



Standard Guide for Design and Construction of Welded Wire Fence Systems for Security Purposes¹

This standard is issued under the fixed designation F3204; 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 (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This guide provides assistance for the site security engineer to select the proper components required to design a site-specific, welded-wire physical security perimeter barrier.

1.2 This standard does not purport to address all of the physical protection security concerns, if any, associated with its use. It is the responsibility of the user of the standard to establish the appropriate design level of physical protection required and determine the applicability of regulatory requirements or limitations.

1.3 Specification **F2453** is to be used in conjunction with this guide.

1.4 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.

1.5 *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. Some specific hazards statements are given in Section 7 on Hazards.*

2. Referenced Documents

2.1 *ASTM Standards:*²

A121 Specification for Metallic-Coated Carbon Steel Barbed Wire

A307 Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

F934 Specification for Colors for Polymer-Coated Chain Link Fence Materials

F1043 Specification for Strength and Protective Coatings on

¹ This test method is under the jurisdiction of ASTM Committee **F14** on Fences and is the direct responsibility of Subcommittee **F14.50** on High Security Fences and Perimeter Barriers.

Current edition approved Nov. 1, 2016. Published November 2016. DOI: 10.1520/F3204-16.

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.

Steel Industrial Fence Framework

F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

F1665 Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence

F1910 Specification for Long Barbed Tape Obstacles

F1911 Practice for Installation of Barbed Tape

F2453 Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) for Meshes of 6 in.² [3871 mm²] or Less, in Panels or Rolls, with Uniform Meshes

2.2 *American Society of Civil Engineers Standards:*³

ASCE/SEI 7-10 (or latest edition) Minimum Design Loads for Buildings and Other Structures

3. Terminology

3.1 *Definitions*—Refer to the terminology listed in Specification **F2453**.

4. Classification

4.1 The welded wire mesh selected for security systems is classified in Specification **F2453** in accordance with the following coatings:

4.1.1 *Type 1*, consists of welded wire mesh manufactured from wire zinc-coated prior to being welded into fabric, known as galvanized before welding.

4.1.2 *Type 2*, consists of welded wire mesh manufactured from uncoated wire, the fabric of which is subsequently zinc-coated after fabrication, known as galvanized after welding.

4.1.3 *Type 3*, consists of welded wire mesh manufactured from wire coated with zinc-5 % aluminum-mischmetal alloy (Zn-5Al-MM) before being welded into fabric, known as zinc 5 % aluminum-mischmetal alloy-coated steel before welding.

4.1.4 *Type 4*, consists of welded wire mesh manufactured from wire zinc-coated prior to being welded into fabric, known as galvanized before welding, and subsequently polymer color coated.

³ Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, <http://www.asce.org>.

5. Ordering Information

5.1 When ordering or specifying welded wire mesh fence systems for security applications, the appropriate mesh type, mesh description, fence height, post size, post spacing, allowable mesh-to-framework attachment methods, and finish should all be defined to ensure that welded wire mesh panels and all associated system components will be compatible in the total system installation.

6. Materials and Manufacture

6.1 Welded Wire Mesh Panels

6.1.1 Finish

6.1.1.1 If Type 2 galvanized mesh is selected, the panels shall be completely and uniformly zinc-coated by the hot-dip process in accordance with Specification F2453 after welding, shall be free from excessive accumulations of zinc in the apexes of mesh openings, and free from bare spots.

6.1.1.2 If Type 4 color coated mesh is required, specify type of coating, color, and thickness of finish in accordance with Specification F2453. Specification F934 is noted for color selection, though color coating shall not be limited to the listed colors.

6.2 Framework

6.2.1 *Line Posts:* Fences designed to provide increased security levels are generally of greater heights, utilize smaller mesh sizes and heavier gauges, and these factors result in added wind load resistance. Line post selection and the spacing of the posts should be designed to meet the anticipated wind loads based on the site geographical location and weather conditions. Increased post sizes or specific post spacing may be required to compensate for wind loading or increased security. Determine the wind load requirements for a minimum 105 mph up to 170 mph wind according to ASCE/SEI 7-10 or consult the fence system manufacturer. After calculating the post spacing and post dimension, select the post specification and protective coating from Specification F1043, Heavy Industrial Fence Framework; Group IA Round Steel Pipe (Specification F1083 Schedule 40), Group IC Round Steel Pipe (Electric Resistance Welded Pipe), Group II Roll-Formed Steel Shapes (C-Sections), Group IV Alternate Design.

6.2.2 *Terminal Posts:* End, corner, or pull posts are to be in accordance with Specification F1043, Heavy Industrial Fence Framework; Group IA (Specification F1083 schedule 40 pipe), Group IC Electric Resistance Welded Pipe). Select the terminal post size based on the line post size.

6.2.3 *Rails:* Top, intermediate and terminal post brace rails when specified shall be in accordance with Specification F1043, Heavy Industrial Fence Framework; Group IA, (F1083 schedule 40 pipe) Group IC (Electric resistance welded pipe) or Group II (Roll-formed steel shapes).

6.2.4 *Polymer-coated Framework:* Specify the type of coating in accordance with Specification F1043 and the color in accordance with Specification F934.

6.3 Barbed Wire

6.3.1 When specified, select the type and coating from one of the following:

6.3.2 If metallic coated steel barbed wire, specify Specification A121 design number 12-4-3-14R having four-point barbs spaced 3 in. [76 mm] on center or 12-4-5-14R having four-point barbs spaced 5 in. [127 mm] on center.

6.3.3 *Aluminum Metallic-Coated:* Specify Coating A for the strand wire and aluminum alloy barbs.

6.3.4 *Zinc Metallic-Coated:* Specify Coating Type Z, Coating Class 3.

6.3.5 *Zinc-5% Aluminum-Mischmetal Alloy (Zn-5Al- MM) Metallic-Coated:* Specify Coating Type ZA, Coating Class 80.

6.3.6 Polymer-coated barbed wire shall be in accordance with Specification F1665; Specify coating type Class 2b, select barb spacing, Type I spacing at 5 in. [127 mm] on center or Type II spacing at 3 in. [76 mm] on center. The color shall match the system in accordance with Specification F934.

6.4 Fittings

6.4.1 The nuts and threaded portions of fasteners used to secure welded wire mesh panels to the framework must either be inaccessible from the attack side of the fence structure with the threads peened, or, if exposed, must be tamper-proof, peened, or welded to prevent removal. Fasteners and fittings shall be of sufficient size, strength and design to prevent removal of the fabric.

6.4.2 Fittings used in securing mesh panels to the framework shall have a strength that closely approximates the load strength of the specified threaded fastener (see Specification A307).

6.5 Barbed Tape Obstacle

6.5.1 *Barbed Tape:* When specified, select the diameter, design and configuration in accordance with Specification F1910.

TABLE 1 Recommended Mesh Size and Wire Gauge as Produced in Panels^A

Vertical Mesh Spacing (in.)	Horizontal Mesh Spacing (in.)	Wire Diameter Gauge	Wire Diameter (in.)	Wire Diameter (mm)	Panel Width for Post Spacings 6, 7, 8, and 10 ft. (in in.)	Panel Length (Height) (ft)
0.5	2.0	11	0.120	3.06	74, 86, 98, 122	6–21
0.5	3.0	10.5	0.128	3.25	74, 87, 99, 123	6–21
0.5	3.0	9	0.148	3.77	74, 87, 99, 123	6–21
0.5	3.0	8.5	0.155	3.94	74, 87, 99, 123	6–21
0.5	3.0	6	0.192	4.88	74, 87, 99, 123	6–21
0.75	3.0	4	0.225	5.72	74, 87, 99, 123	6–21

^APanels available up to 10 ft 6 in. in width (not all meshes) and 21 ft in length. The vertical mesh spacing is the distance measured from the top to the bottom. The horizontal mesh opening is the distance measured from left to right.

7. Installation

7.1 Refer to the manufacturer’s guidelines for installation instructions. Security, location, terrain, and other design parameters must also be factored into proper installation techniques and fittings usage.

7.2 *Caution Regarding Wind Loads*—Framework and concrete post footings must be designed to withstand the expected wind load forces.

7.3 Positioning Welded Wire Panels

7.3.1 When welded wire panels are installed continuously on the attack side of the fence they shall be firmly affixed in such a manner that the attack side of the post and rails are on the same plane (to enable secure attachment of the welded wire panels to the framework). Install the mesh panels, with the direction of the larger horizontal mesh opening pattern of the panel running either horizontal or vertical. When installed between posts, welded wire panels shall be securely fastened to both vertical and horizontal framework members. The overlap of adjacent panels shall be securely attached using the specified system’s attachment method.

7.3.2 Panels shall have no more than a 1-in. (25-mm) space between the bottom of the mesh and grade. Backfilling should be performed where appropriate. Additional security can be obtained by burying a separate section of polymer coated mesh of the same gauge and mesh as the adjacent mesh a minimum of 24 in. (610 mm) below grade. Overlap the buried mesh with the fence mesh a minimum of 6 in. (153 mm). It is recom-

mended not to hog ring the two fabrics together leaving the buried mesh free to adjust to possible movement due to frost. In lieu of burying mesh, install a concrete grade beam of the width and depth required for security, soil conditions, and frost.

7.3.3 When connecting panels to line and terminal posts, connection points shall not exceed 15 in. (381 mm). When connecting panels to horizontal rails, connection points shall not exceed 15 in. (381 mm). For added security, mesh can be attached (sandwiched) to the terminal post using a galvanized steel strap having a minimum cross section of 1 ½ in. (38 mm) by ¼ in. (6.4 mm) with holes spaced 12 in. (305 mm) on center to accommodate minimum ¾ in. (9.5 mm) carriage bolts that are to be bolted through the strap, the mesh, and through the terminal post.

7.3.4 Exposed edges of cut welded wire panels are very sharp and should be avoided. Overlapping panels more than the stated minimum above is the normal practice and is acceptable.

7.4 *Grounding to Earth*: Grounding of the security fence systems, when required, shall be in accordance with local code, and be installed by a licensed electrical contractor.

7.5 *Barbed Tape*: Barbed tape shall be installed in accordance with Specification F1911.

8. Keywords

8.1 barbed tape; high security; panels; security fencing; welded wire fence

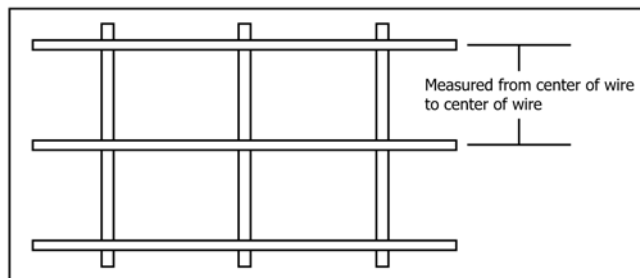


FIG. 1 Center to Center

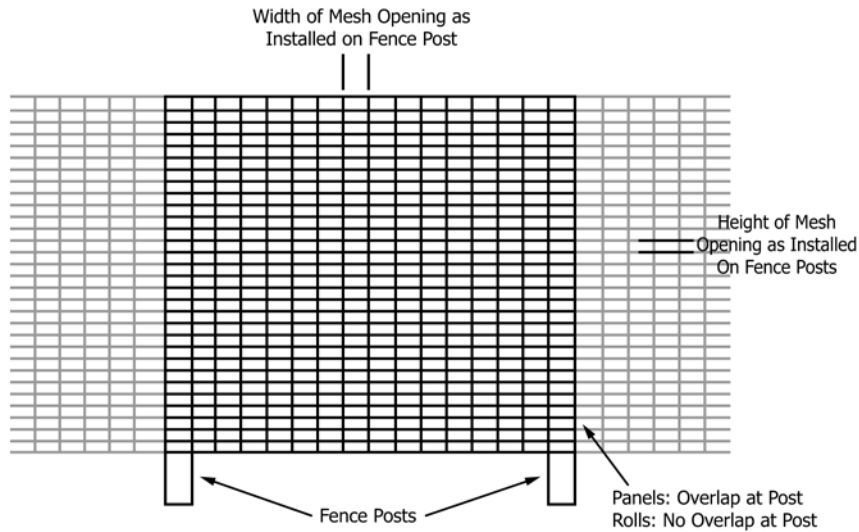


FIG. 2 How to Describe Mesh Spacing

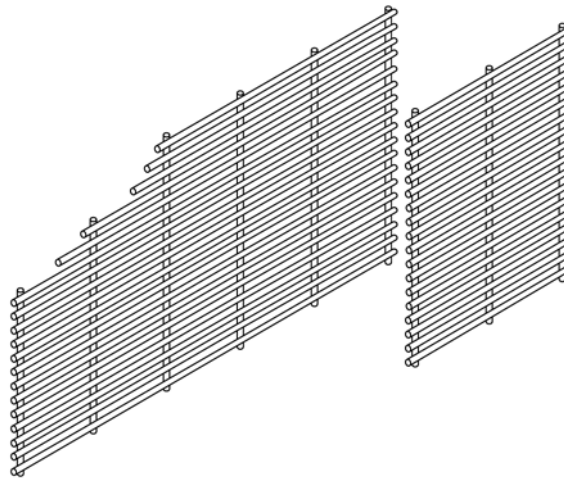


FIG. 3 Below Typical 0.50 x 3.00 in. Mesh

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