



CERTIFICATION



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Technical Evaluation Report

TER 1808-02

Strong-R® Structural Insulation

Ox Engineered Products, LLC

Product:

Strong-R® Structural Insulation

Issue Date:

November 8, 2018

Revision Date:

March 19, 2020

Subject to Renewal:

April 1, 2021



COMPANY
INFORMATION:

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DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 12 00 - Structural Panels

SECTION: 06 12 19 - Shear Wall Panels

SECTION: 06 16 00 - Sheathing

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

SECTION: 07 21 00 - Thermal Insulation

SECTION: 07 25 00 - Water-Resistive Barriers/Weather Barriers

SECTION: 07 27 00 - Air Barriers

1 PRODUCT EVALUATED¹

1.1 Strong-R® Structural Insulation

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

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

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

2.1.3 *IECC— 12, 15, 18: International Energy Conservation Code*

2.1.4 *FBC— 14, 17: Florida Building Code*

2.2 Standards and Referenced Documents

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

2.2.2 *ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*

¹ Building codes require data from valid [research reports](#) be obtained from [approved sources](#). Agencies who are accredited through ISO/IEC 17065 have met the [code requirements](#) for approval by the [building official](#). DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation and the [IAF MLA](#), DrJ certification can be used to obtain product approval in any [jurisdiction](#) or country that has [IAF MLA Members & Signatories](#) to meet the [Purpose of the MLA](#) – “certified once, accepted everywhere.”

Building official approval of a licensed [registered design professional](#) (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant [jurisdiction](#). Therefore, the work of licensed RDPs is accepted by [building officials](#), except when plan (i.e. peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the [building official](#) responds in writing stating the reasons for [disapproval](#).

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit [drjcertification.org](#) or call us at 608-310-6748.

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.

³ All terms defined in the applicable building codes are italicized.

- 2.2.3 *ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*
- 2.2.4 *ASTM E2178: Standard Test Method for Air Permeance of Building Materials*
- 2.2.5 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*
- 2.2.6 *ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*
- 2.2.7 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*
- 2.2.8 *ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials*
- 2.2.9 *NFPA 286: Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*

3 PERFORMANCE EVALUATION

3.1 Strong-R® Structural Insulation was evaluated to determine:

3.1.1 Structural performance under lateral load conditions (wind and seismic) for use as an alternative to the provisions of IRC Section R603.9.

3.1.1.1 Table 2 provides seismic design coefficients (SDC) that conform to the requirements in *ASCE 7* Section 12.2.1 and Table 12.2-1 for design of wall assemblies in buildings that require seismic design in accordance with *ASCE 7* (i.e., all seismic design categories).

3.1.1.2 The basis for equivalency testing is outlined in Section 12.2.1.1 of *ASCE 7*:⁴

Use of seismic force-resisting systems not contained in Table 12.2-1 shall be permitted contingent on submittal to and approval by the Authority Having Jurisdiction and independent structural design review of an accompanying set of design criteria and substantiating analytical and test data. The design criteria shall specify any limitations on system use, including Seismic Design Category and height; required procedures for designing the system's components and connections; required detailing; and the values of the response modification coefficient, R ; overstrength factor Ω_0 ; and deflection amplification factor, C_d .

3.1.1.3 The SDC evaluation uses the approach found in documentation entitled "Establishing Seismic Equivalency for Proprietary Prefabricated Shear Panels" and "Seismic Design Coefficients: How they are determined for light-frame components" using code-defined accepted engineering procedures, experience, and technical judgment.

3.1.2 Resistance to uplift loads for wall assemblies used for light-frame cold-formed steel and wood construction in accordance with IBC Section 1609 and IRC Section R301.2.1.

3.1.3 Resistance to transverse loads for wall assemblies used in light-frame cold-formed steel and wood construction in accordance with IBC Section 1609.1.1.

3.1.4 Performance for use as foam plastic insulation in accordance with the IBC Section 2603 and IRC Section R316.

3.1.5 Performance for use as insulated sheathing in accordance with IRC Section N1102 and IECC Section C402.1.

3.1.6 Performance for use as an air barrier in accordance with the IECC Section C402.5.1.2.1⁵.

3.1.7 Performance for use as a water-resistive barrier (WRB) in accordance with the IBC Section 1404.2 and IRC Section R703.2.

⁴ 2010 *ASCE 7* Section 12.2.1

⁵ 2012 *IECC* Section C402.4.1.2.1

- 3.1.8 Performance for use without a thermal barrier in accordance with *NFPA 286* and the acceptance criteria of *IBC Section 803.1.2.*
- 3.1.9 Performance for vertical and lateral fire propagation in accordance with *NFPA 285* and *IBC Section 2603.5.5.*
- 3.2 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.3 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 The product evaluated in this TER is shown in Figure 1.



FIGURE 1. STRONG-R® STRUCTURAL INSULATION

- 4.2 Strong-R® Structural Insulation is a structural, rigid insulation sheathing product consisting of a proprietary fibrous sheathing board laminated to one side of a proprietary rigid foam plastic insulation.
 - 4.2.1 The proprietary fibrous sheathing is made of specially treated plies that are pressure-laminated with a water-resistant adhesive. The surface finish consists of a facer on one or both side using a 0.113" (2.9 mm) nominal thickness fibrous sheathing board.
 - 4.2.2 The rigid foam plastic insulation is a Class A proprietary polyisocyanurate, which can have facings on one or both sides. The facers are designed with a base foil layer (0.0009 mil).
- 4.3 *Material Availability*
 - 4.3.1 Thickness: up to 4.0" (102 mm)
 - 4.3.2 Standard product width: 48" (1219 mm)
 - 4.3.3 Standard lengths: 96", 108", and 120" (2438, 2743, and 3048 mm)

5 APPLICATIONS

5.1 *General*

- 5.1.1 Strong-R® Structural Insulation is used in the following applications:
 - 5.1.1.1 Wall sheathing in buildings constructed in accordance with the *IBC* and *IRC* for light-frame steel and wood construction.
 - 5.1.1.2 Structural wall sheathing to provide lateral load resistance (wind and seismic) for braced wall panels used in light-frame construction.
 - 5.1.1.3 Structural wall sheathing to provide resistance to transverse loads for wall assemblies used in light-frame construction.
 - 5.1.1.4 Insulating sheathing applied as in-fill to portions of walls that are not designed as braced wall panels or shear walls.
 - 5.1.1.5 Insulated sheathing in accordance with the *IRC Section N1102* and *IECC Section C402.*

- 5.1.1.6 An approved WRB in accordance with IBC Section 1404.2 and IRC Section R703.2 when installed with approved Construction Tape on all sheathing seams, see Section 5.3.3. See the manufacturer's product information for further details.
- 5.1.1.6.1 Where the joints are not taped, a separate WRB shall be installed in accordance with the WRB manufacturer's installation instructions.
- 5.1.1.7 An air barrier material as part of an air barrier assembly in accordance with IRC Section N1102.4 and IECC Section C402 in accordance with the manufacturer's installation instructions and this TER.
- 5.1.2 Strong-R® Structural Insulation contains foam plastics complying with IBC Section 2603 and IRC Section R316.
- 5.2 *Structural Applications*
- 5.2.1 *General Provisions:*
- 5.2.1.1 Except as otherwise described in this TER, Strong-R® Structural Insulation shall be installed in accordance with the applicable building codes listed in Section 2 using the provisions set forth therein for light-frame construction.
- 5.2.1.2 Anchorage for in-plane shear shall be provided to transfer the induced shear force into and out of each shear wall.
- 5.2.1.2.1 For wind design, anchor bolt spacing shall not exceed 6' o.c.
- 5.2.1.2.2 For seismic design, anchor bolt spacing shall not exceed 4' o.c.
- 5.2.1.3 The maximum aspect ratio for Strong-R® Structural Insulation shall be 4:1.
- 5.2.1.4 The minimum full height panel width shall be 24".
- 5.2.1.5 All panel edges shall be supported by framing.
- 5.2.1.6 Fasteners may be countersunk beneath the outer surface of the foam plastic sheathing layer.
- 5.2.1.7 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
- 5.2.2 *Steel-Framed Construction:*
- 5.2.2.1 Strong-R® Structural Insulation panels used in wall assemblies designed as shear walls:
- 5.2.2.1.1 Are permitted to be designed using the capacities shown in Table 1.
- 5.2.2.1.2 Resist lateral wind load forces using the allowable shear loads (in pounds per linear foot) set forth in Table 1.
- 5.2.2.1.3 Resist seismic load forces using the seismic allowable unit shear capacities set forth in Table 2 when seismic design is required in accordance with IBC Section 1613.
- 5.2.2.1.3.1 The response modification coefficient, R , system overstrength factor, Ω_0 , and deflection amplification factor, C_d , indicated in Table 2 shall be used to determine the base shear, element design forces, and design story drift in accordance with ASCE 7 Chapter 12 and Section 14.5.
- 5.2.2.2 Strong-R® Structural Insulation panels have the uplift capacities shown in Table 3.
- 5.2.2.3 Strong-R® Structural Insulation panels are permitted to resist transverse wind load forces using the allowable transverse loads (in pounds per linear foot) set forth in Table 4. Required component and cladding loads to be resisted are found in IBC Section 1609.1.1 and IRC Tables R301.2(2) and R301.2(3).

TABLE 1. STRONG-R® STRUCTURAL INSULATION ALLOWABLE STRESS DESIGN (ASD) CAPACITY - WIND

Stud Type	Structural Sheathing Product	Thickness (in)	Fastener Spacing (edge/field) (in)	Maximum Stud Spacing (in)	Gypsum Wallboard (GWB)	Gypsum Wallboard Fastener Spacing ³ (edge/field)	Allowable Unit Shear Capacity (plf)	Fastener Schedule
Steel ¹	Strong-R® Structural Insulation	1 ¼	3/3	24 o.c.	½" GWB	8/8	280	See Note 4
			3/3			8/12	290	
			3/3			6/12	325	
			3/3		No GWB ²	-	235	See Note 8
			3/3				140	See Note 6
			3/12				395	
			6/12				195	See Note 5
			12/12				105	
		2	3/3				395	See Note 6
			3/12		395			
			6/12		195			
			12/12		105	See Note 5		
			3/3		260	See Note 7		
			6/12		195	See Note 9		
1 ¼	3/12	640						
	6/12	320						
	2	3/12	640					
		6/12	320					

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

- 20 ga. 50 ksi 3/8" metal studs @ 24" o.c.
- Where gypsum wallboard is not installed on the interior face of the wall, the wall shall be constructed with mid height horizontal brace installed every other cavity space.
- Gypsum attached with minimum #6 type S screws 1 ¼" long with a minimum edge distance of ¾".
- #8 x 1 ¼" Self Drilling Modified Truss Head Screw (Head flush w/ exterior of foam board)
- #8 x 1 ½" Self Drilling Modified Truss Head Screw (Head driven through the foam plastic to seat against the backer material)
- #8 x 2 ½" Self Drilling Modified Truss Head Screw (Head driven through the foam plastic to seat against the backer material)
- #8 x 3" Self Drilling Modified Truss Head Screw (Head flush w/ exterior of foam board)
- 0.100" Diameter x 1-½" Length Pins (Bostitch® C4S100 BG)
- Minimum #8 x 1 ¼" Wafer Head Screw (Screw shall penetrate a minimum of 1" into the stud and head shall be driven through the foam plastic to seat against the backer material.) Fastener edge distance shall be a minimum of ¾".

TABLE 2. SEISMIC ALLOWABLE UNIT SHEAR CAPACITY & SEISMIC DESIGN COEFFICIENTS FOR STRONG-R® STRUCTURAL INSULATION⁶

Seismic Force Resisting System	Thickness (in)	Gypsum ⁵ Wallboard Fastening Schedule	Maximum Stud Spacing (in)	Seismic Allowable Unit Shear ⁷ Capacity (plf)	Apparent Shear Stiffness, G_a (kips/in)	Response Modification Factor, R^8	System Overstrength Factor, Ω_0^9	Deflection Amplification Coefficient, C_d^{10}	Structural System Limitations and Building Height Limit ^{11,12,13} (ft)				
									Seismic Design Category				
									B	C	D	E	F
Light-Frame (cold formed steel) Walls Sheathed with Strong-R® Structural Insulation ^{1,3}	1 ¼	No GWB ⁴	24 o.c.	170	9	6.5	3	4	NL	NL	65	65	65
		8:8	24 o.c.	225	14	6.5	3	4	NL	NL	65	65	65
Light-Frame (wood) Walls Sheathed with Strong-R® Structural Insulation ²		No GWB ⁴	24 o.c.	200	10.3	2	2.5	2	NL	NL	35	NP	NP

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/ft = 0.0146 kN/m

- Strong-R® Structural Insulation attached with a minimum #8 x 1½" Self Drilling Modified Truss Head Screw. Fasteners spaced a maximum of 3" o.c. at the panel edges and 3" o.c. in the field. Fastener edge distance shall be a minimum of ¾". Fastener head shall be in contact with the panel surface. Alternately, fastener heads are permitted to be overdriven into foam portion of the panel with no reduction in shear capacities.
- Strong-R® Structural Insulation attached with a minimum #8 x 1¼" Wafer Head Screw shall penetrate a minimum of 1" into the stud. Fasteners are to be installed spaced a maximum of 6" o.c. at the panel edges and 12" o.c. in the field. Fastener edge distance shall be a minimum of 3/8". Fastener head shall be driven through the foam plastic to seat against the backer material.
- 20 ga. 50 ksi 3-5/8" metal studs @ 24" o.c.
- Where gypsum wallboard is not installed on the interior face of the wall, the wall shall be constructed with mid height horizontal brace installed every other cavity space.
- Walls installed with minimum ½" Gypsum wallboard attached with minimum #6 type S screws 1¼" long. Fasteners shall maintain a minimum edge distance of ¾".
- All seismic design parameters follow the equivalency as defined in Section 3 of this TER.
- The allowable unit shear capacity is calculated using a factor of safety of 2.5 per ASCE 7.
- Response modification coefficient, R , for use throughout ASCE 7. Note: R reduces forces to a strength level, not an allowable stress level.
- The tabulated value of the overstrength factor, Ω_0 , is permitted to be reduced by subtracting one-half (0.5) for structures with flexible diaphragms.
- Deflection amplification factor, C_d , for use with ASCE 7 Sections 12.8.6, 12.8.7, and 12.9.2.
- Heights are measured from the base of the structure as defined in ASCE 7 Section 11.2.
- NL = Not Limited
- NP = Not permitted

TABLE 3. UPLIFT PERFORMANCE OF STRONG-R® STRUCTURAL INSULATION^{1,2}

Structural Sheathing Product	Allowable Uplift Capacity (plf)	Maximum Stud Spacing (in)	Fastener Spacing
Light-Frame (cold formed steel) walls sheathed with Strong-R® Structural Insulation: Single Bottom Plate	220	24 o.c.	#8 x 1 5/8" Zinc Coated Self Drilling Modified Truss Head Screw, 3" o.c. to perimeter/field

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

- 20 ga. 50 ksi metal studs @ 24" o.c maximum.
- The capacities shown are for the purpose of providing information on the hold-down capacity of the sheathing to the bottom plate connection independent of lateral loading. Where combined shear and uplift loading is needed, consult a professional engineer.

TABLE 4. TRANSVERSE LOAD PERFORMANCE OF STRONG-R® STRUCTURAL INSULATION FOR RESISTING OUT-OF-PLANE WIND LOADS

Structural Sheathing Product	Allowable Design Value (psf)	Maximum Stud Spacing (in)	Fastener Schedule
Light-Frame (cold formed steel) walls sheathed with Strong-R® Structural Insulation	60	24 o.c.	#8 x 2 1/2" Zinc Coated Self-Drilling Modified Truss Head Screw, 6" o.c. in perimeter and 12" o.c. in field

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m, 1 psf = 0.0479 kN/m²

- 20 ga. 50 ksi metal studs @ 24" o.c maximum.

TABLE 5. BASIC WIND SPEED (MPH) FOR STRONG-R® STRUCTURAL INSULATION USED IN EXTERIOR WALL COVERING ASSEMBLIES

Structural Sheathing Product	Allowable Components & Cladding Basic Wind Speed V_{asd} per ASCE 7-05 (mph)	Allowable Components & Cladding Basic Wind Speed V_{ult} per ASCE 7-16 (mph)
	24" o.c. Framing	24" o.c. Framing
Strong-R® Structural Insulation	136	175

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

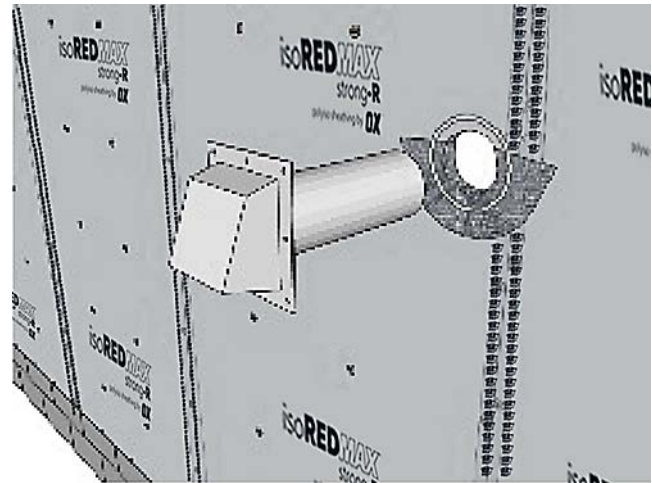
- Allowable wind speeds are based on the following: Components and Cladding wind loads, Zone 4, Mean roof height 30', Exposure B, 10 sq. ft. effective wind area. See the applicable building code for any adjustment needed for specific building location and configuration.
- Design wind load capacity shall be in accordance with *IBC Section 1609.1.1*.

5.3 Water-Resistive Barrier

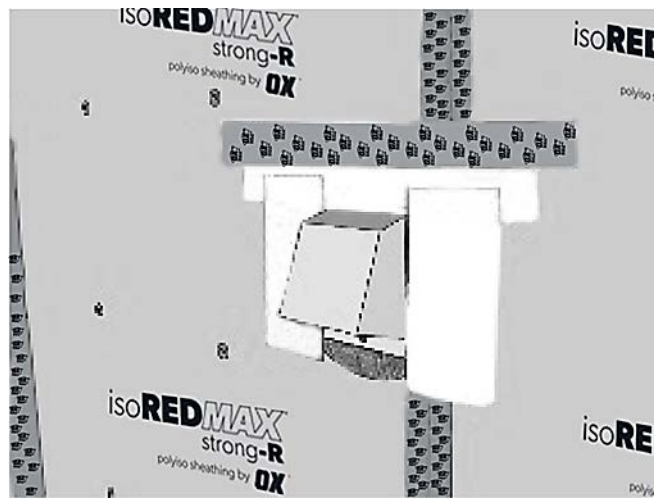
- 5.3.1 Strong-R® is an approved WRB in accordance with *IBC Section 1404.2* and *IRC Section R703.2* when installed with White 3M™ Venture 1558 HT, Venture 1520 CW Aluminum Foil Sheathing Tape or equivalent on all sheathing seams, 4" wide self-adhered flashing tape meeting *AAMA 711* (3M™ All Weather Flashing Tape 8067 or equivalent) with release liner may be required for effective taping of inside and outside corners. See the manufacturer's product information for further details.
- 5.3.2 Strong-R® shall be installed with board joints placed directly over exterior framing spaced a maximum of 24" (610 mm) o.c. The fasteners used to attach the board shall be installed in accordance with Section 6.
- 5.3.3 A separate WRB may also be provided. If a separate WRB method is used, taping of the sheathing joints is not required.
- 5.3.4 Flashing of penetrations shall comply with the applicable code and must be installed at all sheathing penetrations. Use qualified flashing material such as self-adhered flashing tape meeting *AAMA 711* (3M™ All Weather Flashing Tape 8067 or equivalent). See Figure 2, Figure 3, and Figure 4 for typical penetration flashing details.
- 5.3.5 Flashing Details – Typical Flanged and Unflanged Penetration and Flanged Window



STEP 1



STEP 2



STEP 3

FIGURE 2. TYPICAL PENETRATION FLASHING DETAIL – FLANGED

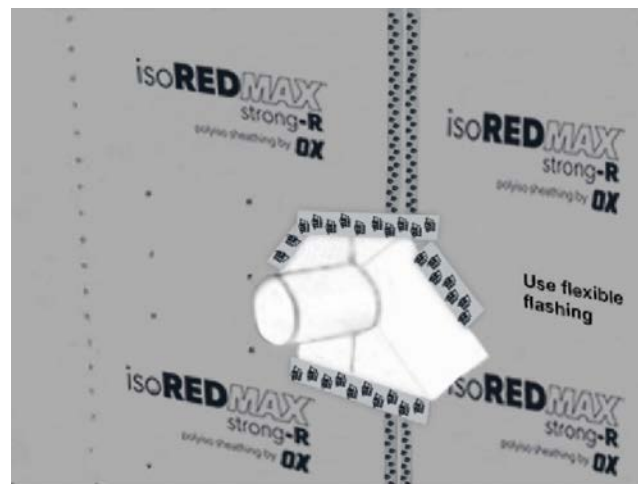
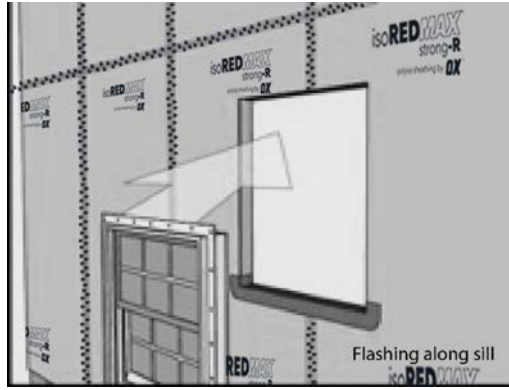
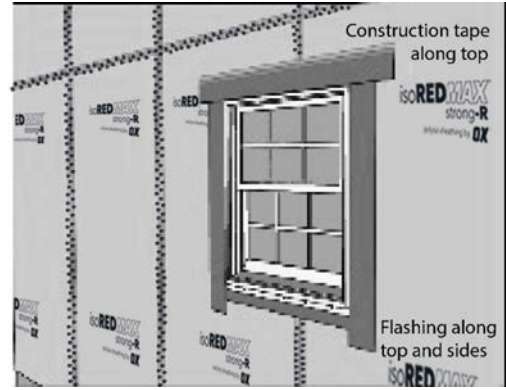


FIGURE 3. TYPICAL PENETRATION FLASHING DETAIL – UNFLANGED



STEP 1



STEP 2

FIGURE 4. TYPICAL WINDOW FLASHING DETAIL

5.4 Thermal Resistance (R-Value)

- 5.4.1 Strong-R® is a FPIS panel used as thermal insulation in wall, roof, and ceiling assemblies.
- 5.4.2 Strong-R® meets the continuous insulating sheathing requirements complying with the provisions of IRC Section N1102 and IECC Section C402.
- 5.4.3 Strong-R® Structural Insulation has the thermal resistance shown in Table 6.

TABLE 6. STRONG-R® STRUCTURAL INSULATION THERMAL RESISTANCE PROPERTIES

Thickness (in)	R-Value (h ² *ft ² *°F/Btu)
2.0	13.0
1.25	7.5

SI: 1 in = 25.4 mm
 1. Thermal values are determined using the *ASTM C518* test method at 75°F mean temperature on material conditioned according to *ASTM C1289* Section 11.1 (Degrees F.ft².h/Btu).

5.5 Air Barrier

- 5.5.1 Wall and ceiling assemblies constructed with Strong-R® are used to meet air barrier requirements in accordance with IECC Section C402.
- 5.5.2 All penetrations shall be flashed and sealed in accordance with the flashing manufacturer’s installation instructions. Self-adhered flashing tape shall meet *AAMA 711* (FortiFlash® Butyl or equivalent).
- 5.5.3 Strong-R® is defined as an air barrier material having an air permeance of less than 0.02 L/m²ft², in accordance with IECC Section C402.5.

5.6 Surface Burn Characteristics

- 5.6.1 Strong-R® has the flame spread and smoke developed ratings as shown in Table 7, when tested in accordance with *ASTM E84* per IBC Section 2603.3 and IRC Section R316.3.

TABLE 7. FIRE PERFORMANCE OF STRONG-R®

Product	Flame Spread	Smoke Developed
Strong-R® ¹	< 25	< 450

1. Foam plastic core tested in accordance with *ASTM E84*, with maximum foam thickness of 4".

5.7 Thermal Barrier

- 5.7.1 Strong-R® boards with a maximum thickness of 4" were tested in accordance with *NFPA 286* and have met the acceptance criteria of *IBC Section 803.1.1.1*⁶ for use on walls only or ceilings only without a thermal barrier, in accordance with *IBC Section 2603.4* and *2603.5.2*.

5.8 Non-Structural Applications

- 5.8.1 Where other means of wall bracing are provided, or are not required, and an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing, Strong-R® Structural Insulation may be installed in accordance with Section 6.2.6.

5.9 Vertical and Lateral Fire Propagation

- 5.9.1 Strong-R® was tested to assess performance with regard to vertical and lateral fire propagation in accordance with *NFPA 285* and *IBC Section 2603.5.5*.
- 5.9.2 Engineering analysis has also been conducted to assess substitution of other products within the approved wall assemblies.
- 5.9.3 The wall assemblies listed in Table 8 and Table 9 are approved for use in buildings of Type I-IV construction.

⁶ 2015 IBC Section 803.1.2.1

TABLE 8. APPROVED NFPA 285 WALL ASSEMBLIES – BRICK CLADDING¹

Wall Component	Materials
Base Wall System Use either 1, 2, 3 or 4 Note: May use 4 optionally when FRTW framing is allowed by code.	1. Cast Concrete Wall 2. Concrete Masonry Wall 3. 20-gauge (min.) 3 $\frac{5}{8}$ " (min.) steel studs spaced 24" o.c. (max) <ol style="list-style-type: none"> a. 1 layer – $\frac{5}{8}$"-thick Type X gypsum wallboard on interior b. Lateral bracing every 4' 4. Where allowed in Types I-IV construction, FRTW (Fire Retardant Treated Wood) studs complying with <u>IBC Section 2303.2</u> , minimum nominal 2x4 spaced at a maximum 16" o.c. <ol style="list-style-type: none"> a. $\frac{5}{8}$" (min.) Type X gypsum wallboard interior. b. Wall braced at mid-height and fire-stopped at top and bottom.
Fire-Stopping in Stud Cavities at Floor Lines. Use 2 with FRTW framing.	1. Any approved 4 pcf mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2. Solid FRTW fire blocking at floor line when Base Wall System, Item 4 is used.
Cavity Insulation Use any option 1-13	1. None 2. 1 $\frac{1}{2}$ " (min.) BASF Wallite™ 2 pcf SPF (or equivalent) up to full cavity fill. 3. 1 $\frac{1}{2}$ " (min.) Premium Spray Products Foamsulate 20 up to full cavity fill. 4. Any noncombustible insulation per <i>ASTM E136</i> . 5. Any mineral fiber (Batt or board type Class A <i>ASTM E84</i> faced or unfaced). 6. Any fiberglass (Batt type Class A <i>ASTM E84</i> faced or unfaced). 7. Icynene Classic, Classic Plus, Classic Ultra or Classic Ultra Select; MD-R-210; MD-C-200; or Proseal. Partial cavity fill with a max. air space of 2" or full cavity fill not exceeding 7 $\frac{5}{8}$ ". Use with $\frac{1}{2}$ " exterior gypsum sheathing (min.). 8. NCFI Polyurethanes, full cavity depth or less of InsulBloc, InsulStar, InsulStar Plus or ThermalStop™ closed cell (2.0 lb/ft ³) spray polyurethane foam applied using sheathing as substrate and covering the width of the cavity. Use with $\frac{1}{2}$ " exterior gypsum sheathing (min.). 9. SWD Urethane Quik-Shield 112 spray polyurethane foam applied using $\frac{5}{8}$ " Type X sheathing as substrate. Air gap must not exceed 2 $\frac{1}{2}$ ". 10. Demilec Sealection 500 or HeatLok Soy 200, up to full cavity fill. Use with $\frac{5}{8}$ " Type X exterior gypsum sheathing. 11. Accella Polyurethane Bayseal® OC and OCX or Bayseal® CC, up to full cavity fill using minimum $\frac{1}{2}$ " exterior gypsum sheathing. 12. Lapolla™ Foam-Lok™ FL 2000 with $\frac{5}{8}$ " Type X exterior sheathing in 3 $\frac{5}{8}$ " studs (max.) 13. Any cavity insulation which has been tested per <i>ASTM E1354</i> (at a min. of 20 kw/m ² heat flux) and shown by analysis to be of equivalent or lesser flammability (based on Tign, Pk. HRR) than the foam tested in Item 2 or 3 above.
Exterior Sheathing Use either 1, 2 or 3 (with limitations noted in Cavity Insulation Allowances) Note: Exterior FRTW sheathing or gypsum wallboard is optional for Base Walls 1 and 2.	1. None 2. Minimum $\frac{1}{2}$ " exterior gypsum sheathing (unless $\frac{5}{8}$ " Type X exterior sheathing is otherwise specified with cavity insulations). 3. $\frac{1}{2}$ " (min.) FRTW structural panels complying with <u>IBC section 2303.2</u> and installed in accordance with the code requirements for Types I-IV construction.

Wall Component	Materials
Water-Resistive Barrier Over Base Wall Use either 1, 2 or 3 Note: Item 3 applies when exterior gypsum sheathing is used.	1. None 2. WRB's over Steel Framing: <ol style="list-style-type: none"> a. Kingspan GreenGuard® Max Building Wrap b. Dupont Tyvek (Various per ESR 2375) c. Dow Weathermate™ d. Dow Weathermate™ Plus e. Ox ThermoPly 3. WRBs over exterior sheathing: <ol style="list-style-type: none"> a. Henry Air Bloc 32MR b. Henry Foilskin c. Henry MetalClad d. CCW 705 FR-A e. Kingspan GreenGuard® Max Building Wrap f. Dupont Tyvek (various per ESR-2375) g. Dow Weathermate™ h. Dow Weathermate™ Plus i. Any WRB that has been tested per <i>ASTM E1354</i> (at a min. of 20 kw/m² heat flux) and shown by analysis to be of equivalent or lesser flammability (based on Tign, Pk. HRR) than the exterior insulation foam core or baseline Item 3a above.
Exterior Insulation	Up to 4"-thick OX Strong-R®, consisting of a single panel or multiple thinner panels
WRB Over Exterior Insulation Use either 1 or 2	1. Aluminum construction tape as tested (or equivalent), max. 6" wide over staggered insulation joints. 2. For use with all Exterior Cladding options as written below: <ol style="list-style-type: none"> a. Henry Foilskin b. Henry MetalClad c. CCW 705 FR-A d. Kingspan GreenGuard® Max Building Wrap e. Dupont Tyvek (various per ESR-2375) f. Dow Weathermate™ g. Dow Weathermate™ Plus h. Any WRB which has been tested per ASTM E1354 (at a min. of 20 kw/m² heat flux) and shown by analysis to be of equivalent or lesser flammability (based on Tign, Pk. HRR) than those listed above.
Exterior Cladding Use 1 through 6 Note: Masonry cladding items 2-6 do not employ an air gap or open joints.	1. Brick – Nominal 4" clay brick or veneer with max. 2" air gap behind the brick. Brick ties/anchors 24" o.c. (max.). 2. Stucco – Minimum ¾"-thick exterior cement plaster and lath with approved WRB over insulation. 3. Limestone – Minimum 2" thick, using any standard non-open joint installation technique such as shiplap. 4. Natural Stone Veneer – Minimum 2" thick using any standard non-open joint installation technique. 5. Terracotta Cladding – Minimum 1¼" thick (solid or equivalent by weight) using any standard non-open joint installation technique such as shiplap. 6. Cast Artificial Stone – Minimum 1½" thick complying with ICC-ES AC51 installed using any standard non-joint installation technique such as shiplap.
SI: 1 in = 25.4 mm 1. The assemblies' combinations created herein and the various substitutions of products are based on testing and professional thermal engineering analysis by Priest & Associates Consulting, LLC. 2. Acceptance criteria for <i>ASTM E1354</i> testing have not been well established in the referenced building codes and foam sheathing related sections. The criteria stated here for substitution of products is based on testing and professional thermal engineering analysis by Priest & Associates. 3. T _{ign} is the time to ignition from the start of the test until the sheathing ignites. Pk. HRR is the peak heat release rate during the test.	

TABLE 9. APPROVED *NFPA 285* WALL ASSEMBLIES – ACM CLADDING¹

Wall Component	Materials
Base Wall System Use either 1, 2, 3 or 4 Note: May use 4 optionally when FRTW framing is allowed by code	1. Cast Concrete Wall 2. Concrete Masonry Wall 3. 20-gauge (min.) 3 $\frac{5}{8}$ " (min.) steel studs spaced 24" o.c. (max) 4. 1 layer – $\frac{5}{8}$ "-thick Type X gypsum wallboard on interior 5. Lateral bracing every 4' 6. Where allowed in Types I-IV construction, FRTW (Fire Retardant Treated Wood) studs complying with IBC Section 2303.2 , minimum nominal 2x4 spaced at a maximum 16" o.c. 7. $\frac{5}{8}$ " (min.) Type X gypsum wallboard interior. 8. Wall braced at mid-height and fire-stopped at top and bottom.
Fire-Stopping in Stud Cavities at Floor Lines. Use either 1 or 2. As an option, use 2 with FRTW framing	1. Any approved 4 pcf mineral fiber based safing insulation in each stud cavity at floor line. Safing thickness must match stud cavity depth. 2. Solid FRTW fire blocking at floor line when Base Wall System, Item 4 is used.
Cavity Insulation Use any option 1-13	1. None 2. 1 $\frac{1}{2}$ " (min.) BASF Wallite™ 2 pcf SPF (or equivalent) up to full cavity fill. 3. 1 $\frac{1}{2}$ " (min.) Premium Spray Products Foamsulate 20 up to full cavity fill. 4. Any noncombustible insulation per <i>ASTM E136</i> . 5. Any mineral fiber (Batt or board type Class A <i>ASTM E84</i> faced or unfaced). 6. Any fiberglass (Batt type Class A <i>ASTM E84</i> faced or unfaced). 7. Icynene Classic, Classic Plus, Classic Ultra or Classic Ultra Select; MD-R-210; MD-C-200; or Proseal. Partial cavity fill with a max. air space of 2" or full cavity fill not exceeding 7 $\frac{5}{8}$ ". Use with $\frac{1}{2}$ " exterior gypsum sheathing (min.). 8. NCFI Polyurethanes, full cavity depth or less of InsulBloc, InsulStar, InsulStar Plus or ThermalStop™ closed cell (2.0 lb/ft ³) spray polyurethane foam applied using sheathing as substrate and covering the width of the cavity. Use with $\frac{1}{2}$ " exterior gypsum sheathing (min.). 9. SWD Urethane Quik-Shield 112 spray polyurethane foam applied using $\frac{5}{8}$ " Type X sheathing as substrate. Air gap must not exceed 2 $\frac{1}{2}$ ". 10. Demilec Sealection 500 or HeatLok Soy 200, up to full cavity fill. Use with $\frac{5}{8}$ " Type X exterior gypsum sheathing. 11. Accella Polyurethane Bayseal® OC and OCX or Bayseal® CC, up to full cavity fill using minimum $\frac{1}{2}$ " exterior gypsum sheathing. 12. Lapolla™ Foam-Lok™ FL 2000 with $\frac{5}{8}$ " Type X exterior sheathing in 3 $\frac{5}{8}$ " studs (max.) 13. Any cavity insulation which has been tested per <i>ASTM E1354</i> (at a min. of 20 kw/m ² heat flux) and shown by analysis to be of equivalent or lesser flammability (based on Tign, Pk. HRR) than the foam tested in Item 2 or 3 above.
Exterior Sheathing Use either 1, 2 or 3 Note: Exterior FRTW sheathing or gypsum wallboard is optional for Base Walls 1 and 2.	1. Minimum $\frac{1}{2}$ " exterior gypsum sheathing ($\frac{5}{8}$ " Type X exterior gypsum sheathing required when SPF in cavity). 2. $\frac{1}{2}$ " (min.) FRTW structural panels complying with IBC section 2303.2 and installed in accordance with the code requirements for Types I-IV construction.

Wall Component	Materials
Water-Resistive Barrier Over Base Wall Use any item 1-8	1. None 2. Any WRB that has been tested per <i>ASTM E1354</i> (at a min. of 20 kw/m ²) and shown by analysis to be of equivalent or lesser flammability (based on Tign, Pk. HRR) than the exterior insulation foam core or baseline Item 3 below. 3. Henry Air Bloc 32MR 4. Kingspan GreenGuard® Max Building Wrap 5. Dupont Tyvek (Various per ESR-2375) 6. Dow Weathermate™ 7. Dow Weathermate™ Plus 8. WRBs over exterior sheathing: <ul style="list-style-type: none"> a. Henry Foilskin b. Henry MetalClad c. CCW 705 FR-A d. Kingspan GreenGuard® Max Building Wrap e. Dupont Tyvek (various per ESR-2375) f. Dow Weathermate™ g. Dow Weathermate™ Plus
Exterior Insulation	Up to 4"-thick OX Strong-R®, consisting of a single panel or multiple thinner panels
WRB Over Exterior Insulation Use any item 1-5	1. None 2. Aluminum construction tape as tested (or equivalent), max. 6" wide over staggered insulation joints. 3. Henry Foilskin 4. Henry MetalClad 5. CCW 705 FR-A
Exterior Cladding Use any item 1-11	1. Brick – Nominal 4" clay brick or veneer with max. 2" air gap behind the brick. Brick ties/anchors 24" o.c. (max.). 2. Stucco – Minimum ¾"-thick exterior cement plaster and lath with an optional secondary water resistive barrier between the exterior insulation and lath. The secondary barrier shall not be full coverage asphalt or self-adhered butyl membrane. 3. Limestone – Minimum 2" thick, using any standard installation technique. 4. Natural Stone Veneer – Minimum 2" thick using any standard installation technique. 5. Cast Artificial Stone – Minimum 1½" thick complying with ICC-ES AC51 installed using any standard installation technique. 6. Terracotta Cladding – Minimum 1¼" thick, using any standard installation technique. 7. Any MCM, ACM (aluminum, steel, copper, zinc) (w/ 1½" ± ½" air gap) that has successfully passed <i>NFPA 285</i> using any standard installation technique. 8. Uninsulated sheet metal building panels including aluminum, steel or copper using any standard installation technique. 9. Uninsulated Fiber-cement siding using any standard installation technique. 10. Stone/Aluminum honeycomb composite building panels that have passed <i>NFPA 285</i> or equivalent (StoneLite Wall Panels by Stone Panels – ESR-1500) 11. Autoclaved-aerated-concrete (AAC) panels that have successfully passed <i>NFPA 285</i> using any standard installation technique.

SI: 1 in = 25.4 mm

1. The assemblies' combinations created herein and the various substitutions of products are based on testing and professional thermal engineering analysis by Priest & Associates Consulting, LLC.
2. Acceptance criteria for *ASTM E1354* testing have not been well established in the referenced building codes and foam sheathing related sections. The criteria stated here for substitution of products is based on testing and professional thermal engineering analysis by Priest & Associates.
3. T_{ign} is the time to ignition from the start of the test until the sheathing ignites. Pk. HRR is the peak heat release rate during the test.

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 *Installation Procedure*
- 6.2.1 *General:*
- 6.2.1.1 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.
- 6.2.2 *Orientation:*
- 6.2.2.1 Strong-R® Structural Insulation may be installed vertically or horizontally over studs, with framing not less than 20 ga. 50 ksi 3 $\frac{5}{8}$ " and spaced a maximum of 24" o.c. (610 mm) or wood framing that has a nominal thickness of not less than 2" (51 mm) and spaced a maximum of 24" o.c. (610 mm).
- 6.2.2.2 Sheathing joints must be butted at framing members, and all panel edges shall be blocked. A single row of fasteners must be applied to each panel edge into the stud or blocking below. Do not tack product to framing, but fasten each panel completely after fastening begins.
- 6.2.3 *Attachment:*
- 6.2.3.1 Strong-R® Structural Insulation:
- 6.2.3.1.1 Minimum #8 x 1 $\frac{5}{8}$ " self-drilling modified truss head screw or 0.100" diameter x 1 $\frac{1}{2}$ " length pins (Bostitch® C4S100 BG) for steel studs.
- 6.2.3.1.1.1 Fastener spacing shall be a maximum of 12" o.c. (305 mm) along the edge and 12" o.c. in the field or as required in Section 5 for the application selected.
- 6.2.3.1.2 Minimum #8 x 1 $\frac{1}{4}$ " Wafer Head Screw for wood studs.
- 6.2.3.1.2.1 Fasteners shall penetrate a minimum of 1" into the stud. Fasteners are to be installed spaced a maximum of 6" o.c. (152 mm) at the panel edges and 12" o.c. (305 mm) in the field. Fastener edge distance shall be a minimum of $\frac{3}{8}$ " (9.5 mm). Fastener head shall be driven through the foam plastic to seat against the backer material.
- 6.2.3.2 Gypsum Wallboard:
- 6.2.3.2.1 Where required, gypsum wallboard shall be a minimum $\frac{1}{2}$ " thickness and shall be attached as follows:
- 6.2.3.2.1.1 #6 x 1 $\frac{1}{4}$ " Type S screws
- 6.2.3.2.1.2 Fastener spacing shall be as shown in Section 5.
- 6.2.4 *Treatment of Joints:*
- 6.2.4.1 Strong-R® Structural Insulation sheathing joints must be butted at framing members, and a single row of fasteners must be applied to each panel edge into the stud below.
- 6.2.4.2 If Strong-R® Structural Insulation is being used as a WRB, joints must be taped as specified in Section 5.3.1. If a separate WRB method is used, taping of the sheathing joints is not required.
- 6.2.5 *Window Treatments:*
- 6.2.5.1 Strong-R® Structural Insulation must be installed with appropriate flashing and counter flashing in conformance with accepted building standards and in compliance with local building codes and the flashing manufacturer's installation instructions.
- 6.2.6 *Non-Structural Applications:*
- 6.2.6.1 Install panels with minimum #8 x 1 $\frac{5}{8}$ " self-drilling modified truss head screw or 0.100" diameter x 1 $\frac{1}{2}$ " length pins (Bostitch® C4S100 BG).
- 6.2.6.2 The fastener spacing shall be 12" o.c. along the top, bottom, and vertical panel edges and 12" o.c. in the field. Do not tack product to framing, but fasten each panel completely after fastening begins.

7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 Lateral load testing and data in accordance with *ASTM E564* and *E2126*
- 7.2 Transverse load testing in accordance with *ASTM E330*
- 7.3 Test reports and data for determining use as a WRB material, in accordance with *ASTM E331*
- 7.4 Test reports and data for determining use as a component of an air barrier, in accordance with *ASTM E2178*
- 7.5 Test reports and data for determining surface burning characteristic in accordance with *ASTM E84*
- 7.6 Test reports and data for determining use in attics and crawlspaces without a thermal barrier or ignition barrier in accordance with *NFPA 286*
- 7.7 Test reports and engineering analysis of vertical and lateral fire propagation properties in accordance with *NFPA 285*
- 7.8 Test reports and data for determining comparative equivalency for use as an alternative material in accordance with *IBC Section 104.11* and *IRC Section R104.11*.
- 7.9 Manufacturer installation recommendations for structural sheathing on exterior walls.
- 7.10 Quality Control Manual in accordance with a third-party quality control program with inspections conducted by an approved agency.
- 7.11 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.
- 7.12 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 Lateral load resistance due to wind and seismic loads carried by shear walls.
 - 8.1.2 Transverse load resistance due to components and cladding pressures on building surfaces.
 - 8.1.3 Performance of the foam plastic component for conformance to *IBC Section 2603* and *IRC Section R316*.
 - 8.1.4 Performance for use as insulating sheathing in accordance with *IRC Sections N1102.1* and *N1102.2* and *IECC Section C402*.
 - 8.1.5 Performance for use as a WRB in accordance with *IBC Section 1404.2* and *IRC Section R703.2*.
 - 8.1.6 Performance for use as an air barrier in accordance with *IRC Section N1102.4* and *IECC Section C402*.
- 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 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.
- 9.1.1 This TER and the installation instructions shall be available to the jurisdiction in which the project is to be constructed.
- 9.1.2 Walls shall not be used to resist horizontal loads from concrete and masonry walls.
- 9.1.3 Strong-R® Structural Insulation shall not be used as a nailing base.
- 9.1.4 Except as provided in Section 5.7, this product shall be fully protected from the interior of the building by an approved 15-minute thermal barrier where required by the applicable code.
- 9.1.5 In areas where the probability of termite infestation is very heavy, in accordance with IBC Section 2603.8 or IRC Section R318.4, the product must not be placed on exterior walls located within 6" (152 mm) of the ground.
- 9.1.6 Allowable shear loads shall not exceed values in Table 1 for wind loads and Table 2 for seismic loads.
- 9.1.7 Transverse design loads shall not exceed those described in Table 4, unless an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing.
- 9.1.8 Strong-R® Structural Insulation are manufactured under a quality control program with quality control inspections in accordance with IBC Sections 110.3.9⁷ and 110.4 and IRC Section R109.2.
- 9.2 When installed as a wall sheathing but not installed per structural requirements, light-framed walls shall be braced by other means.
- 9.3 When used as a WRB, installation shall be in accordance with Section 5.3.
- 9.4 When used in accordance with the *IBC* in high wind areas, special inspections shall comply with IBC Section 1705.11⁸.
- 9.5 When used in accordance with the *IBC* in Seismic Design Categories C, D, E or F, special inspections shall comply with IBC Section 1705.12⁹.
- 9.6 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.
- 9.7 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.8 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).
- 9.9 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.10 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.

⁷ 2015 IBC Section 110.3.8

⁸ 2012 IBC Section 1705.10

⁹ 2012 IBC Section 1705.11

- 9.11 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.
- 9.12 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 oxengineeredproducts.com.

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](#).