



Designation: F1043 – 18 (Reapproved 2022)

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

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.*

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. 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.

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>.

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:

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

TABLE 1 Pipe Diameter Terminology

Trade Size, in. (mm)	Actual Outside Diameter	
	in.	mm
1 $\frac{3}{8}$ (33.40)	1.315	33.40
1 $\frac{1}{2}$ (42.16)	1.660	42.16
1 $\frac{7}{8}$ (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 $\frac{1}{8}$ (141.30)	5.563	141.3
6 $\frac{3}{8}$ (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 $\pm 10\%$ from that prescribed.
Group IC Round Steel Pipe 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 $\pm 10\%$ 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 $\pm 10\%$ 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.

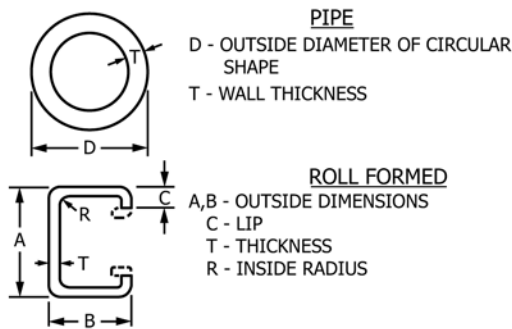


FIG. 1 Definitions of Dimensional Terms

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)	Not Available
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 Specification **B6**.
- 1.2 O.D. 1.8 oz/ft² (550 g/m²) minimum average in accordance with Specification **F1083**.
- 1.3 I.D. 1.8 oz/ft² (550 g/m²) minimum average in accordance with Specification **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)

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 Specification **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 Specification **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.

TABLE 3 Group II Summary of Requirements for Hot Dipped Roll-Formed Material Heavy Industrial Roll-Formed, Galvanized

Reference Specifications	Steel—A1011/A1011M Grade 50 Others			
Framework Dimensions	Uses	T	Weight	Minimum Yield (psi)
A=1.625 in. (41.2 mm)	Rail and Braces	0.080 in. (2.0 mm)	1.35 lb/ft (2.01 kg/m)	50 000 psi (344 MPa)
B=1.25 in. (31.7 mm)				
C=0.375 in. (9.5 mm)				
R=.01875 in. (4.76 mm)				
A=1.875 in. (47.6 mm)	Line Post	0.121 in. (3 mm)	2.40 lb/ft (3.39 kg/m)	50 000 psi (344 MPa)
B=1.625 in. (41.2 mm)				
C=0.5625 in. (14.3 mm)				
R=.25 in. (6.4 mm)				
A=2.25 in. (57.2 mm)	Line Post	0.121 in. (3 mm)	2.78 lb/ft (4.13 kg/m)	50 000 psi (344 MPa)
B=1.70 in. (43.2 mm)				
C=0.75 in. (19.1 mm)				
R=.25 in. (6.4 mm)				
A=3.25 in. (82.6 mm)	Line Post	0.130 in. (3.3 mm)	4.50 lb/ft (6.70 kg/m)	60 000 psi (413 MPa)
B=2.50 in. (64.0 mm)				
C=1.00 in. (25.4 mm)				
R=.025 in. (6.4 mm)				

See Fig. 1 for Definition of Dimensional Terms: A, B, C, R, T

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TABLE 3 Group II-L Summary of Requirements for Hot Dipped Roll-Formed Material Light Industrial

Reference Specifications	Steel—A1011/A1011M Grade 50 Others			
Framework Dimensions	Uses	T	Weight	Minimum Yield (psi)
A=1.625 in. (41.2 mm)	Rails and Braces	0.80 in. (2.0 mm)	1.35 lb/ft (2.01 kg/m)	50 000 psi (344 MPa)
B=1.25 in. (31.7 mm)				
C=0.375 in. (9.5 mm)				
R=0.1875 in. (4.76 mm)				
A=1.875 in. (47.6 mm)	Line Post	0.105 in. (2.67 mm)	1.85 lb/ft (2.75 kg/m)	50 000 psi (344 MPa)
B=1.625 in. (41.2 mm)				
C=0.5625 in. (14.3 mm)				
R=0.25 in. (6.4 mm)				
A=1.875 in. (47.6 mm)	Line Post	0.121 in. (3.1 mm)	2.40 lb/ft (3.57 kg/m)	50 000 psi (344 MPa)
B=1.625 in. (41.2 mm)				
C=0.5625 in. (14.3 mm)				
R=0.25 in. (6.4 mm)				

See Fig. 1 for Definition of Dimensional Terms: A, B, C, R, T

1. Group II and II-L Roll-Formed Protective Zinc Coating

A

1.1 II and II-L Coating Zinc 2.00 oz/ft² (610 g/m²) minimum average coating in accordance with Specification A123/A123M; or zinc coated in accordance with Specification A653/A653M for roll-formed shapes, including longitudinal (vertical) edges with a 4.0 oz/ft² (1220 g/m²), total both sides.

Description

The performance criterion for Alternative Products is stated in: F1043, Table 2 Group IV/IV_L Alternative Design.

Performance Criteria for Alternative Products

- 5. Strength Requirements
- 6. Strength calculations

If requested it is the producer's responsibility to provide information for which Group of material this is an alternative product. The alternative product shall meet or exceed the strength and coating requirements of the referenced Group material.

TABLE 3A Guidelines for Selection of Line Post Size and Spacing for Heavy Industrial Fence

NOTE 1—Advancements have been made to more accurately calculate and define wind load on fences. The American Society of Civil Engineers ASCE/SEI 7-10 Minimum Design Loads for Buildings and Structures is the foundation of The Chain Link Fence Institute's document Chain Link Fence Wind Load Guide for the Selection of Line Post Spacing, WLG 2445, if needed consult guide to calculate post size. More fences are being designed to withstand higher wind load forces. ASCE/SEI 7-10 states that all of the U.S. inland areas can be subjected to 105 MPH wind gusts and many coastal areas up to 170 MPH. The minimum line post size required to achieve setting at 10 ft. 0 in. on center in this table is based on a fence having 2-in. mesh, 9 gauge fabric, 105 MPH wind gust, Category B, no icing. Fences subjected to higher wind gusts, fences over 16 ft. 0 in. and for fences designed with smaller steel mesh configurations having a greater percentage of closure, and for solid fences containing wind screens or privacy inserts consult the Chain Link Fence Manufacturers Institute Guide for the Selection of Line Post and Line Post Spacing WLG2445. The maximum standard post spacing, 10 ft, 0 in. on-center, can be reduced to comply with the structural design.

Fence Fabric Height	Group IA ^A ASTM F 1083 Sch. 40 Pipe Min	Group IC Elec. Resistance Welded Pipe Min	Group II Rolled Formed C-Section Min
up to 6 ft, 0 in.	1.900 in.	1.900 in.	1.875 by 1.625 in.
over 6 ft, 0 in., up to 8 ft, 0 in.	2.375 in.	2.375 in.	1.875 by 1.625 in.
over 8 ft, 0 in., up to 10 ft, 0 in.	2.875 in.	2.875 in.	2.250 by 1.700 in.
over 10 ft, 0 in., up to 12 ft, 0 in.	3.500 in.	2.875 in.	3.250 by 2.500 in.
over 12 ft, 0 in., up to 14 ft, 0 in.	3.500 in.	3.500 in.	N/A ^B
over 14 ft, 0 in., up to 16 ft, 0 in. ^C	4.000 in.	4.000 in.	N/A

^A Regular grade, 30,000 psi steel yield pipe. F1083 High Strength Grade 50 000 psi steel yield pipe, not listed.

^B N/A = Larger post not available than maximum size previously listed.

^C For heights over 20 ft, contact licensed professional engineer.