



Designation: F1043 – 14

Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework¹

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1. Scope

1.1 This specification covers the strength and protective coating requirements for industrial steel fence framework. The intended use is for all types of fence, including but not limited to, chain link, expanded metal, wire mesh both welded and woven, PVC and wood. Consult fencing product manufacturer for post spacing requirements. Post spacings for chain link fence are not to exceed 10 ft. (For additional information, see CLFMI Guide WLG2445.)

1.1.1 *Caution Regarding Windload*—If additives to the fence, such as windscreen, inserts, or signage are required, it is advisable to use stronger framework and fittings, to reduce the on-center spacing of posts, or to add back bracing. Factors to consider when determining windload include the type of screening material to be used, area of fence to be covered and local wind conditions.

1.2 Posts and rails may have any cross-sectional shape meeting the requirements herein. The shapes may be formed and welded, cold formed, hot rolled, or extruded.

1.3 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.

2. Referenced Documents

2.1 ASTM Standards:²

- A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
- B6 Specification for Zinc
- D1499 Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics
- D3359 Test Methods for Measuring Adhesion by Tape Test

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

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² 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.

- E8 Test Methods for Tension Testing of Metallic Materials
- E376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods
- F552 Terminology Relating to Chain Link Fencing
- F934 Specification for Colors for Polymer-Coated Chain Link Fence Materials
- F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
- G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

2.2 Other Documents:

- WLG2445 CLFMI Guide for the Selection of Line Post Spacings³

3. Terminology

3.1 Definitions:

3.1.1 *posts*—vertical members of the fence.

3.1.1.1 *Discussion*—End, corner, and pull posts are posts at which fencing material terminates. Gateposts are posts to which gates are either attached or latched. Line posts are posts that occur in a line of fence in which the fencing material passes and to which it is secured.

3.1.2 *rails*—horizontal members of the fence.

3.1.2.1 *Discussion*—May be top, bottom, intermediate or brace rails.

3.1.3 The dimensional terminology is shown in Fig. 1.

3.1.4 The relationship of measured dimension (used throughout) to trade and industry usage is shown in Table 1.

3.1.5 *open sections*—non-tubular framework sections (such as C-posts, and roll-formed top rail).

3.1.6 *polymer coatings*—examples of some polymer coatings are acrylic urethane, polyurethane, polyvinyl chloride (PVC), polyester, and polyolefin elastomer.

3.1.7 See Terminology F552 for definitions of other terms.

4. Ordering Information

4.1 Orders for steel fence framework purchased to this specification shall include the following information:

³ Available from Chain Link Fence Manufacturers Institute, 10015 Old Columbia Road, Suite B-215, Columbia, MD 21046, http://www.chainlinkinfo.org.

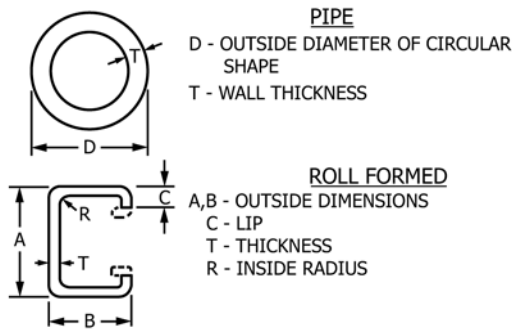


FIG. 1 Definitions of Dimensional Terms

TABLE 1 Pipe Diameter Terminology

| Trade Size, in. (mm) | Actual Outside Diameter | |
|---------------------------|-------------------------|--------|
| | in. | mm |
| 1 $\frac{1}{8}$ (33.40) | 1.315 | 33.40 |
| 1 $\frac{1}{2}$ (42.16) | 1.660 | 42.16 |
| 1 $\frac{3}{8}$ (48.26) | 1.900 | 48.26 |
| 2 $\frac{3}{8}$ (60.33) | 2.375 | 60.33 |
| 2 $\frac{1}{2}$ (73.03) | 2.875 | 73.03 |
| 3 $\frac{1}{2}$ (88.90) | 3.500 | 88.90 |
| 4 (101.60) | 4.000 | 101.60 |
| 4 $\frac{1}{2}$ (114.30) | 4.500 | 114.30 |
| 5 $\frac{1}{16}$ (141.30) | 5.563 | 141.3 |
| 6 $\frac{5}{8}$ (168.28) | 6.625 | 168.28 |
| 8 $\frac{5}{8}$ (219.08) | 8.625 | 219.08 |

TABLE 2 Definitions of Fence Framework Materials Design

| Material | Description of Material |
|--|--|
| Group IA Round Steel Pipe | Steel pipe shall be produced to conform to Specification F1083, standard weight (Schedule 40). Weight shall not vary more than 10 % \pm from that prescribed. |
| Group IC Round Steel Pipe (Electric Resistance Welded Pipe) | Steel pipe shall be produced in accordance with commercial standards. Minimum yield strength shall be 50 000 psi (344 MPa). Such products shall include, without seeking to limit to, cold-formed and welded pipe. Weight shall not vary more than 10 % \pm from that prescribed. |
| Group II/II-L Roll-Formed Steel Shapes (C-Sections) | Roll formed steel shapes shall be produced to commercial standards. Minimum yield strength shall be 50 000 psi (344 MPa), and 60 000 psi (413 MPa) for the 3.25 in. \times 2.50 in. line post sections. The formed lip shall be of the same thickness as the flat elements and shall project no less than $\frac{1}{8}$ the width of the flat element being stiffened. Group II products shall be designated such that the strong axis is perpendicular to the line of fence. Weight shall not vary more than 10 % \pm from that prescribed. |
| Group IV/IV-L Alternate Design | Any suitable design can be delivered, provided it meets the strength and stiffness criteria of (Heavy Industrial) or (Light Industrial/Commercial) and the producer has supplied, in a form acceptable to the purchaser, data that demonstrates conformance with the specification. At the producer's option the methods in either Section 6 or 6.4 may be used. |

- 4.1.1 Number of posts and rails by size and length,
- 4.1.2 Type of outside and inside coating (Section 7) and class of material,
- 4.1.3 Color, if applicable, in accordance with Specification F934,
- 4.1.4 Material group (IA, IC, II, II-L, IV, IV-L) (Table 2),
- 4.1.5 Certification, if required, and
- 4.1.6 Exception(s) to this specification, or special requirements, if any.

NOTE 1—These details may be covered in whole or in any part by accompanying the orders with design drawings and notations thereon.

5. Strength Requirements

5.1 It is the intent of this specification to permit the continuance of historically proven practice in the installation of

fence systems, and to provide strength requirements for alternative shapes and materials. Two categories are described. Heavy Industrial fence represents the most rigid and mechanically durable of the commonly installed framework. Light Industrial/Commercial fence, as provided herein, exhibits 80 % of the load bearing capability of heavy industrial fence. The summary requirements and options for Heavy Industrial fence and those of Light Industrial/Commercial Fence are given in Table 3.

5.2 Historical Practice—Experience has shown that galvanized steel performs satisfactorily as fence posts and rails if furnished to the standard weight (Schedule 40, Regular Grade, 30,000 psi) and nominal sizes listed in Specification F1083. Therefore, the minimum performance criteria is based on the historical strength of Specification F1083 Schedule 40, Regular Grade, 30,000 psi minimum yield.

TABLE 3 Summary of Requirements for Heavy Industrial and Light Industrial/Commercial Fence Framework
TABLE 3 Group IA—Summary of Requirements for Hot Dipped, Welded Schedule 40 Regular Grade and High Strength Grade Heavy Industrial Steel Pipe—Hot Dipped

| Reference Specifications | Steel F1083 | | | Regular Grade | High Strength Grade |
|--------------------------|------------------------|---------------------|--------------------------|---------------------|---------------------|
| Framework Size O.D. | Uses | Wall Thickness | Weight | Minimum Yield | Minimum Yield |
| 1.660 in. (42 mm) | Rail and Braces | 0.140 in. (3.6 mm) | 2.27 lb/ft (3.4 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 1.900 in. (48 mm) | Line Post | 0.145 in. (3.7 mm) | 2.72 lb/ft (4 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 2.375 in. (60 mm) | Line Post and Terminal | 0.154 in. (3.9 mm) | 3.65 lb/ft (5.4kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 2.875 in. (73 mm) | Line Post and Terminal | 0.203 in. (5.2 mm) | 5.80 lb/ft (8.6 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 3.500 in. (89.9 mm) | Line Post and Terminal | 0.216 in. (5.49 mm) | 7.58 lb/ft (11.3 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 4.000 in. (102 mm) | Line Post and Terminal | 0.226 in. (5.7 mm) | 9.12 lb/ft (13.6 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 4.500 in. (114.3 mm) | Line Post and Terminal | 0.237 in. (6.02 mm) | 10.8 lb/ft (16.1 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 5.563 in. (141.3 mm) | Line Post and Terminal | 0.258 in. (6.55 mm) | 14.63 lb/ft (21.77 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 6.625 in. (168 mm) | Line Post and Terminal | 0.280 in. (7.11 mm) | 18.99 lb/ft (28.3 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |
| 8.625 in. (219.10 mm) | Terminal | 0.322 in. (8.18 mm) | 28.58 lb/ft (42.5 kg/m) | 30000 psi (205 Mpa) | 50000 psi (344 Mpa) |

Note: Group IA material is available in two yield strengths:

IA-1. Regular Grade—Minimum yield strength shall be 30 000 psi (205 Mpa)

IA-2. High Strength Grade—Minimum yield strength shall be 50 000 psi (344 MPa).

Group IA Hot-Dipped Protective Zinc Coating:

- 1.1 Zinc for coating shall be Special High Grade per ASTM B6.
- 1.2 O.D. 1.8 oz/ft² (550 g/m²) minimum average in accordance with Specifications F1083.
- 1.3 I.D. 1.8 oz/ft² (550 g/m²) minimum average in accordance with Specifications F1083.
- 1.4 If so specified O.D. 2.0 oz/ft² 610 g/m²) minimum average.
- 1.5 If so specified I.D. 2.0 oz/ft² 610 g/m²) minimum average.

TABLE 3 Group IC Summary of Requirements Galvanized High Strength Material Heavy Industrial Steel Pipe—Galvanized

| Reference Specifications | Steel--Galvanized Before Forming A653/A653M and A924/924M Steel--Galvanized After Forming A1011/1011M | | | | |
|--------------------------|---|---------------------|-------------------------|--|----------------------|
| Framework Size O.D. | Uses | Wall Thickness | Weight | | Minimum Yield (psi) |
| 1.660 in. (42 mm) | Rail and Braces | 0.111 in. (2.8 mm) | 1.84 lb/ft (2.74 kg/m) | | 50 000 psi (344 MPa) |
| 1.900 in. (48 mm) | Line Post | 0.120 in. (3 mm) | 2.28 lb/ft 3.39 kg/m) | | 50 000 psi (344 MPa) |
| 2.375 in. (60 mm) | Line Post and Terminal | 0.130 in. (3.3 mm) | 3.12 lb/ft (4.64 kg/m) | | 50000 psi (344 MPa) |
| 2.875 in. (73 mm) | Line Post and Terminal | 0.160 in. (4 mm) | 4.64 lb/ft (6.90 kg/m) | | 50 000 psi (344 MPa) |
| 3.500 in. (89.9 mm) | Line Post and Terminal | 0.160 in. (4.06 mm) | 5.71 lb/ft (8.50 kg/m) | | 50 000 psi (344 MPa) |
| 4.000 in. (102 mm) | Line Post and Terminal | 0.160 in. (4.1 mm) | 6.56 lb/ft (9.76 kg/m) | | 50 000 psi (344 MPa) |
| 4.500 in. (114.3 mm) | Line Post and Terminal | 0.160 in. (4.1 mm) | 7.42 lb/ft (11.04 kg/m) | | 50 000 psi (344 MPa) |

Group IC products are available in two types of coatings.

1. Group IC Galvanized Before Forming

- 1.1 Zinc for exterior coating shall be Special High Grade per ASTM B6.
- 1.2 O.D. zinc weight to be a minimum of 0.9 oz/ft² (275 g/m²) with a verifiable verifiable polymer overcoat.
- 1.3 I.D. zinc weight to be a minimum of 0.9 oz/ft² (275 g/m²).
- 1.4 Framework produced from galvanized steel sheet meeting Specification A653/A653M shall have exterior welded surface recoated with the same type of material and thickness of base coating.

2. Group IC Galvanized After Forming

- 3.1 Zinc for exterior coating shall be Special High Grade per ASTM B6.
- 3.2 O.D. zinc weight to be a minimum of .9 oz/ft² (275 g/m²) with a verifiable polymer overcoat.
- 3.3 I.D. coating to be 81% nominal zinc pigmented coating, 0.3 mils (0.0076 mm) minimum coverage.