DrJ CERTIFICATION

Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 0804-01

OX-IS®, OX-IS® HS, and SI-Strong
Structural Insulation

Ox Engineered Products, LLC

9/17/2020

COLORADO LICENSED
RYAN J. DEXTER
44687
PROFESSIONAL ENGINEER

Product:

OX-IS® Structural Insulation, OX-IS® HS (High Shear) Structural Insulation, and SI-Strong Structural Insulation

Issue Date:
April 26, 2008
Revision Date:
May 20, 2020
Subject to Renewal:
April 1, 2021

This TER is reviewed and sealed by Ryan Dexter, P.E. of DrJ Engineering, LLC, as a specialty or delegated engineer. The scope of engineering work with respect to this TER is for the engineering analysis provided herein, supported by proprietary intellectual property and other substantiating data. No representation extending beyond this analysis is expressed or implied. Information or data that becomes available at a later date may justify modifications to this TER.

COMPANY
INFORMATION:

Ox Engineered Products, LLC

700 Centreville St
Constantine, MI 49042-1273

800-345-8881

oxengineeredproducts.com

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 Evaluated[1]

1.1. OX-IS® Structural Insulation, OX-IS® HS (High Shear) Structural Insulation, and SI-Strong 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. CBC—16, 19: California Building Code

2.1.5. FBC—14, 17: Florida Building Code (FL16410)

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. Standards and Referenced Documents

2.2.1. ANSI/AWC SDPWS: Special Design Provisions for Wind and Seismic

2.2.2. ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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

2.2.4. ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings

2.2.5. ASTM E2178: Standard Test Method for Air Permeance of Building Materials

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. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

2.2.8. ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings

2.2.9. ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

2.2.10. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials

2.2.11. 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. OX-IS® and SI-Strong were evaluated to determine:

3.1.1. Structural performance under lateral load conditions (wind and seismic) for use as an alternative to the *IRC* Intermittent Wall Bracing provisions of *IRC* Section R602.10, method WSP (Wood structural panel), and the *IRC* Continuous Wall Bracing provisions of *IRC* Section R602.10.4, method CS-WSP (Continually sheathed wood structural panel) and CS-PF (Continually sheathed portal frame).

3.1.2. Structural performance under lateral load conditions for use as an alternative to the Conventional Wall Bracing provisions, *IBC* Section 2308.6[4], Method 3, for Type V construction.

3.2. OX-IS®, OX-IS® HS, and SI-Strong were evaluated to determine:

3.2.1. Structural performance under lateral load conditions for both wind and seismic loading for use with the performance-based provisions, *IBC* Section 2306.1 and 2306.3, for light-frame wood wall assemblies.

3.2.1.1. Table 4 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).

3.2.1.2. The basis for equivalency testing is outlined in Section 12.2.1.1 [5] of *ASCE 7*:

> **Alternative Structural Systems.** 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 medication coefficient, R; overstrength factor, Ω_o; and deflection amplification factor, C_d.

[4] 2012 *IBC* Section 2308.9.3

[5] *ASCE 7-5* and *7-10* Section 12.2.1

3.2.1.3. The SDC evaluation uses the approach found in documentation entitled "Equivalency Characteristics and Parameters for Proprietary Shear Walls Used in Wood Framed or Cold-formed Steel Construction" [6] and "Seismic Design Coefficients: How they are determined for light-frame components"[7] using code-defined accepted engineering procedures, experience, and good technical judgment.

2. Structural performance under lateral load conditions for use as an alternative to *SDPWS* Section 4.3 Wood-Frame Shear Walls

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

4. Resistance to transverse loads for wall assemblies used in light-frame wood construction in accordance with *IBC* Section 1609.1.1 and *IRC* Section R301.2.1

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

6. Performance for use as insulated sheathing in accordance with the *IECC* Section C402.1

7. Performance for use as an air barrier in accordance with the *IECC* Section C402.5.1.2.1

8. Performance for use as a water-resistive barrier (WRB) in accordance with the *IBC* Section 1403.2[8] and *IRC* Section R703.2

3.3. Use in an *IRC* Method PFH (portal frame with hold-downs) braced wall panels is outside the scope of this TER. For this application, see TER 1101-01.

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. Product labels for the products evaluated in this TER are shown in Figure 1, Figure 2, and Figure 3.

Figure 1. OX-IS® Logo

1. http://www.structuremag.org/wp-content/uploads/2014/08/C-StructuralPerformance-Nelson-Aug081.pdf
2. http://www.sbcmag.info/article/2014/seismic-design-coefficients-how-they-are-determined-light-frame-components
3. 2015 *IBC* Section 1404.2

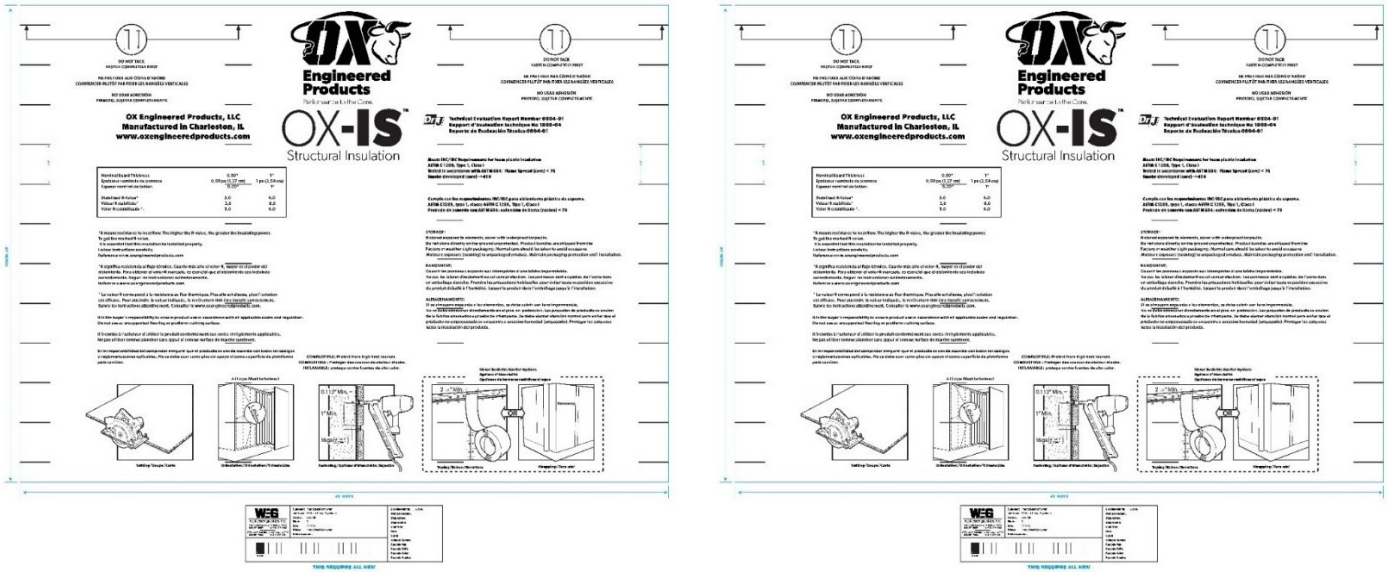

FIGURE 2. OX-IS® AND OX-IS® HS STRUCTURAL INSULATION PRODUCT LABELS

FIGURE 3. SI-STRONG STRUCTURAL INSULATION PRODUCT LABEL

4.2. OX-IS® and SI-Strong are structural, rigid insulation sheathing products 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 sides, using either a 0.113" (2.9 mm) nominal thickness or a 0.135" (3.4 mm) nominal thickness fibrous sheathing board.

4.2.2. The rigid foam plastic insulation is a proprietary polyisocyanurate, which can have facings on one or both sides.

4.3. OX-IS® HS 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.

4.3.1. 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 sides, either using a 0.135" (3.4 mm) nominal thickness fibrous sheathing board.

4.3.2. The rigid foam plastic insulation is a proprietary polyisocyanurate, which can have facings on one or both sides.

4.4.Material Availability

4.4.1 Thickness: 0.5" (12.7 mm) up to 1.5" (38.1 mm)

4.4.2 Standard product width: 48" (1219 mm)

4.4.3 Standard lengths: 96", 108", and 120" (2438, 2743, and 3048 mm)

5. APPLICATIONS

5.1. General

5.1.1. OX-IS®, OX-IS® HS, and SI-Strong are structural insulated sheathing panels for use in the following applications as:

5.1.1.1. Wall sheathing in buildings constructed in accordance with the *IBC* and *IRC* for light-frame wood and steel 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 wood 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 1403.2[9] 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. OX-IS®, OX-IS® HS, and SI-Strong contain foam plastics complying with *IBC* Section 2603 and *IRC* Section R316.

[9] 2015 *IBC* Section 1404.2

5.2. Structural Applications

5.2.1. General Provisions:

5.2.1.1. Except as otherwise described in this TER, OX-IS®, OX-IS® HS, and SI Strong shall be installed in accordance with the applicable building codes listed in Section 2.1 using the provisions set forth therein for the design and installation of wood structural panels (WSP).

5.2.1.1.1. OX-IS®, OX-IS® HS, and SI-Strong shall be permitted to be designed in accordance with *SDPWS* for the design of shear walls using the methods set forth therein, including the perforated shear wall methodology, and subject to the *SDPWS* boundary conditions, except as specifically allowed in this TER.

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 OX-IS®, OX-IS® HS, and SI-Strong 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 blocked with a minimum 2" nominal lumber.

5.2.1.6. Fasteners may be countersunk beneath the outer surface of the foam plastic sheathing layer.

5.2.1.7. Installation is permitted for single top plate (advanced framing method) or double top plate applications.

5.2.1.8. 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. Simplified IRC Bracing Provisions:

5.2.2.1. OX-IS® and SI-Strong are permitted to be used in accordance with the *IRC* simplified bracing method of *IRC* Section R602.12 as modified by Table 1. All other provisions of the *IRC* simplified bracing method shall be met.

TABLE 1. OX-IS® AND SI-STRONG PROTECTIVE SHEATHING SIMPLIFIED BRACING TABLE

Structural Sheathing Product	Ultimate Design Wind Speed (mph)	Story Level	Eave to Ridge Height (ft)	Minimum Number of Bracing Units Required (Long Side)						Minimum Number of Bracing Units Required (Short Side)					
				Length of Short Side (ft)						Length of Long Side (ft)					
				10	20	30	40	50	60	10	20	30	40	50	60
½"OX-IS® or ½" SI-Strong	115	One Story or Top of Two or Three Story	10	1	2	2	2	3	3	1	2	2	2	3	3
		First of Two Story or Second of Three Story		2	3	3	4	5	5	2	3	3	4	5	5
		First of Three Story		2	3	4	6	7	8	2	3	4	6	7	8
		One Story or Top of Two or Three Story	15	1	2	3	3	3	4	1	2	3	3	3	4
		First of Two Story or Second of Three Story		2	3	4	5	6	6	2	3	4	5	6	6
		First of Three Story		2	4	5	6	7	9	2	4	5	6	7	9
1" OX-IS® or 1" SI-Strong		One Story or Top of Two or Three Story	10	1	1	2	2	3	3	1	1	2	2	3	3
		First of Two Story or Second of Three Story		1	2	3	4	4	5	1	2	3	4	4	5
		First of Three Story		2	3	4	5	6	7	2	3	4	5	6	7

One Story or Top of Two or Three Story	15	1	2	2	3	3	4	1	2	2	3	3	4
First of Two Story or Second of Three Story		2	2	3	4	5	6	2	2	3	4	5	6

Structural Sheathing Product	Ultimate Design Wind Speed (mph)	Story Level	Eave to Ridge Height (ft)	Minimum Number of Bracing Units Required (Long Side)						Minimum Number of Bracing Units Required (Short Side)					
				Length of Short Side (ft)						Length of Long Side (ft)					
				10	20	30	40	50	60	10	20	30	40	50	60
		First of Three Story		2	3	4	6	7	8	2	3	4	6	7	8
½" OX-IS® or ½" SI-Strong	130	One Story or Top of Two or Three Story	10	1	2	2	3	3	4	1	2	2	3	3	4
		First of Two Story or Second of Three Story		2	3	4	5	6	7	2	3	4	5	6	7
		First of Three Story		2	4	5	7	8	10	2	4	5	7	8	10
		One Story or Top of Two or Three Story	15	2	3	3	4	4	6	2	3	3	4	4	6
		First of Two Story or Second of Three Story		2	3	4	6	7	8	2	3	4	6	7	8
		First of Three Story		3	4	6	8	9	11	3	4	6	8	9	11
1" OX-IS® or 1" SI-Strong		One Story or Top of Two or Three Story	10	1	2	2	3	3	3	1	2	2	3	3	3
		First of Two Story or Second of Three Story		2	3	4	4	5	6	2	3	4	4	5	6
		First of Three Story		2	4	5	6	8	9	2	4	5	6	8	9
		One Story or Top of Two or Three Story	15	1	2	3	3	4	5	1	2	3	3	4	5
		First of Two Story or Second of Three Story		2	3	4	5	6	7	2	3	4	5	6	7
		First of Three Story		2	4	5	7	8	10	2	4	5	7	8	10

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

1. This simplified bracing table is based on the provisions of *IRC* Section R602.12. All provisions therein shall be observed, except that this table shall replace *IRC* Table R602.12.4, and OX-IS® or SI-Strong shall replace the sheathing material.
2. Interpolation shall not be permitted.
3. Cripple walls or wood-framed basement walls in a walk-out condition shall be designated as the first story and the stories above shall be re-designated as the second and third stories, respectively, and shall be prohibited in a three-story structure.
4. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.
5. For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building and 1.40 for a three-story building.
6. Maximum stud spacing is 16" o.c.
7. OX-IS® and SI-Strong attached with minimum 7/16" crown x 1½" leg staples fastened 3" o.c. at panel edges and 3" o.c. in the field.
8. Minimum ½" gypsum wallboard (GWB) attached to the interior side of the wall in accordance with *IRC* Section R702.3.5 and Table R702.3.5.
9. Where GWB is not applied to the interior side of the wall assembly, bracing lengths in *IRC* Table R602.10.3(1 and 3), as modified by all applicable factors in Table R602.10.3(2 and 4), shall be used, except the factor for omitting the GWB shall be 1.5 when using 16:16 GWB fastening and 1.8 when using 8:8 fastening.

5.2.3. Prescriptive IRC Bracing Applications:

5.2.3.1. OX-IS® and SI-Strong may be used:

5.2.3.1.1. On braced wall lines as an equivalent alternative to the *IRC* Method WSP, when installed in accordance with *IRC* Section R602.10 and this TER.

5.2.3.1.2. To brace walls of buildings as an alternative to the *IRC* Method CS-PF braced wall panel provisions of *IRC* Section R602.10.4.

5.2.3.1.3. Required braced wall panel lengths shall be as determined by the equivalency factor shown in Table 2 and *IRC* Tables R602.10.3(1) and R602.10.3(3), including all footnotes.

TABLE 2. *IRC*B RACED WALL PANEL EQUIVALENCY FOR OX-IS® AND SI-STRONG

Structural Sheathing Product	Thickness (in)	Maximum Stud Spacing (in)	Fastener	Maximum Fastener Spacing (edge:field) (in)	GWB Fastening Spacing (blocked or unblocked) (edge:field)	Wind SPF Framing Equivalency Factors to *IRC* WSP or CS-WSP
OX-IS® or SI-Strong	½	16 o.c.	Minimum 16 ga, Staple, 7/16" Crown x 1 ½" Leg	3:6	16:1 [5]	1.00
				3:3	8:8	0.81
		24 o.c.			16:1	1.10
					8:8	0.91
				3:6		0.92
			0.113" Dia. Nail (min. 3/8" head or 2" cap)			1.10
	1	16 o.c.	Minimum 16 ga, Staple, 7/16" Crown x 2" Leg	3:3	16:1	0.91
					8:8	0.75
		24 o.c.			16:1	1.00
					8:8	0.82

SI: 1 in = 25.4 mm

1. Equivalency factors allow the user to determine the length of bracing required, by multiplying the equivalency factor above by the length of bracing shown in the WSP or CS-WSP columns in *IRC* Table R602.10.3(1 and 3), as modified by all applicable factors in Table R602.10.3(2 and 4) respectively.
2. Where GWB is notapplied to the interior side of the wall assembly, bracing lengths in *IRC* Table R602.10.3(1 and 3), as modified by all applicable factors in Table R602.10.3(2 and 4), shall be used, except the factor for omitting the GWB shall be 1.5 when using 16:16 GWB fastening and 1.8 when using 8:8 fastening.
3. Valid for single top plate (advanced framing method) wall installations or double top plate wall installations.
4. Fastener penetration into the stud shall be a minimum of 1".
5. The first number indicates the required fastener spacing at panel edges. The second number indicates the fastener spacing at intermediate framing members.

5.2.3.2. All other *IRC* prescriptive bracing minimums, spacing requirements and rules must still be met.

5.2.4. OX-IS® and SI-Strong CS-PF Portal Frame:

5.2.4.1. OX-IS® and SI-Strong CS-PF was tested and evaluated for equivalency to the *IRC* Method CS-PF in accordance with *IRC* Section R602.10.6.4 and Table R602.10.5.

5.2.4.2. *IRC* Table R602.10.5 establishes the contributing length of bracing of the CS-PF as equivalent to its actual length and that it contributes this length of bracing to that required by method CS-WSP.

5.2.4.3. The capacity of the OX-IS® and SI-Strong Sheathing CS-PF exceeds the capacity of the *IRC* Method CS-WSP and is, therefore, permitted to be substituted for an equivalent length of bracing.

5.2.4.4. The OX-IS® and SI-Strong CS-PF is depicted in Figure 4.

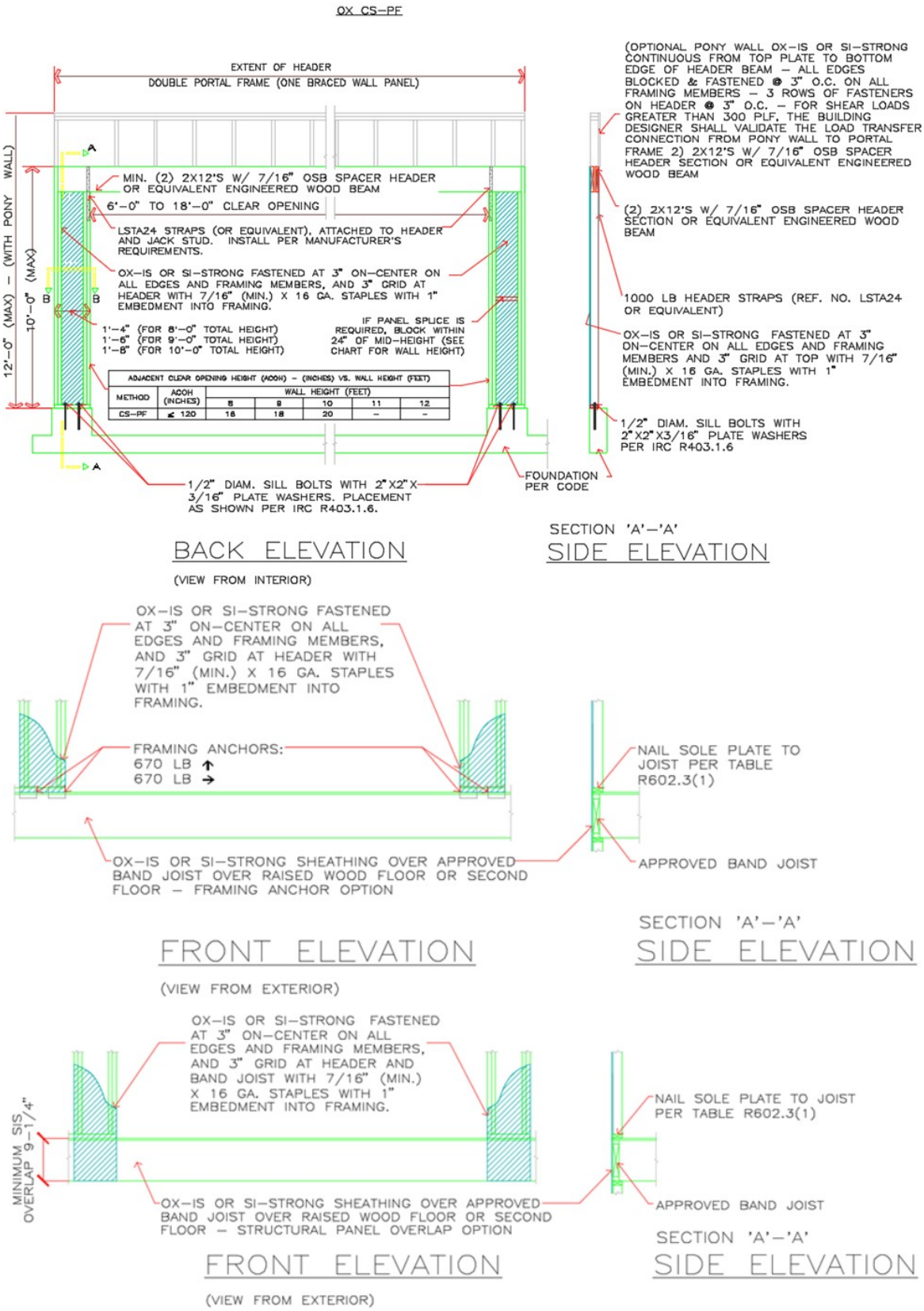

FIGURE 4. CONSTRUCTION DETAILS OF OX-IS® OR SI-STRONG CS-PF

5.2.5.Prescriptive IBC Conventional Light-Frame Wood Construction:

5.2.5.1. OX-IS® and SI-Strong may be used to brace exterior walls of buildings as an equivalent alternative to Method 3 of the *IBC* when installed with blocked or unblocked ½" GWB fastened with a minimum 5d cooler nail or #6 Type W or S screw spaced a maximum of 16" o.c. at panel edges and 16" o.c. in the field. Bracing shall be in accordance with the conventional light-frame construction method of *IBC* Section 2308.6[10] and this TER.

5.2.6.Performance-Based Wood-Framed Construction:

5.2.6.1. OX-IS®, OX-IS® HS and SI-Strong panels used in wall assemblies designed as shear walls:

5.2.6.1.1. Are permitted to be designed in accordance with the methodology used in *SDPWS* for WSP using the capacities shown in Table 3.

5.2.6.1.2. Resist lateral wind load forces using the allowable shear loads (in pounds per linear foot) set forth in Table 3.

5.2.6.1.2.1. The allowable basic wind speed V_{ult} for the use OX-IS®, OX-IS® HS, and SI-Strong panels in exterior wall covering assemblies is given in Table 4.

5.2.6.1.3. Resist seismic load forces using the seismic allowable unit shear capacities set forth in Table 4 when seismic design is required in accordance with *IBC* Section 1613.

5.2.6.1.3.1. The response modification coefficient, R; system overstrength factor, Ω_0; and deflection amplification factor, C_d, indicated in Table 4 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.

5.2.6.2. OX-IS®, OX-IS® HS, and SI-Strong panels are permitted to resist transverse wind load forces using the allowable transverse loads (in pounds per linear foot) set forth in Table 5. Required component and cladding loads to be resisted are found in *IBC* Section 1609.1.1 and *IRC* Table R301.2(2) and R301.2(3).

[10] 2012 *IBC* Section 2308.9.3

TABLE 3. ALLOWABLE STRESS DESIGN (ASD) CAPACITY FOR OX-IS®, OX-IS® HS, AND SI-STRONG – WIND

Structural Sheathing Product	Thickness (in)	Maximum Fastener Spacing (edge:field) (in)	Maximum Stud Spacing (in)	GWB Thickness (in)	GWB Fastener[2] Spacing (edge:field)	Allowable Unit Shear Capacity (plf)
OX-IS® or SI-Strong	½	3:3[1]	16 o.c.	½	8:8	440
					16:16	370
		3:6	16 o.c.	½	8:8	425(1)
						350(3)
		3:3[1]	24 o.c.	½	8:8	385
					8:12(4)	700
		3:3[1]	16 o.c.	None	-	300
			24 o.c.			275
	1	3:3[1]	16 o.c.	½	8:8	475
					16:16	400
			24 o.c.		8:8	450
					16:16	380
			16 o.c.	None	-	325
			24 o.c.	None		295
				½ + Thermo-Ply Red[5]	8:8	550
		3:3[3]	16 o.c.	½	8:8	390
		3:6[1]	16" o.c.	½	8:8	415
	1½	3:3[6]	16 o.c.	None	-	305
			24 o.c.			275
		3:6[6]	16 o.c.	½	8:8	415
			24 o.c.			370

OX-IS® HS	½	3:3[1]	24 o.c.			420

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

1. OX-IS®, SI-Strong, and OX-IS® HS attached to wood framing with a minimum 16 gauge, $^{7}/_{16}$" crown staples shall penetrate a minimum of 1" into the stud. Fasteners are to be installed with the crown parallel to the framing. Fastener edge distance shall be a minimum of $^{3}/_{8}$". 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.
2. Unless noted otherwise, GWB attached with minimum #6 type W or S screws 1¼" long with a minimum edge distance of $^{3}/_{8}$".
3. OX-IS® fastened with a minimum 0.113" diameter roofing nail with 0.280" minimum head size. 2" cap nails having a minimum 0.113" diameter are also permitted.
4. ½" GWB adhered with wall and floor adhesive (*ASTM* C557) and #6 (6"x 1 $^{1}/_{4}$") bugle head, coarse thread drywall screws, edges blocked.
5. Install Thermo-Ply Red on opposite side of wall from the OX-IS® or SI-Strong with minimum 16 gauge, 1" crown staples fastened 3" o.c edge/ 3" o.c. field. Separately attach ½ " GWB over Thermo-Ply Red with minimum#6 type W or S screws 1¼" long fastened 8" o.c edge/ 8" o.c. field.
6. OX-IS® fastened with a minimum 0.113" diameter roofing nail with 0.280" minimum head size.

TABLE 4. SEISMIC PERFORMANCE OF OX-IX® AND SI-STRONG[3]

Seismic Force Resisting System[1]	Thickness (in)	GWB Fastening Spacing[2] (edge:field)	Maximum Stud Spacing (in)	Seismic Allowable Unit Shear Capacity[4] (plf)	Apparent Shear Stiffness, G_a (kips/in)	Response Modification Factor, R[5]	System Over-strength Factor, Ω_0[6]	Deflection Amplification Coefficient, C_d[7]	Structural System Limitations and Building Height Limit[8,9] (ft)				
									Seismic Design Category				
									B	C	D	E	F
Light-Frame (Wood) Walls Sheathed with OX-IS® or SI-Strong	½	16:16	16 o.c.	295	23	6.5	3	4	NL	NL	65	65	65
		8:8		350									
	1	16:16		320	26								
		8:8		380									
		16:16	24 o.c.	300	14								
		8:8		355									
Light-Frame (Wood) Walls Sheathed with OX-IS® HS	½			335	12.5								

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m, 1 psi = 0.00689 MPa

1. OX-IS® and SI-Strong attached to wood framing with a minimum 16 gauge, $^{7}/_{16}$" crown staples shall penetrate a minimum of 1" into the stud. Fasteners are to be installed with the crown parallel to the framing and 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 $^{3}/_{8}$". Fastener head shall be in contact with the panel surface. Alternately, fastener heads are permitted to be overdriven into foam portion of the panel, at a maximum such that they are flush with the structural backer material, with no reduction in shear capacities.
2. Walls installed with minimum ½" GWB attached with minimum #6 type W or S screws 1¼" long. Fasteners shall maintain a minimum edge distance of $^{3}/_{8}$".
3. All seismic design parameters follow the equivalency as defined in Section 3 of this TER.
4. The allowable unit shear capacity is calculated using a factor of safety of 2.5 per *ASCE 7*.
5. Response modification coefficient, R, for use throughout *ASCE 7*. Note: R reduces forces to a strength level, not an allowable stress level.
6. 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.
7. Deflection amplification factor, C_d, for use with *ASCE 7* Sections 12.8.6, 12.8.7, and 12.9.1.2[11].
8. Heights are measured from the base of the structure as defined in ASCE 7 Section 11.2.
9. NL = Not Limited

TABLE 5. OX-IS®, OX-IS® HS, AND SI-STRONG ALLOWABLE DESIGN VALUE (PSF) FOR RESISTING OUT-OF-PLANE WIND LOADS

Structural Sheathing Product	Transverse Wind Load Resistance[1]		
	Allowable Design Value (psf)	Maximum Stud Spacing (in)	Fastener Schedule

OX-IS®, OX-IS® HS, and SI-Strong	95	24 o.c.	$^{7}/_{16}$" crown 16 gauge galvanized staples, minimum 1" penetration into the stud, 3" o.c. to perimeter/field. Staple crowns to be installed parallel to grain.

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m^2

1. Attachment to wood framing having a minimum specific gravity of 0.42.

11. *ASCE 7-10* Section 12.9.2

TABLE 6. BASIC WIND SPEED FOR OX-IS®, OX-IS® HS, AND SI-STRONG 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 7-10 and 7-16* (mph)
	16" o.c. Framing	16" o.c. Framing
OX-IS®, OX-IS® HS, and SI-Strong	190	245

SI: 1 mph = 1.61 km/h

1. Allowable wind speeds are based on the following: 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.
2. Attachment to wood framing having a minimum specific gravity of 0.42.

TABLE 7. UPLIFT PERFORMANCE OF OX-IS®, OX-IS® HS, AND SI-STRONG

Structural Sheathing Product	Allowable Uplift Capacity (plf)	Maximum Stud Spacing (in)	Fastener Schedule
½" OX-IS®, ½" OX-IS® HS, or ½" SI-Strong: Single Bottom Plate	220	16 o.c.	$^{7}/_{16}$" crown, 1 ½" leg 16 gauge galvanized staples or 0.120" x 1 ¼" roofing nails, 3" o.c. to perimeter/field. Staple crowns to be installed parallel to grain.
1" OX-IS®, or 1" SI-Strong Single Bottom Plate	275		
1" OX-IS®, or 1" SI-Strong: Double Bottom Plate	540		
1 ½" OX-IS®, or 1 ½" SI-Strong: Single Bottom Plate	275		
1 ½" OX-IS®, or 1 ½" SI-Strong: Double Bottom Plate	540		

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

1. 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.
2. Attachment to wood framing having a minimum specific gravity of 0.42.

5.2.7. Steel-Framed Construction:

5.2.7.1. OX-IS®, OX-IS® HS, and SI-Strong panels used in steel-framed construction resist lateral wind load forces using the allowable shear loads (in pounds per linear foot) set forth in Table 8.

TABLE 8. ALLOWABLE SHEAR VALUES FOR OX-IS®, OX-IS® HS, AND SI-STRONG ON 20 GA 50 KSI METAL STUDS

Structural Sheathing Product	Thickness (in)	Framing Condition[4]	Maximum Stud Spacing (in)	Allowable Design Value (plf)[1,2]			
				0.100 Pins[3] 3" o.c. edges 6" o.c. field	0.100 Pins[3] 3" o.c. edges 3" o.c. field	#8 Screws[4] 3" o.c. edge 6" o.c. field	#8 Screws[4] 3" o.c. edges 3" o.c. field
OX-IS®, OX-IS® HS, or SI-Strong	½	No GWB	24 o.c.	NT[6]	NT	300	NT
		½" GWB Fasten 8"/12"[5]		245	295	NT	380
		½" GWB Fasten 6"/12"[4]		340	NT	480	NT
OX-IS® or SI-Strong	1	½" GWB Fasten 8"/12"[5]		280	285	NT	465
	1 ½						

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

1. 20 gauge 50 ksi 3.5" metal studs @ 24" o.c. mid height horizontal brace installed every other cavity space.
2. Allowable unit net shear values reflect a safety factor of 2.0.
3. Aerosmith® 2359 0.100" diameter pins.
4. No. 8-18 × 11/4 Phillips modified truss head self-drilling screws.
5. No. 6-20 × 11/4 Phillips Bugle D/W SDS self-drilling screws.
6. NT = Not Tested

5.3. Water-Resistive Barrier (WRB)

5.3.1. OX-IS®, OX-IS® HS, and SI-Strong may be used as a WRB as prescribed in *IBC* Section 1403.2[12] and *IRC* Section R703.2 when installed on exterior walls as described in this section.

5.3.2. OX-IS®, OX-IS® HS, and SI-Strong 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 Table 2, Table 3, Table 4, Table 5, Table 7, and Section 6 as applicable.

5.3.3. All seams and joints between boards shall be sealed with an approved construction tape in accordance with Section 6. Approved construction tape includes 2-½" wide construction tape by 3M™ (8087) or Venture (1585-P2). 4" wide self-adhered flashing tape meeting *AAMA 711* (3M™ All Weather Flashing Tape 8067 or equivalent) may be required for effectively taping of inside and outside corners.

5.3.4. A separate WRB may also be provided. If a separate WRB method is used, overlapping or taping of the sheathing joints is not required.

5.3.5. 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 5, Figure 6, and Figure 7 for typical penetration flashing details.

12.2015 *IBC* Section 1404.2

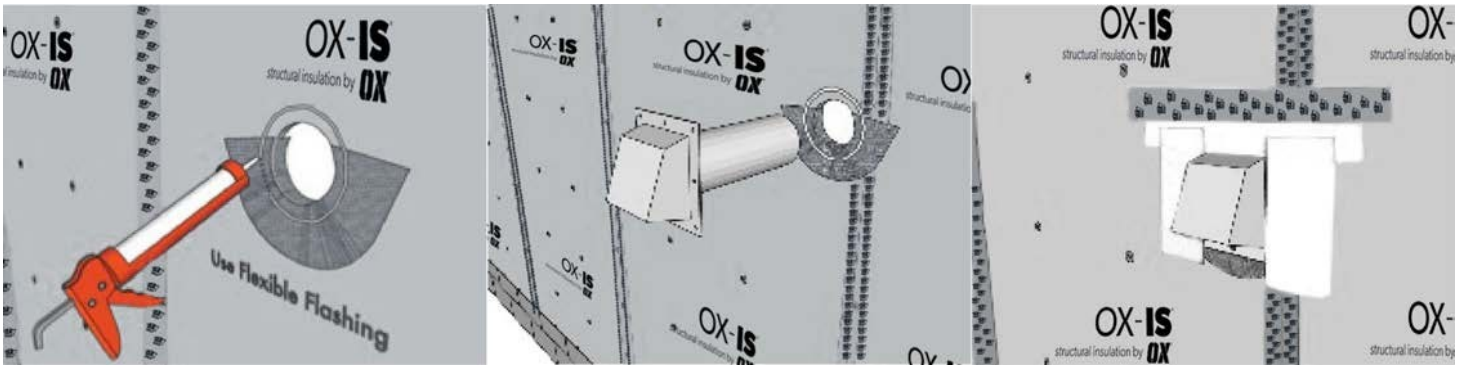

FIGURE 5. TYPICAL PENETRATION FLASHING DETAIL – FLANGED

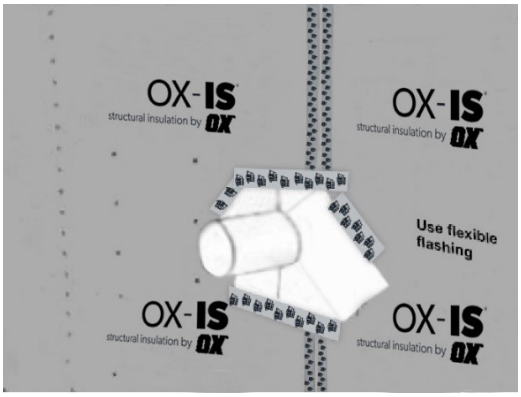

FIGURE 6. TYPICAL PENETRATION FLASHING DETAIL – UNFLANGED

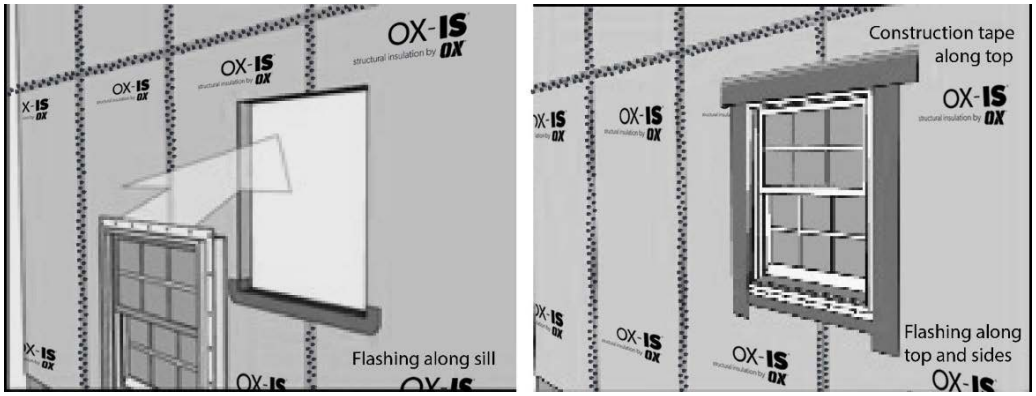

FIGURE 7. TYPICAL WINDOW FLASHING DETAIL

5.4. Thermal Resistance (R-Value)

5.4.1. OX-IS®, OX-IS® HS, and SI-Strong meet the continuous insulated sheathing requirements complying with the provisions of *IECC* Section C402.

5.4.2.

Structural Sheathing Product	Thickness (in)	R-Value (h·ft^2·°F/Btu)
OX-IS®, OX-IS® HS or SI-Strong	½	3.0
OX-IS® or SI-Strong	1	6.0
	1 ½	9.0
SI: 1 in = 25.4 mm		

OX-IS®, OX-IS® HS, and SI-Strong have the thermal resistance shown in Table 9. TABLE 9. OX-IS®, OX-IS® HS, AND SI-STRONG THERMAL RESISTANCE PROPERTIES

5.5. Air Barrier

5.5.1. OX-IS®, OX-IS® HS, and SI-Strong meet the requirements of *IECC* Section C402 for use as a component of the air barrier when installed in accordance with the manufacturer's installation instructions and this TER with all seams, including the top and bottom edges, taped. See Table 10.

TABLE 10. OX-IS®, OX-IS® HS, AND SI-STRONG AIR BARRIER PROPERTIES

Structural Sheathing Product	ASTM E2178 Results (L/s·m2)
OX-IS®, OX-IS® HS, and SI-Strong	< 0.02

5.6. Surface Burn Characteristics

5.6.1.

Structural Sheathing Product	Flame Spread	Smoke Developed
OX-IS®, OX-IS® HS, and SI-Strong	≤ 75	≤ 450
1. Tested in accordance with *ASTM E84*, with maximum foam thickness of 2.25", foam core only.		

The surface burn characteristics of OX-IS®, OX-IS® HS, and SI-Strong are shown in Table 11. TABLE 11. SURFACE BURN CHARACTERISTICS OF OX-IS®, OX-IS® HS, AND SI-STRONG

5.7. Thermal Barrier Requirements – Attic, Crawlspace or Other Uninhabitable Space Applications

5.7.1. Installation shall be fully protected from the interior of the building by an approved 15-minute thermal barrier or ignition barrier as required by *IBC* Section 2603.4 and *IRC* Section R316.4, except as follows:

5.7.1.1. When installed in an attic, crawlspace or other uninhabitable spaces, OX-IS®, OX-IS® HS, and SI-Strong, at a maximum thickness of 1.5", are approved for use without a thermal barrier or ignition barrier. This includes, but is not limited to, knee and gable end walls.

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

5.7.1.2.1. OX-IS®, OX-IS® HS, and SI-Strong are installed on the walls only.

5.7.1.2.2. Access to the space is required by *IRC* Section R807.1 or R408.4.

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

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, OX-IS®, OX-IS® HS, and SI-Strong may be installed in accordance with Section 6.6.

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. Orientation

6.2.1. OX-IS®, OX-IS® HS, and SI-Strong may be installed vertically or horizontally over studs, with framing that has a nominal thickness of not less than 2" (50.8 mm) and spaced a maximum of 24" (610 mm) o.c.

6.2.2. 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.

6.3. Attachment

6.3.1. General:

6.3.1.1. Fasteners shall be installed with a nominal edge distance of $^{3}/_{8}$" (9.5 mm) for GWB.

6.3.1.2. Where used, always fasten staples parallel to the framing member.

6.3.2. OX-IS®, OX-IS® HS, and SI-Strong Structural Insulation:

6.3.2.1. Minimum $^{7}/_{16}$" crown by 1½" leg, 16 ga staples with a 1" minimum embedment into the stud unless otherwise stated in Section 5.

6.3.2.2. Fastener spacing shall be a maximum of 3" o.c. (76.2 mm) along the edge and 3" o.c. in the field unless otherwise permitted in Section 5.

6.3.3. GWB:

6.3.3.1. Where required, GWB shall be a minimum ½" thickness and shall be attached with one of the following.

6.3.3.1.1. #6 x 1¼" Type W or S screws

6.3.3.1.2. 5d cooler nails

6.3.3.1.3. Fastener spacing shall be as shown in Section 5.

6.4. Treatment of Joints

6.4.1. OX-IS®, OX-IS® HS, and SI-Strong 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. Run staples parallel to framing.

6.5. Window Treatments

6.5.1. OX-IS®, OX-IS® HS, and SI-Strong 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.

6.6. Non-Structural Applications

6.6.1. Install panels with nails that have a 0.113" (2.87 mm) minimum shank diameter, a ⅜" (9.53 mm) head diameter, and a 1" (25.4 mm) minimum stud embedment length; or 16 gauge $^{7}/_{16}$" (11.1 mm) crown staples and a 1" (25.4 mm) minimum stud embedment length.

6.6.2. The fastener spacing shall be 6" 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 for determining comparative equivalency for use as an alternative material in accordance with *ASTM E72*, *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 characteristics 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 data for determining comparative equivalency for use as an alternative material in accordance with *IBC* Section 104.11 and *IRC* Section R104.11

7.8. Manufacturer installation recommendations for structural sheathing on exterior walls.

7.9. Quality Control Manual in accordance with a third-party quality control program with inspections conducted by an approved agency.

7.10. 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.

7.11. 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, OX-IS® and SI Strong are approved for the following:

8.1.1. Lateral load resistance due to wind and seismic loads carried by shear walls

8.1.2. Use as an equivalent alternative to the CS-PF as described in *IRC* Section R602.10.5 and R602.10.6.4

8.1.3. Transverse load resistance due to components and cladding pressures on building surfaces

8.1.4. Performance of the foam plastic component for conformance to *IBC* Section 2603 and *IRC* Section R316

8.1.5. Performance for use as insulating sheathing in accordance with *IRC* Sections N1102.1 and N1102.2 and *IECC* Section C402

8.1.6. Performance for use as a WRB in accordance with *IBC* Section 1403.2[13] and *IRC* Section R703.2

8.1.7. Performance for use as an air barrier in accordance with *IRC* Section N1102.4 and *IECC* Section C402

8.2. When used and installed in accordance with this TER and the manufacturer's installation instructions, OX-IS® HS is approved for the following:

8.2.1. Lateral load resistance due to wind and seismic loads carried by shear walls

8.2.2. Transverse load resistance due to components and cladding pressures on building surfaces

8.2.3. Performance of the foam plastic component for conformance to *IBC* Section 2603 and *IRC* Section R316

8.2.4. Performance for use as insulating sheathing in accordance with *IRC* Sections N1102.1 and N1102.2 and *IECC* Section C402

8.2.5. Performance for use as a WRB in accordance with *IBC* Section 1403.2[14] and *IRC* Section R703.2

13. 2015 *IBC* Section 1404.2

14. 2015 *IBC* Section 1404.2

8.2.6. Performance for use as an air barrier in accordance with *IRC* Section N1102.4 and *IECC* Section C402

8.3. *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*.

8.4. This product has been evaluated in the context of the codes listed in Section 2.1 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this TER, they are listed here.

8.4.1. No known variations

9. Conditions of Use

9.1. 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.

9.2. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ 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* or *registered design professional*).

9.3.1. This TER and the installation instructions shall be available to the jurisdiction in which the project is to be constructed.

9.3.2. Walls shall not be used to resist horizontal loads from concrete and masonry walls.

9.3.3. OX-IS®, OX-IS® HS, and SI-Strong shall not be used as a nailing base.

9.3.4. Except as provided in Section 5.5, 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.

9.3.5. 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.

9.3.6. Allowable shear loads shall not exceed values in Table 3 for wind loads and Table 4 for seismic loads.

9.3.7. Transverse design loads shall not exceed those described in Table 5 unless an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing.

9.3.8. OX-IS®, OX-IS® HS, and SI-Strong are manufactured under a quality control program with quality control inspections in accordance with *IBC* Sections 110.3.8 and 110.4 and *IRC* Section R109.2.

9.4. When installed as a wall sheathing but not installed per structural requirements, light-framed walls shall be braced by other means.

9.5. When used as a WRB, installation shall be in accordance with Section 5.3.

9.5.1. When used in accordance with the *IBC* in high wind areas, special inspections shall comply with *IBC* Section 1705.11[15].

[15] 2012 *IBC* Section 1705.10

9.5.2. When used in accordance with the *IBC* in Seismic Design Categories C, D, E or F, special inspections shall comply with *IBC* Section 1705.12[16].

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

9.7. 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.

9.8. 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.

9.9. 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.

[16] 2012 *IBC* Section 1705.11