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CONFERENCE
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MARCH 26-27
2019
NORFOLK
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AIR BARRIER EDUCATION TRACKS FOR
THE CONSTRUCTION INDUSTRY

Does It Pass or Fail?

A Conversation about Quality Control Testing Criteria

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Session Description

The material is applied, the air barrier is complete, and now all you need is to pass the field quality assurance testing. The air barrier adhesion test is performed and then comes the question: what is the pass/fail criteria? Is it the published number under “material properties” on the manufacturer’s data sheet? Is the ABAA required minimum? Is there a different standard written in the specification? Does a 1 psi difference really matter? This discussion can frequently become a point of contention on the job site at a point when a “fix” is expensive and time consuming for many. This session will be a conversation between a manufacturer and a consultant (with additional input from a contractor and auditor) about what really should be the prevailing criteria. It will include a discussion about what the published data means, how lab data compares to that found by testing in the field and what is required during an ABAA audit. Field application parameters based on the material testing criteria that are critical to the air barrier performance will be discussed. Insights from ABAA auditors will be shared about how to avoid this fight in the field and lessons will be shared. The entire conversation will be had around the premise of ensuring a well-installed, durable air barrier system without putting undo pressure onto installers by requiring them to meet unrealistic requirements.

Learning Objectives

- Describe the ABAA air barrier quality control requirements.
- Assess the difference between field testing data and what may be published on a manufacturers' data sheet.
- Contrast differences between material testing standards and actual field installation conditions and the impact to air barrier performance.
- Evaluate what will be acceptable pass/fail criteria for a given product before it is tested.

The story

1. Specify a material on the job based on a data sheet.
2. Install the material on the jobsite – how does that installation differ from what is done in the lab
3. QA/QC on the jobsite
 1. *ABAA Requirements*
 2. *Why might you get different data from the data sheet?*
 3. *Does 1 psi matter?*
 4. *What do we know from all of the ABAA Audits (Research Committee Data)*
4. What can we do to avoid any conflicts on the jobsite?

Common Data Sheet

Properties:

Fluid Applied Membranes



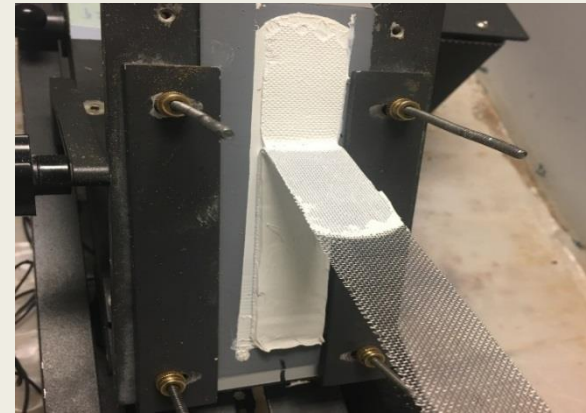
- Adhesion per ASTM D4541
 - *Concrete or mortar*
 - *Concrete block (CMU)*
 - *Exterior Gypsum*
 - *Metal*
- Air infiltration per ASTM E2178 and systems per ASTM E2357
- Water infiltration per ASTM E96 (either Method A or B or both)
- Wet Mil and/or Dry Mil thickness requirements

Common Data Sheet Properties: Self-Adhered Membranes

- Adhesion per ASTM D4541 (and/or D903, D1876)
 - *Concrete or mortar*
 - *Concrete block (CMU)*
 - *Exterior Gypsum*
 - *Metal*
- Air infiltration per ASTM E2178 and systems per ASTM E2357
- Water infiltration per ASTM E96 (either Method A or B or both)
- Self-sealability per ASTM D1970

And Accessory Products

- Fluid applied flashing
 - *Usually tested like a fluid applied membrane, especially in the field*
- Self-adhered flashing
 - *Usually tested like a self-adhered membrane*
- Sealants
 - *Adhesion testing done very differently in the lab vs. the field*





Why is the data sheet different?

- Lots of properties that are important for specification and differentiation but are not able to be tested in the field
 - *Good example: water vapor transmission rate*

- Some properties are tested with more consistency in a lab setting when using different test methods than are able to be done in the field
 - *Example: peel adhesion is done per a test method with equipment at a steady rate vs. a hand pull in the field*

DUPONT™ TYVEK® COMMERCIAL SOLUTIONS

DUPONT™ TYVEK® FLUID APPLIED WB+™

FOR USE IN RESIDENTIAL DEVELOPMENTAL COMMERCIAL WALL SUBSTRATES INCLUDING CONCRETE AND GYPSUM SHEETING



PRODUCT INFORMATION—FEATURES/BENEFITS

Air and Water Barrier Performance

- Offers an ideal combination of air and water holdout with vapor permeability.
- Air Barrier Association of America evaluated to exceed ABAA, ASHRAE 90.1 and IECC air leakage requirements when tested in accordance with ASTM E2357.

Ease of Installation

- Single component, one-coat application.
- Offers 2 to 3 times the coverage of competitive products. Approximately 60 to 85 sq. ft. per gallon coverage on smooth, dry substrates under ideal conditions.
- Comes in a roll for fast and easy application.
- Temperature range 25°F ambient (-4°C) to a maximum surface temperature 140°F (60°C). Do not install once ambient temperature exceeds 95°F (35°C), unless surface is shaded.
- Cracking and pin holing.

High Performance Durability

- The formulation of Tyvek® Fluid Applied is not water soluble and will not wash off the wall when exposed to liquid water, even before curing.
- DuPont™ Tyvek® Fluid Applied WB+™ can be installed on damp surfaces which is defined as when no moisture is transferred to the skin when the substrate is touched.
- The cured membrane exhibits exceptional elongation and recovery properties. When stretched it acts like a rubber band allowing the membrane to move with the building.
- Withstands 9 months of UV exposure.

Sustainable Solutions

- DuPont™ Tyvek® Fluid Applied products may contribute toward LEED® points in the areas of Energy and Atmosphere (EA): Optimizing the Building Envelope and Indoor Environmental Air Quality (EQ): Construction IAQ Management Plan and Low Emitting Materials. In addition, the use of a continuous air barrier is a prerequisite for LEED applications requiring compliance with ASHRAE 90.1-2010.

- By helping to effectively seal the building envelope and reducing air leakage, the DuPont™ Tyvek® Fluid Applied system helps reduce the amount of energy required for heating and cooling.
- Low VOC, < 2% (by wt.)

Complete System

- Part of a complete, integrated fluid applied weather barrier system, all backed by a limited warranty from DuPont. For best results, use with DuPont™ Tyvek® Fluid Applied Flashing & Joint Compound and DuPont Sealant for Tyvek® Fluid Applied System.

DESCRIPTION

This product is a single component, fluid applied weather barrier system based on a unique formulation using advanced technology. It offers low shrinkage during curing, superior elongation and recovery and can be easily applied in one coat.

TYPICAL PROPERTIES

Please contact your local DuPont™ Tyvek® Specialist before writing specifications around this product. Product properties are as follows:

Test Method	Property	Typical Value	Units
	Solids	99	%
	Skinover Time 45% RH, 70 deg F	1.5	Hrs
ASTM E2178	Air Penetration Resistance	0.0002	cm³ / ft² @ 75 Pa (1.57 gr/s)
Burling Hill Test 1.500	Air Penetration Resistance	>10,000	cc / 100 sq. ft.
	Wall Assembly Air Penetration Resistance	<0.01	cm³ / ft² @ 75 Pa
ASTM E283	Wall Assembly Air Penetration Resistance	<0.01	cm³ / ft² @ 75 Pa
ASTM E1677	Wall Assembly Air & Water Leakage	Type I	Type
AATCC 127	Water Penetration Resistance	>1000	cm
ASTM E331	Water Penetration Resistance	No Leakage	Tested to 15 psi
ASTM E910	Water Vapor Transmission	22 @ 25 mils Thick	Method B Perms
ASTM C1305	Low Temperature Crack Bridging	PASS	No Cracking @ 25 mil Thickness
ASTM D4541	Adhesion Strength – Concrete	>33	psi
ASTM D4541	Adhesion Strength – Exterior Gypsum (laminates fiber glass top sheet)	>25	psi
ASTM D803	Peel Strength	13 Cohesive Failure	lb/ in (laminates)
ASTM C794	Adhesion - in - Peel	PASS	lb/ in (mortar)
ASTM D412	Tensile	140	psi
ASTM D412	Elongation at Break	325	%
ASTM D412	Recovery (held at 300% elongation)	96	%
ASTM D2240	Hardness	34	Shore A

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What is done in the lab for sample testing?



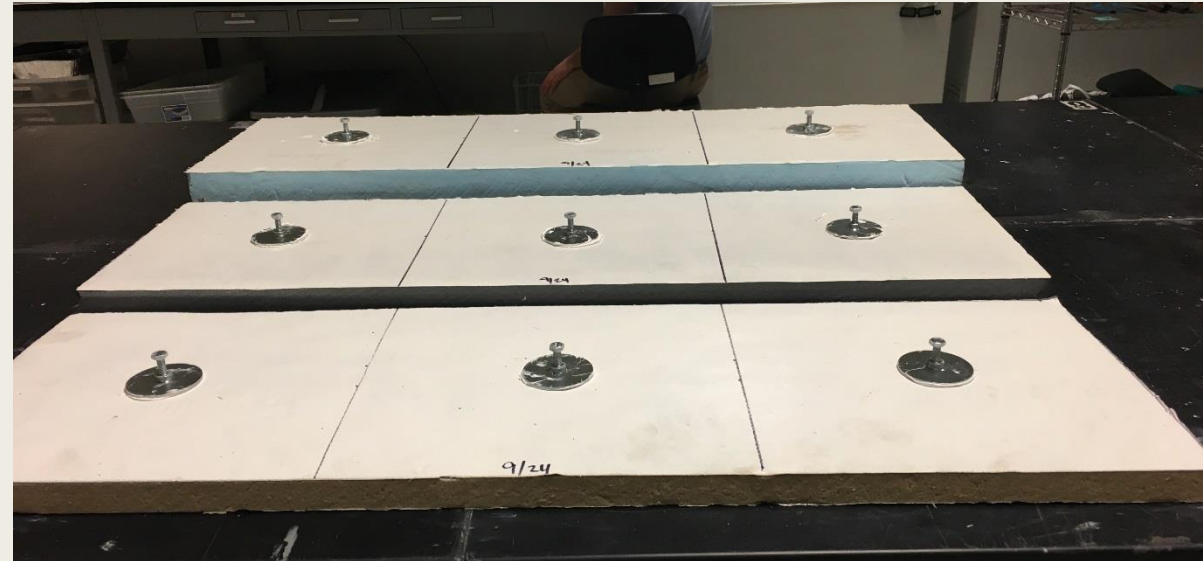
- Everything is cleaned – clean, dry, frost-free (unless the test method says differently)
- Substrates are exact
 - *There is a precise formula on how to make mortar for lab testing*
 - *All exterior gypsums behave differently*
- Requirements for time and conditions of material aging and curing
- Most samples are made and cured on a horizontal surface

ASTM D4541

- Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- Includes 5 test methods based on tester type
- Allows for choice within range for speed of pull
- Requires the user to choose the appropriate adhesive to attach the test buttons
- No clear definition for size of the test button other than what the tester can take

ASTM D4541

- Variables not typically mentioned in test reports or on summary data sheets
 - *Apparatus Type*
 - *Adhesion Tester “Puck” Size*
 - *Rate of pull*
- Failure Mode
 - *Substrate*
 - *Adhesive to Substrate or puck*



Critical Variables of Adhesion Testing

- Material application
 - *Draw down samples, sprayed samples, roll applied samples*
- Cure of material and adhesive
- Orientation of tested area
- Substrate!

ABAA QA/QC Requirements for Audits

Installer/Contractor - Daily

- Visual inspection of membrane
- Visual inspection of transitions
- For Fluid Applied Membranes (FA):
 - *Thickness*
- Adhesion

ABAA QA/QC Requirements for Audits

Auditor – minimum 1 per project

- Visual inspection of substrate, membrane, transitions
- For Fluid Applied Membranes (FA):
 - *Thickness*
- Adhesion

Is there an adhesion minimum
in the auditor's guidelines?
What else should we add about
ABAA's requirements?

Lab vs Field Testing

- Air barrier, sealant, flashing, SA vs Fluid
- D4541
- Substrate differences – standardized substrates
 - *Concrete, CMU, exterior gypsum variances*
 - *Cleaned before application of material in the lab*
- Cure conditions
- Cure time (both of material and primer.... Dirt pickup during primer cure)
- Application method – can be differences between sprayed material, rolled material (for FA), back rolled sheet

Field inspection is more than adhesion

- Overall condition and quality of installation
 - *Fish-mouths, substrate repairs, bug holes*
- Transitions between substrates and building systems
 - *Accessory products*
 - *Transitions between accessory products and main air barrier*
- Installation Guidelines met
 - *Temperature*
 - *Substrate moisture*

What does an auditor REALLY look for?

John to add
content

Common issues found by auditors when it comes to adhesion

John to add
content

Example

John – Add a general example of when you ran into the issue of “what the pass/fail criteria” should be in the field – and how it was ultimately resolved (or could/should have been resolved)

Does 1 psi matter?

- Know the error in the equipment
 - ABAA Standard calls for 0.5% accuracy = 0.08 psi when measuring 16 psi...
 - Maximum adhesion strength in ABAA audit study = 80 psi. 0.5% is 0.4 psi.
 - 1 psi does make a difference. But when measuring to 1 or 2 decimal places, accuracy can come into question.
-
- ASTM D4541 Accuracy Statement

So, what is the right criteria?

- Most manufacturers work off the industry minimum of 16 psi for air barrier adhesion
- If the **authorizing authority** determines it should be greater, it needs to be discussed with all parties prior to installation of material
 - *May change required substrate preparation methods*
- Compatibility and if it affects the physical properties of the material should be commented on by the manufacturer

How do we avoid this fight?

- Before the start of installation, define the quality control requirements for all materials – including test methods, frequency of tests and pass/fail requirements if they are different from industry standard
- Determine who is going to be performing the testing: auditor, consultant, manufacturer
- Determine who determines if it is ok if test is borderline

HOW CAN ABAA HELP?

- Audit Data – Summarized by the Research Committee
- Test Method Development
 - *Provide clarity and remove variability of D4541*

What did we learn from our own adhesion testing data?

- Over 27,000 data points
- 33 manufacturers
- 67 total air barrier materials
 - *Includes Fluid Applied, Self-adhered and SPF*
- 89 different substrates

Failure Modes

- 8% substrate failure
- 12% failure between disk and substrate
- 80% failed either between the air barrier and the substrate or within the substrate at high loading

Substrates vary...

CMU

Concrete

Gypsum

Plywood

Sorted by air barrier material

Removed Data with only 1 specimen

- 139 Data Points
- All 4 substrates had a high percentage (>75%) of materials with lowest adhesion test values below ABAA minimum
- Plywood had the highest variability in results within same AB material
 - *Followed by CMU*
 - *Concrete & Gypsum were about the same*

What do we not know?

- Was the testing impacted by cure times?
- Variability within the subset category
 - *Each exterior gypsum has its own facer*

AABA 0002-2019

Based on ASTM D4541

- Disk size = 2.25"
- 3 pulls in 1 m² = 1 test
- Rate of ½ revolution per 5 seconds or 58 psi/m
- Average 3 results
- “Disregard tests with failures other than substrate/material or cohesive failure within material.”

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