Building Better Quality Homes to SB-12 Efficiency

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Learning Objectives

- Familiarize delegates with the terminology within SB-12.
- Learn how to utilize Tables within SB-12 for planning future housing projects in order to be code compliant.
  - Currently 12 tables within Chapter 3(our focus today). It could be difficult to determine what tables applies to your project and what it all means.
- Develop knowledge of other code provisions within SB-12.
  - The tables are the fundamental building block of todays session but there's other exceptions and provisions within the code that you should be aware of when planning future housing projects.

SB-12 Table Example

Table 3.1.1.3.C (SI)
ZONE 2 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.3.(3)

Component	Thermal Values[8]	Compliance Package	
		C1	C2
Ceiling with Attic Space	Min. Nominal RSI[1]	10.56 + HH	8.80
	Max. U[2]	0.095	0.115
	Min. Effective RSI[2]	10.55	8.67
Ceiling Without Attic Space	Min. Nominal RSI[1]	5.46	5.46
	Max. U[2]	0.205	0.205
	Min. Effective RSI[2]	4.87	4.87
Exposed Floor	Min. Nominal RSI[1]	5.46 + 1.76 ci	6.16
	Max. U[3]	0.143	0.177
	Min. Effective RSI[3]	7.01	5.64
Walls Above Grade	Min. Nominal RSI[1]	4.22 + 1.76 ci	3.87 + 1.32 ci
	Max. U[3]	0.210	0.238
	Min. Effective RSI[3]	4.76	4.21
Basement Walls[6]	Min. Nominal RSI[1]	3.52 + 2.11 ci	3.52 ci
	Max. U[4]	0.213	0.269
	Min. Effective RSI[4]	4.7	3.72
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal RSI[1]	1.76	—
	Max. U[4]	0.51	—
	Min. Effective RSI[4]	1.96	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal RSI[1]	1.76	1.76
	Max. U[4]	0.510	0.510
	Min. Effective RSI[4]	1.96	1.96
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal RSI[1]	1.76	1.76
Windows and Sliding Glass Doors	Max. U[5]	1.2	1.6
	Energy Rating	34	25
Skylights	Max. U[5]	2.8	2.8
Space Heating Equipment	Min.	—	ASHP: 7.1 HSPF
HRV	Min. SRE	81%	70%
Domestic Water Heater[7]	Min. EF	—	—
Column 1	2	3	4

Notes to Table 3.1.1.2.C (SI):
The following definition applies: HH = 250 mm high heel
(1) The values listed are minimum Nominal RSI-values for the thermal insulation component only.
(2) U-Value and *effective RSI value* shall include entire ceiling assembly components, from interior air film to vented space air film above insulation.
(3) U-Value and *effective RSI value* shall include entire exposed floor or above grade wall assembly components, from interior air film to exterior air film.
(4) U-Value and *effective RSI value* shall include entire *basement* wall or slab assembly components and interior air film.
(5) U-Value is the *overall coefficient of heat transfer* for a window assembly, sliding glass door assembly or skylight assembly expressed in W/(m²•K).
(6) In the case of *basement* wall assemblies, where RSI 3.52 ci is required RSI 2.11 + 1.76 ci is permitted to be used or vice versa; or where RSI 2.11 + 0.88 ci is required, RSI 2.64 ci is permitted to be used or vice versa.
(7) If an EF of a water tank is not indicated in a compliance package, there is no EF requirement for water tank for that specific compliance package.
(8) Nominal and *effective RSI values* are expressed in (m²•K)/W. U-Values are expressed in W/(m²•K).

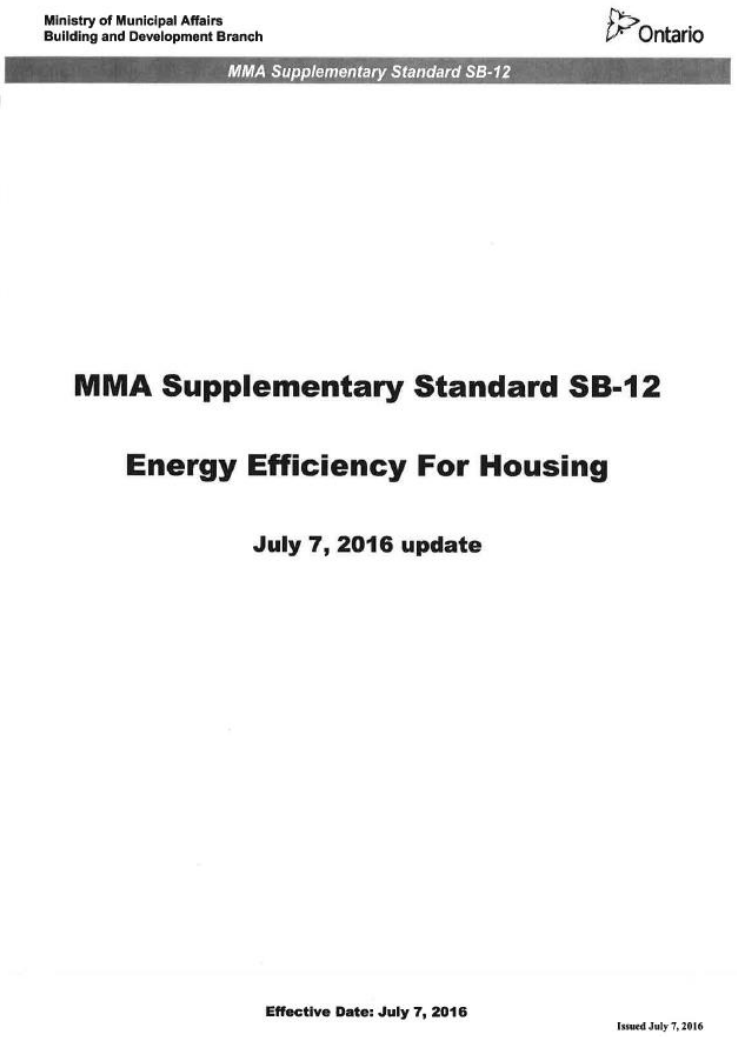
Agenda

- Background
  - SB-12- What is it and why do we need to use it?
  - SB-1- How is climate data used within SB-12?
- Terminology
  - Zones
  - Heating Degree Days
  - Compliance Packages
  - Thermal Values- R-value(Nominal and Effective), RSI value, U-Value
- Building Components
  - Ceilings
    - High Heels Trusses
  - Exposed Floors
    - Insulation Types- Are they the same?

Agenda

- Walls
  - Compacting insulation
- Below Grade Slabs
- Windows, Sliding Glass Doors and Skylights
  - Units in glazing
- HRV's
  - HVI Institute
- Domestic Hot Water Tanks
- Design Examples
  - Zone 2- Fort Albany First Nation
  - Plans Review Examples
- Other Code Provisions
- Questions

Background



Ministry of Municipal Affairs
Building and Development Branch

Ontario

MMA Supplementary Standard SB-12

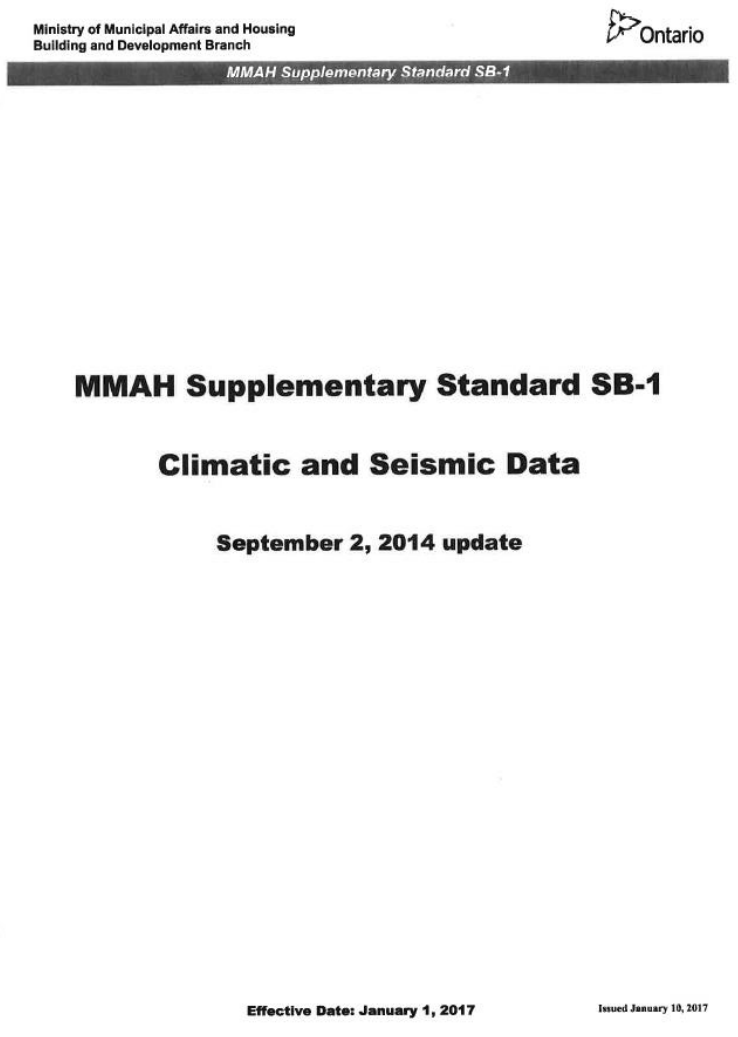
MMA Supplementary Standard SB-12

Energy Efficiency For Housing

July 7, 2016 update

Effective Date: July 7, 2016

Issued July 7, 2016



Ministry of Municipal Affairs and Housing
Building and Development Branch

Ontario

MMAH Supplementary Standard SB-1

MMAH Supplementary Standard SB-1

Climatic and Seismic Data

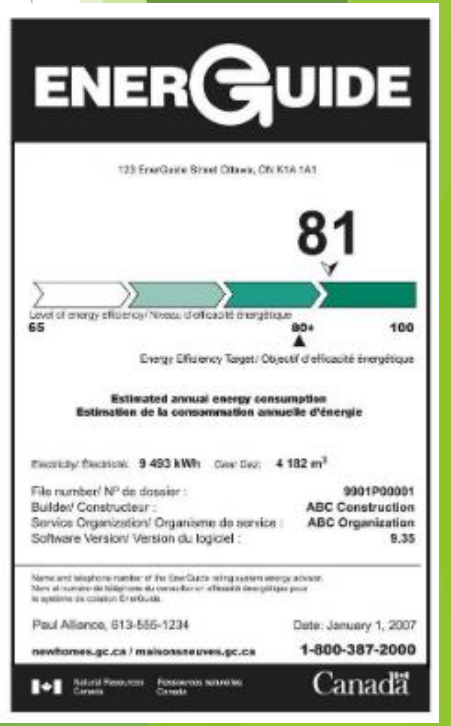
September 2, 2014 update

Effective Date: January 1, 2017

Issued January 10, 2017

MMAH Supplementary Standard SB-12 Energy Efficiency For Housing

- What is SB-12 and why do we need to utilize it?
  - “This Supplementary Standard includes design options regarding the energy efficiency of a building or part of residential occupancy that is within the scope of Part 9 and is intended for occupancy on a continuing basis during the winter months.”
  - First published in 2009, SB-12 was intended to meet or exceed energy efficiency standards of EnerGuide 80 level of energy efficiency.
  - The standard has evolved overtime, “Chapter 3” provides a 15% increase in energy efficiency compared to the requirements that took place in 2012 (Chapter 2).
  - The standard is prescriptive. No specific labelling such as the EnerGuide labelling is required.
  - Utilizing the standard will ensure your housing is built to code and energy efficient for members of your community.



How is SB-12 Structured?

- Chapter 1- General
  - Scope
  - Application
  - Terms and Abbreviations
  - Referenced Documents and Organizations
- Chapter 2- Acceptable Solutions for Compliance Before January 1, 2017
- **Chapter 3- Acceptable Solutions for Compliance After December 31, 2016**

Our focus today.

What Has Changed?

Chapter 2: Before January 1, 2017

Table 2.1.1.2.C
ZONE 1 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 2.1.1.2.(3)

Component	Compliance Package	
	A	B
Ceiling with Attic Space Minimum RSI (R)-Value[1]	8.81 (R50)	8.81 (R50)
Ceiling Without Attic Space Minimum RSI (R)-Value[1]	5.46 (R31)	5.46 (R31)
Exposed Floor Minimum RSI (R)-Value[1]	5.46 (R31)	5.46 (R31)
Walls Above Grade Minimum RSI (R)-Value[1]	5.11 (R29)	5.11 (R29)
Basement Walls Minimum RSI (R)-Value[1]	3.52 (R20)	2.11 (R12)
Below Grade Slab Entire Surface > 600 mm Below Grade Minimum RSI (R)-Value[1]	—	—
Edge of Below Grade Slab ≤ 600 mm Below Grade Minimum RSI (R)-Value[1]	1.76 (R10)	1.76 (R10)
Heated Slab or Slab ≤ 600 mm Below Grade Minimum RSI (R)-Value[1]	1.76 (R10)	1.76 (R10)
Windows and Sliding Glass Doors Maximum U-Value[2]	1.6	1.6
Skylights Maximum U-Value[2]	2.8	2.8
Space Heating Equipment Minimum AFUE	—	—
HRV Minimum Efficiency	55%	75%
Domestic Water Heater Minimum EF	—	—
Column 1	2	3

Chapter 3: After December 31, 2016

Table 3.1.1.2.C (IP)
ZONE 1 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.2.(3)

Component	Thermal Values[8]	Compliance Package			
		C1	C2	C3	C4
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	60 + HH	50	50
	Max. U[2]	0.016	0.016	0.020	0.020
	Min. Effective R[2]	59.90	59.90	49.23	49.23
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	31	35	35
	Max. U[3]	0.034	0.034	0.031	0.031
	Min. Effective R[3]	29.80	29.80	32.02	32.02
Walls Above Grade	Min. Nominal R[1]	19 + 10 ci	22 + 10 ci	22 + 10 ci	22 + 7.5 ci
	Max. U[3]	0.040	0.038	0.038	0.042
	Min. Effective R[3]	25.32	26.40	26.40	23.90
Basement Walls[6]	Min. Nominal R[1]	20 + 8 ci	20 ci	20 ci	20 ci
	Max. U[4]	0.044	0.047	0.047	0.047
	Min. Effective R[4]	22.71	21.12	21.12	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	7.5	—	—	—
	Max. U[4]	0.116	—	—	—
	Min. Effective R[4]	8.63	—	—	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10
	Max. U[4]	0.090	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.25	0.21	0.21	0.28
	Energy Rating	29	34	34	25
Skylights	Max. U[5]	0.49	0.49	0.49	0.49
Space Heating Equipment	Min.	—	—	—	ASHP: 7.1 HSPF
HRV	Min. SRE	81%	75%	81%	55%
Domestic Water Heater[7]	Min. EF	—	—	—	—
Column 1	2	3	4	5	6

MMAH Supplementary Standard SB-1 Climatic and Seismic Data

- Describes how climatic design values are computed and provides recommended design data for a number of locations.
- All climatic data are based off weather observations collected by Atmospheric Environment Service, Environment Canada.
- Not all locations are identified. i.e. Moose Cree First Nation (Moose Factory)
  - May contact Environment Canada for further information.
  - Alternatively use a nearby community. i.e. Moosonee.
  - If there's no community close-by, use a community which is further away but is more restrictive.

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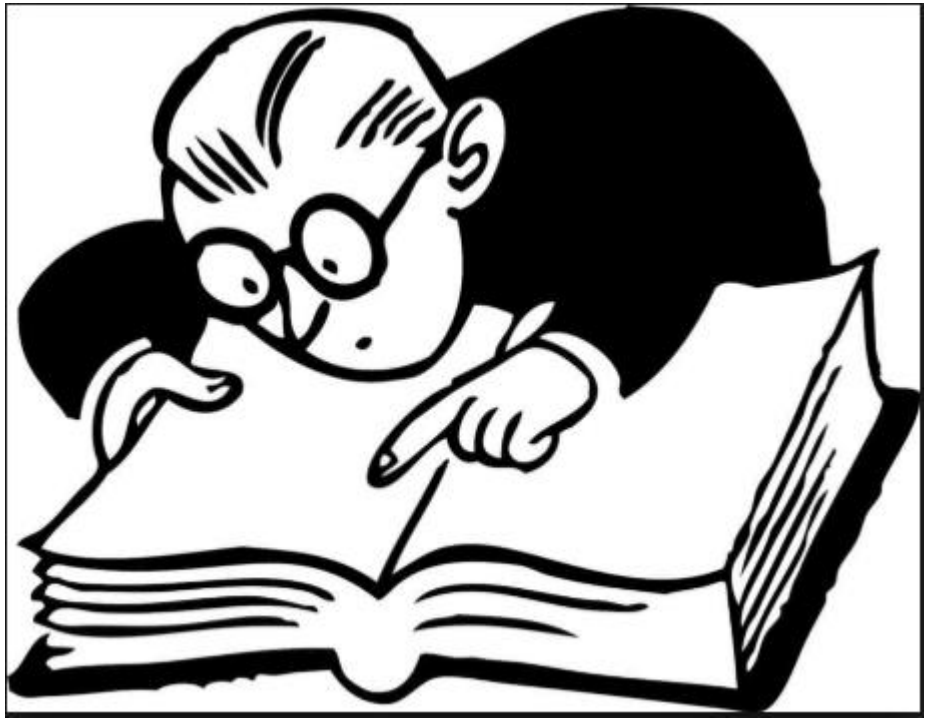
Table 1.2 (Cont'd)
Design Data for Selected Locations in Ontario

Location	Elevation, m	Design Temperature				Degree Days Below 18°C	15 Min Rainfall, mm	One Day Rainfall, 1/50, mm	Annual Rainfall, mm	Annual Total Precipitation, mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa		Seismic Data				
		January		July 2.5%										1/10	1/50					
		2.5%, °C	1%, °C	Dry, °C	Wet, °C							S_s	S_r			$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	PGA
Milverton	370	-19	-21	29	23	4200	28	108	800	1050	160	2.4	0.4	0.33	0.43	0.140	0.086	0.054	0.018	0.044
Minden	270	-27	-29	29	23	4640	25	97	780	1010	100	2.7	0.4	0.27	0.35	0.200	0.140	0.078	0.026	0.065
Mississauga	160	-18	-20	30	23	3880	25	113	720	800	160	1.1	0.4	0.34	0.44	0.260	0.150	0.065	0.020	0.140
Mississauga (Lester B. Pearson International Airport)	170	-20	-22	31	24	3890	26	108	685	790	160	1.1	0.4	0.34	0.44	0.210	0.120	0.065	0.021	0.120
Mississauga (Port Credit)	75	-18	-20	29	23	3780	25	108	720	800	160	0.9	0.4	0.37	0.48	0.280	0.150	0.065	0.021	0.150
Mitchell	335	-18	-20	29	23	4100	28	113	810	1050	160	2.4	0.4	0.37	0.48	0.130	0.083	0.053	0.017	0.042
Moosonee	10	-36	-38	28	22	6800	18	81	500	700	160	2.2	0.3	0.27	0.35	0.130	0.068	0.040	0.014	0.057
Morrisburg	75	-23	-25	30	23	4370	25	103	800	950	180	2.3	0.4	0.32	0.41	0.600	0.300	0.140	0.044	0.310
Mount Forest	420	-21	-24	28	22	4700	28	103	740	940	140	2.7	0.4	0.32	0.41	0.130	0.087	0.055	0.018	0.043
Nakina	325	-36	-38	28	21	6500	20	86	540	750	100	2.8	0.4	0.23	0.30	0.095	0.057	0.026	0.008	0.036
Nanticoke (Jarvis)	205	-17	-18	30	23	3700	28	108	840	900	160	1.4	0.4	0.37	0.48	0.220	0.120	0.062	0.019	0.120
Nanticoke (Port Dover)	180	-15	-17	30	24	3600	25	108	860	950	140	1.2	0.4	0.37	0.48	0.190	0.110	0.060	0.018	0.093
Napanee	90	-22	-24	29	23	4140	23	92	770	900	160	1.9	0.4	0.33	0.43	0.280	0.170	0.094	0.030	0.110
New Liskeard	180	-32	-35	30	22	5570	23	92	570	810	100	2.3	0.4	0.33	0.43	0.240	0.140	0.078	0.025	0.120
Newcastle	115	-20	-22	30	23	3990	23	86	760	830	160	1.5	0.4	0.37	0.48	0.200	0.130	0.074	0.024	0.081
Newcastle (Bowmanville)	95	-20	-22	30	23	4000	23	86	760	830	160	1.4	0.4	0.37	0.48	0.200	0.130	0.073	0.023	0.078
Newmarket	185	-22	-24	30	23	4260	28	108	700	800	140	2.0	0.4	0.29	0.38	0.160	0.110	0.065	0.021	0.051
Niagara Falls	210	-16	-18	30	23	3600	23	96	810	950	160	2.0	0.4	0.33	0.43	0.340	0.190	0.070	0.023	0.200
North Bay	210	-28	-30	28	22	5150	25	95	775	975	120	2.2	0.4	0.27	0.34	0.250	0.150	0.079	0.027	0.110
Norwood	225	-24	-26	30	23	4320	25	92	720	850	120	2.1	0.4	0.32	0.41	0.210	0.140	0.083	0.027	0.070
Oakville	90	-18	-20	30	23	3760	23	97	750	850	160	0.9	0.4	0.36	0.47	0.320	0.170	0.065	0.022	0.180
Orangeville	430	-21	-23	29	23	4450	28	108	730	875	140	2.3	0.4	0.28	0.36	0.150	0.097	0.060	0.020	0.051
Orillia	230	-25	-27	29	23	4260	25	103	740	1000	120	2.4	0.4	0.28	0.36	0.160	0.110	0.068	0.023	0.046
Oshawa	110	-19	-21	30	23	3860	23	86	760	875	160	1.4	0.4	0.37	0.48	0.190	0.120	0.072	0.023	0.074
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Terminology

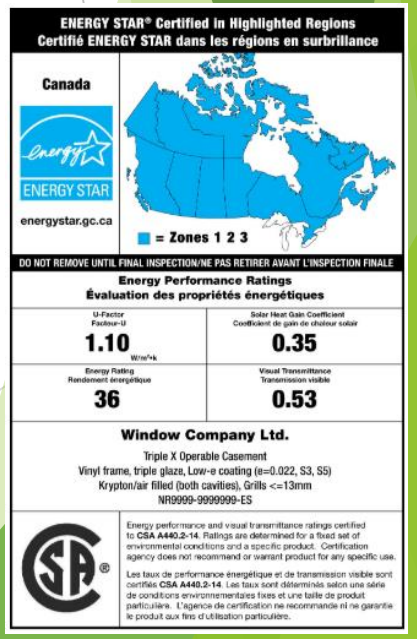
- Zones, Compliance Package, Heating Degree Days…

What does it all mean?

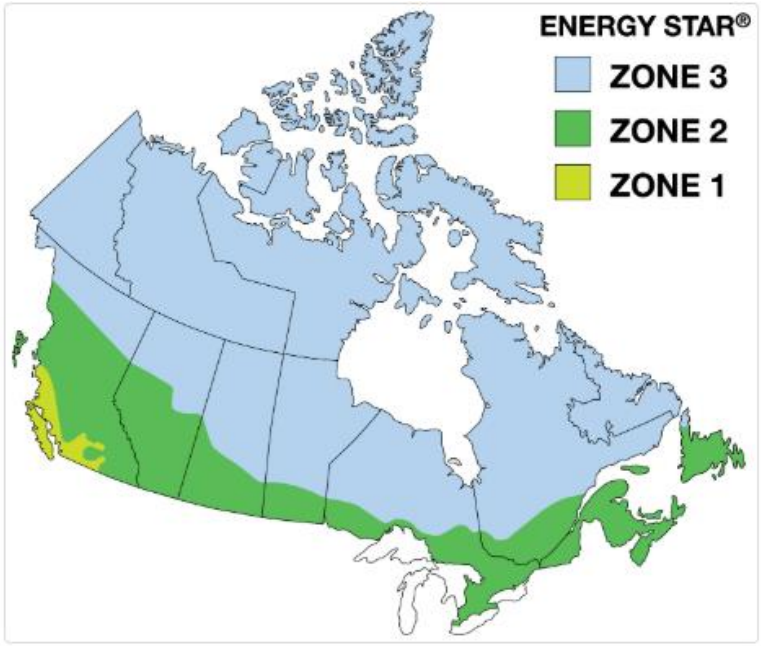


Zones in Reference to SB-12?

- What is a zone and how is it determined?
  - Zone 1- If the building is located in an area where the “Heating Degree Days” is less than 5000.
  - Zone 2- If the building is located in an area where the “ Heating Degree Days” is 5000 or more.
- How does this relate to SB-12?
  - Your zone narrows down which Table in SB-12 to meet code.
  - Once you determine your zone, you narrow down the tables from 12 to 6.
- Don’t confuse SB-12 zones with Energy Star zones. Although they sound the same they have a different scale to classify zones in HDD.



Energy Star Zones



Zone 3: >= 6000 HDDs
Zone 2: >= 3500 to < 6000 HDDs
Zone 1: < 3500 HDDs

Example: Attawapiskat First Nation: 7100 Heating Degree Days

Heating Degree Days (HDD)

- How is HDD Calculated?
  - Data was compiled from stations for the 25 year-period ending in 2006.
  - Add the difference between 18 Degrees Celsius and the mean temperature for every day in that year when the mean temperature is below 18 Degree Celsius.
  - It is assumed no heat is required when the mean outside air temperature for the day is 18 degrees Celsius or higher.
    - Very little heating degree days in the summer. Summer mean temperatures mostly above 18 Degrees Celsius daily. If the mean temperature is above 18 Degrees Celsius the HDD for the that day would be 0.

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Table 1.2 (Cont'd)
Design Data for Selected Locations in Ontario

Location	Elevation, m	Design Temperature				Degree Days Below 18°C	15 Min Rainfall, mm	One Day Rainfall, 1/50, mm	Annual Rainfall, mm	Annual Total Precipitation, mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa		Seismic Data				
		January		July 2.5%										1/10	1/50					
		2.5%, °C	1%, °C	Dry, °C	Wet, °C							S_s	S_r			$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	PGA
Smooth Rock Falls	235	-34	-36	29	21	6250	20	92	560	650	80	2.7	0.3	0.25	0.32	0.160	0.089	0.049	0.017	0.065
South River	355	-27	-29	29	22	5090	25	103	830	975	120	2.8	0.4	0.27	0.35	0.230	0.140	0.077	0.027	0.086
Southampton	180	-17	-19	28	22	4100	25	92	800	830	180	2.7	0.4	0.41	0.53	0.110	0.078	0.051	0.017	0.036
St. Catharines	105	-16	-18	30	23	3540	23	92	770	850	160	1.0	0.4	0.36	0.46	0.340	0.190	0.069	0.023	0.200
St. Mary's	310	-18	-20	30	23	4000	28	108	820	1025	160	2.2	0.4	0.36	0.47	0.140	0.086	0.054	0.017	0.049
St. Thomas	225	-16	-18	31	24	3780	25	103	900	975	180	1.4	0.4	0.36	0.47	0.160	0.096	0.056	0.017	0.068
Stirling	120	-23	-25	30	23	4220	25	97	740	850	120	1.7	0.4	0.31	0.40	0.250	0.160	0.088	0.028	0.096
Stratford	360	-18	-20	29	23	4050	28	113	820	1050	160	2.3	0.4	0.35	0.45	0.140	0.087	0.055	0.018	0.045
Strathroy	225	-17	-19	31	24	3780	25	103	770	950	180	1.9	0.4	0.36	0.47	0.140	0.086	0.052	0.016	0.064
Sturgeon Falls	205	-28	-30	29	21	5200	25	95	700	910	140	2.2	0.4	0.27	0.35	0.220	0.130	0.072	0.025	0.086
Sudbury	275	-28	-30	29	21	5180	25	97	650	875	200	2.5	0.4	0.36	0.46	0.150	0.100	0.069	0.020	0.051
Sundridge	340	-27	-29	29	22	5080	25	97	840	975	120	2.8	0.4	0.27	0.35	0.230	0.140	0.076	0.026	0.082
Tavistock	340	-19	-21	29	23	4100	28	113	820	1010	160	2.1	0.4	0.35	0.45	0.140	0.090	0.056	0.018	0.053
Temagami	300	-30	-33	30	22	5420	23	92	650	875	120	2.6	0.4	0.29	0.37	0.250	0.150	0.077	0.026	0.120
Thamesford	280	-19	-21	30	23	3950	28	108	820	975	160	1.9	0.4	0.37	0.48	0.160	0.095	0.056	0.018	0.076
Thedford	205	-16	-18	31	23	3710	25	103	810	900	180	2.1	0.4	0.39	0.50	0.120	0.077	0.050	0.016	0.038
Thunder Bay	210	-31	-33	29	21	5650	23	108	560	710	160	2.9	0.4	0.30	0.39	0.095	0.057	0.026	0.008	0.036
Tillsonburg	215	-17	-19	30	24	3840	25	103	880	980	160	1.3	0.4	0.34	0.44	0.170	0.100	0.058	0.018	0.091
Timmins	300	-34	-36	29	21	5940	20	108	560	875	100	3.1	0.3	0.27	0.35	0.140	0.090	0.054	0.018	0.056
Timmins (Porcupine)	295	-34	-36	29	21	6000	20	103	560	875	100	2.9	0.3	0.29	0.37	0.160	0.094	0.056	0.018	0.068
Toronto (Metropolitan)																				
Etobicoke	160	-20	-22	31	24	3800	26	108	720	800	160	1.1	0.4	0.34	0.44	0.210	0.120	0.065	0.021	0.110
North York	175	-20	-22	31	24	3760	25	108	730	850	150	1.2	0.4	0.34	0.44	0.190	0.110	0.066	0.021	0.078
Scarborough	180	-20	-22	31	24	3800	25	92	730	825	160	1.2	0.4	0.36	0.47	0.190	0.110	0.068	0.022	0.076
Toronto (City Hall)	90	-18	-20	31	23	3520	25	97	720	820	160	0.9	0.4	0.34	0.44	0.220	0.130	0.067	0.021	0.120
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Thunder Bay- HDD

Daily Data Report for July 2018

	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
DAY											
01											
02	28.6	10.2	19.4	0.0	1.4	M	M	0.0		28	52
03	20.8	12.8	16.8	1.2	0.0	M	M	3.4			<31
04											

Daily Data Report for December 2018

	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
DAY											
01	-2.4	-9.8	-6.1	24.1	0.0			0.0		7	37
02	-1.8	-4.1	-3.0	21.0	0.0			0.0		3	48
03	-4.0	-9.0	-6.5	24.5	0.0			0.0		33	32

Space Heating Equipment and AFUE

- Annual Fuel Utilization Efficiency (AFUE)-
  - How efficient is your equipment at utilizing fuel?
  - The greater the efficiency, the more heat you get per unit of fuel.
  - High efficiency furnaces typically have an AFUE of 90% or more. Units can be as efficient as 98% with the exception of electric heat which is 100% efficient.
  - Units are labelled which specify efficiency and capacity of the unit in question.
  - In order to meet prescription solutions of the selected compliance package, you must ensure your equipment meets the minimum AFUE.
  - Once you determine your heating equipment and AFUE the Tables get further reduced from 6 to 2.

Units- Metric Versus Imperial

- Next you'll need to determine what type of units you'll use.
  - Imperial Units- Feet, pounds, Celsius, R-value
  - Metric Units(English units)- Meter, grams. Kelvin, RSI
- Once you select what type of units you're comfortable with using, you can further reduce the number of Tables from 2 to 1.

Compliance Packages

- Compliance packages are a set of minimum thermal values for each building component.
- Once you've identified your Zone and your Space Heating Equipment you must select a package to which the housing project will comply to.
- You must meet the minimum specification set out in the package. You can't choose a lower spec'd thermal value in another package.

Table 3.1.1.3.B (IP)
ZONE 2 - Compliance Packages for Space Heating Equipment with 84% ≤ AFUE < 92%
Forming Part of Sentence 3.1.1.3.(2)

Component	Thermal Values[3]	Compliance Package					
		B1	B2	B3	B4	B5	B6
Ceiling with Attic Space	Min. Nominal R[1]	50	60	60 + HH	60 + HH	50	60
	Max. U[2]	0.020	0.017	0.016	0.016	0.020	0.017
	Min. Effective R[2]	49.23	59.22	59.90	59.90	49.23	59.22
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65	27.65	27.65

Thermal Values of Housing Components

- Three Thermal Value Types for Assemblies:
  - Minimum Nominal R
  - Maximum U
  - Minimum Effective R
- Important Note: You must meet one of the above thermal values to be within compliance of SB-12.

Table 3.1.1.3.C (IP)
ZONE 2 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.3.(3)

Component	Thermal Values[8]	Compliance Package	
		C1	C2
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	50
	Max. U[2]	0.016	0.020
	Min. Effective R[2]	59.90	49.23

Nominal R-Value of Assemblies

- Nominal R-value of an assembly are the values listed for the insulation component of the assembly.
- The higher the R-value the better.
- Minimum nominal R-values indicated in SB-12 have two components.
  - The first component is the insulating component between your framing. Typically batt insulation.
  - The second component calls for “ci” which means continuous insulation. Continuous insulation is insulation which is uninterrupted by framing components. Typically rigid foam insulation is used such as XPS.
- For example: Minimum nominal R-value= 19 + 10ci

Effective R- Value of Assemblies

- Is the summation of the R-value of each individual component/material in the assembly.
  - For example, if one would calculate the effective R-value of a wall above grade. They would consider the R-value of every component of the wall which includes:
    - Exterior Air Film
    - Exterior Finish(Siding)
    - Air Spaces
    - Exterior Insulation(if any)
    - Sheathing
    - Stud dimensional lumber with the insulating component
    - Vapour Barrier
    - Drywall
    - Interior Air film
- Every material used has an R-value. Different materials have higher or lower R-value compared to one-another.

R-Value of Different Materials

- Different materials have different R-value.
- Would we “insulate” a 2x6 stud cavity with additional SPF lumber?
- Calculation #1
  - SPF Lumber= R-1.23 per inch
  - Lumber depth- 5.5 inch
  - Therefore 1.23*5.5= R-6.765 per 5.5 inch
- Calculation #2
  - R-19 Batt= R-19 per 5.5 inch

Insulating materials discussed have better properties which have a higher thermal resistance.

How Does Framing Effect A Walls Effective R- Value?

NRCan- Tables for Calculating Effective Thermal Resistance of Opaque Assemblies

Walls Above Grade - Lumber Studs[1]
(Walls Above and Not in Contact with Ground)
Stud dimensional lumber - 38 mm x 140 mm (2"x6") with RSI=1.19 m^2K/W

Cavity Insulation Component (Nominal Thermal Resistance)		Framing Configuration[2] (on-centre spacing)			
		304 mm (12")	406 mm (16")	488 mm (19.2")	610 mm (24")
		Effective Thermal Resistance			
RSI	R	RSI	RSI	RSI	RSI
2.99	17	2.18	2.22	2.26	2.30
3.17	18	2.25	2.29	2.33	2.38
3.34	19	2.32	2.36	2.41	2.45
3.52	20	2.38	2.43	2.48	2.53
3.70	21	2.44	2.49	2.55	2.60
3.87	22	2.49	2.55	2.61	2.67
4.05	23	2.55	2.61	2.67	2.74
4.23	24	2.60	2.66	2.73	2.80

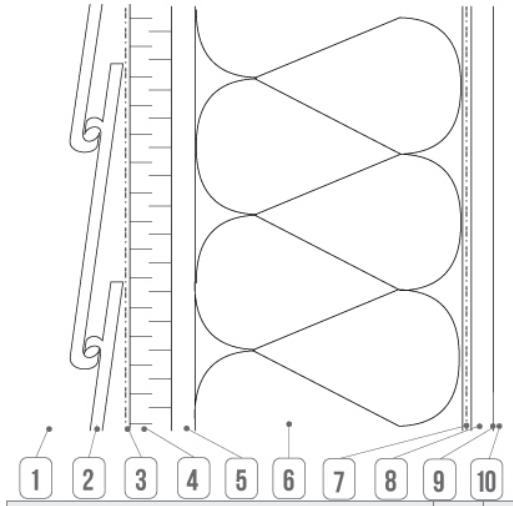
NOTES:

1. Continuous surface air films that are eligible to be added: Exterior air film 0.03 m^2K/W, and interior wall air film 0.12 m^2K/W.
2. Frame-Cavity Percentage – 304 mm (12"): 24.5% frame, 75.5% cavity; 406 mm (16"): 23% frame, 77% cavity; 488 mm (19.2"): 21.5% frame, 78.5% cavity; 610 mm (24"): 20% frame, 80% cavity.

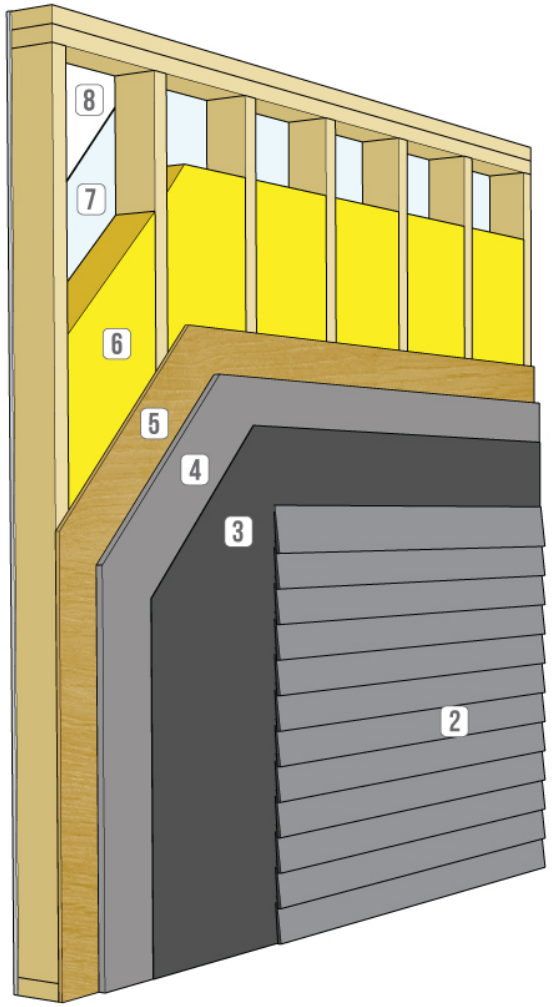
R=13.4
30% Reduction in R-Value due to Framing

Calculating the Effective R-Value for an Assembly

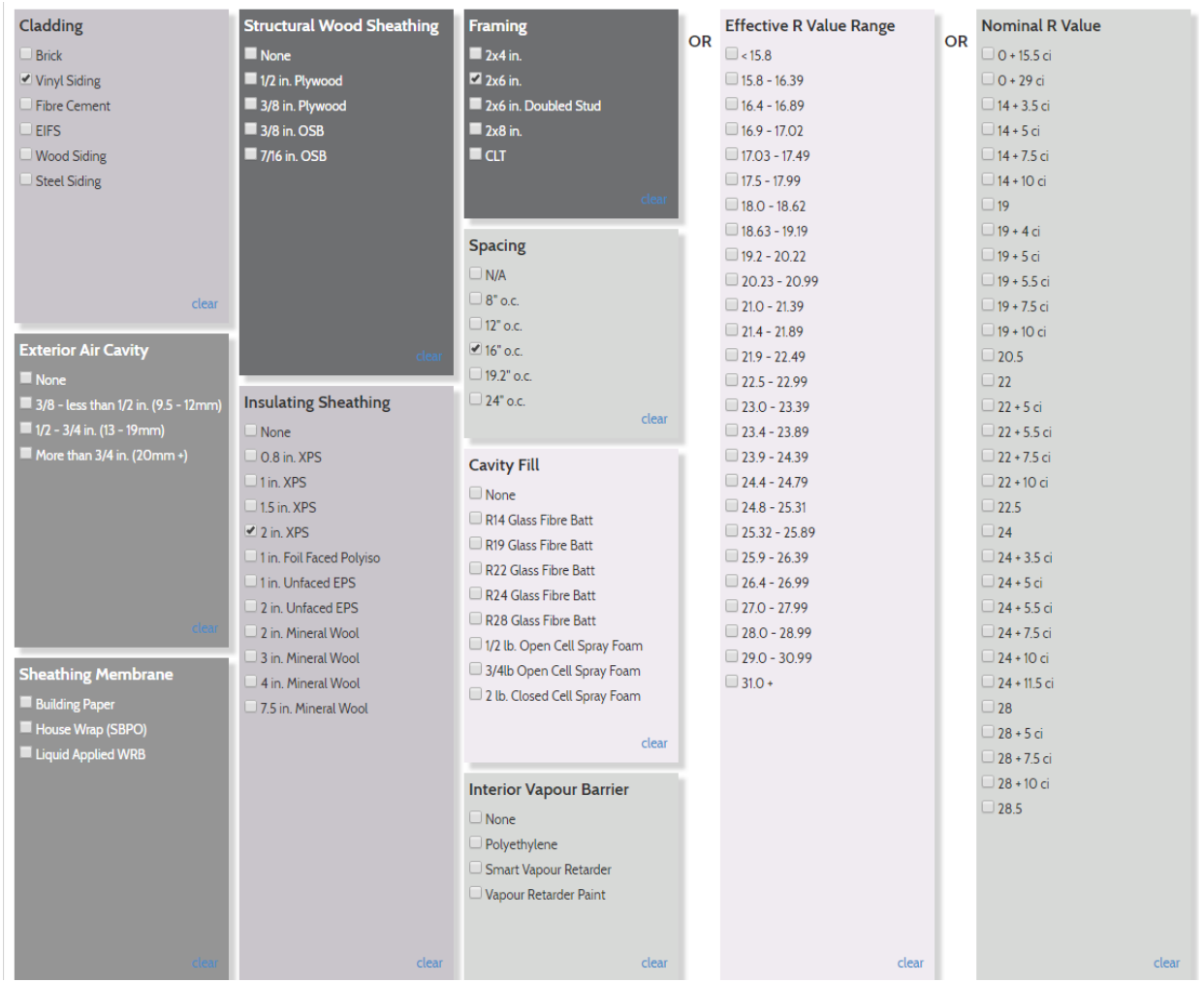
Example: Wall-Above Grade



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	spun bonded polyolefin (house wrap)	0.00	0.00
4	2" (50.8mm) extruded polystyrene type 3/4	1.78	10.10
5	7/16" (11.1mm) OSB sheathing	0.11	0.62
6	2x6 framing filled with R19 batt @ 16" o.c.	2.36	13.40
7	polyethylene	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68
Effective RSI / R Value of Entire Assembly		4.59	26.04
Centre of Cavity RSI / R Value		5.57	31.64
Installed Insulation RSI / R Value(nominal)		5.12	29.10
Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1))		4.72	26.78



EffectiveR.ca



Max U-Value Versus R-Value

- The lower the U-Value the better.
- The industry generally uses R-value. Higher R the better.
- R=1/U or U= 1/R

If the R value of an assembly is R-20 then the u value would be:

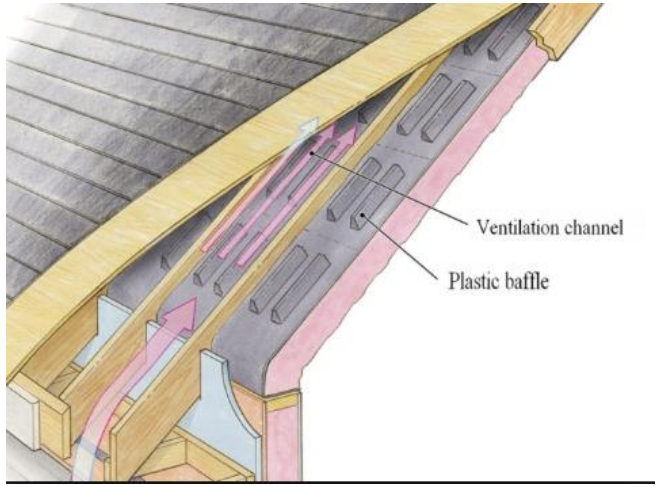
U=1/R
U=1/20
U=0.05

Components of A Home

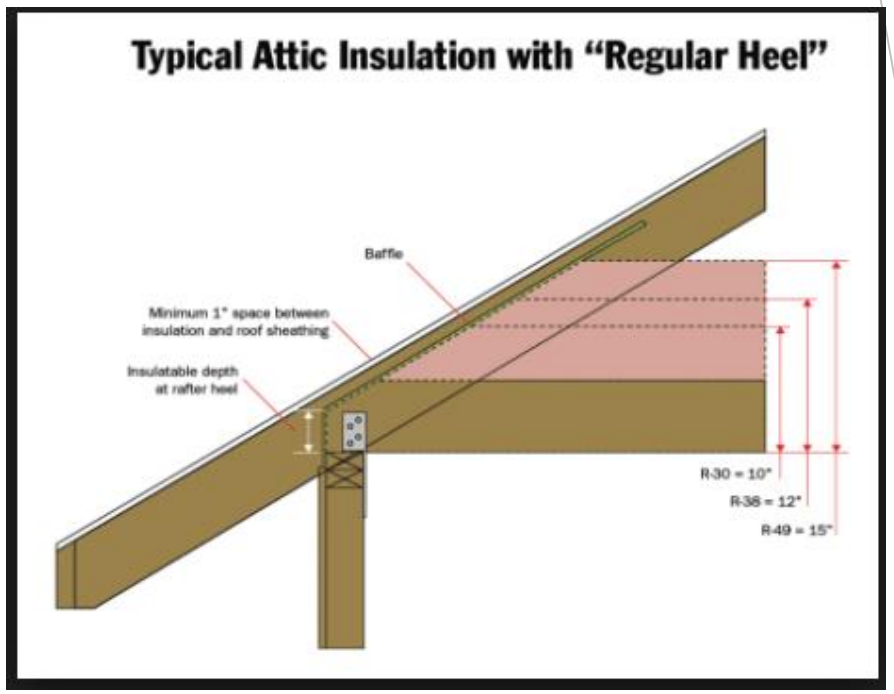
Ceilings

Ceiling with Attic Space

Ceiling Without Attic Space



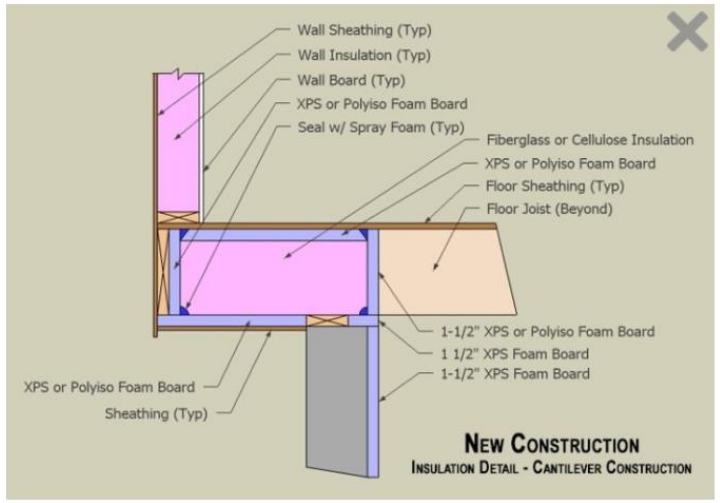
High Heel Trusses



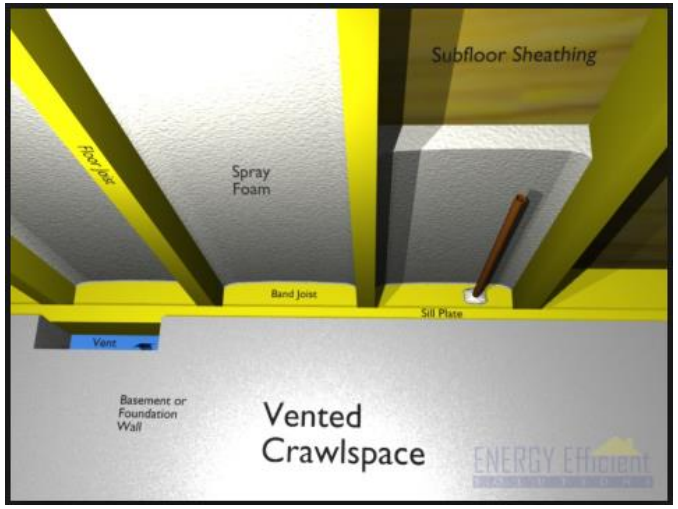
High Heel (HH) Trusses allow for more insulation to be installed. Reduce cold spots. More efficient.

Exposed Floors

Cantilevered Floor Joists



Unconditioned Crawlspace



Types of Insulation

- Rigid Foam Types include: XPS(Expanded Polystyrene), EPS (Expanding Polystyrene), Polyisocyanurate.
- Mineral Wool Insulation, AKA Roxul
- Fiberglass Insulation (blown and batt)
- Cellulose Insulation (blown and batt)
- Spray Foams: Open and Closed Cell

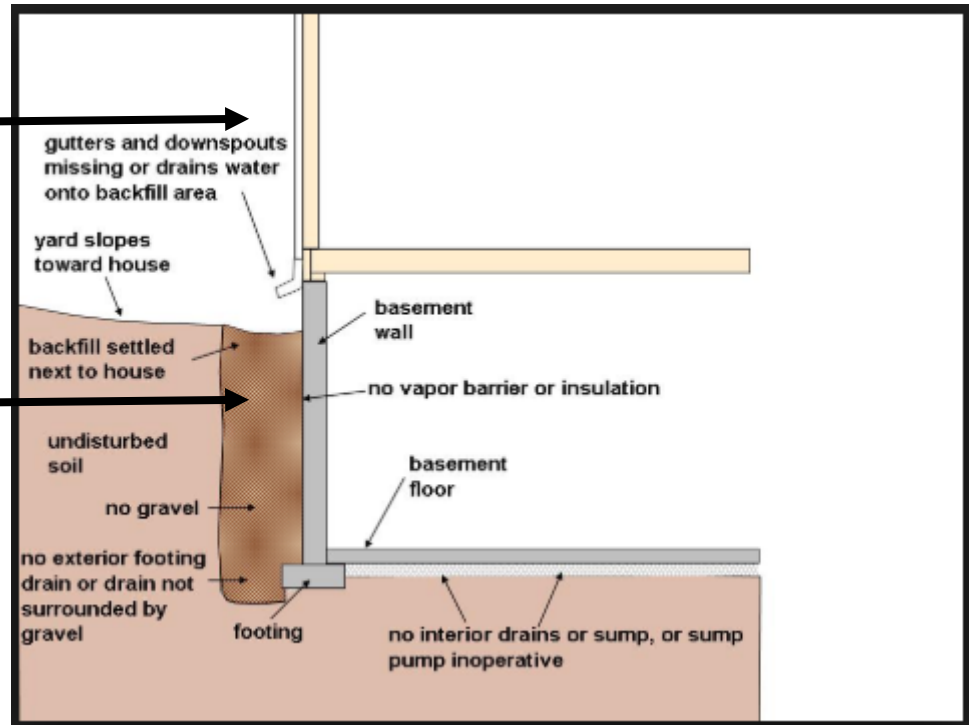
Not all Rigid Foams Are The Same

Type of Insulation	R-Value per Inch	Permeance
XPS	R-5	23-92
EPS	R-3.75	86-160
Polyiso (foil faced)	R-6	4.3

Walls

Walls Above Grade

Basement Wall



What would a rim joist cavity be considered?

Compacting Insulation in Wall Cavities

OWENS CORNING
INNOVATIONS FOR LIVING

Building Insulation Compressed R-value Chart

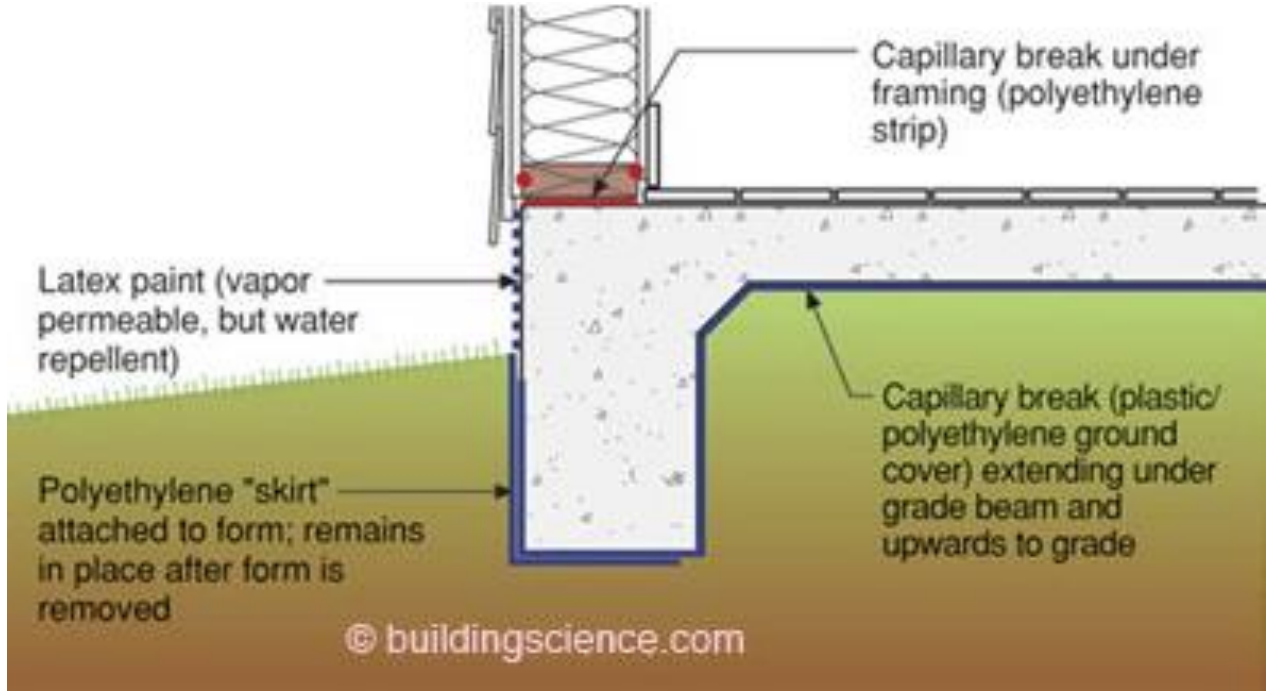
Technical Bulletin

When compressed to less than its' labeled thickness, glass fiber insulation will experience a reduction in R-value. The chart below indicates the compressed R-value of standard building insulation products when installed in framing cavities with a depth that is less than the labeled thickness of the insulation.

Nominal Lumber Size	Cavity Depth	Insulation R-Values When Compressed In Framing Cavity											
2 x 12	11 ¼"	37	38										
2 x 10	9 ¼"	32	35	28									
2 x 8	7 ¼"	27	29	25	27	24							
2 x 6	5 ½"			21	22	20	19	21	18				
2 x 4	3 ½"						14	15	13	15	13	11	
2 x 3	2 ½"									11	10	8.9	8.0
2 x 2	1 ½"										6.6	6.1	5.7
2 x 1	¾"												3.3
Product R-Value		R-38	R-38C	R-30	R-30C	R-25	R-22	R-21	R-19	R-15	R-13	R-11	R-8
Label Thickness		12"	10 ¼"	9 ½"	8 ¼"	8"	6 ¾"	5 ½"	6 ¼"	3 ½"	3 ½"	3 ½"	2 ½"

Notes: 1. Minimum dressed lumber thickness per U.S. Dept. of Commerce/NIST publication PS 20-10.
2. Above listing for information only; some products will resist compression into framing cavities.

Below Grade Slabs

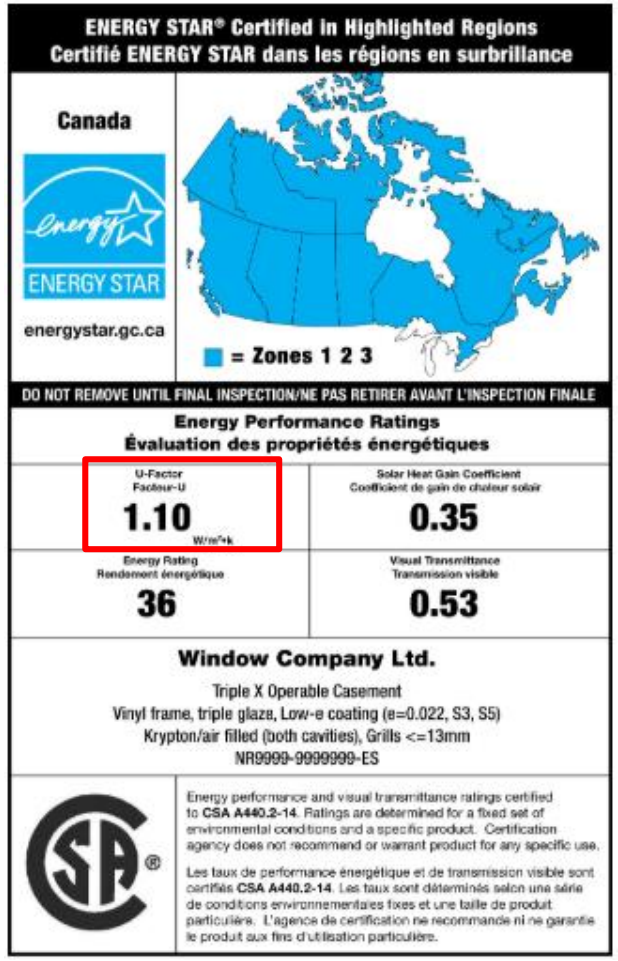


Windows, Sliding Glass Doors and Skylights

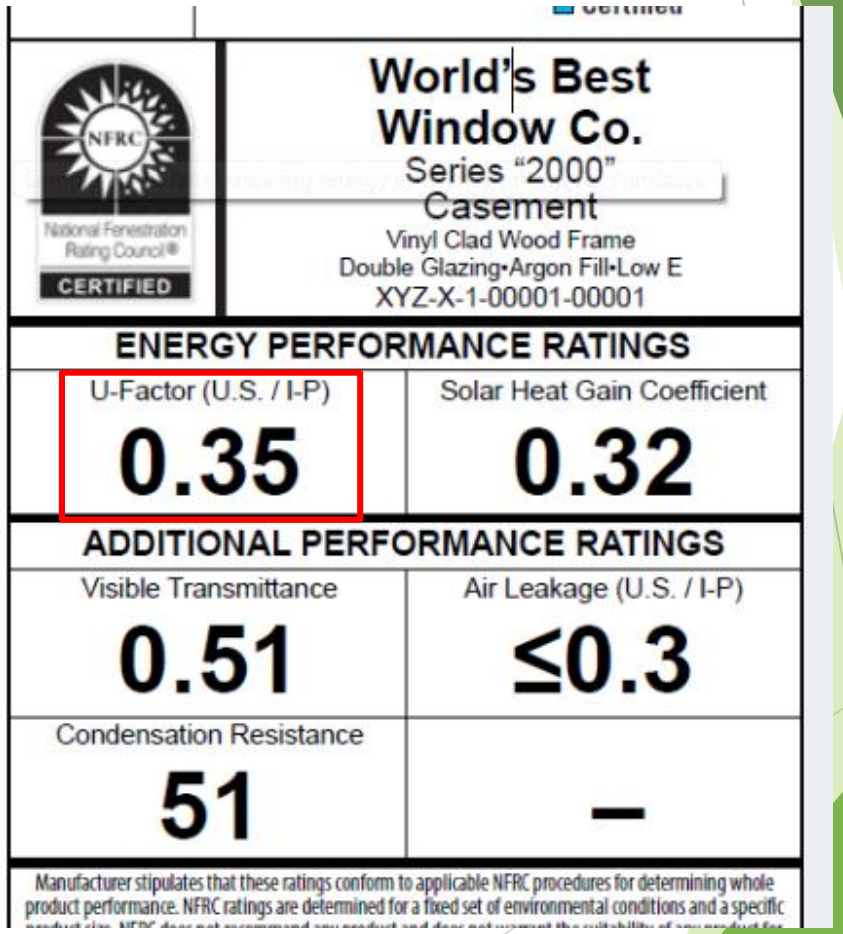
- Be careful of U-value or Energy Rating(ER) of all glazing within the unit.
- Lower U-value= better window. Higher ER= better window.
- Building codes restrict a maximum U-value of glazing or allow minimum specified Energy Rating as determined by Energy Star.
- Choose quality windows and sliding glass doors.
- Fixed windows are more energy efficient as compared to operable.
- Ex. Triple glazed, vinyl clad, gas filled(argon or krypton), low-e coating with insulated spacers.
- Windows could take up to 8 weeks shipped from the manufacturer. Talk to your supplier to ensure you're getting what you want.

Glazing- Units of Measure

Which window is better in terms of U-Factor?



U-Value, W/m²•K (Btu/h•ft²•°F)



Conversion Factor= 0.176 1.1*0.176=0.194

HRV's

- Provides ventilation within the home.
- Ensure the unit is sized(minimum CFM's) and meets the minimum efficiency standards.
- Efficiency measured in Sensible Recovery Efficiency (SRE)
- The greater the efficiency the better. More heat gets transferred from the HRV's core.
- HRV efficiency upwards to 88% efficient. Minimum 55%. Compliance package will specify minimum efficiency of unit.
- Other considerations include, Brand, pricing, defrost cycles etc.
- Plan where the HRV will be located.

Home Ventilating Institute (HVI)

- 3rd Party Testing institution which tests performance of ventilation products such as HRV's, exhaust fans, ERV's.
- Compiles data of every brand and model available in Canada.
- Data includes Sensible recovery efficiency, Airflow, Power consumed, Energy Star certified.
- Sort data to meet your project specifications.

Product Category	Brand Owner	Brand Name	Model	Net Supply at 100 Pa (L/s)	Net Supply at 0.4" w.g. (cfm)	Model Details	Max Rated Sensible Recovery Efficiency at 0 deg C	Net Airflow @ Max Rated SRE (L/s)	Net Airflow @ Max Rated SRE (cfm)	Power Consumed @ Max Rated SRE (watts)	ENERGY STAR (Canada ONLY)
HRVs	MINOTAIR Ventilation Inc.	Minotair	PentaCare-V12	124	262	Model Details	116	47	100	740	No
HRVs	Zehnder America	Zehnder	CA350HRV	111	236	Model Details	88	31	65	20	No
HRVs	Zehnder America	Zehnder	CA550HRV			Model Details	88	55	116	42	No
HRVs	Zehnder America	Zehnder	CA200HRV	69	146	Model Details	86	31	65	34	No
ERVs	Broan-NuTone LLC	Broan	ERV200ECM	99	210	Model Details	84	30	64	21	Yes
ERVs	Venmar Ventilation ULC	vanEE	G2400EE	99	210	Model Details	84	30	64	21	Yes
ERVs	Venmar Ventilation ULC	Venmar	X24ERVE	99	210	Model Details	84	30	64	21	Yes
ERVs	Venmar Ventilation ULC	Venmar	X24ERVECMN	99	210	Model Details	84	30	64	21	Yes
HRVs	Systemair Manufacturing Inc.	Fantech	HERO 150H-EC	83	176	Model Details	82	33	70	30	Yes
HRVs	Systemair Manufacturing Inc.	Fantech	HERO 250H-EC	124	263	Model Details	82	40	85	40	Yes
ERVs	Panasonic Eco Solutions Company North America	Panasonic Eco Solutions	FV10VE1	47	100	Model Details	81	25	53	24	No
ERVs	Panasonic Eco	Panasonic Eco	FV10VEC1	45	95	Model Details	81	25	53	24	Yes

Sorted based on highest efficiency

Domestic Water Heaters

- Compliance determined on Energy Factor (EF) rating.
- The higher the EF the more efficient the water heater.
- Consider capacity when selecting a water heater as well.
- If a compliance package doesn't indicate a EF rating then there's no minimum EF requirement to comply too. In other words choose a model that meets your needs and budget.
- Consideration should be provided to Hot Water on Demand Tanks.

What Have We Learned So Far?

- Determined what Zone we are in depending on the Heating Degree Days.
- Isolated which Table we will utilize based on:
  - Type of heat equipment
  - Efficiency of heating equipment
  - What type of units you're comfortable using (Imperial or Metric)
- Discussed the various components of a home.
- Defined and determined Thermal Values and what they mean.

Can we now utilize the SB-12 tables? Almost…

Notes to Tables

- Notes are often provided below tables through out the building code.
- Subscripts are provide in the Table while the corresponding note is provide below which provide additional definitions or exceptions.

Basement Walls(6)	Min. Nominal R(1)	20 + 12 ci	20 ci
	Max. U(4)	0.037	0.047
	Min. Effective R(4)	26.69	21.12

Notes to Table 3.1.1.3.C (IP):

The following definition applies: HH = 10 inch high heel

(1) The values listed are minimum Nominal R values for the thermal insulation component only.
(2) U-Value and effective R value shall include entire ceiling assembly components, from interior air film to vented space air film above insulation.
(3) U-Value and effective R value shall include entire exposed floor or above grade wall assembly components, from interior air film to exterior air film.
(4) U-Value and effective R value shall include entire *basement* wall or slab assembly components and interior air film.
(5) U-Value is the *overall coefficient of heat transfer* for a window assembly, sliding glass door assembly or skylight assembly expressed in Btu/(h•ft²•F).
(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa
(7) If an EF of a water tank is not indicated in a compliance package, there is no EF requirement for water tank for that specific compliance package.
(8) Nominal and effective R values are expressed in (h•ft²•F)/Btu. U-Values are expressed in Btu/(h•ft²•F).

Design Example #1: Fort Albany First Nation

- Step 1: What Zone Am I In?
- Utilizing SB-1…

Where's Albany?

Zone 2: Greater than 5000 HDD

r_s

Table 1.2
Design Data for Selected Locations in Ontario

Location	Elevation, m	Design Temperature				Degree Days Below 18°C	15 Min Rainfall, mm	One Day Rainfall, 1/50, mm	Annual Rainfall, mm	Annual Total Precipitation, mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa		Seismic Data				
		January		July 2.5%										1/10	1/50					
		2.5%, °C	1%, °C	Dry, °C	Wet, °C							S_s	S_r			$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	PGA
Ailsa Craig	230	-17	-19	30	23	3840	25	103	800	950	180	2.2	0.4	0.39	0.50	0.130	0.082	0.052	0.016	0.045
Ajax	95	-20	-22	30	23	3620	23	92	760	825	160	1.0	0.4	0.37	0.48	0.180	0.120	0.070	0.022	0.074
Alexandria	80	-24	-26	30	23	4600	25	103	900	975	160	2.4	0.4	0.31	0.40	0.640	0.310	0.140	0.047	0.320
Alliston	220	-23	-25	29	23	4200	28	113	690	875	120	2.0	0.4	0.28	0.36	0.150	0.099	0.062	0.020	0.046
Almonte	120	-26	-28	30	23	4620	25	97	730	800	140	2.5	0.4	0.32	0.41	0.550	0.270	0.130	0.042	0.280
Armstrong	340	-37	-40	28	21	6500	23	97	525	725	100	2.7	0.4	0.23	0.30	0.095	0.057	0.026	0.008	0.036
Arnprior	85	-27	-29	30	23	4680	23	86	630	775	140	2.5	0.4	0.29	0.37	0.610	0.290	0.130	0.044	0.310
Atikokan	400	-33	-35	29	22	5750	25	103	570	760	100	2.4	0.3	0.23	0.30	0.095	0.057	0.026	0.008	0.036
Attawapiskat	10	-37	-39	28	21	7100	18	81	450	650	160	2.8	0.3	0.32	0.41	0.110	0.057	0.026	0.008	0.053
Aurora	270	-21	-23	30	23	4210	28	108	700	800	140	2.0	0.4	0.34	0.44	0.160	0.110	0.065	0.021	0.053
Bancroft	365	-28	-31	29	23	4740	25	92	720	900	100	3.1	0.4	0.25	0.32	0.260	0.170	0.089	0.030	0.089
Barrie	245	-24	-26	29	23	4380	28	97	700	900	120	2.5	0.4	0.28	0.36	0.150	0.110	0.065	0.021	0.044
Barriefield	100	-22	-24	28	23	3390	23	108	780	950	[illegible]	2.1	0.4	0.36	0.47	0.300	0.180	0.099	0.031	0.120
Beaverton	240	-24	-26	30	23	4300	25	108	720	950	120	2.2	0.4	0.28	0.36	0.160	0.120	0.070	0.023	0.047
Belleville	90	-22	-24	29	23	3910	23	97	760	850	180	1.7	0.4	0.33	0.43	0.250	0.160	0.088	0.028	0.100
Belmont	260	-17	-19	30	24	3840	25	97	850	950	180	1.7	0.4	0.36	0.47	0.160	0.097	0.056	0.017	0.086
Big Trout Lake (Kitchenuhmaykoosib)	215	-38	-40	26	20	7450	18	92	400	600	150	3.2	0.2	0.33	0.42	0.095	0.057	0.026	0.008	0.036
CFB Borden	225	-23	-25	29	23	4300	28	103	690	875	120	2.2	0.4	0.28	0.36	0.140	0.100	0.063	0.020	0.045
Bracebridge	310	-26	-28	29	23	4800	25	103	830	1050	120	3.1	0.4	0.27	0.35	0.180	0.120	0.072	0.024	0.056
Bradford	240	-23	-25	30	23	4280	28	106	680	800	120	2.1	0.4	0.28	0.36	0.150	0.100	0.065	0.021	0.049
Brampton	215	-19	-21	30	23	4100	28	119	720	820	140	1.3	0.4	0.34	0.44	0.210	0.120	0.063	0.020	0.110
Brantford	205	-18	-20	30	23	3900	23	103	780	850	160	1.3	0.4	0.33	0.42	0.190	0.110	0.061	0.019	0.089
Brighton	95	-21	-23	29	23	4000	23	94	760	850	160	1.6	0.4	0.37	0.48	0.240	0.150	0.083	0.027	0.099
Brockville	85	-23	-25	29	23	4060	25	103	770	975	180	2.2	0.4	0.34	0.44	0.350	0.220	0.120	0.036	0.150
Burk's Falls	305	-26	-28	29	22	5020	25	97	810	1010	120	2.7	0.4	0.27	0.35	0.210	0.140	0.075	0.026	0.074
Column 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Design Example #1: Fort Albany First Nation

- Step 2: How will I heat the home? Electric or Gas?
  - In Albany, new construction is typically heated by Electric Baseboard Heaters. Therefore…

Table 3.1.1.3.C (IP)
ZONE 2 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.3.(3)

Component	Thermal Values[8]	Compliance Package	
		C1	C2
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	50
	Max. U[2]	0.016	0.020
	Min. Effective R[2]	59.90	49.23
Ceiling Without Attic Space	Min. Nominal R[1]	31	31
	Max. U[2]	0.036	0.036
	Min. Effective R[2]	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31 + 10 ci	35
	Max. U[3]	0.025	0.031
	Min. Effective R[3]	39.80	32.02
Walls Above Grade	Min. Nominal R[1]	24 + 10 ci	22 + 7.5 ci
	Max. U[3]	0.037	0.042
	Min. Effective R[3]	27.02	23.90
Basement Walls[6]	Min. Nominal R[1]	20 + 12 ci	20 ci
	Max. U[4]	0.037	0.047
	Min. Effective R[4]	26.69	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	10.0	—
	Max. U[4]	0.090	—
	Min. Effective R[4]	11.13	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10
	Max. U[4]	0.090	0.090
	Min. Effective R[4]	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.21	0.28
	Energy Rating	34	25
Skylights	Max. U[5]	0.49	0.49
Space Heating Equipment	Min.	—	ASHP: 7.1 HSPF
HRV	Min. SRE	81%	70%
Domestic Water Heater[7]	Min. EF	—	—
Column 1	2	3	4

Design Example #1: Fort Albany First Nation

- Step 3: Select a compliance package to build to or exceed the thermal values of the package.

Component	Thermal Values[8]	Compliance Package	
		C1	C2
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	50
	Max. U[2]	0.016	0.020
	Min. Effective R[2]	59.90	49.23
Ceiling Without Attic Space	Min. Nominal R[1]	31	31
	Max. U[2]	0.036	0.036
	Min. Effective R[2]	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31 + 10 ci	35
	Max. U[3]	0.025	0.031
	Min. Effective R[3]	39.80	32.02
Walls Above Grade	Min. Nominal R[1]	24 + 10 ci	22 + 7.5 ci
	Max. U[3]	0.037	0.042
	Min. Effective R[3]	27.02	23.90
Basement Walls[6]	Min. Nominal R[1]	20 + 12 ci	20 ci
	Max. U[4]	0.037	0.047
	Min. Effective R[4]	26.69	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	10.0	—
	Max. U[4]	0.090	—
	Min. Effective R[4]	11.13	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10
	Max. U[4]	0.090	0.090
	Min. Effective R[4]	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.21	0.28
	Energy Rating	34	25
Skylights	Max. U[5]	0.49	0.49
Space Heating Equipment	Min.	—	ASHP: 7.1 HSPF
HRV	Min. SRE	81%	70%
Domestic Water Heater[7]	Min. EF	—	—
Column 1	2	3	4

Don't reduce efficiency!

Build to C1 as designed.

Design Example #1: Fort Albany First Nation

- Step 4: Now what..??
  - Speak to your designer and contractor to ensure new construction is built to the selected specifications.
  - Involve your Tribal Council to perform plans examinations to ensure the plans reflect the selected compliance package.
  - Acquire inspection services from your Tribal Council or 3rd party to ensure specifications are followed. Don't allow change orders without knowing the implications.

Plans Review Example #1

Is my design meeting the compliance package?

- Walls Above Grade:

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	spun bonded polyolefin (house wrap)	0.00	0.00
4	1" (25.4mm) extruded polystyrene type 3/4	0.89	5.05
5	7/16" (11.1mm) OSB sheathing	0.11	0.62
6	2x6 framing filled with R22 batt @ 16" o.c.	2.55	14.48
7	polyethylene	0.00	0.00
8	1/2" (12.7mm) gypsum board	0.08	0.45
9	finish: 1 coat latex primer and latex paint	0.00	0.00
10	interior air film	0.12	0.68

Min. Nominal R[1]	24 + 10 ci	22 + 7.5 ci
Max. U[2]	0.037	0.042
Min. Effective R[3]	27.02	23.90

Nominal R-Value= R-22 + 5ci

Effective R-Value= 22.07

Max. U= 0.045

Design Example #2

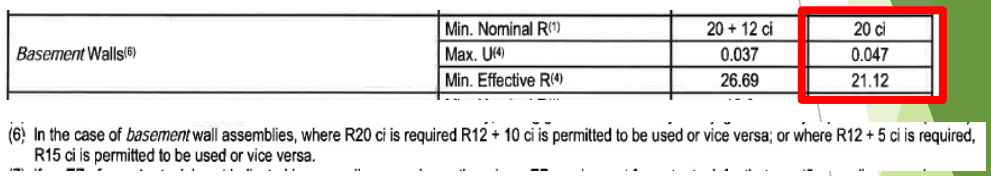
Basement Walls;

Component	R-Value
Interior Air Film	0.68
6 mil Poly Vapour Barrier	0
2x6 Studs at 16''OC w. R-24 Batt	15.13
1''XPS	5
½ Plywood	0.615
Blueskin Waterproofing	0

Nominal R-Value= 24+5ci

Effective R-Value=21.43

Max U.= 0.047



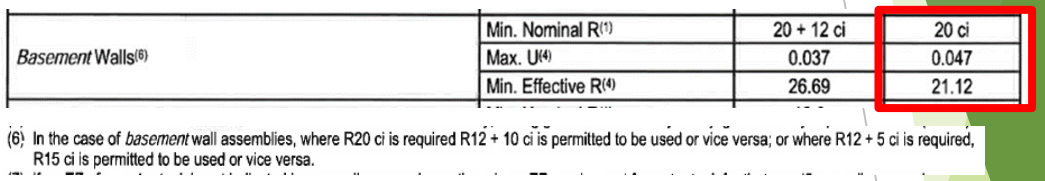
Basement Walls[6]	Min. Nominal R[1]	20 + 12 ci	20 ci
	Max. U[4]	0.037	0.047
	Min. Effective R[4]	26.69	21.12

(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa.

Design Example #3

What if the basement wall assembly in the previous example has no rigid foam?

Component	R-Value
Interior Air Film	0.68
6 mil Poly Vapour Barrier	0
2x6 Studs at 16”OC w. R-24 Batt	15.13
½ Plywood	0.615
Blueskin Waterproofing	0



Basement Walls[6]	Min. Nominal R[1]	20 + 12 ci	20 ci
	Max. U[4]	0.037	0.047
	Min. Effective R[4]	26.69	21.12

(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa.

Nominal R-Value= 24+0ci

Effective R-Value= 16.425

U-Value= 0.060

Design Example #4

- Ceiling with Attic Space

Component	R-Value
½ Plywood Roof Sheathing(not included in calculation)	0
Vented Roof Air Space	0.17
Blown Cellulose R38	38
Roof Truss Bottom Chord dimensional lumber 2x4, 24'' O.C. with R-12 fill between chords	10
6 Mil Poly Vapour Barrier	0
½ Drywall	0.45
Interior Air film- Ceiling	0.62

Table 3.1.1.3.C (IP)
ZONE 2 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.3.(3)

Component	Thermal Values[8]	Compliance Package	
		C1	C2
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	50
	Max. U[2]	0.016	0.020
	Min. Effective R[2]	59.90	49.23

Nominal R-Value= 50

Effective R-Value= 49.24

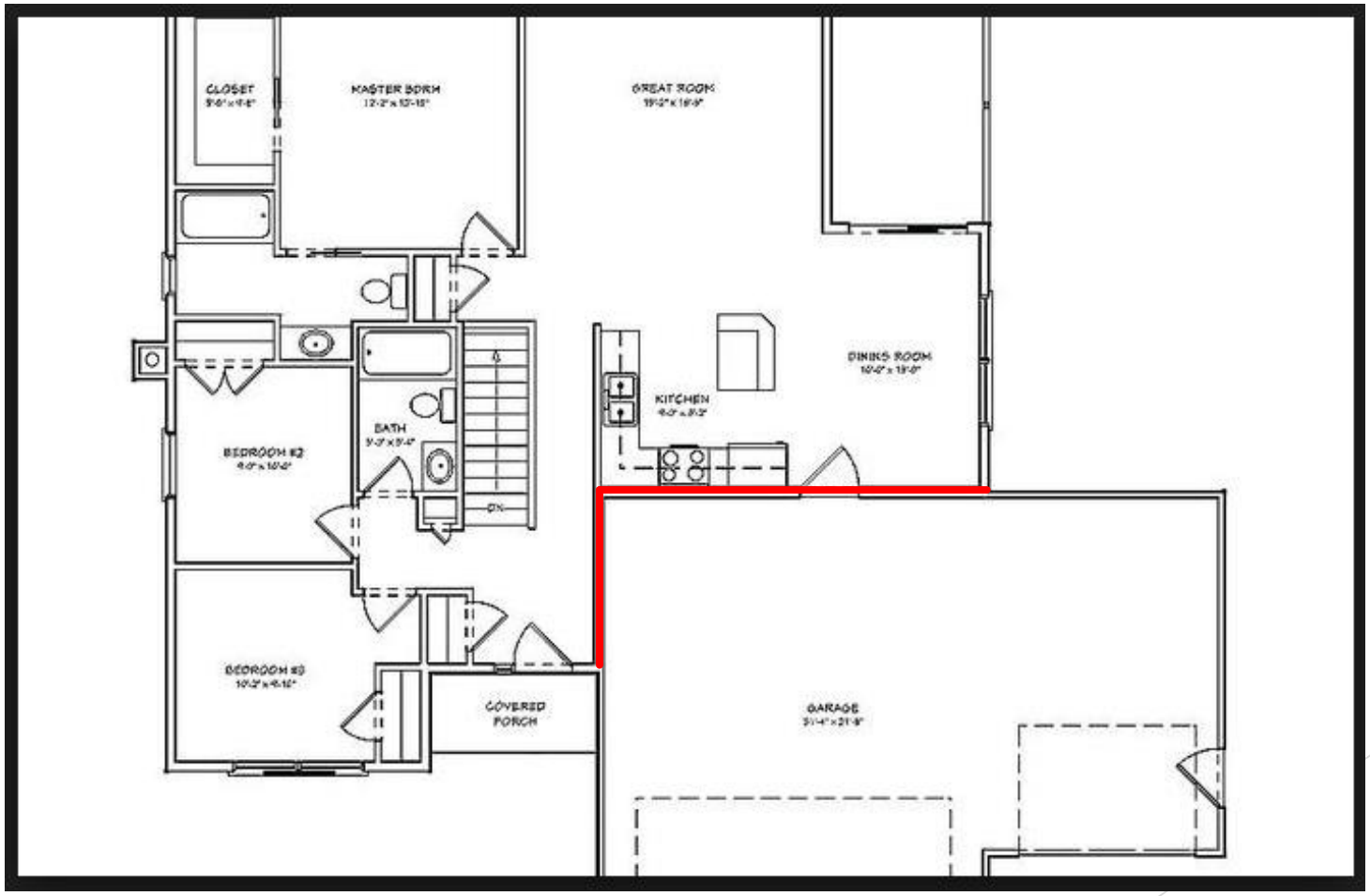
U-Value= 0.020

Additional Code Requirements?

There must be more???

- So far we covered the fundamental components of SB-12. Learning and understanding the tables are critical.
- We've also examined how notes can provide additional information to aid the design process.
- We've practised utilizing what we've learned in using examples.
- We'll now discuss other code provisions within SB-12.

Walls Adjacent to Heated Garages… Do I Need to Insulate?



Glazing

(8) Except as permitted in Sentences 3.1.1.11.(3), where the ratio of the gross area of windows, sidelights, skylights, glazing in doors and sliding glass doors to the gross area of peripheral walls measured from grade to the top of the upper most ceiling is more than 17% but not more than 22%, the *building* shall comply with a compliance package selected from Tables 3.1.1.2.A to 3.1.1.2.C, Tables 3.1.1.3.A to 3.1.1.3.C and Table 3.1.1.11 and the *overall coefficient of heat transfer* of the *fenestration* shall be upgraded to

(a) 1.6 where 1.8 is required by the selected compliance package or permitted by Article 3.1.1.4.,
(b) 1.4 where 1.6 is required by the selected compliance package or permitted by Article 3.1.1.4.,
(c) 1.2 where 1.4 is required by the selected compliance package or permitted by Article 3.1.1.4., and
(d) 1.0 where 1.2 is required by the selected compliance package or permitted by Article 3.1.1.4..

(See Appendix A.)

Potential window upgrades may be required to meet code.

(9) Where the ratio of gross area of windows, sidelights, skylights, glazing in doors and sliding glass doors to the gross area of peripheral walls measured from grade to the top of the upper most ceiling is more than 22%, the *building* shall comply with Subsection 3.1.2. (See Appendix A.)

Performance based compliance must be used.

U Value and ER Equivalency

Table 3.1.1.9.
Maximum U-Values and Minimum Energy Ratings (ER) for Windows, Skylights and Sliding Glass Doors
Forming Part of Sentence 3.1.1.9.(1)

Component	Maximum U-Values	Minimum Energy Ratings, (ER)
	U-Value, W/m²•K (Btu/h•ft²•°F)	ER
Skylights	2.8 (0.50)	—
Windows and Sliding Glass Doors	2.0 (0.35)	17
	1.8 (0.32)	21
	1.6 (0.28)	25
	1.4 (0.25)	29
	1.2 (0.21)	34
	1.0 (0.18)	38
Column 1	2	3

Air Tightness and Targets

(1) Where a *dwelling unit* is designed and *constructed* to be sufficiently airtight such that the air leakage of the whole *dwelling unit* is less than or equal to one of the applicable airtightness targets specified in the same row of Table 3.1.1.4.A, the requirements of Tables 3.1.1.2.A to 3.1.1.2.C, Tables 3.1.1.3.A to 3.1.1.3.C, and Table 3.1.1.11. are permitted to be substituted in accordance with Table 3.1.1.4.B or Table 3.1.1.4.C.

(2) Airtightness targets described in Sentence (1) shall be measured under as operated conditions in accordance with CAN/CGSB 149.10 "Determination of the Airtightness of *Building* Envelopes by the Fan Depressurization Method" or NRCan, "EnerGuide Rating System Technical Procedures Version 15.1".

(3) For purposes of substitutions described in Sentence (1),
(a) a maximum of one substitution per *dwelling unit* may be made if substitutions are made in accordance with Table 3.1.1.4.B, or
(b) a maximum of two substitutions per *dwelling unit* may be made if substitutions are made in accordance with Table 3.1.1.4.C.

e4

Table 3.1.1.4.A
Airtightness Targets
Forming Part of Sentence 3.1.1.4.(1) and Subsection 3.1.2.

Building Type	Airtightness Targets				
	ACH @ 50Pa	NLA @ 10 Pa		NLR @ 50 Pa	
		cm^2/m^2	$in^2/100\ ft^2$	$L/s/m^2$	cfm/ft^2
Detached	2.5	1.26	1.81	0.93	0.18
Attached	3.0	2.12	3.06	1.32	0.26
Column 1	2	3	4	5	6

Air Tightness Substitutions

Table 3.1.1.4.B (IP)
Permitted Substitutions for Airtight Dwelling Units[2]
Forming Part of Sentence 3.1.1.4.(1)

Required Compliance	Permitted Substitution Airtightness Complies with Table 3.1.1.4.A[1]
Maximum One Substitution per *Dwelling Unit*	
R22 + 7.5 ci	R19 + 5 ci
R22 + 10 ci	R19 + 7.5 ci
R24 + 10 ci	R22 + 7.5 ci
HRV with 81% SRE	HRV with 70% SRE
HRV with 75% SRE	HRV with 65% SRE
Furnace with 98%, 96% or 94% AFUE	Reduce furnace efficiency by 4% AFUE
Fenestration U-Value = 0.28, 0.25 or 0.21	Increase U-Value by 0.04 (downgrade one level)
Column 1	2

Notes to Table 3.1.1.4.B (IP):
(1) Where nominal R values are given, the use of corresponding "U" or "effective R" values are permitted.
(2) Use only Table 3.1.1.4.B or Table 3.1.1.4.C, not both.

Table 3.1.1.4.C (IP)
Permitted Substitutions for Airtight Dwelling Units[3]
Forming Part of Sentences 3.1.1.4.(1) and (3)

Required Compliance	Permitted Substitutions Airtightness Complies with Table 3.1.1.4.A[1]
Maximum Two Substitutions per *Dwelling Unit*[2]	
Above grade continuous wall insulation R7.5 ci or R10 ci	Above grade continuous wall insulation R5 ci or R7.5 ci respectively
R22 or R24 insulation between studs in above grade walls with continuous insulation	R19 or R22 insulation respectively between studs in above grade walls with continuous insulation
Basement wall R20 + 12 ci, R20 +10 ci or R20 ci	*Basement* wall R15 ci or R12 + 5 ci
Slab located more than 24 inches below grade and entire under slab insultation is R10 or R5	R0 , if the slab is unheated R5 min, if heated
R60 ceiling insulation with or without 10 inch high heel	R50 ceiling insulation
Column 1	2

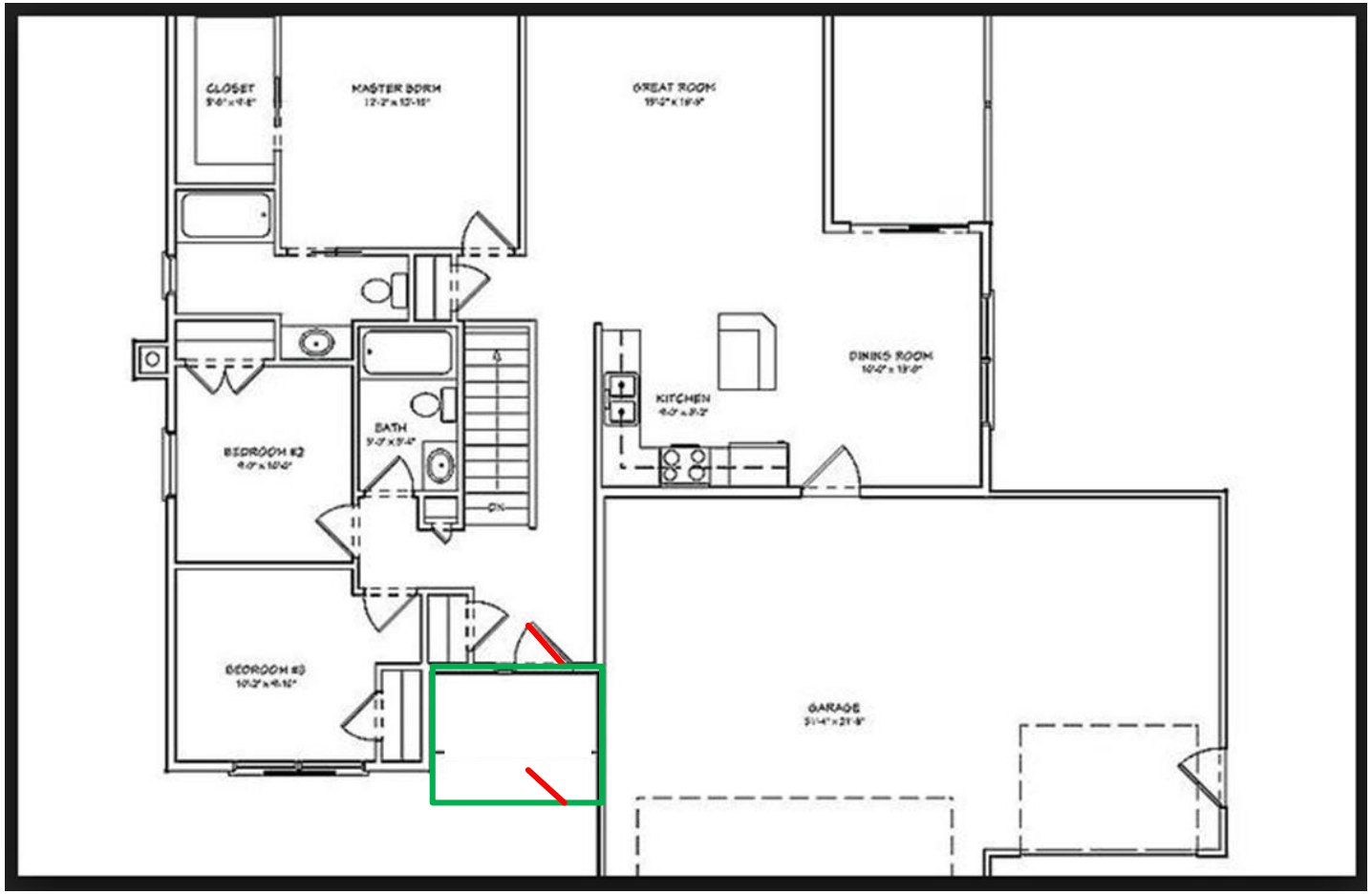
Notes to Table 3.1.1.4.C (IP):
(1) Where nominal R values are given, the use of corresponding "U" or "effective R" values are permitted.
(2) Where the required airtightness is achieved, simultaneous substitution of two components listed in this Table is permitted.
(3) Use only Table 3.1.1.4.B or Table 3.1.1.4.C, not both.

One Substitution OR Two Substitutions

Thermal Resistance of Doors

- Entrance doors, with the exception of the glazed portion of the door, shall have a R-value of R-4 where a storm door is not provided.
  - Applies to all doors that separate heated space from unheated space.
- Doors shall have an insulated core and be installed with weather-stripping.

Does each door need to be insulated if my porch is heated?



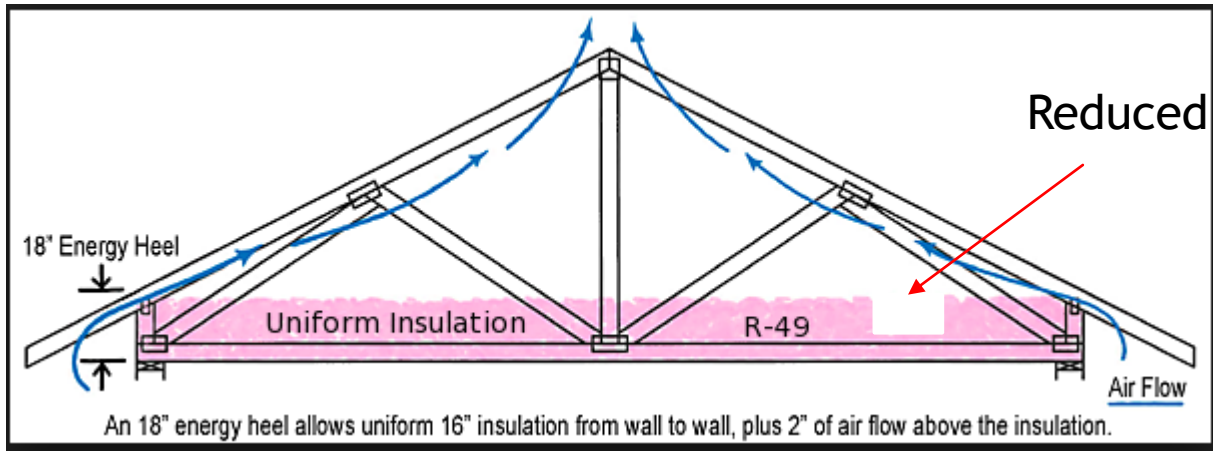
Roof Access Hatches and Eaves

3.1.1.8. Thermal Resistance Values for Roof Access Hatches and Eaves

(1) Except as provided in Sentence (2), the thermal resistance values for insulation required by Articles 3.1.1.2., 3.1.1.3. and 3.1.1.11. for exposed ceilings with attic spaces are permitted to be reduced
(a) directly above access hatches, and
(b) near eaves to the extent made necessary by the roof slope and required ventilation clearances,

except that the thermal insulation value at the location directly above access hatches and inner surfaces of exterior walls shall be not less than RSI 3.52. =R-20

(2) Where 250 mm high heel is required near the eaves, the available space on the inner surface of the wall below the roof venting space shall be fully insulated.



An 18" energy heel allows uniform 16" insulation from wall to wall, plus 2" of air flow above the insulation.

Reduced insulation at attic hatch.

Additions to Existing Buildings

Table 3.1.1.11. (IP)
Thermal Performance Requirements for Additions to Existing Buildings[3]
Forming Part of Sentence 3.1.1.11.(2)

Component	Thermal Values[7]	Compliance Package		
		Zone 1	Zone 2	Electric Space Heating
		Less than 5000 Degree Days	5000 or more Degree Days	Zones 1 and 2
Ceiling with Attic Space	Min. Nominal R[1]	60	60	60
	Max. U[2]	0.017	0.017	0.017
	Min. Effective R[2]	59.22	59.22	59.22
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31
	Max. U[2]	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	31	31
	Max. U[3]	0.034	0.034	0.034
	Min. Effective R[3]	29.80	29.80	29.80
Walls Above Grade	Min. Nominal R[1]	19 + 5 ci	22 + 7.5 ci	22 + 10 ci
	Max. U[3]	0.049	0.042	0.038
	Min. Effective R[3]	20.32	23.90	26.40
Basement Walls[6]	Min. Nominal R[1]	20 ci	20 ci	20 ci
	Max. U[4]	0.047	0.047	0.047
	Min. Effective R[4]	21.12	21.12	21.12
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10
	Max. U[4]	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.28	0.25	0.25
	Energy Rating	25	29	29
Column 1	2	3	4	5

Notes to Table 3.1.1.11 (IP):
(1) The values listed are minimum Nominal R values for the thermal insulation component only.
(2) U-Value and effective R value shall include entire ceiling assembly components, from interior air film to vented space air film above insulation.
(3) U-Value and effective R value shall include entire exposed floor or above grade wall assembly components, from interior air film to exterior air film.
(4) U-Value and effective R value shall include entire *basement* wall or slab assembly components and interior air film.
(5) U-Value is the *overall coefficient of heat transfer* for a window assembly, sliding glass door assembly or skylight assembly expressed in Btu/(h•ft²•F).
(6) In the case of *basement* wall assemblies, where R20 ci is required R12 + 10 ci is permitted to be used or vice versa; or where R12 + 5 ci is required, R15 ci is permitted to be used or vice versa.
(7) Nominal and effective R values are expressed in (h•ft²•F)/Btu. U-Values are expressed in Btu/(h•ft²•F).

Are There Other Ways of Compliance?

- Performance Based Methods
  - Measured on simulated energy use of the “proposed building”.
  - Select a “reference building” taking in account of zone, energy source and equipment efficiency.
  - Simulate the annual energy use of the proposed building and reference building under specified building designs.
    - Reference building design has specified conditions.
    - Proposed building design uses your own selection.
- Other Methods
  - Meet the performance level of NRCan, “Energy Star for New Homes Standard Version 12.6.”
  - Meet the NRCan, “2012 R2000 Standard:.

Where To Go From Here?

- Purchase a copy of the Ontario Building Code if you haven't already yet have a copy.
- Familiarize yourself with SB-12 and the rest of the code.
- Take courses to enhance your knowledge.
- Practise applying the code with drawings/examples.
- Once you are comfortable apply your knowledge to future housing projects to meet SB-12 standard.

Questions?

References

- Ontario Building Code
- Home Ventilation Institute
- Canadian Wood Council
- Energy Star
- NRCan
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