SPECIFICATION FOR ELECTRIC-RESISTANCE-WELDED STEEL PIPE

SA-135

(Identical with ASTM Specification A 135-96)

1. Scope

1.1 This specification covers two grades of electric-resistance-welded steel pipe in NPS 2 to NPS 30 inclusive, with nominal (average) wall thickness up to 0.500 in. (12.70 mm), inclusive, and in nominal sizes $^{3}/_{4}$ to 5 in. (19 to 127 mm) 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; and 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 ANSI B36.10.

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

1.2 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

A 865 Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded and Seamless, for Use in Steel Pipe Joints

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E 59 Test Method of Sampling Steel and Iron for Determination of Chemical Composition

E 213 Practice for Ultrasonic Examination of Metal Pipe and Tubing

E 273 Practice for Ultrasonic Examination of Longitudinal Welded Pipe and Tubing

E 309 Practice for Eddy-Current Examination of Steel Tubular Products Using Magnetic Saturation

2.2 *ANSI Standards:*

B1.20.1 Pipe Threads, General Purpose

B36.10 Welded and Seamless Wrought Steel Pipe

3. Process

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

3.2 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.

3.3 The weld seam of electric-resistance-welded pipe in Grade B 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.

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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 or number of lengths),

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

4.1.3 Grade (Table 1),

4.1.4 Size (nominal size, or outside diameter, and nominal wall thickness),

4.1.5 Length (specific or random, Section 13),

4.1.6 End finish (plain or threaded, Section 14),

4.1.7 Alternative electric test (Section 11),

4.1.8 Skelp for tension tests (see 18.2),

4.1.9 Specification number, and

4.1.10 End use of materials.

5. Chemical Composition

5.1 The steel shall conform to the following requirements as to chemical composition:

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

6 Cast or Heat (Formerly Ladle) Analysis

6.1. An analysis of each heat of steel shall be made by the manufacturer to determine the percentages of the elements specified in Section 5. When requested by the purchaser, the chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified in Section 5.

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 Section 5. Samples for chemical analysis, except for spectrochemical analysis, shall be taken in accordance with Test Method E 59. The number of samples shall be determined as follows:

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

7.2 *Retests* — If the analysis of either length of pipe or length of skelp does not conform to the requirements specified in Section 5, analyses of two additional lengths from the same lot shall be made, each of which shall conform to the requirements specified.

8. Tensile Properties

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

8.2 The yield strength corresponding to a permanent offset of 0.2% of the gage length of the specimen, or to a total extension of 0.5% of the gage length under load shall be determined.

8.3 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 in outside diameter.

9. Flattening Test

9.1 A specimen at least 4 in. (102 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 until 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 until 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

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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 15.

9.4 Superficial ruptures 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 tested at the mill to a hydrostatic pressure calculated from the following equation, provided that in no case shall the specified test pressure exceed 2500 psi (17.2 MPa):

$$P = 2St/D$$

where:

P = minimum hydrostatic test pressure, psi,
S = allowable fiber stress 16 000 to 18 000 psi (110 to 124 MPa) for Grade A and 20 000 to 22 000 psi (138 to 152 MPa) for Grade B, but in no case shall the stress produced exceed 80% of the specified yield point,
t = specified wall thickness, in., and
D = specified outside diameter, in.

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 X1.2.

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 Electric Test

11.1 As an alternate to the hydrostatic test for Schedule 10 pipe in nominal pipe sizes $^{3}/_{4}$ to 5 in. and when accepted by the purchaser, each pipe shall be tested with a nondestructive electric test in accordance with Practice E 213, Practice E 273, or Practice E 309. It is the intent of this test to reject pipe containing injurious defects.

11.2 In order to accommodate the various types of nondestructive electric testing equipment and techniques in use, and manufacturing practices employed, any one of the following calibration standards may be used, at the option of the manufacturer, to establish a minimum sensitivity level for rejection:

11.2.1 *Drilled Hole* — A hole not larger than 0.031 in. (0.787 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.

11.2.2 *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.

11.2.3 *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.

11.3 Pipe producing a signal equal to or greater than the calibration defect shall be rejected.

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

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12. Dimension, Weight, and Permissible Variations

12.1 *Weight* — The weight of any length of pipe shall not vary more than 3.5% under or 10% over that specified, but the carload weight shall be not more than 1.75% under the nominal weight. The weight of pipe furnished to Schedule 10 shall not vary more than ±10% from that prescribed in Appendix, Table X1.2.

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

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

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

NOTE 5 — The minimum wall thickness on inspection is shown in Table X1.1 of the Appendix.

13. Lengths

13.1 Unless otherwise specified, 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 not 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 threading and shall not exceed 5% of the order. Pipe furnished to Schedule 10 shall be in a specified length between 16 and 22 ft (4.9 and 6.7 m) with shorts down to 8 ft (2.4 m). Short lengths shall not exceed 10% of the footage.

14. Workmanship

14.1 *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.

14.2 *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 $\frac{1}{16} \pm \frac{1}{32}$ in. (1.6 ± 0.8 mm). When material is ordered beveled to any other than a 35° 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 35° angle. Pipe shall be sufficiently free from indentations, projections, or roll marks for a distance of 8 in. (203 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 $10\frac{3}{4}$ in. (273 mm) and smaller in outside diameter, shall be not more than $\frac{1}{32}$ in. (0.8 mm) smaller than the nominal outside diameter for a distance of 8 in. (203 mm) from the end of the pipe and shall permit the passing for a distance of 8 in. (203 mm) of a ring gage which has a bore $\frac{1}{16}$ in. (1.6 mm) larger than the nominal outside diameter of the pipe. Sizes larger than $10\frac{3}{4}$ in. (273 mm) in outside diameter shall be not more than $\frac{1}{32}$ in. (0.8 mm) smaller than the nominal outside diameter for a distance of 8 in. (203 mm) from the end of the pipe and shall permit the passing for a distance of 8 in. (203 mm) of a ring gage which has a bore $\frac{3}{32}$ in. (2.4 mm) larger than the nominal outside diameter of the pipe.

14.3 *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 gage, shall not exceed one and one-half turns either way. Pipe shall not be rounded-out by hammering in order to get a full thread. There shall be not more than two black threads for $\frac{3}{4}$-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 the American National Standard for Pipe Threads (ANSI B1.20.1); also "Screw-Thread Standards for Federal Services, 1942," National Bureau of Standards *Handbook H28*, January, 1942, the pertinent data in both sources being identical.

14.4 *Couplings* — Each length of threaded pipe shall be provided with one coupling manufactured in accordance with Specification A 865 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 of threaded pipe NPS $2\frac{1}{2}$ and larger.

NOTE 7 — For sizes NPS 2 and smaller, it is commercial practice to furnish straight-tapped couplings for standard-weight (Schedule

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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 and smaller on standard weight (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 the American National Standard for Pipe Threads (ANSI B1.20.1). The taper-tapped couplings provided on line pipe in these sizes may be used on mill-threaded standard weight type of the same size.

15. Finish

15.1 The finished pipe shall be reasonably straight and free of injurious defects. Defects in excess of 12.5% of the nominal wall thickness shall be considered injurious.

15.2 *Repair by Welding* — Injurious 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.

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

16. Number of Tests

16.1 One longitudinal tension test shall be made on one length (Note 8) from each lot of 400 lengths or fraction thereof of each size under NPS 8 and one transverse body and one transverse weld tension test on one length from each lot of 200 lengths or fraction thereof of each size NPS 8 to NPS 20 and on one length from each lot of 100 lengths or fraction thereof of each size over NPS 20 to NPS 30. When taken from the skelp, the number of tests shall be determined in the same manner as when taken from the finished pipe.

NOTE 8 — Length is defined as the length as ordered, except that in the case of orders for cut lengths shorter than single random, the term lot shall apply to the lengths as rolled, prior to cutting to the required short lengths.

16.2 If any test specimen shows defective machining or develops flaws not associated with the quality of the steel or the welding, it may be discarded and another specimen substituted.

16.3 If the percentage of elongation of any tension test specimen is less than that specified in 8.1 and any part of the fracture is more than $^{3}/_{4}$ in. (19.0 mm) from the center of the gage length of a 2 in. (50 mm) specimen, as indicated by scribe scratches marked on the specimen before testing, the specimen may be discarded and another substituted.

16.4 The flattening test specified in Section 9 shall be made on both crop ends cut from each length of pipe. When pipe is produced in multiple lengths, flattening tests are required on the crop ends from the front and back ends of each coil and on two intermediate rings representing each coil.

16.5 Each length of pipe shall be subjected to the hydrostatic test specified in Section 9.

17. Retests

17.1 If the results of the tension tests of any lot do not conform to the requirements specified in Section 8, retests of two additional lengths from the same lot shall be made, each of which shall conform to the requirements specified.

17.2 If any section of the pipe fails to comply with the requirements of 9.1, for pipe produced in single lengths other sections may be cut from the same end of the same length until satisfactory tests are obtained, except that the finished pipe shall not be shorter than 80% of its length after the initial cropping; otherwise, the length shall be rejected. For pipe produced in multiple lengths, retests may be cut from each end of each individual length in the multiple; such tests shall be made with the weld alternately 0° and 90° from the line of direction of force.

18. Test Specimens and Methods of Testing

18.1 The test specimens and the tests required by these specifications shall conform to those described in Test Methods and Definitions A 370.

18.2 The longitudinal tension test specimen shall be taken from the end of the pipe, or by agreement between the manufacturer and the purchaser may be taken from the skelp, at a point approximately 90° from the weld, and shall not be flattened between gage marks. The sides of each specimen shall be parallel between gage marks.

18.3 Transverse weld test specimens shall be taken with the weld at the center of the specimen. Transverse body test specimens shall be taken opposite to the weld. All transverse test specimens shall be approximately $1^{1}/_{2}$ in. (38.1 mm) wide in the gage length and shall

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represent the full wall thickness of the pipe from which the specimen was cut.

18.4 All specimens shall be tested at room temperature.

19. Inspection

19.1 The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests (except check analysis) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

20. Rejection

20.1 Each length of pipe received from the manufacturer may be inspected by the purchaser and, if it does not meet the requirements of this specification based on the inspection and test method as outlined in the specification, the length may be rejected and the manufacturer shall be notified. Disposition of rejected pipe shall be a matter of agreement between the manufacturer and the purchaser.

20.2 Pipe found in fabrication or in installation to be unsuitable for the intended use, under the scope and requirements of this specification, may be set aside and the manufacturer notified. Such pipe shall be subject to mutual investigation as to the nature and severity of the deficiency and the forming or installation, or both, conditions involved. Disposition shall be a matter for agreement.

21. Protective Coating

21.1 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.

22. Product Marking

22.1 Each length of pipe shall be legibly marked with appropriate symbols by stenciling, stamping, or rolling to show by whom manufactured, the grade of pipe, the hydrostatic test pressure when tested, or the letters "NH" when not tested, and that it conforms to this specification. When furnished without hydrostatic testing the marking shall include the letters "NH."

22.2 *Bar Coding* — In addition to the requirements in 22.1, bar coding is acceptable as a supplementary identification method. Bar coding should be consistent with the Automotive Industry Action Group (AIAG) standard prepared by the Primary Metals Subcommittee of the AIAG Bar Code Project Team.

23. Packaging, Marking, and Loading

23.1 When specified on the purchase order, packaging, marking, and loading for shipment shall be in accordance with Practices A 700.

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TABLE 1
TENSILE REQUIREMENTS

	Grade A	Grade B
Tensile strength, min, ksi (MPa)	48 (331)	60 (414)
Yield strength, min, ksi (MPa)	30 (207)	35 (241)
Elongation in 2 in. (50 mm), min, %:		
Basic minimum elongation for walls $^{5}/_{16}$ in. (7.9 mm) and over in thickness, longitudinal strip tests, and for all small sizes tested in full section	35	30
For longitudinal strip tests, the width of the gage section shall be $1^{1}/_{2}$ in. (38.1 mm) and 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 points	1.75[A]	1.50[A]

[A] The following table gives computed minimum values:

	Elongation in 2 in. (50 mm), min, %	
Wall Thickness, in.	Grade A	Grade B
$^{5}/_{16}$ (0.312) (7.94 mm)	35.00	30.00
$^{9}/_{32}$ (0.281) (7.14 mm)	33.25	28.50
$^{1}/_{4}$ (0.250) (6.35 mm)	31.50	27.00
$^{7}/_{32}$ (0.219) (5.56 mm)	29.75	25.50
$^{3}/_{16}$ (0.188) (4.76 mm)	28.00	24.00
$^{5}/_{32}$ (0.156) (3.97 mm)	26.25	22.50
$^{1}/_{8}$ (0.125) (3.18 mm)	24.50	21.00
$^{3}/_{32}$ (0.094) (2.38 mm)	22.75	19.50
$^{1}/_{16}$ (0.062) (1.59 mm)	21.00	18.00

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 shall be determined by the following equation:

Grade	Equation
A	$E = 56t + 17.50$
B	$E = 48t + 15.00$

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

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APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL DATA

TABLE X1.1
TABLE OF MINIMUM WALL THICKNESS ON INSPECTION FOR NOMINAL (AVERAGE) PIPE WALL THICKNESSES

NOTE 1 — The following equation, upon which this table is based, may be applied to calculate minimal wall thickness from nominal (average) wall thickness:

$$t_n \times 0.875 = t_m$$

where:
t_n = nominal (average) wall thickness, in., and
t_m = minimum wall thickness, in.

The wall thickness is expressed to three decimal places, the fourth decimal place being carried forward or dropped, in accordance with Practice E 29.

NOTE 2 — This table is a master table covering wall thicknesses available in the purchase of different classifications of pipe, but it is not meant to imply that all of the walls listed therein are obtainable under this specification.

Nominal (Average) Thickness (t_n), in. (mm)	Minimum Thickness on Inspection (t_m), in. (mm)	Nominal (Average) Thickness (t_n), in. (mm)	Minimum Thickness on Inspection (t_m), in. (mm)	Nominal (Average) Thickness (t_n), in. (mm)	Minimum Thickness on Inspection (t_m), in. (mm)
0.068 (1.73)	0.060 (1.52)	0.294 (7.47)	0.257 (6.53)	0.750 (19.05)	0.656 (16.66)
0.088 (2.24)	0.077 (1.96)	0.300 (7.62)	0.262 (6.65)	0.812 (20.62)	0.710 (18.03)
0.091 (2.31)	0.080 (2.03)	0.307 (7.80)	0.269 (6.83)	0.843 (21.41)	0.738 (18.75)
0.095 (2.41)	0.083 (2.11)	0.308 (7.82)	0.270 (6.86)	0.864 (21.95)	0.756 (19.20)
0.113 (2.87)	0.099 (2.51)	0.312 (7.92)	0.273 (6.93)	0.875 (22.23)	0.766 (19.46)
0.119 (3.02)	0.104 (2.64)	0.318 (8.08)	0.278 (7.06)	0.906 (23.01)	0.793 (20.14)
0.125 (3.18)	0.109 (2.77)	0.322 (8.18)	0.282 (7.16)	0.937 (23.80)	0.820 (20.83)
0.126 (3.20)	0.110 (2.79)	0.330 (8.38)	0.289 (7.34)	0.968 (24.59)	0.847 (21.51)
0.133 (3.38)	0.116 (2.95)	0.337 (8.56)	0.295 (7.49)	1.000 (25.40)	0.875 (22.23)
0.140 (3.56)	0.122 (3.10)	0.343 (8.71)	0.300 (7.62)	1.031 (26.19)	0.902 (22.91)
0.145 (3.68)	0.127 (3.23)	0.344 (8.74)	0.301 (7.65)	1.062 (26.97)	0.929 (23.60)
0.147 (3.73)	0.129 (3.28)	0.358 (9.09)	0.313 (7.95)	1.093 (27.76)	0.956 (24.28)
0.154 (3.91)	0.135 (3.43)	0.365 (9.27)	0.319 (8.10)	1.125 (28.58)	0.984 (24.99)
0.156 (3.96)	0.136 (3.45)	0.375 (9.53)	0.328 (8.33)	1.156 (29.36)	1.012 (25.70)
0.179 (4.55)	0.157 (3.99)	0.382 (9.70)	0.334 (8.48)	1.218 (30.94)	1.066 (27.08)
0.187 (4.75)	0.164 (4.17)	0.400 (10.16)	0.350 (8.89)	1.250 (31.75)	1.094 (27.79)
0.188 (4.78)	0.164 (4.17)	0.406 (10.31)	0.355 (9.02)	1.281 (32.54)	1.121 (28.47)
0.191 (4.85)	0.167 (4.24)	0.432 (10.97)	0.378 (9.60)	1.312 (33.33)	1.148 (29.16)
0.200 (5.08)	0.175 (4.45)	0.436 (11.07)	0.382 (9.70)	1.343 (34.11)	1.175 (29.85)
0.203 (5.16)	0.178 (4.52)	0.437 (11.10)	0.382 (9.70)	1.375 (34.93)	1.203 (30.56)
0.216 (5.49)	0.189 (4.80)	0.438 (11.13)	0.383 (9.73)	1.406 (35.71)	1.230 (31.24)
0.218 (5.54)	0.191 (4.85)	0.500 (12.70)	0.438 (11.13)	1.437 (36.53)	1.258 (31.95)
0.219 (5.56)	0.192 (4.88)	0.531 (13.49)	0.465 (11.81)	1.500 (38.10)	1.312 (33.33)
0.226 (5.74)	0.198 (5.03)	0.552 (14.02)	0.483 (12.27)	1.531 (38.89)	1.340 (34.04)
0.237 (6.02)	0.207 (5.26)	0.562 (14.27)	0.492 (12.50)	1.562 (39.68)	1.367 (34.72)
0.250 (6.35)	0.219 (5.56)	0.593 (15.06)	0.519 (13.18)	1.593 (40.46)	1.394 (35.41)
0.258 (6.55)	0.226 (5.74)	0.600 (15.24)	0.525 (13.34)	1.750 (44.45)	1.531 (38.89)
0.276 (7.01)	0.242 (6.15)	0.625 (15.88)	0.547 (13.89)	1.781 (45.24)	1.558 (39.57)
0.277 (7.04)	0.242 (6.15)	0.656 (16.66)	0.574 (14.58)	1.812 (46.03)	1.586 (40.28)
0.279 (7.09)	0.244 (6.20)	0.674 (17.12)	0.590 (14.99)	1.968 (49.99)	1.722 (43.74)
0.280 (7.11)	0.245 (6.22)	0.687 (17.45)	0.601 (15.27)	2.062 (52.38)	1.804 (45.82)
0.281 (7.14)	0.246 (6.25)	0.719 (18.24)	0.629 (15.98)	2.343 (59.51)	2.050 (52.07)

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TABLE X1.2
DIMENSIONS NOMINAL WEIGHTS AND TEST PRESSURES FOR LIGHT WALL STEEL PIPE

		Schedule 10		Test Pressure, psi (MPa)[A]	
NPS	Outside Diameter, in.	Nominal Wall Thickness[A] in. (mm)	Weight, lb/ft (kg/cm)	Grade A	Grade B
3/4	1.050	0.083 (2.11)	0.86 (1.28)	2500 (17.24)	2500 (17.24)
1	1.315	0.109 (2.77)	1.40 (2.09)	2500 (17.24)	2500 (17.24)
1 1/4	1.660	0.109 (2.77)	1.81 (2.70)	2400 (16.55)	2500 (17.24)
1 1/2	1.900	0.109 (2.77)	2.08 (3.10)	2100 (14.48)	2400 (16.55)
2	2.375	0.109 (2.77)	2.64 (3.93)	1700 (11.72)	1900 (13.10)
2 1/2	2.875	0.120 (3.05)	3.53 (5.26)	1500 (10.34)	1700 (11.72)
3	3.500	0.120 (3.05)	4.33 (6.45)	1200 (8.27)	1400 (9.65)
3 1/2	4.000	0.120 (3.05)	4.97 (7.41)	1000 (6.89)	1200 (8.27)
4	4.500	0.120 (3.05)	5.61 (8.36)	900 (6.21)	1100 (7.58)
5	5.563	0.134 (3.40)	7.77 (11.58)	850 (5.86)	1000 (6.89)

[A] The test pressures are calculated by the following equation (but shall not exceed 2500 psi or 17.24 MPa):

$$P = 2St/D$$

where:
P = pressure, psi (MPa)
S = fiber stress, 60% of the specified minimum yield point,
t = specified thickness of wall, in. (mm), and
D = specified outside diameter, in. (mm).

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