American National Standard

Standard for Performance-Rated Structural Insulated Panels in Wall Applications

APA – The Engineered Wood Association

Committee Ballot 4
March 2013
Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution. The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036
wwwansi.org
ANSI/APA PRS 610.1-201x

American National Standard

Standard for Performance-Rated Structural Insulated Panels in Wall Applications

APA – The Engineered Wood Association

Approved xxx
American National Standards Institute
**Foreword** (This Foreword is not a part of American National Standard ANSI/APA PRS 610.1-201x)

This standard provides requirements and test methods for qualification and quality assurance for performance-rated structural insulated panels (SIPs), which are manufactured with a foam plastic insulation core bonded between two wood structural panel facings intended for use in wall applications. Product performance requirements are specified.

The development of this consensus American National Standard was achieved by following the *Operating Procedures for Development of Consensus Standards of APA – The Engineered Wood Association*, approved by the American National Standards Institute (ANSI).

Inquiries or suggestions for improvement of this standard are welcome and should be directed to APA – The Engineered Wood Association at 7011 South 19th Street, Tacoma, WA 98466, [www.apawood.org](http://www.apawood.org).
Table of Contents

1. Scope ............................................................................................................. 7
2. Referenced Documents ................................................................................. 7
  2.1 ASTM Standards: ....................................................................................... 8
  2.2 Other Standards and Referenced Documents: ........................................... 8
  2.3 International Standards ............................................................................. 9
3. Terminology ................................................................................................... 9
  3.1 Definitions .................................................................................................. 9
  3.2 Description of terms specific to this standard: ......................................... 9
4. SIP Walls ....................................................................................................... 13
  4.1 SIP Thicknesses ....................................................................................... 13
  4.2 SIP Tolerances ........................................................................................ 13
5. Performance Criteria and Requirements ...................................................... 13
  5.1 Method A (Prescriptive Component Method) ............................................ 14
    5.1.1 Component Requirements ................................................................. 14
    5.1.2 Core Materials .................................................................................. 14
    5.1.3 Facing Materials ............................................................................... 15
    5.1.4 Adhesives .......................................................................................... 15
    5.1.5 Full-Scale SIP Confirmation Test Requirements ............................... 16
    5.1.6 Small-Scale SIP Test Requirements .................................................. 17
  5.2 Method B (Empirical Full-Scale Test Method) ......................................... 17
    5.2.1 SIP Performance Requirements ......................................................... 17
    5.2.2 Small-Scale SIP Test Requirements .................................................. 19
6. Test Methods for SIPs .................................................................................. 19
  6.1 General ..................................................................................................... 19
  6.2 Axial Load Capacity ................................................................................ 20
  6.3 Transverse Load Capacity ...................................................................... 20
  6.4 Racking Resistance .................................................................................. 20
  6.5 Lintel Load Capacity .............................................................................. 21
  6.6 Construction Moisture Effects ................................................................. 21
  6.7 Bond Strength .......................................................................................... 22
  6.8 Durability of Foamed-In-Place Core Materials ....................................... 22
    6.8.1 Construction ..................................................................................... 22
    6.8.2 Shear specimens .............................................................................. 22
    6.8.3 Bond specimens .............................................................................. 22
    6.8.4 Conditioning ..................................................................................... 23
    6.8.5 Testing .............................................................................................. 23
7. Reporting of Test Results ........................................................................... 23
8. Trademarking and Certification .................................................................. 23
  8.1.1 Certification ......................................................................................... 23
  8.2 Product Marking ....................................................................................... 23
Annex A. Test Requirements for Facing Materials .......................................... 25
  A1.1 General ................................................................................................. 25
  A1.2 Sampling and Specimen Preparation ...................................................... 25
  A1.3 Required Tests ...................................................................................... 25
  A2.4 Data Analysis ........................................................................................ 25
  A2.5 Acceptance Criteria ............................................................................. 25
  A2.6 Quality Assurance ............................................................................... 25
Annex B. Testing Requirements for SIP Assemblies ........................................ 28
1. **Scope**

1.1 The PRS-610.1 performance-rated structural insulated panels (referred as SIPs hereinafter) are sandwich panels consisting of a foam plastic insulation core bonded between two wood structural panel facings. Performance rated refers to SIPs that meet the performance requirements as specified in this standard.

1.2 SIPs are intended for use as a wall panels and lintels in above-grade wall applications. Wall panels shall resist axial, transverse, and racking loads. Lintels shall resist vertical loads. The values provided in this standard are obtained from testing under laboratory conditions and do not address end use considerations, such as basic wind speed, connections, creep, load duration, durability, seismic design categories, and combined racking and vertical load conditions. Derivation of design values is beyond the scope of this standard.

1.3 SIPs shall be qualified by Method A (prescriptive components method) or Method B (empirical full-scale test method). The facings used for the SIP walls shall have the strength axis oriented in the vertical direction of the wall with vertical loads applied to both facings at the top of the SIPs. The facings used for the SIP lintels shall have the strength axis oriented in the horizontal 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 described in this standard are beyond the scope of this standard.

1.4 SIPs shall be marked with the rated direction in accordance with the requirements of this standard. Manufacturer’s specific installation requirements for SIPs marked as conforming to this standard shall be in agreement with the requirements of this standard.

1.5 SIPs are intended for use in dry service conditions where the average equilibrium moisture content of sawn lumber is less than 16%. SIPs used as bearing walls or shear walls shall be installed with both panel facings uniformly continuously supported at the bottom of the SIPs and shall be attached to the top and bottom plates. The panels shall be protected from the elements with an appropriate weather-resistive exterior wall covering and flashing, a water-resistive barrier, and a positive means of drainage, in accordance with 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 Annexes A and B contained in this standard are mandatory, and Appendix A 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:**
C203-05a (2012) Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
C272/C272M-12 Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
C393/C393M-11e1 Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure
C578-12a Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
D1621-10 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
D1622-08 Standard Test Method for Apparent Density of Rigid Cellular Plastics
D1623-09 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D2126-09 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D2915-10 Standard Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products
D4761-11 Standard Test Methods for Mechanical Properties of Lumber and Wood-Base Structural Material
D7446-09 Standard Specification for Structural Insulated Panel (SIP) Adhesive for Laminating Oriented Strand Board (OSB) to Rigid Cellular Polystyrene Thermal Insulation Core Materials
E72-10 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
E84-12b Standard Test Method for Surface Burning Characteristics of Building Materials
E96/E96M-10 Standard Test Methods for Water Vapor Transmission of Materials
E1803-06 Standard Test Methods for Determining Structural Capacities of Insulated Panels
F1667-11ae1 Specification for Driven Fasteners: Nails, Spikes, and Staples

2.2 **Other Standards and Referenced Documents:**
CAN/ULC-S102-10 Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
CAN/ULC-S102.2-10 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
CAN/ULC S701-11 Thermal Insulation, Polystyrene Boards and Pipe Covering
CSA O121-M1978 (R2008) Canadian Douglas Fir Plywood
CSA O151-09 Canadian Softwood Plywood
CSA O325-07 Construction Sheathing
NFPA 286-11 Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
PS 1-09 Structural Plywood
PS 2-10 Performance Standard for Wood-Based Structural-Use Panels
PS 20-10 American Softwood Lumber Standard
UL 723 (2008) Test for Surface Burning Characteristics of Building Materials
UL 1040-96 Fire Test of Insulated Wall Construction – with Revisions through September 2007
UL 1715-97 Fire Test of Interior Finish Material – with Revisions through April 2008

2.3 International Standards
ISO Guide 65-1996 General Requirements for Bodies Operating Product Certification Systems
ISO/IEC 17011-2004 Conformity Assessment – General Requirements for Accreditation Bodies Accrediting Conformity Assurance Bodies
ISO/IEC 17020-1998 General Criteria for the Operation of Various Types of Bodies Performing Inspection
ISO/IEC 17020-2012 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection
ISO/IEC 17065-2012 Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services

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:
Approved Agency (U.S.) – an established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by regulatory bodies (see Qualified Inspection Agency and Qualified Testing Agency)
Approved Agency (Canada) – an established and recognized agency regularly engaged in conducting certification services, when such agency has been approved by regulatory bodies (see Qualified Certification Agency)

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

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 provides the required thermal insulation for the wall, supplies buckling resistance to the two panel facings under axial loads, and contributes to the shear and bending resistance of the panel under transverse and lateral loads.

(a) EPS – The letter designation for the molded expanded polystyrene thermal insulation classified by this standard and is defined as cellular plastic product manufactured from pre-expanded polystyrene beads subsequently molded into blocks resulting in a product which is rigid with closed cellular structure.
(b) XPS – The letter designation for the extruded expanded polystyrene thermal insulation classified by this standard and is defined as cellular plastic product manufactured in a one stage process by extrusion and expansion of the base polymer in the presence of blowing agent(s) into boards resulting in a product which is rigid with closed cellular structure.
(c) Foamed-in-place polyurethane insulation – A rigid cellular plastic material that is formed in place by the catalyzed reaction of polyisocyanates and polyhydroxyl compounds, expanded with blowing agents between facers, resulting in a product that is a predominantly closed cell product.

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

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 E84, UL 723, CAN/ULC-S102 or CAN/ULC-S102.2.

Laminating adhesive – The adhesive used to bond the facings to the core.

Lintel – A structural element acting as a header supporting gravity loads above an opening.

Qualified Certification Agency (Canada) – an agency meeting the following requirements:

(a) has trained personnel to perform product certification in compliance with all applicable requirements specified in this standard,
(b) has procedures to be followed by its personnel in performance of the certification,
(c) has no financial interest in, or is not financially dependent upon, any single company manufacturing the product being certified,
(d) is not owned, operated, or controlled by any such company, and
(e) is accredited by a recognized accreditation body under ISO Guide 65 or ISO/IEC 17065
Qualified Inspection Agency (U.S.) – 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 in compliance 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 by a recognized accreditation body under ISO/IEC 17020

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 by a recognized accreditation body under ISO/IEC 17025

Recognized Accreditation Body – an organization complying with ISO/IEC 17011 and recognized by the regulatory body having jurisdiction as qualified to evaluate and accredit certification agencies, inspection agencies and/or testing agencies

Sealant – Material used for sealing SIPs at spline, plate, and other connections to reduce air infiltration

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 E84, UL 723, CAN/ULC-S102 or CAN/ULC-S102.2.

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

Spline, Block – A spline 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 that fit into a recess at the vertical edges of the two structural insulated panels to be connected (see Figure 1). The width of the block spline shall be 3 inches (76 mm) minimum.
Spline, Surface – A pair of wood structural panels of the same material as the structural insulated panel facing that fit into grooves cut into the foam core at the vertical edges of the two structural insulated panels to be connected (see Figure 2). The width of the surface spline must be 3 inches (76 mm) minimum.

Strength Axis, Wood Structural Panels – The axis parallel to the face and back orientation of the flakes (oriented strand board) or the grain of the face veneers (plywood), which is generally the long panel direction, unless otherwise marked.

Structural Insulated Panel (SIP) – A structural sandwich panel which consists of a foam plastic insulation core bonded directly between two structural facings made of wood structural panels (see Figure 3).
Figure 3. Example of a SIP Wall Panel (for foamed in place foam cores, the foam is the adhesive)

Wood Structural Panel – A panel product composed of oriented strand board (OSB) or plywood in conformance with the performance requirements of DOC PS1 or DOC PS2 in the U.S. or CSA O121, CSA O151, or CSA O325 in Canada, and the additional requirements specified in this standard.

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

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

SIP Thickness – Plus 1/8 inch (3.2 mm) or minus 0
SIP Width – Plus or minus 1/8 inch (3.2 mm)
SIP Height – Plus or minus 1/4 inch (6.4 mm)
SIP Squareness – 1/64 inch per lineal foot (1.3 mm per lineal meter) measured along the diagonals
SIP Straightness – 1/16 inch (1.6 mm) of panel edge measured by a straight line drawn from one corner to the adjacent corner
SIP Facing to Facing Alignment – Plus or minus 1/16 inch (1.6 mm) measure from one facing to the other

5. Performance Criteria and Requirements
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 and further confirmed by limited full-scale SIP tests. Method B, specified in Section 5.2, is based on full-scale empirical SIP tests. 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 shall 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 shall be applicable to SIPS that are qualified based on prescriptive component requirements specified in Sections 5.1.2 through 5.1.4. For SIPS manufactured with core materials that are not in compliance with the requirements specified in Sections 5.1.2 through 5.1.4, the SIP shall be qualified in accordance with the Method B specified in Section 5.2.

5.1.2 Core Materials
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 one of the following requirements:
(a) EPS insulation complying with ASTM C578 Type I in the U.S. or CAN/ULC-S701 Type 1 in Canada.
(b) XPS insulation complying with ASTM C578 Type X in the U.S. or CAN/ULC-S701 Type 2 in Canada.
(c) Foamed-in-place polyurethane insulation meeting the physical properties shown in Table 1.

Table 1. Properties for Foamed-in-place Polyurethane Insulation(a)

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum apparent overall core density (ASTM D1622)</td>
<td>2.2 lb/ft³</td>
</tr>
<tr>
<td>Minimum apparent core density(b) (ASTM D1622)</td>
<td>1.8 lb/ft³</td>
</tr>
<tr>
<td>Compressive resistance at yield or 10% deformation, whichever occurs first, (ASTM D1621)</td>
<td>19 psi (perpendicular to rise)</td>
</tr>
<tr>
<td>Minimum flexural strength (ASTM C203, Method B)</td>
<td>30 psi</td>
</tr>
<tr>
<td>Minimum tensile strength (ASTM D1623)</td>
<td>35 psi</td>
</tr>
<tr>
<td>Minimum shear strength (ASTM C273)(c)</td>
<td>25 psi</td>
</tr>
<tr>
<td>Maximum water vapor permeance of 1.00-in. thickness (ASTM E96)</td>
<td>2.3 perm</td>
</tr>
<tr>
<td>Maximum water absorption by total immersion (ASTM C272)</td>
<td>4.3 % (volume)</td>
</tr>
<tr>
<td>Maximum change in dimensions (ASTM D2126, 7 days at 158°F/100 % humidity and 7 days at -20°F)</td>
<td>2 %</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 lbf/ft³ = 16.0 kg/m³, 1 psi = 6.9 kPa
(a) Specimens for all tests shall be from samples from the SIP manufacturer
(b) As measured on the center 1-inch (25.4 mm) of the core thickness
(c) Based on the full thickness SIP

5.1.2.2 Core materials shall have a thickness of 3-5/8 or 5-5/8 inches (92 or 143 mm).
a) In the U.S., the core material shall have 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 E84 or UL 723 at 4 inches in thickness in the U.S. In addition, SIPs with a 5-5/8-inch (143-mm) core shall be tested in accordance with NFPA 286, FM 4880, UL 1040 or UL 1715.

b) In Canada, the core material shall have a flame spread rating less than 500 when tested in accordance with CAN/ULC-S102 for foamed-in-place polyurethane insulation or CAN/ULC-S102.2 for polystyrene insulation in Canada.

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.

5.1.2.4 Core joints shall not be allowed unless specifically qualified with core joints in each assembly tested in accordance with 5.1.5. Cores shall be in full contact with the facings and shall not contain surface channels.

5.1.3 Facing Materials
Facing materials shall be 7/16-inch (11-mm) thick wood structural panels composed of oriented strand board (OSB) or plywood in conformance with DOC PS1 or DOC PS2 in the U.S., or CSA O121, CSA O151, or CSA O325 in Canada, and 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 conformance with Table 2 of this standard.

Table 2. Minimum Properties for Wood Structural Panel Facing Materials

<table>
<thead>
<tr>
<th>Flatwise Bending Stiffness (b)</th>
<th>Flatwise Bending Strength (c)</th>
<th>Tension (c)</th>
<th>Density (b,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flatwise Bending Stiffness (b)</td>
<td>Flatwise Bending Strength (c)</td>
<td>Tension (c)</td>
<td>Density (b,d)</td>
</tr>
<tr>
<td>Along</td>
<td>Across</td>
<td>Along</td>
<td>Across</td>
</tr>
<tr>
<td>55,600</td>
<td>16,500</td>
<td>1,040</td>
<td>460</td>
</tr>
</tbody>
</table>

For SI: 1 lbf-in.²/ft = 9.4 N-mm²/mm, 1 lbf-in./ft = 0.37 N-mm/mm, 1 lbf/ft = 0.015 N/mm, 1 lbf/ft³ = 16.0 kg/m³

(a) Tested in accordance with Annex A 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 used to bond the core to facings of a SIP during manufacture unless the SIPs are manufactured with a foam-in-place component. SIPs shall be produced with a laminating adhesive distributed on the full surface of the core in contact with the facings. The laminating adhesives shall conform to the requirements of ASTM D7446 and the qualification requirements specified in this standard. Bead application of laminating adhesives shall be verified to ensure distribution of the adhesive on the full surface of the core during lamination.

5.1.4.2 The facing surface (rough or smooth surface where applicable) used to qualify the adhesive under ASTM D7446 shall be the same facing surface that the SIP manufacturer is using as the laminating surface. The foam plastic used in the
adhesive qualification tests under ASTM D7446 shall be the same core materials complying with Section 5.1.2.1(a) through (c) as that used in the manufacturing of the SIP and if more than one foam is permitted for manufacturing the panel, each foam-to-adhesive bond shall be qualified.

5.1.4.3 Material parameters including core material, facings, adhesives and manufacturing parameters such as adhesive mix ratios, mixing procedure, application pressure and duration used during the adhesive qualification shall be representative of SIP 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.

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

5.1.4.5 Foam-in-place materials used to simultaneously manufacture the core and provide the bond of the foam core to the facing materials shall be evaluated in accordance with Section 6.8 for compliance with the durability requirements specified in Table 4.

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 SIP performance evaluated by full-scale testing in accordance with Section 6. Confirmation test results for each test type shall meet the applicable requirements specified in Tables 4 and 5 for the specific SIP configurations listed in the footnotes to Table 3. Annex B provides additional testing details such as provisions for electrical chases and electrical boxes.

Three (3) tests of axial load, transverse load, and racking resistance shall be required with none of the results varying more than 15 percent from the average peak load of the three, unless the lowest peak load value is used. The average peak load based on a minimum of five (5) tests shall be permitted for use regardless of the variations. The deflection limit shall be based on the average of all tests from each SIP configuration.

Table 3. SIP Confirmation Test Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Minimum Number of Tests</th>
<th>Test Method Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial Load</td>
<td>3&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>6.2</td>
</tr>
<tr>
<td>Transverse Load</td>
<td>3&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>6.3</td>
</tr>
<tr>
<td>Racking Resistance</td>
<td>3&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>6.4</td>
</tr>
<tr>
<td>Lintel Load</td>
<td>3&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>6.5</td>
</tr>
<tr>
<td>Bond Strength – Tension</td>
<td>5</td>
<td>6.7</td>
</tr>
<tr>
<td>Bond Strength – Shear</td>
<td>5</td>
<td>6.7</td>
</tr>
</tbody>
</table>

<sup>a</sup> A minimum of three (3) tests are required with none of the peak load value varying more than 15 percent from the average peak load of the three, unless the lowest peak load value is used; the average peak load based on a minimum of five (5) tests shall be permitted for use regardless of the variations. The deflection limit shall be based on the average of all tests from each SIP configuration.

<sup>b</sup> 3 - 4-1/2 in. x 4 ft x 10 ft (114 x 1219 x 3048 mm) panels are required to be tested

<sup>c</sup> 3 - 4-1/2 in. x 8 ft x 8 ft (114 x 2438 x 2438 mm) assembles are required to be tested

<sup>d</sup> 3 - 4-1/2 in. x 12 in. x 4 ft (114 x 305 x 1219 mm) lintels are required to be tested
5.1.6 Small-Scale SIP Test Requirements

The characteristic (5th percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIPs in the rated direction shall be established during qualification in accordance with ASTM C393 using SIPs representative of the transverse load qualification testing in Table 3. A minimum of 20 or more specimens, as determined in accordance with ASTM D2915, of 4-1/2 inches (114 mm) in thickness, 4 inches (102 mm) in width, and 4 feet (1219 mm) in length shall be tested at a 46.5-inch (1181-mm) span from center to center of supports using four-point loading with an end bearing of 1-1/2 inches (38 mm).

5.2 Method B (Empirical Full-Scale Test Method)

SIPs shall be permitted to be qualified based on empirical full-scale SIP tests specified in this section. When using this qualification method, core materials, facings, and adhesives shall meet the following requirements.

(a) Core materials shall meet the requirements specified in Sections 5.1.2.2 and 5.1.2.3 and shall be characterized in accordance with the test methods of ASTM C578 in the U.S., CAN/ULC-S701 in Canada, or Table 1.

(b) Adhesives shall meet the requirements specified in Sections 5.1.4.

(c) Facing materials shall be a minimum of 7/16-inch (11-mm) thick wood structural panels composed of oriented strand board (OSB) or plywood in conformance with DOC PS1 or DOC PS2 in the U.S., or CSA O121, CSA O151, or CSA O325 in Canada, and shall be characterized in accordance with Annex A.

(d) 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 1: 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 qualification requirements for the core and wood structural panel facing materials when SIPs are qualified using Method B.

5.2.1 SIP Performance Requirements

5.2.1.1 SIPs shall meet or exceed the minimum test values for all properties listed in Table 4 when tested in accordance with the methods provided in Section 6. Three (3) tests of axial load, transverse load, and racking resistance shall be required with none of the results varying more than 15 percent from the average peak load of the three, unless the lowest peak load value is used. The average peak load based on a minimum of five (5) tests shall be permitted for use regardless of the variations. The deflection limit shall be based on the average of all tests from each SIP configuration.
Table 4. Performance Requirements for SIPs

<table>
<thead>
<tr>
<th>Properties</th>
<th>SIP Configuration (Thickness x Length x Height)</th>
<th>Minimum Number of Tests</th>
<th>Test Method Section</th>
<th>Minimum Test Value&lt;sup&gt;a)&lt;/sup&gt;</th>
<th>Load at Deformation Limit</th>
<th>Test Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Def. Limit (in.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axial Load Capacity</td>
<td>4-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td>6.2</td>
<td>9,600 lbf/ft</td>
<td>0.125</td>
<td>3,200 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>4-1/2 in. x 4 ft x 10 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>9,300 lbf/ft</td>
<td>0.125</td>
<td>3,100 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>6-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>9,600 lbf/ft</td>
<td>0.125</td>
<td>3,200 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>6-1/2 in. x 4 ft x 10 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>9,300 lbf/ft</td>
<td>0.125</td>
<td>3,100 lbf/ft</td>
</tr>
<tr>
<td>Transverse Load Capacity</td>
<td>4-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td>6.3</td>
<td>85 lbf/ft&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.400&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>28 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>4-1/2 in. x 4 ft x 10 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>60 lbf/ft&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.500&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>20 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>6-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>85 lbf/ft&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.400&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>28 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>6-1/2 in. x 4 ft x 10 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>80 lbf/ft&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.500&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>20 lbf/ft</td>
</tr>
<tr>
<td>Racking Resistance&lt;sup&gt;b)&lt;/sup&gt;</td>
<td>4-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td>6.4</td>
<td>945 lbf/ft</td>
<td>0.20</td>
<td>315 lbf/ft</td>
</tr>
<tr>
<td></td>
<td>6-1/2 in. x 4 ft x 10 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td></td>
<td>6.2 &amp; 6.3</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Construction Moisture Effect&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>4-1/2 in. x 4 ft x 8 ft</td>
<td>3&lt;sup&gt;b)&lt;/sup&gt;</td>
<td>6.6 &amp; 6.2</td>
<td>20,160 lbf&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>0.125</td>
<td>2,720 lbf/ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.6 &amp; 6.3</td>
<td>72 lbf/ft&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.400&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>24 lbf/ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.6 &amp; 6.4</td>
<td>80 lbf/ft&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.20</td>
<td>268 lbf/ft</td>
</tr>
<tr>
<td>Bond Strength&lt;sup&gt;d)&lt;/sup&gt;</td>
<td>Polystyrene Cores</td>
<td>5</td>
<td>6.7</td>
<td>20 psi</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>- Tension</td>
<td>5</td>
<td></td>
<td>12 psi</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>- Shear</td>
<td>5</td>
<td></td>
<td>6.7</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22 psi</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Foamed-In-Place cores</td>
<td>5</td>
<td>6.7</td>
<td>25 psi</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>- Tension</td>
<td>5</td>
<td></td>
<td>6.8</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>- Shear</td>
<td>5</td>
<td></td>
<td>19 psi&lt;sup&gt;e)&lt;/sup&gt;</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21 psi&lt;sup&gt;e)&lt;/sup&gt;</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Durability of Foamed-In-Place Core Materials&lt;sup&gt;e)&lt;/sup&gt;</td>
<td>- Tension</td>
<td>5</td>
<td>6.8</td>
<td>19 psi&lt;sup&gt;e)&lt;/sup&gt;</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>- Shear</td>
<td>5</td>
<td></td>
<td>21 psi&lt;sup&gt;e)&lt;/sup&gt;</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

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

<sup>a)</sup> The tabulated values are average test values and not intended for design use. The average test value shall meet the minimum requirements for both peak load and the test load at the specified deformation limit.

<sup>b)</sup> A minimum of three (3) tests are required with none of the peak load value varying more than 15 percent from the average peak load of the three, unless the lowest peak load value is used; the average peak load based on a minimum of five (5) tests shall be permitted for use regardless of the variation.

<sup>c)</sup> 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.

<sup>d)</sup> Based on H/240 where H is the wall height in inches (mm).

<sup>e)</sup> The tabulated peak load and test load are 85% of that of corresponding dry (as-received) assemblies.

<sup>f)</sup> Each specimen shall show no more than 10% bond line failure.

5.2.1.2 SIPs having a 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 SIPs\(^{(a)}\)

<table>
<thead>
<tr>
<th>Property</th>
<th>Span (ft)</th>
<th>Minimum Number of Tests</th>
<th>Test Method Section</th>
<th>Minimum Test Value(^{(b)})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Peak Load (lbf/ft)</td>
<td>Load at Deflection Limit of Span/360</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Def. Limit (in.)</td>
<td>Test Load (lbf/ft)</td>
</tr>
<tr>
<td>Lintel Load Capacity</td>
<td>2</td>
<td>3(^{(c)})</td>
<td>6.5</td>
<td>3,180</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3(^{(c)})</td>
<td></td>
<td>1,620</td>
</tr>
<tr>
<td>Construction Moisture</td>
<td>2</td>
<td>3(^{(c)})</td>
<td>6.6</td>
<td>2,705</td>
</tr>
<tr>
<td>Effect(^{(c,d)})</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

\(^{(a)}\) The tabulated values are average test values and not intended for design use. The average test value shall meet the minimum requirements for both peak load and the test load at the specified deformation limit.

\(^{(b)}\) For SIP thickness of 4-1/2 inches (114 mm) or thicker, and depth of 12 inches (305 mm) or deeper in accordance with the configuration shown in Figure 4.

\(^{(c)}\) A minimum of three (3) tests are required with none of the peak load value varying more than 15 percent from the average peak load of the three, unless the lowest peak load value is used; the average peak load based on a minimum of five (5) tests shall be permitted for use regardless of the variation.

\(^{(c,d)}\) The tabulated peak load and test load are 85% of that of corresponding dry (as-received) lintel.

5.2.2 Small-Scale SIP Test Requirements

The characteristic (5\(^{th}\) percentile with 75% confidence) flatwise bending strength and average bending stiffness of SIPs in the rated direction shall be established during qualification in accordance with ASTM C393 using SIPs representative of the transverse load qualification testing in Table 4. A minimum of 20 or more specimens, as determined in accordance with ASTM D2915, 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 46.5-inch (1181-mm) center span using four-point loading with a end bearing of 1-1/2 inches (38 mm).

6. Test Methods for SIPs

6.1 General

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.

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 centered in the foam core and 4-inch by 4-inch (102 mm by 102 mm) electrical boxes as shown in Annex B. The vertical edges of the SIP shall be recessed to accommodate the spline as required for testing in accordance with Annex B.

Parameters, such as core, facing, adhesive, adhesive application method, 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.
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 related to core joints used in the test setup are shown in Annex B. 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
Axial load capacity of SIPs shall be qualified in accordance with ASTM E1803 with the additional requirement 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 shown in Annex B.

A minimum of three (3) 4-ft (1219-mm) wide assemblies of each SIP configuration (wall thickness and height) shall be tested. The test assembly dimension and minimum number of tests shall be in accordance with Table 3 or 4. Both the peak test load and the load at the deflection limit specified in Table 4 shall be reported.

6.3 Transverse Load Capacity
Transverse load capacity of SIPs shall be qualified in accordance with ASTM E1803 using uniform 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 shown in Annex B.

The test assembly dimension and minimum number of tests shall be in accordance with Table 3 or 4. A minimum of three (3) 4-ft (1219-mm) wide assemblies of each SIP configuration (wall thickness and height) shall be tested. Both the peak test load and the load at the deflection limit specified in Table 4 shall be reported.

6.4 Racking Resistance
Racking resistance of SIPs shall be qualified in accordance with ASTM E1803 with the additional requirement that the maximum stiffness of the load beam shall not exceed 330,000 kips-in.² (947 kN-m²), as specified in ASTM E2126—the load beam as described in Annex B. 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 be as shown in Annex B. 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. Additional details of the test setup are shown in Annex B.

The test assembly dimension and minimum number of tests shall be in accordance with Table 3 or 4. A minimum of three (3) full-size assemblies (see Tables 3 and 4) of each SIP configuration (wall thickness) shall be tested. Both the peak 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.
6.5 Lintel Load Capacity
Lintel load capacity of SIPs shall be qualified in accordance with this section. Additional details of the testing procedures are shown in Annex B. 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.

The test assembly dimension and minimum number of tests shall be in accordance with Table 3 or 5A minimum of three (3) specimens for the lintel thickness of 4-1/2 inches (114 mm) and spans shown in Table 5 shall be tested. Each specimen shall be taken from a separate SIP to permit the assessment of the variability of the test results.

The SIP lintels shall be cut from larger SIPs and fabricated with No. 2 SPF 2x lumber attached to the top and bottom of the lintel with nails (see Figure 4). 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. The SIP facing shall be continuous without joints.

![Figure 4. SIP Lintel (1 inch = 25.4 mm)](image)

Edgewise bending tests shall be conducted in accordance with the third-point load method of ASTM D4761 with the additional requirement 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.

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

6.6 Construction Moisture Effects
The effects of anticipated changes in moisture content on the SIP performance shall be qualified by comparing the performance of SIPs between as-received and wet-and-redry conditions in accordance with Section 15.3 of ASTM E72 with the additional requirement that the specimen shall be re-dried at the final (3rd) cycle and tested when the assembly is re-dried. The test assembly dimension and minimum number of tests shall be in accordance with Table 4A minimum of three assemblies of 4-1/2 inches x 8 feet (114 x 2438 mm) SIPs with matched facing and core materials from the same production shall be tested for axial load, transverse load, racking, and lintel load under dry and wet-redry conditions.
6.7 Bond Strength
The bond shear strength between facing and core, including foam-in-place core as applicable, shall be tested in accordance with Section 15.1 of ASTM D7446. The bond tensile strength between facing and core shall be tested in accordance with Section 15.2 of ASTM D7446.

6.8 Durability of Foamed-In-Place Core Materials

6.8.1 Construction
Test 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 inches (48 mm) in thickness. The custom Specimens specimens shall be prepared by the SIP manufacturer with foam-in-place core material following the same qualified material specification (i.e. density, etc.) and foaming process as used in the SIP panels in production in conformance with Table 4.

6.8.2 Shear specimens
Fifteen (15) shear test specimens shall be prepared in conformance with 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 prepared.
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 D7446. Five (5) of each of the shear and bond specimens shall be subjected to the modified ASTM D1183 “C” cycle in accordance with Table 1 of ASTM D7446. 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 D7446.

6.8.5 Testing
Shear testing shall be performed in accordance with ASTM C273. Load shall be applied through the holes shown in Figure 5 and the specimen shall be able to self-align between load points. Tensile adhesion testing shall be performed in accordance with ASTM C297.

7. Reporting of Test Results
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 to identify possible changes in performance during subsequent re-evaluations.

8. Trademarking and Certification

8.1.1 Certification
SIPs represented as conforming to this standard shall bear the stamp of an approved agency which either (1) inspects the manufacturer or (2) has tested a random sampling of the finished products in the shipment being certified for conformance with this standard.

Quality assurance of the PRS-610.1 performance-rated SIPs shall follow the in-plant quality manual accepted by an approved agency. As a minimum, bond tension tests shall be conducted on a production shift basis in accordance with ASTM C297. The minimum bond tensile strength shall be in compliance with Table 4.

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, the characteristic (5th percentile with 75% confidence) flatwise bending strength and average bending stiffness in the rated direction shall be determined in accordance with ASTM C393. A minimum of 10 specimens of 4-1/2 inches (114 mm) in thickness, 4 inches (102 mm) in width, and 4 feet (1219 mm) in length shall be tested at a 46.5-inch (1181-mm) span from center to center of supports using four-point loading with an end bearing of 1-1/2 inches (38 mm). The characteristic (5th percentile with 75% confidence) bending strength and average stiffness of the SIP specimens shall be compared with the properties established during qualification in accordance with Section 5.1.6 or 5.2.2 and the requirements of the qualified inspection agency.

8.2 Product Marking
SIPs in conformance with this standard shall be identified with a mark or certificate issued by an approved agency. The product marking shall meet the following minimum requirements:
a) Manufacturer Identification (such as name or logo),
b) Manufacturing date or equivalent traceable marking,
c) Approved Agency Identification (such as name or logo),
d) Conformance with this standard as signifying by the designation of “ANSI/APA PRS-610.1”,
e) Flame spread index and smoke-developed index of the core materials in accordance with Section 3.2 of this standard, and
f) 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 Section 3.2. 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. A report of the sampling shall be prepared by the qualified inspection agency. Each panel shall be prepared in accordance with the cutting diagram shown in Figure A1.

A1.3 Required Tests
Tests shall be conducted in accordance with Figure A2 based on standard and as-received moisture conditions.

A2.4 Data Analysis
Test results shall be analyzed in accordance with ASTM D2915 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 are 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 oven-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 Section 3.2. 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. 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

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

Figure A2. 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 is 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 F1667. For power driven nails, the nail head shall not penetrate the facings by more than 1/8 inch (3 mm).

B3. Electrical chases and electrical boxes
Electrical chases and electrical boxes shall be incorporated into tests prescribed in Sections B4 through B6.

B4. Axial load tests
The specimen configuration and an example test setup for axial load tests are shown in Figures B1 and B2, respectively. 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm) nails shall be installed on the top and bottom plates at 6 inches (162 mm) o.c. and minimum 3/8 inch (9.5 mm) from the edge of the facing.

Figure B1. Specimen configuration for axial load tests (1 inch = 25.4 mm)
Figure B2. Example test setup for axial load tests

**B5. Transverse load tests**

The specimen configuration and an example test setup for transverse load tests are shown in Figures B3 and B4, respectively. 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm) nails shall be installed on the end plates at 6 inches (162 mm) o.c. and minimum 3/8 inch (9.5 mm) from the edge of the facing.
Figure B3. Specimen configuration for transverse load tests (1 inch = 25.4 mm)

Figure B4. Example test setup for transverse load tests

B6. **Racking tests**
The specimen configuration and an example test setup for racking tests are shown in Figures B5 and B6, respectively. 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm)
nails shall be installed on the top plate, bottom plate, **spline**, and end posts at 6 inches (162 mm) o.c. and **minimum** 3/8 inch (9.5 mm) from the edge of the facing.

Figure B5. Specimen configuration for racking load tests (1 inch = 25.4 mm)
Load width equal to the plate width

Hold down, plate and rollers

Facing shall not bear on the top plate

#2 SPF 2x lumber, matching core thickness, top and bottom

#2 SPF 2x lumber, matching core thickness (top), matching SIP width (bottom)

Gage A: Measure the horizontal movement of the inserted top plate (not the facing) of the SIP
Gage B: Measure the sliding movement of the inserted bottom plate (not the facing) of the SIP
Gage C: Measure the downward movement of the end stud (not the facing) of the SIP
Gage D: Measure the upward movement of the end stud (not the facing) of the SIP
B7. Lintel tests
An example test setup for lintel tests is shown in Figure B7. 8d common (0.131 x 2-1/2 inches or 3.33 x 63.5 mm) nails shall be installed in the top and bottom lumber at 6 inches (162 mm) o.c. and minimum 3/8 inch (9.5 mm) from the edge of the facing.
Appendix A. History of Standard
(Non-Mandatory Information)

In October 2007, the APA Standards Committee on Standard for Performance-Rated Structural Insulated Panels in Wall Applications was formed to develop a national standard under the consensus processes accredited by the American National Standards Institute (ANSI). This national consensus standard, designated as ANSI/APA PRS 610.1, was developed in collaboration with the Structural Insulated Panel Association (SIPA) based on broad input from around the world. The first version of this standard was approved by ANSI for publication on xxx xx, 201x.

The names of the ANSI/APA PRS 610.1 Committee members when this version of the standard was published are as shown below. The current list of the committee membership is available from the committee secretariat upon request.

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doug Berger</td>
<td>NTA Laboratories</td>
<td></td>
</tr>
<tr>
<td>Todd Bergstrom</td>
<td>AFM Corporation</td>
<td></td>
</tr>
<tr>
<td>Kevin Blau</td>
<td>Tolko Industries</td>
<td></td>
</tr>
<tr>
<td>Julie Bregulla</td>
<td>BRE (United Kingdom)</td>
<td></td>
</tr>
<tr>
<td>Larry Brown</td>
<td>Tectum</td>
<td></td>
</tr>
<tr>
<td>Jim DeStefano</td>
<td>Destefano Associates</td>
<td>Vice Chair</td>
</tr>
<tr>
<td>Bruno Di Lenardo</td>
<td>Canadian Construction Materials Centre</td>
<td></td>
</tr>
<tr>
<td>Gary Ehrlich</td>
<td>NAHB</td>
<td></td>
</tr>
<tr>
<td>Mike Fischer</td>
<td>The Kellen Company (PIMA and CPI)</td>
<td></td>
</tr>
<tr>
<td>Bill Gareis</td>
<td>Ashland Chemical</td>
<td></td>
</tr>
<tr>
<td>Jeff Jayne</td>
<td>Louisiana-Pacific Corporation</td>
<td></td>
</tr>
<tr>
<td>Mike Kingsmore</td>
<td>TP Engineering, Inc.</td>
<td></td>
</tr>
<tr>
<td>Kal Kooner</td>
<td>Intertek Testing Services NA Ltd.</td>
<td></td>
</tr>
<tr>
<td>Russ Krivchuk</td>
<td>ICC-ES</td>
<td></td>
</tr>
<tr>
<td>Mike Krupa</td>
<td>BASF Corporation</td>
<td></td>
</tr>
<tr>
<td>Ken Lau</td>
<td>Ainsworth Lumber Company</td>
<td></td>
</tr>
<tr>
<td>Jeff Linville</td>
<td>Weyerhaeuser</td>
<td></td>
</tr>
<tr>
<td>Vince McClure</td>
<td>Nelson &amp; McClure, PLLC</td>
<td></td>
</tr>
<tr>
<td>Khalid Mosalam</td>
<td>University of California at Berkeley</td>
<td></td>
</tr>
<tr>
<td>Joe Pasma</td>
<td>Insulfoam LLC</td>
<td></td>
</tr>
<tr>
<td>Damian Pataluna</td>
<td>Fischersips, Inc.</td>
<td></td>
</tr>
<tr>
<td>Ron Reindl</td>
<td>PFS Corporation</td>
<td></td>
</tr>
<tr>
<td>Dave Rogne</td>
<td>Emercor Ltd.</td>
<td></td>
</tr>
<tr>
<td>Bob Ross</td>
<td>USDA Forest Products Lab</td>
<td></td>
</tr>
<tr>
<td>Tom Williamson</td>
<td>Structural Insulated Panel Assn</td>
<td></td>
</tr>
<tr>
<td>Jim Whalen</td>
<td>PFB Corporation</td>
<td>Chair</td>
</tr>
<tr>
<td>Chris Whelan</td>
<td>Purbond</td>
<td></td>
</tr>
<tr>
<td>B.J. Yeh</td>
<td>APA - The Engineered Wood Assn</td>
<td>Secretariat</td>
</tr>
</tbody>
</table>

Inquiries or suggestions for improvement of this standard should be directed to:
Secretariat, ANSI/APA PRS 610.1
APA – The Engineered Wood Association
7011 South 19th Street
Tacoma, WA  98466
Internet address: www.apawood.org
e-mail address: help@apawood.org