



# Standard Specification for Steel Casing Pipe, Electric-Fusion (Arc)-Welded (Outside Diameter of 10 in. and Larger)<sup>1</sup>

This standard is issued under the fixed designation A1097; 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 covers electric-fusion (arc)-welded straight seam or spiral seam steel casing pipe 10 in. (254 mm) and larger in diameter (outside diameter as specified by purchaser) with wall thickness 0.200 in. (5.1 mm) or greater. It shall be permissible to specify and furnish pipe having other dimensions provided such pipe complies with all other requirements of this specification. The pipe is intended for use as casing or encasement in horizontal underground boring, tunneling, or open trench applications.

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.

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

1.4 The following precautionary caveat pertains only to the test method portion, Sections 11, 12, and 13 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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

A36/A36M Specification for Carbon Structural Steel

A515/A515M Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

A516/A516M Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

A572/A572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

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

A1011/A1011M Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

A1018/A1018M Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

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

### 2.2 AWS Standard:<sup>3</sup>

D1.1/D1.1M Structural Welding Code – Steel

## 3. Terminology

3.1 Definitions of terms used in this specification shall be in accordance with Terminology A941.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *defect*—an imperfection of sufficient size or magnitude to be cause for rejection.

3.2.2 *imperfection*—any discontinuity or irregularity found in the pipe.

## 4. Ordering Information

4.1 Orders for material under this specification shall contain information concerning as many of the following items as are required to describe the desired material adequately:

4.1.1 Quantity (feet or number of lengths),

4.1.2 Name of material (steel casing pipe),

4.1.3 Size (outside diameter and nominal wall thickness),

4.1.4 Pipe Section Lengths (see Section 9),

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

- 4.1.5 End finish (Section 10),
- 4.1.6 Steel ASTM specification designation and grade (Section 5),
- 4.1.7 ASTM specification designation and year of issue, and
- 4.1.8 Special Requirements (if any).

## 5. Materials and Manufacture

5.1 The pipe shall be made by the electric-fusion (arc) welded process. All seams of welded pipe shall be butt joints and girth, longitudinal, or helical orientation made using complete joint penetration welds.

5.2 The longitudinal edges of the steel shall be shaped to give the most satisfactory results by the particular welding process employed. The weld shall be of reasonably uniform width and height for the entire length of the pipe.

5.3 The steel from which the pipe is made shall conform to Specifications **A515/A515M**, **A516/A516M**, **A572/A572M**, **A36/A36M**, **A1011/A1011M**, or **A1018/A1018M** Classification SS, HSLA, or HSLA-F, or to other ASTM specifications for equally suitable weldable material. For purposes of testing, marking, and certification when required, the requirements for the pipe grade of material shall be established by the Specification A1097 steel specification designation and grade, when applicable.

## 6. Qualification of Welding and Welding Procedures

6.1 Welding operators and procedures shall be qualified in accordance with the AWS D1.1/D1.1M or other welding code acceptable by the purchaser.

## 7. Weights Per Unit Length

7.1 For pipe the weight per unit length shall be calculated as follows:

$$W = 10.69(D - t)t \quad (1)$$

where:

- $W$  = weight per unit length, lb/ft,
- $D$  = specified outside diameter, in., and
- $t$  = specified nominal wall thickness, in.

## 8. Permissible Variations in Weights and Dimensions

8.1 *Weight*—Each length of pipe weight when measured shall not vary more than 5 % under its theoretical weight, calculated using its length and its weight per unit length (see Section 7).

8.2 *Outside Diameter*—The outside diameter of casing pipe measured circumferentially shall not vary more than the lesser of  $\pm 1$  % from the specified outside diameter, or  $\pm 3/4$  in. (19 mm) in circumference.

8.3 *Roundness*—The pipe diameter as measured along any single plane shall not vary more than 1 % from the specified diameter.

8.4 *Straightness*—The maximum deviation from a straight line, over the entire pipe length, shall be 0.1 % of the pipe length.

8.5 *Thickness*—The pipe wall thickness when inspected shall not be less than 87.5 % of the nominal thickness at any

location. Pipe wall thickness shall not be in excess of 112.5 % of the nominal thickness unless approved by the purchaser. Thickness requirements are independent of the weight requirements of 8.1.

NOTE 1—The minimum permissible wall thickness on inspection is shown in **Table X1.1** (see **Appendix X1**) for various nominal wall thicknesses.

## 9. Lengths

9.1 The lengths shall be as specified on the order with a tolerance of  $\pm 1/2$  in. (13 mm), except that the shorter lengths from which test coupons have been cut may also be shipped.

## 10. Ends

10.1 Casing pipe shall be furnished with interlocking joint ends, beveled ends, or plain ends. The pipe end shall not vary by more than  $\pm 1/8$  in. (3 mm) from a plane perpendicular to the pipe axis.

10.2 Casing pipe specified with plain ends shall have either flame-cut or machine-cut ends, with the burrs at the ends removed.

10.3 For ends specified to be beveled, the bevel angle shall be  $30^\circ + 5^\circ$ ,  $-0^\circ$ , measured from a line drawn perpendicular to the axis of the pipe.

10.4 For ends specified with interlocking joints, the joint shall be machined either directly on the pipe end or on a ring that is butt welded to the end of the pipe section. Attached rings may be thicker than the pipe wall and may be made from any steel compliant with 5.3.

## 11. Number of Tests

11.1 One reduced-section weld tension test shall be made, representing each lot of 1000 ft (300 m) of pipe or fraction thereof of each diameter and thickness.

11.2 It shall be permissible to discard any test specimen that shows defective machining or develops imperfections and substitute another test specimen from the same lot.

## 12. Retests

12.1 If the results of the tension test representing any lot fail to conform to the applicable requirements, the lot shall be rejected or retested using two additional lengths from the lot, with each such test being required to conform to such specified requirements.

## 13. Test Specimens and Test Methods

13.1 The weld-test specimens for the reduced-section tension test shall be taken perpendicularly across the weld and from the end of the pipe or, alternatively, from flat test pieces of material conforming to the requirements in the specifications used in the manufacture of the pipe. The alternative weld-test specimens shall be welded with the same procedure and by the same operator and equipment, and in sequence with the welding of the longitudinal joints in the pipe. The test pieces shall have the weld approximately in the middle of the specimen.

13.2 Reduced-section tension test specimens shall be prepared in accordance with Fig. 21 of Test Methods and Definitions **A370**.

13.3 Reduced-section tension test specimens, taken perpendicularly across the weld with the weld shall show a tensile strength not less than 95 % of the specified minimum strength of the grade of steel. At the manufacturer's option, the test may be made without removing the weld reinforcement, or with alternative weld test specimens as defined in **13.1**, in which case the tensile strength shall be not less than the specified minimum tensile strength for the grade of steel used.

13.4 Specimens shall be tested at room temperature.

#### **14. Workmanship, Finish, and Appearance**

14.1 The finished pipe shall not contain imperfections in such number or of such character as to render the pipe unsuitable for casing pipe.

14.2 Surface imperfections having a depth not in excess of 25 % of the specified nominal wall thickness shall be acceptable. It shall be permissible to establish the depth of such imperfections by grinding or filing.

14.3 Surface imperfections having a depth in excess of 25 % of the specified nominal wall thickness shall be considered to be defects. It shall be permissible for defects not deeper than 33⅓ % of the specified nominal wall thickness to be repaired by welding, provided that the defect is completely removed prior to welding.

#### **15. Inspection**

15.1 The inspector representing the purchaser shall have 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 all reasonable facilities to satisfy the inspector that the material is being furnished in accordance with the requirements of this specification and any other requirements specified in the purchase order. All tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified in the purchase order, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

#### **16. Rejection**

16.1 The purchaser may inspect each length of casing pipe and reject any casing pipe that does not meet the requirements

of this specification, based upon the applicable inspection and test methods of the standard. The purchaser shall notify the manufacturer of any pipe that has been rejected, and the disposition of such pipe shall be subject to agreement between the manufacturer and the purchaser.

16.2 Pipe found in fabrication or installation to be unsuitable for the intended end use within the scope of this specification, based on the requirements of this specification shall be set aside. The purchaser shall notify the manufacturer of any pipe that has been set aside. Such pipe shall be subject to mutual investigation as to the nature and severity of the deficiency and conditions involved. The disposition of such pipe shall be subject to agreement between the manufacturer and the purchaser.

#### **17. Certification**

17.1 Where specified in the purchase order, the manufacturer shall furnish a certificate of compliance stating that the casing pipe was manufactured, tested, and inspected in accordance with the requirements of this specification (including year date) and any requirements specified in the purchase order, and was found to meet such requirements.

17.2 Where specified in the purchase order, the manufacturer shall furnish a test report containing the results of the applicable heat analyses, product analyses, and tension tests as defined in the ASTM standard for steel used in the manufacture of the pipe.

#### **18. Product Marking**

18.1 Each length of casing pipe shall be legibly marked by stenciling, stamping, or rolling to show: the name or brand of the manufacturer, the outside diameter, nominal wall thickness, length, the specification designation (year date not required), and the specified minimum yield strength.

18.2 *Bar Coding*—In addition to the requirements in **18.1**, it shall be permissible for bar coding to be used as a supplementary identification method.

#### **19. Keywords**

19.1 casing pipe; electric fusion (arc)-welded casing; electric fusion (arc)-welded pipe; steel casing; steel pipe; welded steel casing; welded steel pipe

## APPENDIX

### (Nonmandatory Information)

#### X1. MINIMUM PERMISSIBLE PIPE WALL THICKNESSES ON INSPECTION

X1.1 See **Table X1.1** for minimum wall thicknesses.

**TABLE X1.1 Table of Minimum Wall Thicknesses on Inspection for Nominal (Average) Pipe Wall Thicknesses**

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

$$t_n \times 0.875 = t_m \quad (\text{X1.1})$$

where:

$t_n$  = nominal wall thickness, in., and

$t_m$  = minimum permissible wall thickness, in.

The wall thickness is expressed to three decimal places, with rounding being in accordance with Practice E29.

NOTE 2—This table is a master table covering some of the nominal wall thicknesses available in the purchase of different classifications of pipe, but it is not meant to imply that all of these nominal wall thicknesses are necessarily obtainable.

Nominal Wall Thickness ( $t_n$ ), in. <sup>A</sup>	Minimum Permissible Wall Thickness on Inspection ( $t_m$ ), in. <sup>A</sup>	Nominal Wall Thickness ( $t_n$ ), in. <sup>A</sup>	Minimum Permissible Wall Thickness on Inspection ( $t_m$ ), in. <sup>A</sup>	Nominal Wall Thickness ( $t_n$ ), in. <sup>A</sup>	Minimum Permissible Wall Thickness on Inspection ( $t_m$ ), in. <sup>A</sup>
0.200	0.175	0.365	0.319	0.937	0.820
0.203	0.178	0.375	0.328	0.968	0.847
0.216	0.189	0.382	0.334	1.000	0.875
0.218	0.191	0.400	0.350	1.031	0.902
0.219	0.192	0.406	0.355	1.062	0.929
0.226	0.198	0.432	0.378	1.093	0.956
0.230	0.201	0.436	0.382	1.125	0.984
0.237	0.207	0.437	0.382	1.156	1.012
0.250	0.219	0.438	0.383	1.218	1.066
0.258	0.226	0.469	0.410	1.250	1.094
0.276	0.242	0.500	0.438	1.281	1.121
0.277	0.242	0.531	0.465	1.312	1.148
0.279	0.244	0.552	0.483	1.343	1.175
0.280	0.245	0.562	0.492	1.375	1.203
0.281	0.246	0.593	0.519	1.406	1.230
0.294	0.257	0.600	0.525	1.438	1.258
0.300	0.262	0.625	0.547	1.500	1.312
0.307	0.269	0.656	0.574	1.531	1.340
0.308	0.270	0.674	0.590	1.562	1.367
0.312	0.273	0.687	0.601	1.593	1.394
0.318	0.278	0.719	0.629	1.750	1.531
0.322	0.282	0.750	0.656	1.781	1.558
0.330	0.289	0.812	0.710	1.812	1.586
0.337	0.295	0.843	0.738	1.968	1.722
0.343	0.300	0.864	0.756	2.062	1.804
0.344	0.301	0.875	0.766	2.343	2.050
0.358	0.313	0.906	0.793	2.375	2.078

<sup>A</sup>1 in. = 25.4 mm.

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