Designation: F2814 – 09 (Reapproved 2015)

Standard Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes[1]

This standard is issued under the fixed designation F2814; 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 guide provides the material and installation standards for selection in the design of an ornamental steel picket fence system for security applications. The proper material selection and system installation and layout can substantially increase the difficulty to penetrate; thereby, increasing the intrusion delay time.

1.2 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A121 Specification for Metallic-Coated Carbon Steel Barbed Wire

A392 Specification for Zinc-Coated Steel Chain-Link Fence Fabric

A491 Specification for Aluminum-Coated Steel Chain-Link Fence Fabric

F668 Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric

F1184 Specification for Industrial and Commercial Horizontal Slide Gates

F1345 Specification for Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric

F1379 Terminology Relating to Barbed Tape

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

F2200 Specification for Automated Vehicular Gate Construction

F2408 Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets

F2453/F2453M Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) for Meshes of 6 in.^{2} [3871 mm^2] or Less, in Panels or Rolls, with Uniform Meshes

F2548 Specification for Expanded Metal Fence Systems for Security Purposes

F2589 Specification for Ornamental Fences Employing Steel Tubular Pickets

F2656 Test Method for Crash Testing of Vehicle Security Barriers

2.2 *U.S. Department of State*[3]

SD-STD-02.01, Revision A, March 2003 Test Method for Vehicle Crash Gate Testing of Perimeter Barriers and Gates.

2.3 *U.S. Department of Defense*[4]

UFC 4-010-01 United Facilities Criteria, DoD Minimum Antiterrorism Standards for Buildings

3. Terminology

3.1 Terms defined in Specifications F2408 and F2589 shall also apply to ornamental steel picket fence systems under the jurisdiction of this guide.

3.2 Terms defined in Terminology F1379 shall apply to the use of barbed tape obstacles referenced in this guide.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *fence security accessory*—an accessory product added at the extremities of an ornamental steel picket security fence system to broaden its coverage range and increase the time and difficulty necessary to breach the system (for example, barbed wire, barbed tape, spiked railing supplements, etc.).

[1] This guide 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 July 1, 2015. Published August 2015. Originally approved in 2009. Last previous edition approved as F2814-09. DOI: 10.1520/F2814-09R15.

[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 the U.S. Department of State, Bureau of Diplomatic Security, Office of Physical Security Programs, Physical Security Division, SA-14, Washing D.C. 20529-1403.

[4] Available electronically from United Facilities Criteria (UFC) Index http://65.204.17.188//report/doc ufc.html

3.3.2 *supplemental security fence fill*—a secondary fence filler material (for example, expanded metal, welded wire mesh, chain-link mini-mesh fabric, etc.) attached to or integrated with the vertical pickets of the ornamental steel picket fence system.

4. Significance and Use

4.1 Ornamental steel picket fence systems can be designed to provide greater levels of security by selecting styles and configurations that increase the difficulty to penetrate and in turn increase delay time. Some examples include: increasing the height of the fence, using ornamental picket styles that curve outward to form a parapet on the attack side of the fence, and decreasing the spacing between vertical pickets.

4.2 Security hardening of ornamental steel picket fence systems can be achieved by adding fence security accessories (that is, barbed wire to the top; barbed tape to the top, side or bottom of the fence; or spiked railing supplements along the top rail) or by attaching supplemental security fence fill materials (that is, expanded metal, barbed tape mesh, welded wire mesh, or chain-link mini-mesh fabric). Slats or screening panels can be inserted to restrict visibility when required.

4.3 Multiple fence lines can be installed to create isolation zones that enhance the ability to patrol or visually monitor the area.

4.4 Anti-ram cable systems may be added to resist vehicle penetration into a protected perimeter.

5. Part 1—General

5.1 List the scope of work included; the performance requirements of the overall project security design criteria; the performance design criteria for the fence system, referenced contract documents, fence design and detail drawings, material specifications, related site work, site drawings with the specific fence layout, product and data submittals, certifications, site preparation, contractor qualifications, warranties and the fence integration with other security products.

5.1.1 Fence placement can be critical and should be well thought out and defined by the contract specifications and drawings. Placement should be coordinated with the grading plan to ensure it does not inhibit drainage flow or cause debris buildup.

5.1.2 Consideration should be given to the fence location to provide the proper offset to protect a building or provide a clear zone from trees, underbrush, buildings and structures. Qualifying federal building sites require specified fence set back distances from the building in compliance with the DoD Minimum Antiterrorism Standards for Buildings, UFC 4-010-01.

5.1.3 Consideration should be given during design of the fence to ensure it will properly support the application of added intrusion detection devices. An integrated system using lighting with video surveillance requires a specific fence layout, for example, the fence must be located to avoid blocking the view or reduce shadows.

5.1.4 Signage posted along the fence line should always be a consideration.

6. Material Requirements

6.1 *Tubular Picket Ornamental Fence System:*

6.1.1 Structural components of tubular picket ornamental fence systems shall meet the material and coating requirements of Specification F2408 or F2589, whichever is applicable.

6.1.2 There are multiple panel and picket design configurations; those recommended for security fence applications are listed in Table 1.

6.1.3 Because ornamental steel picket fence systems designed for increased security levels are generally taller and heavier than fences for other applications, and, because they frequently are hardened by the addition of supplemental expanded metal, welded wire, or chain-link fill, wind resistance is amplified. Fence system designs should be selected to meet the anticipated wind loads based on the site geographical location, soil strength and weather conditions.

6.2 *Fence Security Accessories:*

6.2.1 *Barbed Wire*—When barbed wire is specified, It is recommended that polymer coated barbed wire in accordance with Specification F1665, Type II spacing at 3 in. (76 mm) on center be selected. The color should match the color of the ornamental fence, if possible to match the aesthetics of the fence system. Metallic coated carbon steel barbed wire, high security grade in accordance with Specification A121, is also permissible.

TABLE 1 Panel & Picket Design Characteristics for Security Applications

Characteristic	Design Recommendation
Panel Height	Minimum 8 ft
Component Sizes	Minimum F2408 or F2589, Industrial Class; pickets to be a minimum of 1 in.^{2} × 14 Ga.
Rail Spacing	Minimum 80 in. clear span between rail(s) at top of fence panel and rail(s) at bottom of panel when space between pickets exceeds 2-¼ in. (No minimum if space between pickets is less than 2-¼ in. or if supplemental security fence fill is added to cover the spaces.
Post Spacing	Maximum 8 ft
Picket-To-Rail Connections	Connections must be secured by welding, by enclosed inaccessible retaining system, or by tamper-proof security fasteners.
Picket Profile	Spear-pointed tip extending minimum of 6 in. above top rail; or top rail protection provided by fence security accessories such as barbed wire, barbed tape, spiked railing supplements. Outwardly curved or angled pointed picket designs increase difficulty to climb.

6.2.2 *Barbed Tape Obstacles*—When barbed tape is specified, select the diameter, design and configuration in accordance with Specification F1910.

6.2.3 *Spiked Railing Supplements*—When spiked railing supplements are specified, material and coating shall comply with the requirements for the fence system.

6.3 *Supplemental Security Fence Fill:*

6.3.1 *Expanded Metal*—When expanded metal is specified, select the appropriate material, mesh size, gauge, design and configuration from Specification F2548.

6.3.2 *Welded Wire Mesh*—When welded wire mesh is specified, select the appropriate material, mesh size, gauge, design and configuration from Specification F2453/F2453M.

6.3.3 *Chain Link Fabric*—When chain link fabric is specified, It is recommended that the appropriate material, mesh, size, gauge, color, design, and configuration be selected from Specification F668 to match the aesthetics of the ornamental fence; however, selection from Specification A392, A491, or F1345 is also permissible if metallic coated fabric is acceptable.

6.4 *Fittings:*

6.4.1 The material for post caps, finials and other decorative adornments shall be compatible with the fence system component material; coating shall meet the same performance standard as the fence components (see Specification F2408 or F2589, whichever is applicable).

6.4.2 Brackets and bracket fasteners used for mounting panels to post have a shear strength equal to or greater than the horizontal rail material, coated to meet the same performance standard as the fence components (see Specification F2408 or F2589, whichever is applicable). Fasteners shall be tamper-proof (for example, one-way bolts, break-away cone nuts, etc.).

6.4.3 When barbed wire is specified, select barb arm design to meet the appropriate security requirement (barb arms are available in various configurations to accommodate three to six strands of barbed wire).

6.5 *Swing Gates*—Swing gates shall be fabricated by welding using 2-in.^{2} gate ends and rails and pickets meeting the fence component criteria. Gates frame shall be designed for the width built so that the outer member shall not sag in excess of the lesser of 1 % of the gate leaf width or 2 in. (50.8 mm).

6.5.1 Swing gate post sizes shall be selected based on the manufacturer's specification.

6.5.2 Hinges for post and gate frame shall be manufactured of zinc casting, pressed steel, weldable steel plates or blocks, or malleable iron, hot-dipped galvanized with a minimum zinc weight of 1.20 oz/ft^2 (366 g/m^2). Any tamper points shall be secured by welding or peening the threads. Swing gate latches and drop bar guides shall be manufactured of pressed steel, hot-dipped galvanized with a minimum zinc weight of 1.20 oz/ft^2 (366 g/m^2). Gate hardware shall be color coated to meet the same requirements as the fence system (in accordance with Specification F2408 or F2589, whichever is applicable).

6.5.3 Swing gates shall be coated to meet the same requirements as the fence system (in accordance with Specification F2408 or F2589, whichever is applicable).

6.6 *Slide Gates*—Select the Type and Class of slide gate using Specification F1184.

6.6.1 If cantilever slide gates are to be used, specify Type II, Class 2, interior roller design.

6.6.2 Gates shall be coated to meet the same requirements as the fence system (in accordance with Specification F2408 or F2589, whichever is applicable).

6.6.3 Select the slide gate post size based on the gate size and design in accordance with Specification F1184 or manufacturers recommendation.

6.6.4 Automated vehicle gates shall comply with Specification F2200.

6.7 Vehicle crash gates, bollards, wedges or barrier arms, when required, shall be specified by:

6.7.1 The Condition Designation and Penetration Level, tested and certified in accordance with Test Method F2656.

6.7.2 The K Rating design criteria, tested and certified in accordance with U.S. State Department standard, SD-STD-02.01, Revision A, March 2003.

7. Installation

7.1 *Site Preparation:*

7.1.1 Prior to installation of an ornamental steel picket fence system, all necessary clearing and grading should be performed on both sides of the fence line. Grading along the fence line should minimize uneven surfaces that can lead to washouts and gaps under the fence.

7.1.2 At swing gate locations, grade surface as level as practical consistent with drainage requirements between the hinge and latch posts and within the swing area of the gate. Grading for slide gates should comply with manufacturer's guidelines for smooth travel, free of binding during operation.

7.1.3 Where underground utility lines cross fence lines, consider how the framework and fastening can accommodate removal for maintenance should the need arise without comprising the perimeter.

7.2 *Fence Installation:*

7.2.1 Fence posts shall be set at spacings specified by the manufacturer, not to exceed ten feet. Fence designs requiring larger posts or closer post spacings due to wind load or increased security may require larger, deeper concrete footings depending on soil conditions.

7.2.2 Panels shall be mounted in accordance with the manufacturer's instructions with mounting hardware supplied by the manufacturer. All fasteners must be installed so they are tamper-proof from the attack side of the fence.

7.3 *Installation of Fence Security Accessories:*

7.3.1 Barb arms, when specified, shall be riveted or bolted to the post.

7.3.2 Barbed tape shall be installed in accordance with Practice F1911.

7.3.3 Spiked railing supplements shall be attached in accordance with manufacturer's instructions.

7.4 *Installation of Supplemental Security Fence Fill:*

7.4.1 Expanded metal, welded wire mesh, or chain link fabric, when required as supplemental fill for the ornamental

fence system, shall be attached in accordance with the manufacturer's instructions using fittings and fasteners supplied by the manufacturer.

7.4.2 Additional security can be obtained at the bottom of the fence by attaching an added section of supplemental expanded metal, welded wire, or chain-link fill below the bottom rail and burying it 24 in. (610 mm) below grade.

7.5 *Installation of Anti-Ram Systems:*

7.5.1 Fixed anti-ram systems, when required, shall be integrated with, attached to, or installed immediately behind the ornamental fence system in accordance with manufacturer's instructions using the same installation practices used to test the system under Test Method F2656.

7.5.2 K rated vehicle crash gates shall be installed in compliance with SD-STD-02.01, Revision A, March 2003. It is recommended to specify an on going preventative maintenance program for each vehicle crash barrier to ensure the barrier is always safe and functional.

8. Keywords

8.1 architectural metal fence; iron fence; ornamental fence system; ornamental iron fence; ornamental metal fence; ornamental security fence; ornamental steel fence; picket fence; security fence; steel picket fence; steel picket security fence; tubular picket fence; vertical tube fence; wrought iron fence