Designation: F1043 – 18 (Reapproved 2022)

Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework[1]

This standard is issued under the fixed designation F1043; 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 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.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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:*[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 Rating Adhesion by Tape Test

E8/E8M 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 Standard 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 Lamp Apparatus for Exposure of Materials

2.2 *Other Documents:*[3]

WLG2445 CLFMI Guide for the Selection of Line Post Spacings

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.

[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.

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

5.2.1 Experience has also shown that several additional products performed satisfactorily provided certain additional requirements are met. The nominal dimensions, minimum yield strength (Y), and nominal weight/ft are also listed in Table 3. These satisfactory designs are classified in accordance with products and special requirements as described in Table 2.

6. Strength Calculations

6.1 The strength of a structural member can generally be predicted from established engineering principles. The intent of this section is to provide criteria by which alternate designs can be judged to provide adequate strength without premature failure by local buckling. Accordingly, the criteria of 6.2 and 6.3 shall be satisfied even though, in general, only one will govern a particular design.

6.2 The elastic bending strength equals the yield strength times the section modulus of the entire cross section.

6.2.1 The yield strength may be considered to be either: *(1)* the minimum specified yield strength for material used to form a part, or *(2)* the value determined from tension tests performed in accordance with Test Methods E8/E8M. The specimen may be cut either from material before forming or from the part after fabrication.

6.3 Accepted engineering practice indicates that the full bending strength of a structure can be realized if the additional dimensional restrictions shown below are satisfied.

6.3.1 For circular shapes the ratio of the diameter to the thickness may not exceed 0.1 E/Y.

6.3.2 For cross-sectional shapes composed of flat elements, the ratio of width to thickness for elements supported along two parallel edges may not exceed 1.2 $(E/Y)^{1/2}$, and ratio of width to thickness for elements supported along one edge may not exceed 0.34 $(E/Y)^{1/2}$.

6.3.3 In these formulas, Y is the yield strength of the material and E is the modulus of elasticity of the material. A formed lip shall be considered to provide support only if the radius of gyration of the lip about the mid-thickness of the flat element from which it projects is not less than ⅕ the width of the flat element. For simple rectangular lips of the same thickness as the flat element, this requirement is satisfied when the projecting distance of the lip is not less than ⅓ the width of the flat element being stiffened.

6.4 *Strength Tests:*

6.4.1 At the producer's option, the producer may provide data from appropriate bending tests, to demonstrate compliance with Table 3. The producer shall provide test data from cantilever tests that have a 6-ft (1.83-m) span from the fixed end to the application of load.

6.4.2 Having once provided evidence of the validity of the designs, the producer's responsibility shall thereafter be limited to the quality control provisions of Section 9.

7. Coating Requirements

7.1 Coating requirements are listed in the material description of Group in Table 3.

8. Additional Coating Requirements

8.1 *Coating Materials*—Zinc used for coating shall be Special High Grade conforming to the requirements of Specification B6 and shall be applied by the hot-dip method.

8.1.1 PVC, polyester polymer, or polyolefin elastomer coating shall be of a color conforming to Specification F934. The PVC, polyester, or polyolefin elastomer coating shall not fade, crack, blister, or split under normal use. It shall have demonstrated the ability to withstand exposure in a weatherometer apparatus for 1000 h without failure when tested with Practice D1499.

8.1.2 Adhesion shall be tested as follows:

8.1.2.1 *PVC or Polyolefin Elastomer*—At three separate locations, using a sharp blade, cut two parallel lines ⅛ in. (3.2 mm) apart and 1 in. (25.4 mm) long through the coating. At one end of the parallel cut, with a knife peel back a section of the coating between ⅛ in. (3.2 mm) and ¼ in. (6.4 mm) to form a tab. Using the tab, attempt to pull away the coating from the surface. The coating should break and not peel back in two of the three tests. If unable to cut a tab due to the adhesion, the product is considered to have passed the adhesion test.

8.1.2.2 *Polyester*—Use cross hatch test in accordance with Test Methods D3359, Method B, 95 % minimum coating adhesion.

8.1.2.3 One hundred percent adhesion is generally not possible due to variations of the undercoating.

8.1.3 Zinc-pigmented coating shall yield a dry film with a 0.3-mil (0.0076-mm) minimum total thickness.

8.1.4 *Clear Polymeric*—Clear polymeric coatings shall be a clear film applied in a manner assuring good adhesion. The existence of a clear film coating shall be verified by a 15-second contact with a copper sulfate solution (specific gravity 1.186) at three separate locations on a specimen. Copper sulfate will react with zinc to form a black deposit of copper anywhere the zinc is not protected by the clear polymeric coating. The clear exterior coating shall have a demonstrated ability to withstand exposure for 500 h without failure at a black panel temperature of 145 °F (63 °C) when tested in accordance with Practice D1499. (See Practice G155).

8.2 *Optional Supplemental Color Coating*—Polymer coating, PVC or polyolefin elastomer 10-mils (0.254-mm) minimum or polyester 3-mils (0.0076-mm) minimum coating can be specified in conjunction with all metallic coatings and is applied to the exterior surface of tubular shapes, and to the exterior and interior surfaces of roll-formed open-sided shapes. Unless otherwise specified, color of the coating shall be in accordance with Specification F934.

9. Quality Control Provisions

9.1 *Group IA, IC, IV, and IV-L*—When requested, producers shall furnish, at the time of delivery, the following information for each size ordered:

9.1.1 Statement of conformance,
9.1.2 Outside diameter,
9.1.3 Minimum weight per foot,
9.1.4 Coating requirements,
9.1.5 Minimum yield strength,
9.1.6 Bending moment, and