



# Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures<sup>1</sup>

This standard is issued under the fixed designation F1083; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

## 1. Scope

1.1 This specification covers hot-dipped galvanized welded steel pipe in sizes ranging from 1.315–8.625 in. (33.4–219.1 mm) outside diameter (OD) inclusive, with nominal (average) wall thickness as given in [Table 1](#) and [Table 2](#). Pipe having other dimensions ([Note 2](#)) may be furnished provided such pipe complies with all other requirements of this specification. Pipe ordered under this specification is intended for use as a structural support for fencing in accordance with Specification [F1043](#), Group 1A.

**NOTE 1**—Outside diameter size is designated in that fence fittings are designed to securely fit on the outside of the pipe framework.

**NOTE 2**—A comprehensive listing of standardized pipe dimensions is contained in ANSI B 36.10.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

## 2. Referenced Documents

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

- [A90/A90M Test Method for Weight \[Mass\] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings](#)
- [A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment](#)
- [B6 Specification for Zinc](#)
- [E8 Test Methods for Tension Testing of Metallic Materials](#)
- [E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)
- [F1043 Specification for Strength and Protective Coatings on Steel Industrial Fence Framework](#)

<sup>1</sup> This specification is under the jurisdiction of Committee F14 on Fences and is the direct responsibility of Subcommittee F14.40 on Chain Link Fence and Wire Accessories.

Current edition approved Jan. 1, 2016. Published February 2016. Originally approved in 1987. Last previous edition approved in 2013 as F1083 – 13. DOI: 10.1520/F1083-16.

<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.

### 2.2 ANSI Standard:

[B 36.10 Welded and Seamless Wrought Steel Pipe](#)<sup>3</sup>

## 3. Ordering Information

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

- 3.1.1 Specification designation,
- 3.1.2 Quantity (feet, metres, or number of lengths),
- 3.1.3 Name of material (schedule 40 steel pipe or schedule 80 steel pipe),
- 3.1.4 Method of manufacture (electric-resistance welded or furnace welded),
- 3.1.5 Grade (Regular or High Strength) *High Strength Grade available in sizes 1.660 in. (42.2 mm) OD and larger. Regular Grade is available for all sizes.*
- 3.1.6 Type ([Table 1](#) or [Table 2](#)),
- 3.1.7 Size (outside diameter and weight per foot),
- 3.1.8 Length (see [Section 14](#)),
- 3.1.9 Certification (see [18.1](#)), and
- 3.1.10 Selection of applicable level of preservation and packaging required, if other than in accordance with Practices [A700](#) (see [20.1](#)).

## 4. Process

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

4.2 Welded pipe 4.500 in. (114.3 mm) OD and under may be butt-welded, unless otherwise specified. Welded pipe over 4.500 in. (114.3 mm) OD shall be electric-welded.

## 5. Coating

5.1 Pipe shall be coated with zinc inside and outside by the hot-dip process.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

**TABLE 1 Dimensions, Nominal Weights (Plain Ends) for Standard Weight Pipe (Schedule 40)**

NOTE 1—Pipe furnished in accordance with this table will be standard pipe. Nominal size designations are names, not dimensions, thus they are a unit-less term. The dimensionless designator NPS (nominal pipe size) is referenced in this specification as it is the historical designation for schedule 40 pipe. The fence framework application requires the framework fittings to fit securely on the outside of the pipe and therefore the OD, outside diameter, is the applicable dimension for this specification.

NOTE 2—The wall thickness is expressed in three decimal places, the fourth decimal place being carried forward or dropped, in accordance with Practice E29.

Designator	Trade Size O.D.		Outside Diameter		Wall Thickness		Weight	
	NPS	in.	in.	(mm)	in.	(mm)	lb/ft	(kg/m)
1		1 $\frac{3}{8}$	1.315	(33.4)	0.133	(3.38)	1.68	(2.5)
1 $\frac{1}{4}$		1 $\frac{5}{8}$	1.660	(42.2)	0.140	(3.56)	2.27	(3.4)
1 $\frac{1}{2}$		1 $\frac{7}{8}$	1.900	(48.3)	0.145	(3.68)	2.72	(4.0)
2		2 $\frac{3}{8}$	2.375	(60.3)	0.154	(3.91)	3.65	(5.4)
2 $\frac{1}{2}$		2 $\frac{7}{8}$	2.875	(73.0)	0.203	(5.16)	5.80	(8.6)
3	<sup>A</sup>	3 $\frac{1}{2}$	3.500	(88.9)	0.216	(5.49)	7.58	(11.3)
3 $\frac{1}{2}$		4 <sup>A</sup>	4.000 <sup>A</sup>	(101.6)	0.226	(5.74)	9.12	(13.6)
4		4 $\frac{1}{2}$	4.500	(114.3)	0.237	(6.02)	10.80	(16.1)
5		5 $\frac{9}{16}$	5.563	(141.3)	0.258	(6.55)	14.63	(21.77)
6		6 $\frac{3}{8}$	6.625	(168.3)	0.280	(7.11)	18.99	(28.3)
8		8 $\frac{5}{8}$	8.625	(219.1)	0.322	(8.18)	28.58	(42.5)

<sup>A</sup> F1083 4.000" OD High Strength Schedule 40 Pipe is not available.

**TABLE 2 Dimensions, Nominal Weights (Plain Ends) for Extra Strong Pipe (Schedule 80)**

NOTE 1—Pipe furnished in accordance with this table will be extra-strong pipe. Nominal size designations are names, not dimensions, thus they are a unit-less term. The dimensionless designator NPS (nominal pipe size) is referenced in this specification as it is the historical designation for schedule 80 pipe. The fence framework application requires the framework fittings to fit securely on the outside of the pipe and therefore the OD, outside diameter, is applicable dimension for this specification.

NOTE 2—The wall thickness is expressed in three decimal places, the fourth decimal place being carried forward or dropped, in accordance with Practice E29.

Designator	Trade Size O.D.		Outside Diameter		Wall Thickness		Weight	
	NPS	in.	in.	(mm)	in.	(mm)	lb/ft	(kg/m)
1		1 $\frac{3}{8}$	1.315	(33.4)	0.179	(4.55)	2.17	(3.23)
1 $\frac{1}{4}$		1 $\frac{5}{8}$	1.660	(42.2)	0.191	(4.85)	3.00	(4.47)
1 $\frac{1}{2}$		1 $\frac{7}{8}$	1.900	(48.3)	0.200	(5.08)	3.63	(5.41)
2		2 $\frac{3}{8}$	2.375	(60.3)	0.218	(5.54)	5.03	(7.48)
2 $\frac{1}{2}$		2 $\frac{7}{8}$	2.875	(73.0)	0.276	(7.01)	7.67	(11.41)
3		3 $\frac{1}{2}$	3.500	(88.9)	0.300	(7.62)	10.26	(15.27)
3 $\frac{1}{2}$		4	4.000	(101.6)	0.318	(8.08)	12.52	(18.63)
4		4 $\frac{1}{2}$	4.500	(114.3)	0.337	(8.56)	15.00	(22.32)
5		5 $\frac{9}{16}$	5.563	(141.3)	0.375	(9.52)	20.80	(30.94)
6		6 $\frac{3}{8}$	6.625	(168.3)	0.432	(10.97)	28.60	(42.56)
8		8 $\frac{5}{8}$	8.625	(219.1)	0.500	(12.70)	43.43	(64.64)

5.2 The zinc used for the coating shall be any grade of zinc conforming to Specification B6.

## 6. Tensile Requirements

6.1 Pipe furnished to this specification shall meet the following minimum tensile requirements when tested in accordance with Test Methods E8.

### 6.1.1 Tensile Strength:

6.1.1.1 *Regular Grade*—Minimum tensile strength shall be 48 000 psi (330 MPa).

6.1.1.2 *High Strength Grade Sch 40*—Minimum tensile strength shall be 60 000 psi (414 MPa). Available in sizes 1.660 in. (42.2 mm) OD and larger. 4 in. (101.6 mm) OD is not available.

### 6.1.2 Yield Strength:

6.1.2.1 *Regular Grade*—Minimum yield strength shall be 30 000 psi (205 MPa).

6.1.2.2 *High Strength Grade Sch 40*—Minimum yield strength shall be 50 000 psi (344 MPa). Available in sizes 1.660 in. (42.2 mm) OD and larger. 4 in. (101.6 mm) OD is not available.

## 7. Weight of Coating

7.1 The weight of zinc coating shall be not less than 1.8 oz/ft<sup>2</sup> (550 g/m<sup>2</sup>), as determined from the average results of the two specimens taken for test in accordance with 10.1 and not less than 1.6 oz/ft<sup>2</sup> (490 g/m<sup>2</sup>) for either of these specimens. The weight of coating expressed in ounces per square foot shall be calculated by dividing the total weight of zinc, inside plus outside, by the total area, inside plus outside, of the surface coated. Each specimen shall have not less than 1.3 oz/ft<sup>2</sup> (400 g/m<sup>2</sup>) of zinc coating on each surface, calculated by dividing the total weight of zinc on the given surface (outside or inside) by the area of the surface coated (outside or inside).

## 8. Weight of Coating Test

8.1 Determine the weight of zinc coating by a strip test in accordance with Test Method [A90/A90M](#). The total zinc on each specimen shall be determined in a double stripping operation.

## 9. Test Specimens

9.1 Test specimens for determination of weight of coating shall be cut approximately 4 in. (102 mm) in length. Specimens of toprail and brace material shall be taken from the ends of mill lengths. Specimens of post material shall be cut from the length from which the post is to be cut. Under no circumstances shall specimens of post material be taken after the post is cut from the mill length.

9.2 Tensile and yield samples shall be of sufficient length to prepare specimens for testing in accordance with Test Methods [E8](#).

## 10. Number of Tests

10.1 Two test specimens for the determination of weight of coating shall be taken, one from each end of one length of galvanized pipe, selected at random from each lot of 500 lengths or fraction thereof of each size.

10.1.1 For purposes of testing, a lot shall consist of not more than 500 lengths of pipe of the same type, grade, size, and weight.

10.1.2 For electric-resistance welded pipe, one tensile test shall be made on one length of pipe from each lot of 500 lengths, or fraction thereof, of each size. A 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.

10.1.3 For continuous-welded pipe, one tensile test shall be made on one length of pipe from each lot of 25 tons, or fraction thereof, of pipe 1.900 in. (48.3 mm) OD and smaller, and from each lot of 50 tons, or fraction thereof, of pipe 2.375 in. (60.3 mm) OD and larger.

## 11. Retests

11.1 If the weight of coating of any lot does not conform to the requirements specified in Section [7](#), retests of two additional pipes from the same lot shall be made, each of which shall conform to the requirements specified.

## 12. Standard Weights

12.1 The standard weights with the corresponding wall thickness for pipe of various nominal outside diameters are prescribed in [Table 1](#) and [Table 2](#).

NOTE 3—A system of standard pipe sizes has been approved by ANSI as B 36.10 that dispenses with the double-extra-strong weight and reclassifies the standard and extra-strong weights, substituting, therefore, schedules of wall thicknesses based on minimum pressure-stress ratios. Wall thicknesses corresponding to most of these now listed as standard weight and extra-strong are incorporated in Schedules 40 and 80, respectively, of B 36.10.

## 13. Dimensions, Mass, and Permissible Variations

13.1 *Weight*—The weight of the pipe covered by [Table 1](#) and [Table 2](#) shall not vary by more than  $\pm 10\%$  from that prescribed.

NOTE 4—The weight tolerance of  $\pm 10\%$  is determined from the weights of the customary lifts of pipe as produced for shipment by the mill, divided by the number of feet of pipe in the lift. On pipe sizes over 4.500 in. (114.3 mm) OD where individual lengths may be weighed, the weight tolerance is applicable to the individual length.

13.2 *Diameter*—For pipe 1.900 in. (48.3 mm) OD and under, the outside diameter at any point shall not vary more than  $\frac{1}{64}$  in. (0.4 mm) over nor more than  $\frac{1}{32}$  in. (0.8 mm) under the standard specified. For pipe 2.375 in. (60.3 mm) OD and over, the outside diameter shall not vary more than  $\pm 1\%$  from the standard specified.

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

## 14. Lengths

14.1 Lengths of toprail may be of random lengths, for example, 16 ft (4.9 m) to 24 ft (7.3 m), unless otherwise specified. Post lengths shall be as noted in the purchase order or producer plans and specifications with a tolerance of  $\pm 1$  in. (25.4 mm).

## 15. Workmanship, Finish, and Appearance

15.1 The finished pipe shall be galvanized and reasonably straight and free of defects. Any imperfection that is deeper than  $12\frac{1}{2}\%$  of the wall thickness or violates the minimum wall shall be considered a defect. All burrs at the ends of the pipe shall be removed.

15.2 The zinc coating shall be free of voids or excessive roughness.

15.3 End finish shall be plain end square cut.

15.4 Posts and rails shall be one piece free of welded sections.

## 16. Inspection and Certification

16.1 All tests 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.

16.2 Responsibility for inspection, unless otherwise specified in the contract or purchase order, rests upon the producer. This includes performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract order, the producer may use their own or any other suitable facilities for the performance of the inspection and test requirements specified herein unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

## 17. Rejection

17.1 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 this 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.

17.1.1 Pipe found in fabrication or 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.

## 18. Certification

18.1 The producer or supplier shall, upon request, furnish to the purchaser a certificate of inspection stating that the material has been sampled, tested, and inspected in accordance with this specification, and has been found to meet the requirements.

## 19. Product Marking

19.1 Except as allowed by 19.6 and 19.7, each length of pipe shall be legibly marked in the following sequence by rolling, stamping, or stenciling to show:

- 19.1.1 Manufacturer's name or mark,
- 19.1.2 Country of origin,
- 19.1.3 Method of manufacture (electric-resistance welded or furnace welded),
- 19.1.4 Specification number (year of issue not required), and

NOTE 5—Pipe that complies with multiple compatible specifications may be marked with the appropriate designation for each specification.

19.1.5 Size (specified outside diameter and weight class, schedule number, or nominal wall thickness; or specified outside diameter and nominal wall thickness).

19.2 Unless another marking format is specified in the purchase order, length shall be marked in feet and tenths of a foot, or metres to two decimal places, dependent upon the units

to which the pipe was ordered. The location of such marking shall be at the option of the manufacturer.

19.3 Heat number, lot number, run number, or a combination thereof shall be marked at the option of the manufacturer, unless specific marking is specified in the purchase order. The location of such marking shall be at the option of the manufacturer.

19.4 *Grade Designation*—The letters “HS 50000” shall be used when product meets the High Strength grade of material. The location of such marking shall be at the option of the manufacturer.

19.5 Any additional information desired by the manufacturer or specified in the purchase order.

19.6 For pipe 1.900 in. (48.3 mm) OD (DN 40) and smaller that is bundled, it shall be permissible to mark this information on a tag securely attached to each bundle.

19.7 When pipe sections are cut into shorter lengths by a subsequent producer for resale as material, the processor shall transfer complete identification including the name or brand of the manufacturer, to each unmarked cut length, or to metal tags securely attached to unmarked pipe bundled in accordance with the requirements of 19.6. The same material designation shall be included with the information transferred, and the processor's name, trademark, or brand shall be added.

19.8 *Bar Coding*—In addition to the requirements in 19.1, 19.6, and 19.7, bar coding is acceptable as a supplementary identification method. It is recommended that bar coding be consistent with the Automotive Industry Action Group (AIAG) standard prepared by the Primary Metals Subcommittee of the AIAG Bar Code Project Team.

## 20. Packaging and Loading

20.1 When specified on the purchase order, packaging, marking, and loading for shipment shall be in accordance with Practices A700.

## 21. Keywords

21.1 fence; posts, fence; strength; strength, fence posts; top rails, fence

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