



**CERTIFICATION**



# Technical Evaluation Report™

**TER 1101-01**

OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH)

**OX Engineered Products, LLC**

## Products:

**OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH)**

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COMPANY  
INFORMATION:

OX Engineered Products, LLC  
22260 Haggerty Rd Ste 365  
Northville, MI 48167-8970

1255 N 5th St  
Charleston, IL 61920-1175

P: 612-220-0140

P: 217-348-8151

[oxengineeredproducts.com](http://oxengineeredproducts.com)

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 11 00 - Wood Framing

SECTION: 06 12 19 - Shear Wall Panels

## 1 Products Evaluated<sup>1,2</sup>

- 1.1 OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH)

## 2 Applicable Codes and Standards<sup>3,4</sup>

### 2.1 Codes

- 2.1.1 *IBC—15, 18, 21: International Building Code®*  
2.1.2 *IRC—15, 18, 21: International Residential Code®*  
2.1.3 *CBC—16, 19: California Building Code*

### 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 E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*  
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*

<sup>1</sup> For more information, visit [drjcertification.org](http://drjcertification.org) or call us at 608-310-6748.

<sup>2</sup> 24 CFR 3280.2 “Listed or certified” means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner. Listed. Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose Listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. Labeled. Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

<sup>3</sup> This Listing is a code defined research report, which is also known as a duly authenticated report, provided by an approved agency (see IBC Section 1703.1) and/or an approved source (see IBC Section 1703.4.2). An approved agency is “approved” as an approved agency when it is ANAB accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory. A professional engineer is “approved” as an approved source when that professional engineer is properly licensed to transact engineering commerce. Where sealed by a professional engineer, it is also a duly authenticated report certified by an approved source. (i.e., Registered Design Professional). DrJ is an ANAB accredited product certification body.

<sup>4</sup> Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

### 3 Performance Evaluation

- 3.1 Tests, testing, test reports, research reports, duly authenticated reports and related engineering evaluations are defined as intellectual property and/or trade secrets and protected by Defend Trade Secrets Act 2016 (DTSA).<sup>5</sup>
- 3.2 Testing and/or inspections conducted for this TER were performed at an ISO/IEC 17025 accredited testing laboratory,<sup>6</sup> an ISO/IEC 17020 accredited inspection body,<sup>7</sup> which are internationally recognized accreditations through International Accreditation Forum (IAF), and/or a licensed Registered Design Professional (RDP).
- 3.3 The OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® PFH were tested and evaluated for pier widths between 12" and 24" for equivalency to the following IBC requirement:

**2308.6.5 Alternative bracing.** An alternate braced wall (ABW) or a portal frame with hold-downs (PFH) described in this section is permitted to substitute for a 48-inch (1219 mm) braced wall panel of Method DWB, WSP, SFB, PBS, PCP or HPS. For Method GB, each 96-inch (2438 mm) section (applied to one face) or 48-inch (1219 mm) section (applied to both faces) or portion thereof required by Table 2308.6.1 is permitted to be replaced by one panel constructed in accordance with Method ABW or PFH.

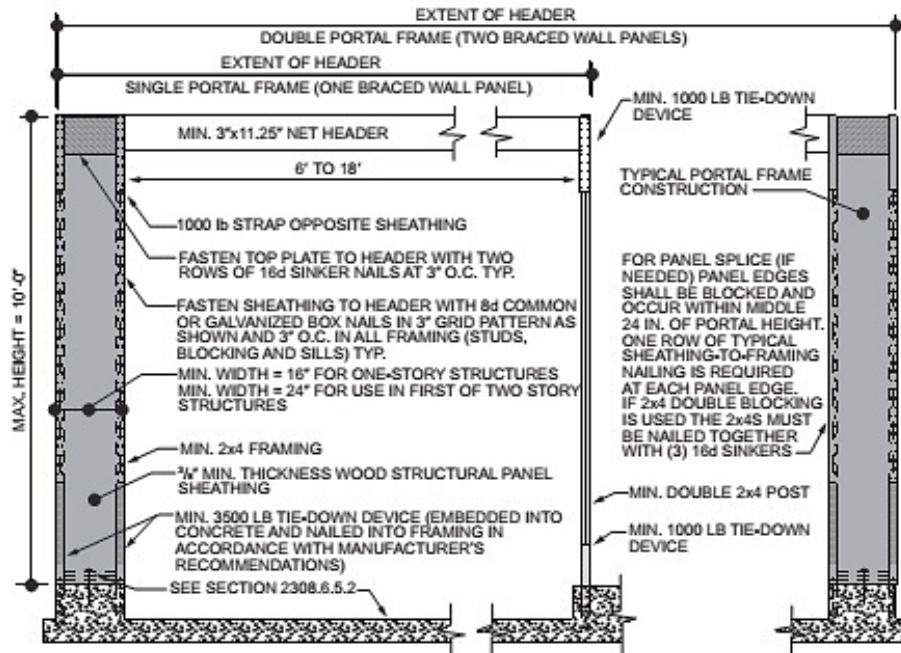
<sup>5</sup> <https://www.law.cornell.edu/uscode/text/18/part-II/chapter-90>. As our professional duty to inform, please be aware that whoever, with intent to convert a trade secret (TS), that is related to a product or service used in or intended for use in interstate or foreign commerce, to the economic benefit of anyone other than the owner thereof, and intending or knowing that the offense will, injure any owner of that trade secret, knowingly without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys such information; shall be fined under this title or imprisoned not more than 10 years, or both. Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of \$5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. As the National Society of Professional Engineers states, "Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve." Therefore, to protect intellectual property (IP) and TS, and to achieve compliance with public records and trade secret legislation, requires approval through the use of Listings, certified reports, technical evaluation reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.

<sup>6</sup> Internationally recognized accreditations are performed by members of the International Accreditation Forum (IAF). Accreditation Body and Regional Accreditation Group Members of IAF are admitted to the IAF MLA only after a stringent evaluation of their operations by a peer evaluation team, which is charged to ensure that the applicant complies fully with both international standards and IAF requirements. Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.

<sup>7</sup> Ibid.

3.4 The portal frame that is directly referenced in the code is shown in Figure 1 and adopted into the code in IBC Section 2308.6.5.2 as follows:

**2308.6.5.2 Portal frame with hold-downs (PFH).** A PFH shall be constructed in accordance with this section and IBC Figure 2308.6.5.2. The adjacent door or window opening shall have a full-length header...<sup>8</sup>



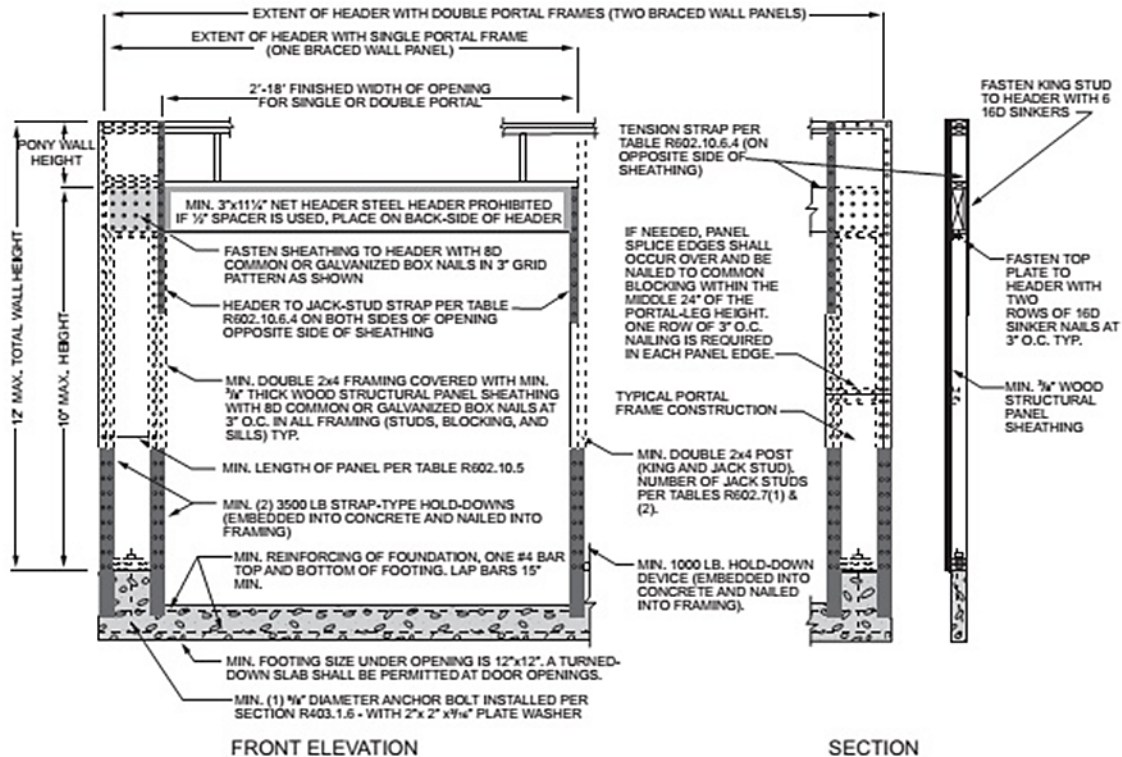
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

**Figure 1.** Portal Frame with Hold-Downs as depicted in IBC Figure 2308.6.5.2.

<sup>8</sup> Wood structural panel sheathing with a thickness not less than 3/4" (9.5 mm) for 16" (406 mm) or 24" (610 mm) stud spacing in accordance with Table 2308.6.3(2) and 2308.6.3(3).

- 3.5 The IRC defines the PFH detail in [IRC Figure R602.10.6.2](#) (see Figure 2) and identifies it as an equivalent replacement to the capacity of a 4' x 8' sheet of  $\frac{3}{8}$ " WSP (Wood Structural Panel) sheathing in [IRC Table R602.10.5](#) (see Table 1) through the use of the following language of [IRC Section R602.10.6.2](#):

**Method PFH: Portal frame with hold-downs.** Method PFH braced wall panels shall be constructed in accordance with Figure R602.10.6.2.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**Figure 2.** Method PFH—Portal Frame with Hold-Downs as depicted in IRC Figure R602.10.6.2

**Table 1.** Minimum Length of Braced Wall Panels as depicted in IRC Table R602.10.5

METHOD (See Table R602.10.4)		MINIMUM LENGTH* (inches)					CONTRIBUTING LENGTH (inches)
		Wall Height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP		48	48	48	53	58	Actual <sup>b</sup>
GB		48	48	48	53	58	Double sided = Actual Single sided = 0.5 × Actual
LIB		55	62	69	NP	NP	Actual <sup>b</sup>
ABW	SDC A, B and C, wind speed < 110 mph	28	32	34	38	42	48
	SDC D <sub>o</sub> , D <sub>1</sub> and D <sub>2</sub> , wind speed < 110 mph	32	32	34	NP	NP	
PFH	Supporting roof only	16	16	16	18°	20°	48
	Supporting one story and roof	24	24	24	27°	29°	48

- 3.6 While the PFH referenced in the code is one alternate method of compliance, other methods of compliance are permissible, provided they can show equivalence to the code in accordance with [IBC Section 104.11](#) and [IRC Section R104.11](#).
- 3.7 It is clear from [IBC Section 2308.6.5.2](#) and [IRC Figure R602.10.6.2](#) that the performance requirement is to be an equivalent replacement to the capacity of a 4' x 8' sheet of  $\frac{3}{8}$ " WSP sheathing.
- 3.8 Testing conducted to compare the performance of an alternative PFH to replace a 4' x 8' Method WSP braced wall panel using  $\frac{3}{8}$ " WSP sheathing.
- 3.9 Since deflection limits are neither a consideration of the IRC nor a consideration of the light-frame provisions of the IBC, they are not a consideration of this assessment.
- 3.10 Any building code and/or accepted engineering evaluations (i.e. research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an [ISO/IEC 17065 accredited certification body](#) and a professional engineering company operated by RDPs / [approved sources](#). DrJ is qualified<sup>9</sup> to practice product and code compliance services within its scope of accreditation and engineering expertise, respectively.
- 3.11 Engineering evaluations are conducted with DrJ's ANAB [accredited ICS code scope](#), which are also its areas of professional engineering competence.
- 3.12 Any regulation specific issues not addressed in this section are outside the scope of this TER.

## 4 Product Description and Materials

- 4.1 OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® PFH assemblies differ from the PFH details in the IBC and IRC in that the intent is to allow the use of these sheathing materials in place of the WSP shown in the code-prescribed details to facilitate use of continuous insulation or carry through the proprietary sheathing materials without the need to change the sheathing thickness at the portal frame.
  - 4.1.1 OX-IS® and SI-Strong are structural insulated sheathing (SIS) products and therefore, are also referred to as SIS in this TER.
- 4.2 Details of the construction are as follows:
  - 4.2.1 *Piers*
    - 4.2.1.1 The piers are made up of  $\frac{7}{16}$ " OSB sandwiched between nominal 2x4 studs installed flatwise with additional 2x4 studs framing the outside corner (see Figure 5). This pier is then attached to the adjoining full-height studs and the opening header.
  - 4.2.2 *Header*
    - 4.2.2.1 The header is made up of a minimum of two (2) 2" x 12"s with a  $\frac{7}{16}$ " OSB spacer or an equivalent engineered wood beam.
    - 4.2.2.2 The header extends over the top of the pier(s) and is fastened to the pier(s) using straps, plates, and fasteners, as shown in Figure 3, Figure 4, and Figure 5.
  - 4.2.3 The maximum PFH height is 10'. Where needed, a pony wall may be built above the header to extend the framing to a maximum of 12'.

<sup>9</sup> Qualification is performed by a legislatively defined [Accreditation Body](#). [ANSI National Accreditation Board \(ANAB\)](#) is the largest independent accreditation body in North America and provides services in more than 75 countries. [DrJ](#) is an ANAB accredited [product certification body](#).

#### 4.2.4 Sheathing Options

##### 4.2.4.1 OX-IS® or SI-Strong Structural Insulation

4.2.4.1.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to [TER 0804-01](#).

##### 4.2.4.2 ISO-RED CI Polyiso Insulation

4.2.4.2.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to [TER 1306-02](#).

##### 4.2.4.3 Thermo-Ply® Structural Sheathing: Green, Red, or Blue Grade

4.2.4.3.1 For other sheathing performance characteristics that may be required in an exterior wall assembly, please refer to one of the following:

4.2.4.3.1.1 Thermo-Ply® Green [TER 1004-03](#).

4.2.4.3.1.2 Thermo-Ply® Red [TER 1004-01](#).

4.2.4.3.1.3 Thermo-Ply® Blue [TER 1004-02](#).

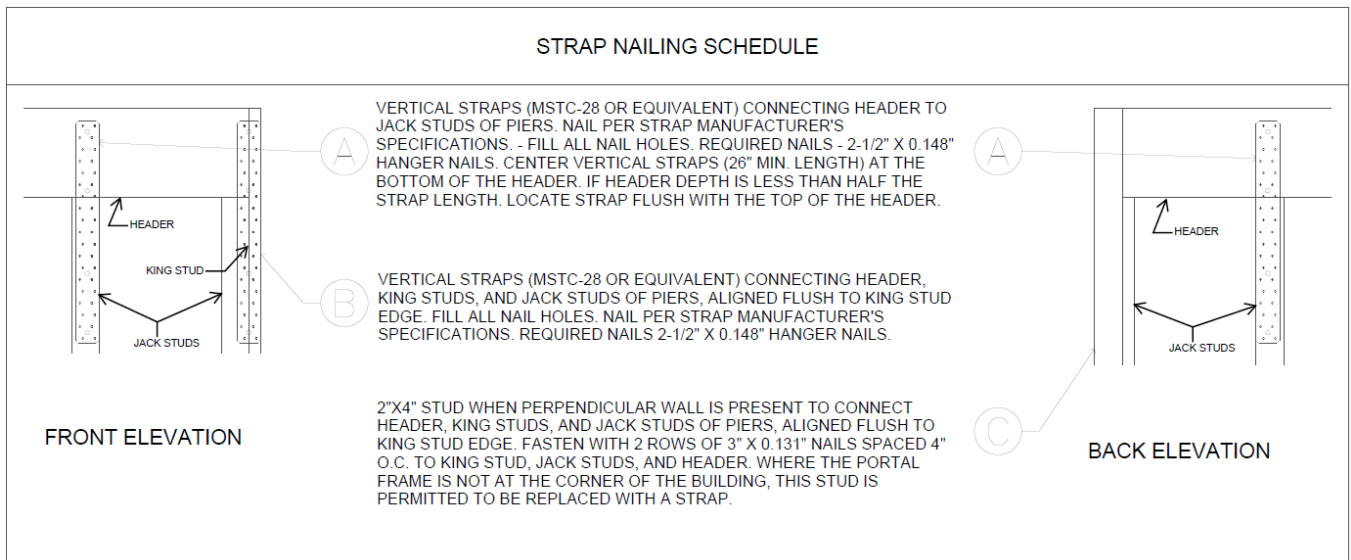
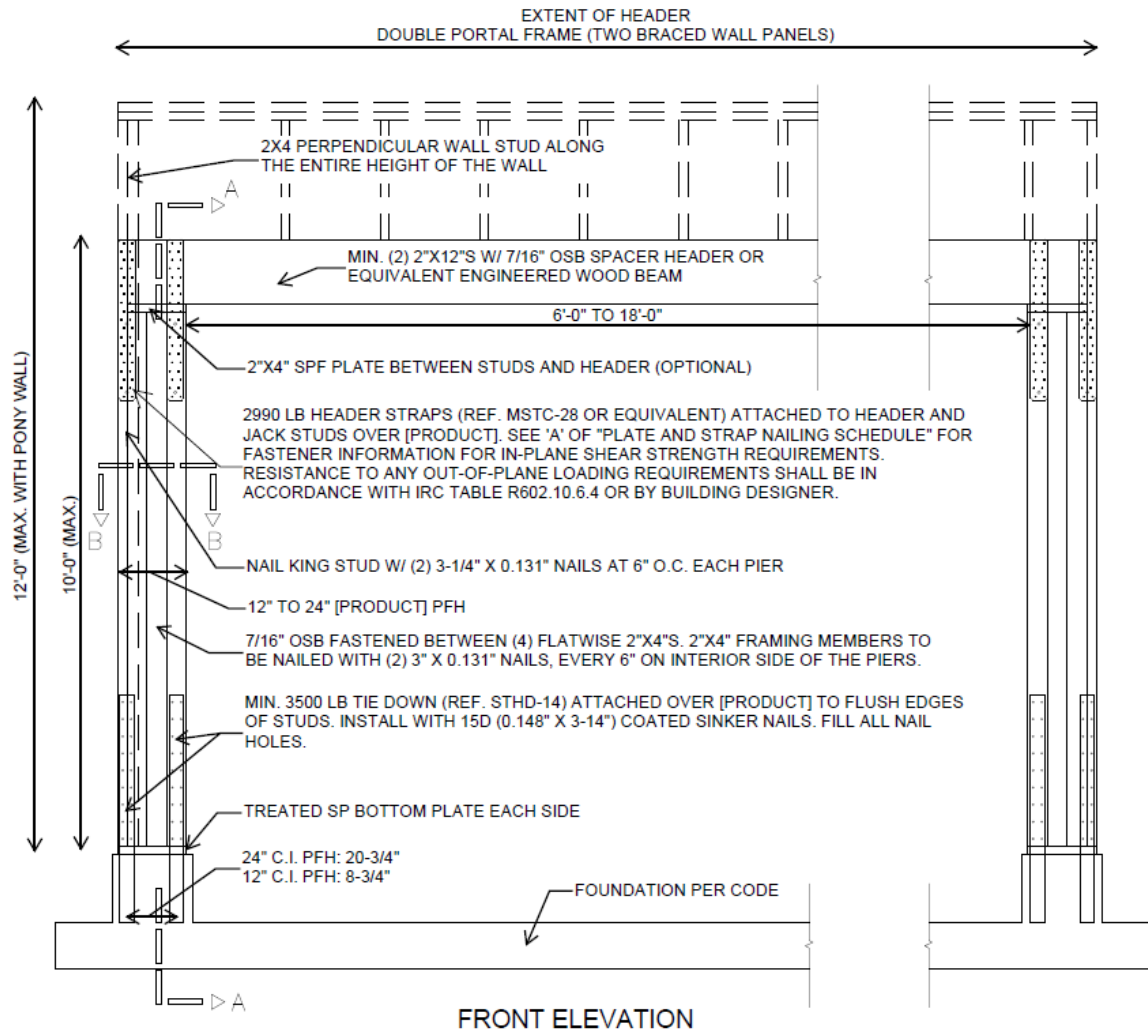
## 5 Applications

### 5.1 IBC/IRC Method WSP

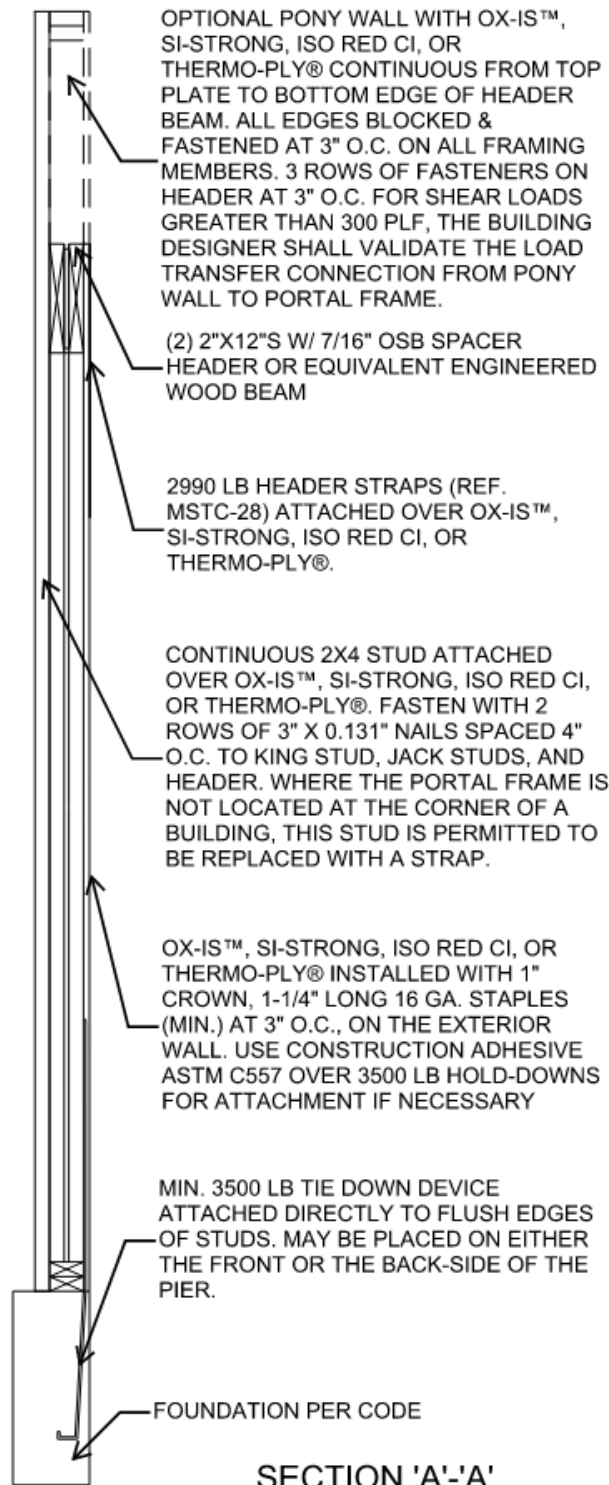
- 5.1.1 To establish the baseline for equivalency, a full scale 12' x 30' building was constructed in accordance with the minimum requirements of the IRC and IBC.
- 5.1.2 In the first series of tests, two 4' braced wall panels (BWP) were placed in each of the 30' walls.
- 5.1.3 Each BWP was placed 6' from each end of each braced wall line.
- 5.1.4 Anchor bolts were placed every 4' along the base of the wall. No other hold down devices were used as they are not required by the IRC or the prescriptive provisions of the IBC.
- 5.1.5 The roof of the structure was constructed with trusses, and dead loads were applied to simulate typical dead loads on a single story roof.
- 5.1.6 All other wall construction details are per [IRC Table R602.3\(1\)](#).
- 5.1.7 The walls were tested in accordance with the provisions of ASTM E564.
- 5.1.8 Testing with the OSB in various positions in the wall was assessed as well as fully sheathed walls and walls with window and door openings.
- 5.1.9 23' walls were constructed and tested in accordance with ASTM E2126 to understand the performance of these walls under cyclic loading conditions.
- 5.1.10 The results of the testing were then compared to the capacity of the OSB sheathing as defined in the provisions of the IBC and IRC, and an equivalent capacity was derived such that comparisons can be made on an equivalency basis.

## 5.2 *Alternate PFH Portal Frame*

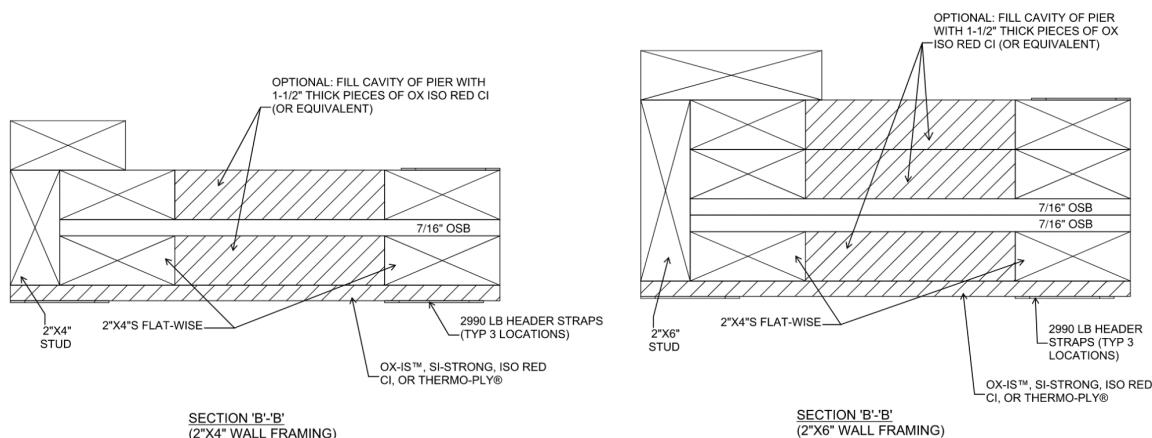
- 5.2.1 An alternate PFH Portal Frame was developed to see if an equivalent replacement of the 4' x 8' Method WSP Braced Wall Panel could be achieved (see Figure 3, Figure 4, and Figure 5).
- 5.2.2 Two (2) 23' braced wall lines were framed using standard code-complying framing techniques with Spruce-Pine-Fir (SPF) top plate, sill plate, and studs from stud grade lumber.
- 5.2.3 The assembly was constructed with  $\frac{7}{16}$ "-thick OSB sheathing (10½" wide for the 12" PFH and 22½" wide for the 24" PFH) fastened between four (4) flatwise SPF 2x4s attached to a SPF king stud.
- 5.2.4 Bottom plate is treated Southern Pine (SP) 2x4s. Single or double bottom plates may be used.
- 5.2.5 Interior gypsum was not applied.
- 5.2.6 The portal frames were tested in accordance with ASTM E2126 testing procedures. Testing determined their lateral resistance within an identical braced wall line so that a direct performance comparison could be made with respect to the tests performed on the isolated braced wall panel assemblies.



**Figure 3.** Construction Details of OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® 12" to 24" CI PFH.



**Figure 4. PFH Section A-A.**



**Figure 5. PFH Section B-B.**

### 5.3 Equivalency Results

- 5.3.1 A comparison of the  $\frac{3}{8}$ " WSP braced wall lines and the OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® 12" CI PFH and 24" CI PFH is shown in Table 2.
- 5.3.2 The test data and subsequent engineering analysis provides confirmation that the performance of the OX-IS®, SI Strong, ISO-RED CI, and Thermo-Ply® 12" CI PFH and 24" CI PFH provide comparable equivalence to the  $\frac{3}{8}$ " BWP.

**Table 2. Portal Frame Design Values<sup>1,2,3</sup>**

Test Name	Sheathing Material	Fastener Size & Spacing	Total Bracing Width (in)	Maximum Wall Height (ft)	Design Value per Panel/Pier <sup>4,5</sup> (lbs)
IBC/IRC Benchmark	$\frac{3}{8}$ " OSB, Isolated 4'x8' panels, 6' from corners	2 $\frac{3}{8}$ " x 0.113" nails, 6:12 spacing	96	Up to 10	700
12" CI PFH	OX-IS®, SI-Strong, ISO-RED CI, or Thermo-Ply® (Green, Red, or Blue Grade)	See Figure 3	12	8	1,280
				10	960
24" CI PFH	OX-IS®, SI-Strong, ISO-RED CI, or Thermo-Ply® (Green, Red, or Blue Grade)	See Figure 3	24	8	2,560
				10	1,920

SI: 1 in. = 25.4 mm, 1 lb. = 4.45 N

- Capacity derived from multiple full-scale tests, as well as testing from other labs, showing the capacity of OSB sheathing in buildings constructed in accordance with the minimum requirements of the IRC.
- The PFH bracing type in the IRC/IBC is defined as equivalent to a 4' BWP using  $\frac{3}{8}$ " WSP. Equivalent capacity is based on comparison testing of the PFH and  $\frac{3}{8}$ " OSB as compared to the published capacities as defined in the IBC and SDPWS.
- For seismic design, reduce capacities by a factor of 1.4.
- Interpolation between the wall heights and pier widths for the 12" CI PFH & 24" CI PFH is permitted.
- 10'-high wall design values are provided here that use a 75% factor to reduce the 8'-high wall design values generated by test data.

- 5.3.3 Based on the test results using the equivalency principle as defined in [IBC Section 104.11](#) and [IRC Section R104.11](#), the ISO-RED CI, and Thermo-Ply® 12" to 24" CI PFH are assigned the recommended design values for designs controlled by wind or gravity loading conditions as provided in Table 2.

- 5.3.4 The design values for the OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® 12" to 24" CI PFH are based on testing and the evaluation of the test data compared to  $\frac{3}{8}$ " OSB braced wall panel test data using Method WSP.
- 5.3.5 As detailed in Figure 3 through Figure 5, the maximum allowable compressive strength of the OX 12" to 24" CI PFH is 11,156 lbs. per pier. Additional compressive capacity may be engineered into each pier.
- 5.3.6 The design values in Table 2 show that the OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® PFH provide equivalent or better shear resistance to the code-compliant benchmark (IBC/IRC  $\frac{3}{8}$ " OSB).
- 5.4 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science, and fire science.

## 6 Installation

- 6.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this TER, and the applicable building code.
- 6.2 In the event of a conflict between the manufacturer installation instructions and this TER, the more restrictive shall govern.
- 6.3 *General Applications*
  - 6.3.1 OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® shall be installed in accordance with the manufacturer published installation instructions and this TER as defined in Figure 3, Figure 4, and Figure 5.
  - 6.3.2 In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- 6.4 *Orientation*
  - 6.4.1 OX-IS®, SI-Strong, and ISO-RED CI
    - 6.4.1.1 OX-IS®, SI-Strong, and ISO-RED CI 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.
    - 6.4.1.2 Sheathing joints must be butted at framing members, and all panel edges shall be blocked 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. 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.
  - 6.4.2 Thermo-Ply®
    - 6.4.2.1 Thermo-Ply® may be installed in either the vertical or horizontal orientation. To be recognized for the structural values listed in this TER, or as a water or air barrier, all joints must be backed by studs, plates, or blocks and fastened.
- 6.5 *Fastener Type*
  - 6.5.1 OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply®
    - 6.5.1.1 Minimum  $\frac{15}{16}$ " crown, 16 ga. staples or minimum 0.120" x galvanized roofing nail. Length of fastener to provide 1" embedment into framing.
    - 6.5.1.2 Fasteners shall be installed with a nominal edge distance of  $\frac{3}{8}$ " (9.5 mm).
    - 6.5.1.3 Where used, always fasten staples parallel to the framing member.
    - 6.5.1.4 Fasteners for Thermo-Ply® shall be driven such that the head of the fastener is in contact with the surface of the sheathing. Do not overdrive fasteners.



## 6.6 Treatment of Joints

### 6.6.1 OX-IS®, SI-Strong, and ISO-RED CI

- 6.6.1.1 OX-IS®, SI-Strong, and ISO-RED CI 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.

### 6.6.2 Thermo-Ply®

- 6.6.2.1 Lapped joints shall be overlapped  $\frac{3}{4}$ " (19 mm) (nominal) and fastened with a single row of fasteners. Always run staples parallel with framing.
- 6.6.2.2 Butt joints shall be placed over framing members and fastened with a single row of fasteners at each panel edge and shall be installed with a small gap ( $\frac{1}{16}$ " to  $\frac{1}{8}$ ") between panels.

## 6.7 Structural Applications

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

# 7 Substantiating Data

- 7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:
  - 7.1.1 PFH Double Portal Frame lateral resistance testing braced at 12" and 24" in a 23' wall in accordance with ASTM E2126
  - 7.1.2 PFH Double Portal Frame lateral resistance testing braced at 12" and 24" in a 12' x 30' Full Scale Building in accordance with ASTM E564
  - 7.1.3 Comparison Braced Wall Panel lateral resistance testing using Method WSP with  $\frac{3}{8}$ " OSB in accordance with ASTM E2126
  - 7.1.4 Comparison Portal Frames lateral resistance testing using Southern Pine Bottom Plates in accordance with ASTM E2126
- 7.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies (i.e., ANAB accredited agencies), approved sources (i.e., RDPs), and/or professional engineering regulations. Accuracy of external test data and resulting analysis is relied upon.
- 7.3 Where pertinent, testing and/or engineering analysis is based upon provisions that have been codified into law through state or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ's engineering practice may use a code-adopted provision as the control sample. A control sample versus a test sample establishes a product as being equivalent to the code-adopted provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.
- 7.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, Listings, certified reports, duly authenticated reports from approved agencies, and research reports prepared by approved agencies and/or approved sources provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this TER, may be dependent upon published design properties by others.

- 7.5 Testing and engineering analysis: The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.<sup>10</sup>
- 7.6 Where additional condition of use and/or code compliance information is required, please search for OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH) on the [DrJ Certification](#) website.

## 8 Findings

- 8.1 As delineated in Section 3, the OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH) have performance characteristics that were tested and/or meet pertinent standards and is suitable for use pursuant to its specified purpose.
- 8.2 When used and installed in accordance with this TER and the manufacturer installation instructions, OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH) shall be approved for the following applications:
- 8.2.1 The testing and generally accepted engineering analysis performed provides the basis for the use of the OX-IS®, SI Strong, ISO-RED CI and Thermo-Ply® 12" to 24" CI PFH as a substitution for a 4' braced wall panel using  $\frac{3}{8}$ " OSB, fastened 6:12 with  $2\frac{3}{8}$ " x 0.113" diameter nails, and have the relative performance as defined in Table 2.
- 8.2.2 The testing and engineering analysis performed provides the basis for the use of the OX-IS®, SI-Strong, ISO-RED CI and Thermo-Ply® 12" to 24" CI PFH in all locations that require the use of a 4' BWP within the IBC and IRC.
- 8.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from OX Engineered Products, LLC.
- 8.4 [IBC Section 104.11](#) ([IRC Section R104.11](#) and [IFC Section 104.10](#)<sup>11</sup> are similar) in pertinent part 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. 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.
- 8.5 **Approved:**<sup>12</sup> Building codes require that [the building official shall accept duly authenticated reports](#)<sup>13</sup> or [research reports](#)<sup>14</sup> from [approved agencies](#) and/or [approved sources](#) (i.e., licensed RDP) with respect to the quality and manner of use of new products, materials, designs, services, assemblies, or methods of construction.
- 8.5.1 [Acceptability](#) of an [approved agency](#), by a building official, is performed by verifying that the agency is accredited by a recognized accreditation body of the [International Accreditation Forum](#) (IAF).
- 8.5.2 [Acceptability](#) of a licensed RDP, by a building official, is performed by verifying that the RDP and/or their business entity is listed by the [licensing board](#) of the relevant [jurisdiction](#).

<sup>10</sup> See Code of Federal Regulations (CFR) [Title 24 Subtitle B Chapter XX Part 3280](#) for definition.

<sup>11</sup> [2018 IFC Section 104.9](#)

<sup>12</sup> Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC [Section 201.4](#) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

<sup>13</sup> <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1>

<sup>14</sup> <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2>

- 8.5.3 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved, as denial without written reason deprives a protected right to free and fair competition in the marketplace.
- 8.6 DrJ is an engineering company, employs RDPs and is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131.
- 8.7 Through ANAB accreditation and the IAF Multilateral Agreements, this TER 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.*” IAF specifically says: “*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope.*”<sup>15</sup>

## 9 Conditions of Use

- 9.1 Material properties shall not fall outside the boundaries defined in Section 3.
- 9.2 As defined in Section 3, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.
- 9.3 The OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® 12" to 24" CI PFH described in this TER comply with, or are suitable alternatives to, the applicable sections of the IBC and the IRC listed in Section 2 and are subject to the following conditions:
- 9.3.1 This TER and the installation instructions, when required by a code official, shall be submitted at the time of permit application.
- 9.3.2 Where required by the statutes of the jurisdiction where the building is to be constructed, the design drawings shall be prepared by a Registered Design Professional licensed in the jurisdiction.
- 9.3.3 Sheathing material located on the exterior side of the portal frame shall be one of the following:
- 9.3.3.1 ½" minimum OX-IS®, SI-Strong, or ISO-RED CI
- 9.3.3.2 Green, Red, or Blue grade Thermo-Ply®
- 9.3.4 Each portal frame may replace 4' of braced wall panel. All other braced wall provisions shall be followed per the applicable code.
- 9.4 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:
- 9.4.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice, and, when prepared by an approved source, shall be approved when requirements of adopted legislation are met.
- 9.4.2 This TER and the installation instructions shall be submitted at the time of permit application.
- 9.4.3 These products have an internal quality control program and a third-party quality assurance program.
- 9.4.4 At a minimum, these products shall be installed per Section 6 of this TER.
- 9.4.5 The review of this TER, by the AHJ, shall be in compliance with IBC Section 104 and IBC Section 105.4.
- 9.4.6 These products have an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.

<sup>15</sup> <https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise>

- 9.4.7 The application of these products in the context of this TER is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by [IBC Section 110.3](#), [IRC Section R109.2](#) and any other regulatory requirements that may apply.
- 9.5 The approval of this TER by the AHJ shall comply with [IBC Section 1707.1](#), where legislation states in pertinent part, “the *building official* shall accept duly authenticated reports from *approved agencies* in respect to the quality and manner of *use* of new materials or assemblies as provided for in [Section 104.11](#)”, all of [IBC Section 104](#), and [IBC Section 105.4](#).
- 9.6 [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 (i.e., [owner](#) or RDP).
- 9.7 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the [owner](#) or the owner’s authorized agent.

## 10 Identification

- 10.1 The products listed in Section 1.1 are identified by a label on the board or packaging material bearing the manufacturer name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at [oxengineeredproducts.com](http://oxengineeredproducts.com).

## 11 Review Schedule

- 11.1 This TER is subject to periodic review and revision. For the most recent version, visit [drjcertification.org](http://drjcertification.org).
- 11.2 For information on the status of this TER, contact [DrJ Certification](#).

## 12 Approved for Use Pursuant to US and International Legislation Defined in Appendix A

- 12.1 OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH) are included in this TER published by an approved agency that is concerned with evaluation of products or services, maintains periodic inspection of the production of listed materials or periodic evaluation of services, and whose TER Listing states either that the material, product, or service meets identified standards or has been tested and found suitable for a specified purpose. This TER meets the legislative intent and definition of being acceptable to the AHJ.

## Appendix A

### 1 Legislation that Authorizes AHJ Approval

- 1.1 **Fair Competition:** State legislatures have adopted Federal regulations for the examination and approval of building code referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:
- 1.1.1 Advance Innovation,
  - 1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and
  - 1.1.3 Benefit consumers through lower prices, better quality, and greater choice.
- 1.2 **Adopted Legislation:** The following local, state, and federal regulations affirmatively authorize OX-IS®, SI-Strong, ISO-RED CI, and Thermo-Ply® “Portal Frame with Hold-Down” (12" to 24" CI PFH) to be approved by AHJs, delegates of building departments, and/or delegates of an agency of the federal government:
- 1.2.1 Interstate commerce is governed by the Federal Department of Justice to encourage the use of innovative products, materials, designs, services, assemblies and/or methods of construction. The goal is to “protect economic freedom and opportunity by promoting free and fair competition in the marketplace.”
  - 1.2.2 Title 18 US Code Section 242 affirms and regulates the right of individuals and businesses to freely and fairly have new products, materials, designs, services, assemblies and/or methods of construction approved for use in commerce. Disapproval of alternatives shall be based upon non-conformance with respect to specific provisions of adopted legislation, and shall be provided in writing stating the reasons why the alternative was not approved, with reference to the specific legislation violated.
  - 1.2.3 The federal government and each state have a public records act. In addition, each state also has legislation that mimics the federal Defend Trade Secrets Act 2016 (DTSA).
    - 1.2.3.1 Compliance with public records and trade secret legislation requires approval through the use of listings, certified reports, Technical Evaluation Reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.
  - 1.2.4 For new materials<sup>16</sup> that are not specifically provided for in any building code, the design strengths and permissible stresses shall be established by tests, where suitable load tests simulate the actual loads and conditions of application that occur.
  - 1.2.5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design using accepted engineering practice.<sup>17</sup>
  - 1.2.6 The commerce of approved sources (i.e., registered PEs) is regulated by professional engineering legislation. Professional engineering commerce shall always be approved by AHJs, except where there is evidence, provided in writing, that specific legislation has been violated by an individual registered PE.
  - 1.2.7 The AHJ shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in IBC Section 104.11.<sup>18</sup>

<sup>16</sup> <https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706.2>

<sup>17</sup> IBC 2021, Section 1706.1 Conformance to Standards

<sup>18</sup> IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General

- 1.3 **Approved<sup>19</sup> by Los Angeles:** The Los Angeles Municipal Code (LAMC) states in pertinent part that the provisions of LAMC are not intended to prevent the use of any material, device, or method of construction not specifically prescribed by LAMC. The Department shall use Part III, Recognized Standards in addition to Part II, Uniform Building Code Standards of Division 35, Article 1, Chapter IX of the LAMC in evaluation of products for approval where such standard exists for the product or the material and may use other approved standards, which apply. Whenever tests or certificates of any material or fabricated assembly are required by Chapter IX of the LAMC, such tests or certification shall be made by a testing agency approved by the Superintendent of Building to conduct such tests or provide such certifications. The testing agency shall publish the scope and limitation(s) of the listed material or fabricated assembly.<sup>20</sup> The Superintendent of Building roster of approved testing agencies is provided by the Los Angeles Department of Building and Safety (LADBS). The Center for Building Innovation (CBI) Certificate of Approval License is TA24945. Tests and certifications found in a CBI Listing are LAMC approved. In addition, the Superintendent of Building shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the California Building Code (CBC) Section 1707.1.<sup>21</sup>
- 1.4 **Approved by Chicago:** The Municipal Code of Chicago (MCC) states in pertinent part that an Approved Agency is a Nationally Recognized Testing Laboratory (NRTL) acting within its recognized scope and/or a certification body accredited by the American National Standards Institute (ANSI) acting within its accredited scope. Construction materials and test procedures shall conform to the applicable standards listed in the MCC. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material, service, design, assembly and/or method of construction not specifically provided for in the MCC. This technical data shall consist of research reports from approved sources (i.e., MCC defined Approved Agencies).
- 1.5 **Approved by New York City:** The NYC Building Code 2022 (NYCBC) states in pertinent part that an approved agency shall be deemed<sup>22</sup> an approved testing agency via ISO/IEC 17025 accreditation, an approved inspection agency via ISO/IEC 17020 accreditation, and an approved product evaluation agency via ISO/IEC 17065 accreditation. Accrediting agencies, other than federal agencies, must be members of an internationally recognized cooperation of laboratory and inspection accreditation bodies subject to a mutual recognition agreement<sup>23</sup> (i.e., ANAB, International Accreditation Forum (IAF), etc.).

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<sup>19</sup> See Section 8 for the distilled building code definition of **Approved**

<sup>20</sup> Los Angeles Municipal Code, SEC. 98.0503. TESTING AGENCIES

<sup>21</sup> <https://up.codes/viewer/california/ca-building-code-2022/chapter/17/special-inspections-and-tests#1707.1>

<sup>22</sup> New York City, The Rules of the City of New York, § 101-07 Approved Agencies

<sup>23</sup> New York City, The Rules of the City of New York, § 101-07 Approved Agencies

- 1.6 **Approved by Florida:** Statewide approval of products, methods, or systems of construction shall be approved, without further evaluation, by 1) A certification mark or listing of an approved certification agency, 2) A test report from an approved testing laboratory, 3) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, from an approved product evaluation entity; 4) A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a professional engineer or architect, licensed in Florida. For local product approval, products or systems of construction shall demonstrate compliance with the structural wind load requirements of the Florida Building Code (FBC) through one of the following methods; 1) A certification mark, listing, or label from a commission-approved certification agency indicating that the product complies with the code; 2) A test report from a commission-approved testing laboratory indicating that the product tested complies with the code; 3) A product-evaluation report based upon testing, comparative or rational analysis, or a combination thereof, from a commission-approved product evaluation entity which indicates that the product evaluated complies with the code; 4) A product-evaluation report or certification based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a Florida professional engineer or Florida registered architect, which indicates that the product complies with the code; 5) A statewide product approval issued by the Florida Building Commission. The Florida Department of Business and Professional Regulation (DBPR) website provides a listing of companies certified as a Product Evaluation Agency (i.e., EVLMiami 13692), a Product Certification Agency (i.e., CER10642), and as a Florida Registered Engineer (i.e., ANE13741).
- 1.7 **Approved by Miami-Dade County (i.e., Notice of Acceptance [NOA]):** A Florida statewide approval is an NOA. An NOA is a Florida local product approval. By Florida law, Miami-Dade County shall accept the statewide and local Florida Product Approval as provided for in Florida legislation 553.842 and 553.8425.
- 1.8 **Approved by New Jersey:** Pursuant to Building Code 2018 of New Jersey in IBC Section 1707.1 General,<sup>24</sup> it states: "In the absence of approved rules or other approved standards, the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the administrative provisions of the Uniform Construction Code (N.J.A.C. 5:23)".<sup>25</sup> Furthermore N.J.A.C 5:23-3.7 states: Municipal approvals of alternative materials, equipment, or methods of construction. **(a) Approvals:** Alternative materials, equipment, or methods of construction shall be approved by the appropriate subcode official provided the proposed design is satisfactory and that the materials, equipment, or methods of construction are suitable for the intended use and are at least the equivalent in quality, strength, effectiveness, fire resistance, durability and safety of those conforming with the requirements of the regulations. 1. A field evaluation label and report or letter issued by a nationally recognized testing laboratory verifying that the specific material, equipment, or method of construction meets the identified standards or has been tested and found to be suitable for the intended use, shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. 2. Reports of engineering findings issued by nationally recognized evaluation service programs, such as, but not limited to, the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress International (SBCCI), the International Code Council (ICC), and the National Evaluation Service, Inc., shall be accepted by the appropriate subcode official as meeting the requirements of (a) above. The New Jersey Department of Community Affairs has confirmed that technical evaluation reports, from any accredited entity listed by ANAB, meets the requirements of item 2 given that the listed entities are no longer in existence and/or do not provide "reports of engineering findings".

<sup>24</sup> [https://up.codes/viewer/new\\_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1](https://up.codes/viewer/new_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1)

<sup>25</sup> <https://www.nj.gov/dca/divisions/codes/codereg/ucc.html>

- 1.9 **Approved by the Code of Federal Regulations Manufactured Home Construction and Safety Standards:** Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14<sup>26</sup> and Part 3280,<sup>27</sup> the Department encourages innovation and the use of new technology in manufactured homes. The design and construction of a manufactured home shall conform with the provisions of Part 3282 and Part 3280 where key approval provisions in mandatory language follow: 1) “All construction methods shall be in conformance with accepted engineering practices”; 2) “The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.”; and 3) “The design stresses of all materials shall conform to accepted engineering practice.”
- 1.10 **Approval by US, Local, and State Jurisdictions in General:** In all other local and state jurisdictions, the adopted building code legislation states in pertinent part that:
- 1.10.1 For new materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests.<sup>28</sup>
- 1.10.2 For innovative alternative products, materials, designs, services and/or methods of construction, in the absence of approved rules or other approved standards...the building official shall accept duly authenticated reports (i.e., listing and/or research report) from approved agencies with respect to the quality and manner of use of new materials or assemblies.<sup>29</sup> A building official approved agency is deemed to be approved via certification from an accreditation body that is listed by the International Accreditation Forum<sup>30</sup> or equivalent.
- 1.10.3 The design strengths and permissible stresses of any structural material...shall conform to the specifications and methods of design of accepted engineering practice performed by an approved source.<sup>31</sup> An approved source is defined as a PE subject to professional engineering laws, where a research and/or a technical evaluation report certified by a PE, shall be approved.
- 1.11 **Approval by International Jurisdictions:** The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements:
- 1.11.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,
- 1.11.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.
- 1.11.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

<sup>26</sup> <https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14>

<sup>27</sup> <https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280>

<sup>28</sup> IBC 2021, Section 1706 Design Strengths of Materials, 1706.2 New Materials. Adopted law pursuant to IBC model code language 1706.2.

<sup>29</sup> IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General. Adopted law pursuant to IBC model code language 1707.1.

<sup>30</sup> Please see the ANAB directory for building official approved agencies.

<sup>31</sup> IBC 2021, Section 1706 Design Strengths of Materials, Section 1706.1 Conformance to Standards Adopted law pursuant to IBC model code language 1706.1.



- 1.11.4 **Approved:** The purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories to the MLA, and subsequently acceptance of accredited certification and validation/verification statements in many markets based on one accreditation for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.