Designing and Detailing Air Barrier Connections at Storefronts and Curtainwalls

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Learning Objectives

Identify common sources of air leakage at curtain wall and storefront interfaces and explain their impact on overall building performance.

Evaluate current industry standards and best practices for detailing air barrier transitions.

Recognize the importance of early design coordination among manufacturers, designers, and contractors to achieve continuous air barrier systems.

Apply design and detailing strategies that improve product compatibility, constructability, and airtightness at fenestration openings.

Why?

Building Enclosure Failures & Challenges

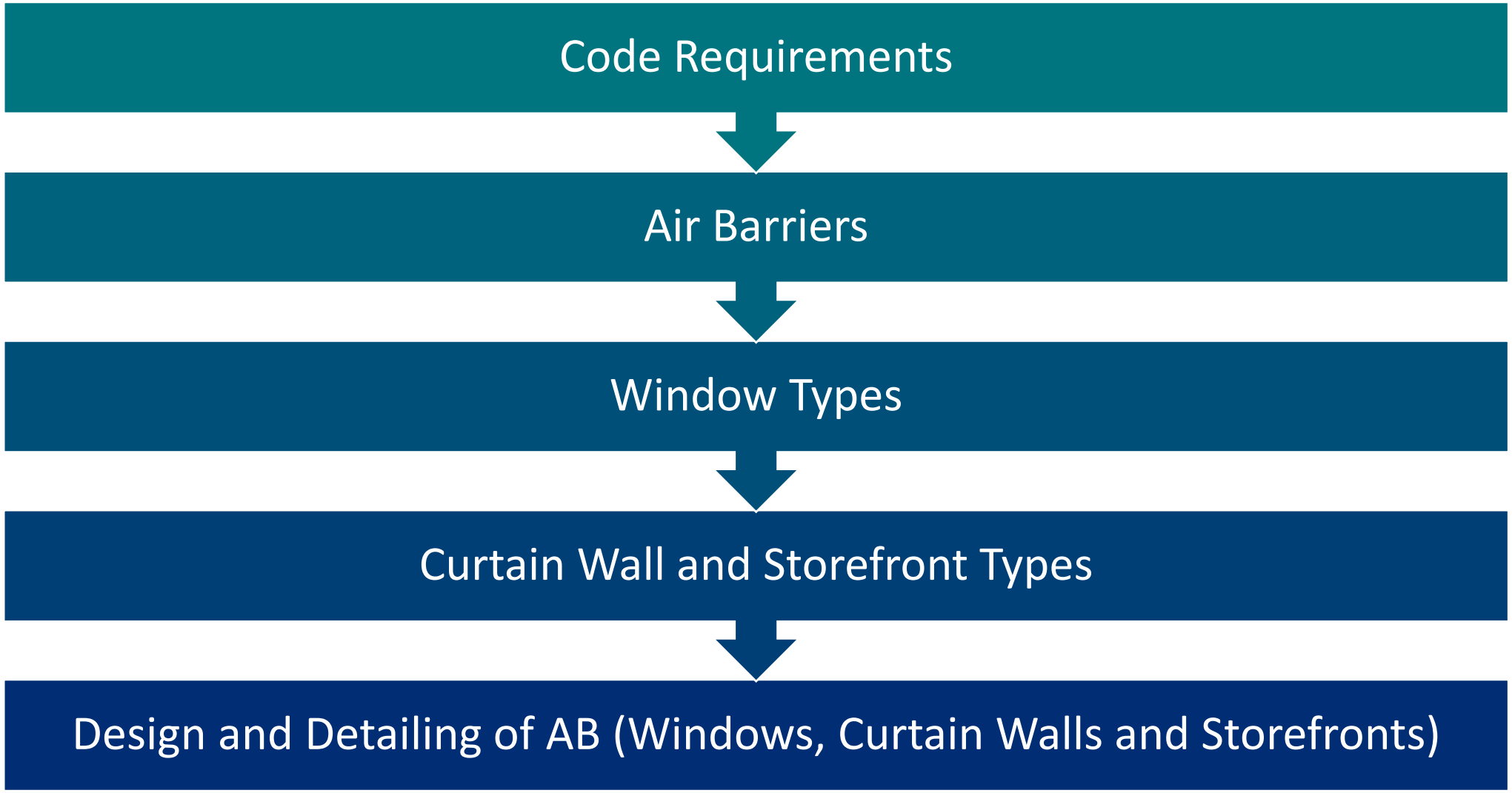
Legal fees, rework, and all forensics involved in investigating building failures account for billions spent in the construction industry annually.

- ***Over 80% of construction litigation is a result of building enclosure failures.***
- ***Over 90%*** of these failures occur in ***1% of the enclosure***. These failures are related to issues typically observed at penetrations, fenestrations, roof-to-wall transition, and dissimilar material transitions.

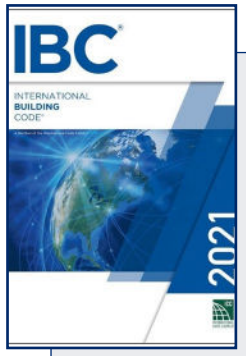
Why Else?

- General lack of knowledge by design professionals of water management systems for the various fenestration assemblies
- Poor consideration for constructability & sequencing
- Poor understanding of air barrier material limitations

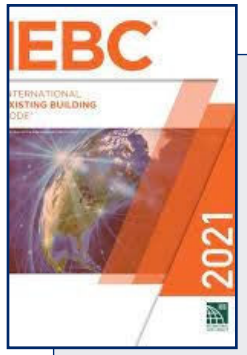
Overview


Code Requirements
Air Barriers
Window Types
Curtain Wall and Storefront Types
Design and Detailing of AB (Windows, Curtain Walls and Storefronts)

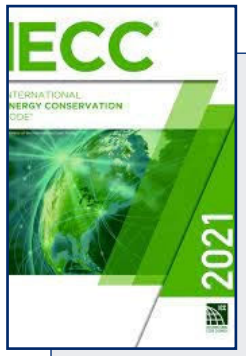
Code Requirements



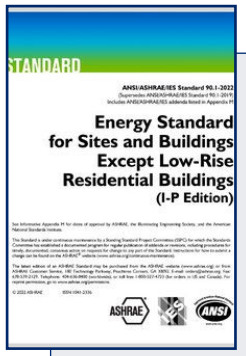
International Building Code (IBC)



International Existing Building Code (IEBC)



International Energy Conservation Code (IECC)

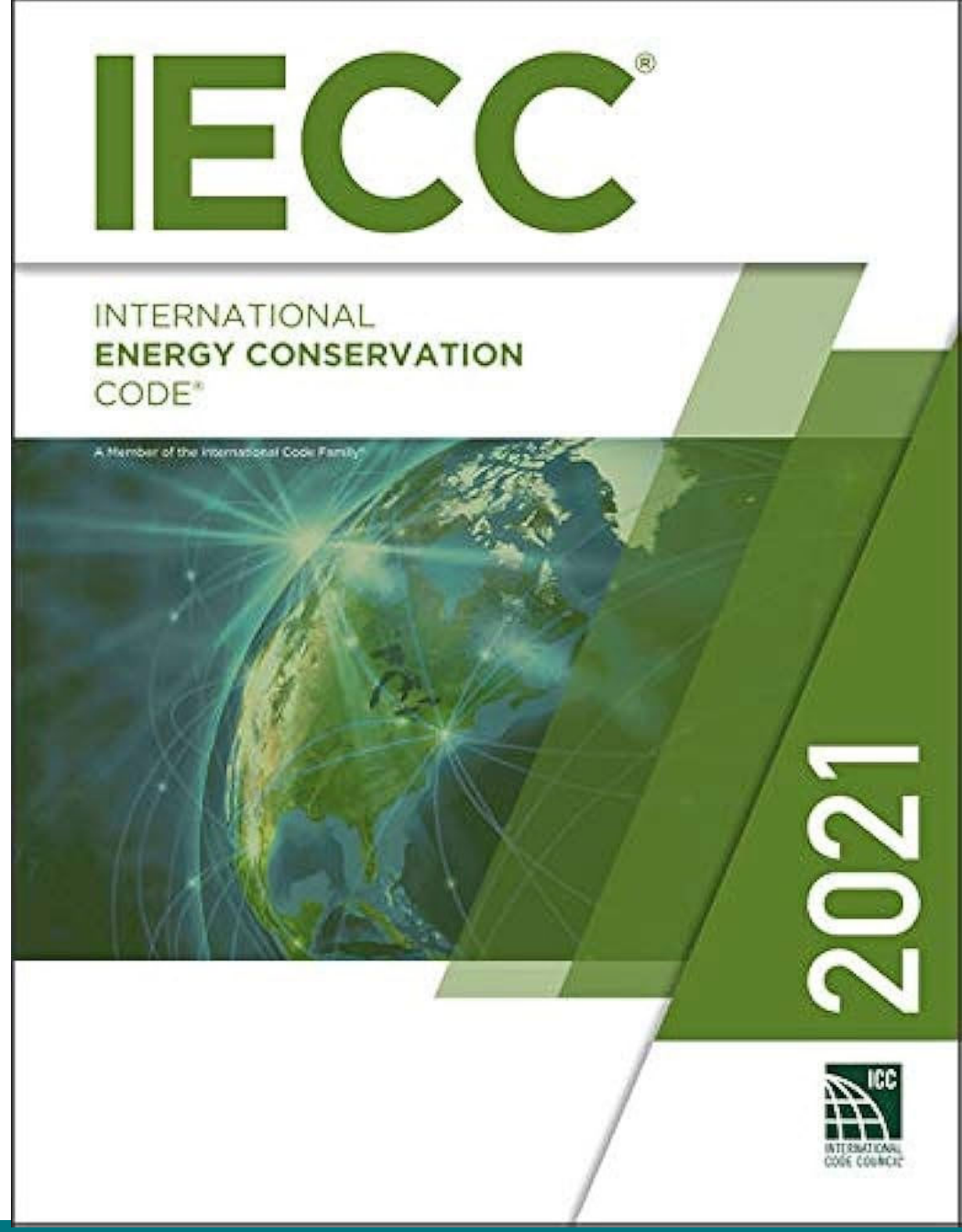


Energy Standards for Buildings, except Low-Rise Residential Buildings (ASHRAE 90.1)

Optional Codes: International Green Conservation Code (IGCC)

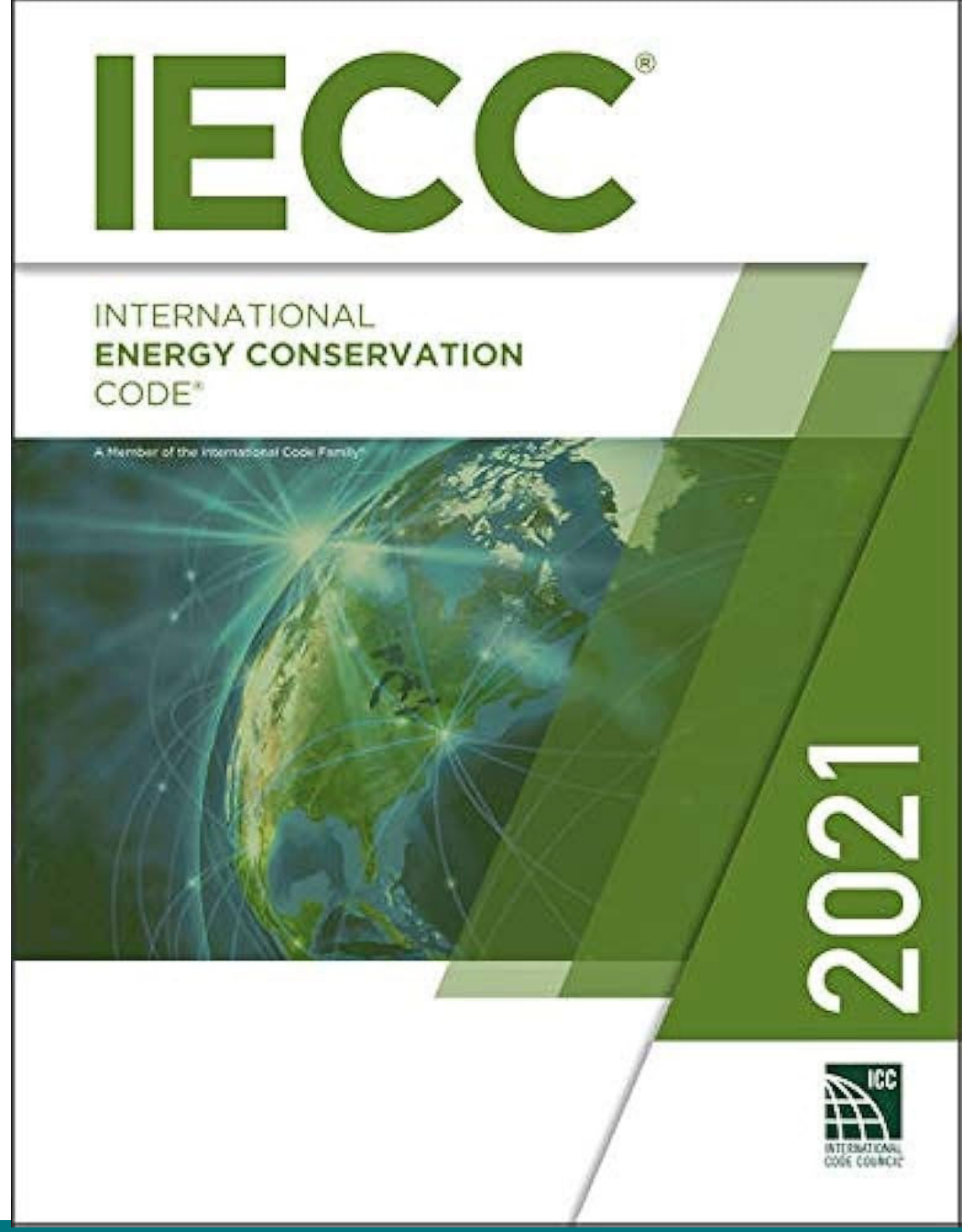
IECC Chapter 4 – Commercial Energy Efficiency *cont.*

- C402.5 –Air Leakage – Building Thermal Envelope:
  - Comply with **C402.5.1** – C402.5.11.1 OR Testing in accordance with C402.5.2 or **C402.5.3**
- **C402.5.1 – Air Barriers**
- C402.5.2 – Dwelling and sleeping unit enclosure testing
- **C402.5.3 – Building thermal envelope testing**
- C402.5.4 – Air leakage of fenestration
- C402.5.5 – Rooms containing fuel-burning appliances
- C402.5.6 – Doors and openings to shafts, stairs, elevator lobbies
- C402.5.7 – Air intakes, stairways, and shafts
- C402.5.8 – Loading dock weather seals
- C402.5.9 – Vestibules
- C402.5.10 – Recessed lighting
- C402.5.11 – Operable openings interlocking

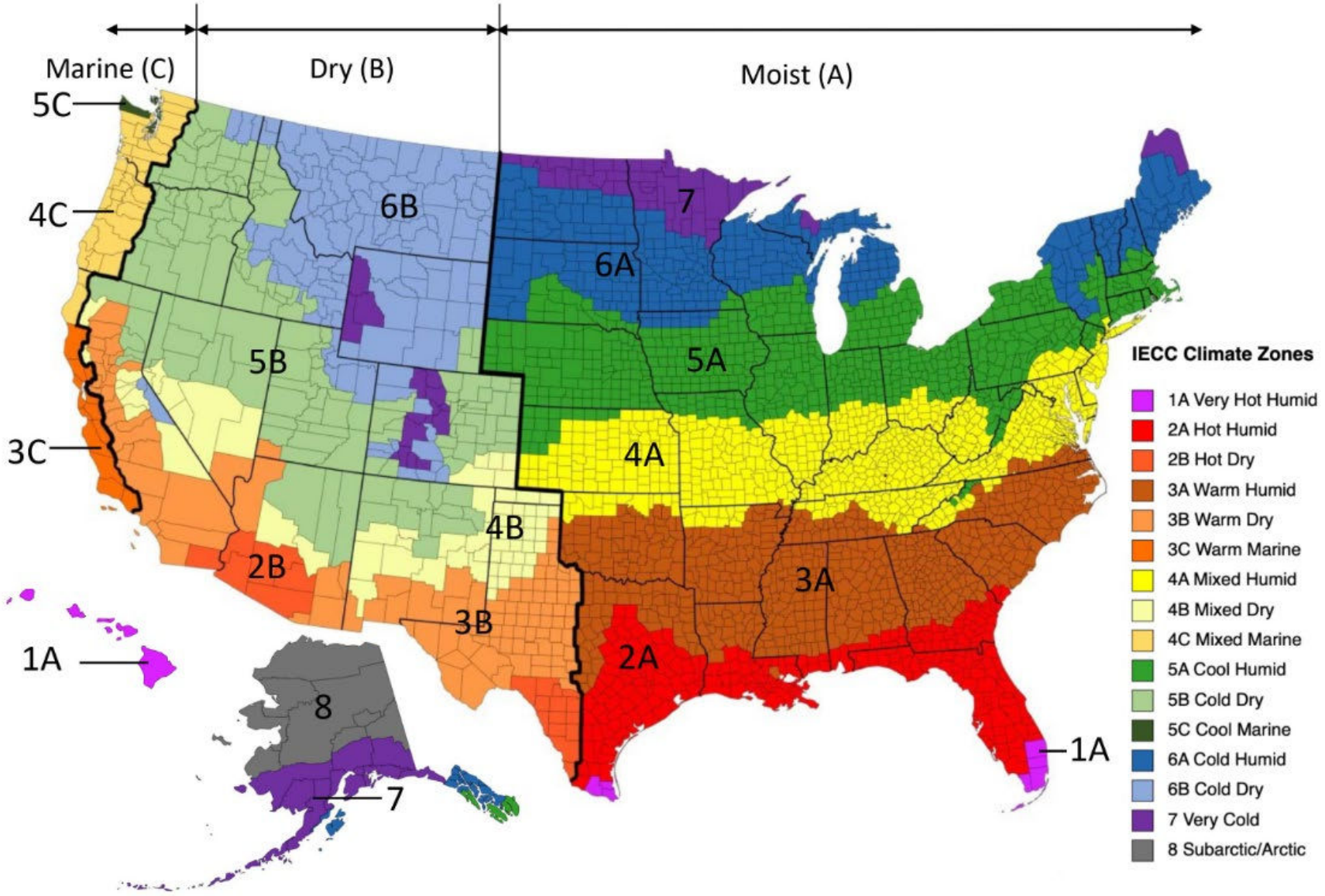


IECC Chapter 4 – Commercial Energy Efficiency *cont.*

- C402.5.1 – Air Barriers:
  - "A continuous air barrier shall be provided throughout the building thermal envelope."
  - "Shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof."
    - **Exception:** Air barriers are not required in buildings located in Climate Zone 2B.

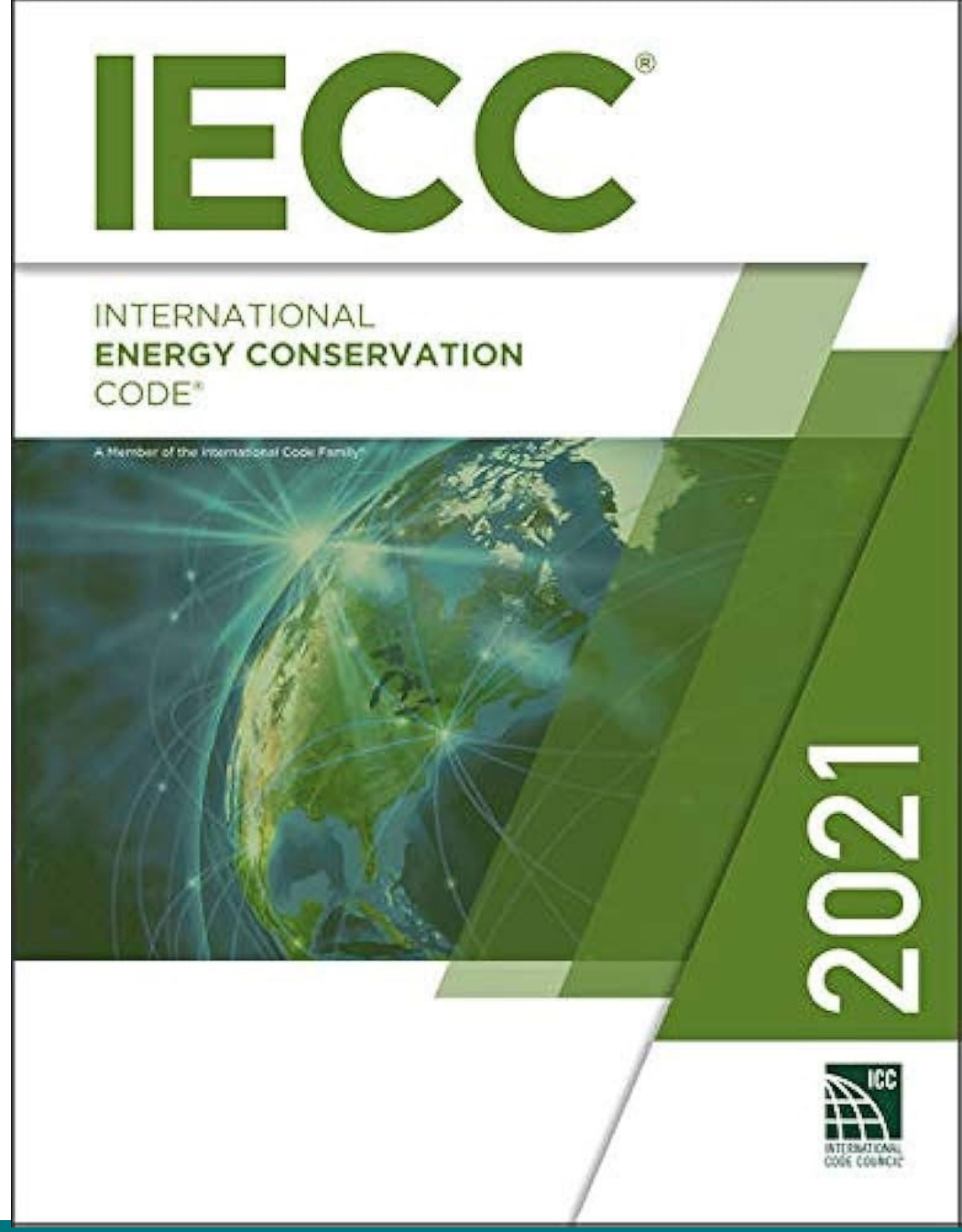


Climate Zones



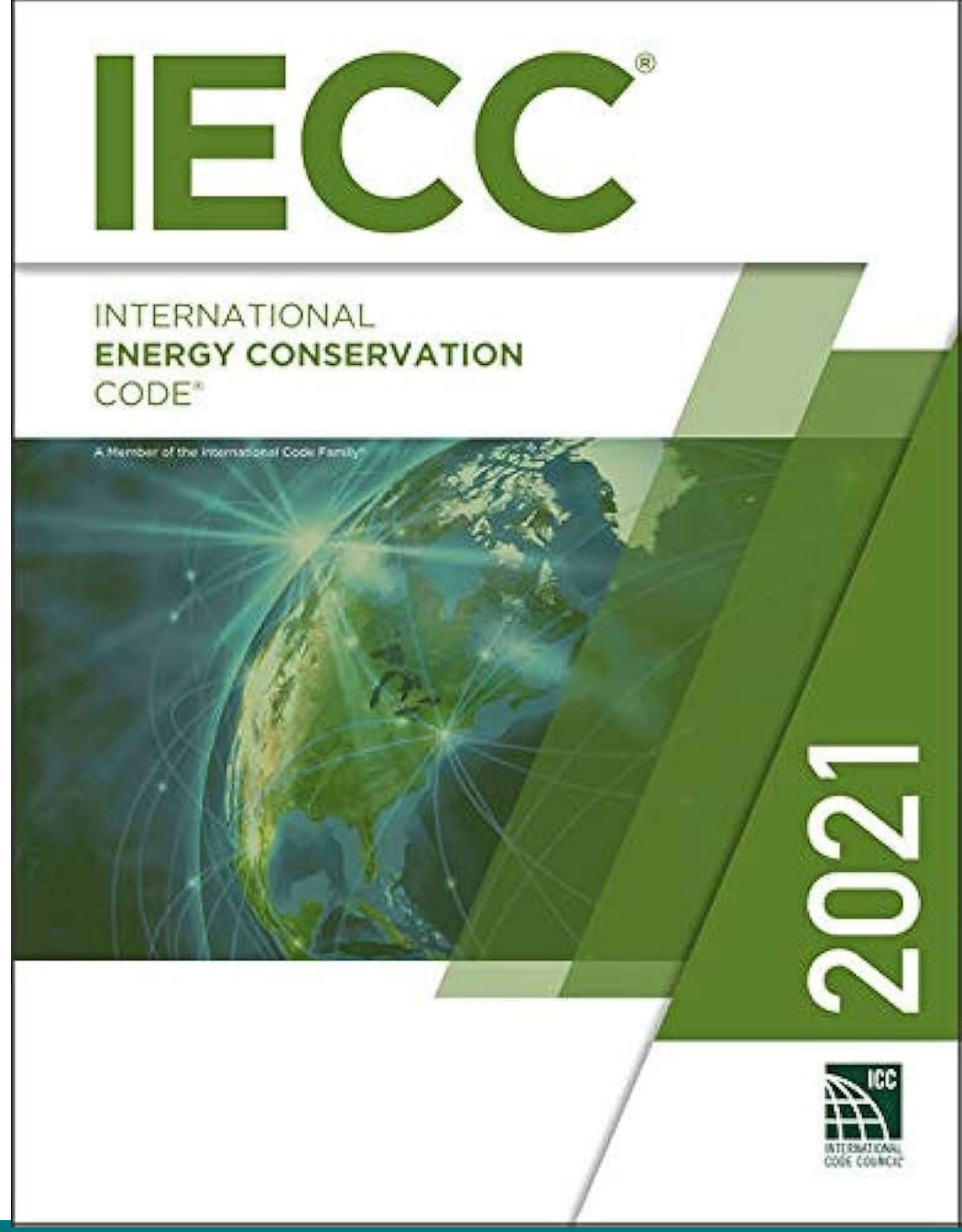
IECC Chapter 4 – Commercial Energy Efficiency *cont.*

- C402.5.1 – Air Barriers:
- C402.5.1.1 – Air barrier construction
  - **Continuous** for all assemblies that make up the thermal envelope, including joints and assemblies
  - Joints and seams shall be **sealed**, including transitions and changes in materials; securely installed so as not to **dislodge or loosen**
  - Penetrations shall be sealed, **allowing for movement** & vibration
  - **Recessed lighting fixtures** within the thermal envelope



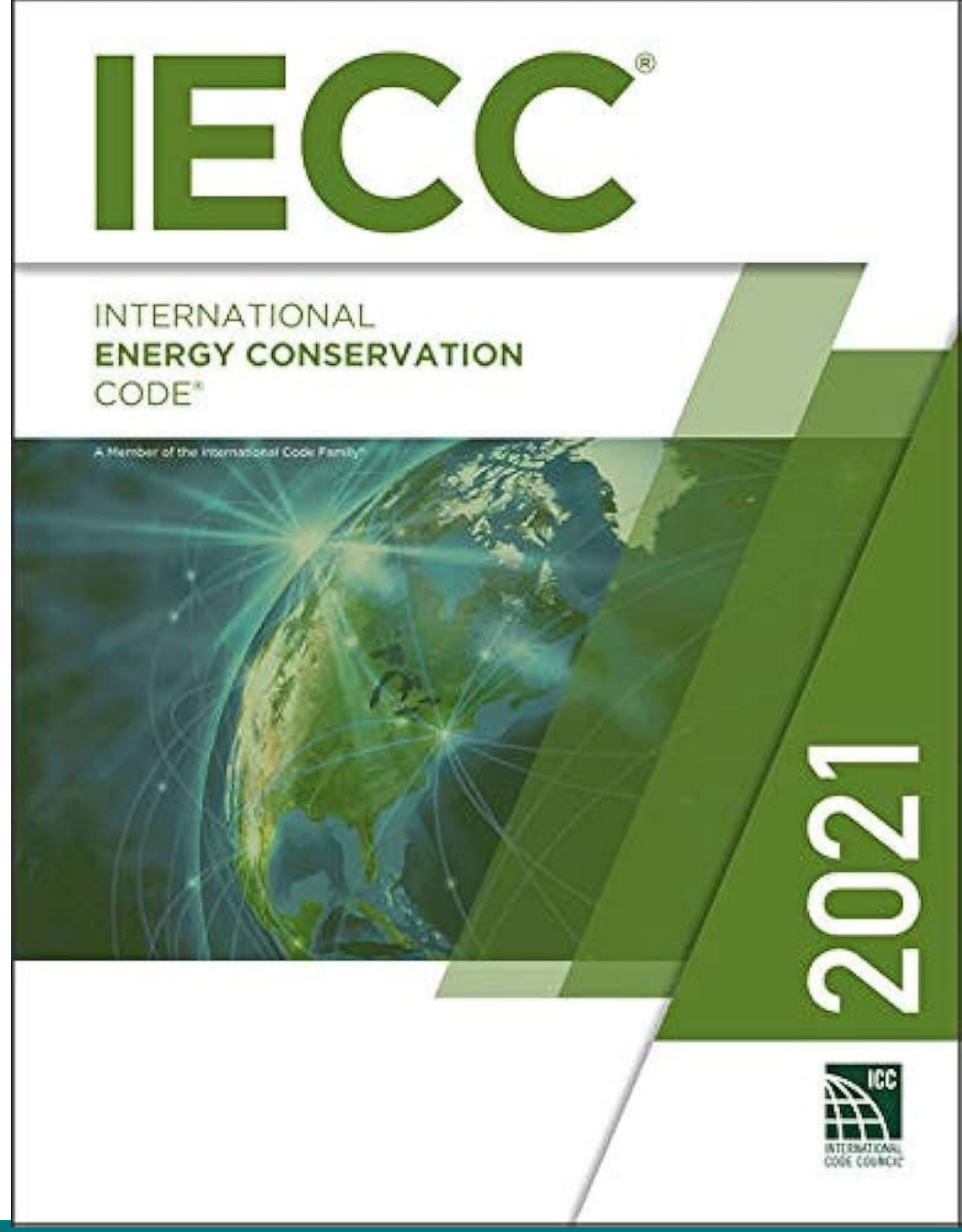
IECC Chapter 4 – Commercial Energy Efficiency *cont.*

- C402.5.1 – Air Barriers:
- C402.5.1.2 – Air barrier compliance:
  - **Group R and I: Test** per C402.5.2 except:
    - Buildings in Climate Zones 2B, 3C, and 5C
  - **Other than Group R and I: Test** per C402.5.3 except:
    - Buildings in Zones 2B, 3B, 3C, and 5C
    - Buildings >5,000 sf in Zones 0B, 1, 2A, 4B, and 4C
    - Buildings >5,000 sf <50,000 sf in Zones 0A, 3A, and 5B
  - Buildings that do not complete testing shall meet C402.5.1.3 or C402.5.1.4 in addition to C402.5.1.5



IECC Chapter 4 – Commercial Energy Efficiency *cont.*

- C402.5.1 – Air Barriers:
- C402.5.3 – Building thermal envelope testing:
  - ASTM E779 – Fan Pressurization
  - ANSI/RESNET/ICC 380
  - ASTM E3158 – Large / multi-zone buildings
  - ASTM E1827 – Orifice Blower Door
- Must not exceed 0.40 cfm/ft^2 of the building thermal envelope area at 0.3 in/H_2O (75 Pa).
- **Exception:** Where air leakage exceeds 0.40 cfm/ft^2 but is less than 0.60 cfm/ft^2, perform diagnostic evaluation.
  - Smoke trace
  - Infrared imaging



IECC Maximum Air Leakage Requirement

- C402.5.1.3 Materials 0.004 cfm/sf
- C402.5.1.4 Assemblies 0.04 cfm/sf
- C402.5.3 Total Thermal Envelope 0.40 cfm/sf

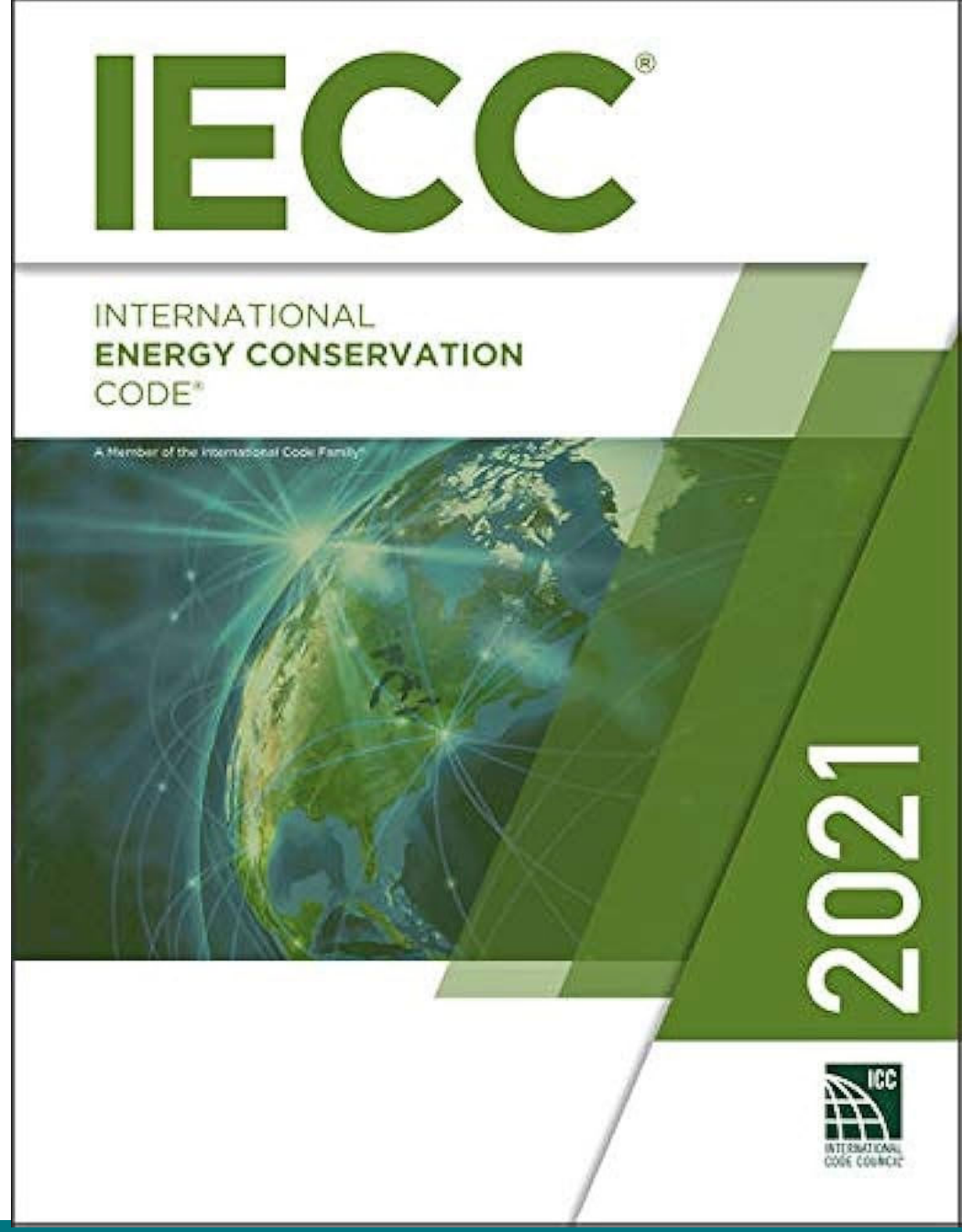


TABLE C402.5.4 MAXIMUM AIR LEAKAGE RATE FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT^2)	TEST PROCEDURE
Windows	0.20[a]	AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400
Sliding doors	0.20[a]	
Swinging doors	0.20[a]	
Skylights—with condensation weepage openings	0.30	
Skylights—all other	0.20[a]	
Curtain walls	0.06	NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	
Power-operated sliding doors and power operated folding doors	1.00	
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^2.

a. The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).

Wall Assemblies

Basic Control Layers in Wall Assemblies

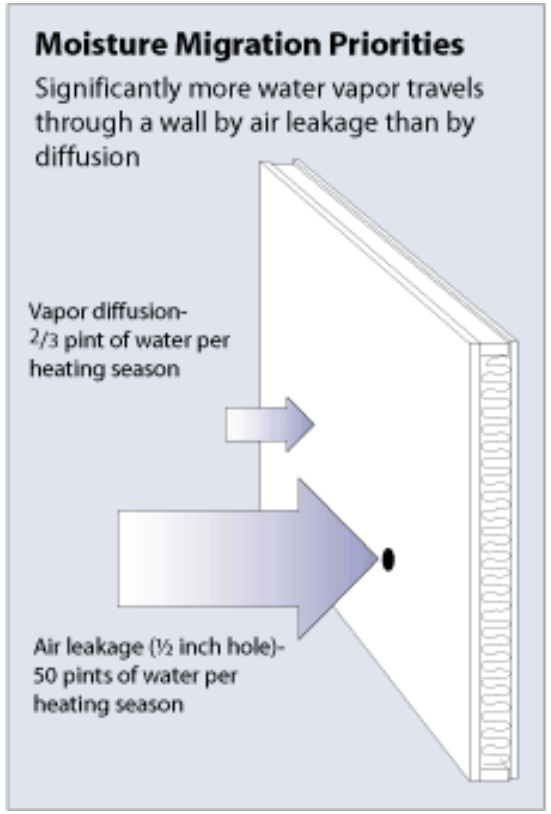
- Water Resistive Barrier
- Air Barrier
- Thermal Barrier
- Vapor Retarder

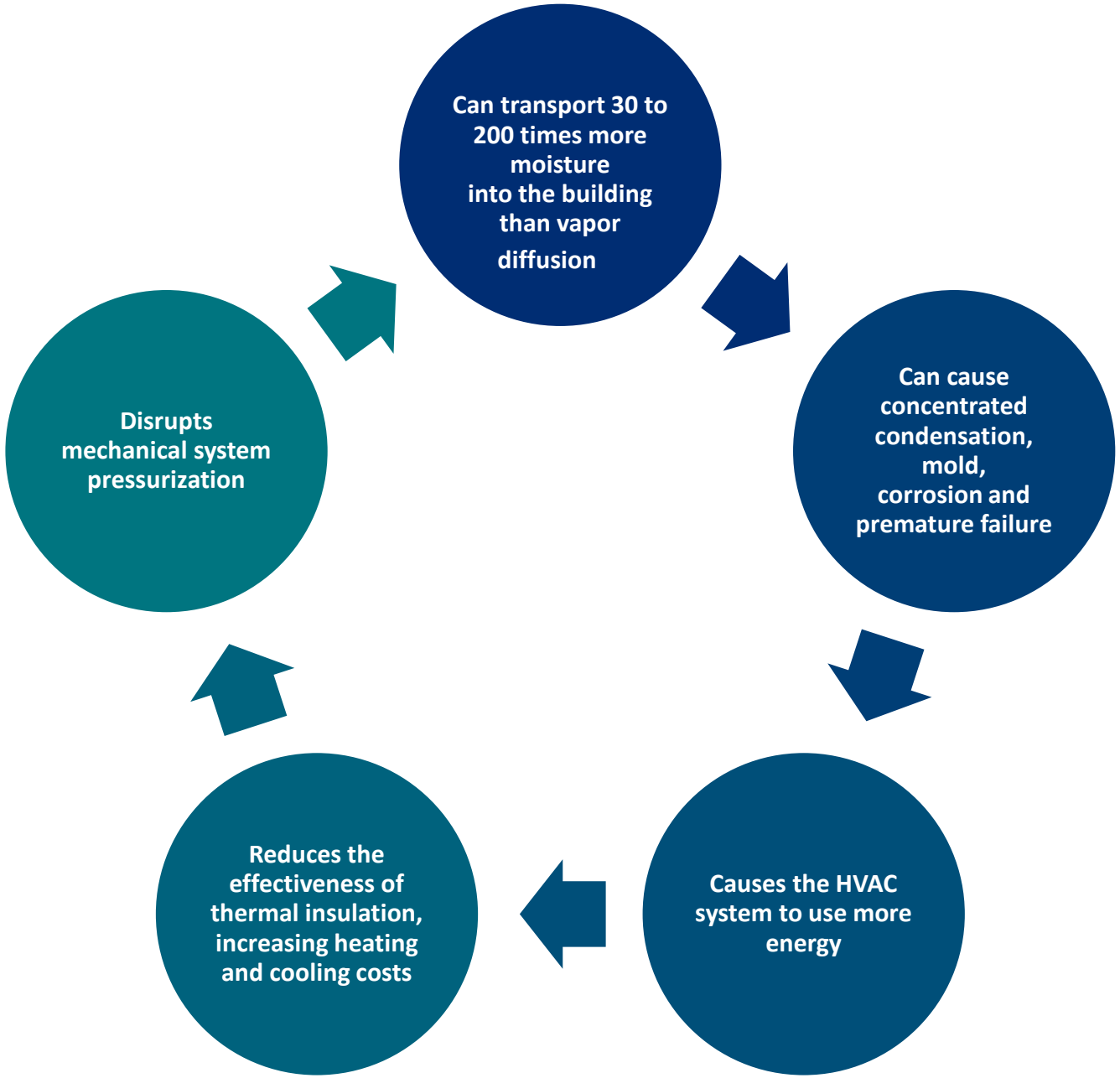
Air Barriers

What is an Air Barrier?

- A group of assemblies made of materials and accessories designated to prevent or retard the **flow of air** through a building envelope

Why Stop the Flow of Air?





Basic Principles of Air Barriers

Continuous

Withstand positive/negative wind/fan/stack pressures

Durable

Accommodate movement in the structure

Types of Air Barriers

Liquid-applied membranes (spray, roll)

Sheet-applied (self-adhering, wall transition, flashing)

Spray polyurethane foam (SPF) – air barrier and insulation all in one

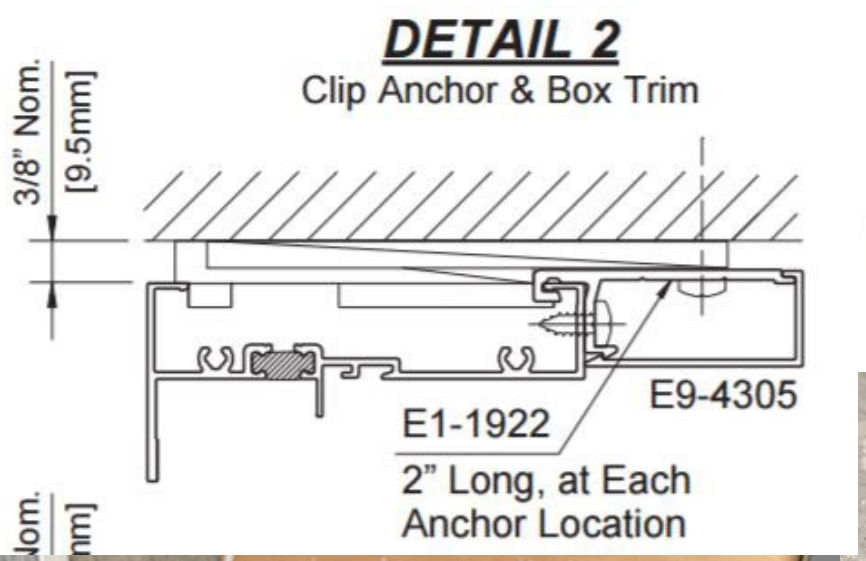
Other – sheathing with taped seams and house wraps

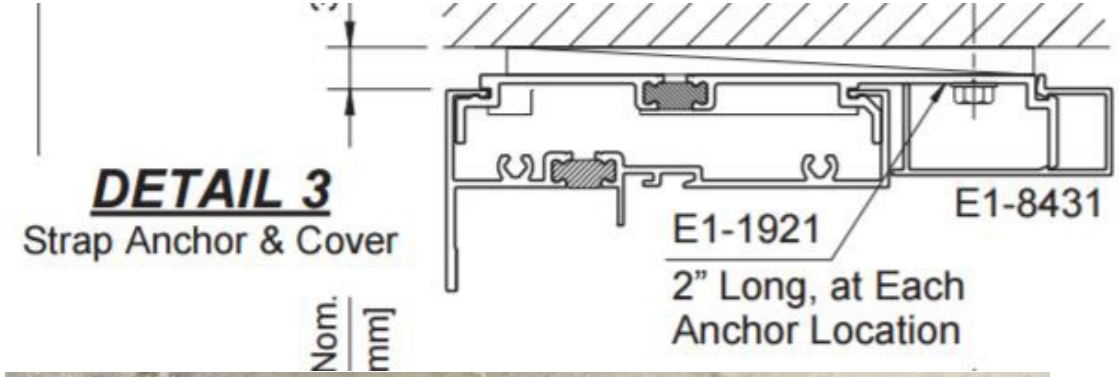
Window Types

Window Anchorage

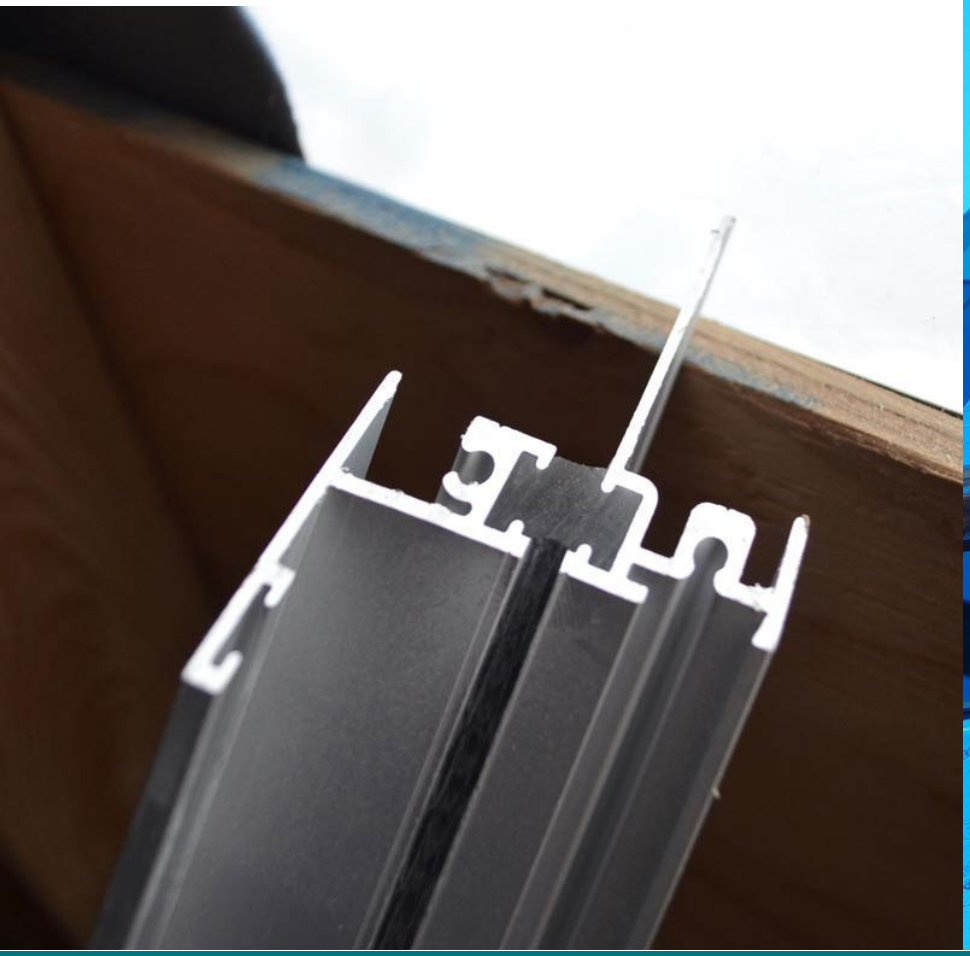
- Concealed Clips/Straps
- Receptors
- Through Frame
- Integral Fins

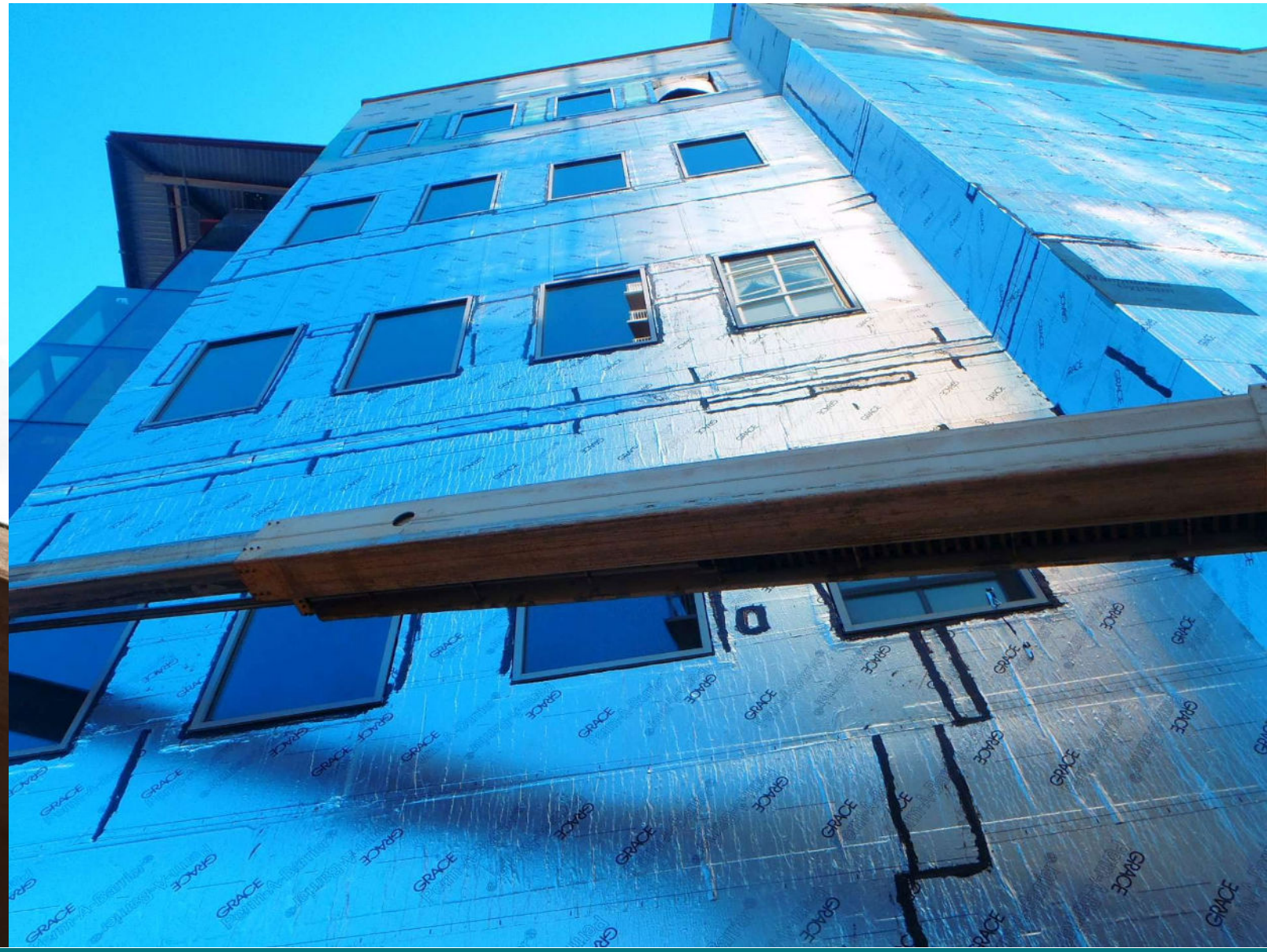
Clip Systems



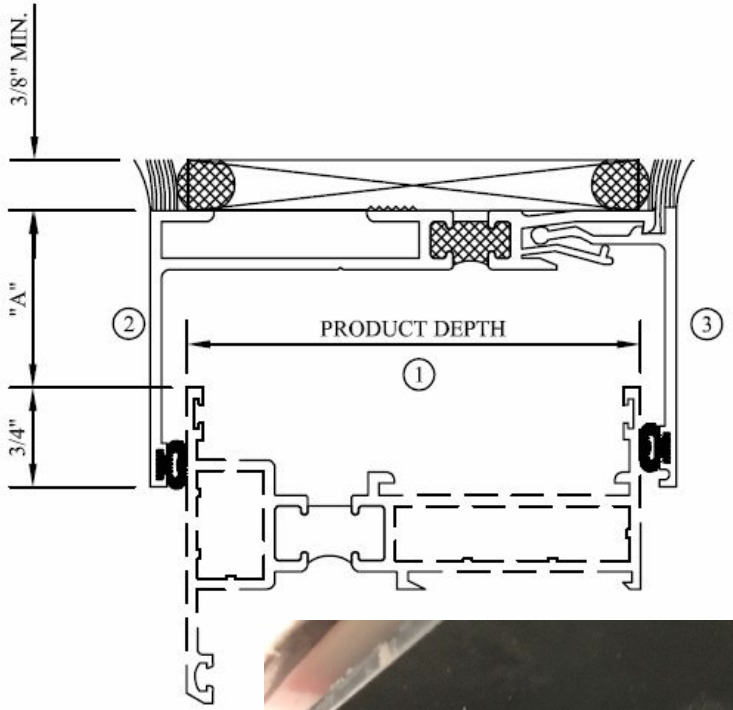


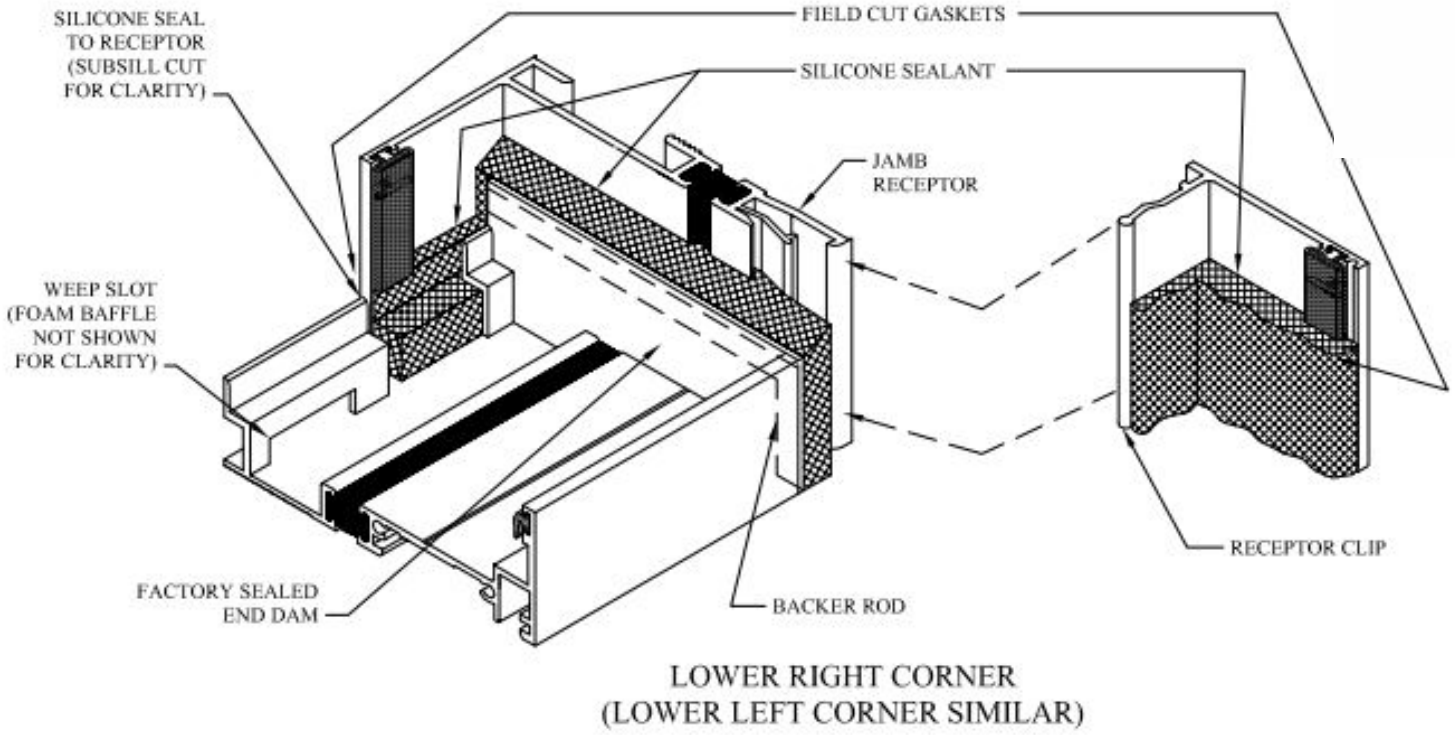
Integral Fins





Receptor Systems





LOWER RIGHT CORNER
(LOWER LEFT CORNER SIMILAR)

Curtain Wall Types and Storefronts

Curtainwall

North American Fenestration Standard defines *curtainwall* as, "... a non-load bearing exterior wall cladding that is hung to the exterior of the building, usually spanning from floor to floor."

The standard goes on to note, "...Curtain wall systems can be factory-glazed or designed to accommodate field fabrication and glazing, including optional structural glazing. Curtain wall employs deep rectilinear framing profiles (approximately 150 mm [6 in] or greater), which are often made available in "stock lengths". Curtain wall vertical framing members run past the face of floor slabs, and provision for anchorage is typically made at vertical framing members only.... curtain wall systems often need to meet additional performance requirements for inter-story differential movement, seismic drift, dynamic water infiltration, etc."

Storefront

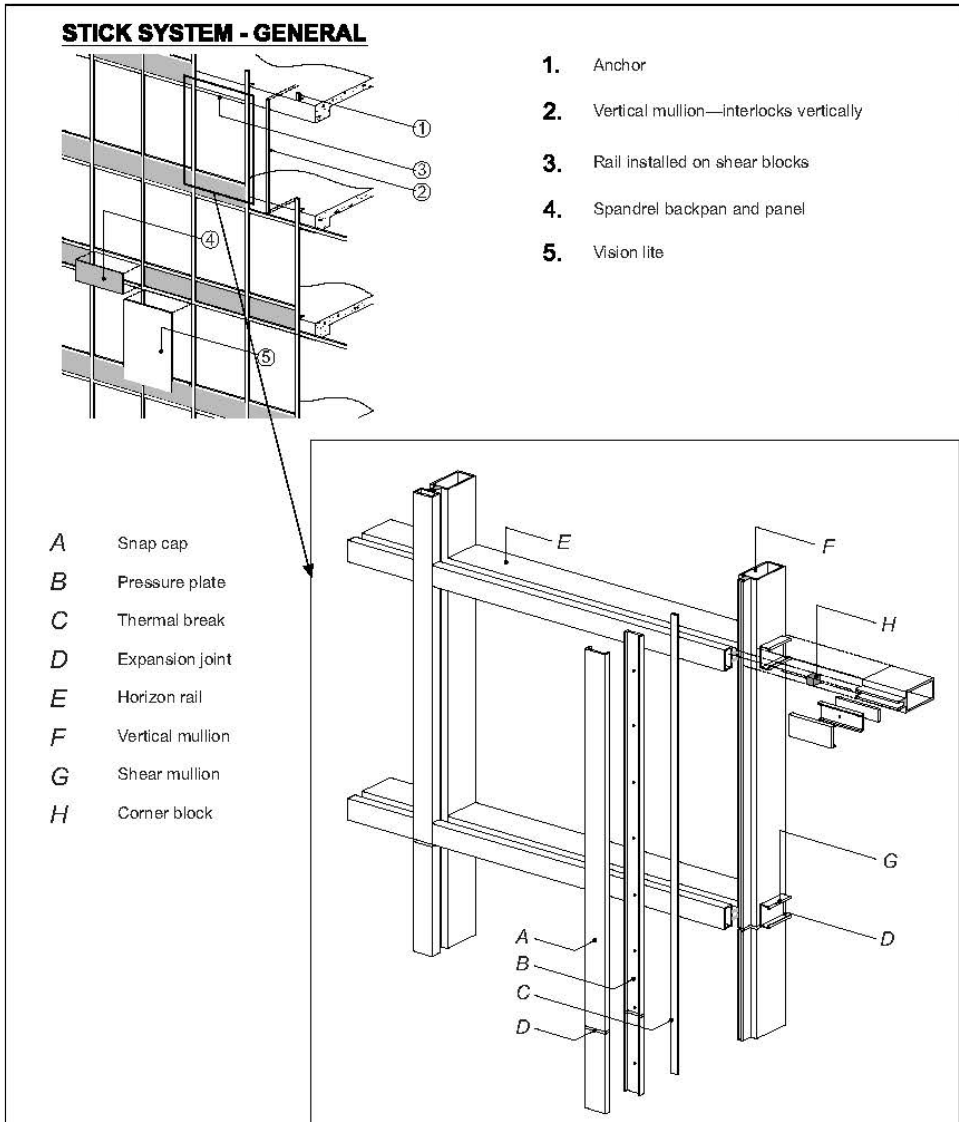
NAFS, defines ***storefront*** as, "...a non-residential, non-load bearing assembly of commercial entrance systems and windows usually spanning between the floor and the structure above, designed for high use/abuse and strength."

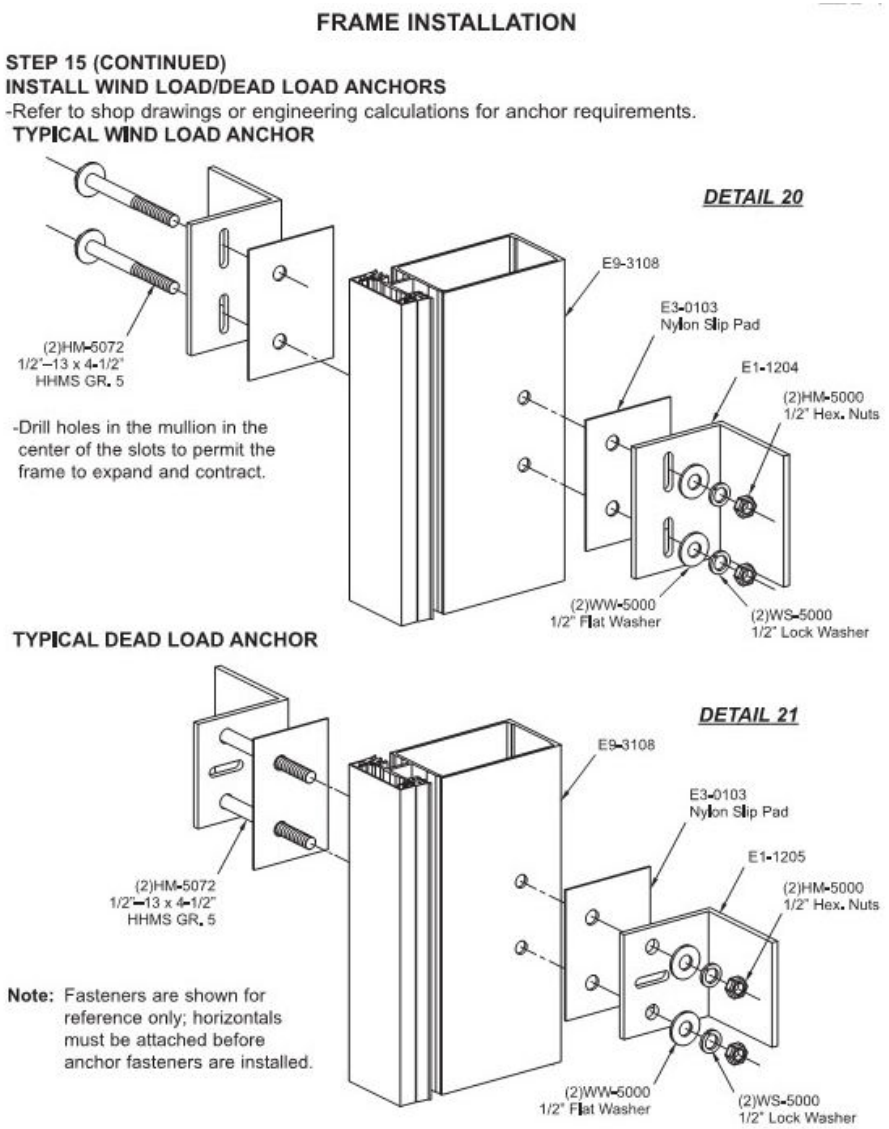
The standard goes on to note, "...Storefront systems are typically designed to accommodate field fabrication and glazing and employ exterior glazing stops at one side only. Storefront employs shallow rectilinear framing profiles (approximately 150 mm [6 in] or less), which are often made available in 'stock lengths.' Vertical framing members run between the top of the floor slab and structure above, with provision for anchorage at all perimeter conditions."

Stick System

- Mullions and rails assembled on site
- Field glazed
- Potential quality control issues

Stick System





Unitized System

- Shop fabricated
- Shop or field glazed
- Field installed as panels
- Factory QC

Unitized System

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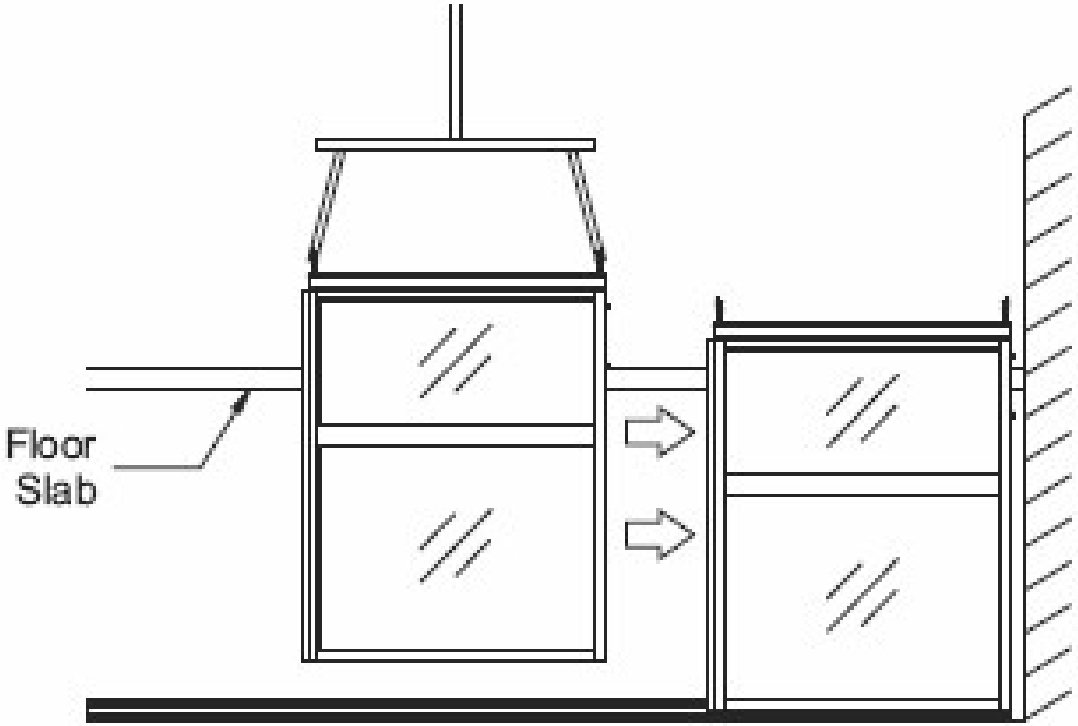
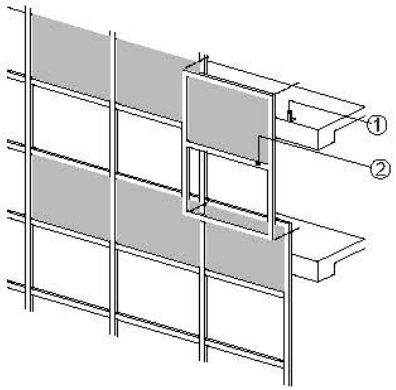
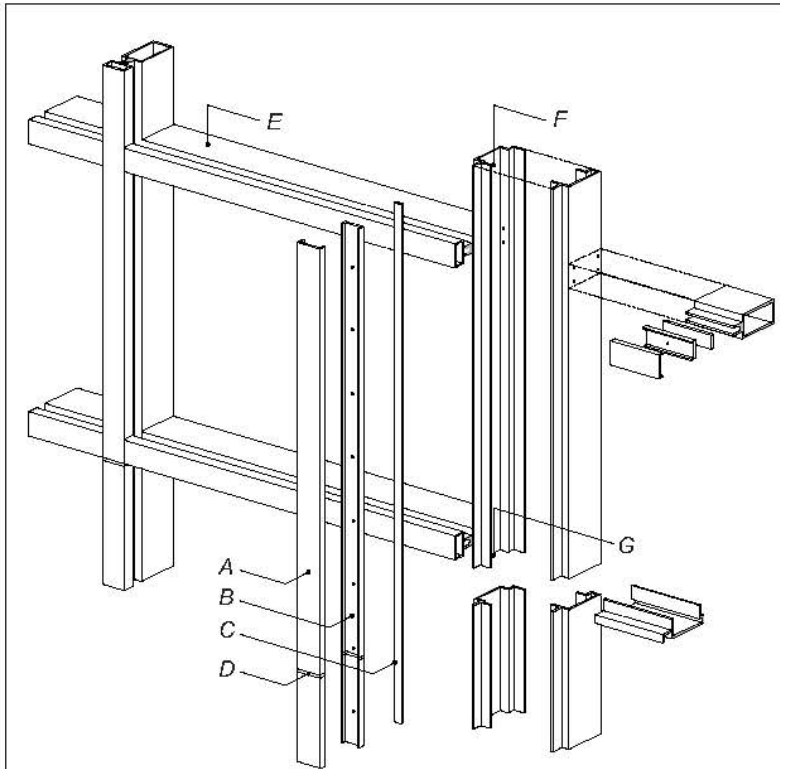
Unitized System



UNITIZED SYSTEM - GENERAL



1. Anchor
2. Prefabricated, pre-glazed frame



A Snap cap

B Pressure plate
(May be in two pieces)

C Thermal break

D Expansion joint

E Horizontal rail

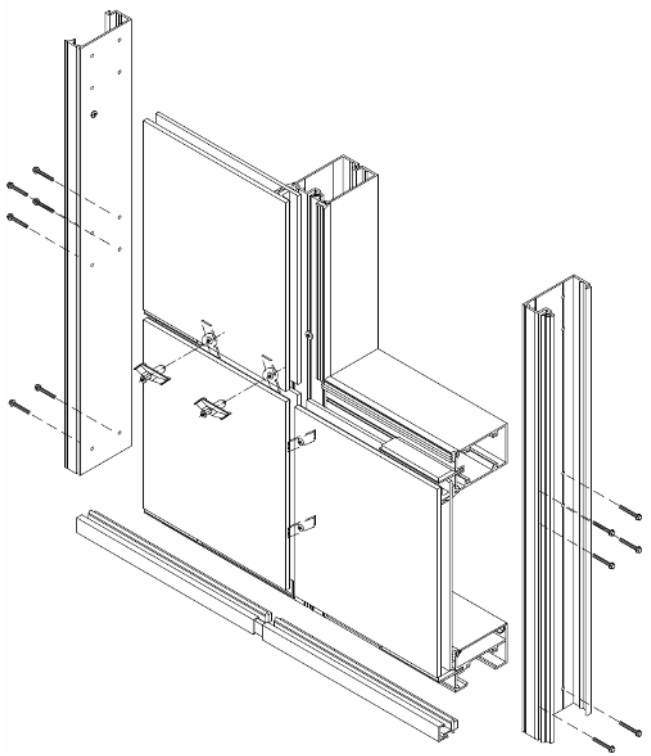
F Split mullion

G Mullion sleeve*

* Connection at expansion or stack joint varies widely with different designers

Air Seal Management

- Seals



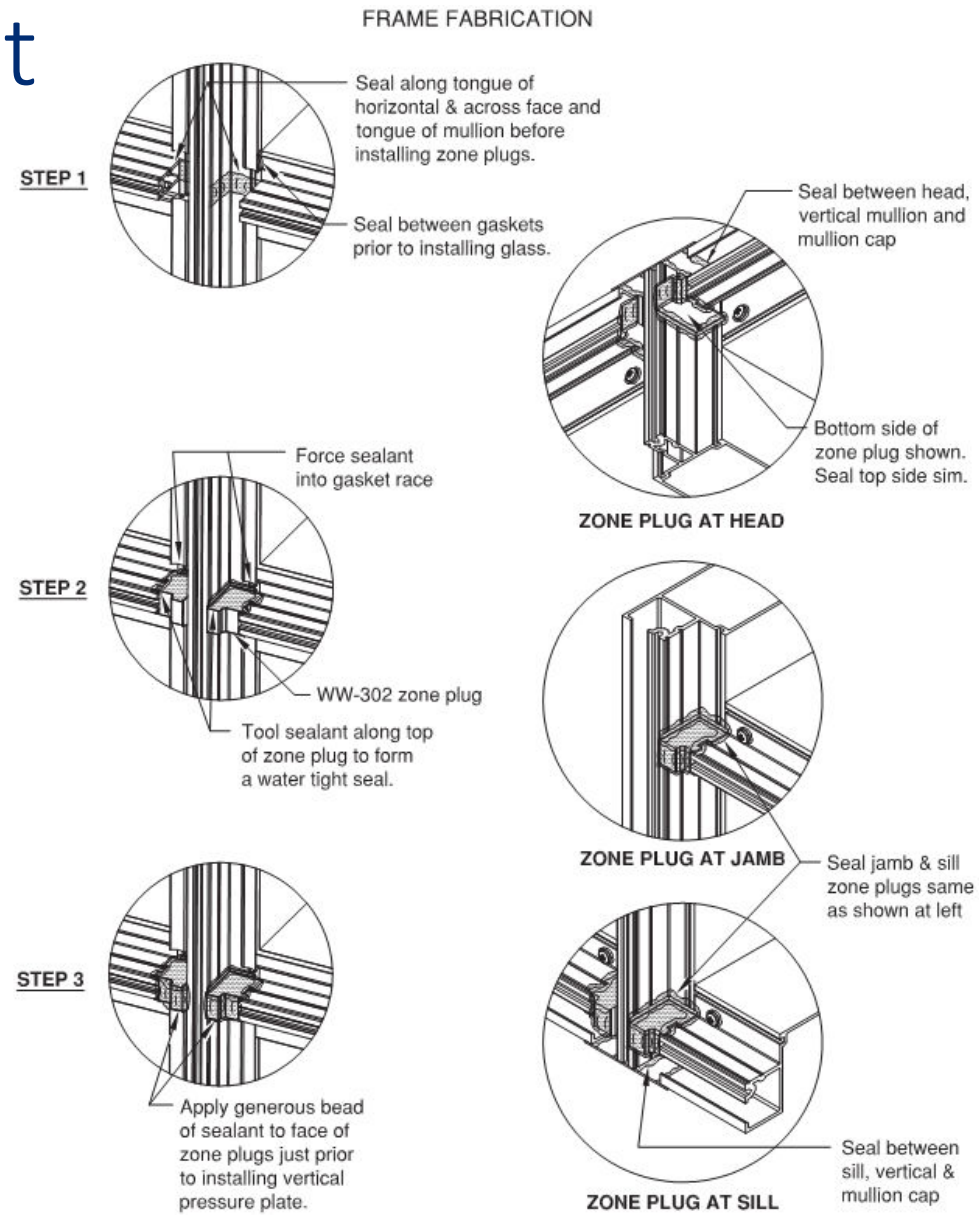
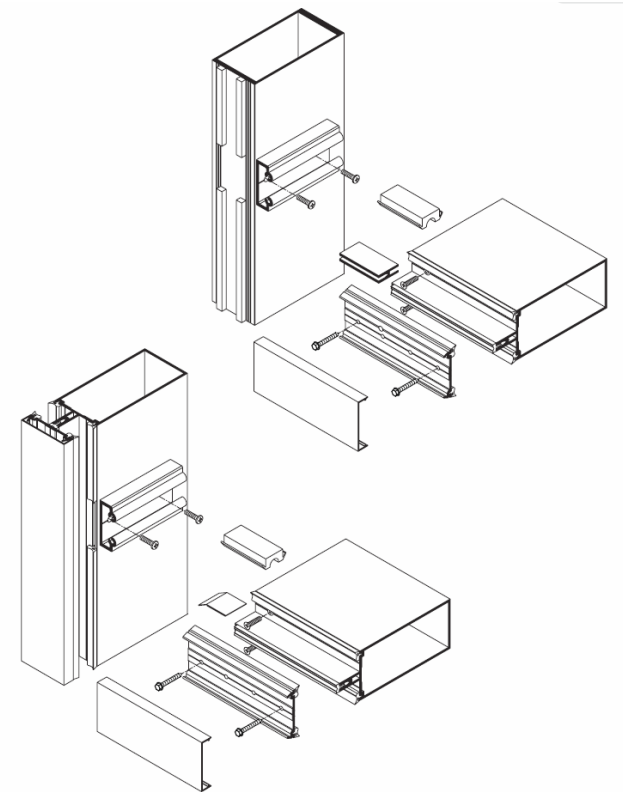
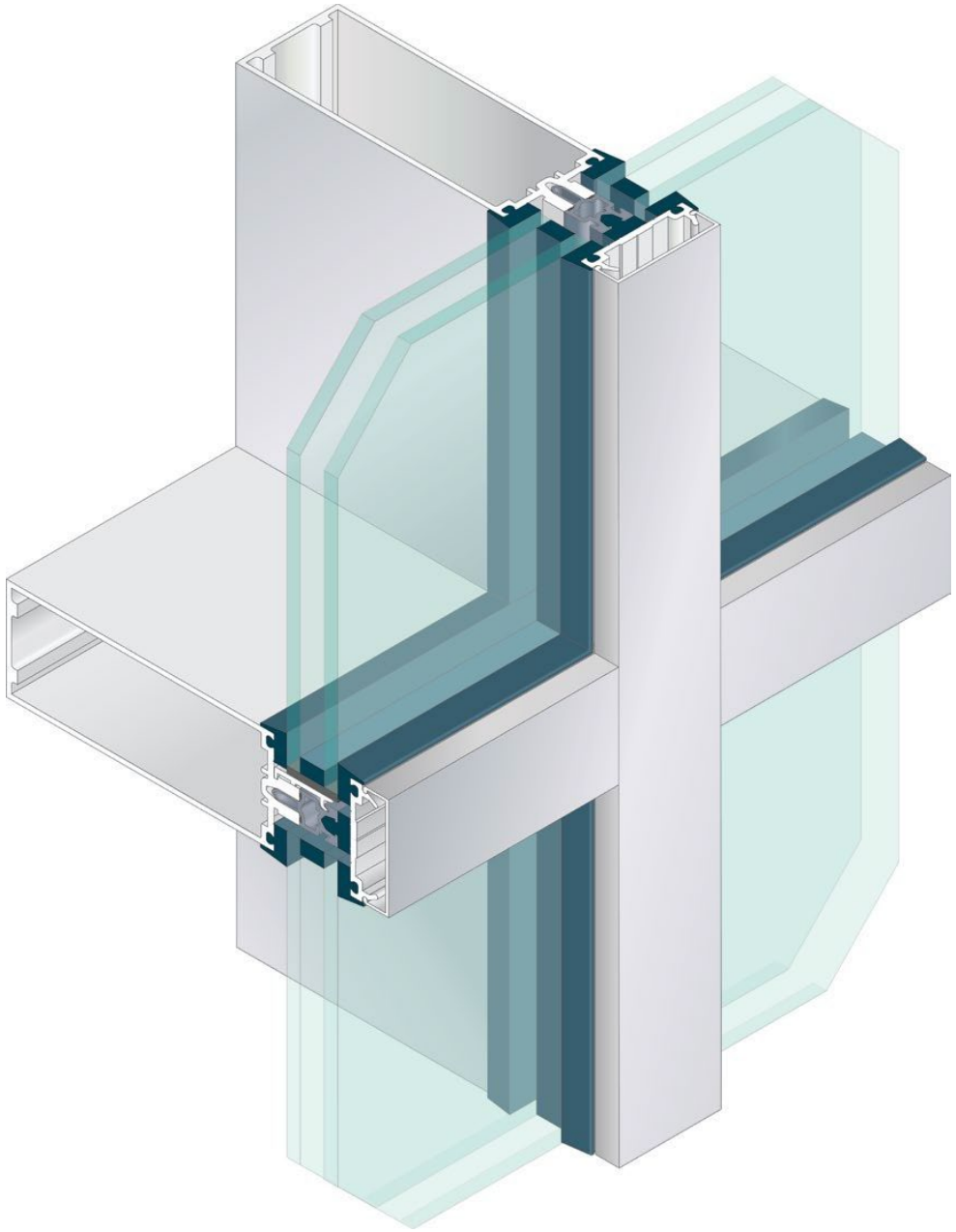


Figure 10
Zone Plug Installation



Captured Glazing

- Water-managed
- Pressure-fit gaskets



Structural Silicone Glazing

- Face-sealed
- Sealant-to-glass
- Glass-to-frame

Designing and Detailing Air Barrier Connections at Windows and Curtainwalls

Design Considerations – Where are the primary seals?

Continuity – air and moisture control layers must be continuous through the enclosure elements.

Location – Fenestration location within the wall assembly

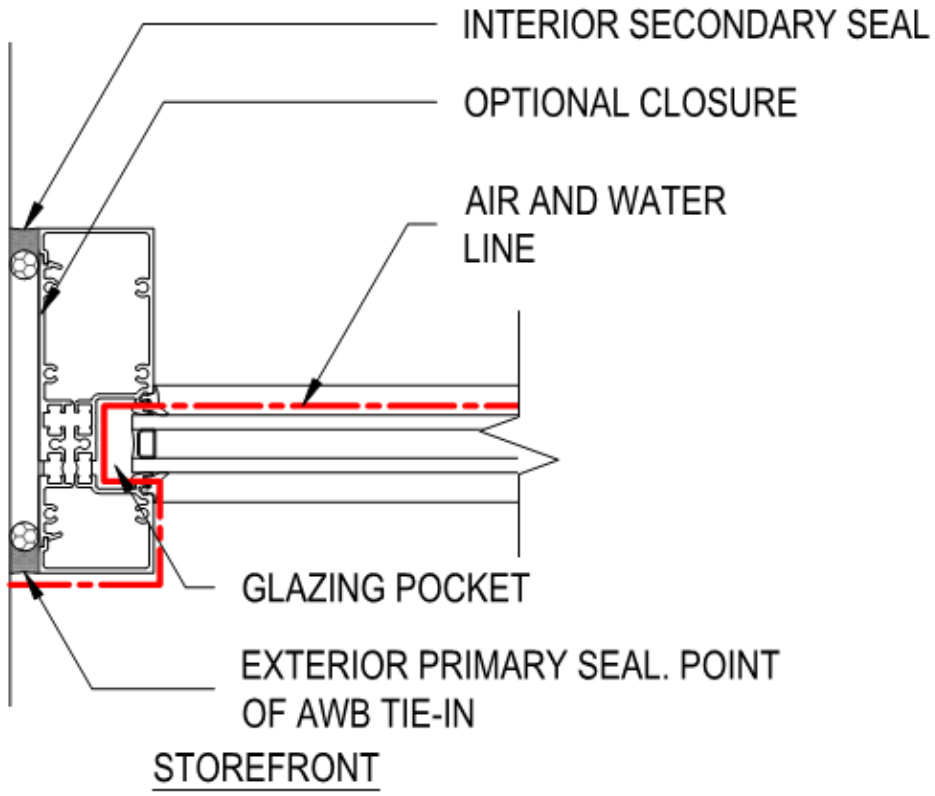
Durability – Accommodate anticipates movement and environmental conditions

Redundancy - Provide multiple point of contact with AVB at connections where possible

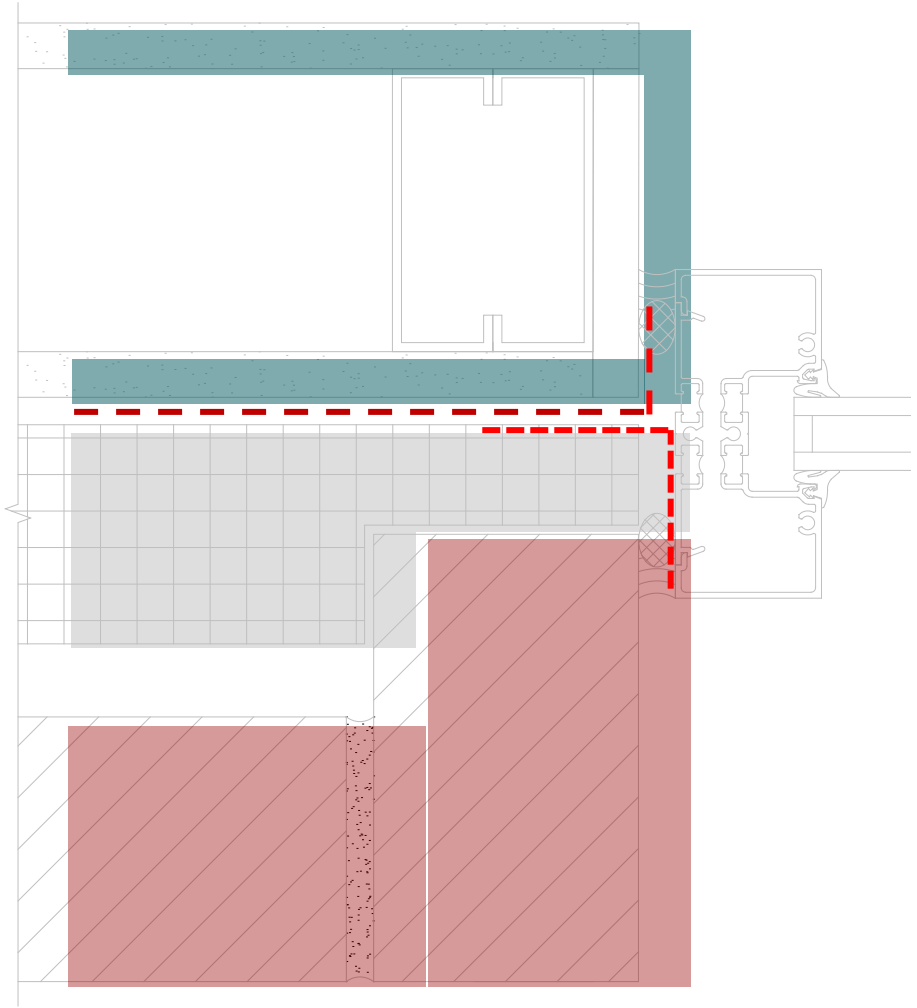
Constructability – Construction sequencing and material compatibility

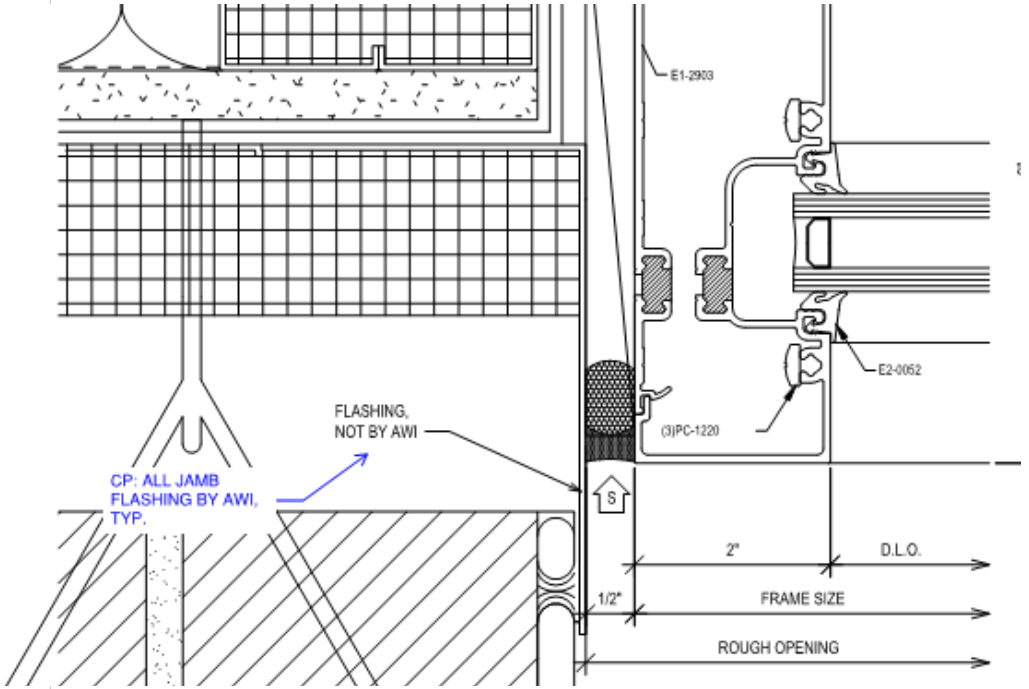
Storefront

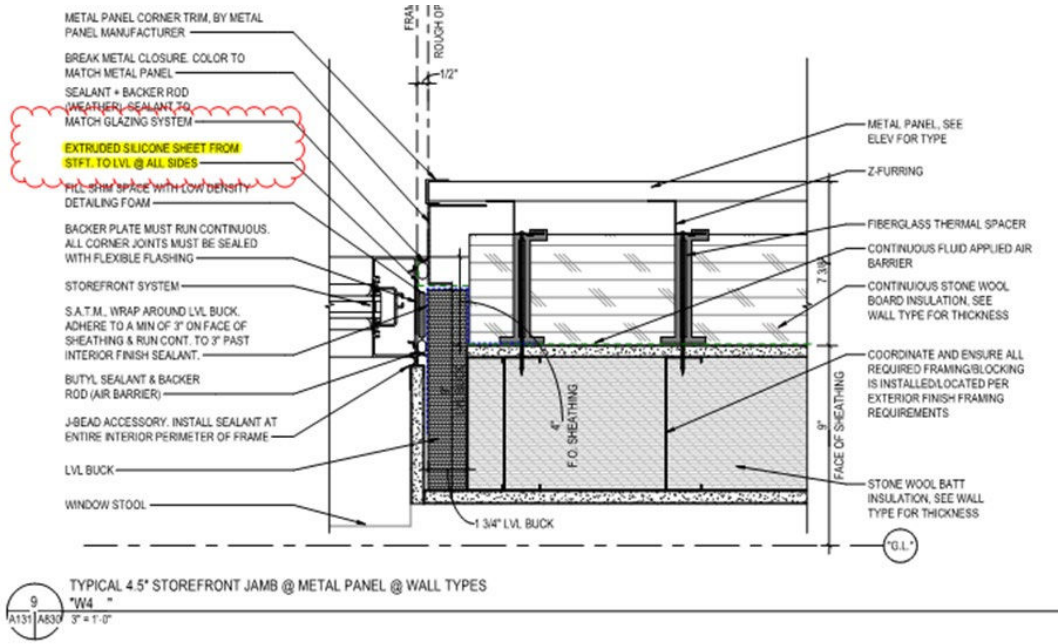
- Transitions problematic due to limited bonding surface for sealing.
- Sealant dependent detailing.



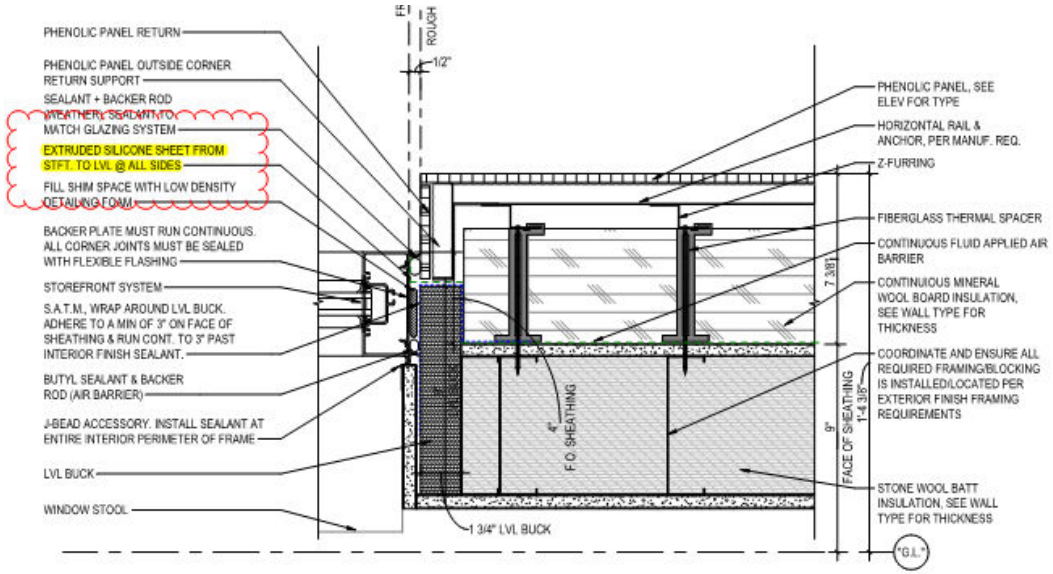
Storefront Transition (Jamb Flashing)



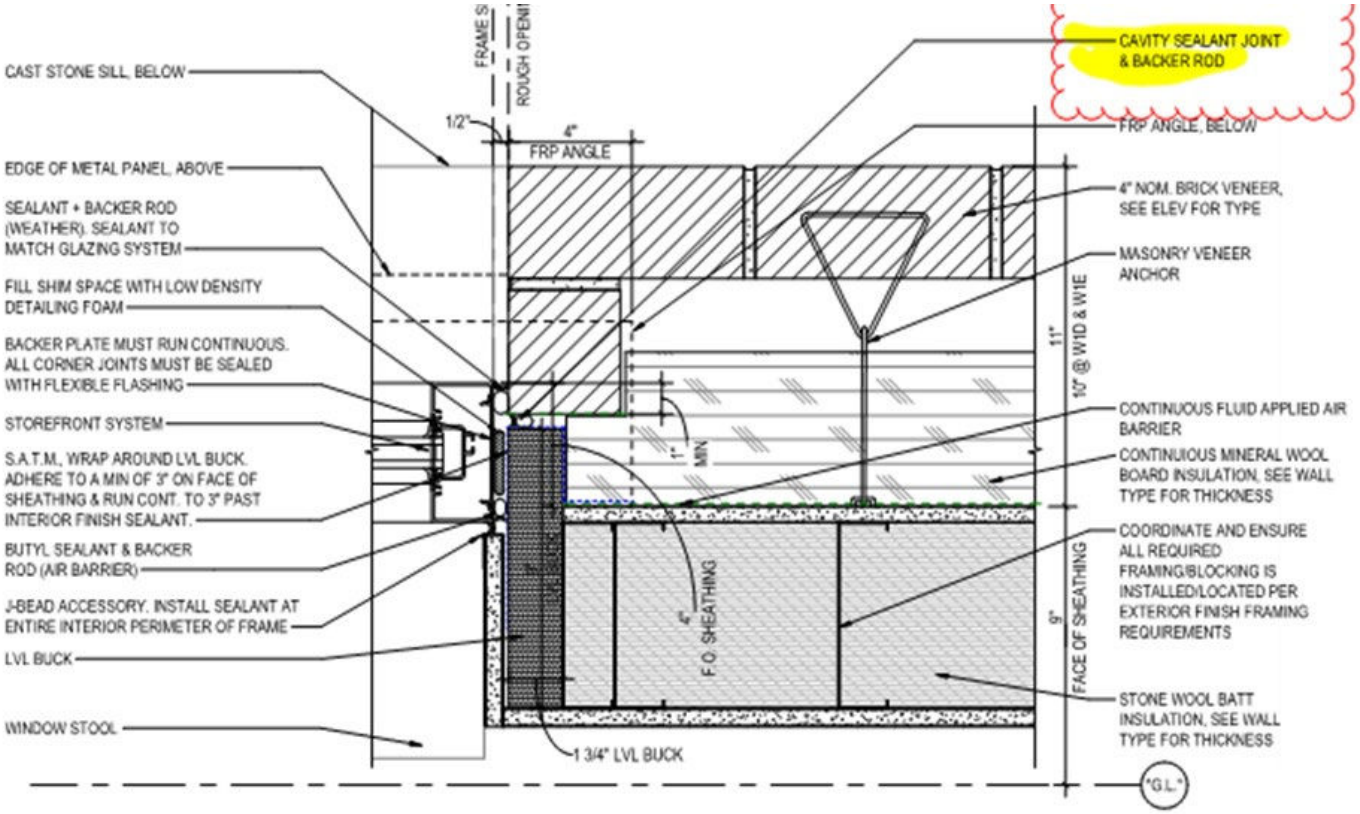




9 A131 A830 TYPICAL 4.5" STOREFRONT JAMB @ METAL PANEL @ WALL TYPES "W4 " 3" = 1'-0"



6 A111 A830 TYPICAL 4.5" STOREFRONT JAMB @ PHENOLIC PANEL @ WALL TYPES "W3 " 3" = 1'-0"


CAST STONE SILL, BELOW
EDGE OF METAL PANEL, ABOVE
SEALANT + BACKER ROD (WEATHER). SEALANT TO MATCH GLAZING SYSTEM
FILL SHIM SPACE WITH LOW DENSITY DETAILING FOAM
BACKER PLATE MUST RUN CONTINUOUS. ALL CORNER JOINTS MUST BE SEALED WITH FLEXIBLE FLASHING
STOREFRONT SYSTEM
S.A.T.M., WRAP AROUND LVL BUCK. ADHERE TO A MIN OF 3" ON FACE OF SHEATHING & RUN CONT. TO 3" PAST INTERIOR FINISH SEALANT.
BUTYL SEALANT & BACKER ROD (AIR BARRIER)
J-BEAD ACCESSORY. INSTALL SEALANT AT ENTIRE INTERIOR PERIMETER OF FRAME
LVL BUCK
WINDOW STOOL
1/2"
4"
FRP ANGLE
1" MIN
4" F.O. SHEATHING
1 3/4" LVL BUCK
CAVITY SEALANT JOINT & BACKER ROD
FRP ANGLE, BELOW
4" NOM. BRICK VENEER, SEE ELEV FOR TYPE
MASONRY VENEER ANCHOR
11" @ W1D & W1E
CONTINUOUS FLUID APPLIED AIR BARRIER
CONTINUOUS MINERAL WOOL BOARD INSULATION, SEE WALL TYPE FOR THICKNESS
COORDINATE AND ENSURE ALL REQUIRED FRAMING/BLOCKING IS INSTALLED/LOCATED PER EXTERIOR FINISH FRAMING REQUIREMENTS
9" FACE OF SHEATHING
STONE WOOL BATT INSULATION, SEE WALL TYPE FOR THICKNESS
"G.L."

Curtain Wall Transitions

Curtain Wall

INTERFACE GUIDELINES

July 2020

air barrier abaa association of america

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).

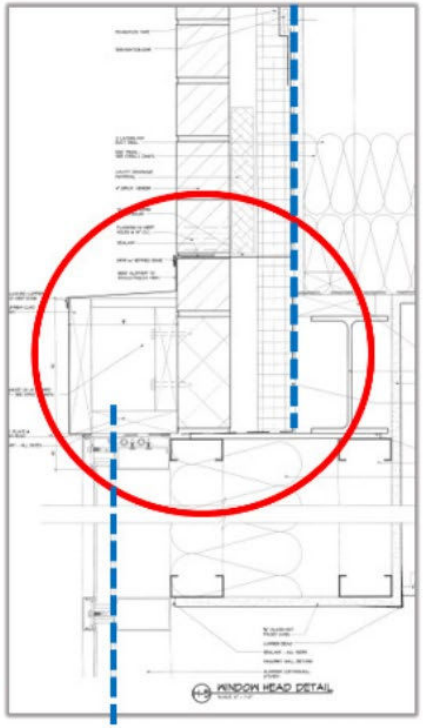
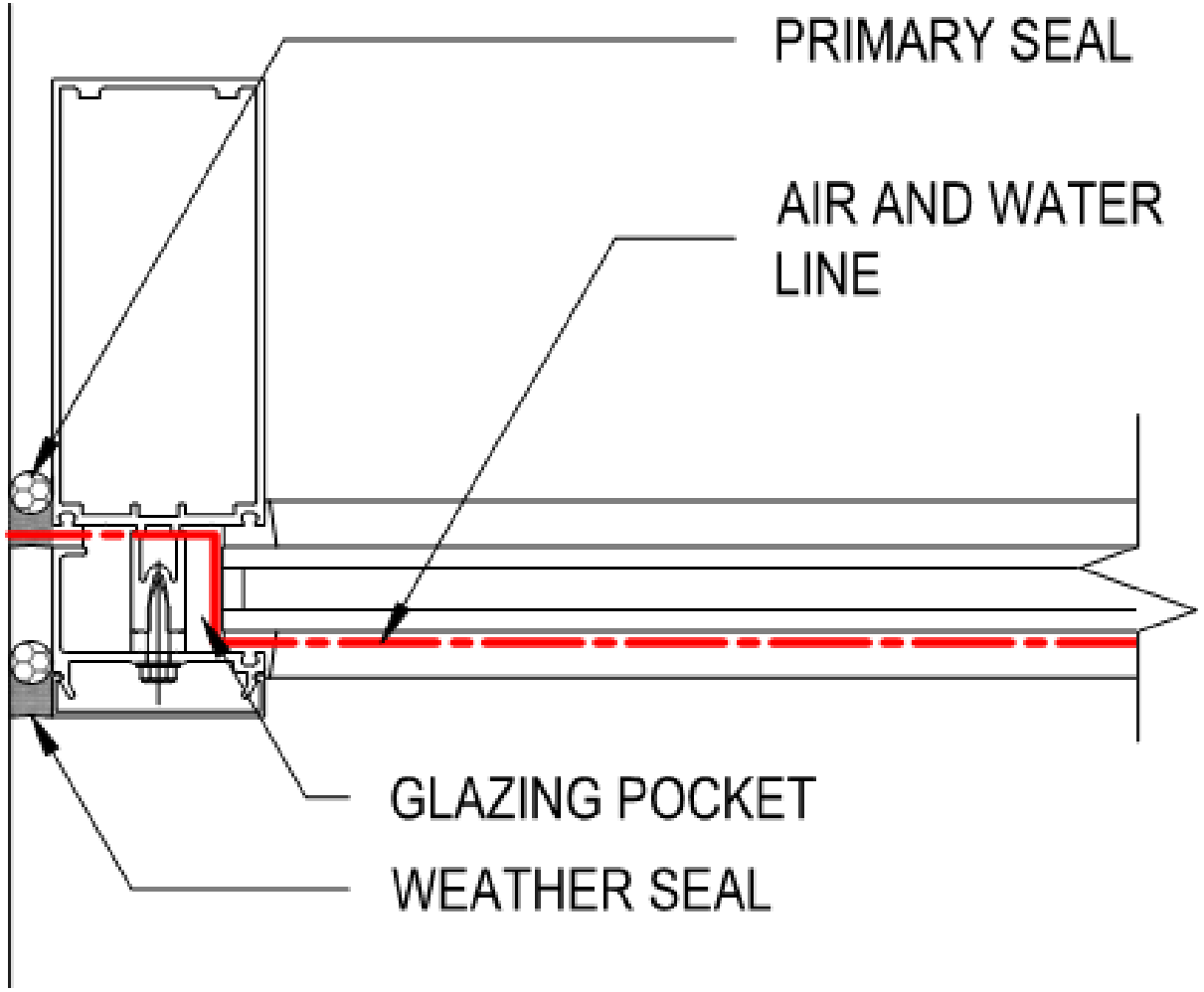


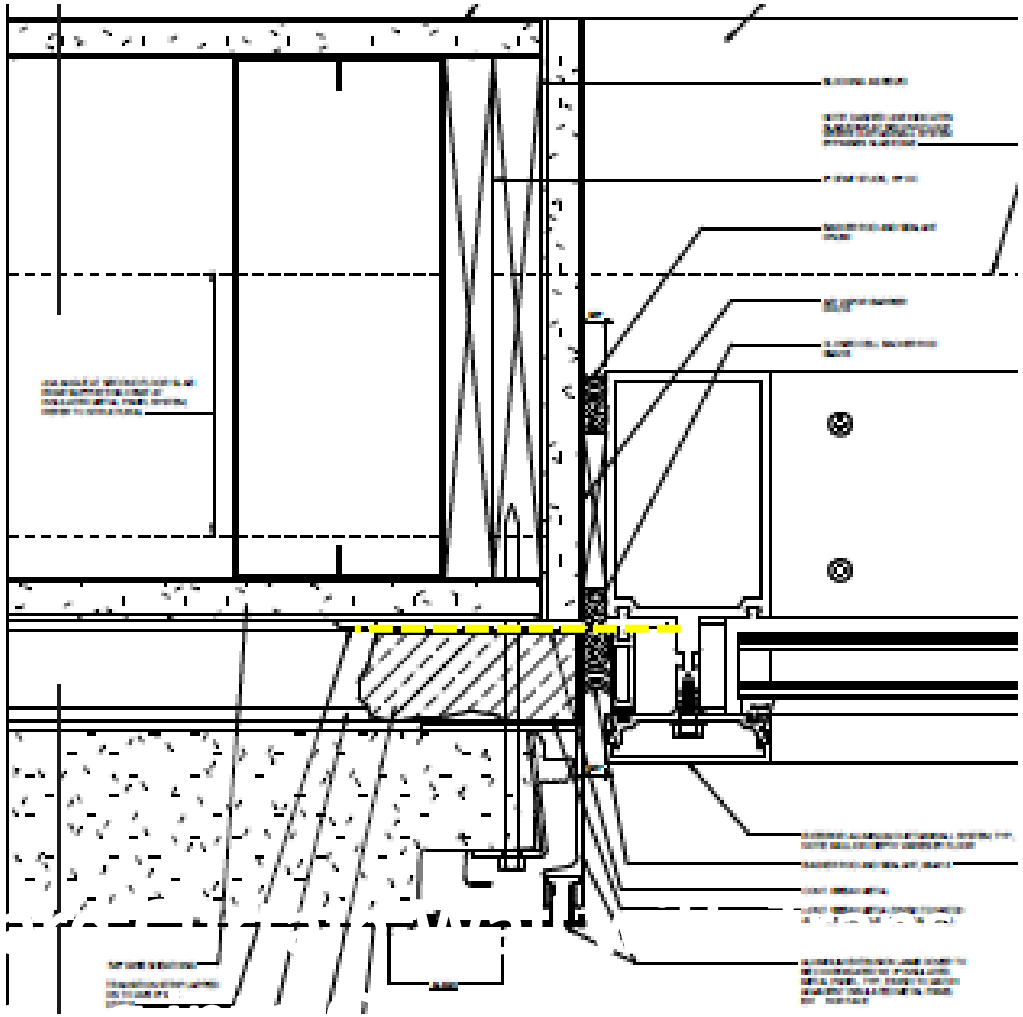
Figure 1a, Failure Investigation

Curtain Wall

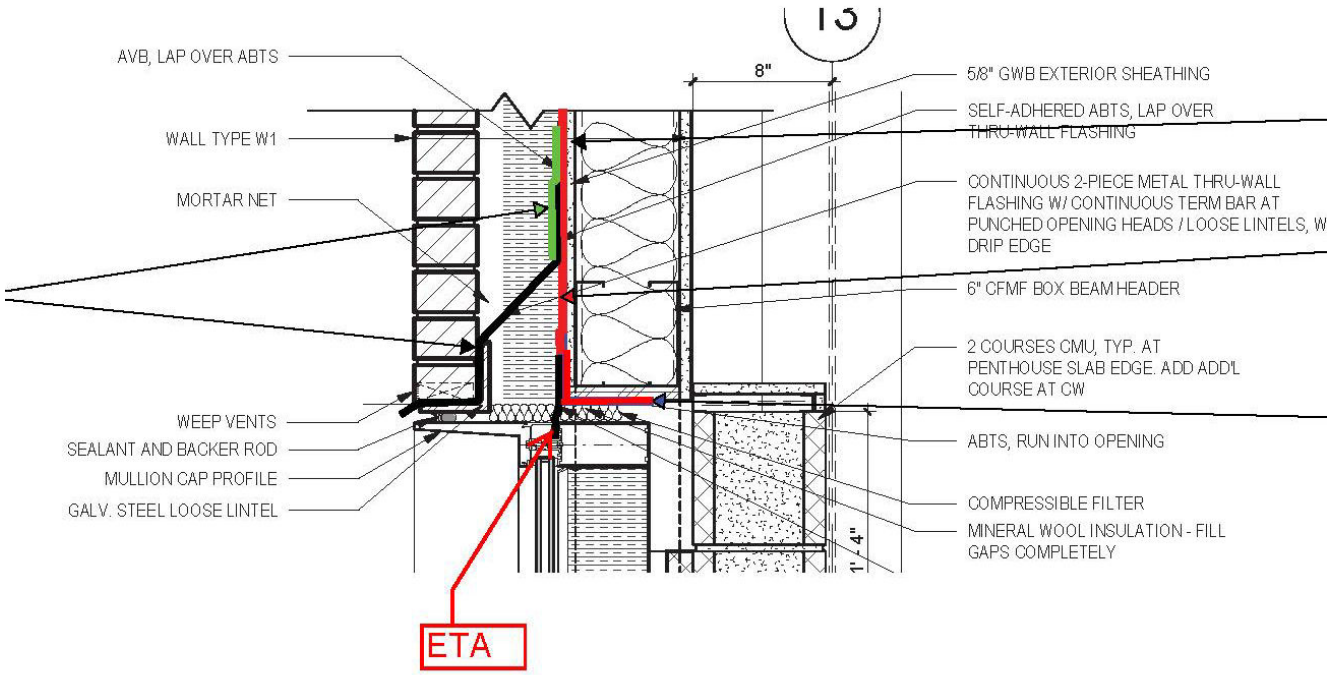


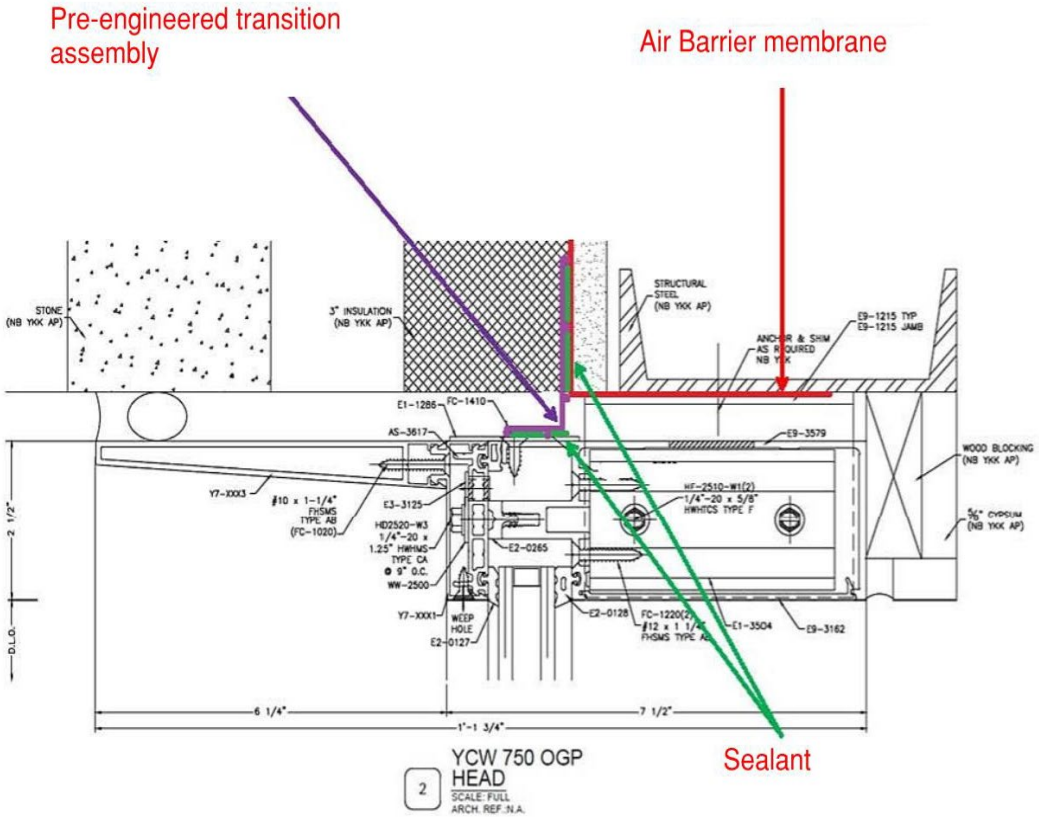
AB Transitions at Curtain Walls

Standard Curtain Wall with Transition Extending into Glazing Pocket

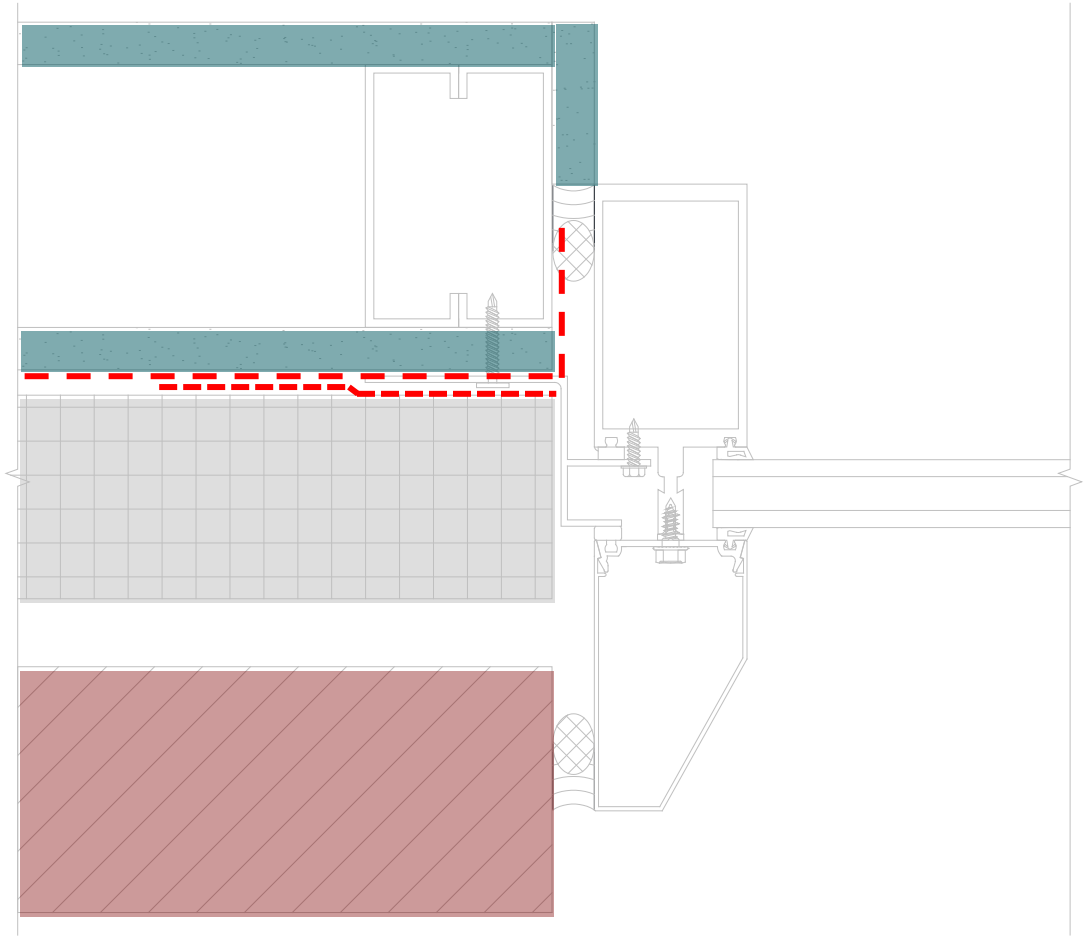


Head with ETA





Curtain Wall Transition (Custom Jamb)



Additional Design Considerations

Detailing

- Sequencing

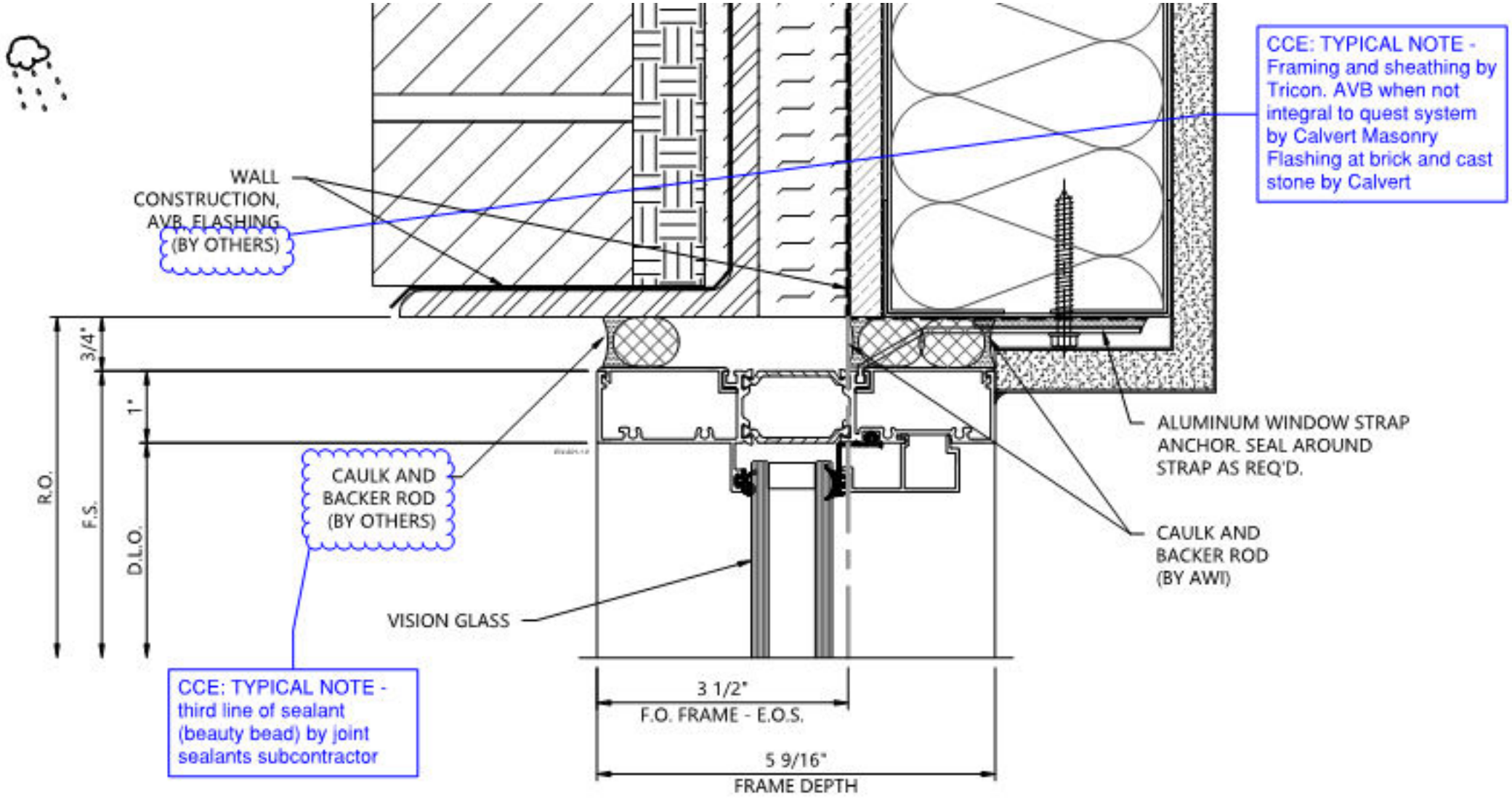
Detailing

- Sequencing

Detailing

- Head to Jamb

Detailing

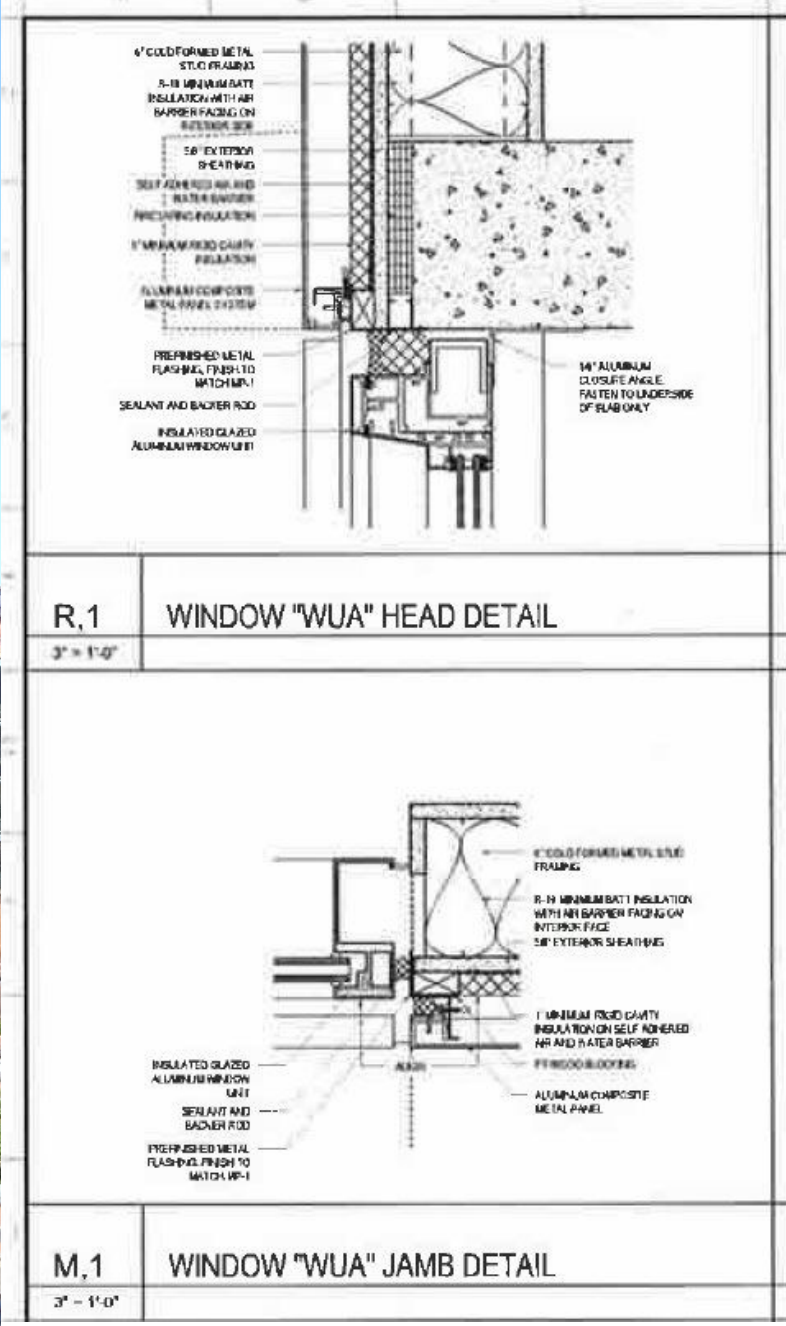

WALL CONSTRUCTION, AVB, FLASHING (BY OTHERS)
CCE: TYPICAL NOTE - Framing and sheathing by Tricon. AVB when not integral to quest system by Calvert Masonry Flashing at brick and cast stone by Calvert
3/4"
1"
R.O.
F.S.
D.L.O.
CAULK AND BACKER ROD (BY OTHERS)
ALUMINUM WINDOW STRAP ANCHOR. SEAL AROUND STRAP AS REQ'D.
CAULK AND BACKER ROD (BY AWI)
VISION GLASS
CCE: TYPICAL NOTE - third line of sealant (beauty bead) by joint sealants subcontractor
3 1/2"
F.O. FRAME - E.O.S.
5 9/16"
FRAME DEPTH

Detailing

- Head to Jamb

Detailing

- Difficult Transitions



Detailing

Detailing

- Placement

Detailing

- Difficult Transitions

Detailing

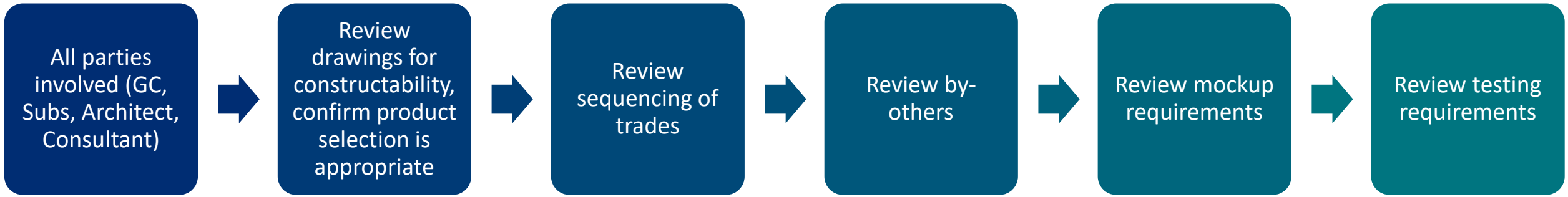
- SPUF at perimeter

Detailing

- Differing Materials

Construction Coordination/QA

Detailing- Coordination Meetings



Mockups

To include as many typical details as possible

To be tested for compliance with established standards

Access for modifications to address potential problems

Troubleshoot potential problems

Establishes standard of care for trades

Quality Assurance - Testing

ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, CW & Doors under pressure differential.

ASTM E 301 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, CW & Doors under pressure differential.

ASTM E 783 - Standard Test Method for Field Measurements of Air Leakage Through Installed Exterior Windows and Doors.

ASTM E 1105 - Standard Test Method for Determination of Water penetration of installed Exterior Windows, CW & Doors by uniform or cyclic static air pressure difference.

AAMA 501.1 - Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

AAMA 501.2 -Quality Assurance and Water Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems

ASTM E 779/3158 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

BECx

- ASHRAE Guideline 0
- National Institute for Building Science (NIBS) Guideline 3
- *ASTM 2813 - Standard Practice for Building Enclosure Commissioning*
- *ASTM E2947 - Standard Guide for Building Enclosure Commissioning*
- ASHRAE 202 - Commissioning Process for Buildings and Systems
- LEED V4
- International Green Construction Code (IGCC)
- AIA Best Practices: Building Enclosure Commissioning: An Introduction

The Devil is in the Details!

Thank you!

Derek J. Ziese

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Senior Project Manager
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PRAIRIE
kitchen + bar

Floor 1
6:00PM - 9:00PM

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Annual General Meeting

Thursday June 4, 2026

11:00AM ET

Members - you will have received an email invitation to attend. If you cannot attend, please make sure to appoint a proxy.