

**DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES**

**Section: 06 12 00—Structural Panels**

**REPORT HOLDER:**

**GENERAL PANEL CORPORATION**

**EVALUATION SUBJECT:**

**GENERAL PANEL WALL AND ROOF STRUCTURAL INSULATED PANELS: WALL AND ROOF PANELS 8 FT. TO 24 FT. LONG, 6-1/2-IN. to 10-1/4-IN. THICK**

## 1.0 EVALUATION SCOPE

**Compliance with the following codes:**

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Residential Code*® (IRC)

**Property evaluated:**

Structural

## 2.0 USES

### 2.1 General:

*Structural Insulated Panels* are used as structural insulated wall and roof panels capable of resisting transverse, axial and in-plane shear loads.

### 2.2 Construction Types:

*Structural Insulated Panels* shall be considered combustible building elements when assessing construction type in accordance with IBC Chapter 6.

### 2.3 Fire Resistive Assemblies:

*Structural Insulated Panels* shall not be used as part of a fire-rated assembly unless suitable evidence and details are submitted and approved by the authority having jurisdiction.

## 3.0 DESCRIPTION

### 3.1 General:

*Structural Insulated Panels* are factory-assembled, engineered-wood-faced, structural insulated panels (SIPs) with an expanded polystyrene (EPS) foam plastic core. The panels are intended for use as load bearing or non-load bearing wall and roof components. Panels are available in 6<sup>1</sup>/<sub>2</sub>-inch (165 mm) through 10<sup>1</sup>/<sub>4</sub>-inch (260 mm) overall thicknesses. The panels are custom made to the specifications for each use and are assembled under factory-controlled conditions. The maximum panel size is 8 feet (2.44 m) wide and up to 24 feet (7.32 m) in length.

## 3.2 Materials:

**3.2.1 Facing:** The facing consists of two single-ply oriented strand board (OSB) facings, a minimum of <sup>7</sup>/<sub>16</sub>-inch (11.1 mm) thick conforming to values in 2012 and 2009 IRC Table R613.3.2 and complying with DOC PS 2-92, Exposure 1, Rated Sheathing with a span index of 24/16. Panels shall be manufactured with the facing strength axis oriented parallel with respect to the direction of SIP bending.

**3.2.2 Core:** The core material is expanded polystyrene (EPS) foam conforming to the Type I specification defined in ASTM C578. The foam core up to 4 inches (102 mm) thick has a flame spread rating not exceeding 75 and a smoke-developed index not exceeding 450.

**3.2.3 Adhesive:** Facing materials are adhered to the core material using a structural adhesive. The adhesive is applied during the lamination process in accordance with the in-plant quality control manual.

**3.2.4 Material Sources:** The facing, core and adhesive materials used in the construction of *Structural Insulated Panels* shall be composed only of materials from approved sources as identified in the in-plant quality system documentation.

**3.2.5 Splines:** *Structural Insulated Panels* are interconnected with surface splines or block splines (Figure 1). Connections using dimensional lumber splines or engineered structural splines are not specifically addressed in this report and must be designed in accordance with accepted engineering practice to meet applicable code requirements.

**3.2.5.1 Surface Splines:** Surface splines (Figure 1) consist of 3-inch-wide-by-<sup>7</sup>/<sub>16</sub>-inch-thick (76.2 mm x 11.1 mm) or thicker OSB. At each panel joint, one surface spline is inserted into each of two tight-fitting slots in the core. The slots in the core are located inside the facing.

**3.2.5.2 Block Splines:** Block splines (Figure 1) are manufactured in the same manner as the SIP except with an overall thickness that is 1 inch (25.4 mm) less than the overall thickness of the panels to be joined.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 General:** The scope of this report is limited to the evaluation of the SIP component. Panel connections and other details related to incorporation of the panel into the overall structural system of a building are outside the scope of this report.

**4.1.2 Design Approval:** Where required by the authority having jurisdiction, structures using *Structural Insulated Panels* shall be designed by a registered design professional. Construction documents, including engineering calculations and drawings providing floor plans, window details, door details and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall be available at all times on the jobsite during installation.

**4.1.3 Design Loads:** Design loads to be resisted by *Structural Insulated Panels* shall be as required under the applicable building code. Loads shall not exceed the loads noted in this report.

**4.1.4 Allowable Loads:** Allowable axial, transverse and racking loads may be calculated using the panel properties provided in Tables 1 and 2 or may be selected from Tables 3 through 5. Maximum and minimum panel heights, spans and thicknesses are limited as provided in Tables 2 through 5. Unless otherwise noted, all properties and allowable loads apply to panels joined with surface or block splines. Allowable loads for reinforced panel capacities shall be designed by a registered professional. Calculations demonstrating that the loads applied are less than the allowable loads described in this report shall be submitted to the code official for approval. For loading conditions not specifically addressed herein, structural members designed in accordance with accepted engineering practice shall be provided to meet applicable code requirements.

**4.1.5 Concentrated Loads:** Axial loads shall be applied to the SIP through continuous members such as structural insulated roof or floor panels or repetitive members such as joists, trusses or rafters spaced at regular intervals of 24 inches (610 mm) on center or less. Such members shall be fastened to a rim board or similar member to distribute the load to the SIP. For other loading conditions reinforcement shall be provided. This reinforcement shall be designed in accordance with accepted engineering practice.

**4.1.6 Eccentric and Side Loads:** Axial loads shall be applied concentrically to the top of the SIP. Loads shall not be applied eccentrically or through framing attached to one side of the panel (such as balloon framing) except where additional engineering documentation is provided.

**4.1.7 Openings:** Openings in panels shall be reinforced with structural materials designed in accordance with accepted engineering practice to resist all loads applied to the opening as required by the applicable code. Details of the door and window openings shall be provided to clarify the manner of supporting axial, transverse and/or racking shear loads at openings. Such details shall be shown on approved design documents and subject to approval by the local authority having jurisdiction.

**4.1.8 In-Plane Shear Design:** Shear walls utilizing block or surface splines shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided in Table 5. The maximum panel height-to-width ratio shall be 2:1. Shear wall chords, hold-downs and connections to transfer shear forces between the wall and surrounding structure shall be designed in accordance with accepted engineering practice. Allowable strengths for shear walls with structural splines along each panel edge shall be designed in accordance with accepted engineering

practice and subject to the limitations for wood sheathed shear walls.

**4.1.9 Seismic Design:** The use of the shear walls (racking shear) is limited to structures in Seismic Design Categories A, B and C. Where SIPs are used to resist seismic forces, the following factors shall be used for design: Response Modification Coefficient,  $R = 2.0$ ; System Overstrength Factor,  $\Omega_0 = 2.5$ ; Deflection Amplification Factor,  $C_d = 2.0$ .

**4.1.10 Combined Loads:** Panels subjected to any combination of transverse, axial or in-plane shear loads shall be analyzed utilizing a straight-line interaction.

## 4.2 Installation:

**4.2.1 General:** *Structural Insulated Panels* shall be fabricated, identified and installed in accordance with this report, the approved construction documents and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report shall govern. Approved construction documents shall be available at all times on the jobsite during installation.

**4.2.2 Splines:** *Structural Insulated Panels* are interconnected at the panel edges through the use of a spline. The spline type may be of any configuration listed in Section 3.2.5 as required by the specific design. The spline shall be secured in place with not less than 0.113-inch x 2<sup>3</sup>/<sub>8</sub>-inch (2.9 mm x 60.3 mm) nails, spaced 6 inches (152 mm) on center, or an approved equivalent fastener. Alternate spline connections may be required for panels subjected to in-plane racking forces. Such panels shall be interconnected with the minimum fasteners required in Table 5 or as directed by the designer.

**4.2.3 Plates:** The top and bottom plates of the panels shall be dimensional or engineered lumber sized to match the core thickness of the panel. The plates shall be secured using not less than 0.113-inch x 2<sup>3</sup>/<sub>8</sub>-inch (2.9 mm x 60.3 mm) nails, spaced 6 inches (152 mm) on center, on both sides of the panel or an approved equivalent fastener.

**4.2.4 Cutting and Notching:** No field cutting or routing of the panels shall be permitted except as shown on approved construction documents.

**4.2.5 Protection from Decay:** SIPs that rest on exterior foundation walls shall not be located less than 8 inches (203 mm) from exposed earth. SIPs supported by concrete or masonry that is in direct contact with earth shall be protected from the concrete or masonry by a moisture barrier.

**4.2.6 Protection from Termites:** In areas subject to damage from termites, SIPs shall be protected from termites using an approved method. Panels shall not be installed below grade or in contact with earth.

**4.2.7 Heat-Producing Fixtures:** Heat-producing fixtures shall not be installed in the panels unless protected by a method approved by the code official or documented in test reports.

## 4.2.8 Voids and Holes:

**4.2.8.1 Voids in Core:** In lieu of openings designed in accordance with section 4.1.7, the following voids are permitted. Voids may be provided in the panel core during fabrication at predetermined locations only. Voids parallel to the panel span shall be limited to a single 1-inch (25.4 mm) maximum diameter hole. Such voids shall be spaced a minimum of 4 feet (1.22 m) on center measured perpendicular to the panel span. Two 1/2-inch (12.7 mm)

diameter holes may be substituted for the single 1-inch (25.4 mm) hole provided they are maintained parallel and within 2 inches (50.8 mm) of each other.

Voids perpendicular to the panel span shall be limited to a single 1½-inch (38.1 mm) maximum hole placed not closer than 12 inches (304.8 mm) from the support. Additional voids in the same direction shall be spaced not less than 32 inches (812.8 mm) on center.

**4.2.8.2 Holes in Panels:** Holes may be placed in panels during fabrication at predetermined locations only. Holes shall be limited to 4-inches x 4-inches (102 mm x 102 mm) square. The minimum distance between holes shall not be less than 4 feet (1.22 m) on center measured perpendicular to the panel span and 24 inches (610 mm) on center measured parallel to the panel span. Not more than three holes shall be permitted in a single line parallel to the panel span. The holes may intersect voids permitted elsewhere in this report.

**4.2.9 Panel Cladding:**

**4.2.9.1 Roof Covering:** The roof covering, underlayment and flashing shall comply with the applicable codes. All roofing materials must be installed in accordance with the manufacturer’s installation instructions. The use of roof coverings requiring the application of heat during installation shall be reviewed and approved by a registered design professional.

**4.2.9.2 Exterior Wall Covering:** Panels shall be covered on the exterior by a water-resistive barrier as required by the applicable code. The water-resistive barrier shall be attached with flashing in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The exterior facing of the SIP wall shall be covered with weather protection as required by the adopted building code or other approved materials.

**4.2.9.3 Interior Wall Covering:** The SIP foam plastic core shall be separated from the interior of the building by an approved thermal barrier of ½-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier where required by IBC Section 2603.4.

**5.0 CONDITIONS OF USE**

*Structural Insulated Panels* as described in this report comply with the codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation complies with this report and the approved construction documents.
- 5.2 This report applies only to the panel thicknesses specifically listed herein.
- 5.3 In-use panel heights/spans shall not exceed the values listed herein. Extrapolation beyond the values listed herein is not permitted.
- 5.4 This evaluation report is revised to add a manufacturing location that has been qualified and is under the inspection program with inspections by ICC-ES, since the *Structural Insulated Panels* are currently not manufactured under this evaluation report.

**6.0 EVIDENCE SUBMITTED**

Reports of axial load, transverse load, and in-plane racking shear tests of panels in accordance with the general guidelines of ASTM E72.

**7.0 IDENTIFICATION**

- 7.1 *Structural Insulated Panels* are not to be labeled with this evaluation report number, since there is no product manufacturing as described in Section 5.4
- 7.2 The report holder’s contact information is the following:

**GENERAL PANEL CORPORATION**  
**POST OFFICE BOX 279**  
**2604 SUNSET DRIVE**  
**GRENADA, MISSISSIPPI 38901**  
[www.generalpanel.com](http://www.generalpanel.com)

**TABLE 1—BASIC PROPERTIES<sup>1,2</sup>**

PROPERTY	STRONG-AXIS BENDING
Allowable Tensile Stress, $F_t$ (psi)	495
Allowable Compressive Stress, $F_c$ (psi)	345
Elastic Modulus (Bending), $E_b$ (psi)	1032000
Shear Modulus, $G$ (psi)	357
Allowable Core Shear Stress, $F_v$ (psi)	3.3
Reference Depth, $h_o$ (inch)	6.5
Shear Depth Factor Exponent, $m$	0.88

For SI: 1 inch = 25.4 mm; 1 psi = 6.8948 kPa.

<sup>1</sup> All properties are based on a minimum panel width of 24 inches.

<sup>2</sup> Refer to *Structural Insulated Panel (SIP) Engineering Design Guide (SIP-EDG01-19)* for details on engineered design using basic panel properties.

**TABLE 2—SECTION PROPERTIES**

PANEL THICKNESS $h$ (inches)	CORE THICKNESS $c$ (inches)	DEAD WEIGHT $w_d$ (psf)	FACING AREA $A_f$ (inches <sup>2</sup> /foot)	SHEAR AREA $A_v$ (inches <sup>2</sup> /foot)	MOMENT OF INERTIA $I$ (inches <sup>4</sup> /foot)	SECTION MODULUS $S$ (inches <sup>3</sup> /foot)	RADIUS OF GYRATION $r$ (inches)	CENTROID-TO-FACING DISTANCE $y_c$ (inches)
6.50	5.63	3.3	10.5	72.8	96.5	29.7	3.03	3.25
8.25	7.38	3.4	10.5	93.8	160.2	38.8	3.91	4.13
10.25	9.38	3.6	10.5	117.8	252.7	49.3	4.91	5.13

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 psf = 0.0479 kPa.

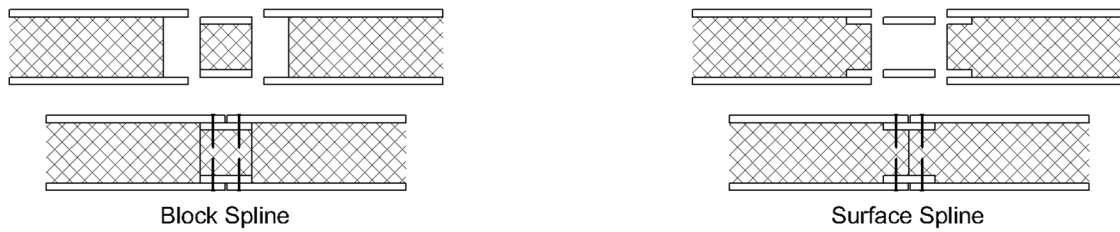


FIGURE 1—TYPES OF SPLINES

TABLE 3—ALLOWABLE UNIFORM TRANSVERSE LOADS (psf)<sup>1, 3, 4</sup>

PANEL LENGTH (feet)	6 1/2-INCH-THICK SIP			8 1/4-INCH-THICK SIP			10 1/4-INCH-THICK SIP		
	Deflection Limit <sup>2</sup>			Deflection Limit <sup>2</sup>			Deflection Limit <sup>2</sup>		
	L/180	L/240	L/360	L/180	L/240	L/360	L/180	L/240	L/360
8	72.0	72.0	57.7	78.7	78.7	77.8	79.5	79.5	79.5
10	55.4	55.4	41.5	59.9	59.9	57.1	63.6	63.6	63.6
12	45.0	45.0	30.8	48.4	48.4	43.1	51.8	51.8	51.8
14	37.9	35.0	23.3	40.5	40.5	33.3	43.2	43.2	43.2
16	32.7	27.0	18.0	34.9	34.9	26.2	37.1	37.1	36.1
18	28.3	21.2	14.1	30.6	30.6	20.8	32.4	32.4	29.1
20	22.5	16.9	11.3	27.3	25.2	16.8	28.9	28.9	23.7

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 psf = 0.0479 kPa.

<sup>1</sup>Table values assume a simply supported panel with 1 1/2 inches (38.1 mm) of continuous bearing on facing at supports ( $C_v = 1.0$ ) with solid wood plates at bearing locations. Values do not include the dead weight of the panel.

<sup>2</sup>Deflection limit shall be selected by building designer based on the serviceability requirements of the structure and the requirements of adopted building code. Values are based on loads of short duration only and do not consider effects of creep.

<sup>3</sup>Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load.

<sup>4</sup>For wall panel capacities utilizing a zero bearing configuration, shown in Figure 2, multiply the allowable uniform load shown by  $C_v = 0.77$ . Required connections must be made on each side of the panel. Fasteners shall be equivalent to 0.113-inch x 2 3/8-inch (2.9 mm x 60.3 mm) nails spaced 6 inches (152 mm) on center into dimensional or engineered lumber having an equivalent specific gravity of 0.42 or greater.

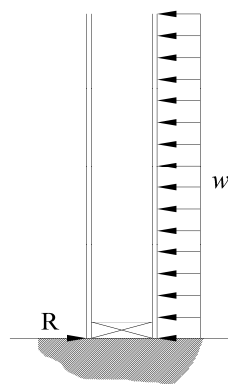


FIGURE 2—ZERO BEARING SUPPORT

**TABLE 4—ALLOWABLE AXIAL LOADS (plf)<sup>1,2,3,4</sup>**

LATERAL BRACE SPACING (feet)	OVERALL SIP PANEL THICKNESS		
	6½ inches	8¼ inches	10¼ inches
8	2540	2590	2620
10	2500	2570	2610
12	2450	2540	2590
14	2390	2500	2570
16	2320	2460	2540
18	2240	2420	2510
20	2150	2360	2480

For **SI**: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 plf = 14.6 N/m.

<sup>1</sup>Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load.

<sup>2</sup>All values are for normal duration and may not be increased for other durations.

<sup>3</sup>Axial loads shall be applied concentrically to the top of the panel through repetitive members spaced not more than 24 inches (609.6 mm) on center. Such members shall be fastened to a rim board or similar member to distribute load along the top of the panel.

<sup>4</sup>The ends of both facings must bear on the supporting foundation or structure to achieve the tabulated axial loads.

**TABLE 5—ALLOWABLE IN-PLANE RACKING SHEAR STRENGTH FOR SIP SHEAR WALLS (WIND AND SEISMIC LOADS IN SEISMIC DESIGN CATEGORIES A, B AND C)<sup>1</sup>**

SPLINE TYPE <sup>3</sup>	OVERALL SIP PANEL THICKNESS (inches)	MINIMUM FACING CONNECTIONS <sup>4</sup>			ALLOWABLE SHEAR LOAD (plf)
		Chord <sup>2,3</sup>	Plate <sup>2</sup>	Spline <sup>3</sup>	
Block or Surface Spline	6½	0.113"x 2¾" nails, 6" on center	0.113"x 2¾" nails, 6" on center	0.113"x 2¾" nails, 6" on center	250
	10¼	0.113"x 2¾" nails, 6" on center	0.113"x 2¾" nails, 6" on center	0.113"x 2¾" nails, 6" on center	265

For **SI**: 1 inch = 25.4 mm; 1 plf = 14.6 N/m.

<sup>1</sup>Maximum shear wall dimension ratio shall not exceed 2:1 (height:width) for resisting wind or seismic loads.

<sup>2</sup>Chords, hold downs and connection to other structure elements must be designed by a registered design professional in accordance with accepted engineering practice.

<sup>3</sup>Spline type at interior panel-to-panel joints only; solid chord members are required at each end of each shear wall segment.

<sup>4</sup>Required connections must be made at each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity of 0.42 or greater.