

## Technical Note 2

### Air Barrier Materials

**Abstract:** This Technical Note lists the defining property of air barrier materials, lists commonly used air barrier materials and lists the ancillary properties that each type of air barrier material must possess in order to function as an air barrier for the life expectancy of the air barrier system. Lastly, air barrier materials can possess certain properties that design professionals need to know in order to properly assess the applicability of an air barrier in a particular assembly.

#### Air Barrier Materials

An air barrier material is a material that has a maximum air leakage rate of 0.004 cfm/ft<sup>2</sup> at a pressure difference of 1.57 psi [ .02 L/(s·m<sup>2</sup>) ] at a pressure difference of 75 Pa ) when tested in accordance with ASTM E2178.

#### Types of Air Barrier Materials

Common categories of and types of air barrier materials are as follows:

Adhesive backed commercial building wraps

Board stock materials

- Extruded polystyrene insulation 1 1/2” thick or greater
- Faced expanded polystyrene insulation 1 1/2” thick or greater
- Gypsum board 1/2” thick or greater
- Oriented strand board 3/8” thick or greater
- Polyisocyanurate insulation 1 1/2” thick or greater
- Plywood 3/8” thick or greater
- Cement board

Concrete

Flexible adhered sheet membranes

Flexible fluid applied membranes

Flexible mechanically fastened sheet membranes

Flexible self-adhering sheet membranes

Glass

Metals

Non-board stock insulation

- Spray foam insulation 1” thick or greater
- Cellulose insulation 6” thick or greater

Plastics

Roofing membranes

Rubber

Sealant materials

Wood

The Air Barrier Association of America currently has acceptance criteria for many of these air barrier materials. These materials are:

Boardstock air barrier – rigid cellular thermal insulation board

Factory bonded membranes to sheathing

Fluid applied membranes

Mechanically fastened commercial building wraps

Self-adhering sheet membranes

Medium density closed cell spray polyurethane foam insulation

Torch applied membranes

### **Ancillary Properties of Air Barrier Materials**

Different types of air barrier materials require different properties to maintain their ability to function as an air barrier and to do so for the expected life of either the air barrier materials or the building enclosure assembly. If the air barrier materials can be easily accessed for maintenance or replacement, the expected life of the air barrier materials would be the metric to be used in determining the required ancillary property of the materials. If the air barrier materials cannot be easily accessed, this metric will be the life expectancy of the building enclosure. Also, the air barrier material needs to be able to withstand exposure to the outside environment for the expected exposure period to this environment. This may be for the expected life of the air barrier systems or the duration of the construction process.

These ancillary properties are listed in the following tables and are to be used as acceptance criteria for air barrier materials.

**Table 1: Rigid Cellular Thermal Insulation Air Barrier**

Product Property	Test Standard	Material Type	Test Standard Title	Unit	Requirement	
					Min.	Max.
Standard Specification	ASTM C1289-12e1	Polyisocyanurate	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	n/a	As defined by standard	
	Or					
	ASTM C578-12a	Polystyrene	Standard Specification for Rigid Cellular Polystyrene Thermal Insulation	n/a	As defined by standard	

**Table 2: Factory Bonded Membranes to Sheathing**

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min.	Max.
Pull Adhesion	ASTM D4541-09e1	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers – Specify substrate and surface preparation.	PSI  (kPa)	16  (110)	n/a
				Declare failure mode  or report value at substrate	

				failure	
Peel Adhesion ( of adjoining board transition material to factory- bonded laminated material	ASTM D3330 / D3330M – 04 ( 2010 ) Method F	Standard Test Method for Peel Adhesion of Pressure Sensitive Tape	lbf/in (pli)  (N/mm)	1.0  (0.175)	n/a
Nail Sealability	ASTM D1970 / D1970M- 13	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection	n/a	Pass	n/a

**Table 3: Fluid Applied Membranes**

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min.	Max.
Nail Sealability	ASTM D 1970 / D1970M - 11	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection	n/a	Pass	n/a
Pull Adhesion	ASTM D4541-09e1	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers – Specify substrate and surface preparation.	Psi  (kPa)	16  (110)  Declare failure mode  or report	n/a

				value at substrate failure	
Crack Bridging	ES-AC 212	Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers over Exterior Sheathing	n/a	Pass	n/a
	Or				
	ASTM C1305-08	Standard Test Method for Crack Bridging Ability of Liquid Applied Waterproofing Membrane – Report thickness and joint treatment (158° for 2 weeks )	n/a	Pass	n/a

**Table 4: Mechanically Fastened Commercial Building Wraps**

Product Property	Specimen Type	Material Type	Test Standard	Test Standard Title	Unit	Requirement	
						Min.	Max.
Dry Tensile Strength or Dry Breaking Force	As received	Paper and felt based	ASTM D828-97 (2002)	Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus  Test to machine direction and cross	lbf/in  (N/mm)	20  (3.5)	n/a

				direction.			
		Polymeric based	ASTM D882-12	Standard Test Method for Tensile Properties of Thin Plastic Sheathing	lbf/in  (N/mm)	20  (3.5)	n/a
		Or					
			ASTM D5034-09	Standard Test Method for Breaking Strength and Elongation of Textile Fabrics ( Grab Test )  Test to machine direction and cross direction	lbf/in  (N/mm)	40 machine/ 35 cross direction  (7.0 machine/ 6.1 cross direction	
Pliability	As received	All materials	ICC-ES AC348, Section 3.3.4	Acceptance Criteria for Water Resistive Barrier – the material does not crack when bent over a 1/16” (1.6 mm) mandrel at a temperature of 32° F (0° C)	n/a	Pass	n/a
Or							

Standard Specification	As received	All materials	ASTM E2556 / E2556M – 10	Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment	n/a	As defined by standard
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**Table 5: Self Adhered Membranes**

Product Property	Test Standard	Test Standard Title	Unit	Requirements	
				Min.	Max.
Puncture Resistance	ASTM E154-08a	Standard Test Method for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as round Cover	lbf	40	n/a
			(N)	(178)	
Tensile Strength	ASTM D882-12	Standard Test Method for Tensile Properties of Thin Plastic Sheeting	lbf/in	20 or until substrate failure	n/a
			(N/mm)	(3.5 or until substrate failure)	
Peel or Stripping Strength of Adhesive Bond	ASTM D903-09 (2004)	Standard Test Method for Peel or Stripping Strength of Adhesive Bonds – Specify substrates and surface preparation for glass fiber faced gypsum sheathing and/or concrete masonry	lbf/in	5.0	n/a
			(N/mm)	(0.875)	
				Declare	

		units.		failure mode.	
Lap Adhesion	ASTM D1876-08	Standard Test Method for Peel Resistance of Adhesives (T peel test) – Specify substrate preparation for glass fiber faced gypsum sheathing and/or concrete masonry units.	lbf/in  (N/mm)	5.0  (0.875)  Declare failure mode	n/a
Low Temperature Flexibility	ASTM D1970 / D1970M - 11	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection – Section 7.6 Low Temperature Flexibility	-20°F  (-30°C)	Pass	n/a
Nail Sealability	ASTM D1970 / D1970M – 11	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection – Section 8.9 Nail Sealability	n/a	Pass or specify sealing detail around fasteners	n/a
Pull Adhesion	ASTM D4541-09e1	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers – Specify substrate and surface preparation.	Psi  (kPa)	16  (110)  Declare failure mode  or report value at substrate failure	n/a
Tear Initiation	ASTM D4073-	Standard Test Method for Tensile-Tear Strength of	lbf	9.0	n/a



and Tear Propagation	06	Bituminous Roofing Membrane  Machine direction / cross direction	(N)	(40)	
Crack Bridging	ASTM C1305-08	Standard Test Method for Crack Bridging Ability of Liquid Applied Waterproofing Membrane	-15°F  (-26°C)	Pass	n/a

**Table 6: Medium Density Spray Polyurethane Foam Insulation**

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min.	Max.
Flame Spread Characteristics	ASTM E84 – 12c	Standard Test Method for Surface Burning Characteristics of Building Materials	n/a	n/a	75
Thermal Transmission	ASTM C177 – 10	Standard Test Method for Steady State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus	ft <sup>2</sup> ·F·h/Btu  (m <sup>2</sup> ·C/W)	Report	
	Or				
	ASTM C518-10	Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	ft <sup>2</sup> ·F·h/Btu  (m <sup>2</sup> ·C/W)	Report	
Compressive Strength	ASTM D1621-10	Standard Test Method for Compressive Properties of Rigid Cellular Plastics	psi	15	n/a
			(kPa)	(104)	

Density	ASTM D1622-08	Standard Test Method for Tensile and Tensile Adhesive Properties of Rigid Cellular Plastics	lb/ft <sup>3</sup>  (kg/m <sup>3</sup> )	1.75  (28)	2.25  (36)
Tensile Strength	ASTM D1623-09	Standard Test Method for Tensile and Tensile Adhesive Properties of Rigid Cellular Plastics	psi  (kPa)	20  (138)	n/a
Dimensional Stability	ASTM D2126 – 09	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging  -4°F (-20°C)  176°F (80°C)  158°F (70°C), 97% +/- 3% RH	%	n/a	-4  +8  +15
Water Absorption	ASTM D2842-12	Standard Test Method for Water Absorption of Rigid Cellular Plastics	%	n/a	4
Open Cell Content	ASTM D2842-12	Standard Test Method for Water Absorption of Rigid Cellular Plastics	%	n/a	10
Pull Adhesion	ASTM D4541-09e1	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers	psi  (kPa)	16  (110)  or report value at substrate failure	n/a
Crack Bridging	ASTM C1305-08	Standard Test Method for Crack Bridging Ability of Coatings Using Portable Adhesion Testers	-15°F  (-26°C)	Pass	n/a

**Table 7: Adhesive Backed Commercial Building Wraps**

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min.	Max.
Adhesion	ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers	psi  (kPa)	16  (110)  or report value at substrate failure	n/a
Dry Tensile Strength or Dry Breaking Force	ASTM D882-12	Standard Test Method For Tensile Properties of Thin Plastic Sheeting  Test to machine direction and cross section	lbf/in  (N/mm>	20  (3.50)	n/a
	Or				
	ASTM D5034-09	Standard Test Method for Breaking Strength and Elongation of Textile Fabrics ( Grab Test )  Test to machine direction and cross direction	lbf/in  (N/mm)	40 machine/35 cross direction  (7.0 machine/6.1 cross direction)	n/a
Lap Adhesion	ASTM D1876-08	Standard Test Method for Peel Resistance of Adhesives (T peel test) – Specify substrate preparation for glass fiber faced gypsum sheathing and/or concrete masonry	lbf/in  (N/mm)	5  (0.875)  Declare failure	n/a

		unites.		mode.	
	Or				
	ASTM D3330-10	Standard Test Method for Peel Adhesion of Pressure Sensitive Tape – Method B.	lbf/in  (N/mm)	5  (0.875)  Declare failure mode.	
Pliability	ASTM D1970-14 Section 7.6	Standard Test Method for Peel Adhesion of Pressure Sensitive Tape – Method B	lbf/in  (N/mm)	Pass	n/a
	Or				
	ICC-ES AC38, Section 3.3.4	Acceptance Criteria For Water Resistant Barriers – use 1/16” (1.6 mm ) diameter mandrel at a temperature of 32° F (0°C)	Specimen exhibits no visible surface cracking	Pass	n/a

**Non-Ancillary Properties of Air Barrier Materials to Be Reported**

Design professionals also need to know some non-ancillary properties of air barrier materials in order to determine whether the air barrier material will function as intended for the expected life of the air barrier assembly and/or system. Also, many air barrier materials provide other functions needed for the proper function of building enclosure assemblies in addition to the air barrier function. These are:

- The water barrier
- The vapor barrier
- The heat barrier (insulation)

If the air barrier material is also intended to be the water barrier material, the material must be tested to prove that it can perform the functions of the water barrier.

If the air barrier material is also intended to perform the vapor barrier function, the material must be tested to prove that it can perform the functions of the vapor barrier. If

the vapor barrier function is to be provided by another material, design professionals still need to know the water vapor permeance of the air barrier material in order to design the exterior wall assembly correctly.

In some cases, the air barrier material is also intended to perform the heat barrier function. If so, the design professional can use the values required under tables 1 and 6 to determine the thickness required of the material to provide the R-value required by the applicable building code.

The following tables list the properties to be reported in order to provide the design professional with the non-ancillary properties needed for the proper design of the building enclosure assembly.



**Table 8: Values to Be Reported For Water Penetration and Water Vapor Permeance**

Product Property	Test Standard	Test Standard Title	Unit	Requirement	
				Min.	Max.
Water Penetration	AATCC 127-08	Water Resistance: Hydrostatic Pressure Test for 5 hours	inches  (cm)	pass @ 22  (pass @ 55)	n/a
Water Vapor Permeance	ASTM E96 / E96M - 12	Standard Test Methods for Water Vapor Transmission of Materials  (Water and Desiccant methods)	US Perms  (ng/Pa·s·m <sup>2</sup> )	Declare	

**Summary**

This Technical Note contains information about the air barriers. This information may be used to design and construct building enclosure assemblies.

The information and suggestions contained in this Technical Note are based on the available data and the experience of the Technical Committee of the Air Barrier Association of America. The information contained herein must be used in conjunction



with good technical judgment and a basic understanding of the properties of air barriers. Final decisions on the use of the information contained in this Technical Notes are not within the purview of the Air Barrier Association of America and must rest with project owners, architects, engineers, consultants and contractors.