

Wind Pressure Performance of Dow Chemical Insulated Sheathing Products

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The Dow Chemical Company

200 Larkin Center
1501 Larkin Center Drive
Midland, MI 48674
866-583-2583
<http://building.dow.com/en-us/>

DIVISION: 06 00 00 – WOOD, PLASTICS AND COMPOSITES

Section: 06 16 00 – Sheathing

DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 – Thermal Insulation

1. Products Evaluated:

1.1. Dow insulating sheathing:

- 1.1.1.** STYROFOAM™ Brand Products – Square Edge, Tongue and Groove, Ultra Ship Lap, UTILITYFIT™, DURAMATE™ Plus and Residential Sheathing
- 1.1.2.** TUFF-R™ Brand Products – TUFF-R™ Residential and Commercial, Super TUFF-R™ Residential and Commercial, TUFF-R™ ci
- 1.1.3.** THERMAX™ Brand Products – THERMAX™ Sheathing, THERMAX™ ci, THERMAX XARMOR™ (ci) Exterior Insulation, HD, LD, Metal Building and White Finish

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).

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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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.
- 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 take 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 Residential Code (IRC)*
- 2.3. *ANSI/AWC NDS – National Design Specification for Wood Construction*
- 2.4. *ANSI/SBCA FS100 – Standards Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies*
- 2.5. *ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures*
- 2.6. *ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*
- 2.7. *ASTM C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation*
- 2.8. *ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*
- 2.9. *ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board*

3. Performance Evaluation:

- 3.1. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing were evaluated for the following:
 - 3.1.1. Wind pressure resistance performance for use as part of an exterior wall covering assembly in accordance with the following code sections:
 - 3.1.1.1. [IBC Section 104.11](#) and [1404.8](#)
 - 3.1.1.2. [IRC Section R104.11](#), [R703.1.2](#) and [R703.3](#), and [Table R703.3\(1\)](#).
 - 3.1.2. Wind pressure resistance performance for use as exterior wall sheathing in compliance with the building codes listed in [Section 2](#).
- 3.2. When used as over-sheathing² on light-frame, masonry, or concrete exterior walls, STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing is not required to meet the wind pressure requirements of this TER.

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](#).

² 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

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- 3.3. This TER does not address wind pressure resistance requirements for STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing used as part of an Exterior Insulation Finish System (EIFS). Refer to the EIFS manufacturer's installation instructions for building code compliance.
- 3.4. Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

4. Product Description and Materials:

4.1. STYROFOAM™ Brand

- 4.1.1. STYROFOAM™ Brand insulation is an extruded polystyrene foam insulation, manufactured in compliance with *ASTM C578*, and includes:
 - 4.1.1.1. SE – Square Edge (Type IV)
 - 4.1.1.2. TG – Tongue and Groove (Type IV)
 - 4.1.1.3. Ultra SL – Shiplap (Type IV)
 - 4.1.1.4. UTILITYFIT™ (Type X)
 - 4.1.1.5. DURAMATE™ Plus (Type X)
 - 4.1.1.6. Residential Sheathing (Type X)
- 4.1.2. STYROFOAM™ Brand insulated sheathing is manufactured in 2'x8', 4'x8' or 4'x9' sheets in thicknesses ranging from ½" to 3".

4.2. TUFF-R™ Brand

- 4.2.1. TUFF-R™ insulation is a Type I polyisocyanurate (Polyiso) foam insulation with aluminum foil facers, manufactured in compliance with *ASTM C1289*, and includes:
 - 4.2.1.1. TUFF-R™ Commercial and TUFF-R™ Residential
 - 4.2.1.2. Super TUFF-R™ Commercial and Super TUFF-R™ Residential
 - 4.2.1.3. TUFF-R™ ci
- 4.2.2. TUFF-R™ and Super TUFF-R™ are manufactured in 4'x8' or 4'x9' sheets in thicknesses ranging from ½" to 2", and TUFF-R™ ci is manufactured in 4'x8' or 4'x9' sheets in thicknesses ranging from ½" to 3.2".

4.3. THERMAX™ Brand

- 4.3.1. THERMAX™ insulation is a Type I, Class 2 Polyiso foam plastic core material with a glass fiber mat, bonded on both sides to aluminum facers, is manufactured in accordance with *ASTM C1289*, and includes:
 - 4.3.1.1. Sheathing
 - 4.3.1.2. ci
 - 4.3.1.3. XARMOR™ (ci) Exterior Insulation
 - 4.3.1.4. HD
 - 4.3.1.5. LD
 - 4.3.1.6. Metal Building
 - 4.3.1.7. White Finish
- 4.3.2. THERMAX™ is manufactured in various lengths and widths with thicknesses ranging from ½" to 4½".

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.

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5. Applications:

5.1. General Requirements

- 5.1.1. The following are minimum installation requirements for STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing when applied to light-frame wall framing members:
- 5.1.1.1. Light-frame wood framing members supporting the insulating sheathing shall have a nominal thickness of not less than 2" (1½" actual).
 - 5.1.1.2. Light-frame steel framing members shall have a flange width of not less than 1½" (including bend radius at web and lip).
 - 5.1.1.3. Framing members shall be spaced at a maximum of 24" o.c.
 - 5.1.1.4. The insulating sheathing shall be attached to the wall framing in accordance with the manufacturer's installation instructions and this TER.
 - 5.1.1.5. 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), STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing shall comply with the requirements of [Section 5.2](#), in accordance with [IBC Section 104.11](#), [IRC Section R104.11](#) and ASTM C578 or ASTM C1289, as applicable.

5.2.2. Specific Requirements

- 5.2.2.1. The minimum thickness of STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing shall comply with [Table 1](#), for one of the following two conditions:
- 5.2.2.1.1. The insulated sheathing is directly constrained by a code-compliant cladding material (i.e., no gap between the cladding and the insulating sheathing).
 - 5.2.2.1.2. Where a code-compliant cladding system is installed over but not directly on the surface of the insulating sheathing such that there is a space between the sheathing and the cladding (e.g., furring is used over insulating sheathing product).
- 5.2.2.2. The components and cladding design wind pressure and basic wind speed determined in accordance with [IRC Section R301.2](#) or [IBC Section 1609.6](#) shall not exceed the allowable wind pressure value or basic wind speed of the insulating sheathing shown in [Table 1](#).
- 5.2.2.3. The insulating sheathing 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.

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DOW Products ²	Sheathing Thickness (in.)	Fastener Spacing	Allowable (ASD) Components & Cladding Design Wind Pressure (PSF)		Components & Cladding Basic Wind Speed (mph)(V _{ult})	
			16" o.c. Framing	24" o.c. Framing	16" o.c. Framing	24" o.c. Framing
STYROFOAM™ Duramate Plus	½"	12 Perimeter:16 Field	22.0	-	120	-
STYROFOAM™ Residential Sheathing	½"	6 Perimeter:12 Field	29.9	-	140	-
STYROFOAM™ Utility Fit	1"	12 Perimeter:16 Field	47	--	180	--
STYROFOAM™ Ultra Ship Lap	1"	12 Perimeter:16 Field	35.9	35.9	150	150
STYROFOAM™ Tongue and Groove	1"	12 Perimeter:16 Field	35.9	35.9	150	150
STYROFOAM™ Square Edge	1"	12 Perimeter:16 Field	35.9	35.9	150	150
TUFF-R™ ci	½"	12 Perimeter:16 Field	19.3	--	115	-
Tuff- R™ Residential and Commercial	½"	6 Perimeter:12 Field	18.9	--	110	--
	5/8"	6 Perimeter:12 Field	18.7	--	110	--
	¾"	6 Perimeter:12 Field	19.6	--	115	--
	1"	12 Perimeter:16 Field	20.7	20.7	115	115
Super Tuff- R™ Residential & Commercial	½"	12 Perimeter:16 Field	19.2	--	115	--
THERMAX™ ci	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX™ Sheathing	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX XARMOR™ (ci)	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX™ HD	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX™ LD	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX™ Metal Building	½"	12 Perimeter:16 Field	19.3	--	115	-
THERMAX™ White Finish	½"	12 Perimeter:16 Field	19.3	--	115	-

For SI: 1" = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa., -- = not permitted

1. Linear interpolation shall not be permitted.
2. Table 1 shall be used in accordance with requirements of [Section 6](#). 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/SBCA 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. Products without a listed design wind pressure for 24" o.c. framing may be installed in wall assemblies with framing 24" o.c. provided the exterior cladding (e.g. brick, stucco, cultured stone or cement fiber siding) is able to resist 100% of the required wind pressures.
4. Based on yield load in accordance with *ANSI/SBCA FS100*.
5. Allowable wind speeds are based on the following: Mean roof height – 30', Exposure B, 10 sq. ft. effective wind area in accordance with *ASCE 7-10*.
6. Minimum fastener specifications of 2-½" x 0.113" Ring Shank Nails with 1" Plastic Cap.

Table 1: Allowable Wind Pressure Resistance Values (PSF) and Basic Wind Speed Values (mph) for STYROFOAM™, TUFF-R™ and THERMAX™ Brand Insulating Sheathing Used in Exterior Wall Covering Assemblies

6. Installation:

6.1. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing installation

- 6.1.1. 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.
- 6.1.2. The insulation boards should be oriented with the printed side facing the exterior side of the building.
 - 6.1.2.1. The insulating sheathing can be oriented with the length dimension parallel or perpendicular to the wall framing members. All joints shall be supported by blocking.
- 6.1.3. 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.
 - 6.1.3.1. 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.
 - 6.1.3.2. Minimum penetration of the fasteners into wood framing is ¾".
 - 6.1.3.3. Minimum penetration of the fasteners into steel studs is 3 threads through the steel flange.

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6.2. Cladding Installation

- 6.2.1. Wind pressure rating adjustments for vinyl siding installed directly over STYROFOAM™ Brand, TUFF-R™ and THERMAX™ insulating sheathing shall comply with [IRC Section R703.11.2](#) for buildings constructed under the *IRC* or *IBC*.
- 6.2.2. Cladding installation and fastening through foam sheathing shall comply with the applicable building code and the cladding manufacturer's installation instructions. The minimum fastener size shall be capable of supporting the cladding weight when cantilevering through the insulating sheathing.
- 6.2.3. Wall assemblies that include STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing 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.
- 6.2.4. Wall assemblies with insulating sheathing 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. Test and Engineering Substantiating Data:

- 7.1. Test reports and data supporting the following material properties:
 - 7.1.1. Wind pressure resistance in accordance with *ANSI/SBCA FS100*.
 - 7.1.2. Load and flexural properties testing in accordance with *ASTM C203*, performed by SBCRI.
 - 7.1.3. Wind pressure performance testing in accordance with *ASTM E330*, performed by SBCRI.
- 7.2. 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.
- 7.3. 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.
- 7.4. 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.
- 7.5. 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.
- 7.6. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.7. 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. When installed in accordance with the manufacturer's installation instructions and this TER, STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing products, as listed in [Section 4](#), comply with, or are a suitable alternative to, the applicable sections of the codes listed in [Section 2](#) for the following applications:
 - 8.1.1. Wind pressure resistance in accordance with *ANSI/SBCA FS100* as referenced in [IBC Section 2603.10](#) and [IRC Section R316.8](#).

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- 8.2. [IBC Section 104.11](#) ([IRC Section R104.11](#) and [IFC Section 104.9](#) are similar) 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, 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*.

- 8.3. 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:

8.3.1. No known variations

- 8.4. 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 report 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 and/or by the Building Designer (e.g., Owner, Registered Design Professional, etc.).
- 9.4. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing products listed herein comply with, or are a suitable alternative to, the applicable sections of the *IBC* and *IRC* and are subject to the following conditions.
- 9.4.1. These products shall be installed in compliance with the manufacturer's instructions, the applicable building code and this TER.
- 9.4.2. 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.
- 9.5. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing shall comply with the material standards listed in [Section 4](#) as applicable 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](#).
- 9.6. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing used in accordance with this TER that are 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](#).
- 9.7. Design
- 9.7.1. Building Designer Responsibility
- 9.7.1.1. 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](#).
- 9.7.1.2. 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](#).

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9.7.2. Construction Documents

9.7.2.1. 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.

9.8. Responsibilities

- 9.8.1. 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.
- 9.8.2. DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
- 9.8.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.8.4. This product is manufactured under a third-party quality control program in accordance with [/IRC Section R104.4](#) and [R109.2](#) and [/BC Section 104.4](#) and [110.4](#).
- 9.8.5. 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.
- 9.8.6. 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. STYROFOAM™, TUFF-R™ and THERMAX™ Brand insulating sheathing products described in this TER are identified by a label on the board or packaging material 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 building.dow.com.

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](#)