

air barrier

abaa

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CONFERENCE
& TRADE SHOW

MAY 8-9

2018

SALT LAKE

CITY

AIR BARRIER EDUCATION TRACKS FOR
THE CONSTRUCTION INDUSTRY

The Proper Way to Specify an Air Barrier to Meet ASHRAE 90.1, IECC- 2015, IGCC, and LEED v4.0

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Learning Objectives

- Understand the benefits of the air barrier systems to the environment, building owner, and occupants.
- Discuss performance test standards relating to air barrier systems, including the NFPA 285 fire test.
- Examine the IECC 2012 & 2015 and ASHRAE 90.1-2010 and their impact on air barrier systems.
- How to properly develop a performance specification for an air barrier system.

New Mandatory Requirements

- 1. Air Barriers
- 2. Continuous Insulation for vast majority of buildings
- **3. Compliance to NFPA-285 Fire Test**

IECC 2012 & 2015

building & all joints must be durably sealed

- The use of duct tape, packaging tape, scotch tape, and masking tape is not allowed.
- Sealing the building and joints must be done with a material that accommodate the anticipated building movement (needs to be elastomeric, >15/20% movement)
- Sealants used in contact with any and all components of the wall must be chemically compatible. The specifier should require letters of chemical compatibility from all manufacturers.

SECTION C402 BUILDING ENVELOPE REQUIREMENTS

C402.1 General (Prescriptive). Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in Item 2 of Section C401.2, shall comply with the following:

1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the *R*-value-based method of Section C402.1.3; the *U*-, *C*- and *F*-factor-based method of Section C402.1.4; or the component performance alternative of Section 402.1.5.
2. Roof solar reflectance and thermal emittance shall comply with Section C402.3.
3. Fenestration in building envelope assemblies shall comply with Section C402.4.
4. Air leakage of building envelope assemblies shall comply with Section C402.5.

C402.5 Air leakage—thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building *thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft² (0.2 L/s · m²). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Building Envelope Insulation Requirements

	<u>2009</u>	<u>2015</u>
Roofs (above deck)	R-20 CI	R-25 CI
Metal Bldg Roofs	R-13 + R-13	R-19 + R-11 LS
Attic	R-38	R-38
	Walls, above grade	
Mass	R-5.7 CI	R-5.7 CI
Metal Bldg. (Metal Façade)	R-16	R-13 + R-6.5 CI (1" thick foil faced PISO)
Metal Framed (Masonry/Stone Facade)	R-13	R-13 + R-5 CI (1" thick XPS or foil faced PISO, R-5.0)
Wood Framed and other	R-13	R-13 + R-3.7 CI or R-20

This is the Effective R-value that has been presented many times.

It is now part of the Energy Code!

TABLE C402.1.4.1
EFFECTIVE R-VALUES FOR STEEL STUD WALL ASSEMBLIES

NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY R-VALUE (insulation)	CORRECTION FACTOR (F_c)	EFFECTIVE R-VALUE (ER) (Cavity R-Value $\times F_c$)
3 $\frac{1}{2}$	16	13	0.46	5.98
		15	0.43	6.45
3 $\frac{1}{2}$	24	13	0.55	7.15
		15	0.52	7.80
6	16	19	0.37	7.03
		21	0.35	7.35
6	24	19	0.45	8.55
		21	0.43	9.03
8	16	25	0.31	7.75
	24	25	0.38	9.50

Air Barrier Materials by IECC 2015

Definition

1. Plywood of not less than 3/8" thickness
2. OSB of not less than 3/8" thickness
3. Extruded Polystyrene of not less than 1/2" thickness
4. Foil polyisocyanurate board of not less than 1/2" thickness
5. Closed cell spray foam of not less than 1 1/2" thickness
6. Open cell spray foam of not less than 4.5" thickness
7. Exterior or interior Gyp board of not less than 1/2" thickness
8. Cement board of not less than 1/2" thickness
9. BUR Membrane
10. Mod bit roof membrane
11. Fully adhered single ply membrane
12. Cement/sand parge or gypsum plaster of not less than 5/8" thickness
13. Cast-in place and tilt-up concrete
14. Fully grouted CMU

Air Barrier Materials

An Air Barrier Material is a material that has been designed to provide the primary function of controlling the air movement through a building assembly.

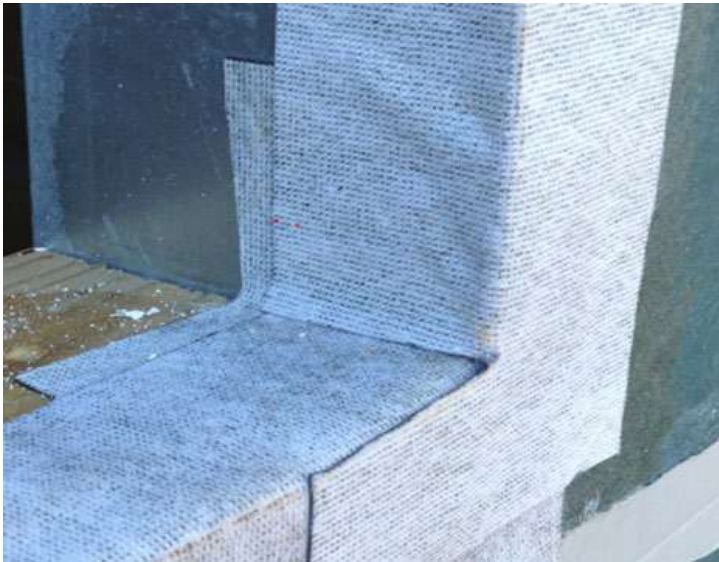
To qualify as an Air Barrier Material an air permeance of less than $0.004\text{CFM}/\text{ft}^2 @1.56\text{ lb}/\text{ft}^2$ as tested by ASTM E2178-01 must be met.



Air Barrier Components



An Air Barrier Component is a material used to make connections between the primary air barrier material and other substrates.



The most common air barrier components are primed & self-adhering tapes and sealants.

What is an Air Barrier Assembly?



An Air Barrier Assembly is the combination of the primary **air barrier material** and the **air barrier components**.

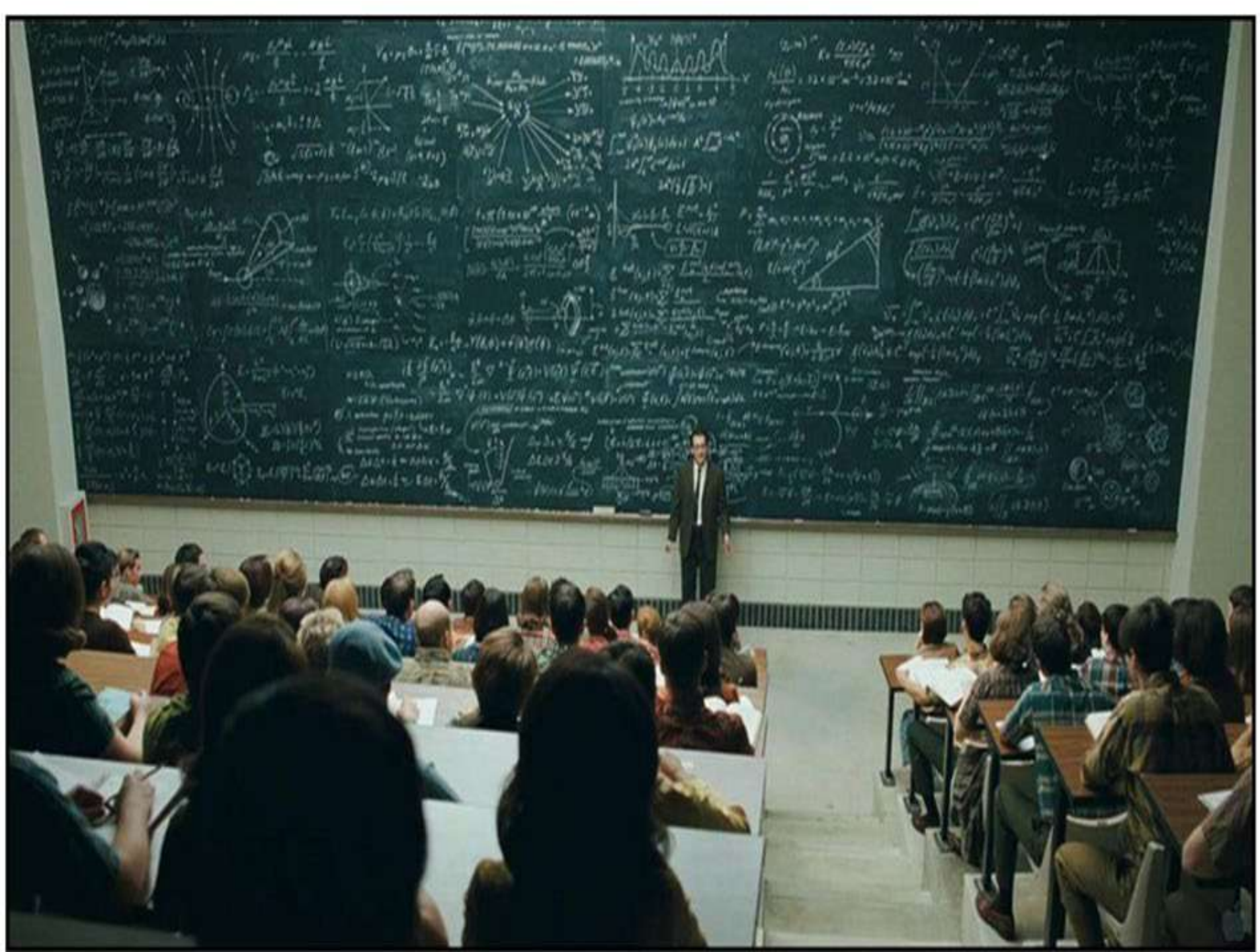
What is an Air Barrier System?



An Air Barrier System is a combination of an **air barrier assembly** along with other building components to create a plane of air separation between different environments.

Learning Objectives

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- How to properly develop a performance specification for an air barrier system.



Benefits of an Air Barrier System

- Conserve Energy
- Lower Initial Construction Costs
- Reduced Maintenance Costs
- Improve Indoor Air Quality



Energy Conservation

- According to the DOE controlling air leakage can reduce energy costs by up to 40%
- National Institute of Standards and Technology (NIST)
 - Air Barriers reduce air leakage by up to 83%
 - Reduce Gas Consumption by up to 40%
 - Reduce Electric Consumption by up to 25%



Lower Initial Construction Costs

- Air Barriers prevent the leaking of conditioned air, therefore, smaller mechanical systems are needed.



Reduce Maintenance Costs

- Less strain on Mechanical Systems.
- Reduction in moisture helps prevent:
 - Corrosion
 - Mold Growth



Indoor Air Quality

- An effective air barrier keeps pollutants and allergens out of the building, leading to:
 - Healthier more productive employees
 - Fewer sick days
 - Fewer doctor visits
 - More alert employees



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Testing – ASTM E2178

- Determines air permeance of a material at a pressure difference of 75Pa.
- Air leakage must not exceed 0.004cfm/ft^2 to be classified as a air barrier material.
- Only tests the air barrier material not the air barrier system.

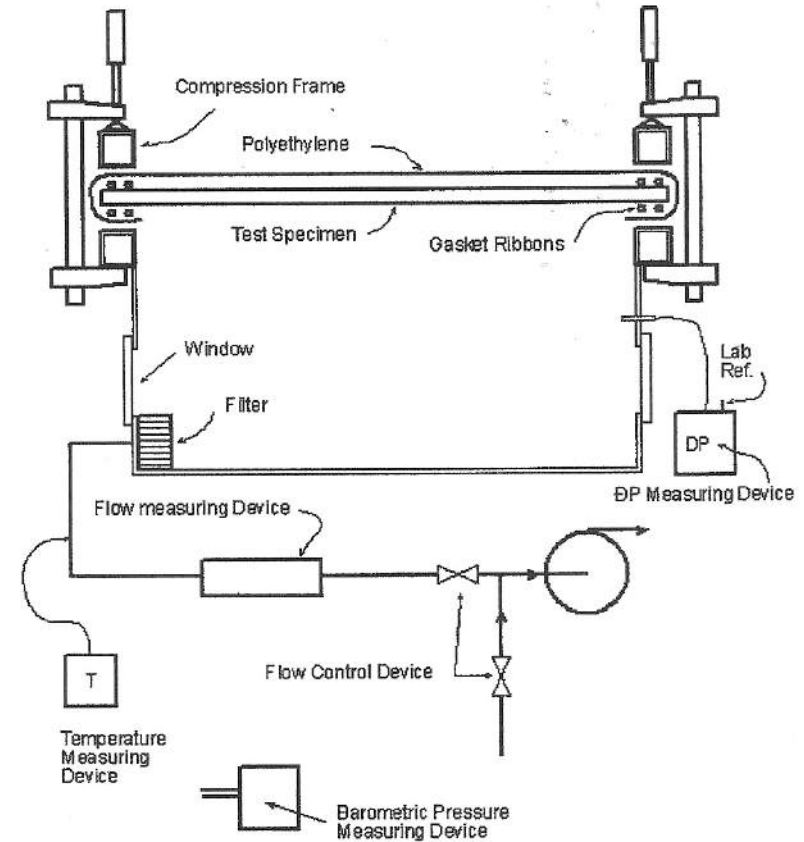




Figure 5 - Full Application of Peanut Butter

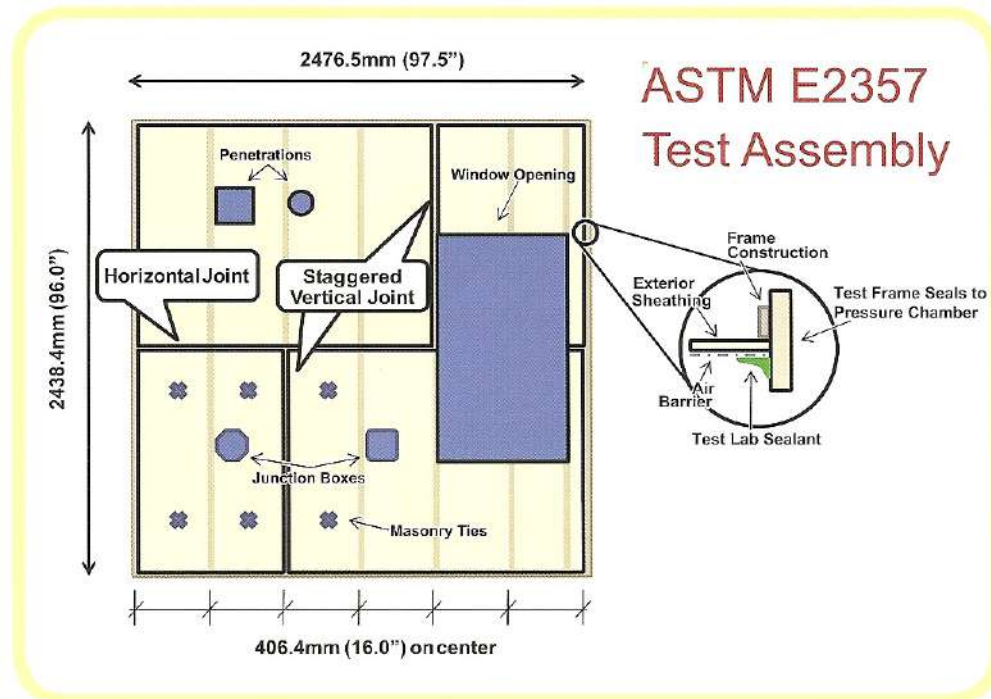
Testing – ASTM E2357

“ASTM E 2357 is the only test method that gives the user any information on the performance of an installed air barrier assembly. Every building contains multiple air barrier materials. It is only when a material is selected and combined into an assembly does it actually perform the function of an air barrier. ASTM E 2357 determines the air leakage rate after being conditioned under real world loads which provides the user with a precise air leakage rate and confidence that it will provide this performance when installed. Data from ASTM E 2357 is critical to every design professional.”

-Mr. Laverne Dalgleish, Executive Director of the Air Barrier Association of America

Testing – ASTM E2357

- Determines air permeance of an air barrier system.
- Uses negative and positive pressure in 3 testing phases.
- Simulates wind gusts up to 99 mph.
- Important to verify that air barrier systems are tested on the same substrate and same application as specified.



Testing – ASTM E2357



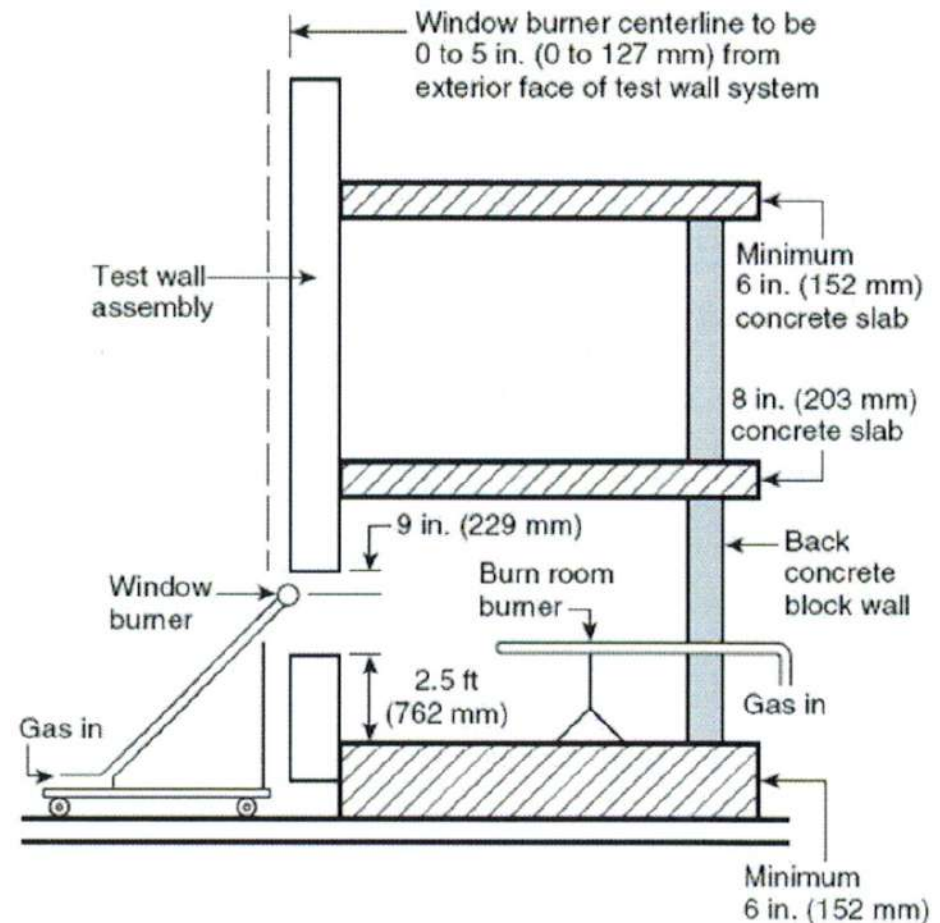
NFPA 285 Fire Tested Assemblies

- Construction Types I, II, III, or IV must have exterior walls constructed of non-combustible materials
- NFPA 285 may be required in the International Building Code (IBC) when combustible products are used
- This includes the exterior insulation, the air barrier assembly, the veneer, etc.



NFPA 285 Fire Tested Assemblies

- The test is to determine that combustible materials, when exposed to fire on the exterior face of the wall does not spread flame over the surface or through the core of the otherwise non-combustible wall assembly.
- 30 minute test on a full scale two story wall assembly.



NFPA 285 Fire Tested Assemblies

- To pass, the wall assembly must demonstrate limited fire spread vertically and horizontally away from the window.
- Temperature must not exceed 1,000 F°



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ASHRAE 90.1 - 2010

American Society of Heating, Refrigeration, and Air-Conditioning Engineers

5.4.3.1 Continuous Air Barrier – **The entire building envelope shall be designed and constructed with a continuous air barrier.**

- Assemblies of materials and components shall have an air leakage not to exceed 0.04 cfm/ft² under a pressure differential of 1.57psf when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680, or ASTM R283.
- Materials shall have an air permeance not exceeding 0.004 cfm/ft² under a pressure differential of 1.57psf when tested in accordance with ASTM E2178.

IECC 2012 & 2015

International Energy Conservation Code

C402.4 – Air Leakage



- A continuous air barrier shall be provided throughout the building thermal envelope.
- The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
- Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed, or otherwise sealed.
- IECC 2012 & 2015 are based on ASHRAE 90.1 – 2010.

IECC 2015 & Texas

- It is in effect for all areas of Texas with the exception of counties in climate zone 2B
 - Bandera, Dimmit, Edwards, Frio, Kinney, La Salle, Maverick, Medina, Real, Uvalde, Val Verde, Webb, Zapata, Zavala

IGCC

International Green Construction Code

606.1.2 Air leakage. Air leakage mitigation measures shall be provided in accordance with this section.

606.1.2.1 Sealing of the building envelope. *The building thermal envelope shall be durably sealed to limit infiltration.* The sealing methods between dissimilar materials shall allow for differential expansion and contraction. *The following shall be caulked, gasketed, and weather-stripped and additionally sealed with an air barrier film.*

1. All joints, seams and penetrations.
 2. Site-built windows, doors and *skylights*.
 3. Openings between window and door assemblies and their respective jambs and framing.
1. Utility penetrations.



ABAA

- Air Barrier Association of America
- Mission: “To promote the use and benefits of air barrier systems, educate the public about air barrier systems and develop a professional air barrier specialty trade and industry dedicated to the installation of effective air barrier systems in buildings on a nationwide scale.”
- **ABAA lists air barrier materials that have passed their testing standards. Testing standards can be viewed on their website**
www.airbarrier.org/materials/assemblies_e.php.
- **ABAA certifies contractors who have completed and passed their training sessions on proper installation.**
- ***For the best quality control only ABAA listed materials and ABAA certified contractors should be mandated in the specification.***

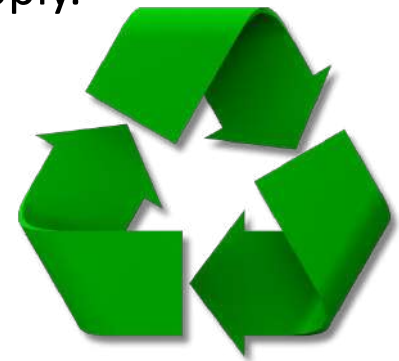
ABAA Performance Standards

Liquid/Fluid Applied Membranes

Air Permeance	ASTM E 2178-03	Standard Test Method for Air Permeance of Building Materials
Water Resistance	AATCC 127 - 03	Water Resistance: Hydrostatic Pressure Test for 5 h
Fastener Sealability	ASTM D 1970-01	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection - Section 7.9 Nail Sealability
Pull Adhesion	ASTM D 4541-05	Modified Version of Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete using Portable Pull-Off Adhesion Testers– Specify substrates and surface preparation for glass fiber faced gypsum sheathing and concrete block. Declare failure mode.
Crack Bridging	ES-AC 212	Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers over Exterior Sheathing Standard Test Method for Crack Bridging Ability of Liquid Applied Waterproofing Membrane– Report thickness and joint treatment (158° for 2 weeks)
	OR ASTM C 1305	
Water Vapor Transmission (at applied thickness)	ASTM E 96-00e1	Standard Test Methods for Water Vapor Transmission of Materials – Water and Desiccant Method

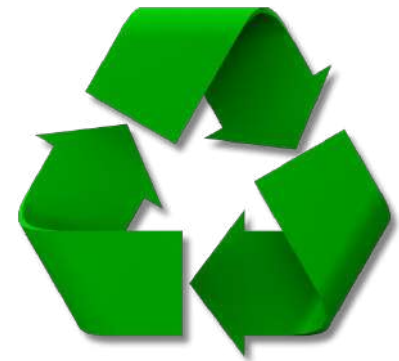
LEED

- Air Barrier Systems can contribute to LEED certification.
- Simply using an Air Barrier or any product does not guarantee any LEED points.
 - There is no such thing as a LEED certified product!
- Possible LEED Contribution:
 - EA Credit 1: Optimize Energy Performance
 - MR Credit 1.1: Building Reuse-Maintaining existing walls, floors, and roof.
 - IEQ Credit 7.1: Thermal Comfort-Design.
 - Depending on product used other credits may also apply.



LEED

- LEED v4.0 Buildings require air barrier systems as a mandatory building component.



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Specifications

- Specifications must be clear, and call out the appropriate test standards.
- Scheduling among the trades must be communicated.
- **Involvement of the manufacturers representative should be mandatory.**



Air Barrier Specification

1.03 PERFORMANCE REFERENCES

A. ASTM E 2178-01: Standard Test for Determining the Air Permeability of Building Materials.

B. ASTM E 2357, Specimen 2, Standard Test Method for Determining Air Leakage of Air Barrier Systems (**Full Scale Wall Testing of the Air Barrier System**).

C. Air Barrier System must be fully tested and listed at www.airbarriers.org/materials/assemblies_e.php.

Air Barrier Specification

1.05 SUBMITTALS

- A. Section 01 33 00 – Submittal Procedures: Submittal Procedures.
- B. Prior to commencing the Work, submit manufacturer's independent Laboratory Report for the Air Barrier Systems testing on ASTM E 2357 tested on a steel stud frame wall and the ABAA listing.
- C. Prior to commencing the Work, submit independent documentation certifying that the air barrier membranes have been tested independently, indicating air leakage at rates recommended by the NRC and the National Building Code.
- D. Prior to commencing the Work, submit copies of manufacturers' literature for membrane, primers, sealants, adhesives and associated auxiliary materials shall be included.
- E. Prior to commencing the Work, submit references clearly indicating that the materials proposed have been installed for not less than three years on projects of similar scope and nature. Submit references for a minimum of five projects.
- F. Prior to commencing the Work, submit manufacturers' complete set of standard details for air/vapor retarders. The manufacturer's representative shall review the contract drawings and note any modifications required to make the system air and water tight.

Air Barrier Specification

1.08 PRE-INSTALLATION CONFERENCE

A. Convene four weeks prior to commencing work of this section, under provisions of Section 01 30 00 – Administrative Requirements: Pre-Installation Meeting. Attendance by the manufacturer's representative along with the installer is **mandatory**.

DO NOT PROCEED WITH THE INSTALLATION OF THE AIR BARRIER MEMBRANE AND THE THROUGH WALL FLASHING MEMBRANE PRIOR TO THE PRE-INSTALLATION CONFERENCE.

Air Barrier Specification

2.01 MEMBRANES

- A. Liquid air barrier: One component elastomeric membrane, spray, trowel or brush applied, having the following characteristics and have passed all evaluations by the Air Barrier Association of America (ABAA) and be listed on their web site as having passed all the evaluations :
1. Air permeability:
 - a. Air Leakage Thru Cured Films: <0.001 cfm/ft² @ 10.5 lbs/ ft² or <0.005 L/sm² @ 75 Pa to ASTM E283 (Modified) 24 hours, +/- 10%.
 - b. Air Leakage per ASTM E 2178, 30 mil dry film, delta P of 0.3 inches of water, 0.001 +/- 10%
 2. Air Barrier System Test on Full Scale Wall Assembly, ASTM E 2357
 - a. System Air Leakage, 0.0005 CFM/ft² +/- 10%
 - b. Penetrations Check, MUST PASS ASTM E 2357 requirements

Air Barrier Specification

3.05 PRIMARY AIR BARRIER

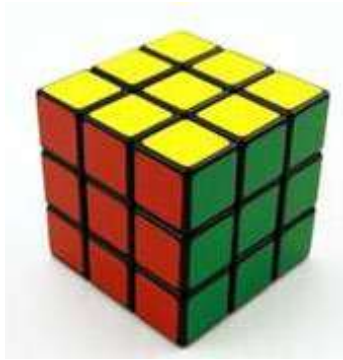
A. Apply by spray or roller, a complete and continuous unbroken film at a temperature of 40F and rising with less than a 30% chance of rain in the next 24 hours:

1. Exterior Gypsum Sheathing, Plywood or OSB

- a. Apply at same rate used to pass ASTM E2357 requirements and as listed by ABAA.
- b. Spray around all projections, including masonry veneer anchors, ensuring a complete and continuous air seal.

Compatibility

Are They Compatible?



AIR BARRIERS & INSULATIONS

		Spray Polyurethane Foam	Liquid Applied Asphaltic Air Barrier	Liquid Applied Acrylic Air Barrier	Membrane Applied Asphaltic Air Barrier	Polystyrene Foam Insulation	Maximum Warranty
F	Asphaltic copper fabric	Red	Red	Red	Red	Red	None
L	Non-asphaltic copper fabric	Green	Green	Green	Green	Green	Lifetime
A	Copper Drainage Plane	Green	Green	Green	Green	Green	Lifetime
S	EPDM	Red	Red	Green	Red	Yellow	10 years
H	PVC	Red	Red	Red	Red	Red	5 years
I	PVC KEE Self Adhered	Yellow	Yellow	Red	Yellow	Yellow	10 years
N	Peel & Stick	Yellow	Yellow	Red	Yellow	Yellow	5 years
G							
S							

NOT COMPATIBLE
CAUTION
COMPATIBLE

Thank you for your time!

QUESTIONS??

**This concludes The American Institute of Architects
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BUILDING TRUST



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