



Illustrated Guide

for the Alberta Building Code
9.36. Prescriptive Energy Efficiency
Requirements for Houses



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Foreword

This guide has been developed to assist residential builders and industry stakeholders in Alberta to interpret and comply with changes to the 2014 Alberta Building Code (“the Code”) Section 9.36. which contains both prescriptive and performance paths for energy efficiency for housing and small buildings. This guide will deal with the prescriptive requirements of Section 9.36. only.

Changes to Provincial Energy Efficiency Requirements

Commencing November 1, 2016 applications for building permits must comply with new requirements for energy efficiency in housing, small commercial and industrial buildings contained in Section 9.36. of the 2014 Alberta Building Code. The new building envelope requirements vary depending on your location. New code requirements are also being added related to the energy efficiency of heating, ventilation and air conditioning (HVAC) equipment and service water heating (SWH).

Other Useful Information

A number of documents are available from various manufacturers, the Canadian Home Builders' Association and BC Housing in British Columbia and are recommended reading to assist builders in the design and construction of homes. Please see the "Additional Resources" section in the Appendix beginning on page 42.

Acknowledgments

The publication was developed through extensive consultation with many individuals and organizations involved in residential construction in Alberta. CHBA – Alberta gratefully acknowledges the valued contributions made by the project industry committee, including insulation manufacturers, residential builders, building officials, and warranty providers. This guide was prepared by RDH Building Science Inc. This guide would not have been possible without the support of BC Housing, which generously provided the rights to its publication entitled [Illustrated Guide – Energy Efficiency Requirements for Houses in British Columbia](#).

Disclaimer

This guide is intended to provide readers with general information about the **prescriptive** aspects of Section 9.36. of the 2014 Alberta Building Code. Readers are urged not to rely simply on this guide, but to carefully review the Code and consult with appropriate and reputable professionals and construction specialists to assist in interpreting and applying the Code. It is the responsibility of all persons undertaking the design and construction of a house to fully comply with the requirements of the Code. The authors, contributors, funders and publishers assume no liability for the accuracy of the statements made or for any damage, loss, injury or expense that may be incurred or suffered as a result of the use of or reliance on the contents of this guide. The views expressed do not necessarily represent those of the individual contributors or CHBA – Alberta.

General (9.36.1.)

All code references in this guide refer to the 2014 Alberta Building Code.

This guide has been developed for CHBA – Alberta to assist residential low-rise builders and industry stakeholders. It deals with key new concepts in 9.36.1 to 9.36.4 such as air sealing and continuity of insulation. It includes examples of assemblies that show common variations in methods of construction and how these variations affect the assembly RSI calculations. More information on assembly construction is provided in the "Additional Resources" section in the Appendix.

Scope (9.36.1.1.)

The scope of this guide is primarily limited to low-rise single family and multi-family wood-frame houses within the scope of Part 9 of the Alberta Building Code. While Section 9.36. does include other small residential, commercial and industrial buildings, they are not addressed in this document.

Compliance and Application (9.36.1.3.)

Buildings must comply with the **prescriptive** requirements of Subsections 9.36.2. through 9.36.4. Alternatively, buildings can be built to meet the **performance** compliance path requirements described in Subsection 9.36.5. of the Code, however, **the performance path is not discussed in this document.**

Section 9.36. references six climate zones. Alberta has 4 of these zones. Zones 6 and 7A cover most areas between Grande Prairie and Medicine Hat. Zone 7B would apply in areas such as Fort McMurray (**Figure 1**). The specific weather location may be determined by referencing Appendix C of Division B in the Code or by consulting the local authority.

Relation to the NECB

Although the 2011 National Energy Code for Buildings (NECB 2011), adopted for use in Alberta, may be used for compliance for Part 9 dwellings, this guide was not written with consideration for the NECB. There may be situations where Part 9 dwelling, such as large homes, may be able to benefit using the NECB.

A Note on Assemblies and Materials Shown in the Guide

In most diagrams shown, areas that contain insulation appear in a light yellow/beige colour with no textures or standard indicators of insulation type. This is because many different types of insulation materials can be used in these areas. The exception to this are the assemblies used as examples to calculate RSI values, as the calculations are based on specific types of insulation. Assemblies and materials shown in the guide are not intended to show the only materials or means of construction to meet the Code. In all assemblies, various insulation materials and framing combinations can be used. The resource section of the guide contains much more extensive information from manufacturers on alternative materials that can be used.

CHBA - Alberta would like to thank the following CHBA member sponsors and member partners who helped make this publication possible.

Please see additional resources provided by these companies in the Appendix of this guide.



Beaver Plastics



Urban Centres in Climate Zones 6, 7A and 7B

Figure 1: Climatic Zone Map for Alberta



ZONE	
6	4000 to 4999 HDD
7A	5000 to 5999 HDD
7B	6000 to 6999 HDD
8	≥ 7000 HDD

Zone 6

- Brooks
- Cardston
- Claresholm
- High River
- Lethbridge
- Medicine Hat
- Okotoks
- Pincher Creek
- Taber

Zone 7A

- | | |
|---------------------|------------------------|
| • Airdrie | • Leduc |
| • Banff | • Lloydminster |
| • Beaumont | • Red Deer |
| • Calgary | • Rocky Mountain House |
| • Camrose | • Sherwood Park |
| • Canmore | • Slave Lake |
| • Cochrane | • Spruce Grove |
| • Cold Lake | • Stettler |
| • Drumheller | • Stony Plain |
| • Edmonton | • Sylvan Lake |
| • Edson | • Valleyview |
| • Fairview | • Vegreville |
| • Fort Saskatchewan | • Wetaskiwin |
| • Grand Prairie | • Whitecourt |
| • Hinton | |
| • Jasper | |

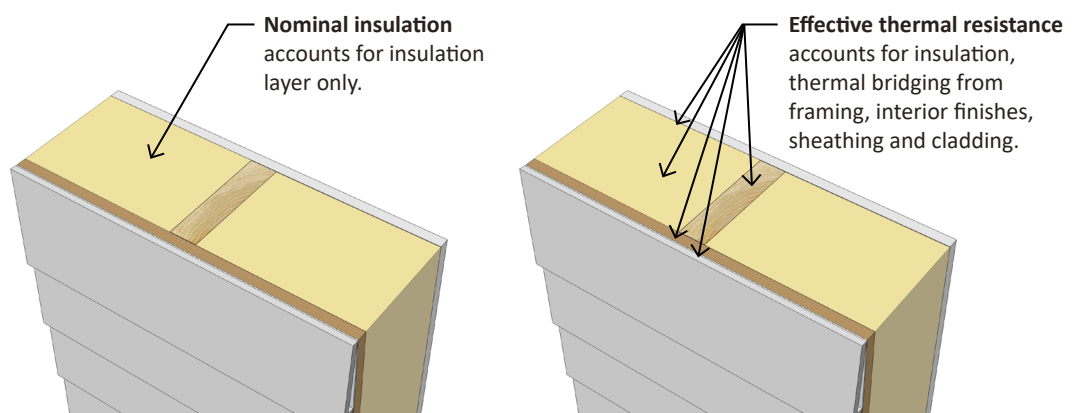
Zone 7B

- Athabasca
- Fort McMurray
- Fort Vermilion
- Lac la Biche
- Manning
- Peace River

Note #1 | Always check with your local authority to confirm the climate zone.

Glossary of New Terms

Advanced framing	A variety of framing techniques designed to reduce the amount of framing materials and subsequent thermal bridging through an assembly, thereby improving the thermal performance of the assembly.
Air barrier	An air barrier system is used to control the flow of air into and out of a building. Control of airflow is important to limit energy loss, reduce the potential for air leakage and associated condensation, for occupant comfort, and for indoor air quality. Any air tight material can be part of the air barrier system, however it is imperative to keep it continuous by sealing all transitions and interfaces across the building envelope.
Building assembly	A distinctive combination of materials that make up a significant piece of the building envelope of a building, such as an above grade wall or rim joist area or a basement wall.
Effective thermal resistance	The thermal resistance RSI value (R-value) provided by all components in an assembly, including continuous elements such as sheathing and interior finishes, as well as air films where applicable. For components using materials with varying thermal resistance within the same layer, for example insulated wood frame walls, the thermal resistance must be calculated for that layer to account for thermal bridging of the higher thermal resistance material (insulation) by the lower thermal resistance material (wood framing). As such, assemblies that use the same nominal insulation value of insulation but with different wood framing configurations can produce different assembly effective thermal resistance values. See page 12.
Fenestration	All forms of transparent or semi-transparent materials used for light transfer into a living space. Most common types are windows, door sidelights, skylights, and glass block assemblies.
Nominal insulation value	The thermal resistance of one of the materials in the assembly such as the insulating value of the insulation between the wood studs in a wall assembly.



Opaque assembly A building assembly, other than windows and doors, located above or below ground that heat can flow through.

RSI value (R-value) The resistance to heat flow of a material. It is expressed in the metric units of $(\text{m}^2\cdot\text{K})/\text{W}$. It is the inverse of USI value (overall thermal transmittance), which is expressed in units of $\text{W}/(\text{m}^2\cdot\text{K})$. The metric measurement for thermal resistance, RSI, can be converted to the imperial measurement of thermal resistance, R-value, by this formula:

$$\text{RSI} \times 5.678 = \text{R-value}$$

Thermal bridge A component in an assembly that transfers heat significantly faster than the surrounding materials. The most common example is a wood or metal stud in a wall that is insulated.

USI (U-value) The overall thermal transmittance is the rate at which heat is transferred through a building assembly that is subject to temperature differences.

RSI values are usually used in 9.36 in relation to building materials such as insulations, framing materials, claddings and foundation materials. Doors, windows and other fenestration products typically use USI values.

Vapour retarder A material with low vapour permeability used to limit the amount of water vapour which is able to flow through an assembly. It is also known within the industry as a “vapor barrier”.

Thermal Characteristics of Building Assemblies (9.36.2.6. to 9.36.2.8.)

Effective thermal resistance values to achieve the requirements of Section 9.36. in the 2014 Alberta Building Code are shown in **Table 1** below. Wall assembly requirements are relaxed where a heat recovery ventilator (HRV) is utilized.

Table 1: Insulation levels by assembly to achieve effective thermal resistance requirements

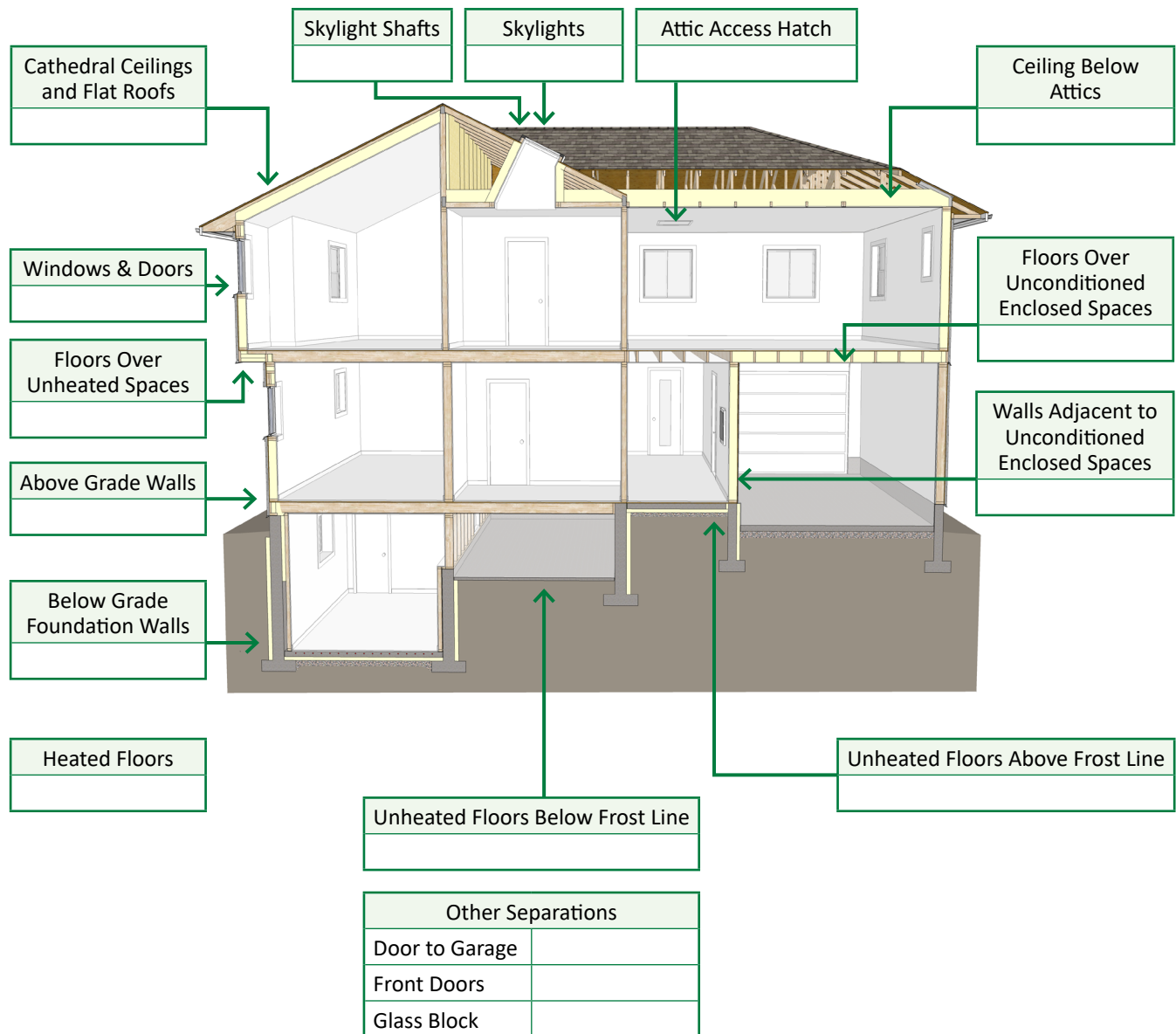
	Zone 6		Zone 7A		Zone 7B	
	No HRV RSI (R)	HRV RSI (R)	No HRV RSI (R)	HRV RSI (R)	No HRV RSI (R)	HRV RSI (R)
Ceiling below attics	8.67 (49.2)	8.67 (49.2)	10.43 (59.2)	8.67 (49.2)	10.43 (59.2)	10.43 (59.2)
Cathedral ceilings and flat roofs	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Above grade walls	3.08 (17.5)	2.97 (16.9)	3.08 (17.5)	2.97 (16.9)	3.85 (21.9)	3.08 (17.5)
Floors over unheated spaces	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Rim joists	3.08 (17.5)	2.97 (16.9)	3.08 (17.5)	2.97 (16.9)	3.85 (21.9)	3.08 (17.5)
Below grade foundation walls	2.98 (16.2)	2.98 (16.2)	3.46 (19.7)	2.98 (16.2)	3.46 (19.7)	2.98 (16.2)
Unheated floors below frost line	Uninsulated		Uninsulated		Uninsulated	
Exterior walls of an attached garage	3.08 (17.5)	2.97 (16.9)	3.08 (17.5)	2.97 (16.9)	3.85 (21.9)	3.08 (17.5)
Walls adjacent to an unconditioned garage	2.92 (16.6)	2.81 (16.0)	2.92 (16.6)	2.81 (16.0)	3.69 (21.0)	2.92 (16.6)
Unheated floors above frost line	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)
Slabs-on-grade with an integral footing	1.96 (11.1)	1.96 (11.1)	3.72 (21.1)	2.84 (16.1)	3.72 (21.1)	2.84 (16.1)
Heated floors	2.32 (13.2)	2.32 (13.2)	2.84 (16.1)	2.84 (16.1)	2.84 (16.1)	2.84 (16.1)
Skylight shafts	3.08 (17.5)	2.97 (16.9)	3.08 (17.5)	2.97 (16.9)	3.85 (21.9)	3.08 (17.5)
Attic access hatch	2.60 (14.8)	2.60 (14.8)	2.60 (14.8)	2.60 (14.8)	2.60 (14.8)	2.60 (14.8)
Windows, Doors and Skylights	See Page 27					

Note #2 | Section 9.36.2.4.(4) of the Code allows for a relaxation of RSI 0.16 for building envelope assemblies adjacent to unconditioned enclosed spaces such as enclosed verandas, sun porches, floors over garages, or walls between an attached garage and a house. This does not include vented spaces such as an attic, roof and crawl spaces.

Note #3 | See the exception for site-glazed or site-assembled, factory made products in 9.36.2.7.(3).

Thermal Characteristics of Building Assemblies

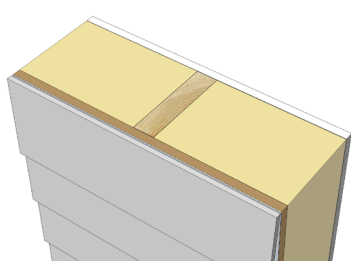
The graphic below illustrates the various common building envelope assemblies that must each meet the minimum effective thermal performance values as given in Section 9.36. and outlined in **Table 1** on page 7 and **Table 2** on page 27. The graphic may also be useful as a checklist and tracking sheet during design and code compliance work.



Continuity of Insulation (9.36.2.5.)

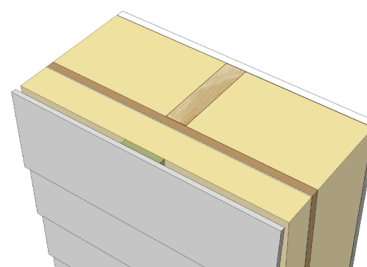
For insulation to be truly effective it must have continuity. The Code requires that interior building components that meet building envelope components and major structural members that partly penetrate the building envelope do not break the continuity of the insulation and shall not decrease the effective RSI value by a specified amount. Studs in framing are not considered to break the continuity of insulation where insulation is located in the stud cavities. The diagrams below illustrate the different concepts of insulation continuity and continuous insulation.

Typical locations requiring attention to detailing to provide for continuity of insulation are presented in **Figure 2**. See the following pages for detailed information for each location. For more details see A-9.36.2.6. and A-9.36.2.8. in the ABC.



Continuity of Insulation

Insulation in the framing cavity is considered to achieve continuity of insulation even though the insulation is not continuous across or behind the stud space.



Continuous Insulation

Insulation that spans across framing components such as wall studs is called continuous insulation. It achieves continuity of the insulation by significantly reducing thermal bridging through the framing.

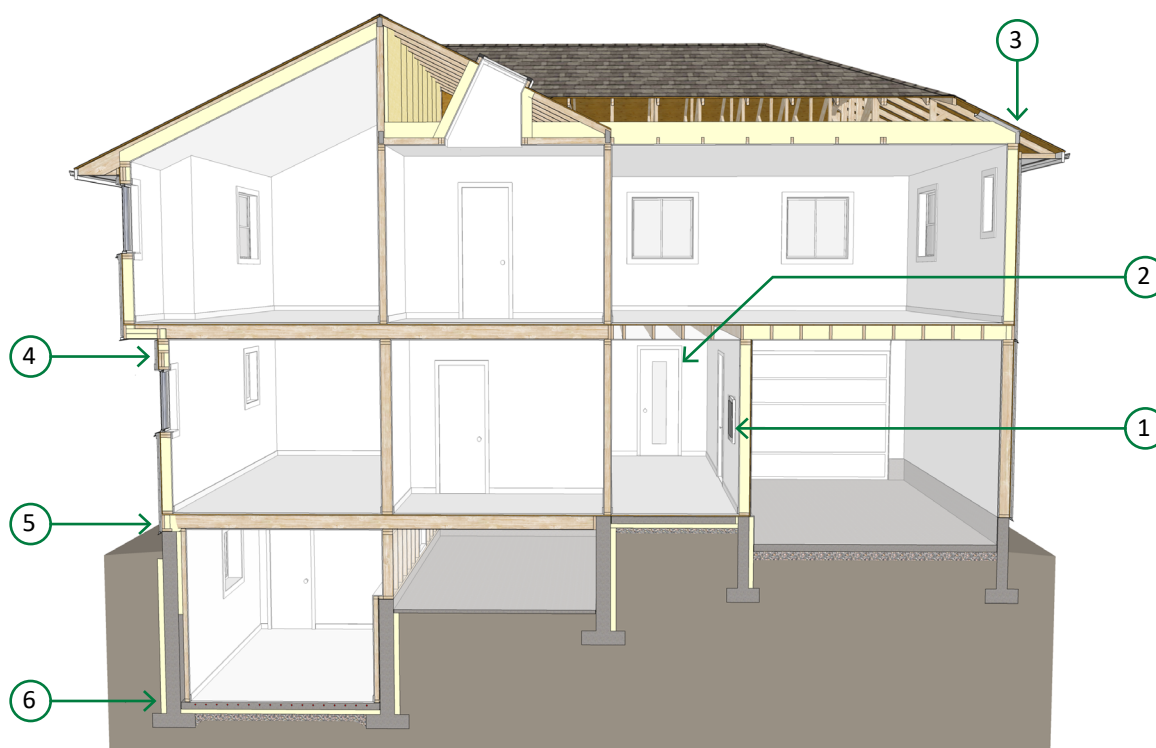
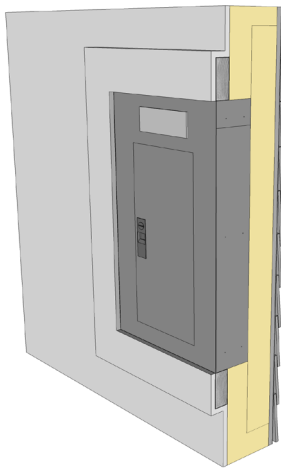
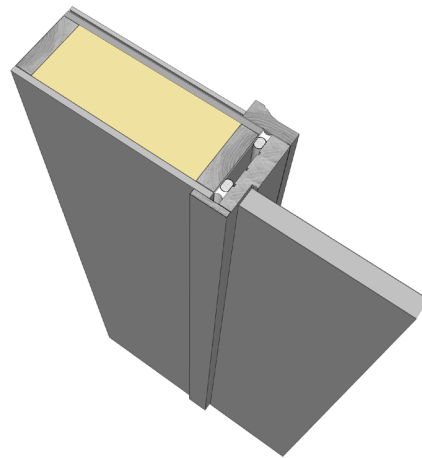


Figure 2: Typical Problem Areas for Insulation Continuity



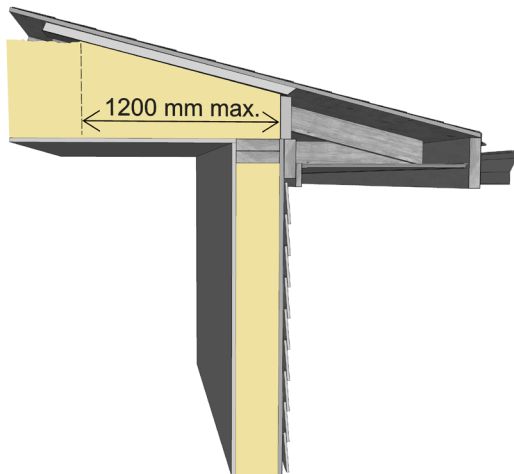
1 Electrical Panel

Mechanical, electrical and plumbing components placed within and parallel to an exterior wall are required to be insulated to the effective thermal resistance required for the wall at the projected area of the component.



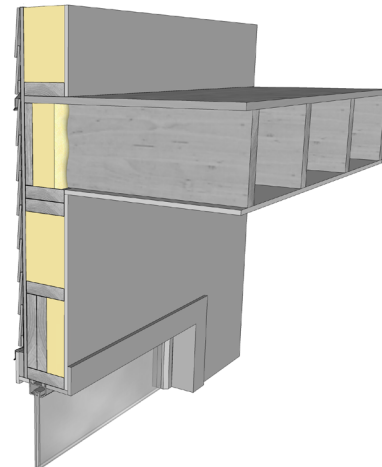
2 Wall to Window or Door Interface

The thermal bridging effect of closely spaced, repetitive joints and junctions between walls and other components like windows and doors need to have the same effective RSI value as the lower of the adjoining components. Additional insulation at the rough opening is typically not required to meet code requirements though is commonly installed. See A-9.36.2.5.(8) for further information.



3 Attic Insulation at Outside Walls

A reduction in the thermal resistance of the attic insulation at the perimeter is permitted, provided the insulation is constrained only by the roof slope and venting requirements, and the minimum thermal resistance value above the exterior wall is at least RSI 3.52 (R-20).

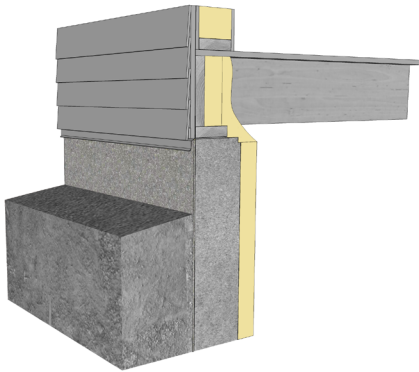


4 Headers and Rim Joists

The thermal bridging effect of closely spaced, repetitive structural members like studs and joists, and of ancillary members like lintels, sills and plates, must be accounted for when calculating the thermal resistance of building envelope assemblies.

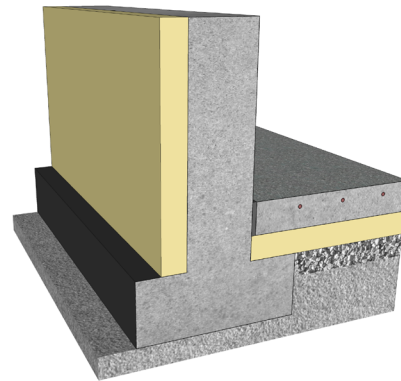
A table for percentage framing for common assemblies can be found in A-9.36.2.4.(1) A. The framing percentages given in this table account for lintels, double top plates, cripples etc. See note 1 of this table for more information.

Exceptions to Continuity | Foundation Walls



5 Foundation Wall/Rim Joist Transition

The Code considers insulation continuity maintained where a foundation wall is insulated on the inside and the insulation is continued through the rim joist cavity. In the case of hollow-core masonry, continuity is broken and needs to be addressed with the 4X rule. See A-9.36.2.5.(5).

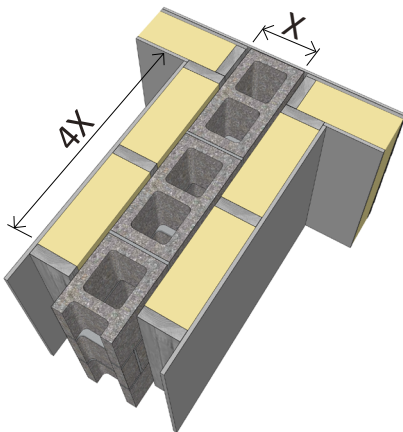


6 Foundation Wall at Floor Slab

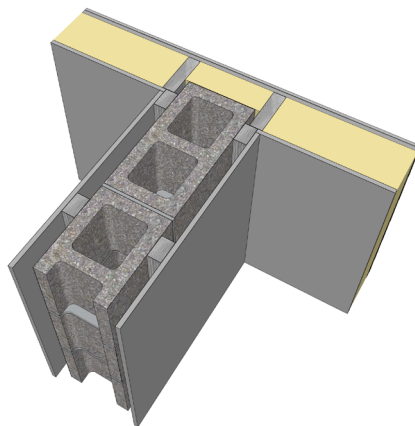
Insulation separated by the foundation wall at the floor slab is not required to be continuous, provided the exterior insulation extends down to the footing. See 9.36.2.5.(9)(a).

Continuity at Fire Separation (9.36.2.5.(2))

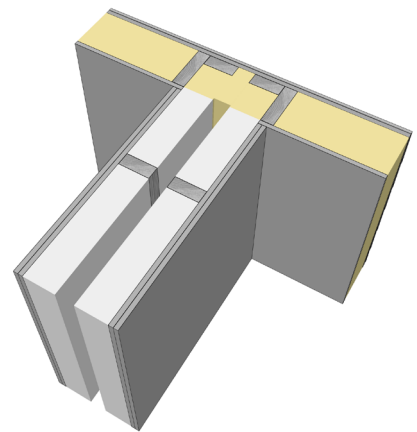
A reduction in insulation level is permitted at assemblies that must penetrate the building envelope such as fire separations and party walls. The 2014 Alberta Building Code shows these examples for insulation continuity in A-9.36.2.5. A, B and C.



A masonry fire separation which protrudes through the exterior envelope can be left exposed provided it is insulated along the interior to a distance four times the length left uninsulated.



The thermal resistance of the assembly covering the end of a masonry fire separation where it partially penetrates the exterior envelope must be at least 60% of that required for the exterior envelope element.



Wood framed fire separations (containing fire resistant insulation and multiple layers of Type X gypsum board) must be assembled to provide continuous insulation along the exterior envelope.

Calculating Effective RSI Values for Assemblies (9.36.2.1. to 9.36.2.8.)

Effective RSI values are the basis for all calculations in 9.36. Even homes that are modeled using energy calculation software must start from a reference house that must meet the prescriptive requirements of Sub-sections 9.36.2. to 9.36.4. of the 2014 Alberta Building Code. The steps for calculating effective RSI values for an assembly are:

1. List the various assemblies used in the building

Each change in assembly configuration such as interior finish, framing spacing, insulation method, sheathing, strapping and cladding will necessitate the creation of a new assembly.

2. List the materials in the assembly

This could include some or all of these components:

- | | |
|-----------------------------------|---|
| a. Exterior air film | f. Cladding |
| b. Strapping | g. Exterior insulation |
| c. Weather barrier | h. Structural support (framing , concrete wall) |
| d. Interior insulation | i. Air and/or vapour retarder |
| e. Interior finish (gypsum board) | j. Interior air space |

3. For a framed wall, determine framing and cavity insulation percentages

See ABC appendix page A-246, Table 9.36.2.4.(1).

4. Determine the thermal resistance of each material

This should be done for the thickness or dimension in the assembly using Table A-9.36.2.4.(1) D.

5. Calculate the effective RSI value for the framed portion of the assembly

$$\text{Effective RSI} = \frac{100\%}{\frac{\% \text{ area of framing}}{\text{RSI-value of the framing}} + \frac{\% \text{ area of cavity}}{\text{RSI-value of the insulation material in the cavity}}}$$

6. Calculate the effective RSI value for the entire assembly

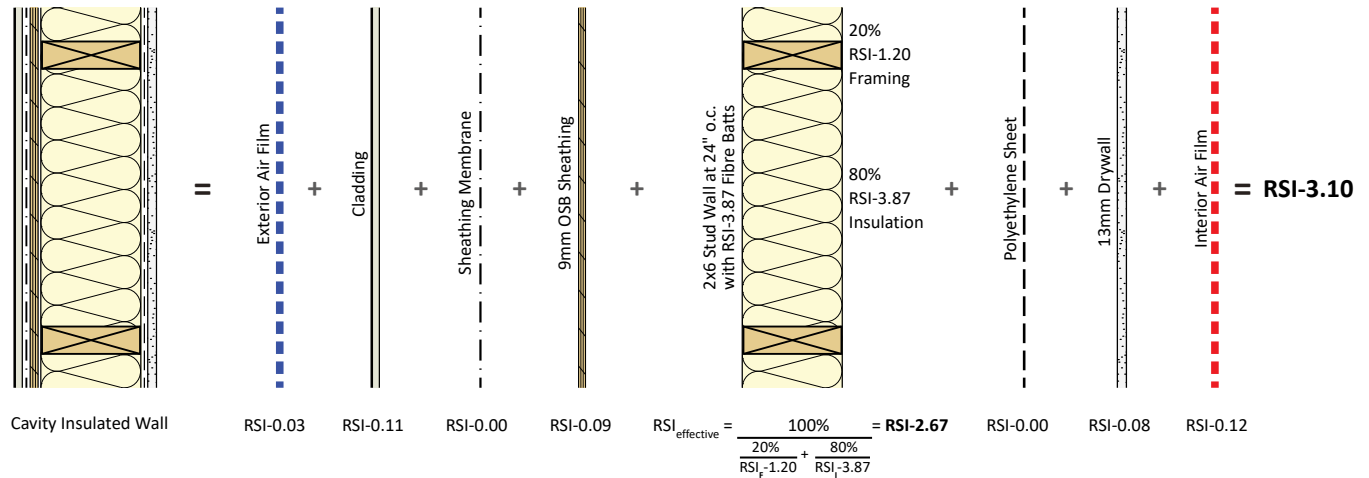
Add the RSI values for the continuous components in the assembly and the framed wall to arrive at an effective RSI value for the assembly. See next page (page 13) for further explanation.

7. Compare the calculated effective RSI value to the code requirements listed on page 7

Note #4 | Alternatively a wall calculator could be used. See the resources section of this document.

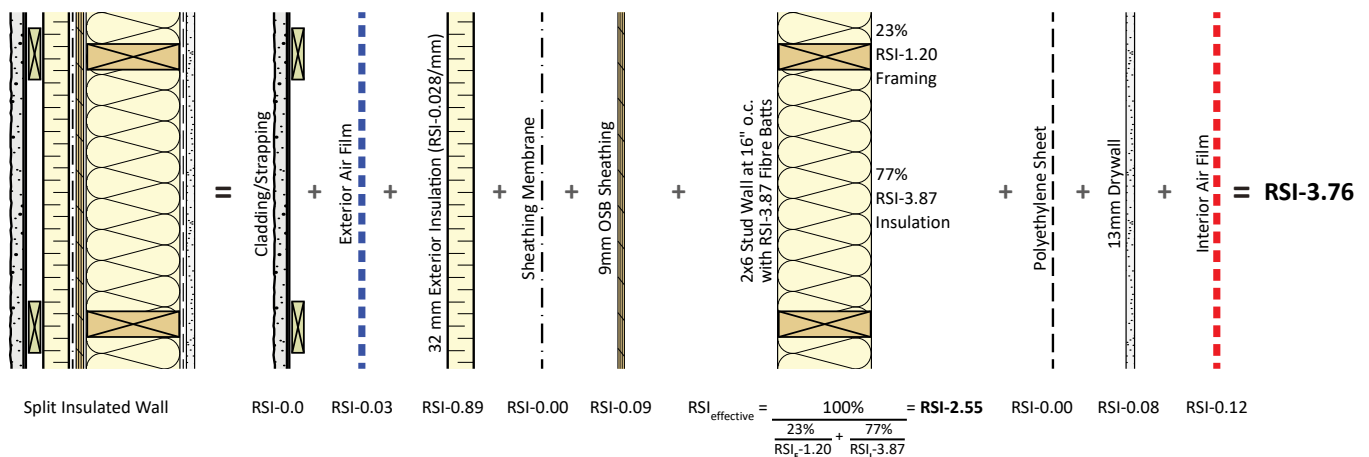
Effective RSI Value Example Calculations

Cavity Insulated Wall Assembly



Note #5 | For wall assemblies with no exterior vented air space behind the cladding, the insulation value of the cladding can be included in the effective RSI value calculation.

Split Insulated Wall Assembly with a Vented Air Space



Note #6 | Table A-9.36.2.4.(1)A in the Code does not explicitly assign an RSI value to exterior vented air cavities in a wall assembly, nor does it provide RSI values for air cavities less than 13 mm thick. An effective RSI-value of 0.03, equivalent to an exterior air film, can be assigned to exterior vented air spaces. The insulation value of the cladding is not included in the effective RSI value calculation.

Split Insulated Walls

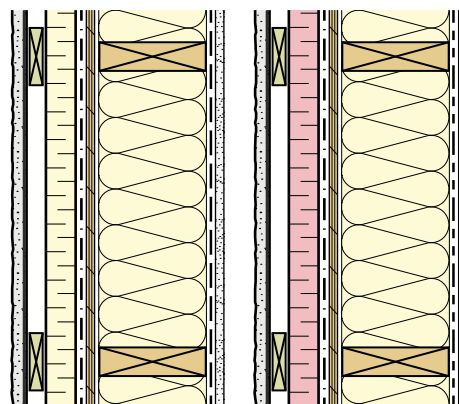
The permeability of the materials is of particular importance with respect to the drying capacity of the wall assembly. A relatively impermeable foam plastic insulation will not allow for moisture in the wall to dry outwards. If this insulation is installed in conjunction with an interior vapour retarder (i.e. polyethylene sheet), the two vapour retarders can trap moisture that inadvertently gets into the assembly and can potentially lead to fungal growth and decay.

To avoid this situation, when impermeable insulation is used, the ratio of the total thermal resistance of the sheathing and components outboard of the sheathing to the total thermal resistance of the components inboard of the sheathing should be compared to Table 9.25.5.2. in order to maintain the temperature of the interior surface of the sheathing at relatively safe levels and avoid condensation. While not explicitly required by the Code, a relatively more permeable interior vapour retarder such as a smart vapour retarder or vapour retarder paint could be used to permit some amount of inward drying. Additionally, a thin drainage layer can be included at the exterior of the sheathing membrane to facilitate drainage of any water which may penetrate behind the insulation. In general, a vapour permeable exterior insulation in combination with an interior vapour retarder typically provides a lower risk wall assembly than does an assembly using impermeable exterior insulation.

Code Compliance Paths for Split Insulated Wall Assemblies

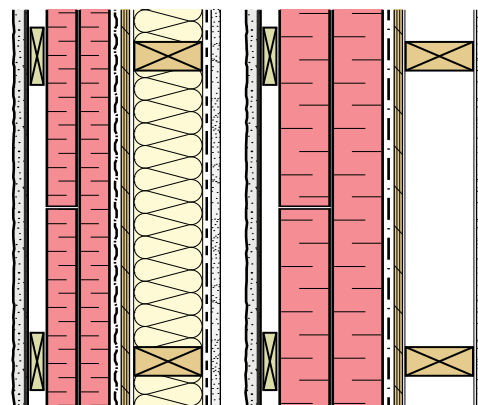
Relatively Permeable Exterior Insulation ($> 60 \text{ ng}/(\text{s}\cdot\text{m}^2\cdot\text{Pa})$)

Using permeable exterior insulation does not trigger the requirements regarding placement of impermeable insulation and consequently can comply with the Code. When using this approach it is important to consider the thickness of the insulation in determining its permeance. When exterior insulation with permeance relatively close to the code limit is used, it may be prudent to provide a relatively permeable interior vapour retarder such as a smart vapour retarder or vapour retarder paint, as well as a drainage layer behind the insulation.



Exterior-to-Interior Insulation Ratio (Table 9.25.5.2.)

When impermeable exterior insulation is used, the wall can comply by meeting the insulation ratio requirements of Table 9.25.5.2. which are intended to limit the potential for condensation within the wall assembly. Since outward drying in these assemblies is limited by the impermeable insulation, it may be prudent to provide a relatively permeable interior vapour retarder such as a smart vapour retarder or vapour retarder paint, as well as a drainage layer behind the insulation. The exterior-to-interior insulation ratio can also be taken to an extreme such that only exterior insulation is used.



Examples of Above Grade and Below Grade Assemblies

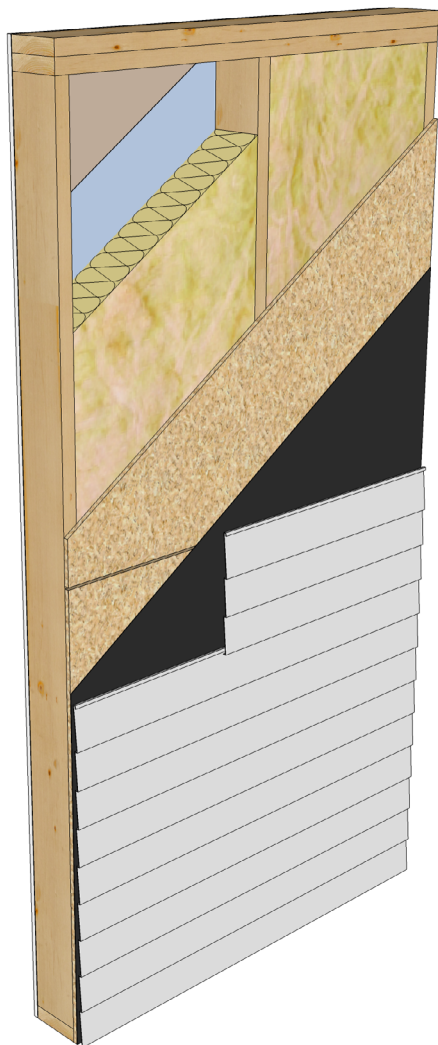
The series of examples in this section were selected to highlight RSI calculations that demonstrate various types of wall systems (interior insulated, split insulated, exterior insulated). The RSI values in the Code differ for various types of insulation and framing methods.

These examples are not meant to comprise all possible constructions or materials that could meet the effective RSI requirements. There are many other combinations of materials other than the specific ones shown in these examples that could be combined in varying combinations and thicknesses to meet or exceed code requirements. Please see the resources section of the guide for many more combinations of insulation materials.

The RSI values used in the calculation examples are taken from the 2014 Alberta Building Code Appendix A, Table 9.36.2.4.(1)D. These values may differ from the manufacturer's data. Please consult with manufacturer's data for exact RSI values for specific materials. To be consistent with tables in the Code, 400 mm and 600 mm has been used in the following assembly examples as the designation for framing spacing at 16 inches and 24 inches on centre.

Above Grade Assemblies

1 | 2x6 Wood-framed Wall with Mineral Fibre Batt Cavity Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior air film	-	-	0.03
Vinyl siding	-	-	0.11
Building paper	-	-	0.00
OSB sheathing	9.5	0.0098	0.09
2x6 wood framing at 24" o.c. filled with R22 batt insulation*	-	-	2.67*
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.10
(R-17.6)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

* RSI for 2x6 (38x140mm) wood framing at 24" (600mm) on centre filled with R22 mineral fibre batt insulation

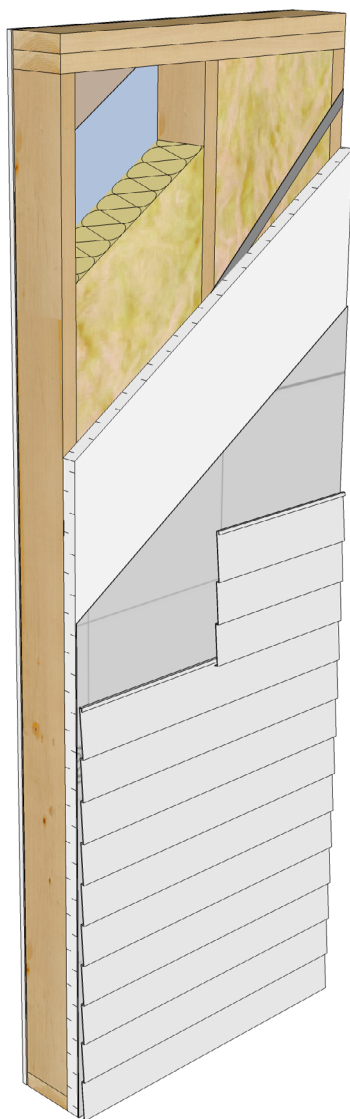
	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 600 mm o.c.	140	0.0085	1.19	$\frac{100}{20 + 80}$	= 2.67 (R-15.2)
R22 batt insulation	140	-	3.87	$\frac{1.19}{1.19} + \frac{80}{3.87}$	

Note #7 | When using the framing percentages in Table A-9.36.2.4.(1)A, the framing percentages account for lintels, double top plates and cripple studs. (See note 1, Appendix table A-9.36.2.4.(1) page A-246).

Note #8 | The Code differentiates between traditional framing and advanced framing (see glossary). If advanced framing is used it should be shown on the drawing set reviewed by the local authority. Builders must ensure their framers understand this and frame a home according to the drawings.

Note #9 | Thin membranes such as air barriers, vapour retarders, and water resistant barriers are not considered to have significant RSI values and therefore do not have values in the Code tables.

2 | 2x6 Wood-framed Wall with Glass Fibre Batt Cavity Insulation and Expanded Polystyrene (EPS) Exterior Insulation with Let-in Bracing



	Thickness (mm)	RSI/mm	RSI-value
Exterior air film	-	-	0.03
Vinyl siding	-	-	0.11
Housewrap	-	-	0.00
Type 1 EPS	38	0.026	0.99
Metal let-in bracing	-	-	0.00
2x6 wood framing at 16" o.c. filled with R20 batt insulation*	-	-	2.36*
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.69
(R-21.0)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

* RSI for 2x6 (38x140mm) wood framing at 16" (400mm) on centre filled with R20 glass fibre batt insulation

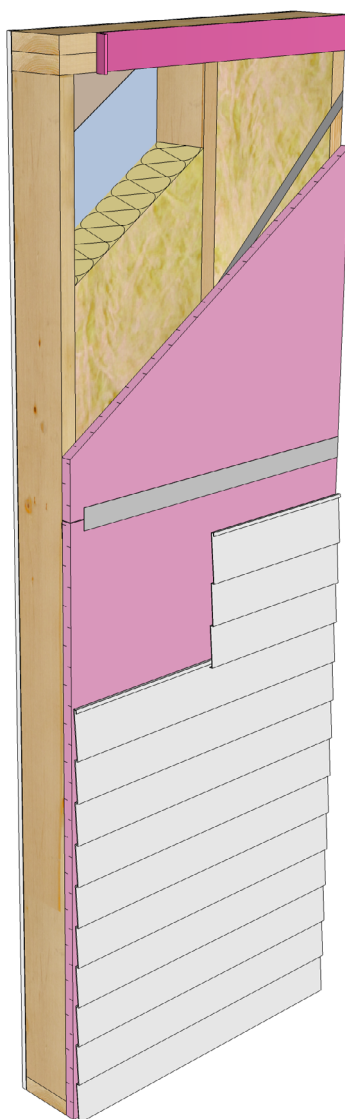
	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 400 mm o.c.	140	0.0085	1.19	$\frac{100}{23} = 4.35$	$\frac{1.19}{4.35} = 0.27$ (R-13.4)
R20 batt insulation	140	-	3.34	$\frac{100}{77} = 1.30$	
				$4.35 + 1.30 = 5.65$	
				$\frac{1.19}{5.65} = 0.21$	

Note #10 | R20 Glass fibre batts are currently only manufactured in 152 mm thickness. The RSI value used should be that for compressed R20 glass fibre batt as shown in Table 9.36.2.4.(1) D and the accompanying note 7. (Mineral fibre batts are currently not manufactured with an R-value of 20.)

Note #11 | Minimum thickness of EPS and XPS rigid insulation used as wall sheathing to provide backing for exterior cladding as per Sentence 9.23.17.2.(1) shall comply with Table 9.23.17.2.A in the Alberta Building Code.

Note #12 | Thin metal bracing used to diagonally brace the wall section as per Sentence 9.23.10.2.(1) of the Alberta Building Code does not significantly detract the RSI of the wall and is not addressed by the Code for RSI calculation.

3 | 2x6 Wood-framed Wall with Glass Fibre Batt Cavity Insulation and Extruded Polystyrene Insulation (XPS) with Let-in Bracing



	Thickness (mm)	RSI/mm	RSI-value
Exterior air film	-	-	0.03
Vinyl siding	-	-	0.11
Taped XPS Type 3	25	0.035	0.88
Metal let-in bracing	-	-	0.00
2x6 wood framing at 16" o.c. filled with R20 batt insulation*	-	-	2.36*
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.58
(R-20.3)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

* RSI for 2x6 (38x140mm) wood framing at 16" (400mm) on centre filled with R20 glass fibre batt insulation

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 400 mm o.c.	140	0.0085	1.19	$\frac{100}{23}$	= 2.36 (R-13.4)
R20 batt insulation	140	-	3.34	$\frac{77}{1.19} + 3.34$	

Note #13 | Thin metal bracing used to diagonally brace the wall section as per Sentence 9.23.10.2.(1) of the Alberta Building Code does not significantly detract the RSI of the wall and is not addressed by the Code for RSI calculation.

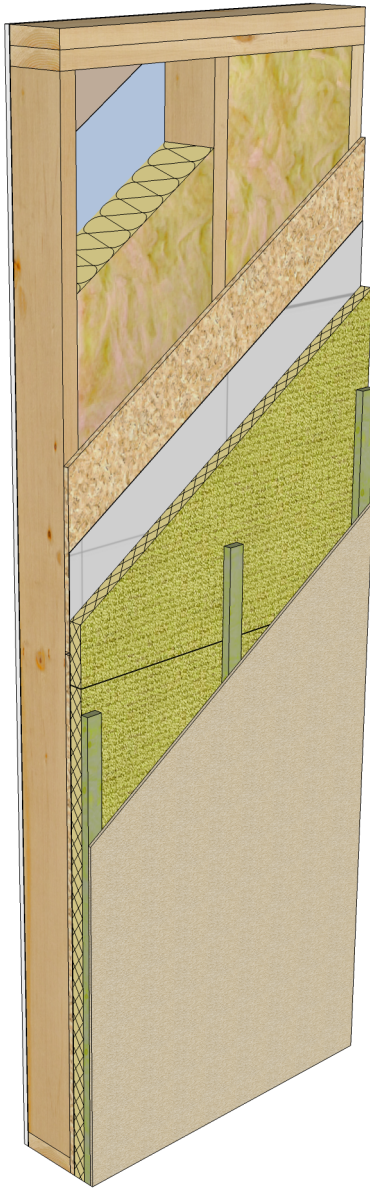
Note #14 | If exterior sheathing is sealed to act as an air barrier, the additional airtightness does not contribute extra RSI value to the wall assembly RSI value.

Note #15 | Either EPS or XPS can be used as an air barrier in this type of application.

Note #16 | Assemblies with exterior rigid polystyrene may still need to meet 9.25.5.2. for the appropriate ratio of inboard and outboard insulation as their vapour permeability is relatively low.

Note #17 | R20 Glass fibre batts are currently only manufactured in 152 mm thickness. The RSI value used should be that for compressed R20 glass fibre batt as shown in Table 9.36.2.4.(1) D and the accompanying note 7. (Mineral fibre batts are currently not manufactured with an R-value of 20.)

4 | 2x6 Wood-framed Wall with Mineral Fibre Batt Cavity Insulation and Strapped Semi-rigid Mineral Fibre Insulation



	Thickness (mm)	RSI/mm	RSI-value
Cladding on wood strapping	-	-	0.00
Exterior air film	-	-	0.03
Semi-rigid mineral fibre insulation	32	0.0277	0.89
Housewrap	-	-	0.00
OSB sheathing	9.5	0.0098	0.09
2x6 wood framing at 16" o.c. filled with R22 batt insulation*	-	-	2.55*
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.76
(R-21.4)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

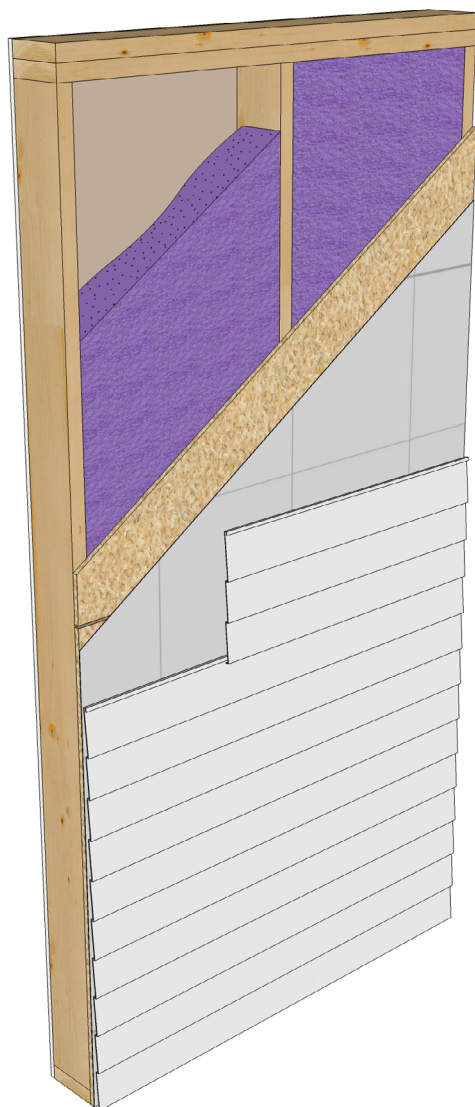
* RSI for 2x6 (38x140mm) wood framing at 16" (400mm) on centre filled with R22 mineral fibre batt insulation

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 400 mm o.c.	140	0.0085	1.19	$\frac{100}{23 + 77}$	= 2.55 (R-14.5)
R22 batt insulation	140	-	3.87	$\frac{1.19}{3.87}$	

Note #18 | Semi-rigid exterior insulations require strapping or special fasteners to hold them to the substrate.

Note #19 | For exterior vented air cavities, an effective RSI-value of 0.03 can be assigned. The insulation value of the cladding is not included in the effective RSI value calculation.

5 | 2x6 Wood-framed Wall with Closed Cell Spray Foam Cavity Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior air film	-	-	0.03
Vinyl siding	-	-	0.11
Housewrap	-	-	0.00
OSB sheathing	9.5	0.0098	0.09
2x6 wood framing at 24" o.c. filled with 5" of medium density spray foam insulation*	-	-	2.78*
Air cavity in framing	13	-	0.16
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.37
(R-19.1)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

* RSI for 2x6 (38x140mm) wood framing at 24" (600mm) on centre filled with 5" (127mm) of medium density spray foam insulation

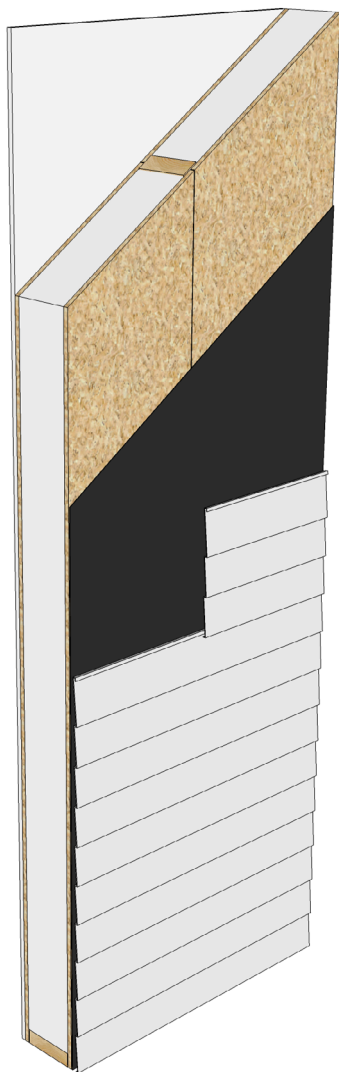
	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 600 mm o.c.	127	0.0085	1.08	$\frac{100}{20} = 5.0$	$\frac{1.08}{5.0} = 0.216$ = 2.78 (R-15.8)
Medium density spray foam insulation	127	0.036	4.57	$\frac{80}{4.57} = 17.5$	

Note #20 | Although the Code provides generic RSI values for medium density and light density spray foams, for accurate values consult the manufacturer of the material being used.

Note #21 | The insulation value of interior air cavities, such as between components or within the stud space, can be included in the effective RSI calculation for the wall assembly as per Table A-9.36.2.4.(1)A. Confirm with the local authority that the consideration for specific air cavities in the effective RSI calculation is acceptable.

Note #22 | Where foam plastic insulation functions as the vapour retarder it must meet the requirements of 9.25.4.2.(6).

6 | Structural Insulated Panels (SIPs) with Expanded Polystyrene (EPS) Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior air film	-	-	0.03
Vinyl siding	-	-	0.11
Building paper	-	-	0.00
OSB sheathing	11	0.0098	0.11
143 mm EPS Type 1 insulation with 2x6 framing at 4' o.c.*	-	-	2.87*
OSB sheathing	11	0.0098	0.11
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.43
(R-19.5)

Zone 6 requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7A requirement (No HRV / HRV) **3.08 / 2.97**

Zone 7B requirement (No HRV / HRV) **3.85 / 3.08**

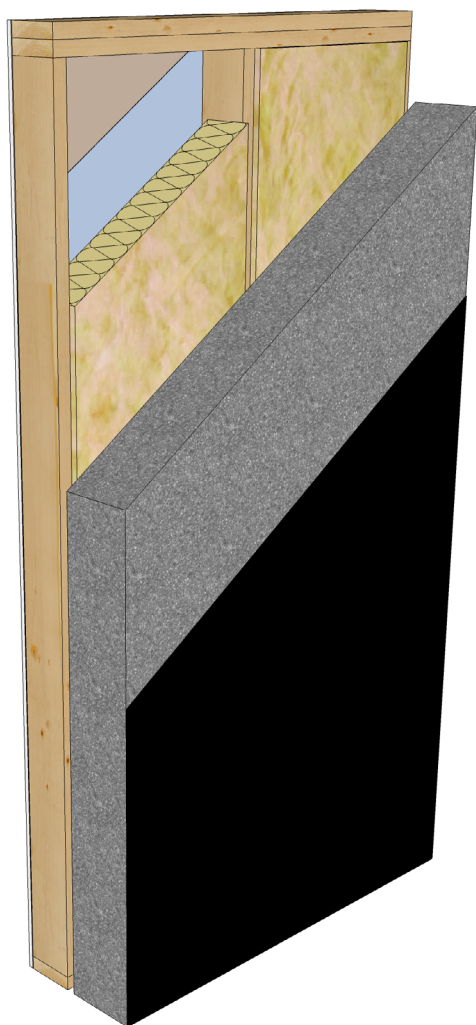
* RSI for 6 1/2" (165mm) structural insulated panels (SIPs) faced with 11mm OSB, filled with 143mm of type 1 EPS insulation and joined every 4' (1200mm) with 2x6 (38x140mm) wood framing

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 1200 mm o.c.	140	0.0085	1.19	$\frac{100}{14} = 7.14$	= 2.87 (R-16.3)
EPS Type 1 insulation	143	0.026	3.72	$\frac{86}{1.19} + 3.72$	

Note #23 | The framing factor varies depending on manufacturer, product and panel size.

Below Grade Assemblies

7 | Concrete Wall, Interior Wood-framed Wall with Mineral Fibre Batt Cavity Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior water-/dampproofing	-	-	0.00
Concrete wall	203	0.0004	0.08
1/2" batt insulation against concrete	13	0.030	0.39
2x6 wood framing at 24" o.c. filled with R24 batt insulation*	-	-	2.53*
Air cavity in framing	13	-	0.16
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.36
(R-19.1)

Zone 6 requirement (No HRV / RSI HRV) **2.98 / 2.98**

Zone 7A requirement (No HRV / RSI HRV) **3.46 / 2.98**

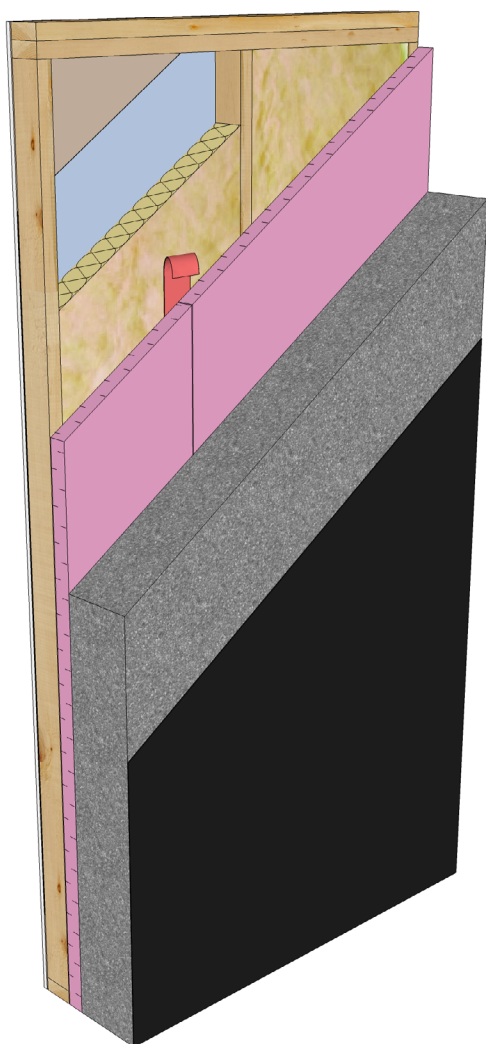
Zone 7B requirement (No HRV / RSI HRV) **3.46 / 2.98**

* RSI for 2x6 (38x140mm) wood framing at 24" (600mm) on centre with 5" (127mm) R24 mineral fibre batt insulation

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 600 mm o.c.	127	0.0085	1.08	$\frac{100}{20} \times 1.08 = 5.4$	= 2.53 (R-14.4)
R24 batt insulation	127	0.030	3.81	$\frac{100}{80} \times 3.81 = 4.76$	
				5.4 + 4.76	

Note #24 | The insulation value of interior air cavities, such as between components or within the stud space, can be included in the effective RSI calculation for the wall assembly as per Table A-9.36.2.4.(1)A. Confirm with the local authority that the consideration for specific air cavities in the effective RSI calculation is acceptable.

8 | Concrete Wall, Interior Wood-framed Wall with Fibre Batt Cavity Insulation and Extruded Polystyrene (XPS)



	Thickness (mm)	RSI/mm	RSI-value
Exterior water-/dampproofing	-	-	0.00
Concrete wall	203	0.0004	0.08
Taped XPS Type 3	51	0.035	1.79
2x4 wood framing at 24" o.c. filled with R14 batt insulation*	-	-	1.70*
Polyethylene sheet	-	-	0.00
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.77
(R-21.4)

Zone 6 requirement (No HRV / RSI HRV) **2.98 / 2.98**

Zone 7A requirement (No HRV / RSI HRV) **3.46 / 2.98**

Zone 7B requirement (No HRV / RSI HRV) **3.46 / 2.98**

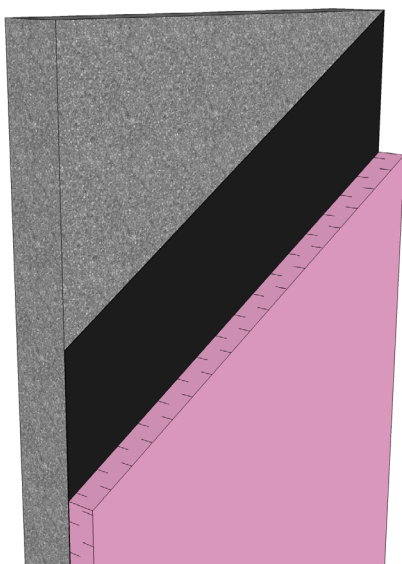
* RSI for 2x4 (38x89mm) wood framing at 24" (600mm) on centre filled with R14 fibre batt insulation

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x89 wood studs at 600 mm o.c.	89	0.0085	0.76	100	
				20	
				80	
					= 1.70 (R-9.7)
R14 batt insulation	89	-	2.46	0.76 + 2.46	

Note #25 | Although rigid foam (low permeability) is used at the concrete foundation wall, this assembly still requires an interior vapour retarder (interior of the batt insulation) in order to meet code requirements. Given the limited outward drying capacity of this assembly, it may be prudent to use a relatively permeable interior vapour retarder such as a smart vapour retarder or vapour retarder paint.

Note #26 | Expanded or extruded rigid polystyrene, spray foam as well as rigid mineral fibre or fibreglass insulation can also be used on the interior of a below grade foundation wall. Insulation placed directly against the foundation wall should be glued or tightly secured against the concrete surface in order to reduce the risk of condensation. In all cases, it may be prudent to use a relatively permeable interior vapour retarder such as a smart vapour retarder or vapour retarder paint. See the resource section for more details.

9 | Concrete Wall with Exterior Extruded Polystyrene (XPS) Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior water-/dampproofing	-	-	0.00
XPS Type 3	102	0.035	3.57
Concrete wall	203	0.0004	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.77
(R-21.4)

Zone 6 requirement (No HRV / RSI HRV) **2.98 / 2.98**

Zone 7A requirement (No HRV / RSI HRV) **3.46 / 2.98**

Zone 7B requirement (No HRV / RSI HRV) **3.46 / 2.98**

Note #27 | Rigid or mineral or glass fibre insulation and spray foam can also be used on the foundation wall exterior below grade. See resource section for more details.

10 | Insulating Concrete Form (ICF) Wall



	Thickness (mm)	RSI/mm	RSI-value
Exterior water-/dampproofing	-	-	0.00
EPS Type 2	70	0.028	1.96
Concrete wall	152	0.0004	0.06
EPS Type 2	70	0.028	1.96
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 4.22
(R-24.0)

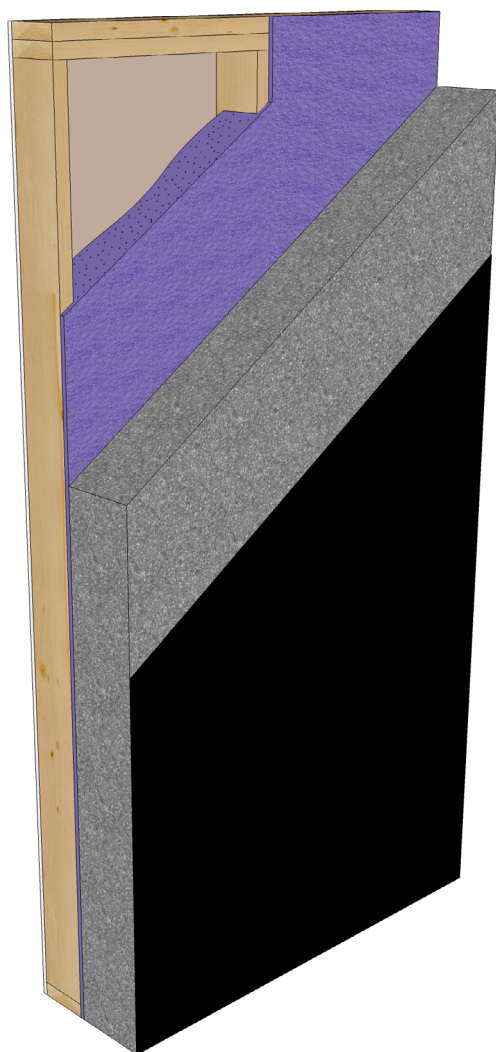
Zone 6 requirement (No HRV / RSI HRV) **2.98 / 2.98**

Zone 7A requirement (No HRV / RSI HRV) **3.46 / 2.98**

Zone 7B requirement (No HRV / RSI HRV) **3.46 / 2.98**

Note #28 | The ICF form ties are not accounted for in the RSI value calculation due to limited thermal bridging through the plastic.

11 | Concrete Wall, Interior Wood-framed Wall with Closed Cell Spray Foam Cavity Insulation



	Thickness (mm)	RSI/mm	RSI-value
Exterior water-/dampproofing	-	-	0.00
Concrete wall	203	0.0004	0.08
1/2" medium density spray foam insulation	13	0.036	0.47
2x6 mm wood framing at 24" o.c. filled with 5" of medium density spray foam insulation*	-	-	2.78*
Air cavity in framing	13	-	0.16
Gypsum board	12.7	0.0061	0.08
Interior air film	-	-	0.12

Assembly effective RSI = 3.69
(R-21.0)

Zone 6 requirement (No HRV / RSI HRV) **2.98 / 2.98**

Zone 7A requirement (No HRV / RSI HRV) **3.46 / 2.98**

Zone 7B requirement (No HRV / RSI HRV) **3.46 / 2.98**

* RSI for 2x6 (38x140mm) wood framing at 24" (600mm) on centre filled with 5" (127mm) of medium density spray foam insulation

	Thickness (mm)	RSI/mm	RSI-value (R-value)	Effective RSI-value calculation	RSI-value Effective
38x140 wood studs at 600 mm o.c.	127	0.0085	1.08	$\frac{100}{20 + 80}$	= 2.78 (R-15.8)
Medium density spray foam insulation	127	0.036	4.57	$\frac{1.08}{1.08} + \frac{80}{4.57}$	

Note #29 | The type and thickness of spray foam in a cavity will determine if an air barrier and vapour retarder are required behind the gypsum board. Closed cell foam may act as both the air barrier and vapour retarder when it is in contact with the concrete wall.

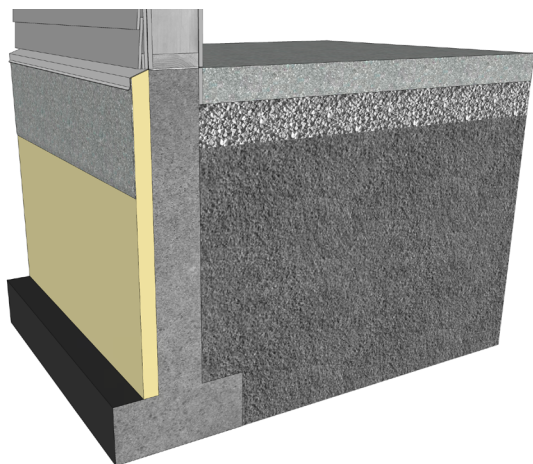
Note #30 | Although the Code provides generic RSI values for medium density and light density spray foams, for accurate values consult the manufacturer of the material being used.

Note #31 | The insulation value of interior air cavities, such as between components or within the stud space, can be included in the effective RSI calculation for the wall assembly as per Table A-9.36.2.4.(1)A. Confirm with the local authority that the consideration for specific air cavities in the effective RSI calculation is acceptable.

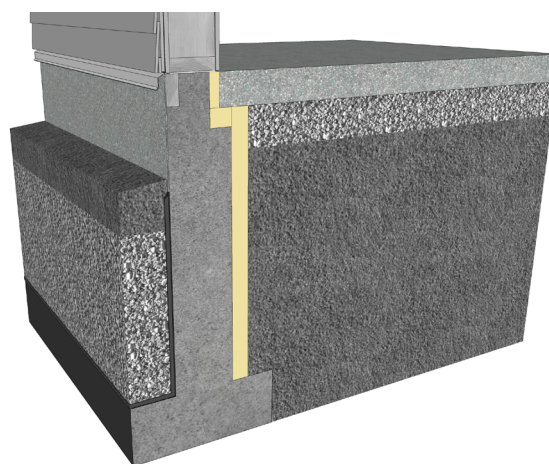
Insulation of Unheated and Heated Slabs Above Frost Line

In Alberta the most common type of unheated slab situated above the frost line is the slab for a walk-out basement.

Insulation Placement for Unheated Slabs

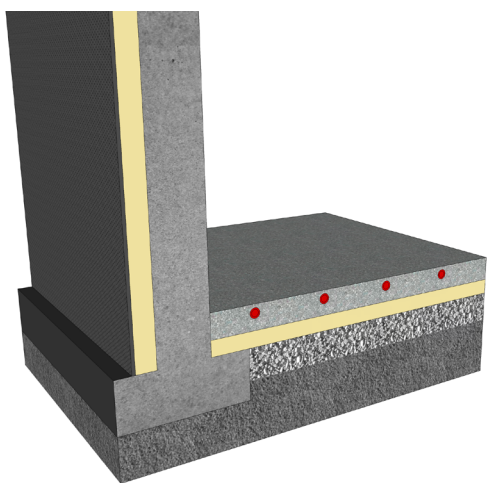


Slab on grade at foundation wall with exterior insulation to the footing.

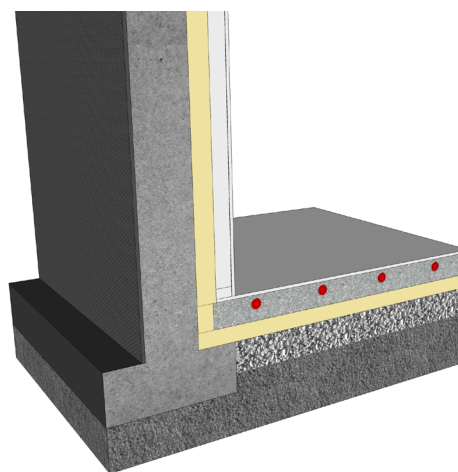


Slab on grade at foundation wall with interior insulation to the footing with a thermal break at the slab.

Insulation Placement for Heated Slabs



Exterior insulation to the footing and insulation under all heated slab areas.



Interior wall insulation and insulation under all heated slab areas.

Note #32 | The plane of the air barrier must also be sealed for soil gas mitigation. See section A-9.13.4.

Note #33 | Many types of insulation such as expanded or extruded rigid polystyrene, closed cell spray foams and semi-rigid fibre insulations can be used below grade. See the resource section for more types of insulation details.

Windows, Doors and Skylights (9.36.2.7.)

Windows, doors, skylights and other types of fenestration such as glass blocks that separate conditioned space from unconditioned space or the exterior must have an overall thermal transmittance value (USI value) not greater than or an Energy Rating not less than those shown in **Table 2** below.

Table 2: Required insulation values for windows, doors and skylights (from table 9.36.2.7.A.)

	Thermal Characteristics	Zone 6	Zone 7A	Zone 7B
Doors and windows	Maximum USI-value ($\text{W}/\text{m}^2\cdot\text{K}$)	1.60	1.60	1.40
	Minimum Energy Rating (ER)	25	25	29
Skylights	Maximum USI-value ($\text{W}/\text{m}^2\cdot\text{K}$)	2.70	2.70	2.40
Glass block assemblies	Maximum USI-value ($\text{W}/\text{m}^2\cdot\text{K}$)	2.9	2.9	2.9
Vehicle access doors	Minimum RSI-value ($\text{m}^2\cdot\text{K}/\text{W}$)	1.1	1.1	1.1

Note #34 | Glass block area is limited to a total aggregate area of 1.85 m^2 . See 9.36.2.7.(4).

USI-values and Energy Ratings—Which to Use?

The Code allows windows to qualify under two different energy performance rating methods: by USI-value, and by Energy Rating (ER). A USI-value reports the rate of heat loss through windows under standardized winter conditions. The USI-value does not take solar heat gain into account. The ER reports an overall energy balance rating that takes account of passive solar heat gain in addition to heat loss.

The ER is intended for use in homes with average window-to-wall ratios, and an approximately even distribution of windows on all sides of the home, and no external window shading devices. In such homes it has been shown to be more effective for selecting windows for lowest year round energy use. The ER is not recommended for homes with higher window-to-wall ratios (above 30%), or with windows facing primarily one or two orientations. Under these conditions occupants could face heating discomfort, or fail to obtain the benefits of moderate passive solar heat gain.

For homes with high window to wall ratios, or windows primarily facing one or two orientations, windows should be selected on the basis of USI-value, and with consideration to reduce occupant discomfort from excessive solar heat gain by use of external shading or glass with lower solar heat gain.

Does Every Window and Door Need to Comply With These Prescriptive USI-value/Energy Rating Requirements?

There is some flexibility. Section 9.36. allows trade-offs, in which a better performing window or glass door can compensate for a worse-performing product having the same orientation. It also has a performance path, and it is possible that homes designed under the performance path could accommodate several products that have worse than prescriptive ratings.

Sentence 9.36.2.7.(9) also relaxes the USI-value requirement for one door in a home. The intent is to allow decorative or heritage style entrance doors to be used which might be constructed of materials that cannot achieve the prescriptive USI-values. As the type of door is not qualified, this higher USI-value can be used for any door in the home.

Sentence 9.36.2.7.(3) allows site-built products to comply by using prescriptive glazing in Table 9.36.2.7.C. instead of USI-values or Energy Ratings.

Factory Glazed versus Site-built Products

What is a site-built window or door product? The Code does not define this term, but the title of sub-section 9.7.5. suggests this term can refer to fenestration products outside the scope of the NAFS standard. The Code recognizes that determining the USI-values for these “commercial” products is not as straightforward as it is for residential factory glazed window and door manufacturers, and allows the prescriptive glass types defined in Table 9.36.2.7.C. to be used. Site-built products glazed with the glass types in this table do not have to comply with the USI-value requirements in Table 9.36.2.7.A., reproduced on page 27. This table applies to glass in site-built doors as well.

About Energy Performance Labels

The Code requires factory glazed window, door and skylight products to be labeled with energy performance ratings determined according to specified CSA or NFRC standards. As energy performance requirements are new to the Code, builders are encouraged to discuss the energy performance requirements with suppliers before ordering products.

Airtightness (9.36.2.9.)

As part of the prescriptive requirements, article 9.36.2.9. requires an air barrier system which is continuous:

- Across construction, control and expansion joints,
- Across junctions between different building materials and assemblies, and
- Around penetrations through all building assemblies.

In addition:

- Vehicle access doors that separate HEATED garages from unconditioned space must be weather-stripped.
- Fireplaces must be equipped with doors or other closures to restrict air movement up the chimney when the fireplace is not in use.
- Other specific requirements found in Article 9.36.2.9.

Besides the prescriptive path, the Code also offers performance compliance. See the Code for further information.

Air Barrier Systems

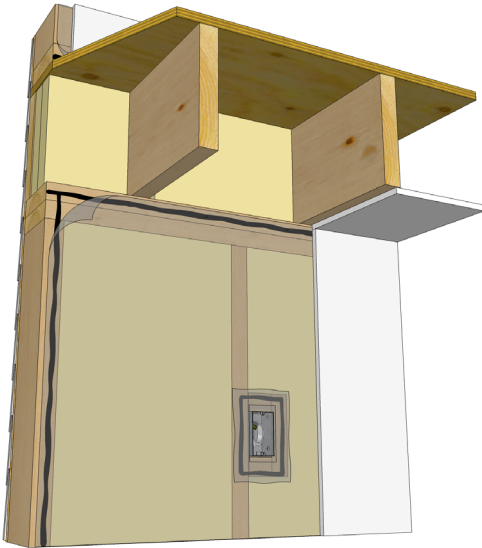
An air barrier system is used to control the flow of air into and out of a building. Control of these airflows is important to limit energy loss due to exfiltration, to reduce the potential for air leakage and associated condensation, for occupant comfort, and for indoor air quality.

For an air barrier to be effective, it must meet five design requirements:

1. All the elements (materials) of the air barrier system must be adequately air-impermeable.
2. The air barrier system must be continuous throughout the building enclosure including at transition and penetration details.
3. The air barrier system must be structurally adequate or be supported to resist air pressure forces due to peak wind loads, sustained stack effect, and mechanical equipment such as fans.
4. The air barrier system must be sufficiently rigid or be supported so that displacement under pressure does not compromise its performance or that of other elements of the assembly.
5. The air barrier system should have a service life as long as that of the surrounding assembly components or alternately be easily accessible for repair or replacement.

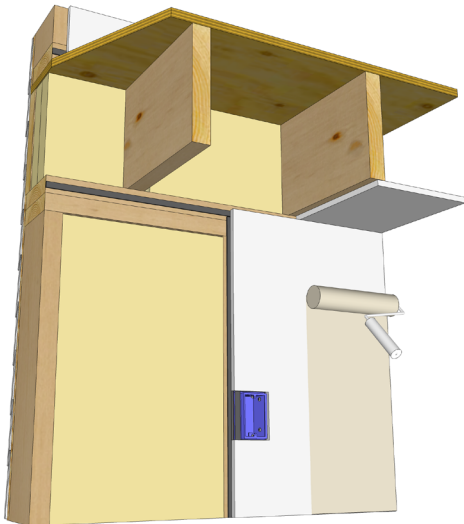
A number of different systems exist which can fulfill these requirements, and each has potentially positive and negative attributes. The following pages outline various common interior and exterior air barrier systems.

Interior Air Barrier Systems



Sealed Polyethylene (or other membranes)

In the sealed polyethylene sheet air barrier system approach, the polyethylene sheet installed to the interior of the stud cavity is sealed at all transitions and penetrations with tapes and sealants to provide a continuous air barrier system. The polyethylene sheet is clamped between the framing and the gypsum wall board which provide the necessary structural support. A similar approach can also be used with alternative sheet products such as smart vapour retarders or other appropriate membranes.

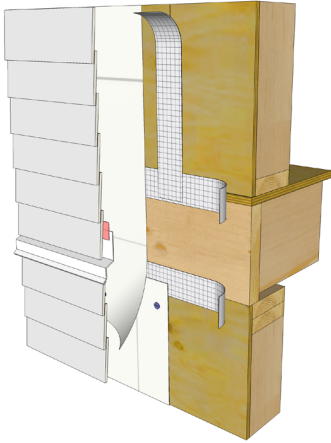


Airtight Drywall Approach (ADA)

In the ADA, the interior gypsum wall board (i.e. drywall) provides the air barrier system, and continuity is maintained using sealants and/or gaskets. Special attention must be paid to ensure continuity at intersections of the exterior walls with partition walls, ceilings, and floors. This assembly may also use a vapour retarder paint rather than polyethylene as the vapour retarder.

Note #35 | While spray foam can often be used as part of the air barrier at transitions and interfaces, such as at the rim joist, its use over the whole assembly would generally not be considered a complete air barrier approach. Also note, where foam plastic insulation functions as the vapour retarder it must meet the requirements of 9.25.4.2.(6).

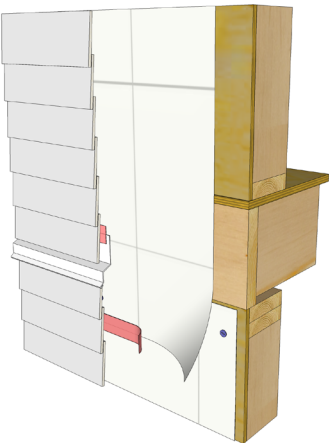
Exterior Air Barrier Systems



Sealed Sheathing

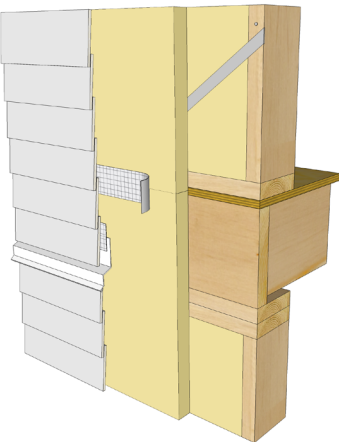
The sealed sheathing air barrier system approach consists of sealing the joints between sheathing boards using membrane, tape, or sealant so that the sheathing itself provides the air barrier. As the sheathing itself is rigid and fastened to the studs, no additional support is typically required for this system.

Penetrations such as ducts through this air barrier system must be sealed.



Sealed Sheathing Membrane

The sheathing membrane, which is usually installed as a water resistive barrier (WRB), can also function as the air barrier. Both mechanically fastened and self-adhered sheet membranes can potentially be used. For mechanically fastened systems, the laps between sheets should be sealed, and in all systems penetrations and transitions should be sealed. While adhesion and fastening of these systems provides some support, often the cladding, wood strapping, or exterior insulation provide improved support for these systems.



Sealed Exterior Rigid Polystyrene Insulation

The joints between the insulation boards are sealed with a specialized tape and the boards are sealed or gasketed on the backside around the perimeter of the assembly. Insulation boards typically cover the rim joist area.

Penetrations such as ducts through this air barrier system must be sealed.

Note #36 | Tapes and sealants are to be compatible with the materials they are installed to seal.

Construction of Air Barrier Details (9.36.2.10.)

The Code identifies electrical wiring penetrations, joints at foundation walls, the interfaces around windows and doors, cantilevered floors, interior walls that meet exterior spaces, chimneys, ducts, plumbing stacks, and party walls as typical potentially problematic locations for air sealing. The locations are highlighted in **Figure 3** below. See the following pages for detailed information for each location, which assume an interior polyethylene sheet as the primary air barrier. As discussed in the previous section, many alternate air barrier systems exist.

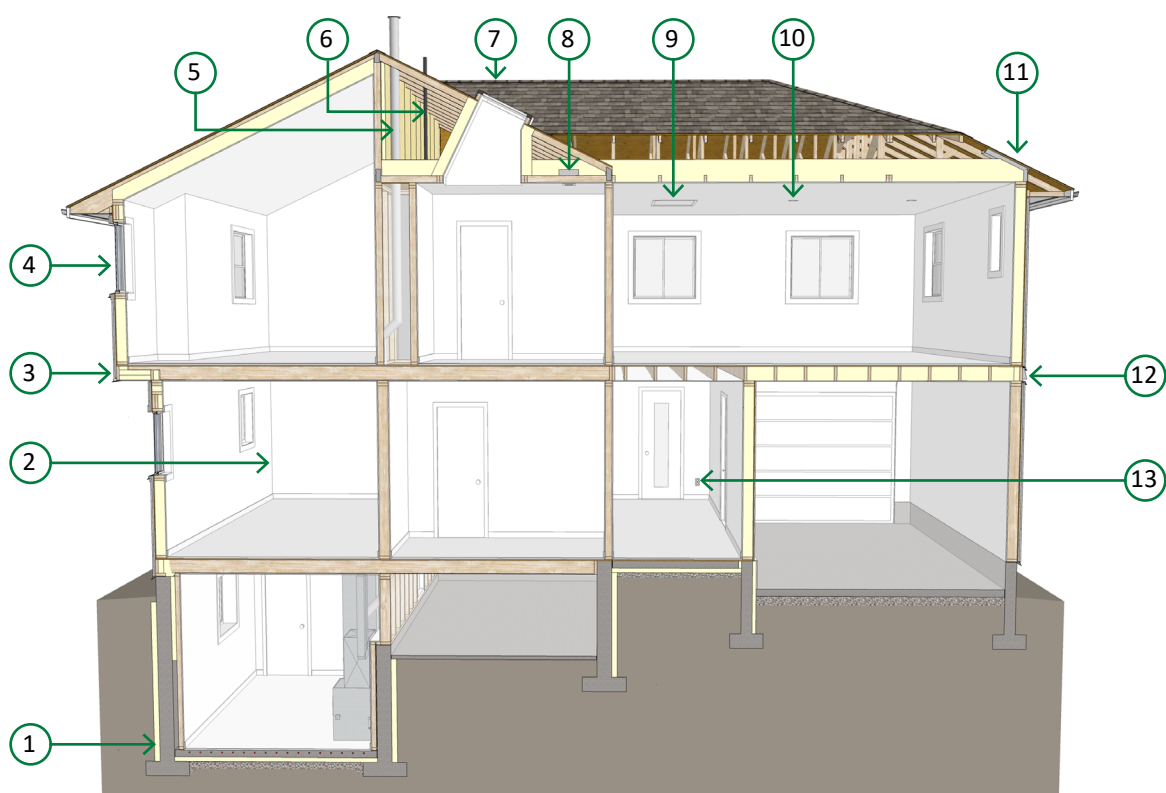
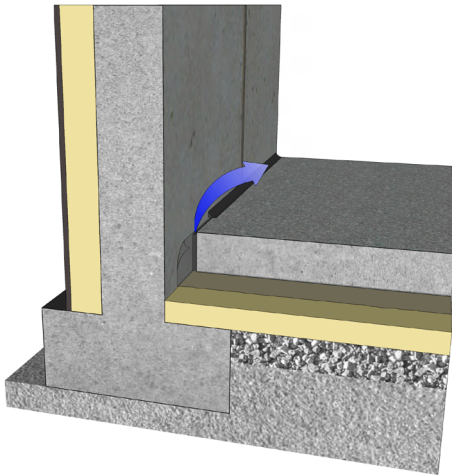
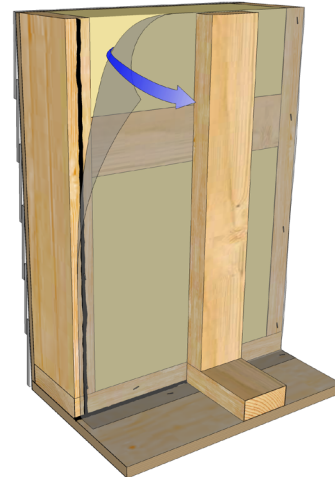


Figure 3: Typical Focus Areas for Air Sealing



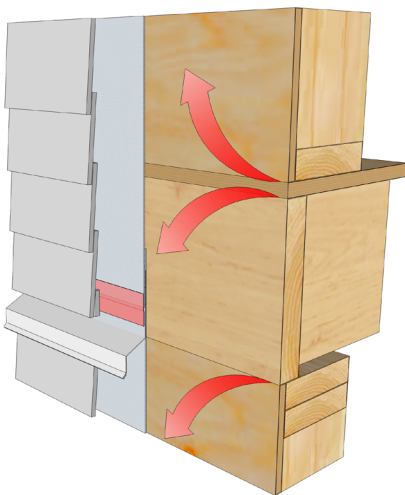
1 Slab Foundation Wall

The floor slab air barrier must be made airtight by connecting the air barrier to the element that forms the air barrier in the foundation wall. In most cases this will be a connection between the polyethylene and the foundation wall.



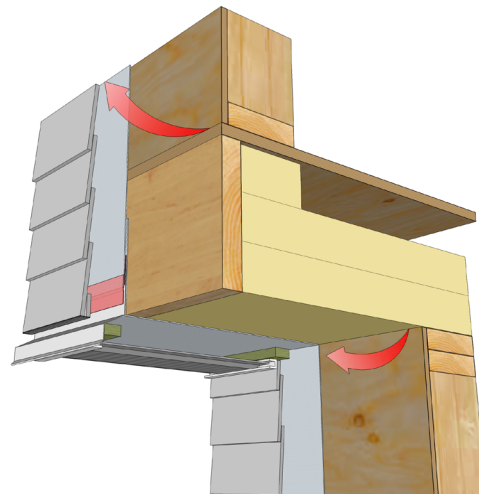
2 Interior Wall Interface

Interior walls that meet exterior walls or ceilings with an interior plane of airtightness must be made airtight by either sealing all junctions between the structural components, covering the structural components with an air barrier material and sealing it to the adjacent air barrier material, or maintaining the continuity of the air barrier system through the interior wall.



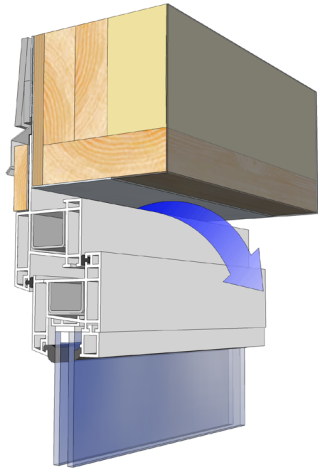
3a Rim Joist

All joints at the rim joist assembly must be made airtight by sealing all joints and junctions between the structural components, or covering the structural components with an air barrier material.



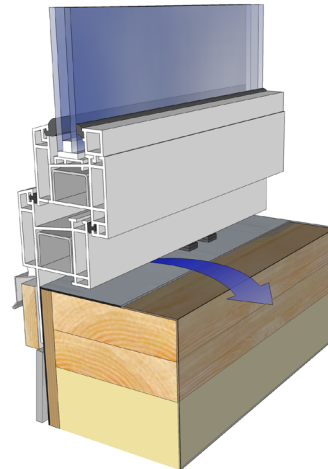
3b Cantilevered Floor

Cantilevered floors and floors over unheated/exterior space must be made airtight by sealing all joints and junctions between the structural components, or covering the structural components with an air barrier material and sealing it to the adjacent air barrier material.



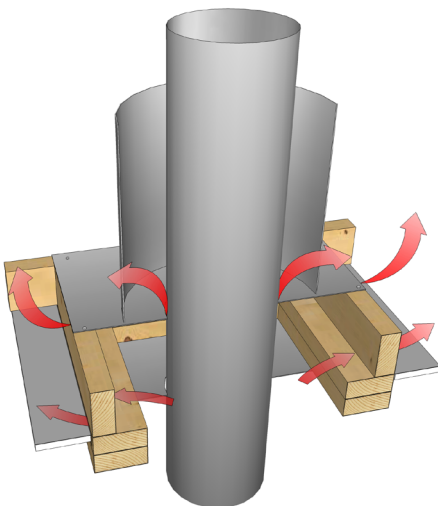
4a Window Head

The interface between the window head/jamb and the wall assembly must be made airtight by sealing all joints and junctions between the air barrier material in the wall and the window. The requirement also applies to doors and skylights.



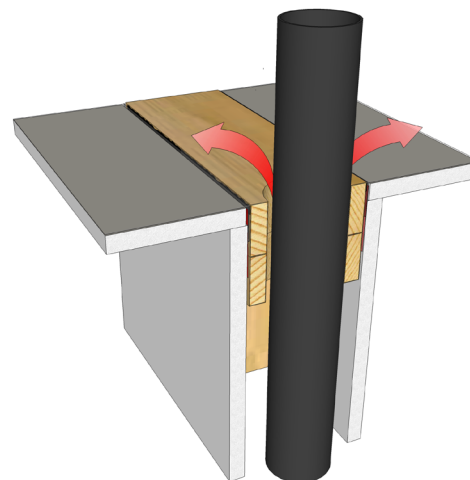
4b Window Sill

The interface between the window sill and the wall assembly must be made airtight by sealing all joints and junctions between the air barrier material in the wall and the window. The requirement also applies to doors and skylights.



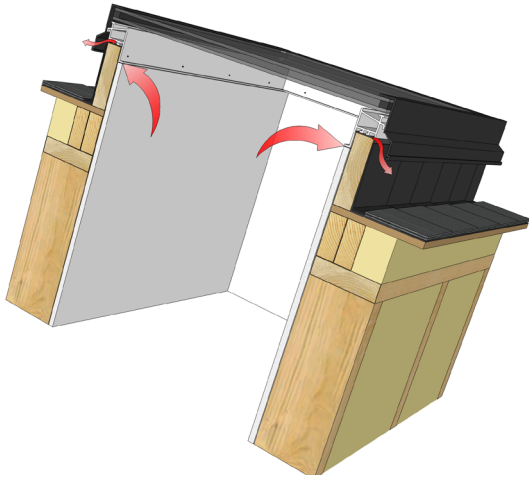
5 Mechanical Flues and Chimneys

Steel-lined chimneys that penetrate the building envelope must be made airtight by blocking the void between required clearances for metal chimneys and surrounding construction with sheet metal and sealant capable of withstanding high temperatures.



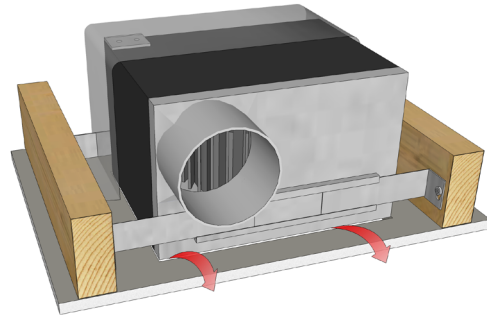
6 Plumbing Stacks

Plumbing vent stack pipes that penetrate the building envelope must be made airtight by either sealing the air barrier material to the vent stack pipe with a compatible material or sheathing tape, or installing a rubber gasket or prefabricated roof flashing at the penetration of the plane of airtightness and sealing it to the adjacent air barrier.



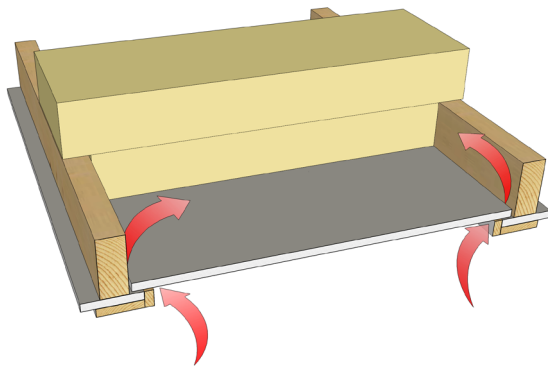
7 Skylights

The interface between the skylight and wall assembly must be made airtight by sealing all joints and junctions between the air barrier material in the wall and the skylight.



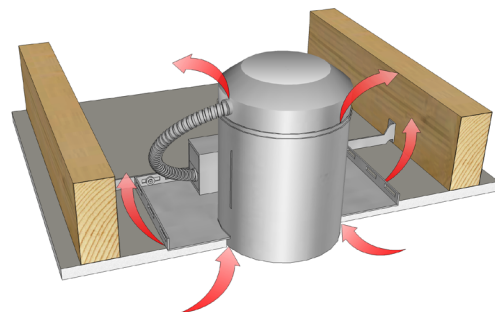
8 Bathroom Exhaust Fans

Bathroom exhaust fans are another air leakage point through the ceiling plane into the attic. Air leakage occurs between the housing and the air barrier and through the perimeter at electrical connections and the duct port. Installing a box or a polyethylene cover which is sealed to the air barrier around the bathroom fan is an effective way to deal with this issue.



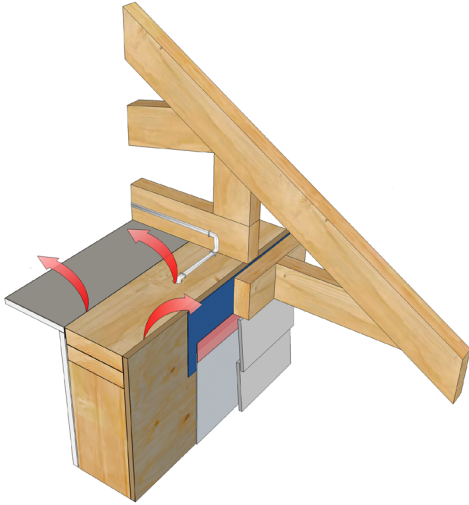
9 Attic Hatches

Air leakage occurs through the joint between the hatch and the air barrier in the ceiling. The hatch is most often a piece of gypsum board cut to size resting on a ledge made from wood trim or the edge of the ceiling. Air sealing can be achieved by ensuring the hatch is sized properly so that it has enough contact with the opening ledge and providing a closed cell foam gasket around the perimeter.



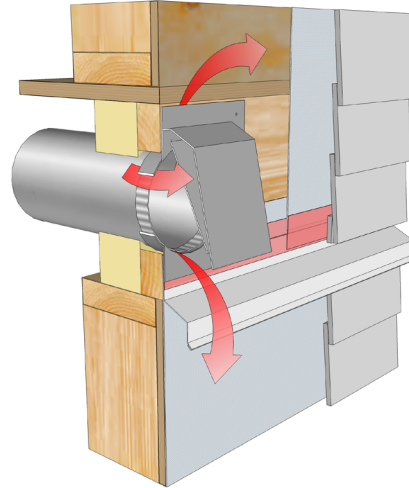
10 Pot Lights

Recessed pot light housings are one of the most common air leakage points through the ceiling plane into the attic. Air leakage occurs between the housing and air barrier through the fixture housing holes and its electrical connections. Installing boxes around the pot lights which are sealed to the air barrier is an effective way to deal with this issue. Other options are to use spray foam insulation or a shaped polyethylene cover.



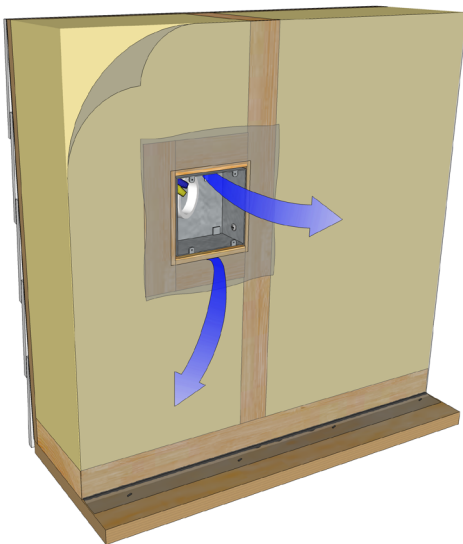
11 Wall to Ceiling

All joints at the transition between the above grade wall and ceiling must be made airtight by sealing all joints and junctions between the structural components and/or covering the structural components with an air barrier material.



12 Wall Vented Ducts

Duct penetrations through the building envelope must have an airtight seal.



13 Electrical Penetrations in Walls

Electrical penetrations in walls, including electrical outlets, wiring, switches and recessed light fixtures through the plane of airtightness must be airtight. Options include using a component that is designed to be airtight and sealing it to the adjacent air barrier material, or by covering the component with an air barrier material and sealing it to the adjacent air barrier material, and including adequate structural support.

Trade-off Options for Above-ground Building Envelope Components and Assemblies (9.36.2.11.)

Article 9.36.2.11. is not mandatory. It is intended to permit minor trade-offs of building envelope components to allow for the reduction in the thermal performance of one assembly, while compensating with increased performance of the assembly in a different location. An example is an area of wall with less insulation value than required being compensated by an area of wall with more insulation value than required. The sum of the areas of all the trade-off walls divided by their respective effective thermal resistance must be less than or equal to what it would be if all assemblies had the required amount of insulation value.

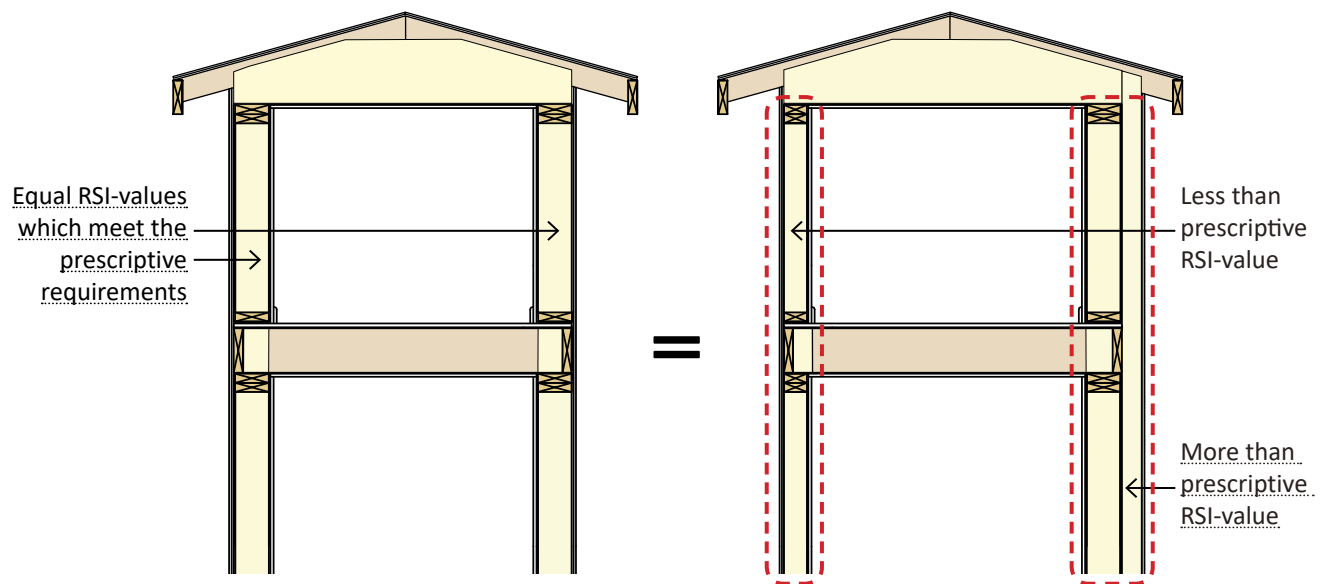
Trade-offs are permitted:

- With above grade walls, floors and roofs
- Between windows that are located on the same wall.

There are a number of restrictions, for example:

- Trade-offs have limits on how much reduction can take place.
- Walls cannot be used as a trade-off for windows (or vice versa).

Reference to the Code is recommended to determine the allowable trade-offs.



HVAC and Service Water Heating Requirements (9.36.3. & 9.36.4.)

While HVAC and service water heating requirements are in different parts of Section 9.36., they have been combined in this guide for simplicity.

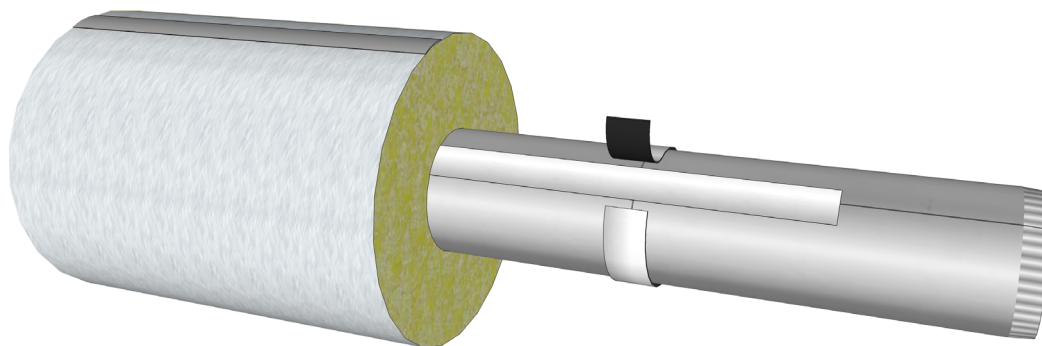
Scope and Application (9.36.3.1. & 9.36.4.1.)

This section applies to the efficiency of heating ventilation and air conditioning equipment and service water heating. The design and installation of HVAC and service water heating systems are covered in Sections 9.32. and 9.33. of the Code.

Equipment and Ducts (9.36.3.2.)

HVAC systems and ducts are required to be sized in accordance with “good practice,” such as described in the Thermal Environmental Comfort Association (TECA) reference material, CSA 280, and Sections 9.32. and 9.33. In addition, 9.36. requires that:

- Transverse and longitudinal joints in duct work must be sealed using an approved tape and sealant when outside the plane of insulation
- Ducts must be insulated to the same level as required for walls if they are outside of the envelope and carry conditioned air.



Sealing and Insulation Requirements for
Ducts Outside the Building Envelope.

Air Intake and Outlet Dampers (9.36.3.3.)

In general, ducts are required to be equipped with a damper. The damper may be gravity operated, motorized or spring loaded. Where motorized dampers are used, they must remain in an open position if damper operation fails, such as during power outages. Examples of requirements are summarized below (**Table 3**).

Table 3: Requirements for Dampers

Location	Damper Required
Flue connected to water heater	No
Condensing furnace/boiler air intake/exhaust	No
Combustion air intake on fireplace or wood stove	No
Ventilation air intake	Yes
Clothes dryer vent	Yes
Combined supply and exhaust ventilators	Yes
Exhaust and supply fans	Yes

Heat Recovery from Dehumidification in Spaces with an Indoor Pool or Hot Tub (9.36.3.8.)

Installation of a heat recovery ventilation system or dehumidification is required unless the total water surface area is less than 10 m² (108 ft²) and the pool or hot tub is equipped with a cover having a nominal thermal resistance greater than or equal to RSI 2.1 (R-12).

Heat Recovery from Ventilation Systems (9.36.3.9.)

Heat recovery ventilation is not a requirement of Section 9.36. Where heat recovery ventilators are used, equipment must conform to the requirements of 9.36.3.9., including having a minimum sensible heat recovery efficiency of 60%.

Space Heat and Service Water Heating Equipment Efficiency (9.36.3.10.) & (9.36.4.2.)

Equipment efficiency requirements are defined for a range of equipment and fuel options in Table 9.36.3.10. of the Code. A summary of requirements for typical equipment is presented in **Table 4**.

Table 4: Summary of HVAC Performance Requirements

Equipment Type	Size	Performance Requirement
Space Heating Equipment		
Gas Fired Furnace	Less than 220,000 BTU/Hr (66 kW)	Annual Fuel Use Efficiency (AFUE) must be greater than or equal to 92%
Gas Fired Boiler	Less than or equal to 300,000 BTU/Hr (88 kW)	Annual Fuel Use Efficiency (AFUE) must be greater than or equal to 90%
Air Cooled Unitary Air Conditioner and Heat Pump Split System	Less than or equal to 65,000 BTU/Hr (19 kW)	Seasonal Energy Efficiency Rating (SEER) of 14.5 and Energy Efficiency Rating (EER) of 11.5
Gas Fired Tankless	Less than or equal to 250,000 BTU/Hr (73.2 kW)	Energy Factor (EF) must be greater than or equal to 0.8
Service Water Heating Equipment		
Electric Storage	13-71 Gal (50 to 270 L)	Standby loss less than or equal to $35 + 0.20V$ (top inlet) $40 + 0.20V$ (bottom inlet) Where V = the tank volume (in Litres)
Gas Fired Storage	Less than 75,000 BTU/Hr (22 kW)	Energy Factor (EF) must be greater than or equal to $0.67 - 0.0005V$ Where V = the tank volume (in Litres)
Gas Fired Tankless	Less than or equal to 250,000 BTU/Hr (73.2 kW)	Energy Factor must be greater than or equal to 0.8

Solar Thermal Systems for Space Heat and Service Water Heating (9.36.4.3.)

Solar thermal systems are not required in Section 9.36. However, if they are installed, the systems must comply with the following requirements:

- Installed in accordance with manufacturers requirements and procedures,
- Installed in accordance with other plumbing systems requirements of the Code, and
- The storage tank must be installed in conditioned space.

Service Water Heating Piping (9.36.4.4.)

Pipe insulation is required for the first 2 m (6.5 ft) of the storage tank inlet and outlet. The insulation must be at least 12mm (0.5”) thick. In cases where piping is located outside the building enclosure or within unconditioned space, the insulation must be installed to a thermal resistance not less than the effective resistance requirements of the exterior above grade wall. In homes with recirculating hot water systems, all piping must be insulated.

Service Water Heating Controls (9.36.4.5.)

Service water heating systems are required to be equipped with controls to permit adjustment of the temperature settings.

Appendix | Additional Resources

Information from the Province on Energy Codes

[Alberta Municipal Affairs - Information on Energy Codes](#)

Effective R-value (RSI) Calculators

[Canadian Wood Council Wall Thermal Design Calculator](#)

[Energy Star Tables for Calculating Effective Thermal Resistance of Opaque Assemblies](#)

[Owens Corning Effective Thermal Resistance Calculator](#)

[Roxul Effective R-Value Calculator](#)

Insulation Information

BASF (Medium Density Spray Foam)

[BASF Walltite Resource Download Centre](#)

[Effective Thermal Resistance of Wall Assemblies BASF](#)

[Residential Details for Above Grade Walls](#)

[Residential Details Below Grade Walls](#)

Beaver Plastics (Expanded and Graphite Polystyrene Sheets)

[LOGIX Insulating Concrete Forms](#)

[HALO - Laminated Rigid Graphite Polystyrene Insulation](#)

[Heat-Sheet - Hydronic System Insulation Panels](#)

[Terrafoam - Rigid EPS Insulation](#)

Owens Corning

[Continuous Insulation and Exterior Air-Barrier Details](#) (includes manuals, visual guides, data-sheets, etc.)

[Video Installation Guides for Continuous Insulation and Exterior Air-Barriers](#)

[Owens Corning Acoustic and Fire Calculator](#)

[Additional Resources](#) (manuals, data-sheets, all available through the Canadian website)

Plasti-Fab Ltd (Expanded Polystyrene Foam and Structural Insulating Panels)

[Plasti-Fab PIB 281 - DuroFoam Laminated EPS rigid insulation](#)

[Plasti-Fab PIB 282 - Type 1 insulation Rigid foam \(non-laminated\)](#)

[Plasti-Fab PIB 287 - PlastiSpan HD Rigid Foam Insulation \(non-laminated\)](#)

[Insulspan PIB 221 - Structural Insulating Panels \(SIP\)](#)

[Advantage ICF PIB 222 - Insulating Concrete Forms \(ICF\)](#)

Roxul

[Roxul Residential Insulated Sheathing Installation Guide](#)

[Roxul Residential Insulated Sheathing Design Guide](#)

[Roxul Vapour Diffusion Guide for Residential Construction](#)

[Roxul Fastener Guide - Roxul Fastener Guidelines](#)

[Roxul Insulated Sheathing Install Video Part 1](#)

[Roxul Insulated Sheathing Install Video Part 2](#)

Additional Resources

[CHBA Builders Manual](#)

This book has comprehensive diagrams and information on building design, building envelope, mechanical systems as well as a great number of diagrams on methods and locations for air-sealing.

[Builder's Guide to Cold Climates](#)

Created by the team at Building Science Corporation and Joe Lstiburek, it deals with many aspects of building envelope issues related to cold climates. It has very good detail drawings including one for an exterior air barrier.