Designation: F1450 – 12a

Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention and Correctional Facilities[1]

This standard is issued under the fixed designation F1450; 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 These test methods cover requirements for mechanical tests, simulated service test, and testing equipment for determining the performance characteristics of swinging detention hollow metal door assemblies of various styles and types of construction for use in wall openings designed to incarcerate inmates in detention/correctional institutions.

1.2 These test methods test the capability of a swinging door assembly to prevent, delay, and frustrate escape, to limit or control access to unauthorized or secure areas, and to resist common types of vandalism.

1.3 These test methods apply primarily to detention door assemblies to and from secure areas generally found inside detention/correctional facilities, such as: day rooms, control rooms, cells, and sally ports.

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

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1577 Test Methods for Detention Locks for Swinging Doors

F1592 Test Methods for Detention Hollow Metal Vision Systems

F1643 Test Methods for Detention Sliding Door Locking Device Assembly

F1758 Test Methods for Detention Hinges Used on Detention-Grade Swinging Doors

F1915 Test Methods for Glazing for Detention Facilities

2.2 *ANSI/NAAMM/HMMA Standard:*[3]

ANSI/NAAMM/HMMA 863 Guide Specifications for Detention Security Hollow Metal Doors and Frames

2.3 *NFPA Standard:*[4]

252 Methods of Fire Tests of Door Assemblies

2.4 *UL Standards:*[5]

UL-10 (B) Fire Tests of Door Assemblies

UL-10 (C) Fire Tests of Door Assemblies

UL-437 Standard for Key Locks

UL-752 Bullet Resisting Equipment

UL-1034 Standard for Burglary Resistant Electric Locking Mechanisms

3. Terminology

3.1 *Definitions:*

3.1.1 *bolt*—metal bar which, when actuated, is projected (or thrown) either horizontally or vertically into a retaining member, such as a strike plate, to prevent a door from moving or opening.

3.1.2 *bolt projection (or bolt throw)*—distance from the edge of the door or frame, at the bolt center line, to the farthest point on the bolt in the projected position.

3.1.3 *component*—a subassembly, as distinguished from a part, that combines with other components to make up a total door assembly.

3.1.3.1 *Discussion*—The prime components of a door assembly include the following: door, lock, hinges, wall, and door frame (includes hinge jamb, strike jamb, and header).

3.1.4 *detention security*—assurance of the restriction of mobility of inmates to designated areas within a correctional or detention facility.

[1] These test methods are under the jurisdiction of ASTM Committee F33 on Detention and Correctional Facilities and are the direct responsibility of Subcommittee F33.02 on Physical 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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.

[5] Available from Underwriters Laboratories (UL), 333 Pfingsten Rd., Northbrook, IL 60062-2096, http://www.ul.com.

3.1.5 *door assembly*—unit composed of a group of parts or components that make up an opening barrier for a passageway through a wall.

3.1.5.1 *Discussion*—For the purpose of these test methods, a door assembly consists of the following parts: door; hinges; locking device or devices; operation contacts (such as handles, knobs, or flush pulls); security glazing and glazing molding; miscellaneous hardware and closers; the frame, including the head and jambs plus anchorage devices to the surrounding wall; and a portion of the surrounding wall extending 32 in. (81.3 cm) from each side of the jambs and 16 in. (40.65 cm) above the head.

3.1.6 *forcible egress*—ability to pass a 5 × 8 × 8 in. (127 mm × 203 mm × 203 mm) rigid rectangular box through an opening in the test sample created by destructive testing procedures using no more than 10 lbf (44.5 N).

3.1.7 *frame*—assembly of members surrounding and supporting a door or doors.

3.1.8 *hinged door*—door equipped with hinges that permit it to swing about the vertical hinge axis, either right-hand, left-hand, right-hand reverse bevel, or left-hand reverse bevel, depending upon hardware configuration.

3.1.9 *hollow metal*—term used in reference to such items as doors, frames, partitions, enclosures, and other items that are fabricated from metal sheet, typically cold-rolled or hot-rolled pickled-and-oiled carbon steel.

3.1.9.1 *Discussion*—These products are internally reinforced but hollow, hence the term *hollow metal*. Typically, the voids in doors and partitions are filled with insulation. When installed in masonry walls, the voids in frame jambs, headers, and mullions may be grouted or left hollow.

3.1.10 *manufacturer*—party responsible for the fabrication of the test samples.

3.1.11 *panel*—for the purposes of these test methods, the *panel* is a steel plate at least 0.375 in. (9.5 mm), installed in order to transfer impact energy to the glazing stops and the assembly.

3.1.12 *performance characteristic*—response of the door assembly in any one of the tests described herein.

3.1.13 *test completion*—conduct of one test sequence for each of the door assemblies.

3.1.14 *testing laboratory*—independent materials testing laboratory not associated with the manufacturer.

4. Significance and Use

4.1 A major concern for prison administrative officials is security barriers used in detention/correctional facilities. These test methods are designed to aid in identifying levels of physical security for swinging detention hollow metal door assemblies.

4.2 The construction and size of test doors and all hardware components are representative of the application under investigation, and are the same construction and size throughout all of the tests.

4.3 These test methods are not intended to provide a measure of resistance for a door assembly subjected to attack by corrosive agents, by high-powered rifles, explosives, sawing, or other such methods. These test methods are intended to evaluate the resistance of a door assembly to violent attacks using battering devices, such as benches, bunks, or tables; by handguns up to and including .44 magnum, UL-752 Level 3; by prying devices; by devices used to deform the door and render it inoperable; and by fires started by using mattresses, books, and other flammable materials.

4.4 The primary purpose or result of these test methods is to approximate the levels of abuse to which door assemblies are potentially subjected in the field. The desired result of its use is to help provide insurance of protection to the public, to facility administrative personnel, and to the inmates themselves.

4.5 It is recommended that detention/correctional facility administration provide adequate training, supervision, and preventative maintenance programs to enable door assemblies to function as intended throughout the expected service life.

5. Sampling

5.1 Sample door and frame assemblies shall be constructed in accordance with 6.1.

5.2 The manufacturer shall permanently mark the test samples and retain them at the manufacturing facility for future reference for a period of at least one year from test date. Instead of test samples, the manufacturer has potential to contract with the testing laboratory to provide a certified procedure for the construction of tested assemblies with factory follow-up service as an option (see 8.2).

5.3 Test reports shall include complete details of the test assemblies, details, photographs, or a combination thereof, of the testing apparatus, and installation instructions including templates for all items of hardware (see Section 9).

5.4 In the event of failure in one or more of the performance tests, the manufacturer shall provide another complete test sample including door, frame, and hardware assembly along with test wall where applicable. If the test is performed only on the door, as in the door rack test (7.4), only the door need be provided for retesting.

6. Specimen Preparation

6.1 *Construction:*

6.1.1 A total of four (4) doors, for each impact, static load, and rack test, shall be constructed as described in 6.1.2 and 6.1.3. Two of the doors shall be constructed in accordance with the door elevation described in section 6.1.2. Two of the doors shall be constructed in accordance with the door elevation described in section 6.1.3. A fifth door for rack testing only shall be constructed and tested in accordance with section 6.1.4.

6.1.2 The first door elevation (Door Elevation #1) is described as a flush door with a single narrow vision light.

6.1.2.1 The construction and size of the test door assemblies consisting of single doors, frames, and all hardware components shall be representative of the application under investigation within the following guidelines:

6.1.2.2 The same construction and size of test doors and assemblies shall apply to all tests.

6.1.2.3 Each test door shall be equipped with a 100 in.^{2} (64 516 mm^2) vision light with impact panel installed, 4 by 25 in. (102 by 635 mm) clear opening positioned generally as shown in Fig. 1.

6.1.2.4 The first door shall swing on three full mortised butt hinges and shall be locked using a door-mounted, pocket-type detention security lock with bolt size not to exceed 2 in. (51 mm) high by ¾ in. (19 mm) wide and latch bolt engagement not to exceed ⅞ in. (22.3 mm).

6.1.2.5 The second door shall swing on three full mortised butt hinges and shall be locked using a jamb-mounted security lock with bolt size not to exceed 2 in. (51 mm) high by ¾ in. (19 mm) wide and latch bolt engagement not to exceed ⅞ in. (22.3 mm).

6.1.2.6 Required results indicated in Table 1 are based upon a nominal door size of 3 by 7 ft (914 by 2133 mm).

6.1.3 The second door elevation (Door Elevation #2) is described as a vision light door with two large vision lights as shown in Fig. 2.

6.1.3.1 The construction and size of the test door assemblies consisting of single doors, frames, and all hardware components shall be representative of the application under investigation within the following guidelines:

6.1.3.2 The same construction and size of test doors and assemblies shall apply to all tests.

6.1.3.3 Each test door shall be equipped with two vision lights centered horizontally and located generally as shown in Fig. 2. The top vision light shall be a 532 in.^{2} (343 225 mm^2) vision light with impact panel installed, 19 by 28 in. (483 by 711 mm) clear opening positioned generally as shown in Fig.

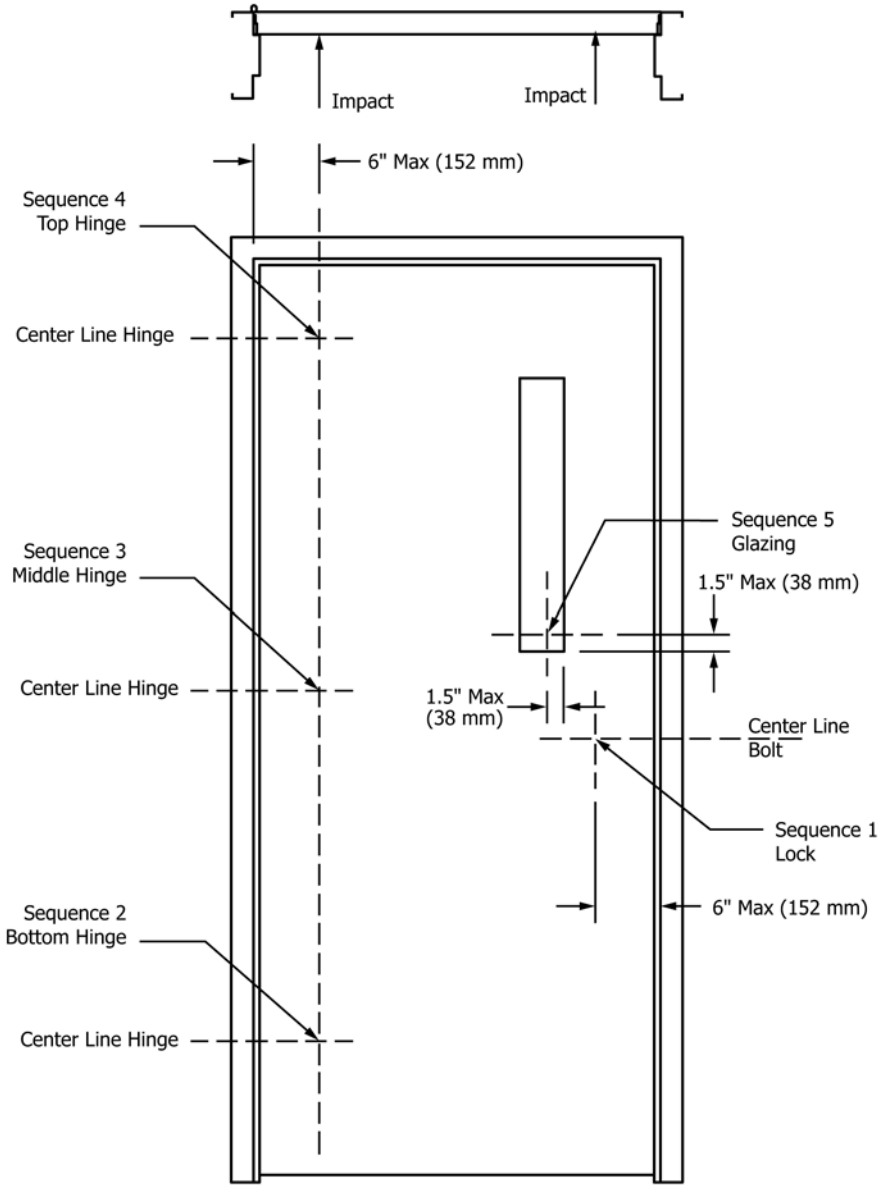


FIG. 1 Test Assembly Door Elevation #1 Location of Strike Points Described in Table 1

TABLE 1 Security Grades and Test Load Requirements Door Elevation #1[A]

Grade Number (Impacts)	Recommended Door Face Sheet and Frame Thickness, in. (mm) gauge, min	Static Load Test, lbf (N)	Rack Load Test, lbf (N)	Impact Test A Impact Energy = 200 ft·lbf (271.2 J)			ASTM Reference Standards
				Lock Impacts	Hinge Impacts	Glazing/ Panel Impacts	
1 (1600 impacts 2 h 40 min)	0.093 (2.3) 12	14 000 (62 275)	7500 (33 360)	600	200	400	F1592, F1577, F1643
2 (1050 impacts 1 h 45 min)	0.093 (2.3) 12	14 000 (62 275)	7500 (33 360)	400	150	200	F1592, F1577, F1643
3 (525 impacts 53 min)	0.067 (1.7) 14	11 000 (48 930)	5500 (24 465)	200	75	100	F1592, F1577, F1643
4 (305 impacts 30 min)	0.067 (1.7) 14	11 000 (48 930)	5500 (24 465)	100	35	100	F1592, F1577, F1643

[A] The cyclic sequence of impacts on the hinge side shall be 25 hits per hinge location and then moving to the next hinge location.

2. The bottom vision light shall be a 342 in.^{2} (220 645 mm^2) vision light with impact panel installed, 19 by 18 in. (483 by 457 mm) clear opening positioned generally as shown in Fig. 2. The impact plate in the top vision panel shall be installed using face mount "Z" type or "P" type removable surface applied glazing stops as shown in Fig. 2 Section B-B or Section C-C. The impact plate in the bottom vision light shall be installed using pressed angle type removable glazing stops as shown in Fig. 2 Section A-A.

6.1.3.4 The first door shall swing on three full mortised butt hinges and shall be locked using a door-mounted, pocket-type detention security lock with bolt size not to exceed 2 in. (51 mm) high by ¾ in. (19 mm) wide and latch bolt engagement not to exceed ⅞ in. (22.3 mm).

6.1.3.5 The second door shall swing on three full mortised butt hinges and shall be locked using a jamb-mounted security lock with bolt size not to exceed 2 in. (51 mm) high by ¾ in. (19 mm) wide and latch bolt engagement not to exceed ⅞ in. (22.3 mm).

6.1.3.6 Required results indicated in Table 2 are based upon a nominal door size of 3 by 7 ft (914 by 2133 mm).

6.1.4 The third door elevation, Elevation #3 (Fig. 3), is described as a 12 ga., 0.093 in. (2.3 mm) vision light door with two large vision lights as shown in Fig. 2, with the addition of an "Edge Cut" food pass / cuff port, opening size 5 in. (127 mm) high × 14.25 in. (362 mm) long, located 36.5 in. (927 mm) from the bottom of the door to the centerline of the opening.

6.2 *Impact Test Fixture:*

6.2.1 The door assembly support fixture and wall shall simulate the rigidity normally provided to a door assembly in a building by the ceiling, floor, and walls. Fig. 4 illustrates an acceptance fixture.

6.2.2 The fixture is designed to accommodate two test samples; however, it is permissible to construct a test fixture that accommodates one sample only, if the manufacturer so chooses.

6.2.3 *Description of the Test Wall*—The door assembly shall be mounted in a vertical wall section constructed suitably to retain the sample(s) throughout the testing procedure. Typical wall details shown in Figs. 4-7 describe an acceptance wall. The wall specification shall be included as part of the test report.

6.3 *Mounting for Impact Testing:*

6.3.1 Mount the swinging doors so as to open away from the working area. Position the impact test ram opposite the door side of the assembly so that the door opens away from the ram.

6.3.2 Prepare doors and door jambs for the installation of locksets and hinges in conformance with the hardware manufacturer's instructions and templates. Follow the hollow metal door assembly manufacturer's instructions for fastening the jamb to the support fixture described in 7.2.

6.3.3 Install components such as test doors, door frames, hinges, and hardware in the component test fixture described in 7.2. Provide clearances on the lock side, hinge side, and top of the door ⅛ in. ± 1⁄16 in. (3.2 ± 1.5 mm) maximum. Clearance at the threshold is not considered critical in these tests.

7. Procedures

7.1 *Bullet Penetration:*

7.1.1 When specified by the contract documents of a detention/correctional facility project, test door assemblies for bullet penetration in accordance with UL-752.

7.1.2 Testing of the door, frame, hardware, and security glazing preparation as individual components is acceptable if conducted in accordance with UL-752. The level of performance shall meet the rating of .44 magnum, Level 3.

7.1.3 The pass/fail criteria shall be in accordance with UL-752.

7.2 *Door Assembly Impact Test:*

7.2.1 *Scope*—This test method is designed to evaluate the capability of a complete swinging detention door assembly including frame, door, wall anchoring, lock, hinges, and other options as required by the manufacturer, to resist repetitive impact forces at the designated critical areas.

7.2.2 *Significance and Use:*

7.2.2.1 This test method is intended to closely simulate a sustained battering ram style attack and provide an evaluation of the capability of the assembly to prevent, delay, and frustrate

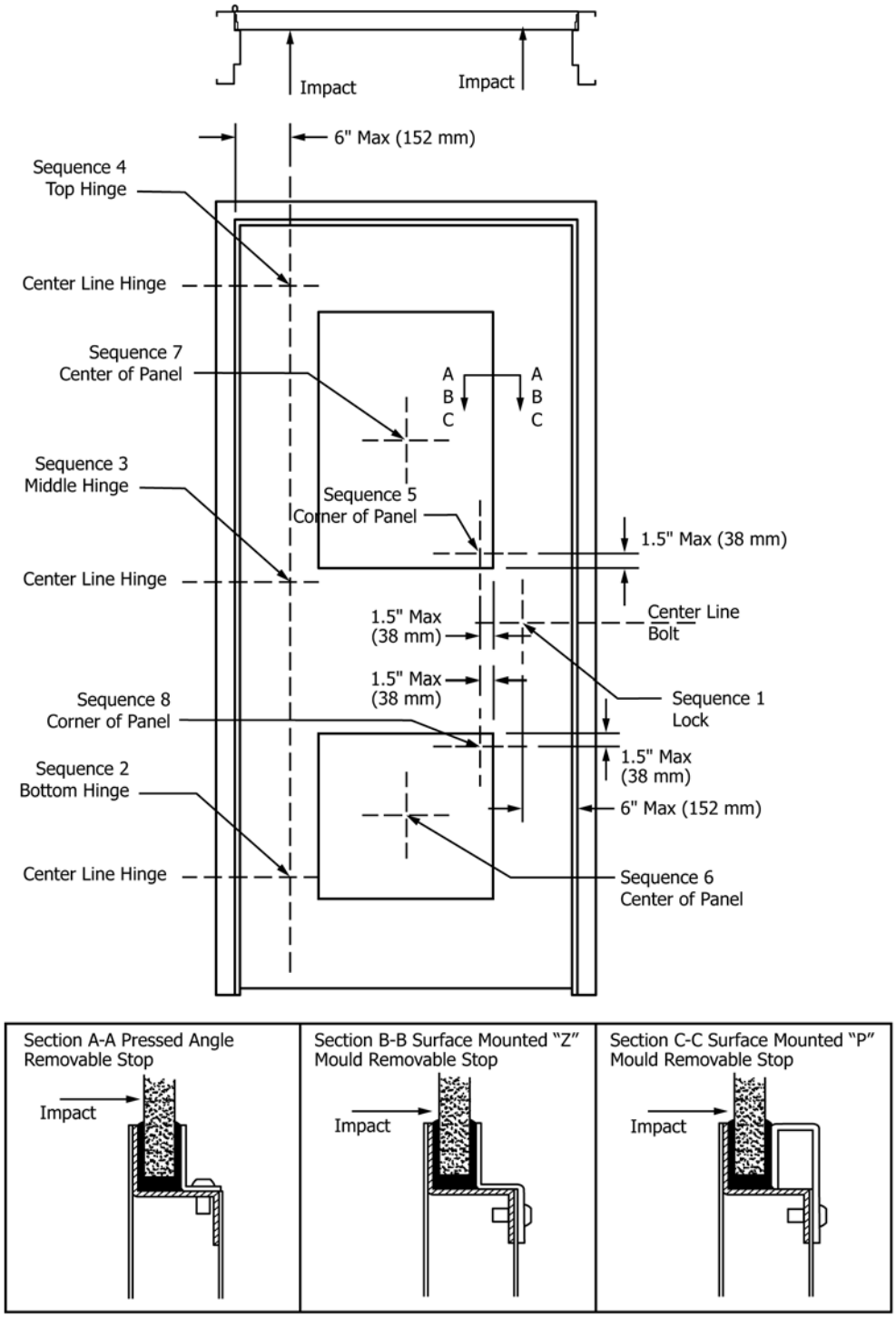


FIG. 2 Test Assembly Door Elevation #2 Location of Strike Points Described in Table 2

escape or access, or both, to unauthorized areas. The test has the potential to be used to aid in identifying a level of physical security for various configurations of swinging detention hollow metal door assemblies.

7.2.2.2 An impact test of this design performed on a complete assembly evaluates the impact fatigue strength of the assembly and its components as well as quality of fabrication techniques and strength of materials used.

7.2.3 *Apparatus:*

7.2.3.1 *Door Ram*—The door ram shall be a pendulum system with steel weight capable of delivering horizontal impacts of up to 200 ft·lbf (271.2 J). The weight of the ram shall be 80 lb (36 kg) ± 0.25 lb (0.10 kg). The striking nose of the ram shall be made from C1010–1020 carbon steel, the striking surface area of which shall be 4.0 ± 0.04 in.^{2} (2580 mm^2 ± 25.8 mm^2) (see Fig. 8).

TABLE 2 Security Grades and Test Load Requirements Door Elevation #2 (Two Large Vision Lights)[A]

Grade Number	Recommended Door Face Sheet and Frame Thickness, in. (mm) gauge, min	Static Load Test, lbf (N)	Rack Load Test, lbf (N)	ASTM Reference Standards
1	0.093 (2.3) 12	14 000 (62 275)	7500 (33 360)	F1592, F1577, F1643
2	0.093 (2.3) 12	14 000 (62 275)	7500 (33 360)	F1592, F1577, F1643
3	0.067 (1.7) 14	11 000 (48 930)	5500 (24 465)	F1592, F1577, F1643
4	0.067 (1.7) 14	11 000 (48 930)	5500 (24 465)	F1592, F1577, F1643

Impact Series for Door Assembly Impact Test, Door Elevation #2 (Two Large Vision Lights)[A]

Sequence[A]	Number of Blows Grade 1	Number of Blows Grade 2	Number of Blows Grade 3	Number of Blows Grade 4	Impact Energy of Each Blow ft·lbf (J)	Location of Blows
1	600	400	200	100	200 (271.2)	Centerline of the lock bolt, 6 in. max from door edge
2	200	150	75	35	200 (271.2)	Centerline of bottom Hinge 6 in. max from door edge[A]
3	200	150	75	35	200 (271.2)	Centerline of middle Hinge 6 in. max from door edge[A]
4	200	150	75	35	200 (271.2)	Centerline of top Hinge 6 in. max from door edge[A]
5	400	200	100	100	200 (271.2)	Lower corner, nearest the lock edge, of upper glazing/ panel within 1.5 in. of the glazing stop
6	400	200	100	100	200 (271.2)	Center of lower glazing/ panel
7	400	200	100	100	200 (271.2)	Center of upper glazing/ panel
8	400	200	100	100	200 (271.2)	Upper corner, nearest lock edge, of lower glazing/ panel within 1.5 in. of the glazing stop
Total Impacts	2800	1650	825	605		
Total approximate Time	4 h 40 min	2 h 45 min	1 h 25 min	1 h		

[A] The cyclic sequence of impacts on the hinge side shall be 25 hits per hinge location and then moving to the next hinge location.

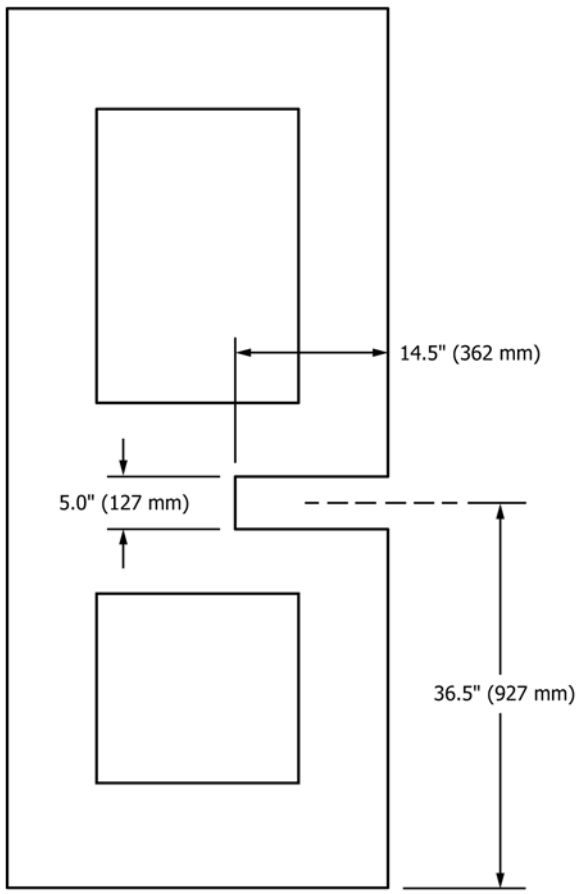


FIG. 3 Door Elevation #3

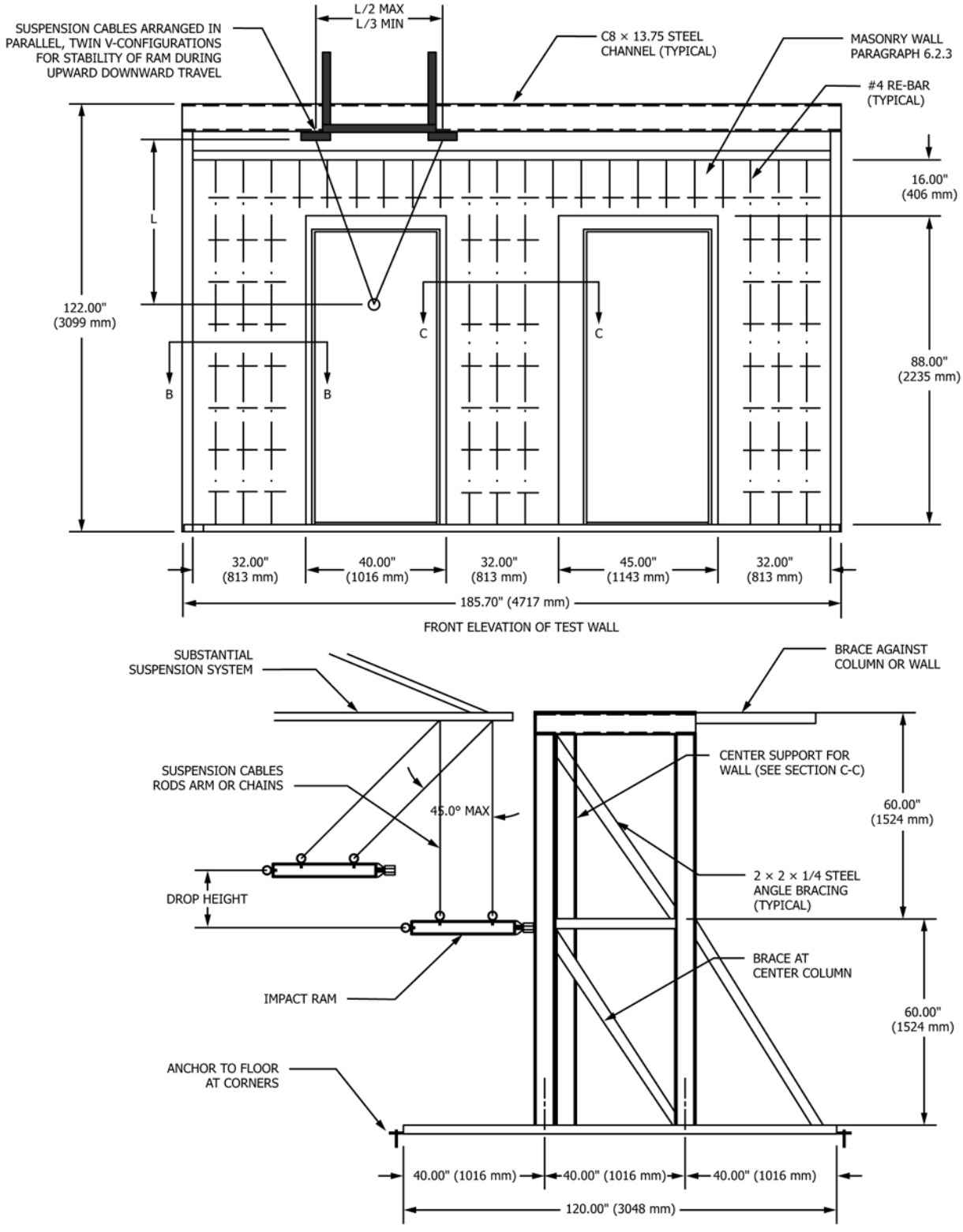


FIG. 4 Test Wall

7.2.4 *Procedure:*

7.2.4.1 With the test fixture and test apparatus, deliver the series of impacts listed in Table 1 (and shown in Fig. 1) to the assembly on the push side of the door. For door elevation #2 (two large vision lights), deliver the series of impacts in Table 2 (and shown in Fig. 2) to the push side of the door.

7.2.4.2 Keep the door closed and locked, and keep security glazing, if used in the assembly, in place throughout the testing

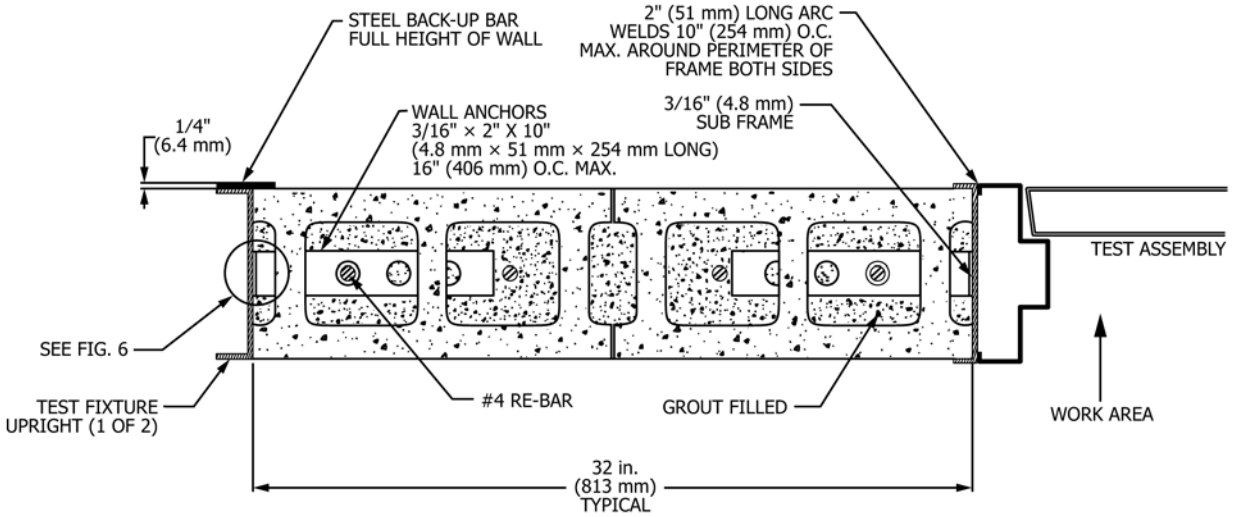


FIG. 5 Section B-B from Fig. 4

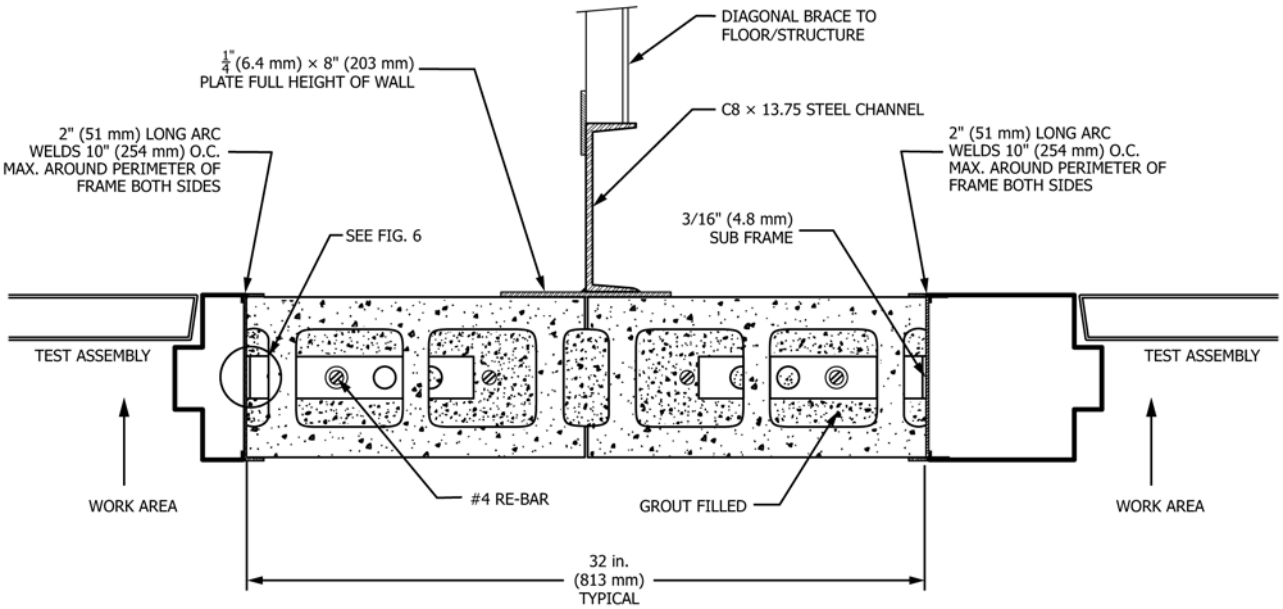


FIG. 6 Section C-C from Fig. 4

procedure. Failure is constituted by the door assembly being damaged to the extent that forcible egress can be achieved. This does not apply to the passage of contraband.

7.2.4.3 After impact testing is completed, keep the doors locked and secure such that forcible egress cannot be achieved.

7.2.4.4 Disengage or remove the lock electrically or manually. If the lock will not disengage normally, disengage it using tools commonly carried in a correctional facility maintenance tool kit, such as: hand screwdrivers (various sizes and tip configurations including tips for coverplate security screws), claw hammer, ball peen hammer, chisel, pliers (any common size), and vice grips.

7.2.4.5 Once the lock is disengaged or removed, open the door enough to provide normal personnel egress.

7.2.4.6 If the lock cannot be disengaged or removed with conventional hand tools as listed, or the door cannot be opened enough to provide personnel egress, the assembly shall be judged to have failed the impact test.

7.2.5 *Precision and Bias:*

7.2.5.1 The precision and bias of this test method for evaluating the impact fatigue strength of the swinging detention hollow metal door assembly are being determined.

7.3 *Door Static Load Test:*

7.3.1 *Scope*—This test method is designed to evaluate the capability of a detention hollow metal door prepared for hardware and other options, not installed in the frame to resist a steadily increasing force applied at quarter points on its surface.

7.3.2 *Significance and Use:*

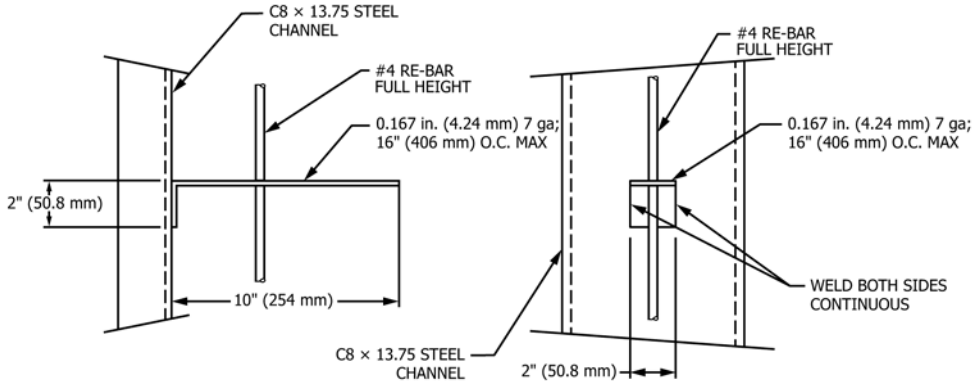
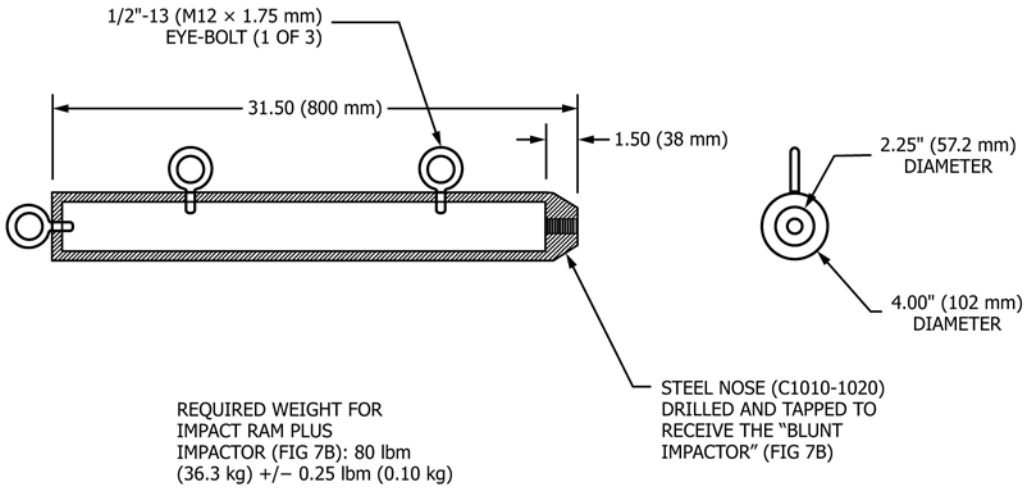


FIG. 7 Wall Anchor Welding Detention Hollow Metal Vision Systems



NOTE: TO PREVENT SHIFTING DURING TEST PROCEDURES, ANY MATERIAL ADDED INSIDE OR OUTSIDE THE RAM TO SATISFY THE WEIGHT REQUIREMENTS SHALL BE RIGIDLY ATTACHED

FIG 7A: STEEL IMPACT RAM

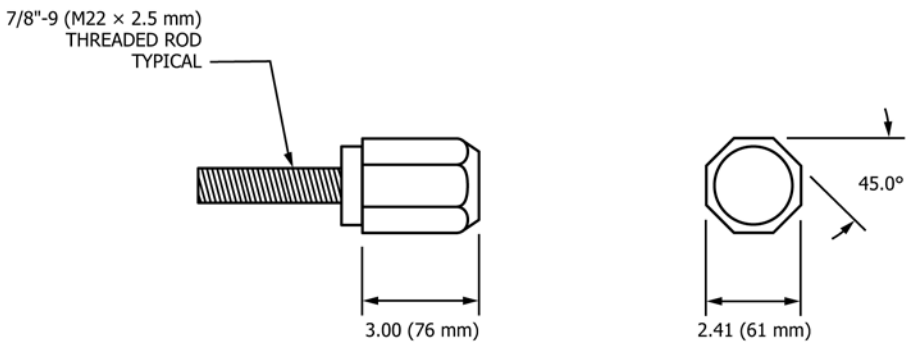


FIG 7B: BLUNT IMPACTOR

FIG. 8 Steel Impact Ram Assembly

7.3.2.1 Although this test method is not intended to simulate a particular field condition or abuse, it is considered a prerequisite test for adequacy of fabrication methods, door design, quality of joints, strength of materials used, and rigidity.

7.3.2.2 The results of this test method have the potential to be used to assist in identifying a level of physical security for various configurations of swinging detention hollow metal door assemblies.

7.3.3 *Apparatus:*

7.3.3.1 *Static Load Test Fixture,* constructed using steel tubing, I-beam, angle and plate to provide a means to place a detention security door in the horizontal position, and to apply an increasing static load at quarter points. The door shall be uniformly supported over its width and no more than 4 in. (102 mm) from each end. An acceptance fixture is shown in Fig. 9.

7.3.3.2 *1-in. (2.54 cm) Travel Dial Indicator,* with resolution of 0.001 in. (0.02 mm) and support stand, such that center point deflection of the test sample can be accurately measured as the static load is applied.

7.3.3.3 *Hydraulic Ram and Pump,* equipped with a gage or load cell, to provide the static load. The pump, ram, and gage shall be calibrated by the testing laboratory and a chart provided that converts pounds-force per square inch gage (Newtons per square millimetre, kPa) to pounds-force (Newtons). If a load cell is used, it shall be certified by the testing laboratory prior to use.

7.3.3.4 It is acceptable to submit load testing fixtures of alternate designs other than that shown in Fig. 9 to the testing laboratory for evaluation and possible approval.

7.3.4 *Procedure:*

7.3.4.1 Each of four detention hollow metal doors prepared for hardware and other options, which are identical in design and construction to those provided for the impact test, and with hardware installed, shall be tested.

7.3.4.2 Support each sample door in the horizontal position no more than 4 in. (102 mm) from each end, in the test apparatus described in Fig. 9. Position I-beams, plates, and hydraulic ram on top of the sample as shown in Fig. 9. Position the 1-in. (2.54-cm) travel dial indicator vertically such that the stem contacts the center point of the sample and is depressed at least 80 % of its travel. Set the dial indicator at 0 and as the static load is applied, the dial indicator stem will extend as the sample moves, thereby displaying the deflection within 0.001 in. (0.02 mm) accuracy.

7.3.4.3 Record force (pound-force (newtons)) and deflection (inches (millimetres)) at 2000 lbf (8900 N) increments to produce a graph of static load versus deflection. Increase the static load until target loads for each sample are reached (see 7.3.4.4).

7.3.4.4 After reaching maximum load and recording maximum deflection, release ram pressure and reduce static load to zero. Record deflection within 1 minute after release of load.

7.3.4.5 *Required Results*—The required loads and impacts are as shown in Table 1 for door elevation #1 and in Table 2 for door elevation #2 for the security grades being obtained. For all grades, the required maximum deflection shall be 0.580 in. (14.73 mm) and the maximum deflection after release of load shall be 0.100 in. (2.54 mm).

7.3.5 *Precision and Bias*—The precision and bias of this test method are being determined.

7.4 *Door Rack Test:*

7.4.1 *Scope*—This test method is designed to evaluate the capability of a detention hollow metal door, prepared for hardware and other options, not installed in the frame, to resist a steadily applied racking (twisting) force.

7.4.2 *Significance and Use:*

7.4.2.1 This test method is intended to closely simulate the racking (twisting) force to which a door is potentially subjected in the field if inmates attempt to force the door open using a pry bar or similar device applied to the top or bottom corner, lock side. A racking force of the specified level tests the adequacy of fabrication methods, strength of materials used, and rigidity of the door.

7.4.2.2 As in the impact test, the results of this test have the potential to be used to aid in identifying a level of physical security for various configurations of swinging detention hollow metal door assemblies.

7.4.3 *Apparatus:*

7.4.3.1 *Rack Test Fixture*—The rack test fixture shall consist of a rigid frame designed to clamp the top of the door in the horizontal flat position. The fixture shall also include a support block to support the bottom hinge-edge corner of the door, leaving the bottom, lock-edge corner unsupported. The unsupported corner shall receive static vertical downward force using a load cell or hydraulic ram that has been fitted with a laboratory certified calibrated gage, and is capable of exerting a static force up to 7500 lbf (33 360 N) (see Figs. 10-12). It is acceptable to submit test fixtures of alternate designs other than that shown in Figs. 10-12 to the testing laboratory for evaluation and possible approval.

7.4.4 *Procedure:*

7.4.4.1 Each of four detention hollow metal doors prepared for hardware and other options, which are identical in design and construction to those provided for the impact test, and with hardware installed, shall be tested.

7.4.4.2 Mount each detention hollow metal door, not installed in the frame and with hardware installed, into the rack test fixture, leaving the lock-edge bottom corner unsupported (see Figs. 10-12). These doors must be identical in construction to the impact test doors.

7.4.4.3 Place a calibrated load cell or hydraulic ram capable of exerting up to 7500 lbf (33 360 N) on top of the unsupported corner with its centerline 3.0 in. (7.6 cm) from the bottom of the door and 3.0 in. from the lock edge. The travel/stroke of the load cell or ram shall be a minimum of 4.0 in. (10.16 cm) to accommodate the maximum allowable deflection specified herein.

7.4.4.4 Place the base of the load cell/hydraulic ram against a fixed object so that when the hydraulic pressure is applied, the resulting force will be in the downward direction against the unsupported corner of the door.

7.4.4.5 A hydraulic ram and pump equipped with a gage or load cell shall be used to provide the static load. The pump, ram, and gage shall be calibrated by the testing laboratory and a chart provided that converts pounds-force per square inch gage (Newtons per square millimetre, kPa) to pounds-force (Newtons). If a load cell is used, it shall be certified by the testing laboratory prior to use.

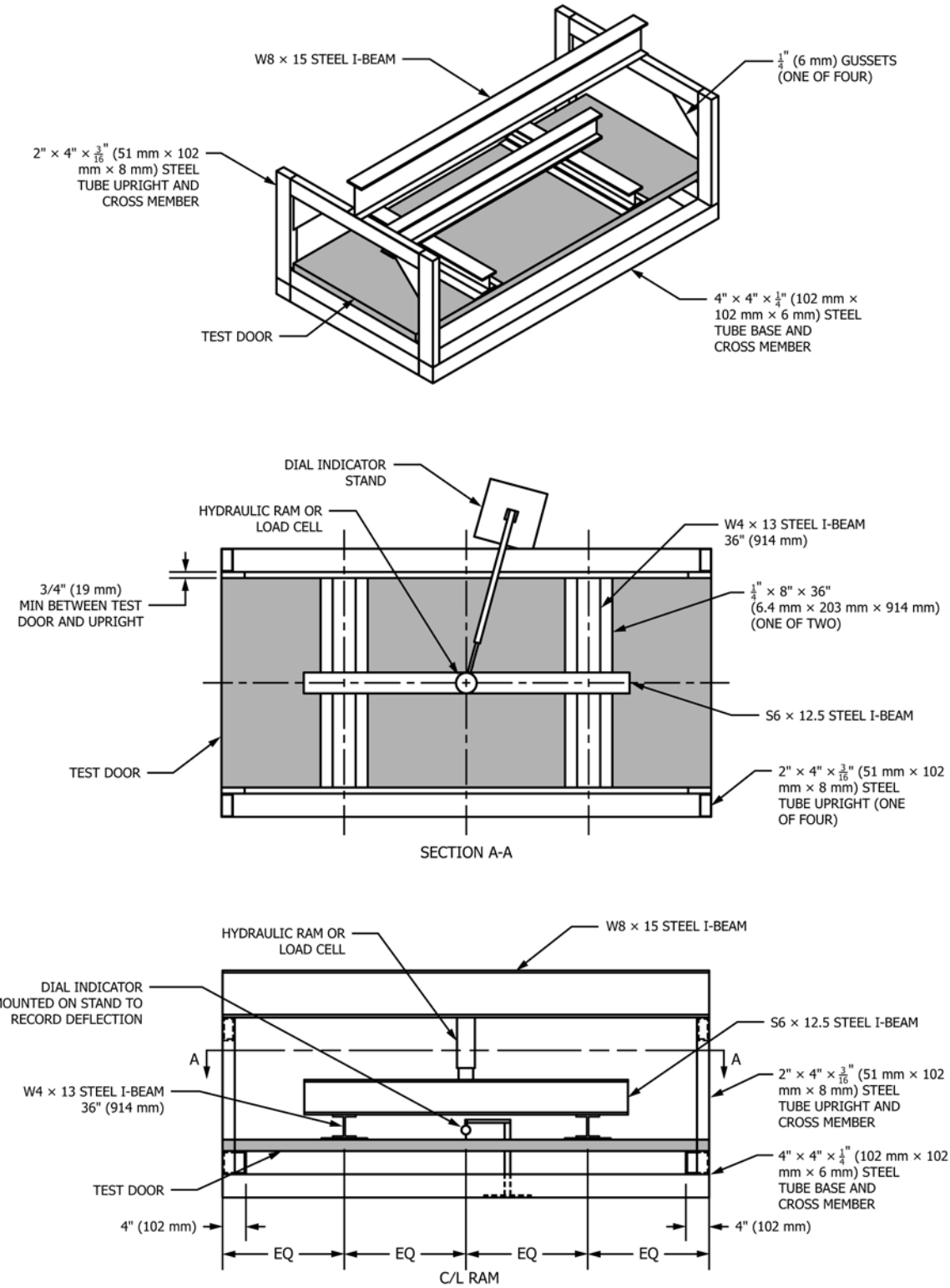


FIG. 9 Static Load Test Apparatus

7.4.4.6 Apply hydraulic pressure steadily to the ram until the force on the corner of the door has reached the force required by Table 1 for door elevation #1 and by Table 2 for door elevation #2 for the security grade being obtained.

7.4.4.7 Measure the deflection of the unsupported corner at the corner where the bottom edge of the door meets the lock edge. Measured deflection shall not exceed 3.55 in. (9.0 cm) at

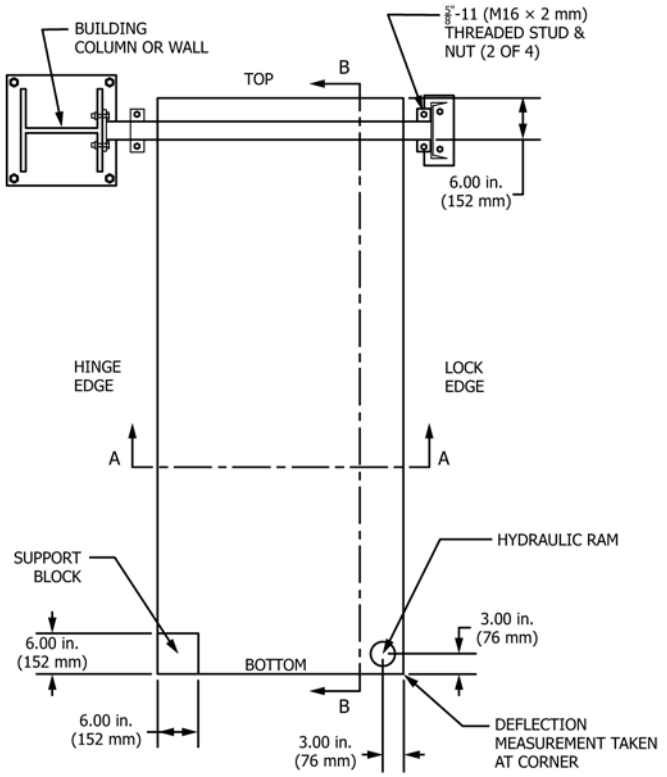


FIG. 10 Rack Test Fixture (Plan View)

the required load. Corner deflection exceeding 3.55 in. at the required load constitutes failure.

7.4.4.8 After reaching maximum load and recording maximum deflection, release ram pressure and reduce static load to zero. Record deflection within 1 minute after release of load.

7.4.4.9 The maximum acceptable deflection after release of load is 1.40 in. (3.6 cm). Deflection after release of load in excess of this value constitutes failure.

7.4.4.10 The rack test shall be performed on Door Elevation #3 (section 6.1.4).

7.4.4.11 Under an applied load of 3000 lbf (13 345 N), corner deflection shall not exceed 2.1 in. (53 mm). A corner deflection exceeding 2.1 in. (53 mm) at the required load constitutes failure.

7.4.5 *Precision and Bias*—The precision and bias of this test method are being determined.

7.5 *Door Assembly Fire Test:*

7.5.1 When specified by the contract documents of a detention/correctional facility project, door assemblies shall be fire protection rating tested in accordance with UL-10 (B), UL-10(C), or NFPA 252.

7.5.2 Manufacturers shall be permitted to omit or add options at their discretion, recognizing that the omission of an option in the fire test will prevent them from including that option in production models that are required to carry a fire rating.

7.5.3 The pass/fail criteria and criteria for assignment of fire protection ratings shall be in accordance with Test Method UL-10 (B), UL-10(C), or NFPA 252.

7.6 *Door Assembly and Hardware Tool Attack Test (Prying/Picking Devices):*

7.6.1 When specified by the contract documents of a detention/correctional facility project, door assemblies shall be tested for resistance to tool attack. Attacks similar to those described in UL-1034 and UL-437 shall be performed.

7.6.2 Testing of the door, frame, hardware, or security glazing as individual components is acceptable if conducted in accordance with 7.6.1. The level of performance shall meet the rating of small tool attack.

7.6.3 The pass/fail criteria shall be similar to those established by UL-1034 and UL-437.

7.7 *Door Edge Crush Test:*

7.7.1 *Scope*—This test is designed to measure the ability of the edge of a detention hollow metal door, prepared for hardware and other options, not installed in the frame, to resist a load applied perpendicularly to the edge in the plane of the door leaf.

7.7.2 *Significance and Use:*

7.7.2.1 Damage to swinging doors is frequently affected by placing objects between the jamb and door and forcing the door against the object. If the door is sufficiently dented to be unserviceable, it is possible that security will be impaired.

7.7.2.2 This test has the potential to be used to assist in identifying a required resistance to such vandalism.

7.7.3 *Apparatus:*

7.7.3.1 *Framework,* constructed to hold a sample door. The framework shall be constructed so that a calibrated load cell or hydraulic ram can be used to apply force to the edge of the door, with the ram acting in the plane of the door leaf and perpendicular to the door edge. Fig. 13 shows an acceptance apparatus.

7.7.3.2 *Endpiece,* provided for the ram, comprising a 1.5 in. (38 mm) diameter steel cylinder mounted to the ram so that the axis of the cylinder is perpendicular to the surface of the door leaf.

7.7.3.3 *Attachment Point,* provided so that a dial indicator having at least 1 in. (25.4 mm) of travel with resolution of 0.001 in. (0.02 mm) can be attached to the framework and measure the travel of the hydraulic ram once it is in contact with the edge of the sample door.

7.7.3.4 It is acceptable to submit load testing fixtures of alternate designs other than that shown in Fig. 13 to the testing laboratory for evaluation and possible approval.

7.7.4 *Procedure:*

7.7.4.1 One detention hollow metal door prepared for hardware and other options, which is identical in design and construction to either of the doors provided for the impact test, with hardware installed, shall be tested.

7.7.4.2 Install the door in the framework, hinge side up. Install the calibrated load cell or hydraulic ram and load it with sufficient pressure to prevent it from falling out of position. Attach the dial indicator with its stem parallel with the travel of the ram, so that it measures the progress of the ram into the door edge.

7.7.4.3 Apply pressure to the door until required loads in Table 3 are reached and record deflections as required.

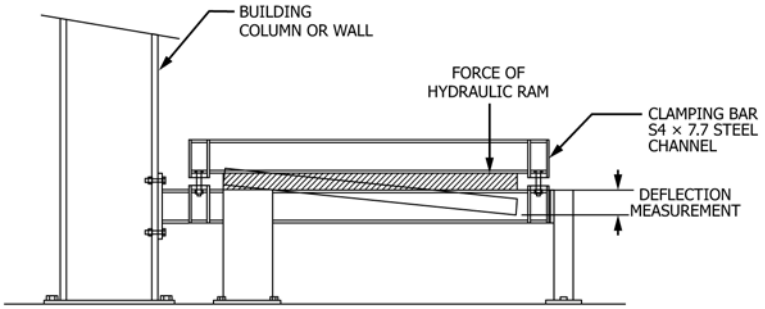


FIG. 11 Section A-A from Fig. 10 Rack Test Fixture

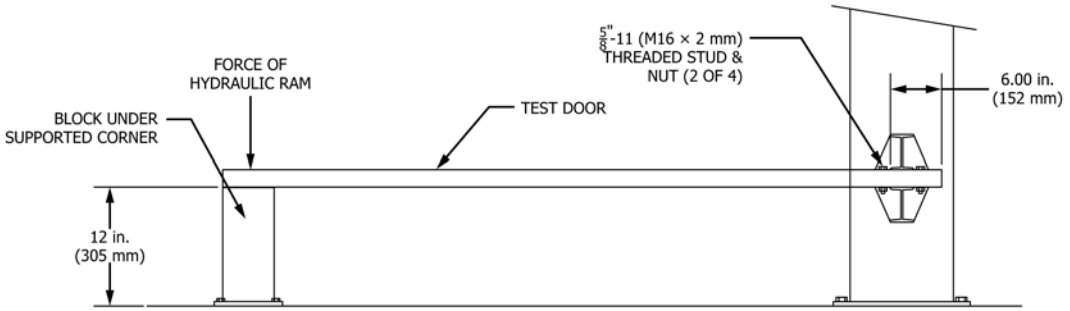


FIG. 12 Section B-B from Fig. 10 Rack Test Fixture

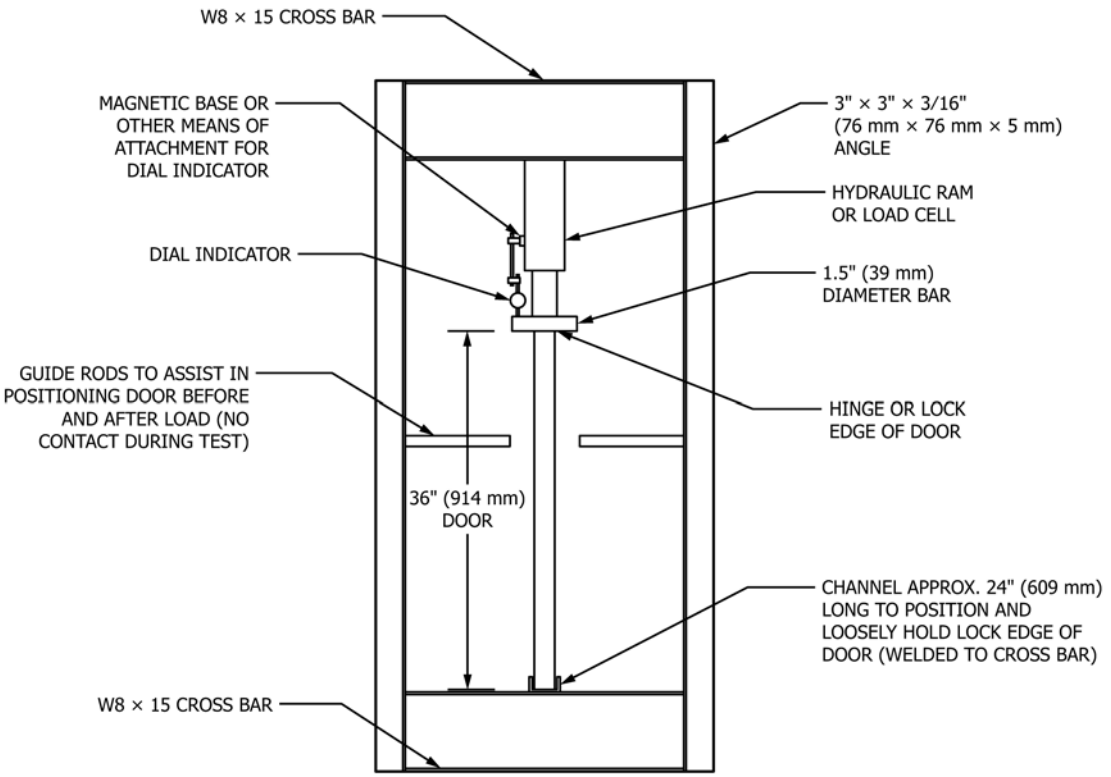


FIG. 13 Edge Crush Test Fixture (End View)

TABLE 3 Required Loads for Door Edge Crush Test

Minimum Face Sheet Thickness, in. (mm) gauge	Security Grades (Table 1)	Load Supported at Deflection Less Than 0.25 in. (6 mm)	Total Load Supported
0.093 (2.3) 12	Grades 1 and 2	8000 lbf (35 585 N)	15 000 lbf (66 725 N)
0.067 (1.7) 14	Grades 3 and 4	8000 lbf (35 585 N)	10 000 lbf (44 480 N)

7.7.4.4 Remove the door from the framework. Place the door back into the framework, with the lock side up, and then repeat the test procedure.

7.7.5 *Required Results:*

7.7.5.1 Both the hinge edge and the lock edge must meet the required results set forth in Table 3.

7.7.5.2 If load values and deflections are not achieved, this shall constitute failure.

7.7.6 *Precision and Bias*—The precision and bias of this test are being determined.

8. Certification

8.1 *Certification*—The manufacturer shall provide test reports by an independent testing laboratory which certify that the assemblies were successfully tested in accordance with these test methods and which comply with Section 9, Report.

8.2 *Manufacturer's Procedure*—The manufacturer shall be permitted to contract with the testing laboratory to provide the manufacturer with a certified procedure and security labeling service for the construction of tested assemblies with factory follow-up inspection service as an option.

9. Report

9.1 Report the following information:

9.1.1 Name and address of laboratory,

9.1.2 Date laboratory completed tests,

9.1.3 Name and address of door assembly manufacturer,

9.1.4 Description of identifying markings on all components of test assembly,

9.1.5 Location of testing equipment,

9.1.6 Diagrams, details, and photographs of testing equipment,

9.1.7 Specifications and details of components of test assembly including test assembly drawings, door and frame component drawings, hardware templates and instructions, wall specifications, and details on anchoring devices, and

9.1.8 All test data and load deflection graphs.

10. Keywords

10.1 battering ram; correctional facility; detention facility; detention hollow metal; detention security; door; escape; fire test (door); frame; hardware; hinges; hollow metal; impact test (door); lock; physical security; rack test (door); security hollow metal; static load test (door); swinging detention hollow metal door assemblies

APPENDIXES

(Nonmandatory Information)

X1. TEST APPARATUS

X1.1 Test equipment suitable for use in evaluating the physical security of door assemblies and components is described in this appendix. While certain commercial instruments are identified to adequately describe the test equipment, in no case does such identification imply recommendation or endorsement, nor does it imply that the material or equipment described is necessarily the best for the purpose.

X1.2 Figs. 1-13 show the test wall and fixtures necessary to carry out the test methods described in 7.2 – 7.4, and 7.7.

X1.3 Information on equipment necessary to perform the tests described in 7.1, 7.5, and 7.6 is included in the referenced test methods.

X2. RELATED STANDARDS

X2.1 These test methods are part of a family of interrelated standards developed to work together using common testing approaches and grade classifications to address the specific needs of detention and correctional facilities, including the following: Test Methods F1450, F1577, F1592, F1643, F1758, and F1915.

X2.2 This Appendix is intended to explain some of the common approaches underlying the test methods noted above, including how to distinguish between primary and secondary materials and test objectives.

X2.3 Primary is typically an entire full-scale operating assembly of many components and materials that are tested together, whereas secondary is individual components that are only a portion of a whole assembly.

X2.4 In some instances, components that are secondary in one test become primary under a distinct and separate related standard developed specifically for that component. These separate standards typically apply more rigorous test methods to fully exploit susceptibilities unique to that component.

X2.5 Titles of related standards indicated above pertain to performance objectives for the primary component or assembly. This is explained further in examples below.

X2.6 Each related standard contains grades or levels of performance developed: to restrict passage to unauthorized areas, to delay and frustrate escape attempts, and to resist vandalism. These grades or levels were developed based on an attacker's predicted ingenuity using "riot-like" attack methods, modified depending upon strengths and weaknesses of various components. Attack sequence format(s), impact intensities, test

duration(s), and tools utilized are comparable from one standard to another. Using the established security grades, a user is given reasonable assurance that components and assemblies will perform satisfactorily at their tested security grade levels. These security grades establish specific measurements of performance of the primary assembly or component material.

X2.7 *Test Methods F1450*—Attack impact test methods incorporated into Test Methods F1450 address performance characteristics of door assemblies, including constituent doors, door frames, and sub-components installed and operating as they would normally function in an actual detention or correctional facility. Components installed in test doors and frames are intended to be certified by their applicable separate component standard performance. For example, separately certify components to standards as follows: locks to Test Methods F1577, hinges to Test Methods F1758, sliding door devices to Test Methods F1643, and glazing to Test Methods F1915.

X2.8 *Test Methods* F1592:

X2.8.1 Impact test method(s) for Test Methods F1592 address not only the performance characteristics of doors and door frames, but also side light and multiple light frame assemblies, again, with all necessary components installed to form a full scale operating assembly. Once again, it is intended that individual components should be certified under their separate applicable standards.

X2.8.2 Users of detention components should review the related standards applicable to those components and their test reports for comparable attack testing grade or level of performance.

X2.8.3 Since the primary subjects of attack under Test Methods F1592 are the frame construction, glazing stops, and fasteners, a consistent steel impact "panel" may be substituted for uniformity of test results, instead of using actual security glazing. This substitution also applies to Test Methods F1450 door vision lights.

X2.9 *Complementary/Dual Certifications*:

X2.9.1 Manufacturers of components may work together to obtain multiple complementary certifications. For example, a lock manufacturer may team with a hollow metal manufacturer to conduct impact testing on an assembly under Test Methods F1450 and obtain dual certifications for impact test portions of both Test Methods F1450 and F1577, since the test methods in both are comparable.

X2.9.2 In another example, a security glazing manufacturer may team with a hollow metal manufacturer to obtain a complementary certification under Test Methods F1592. However, in this case, Test Methods F1915 requires additional testing of the security glazing that involves sharp as well as blunt attack tools, and application of heat using a torch during a blunt impact test. A security glazing product that performs well under Test Methods F1592 hollow metal frame testing may not satisfy all of the separate requirements of Test Methods F1915. Separate certification under Test Methods F1915 must also be obtained.

X2.10 *Components Tested for Specific Susceptibilities*—Differences in attack testing under these two test methods (Test Methods F1915 and F1592) are related to performance degradation of some security glazing, undergoing attack testing at various thermal conditioning exposures, as well as the specific number of impacts. Test Methods F1915 contains impact tool attacks under both severe hot and cold conditioning, as well as a torch sequence combined with impact from blunt tools. Typically, heavily constructed detention hollow metal sheet is not as susceptible to these temperature changes, which is the reason why temperature conditioning is not included in impact testing for Test Methods F1592 or F1450 (except temperature conditioning for bullet resisting UL-752). Consequently, security glazing tested and certified under Test Methods F1915 provides superior assurance of performance across a range of environmental conditions not tested under most other previously existing standards.

X2.11 In conclusion, by choosing consistent grade levels from these related standards, a user can obtain greater assurance that both the security assembly and the multitude of constituent components are integrated to deliver the security performance required.

X3. REPRESENTATIVE BARRIER DURATION TIME

X3.1 The element of time shown in Tables 1 and 2, is based upon historical testing observation that indicates that sustained manpower can deliver 600 blows of 200 ft·lb (271.2 J) each in one (1) hour. The Table includes total numbers of impacts for each Grade Level, and total approximate times to deliver these numbers, excluding set up times for cyclic sequences. This is offered solely as supplementary design information to assist the user in matching security grades with the attack resistance times and staff response times required for each opening in the facility.

X4. COMBINATION TESTING AND TESTING SCHEDULE

X4.1 The test methods described in Test Methods F1450 and Test Methods F1592 are closely related and the test samples may be tested in various combinations in order to minimize duplicate or redundant testing.

X4.2 If such a combined test schedule is used, combined reporting may be incorporated, provided all required assemblies are addressed and subject to testing laboratory approval.

X4.3 The detention and corrections industry relies heavily upon the credibility of the testing of security door and vision system assemblies in accordance with these test methods, and the performance that successful testing helps to ensure. In consideration of the importance placed by the industry upon this product performance testing, the developers and reviewers of these test methods agree that retesting every five (5) years will help ensure that product designs and production methods remain reliable and do not exhibit performance degradation over time. This five (5) year retesting schedule coordinates well with the five (5) year review that is mandated by ASTM for all standards. By following this schedule, the industry is assured that if a review precipitates changes or additions to the testing procedures, then these new procedures will be utilized by the manufacturers and laboratories upon their next retesting cycle, thereby providing assurance that products are always being tested and retested in accordance with the most current revisions of the standards. However, in the interest of not requiring unnecessary testing, if the revisions to a standard during its review are editorial only, or if the standard is reapproved with no changes, retesting may be waived.

X5. DOOR ELEVATION #2

X5.1 Door elevation #2 has been added to the required list of samples to be tested under this standard because it is representative of door elevations that are commonly needed in detention and correctional facilities. The large glass openings are necessary to provide adequate visibility, and to facilitate good supervision of inmates by facility staff.

X5.2 It is widely held by the design community that this door type is not only important, but is routinely needed in maximum security applications where Grade 1 or Grade 2 performance is required.

X5.3 Detention door manufacturers involved in the development of this revision agree that the internal construction for Door Elevation #2 is significantly more material and design intensive in order to achieve Grades 1 and 2.

X5.4 This appendix section is intended to offer this explanation and to inform the design community that this door type, tested and certified to Grades 1 and 2, will be significantly more costly to produce than the same door type certified to Grades 3 and 4, and therefore, will be somewhat expensive.