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

Committee Ballot #2

September 2010

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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 bonded between two structural facings made of wood structural panels. Performance rated refers to SIPs that meet the performance requirements as specified in this standard.

1.2 The PRS-610.1 performance-rated SIPs are intended for use as a structural element in above-grade wall applications. The values provided in this standard are test values which are obtained from testing under as-tested conditions. The values do not address end use considerations, such as connections, creep, load duration, durability, and seismic design categories.

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

1.3 PRS-610.1 performance-rated SIPs may be qualified by Method A (prescriptive requirements for components) or Method B (full-scale empirical testing). The facings used for the PRS-610.1 performance-rated SIPs shall have the strength axis (axis parallel to the long dimension) oriented in the vertical direction of the wall and gravity loads applied equally and uniformly 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 PRS-610.1 performance-rated SIPs shall be labeled with the rated direction in accordance with the requirements of this standard and the applicable building codes. Manufacturer published installation requirements for SIPs labeled as conforming to this standard must be in agreement with the requirements of this standard.

1.5 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%. The panels must be protected from the elements with an appropriate weather-resistive exterior wall covering, use of flashing, use of a water-resistive barrier, and by providing a positive means of drainage while meeting or exceeding building code requirements.

1.6 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.

1.7 Certification of design values is beyond the scope of this standard.

1.8 Annexes A and B contained in this standard are 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 Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
C 272-01 (2007) Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
C 273/C273M-07a Standard Test Method for Shear Properties of Sandwich Core Materials
C 297/C297M-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 578-09 Specification for Rigid, Cellular Polystyrene Thermal Insulation
D 1621-04a Standard Test Method for Compressive Properties of Rigid Cellular Plastics
D 1622-08 Standard Test Method for Apparent Density of Rigid Cellular Plastics D 1623-03 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 2126-09 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D 2915-03 Standard Practice for Evaluating Allowable Properties for Grades of Structural Lumber
D 4761-05 Standard 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 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
E 84-09 Standard Test Method for Surface Burning Characteristics of Building Materials
E 96/E96M-05 Standard Test Methods for Water Vapor Transmission of Materials
E 1803-06 Standard Test Methods for Determining Structural Capacities of Insulated Panels
E 2126-09 Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems 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-S102.2-07 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 (R2008) Canadian Douglas Fir Plywood
CSA O151-04 Canadian Softwood Plywood
CSA O325-07 Construction Sheathing
CSA O437-93 (R2006) Standards for OSB and Waferboard
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 and is expected to provide the required thermal insulation for the wall, the long term structural support of the two panel facers to support axial loads and the required structural shear performance when the panel is subjected to bending due to short-term transverse and lateral loads.

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 Laminating adhesive – laminating adhesives are adhesives used to bond the facers to the core.

3.2.7 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.

3.2.8 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.

3.2.9 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 ($h \bullet ft^2 \bullet {}^\circ F/Btu$).

3.2.10 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.

3.2.11 Spline – A full height longitudinal connector installed between two adjacent wall panels.

3.2.12 Spline, Block – A structural component consisting 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 block spline is 3 inches (76 mm).

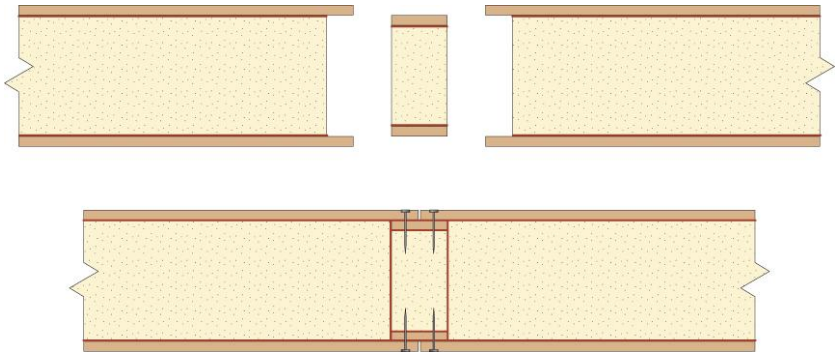

Figure 1. Block Spline

3.2.13 Spline, Surface – A pair of wood structural panels of the same material as the structural insulated panel facings that fits into a groove cut into the foam core at the longitudinal edges of the two structural insulated panels to be connected (see Figure 2).

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

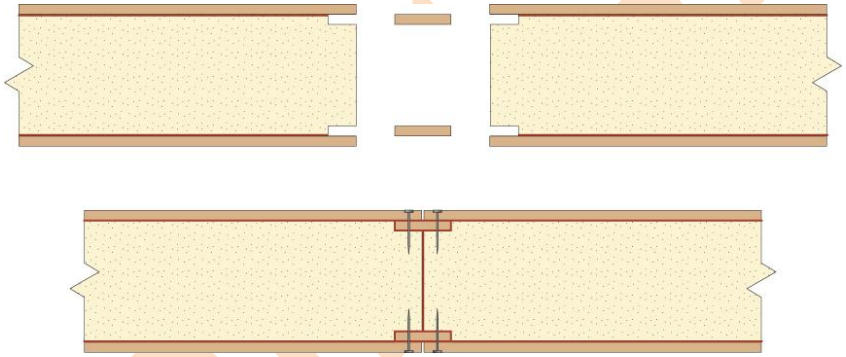

Figure 2. Surface Spline

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

Figure 3. Example of a SIP Wall Panel (for foamed in place foam cores, the foam is the adhesive)

4. SIP Walls

SIPs for above grade wall construction shall comply with the shapes and cross section shown in Figure 3 and shall have panel thickness as specified in Section 4.1.

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) subject 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 1/8 inch (3.2 mm) or minus 0
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 SIP facing squareness shall be within plus or minus 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 as prescribed in this standard. Method A, as prescribed in Section 5.1 is

based on prescriptive requirements for components of SIPs as confirmed by limited full-scale SIP tests. Method B, prescribed in Section 5.2, is based on full-scale empirical SIP tests. SIPs qualified by Method A and Method B will qualify for the properties in Table 4. For both Methods A and B the test materials shall be representative of production and substitutions of components or changes in manufacturing processes after qualification can only be made with the approval of the approved agency.

5.1 Method A (Prescriptive Component Method)

5.1.1 Component Requirements

Requirements contained in this section are applicable to SIPs that are qualified based on prescriptive component requirements specified in this section and installed in accordance with the manufacturer-published installation instructions. SIP panels used as bearing walls or shear walls are to be installed with both panel facings uniformly supported at the bottom of the panels. For SIPs 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 (EPS and XPS) complying with ASTM C 578 Type I, or CAN/ULC-S701 Type 1
b) Polyurethane foam foamed in place insulation meeting the physical properties shown in Table 1.

When SIPs are qualified in accordance with Method A, core joints shall not be permitted perpendicular to the rated direction.

Table 1. Properties for Polyurethane Foam Foamed in Place Insulation Used as the Core of SIPs [d]

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 (perpendicular to rise)
Minimum flexural strength (ASTM C 203) [b]	30 psi
Minimum tensile strength (ASTM D 1623)	35 psi
Minimum shear strength (ASTM C 273) [c]	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 %
R values for thermal qualification	LTTR test in accordance with ULC S705.1

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.
[b] Test method used must be documented (I or II and procedure A, B, C, or D).
[c] Based on full depth SIP panel
[d] Specimens for all tests shall be from samples of production run SIP panels by each manufacturer

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 or UL 723 for compliance with the 2009 IRC. Core materials shall have a flame-spread rating less than 500 when tested in accordance with CAN/ULC-S102 or CAN/ULC-S102.2 for compliance with the NBCC 2005.

5.1.2.3 Prior to SIP manufacturing 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 7/16-inch (11-mm) thick wood structural panels defined as 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 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

5.1.4.1 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 laminated PRS-610.1 performance-rated SIPs shall be produced with a laminating adhesive on the full surface of the panel core in contact with the panel facers with adhesives specifically intended for the lamination of SIPs conforming to the requirements of ASTM D 7446, and the qualification requirements specified in this standard.

The OSB laminating surface (rough or smooth surface where applicable) used to qualify the adhesive under ASTM D 7446 shall be compatible with the OSB surface that the SIP manufacturer will be using as the laminating surface. The foam plastic used in the adhesive qualification tests under ASTM D 7446 shall be the same as used in the manufacturing of the SIP and if more than one foam is permitted for manufacturing the panel, each foam-adhesive bond shall be qualified.

Material parameters including core material, facers and adhesives and manufacturing parameters such as adhesive mix ratios, mixing procedure, application pressure and duration used during the adhesive qualification shall be representative of panel manufacturing and shall be identified as part of the qualification procedures. Changes in these parameters shall require evaluation by the approved agency to determine if a new qualification is required.

5.1.4.2 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.

5.1.4.3 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 Full-Scale SIP Confirmation Test Requirements

A limited number of full-scale SIP confirmation tests, as listed in Table 3, are required to verify that the performance of the component materials specified in this standard conform with the expected performance of SIP panels evaluated by full-scale testing as

required in Section 6. Confirmation test results for each test type shall meet the applicable requirements specified in Table 4 and Section 6. Annex B provides additional testing details such as provisions for electrical chases and electrical boxes.

Table 3. Full-Scale SIP Confirmation Test Requirements

Requirements	Referenced section of this standard
Transverse Load	6.3
Construction Moisture Effects	6.6
Bond Strength	6.7
Axial [a]	6.2
Racking [b]	6.4

[a] One test of 4-1/2 in. x 4 ft x 10 ft (114 x 1219 x 3048 mm) panel required
[b] One test of 4-1/2 in. x 8 ft x 8 ft (114 x 2438 x 2438 mm) assembly required

5.1.6 SIP Flatwise Bending Test Requirements

For periodic re-evaluations by the approved agency , the characteristic (5th percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIP panels in the rated direction shall be established during qualification in accordance with ASTM C 393 using panels representative of the transverse load qualification testing in Table 3. A minimum of 20 specimens of 4-1/2 inches (114 mm) in thickness, 4 inches (102 mm) in width, and 4 feet (1219 mm) in length, and tested at a 45-inch (1143-mm) center span using third point loading with a minimum end bearing of 1-1/2". Periodic re-evaluations shall be conducted quarterly using 10 tests.

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 CAN/ULC-5701 or Table 1, and Annex A1, respectively. Lumber and fasteners used for qualification under this method as described in Annex B shall be documented and specified for end-use applications. Annex B also provides details regarding provisions for electrical chases and boxes.

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 panel qualification requirements for the core and wood structural panel facing materials when SIPs are qualified using Method B.

5.2.1 SIPs in wall applications 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]	4-12 in. x 8 ft x 8 ft 6-1/2 in. x 8 ft x 8 ft 4-1/2 in. x 8 ft x 10 ft 6-1/2 in. x 8 ft x 10 ft	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. Allowable design values shall be established in accordance with AC04 and the variability of the test results shall be in accordance with AC04.

[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 SIPs having a minimum depth of 12 inches (305 mm) shall meet the minimum test values for lintels 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	
			Def. Limit (in.)	Test Load (lbf/ft)
Lintel Load Capacity	2	3,180	0.067	1,060
	4	1,620	0.133	540

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 SIPs shall meet the construction moisture effects 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 periodic evaluation purposes, the characteristic (5th percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIPs shall be established during qualification in accordance with Section 5.1.6.

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 4. Further details regarding the location of the electrical chases and boxes are given in Annex B. Other details such as recessing the vertical edges of the foam core to accommodate the spline type are also given in Annex B.

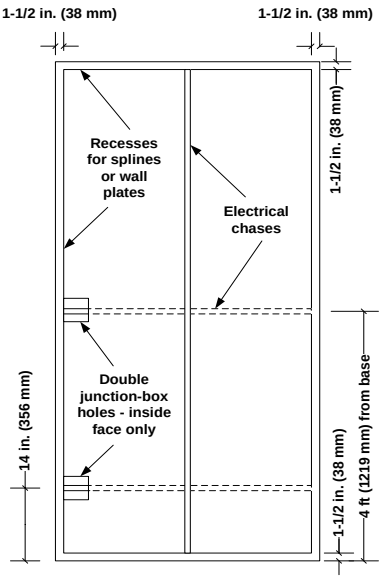

Figure 4. A Typical SIP Panel

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 approved agency.

6.1.4 Core joints shall not be allowed unless specifically qualified. Additional details related to core joints used in the test setup are given in Annex B.

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. Additional details of the test setup are given in Annex B.

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. Additional details of the test setup are given in Annex B.

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 consisting of No. 2 spruce-pine-fir (SPF) lumber shall 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 qualification testing, sealants shall not be used in spline, panel-to-top plate, panel-to-bottom plate, or panel to end post connections of the test specimen. Additional details of the test setup are given in Annex B.

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. The failure mode and measurements of all displacement measuring devices 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. Additional details of the testing procedures are given in Annex B.

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 larger SIPs and fabricated with 2x No. 2 SPF 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 recessed 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.

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 be 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 Construction Moisture Effects

6.6.1 The effects of anticipated changes in moisture content on the performance of the of the SIPs due to potential construction delays 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 are 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 Section 10.2 of ASTM D 7446.

6.8 Durability of Foamed-In-Place Core Materials

6.8.1 Construction – SIP assemblies shall be constructed using Douglas fir panel facings having a specific gravity range of 0.45 and 0.55 with 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. If the foamed-in-place core used differs from the foam requirements in Table 1 the actual density of the core material shall be used.

6.8.2 Shear specimens – Fifteen (15) shear test specimens shall be cut from the panel matching Figure 5.

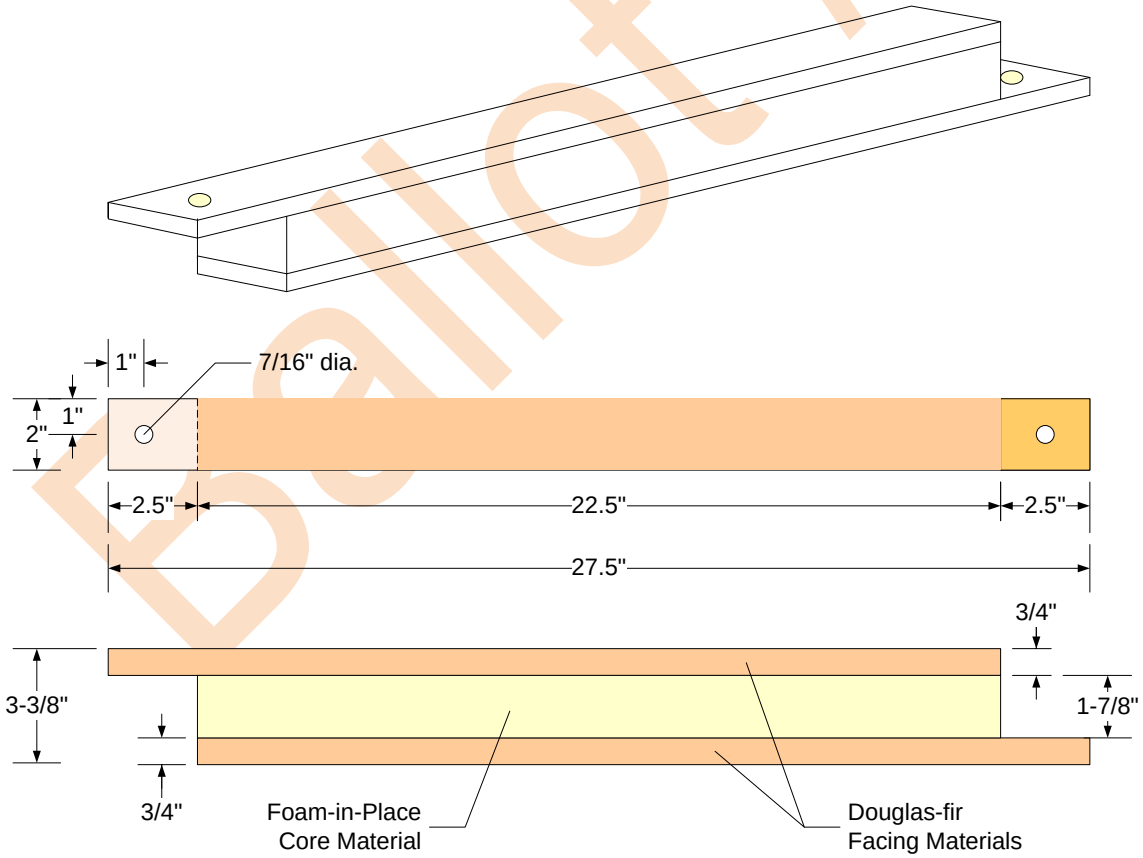

Figure 5. Specimen for the Durability of Foamed-In-Place Cores (1 inch = 25.4 mm)

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 15.2.2 of ASTM D 7446 Five (5) of each of the shear and bond specimens shall be subjected to the modified ASTM D 1183 “C” cycle 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 5.

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 Sections 15.2.2 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. Reporting of Test Results

Upon completion of qualification tests, all test results shall be evaluated and documented by a qualified testing agency in a test report and evaluated by an approved agency. This applies to tests done for qualification using Method A (Section 5.1) or Method B (Section 5.2). Failure modes for the SIPs shall be recorded during qualifications to be used to identify possible changes in performance during subsequent re-evaluations.

8. Trademarking and Certification

8.1 SIPs represented as conforming to this standard shall bear the stamp of a qualified inspection agency.

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 the conditions of acceptance given in Section 10.2.2 of ASTM D 7446. For foamed in place polyurethane cores, the minimum gluebond strength shall be 22 psi in accordance with Table1.

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 quarterly with 10 tests per quarter in accordance with Section 5.1.6 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 and the requirements of the qualified inspection agency.

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 "ANSI/APA PRS-610.1",
d) Flame spread index and smoke-developed index of the core materials in accordance with Sections 3.2.5 and 3.2.10, respectively, of this standard, and
e) Designation as "Wall" or "W" with the rated direction identified.

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 0 and 1.1.1. 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 0 and 1.1.1. 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).

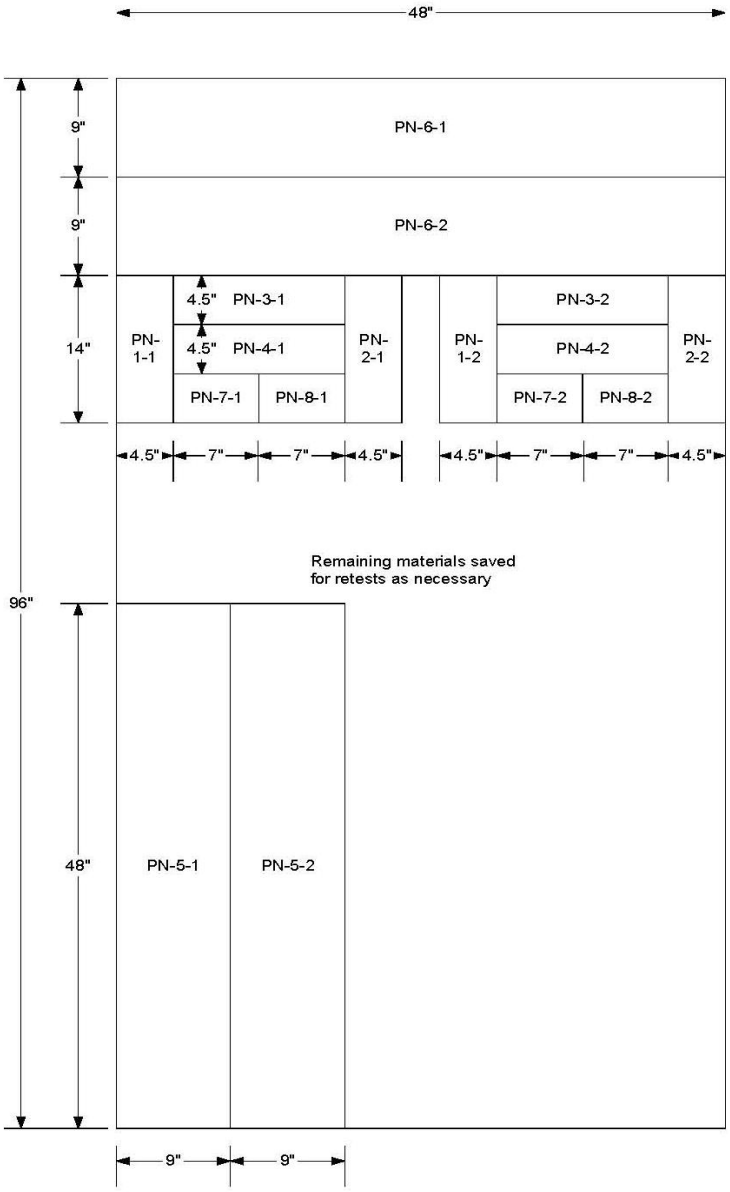

Figure A1.1 Cutting diagram for specimen preparation (1 inch = 25.4 mm)

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)

Annex B. Testing Requirements for SIP Assemblies (Mandatory Information)

B1. Lumber

The top and bottom plates of SIP assemblies shall be 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 Spruce-Pine-Fir (SPF).

B2. Fasteners

Nails used for SIPs assemblies shall be 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm) nails meeting the requirements of ASTM F 1667. For power driven nails the nail head shall not penetrate the facers by more than 3 mm.

B3. Foam core, sheathing, and adhesives

Foam core, sheathing, and adhesives shall conform to Sections 5.1.2, 5.1.3, and 5.1.4, respectively.

B4. Electrical chases and electrical boxes

Electrical chases and electrical boxes shall be incorporated into tests prescribed in Sections 6 and B5 through B7.

B5. Axial load tests

The specimen configuration and an example test setup for axial load tests are shown in Figures B5a and B5b, respectively.

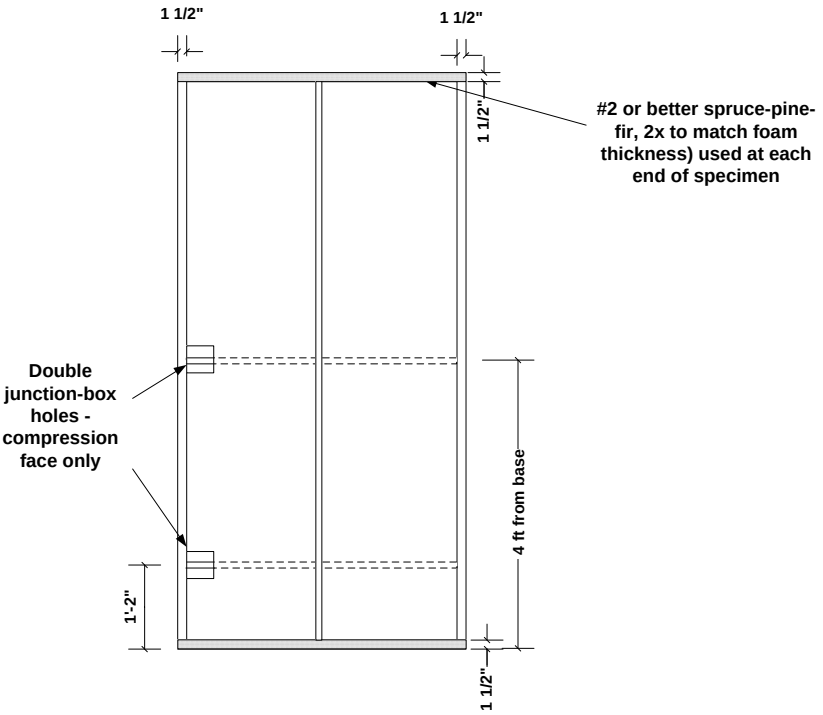

Figure B5a. Specimen configuration for axial load tests (1 inch = 25.4 mm)

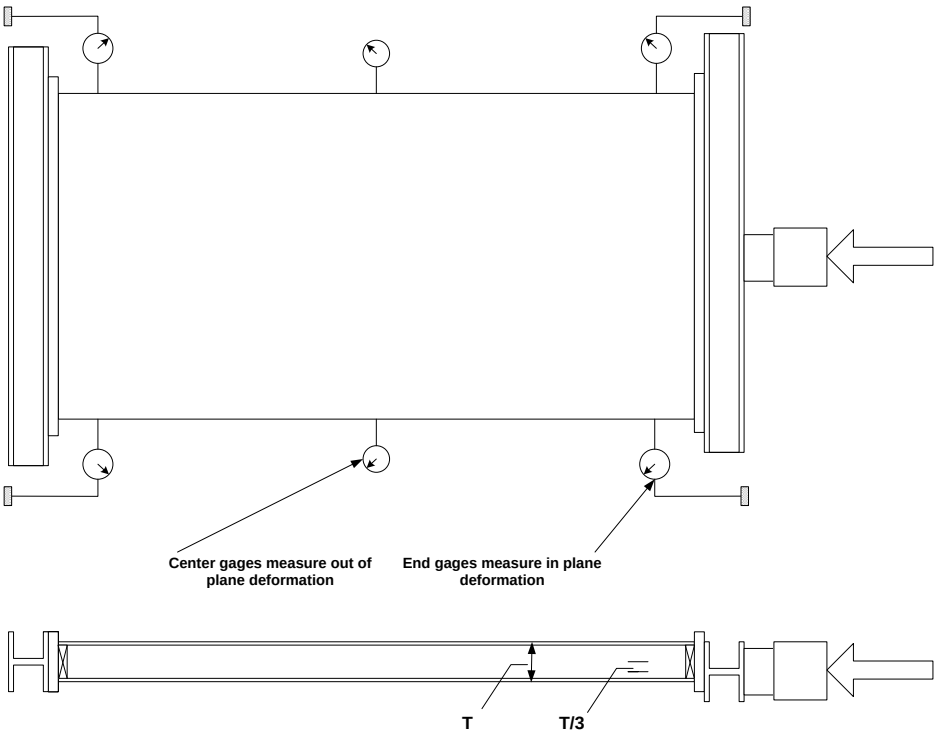

Figure B5b. Example test setup for axial load tests

B6. Transverse load tests

The specimen configuration and an example test setup for transverse load tests are shown in Figures B6a and B6b, respectively.

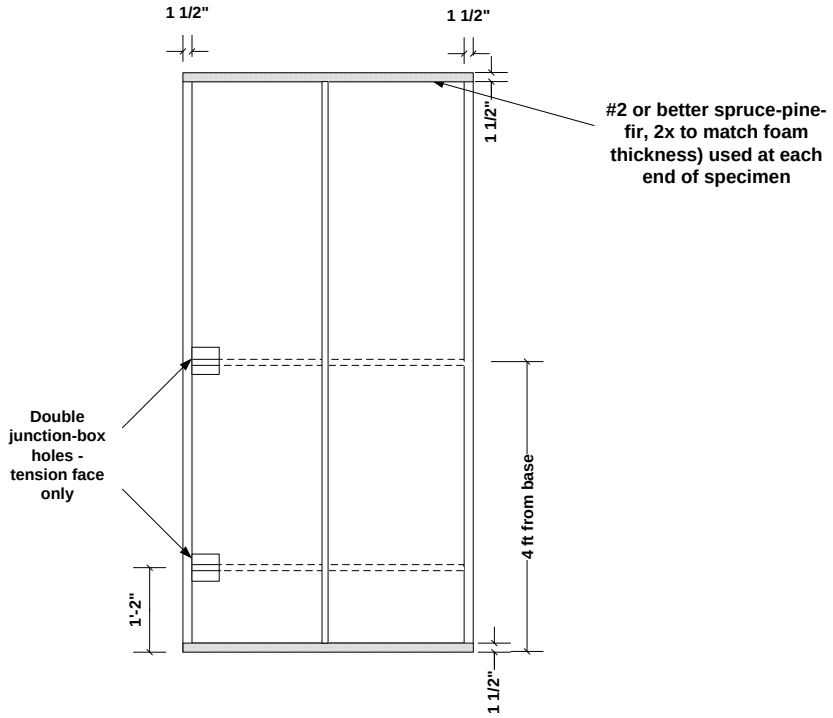

Figure B6a. Specimen configuration for transverse load tests (1 inch = 25.4 mm)

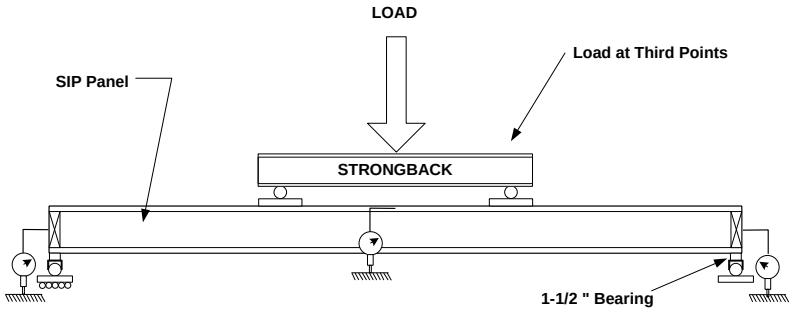

Figure B6b. Example test setup for transverse load tests (1 inch = 25.4 mm)

B7. Racking tests

The specimen configuration and an example test setup for racking tests are shown in Figures B7a and B7b, respectively.

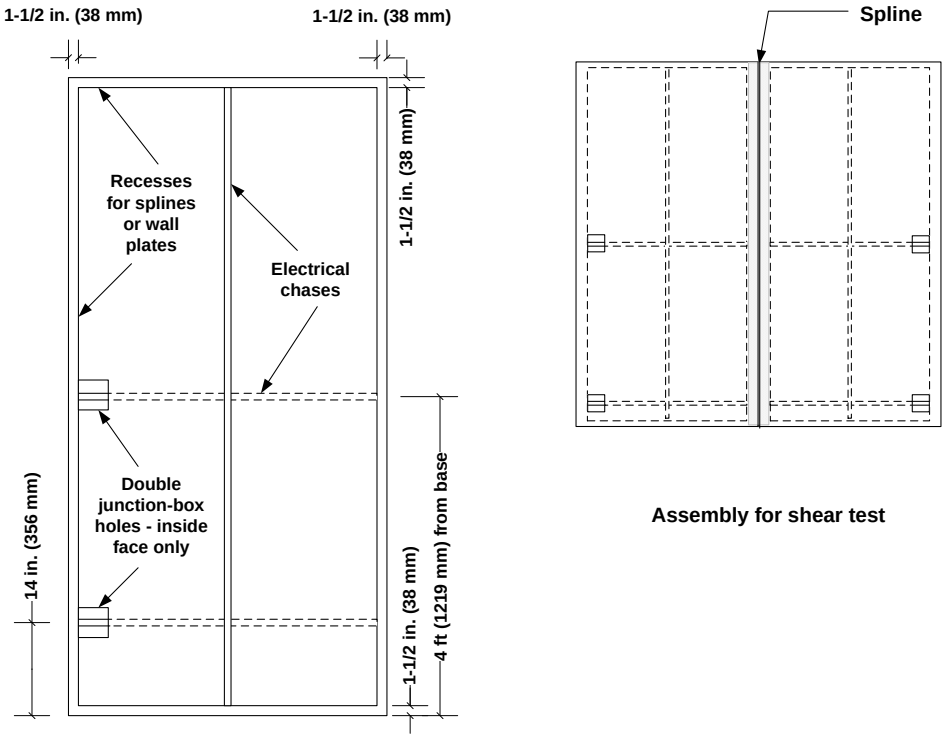

Figure B7a. Specimen configuration for racking load tests (1 inch = 25.4 mm)

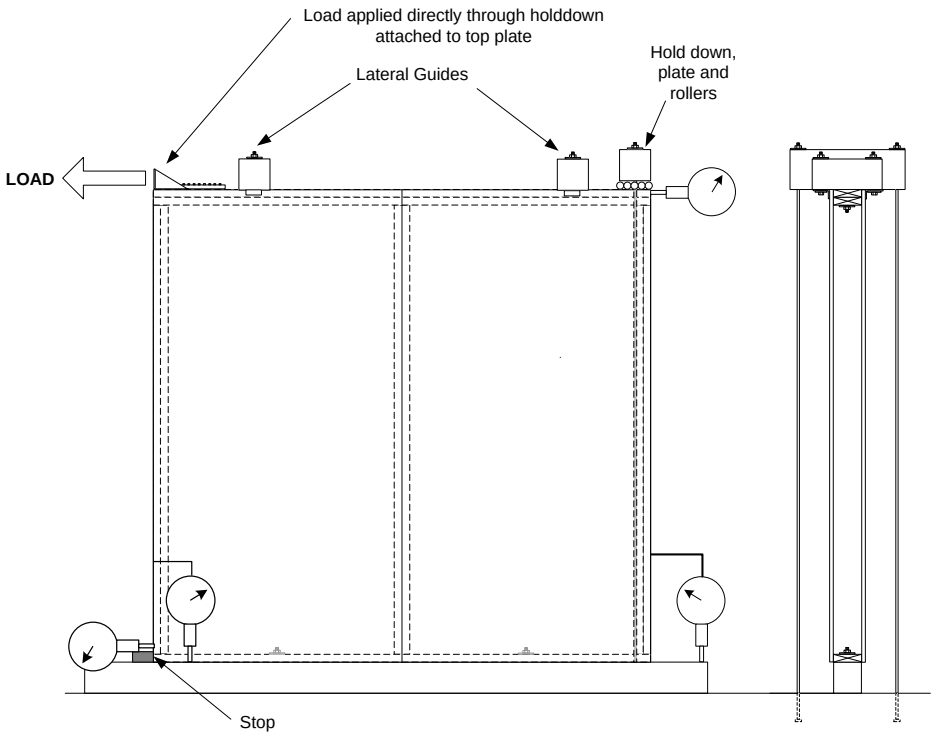

Figure B7b. Example test setup for racking load tests

B8. Lintel tests

An example test setup for lintel tests is shown in Figure B8.

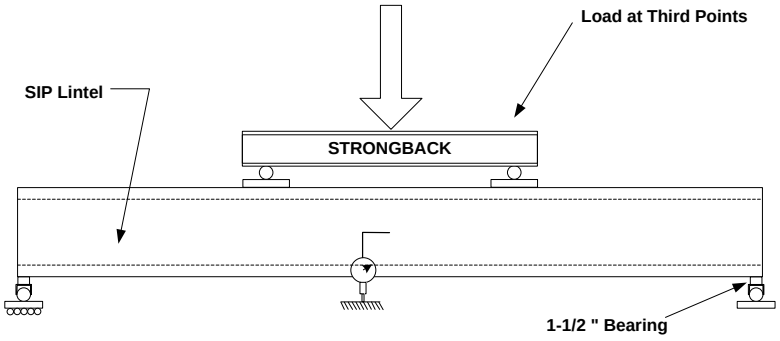

Figure B8. Example test setup for lintel tests