

**NFPA 286 Tested Wall Assemblies Using
Kingspan Kooltherm® Insulation Boards in Attics, Crawlspace,
Basements, and Other Interior Applications**

TER No. 1601-07

Issue Date: April 12, 2017

Updated: March 13, 2018

Subject to Renewal: April 1, 2019

Kingspan Insulation LLC

2100 RiverEdge Parkway
Suite 175
Atlanta, GA 30328
www.kingspaninsulation.us

DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 – Thermal Insulation

Section: 07 24 00 – Exterior Insulation and Finish Systems

Section: 07 25 00 – Water-Resistive Barriers/Weather Barriers

Section: 07 27 00 – Air Barriers

1. Products Evaluated:

1.1. Kingspan Insulation LLC – Kingspan Kooltherm® Insulation Boards

1.1.1. K5 External Wallboard

1.1.2. K8 Cavity Board

1.1.3. K10 FM Soffit Board

1.1.4. K12 Framing Board

1.1.5. K15 Rainscreen Board

1.1.6. K20 Concrete Sandwich Board

1.2. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.

1.3. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).

DrJ is a Professional Engineering Approved Source

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with IBC Section 1703.

Technical Evaluation Report (TER)

- 1.4. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see [drjcertification.org](#).
- 1.5. Requiring an evaluation report from a specific private company (i.e. ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
- 1.6. DrJ's code compliance work:
 - 1.6.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
 - 1.6.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ takes professional responsibility for its specified scope of work.

2. Applicable Codes and Standards:¹

- 2.1. 2012, 2015 and 2018 International Building Code (IBC)
- 2.2. 2012, 2015 and 2018 International Energy Conservation Code (IECC)
- 2.3. ANSI/AWC NDS – National Design Specification for Wood Construction
- 2.4. ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board
- 2.5. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- 2.6. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- 2.7. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics
- 2.8. ASTM D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
- 2.9. ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- 2.10. ASTM D6226 – Standard Test Method for Open Cell Content of Rigid Cellular Plastics
- 2.11. ASTM E84 / UL 723 – Standard Test Method for Surface Burning Characteristics of Building Materials
- 2.12. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials
- 2.13. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials
- 2.14. NFPA 286 – Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

3. Performance Evaluation:

- 3.1. Kingspan Kooltherm® Insulation Board products were evaluated to determine:
 - 3.1.1. Material properties in accordance with ASTM C209.
 - 3.1.2. Thermal resistance properties in accordance with [IECC Section C402](#).
 - 3.1.3. Use as a water-resistant barrier (WRB) in accordance with [IBC Section 1404.2](#).
 - 3.1.4. Use as an air barrier material in accordance with [IECC Section C402.5.1.2](#).
 - 3.1.5. Performance for use in buildings of Type I-IV construction in accordance with [IBC Section 2603.5](#).
 - 3.1.5.1. Performance in accordance with ASTM E84 / UL 723 for flame spread and smoke development ratings in accordance with [IBC Section 2603.3](#) and [2603.5.4](#).

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2018 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2015 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any see [Section 8](#).

Technical Evaluation Report (TER)

3.1.5.2. Performance for use without a thermal barrier in accordance with [IBC Section 2603.4](#) and [2603.5.2](#).

3.1.5.3. Performance with regard to vertical and lateral fire propagation in accordance with [IBC Section 2603.5.5](#).

3.1.5.4. Performance with regard to ignition in accordance with [IBC Section 2603.5.7](#).

3.1.5.5. Use as part of an *NFPA 286* wall assembly in accordance with [IBC Section 2603.7.2](#).

3.1.6. Wind pressure resistance is out of scope of this TER.

3.2. Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

4. Product Description and Materials:



Figure 1: Kingspan Kooltherm® Insulation Board

4.1. Kingspan Kooltherm® Insulation Board is:

4.1.1. A proprietary plastic foam made from rigid cellular phenol resin.

4.1.2. Used for non-structural thermal insulation in ceiling, wall and floor assemblies in all types of construction.

4.1.3. Available with foil, foil-glass and glass facers.

4.1.3.1. Material Availability

4.1.3.1.1. Thickness: ¾" (20 mm) through 4¾" (120 mm)

4.1.3.1.2. Standard product width: 48" (1,219 mm)

Product Name	Facers	Application	Thickness (mm.)	
			Thinnest	Thickest
K8	Reinforced Foil Facers Both Sides	Brick with Block Wall (16" pre-cut)	20 mm	120 mm
K12		Wood or Steel Stud Framed Wall		
K15		Rainscreen		
K10	Reinforced Foil on One Side, Glass Facer on Other	Soffit and Exposed Applications (Not Below Grade)	25 mm	120 mm
K5	Glass Facer on Both Sides	EIFS Wall System	20 mm	100 mm
K20		Precast /Tilt-up Concrete		120 mm

Table 1: Kingspan Kooltherm® Products

Technical Evaluation Report (TER)

5. Applications:

5.1. General

- 5.1.1. Kingspan Kooltherm® Insulation Board is a rigid thermoset closed cell phenolic thermal insulation complying with [IBC Section 2603](#).
- 5.1.2. Kingspan Kooltherm® Insulation Board is used in buildings of Type I through IV construction in accordance with [IBC Section 2603.5](#).
- 5.1.3. Kingspan Kooltherm® Insulation Board is used in buildings of Type V construction in accordance with [IBC Section 2603.4.1.4](#).
- 5.1.4. Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience and technical judgment.

5.2. Permeance

- 5.2.1. Kingspan Kooltherm® Insulation Boards have a permeance rating of <1. Per [IBC Section 1405.3.2](#), Class III vapor retarders shall be used on the interior side of walls framed with Insulation Boards with <1 permeance installed on the exterior side of the framed wall. Water vapor permeance of Kingspan Kooltherm® is indicated in [Table 2](#).

Test Method	Water Vapor Permeance (grains/h ² *ft ² *in Hg) ¹		
	Foil Facers (K8, K12 and K15)	Foil-Glass Facers (K10)	Glass Facers (K5 and K20)
ASTM E96 A (Desiccant Method)	0.51	0.48	0.79
1. Results for 1" thickness board			

Table 2: Water Vapor Permeance

5.3. Air Barrier

- 5.3.1. Kingspan Kooltherm® Insulation Board is an air barrier material and meets the requirements of [IECC Section C402.5.1.2.1](#) for use as part of an air barrier assembly when installed in accordance with the manufacturer's installation instructions and this TER and with all seams, including the top and bottom edges, taped.

5.4. Thermal Barrier

- 5.4.1. Kingspan Kooltherm® Insulation Boards shall be fully protected from the interior of the building by an approved thermal barrier or ignition barrier as required by [IRC Section R316.4](#) and [IBC Section 2603.4](#), except as follows:

5.4.1.1. Use Without an Ignition Barrier

- 5.4.1.1.1. Kingspan Kooltherm® K20 and K5 Insulation Boards and K10 Insulation Boards (with glass facer exposed), up to 4¾" thick, have been approved for use without an ignition barrier on walls and/or ceilings in attics and crawl spaces based on testing to *NFPA 286*, in accordance with [IBC Section 2603.9²](#) and [IRC Section 316.6](#). This includes, but is not limited to, knee and gable end walls.

- 5.4.1.1.2. Use without an approved thermal barrier or ignition barrier is limited to areas where:

- 5.4.1.1.2.1. Access to the space is required by [IRC Section R807.1](#) or [R408.4](#).

- 5.4.1.1.2.2. Entry is made only for the purposes of repairs or maintenance.

- 5.4.1.1.2.3. Combustion air is provided in accordance with the International Mechanical Code (IMC) Section 701.

² [2012 IBC Section 2603.10](#)

Technical Evaluation Report (TER)

- 5.4.1.1.2.4. For vented attics, ventilation is provided when required by [IBC Section 1203.2](#) or [IRC Section R806](#).
- 5.4.1.1.2.5. For unvented attics, ventilation is not required where permitted in accordance with [IRC Section R806.5](#)³.
- 5.4.1.1.2.6. For vented crawlspaces, ventilation is provided when required by [IBC Section 1203.4](#)⁴ or [IRC Section R408.1](#).
- 5.4.1.1.2.7. For unvented crawlspaces, ventilation is not required where permitted in accordance with [IRC Section R408.3](#).

5.4.1.2. Use Without a Thermal Barrier

- 5.4.1.2.1. Kingspan Kooltherm® K20, K10, and K5 Insulation Boards, up to 75 mm with glass tissue facer left exposed, have been tested to *NFPA 286* for use on ceilings only or walls only, in accordance with [IBC Section 2603.9](#)⁵ and [IRC Section 316.6](#), and is approved for use without a thermal barrier.
- 5.4.1.2.2. Kingspan Kooltherm® K15, K12, K10, and K8 Insulation Boards, up to 75 mm thick with exterior foil facer left exposed, have been tested to *NFPA 286* for use on ceilings only, in accordance with [IBC Section 2603.9](#)⁶ and [IRC Section 316.6](#), and is approved for use without a thermal barrier.

5.5. Surface Burn Characteristics

Product Name	Flame Spread Index	Smoke Developed Index
Kingspan Kooltherm® Insulation	<25	<450
Tested in accordance with <i>UL 723 (ASTM E84)</i> . Flame spread and smoke-developed indexes are shown for comparison purposes only and are not intended to represent the performance under actual fire conditions.		

Table 4: Fire Performance of Insulation Boards

5.6. Ignition

- 5.6.1. Kingspan Kooltherm® Insulation Boards were evaluated to assess performance with regard to ignition in accordance with [IBC Section 2603.5.7](#).
 - 5.6.1.1. Kingspan Kooltherm® Insulation Boards comply with this section when the exterior side of the sheathing is protected with one of the following materials:
 - 5.6.1.1.1. A thermal barrier complying with [IBC Section 2603.4](#).
 - 5.6.1.1.2. A minimum 1" (25 mm) thickness of concrete or masonry.
 - 5.6.1.1.3. Glass-fiber-reinforced concrete panels of a minimum thickness of $\frac{3}{8}$ " (9.5 mm).
 - 5.6.1.1.4. Metal-faced panels having a minimum 0.019"-thick (0.48 mm) aluminum or 0.016"-thick (0.41 mm) corrosion-resistant steel outer facings.
 - 5.6.1.1.5. A minimum $\frac{7}{8}$ " (22.2 mm) thickness of stucco complying with [IBC Section 2510](#).
 - 5.6.1.1.6. A minimum $\frac{1}{4}$ " (6.4 mm) thickness fiber-cement lap, panel or shingle siding complying with [IBC Section 1405.16](#).

6. Installation:

- 6.1. Installation shall comply with the manufacturer's [installation instructions](#) and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- 6.2. For applications outside the scope of this TER, an engineered design is required.

³ [2009 IRC Section R806.4](#)

⁴ [2009 and 2012 IBC Section 1203.3](#)

⁵ [2012 IBC Section 2603.10](#)

⁶ [2012 IBC Section 2603.10](#)

Technical Evaluation Report (TER)

7. Test and Engineering Substantiating Data:

- 7.1. Test reports and data supporting the following material properties and wall assembly performance:
 - 7.1.1. Material properties in accordance with *ASTM C209* by Intertek.
 - 7.1.2. Thermal resistance values in accordance with *ASTM C518* by Intertek.
 - 7.1.3. Compressive strength properties in accordance with *ASTM D1621* by Intertek.
 - 7.1.4. Apparent core density properties in accordance with *ASTM D1622* by Intertek.
 - 7.1.5. Tensile strength in accordance with *ASTM D1622* by Intertek.
 - 7.1.6. Flame spread and smoke developed ratings in accordance with *ASTM E84/UL 723* by Underwriters Laboratories, Inc.
 - 7.1.7. Water vapor transmission and permeance properties in accordance with *ASTM E96* by Intertek.
 - 7.1.8. Air barrier material performance of Kingspan Kooltherm® Insulation Boards in accordance with *ASTM E2178* by Intertek.
 - 7.1.9. *NFPA 286* room corner testing performed by Underwriters Laboratories, Inc.
 - 7.1.10. Exclusion of thermal and ignition barriers in attics and crawlspaces in accordance with *NFPA 286* by Jensen Hughes.
- 7.2. Engineering analysis supporting the following material properties:
 - 7.2.1. Jensen Hughes, Analysis of Kingspan's Kooltherm® Insulation Boards and Section 1403.5 of the *IBC* (2015 edition), Project No. 1JJB00153.006
 - 7.2.2. FM Approvals, Approval Examination of Kingspan Kooltherm® K10 Soffit Board for Standard 4880, Project ID: 3044265.
- 7.3. Manufacturer technical data sheets and installation instructions.
- 7.4. Manufacturer quality control manual and evidence of approved agency inspections.
- 7.5. Test reports and data for determining comparative equivalency for use as an alternative material in accordance with [IBC Section 104.11](#).
- 7.6. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.7. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.8. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate, as it undertakes its engineering analysis.
- 7.9. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.10. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.

Technical Evaluation Report (TER)

7.11. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC, WFCM, IBC, SDPWS, NDS, ACI, AISI, PS-20, PS-2*, etc.). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g. lumber, steel, concrete, etc), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8. Findings:

- 8.1. Kingspan Kooltherm® Insulation Boards are approved for use in exterior walls of buildings of Type I-IV construction in accordance with [IBC Section 2603.5](#).
- 8.2. Kingspan Kooltherm® K10 Insulation Boards are approved for use in attics and crawlspaces, walls and ceilings, without a thermal or ignition barrier when constructed in accordance with [Section 5.4](#).
- 8.3. Kingspan Kooltherm® Insulation Boards described in this TER comply with, or are a suitable alternative to, the applicable sections of the codes listed in [Section 2](#).
- 8.4. [IBC Section 104.11](#) and [IRC Section R104.11](#) ([IFC Section 104.9](#) is similar) state:

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, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in 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*.
- 8.5. This product has been evaluated with the codes listed in [Section 2](#), and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:
 - 8.5.1. No known variations
- 8.6. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

- 9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the [installation instructions](#) shall be submitted at the time of permit application.
- 9.2. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.
- 9.3. Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.
- 9.4. The products listed in this TER shall be installed in accordance with this TER and the manufacturer's installation instructions.
- 9.5. When the insulation boards are used on exterior walls of buildings of Type I, II, III or IV, construction must be as described in [Section 5.6](#).
- 9.6. In areas where the probability of termite infestation is very heavy and the building is wood-framed construction, the product must not be placed on exterior walls located within 6" (152 mm) of the ground and shall meet the requirements of [IBC Section 2603.8](#).
- 9.7. Kingspan Kooltherm® Insulation Boards shall be separated from the interior of the building by an approved thermal barrier except as provided for in [Section 5.4](#).
- 9.8. This product shall not be used as a nailing base for claddings.

Technical Evaluation Report (TER)

- 9.9. The insulation boards shall not be used to resist lateral loads. Walls shall be braced by other materials in accordance with the applicable code, and the exterior wall covering shall be capable of resisting the full design wind pressure.
- 9.10. The insulation boards are manufactured in Pembridge, United Kingdom under a quality control program with quality control inspections in accordance with [IBC Section 110.3.8](#) and [110.3.9](#).
- 9.11. Design
- 9.11.1. Building Designer Responsibility
- 9.11.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
- 9.11.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).
- 9.11.2. Construction Documents
- 9.11.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.
- 9.12. Responsibilities
- 9.12.1. The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.
- 9.12.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
- 9.12.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.12.4. This product is manufactured under a third-party quality control program in accordance with [IRC Section R104.4](#) and [R109.2](#) and [IBC Section 104.4](#) and [110.4](#).
- 9.12.5. 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, and the TER shall be reviewed for code compliance by the Building Official.
- 9.12.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10. Identification:

- 10.1. The insulation boards and building wraps described in this TER are identified by a label bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2. Additional technical information can be found at www.kingspaninsulation.us.

11. Review Schedule:

- 11.1. This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjengineering.org.
- 11.2. For information on the current status of this TER, contact [DrJ Engineering](#).



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law and P.E. Law](#)