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Standard Guide for Design and Construction of Chain Link Security Fencing[1]

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1. Scope

1.1 This guide provides the material and installation standards for selection in the design of a security chain link fence system. The proper material selection, system installation and layout can substantially increase the difficulty to penetrate; thereby, increasing the intrusion delay time.

1.2 This guide does not purport to address all of the physical protection security concerns. It is the responsibility of the user of this standard to establish the appropriate design for the level of physical protection required and determine the applicability of regulatory requirements or limitations prior to use.

~~1.3~~It is recommended that Guide

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 It is recommended that Guide F1553 be followed for the format of this guide.

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
A817 Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire
A824 Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
F552 Terminology Relating to Chain Link Fencing
F567 Practice for Installation of Chain-Link Fence
F626 Specification for Fence Fittings
F668 Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric
F900 Specification for Industrial and Commercial Steel Swing Gates
F934 Specification for Colors for Polymer-Coated Chain Link Fence Materials
F1043 Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
F1083 Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
F1184 Specification for Industrial and Commercial Horizontal Slide Gates
F1345 Specification for Zinc-5 % Aluminum-Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric
F1553 Guide for Specifying Chain Link Fence
F1664 Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence
F1665 Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence
F1712 Specification for Steel Chain-Link Fencing Materials Used for High Security Applications
F1910 Specification for Long Barbed Tape Obstacles
F1911 Practice for Installation of Barbed Tape
F2200 ~~Specification for Automated Vehicular Gate Construction~~ Specification for Automated Vehicular Gate Construction
F2656 Test Method for Vehicle Crash Testing of Perimeter Barriers

[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.

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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.

F2781 Practice for Testing Forced Entry, Ballistic and Low Impact Resistance of Security Fence Systems

2.2 *Chain Link Fence Manufacturers Institute:*

WLG 2445~~Guide for the Selection of Line Post and Spacing for Chain Link Fence~~ Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing[3]

The Tested and Proven Performance of Security Grade Chain Link Fencing Systems

2.3 *U. S. Department of Defense:*

UFC 4-010-01 United Facilities Criteria, DOD Minimum Antiterrorism Standards for Buildings[4]

~~2.4 *U.S. Department of State:*~~

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

3. Terminology

3.1 Definitions, see Terminology F552.

4. Summary of Practice

4.1 Chain link fence systems can be designed to provide greater levels of security by selecting products and configurations that increase the difficulty to penetrate and in turn increase delay time. Some examples; increase the height of the fence, the configuration of chain link mesh size and wire gauge, securing the bottom of the fence ~~via bottom rail or~~ by means of bottom rail, burying the chain link mesh, adding barbed wire to the top or barbed tape to the top, side or bottom of the fence, selecting stronger framework, adding multiple fence lines to create isolation zones, adding slats to the fencing to restrict visibility when required~~.~~ A, and adding anti-ram cable systems 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 by location or 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 4-040-01.

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.

5.1.5 Review Specification F1712 for security chain link material recommendations, Practice F2781 for testing security fence systems, and the Chain Link Fence Manufacturers Institute Tested and Proven Performance of Security Grade Chain Link Fencing Systems.

6. Materials and Sizes

6.1 *Chain Link Fabric*:

6.1.1 There are many chain link mesh design configurations; those to be considered for security fencing, in order of difficulty to penetrate are listed in Table 1.

6.1.2 Select the chain link mesh configuration from Table 1; choose the type of coating required from one of the following:

6.1.2.1 Zinc-Coated Steel in accordance with Specification A392, select Class 1 or Class 2 coating. ~~Note1—⅝-in. [16-mm], ½-in. [13-mm] and ⅜-in. [10-mm] smaller mesh sizes are not listed in Specification A392.~~

6.1.2.2 Aluminum Coated Steel in accordance with Specification A491.

6.1.2.3 Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel in accordance with Specification F1345, Class 2.

6.1.2.4 Polyvinyl Chloride (PVC) and other Organic Polymer-Coated Steel in accordance with Specification F668, Class 2b. Select the color as listed in Specification F934.

6.2 *Fence Framework*:

6.2.1 *Line Posts*~~:~~

~~Fences~~—Fences designed to provide increased security levels are generally of greater heights and utilize smaller mesh sizes, both of 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

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

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

TABLE 1 Security Chain Link Mesh Configurations

Security Chain Link Fabric Considerations	Mesh Size and Gauge
Standard Industrial Commercial Chain Link Mesh	2 in. mesh 9 gauge
Bolt cutters required for heavier 6 gauge wire	2 in. mesh 6 gauge
Smaller mesh size increases difficulty to climb and time to cut thru	1 ¾ in. mesh 9 gauge
Bolt cutters required for heavier 6 gauge wire	1 ¾ in. mesh 6 gauge
1 in. mesh increases difficulty to climb and increases time to cut thru	1 in. mesh 11 gauge
9 gauge wire increases cutting time to that of 11 gauge, above	1 in. mesh 9 gauge
Small mesh sizes eliminates finger hold for climbing	⅝ in. mesh 11 gauge
~~Small mesh requires special equipment is to cut through~~	~~½ in. mesh 11 gauge~~
Small mesh requires special equipment to cut through	½ in. mesh 11 gauge
Small mesh with larger wire, maximum security	½ in. mesh 9 gauge
Penetration time is increased to cut through small mesh	⅜ in. mesh 11 gauge
~~Metric Equivalents: 2 in. [50 mm,] 1¾ in. [44.45 mm], 1 in. [25 mm], ⅝ in. [16 mm], ½ in. [13 mm], ⅜ in. [10 mm]~~	
Metric Equivalents: 2 in. (50 mm,) 1¾ in. (44.45 mm), 1 in. (25 mm), ⅝ in. (16 mm), ½ in. (13 mm), ⅜ in. (10 mm)	
~~6ga. 0.192 in. [4.88 mm], 9 ga. 0.148 in. [3.76 mm], 11 ga. 0.120 in. [3.05 mm]~~ 6ga. 0.192 in. (4.88 mm), 9 ga. 0.148 in. (3.76 mm), 11 ga. 0.120 in. (3.05 mm)	

post spacing may be required to compensate for wind loading or increased security. The Chain Link Fence Manufacturers Institute's, Guide for the Selection of Line Posts and their Spacing, WLG 2445, guides the designer through the process to select the post size and post spacing. After calculating the post spacing and post dimensions select the post specification and protective coating from Specification F1043, Table 3, Heavy Industrial Fence Framework or Specification F1083.

6.2.1.1 *Terminal Posts*:

~~(end, —~~End, corner, or ~~pull)~~pull posts are to be in accordance with Specification F1043, Table 3, Heavy Industrial Fence Framework or Specification F1083. Select the terminal post size based on the line post size in accordance with Table 2.

6.2.1.2 *Rails*:

~~Top, —~~Top, intermediate and terminal post brace rails when specified shall be in accordance with Specification F1043, Table 3, Heavy Industrial Fence Framework or Specification F1083.

6.2.1.3 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*:

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

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

6.3.1.1 *Aluminum Metallic-Coated*:

~~specify —~~specify Coating A for the strand wire and aluminum alloy barbs.

6.3.1.2 *Zinc Metallic-Coated*:

~~specify —~~specify Coating Type Z, Coating Class 3.

6.3.1.3 *Zinc-5% Aluminum-Mischmetal Alloy (Zn-5AL-MM) Metallic-Coated*:

~~specify —~~specify Coating Type ZA, Coating Class 80.

6.3.1.4 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]~~(127 mm) on center or Type II spacing at 3 in. ~~[76 mm]~~(76 mm) on center. The color shall match the system in accordance with Specification F934.

TABLE 2 Security Fence Post Selection

~~Line Post Description~~	~~Terminal Post Description~~
Line Post Description, outside diameter	Terminal Post Description, outside diameter
~~2.375 in. [60.3 mm] Diameter Pipe~~	~~2.875 in. [73.0 mm] Diameter Pipe~~
2.375 in. (60.3 mm) Diameter Pipe	2.875 in. (73.0 mm) Diameter Pipe
~~2.25 by 1.70 in. [57.2 by 43.2 mm] C-Section~~	~~2.875 in. [73.0 mm] Diameter Pipe~~
2.25 by 1.70 in. (57.2 by 43.2 mm) C-Section	2.875 in. (73.0 mm) Diameter Pipe
~~2.875 in. [73.0 mm] Diameter Pipe~~	~~4.00 in. [101.6 mm] Diameter Pipe~~
2.875 in. (73.0 mm) Diameter Pipe	4.000 in. (101.6 mm) Diameter Pipe
~~3.25 by 2.50 in. [82.6 by 64.0 mm] C-Section~~	~~4.00 in. [101.6 mm] Diameter Pipe~~
3.25 by 2.50 in. (82.6 by 64.0 mm) C-Section	4.000 in. (101.6 mm) Diameter Pipe
~~4.00 in. [101.5 mm] Diameter Pipe~~	~~6.625 in. [168.3 mm] Diameter Pipe~~
4.000 in. (101.5 mm) Diameter Pipe	6.625 in. (168.3 mm) Diameter Pipe
~~6.625 in. [168.3 mm] Diameter Pipe~~	~~6.625 in. [168.3 mm] Diameter Pipe~~
4.500 in (114.3 mm) Diameter Pipe	6.625 in. (168.3 mm) Diameter Pipe
~~8.625 in. [219.1 mm] Diameter Pipe~~	~~8.3 mm) Diameter Pipe~~
6.625 in. (168.3 mm) Diameter Pipe	6.625 in. (168.3 mm) Diameter Pipe
~~8.625 in. [219.1 mm]) Diameter Pipe~~	~~8.625 in. (219.1 mm) Diameter Pipe~~
8.625 in. (219.1 mm) Diameter Pipe	8.625 in. (219.1 mm) Diameter Pipe