Built Environments, Inc.
www.built-environments.com

THERMAL PERFORMANCE REPORT

Report No.: 012019-1

Issued to:

QUIK-THERM SOLUTIONS, INC.

1680 Sargent Ave. Unit 3
Winnipeg, MB
Canada, R3H 0C2

ASSEMBLY: Solar Dry Insulation on Wood Framed Wall

Issued by:

Built Environments, Inc.
2850 Curve Crest Blvd. W. Suite 220
Stillwater, Minnesota 55082

Phone: 651.439.9396
Fax: 651.204.2247

1.0 Summary

Assembly Type: Solar Dry Insulation on Wood Framed Wall

Assembly Size: 4 ft (w) x 10 ft (h)
1.219 m (w) x 3.048 m (h)

Procedure: Three-dimensional analysis by Finite Element Method. Analyses were performed in accordance with the International Energy Conservation Code (IECC) and ASHRAE 90.1, Appendix A. Section A1.2 of ASHRAE 90.1 provides provisions stated in Section A9 for applicant-determined assembly U-factors for assemblies not adequately represented by Sections A2-A8. The tested assembly and procedures apply to the requirements of Section A9.2 b.1 whereby two- or three-dimensional analyses are acceptable alternative methods for calculating thermal performance values. The guidelines for thermal performance analyses are stated in Section A9.4.

Standard: *ANSI/ASHRAE/IES Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings*

Software: Comsol Multiphysics, version 5.4; Heat Transfer Module

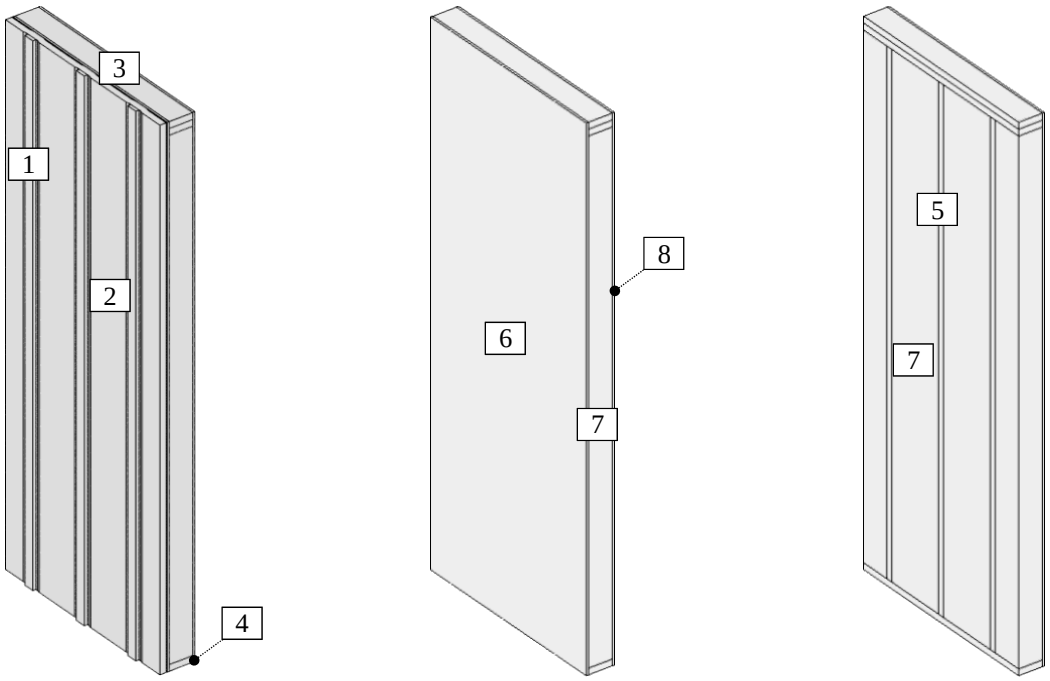
Validation: Computational methods utilized in this analysis have been benchmarked against independent hot box studies performed in accordance with ASTM C 1363. Thresholds of ±8% for simulation vs. tested transmittance values are generally accepted for validation purposes. Methods employed in this analysis achieve thresholds that are generally less than ±2.5% of tested transmittance values, which are well below the ±8% threshold criterion.

Results Summary:

	Imperial Units	Metric Units
1.5" Solar Dry Insulation		
Thermal Transmittance, U-factor	0.038 Btu/h·ft^2·F	0.218 W/m^2·K
Overall Thermal Resistance (Air-to-Air)	26.0 (h·ft^2·F)/Btu	4.58 m^2·K/W
4" Solar Dry Insulation		
Thermal Transmittance, U-factor	0.028 Btu/h·ft^2·F	0.157 W/m^2·K
Overall Thermal Resistance (Air-to-Air)	36.1 (h·ft^2·F)/Btu	6.36 m^2·K/W
8" Solar Dry Insulation		
Thermal Transmittance, U-factor	0.019 Btu/h·ft^2·F	0.109 W/m^2·K
Overall Thermal Resistance (Air-to-Air)	52.1 (h·ft^2·F)/Btu	9.18 m^2·K/W

2.0 Assembly Geometry

Isometric View



1. Wood Furring: 3/4” (as modeled)

2. Expanded Polystyrene: 1.5”, 4”, or 8”

3. Top Plates: 2” x 6” (nominal); 1-1/2” x 5-1/2” (as modeled)

4. Bottom Plate: 2” x 6” (nominal); 1-1/2” x 5-1/2” (as modeled)

5. Wood Framing: 2” x 6” (nominal); 1-1/2” x 5-1/2” (as modeled)

6. Oriented Strand Board Sheathing: 1/2" (as modeled)

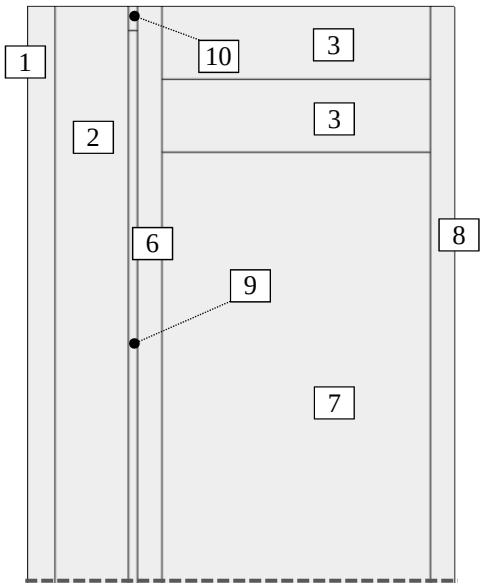
7. Low Density Fiberglass Batt Insulation: 5-1/2”

8. Interior Gypsum Board: 1/2" (as modeled)

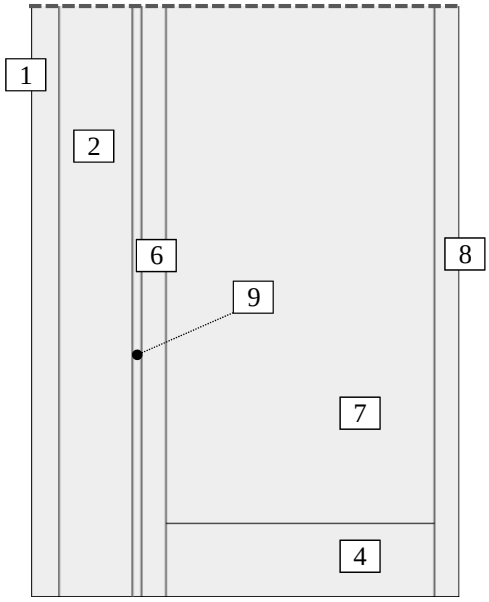
2.0 Assembly Geometry (continued)

Section View

Top of Wall



Base of Wall



1. Wood Furring: 3/4” (as modeled)

2. Expanded Polystyrene: 1.5”, 4”, or 8”

3. Top Plates: 2” x 6” (nominal); 1-1/2” x 5-1/2” (as modeled)

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5. Wood Framing: 2” x 6” (nominal); 1-1/2” x 5-1/2” (as modeled)

6. Oriented Strand Board Sheathing: 1/2" (as modeled)

7. Low Density Fiberglass Batt Insulation: 5-1/2”

8. Interior Gypsum Board: 1/2" (as modeled)

9. Air/Drainage Space: 3/16" (as modeled)

10. Closed Cell Polyurethane Foam: 3/16" (as modeled)

3.0 Conditions

Temperatures and Film Coefficients

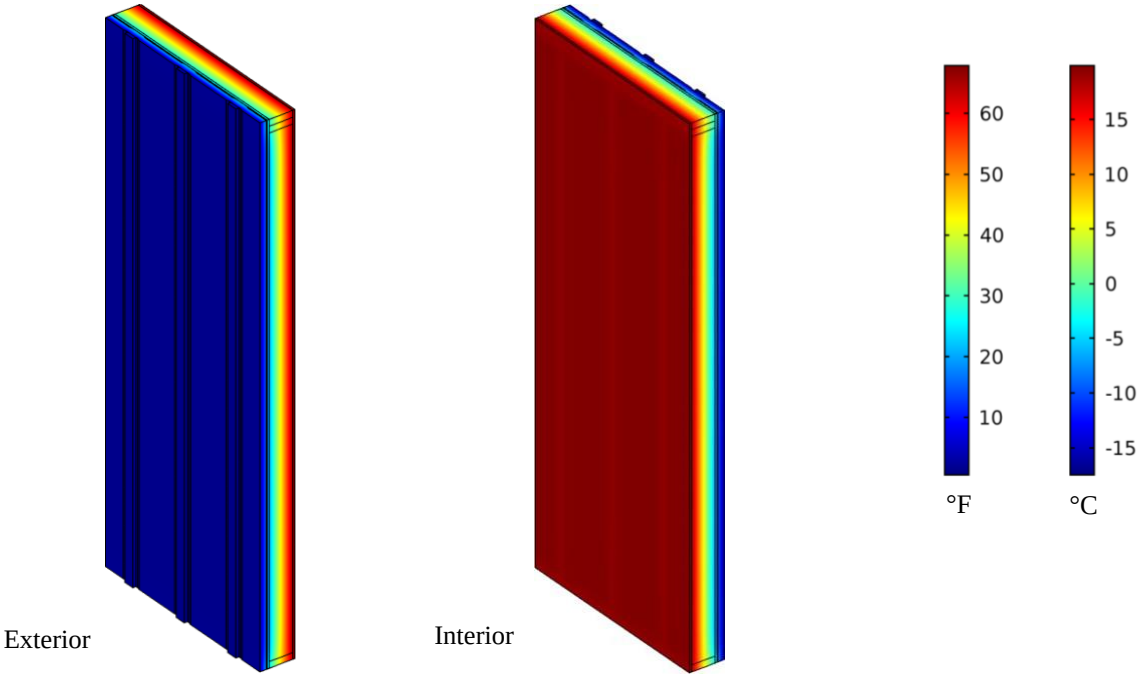
	Imperial Units	Metric Units
1. Interior Air Temperature	69.8°F	21°C
2. Exterior Air Temperature	-0.4°F	-18°C
3. Interior Film Coefficient	1.5 Btu/h·ft^2·°F	8.3 W/m^2 K
4. Exterior (Rainscreen) Film Coefficient	2.9 Btu/h·ft^2·°F	16.6 W/m^2 K
5. Surface Contact Resistances		
A. Wood Framing Interfaces	0.057 h·ft^2·F/Btu	0.010 m^2·K/W
B. Batt Insulation Interfaces	0.057 h·ft^2·F/Btu	0.010 m^2·K/W

Material Properties

Component	Thickness in (mm)	Density lb/ft^3 (kg/m^3)	Heat Capacity BTU/lb°F (J/kg-K)	Conductivity BTU in/hr ft^2°F (W/mK)
1. Wood Furring (Spruce)	0.75 (25.4)	25.0 (400)	0.449 (1,880)	0.597 (0.086)
2. Expanded Polystyrene	1.5 – 8.0 (38.1 – 203.2)	0.92 (14.8)	0.351 (1,470)	0.250 (0.036)
3. Top Plates (Spruce)	0.75 (25.4)	25.0 (400)	0.449 (1,880)	0.597 (0.086)
4. Bottom Plate (Spruce)	0.75 (25.4)	25.0 (400)	0.449 (1,880)	0.597 (0.086)
5. Wood Framing (Spruce)	0.75 (25.4)	25.0 (400)	0.449 (1,880)	0.597 (0.086)
6. Oriented Strand Board	0.5 (12.7)	40.6 (650)	0.449 (1,880)	0.638 (0.092)
7. Low Density Fiberglass Batt	5.5 (139.7)	0.55 (8.8)	0.201 (840)	0.286 (0.0412)
8. Interior Gypsum Board	0.5 (12.7)	53.1 (850)	0.208 (870)	1.11 (0.16)
9. Air/Drainage Space	0.1875 (4.76)	0.081 (1.3)	0.239 (1,000)	0.326 (0.047)
10. Closed Cell Polyurethane Foam	0.1875 (4.76)	2.43 (39)	0.351 (1,470)	0.173 (0.025)

4.0 Results

Isometric Views



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8" Solar Dry Insulation		
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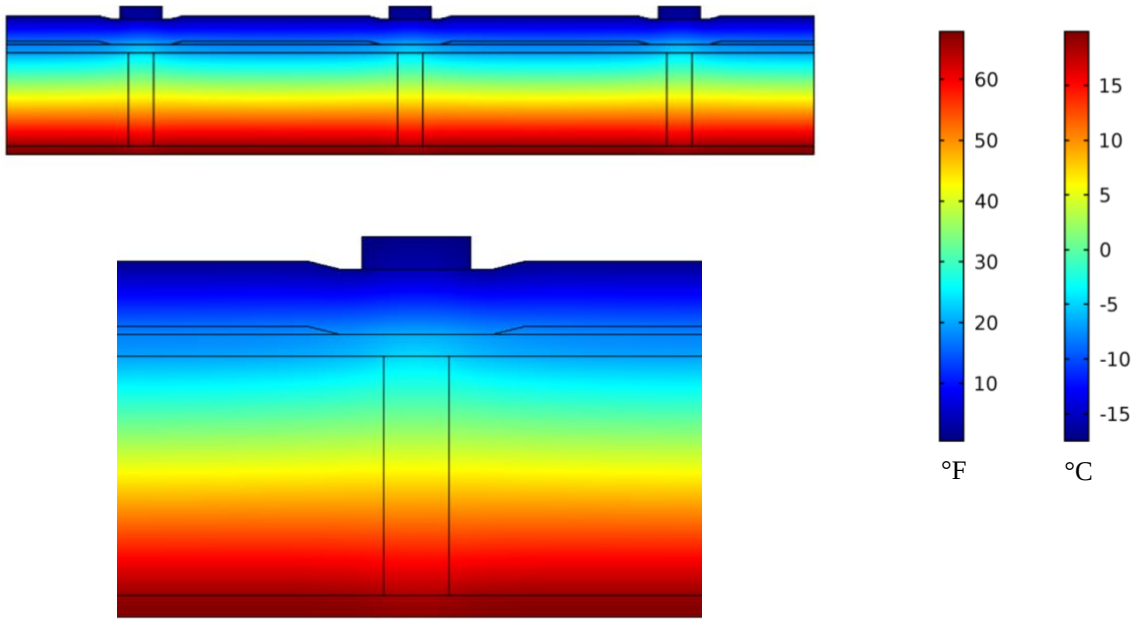
4.0 Results (continued)

Plan Views at Mid-Wall Height



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Overall Thermal Resistance (Air-to-Air)	36.1 (h·ft^2·F)/Btu	6.36 m^2·K/W
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