Technical Evaluation Report
TER 1506-03
Wind Pressure Performance of DuPont Insulated Sheathing Products

DuPont Performance Building Solutions

Product:
STYROFOAM™ Brand Products
TUFF-R™ Brand Products
THERMAX™ Brand Products

Issue Date:
May 27, 2016
Revision Date:
July 2, 2019
Subject to Renewal:
July 1, 2020
1 PRODUCTS EVALUATED

1.1 STYROFOAM™ Brand Products
TUFF-R™ Brand Products
THERMAX™ Brand Products

1.1.1 STYROFOAM™ Brand Products include: Square Edge, Tongue and Groove, Ultra Ship Lap, UTILITYFIT™,
DURAMATE™ Plus and, Residential Sheathing

1.1.2 TUFF-R™ Brand Products include: TUFF-R™ Residential and Commercial, Super TUFF-R™ Residential and
Commercial, TUFF-R™ ci

1.1.3 THERMAX™ Brand Products include: THERMAX™ Sheathing, THERMAX™ ci, THERMAX XARMOR™ (ci)
Exterior Insulation, HD, LD, Metal Building and White Finish

2 APPLICABLE CODES AND STANDARDS

2.1 Codes

2.1.1 IBC—12, 15, 18: International Building Code®

2.1.2 IRC—12, 15, 18: International Residential Code®

1 Building codes require data from valid research reports be obtained from approved sources. An approved agency, which is an approved source, is defined as "an established and recognized agency that is regularly engaged in...furnishing product certification where such agency has been approved..." Being approved, defined as "acceptable to the building official," is accomplished via accreditation using ISO/IEC 17065 evaluation procedures meeting code requirements of independence, adequate equipment, and experienced personnel. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation, DrJ certification can be used to obtain product approval in any country that is an IAF MLA Signatory and covered by an IAF MLA Evaluation per the Purpose of the MLA – “certified once, accepted everywhere.” Manufacturers can go to jurisdictions in any IAF MLA Signatory Country and have their products readily approved by authorities having jurisdiction using DrJ’s ANSI accreditation.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, see drjcertification.org.

2 Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., ASCE 7, NDS, ASTM). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein. As required by code, where this TER is not approved, the building official shall respond in writing stating the reasons this TER was not approved. For any variations in state and local codes, see Section 8.

3 All terms defined in the applicable building codes are italicized.
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 C1289: Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
2.2.4 ASTM C203: Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
2.2.5 ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
2.2.6 ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
2.2.7 SBCA ANSI/FS 100: Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies

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.

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.

3.5 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within DrJ’s professional scope of work.

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 Grove (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)

---

2 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.
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

4.3 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".

4.4 THERMAX™ Brand

4.4.1 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, manufactured in accordance with ASTM C1289, and includes:

4.4.1.1 Sheathing

4.4.1.2 ci

4.4.1.3 XARMOR™ (ci) Exterior Insulation

4.4.1.4 HD

4.4.1.5 LD

4.4.1.6 Metal Building

4.4.1.7 White Finish

4.4.2 THERMAX™ is manufactured in various lengths and widths with thicknesses ranging from ½" to 4½".

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 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 IBC Section 1609 or IRC Section R301.2 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.

5.2.3 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
### Table 1. Allowable Wind Pressure Resistance Values (psf) and Basic Wind Speed Values for STYROFOAM™, TUFF-R™, and THERMAX™ Brand Insulating Sheathing Used in Exterior Wall Covering Assemblies

<table>
<thead>
<tr>
<th>Dupont Products</th>
<th>Sheathing Thickness (in)</th>
<th>Fastener Spacing (Perimeter:Field) (in)</th>
<th>Allowable (ASD) Components &amp; Cladding Design Wind Pressure (psf)</th>
<th>Components &amp; Cladding Basic Wind Speed (Vw) (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>16&quot; o.c. Framing</td>
<td>24&quot; o.c. Framing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16&quot; o.c. Framing</td>
</tr>
<tr>
<td>STYROFOAM™ Duramate Plus</td>
<td>½</td>
<td>12:16</td>
<td>22.0</td>
<td>-</td>
</tr>
<tr>
<td>STYROFOAM™ Residential Sheathing</td>
<td>½</td>
<td>6:12</td>
<td>29.9</td>
<td>-</td>
</tr>
<tr>
<td>STYROFOAM™ Utility Fit</td>
<td>1</td>
<td>12:16</td>
<td>47</td>
<td>-</td>
</tr>
<tr>
<td>STYROFOAM™ Ultra Ship Lap</td>
<td>1</td>
<td>12:16</td>
<td>35.9</td>
<td>35.9</td>
</tr>
<tr>
<td>STYROFOAM™ Tongue and Groove</td>
<td>1</td>
<td>12:16</td>
<td>35.9</td>
<td>35.9</td>
</tr>
<tr>
<td>STYROFOAM™ Square Edge</td>
<td>1</td>
<td>12:16</td>
<td>35.9</td>
<td>35.9</td>
</tr>
<tr>
<td>TUFF-R™ ci</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>TUFF-R™ Residential and Commercial</td>
<td>½</td>
<td>6:12</td>
<td>18.9</td>
<td>-</td>
</tr>
<tr>
<td>Super Tuff- R™ Residential &amp; Commercial</td>
<td>½</td>
<td>6:12</td>
<td>18.7</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ ci</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ Sheathing</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ XARMOR™ (ci)</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ HD</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ LD</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ Metal Building</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
<tr>
<td>THERMAX™ White Finish</td>
<td>½</td>
<td>12:16</td>
<td>19.3</td>
<td>-</td>
</tr>
</tbody>
</table>

St: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m², 1 mph = 1.61 km/h
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 SBCA ANSI/FS 100 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 SBCA ANSI/FS 100.
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 and 7-16.
6. Minimum fastener specifications of 2½” x 0.113” Ring Shank Nails with 1” Plastic Cap.

### 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.

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 IBC or IRC.

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 IBC Section 2308.6, IRC Section R602.10, or a design in accordance with IBC Section 2305 or IRC Section R301, 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 ENGINEERING SUBSTANTIATING DATA

7.1 Test reports and data supporting the following material properties:

7.1.1 Wind pressure resistance in accordance with SBCA ANSI/FS 100.

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 Some information contained herein is the result of testing and/or data analysis by other sources which conform to IBC Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.

7.3 Where appropriate, DrJ’s analysis is based on design values that have been codified into law through codes and standards (e.g., IBC, IRC, NDS®, and SDPWS). 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, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

8.1 When used and installed in accordance with this TER and the manufacturer’s installation instructions, the product(s) listed in Section 1.1 are approved for the following:

8.1.1 Wind pressure resistance in accordance with SBCA ANSI/FS 100 as referenced in IBC Section 2603.10 and IRC Section R316.8.
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 in the context of 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 applicable to this evaluation, they are listed here.

8.3.1  No known variations

9  CONDITIONS OF USE

9.1  STYROFOAM™, TUFF-R™, and THERMAX™ Brand insulating sheathing products listed herein comply with the applicable sections of the *IBC* and *IRC* and are subject to the following conditions.

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

9.1.2  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.

9.1.3  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.

9.1.4  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.

9.2  Where required by the building official, also known as 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.

9.3  Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval. 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 or registered design professional).

9.5  At a minimum, this product shall be installed per Section 6 of this TER.

9.6  This product is manufactured under a third-party quality control program in accordance with *IBC* Section 104.4 and 110.4 and *IRC* Section R104.4 and R109.2.

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. Therefore, the TER shall be reviewed for code compliance by the building official for acceptance.

9.8  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 product(s) listed in Section 1.1 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 dupont.com/building.

11 REVIEW SCHEDULE

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

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