DrJ CERTIFICATION

Technical Evaluation Report™

TER 1011-01

Wind Pressure Performance of Kingspan® GreenGuard® XPS Insulation Board Used in Exterior Wall Covering Assemblies

Kingspan® Insulation LLC

Product:

Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards

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COMPANY INFORMATION:	ADDITIONAL LISTEES:

Kingspan® Insulation LLC
2100 RiverEdge Pkwy Suite 175
Atlanta, GA 30328-4656

www.kingspan.com

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES	DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION
SECTION: 06 16 00 - Sheathing	SECTION: 07 21 00 - Thermal Insulation

1 Innovative Products Evaluated[1,2]

1.1 Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards

1.1.1 GreenGuard® CM

1.1.2 GreenGuard® LG CM

1.1.3 GreenGuard® SL

1.1.4 GreenGuard® LG SL

1.1.5 GreenGuard® SLX

1.1.6 GreenGuard® LG SLX

1.1.7 GreenGuard® PGU

2 Applicable Codes and Standards[3,4]

2.1 *Codes*

2.1.1 *IBC—15, 18, 21: International Building Code®*

2.1.2 *IRC—15, 18, 21: International Residential Code®*

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

2 **Federal Regulation Definition.** 24 CFR 3280.2 "Listed or certified" means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection 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. **International Building Code (IBC) Definition of Listed.** Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose Listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. **IBC Definition of Labeled**. Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

3 This Listing is a code defined research report, which is also known as a duly authenticated report, provided by an approved agency (see IBC Section 1703.1) and/or an approved source (see IBC Section 1703.4.2). An approved agency is "approved" when it is ANAB accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory). A professional engineer is "approved" as an approved source when that professional engineer is properly licensed to transact engineering commerce. Where sealed by a professional engineer, it is also a duly authenticated report certified by an approved source. (i.e., Registered Design Professional). DrJ is an ANAB accredited product certification body.

4 Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

2.2 *Standards and Referenced Documents*

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

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

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

2.2.4 *ASTM E2178: Standard Test Method for Air Permeance of Building Materials*

2.2.5 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*

2.2.6 *ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*

2.2.7 *ABTG ANSI/FS 100: Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies*[5]

3 Performance Evaluation

3.1 Tests, test reports, research reports, duly authenticated reports and related engineering evaluations are defined as intellectual property and/or trade secrets and protected by Defend Trade Secrets Act 2016 (DTSA).[6]

3.2 Testing and/or inspections conducted for this TER were performed an ISO/IEC 17025 accredited testing laboratory,[7] an ISO/IEC 17020 accredited inspection body,[8] which are internationally recognized accreditations through International Accreditation Forum (IAF), and/or a licensed Registered Design Professional (RDP).

3.3 The wind pressure resistance performance of GreenGuard® XPS Insulation Board was evaluated for use as part of an exterior wall covering assembly in accordance with the following code sections:

3.3.1 IBC Section 104.11 and IBC Section 1404.8.

3.3.2 IRC Section R104.11, IRC Section R703.1.2, IRC Section R703.3 and IRC Table R703.3(1).

3.4 This TER evaluates the wind pressure resistance performance of GreenGuard® XPS Insulation Board for use as exterior wall sheathing in compliance with the building codes listed in Section 2.

3.4.1 When used as over-sheathing[9] on light-frame, masonry, or concrete exterior walls, GreenGuard® XPS Insulation Board is not required to meet the wind pressure requirements of this TER.

3.4.2 This TER does not address wind pressure resistance requirements for GreenGuard® XPS Insulation Board used as part of an Exterior Insulation Finish System (EIFS). Refer to the EIFS manufacturer installation instructions for building code compliance.

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5 Formerly SBCA ANSI/FS 100

6 https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90. Given our professional duty to inform, please be aware that whoever, with intent to convert a trade secret (TS), that is related to a product or service used in or intended for use in interstate or foreign commerce, to the economic benefit of anyone other than the owner thereof, and intending or knowing that the offense will, injure any owner of that trade secret, knowingly without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys such information; shall be fined under this title or imprisoned not more than 10 years, or both. 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. As the National Society of Professional Engineers states, "Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve." Therefore, to protect intellectual property (IP) and TS, and to achieve compliance with public records and trade secret legislation, requires approval through the use of Listings, certified reports, technical evaluation reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

7 Internationally recognized accreditations are performed by members of the International Accreditation Forum (IAF). Accreditation Body and Regional Accreditation Group Members of IAF are admitted to the IAF MLA only after a stringent evaluation of their operations by a peer evaluation team, which is charged to ensure that the applicant complies fully with both international standards and IAF requirements. Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.

8 Ibid.

9 Over-sheathing definition: As used in this TER, over-sheathing refers to the application of foam sheathing over and directly on the surface of wall sheathing material or solid wall construction, such as masonry or concrete, whereby the substrate is capable of resisting the full design transverse wind load required by the applicable building code or latest edition of ASCE 7. In addition, cladding is separately installed over foam sheathing in accordance with Section 5.2. An over-sheathing application of foam sheathing does not require that the foam sheathing resist wind pressure in accordance with this TER.

3.5 GreenGuard® XPS Insulation Board shall comply with the material standard listed in Section 4 and shall be applied to exterior wall construction in accordance with the general requirements of Section 5.1, as well as the prescriptive wind pressure resistance requirements of Section 5.2.

3.6 GreenGuard® XPS Insulation Board used in accordance with this TER that is required to resist wind pressure in exterior wall covering assemblies shall also comply with the product marking requirements of Section 10 and the conditions of use listed in Section 9.

3.7 GreenGuard® XPS Insulation Board was also evaluated for the following:

3.7.1 Use as an air barrier material in accordance with IRC Section N1102.4.1.1, IECC Section C402.5.1.1 and IRC Section R402.4.1.1.

3.7.2 Use as a water-resistant barrier (WRB) in accordance with IRC Section R703.2 and IBC Section 1403.2.[10]

3.8 Only products in this TER with thicknesses ranging from 1" to 3" are certified for wind pressure resistance. Results of testing for other thicknesses are provided for informational purposes only.

3.8.1 For the scope of this TER, only products with thicknesses ranging from 1" to 3" are subject to an ongoing quality control program for performance to meet wind requirements, in accordance with ANSI/ABTG FS100.

3.9 Any building code and/or accepted engineering evaluations (i.e. research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDPs / approved sources. DrJ is qualified[11] to practice product and code compliance services within its scope of accreditation and engineering expertise, respectively.

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

3.11 Any regulation specific issues not addressed in this section are outside the scope of this TER.

4 Product Description and Materials

4.1 GreenGuard® XPS Insulation Board used in accordance with this TER shall comply with the following material standards:

4.1.1 XPS manufactured in compliance with ASTM C578, Type IV.

4.2 GreenGuard® XPS Insulation Board is produced under a proprietary manufacturing process and formed into rigid insulation panels.

4.2.1 GreenGuard® XPS Insulation Board is manufactured with or without edge treatments and facers as follows:

4.2.1.1 CM – square edges

4.2.1.2 SL – shiplap edges

4.2.1.3 SLX – shiplap edges and clear plastic facers on both sides

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

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

4.3 Green Guard® XPS Insulation Board is manufactured in 4x8 sheets in $^{1}/_{2}$", $^{3}/_{4}$", 1", 1$^{1}/_{2}$", 2", and 3" thicknesses.

[10] 2015 IBC Section 1404.2

[11] 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.

5 Applications

5.1 *General Requirements*

5.1.1 The following are minimum installation requirements for GreenGuard® XPS Insulation Board when applied to light-frame wall framing members:

5.1.1.1 Light-frame wood framing members supporting GreenGuard® XPS Insulation Board shall have a nominal thickness of not less than 2" (1 1/2" actual).

5.1.1.2 Light-frame steel framing members shall have a flange width of not less than 1 1/2" (including bend radius at web and lip).

5.1.1.3 Framing members shall be spaced a maximum of 24" o.c.

5.1.1.3.1 GreenGuard® XPS Insulation Board shall be attached to the wall framing in accordance with the manufacturer installation instructions and this TER.

5.1.1.3.2 All sheathing edges shall be supported by wall framing or blocking.

5.2 *Wind Pressure Requirements*

5.2.1 *General:*

5.2.1.1 When fastened directly to light-frame wall members (i.e., studs), GreenGuard® XPS Insulation Board shall comply with the requirements of Section 5.1, in accordance with IBC Section 104.11, IRC Section R104.11 and ASTM C578, as applicable.

5.2.1.2 When installed as over-sheathing, GreenGuard® XPS Insulation Board shall not be required to comply with this TER.

5.2.2 *Specific Requirements:*

5.2.2.1 When using ASCE 7-16 as referenced by the 2018 IBC for the conditions listed in Section 5.2.2.1, the wind pressures listed in ASCE 7 shall be multiplied by a factor of 0.6 to convert them to ASD level loads and then compared to the values in Table 1.

Table 1. Allowable Wind Pressure Resistance Values (PSF) for Kingspan® GreenGuard® XPS Insulation Boards Used in Exterior Wall Covering Assemblies[1,2,5]

Kingspan® XPS Products	Sheathing Thickness (in)	Allowable (ASD) Components & Cladding Design Wind Pressure (psf)	
		16" o.c. Framing	24" o.c. Framing
GreenGuard® XPS Insulation Board	1/2	19.5	NP[6]
	3/4	25.9	20.5
	1	38.4[(3)]	30.6
	1 1/2	72.8	41.3
	2	122	53.7[(3)]
	3[(4)]	260	139.4
GreenGuard® Plygood® Ultra (PGU)	7/16	78.6	61.4

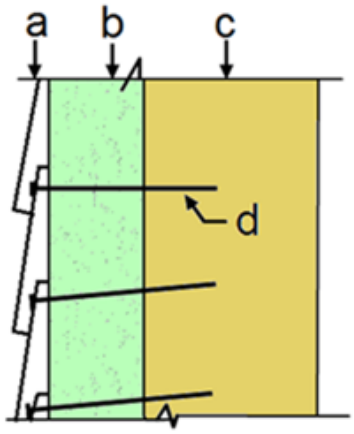
SI: 1in = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa.

1. Linear interpolation shall not be permitted.
2. Table 1 shall be used in accordance with requirements of Section 6.1. Allowable design wind pressure ratings are based on ASTM E330 testing in accordance with IBC Section 1609 and IRC Section R301.2. These values were determined in accordance with ANSI/ATBG FS100 for a fully-blocked condition (i.e., all horizontal and vertical sheathing joints supported on blocking or framing members) using a Pressure Equalization Factor (PEF) of 1.0.
3. Based on yield load in accordance with ANSI/ATBG FS100.
4. Table values for the 3" GreenGuard® XPS Insulation Board are limited to sheathing panels installed with the length dimension parallel to the framing.
5. Design values are applicable to the bending strength of the product only. Fastening to resist wind loads must be achieved by separate specification for attachment of the foam and/or the cladding system over the foam sheathing in addition to the manufacturer minimum attachment requirements.
6. NP = not permitted

5.2.2.2 The minimum thickness of GreenGuard® XPS Insulation Board shall comply with Table 1, for one of the following two conditions:

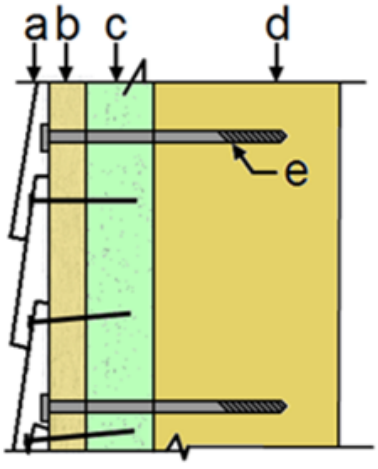
5.2.2.2.1 Where the GreenGuard® XPS Insulation Board is directly constrained by a code-compliant cladding material (i.e., no gap between the cladding and GreenGuard® XPS Insulation Board product, as shown in Figure 1), the components and cladding design wind pressure determined in accordance with IRC Section R301.2 or IBC Section 1609.1 shall not exceed the allowable wind pressure value of the FPIS product per Table 1.

5.2.2.2.2 Where a code-compliant cladding system is installed over but not directly on the surface of the GreenGuard® XPS Insulation Board such that there is a space between the sheathing and the cladding (i.e., furring is used over GreenGuard® XPS Insulation Board product, as shown in Figure 2), the components and cladding design wind pressure determined in accordance with IRC Section R301.2 or IBC Section 1609.1 shall not exceed the allowable wind pressure value of GreenGuard® XPS Insulation Board, per Table 1.



a. Cladding material and fasteners
b. GreenGuard® Insulation Board
c. Wall framing per code (i.e., wood or steel studs)
d. Cladding fastener per code and of minimum size to support cladding weight

Figure 1. Exterior Wall Covering Assembly with Cladding Installed Directly Over GreenGuard® Insulation Board



a. Cladding material and fasteners
b. Wood or steel furring (which battens the foam sheathing to the wall framing and creates an airspace between the foam sheathing and the cladding)
c. GreenGuard® Insulation Board
d. Wall framing per code (i.e., wood or steel studs)
e. Furring fastener by design and with minimum size to support cladding weight

Figure 2. Exterior Wall Covering Assembly with Cladding and Furring Installed Over GreenGuard® Insulation Board

5.2.2.3 The basic wind speed for GreenGuard® XPS Insulation Board shall not exceed the values in Table 2.

Table 2. Basic Wind Speed Values (mph) for Kingspan® GreenGuard® XPS Insulation Boards Used in Exterior Wall Covering Assemblies Based on ASCE 7-10 Three-Second Gust[1]

Kingspan® XPS Products	Sheathing Thickness (in)	Components & Cladding Basic Wind Speed (mph)	
		16" o.c. Framing	24" o.c. Framing
GreenGuard® XPS Insulation Board	½	115	NP
	¾	130	115
	1	160	140
	1½	200	160
	2	200	180
	3	200	200
GreenGuard® Plygood® Ultra (PGU)	7/16	200	190

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. Allowable wind speeds are based on the following: Mean roof height – 30', Exposure B, 10 sq. ft. effective wind area.

5.2.2.4 Except as noted in Table 1, footnote 4, GreenGuard® XPS Insulation Board can be oriented with the length dimension parallel or perpendicular to the wall framing members. When perpendicular to framing members, horizontal joints shall be supported by blocking, unless use of unblocked joints qualifies in accordance with IBC Section 104.11, IRC Section R104.11 and ASTM C578, as applicable.

5.3 *Water Resistive Barrier*

5.3.1 GreenGuard® Insulation Product (**Note**: Applies to both XPS Insulation Boards and PGU) may be used as a WRB as prescribed in IRC Section R703.2 and IBC Section 1403.2,[12] when installed on exterior walls as described in this section.

5.3.2 GreenGuard® Insulation Products shall be installed with board joints placed directly over exterior framing spaced a maximum of 24" (610 mm) o.c. The fasteners used to attach the board shall be installed in accordance with Section 6.

5.3.3 All seams and joints between boards shall be butt jointed and sealed with an approved construction tape in accordance with Section 6. Approved construction tapes include 1 7/8" GreenGuard® Seam Tape or equivalent except:

5.3.3.1 7/16" PGU approved construction tape shall be a minimum 3" GreenGuard® Seam Tape or equivalent.

5.3.4 A separate WRB may also be provided. If a separate WRB method is used, taping of the sheathing joints is not required.

5.3.5 Flashing must be installed at all sheathing penetrations and shall comply with all applicable code sections.

[12] 2015 IBC Section 1404.2

5.4 *Air Barrier*

5.4.1 GreenGuard® XPS Insulation Board may be used as an air barrier material as prescribed in IRC Section N1102.4.1.1, IECC Section C402.5.1.1 and IECC Section R402.4.1.1.

5.4.2 When used as part of a continuous air barrier, GreenGuard® XPS Insulation Board shall be installed as follows:

5.4.2.1 All sheathing panel edges at the top and bottom of the wall assemblies and all butted joints between sheathing panels shall be sealed with an approved seam tape, self-adhering flashing or sealant.

5.5 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science, and fire science.

6 Installation

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

6.2 In the event of a conflict between the manufacturer installation instructions and this TER, the more restrictive shall govern.

6.3 *GreenGuard® XPS Insulation Board Installation*

6.3.1 Refer to the manufacturer installation instructions in addition to this TER, for complete details and requirements.

6.3.2 All required wall bracing shall be installed prior to insulation board installation.

6.3.3 The insulation boards should be oriented with the printed side facing the exterior side of the building.

6.3.3.1 Except as noted in Table 1, footnote 4, GreenGuard® XPS Insulation Board can be oriented with the length dimension parallel or perpendicular to the wall framing members. When perpendicular to framing members, horizontal joints shall be supported by blocking, unless use of unblocked joints qualifies in accordance with IBC Section 104.11, IRC Section R104.11 and ASTM C578, as applicable.

6.3.4 Secure the sheathing to framing members with fasteners capable of resisting the imposed loads in accordance with NDS. Fasteners will vary, depending on the substrate and cladding materials.

6.3.4.1 Fastener heads shall be a minimum of $^{3}/_{8}$" diameter. Do not allow the fastener head to penetrate the sheathing facer. Use of washers at the fastener head is recommended.

6.3.4.2 Space fasteners 12" o.c. in both the field and perimeter.

6.3.4.3 Minimum penetration of the fasteners into the substrate is $^{3}/_{4}$".

6.4 *Cladding Installation*

6.4.1 Wind pressure rating adjustments for vinyl siding installed directly over GreenGuard® XPS Insulation Board shall comply with IRC Section R703.11.2 for buildings constructed under the IRC or IBC.

6.4.2 Cladding installation and fastening through foam sheathing shall comply with the applicable building code and the cladding manufacturer installation instructions. The minimum fastener size shall be capable of supporting the cladding weight when cantilevering through the GreenGuard® XPS Insulation Board.

6.4.3 Wall assemblies that include GreenGuard® XPS Insulation Board and that are intended to serve as part of the lateral force resisting system of a structure shall be braced to resist the in-plane shear force in accordance with IRC Section R602.10, IBC Section 2308.6, or a design in accordance with IRC Section R301 or IBC Section 2305, as applicable.

6.4.4 Wall assemblies with GreenGuard® XPS Insulation Board attached to gravity load supporting members (i.e., studs) that require buckling restraint in a direction parallel to the plane of the wall shall have such restraint provided by other suitable materials. Wall assemblies shall be designed with an effective buckling length equal to the length of the member between points of lateral support provided by attachment to other building assemblies.

7 Substantiating Data

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

7.1.1 Air barrier material testing in accordance with ASTM E2178

7.1.2 Water-resistive barrier testing in accordance with ASTM E331

7.1.3 Wind pressure resistance testing in accordance with ABTG ANSI/FS 100

7.2 *Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC Tech Matters.*

7.3 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies (i.e., ANAB accredited agencies), approved sources (i.e., RDPs), and/or professional engineering regulations. Accuracy of external test data and resulting analysis is relied upon.

7.4 Where pertinent, testing and/or engineering analysis is based upon provisions that have been codified into law through state or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ's engineering practice may use a code-adopted provision as the control sample. A control sample versus a test sample establishes a product as being equivalent to the code-adopted provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

7.5 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, Listings, certified reports, duly authenticated reports from approved agencies, and research reports prepared by approved agencies and/or approved sources provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this TER, may be dependent upon published design properties by others.

7.6 Testing and engineering analysis: 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.[13]

7.7 Where additional condition of use and/or code compliance information is required, please search for Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards on the DrJ Certification website.

[13] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition.

8 Findings

8.1 As delineated in Section 3, Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards have performance characteristics that were tested and/or meet pertinent standards and are suitable for use pursuant to its specified purpose.

8.2 When used and installed in accordance with this TER and the manufacturer installation instructions, Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards shall be approved for the following applications:

8.2.1 Performance for use as a WRB in accordance with IRC Section R703.2 and IBC Section 1403.2.[14]

8.2.2 Performance for use as an air barrier in accordance with IRC Section N1102.4.1.1, IECC Section C402.5.1.1 and IECC Section R402.4.1.1.

8.2.3 Transverse load resistance due to components and cladding pressures on building surfaces as defined in Section 5.

8.3 Unless exempt by state statute, when the Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) 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.

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

8.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10[15] are similar) in pertinent part states:

> **104.11 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. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons the alternative was not approved.

8.6 **Approved**:[16] Building codes require that the building official shall accept duly authenticated reports[17] or research reports[18] from approved agencies and/or approved sources (i.e., licensed RDP) with respect to the quality and manner of use of new products, materials, designs, services, assemblies, or methods of construction.

8.6.1 Acceptance of an approved agency, by a building official, is performed by verifying that the agency is accredited by a recognized accreditation body of the International Accreditation Forum (IAF).

8.6.2 Acceptance of a licensed RDP, by a building official, is performed by verifying that the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.

8.6.3 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, as denial without written reason deprives a protected right to free and fair competition in the marketplace.

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[14] 2015 IBC Section 1404.2

[15] 2018 IFC Section 104.9

[16] 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 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[17] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1

[18] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2

8.7 DrJ is an engineering company, employs RDPs and is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131.

8.8 Through ANAB accreditation and the IAF Multilateral Agreements, this TER can be used to obtain product approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*." IAF specifically says, "*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope*."[19]

9 Conditions of Use

9.1 Material properties shall not fall outside the boundaries defined in Section 3.

9.2 As defined in Section 3, 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.

9.3 GreenGuard® XPS Insulation Boards listed herein comply with, or are a suitable alternative to, the applicable sections of the IBC and IRC and is subject to the following conditions:

9.3.1 These products shall be installed in compliance with the manufacturer instructions, the applicable building code and this TER.

9.3.2 The manufacturer shall provide the building official and purchaser with evidence of code compliance for matters beyond the wind pressure resistance scope of this TER.

9.4 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:

9.4.1 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.

9.4.2 This TER and the installation instructions shall be submitted at the time of permit application.

9.4.3 These innovative products have an internal quality control program and a third-party quality assurance program.

9.4.4 At a minimum, these innovative products shall be installed per Section 6 of this TER.

9.4.5 The review of this TER, by the AHJ, shall be in compliance with IBC Section 104 and IBC Section 105.4.

9.4.6 These innovative products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.

9.4.7 The application of these innovative products in the context of this TER are 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.

9.5 The approval of this TER by the AHJ shall comply with IBC Section 1707.1, where legislation states in pertinent part, "*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 104.11*", all of IBC Section 104, and IBC Section 105.4.

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

9.7 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent.

[19] https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise

10 Identification

10.1 The innovative products listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer name, product name, TER number, and other information to confirm code compliance.

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

11 Review Schedule

11.1 This TER is subject to periodic review and revision. For the most recent version, visit drjcertification.org.

11.2 For information on the status of this TER, contact DrJ Certification.

12 Approved for Use Pursuant to US and International Legislation Defined in Appendix A

12.1 Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards are included in this TER published by an approved agency that is concerned with evaluation of products or services, maintains periodic inspection of the production of listed materials or periodic evaluation of services, and whose TER Listing states either that the material, product, or service meets identified standards or has been tested and found suitable for a specified purpose. This TER meets the legislative intent and definition of being acceptable to the AHJ.

Appendix A

1 Legislation that Authorizes AHJ Approval

1.1 **Fair Competition**: State legislatures have adopted Federal regulations for the examination and approval of building code referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:

1.1.1 Advance Innovation,

1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and

1.1.3 Benefit consumers through lower prices, better quality, and greater choice.

1.2 **Adopted Legislation**: The following local, state, and federal regulations affirmatively authorize Kingspan® Insulation LLC – GreenGuard® Extruded Polystyrene (XPS) Insulation Boards to be approved by AHJs, delegates of building departments, and/or delegates of an agency of the federal government:

1.2.1 Interstate commerce is governed by the Federal Department of Justice to encourage the use of innovative products, materials, designs, services, assemblies and/or methods of construction. The goal is to "protect economic freedom and opportunity by promoting free and fair competition in the marketplace."

1.2.2 Title 18 US Code Section 242 affirms and regulates the right of individuals and businesses to freely and fairly have new products, materials, designs, services, assemblies and/or methods of construction approved for use in commerce. Disapproval of alternatives shall be based upon non-conformance with respect to specific provisions of adopted legislation, and shall be provided in writing stating the reasons why the alternative was not approved, with reference to the specific legislation violated.

1.2.3 The federal government and each state have a public records act. In addition, each state also has legislation that mimics the federal Defend Trade Secrets Act 2016 (DTSA),[20] where providing test reports, engineering analysis and/or other related IP/TS is subject to prison of not more than 10 years[21] and/or a $5,000,000 fine or 3 times the value of[22] the Intellectual Property (IP) and Trade Secrets (TS).

1.2.3.1 Compliance with public records and trade secret legislation requires approval through the use of listings, certified reports, Technical Evaluation Reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.

1.2.4 For new materials[23] that are not specifically provided for in any building code, the design strengths and permissible stresses shall be established by tests, where suitable load tests simulate the actual loads and conditions of application that occur.

1.2.5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design using accepted engineering practice.[24]

1.2.6 The commerce of approved sources (i.e., registered PEs) is regulated by professional engineering legislation. Professional engineering commerce shall always be approved by AHJs, except where there is evidence, provided in writing, that specific legislation has been violated by an individual registered PE.

1.2.7 The AHJ 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 IBC Section 104.11.[25]

[20] http://www.drjengineering.org/AppendixC and https://www.drjcertification.org/cornell-2016-protection-trade-secrets.

[21] https://www.law.cornell.edu/uscode/text/18/1832#:~:text=imprisoned%20not%20more%20than%2010%20years

[22] https://www.law.cornell.edu/uscode/text/18/1832#:~:text=Any%20organization%20that,has%20thereby%20avoided

[23] https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706.2

[24] IBC 2021, Section 1706.1 Conformance to Standards

[25] IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General

1.3 **Approved**[26] **by Los Angeles**: The Los Angeles Municipal Code (LAMC) states in pertinent part that the provisions of LAMC are not intended to prevent the use of any material, device, or method of construction not specifically prescribed by LAMC. The Department shall use Part III, Recognized Standards in addition to Part II, Uniform Building Code Standards of Division 35, Article 1, Chapter IX of the LAMC in evaluation of products for approval where such standard exists for the product or the material and may use other approved standards, which apply. Whenever tests or certificates of any material or fabricated assembly are required by Chapter IX of the LAMC, such tests or certification shall be made by a testing agency approved by the Superintendent of Building to conduct such tests or provide such certifications. The testing agency shall publish the scope and limitation(s) of the listed material or fabricated assembly.[27] The Superintendent of Building roster of approved testing agencies is provided by the Los Angeles Department of Building and Safety (LADBS). The Center for Building Innovation (CBI) Certificate of Approval License is TA24945. Tests and certifications found in a CBI Listing are LAMC approved. In addition, the Superintendent of Building 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 the California Building Code (CBC) Section 1707.1.[28]

1.4 **Approved by Chicago**: The Municipal Code of Chicago (MCC) states in pertinent part that an Approved Agency is a Nationally Recognized Testing Laboratory (NRTL) acting within its recognized scope and/or a certification body accredited by the American National Standards Institute (ANSI) acting within its accredited scope. Construction materials and test procedures shall conform to the applicable standards listed in the MCC. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material, service, design, assembly and/or method of construction not specifically provided for in the MCC. This technical data shall consist of research reports from approved sources (i.e., MCC defined Approved Agencies).

1.5 **Approved by New York City**: The NYC Building Code 2022 (NYCBC) states in pertinent part that an approved agency shall be deemed[29] an approved testing agency via ISO/IEC 17025 accreditation, an approved inspection agency via ISO/IEC 17020 accreditation, and an approved product evaluation agency via ISO/IEC 17065 accreditation. Accrediting agencies, other than federal agencies, must be members of an internationally recognized cooperation of laboratory and inspection accreditation bodies subject to a mutual recognition agreement[30] (i.e., ANAB, International Accreditation Forum (IAF), etc.).

[26] See Section 8 for the distilled building code definition of **Approved**

[27] Los Angeles Municipal Code, SEC. 98.0503. TESTING AGENCIES

[28] https://up.codes/viewer/california/ca-building-code-2022/chapter/17/special-inspections-and-tests#1707.1

[29] New York City, The Rules of the City of New York, § 101-07 Approved Agencies

[30] New York City, The Rules of the City of New York, § 101-07 Approved Agencies

1.6 **Approved by Florida**: Statewide approval of products, methods, or systems of construction shall be approved, without further evaluation, by 1) A certification mark or listing of an approved certification agency, 2) A test report from an approved testing laboratory, 3) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, from an approved product evaluation entity; 4) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a professional engineer or architect, licensed in Florida. For local product approval, products or systems of construction shall demonstrate compliance with the structural wind load requirements of the Florida Building Code (FBC) through one of the following methods; 1) A certification mark, listing, or label from a commission-approved certification agency indicating that the product complies with the code; 2) A test report from a commission-approved testing laboratory indicating that the product tested complies with the code; 3) A product-evaluation report based upon testing, comparative or rational analysis, or a combination thereof, from a commission-approved product evaluation entity which indicates that the product evaluated complies with the code; 4) A product-evaluation report or certification based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a Florida professional engineer or Florida registered architect, which indicates that the product complies with the code; 5) A statewide product approval issued by the Florida Building Commission. The Florida Department of Business and Professional Regulation (DBPR) website provides a listing of companies certified as a Product Evaluation Agency (i.e., EVLMiami 13692), a Product Certification Agency (i.e., CER10642), and as a Florida Registered Engineer (i.e., ANE13741).

1.7 **Approved by Miami-Dade County (i.e., Notice of Acceptance [NOA])**: A Florida statewide approval is an NOA. An NOA is a Florida local product approval. By Florida law, Miami-Dade County shall accept the statewide and local Florida Product Approval as provided for in Florida legislation 553.842 and 553.8425.

1.8 **Approved by New Jersey**: Pursuant to Building Code 2018 of New Jersey in IBC Section 1707.1 General,[31] it states: “In the absence of approved rules or other approved standards, 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 the administrative provisions of the Uniform Construction Code (N.J.A.C. 5:23)”.[32] Furthermore N.J.A.C 5:23-3.7 states: Municipal approvals of alternative materials, equipment, or methods of construction. **(a) Approvals**: Alternative materials, equipment, or methods of construction shall be approved by the appropriate subcode official provided the proposed design is satisfactory and that the materials, equipment, or methods of construction are suitable for the intended use and are at least the equivalent in quality, strength, effectiveness, fire resistance, durability and safety of those conforming with the requirements of the regulations. 1. A field evaluation label and report or letter issued by a nationally recognized testing laboratory verifying that the specific material, equipment, or method of construction meets the identified standards or has been tested and found to be suitable for the intended use, shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. 2. Reports of engineering findings issued by nationally recognized evaluation service programs, such as, but not limited to, the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress International (SBCCI), the International Code Council (ICC), and the National Evaluation Service, Inc., shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. The New Jersey Department of Community Affairs has confirmed that technical evaluation reports, from any accredited entity listed by ANAB, meets the requirements of item 2 given that the listed entities are no longer in existence and/or do not provide “reports of engineering findings”.

[31] https://up.codes/viewer/new_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1

[32] https://www.nj.gov/dca/divisions/codes/codreg/ucc.html

1.9 **Approved by the Code of Federal Regulations Manufactured Home Construction and Safety Standards**: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[33] and Part 3280,[34] the Department encourages innovation and the use of new technology in manufactured homes. The design and construction of a manufactured home shall conform with the provisions of Part 3282 and Part 3280 where key approval provisions in mandatory language follow: 1) "All construction methods shall be in conformance with accepted engineering practices"; 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."; and 3) "The design stresses of all materials shall conform to accepted engineering practice."

1.10 **Approval by US, Local, and State Jurisdictions in General**: In all other local and state jurisdictions, the adopted building code legislation states in pertinent part that:

1.10.1 For new materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests.[35]

1.10.2 For innovative alternative products, materials, designs, services and/or methods of construction, in the absence of approved rules or other approved standards…the building official shall accept duly authenticated reports (i.e., listing and/or research report) from approved agencies with respect to the quality and manner of use of new materials or assemblies.[36] A building official approved agency is deemed to be approved via certification from an accreditation body that is listed by the International Accreditation Forum[37] or equivalent.

1.10.3 The design strengths and permissible stresses of any structural material…shall conform to the specifications and methods of design of accepted engineering practice performed by an approved source.[38] An approved source is defined as a PE subject to professional engineering laws, where a research and/or a technical evaluation report certified by a PE, shall be approved.

1.11 **Approval by International Jurisdictions**: The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements:

1.11.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,

1.11.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.

1.11.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

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

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

[35] IBC 2021, Section 1706 Design Strengths of Materials, 1706.2 New Materials. Adopted law pursuant to IBC model code language 1706.2.

[36] IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General. Adopted law pursuant to IBC model code language 1707.1.

[37] Please see the ANAB directory for building official approved agencies.

[38] IBC 2021, Section 1706 Design Strengths of Materials, Section 1706.1 Conformance to Standards Adopted law pursuant to IBC model code language 1706.1.

1.11.4 **Approved**: The purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories to the MLA, and subsequently acceptance of accredited certification and validation/verification statements in many markets based on one accreditation for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.