Section 9.36.
Permit
Application
Information
Required on
Submitted Drawings

the inspectionsgroup inc.

County of Two Hills No. 21
Zone: 7A

Section 9.36 Building Permit Application Guideline

Section 9.36 of the Alberta Building Code came into force Nov 1, 2016. The change introduced efficiency requirements for appliances in buildings, as well as changing how insulation values are measured. Insulation used to be measured based on the performance of only the nominal value of one component…the actual insulation. Now a wall/floor/roof/foundation are measured for their effective insulating value based on all materials in the assembly.

When applying for a building permit the submitted plans need to indicate, on **the cover page of the submitted drawings**, which method of compliance with Section 9.36 the applicant has chosen. Details on the Three options are contained below.

Prescriptive Method

On your submitted drawings you need to clearly identify how each of the wall/floor/roof/foundation assemblies are going to be built and provide a summary calculation that shows what each of the wall/floor/roof/foundation assemblies has for an RSI value. This can be noted for each assembly on the section drawings through the building, listed as a specification on the drawings, or provided on separate documents attached to your permit application.

Required effective insulation values are available on information sheets for each climactic zone.

If you don't have your window and door installation schedules at the time of permit application, this will be a condition of your permit that will need to be provided once they become available. You can indicate on your submitted plans what the intended energy value for each door and window energy value will be not more than [see the information sheets for code required values].

Trade-Off Method

Trade-Off applications are an advanced method of prescriptive compliance where some element(s) are allowed to be reduced in efficiency when traded with other higher efficiency components. The end result must be equal or greater in efficiency. There are also limitations on this approach in the Alberta Building Code Division B Article. 9.36.2.11. which must be strictly followed.
Trade-Off applications need to provide a clear set of calculations that show the proposed building conforming to the prescriptive requirements and a clear comparison with the component(s) that are being traded or altered due to traded components. If the calculations are unclear, you will be requested to clarify the submitted information.

Performance Method

This approach requires the services of a design professional to evaluate your proposed project via a computer energy model. This approach requires 100% conformance to the professional's design. Deviations will require re-submission of the design with changes made to reflect what has been changed on site.
The complete energy model package is required to be submitted with the drawings for the permit application when this method is selected. The documentation package must clearly identify the designer.

***All information normally required on a permit application is still required to evaluate the proposed project for conformance with applicable codes and regulations. This document is only to assist with Section 9.36. information portion of those requirements.

ABC 2016 9.36.

ZONE

7A 9.36 Prescriptive Requirements General Information Summary

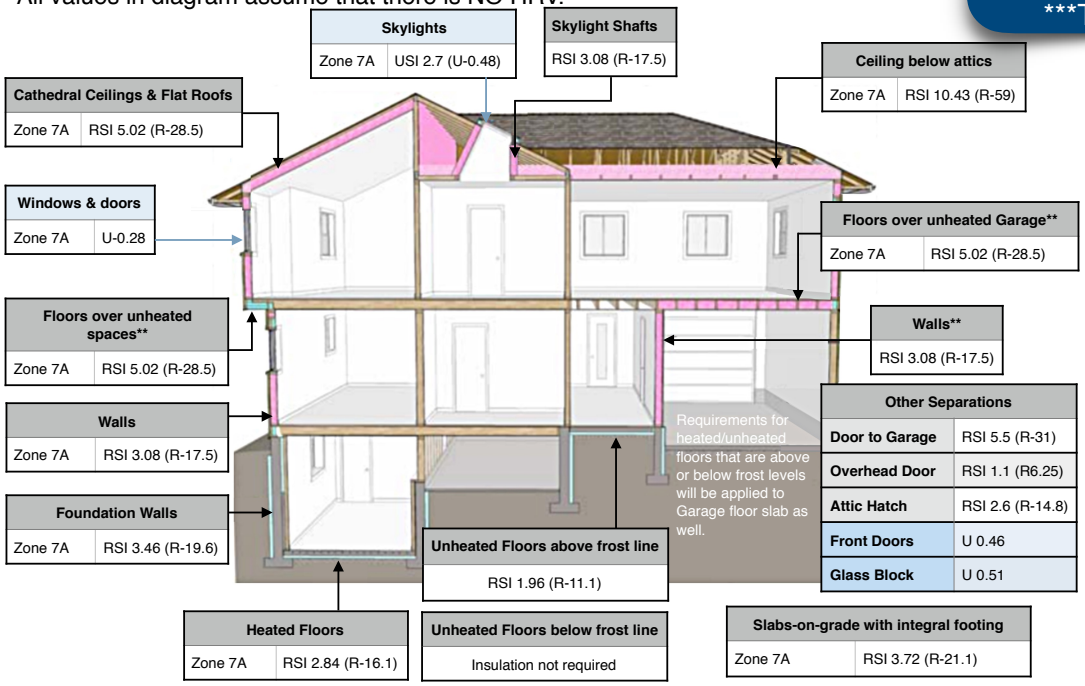
Assembly	Effect. Insul. Value (without HRV)	Effect. Insul. Value (with HRV)
	Air intake/outlets shall have dampers or an HRV.	
Wall (incl. att. garage walls)	R-17.5 (RSI 3.08)	R 16.8 (RSI 2.97)
Attic Ceiling	R-59 (RSI 10.43)	R 49.2 (RSI 8.67)
Cathedral Ceiling	R-28.5 (RSI 5.02)	R 28.5 (RSI 5.02)
Floor over Unheated Space	R-28.5 (RSI 5.02)	R 28.5 (RSI 5.02)
Floor over Unheated Garage	R 28.5 (RSI 5.02)	R-28.5 (RSI 5.02)
Slab on Grade	R 21.1 (RSI 3.72)	R 16.1 (RSI 2.84)
Foundation Walls	R 19.6 (RSI 3.46)	R 16.93 (RSI 2.98)

HVAC	Efficiency Values
Gas Fired furnace	Min AFUE 92%
Gas Fired Water Heater	EF>0.67

Windows, Doors & Skylights *U values are MAXIMUMS*	Transmittance / Insul. Values	Min. Energy Rating
Windows & Doors	USI 1.6 (U 0.28)	25
Front Door	USI 2.6 (U 0.46)	25
Garage Mandoor	R 6.25 (RSI 1.1)	25
Skylights	USI 2.7 (U 0.48)	25

***Triple Glazed are required.

All values in diagram assume that there is NO HRV.



**Requirements specific to effective insulation requirements for separation of conditioned from unconditioned space(s).

This document is designed to provide you with clarity on information required to be identified on the submitted plans for a building permit.

The required values are shown to clearly indicate what our plan reviewers will be looking/asking for on applications submitted as of Nov 1, 2016.

Your doors, windows/skylights need to meet the required U values shown. Your door/window supplier can provide you with the required information on the door/ window schedules they provide. If this information is not provided at the time of application, it will be a condition of the permit.

Wall assembly calculator: http://cwc.ca/resources/wall-thermal-design/

Link will allow you to input what you are building and calculate if what you are planning will meet the noted requirements.

Additional Items of Note

- Attic insulation needs to reach required depth within 1.2m/4' of the outside wall.
- Hot water line off the hot water tank needs to be insulated for the first 2m off the tank.
- If you choose automated dampers to control air inlet/exhaust, instead of an HRV, then these automatically controlled dampers must fail open.
- If you have ductwork, electrical panels, plumbing lines in an exterior wall you must have the full effective insulation achieved behind these elements as for the entire wall assembly.

ABC 2016 9.36.

ZONE

7B

9.36 Prescriptive Requirements General Information Summary

Air intake/outlets shall have dampers or an HRV.

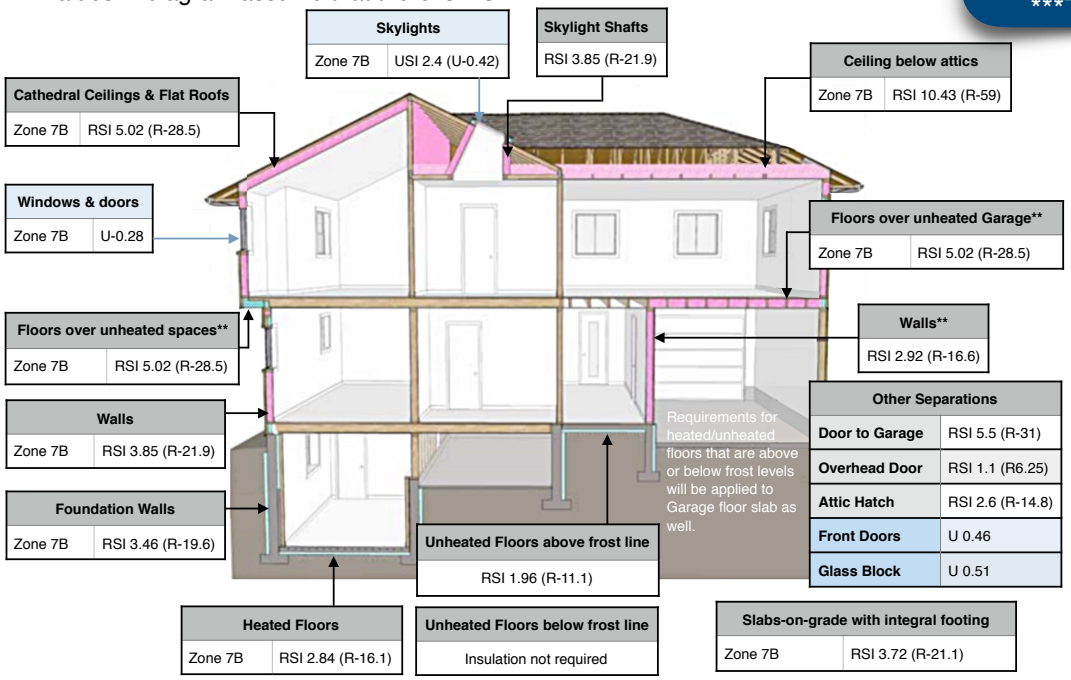
Assembly	Effect. Insul. Value (without HRV)	Effect. Insul. Value (with HRV)
Wall (incl. att. garage walls)	R-21.9 (RSI 3.85)	R 17.5 (RSI 3.08)
Attic Ceiling	R-59 (RSI 10.43)	R-59 (RSI 10.43)
Cathedral Ceiling	R-28.5 (RSI 5.02)	R 28.5 (RSI 5.02)
Floor over Unheated Space	R-28.5 (RSI 5.02)	R 28.5 (RSI 5.02)
Floor over Unheated Garage	R 28.5 (RSI 5.02)	R-28.5 (RSI 5.02)
Slab on Grade	R 21.1 (RSI 3.72)	R 16.1 (RSI 2.84)
Foundation Walls	R 19.6 (RSI 3.46)	R 16.93 (RSI 2.98)

HVAC	Efficiency Values
Gas Fired furnace	Min AFUE 92%
Gas Fired Water Heater	EF>0.67

Windows, Doors & Skylights *U values are MAXIMUMS*	Transmittance / Insul. Values	Min. Energy Rating
Windows & Doors	USI 1.6 (U 0.28)	29
Front Door	USI 2.6 (U 0.46)	29
Garage Mandoor	R 6.25 (RSI 1.1)	29
Skylights	USI 2.7 (U 0.48)	29

***Triple Glazed are required.

All values in diagram assume that there is NO HRV.



**Requirements specific to effective insulation requirements for separation of conditioned from unconditioned space(s).

Wall assembly calculator: http://cwc.ca/resources/wall-thermal-design/

Link will allow you to input what you are building and calculate if what you are planning will meet the noted requirements.

This document is designed to provide you with clarity on information required to be identified on the submitted plans for a building permit.

The required values are shown to clearly indicate what our plan reviewers will be looking/asking for on applications submitted after Nov 1, 2016

Your doors, windows/skylights need to meet the required U values shown. Your door/window supplier can provide you with the required information on the door/window schedules they provide. If this information is not provided at the time of application, it will be a condition of the permit.

Additional Items of Note

- Attic insulation needs to reach required depth within 1.2m/4' of the outside wall.
- Hot water line off the hot water tank needs to be insulated for the first 2m off the tank.
- If you choose automated dampers to control air inlet/exhaust, instead of an HRV, then these automatically controlled dampers must fail open.
- If you have ductwork, electrical panels, plumbing lines in an exterior wall you must have the full effective insulation achieved behind these elements as for the entire wall assembly.

ABC 2016 9.36.

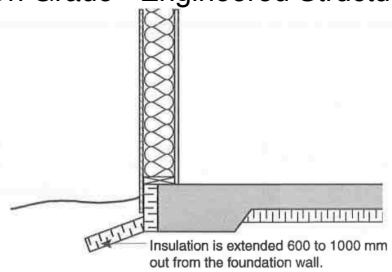
ZONE

7A/B

9.36 Prescriptive Requirements Foundation Information

Assembly	Effect. Insul. Value (without HRV)	Effect. Insul. Value (with HRV)
Unheated Floor BELOW frost	Uninsulated	Uninsulated
Unheated Floor ABOVE frost	R 11.13 (RSI 1.96)	R 11.13 (RSI 1.96)
Slab on Grade	R 21.1 (RSI 3.72)	R 16.1 (RSI 2.84)
Foundation Walls	R 19.6 (RSI 3.46)	R 16.93 (RSI 2.98)

Slab On Grade - Engineered Structural Slab



Length of extension as per eng. design.
***N/A to detached garage/accessory buildings not required to be heated.

Please note that these the assemblies listed here are NOT the only code compliant options but are provided to assist you the applicant with meeting the requirements of the Alberta Building Code energy requirements. This document is not intended to address all elements of the energy code, but intended to provide information on requirements that are difficult to change if constructed incorrectly.

Samples of Compliant Foundation Assemblies

Foundation Example 1: RSI = 3.49

Component	R.eff
8" Concrete	0.08
Air Cavity - 1" / 25mm	0.18
2x6 Framing w/R20 batt @ 24" o/c	14.36
Rigid Foam - 1" / 25mm	4.99
Gypsum Board - 12.7mm	0.08
Air Film	0.12
Effective R value for assembly	**19.81**

Foundation Example 2: RSI =3.46

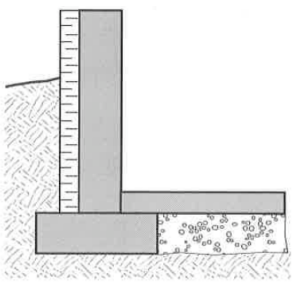
Component	R.eff
8" Concrete	0.08
Air Cavity - 1" / 25mm	0.18
2x4 Framing w/R14 batt @ 16" o/c	9.20
Rigid Foam - 2" / 50mm	9.98
Gypsum Board - 12.7mm	0.08
Air Film	0.12
Effective R value for assembly	**19.64**

Foundation Example - ICF

Description	Continuous Material rating	Entire Assembly
6"/150mm ICF Form	3.52 (R-20)	RSI 3.58 [R.eff-20.33]
	3.73 (R-21.1)	RSI 3.79 [R.eff-21.52]

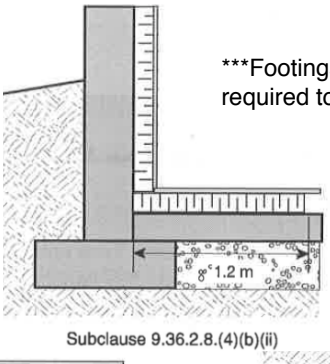
Floors ABOVE Frost Level

Clarification on insulation of unheated floors and insulation location requirements. (Div. B Art. 9.36.2.8. Alberta Building Code)

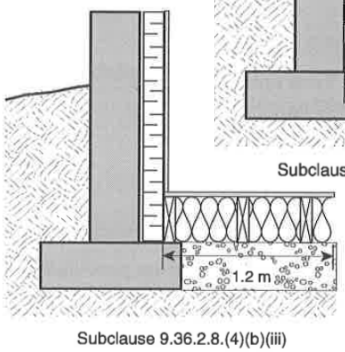


Clause 9.36.2.8.(4)(a)

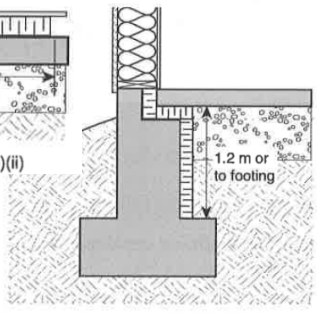
OR



Subclause 9.36.2.8.(4)(b)(ii)



Subclause 9.36.2.8.(4)(b)(iii)



Subclause 9.36.2.8.(4)(b)(i)

***Footings exposed to Frost are required to be designed by an engineer.

9.36 Air Barrier System Information

the inspectionsgroup inc.

For additional questions please contact us at info@inspectionsgroup.com

What is an Air Barrier System?

The Building Code defines it as the assembly installed to provide a continuous barrier to the movement of air.

Essentially the air barrier is used to control air flow in/out of your building through the outside walls/foundation/roof; creating a sealed envelope around your building. When this is done effectively it substantially improves the ability to control moisture and energy within your building.

Current construction practices use a single component, the poly on the inside of the wall to act as both a vapour barrier and as the air barrier. This approach uses one material to serve two functions.

So what is new about this?

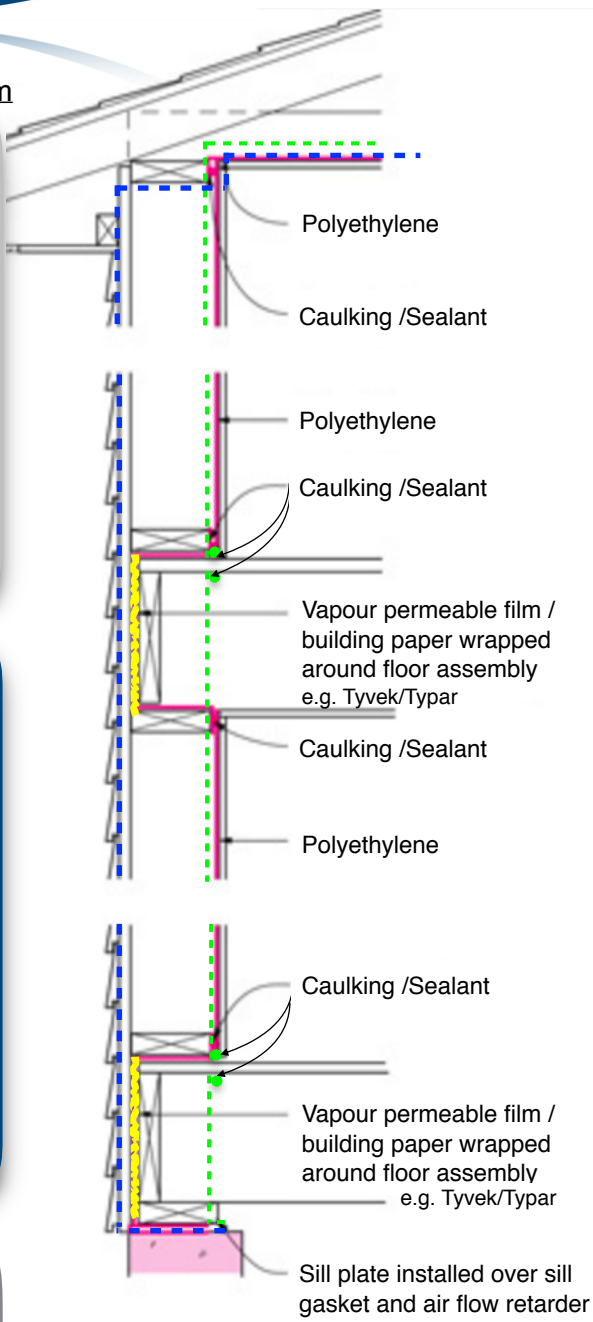
Section 9.36 of the 2014 Alberta Building Code brought additional requirements that increase minimum levels of building performance.

The biggest change to the air barrier system is that now all joints are required to be sealed [which was there before] AND **structurally supported**. Depending on where you put the air barrier in the wall assembly, achieving this can add a significant amount of work. Current construction practice would now require supporting every joint at every light switch, electrical outlet and fixture. This will add a significant amount of solid blocking or require specialized electrical boxes with flanges and a gasket built into the boxes.

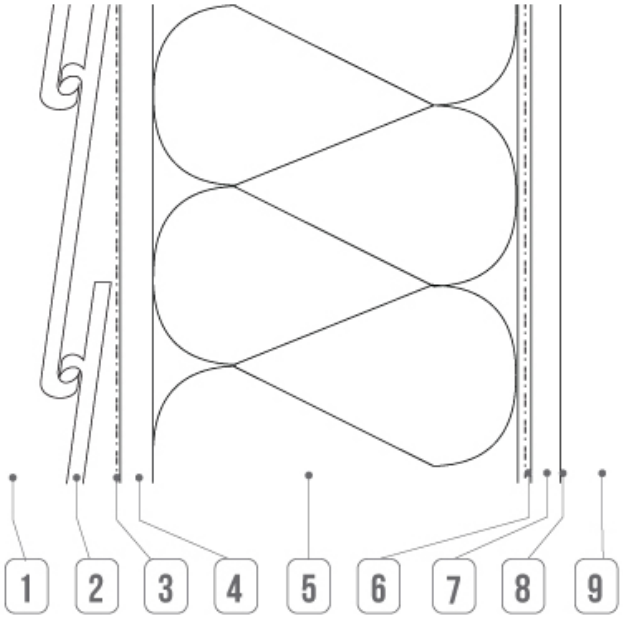
Exterior Air Barrier Approach

This approach separates the air barrier from the vapour barrier. By installing the air barrier on the exterior of the building, the walls of your project have significantly fewer penetrations that require sealing, you don't have all the sealing between floor joists on the interior and by virtue of the exterior sheathing, all joints are structurally supported. You only need to install and seal your air barrier according to the manufacturer's installation instructions for the material you have chosen; but not less of a lap than 2" at all joints.

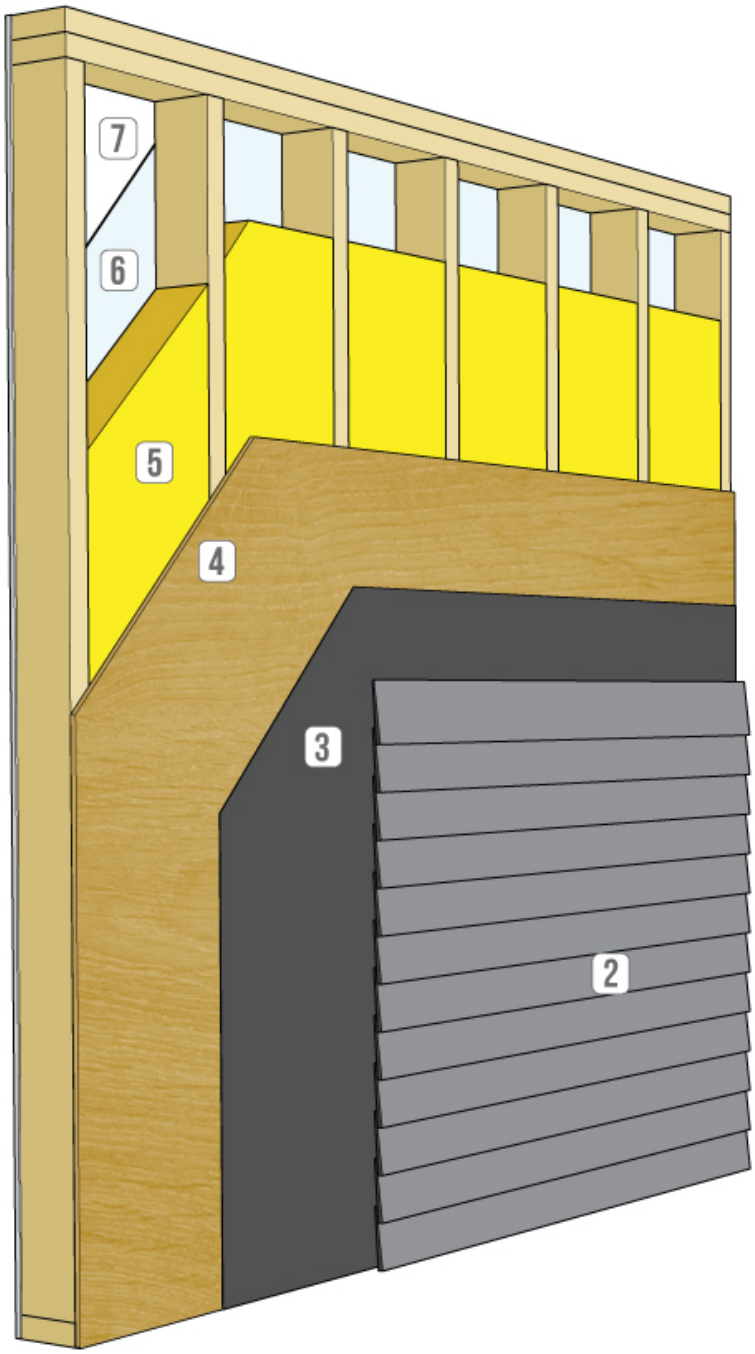
By separating the air barrier and vapour barrier, the air barrier controls the air seal/envelope continuity and the vapour barrier prevents the accumulation of water vapour in your walls. This approach is an alternative to the traditional method of using the vapour barrier as the air barrier.



Alternatively to sealing every joint in the air barrier system as required by prescriptive requirements you can blower door test your building to CAN/ULC-S742 or ASTM E2357. IF the blower door test meets the air changes per hour requirement this will also meet the Building Code requirements.



WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	7/16" (11.1mm) OSB sheathing	0.11	0.62
5	2x6 framing filled with R22 batt @ 24" o.c.	2.67	15.16
6	polyethylene	0.00	0.00
7	1/2" (12.7mm) gypsum board	0.08	0.45
8	finish: 1 coat latex primer and latex paint	0.00	0.00
9	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**3.12**	**17.70**
Centre of Cavity RSI / R Value		4.32	24.54
Installed Insulation RSI / R Value(nominal)		3.87	22.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		3.25	18.44



Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					

17.7 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due mainly to the rain screen properties of the vinyl siding. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining excellent drying potential towards the outside due to the "air-leakiness" of the siding (should any moisture find its way into the wall). The rest of the wall assembly is also relatively vapour permeable outboard of the polyethylene vapour retarder, maintaining excellent drying characteristics towards the outside.

Energy & Thermal Performance

- This wall is subject to some thermal bridging due to exposure of framing elements to outside temperature conditions.
- The framing factor for this wall at 24" o.c. is 20% (i.e. 20% of the wall is wood only and 80% is insulated)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation

Exterior Moisture/Wetting 

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper with lapped joints, lapped over a flashing at the bottom of the wall assembly which acts as a secondary drainage plane and will be drained to the outside
- The vinyl siding is non-absorptive and rain shedding
- Any moisture which may leak into the wall through penetrations can dry to the outside due to the "air-leakiness" of the vinyl siding, and the excellent drying characteristics of the whole assembly
- Care must be taken at penetrations (windows etc.) by use of proper detailing and use of flashings/ sealants etc. so that water does not leak into the assembly

Air Leakage Transported Moisture from Inside 

- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs
- This wall assembly has excellent drying potential towards the outside due to the "air-leakiness" or "breathability" of the vinyl siding

Water Vapour Diffusion from Outside 

- Solar driven moisture is not an issue with vinyl siding and other similar non-absorptive and rain-shedding sidings

Water Vapour Diffusion from Inside 

- Should moisture get into the assembly, it has very good drying potential towards the

outside:
o Fibreglass batt is very vapour permeable
o Wood sheathing is relatively vapour permeable when on the cold side of a wall, where relative humidity is typically higher
o Asphalt impregnated 30 minute paper is vapour permeable
o vinyl siding is "air-leaky" or "breathable", allowing convective drying to the outside

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing can potentially reduce the framing factor by 10% to 20%) could be further enhanced through in-line framing wherein double top plates can be limited to single plates (this is most efficiently done by referencing the roof truss layout spacing prior to laying out the first wall assembly) . See http://www.performancewalls.org/?content=app_pf_afadvantages.

Affordability: Cost Implications

- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)

Additional Sources of Information

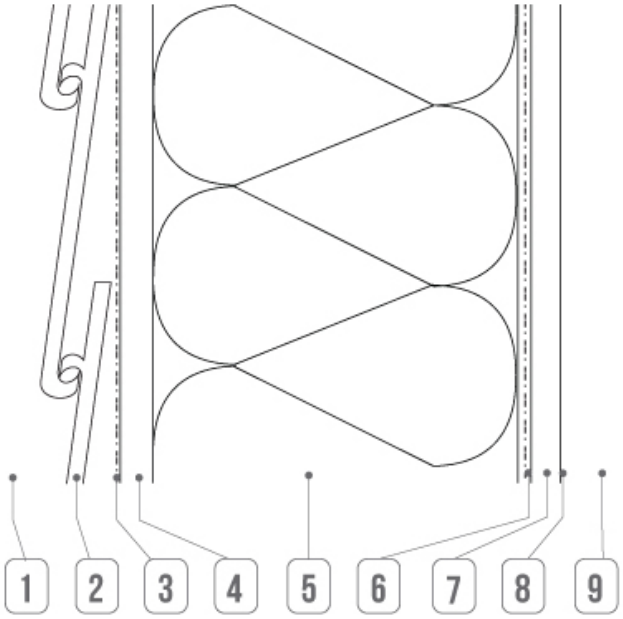
Designing Energy Efficient Building Enclosures, FPInnovations

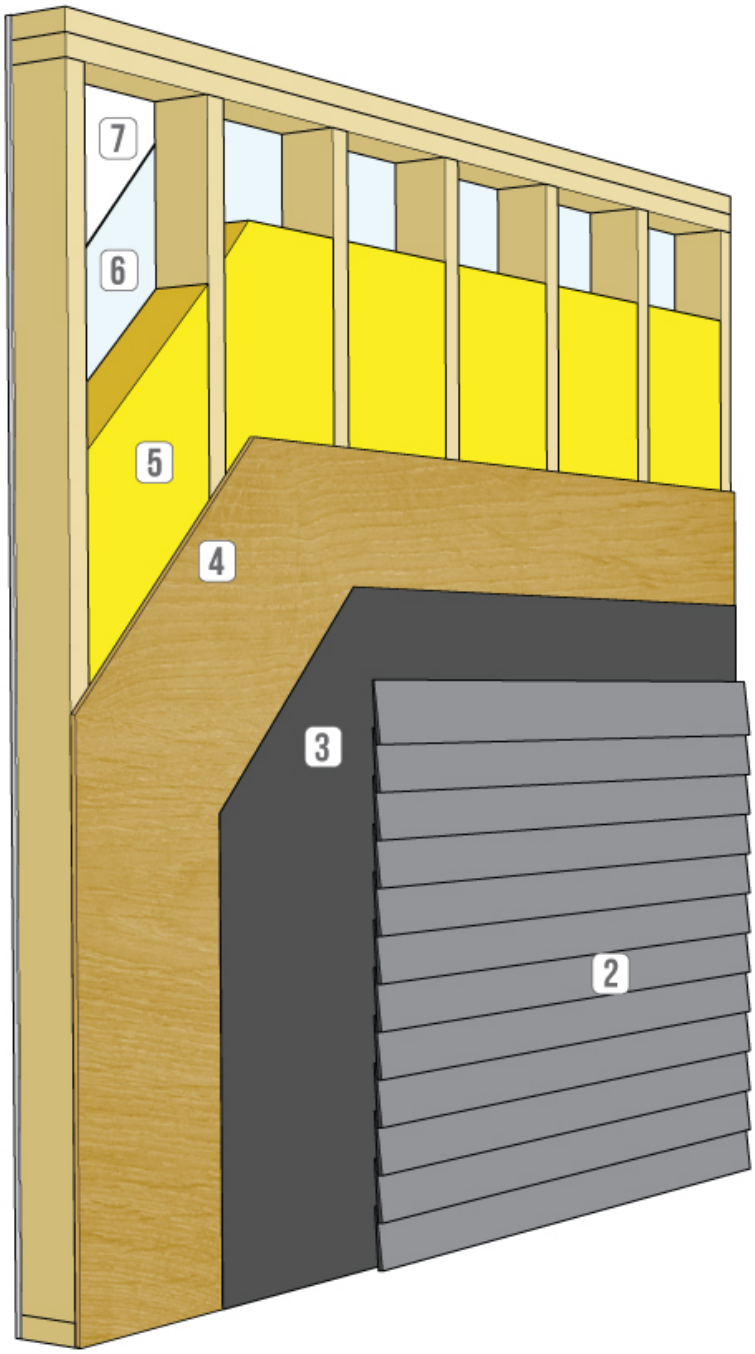
High R Value Enclosure Assemblies, Building Science Corporation

Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to wtd@cwc.ca

Version 4.0 - Feb 1, 2016





WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	1/2" (12.7mm) Plywood sheathing	0.11	0.62
5	2x6 framing filled with R24 batt @ 16" o.c.	2.66	15.10
6	polyethylene	0.00	0.00
7	1/2" (12.7mm) gypsum board	0.08	0.45
8	finish: 1 coat latex primer and latex paint	0.00	0.00
9	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**3.11**	**17.64**
Centre of Cavity RSI / R Value		4.68	26.54
Installed Insulation RSI / R Value(nominal)		4.23	24.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		3.25	18.44

Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					

17.6 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due mainly to the rain screen properties of the vinyl siding. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining excellent drying potential towards the outside due to the "air-leakiness" of the siding (should any moisture find its way into the wall). The rest of the wall assembly is also relatively vapour permeable outboard of the polyethylene vapour retarder, maintaining excellent drying characteristics towards the outside.

Energy & Thermal Performance

- This wall is subject to some thermal bridging due to exposure of framing elements to outside temperature conditions.
- The framing factor for this wall at 16" o.c. is 23% (i.e. 23% of the wall is wood only and 77% is insulated)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation

Exterior Moisture/Wetting

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper with lapped joints, lapped over a flashing at the bottom of the wall assembly which acts as a secondary drainage plane and will be drained to the outside
- The vinyl siding is non-absorptive and rain shedding
- Any moisture which may leak into the wall through penetrations can dry to the outside due to the "air-leakiness" of the vinyl siding, and the excellent drying characteristics of the whole assembly
- Care must be taken at penetrations (windows etc.) by use of proper detailing and use of flashings/ sealants etc. so that water does not leak into the assembly

Air Leakage Transported Moisture from Inside

- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs
- This wall assembly has excellent drying potential towards the outside due to the "air-leakiness" or "breathability" of the vinyl siding

Water Vapour Diffusion from Outside

- Solar driven moisture is not an issue with vinyl siding and other similar non-absorptive and rain-shedding sidings

Water Vapour Diffusion from Inside

- Vapour diffusion is controlled by the installation of a vapour retarding membrane

(such as polyethylene or a vapour retarder paint) on the inside behind the gypsum board or painted onto the gypsum board
- Should moisture get into the assembly, it has very good drying potential towards the outside:
  o Fibreglass batt is very vapour permeable
  o Wood sheathing is relatively vapour permeable when on the cold side of a wall, where relative humidity is typically higher
  o Asphalt impregnated 30 minute paper is vapour permeable
  o vinyl siding is "air-leaky" or "breathable", allowing convective drying to the outside

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights

Affordability: Cost Implications

- Reduction in wood use framing stud members possible (19.2" OR 24" o.c.) with no additional engineering required.
- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- This wall assembly design can be used up to 3 storey construction under most prevailing building codes
- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)

Additional Sources of Information

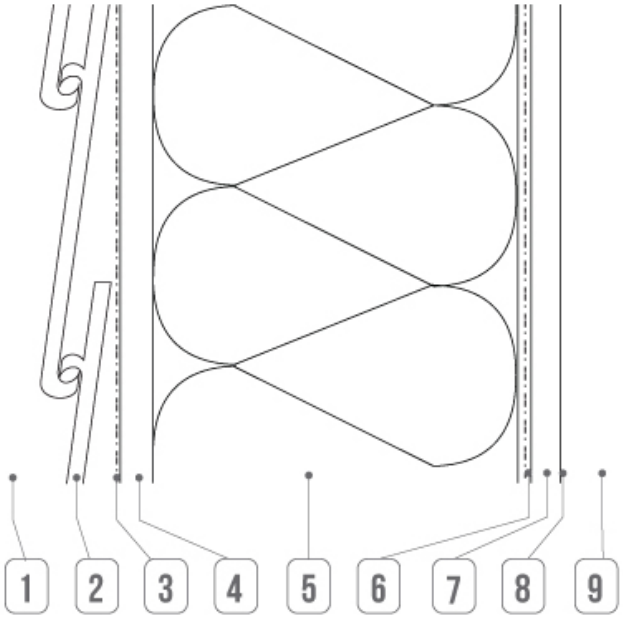
Designing Energy Efficient Building Enclosures, FPInnovations

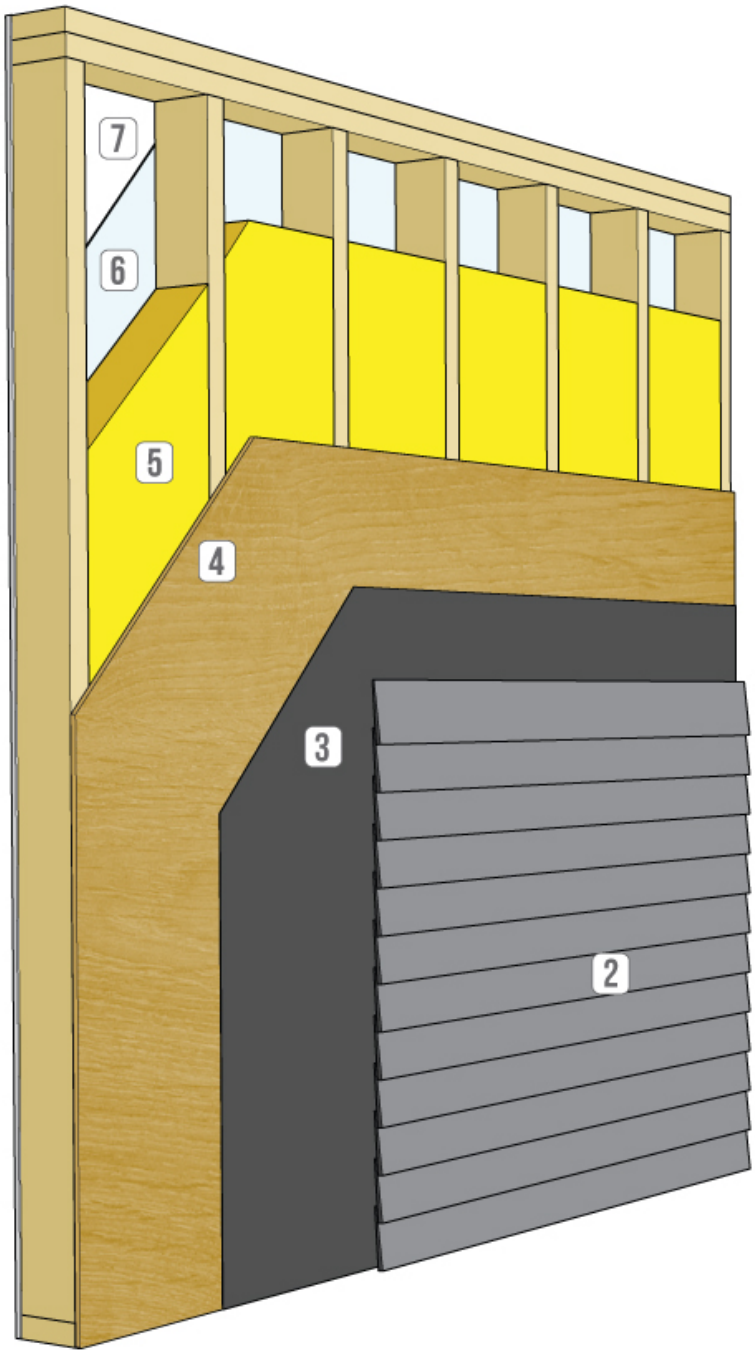
High R Value Enclosure Assemblies, Building Science Corporation

Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

under any circumstances guarantee the completeness, accuracy or exactness of the information. Suggestions regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to wtd@cwc.ca

Version 4.0 - Feb 1, 2016





WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	1/2" (12.7mm) Plywood sheathing	0.11	0.62
5	2x6 framing filled with R22 batt @ 24" o.c.	2.67	15.16
6	polyethylene	0.00	0.00
7	1/2" (12.7mm) gypsum board	0.08	0.45
8	finish: 1 coat latex primer and latex paint	0.00	0.00
9	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**3.12**	**17.70**
Centre of Cavity RSI / R Value		4.32	24.54
Installed Insulation RSI / R Value(nominal)		3.87	22.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		3.25	18.44

Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass Pass Conditional Pass Conditional Fail Fail

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					

17.7 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due mainly to the rain screen properties of the vinyl siding. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining excellent drying potential towards the outside due to the "air-leakiness" of the siding (should any moisture find its way into the wall). The rest of the wall assembly is also relatively vapour permeable outboard of the polyethylene vapour retarder, maintaining excellent drying characteristics towards the outside.

Energy & Thermal Performance

- This wall is subject to some thermal bridging due to exposure of framing elements to outside temperature conditions.
- The framing factor for this wall at 24" o.c. is 20% (i.e. 20% of the wall is wood only and 80% is insulated)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation

Exterior Moisture/Wetting 

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper with lapped joints, lapped over a flashing at the bottom of the wall assembly which acts as a secondary drainage plane and will be drained to the outside
- The vinyl siding is non-absorptive and rain shedding
- Any moisture which may leak into the wall through penetrations can dry to the outside due to the "air-leakiness" of the vinyl siding, and the excellent drying characteristics of the whole assembly
- Care must be taken at penetrations (windows etc.) by use of proper detailing and use of flashings/ sealants etc. so that water does not leak into the assembly

Air Leakage Transported Moisture from Inside 

- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs
- This wall assembly has excellent drying potential towards the outside due to the "air-leakiness" or "breathability" of the vinyl siding

Water Vapour Diffusion from Outside 

- Solar driven moisture is not an issue with vinyl siding and other similar non-absorptive and rain-shedding sidings

Water Vapour Diffusion from Inside 

- Vapour diffusion is controlled by the installation of a vapour retarding membrane

(such as polyethylene or a vapour retarder paint) on the inside behind the gypsum board or painted onto the gypsum board
- Should moisture get into the assembly, it has very good drying potential towards the outside:
  o Fibreglass batt is very vapour permeable
  o Wood sheathing is relatively vapour permeable when on the cold side of a wall, where relative humidity is typically higher
  o Asphalt impregnated 30 minute paper is vapour permeable
  o vinyl siding is "air-leaky" or "breathable", allowing convective drying to the outside

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing can potentially reduce the framing factor by 10% to 20%) could be further enhanced through in-line framing wherein double top plates can be limited to single plates (this is most efficiently done by referencing the roof truss layout spacing prior to laying out the first wall assembly) . See http://www.performancewalls.org/?content=app_pf_afadvantages.

Affordability: Cost Implications

- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)

Additional Sources of Information

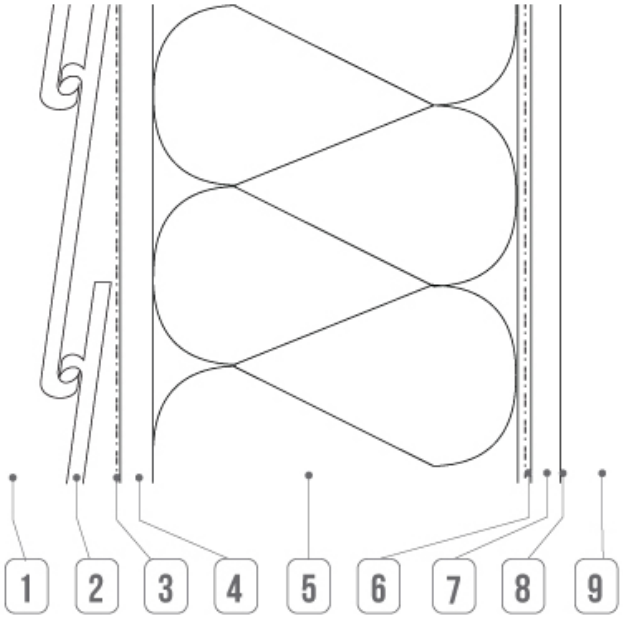
Designing Energy Efficient Building Enclosures, FPInnovations

High R Value Enclosure Assemblies, Building Science Corporation

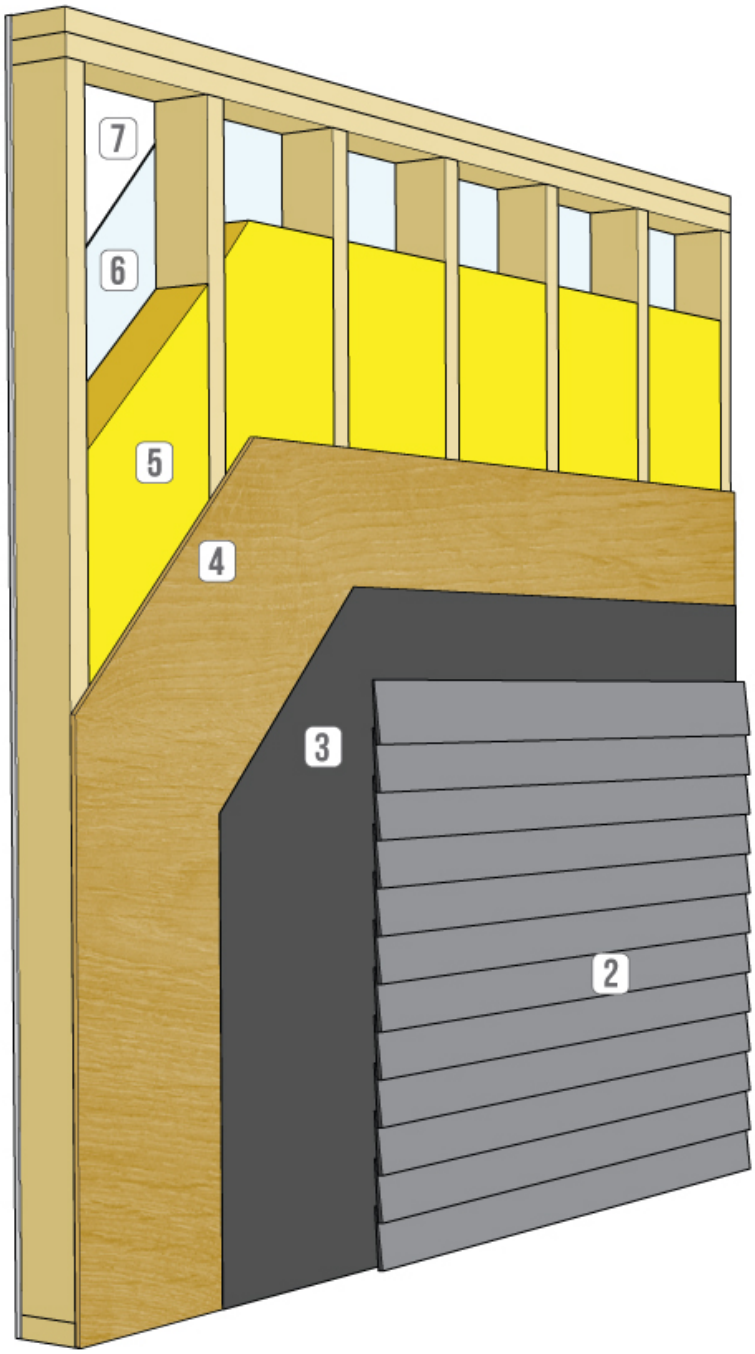
Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

Although all possible efforts have been made to ensure that the information on this tool is accurate, we cannot under any circumstances guarantee the completeness, accuracy or exactness of the information. Suggestions regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to wtd@cwc.ca

Version 4.0 - Feb 1, 2016



WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	7/16" (11.1mm) OSB sheathing	0.11	0.62
5	2x6 framing filled with R22 batt @ 24" o.c.	2.67	15.16
6	polyethylene	0.00	0.00
7	1/2" (12.7mm) gypsum board	0.08	0.45
8	finish: 1 coat latex primer and latex paint	0.00	0.00
9	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**3.12**	**17.70**
Centre of Cavity RSI / R Value		4.32	24.54
Installed Insulation RSI / R Value(nominal)		3.87	22.00
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		3.25	18.44



Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					

17.7 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due mainly to the rain screen properties of the vinyl siding. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining excellent drying potential towards the outside due to the "air-leakiness" of the siding (should any moisture find its way into the wall). The rest of the wall assembly is also relatively vapour permeable outboard of the polyethylene vapour retarder, maintaining excellent drying characteristics towards the outside.

Energy & Thermal Performance

- This wall is subject to some thermal bridging due to exposure of framing elements to outside temperature conditions.
- The framing factor for this wall at 24" o.c. is 20% (i.e. 20% of the wall is wood only and 80% is insulated)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation

Exterior Moisture/Wetting 

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper with lapped joints, lapped over a flashing at the bottom of the wall assembly which acts as a secondary drainage plane and will be drained to the outside
- The vinyl siding is non-absorptive and rain shedding
- Any moisture which may leak into the wall through penetrations can dry to the outside due to the "air-leakiness" of the vinyl siding, and the excellent drying characteristics of the whole assembly
- Care must be taken at penetrations (windows etc.) by use of proper detailing and use of flashings/ sealants etc. so that water does not leak into the assembly

Air Leakage Transported Moisture from Inside 

- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs
- This wall assembly has excellent drying potential towards the outside due to the "air-leakiness" or "breathability" of the vinyl siding

Water Vapour Diffusion from Outside 

- Solar driven moisture is not an issue with vinyl siding and other similar non-absorptive and rain-shedding sidings

Water Vapour Diffusion from Inside 

- Vapour diffusion is controlled by the installation of a vapour retarding membrane

(such as polyethylene or a vapour retarder paint) on the inside behind the gypsum board or painted onto the gypsum board
- Should moisture get into the assembly, it has very good drying potential towards the outside:
  o Fibreglass batt is very vapour permeable
  o Wood sheathing is relatively vapour permeable when on the cold side of a wall, where relative humidity is typically higher
  o Asphalt impregnated 30 minute paper is vapour permeable
  o vinyl siding is "air-leaky" or "breathable", allowing convective drying to the outside

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing can potentially reduce the framing factor by 10% to 20%) could be further enhanced through in-line framing wherein double top plates can be limited to single plates (this is most efficiently done by referencing the roof truss layout spacing prior to laying out the first wall assembly) . See http://www.performancewalls.org/?content=app_pf_afadvantages.

Affordability: Cost Implications

- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)

Additional Sources of Information

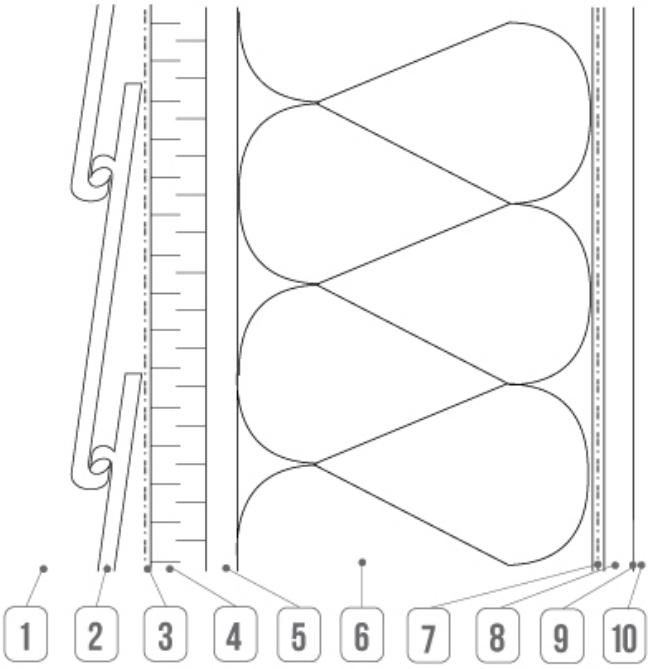
Designing Energy Efficient Building Enclosures, FPInnovations

High R Value Enclosure Assemblies, Building Science Corporation

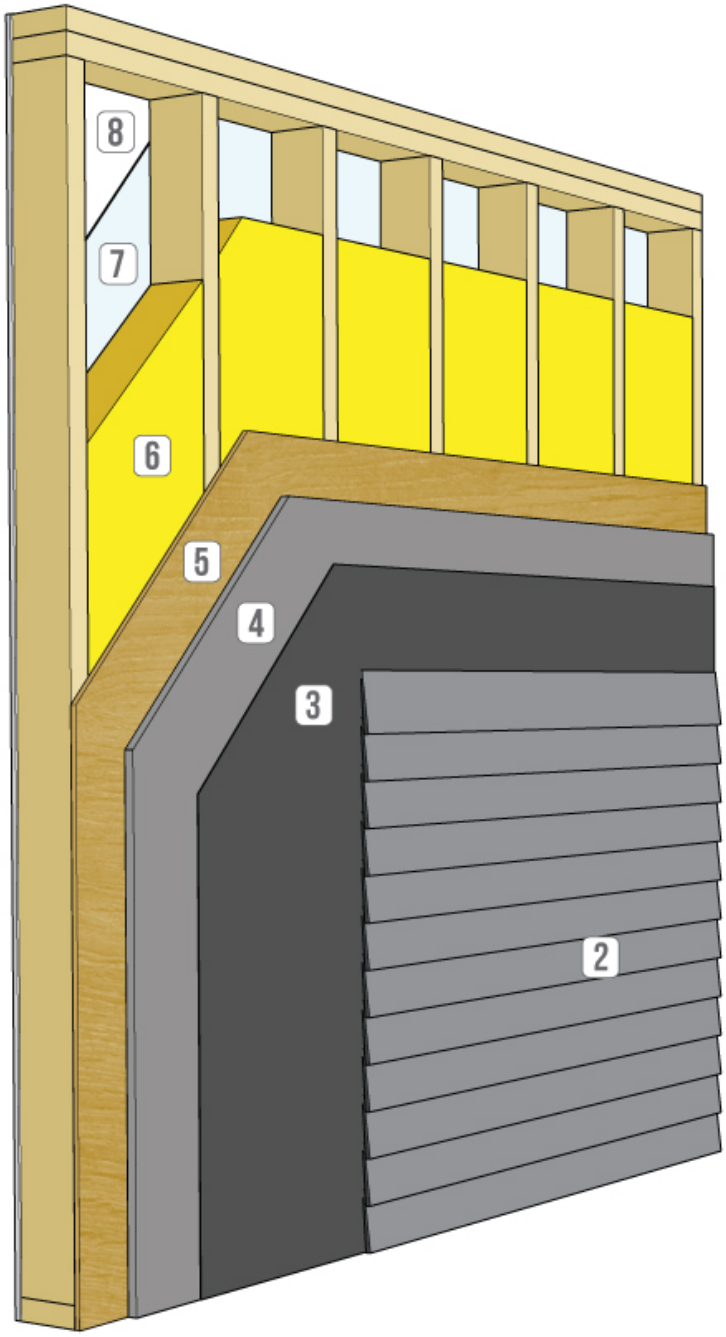
Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

Although all possible efforts have been made to ensure that the information on this tool is accurate, we cannot under any circumstances guarantee the completeness, accuracy or exactness of the information. Suggestions regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to wtd@cwc.ca

Version 4.0 - Feb 1, 2016



WALL ASSEMBLY COMPONENTS[1]		RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	1" (25.4mm) extruded polystyrene type 3/4	0.89	5.05
5	7/16" (11.1mm) OSB sheathing	0.11	0.62
6	2x6 framing filled with R22 batt @ 16" o.c.	2.55	14.48
7	polyethylene	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**3.89**	**22.07**
Centre of Cavity RSI / R Value		5.21	29.59
Installed Insulation RSI / R Value(nominal)		4.76	27.05
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		4.05	22.98



Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

OUTBOARD TO INBOARD RATIO 0.25

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					
OUTBOARD TO INBOARD RATIO COMPLIANCE	0.2	0.3	0.2	0.2	0.2

22.1 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due to both the rain screen properties of the vinyl siding combined with the benefits of the insulative sheathing. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining good drying potential towards the outside due to the "air-leakiness" of the siding should any moisture find its way behind it. The insulative sheathing acts as a secondary drainage plane behind the vinyl siding, and also reduces the risk of interstitial condensation by raising the temperature of the wall assembly inboard of it. For colder climates, the thickness of the insulative sheathing will need to be increased.

Energy & Thermal Performance

- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation
- Continuous exterior Insulation significantly minimizes thermal bridging and enhances overall effective R-value of the entire assembly
- Due to the limited permeance of exterior insulation materials, keeping the wall dry through detailed flashing and rigorous air barrier applications is important

Exterior Moisture/Wetting

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper lapped at joints and over a flashing at the bottom of the wall assembly, or by the layer of insulative sheathing between the asphalt impregnated paper and the wood sheathing, which both act as a secondary drainage planes and will drain any liquid water to the outside
- The vinyl siding is non-absorptive and rain shedding
- The outward drying potential of this wall is greatly reduced by the layer of insulative sheathing, and if a polyethylene vapour retarder is used, it cannot dry to the inside either, so extra care must be taken at all penetrations and transitions (windows etc.) so water does not leak in behind the asphalt impregnated paper and the insulative sheathing, and also that built-in construction moisture is managed to reasonable levels.

Air Leakage Transported Moisture from Inside

- The effect of the insulative sheathing is a reduced risk of interstitial condensation on the wood sheathing or in the stud cavity from warm moisture-laden interior air leaking into the wall assembly, as the insulative sheathing raises the temperature inboard of it, causing the dew point in the heating season mostly to fall outboard of the inner surface of the insulative sheathing
- For colder climates, the thickness of the insulative sheathing must be increased to maintain the location of the dew point falling outside of the stud cavity and the wood sheathing
- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs

Water Vapour Diffusion from Outside

- Solar driven moisture is not a significant issue with vinyl siding and other similar non-absorptive and rain-shedding sidings, provided they are detailed properly and in accordance to manufacturer guidelines

Water Vapour Diffusion from Inside

- Vapour diffusion from the inside must be controlled by the installation of a vapour retarding membrane (polyethylene or vapour retarder paint or variable permeance “smart” vapour retarder if the code allows) on the inside behind the gypsum board or painted onto the gypsum board according to code

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- 19.2" stud spacing will typically require exterior sheathing and/or insulation panels to be installed horizontally, whereas 16" and 24" stud spacing can accommodate vertically installed panels (most panel goods have fastener spacing guidelines printed on the material based on vertical installation)
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Constructing walls with exterior insulation is rapidly becoming common practice in some Canadian Zones
- Handling, application and process integration of rigid insulation by Suppliers and Framers can initially affect cycle time - however, production cycle times quickly return to normal after the first few built units
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Length of fastener may need minor adjustment to ensure proper penetration depth into framing member
- Exterior insulating sheathing can be an effective exterior air barrier when joints and seams are properly sealed with compatible air barrier qualified tapes, mastic, or caulking

Affordability: Cost Implications

- Cost of exterior rigid insulation material and labour vary widely from region to region
- Reduction in wood use framing stud members possible (19.2" OR 24" o.c.) with no additional engineering required.
- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- This wall assembly design can be used up to 3 storey construction under most prevailing building codes
- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Exterior wall dimension width may have minor effect on interior dimensions (i.e. stair widths on exterior walls and overall interior useable square footage)

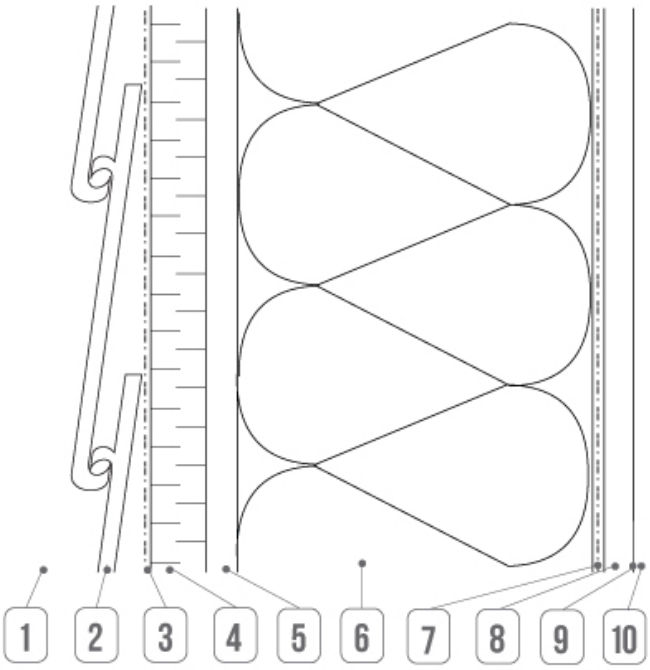
Additional Sources of Information

Designing Energy Efficient Building Enclosures, FPInnovations

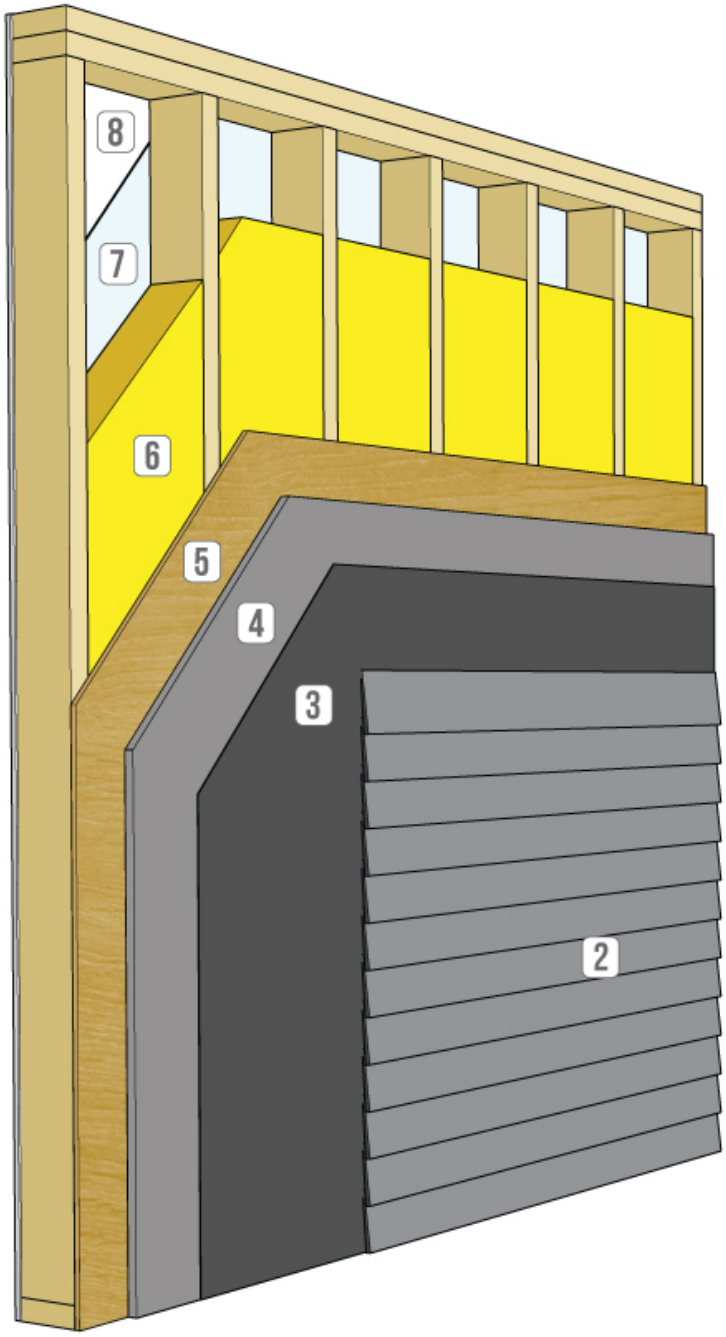
High R Value Enclosure Assemblies, Building Science Corporation

Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

Version 4.0 - Feb 1, 2016



	WALL ASSEMBLY COMPONENTS[1]	RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	1" (25.4mm) extruded polystyrene type 3/4	0.89	5.05
5	7/16" (11.1mm) OSB sheathing	0.11	0.62
6	2x6 framing filled with R24 batt @ 24" o.c.	2.80	15.90
7	polyethylene	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**4.14**	**23.49**
Centre of Cavity RSI / R Value		5.57	31.59
Installed Insulation RSI / R Value(nominal)		5.12	29.05
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		4.34	24.62



Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

OUTBOARD TO INBOARD RATIO 0.23

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					
OUTBOARD TO INBOARD RATIO COMPLIANCE	0.2	0.3	0.2	0.2	0.2

23.5 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due to both the rain screen properties of the vinyl siding combined with the benefits of the insulative sheathing. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining good drying potential towards the outside due to the "air-leakiness" of the siding should any moisture find its way behind it. The insulative sheathing acts as a secondary drainage plane behind the vinyl siding, and also reduces the risk of interstitial condensation by raising the temperature of the wall assembly inboard of it. For colder climates, the thickness of the insulative sheathing will need to be increased.

Energy & Thermal Performance

- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation
- Continuous exterior Insulation significantly minimizes thermal bridging and enhances overall effective R-value of the entire assembly
- Due to the limited permeance of exterior insulation materials, keeping the wall dry through detailed flashing and rigorous air barrier applications is important

Exterior Moisture/Wetting

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper lapped at joints and over a flashing at the bottom of the wall assembly, or by the layer of insulative sheathing between the asphalt impregnated paper and the wood sheathing, which both act as a secondary drainage planes and will drain any liquid water to the outside
- The vinyl siding is non-absorptive and rain shedding
- The outward drying potential of this wall is greatly reduced by the layer of insulative sheathing, and if a polyethylene vapour retarder is used, it cannot dry to the inside either, so extra care must be taken at all penetrations and transitions (windows etc.) so water does not leak in behind the asphalt impregnated paper and the insulative sheathing, and also that built-in construction moisture is managed to reasonable levels.

Air Leakage Transported Moisture from Inside

- The effect of the insulative sheathing is a reduced risk of interstitial condensation on the wood sheathing or in the stud cavity from warm moisture-laden interior air leaking into the wall assembly, as the insulative sheathing raises the temperature inboard of it, causing the dew point in the heating season mostly to fall outboard of the inner surface of the insulative sheathing
- For colder climates, the thickness of the insulative sheathing must be increased to maintain the location of the dew point falling outside of the stud cavity and the wood sheathing
- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs

Water Vapour Diffusion from Outside

- Solar driven moisture is not a significant issue with vinyl siding and other similar non-absorptive and rain-shedding sidings, provided they are detailed properly and in accordance to manufacturer guidelines

Water Vapour Diffusion from Inside

- Vapour diffusion from the inside must be controlled by the installation of a vapour retarding membrane (polyethylene or vapour retarder paint or variable permeance “smart” vapour retarder if the code allows) on the inside behind the gypsum board or painted onto the gypsum board according to code

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- 19.2" stud spacing will typically require exterior sheathing and/or insulation panels to be installed horizontally, whereas 16" and 24" stud spacing can accommodate vertically installed panels (most panel goods have fastener spacing guidelines printed on the material based on vertical installation)
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Constructing walls with exterior insulation is rapidly becoming common practice in some Canadian Zones
- Handling, application and process integration of rigid insulation by Suppliers and Framers can initially affect cycle time - however, production cycle times quickly return to normal after the first few built units
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Length of fastener may need minor adjustment to ensure proper penetration depth into framing member
- Exterior insulating sheathing can be an effective exterior air barrier when joints and seams are properly sealed with compatible air barrier qualified tapes, mastic, or caulking
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing can potentially reduce the framing factor by 10% to 20%) could be further enhanced through in-line framing wherein double top plates can be limited to single plates (this is most efficiently done by referencing the roof truss layout spacing prior to laying out the first wall assembly) . See http://www.performancewalls.org/?content=app_pf_afadvantages.

Affordability: Cost Implications

- Cost of exterior rigid insulation material and labour vary widely from region to region
- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud

corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Exterior wall dimension width may have minor effect on interior dimensions (i.e. stair widths on exterior walls and overall interior useable square footage)

Additional Sources of Information

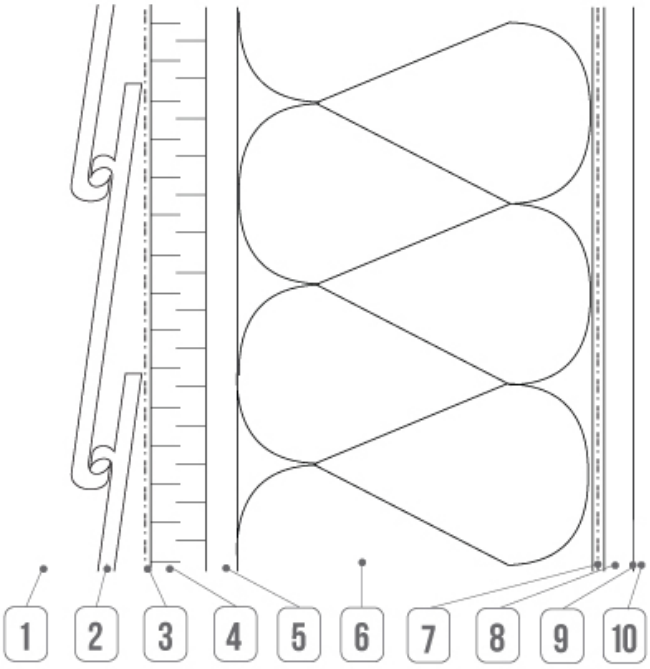
Designing Energy Efficient Building Enclosures, FPInnovations

High R Value Enclosure Assemblies, Building Science Corporation

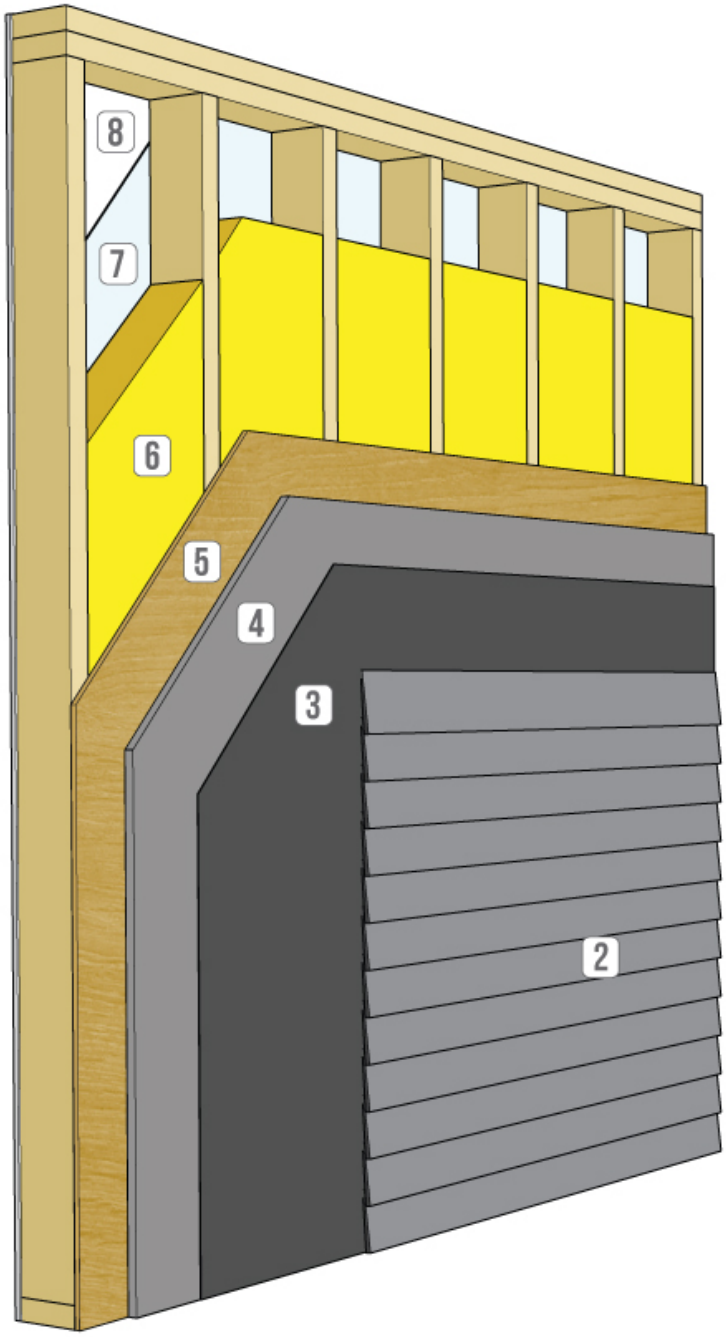
Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

Although all possible efforts have been made to ensure that the information on this tool is accurate, we cannot under any circumstances guarantee the completeness, accuracy or exactness of the information. Suggestions regarding this tool are welcome. If you feel that areas are missing, unclear or incorrect, please forward your suggestions to wtd@cwc.ca

Version 4.0 - Feb 1, 2016



	WALL ASSEMBLY COMPONENTS[1]	RSI	R
1	exterior air film	0.03	0.17
2	vinyl siding (no air space)	0.11	0.62
3	asphalt impregnated paper[2]	0.00	0.00
4	1" (25.4mm) extruded polystyrene type 3/4	0.89	5.05
5	7/16" (11.1mm) OSB sheathing	0.11	0.62
6	2x6 framing filled with R24 batt @ 16" o.c.	2.66	15.10
7	polyethylene	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		**4.00**	**22.69**
Centre of Cavity RSI / R Value		5.57	31.59
Installed Insulation RSI / R Value(nominal)		5.12	29.05
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		4.19	23.77



Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly, the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane Breather Type."

LEGEND High Pass | Pass | Conditional Pass | Conditional Fail | Fail

OUTBOARD TO INBOARD RATIO 0.23

SIMULATED DURABILITY ANALYSIS

Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

LOCATION:	Vancouver	Edmonton	Toronto	Montreal	St. John's
DURABILITY RATING BASED ON SIMULATIONS AND FIELD EXPERIENCE					
OUTBOARD TO INBOARD RATIO COMPLIANCE	0.2	0.3	0.2	0.2	0.2

22.7 R_{eff}

Summary

This is a very durable wall overall in all the climate zones listed, due to both the rain screen properties of the vinyl siding combined with the benefits of the insulative sheathing. The vinyl siding is non-absorptive to moisture, thus avoiding solar-driven moisture issues, while maintaining good drying potential towards the outside due to the "air-leakiness" of the siding should any moisture find its way behind it. The insulative sheathing acts as a secondary drainage plane behind the vinyl siding, and also reduces the risk of interstitial condensation by raising the temperature of the wall assembly inboard of it. For colder climates, the thickness of the insulative sheathing will need to be increased.

Energy & Thermal Performance

- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce the framing factor by 10% to 20%)
- Maximum nominal R-value of cavity insulation is typically limited to R19,20,22,24 (fiberglass batt) to R30 with medium density spray-applied insulation
- Continuous exterior Insulation significantly minimizes thermal bridging and enhances overall effective R-value of the entire assembly
- Due to the limited permeance of exterior insulation materials, keeping the wall dry through detailed flashing and rigorous air barrier applications is important

Exterior Moisture/Wetting

- Any liquid water leaking past the vinyl siding will be intercepted by the asphalt impregnated 30 minute paper lapped at joints and over a flashing at the bottom of the wall assembly, or by the layer of insulative sheathing between the asphalt impregnated paper and the wood sheathing, which both act as a secondary drainage planes and will drain any liquid water to the outside
- The vinyl siding is non-absorptive and rain shedding
- The outward drying potential of this wall is greatly reduced by the layer of insulative sheathing, and if a polyethylene vapour retarder is used, it cannot dry to the inside either, so extra care must be taken at all penetrations and transitions (windows etc.) so water does not leak in behind the asphalt impregnated paper and the insulative sheathing, and also that built-in construction moisture is managed to reasonable levels.

Air Leakage Transported Moisture from Inside

- The effect of the insulative sheathing is a reduced risk of interstitial condensation on the wood sheathing or in the stud cavity from warm moisture-laden interior air leaking into the wall assembly, as the insulative sheathing raises the temperature inboard of it, causing the dew point in the heating season mostly to fall outboard of the inner surface of the insulative sheathing
- For colder climates, the thickness of the insulative sheathing must be increased to maintain the location of the dew point falling outside of the stud cavity and the wood sheathing
- Air leakage into the wall must be managed by means of a continuous interior or exterior air barrier (preferably both), combined with proper detailing at any connection or penetrations (window openings, electrical boxes, plumbing penetrations etc.), which will also help reduce heating and air conditioning costs

Water Vapour Diffusion from Outside

- Solar driven moisture is not a significant issue with vinyl siding and other similar non-absorptive and rain-shedding sidings, provided they are detailed properly and in accordance to manufacturer guidelines

Water Vapour Diffusion from Inside

- Vapour diffusion from the inside must be controlled by the installation of a vapour retarding membrane (polyethylene or vapour retarder paint or variable permeance “smart” vapour retarder if the code allows) on the inside behind the gypsum board or painted onto the gypsum board according to code

Ease of Construction

- This wall is easily constructed through traditional stick frame methods on-site
- Exterior wood sheathing provides both structural resistance to "racking" and a nailing substrate for cladding materials
- 19.2" stud spacing will typically require exterior sheathing and/or insulation panels to be installed horizontally, whereas 16" and 24" stud spacing can accommodate vertically installed panels (most panel goods have fastener spacing guidelines printed on the material based on vertical installation)
- Insulation, weather barrier and air barrier details and materials are readily available and understood within the Canadian industry
- Constructing walls with exterior insulation is rapidly becoming common practice in some Canadian Zones
- Handling, application and process integration of rigid insulation by Suppliers and Framers can initially affect cycle time - however, production cycle times quickly return to normal after the first few built units
- Materials such as studs, wood sheathing panels and/or insulation sheet goods are readily available in pre-cut lengths for 8' and 9' wall heights
- Length of fastener may need minor adjustment to ensure proper penetration depth into framing member
- Exterior insulating sheathing can be an effective exterior air barrier when joints and seams are properly sealed with compatible air barrier qualified tapes, mastic, or caulking

Affordability: Cost Implications

- Cost of exterior rigid insulation material and labour vary widely from region to region
- Reduction in wood use framing stud members possible (19.2" OR 24" o.c.) with no additional engineering required.
- Alternative bracing methods can be substituted for the wood sheathing panel (e.g. T-slot inlet bracing) - however, details for wall bracing, tall walls, and more than 3-storey construction may require additional engineering
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Advanced framing as defined by NBC 9.36.2.4. (1) (e.g. insulated headers, 2 stud corners, ladder blocking, and in-line framing) can potentially reduce overall lumber costs by upwards of 10 to 20% (i.e. for softwood and panel products)

Esthetics: Architectural Design

- This wall assembly design can be used up to 3 storey construction under most prevailing building codes
- Exterior wood sheathing provides a nailing substrate for cladding materials including various siding applications (vertical or horizontal)
- Wall thickness adjustment could require minor increase of foundation wall thickness (e.g. 8" to 10" foundation width) and increase costs
- Wall thickness adjustment could require minor jamb extensions or additional trim details on openings in the enclosure (i.e. for windows and doors)
- Exterior wall dimension width may have minor effect on interior dimensions (i.e. stair widths on exterior walls and overall interior useable square footage)

Additional Sources of Information

Designing Energy Efficient Building Enclosures, FPInnovations

High R Value Enclosure Assemblies, Building Science Corporation

Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC

Version 4.0 - Feb 1, 2016