Rainscreen Technology for Residential Applications

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AIA Learning Credits: 1.0 LU/HSW
RAiNA AIA Provider #: 502111378
Course #: RESAPP2021

RAiNA
RAINSCREEN ASSOCIATION IN NORTH AMERICA

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Provider #: 502111378
Course ID: *RESAPP2021*

Presenter Bio

Peter Barrett
BA (Hons), MBA
Dörken

Peter Barrett is the Product & Marketing Manager for Dörken Systems Inc., and has been with the company for over 16 years. His involvement with the design community and building materials industry spans over 30 years. Peter earned a BA (Hons.) from Queen's University and an MBA from Wilfrid Laurier University. He currently serves on the Board of Directors for the Air Barrier Association of America (ABAA), chairs the Audit Committee, and as Co-Chair of the RAiNA Residential Rainscreen Committee. Peter has also contributed technical articles to The Construction Specifier, Construct Canada, Tunnel Business, and Masonry Magazine.

Presenter Bio

Keith Lolley

Advanced Building Products

Keith has been working in the construction industry at Advanced Building Products for the past 25 years. Over the years Keith has been highly active in the sales, marketing, product development and manufacturing of various moisture protection products. From flashings to drainage and ventilation mats, Keith has collaborated closely with designers, distributors, installers, and large corporations in both commercial and residential construction. Keith held the position of chairperson for the Building Enclosure Moisture Management Institute (BEMMI) and is a past co-chairman for the residential division of RAiNA, which is the Rainscreen Association in North America. Here Keith has collaborated with a team to design an accredited AIA Presentation and installation details to better educate the building community. Keith holds a Bachelor of Science Degree from Southern New Hampshire University.

Learning Objectives

- Understand the term rainscreen and how it applies to residential wall applications
- Identify the hazards and risks caused by moisture intrusion
- Understand the various sources of moisture
- Explore how utilizing rainscreen technology greatly increases the durability of residential wall construction and reduces risks
- Understand the role RAiNA plays in supporting the building industry

Creating Space

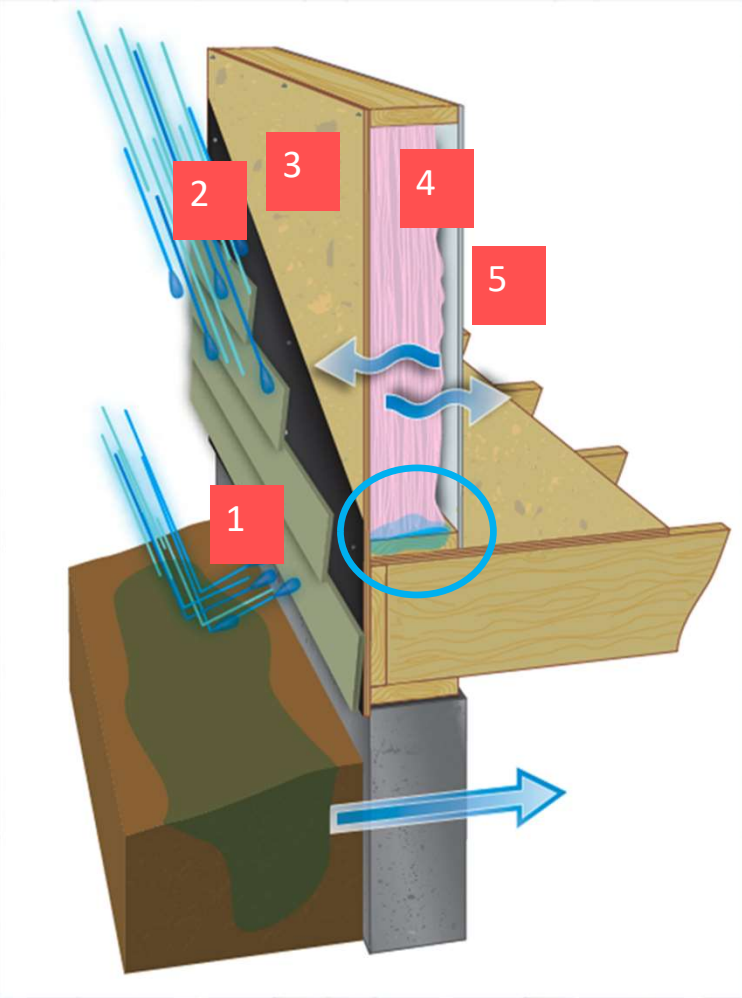
It's learned at an early age

- Spread out
- Good things happen

- Bunch together
- Ineffectiveness happens

Typical Residential Walls

1. Exterior cladding
2. Water-resistive barrier
3. Sheathing (continuous insulation)
4. Structural framing, cavity insulation
5. Interior finish materials



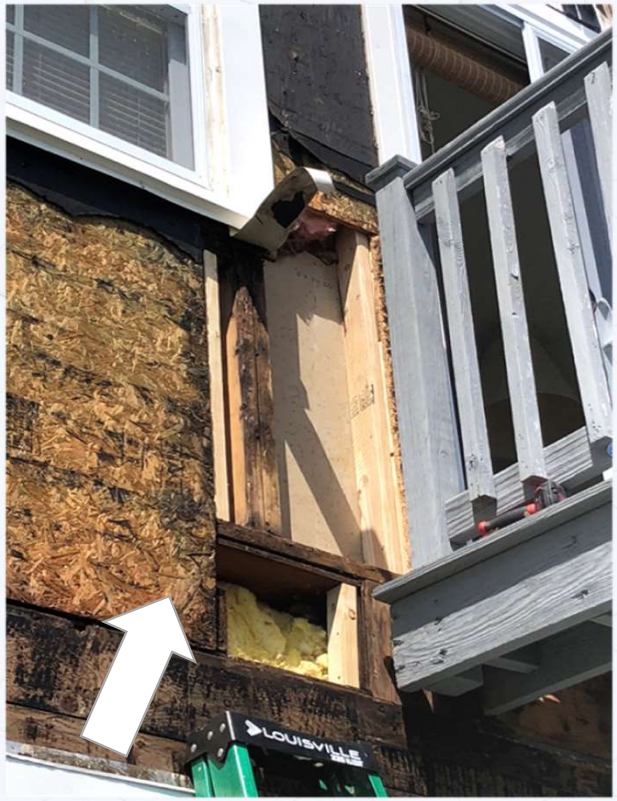
Did You Know?

- An EPA study* of 100 buildings found:
  - 85% of the buildings were damaged by moisture
  - 45% currently had leaks
- 90% of failures in wall systems are from moisture
- Trapped moisture is the primary cause

*EPA Publication 402-F-13053 – Moisture Control Guidance for Building Design, Construction & Maintenance

Case Study

Cape Cod, MA



Case Study

Cape Cod, MA

Coastal house

Numerous nail penetrations

Case Study

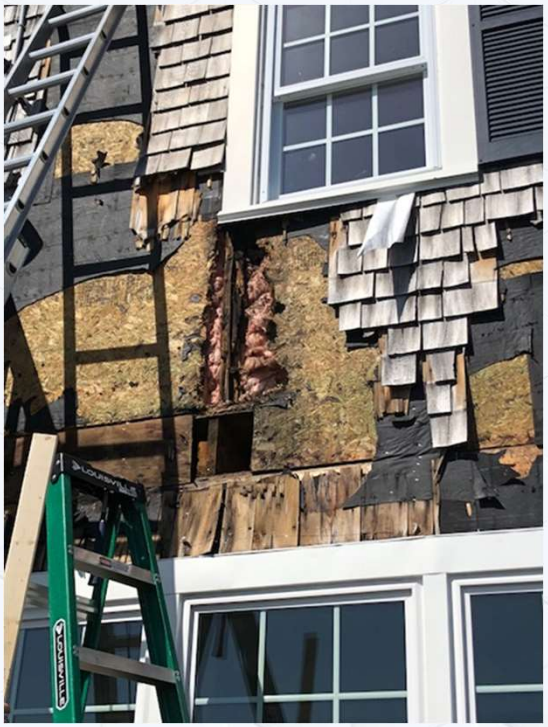
Cape Cod, MA

Sill plate damage in basement

Remediation Cost

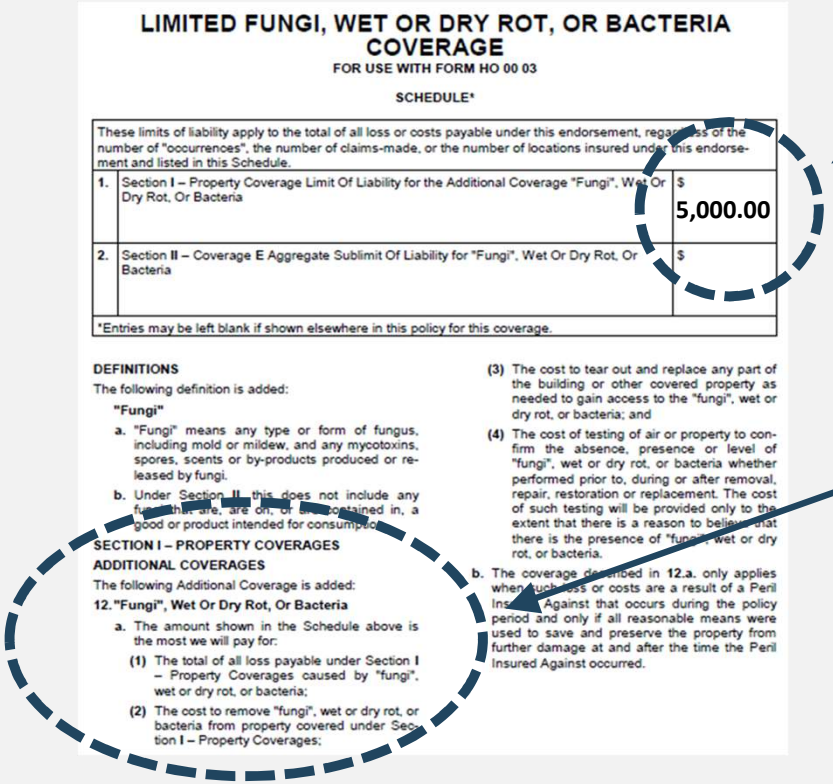
Residential Case Study- Cape Cod, MA

	$/SF	$/2000 SF
Demo & Disposal	$ 2.00	$ 4,000
Framing & Facia	$ 30.00	$60,000
Installation	$ 1.75	$ 3,500
Shingle, Trim, & Paper	$ 10.00	$20,000
Sheetrock	$ 2.20	$ 4,400
Paint (interior walls & ceiling)	$ 3.50	$ 7,000
Total Remediation SF	**$ 49.45**	
Total Remediation House		**$98,900**



Remediation Insurance Support

Residential Case Study- Cape Cod, MA



LIMITED FUNGI, WET OR DRY ROT, OR BACTERIA COVERAGE

FOR USE WITH FORM HO 00 03

SCHEDULE*

These limits of liability apply to the total of all loss or costs payable under this endorsement, regardless of the number of "occurrences", the number of claims-made, or the number of locations insured under this endorsement and listed in this Schedule.		
1.	Section I – Property Coverage Limit Of Liability for the Additional Coverage "Fungi", Wet Or Dry Rot, Or Bacteria	$ 5,000.00
2.	Section II – Coverage E Aggregate Sublimit Of Liability for "Fungi", Wet Or Dry Rot, Or Bacteria	$

*Entries may be left blank if shown elsewhere in this policy for this coverage.

DEFINITIONS

The following definition is added:

"Fungi"

a. "Fungi" means any type or form of fungus, including mold or mildew, and any mycotoxins, spores, scents or by-products produced or released by fungi.

b. Under Section II, this does not include any fungi that are, are on, or are contained in, a good or product intended for consumption.

SECTION I – PROPERTY COVERAGES

ADDITIONAL COVERAGES

The following Additional Coverage is added:

12. "Fungi", Wet Or Dry Rot, Or Bacteria

a. The amount shown in the Schedule above is the most we will pay for:

(1) The total of all loss payable under Section I – Property Coverages caused by "fungi", wet or dry rot, or bacteria;

(2) The cost to remove "fungi", wet or dry rot, or bacteria from property covered under Section I – Property Coverages;

(3) The cost to tear out and replace any part of the building or other covered property as needed to gain access to the "fungi", wet or dry rot, or bacteria; and

(4) The cost of testing of air or property to confirm the absence, presence or level of "fungi", wet or dry rot, or bacteria whether performed prior to, during or after removal, repair, restoration or replacement. The cost of such testing will be provided only to the extent that there is a reason to believe that there is the presence of "fungi", wet or dry rot, or bacteria.

b. The coverage described in 12.a. only applies when such loss or costs are a result of a Peril Insured Against that occurs during the policy period and only if all reasonable means were used to save and preserve the property from further damage at and after the time the Peril Insured Against occurred.

- Only **$5,000.00** was covered

SECTION 1- PROPERTY COVERAGES

ADDITIONAL COVERAGES

The following Additional Coverage is added;

12. "Fungi", Wet or Dry Rot, or Bacteria

a. The amount shown in the Schedule above is **the most we will pay for:**

(1) The total of all loss payable under Section 1-Property Coverages cause by "fungi", wet or dry rot, or bacteria;

(2) The cost to remove "fungi", wet or dry rot, or bacteria from property covered under Section 1-Property Coverages;

Pacific Northwest

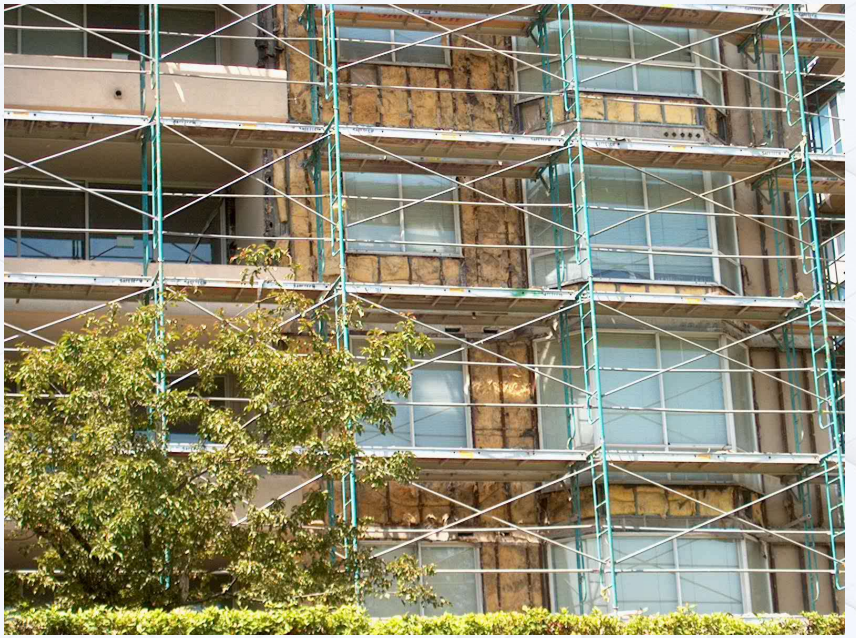
$100 Per Sq. Ft. Restoration

Pacific Northwest

$100 Per Sq. Ft. Restoration project over 10 years old

Pacific Northwest

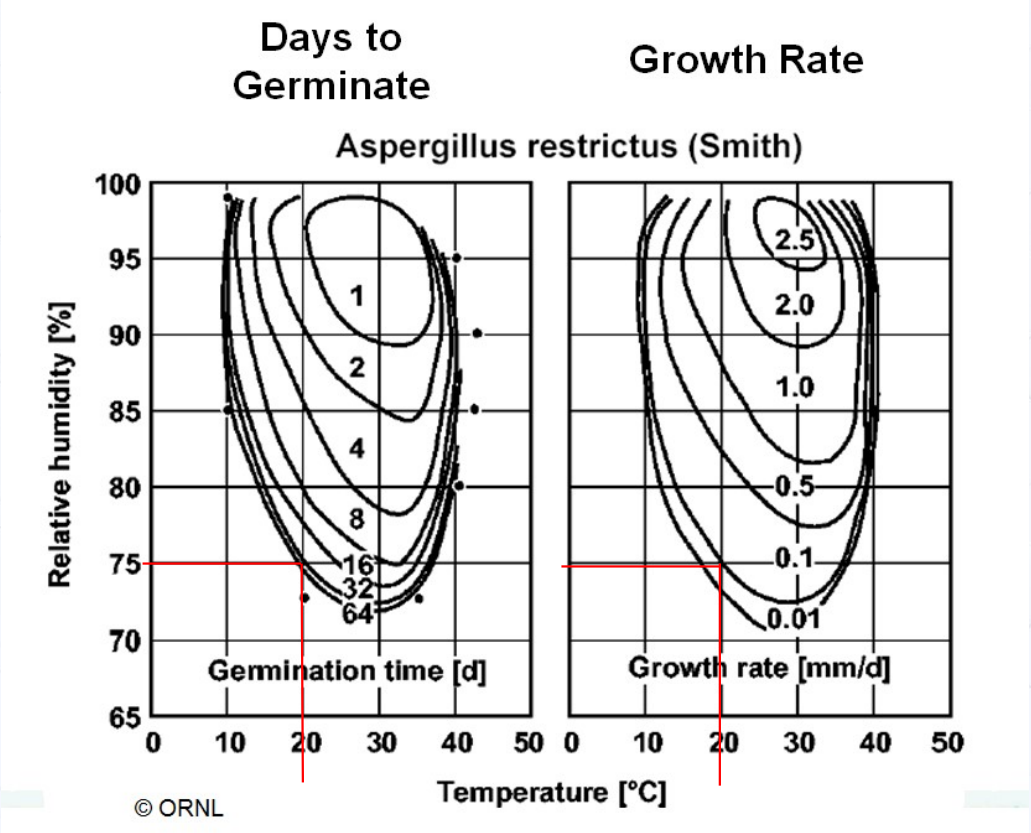
$130 Per Sq. Ft. Restoration project over 10 years old



Relatively New Construction

Mold Growth Rates

- Mold can colonize in 3-12 days
- Mold can be visible in 18-21 days
- When building materials get saturated, there is a **48 -72 hour window** for drying before the mold cycle begins



Builder Liability?

- Varies state to state
- Average 6 month to 2 years
- California for example
  - 4 years for defects
  - 10 years for latent defects

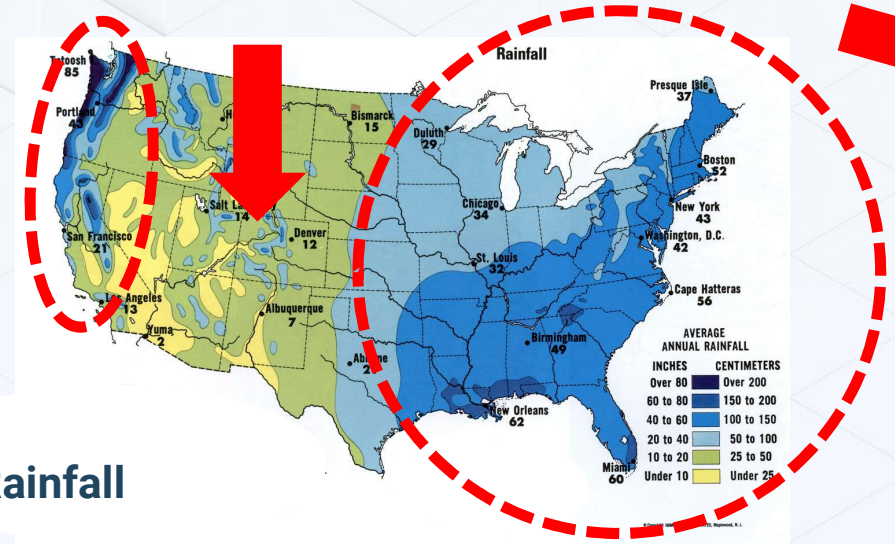
Ask Yourself Three Questions

A. **Geography/Climate** – where is the project being built?
B. **Cladding Material** – absorptive or non-absorptive?
C. **Wall Designs** – what measures of protection are being utilized?

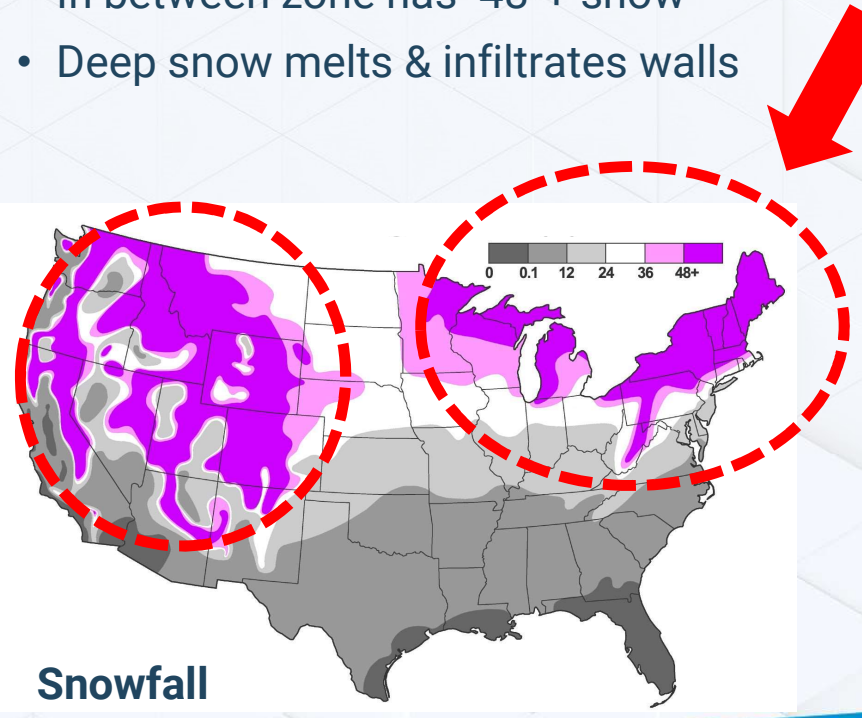
Geographical Considerations

- Rainscreens recommended in areas exceeding 20” of annual rainfall

- Need to consider snowfall
- In between zone has 48”+ snow
- Deep snow melts & infiltrates walls

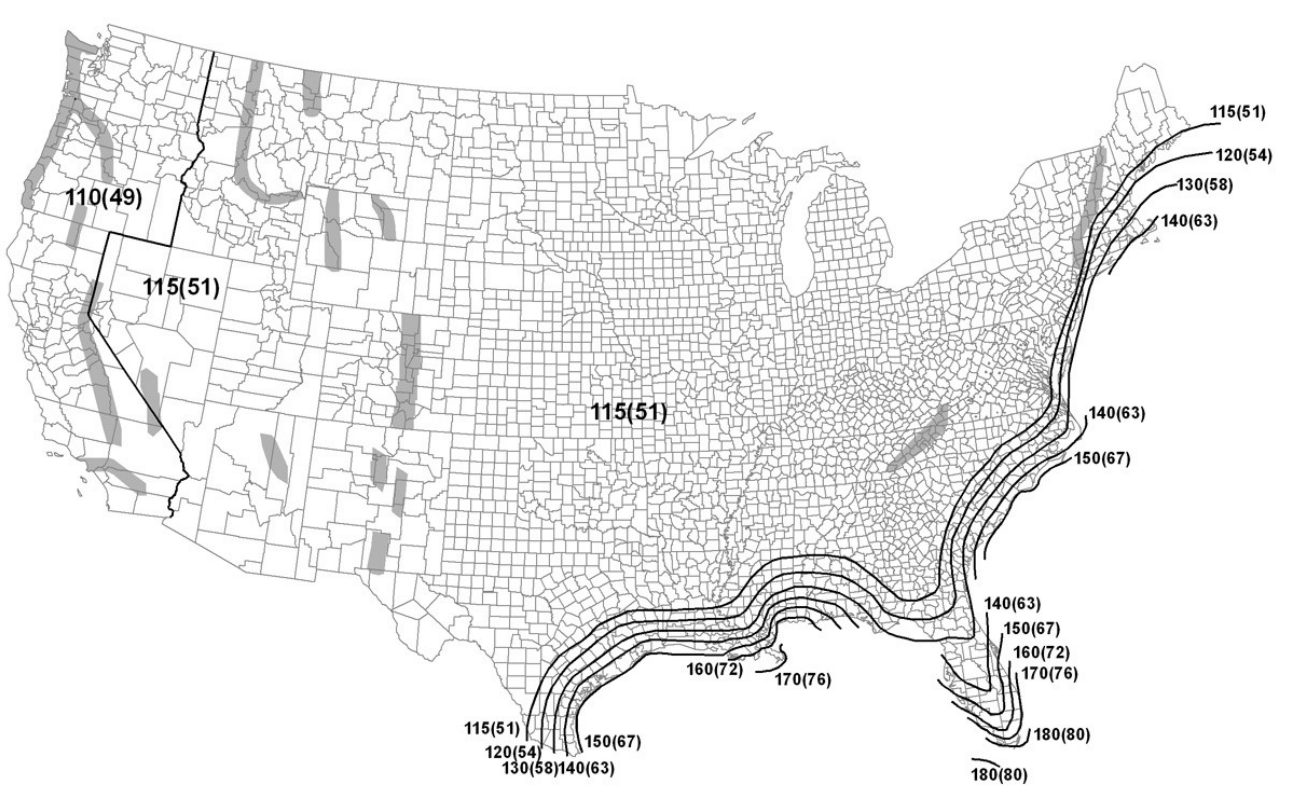


Rainfall



Snowfall

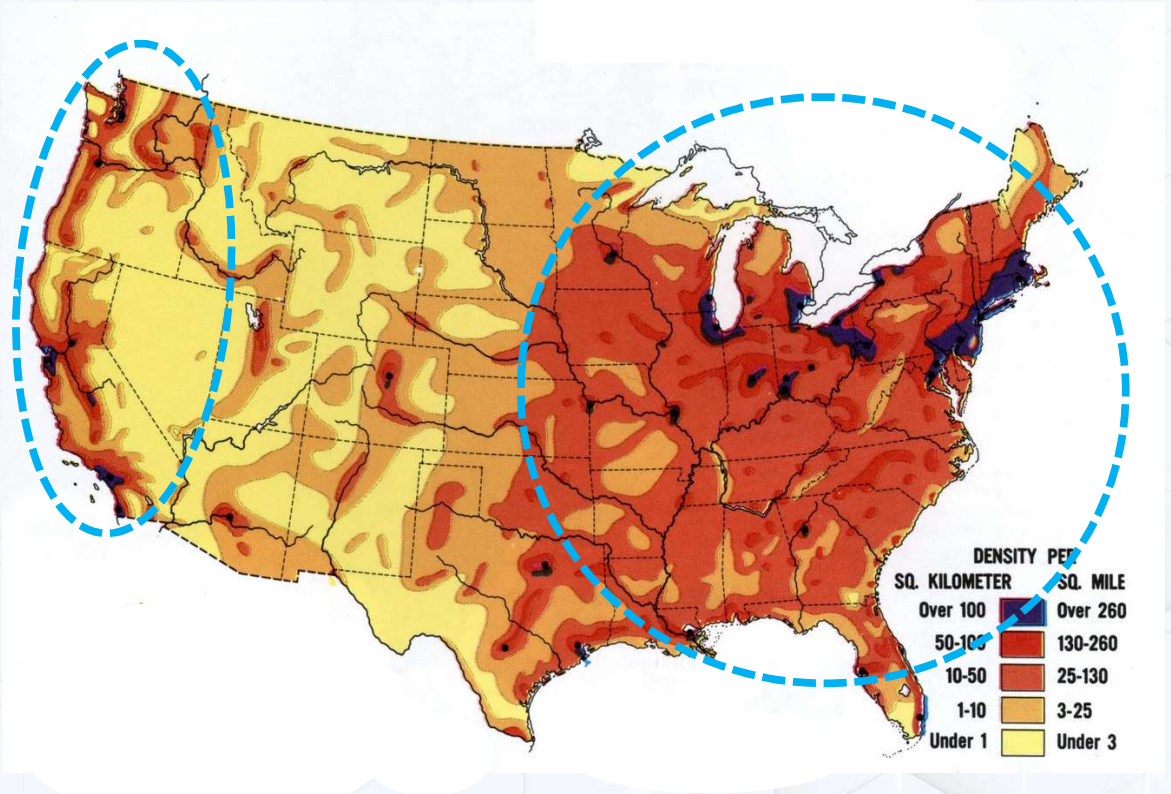
Wind Loads for Structural Design



- Wind is another factor
- Wind driven rain & snow find cracks & gaps in cladding
- Even lowest zone has 130 mph winds

Population

- Highest moisture index = highest population
- Locations with sun, heat and air-conditioning use create issues



Cladding Materials

Absorptive/Porous

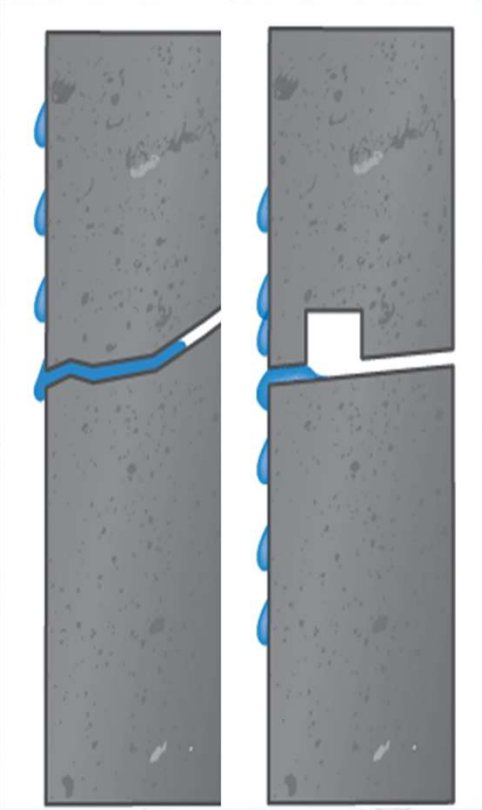
- Non-Absorptive
- Absorptive
- 81% of cladding is absorptive
- All can move moisture into wall through capillary action

Mechanisms For Bulk Water Intrusion

1. Capillary Action
2. Kinetic Energy
3. Vapor Drive
4. Condensation
5. Pressure Differences

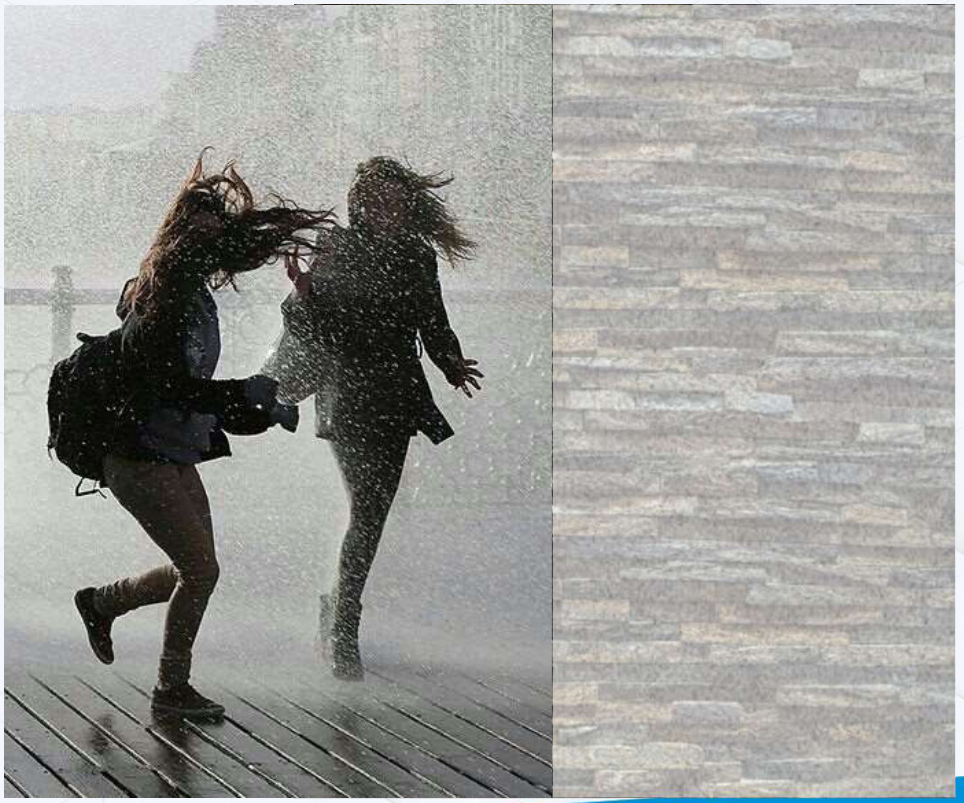
1. **Capillary Movement**

- Porous materials are capable of wicking water large distances due to capillary suction
- Tiny pores are found in wood, fiber cement, concrete, stucco, mortar and brick
- Porous building materials can be in direct contact with precipitation & porous wet soils
- Building materials can wick water both inwards and upwards
- In foundations it is known as “rising damp”



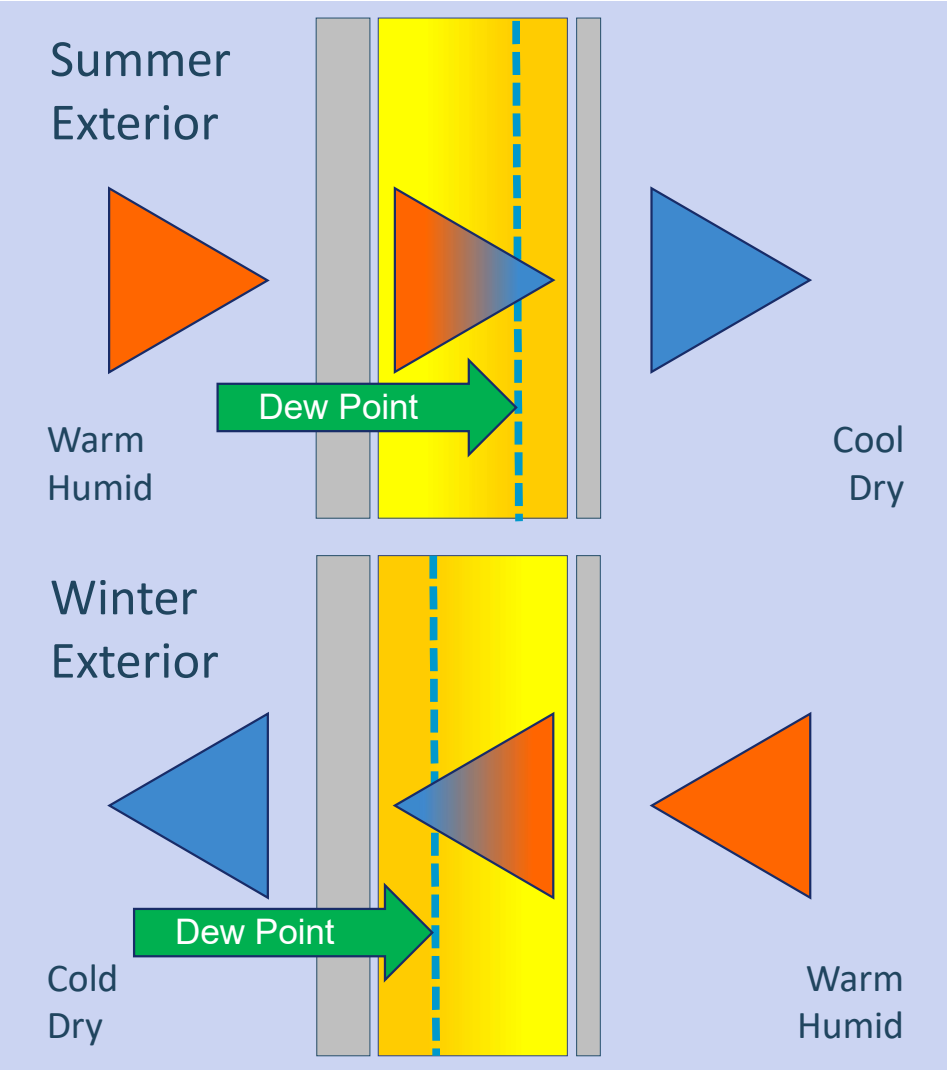
2. **Kinetic Energy**

- Kinetic energy is a result of something being in motion
- Momentum of rain driven by wind causes increased penetration of water into walls
- Not all insurance policies cover damage from wind driven rain
- Flood insurance may be exclude
- Closely connected to pressure differences

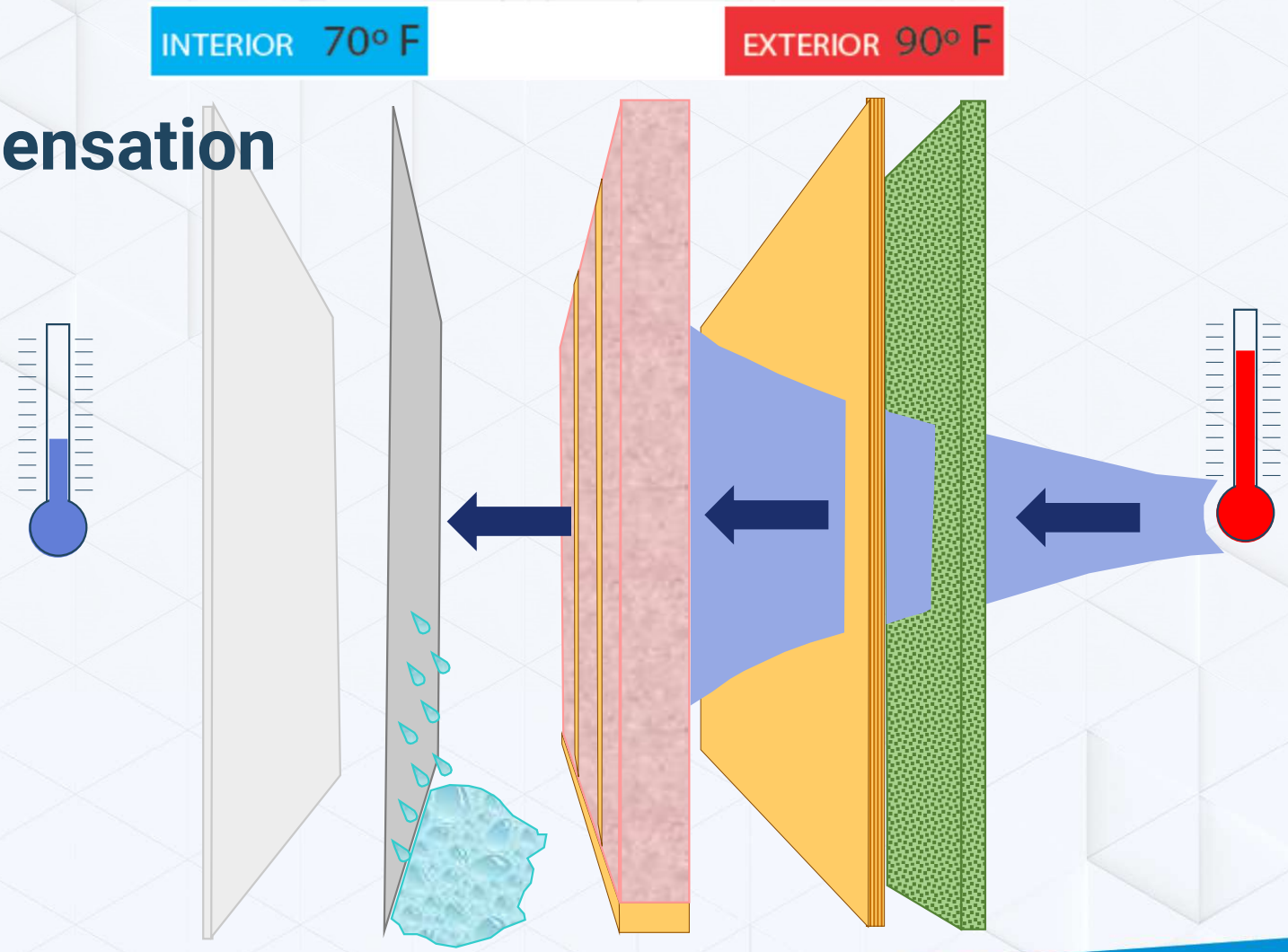


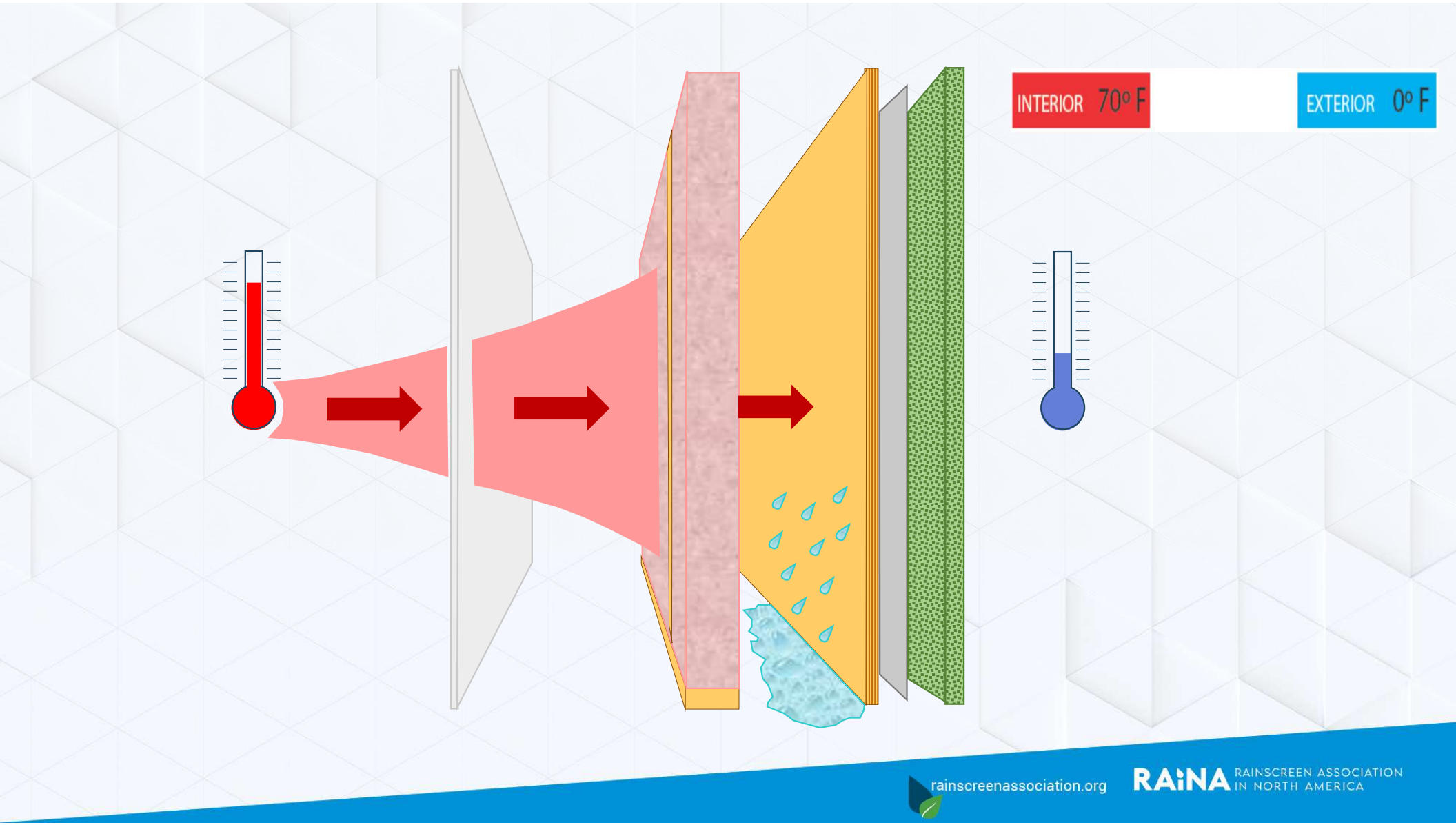
3. **Vapor Drive**

- Water vapor moves through vapor permeable materials not through vapor barriers
- Warm air is dense with water molecules
- Cooler air is sparse with water molecules
- Warm moves to cool to reach equilibrium
- How intensely water vapor molecules try to move through the wall is vapor drive



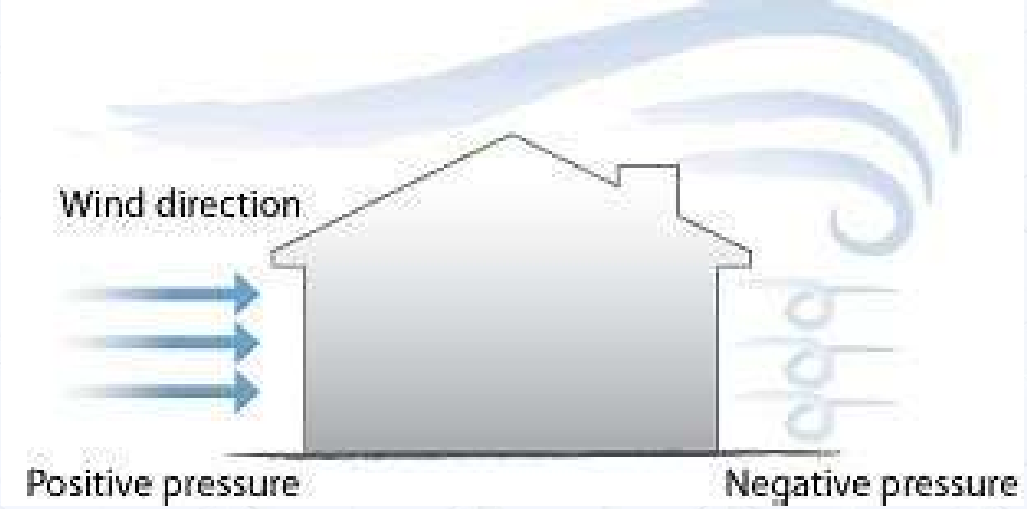
4. Condensation




INTERIOR 70° F
EXTERIOR 0° F

5. **Pressure Differences**

- Wind Pressure
- Pressure differences + capillarity
- Pressure differential
  - Can either push or draw water through cracks, gaps, or openings in exterior wall materials



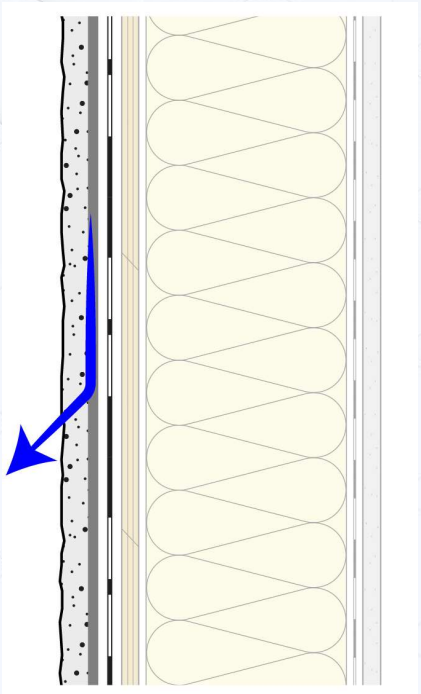
WHAT IS THE SOLUTION

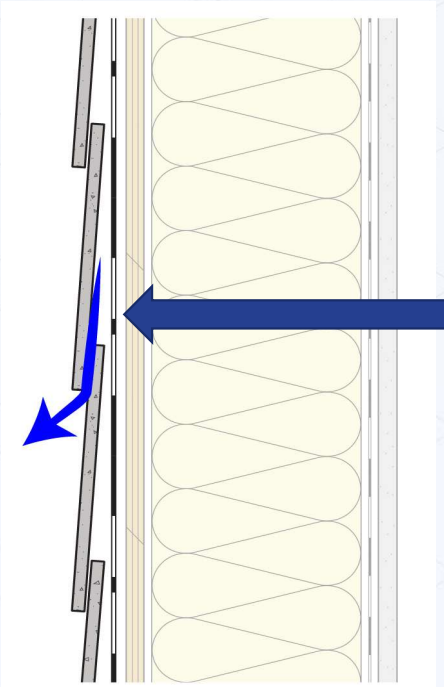
- QUESTION #3…WHAT IS YOUR WALL DESIGN

Wall Designs – Face Sealed/Concealed Barrier

Water control behind cladding but no specific drainage or ventilation cavity.

One Layer Building Paper

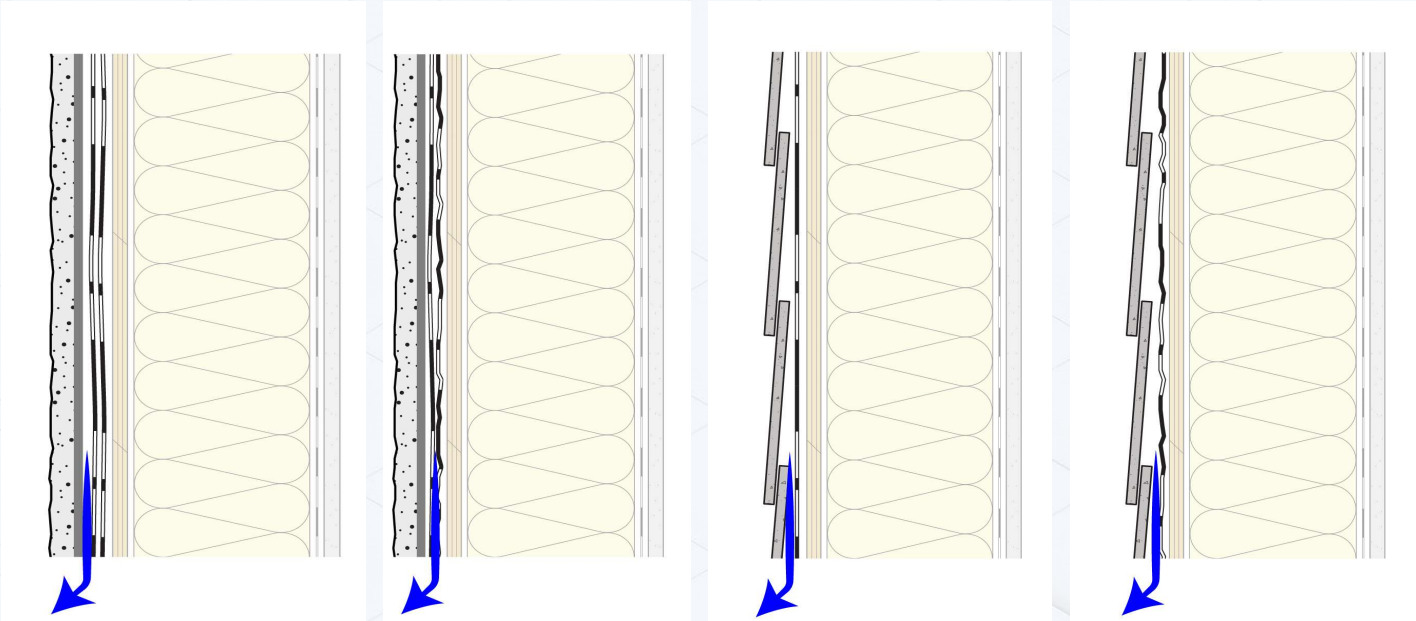




One Layer Building Paper with No Detailing for Drainage

Drained

- Two Layers of Building Paper
- Building Paper on Textured Wrap
- One Layer of Building Paper with Detailing for Drainage
- Textured Wrap

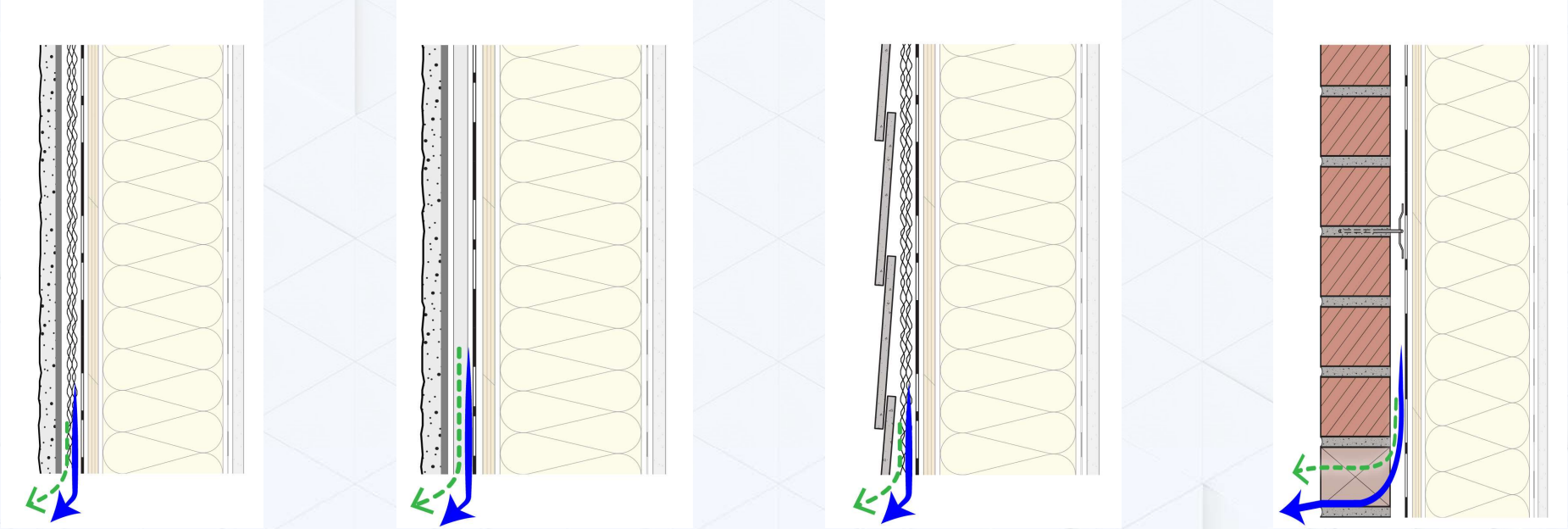


Specific detailing for drainage cavity to exterior. Drainage effectiveness can be measured per ASTM E2925-19A. Some degree of venting can occur in some build-ups though is unintentional and is a differentiator between a drained only vs rainscreen wall

Drained & Vented

Drainage Medium/Bottom Vent

A rainscreen wall

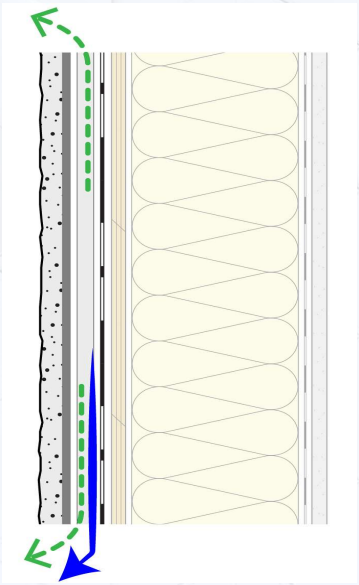


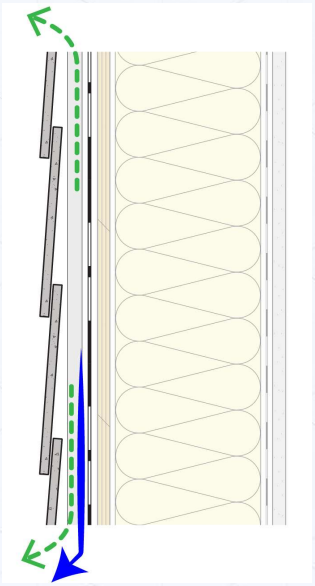
Specific detailing for cavity that allows drainage and venting or ventilation behind cladding. Larger capillary break and intentional airflow behind cladding. Degree of ventilation can be defined by an air exchange rate.

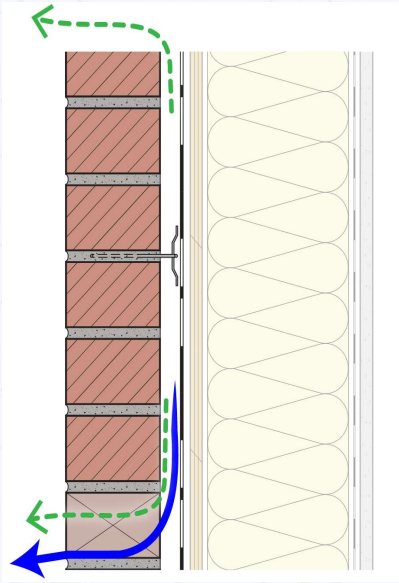
Drained & Ventilated

Intake & Exhaust

A rainscreen wall



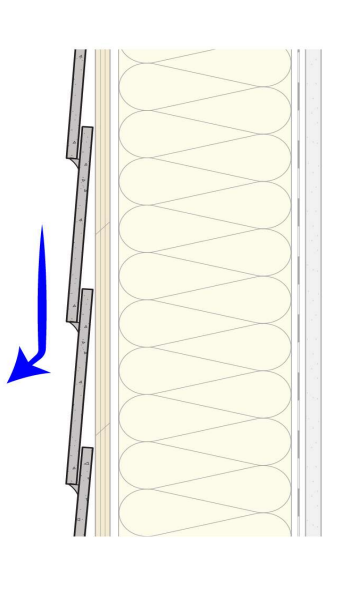




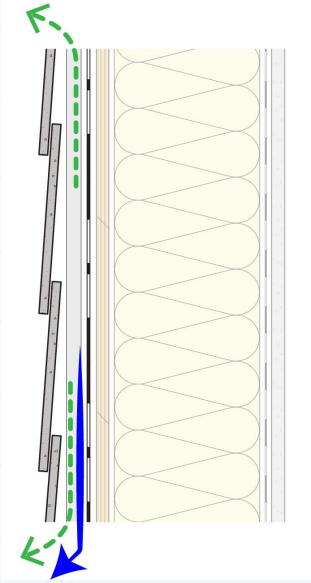
Specific detailing for cavity that allows drainage and venting or ventilation behind cladding. Larger capillary break and intentional airflow behind cladding. Degree of ventilation can be defined by an air exchange rate.

What is considered a rainscreen?

A rainscreen is not a product. A rainscreen is an assembly applied to an exterior wall which consists of, at minimum, an outer layer, an inner layer, and ***a cavity between them sufficient for the passive removal of liquid water and water vapor.***



Vs.



The Rainscreen Concept

- Rainscreen walls create a space for drainage and ventilation within the wall
- *A required capillary break of 3/16” or greater per ASTM E2925 will reduce bulk moisture from reaching the water-resistive barrier.*
- Reduces the transmission of surfactants contained in some claddings
- Permits drainage
- Allows for air movement behind cladding

Designing For Moisture Intrusion

- Sheathing
- Weather Resistant Barrier
  - **Must be detailed correctly**
  - **Must be installed correctly**
  - **The proper function of a rainscreen wall depends on the performance of the weather resistant barrier**
- Capillary Break
- Cladding

1 Layer No. 15 Felt

IRC Section R703.2

- Fails if torn or damaged during installation
- Lower quality felts absorb moisture
  - Damages sheathing over time
- Contains volatile compounds that dissipate over time
  - Causes underlayment to become more fragile and moisture absorbent

1 Layer Water Resistive Barrier (WRB)

IRC Section R703.2

- Housewraps can tear
  - Often repairs are not made
- Fastening punctures WRB
- Siding leaks
  - When the WRB (last line of defense) also leaks, water gets into the wall
  - Leads to mold & rot
- Per IRC Section R703.2 WRB must be “free from holes and breaks”

Integrated Air & Water Resistive Barrier

IRC Section R703.2

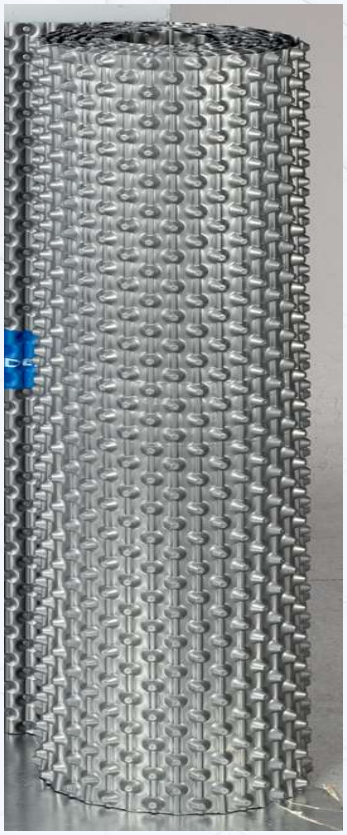
- A new form of a WRB is integrated within the sheathing board
- WRB is only on one side of the sheathing
- Cut edges can leave exposure for moisture intrusion
- Equivalent to 30 minute not 60 minute building paper
- One advantage is fewer penetrations in the WRB

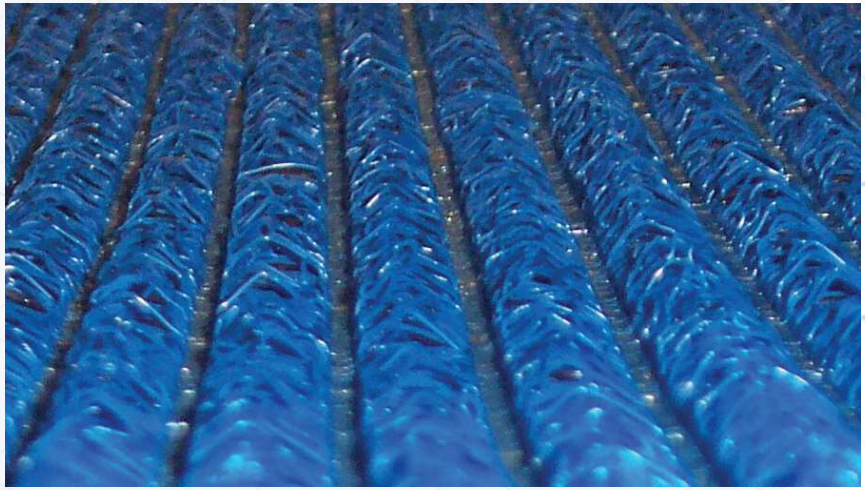
1 Layer Drainable Water-Resistant Barrier

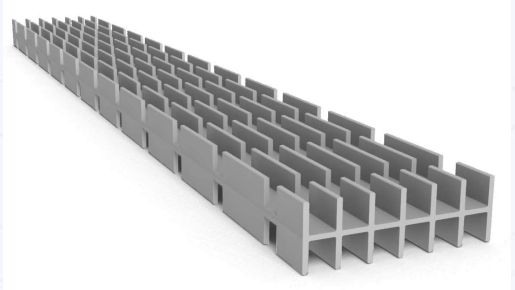
- Drainable housewrap is typically 1 to 1.5mm thick
- Surface tension of water spans 1-2 mm
- Ventilation requires at least 4.5 mm of airspace
- A very good housewrap but lacks ventilation

1 Layer WRB + 1 Layer EDVM

Engineered Drainage & Ventilation Mat





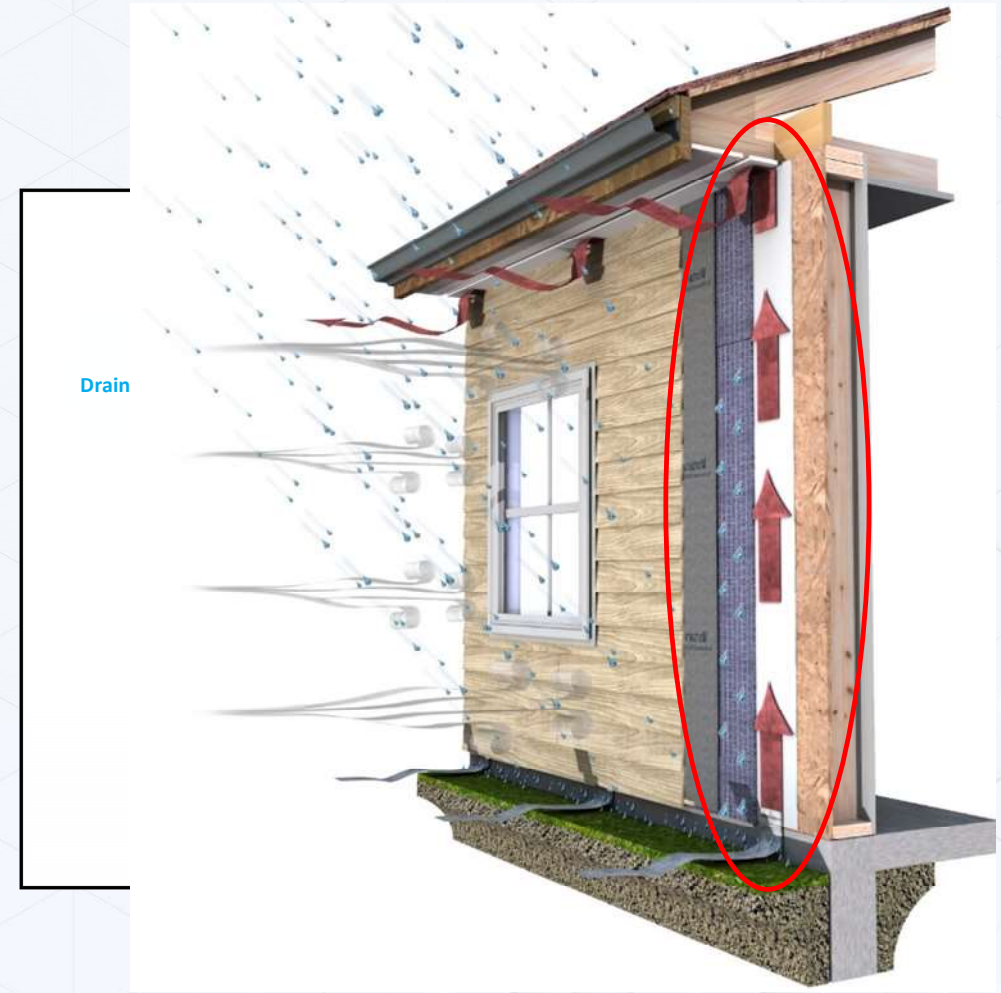


What Does An EDVM Do?

Engineered Drainage & Ventilation Mat

- Creates space within the wall
- A gap to promote drainage
- A void to ventilate and dry out the wall
- Separation to stop capillary water movement
- Uncoupling to give a thermal break

Creates Space



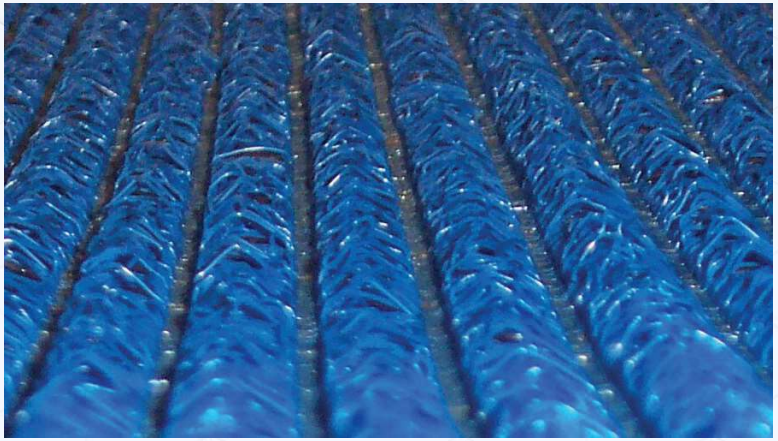
ASTM E2925

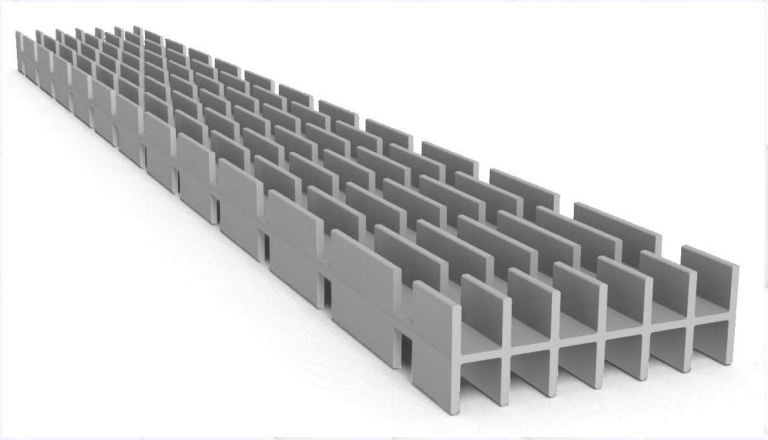
ASTM E2925 - Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

- ASTM D3045 – Heat Aging
- ASTM D5199 – Nominal Thickness Test
- ASTM D5322 – Immersion Procedures
- ASTM D 6108 – Compression Testing
- ASTM D 6364 – Short-Term Compression Testing
- ASTM E84 – Surface Burning Test
- ASTM E2273 – Drainage Efficiency
- ASTM G 154 – UV Testing

ASTM E2925 Recommends

- Type A – Entangled Mesh
- Type B – Formed Polymeric Sheet
- Type C – Formed Battens

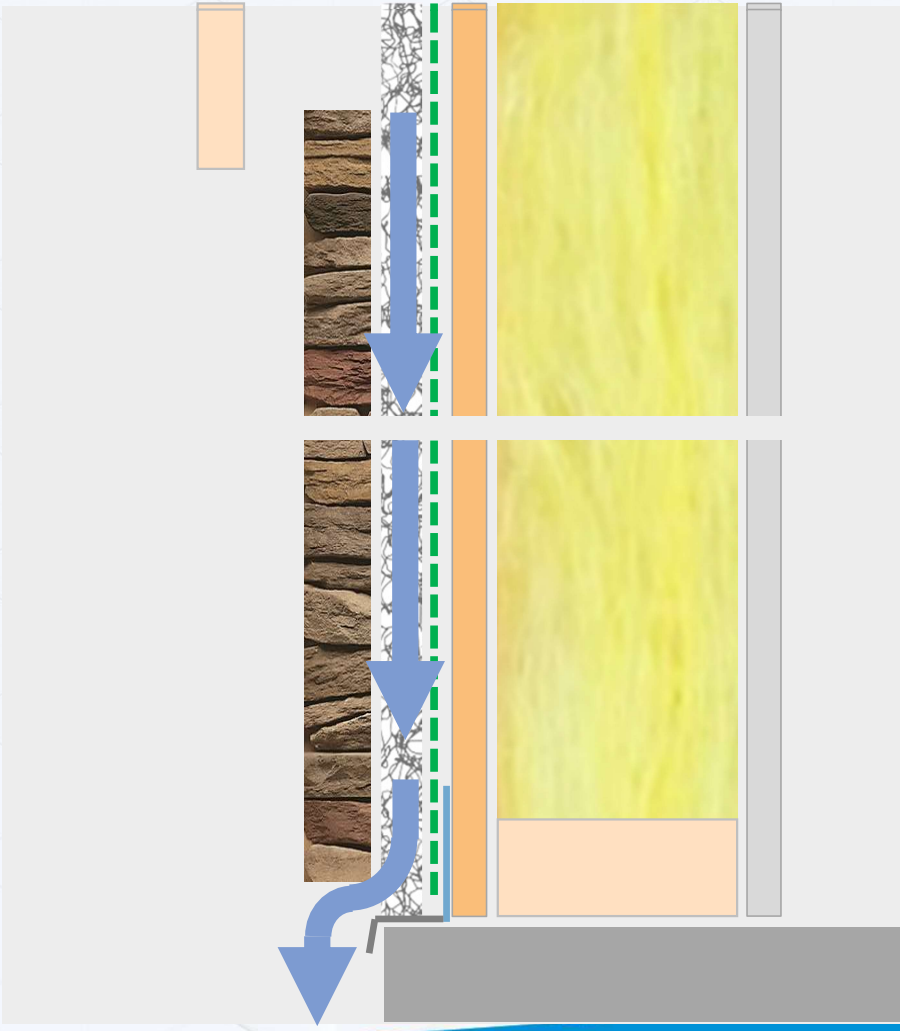




Rainscreen/Ventilated Wall

1 Layer WRB + 1 Layer EDVM

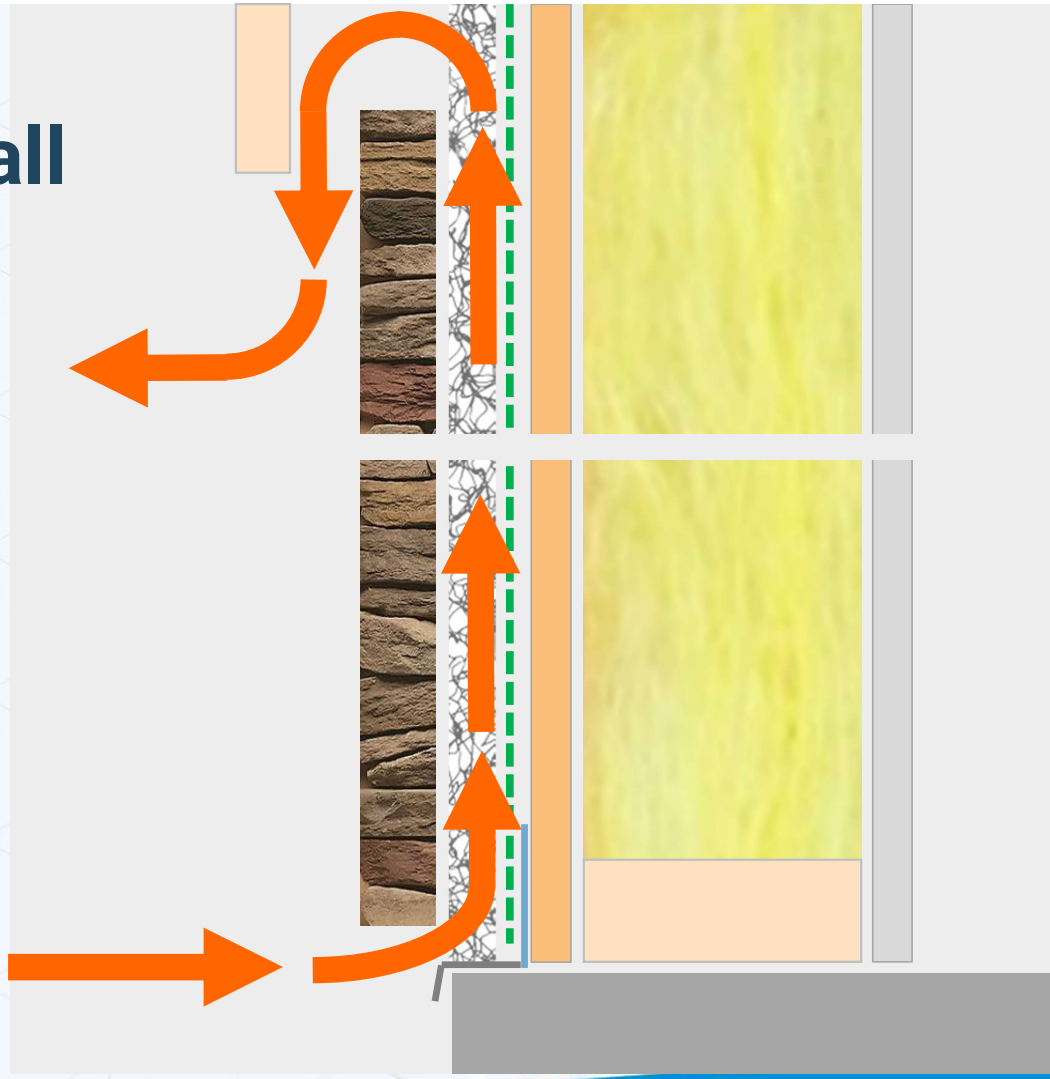
- Continuous rainscreen mat turns a direct applied wall system into a ventilated wall system
- Ventilated wall redistributes moisture
  - Through draining liquid water
  - Also, by evaporating & drying residual moisture



Rainscreen/Ventilated Wall

1 Layer WRB + 1 Layer EDVM

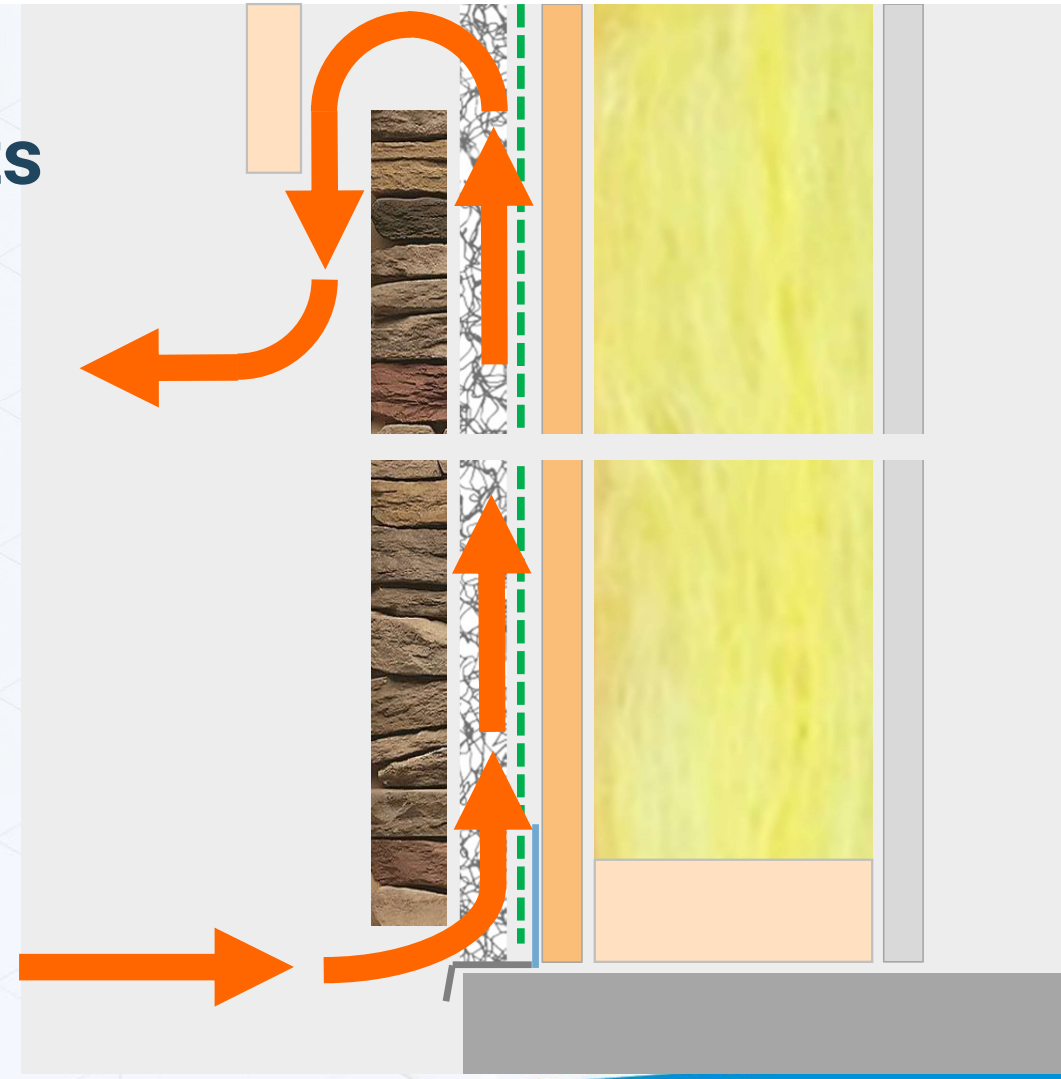
- Wall is “ventilated” when open at top & bottom
- Creates a stack effect
  - Air movement over entire surface of wall
  - Stack effect greatly enhances drying potential
  - Especially when cladding is heated by sun
- **Rainscreen wall only open at bottom has limited drying effect- vented**
  - **Air movement at base only**



Rainscreen/Drying Effects

1 Layer WRB + 1 Layer EDVM

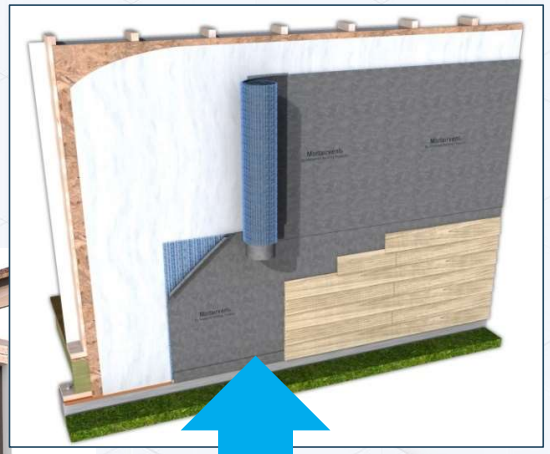
- Openings at the top and bottom of the wall dries residual moisture left after drainage of bulk moisture
- Small but significant water amounts are attached to surfaces by surface tension also absorbed by porous materials
- Also helps remove 2 types of moisture vapor before it can condense
  - Vapor inside house moving out
  - Moisture stored in “reservoir” cladding after rainfall that is moving in by solar vapor drive

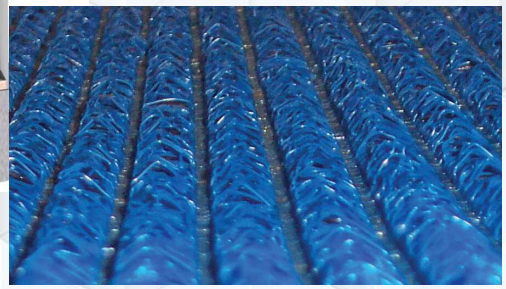


Type A

Entangled Matrix

- A three-dimensional entangled net extruded from polypropylene or Nylon 6
- Most have a heat bonded filter fabric.
- The fabric acts as a mortar deflection.
- Keep uniformity throughout the surface area of the product.
- Mold & mildew resistant
- Excellent compression strength
  - Will not crack to failure when manipulated
- Resistant to most known chemicals
- Class A fire rating (ASTM E84)
- Compatible with all siding materials
- Tested to ASTM E2925





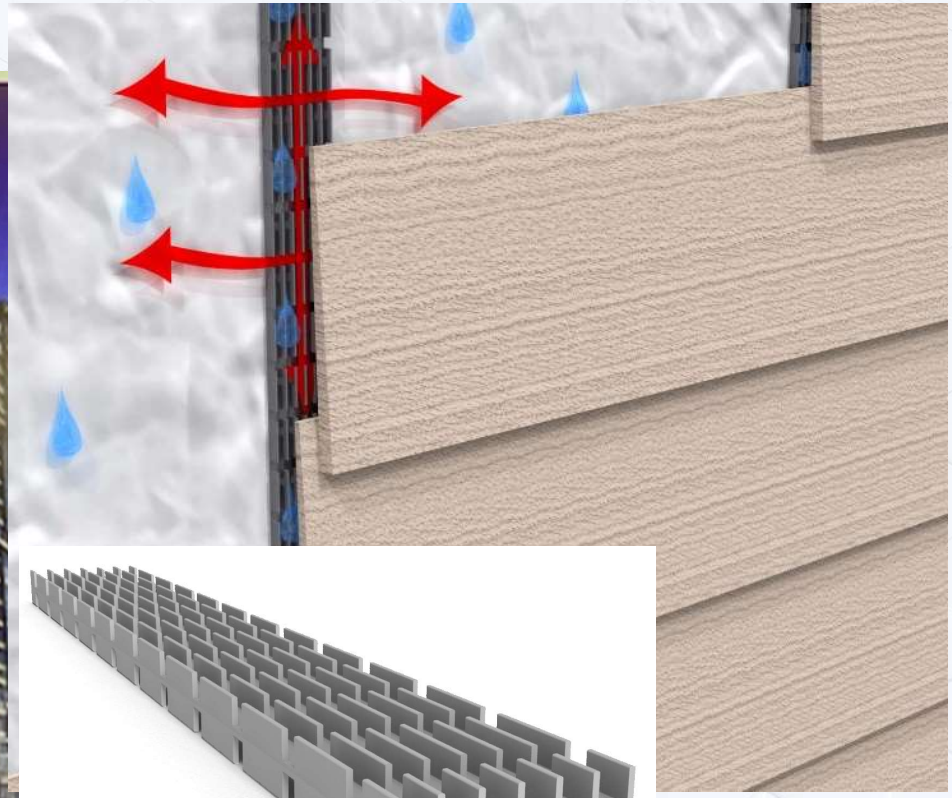
Type B

Engineered Drainage & Ventilation Mat

- A three-dimensional dimple mat
- Most have a heat bonded filter fabric.
- The fabric acts as a mortar deflection.
- Keep uniformity throughout the surface area of the product.
- Mold & mildew resistant
- Excellent compression strength
  - Will not crack to failure when manipulated
- Resistant to most known chemicals
- Class A fire rating (ASTM E84)
- Compatible with all siding materials
- Tested to ASTM E2925

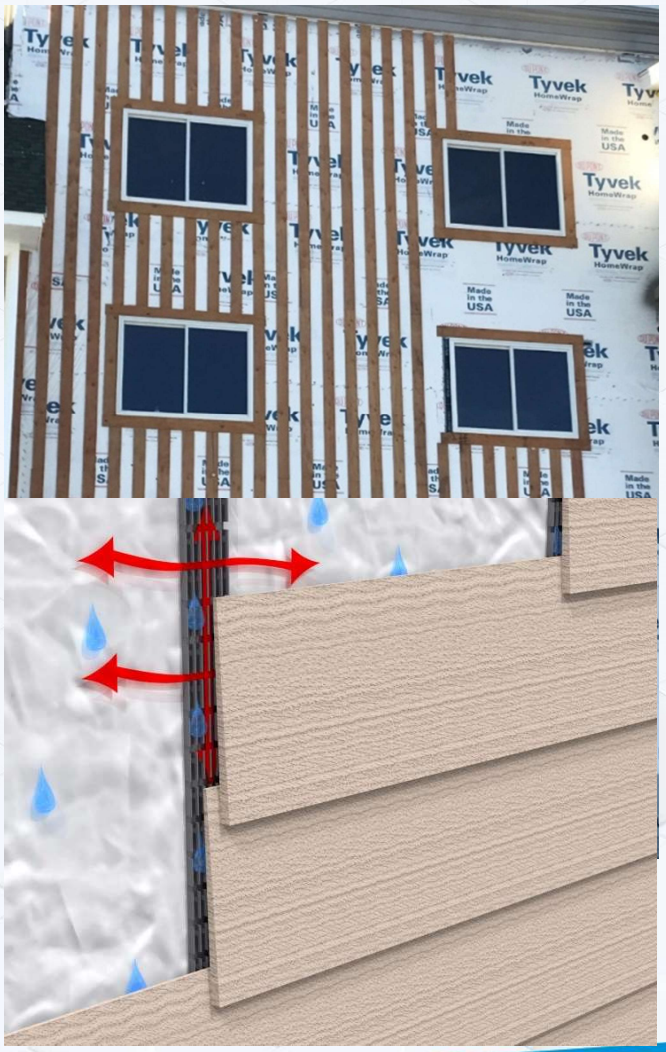
Type C

Batten/Furring Strips



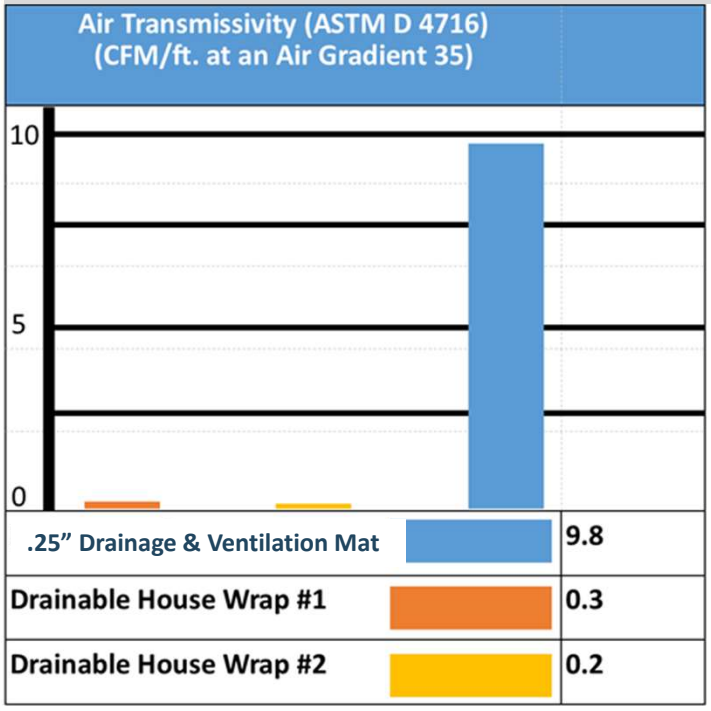
Considerations

Wooden Batten Strips	Engineered Batten Strips
Inexpensive	Create Dual Drainage & Ventilation in Horizontal & Vertical Applications
Readily Available	Continuity
Can Be Structural	Labor Savings
Can Hold Moisture	Do Not Absorb Moisture
No Cross Ventilation	Are Not Structural



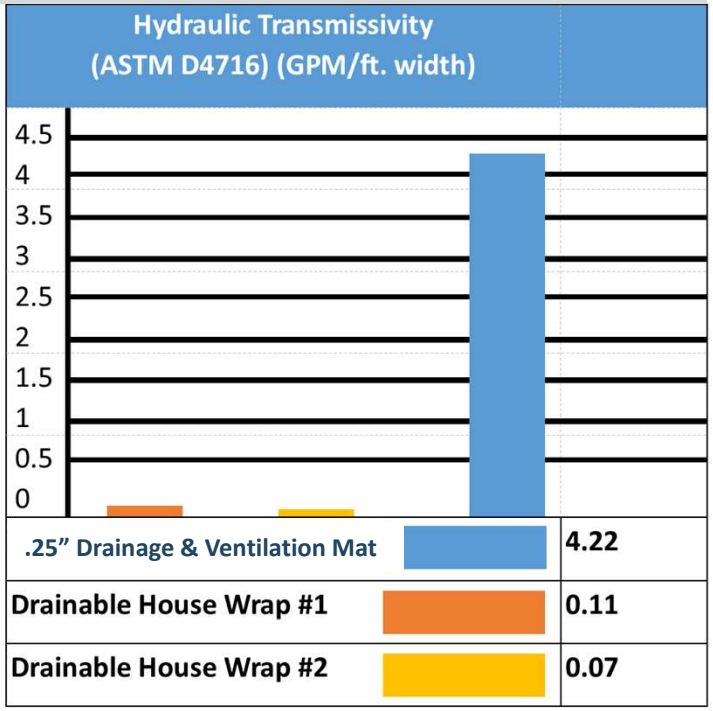
1 Layer Drainable Water-Resistant Barrier

Movement of Air



.25” Drainage & Ventilation Mat	9.8
Drainable House Wrap #1	0.3
Drainable House Wrap #2	0.2

Movement of Water

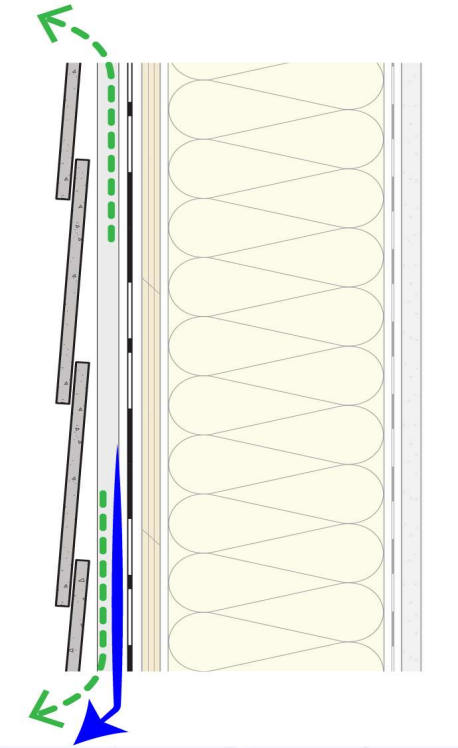


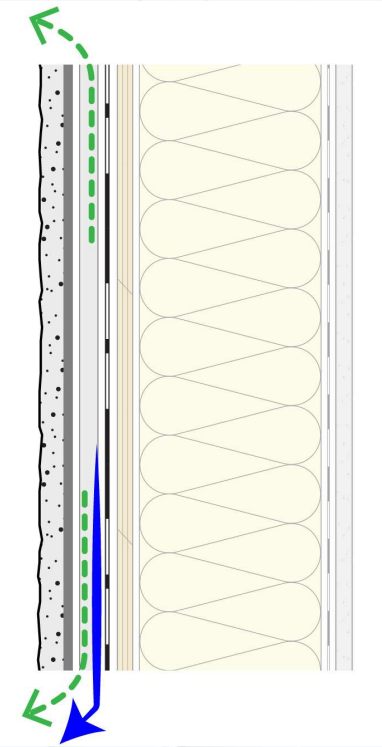
.25” Drainage & Ventilation Mat	4.22
Drainable House Wrap #1	0.11
Drainable House Wrap #2	0.07

What Have We Learned?

- It is recommended that walls in a geographic area receiving over 20-inches of annual rainfall be designed with drainage & ventilation abilities.
- 81% of all cladding materials used today are absorptive claddings
- 90% of all wall failures are moisture related
- Moisture in three main forms (rain, snow, wind) can enter the wall numerous ways
- There are four common wall designs in residential applications
  - **Direct (Face Sealed) – currently the most common**
  - Drained
  - Drained & Vented
  - Drained & Ventilated

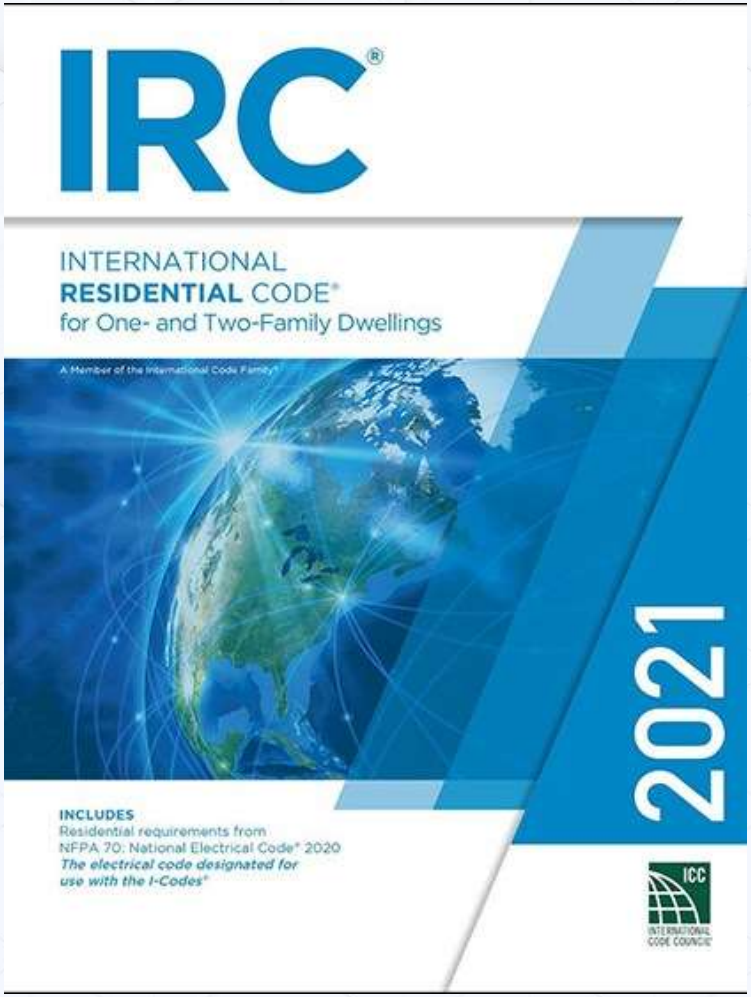
- Creating a capillary break turns a direct applied wall system into a drained & ventilated wall system.
- Rainscreen technology protects the WRB and other building materials from surfactants.
  - Prevents deterioration of interior finishes
  - Assist to prevent mold
  - Promotes indoor air quality
  - Decreased maintenance
  - Decreased corrosion of building materials
  - Increased wall system longevity
- Labor efficient





Industry Support

- RAiNA
  - Building Codes
  - Education & Training
  - Definitions
  - Industry Outreach
  - Performance
  - Residential
- International Building Code
- International Residential Code
- National Building Code of Canada
- International Masonry Institute
- National Association of Homebuilders
- Building Science Corporation
- National Concrete Masonry Association
- Oregon State Building Code



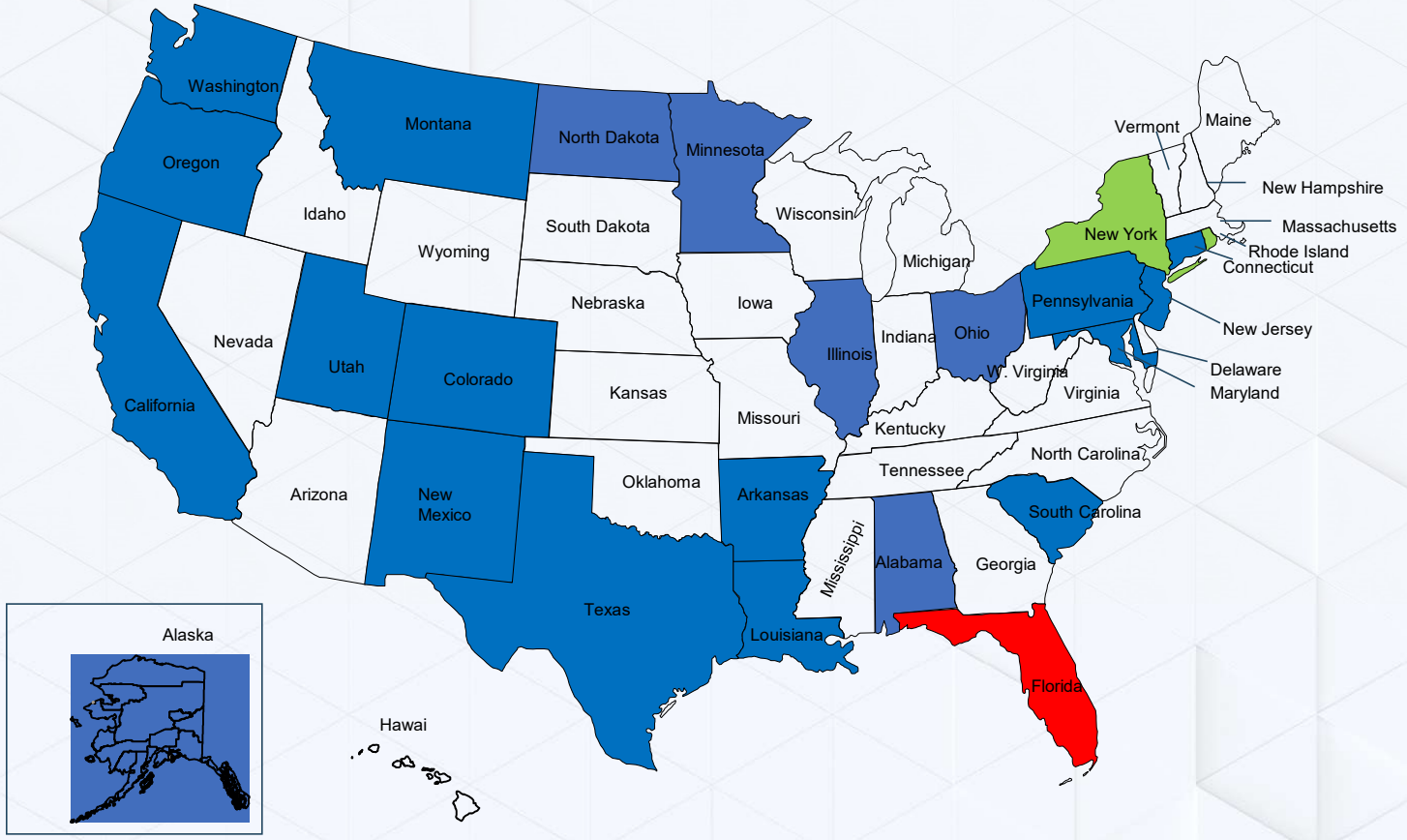
Industry Support

- **R703.7.3.2 Moist or marine climates.** In the Moist (A) or Marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

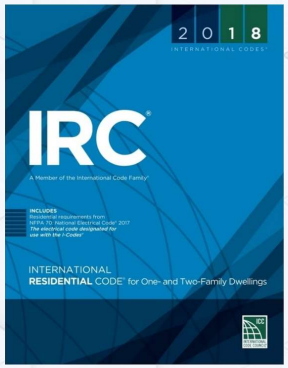
- 1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than ***3/16 inch (5mm) in depth shall be added to the exterior side of the water-resistive barrier.***

- 2. In addition to complying with Section R703.7.3.1, Item 2, ***drainage on the exterior*** of the water-resistive barrier shall have a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or ***Annex A2 of ASTM E2925***

2021 Rainscreen Code Adoption



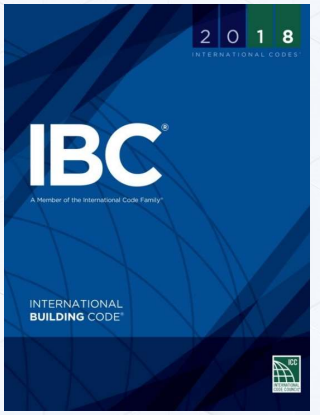
International Residential Code (IRC) 2018



R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and **a means of draining to the exterior water that enters the assembly.** Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R702.7 of this code.

Section R703.2 – Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls.

International Building Code (IBC) 2018



Chapter 14 – Exterior Walls / 1403.2 Weather-resistive barrier

Not fewer than one layer of No. 15 asphalt felt, complying with ASTM D226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing as described in Section 1404.4 to provide a continuous water-resistive farrier behind the exterior wall veneer.

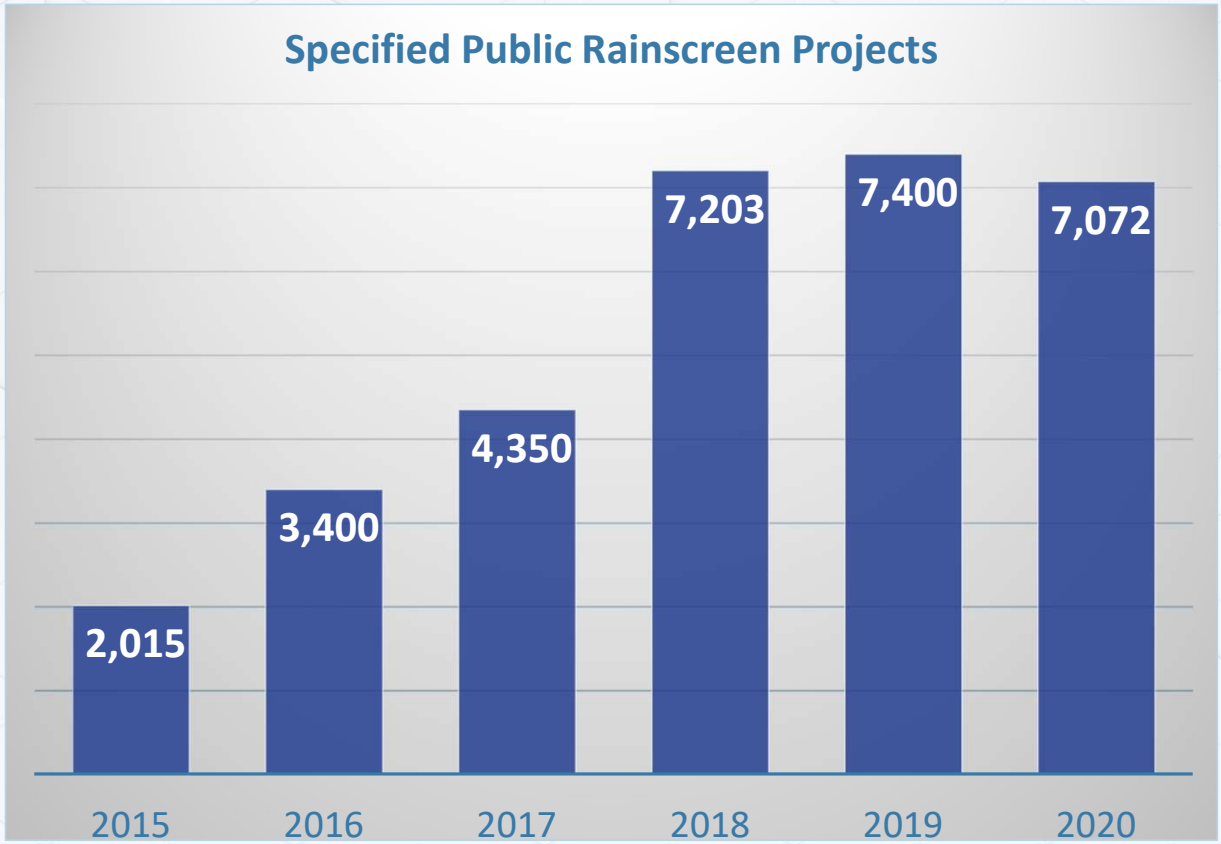
Many exterior veneers provide weather resistance but may allow either penetration of water through joints or seams or the development of condensation to occur behind the veneer. To increase the weather resistance of the wall, a layer of asphalt felt or other approved material is required to be installed over the wall backing.

Specification Considerations

- Products that have been tested to ASTM E2925 and that fall under Type A, B, or C of ASTM E2925

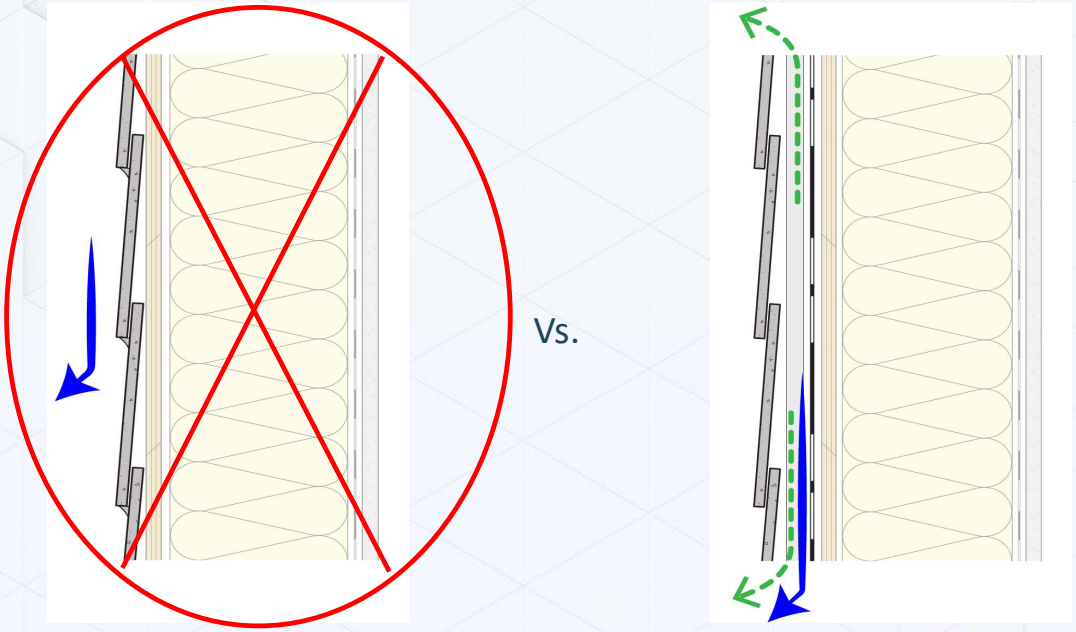
- Section 072800 - Rainscreens
- Section 074600 – Rainscreen Components
- Section 074646 – Mineral Fiber Cement
- Section 042000 – Unit Masonry
- Section 042001 – Masonry Veneer
- Section 042723 – Cavity Wall Unit Masonry
- Section 092400 – Portland Cement Plastering

United States Rainscreen Specifications



One Last Time. What is considered a rainscreen?

A rainscreen is not a specific product. A rainscreen is an assembly applied to an exterior wall which consists of, at minimum, an outer layer, an inner layer, and ***a cavity between them sufficient for the passive removal of liquid water and water vapor.***



THANK YOU

RAiNA
RAINSCREEN ASSOCIATION
IN NORTH AMERICA

rainscreenassociation.org