Designation: E2319 – 22

Standard Test Method for Determining Air Flow Through the Face and Sides of Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen[1]

This standard is issued under the fixed designation E2319; 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 test method is a modified version of Test Method E283/E283M, and provides a standard laboratory procedure for determining air leakage separately through the face and sides of exterior windows, curtain walls, and doors under specified differential pressure conditions across the specimen. The test method described is for tests with constant temperature and humidity across the specimen.

NOTE 1—Detailing buildings with continuous air barriers requires that the air barrier plane in a window system be clearly defined. When special circumstances dictate that the air barrier be sealed to the window frame at a location other than that used to seal the specimen to the test chamber in this test method, additional laboratory testing may be required to clarify potential paths of air flow through the sides of the window frame. The adapted testing procedure described herein is intended for this purpose.

1.2 This laboratory procedure is applicable to exterior windows, curtain walls, and doors and is intended to measure only such leakage associated with the assembly and not the installation. The test method can be adapted for the latter purpose.

NOTE 2—Performing tests at non-ambient conditions or with a temperature differential across the specimen may affect the air leakage rate. This is not addressed by this test method.

1.3 This test method is intended for laboratory use. Persons interested in performing field air leakage tests on installed units should reference Test Method E783. Test Method E783 will not provide the user with a means of determining air flow through the sides of tested specimens.

1.4 Persons using this procedure should be knowledgeable in the areas of fluid mechanics, instrumentation practices, and shall have a general understanding of fenestration products and components.

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

1.6 *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.* For specific hazard statement see Section 7.

1.7 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

E631 Terminology of Building Constructions

E783 Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

2.2 *ISO/IEC Standard:*[3]

ISO/IEC 17025 Testing and Calibration Laboratories

3. Terminology

3.1 *Definitions*—Terms used in this standard are defined in Terminology E631.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *air leakage rate through the face of the specimen* ($q_{A(f)}$ or $q_{lc(f)}$), L/(s·m^2) (ft^3/min·ft^2), or L/(s·m) (ft^3/min·ft)—

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[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 International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

the air leakage through the face of the specimen per unit of specimen area (*A*) or per unit length of operable crack perimeter (*lc*).

3.2.2 *air leakage rate through the face and sides of the specimen ($q_{A(fs)}$),* L/(s·m^2) (ft^3/min·ft^2)—the air leakage through the face and sides of the specimen per unit of specimen area (*A*).

3.2.3 *air leakage rate through the sides of the specimen ($q_{A(s)}$ or $q_{lf(s)}$),* L/(s·m^2) (ft^3/min·ft^2), or L/(s·m) (ft^3/min·ft)—the air leakage through the sides of the specimen per unit of specimen area (*A*) or per unit length of outside perimeter of specimen frame (*lf*).

3.2.4 *air leakage through the face of the specimen ($Q_{s(f)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the face of the test specimen under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.5 *air leakage through the face and sides of the specimen ($Q_{s(fs)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the face and sides of the test specimen under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.6 *air leakage through the sides of the specimen ($Q_{s(s)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the sides of the test specimen under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.6.1 *Discussion*—Air leakage through the sides of the frame ($Q_{s(s)}$) is provided to inform specifiers of the potential leakage through the specimen at the window surrounds. The actual amount of leakage through the sides of the frame depends on the positioning of the sealants, flashings and air barriers relative to the frame.

3.2.7 *extraneous air leakage (Q_e),* L/s (ft^3/min)—the volume of air flowing per unit of time through the test chamber and test apparatus, exclusive of the air flowing through the test specimen, under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.7.1 *Discussion*—Extraneous leakage is the sum of all leakage other than that intended to be measured by the test.

3.2.8 *specimen*—the entire assembled unit submitted for test as described in Section 8.

3.2.9 *specimen area (A),* m^2 (ft^2)—the area determined by the overall dimensions of the frame that fits into the rough opening.

3.2.10 *standard test conditions*—in this test method, dry air at:

Pressure—101.3 kPa (29.92 in. Hg)
Temperature—20.8 °C (69.4 °F)
Air Density—1.202 kg/m^3 (0.075 lb/ft^3)

3.2.11 *test pressure differences,* Pa (lbf/ft^2) —the specified differential static air pressure across the specimen.

3.2.12 *total air flow through face ($Q_{t(f)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the test chamber and test apparatus, inclusive of the air flowing through the face of the test specimen but exclusive of the air flowing through the sides of the specimen, under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.13 *total air flow through face and sides ($Q_{t(fs)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the test chamber and test apparatus, inclusive of the air flowing through the face and sides of the test specimen, under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.14 *total air flow through sides ($Q_{t(s)}$),* L/s (ft^3/min)—the volume of air flowing per unit of time through the test chamber and test apparatus, inclusive of the air flowing through the sides of the test specimen but exclusive of the air flowing through the face of the specimen, under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.15 *unit length of operable crack perimeter (lc),* m (ft)—the sum of all perimeters of operable ventilators, sash, or doors contained in the test specimen, based on the overall dimensions of such parts. Where two such operable parts meet the two adjacent lengths of perimeter shall be counted as only one length.

3.2.16 *unit length of outside perimeter of specimen frame (lf),* m (ft)—the perimeter of the test specimen, measured at the edge of the outer frame.

4. Summary of Test Method

4.1 The test consists of sealing the interior and exterior of a test specimen into or against one face of an air chamber, supplying air to or exhausting air from the chamber at the rate required to maintain the specified test pressure difference across the specimen, and measuring the resultant air flow through the face and sides of the specimen.

5. Significance and Use

5.1 This test method is a standard procedure for determining the air flow characteristics of various components of the window system under specified air pressure differences at ambient conditions.

NOTE 3—The air pressure differences acting across a building envelope vary greatly. The factors affecting air pressure differences and the implications or the resulting air leakage relative to the environment within buildings are discussed in the literature.[4,5,6] These factors should be fully considered in specifying the test pressure differences to be used.

5.2 Rates of air leakage are sometimes used for comparison purposes. Such comparisons may not be valid unless the components being tested and compared are of essentially the same size, configuration, and design.

[4] *ASHRAE Handbook of Fundamentals*, 1989. Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

[5] *Fluid Meters—Their Theory and Application*, 5th Edition, 1959.

[6] *Power Test Code*, 2nd Edition, Part 5, Chapter 4, "Flow Measurements," 1956. Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.