Designation: F 1450 – 97

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

This standard is issued under the fixed designation F 1450; 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: dayrooms, 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:*

E 152 Methods of Fire Tests of Door Assemblies[2]

F 1577 Test Methods for Detention Locks for Swinging Doors[3]

F 1643 Test Methods for Detention Sliding Door Locking Device Assembly[4]

2.2 *NFPA Standard:*

252 Methods of Fire Tests of Door Assemblies[5]

2.3 *UL Standards:*[6]

UL-10 (B) Fire Tests of Door Assemblies

UL-752 Bullet Resisting Equipment

UL-437 Standard for Key Locks

UL-1034 Standard for Burglary Resistant Electric Locking Mechanisms

3. Terminology

3.1 *Definitions:*

3.1.1 *bolt*—a 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)*—the 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.

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

[1] These test methods are under the jurisdiction of ASTM Committee F-33 on Detention and Correctional Facilities and are the direct responsibility of Subcommittee F33.02 on Physical Barriers.

Current edition approved Oct. 10, 1997. Published June 1998. Originally published as F 1450 – 92. Last previous edition F 1450 – 92.

[2] Discontinued; see *1994 Annual Book of ASTM Standards*, Vol 04.07.

[3] *Annual Book of ASTM Standards*, Vol 04.07.

[4] *Annual Book of ASTM Standards*, Vol 15.07.

[5] Available from the National Fire Protection Association, Battery March Park, Quincey, MA 02269.

[6] Available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062.

3.1.7 *hinged door*—a 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.

3.1.8 *hollow metal*—a 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.

3.1.8.1 *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.

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

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

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

3.1.12 *testing laboratory*—an 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 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; 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.

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

4.4 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 Section 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 may 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 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:

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

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

6.1.1.3 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).

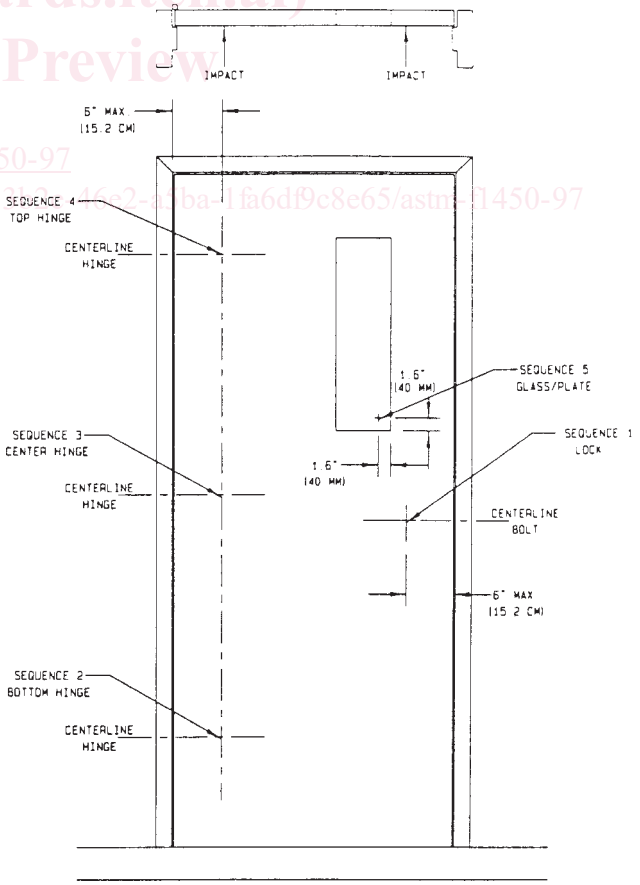

FIG. 1 Test Assembly Elevation Location of Strike Points Described in Table 1

6.1.1.4 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).

6.1.1.5 Required results indicated in Table 1 are based upon a door size of 3 by 7 ft.

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. 2 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. 2-5 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 ± 1/32 in. (3.2 ± 0.8 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, or security glazing 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 escape or access, or both, to unauthorized areas. The test may 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 pendular system with steel weight capable of delivering horizontal impacts of up to 200 ft·lbf (271.2 J). The weight of the ram may vary from 80 to 100 lb (36.0 to 45.0 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} (25.8 cm^2) (see Fig. 6).

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.

7.2.4.2 Keep the door closed and locked, and keep security glazing, if used in the assembly, in place throughout the testing 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 escape breach cannot be achieved.

7.2.4.4 Disengage the lock electrically or manually. If the lock will not disengage normally, disengage it using tools commonly carried in a correctional facility maintenance tool

TABLE 1 Security Grades and Test Load Requirements[A,B]

Grade Number	Recommended Door Face Sheet and Frame Thickness, in. (mm) gage, min	Static Load Test B, lbf (N)	Rack Load Test C, lbf (N)	Impact Test A Impact Energy = 200 ft·lbf (271.2 J)			ASTM Reference Standards
				Lock Impacts	Hinge Impacts	Glazing Impacts	
1	0.093 (2.3) 12	14 000 (62 272)	7500 (33 360)	600	200	100	F 1450, F1577, F1643
2	0.093 (2.3) 12	14 000 (62 272)	7500 (33 360)	400	150	100	F 1450, F1577, F1643
3	0.067 (1.7) 14	11 000 (48 939)	5500 (24 470)	200	75	100	F 1450, F1577
4	0.067 (1.7) 14	11 000 (48 939)	5500 (24 470)	100	35	100	F 1450, F1577

[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.

[B] The element of time, which is not shown in Table 1, is based upon historical testing observation that indicates that sustained manpower can deliver 400 blows of 200 ft·lb (271.2 J) each in 45 min. The number of blows required to achieve Grade 1 will require more time, predicted to be 1 h or more, and the number of blows required to achieve Grades 3 and 4 will be less than Grade 2, predicted to be 30 min and 15 min, respectively. 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.

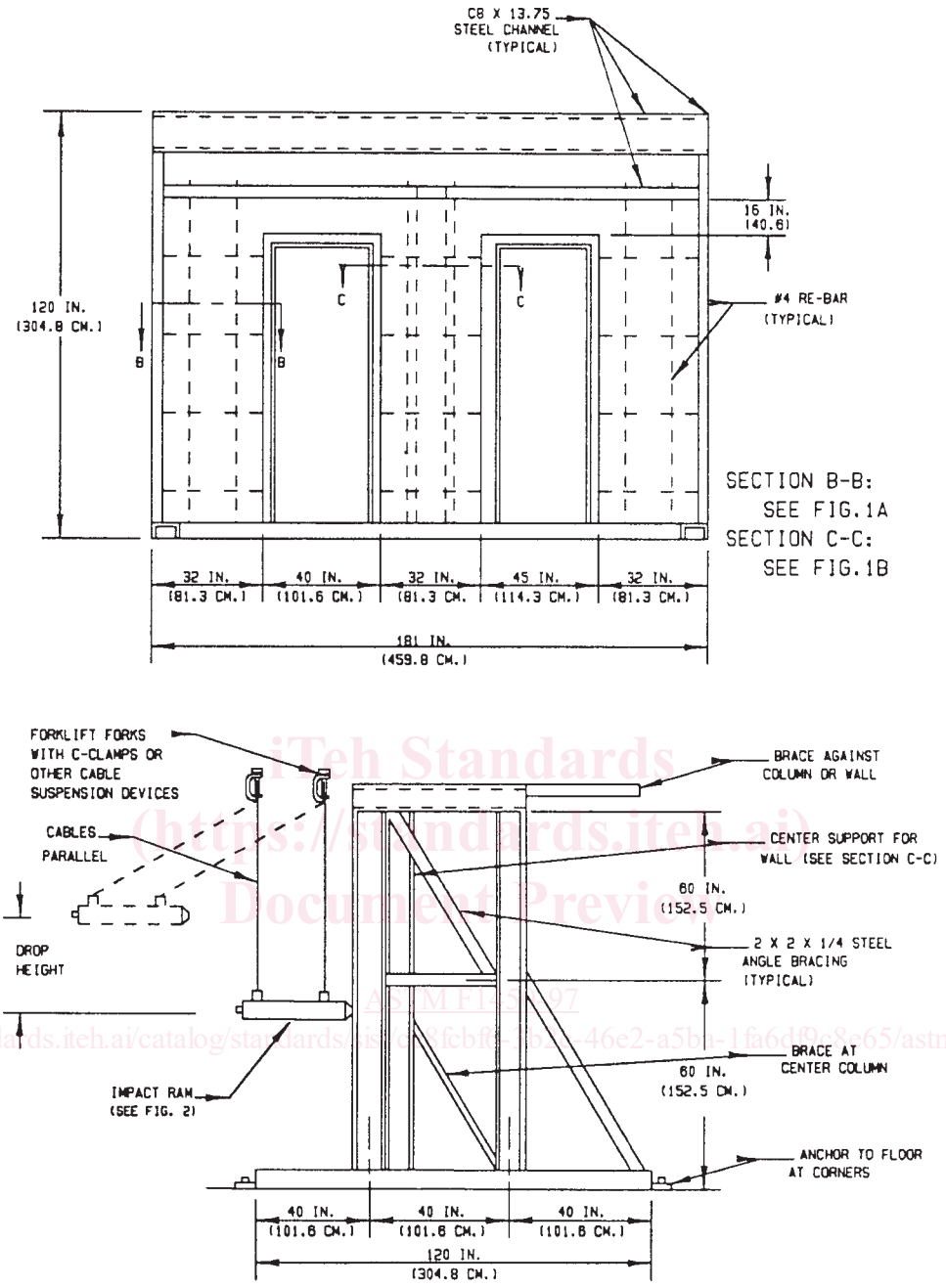

FIG. 2 Test Wall

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, open the door enough to provide normal personnel egress.

7.2.4.6 If the lock cannot be disengaged 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*:

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 may be used to assist in identifying a level of physical security for various configurations of swinging detention hollow metal door assemblies.