Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report No: 1410-09

Issue Date: January 30, 2015

Revision Date: July 28, 2026

Subject to Renewal: October 1, 2027

Attachment of Exterior Wall Coverings Through Kingspan® GreenGuard® Extruded Polystyrene Sheathing to Wood or Steel Wall Framing

Trade Secret Report Holder:

Kingspan® Insulation, LLC

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CSI Designations:

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 - Thermal Insulation

Section: 07 40 00 - Roofing and Siding Panels

Section: 07 46 00 - Siding

1 Innovative Products Evaluated[1]

1.1 Kingspan GreenGuard Insulation Boards:

1.1.1 Kingspan® GreenGuard® CM

1.1.2 Kingspan® GreenGuard® LG CM

1.1.3 Kingspan® GreenGuard® SL

1.1.4 Kingspan® GreenGuard® LG SL

1.1.5 Kingspan® GreenGuard® SLX

1.1.6 Kingspan® GreenGuard® LG SLX

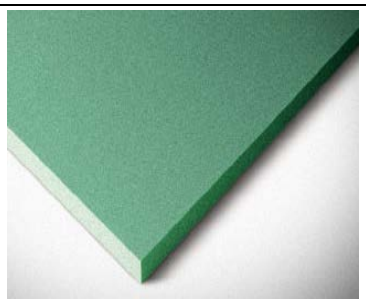
1.1.7 Kingspan® GreenGuard® PGU

2 Product Description and Materials

2.1 Examples of the innovative products evaluated in this report are shown in **Figure 1**.



GreenGuard XPS Label



GreenGuard XPS CM and PGU



GreenGuard XPS SL

Figure 1. GreenGuard XPS CM, PGU, and SL Insulation Boards

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2.2 GreenGuard Insulation Boards are proprietary Foam Plastic Insulating Sheathing (FPIS) made from extruded polystyrene (XPS) in accordance with ASTM C578, Type IV.

2.2.1 GreenGuard Insulation Boards are available with various edge treatments and facers as follows:

2.2.1.1 *GreenGuard CM:* square edges

2.2.1.2 *GreenGuard SL:* shiplap edges

2.2.1.3 *GreenGuard SLX:* film facer on both sides, shiplap edges

2.2.1.4 *PGU:* $^{7}/_{16}$" XPS with a reinforcing polyolefin fabric on one side and a clear plastic facer on the other side

2.2.2 GreenGuard Insulation Boards are manufactured with or without edge treatments and facers as described in **Section 2.2.1**.

2.2.2.1 Kingspan GreenGuard LG XPS has the same physical properties as GreenGuard XPS, except that it is produced with a lower Global Warming Potential (GWP) blowing agent formulation. All references in this report to GreenGuard Insulation Boards include both the GreenGuard XPS and the GreenGuard LG XPS insulation board.

2.3 *Material Availability*

2.3.1 *Thickness:*

2.3.1.1 $^{1}/_{4}$" (32 mm) through 3" (76 mm)

2.3.2 *Standard Product Width:*

2.3.2.1 48" (1,219 mm)

2.3.3 *Standard Product Length:*

2.3.3.1 96" (2,438 mm)

2.3.3.2 108" (2,743 mm)

2.3.4 Consult the manufacturer for the availability of a given product with non-standard width or length.

2.4 As needed, review material properties for design in **Section 6** and the regulatory evaluation in **Section 8**.

3 Definitions[2]

3.1 New Materials[3] are defined as building materials, equipment, appliances, systems, or methods of construction, not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[4] The design strength and permissible stresses shall be established by tests[5] and/or engineering analysis.[6]

3.2 Duly authenticated reports[7] and research reports[8] are test reports and related engineering evaluations that are written by an approved agency[9] and/or an approved source.[10]

3.2.1 This report utilizes intellectual property and/or trade secrets to create public domain material properties for commercial end-use.

3.2.1.1 This report protects confidential Intellectual Property and trade secrets under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[11]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is accredited and listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional, hereinafter RDP) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[12]

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3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body, and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[13] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[14] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[15] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[16]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory. Therefore, recognition of certificates and validation statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope shall be approved.[17] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[18] and can be used in any country that is an MLA signatory found at this link: https://iaf.nu/en/recognised-abs/

3.9 Approval equity is a fundamental commercial and legal principle.[19]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[20]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured local jurisdictions: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, St. Louis County, Texas Department of Insurance, and Wichita.[21]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured states: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[22]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[23] and Part 3280[24] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Regulations*

4.2.1 *IBC – 18, 21, 24: International Building Code®*

4.2.2 *IRC – 18, 21, 24: International Residential Code®*

4.2.3 *IECC – 18, 21, 24: International Energy Conservation Code®*

4.3 *Standards*

4.3.1 *ABTG ANSI/FS 100: Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies[25]*

4.3.2 *AISI S100: North American Specification for the Design of Cold-formed Steel Structural Members*

4.3.3 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*

4.3.4 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.3.5 *ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*

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4.3.6 *ASTM C847: Standard Specification for Metal Lath*

4.3.7 *ASTM C1063: Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster*

4.3.8 *ASTM C1513: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections*

4.3.9 *ASTM F1667: Standard Specification for Driven Fasteners: Nails, Spikes, and Staples*

5 Listed[26]

5.1 Equipment, materials, products, or services included in a List published by a nationally recognized testing laboratory (e.g., CBI), an approved agency (e.g., CBI and DrJ), and/or an approved source (e.g., DrJ), or other organization(s) concerned with product evaluation (e.g., DrJ), that maintains periodic inspection (e.g., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 *Structural Applications*

6.1.1 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

6.2 *Design Procedure*

6.2.1 Determine an appropriate cladding attachment requirement in accordance with **Section 6.2** through **Section 6.4**.

6.2.2 Select one of the following methods of cladding attachment:

6.2.2.1 Direct attachment of cladding through GreenGuard Insulation Boards to wall framing as shown in **Figure 2**.

6.2.2.2 Furring attachment through GreenGuard Insulation Boards to wall framing, as shown in **Figure 3**, whereby cladding is attached to furring in accordance with the applicable building code and the cladding manufacturer installation instructions.

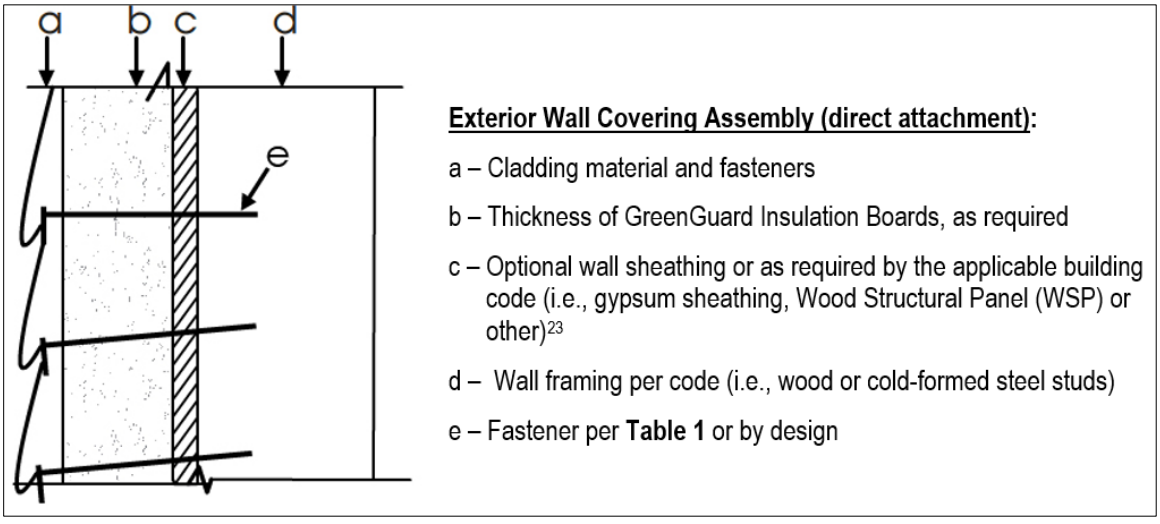

Figure 2. Exterior Wall Covering Assembly Components (Direct Attachment)
**Note:* Wall Sheathing layer *"c"* is optional unless required by the applicable building code

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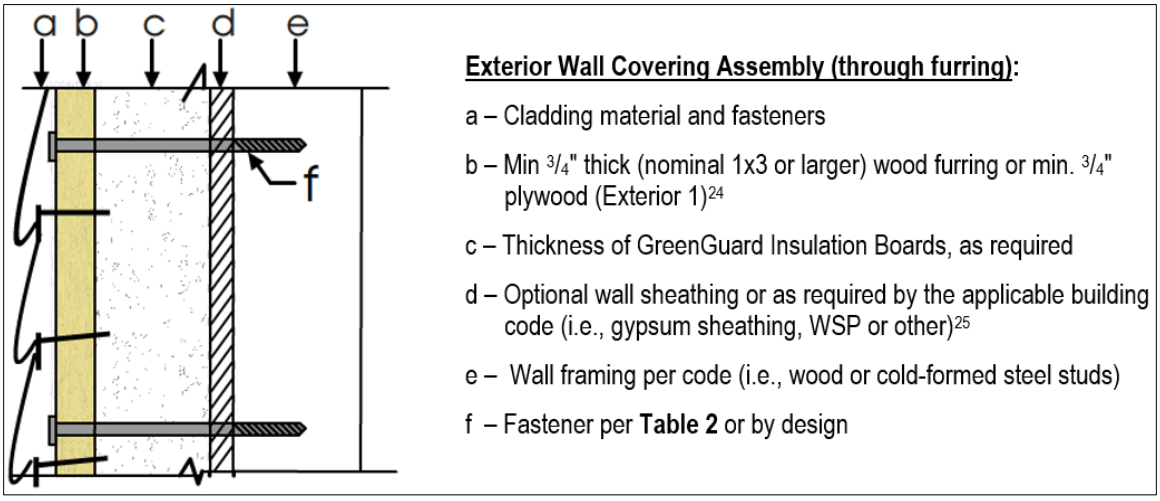

Figure 3. Exterior Wall Covering Assembly Components (Through Furring)
**Note:* Wall sheathing layer *"d"* is optional unless required by the applicable building code

6.3 From **Table 1** for the *"direct attachment"* method, or **Table 2** for the *"furring attachment"* method, determine the maximum allowable GreenGuard Insulation Boards thickness based on a selected minimum fastener size, maximum fastener spacing, and the cladding system weight.

6.3.1 To determine cladding system weight, add the weight of all materials on the exterior side of the foam sheathing (see *"a"* in **Figure 2** and *"a"* and *"b"* in **Figure 3**).

6.3.2 Use actual weights for the materials installed. Actual cladding weights of materials can be obtained from the cladding manufacturer material specifications. Other typical weights of building materials can be found in the Commentary of ASCE 7-22.

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Table 1. Siding Minimum Fastening Requirements for Direct Cladding Attachment[1,9,11]

Framing Type	Siding Fastener Type and Minimum Size[4,5]	Siding Fastener Vertical Spacing (in)[10]	Maximum Thickness of GreenGuard Insulation Boards (in)[8]							
			16" o.c. Fastener Horizontal Spacing				24" o.c. Fastener Horizontal Spacing			
			Maximum Cladding Weight[2,3,6,12] (psf)							
			3	11	18	25	3	11	18	25
Wood Framing (Minimum 1¼" Penetration)	0.113" Diameter Nail[7]	6	2.00	1.45	0.75	DR[13]	2.00	0.85	DR	DR
		8	2.00	1.00	DR	DR	2.00	0.55	DR	DR
		12	2.00	0.55	DR	DR	1.85	DR	DR	DR
	0.120" Diameter Nail[7]	6	3.00	1.70	0.90	0.55	3.00	1.05	0.50	DR
		8	3.00	1.20	0.60	DR	3.00	0.70	DR	DR
		12	3.00	0.70	DR	DR	2.15	DR	DR	DR
	0.131" Diameter Nail	6	4.00	2.15	1.20	0.75	4.00	1.35	0.70	DR
		8	4.00	1.55	0.80	DR	4.00	0.90	DR	DR
		12	4.00	0.90	DR	DR	2.70	0.50	DR	DR
	0.162" Diameter Nail	6	4.00	3.55	2.05	1.40	4.00	2.25	1.25	0.80
		8	4.00	2.55	1.45	0.95	4.00	1.60	0.85	0.50
		12	4.00	1.60	0.85	0.50	4.00	0.95	DR	DR
Steel Framing (Minimum Penetration of Steel Thickness + 3 Threads)	#8 Screw into 33 mil Steel or Thicker	6	3.00	2.95	2.20	1.45	3.00	2.35	1.25	DR
		8	3.00	2.55	1.60	0.60	3.00	1.80	DR	DR
		12	3.00	1.80	DR	DR	3.00	0.65	DR	DR
	#10 Screw into 33 mil Steel	6	4.00	3.50	2.70	1.95	4.00	2.90	1.70	0.55
		8	4.00	3.10	2.05	1.00	4.00	2.25	0.70	DR
		12	4.00	2.25	0.70	DR	3.70	1.05	DR	DR
	#10 Screw into 43 mil Steel or Thicker	6	4.00	4.00	4.00	3.60	4.00	4.00	3.45	2.70
		8	4.00	4.00	3.70	3.00	4.00	3.85	2.80	1.80
		12	4.00	3.85	2.80	1.80	4.00	3.05	1.50	DR

SI: 1 in = 25.4 mm; 1-psf = 0.0479 kPa

1. Tabulated requirements are based on wood framing of Spruce-Pine-Fir, or any wood species with a specific gravity of 0.42 or greater, in accordance with AWC/NDS and minimum 33-ksi steel for 33 mil and 43 mil steel, and 50-ksi steel for 54 mil steel or thicker.
2. Cladding weight shall include all materials supported by the fasteners on the exterior side of GreenGuard Insulation Boards (i.e., wood structural panel sheathing may be installed between the cladding material and GreenGuard Insulation Boards). In such cases, both the cladding and the WSP sheathing weight must be included in the calculation for the cladding weight.
3. Examples of cladding included in each weight category: 3-psf–vinyl siding, 11-psf–fiber cement siding, 25-psf–masonry or cultured stone. Examples are not inclusive.
4. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths. Screws shall comply with ASTM C1513.
5. Self-drilling tapping screw fasteners for connection of siding to steel framing shall comply with the requirements of AISI S200. Other approved fasteners of equivalent or greater diameter and bending strength shall be permitted.
6. For cladding system weights exceeding 25-psf with any thickness of GreenGuard Insulation Boards, a design professional should be consulted.
7. Maximum foam thickness of 2" for 0.113" and 3" for 0.120" diameter nails for 3-psf cladding weight due to limiting factor of nail length.
8. In accordance with ASTM C578, GreenGuard Insulation Boards shall have a minimum compressive strength of 15-psi.
9. Metal lath shall be minimum 2.5 lbs/yd^2 diamond mesh in accordance with ASTM C847. Metal lath lock washers on fasteners are highly recommended.
10. Vertical spacing of fasteners in metal lath shall not exceed 7" o.c., in accordance with ASTM C1063 and the Masonry Veneer Manufacturers Association (MVMA) Installation Guide
11. Where adhered masonry is used, it shall be installed in accordance with the MVMA Installation Guide.
12. Linear interpolation between cladding weight categories is not permitted.
13. DR = Design Required

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Table 2. Furring Minimum Fastening Requirements for Application Over Foam Plastic Insulating Sheathing[1]

Furring Material	Framing Member	Fastener Type and Minimum Size[2,3,5,6,7]	Minimum Penetration into Wall Framing (in)	Fastener Spacing in Furring (in)	Maximum Thickness of GreenGuard Insulation Boards (in)[11]								Allowable Wind Pressure Resistance of Furring Attachment (psf)	
					16" o.c. Furring[4,8]				24" o.c. Furring[4,8]					
					Siding Weight[9,10,12] (psf)									
					3	11	18	25	3	11	18	25	16" o.c.	24" o.c.
Minimum 1 x 3 Wood Furring	Minimum Wood Stud	Nail (0.131" Shank; 0.281" Head)	1 1/4	8	4.00	2.45	1.45	0.95	4.00	1.60	0.85	DR[13]	46.5	31.0
				12	4.00	1.60	0.85	DR	4.00	0.95	DR	DR	31.0	20.7
				16	4.00	1.10	DR	DR	3.05	0.60	DR	DR	23.3	15.5
		0.162" Diameter Nail	1 1/4	8	4.00	4.00	2.45	1.60	4.00	2.75	1.45	0.85	57.5	38.3
				12	4.00	2.75	1.45	0.85	4.00	1.65	0.75	DR	38.3	25.6
				16	4.00	1.90	0.95	DR	4.00	1.05	DR	DR	28.8	19.2
		#10 Wood Screw	1	12	4.00	2.30	1.20	0.70	4.00	1.40	0.60	DR	107.3	71.6
				16	4.00	1.65	0.75	DR	4.00	0.90	DR	DR	79.0	52.7
				24	4.00	0.90	DR	DR	2.85	DR	DR	DR	35.1	23.4
		1/4" Lag Screw	1 1/2	12	4.00	2.65	1.50	0.90	4.00	1.65	0.80	DR	140.4	93.6
				16	4.00	1.95	0.95	0.50	4.00	1.10	DR	DR	79.0	52.7
				24	4.00	1.10	DR	DR	3.25	0.50	DR	DR	35.1	23.4
Minimum 33 mil Steel Hat Channel or Minimum 1 x 3 Wood Furring	33 mil Steel Stud	#8 Screw (0.285" Head)	Steel Thickness +3 Threads	12	3.00	1.80	DR	DR	3.00	0.65	DR	DR	52.9	35.3
				16	3.00	1.00	DR	DR	2.85	DR	DR	DR	39.7	26.5
				24	2.85	DR	DR	DR	2.20	DR	DR	DR	26.5	17.6
		#10 Screw (0.333" Head)	Steel Thickness +3 Threads	12	4.00	2.25	0.70	DR	3.70	1.05	DR	DR	62.9	41.9
				16	3.85	1.45	DR	DR	3.40	DR	DR	DR	47.1	31.4
				24	3.40	DR	DR	DR	2.70	DR	DR	DR	31.4	21.0
	43 mil or Thicker Steel Stud	#8 Screw (0.285" Head)	Steel Thickness +3 Threads	12	3.00	1.80	DR	DR	3.00	0.65	DR	DR	69.0	46.0
				16	3.00	1.00	DR	DR	2.85	DR	DR	DR	51.8	34.5
				24	2.85	DR	DR	DR	2.20	DR	DR	DR	34.5	23.0
		#10 Screw (0.333" Head)	Steel Thickness +3 Threads	12	4.00	3.85	2.80	1.80	4.00	3.05	1.50	DR	81.9	54.6
				16	4.00	3.30	1.95	0.60	4.00	2.25	DR	DR	61.5	41.0
				24	4.00	2.25	DR	DR	4.00	0.65	DR	DR	35.1	23.4

SI: 1 in = 25.4 mm; 1-psf = 0.0479 kPa

1. Table values are based on:
   a. Minimum 3/4" (19.1 mm) thick wood furring and wood studs of Spruce-Pine-Fir or any softwood species with a specific gravity of 0.42 or greater per AWC/NDS.
   b. Minimum 33 mil steel hat channel furring of 33-ksi steel. Steel hat channel shall have a minimum 7/8" (22.2 mm) depth.
   c. Steel framing of indicated nominal steel thickness and minimum 33-ksi steel for 33 mil and 43 mil steel, and 50-ksi steel for 54 mil steel or thicker.
2. Self-drilling, self-tapping screw fasteners for connection of siding to steel framing shall comply with the requirements of AISI S200. Other approved fasteners of equivalent or greater diameter and bending strength shall be permitted.
3. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths. Screws shall comply with ASTM C1513.

Continued . . .

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Table 2. Furring Minimum Fastening Requirements for Application Over Foam Plastic Insulating Sheathing[1]

Furring Material	Framing Member	Fastener Type and Minimum Size[2,3,5,6,7]	Minimum Penetration into Wall Framing (in)	Fastener Spacing in Furring (in)	Maximum Thickness of GreenGuard Insulation Boards (in)[11]								Allowable Wind Pressure Resistance of Furring Attachment (psf)	
					16" o.c. Furring[4,8]				24" o.c. Furring[4,8]					
					Siding Weight[9,10,12] (psf)									
					3	11	18	25	3	11	18	25	16" o.c.	24" o.c.

4. Furring shall be spaced a maximum of 24" o.c. in a vertical or horizontal orientation:
   a. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing.
   b. Where placed horizontally, wood furring shall be preservative treated wood in accordance with IRC Section R304.1(27) or naturally durable wood and fasteners shall be corrosion resistant in accordance to IRC Section R304.3.(28) Steel furring shall have a minimum G60 galvanized coating.
   c. Furring strips installed in a horizontal direction shall be fastened at each stud with a number of fasteners equivalent to that required by the fastener spacing. If the required nail spacing is 12" o.c. and the studs are 24" o.c., then two (2) nails would be required at each stud (24 / 12 = 2). In no case shall fasteners be spaced more than 24" (0.6 m) apart.
5. Lag screws shall be installed with a standard cut washer.
6. Lag screws and wood screws shall be pre-drilled in accordance with AFPA/NDS.
7. Approved self-drilling screws of equal or greater shear and withdrawal strength shall be permitted without pre-drilling.
8. A minimum 2x wood furring shall be used where the required siding fastener penetration into wood material exceeds $^3/_4$" (19.1 mm) and is not more than $1^1/_2$" (38.1 mm), unless approved deformed shank siding nails or siding screws are used to provide equivalent withdrawal strength, allowing the siding connection to be made to a 1x wood furring.
9. Examples of cladding included in each weight category: 3-psf–vinyl siding, 11-psf–fiber cement siding, 25-psf–masonry or cultured stone. Examples are not inclusive.
10. For cladding system weights exceeding 25-psf with any thickness of GreenGuard Insulation Boards, a design professional should be consulted.
11. Foam sheathing shall have a minimum compressive strength of 15-psi, in accordance with ASTM C578.
12. Linear interpolation between cladding weight categories is not permissible.
13. DR = Design Required

6.4 The minimum fastening requirement shall be the more stringent of that required by:

6.4.1 Fastening schedule determined in accordance with **Section 6.3** of this report.

6.4.2 Fastener type, head size, diameter, spacing, and penetration into framing required by the applicable building code for the specific cladding material and the cladding manufacturer installation instructions.[29]

6.4.2.1 Where the seismic provisions of IRC Section R301.2.2 apply, the wall assembly shall not exceed the weight limits of IRC Section R301.2.2.1, unless an engineered design is provided in accordance with IRC Section R301.1.3.

6.4.2.2 Where the seismic load provisions of IBC Section 1613 apply, the cladding attachment shall be verified to provide resistance to meet or exceed minimum required earthquake loads.

6.4.3 Fastenings that are not at least equivalent to minimum required fastener characteristics described in **Section 6.4.2** shall be designed to provide adequate support of cladding weight, resistance to wind loading, and seismic loads as required by the applicable building code.

6.4.4 For furring connections in accordance with **Table 2**, allowable wind load resistance shall be verified to meet or exceed the minimum required wind load of the applicable code.

6.4.4.1 Refer to IRC Table R301.2.1(1)[30] for components and cladding wind loads for the applicable wall wind zone and for an effective wind area of 10 square feet.

6.4.4.2 For IBC required wind loads, see IBC Section 1609.

6.5 Alternative techniques shall be permitted in accordance with accepted engineering practice and experience. These provisions for the use of alternative materials, designs, and methods of construction are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed herein. This includes, but is not limited to, the following areas of engineering: mechanics of materials, structures, building science, and fire science.

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7 Certified Performance[31]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[32]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[33]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 GreenGuard Insulation Boards comply with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 Lateral force resisting systems for use in both wind and seismic applications follow the performance-based provisions of IBC Section 2306.1, IBC Section 2306.3, and/or SDPWS Section 4.3 for light-frame wood wall assemblies.

8.2 This report examines the attachment of exterior wall coverings through Kingspan GreenGuard Extruded Polystyrene (XPS) Insulation Boards with thickness up to 3", to wood or cold-formed steel wall studs.

8.3 This report also provides a systematic approach for the design process of attaching exterior wall coverings through XPS to wood or steel wall framing.

8.4 This report and design methodology considers only the weight of the exterior covering on fasteners cantilevered though the XPS and into the stud.

8.5 Wind pressure resistance of the exterior covering is outside the scope of this report. Consult the exterior covering manufacturer installation instructions for information regarding the allowable design wind pressure for a given product in accordance with ABTG ANSI/FS 100.

8.5.1 The intent of this report is not to reduce minimum fastener sizes, penetrations, and spacings required to resist wind loads. Where fastener requirements for wind resistance or cladding weight are more stringent, they shall control the design.

8.6 Attachment of window flanges over XPS is outside the scope of this report.

8.7 Any building code, regulation and/or accepted engineering evaluations (e.g., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[34] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[35] respectively.

8.8 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which is also its areas of professional engineering competence.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

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9.3 *Installation Procedure*

9.3.1 Verify that materials comply with the following provisions of this report:

9.3.1.1 GreenGuard Insulation Boards shall comply with the requirements of **Section 6**.

9.3.1.2 Wall framing materials shall comply with **Section 6**, specifically the minimum wood and cold-formed steel framing member requirements in the footnotes of **Table 1** and **Table 2**, as applicable.

9.3.1.3 Cladding or furring fastener type and size, including fastener length to obtain required penetration into or through framing members, complies with the solution determined in accordance to **Section 6.4.1**.

9.3.1.3.1 Where fasteners are permitted to penetrate into, or fully through, sheathing or nailable substrate without penetrating into framing as specified by the manufacturer instructions and supported by a test report, the end of the fastener shall extend a minimum of 1/4" beyond the opposite face of the sheathing or nailable substrate in accordance with IRC Section R703.11.1.4.[36]

9.3.2 Fasteners shall be installed into framing members and driven flush and snug so that gaps between layers are removed, except where a gap under the cladding fastener head is required for attachment of vinyl siding.

9.3.3 Fasteners shall be installed in a workmanlike manner and not over-driven, resulting in material damage or excessive distortion of cladding, furring, or GreenGuard Insulation Boards.

9.3.4 Ensure framing members or blocking are provided to allow for attachment of siding and trim materials at transitions such as corners and wall penetrations.

9.3.5 Ensure that a code compliant water-resistive barrier system and flashing are provided prior to, or during the installation of cladding materials. Refer to DRR[37] 1205-05 for construction detailing concepts.

9.3.6 Where required by contract documents, the project owner, the owner's agent, or good practice, construct a mock-up assembly to demonstrate constructability and a proper integration of components.

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 National Design Specification for Wood Construction –American Wood Council.

10.1.2 General Dowel Equations for Calculating Lateral Connection Values, TR-12, American Forest & Paper Association.

10.1.3 North American Cold-Formed Steel Specification – American Iron & Steel Institute (AISI S100 standard).

10.1.4 New York State Energy Research and Development Authority, Fastening Systems for Continuous Insulation.

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources, and/or an RDP. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

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10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 *Testing and Engineering Analysis*

10.5.1 The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[38]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for GreenGuard Insulation Boards on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, GreenGuard Insulation Boards have performance characteristics that were tested and/or meet applicable regulations. In addition, they are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, GreenGuard Insulation Boards shall be approved for the following applications:

11.2.1 The design procedure and installation requirements outlined in this report may be used to attach exterior wall coverings through GreenGuard Insulation Boards to wood or steel wall framing.

11.2.2 IRC Section R703.3, IRC Section R703.15, and IRC Section R703.16 include provisions for the attachment of cladding and/or furring over GreenGuard Insulation Boards to appropriately resist the required design wind loads.

11.3 Unless exempt by state statute, when GreenGuard Insulation Boards are to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Kingspan Insulation, LLC.

11.5 IBC Section 104.2.3[39] (IRC Section R104.2.2[40] and IFC Section 104.2.3[41] are similar) in pertinent part state:

> 104.2.3 Alternative Materials, Design and Methods of Construction and Equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative is not specifically prohibited by this code and has been approved.

11.6 **Approved:**[42] Building regulations require that the building official shall accept duly authenticated reports.[43]

11.6.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.6.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.6.3 Federal law, Title 18 US Code Section 242, requires that, where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.7 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB Accredited Product Certification Body – Accreditation #1131.

11.8 Through the IAF Multilateral Arrangement (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[44]

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12 Conditions of Use

12.1 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.2 Installation of GreenGuard Insulation Boards shall be on exterior walls with code compliant wood framing or cold-formed steel framing meeting the minimum requirements as indicated in **Table 1** and **Table 2**.

12.3 When required by adopted legislation and enforced by the building official, also known as the Authority Having Jurisdiction (AHJ) in which the project is to be constructed:

12.3.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.3.2 This report and the installation instructions shall be submitted at the time of permit application.

12.3.3 At a minimum, these innovative products shall be installed per **Section 9**.

12.3.4 The review of this report by the AHJ shall comply with IBC Section 104.2.3.2 and IBC Section 105.3.1.

12.3.5 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.7.2, IBC Section 110.4, IBC Section 1703, IRC Section R104.7.2, and IRC Section R109.2.

12.3.6 The application of these innovative products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2, and any other regulatory requirements that may apply.

12.4 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, *"the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3"*, all of IBC Section 104, and IBC Section 105.3.

12.5 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.6 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 GreenGuard Insulation Boards (GreenGuard CM, GreenGuard LG CM, GreenGuard SL, GreenGuard LG SL, GreenGuard SLX, GreenGuard LG SLX, and GreenGuard PGU), as listed in **Section 1.1**, are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

13.2 Additional technical information can be found at www.kingspan.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

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Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 Capitalized terms and responsibilities are defined pursuant to the applicable building code, applicable reference standards, the latest edition of TPI 1, the NDS, AISI S202, US professional engineering law, Canadian building code, Canada professional engineering law, Qualtim External Appendix A: Definitions/Commentary, Qualtim External Appendix B: Project/Deliverables, Qualtim External Appendix C: Intellectual Property and Trade Secrets, definitions created within Design Drawings and/or definitions within Reference Sheets. Beyond this, terms not defined shall have ordinarily accepted meanings as the context implies. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

3 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1702

4 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3

5 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.2:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests

6 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.1:~:text=Conformance%20to%20Standards-,The%20design%20strengths%20and%20permissible%20stresses,-of%20any%20structural

7 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20make%2C%20or%20cause%20to%20be%20made%2C%20the%20necessary%20tests%20and%20investigations%3B%20or%20the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.2.3.

8 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4.2

9 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_agency

10 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_source

11 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

12 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

13 https://www.cbitest.com/accreditation/

14 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.1:~:text=directed%20to%20enforce%20the%20provisions%20of%20this%20code

15 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3 AND https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#105.3.1

16 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

17 https://iaf.nu/en/about-iaf-mla/#:~:text=Once%20an%20accreditation%20body%20is%20a%20signatory%20of%20the%20IAF%20MLA%2C%20it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

18 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

19 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

20 Unless otherwise noted, the links referenced herein use un-amended versions of the 2024 International Code Council (ICC) 2024 International Code Council (ICC) model codes as foundation references. Mississippi versions of the IBC 2024 and the IRC 2024 are un-amended. This material, product, design, service and/or method of construction also complies with the 2000-2012 versions of the referenced codes and the standards referenced therein. As pertinent to this technical and code compliance evaluation, CBI and/or DrJ staff have reviewed any state or local regulatory amendments to assure this report is in compliance.

21 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

22 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

23 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

24 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

25 Formerly SBCA ANSI/FS 100

26 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#listed AND https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#labeled

27 2021 IRC Section R317.1

28 2021 IRC Section R317.3

29 An example of this would be lath attachments for stucco where a maximum of 7" o.c. spacing is required. 2018 IRC Section R703.3 provides a prescriptive table for the attachment of furring to resist up to 30-psf design wind loading.

30 2018 IRC Table R301.2(2)

31 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4

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[32] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

[33] https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

[34] Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

[35] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

[36] 2021 IRC Section R703.11.1.2

[37] DrJ Research Report

[38] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition: https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[39] 2021 IBC Section 104.11

[40] 2021 IRC Section R104.11

[41] 2018: https://up.codes/viewer/wyoming/ifc-2018/chapter/1/scope-and-administration#104.9 AND 2021: https://up.codes/viewer/wyoming/ibc-2021/chapter/1/scope-and-administration#104.11

[42] Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 (https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#201.4) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[43] https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

[44] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.

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