



Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems¹

This standard is issued under the fixed designation E 1425; 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 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 SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 ASTM Standards:²

C 634 Terminology Relating to Building and Environmental Acoustics

E 90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

E 283 Test Method for Determining Rate of Air Leakage

Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E 413 Classification for Rating Sound Insulation

E 631 Terminology of Building Constructions

E 1332 Classification for Determination of Outdoor-Indoor Transmission Class

E 2068 Test Method for Determination of Operating Force of Sliding Windows and Doors

2.2 Other Standards:

28 CFR Part 36 ADA Standards for Accessible Design³

AAMA/WDMA/CSA 101/I.S.2/A440 Standard Specification for Windows, Doors, and Unit Skylights^{4,5}

AAMA 501 Methods of Tests for Exterior Walls⁴

NFRC 100 Procedure for Determining Fenestration Product U Factors⁶

ISO 140 Acoustics—Measurement of sound insulation in buildings and of building elements⁷

3. Terminology

3.1 **Definitions**—For definitions of terms used in this practice, refer to Terminologies **C 634** and **E 631**, 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

¹ 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.

Current edition approved Oct. 1, 2007. Published November 2007. Originally approved in 1991. Last previous edition approved in 1999 as E 1827 – 91 (1999).

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 Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

⁴ Available from the American Architectural Manufacturers Association (AAMA), 1827 Walden Office Square, Suite 550, Schaumburg, Illinois 60173-4268.

⁵ Available from Canadian Standards Association (CSA), 5060 Spectrum Way, Mississauga, ON L4W 5N6, Canada, <http://www.csa.ca>.

⁶ Available from the National Fenestration Rating Council (NFRC), 6305 Ivy Lane, Suite 140 Greenbelt, MD 20770.

⁷ Available from International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

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 22.2 N (5 lbf). 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 latching force shall not exceed 65 N (15 lbf).

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, skylight, and roof window test specimen size shall not vary by more than 25 mm (1 in.) for either dimension. The single and

TABLE 1 Test Specimen Size

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

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.

double hinged door test specimen width shall not vary by more than 50 mm (2 in.) and the height shall not vary by more than 75 mm (3 in.).

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 E 2068. 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 latching force shall not exceed the maximum latching force requirement 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 E 283. 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 75 Pa (1.57 psf) and then at a test pressure 300 Pa (6.24 psf).

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 $0.3 \text{ L/s} \cdot \text{m}^2 (0.06 \text{ cfm/ft}^2)$ at both test pressures, which is an industry standard and recommended in AAMA 501.

6.5 *Sound transmission loss test*—The sound transmission loss shall be performed in accordance with ASTM Test Method

E 90. 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 E 1332 for exterior window, door, skylight and glazed wall sections. The STC rating shall be calculated in accordance with Classification E 413 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.

8.1.11 The transmission loss data in one-third octave bands 80-4000 Hz as measured in accordance with 6.5. The temperature and relative humidity in both rooms at the time of test shall be reported. The glass temperature shall be reported for test specimens containing laminated glass.

8.1.12 The classification of the specimen in accordance with Section 7.

8.1.13 A statement that the test or tests were conducted in accordance with this practice. Any deviations from this practice shall be explicitly noted.

9. Keywords

practice; sound; skylight; STC; storefront; window

9.1 acoustics; air leakage; curtain wall; door; fenestration;
glazed wall system; latching force; OITC; operating force;

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).