2014 British Columbia Building Code Changes

A City of Kelowna interpretation of the 2014 Building Code Changes for 9.36 & 9.32

The following changes reflect the most notable revisions and staff interpretations. This package is for information purposes only and does not constitute a formal or legal document. The actual British Columbia Building Code (BCBC) 2012 should be reviewed in its entirety for any design / construction applications.

Prepared by the Development Services Department

Energy Efficiency Requirements 9.36

The following information has been obtained from the HPO Illustrated Guide, Energy Efficiency Requirements for Houses in British Columbia, BCBC 9.36 & 9.32, Building Officials Association of British Columbia and The Canadian Wood Council.

9.36. Compliance Options

Building Type	Compliance Options		
	Part 9 - Prescriptive	Part 9 - Performance	NECB
- Houses, houses with secondary suites, - Buildings containing only dwelling units with common spaces ≤ 20% floor area	✔	✔	✔
- Purely residential buildings - Any building, where all non-residential portions (not F2) have a floor area ≤ 300 m²	✔		✔
- Any building where non-residential occupancies have a floor area > 300m² - Buildings containing F2 occupancies (any size)			✔

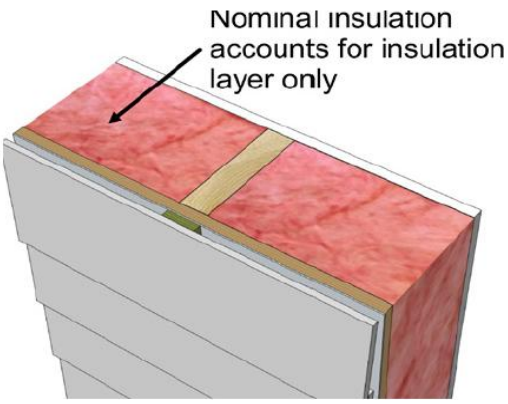
3 Compliance options

1. Prescriptive
   - Table with minimum *effective* R-values
     - Look-up tables for most common assemblies, and information on how to calculate others
       - No HRV option or
       - with HRV
     - No limits on glazing area
     - Air tightness criteria - identifies details that must be addressed.
2. Prescriptive + Simple trade-offs
3. Performance

9.36.2. Building Envelope
Scope and Application

- The walls in skylight shafts are treated like exterior walls. 9.36.2.1.(3)
- Walls less than 60˚ from horizontal are considered as roof assemblies
- Windows must conform to section 9.7
- Properties of insulation, location and installation of air barriers, and vapour barriers must conform to section 9.25.

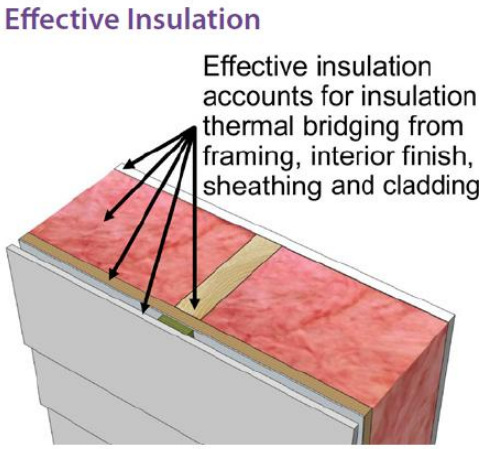
Nominal Insulation



Before December 19, 2014

The above cross section indicates the typical framing with insulation being constructed prior to December 19, 2014 where the nominal insulation thickness determined the required R-value.

Energy Efficiency Requirements 9.36



After December 19, 2014

9.36.2.4 now takes into account all of the assembly components including, cladding, sheathing framing, insulation and interior finish materials. This is known as <u>Effective Insulation</u> / <u>Effective Thermal Resistance</u> taking the whole wall assembly into consideration.

Difference Between Nominal and Effective Thermal Resistance of Assemblies

Assembly	Nominal R-value	Effective R-value
Conventional 2x6 wood stud @ 16" o/c; R-20 batt insul; gyp bd interior; ply sheathing; wood siding	20 (RSI 3.52)	17.2 (RSI 3.02)
Advanced 2x6 framing, studs @ 24" o/c, R-20 batt insul; gyp bd interior; ply sheathing; wood siding	20 (RSI 3.52)	18.2 (RSI 3.20)
2x4 wood studs @ 16" o/c; R12 batt insul; plus R-10 XPS, gyp bd interior; ply sheathing; wood siding	22 (3.87)	22.4 (RSI 3.94)
2x6 steel studs @ 16" o/c, ; R-20 batt insul.; gyp bd interior; ply sheathing; wood siding	20 (RSI 3.52)	11.35 (RSI 1.99)

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Energy Efficiency Requirements 9.36

Wall Thermal Design Calculator

SEARCH FOR WALLS NOW
Click here to go to Calculator

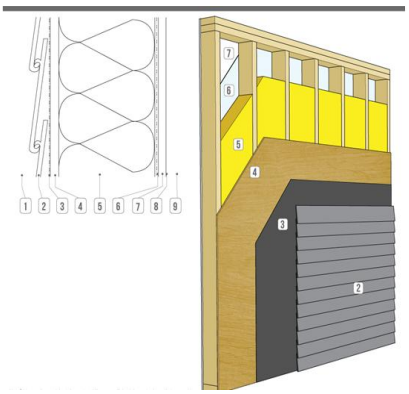
The purpose of this online tool and calculator is to provide designers with prescriptive wall assembly solutions complying with national energy efficiency requirements. This tool is meant to provide enough information that architects, designers, engineers, consultants and contractors can quickly determine suitable wall assemblies for each climate zone in Canada with confidence. While the focus is complying with 2010 National Building Code (NBC) December 2012 amendments for houses and 2011 National Energy Code for Buildings (NECB) for larger buildings, the wall assemblies will be a handy reference to comply to any building code that enables the designer to choose an effective R value. Please note that the calculation of effective thermal resistance was performed in compliance with NBC Subsection 9.36.5. of Division B.

A wall effective thermal resistance design calculator is available at http://cwc.ca/wtd, a list of assembly's and their effective insulation values is available from the Canadian Wood Council site at the address listed.

F6.S16.I22.O.V

- **Reff:** 17
- **Rnominal:** 22
- **Interior Strapping:** None
- **Interior Air Barrier / Vapour Retarder:** Polyethylene
- **Framing (inches):** 2X6
- **Spacing (inches):** 16 o.c.
- **Cavity Fill:** R22 batt
- **Structural Wood Sheathing:** 7/16 in. OSB
- **Insulating Sheathing:** None
- **Weather Barrier:** Building Paper
- **Cladding:** Vinyl
- **Exterior Strapping:** None

	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" (11.1 mm) OSB sheathing	0.11	0.62
5	2×6 framing filled with R22 batt @ 16" o.c.	2.55	14.48
6	polyethylene	0.00	0.00
7	1/2" (12.7 mm) 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	3.00	17.02
	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))	3.13	17.76



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)

As an example for calculation purposes, the wall assembly above was taken from the Canadian Wood Council's Thermal Design Calculator and to meet the minimum RSI value for the wall assembly of 2.97 or R-value of 16.86 an HRV must be incorporated into this design.

Energy Efficiency Requirements 9.36

Kelowna is located in Zone 5

9.36.2.6. Thermal Characteristics of Above Ground Opaque Assemblies
Table 9.36.2.6.B

Effective RSI-values – with *HRV*

Assembly	Climate Zone (Heating Degree Days °C)				
	Zone 4 < 3,000	Zone 5 3,001 to 3,999	Zone 6 4,000 to 4,999	Zone 7A 5,000 to 5,999	Zone 7B 6,000 to 6,999
Ceilings	6.91 (39.23)	6.91 (39.23)	8.67 (49.2)	8.67 (49.2)	10.43 (59.2)
Cathedral ceilings	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)
Walls (2x6 @ 16")	2.78 (15.78)	2.97 (16.86)	2.97 (16.86)	2.97 (16.86)	3.08 (17.48)
Floors over unheated space	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)

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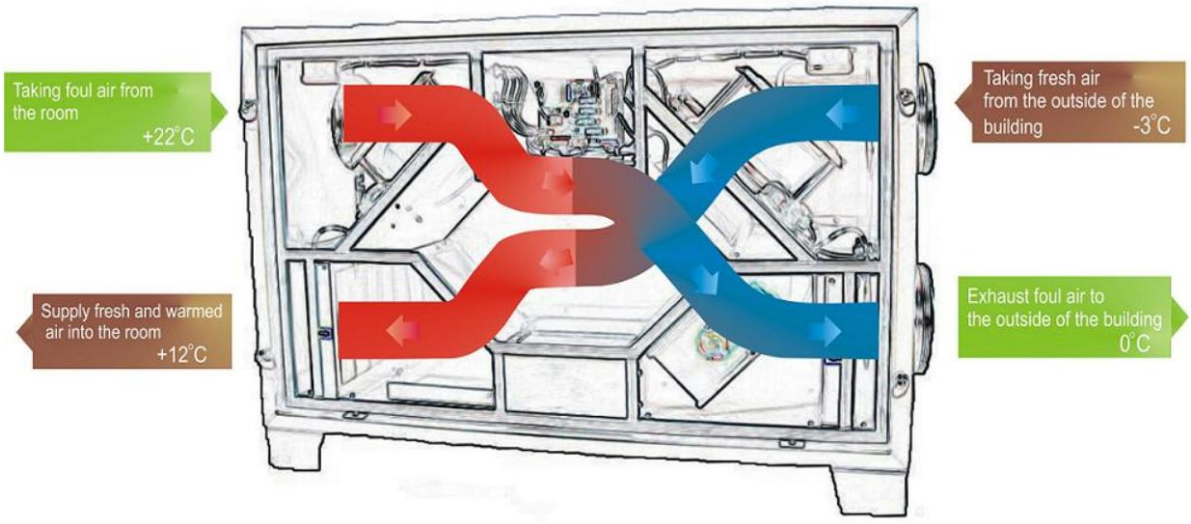

Prescriptive reductions for insulation values will apply for the walls, ceilings below attics and skylight shafts when an HRV is introduced into the home.

Energy Efficiency Requirements 9.36

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" (11.1 mm) OSB sheathing	0.11	0.62
5	2×6 framing filled with R22 batt @ 24" o.c.	2.67	15.16
6	polyethylene	0.00	0.00
7	1/2" (12.7 mm) 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))		3.26	18.50

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)

As an example for calculation purposes, the wall assembly above was taken from the Canadian Wood Council's Thermal Design Calculator and meets the minimum RSI value of 3.08 or R-value of 17.48 for a wall assembly not incorporating an HRV

9.36.2.6. Thermal Characteristics of Above Ground Opaque Assemblies
Table 9.36.2.6.A

Effective RSI-values – without *HRV*

Assembly	Climate Zone (Heating Degree Days °C)				
	Zone 4 < 3,000	Zone 5 3,001 to 3,999	Zone 6 4,000 to 4,999	Zone 7A 5,000 to 5,999	Zone 7B 6,000 to 6,999
Ceilings	6.91 (39.23)	8.67 (49.2)	8.67 (49.2)	10.43 (59.2)	10.43 (59.2)
Cathedral ceilings	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)
Walls (2x6 @ 16")	2.78 (15.78)	3.08 (17.48)	3.08 (17.48)	3.08 (17.48)	3.85 (21.86)
Floors over unheated space	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)

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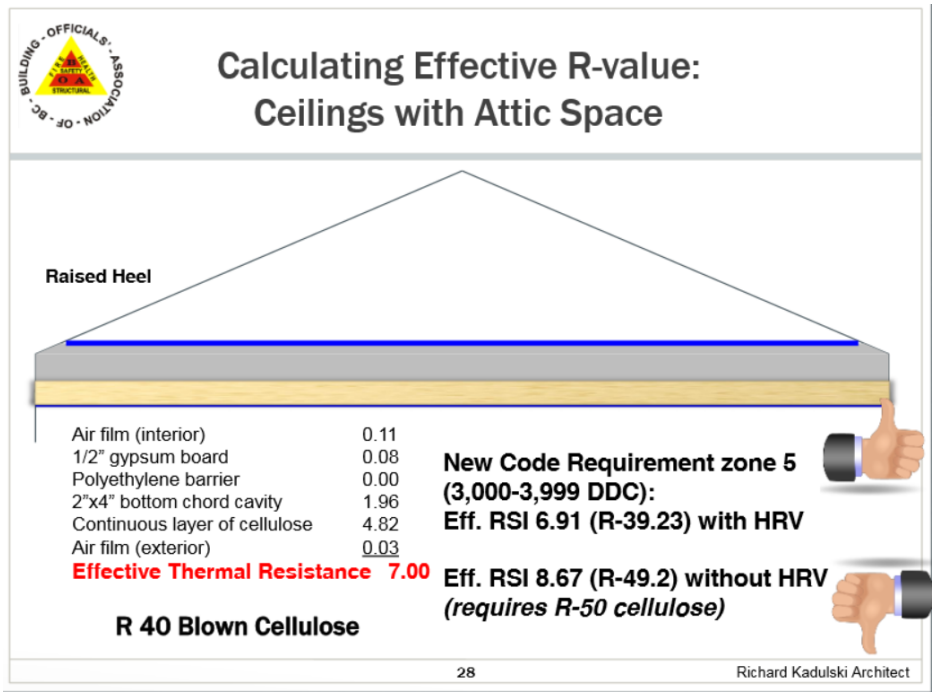
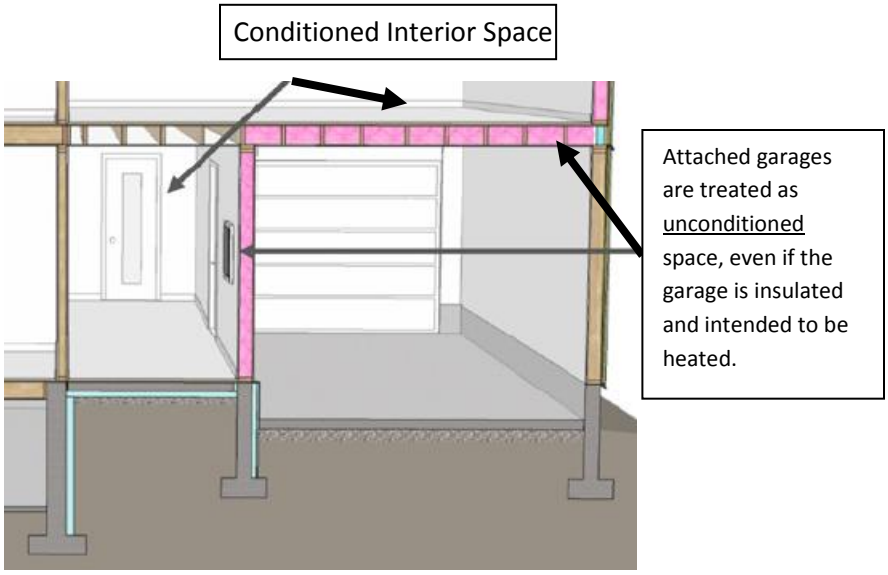
The RSI (R-value Systeme International) can be multiplied by 5.678 to obtain the R-Value. Kelowna is located in Zone 5, 3000 – 3999 Heating Degree Days, the above table indicates the required RSI values of the solid building assembly.

Energy Efficiency Requirements 9.36

Example



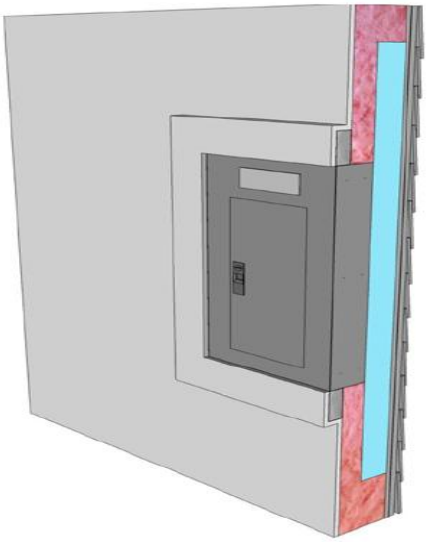
The illustration incorporates R-40 Blown Cellulose insulation in Zone 5, with an installed HRV is compliant, without an HRV will require R-50



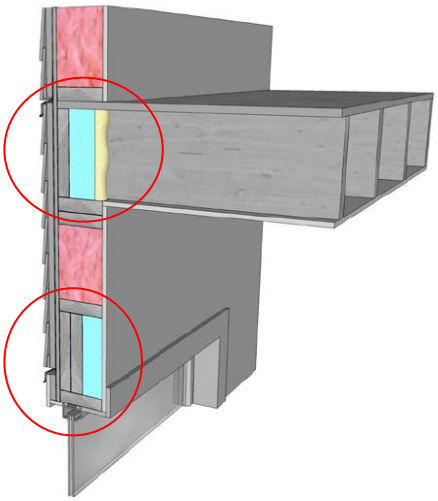
1) Wall between house and garage built to RSI of the above ground wall assembly

Attached garages are treated as unconditioned space with no allowances for heat. The assembly (walls & ceilings) separating the garage from the conditioned space must be insulated and air tight.

Energy Efficiency Requirements 9.36



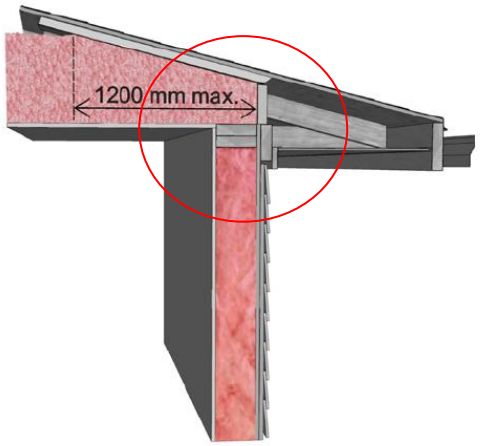
Mechanical, electrical and plumbing components placed within an exterior wall must be insulated behind to the effective thermal resistance required for the above or below grade wall assembly.



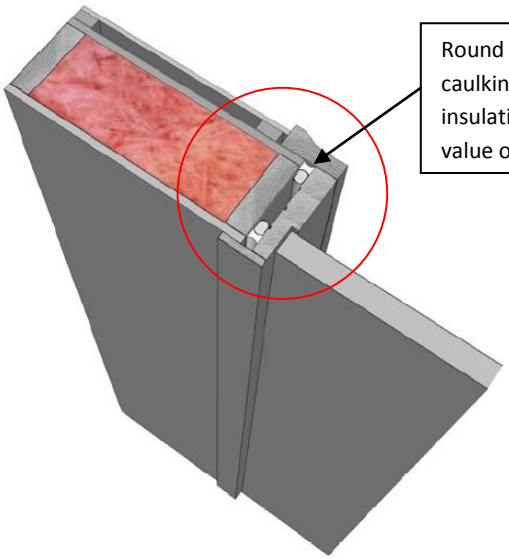
Exposed foam plastics to be protected as per BCBC 9.25.2

Thermal bridging of repetitive structural members (ie; joist box ends, header spaces) must be included when calculating the thermal resistance of the exterior above grade wall assembly.

Energy Efficiency Requirements 9.36

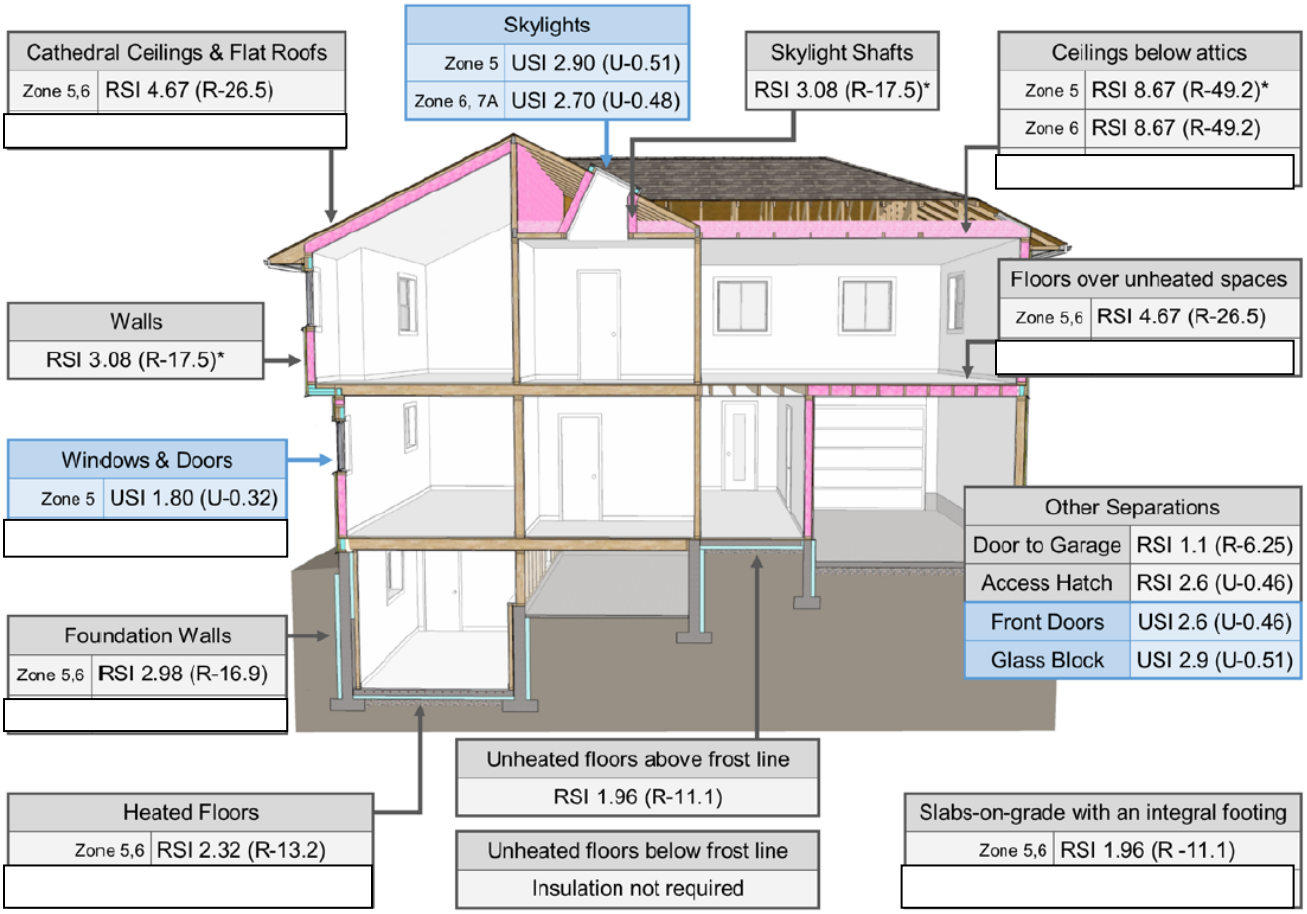


In the attic at the perimeter wall, the insulation value must maintain a minimum RSI value as the wall assembly for a maximum of 4'. (In some designs the introduction of a high heeled truss may be warranted)



The space between the framing member and window / door frame may have the same effective U-value as the adjoining window / door.

Energy Efficiency Requirements 9.36



The detailed illustration above indicates the Nominal Insulation values required in a home constructed in Zone 5 & 6 not incorporating an HRV.

Energy Efficiency Requirements 9.36

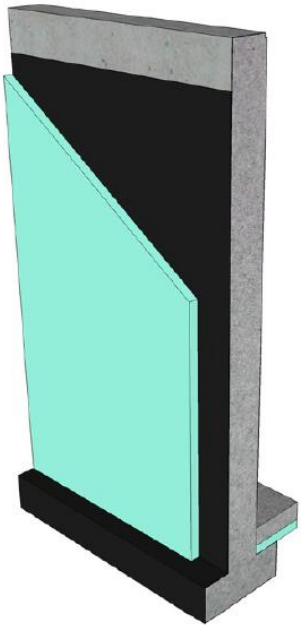
Below Grade Wall Assembly for Zones 5 and 6

Description	Nominal	Effective
3" XPS insulation over 8" poured-in-place concrete wall	RSI 2.64 (R-15)	RSI 2.65 (R-15.3)
Other building enclosure layers that contribute to effective insulation: 1. dampproofing 2. interior air film	-	RSI 0.33 (R-1.9)
Total effective insulation value:		RSI 2.98 (R-16.9)
Minimum effective thermal resistance for below grade walls:		RSI 2.98 (R-16.9)

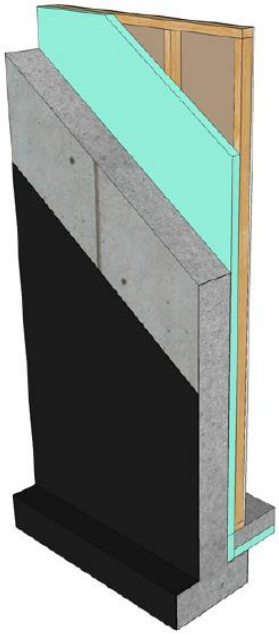
Above Grade Wall Assembly

Description	Nominal	Effective
R-22 batt insulation in 2x6 wood framing at 16" o.c.	RSI 3.87 (R-22)	RSI 2.66 (R-15)
Other building enclosure layers that contribute to effective insulation: 1. exterior air film 2. cladding & air cavity 3. sheathing membrane 4. sheathing 5. polyethylene 6. gypsum board 7. interior air film		RSI 0.63 (R-3.57)
Total effective insulation value:		RSI 3.29 (R-19.0)
Minimum effective thermal resistance for above grade walls:		RSI 3.08 (R-17.5)

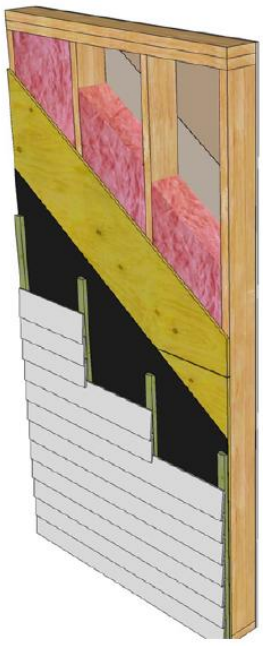
Basement Wall with Exterior Insulation



Basement Wall with Interior Insulation

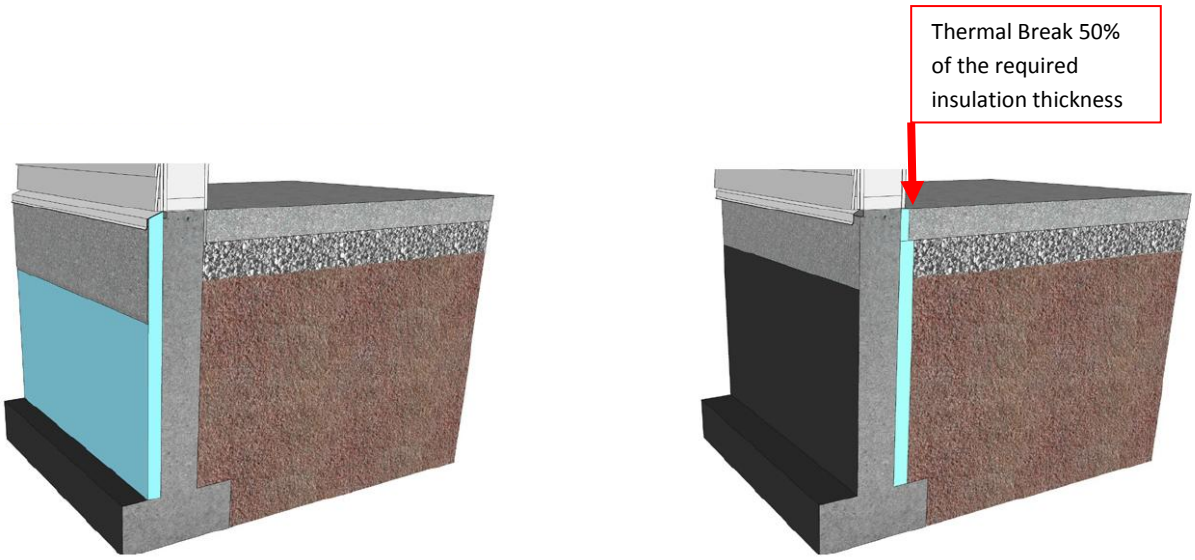


Above Grade Framed Wall

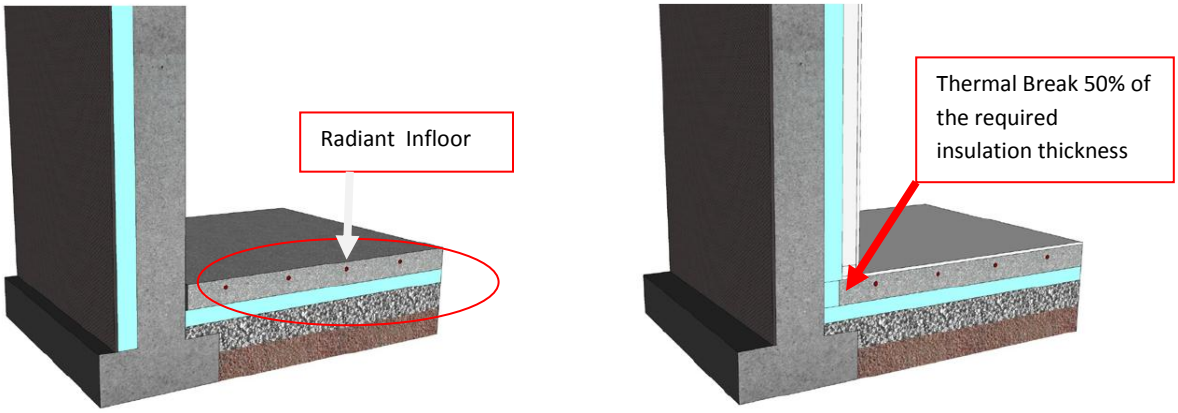


Energy Efficiency Requirements 9.36

Illustrations below indicate insulation placement for unheated and heated slabs on grade above the frost line



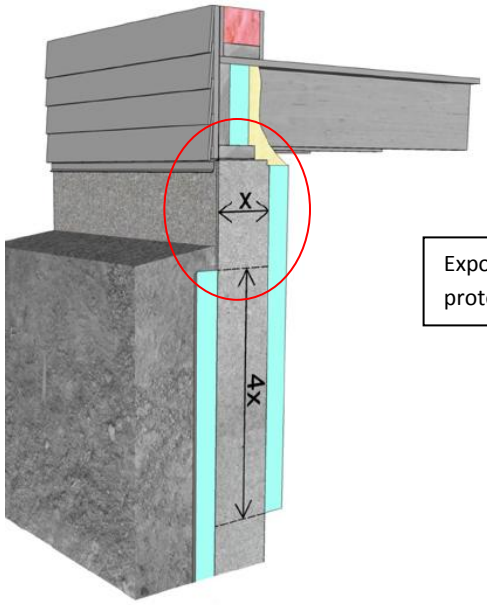
Insulation placement of unheated slabs



Insulation placement of heated slabs

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.

Energy Efficiency Requirements 9.36



Exposed foam plastics to be protected as per BCBC 9.25.2

When insulation is separated by the building envelope as indicated above, the interior insulation side must extend down the wall 4 times the thickness of the wall.

Junctions between the floor and rim joist and rim joist to foundation must be sealed

Illustrations above indicate where potential leakage conditions occur and where sealing is required between all joints and junctions between the structural components, and/or covering the structural components with an air barrier material and sealing it to the adjacent air barrier material.

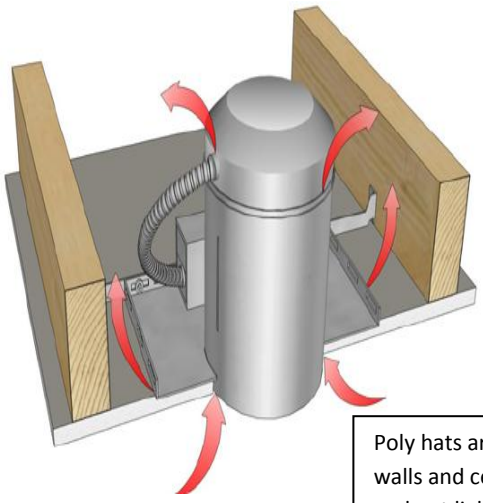
Energy Efficiency Requirements 9.36

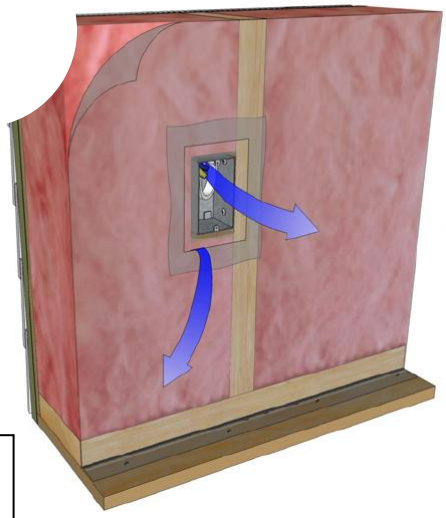
Flexible sheet air barrier materials require all joints to be

- lapped at least 50 mm (2")
- Sealed and
- structurally supported

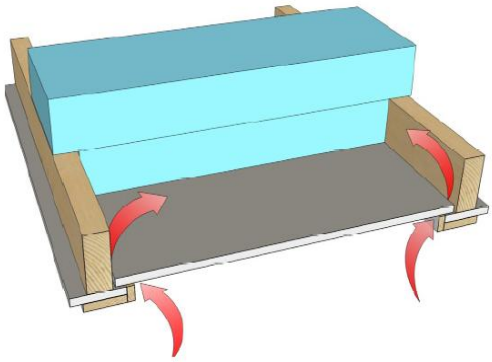
Sealants must be non-hardening

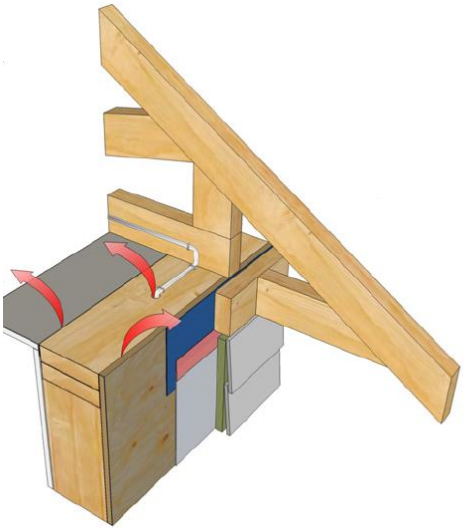
Energy Efficiency Requirements 9.36





Poly hats are required on exterior walls and ceilings for electrical boxes and pot lights and must be sealed to the air / vapor barrier





The attic hatches and all electrical penetrations into the attic space along any gaps, spaces, penetrations, irregularities that could inhibit leakage must be sealed

Section 9.36 of the BCBC details all areas requiring attention to air leakage, the illustrations are a few of the most common areas of concern.

Energy Efficiency Requirements 9.36

Section 9.36.2.7 of the BCBC requires garage vehicular doors to have an R Value of 6.245 or RSI 1.1 when conditioned.

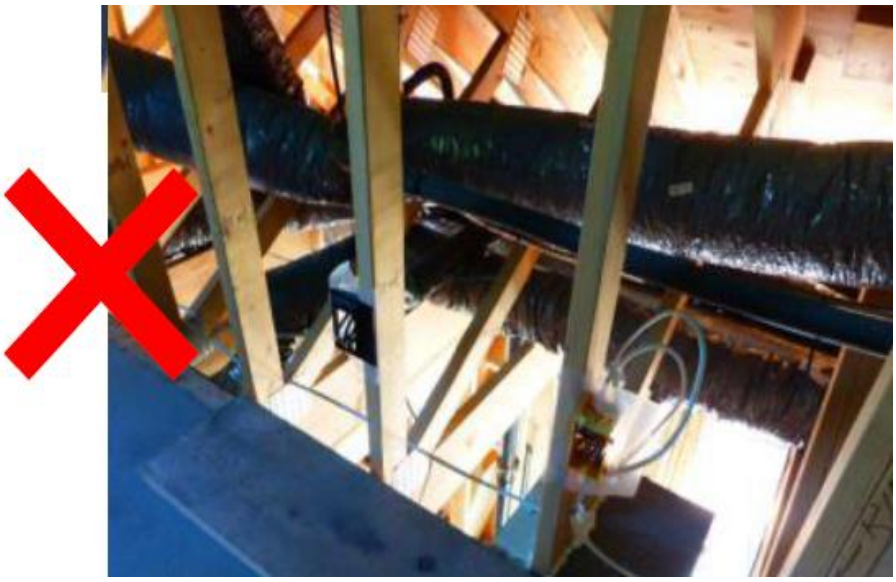
Example Window Label showing U-value

ENERGY PERFORMANCE RATINGS		
U-Factor	Solar Heat Gain Coefficient	Visual Transmittance
1.60 W/m²•K	**0.19**	**0.35**
Energy Rating	Air Leakage	
17	1.2 L/s/m²	
BC's Best Window Company A100 Series Casement window Vinyl frame, Double glazed, Low-E coating Argon fill		
Certification Agency Logo	Energy performance ratings certified to CSA A440.2-09. Ratings are determined for a fixed set of environmental conditions and a specific reference product size. Certification agency does not recommend or warrant product for any specific use.	

The U-factor is a rating given to a window based on how much heat loss it allows. U-factors generally range from 0.2 (very little heat loss) to 1.2 (high heat loss). The U-factor is the inverse of the R-value of a window, which measures a window's insulating value. Thus, a high R-value is the same as a low U-factor, and means that a window does not allow much heat to escape.

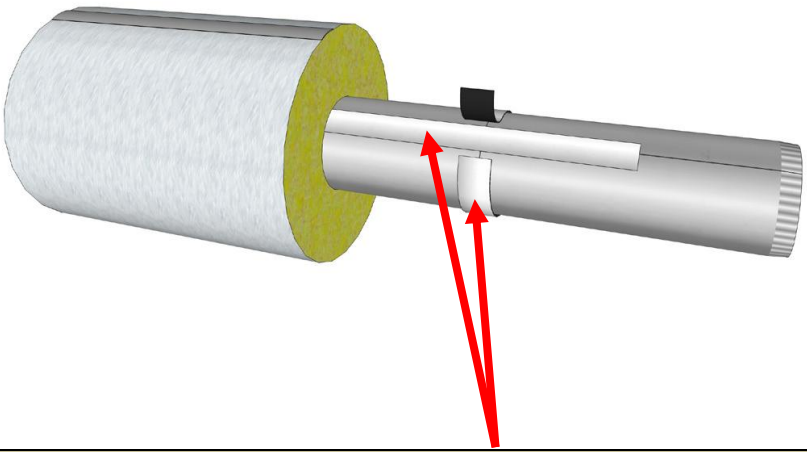
Energy Efficiency Requirements 9.36

Heating Efficiencies



Ducts must be insulated to the same level as required for walls if they are outside of the heated space and carrying conditioned air.

Bathroom, dryer and kitchen exhaust are exempt from this requirement though are required to be directed directly outdoors, insulated to RSI 0.75 and have a vapor barrier

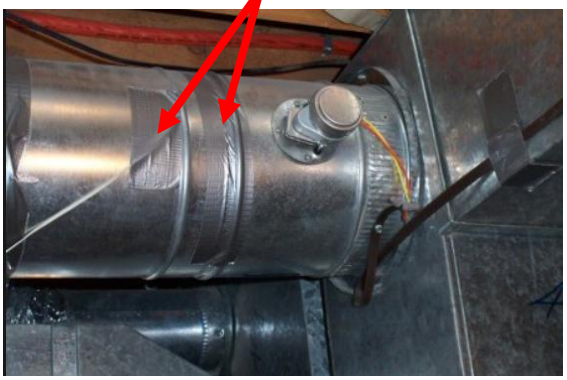


Transverse and longitudinal joints in duct work must be sealed using an approved tape and sealant when outside the heated space.

Energy Efficiency Requirements 9.36

Heating Efficiencies

Fabric tape is not approved in the BCBC for this application



Ventilation air intake	Required
Clothes dryer vent	Required
Combined supply and exhaust ventilators	Required
Exhaust and supply fans	Required

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.

Energy Efficiency Requirements 9.36

Heating Efficiencies

Exterior Roof Top Heat / Cool Unit

Interior Residential Gas Furnace

HVAC equipment must be located inside the heated space.
Only HVAC equipment designed strictly for outdoor installation can be located outside the Heated space. Attached garages, even if heated, are considered unconditioned space.

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Heating Efficiencies

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 or 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

Minimum Efficiency 92%

Gas Fired Tankless

Energy Efficiency Requirements 9.36

Heating Efficiencies

Gas Fired Boiler Minimum Efficiency 90%

Air Conditioners now have a 14.5 SEER rating (Seasonal Energy Efficiency Rating)

Heat Pumps now must have an 11.5 Energy Efficiency Rating

The efficiency ratings for gas furnaces, boilers and hot water tanks both storage and instantaneous have been adjusted in the new requirements. Air conditioners and heat pumps also have increased efficiency ratings.

Energy Efficiency Requirements 9.36

Heating Efficiencies

Service Water Heating Equipment		
Electric Storage	13-71 Gal (50 to 270 L)	Standby loss less than or equal to 25+ 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

Gas Fired Tankless Instantaneous

Gas Fired Storage HWT

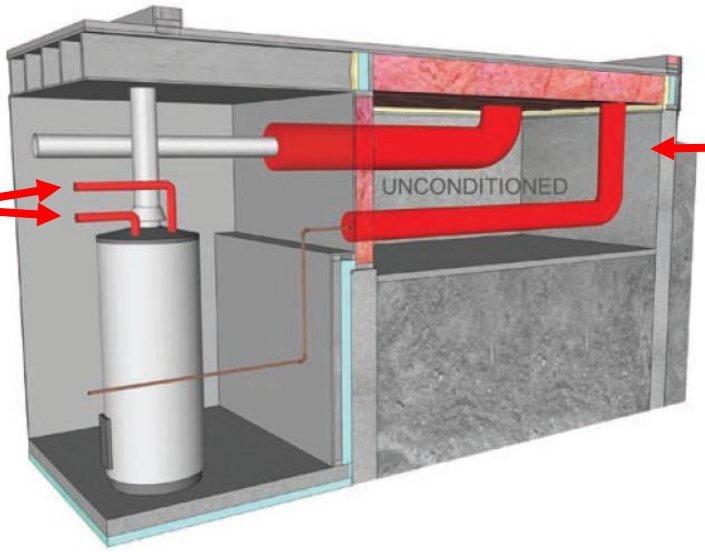
Electric Storage HWT

The efficiency ratings for hot water tanks both storage and instantaneous have been adjusted in the new requirements.

Service Water Heating Piping

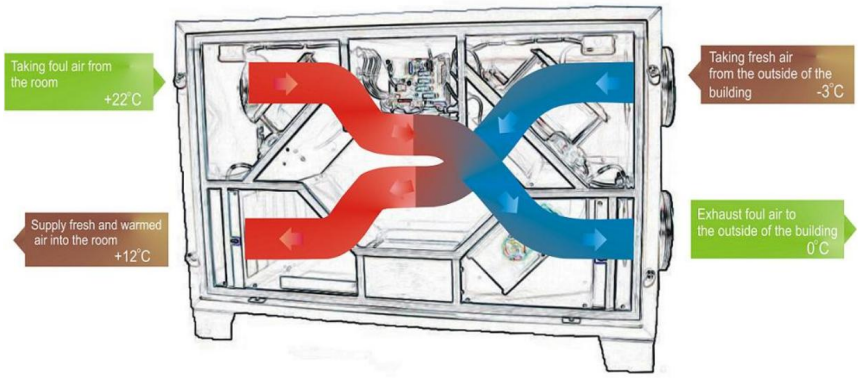
Pipe insulation is required for the first 2 m (6.5 ft) of the storage tank inlet and outlet. The insulation must be at least 12 mm (0.5”) thick. In cases where piping is located outside the building enclosure or within unconditioned space, the insulation must be installed to a thermal resistance not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

First 2m of piping on the water storage tanks requires at least 12mm (1/2”) of insulation.



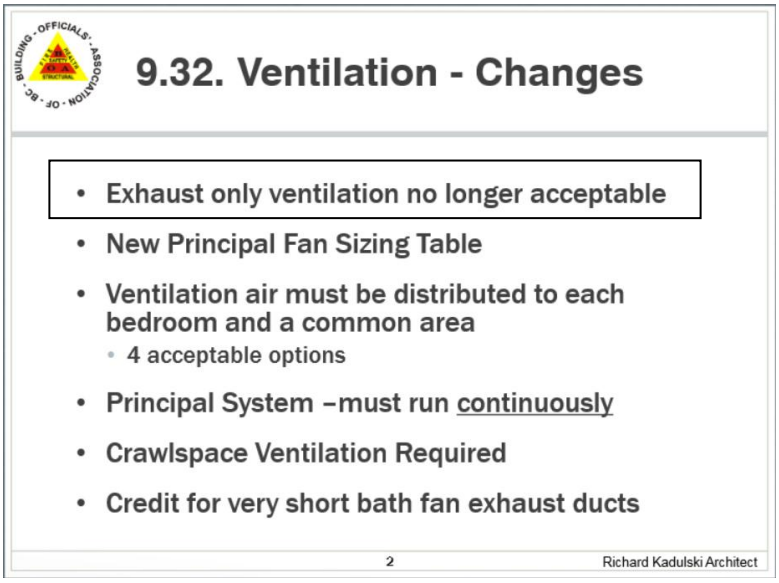
Piping located in unconditioned space must be insulated to the same value as the above grade wall.

***In homes with recirculating hot water systems, all piping must be insulated*.**

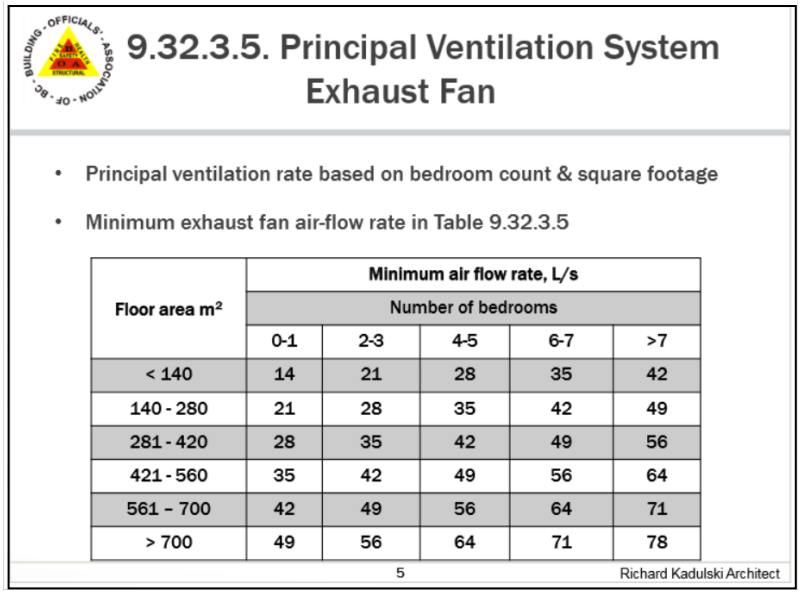


Heat recovery ventilation is not a requirement of Section 9.36. Where heat recovery ventilators are used, equipment must conform to the requirements of 9.36.3.9., including having a minimum sensible heat recovery efficiency of 60%.

9.32 Ventilation



Pre December 19, 2014 the exhaust only systems were used where a fan (bathroom) was used to create a negative pressure within the space and ventilation air was achieved through air leakage from loose building construction.



Post December 19, 2014 and with the introduction of a principal exhaust fan in 2006, the sizing was based on the number of bedrooms, the table above now indicates the number of bedrooms as well as floor area to determine the principal ventilation fan sizing.

Energy Efficiency Requirements 9.36

9.32.3.5. Principal Ventilation System Exhaust Fan

- Principal exhaust fan capacity @ 50 Pascals
- Designed to run continuously
- Controlled by dedicated switch
  - Clearly marked “principal Ventilation Exhaust Fan”
  - Two settings: on & off
  - Accessible for servicing
  - If capable of running at multiple flow rates, must have a separate switch so low rate is not less than required
- Sound rating not to exceed 1.0 sone

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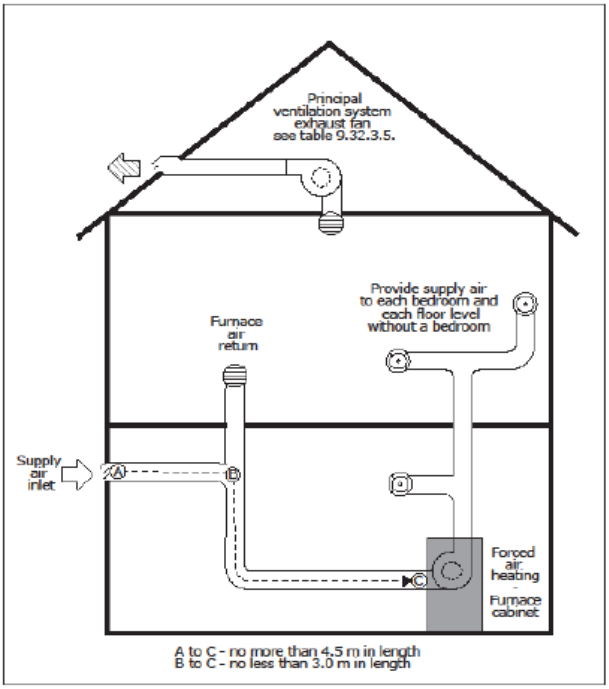
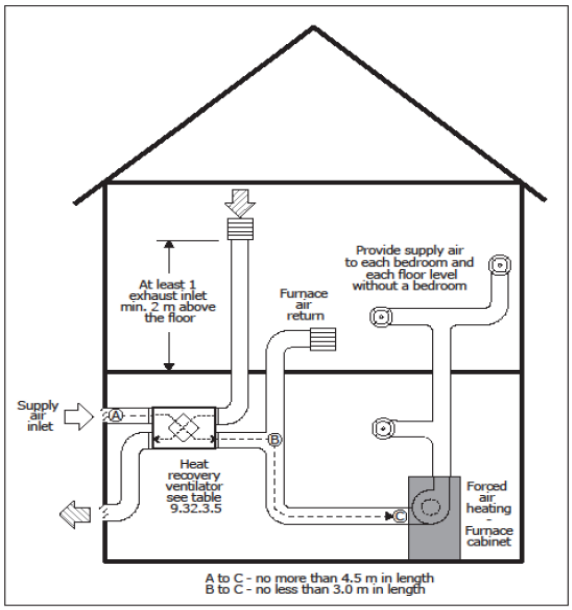
The primary ventilation system is required to run continuously, this can be achieved by the use of an HRV or a dedicated Lo-Sone fan not exceeding 1.0 sones. (noise level)

Energy Efficiency Requirements 9.36

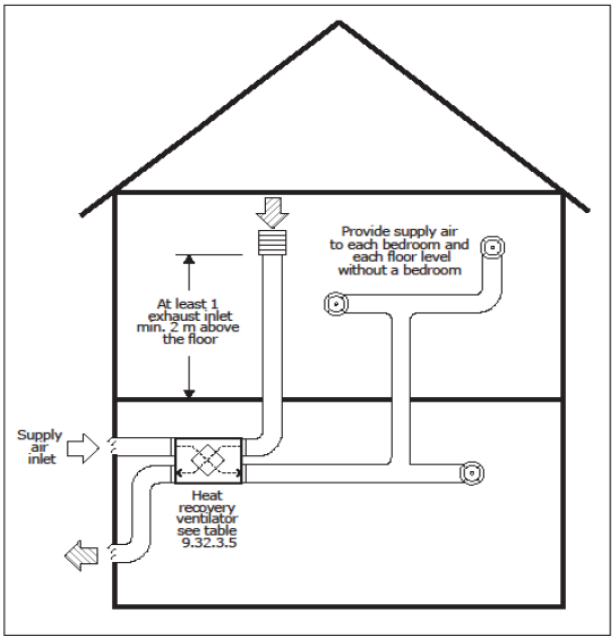


With 4 options to deliver ventilation air, utilizing the forced air system interlocked to the primary ventilation fan is cost effective in a majority of applications. The fresh air piping to the forced air return duct has also been reduced in length to the furnace cabinet and must not be located upstream of a return air grill.

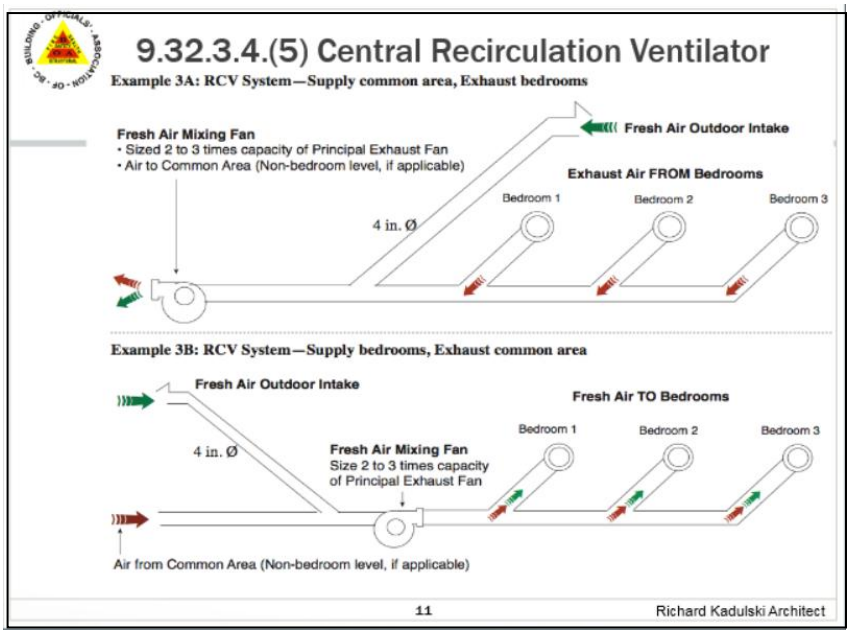


A 2nd option is to incorporate a passive HRV as the primary ventilation fan, the furnace blower would be required to run continuously 24/7

Energy Efficiency Requirements 9.36

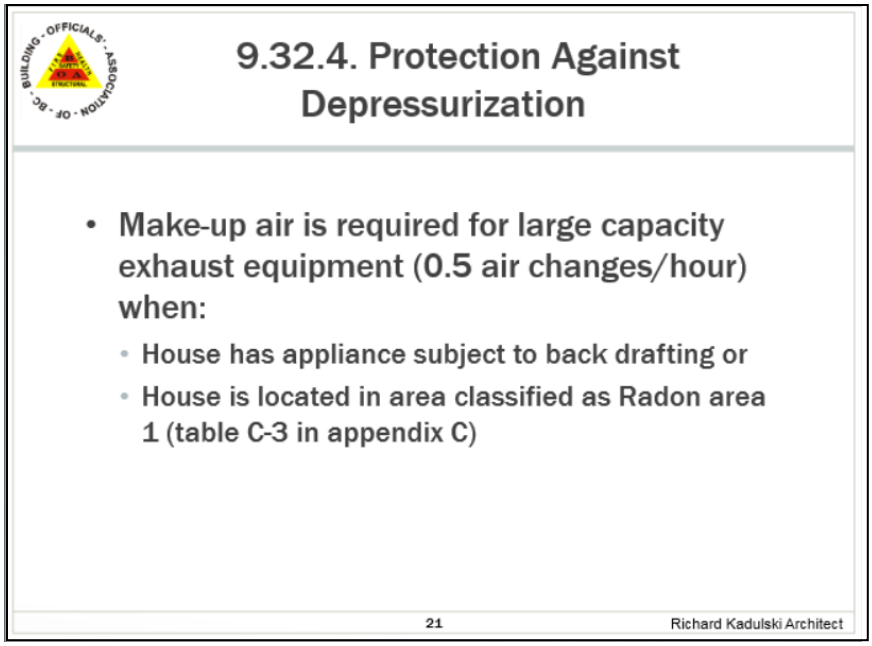


The 3rd option is to incorporate an HRV as the primary ventilation system. This system is installed separately from the forced air system or as a standalone ventilation system when forced air is not being installed.

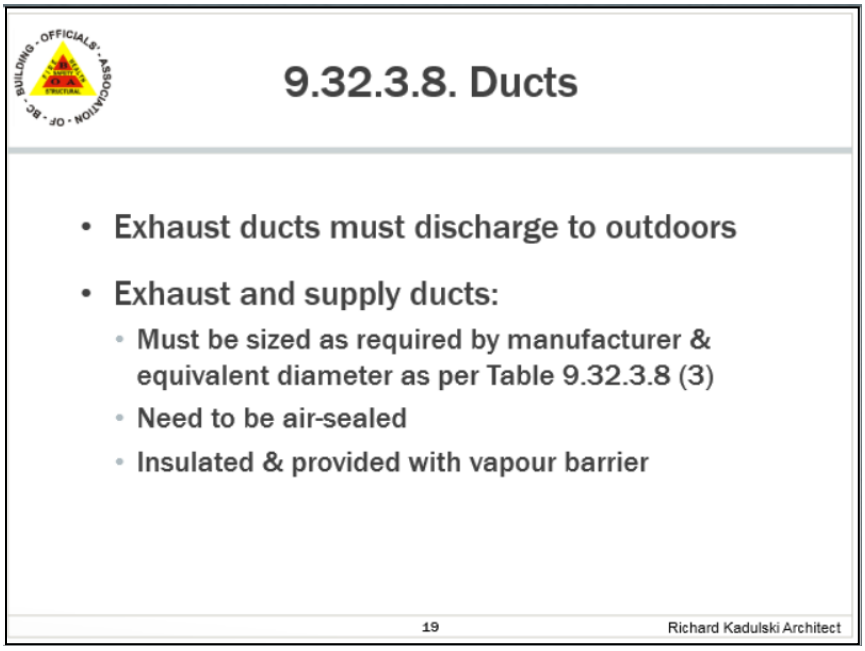


The 4th option is also installed separately from the forced air or as a system when forced air is not being installed. A primary ventilation fan is installed and interlocked with a distribution fan sized 2-3 times the primary ventilation fans capacity. The air discharge grill should be installed no closer than 2m from the floor ensuring that the cooler air is mixed with tempered air maintaining a suitable comfort level.

Energy Efficiency Requirements 9.36

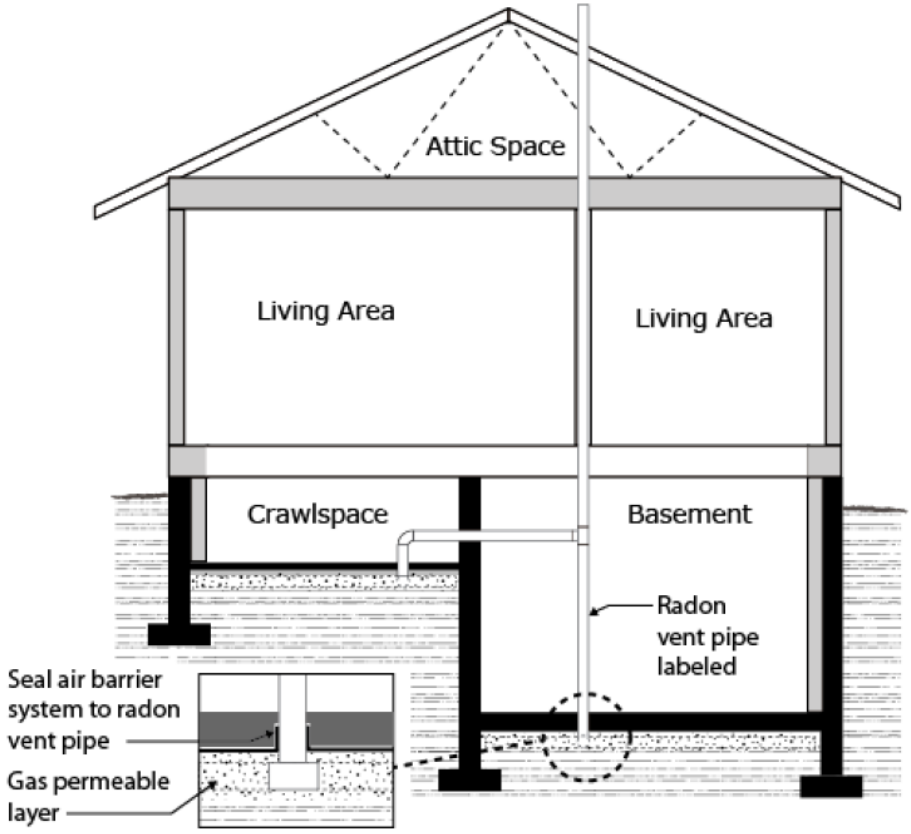


Should the calculations provided on the Mechanical Ventilation Check list provided by the HVAC installer indicate the collective exhaust appliances exceed the ½ air change per hour, make up air sized accordingly to the excess exhaust must be provided to the dwelling. As Kelowna is in Radon Area 1 this clause applies.



Exhaust from bath fans, primary ventilation fans and range exhaust ducts must be vented directly out doors, insulated with an RSI of 0.75 (R-4) and have a continuous vapor barrier.

RADON CHANGES



The BC Building Code does not require installation of a fan during initial construction, although designers should consider the future installation of a fan (which will require access and electrical supply) somewhere along the radon vent pipe.

The BC Building Code refers to material that creates the space allowing the movement of soil gases between the air barrier system and the ground as a gas permeable layer
The gas permeable layer allows for effective depressurization of that space, and functions as the drainage layer required in Article 9.16.2.1. A typical solution is to install coarse clean granular material below the floor on the ground. This allows compliance with 9.16.2.1.(1)

The Radon rough in must be piped directly outdoors, an in-line fan is not required by code to complete a mitigation system. Changes have also occurred to the granular materials component and now are referred to as approved materials within the code. Alternate piping configurations may be considered by the Authority Having Jurisdiction.