IAPMO ES

Cover Sheet

Evaluation Criteria of

IN-PLANE SHEAR RESISTANCE AND EQUIVALENCY OF PROPRIETARY BRACING METHODS FOR LIGHT-FRAME WOOD WALL CONSTRUCTION

Draft Evaluation Criteria for Committee Adoption.

EVALUATION CRITERIA FOR IN-PLANE SHEAR RESISTANCE AND EQUIVALENCY OF PROPRIETARY SHEATHING AS BRACING FOR WOOD FRAME WALL CONSTRUCTION

EC008-2011

1.0 INTRODUCTION

1.1 **Purpose:** This evaluation criteria (EC) provides testing and evaluation requirements to establish in-plane (racking) shear resistance properties and equivalency of *proprietary sheathing* as bracing for light-frame wood wall construction in an IAPMO-ES evaluation report.

1.2 **Scope:** This EC applies to *proprietary sheathing* used for wood frame shear wall applications in accordance with the 2009 International Building Code (IBC) or light-frame wood braced wall panel applications in accordance with the 2009 IBC and the 2009 International Residential Code (IRC). It provides a means of qualifying a *proprietary sheathing* for one or more of the following end-use applications:

Method 1: Alternatives to intermittent bracing methods recognized in the prescriptive provisions of IRC Section R602.10.2 and IBC Section 2308.9.3, 2308.11, and 2308.12 per Section 4.2.
Method 2: Alternatives *to continuously sheathed* bracing methods recognized in the prescriptive provisions of IRC Section R602.10.4 per Section 4.3, and/or
Method 3: Design properties for use with engineering provisions of IBC Section 2306 per Section 4.4.

1.3 **Limitations of Use of Criteria:** Qualification of a *proprietary sheathing* for any of the above applications shall be limited to the sizes and types of materials used for evaluation in accordance with this EC and other limitations as applicable to the scope of qualification achieved. This EC addresses only in-plane racking shear resistance; other requirements for code-compliance such as out-of-plane wind resistance, wind uplift resistance, bracing of framing for lateral stability, fire resistance, water resistive barrier performance, proprietary fasteners and other considerations as applicable must be separately evaluated or designed.

1.3.1 Methods 1 and 2 are permitted in Seismic Design Category A, B, and single-family detached dwellings in Seismic Design Category C.

1.3.2 Method 3 Design racking shear properties are applicable to building design to resist lateral wind loading in accordance with the IRC and IBC. They shall be permitted to be used for building design to resist lateral seismic loading in accordance with the IRC and IBC provided all of the following conditions are met:

1. Shear wall panel framing is limited to light frame wood construction in accordance with Section 1.2 and 3.2.
2. Seismic design coefficients, height limits, and seismic design category limits shall not exceed limits in accordance with “light-frame bearing walls with shear panels of other

materials" as shown in Table 12.2-1 of ASCE 7-05 and with applicability of these parameters confirmed in accordance with Section 4.4.4 of this EC.

3. Is permitted in Seismic Design Category A and B, and single-family detached dwellings in Seismic Design Category C.
4. *Proprietary sheathing*s are only permitted to resist seismic forces contributed by masonry or concrete conforming to Section 4.1.6 of the Special Design Provisions for Wind and Seismic.

1.3.3 Aspect Ratio Limitations: For braced wall panel applications of the *proprietary sheathing* evaluated in accordance with Section 4.2, the maximum aspect ratio shall be limited by the minimum braced wall panel length requirements in IRC Tables R602.10.3, R602.10.3.1, and IBC Section 2308.9.3. For *proprietary sheathing* evaluated in accordance with Section 4.3, the maximum aspect ratio shall be limited by the continuously sheathed braced wall panel minimum length requirements of IRC Table R602.10.4.2. For shear wall panel applications of the *proprietary sheathing*, design properties for the maximum aspect ratio tested shall be determined by testing in accordance with Section 4.4, but shall not exceed a height to width ratio of 3.5:1.when the wall panel is blocked and 2:1 when the wall panel is unblocked.

1.4 Property Evaluated: Structural Lateral Shear

2.0 CODES AND REFERENCE STANDARDS

- 2009 *International Building Code*® (IBC) International Code Council
- 2009 *International Residential Code*® (IRC) International Code Council.
- AF&PA SDPWS-2008, Special Design Provisions for Wind and Seismic, American Forest and Paper Association.
- AISI S100-2007, North American Specification for the Design of Cold-Formed Steel Structural Members.
- ANSI/AF&PA NDS-2005, National Design Specification (NDS) for Wood Construction, American Forest and Paper Association.
- ANSI/AF&PA SDPWS-2008 Special Design Provisions for Wind and Seismic
- ASCE 7-05, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers.
- ASTM E 72-05, Standard Test Method of Conducting Strength Tests of Panels for Building Construction, ASTM International.
- ASTM E 564-06, Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings, ASTM International.
- ASTM E 661-88 (1997) Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads, ASTM International.
- DOC PS 2-04, Performance Standard for Wood-Based Structural-Use Panels, National Institute of Standards and Technology.

3.0 DEFINITIONS

Aspect Ratio: The height divided by the length of a braced wall panel or shear wall panel. Also refer to Section R202 of the IRC.

Bracing Method: A configuration of bracing materials (including elements and their connections) in a light-frame wall assembly to provide racking (in-plane shear) resistance.

Braced Wall Panel: A full-height section of wall braced with bracing materials uninterrupted by openings or discontinuations and consisting of a *proprietary sheathing* or a bracing method in accordance with IBC Section 2308.9.3, 2308.12.4, or IRC Section R602.10. Also refer to Section R202 of the IRC and Section 2302.1 of the IBC.

Proprietary Sheathing: Panel or board-type material(s) mechanically fastened to a light-frame wood wall to form a bracing method. The *proprietary sheathing* material shall comply with minimum performance requirements of an industry standard such as an IAPMO ES Evaluation Criteria, ASTM International Standard, Underwriters Laboratory Standard, or otherwise to the satisfaction of IAPMO ES.

Continuously Sheathed: A technique of installing a sheathing material to all sheathable areas of a wall, including areas above and below openings. Also refer to IRC Section R202 definition for "Braced wall line, continuously sheathed".

Intermittent Bracing: A technique for installing bracing materials in a non-continuous fashion at discrete and separate locations along a wall.

Perforated Shear Wall: Refer to IBC Section 2302 and Continuously Sheathed Definition.

Drift: The horizontal in-plane displacement under racking load of the top horizontal member of the wall frame relative to the bottom horizontal member of the wall frame.

Apparent Shear Deflection: Drift reduced by subtracting a calculated component of horizontal deflection caused by assumed rigid-body rotation of the wall frame as determined from uplift and downward movement of chord members (end studs) and the aspect ratio of the wall.

Light-frame Wall Construction: Refer to IBC Section 202.

Shear Stiffness: Applied horizontal shear load divided by drift or apparent shear deflection as indicated.

Shear Wall Panel: A full-height section of a light-frame wall containing an approved bracing material or method and meeting analysis and detailing requirements for an engineered design; refer also to IBC 2302.1.

Unit Shear Resistance: Unit shear resistance is determined by dividing the applied racking shear load by the horizontal length of a braced wall panel.

Unit Shear Stiffness: Shear stiffness divided by the length of the wall.

3.1 PRODUCT USE

3.1.1 Product Category Typical Use: In-Plane Shear Resistance bracing for Wood Frame Wall construction

3.1.2 Evaluation Basis:

Option 1: Evaluation of submittals to evidence and demonstrate equal or better performance characteristics of Evaluation subject to those of code sanctioned products that comply with the following code sections: Refer to code sections listed with Method 1 and Method 2 in Section 1.2.

Option 2: Evaluation of submittals to evidence and demonstrate the compliance of Evaluation subject product category to the following applicable code sections: Refer to the code section listed with Method 3 in Section 1.2.

3.2 PRODUCT DESCRIPTION AND SUBMITTAL INFORMATION

3.2.1 The following information shall be submitted to initiate the evaluation process:

Product Description: Documentation shall be provided for specifications, thickness, size and the manufacturing process of proprietary bracing materials comprising the *proprietary sheathing*.

Installation Instructions: Installation instructions shall be provided indicating materials, construction details, requirements, and limitations consistent with the scope of application for which evaluation is sought in accordance with this EC. Installation instructions shall match installation conditions as tested in accordance with this EC.

Packaging and Identification: Evidence shall be provided regarding the method of packaging and field identification (labeling) of proprietary bracing material(s) used to construct the *proprietary sheathing*.

Test Reports: Submitted test reports shall comply with requirements for evaluation in Sections 3.0 and 4.0. Testing laboratories providing such test reports shall be an approved agency as defined in accordance with the code. In addition, product sampling for testing purposes shall be representative of typical production either through random sampling by an approved independent agency, or retail product purchased from a random retail source.

3.2.2 General Requirements for Evaluation and Use: The *proprietary sheathing* shall be tested and results reported by an approved testing laboratory. The test laboratory shall include the following information as applicable to the test(s) performed:

Bracing Material(s): A description of all bracing material(s) shall be provided in the test report including the product dimensions, and generic material composition at the time of testing. Product labeling information also shall be described or documented. Bracing

materials shall be applied to the light-frame wood wall assembly in a manner consistent with intended end use and installation instructions per Section 3.1. Additive use of design values for similar or dissimilar bracing materials on opposite sides or dissimilar bracing materials on the same side of a wall shall not be permitted unless the configuration of bracing materials is specifically evaluated in accordance with this EC.

Wall Framing: Wall framing used to test wall assemblies in accordance with Section 4.0 shall be described in the test report including a description of the stud spacing, wall height and length, framing member dimensions, wood species, and grade at the time of testing. Framing shall be limited to code-compliant dimension lumber or code-compliant solid engineered wood members for the purposes of this EC.

Connections: *Proprietary sheathing* connection details shall be described in the test report and include fastener manufacturer, type, size, length, edge distances, spacing, and locations. Hold-down devices, when used, shall be identified by manufacturer, model number, type, size, and fastening hardware used to install the hold-down bracket on the test wall assembly. Framing member connections shall be described including type, size, length, and location. Framing connections or details which do not comply with the minimum framing connection requirements for conventional wood frame construction in the IBC and IRC shall be especially noted in the laboratory test report.

4.0BRACED WALL PANEL AND SHEAR WALL PERFORMANCE REQUIREMENTS

4.1 Wet Service Criteria: *Proprietary sheathing* subject to potential temporary exposure to moisture during storage or construction shall be tested in accordance with Section DOC PS 2 Sections 5.3.1.4, 7.4, and Table 5 for fastener holding under lateral load. A minimum of twenty (20) 6”x6” samples of bracing material shall be prepared in the as-received “dry” condition. Ten of these samples shall be wetted by spray on the outer surface for three days in accordance with ASTM E661 Section 6.3.2 with the back surface suspended above the water collection tray to prevent water ponding on the top surface and to prevent immersion of the sample. These ten samples shall then be re-dried in accordance with ASTM E661 Section 6.3.1. Lateral shear tests shall be conducted on the as-received “dry” samples and the “wet/redry” samples in accordance with Section 7.4 and Table 5 of DOC PS 2-04, except direct withdrawal tests shall not be required. The average ultimate lateral shear value of all tests for the “wet/redry” samples shall not be degraded by more than 25% in comparison to the average result for all tests of the as-received “dry” samples. *Proprietary sheathing* that fails to meet this criterion shall not be considered for an IAPMO Evaluation Report.

4.2 Method 1: Alternative to Intermittent Bracing Methods in IRC Section R602.10.2 and IBC Sections 2308.9.3, 2308.11, and 2308.12

4.2.1 Test Methods: Wall assemblies consisting of the *proprietary sheathing* shall be constructed and tested in accordance with ASTM E72, Section 14, with the exception that framing lumber shall be Spruce Pine Fir. The load beam shall be applied to the top framing member (top plate) in a manner that does not directly interfere with or restrain movement of the *proprietary sheathing.*

4.2.2 Test Specimen Construction: Wall assembly test specimens containing the *proprietary sheathing* shall be 8'x8' in height and length. The installation and configuration of bracing materials in the test wall assembly shall be consistent with information provided in Section 3.2.1 and 3.2.2 describing the assembly with *proprietary sheathing* as intended for end-use.

4.2.3 Test Repetitions: A minimum of three identically constructed assemblies with the *proprietary sheathing* shall be tested.

4.2.4 Nominal Unit Shear Capacity Value: The nominal unit shear capacity value shall be taken as the lowest peak unit shear capacity from the required number of test repetitions (Section 4.2.3).

4.2.5 Allowable Stress Design (ASD) Unit Shear Resistance Value for Wind: The ASD unit shear value for wind design shall be taken as the lesser of the following:

- nominal unit shear value (Section 4.2.4) divided by a safety factor of 2, and
- the average applied unit shear load at 0.2 inches apparent shear deflection multiplied by 1.4 or, alternatively, the average applied unit shear load at h/180 drift.

4.2.6 Equivalence Procedure for Wind and Seismic Design Categories A, B, and C: The *proprietary sheathing* bracing method's equivalence to a specific intermittent braced wall panel construction method shall be determined in accordance with this section for use with IRC Table R602.10.1.2(1) Bracing Requirements Based on Wind Speed and IBC Table 2308.9.3(1) Braced Wall Panels for Seismic Design Categories A, B, and C. The ASD unit shear resistance values (Section 4.2.5) used to establish equivalence to code-compliant wall bracing shall be based on testing of *proprietary sheathing* alone (i.e., without presence of gypsum finish on the interior side of the wall assembly).

4.2.6.1 Direct Equivalence Method: The *proprietary sheathing* bracing method shall develop an ASD unit shear resistance value (Section 4.2.5) equal to or greater than that for a specific grouping of code-compliant wall bracing method listed in Table 1. If this criterion is met, the *proprietary sheathing* bracing method shall be considered as an alternative to the specific group of code-compliant bracing methods listed in Table 1. Proprietary sheathing bracing methods with less than 100 plf ASD unit shear value (minimum value in Table 1) shall not be permitted for use on the basis of equivalency.

4.2.6.2 Scaled Equivalence Method (2009 IRC Only): The bracing amount required for the *proprietary sheathing* bracing method shall be permitted to be determined using a bracing amount (length) scaling factor. The scaling factor shall be determined as follows and in no case shall be taken as less than 1.0. The scaling factor shall be determined by dividing 350 plf by the sum of the *proprietary sheathing* bracing method's ASD unit shear resistance value (Section 4.2.5) and 100 plf.

For example, a *proprietary sheathing* bracing method having an ASD unit shear resistance (4.2.5) of 225 plf shall use a bracing amount scaling factor of 350 plf / (225 +100) plf = 1.08. Thus, the bracing amount for the *proprietary sheathing* shall equal the

amount of bracing from IRC Table R602.1.2(1) – for any one of the 250 plf code-complying bracing methods listed in Table 1 – multiplied by 1.08.

4.3 Method 2: Alternatives to Continuously Sheathed Bracing Method per IRC Section R602.10.4:

4.3.1 General: A *proprietary sheathing* bracing method successfully evaluated in accordance with Section 4.2 as an alternative intermittent bracing method shall be permitted to be additionally evaluated as an alternative to the continuously sheathed wood structural panel bracing method (CS-WSP) of IRC Section R602.10.4.

4.3.2 Test Method: The continuously sheathed application of the *proprietary sheathing* bracing method shall be tested using the ASTM E564 racking test method. A displacement-controlled ramp function shall be permitted in lieu of the loading procedure of ASTM E 564 when an electronic data acquisition system is used. The maximum load shall be achieved in not less than five minutes and not more than twenty minutes. The load beam shall be applied to the top framing member (top plate) in a manner that does not directly interfere with or restrain movement of the bracing materials used in the *proprietary sheathing* bracing method.

4.3.3 Test Specimen Construction: Wood framed wall test specimens shall be constructed using Spruce-Pine-Fir framing in accordance with the wall configurations of Table 2 and the following:

4.3.3.1 Overturning Restraints: Hold-down connectors or a corner return overturning restraint shall be provided at the wall ends as indicated in Table 2. Where specified in Table 2, hold-downs shall be sized to prevent an overturning failure mode.

4.3.3.2 Specimen Configuration and Sample Size: Specimen configurations shall be in accordance with Table 2. Configuration 1 (Table 2) shall have a minimum sample size in accordance with ASTM E 564. Remaining configurations in Table 2 shall be permitted to have a minimum sample size of one wall specimen for each configuration. Different wall heights need not be evaluated.

4.3.3.3 Boundary Conditions for Testing Purposes: A pretension force not exceeding 1,200 pounds (5400 N) shall be applied to anchor bolts and hold-down devices. Alternatively, nuts shall be permitted to be turned an additional 3/4-turn after finger tight. The loading beam required by ASTM E564 shall be sized such that the bending stiffness, EI, does not exceed 330,000 kip-in^2 (e.g., 29,000 ksi x 11.3 in^4). Bottom and top plates shall be anchored to the test rigging using maximum 5/8-inch diameter anchor bolts or lag screws spaced at minimum 24 inches on center (610 mm) with 3-inch-by-3-inch-by-1/4-inch-thick (76 mm x 76 mm by 6.35 mm thick) square plate washers installed between the wood bottom plate and the fastener head or nut. Anchor bolts shall be located not more than 11 inches (330 mm) nor less than 13 inches (279 mm) from each end of the wall. For Configuration 2 of Table 2, one anchor bolt shall be centrally located in the bottom plate of the corner return and a 2'x2' triangular gusset plate of 7/16" OSB shall be placed on top of wall plates at the corner. Each 2-foot leg of the gusset plate shall be face nailed to the top plates of the wall and corner return at 6 inches on center using 8d

common nails. At the corner in Configuration 2, the sheathing materials on the corner return and wall shall be permitted to be fastened to the common corner stud using the required edge fastening requirement for the sheathing material.

4.3.4 Conditions of Acceptance: For the continuous sheathing application of the *proprietary sheathing* bracing method, the measured test results for ultimate shear capacity shall be equal to or greater than the predicted values using the reduction factors noted in Table 2. The predicted ultimate shear capacity shall be determined as the product of the reduction factor from Table 2, the average unit shear (from Configuration 1 specimen per Table 2), and the wall length.

4.3.5 Bracing Amount for Alternatives to IRC R602.10.4 Continuously Sheathed Bracing Method for Seismic Design Categories A, B and C (excluding townhouses in Seismic Design Category C): Provided the conditions of acceptance (Section 4.3.4) for use as an alternative continuously sheathed bracing method are met by the tested *proprietary sheathing* bracing method, bracing amounts required for an intermittent bracing method application of the *proprietary sheathing* bracing method as determined in accordance with Section 4.2 by the direct equivalence method (Section 4.2.6.1) or the scaled equivalence method (Section 4.2.6.2) shall be permitted to be multiplied by 0.85. The *proprietary sheathing* bracing method shall be installed on wall framing in accordance with the tested assembly conditions and shall otherwise comply with the requirements for CS-WSP and CS-G bracing methods in accordance with IRC Section R602.10.4.

4.4 Method 3: Evaluation of Design Properties for *Proprietary Sheathing* Bracing Methods Used for Shear Wall Construction in Accordance With IBC Section 2306 and AF&PA/SDPWS:

4.4.1 Scope: Design values for a *proprietary sheathing* bracing method used for shear wall panel construction shall be determined in accordance with Section 4.4.2 or Section 4.4.3 for wind load resistance. Seismic design values shall be determined in accordance with Section 4.4.4 and subject to the limitations of Section 1.3.

4.4.2 Wind Load Design Resistance Values in Accordance with ASTM E72: The allowable stress design (ASD) unit shear resistance value for the *proprietary sheathing* used as a shear wall construction method shall be permitted to be determined in accordance with Section 4.2.5 for wind load resistance applications only. The ASD unit shear value determined in accordance with Section 4.2.5 using the ASTM E72 test method shall apply to the design of segmented shear walls with a maximum aspect ratio of 1:1. For application to a greater aspect ratio than 1:1, additional tests following the procedure of Sections 4.2.1 through 4.2.5 shall be required for the maximum aspect ratio(s) of interest. If two or more additional aspect ratio conditions are tested, a reduction factor equation based on the ASD unit shear resistance value derived for each tested aspect ratio condition shall be permitted to be developed and used as a basis for adjusting the design values that are based on a 1:1 aspect ratio. The apparent shear deflection (excluding effect of rotation due to end stud uplift and compression) at a load corresponding to the ASD unit shear resistance value shall be reported for all aspect ratios evaluated.

4.4.3 Wind Load Design Resistance Values in Accordance with ASTM E564: The *proprietary sheathing* bracing method used for shear wall construction shall be tested using the ASTM E564 racking test method. A displacement-controlled ramp function shall be permitted in lieu of the loading procedure of ASTM E 564 when an electronic data acquisition system is used. The maximum load shall be

achieved in not less than five minutes and not more than twenty minutes. The load beam shall be applied to the top framing member (top plate) in a manner that does not directly interfere with or restrain movement of the *proprietary sheathing*. The procedure of Sections 4.2.2 through 4.2.5 shall be followed to derive nominal and design unit shear resistance values applicable to each aspect ratio condition tested. In addition to tests at 1:1 aspect ratio and where at least two more aspect ratio conditions are tested, a reduction factor equation based on the ASD unit shear resistance value derived for each tested aspect ratio condition shall be permitted to be developed and used as a basis for adjusting the design values that are based on a 1:1 aspect ratio. The apparent shear deflection (excluding effect of rotation due end stud uplift and compression) at a load corresponding to the ASD unit shear resistance value shall be reported for all aspect ratios evaluated.

4.4.4 Seismic Design Properties: Seismic design properties determined in this EC shall be limited to conditions described in Section 1.3. The ASD unit shear resistance value determined in accordance with Section 4.4.2 or 4.4.3 shall be multiplied by 0.7 for seismic design applications. Apparent shear deflection as determined in accordance with Sections 4.4.2 and 4.4.3 shall be used as a basis for determining elastic deflection at strength-based (LRFD) seismic force levels. Applicability of default seismic design parameters given in Section 1.3 shall be confirmed by demonstrating that the proprietary sheathing as tested in accordance with Section 4.4.2 or 4.4.3 using an 8'x8' wall assembly meets the following criteria[1]:

$\Delta_u/H \geq 0.012$
$\Delta_u/\Delta_{peak} \geq 1.2$

where
Δ_u = average post-peak drift (inches) at a point where applied shear load drops 20% from peak
Δ_{peak} = average drift (inches) at average peak shear resistance from required tests
H = wall height in inches (96 inches)

If the above criteria are not satisfied, the proprietary sheathing shall be limited to use in design of light frame wood buildings in Seismic Design Category A or B only.

4.4.5 Shear Wall Design Applications for the Proprietary Sheathing: The *proprietary sheathing* bracing method's ASD unit shear resistance value determined in accordance with Section 4.4.2 or 4.4.3 for wind design and Section 4.4.4 for seismic design (including limitations of Section 1.3) shall be applicable to the design of segmented shear walls in accordance with IBC Section 2306, AFPA/SDPWS, and AFPA/NDS. For qualification to use the perforated shear wall (PSW) design provisions in AFPA/SDPWS, the proprietary sheathing must be tested in accordance with Section 4.3 using wall Configurations 1 and 3-5 from Table 2 and, for those wall configurations, satisfy the conditions of acceptance in Section 4.3.4.

Alternatively, an empirical equation providing reduction factors fitted to the test results shall be permitted to be used as a means of PSW design for the *proprietary sheathing* bracing method provided no single test result falls below the fitted empirical trend from a minimum of three test specimens

[1] Criteria based on ASTM E72 tests of IRC bracing method LIB (let-in braces plus gypsum wallboard) reported as wall configuration #4 in "Evaluation of the Lateral Performance of Let-in Bracing and Mixed Bracing Systems", Report # EG5736_052908, NAHB Research Center, Inc., Upper Marlboro, MD, May 29, 2008.

conducted for each configuration required by 4.4.5. If the nominal load for any one of the test configuration specimens varies more than 15 percent from the average, a minimum of three additional tests shall be conducted on that configuration. Since the particular characteristics of a proprietary sheathing may not be anticipated sufficiently, the final scope of the PSW testing program using this alternate method must be approved by IAPMO based upon a review of expected performance versus test results. Where tests indicate the proprietary material will behave in a manner inconsistent with code based assemblies, IAPMO in its sole discretion may disallow the testing.

5.0 QUALITY CONTROL

5.1 IAPMO ES approved inspection of manufacturing facilities are required for this product.

5.2 Quality documentation complying with the IPAMO ES Minimum Requirements for Listee's Quality Assurance System (IAPMO ES-010) shall be submitted.

6.0 EVALUATION REPORT RECOGNITION

6.1 The following information shall be included in the IAPMO evaluation report:

6.1.1 Equivalency to IRC and IBC Braced Wall Panel Construction Methods: The evaluation report shall indicate equivalency to specific IRC and IBC braced wall panel construction methods as successfully determined in accordance with Sections 4.2 and 4.3, if evaluated.

6.1.2 Shear Wall Design Properties: The evaluation report shall indicate design properties as successfully determined in accordance with Section 4.4 for shear wall design applications in accordance with the IBC, if evaluated.

6.1.3 Aspect Ratio Limitations: The maximum aspect ratio for the proprietary bracing material shall be reported in accordance with Section 1.3.3 for braced wall panel applications and as determined by testing in accordance with Section 4.4 for shear wall applications.

6.1.4 Wet Service Criteria: The evaluation report shall indicate compliance with wet service use based on successful evaluation in accordance with Section 4.1.

6.1.5 Detailing Requirements: Wall assembly conditions specific to the proper installation of the proprietary sheathing and construction of the wall framing as evaluated in this EC shall be detailed in the evaluation report. For example wood framing species, minimum density, framing size and spacing, fasteners, etc shall be reported. Details that are identified in this EC as being part of the required boundary conditions for testing purposes only shall not be required to be reported as a use condition in the evaluation report. Details that rely on prescriptive requirements in the IBC or IRC shall be noted as such in the evaluation report and differentiated from details specific to the unique and proper installation of the *proprietary sheathing* bracing method as evaluated. The evaluation report shall indicate that sill plate anchor bolts require washers at least equivalent in size and thickness to those used in the product evaluation and nuts shall be tightened a minimum of ¾ turn after finger tight.

6.1.6 Additional Considerations: The following additional considerations shall be addressed in the evaluation report:

1. As with other sheathing bracing methods in the building code, cutting, notching, and boring of sheathing-type bracing materials is prohibited unless specifically evaluated as part of the *proprietary sheathing* bracing method or considered to be of an incidental nature (e.g., typical electric receptacle, plumbing pipe penetration, ripping panel to proper dimension for application to framing, etc.).
2. As with other bracing methods recognized in the building code, this evaluation report applies to materials in an undamaged condition. Damaged materials shall be replaced or repaired by an approved design in accordance with the manufacturer's requirements.
3. Evaluation report recognition based solely on this EC shall state applicability of the proprietary sheathing for resistance to in-plane shear only and that other aspects of wall sheathing performance as described in Section 1.3 have not been evaluated.

TABLE 1:
2009 IRC and IBC Intermittent Braced Wall Panel Construction Methods and Design Properties for Evaluation of Equivalence of Alternative Methods Per Section 4.1 [1,2]

Method ID per IBC (IRC)	Description (see IRC Section R602.10.3 for full description)	Bracing Properties	
		Nominal Unit Shear Value (plf)	ASD Unit Shear Value (plf)
		Without Interior Finish	Without Interior Finish
1 (LIB) or 5/G-P (GB)	1x4 wood let-in brace or Gypsum Wall Board (double sided)	200	100
2 (DBS), 3/W-S (WSP), 4 (SFB), 6 (PBS), 7 (PCP), or 8 (HPS)	Diagonal wood boards, Wood structural panels, Structural Fiberboard, Particle Board Sheathing, Portland Cement Plaster, Hardboard Panel Siding	500	250

TABLE NOTES:

1. Design properties are based on use of Spruce-Pine-Fir framing lumber and are rounded to the values indicated for the grouped bracing methods. For basis of design values refer to: Crandell, J.H. and Martin, Z., "The Story Behind 2009 IRC Wall Bracing Provisions (Part 2: New Wind Bracing Requirements)", *Wood Design Focus*, Forest Products Society, Madison, WI, Spring 2009. For seismic design values and parameters used in the IRC (not reported in Table 1), refer to: Crandell, J.H., "The Story Behind IRC Wall Bracing Provisions", *Wood Design Focus*, Forest Products Society, Madison, WI, Summer 2007.
2. Table values are for the bracing method alone without presence of gypsum wall board on interior face of wall, except for gypsum wall board (double sided). Tabulated bracing amounts in the IRC Table R602.10.1.2(1), however, include a 100 plf ASD unit shear value contribution for gypsum interior finish installed in accordance with IRC Section R702.3.1.

TABLE 2: Test Matrix for Continuous Sheathed Braced Wall Equivalency to IRC Section R602.10.4 and Perforated Shear Wall (PSW) Design Method Qualification for Use with IBC Chapter 23

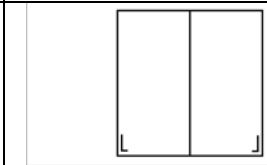
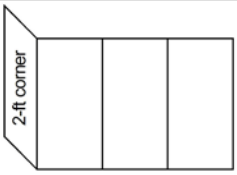
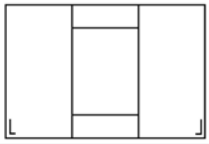
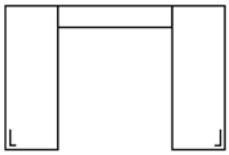
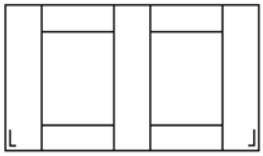
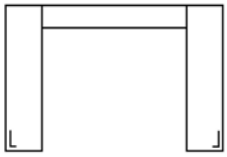
Wall Type ID	Wall Type Configuration[1]	Size, HxW, feet	Clear Opening Hgt., % of H	Reduction Factor[2]	Type of Openings	Segment Aspect Ratio	Purpose of Test
1		8x8	0%	1.0	None	1:1	Baseline
2		8x12	0%	0.79	None	1:1.5	Evaluate corner restraint for IRC equivalency
3		8x12	65%	0.51	Window	2:1	IRC CS-WSP equivalency and IBC PSW qualification
4		8x13.3	85%	0.21	Door	3:1	IRC CS-WSP equivalency and IBC PSW qualification
5		8x14	65%	0.28	Windows	4:1	IRC CS-WSP equivalency and IBC PSW qualification
6		8x12	85%	0.16	Garage Door	4:1	IRC CS-G equivalency

Table Note:

1. Configurations 1 and 3 through 6 shall be tested with metal hold-down devices anchoring end studs of wall as a shown. For single direction loading per ASTM D564, hold-down devices and corner restraint shall be permitted to be located on the tension chord (uplift) end of the wall assembly.
2. With exception of wall type Configuration 2, reduction factors are determined using the perforated shear wall design method's shear capacity ratio, F = r/(3-2r), where r is a parameter based on the area of the continuous-sheathed wall and wall openings as referenced in *SDPWS Commentary: Lateral Force-Resisting Systems*, Section C4.3.3.4, American Wood Council, Washington, DC, 2005. For wall type Configuration 2, the reduction factor value accounts for the effect of partial restraint by a 2-foot corner return as representative of conventional construction practice and is based on testing of an reference WSP sheathed wall assembly with corner framing as reported in Dolan & Heine, "Sequential Phased Displacement Tests of Wood-framed Shear Walls with Corners", Report No. TE-1997-003, VPI&SU, Timber Engineering Center, Blacksburg, VA, 1997.