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Standard Specification for Electric-Resistance-Welded Steel Pipe[1]

This standard is issued under the fixed designation A135/A135M; 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 two grades of electric-resistance-welded steel pipe in NPS 2 to NPS 30 [DN 50 to DN 750] inclusive, with nominal (average) wall thickness up to 0.500 in. [12.70 mm], inclusive, and in nominal sizes NPS ¾ to NPS 5 [DN 20 to DN 125] inclusive with nominal (average) wall thickness 0.083 in. [2.11 mm] to 0.134 in. [3.40 mm], depending on size. Pipe having other dimensions (Note 1) may be furnished provided such pipe complies with all other requirements of this specification. The pipe is intended for conveying gas, vapor, water or other liquid; only Grade A is adapted for flanging and bending (Note 2). The suitability of pipe for various purposes is somewhat dependent upon its dimensions, properties, and conditions of service, so that the purpose for which the pipe is intended should be stated in the order. The pipe may be furnished either nonexpanded or cold expanded at the option of the manufacturer. When pipe is cold expanded, the amount of expansion shall not exceed 1.5 % of the outside diameter pipe size.

NOTE 1—A comprehensive listing of standardized pipe dimensions is contained in ASME B36.10M.

NOTE 2—This provision is not intended to prohibit the cold bending of Grade B pipe.

1.2 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.

1.3 *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]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment

A751 Test Methods and Practices 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

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

[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-135 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.

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

E6 Terminology Relating to Methods of Mechanical Testing
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 *ASME Standard:*
B1.20.1 Pipe Threads, General Purpose[4]
B36.10M Welded and Seamless Wrought Steel Pipe[4,5]

2.3 *Federal Standards:*
Fed. STD No. 123 Marking for Shipments (Civil Agencies)[6]
Fed. STD No. 183 Continuous Identification Marking of Iron and Steel Products[6]

2.4 *Military Standards:*
MIL-STD-129 Marking for Shipment and Storage[7]

3. Terminology

3.1 For definitions of terms relating to steel manufacturing and properties, refer to Terminology A941.

3.2 For definitions of terms relating to mechanical testing, refer to Terminology E6.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *burr, n*—a rough or sharp edge left on pipe ends by cutting or sawing.

3.3.2 *lot, n*—all pipe of the same size, wall thickness and rolled length that is produced from the same heat of steel and subject to the same heat treatment.

TABLE 1 Tensile Requirements

	Grade A	Grade B
Tensile strength, min, ksi [MPa]	48 [330]	60 [415]
Yield strength, min, ksi [MPa]	30 [205]	35 [240]
Elongation in 2 in. or [50 mm], min, %:		
For pipe having a specified wall thickness of 5/16 in. [7.9 mm] or more, if tested using a longitudinal strip test specimen.	35	30
For pipe having a specified wall thickness of less than 5/16 in. [7.9 mm], if tested using a longitudinal strip test specimen.	[A]	[B]
For pipe of any size, if tested using a full-size longitudinal test specimen.	35	30

[A] The minimum elongation shall be determined by the following equation, with the calculated value rounded to the nearest percent:

$$E = 56t + 16.5$$

$$[E = 2.2t + 16.5]$$

where:

E = elongation in 2 in. or [50 mm], minimum, %, and
t = specified wall thickness, in. [mm].

[B] The minimum elongation shall be determined by the following equation, with the calculated value rounded to the nearest percent:

$$E = 48t + 14$$

$$[E = 1.9t + 14]$$

where:

E = elongation in 2 in. or [50 mm], minimum, %, and
t = specified wall thickness, in. [mm].

[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 General Service Administration, Washington, DC 20405.
[7] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111–5094. Attn.: NOPD.

3.3.3 *black thread, n*—a thread crease exhibiting the original pipe surface after machining.

4. Ordering Information

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

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

4.1.2 Name of product (electric-resistance-welded pipe),

4.1.3 Specification designation and year of issue,

4.1.4 Grade (see Table 1),

4.1.5 Size (nominal size, NPS [DN], or outside diameter; and nominal wall thickness),

4.1.6 Length (specific or random, see 12.4),

4.1.7 End finish (plain or threaded, see 13.2),

4.1.7.1 Threaded and coupled, if specified,

4.1.7.2 Threads only, if specified,

4.1.7.3 Plain end, if specified,

4.1.8 Alternative electric test (see Section 11),

4.1.9 Tension test specimen (see Section 15),

4.1.10 Heat analysis, if required (see 6.1),

4.1.11 Certificate of compliance, if required (see Section 19), and

4.1.12 Special requirements.

5. Manufacture

5.1 The steel shall be made by either or both of the following processes: basic-oxygen or electric-furnace.

5.2 Steel may be cast in ingots or may be strand cast. When steels 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.

5.3 The pipe shall be manufactured from flat rolled steel in individual lengths or in continuous length by electric-resistance or electric-induction welding without the addition of extraneous material.

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

6. Chemical Composition

6.1 The steel shall conform to the requirements prescribed in Table 2, based on the heat analysis. When specified in the order, the heat analyses shall be reported to the purchaser or a representative of the purchaser.

TABLE 2 Chemical Requirements

Element	Composition, max, %	
	Grade A	Grade B
Carbon	0.25	0.30
Manganese	0.95	1.20
Phosphorus	0.035	0.035
Sulfur	0.035	0.035

7. Product Analysis

7.1 An analysis may be made by the purchaser on samples of pipe selected at random and shall conform to the requirements specified in Table 2. Methods and Practices relating to chemical analysis shall be in accordance with Test Method, Practices, and Terminology A751.

8. Mechanical Properties Requirements

8.1 *Tensile Properties:*

8.1.1 The material shall conform to the requirements as to tensile properties prescribed in Table 1.

8.1.2 The yield strength shall be determined by the offset method utilizing 0.2 % of the gauge length or by the total extension under load method using 0.5 % of the gauge length.

8.1.3 Longitudinal test specimens shall be full-size longitudinal test specimens (see Figure A2.1 of Test Methods and Definitions A370) or longitudinal strip test specimens (see Specimen No. 4 in Fig. A2.3 of Test Methods and Definitions A370).

8.2 The test specimen taken across the weld shall show a tensile strength not less than the minimum tensile strength specified for the grade of pipe ordered. This test will not be required for pipe under NPS 8 [DN 200].

9. Flattening Test

9.1 A 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 in 9.2. During the first step, which is a test for ductility of the weld, no cracks or breaks on the inside or outside surfaces shall occur before the distance between the plates is less than two thirds of the original outside diameter of the pipe. As a second step, the flattening shall be continued. During the second step, which is a test for ductility exclusive of the weld, no cracks or breaks on the inside or outside surfaces shall occur before the distance between the plates is less than one third of the original outside diameter of the pipe but is not less than five times the wall thickness of the pipe. During the third step, which is a test for soundness, the flattening shall be continued until the specimen breaks or the opposite walls of the pipe meet. Evidence of laminated or unsound material or of incomplete weld that is revealed during the entire flattening test shall be cause for rejection.

9.2 For pipe produced in single lengths, the flattening test specified in 9.1 shall be made on both crop ends cut from each length of pipe. The tests from each end shall be made alternately with the weld at 0° and at 90° from the line of direction of force. For pipe produced in multiple lengths, the flattening test shall be made on crop ends representing the front and back of each coil with the weld at 90° from the line of direction of force, and on two intermediate rings representing each coil with the weld 0° from the line of direction of force.

9.3 Surface imperfections in the test specimen before flattening, but revealed during the first step of the flattening test, shall be judged in accordance with the finish requirements in Section 13.

9.4 Superficial cracks as a result of surface imperfections shall not be cause for rejection.

10. Hydrostatic Test

10.1 Except as provided for in 10.3, each length of pipe shall be hydrostatically tested at the mill, without leakage through the wall, to a pressure calculated from the following equation:

$$P = 2St/D$$

where:

P = minimum hydrostatic test pressure, psi, [kPa]. The test pressure need not exceed 2500 psi [17 200 kPa],
S = allowable fiber stress 18 000 psi [124 000 kPa] for Grade A and 21 000 psi [145 000 kPa] for Grade B. This does not prohibit testing at higher pressure at the manufacturer's option,
t = specified wall thickness, in. [mm], and
D = specified outside diameter, in. [mm].

Plain end pipe may be tested at the discretion of the manufacturer in single lengths or in multiple lengths.

10.2 The hydrostatic pressure shall be maintained for not less than 5 s.

10.3 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."

NOTE 3—This provision is not intended to apply to light wall (Schedule 10) pipe listed in Table X1.1.

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

11. Nondestructive Examination Requirements

11.1 As an alternate to the hydrostatic test, and when accepted by the purchaser, each pipe shall be tested with a nondestructive electric test. Except for pipe produced on a hot-stretch reducing mill, the weld seam of each length of pipe shall be tested with a nondestructive test in accordance with Practices E213, E273, E309, or E570. Each length of pipe produced on a hot-stretch-reducing mill shall be tested with a nondestructive electric test that inspects the full volume of the pipe in accordance with Practices E213, E309, or E570.

11.2 Recognized methods for meeting this test are electromagnetic (eddy current) or ultrasonic.

11.3 The following information is for the benefit of the user of this specification:

11.3.1 The ultrasonic examination referred to in this specification is intended to detect longitudinal imperfections having a reflective area similar to or larger than the reference notch. The examination may not detect circumferentially oriented imperfections of short, deep imperfections.

11.3.2 The eddy-current examination referenced in this specification has the capability of detecting significant imperfections, especially of the short, abrupt type.

11.3.3 The hydrostatic test referred to in Section 10 is a test method provided for in many product specifications. This test has the capability of finding imperfections of a size permitting the test fluid to leak through the tube wall and may be either visually seen or detected by a loss of pressure. This test may not detect very tight, through-the-wall imperfections or imperfections that extend an appreciable distance into the wall without complete penetration.

11.3.4 A purchaser interested in ascertaining the nature (type, size, location, and orientation) of imperfections that can be detected in the specific application of these examinations should discuss this with the manufacturer of the tubular product.

11.4 In order to accommodate the various types of nondestructive electric testing equipment and techniques in use, the calibration pipe shall contain, at the option of the producer, any one or more of the following discontinuities to establish a minimum sensitivity level for rejection:

11.4.1 *Drilled Hole*—A hole not larger than 0.031-in. [0.8-mm] diameter shall be drilled radially and completely through pipe wall, preferably in the weld area, care being taken to avoid distortion of the pipe while drilling.

11.4.2 *Transverse Tangential Notch*—A notch shall be filed or milled tangential to the surface and transverse to the longitudinal

axis of the pipe preferably in the weld area. Said notch shall have a depth not exceeding 12.5 % of the nominal wall thickness of the pipe or 0.004 in., [0.10 mm], whichever is greater.

11.4.3 *Longitudinal Notch*—A notch 0.031 in. [0.8 mm] or less in width shall be machined in a radial plane parallel to the pipe axis on the outside surface of the pipe preferably in the weld area, to have a depth not exceeding 12.5 % of the nominal wall thickness of the pipe or 0.004 in. [0.10 mm], whichever is greater.

11.5 Pipe producing a signal equal to or greater than the calibration imperfection shall be rejected.

12. Dimensions, Weight (Mass), and Permissible Variations

12.1 *Weight (Mass)*—The weight (mass) of any length of pipe other than Schedule 10 shall not vary more than 3.5 % under or 10 % over that specified, but the carload weight (mass) shall be not more than 1.75 % under the nominal weight (mass). The weight (mass) of pipe furnished to Schedule 10 shall not vary more than ±10 % from that calculated using the weight (mass) per unit length prescribed in Appendix Table X1.1. The weight (mass) of the pipe shall be calculated from the relevant equation in ASME B36.10M.

NOTE 4—A system of standard pipe sizes has been approved by the American National Standards Institute as American National Standard for Welded and Seamless Wrought Steel Pipe (ASME B36.10M).

12.2 *Diameter*—The outside diameter shall not vary more than ±1 % from the nominal size specified.

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

NOTE 5—The minimum wall thickness on inspection is shown in Table X1.2 of the Appendix.

12.4 *Lengths:*

12.4.1 Except as allowed in 12.4.2, pipe shall be furnished in lengths averaging 38 ft [11.6 m] or over, with a minimum length of 20 ft [6.1 m], but no more than 5 % may be under 32 ft [9.8 m]. Jointers made by welding are permissible. When threaded pipe is ordered, jointers shall be made by threaded connections and shall not exceed 5 % of the order.

12.4.2 Unless otherwise specified, Schedule 10 pipe shall be between 16 and 22 ft [4.9 and 6.7 m] for a minimum of 90 % of the footage furnished, with any balance being shorter lengths at least 8 ft [2.4 m] long.

13. Workmanship, Finish, and Appearance

13.1 The finished pipe shall be reasonably straight and free of defects. Surface imperfections in excess of 12.5 % of the nominal wall thickness shall be considered defects.

13.2 *End Finish:*

13.2.1 *Schedule 10 Pipe*—Pipe furnished to Schedule 10 shall be plain end only. All inside and outside cutting burrs shall be removed. This generally involves breaking the corners.

13.2.2 *Ends, Plain End Pipe*—Unless otherwise specified, plain end pipe for use with the Dresser or Dayton type coupling shall be reamed both outside and inside sufficiently to remove all burrs. Plain end pipe for welding shall be beveled on the outside to an angle of 30° with a tolerance of + 5° and – 0° and with a width of flat at the end of the pipe of 1/16 ± 1/32 in. [1.6 ± 0.8 mm]. When material is ordered beveled to any other than a 30° angle, it should be understood that the angle is to be measured from a line drawn perpendicular to the axis of the pipe. This means that a greater amount of material is removed with a 60° angle than with a 30° angle. Pipe shall be sufficiently free from indentations, projections, or roll marks for a distance of 8 in. [200 mm] from the end of the pipe to make a tight joint with the rubber gasket type of coupling. All plain end pipe intended for Dresser or Dayton type joints or for welding, sizes NPS 10 [DN 250] and smaller in outside diameter specified, shall be not more than 1/32 in. [0.8 mm] smaller than the outside diameter specified for a distance of 8 in. [200 mm] from the ends of the pipe and shall permit the passing for a distance of 8 in. [200 mm] of a ring gauge that has a bore 1/16 in. [1.6 mm] larger than the outside diameter specified of the pipe. Sizes larger than NPS 10 [DN 250] shall be not more than 1/32 in. [0.8 mm] smaller than the nominal outside diameter

for a distance of 8 in. [200 mm] from the end of the pipe and shall permit the passing for a distance of 8 in. [200 mm] of a ring gauge which has a bore 3⁄32 in. [2.4 mm] larger than the nominal outside diameter of the pipe.

13.2.3 *Ends, Threaded Pipe*—Each end of threaded pipe shall be reamed to remove all burrs. All threads shall be in accordance with the American National Standard Pipe Threads (Note 6) and cut so as to make a tight joint when the pipe is tested at the mill to the specified internal hydrostatic pressure. The variation from the standard, when tested with the standard working gauge, shall not exceed one and one-half turns either way. Pipe shall not be rounded by hammering in order to get a full thread. There shall be not more than two black threads for ¾-in. [19.0-mm] taper among the perfect threads. Black threads should not be confused with imperfect threads, such as those torn, shaven, or broken.

NOTE 6—A complete description of the American National Standard Pipe Threads applicable to pipe, valves, and fittings is contained in ASME B1.20.1; also "Screw-Thread Standards for Federal Services, 1942," National Bureau of Standards *Handbook H 28*, January, 1942, the pertinent data in both sources being identical.

13.3 *Couplings*—Each length of threaded pipe shall be provided with one coupling manufactured in accordance with Specification A865/A865M except that the coupling may be wrought iron (Note 7). Threads shall be cut so as to make a tight joint. Taper-tapped couplings shall be furnished on all weights (masses) of threaded pipe NPS 2½ [DN 65] and larger.

NOTE 7—For sizes NPS 2 [DN 50] and smaller, it is commercial practice to furnish straight-tapped couplings for standard-weight (mass) (Schedule 40) pipe and taper-tapped couplings for extra-strong (Schedule 80) and double-extra-strong pipe. If taper-tapped couplings are required for sizes NPS 2 [DN 50] and smaller on standard weight (mass) (Schedule 40) pipe, line pipe in accordance with Specification 5L of the American Petroleum Institute should be ordered, thread lengths to be in accordance with ASME B1.20.1. Taper-tapped couplings for sizes NPS 2 [DN 50] and smaller in standard weight (mass) may be used on mill-threaded standard weight (mass) type of the same size.

13.4 *Protective Coating:*

13.4.1 After the pipe has been subjected to the hydrostatic test, and if required by the purchaser, it shall be thoroughly cleaned of all dirt, oil, grease, loose scale, and rust; then dried, and given a protective coating of the kind and in the manner specified by the purchaser. Pipe furnished to Schedule 10 shall be normally shipped with a light coating of processing oil. If so specified, the pipe can be given a mill coating or a special coating.

14. Weld Repair

14.1 *Welding Repair:*

14.2 Defects in the pipe wall, provided their depth does not exceed one third the specified wall thickness, shall be repaired by electric welding. Defects in the welds such as sweats or leaks, unless otherwise specified, shall be repaired or the piece rejected at the option of the manufacturer. Repairs of this nature shall be made by completely removing the defect, cleaning the cavity, and then electric welding.

14.3 All repaired pipe shall be retested hydrostatically in accordance with Section 10.

15. Sampling

15.1 *Chemical Analysis:*

15.1.1 Samples for chemical analysis, except for spectrochemical analysis, shall be taken in accordance with Practice E1806. The number of samples shall be determined as follows:

NPS	Numbers of Samples Selected
Under 6 [DN 150]	2 from each lot of 400 pipes or fraction thereof
6 [DN 150] to 20 [DN 500], incl	2 from each lot of 200 pipes or fraction thereof
Over 20 [DN 500] to 30 [DN 750], incl	2 from each lot of 100 pipes or fraction thereof

15.2 *Tension Test:*