ANSI/APA PRS-610.1
Standard for Performance-Rated Structural Insulated Panels in Wall Applications

Committee Ballot #1

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ANSI/APA PRS-610.1
Standard for Performance-Rated Structural Insulated Panels in Wall Applications

1. Scope

1.1 The PRS-610.1 performance-rated structural insulated panels (SIPs) are structural sandwich panels consisting of a foam plastic insulation core securely bonded in full surface between two structural facings made of wood structural panels.

1.2 The PRS-610.1 performance-rated SIPs are intended for use as a structural element in above-grade wall applications. This standard covers SIPs intended for wall applications in Seismic Design Categories C or lower or a basic speed of 130 mph or less, as defined in ASCE 7.

Note 1: PRS-610.2 and 610.3, which are being developed, will cover roof and floor applications, respectively.

1.3 Unless otherwise qualified, the facings used for the PRS-610.1 performance-rated SIPs shall have the strength axis oriented in the vertical direction of the wall and the gravity loads are applied to both facings at the top of the SIPs. For this standard, the facing materials on both exterior layers of the SIP shall be of the same type and thickness. Wall penetrations of SIPs other than the precut holes for electrical boxes are beyond the scope of this standard.

1.4 When used as lintels, PRS-610.1 performance-rated SIPs shall be applied with the strength axis of the facing materials parallel to the span direction. Core joints of SIPs shall not occur between supports.

1.5 PRS-610.1 performance-rated SIPs shall be identified and installed in accordance with this standard, the manufacturer-published installation instructions, and the building code requirements.

1.6 The PRS-610.1 Performance-rated SIPs are intended for use in dry-service conditions where the average moisture content of sawn lumber is less than 16% and the panels are protected with an appropriate weather-resistive exterior wall covering (i.e., with weather-resistive covering and cladding in accordance with the code).

1.7 This standard provides minimum properties for the performance-rated SIPs. To qualify for marking as a PRS-610.1 performance-rated SIP, the SIP product shall demonstrate conformance to the qualification and quality assurance requirements set forth in this standard. The installation requirements shall be considered as part of the qualification.

1.8 The annex contained in this standard is mandatory and notes are non-mandatory. This standard incorporates the U.S. customary units as well as the International System of Units (SI). The values given in the U.S. customary units are the standard and the SI values given in parentheses are for information only.

2. Referenced Documents

This standard incorporates dated references. These normative references are cited at the appropriate places in the text. Subsequent amendments or revisions to these references apply to this standard only when incorporated into this standard by amendments or revisions.

2.1 ASTM Standards:

C 203-05a Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
C 272-01 (2007) Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
C 273-07a Test Method for Shear Properties of Sandwich Core Materials
C 297-04 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
C 393/C 393M-06 Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure
C 578-07 Specification for Rigid, Cellular Polystyrene Thermal Insulation
D 1621-04a Test Method for Compressive Properties of Rigid Cellular Plastics
D 1622-03 Test Method for Apparent Density of Rigid Cellular Plastics
D 1623-03 Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 2915-03 Practice for Evaluating Allowable Properties for Grades of Structural Lumber
D 4761-05 Test Methods for Mechanical Properties of Lumber and Wood-Base Structural Material
D 7446-09 Specification for Structural Insulated Panel (SIP) Adhesive for Laminating Oriented Strand Board (OSB) to Rigid Cellular Polystyrene Thermal Insulation Core Materials
E 72-05 Test Methods of Conducting Strength Tests of Panels for Building Construction
E 84-07a Test Method for Surface Burning Characteristics of Building Materials
E 96-05 Test Methods for Water Vapor Transmission of Materials
E 1803-06 Test Methods for Determining Structural Capacities of Insulated Panels
E 2126-07 Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Walls for Buildings
F 1667-05 Specification for Driven Fasteners: Nails, Spikes, and Staples

2.2 Other Standards and Referenced Documents:

ASCE 7-05 Minimum Design Loads for Buildings and Other Structures
CAN/ULC-S102-07 Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
CAN/ULC-102.2-07 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
CAN/ULC-S701-05, Thermal Insulation, Polystyrene Boards and Pipe Covering
CSA O121-M1978 (R2003) Canadian Douglas Fir Plywood
CSA O151-04 Canadian Softwood Plywood
CSA O325-07 Construction Sheathing
CSA O437-93 (R2006) Standards for OSB and Waferboard

ICC-ES AC05 (2005) Acceptance Criteria for Sandwich Panel Adhesives
ISO/IEC 17020-1998 General Criteria for the Operation of Various Types of Bodies Performing Inspection
ISO/IEC 17025-2005 General Requirements for the Competence of Testing and Calibration Laboratories
PS 1-07 Structural Plywood
PS 2-04 Performance Standard for Wood-Based Structural-Use Panels
PS 20-05 American Softwood Lumber Standard
UL 723 (2003) Test for Surface Burning Characteristics of Building Materials

3. Terminology

3.1 Definitions -- See the referenced documents for definitions of terms used in this standard.

3.2 Description of terms specific to this standard:

3.2.1 Approved Agency – An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved (see Qualified Inspection Agency and Qualified Testing Agency) by regulatory bodies.

3.2.2 Characteristic Value – The structural property estimate, typically a population mean for stiffness properties or a tolerance limit (5^{th} percentile with 75% confidence) for strength properties, as estimated from the test data that is representative of the population being sampled.

3.2.3 Core – The light-weight middle section of the SIP composed of foam plastic insulation, which provides the link between the two structural panel facings.

3.2.4 Facing – The wood structural panel material that forms both exterior layers of the SIP.

3.2.5 Flame Spread Index – A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84, UL 723, CAN/ULC-S102 or CAN/ULC-S102.2.

3.2.6 Lintel – A structural element acting as a header supporting gravity loads above a door or window opening.

3.2.7 Oriented Strand Board (OSB) – A performance-rated structural panel meeting DOC PS 2, CSA O325, or CSA O437, and manufactured to meet requirements specified in this standard.

3.2.8 Plywood – A conventional all-veneer panel meeting DOC PS 1, CSA O121, or CSA O151, and manufactured to meet requirements specified in this standard.

3.2.9 Qualified Inspection Agency – An agency meeting the following requirements:

(a) Has trained personnel to verify that the grading, measuring, species, construction, bonding, workmanship, and other characteristics of the products as determined by inspection comply with all applicable requirements specified in this standard,
(b) Has procedures to be followed by its personnel in performance of the inspection,
(c) Has no financial interest in, or is not financially dependent upon, any single company manufacturing the product being inspected,
(d) Is not owned, operated, or controlled by any such company, and
(e) Is accredited under ISO/IEC 17020.

3.2.10 Qualified Testing Agency – An agency meeting the following requirements:
(a) Has access to the facilities and trained technical personnel to conduct testing on the characteristics of the products by sampling and testing in compliance with all applicable requirements specified in this standard,
(b) Has procedures to be followed by its personnel in performance of the testing,
(c) Has no financial interest in, or is not financially dependent upon, any single company manufacturing the product being tested,
(d) Is not owned, operated, or controlled by any such company, and
(e) Is accredited under ISO/IEC 17025.

3.2.11 R-Value, Thermal Resistance – The inverse of the time rate of heat flow through a building thermal envelope element for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \cdot ft^2 \cdot ^\circ F/Btu$).

3.2.12 Smoke-Developed Index – A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E 84, UL 723, CAN/ULC-S102 or CAN/ULC-S102.2.

3.2.13 Spline – A full height longitudinal connection between two walls.

3.2.14 Spline, Block – A pair of wood structural panels of the same material as the structural insulated panel facings bonded with the same foam core to form a block with overall thickness equal to the core thickness of the two structural insulated panels to be connected (see Figure 1).

Note 2: The typical width of the spline is 3 inches (76 mm).

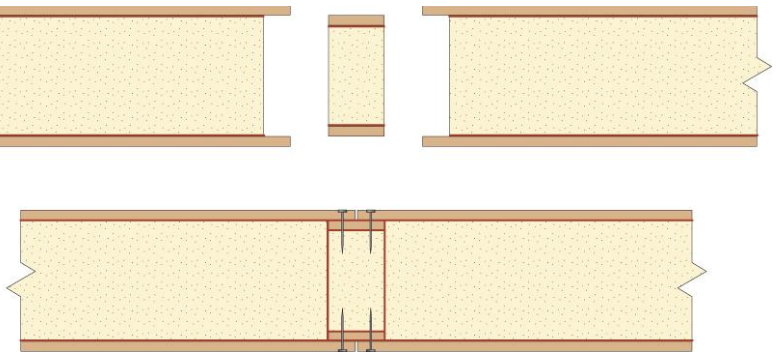

Figure 1. Block Spline

3.2.15 Spline, Surface – A strip of wood structural panel of the same material as the structural insulated panel facings that fits into a groove cut into the longitudinal edges of the two structural insulated panels to be joined (see Figure 2).

Note 3: The typical width of the spline is 3 inches (76 mm).

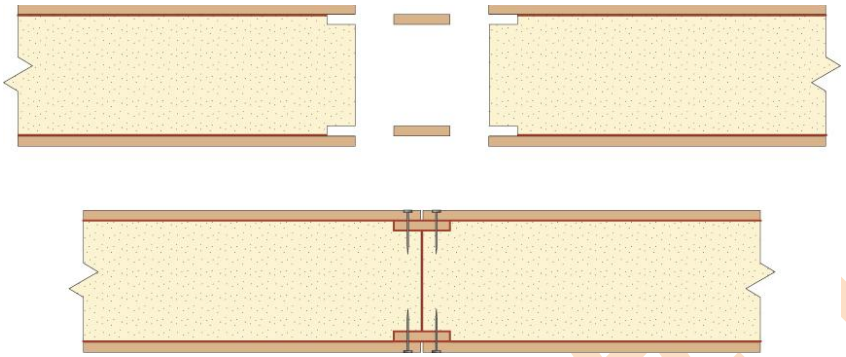

Figure 2. Surface Spline

3.2.16 Structural Insulated Panel (SIP) – A structural sandwich panel which consists of foam plastic insulation core securely bonded between two structural facings made of wood structural panels.

3.2.17 Wood Structural Panels – A panel product composed of oriented strand board (OSB) or plywood in conformance with the performance requirements of one or more of the end-uses specified in DOC PS1 , DOC PS2, CSA O121, CSA O151, CSA O325, or CSA O437, and the requirements specified in this standard.

4. SIP Wall Systems

SIPs for above grade wall construction shall comply with the shapes and cross section shown Figures 3 and 4, and shall have panel thickness as specified in Section 4.1. The strength axis of the facings shall be in the vertical direction.

Figure 3. Example of a SIP Wall Panel (adhesive is not required with the polyurethane core)

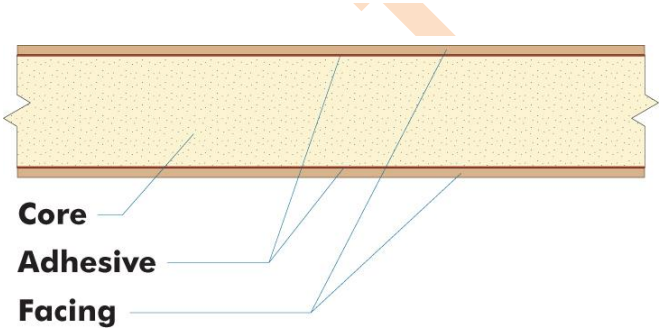

Figure 4. Example of a Cross Section of SIP (adhesive is not required with the polyurethane core)

4.1 SIP Panel Thicknesses

The PRS-610.1 performance-rated SIPs shall have a panel thickness of 4-1/2 or 6-1/2 inches (114 or 165 mm) subjected to the tolerances specified in Section 4.2.

4.2 SIP Panel Tolerances

The tolerances for the SIPs at the time of manufacture shall not exceed the following:

SIP Panel Thickness – Plus or minus 1/8 inch (3.2 mm)
SIP Panel Width – Plus or minus 1/8 inch (3.2 mm)
SIP Panel Length – Plus or minus 1/4 inch (6.4 mm)
SIP Panel Squareness – 1/64 inch per lineal foot (1.3 mm per lineal meter) measured along the diagonals
SIP Panel Straightness – 1/16 inch (1.6 mm) of panel edge measured by a straight line drawn from one corner to the adjacent corner

To ensure equal bearing on both facings, the facings of the SIP panel shall be aligned within 1/32 inch (0.8 mm).

5. Performance Criteria and Requirements

The PRS-610.1 performance-rated SIPs shall be qualified in accordance with Method A or Method B prescribed in this standard. Method A, as prescribed in Section 5.1 is based on prescriptive requirements for components of SIPs and confirmed by limited full-scale SIP tests. Method B, prescribed in Section 5.2, is based on full-scale empirical SIP tests.

5.1 Method A (Prescriptive Component Method)

5.1.1 Component Requirements

Requirements contained in this section are applicable to SIP panels that are qualified based on prescriptive component requirements specified in this section. For SIP panels manufactured with components that are not in compliance with the requirements specified in this section, the SIP qualification shall be in accordance with the Method B prescribed in Section 5.2.

5.1.2 Core Materials

The PRS-610.1 performance-rated SIPs shall be produced using a foam plastic insulation core material meeting the requirements specified in this section.

5.1.2.1 The core material shall meet the following requirements:

a) Polystyrene foam complying with ASTM C 578 Type I, or
b) Polyurethane foam meeting the physical properties shown in Table 1.

When qualified in accordance with Method A, core joints shall not be permitted.

Table 1. Properties for Polyurethane Foam Insulation Used as the Core of SIPs

Physical Property	Polyurethane
Minimum apparent overall core density (ASTM D 1622)	2.2 lb/ft^3
Minimum apparent core density[(a)] (ASTM D 1622)	1.8 lb/ft^3
Compressive resistance at yield or 10% deformation, whichever occurs first, (ASTM D 1621)	19 psi (perp to rise)
Minimum flexural strength (ASTM C 203)	30 psi
Minimum tensile strength (ASTM D 1623)	35 psi
Minimum shear strength (ASTM C 273)	25 psi
Minimum substrate adhesion (ASTM D 1623)	22 psi
Maximum water vapor permeance of 1.00-in. thickness (ASTM E 96)	2.3 perm
Maximum water absorption by total immersion (ASTM C 272)	4.3 % (volume)
Maximum change in dimensions (ASTM D 2126, 7 days at 158°F/100 % humidity and 7 days at -20°F)	2 %

For SI: 1 inch = 25.4 mm, 1 lbf/ft^3 = 16.0 kg/m^3, 1 psi = 6.9 kPa

[(a)] As measured on the center 1-inch of the core thickness.

5.1.2.2 Core materials shall have a thickness of 3-5/8 or 5-5/8 inches (92 or 143 mm) with a flame spread index of not more than 75 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E 84, UL 723, CAN/ULC-S102 or CAN/ULC-S102.2.

5.1.2.3 Core materials shall bear a label containing manufacturer identification, flame spread index, smoke-developed index, and name, logo or identification of an approved agency certifying the foam materials.

5.1.3 Facing Materials

Facing materials shall be produced using 7/16-inch (11-mm) thick wood structural panels as defined in Section 3.2.17, and shall meet the properties specified in Table 2. Wood structural panels shall be identified by a grade mark or letter of conformance issued by a qualified inspection agency, signifying the conformance with Table 2 of this standard

Table 2. Properties for Wood Structural Panel Facing Materials[(a)]

Flatwise Bending Stiffness[(b)] (lbf-in.^{2}/ft)		Flatwise Bending Strength[(c)] (lbf-in./ft)		Tension[(c)] (lbf/ft)		Density[(b,d)] (pcf)
Along	Across	Along	Across	Along	Across	
55,600	16,500	1,040	460	7,450	5,800	34

For SI: 1 lbf-in.^{2}/ft = 9.4 N-mm^2/mm, 1 lbf-in./ft = 0.37 N-mm/mm, 1 lbf/ft = 0.015 N/mm, 1 lbf/ft^3 = 16.0 kg/m^3

[(a)] Tested in accordance with Annex A1 of this standard.
[(b)] Mean test value.
[(c)] Characteristic test value (5th percentile with 75% confidence).
[(d)] Based on oven-dry weight and oven-dry volume.

5.1.4 Adhesives

Laminating adhesives shall be required to bond the core to facings of a SIP during manufacture unless the SIP panels are manufactured with a foam-in-place component.

The PRS-610.1 performance-rated SIPs shall be produced using adhesives specifically intended for the lamination of SIPs in full surface conforming to the requirements of Type II Class 2 in ICC-ES AC05 or ASTM D 7446, and the qualification requirements specified in this standard.

5.1.4.1 Each container of adhesive qualified under this standard and used in manufacturing SIPs shall bear a label with the adhesive manufacturer identification (such as name or logo), adhesive name and type, and the name or logo of the approved agency certifying the adhesive.

5.1.4.2 Foam-in-place materials used to simultaneously manufacture the core and provide the lamination of the foam core to the facing materials shall be evaluated in accordance with Sections 6.8 and 6.9 for compliance with the requirements specified therein.

5.1.5 Lumber

The top and bottom plates of SIP assemblies shall be manufactured using lumber conforming to the requirements of PS 20 and bearing the trademark and grade of a lumber grading agency recognized by American Lumber Standards Committee (ALSC) or Canadian Lumber Standards Accreditation Board (CLSAB), provided that the wood species/grade meets or exceeds the mechanical properties and specific gravity of No. 2 SPF.

5.1.6 Fasteners

Nails used for SIPs assemblies shall be 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm) or galvanized box (0.113 x 2-1/2 inches or 2.87 x 63.5 mm) nails meeting the requirements of ASTM F 1667. The use of screws in lieu of nails for SIP assemblies in end-use applications shall be based on documented performance data and reports.

5.1.7 Full-Scale SIP Confirmation Test Requirements

A limited number of full-scale SIP confirmation tests, as listed in Table 3, are required to verify the performance of SIP panels. Confirmation test results for each test type shall meet the applicable requirements specified in Table 4 and Section 6.

Table 3. Full-Scale SIP Confirmation Test Requirements

Requirements	Referenced section of this standard
SIP Transverse Load	6.3
SIP Durability	6.6
SIP Bond Strength	6.7

5.1.8 SIP Flatwise Bending Test Requirements

For period re-evaluation purposes, the characteristic (5^{th} percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIP panels shall be established during qualification in accordance with ASTM C 393 using a minimum of 20 specimens of 4-1/2 inches (114 mm) in thickness, 6 inches (152 mm) in width, and 4 feet (1219 mm) in length, and tested at a 45-inch (1143-mm) span on center.

5.2 Method B (Empirical Full-Scale SIP Test Method)

The PRS-610.1 performance-rated SIPs are permitted to be qualified based on empirical full-scale SIP tests specified in this section. When using this qualification method, core materials shall meet the requirements specified in Sections 5.1.2.2 and 5.1.2.3, the adhesives shall meet the requirements specified in Sections 5.1.4, and the core and facing materials shall be characterized in accordance with ASTM C 578 or Table 1, and Annex A1, respectively. Lumber and fasteners used for qualification under this method shall be documented and specified for end-use applications.

Note 4: The core and facing material characterization tests are intended for the development of the on-going quality control values and there are no minimum property requirements for the core and wood structural panel facing materials when SIPs are qualified using Method B.

5.2.1 SIP panels shall meet or exceed the minimum test values for each property listed in Table 4 when tested in accordance with the test methods provided in Section 6.

Table 4. Properties for PRS-610.1 Performance-Rated SIPs in Wall Applications

Properties	SIP Dimension	Minimum Test Value[a]		
		Ultimate Load	Load at Deformation Limit	
			Def. Limit (in.)	Test Load
Axial Load Capacity	4-1/2 in. x 8 ft	9,600 lbf/ft	0.125	3,200 lbf/ft
	4-1/2 in. x 10 ft	9,300 lbf/ft	0.125	3,100 lbf/ft
	6-1/2 in. x 8 ft	9,600 lbf/ft	0.125	3,200 lbf/ft
	6-1/2 in. x 10 ft	9,300 lbf/ft	0.125	3,100 lbf/ft
Transverse Load Capacity	4-1/2 in. x 8 ft	114 lbf/ft^2	0.400[c]	38 lbf/ft^2
	4-1/2 in. x 10 ft	81 lbf/ft^2	0.500[c]	27 lbf/ft^2
	6-1/2 in. x 8 ft	114 lbf/ft^2	0.400[c]	38 lbf/ft^2
	6-1/2 in. x 10 ft	86 lbf/ft^2	0.500[c]	29 lbf/ft^2
Racking Resistance	--[b]	945 lbf/ft	0.200	315 lbf/ft

For SI: 1 in. = 25.4 mm, 1 ft = 304.8 mm, 1 lbf/ft = 0.015 N/mm, 1 lbf/ft^2 =47.9 Pa

[a] The tabulated values are average test values and not intended for design use. The average test value shall meet the minimum requirements for both maximum load and the load at the specified deformation limit.

[b] Based on 8d common (0.131 x 2-1/2 in. or 3.33 x 63.5 mm) nails at 6 in. (152 mm) oc.

[c] Based on H/240 where H is the wall height in inches.

5.2.2 SIP panels shall meet or exceed the minimum test values for lintel specified in Table 5 when tested in accordance with the test methods provided in Section 6.

Table 5. Lintel Load Capacities for PRS-610.1 Performance-Rated SIPs

Property	Span (ft)	Minimum Test Value[a]				
		Ultimate Load (lbf/ft)	Load at Deflection Limit			
			Span/360		Span/600	
			Def. Limit (in.)	Test Load (lbf/ft)	Def. Limit (in.)	Test Load (lbf/ft)
Lintel Load Capacity	2	3,180	0.067	1,060	0.040	630
	4	1,620	0.133	540	0.080	325
	6	900	0.200	300	0.120	180
	8	525	0.267	175	0.160	105

For SI: 1 in. = 25.4 mm, 1 ft = 304.8 mm, 1 lbf/ft = 0.015 N/mm

[a] For SIP thickness of 4-1/2 or 6-1/2 inches (114 or 165 mm).

5.2.3 SIP panels shall meet or exceed the durability and bond strength requirements specified in Sections 6.6 and 6.7 when tested in accordance with the test methods provided in Section 6.

5.2.4 For period re-evaluation purposes, the characteristic (5th percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIP panels shall be established during qualification in accordance with Section 5.1.8.

6. Qualification Test Methods for SIPs

6.1 General

6.1.1 Sampling procedures, number of samples, test methods, and data analyses for the SIP qualification shall conform to the principles set forth in the referenced standard of each qualification test method unless specifically noted in this section.

6.1.2 Specimens shall be sampled from representative production by the qualified inspection or test agency. The specimens shall include electrical chases of 1-1/2 inches (38 mm) in diameter and 4-inch by 4-inch (102 mm by 102 mm) electrical boxes as shown in Figure 5.

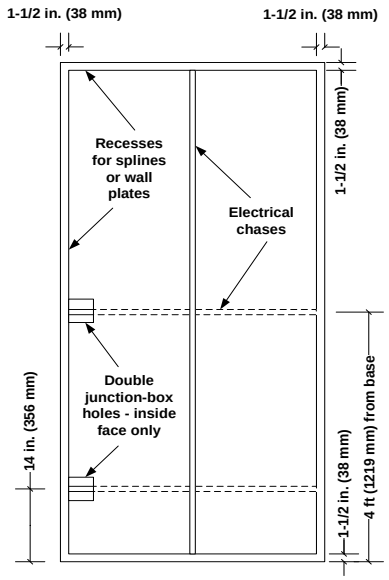

Figure 5. A Typical SIP Panel

6.1.3 Parameters, such as core, facing, adhesives, fasteners, lumber, splines, SIP configuration, and processing details, shall be identified as part of the qualification procedures. Changes in these parameters shall require evaluation by the qualified inspection agency.

6.1.4 Core joints shall not be allowed unless specifically qualified.

6.1.5 The SIP assemblies shall be tested at the as-received moisture conditions. The moisture content and specific gravity of the representative facing materials and lumber shall be reported.

6.2 Axial Load Capacity

6.2.1 Axial load capacity of SIPs shall be qualified in accordance with ASTM E 1803 except that the wall panel shall be loaded with an eccentricity of 1/6 the panel thickness to the interior panel. The test setup shall accommodate rotation of the test specimen at the top of the wall. The electrical chases in the core and the pre-cut holes for electrical boxes on the facing materials shall be included in the test assembly. Splines shall not be used on the edge parallel to the applied axial load of the SIP specimen.

6.2.2 A minimum of 3 full-size (4-ft or 1219-mm wide) assemblies of each SIP configuration (wall thickness and height) shall be tested.

6.2.3 Both the ultimate test load and the load at the deflection limit specified in Table 4 shall be reported.

6.2.4 Qualification test results shall conform to the test values specified in Table 4.

6.3 Transverse Load Capacity

6.3.1 Transverse load capacity of SIPs shall be qualified in accordance with ASTM E 1803 except that the loading shall be by uniform loading or third point loading. The bearing of the SIP specimen at the support shall simulate the end-use conditions. The electrical chases in the core and the pre-cut holes for electrical boxes on the facing materials shall be included in the test assembly and placed on the tension side of the test setup. Splines shall not be used along the test span of the SIP specimen.

6.3.2 A minimum of 3 full-size (4-ft or 1219-mm wide) assemblies of each SIP configuration (wall thickness and height) shall be tested.

6.3.3 Both the ultimate test load and the load at the deflection limit specified in Table 4 shall be reported.

6.3.4 Qualification test results shall conform to the test values specified in Table 4.

6.4 Racking Resistance

6.4.1 Racking resistance of SIPs shall be qualified in accordance with ASTM E 1803 except that the maximum stiffness of the load beam shall not exceed 330,000 kips-in.^{2} (947 kN-m^2), as specified in ASTM E 2126 (see Note 5 below). Splines meeting the requirements shown in Figures 1 and 2 shall be used in the SIP assembly. End posts shall be permitted to be installed. The bearing of the SIP specimen at the top and bottom plates shall simulate the end-use conditions. The electrical chases in the core and the pre-cut holes for electric boxes on the facing materials shall be included in the test assembly. For the purpose of this qualification, the sealant that may be used in spline, panel-to-top plate, panel-to-bottom plate, or panel to end post joints of the test specimen shall not be used.

Note 5: The selected loading beam stiffness corresponds with an HSS 5 x 3 x 1/4-in. (127 x 76 x 6.4-mm) steel section.

6.4.2 A minimum of 3 full-size (8 ft x 8 ft or 2438 x 2438 mm) assemblies of each SIP configuration (wall thickness) shall be tested.

6.4.3 Both the ultimate test load and the load at the deflection limit specified in Table 4 shall be reported.

6.4.4 Qualification test results shall conform to the test values specified in Table 4.

6.5 Lintel Load Capacity

6.5.1 Lintel load capacity of SIPs shall be qualified in accordance with this section.

6.5.2 For the purpose of this standard, the lintel depth of 12 inches (305 mm) is considered as the standard depth and the results obtained from the qualification are applicable to lintel depths of 12 inches (305 mm) or deeper.

6.5.3 A minimum of 3 specimens for each combination of lintel thickness and length shall be prepared for testing. The lintel length shall be based on those shown in Table 4. Each specimen for each combination shall be taken from a separate SIP panel to permit the assessment of the variability of the test results.

6.5.4 The SIP lintels shall be cut out from large SIP panels and fabricated with 2x SPF No. 2 Grade lumber attached to the top and bottom of the lintel with nails. The long edges (lintel length) of the core material in each specimen shall be routed out to a depth of 1-1/2 inches (38 mm) to accommodate the 2x lumber. The short edge of the specimens shall not include the 2x lumber and the core material shall be kept flush with the ends of the specimen. The 2x lumber shall run the full length of the specimen. The bearing length at each reaction shall be 1-1/2 inches (38 mm).

6.5.5 Edgewise bending tests shall be conducted in accordance with the third-point loading method of Section 18 of ASTM D 4761 except that the facings of the SIP specimens shall not bear on the supports of the test setup and the bearing length shall not exceed 1-1/2 inches (38 mm). Load and deflection data shall be continuously recorded until failure.

6.5.6 Test results from each specimen shall be reported to include the maximum test load and the load at the deflection limit of L/360, where L is the lintel span in inches.

6.5.7 Qualification test results shall conform to the test values specified in Table 4.

6.6 Durability of SIP Panels

6.6.1 Durability of SIPs shall be qualified by comparing the performance of SIPs between as-received and wet-and-redry conditions per Section 15.3 of ASTM E 72 except that the specimen shall be re-dried at the final (3rd) cycle and tested when the assembly is re-dried.

6.6.2 One set (a minimum of 3 assemblies) of 4-1/2 inches x 8 feet (114 x 2438 mm) SIP assemblies that are matched (side- or end-matched for larger dimension SIPs, or matched facing and core materials from the same production) shall be tested for racking, axial load, and transverse load for dry and wet-redry.

6.6.3 Durability of SIPs is satisfied when the results of redry assemblies is no less than 75% of that of dry (as-received) assemblies on the average result of each assembly set.

6.7 Gluebond Strength

6.7.1 The gluebond strength between facing and core shall be in compliance with ASTM D 7446.

6.8 Durability of Foamed-In-Place Core Materials

6.8.1 Construction – SIP assemblies shall be constructed using Douglas fir facings having a specific gravity range of 0.45 and 0.55 with a moisture content between 10 to 12 percent. The assemblies shall be sized so that the core material shall measure 1-7/8 in. (48 mm) in thickness. The apparent overall panel density shall match the value listed in Table 1.

6.8.2 Shear specimens – Fifteen (15) shear test specimens shall be cut from the panel matching Figure 6.

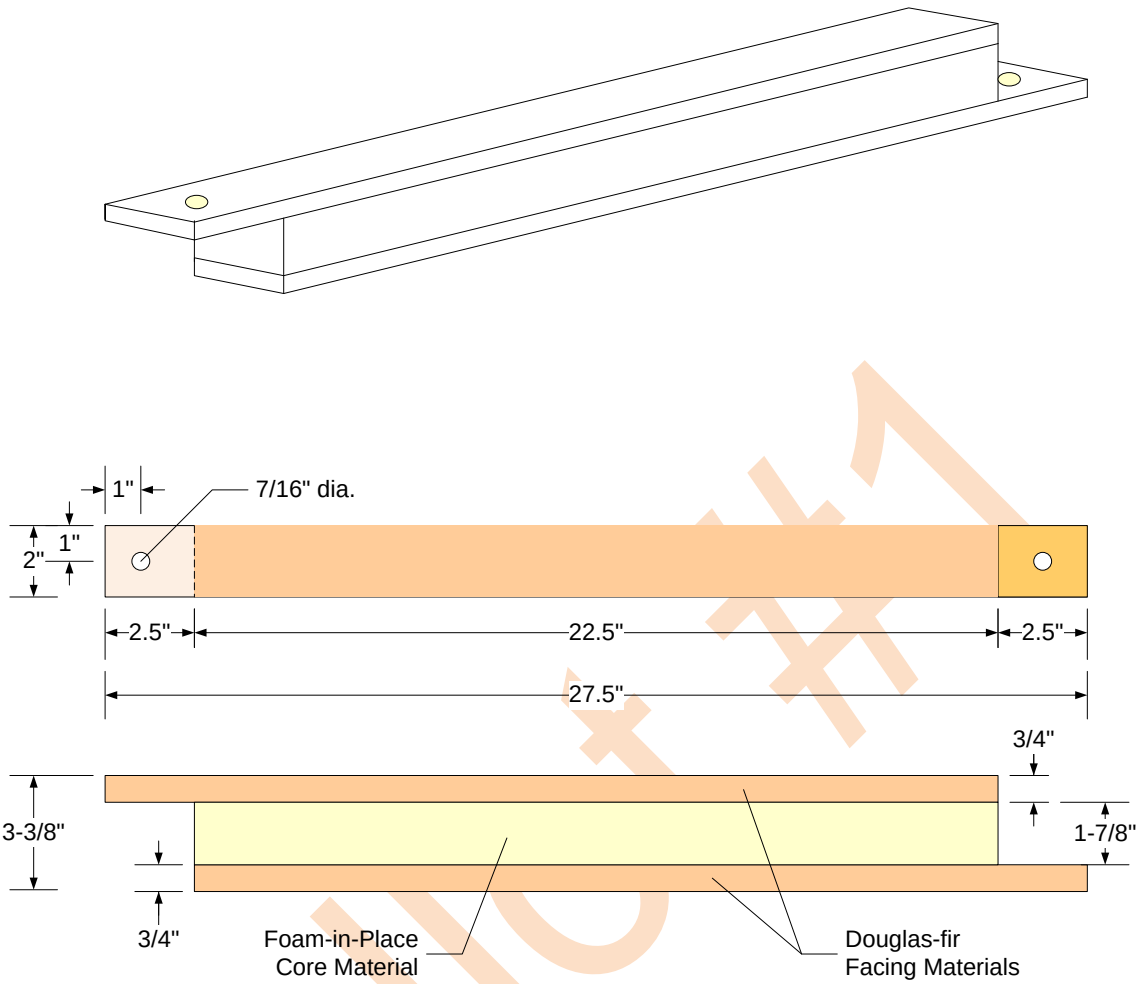

Figure 6. Specimen for the Durability of Foamed-In-Place Cores (1 inch = 25.4 mm)

6.8.3 Bond specimens – Fifteen (15) 3 x 3 x 3-3/8-in. (76 x 76 x 86-mm) bond test specimens shall be cut from the panel.

6.8.4 Conditioning – Five (5) of each of the shear and bond specimens shall be conditioned in accordance with Section 10.6 of ASTM D 14. Five (5) of each of the shear and bond specimens shall be aged in accordance with Table 1 of ASTM D 7446. Five (5) of each of the shear and bond specimens shall be subjected to the soak/dry cycle in accordance with Table 1 of ASTM D 7446.

6.8.5 Testing

6.8.5.1 Shear testing – Shear testing shall be performed in accordance with ASTM C 273. Load shall be applied through the holes shown in Figure 6.

6.8.5.2 Bond testing – Bond testing shall be performed in accordance with ASTM C 297.

6.8.6 Requirements – Shear and bond test results of accelerated aged and soaked/dried specimens shall be no less than 80% of the results of conditioned-only control specimens.

6.9 Qualification of Foamed-In-Place Core with Facings

6.9.1 Test Method – Qualification of foam-in-place core with facings shall be performed in accordance with Section 14 of ASTM D 7446.

6.9.2 Requirements -- Results of shear tests shall meet or exceed the minimum core shear strength as listed in Table 1. Results of bond tests shall meet or exceed the substrate adhesion core strength as listed in Table 1

7. Test Results Evaluation

Upon completion of qualification tests, all test results shall be evaluated and documented by a qualified testing agency in a test report.

8. Trademarking and Certification

8.1 SIP panels represented as conforming to this standard shall bear the stamp of a qualified inspection or testing agency which (1) inspects the manufacture (with adequate sampling, testing and examination for quality) or (2) has tested a randomized sampling of the finished panels in the shipment being certified for conformance with this standard.

8.2 Quality assurance of the PRS-610.1 performance-rated SIPs shall follow the in-plant quality manual accepted by a qualified inspection agency. As a minimum, gluebond tension tests shall be conducted on the production shift basis in accordance with ASTM C 297. The minimum gluebond strength shall be in compliance with ASTM D 7446.

8.3 Periodic re-evaluation of the PRS-610.1 SIPs shall be conducted in accordance with the requirements of the qualified inspection agency. As a minimum, flatwise bending tests on SIP panels shall be conducted annually in accordance with Section 5.1.8 or 5.2.4. The characteristic (5^{th} percentile with 75% confidence) bending strength and average stiffness of the SIP specimens shall be compared with the properties established during qualification.

8.4 Product Labeling

8.4.1 All PRS-610.1 performance-based SIPs shall be identified with a label or certificate of inspection issued by a qualified inspection agency. The product label shall meet the following minimum requirements:

a) Manufacturer Identification (such as name or logo)
b) Quality Assurance Agency Identification (such as name or logo)
c) Conformance with this standard as signifying by the designation of “APA/ANSI PRS-610.1.”
d) Flame spread index and smoke-developed index of the core materials in accordance with Sections 3.2.5 and 3.2.12, respectively, of this standard.

Annex A. Test Requirements for Facing Materials (Mandatory Information)

A1.1 General

This annex provides test requirements for facing materials to a) demonstrate compliance with the properties specified in Table 2 when Method A is used for SIP qualification, or b) characterize the facing material properties when Method B is used for SIP qualification. Prior to testing, the facing material shall be pre-qualified in accordance with a recognized wood structural panel standard specified in Sections 3.2.7 and 3.2.8. For each formulation of facing materials from each supplier, a separate test series in accordance with this annex is required.

A1.2 Sampling and Specimen Preparation

A minimum of 10 – 4-ft x 8-ft (1219 mm x 2438 mm) panels shall be randomly sampled from representative production by a qualified inspection agency. Each panel shall be prepared in accordance with the cutting diagram shown in Figure A1.1.

A1.3 Required Tests

Tests shall be conducted in accordance with Figure A1.2 based on standard and as-received moisture conditions.

A2.4 Data Analysis

Test results shall be analyzed in accordance with ASTM D 2915 and the results from the standard moisture conditions shall be used to compare with the properties specified in Table 2. Test results from the as-received moisture conditions shall be used to establish the control values for quality assurance purposes unless the quality assurance tests at the panel plant or the SIP manufacturer's facility can be conducted at the standard moisture conditions.

A2.5 Acceptance Criteria

When Method A is used for SIP qualification, the facing materials shall be considered as in conformance with this standard when the following criteria are all met:

a) The mean test values from the standard moisture conditions for flatwise stiffness in both along and across directions are not less than the values tabulated in Table 2.
b) The 5th percentile values with 75% confidence from the standard moisture conditions for flatwise strength and tensile strength in both along and across directions are not less than the values tabulated in Table 2.
c) The mean panel density based on the oven-dry weight and over-dry volume is not less than the value tabulated in Table 2.

When Method B is used for SIP qualification, test results are used to characterize the facing material properties and there are no minimum requirements.

A2.6 Quality Assurance

A quality assurance program shall be established by the panel or SIP manufacturer and a qualified inspection agency in accordance with a recognized wood structural panel standard specified in Sections 3.2.7 and 3.2.8. The control values for small-specimen flatwise bending tests shall be established based on the test results at the as-received moisture conditions, as described in A1.4.

Note: The first number (PN = 01 - 10) is the panel number, the 2nd number is the test type (1 - 8) and the 3rd number is the replicate number (1 -2). For example, 10-5-2 is the specimen cut from the 10th panel (10) for tension test parallel to the strength axis (5) and is the second replicate (2).

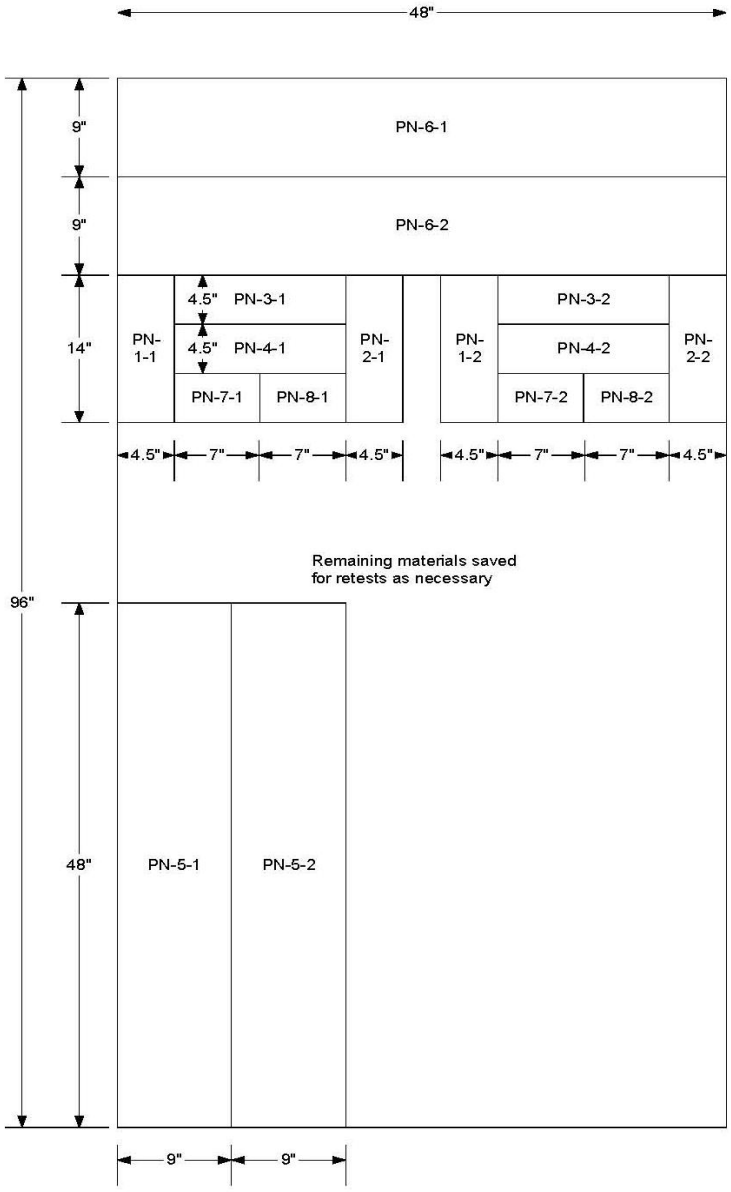

Figure A1.1 Cutting diagram for specimen preparation (1 inch = 25.4 mm)

Required panels: 10 - 4' x 8' randomly selected by a third-party auditor from representative production
Specimen preparation: per cutting diagram
Moisture conditioning: Standard conditions are 65% RH and 68F

Detailed test information for each supplier

Property ID	Test type	Orientation	Condition	No of tests	Specimen dimension	Test setup	Required data	Note
(1)	S14 (ASTM D1037) flatwise bending	Parallel	Standard	20 (2 per panel)	4.5" (across) x 14" (along)	Center-point load with a span of 24 times panel thickness (10.5" for 7/16" panels)	MM, EI, and specimen thickness	Screened-side up
(2)	S14 (ASTM D1037) flatwise bending	Parallel	As-received	20 (2 per panel)	4.5" (across) x 14" (along)	Center-point load with a span of 24 times panel thickness (10.5" for 7/16" panels)	MM, EI, and specimen thickness	Screened-side up
(3)	S14 (ASTM D1037) flatwise bending	Perpendicular	Standard	20 (2 per panel)	4.5" (along) x 14" (across)	Center-point load with a span of 24 times panel thickness (10.5" for 7/16" panels)	MM, EI, and specimen thickness	Screened-side up
(4)	S14 (ASTM D1037) flatwise bending	Perpendicular	As-received	20 (2 per panel)	4.5" (along) x 14" (across)	Center-point load with a span of 24 times panel thickness (10.5" for 7/16" panels)	MM, EI, and specimen thickness	Screened-side up
(5)	ASTM D3500 tension	Parallel	Standard	20 (2 per panel)	9" (across) x 48" (along)	Axial tension with 24" gauge length	Tensile capacity and specimen thickness	
(6)	ASTM D3500 tension	Perpendicular	Standard	20 (2 per panel)	9" (along) x 48" (across)	Axial tension with 24" gauge length	Tensile capacity and specimen thickness	
(7)	Density and moisture content	--	Standard/OD	20 (2 per panel)	5" x 7"	--	Density (OD weight, OD volume) and MC	For comparison between suppliers
(8)	Density and moisture content	--	As-received/OD	20 (2 per panel)	5" x 7"	--	Density (OD weight, As-received volume) and MC	For control value

Figure A1.2 Detailed test requirements (1 inch = 25.4 mm)