



~~Designation: F2781-09~~ Designation: F2781 - 10

~~Standard Practice for Testing Forced Entry Resistance of Security Fence Systems~~ Testing Forced Entry, Ballistic and Low Impact Resistance of Security Fence Systems¹

This standard is issued under the fixed designation F2781; 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 The forced entry resistance of fence systems is evaluated relative to three levels of forced entry threat using the limited hand tool inventory outlined in Table 1. It also establishes a system for rating the forced entry resistance of those systems (see Table 2). The tools specified to be used for testing at each threat level are those that are known to have a maximum destructive effect on structures and their sub-assemblies and are readily available to aggressors categorized as posing that level of threat.

1.1.1 *Low Threat Level (L)*—Specifically exempted from the inventory of available tools for the low (L) threat level category are power tools (gasoline, electric or hydraulic), and devices requiring more than one person to transport and operate.

1.1.2 *Medium Threat Level (M)*—Specifically exempted from the inventory of available tools for the medium (M) threat level category are power tools requiring an outside power source or self contained gasoline or battery driven tools and devices requiring more than two persons to transport and operate.

1.1.3 *Aggressive Threat Level (A)*—Specifically exempted from the inventory of available tools for the high (H) threat level category are devices requiring more than two persons to transport and operate.

1.2 The ability of a fence system to offer protection from bullets fired from a rifle or handgun would be beneficial particularly in Border Fence areas where security personnel can be targets during patrol activities. Accordingly, a limited test using a .38 Special handgun and a 7.62-mm rifle is performed to determine if any level of protection is provided by the fence system.

1.3 The ability of a fence system to provide impact resistance from a 4000 pound mass vehicle moving at a velocity of 20 MPH at a modest cost will provide relative guidance as to the strength of a security fence system in resisting low impact situations.

2. Terminology—Referenced Documents

2.1 *ASTM Standards:*

F1233 [Test Method for Security Glazing Materials And Systems](#)

2.2 *U.S. Military Standards:*

MIL-STD-662F Department of Defense Test Method Standard V50 Ballistic Test for Armor [2a73ba/astm-f2781-10](#)

2.3 *U.S. Dept. of Justice:*

NIJ Standard 0108.01 National Institute of Justice Ballistic Resistant Protective Materials

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

~~2.1.1~~

3.1.1 *test director*—the individual identified by the independent testing laboratory as being responsible to complete the specified tests and to document the results.

~~2.1.2~~

3.1.2 *forced entry*—creating a four square feet opening.

3.

4. Summary of Practice

~~3.1~~4.1 For each rating a structured portion and a discretionary portion as described in ~~3.2.4.2~~ and ~~3.3-4.3~~ is required.

~~3.2~~

¹ This practice 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, 2009. Published August 2009. DOI: 10.1520/F2781-09.~~

Current edition approved July 1, 2010. Published July 2010. Originally approved in 2009. Last previous edition approved in 2009 as F2781 - 09. DOI:10.1520/F2781-10.

4.2 The structured portion of the test provides for a zero to five minute test with specific tools selected as the most debilitating from the tool list in Table 1, regardless of the fence system being tested.

3.3

4.3 Following the structured portion of the test, the discretionary portion of the test provides up to 55 minutes of testing, optimizing forced entry efforts by selecting any (or all) tools from the applicable category of the list (low (A), medium (B), or aggressive (C)). Selection of tools is based on the perception of the test director as to which tools will most effectively result in a forced entry.

3.4.4 Testing of security fence systems in accordance with the requirements of this test method shall result in a rating reflecting the severity of the threat and the cumulative penetration resistance time (see Table 2).

3.5.4.5 The times used to establish the protection ratings of Table 2 range from 0–60 minutes and are intended to reflect the elapsed time of forced entry resistance necessary for a response force to arrive and counter the threat with additional defensive personnel and equipment. It is important to recognize that the lowest threat level time will establish the maximum time limit for a greater threat level.

4.

4.6 The ballistic is intended to provide the probability of a person standing behind the secure fence side from being hit with a bullet fired by a 38-caliber hand gun or a .30-06 rifle.

4.7 The impact test is intended to provide relative guidance as to the strength of a fence system to absorb 53.5 K-ft-lbs of kinetic energy.

5. Significance and Use

4.1.5.1 The success or failure of any attempt to forcefully penetrate a fence system is dependent upon three primary factors that collectively define the threat—the tools and devices employed, the number of aggressors, and their level of sophistication.

4.5.2 Normally, a test procedure of this scope would be supported by years of laboratory testing intended to qualify and accurately reproduce the destructive effects of a variety of tools, implements, and devices. However, rapidly changing social conditions have created an immediate need for building components resistant to evolving forced entry techniques. Accordingly, the procedures presented herein are based more on field experience than laboratory analysis. They are more representative than inclusive, are intended to provide a basis for the comparative evaluation of different fence systems using forced penetration procedures, ballistic tests and impact testing, and are not primarily intended to be used to establish or confirm the absolute prevention of forced entries.

TABLE 1 Schedule of Testing—All Levels of Threat Severity

Tool(s)	Time of Application (minutes)					
	Structured Testing			Discretionary Testing		
	L	M	A	L	M	A
Crowbar 5 lb by 28 in. (2)	3-5	3-5	3-5	0-55	0-55	0-55
Cold Chisels and Hammer (2)	3-5	3-5	3-5	0-55	0-55	0-55
Hacksaw and Two HSS Blades	3-5	3-5	3-5	0-55	0-55	0-55
Sledgehammer 16 in. by 6 lb	3-5	3-5	3-5	0-55	0-55	0-55
Fire Axe 36 in. by 6 lb	3-5	3-5	3-5	0-55	0-55	0-55
Bolt Cutter (2)	-	3-5	3-5	-	0-55	0-55
Fire Axe 36 in. by 10 lb	-	3-5	3-5	-	0-55	0-55
Hole Saw 2 in. (1)	-	0-5	0-5	-	0-55	0-55
Pry Bar 30 in. Steel (2)	-	0-5	0-5	-	0-55	0-55
Sledgehammer 30 in. by 12 lb	-	0-5	0-5	-	0-55	0-55
Steel Wedge 6 in. long (2)	-	0-5	0-5	-	0-55	0-55
Circular Saw 8 in., 1100 W, and 3 Blades (1)	-	-	0-5	-	-	0-55

TABLE 1 *Continued*

Tool(s)	Time of Application (minutes)					
	Structured Testing			Discretionary Testing		
	L	M	A	L	M	A
Disc Grinder 5 in., 1100 W, and 3 Blades (1)	-	-	0-5	-	-	0-55
Rotary and Hammer Drill 750 W and 5 Drill Bits, ½ in. (1)	-	-	0-5	-	-	0-55
Hole Saw Greater than 2 in. (1)	-	-	0-5	-	-	0-55
Steel Pinch Bar 60 in. long (2)	-	-	0-5	-	-	0-55
Reciprocating Saw 750 W and 3 Carbide Blades (1)	-	-	0-5	-	-	0-55
Sledgehammer 30 in. by 15 lb (1)	-	-	0-5	-	-	0-55
Oxyacetylene Torch with 80 ft ³ Oxygen and 40 ft ³ Acetylene Tanks (1)	-	-	0-5	-	-	0-55
Cut-Off Saw 5 KW or HD Gasoline 18 in. Dia. and 3 Blades (1)	-	-	0-5	-	-	0-55
Breaker (1900 W) 30 lb with 3 Bits (1)	-	-	0-5	-	-	0-55
Scissor Jack 1500 lb with 4 in. min retraction and 8 in. Stroke (1)	-	-	0-5	-	-	0-55
Adhesive Tape (1)	-	-	-	0-55	0-55	0-55
Fishing Line (250')	-	-	-	0-55	0-55	0-55
Grappling Hook (1)	-	-	-	0-55	0-55	0-55
5-in. Knife (1)	-	-	-	0-55	0-55	0-55
8 in. Std and Self Grip Pliers (2)	-	-	-	0-55	0-55	0-55
10 in. Multiple Slip Pliers (2)	-	-	-	0-55	0-55	0-55
10 in. Pipe Wrench (2)	-	-	-	0-55	0-55	0-55
1.660 in. O.D. by 12 ft. pipe (2)	-	-	-	0-55	0-55	0-55
8 in. Plate Shears (1)	-	-	-	0-55 (1)	0-55 (1)	0-55 (2)
Screwdrivers 7 in., 10 in., and 16 in. (1)	-	-	-	0-55	0-55	0-55

TABLE 1 *Continued*

Tool(s)	Time of Application (minutes)					
	Structured Testing			Discretionary Testing		
	L	M	A	L	M	A
Cordless ½ in. Drill with spare power pack and carbide bits (1)	-	-	-	0-55	0-55	0-55
Butane Torch (1)	-	-	-	0-55	0-55	0-55
Rope (1)	-	-	-	0-55	0-55	0-55

TABLE 2 Forced Entry Resistant Ratings

Threat Level	Active Test Personnel	Resistance Time (minute)			Rating
		Structured Test	Discretionary Test	Cumulative	
Low (L)	2	Less than 5	0	Less than 5	L0 to L4.9
		5	Less than 5	Less than 10	L5 to L9.9
		5	5 to 9.9	Less than 15	L10 to L14.9
		5	10 to 14.9	Less than 20	L15 to L19.9
		5	20 to 25	30	L20 to L30
		5	31 to 55	60	L31 to L60
Medium (M)	2	Less than 5	0	Less than 5	M0 to M4.9
		5	Less than 5	Less than 10	M5 to M9.9
		5	5 to 9.9	Less than 15	M10 to M14.9
		5	10 to 14.9	Less than 20	M15 to M19.9
		5	20 to 25	30	M20 to M30
		5	31 to 55	60	M31 to M60
Aggressive (A)	4	Less than 5	0	Less than 5	A0 to A4.9
		5	Less than 5	Less than 10	A5 to A9.9
		5	5 to 9.9	Less than 15	A10 to A14.9
		5	10 to 14.9	Less than 15	A15 to A19.9
		5	20 to 25	30	A20 to A30
		5	31 to 55	60	M31 to A60

4.3.3 The test requirements specified herein have been established for use in evaluating the penetration resistance characteristics of standard fence systems to be used in commercial, government and military installations.

4.3.4 The success of any forced entry threat is dependent on the cumulative effect of the implements used, the elapsed time, and the sophistication and motivation of the personnel affecting the forced entry.

4.5.3.2 Absolute penetration resistance from forced entry by a determined and well-equipped attack group is impossible.

4.5.3.3 Aggressor groups range from unsophisticated criminals and vandals to organized criminals.

4.5.3.4 Attempts to force an entry may be thwarted by increasing the time necessary to affect such an entry and by early detection. Intrusion sensors positioned as far as possible from the protected environment in conjunction with optimal structural and component design will maximize the time available for a response force to intercept the intruders.

4.4 The procedures of this test method are intended to evaluate the time necessary for vandals and unsophisticated criminals to forcefully penetrate security fence systems by using manually operated tools—defined as a low, medium, or aggressive forced entry threat.

5.6. Documentation of Test Materials

5.1

6.1 Configuration Documentation—All materials and assemblies to be tested shall conform to and be in compliance with the latest revision of the appropriate publication or specification governing the fence system configuration. The following documents shall apply:

5.1.1.1 Standard Commercial Materials—Commercial materials used in fabricating security fence systems will conform to the configuration and performance standards established for that material by ASTM International.

5.1.2

6.1.2 Non-Standard Materials—All materials and sub-assemblies used in the fabrication of forced entry barriers whose nature and configuration are not otherwise controlled by recognized industrial, government, or manufacturer’s specifications will be accompanied by full disclosure drawings and specifications.

5.1.2.1

6.1.2.1 Component Material Details—Specific industrial specifications, including size, thickness composition, etc.

5.1.2.2 Make, model number, serial numbers, and date of manufacture (as appropriate).

5.1.2.36.1.2.3 Construction instructions, including weldments, bolting, bonding materials, etc.

5.1.3

6.1.3 *Proprietary Information*—None of the requirements of 5.1.1-6.1.1 through 5.1.2.3-6.1.2.3 are intended to compromise or circumvent a manufacturer's proprietary rights with respect to any feature, configuration, material, or design. Those portions of the design disclosure documentation considered proprietary would be clearly marked or eliminated from the disclosure documentation with an appropriate explanation. All submitted documentation, however, would accurately represent the sample tested.

6.

7. Sampling, Test Specimens, and Test Units

6.1

7.1 *Sample Size*—In order to facilitate test standardization all test samples will conform to the sizes specified in 6.1.1-7.1.1.

6.1.1A minimum lateral area of 96 in. high and 30 ft in length. The requirements of this section and the procedures of the test method are intended to minimize test costs by conducting as much testing on single test segments, if possible.

6.1.2

7.1.1 A minimum lateral area of 96 in. high and 30 ft in length. The requirements of this section and the procedures of the test method are intended to minimize test costs by conducting as much testing on single test segments, if possible. Impact Tests shall target the impact location of the vehicle at the midpoint of the 30 ft. length to avoid contacting the vertical posts and performed after penetration tests have been completed to minimize costs of material and repair labor.

7.1.2 *Test Environment*—The location of the test shall be in a natural environment where the temperature minimum is not less than 40°F and the maximum is 95°F during the performance of the test. All tested materials and tools will be temperature conditioned in this environment for a minimum of 24 h immediately prior to initiation of any test. The area immediately adjacent to the test sample extending 6 ft to the left and right of either vertical edge of the sample, 10 ft from the assault face of the sample, and 10 ft above the horizontal surface supporting the test (attack) personnel, shall be free of any and all obstructions and appurtenances.

7.

8. Preparation of Apparatus

7.1

8.1 *Tools, Devices and Materials:*

7.8.1.1 Analysis of many of the aggressive actions against installations that have resulted in forced entry has produced an extensive list of tools and implements that are readily accessible to aggressor groups. From this comprehensive listing, tools and devices have been categorized as to the likelihood of their use and forced entry threat severity. While infinite in type, size, and construction, all can be categorized with respect to their principal effect and function—prying, screwing, pulling, shearing, cutting, and impacting. Additionally, certain tools have been identified as those which are not actually tools, but which have a debilitating effect on protective barriers and are readily available (that is, ropes, and so forth). While no attempt will be made to completely list all the tools and implements which can be utilized to effect forced entry, Table 1 presents those tools and implements which have been determined to be readily available and representative of the most effective of forced entry tools for the very low, low, medium, and high threat severity categories, respectively.

7.1.2A8.1.2 All tools proposed for use in this test are to be clean and verified for proper operation prior to commencement with the test.

7.2.2 *Low Threat Severity Category Tools:*

7.2.1

8.2.1 *Adhesive Tape.*

7.2.2

8.2.2 *Fishing Line.*

7.2.3

8.2.3 *Grappling Hook.*

7.2.4

8.2.4 *Knife, 5 in.*

7.2.5

8.2.5 *Standard and Self-Gripping Pliers, 8 in.*

7.2.6

8.2.6 *Multiple Slip Pliers, 10 in.*

7.2.7

8.2.7 *Pipe Wrench, 10 in.*

7.2.8

8.2.8 *Pipe*, 1.660 in. O.D. by 12 ft.

~~7.2.9~~

8.2.9 *Plate Shears*, 8 in.

~~7.2.10~~

8.2.10 *Screwdrivers*, 7 in., 10 in., and 16 in. long.

~~7.2.11~~

8.2.11 *Crowbar*, 5 lb, 28 in.

~~7.2.12~~

8.2.12 *Cold Chisels*, 10 in. long by 1 in. wide.

~~7.2.13~~

8.2.13 *Drill*, cordless, ½ in., spare power pack, and carbide drill bits.

~~7.2.14~~

8.2.14 *Butane Torch*.

~~7.2.15~~

8.2.15 *Hacksaw*, two HSS blades.

~~7.2.16~~

8.2.16 *Sledgehammer*, 16 in., 6 lb.

~~7.2.17~~

8.2.17 *Rope*, 20-ft length of ½-in. diameter manila rope, (4-lb).

~~7.2.18~~

8.2.18 *Fireman's Axe*, 36 in., 6 lb.

~~7.2.19~~

8.2.19 *Pipe Cutter*, 4 in. O.D.

~~7.2.20~~

8.2.20 *Bolt Cutter*. 12 in.

~~7.2.21~~

8.2.21 *Fence Pliers*, 10 in.

~~7.2.22~~

8.2.22 *Cable Ratchet*, 2000 lb capacity.

~~7.3~~

8.3 *Medium Threat Severity Category Additional Tools:*

~~7.3.1~~

8.3.1 *Bolt Cutter*, 20 in.

~~7.3.2~~

8.3.2 *Disc Grinder*, 12 V with spare power pack and three cutting discs.

~~7.3.3~~

8.3.3 *Drill Bits*, 5.5 in., carbide.

~~7.3.4~~

8.3.4 *Axe*, 36 in., 6 lb.

~~7.3.5~~

8.3.5 *Hole Saw*, 2 in.

~~7.3.6~~

8.3.6 *Steel Pry Bar*.

~~7.3.7~~

8.3.7 *Jigsaw*, cordless, 12 V, and three carbide blades.

~~7.3.8~~

8.3.8 *Plate Shears*, 12 in.

~~7.3.9~~

8.3.9 *Sledgehammer*, 30 in., 12 lb.

~~7.3.10~~

8.3.10 *Pipe*, 1.660 in. O.D. by 20-ft long.

~~7.3.11~~

8.3.11 *Steel Wedges*, 6-in. long.

~~7.3.12~~

8.3.12 *Circular Saw*, cordless, 18 V, 8-in. diameter, and three blades.

~~7.3.13~~

8.3.13 *Disc Grinder*, 18 V with spare power pack and three cutting discs.

~~7.3.14~~