

Accelerated Physical Endurance Test Procedure for Steel Doors



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STEEL DOOR INSTITUTE

30200 DETROIT ROAD • CLEVELAND, OHIO 44145

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1 Purpose

The purpose of this test procedure is to provide manufacturers with an accelerated method of testing the performance of doors.

This test procedure will provide performance data for comparative purposes and is not intended to simulate field operating conditions. This test subjects the product to more severe conditions than those experienced in normal field operation.

2 Reference Documents

ANSI/BHMA A156.7-2022, *Template Hinge Dimensions*

ANSI/SDI A250.4-2022, *Test Procedure and Acceptance Criteria for – Physical Endurance for Steel Doors, Frames and Frame Anchors*

3 Apparatus and Equipment

The testing structure shall be constructed as shown in Figures 1 and 2. The structure shall conform to the parts shown, except the opening width and height are permitted to vary, allowing the testing of various door sizes.

The cycling mechanism shall be positioned so that the connecting arm is perpendicular to the stop face of the door. It shall have a threaded swivel connector that is attached to the door through the lock preparation or by means of a bracket mounted directly to the door face at the vertical and horizontal location of the lock preparation. The cycling mechanism shall have an operating stroke so that the door lock edge will be opened not less than 4 inches from the frame stop and then returned to the closed position. The minimum cycle rate shall be one cycle per second. A mechanical or electronic counter shall be used to record the cycles.

4 Preparation for Test

The door shall be hung in the frame on hinges conforming to the most current edition of ANSI/BHMA A156.7, *Template Hinge Dimensions*. The hinges and their locations shall be noted on Form 1 of the report.

Care shall be taken to ensure the hinges are properly attached to the door and frame, and any required hinge fillers are in place. The initial clearances between the door and frame shall be recorded as part of the performance test report. Silencers, weather strip or gasketing shall be installed on the frame, and the stop face of the door shall contact them.

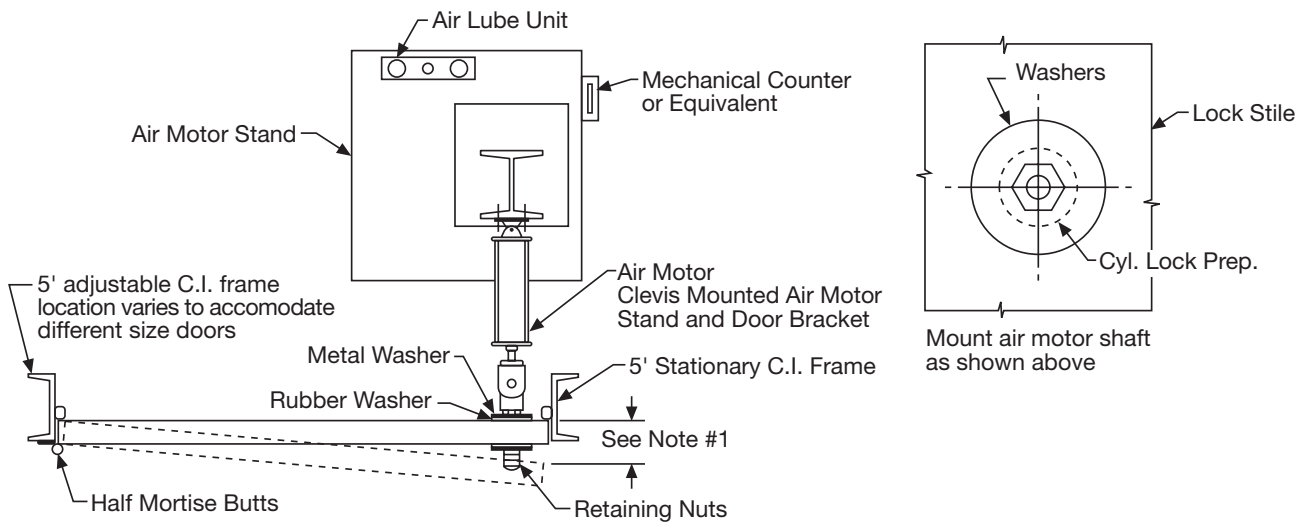
5 Test Specimen

The test shall be performed on a 3'0" wide x 7'0" high nominal size door; although, other sizes are permitted to be evaluated at the discretion of the sponsor.

A detailed description of the door construction shall be recorded as part of the test report. This information shall cover all components as well as applicable processes (such as welding, bonding, etc.) used for attaching and connecting components.

6 Cycle Test

The duration of the test shall be 250,000 cycles for Level C; 500,000 cycles for Level B; 1,000,000 cycles for Level A; or longer, if specified by the test sponsor. A general inspection of the door shall be made at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycles thereafter until the completion of the required number of cycles. The general inspection shall cover all components readily accessible, such as face skins, exposed hinge and/or lock edges, head

**NOTES:**

- 1 Door should open approximately 4"
- 2 Cycle Rate — minimum one cycle per second
- 3 Door to contact mute

Figure 1 – Cycle Test Detail

and sill closures, flush-closing channels, hinge reinforcements, etc. Additionally, the inspection shall cover the welding, bonding, staking, mechanical interlocking, etc., used to connect the various door components.

The results shall be recorded on a standard performance report “Door Test Form 1.”

When an independent individual or organization is employed to certify the overall performance of the door design, they shall validate the initial, mid-point, and final observations.

7 Twist Test

The deterioration of the door strength during the cycle test, if any, shall be checked through a series of twist tests. These tests shall be performed before the cycle test begins and at 25,000 cycle intervals for the first 100,000 cycles and at 50,000 cycle intervals for the balance of the test.

At the recorded intervals, the hinge pins shall be removed and the door moved to the twist test

fixture (if a separate fixture is used) and clamped in place as shown in ANSI/SDI A250.4.

If the same fixture is used for both the cycle test and twist test, the hinge pins shall be removed and the door clamped in place as shown in ANSI/SDI A250.4.

Loads in 30-pound increments shall be applied at the upper or lower lock edge corner through the screw jack and force gauge in an area as described in ANSI/SDI A250.4. The deflection noted on the dial indicator shall be plotted against the load applied to the corner. A maximum 300 pounds pressure shall be applied. The pressure shall then be reduced in 30-pound increments and the deflection recorded on the inspection interval form. A smooth curve drawn through the points shall graphically demonstrate the reaction of the door. Use “Performance Report – Door Test Form 2” to graphically represent the deflections.

Measurements for deflections shall be taken one minute or less after the force has been stabilized.

At the completion of each twist test, and prior to the continuance of the cycle test, the hinges shall be inspected and lubricated or replaced, if necessary.

8 Acceptance Criteria

8.1 Doors shall not show any visible signs of metal fatigue cracking, or deformation on the edges or the door face.

8.2 Doors of either laminated or welded construction shall not delaminate or have weld breakage in excess of 10% of total bonded or welded surface.

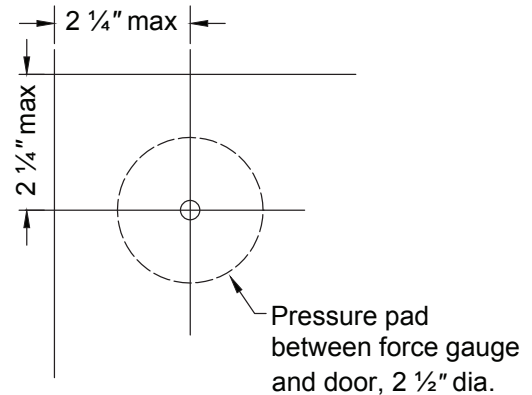
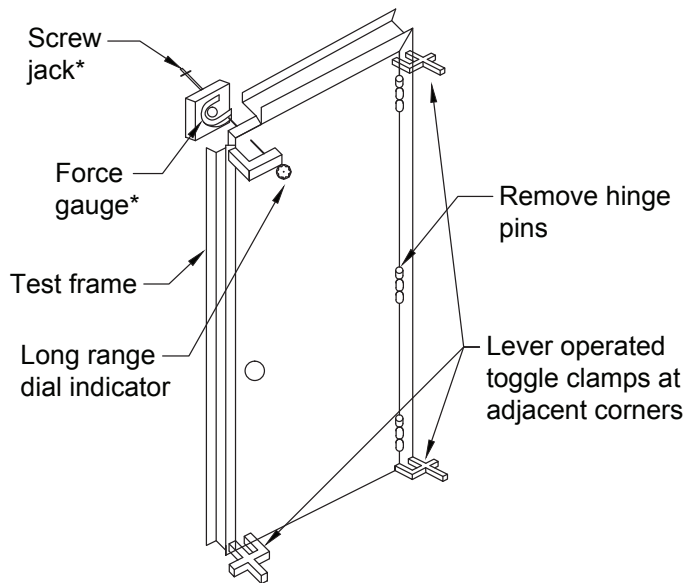
8.3 Top, bottom, and/or edge channels, if applicable, must remain securely in place, with no signs of weld or bond breakage.

8.4 Doors of stile and panel or stile and rail construction shall not be misaligned.

8.5 Where visible seams are inherent in the door design, no opening or spreading shall occur.

8.6 As a result of the twist test, the maximum deflection shall not exceed 2-½" when loaded to 300 lb for Level C doors. For Level B and A doors, the maximum deflection shall not exceed 1-¼" when loaded to 300 lb.

8.7 Permanent deflection measured within 5-minutes after the force is removed shall not exceed ⅛".



* Screw jack and force gauge can be mounted at upper or lower lock edge corner.

Note: Twist test to be made at beginning and end of cycle test.

Figure 2 – Twist Test Detail

Performance Report – Cycle Test Form No. 1

Door Manufacturer: _____ Door Model: _____ Hinge Manufacturer: _____
 Weight of Door: _____ Door Size: _____ Hinge Model: _____
 Test No.: _____ Start Test Date: _____ Finish Test Date: _____

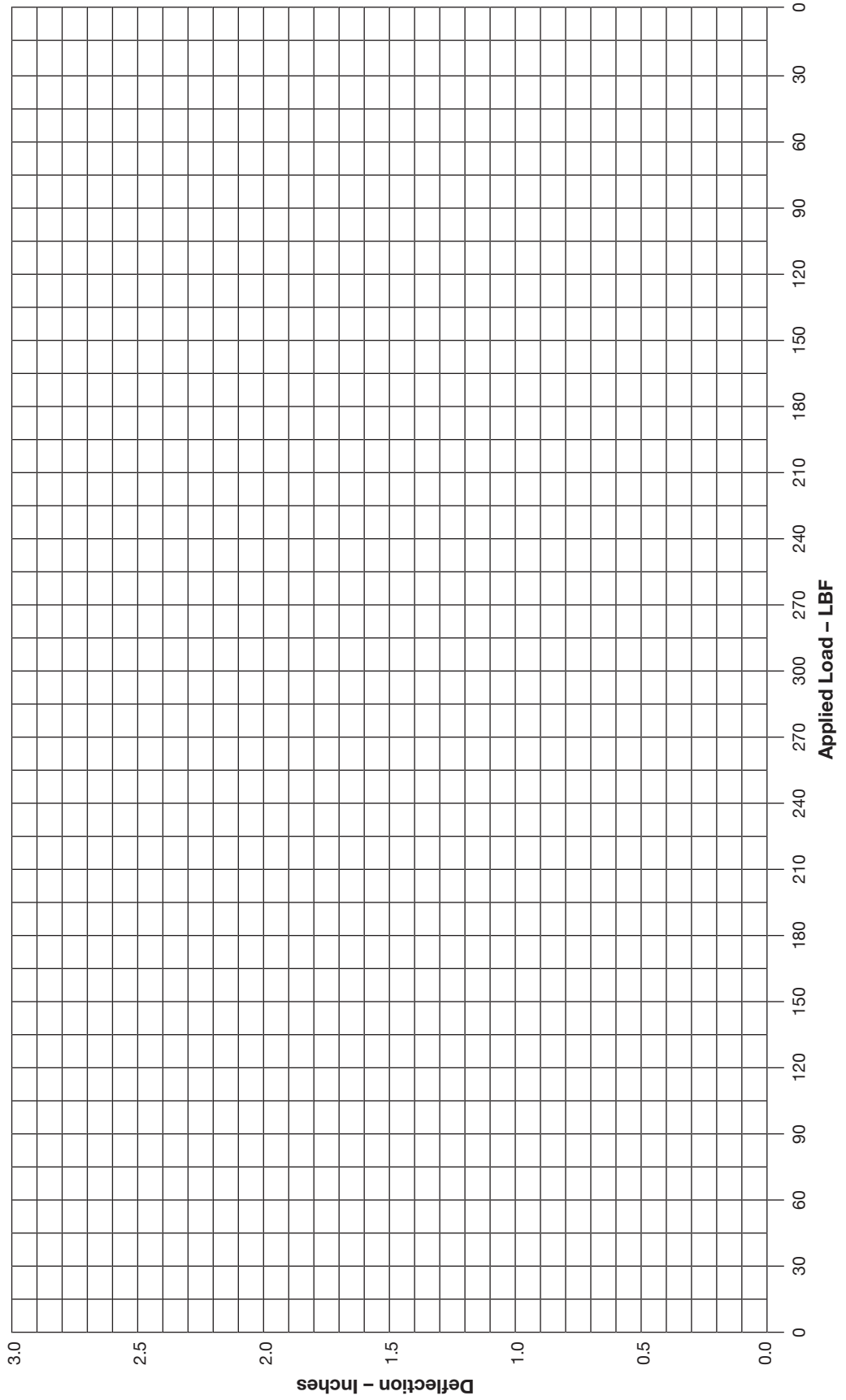
		Inspection Intervals – (000)																						
		25	50	75	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	
Edge Condition	Top																							
	Intermediate																							
	Bottom																							
Top Closer Condition																								
Bottom Closer Condition																								
Condition of Core																								
Condition of Panels																								

“S” indicates satisfactory performance. Use footnotes under remarks for any further explanations.

Remarks: _____

Performance Report – Twist Test Form No. 2

Test No: _____ Date: _____
Door Manufacturer: _____ Door Model: _____
Door Size: _____ Weight of Door: _____



AVAILABLE PUBLICATIONS

Specifications

- ANSI/SDI A250.6** Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
- ANSI/SDI A250.8** Specifications for Standard Steel Doors and Frames (SDI-100)
- ANSI/SDI A250.14** Hardware Preparation in Steel Doors and Steel Frames
- SDI-108** Recommended Selection & Usage Guide for Standard Steel Doors
- SDI-118** Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements
- SDI-128** Guidelines for Acoustical Performance of Standard Steel Doors and Frames
- SDI-129** Hinge and Strike Spacing
- SDI-133** Guideline for Specifying Steel Doors & Frames for Blast Resistance
- SDI-136** Guideline for Specifying Windstorm Products

Test Procedures

- ANSI/SDI A250.3** Test Procedure & Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
- ANSI/SDI A250.4** Test Procedure & Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
- ANSI/SDI A250.10** Test Procedure & Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- ANSI/SDI A250.13** 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)
- SDI-113** Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies
- SDI-131** Accelerated Physical Endurance Test Procedure for Steel Doors

Construction Details

- ANSI/SDI A250.11** Recommended Erection Instructions for Steel Frames
- SDI-110** Standard Steel Doors & Frames for Modular Masonry Construction
- SDI-111** Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components
- SDI-122** Installation Troubleshooting Guide for Standard Steel Doors & Frames

Miscellaneous Documents

- SDI-112** Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames
- SDI-117** Manufacturing Tolerances for Standard Steel Doors and Frames
- SDI-124** Maintenance of Standard Steel Doors & Frames
- SDI-127** Industry Alert Series (A-L)
- SDI-130** Electronic Hinge Preparations
- SDI-134** Glossary of Terms for Hollow Metal Doors and Frames
- SDI-135** Guidelines to Measure for Replacement Doors in Existing Frame Openings

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CECO

AN ASSA ABLOY DOOR GROUP COMPANY
9159 Telecom Drive
Milan, TN 38358-3425
(731) 686-8345
www.cecodoor.com

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AN ASSA ABLOY DOOR GROUP COMPANY
1502 12th Street, P.O. Box 1648
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(641) 423-1334
www.curries.com

DEANSTEEL MANUFACTURING CO.

931 S. Flores Street
San Antonio, TX 78204-1406
(210) 226-8271
www.deansteel.com

DE LA FONTAINE INDUSTRIES, INC.

3 Normac Road
Woburn, MA 01801
(781) 932-8663
www.delafontaine.com

DCI

7980 Redwood Avenue
Fontana, CA 92336-1638
(909) 770-5700
www.dcihollowmetal.com

HOLLOW METAL XPRESS (HMX)

3440 Stanwood Boulevard
Huntsville, AL 35811-9021
(256) 851-6670
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3440 Stanwood Boulevard
Huntsville, AL 35811-9021
(256) 851-6670
www.meskerdoor.com

MPI

319 North Hills Road
Corbin, KY 40701
(606) 523-0173
www.metalproductsinc.com

PIONEER INDUSTRIES, INC.

AN ASSA ABLOY DOOR GROUP COMPANY
111 Kero Road
Carlstadt, NJ 07072
(201) 933-1900
www.pioneerindustries.com

PREMIER STEEL DOORS & FRAMES

2840 Sterlington Road
Monroe, LA 71203
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STEELCRAFT

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(513) 745-6400
www.steelcraft.com

STILES

AN ASSA ABLOY DOOR GROUP COMPANY
1885 Kinser Road
Ceres, CA 95307
(209) 538-3667
www.stilesdoors.com



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30200 DETROIT ROAD • CLEVELAND, OHIO 44145
440.899.0010 • www.steeldoor.org