and shall represent the full wall thickness of the pipe from which the test specimens were cut.

TABLE 2 Tensile Requirements

	Grade A	Grade B
Tensile strength, min, psi [MPa]	48 000 [330]	60 000 [415]
Yield strength, min, psi [MPa]	30 000 [205]	35 000 [240]
Elongation in 2 in. or 50 mm	A,B	A,B

^A The minimum elongation in 2 in. [50 mm] shall be that determined by the following equation:

$$e = 625000 [1940] A^{0.2} / U^{0.9}$$

where:

- e = minimum elongation in 2 in. or 50 mm in percent, rounded to the nearest percent,
- A = the lesser of 0.75 in.² [500 mm²] and the cross-sectional area of the tension test specimen, calculated using the specified outside diameter of the pipe, or the nominal width of the tension test specimen and the specified wall thickness of the pipe, with the calculated value rounded to the nearest 0.01 in.² [1 mm²], and
- U = specified minimum tensile strength, psi [MPa].

^B See **Table X4.1** or **Table X4.2**, whichever is applicable, for the minimum elongation values that are required for various combinations of tension test specimen size and specified minimum tensile strength.

7.2 Bend Test:

7.2.1 For pipe NPS 2 [DN 50] or smaller, a sufficient length of pipe shall be capable of being bent cold through 90° around a cylindrical mandrel, the diameter of which is twelve times the specified outside diameter of the pipe, without developing cracks at any portion and without opening the weld.

7.2.2 If 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 specified outside diameter of the pipe, without failure.

7.2.3 Double-extra-strong pipe over NPS 1¼ [DN 32] need not be subjected to the bend test.

7.3 Flattening Test:

7.3.1 The flattening test shall be made on welded pipe over NPS 2 [DN 50] in extra-strong weight or lighter.

7.3.2 Seamless Pipe:

7.3.2.1 Although testing is not required, pipe shall be capable of meeting the flattening test requirements of Supplementary Requirement S1, if tested.

7.3.3 Electric-Resistance-Welded Pipe:

7.3.3.1 A test specimen at least 4 in. [100 mm] in length shall be flattened cold between parallel plates in three steps, with the weld located either 0° or 90° from the line of direction of force as required by **7.3.3.2** or **7.3.3.3**, whichever is applicable. During the first step, which is a test for ductility of the weld, except as allowed by **7.3.5**, **7.3.6**, and **7.3.7**, no cracks or breaks on the inside or outside surface at the weld shall be present before the distance between the plates is less than two thirds of the specified outside diameter of the pipe. As a second step, the flattening shall be continued as a test for ductility away from the weld. During the second step, except as allowed by **7.3.6** and **7.3.7**, no cracks or breaks on the inside or outside surface away from the weld shall be present before the distance between the plates is less than one third of the specified outside diameter of the pipe but is not less than five times the specified wall thickness of the pipe. During the third step, which is a test for soundness, the flattening shall be continued until the test specimen breaks or the opposite walls of the test specimen meet. Evidence of laminated or unsound material or of incomplete weld that is revealed by the flattening test shall be cause for rejection.

7.3.3.2 For pipe produced in single lengths, the flattening test specified in **7.3.3.1** shall be made using a test specimen