

Province-specific version available upon request

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The Situation

Unvented attic assemblies insulated with closed-cell spray foam (ccSPF) are a mainstream option in modern construction. However, historical concerns and misconceptions persist. Genyk Polyurethanes has compiled the most relevant science pertaining to unvented assemblies. This research collection is intended to provide end-users and design professionals with the information necessary to make informed decisions. The documentation contained in this paper has been reviewed and stamped by Professional Engineers and contains heat and moisture analysis from each Canadian region.

Concerns associated with unvented attic spaces sprayed with (ccSPF) include the potential for moisture accumulation on the roof sheathing during cold weather and potential shingle deterioration due to temperature build-up. Further exasperating the use of spray foam for unvented assemblies is building code limitations.

Research has shown that when installed in accordance with Genyk's installation guidelines, an unvented roof assembly comprised of *Boreal Elite* will not allow air transported moisture to penetrate the insulative layer. Thus, the levels of moisture accumulation on the roof sheathing are similar that of vented assemblies. Similarly, despite common opinion, field performance and available research have demonstrated that there is inconsequential impact on roofing temperatures when using an unvented attic assembly.

The Research

Building Science Laboratories conducted a one-year in-situ research project measuring heat and moisture-related performance. Hygrothermal simulations were used to predict the identical roof systems in various cold climates.¹ Data collected predicted roof sheathing moisture accumulation at various indoor humidity levels (Appendix A).

Highlights of the field testing and hygrothermal analysis include –

- At recommended interior humidities (less than 40%RH), ccSPF did not present any issues or concerns within the unvented assembly
- Unvented ccSPF perform well in climate zones with less than 8000 degree days
- Unvented ccSPF will require additional moisture protection in extreme north
- Vented ccSPF will work in any climate zone

The research identifying the benefits of an unvented ccSPF roof assembly is comprehensive. The benefits of a ccSPF unvented roof include –

- CMHC – “unvented assemblies reduce wind-blown snow accumulation in vent space”ⁱⁱ
- Rose and TenWolde – attic venting tends to increase rather than decrease moisture levels in attics (especially warmer months)ⁱⁱⁱ
- Rudd – unvented roof assemblies limit insect and rodent infestation^{iv}
- Lstiburek – unvented roof assemblies prevent potential for soffit rainwater intrusion^v

The Genyk Project

To augment the available research material, Genyk Polyurethane commissioned PUR Consulting to produce heat and moisture analysis of Boreal Nature Elite ccSPF roof assemblies in each Canadian region. WUFI analyses were executed to predict performance in climate zones across Canada. Drawings and model examples are shown in this document (Appendix B). The complete report is available upon request and can be found on the Genyk Polyurethane website (www.genyk.com).

Conclusions

Prevailing and historical building science related to unvented attic assembly applications is clear –

1. There is literally more than a million square feet of successful ccSPF unvented assemblies done in all kinds of climate zones.
2. While ventilation is worthwhile design feature, the reality is that effective ventilation is often difficult to attain.
3. The colour of the shingles makes significantly more temperature impact than the absence of an air space.
4. There are numerous advantages to a *Boreal Elite* ccSPF roof assembly. All supported by building science professionals.

Given the success of unvented assemblies and the challenges of effectively venting some construction assemblies, the unvented spray foam roof is a desirable outcome. Please review the information contained within this report. If you require further information, a Genyk representative is available to discuss your inquiries.

APPENDIX A

Moisture Content (MC) in Wood Roof Sheathing Subjected to Various Canadian Climates and Interior Relative Humidities
 Chart values are %MC by dry mass of wood and represent a predicted maximum annual value

= MC < 20%, no mold growth
 = MC is 20 to 28%, potential for mold growth
 = MC > 28%, moisture problems expected, this design is NOT recommended

Cathedral Roof Construction				Vancouver			Toronto			Ottawa			St. John's			Calgary			Québec City			Winnipeg*			Yellowknife			Inuvik			
				HDD 3000			HDD 4000			HDD 4500			HDD 5000			HDD 5000			HDD 5000			HDD 6000			HDD 8000			HDD 10000			
Contents of Cavity	Depth of Cavity	Ventilation	Type of Vapour Control	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	Low RH	Med. RH	High RH	
				30/55%	40/60%	50%	30/55%	40/60%	50%	30/55%	40/60%	50%	30/55%	40/60%	50%	30/55%	40/60%	50%	30/55%	40/60%	50%	30/55%	40/60%	50%	20/50%	30/55%	50%	20/50%	30/55%	50%	
Spray Polyurethane Foam (SPF)	2.0 pcd Closed Cell ³	5" R30	Ventilated Continuous Baffle	ccSPF	13%	13%	13%	10%	10%	10%	10%	10%	10%	11%	11%	11%	10%	10%	10%	10%	10%	10%	9%	9%	9%	18%	18%	18%	12%	13%	12%
		5" R30	Non-ventilated	ccSPF	11%	14%	14%	10%	13%	13%	12%	14%	14%	15%	43%	46%	15%	39%	39%	13%	19%	20%	13%	21%	22%	>60%	>60%	>60%	>60%	>60%	>60%
	0.5 pcd Open Cell	8" R30	Non-ventilated	interior poly	13%	13%	13%	13%	13%	13%	13%	14%	15%	14%	15%	16%	15%	16%	17%	14%	14%	17%	13%	14%	15%	21%	52%	55%	51%	>60%	>60%
		8" R30	Ventilated	latex paint	13%	13%	14%	11%	11%	11%	11%	11%	11%	12%	12%	12%	10%	11%	13%	11%	11%	12%	11%	13%	14%	24%	27%	31%	18%	25%	28%
		8" R30	Non-ventilated	1 US perm paint on foam	12%	17%	18%	13%	24%	28%	15%	30%	32%	27%	>60	>60	30%	>60%	>60%	32%	>60%	>60%	24%	59%	60%	>60%	>60%	>60%	>60%	>60%	>60%
		8" R30	Non-ventilated	latex paint	17%	30%	35%	25%	40%	50%	38%	52%	64%	35%	>60	>60	61%	60%	>60%	39%	65%	68%	61%	66%	67%	>60%	>60%	>60%	>60%	>60%	>60%
Fiberglass Batt	9 1/4" R30	Ventilated Continuous Baffle	interior poly																			12%	12%	12%	19%	19%	19%	16%	16%	16%	
	9 1/4" R30	Ventilated Continuous Baffle	latex paint	16%	17%	17%	14%	14%	14%	13%	13%	13%	14%	14%	14%	13%	13%	13%	14%	14%	14%	14%	15%	16%	27%	31%	33%	21%	26%	28%	
Other Applicable Locations (Heating Degree Days below 18°C) <i>From Environment Canada's Canadian Climate Normals 1971-2000</i>				White Rock (2782) Vancouver (2926) Abbotsford (2981) Victoria (3040)	Windsor (3524) Niagara Falls (3661) Kelowna (3869) Oshawa (3917) Hamilton (4012) Halifax (4030) London (4057) Toronto (4065)	Kitchener-Waterloo (4288) Kingston (4289) Montréal (4518) Moncton (4585) Ottawa (4602) Charlottetown (4715)	St. John's (4881) Trois-Rivières (4929) Calgary (5108) Prince George (5132) Sherbrooke (5151) Québec City (5202) Sudbury (5343)	St. John's (4881) Trois-Rivières (4929) Calgary (5108) Prince George (5132) Sherbrooke (5151) Québec City (5202) Sudbury (5343)	St. John's (4881) Trois-Rivières (4929) Calgary (5108) Prince George (5132) Sherbrooke (5151) Québec City (5202) Sudbury (5343)	St. John's (4881) Trois-Rivières (4929) Calgary (5108) Prince George (5132) Sherbrooke (5151) Québec City (5202) Sudbury (5343)	Regina (5660) Edmonton (5708) Thunder Bay (5717) Winnipeg (5777) Saskatoon (5852) Whitehorse (6811)	Dawson (8166) Yellowknife (8256)	Inuvik (9767) Iqaluit (10117) Resolute (12526)																		

General Notes:

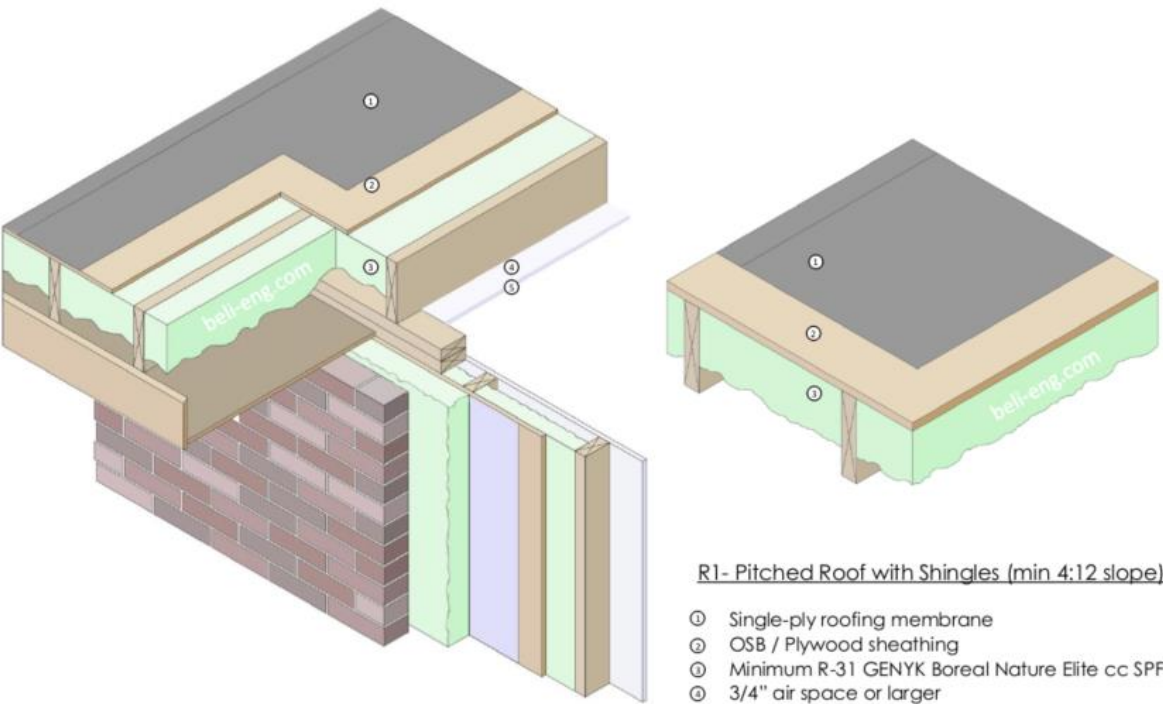




- a. Roofs are residential wood frame with dark asphalt shingles with a 12/12 pitch facing north; this is a worse-case scenario for cold-weather diffusion wetting
- b. Results are for OSB sheathing. Plywood sheathing values will be equal or lower. Effective Air Barrier is assumed to be installed, as is proper rain control
- c. Results assume no air leakage from the interior space into the roof assembly

Specific notes:

- 1. Apply SPF directly onto back of exterior sheathing, or against interior surface of baffle
- 2. MC values are for inner 3mm of OSB sheathing
- 3. Closed Cell SPF should be applied in total thicknesses of more than 2" (50 mm), usually in lifts of no more than 2" (50 mm)

* - CWEC data was used for the analysis in Winnipeg, as the predicted moisture content values appeared to be more realistic than the WUFI weather file based on our experience and the results of other simulated cities.

APPENDIX B

 <p style="text-align: center;">R1- Pitched Roof with Shingles (min 4:12 slope)</p> <ul style="list-style-type: none"> ① Single-ply roofing membrane ② OSB / Plywood sheathing ③ Minimum R-31 GENYK Boreal Nature Elite cc SPF ④ 3/4" air space or larger ⑤ 1/2" drywall or thicker 	<div style="text-align: right;">  <p>tom harris (c) 763-898-3097 tom@letstalkpur.com www.letstalkpur.com</p> </div> <p style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;">BELi</p> <p>Building Enclosure Labs Inc 71 Wellington St. London ON 519.488.5573 lab@beli-eng.com</p> <hr/> <p>Detail Name</p> <p>Medium density spray foam without a vapour retarder</p> <hr/> <p>Roof Slope Application – Low Slope Roof</p> <div style="text-align: center;">  <p>0.5/12 to 4/12 slope</p> </div> <hr/> <p>Drawn by: RVS Checked by: TR Date: 2024-05-10 Scale: NTS</p> <hr/> <div style="text-align: center;">  </div>
<p>Low Slope Roof with Single-Ply Roofing Membrane</p> <p>Design performance of the medium density spray foam without a vapour retarder has been analyzed for Toronto and Thunder Bay climates using HAM and WUFI hygrothermal simulations, using typical indoor environment conditions, on Page 2. The detail analysis included a low slope roof. Note: the wall is not part of the analysis.</p>	

HAM Design Analysis (Thunder Bay)

CLIMATE CONDITIONS

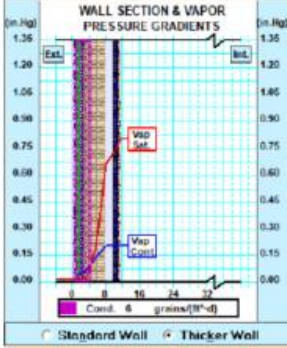
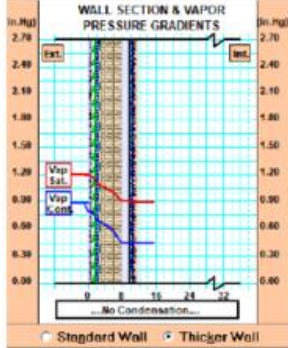
	Winter		Summer	
	Temp (°F)	RH (%)	Temp (°F)	RH (%)
Indoor	72	25	75	50
Outdoor	-18	80	84	74

City: Thunder Bay, ON

CLIMATE CONDITIONS

	Winter		Summer	
	Temp (°F)	RH (%)	Temp (°F)	RH (%)
Indoor	72	25	75	50
Outdoor	-18	80	84	74

City: Thunder Bay, ON



HAM Design Analysis (Toronto)

CLIMATE CONDITIONS

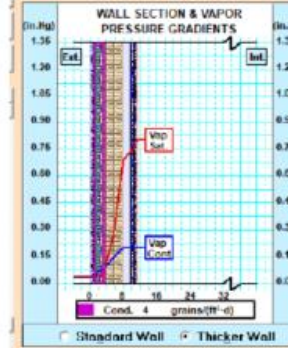
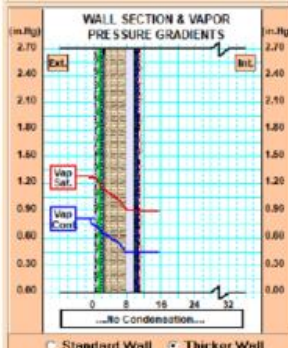
	Winter		Summer	
	Temp (°F)	RH (%)	Temp (°F)	RH (%)
Indoor	72	25	75	50
Outdoor	1	80	86	64

City: Toronto, ON

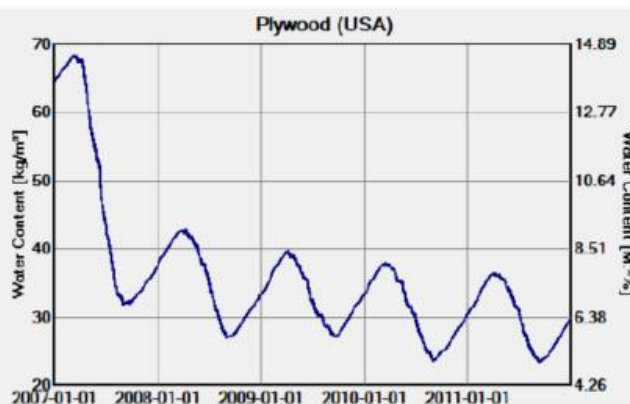
CLIMATE CONDITIONS

	Winter		Summer	
	Temp (°F)	RH (%)	Temp (°F)	RH (%)
Indoor	72	25	75	50
Outdoor	1	80	86	64

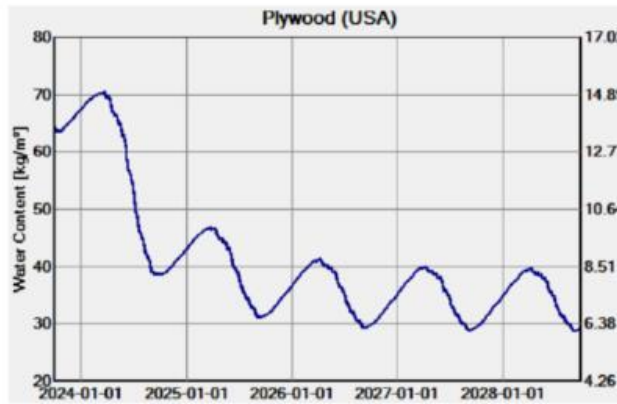
City: Toronto, ON



WUFI Design Analysis (Thunder Bay)



WUFI Design Analysis (Toronto)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 7.2% to 10.2%. The analysis assumes typical exposure in the Toronto and Thunder Bay climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



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Detail Name
Medium density spray foam without a vapour retarder

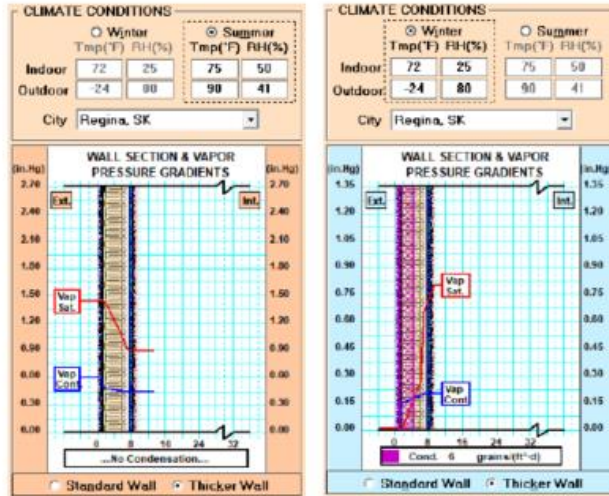
Roof Slope Application -
Low Slope Roof

0.5/12 to 4/12 slope

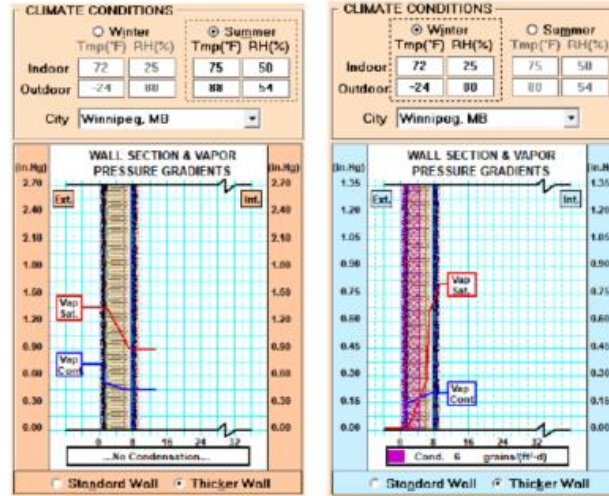
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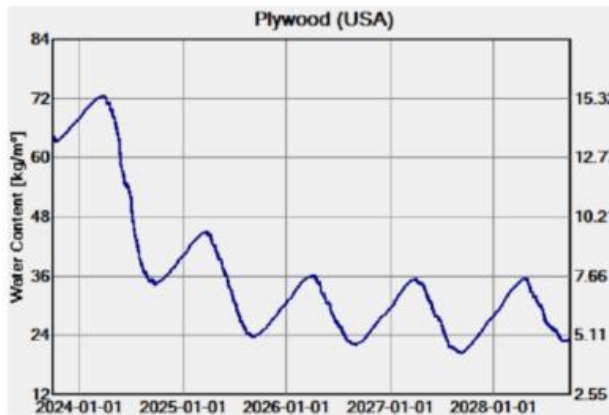
HAM Design Analysis (Regina)



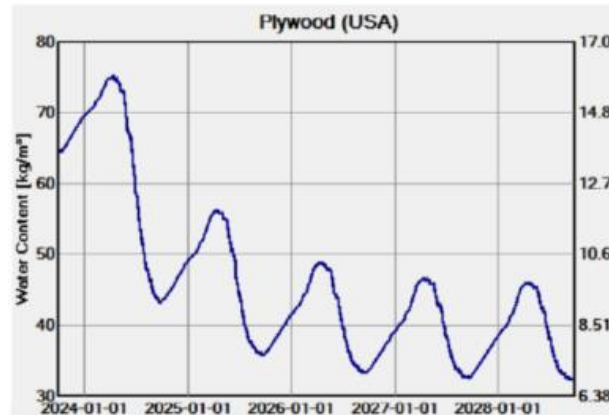
HAM Design Analysis (Winnipeg)



WUFI Design Analysis (Regina)



WUFI Design Analysis (Winnipeg)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.5% to 10.2%. The analysis assumes typical exposure in the Regina and Winnipeg climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



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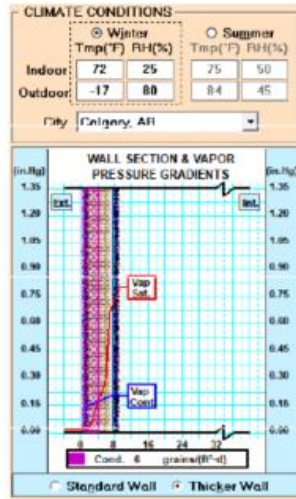
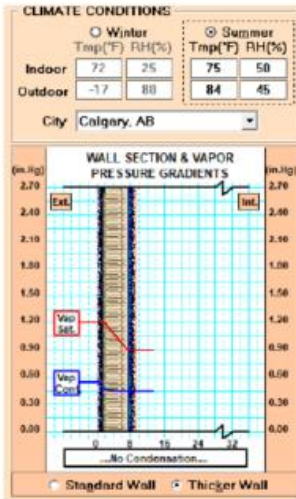
Roof Slope Application -
Low Slope Roof

0.5/12 to 4/12 slope

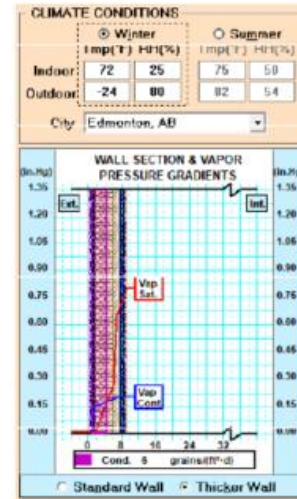
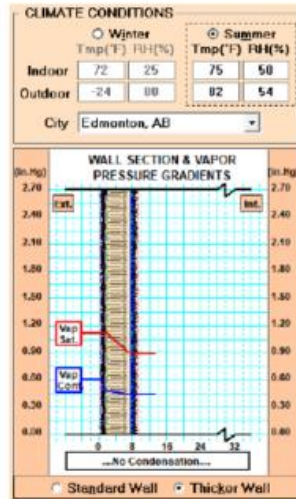
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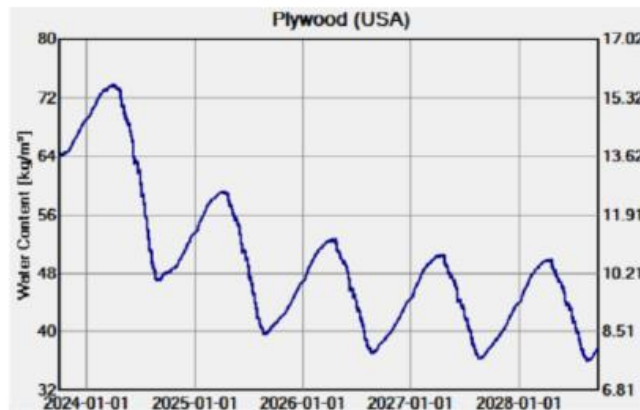
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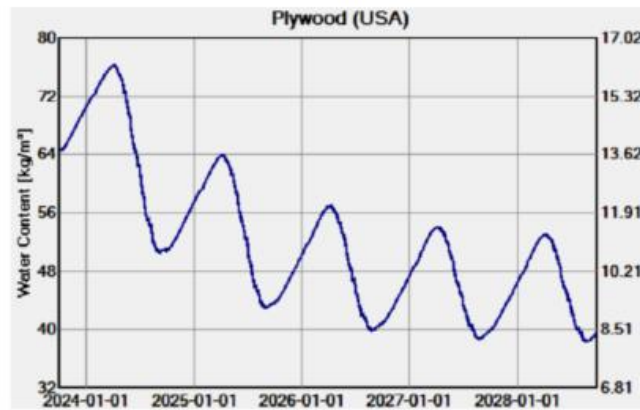
HAM Design Analysis (Edmonton)



WUFI Design Analysis (Calgary)



WUFI Design Analysis (Edmonton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 8.4% to 11.5%. The analysis assumes typical exposure in the Calgary and Edmonton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



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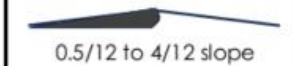
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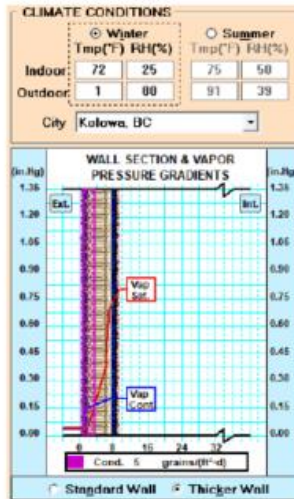
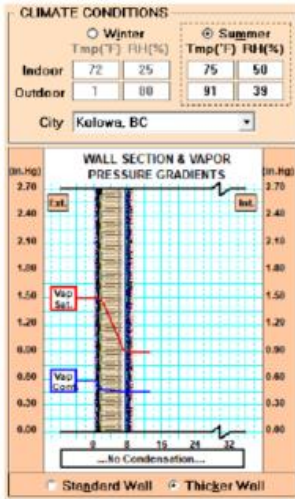
Roof Slope Application -
Low Slope Roof



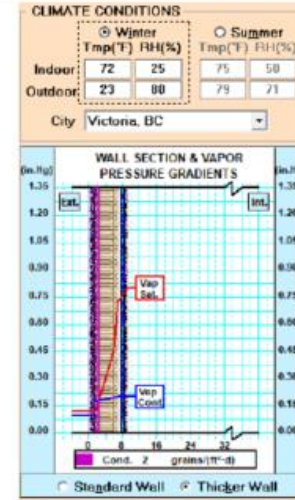
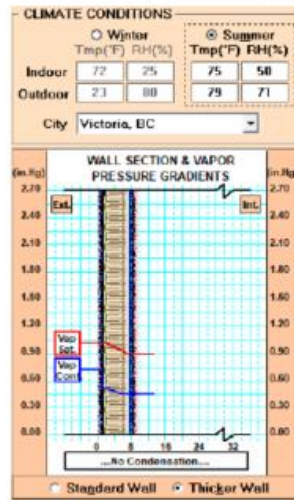
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HAM Design Analysis (Kelowna)



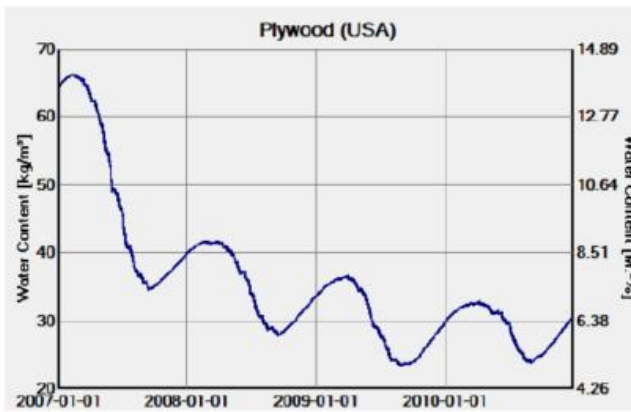
HAM Design Analysis (Victoria)



WUFI Design Analysis (Kelowna)



WUFI Design Analysis (Victoria)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 7.8% to 9.4%. The analysis assumes typical exposure in the Kelowna and Victoria climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



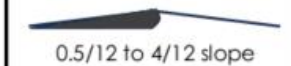
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Detail Name
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Roof Slope Application –
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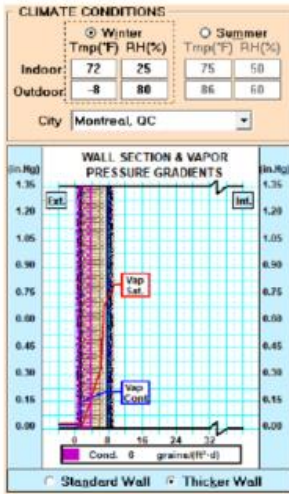
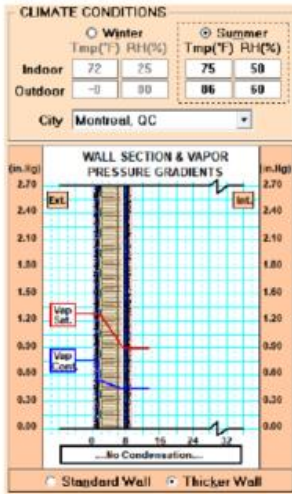


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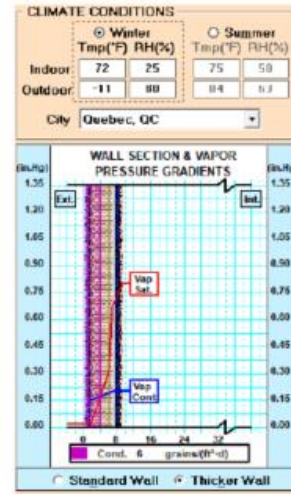
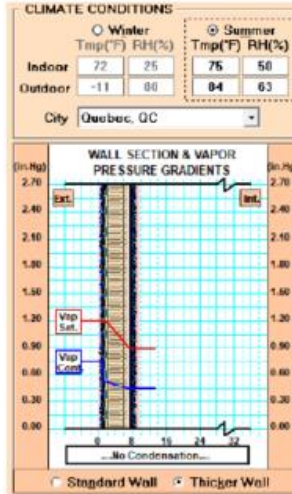


Randy Van Straaten
 April 30, 2024

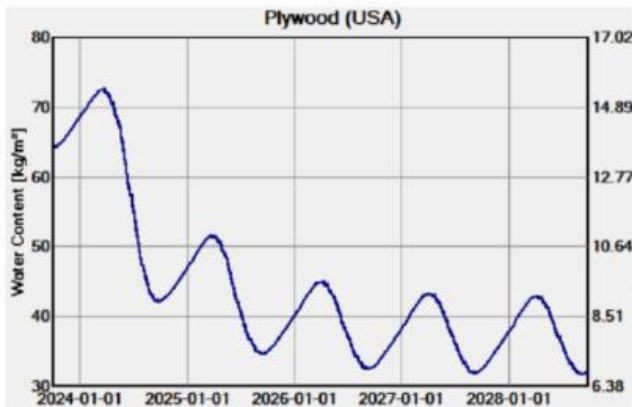
HAM Design Analysis (Montreal)



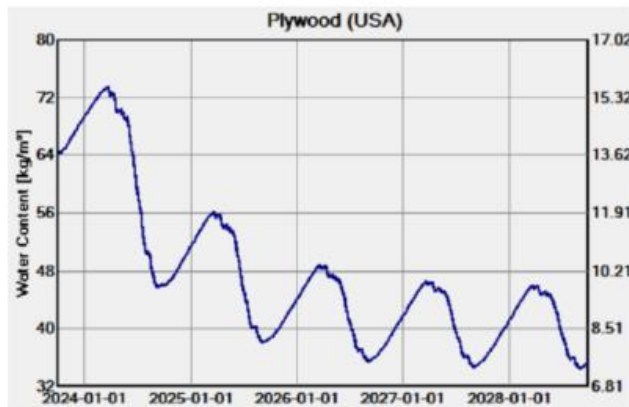
HAM Design Analysis (Quebec City)



WUFI Design Analysis (Montreal)



WUFI Design Analysis (Quebec City)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.9% to 9.9%. The analysis assumes typical exposure in the Montreal and Quebec City climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



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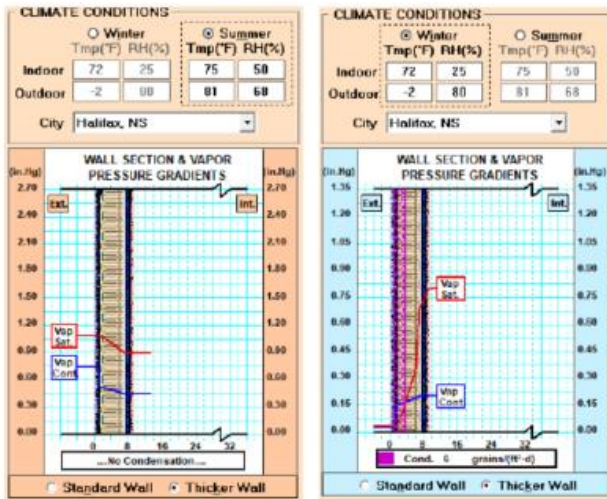
Detail Name
Medium density spray foam without a vapour retarder

Roof Slope Application - Low Slope Roof

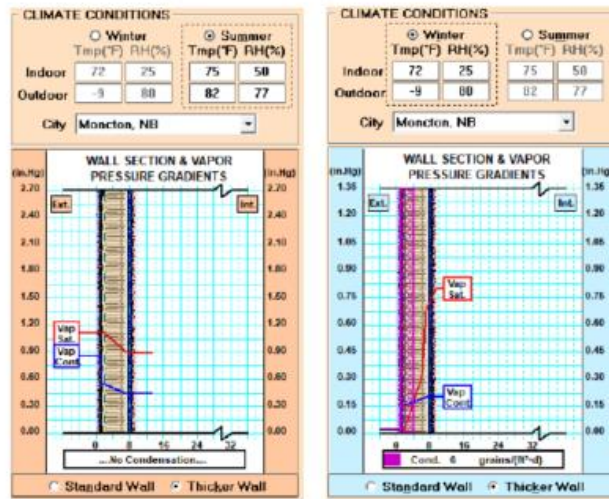


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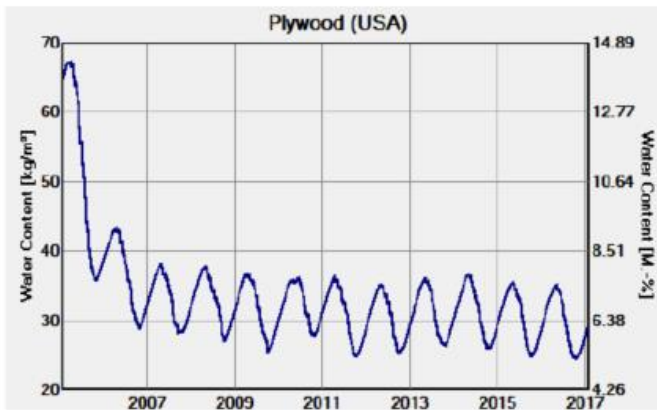
HAM Design Analysis (Halifax)



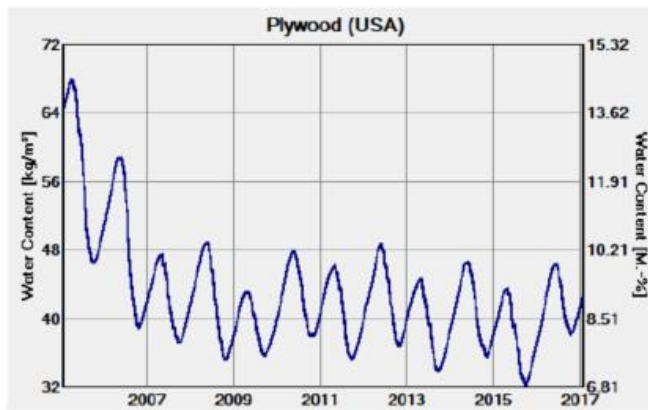
HAM Design Analysis (Moncton)



WUFI Design Analysis (Halifax)



WUFI Design Analysis (Moncton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 8.2% to 11.6%. The analysis assumes typical exposure in the Halifax and Moncton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (0.5/12 to 4/12) based on roofing manufacturer instructions



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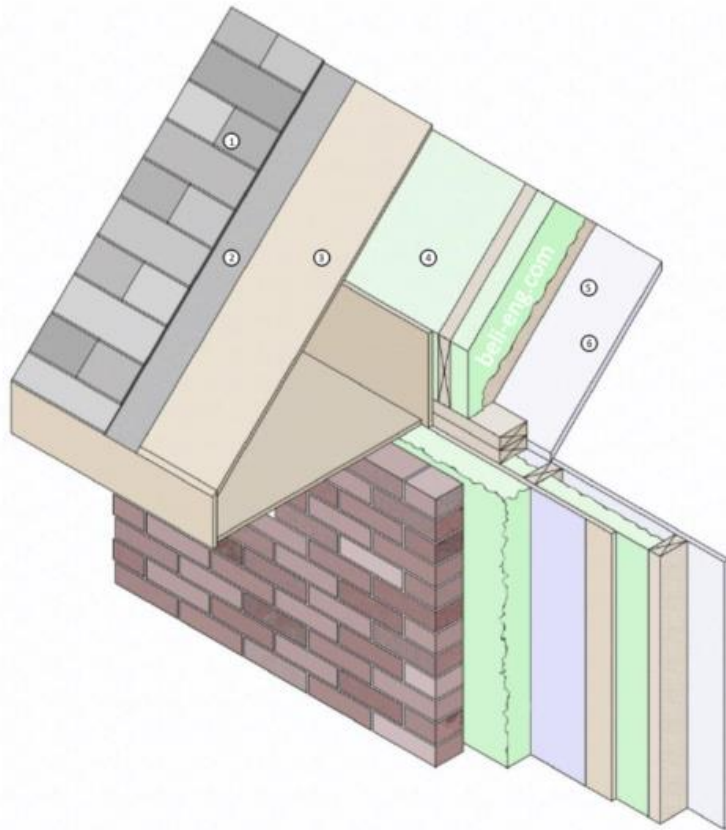
Medium density spray foam without a vapour retarder

Roof Slope Application - Low Slope Roof

0.5/12 to 4/12 slope

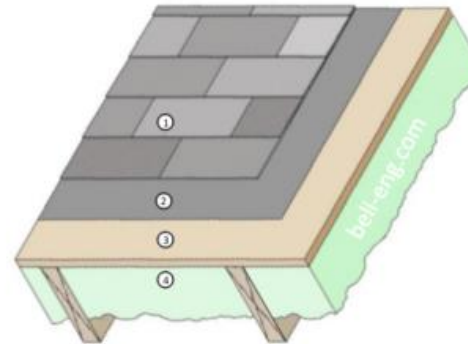
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Date: 2024-05-13
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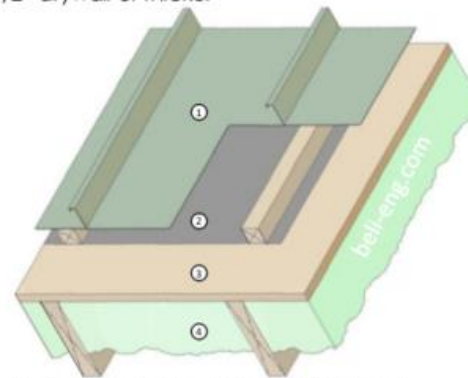
Pitched Roof to Wall Transition Detail

Design performance of the medium density spray foam without a vapour retarder has been analyzed for Toronto and Thunder Bay climates using HAM and WUFI hygrothermal simulations, using typical indoor environment conditions, on Page 2. The analysis included a pitched roof. Note: the wall is not part of the analysis.



R1- Pitched Roof with Shingles (min 4:12 slope)

- ① Asphalt Shingles
- ② #30 Felt Membrane
- ③ OSB / Plywood sheathing
- ④ Minimum R-31 GENYK Boreal Nature Elite cc SPF
- ⑤ 3/4" air space or larger
- ⑥ 1/2" drywall or thicker



R2- Pitched Metal Roof (min 3:12 slope)

- ① Ventilated Metal Roofing
- ② #30 Felt Membrane
- ③ OSB / Plywood sheathing
- ④ Minimum R-31 GENYK Boreal Nature Elite cc SPF
- ⑤ 3/4" air space or larger
- ⑥ 1/2" drywall or thicker



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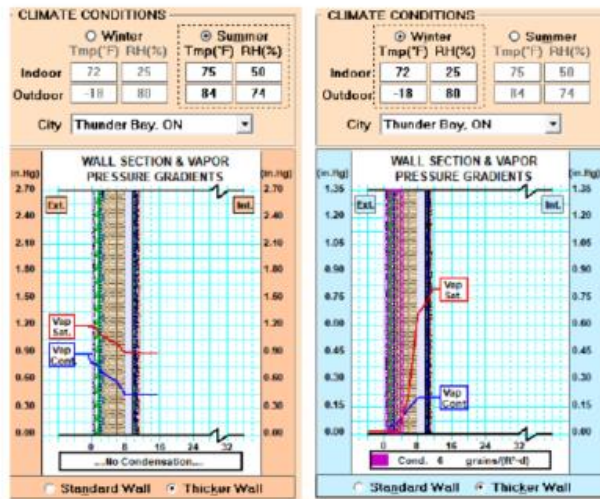
Detail Name
 Medium density spray foam without a vapour retarder

Roof Slope Application - Pitched Roof

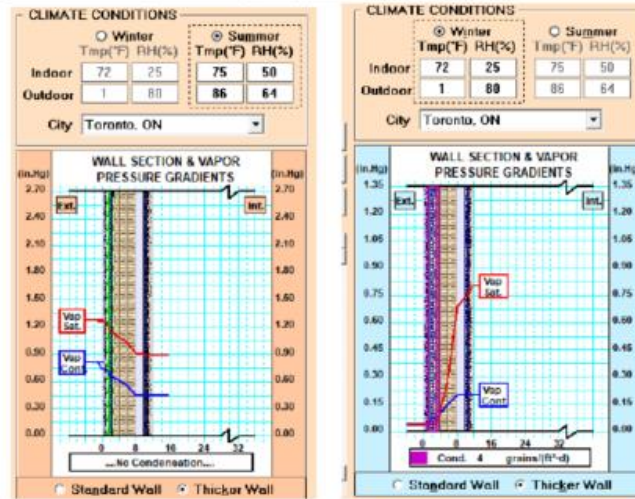

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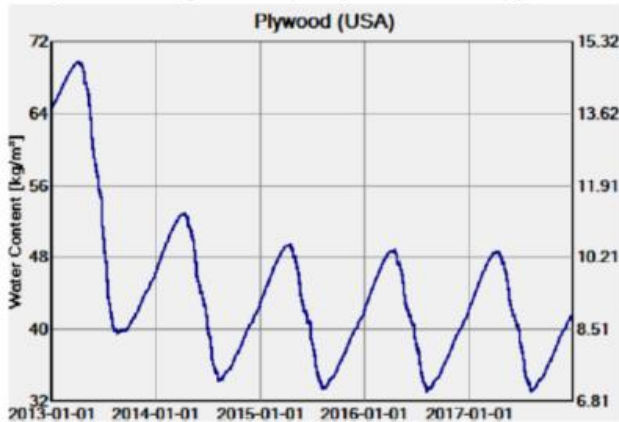
HAM Design Analysis (Thunder Bay)



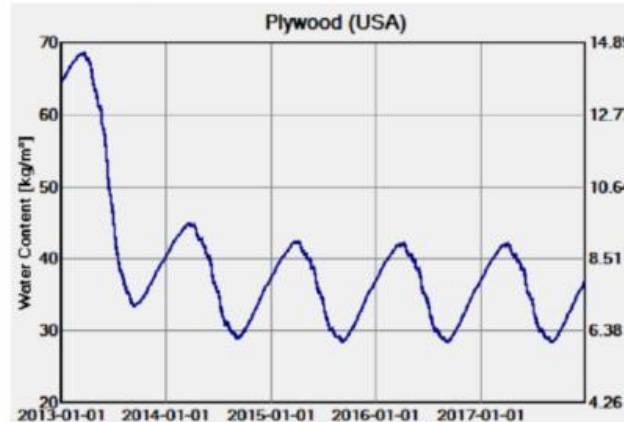
HAM Design Analysis (Toronto)



WUFI Design Analysis (Thunder Bay)



WUFI Design Analysis (Toronto)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.3 % to 10.3%. The analysis assumes typical exposure in the Toronto and Thunder Bay climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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Detail Name

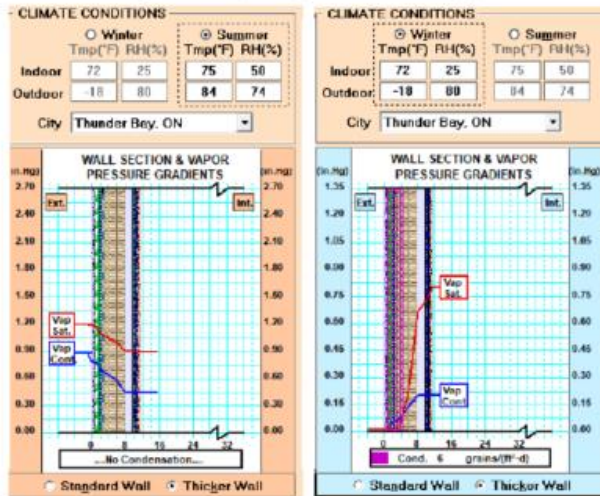
Medium density spray foam without a vapour retarder



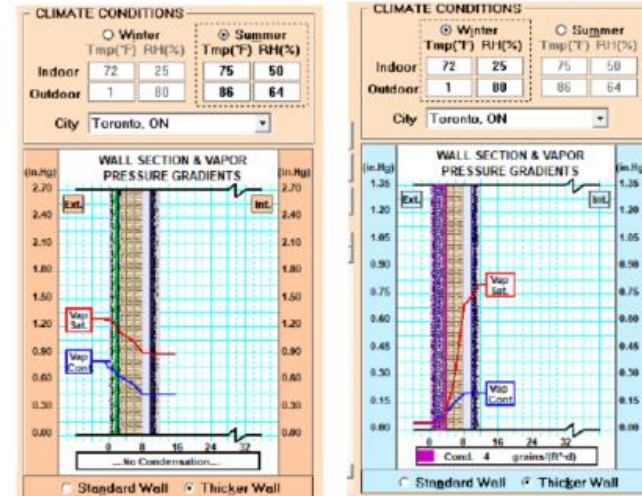
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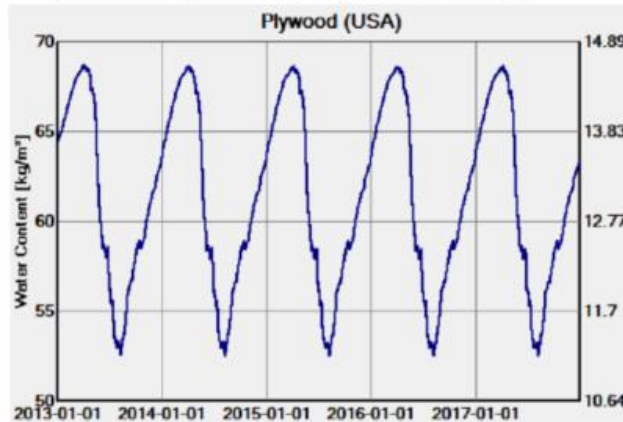
HAM Design Analysis (Thunder Bay)



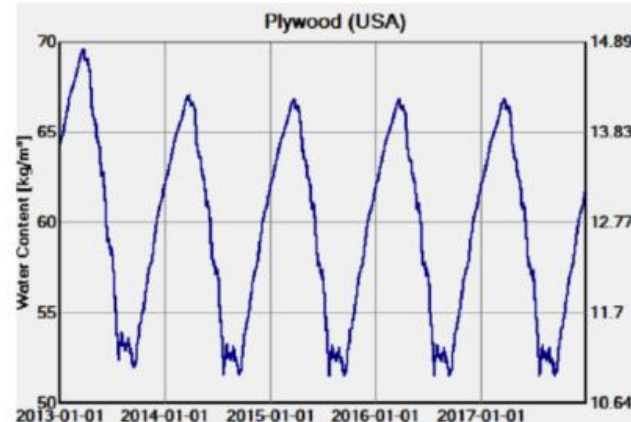
HAM Design Analysis (Toronto)



WUFI Design Analysis (Thunder Bay)



WUFI Design Analysis (Toronto)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 11.2 % to 14.4%. The analysis assumes typical exposure in the Toronto and Thunder Bay climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions

GENYK 
POLYURETHANE

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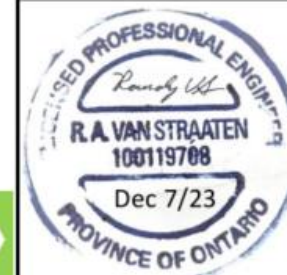
Detail Name

Medium density spray foam without a vapour retarder

Roof Slope Application – Pitched Roof Analysis (Metal Deck)

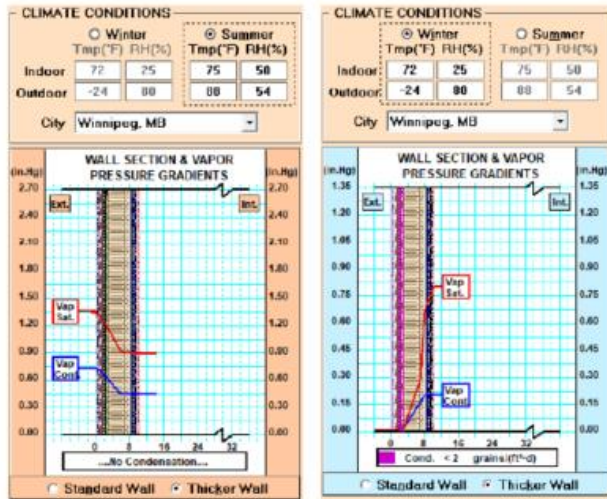


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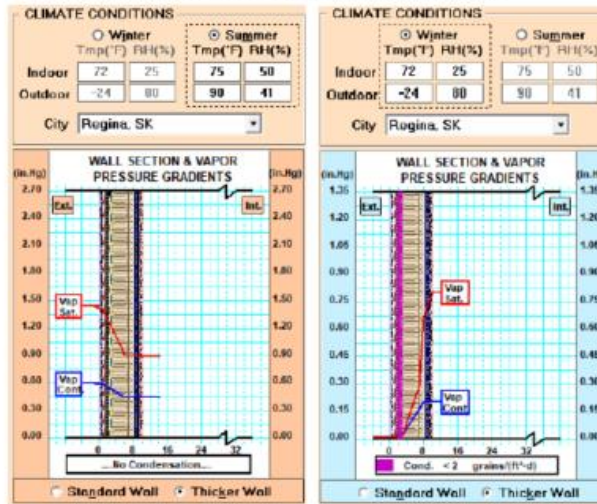


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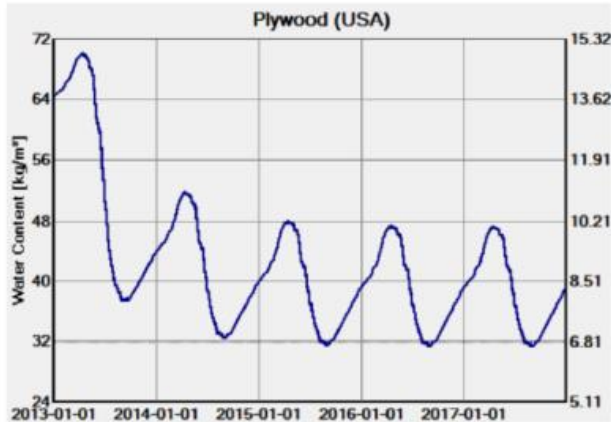
HAM Design Analysis (Winnipeg, MB)



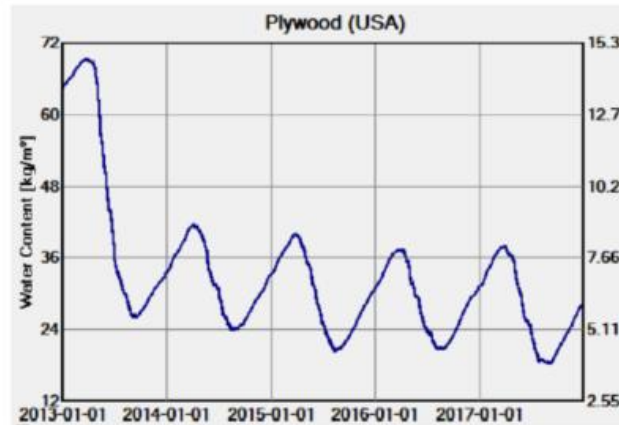
HAM Design Analysis (Regina, SK)



WUFI Design Analysis (Winnipeg, MB)



WUFI Design Analysis (Regina, SK)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.8% to 10.2%. The analysis assumes typical exposure in the Winnipeg and Regina climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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Detail Name

Medium density spray foam without a vapour retarder

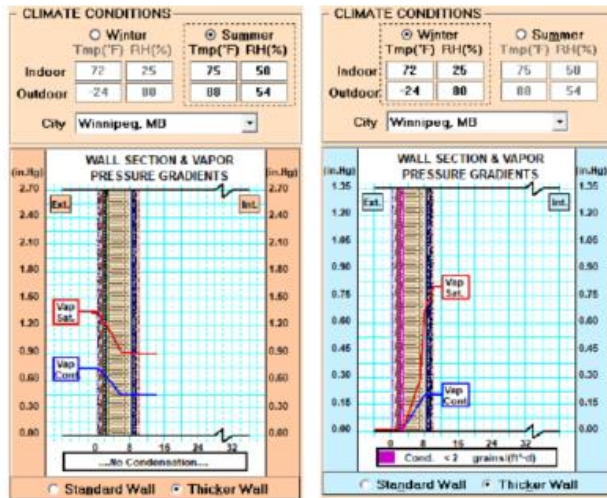
Roof Slope Application – Pitched Roof Analysis (Shingles)



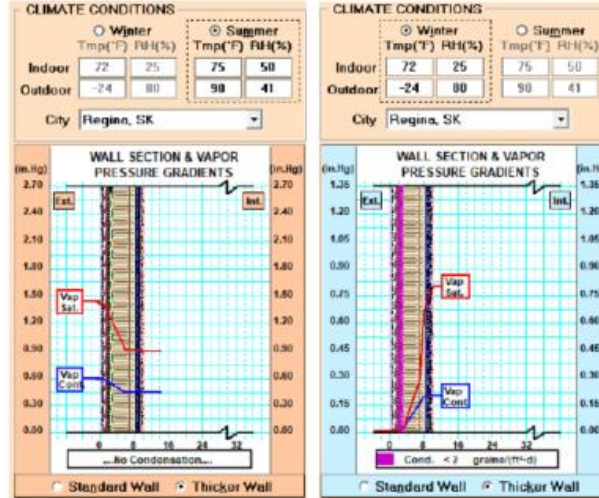
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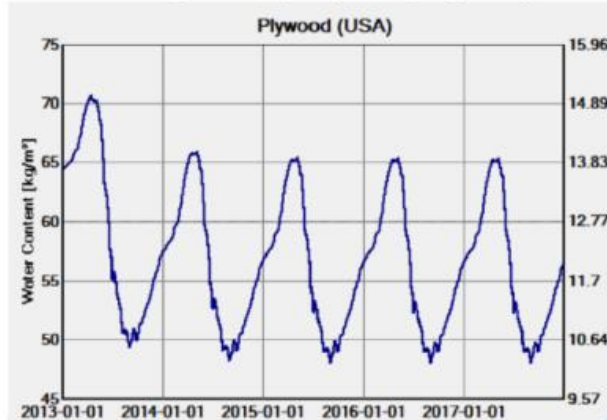
HAM Design Analysis (Winnipeg, MB)



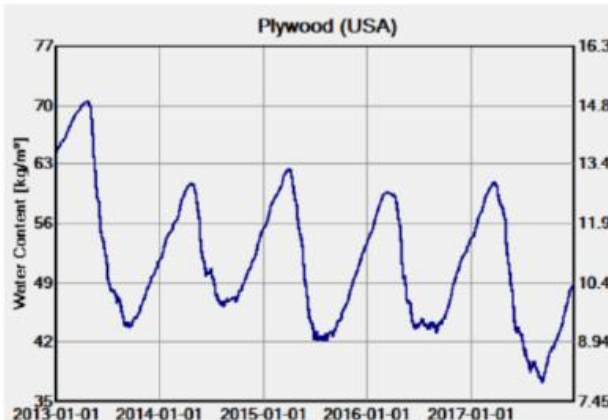
HAM Design Analysis (Regina, SK)



WUFI Design Analysis (Winnipeg, MB)



WUFI Design Analysis (Regina, SK)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 10.5% to 13.9%. The analysis assumes typical exposure in the Winnipeg and Regina climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions



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Detail Name
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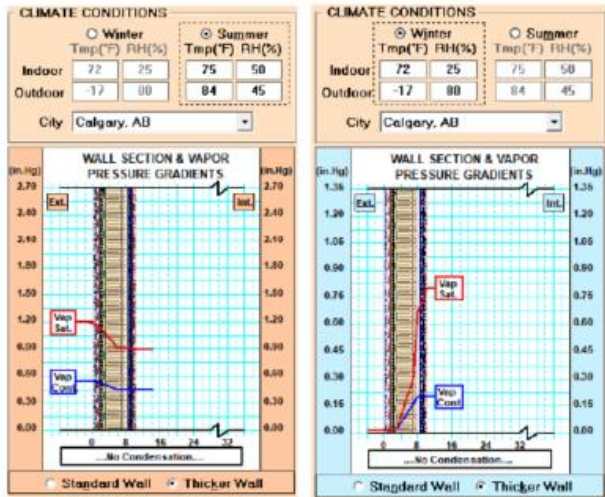
Roof Slope Application – Pitched Roof Analysis (Metal Deck)



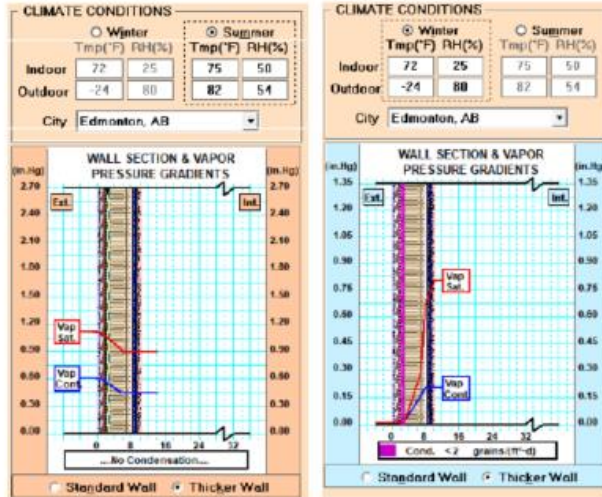
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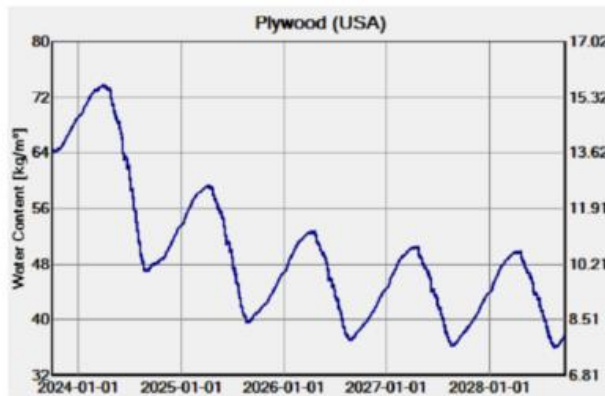
HAM Design Analysis (Calgary)



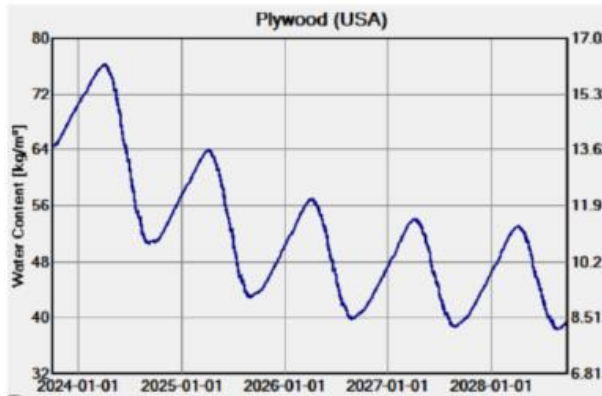
HAM Design Analysis (Edmonton)



WUFI Design Analysis (Calgary)



WUFI Design Analysis (Edmonton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 8.4% to 11.7%. The analysis assumes typical exposure in the Calgary and Edmonton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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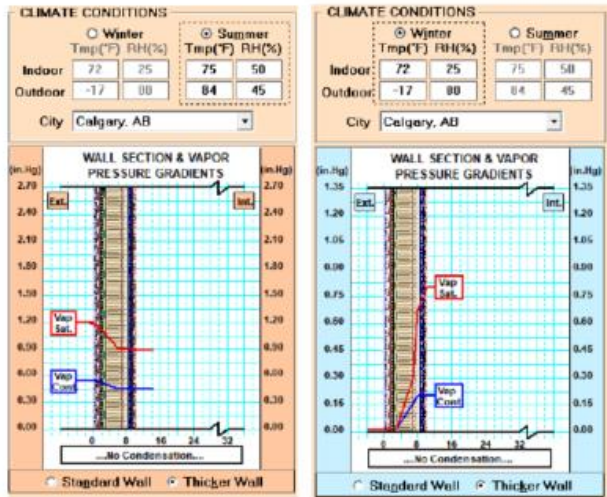
Medium density spray foam without a vapour retarder

Roof Slope Application – Pitched Roof Analysis (Shingles)

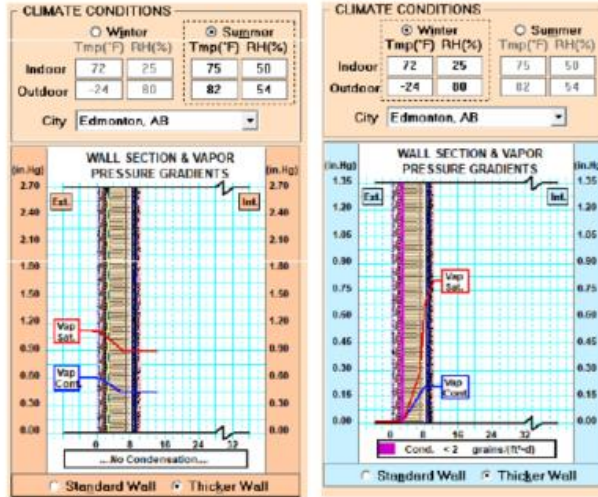
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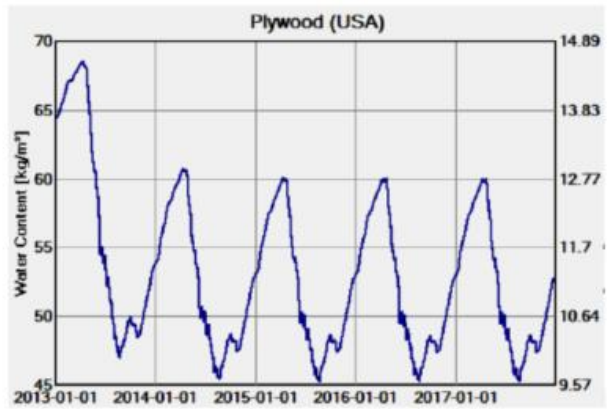
HAM Design Analysis (Calgary)



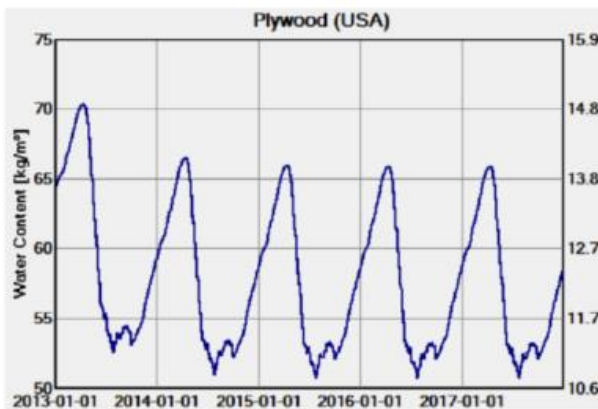
HAM Design Analysis (Edmonton)



WUFI Design Analysis (Calgary)



WUFI Design Analysis (Edmonton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 10.7 % to 13.9%. The analysis assumes typical exposure in the Calgary and Edmonton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions



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Detail Name
Medium density spray foam without a vapour retarder

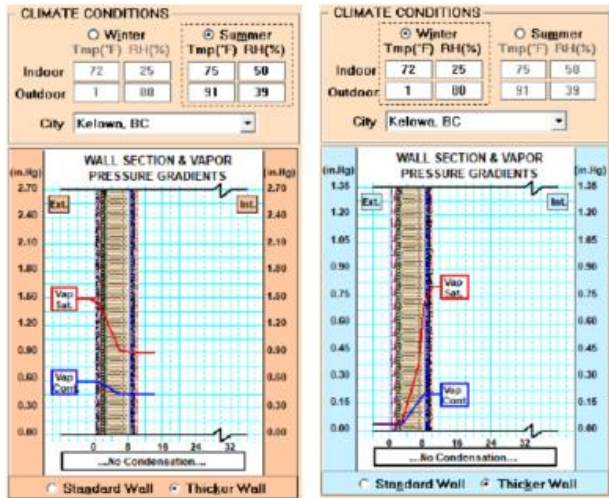
Roof Slope Application –
Pitched Roof Analysis
(Metal Deck)



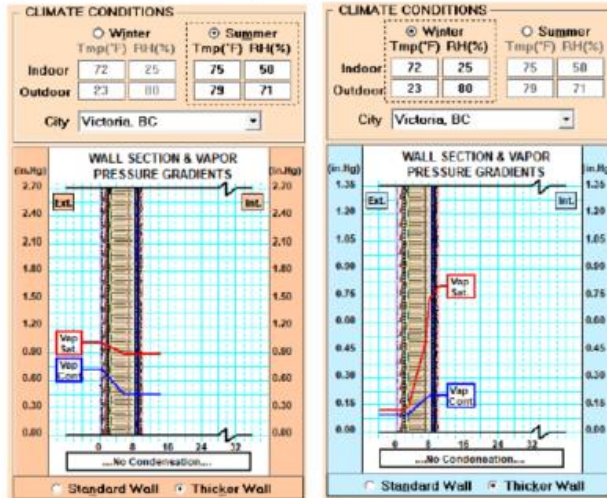
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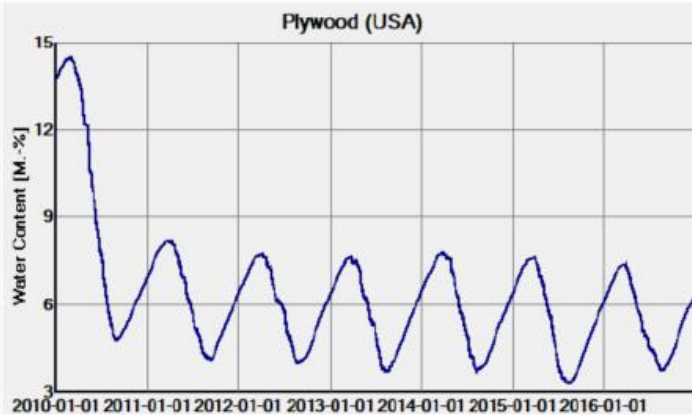
HAM Design Analysis (Kelowna)



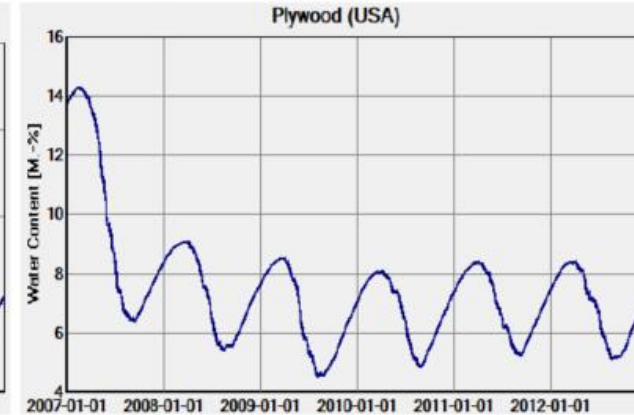
HAM Design Analysis (Victoria)



WUFI Design Analysis (Kelowna)



WUFI Design Analysis (Victoria)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 7.8 % to 10.1%. The analysis assumes typical exposure in the Kelowna and Victoria climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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Detail Name
Medium density spray foam without a vapour retarder

Roof Slope Application - Pitched Roof Analysis (Shingles)

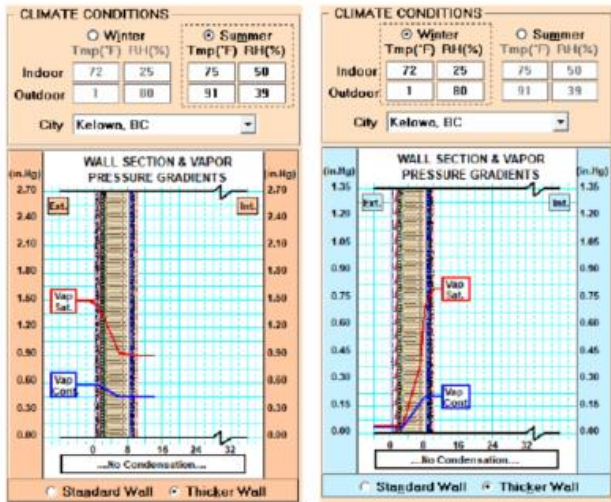


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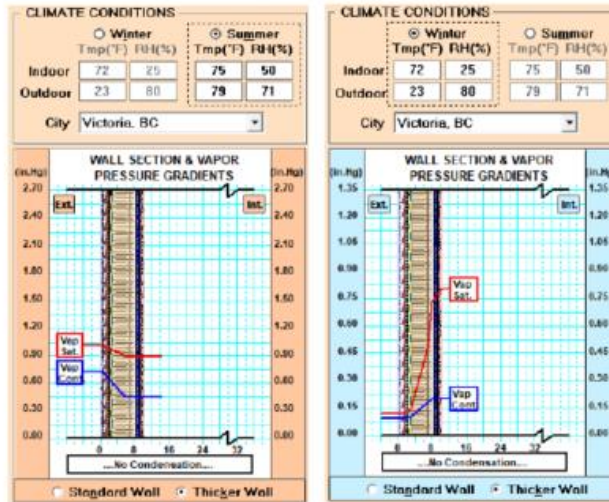


Randy W.
April 30, 2024

HAM Design Analysis (Kelowna)



HAM Design Analysis (Victoria)



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Detail Name
Medium density spray foam without a vapour retarder

**Roof Slope Application –
Pitched Roof Analysis
(Metal Deck)**

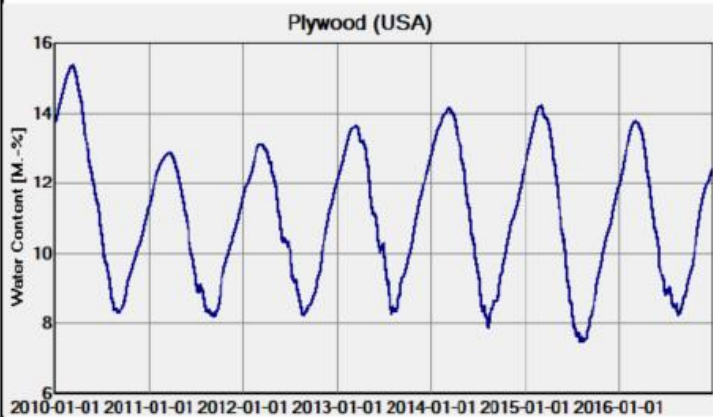


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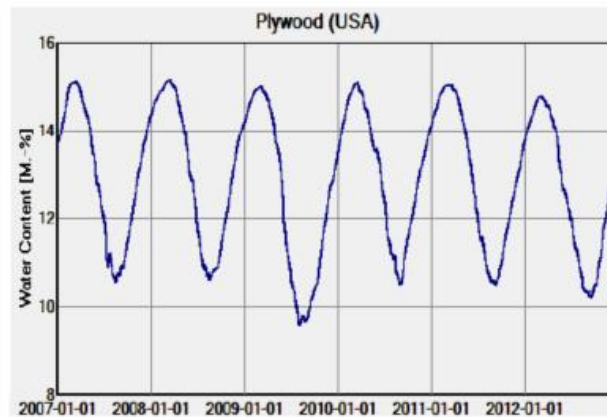


Randy Van Straaten
April 30, 2024

WUFI Design Analysis (Kelowna)



WUFI Design Analysis (Victoria)



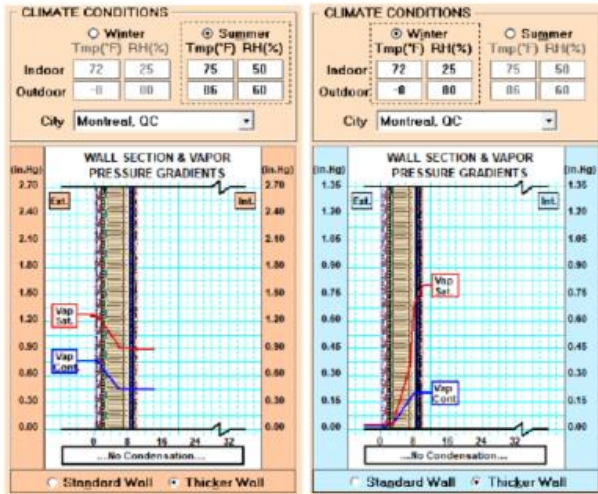
NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 13.4 % to 15.1%. The analysis assumes typical exposure in the Kelowna and Victoria climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions

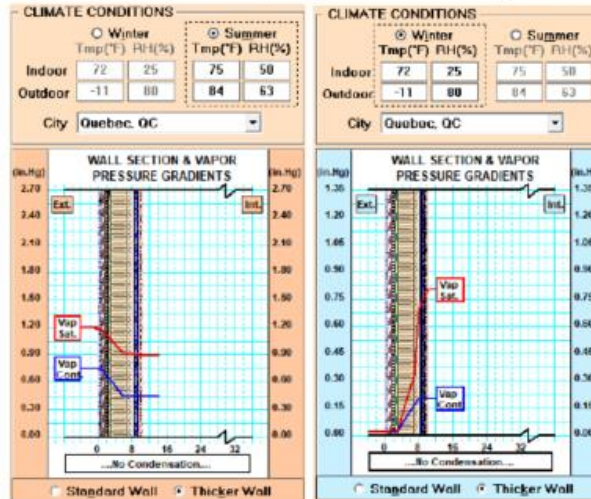


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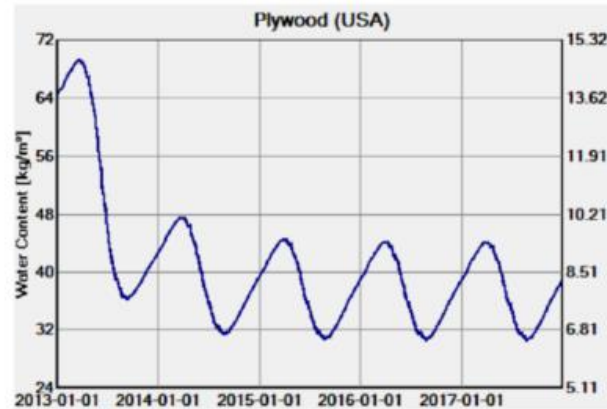
HAM Design Analysis (Montreal)



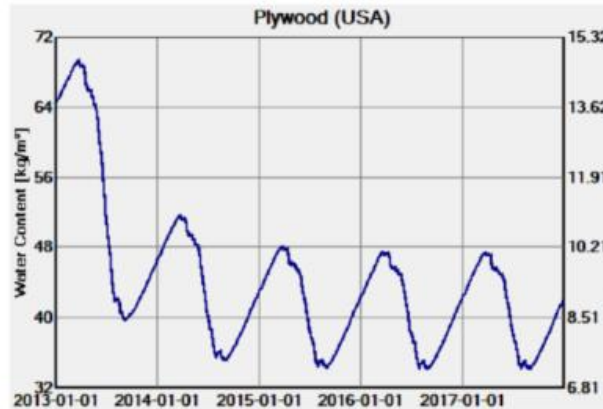
HAM Design Analysis (Quebec City)



WUFI Design Analysis (Montreal)



WUFI Design Analysis (Quebec City)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.9 % to 10.2%. The analysis assumes typical exposure in the Montreal and Quebec City climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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Detail Name

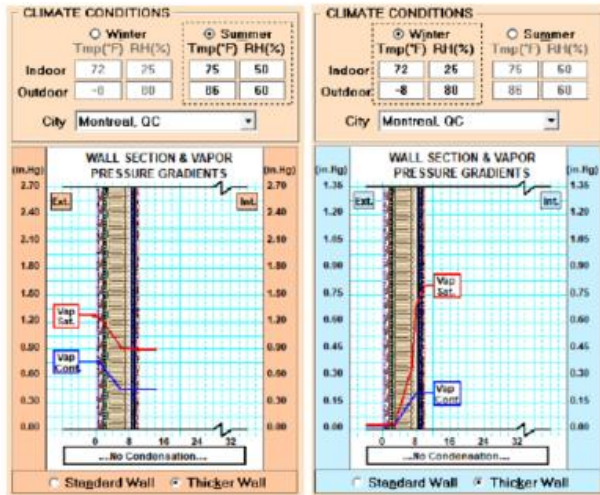
Medium density spray foam without a vapour retarder

Roof Slope Application - Pitched Roof Analysis (Shingles)

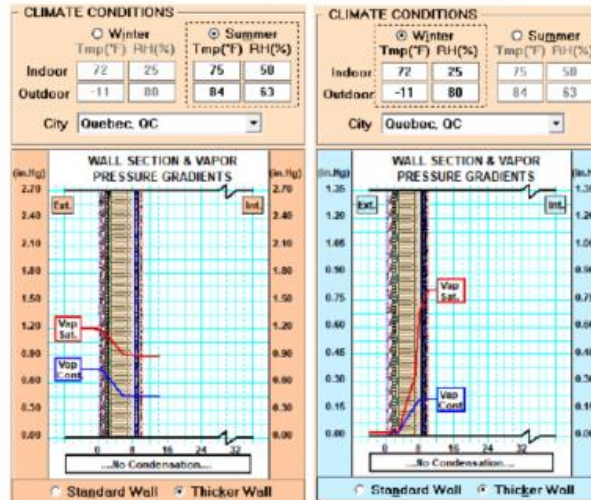


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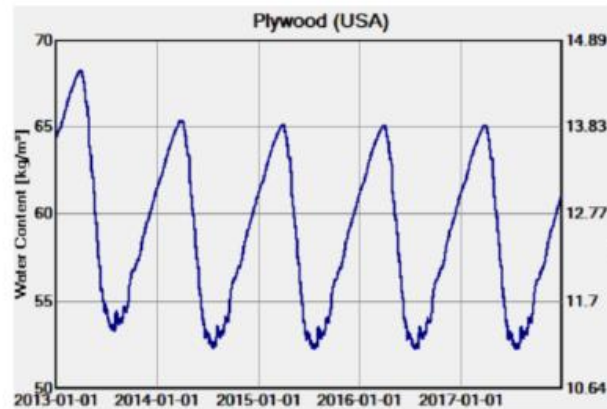
HAM Design Analysis (Montreal)



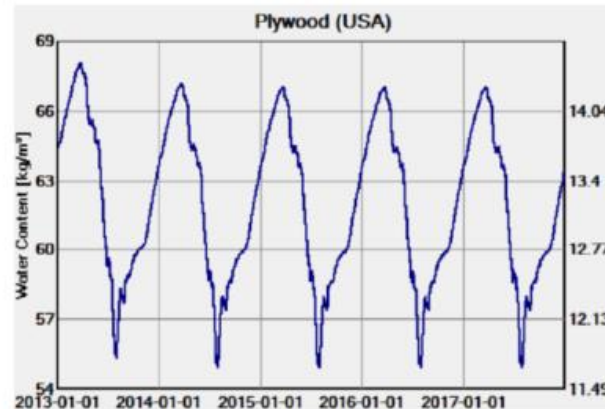
HAM Design Analysis (Quebec City)



WUFI Design Analysis (Montreal)



WUFI Design Analysis (Quebec City)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 11.7% to 14.2%. The analysis assumes typical exposure in the Montreal and Quebec City climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions



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Detail Name

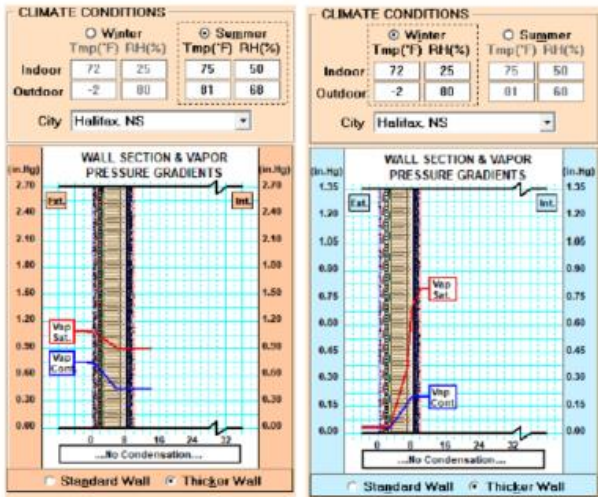
Medium density spray foam without a vapour retarder

**Roof Slope Application –
Pitched Roof Analysis
(Metal Deck)**

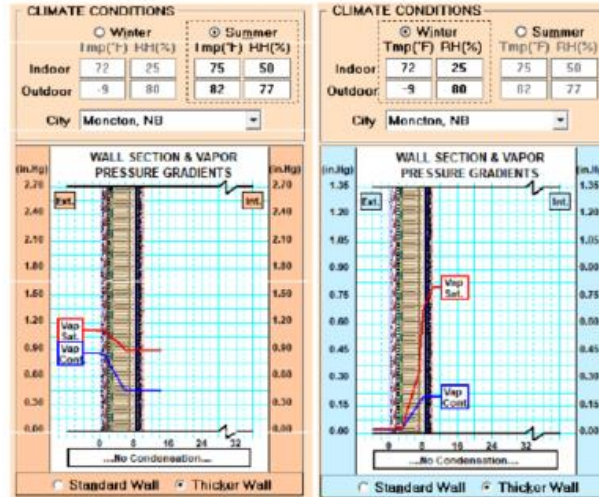


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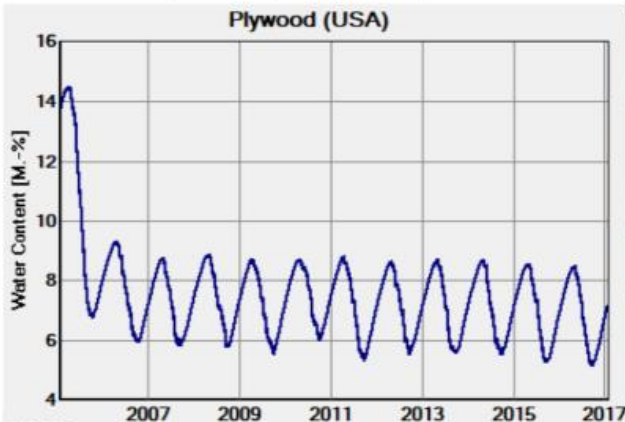
HAM Design Analysis (Halifax)



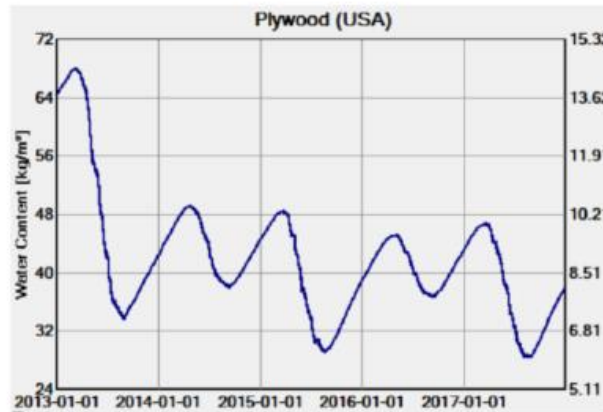
HAM Design Analysis (Moncton)



WUFI Design Analysis (Halifax)



WUFI Design Analysis (Moncton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 6.5 % to 10.2%. The analysis assumes typical exposure in the Halifax and Moncton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (4/12) based on roofing manufacturer instructions.



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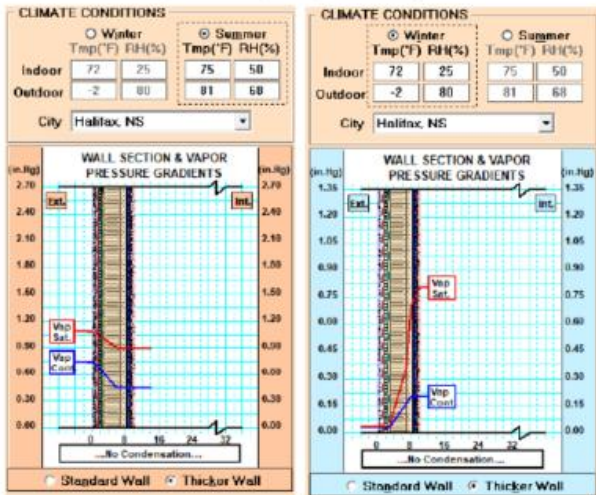
Detail Name
 Medium density spray foam without a vapour retarder

Roof Slope Application – Pitched Roof Analysis (Shingles)

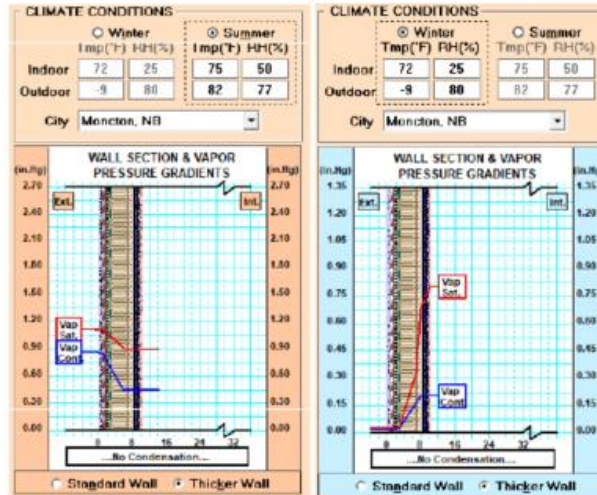
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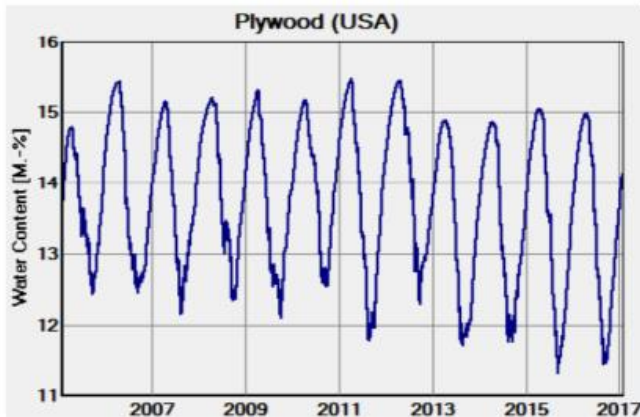
HAM Design Analysis (Halifax)



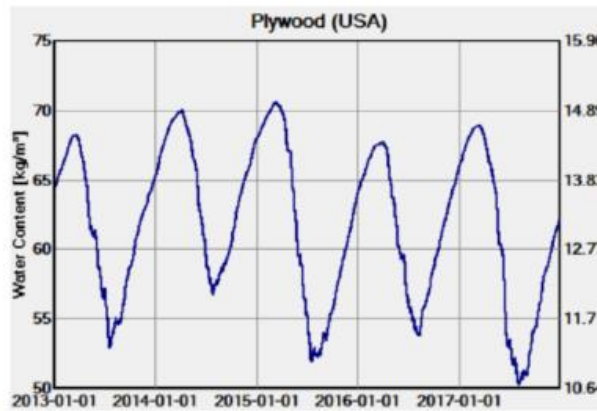
HAM Design Analysis (Moncton)



WUFI Design Analysis (Halifax)



WUFI Design Analysis (Moncton)



NOTES

WUFI Design analysis shows that the moisture content of the plywood ranges from 10.2% to 14.9%. The analysis assumes typical exposure in the Halifax and Moncton climate regions. Additionally, the analysis assumes typical indoor humidity. High humidity may require a different assembly. Applies to medium density spray foam insulation (min 2.0 lb/ft³). Minimum roof pitch (3/12) based on roofing manufacturer instructions



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Detail Name
Medium density spray foam without a vapour retarder

**Roof Slope Application –
Pitched Roof Analysis
(Metal Deck)**



Drawn by: RVS
Checked by: TR
Date: 2024-05-13
Scale: NTS



ⁱ Smegal, Straube. "Ventilation and Vapour Control for SPF-insulated Cathedral Ceilings", 2014

ⁱⁱ CMHC. "About Your House", North Series 6, Artic Hot Roof Design, 2001

ⁱⁱⁱ TenWolde, Rose. "Issues Related to Venting of Attics and Cathedral Ceilings", ASHRAE Transactions, V.105, Pt.1

^{iv} Rudd. "Field Performance of Unvented Cathedralized (UC) Attics in the USA", Journal of Building Physics, 2005, Vol. 29, No. 2

^v Lstiburek. "Understanding Attic Ventilation", Building Science Digest 102, Building Science Press, Westford, MA