Prescriptive Calculation

Grande Prairie Region

Canadian Home Builders' Association

PRESENTATION BY CHBA GRANDE PRAIRIE REGION

BUILDER TECHNICAL COMMITTEE

Monte Heyn
i4HomeEnergy_Energy Advisor

Effective Thermal Resistance Calculations

- Above Grade Wall Assemblies
- Foundation Wall / Frost Wall
- Roof / Ceiling/ Attic

Also Pertaining To:

- Rim Joists
- Floors Over Unheated Spaces

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Above Grade Walls

ALBERTA BUILDING CODE 2014 _ A-9.36.2.4(1)

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Process Overview

- Wall Analysis
- Data Collection/ Input
- Blended Calculations
- Total Effective RSI Calculation
- Required RSI Comparison

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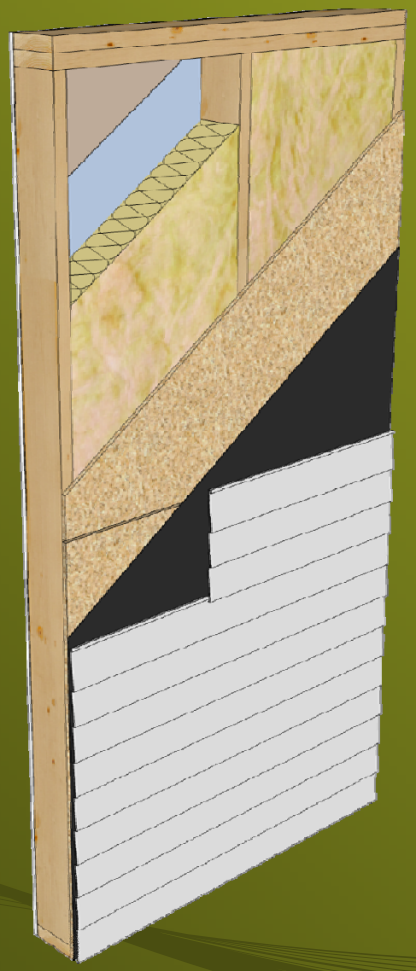
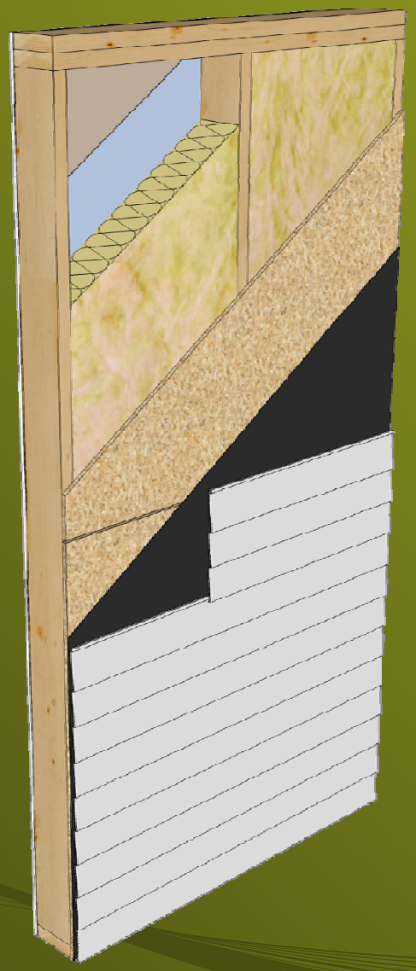
Wall Sample # 1



Wall Analysis

- Exterior Air Film
- Vinyl Siding
- Building Paper
- OSB Sheathing
- 2x6 Wood Framing 16” O.C. w/ R24 Batt Insulation
- Polyethylene Sheet
- Gypsum Board
- Interior Air Film

Wall Sample # 1



EFFECTIVE THERMAL RESISTANCE CALCULATIONS

FRAMED WALL

Blended RSI Calculations
2X6 Wall (140mm X 0.0085 RSI/mm) 16" O.C.
R24 Batt. Insulation (140mm = RSI 4.23)

$$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{140 \times 0.0085}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{1.19}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{[19.33] + [18.2]}$$

$$RSI = \frac{100}{37.53}$$

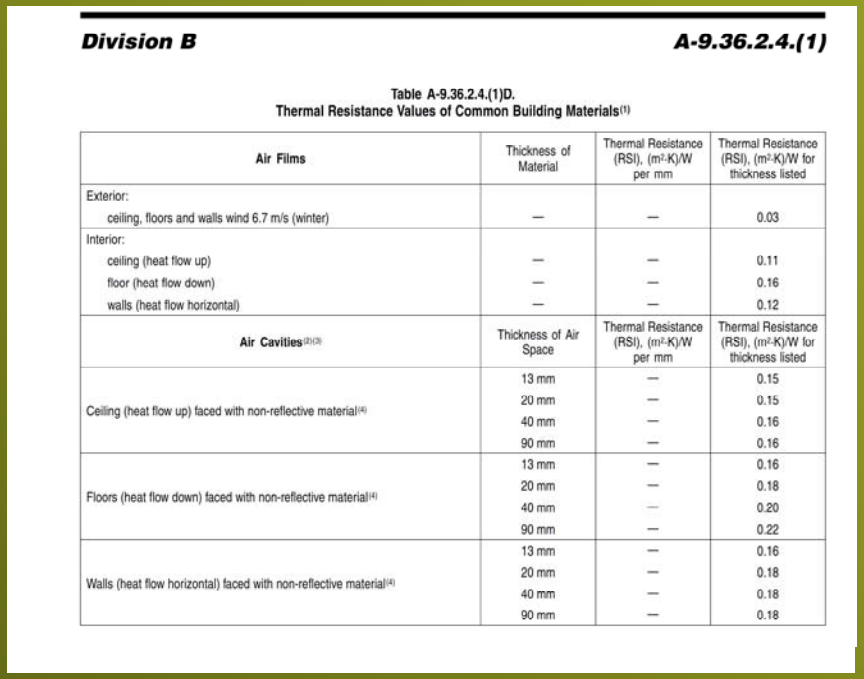
$RSI_{PARALLEL}$ = 2.66

EXTERIOR AIR FILM	
VINYL SIDING	
BUILDING PAPER	
OSB (9.525mm)	
BLENDED RSI CALCULATION	
VAPOUR BARRIER	
GYPSUM (12.7mm)	
INTERIOR AIR FILM	

RSI_{EFF}	
R_{EFF}	

Data Collection / Input

- Alberta Building Code 2014 _ A.9.36.2.4
  - Page A-249 – A-256 RSI Values



Division B **A-9.36.2.4.(1)**

Table A-9.36.2.4.(1)D.
Thermal Resistance Values of Common Building Materials[1]

Air Films	Thickness of Material	Thermal Resistance (RSI), (m²·K)/W per mm	Thermal Resistance (RSI), (m²·K)/W for thickness listed
Exterior:			
ceiling, floors and walls wind 6.7 m/s (winter)	—	—	0.03
Interior:			
ceiling (heat flow up)	—	—	0.11
floor (heat flow down)	—	—	0.16
walls (heat flow horizontal)	—	—	0.12
Air Cavities[2][3]	Thickness of Air Space	Thermal Resistance (RSI), (m²·K)/W per mm	Thermal Resistance (RSI), (m²·K)/W for thickness listed
Ceiling (heat flow up) faced with non-reflective material[4]	13 mm	—	0.15
	20 mm	—	0.15
	40 mm	—	0.16
	90 mm	—	0.16
Floors (heat flow down) faced with non-reflective material[4]	13 mm	—	0.16
	20 mm	—	0.18
	40 mm	—	0.20
	90 mm	—	0.22
Walls (heat flow horizontal) faced with non-reflective material[4]	13 mm	—	0.16
	20 mm	—	0.18
	40 mm	—	0.18
	90 mm	—	0.18

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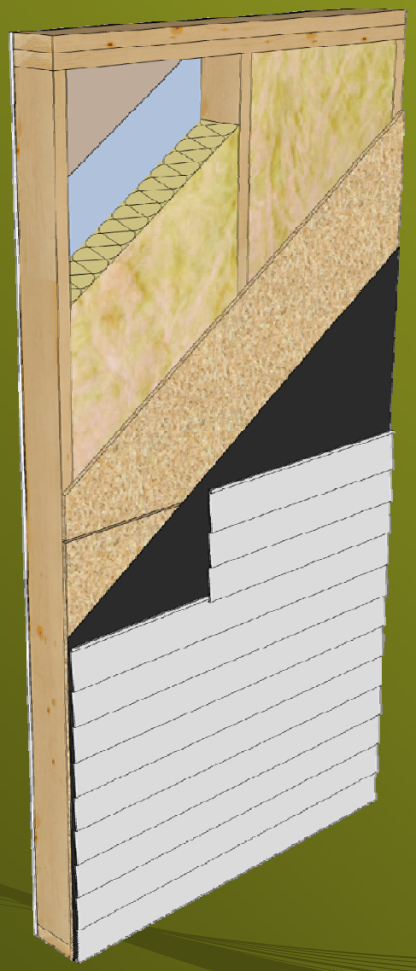
Wall Sample # 1



EFFECTIVE THERMAL RESISTANCE CALCULATIONS

FRAMED WALL

Blended RSI Calculations
2X6 Wall (140mm X 0.0085 RSI/mm) 16" O.C.
R24 Batt. Insulation (140mm = RSI 4.23)

$$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{140 \times 0.0085}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{1.19}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{[19.33] + [18.2]}$$

$$RSI = \frac{100}{37.53}$$

$RSI_{PARALLEL}$ = 2.66

EXTERIOR AIR FILM	0.03
VINYL SIDING	0.11
BUILDING PAPER	0.00
OSB (9.525mm)	0.093
BLENDED RSI CALCULATION	
VAPOUR BARRIER	
GYPSUM (12.7mm)	
INTERIOR AIR FILM	

RSI_{EFF}	
R_{EFF}	

Blended Wall Calculation

- Alberta Building Code 2014 _ A.9.36.2.4 Page A-244

A-9.36.2.4.(1) **Division B**

Calculating the Effective Thermal Resistance of a Wood-frame Assembly: Isothermal-Planes and Parallel-Path Flow Methods

To calculate the effective thermal resistance of a building envelope assembly containing wood framing, RSI_{eff}, add up the results of the following calculations:

A. calculate the effective thermal resistance of all layers with continuous materials using the isothermal-planes method, and

B. calculate the effective thermal resistance of the framing portion, $RSI_{parallel}$, using the following equation, which is taken from the parallel-path flow method described in the ASHRAE 2009, "ASHRAE Handbook – Fundamentals":

$$RSI_{parallel} = \frac{100}{\frac{\%\ \text{area of framing}}{RSI_F} + \frac{\%\ \text{area of cavity}}{RSI_C}}$$

where

RSI_F = thermal resistance of the framing member obtained from Table A-9.36.2.4.(1)D.,

RSI_C = thermal resistance of the cavity (usually filled with insulation) obtained from Table A-9.36.2.4.(1)D.,

% area of framing = value between 0 and 100 obtained from Table A-9.36.2.4.(1)A. or by calculation, and

% area of cavity = value between 0 and 100 obtained from Table A-9.36.2.4.(1)A. or by calculation.

When the values in Table A-9.36.2.4.(1)D. are used in the calculation of effective thermal resistance of assemblies, they must not be rounded; only the final result, RSI_{eff}, can be rounded to the nearest significant digit.

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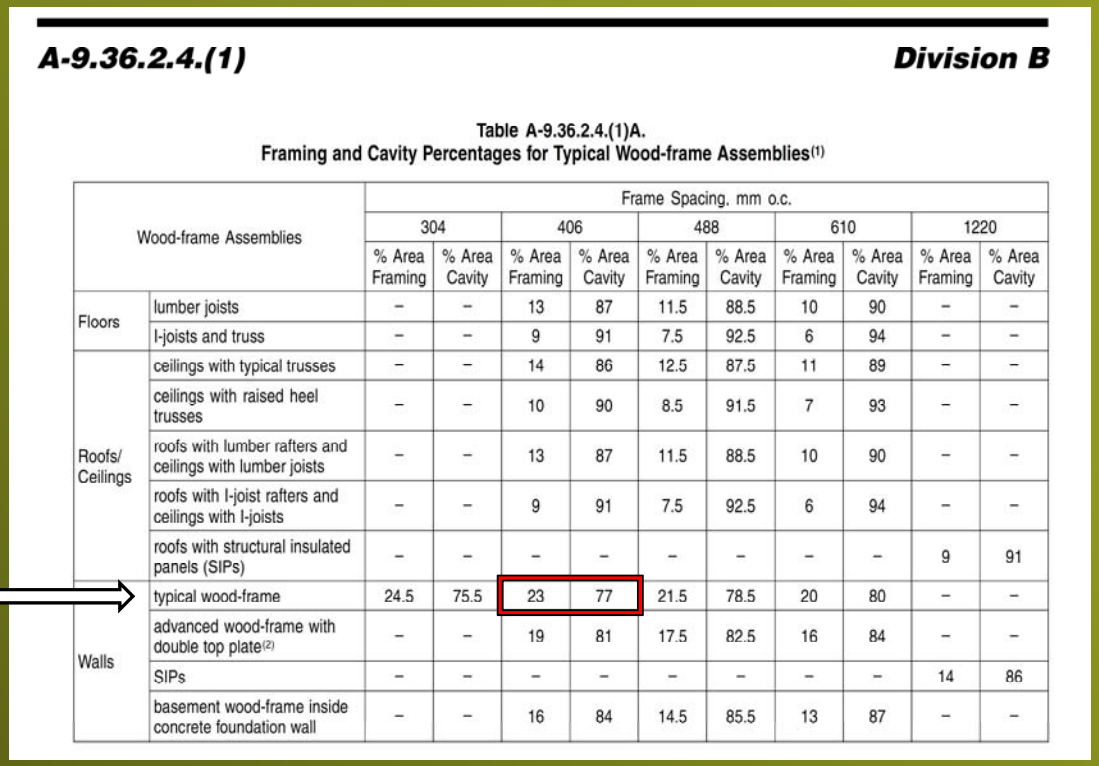
Blended Wall Calculation

- Alberta Building Code 2014 _ A.9.36.2.4 Page A-246
  Framing and Cavity Percentages



A-9.36.2.4.(1) **Division B**

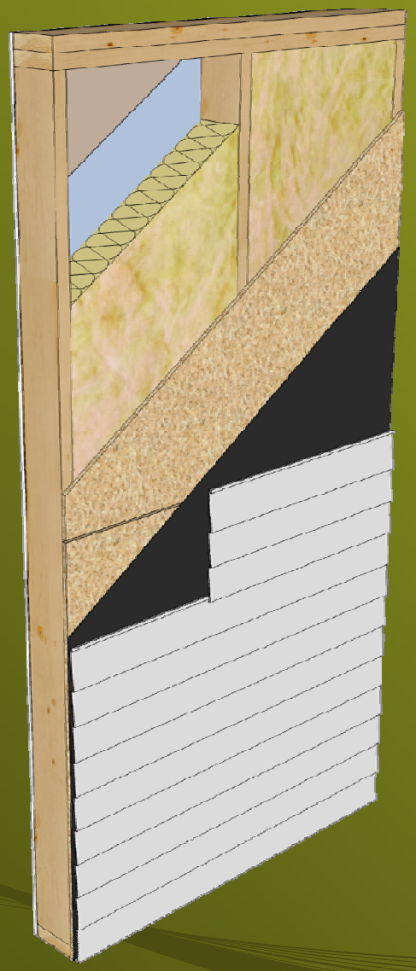
Table A-9.36.2.4.(1)A.
Framing and Cavity Percentages for Typical Wood-frame Assemblies[1]

Wood-frame Assemblies		Frame Spacing, mm o.c.									
		304		406		488		610		1220	
		% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity
Floors	lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	I-joists and truss	–	–	9	91	7.5	92.5	6	94	–	–
Roofs/ Ceilings	ceilings with typical trusses	–	–	14	86	12.5	87.5	11	89	–	–
	ceilings with raised heel trusses	–	–	10	90	8.5	91.5	7	93	–	–
	roofs with lumber rafters and ceilings with lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	roofs with I-joist rafters and ceilings with I-joists	–	–	9	91	7.5	92.5	6	94	–	–
	roofs with structural insulated panels (SIPs)	–	–	–	–	–	–	–	–	9	91
Walls	typical wood-frame	24.5	75.5	23	77	21.5	78.5	20	80	–	–
	advanced wood-frame with double top plate[2]	–	–	19	81	17.5	82.5	16	84	–	–
	SIPs	–	–	–	–	–	–	–	–	14	86
	basement wood-frame inside concrete foundation wall	–	–	16	84	14.5	85.5	13	87	–	–

16”o.c. spacing
16 x 25.4 = 406mm

Grande Prairie Region
Canadian Home Builders' Association

Wall Sample # 1



EFFECTIVE THERMAL RESISTANCE CALCULATIONS

FRAMED WALL

Blended RSI Calculations
2X6 Wall (140mm X 0.0085 RSI/mm) 16" O.C.
R24 Batt. Insulation (140mm = RSI 4.23)

$$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{140 \times 0.0085}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{\left[\frac{23}{1.19}\right] + \left[\frac{77}{4.23}\right]}$$

$$RSI = \frac{100}{[19.33] + [18.2]}$$

$$RSI = \frac{100}{37.53}$$

$RSI_{PARALLEL}$ = 2.66

EXTERIOR AIR FILM	0.03
VINYL SIDING	0.11
BUILDING PAPER	0.00
OSB (9.525mm)	0.093
BLENDED RSI CALCULATION	2.66
VAPOUR BARRIER	0.00
GYPSUM (12.7mm)	0.08
INTERIOR AIR FILM	0.12

RSI_{EFF}	3.09
R_{EFF}	17.56

Required RSI Comparison

- Alberta Building Code 2014 _ 9.36.2.6
  Page 9-227 – Table 9.36.2.6.A
- Above-ground Assemblies w/out HRV

Table 9.36.2.6.A.
Effective Thermal Resistance of Above-ground Opaque Assemblies in Buildings without a Heat-Recovery Ventilator
Forming Part of Sentence 9.36.2.6.(1)

Above-ground Opaque *Building* Assembly	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), (m²·K)/W					
Ceilings below attics	6.91	8.67	8.67	10.43	10.43	10.43
Cathedral ceilings and flat roofs	4.67	4.67	4.67	5.02	5.02	5.02
Walls(2)	2.78	3.08	3.08	3.08	3.85	3.85
Floors over unheated spaces	4.67	4.67	4.67	5.02	5.02	5.02

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Required RSI Comparison

Required Effective Thermal Resistance RSI of Above-ground Opaque Wall Assembly (Zone 7A) w/out HRV

RSI - 3.08

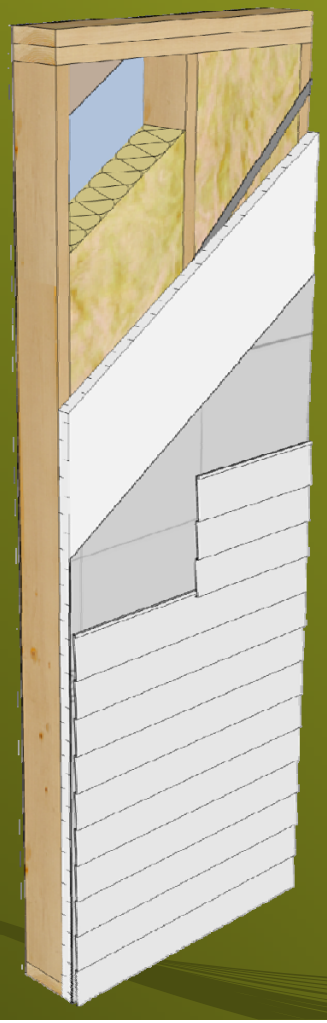
Effective Thermal Resistance
Sample #1 Wall -2x6 16” o.c. R24

RSI - 3.09 ✓

Prescriptive Path Compliant (Zone 7A) No HRV

Grande Prairie Region
Canadian Home Builders' Association

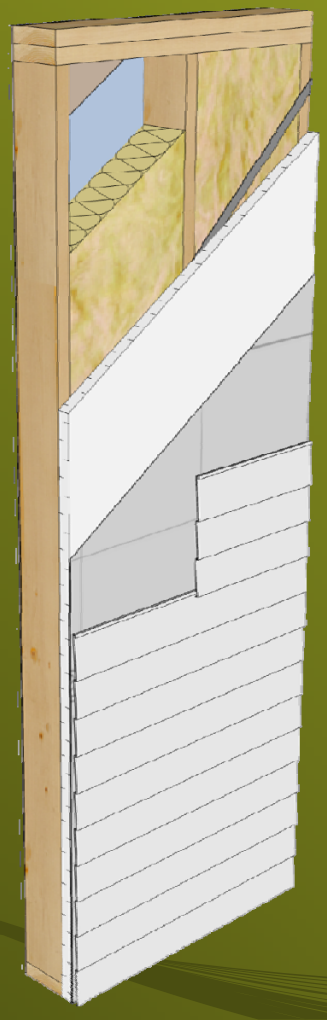
Wall Sample # 2



Wall Analysis

- Exterior Air Film
- Vinyl Siding
- Building Paper
- Type 1 EPS
- Metal let-in bracing
- 2x6 Wood Framing at 16” o.c. w/R20 Batt insulation
- Polyethylene Sheet
- Gypsum Board
- Interior Air Film

Wall Sample # 2

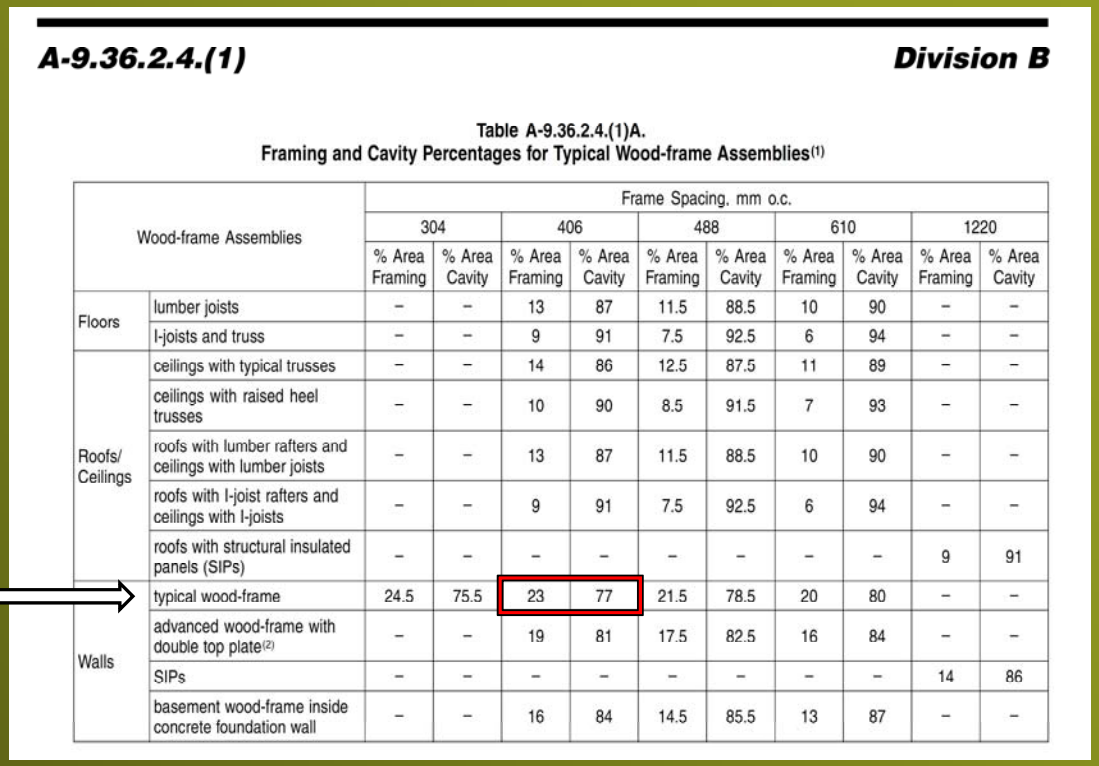


EFFECTIVE THERMAL RESISTANCE CALCULATIONS		
FRAMED WALL		
2X6 Wall (140mm x 0.0085 RSI/mm) 16”o.c. w/ R20 Batt. Insulation.	Exterior Air Film	0.03
	Vinyl Siding	0.11
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$	Building Paper	0.00
	Type 1 EPS (1 ½”- 38mm)	0.99
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Metal let-in bracing	0.00
	Blended RSI Calculation	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Polyethylene Sheet	
	Gypsum Board	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Interior Air Film	

$RSI = \frac{100}{\quad}$	-------	
	RSI_{EFF}	
$RSI_{PARALLEL} =$	R_{EFF}	

Blended Wall Calculation

- Alberta Building Code 2014 _ A.9.36.2.4 Page A-246
  Framing and Cavity Percentages



A-9.36.2.4.(1) **Division B**

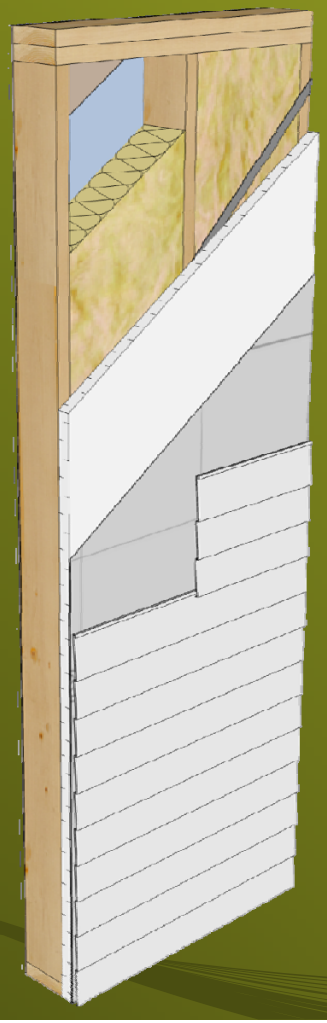
Table A-9.36.2.4.(1)A.
Framing and Cavity Percentages for Typical Wood-frame Assemblies[1]

Wood-frame Assemblies		Frame Spacing, mm o.c.									
		304		406		488		610		1220	
		% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity
Floors	lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	I-joists and truss	–	–	9	91	7.5	92.5	6	94	–	–
Roofs/ Ceilings	ceilings with typical trusses	–	–	14	86	12.5	87.5	11	89	–	–
	ceilings with raised heel trusses	–	–	10	90	8.5	91.5	7	93	–	–
	roofs with lumber rafters and ceilings with lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	roofs with I-joist rafters and ceilings with I-joists	–	–	9	91	7.5	92.5	6	94	–	–
	roofs with structural insulated panels (SIPs)	–	–	–	–	–	–	–	–	9	91
Walls	typical wood-frame	24.5	75.5	23	77	21.5	78.5	20	80	–	–
	advanced wood-frame with double top plate[2]	–	–	19	81	17.5	82.5	16	84	–	–
	SIPs	–	–	–	–	–	–	–	–	14	86
	basement wood-frame inside concrete foundation wall	–	–	16	84	14.5	85.5	13	87	–	–

16”o.c. spacing
16 x 25.4 = 406mm

Grande Prairie Region
Canadian Home Builders' Association

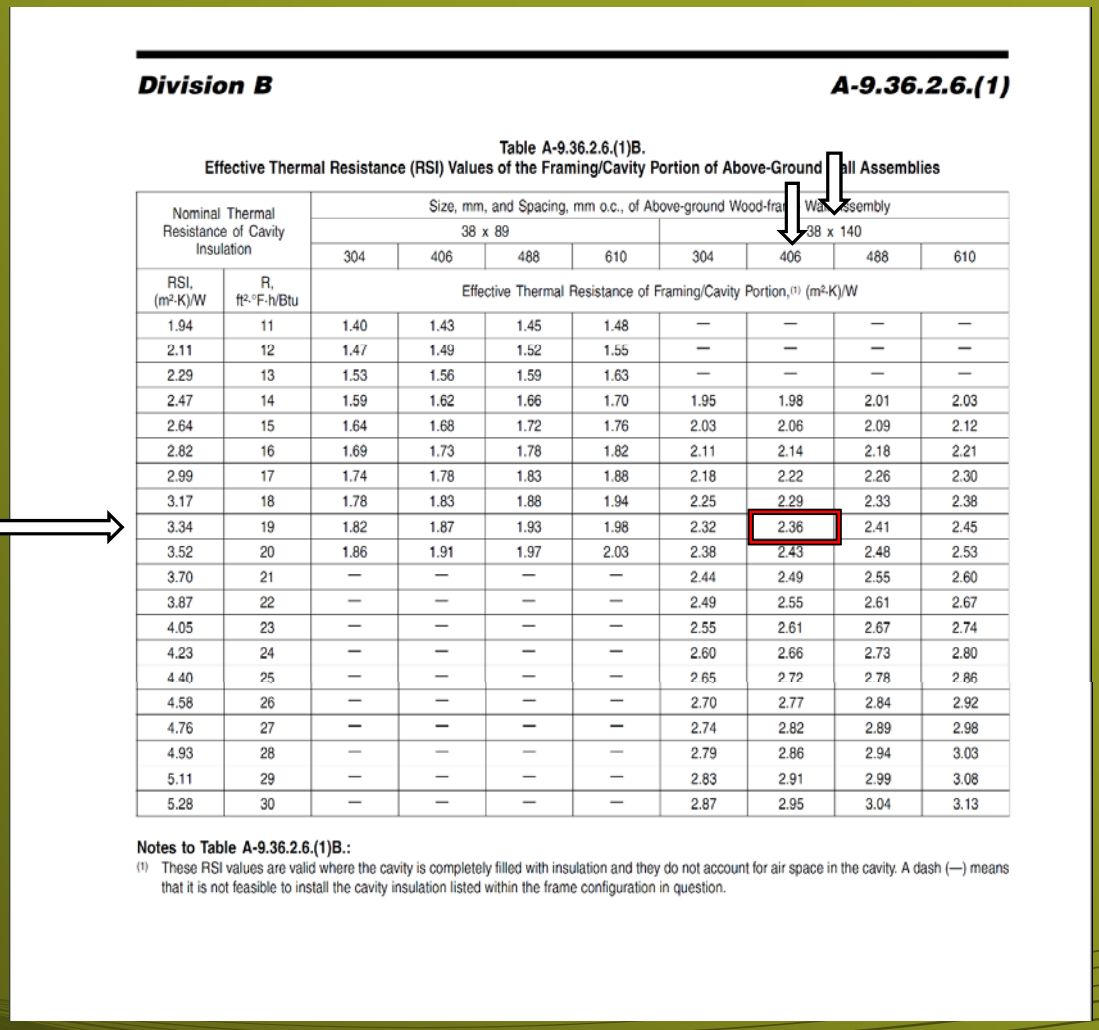
Wall Sample # 2



EFFECTIVE THERMAL RESISTANCE CALCULATIONS		
FRAMED WALL		
2X6 Wall (140mm x 0.0085 RSI/mm) 16”o.c. w/ R20 Batt. Insulation.	Exterior Air Film	0.03
	Vinyl Siding	0.11
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$	Building Paper	0.00
	Type 1 EPS	0.99
$RSI = \frac{100}{\left[\frac{23}{140X0.0085}\right] + \left[\frac{77}{3.34}\right]}$	Metal let-in bracing	0.00
	Blended RSI Calculation	2.36
$RSI = \frac{100}{\left[\frac{23}{1.19}\right] + \left[\frac{77}{3.34}\right]}$	Polyethylene Sheet	
	Gypsum Board	
$RSI = \frac{100}{\left[19.33\right] + \left[23.05\right]}$	Interior Air Film	

$RSI = \frac{100}{42.38}$	-------	
	RSI_{EFF}	
$RSI_{PARALLEL} =$ 2.36	R_{EFF}	

- Alberta Building Code 2014 _ A.9.36.2.6(1) Page A-265



Division B **A-9.36.2.6.(1)**

Table A-9.36.2.6.(1)B.
Effective Thermal Resistance (RSI) Values of the Framing/Cavity Portion of Above-Ground Wall Assemblies

Nominal Thermal Resistance of Cavity Insulation		Size, mm, and Spacing, mm o.c., of Above-ground Wood-frame Wall Assembly							
		38 x 89				38 x 140			
		304	406	488	610	304	406	488	610
RSI, (m²·K)/W	R, ft²·°F·h/Btu	Effective Thermal Resistance of Framing/Cavity Portion,(1) (m²·K)/W							
1.94	11	1.40	1.43	1.45	1.48	—	—	—	—
2.11	12	1.47	1.49	1.52	1.55	—	—	—	—
2.29	13	1.53	1.56	1.59	1.63	—	—	—	—
2.47	14	1.59	1.62	1.66	1.70	1.95	1.98	2.01	2.03
2.64	15	1.64	1.68	1.72	1.76	2.03	2.06	2.09	2.12
2.82	16	1.69	1.73	1.78	1.82	2.11	2.14	2.18	2.21
2.99	17	1.74	1.78	1.83	1.88	2.18	2.22	2.26	2.30
3.17	18	1.78	1.83	1.88	1.94	2.25	2.29	2.33	2.38
3.34	19	1.82	1.87	1.93	1.98	2.32	2.36	2.41	2.45
3.52	20	1.86	1.91	1.97	2.03	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
4.40	25	—	—	—	—	2.65	2.72	2.78	2.86
4.58	26	—	—	—	—	2.70	2.77	2.84	2.92
4.76	27	—	—	—	—	2.74	2.82	2.89	2.98
4.93	28	—	—	—	—	2.79	2.86	2.94	3.03
5.11	29	—	—	—	—	2.83	2.91	2.99	3.08
5.28	30	—	—	—	—	2.87	2.95	3.04	3.13

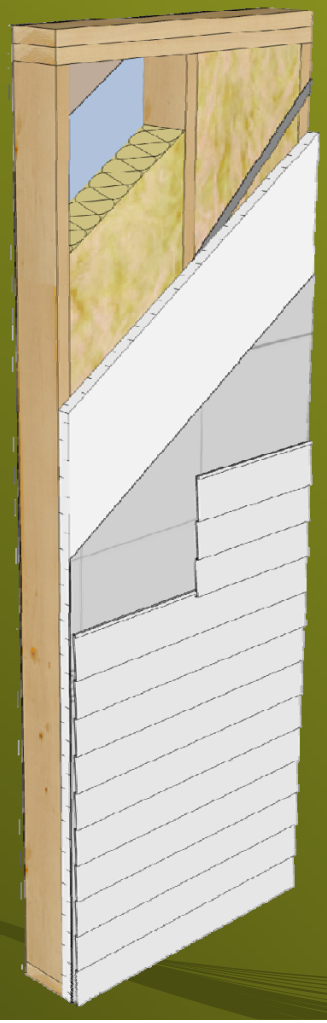
Notes to Table A-9.36.2.6.(1)B.:
(1) These RSI values are valid where the cavity is completely filled with insulation and they do not account for air space in the cavity. A dash (—) means that it is not feasible to install the cavity insulation listed within the frame configuration in question.

16”o.c. spacing
16 x 25.4 = 406mm

R20 Compressed
In a 5 ½” Cavity = R19

Grande Prairie Region
Canadian Home Builders' Association

Wall Sample # 2



EFFECTIVE THERMAL RESISTANCE CALCULATIONS			
FRAMED WALL			
2X6 Wall (140mm x 0.0085 RSI/mm) 16”o.c. w/ R20 Batt. Insulation.		Exterior Air Film	0.03
		Vinyl Siding	0.11
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$		Building Paper	0.00
		Type 1 EPS	0.99
$RSI = \frac{100}{\left[\frac{23}{140X0.0085}\right] + \left[\frac{77}{3.34}\right]}$		Metal let-in bracing	0.00
		Blended RSI Calculation	2.36
$RSI = \frac{100}{\left[\frac{23}{1.19}\right] + \left[\frac{77}{3.34}\right]}$		Polyethylene Sheet	0.00
		Gypsum Board	0.08
$RSI = \frac{100}{\left[19.33\right] + \left[23.05\right]}$		Interior Air Film	0.12

$RSI = \frac{100}{42.38}$		-------	
		RSI_{EFF}	3.69
$RSI_{PARALLEL} =$ 2.36		R_{EFF}	20.95

Required RSI Comparison

Required Effective Thermal Resistance RSI of Above-ground Opaque Wall Assembly (Zone 7A) w/out HRV

RSI - 3.08

Effective Thermal Resistance Sample
#2 Wall -2x6 16” o.c. R20 w/EPS

RSI – 3.69 ✓

Prescriptive Path Compliant (Zone 7A) No HRV

Grande Prairie Region
Canadian Home Builders' Association

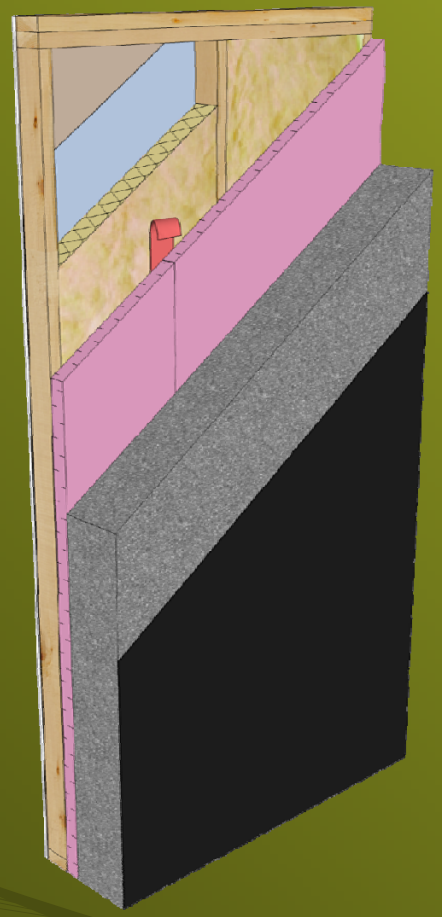
Below Grade Walls

ALBERTA BUILDING CODE 2014 _ A-9.36.2.4(1)

Grande Prairie Region

Canadian Home Builders' Association

Wall Sample # 3



EFFECTIVE THERMAL RESISTANCE CALCULATIONS		
2X4 Wall (89mm x 0.0085 RSI/mm) 24”o.c. w/ R12 Batt. Insulation.	Exterior Dampproofing	0.00
	Concrete Wall (8”)	0.08
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$	Taped XPS Type 3 (2”)	1.78
	Blended RSI Calculation	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Polyethylene Sheet	
	Gypsum Board	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Interior Air Film	

$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	-------	

$RSI = \frac{100}{\quad}$	-------	
	RSI_{EFF}	
$RSI_{PARALLEL}$ =	R_{EFF}	

Blended Wall Calculation

- Alberta Building Code 2014 _ A.9.36.2.4 Page A-246
  Framing and Cavity Percentages

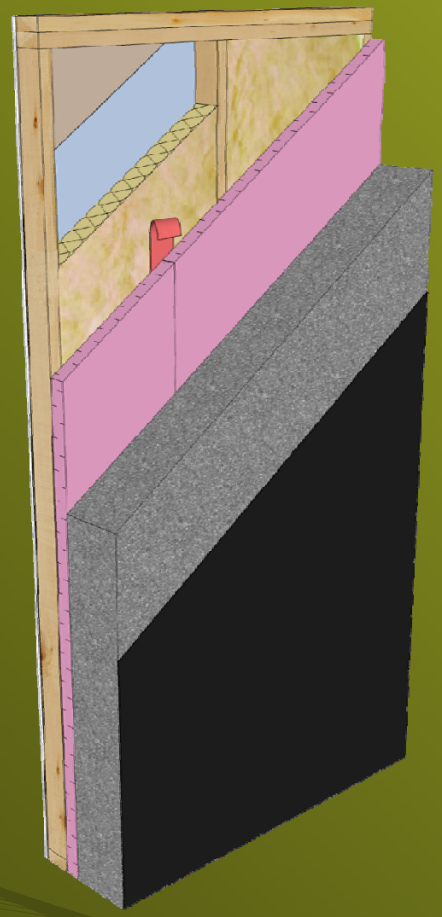
A-9.36.2.4.(1) **Division B**

Table A-9.36.2.4.(1)A.
Framing and Cavity Percentages for Typical Wood-frame Assemblies(1)

Wood-frame Assemblies		Frame Spacing, mm o.c.									
		304		406		488		610		1220	
		% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity
Floors	lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	I-joists and truss	–	–	9	91	7.5	92.5	6	94	–	–
Roofs/ Ceilings	ceilings with typical trusses	–	–	14	86	12.5	87.5	11	89	–	–
	ceilings with raised heel trusses	–	–	10	90	8.5	91.5	7	93	–	–
	roofs with lumber rafters and ceilings with lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	roofs with I-joist rafters and ceilings with I-joists	–	–	9	91	7.5	92.5	6	94	–	–
	roofs with structural insulated panels (SIPs)	–	–	–	–	–	–	–	–	9	91
Walls	typical wood-frame	24.5	75.5	23	77	21.5	78.5	20	80	–	–
	advanced wood-frame with double top plate(2)	–	–	19	81	17.5	82.5	16	84	–	–
	SIPs	–	–	–	–	–	–	–	–	14	86
	basement wood-frame inside concrete foundation wall	–	–	16	84	14.5	85.5	13	87	–	–

24”o.c. spacing
24 x 25.4 = 610mm

Wall Sample # 3



EFFECTIVE THERMAL RESISTANCE CALCULATIONS			
2X4 Wall (89mm x 0.0085 RSI/mm) 24”o.c. w/ R12 Batt. Insulation.		Exterior Dampproofing	0.00
		Concrete Wall (8”)	0.08
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$		Taped XPS Type 3 (2”)	1.78
		Blended RSI Calculation	1.71
$RSI = \frac{100}{\left[\frac{13}{89X0.0085}\right] + \left[\frac{87}{2.11}\right]}$		Polyethylene Sheet	
		Gypsum Board	
$RSI = \frac{100}{\left[\frac{13}{0.7565}\right] + \left[\frac{87}{2.11}\right]}$		Interior Air Film	

$RSI = \frac{100}{\left[17.18\right] + \left[41.23\right]}$		-------	

$RSI = \frac{100}{58.42}$		RSI_{EFF}	
$RSI_{PARALLEL} =$ 1.71		R_{EFF}	

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Table A-9.36.2.8.(1)C.
Effective Thermal Resistance (RSI) Values of the Framing/Cavity Portion of Below-Grade Interior Non-loadbearing Wood-frame Wall Assemblies

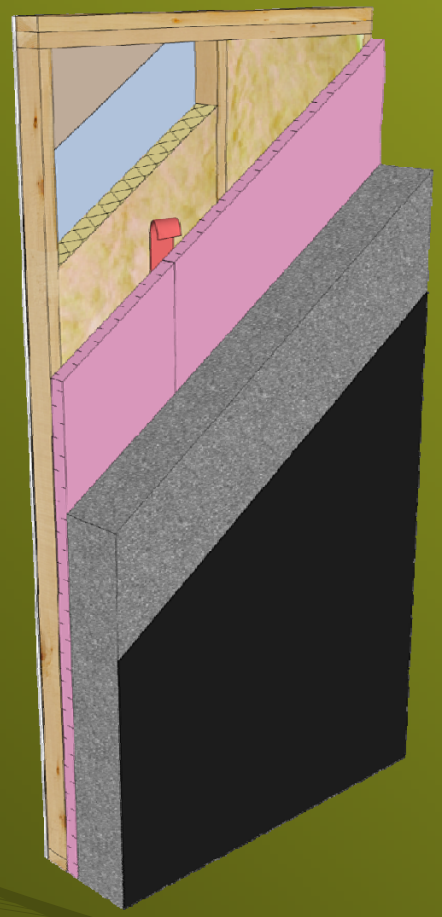
Nominal Thermal Resistance of Cavity Insulation		Size, mm, and Spacing, mm o.c., of Below-Grade Interior Non-loadbearing Wood-frame Wall Assembly							
		38 x 89				38 x 140			
		203	304	406	610	203	304	406	610
RSI, (m²·K)/W	R, ft²·°F·h/Btu	Effective Thermal Resistance of Framing/Cavity Portion,(1) (m²·K)/W							
0.00	0	0.22	0.21	0.20	0.20	—	—	—	—
1.41	8	1.17	1.21	1.24	1.27	—	—	—	—
1.94	11	1.41	1.50	1.55	1.61	—	—	—	—
2.11	12	1.48	1.57	1.64	1.71	—	—	—	—
2.29	13	1.54	1.65	1.73	1.81	—	—	—	—
2.47	14	1.60	1.73	1.81	1.91	—	—	—	—
2.64	15	1.65	1.79	1.89	1.99	—	—	—	—
2.82	16	1.70	1.86	1.96	2.08	2.12	2.24	2.31	2.39
2.99	17	1.75	1.92	2.03	2.16	2.19	2.32	2.41	2.50
3.17	18	1.80	1.97	2.10	2.24	2.27	2.41	2.50	2.61
3.34	19	1.84	2.03	2.16	2.31	2.33	2.49	2.59	2.70
3.52	20	1.88	2.08	2.22	2.39	2.39	2.57	2.68	2.81
3.70	21	1.91	2.13	2.28	2.46	2.46	2.64	2.77	2.90
3.87	22	1.95	2.17	2.33	2.52	2.51	2.71	2.84	2.99
4.05	23	1.98	2.22	2.39	2.59	2.57	2.78	2.93	3.09
4.23	24	2.01	2.26	2.44	2.65	2.62	2.85	3.00	3.18
4.40	25	—	—	—	—	2.67	2.91	3.07	3.26
4.58	26	—	—	—	—	2.72	2.97	3.15	3.34
4.76	27	—	—	—	—	2.77	3.03	3.22	3.42
4.93	28	—	—	—	—	2.81	3.09	3.28	3.50

Notes to Table A-9.36.2.8.(1)C.:

(1) These RSI values are valid where the cavity is completely filled with insulation and they do not account for air space in the cavity. A dash (—) means that it is not feasible to install the cavity insulation listed within the frame configuration in question.

24”o.c. spacing
24 x 25.4 = 610mm

Wall Sample # 3



EFFECTIVE THERMAL RESISTANCE CALCULATIONS			
2X4 Wall (89mm x 0.0085 RSI/mm) 24”o.c. w/ R12 Batt. Insulation.		Exterior Dampproofing	0.00
		Concrete Wall (8”)	0.08
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$		Taped XPS Type 3 (2”)	1.78
		Blended RSI Calculation	1.71
$RSI = \frac{100}{\left[\frac{13}{89X0.0085}\right] + \left[\frac{87}{2.11}\right]}$		Polyethylene Sheet	0.00
		Gypsum Board	0.08
$RSI = \frac{100}{\left[\frac{13}{0.7565}\right] + \left[\frac{87}{2.11}\right]}$		Interior Air Film	0.12

$RSI = \frac{100}{\left[17.18\right] + \left[41.23\right]}$		-------	

$RSI = \frac{100}{58.42}$		RSI_{EFF}	3.77
$RSI_{PARALLEL} = 1.71$		R_{EFF}	21.41

Required RSI Comparison

- Alberta Building Code 2014 _ 9.36.2.6
  Page 9-230 – Table 9.36.2.8.A
- Below Grade Assemblies w/out HRV

Table 9.36.2.8.A.
Effective Thermal Resistance of Assemblies Below-Grade or in Contact with the Ground in Buildings without a Heat-Recovery Ventilator
Forming Part of Sentences 9.36.2.8.(1) to (9)

Building Assembly Below-*Grade* or in Contact with the Ground[1]	Heating Degree-Days of *Building* Location,[2] in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A [illegible]	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), $(m^2 \cdot K)/W$					
Foundation walls	1.99	2.98	2.98	3.46	3.46	3.97
Unheated floors[3]						
below frost line[4][5]	uninsulated	uninsulated	uninsulated	uninsulated	uninsulated	uninsulated
above frost line[5]	1.96	1.96	1.96	1.96	1.96	1.96
Heated and unheated floors on permafrost	n/a	n/a	n/a	n/a	4.44	4.44
Heated floors[6]	2.32	2.32	2.32	2.84	2.84	2.84
Slabs-on-grade with an integral footing[6]	1.96	1.96	1.96	3.72	3.72	4.59

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Required RSI Comparison

Required Effective Thermal Resistance RSI of Below-Grade Wall Assembly (Zone 7A) w/out HRV

RSI - 3.46

Effective Thermal Resistance Sample
#3 Wall – 2x4 24" o.c. R12 w/XPS

RSI – 3.77 ✓

Prescriptive Path Compliant (Zone 7A) No HRV

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Roof / Ceiling/ Attic

ALBERTA BUILDING CODE 2014 _ A-9.36.2.4(1)

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Roof/Ceiling Sample # 4

24” o.c. Trusses
Flat Ceiling
2x4 Bottom Chord

Total of 17” Blow-in Cellulose Insulation.

EFFECTIVE THERMAL RESISTANCE CALCULATIONS		
2X4 Bottom Chord(89mmx0.0085 RSI/mm) 24”o.c. Cellulose Insulation(89mm x 0.025 RSI/mm)	Exterior Air Film	0.03
	13 ½” Cellulose (343mm X 0.025)	8.58
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$	Blended RSI Calculation	
	Polyethylene Sheet	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	Gypsum Board	
	Interior Air Film	
$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	-------	

$RSI = \frac{100}{\left[\quad\right] + \left[\quad\right]}$	-------	

$RSI = \frac{100}{\quad}$	-------	
	RSI_{EFF}	
$RSI_{PARALLEL} =$	R_{EFF}	

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Blended Wall Calculation

- Alberta Building Code 2014 _ A.9.36.2.4 Page A-246
  Framing and Cavity Percentages

A-9.36.2.4.(1) **Division B**

Table A-9.36.2.4.(1)A.
Framing and Cavity Percentages for Typical Wood-frame Assemblies[1]

Wood-frame Assemblies		Frame Spacing, mm o.c.									
		304		406		488		610		1220	
		% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity	% Area Framing	% Area Cavity
Floors	lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	I-joists and truss	–	–	9	91	7.5	92.5	6	94	–	–
Roofs/ Ceilings	ceilings with typical trusses	–	–	14	86	12.5	87.5	11	89	–	–
	ceilings with raised heel trusses	–	–	10	90	8.5	91.5	7	93	–	–
	roofs with lumber rafters and ceilings with lumber joists	–	–	13	87	11.5	88.5	10	90	–	–
	roofs with I-joist rafters and ceilings with I-joists	–	–	9	91	7.5	92.5	6	94	–	–
	roofs with structural insulated panels (SIPs)	–	–	–	–	–	–	–	–	9	91
Walls	typical wood-frame	24.5	75.5	23	77	21.5	78.5	20	80	–	–
	advanced wood-frame with double top plate[2]	–	–	19	81	17.5	82.5	16	84	–	–
	SIPs	–	–	–	–	–	–	–	–	14	86
	basement wood-frame inside concrete foundation wall	–	–	16	84	14.5	85.5	13	87	–	–

24”o.c. spacing
24 x 25.4 = 610mm

Grande Prairie Region
Canadian Home Builders' Association

Roof/Ceiling Sample # 4

24” o.c. Trusses
Flat Ceiling
2x4 Bottom Chord

Total of 17” Blow-in Cellulose Insulation.

EFFECTIVE THERMAL RESISTANCE CALCULATIONS			
2X4 Bottom Chord(89mmx0.0085 RSI/mm) 24”o.c. Cellulose Insulation(89mm x 0.025 RSI/mm)		Exterior Air Film	0.03
		13 ½” Cellulose (343mm X 0.025)	8.58
$RSI = \frac{100}{\left[\frac{\%\ \text{AREA OF FRAMING}}{RSI_F}\right] + \left[\frac{\%\ \text{AREA OF CAVITY}}{RSI_C}\right]}$		Blended RSI Calculation	1.96
		Polyethylene Sheet	0.00
$RSI = \frac{100}{\left[\frac{7}{89X0.0085}\right] + \left[\frac{93}{89X0.025}\right]}$		Gypsum Board	0.08
		Interior Air Film	0.11
$RSI = \frac{100}{\left[\frac{7}{0.7565}\right] + \left[\frac{93}{2.225}\right]}$		-------	

$RSI = \frac{100}{\left[9.25\right] + \left[41.80\right]}$		-------	

$RSI = \frac{100}{51.05}$		-------	
		RSI_{EFF}	10.76
$RSI_{PARALLEL} =$ 1.96		R_{EFF}	61.12

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Required RSI Comparison

- Alberta Building Code 2014 _ 9.36.2.6
  Page 9-227 – Table 9.36.2.6.A
- Above-ground Assemblies w/out HRV

Table 9.36.2.6.A.
Effective Thermal Resistance of Above-ground Opaque Assemblies in Buildings without a Heat-Recovery Ventilator
Forming Part of Sentence 9.36.2.6.(1)

Above-ground Opaque *Building* Assembly	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4 < 3000	Zone 5 3000 to 3999	Zone 6 4000 to 4999	Zone 7A 5000 to 5999	Zone 7B 6000 to 6999	Zone 8 ≥ 7000
	Minimum Effective Thermal Resistance (RSI), (m²·K)/W					
Ceilings below attics	6.91	8.67	8.67	10.43	10.43	10.43
Cathedral ceilings and flat roofs	4.67	4.67	4.67	5.02	5.02	5.02
Walls(2)	2.78	3.08	3.08	3.08	3.85	3.85
Floors over unheated spaces	4.67	4.67	4.67	5.02	5.02	5.02

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Required RSI Comparison

Required Effective Thermal Resistance RSI of
Ceilings Below Attics (Zone 7A) w/out HRV

RSI – 10.43

Effective Thermal Resistance Sample #4
24”o.c. Trusses w/ 17” Blow-in Cellulose

RSI – 10.76 ✓

Prescriptive Path Compliant (Zone 7A) No HRV

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Links & Other Info.

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Links and other information.

- COPY OF ALBERTA BUILDING CODE IS ESSENTIAL.
- Purchase at _ http://www.nrc-cnrc.gc.ca
- CHBA Website - http://www.chbaalberta.ca/alberta-codes
- CHBA Illustrated Guide for 9.36 and Zone Map
  http://www.chbaalberta.ca/alberta-codes
- Canadian Wood Council Wall Calculator
  http://cwc.ca/resources/wall-thermal-design/

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Prescriptive Calculation

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BUILDER TECHNICAL COMMITTEE

Any questions?

Monte Heyn : 780-978-1316