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BUILDING ENCLOSURE CONFERENCE
RESTON VA 2022
MAY 10-11

THE INTERFACE: Glazing Assembly Edition

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ABAA Board of Director

Task Group Chair, ABAA Termination Transitions and Flashings
Task Group Co-Chair, ABAA Whole Building Airtightness Testing

abaa EDUCATION

OVERVIEW

01 Building Science Principles

02 Building Enclosure Design and Construction

03 Functional Performance Verification

04 Aluminum Glazing Assembly Interface Strategies

05 ABAA Guidelines – Curtain Wall, Roof to Wall Details

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intertek BUILDING SCIENCE SOLUTIONS

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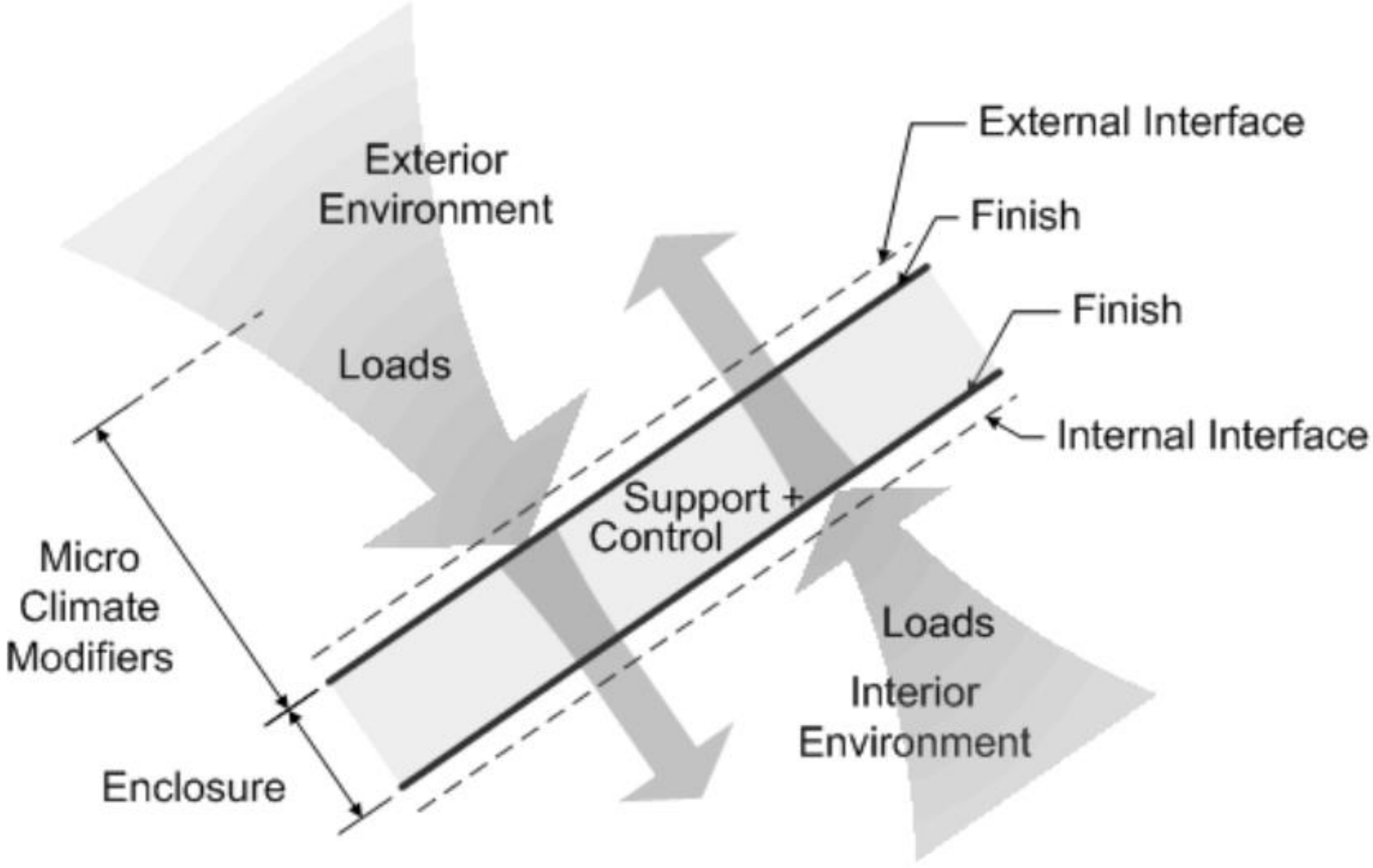
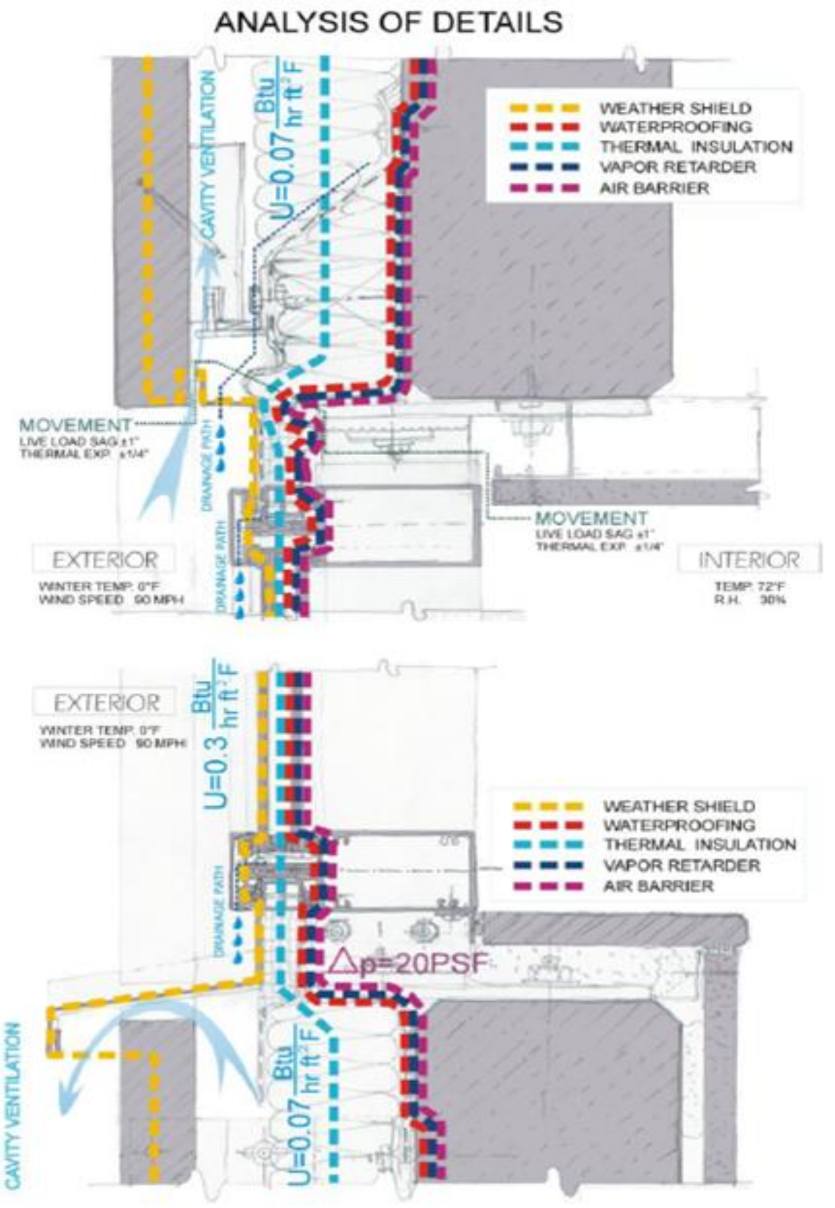
THE BUILDING ENCLOSURE



THE BUILDING ENCLOSURE

Control Layers

1. Water Control Layer
2. Air Control Layer
3. Vapor Diffusion Control Layer
4. Thermal Control Layer



THE BUILDING ENCLOSURE

THE BUILDING ENCLOSURE

Historic Building Enclosure

- Simpler building systems
- Fewer layers
- Master tradesmen
- Apprenticeship training
- Lower Expectations?

https://en.wikipedia.org/wiki/Old_Stone_House_(Washington,_D.C.)#/media/File:Old_Stone_House_-_ca._1890.jpg

MASS MASONRY CONSTRUCTION

THE BUILDING ENCLOSURE

Today's Building Enclosure

- Complex building materials
- Multi-layer construction / multiple trades
- Thinner construction
- Limited on-the-job training
- Higher expectations
- Schedule Critical
- Cost Sensitive

http://www.mgac.com/projects/house-of-sweden/33

THE BUILDING ENCLOSURE

NEW CONSTRUCTION – DEFINED CONTROL LAYERS

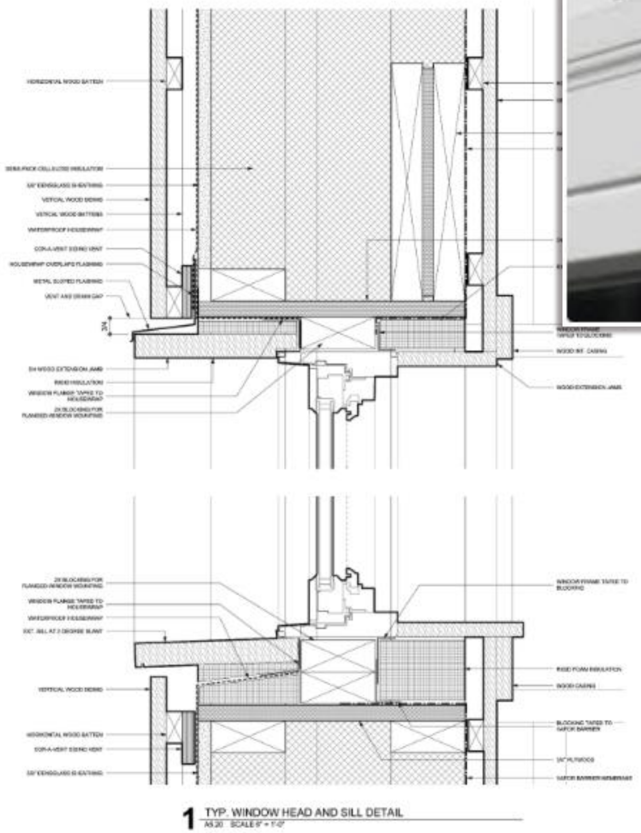
THE INTERFACE

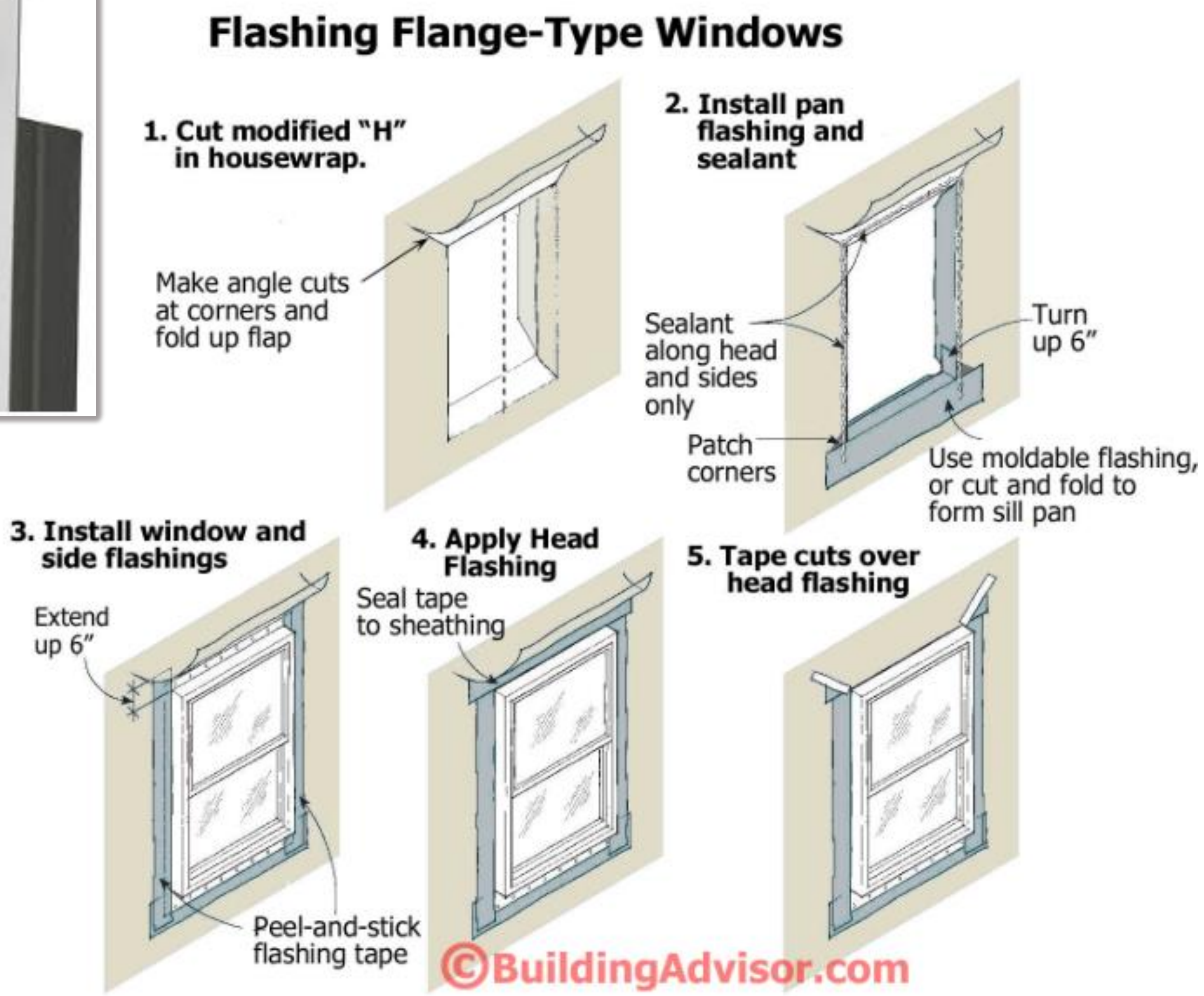
GLAZING ASSEMBLY EDITION

intertek
Total Quality. Assured.

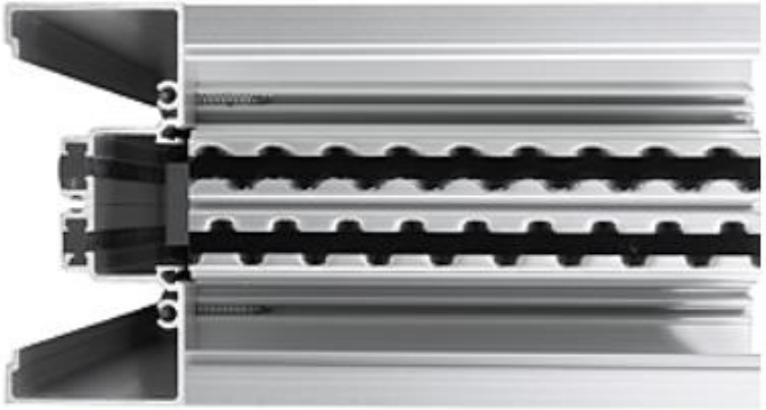
COMMON FENESTRATION TYPES

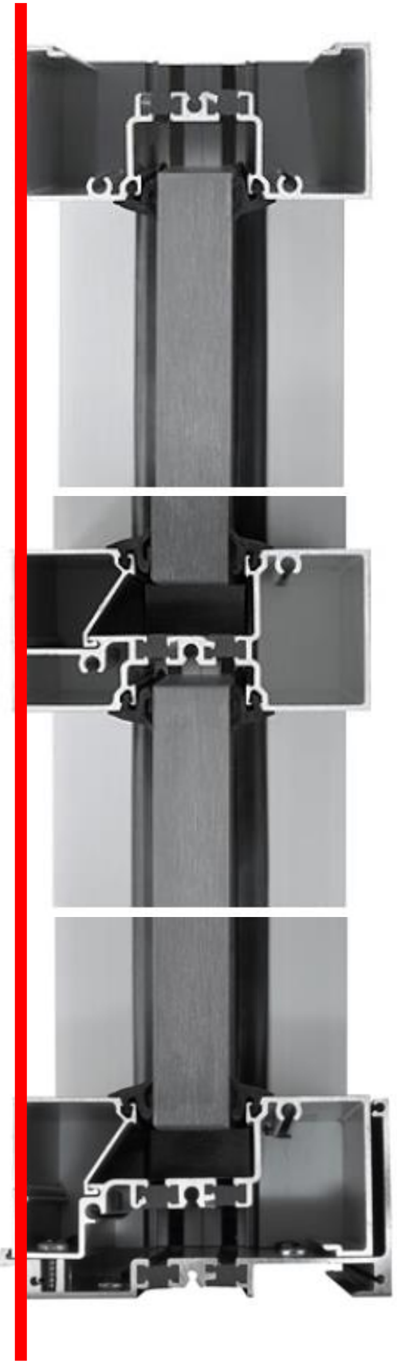
NAILING FLANGE WINDOW



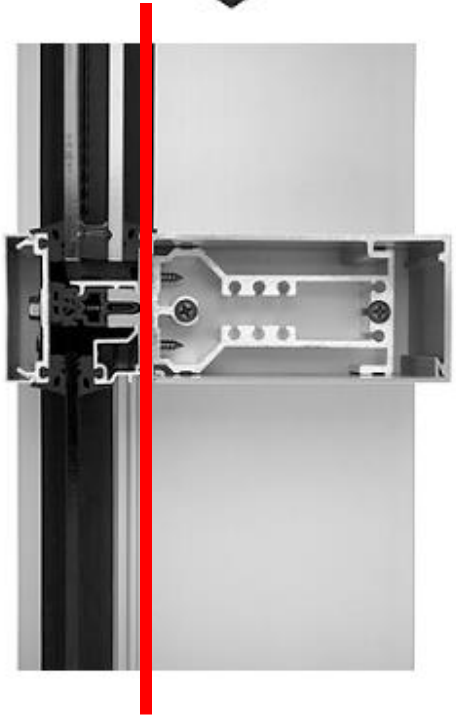


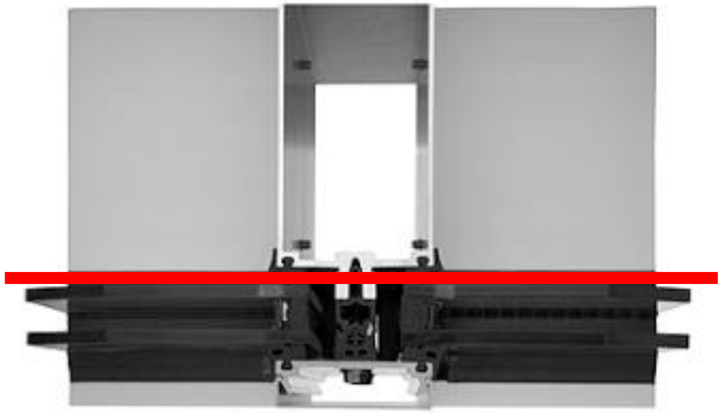
STOREFRONT





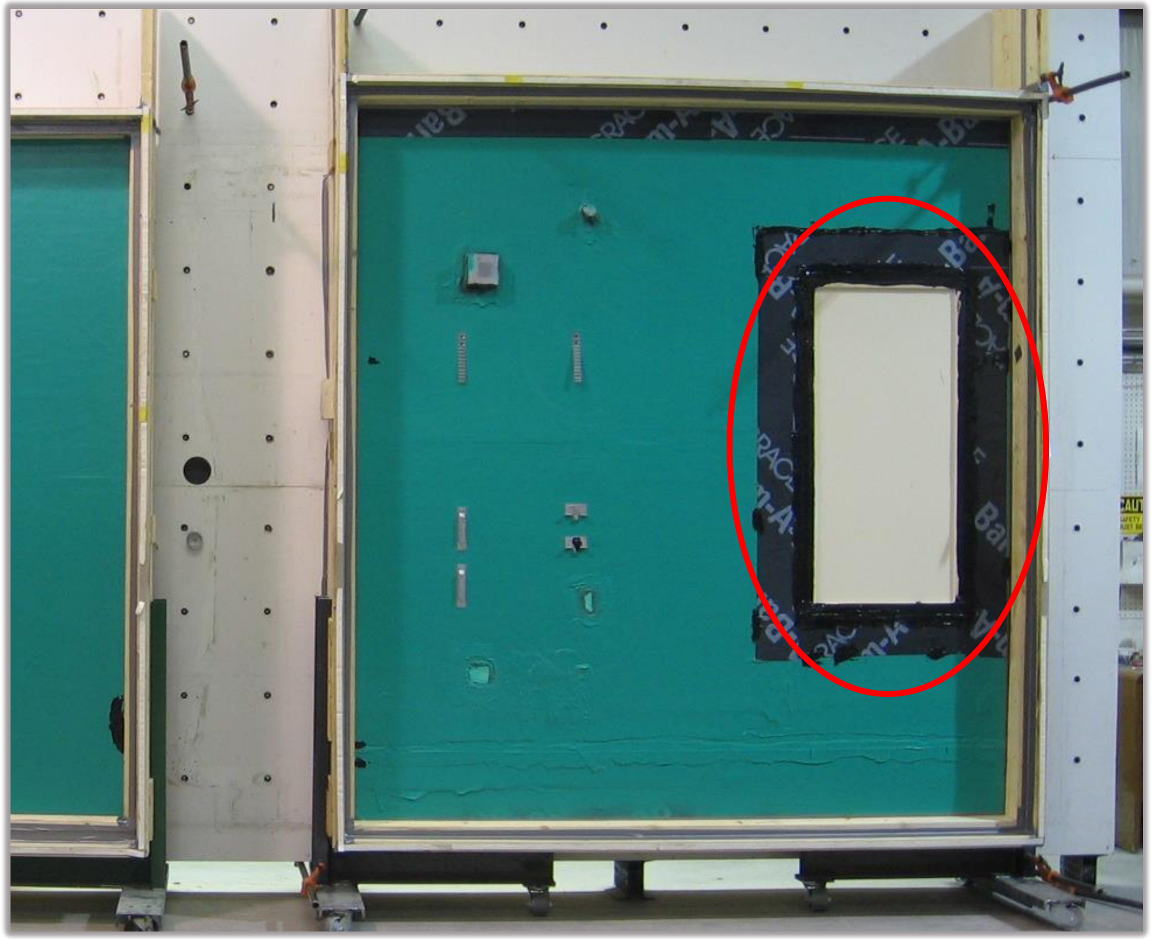
CURTAIN WALL





MATERIAL AND SYSTEM LAB TESTING

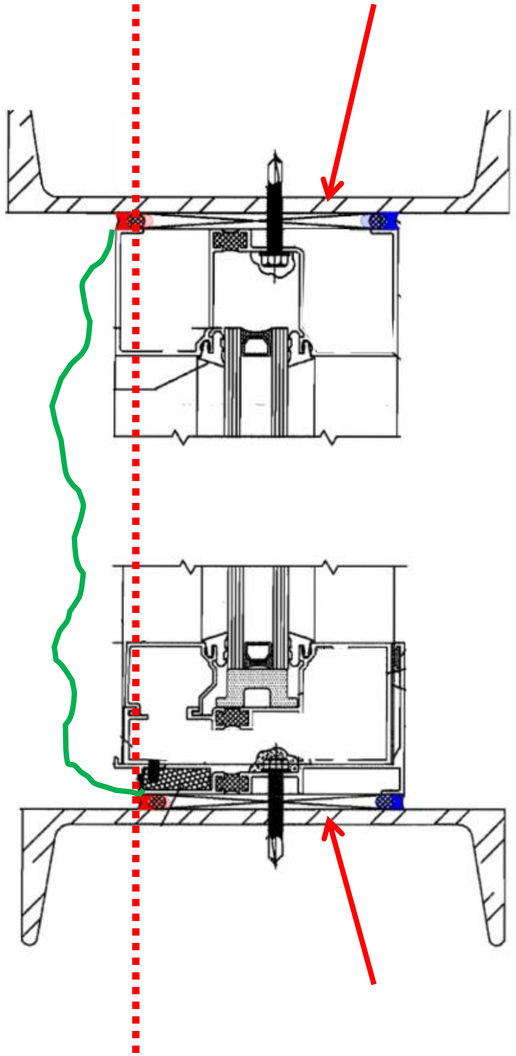
ASSEMBLIES – AIR BARRIERS

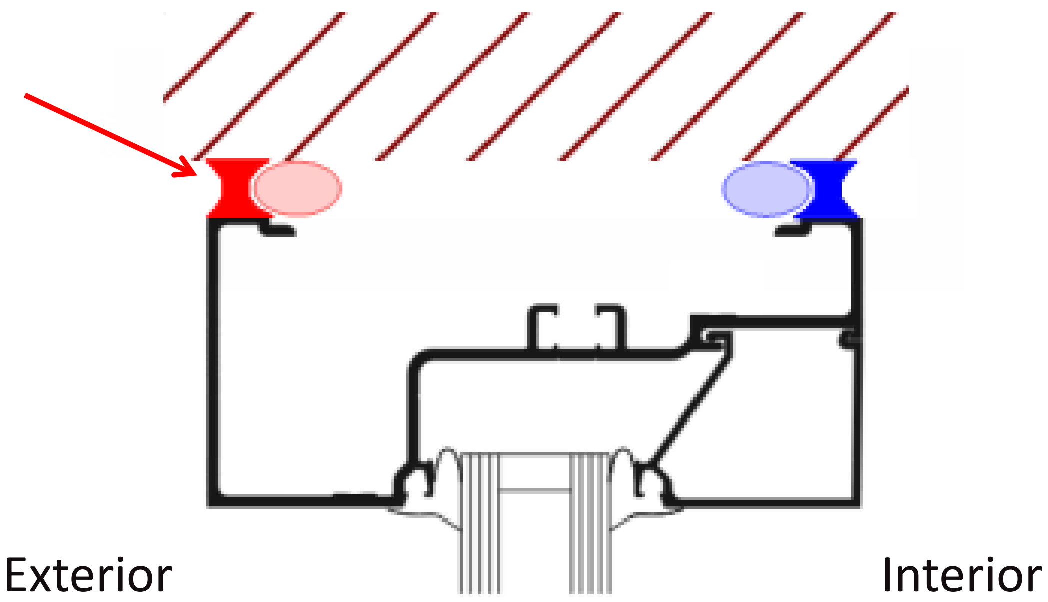


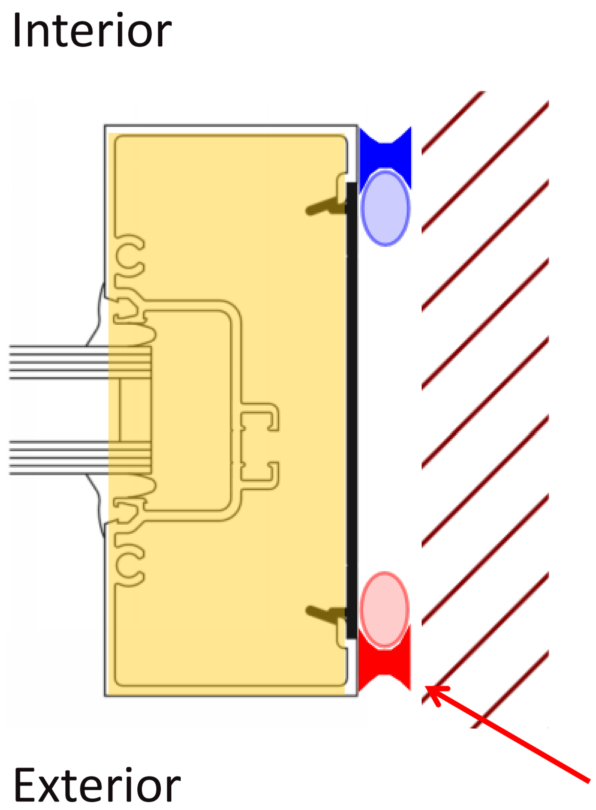
ASTM E2357*

- < 0.040 cfm/ft^2 75 Pa
- <u>Structural loading</u>
- **Simulated window opening**
- Detailing included
- **No interface details**

ASSEMBLIES – FENESTRATION
ASTM E283 AIR LEAKAGE/ASTM E331 WATER PENETRATION







PLANE OF AIR AND WATER TIGHTNESS

THERMAL PERFORMANCE TESTING

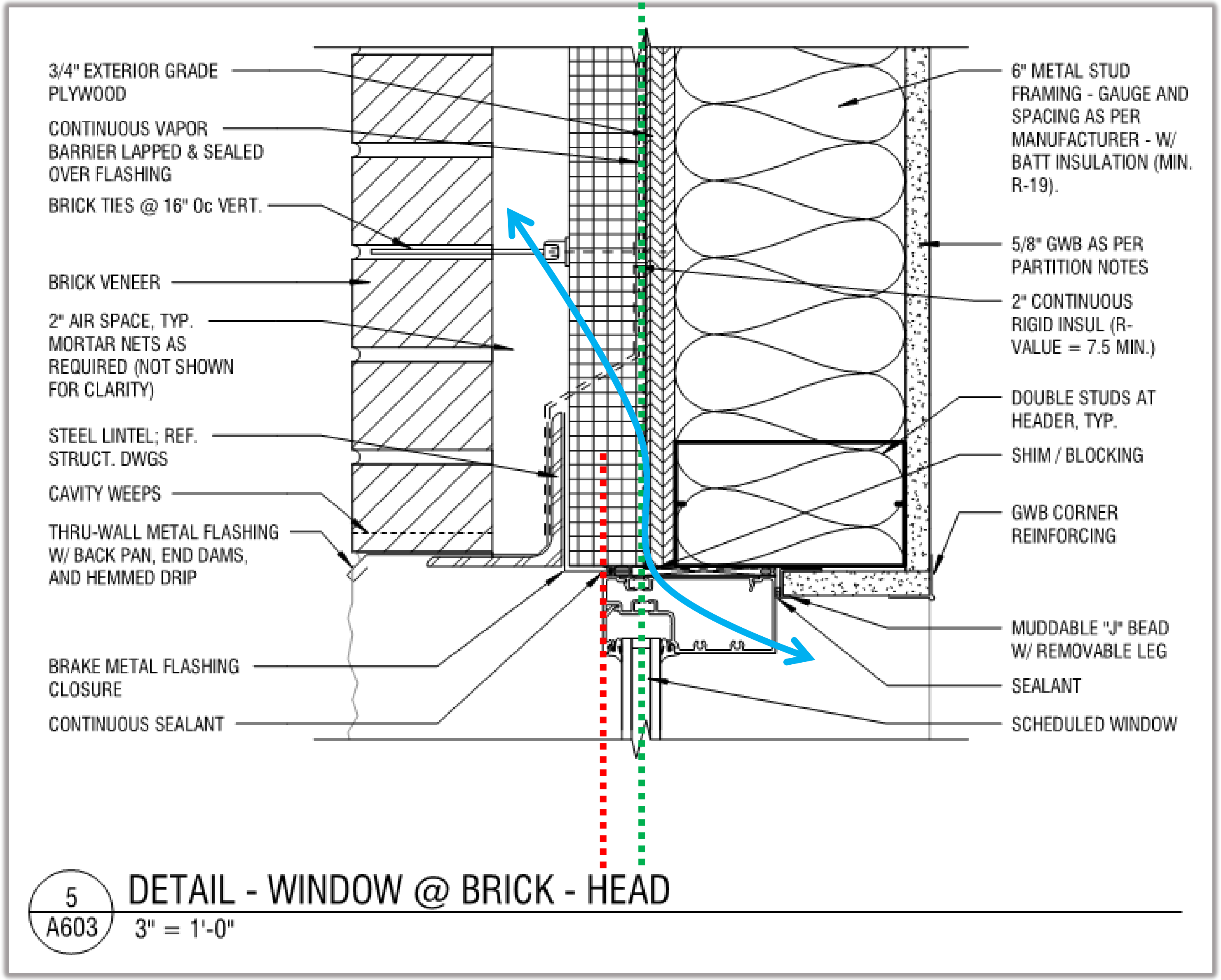
NFRC 102 OR AAMA 1503

- **Air infiltration eliminated for testing**
- Perimeter condition is taped/sealed
- Framing joinery is taped/sealed
- Rough opening is comprised of rigid insulation
- Roughly 80” x 80” specimen

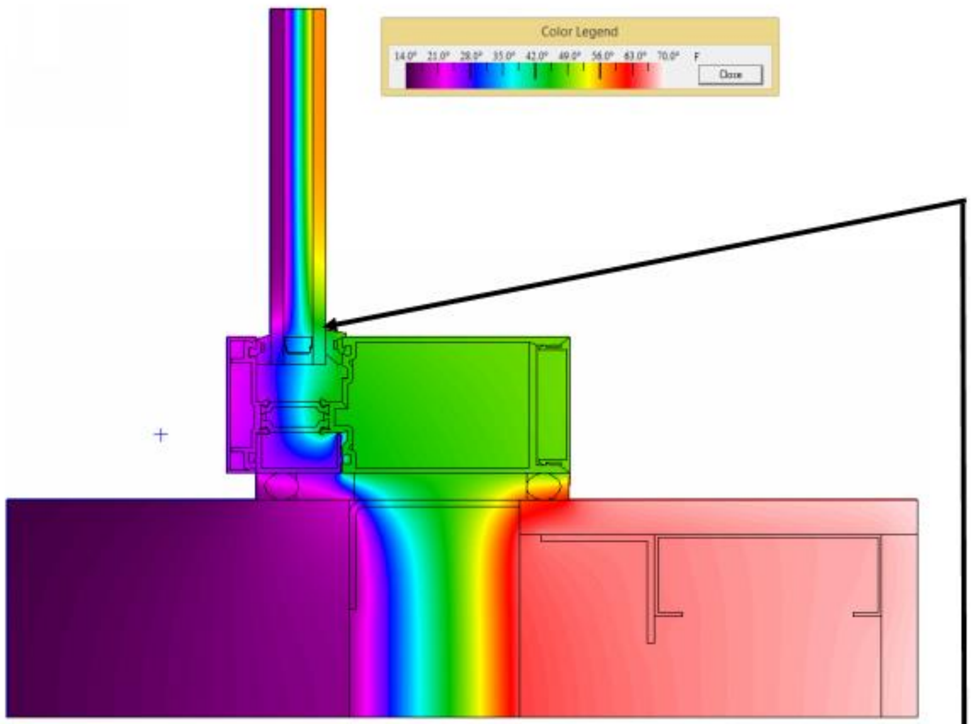
If air is allowed to bypass thermal break of assembly, the thermal performance of the assembly is significantly impacted.

THE INTERFACE

THE INTERFACE



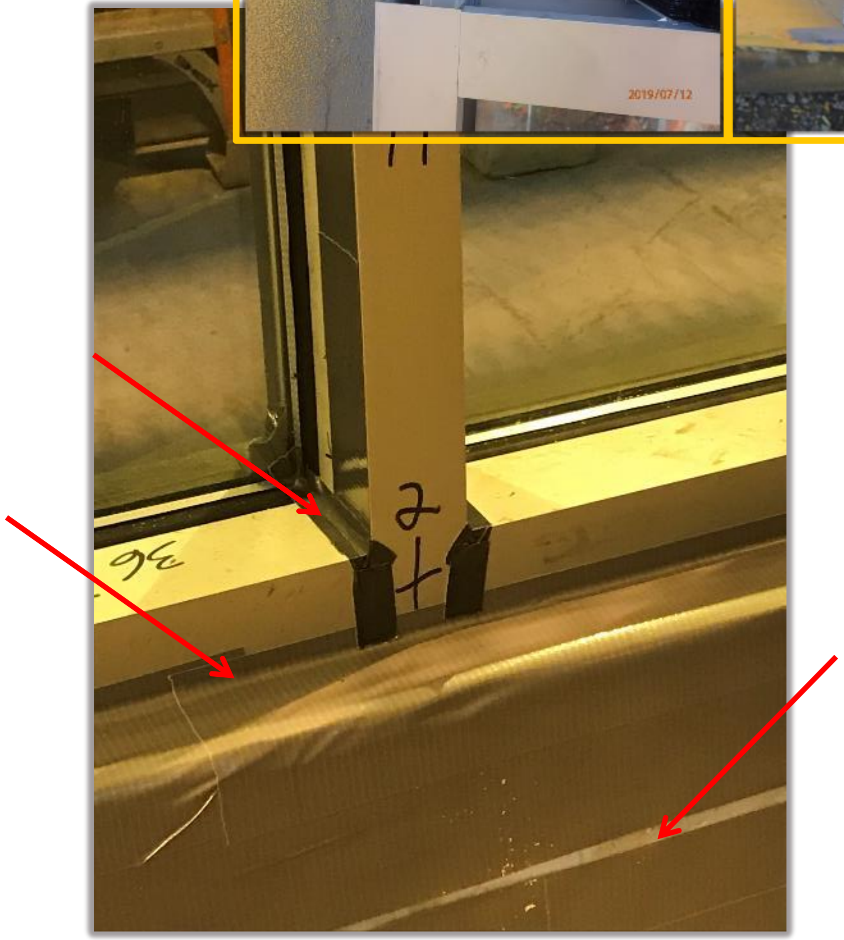
THERM



Dewpoint Temperature	37.2°F @ 30%RH / 47.8 @ 45%RH / 55.6 @ 60%RH
Coldest Interior Frame Temperature	46.7°F
Edge of Glass Temperature	50.1°F
Coldest Interior Temperature	44.5°F

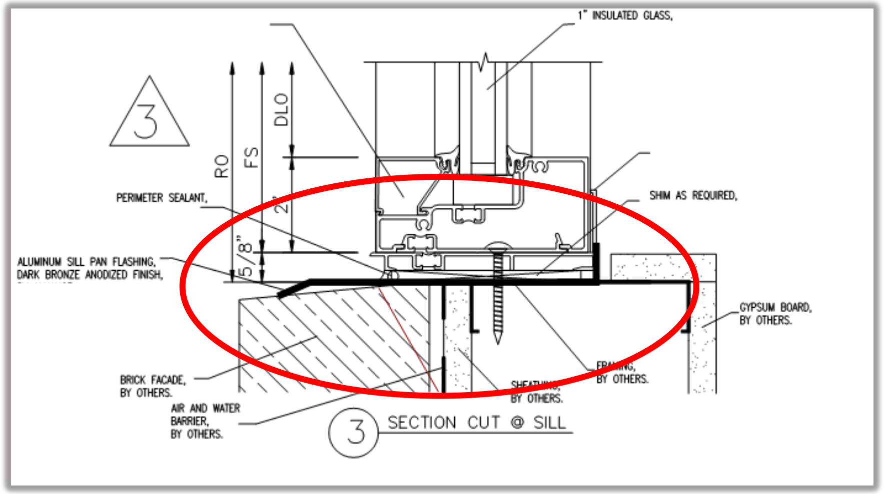
Does not accurately model impact of air leakage at perimeter condition.

LAB THERMAL PERFORMANCE



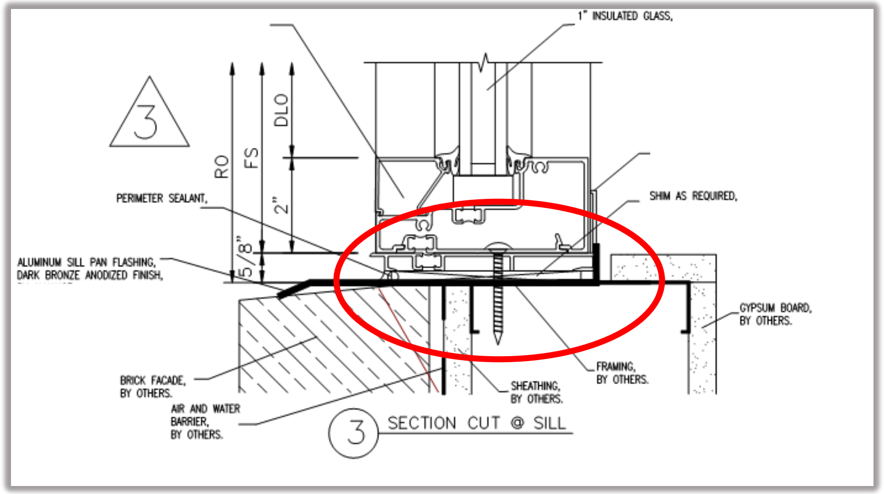
CONSTRUCTION AND SEQUENCING/SEPARATION OF TRADES

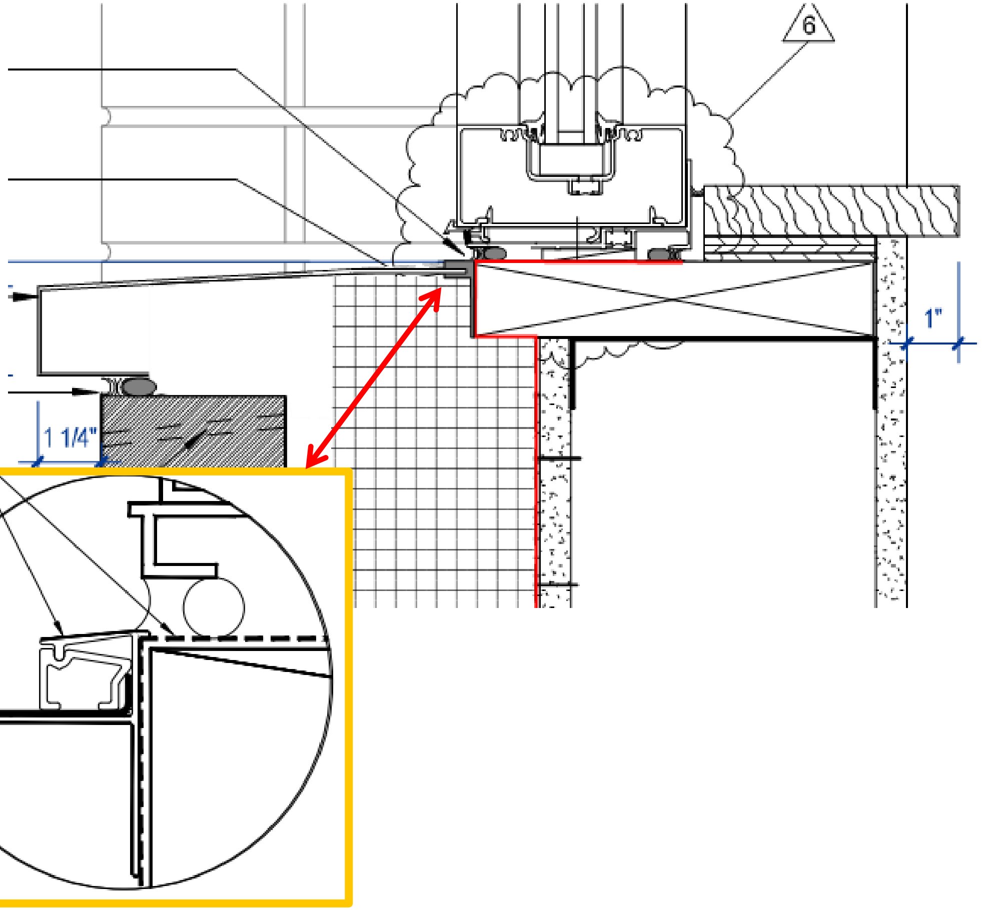
NEW VS. OLD



1" INSULATED GLASS,
3
RO
FS
DLO
2"
5/8"
PERIMETER SEALANT,
SHIM AS REQUIRED,
ALUMINUM SILL PAN FLASHING,
DARK BRONZE ANODIZED FINISH,
GYPSUM BOARD,
BY OTHERS.
BRICK FACADE,
BY OTHERS.
BY OTHERS.
BY OTHERS.
AIR AND WATER
BARRIER,
BY OTHERS.
3 SECTION CUT @ SILL

NEW VS. OLD

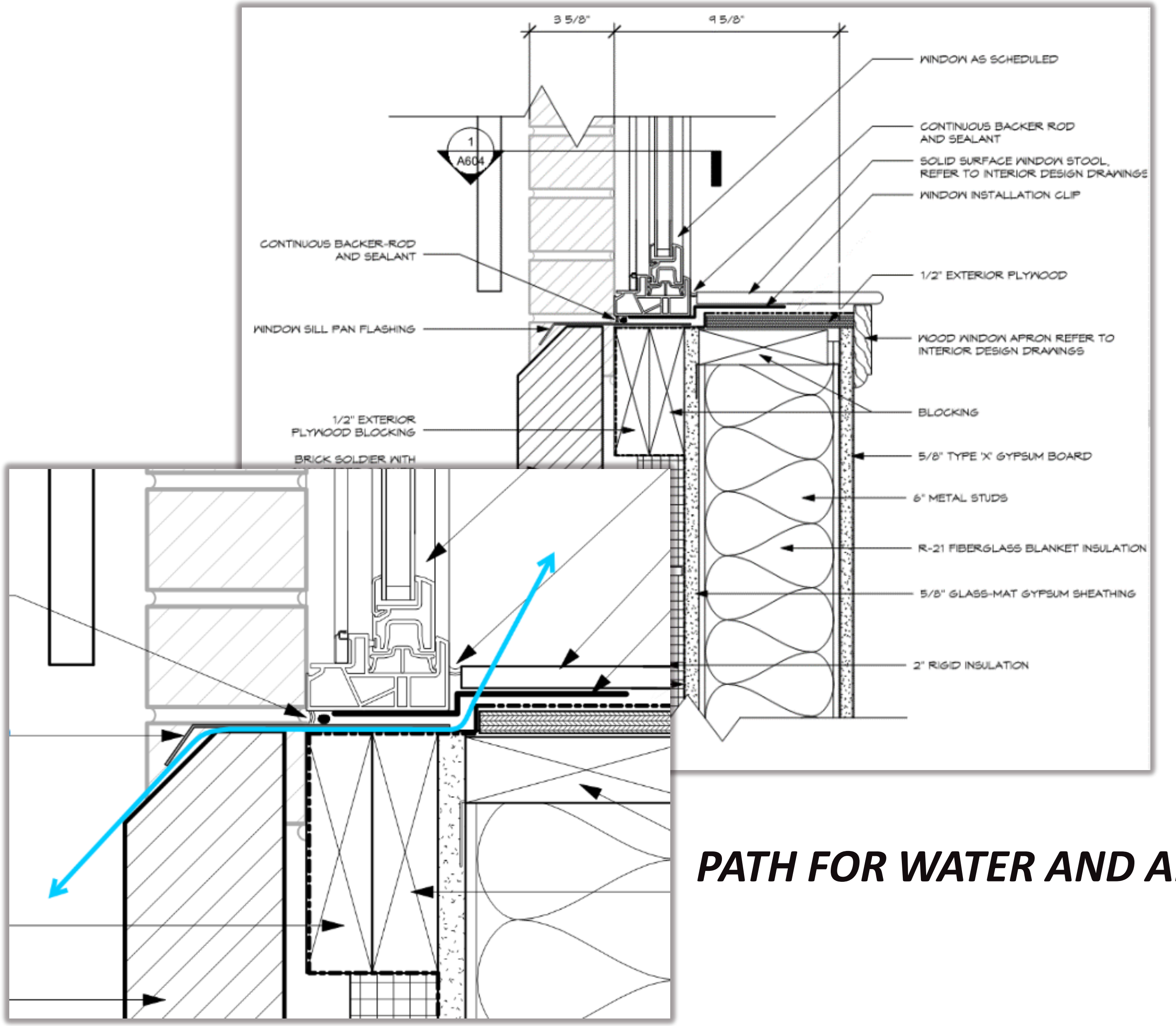




- Performance issues (penetrates seal to air/water barrier and bypasses thermal break)
- Impacts construction sequencing (metal flashing must go in before fenestration)
- Flashing replacement requires fenestration to be removed
- Cladding is typically sequenced first; need to separate cladding and fenestration to allow for simultaneous construction of interior finishes and enclosure assemblies.
- Key is fenestration before cladding.

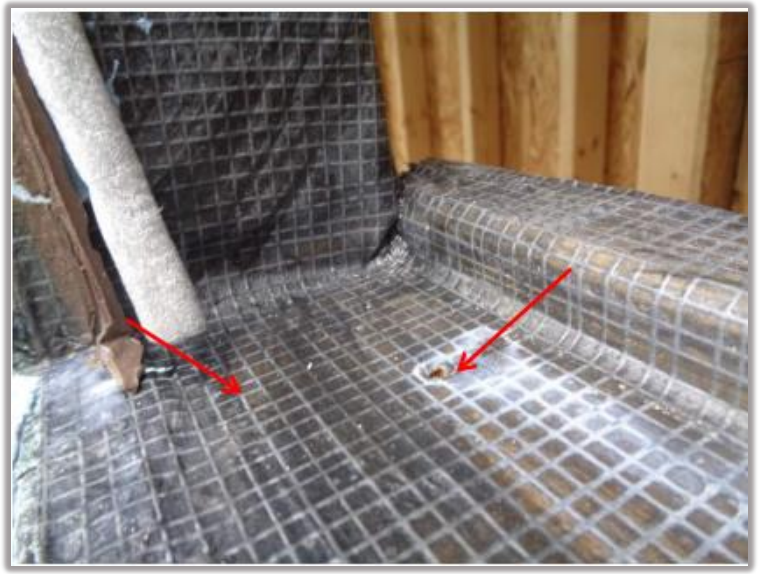
- Cladding and fenestration detached

METAL FLASHING

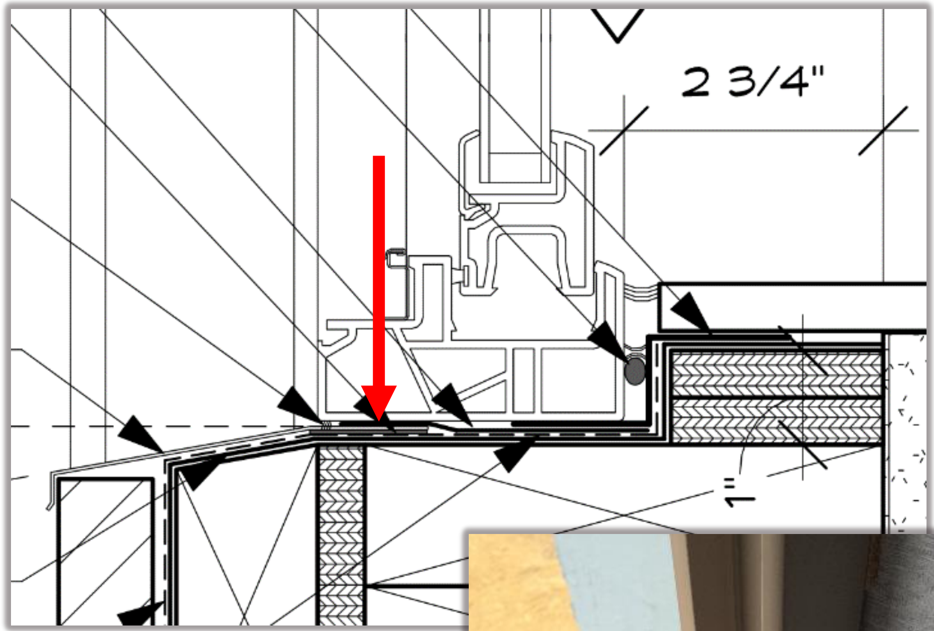


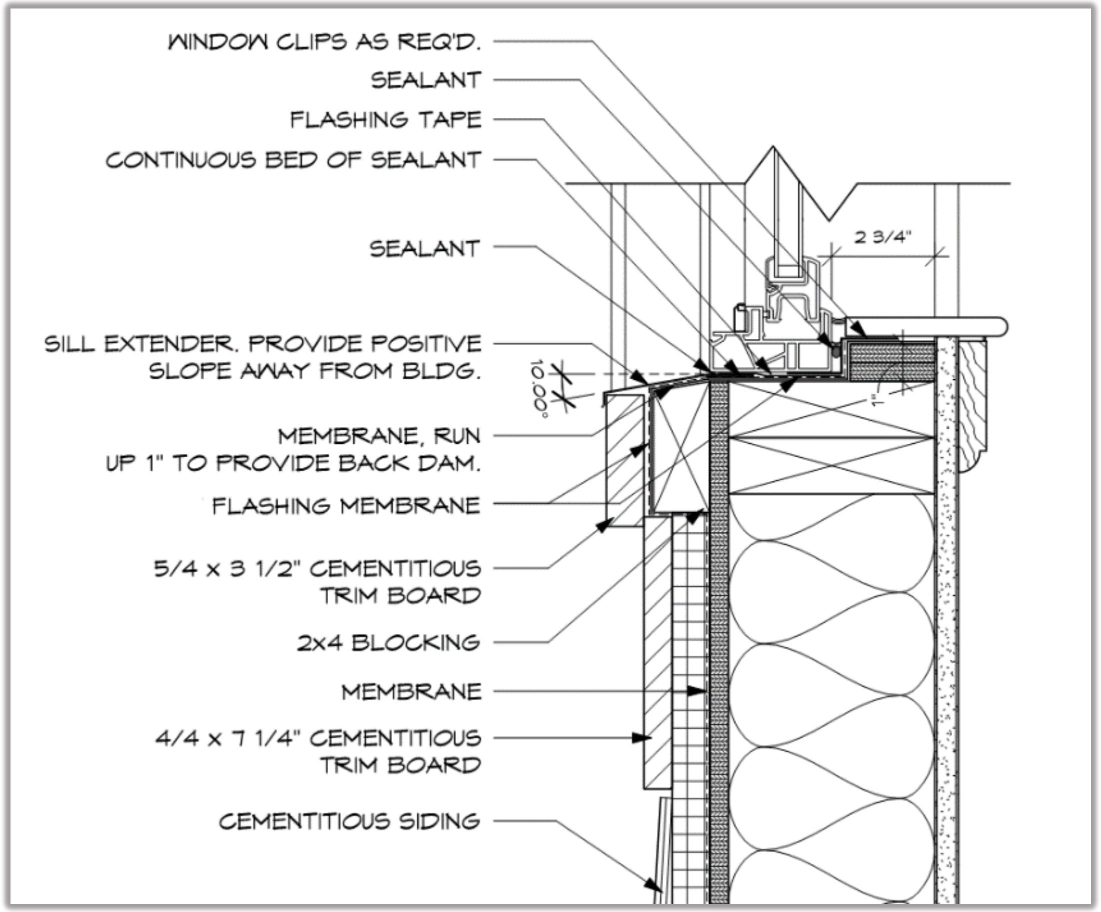
PATH FOR WATER AND AIR

METAL SILL/PERIMETER FLASHING

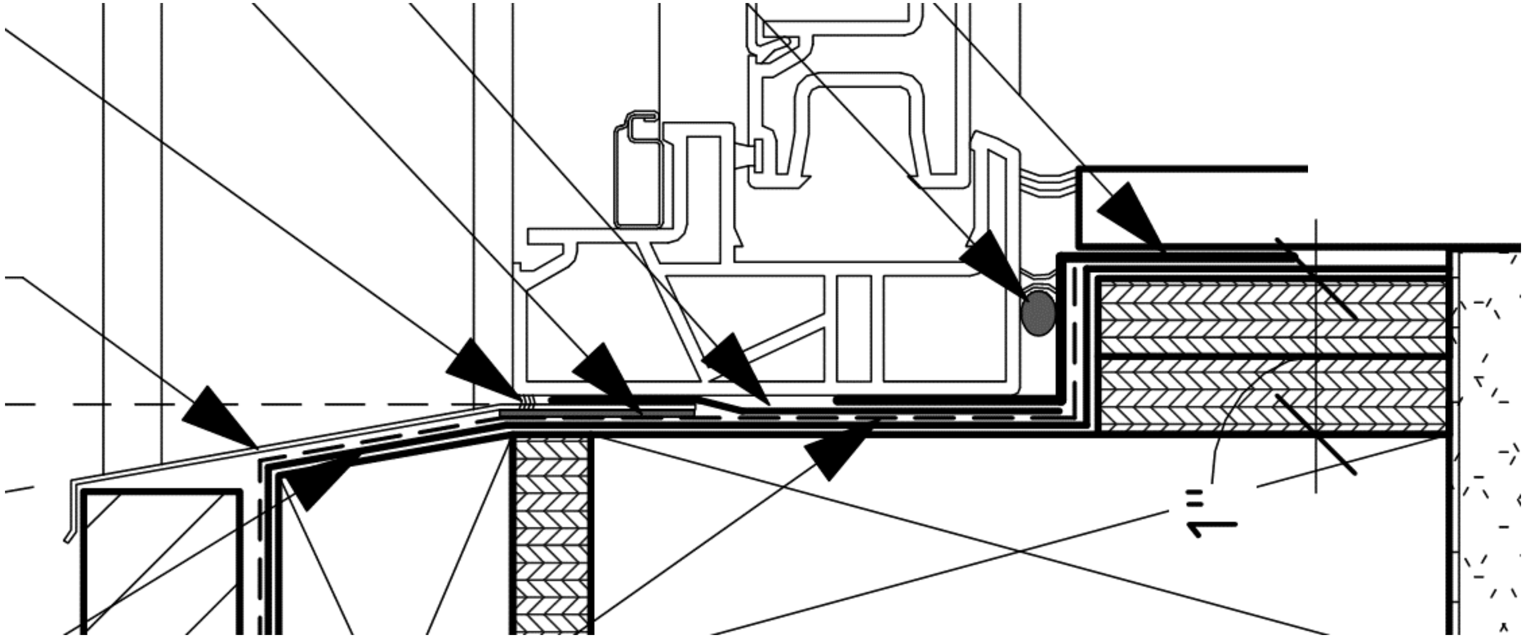


INTEGRATED METAL FLASHING





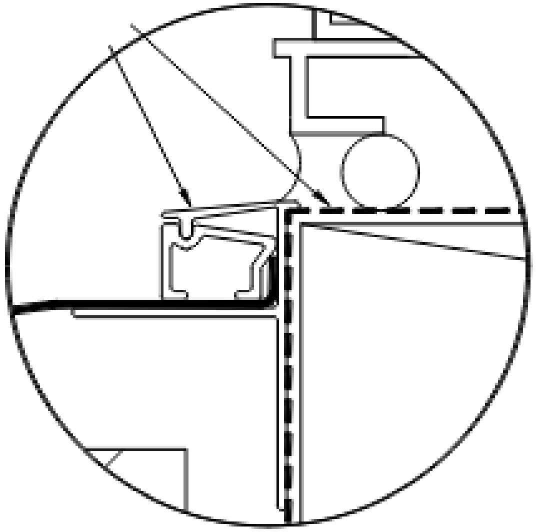
FIELD QC

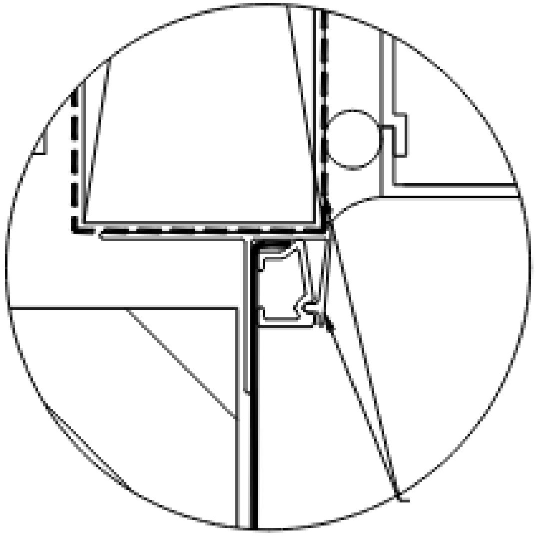


CONSTRUCTION SEQUENCING

PERFORMANCE MOCK-UPS

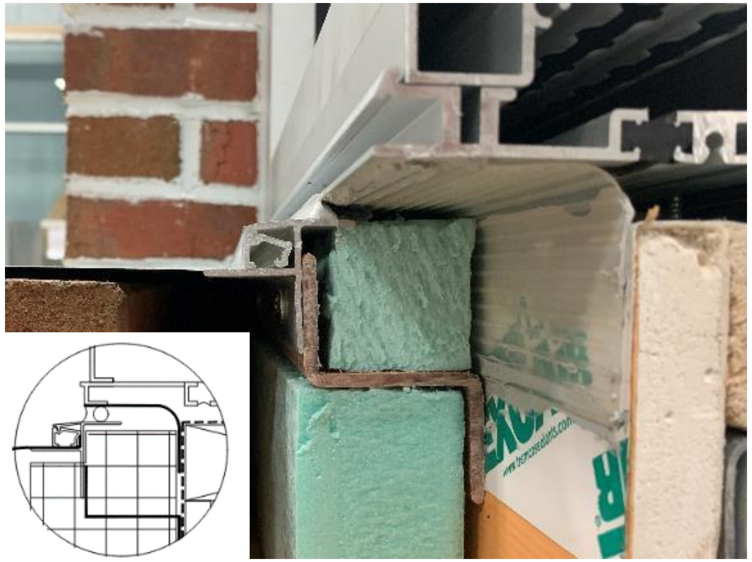
CONSTRUCTION SEQUENCING/SEPARATION OF TRADES

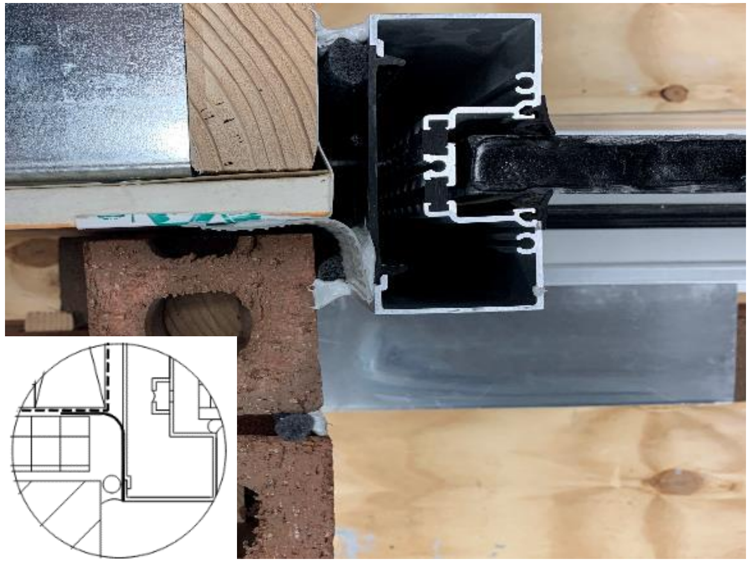




SOLUTIONS

FLASHING RECEIVER

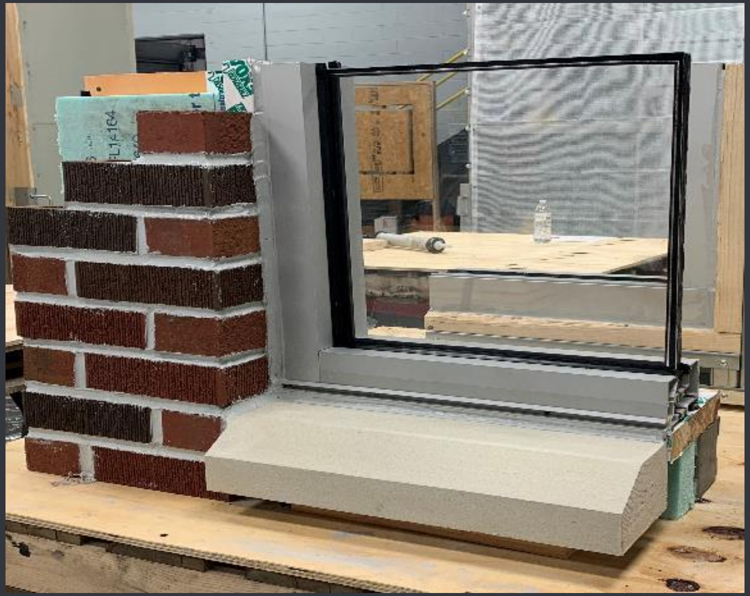


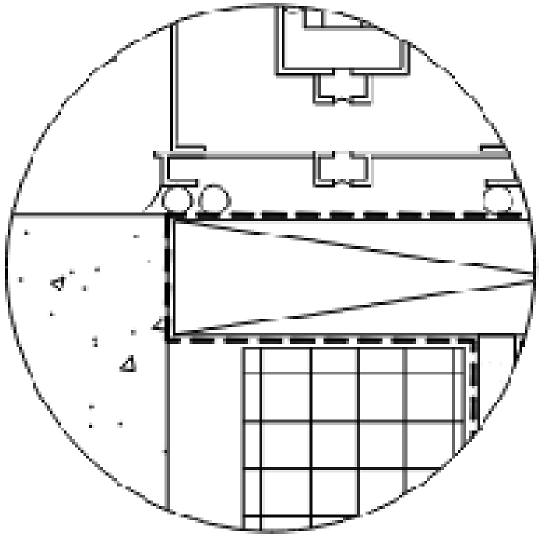


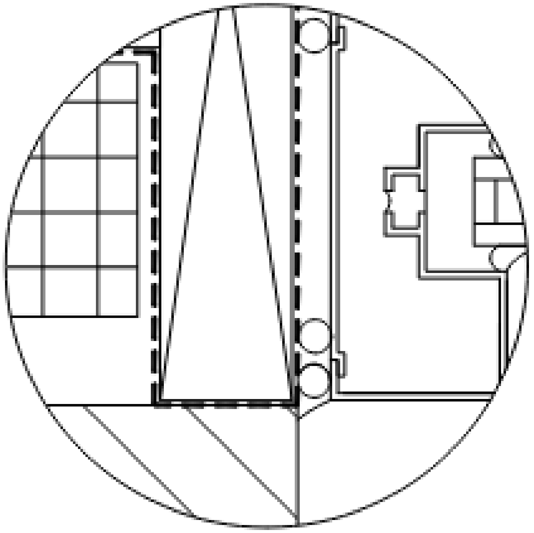
SOLUTIONS

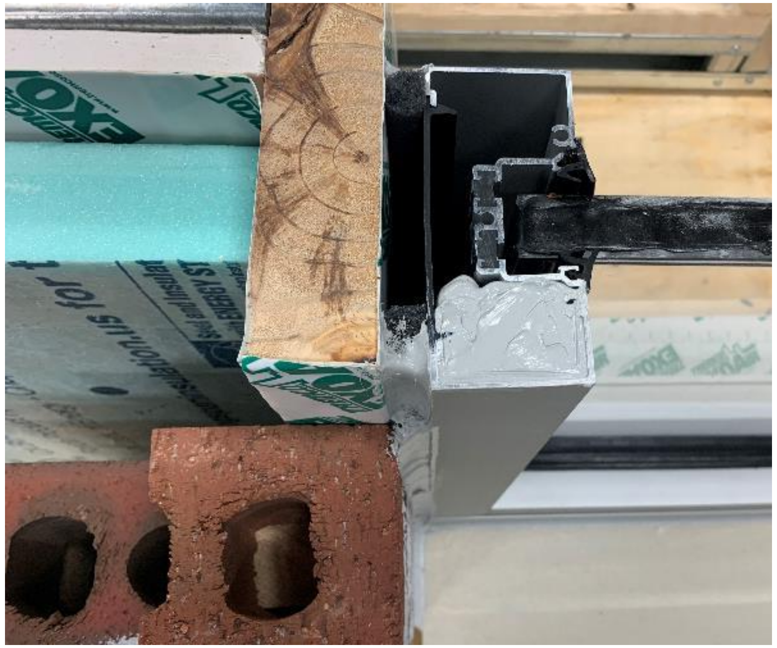
SILICONE SHEET AND FLASHING RECEIVER

SOLUTIONS
DUAL SEALANT JOINTS



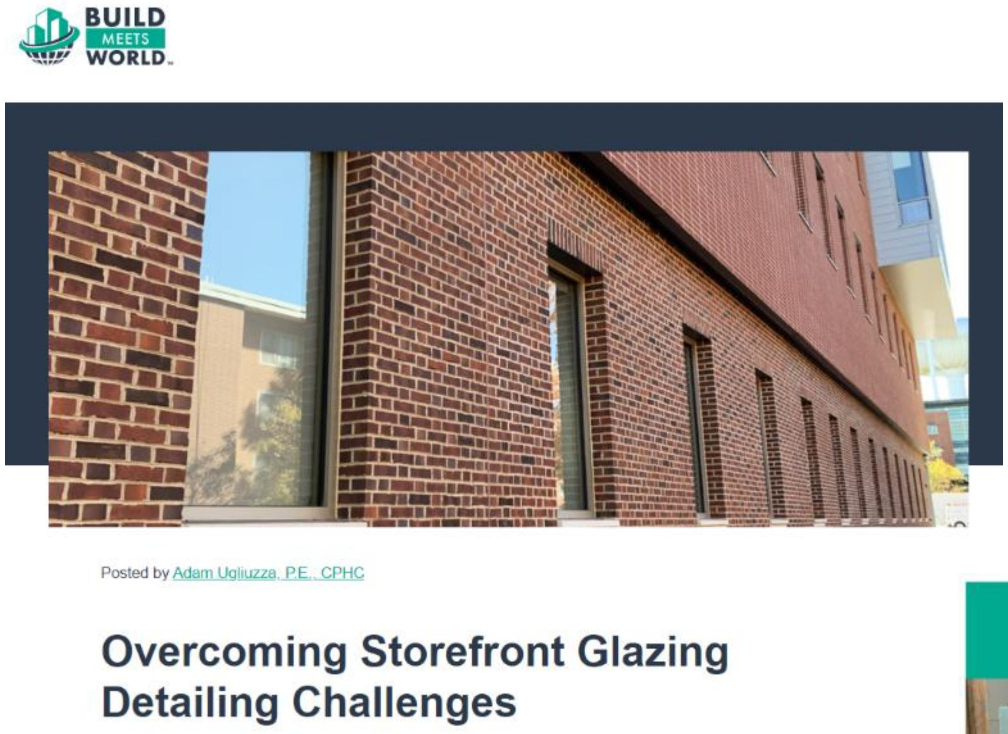






ADDITIONAL INFORMATION

For additional information reference "Overcoming Storefront Glazing Detailing Challenges"
https://lnkd.in/dkMPZscY [blog.buildmeetsworld.com



ABAA GUIDELINES – STOREFRONT COMING SOON!

ABAA – CURTAIN WALL GUIDELINE

https://www.airbarrier.org/wp-content/uploads/2020/09/D-115-032-rev-0-ABAA-Guidelines-Curtainwall-FINAL-2020.08.02.pdf

INTERFACE GUIDELINES

July 2020

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CURTAIN WALL GLAZING ASSEMBLIES

DEVELOPED BY THE TRANSITION, TERMINATIONS, AND FLASHINGS TASK GROUP, HEADED UP BY GROUP CHAIRMAN, ADAM UGLIUZZA, P.E., CPHC

INTRODUCTION

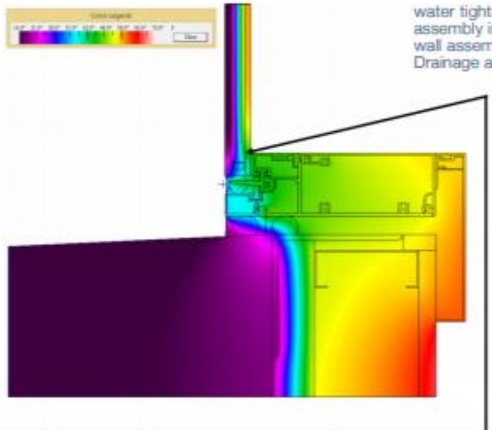
Air leakage and water penetration performance has been established for most building enclosure material and assembly components that are commonly used in the building construction industry. However, air leakage and water penetration performance at the interface of materials and assemblies is often missed or misunderstood. Continuity of a building's air and water control layer(s) lies heavily on how well the building enclosure components are interfaced. It is critical for the design professional to establish which components of the building enclosure will comprise the building enclosure air and water control layer(s). These components may include, but are not limited to, air barriers, waterproofing (WP), fenestration, roofing, precast and cast-in-place concrete, prefabricated panel/unitized systems, insulation, miscellaneous and structural steel components and more.

The relationship between components and trades that is required to ensure continuity of the building enclosure's air and water control layer(s) may not be immediately apparent or intuitive if the contract documents are unsuccessful in presenting the building enclosure as a contiguous and cohesive assembly, composed of inter-related parts. Furthermore, if the contract documents fail to clearly represent the building enclosure's continuous air and water control layer(s) and trade relationships, the related subcontractor's obligation will be limited to the installation and performance of their material, system or assembly alone. This paper will focus primarily on curtain wall glass glazing systems and the integration with adjacent building enclosure air and water control components.

BACKGROUND

With proper interfacing of the curtain wall to the building enclosure's air and water control layer(s), the curtain wall assembly and the adjacent enclosure assemblies become compartmentalized. There is a clear delineation of where air and water control layers of each assembly begins and ends, when transitioning across the wall. Conversely, when the marriage of assemblies is not continuous, there is breach that can lead to water penetration, air leakage, energy loss, condensation, and other performance issues. In these cases, it can be difficult to assign responsibility when a failure occurs. Often there is confusion as to what trade is to blame. When evaluated separately, there may not be deficiencies that are leading to the reported failure. Rather, poor interfacing exposed portions of the assemblies, specifically curtain wall, that can not effectively control air or water (reference Figure 1a-c).

Figure 1a, Failure Investigation



Dewpoint Temperature	37.2°F @ 30%RH / 47.8 @ 45%RH / 55.6 @ 60%RH
Coldest Interior Frame Temperature	47.9°F
Edge of Glass Temperature	51.8°F
Coldest Interior Temperature	47.5°F

Figure 7, THERM Model
Precast Concrete Opening

Air, Water and Thermal Control

Each assembly typically has a defined plane for air and water tightness. The complexity of the noted assemblies may require the plane to jog inward and/or outward to maintain continuity when transitioning to different materials that make up the assembly. Understanding the location of this plane, specifically at the perimeter condition, is critical to interfacing with adjacent building enclosure components to achieve continuous air and water control. Consulting the curtain wall manufacturer or reviewing product test reports are usually the easiest way to identify the plane of air and water tightness and location of the primary perimeter seal. Consideration must also be given to not negate the function of thermal separator or thermal break materials that are typically required for thermal performance of the curtain wall assembly; this is typically addressed when sealing the curtain wall assembly at the plane of air and water tightness. The curtain wall alignment with adjacent opaque wall assembly thermal control (insulation) must also be considered. Generally, it is best practice to align the insulated glass unit (IGU) with the opaque wall insulation; however, thermal modeling software, like THERM (reference Figure 7), is recommended to review each project condition to better mitigate thermal losses.

Drainage Accommodation

The drainage strategy of the assembly can be easily overlooked. Like understanding the plane of air and water tightness of the assembly, drainage of the assembly is also key. There are two types of curtain wall assemblies, drainage vs. barrier assemblies. Drainage assemblies allow some water to migrate past the exterior surface of the wall to a continuous interior drainage plane, where it is collected and drained back to the exterior utilizing integrated channels and weeps, as well as flashings and other accessories, to collect and drain water. When interfacing with adjacent assemblies, be sure that the curtain wall assembly weeps or weep channels are not sealed, blocked or restricted from properly weeping. In contrast to drainage assemblies, barrier wall assemblies are designed to prevent water from penetrating the wall by employing an exterior face seal. Barrier wall assemblies rely on the exterior surface of the wall and sealant joints to remain air and watertight.

CONSTRUCTION SEQUENCE

The sequence of construction can vary; regardless, it is critical that the curtain wall glazing assembly is continuously sealed to the surrounding building enclosure air and water control layer(s). Best practice is that the curtain wall glazing assembly is installed prior to the installation of cladding to allow uninhibited access to the critical seals. This also allows the curtain wall glazing assembly to be field tested when all adjacent air and water control layers are exposed, making it easier to diagnose and correct issues. Further, the building is dried in quicker, mitigating the need for temporary tarping; this methodology can help to compress construction schedules as building interiors can be installed simultaneous to exterior cladding (reference Figure 9).

Figure 9, Construction Sequencing
Building Air and Water Control Layers Complete prior to Wall Cladding Installation

ABAA – CURTAIN WALL GUIDELINE

https://www.airbarrier.org/wp-content/uploads/2020/09/D-115-032-rev-0-ABAA-Guidelines-Curtainwall-FINAL-2020.08.02.pdf

MOVEMENT	MOVEMENT TYPE	CAUSE(S)
Vertical Movement	Vertical inter-story drift	Live and dead load deflection Thermal expansion/contraction
Horizontal Movement	Horizontal inter-story drift	Seismic & wind loading Weather/environmental
Horizontal Deflection	Perpendicular to the plane of the curtain wall	Wind Loading

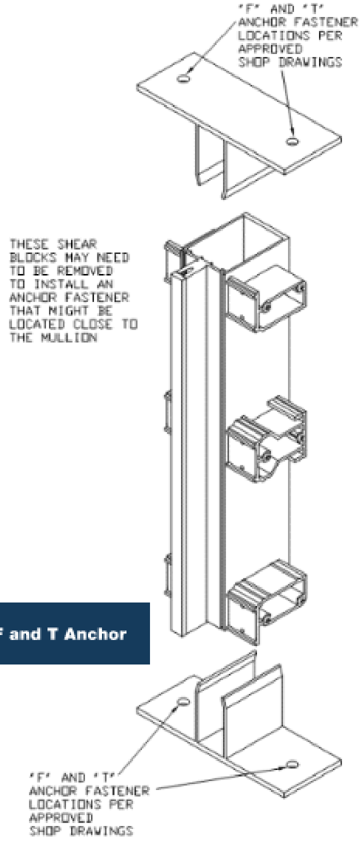
Figure 4, Curtain wall Movement

CURTAIN WALL DESIGN CONSIDERATIONS

Movement and Anchorage

Curtain wall assemblies are all designed to accommodate building movement. Weather, environmental factors and a multitude of loading conditions all impose forces on the curtain wall assembly and require the curtain wall to accommodate movement (reference Figure 4, Curtain Wall Movement).

A structural engineer must be involved in the design to ensure curtain wall structural integrity and to provide anticipated movement requirements so that air and water tightness is maintained within the curtain wall assembly and at the perimeter condition where interfacing with adjacent assemblies. The anchoring method used is based on calculations and the determination of which method is best suited for the application. Stick Built assemblies will accommodate several types of anchoring methods. For Stick Built assemblies these can vary from "F" and "T" anchors or "F" perimeter anchors for sill and head conditions and slab edge/structural member connections for anchorage within the vertical span. Vertical splice connections are commonly employed to transfer load or accommodate movement for taller curtain wall spans or when the vertical mullions cannot be continuous (reference Figure 5, Stick Built Connections).



F and T Anchor

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INTERFACE COORDINATION

Chemical and Adhesive Compatibility of Materials

To create an air and watertight interface between the wall and curtain wall glazing assemblies, materials must be used that are both chemically and adhesively compatible. Sealants, self-adhered and fluid applied flashing membranes, engineered transition membranes (ETAs), etc. can all be used at curtain wall openings to seal the perimeter condition; it is critical that the construction team verify that the project specific combination of materials can work together, especially those sourced from different manufactures.

- **Sealant Joints** – Sealant joints are typically an hour-glass shape formed by tooling the sealant against backer rod or bond breaker tape with a knife. Use of sealant joints is further explained in ASTM C920 which outlines different uses, applications, movement classes, and a variety of other items relative to "Performance Sealants".
- **Flashing Membranes and Pre-cured Silicone Sheet Extrusions** - Flashing membranes can be offered in self-adhered sheet or fluid applied options. These membranes and pre-cured silicone sheets include properties such as elongation that accommodates building and curtain wall movement, tear resistance and resistance to flex cracking and abrasions.

For chemical compatibility, request letters from the manufactures of the materials which will be in contact with each other. For adhesion, field testing is required unless the manufacturers have already performed the testing. Note that the manufacturer laboratory testing typically involves sourcing and shipping the test materials that can delay the project. When reviewing, it is common practice for the responsibility of determining chemical and adhesive compatibility be of the manufacturer of the material that is lapping or adhering to an installed material. Consult the manufacturer on the recommended field adhesion test method applicable for the project. Also reference the Quality Assurance (QA)/Quality Control (QC) Requirement Checklist section in this guideline paper that includes industry standard test methods for adhesion.

Preconstruction planning is the best approach to mitigating issues with chemical and adhesive compatibility; the construction team should consider implementing a compatibility matrix to review interfacing materials before installation in the field. Minimizing the number of manufacturers supplying products for a project can also help mitigate issues with verifying chemical and adhesive compatibility, as product manufacturers are generally more equipped to respond to material interface compatibility concerns within their respective product lines.

CONCEPTUAL INTERFACE

The plane of air and water tightness of each component must be understood to ensure proper integration of components and ultimately that a continuous air and water control boundary for the building is achieved. The conceptual detail provided identifies the plane of air and water tightness and integration of the curtain wall glazing assembly at an opening condition. The detail below is representative of a typical "pressure wall" type curtain wall glazing assembly.

The example below does not represent all curtain wall glazing assemblies; the plane of air and water tightness assembly may vary. The designer and installer must review the curtain wall assembly design, product data and test reports to fully understand the plane of air and water tightness for the specified curtain wall assembly. This is the foundation for determining the location for the curtain wall assembly primary seal and tie-in to the adjacent building enclosure assembly air and water control layers.

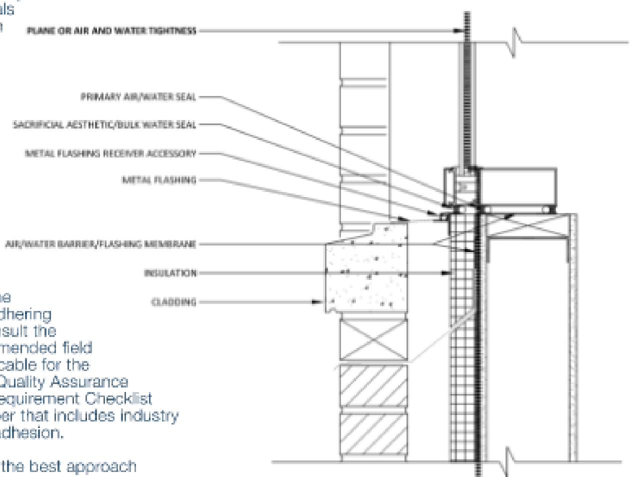
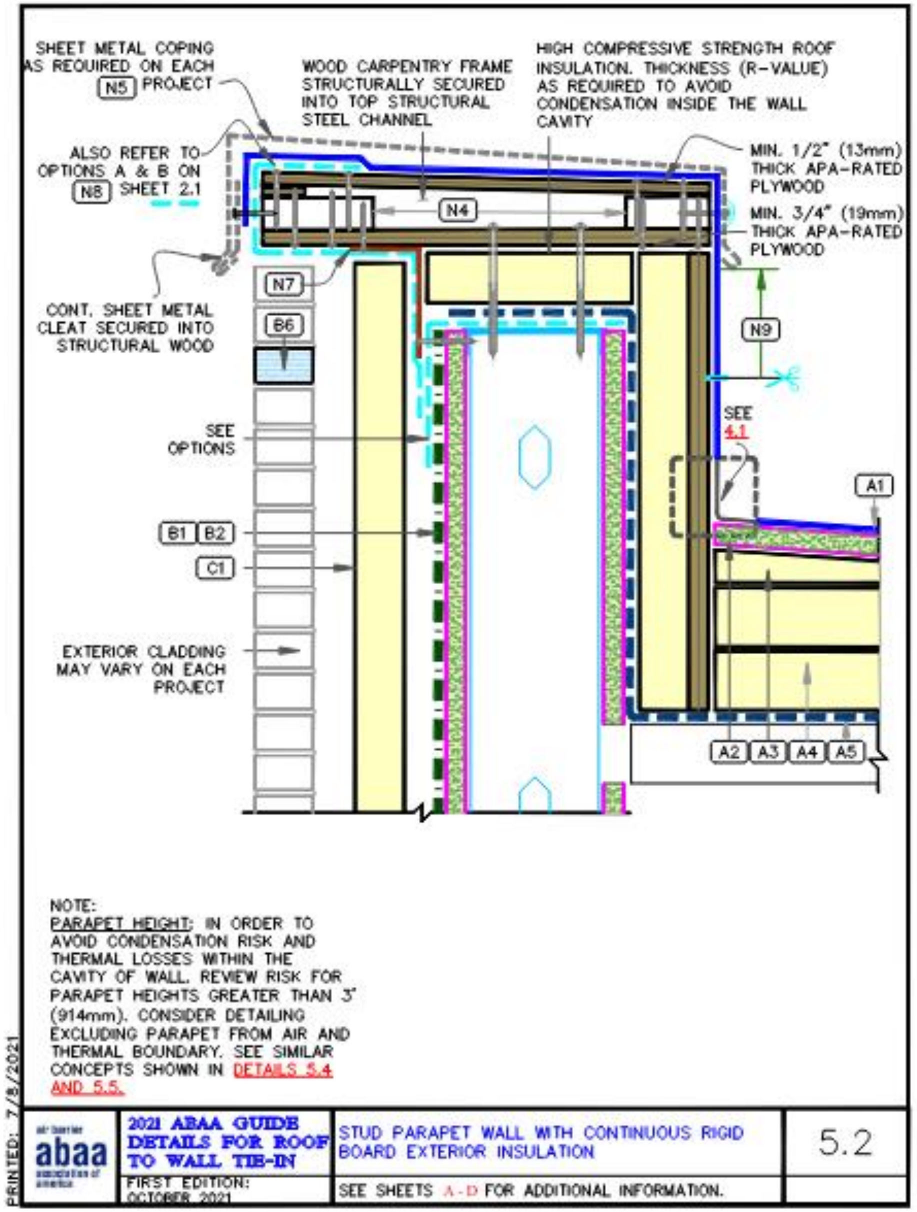
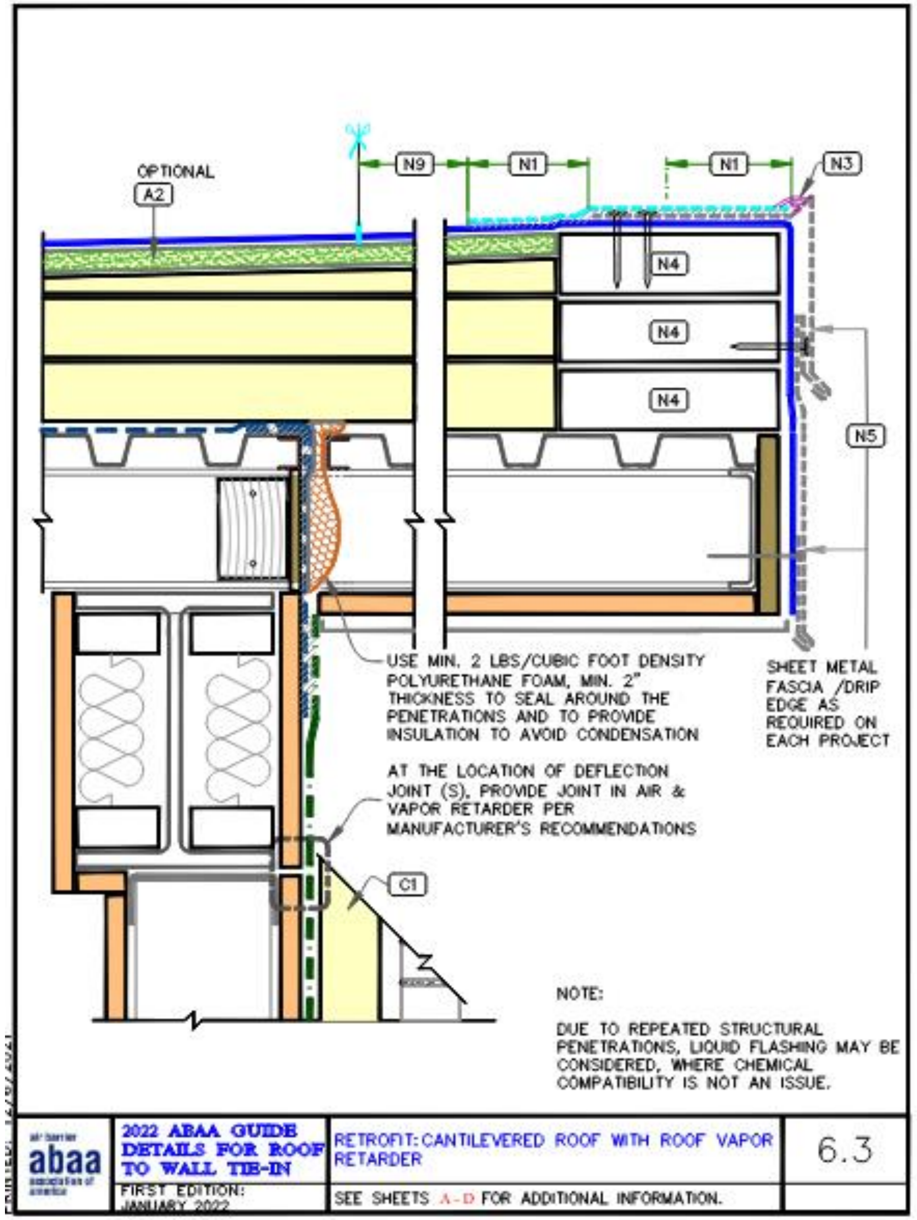


Figure 10, Conceptual Detail

ABAA – ROOF TO WALL INTERFACE DETAIL GUIDELINE

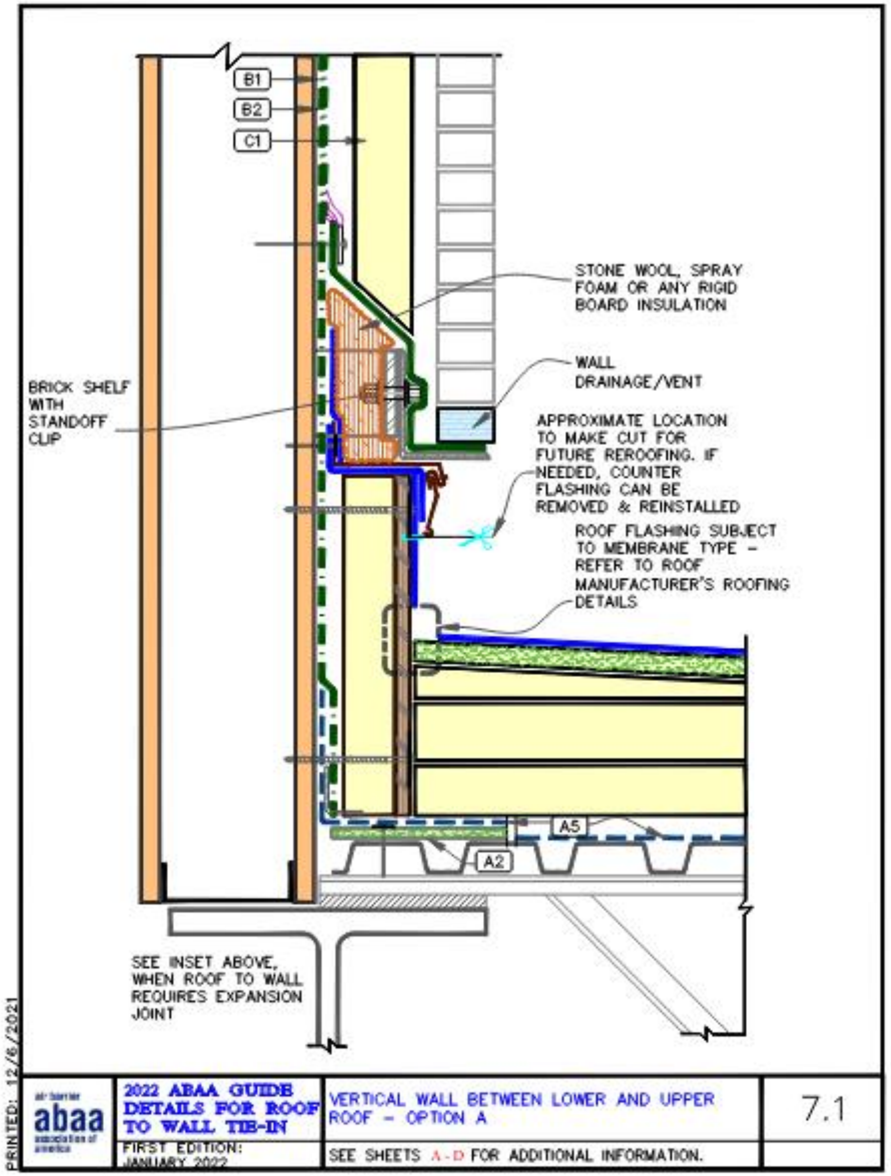
Final Coming Soon with 3D!

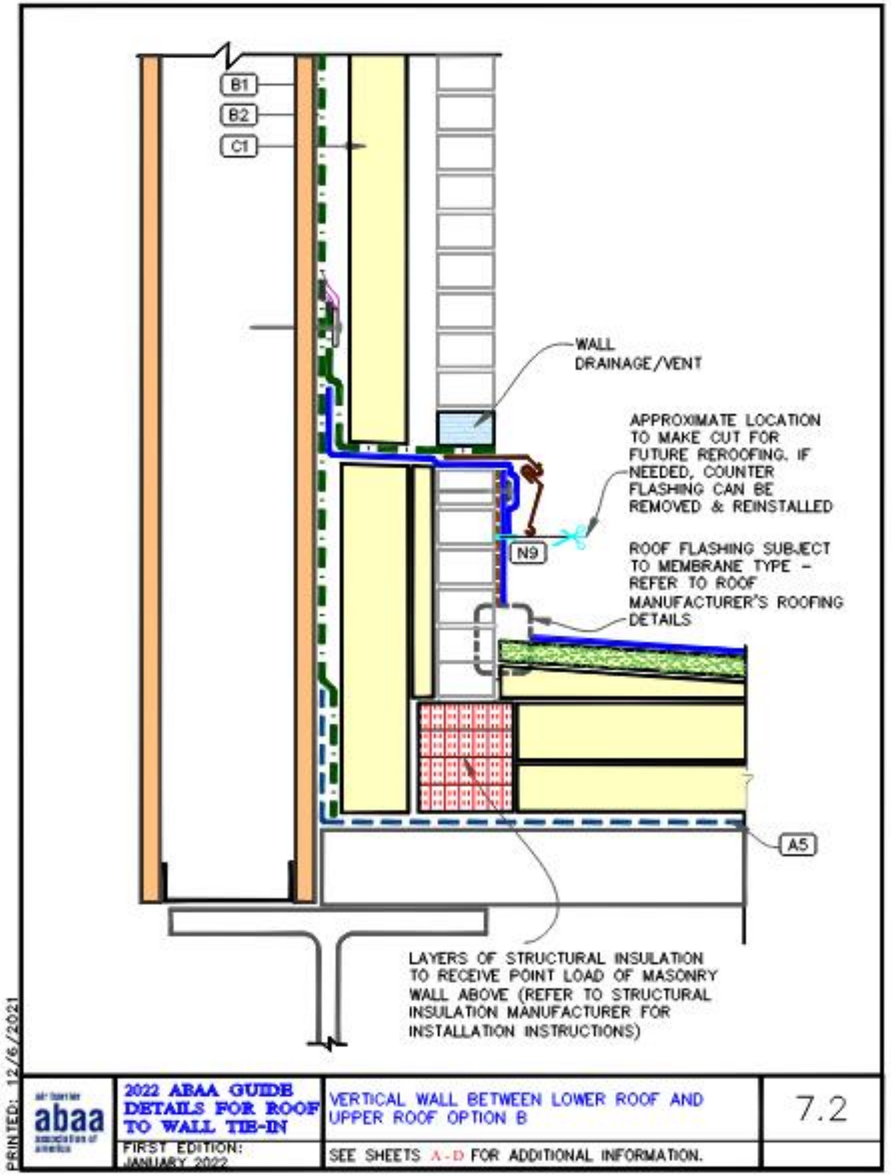




ABAA – ROOF TO WALL INTERFACE DETAIL GUIDELINE

Final Coming Soon with 3D!





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