Designation: E 283 – 91 (Reapproved 1999)

An American National Standard

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

This standard is issued under the fixed designation E 283; 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 provides a standard laboratory procedure for determining the air leakage rates 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.[1]

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 1—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 Method E 783E 783.

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 Throughout this test method, SI units are listed first in accordance with E-6 metric policy, and shall be considered the primary units. Non-SI units are provided in parenthesis.

1.6 *This standard does not purport to address all of the safety problems, 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.* For specific hazard statement see Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*

E 631 Terminology of Building Constructions[2]

E 783 Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors[2]

3. Terminology

3.1 *Definitions*—Terms used in this standard are defined in Terminology E 631E 631.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *air leakage rate* (q_A or q_L), $m^3/s{\cdot}m^2$ ($ft^3/min{\cdot}ft^2$), or $m^3/s{\cdot}m$ ($ft^3/min{\cdot}ft$)—the air leakage per unit of specimen area (A) or per unit length of operable crack perimeter (L).

3.2.2 *extraneous air leakage* (Q_e), m^3/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.

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

3.2.3 *specimen*—the entire assembled unit submitted for test as described in Section 7.

3.2.4 *specimen air leakage* (Q_s), m^3/s (ft^3/min)—the volume of air flowing per unit of time through the specimen under a test pressure difference and test temperature difference, converted to standard conditions.

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

3.2.6 *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 lbm/ft^3)

3.2.7 *test pressure differences, Pa (lbf/ft²)*—the specified differential static air pressure across the specimen.

3.2.8 *total air flow* (Q_t), m^3/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 test specimen, under a test pressure difference and test temperature difference, converted to standard conditions.

3.2.9 *unit length of operable crack perimeter* (L), m (ft)—the sum of all perimeters of operable ventilators, sash, or doors contained in the test specimen, based on the overall dimensions

[1] This test method is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.51 on Component Performance of Windows, Curtain Walls, and Doors.

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[2] *Annual Book of ASTM Standards*, Vol 04.11.

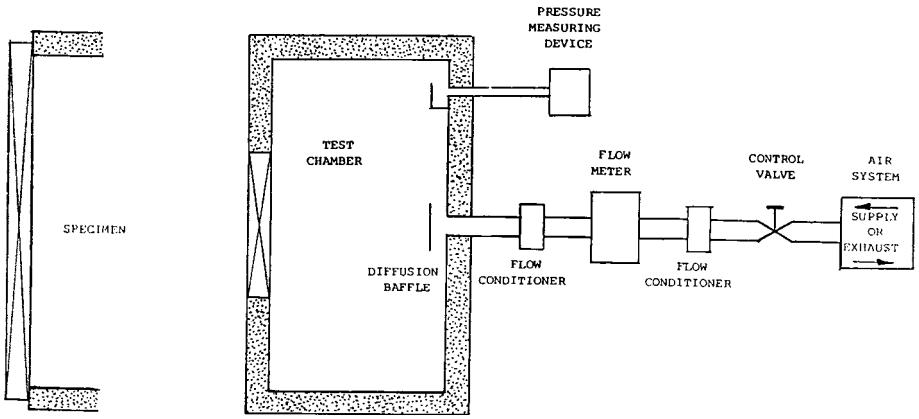

FIG. 1 General Arrangement of the Air Leakage Apparatus

of such parts. Where two such operable parts meet the two adjacent lengths of perimeter shall be counted as only one length.

4. Summary of Test Method

4.1 The test consists of sealing 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 specimen.

5. Significance and Use

5.1 This test method is a standard procedure for determining the air leakage characteristics under specified air pressure differences at ambient conditions.

NOTE 2—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.[3,4,5] 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.

6. Apparatus

6.1 The description of the apparatus in this section is general in nature. Any suitable arrangement of equipment capable of maintaining the required test tolerances is permitted.

6.2 *Test Chamber*—A well sealed box, wall, or other apparatus into or against which the specimen is mounted and secured for testing. An air supply shall be provided to allow a positive or negative pressure differential to be applied across the specimen without significant extraneous losses. The chamber shall be capable of withstanding the differential test pressures that may be encountered in this procedure. At least one static air pressure tap shall be provided on each side of the specimen to measure the test pressure differences. The pressure tap shall be located in an area of the chamber in which pressure readings will not be affected by any supply air. The air supply opening to the chamber shall be located in an area in which it does not directly impinge upon the test specimen.

6.2.1 *Supply Air System*—A controllable blower, exhaust fan, or reversible blower designed to provide the required air flow at the specified test pressure difference. The system should provide essentially constant air flow at the specified test pressure difference for a time period sufficient to obtain readings of air flow.

6.2.2 *Pressure Measuring Apparatus*—A device to measure the differential test pressures to ± 2 % of setpoint or ± 2.5 Pa (± 0.01 in. of water column), whichever is greater.

6.2.3 *Air Flow Metering System*—A device to measure the air flow into the test chamber or through the test specimen. The air flow measurement error shall not exceed ± 5 % when the air flow equals or exceeds 9.44×10^{-4} m^3/s (2 ft^3/min) or ± 10 % when the air flow is less than $9.44^{-4} \times 10$ m ^{3}/s (ft^3/min).

NOTE 3—At lower flows a greater percentage of errors will be acceptable. If higher precision is required, special flow metering techniques are necessary. The accuracy of the specimen air leakage flow measurement is affected by the accuracy of the flowmeter and the amount of extraneous air leakage. (See Annex A1.)

7. Hazards

7.1 **Precaution**—Glass breakage may occur at the test pressure differences applied in this test. Adequate precautions should be taken to protect personnel.

8. Test Specimen

8.1 The test specimen for a wall shall be of sufficient size to determine the performance of all typical parts of the wall system. For curtain walls or walls constructed with prefabricated units, the specimen width shall be not less than two typical units plus the connections and supporting elements at both sides, and sufficient to provide full loading on at least one typical vertical joint or framing member, or both. The height shall be not less than the full building story height or the height of the unit, whichever is greater, and shall include at least on

[3] Available from American Society of Heating, Refrigeration, and Air-Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329. ASHRAE Handbook of Fundamentals, 1989.

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

[5] Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017. Power Test Code, 2nd Edition, 1956, Part 5, Chapter 4, "Flow Measurements."