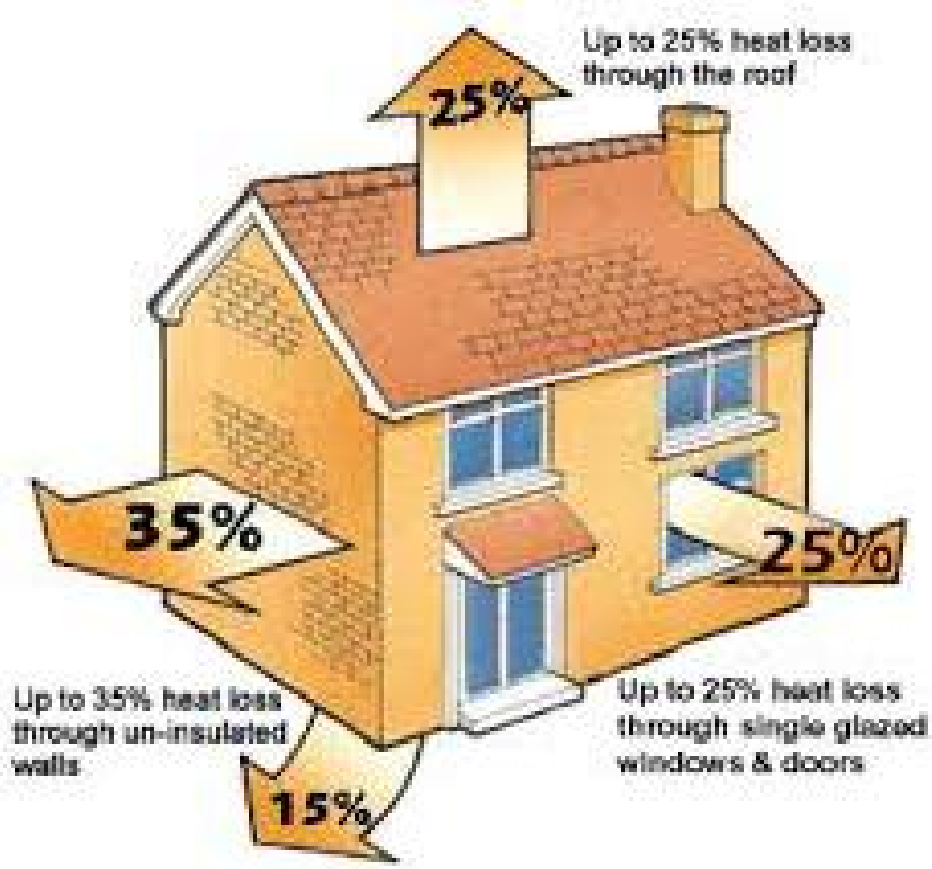
Energy Efficiency for Houses & Small Buildings
New Section 9.36 of NBC 2010

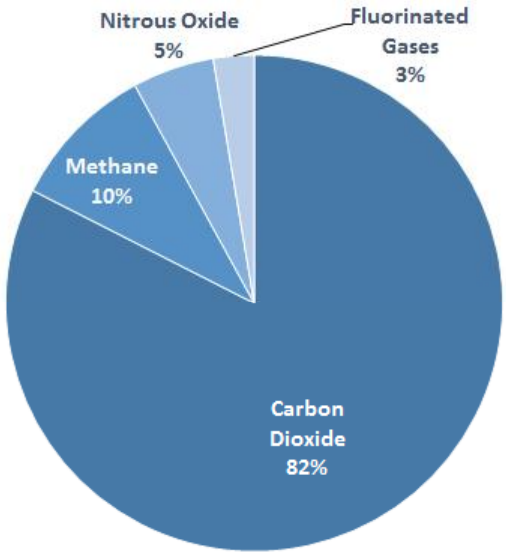


Manitoba

Why do we need Energy Codes?

- buildings account for about 30% of all greenhouse gases
- road transportation accounts for about 10% of all greenhouse gases
- if buildings are more energy efficient, then less greenhouse gases are produced
- energy efficiency in building codes is a reflection of the changing times

  (just as Section 3.8 Barrier-Free Design was added in NBC 1995)



There are 2 Buildings Energy Codes for Manitoba

- National Energy Code of Canada for Buildings 2011
- new Section 9.36 of NBC 2010

These 2 energy codes are distinct documents (but compatible)

These Energy Codes do NOT

- apply to existing buildings, farm buildings & temporary buildings
- consider the electric energy source (hydroelectric, coal power plant etc)
- compare relative energy costs
- deal with water conservation, re-using existing construction materials or other environmental initiatives such as green space

These Energy Codes do address

- air leakage
- building insulation
- HVAC system energy efficiency
- hot water system energy efficiency
- lighting efficiency (NECB only)
- electric power systems efficiency (NECB only)

(the Codes only deals with building construction matters)

Manitoba

National Energy Code of Canada for Buildings (2011)

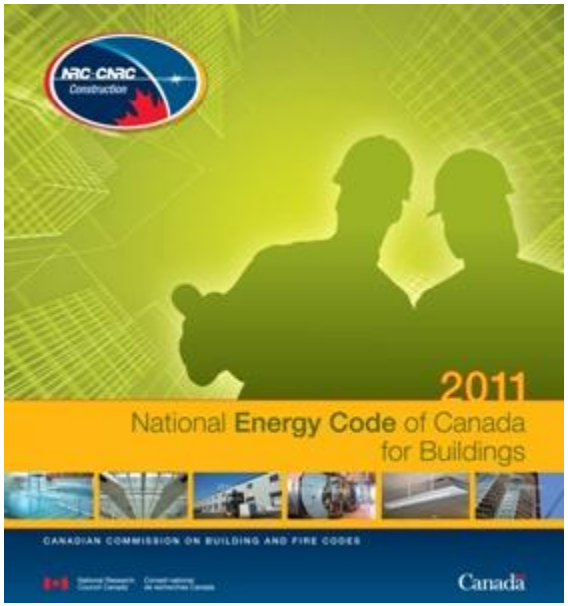
- NECB 2011 is a distinct code from NBC 2010 (which includes Section 9.36)
  (also available is a NECB User's Guide - very helpful)

- Manitoba Energy Code for Buildings 2013 (MECB) is the NECB with Manitoba amendments
  http://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=213/2013

- MECB came into effect **December 1, 2014** in Manitoba

- MECB applies to
  - new Part 3 Buildings
  - new Part 3 Additions only
  - new Part 3 additions & existing buildings
    (if the designers choose)
  - some Part 9 Buildings

- MECB does NOT apply to:
  - existing buildings (usually)
  - renovated buildings
  - some part 9 buildings (see next page)



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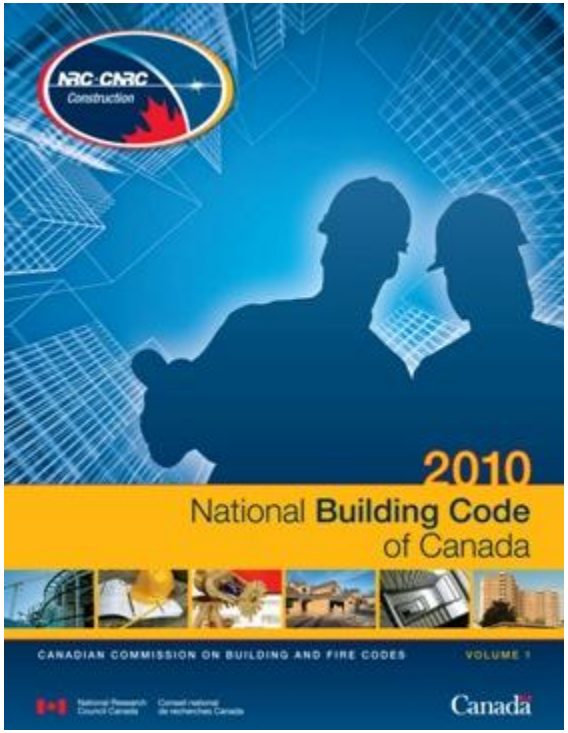
NBC SECTION 9.36 – ENERGY EFFICIENCY



- There are presently 35 "Prescriptive" Sections within Part 9 of NBC 2010
  - Section 9.1 – General
  - Section 9.2 – Definitions
  - Section 9.3 - Material, Systems and Equipment
  - Section 9.4 - Structural Requirement
  - Section 9.35 - Garages and Carports
  - Section 9.36 – Energy Efficiency (new section in NBC)

- Section 9.36 takes effect on **April 1, 2016** in Manitoba

- Section 9.36 applies to **new** Part 9 Buildings with:
  - C occupancy only
  - C occupancy and a D, E & F3 occupancy with a floor area of 300 m^2 (3228 ft^2) or less
  - any D, E & F3 occupancy with a combined floor area of 300 m^2 (3228 ft^2) or less

- Section 9.36 re-directs to NECB (2011) for a Part 9 Building with:
  - any D, E & F3 occupancy with a combined floor area greater than 300 m^2 (3228 ft^2)
  - any F2 occupancy (regardless of floor area)

Manitoba

Which Code Applies?

For any Part 3 Building → NECB

For Part 9 Buildings

- "C" (600 m^2 or less) → Section 9.36
- "C" (300m^2) + {"D" + "E" + "F3"} (300m^2 or less) → Section 9.36
- "C" (any area) + {"D" + "E" + "F3") (> 300m^2) → NECB
- {"D" + "E" + "F3"} (300m^2 or less) → Section 9.36
- {"D" + "E" + "F3"} > 300m^2 → NECB
- "F2" (any area) + {"C" + "D" + "E" + "F3"} (any area) → NECB

Q1 "C" (350m^2) + {"D" + "E"} (200m^2) → Section 9.36 or NECB ?

Q2 "C" (100m^2) + "E" (350m^2) → Section 9.36 or NECB ?

Q3 "F2" (100 m^2) + "F3" (250m^2) → Section 9.36 or NECB ?

Q4 "C" (350m^2) + "F3" (200m^2) → Section 9.36 or NECB ?

Q5 "C" (450m^2) + "F3" (200m^2) → Section 9.36 or NECB ?

Q6 {"D" + "E"} (400 m^2) 1st floor + "C" (400 m^2) on 2nd & 3rd floor → Section 9.36 or NECB ?

OVERVIEW OF SECTION 9.36-ENERGY EFFICIENCY

1. Climatic Zones in Manitoba
2. Thermal Resistance
3. **Building Envelope** (Subsection 9.36.2)
4. **HVAC Requirements** (Subsection 9.36.3)
5. **Service Water Heating Systems** (Subsection 9.36.4)
6. **Energy Performance Compliance** (Subsection 9.36.5)

CLIMATIC ZONES IN MANITOBA

Zone 7A (HDD between 5000 to 6000)

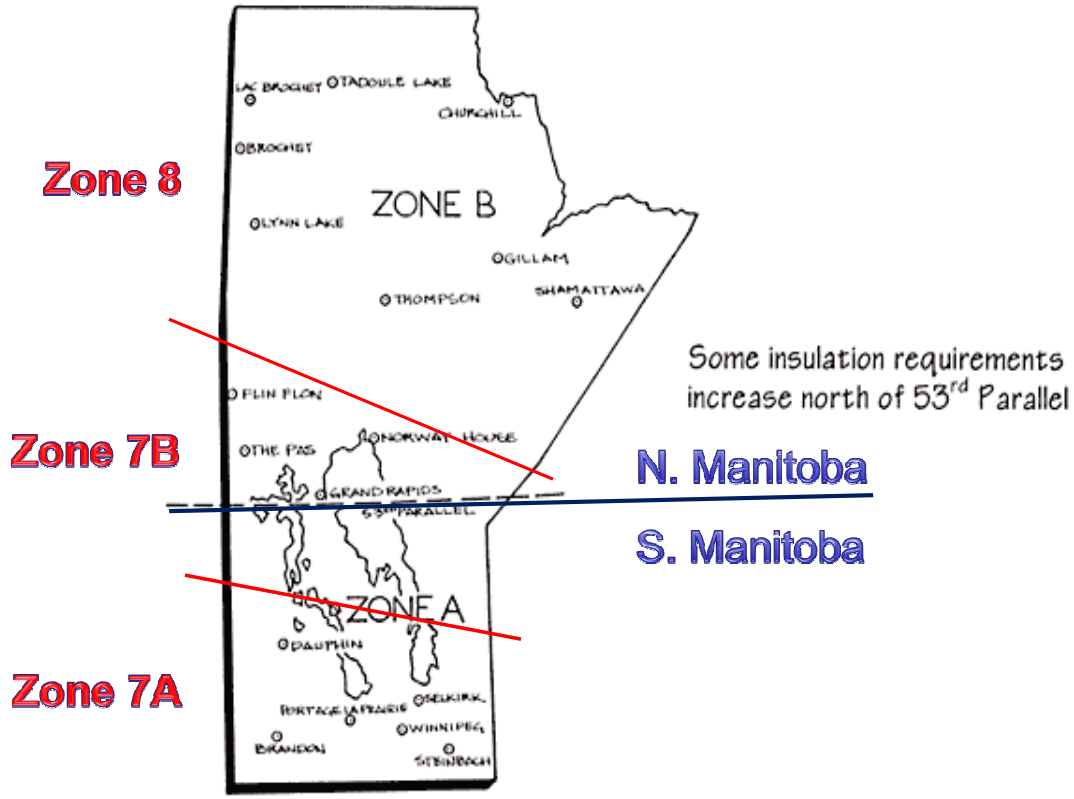
- Brandon (5760)
- Dauphin (5900)
- Portage la Prairie (5600)
- Steinbach (5670)

Zone 7B (HDD between 6000 to 7000)

- Flin Flon (6440)
- Swan River (6100)
- The Pas (6490)

Zone 8 (HDD greater than 8000)

- Lynn Lake (7770)
- Thompson (7600)
- Churchill (8950)



HDD = Heating Degree Days

see NBC 2010 Appendix C-20 for HDD values for Manitoba locations

THERMAL RESISTANCE

Nominal Thermal Resistance (present Building Code requirement)

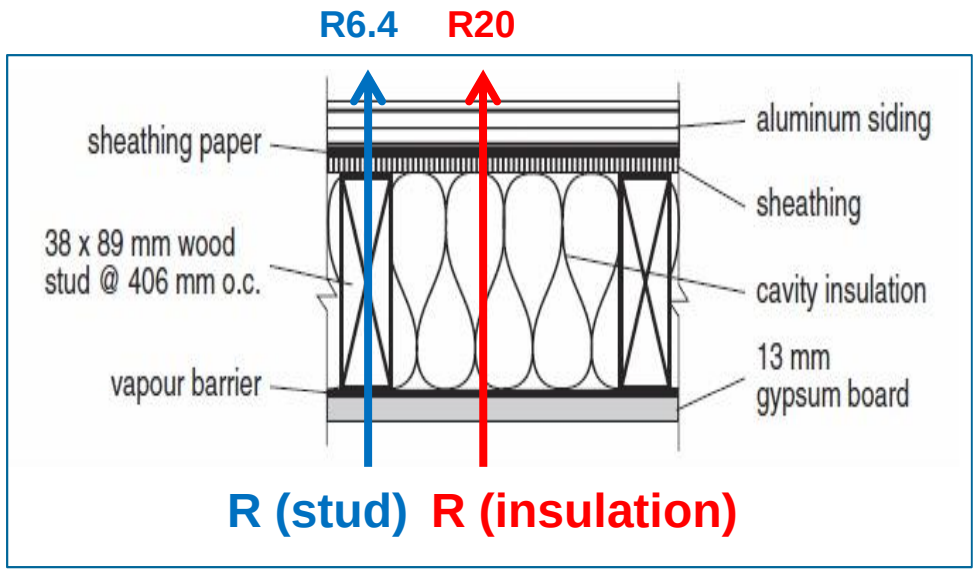
- thermal resistance is measured only at insulated areas
- does not account for building layers in front or behind insulation layers
- thermal bridges such as studs, wall plates or lintels are not considered
- for studs spaced at 12” , 16” or 24” all have the same nominal thermal resistance

Effective Thermal Resistance (Section 9.36 requirements)

- thermal resistance measurements are taken at insulated areas as well as any areas where other thermal bridging occurs
- studs spaced at 12”, 16” or 24” will have different effective thermal resistance values

R-Value for 2x6 Wall

- exterior metal siding (R = 0.6)
- ½” plywood (R = 0.6)
- 2x6 studs (R = 6.4)
- 6” batt insulation (R = 20)
- poly vapour barrier (R = 0)
- ½” GWB (R = 0.6)



- Nominal **R = 21.8** (regardless of stud spacing) (including inner & outer wall skin layers)
- Effective **R = 18.1** (w studs @ **24”** spacing)
- Effective **R = 17.3** (w studs @ **16”** spacing)
- Effective **R = 16.6** (w studs @ **12”** spacing)

GWB = gypsum wall board = drywall

RSI (METRIC) vs. R (IMPERIAL)

Building Code & User's Guide only use metric terms (RSI values)

- "RSI" is the metric R-value
  - RSI = R + SI {system international}
  - units = m^2 K / W or sometime m^2 C / W
    K = Kelvin C = Celsius

- "R" is the imperial R-value
  - units = ft^2 F hr / BTU
    F = Fahrenheit
    hr = hour
    BTU = British Thermal Unit

- To convert RSI to R multiply by 5.678
  - RSI = 3.0 (m^2 K / W)
  - R = 3.0 x 5.678 = 17.0 (ft^2 F hr / BTU)

- To convert R to RSI divide by 5.678
  - R = 20 (ft^2 F hr / BTU)
  - RSI = 20 / 5.678 = 3.5 (m^2 K / W)

U-values (or thermal transmittance)

The NECB & Section 9.36 uses the term “thermal transmittance” or U-value

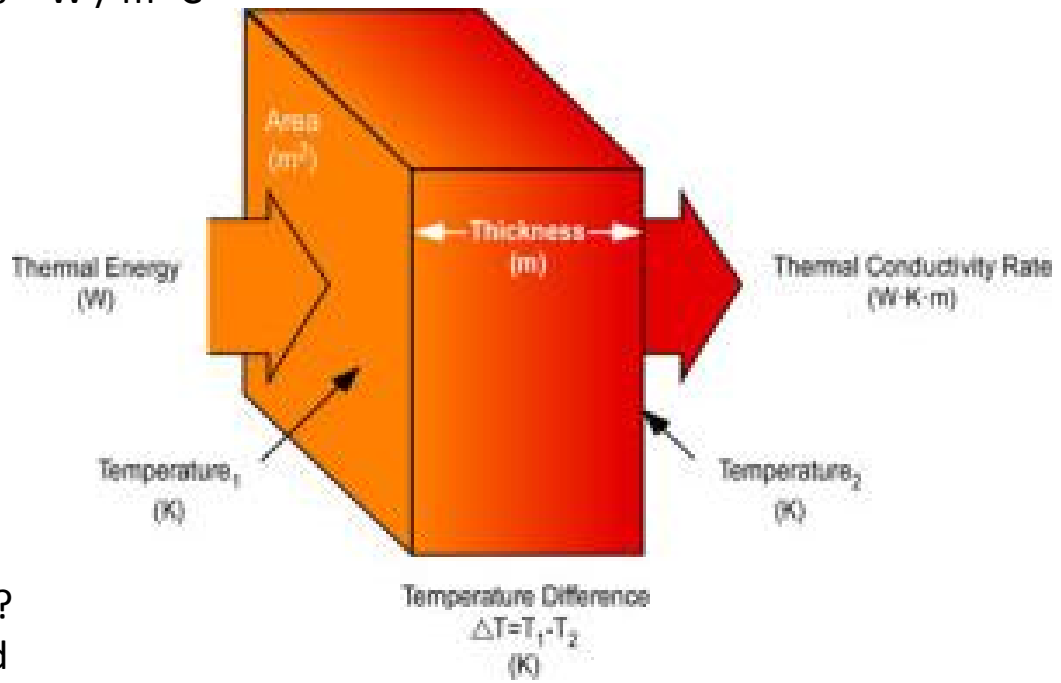
- U = 1 / RSI RSI = 1 / U
- U-value units = W / m^2 K RSI units = W / m^2 C

Example

- U = 0.5 (W / m^2 K)

- RSI = 1 / 0.5
  = 2.0 (m^2 K / W) (metric)

- R = 2.0 x 5.678
  = 11.4 (ft^2 F hr / BTU (imperial)



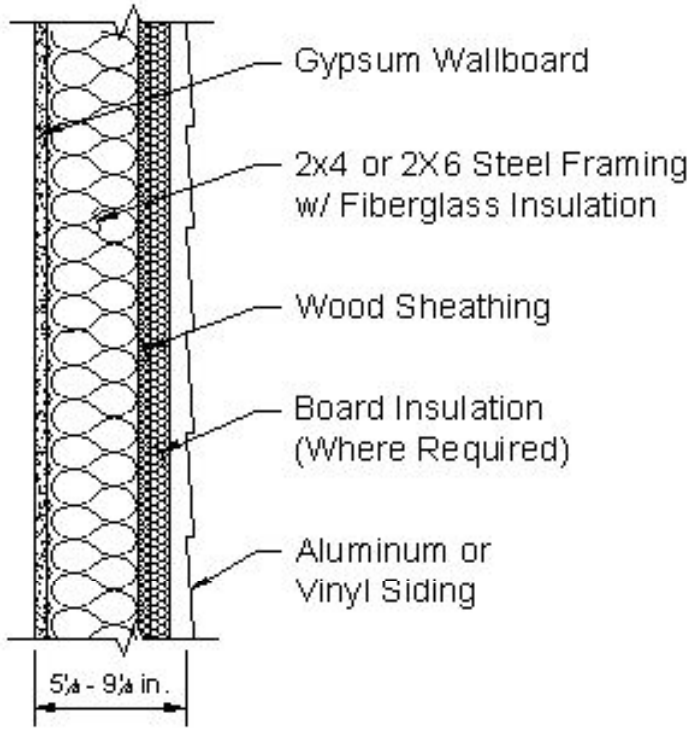
Why do we use U-values instead of R-value?

- U-value is what is actually measured
- we convert U-values to R-values for our convenience (higher R-value means higher insulation performance)

Calculating the overall Effective R-Value

As an example:

Layer	RSI (m^2 K / W)	
interior air film	0.12	
½" GWB	0.08	
vapour barrier	0.00	
RSI $_{parallel}$	2.67	(see page 14)
½" plywood	0.11	
building paper (Tyvek)	0.00	
metal siding	0.11	
outside air film	0.03	
Total	**3.12**	**m^2 K / W**



Overall Effective RSI Value = 3.12 m^2 K / W
Overall Effective U Value = 1 / 3.12 = 0.321 W / m^2 K
Overall Effective R Value = 3.12 x 5.678 = 17.7 ft^2 F hr / BTU

RSI Values for various Materials

- 9.36 Table A-9.36.2.4(1)D (page A-254)
- NECB 2011 User's Guide: Table 3-5 to Table 3-9 (page 29 to 36)

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CALCULATING THE EFFECTIVE R-VALUE

(within a layer of a wall or roof or floor assembly with mixed components)

As an example:

- if framing area (consists of studs, plates, lintels, etc) = 15% of total wall area
- then insulated area = 85% of total wall area

- if the $RSI_{insulation} = 3.52$ and the $RSI_{wood} = 1.13$ (using metric units "SI")

$$RSI_{parallel} = \frac{100\%}{\left(\frac{15\%}{1.13} + \frac{85\%}{3.52}\right)} = \frac{100}{(13.3 + 24.1)} = 2.67\ (m^2\ K / W)$$

as expected $RSI_{parallel}$ (2.67) ≤ $RSI_{insulation}$ (3.52)
(because of thermal bridging from the wood framing)

$RSI_{parallel}$ Values

- See 9.36 Table A-9.36.2.6(1)B (page A-268)
- NECB 2011 User's Guide: Table 3-5 to Table 3-10 (page 37)

RSI values (for complete wall assemblies)

- above grade walls Table A-9.36.2.2(4.1)A (pg 8)
- below grade walls Table A-9.36.2.2(4.1)B (pg 9)

of the Manitoba Amendment

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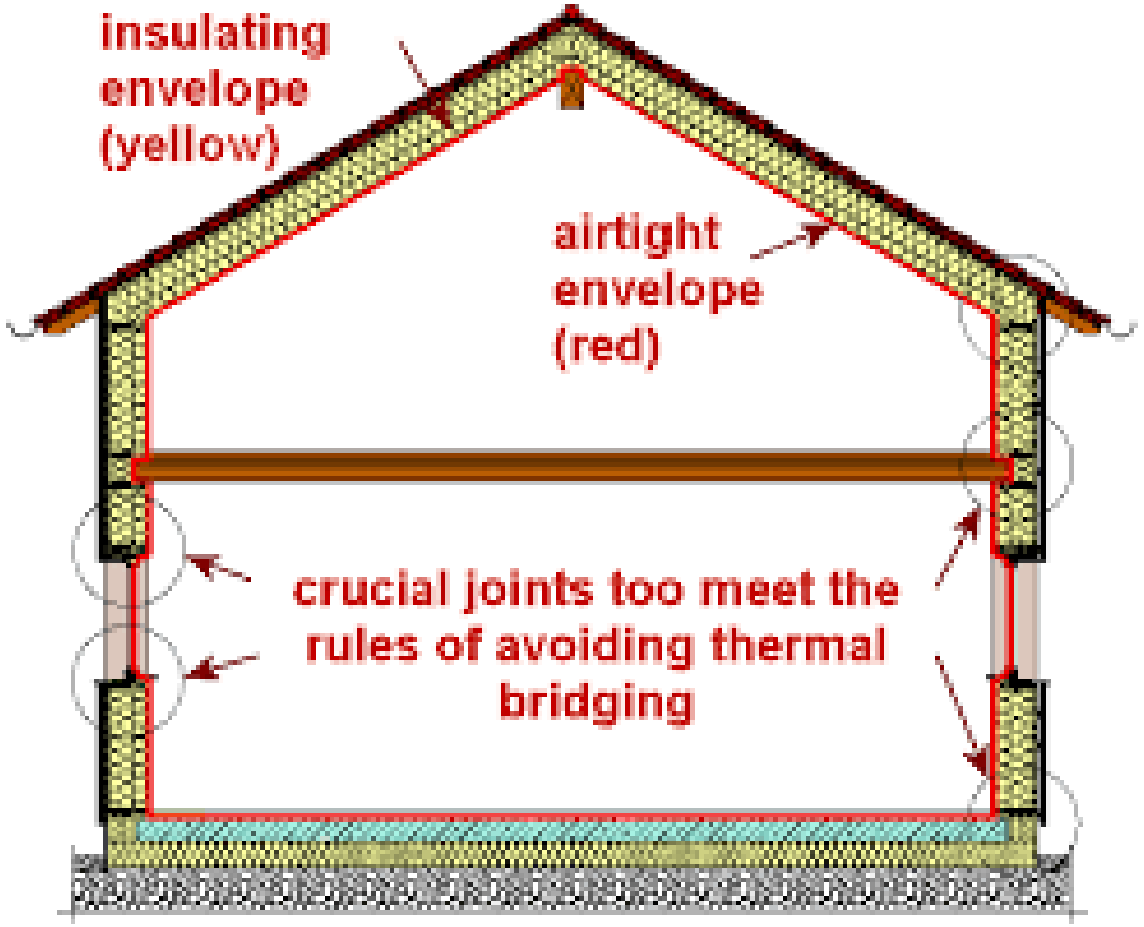
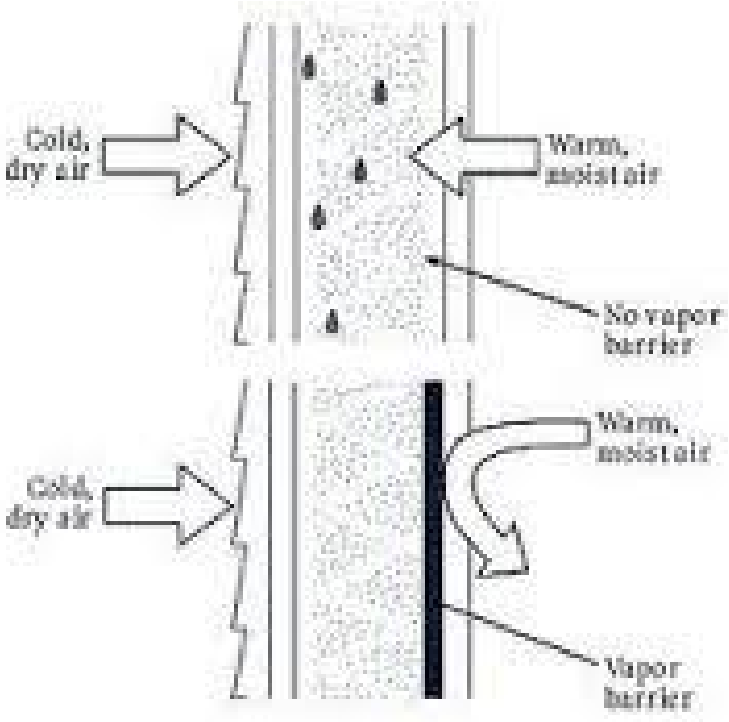
BUILDING ENVELOPE (Subsection 9.36.2)

- Airtightness
  (vapour barriers & air barriers)
- R-Values
- Continuity of Insulation
- Building Envelope Trade-offs



Airtightness (Articles 9.36.2.9 & 9.36.2.10)



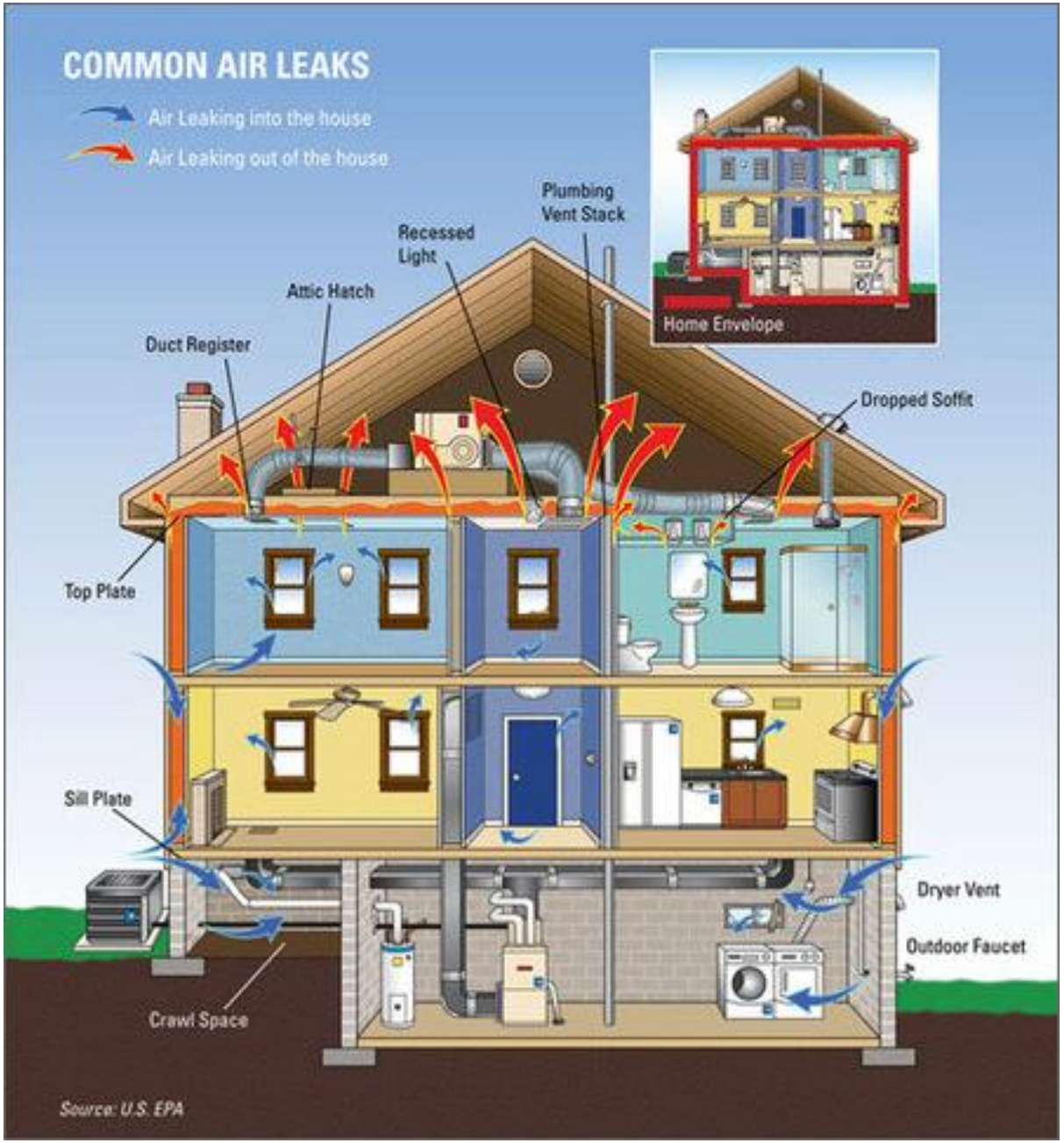
- maximum air leakage
  - 0.20 L / (m^2 s) = 200 mL / (m^2 s), or
  - as per 9.25.3

  (see NBC Appendix A pg A-211 for permeance values)

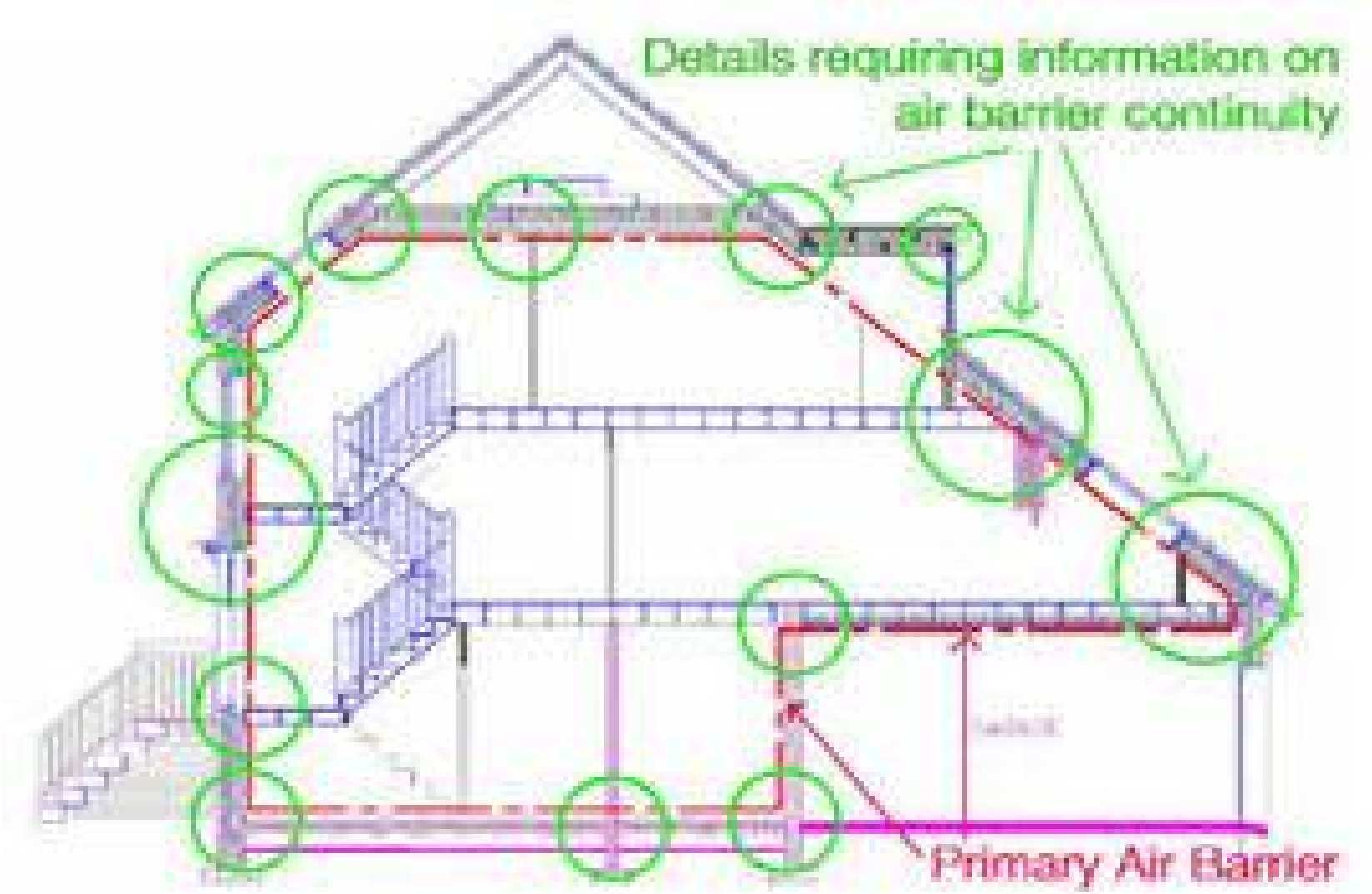
- Air barrier are to be <u>continuous</u>
  - over control & expansion joints
  - free of cracks & holes
  - between assemblies
  - around penetrations
  - structurally supported (i.e. VB cannot be loose)
- Windows, doors & overhead doors are to be weather-stripped
- Fireplaces are to have doors or enclosures

❖ **Section 9.36 requirements not different from what is presently required**

❖ **as before, the big concern is to stop the leakage at penetrations & joints**

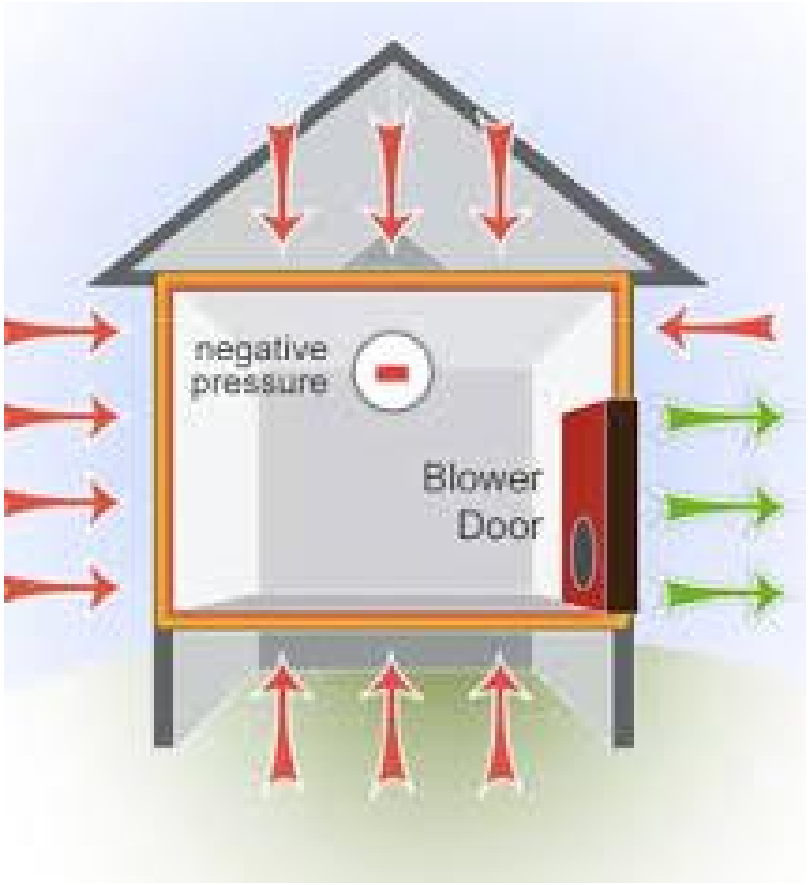

COMMON AIR LEAKS
Air Leaking into the house
Air Leaking out of the house
Plumbing Vent Stack
Recessed Light
Attic Hatch
Duct Register
Home Envelope
Dropped Soffit
Top Plate
Sill Plate
Dryer Vent
Outdoor Faucet
Crawl Space
Source: U.S. EPA

- **if we had R40 walls & R60 roof insulation but the windows are left open then the insulation level is meaningless**



MB Amendment to {9.36.2.9)

- if airtightness cannot be determined from a visual examination a “blower test” can be requested
- “blower test” is 2.5 air changes per hr (at 50 Pa depressurization) 50 Pa = 1.04 lb / ft^2



Building with HRV RSI Value (metric)	Nominal RSI		Effective RSI Values		
	S Man	N Man	Zone 7A	Zone 7B	Zone 8
Foundation Walls	3.50	3.50	2.80	2.80	2.80
Floors on permafrost	0.88	0.88	0	4.44	4.44
Unheated Floor (above frost line)	0.88	0.88	1.96	1.96	1.96
Unheated floors (below frost line)	0	0	0	0	0
Heated Floors on ground	0.88	0.88	2.84	2.84	2.84
Thickened Edge Slabs	0.88	0.88	2.84	2.84	3.72
Suspended Floors	4.90	4.90	5.02	5.02	5.02
Exterior Walls	3.50	4.40	2.80	2.80	3.08
Flat Roofs & Cathedral Ceilings	4.90	4.90	5.02	5.02	5.02
Roof with Attics	8.80	8.80	8.50	8.50	8.50

	Building with HRV R Value (imperial)	Nominal R		Effective R Values		
		S Man	N Man	Zone 7A	Zone 7B	Zone 8
1	Foundation Walls	19.9	19.9	15.9	15.9	15.9
2	Floors on permafrost	5.0	5.0	0.0	25.2	25.2
3	Unheated Floor (above frost line)	5.0	5.0	11.1	11.1	11.1
	Unheated floors (below frost line)	0.0	0.0	0.0	0.0	0.0
4	Heated Floors on ground	5.0	5.0	16.1	16.1	16.1
5	Thickened Edge Slabs	5.0	5.0	16.1	16.1	21.1
	Suspended Floors	27.8	27.8	28.5	28.5	28.5
6	Exterior Walls	19.9	25.0	15.9	15.9	17.5
	Flat Roofs & Cathedral Ceilings	27.8	27.8	28.5	28.5	28.5
	Roof with Attics	50.0	50.0	48.3	48.3	48.3

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Building without HRV RSI Value (metric)	Nominal RSI		Effective RSI Values		
	S Man	N Man	Zone 7A	Zone 7B	Zone 8
Foundation Walls	3.50	3.50	3.46	3.46	3.97
Floors on permafrost	0.88	0.88	0	4.44	4.44
Unheated Floor (above frost line)	0.88	0.88	1.96	1.96	1.96
Unheated floors (below frost line)	0	0	0	0	0
Heated Floors on ground	0.88	0.88	2.84	2.84	2.84
Thickened Edge Slabs	0.88	0.88	3.72	3.72	4.59
Suspended Floors	4.90	4.90	5.02	5.02	5.02
Exterior Walls	3.50	4.40	3.08	3.85	3.85
Flat Roofs & Cathedral Ceilings	4.90	4.90	5.02	5.02	5.02
Roof with Attics	8.80	8.80	10.43	10.43	10.43

	Building without HRV R Value (imperial)	Nominal R		Effective R Values		
		S Man	N Man	Zone 7A	Zone 7B	Zone 8
	Foundation Walls	19.9	19.9	19.6	19.6	22.5
1	Floors on permafrost	5.0	5.0	0.0	25.2	25.2
2	Unheated Floor (above frost line)	5.0	5.0	11.1	11.1	11.1
	Unheated floors (below frost line)	0.0	0.0	0.0	0.0	0.0
3	Heated Floors on ground	5.0	5.0	16.1	16.1	16.1
4	Thickened Edge Slabs	5.0	5.0	21.1	21.1	26.1
	Suspended Floors	27.8	27.8	28.5	28.5	28.5
5	Exterior Walls	19.9	25.0	17.5	21.9	21.9
	Flat Roofs & Cathedral Ceilings	27.8	27.8	28.5	28.5	28.5
6	Roof with Attics	50.0	50.0	59.2	59.2	59.2

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Effective RSI Values RSI Value (metric)	with HRV			without HRV		
	Zone 7A	Zone 7B	Zone 8	Zone 7A	Zone 7B	Zone 8
Foundation Walls	2.80	2.80	2.80	3.46	3.46	3.97
Floors on permafrost	0	4.44	4.44	0	4.44	4.44
Unheated Floor (above frost line)	1.96	1.96	1.96	1.96	1.96	1.96
Unheated floors (below frost line)	0	0	0	0	0	0
Heated Floors on ground	2.84	2.84	2.84	2.84	2.84	2.84
Thickened Edge Slabs	2.84	2.84	3.72	3.72	3.72	4.59
Suspended Floors	5.02	5.02	5.02	5.02	5.02	5.02
Exterior Walls	2.80	2.80	3.08	3.08	3.85	3.85
Flat Roofs & Cathedral Ceilings	5.02	5.02	5.02	5.02	5.02	5.02
Roof with Attics	8.50	8.50	8.50	10.43	10.43	10.43

	Effective RSI Values R Value (imperial)	with HRV			without HRV		
		Zone 7A	Zone 7B	Zone 8	Zone 7A	Zone 7B	Zone 8
1	Foundation Walls	15.9	15.9	15.9	19.6	19.6	22.5
	Floors on permafrost	0.0	25.2	25.2	0.0	25.2	25.2
	Unheated Floor (above frost line)	11.1	11.1	11.1	11.1	11.1	11.1
	Unheated floors (below frost line)	0.0	0.0	0.0	0.0	0.0	0.0
	Heated Floors on ground	16.1	16.1	16.1	16.1	16.1	16.1
2	Thickened Edge Slabs	16.1	16.1	21.1	21.1	21.1	26.1
	Suspended Floors	28.5	28.5	28.5	28.5	28.5	28.5
3	Exterior Walls	15.9	15.9	17.5	17.5	21.9	21.9
	Flat Roofs & Cathedral Ceilings	28.5	28.5	28.5	28.5	28.5	28.5
4	Roof with Attics	48.3	48.3	48.3	59.2	59.2	59.2

Manitoba

No present MBC Code window & doors insulation requirements

Section 9.36 Requirements

Windows & Door R-Values

	Overall U values			Overall RSI values			Overall R values		
	Zone 7A	Zone 7B	Zone 8	Zone 7A	Zone 7B	Zone 8	Zone 7A	Zone 7B	Zone 8
Fenestrations & Doors	1.60	1.40	1.40	0.63	0.71	0.71	3.55	4.06	4.06
Skylights	2.70	2.40	2.40	0.37	0.42	0.42	2.10	2.37	2.37

see Table 9.36.2.7(1) & Table 9.36.2.7(2)

OR

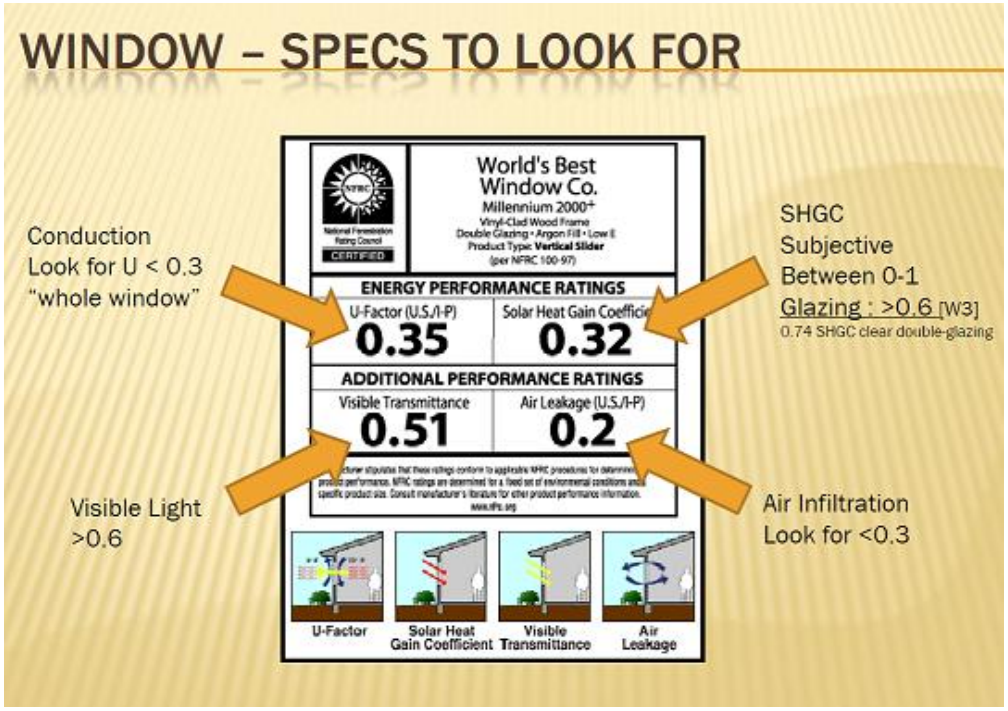
In Terms of minimum Energy Rating (ER)

- Zone 7A ER (min) = 25
- Zone 7B & Zone 8 ER (min) = 29

$$U = \{(57-ER) / 20$$

$$RSI = \{20 / (57 - ER)\}$$

$$ER = 57 - 20/RSI$$



Natural Resources Canada | Ressources naturelles Canada

ecoENERGY an ecoACTION initiative

ENERGY STAR® Qualified Windows, Doors & Skylights

Updated October 2010

When Canadians want to save energy and money and help the environment, they look for the ENERGY STAR symbol to identify energy-efficient products.

Even though windows, doors and skylights do not consume energy, they can be a significant source of heat loss in a home or building. ENERGY STAR qualified products will save money by reducing overall annual energy costs by up to 16 percent. They will also help keep the home or building more comfortable year-round and reduce outside noise, and may have less condensation in cold weather compared with a conventional product.

How Do These Products Qualify for ENERGY STAR?

To be ENERGY STAR qualified, products must meet specific energy efficiency levels that have been set for four climate zones (A, B, C and D) in Canada. In addition, all products must be certified by an accredited agency for their energy efficiency.

The four climate zones were developed using heating degree-days, a measure of annual average temperature. The efficiency levels measure how well a window, door or skylight insulates against the cold or how well it uses the sun's heat to supplement the home's or building's heating system. Because the climate becomes progressively colder from Zone A to Zone D, the levels are more stringent for each successive zone. This means that models that qualify for Zone B also qualify for Zone A, models that qualify for Zone C also qualify for Zones A and B, and models that qualify for Zone D also qualify for Zones A, B and C.

ENERGY STAR Requirements for Windows and Doors

Products may comply based on either their U-factor or their Energy Rating (ER). The U-factor is a measure of the rate of heat loss. The lower the number, the slower the heat loss. ER is a formula that includes the U-factor, air leakage and the benefit of potential solar gain. The higher the value, the higher the potential annual energy savings. Windows and sliding glass doors must also have an air leakage rate of ≤1.65 cubic metres per hour per metre of product opening or ≤1.5 litres per second per square metre of product area.

Windows and Doors

Zone	Heating Degree-Day Range	Compliance Paths			
		Energy Rating	or	U-factor	
		Minimum ER (unitless) Maximum U-factor 2.00 W/m²·K (0.35 Btu/h·ft²·°F)		Maximum U-factor W/m²·K (Btu/h·ft²·°F)	Windows only Minimum ER (unitless)
A	≤3500	21	or	1.80 (0.32)	13
B	>3500 to ≤5000	25	or	1.60 (0.28)	17
C	>5000 to ≤8000	29	or	1.40 (0.25)	21
D	>8000	34	or	1.20 (0.21)	25

Climate Zones

ENERGY STAR Requirements for Skylights

Skylights*

Zone	Heating Degree-Day Range	Maximum U-factor W/m²·K (Btu/h·ft²·°F)
A	≤3500	2.80 (0.50)
B	>3500 to ≤5500	2.60 (0.46)
C	>5500 to ≤8000	2.40 (0.42)
D	>8000	2.20 (0.39)

*Includes tubular skylights

U-factor Conversion to R-value

Windows, doors and skylights are not normally assigned an R-value when tested. However, contractors and window salespeople may refer to the R-value as a way to measure performance. To help you better understand the R-value system, sample U-factors in both metric and imperial units have been converted to R-values in the following table. Because ER values are derived from a formula that uses both the U-factor and solar heat gain, there is no method to directly convert the ER value to an R-value.

U-factor Conversion to R-value

U-factor (W/m²·K)	U-factor (Btu/h·ft²·°F)	R-value (ft²·h·°F/Btu)
3.40	0.60	1.7
3.20	0.56	1.8
3.00	0.53	1.9
2.80	0.50	2.0
2.60	0.46	2.2
2.40	0.42	2.4
2.20	0.39	2.6
2.00	0.35	2.9
1.80	0.32	3.2
1.60	0.28	3.6
1.40	0.25	4.0
1.20	0.21	4.8
1.00	0.18	5.6
0.80	0.14	7.1
0.60	0.11	9.1

How to Identify a Qualified Product

All qualified products must be visibly labelled with the ENERGY STAR symbol and the zone or zones that the product qualifies for. This information may also be in the product literature for each model, along with an explanation of the four climate zones in Canada.

Sample Label Without a Map, Showing Qualification for Zones A and B

ENERGY STAR

Canada • Zones

A B

energystar.nrcan-rncan.gc.ca

Sample Label With a Map, Showing Qualification for Zones A, B and C

ENERGY STAR HIGH EFFICIENCY WATER EFFICIENT

Qualified for area indicated.
Admissible pour les régions indiquées.

Canada

ENERGY STAR

1 800 387-2000

energystar.nrcan-rncan.gc.ca

Environmental Benefits

If all of the original windows and doors in an average older home were replaced by ENERGY STAR qualified windows and doors, the household energy consumption would be reduced by about 7 percent. If ENERGY STAR qualified windows, doors and skylights where installed in an average new home instead of conventional products, energy consumption would be reduced by about 16 percent.

ENERGY STAR in General

Natural Resources Canada (NRCan) administers the ENERGY STAR initiative in Canada. Manufacturers who want to label some or all of their models with the ENERGY STAR mark for sale in Canada must sign an administrative arrangement with NRCan and have these models registered and qualified for ENERGY STAR. By signing the arrangement, the manufacturer verifies that the products to be labelled meet the ENERGY STAR specifications for Canada. Dealers and retailers may also sign an arrangement with NRCan or receive permission to use the ENERGY STAR name and promotional symbols directly from their manufacturer supplier.

For more information on ENERGY STAR in Canada, visit the Web site at **energystar.nrcan.gc.ca**, or to order ENERGY STAR publications call the publications line at **1-800-387-2000 (toll-free)**.

For other free publications write to:

Energy Publications
Office of Energy Efficiency
Natural Resources Canada
c/o St. Joseph Communications
Order Processing Unit
1165 Kenaston Street
PO Box 9809 Station T
Ottawa ON K1G 6S1
Fax: 613-740-3114
TTY: 613-996-4397 (teletype for the hearing-impaired)

Cat. No. M144-147/1-1-2010E (Print) ISBN 978-1-100-17113-7
Cat. No. M144-147/1-1-2010E-PDF (On-line) ISBN 978-1-100-17120-3

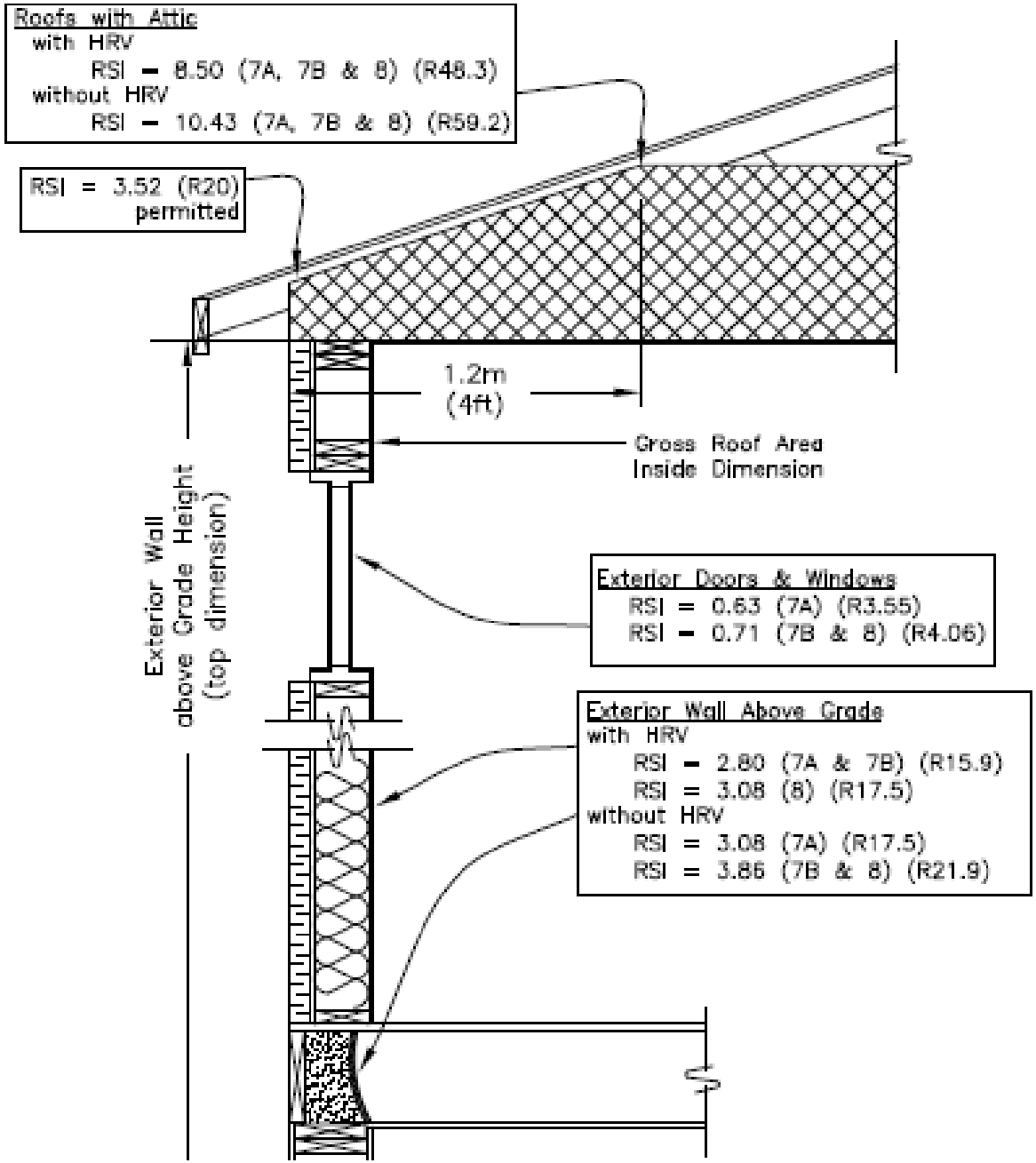
Aussi disponible en français sous le titre : Portes, fenêtres et puits de lumière homologués ENERGY STAR®

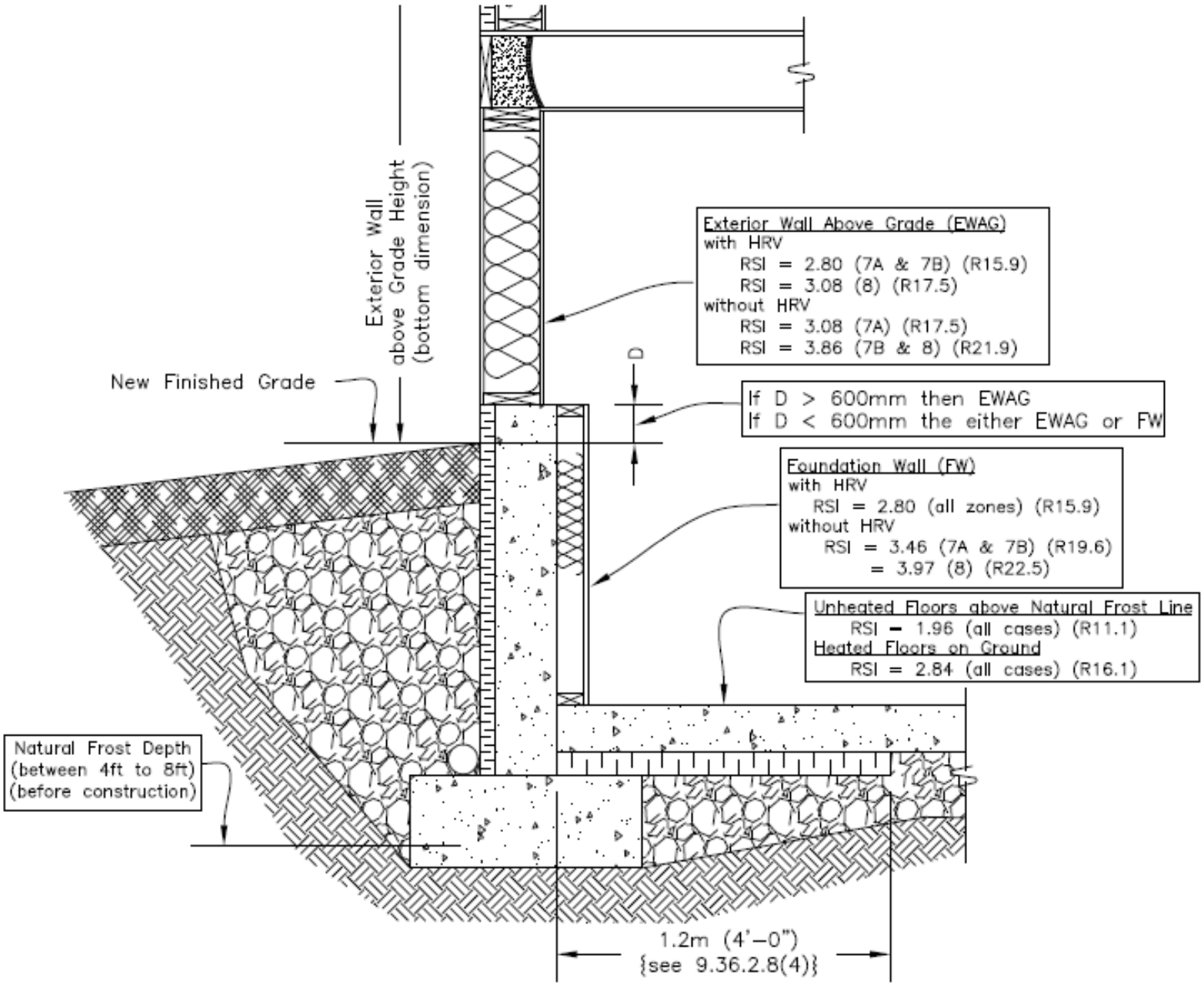
Natural Resources Canada's Office of Energy Efficiency
Leading Canadians to Energy Efficiency at Home, at Work and on the Road

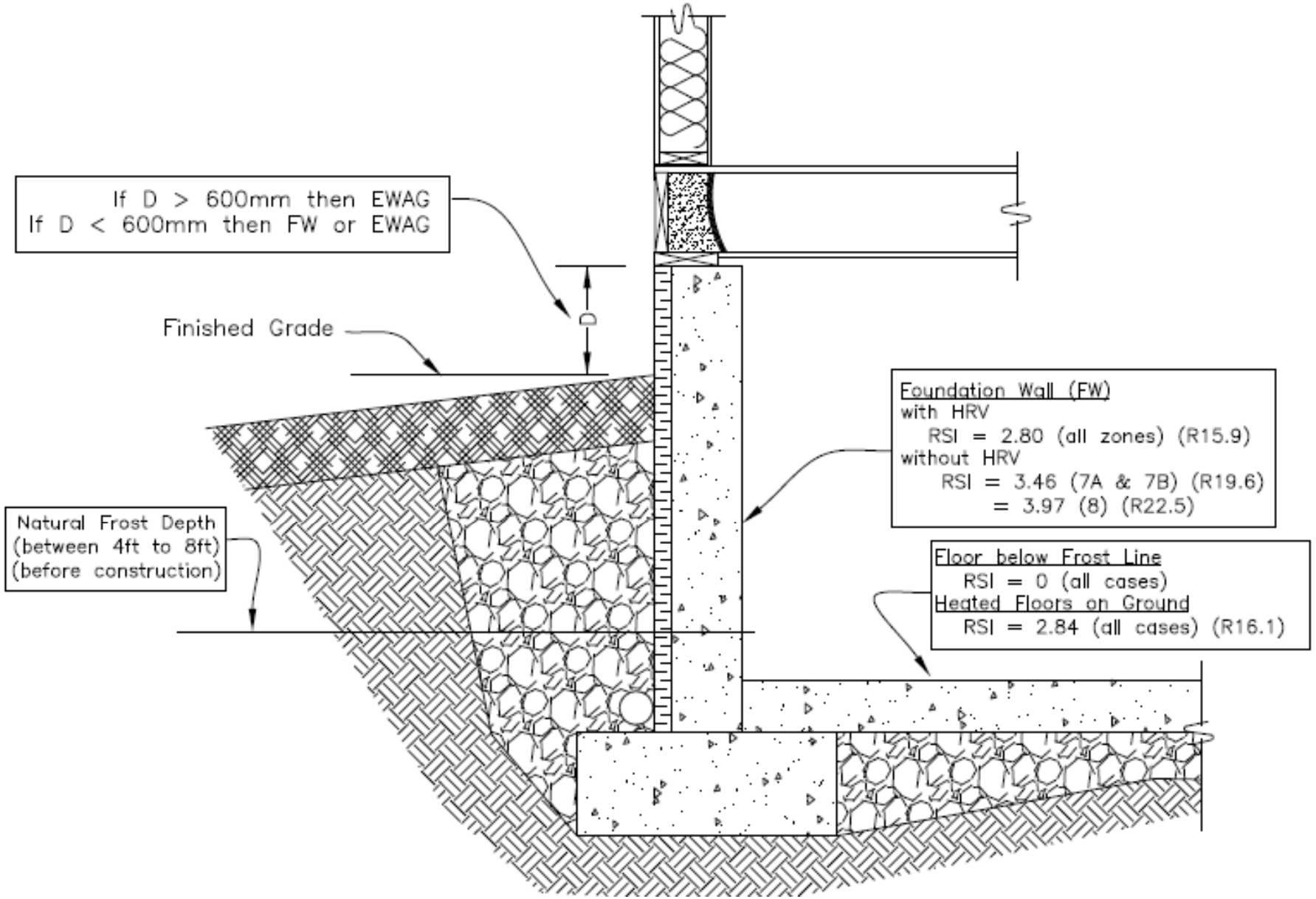
Canada

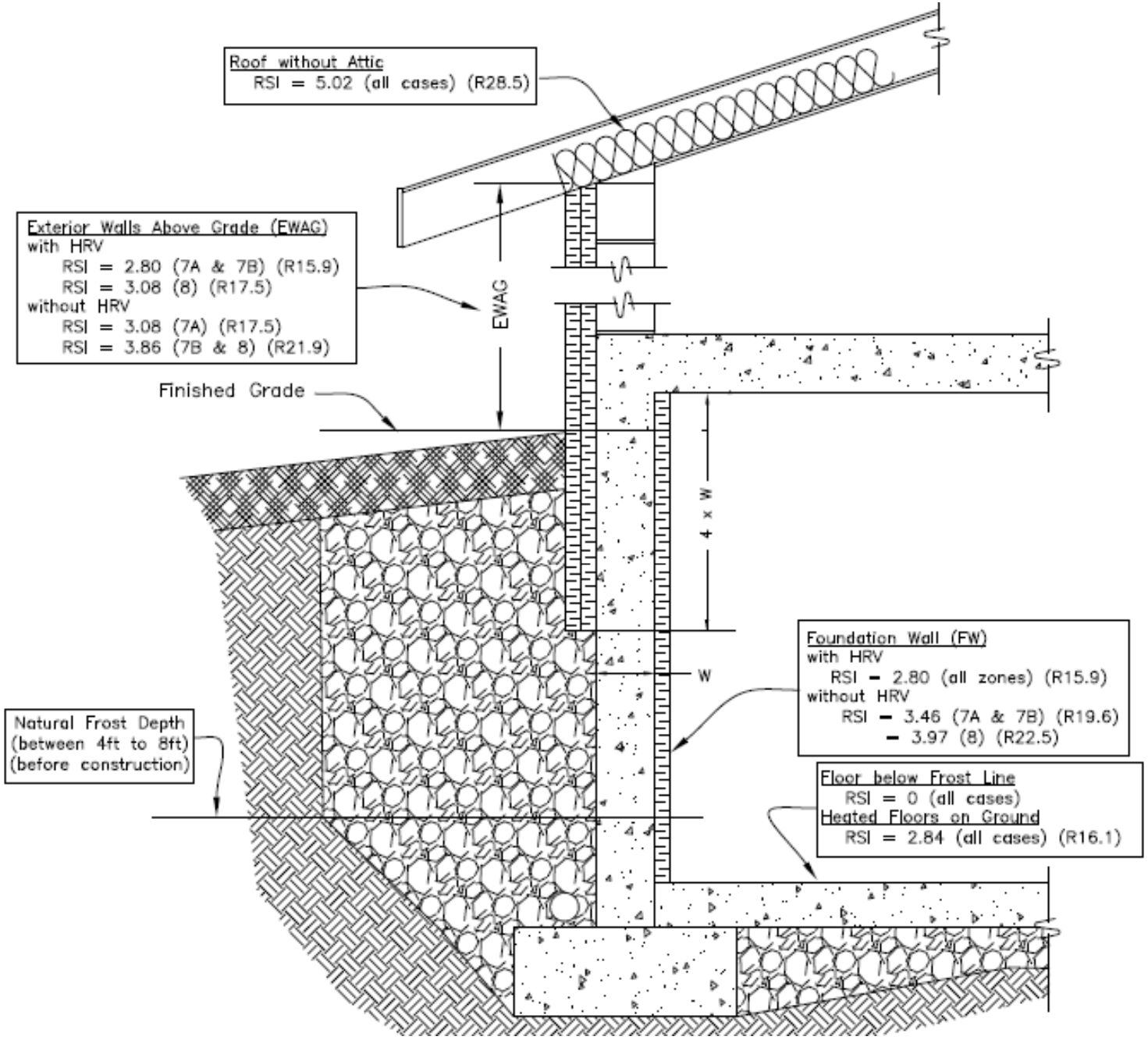
OFFICE OF THE FIRE COMMISSIONER MANITOBA

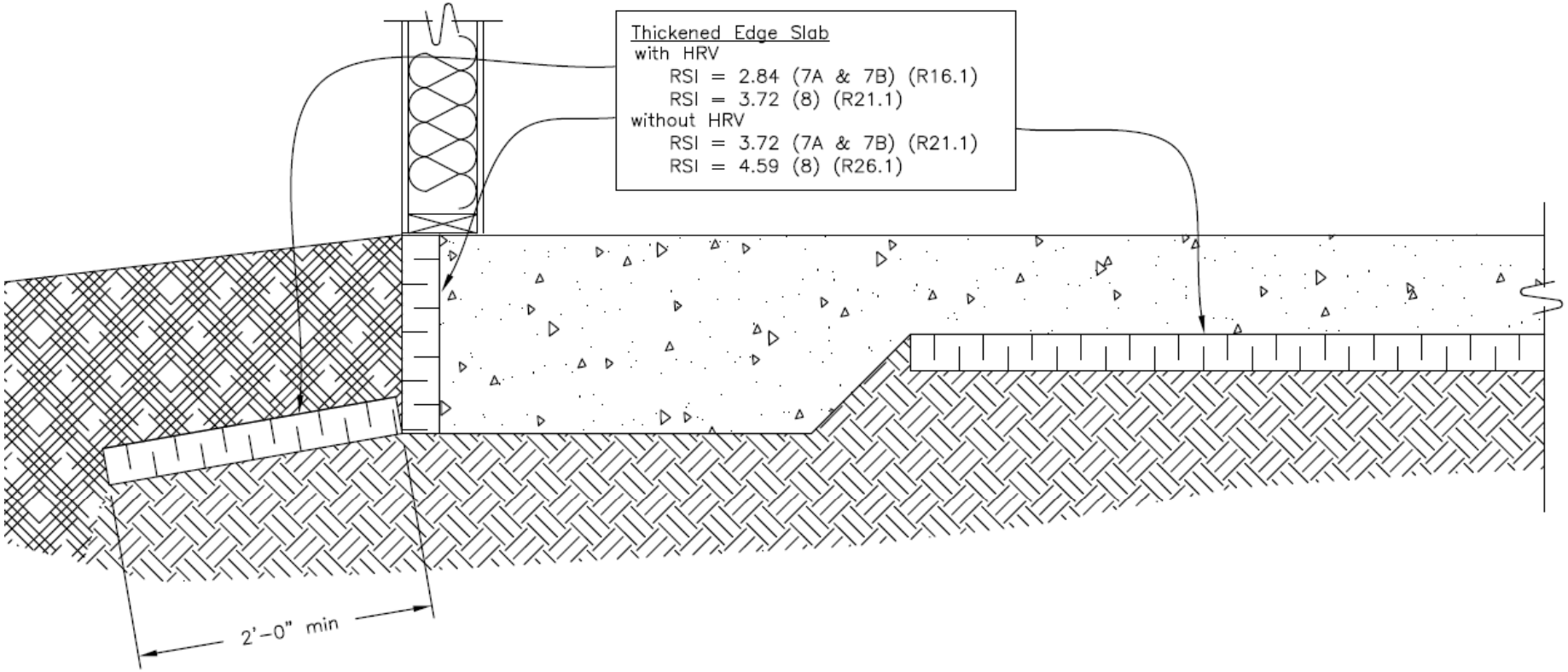
Manitoba

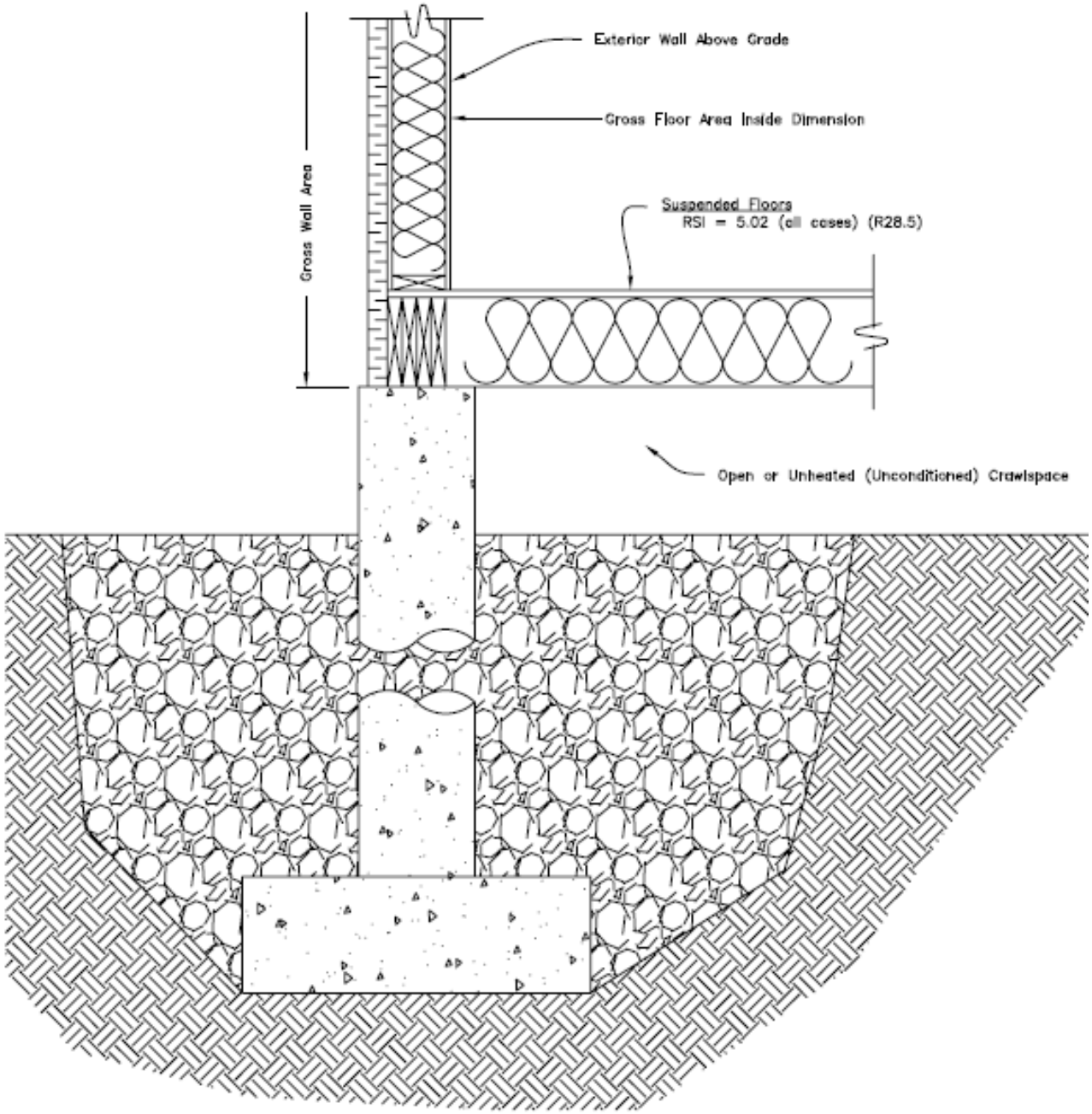

Roofs with Attic
with HRV
RSI = 8.50 (7A, 7B & 8) (R48.3)
without HRV
RSI = 10.43 (7A, 7B & 8) (R59.2)
RSI = 3.52 (R20) permitted
1.2m (4ft)
Gross Roof Area Inside Dimension
Exterior Wall above Grade Height (top dimension)
Exterior Doors & Windows
RSI = 0.63 (7A) (R3.55)
RSI = 0.71 (7B & 8) (R4.06)
Exterior Wall Above Grade
with HRV
RSI = 2.80 (7A & 7B) (R15.9)
RSI = 3.08 (8) (R17.5)
without HRV
RSI = 3.08 (7A) (R17.5)
RSI = 3.86 (7B & 8) (R21.9)

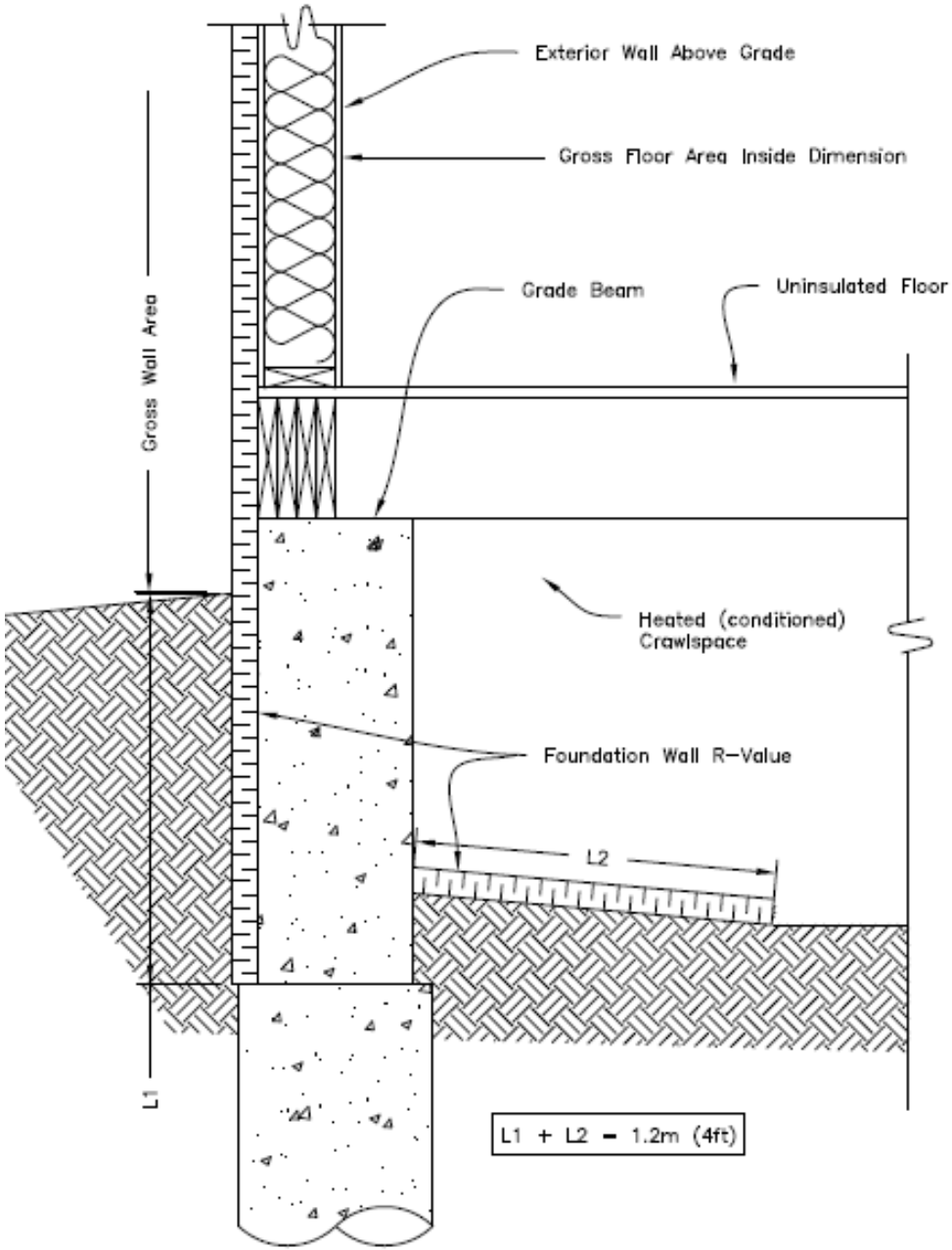

Exterior Wall
above Grade Height
(bottom dimension)
New Finished Grade
D
Exterior Wall Above Grade (EWAG)
with HRV
RSI = 2.80 (7A & 7B) (R15.9)
RSI = 3.08 (8) (R17.5)
without HRV
RSI = 3.08 (7A) (R17.5)
RSI = 3.86 (7B & 8) (R21.9)
If D > 600mm then EWAG
If D < 600mm the either EWAG or FW
Foundation Wall (FW)
with HRV
RSI = 2.80 (all zones) (R15.9)
without HRV
RSI = 3.46 (7A & 7B) (R19.6)
= 3.97 (8) (R22.5)
Unheated Floors above Natural Frost Line
RSI = 1.96 (all cases) (R11.1)
Heated Floors on Ground
RSI = 2.84 (all cases) (R16.1)
Natural Frost Depth
(between 4ft to 8ft)
(before construction)
1.2m (4'–0")
{see 9.36.2.8(4)}

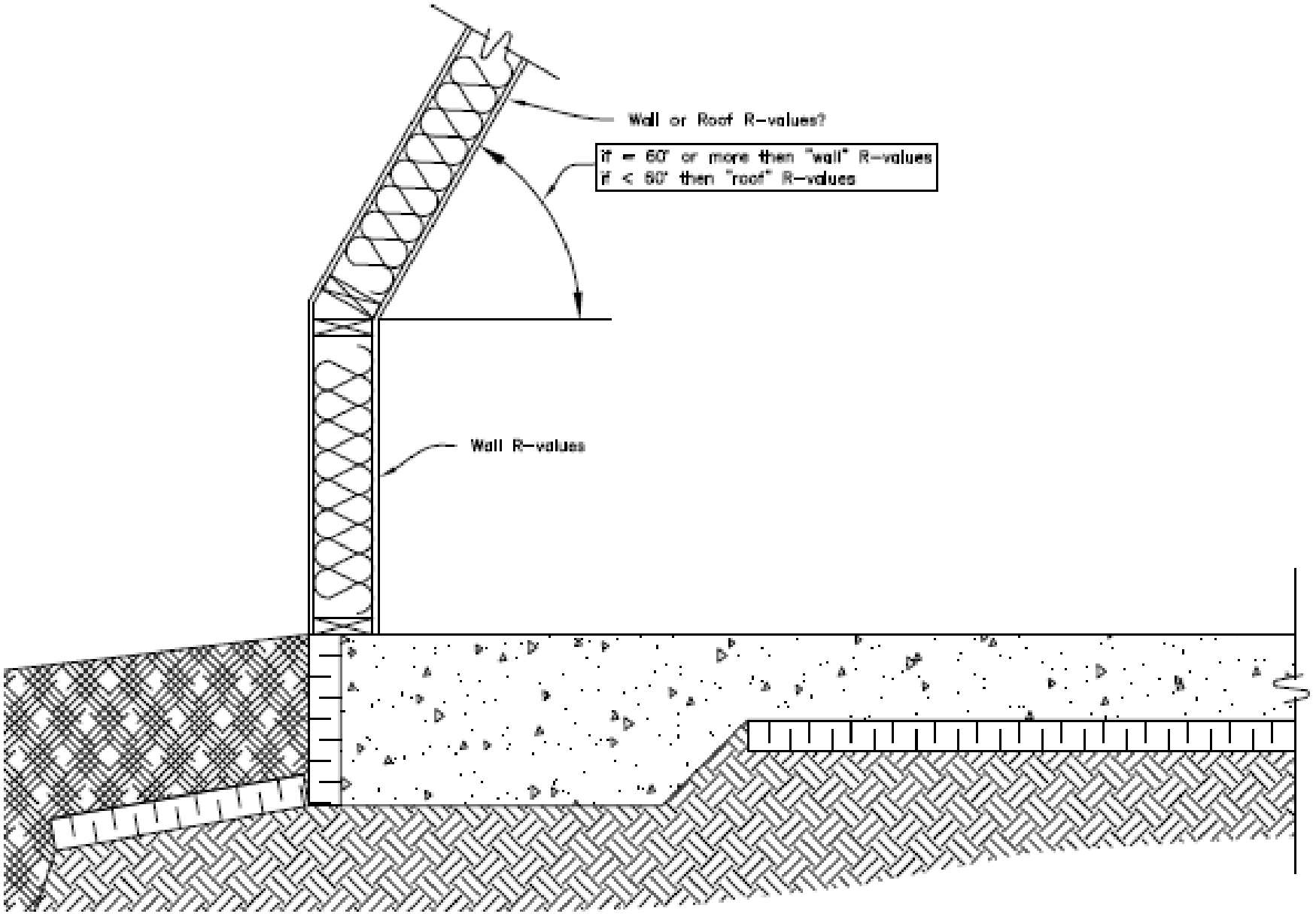

If D > 600mm then EWAG
If D < 600mm then FW or EWAG
D
Finished Grade
Natural Frost Depth
(between 4ft to 8ft)
(before construction)
Foundation Wall (FW)
with HRV
RSI = 2.80 (all zones) (R15.9)
without HRV
RSI = 3.46 (7A & 7B) (R19.6)
= 3.97 (8) (R22.5)
Floor below Frost Line
RSI = 0 (all cases)
Heated Floors on Ground
RSI = 2.84 (all cases) (R16.1)


Roof without Attic
RSI = 5.02 (all cases) (R28.5)
Exterior Walls Above Grade (EWAG)
with HRV
RSI = 2.80 (7A & 7B) (R15.9)
RSI = 3.08 (8) (R17.5)
without HRV
RSI = 3.08 (7A) (R17.5)
RSI = 3.86 (7B & 8) (R21.9)
EWAG
Finished Grade
4 x W
W
Natural Frost Depth
(between 4ft to 8ft)
(before construction)
Foundation Wall (FW)
with HRV
RSI – 2.80 (all zones) (R15.9)
without HRV
RSI – 3.46 (7A & 7B) (R19.6)
– 3.97 (8) (R22.5)
Floor below Frost Line
RSI = 0 (all cases)
Heated Floors on Ground
RSI = 2.84 (all cases) (R16.1)


Thickened Edge Slab
with HRV
RSI = 2.84 (7A & 7B) (R16.1)
RSI = 3.72 (8) (R21.1)
without HRV
RSI = 3.72 (7A & 7B) (R21.1)
RSI = 4.59 (8) (R26.1)
2'-0" min

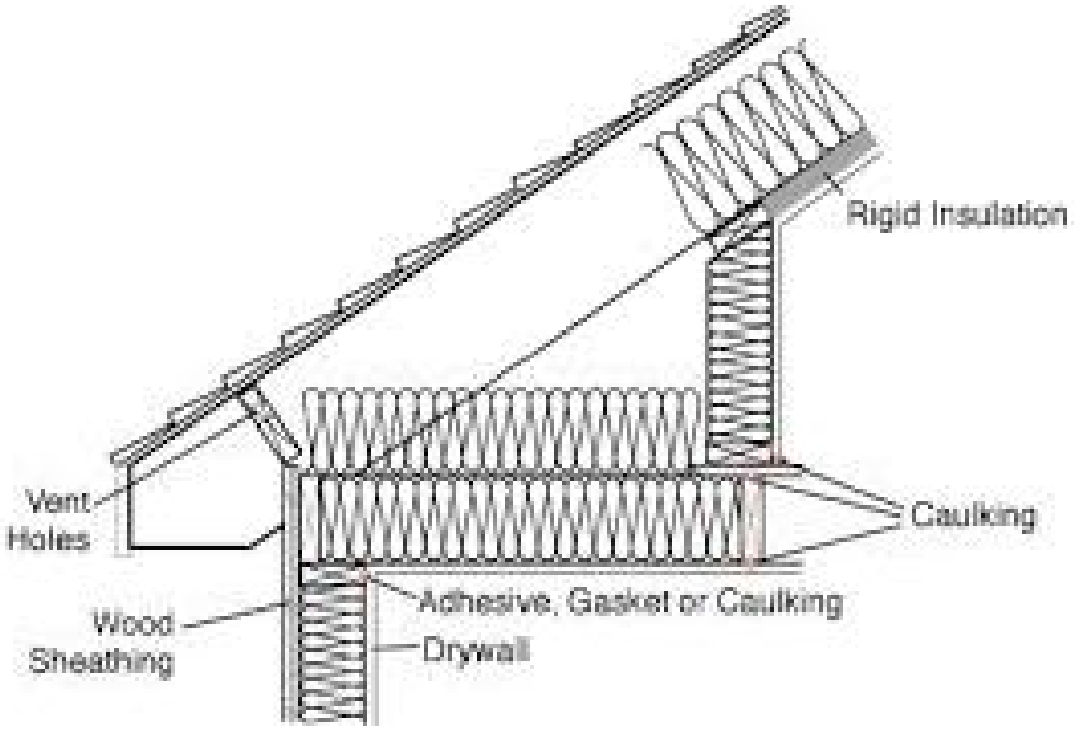

Exterior Wall Above Grade
Gross Floor Area Inside Dimension
Gross Wall Area
Suspended Floors
RSI = 5.02 (all cases) (R28.5)
Open or Unheated (Unconditioned) Crawlspace

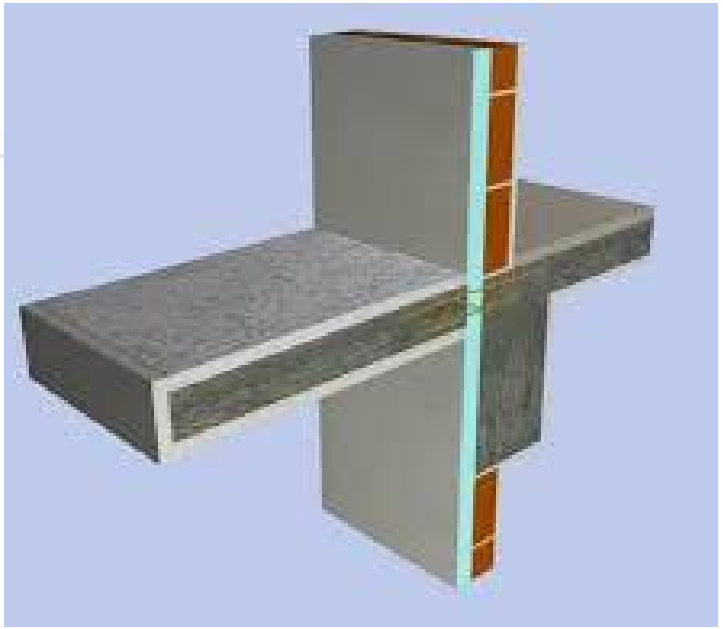

Exterior Wall Above Grade
Gross Floor Area Inside Dimension
Grade Beam
Uninsulated Floor
Gross Wall Area
Heated (conditioned)
Crawlspace
Foundation Wall R-Value
L2
L1
L1 + L2 = 1.2m (4ft)


Wall or Roof R-values?
if = 60° or more then "wall" R-values
if < 60° then "roof" R-values
Wall R-values

CONTINUITY OF INSULATION (Article 9.36.2.5)

- The overall objective is to ensure that the effective thermal resistance of the wall, roof and floor is not significantly reduced from the Code specified R-value

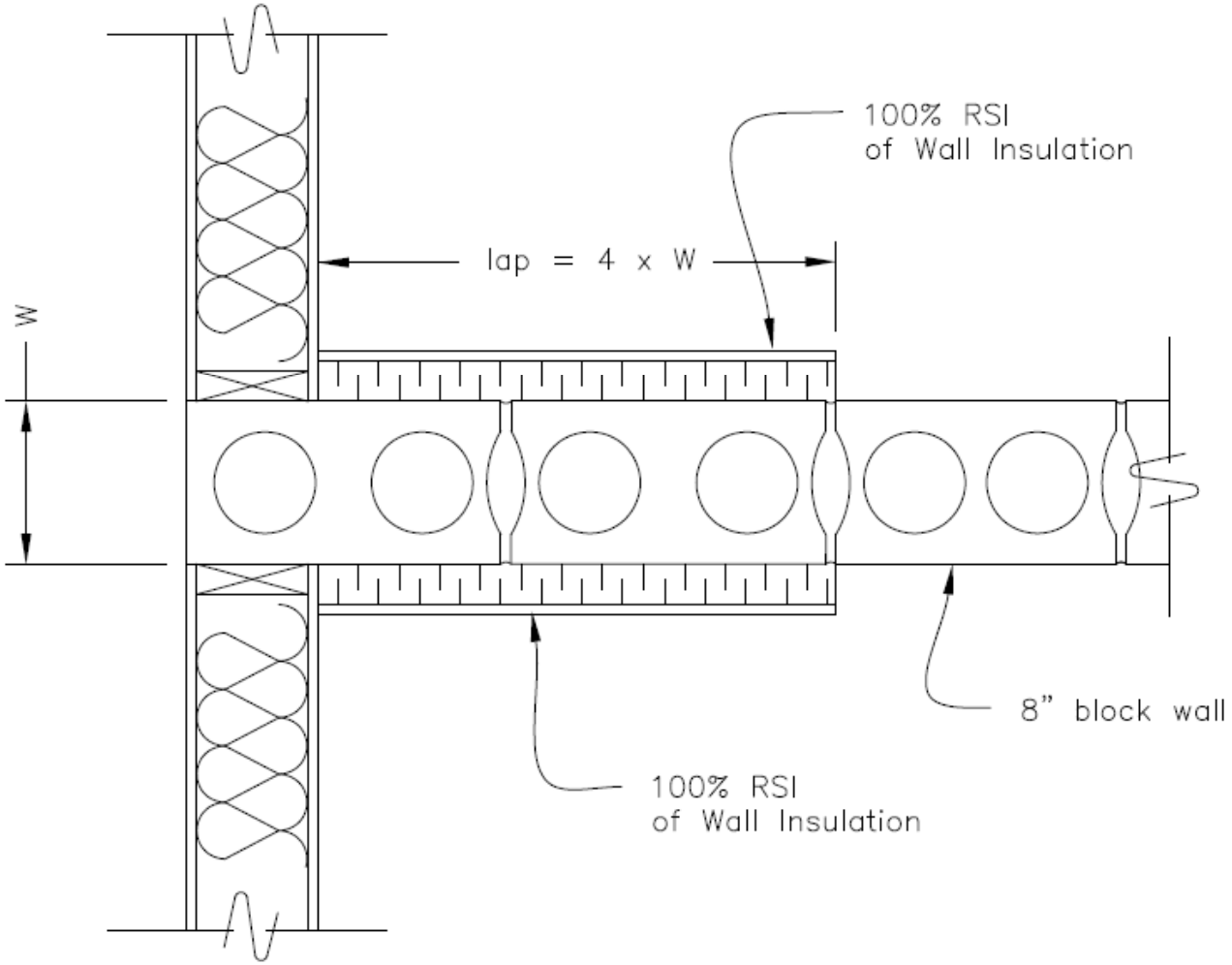


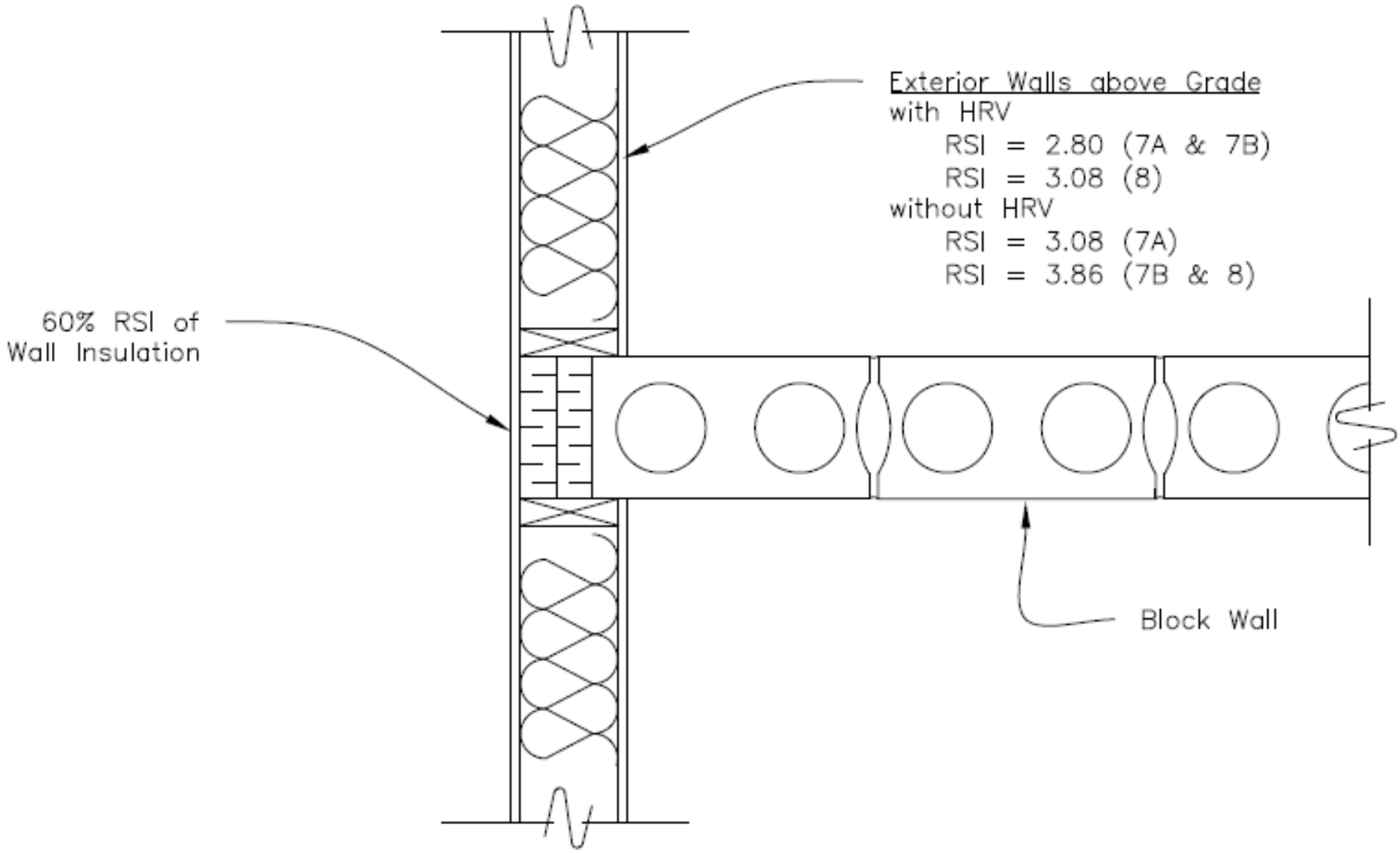


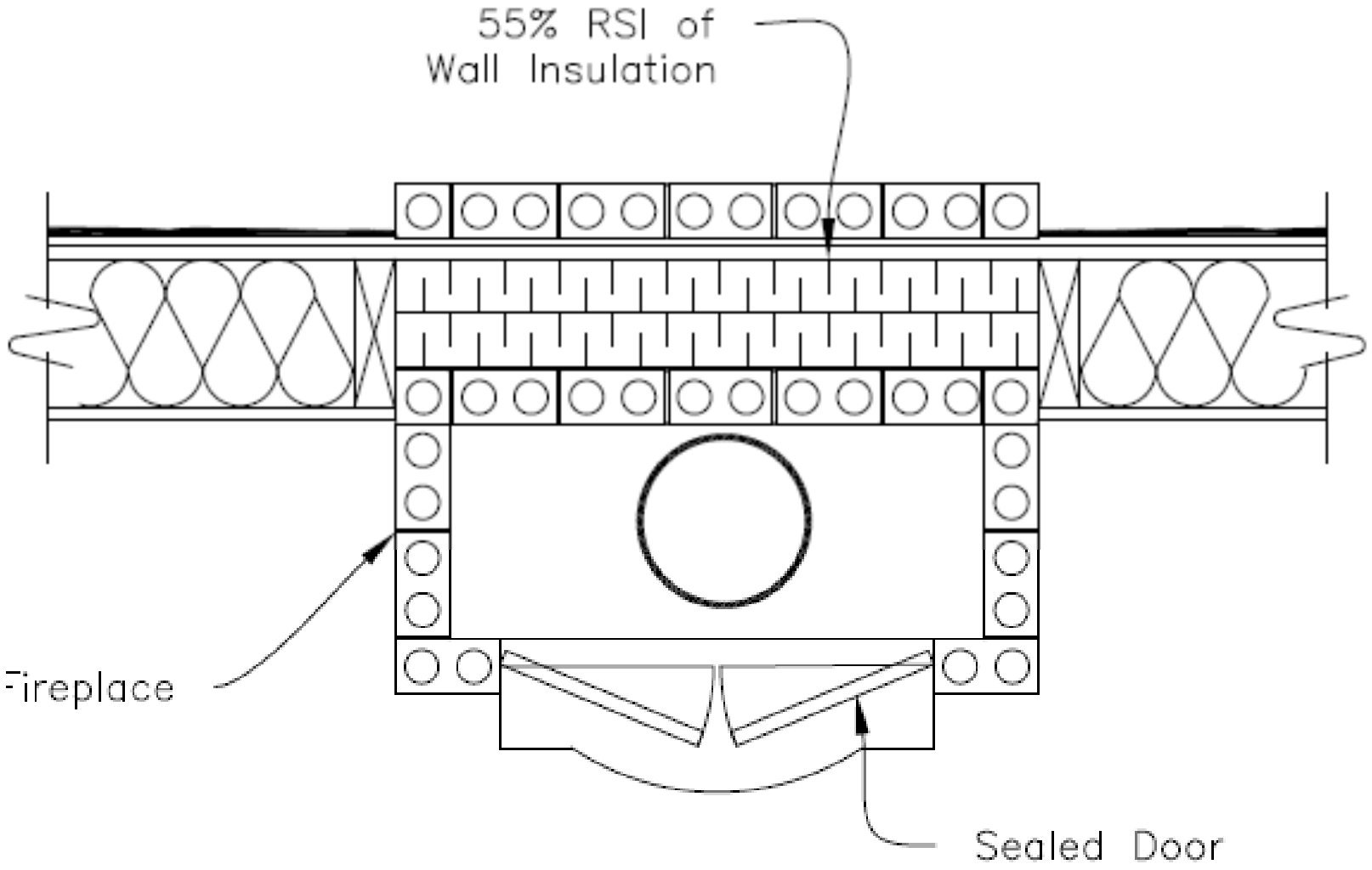
- Areas where thermal barrier is disrupted include:
  - basement wall/floor slab/exterior wall intersection
  - exterior wall/roof intersection
  - exterior wall/interior wall intersection
  - wall/roof penetrations (fireplaces, mechanical ducts, anchors, balcony slabs)
  - piping vents, electrical conducts inside the wall

- Design Professionals objective is to minimize the thermal bridging effects at the insulation disruption

- Exceptions to insulation continuity include:
  - inward insulation of 4 x penetration thickness {9.36.2.5(2a)}
  - at least 60% in front of penetration {9.36.2.5(2b)} (see page 35)
  - masonry fireplaces to be insulated to 55% {9.36.2.5(3)} (see page 36)




Exterior Walls above Grade
with HRV
RSI = 2.80 (7A & 7B)
RSI = 3.08 (8)
without HRV
RSI = 3.08 (7A)
RSI = 3.86 (7B & 8)
60% RSI of
Wall Insulation
Block Wall


55% RSI of
Wall Insulation
Fireplace
Sealed Door

Building Insulation Trade-Off (Article 9.36.2.11)

- The objective is to ensure the overall building envelope has the same thermal resistance and that more energy would not be required to heat/cool the building.

- Examples of Trade-offs:
  - using a stained glass window (which has a low R-value) provided other windows have a higher R-value
  - using walls with a lower R-value provided the roof has a higher R-value

- Limitations of Trade-offs
  - apply only to above grade assemblies
  - cannot be applied to walls / floors with a heating piping system
  - walls and flat roof RSI's cannot be reduced by more than 55%
  - for other conditions the trade-off cannot reduce RSI by more than 60%

Example of Building Insulation Trade-Off:

Owner (from Selkirk) wants to use R60 for roof attic (more than required R = 48.3)
so a trade off (compensation) by having lower R-value in walls is permitted

Selkirk (Zone 7A):

- since building is a house – needs a HRV {MB Amendment 9.36.3.8.1}
- gross wall area = 500 m^2 {see 9.36.2.3(2) for calculating gross wall area}
- gross roof area = 300 m^2 {see 9.36.2.3(1) for calculating gross roof area}
- "reference building" (or Section 9.36) requirements
  - RSI_{wall} = 2.80 (R = 15.9) {as per table 9.36.2.6B of MB Amendment}
  - RSI_{roof} = 8.50 (R = 48.3) (as per table 9.36.2.6B of MB Amendment}

- R = 60 converts to → RSI = 60 / 5.678 = 10.6 (proposed roof insulation level)
- What is the minimum wall insulation required (RSI_{wall})?

$$\mathbf{\sum (A_{reference} / RSI_{reference}) \geq \sum (A_{proposed} / RSI_{proposed})}$$

reference bldg (9.36) ≥ proposed side (actual construction)

$$\{(A_{wall} / RSI_{wall}) + (A_{roof} / RSI_{roof})\} \geq \{(A_{wall} / RSI_{wall}) + (A_{roof} / RSI_{roof})\}$$

$$\{(500 / 2.80) + (300 / 8.50)\} \geq \{(500 / RSI_{wall}) + (300 / 10.6)\}$$

$$214 \geq \{(500 / RSI_{wall}\ RSI_{wall} + 28.3\}$$

$$214 - 28.3 \geq 500 / RSI_{wall}$$

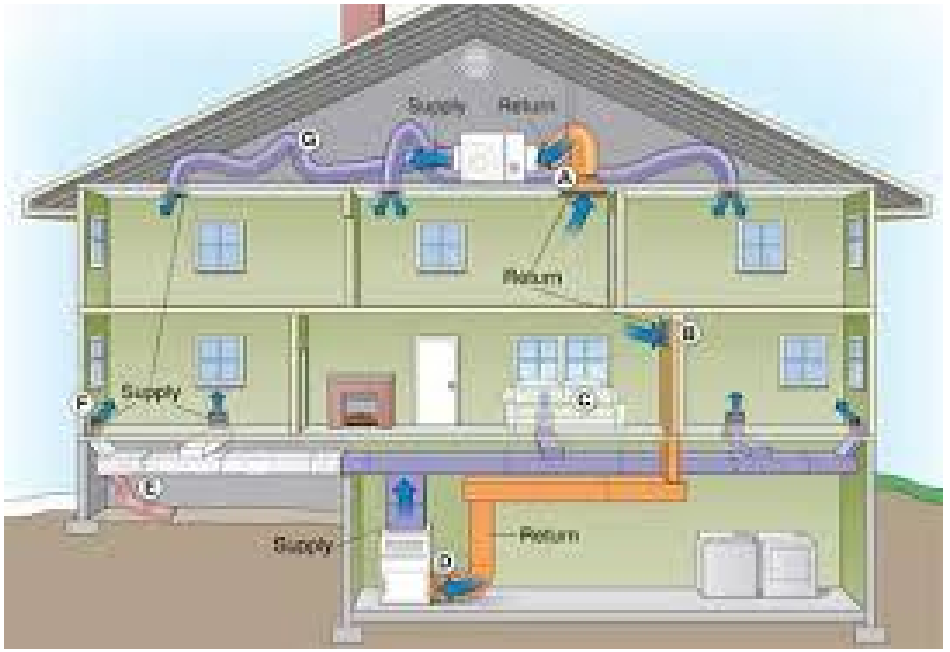
$$186 \geq 500 / RSI_{wall}$$

$$RSI_{wall} \geq 500 / 186 = 2.69\ m^2\ K / W$$

$$R_{wall} \geq 15.3$$ (note: less than R = 15.9)

HVAC Requirements (Subsection 9.36.3)

- Does not deal with the HVAC design itself (only the energy efficiency)
- Ducts
  - to be sealed at joints
  - if ducts are outside, then insulated same as the adjacent floor, wall or roof assembly
  - have dampers at outside vents
- Controls
  - to prevent simultaneous heat & cooling at the same time
- Equipment Efficiency
  - as per Table 9.36.3.10 for Equipment Efficiency
  - natural gas or propane furnaces
    - Annual Fuel Utilization Efficiency (AFUE) ≥ 94% (MB Amendment) (NBC 9.36 → AFUE ≥ 92%) (no different than before for MB)



- HRV's required for dwelling units that have a self-contained mechanical ventilation system {MB Amendment 9.36.3.8.1(1)}

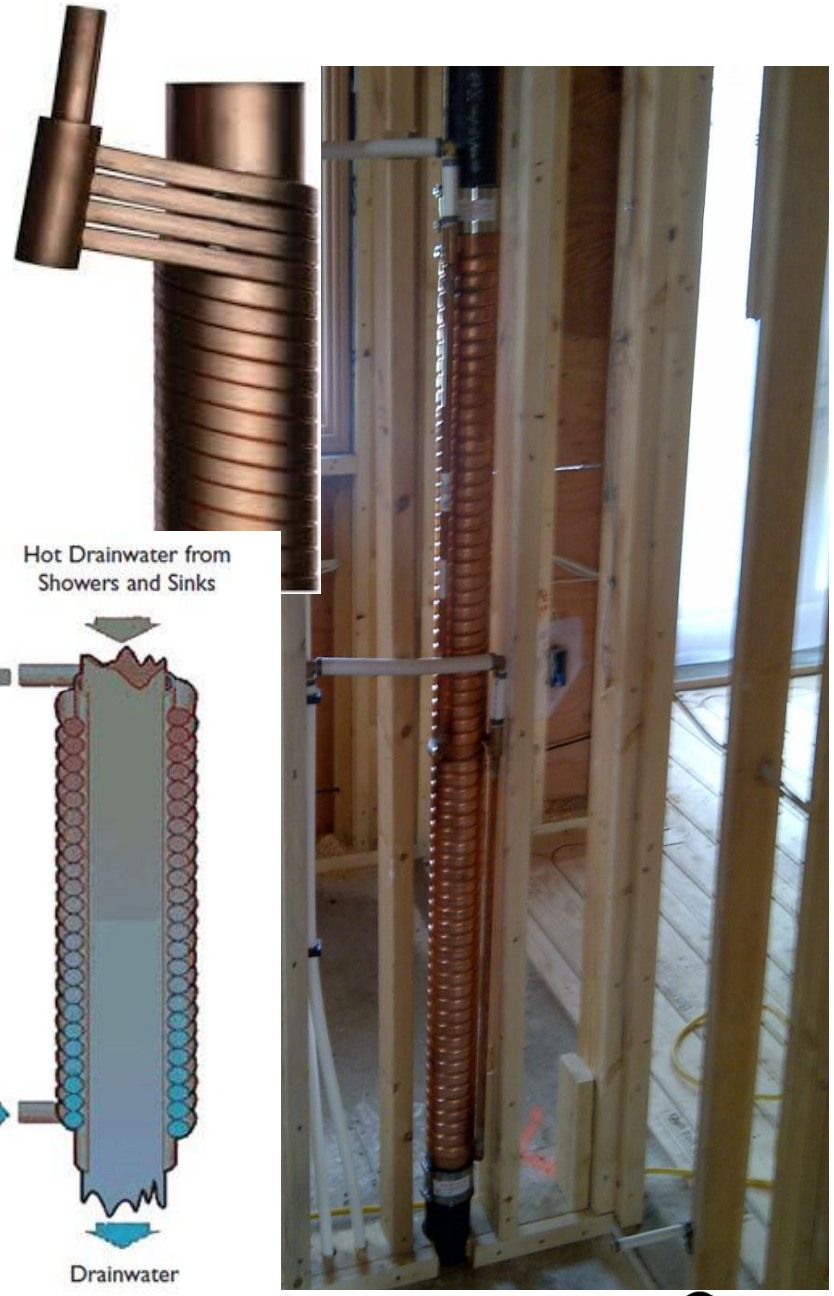
Service Water Heating Systems

(Subsection 9.36.4)

- HWT Energy Efficiency as per Table 9.36.4.2
- HWT - insulate 2M of outlet & inlet piping
- piping in recirculation system to be insulated (i.e. in floor heating piping)
- thermostats & timer controls for pool heaters & pumps

Drain Water Heat Recovery (DWHR)

- required for all houses {MB Amendment 9.36.4.7}
- not required where can't physically be installed
  - main floor shower with no basements
  - basement showers



Manitoba

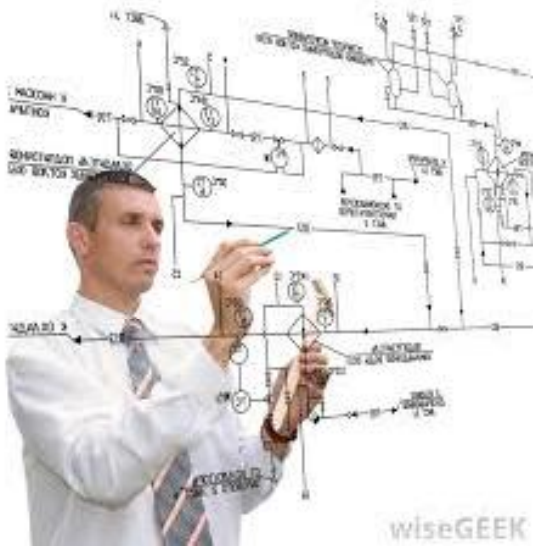
<u>Energy Performance Compliance</u> (Subsection 9.36.5)

- 9.36.5 applies only to residential occupancies
- could use energy performance compliance for other occupancies by NECB

annual energy use of proposed bldg ≤ annual energy use of reference bldg

proposed bldg = the actual building being built

reference bldg = meeting the requirements of Section 9.36



Energy to be included:

- heating
- cooling
- ventilation
- service water heating

Energy not to be included:

- Lighting (note: MECB does include Lighting in the Energy Use)
- ventilation in unconditioned spaces

- Energy Modelling requires computer modelling & in most cases will require a mechanical engineer

Future

- present energy code has same energy use allowance regardless of occupancy
- for example, a hospitals will have same wall insulation requirements as a warehouse bldg

➢ future code will likely use Energy Use Intensity (EUI)

- EUI = allowance for energy consumption based on occupancy / use

➢ energy modelling of buildings will be the norm for Part 3 buildings (5 years?) and later Part 9 buildings (10 years?)

➢ energy modelling will use HDD (for the specific site rather than climatic zones)

so climatic zones in codes will be phased out as energy modeling become the norm

Link to the Manitoba Regulation 52/2015
(which included MBC Section 9.36 Amendments)
http://web2.gov.mb.ca/laws/regs/annual/2015/052.pdf

Link to the Manitoba Regulation 213/2011 (Manitoba Energy Code)
http://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=213/2013

Web: http://www.firecomm.gov.mb.ca/codes.html
Email: firecomm@gov.mb.ca

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email: calvin.gray@gov.mb.ca