

**Ox Thermo-Ply[®], SI-Strong Structural Insulation,
Styrofoam SIS[™] & SIS[™] Plus, ISO RED ci and ISO RED
MAX FPIS - One & Two Hour Fire Rated Wall Assemblies**

TER No. 1510-04

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DIVISION: 06 00 00 – WOOD, PLASTICS, AND COMPOSITES

Section: 06 12 00 – Structural Panels
Section: 06 12 19 – Shear Wall Panels
Section: 06 16 00 – Sheathing
Section: 06 16 13 – Insulating Sheathing

DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 – Thermal Insulation

1. Products Evaluated:

- 1.1. Thermo-Ply[®] Structural Sheathing
- 1.2. SI-Strong Structural Insulation, Styrofoam SIS[™] & SIS[™] Plus Brand Structural Insulated Sheathing
- 1.3. ISO RED ci Polyiso Foam Sheathing
- 1.4. ISO RED MAX Polyiso Foam Sheathing
- 1.5. For the most recent version of this Technical Evaluation Report (TER), visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.
- 1.6. This TER can be used to obtain product approval in any country that is an IAF MLA Signatory (all countries found [here](#)) and covered by an [IAF MLA Evaluation](#) per the [Purpose of the MLA](#) (as an example, see [letter to ANSI](#) from the Standards Council of Canada). Manufacturers can go to jurisdictions in the U.S., Canada and other [IAF MLA Signatory Countries](#) and have their products readily approved by authorities having jurisdiction using [DrJ's ANSI accreditation](#).

DrJ is a Professional Engineering Approved Source

 **Learn more about DrJ's Accreditation**

- DrJ is an ISO/IEC 17065 accredited product certification body through ANSI Accreditation Services.
- DrJ provides certified evaluations that are signed and sealed by a P.E.
- DrJ's work is backed up by professional liability insurance.
- DrJ is fully compliant with IBC Section 1703.

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- 1.7. Building code regulations require that evaluation reports are provided by an approved agency meeting specific requirements, such as those found in [IBC Section 1703](#). Any agency accredited in accordance with ANSI ISO/IEC 17065 meets this requirement within ANSI's scope of accreditation. For a list of accredited agencies, visit ANSI's [website](#). For more information, see [drjcertification.org](#).
- 1.8. Requiring an evaluation report from a specific private company (i.e., ICC-ES, IAPMO, CCMC, DrJ, etc.) can be viewed as discriminatory and is a violation of international, federal, state, provincial and local anti-trust and free trade regulations.
- 1.9. DrJ's code compliance work:
 - 1.9.1. Conforms to code language adopted into law by individual states and any relevant consensus based standard such as an ANSI or ASTM standard.
 - 1.9.2. Complies with accepted engineering practice, all professional engineering laws and by providing an engineer's seal DrJ takes professional responsibility for its specified scope of work.

2. Applicable Codes and Standards:¹

- 2.1. 2012, 2015 and 2018 International Building Code (IBC)
- 2.2. 2012, 2015 and 2018 International Residential Code (IRC)
- 2.3. 2016 California Building Standards Code
- 2.4. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
- 2.5. ASTM E2032 – Standard Guide for Extension of Data from Fire Resistance Tests Conducted in Accordance with ASTM E119
- 2.6. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

3. Performance Evaluation:

- 3.1. Thermo-Ply®, SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus, ISO RED ci, and ISO RED MAX were evaluated in accordance with ASTM E119 for the following designs:
 - 3.1.1. Performance of one hour and two-hour fire rated wall assemblies using:
 - 3.1.1.1. UL-U364, U397 & V306 designs.
 - 3.1.1.2. UL-U356 design.
 - 3.1.1.3. UL-U425 & UL-V454 designs.
- 3.2. Any code compliance issues not specifically addressed in this section are outside the scope of this Technical Evaluation Report (TER).

4. Product Description and Materials:

- 4.1. Thermo-Ply®
 - 4.1.1. Thermo-Ply® is a proprietary foam plastic insulated sheathing (FPIS) product, composed of pressure laminated plies consisting of high-strength cellulosic fibers. These fibers are specially treated to be water resistant and are bonded with a proprietary water resistive adhesive.
 - 4.1.2. Polymer facings are applied on both sides of the sheathing panels. Facings may be aluminum foil or Kraft/polymer/Kraft facing on both sides.
- 4.2. SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus
 - 4.2.1. SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus are structural, rigid FPIS products consisting of a proprietary fibrous sheathing board laminated to one side of a proprietary rigid foam plastic

¹ Unless otherwise noted, all references in this code compliant technical evaluation report (TER) are from the 2018 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2015 versions of the IBC and IRC and the standards referenced therein. As required by law, where this TER is not approved, the building official shall respond in writing, stating the reasons this TER was not approved. For variations in state and local codes, if any see [Section 8](#).

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insulation. The 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.

4.3. ISO RED ci

4.3.1. ISO RED ci is a Type 1, Class 1 Dual Faced Rigid Cellular Polyisocyanurate Insulation Board product as defined in *ASTM C1289*.

4.3.2. ISO RED ci consists of a proprietary Polyisocyanurate rigid board, with facers on both sides. The facers are designed with a base foil layer, with which layers of other material(s) are combined.

4.4. ISO RED MAX

4.4.1. ISO RED MAX is a Type 1, Class 2 Dual Faced Rigid Cellular Polyisocyanurate Insulation Board product as defined in *ASTM C1289*.

4.4.2. ISO RED MAX consists of a proprietary Polyisocyanurate rigid board, with facers on both sides. The facers are designed with a base foil layer.

4.5. Material Availability

4.5.1. Thicknesses:

4.5.1.1. Thermo-Ply® – standard structural grade (Red): 0.113" (2.9 mm), and high structural grade (Blue): 0.135" (3.4 mm).

4.5.1.2. SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus – range from 0.5" (12.7 mm) up to 1.0" (25.4 mm).

4.5.1.3. ISO RED ci – range from 0.5" (12.7 mm) up to 2.0" (51 mm).

4.5.1.4. ISO RED MAX – Thicknesses up to 4.0" (102 mm).

4.5.2. The standard widths include 48" (1219 mm) and 48^{3/4}" (1238 mm).

4.5.3. The standard lengths include 96" (2438 mm), 108" (2743 mm) and 120" (3048 mm).

5. Applications:

5.1. Wood - One-hour Fire Rating - Non Load Bearing

5.1.1. One-hour Fire Rating from Interior or Exterior using Assembly 1 – Design No. U364, U397 & V306 ([Figure 1](#))

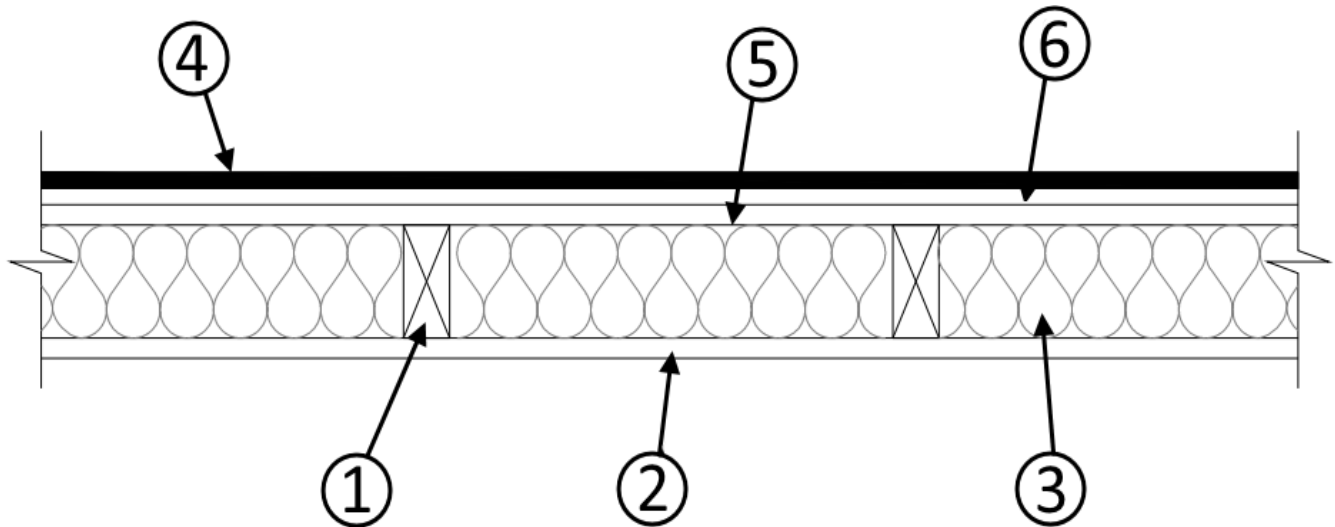


Figure 1: One Hour Rated Assembly 1 Using UL Design No. U364, U397 & V306

5.1.1.1. (1) Wood Studs – Nominal 2x4, minimum spaced 16" o.c. (406 mm), maximum spaced 24" o.c. (6010 mm)

5.1.1.2. (2) Gypsum Board

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- 5.1.1.2.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick
- 5.1.1.2.2. Oriented: Vertically on interior side
- 5.1.1.2.3. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud
- 5.1.1.2.4. Fastener: GWB to studs using $1\frac{7}{8}$ " (48 mm) 6d nails or No. 6 Type W screws
- 5.1.1.2.5. Fastener Space: 7" (178 mm) o.c. at perimeter edges and field
- 5.1.1.3. (3) Cavity Insulation
 - 5.1.1.3.1. Type: Glass fiber or mineral wool
 - 5.1.1.3.2. R-value: R-13
 - 5.1.1.3.3. Minimum Thickness: $3\frac{1}{2}$ " (89 mm)
- 5.1.1.4. (4) Exterior Cladding Installed in accordance with the manufacturer's installation instructions and UL-U356
 - 5.1.1.4.1. Siding including vinyl, fiber cement siding
 - 5.1.1.4.2. Molded Plastic – Particle Board Siding
 - 5.1.1.4.3. Wood Structural Panel or Lap Siding
 - 5.1.1.4.4. Cementitious Stucco
 - 5.1.1.4.5. Brick Veneer
 - 5.1.1.4.6. Exterior Insulation and Finish System (EIFS)
- 5.1.1.5. (5) Exterior Gypsum Sheathing
 - 5.1.1.5.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick
 - 5.1.1.5.2. Oriented: Vertically on exterior side
 - 5.1.1.5.3. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud
 - 5.1.1.5.4. Fastener: GWB to studs using $1\frac{7}{8}$ " (48 mm) 6d nails or No. 6 Type W screws
 - 5.1.1.5.5. Fastener Spacing: 7" (178 mm) o.c. on perimeter edges and field
- 5.1.1.6. (6) Exterior Sheathing
 - 5.1.1.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus
 - 5.1.1.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®
 - 5.1.1.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci or up to 4" (102 mm) thick ISO RED MAX

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5.1.2. One-hour Fire Rating from Interior using Assembly 2 – Design No. U356 (Figure 2)

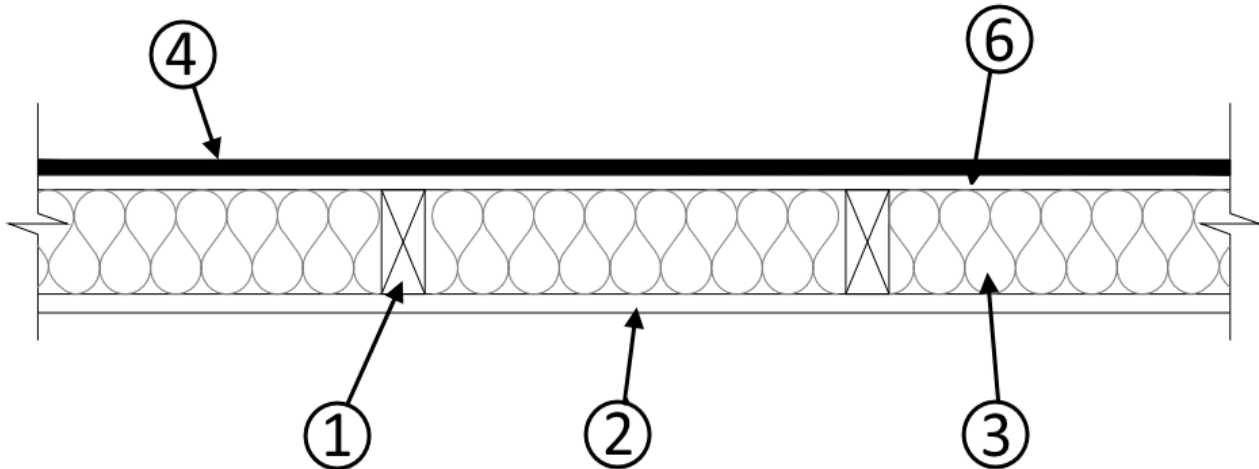


Figure 2: One-Hour Fire Rated Assembly 2 Using UL Design U356

5.1.2.1. (1) Wood Studs – Nominal 2x4, minimum spaced 16" (406 mm) o.c.

5.1.2.2. (2) Gypsum Board

5.1.2.2.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick

5.1.2.2.2. Oriented: Vertically on interior side

5.1.2.2.3. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud

5.1.2.2.4. Fastener: GWB to studs using $1\frac{7}{8}$ " (48 mm) 6d nails or No. 6 Type W screws

5.1.2.2.5. Fastener Space: 7" (178 mm) o.c. on perimeter edges and field

5.1.2.3. (3) Cavity Insulation

5.1.2.3.1. Type: Glass fiber or mineral wool

5.1.2.3.2. R-value: R-13

5.1.2.3.3. Minimum Thickness: $3\frac{1}{2}$ " (89 mm)

5.1.2.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and UL-U356

5.1.2.4.1. Siding including vinyl, fiber cement siding

5.1.2.4.2. Molded Plastic – Particle Board Siding

5.1.2.4.3. Wood Structural Panel or Lap Siding

5.1.2.4.4. Cementitious Stucco

5.1.2.4.5. Brick Veneer

5.1.2.4.6. Exterior Insulation and Finish System (EIFS)

5.1.2.5. (5) Exterior Gypsum Sheathing not used

5.1.2.6. (6) Sheathing – When nominal $\frac{1}{2}$ " (12.7 mm) wood structural panels are fastened directly to studs, the axial load is not restricted

5.1.2.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#); up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus

5.1.2.6.2. As installed per [TER No. 1210-01](#) Thermo-Ply®

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5.1.2.6.3. As installed per [TER No. 1306-02](#): 1" (25.4 mm) of ISO RED ci or up to 4" (102 mm) thick ISO RED MAX

5.1.3. One-hour Fire Rating from Interior or Exterior using Assembly 2 – Design No. U356

5.1.3.1. Assembled as shown in [Figure 2](#) using brick veneer as exterior cladding (4).

5.2. Wood - One-hour Fire Rating - Limited Load Bearing

5.2.1. One-hour Fire Rating from Interior using Assembly 2 – Design No. U356²

5.2.1.1. Assembled as shown in [Figure 2](#).

5.2.1.2. The wall assembly was loaded to 55% of the allowable load.

5.2.1.3. A superimposed load of 1,800 lbs. per stud was applied to the assembly at the start of the test and was maintained throughout the test. This superimposed load imposed a stress of 342.9 psi, compression parallel to grain.

5.2.1.4. This results in a wall assembly permitted to be built as follows:

5.2.1.4.1. 8' wall heights can be loaded to a maximum of 1,800 lbs. per stud (1,350 plf).

5.2.1.4.2. 9' wall heights can be loaded to a maximum of 1,180 lbs. per stud (885 plf).

5.2.1.5. The test was unsymmetrical with the fire side of the wall being external to the 5/8" Type X GWB.

5.2.1.6. (1) Wood Studs – Nominal 2x4, minimum spaced 16" (406 mm) o.c.

5.2.1.7. (2) Gypsum Board

5.2.1.7.1. Type: Georgia-Pacific Firestop Type X GWB 5/8" (15.9 mm) thick OR Gold Bond Fire-Shield Type X GWB 5/8" (15.9 mm) thick

5.2.1.7.2. Oriented: Vertically on interior side

5.2.1.7.3. Joints: Centered over studs

5.2.1.7.4. Fastener: GWB to studs using 2"-long 12¹/₂ ga annular ringed GWB nails with 19/64"-diameter heads and long diamond points

5.2.1.7.5. Fastener Space: 6" (152 mm) o.c. on perimeter edges and 12" (305 mm) o.c. on intermediate studs

5.2.1.8. (3) Cavity Insulation

5.2.1.8.1. Type: Glass fiber

5.2.1.8.2. R-value: R-13

5.2.1.8.3. Minimum thickness: 3⁵/₈" (92 mm)

5.2.1.9. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and UL-U356

5.2.1.9.1. 19/32"-thick by 4'-wide by 8'-long plywood panel siding OR

5.2.1.9.2. 0.024"-thick unbacked aluminum lap siding

5.2.1.10. (5) Exterior Gypsum Sheathing not used

5.2.1.11. (6) Sheathing

5.2.1.11.1. Proprietary laminated fibrous board sheathing, the same structural sheathing component of STYROFOAM SIS™ and STYROFOAM SIS™ Plus, fiber-based board faced on both sides

5.2.1.11.2. Thickness: Minimum of 0.113" thick

² Testing conducted by the Building Research Laboratory at Ohio State University by Dr. Richard Bletzacker of Richard W. Bletzacker & Associates Inc in accordance with ASTM E119

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5.2.1.11.3. Oriented: Vertically with butt joints over studs.

5.2.1.11.4. Fastener: Attached to unexposed side of the studs and plates with 1¹/₄"-long 11 ga galvanized roofing nails with ⁷/₁₆"-diameter heads and diamond points

5.2.1.11.5. Fastener Space: 3" (76 mm) o.c. around the perimeter of each sheet and 6" (152 mm) o.c. on the intermediate studs.

5.3. Wood - Two-hour Fire Rating

5.3.1. Two-hour Fire Rating from Interior using Assembly 1 – Design No. U364, U397 & V306 (Figure 3)

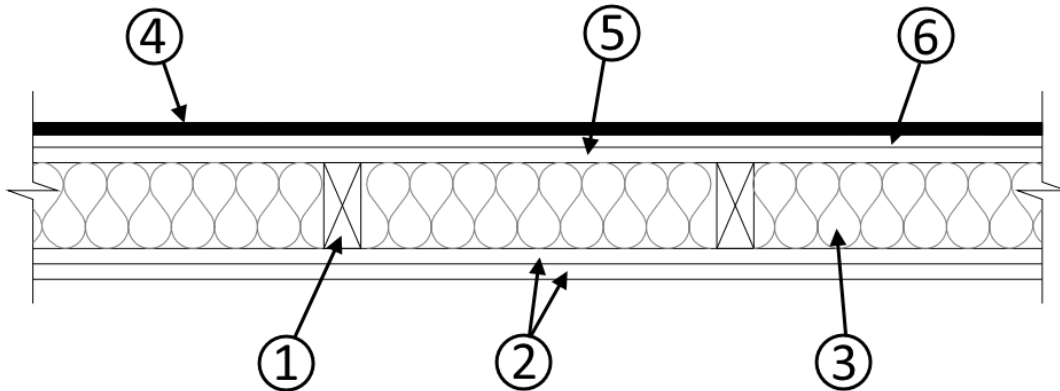


Figure 3: Two-Hour Fire Rated Assembly 1 Using UL Design U364, U397 & V306

5.3.1.1. (1) Wood Studs – Nominal 2x4, minimum spaced 16" (406 mm) o.c., maximum spaced 24" (610 mm) o.c.

5.3.1.2. (2) Gypsum Board – Requires two GWB layers

5.3.1.2.1. Type: X GWB ⁵/₈" (15.9 mm) thick

5.3.1.2.2. Oriented: Vertically on interior side

5.3.1.2.3. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud

5.3.1.2.4. Fastener interior layer: GWB to studs using 1⁷/₈" (48 mm) 6d nails or No. 6 Type W screws

5.3.1.2.5. Fastener Space interior layer: 7" (178 mm) o.c. on perimeter edges and field

5.3.1.2.6. Fastener secondary layer: Using 2³/₈" (61 mm) 8d nails or screws, 8" (203 mm) o.c.

5.3.1.2.7. Fastener Space secondary layer: 8" (203 mm) o.c.

5.3.1.3. (3) Cavity Insulation

5.3.1.3.1. Type: Glass fiber or mineral wool

5.3.1.3.2. R-value: R-13

5.3.1.3.3. Minimum Thickness: 3¹/₂" (89 mm)

5.3.1.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and U356

5.3.1.4.1. Siding including vinyl, fiber cement siding

5.3.1.4.2. Molded Plastic – Particle Board Siding

5.3.1.4.3. Wood Structural Panel or Lap Siding

5.3.1.4.4. Cementitious Stucco

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- 5.3.1.4.5. Brick Veneer
 - 5.3.1.4.6. Exterior Insulation and Finish System (EIFS)
 - 5.3.1.5. (5) Exterior Gypsum Sheathing – Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick
 - 5.3.1.5.1. Oriented: Vertically on exterior side
 - 5.3.1.5.2. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud
 - 5.3.1.5.3. Fastener: GWB to studs using $1\frac{7}{8}$ " (48 mm) 6d nails or No. 6 Type W screws
 - 5.3.1.5.4. Fastener Space: 7" (178 mm) o.c. on perimeter edges and field
 - 5.3.1.6. (6) Exterior Insulation
 - 5.3.1.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus
 - 5.3.1.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®
 - 5.3.1.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci. or up to 4" (102 mm) thick ISO RED MAX
- 5.3.2. Two-hour Fire Rating from Interior or Exterior using Assembly 1 – Design No. U364, U397 & V306
- 5.3.2.1. Assembled as shown in [Figure 3](#) using brick veneer as exterior cladding (4).
- 5.3.3. Two-hour Fire Rating from Interior using Assembly 2 – Design No. U356 ([Figure 4](#))

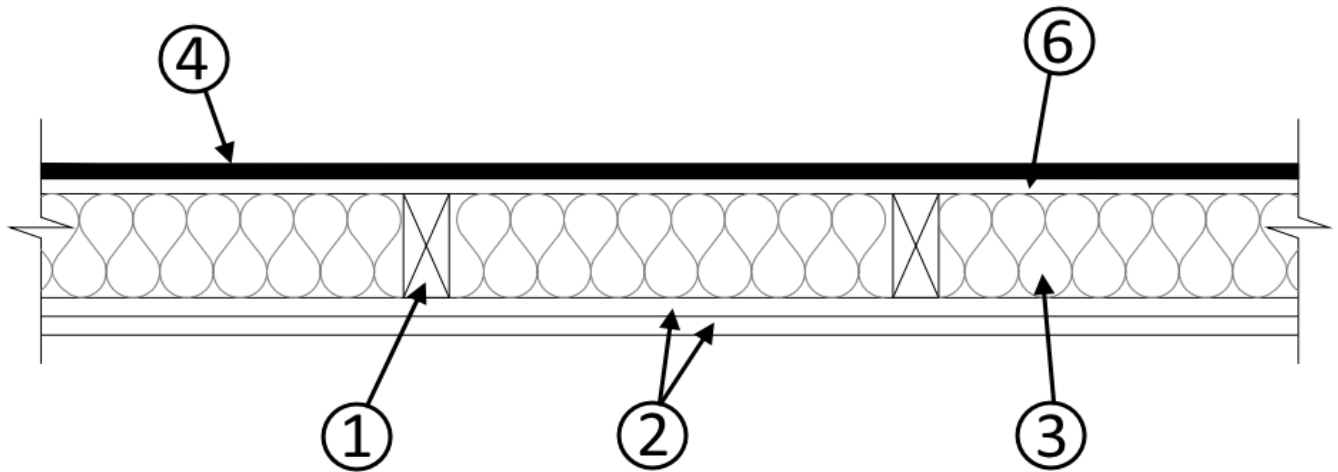


Figure 4: Two-Hour Fire Rated Assembly 2 Using UL Design No. U356

- 5.3.3.1. (1) Wood Studs – Nominal 2x4, minimum spaced 16" (406 mm) o.c.
- 5.3.3.2. (2) Gypsum Board – Requires two GWB layers
 - 5.3.3.2.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick
 - 5.3.3.2.2. Oriented: Vertically on interior side
 - 5.3.3.2.3. Joints: Centered over studs and staggered 1 stud cavity on opposite side of stud
 - 5.3.3.2.4. Fastener interior layer: GWB to studs using $1\frac{7}{8}$ " (48 mm) 6d nails or No. 6 Type W screws
 - 5.3.3.2.5. Fastener Space interior layer: 7" (178 mm) o.c. on perimeter edges and field
 - 5.3.3.2.6. Fastener secondary layer: Using $2\frac{3}{8}$ " (61 mm) 8d nails or screws, 8" (203 mm) o.c.
 - 5.3.3.2.7. Fastener Space secondary layer: 8" (203 mm) o.c.
- 5.3.3.3. (3) Cavity Insulation
 - 5.3.3.3.1. Type: Glass fiber or mineral wool

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5.3.3.3.2. R-value: R-13

5.3.3.3.3. Minimum Thickness: 3½" (89 mm)

5.3.3.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and UL-U356

5.3.3.4.1. Siding including vinyl, fiber cement siding

5.3.3.4.2. Molded Plastic – Particle Board Siding

5.3.3.4.3. Wood Structural Panel or Lap Siding

5.3.3.4.4. Cementitious Stucco

5.3.3.4.5. Brick Veneer

5.3.3.4.6. Exterior Insulation and Finish System (EIFS)

5.3.3.5. (5) Exterior Gypsum Sheathing not used

5.3.3.6. (6) Exterior Insulation

5.3.3.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus

5.3.3.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®

5.3.3.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci. or up to 4" (102 mm) thick ISO RED MAX

5.3.4. Two-hour Fire Rating from Interior or Exterior using Assembly 2 – Design No. U356.

5.3.4.1. Assembled as shown in [Figure 4](#) using brick veneer for exterior cladding (4).

5.4. Steel - One-hour Fire Rating - Load Bearing

5.4.1. One-hour Fire Rating from Interior or Exterior using Assembly 1 – Design No. U425 ([Figure 5](#))

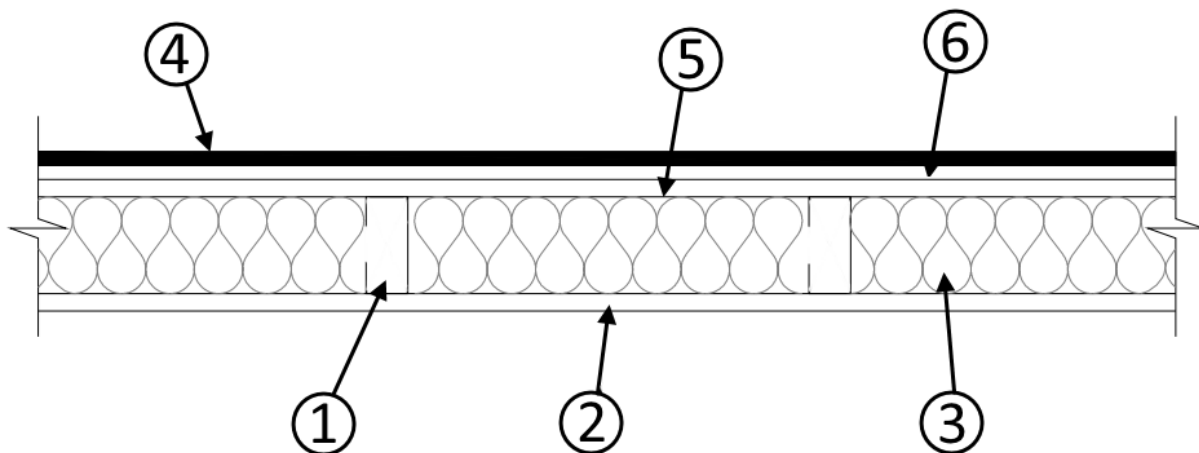


Figure 5: One-Hour Rated Assembly 1 Using UL Design No. U425

5.4.1.1. (1) Steel Studs – Minimum 20 ga., maximum spaced 24" (610 mm) o.c.

5.4.1.2. (2) Interior Gypsum Board

5.4.1.2.1. 1 Layer – 1 hour (100% of design load)

5.4.1.2.1.1. Type: X GWB 5/8" (15.9 mm) thick

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- 5.4.1.2.1.2. Oriented: Vertically on interior side
- 5.4.1.2.1.3. Joints: Centered over studs
- 5.4.1.2.1.4. Fastener: GWB to studs using Type S-12 1" (25.4 mm) self-tapping bugle head sheet steel screws
- 5.4.1.2.1.5. Fastener Space: 12" (178 mm) o.c. on perimeter edges and field
- 5.4.1.3. (3) Cavity Insulation
 - 5.4.1.3.1. Type: Any UL-classified glass fiber batt, mineral wool or sprayed cellulosic fiber
- 5.4.1.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and U425
 - 5.4.1.4.1. Siding including aluminum, steel, brick or stucco
 - 5.4.1.4.2. Cementitious Backer Units
 - 5.4.1.4.3. Fiber-Cement Siding
 - 5.4.1.4.4. Molded Plastic
 - 5.4.1.4.5. Wood Structural Panel or Lap Siding
 - 5.4.1.4.6. Building Units (Cellular Glass Blocks)
- 5.4.1.5. (5) Exterior Gypsum Sheathing – Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick
 - 5.4.1.5.1. Oriented: Vertically on exterior side
 - 5.4.1.5.2. Joints: Centered over studs staggered from back layer
 - 5.4.1.5.3. Fastener: GWB to studs using Type S-12 1" (25.4 mm) self-tapping bugle head sheet steel screws
 - 5.4.1.5.4. Fastener Space: 12" (178 mm) o.c. along studs and tracks
- 5.4.1.6. (6) Exterior Insulation
 - 5.4.1.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus
 - 5.4.1.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®
 - 5.4.1.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci. or up to 4" (102 mm) thick ISO RED MAX

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5.4.2. One-hour Fire Rating from Either Side using Assembly 2 – Design No. V454 (Figure 6)

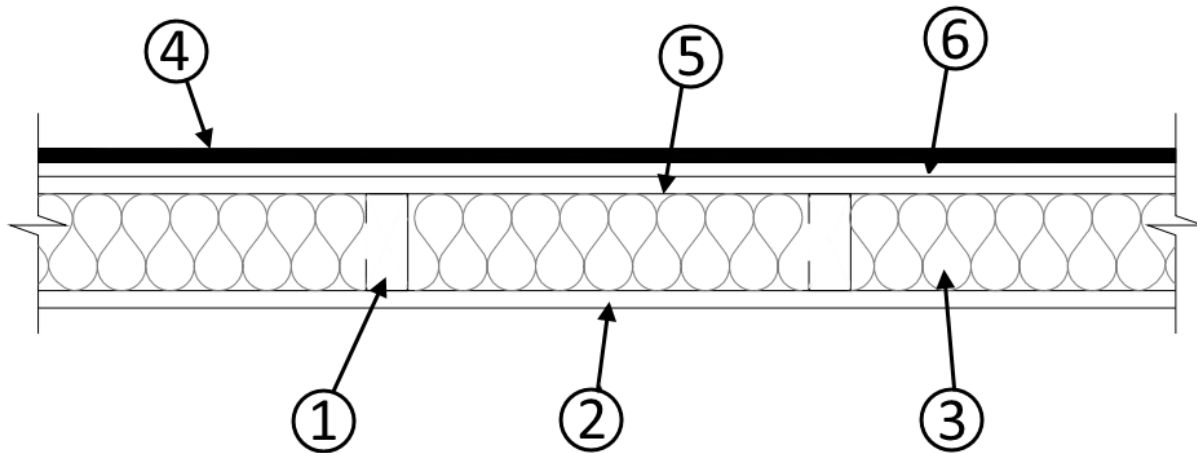


Figure 6: One-Hour Rated Assembly 2 Using UL Design No. V454

5.4.2.1. (1) Steel Studs – Minimum 20 ga., spaced maximum 24" (610 mm) o.c.

5.4.2.2. (2) Interior Gypsum Board

5.4.2.2.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick

5.4.2.2.2. Oriented: Vertically on interior side

5.4.2.2.3. Joints: Centered over studs staggered from exterior gypsum sheathing joints

5.4.2.2.4. Fastener: GWB to studs using Type S 1" (25.4 mm) self-drilling, self-tapping steel screws

5.4.2.2.5. Fastener Space: 8" (203 mm) o.c. on perimeter edges and 12" (305 mm) o.c. in the field

5.4.2.3. (3) Cavity Insulation

5.4.2.3.1. Type: Any UL-classified glass fiber batt, mineral wool or sprayed cellulosic fiber or proprietary spray polyurethane foam (SPF) allowed in UL V454. See [listing](#) for full details.

5.4.2.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and V454

5.4.2.4.1. Siding including aluminum, steel, vinyl, wood, hard board, fiber-cement, stone, brick veneer, concrete or masonry veneer, stucco, one-coat stucco, Exterior Insulation and Finish System (EIFS), metal panel, or wall and partition facing and accessories.

5.4.2.5. (5) Exterior Gypsum Sheathing – Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick

5.4.2.5.1. Oriented: Vertically on exterior side

5.4.2.5.2. Joints: Centered over studs staggered from interior GWB

5.4.2.5.3. Fastener: GWB to studs using Type S 1" (25.4 mm) self-drilling, self-tapping steel screws

5.4.2.5.4. Fastener Space: 8" (203 mm) o.c. on perimeter edges and 12" (305 mm) o.c. in the field

5.4.2.6. (6) Exterior Insulation

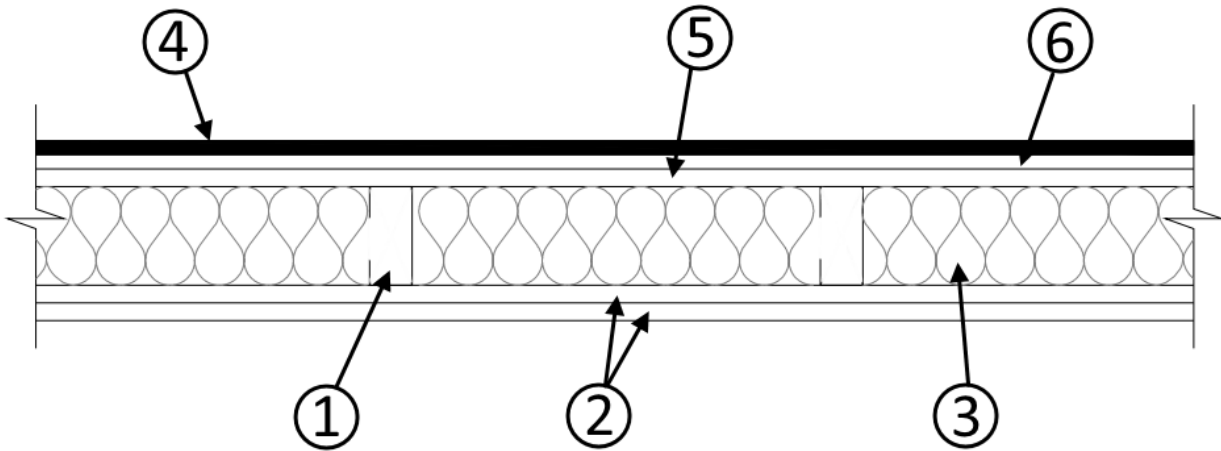
5.4.2.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus

5.4.2.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®

5.4.2.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci. or up to 4" (102 mm) thick ISO RED MAX

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5.5. Steel - Two-hour Fire Rating - Load Bearing



5.5.1. Two Hour Fire Rating from the Interior using Assembly 1 – Design No. U425 ([Figure 7](#))

Figure 7: Two Hour Rated Assembly 2 Using UL Design No. U425

5.5.1.1. (1) Steel Studs – Minimum 20 ga., spaced 24" (610 mm) o.c. maximum

5.5.1.2. (2) Interior Gypsum Board

5.5.1.2.1. 2 Layers – 2 hours (80% of design load)

5.5.1.2.1.1. Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick

5.5.1.2.1.2. Oriented: Vertically on interior side

5.5.1.2.1.3. Joints: Centered over studs and staggered 1 stud cavity between layers

5.5.1.2.1.4. Fastener: GWB to studs using Type S-12 x 1" (25.4 mm) self-tapping bugle head sheet steel screws in first layer, Type S-12 x 1- $\frac{5}{8}$ " self-tapping bugle head sheet steel screws in second layer.

5.5.1.2.1.5. Fastener Space: 12" (178 mm) o.c. on perimeter edges and field.

5.5.1.3. (3) Cavity Insulation

5.5.1.3.1. Type: Any UL-classified glass fiber batt, mineral wool or sprayed cellulosic fiber

5.5.1.4. (4) Exterior Cladding – Installed in accordance with the manufacturer's installation instructions and U425

5.5.1.4.1. Siding including aluminum, steel, brick or stucco

5.5.1.4.2. Cementitious Backer Units

5.5.1.4.3. Fiber-Cement Siding

5.5.1.4.4. Molded Plastic

5.5.1.4.5. Wood Structural Panel or Lap Siding

5.5.1.4.6. Building Units (Cellular Glass Blocks)

5.5.1.5. (5) Exterior Gypsum Sheathing – Type: X GWB $\frac{5}{8}$ " (15.9 mm) thick

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- 5.5.1.5.1. Oriented: Vertically on exterior side
- 5.5.1.5.2. Joints: Centered over studs staggered from back layer
- 5.5.1.5.3. Fastener: GWB to studs using Type S-12 1" (25.4 mm) self-tapping bugle head sheet steel screws
- 5.5.1.5.4. Fastener Space: 12" (178 mm) o.c. along studs and tracks
- 5.5.1.6. (6) Exterior Insulation
 - 5.5.1.6.1. As installed per [TER No. 0804-01](#) & [TER No. 1109-01](#): up to 1" (25.4 mm) thickness SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus
 - 5.5.1.6.2. As installed per [TER No. 1210-01](#): Thermo-Ply®
 - 5.5.1.6.3. As installed per [TER No. 1306-02](#): up to 2" (51 mm) of ISO RED ci. or up to 4" (102 mm) thick ISO RED MAX

6. Installation:

- 6.1. Refer to the [manufacturer's installation instructions](#), in addition to this TER for complete details and requirements. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- 6.2. Insulation boards shall be installed horizontally with sheathing edges bearing directly on framing members and edges of abutting panels in moderate contact with each other.
- 6.3. Install cladding materials in accordance with the cladding manufacturer's installation instructions.
- 6.4. One and Two Hour Fire Rated Wall Assemblies:
 - 6.4.1. The one-hour rated wall assembly shall be constructed as described in [Section 5.1](#).
 - 6.4.2. The two-hour rated wall assembly shall be constructed as described in [Section 5.2](#).
 - 6.4.3. Specifications as defined in the UL Directory (e.g., UL assembly U356 or U364)
 - 6.4.4. Thermo-Ply® shall be installed per [TER No. 1210-01](#).
 - 6.4.5. SI-Strong Structural Insulation, Styrofoam SIS™ & SIS™ Plus shall be installed per [TER No. 0804-01](#).
 - 6.4.5.1. Up to 1" (25.4 mm) thickness.
 - 6.4.6. ISO RED ci or ISO RED MAX shall be installed per [TER No. 1306-02](#).
 - 6.4.6.1. ISO RED ci up to 2" (51 mm) thickness.
 - 6.4.6.2. ISO RED MAX up to 4" (102 mm) thickness.

7. Test and Engineering Substantiating Data:

- 7.1. Evaluation and analysis of *ASTM E119* testing conducted by Architectural Testing, Inc., an Intertek company.
- 7.2. Evaluation and analysis of *ASTM E119* testing conducted by the Building Research Laboratory at Ohio State University by Dr. Richard Bletzacker of Richard W. Bletzacker & Associates Inc.
- 7.3. Engineering evaluation of equivalent design for 1- or 2-hour fire rated wall assemblies in accordance of *ASTM E2032-09* by Priest & Associates Consulting.
- 7.4. DrJ Technical Evaluation Report, [TER No. 0804-01](#) flame spread and smoke developed ratings in accordance with *ASTM E84*.
- 7.5. DrJ Technical Evaluation Report, [TER No. 1109-01](#) One-Hour Fire-Resistance Rated, Limited Load Bearing Wall Assemblies for SI-Strong Structural Insulation, STYROFOAM SIS™ & SIS™ Plus.
- 7.6. DrJ Technical Evaluation Report, [TER No. 1210-01](#) One-Hour Fire-Resistance Rated, Limited Load Bearing Wall Assemblies for Thermo-Ply®.
- 7.7. DrJ Technical Evaluation Report, [TER No. 1306-02](#) Ox ISO RED ci & ISO RED MAX.

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- 7.8. The product(s) evaluated by this TER fall within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 7.9. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineering mechanics based means of compliance. This TER assesses compliance with defined standards, accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 7.10. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate, as it undertakes its engineering analysis.
- 7.11. DrJ has reviewed and found the data provided by other professional sources are credible. The information in this TER conforms with DrJ's procedure for acceptance of data from approved sources.
- 7.12. DrJ's responsibility for data provided by approved sources conforms with [IBC Section 1703](#) and any relevant professional engineering law.
- 7.13. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC, WFCM, IBC, SDPWS, NDS, ACI, AISI, PS-20, PS-2*, etc.). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, concrete, etc.), DrJ relies upon grade/properties provided by the raw material supplier to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8. Findings:

- 8.1. When installed in accordance with the [manufacturer's installation instructions](#) and this TER, Thermo-Ply[®], SI-Strong Structural Insulation, Styrofoam SIS[™] & SIS[™] Plus, ISO RED ci, ISO RED MAX complies with, or is a suitable alternative to, the applicable sections of the codes listed in [Section 2](#) for the following applications:
 - 8.1.1. As a component element of one & two-hour fire rated wall assemblies as described in [Section 6](#).
- 8.2. Thermo-Ply[®], Styrofoam SIS[™] & SIS[™] Plus, ISO RED ci and ISO RED MAX are approved for use in the wall assemblies listed in [Section 5](#) when installed as described in [Section 6](#).
- 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 with the codes listed in [Section 2](#), and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:
 - 8.4.1. No known variations
- 8.5. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

- 9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.

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- 9.2.** Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.
- 9.3.** Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the Building Designer (e.g., Owner, Registered Design Professional, etc.).
- 9.4.** Design
- 9.4.1.** Building Designer Responsibility
- 9.4.1.1.** Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
- 9.4.1.2.** The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).
- 9.4.2.** Construction Documents
- 9.4.2.1.** Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.
- 9.5.** Responsibilities
- 9.5.1.** The information contained herein is a product, material, detail, design and/or application TER evaluated in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering practice, experience and technical judgment.
- 9.5.2.** DrJ TERs provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated sections.
- 9.5.3.** The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.
- 9.5.4.** This product is manufactured under a third-party quality control program in accordance with [IRC Section R104.4](#) and [R109.2](#) and [IBC Section 104.4](#) and [110.4](#).
- 9.5.5.** The actual design, suitability and use of this TER, for any particular building, is the responsibility of the Owner or the Owner's authorized agent, and the TER shall be reviewed for code compliance by the Building Official.
- 9.5.6.** The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10. Identification:

- 10.1.** All Ox Engineered Products, FPIS boards described in this TER are identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2.** Additional technical information can be found at OxEngineeredProducts.com.

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11. Review Schedule:

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



- [Mission and Professional Responsibilities](#)
- [Product Evaluation Policies](#)
- [Product Approval – Building Code, Administrative Law and P.E. Law](#)