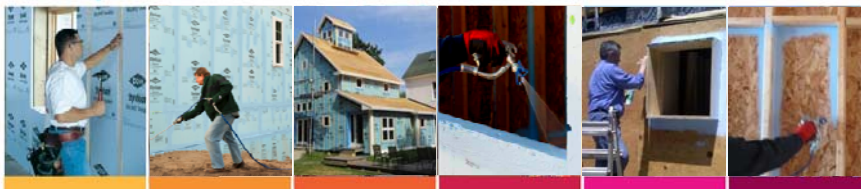




**Building Solutions**



# Smart Flashing Solutions for Exterior Insulation Sheathing



**Linda Jeng and Dan Tempas**

02/2015

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## ■ Learning Objectives

1. Understanding of different flashing options to meet code requirements
2. Understand testing and performance requirements
3. Recognize typical flashing products and techniques today, and understand advantages and disadvantages.
4. Understand factors which lead to more effective and efficient flashing from a builder's perspective and reduce call backs.

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## ■ Agenda

- Introduction
- Code Requirements
- Applications:
  - Flashed Window and Door Openings
  - Taped Insulating Sheathing Drainage Plane
- Current Flashing Options
- What is New
- Making the Wise Choice
- Summary
- Q&A


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## Introduction


Why Use HERS Rater: Help build and market the more EE Home

- Comprehensive water management system is associated with durability
- Part of Energy Star Rated Home Checklist
- Raters can expand service to include Energy Star water management checklist
- 84,695 ENERGY STAR certified homes built in 2014
- 114,432 HERS rated SF in 2014




**ENERGY STAR® Certified Home Features**  
Energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA)

### A COMPLETE WATER MANAGEMENT SYSTEM




**REDUCED LEAKS AND DRAFTS**

Comprehensive air sealing, quality-installed insulation, and high performance windows and doors minimize warm and cold spots.



**MORE CONSISTENT TEMPERATURES**

A high efficiency heating and cooling system, designed and installed for optimal performance, ensures better comfort in every room, year-round.



**BETTER DURABILITY**

A comprehensive water management system, including flashing, moisture barriers, and heavy-duty membranes, protects roofs, walls, and foundations from moisture damage.

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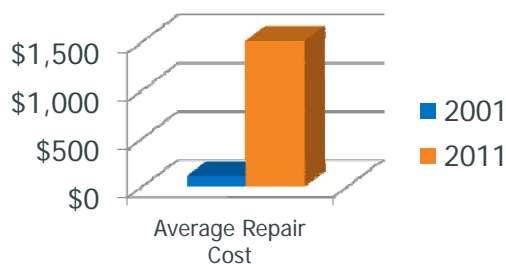
## Introduction



**#1 Repair Cost from water management\***

### Builder Survey

- ❑ 2011 Informal Survey of Production Builders of 27,000 Homes participating in Building America Project
- ❑ Cost of repairs increased 10x largely due to expense of water management issues

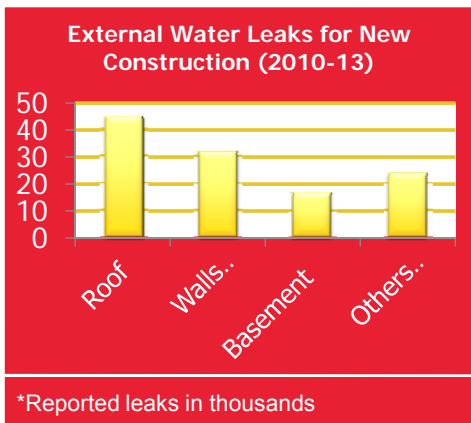


\*Source: Guidance on Taped Insulating Sheathing Drainage Planes, A. Grin, J. Lstiburek, Building Science Corporation, Building America Report, Dec., 2012

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## Introduction



### 2013 American Housing Survey

Released Oct., 2014

- Water leaks from walls, window and doors:
- 33% of all exterior leaks within yr
- 2<sup>nd</sup> most likely source
- **Pays to get it right 1<sup>st</sup> time!**

## Introduction

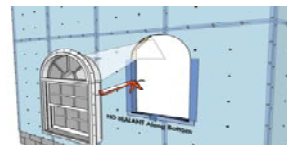
- Installed cost of taped insulating sheathing ≈ to Installed cost of HW
- Taped insulating sheathing = WRB
- Potential added benefit from air sealing efficiency
- Focus on 2012 IECC ci compliant systems

### 2011 Building America Builder Survey\*

\*Source: Guidance on Taped Insulating Sheathing Drainage Planes, A. Grin, J. Lstiburek, Building Science Corporation, Building America Report, Dec., 2012



HW as WRB



Insulation as WRB

## Introduction

Current Residential Building Energy Code Adoption Status

10	IECC 2012, equivalent or more energy efficient	29	IECC 2009, equivalent or more energy efficient	5	IECC 2006, equivalent or more energy efficient
3	IECC 2003, equivalent or less energy efficient	9	No Statewide Code		

\* Adopted new Code to be effective at a later date  
As of January 2015

### 2012 IECC

- 10 states adopted
- Climate Zones 1-2
  - R13
- Climate Zones 3-5
  - R13+R5 or R20
- Climate Zones 6-8
  - R13+R10 or R20+R5


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## Introduction

### IRC R703.1 General

Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include **flashing** as described in Section R703.8.

- Critical component of controlled water drainage in a building
- As early as 1832, builder books reference use of lead flashing
- Flashing can be exposed or concealed
- Historical material used for flashing includes:
  - **Metal:** lead, aluminum, copper, stainless steel, zinc alloy etc.
  - **Flexible flashing:** rubberized asphalt, butyl rubber and acrylic



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## Code Requirements

### IRC R703.8 Flashing

Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711.



- ❑ The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at all of the following locations:
  1. **Exterior window and door openings.**
  2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
  3. Under and at the ends of masonry, wood or metal copings and sills.
  4. Continuously above all projecting wood trim.
  5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
  6. At wall and roof intersections.
  7. At built-in gutters

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## Agenda

- ❑ Introduction
- ❑ Code Requirements
- ❑ **Applications:**
  - Flashed Window and Door Openings
  - Taped Insulating Sheathing Drainage Plane
- ❑ Current Flashing Options
- ❑ What is New
- ❑ Making the Wise Choice
- ❑ Summary
- ❑ Q&A

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## Window and Door Basics

U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

**Building America Solution Center**

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EERE • BTO • Building America • Solution Center • Guides

Solution Center Home Help

FIND YOUR TOPIC BY:

Building Components  
Guides A-Z  
ENERGY STAR Certified Homes  
Zero Energy Ready Home

FIND RESOURCES:  
References and Resources  
CAD Files  
Image Gallery  
Case Studies  
Optimized Climate Solutions

FIND PUBLICATIONS:  
Building Science Publications

**Fully Flashed Window and Door Openings**

Please [Register](#) or [Login](#) to Provide Feedback.

Home | [Home](#) | [CAD](#) | [Compliance](#) | [More info.](#)

Scope Description Ensuring Success Climate Training CAD Compliance More info.

**Scope**

Water Managed Above Grade Wall Assembly

A. Install pan flashing at sills.  
B. Install window or door.  
C. Install side flashing that extends over the pan flashing.  
D. Install top flashing that extends over the side flashing.



**ENERGY STAR Notes:**  
Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing; side flashing that extends over pan flashing; and top flashing that extends over side flashing or equivalent details for structural masonry walls.

Last Updated: 08/15/2013

### Water Managed Above Grade Wall Assembly:

- Install pan flashing at sills.
- Install window or door.
- Install side flashing that extends over the pan flashing.
- Install top flashing that extends over the side flashing.

### ENERGY STAR Notes:

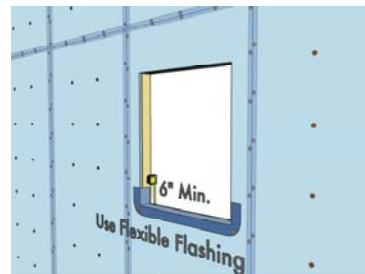
Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing; side flashing that extends over pan flashing; and top flashing that extends over side flashing or equivalent details for structural masonry walls.

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## Window and Door Basics

- AAMA 2400:** Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction
- 5.3 Flashing Requirements**
- Proper flashing and/or sealing is necessary as a barrier to prevent water from infiltrating into the building. **Flashing and/or an appropriate method of sealing shall be designed as a part of an overall weather resistant barrier system.** It is not the responsibility of the window manufacturer to design or recommend a flashing system appropriate to each job condition.



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## Window OEM Installation Instructions



### PREPARING FOR NAIL FIN WINDOW INSTALLATION

**YOU WILL NEED TO SUPPLY:**

- Moisture resistant shims/spacers
- Fasteners (see nail fin anchor instructions at the end of this booklet)
- Closed cell foam backer rod/sealant backer
- #10 x 2" Corrosion-resistant screws (See Anchor Table for use)
- Pella® SmartFlash™ foil backed butyl window and door flashing tape or equivalent
- Low expansion, low pressure polyurethane insulating window and door foam sealant DO NOT use high pressure or latex foams.
- Pella Window and Door Installation Sealant or equivalent high quality, multi-purpose sealant

*Other construction materials may be required. Read and understand the instructions and inspect the wall conditions before you begin.*

### Flashing tapes:

- Butyl adhesive flashing with foil or polymer backer film
- Synthetic adhesive based flashing
- Asphalt adhesive based

### Construction tapes:

- Acrylic adhesive based

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## Window OEM Installation Instructions



### PELLA INSTALLATION INSTRUCTIONS

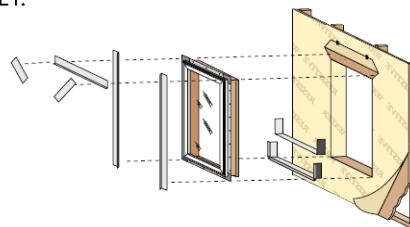
#### Nail Fin, Nail Fin with J-Channel and EnduraClad Exterior Trim with Nail Fin Windows

THE FOLLOWING INSTALLATION METHODS ARE INCLUDED IN THIS BOOKLET:

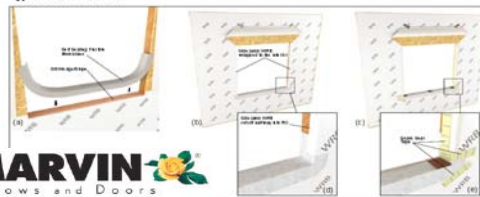
New Construction Installation After Building Wrap for Nail Fin Windows

### Most best practices include:

1. Rough opening Sill flashing (recommend sloped)
2. Jam flashing
3. Header flashing



Type III Sill Pan Flash



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## Window Water Management Challenge

- ❑ Water gets behind the cladding and HW



< 1 cm water  
~ 2 psf  
~ 28 mph wind

## Building America Solution Center

Scope	Description	Ensuring Success	Climate	Training	CAD	Compliance	More Info.
-------	-------------	------------------	---------	----------	-----	------------	------------

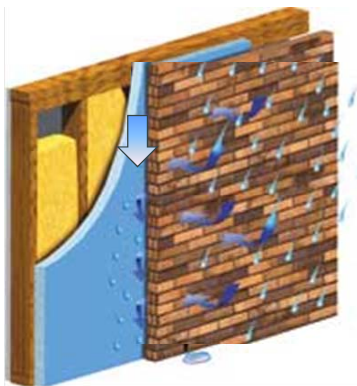
### Training

#### Right and Wrong Images



## Taped Sheathing as WRB

"The lowest cost, highest performing rainwater management strategy is rigid polymeric foam sheathing with sealed joints. (Lstiburek 2006, 2010, 2012)"



- ❑ Taped rigid foam systems are code compliant WRB per ASTM E331, water leakage test
- ❑ Performance depends on:
  - ❑ Material durability (tape)
  - ❑ System (drainage plane) durability



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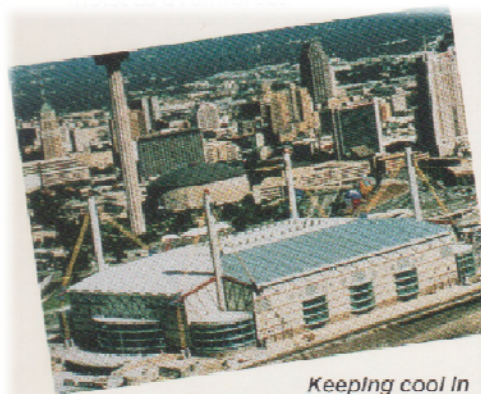
## Drainage Plane / Foam Durability

What do we know?

- ❑ **Foam insulation is stable and persistent**
  - 99% of the opaque wall surface area already proven and has lasted
  - Available thermal warranties



Alaska Pipeline  
1974-1977



Keeping cool in another harsh environment.  
The Alamodome, San Antonio, Texas.

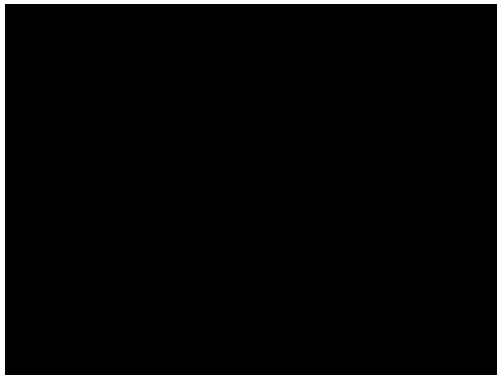
Alamodome, TX, 1993  
65, 000 seat stadium

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## Window Water Management Challenge

- ❑ Harder for water to get behind the cladding and rigid foam (gasketing effect)



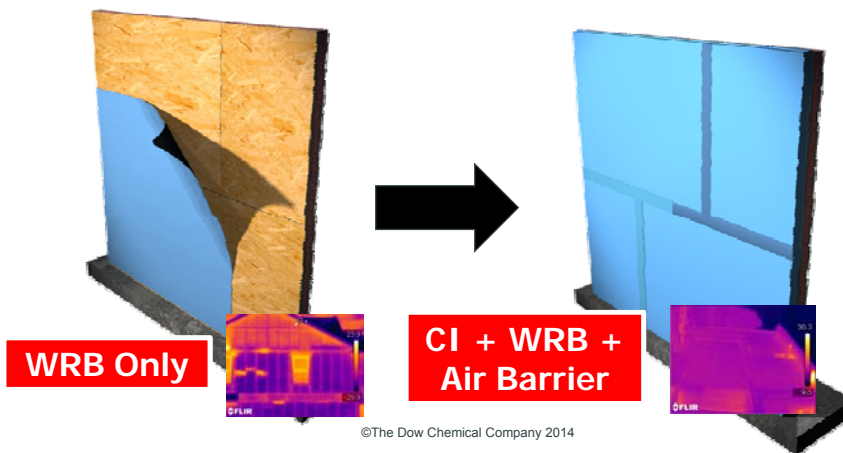
< 1 cm water  
~ 2 psf  
~ 28 mph wind

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## Taped Foam Sheathing System

- ❑ Exterior Sheathing IS Air & Water Barrier
  - For example, rigid foam sheathing
- ❑ Sealing Joint Areas Creates Full Air & Water Barrier



### Best Practice:

- ❑ Minimize Horizontal joints
- ❑ Use superior materials
- ❑ Inspect

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## ■ Agenda

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## ■ Current Flashing Options



### Good: Thin Construction tape

- Acrylic adhesive based
- Available in wide widths up to 4"
- Reliable adhesion
- Have good temperature and UV resistance



### Better: Flashing Tape

- Butyl adhesive based preferred over rubberized asphalt
- Available in wide widths up to 9"
- More reliable adhesion. Cold flow.
- Have good temperature and UV resistance
- Facer and adhesive dimensional match (min fish mouth edge gaps)

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## **New Liquid Flashing Technology**

Fluid applied flashing can be:

- Modified acrylic latex or moisture cured STPE
- High viscosity (yogurt –like to paste-like) for gap bridging
- Good nail sealability
- Aged resistance
- Potential to be air and water barrier for building envelope
- Look for system testing approvals, such as ASTM E331 and ASTM E2357

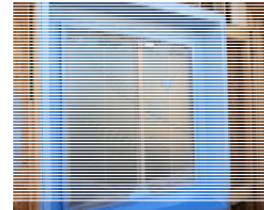


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## **Why *Liquid* Flashing**

- Conforms easily to any shape or texture
- Tolerant to wide range of assembly variations:
  - OSB, vinyl, CMU. Wood, brick, foam insulation, housewrap...
- Target area of the house most prone to water leakage
- No measuring or cutting of flashing
- Uniform “coat” after application
- Enables complex windows shapes, recessed windows and curved designs to be handled the same way as standard rectangular windows



***Already accepted in building codes and by window OEMs***

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## AAMA 200-09 Flanged Window Installation for Masonry

### •Specifies Liquid Applied Coating / Flashing...

6.3.3.2 When wood bucks are used, the exposed exterior face and the return surface of the jambs shall be coated with a liquid applied water resistive coating/sealant or a self-adhering flashing membrane per AAMA 711 to restrict liquid water from penetrating (see Photos 13 & 14).



Photo 13



Photo 14

The height of the coating on the return surface shall be a minimum of 150 mm (6 in) from the bottom edge. The coating shall be compatible and allow adhesion with the sealant applied to the back side of the flange later. The interior surface of the wood buck shall be left unsealed to allow drying to the interior.

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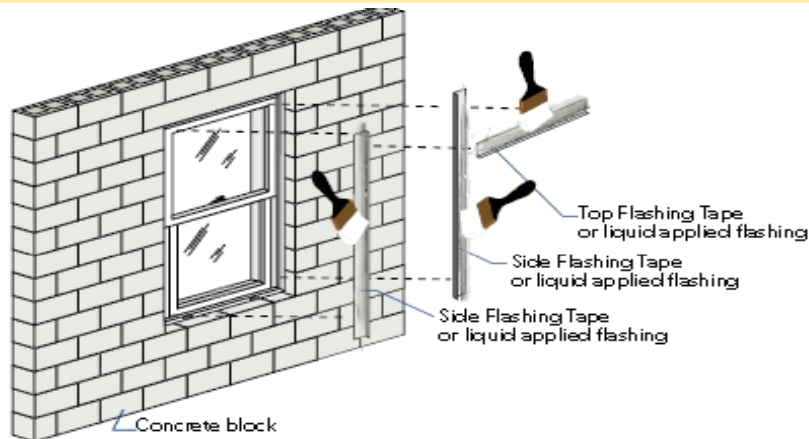
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## Window OEM

Pella already approves use of liquid coating / flashing with their windows



**NEW CONSTRUCTION INSTALLATION INTO MASONRY CONSTRUCTION** — FOR THE INSTALLATION OF NEW NAIL FIN WINDOWS INTO MASONRY OPENINGS WITH WOOD BUCKS (CONTINUED)



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## Window OEM

- ❑ Window Rough Opening Prep and Flashing allows for flexible membrane per ASTM E2112
- ❑ Cured liquid flashing is a flexible, elastic flashing which can be used as the flashing component and the seam seal tape referenced in the instructions



Type III Sill Pan Flash

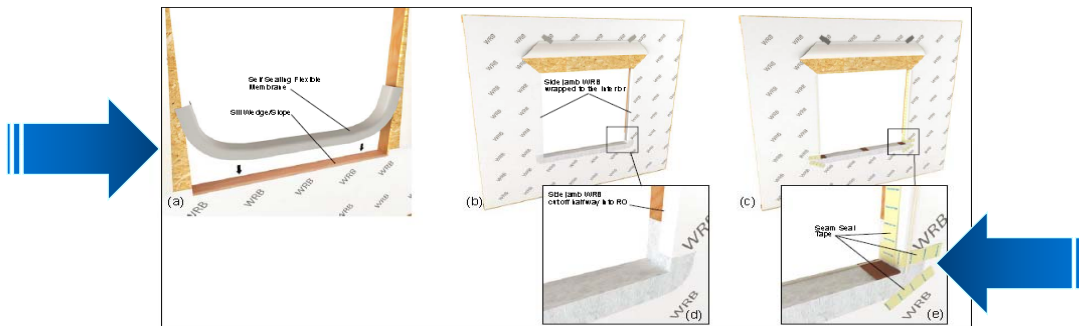


Figure 2 Type III Sill Pan Flash using a sill wedge and flexible membrane.

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## Agenda

- ❑ Introduction
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- ❑ **Making the Wise Choice**
- ❑ Summary
- ❑ Q&A

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## ■ Making the Wise Choice



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## ■ Making It Last...

Success and sustainability can be achieved through diligence in design and execution:

- Installation
- Performance Durability

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## ■ Installation

Construction process is under performance pressure from a variety of sources

- ❑ How easy is it to get the installation right?
- ❑ How efficiently and effectively are materials being used in the construction process for sustainable best practices?

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## ■ Installation – Tape



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## Installation – Liquid Flashing




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## Installation - Liquid Flashing

- ❑ Technology innovation to combine “caulk” fill and long term elastomer performance
- ❑ Spraying offers the best opportunity for labor savings



Window Flashing Step	Current Solid Flashing	New Liquid Flashing
Rough Opening – 3’ x 5’	3 min 25 s	44 s + 1 min touch-ups
Window Set-In Delay	None	1 to 1.5 hours (will vary)
Window Flange	2 min 41 s	2 min 11 s to 2 min 48s
Total Installation	10.5 min Note: Survey Avg 12.5 min	6 to 8 min (excludes drying time)

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## Long Term, Sustainable Performance

### No industry standard for predictive long term performance

- ❑ Factors which impact long term building durability and sustainability
  - ❑ U.V. Exposure
  - ❑ Seasonal temperature
  - ❑ Precipitation
  - ❑ Wind zone
  - ❑ Seismic Event
  - ❑ Site specific parameters
    - ❑ Ground movement / settling
    - ❑ Adjacencies – buildings etc.
    - ❑ Orientation
    - ❑ Shading
    - ❑ Installation
  - ❑ Facility Operations / Human Factor

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## Long Term Sustainable Performance

### Laboratory Techniques

- ❑ Accelerated weatherization testing
  - ❑ QUV Chambers
  - ❑ Weatherometers – impact of Temperature and humidity
    - ❑ Materials
  - ❑ Large Scale Stress Chambers
    - ❑ Racking tests (wall or building sections)
    - ❑ Temperature effects
    - ❑ Humidity cycling



60/21 Local Time w/o day saving	Global Irradiance @ 900nm (W/m <sup>2</sup> ·nm)			
	Direction	Sum	12pm	3pm
Central Arizona	South	0.284	0.157	0.284
	East	0.454	0.225	
	West		0.225	0.454
	North		0.321	
South Florida	South		0.382	
	East	0.445		
	West			0.445
	North		0.382	
Minneapolis	South		0.415	
	East	0.416		
	West			0.416
	North		0.384	

Source: Atlas CESORA. CESORA computes instantaneous ('single case'), as well as time-integrated ('diurnal variations', 'time series') spectral or broadband irradiance on surfaces of specifiable geometry exposed to solar radiation at selectable times and locations under precise meteorological conditions

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## ■ Long Term Sustainable Performance

### Real Time Exposure

- Test Fields
  - Industry
  - Research institution
  - Government Agencies



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## ■ Long Term Sustainable Performance

### Real Time Exposure

- Test Huts
  - Instrumented and research use



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## Building Sustainability Performance

### What do we know?

- ❑ Taped joints can hold



Building Science Corp.:  
"Stuck On You"  
April, 2013  
By: Joe Lstiburek

**Photograph 10: Fifteen Year Old Tape (left)** – This is my house. I took things apart at a few locations last summer to have a look at how things were working out. The tape, which is acrylic based, looks brand new and is sticking like it is brand new. The wood furring has aged, but not the tape. I am a believer. Wasn't that was a Monkey's hit recorded in 1966?

Source:

<http://www.buildingscience.com/documents/insights/content/bsi-067-stuck-on-you>

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## Building Sustainability Performance

### What do we know?

- ❑ Fluid applied seals are better

*"Several liquid (or fluid) applied rainwater management barriers could be used in place of tapes and other self-adhering membranes if applied correctly to increase the long-term durability and effectiveness of the rainwater management system..."*

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

### Water Management of Noninsulating and Insulating Sheathings

April, 2012

J. Smegal and J. Lstiburek  
Building Science Corporation



Source:

[U.S. Department of Energy, Office of Scientific and Technical Information Publication](#)

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## What if we used it inside?

- ❑ Take advantage of durable flashing and sealing technology and apply it to air sealing for long lasting energy savings
- ❑ *But is it better to have air barrier control layer inside or outside?*



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## Side-by-Side Comparison – Duplex Case Study

### Air Sealing Challenge:

Can sealing the exterior envelope only be as effective as sealing interior gaps and cracks?

### Construction and Procedure:

- ❑ 1" XPS sheathed duplex
- ❑ Blower Door test baseline after drywall
- ❑ Total Duct Leakage after duct sealing
- ❑ One blower test only after drywall stage



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## Side-by-Side Comparison – Duplex Case Study

### Spray Foam Cavity vs. Liquid Flashing: Cavity interior air sealing vs. simple exterior air sealing

Target Area	REF Unit – SPF Cavity	Unit – Interior Liquid Flashing	Unit – Exterior Liquid Flashing
Exterior Sheathing	OSB/XPS/Tape	OSB/XPS/Tape	XPS/LF Joints
Cavity Insulation	2# SPF	LF + FG	FG
Window Flashing	Sill Pan	Sill Pan	Sill Pan
Attic Insulation	Sprayed cellulose	Sprayed cellulose	Sprayed cellulose
Stud to Stud Interface	Latex Caulk	Not Done	Not Done
Blower Door (cfm)	755	695 (-7.3%)	853 (+13%)
ACH50	1.9	1.8	2.0
HERS	63	64	62

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## Side-by-Side Comparison – Duplex Case Study

**Summary:** XPS/LF and Cavity FG/LF are effective air barrier options comparable to Cavity SPF as best in class.

Note: Less linear feet when air sealed from exterior.



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# Summary

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## Summary

- Properly flashed windows is worth the time and expense. We know HOW.
- Highest performing rainwater management strategy is foam sheathing with sealed joints
- Help the builder and installer choose wisely for both the short term (install) and long term benefit (durable)



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## ■ Review Learning Objectives

1. Understanding of different flashing options to meet code requirements
2. Understand testing and performance requirements
3. Recognize typical flashing products and techniques today, and understand advantages and disadvantages.
4. Understand factors which lead to more effective and efficient flashing from a builder's perspective and reduce call backs.

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## ■ References

### Wall Solutions

[www.AirSealWithDow.com](http://www.AirSealWithDow.com)

[www.DowBuildingSolutions.com](http://www.DowBuildingSolutions.com)

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# **Thank You**

Please take a moment to complete the survey for CEU confirmation.

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