



# Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls<sup>1</sup>

This standard is issued under the fixed designation E 1677; 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 specification covers minimum performances and specification criteria for an air retarder (AR) material or system for framed walls of low-rise buildings. The intended users are purchasers of the AR, specifiers of the AR and regulatory groups. The provisions contained in this specification are intended to allow the user to design the wall performance criteria and increase AR specifications to accommodate a particular climate location, function, or design of the intended building. Air retarder performance and specification minimums were selected with the service life of the building wall in mind.

1.2 This specification focuses on ARs 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:

C 755 Practice for Selection of Vapor Retarders for Thermal Insulation<sup>2</sup>

E 96 Test Methods for Water Vapor Transmission of Materials<sup>2</sup>

E 241 Practices for Increasing Durability of Building Constructions Against Water-Induced Damage<sup>3</sup>

E 283 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across Specimen<sup>3</sup>

E 330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Differences<sup>3</sup>

E 331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference<sup>3</sup>

E 1424 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<sup>3</sup>

### 2.2 ASHRAE Standard:

ASHRAE 62 Acceptable Indoor Air Quality<sup>4</sup>

## 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 or both positive (infiltration) and negative (exfiltration) pressure differences across the envelope.

<sup>1</sup> 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.

Current edition approved Jan. 15, 1995. Published March 1995.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.11.

<sup>4</sup> Available from American Society for Heating, Refrigerating, and Air Conditioning Engineers, Inc., 1791 Tullie Crete, N. E., Atlanta, GA 30329.

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 retarder. Expressed as cubic feet per minute per square foot of AR surface at a stated pressure differential across the AR expressed in inches of H<sub>2</sub>O. (Cubic meters per second per square meter of AR surface at a pressure differential in Pascals.)

3.1.5 *air retarder (AR)*—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 AR to maintain air leakage performance after exposure to elevated positive and negative pressure (see 5.1.2 for performance).

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

3.1.8.1 *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<sup>2</sup> · Pa)), although at present this value may only be appropriate for residential construction. For certain other types of construction the permeance must be lower.

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

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

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

3.1.12 *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.

3.1.12.1 *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<sup>2</sup> in. Hg (metric perm = expressed in the units ng/(s · m<sup>2</sup> · Pa)).

**4. Classification**

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

**TABLE 1 AR 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

**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 ARs.

5.1.1 *Air Leakage*—AR shall be tested in accordance with Test Method E 283. Air leakage rate shall not exceed 0.06 cfm/ft<sup>2</sup> at 0.3 in. H<sub>2</sub>O. (0.3 × 10<sup>-3</sup> m<sup>3</sup>/(s · m<sup>2</sup>)) at 75 Pa.)

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

5.1.2 *Structural Integrity*—Air retarder shall be tested in accordance with Test Method E 330, Procedure A—no deflection information is required. The AR shall withstand sustained minimum pressure of 2 in. H<sub>2</sub>O (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 Fig. 1, reference (1) and Test Method E 330 (Significance and Use Section) 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 AR is used in a high gust area, the user may require testing at a higher pressure for a shorter period to simulate gust conditions.

5.1.3 *Water Resistance*—Type I ARs shall be tested in accordance with Test Method E 331. No water penetration shall occur onto the exterior plane of framing or cavity insulation, at 0.11 in. H<sub>2</sub>O (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 AR material or materials of a system shall be determined and reported in accordance with Test Method E 96, Procedure A. The test shall utilize standard test conditions of 73.4°F (23°C) and a relative humidity of 50 ± 2 %.

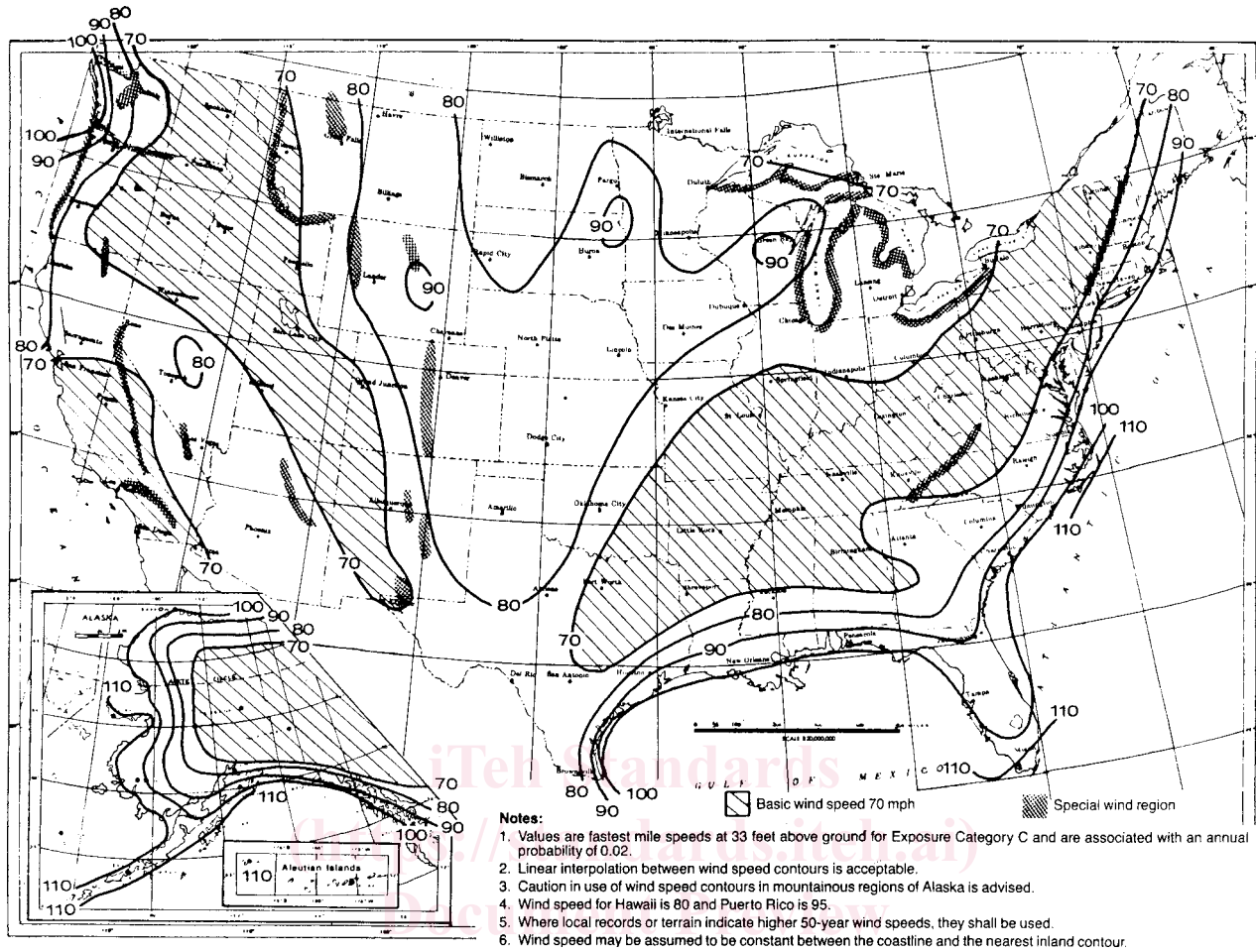
NOTE 3—This test specification is specific to the AR material or materials that make up the system. The user can consult X2.3 for information on permeance.

**6. Supplemental Requirements**

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

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

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



NOTE 1—Reprinted from the March/April 1990 issue of *Building Standards*, copyright © 1990, with the permission of the publishers, the International Conference of Building Officials.

FIG. 1 Basic Wind Speeds in Miles Per Hour

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

## 7. Keywords

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