HUNTER PANELS, LLC

Hygrothermal Analysis of Polyisocyanurate Wall Assemblies: Xci CG and Xci Ply

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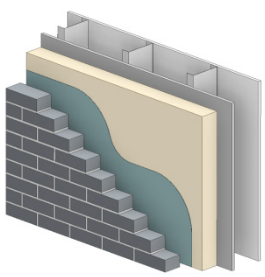
Hygrothermal Analysis

1. EXECUTIVE SUMMARY

This report assesses simulated moisture performance of wall assemblies configured with Hunter's Xci CG and Xci Ply insulation panels applied to conventional steel frame construction. Hygrothermal analyses were performed with WUFI® Pro 5.3 hygrothermal modeling software with the specific objective of demonstrating moisture-resilience for all North American climate zones. The approach emphasized several conservative (worst-case) scenarios to evaluate moisture performance under challenging, but realistic, conditions and stringent failure criteria. The assemblies demonstrated high moisture performance (low moisture risks) for all 19 representative climate locations.

Wall designs were established on the basis of minimum insulation thicknesses complying with current energy codes and climate-based requirements. The assemblies rely exclusively on exterior insulation, which greatly simplifies the wall's overall design while vastly improving moisture performance across most climate zones. Both assemblies also adopt the same permeable weather-resistive barrier. For design flexibility, weather-resistive barriers may vary along a wide moisture permeance range of 10 to >60 U.S. perms. Exterior insulation thicknesses may be increased to accommodate preferred R-values and improved moisture performance.

Hunter Xci CG 2.0*



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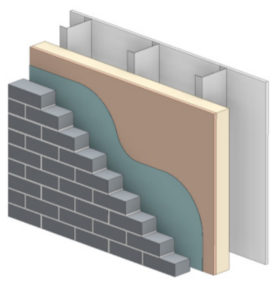
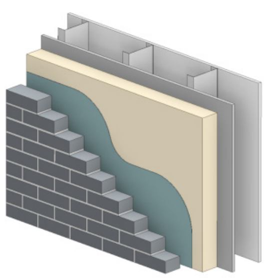
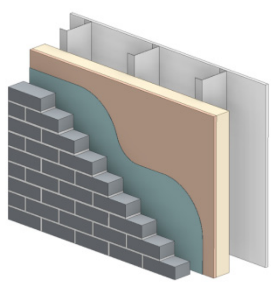
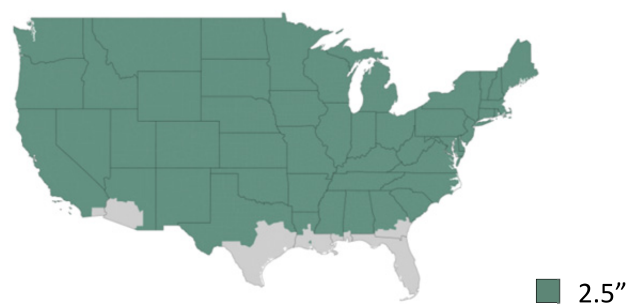


Hunter Xci CG 2.5*

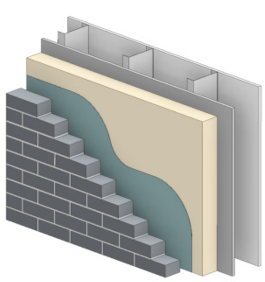


Hunter Xci Ply 2.5*





Hunter Xci CG 3.5*



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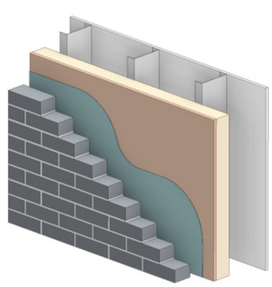
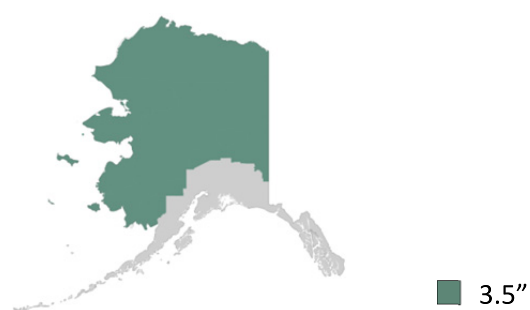




* value refers to insulation thickness only

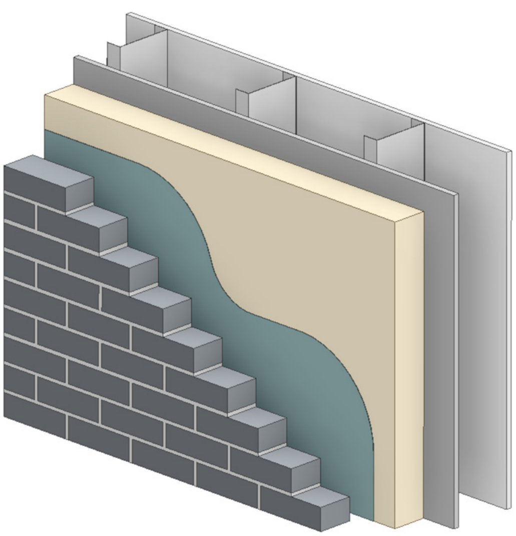
2. APPROACH

Wall Design

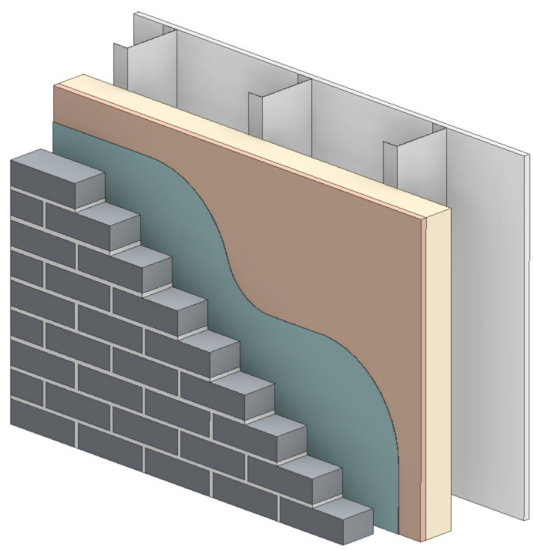
The preferred wall designs are based on Hunter's Xci CG and Xci Ply polyisocyanurate panels applied to 6" steel frame construction. Material properties for the modeled assembly components are contained in Appendix A (Table A-1). Insulation thickness varied from 2 to 3.5 inches on the basis of minimum energy code requirements and respective climate zones. Compliance methods for achieving minimum U-factors are described in the following section.

Preliminary studies and sensitivity analyses evaluated moisture performance under two insulation strategies, including: 1) assemblies that relied solely on exterior insulation; and 2) assemblies that incorporated both exterior and cavity insulation. These earlier studies demonstrated enhanced performance across all climate zones when wall cavity insulation was excluded. Strategies that use a combination of exterior and cavity insulation may still provide acceptable performance; however, such strategies demand modification of the assembly's overall design and further analysis for each climate location. When considering a simplified wall for all climates, exterior insulation offers a preferred core design to which other important components can be applied consistently and without further modification. Each panel product therefore relied on the same design considerations regarding weather-resistive barriers, insulation placement, and interior vapor retarders. The resulting wall designs were highly simplified, varying only in insulation thickness for each climate zone.

Hunter Xci CG



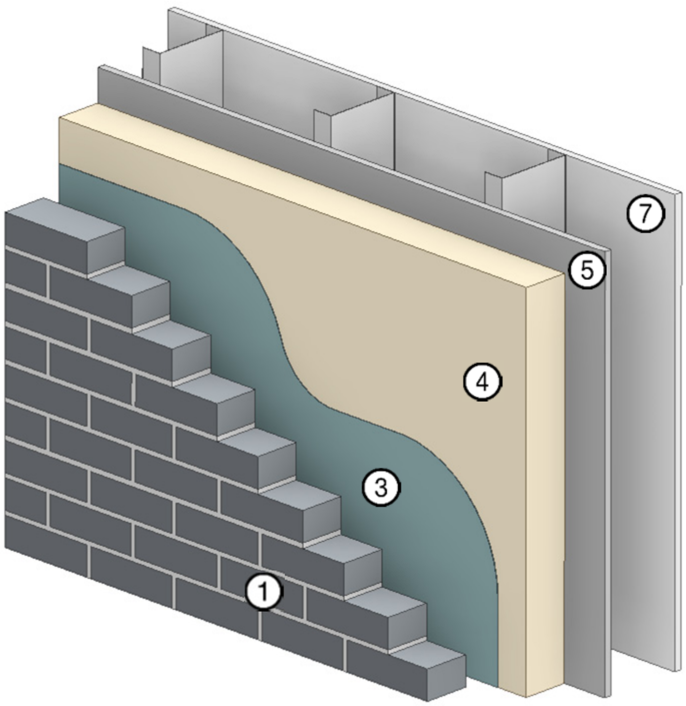
Hunter Xci Ply



Brick veneer was chosen as a representative wall cladding based on its common use in residential and commercial construction. As a moisture-reservoir cladding, it also serves as a conservative (worst-case) condition for moisture-resilient design. In this study, the 1" air space mandated by most jurisdictions was ventilated at a realistic 10 air changes per hour. The intent of this design was to provide a representative, but challenging, enclosure system with conservative assumptions regarding rainscreen ventilation. Prior analyses with other common cladding systems (e.g. metal composite materials, metal, aluminum, terra cotta, stone, stucco, and fiber cement) demonstrate similar or improved results when modeled under the same assumptions and constraints.

2. APPROACH

Hunter Xci CG



1 Brick (3.625”)

2 Ventilated Air Space (1”)

3 Weather-Resistive Barrier (0.039”)

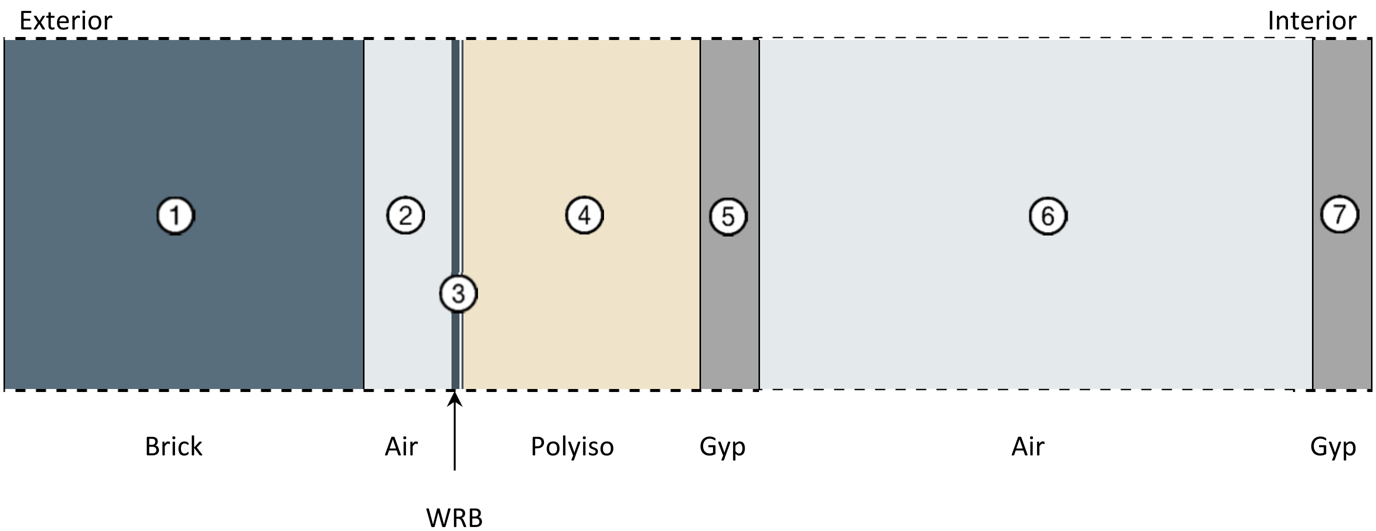
4 Glass Mat-Faced Polyiso. (2” - 3.5”)

5 Gypsum Sheathing (0.625”)

6 Wall Cavity (6”)

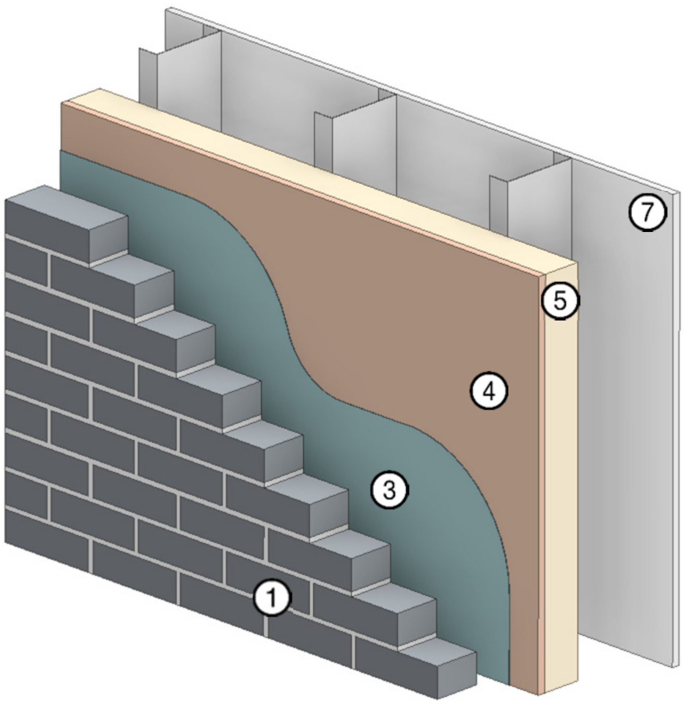
7 Interior Gypsum Wallboard (0.625”)

Xci CG Wall Section



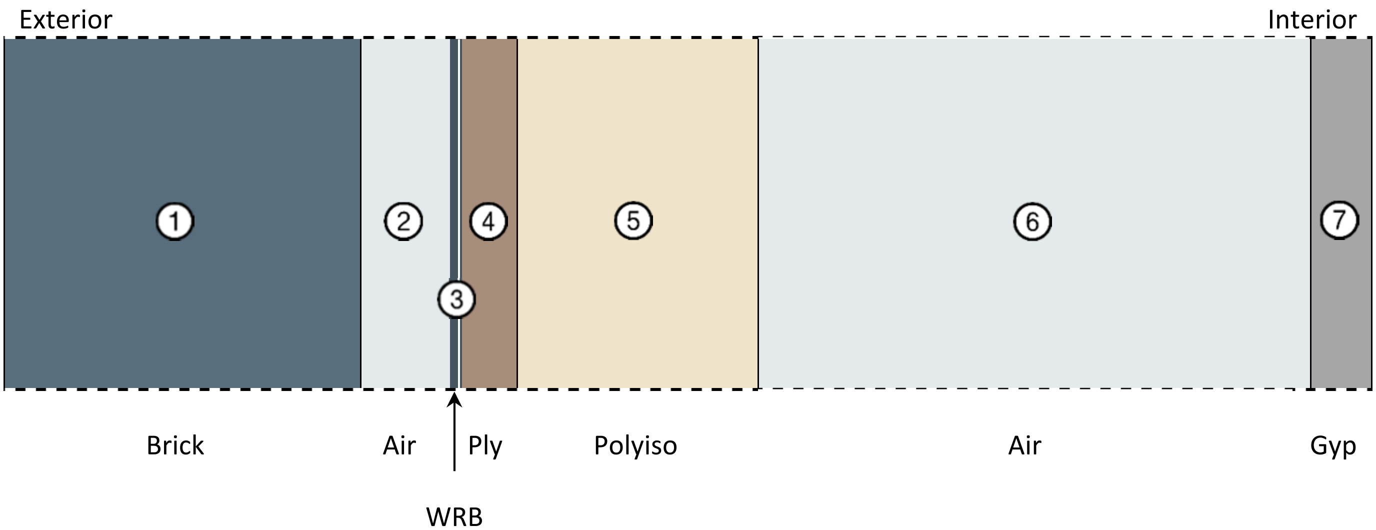
2. APPROACH

Hunter Xci Ply



1 Brick (3.625”)
2 Ventilated Air Space (1”)
3 Weather-Resistive Barrier (0.032”)
4 Plywood Sheathing (0.625”)
5 Glass Mat-Faced Polyiso. (2 – 3.5”)
6 Wall Cavity (6”)
7 Interior Gypsum Wallboard 0.625”)

Xci Ply Wall Section



2. APPROACH

U-Factor Calculations

Assemblies that lack cavity insulation represent a unique condition defined by the International Energy Conservation Code (IECC, 2012; Table C402.1.2) and ASHRAE Standard 90.1, 2013 (Appendix Table A9.2-2). Based on the assumed 16-inch spacing and 6” depth of the steel framing, the empty wall cavity is credited with an R-value of 0.79. This study assumed a conservative approach whereby the outside air film, rainscreen airspace, and cladding are not included in the overall U-factor calculation. The assembly U-factor was determined as follows:

$U_w = 1/[R_s+R_e]$
U_w = U-factor of wall assembly
R_s = R-value of selected elements of the wall, excluding the framing and empty wall cavity
R_e = R-value of the empty wall cavity based on 16 inch metal framing spacing and ASHRAE Standard 90.1 Table A9.2B

Hunter Xci CG 2.0*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Gypsum Sheathing	0.625	0.56
Exterior Insulation	2	12.1
Sum R_w		**14.69**
Sum U_w		**0.068**

Hunter Xci Ply 2.0*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Exterior Insulation	2	12.1
Plywood Sheathing	0.625	0.6
Sum R_w		**14.73**
Sum U_w		**0.068**

Hunter Xci CG 2.5*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Gypsum Sheathing	0.625	0.56
Exterior Insulation	2.5	15.3
Sum R_w		**17.89**
Sum U_w		**0.056**

Hunter Xci Ply 2.5*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Exterior Insulation	2.5	15.3
Plywood Sheathing	0.625	0.6
Sum R_w		**17.93**
Sum U_w		**0.056**

Hunter Xci CG 3.5*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Gypsum Sheathing	0.625	0.56
Exterior Insulation	3.5	21.7
Sum R_w		**24.29**
Sum U_w		**0.041**

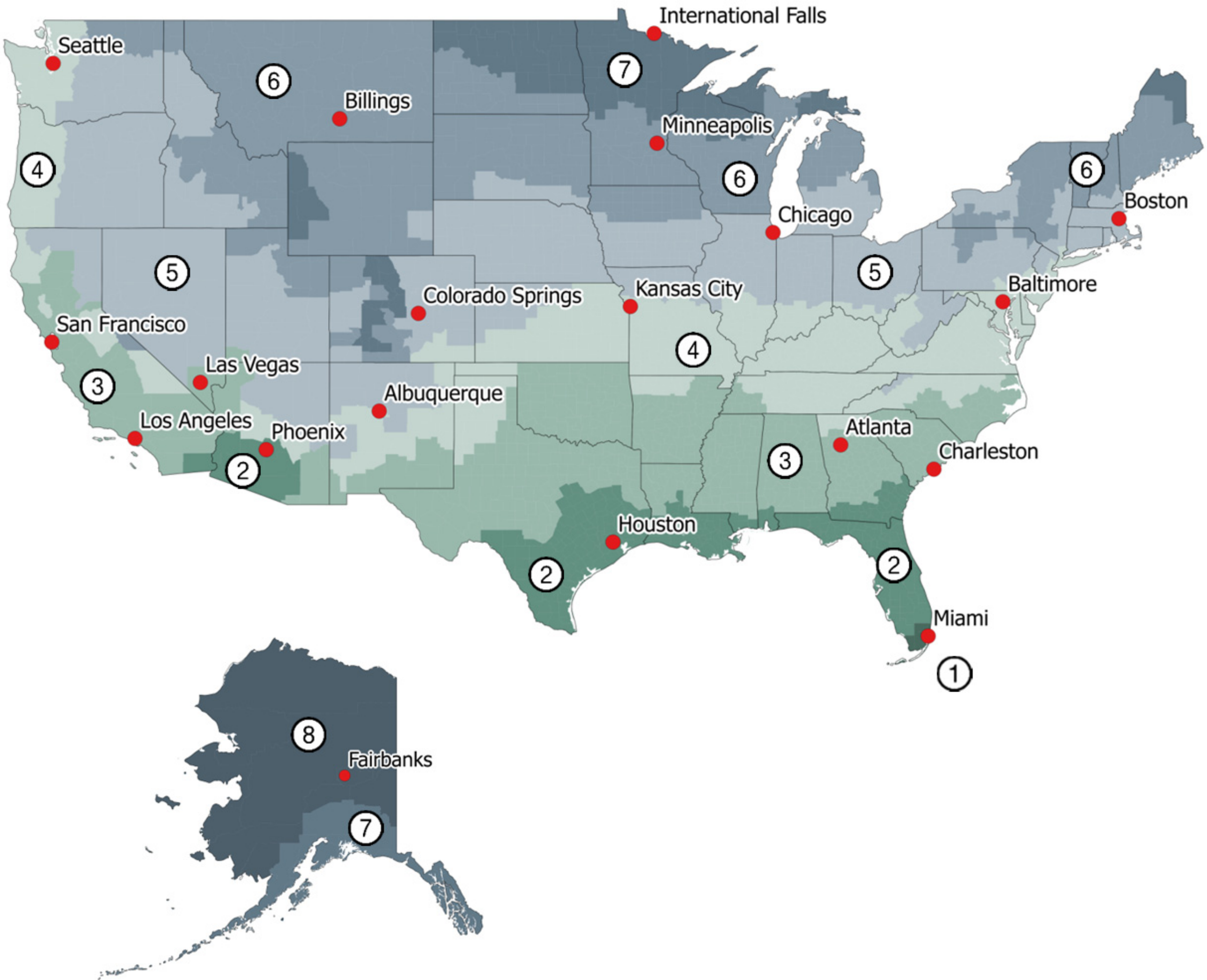
Hunter Xci Ply 3.5*		
Component	Thickness (in)	R-value
Interior Air Film	-	0.68
Gypsum Board	0.625	0.56
Empty Wall Cavity	6	0.79
Exterior Insulation	3.5	21.7
Plywood Sheathing	0.625	0.6
Sum R_w		**24.33**
Sum U_w		**0.041**

* value refers to insulation thickness only

2. APPROACH

Climate Locations

Climates chosen for this study included 19 cities located within the 48 contiguous states and Alaska. This list was modified from the climate locations specified by the Advanced Energy Design Guides to include representative locations with appropriate climate datasets. All ASHRAE climate zones and moisture regimes are represented as illustrated below. Locations and actual weather years from the chosen ASHRAE RP-1325 datasets are also summarized in Appendix B (Table B-3).



2. APPROACH

Exterior Climate Data

Hygrothermal analyses were performed with exterior climate data files provided by WUFI Pro 5.3. Climate datasets used in this study represent worst case scenarios.

Prior to 2012, WUFI data files included 'warm year' and 'cold year' datasets which represented 10-year hourly data provided by the U.S. Department of Energy for the 1961-1990 period of record. These datasets were supplemented with hourly rainfall data, providing hygrothermal years selected from the 10th percentile of the warmest and coolest years. The DOE-WUFI climate files represent composite Hygrothermal Reference Years, not contiguous weather years.

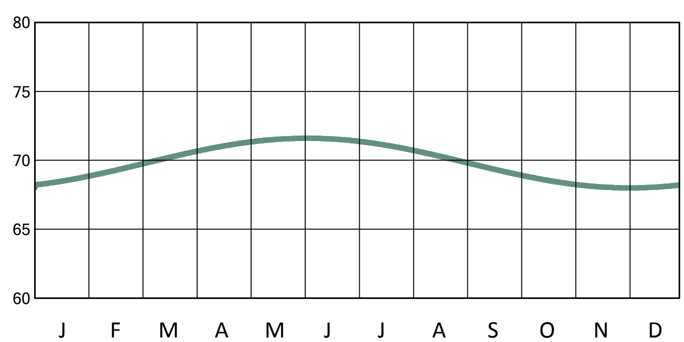
In 2011, ASHRAE RP-1325 developed Moisture Design Reference Years (MDRY) from hourly climate records for 100 locations in the United States and seven locations in Canada. The current data include a collection of three 'worst' years for each location. ASHRAE RP-1325 recommends the third year, which corresponds to the 10th percentile for a 30-year dataset and a severity event that is expected to occur once in every 10 years. It is important to note that these reference years represent Actual Meteorological Years (AMY) comprised from contiguous data for a given location.

Preliminary studies demonstrated similar results when assemblies were modeled with the WUFI cold year and ASHRAE RP-1325 datasets. Results varied largely on the basis of building orientation. Final analyses employed ASHRAE Year 1 datasets. For most locations, Year 1 represented slightly more rigorous climates based on a north building orientation. Selection of ASHRAE's Year 1 datasets was also consistent with this study's emphasis on moisture resilience under conditions that are challenging, yet realistic. It is expected that results derived from the Year 1 datasets represent conservative (worst-case) findings that are similar to WUFI's cold year datasets.

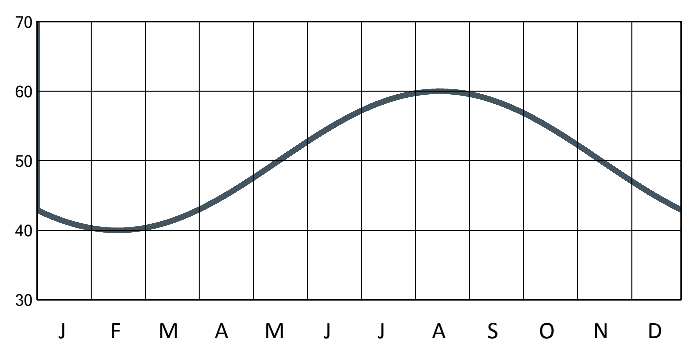
Interior Climate Data

Interior humidity regimes were determined by WUFI's integrated sinusoidal curve, which represents the WTA Guideline 6-2/E. The selected dataset reflects a 'medium' moisture load with a relative humidity of 40% in winter and 60% in summer:

Interior Temperature (°F)



Interior Relative Humidity (%)



2. APPROACH

Additional Model Inputs

Inputs regarding building exposure, moisture sources, surface transfer coefficients, and initial conditions are outlined in Appendix B. These inputs were applied to both wall systems for all climate-based analyses.

Simulations involved five-year calculation periods with initial start times of October 1 (Year 0) and end times of December 31 (Year 5) for a total calculation period of 5 years and 3 months. All results are reported as thirty-day running averages for Year 5.

Design rain loads and rain penetration were consistent with recognized standards for moisture control design analysis as outlined by ASHRAE 160 (2009). A default value of 1% of the driving rain was deposited on the exterior surface of the weather-resistive barrier. The 1% driving rain source was further controlled using WUFI's 'moisture clipping' option set to 'maximum moisture saturation' to simulate provisions for moisture drainage and release.

Performance Criteria & Risk Evaluation

Simulation outcomes were compared to evaluation criteria derived from ASHRAE 160 (2009). These criteria are intended as conservative benchmarks for the prevention of mold and corrosion (Table 2.1).

Wall sheathing and interior gypsum wallboard were selected as reference components to assess the potential for moisture accumulation. Moisture risks were assessed on the basis of surface relative humidity and material moisture content. When determining risks associated with surface relative humidity, WUFI accommodates monitoring positions for any point within a given component layer, which, in this study, included exterior and interior surfaces of wall sheathing and interior gypsum wallboard.

Moisture contents for reference components were determined by sub-dividing each component into three-layers consisting of an exterior domain, a core domain, and an interior domain. Dividing these components into subdomains offers improved moisture responses and more accurate assessment of moisture content as compared to broader distributions over the entire component thicknesses. This study evaluated risks at the exterior and interior domains for each reference component. Water content data were expressed as water density, which is the weight of water (lb) in one ft^3 of building material. Conversion to mass percent is made as follows: Water Density / [Material Density / 100]

Table 2.1 Evaluation Criteria

System / Component	Surface RH 30-Day Running Avg.[1]			Surface RH 7-Day Running Avg.[1]			Surface RH 1-Day Running Avg.[1]			Moisture Content[2] 7-Day Running Avg.		
	Low	Mod.	High	Low	Mod.	High	Low	Mod.	High	Low	Mod.	High
CG												
Gypsum Sheathing[3]	<80%	>80%	>95%	<98%	>98%	>99%	<100%	-	100%	<0.8%	>0.8%	>1%
Interior Wallboard	<80%	>80%	>90%	<98%	>98%	>99%	<100%	-	100%	<0.8%	>0.8%	>1%
								-				
Ply								-				
Plywood Sheathing	<80%	>80%	>90%	<98%	>98%	>99%	<100%	-	100%	<16%	>16%	>20%
Interior Wallboard	<80%	>80%	>90%	<98%	>98%	>99%	<100%	-	100%	<0.9%	>0.9%	>1%

[1] Criteria derived from ASHRAE 160 (2009) based on a temperature range between 41°F (5°C) and 104°F (40°C) during the same running average period.

[2] Criteria based on minimum corresponding surface temperatures of ≥41°F.

[3] Criteria assume glass mat facings on gypsum wall sheathing and demonstrable mold resistance in accordance with ASTM D3273, ASTM G21, or ASTM C1338.

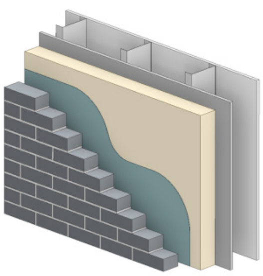
Hygrothermal Analysis

3. RESULTS

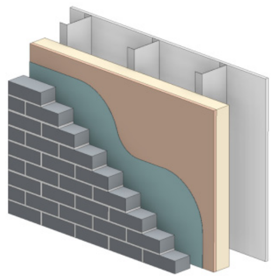
Model outcomes for the CG and Ply assemblies are summarized in Tables 3.1 and 3.2, respectively. Appendix C contains detailed comparative graphs for reference component temperature, relative humidity, and water content. These data represent 30-day running averages for Year 5 for each climate location.

The results demonstrate high moisture performance (low moisture risks) for both assembly systems when simulated under rigorous conditions for all North American climate zones. These findings provide the basis for a simplified prescriptive approach for moisture-resilient design utilizing current code-minimum U-factors. Minimum insulation thicknesses are 2 inches for climate zones 1 and 2; 2.5 inches for climate zones 3-7; and 3.5 inches for climate zone 8. Climate-based recommendations for the simulated Hunter Xci CG and Xci Ply assemblies are illustrated below on the basis of minimum insulation thicknesses.

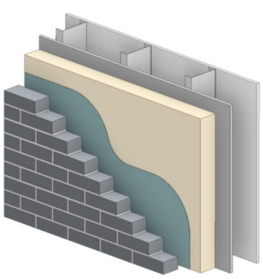
Hunter Xci CG 2.0*



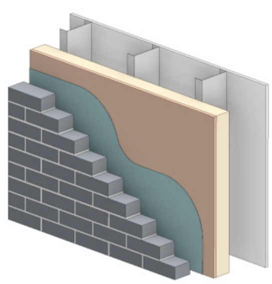
Hunter Xci Ply 2.0*

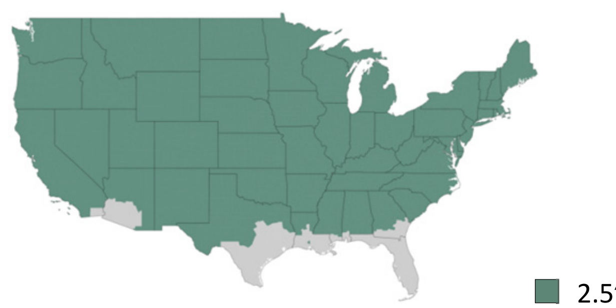


Hunter Xci CG 2.5*

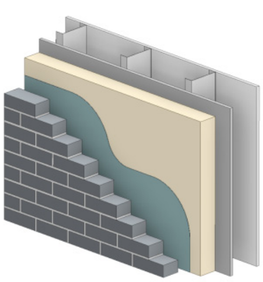


Hunter Xci Ply 2.5*

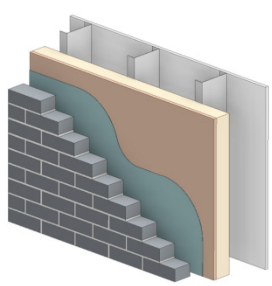


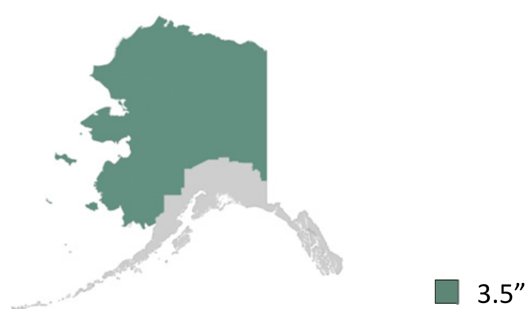


Hunter Xci CG 3.5*



Hunter Xci Ply 3.5*





* value refers to insulation thickness only

3. RESULTS

Table 3.1. Summary Results: Hunter Xci CG					
City	Climate Zone	Insulation Thickness (inches)	Assembly U-Factor	Moisture Risks*	
				Relative Humidity	Moisture Content
Miami, FL	1A	2	0.068	Low	Low
Houston, TX	2A	2	0.068	Low	Low
Phoenix AZ	2B	2	0.068	Low	Low
Atlanta, GA	3A	2.5	0.056	Low	Low
Charleston, SC	3A	2.5	0.056	Low	Low
Los Angeles, CA	3B	2.5	0.056	Low	Low
Las Vegas, NV	3B	2.5	0.056	Low	Low
San Francisco, CA	3C	2.5	0.056	Low	Low
Baltimore, MD	4A	2.5	0.056	Low	Low
Kansas City, MO	4A	2.5	0.056	Low	Low
Albuquerque, NM	4B	2.5	0.056	Low	Low
Seattle, WA	4C	2.5	0.056	Low	Low
Boston, MA	5A	2.5	0.056	Low	Low
Chicago, IL	5A	2.5	0.056	Low	Low
Colorado Springs, CO	5B	2.5	0.056	Low	Low
Minneapolis, MN	6A	2.5	0.056	Low	Low
Billings, MT	6B	2.5	0.056	Low	Low
International. Falls, MN	7A	2.5	0.056	Low	Low
Fairbanks, AK	8	3.5	0.041	Low	Low

* moisture risks are based on referenced evaluation criteria (Table 2.1)

3. RESULTS

Table 3.2 Summary Results: Hunter Xci Ply					
City	Climate Zone	Insulation Thickness (inches)	Assembly U-Factor	Moisture Risks*	
				Relative Humidity	Moisture Content
Miami, FL	1A	2	0.068	Low	Low
Houston, TX	2A	2	0.068	Low	Low
Phoenix AZ	2B	2	0.068	Low	Low
Atlanta, GA	3A	2.5	0.056	Low	Low
Charleston, SC	3A	2.5	0.056	Low	Low
Los Angeles, CA	3B	2.5	0.056	Low	Low
Las Vegas, NV	3B	2.5	0.056	Low	Low
San Francisco, CA	3C	2.5	0.056	Low	Low
Baltimore, MD	4A	2.5	0.056	Low	Low
Kansas City, MO	4A	2.5	0.056	Low	Low
Albuquerque, NM	4B	2.5	0.056	Low	Low
Seattle, WA	4C	2.5	0.056	Low	Low
Boston, MA	5A	2.5	0.056	Low	Low
Chicago, IL	5A	2.5	0.056	Low	Low
Colorado Springs, CO	5B	2.5	0.056	Low	Low
Minneapolis, MN	6A	2.5	0.056	Low	Low
Billings, MT	6B	2.5	0.056	Low	Low
International. Falls, MN	7	2.5	0.056	Low	Low
Fairbanks, AK	8	3.5	0.041	Low	Low

* moisture risks are based on referenced evaluation criteria (Table 2.1)

4. LIMITATIONS & CONSIDERATIONS

General Limitations

These findings demonstrate wall designs that exhibit robust moisture performance across diverse climate zones and moisture regimes. The results are expected to represent reasonable estimations of actual moisture performance under real conditions. Nonetheless, model outcomes and the recommendations derived from these results are based on the specific conditions described in this report including, but not limited to, assembly configurations, climate data, material properties, and specific model inputs. Variations from these expressed conditions may result in outcomes that vary significantly from these results. Sound engineering judgement and case-specific hygrothermal analyses are therefore advised for any such variation in design or model assumption.

Wall Framing

The modeled assemblies represent steel frame construction with an assumed 6-inch wall cavity depth. Preliminary studies demonstrated very similar outcomes with wall cavity depths of 3.5 inches. Either framing width may be used to accommodate specific design preferences. The simulated outcomes also support to use of wood frame construction with nominal framing widths of 4 inches or greater.

U-Factors & Insulation Strategies

The U-factor calculations represent insulation R-values provided by the panel manufacturer. Thermal performance based on long-term thermal resistance of 5.6 per inch, which is a measurement associated with polyiso roof insulation and not applicable to wall insulation, may be used in these assemblies. This reduced resistance still complies with the minimum requirements of IECC 2012 and ASHRAE 90.1 (2013). Exterior insulation thicknesses for the tested assemblies may be increased to accommodate preferred R-values and improved moisture performance for any climate zone. However, strategies that use a combination of exterior and cavity insulation may or may not provide acceptable performance. Such hybrid approaches demand case-specific design analysis for each climate location.

Water-Resistive Barriers

This study recognizes that current construction practices involve a myriad of options for weather-resistive barriers having diverse material properties and, most notably, moisture permeability. The preferred designs for the CG and Ply assemblies incorporated a permeable weather-resistive barrier with a corresponding perm rating of 33 US perms. Sensitivity analyses demonstrated low moisture risks over a wide permeability range corresponding to perm ratings of 7 to >60 perms. Based on the preferred assembly configurations, the recommended moisture vapor permeance should be 10 US perms or greater when tested in accordance with the desiccant method (Method A) of ASTM E96. Selection of appropriate weather-resistive barriers should reflect sound engineering judgment that adequately considers all relevant physical properties and hygrothermal functions.

Design & Construction

The findings and recommendations contained in this report assume sound practices in assembly design and construction that wholly address factors associated with moisture degradation in building enclosures. Conditions such as air leakage, rainscreen design, mechanically-induced pressure differentials, panel joints, and component flashings demand careful consideration. The simulation outcomes in this report assume that no such deficiencies exist that would result in the accumulation of water within assembly components. Specifically, water management practices must ensure continuous drainage planes that divert water to exterior surfaces of the weather-resistive barrier.

Material	Thickness (inches)	Density (lb/ft^3)	Porosity (ft^3/ft^3)	Heat Capacity (Btu/lb°F)	Thermal Conductivity (Btu/h ft^3°F)	Permeability (perm in)
Red Matt Clay Brick	3.625	121	0.217	0.191	0.286	0.935
Air Layer 25 mm*	0.984	0.0812	0.999	0.239	0.0896	253
Weather Barrier	0.039	0.812	0.001	0.549	1.33	1.29
Plywood	0.625	37.5	0.96	0.449	0.0584	0.336
Glass Mat Facer	0.0323	26.9	0.8	0.2	0.1	1.25
Polyisocyanurate	2 – 3.5	1.65	0.99	0.351	0.0139	2.5
Gypsum Board	0.625	53.1	0.65	0.208	0.0942	21.5
Air Layer 150 mm	5.906	0.0812	0.999	0.239	0.543	1,840
Interior Gypsum Board	0.625	39	0.706	0.208	0.0924	18.3

* Rainscreen Air = 25 mm air layer without additional moisture capacity

Table B-1. Building Exposure & Air/Moisture Sources	
Parameter	Value / Condition
Orientation	North
Inclination	90°
Rain Exposure Factor	1.5
Building Height	>20
Exposure Category	Severe
Rain Deposition Factor	0.5
Rainscreen Air Change	10 ACH
Moisture Source	1% Driving Rain*
Moisture Clipping	Yes, Max. Water Content

* ASHRAE 160 (applied to exterior surface of WRB)

Table B-2. Surface Transfer Coefficients & Initial Conditions	
Parameter	Value
Exterior Surface: Heat Transfer	2.99 Btu/h ft^2F
Exterior Permeance	No Coating
Short-Wave Radiation Absorptivity	0.68
Long-Wave Radiation Emissivity	0.9
Explicit Radiation Balance	Yes
Ground Short-Wave Reflectivity	0.2
Adhering Fraction of Rain	0.7
Interior Surface: Heat Transfer	1.41 Btu/h ft^2F
Interior Permeance	7 perms
Initial Condition: RH	80%
Initial Condition: Temperature	68°F

Table B-3. Exterior Climate Data (ASHRAE RP-1325)			
City	Zone	ASHRAE	Actual
Miami, FL	1A	Year 1	1985
Houston, TX	2A	Year 1	1973
Phoenix, AZ	2B	Year 1	1984
Atlanta, GA	3A	Year 1	1964
Charleston, SC	3A	Year 1	1964
Las Angeles, CA	3B	Year 1	1977
Las Vegas, NV	3B	Year 1	1989
San Francisco, CA	3C	Year 1	1962
Baltimore, MD	4A	Year 1	1989
Kansas City, MO	4A	Year 1	1985
Albuquerque, NM	4B	Year 1	1978
Seattle, WA	4C	Year 1	1990
Boston, MA	5A	Year 1	1972
Chicago, IL	5A	Year 1	1990
Colorado Springs, CO	5B	Year 1	1961
Minneapolis, MN	6A	Year 1	1983
Billings, MT	6B	Year 1	1964
International Falls, MN	7A	Year 1	1964
Fairbanks, AK	8	Year 1	1962

Interior Climate Data (WTA Guideline Sine Curve)

Figure C-1. Temperature (°F)

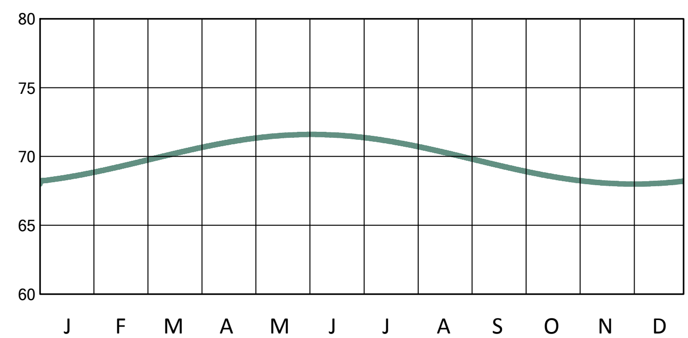
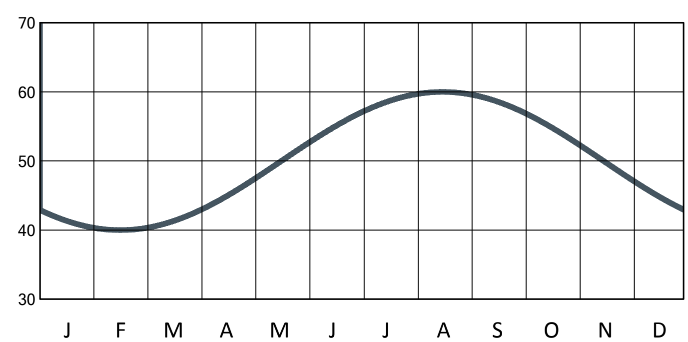


Figure C-2. Relative Humidity (%)



Results for each climate location are summarized in Appendix C. Temperature, relative humidity, and moisture contents for selected referenced components were monitored over a five-year period. Each graph represents results for Year 5 expressed as thirty-day running averages. Moisture performance may be evaluated by comparing these data to the evaluation criteria contained in Table 2.1. It should be noted that data intervals along the vertical (y) axis vary between the CG and Ply systems.

Interpreting the Results

A. Each graph contains data for four reference components:
1) exterior domain of wall sheathing
2) interior domain of wall sheathing
3) exterior domain of interior gypsum wallboard
4) interior domain of interior gypsum wallboard

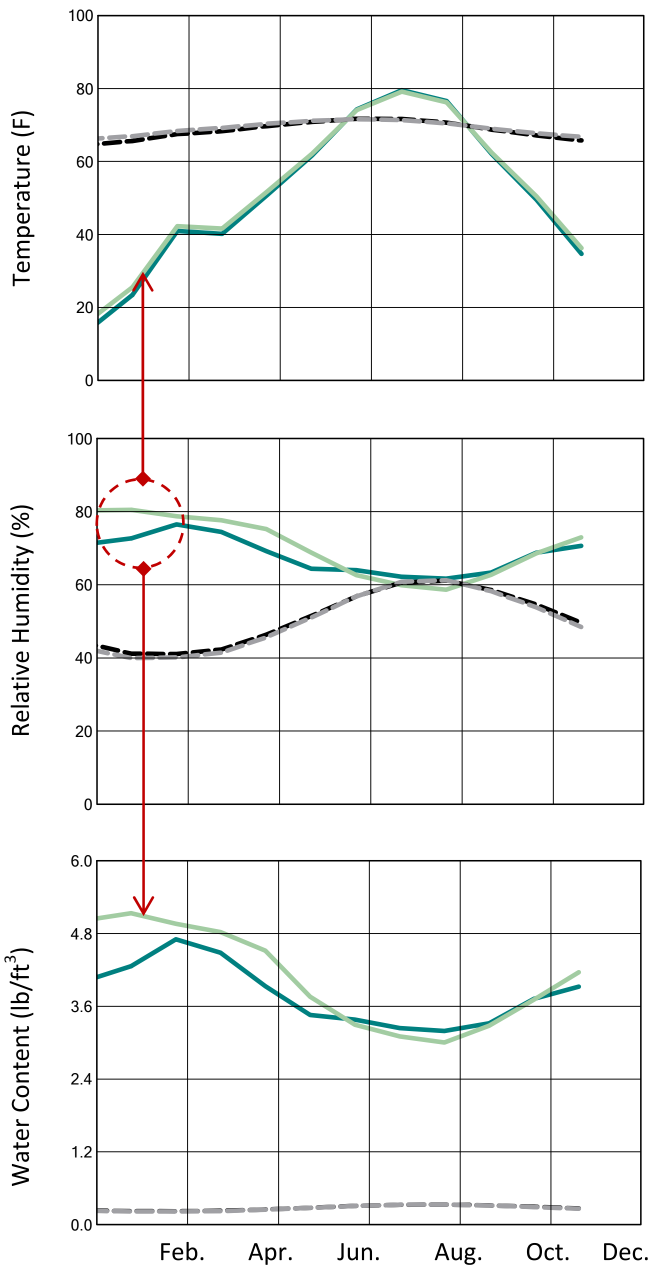
B. Data points for each condition (i.e. Temperature, Relative Humidity, and Moisture Content) reflect the same time period. In this example, relative humidity during January and February at the interior domain of wall sheathing was approximately 80%. The corresponding temperature during that same period was less than 40°F. The corresponding moisture content at the interior domain of wall sheathing was approximately 5 lb/ft^3.

C. Water content data are expressed as water density, which is the weight of water (lb) in one ft^3 of building material. Conversion to mass percent is made as follows:

Water Density / [Material Density / 100]

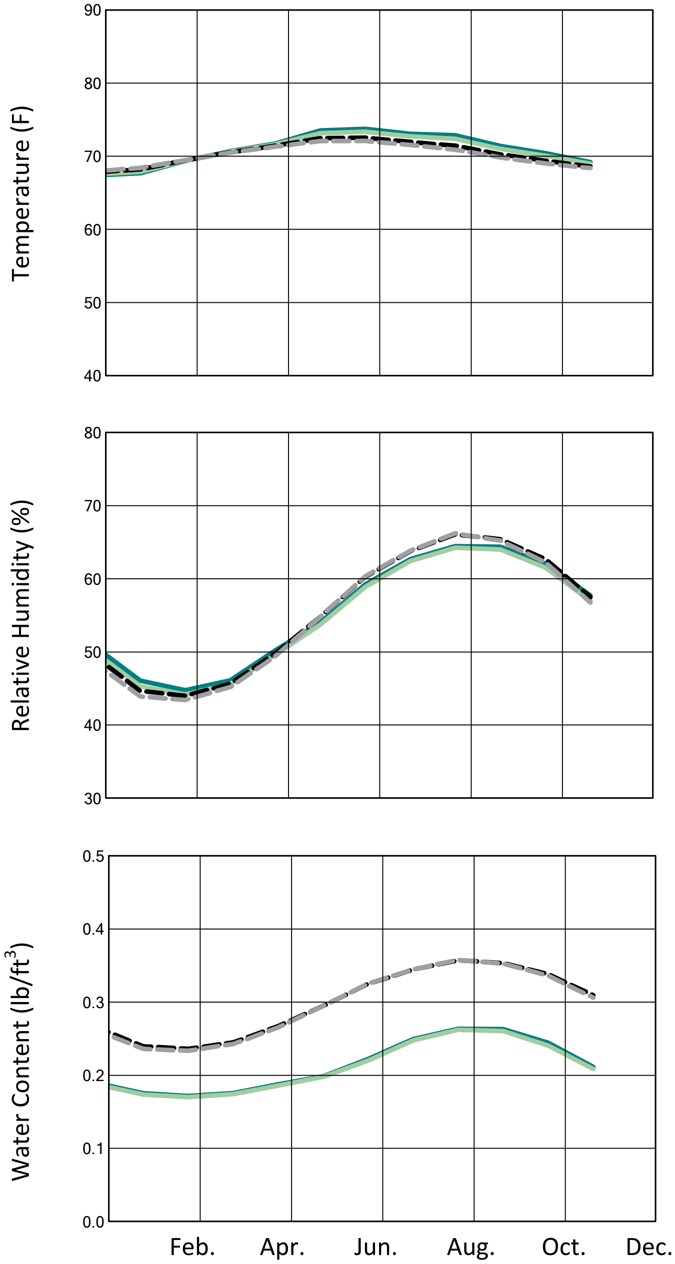
In this particular example, the sheathing represents plywood with a density of 37.5 lb/ft^3: 5 lb/ft^3 / [37.5 lb/ft^3 / 100] = 13%

D. Table 2.1 contains evaluation criteria for assessing moisture risks. Moisture risks associated with relative humidity or moisture content are temperature-dependent. The interpretation of risks should therefore consider temperature at the corresponding period of time.

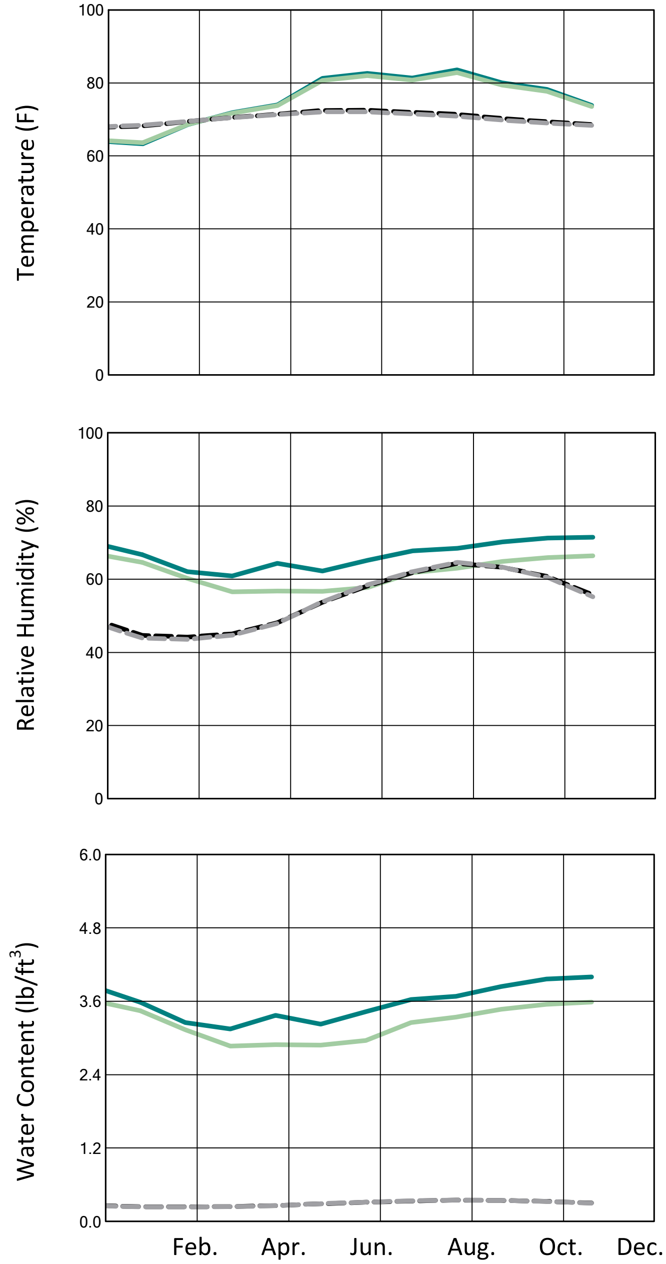


Hygrothermal Analysis

Hunter Xci CG 2.0



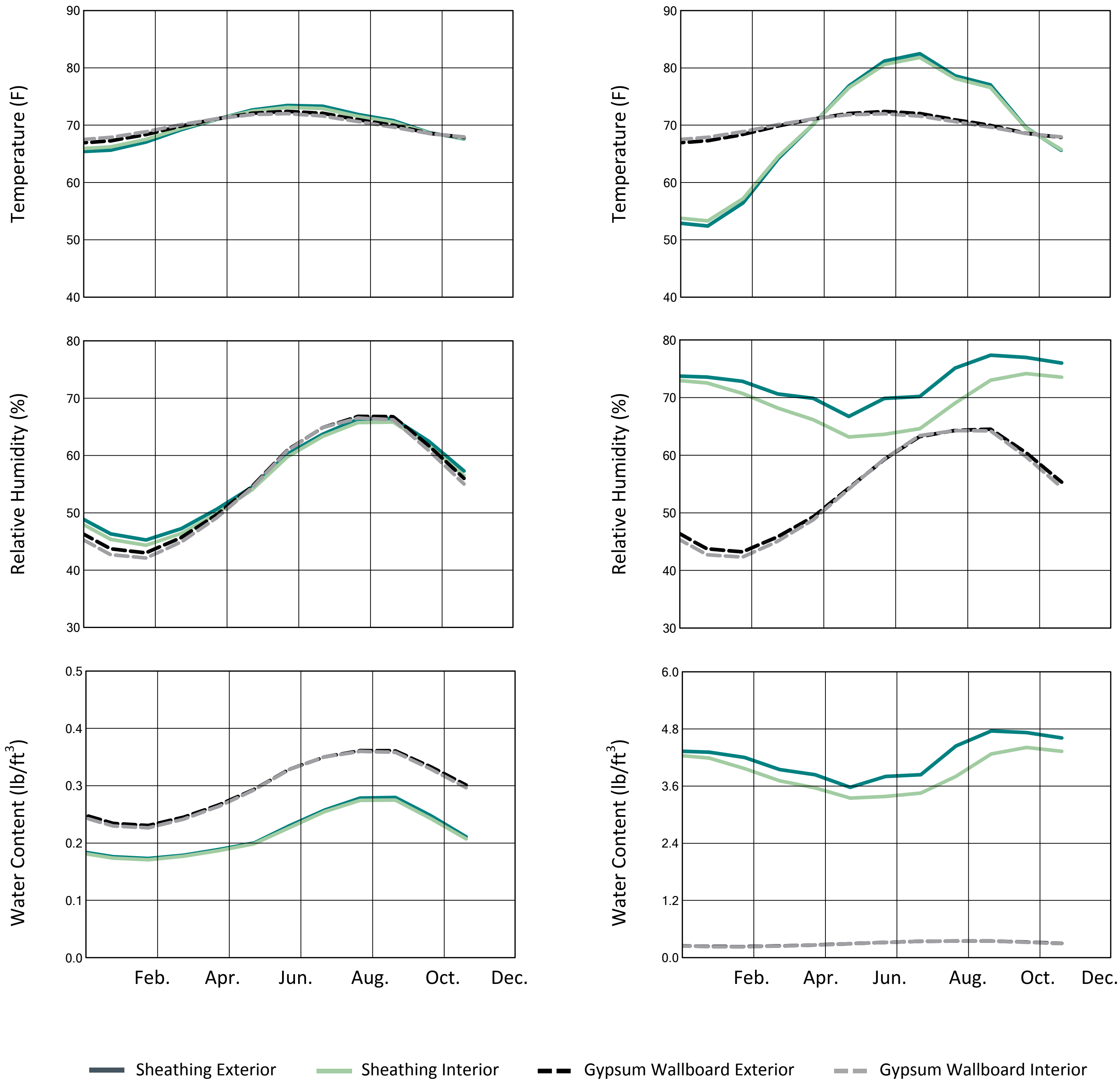
Hunter Xci Ply 2.0



Sheathing Exterior Sheathing Interior Gypsum Wallboard Exterior Gypsum Wallboard Interior

Hygrothermal Analysis

Hunter Xci CG 2.0 | Hunter Xci Ply 2.0



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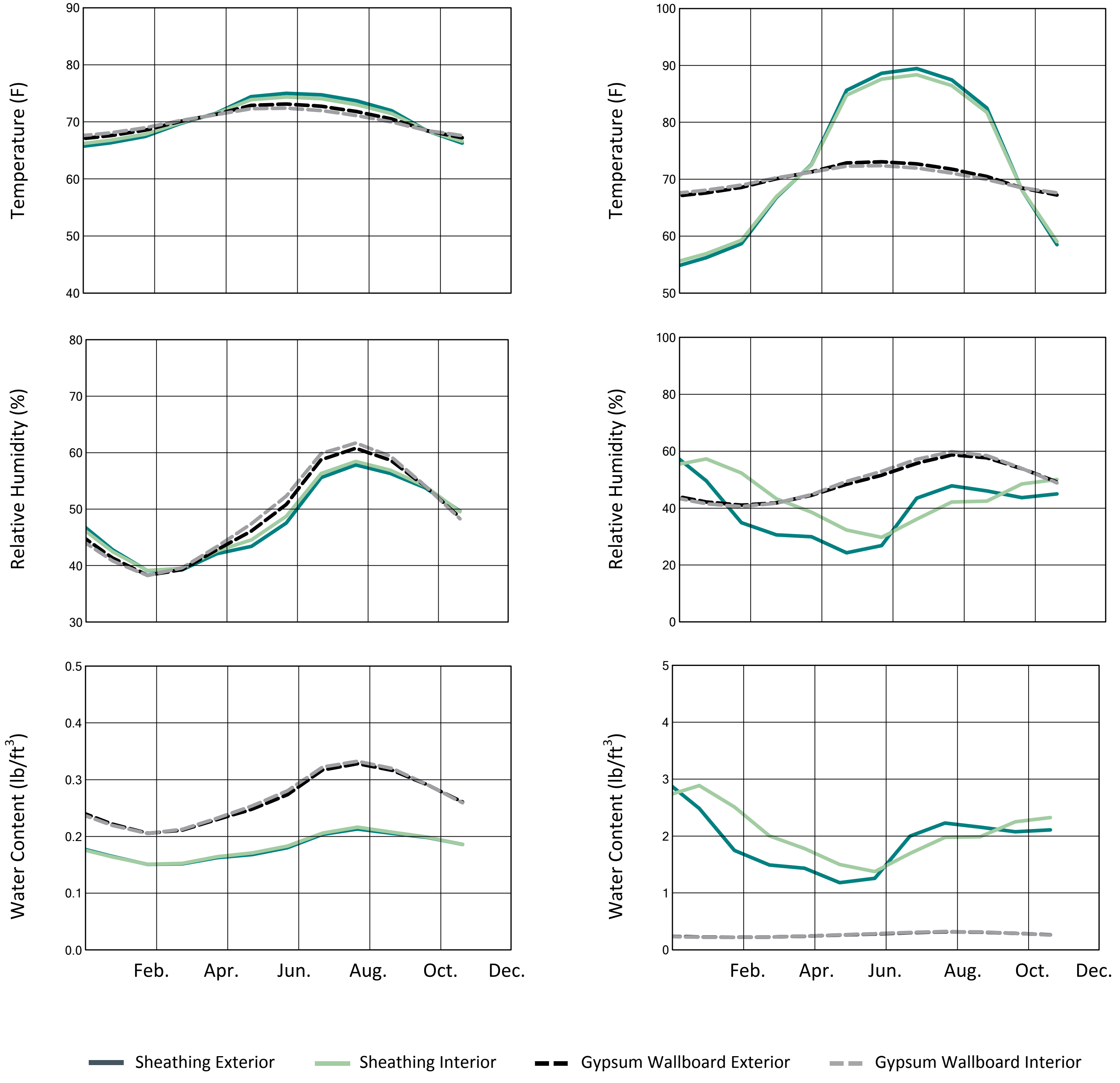
Hunter Xci Ply 2.0



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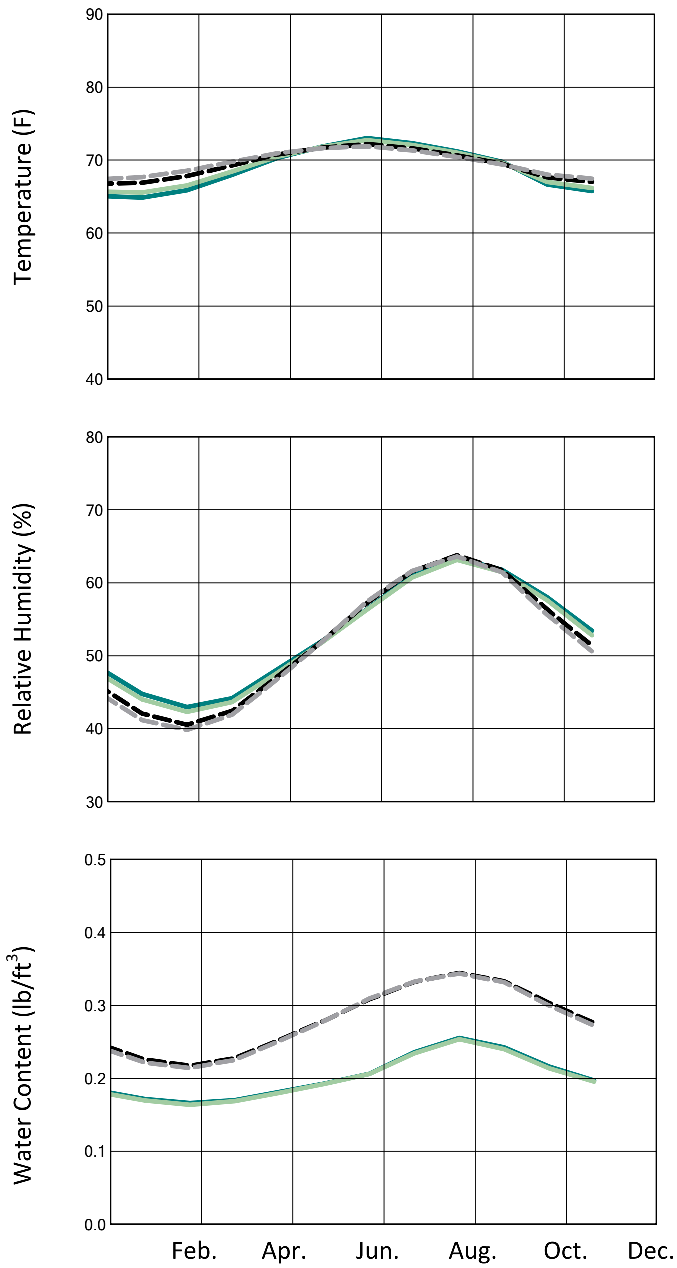

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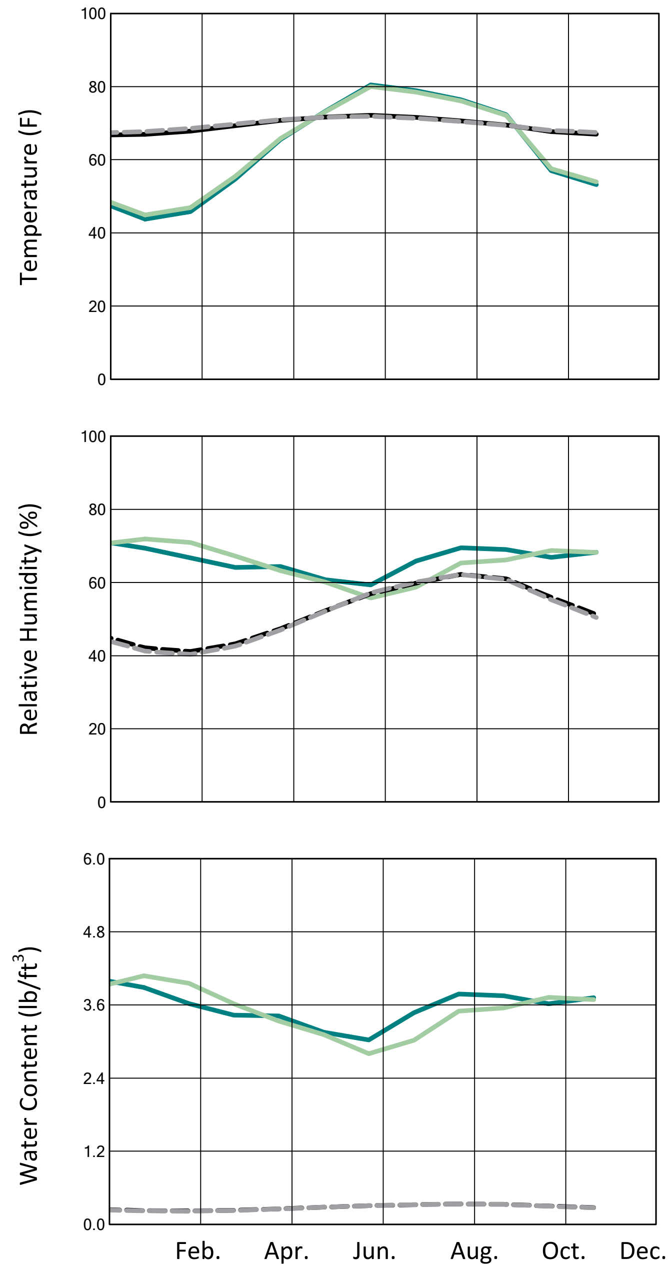

Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

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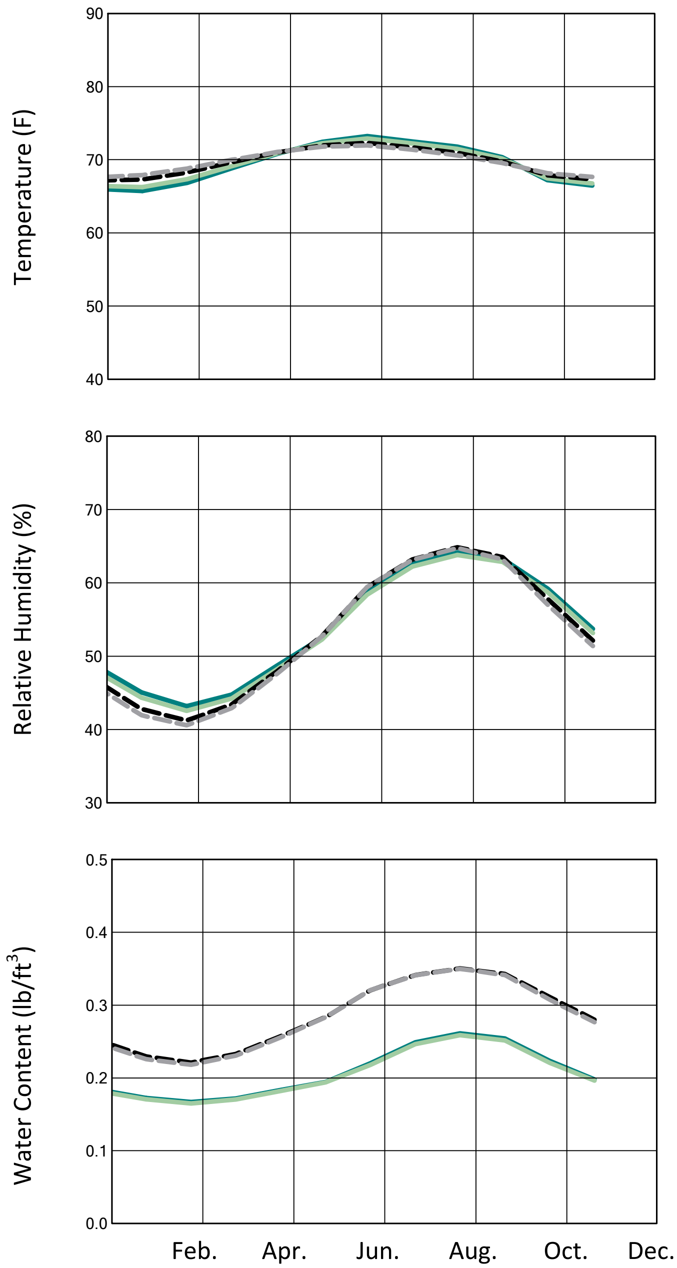

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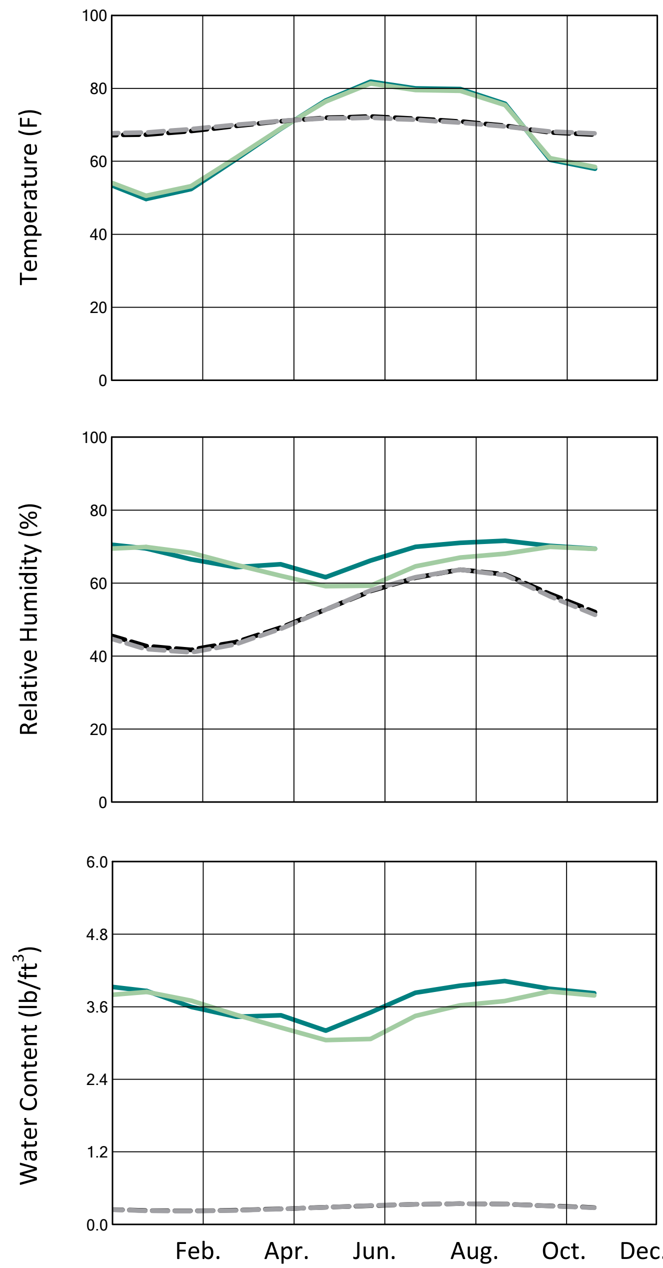

Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

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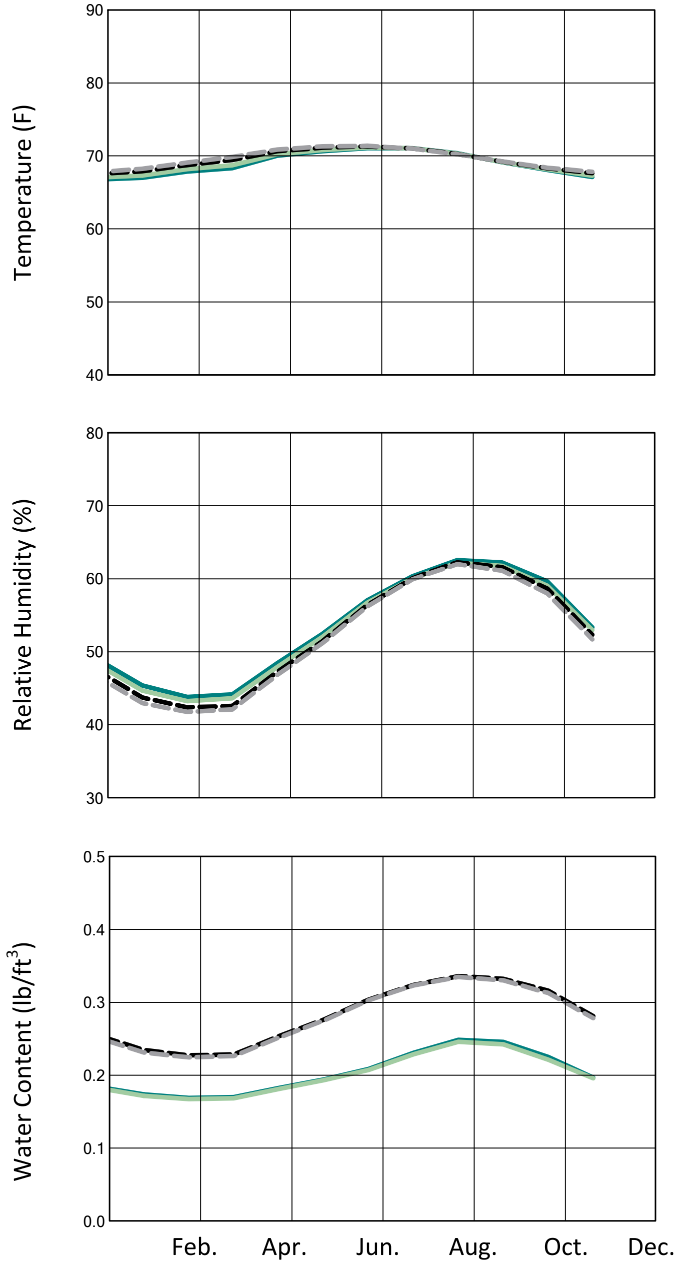

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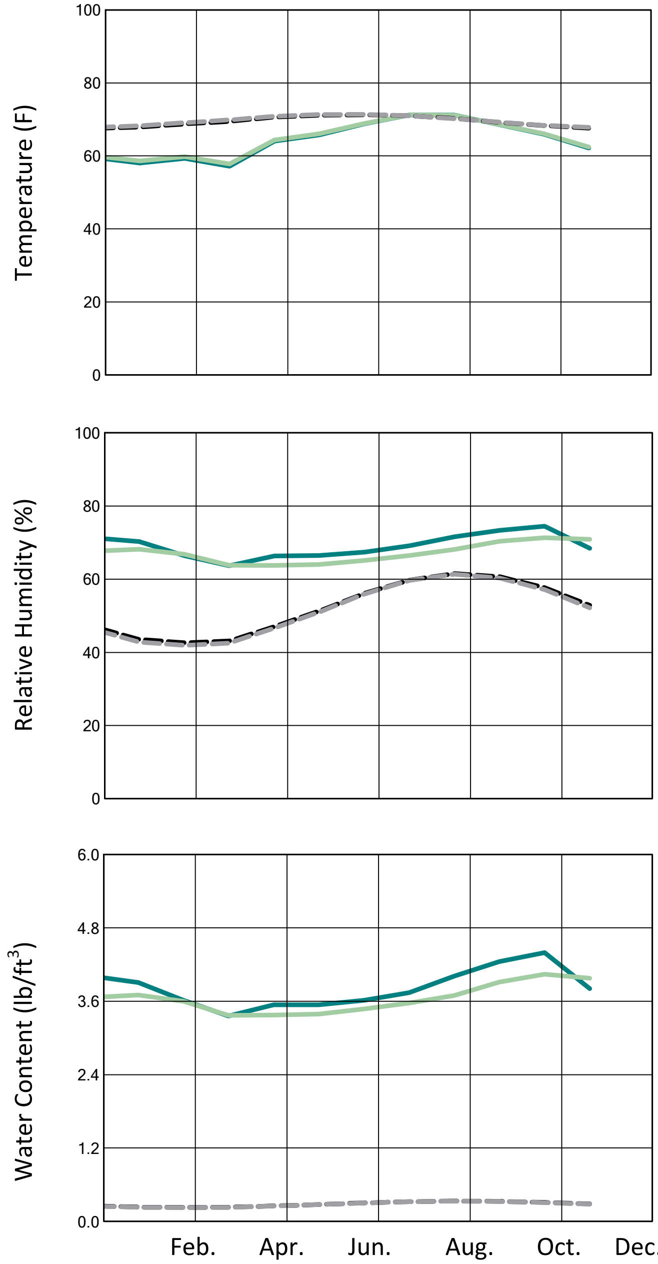

Sheathing Exterior   Sheathing Interior   Gypsum Wallboard Exterior   Gypsum Wallboard Interior

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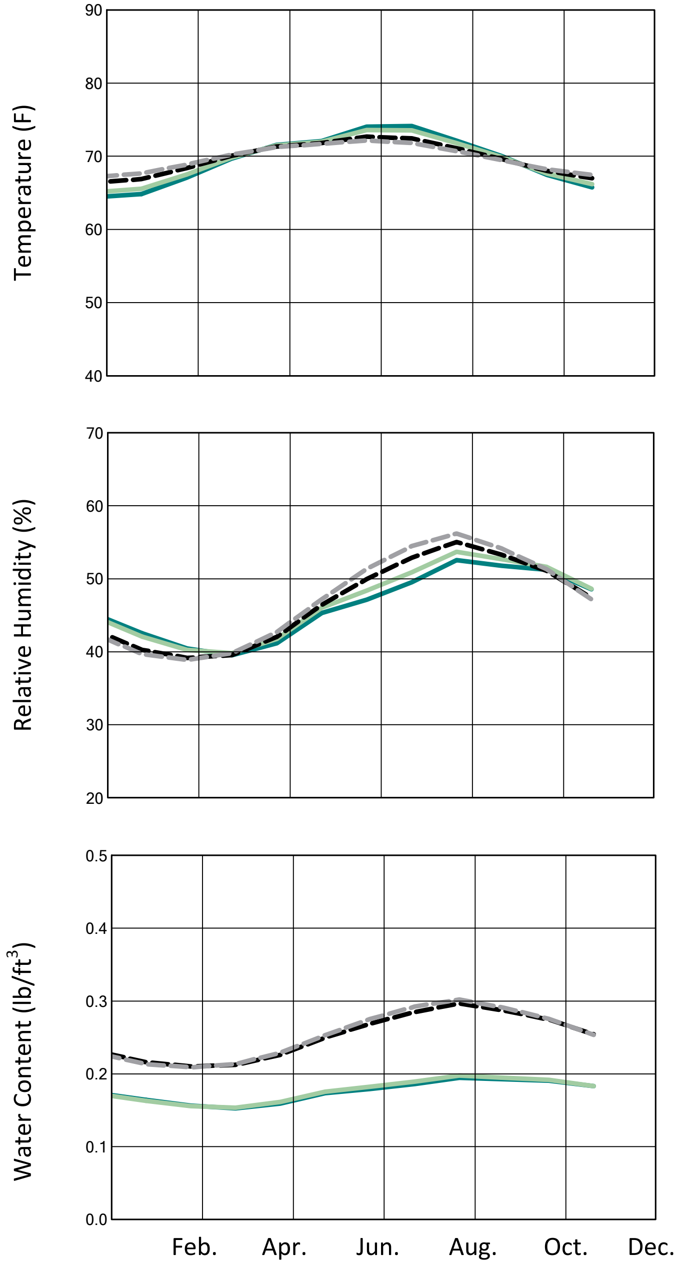

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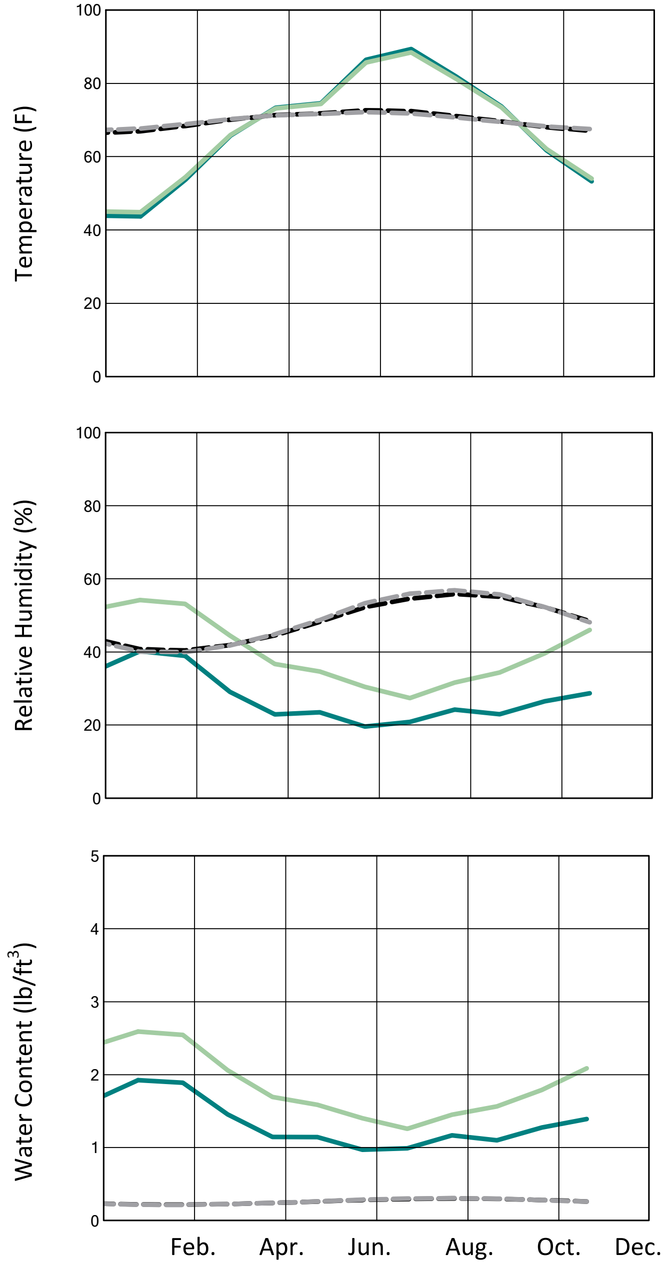

Sheathing Exterior   Sheathing Interior   Gypsum Wallboard Exterior   Gypsum Wallboard Interior

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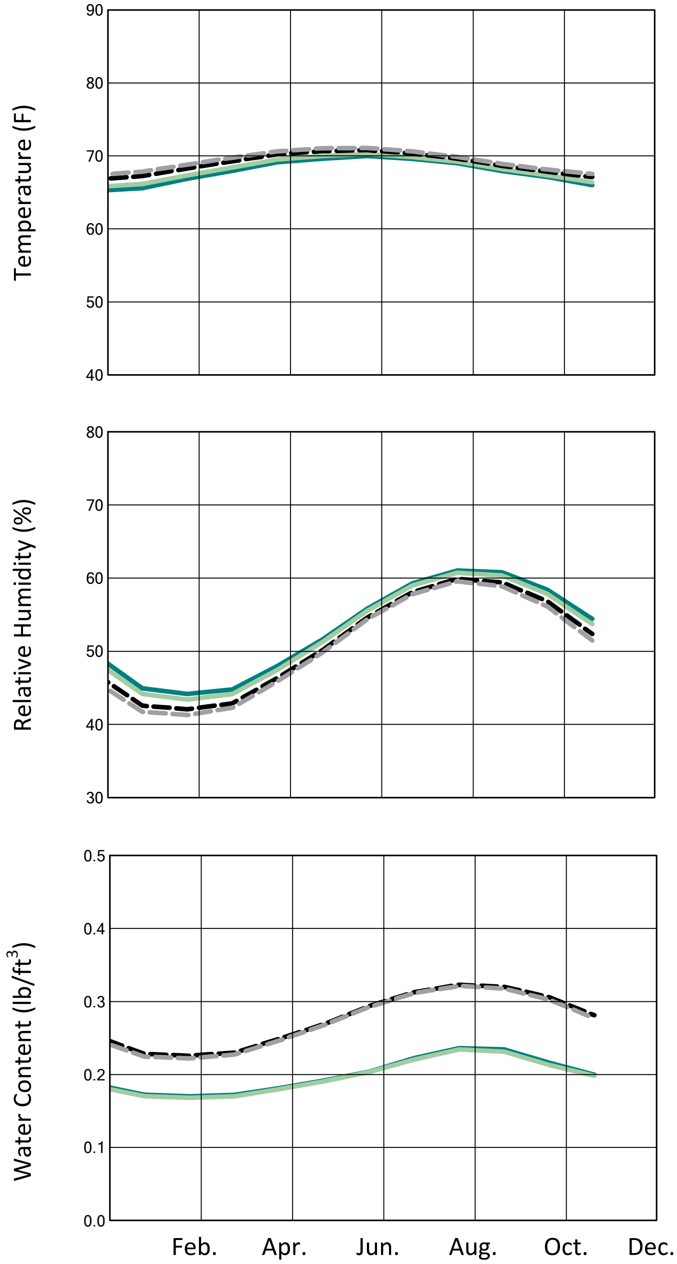

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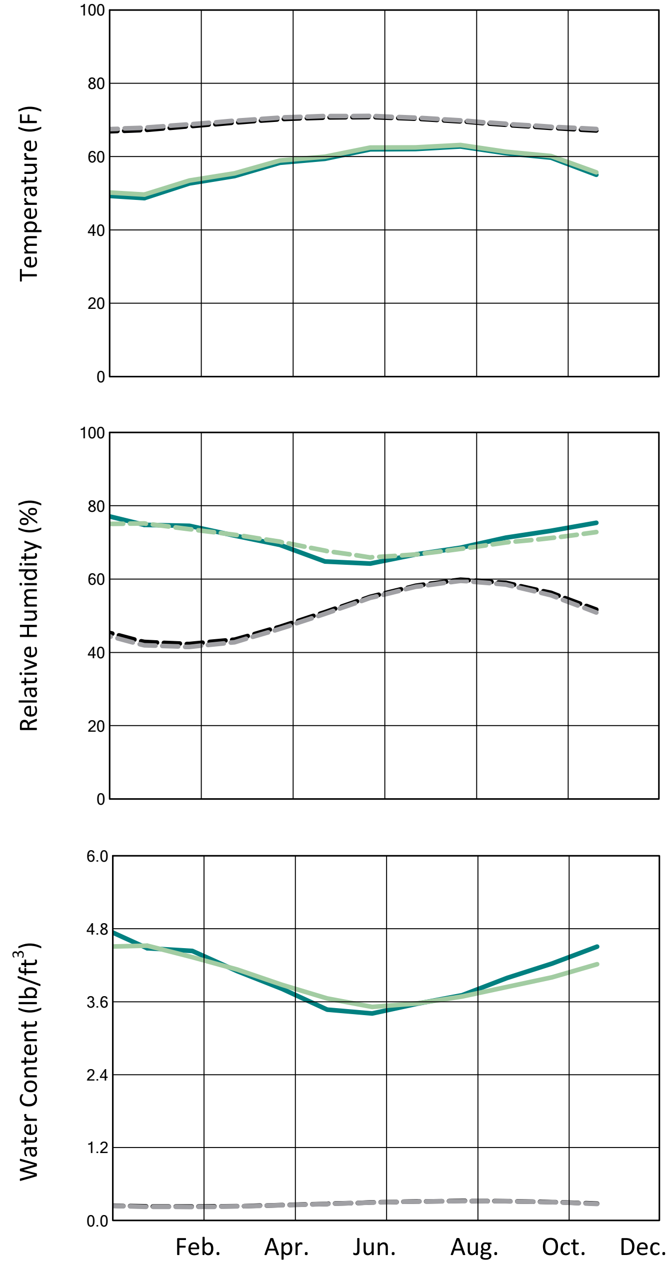
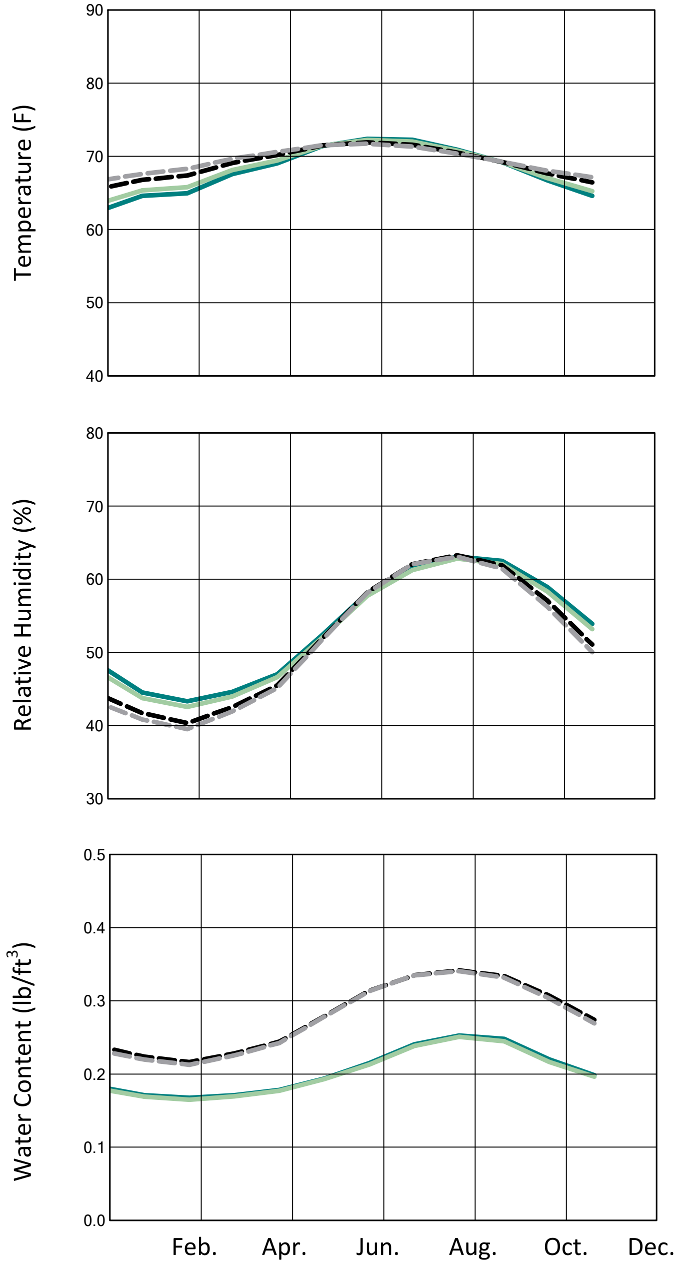


Sheathing Exterior   Sheathing Interior   Gypsum Wallboard Exterior   Gypsum Wallboard Interior

Hunter Xci CG 2.5



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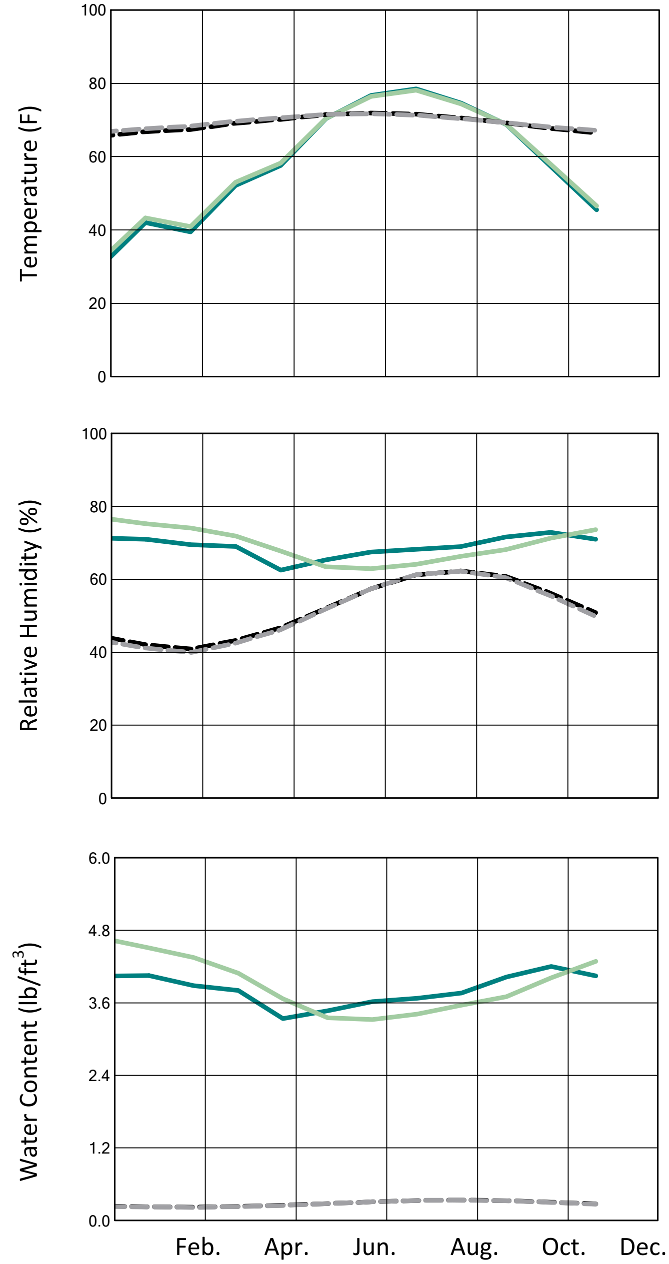

Sheathing Exterior   Sheathing Interior   Gypsum Wallboard Exterior   Gypsum Wallboard Interior

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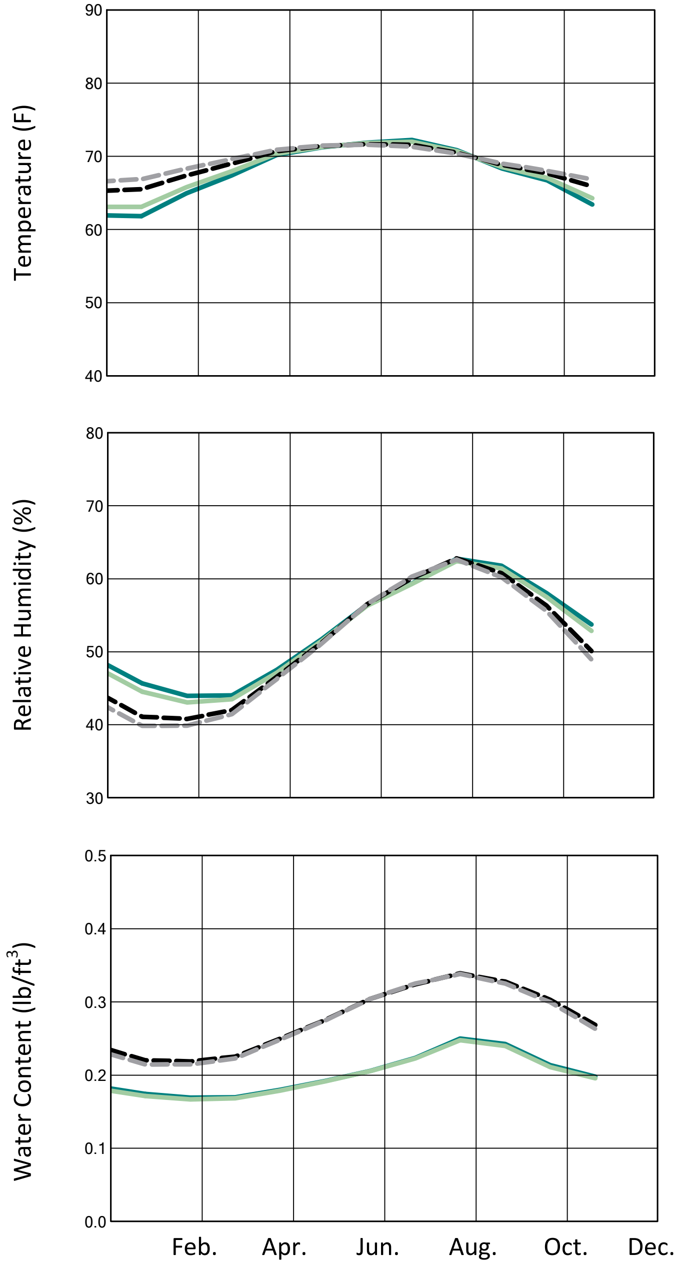

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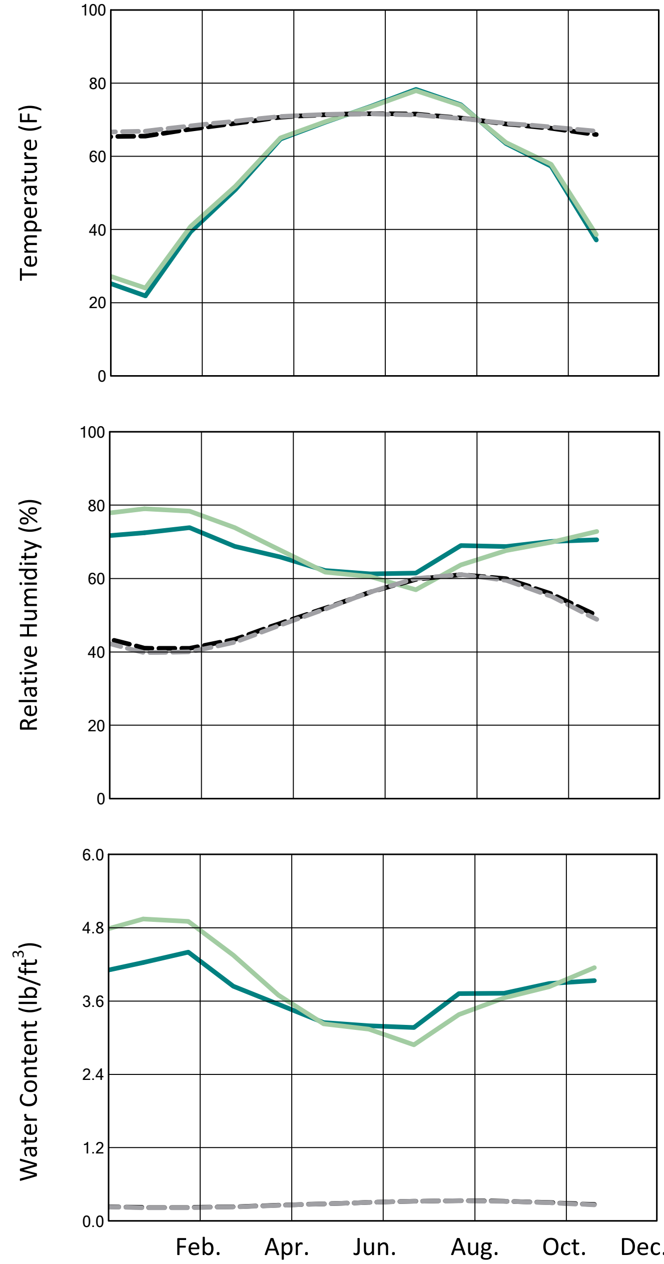
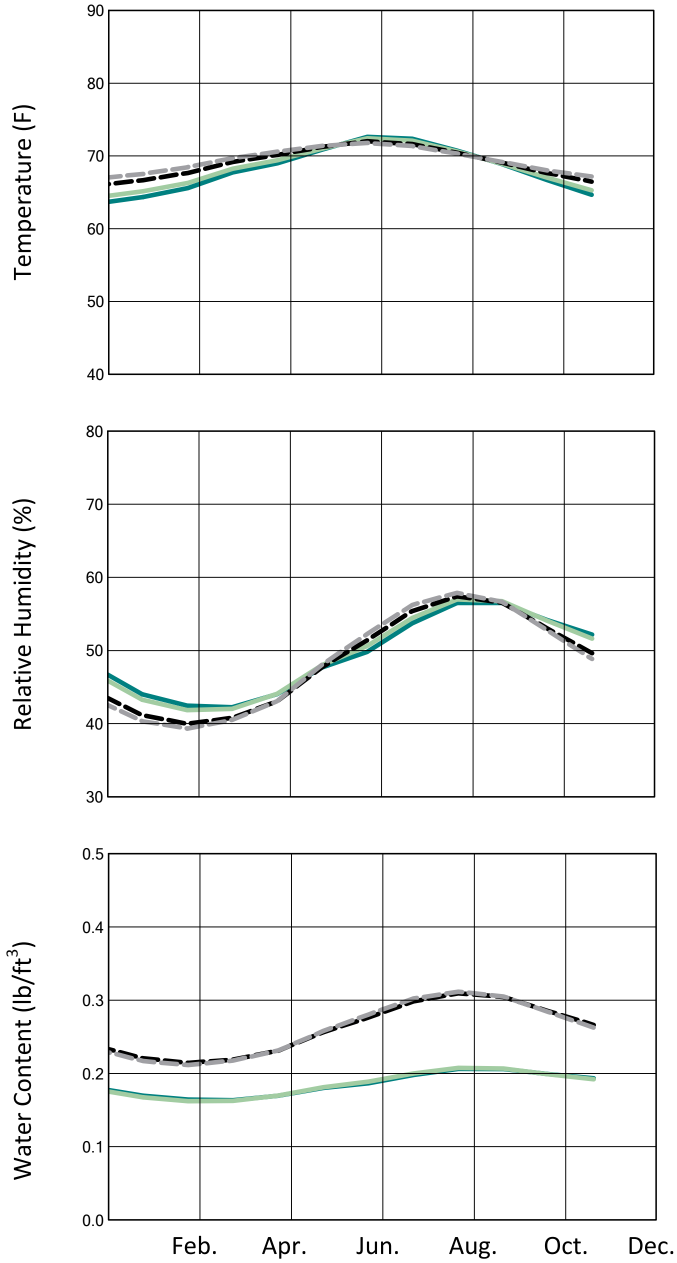


Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

Hygrothermal Analysis

Hunter Xci CG 2.5



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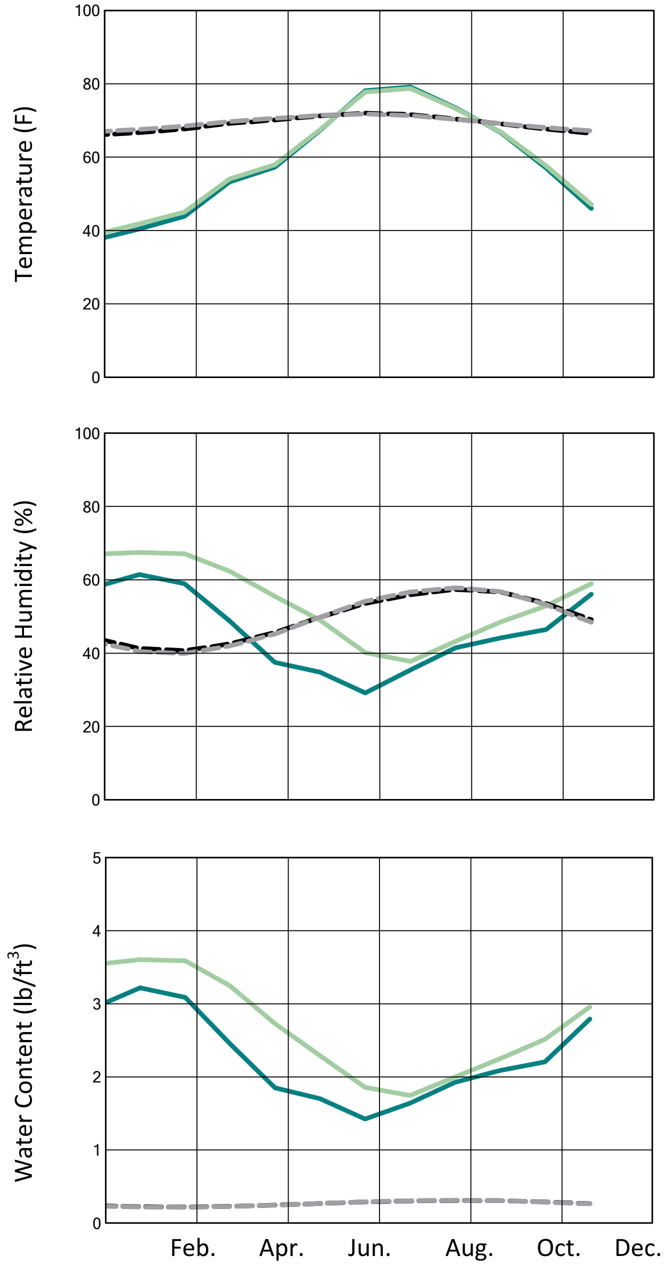

Sheathing Exterior | Sheathing Interior | Gypsum Wallboard Exterior | Gypsum Wallboard Interior

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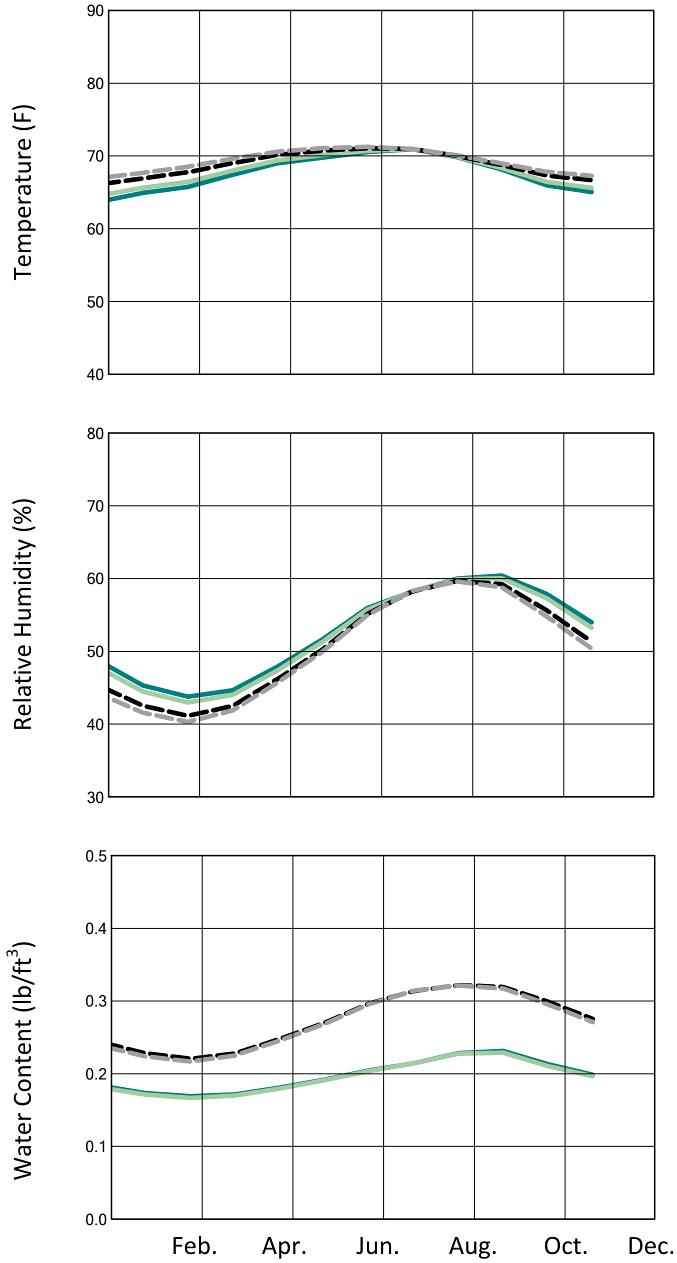

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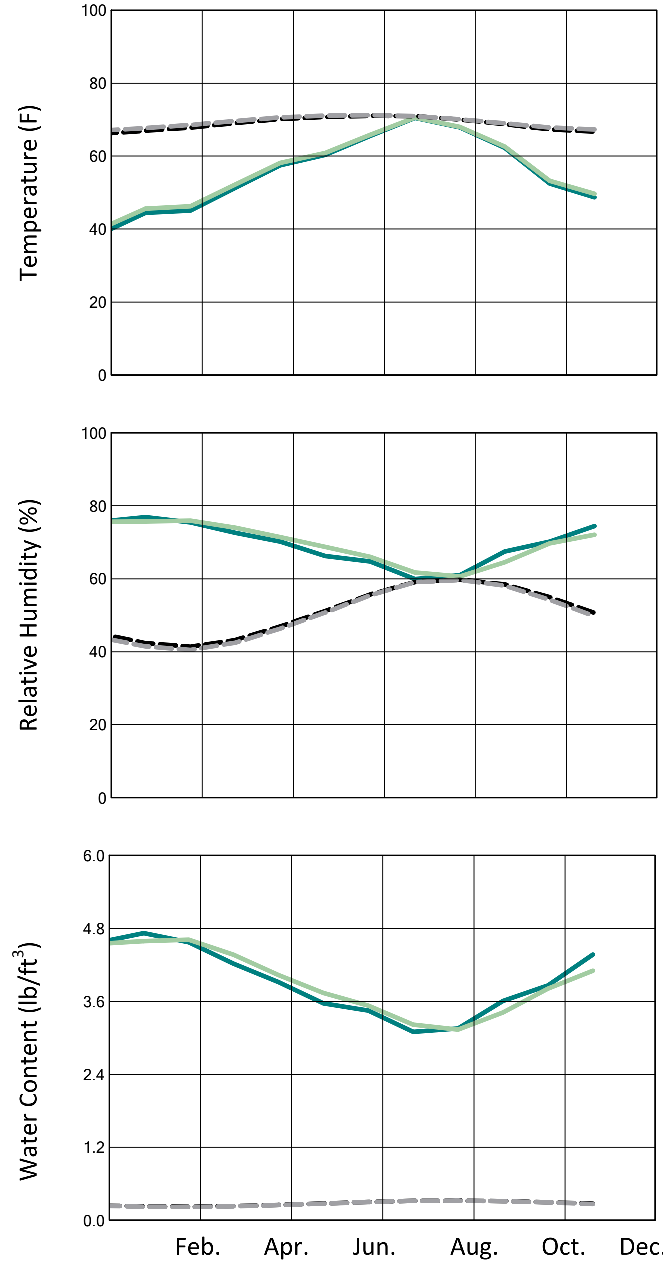

Sheathing Exterior | Sheathing Interior | Gypsum Wallboard Exterior | Gypsum Wallboard Interior

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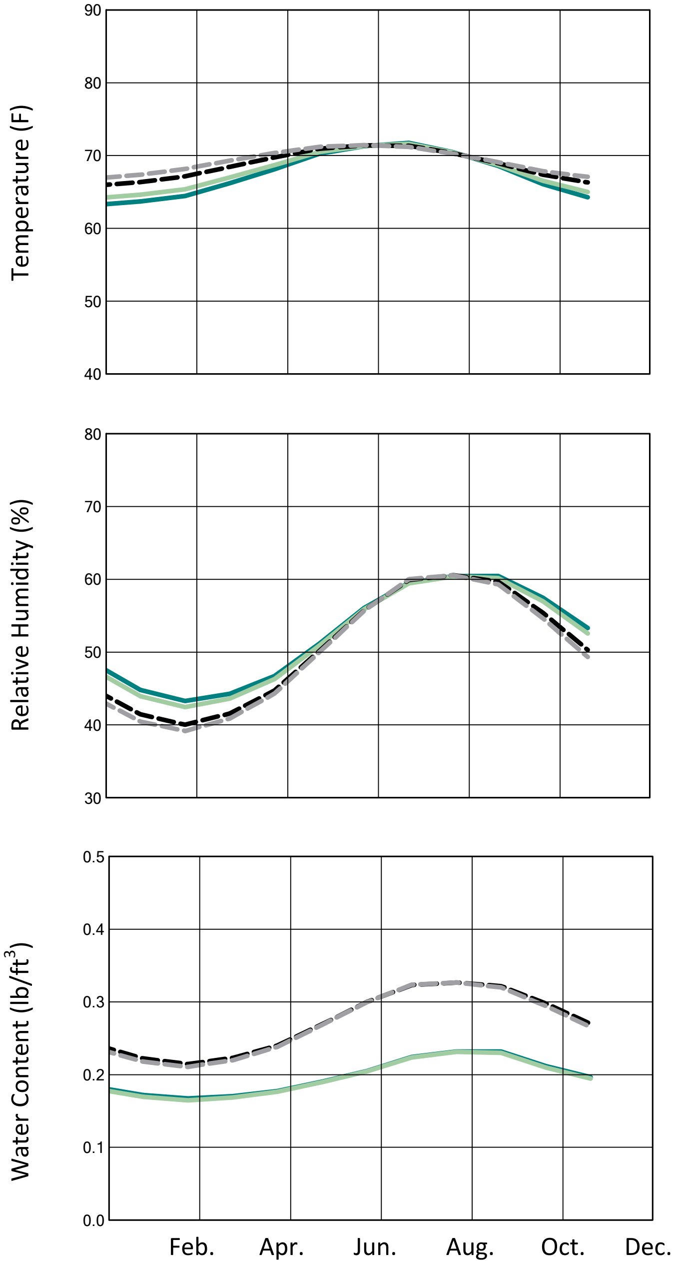

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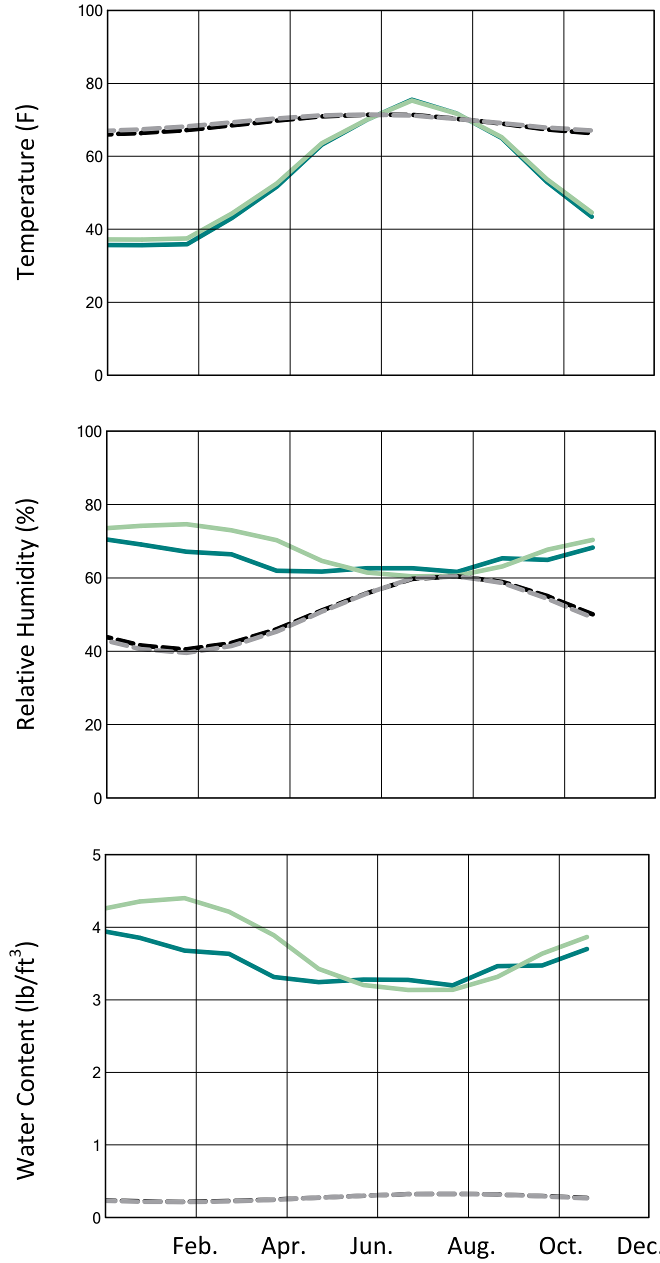

Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

Hygrothermal Analysis

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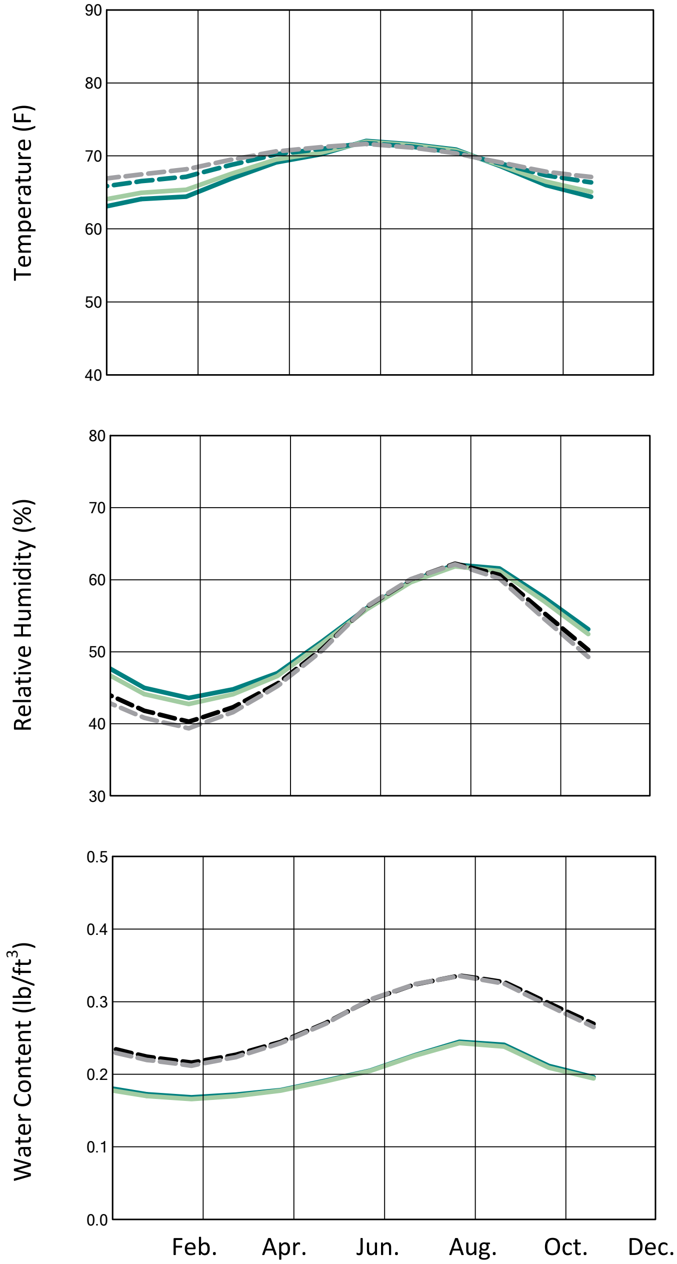

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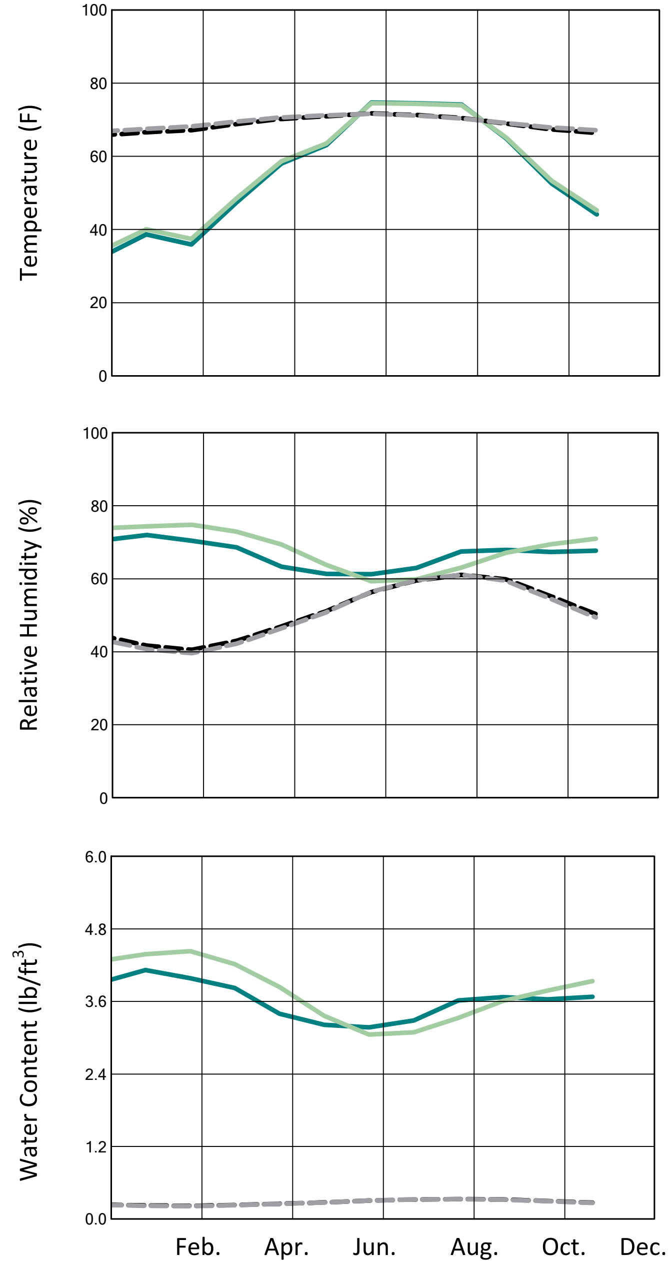

Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

Hygrothermal Analysis

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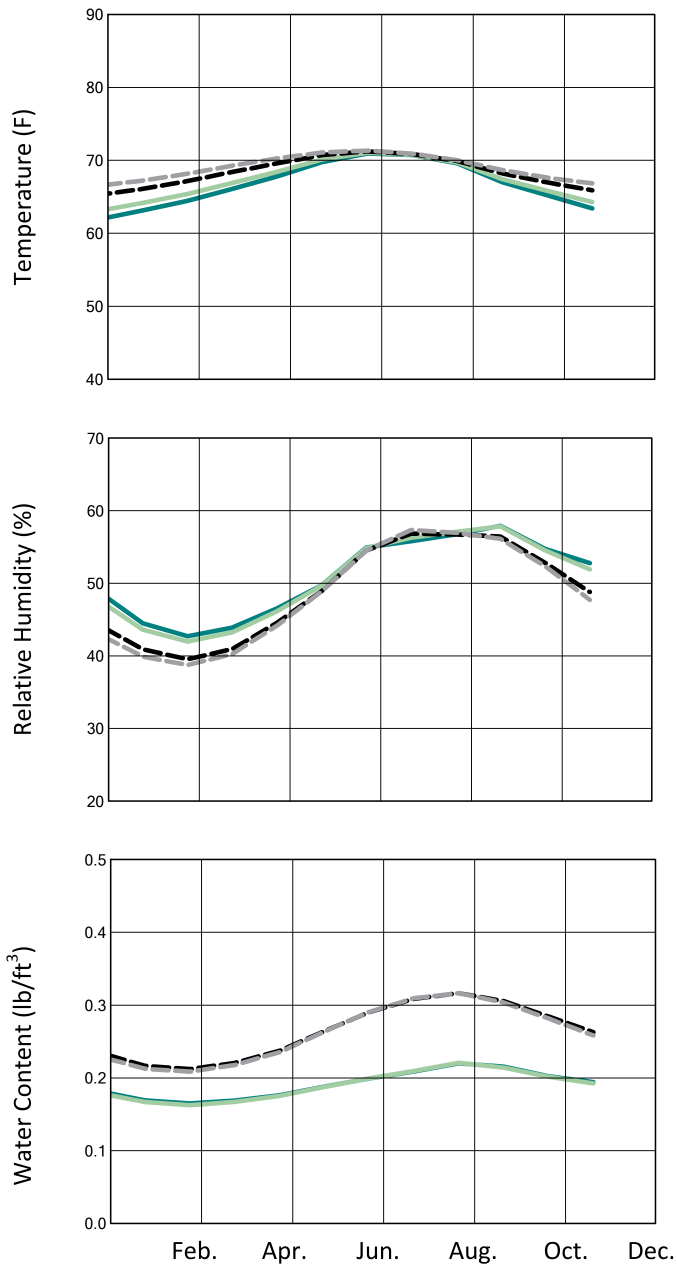

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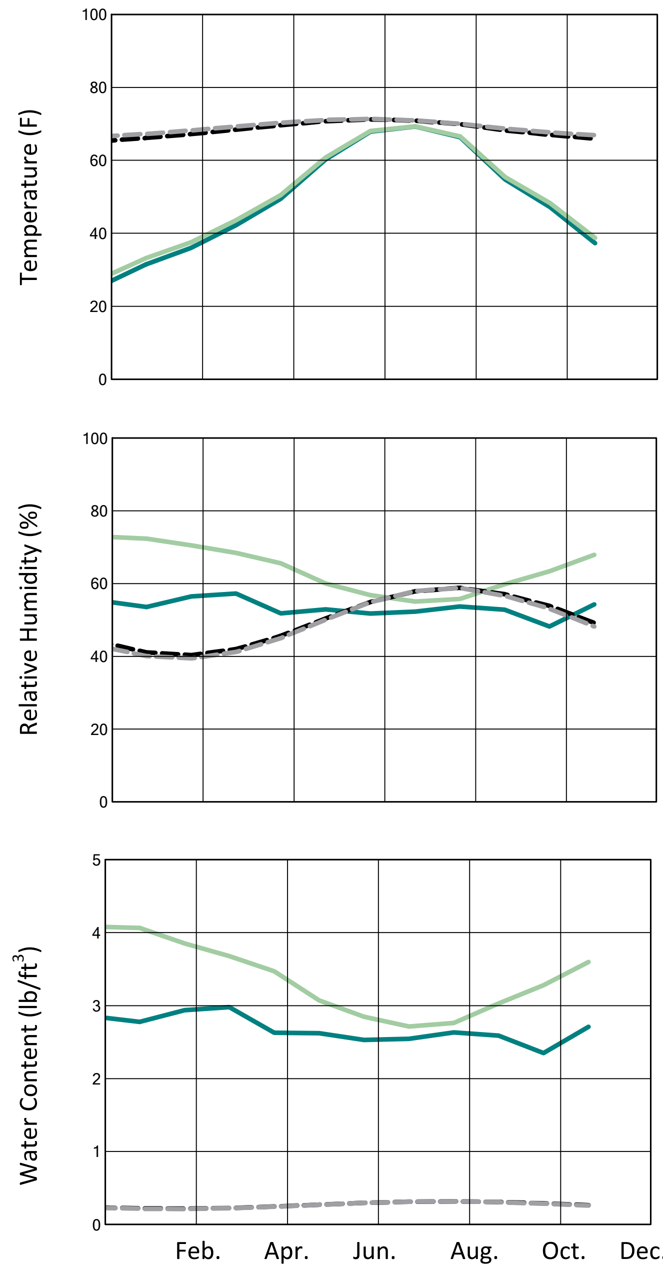

Sheathing Exterior Sheathing Interior Gypsum Wallboard Exterior Gypsum Wallboard Interior

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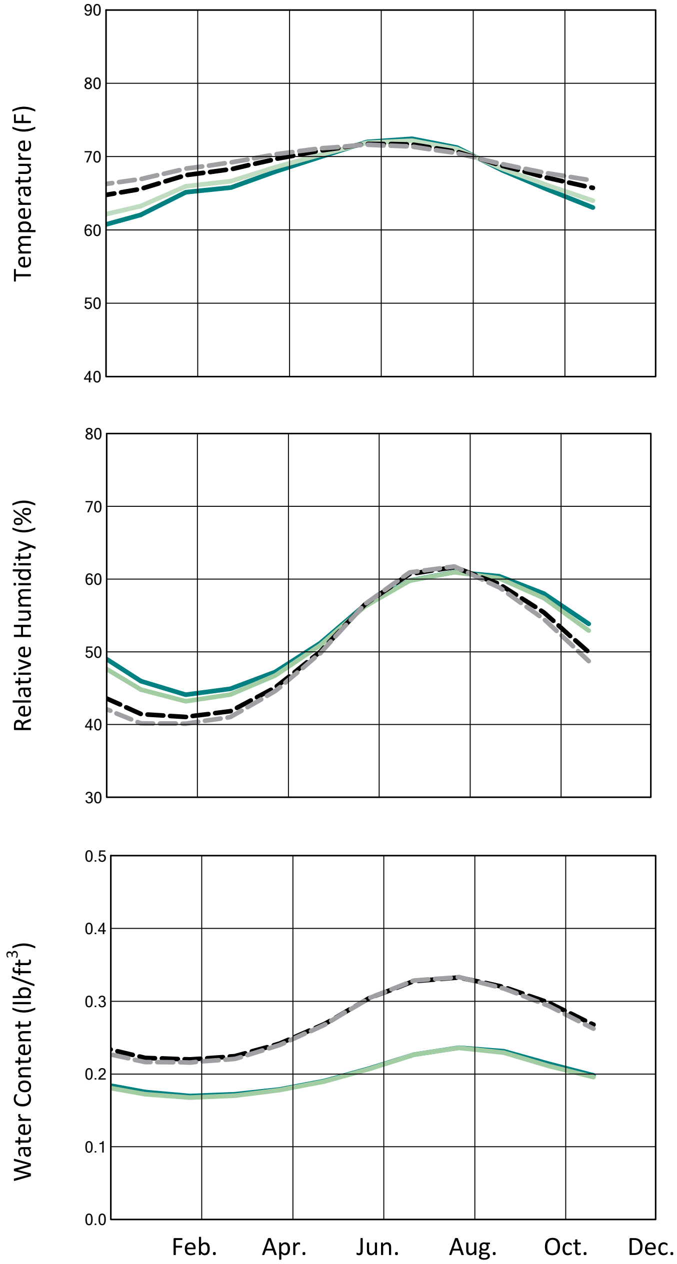

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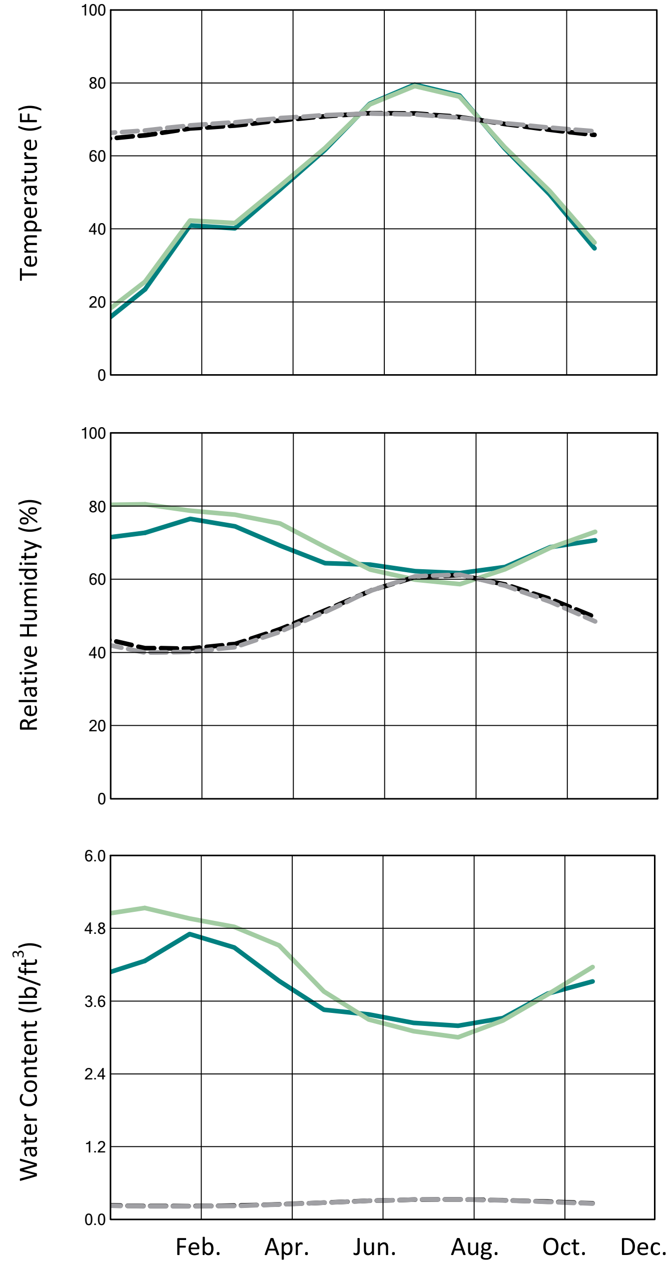
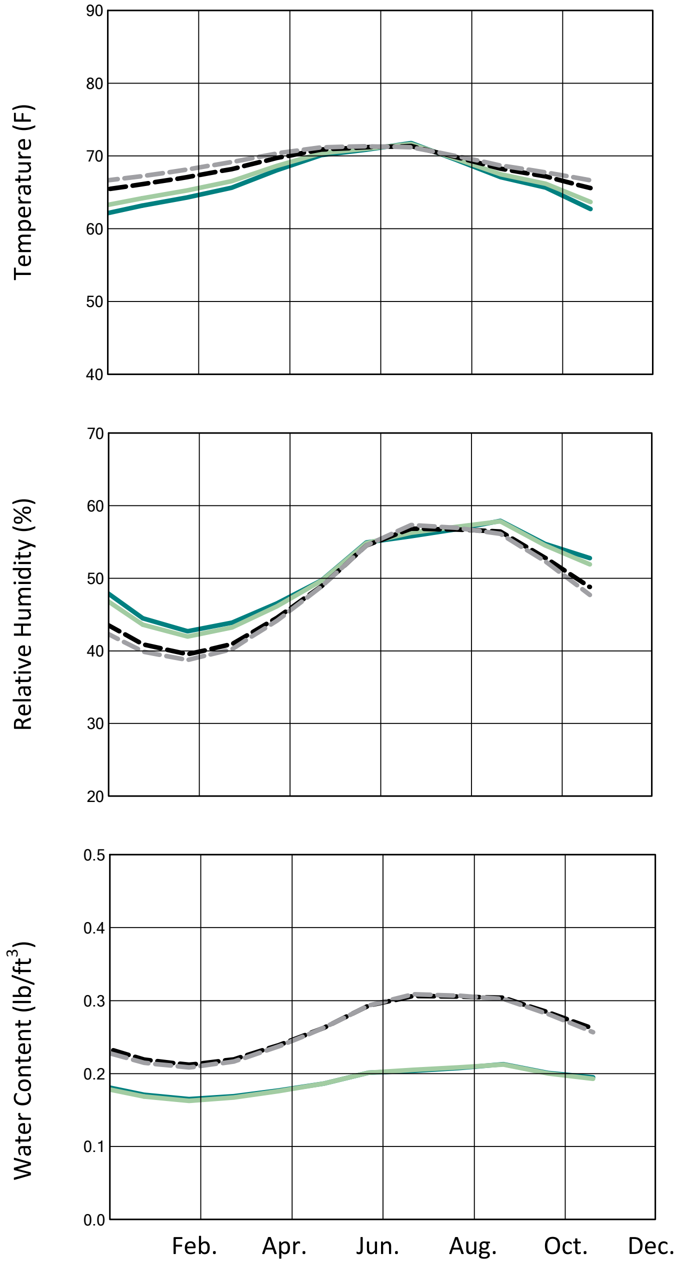


Sheathing Exterior　Sheathing Interior　Gypsum Wallboard Exterior　Gypsum Wallboard Interior

Hunter Xci CG 2.5



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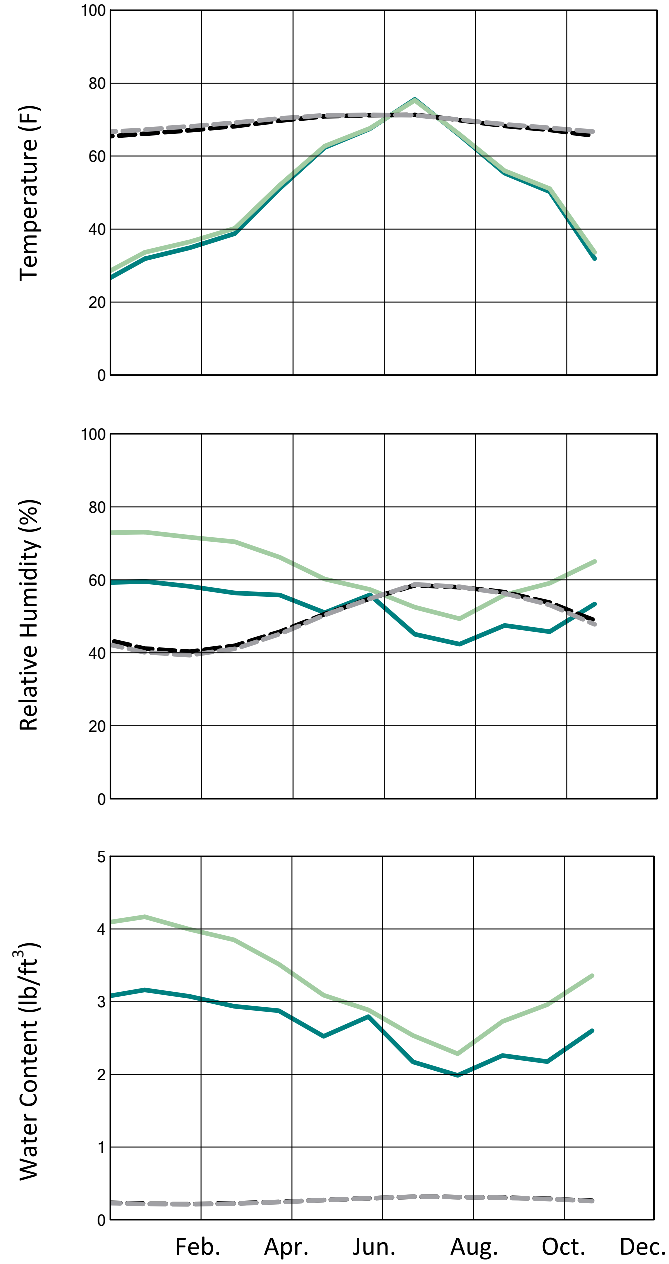
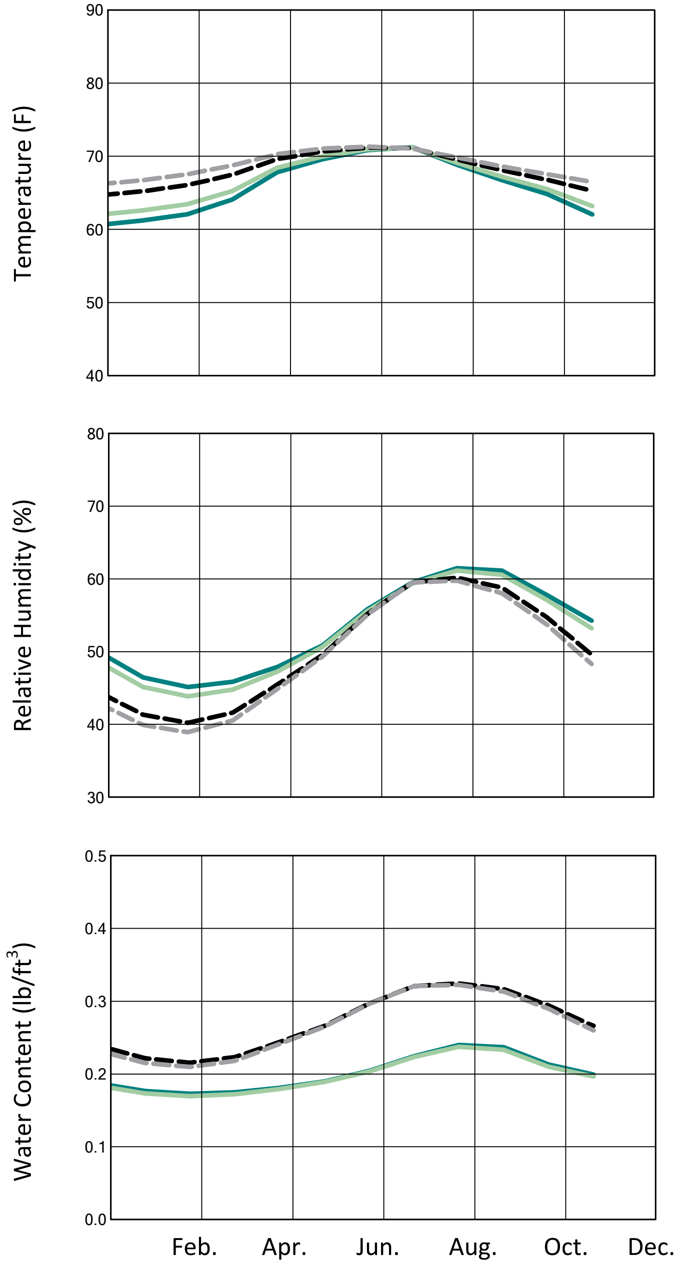


Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior

Hunter Xci CG 2.5



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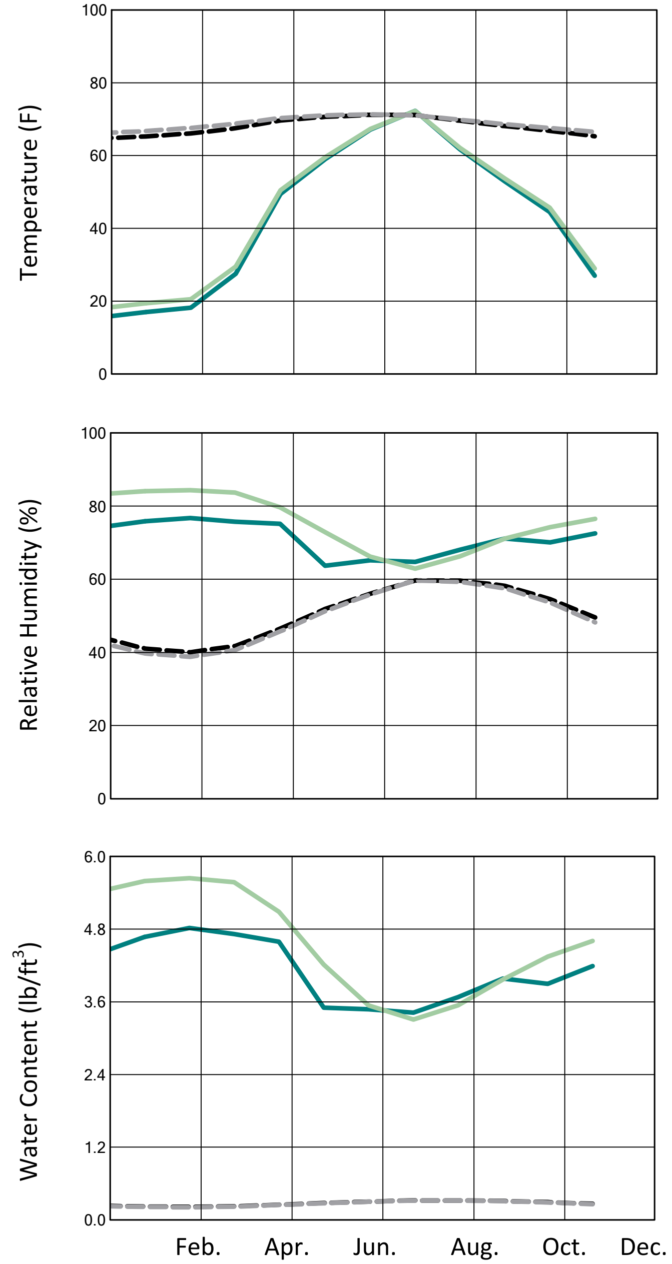
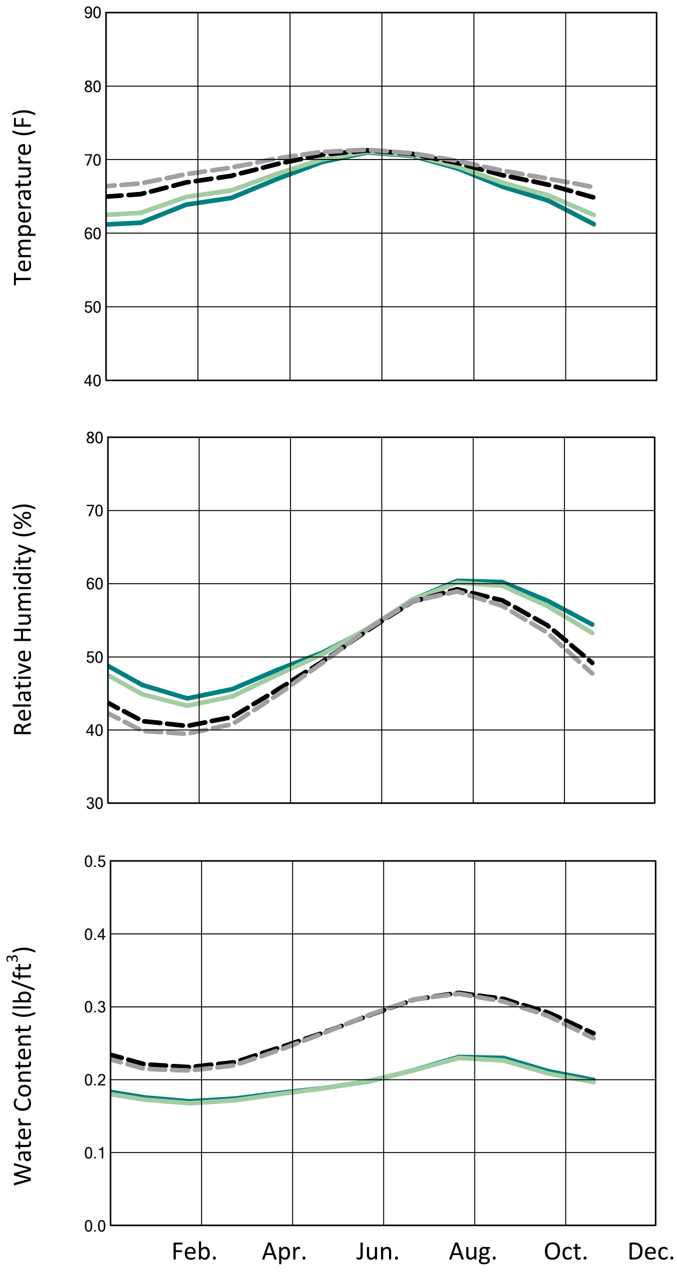


Sheathing Exterior | Sheathing Interior | Gypsum Wallboard Exterior | Gypsum Wallboard Interior

Hygrothermal Analysis

Hunter Xci CG 3.5



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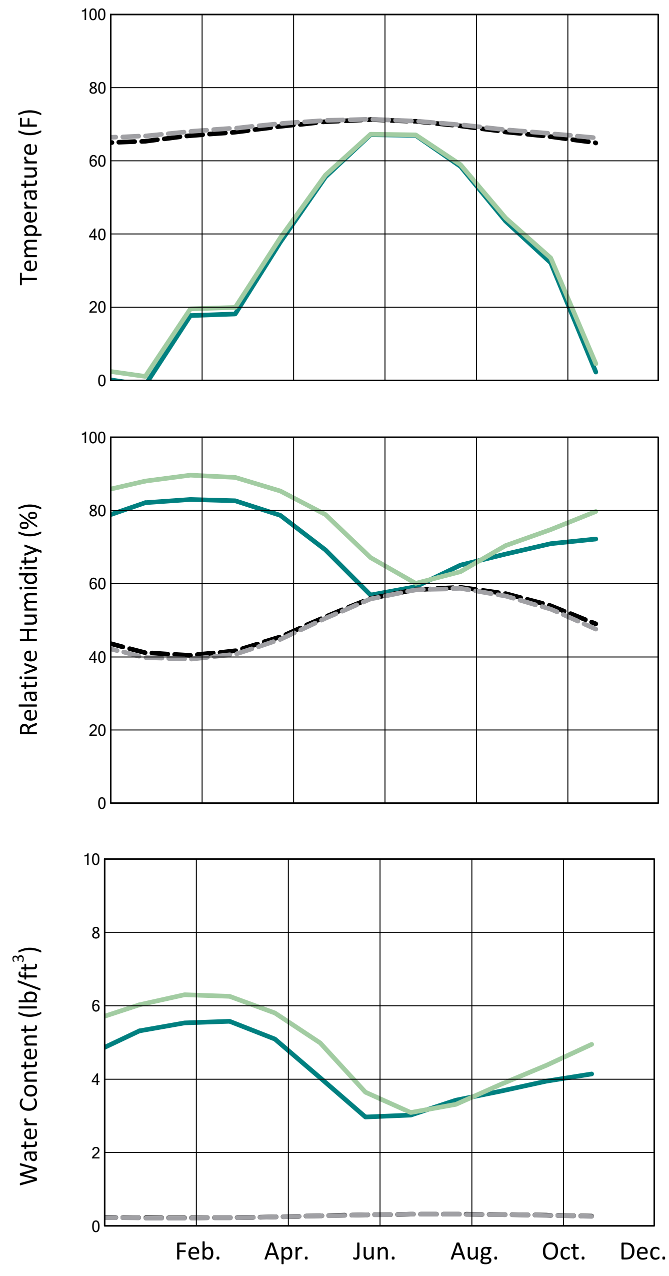

Sheathing Exterior — Sheathing Interior — Gypsum Wallboard Exterior — Gypsum Wallboard Interior