



# Standard Specification for Expanded Metal Fence Systems for Security Purposes<sup>1</sup>

This standard is issued under the fixed designation F2548; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers selection and installation of expanded metal fence systems for applications on new or retrofit fences for commercial, industrial, governmental or institutional facilities as applicable to homeland security, or where the possibility of malevolent incursion is significant. See Fig. 1 for typical examples of expanded metal fence applications. This type of fence system is not recommended for residential or public recreational facilities such as pools, schools, and kindergartens.

1.2 This specification is intended to guide those responsible for or concerned with the design and installation of an expanded metal fence system capable of denying or delaying unwanted access into or out of an area.

1.3 No recommendation is made or implied here as to the merits of the product from any particular manufacturer. Choice of component selection for the expanded metal system should be made by the writer of the project specification based on their own perception of the product's merit and the consequence of a malevolent incursion.

1.4 The values stated in inch-pound units are to be regarded as standard. Any values given in parentheses are for information only.

1.5 *This specification does not purport to address all of the safety and security concerns, if any, associated with homeland security. It is the responsibility of the user of this standard to establish the required and appropriate level of security.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[A123/A123M Specification for Zinc \(Hot-Dip Galvanized\) Coatings on Iron and Steel Products](#)

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F14 on Fences and is the direct responsibility of Subcommittee F14.35 on Architectural Metal Fence Systems.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[A307 Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength](#)  
[B117 Practice for Operating Salt Spray \(Fog\) Apparatus](#)  
[F934 Specification for Colors for Polymer-Coated Chain Link Fence Materials](#)  
[F1267 Specification for Metal, Expanded, Steel](#)  
[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](#)

2.2 *American Society of Civil Engineers (ASCE):*

[ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures](#)

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *expanded metal fence system*—combines expanded metal panels and structural framework posts and rails, if required with accessories and fasteners, assembled and evaluated as a complete system. Fig. 1 shows typical applications.

3.1.2 *expanded metal panel*—element used as filler for the fence system. The following terms are used to further define characteristics of the expanded metal panels (see Fig. 2 and Fig. 3).

3.1.3 *fitting*—any type of formed metal with the intent of securing mesh filler to a framework.

3.1.4 *flattened expanded metal (F)*—Expanded metal which has been cold rolled leaving a flat, smooth surface.

3.1.5 *LWD*—long way of diamond, nominal dimension (see Fig. 2).

3.1.6 *regular (raised) expanded metal (R)* —Expanded metal as it comes from the press after being simultaneously slit and stretched having the strands and bonds form a uniform angle to the original plane of the solid sheet from which it was formed creating an open mesh diamond making one continuous panel that cannot unravel.

3.1.7 *SWD*—short way of diamond, nominal dimension (see Fig. 2).

3.1.8 *strand thickness*—thickness of base metal.

3.1.9 *strand width*—amount of material fed under the die to produce one strand.

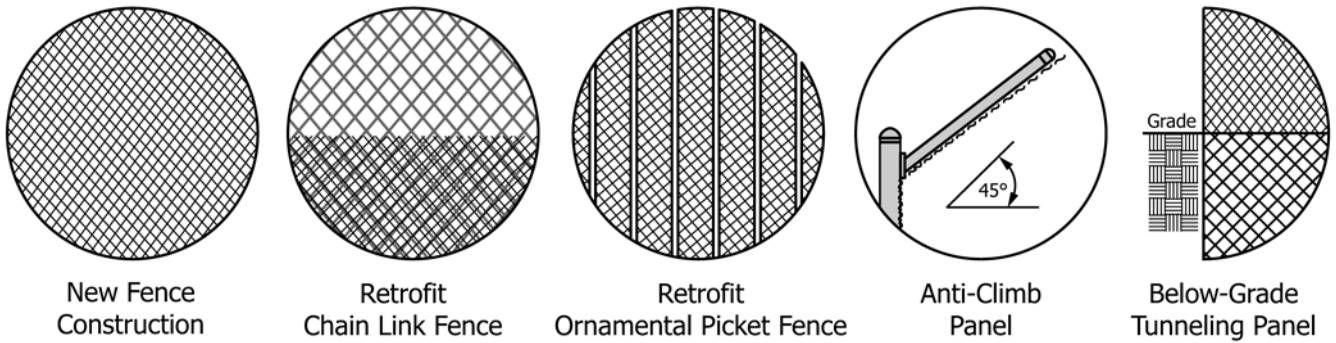


FIG. 1 Expanded Metal Fencing Applications

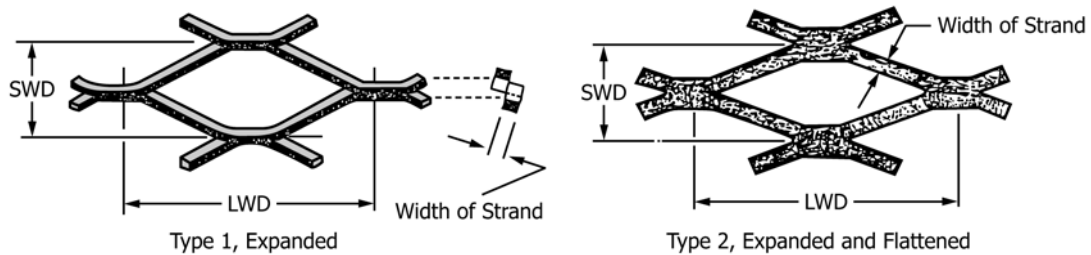


FIG. 2 Diamond Description—Regular and Flattened

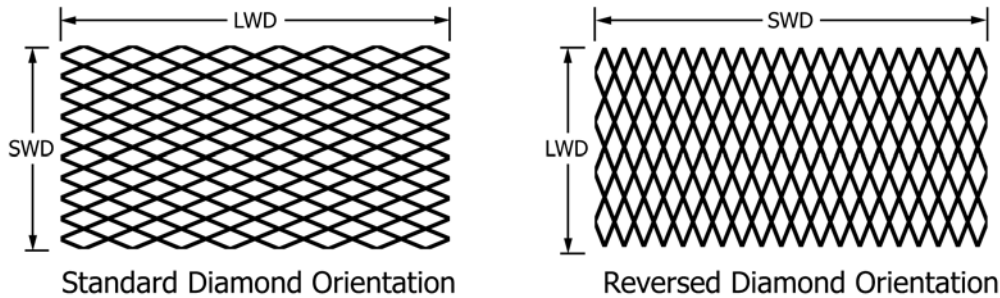


FIG. 3 Mesh Description—Standard and Reversed Diamond

#### 4. Classification

4.1 Expanded metal used on fences for security applications shall meet the material requirements of Specification F1267. Expanded metal referenced in this specification is classified by types and classes as follows:

##### 4.2 Type

4.2.1 Type 1—Expanded (see Fig. 2 – Type 1)

4.2.2 Type 2—Expanded and flattened (see Fig. 2 – Type 2)

NOTE 1—While it is not the intent of this specification to limit the selection of expanded metal “Type” to a specific fence application, historical practice is a relevant factor to consider during the selection process. Construction of new expanded metal fence systems and retrofit of chain link fences historically involved the use of Type 1 expanded metal panels; retrofit of ornamental picket fences historically involved the use of Type 2 expanded metal panels.

##### 4.3 Class

4.3.1 Class 1—Uncoated

4.3.2 Class 2—Hot-dip zinc coated (galvanized)

4.3.3 Class 3—Corrosion-resisting steel

#### 5. Ordering/Specifying Information

5.1 When ordering or specifying expanded metal 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 expanded metal panels and all associated system components will work compatibly in the total system installation.

#### 6. Materials

##### 6.1 Expanded Metal Panels

6.1.1 Panels shall be manufactured in accordance with the requirements and within the allowable tolerances of Specification F1267. Table 1 and Fig. 4 show selection options of expanded metal panels for use in security applications.

6.2 Acceptable panel types shall conform to these minimum requirements.

6.2.1 The minimum allowable weight per square foot for any expanded metal panel specified or used in security fence

**TABLE 1 Panel Description**

Description	Panels Used in Security Fence Applications					
	½ in.–13R	½ in.–13R (.188)	¾ in.–9R	¾ in.–9F	1 in.–7R (.240)	1 ½ in.— 6R
Width of Panel (ft)	3 – 6	3 – 6	3 – 6	3 – 6	3 – 5	3 – 5
Height of Panel (ft)	6 – 12	6 – 12	6 – 12	6 – 12	6 – 12	6 – 12
Diamond Dimensions (in.) SWD by LWD	0.500 by 1.20	0.500 by 1.20	0.923 by 2.00	0.923 by 2.10	1.00 by 2.40	1.330 by 3.00
Percent Open Area	57 %	25 %	68 %	63 %	52 %	63 %
Strand thickness (in.)	0.092	0.09	0.134	0.120	0.170	0.198
Strand Width (in.)	0.096	0.188	0.150	0.164	0.240	0.203
Weight per ft <sup>2</sup>	1.47	2.82	1.80	1.71	3.50	2.50
Weight galvanized per ft <sup>2</sup>	1.73	3.1	1.95	1.86	3.70	2.73

system applications shall not be less than nominal 1.47 lbs per square foot prior to galvanizing or color coating.

6.2.2 No expanded metal specified or used for above-ground security purposes shall have an opening larger than three square inches.

6.3 The overall width and height of expanded metal panels can be as large as 8 ft by 12 ft. Other factors such as panel weight, transportation, galvanizing and color coating may dictate a more practical panel size. Expanded metal security barrier systems vary as do production limitations.

#### 6.4 Finish

6.4.1 If galvanized mesh is selected, the panels shall be completely and uniformly zinc coated by the hot-dip process in accordance with Specification **A123/A123M**, after expanding, shearing, and deburring, shall be free from excessive accumulations of zinc in the apexes of diamond openings, and free from bare spots.

6.4.2 If color coated mesh is required, specify type of coating, color, and thickness of finish. Specification **F934** is noted as a guideline for color selection, though color coating shall not be limited to the listed colors. The coating shall show no effect after 1000 h of salt spray exposure in accordance with Practice **B117**.

#### 6.5 Framework

6.5.1 Posts and horizontal rails, (round or shapes), shall be selected to meet the size and strength requirements from Specifications **F1043** or **F1083**, as applicable. If color coated, specify type of coating, color, and thickness of finish.

6.5.2 Fences used for security shall be a minimum of 8 ft in height.

6.5.3 Fences less than 10 ft in height shall have a top and bottom rail; middle rail is optional. Fences 10 ft and higher shall have additional rail(s) equally spaced in accordance with manufacturers' recommendation. Instead of a bottom rail, panels may be imbedded in concrete.

#### 6.6 Fittings

6.6.1 The nuts and threaded portions of fasteners used to secure expanded metal 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.

6.6.2 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**).

6.6.3 Welding galvanized or color coated mesh to framework is not recommended since it will compromise the finish.

#### 6.7 Gates

6.7.1 Gate frames shall be of a welded construction and fabricated to allow for the weight of the expanded metal filler. See **7.2**.

#### 6.8 Anti-Climb Panels (see Fig. 1).

6.8.1 Anti-climb panels may be used as an addition to the security fence structure, extending above the vertical portion of the fence to prevent circumvention by climbing.

6.8.2 The length and overall shape of the anti-climb panel shall vary as required by user. Framework size, (O.D.), may need to be increased to accommodate the additional weight of this panel. Panels must join on extension posts.

#### 6.9 Below Grade Tunneling Prevention (see Fig. 1).

6.9.1 Tunneling barrier panels are a below grade barrier intended to prevent tunneling and shall be installed to a specified depth and installed to the vertical fence using the specified system's attachment method. A space no more than 12 in. between the end of the panel and the post shall be permitted.

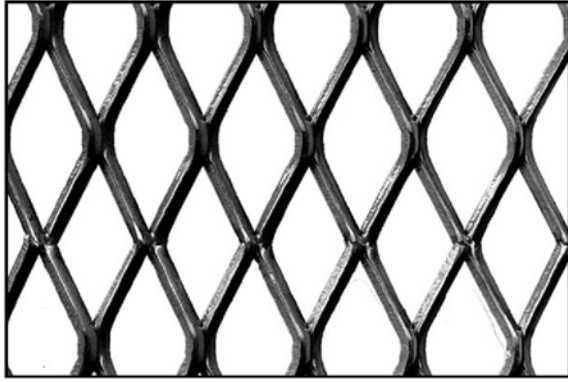
6.9.2 Tunneling barrier mesh panel selection and installation shall follow the manufacturers' recommendation.

### 7. Recommendations, Cautions, and Methods

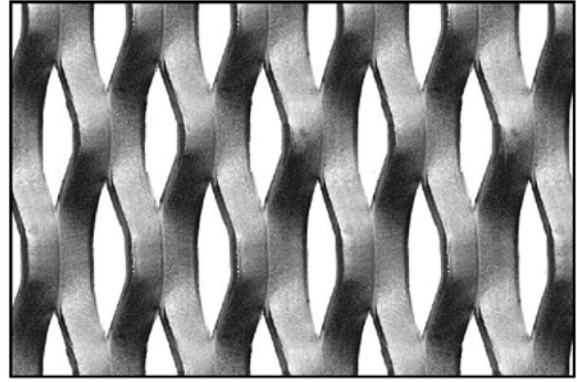
7.1 Refer to the manufacturer's guidelines for installation instructions. Security, location, terrain, and other design parameters must also be factored into proper installation techniques and fittings usage.

7.2 *Caution Regarding Wind Loads*—Framework selection must meet local building codes and wind load requirements. Due to the nature of this product, in general, having more steel per square foot than many other types of fencing, it is advisable to select framework capable of supporting acceptable wind load. Reducing the space between posts may also be required. If wind screens are to be installed at time of erection or at a later time, the additional resistance to wind must be considered at the time of selecting framework and post spacing. Increasing the height of the barrier by adding any additional type of formed top panel to deter climbing as well as snow or icing

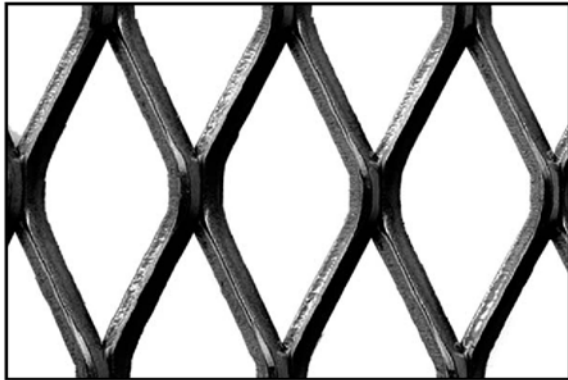




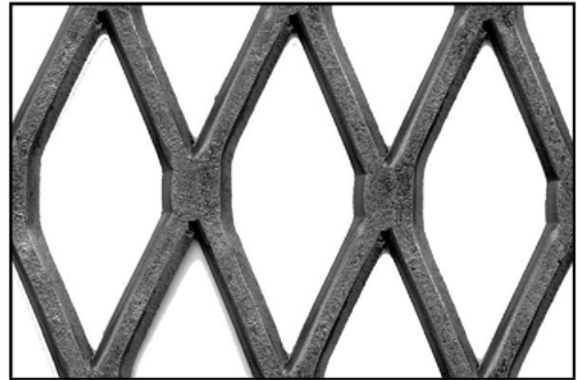
1/2 in. - 13R



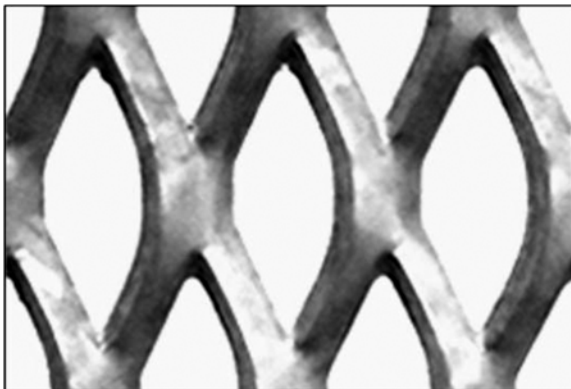
1/2 in. - 13R (.188)



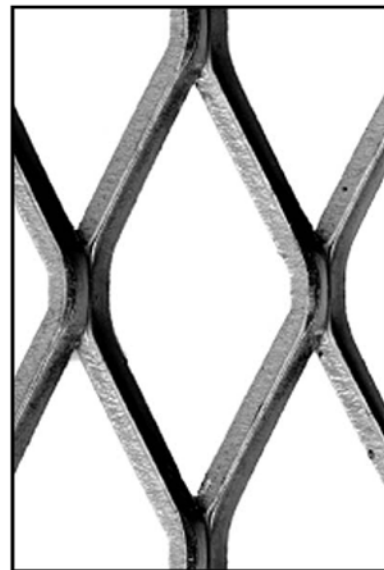
3/4 in. - 9R



3/4 in. - 9F



1 in. - 7R (.240)



1 1/2 in. - 6R

FIG. 4 Panels commonly used in expanded metal security barriers. Other panels may be used provided the opening sizes and weight per square foot meet the specific security requirements noted in 6.2.

conditions must also be considered in determining the prescribed framework. For additional information, see ASCE/SEI 7-05 (Manufacturer shall demonstrate framework design for wind load criteria for the selection of line posts and line post spacing.).

### 7.3 Positioning Expanded Metal Panels

7.3.1 When expanded metal is installed continuously on the attack side of the fence, it shall be firmly affixed in such a manner that the attack side of the post and rails is on the same plane (to enable secure attachment of the expanded metal panels to the framework). The LWD, long way of diamond, may be installed either vertically or horizontally.

7.3.2 When installed between posts, expanded metal 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.

7.3.3 Panels shall have no more than a 1-in. space between the bottom of the mesh and grade. Backfilling should be performed where appropriate.

7.4 Line post spacing shall be set to allow panels to join on line posts where possible. Any panels joining between posts shall overlap a minimum of three diamonds, (or a minimum of 3 in. depending upon diamond size), except to allow for slight variations in terrain. Panels shall (at a minimum) also overlap the outside edge of each terminal post as not to permit any space to compromise the barrier.

7.5 When connecting panels to line and terminal posts, connection points shall not exceed 18 in. When connecting panels to horizontal rails, connection points shall not exceed 18 in.

7.6 Exposed edges of cut expanded metal panels are very sharp and should be avoided. Overlapping panels more than the stated minimum above, 7.4 is the normal practice and is acceptable.

## 8. Keywords

8.1 expanded metal fences; fence; fences; metal fencing; security fencing; specifications; steel fencing

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