Designation: E1677 – 05

Standard Specification for an Air Barrier (AB) Material or System for Low-Rise Framed Building Walls[1]

This standard is issued under the fixed designation E1677; 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 specification covers minimum performances and specification criteria for an air barrier (AB) material or system for framed walls of low-rise buildings. The intended users are purchasers of the AB, specifiers of the AB and regulatory groups. The provisions contained in this specification are intended to allow the user to design the wall performance criteria and increase AB specifications to accommodate a particular climate location, function, or design of the intended building. Air barrier performance and specification minimums were selected with the service life of the building wall in mind.

1.2 This specification focuses on ABs for opaque walls. Other areas of the exterior envelope, such as roofs, floors, and interfaces between these areas are not included in this specification.

1.3 This specification does not address air leakage into the wall cavity, that is, windwashing. No standardized test has been developed that adequately identifies all of the influencing factors and measures the impact of this effect on the wall's thermal performance.

1.4 The specifications in this standard are not intended to be utilized for energy load calculations and are not based on an expected level of energy consumption.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only and are closely approximated.

1.6 The following safety hazards caveat pertains only to the test method portion, Annex A1, of this specification. *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]

C755 Practice for Selection of Water Vapor Retarders for Thermal Insulation

E96/E96M Test Methods for Water Vapor Transmission of Materials

E241 Guide for Limiting Water-Induced Damage to Buildings

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

E330 Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

E331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

E1424 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen

2.2 *ASHRAE Standard:*

ASHRAE 62 Acceptable Indoor Air Quality[3]

2.3 *American Society of Civil Engineers:*[4]

ASCE 7-88 1990, Minimum Design Loads for Buildings and Other Structure, Fig 1, Basic Wind Speed (mph)

2.4 *Canadian Standard:*[5]

Air Barrier System For Walls of Low-Rise Buildings: Performance and Assessment

[1] This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

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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 American Society for Heating, Refrigerating, and Air Conditioning Engineers, Inc., 1791 Tullie Crete, N. E., Atlanta, GA 30329.

[4] Available from The American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191.

[5] Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON Canada M9W1R3.

3. Terminology

3.1 *Definitions:*

3.1.1 *air exfiltration*—air leakage out of the building driven by negative pressure.

3.1.1.1 *negative pressure*—air pressure on the outdoor side of a building envelope lower than on the indoor side.

3.1.2 *air infiltration*—air leakage into the building driven by positive pressure.

3.1.2.1 *positive pressure*—air pressure on the outdoor side of a building envelope higher than on the indoor side.

3.1.3 *air leakage*—the movement/flow of air through the building envelope, which is driven by either positive (infiltration) or negative (exfiltration) pressure differences, or both, across the envelope.

3.1.3.1 *Discussion*—These pressure differences are caused by wind, mechanical systems, and temperature differences (stack effect).

3.1.4 *air leakage rate*—the time rate of air flow across the air barrier. Expressed as cubic feet per minute per square foot of AB surface at a stated pressure differential across the AB expressed in inches of H_2O. (Cubic metres per second per square metre of AB surface at a pressure differential in Pascals.)

3.1.5 *air barrier (AB)*—a material or system in building construction that is designed and installed to reduce air leakage either into or through the opaque wall.

3.1.6 *opaque wall*—all exposed areas of a wall that enclose conditioned space, except openings for windows, doors, and building service systems.

3.1.7 *structural integrity*—for the purpose of this specification, it is the ability of the AB to maintain air leakage performance after exposure to elevated positive and negative pressure (see 5.1.2 for performance).

3.1.8 *ultra-violet*—radiation lying in the ultraviolet range; wavelengths shorter than visible light, but longer than X-rays. Ultraviolet light can effect the durability of some building materials.

3.1.9 *vapor retarder*—a material or system that adequately impedes the transmission of water vapor under specified conditions.

3.1.9.1 *Discussion*—For practical purposes it is assumed that the permeance of a vapor retarder will not exceed one perm in inch-pound units (57.4 ng/(s · m^2 · Pa)), although at present this value may only be appropriate for residential construction. For certain other types of construction, the permeance must be lower.

3.1.10 *water leakage*—penetration of water onto the exterior plane of framing or cavity insulation under specified conditions of air pressure difference across the AB during a test period.

3.1.11 *water resistance*—the capability of a material or system to retard water leakage.

3.1.12 *water vapor diffusion*—the process by which water vapor spreads or moves through permeable materials caused by a difference in water vapor pressure.

3.1.13 *water vapor permeance*—the time rate of water vapor transmission through unit area of flat material or construction induced by unit vapor pressure difference between two specific surfaces, under specified temperature and humidity conditions.

3.1.13.1 *Discussion*—Permeance is a performance evaluation and not a property of a material. An acceptable unit of permeance is the perm: expressed in the units grain/h · ft^2 in. Hg (metric perm = expressed in the units ng/(s · m^2 · Pa)).

4. Classification

4.1 This specification covers two types of ABs. The performance requirements are shown in Table 1.

5. Performance Requirements

5.1 This specification does not prohibit a user from increasing a specification performance requirement; however, the specification shown shall not be reduced. The user shall consult Annex A1 for additional mandatory requirements, for example, test specimen and procedure. Appendix X1-Appendix X3 contain additional considerations. The performance requirements are not intended to be used to predict specific levels of performance in the field, however they are intended to be used in the evaluation of ABs.

5.1.1 *Air Leakage*—AB shall be tested in accordance with Test Method E283. Air leakage rate shall not exceed 0.06 cfm/ft^2 at 0.3 in. H_2O. (0.3×10^{-3} m^3/(s · m^2) at 75 Pa.)

NOTE 1—Air leakage rate of 0.06 cfm/ft^2 at 0.3 in. H_2O corresponds approximately to a low rise building (floor area = 125 m^2) with an air leakage rate of 1.0 to 2.0 air changes/h at 0.2 in. H_2O (50 Pa) in which 25 % of the leakage occurs through the opaque walls.

5.1.2 *Structural Integrity*—Air barrier shall be tested in accordance with Test Method E330, Procedure A—no deflection information is required. The AB shall withstand sustained minimum pressure of 2 in. H_2O (500 Pa) (equivalent wind speed of approximately 65 mph or 29 m/s) for 1 h. The specimen shall pass this test by retesting the air leakage performance requirement and passing the requirement in 5.1.1.

NOTE 2—The user can consult the map in ASCE 7-88 for guidance on wind speeds for the area where the building will be located. This requirement does not address gust wind loads where the windspeed can be significantly higher but for a very short period of time. If an AB is used in a high gust area, the user may require testing at a higher pressure for a shorter period to simulate gust conditions. The Canadian standard, Air Barrier Systems for Walls of Low-Rise Buildings: Performance and asessment is an example of structural integrity, which is referred to as structural capacity.

5.1.3 *Water Resistance*—Type I ABs shall be tested in accordance with Test Method E331. No water penetration shall occur onto the exterior plane of framing or cavity insulation at

TABLE 1 AB Classifications

Performance Properties	Classifications	
	Type I	Type II
Air leakage	in accordance with 5.1.1	in accordance with 5.1.1
Structural integrity	in accordance with 5.1.2	in accordance with 5.1.2
Water resistance	in accordance with 5.1.3	not required
Water vapor permeance	in accordance with 5.1.4	in accordance with 5.1.4
Supplemental requirements	in accordance with Section 6	in accordance with Section 6

0.11 in. H_2O (27 Pa) pressure difference (equivalent wind speed of approximately 15 mph) during a 15-min. test period (see Table 1).

5.1.4 *Water Vapor Permeance*, or water vapor transmission rate of an AB material or materials of a system shall be determined and reported in accordance with Test Method E96/E96M, Procedure A. The test shall utilize standard test conditions of 73.4°F (23°C) and a relative humidity of 50 ± 2 %.

NOTE 3—This test specification is specific to the AB material or materials that make up the system. The user can consult X2.3 for information on permeance.

6. Supplemental Requirements

6.1 Air barrier manufacturers shall provide field application instructions on how to install the AB to achieve continuity.

6.2 Air barrier manufacturers shall make available upon request the test configuration used to achieve the performance requirements of Section 5.

6.3 If an AB is susceptible to ultraviolet (UV) degradation, the AB manufacturers shall provide application/installation instructions that indicate the amount of UV exposure the product can withstand. The AB manufacturer shall also provide upon request test configuration and procedure for UV testing.

6.4 The classification of ABs shall be clearly identifiable either in the accompanying literature, on their packaging, or on their product. (See Table 1 for classification of ABs.)

7. Keywords

7.1 air barrier; air exfiltration; air infiltration; air leakage; air leakage rate; opaque wall; structural integrity; vapor retarder; water leakage; water resistance; water vapor permeance

ANNEX

(Mandatory Information)

A1. TESTING AIR LEAKAGE, STRUCTURAL INTEGRITY, AND WATER RESISTANCE

A1.1 Test Apparatus

A1.1.1 Test apparatus shall conform to Test Methods E283, E330, and E331 except as modified by this specification.

A1.2 Test Specimen

A1.2.1 Wall shall be constructed 8 ft by 8 ft or larger, 2 in. by 4 in. framing, and stud spacing of 16 in. on center (any additional material attached to this frame shall be considered part of the AB).

A1.2.2 The AB tested shall not include installation procedures that are different from those in field application instructions. Seams representative of those in the field application shall be included within the test area.

A1.2.2.1 If a component of an exterior AB is installed as 4 ft by 8 ft sheathing (with long dimension vertically installed) or less, at least two vertical seams shall be within the test area.

A1.2.2.2 If an AB is less than 8 ft in the vertical direction, at least one horizontal seam shall be within the test area. More seams are required with narrow (less than 4-ft wide) products.

A1.2.2.3 Both vertical edges of the wall shall be sealed with caulk, gasket, or tape. The AB manufacturer shall specify how the top and bottom of the wall shall be treated. If the wall has caulking, gasketing, or tape utilized at the top or bottom, or both, it shall be considered part of the AB, and shall be prescribed by the manufacturer for field application.

A1.2.3 If interior wallboard, or similar type material, is used as part of the AB, the following practices shall be incorporated.

A1.2.3.1 The wallboard shall be installed by sealing seams at the top and both vertical edges of the wall. The bottom shall remain unsealed to simulate normal construction practice. If sealing of the bottom edge is called for by the AB manufacturer, it is then considered part of their system. Vertical or horizontal seams within the field of the test area shall be sealed to simulate taping.

A1.2.3.2 A minimum of one electrical receptacle shall be installed through the interior wallboard surface (14 in. off the floor for every 64 ft^2 of test area). The outlet shall be nongasketing with a minimum of 2 open knockouts. Holes shall be drilled (⅝ in. not less than 14 in. from the floor) through each internal stud to simulate wiring penetration and allow for pressure equalization of each stud cavity. Wiring shall not be installed in tested assembly. If any gasketing/caulk is requested by the AB manufacturer, it shall be considered part of the AB.

A1.2.4 For negative and positive pressure difference testing, use either of the following two test options to simulate the installation of an exterior finish/cladding. If the exterior finish/cladding is the AB the following two test options are not required (see reference **(2)** and **(3)** for additional guidance).

A1.2.4.1 To simulate a lap siding install 1 in. by 1 in. wood strips placed horizontally 9 in. apart to the face of the exterior AB. Install the specimen in the test apparatus so the AB is observable, particularly during the structural integrity test.

A1.2.4.2 To simulate brick veneer, install brick ties in a 16 in. by 16 in. grid pattern to the face of the exterior AB. Install the specimen in the test apparatus so the AB is observable, particularly during the structural integrity test.

A1.3 Test Procedure

A1.3.1 For this specification, conduct both Test Methods E283 and E330 utilizing both negative and positive pressure differences.

A1.3.2 *Structural Integrity*—(Test Method E330) Conduct sustained loading on the specimen at a positive and negative pressure difference of 2 in. H_2O (500 Pa) (approximately 65 mph) for a period of 1 h. The specimen shall have passed this test for structural integrity by retesting the air leakage performance requirement and passing the requirement in 5.1.1. No