



Designation: E3127 – 24

Standard Guide for Specifying Water Vapor Transmission Material Properties of Water-Resistive Barriers and Air Barriers¹

This standard is issued under the fixed designation E3127; 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 document covers guidelines for specifying water vapor transmission (WVT) properties for above-grade water-resistive barriers and air barriers (WRB/AB), typically installed between building structural components and cladding that compose the exterior side of building envelopes in North America.

1.2 This guide applies to all types of water-resistive barrier and air barrier products, including multifunctional products, regardless of the manufacturing process, type of material, or installation technique.

1.3 This guide provides general provisions for specifying and reporting the water vapor transmission properties of WRB/AB determined by standardized test methods, in accordance with in-service conditions these products typically experience within building envelopes.

1.4 It is beyond the scope of this guide to optimize the water vapor transmission characteristics of WRB/AB for specific conditions of use. The specific conditions of use should account for variations in indoor and outdoor climates, cladding type, moisture storage capacity of cladding materials, thermal insulating measures for wall and roof assemblies, air movement, and vapor diffusion control strategies.

1.5 This guide does not address proper installation and integration of WRB/AB with other wall and roof components.

1.6 The values stated in inch-pound units are to be regarded separately as standard. Within the text, the SI units shown in parentheses are provided for information only. The values stated in each system are not exact equivalents; therefore, each system shall be used independently. Combining values from two systems may result in non-conformance with the standard. However, derived results can be converted between systems using appropriate conversion factors (see [Table 1](#)).

¹ This guide 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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1.7 *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.*

1.8 *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

- C168 Terminology Relating to Thermal Insulation
- C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
- C1289 Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- D226/D226M Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
- D779 Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method
- D1079 Terminology Relating to Roofing and Waterproofing
- D1653 Test Methods for Water Vapor Transmission of Organic Coating Films
- D3833/D3833M Test Method for Water Vapor Transmission of Pressure-Sensitive Tapes
- E96/E96M Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
- E398 Test Method for Water Vapor Transmission Rate of Sheet Materials Using Dynamic Relative Humidity Measurement
- E631 Terminology of Building Constructions
- E2556/E2556M Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

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.

TABLE 1 Units and Conversion Factors^{A, B}

Multiply	By	To Obtain (for the same test condition)
	<i>WVT^C</i>	
g/h·m ²	1.43	grains/h·ft ²
grains/h·ft ²	0.697	g/h·m ²
	<i>Permeance</i>	
g/Pa·s·m ²	1.75×10^7	1 Perm (Inch-pound)
1 Perm ^D (Inch-pound)	5.72×10^{-8}	g/Pa·s·m ²
	<i>Permeability</i>	
g/Pa·s·m	6.88×10^8	1 Perm-inch
1 Perm-inch	1.45×10^{-9}	g/Pa·s·m

^A These units are used in the construction trade. Other units may be used in other standards.

^B All conversions of mm Hg to Pa are made at a temperature of 0 °C.

^C WVT = water vapor transmission.

^D 1 Perm = 1 US Perm = 1 grains/h·ft²·in. Hg.

E3054/E3054M Guide for Characterization and Use of Hygrothermal Models for Moisture Control Design in Building Envelopes

F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

2.2 *ANSI/ASHRAE Standard*:³

ANSI/ASHRAE 160 Criteria for Moisture-Control Design Analysis in Buildings (ANSI Approved)

2.3 *Other Informative References*:

ICC-ES Acceptance Criteria AC38 Water-resistive Barriers⁴

ICC-ES Acceptance Criteria AC71 Foam Plastic Sheathing Panels Used as Water-resistive Barriers⁴

ICC-ES Acceptance Criteria AC212 Water-resistive Coatings Used as Water-resistive Barriers over Exterior Sheathing⁴

ICC-ES Acceptance Criteria AC310 Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-resistive Barriers⁴

IBC⁵ ICC International Building Code⁵

IRC⁵ ICC International Residential Code⁵

3. Terminology

3.1 *Definitions*—For possible variation in definitions of terms used in this guide, refer to corresponding Terminology section in Terminologies **C168**, **D1079**, and **E631**.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *air barrier (AB), n*—a material or assembly installed as a system in a building envelope and designed to resist uncontrolled air movement into or through the opaque wall or roof assembly. An air barrier can be specified as a control layer on the inside, outside, or middle sections of exterior wall and roof assemblies, or as an entire assembly.

³ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, <http://www.ashrae.org>.

⁴ Available from ICC Evaluation Service (a registered trademark) (ICC-ES), 3060 Saturn Street, Suite 100, Brea, Ca 92821, <https://icc-es.org>.

⁵ Available from and a registered trademark of International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, <http://www.iccsafe.org>.

3.2.1.1 *Discussion*—A given material may serve multiple functions within a wall or roof assembly if it meets the requirements for each function. For example, it is possible to specify and install a single product that functions both as a water-resistive and air barrier on the exterior side of the assembly. Some products can also provide additional structural support and thermal insulating capability.

3.2.2 *air leakage, n—in buildings*, the passage of uncontrolled air through cracks or openings in the building envelope or its components, such as ducts, because of air pressure or temperature difference.

3.2.3 *building envelope, n*—a boundary that encloses and separates conditioned space from the outdoor environment or other environments with different conditions (for example, semi-conditioned spaces, cold storage spaces, manufacturing or industrial processing environments).

3.2.3.1 *Discussion*—A building's interior is typically the enclosed conditioned space that, in general, does not include vented attics, unconditioned basements, vented crawl spaces, or attached spaces (for example, unconditioned garages or other utility spaces that are connected to the main structure but are not conditioned). In commercial buildings, these interior environments may include designated spaces for storage, manufacturing, or industrial processing.

3.2.4 *responsive water vapor transmission properties, n*—water vapor transmission properties that vary as a function of temperature and relative humidity.

3.2.4.1 *Discussion*—The water vapor permeance (WVP) of many WRB/AB materials increases with increasing temperature and relative humidity, often in a nonlinear fashion.

3.2.5 *water vapor diffusion, n*—the process by which water vapor moves through a vapor permeable material by molecular diffusion due to a difference (gradient) in water vapor pressure across the material.

3.2.6 *water-resistive barrier (WRB), n*—a protective material installed on the exterior surface or behind the exterior building covering (for example, wall cladding or roof covering) that is intended to resist further intrusion of liquid water that has penetrated the exterior covering and prevent it from reaching interior components of the building envelope.

3.2.6.1 *Discussion*—Wall and roof assemblies designed to function as a drainage system include two layers of resistance against rainwater penetration; the exterior covering provides the initial resistance to rainwater penetration, and the WRB provides the ultimate resistance against any water that bypasses the exterior covering or drains down from upper levels.

3.2.7 *water vapor permeability, n*—a material property that represents the time rate of water vapor transmission by diffusion through unit area of a flat material of unit thickness induced by a unit vapor pressure difference between two specific surfaces, under specified temperature and relative humidity conditions.

3.2.8 *water vapor permeance, n*—a material layer property that represents the time rate of water vapor transmission by diffusion through unit area of a flat material or assembly