Achieving the BC Energy Step Code Targets with ROCKWOOL Insulation Products

The BC Energy Step Code

In December 2017, the Province of British Columbia adopted the BC Energy Step Code as a voluntary energy efficiency compliance path. The new standard provides an incremental and consistent approach to achieving more energy-efficient buildings that go beyond the requirements of the base BC Building Code. It is a tool designed to help both government and industry achieve a future in which all new construction across the province is "net-zero energy ready" by 2032.

The BC Energy Step Code uses performance targets, setting maximum values for energy consumption and air leakage. It promotes an enclosure-first approach in its pathway to net zero. Using ROCKWOOL products to build highly insulated enclosures is an effective method for achieving the building enclosure performance targets and provides for comfortable and durable buildings.

Step Code Metrics

The Step Code uses energy consumption and airtightness metrics to assess building efficiency. This new system requires whole-building energy modelling and airtightness testing of the building before occupancy.

Equipment & Systems Metrics – Measure the energy consumption from HVAC systems including domestic hot water, pumps, and fans (omitting base loads such as plug-loads and lighting for Part 9 buildings).

Airtightness Metrics – Measure the amount of air leakage across the enclosure of a building.

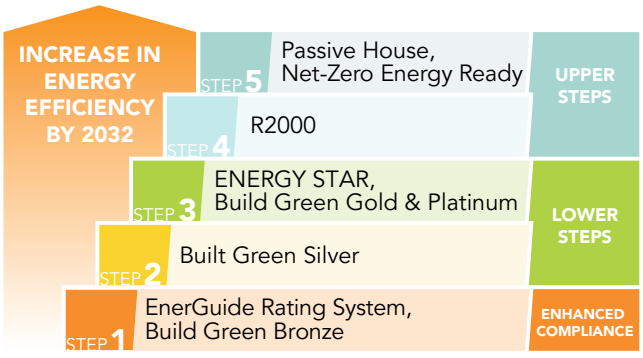
Building Enclosure Metrics – Measure the heating demand of the building, considering heat loss through the enclosure and passive gains. Both enclosure performance and ventilation impact these metrics.

The key building enclosure metric is **Thermal Energy Demand Intensity (TEDI)**, which describes the annual heating required by the building, measured in kWh/m²/yr. An alternative metric for Part 9 buildings is **Peak Thermal Load (PTL)** which describes the maximum amount of energy needed to heat a building on the coldest day of the year, measured in W/m². The Step Code targets for both enclosure metrics can be achieved by using highly insulated enclosures.

Applicability to Other Energy Standards

All authorities having jurisdiction to enforce the BC Building Code can opt to require or incentivize levels of the Step Code instead of the prescriptive requirements. No other energy efficiency program may be enforced in these jurisdictions.

The strategies to achieve Step Code targets (as shown in this bulletin) can also be applied to other optional performance-based standards, for example elsewhere in Canada or even pre-emptive to a potential future National Step Code.

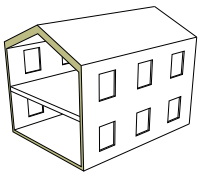


NEW CONSTRUCTION | PART 9 RESIDENTIAL BUILDINGS

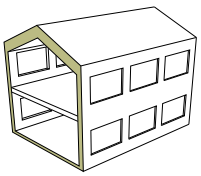
Wide Range in R-value Options

The Energy Step Code replaces the prescriptive energy efficiency requirements of the BC Building Code with performance based energy targets. This allows for more innovation and flexibility in design, and enables the market to develop the most cost-effective methods and materials to meet the desired energy targets.

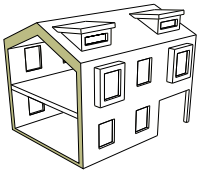
The nature of a performance-based code is that there are many potential solutions for compliance. The necessary R-values for the enclosure of specific projects depend on factors like climate zone, airtightness, window-wall-ratio, form factor (e.g. massing ratio and articulation), orientation, and building size. Choosing high R-values for the building enclosure components enables design flexibility while meeting the desired performance targets.



Simple building designs with low window-wall-ratios allow for code compliance with lower insulation values compared to designs with high window-wall-ratios and articulation.



Higher insulation values enable designs with high window-wall-ratios.



Higher insulation values enable articulated designs.

Choosing higher effective R-values for the building enclosure components enables more flexibility in design.

The table below shows recommended effective R-values for best practice in reaching the Step Code targets for Part 9 buildings. The effective R-value ranges are informed by BC Housing energy modelling of a medium-size single family home and show a wide range of possible values due to other factors such as window performance, ventilation system, or airtightness. Recommended effected R-values are no lower than the prescriptive requirements in BCBC Section 9.36, although through energy modelling individual projects may choose to use effective R-values outside the recommended range (both higher or lower), depending on other design decisions. Effective R-values account for insulation, thermal bridging from framing, interior finishes, sheathing and cladding.

Recommended Effective R-Value Ranges to Meet the Step Code Targets				
Step	Assembly	Climate Zone		
		4	5 & 6	7A, 7B, & 8
1	Above Grade Wall	R-16	R-18	R-18 to R-22
	Roof *	R-40	R-50	R-60
	Below Grade Wall	R-11	R-17	R-20
	Slab on Grade	R-11	R-11	R-11
2	Above Grade Wall	R-16 to R-18	R-18 to R-20	R-18 to R-60
	Roof	R-40 to R-50	R-50 to R-60	R-60 to R-100
	Below Grade Wall	R-11 to R-16	R-17 to R-20	R-20 to R-25
	Slab on Grade	R-11	R-11	R-11 to R-15
3	Above Grade Wall	R-16 to R-18	R-18 to R-22	R-18 to R-60
	Roof	R-40 to R-60	R-50 to R-70	R-60 to R-100
	Below Grade Wall	R-11 to R-25	R-17 to R-20	R-20 to R-25
	Slab on Grade	R-11	R-11	R-11 to R-15
4	Above Grade Wall	R-16 to R-25	R-18 to R-25	R-22 to R-60
	Roof	R-40 to R-70	R-50 to R-100	R-60 to R-100
	Below Grade Wall	R-11 to R-25	R-17 to R-25	R-20 to R-25
	Slab on Grade	R-11 to R-15	R-11 to R-11	R-11 to R-20
5	Above Grade Wall	R-22 to R-40	R-60+	R-60+
	Roof	R-40 to R-100	R-50 to R-100+	R-100+
	Below Grade Wall	R-11 to R-25	R-17 to R-25+	R-25+
	Slab on Grade	R-11 to R-15	R-11 to R-15+	R-20+

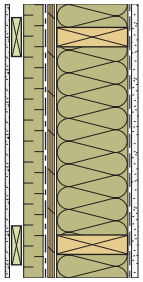
** Effective R-values in Step 1 reflect BCBC code minimum for an attic roof.*

Reaching Performance Targets With ROCKWOOL

ROCKWOOL provides a wide range of products for the building enclosure offering great solutions to the enclosure-first approach. The following examples show the effective R-values for some of the many possible enclosure assemblies as solutions to the Step Code.

ROCKWOOL stone wool insulation delivers additional benefits beyond thermal performance, such as best in class fire resistance, exceptional noise reduction, water repellence, vapor permeability, and dimensional stability.

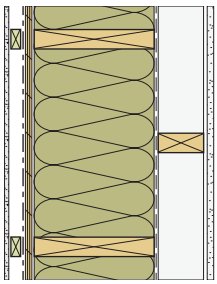
Split Insulated Above Grade Wall Assembly



Effective R-Values for Split Insulated Above Grade Wall Assemblies											
Wall Assembly Framing Filled with COMFORTBATT®	Inches of Exterior Insulation - COMFORTBOARD™ 80/110 (R-4 per inch)										
	0	1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
2x4 Framed Wall (R-14 Batts)	12.0	16.0	18.0	20.0	24.0	28.0	32.0	36.0	44.0	52.0	60.0
2x6 Framed Wall (R-22 Batts)	17.3	21.3	23.3	25.3	29.3	33.3	37.3	41.3	49.3	57.3	65.3

Effective R-values have been calculated with BCBC framing factor for standard 16" o.c. roof framing practices.

Deep Stud Above Grade Wall Assembly



Effective R-Values for Deep Studs (with Service Wall) Above Grade Wall Assemblies								
2x4 Framed Service Wall	Wall Assembly Framing Filled with COMFORTBATT® (R-4 per inch)							
	2x6	2x8	2x10	2x12	9 1/2 in. I-Joist	11 7/8 in. I-Joist	14 in. I-Joist	16 in. I-Joist
Uninsulated	18.3	22.9	28.1	33.4	30.6	38.6	45.7	52.4
Insulated with COMFORTBATT® (R-14 Batts)	26.5	31.1	36.3	41.6	38.8	46.8	53.9	60.6

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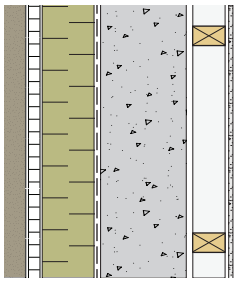
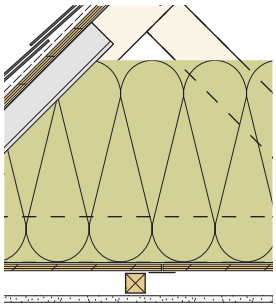
Exterior Insulated Below Grade Wall



Effective R-Values for Exterior Insulated Below Grade Wall Assemblies							
Wall Construction	Inches of Exterior Insulation - COMFORTBOARD™ 80/110 (R-4 per inch)						
	2.0	3.0	4.0	5.0	6.0	7.0	8.0
8 inch Concrete Wall with 2x4 Framed Service Wall (Uninsulated)	10.4	14.4	18.4	22.4	30.4	34.4	38.4

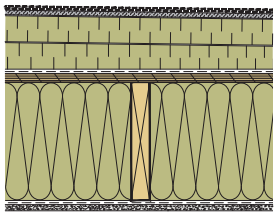
Attic Roof Assembly



Effective R-Values for Raised Heel Truss Attic Roof Assemblies										
Depth of COMFORTBATT® Insulation (R-4 per inch) (add R-0.9 for Uninsulated 2x2 Framed Service Cavity)										
10 in.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.
38.7	46.7	54.7	62.7	70.7	78.7	86.7	94.7	103	111	119

Effective R-values have been calculated with BCBC framing factor for standard 16" o.c. roof framing practices.

Unvented Split Insulated Flat Roof Assembly

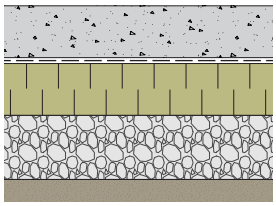


To avoid the risk of condensation within the assembly, ensure inboard to outboard effective thermal resistance ratios are appropriate for the project climate zone.

Effective R-Values for Split Insulated Flat Roof Assemblies						
Inches of Exterior Insulation TOPROCK® DD (R-3.8 per inch)	Roof Assembly Framing Filled with COMFORTBATT® (R-4 per inch) (add R-0.9 for Uninsulated 2x2 Framed Service Cavity)					
	2x8	2x10	2x12	9 1/2 in. I-Joist	11 7/8 in. I-Joist	14 in. I-Joist
4.0	40.1	46.3	52.4	49.2	57.2	64.2
6.0	47.7	53.9	60.0	56.8	64.8	71.8
8.0	55.3	61.5	67.6	64.4	72.4	79.4
10.0	62.9	69.1	75.2	72.0	80.0	87.0
12.0	70.5	76.7	82.8	79.6	87.6	94.6

Effective R-values have been calculated with BCBC framing factor for standard 16" o.c. roof framing practices.

Below Slab Insulated Floor Assembly



Effective R-Values for Below Slab Insulated Floor Assemblies			
Slab Construction	Inches of Below Slab Insulation COMFORTBOARD™ 80/110 (R-4 per inch)		
	2.0	3.0	4.0
4 inch Concrete Slab	9.0	13.0	17.0

Additional Resources

BCBC 2015, Section 9.36. and Article 9.36.6

Illustrated Builders Guide to the BC Energy Step Code, to be published by BC Housing in early 2018

ROCKWOOL Effective R-Value Calculator. https://www.rockwool.com/technical-resources/tools/r-value-calculator/

Canadian Wood Council Wall Thermal Design Calculator. http://cwc.ca/resources/wall-thermal-design/

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