



Designation: E1425 – 14 (Reapproved 2023)

# Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems<sup>1</sup>

This standard is issued under the fixed designation E1425; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice establishes requirements for testing and rating acoustical performance of window, door, skylight, and glazed wall systems, regardless of their method or materials of manufacture.

1.1.1 Operating force, latching force, and air leakage are integral elements of the acoustical performance of window, door, skylight, and glazed wall systems. This practice requires (when applicable) the concurrent testing of operating force, latching force, and air leakage, in addition to the sound transmission loss test.

1.2 This practice establishes the test methodology, specimen criteria, and classification rating system for purposes of determining the acoustical performance levels of window, door, skylight, and glazed wall systems only, and not through openings between such assemblies and adjacent construction.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.51 on Performance of Windows, Doors, Skylights and Curtain Walls.

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*mentations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

C634 Terminology Relating to Building and Environmental Acoustics

E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

E283/E283M Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E413 Classification for Rating Sound Insulation

E631 Terminology of Building Constructions

E1332 Classification for Rating Outdoor-Indoor Sound Attenuation

E2068 Test Method for Determination of Operating Force of Sliding Windows and Doors

### 2.2 Other Standards:

28 CFR Part 36 ADA Standards for Accessible Design<sup>3</sup>

AAMA/WDMA/CSA 101/1.S.2/A440 Standard Specification for Windows, Doors, and Unit Skylights<sup>4,5</sup>

AAMA 501 Methods of Test for Exterior Walls<sup>4</sup>

NFRC 100 Procedure for Determining Fenestration Product U-factors<sup>6</sup>

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

<sup>4</sup> Available from Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)), 1900 E. Golf Rd., Suite 1250, Schaumburg, IL 60173, <https://fgiaonline.org/>.

<sup>5</sup> Available from CSA Group, 178 Rexdale Blvd., Toronto, ON, Canada M9W 1R3, <http://www.csagroup.org>.

<sup>6</sup> Available from National Fenestration Rating Council (NFRC), 6305 Ivy Lane, Suite 410, Greenbelt, MD 20770, <http://www.nfrccommunity.org/store>.

**ISO 140 Acoustics—Measurement of sound insulation in buildings and of building elements<sup>7</sup>**

### 3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminologies **C634** and **E631**, unless otherwise indicated.

### 4. Significance and Use

4.1 *Air Leakage Relative to Sound Transmission*—Certain frequencies are more susceptible to sound transmission through cavities or discontinuities in the test specimen; therefore, the air leakage of the test specimen is reported to allow the approving authority information relative to air tightness.

NOTE 1—The AAMA/WDMA/CSA 101/I.S.2/A440 document provides air leakage acceptance criteria for these products based on their performance class. Acoustical products could require a lower air leakage rate than what is required in this standard in order to achieve the desired acoustical performance.

4.2 *Operating Force Relative to Sound Transmission*—The use of specific sealing components to achieve a given sound rating could affect operating force of the vertical or horizontal sliding sash or panels of the assembly; therefore, operating force is reported to allow the approving authority information relative to sash or panel operating forces.

NOTE 2—The opening force in 28 CFR Part 36 ADA for interior hinged doors and sliding doors is limited to 5 lbf (22.2 N). The AAMA/WDMA/CSA 101/I.S.2/A440 document provides operating force acceptance criteria for products based on their performance class.

4.3 *Latching Force Relative to Sound Transmission*—Latching force can affect the compression of seals and the amount of damping applied to the system that in turn affects the air leakage and the acoustical performance. The use of specific sealing components and latching/locking hardware can affect the force required to close and latch the door under test. The latching force is reported to allow the approving authority information relative to sash or panel latching conditions.

NOTE 3—The AAMA/WDMA/CSA 101/I.S.2/A440 document states that the maximum force to latch shall be measured and reported.

### 5. Test Specimen

5.1 Assemblies to be tested in accordance with this practice shall be representative of those produced by the manufacturer or fabricator. Test specimens shall be sealed, painted or otherwise finished or prepared only as they would normally be prepared for actual installation and use. Test specimens shall be mounted for testing as specified by each applicable test method.

5.1.1 Test specimens shall not be modified with supplementary adhesives, sealants, tapes, or clamping devices not normally a part of the product.

5.2 The test specimen size for window, door, skylight, and glazed wall systems are listed below in **Table 1**. The window, sliding door, glazed wall system, sloped glazing system,

<sup>7</sup> Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandinnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

skylight, and roof window test specimen size shall not vary by more than 1 in. (25 mm) for either dimension. The single and double hinged door test specimen width shall not vary by more than 2 in. (50 mm) and the height shall not vary by more than 3 in. (75 mm).

### 6. Test Methods

6.1 The sequence of testing shall be: operating force (if applicable); followed by latching force (if applicable); followed by air leakage; and ending with sound transmission loss. If additional sash or panels are tested in the same specimen frame, the complete sequence of tests shall be repeated for each set of sash or panels. The specimen shall be opened and closed (where applicable) at least five times prior to conducting the operating, latching force and air leakage tests.

6.2 *Operating Force*—The operating force test shall be conducted on horizontal or vertical operating windows and sliding doors in accordance with ASTM Test Method **E2068**. For dual windows or doors, the operating force shall be measured on both sets of sash or panels. The operating force of rotary operators shall be determined in accordance with the procedures contained in the AAMA/WDMA/CSA 101/I.S.2/A440 standard.

6.2.1 The operating force shall not exceed the maximum force to initiate motion and the maximum force to maintain motion criteria contained in the AAMA/WDMA/CSA 101/I.S.2/A440 standard. If adjustments need to be made, the operating force shall be remeasured.

6.3 *Latching Force*—Latching force tests shall be conducted on swinging (side-hinged) doors with latches. The latching force test shall be conducted in accordance with procedures contained in the AAMA/WDMA/CSA 101/I.S.2/A440 standard. For multiple doors, such as dual doors (back to back) or double doors (side by side) the latching force shall be conducted on all panels containing latching hardware.

6.3.1 The maximum latching force shall be reported as required in the AAMA/WDMA/CSA 101/I.S.2/A440 standard. If adjustments need to be made, the operating force and latching force must be remeasured.

NOTE 4—A swinging door is defined as closed when the latch is fully secured in the strike plate and the door remains in the closed position.

6.4 *Air Leakage Test*—The air leakage test shall be performed in accordance with Test Method **E283/E283M**. The air leakage test pressure for windows, doors, and skylights shall be as specified in the AAMA/WDMA/CSA 101/I.S.2/A440 standard. The air leakage test for glazed wall and sloped glazing systems shall be initially conducted at a test pressure of 1.57 psf (75 Pa) and then at a test pressure 6.24 psf (300 Pa).

6.4.1 For windows, doors, and skylights, the air leakage shall be recorded as pass or fail in accordance with the criteria contained in the AAMA/WDMA/CSA 101/I.S.2/A440 standard. For glazed wall and sloped glazing systems, report the air leakage at both test pressures. If any adjustments need to be made, the operating force, latching force and air leakage measurements (where applicable) shall be repeated.

NOTE 5—For glazed wall and sloped glazing systems, the air leakage shall not exceed 0.06 cfm/ft<sup>2</sup> (0.3 L/s • m<sup>2</sup>) at both test pressures, which is an industry standard and recommended in AAMA 501.

**TABLE 1 Test Specimen Size**

Window Descriptions	Width (in.) × Height (in.)	Width (mm) × Height (mm)
basement window	35.4 × 23.6	900 × 600
casement window	23.6 × 59.1	600 × 1500
composite—fixed beside operable	59.1 × 47.2	1500 × 1200
composite—fixed over/under operable	47.2 × 59.1	1200 × 1500
dual action window (tilt/turn window)	47.2 × 59.1	1200 × 1500
fixed window (picture window)	47.2 × 59.1	1200 × 1500
greenhouse/garden window	35.4 × 35.4 × 11.8	900 × 900 × 300
horizontal sliding window	59.1 × 47.2	1500 × 1200
jal—awning window	47.2 × 59.1	1200 × 1500
jalousie window	35.4 × 47.2	900 × 1200
pivoted window (vertical or horizontal)	47.2 × 59.1	1200 × 1500
projected window (awning or hopper)	59.1 × 23.6	1500 × 600
side-hinged window	47.2 × 59.1	1200 × 1500
top-hinged window	47.2 × 59.1	1200 × 1500
vertical sliding (single, double, and triple hung) window	47.2 × 59.1	1200 × 1500
<b>Door Descriptions and Required Elements</b>		
single swinging (hinged) door	39.4 × 83.7	1000 × 2125
double swinging (hinged) door	74.8 × 83.7	1900 × 2125
sliding door	71.9 × 79.7	1825 × 2025
sidelites	23.6 × 78.7	600 × 2000
transoms	78.7 × 23.6	2000 × 600
<b>Glazed Wall System Descriptions</b>		
curtain walls, storefront, and so forth.	78.7 × 78.7	2000 × 2000
sloped glazing system	78.7 × 78.7	2000 × 2000
<b>Skylight Descriptions</b>		
unit skylights	47.2 × 47.2	1200 × 1200
roof windows	47.2 × 47.2	1200 × 1200

NOTE 1—The area used to calculate the sound transmission loss of the window, door, skylight, or glazed wall assembly shall include the test specimen frame.

NOTE 2—For a more thorough description of the window and door types, refer to The AAMA/WDMA/CSA 101/I.S.2/A440 document.

NOTE 3—The window sizes listed above were taken primarily from NFRC 100 and AAMA/WDMA/CSA 101/I.S.2/A440 standards with some modifications due to the inconsistencies between the two documents. Some consideration was also given to the size (1250 mm × 1500 mm ± 50 mm) recommended in the ISO 140 standard.

NOTE 4—For high STC rated products, two units in the size specified above might need to be tested in the filler wall in order to obtain sound transmission coefficient differences that are greater than 6 dB at all frequencies.

**6.5 Sound Transmission Loss Test**—The sound transmission loss shall be performed in accordance with ASTM Test Method E90. If any adjustments or modifications are performed, the whole sequence of tests (operating force, latching force, air leakage and sound transmission loss) shall be repeated, where applicable.

## 7. Classification

7.1 Products shall be classified based on their Outdoor-Indoor Transmission Class (OITC) and/or Sound Transmission Class (STC) ratings.

7.2 The OITC rating shall be calculated in accordance with Classification E1332 for exterior window, door, skylight and glazed wall sections. The STC rating shall be calculated in accordance with Classification E413 for interior window, door and glazed wall sections. For products used for both interior and exterior applications, both the OITC and STC ratings shall be reported.

## 8. Report

8.1 Report the following information (if applicable):

8.1.1 Date of test and date of report.

8.1.2 Identification of the specimen (manufacturer, dimensions, type, model, materials, weight, and any other pertinent information). It shall be noted if test specimen does not meet the size requirements in 5.2 and Table 1.

8.1.3 Detailed drawings of the specimen showing dimensioned section profiles of the frame, sash or door panels, weep holes, weep covers, hardware, weather-stripping, seals, glazing details and any other pertinent construction details. Any modifications made on the specimen to obtain the reported values shall be noted on the drawings.

8.1.4 Frame or sash fill material (fiberglass, foam, sand, mortar, etc.).

8.1.5 Descriptions of locking and operating mechanisms, if applicable.

8.1.6 Descriptions of glazed assemblies (glass thickness, glass type (annealed, tempered, laminated, insulated glass, etc.), interlayer thickness and type (for laminated glass), spacer system, air space (for insulated glass and dual windows), air space media for insulated glass units (air, argon gas, krypton gas, etc.), insulating glass films, muntins, manufacturer, method of glazing, and any other pertinent information.

8.1.7 Descriptions of all weather-stripping and/or seals and the location on the test specimen.

8.1.8 The operating forces as measured and recorded in accordance with 6.2.

8.1.9 The latching forces as measured and recorded in accordance with 6.3.

8.1.10 The air leakage as measured and recorded in accordance with 6.4.