

Use of Icynene Classic Plus Spray Polyurethane Foam (SPF) in Unvented Attics & Crawlspace

TER No. 1703-15

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Section: 07 21 19 – Foamed-in-Place Insulation

Section: 07 27 36 – Sprayed Foam Air Barrier

1. Products Evaluated:

- 1.1. Icynene Classic Plus (LD-C-70)
- 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](#).
- 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.

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.

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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. *2010 and 2015 National Building Code of Canada (NBC)*
- 2.2. *ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*
- 2.3. *ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics*
- 2.4. *ASTM D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics*
- 2.5. *ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging*
- 2.6. *ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics*
- 2.7. *ASTM D6226 – Standard Test Method for Open Cell Content of Rigid Cellular Plastics*
- 2.8. *ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials*
- 2.9. *ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*
- 2.10. *ASTM E2178 – Standard Test Method for Air Permeance of Building Materials*
- 2.11. *CAN/ULC-S102 – Test for Surface Burning Characteristics of building Materials and Assemblies*
- 2.12. *CAN/ULC-S705.1 – Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density - Material – Specification*
- 2.13. *CAN/ULC-S705.2 – Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density - Application*
- 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. NBC Compliance

3.1.1. This TER assesses Icynene Classic Plus for the following:

- 3.1.1.1. Physical properties of the product in accordance with the standards listed in [Section 2](#).
- 3.1.1.2. Surface burning characteristics complying with the provisions of NBC Division B, Part 3, Section 3.1.12.
- 3.1.1.3. Thermal performance (R-values) complying with the provisions of NBC Division B, Part 5, Section 5.3.1 and Part 9, Sections 9.25.2 and 9.36.2.
- 3.1.1.4. Use in unvented attic spaces and crawlspaces without a thermal barrier in accordance with NBC Division B, Part 3, Sections 3.1.4.2 and 3.1.5.15 and Part 9, Section 9.10.17.10.
- 3.1.1.5. Air permeability in accordance with NBC Division B, Part 5, Section 54.1 and Part 9, Section 9.25.3.

3.2. Use in a ventilated attic or crawl space without a thermal barrier is outside the scope of this evaluation.

¹ Unless otherwise noted, all references in this code-compliant technical evaluation report (TER) are from the 2015 version of the NBC code and the standards referenced therein. This product also complies with the 2005 and 2010 versions of the NBC and the standards referenced therein. Where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in provincial and territorial codes, if any, see [Section 8](#).

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- 3.3. Use in fire-resistance rated construction is outside the scope of this evaluation.
- 3.4. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

4. Product Description and Materials:



Figure 1: Icynene Classic Plus SPF in Unventilated Attics

- 4.1. Icynene Classic Plus is a two-component, open-cell SPF insulation product.
 - 4.1.1. Classic Plus has a density of 0.7 pounds per cubic foot (pcf) (11 kg/m³).
- 4.2. The two components of Icynene low density SPF are:
 - 4.2.1. Component A: MDI/pMDI isocyanate
 - 4.2.2. Component B: proprietary resin
- 4.3. These two components are combined at the point of spray application.

5. Applications:

5.1. General

- 5.1.1. Icynene Classic Plus insulation is used in the following applications:
 - 5.1.1.1. Thermal insulation in buildings constructed in accordance with the *NBC*.
 - 5.1.1.2. Sealant for penetrations as part of an air barrier system.
- 5.1.2. Where fire resistance rated construction is required, contact the manufacturer for more information.

5.2. Surface Burning Characteristics

- 5.2.1. Icynene Classic Plus has the surface burning characteristics as shown in [Table 1](#).

Fire Performance of Icynene Low Density SPF		
	Flame Spread	Smoke Developed
Icynene Classic Plus¹	375	110
1. Tested in accordance with <i>CAN/ULC S102</i> at a thickness of 75 mm (3").		

Table 1: Flame Spread & Smoke Developed Indexes of Icynene Low Density SPF

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5.3. Thermal Resistance

5.3.1. Icynene low density SPF has the thermal resistance as defined in [Table 2](#).

Thickness		Thermal Resistance (R-values) (h-ft. ² ·°F/Btu) ^{1,2}	Thermal Resistance (U-factors) (Btu/(h °F ft. ²))	Thermal Resistance (R-values) (W/(m ² ·K)) ^{1,2}	Thermal Resistance (U-factors) ((m ² ·K)/W)
Classic Plus	1"	4	0.250	0.7	1.420
	2"	8	0.125	1.4	0.710
	3"	12	0.083	2.1	0.471
	3.5"	14	0.071	2.5	0.403
	4"	16	0.063	2.8	0.358
	5"	20	0.050	3.5	0.284
	5.5"	22	0.045	3.9	0.256
	6"	24	0.042	4.2	0.238
	7"	28	0.036	4.9	0.204
	7.5"	30	0.033	5.3	0.187
	8"	32	0.031	5.6	0.176
	9"	36	0.028	6.3	0.159
	9.5"	38	0.026	6.7	0.148
	10"	40	0.025	7.0	0.142
	11.5"	46	0.022	8.1	0.125
13.5"	54	0.019	9.5	0.108	
14"	56	0.018	9.9	0.102	

1. Tested at a mean temperature of 75° F.
 2. R-values are calculated from testing at 1" and 3.5" thickness. Calculated R-values over 10 are rounded to the nearest integer.

Table 2: Classic Plus Thermal Resistance Properties

5.4. Air Permeability

5.4.1. Icynene Classic Plus has the air permeability characteristics shown in [Table 3](#) and, therefore, are an air-impermeable insulation in accordance with *NBC* Division B, Part 9, Section 9.25.4.

Icynene Classic Plus^{1,2}	< 0.02 (L/s.m ²)
1. Sprayed to a minimum thickness of 3" 2. Tested in accordance with <i>ASTM E2178</i> .	

Table 3: Classic Plus Air Barrier Material Properties

5.5. Thermal Barrier

5.5.1. General

5.5.1.1. *NBC* Compliance

5.5.1.1.1. Icynene Classic Plus installed in combustible construction is not required to be covered with a thermal barrier in attic or roof spaces, and crawl spaces in accordance with *NBC* Division B, Part 3, Section 3.1.4.2 and Part 9, Section 9.10.17.10.

5.5.1.1.2. In accordance with *NBC* Division B, Part 3, Section 3.1.5.15, in noncombustible construction, Icynene Classic Plus shall be separated from the adjacent building spaces by a thermal barrier consisting of:

5.5.1.1.2.1. A minimum 12.7 mm thick gypsum wallboard mechanically fastened to a supporting assembly independent of the insulation

5.5.1.1.2.2. Lath and plaster fastened to a supporting assembly independent of the insulation,

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5.5.1.1.2.3. Masonry,

5.5.1.1.2.4. Concrete,

5.5.1.1.2.5. Or any thermal barrier meeting the requirements of Classification B when tested to *CAN/ULC S124*.

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

6. Installation:

6.1. General

- 6.1.1. Installation shall comply with the manufacturer's installation instructions and this TER.
- 6.1.2. SPF insulation shall be applied by licensed dealers and installers certified by Icynene, Inc.
- 6.1.3. A copy of the manufacturer's published installation instructions shall be available at all times on the jobsite during installation.
- 6.1.4. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- 6.1.5. Icynene Classic Plus shall be applied to the framing using two-component spray equipment and shall be applied using a 1:1 ratio of [Component A and Component B](#).
- 6.1.6. The substrate shall be dry and free of frost, ice, rust, oil, grease, dirt or any other substances that may prevent adhesion of the SPF to the substrate.
- 6.1.7. Icynene Classic Plus is intended for interior use only and are not to be used where it could come in contact with water. Provide protection from weather during and after installation.
- 6.1.8. Where used as an air barrier in unventilated attics, the insulation shall be installed to the minimum thickness required as specified in [Table 3](#).
- 6.1.9. Icynene Classic Plus may be installed to the required thickness with one pass of the spray equipment. If installation using multiple passes is desired, no cure time is required between passes.
- 6.1.10. Do not use Icynene Classic Plus inside of electrical or junction boxes.
- 6.1.11. Icynene Classic Plus shall be installed only when the temperature is at or above 14°F (-10°C).
- 6.1.12. Insulation shall not be installed in areas where the service temperature is greater than 180°F (82°C).

6.2. Icynene Classic Plus Installation

- 6.2.1. For general SPF installation guidelines, see the American Chemistry Council's [Guidance on Best Practices for the Installation of Spray Polyurethane Foam](#).
- 6.2.2. Icynene Classic Plus shall be installed in accordance with Icynene, Inc.'s installation instructions and this TER. For compliance with the *NBC*, installation in accordance with *CAN/ULC-S705.2* is required.

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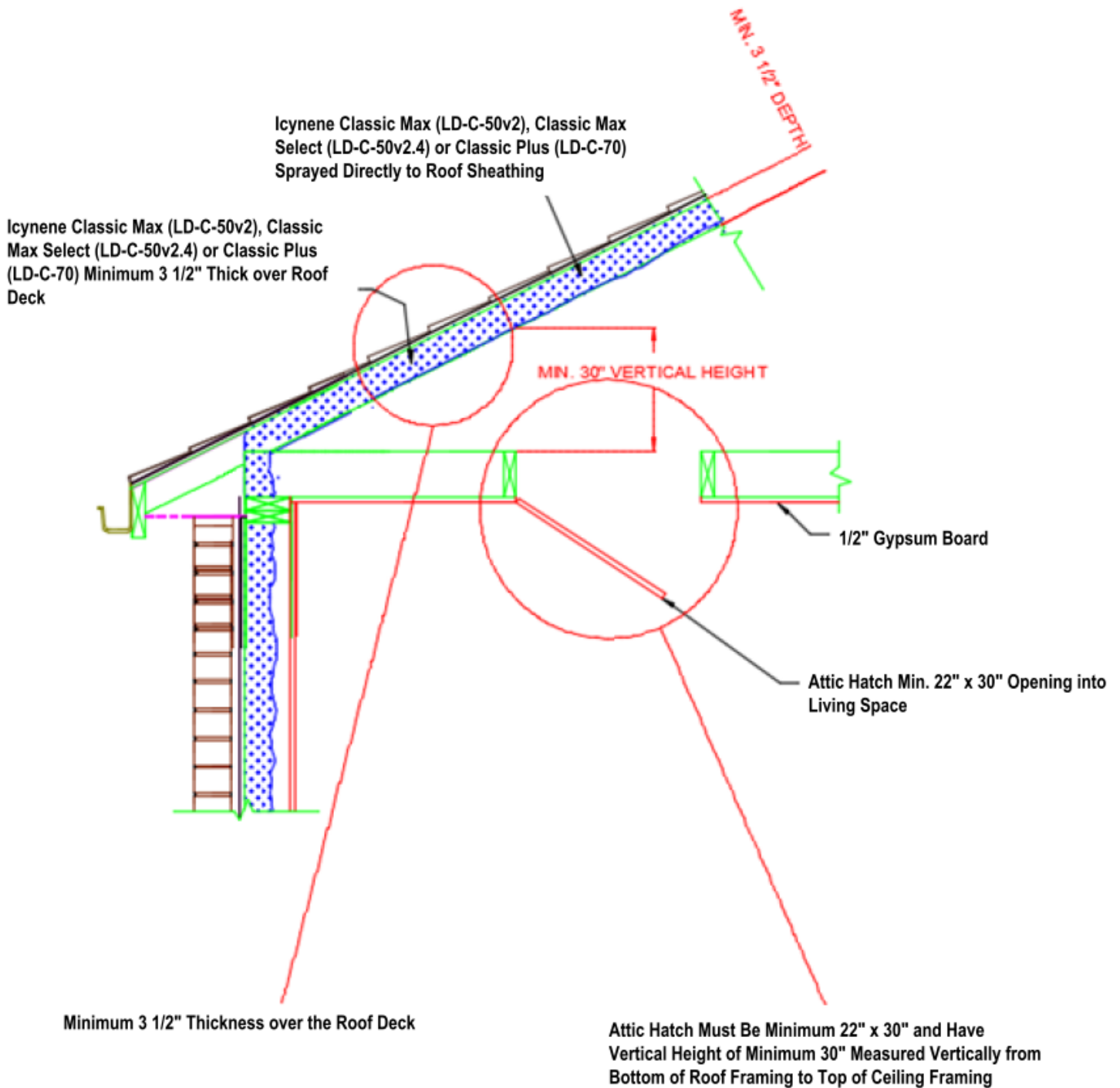


Figure 2: Icynene Classic Plus Used in an Unvented Attic Space

7. Test and Engineering Substantiating Data:

- 7.1. Structural testing of trusses, joists, and rafters for comparison before and after *NFPA 286* modified fire testing. The fire testing was performed by QAI Labs in 2014, and the structural testing was performed by SBCRI under contract with Qualtim, Inc.
- 7.2. Testing and data in accordance with *NFPA 286*. Testing modified for unventilated attics and performed by Intertek.

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- 7.3. Testing and data in accordance with *NFPA 286*. Testing modified for unventilated attics and performed by QAI Labs.
- 7.4. Engineering analysis of Classic Plus fire performance. Analysis done by Priest and Associates.
- 7.5. Testing and data determining the material properties of Icynene Classic Plus. Testing performed by Bodycote.
- 7.6. Testing showing surface burning characteristics in accordance with *ASTM E84*. Testing performed by Bodycote.
- 7.7. Testing as an air barrier material in accordance with *ASTM E2178*. Testing performed by Exova.
- 7.8. The product evaluated by this TER falls within the scope of one or more of the model, provincial or territorial building codes for building construction. The testing and substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.9. The provisions of model, provincial or territorial 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 engineered alternative means of compliance. This TER assesses compliance with defined standards, generally accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.10. Some information contained herein is the result of testing or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.
- 7.11. DrJ has reviewed the data provided by other professional sources and found them to be credible. This information has been approved in accordance with DrJ's procedure for acceptance of data from approved sources.
- 7.12. DrJ's responsibility for data provided by approved sources is in accordance with professional engineering law.
- 7.13. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards. This includes review of code provisions and any related test data that helps with comparative analysis or provides support for equivalency to an intended end-use application.

8. Findings:

- 8.1. The testing protocol for this project included:
 - 8.1.1. Structural testing of joists and trusses before application of Icynene Classic Plus SPF. Testing performed by SBCRI under contract with Qualtim, Inc.
 - 8.1.2. Shipping, and installation of trusses and joists into an attic assembly with subsequent application of Icynene Classic Plus for the purpose of fire testing the assembly and comparing the structural stiffness of the joists and trusses before and after the fire test. Control specimens were also included in the shipping and assembly to benchmark performance.
 - 8.1.3. Fire testing of the described attic assembly to a modified version of *NFPA 286*. Testing performed by QAI Labs.
 - 8.1.4. Disassembly of the attic by QAI Labs and shipping of trusses and joists back to SBCRI.
 - 8.1.5. Repeat structural testing by SBCRI to determine the stiffness loss and strength effects of:
 - 8.1.5.1. Shipping and handling, installation and disassembly of the control and the fire tested structural elements.
 - 8.1.5.2. Application of spray foam to these elements.
 - 8.1.5.3. Attic fire testing, including realistic fire temperatures and duration.
 - 8.1.5.4. Comparison of the performance of the control specimens to the attic fire tested specimens.
- 8.2. There was no measured difference in performance between rafter framing and truss framing in the context of performance post-*NFPA 286* fire testing. The comparisons included:

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- 8.2.1. Truss and rafter framing that had been transported and installed in a building.
 - 8.2.2. Truss and rafter framing onto which Icynene Classic Plus foam had been applied in accordance with standard Icynene application procedures for attics.
 - 8.2.3. Truss and rafter framing subjected to modified *NFPA 286* testing of an unvented attic.
 - 8.2.4. Truss and rafter framing compared to control specimens.
 - 8.3. Additional test data and evaluations comparing the fire performance of Icynene Classic Plus in unvented attics and crawlspaces using modified *NFPA 286* testing was also provided to prove the similarity of the performance of Icynene Classic Plus and that these products can be used interchangeably.
 - 8.4. The application of Icynene Classic Plus does not compromise the structural performance of standard rafter or truss framing in code compliant unvented attic and crawlspace applications
 - 8.5. *NBC* Division A, Part 1, Section 1.2.1 states:
 - 1.2.1.1. **Compliance with this Code**
 - 1) Compliance with this Code shall be achieved by
 - a) complying with the applicable acceptable solutions in Division B (see Note 1.2.1.1.(1)(a)), or
 - b) using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Note 1.2.1.1.(1)(b)).
 - 2) For the purposes of compliance with this Code as required in Clause 1.2.1.1.(1)(b), the objectives and functional statements attributed to the acceptable solutions in Division B shall be the objectives and functional statements referred to in Subsection 1.1.2. of Division B.
 - 8.6. *NBC* Division C, Part 2, Section 2.3 includes additional guidance for Alternative Solutions.
 - 8.7. This product has been evaluated with the codes listed in [Section 2](#), and is compliant with all known provincial or territorial building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:
 - 8.7.1. No known variations
 - 8.8. 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. Icynene Classic Plus insulation described in this TER comply with, or is a suitable alternative to, what is specified in the codes listed in [Section 2](#), subject to the following conditions:
 - 9.4.1. The manufacturer's installation instructions and this TER shall be available on the jobsite for inspection.
 - 9.4.2. The SPF insulation shall be installed in accordance with the manufacturer's published installation instructions, this TER and the applicable code. If there is a conflict between the installation instructions and this TER, the more restrictive governs.
 - 9.4.3. The SPF insulation shall be separated from the interior of the building by an approved 15-minute thermal barrier, except as noted in this TER.
 - 9.4.4. When installed in unvented attics without a code-prescribed ignition barrier or thermal barrier, the installation shall meet the conditions outlined in [Section 5.5](#).
 - 9.4.5. The SPF insulation shall meet the minimum thicknesses and densities noted in this TER.

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- 9.4.6. The SPF insulation shall be protected from the weather during and after application.
- 9.4.7. The SPF insulation shall be applied by licensed dealers and installers certified by Icynene, Inc.
- 9.4.8. Use of the SPF insulation in localities where termites are known to occur shall be in accordance with *NBC* Division B, Part 9, Section 9.3.2.9 as applicable.
- 9.4.9. Jobsite certification and labeling of the SPF insulation shall comply with governing Canadian regulations, as applicable.
- 9.4.10. A vapor retarder shall be installed in accordance with the applicable code.
- 9.4.11. The components used to produce Icynene Classic Plus are manufactured in Mississauga, Ontario, Canada, under a quality control program with inspections in accordance with governing Canadian regulations, as applicable.

9.5. Design

9.5.1. Building Designer Responsibility

- 9.5.1.1. Unless the AHJ allows otherwise, construction documents shall be prepared by a building designer (owner, registered design professional, etc.) for the building and shall be in accordance with *NBC* Division C, Part 2, Section 2.2.4.
- 9.5.1.2. The construction documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads. The documents shall be in accordance with *NBC* Division C, Part 2, Section 2.2.4. and Note A-2.2.6.2.(1).

9.5.2. Construction Documents

- 9.5.2.1. 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.

9.6. Responsibilities

- 9.6.1. The information contained herein is a product, engineering or building code compliance technical evaluation report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and technical judgment.
- 9.6.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated section.
- 9.6.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.6.4. This product is manufactured under a third-party quality control program in accordance with governing Canadian regulations, as applicable.
- 9.6.5. 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.
- 9.6.6. The use of this TER is dependent on the manufacturer's in-plant quality control procedures, the ISO/IEC 17020 third-party inspection process, proper installation per the manufacturer's instructions, the building official's inspection, and any other code requirements that may apply to ensure accurate compliance with the applicable building code.

10. Identification:

- 10.1. Icynene Classic Plus as described in this TER is identified by a label on the containers bearing the manufacturer's name, product name, label of the third-party inspection agency, and other information to confirm code compliance.
- 10.2. Additional technical information can be found at lcynene.com.

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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](#)