

*Testing and Rating of—
Severe Windstorm Resistant Components for
Swinging Door Assemblies for Protection of
Building Envelopes
(Not applicable for FEMA 320/361 or ICC-500 Shelters)*



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American National Standard
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Door Assemblies for Protection of Building Envelopes
(Not applicable for FEMA 320/361 or ICC-500 Shelters)**

Secretariat

Steel Door Institute

Approved February 25, 2014

American National Standards Institute, Inc.

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Foreword (This Foreword is not part of American National Standard A250.13-2014)

The material contained in this document has been developed under the auspices of the Technical Committee of the Steel Door Institute.

Suggestions for improvement gained in the use of this standard will be welcome and should be sent to the Steel Door Institute, 30200 Detroit Road, Cleveland, Ohio, 44145-1967.

The organizations that have approved this standard are as follows:

American Institute of Architects/ARCOM
Architectural Testing
Builders Hardware Manufacturers Association
Canadian Steel Door Manufacturers Association
Cedar Valley Associates
Door and Hardware Institute
Door Control Services
FM Approvals
HMMA/Division of NAAMM
Intertek Testing Services
National Wind Institute / Texas Tech
Steel Door Institute
Underwriters Laboratories LLC
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J. Jeffery Wherry, Secretary

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American National Standard

Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies for Protection of Building Envelopes (Not applicable for FEMA 320/361 or ICC-500 Shelters)

1 Scope

1.1 This standard provides procedures for testing and establishing load ratings (design pressure in pounds per square foot or design load in pounds force) for components of exterior swinging door assemblies for purposes of protection of openings in building envelopes during severe windstorm conditions, such as a hurricane, that produces sustained wind speeds or gusts in a range of 110 to 150 miles per hour as defined by ASCE 7. It is not intended to simulate wind forces generated by tornadoes. These products are for non-life safety installations and not for use in storm shelters. Life Safety/Shelter products must meet FEMA 320/361 and/or ICC-500.

1.2 The procedures cover all components normally assembled to form an exterior swinging door system. This includes door frames, hardware Mullions, thresholds, frame anchorage, hinges, locksets, latches and bolts, doors, sidelights, transoms and glazing systems. This procedure applies to both single swing and pair assemblies and also includes procedures for testing and rating components for both in-swing and out-swing installations.

1.3 The evaluations required by this standard are based on the performance tests specified in ASTM E1886, ASTM E1996 and ASTM E330.

1.4 Evaluations under this procedure are designed to determine the ability of exterior doors to remain closed under conditions present in severe windstorms, including high, fluctuating wind speeds and the presence of wind-born debris. Assemblies meeting these requirements are less likely to open during a storm, preventing potentially large pressure differentials which may cause or contribute to major structural damage. This procedure does not consider it necessary for the door assembly to be capable of preventing water intrusion as a result of severe windstorm exposure conditions.

It is recognized that products and assemblies meeting these requirements will not necessarily prevent all forms of damage associated with hurricanes and other severe windstorms. It is also assumed that these assemblies themselves might be damaged in a severe windstorm to an extent that would require repair or replacement after such an event.

2 Definitions

Building Envelope: Windows, doors, curtain walls, wall and roof assemblies.

Classified: Products or materials of a specific group category that are constructed, inspected, tested and subsequently reinspected in accordance with an established set of requirements. The classification process is performed by an organization acceptable to the authority having jurisdiction.

Component: Any of several manufactured items, classified/listed and labeled, used in the construction and installation of a swinging door assembly. Components include door frames, doors, hardware, glazing systems and similar products normally supplied separately to a job-site where they are assembled and/or installed to form a complete assembly.

Design Load: The specified point force applied to a product. Units of measure are pounds force (lbf).

Design Pressure: The specified force applied to a specified unit area of product surface. Units of measure are pounds-force per square foot (psf).

Impact Energy (Kinetic Energy - KE): The specified dynamic load applied to a product. Units of measure are foot-pounds (ft-lbf).

In-Swing Door: A door with the push side on the exterior or that swings into the building when

opened. Negative pressure acts to close this door and positive pressure acts to open this door.

Labeled: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction (AHJ) and concerned with product evaluation, that maintains periodic inspections of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed: Equipment materials or services included in a list published by an organization that is acceptable to the Authority Having Jurisdiction (AHJ) and concerned with evaluation of products or services, that maintains periodic evaluation of services and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Operable: Capable of being opened by the application of ordinary levels of applied force to the latch operator and door assembly.

Note: Door assemblies that have been subjected to the severe conditions of the tests involved in this method are not expected to be undamaged and thus will normally not operate with the low force levels generally required for undamaged assemblies. The goal is to provide an assembly that will remain closed during the windstorm, but not be damaged to the extent that it requires the use of tools to be opened after the event.

Out-Swing Door: A door with the pull side on the exterior or that swings away from the building when opened. Negative pressure acts to open this door and positive pressure acts to close this door.

Severe Windstorm: A weather event such as a hurricane that produces sustained wind speeds or gusts in a range of 110 to 150 miles per hour.

Stiffness Classification: A measure of a door's resistance to bending as determined by a twist test under a prescribed loading condition.

3 General

3.1 Units of Measurement

3.1.1 When a value for measurement is followed by a value in other units in parentheses, the second value is only approximate. The first stated value is the requirement. The primary units are inch-

pound. Appendix A contains a table of the Imperial values used in this standard and corresponding SI values.

3.1.2 Unless specifically indicated otherwise, tolerances shall be in accordance with Appendix A.

3.1.3 Where load ratings are to be applied in units of pounds per square foot (psf), these values shall be expressed in 5-pound-per-square-foot increments. For components that are rated in terms of pounds force, values shall be expressed in 10-pound increments. All rated values shall be determined by rounding down from values derived from tests.

3.2 Referenced Standards

3.2.1 ANSI/ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*

3.2.2 ANSI/SDI A250.4-2011, *Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings*

3.2.3 ASTM E330-02 (2010), *Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*

3.2.4 ASTM E1886-05, *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials*

3.2.5 ASTM E1996-12a, *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes*

3.2.6 ASTM F476-84 (2002) *Standard Test Methods for Security of Swinging Door Assemblies*

3.2.7 ANSI/BHMA A156.1-2013, *Butts and Hinges*

3.2.8 ANSI/BHMA A156.16-2008, *Auxiliary Hardware*

4 Overview

4.1 The procedures in this document are designed to evaluate each critical component used in a swinging door assembly for the component's ability to perform its intended function. The evaluation is conducted under the conditions of stress and loading the component would be subjected to in the testing of a complete assembly under the

assembly test methods commonly specified for severe windstorm resistance.

4.2 The tests and evaluations required by this procedure include both the application of engineering safety factors and worst-case analysis to ensure that component substitutions in field assemblies will perform to the minimum levels expected.

4.3 Components evaluated by this method are classified into various strength categories that can be used to determine assembly ratings. A single component may have multiple ratings depending on various parameters such as size, number and location of anchors or fasteners, type of surrounding construction and other factors. Proper application of these ratings allows for the determination of an assembly's design pressure rating and minimum impact energy resistance. These ratings are intended to be used to determine compliance with code requirements developed for complete assemblies.

4.3.1 Doors are rated for design pressure in pounds per square foot (psf), impact energy in foot-pounds (ft-lbf) and stiffness classification. Stiffness is required in determining the interaction between the door bending under load, transmission of impact energy to latching hardware and frames, and latching engagement.

4.4 Proper application of this standard requires a basic level of understanding of physics, mechanics and materials science.

4.5 This procedure provides specific tests and rating methods for the following components:

Section 5 – Door Frames

Section 6 – Hinges

Section 7 – Latching Hardware

Section 7.1 – Locksets (Bored, Mortise, Deadbolts)

Section 7.2 – Single Point Rim or Mortise Exit Devices

Section 7.3 – Multi-point Latches (including flush and surface bolts)

Section 8 – Doors

Section 9 – Door Vision Light Kits

Section 10 – Sidelight and Transom frames

Section 11 – Miscellaneous Components

Section 11.1 – Hardware Mullions

Section 11.2 – Thresholds

5 Door Frames

5.1 Frames are to be evaluated in the largest door opening sizes, minimum jamb depth and minimum frame material thickness for which a design rating is to be determined. Frames intended for use in both single swing and pair assemblies shall be tested in both configurations. Frames are to be installed following the manufacturer's written instructions which are to include:

- a) Wall substrate – wood/steel stud, concrete, masonry, structural steel.
- b) Anchors – number, size, type and spacing of anchors, anchor or bolt embedment, and number and type of fasteners required at each anchor location.
- c) Reinforcements – location and attachment.
- d) Gasketing – location, type and attachment.
- e) Hinges – number, type, size and locations.
- f) Latching Hardware – type and location.

5.2 Test Procedure

5.2.1 Static Pressure Test

5.2.1.1 The frame shall be installed into a test unit constructed to simulate the wall design specified by the frame manufacturer. The frame installation shall be in accordance with the frame manufacturer's written instructions (refer to figure 1 for typical details). For wall designs that differ significantly from those shown, the test installation shall simulate actual intended wall design and anchorage.

A flush door rated for not less than the desired frame design pressure shall be mounted with the number of hinges specified by the frame manufacturer. For single-swing frames, a single-point simulated latch and a stainless steel strike shall be installed between 38" and 42" above the bottom of the frame (see figure 2.) The door and latching hardware shall be of sufficient strength so that they do not fail at the required test load. Door(s) shall be installed in the direction of swing for the desired listing.

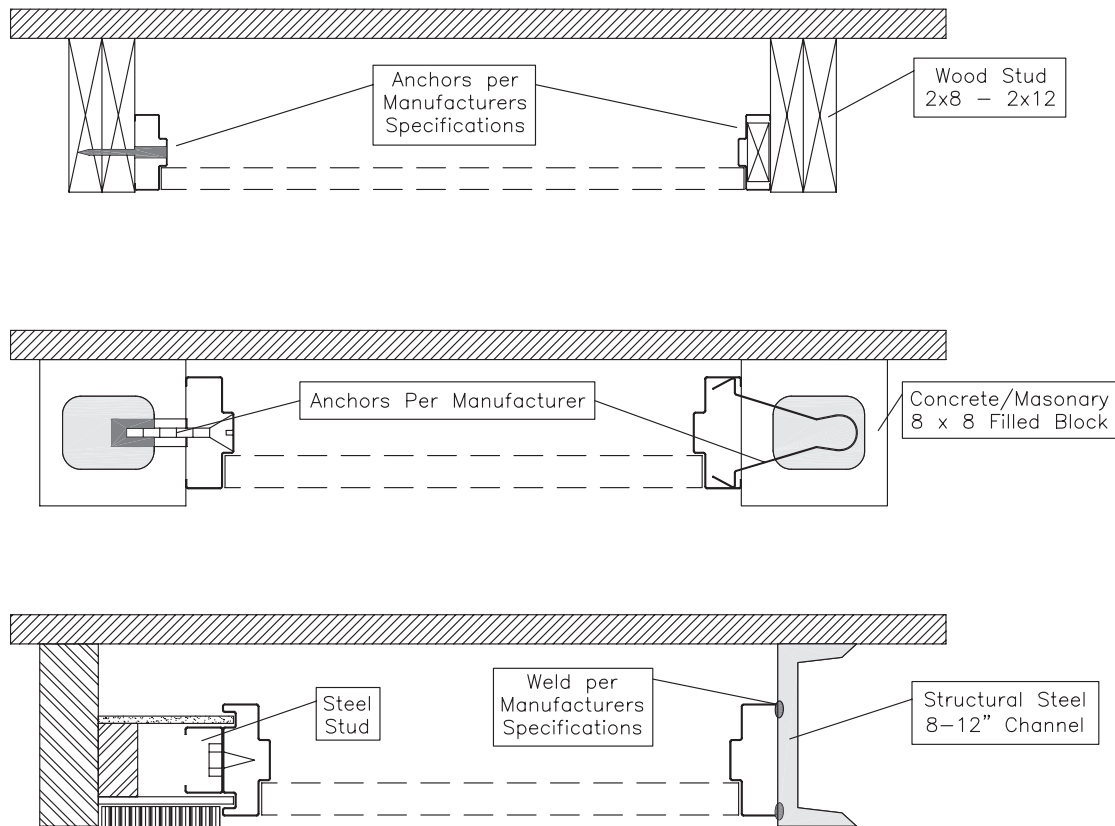


Figure 1 – Wall Substrates for Frame Tests

5.2.1.2 For pair frames, two flush doors rated for not less than the desired frame design pressure shall be installed with a simulated latching arrangement with a top and bottom bolt on the inactive door and a single point latch on the active door latching into the inactive door. The doors used are to be reinforced as described in 5.2.1.2.1 and latched as shown in figure 2.

If the manufacturer specifies other latch/lock locations, tests shall be conducted under specified conditions and the resulting rating shall specify the latching requirements.

5.2.1.2.1 The flush door used shall be reinforced along the latch or meeting edge by bolting a 1-1/4 inch by 1-1/4 inch by 3/16 inch structural steel angle to both faces of the door with 1/4-20 bolts at 16 (±) 1 inches on center and within 6 (±1) inches of the corners. The angle shall be placed such that the free leg of the angle is oriented toward the edge of the door and is located at 3 inches from the door latch edge (see figure 2).

5.2.1.3 The frame and door assembly shall be installed in a static pressure test chamber per the requirements of ASTM E330.

5.2.1.4 The assembly shall be subjected to a static pressure equal to 1.5 times the design pressure rating specified by the frame manufacturer under both positive and negative pressure. Each pressure cycle shall be applied for a minimum of 30 seconds, then released and reduced to zero.

5.2.1.5 At the conclusion of this test, the frame shall not prevent the door(s) from operating after the simulated latch bolt(s) has been retracted and a 15 pound force is applied at the mid-height of the door, horizontally 1 inch from the lock edge. The frame shall remain in the opening.

5.2.2 Impact Test

5.2.2.1 Upon completion of the static pressure test an identical assembly shall be subjected to impacts with an impact energy of 350 foot-pounds.

The impact energy shall be delivered by one of the following two methods:

Method 1 – Deliver impact energy by a 100-pound total weight pendulum impactor fitted with a number 2 or better, 12-inch-long Douglas Fir or Southern Yellow Pine, nominal 2 by 4 striking face. The pendulum is to be suspended in a manner that assures a direct normal impact to the door assembly. Refer to ASTM F476 for details of a comparable pendulum impact device (see figure 3).

Method 2 – Deliver the impact energy in accordance with the impact method defined in ASTM E1996 using a 9 pound 2 x 4 missile impacting end-on at a velocity of 50 feet per second.

5.2.2.2 Impacts are to be delivered to the exterior side of the door(s) per ASTM E1886. Impact locations as described below and as shown in figure 4).

5.2.2.2.1 Single Frames

Five impacts in accordance with Figure 4.

5.2.2.2.2 Pair Frames

Six impacts in accordance with Figure 4.

5.2.3 At the conclusion of this test, the frame shall not prevent the door(s) from operating after the simulated latch bolt(s) has been retracted and a 15-pound force is applied at the mid-height of the door, 1 inch horizontally from the lock edge. The frame shall remain in the opening.

5.3 Cycle Test

5.3.1 Upon completion of the impact tests specified in 5.2, the same assembly shall be subjected to the pressure cycling test specified in ASTM E1886.

5.3.2 At the conclusion of this test, the frame shall not prevent the door(s) from operating after the simulated latch bolt(s) has been retracted and a 15-pound force is applied at the mid-height of the door, 1-inch horizontally from the lock edge. The frame shall remain in the opening.

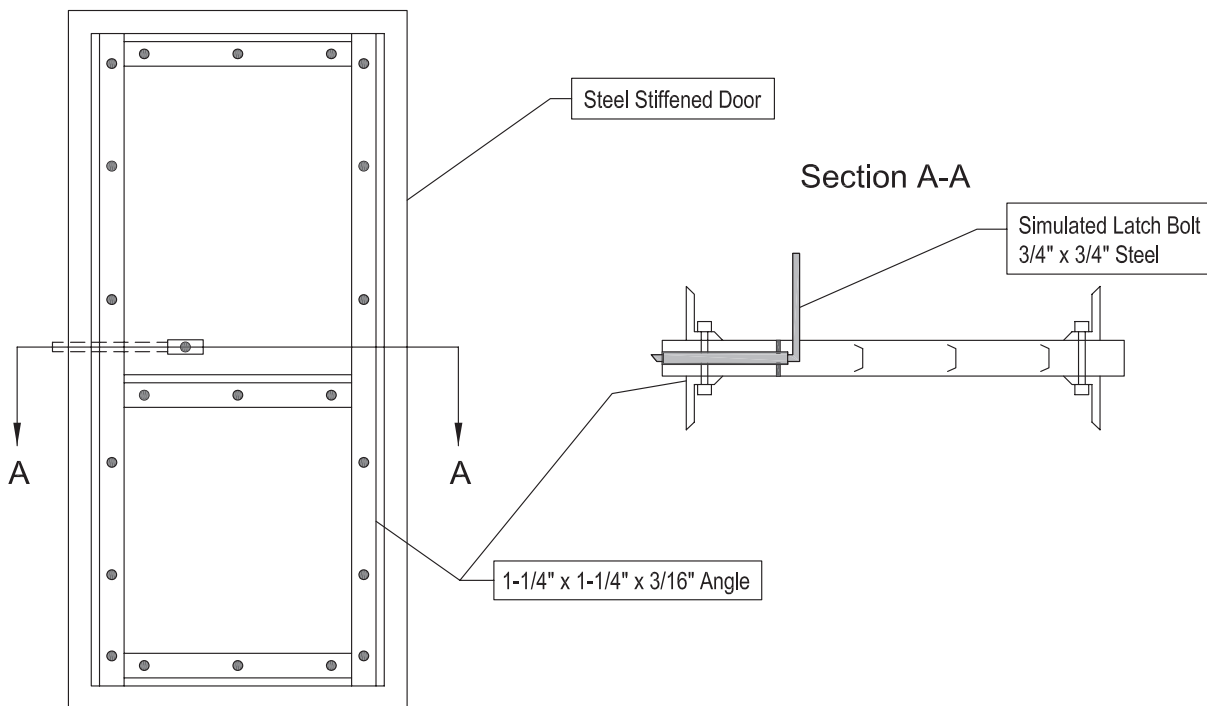


Figure 2 – Door Reinforcement for Frame Tests