



MBOA Presentation on Window Installation

April 29, 2021





Chelster Hall, Oakville Ontario







Code changes and keeping up

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Canadian Commission on Building and Fire Codes 1405

[Submit a comment](#)

Proposed Change 1405

Code Reference(s):	NBC15 Div.B 1.1.3. NBC15 Div.B Appendix C
Subject:	Earthquake Load and Effects
Title:	Seismic Hazard Values for the Design of Part 4 Buildings
Description:	This proposed change updates the seismic hazard values for the design of buildings under Part 4 and replaces Table C-3 in Appendix C with a reference to a Web site listing the values. (PCF 1475 updates the seismic hazard values for the design of buildings under Part 9.)
Related Proposed Change(s):	PCF 1203, PCF 1403, PCF 1430, PCF 1475, PCF 1514

PROPOSED CHANGE

[\[1.1.3.\]](#) 1.1.3. Climatic and Seismic Data

[\[1.1.3.1\]](#) 1.1.3.1. Climatic and Seismic Values

[1] 1) Insert as provided in Sentences (2), (3), (4) and (5) ~~the~~ the climatic and seismic values





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The term “farm” - 385

Canadian Commission on Building and Fire Codes 1405

Submit a comment

Proposed Change 1405

Code Reference(s): NBC15 Div.B 1.1.3.
NBC15 Div.B Appendix C

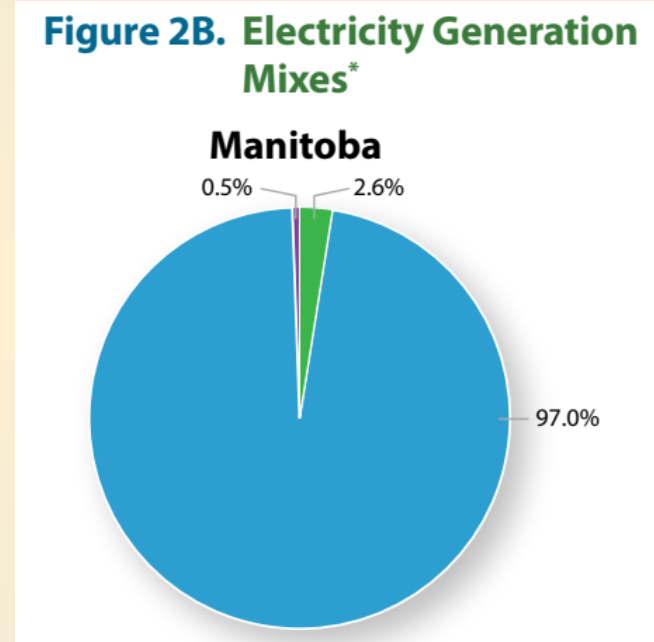
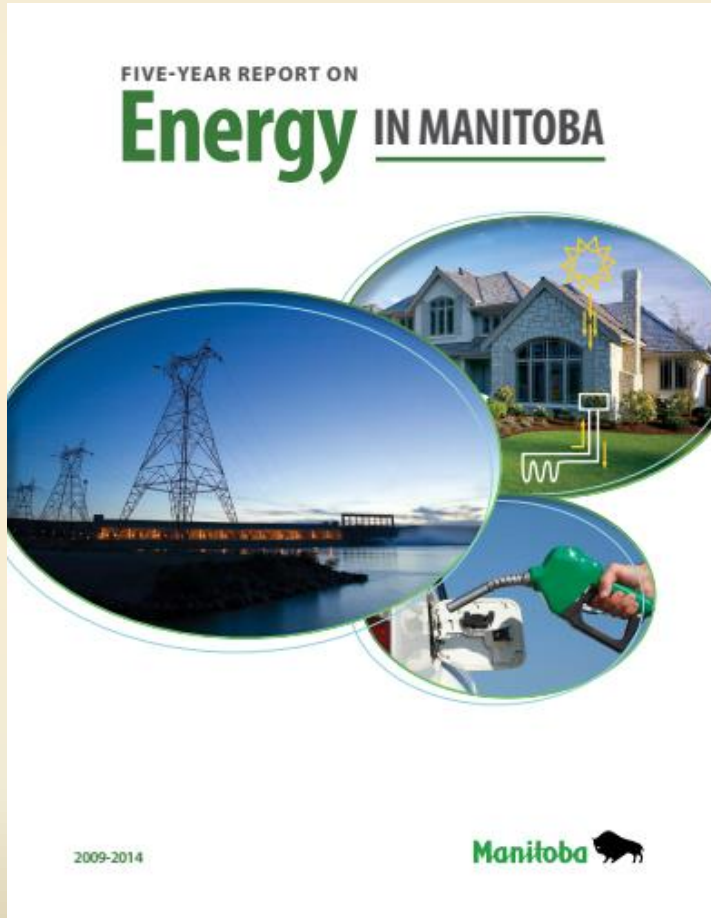
Subject: Earthquake Load and Effects





Net Zero Energy (2030)

Net Zero (carbon based) Energy





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Windows

www.nationalcodes.nrc.gc.ca/eng/presentations/windows/player.html

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Windows (22:05 / 25:52) ATTACHMENTS

 **Frank Lohmann**
Team Coordinator - Housing and Small Buildings, NRC
Canadian Codes Centre

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- 11. NBC Part 9
- 12. 9.6. Glass
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- 14. 9.7.1. General
- 15. 9.7.2. General Requirements
- 16. 9.7.3. General Performance
- 17. 9.7.3. General Performance
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- 26. 9.27.4. and 5.10. Sealants
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9.7.6. Installation



- All fenestration products have to conform with CSA A440.4
 - Plywood shims can be used
 - Follow 9.27. for proper detailing of
 - flashing and
 - wall-window junctions
- Manufactured, pre-assembled and field-assembled products shall conform to manufacturer's instructions (i.e. not site-built)
- Seal fenestration products to air barriers and vapour barriers

SLIDE 24 OF 29 PAUSED 00:04 / 01:03

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A440.4-07

**Window, door, and skylight
installation**

136 page
document

Ballot Draft — Not for Further Distribution





NBC 2010

9.7.6.1. Installation of Windows, Doors and Skylights

1) The installation of windows, doors and skylights shall conform to CAN/CSA-A440.4, “Window, Door, and Skylight Installation,” except that

- a) shims used to support windows, doors and skylights are permitted to be made of treated plywood, and
- b) protection from precipitation for walls incorporating windows or doors and for roofs incorporating skylights, and the interfaces of these walls with windows or doors and of roofs with skylights, shall conform Section 9.27. (this is the cladding requirements section)

2) The installation of manufactured and pre-assembled windows, doors and skylights and the field assembly of manufactured window and door combination units shall conform to the manufacturer’s instructions.

3) Windows, doors and skylights shall be sealed to air barriers and vapour barriers.





Installation Instructions for:



Project Type -
 New Construction
Coastal Installation -
 No
Product Series -
 400 Series
Product Type -
 Casement Window
Shape -
 Rectangle
Wall Type -
 Wood or Steel Stud

Weather Resistant Barrier (House Wrap) -
 Applied Before Window/Door Installation
Water Management Method -
 Drainage Method

Sill Flashing Method -
 Single Piece (Continuous Pan or Continuous Formable Flashing)

Anchoring Method -
 Vinyl Installation Flange (only)
Drip Cap Pre-applied -
 No



IMPORTANT SAFETY AND PRODUCT INFORMATION - WINDOW

CAUTION: Many windows in older homes are painted with lead based paint. Removal of old windows may disturb this paint. Proper precautions must be taken to minimize exposure to dust and debris. Consult state or local authorities and/or go to www.epa.gov/lead for more information.

WARNING: To ensure safety and security and help prevent property damage, including potholes, always use proper tie-off techniques and use proper tie-off points.

Important Notice

Because all construction must anticipate some water infiltration, it is important that the wall system maintain full performance is not responsible for claims or damages caused by anticipated and/or design, construction and maintenance, failure to install Pella products in accordance with Pella's install systems which do not allow for proper management of moisture within the wall systems. The components, including the use of Pella products, as well as the design and installation of flashing or tie-off, the architect, contractor, installer or other construction professional are not the responsibility of Pella. Pella products should not be used in barrier wall systems which do not allow for proper management barrier Exterior Insulation and Finish Systems (EIFS) (also known as synthetic stucco) or other masonry California, New Mexico, Arizona, Nevada, Utah and Colorado. Pella makes no warranty of any kind, and does not install in barrier wall systems. In the states listed above, the installation of Pella Products accordance with Pella's installation instructions. Product modifications that are not approved by Pella are not covered by the Limited Warranty.

Care and Maintenance

Care and maintenance information is available by contacting your local Pella retailer. This information is available by contacting your local Pella retailer. This information is available by contacting your local Pella retailer.

Cleaning Instructions

GLASS: Remove any protective film and labels and clean the glass, using a soft, clean, grit free cloth kept by wiping dry or use a clean squeegee.
FACTORY FINISHED PRODUCT: Pella product that has been prefinished with stain or paint from its surface with soap and water.
PELLA ALUMINUM CLAD OR INTERIOR FRAMES: The interior and exterior frame and sash are gaskets with stainless steel or stainless steel. Stainless steel may be removed with mineral spirits. DO NOT use abrasive cleaners on the surface.
ENCLOSURE BY PELLA (THERMACLOS BY PELLA, PELLA 150 SERIES, PELLA 350 SERIES AND PELLA 400 SERIES): These parts are removed. After finishing, allow venting windows and do not use solvents such as mineral spirits, toluene, xylene, naphtha or methanol acid as they can damage the material and seal. Keep these materials off the sill and sashes. Keep weep holes open. DO NOT use alkaline. DO NOT scrape or use tools that might damage the surface.
NOTICE: DO NOT use aggressive solvents or bristles for cleaning chemicals. If you do, paint or damage would not be covered by the Limited Warranty.

Interior Finish (Wood Windows)

Paint or finish immediately after installation.
 If products cannot be finished immediately, cover with clear plastic to protect from dirt, damage or fading. Sand all wood surfaces lightly with 180 grit or finer sandpaper. DO NOT use steel wool. If sanding dust, Pella products must be finished per the below instructions. Failure to follow these instructions may result in product performance. Do not paint, finish or remove the weatherstripping water leakage will result if these parts are removed. After finishing, allow venting windows and do not use or finish gaps on the weatherstripping, wrap it off immediately with a damp cloth.
 Window Cleaning and Prep Instructions for Unfinished or Primed windows: Dry wipe dust from sill or fingerprints from normal handling in construction. To remove smudges, lightly wipe with paper or abrasive pad (200-grit or higher). Rinse surface with warm water. Let window surfaces dry.
 Finish the windows as soon as possible after installation.
 • On unprimed and double hungs, it is optional to paint, stain or finish the vertical and horizontal sash.
 • On single hungs and double hungs, do not paint, stain or finish the vertical sash edges, any fin or muntin. It is optional to paint, stain or finish the horizontal sash edges.
 Pella Corporation is not responsible for improper paint and stain finish. Specifications for any product additional information on finishing see the Pella Owner's Manual or go to www.pella.com. The use of unapproved finishes, solvents or cleaning chemicals may void warranty and/or cause damage to the product caused by the use of unapproved materials. If in doubt, contact your local retailer or rep.

Exterior Finish of Existing Frame (Pocket Replacement)

It is the responsibility of the homeowner, contractor or installer to ensure any exposed unfinished sashes, however are not finished, covering with plastic and seal or painting.
 For Coasment Hardware Installation go to www.ista.com/usa/wholesale/usa/index.html

NF-2 Revised 11/09/2020 © 2020 Pella Corporation

Clad Window Installation New Wood Frame Construction



Introduction

These instructions are applicable for the following window products:

- Ultimate Casement Family
- Ultimate Polytip
- Ultimate Tri-Turn-Inset Casement/Hopper
- Ultimate Slider
- Ultimate Round Top

ABSTRACT: Please read these instructions in their entirety before beginning to install. These instructions demonstrate the installation of a Marvin wood vein using an industry approved water management system. For installation using a remodeling, replacement, and recessed openings refer to "ASTM E2112, Standard for Windows, Doors and Skylights," for installation suggestions. Information to ASTM website, www.astm.org

For product specific issues, service instructions and other field service guides, visit our website at www.marvin.com, or contact your Marvin representative.

Regional standard practices, environmental conditions, and codes may vary by location. The responsibility for compliance is yours, the installer. Inspect the procedures within these instructions are consistent with those used in testing.

The English language version of this Clad Installation Instruction is the official over any translation.



Read these instructions and the product safety information before starting procedure.

Typical Tools Needed



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US Tort Law
 A tort is an act or omission that gives rise to injury or harm to another and amounts to a civil wrong for which courts impose liability.





Lohmann, Frank

to me, CONST-CONST

Brian,

I reviewed the installation requirements in the NBC Subsection 9.7.6., which state:

9.7.6.1. Installation of Windows, Doors and Skylights





1) The installation of windows, doors and skylights shall conform to CAN/CSA-A440.4, “Window, Door, and Skylight Installation,” except that

- a) shims used to support windows, doors and skylights are permitted to be made of treated plywood, and
- b) protection from precipitation for walls incorporating windows or doors and for roofs incorporating skylights, and the interfaces of these walls with windows or doors and of roofs with skylights, shall conform Section 9.27.

2) The installation of manufactured and pre-assembled windows, doors and skylights and the field assembly of manufactured window and door combination units shall conform to the manufacturer's instructions.



The convention for the NBC is that each sentence has to be complied with unless it is exempted from a requirement or its application has been modified by another sentence (which is not the case here). The intent of writing the installation requirements for windows, doors and skylights for housing and small buildings this way was that the manufacturer's installation instructions apply in addition to A440.4, not as an alternative. Sentence (2) was added mainly because the A440.4 installation standard does not address the installation of some of the components described in Sentence 9.7.6.1.(2).





The views expressed in this letter are those of the staff of the Canadian Codes Centre of the National Research Council who assist the Committees which are responsible for the preparation of the National Building, Plumbing and Fire Codes. These views should not be considered as official interpretations of legislated requirements based on the National Building and Fire Codes of Canada because the final responsibility for an official interpretation rests with the authority having jurisdiction.

Kind Regards

Frank Lohmann,

Senior Technical Advisor, Housing and Small Buildings (NBC Part 9)

NRC Construction

Canadian Codes Centre

1200 Montreal Road Building M23a

Ottawa, ON, K1A 0R6





Here's one of the reasons why both the manufacturers instructions as well as A440.4 apply;

When windows are tested according to NAFS for their structural wind load capacity, the results depend on how the window tested is fastened to the test apparatus. The type, size, length and spacing of the fasteners becomes part of the test result, and must be duplicated in the field to ensure those results transfer over to the in-situ application.





Everything has a starting place, something that triggered it.
So, what was it that got this mandated installation requirements
ball rolling?

Issues!

“By 2003, the **B.C.** Homeowner Protection Office had identified about 65,000 **leaky condos** across the province. The Canada Mortgage and Housing Corporation defines **leaky condos** as a "catastrophic failure" of building envelopes, which lets water into the building frame and leads to rot, rust, decay and mould.”





“Tony Gioventu, executive director of the Condominium Home Owners Association of B.C., said the leaky condo problem was prompted by several factors.”

“Gioventu estimates the problem will eventually cost the provincial economy between \$3 billion and \$5 billion. He said condo developers had established a warranty program, but it didn't have the resources to pay out everyone affected by the issue.”





“When the program folded, the province stepped in to establish an interest-free loan for leaky condo homeowners. It ended in 2009.”

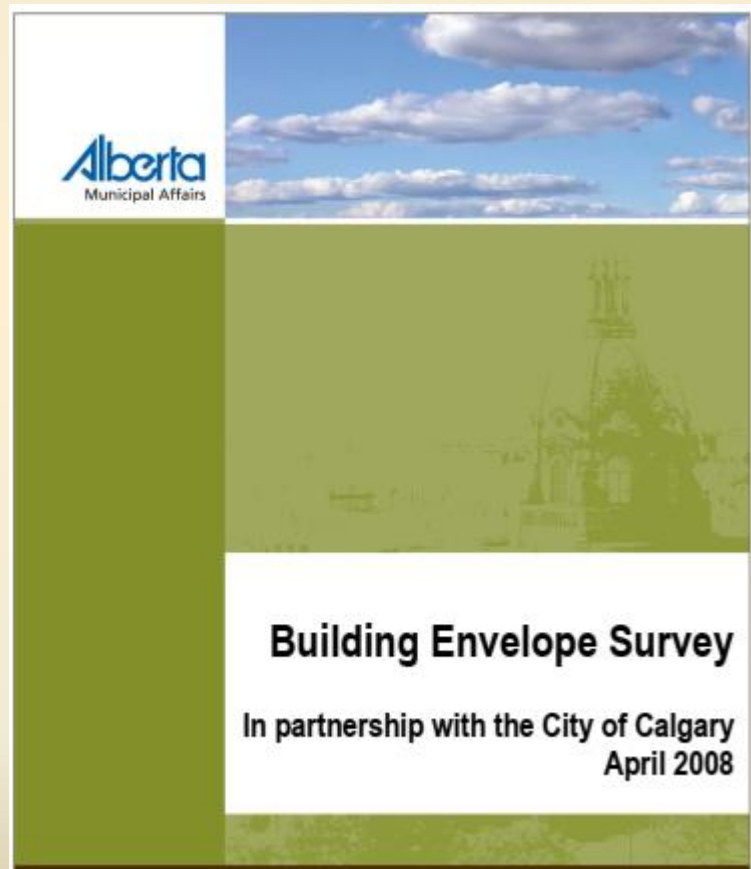
“Gioventu said the Barrett inquiry, which rolled out in two parts, eventually led to higher standards in the real estate development sector - including design, engineering and building codes.”





This is not an **Issue** that affected BC alone....

“In 2007 the Alberta Municipal Affairs department commissioned a survey in response to homeowner concerns with the construction quality of their homes because of moisture penetration of the outer walls and ceilings (known as the “building envelope”)”.





“The survey found the homes examined generally did not meet the requirements for the building envelope in the Alberta Building Code and that industry’s moisture control program did not improve building envelope installation quality and code compliance in these homes.”

“The survey team’s observations demonstrate a need for government, municipal and residential construction industry representatives to take steps to safeguard the quality and integrity of new home construction in Alberta as it relates to the building envelope.”

(this issue was not limited to the west)





First, a disclaimer – not all window problems are necessarily installation problems





So..... What did they find in Alberta?







Moisture Index:
Calgary .37 Winnipeg .58



Acceptable moisture content for wood is between 5 and 12% with a safe maximum not exceeding 17%

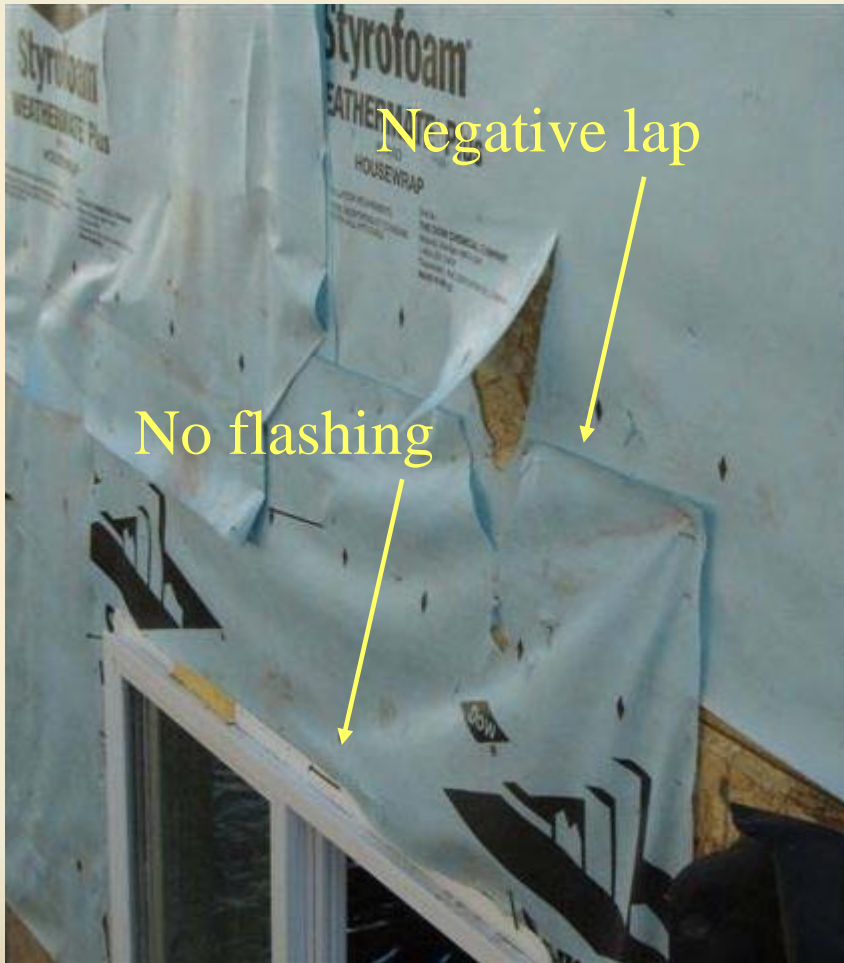


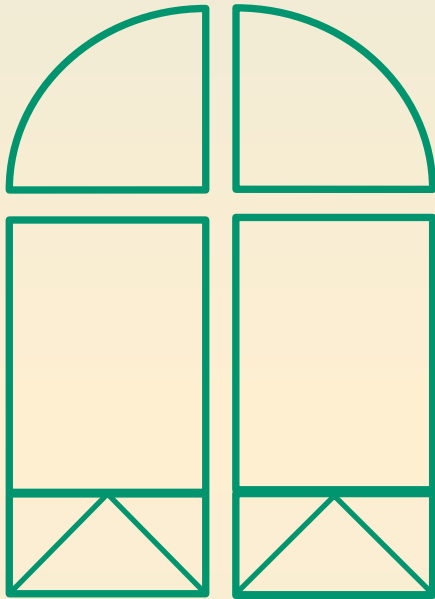


Just a note here.....

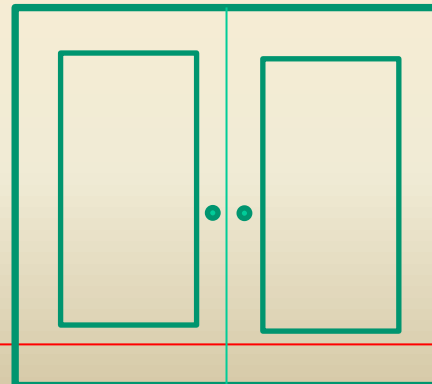
The overwhelming single cause of lawsuits against window and door manufacturers and contractors is water penetration.
The most frequent issue is mold.







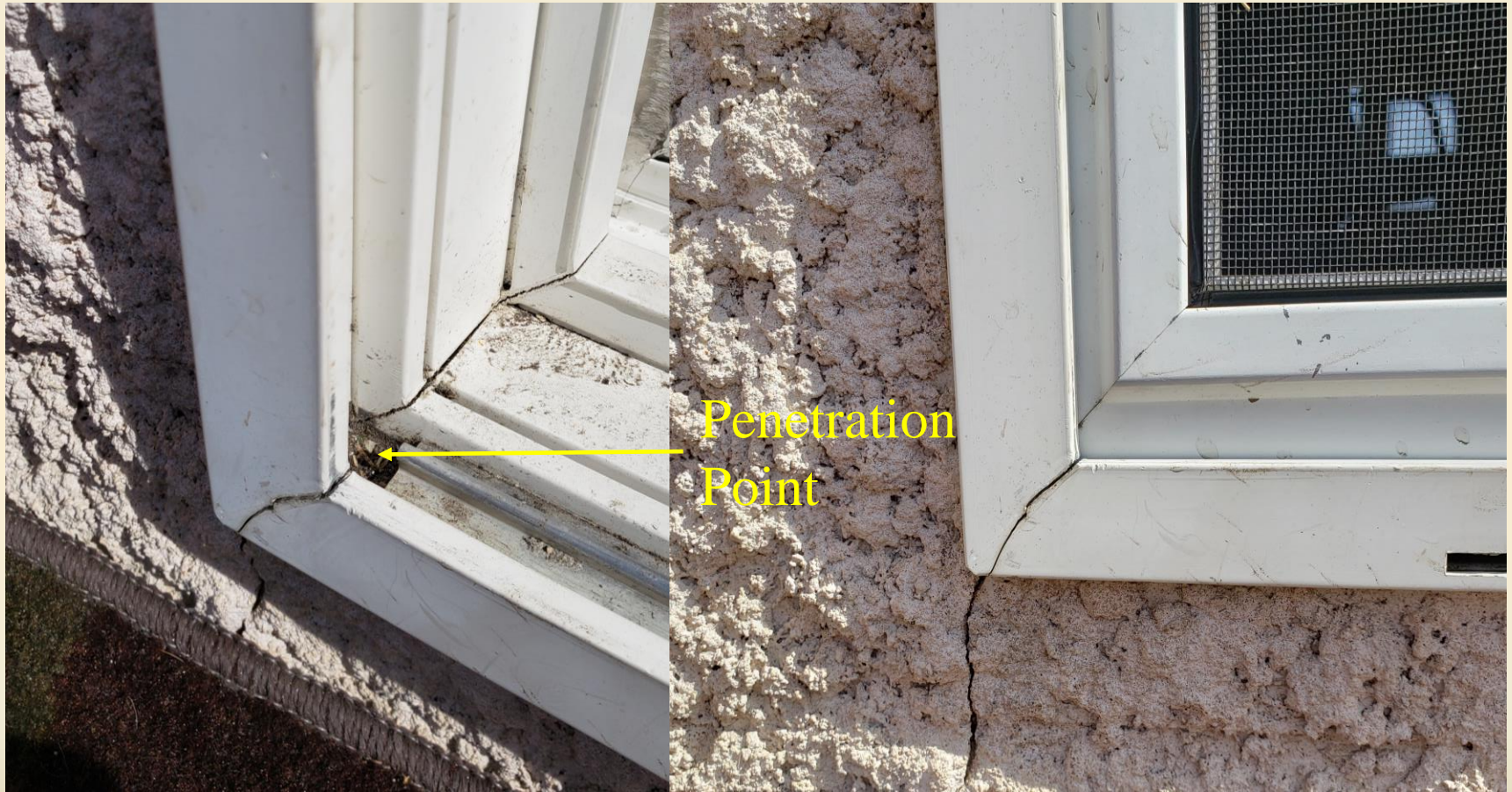
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1. Water dripping from the inside top of the garden door
 2. The lady of the house developed a respiratory disease

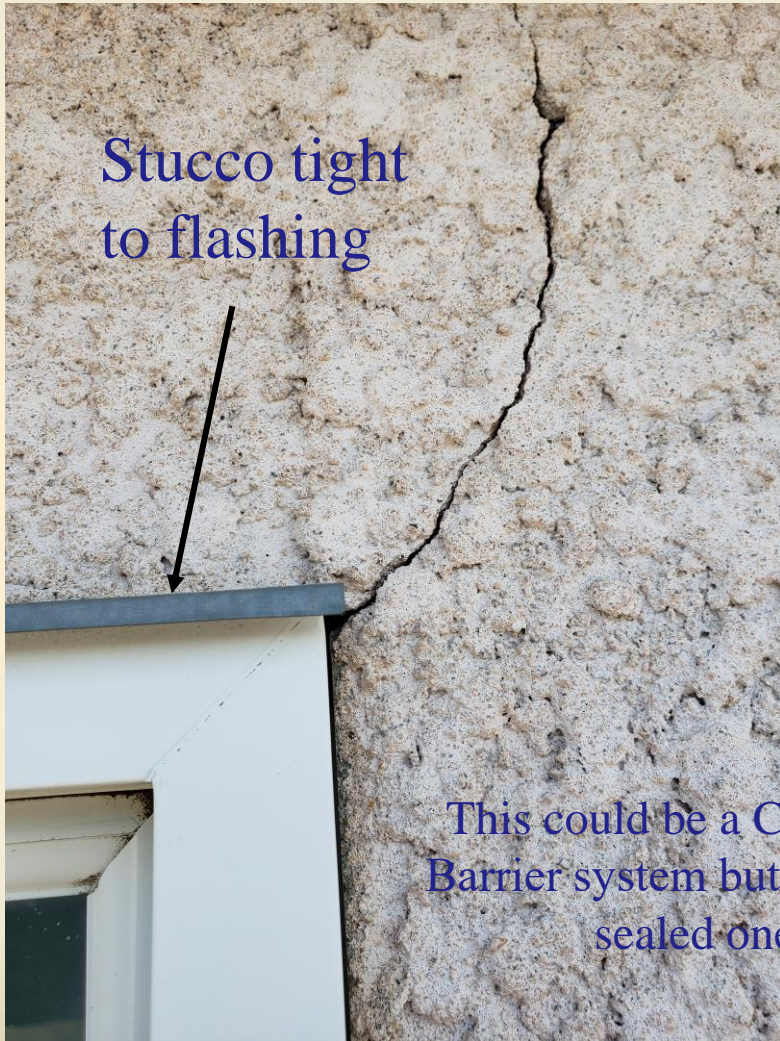




In the past several years I have been doing site visits on behalf of manufacturers and builders to observe installation quality as an audit, and in some cases these installation practices resulted in being the basis of a lawsuit. Here are some things I have seen.







Stucco tight to flashing



Stucco tight To Frame

This could be a Concealed Barrier system but it's a face sealed one.





This door was 10 years old when it needed to be replaced. It was in a protected inside corner of a deck, with a typical stucco wall finish.







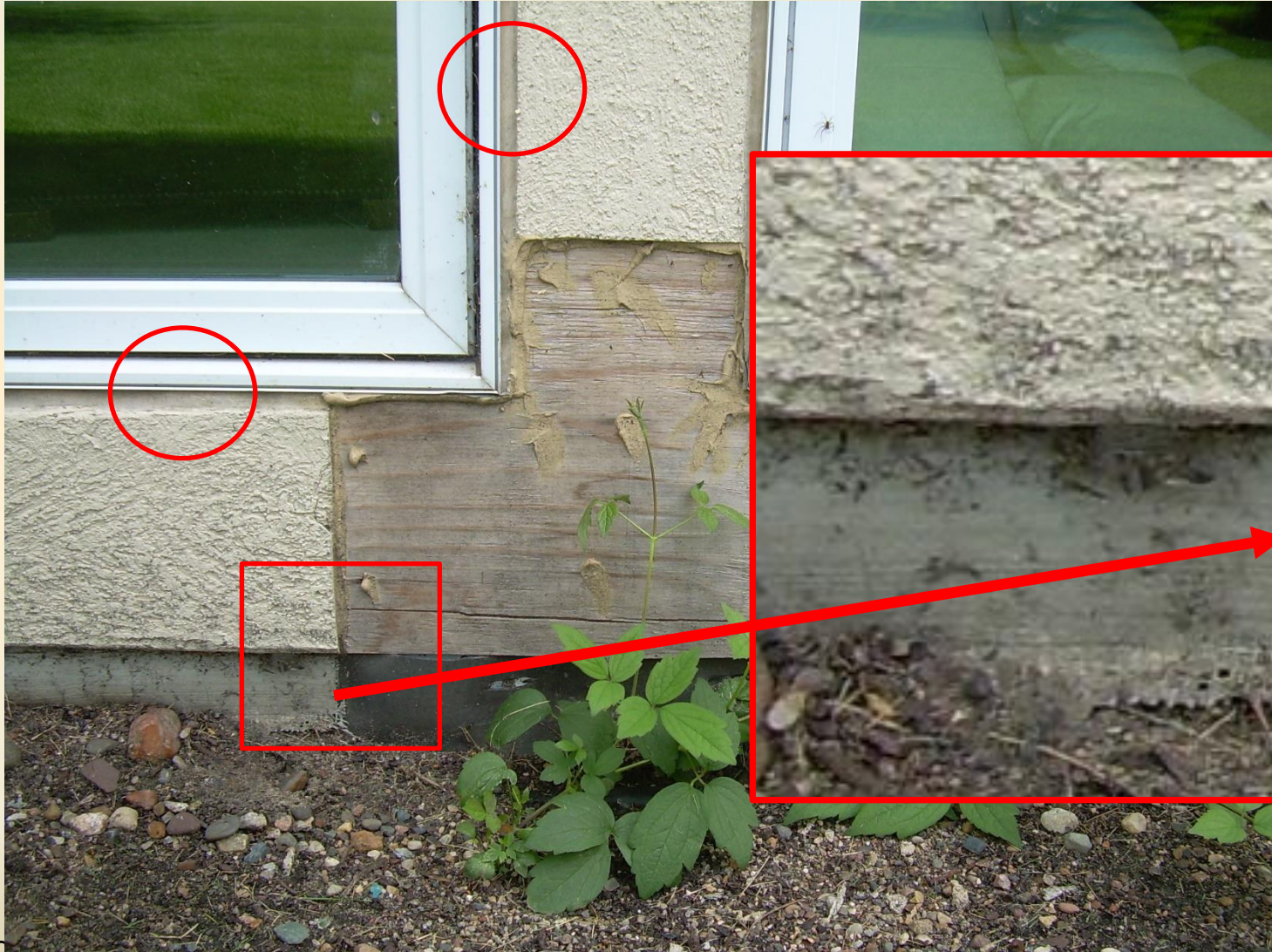
WHICH BRINGS ME TO A POINT:

I've been told "I've been installing windows and doors for 30 years – don't tell me I have an installation problem!!"

Every time I've heard this I know that the individual saying it does not do re & re, or they would have seen what I've seen. Best practices of the 80's didn't cut it.











Someone knew that there
was a moisture problem

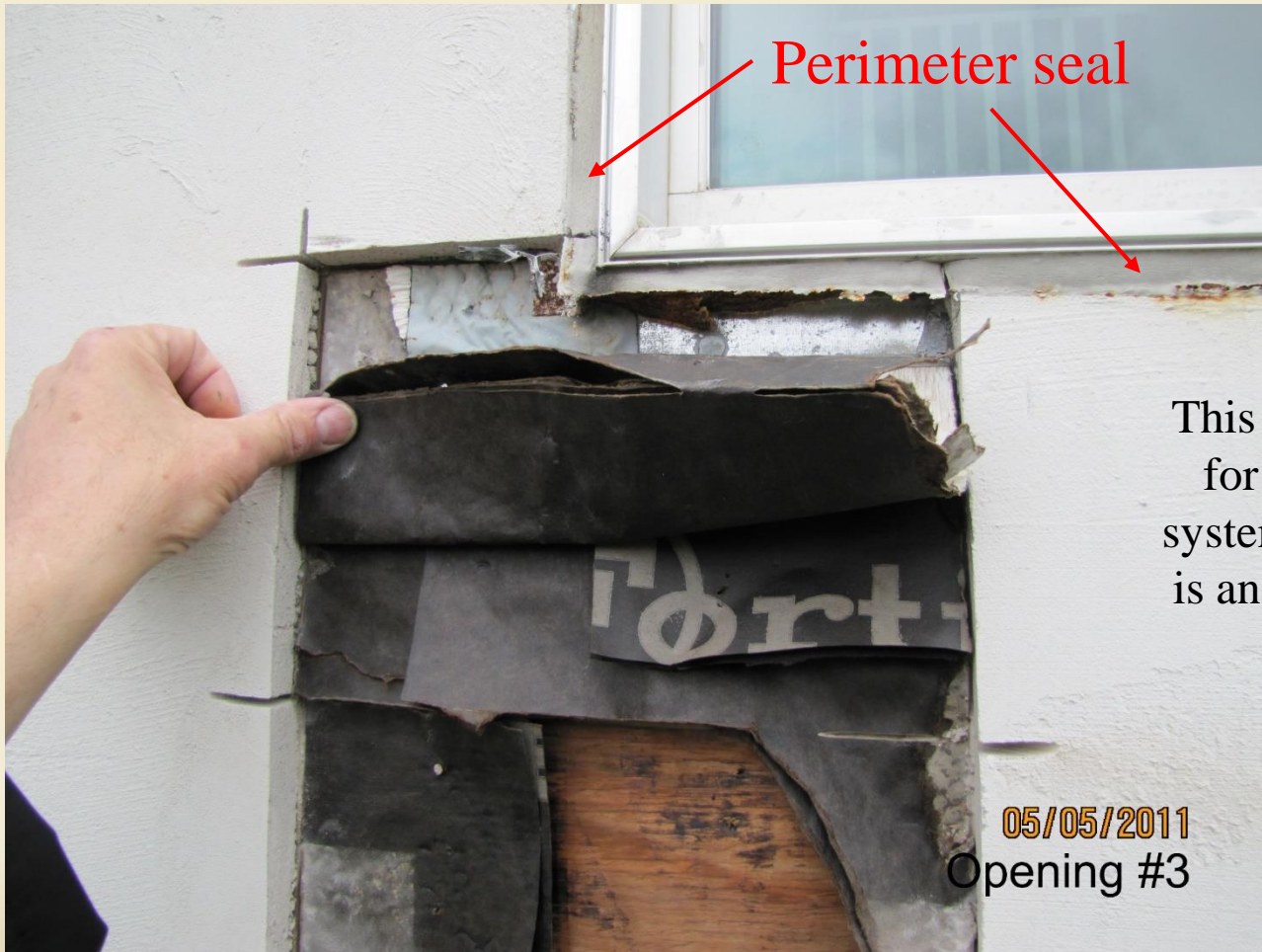




05/05/2011
Front Right Elevation







Perimeter seal

This is code compliant for a hidden barrier system, as long as there is an egress path at the bottom

05/05/2011
Opening #3



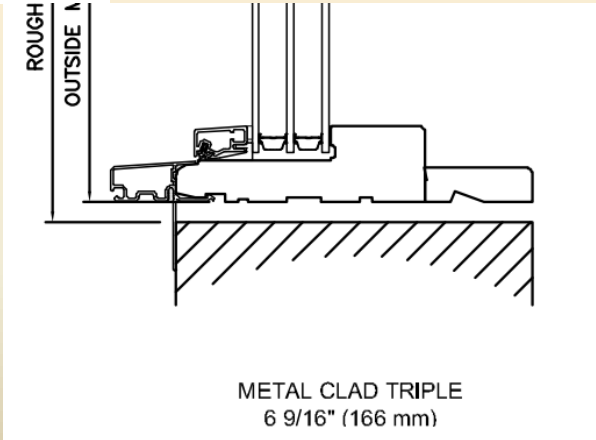
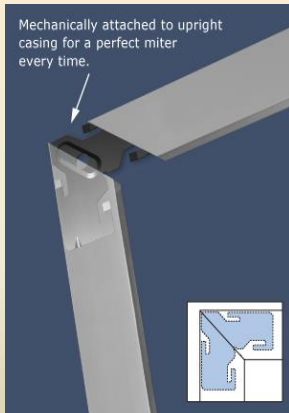
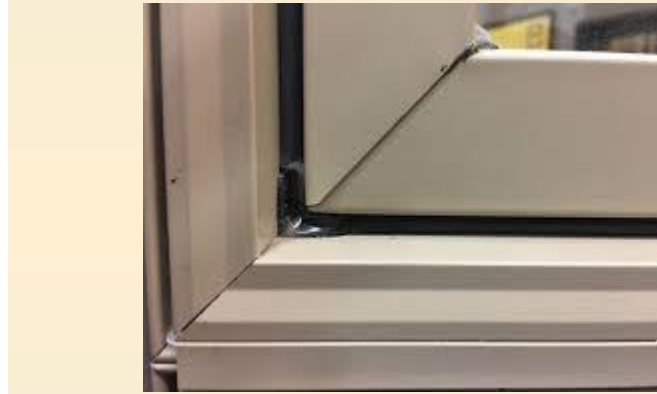
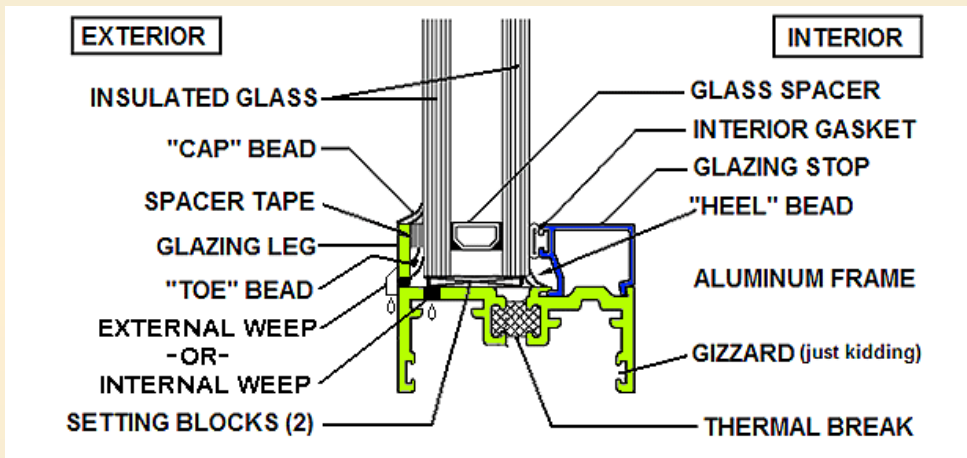


Penetration
Point



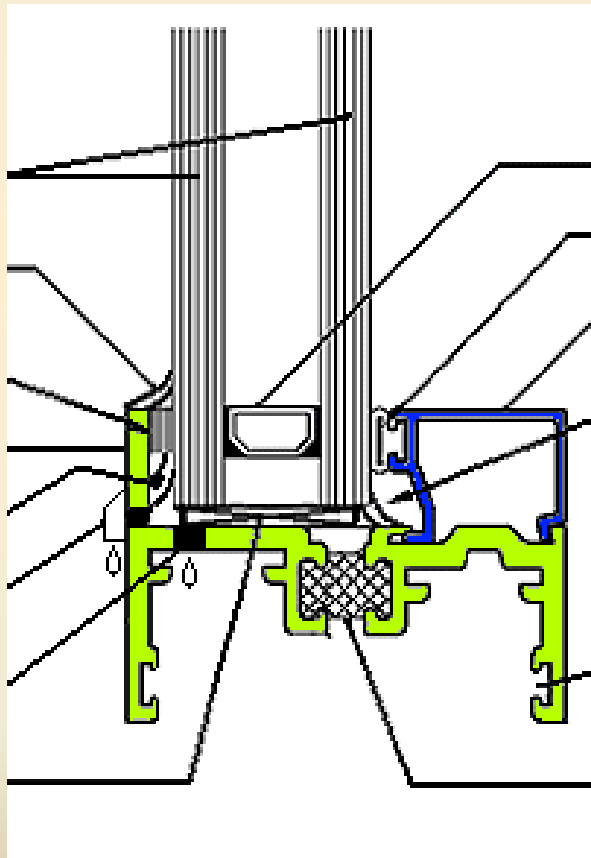


Possible points of water ingress in mechanically fastened window systems



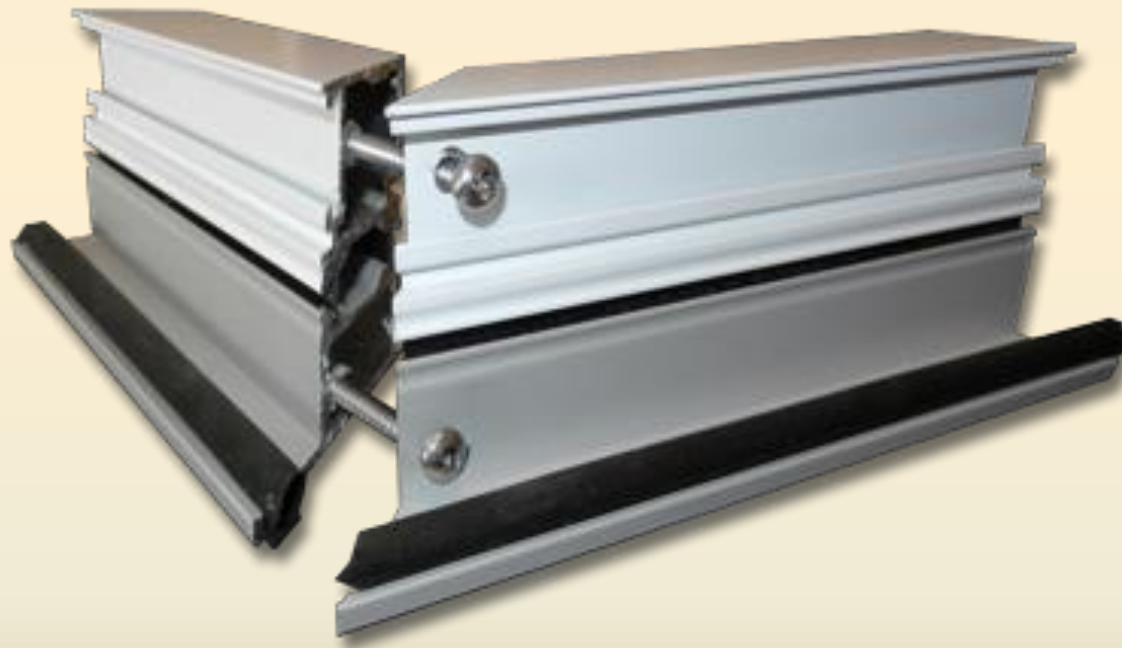


Open-backed aluminum or fiberglass systems



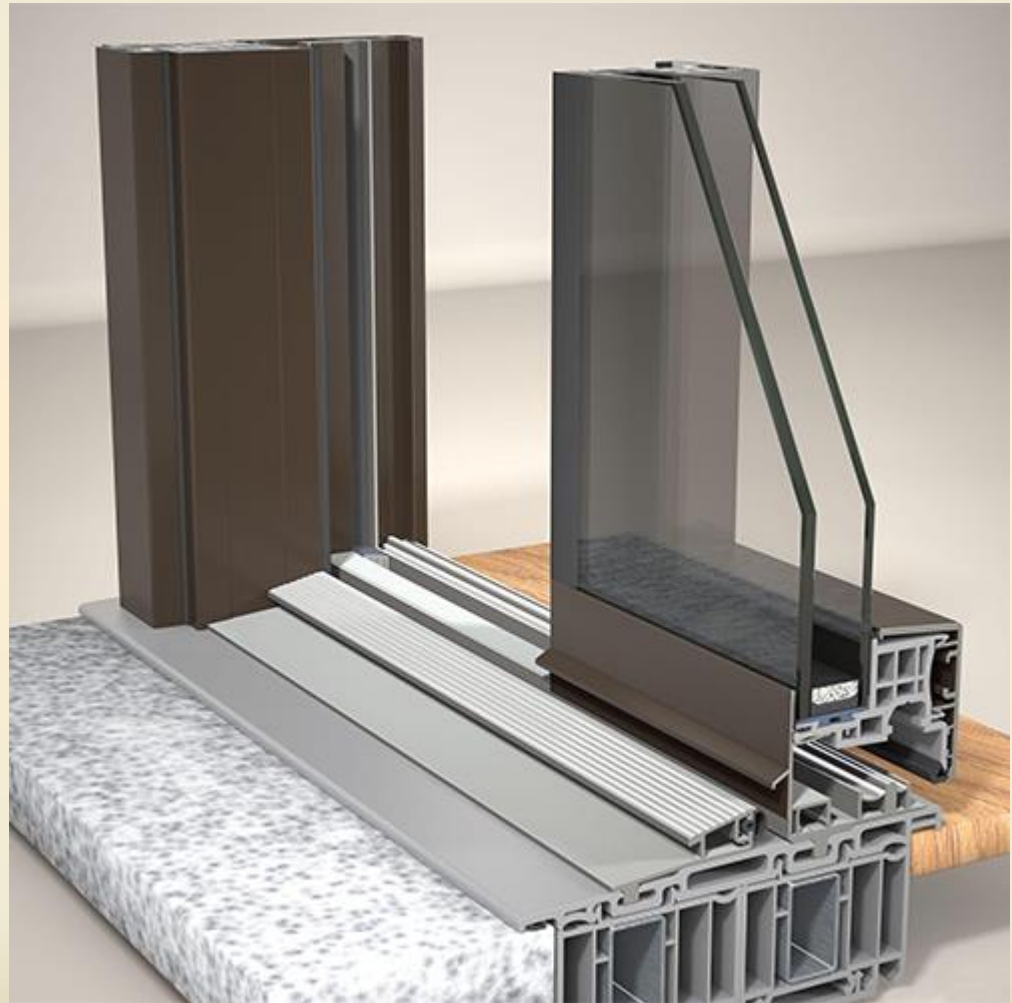


Mitered with or without corner keys



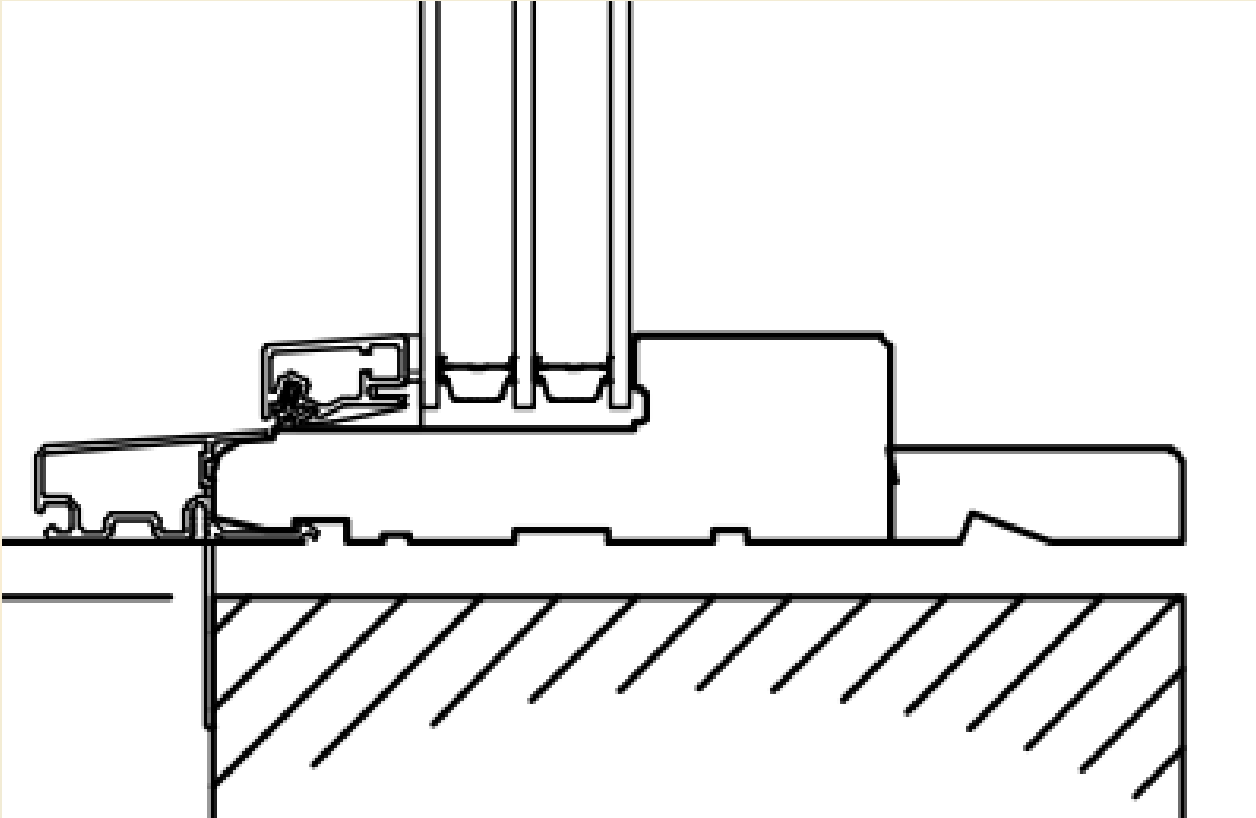


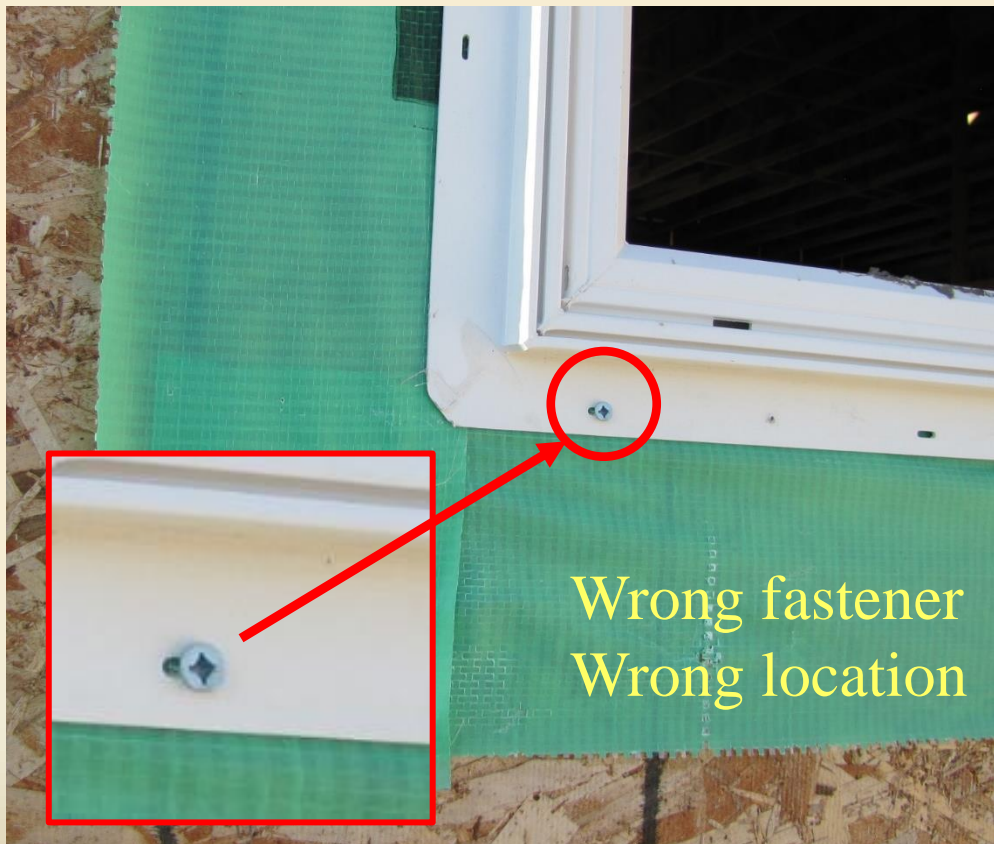
Fastened butt joint



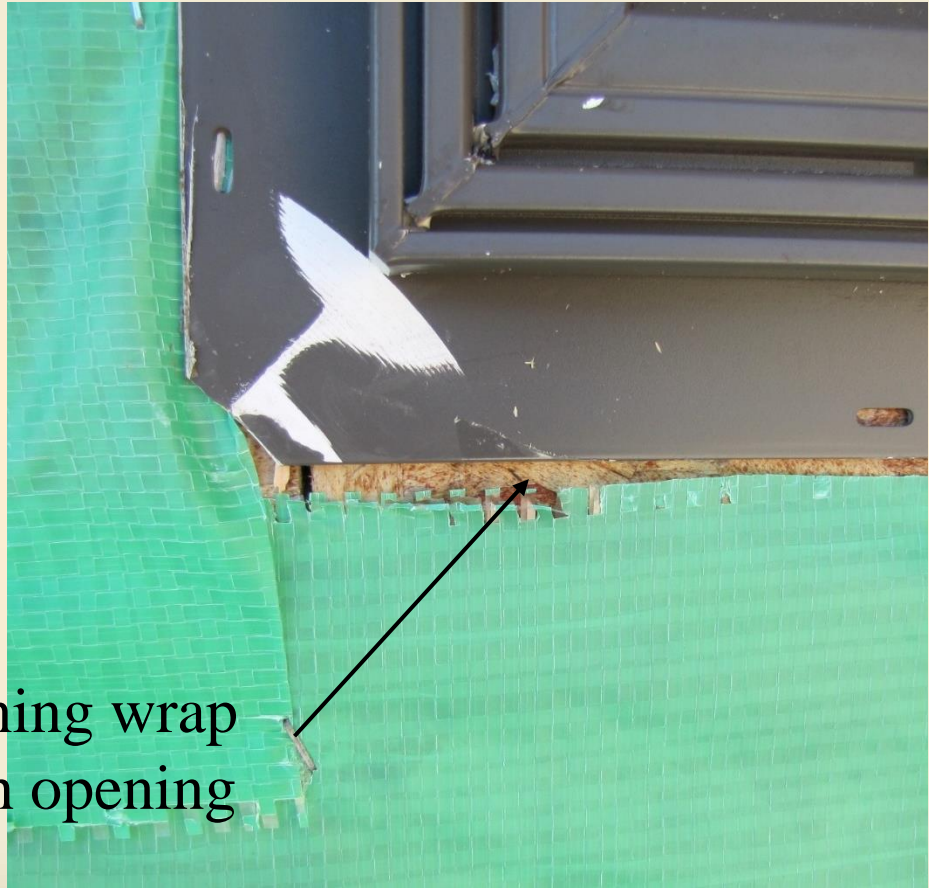
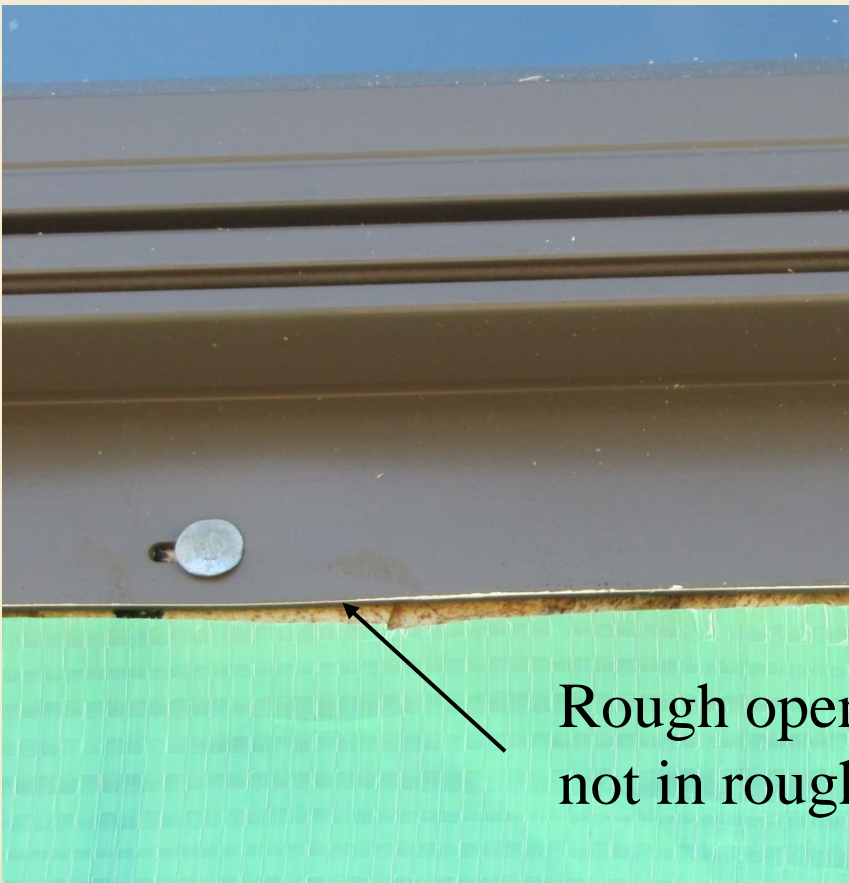


Butt or mitered
wood joints









Rough opening wrap
not in rough opening





Not sure what this
guy was thinking

I bet the framer
installed this window
(26 oz. you know)





OSB shim



RO so big the nail
flange fastener hole
shows







Is top gap



Is bottom not gap





Stucco wire fasteners
through window flange





Remember what Gioventu said; “changes are needed in design, engineering and building codes.”

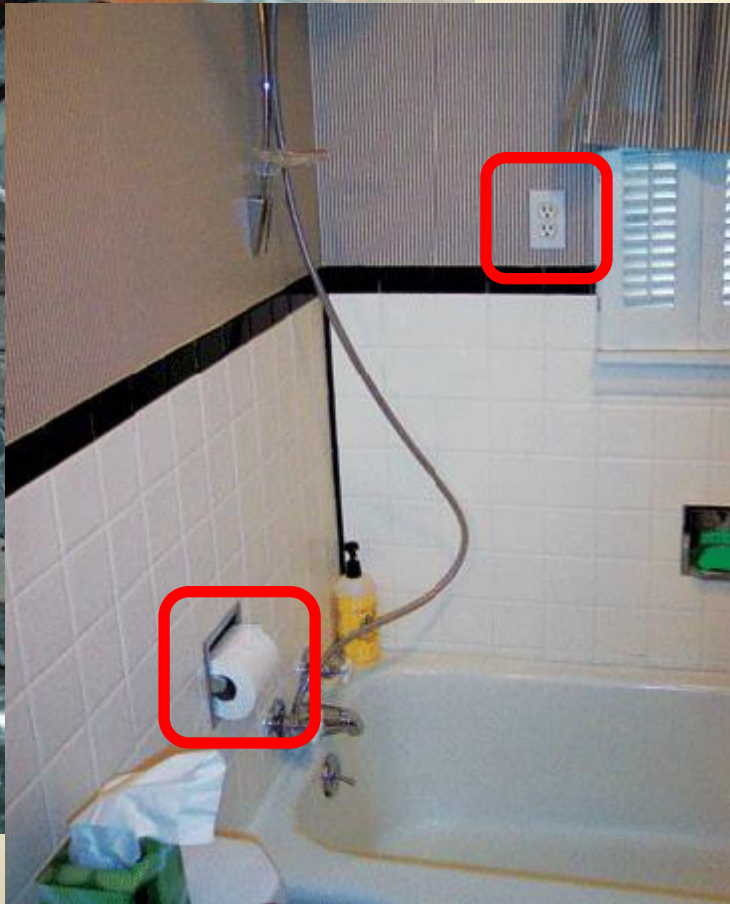
This was echoed by the Alberta report on water infiltration where the recommendation was for “government, municipal and residential construction industry representatives to take steps”

As it applies to our discussion today, changes were made at the code level to resolve issues related to window installations





First a quick quiz.. Spot the problem.....





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Windows

www.nationalcodes.nrc.gc.ca/eng/presentations/windows/player.html

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Team Coordinator - Housing and Small Buildings, NRC
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SLIDE 24 OF 29 PAUSED 00:04 / 01:03

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BC went a couple of steps further requiring;

- All multi-family projects must use a building envelope engineer
- Requirement for the building envelope of multi-family projects to be tested for resistance to water infiltration around building envelope penetrations before the exterior finish is applied

The majority of multi family projects use “rain screen” as a moisture control strategy.





In the case of windows
this is how it's done



Water spray bar

Interior suction box







5.1.1 General requirements

The general requirements for the practice of installing windows, doors, and skylights include health and safety considerations in order to provide satisfactory structural performance and control of air leakage, condensation, and rain penetration, for

- (a) thermal comfort (in the occupied interior space); and
- (b) the prevention of indoor air quality problems caused by pollutants released from biological growth or decomposition of building materials.

The biggest single issue arising from water penetration is mold growth. This is a health issue.

The second most relevant issue arising from water penetration is the rotting and deterioration of structural components. This is a building integrity issue.

The NBC's prime directive is the protection of health and safety.





So, on what basis was the A440.4 standard developed?

The starting premise/assumption is this: **all windows and window openings may leak at some point in their life.**

So, what is to be done about it?

The emphasis became **water management**





So lets take a look at the A440.4 standard. We won't go into all the details but instead hit some of the things which may be different from the past as well as take a look at what a code compliant installation looks like and how to determine if it's correct





Fasteners

4.5.3

Acceptable materials for fasteners and the performance requirements they are obliged to meet are as follows:

- (a) steel-cadmium plated (ASTM B 766, Class 8, Type II or Type III);
- (b) steel-zinc coated (ASTM B 633, ASTM A 123 or ASTM A 641);
- (c) steel-nickel/chrome plated (ASTM B 456, Type SC);
- (d) magnetic stainless steel, minimum 16% chrome;
- (e) non-magnetic stainless steel;
- (f) aluminum; or
- (g) nails, spikes, and staples (CSA B111).

Notes:

- (1) *Where industrial pollutants, salt water spray, moisture, and high humidity in the atmosphere can create conditions conducive to corrosion, the use of austenitic stainless steels is recommended.*
- (2) *Nails, spikes, and staples may be used but are not recommended because there are better fasteners available.*

4.5.4

Fasteners shall be non-rusting or protected by a rust-resistant coating.

4.5.4 precludes the use of drywall screws and box/common nails

5.2 Anchorage

Anchorage systems shall be capable of transferring live loads to the wall structure, yet allow differential expansion between the window and the wall.





6.4.4.3

If anchoring is required at the head of the unit, the anchor shall be designed to restrict inward and outward movement, while still allowing for differential movement between the head of the unit and the lintel.

Notes:

- (1)** *Window and doors are designed to support their own internal weight only. If downward vertical loads from the building are transferred to the head of the window or door frame, deflection of that member will occur. Loads might then be transferred to the door slab or to sashes and/or glass, affecting ease of operation and inducing stresses on the unit. Therefore, vertical loads should be prevented from transferring to the head of window or door units.*
- (2)** *To prevent the vertical transfer of the building loads to the window or door unit, a lintel or other structural system that limits deflection to an acceptable amount should be installed above the head of the unit. Building codes typically specify the requirement for lintels.*
- (3)** *A lateral restraint device may be installed at the head of a window or door to limit the rotation of the head member at that location. However, such a device should allow a gap for vertical deflection of the building structure and/or expansion of the window frame without imposing additional loads on the window or door unit.*





Sealants

4.9.1

Sealants shall meet the following performance requirements:

- (a) acrylic-based, solvent curing sealant (CAN/CBSB-19-GP-5 or ASTM C 1311);
- (b) silicone-based, solvent curing sealant (CAN/CBSB-19.18 or ASTM C 920);
- (c) acrylic emulsion-based sealant (CAN/CGSB-19.17);
- (d) elastomeric, chemical curing sealant (CAN/CBSB-19.13 or ASTM C 920);
- (e) multicomponent, chemical curing sealant (CAN/CGSB-19.24); and
- (f) butyl-polyisobutylene polymer-based, solvent curing sealant (CGSB-19-GP-14 or ASTM C 1311).



Water-Based Advanced Acrylic Polymer





Shims

4.10.1

Material used for shims shall

- (a) be hard enough to permanently sustain the required loads without creeping;
- (b) be a good thermal separator;
- (c) resist decay; and
- (d) allow for anchoring through the shim.

Note: Acceptable materials for shims are neoprene, EPDM or silicone with a Durometer hardness of 40–60 Shore A, cedar, vinyl, rubber, or high-density polyurethane, specifically designated as shims. Wood shims may not be used unless they are cedar and comply with [Clause 4.10.2](#).

Shims cannot be spruce, plywood or OSB. An exception is made in the NBC for PWF plywood because it also resists decay.





6.4.3 Shimming

6.4.3.1

Shims shall be installed in a manner and number sufficient to minimize deflection, distortion, or rotation of the frame or sill and to permit the proper operation of the window or door.

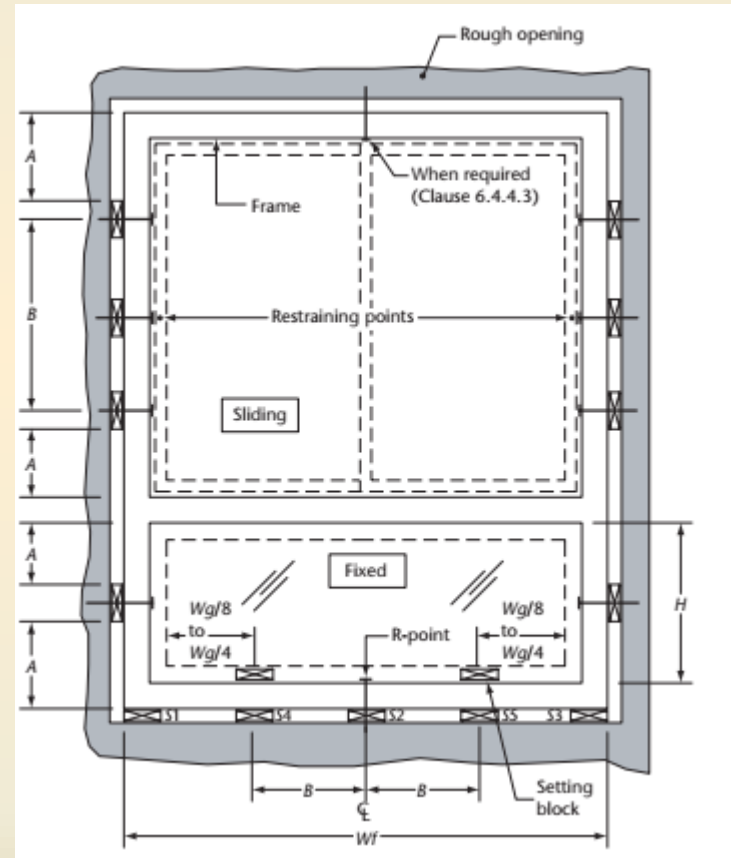
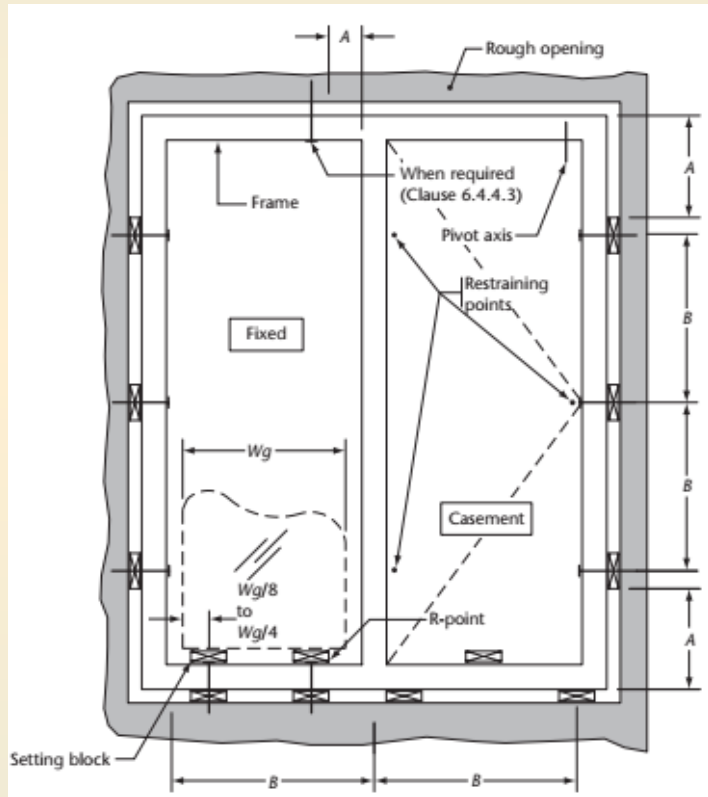
Shims may be installed in accordance with [Figures 1 to 13](#). A minimum distance A , as indicated in [Figures 1 to 13](#), shall be maintained between the exterior corner of the window or door frame and lateral shims.

6.4.3.2

Shims shall be placed evenly along the bottom and sides of the window or door frame. There shall be shims at each fastener location.

Notes:

- (1) *The installation of shims at the head of a window or door unit can cause vertical loads to be transferred to the unit as the lintel deflects. Therefore, this practice is not recommended and should be avoided whenever possible. However, situations can arise in which a shim at the head of a window or door unit is needed. For example, a larger unit may require a shim at the head to help prevent lateral rotation of the head member. Extreme caution should be used when installing shims at the heads of window or door units. See [Clause 6.4.4](#) for more information.*
- (2) *When installing shims at the head of a window or door unit, the window or door assembly should be designed to accommodate the short- and long-term differential movement between the rough opening and the window head.*





5.1.2

The completed installation of windows, doors, and skylights shall control the following:

- (a) moisture flow (liquid and vapour);
- (b) condensation;
- (c) insect entry;
- (d) thermal transmission;
- (e) air flow;
- (f) rain penetration; and
- (g) movement due to wind pressure differentials.

5.3 Continuity with the wall

Continuity shall be maintained between elements in the window, door, or skylight and the wall to provide resistance to rain penetration, air leakage, heat transfer, and vapour diffusion.





Flashings

4.6.1

Flexible and rigid flashing materials shall be waterproof and securely attached to minimize any weather damage to buildings prior to the application of the exterior wall cladding. The flashing shall be integrated into the weather barrier of the building in accordance with the applicable building code. Acceptable flashing materials include reinforced bitumen type flashing and rigid metal flashings composed of factory-finished aluminum, copper, galvanized metal, or other nonferrous metal.

If the flashing is ferrous it must be galvanized
(i.e. not just painted)





Flashing

10.2.5.2

Head flashing shall

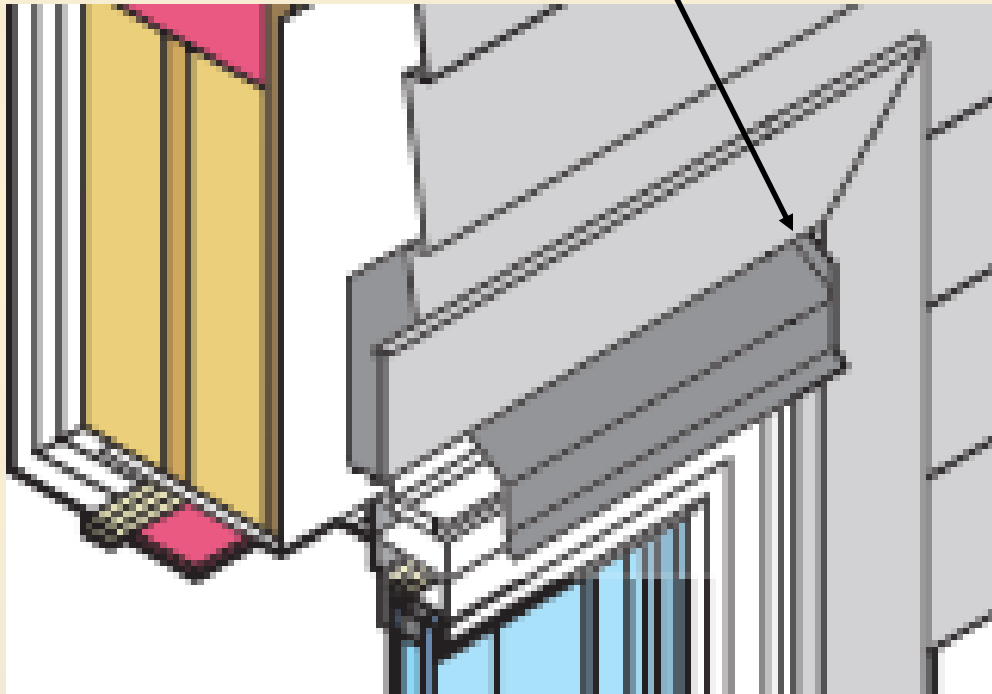
- (a) be a continuous piece long enough to cover the entire window or door head, except as provided in [Clause 10.2.5.5](#) ;
- (b) slope a minimum 6% (5.4°) to the exterior to limit the running of water along the flashing and entering the wall at upper corners of windows;
- (c) extend upward behind the wall sheathing membrane, or insulating sheathing installed instead of the sheathing membrane, at least 50 mm (2 in);
- (d) extend not less than 19 mm (3/4 in) beyond the face of the window or door frame below and have a drip edge to prevent the backflow or runoff of water onto the window or door below;
- (e) extend horizontally past the trim at the top corner of the window or door to span the width of the joint between the window or door and the cladding; and
- (f) terminate at each end with an end dam
 - (i) with a height not less than 25 mm (1 in) or 1/10 the value of the 1 in 10 driving rain wind pressure in Pa; and
 - (ii) at the height defined in Item (f)(i), extending to the face of the adjacent cladding.





This

Not this





10.2.4.1

Exterior sills and sill flashings for windows and doors shall

- (a) consist of a continuous piece, except as provided in [Clause 10.2.5.3](#);
- (b) slope a minimum 6% (5.4°) to the exterior;
- (c) extend not less than 6 mm (1/4 in) beyond the cladding below and have a drip edge with a 45° angle from the vertical plane of the wall to prevent the backflow of runoff water onto the wall cladding below; and
- (d) prevent water from entering the walls at the lower corners of windows and doors.

Notes:

- (1) *Upstands (or end dams) that are an extension of the flashing material or are formed separately and sealed to the flashing may be used to prevent water from entering the walls at the ends of the sill. The minimum return or height of the upstands should be 50 mm (2 in).*
- (2) *Installation of sub-sill flashing is described in [Clause 10.3](#).*





Installation system selection





Performance Rating for NAFS Required 3 things

1. Statistical Data
2. Height Above Grade
3. Terrain

Table A.1 (Continued)

Location	Column A	Column B	Column C		Column D
	Driving rain wind pressure (DRWP), Pa, 1/10	Hourly wind pressure (HWP), kPa, 1/50	Ground snow load, S_g	Associated rain load, S_r	January design temp. (JDT), °C, 2.5%
Split Lake	160	0.49	2.5	0.2	-38
Steinbach	220	0.40	2.0	0.2	-33
Swan River	160	0.38	2.0	0.2	-36
The Pas	200	0.44	2.1	0.2	-36
Thompson	120	0.49	2.4	0.2	-42
Virden	220	0.46	2.0	0.2	-33
Winnipeg	220	0.45	1.9	0.2	-33



Table 1
Specified DRWP (p_r) for open terrain
 (See Clauses 4.2.1 and A.4.2.1 and Figure A.1.)

Height, m	p_r , Pa																				
	1/10 DRWP, Pa																				
10	49	73	98	122	146	171	195	220	244	268	293	317	342	366	427	488	549	610	671	732	793
15	53	79	106	132	159	185	212	238	265	291	318	344	370	397	463	529	595	662	728	794	860
20	56	84	112	140	168	196	224	252	280	308	336	364	392	420	490	561	631	701	771	841	911
25	59	88	117	147	176	205	234	264	293	322	352	381	410	440	513	586	659	733	806	879	952
30	61	91	122	152	182	213	243	274	304	334	365	395	426	456	532	608	684	760	836	912	988

Table 2
Specified DRWP (p_r) for rough terrain
 (See Clauses 4.2.1 and A.4.2.1 and Figure A.1.)

Height, m	p_r , Pa																				
	1/10 DRWP, Pa																				
10	34	51	68	85	102	120	137	154	171	188	205	222	239	256	299	342	384	427	470	512	555
15	37	55	73	91	110	128	146	164	183	201	219	237	256	274	320	365	411	457	502	548	594
20	40	60	80	100	119	139	159	179	199	219	239	259	279	299	348	398	448	498	547	597	647
25	43	64	85	106	128	149	170	192	213	234	255	277	298	319	373	426	479	532	585	639	692
30	45	67	90	112	135	157	180	202	225	247	270	292	315	337	393	450	506	562	618	675	731



Table 3
Specified wind load (p) for windows, doors, and positive loads on unit skylights – Open terrain

(See Clauses 4.2.2 and A.4.2.2 and Figure A.1.)

Height, m	p , kPa																					
	1/50 Hourly wind pressure, kPa																					
	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25
10	0.56	0.70	0.84	0.98	1.13	1.27	1.41	1.55	1.69	1.83	1.97	2.11	2.25	2.39	2.53	2.67	2.81	2.95	3.09	3.23	3.38	3.52
15	0.61	0.76	0.92	1.07	1.22	1.37	1.53	1.68	1.83	1.98	2.14	2.29	2.44	2.59	2.75	2.90	3.05	3.20	3.36	3.51	3.66	3.81
20	0.65	0.81	0.97	1.13	1.29	1.45	1.62	1.78	1.94	2.10	2.26	2.42	2.58	2.75	2.91	3.07	3.23	3.39	3.55	3.72	3.88	4.04
25	0.68	0.84	1.01	1.18	1.35	1.52	1.69	1.86	2.03	2.20	2.36	2.53	2.70	2.87	3.04	3.21	3.38	3.55	3.72	3.88	4.05	4.22
30	0.70	0.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10	2.28	2.45	2.63	2.80	2.98	3.15	3.33	3.50	3.68	3.85	4.03	4.20	4.38

Table 4
Specified wind load (p) for windows, doors, and positive loads on unit skylights – Rough terrain

(See Clauses 4.2.2 and A.4.2.2 and Figure A.1.)

Height, m	p , kPa																					
	1/50 Hourly wind pressure, kPa																					
	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.25
10	0.39	0.49	0.59	0.69	0.79	0.89	0.98	1.08	1.18	1.28	1.38	1.48	1.58	1.67	1.77	1.87	1.97	2.07	2.17	2.26	2.36	2.46
15	0.42	0.53	0.63	0.74	0.84	0.95	1.05	1.16	1.26	1.37	1.47	1.58	1.68	1.79	1.89	2.00	2.11	2.21	2.32	2.42	2.53	2.63
20	0.46	0.57	0.69	0.80	0.92	1.03	1.15	1.26	1.38	1.49	1.61	1.72	1.84	1.95	2.07	2.18	2.29	2.41	2.52	2.64	2.75	2.87
25	0.49	0.61	0.74	0.86	0.98	1.10	1.23	1.35	1.47	1.59	1.72	1.84	1.96	2.09	2.21	2.33	2.45	2.58	2.70	2.82	2.94	3.07
30	0.52	0.65	0.78	0.91	1.04	1.17	1.30	1.43	1.55	1.68	1.81	1.94	2.07	2.20	2.33	2.46	2.59	2.72	2.85	2.98	3.11	3.24



With A440.4 there are also three things to take into account

1. Moisture Index (MI)
2. Terrain
3. Overhang Ratio



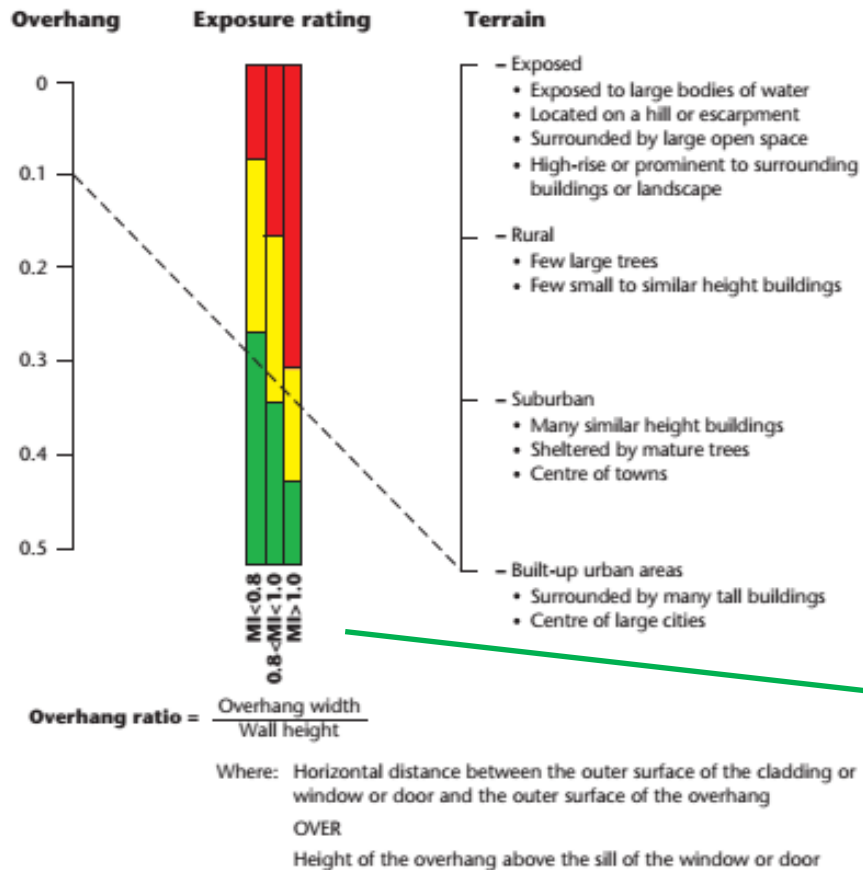


The result will be an

Exposure Rating

The nomograph shown in [Figure A.1](#) establishes a relationship between the most significant micro-exposure conditions (moisture index, overhang ratio, and terrain) to arrive at an exposure rating, which is a relative scale for how often an area will be wetted and how quickly it can dry. As an example, the dotted red line indicates the assessment of exposure conditions for a wall on a one-storey house with 200 mm roof overhangs in a flat, well-protected location. If this building were located in Vancouver (MI >1), it would result in a moderate-exposure rating while the same building in Calgary (MI < 0.85) would have a low-exposure rating.





MI < 0.8
0.8 < MI < 1.0
MI > 1.0

Moisture index (MI): See Table A.1.

Exposure rating

- High exposure
- Moderate exposure
- Low exposure



A.2.3.3

Once the exposure is known and the water management strategy has been selected, it is possible to develop appropriate window installation details. The exposure of the wall should be used to determine the water management strategy for window installation as follows:

- (a) High exposure — Rainscreen installation is recommended.
- (b) Moderate exposure — Rainscreen is recommended; concealed barrier is acceptable.
- (c) Low or no exposure — Rainscreen, concealed barrier, and face-sealed are acceptable.

The installation water management strategy should not be compromised to match the water penetration strategy for the wall.



**Table A.1
Moisture index***

Manitoba

Beausejour	0.61
Boissevain	0.54
Brandon	0.56
Churchill	0.82
Dauphin	0.56

Flin Flon	0.59
Gimli	0.65
Island Lake	0.67
Lac du Bonnet	0.65
Lynn Lake	0.62

Morden	0.55
Neepawa	0.58
Pine Falls	0.66
Portage la Prairie	0.51
Rivers	0.56

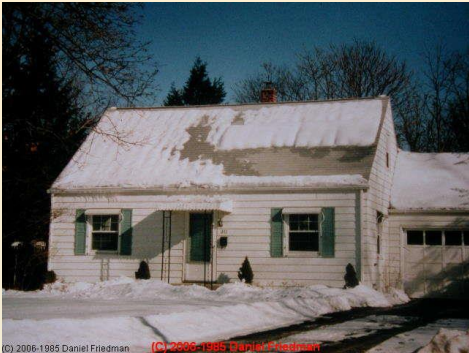
Sandilands	0.58
Selkirk	0.61
Split Lake	0.66
Steinbach	0.58
Swan River	0.58

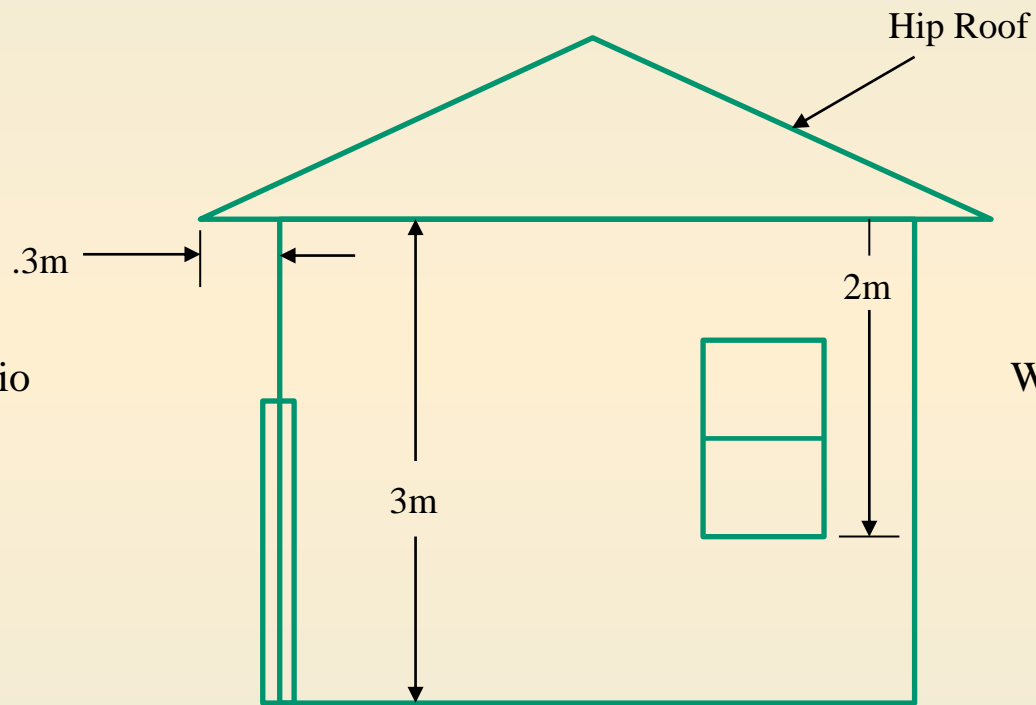
The Pas	0.59
Thompson	0.64
Virden	0.53
Winnipeg	0.58





OVERHANG

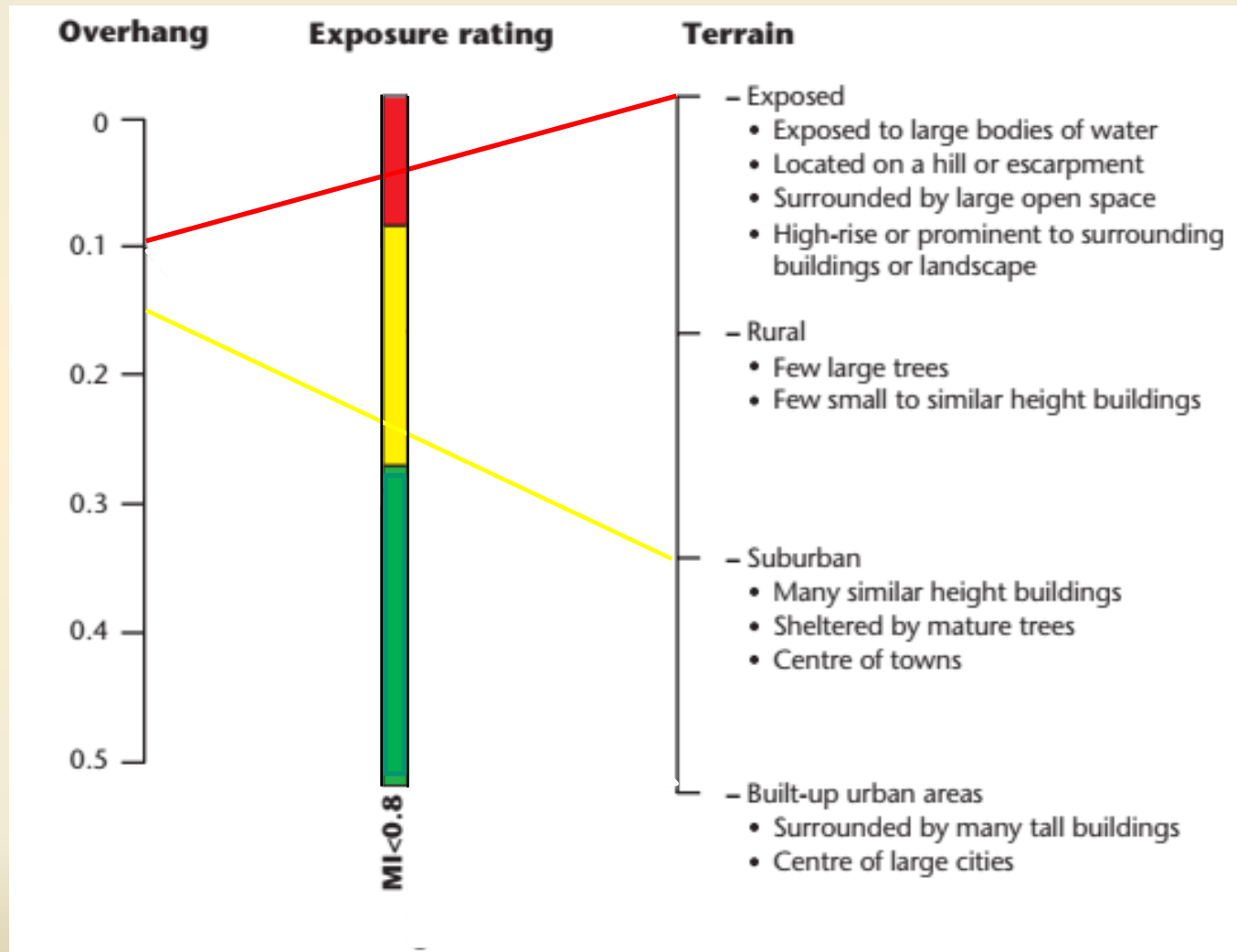


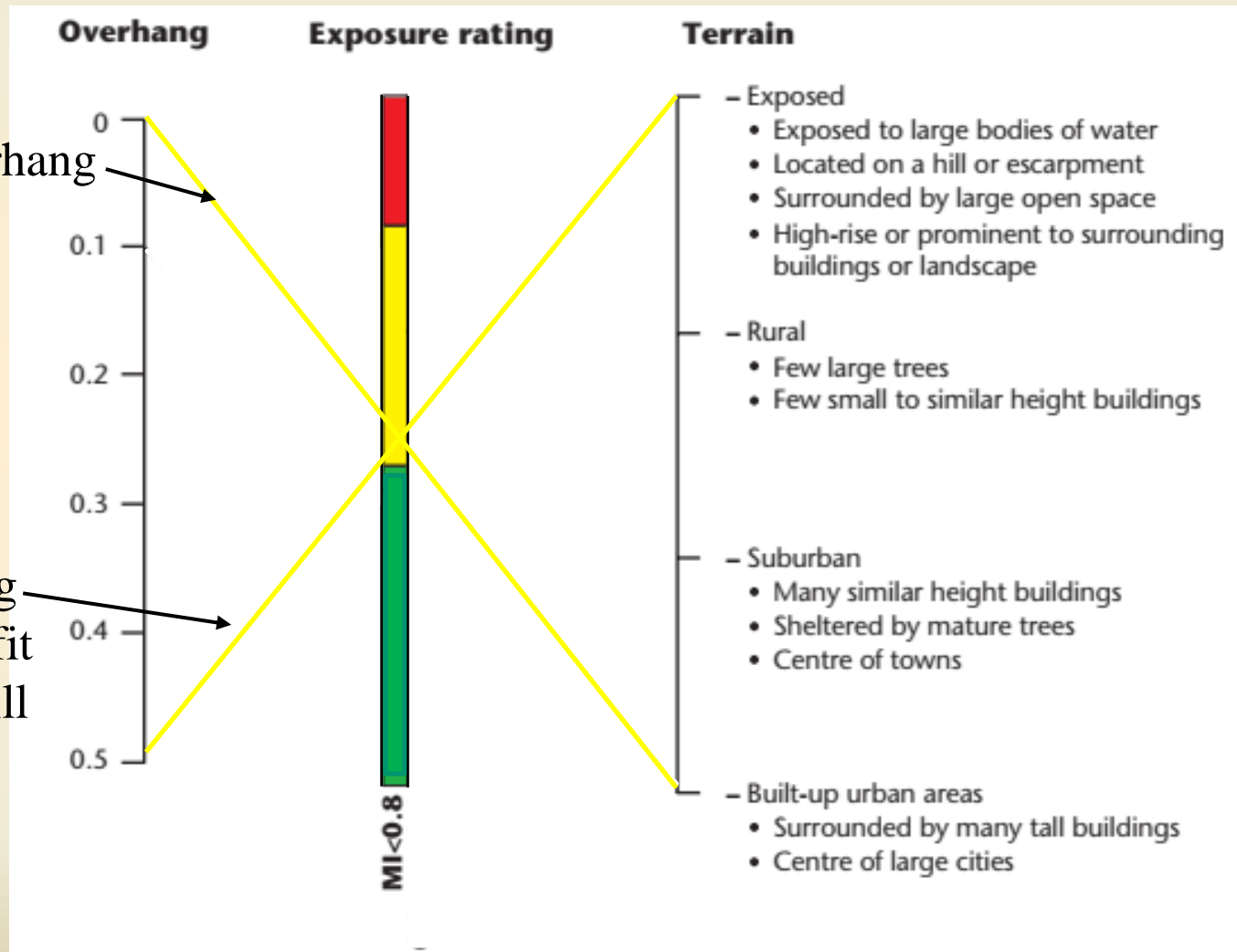


Door overhang ratio
 $.3/3 = .1$

Window overhang ratio
 $.3/2 = .15$







No Overhang

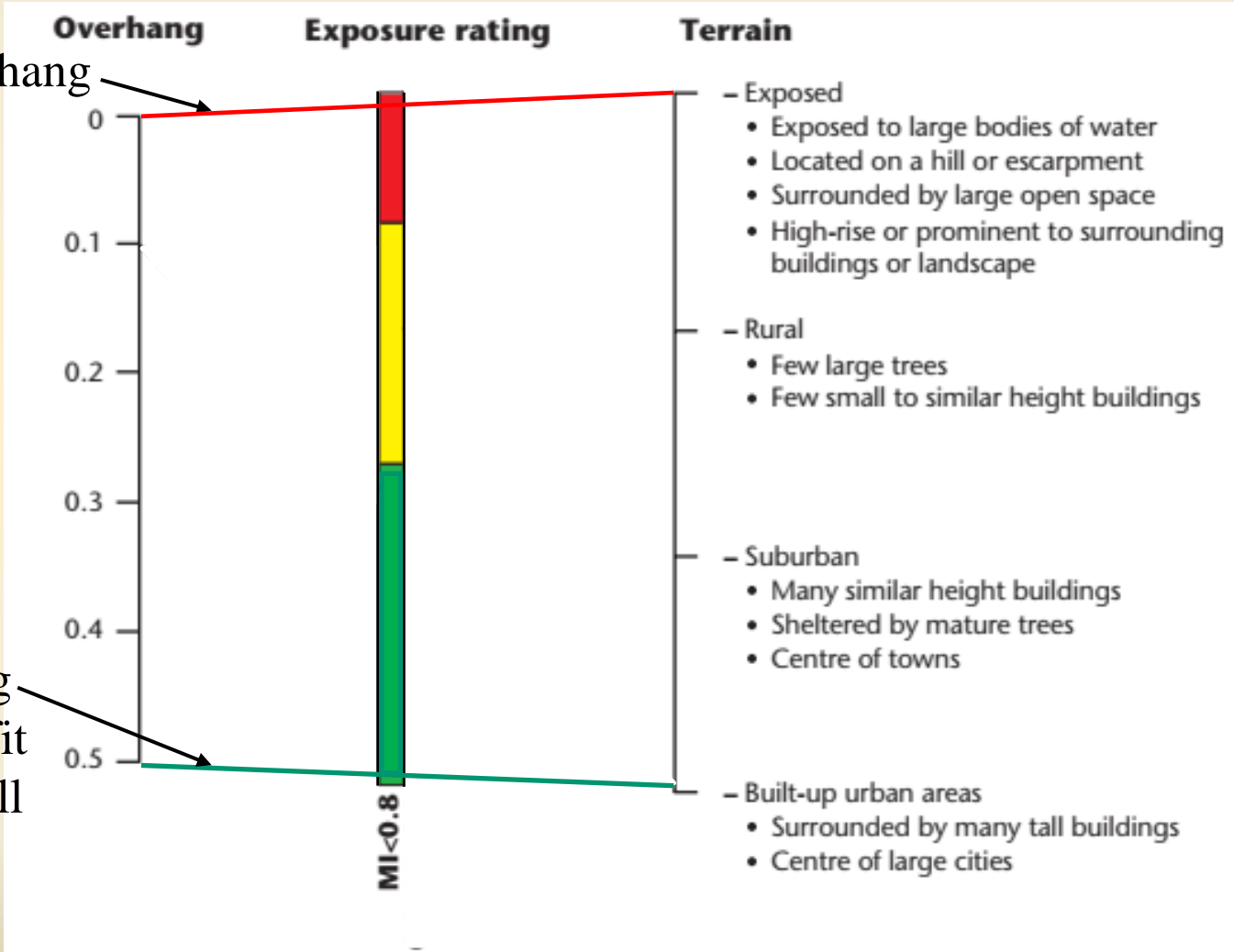
1m Overhang
2m from soffit
to window sill





No Overhang

1m Overhang
2m from soffit
to window sill





Building Envelope Moisture Control Strategies

A.2.3.2

The three moisture control strategies are defined as follows:

- (a) Face-sealed — A system where the water-shedding surface is coincident with the water-resistive barrier and air barrier on the exterior surface. In face-sealed systems there is no ability for water to drain behind the cladding, and therefore the exterior cladding layer must resist 100% of the exterior wetting. Face-sealed EIFS and stucco with a waterproof coating are examples of walls that use this moisture control strategy.

“must resist 100% of the exterior wetting”





Building Envelope Moisture Control Strategies

(b) Concealed barrier — Similar to the rainscreen approach, the water-shedding surface is at a different location than the water-resistive barrier. However, a more significant amount of water contacts and remains in contact with the water-resistive barrier because of discontinuities in the water-shedding surface, air barrier, the lack of a clear air space or drainage plane between the water-shedding surface and the water-resistive barrier, poor pressure equalization characteristics, or a combination of these variables. The risk of water penetration for a concealed barrier system usually falls somewhere between a face-sealed and a rainscreen system. The effective performance of a concealed barrier system is therefore dependent on the management of the variables described above (continuity of water-shedding surface, location and continuity of air barrier, and drainage capability between the water-shedding surface and the water-resistive barrier). Conventional stucco and some drained EIFS systems are examples of concealed barrier wall systems.



Building Envelope Moisture Control Strategies

- (c) Rainscreen — An assembly where the water-shedding surface is not coincident with the water-resistive barrier and air barrier. The water-resistive barrier is located to the interior of the water-shedding surface, and there is a continuous vented air space between the water-shedding surface and the water-resistive barrier that creates a capillary break. The flow of exterior moisture (rain) through the water-shedding surface is effectively minimized, and the vented airspace facilitates drainage of the minimal water that may get past the water-shedding surface. Brick masonry veneer walls are an example of a conventional rainscreen wall assembly. A variant of the conventional rainscreen assembly is the exterior insulated rainscreen assembly. In this system the building insulation is placed on the exterior of the water-resistive barrier, which allows a fully waterproof air and vapour barrier to be used. This type of system is often used in high-exposure locations such as direct water or oceanfront, where increased humidity control or air tightness is required, and on mid- to high-rise buildings.



Window Installation Water Management Strategies

A.2.3.3

Once the exposure is known and the water management strategy has been selected, it is possible to develop appropriate window installation details. The exposure of the wall should be used to determine the water management strategy for window installation as follows:

- (a) High exposure — Rainscreen installation is recommended.
- (b) Moderate exposure — Rainscreen is recommended; concealed barrier is acceptable.
- (c) Low or no exposure — Rainscreen, concealed barrier, and face-sealed are acceptable.

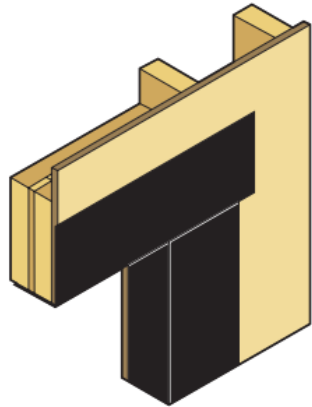
The installation water management strategy should not be compromised to match the water penetration strategy for the wall.



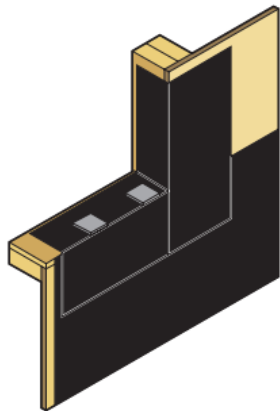


L
O
W

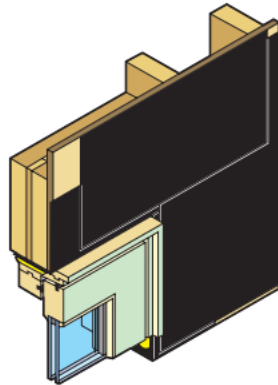
E
X
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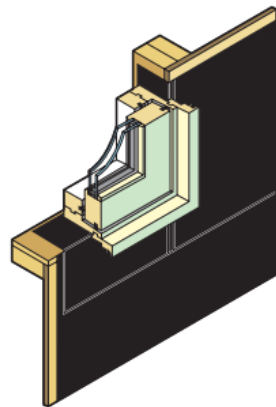
(a) Prepare window opening



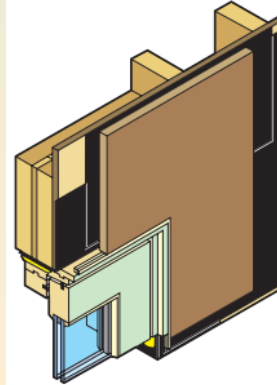
(a) Prepare window opening



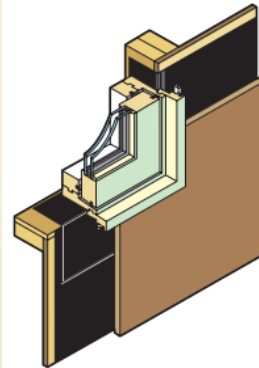
(b) Install window and complete water-resistant barrier



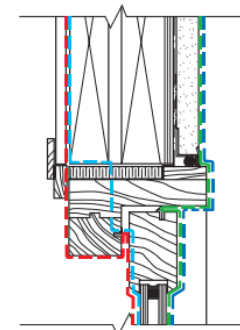
(b) Install window and complete water-resistant barrier



(c) Install cladding and exterior sealant to complete water-shedding surface

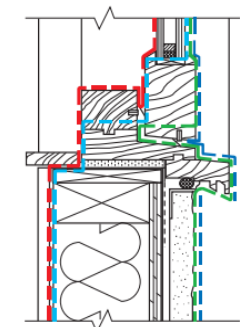


(c) Install cladding and exterior sealant to complete water-shedding surface



- - - Vapour barrier
- - - Air barrier
- - - Water-resistant barrier
- - - Water-shedding barrier

(f) Check continuity of critical barriers



- - - Vapour barrier
- - - Air barrier
- - - Water-resistant barrier
- - - Water-shedding barrier

(f) Check continuity of critical barriers

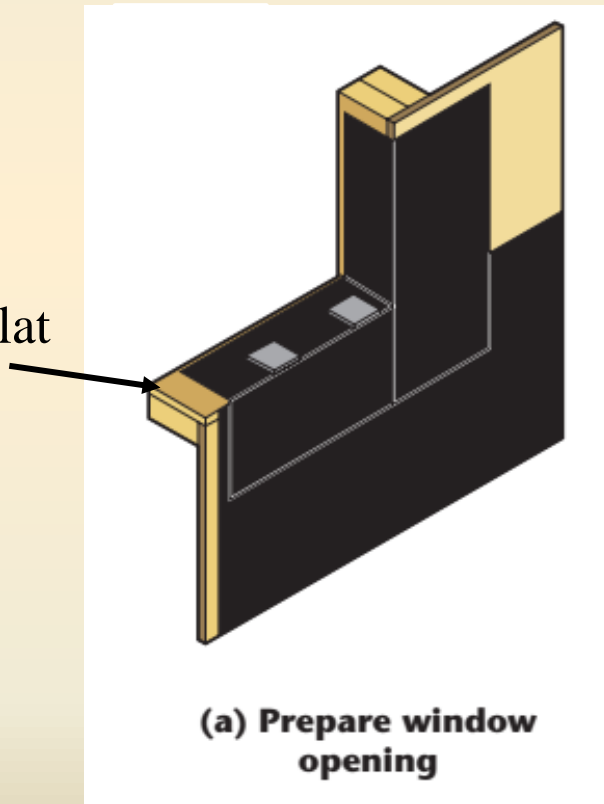
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S
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e
d

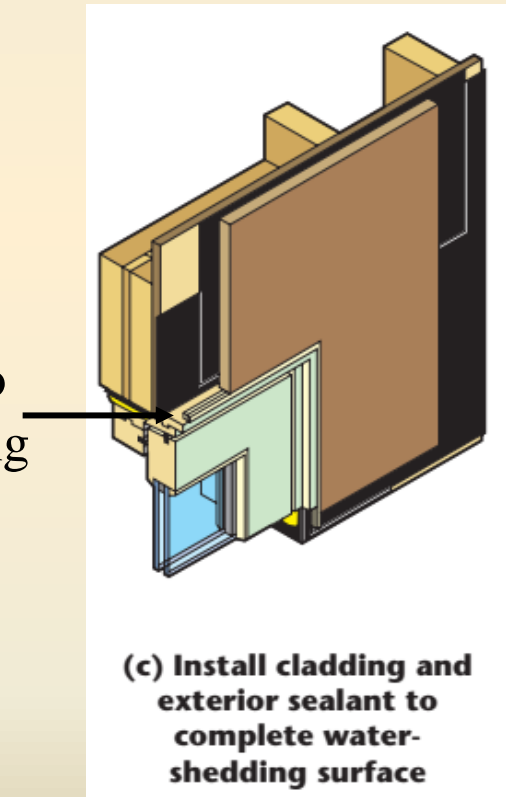


A couple of notes on this low exposure face sealed method:

The sill is flat

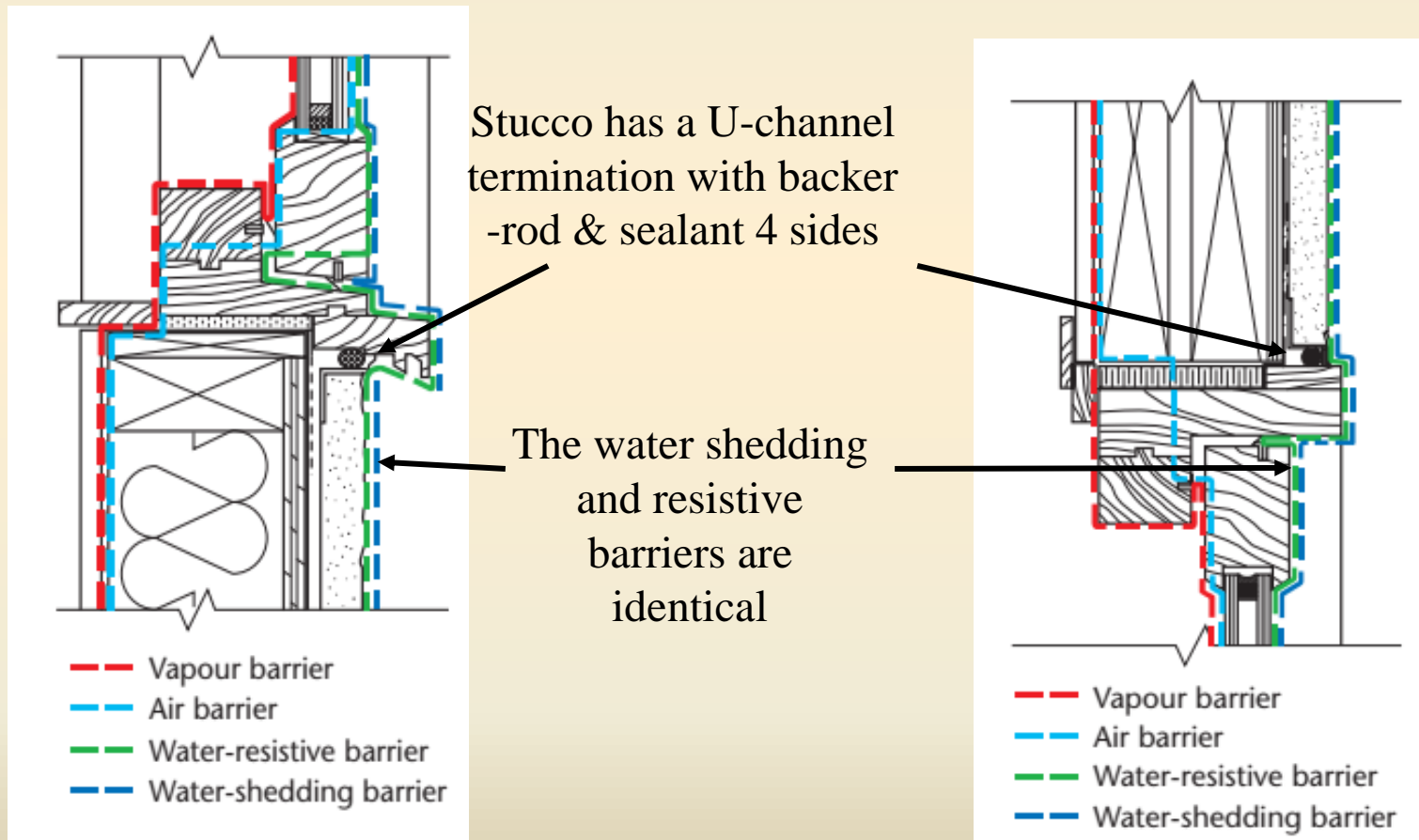


There is no head flashing



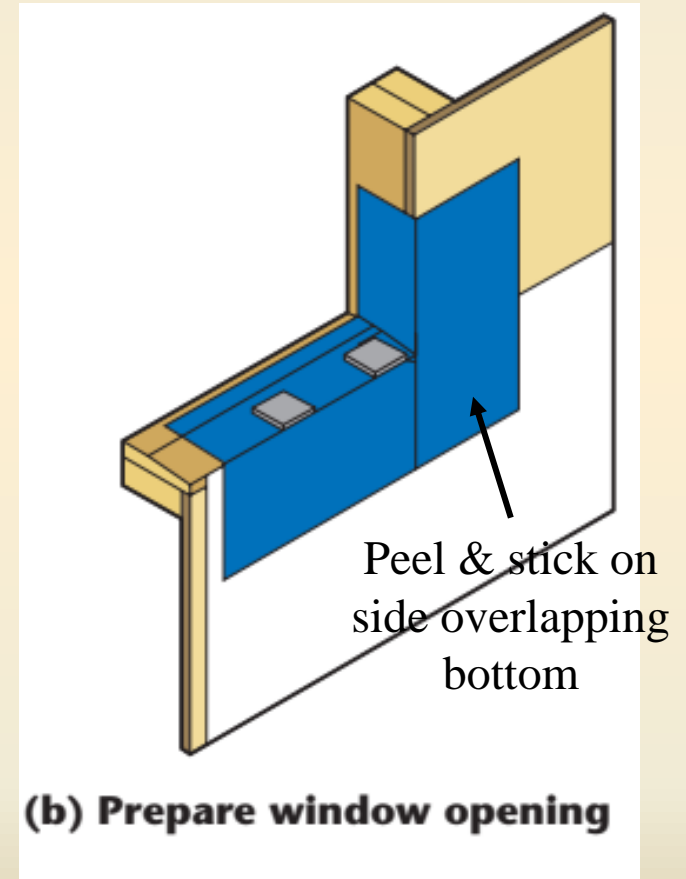
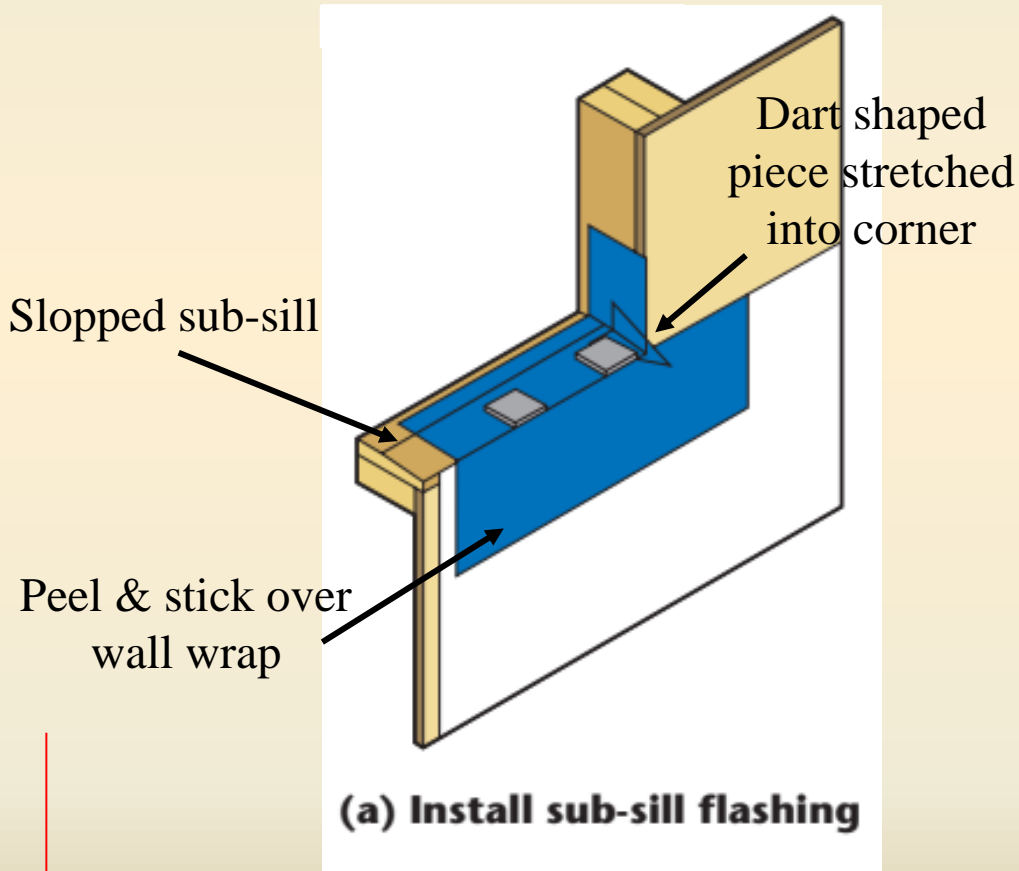


A couple of notes on this low exposure face sealed method:



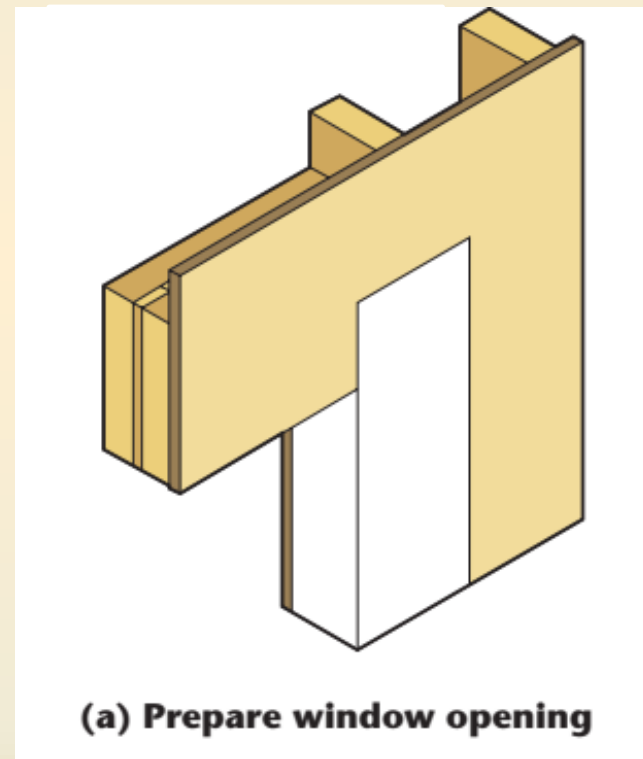
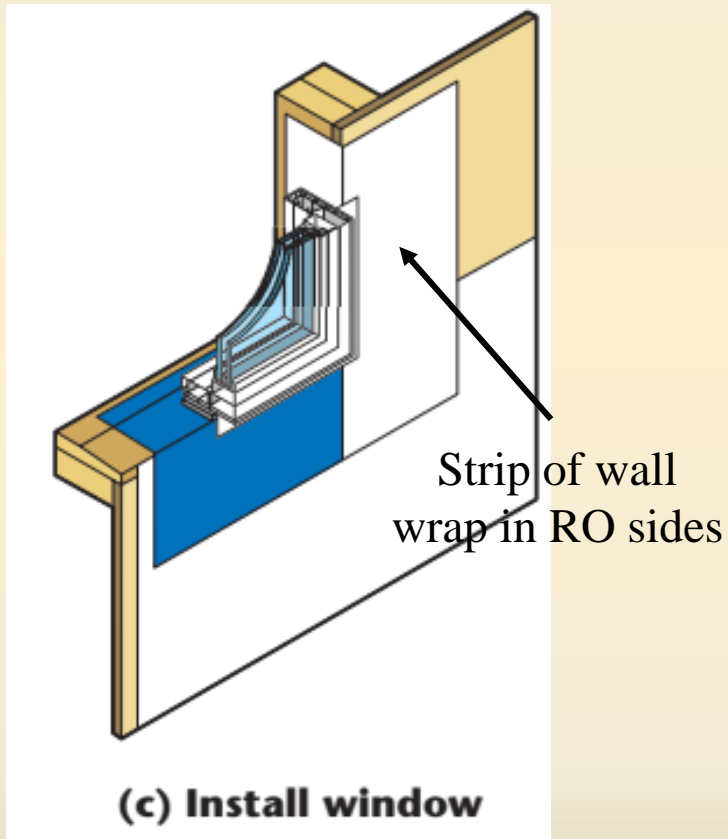


Moderate Exposure



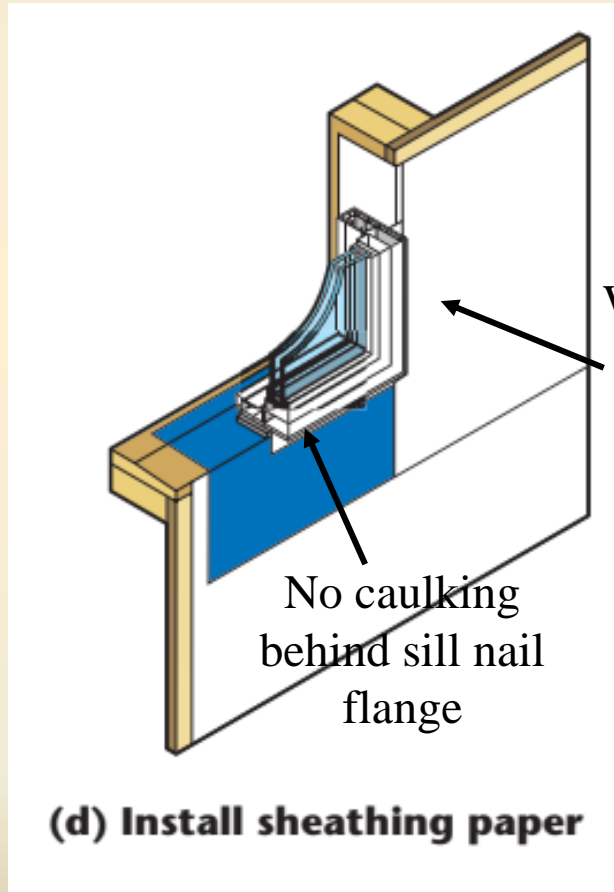


Moderate Exposure

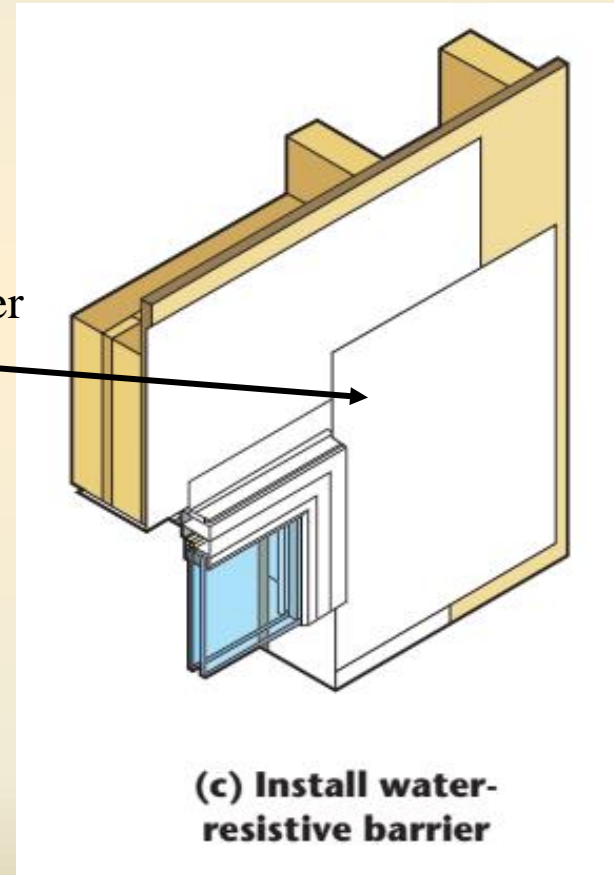




Moderate Exposure



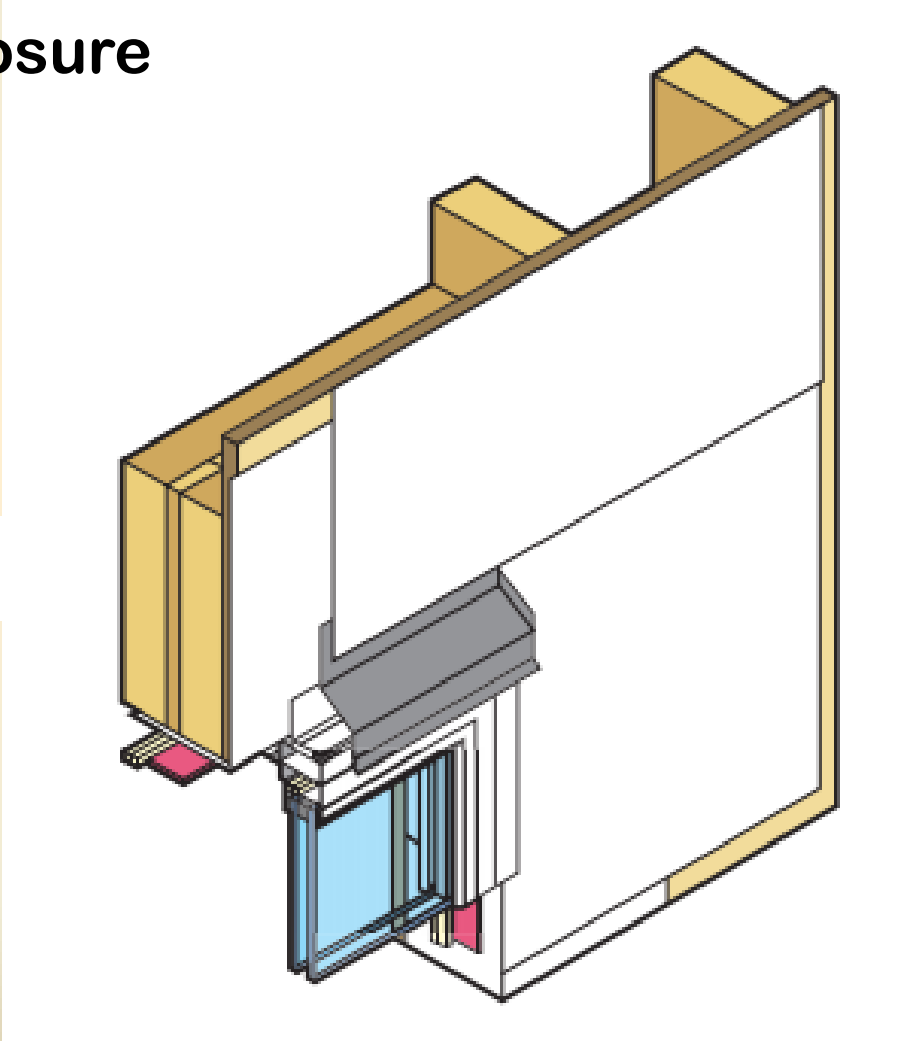
Wall wrap over
nail flange





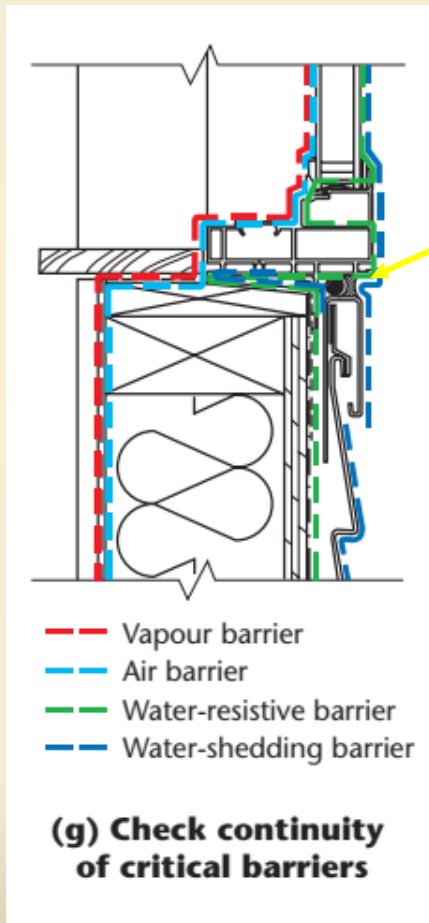
Moderate Exposure

(d) Install flashing

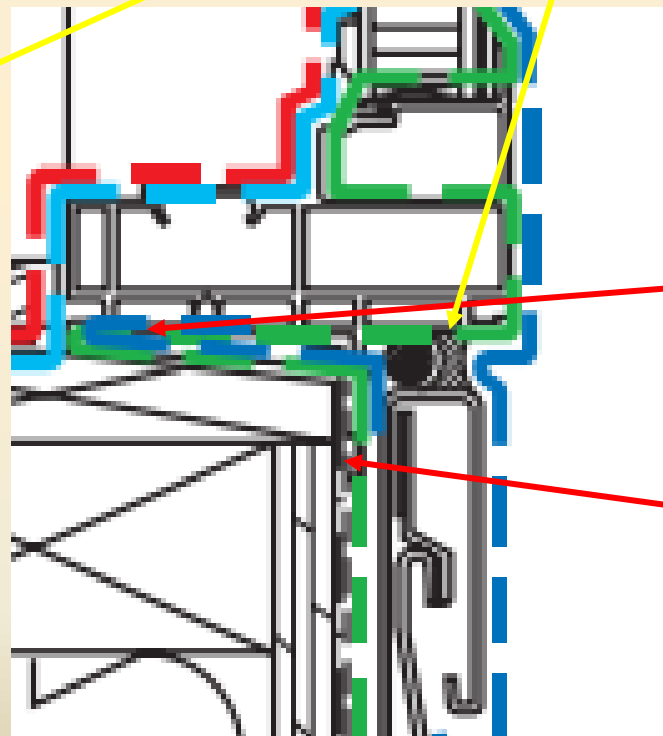




A couple of notes on the moderate exposure method:



Backer rod & sealant
between siding under-sill
trim and window sill

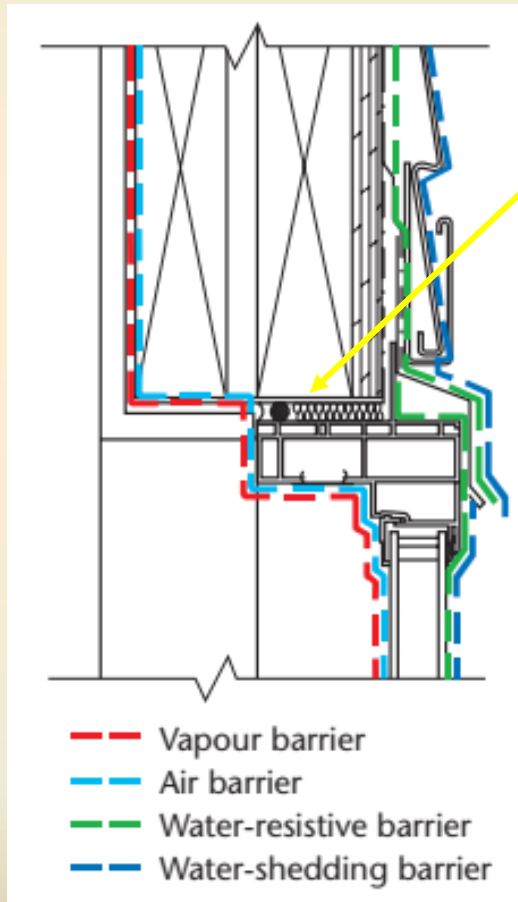


Water resistive and
shedding barriers extends
to the inside of the
window sill

You can see that there
would be no water egress
path if the nail flange were
caulked here

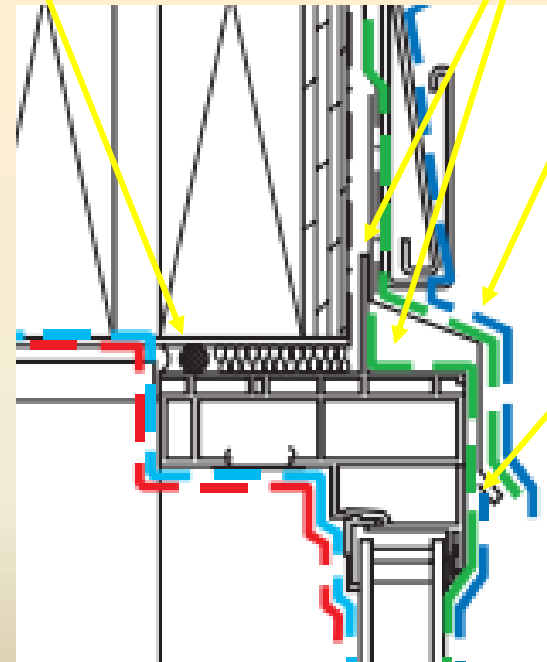


A couple of notes on the moderate exposure method:



Interior air/vapour barrier backer rod & sealant (3 sides)

Water-shedding and dual water-resistive barriers

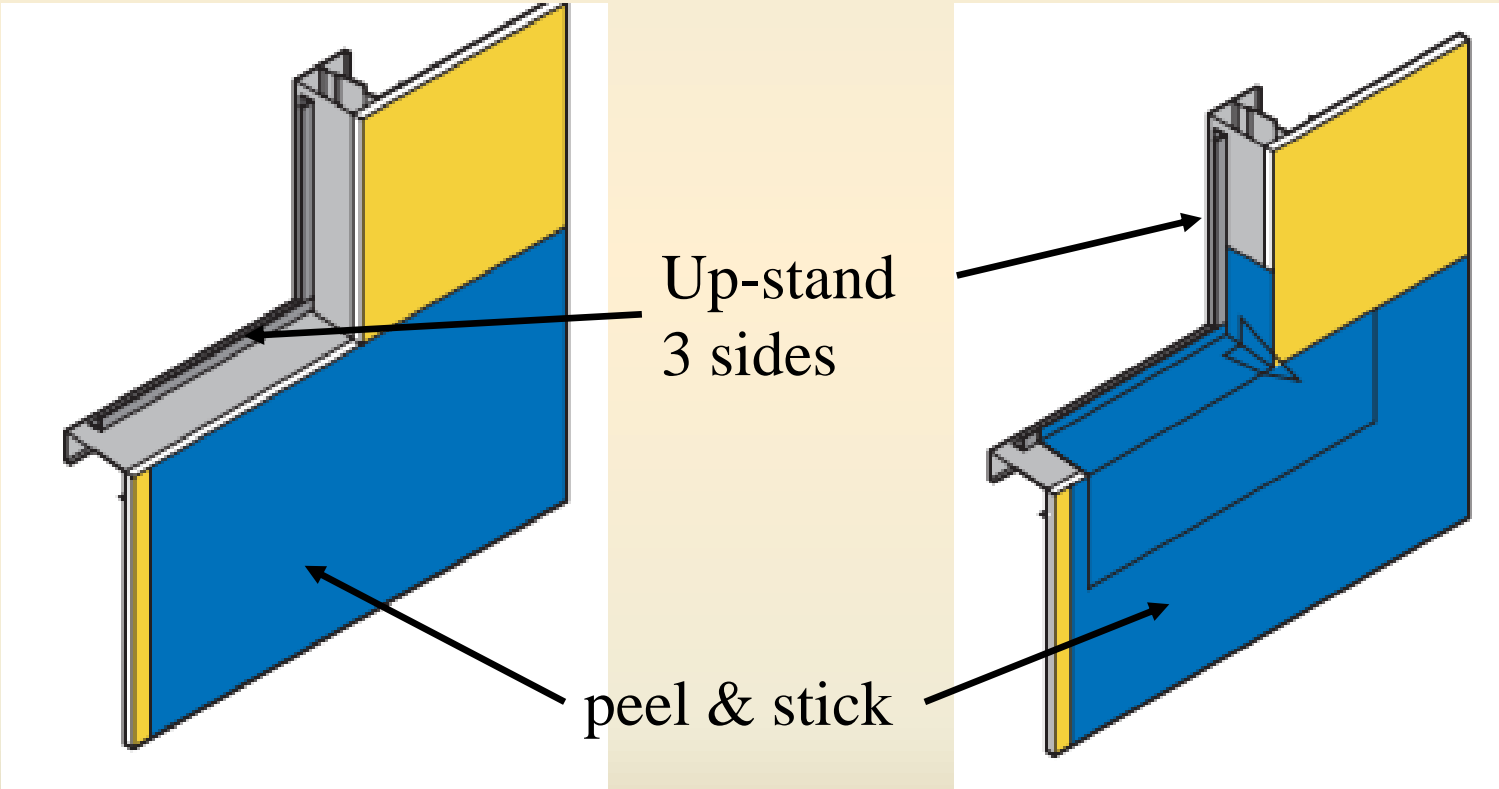


Flashing



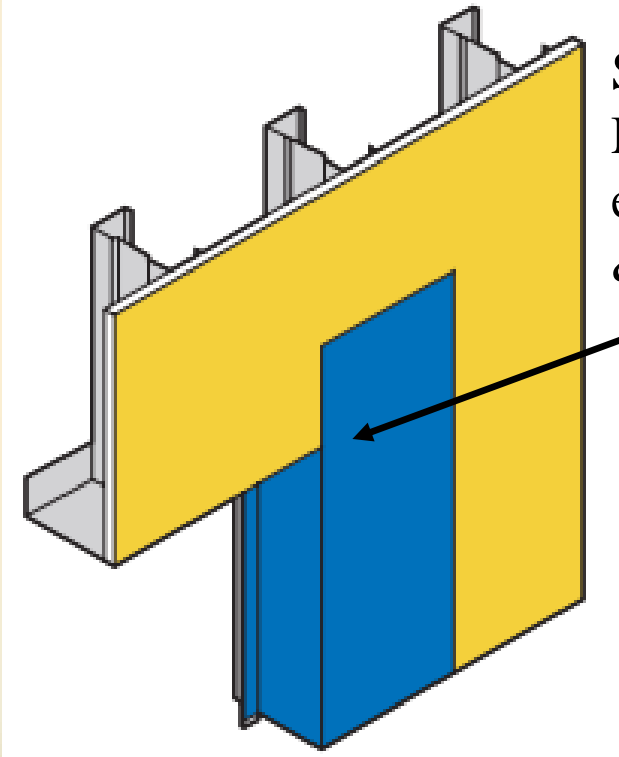


High Exposure

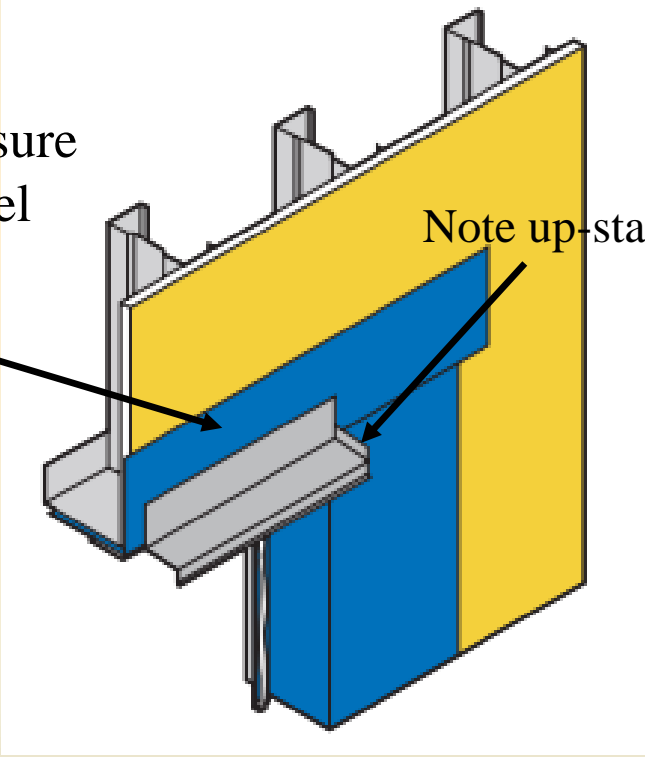




High Exposure



Similar to
Medium Exposure
except with peel
& stick



Note up-stand

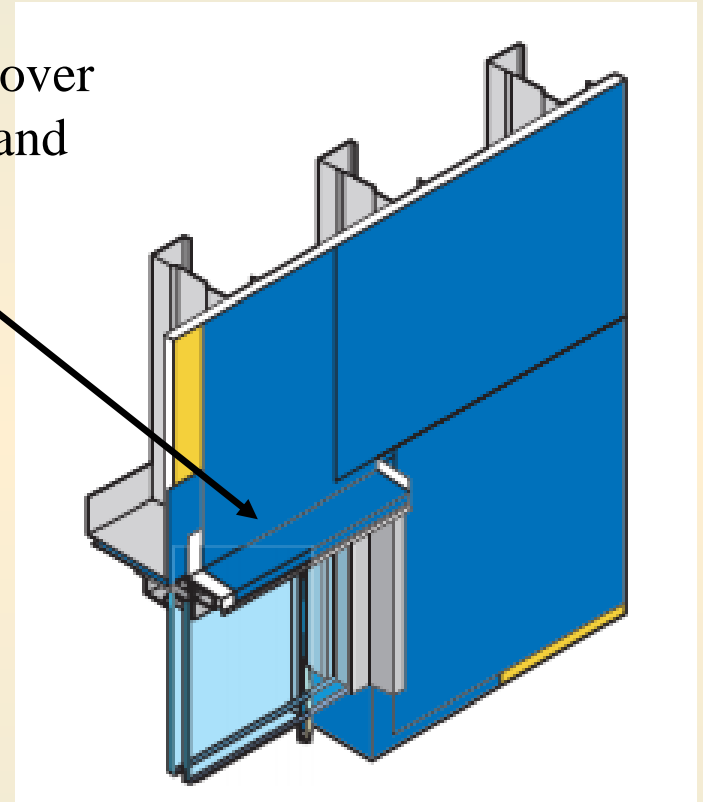
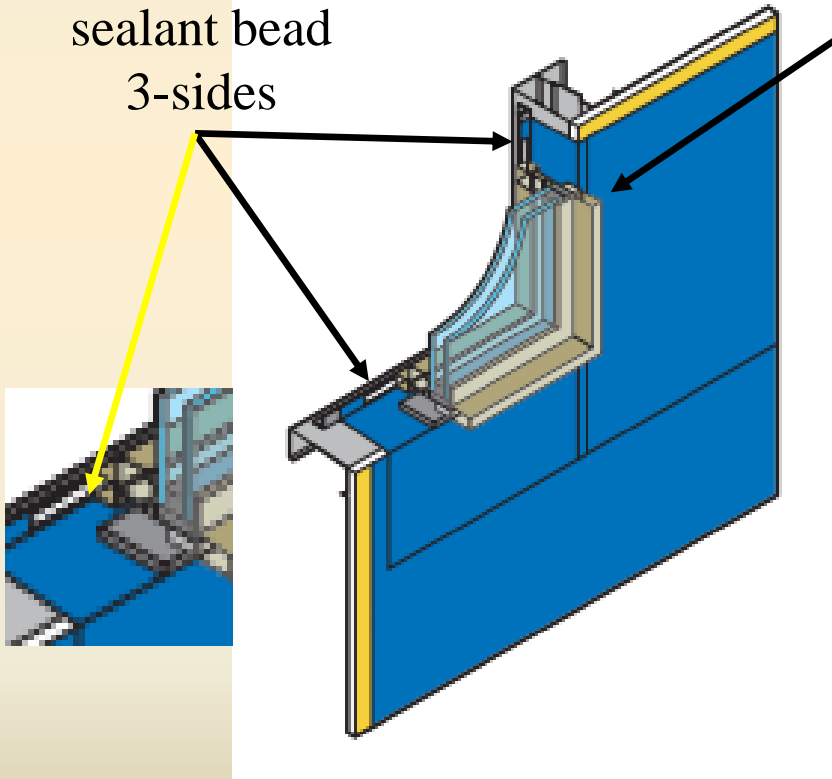




High Exposure

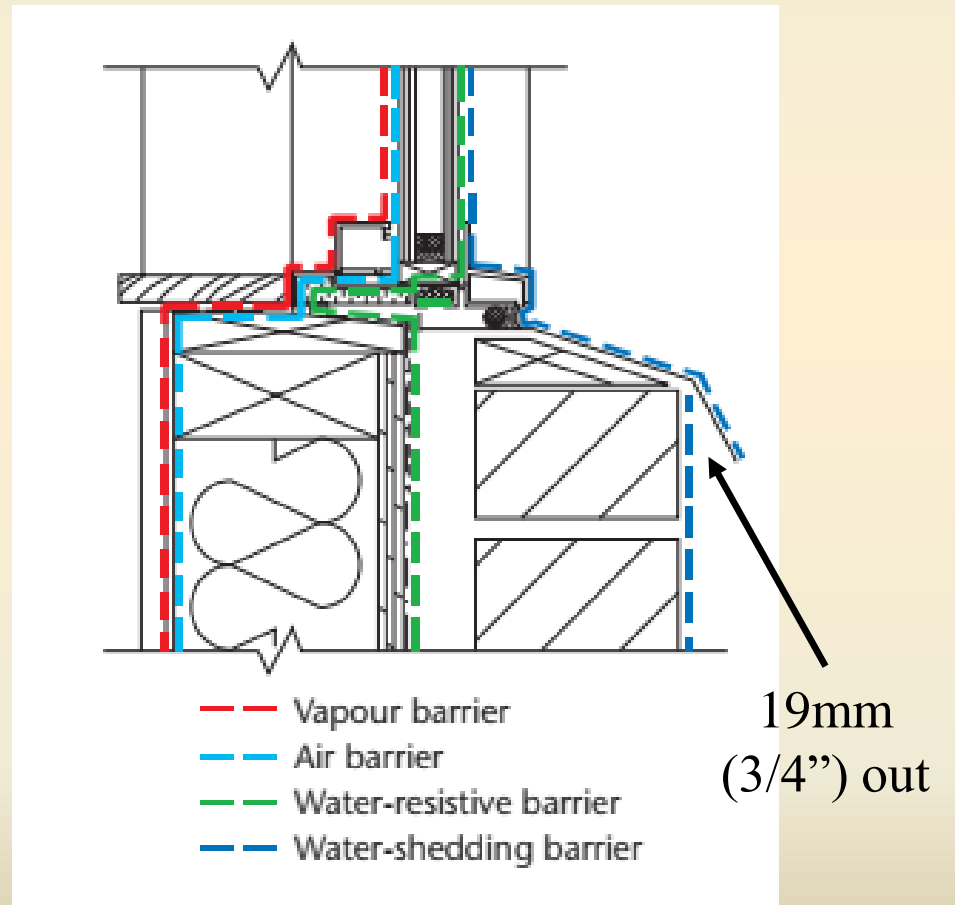
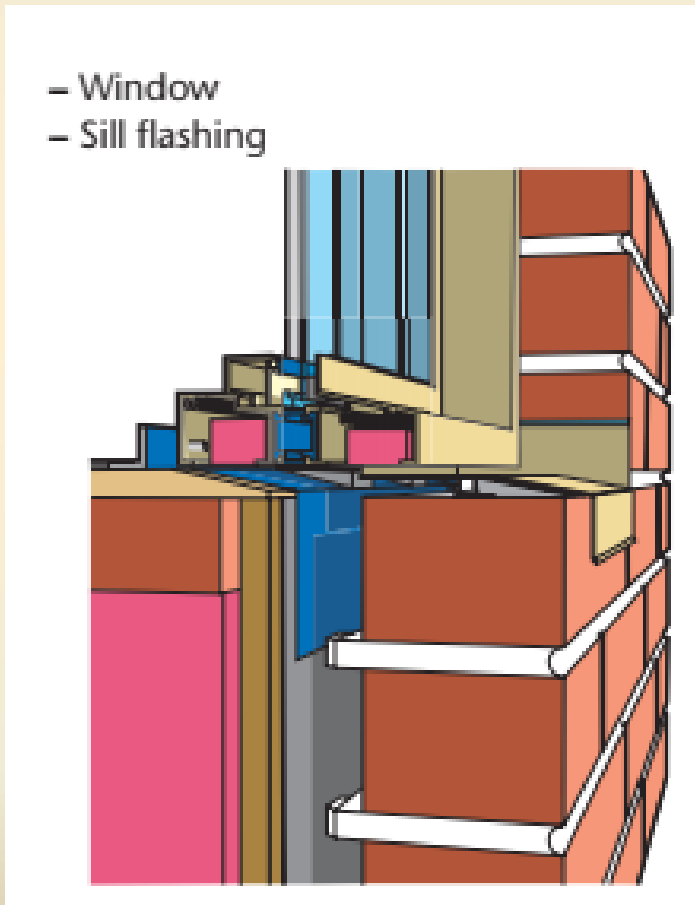
Window embedded into
sealant bead
3-sides

Peel & stick over
nail flange and
flashing





High Exposure sill, rain screen or brick





In Review

- The NBC references CSA A440.4 as a window, door & skylight installation procedure
- It also references the manufacturers installation methods as mandatory
- The most stringent methods of each of these procedures applies
- The applicable installation method can be determined by using the “nomograph”
- This is a health (mold) and safety (rot & decay) issue

