APA PRP-108

Performance Standards and Qualification Policy for Wood Structural Panels

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SCOPE

APA – The Engineered Wood Association developed the *Performance Standards and Qualification Policy for Structural-Use Panels* in the early 1980s. The scope included Rated Sturd-I-Floor and Rated Sheathing. In 1984, a performance standard and criteria for Rated Siding were added. In March 1991, APA signed an agreement with the National Institute of Standards and Technology (NIST) to support development of a national standard for single-floor and sheathing under the Voluntary Product Standard system in order to provide a harmonized standard with Canada in accordance with the Free Trade Agreement of 1987. The resultant standard, *Product Standard PS 2 – Performance Standard for Wood-Based Structural-Use Panels* was finalized in 1992. The scope of PS 2 standard includes single-floor (Sturd-I-Floor) and sheathing based on the technical criteria of PRP-108. Since its inception, PS 2 provides a basis for model code acceptance in the U.S., and its Canadian counterpart, CSA O325, provides the basis for model code acceptance in Canada. This version of PRP-108 maintains inclusion of Rated Sturd-I-Floor, Rated Sheathing and Rated Siding, but refers to PS 2 for Rated Sturd-I-Floor and Rated Sheathing.

1. DEFINITIONS

Definitions shall follow those provided in PS 1 and PS 2 with modifications or additions herein.

APA 303*—Siding Manufacturing Specification*

ANSI/APA PRP 210—*Standard for Performance-Rated Engineered Wood Siding*

PS 1—*Voluntary Product Standard PS 1 Structural Plywood*

PS 2—*Voluntary Product Standard PS 2 Performance Standard for Wood-Based Structural-Use Panels*

Qualification Policy—APA policy that describes the procedures by which a mill may obtain trademarking privileges for performance-rated products.

Quality Assurance Policies—APA policies covering the third-party auditing of a mill's quality control program.

Stability Coefficient—A numerical coefficient that is an indication of a siding product's ability to remain flat when installed according to the manufacturer's application recommendations.

PERFORMANCE STANDARD FOR APA RATED STURD-I-FLOOR AND APA RATED SHEATHING PANELS

2. GENERAL

APA RATED STURD-I-FLOOR is a wood-based, structural-use panel intended for use as combination subfloor and underlayment when fastened to supports spaced in accordance with the Span Rating in inches.

APA RATED SHEATHING is a wood-based, structural-use panel intended for use in construction applications as sheathing for roofs, subflooring, and walls when fastened to supports spaced in accordance with the Span Rating in inches.

APA STRUCTURAL I RATED SHEATHING panels are intended for use where cross-panel strength and stiffness or racking shear properties are of major importance.

APA Rated Sturd-I-Floor, APA Rated Sheathing, and APA Structural I Rated Sheathing shall meet the applicable requirements for Single Floor, Sheathing, and Structural I Sheathing, respectively, of PS 1 or PS 2.

PERFORMANCE STANDARD FOR APA RATED SIDING PANELS

3. GENERAL

APA RATED SIDING is a wood-based, structural-use panel intended for use in construction application as exterior siding when fastened to supports spaced in accordance with the Span Rating in inches. APA RATED SIDING structural-use panels also include strips which may be cut from such panels by the manufacturer for use as lap siding.

This standard covers the raw materials and binding materials as they affect performance, dimensions, tolerances, and moisture content of APA RATED SIDING. Included are criteria as measured by standard test procedures to determine compliance through performance.[a]

4. REQUIREMENTS

4.1 Raw Materials

4.1.1 Wood Veneer

Any wood veneer used as a component of a panel shall be in accordance with the applicable veneer grade and workmanship requirements of the most recent edition of the *APA 303 Siding Manufacturing Specification* or ANSI/APA PRP 210, *Standard for Performance-Rated Engineered Wood Siding.* Exception: Veneer of other quality may be used in one-step composite panels, provided the manufacturer defines the quality and demonstrates that its use and the control of its quality will assure adequate performance both during qualification and in routine production.

4.1.2 Other Material

Other raw material used in panel manufacture shall be produced primarily from wood.

4.2 Panel Construction

Panels may be identified in three classes: all-veneer panels, composite panels, or mat-formed panels. See PS 2 for definition of terms. Panels shall qualify on an individual panel construction basis for the Span Rating upon demonstrated conformance to the appropriate requirements of Sections 4.3 through 4.8. Plywood manufactured to the provisions of the most recent edition of *APA 303 Siding Manufacturing Specification* or ANSI/APA PRP 210, *Standard for Performance-Rated Engineered Wood Siding* qualifies as APA Rated Siding.

4.3 Structural Performance

Performance shall be as given below when tested for each structural condition in accordance with the referenced standard APA test method.

4.3.1 Concentrated Static Loads

Products shall be tested in accordance with the procedures of APA Test Method S-9[b] for concentrated static loads. Panel and lap siding products shall conform to the criteria of Table 1 for the span shown on the trademark.

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a Publications to provide product end-use information are available from *APA – The Engineered Wood Association,* Tacoma, WA. www.apawood.org

b Methods given in *Manual of APA Test Methods for Wood Structural Panels.*

4.3.2 Uniform Loads

Products shall be tested in accordance with the procedures of APA Test Method S-10 for uniform loads. Panel and lap siding products shall conform to the criteria of Table 2 for the span shown on the trademark.

4.3.3 Hard-Body Impact Loads

Products shall be tested in accordance with the procedures of APA Test Method S-11 for hard-body impact loads. Panel and lap siding products shall conform to the criteria of Table 3 for the span shown on the trademark.

4.3.4 Soft-Body Impact Loads

Products shall be tested in accordance with the procedures of APA Test Method S-12 for soft-body impact loads. Panel and lap siding products shall conform to the criteria of Table 4 for the span shown on the trademark.

4.3.5 Fastener Head Pull-Through

Products shall be tested in accordance with the procedures of APA Test Method S-4 for fastener head pull-through. Panel and lap siding products shall conform to the criteria of Table 5 for the span shown on the trademark.

4.3.6 Wall Racking

Products shall be tested in accordance with the procedures of APA Test Method S-3 for wall racking. Panel siding products shall conform to the criteria of Table 6 for the span shown on the trademark. Lap siding products do not have racking resistance capability and therefore are not tested.

TABLE 1

CONCENTRATED STATIC LOAD PERFORMANCE CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-9

		Performance Requirements		
Span Rating	**Test Exposure Conditions**	**Maximum Residual Deflection (in.) After 100-lbf Load**	**Average Residual Indentation (in.) After 100-lbf Load**	**Minimum Ultimate Load (lbf)**
16 & 24	Dry & Wet[a]	0.200[b]	0.040[b]	200

a. Wet conditioning is exposure to seven days continuous wetting and tested wet.
b. Residual indentation or deflection is measured one minute following load removal.

TABLE 2

UNIFORM LOAD PERFORMANCE CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-10

		Performance Requirements	
Span Rating	Test Exposure Conditions	Maximum Residual Deflection (in.) After 50-psf Load	Minimum Ultimate Load (psf)
16 & 24	Dry & Wet[a]	0.200[b]	150

a. Wet conditioning is exposure to seven days continuous wetting and tested wet.
b. Residual deflection is measured one minute following load removal.

TABLE 3

HARD-BODY IMPACT LOAD PERFORMANCE CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-11

		Performance Requirements	
Span Rating	Test Exposure Conditions	Average Residual Indentation (in.) After 4 ft-lbf Impact	Minimum Ultimate Load (ft-lbf)
16 & 24	Dry & Wet[a]	0.040[b]	8

a. Wet conditioning is exposure to seven days continuous wetting and tested wet.
b. Residual indentation is measured one minute following load removal.

TABLE 4

SOFT-BODY IMPACT LOAD PERFORMANCE CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-12

		Performance Requirements	
Span Rating	Test Exposure Conditions	Maximum Residual Deflection (in.) After 30 ft-lbf Impact	Minimum Ultimate Load (ft-lbf)
16 & 24	Dry & Wet[a]	0.200[b]	45

a. Wet conditioning is exposure to seven days continuous wetting and tested wet.
b. Residual deflection is measured one minute following load removal.

TABLE 5

FASTENER HEAD PULL-THROUGH CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-4

		Performance Requirements	
Span Rating	Test Exposure Conditions	Nail Size[b]	Minimum Ultimate Load (lbf)
16 & 24	Dry	6d	55
	Wet[a]		40

a. Wet conditioning is exposure to seven days continuous wetting and tested wet.
b. Hot-dipped galvanized casing nail or siding nail.

TABLE 6

RACKING LOAD PERFORMANCE CRITERIA FOR PRODUCTS TESTED ACCORDING TO APA TEST METHOD S-3

		Nail Spacing			Performance Requirements[a]		
Thickness (in.)	Nail Size (box)	Panel Edge (in.)	Intermediate Studs (in.)	Test Exposure Conditions	Design Load (lbf/ft)	Maximum Deflection at Design (in.)	Minimum Ultimate Load (lbf/ft)
At Point of Nailing[b]	6d	6	12	Dry	150	0.20	650
					300	0.60	—
				Wet[c]	150	0.28	500
					300	0.80	—

a. Stud spacing – 16" o.c. or 24" o.c.
b. Thickness at point of nailing shall be that at base of grooves (if grooved) unless otherwise recommended by the manufacturer.
c. Wet exposure shall follow the recommended procedures outlined in ASTM E72.

4.4 Physical Properties

Performance shall be as given below for each physical property when tested in accordance with the referenced APA test method.

4.4.1 Stability

Panels shall be tested according to one of the following stability test procedures:

4.4.2 Stability Coefficient

Panels shall be tested according to the procedures of APA Test Method P-10 for stability coefficient of siding products. The stability coefficient shall be 0.80 or greater.

4.4.3 Full-Scale Testing

Panels shall be tested according to the procedures of APA Test Method P-11 for stability on a large-scale test frame. The average expansion of the restrained panels, as measured over the entire assembly, shall be less than or equal to 0.20% along either axis of the frame. The five percent exclusion limit of buckling distortions across supports and panel distortions along any support shall be no greater than 0.20 inch as determined by the procedures of Method P-11.

4.4.4 Edge Stability

Siding shall be tested according to the following edge stability test procedures:

4.4.5 Edge Swell

Panels shall be tested for edge swell according to the procedures of APA Test Method P-2 for dimensional change due to one-sided wetting. The edge thickness swell shall be no greater than 25% after three weeks of wetting exposure.

4.4.6 Edge Checking

Panels shall be tested according to the procedures of APA Test Method P-12 for edge checking. APA Rated Siding shall satisfy edge checking requirements.

4.5 Surface Characteristics

Performance shall be as given below for properties that affect finish performance when tested in accordance with the referenced APA test method.

4.5.1 Surface Texture Change

Specimens shall be tested according to the procedures of APA Test Method F-1. The numerical value for surface change shall be no greater than 1.0.

4.5.2 Finish Adhesion

Specimens shall be tested according to the procedures of APA Test Method F-2. The average numerical value for initial dry adhesion of the standard control finish shall be not less than 2.0 pounds per inch of width, with no specimen being less than 1.5. If adhesion failures occur within the substrate, the product is acceptable, providing that more than 50 percent of the failed area is within the substrate. (Substrate bond performance is evaluated in Section 4.6.)

4.5.3 Surface Repairs

Specimens with surface repairs shall be tested according to the procedures of APA Test Method F-3. Products shall conform to the criteria of Table 7. Size and type of repair shall be according to the most recent edition of PS 1.

4.5.4 Overlays

Specimens with overlays shall be tested according to the procedures of APA Test Method F-4. Products shall conform to the criteria of Table 8 in addition to Sections 4.5.1 and 4.5.2.

TABLE 7

SURFACE REPAIR PERFORMANCE CRITERIA FOR SAMPLES TESTED ACCORDING TO APA TEST METHOD F-3

Test Exposure Condition			Performance Requirements
Test 1	Boil-Dry Cycles	Probe	No cracking, shrinkage, or loss of bond.
		Power Sawing	Repair shall cut cleanly and stay in place. Cut repair is also probed as above.
Test 2	Soak-Dry Cycles	Probe	No cracking, shrinkage, or loss of bond.
		Power Sawing	Repair shall cut cleanly and stay in place. Cut repair is also probed as above.
Test 3	Finishability	Finish Compatibility	Standard control finish shows no signs of incompatibility (e.g., alligatoring, crawling, etc.).
		Finish Adhesion	Requirements of Section 4.5.2 shall be satisfied.
Test 4	Machinability		The repairs shall machine cleanly and stay in place.

TABLE 8

OVERLAY PERFORMANCE CRITERIA FOR SAMPLES TESTED ACCORDING TO APA TEST METHOD F-4

Test Exposure Condition		Performance Requirements
Test 1	Vacuum-	Delamination limited to an area 1/2 inch deep x 1 inch wide.
	Pressure-Dry	No internal separation of the overlay.
		No cracks in the overlay.
Test 2	Machinability	Performance of the overlay must be at least equivalent to that of the typical PS 1 phenolic Medium Density Overlay. The overlay shall present a smooth edge after the machining tests (sawing, nailing, routing, drilling) and shall not tear, crack, chip or fuzz.
Test 3	Finishability	Requirements of Section 4.5.2 shall be satisfied.

4.6 Bond Performance

Performance shall be as given below for properties that affect the adhesive bonding system when tested in accordance with the referenced APA test method. Panels composed entirely of veneer shall meet the PS 1 bond requirements for Exterior type. Mat-formed panels, wood-based material for composite panels, and finished (veneered) composite panels shall exhibit a minimum average strength retention of 55%, with no individual panel retained strength less than 45%, when tested in accordance with the procedures of APA Test Method S-6 following moisture cycling according to the procedures of APA Test Method D-5. In addition, at least 95% of composite panel specimens shall pass delamination requirements when tested in accordance with the procedures of APA Test Method P-9, following moisture cycling according to the procedures of APA Test Method D-5 extended to ten (10) moisture cycles.

Alternatively, OSB shall comply with the bond performance criterial of AC 321.

4.6.1 Adhesive Performance

Sections 4.6.2 to 4.6.4 shall be applied when the chemical makeup of the adhesive is known to be susceptible to mold, elevated temperatures, or bacteria.

4.6.2 Adhesive Mold Resistance

Panels shall satisfy the mold resistance test according to the procedures of APA Test Method D-2.

4.6.3 Adhesive Resistance to Elevated Temperature

Panels satisfy sufficient elevated-temperature resistance (160°F) when they meet the requirements of Section 4.6.2.

4.6.4 Adhesive Bacteria Resistance

Panels shall satisfy the bacteria test according to the procedures of APA Test Method D-3.

4.7 Dimensional Tolerance and Squareness of Panels

4.7.1 Size

A tolerance of plus or minus 1/16 inch shall be allowed on manufactured length and/or width.

4.7.2 Thickness

A tolerance of plus or minus 1/32 inch for trademark-specified Performance Category of 13/16 inch or less and plus or minus 5% of the trademark-specified Performance Category for panels thicker than 13/16 inch shall be allowed, unless otherwise determined through qualification testing.

4.7.3 Squareness and Straightness

Panels shall be square within 1/64 inch per lineal foot of panel length, as measured along the diagonals. All panels shall be manufactured so that a straight line drawn from one corner to the adjacent corner is within 1/16 inch of the panel edge.

4.8 Moisture Content

Moisture content of panels at time of shipment shall not exceed 16% of oven-dry weight as determined by APA Test Method P-6.

5. IDENTIFICATION

All APA RATED SIDING shall be identified with an APA trademark bearing the APA RATED SIDING designation appropriate under these specifications. The manufactured nominal thickness, EXTERIOR bond performance classification and the Span Rating shall be included in the trademark. Products which carry the APA RATED SIDING trademark are to be applied in accordance with APA RATED SIDING application recommendations published by *APA – The Engineered Wood Association*. Any supplemental application recommendation of the manufacturer must be clearly marked on each piece.

APA QUALIFICATION POLICY FOR TRADEMARKING PRIVILEGES FOR RATED SIDING

6. QUALIFICATION TESTING FOR RATED SIDING

6.1 General

Required tests and criteria are detailed in the Performance Standard for APA Rated Siding Panels. Conformance and retest requirements are given by test in this section.

Tests are conducted according to the application recommendations of the APA Rated Siding Standard, at the support spacing to be shown on the trademark. Any special product modification which enhances performance, such as moisturizing or water repellent treatment, shall be noted per Section 7.

When necessary, retest options are followed if no change is made in the manufacturing process. If a change in panel configuration or processing is made, additional qualification tests, as necessary, shall be performed.

6.2 Structural Performance

6.2.1 Concentrated Loads

A minimum of three tests (specimens taken from at least three panels) for each test exposure condition shall be evaluated for concentrated static and impact loads according to APA Test Methods S-9, S-11, and S-12.

6.2.1.1 Residual Deflection

For each sample, 100% of the tests shall exhibit residual deflections no more than the specified maximum.

Retest. If no more than one test in a sample of three fails to meet the residual deflection requirements, another sample of three may be tested for that requirement. If all pass the retest, the requirements shall be considered satisfied.

6.2.1.2 Residual Indentation

The average residual indentation shall not be greater than that specified.

Retest. If the average residual indentation is greater than specified, but does not exceed the requirement by 20%, another sample of three may be tested for that requirement. If the average of the first and second sample taken together does not exceed that specified, the requirement shall be considered satisfied.

6.2.1.3 Ultimate Load

For each sample, 100% of tests shall support the specified minimum ultimate load.

Retest. If no more than one test in a sample of three fails to meet the minimum ultimate requirement, another sample of three may be tested for that requirement. If all pass the retest, the requirements shall be considered satisfied.

6.2.2 Uniform Loads

A minimum of three tests (specimens taken from at least three panels) for each test exposure condition shall be evaluated for uniform load capacity according to APA Test Method S-10.

6.2.2.1 Residual Deflection

For each sample, 100% of the tests shall exhibit residual deflections no more than the specified maximum.

Retest. If no more than one test in a sample of three fails to meet the minimum ultimate requirement, another sample of three may be tested for that requirement. If all pass the retest, the requirements shall be considered satisfied.

6.2.2.2 Ultimate Load

For each sample, 100% of tests shall support the specified minimum ultimate load.

Retest. If no more than one test in a sample of three fails to meet the minimum ultimate requirement, another sample of three may be tested for that requirement. If all pass the retest, the requirements shall be considered satisfied.

6.2.3 Wall Racking

A minimum of two tests for each test exposure condition shall be evaluated for wall racking according to APA Test Method S-3.

6.2.3.1 Deflection

The average deflection shall not be greater than that specified.

Retest. If the average deflection is greater than specified, but does not exceed the requirement by 20%, another wall may be tested for that requirement. If the average of the three walls taken together does not exceed that specified, the requirement shall be considered satisfied.

6.2.3.2 Ultimate Load

For each sample, 100% of tests shall support the specified minimum ultimate load. If only two tests are evaluated, then values shall be within 10% of each other.

Retest. If the two ultimates do not agree within 10%, another wall may be tested for that requirement. If the lowest value of the three walls tested exceeds the specified minimum ultimate load, the requirement shall be considered satisfied.

6.2.4 Fastener Head Pull-Through

A minimum of fifteen tests (specimens taken from at least three panels) for each test exposure condition shall be tested for fastener head pull-through according to APA Test Method S-4. Thickness of the panel shall be that at base of grooves (if grooved) unless otherwise recommended by the manufacturer.

6.2.4.1 Ultimate Load

At least 85% of tests shall support the specified minimum ultimate load.

Retest. If no more than three tests in a sample of fifteen fail to meet the minimum ultimate load requirement, another sample of fifteen may be tested for that requirement. If no more than one fails the retest, the requirements shall be considered satisfied.

6.3 Physical Properties

6.3.1 Stability

One of the following stability test methods and associated criteria shall be satisfied as noted in the APA Rated Siding Standard. Any special feature included by the manufacturer, such as coatings or moisture conditioning, shall be noted per Section 7.

6.3.1.1 Stability Coefficient

A minimum of ten tests (specimens taken from at least five panels) both along and across the panel strength axis shall be conducted to determine the panel's stability coefficient according to the procedures of APA Test Method P-10.

At least 70% of tests from each panel direction shall exhibit a minimum stability coefficient no less than that specified.

Retest. If no more than four tests in a sample of ten fail to meet the stability requirements, another sample of ten may be tested for that requirement. If no more than three fail in this second round, the requirement shall be considered satisfied.

6.3.1.2 Full-Scale Testing

A large-scale test wall shall be constructed according to APA Test Method P-11. The average panel expansion, as measured over the entire assembly, shall be less than or equal to that specified. The upper five percent exclusion limit of buckling distortions across the supports and panel distortions along any support shall be no greater than that specified.

6.3.2 Edge Swell and Edge Checking

The following test methods and associated criteria shall be satisfied as noted in the APA Rated Siding Standard. Any special feature included by the manufacturer, such as coatings or moisture conditioning, shall be noted per Section 7.

6.3.2.1 Edge Swell

A minimum of ten tests (specimens taken from at least five panels) shall be conducted according to APA Test Method P-2 for edge swell after three weeks one-sided wetting.

At least 80% of specimens shall exhibit a maximum thickness swell no more than specified.

Retest. If no more than three tests in a sample of ten fail to meet the maximum edge swell requirement, another sample of ten may be tested for that requirement. If no more than two fail in this second round of testing, the requirement shall be considered satisfied.

6.3.2.2 Edge Checking

A minimum of ten tests (specimens taken from at least five panels) shall be conducted according to APA Test Method P-12 for edge checking.

At least 90% of the specimens shall exhibit no edge checks.

Retest. If no more than two tests in a sample of ten fail to meet the edge checking requirement, another sample of ten may be tested for that requirement. If no more than one test fails in this second round of testing, the requirement shall be considered satisfied.

6.4 Surface Characteristics

6.4.1 Surface Change

A minimum of nine tests (three specimens taken from at least three panels) shall be evaluated for surface change according to APA Test Method F-1.

No more than one test shall develop surface change values greater than those specified.

Retest. If no more than two tests in a sample of nine develop surface change values greater than that specified, another sample of nine may be tested for that requirement. If eight tests pass in this second round of testing, the requirement shall be considered satisfied.

6.4.2 Finish Adhesion

A minimum of ten tests (two specimens taken from at least five panels) shall be evaluated for finish adhesion according to APA Test Method F-2.

For each sample, 100% of the tests shall develop adhesion values no smaller than those specified.

Retest. If the average load is at least 90% of that specified and if no more than one test is below the minimum value specified, another sample of ten may be tested for that requirement. If the average of the first and second samples taken together meets the requirement and no value in the second sample falls below that specified, the requirement shall be considered satisfied.

6.4.3 Surface Repairs

A minimum of five samples, each containing a surface repair of the maximum size intended for the product, shall be evaluated in each of the tests outlined in APA Test Method F-3.

6.4.3.1 Boil-Dry Cycles

For each sample, 100% of the tests shall meet the criteria outlined in Table 7 of the APA Rated Siding Standard.

Retest. If no more than one test in a sample of five fails to meet the test requirement, another sample of five may be tested for that requirement. If all specimens pass the retest, the requirements shall be considered satisfied.

6.4.3.2 Soak-Dry Cycles

For each sample, 100% of the tests shall meet the criteria outlined in Table 7 of the APA Rated Siding Standard.

Retest. If no more than one test in a sample of five fails to meet the test requirement, another sample of five may be tested for that requirement. If all specimens pass the retest, the requirements shall be considered satisfied.

6.4.3.3 Finishability

Requirements of Section 6.4.2 shall be satisfied.

6.4.3.4 Machinability

For each sample, 100% of the tests shall meet the criteria outlined in Table 7 of the APA Rated Siding Standard.

Retest. If no more than one test in a sample of five fails to meet the test requirements, another sample of five may be tested for that requirement. If all specimens pass the retest, the requirements shall be considered satisfied.

6.4.4 Overlays

A minimum of five tests (one specimen taken from at least five panels) shall be evaluated in each of the tests outlined in APA Test Method F4.

6.4.4.1 Bond Performance Vacuum-Soak-Dry Cycles

For each sample, 100% of tests shall meet the criteria outlined in Table 8 of the APA Rated Siding Standard.

Retest. If no more than one test in a sample of five fails to meet the test requirements, another sample of five may be tested for that requirement. If all specimens pass the retest, the requirements shall be considered satisfied.

6.4.4.2 Finishability

Requirements of Section 6.4.2 shall be satisfied.

6.4.4.3 Machinability

For each sample, 100% of tests shall meet the criteria outlined in Table 8 of the APA Rated Siding Standard.

Retest. If no more than one test in a sample of five fails to meet the test requirement, another sample of five may be tested for that requirement. If all specimens pass the test, the requirement shall be considered satisfied.

6.5 Exterior Bond Performance

Panels composed entirely of veneer shall satisfy the PS 1 bond requirements for Exterior type. OSB, other mat-formed panels, wood-based material for composite panels, and finished (veneered) composite panels shall have one sample from each of at least twenty panels cycled according to APA Test Method D-5 and tested for strength retention according to APA Test Method S-6. Strength retention is calculated by the following method:

$$\%RS = \frac{P_t}{P_c} \times 100$$

Where:

% RS = Percent retained strength of sample

P_t = Average sample (five-specimen) breaking load after cycling.

P_c * = Average unexposed sample (five-specimen) breaking load.

*Control specimens are broken in the as-received condition.

Samples tested shall exhibit the specified minimum average and individual panel strength retention following six moisture cycles.[c] In addition, composite panels shall meet the delamination requirements specified following exposure to APA Test Method D-5 extended to ten cycles.

As an alternative, OSB shall comply with the bond performance criteria of AC 321.

Retest. For composite, OSB and other mat-formed panels, if the twenty-panel average strength retention meets the requirements but no more than one panel fails to meet the minimum individual panel strength retention specified, another sample of twenty panels may be tested. For composite panels, if more than 90% but fewer than 95% of specimens pass delamination requirements, another sample of twenty panels may be tested. If the retest meets requirements, bond performance requirements shall be considered satisfied.

6.6 Adhesive Performance

Sections 6.6.1 to 6.6.3 shall be applied when the chemical makeup of the adhesive is known to be susceptible to mold, elevated temperatures and bacteria.

6.6.1 Adhesive Mold Resistance

Four panels shall be tested according to the procedures of APA Test Method D-2.

c. Because of the extreme severity of the six-cycle test, the strength retention requirement relates to bond performance and does not relate to structural design.

6.6.1.1 All-Veneer Panels

Panels composed entirely of veneer are considered to have satisfactory mold resistance if each test group over the twenty-week period shows an average glueline shearing load of at least 90% of the control. In addition, no more than two groups may rate less than 80% and no single group may rate less than 75%.

6.6.1.2 Composite, OSB and Other Mat-formed Panels

Other panels are considered to have satisfactory mold resistance if no test group average is less than the control sample mean less 1.8 times the control sample standard deviation.

6.6.2 Adhesive Resistance to Elevated Temperature

Panels satisfying the moisture-cycling requirements of Section 6.5 shall be considered to have satisfactory resistance to elevated temperature.

6.6.3 Adhesive Bacteria Resistance

At least four panels shall be tested according to the procedures of APA Test Method D-3.

6.6.3.1 All-Veneer Panels

Panels composed entirely of veneer are considered to have satisfactory bacteria resistance if each test group over the twelve-week test shows an average load of at least 80% of the control. No single group may rate below 70% of the control.

6.6.3.2 Composite, OSB and Other Mat-formed Panels

Other panels are considered to have satisfactory bacteria resistance if no test group average is less than the control sample mean less 1.8 times the control sample standard deviation.

7. MILL SPECIFICATION

Upon satisfactory completion of the appropriate paragraphs of Section 6, a mill specification unique to the product and mill will be written based on product evaluation under this section. This specification will be used in conjunction with the APA policies. The mill specification shall be based on values from this standard and unique characteristics of the same materials supplied by the manufacturer for qualification testing. Reference values established during product evaluation or applicable performance requirements from this standard will be the basis for quality evaluation of future production. For all-veneer and composite panels, the grade and construction requirements are permitted for use in lieu of reference values for quality evaluation purposes. These values or characteristics will be used in both the individual mill quality procedures and by APA policies.

Besides the panel characteristics specifically evaluated in this section, any unique manufacturing technique which influences product qualification will be included in the individual mill specification. This would include special coatings; heat, water or chemical treatments; overlays; additives; or other manufacturing-related activities.

A specification will be developed describing characteristic values monitored in quarterly verification under Section 7.5.2 and under the APA Quality Assurance Policy. Modification of this specification at mill request is covered under Section 7.5.3.

7.1 Panel Construction

7.1.1 All-Veneer Panels

Panels shall be defined as to species and veneer construction for the mill specification and evaluated under Sections 7.2 and 7.3 but excluding Section 7.3.2.

7.1.2 Composite Panels

Wood-based material shall be evaluated as required in Sections 7.2, 7.3.1 and 7.4. In addition, the finished (veneered) panel shall be evaluated by the provisions of Sections 7.2, 7.3.1, 7.3.3 and 7.4. Composite panels evaluated for APA Rated Siding are also subject to provisions of Section 7.3.4.

7.1.3 Mat-formed Panels

Mat-formed panels shall be evaluated under the provisions of Sections 7.2, 7.3 and 7.4.

7.2 Panel Properties

7.2.1 Bending Stiffness

Twenty tests (specimens taken from at least ten panels) shall be evaluated for bending stiffness both along and across the panel strength axis according to the procedures of APA Test Method S-5. Reference values for each panel direction will be the lower value of a 90% confidence interval established on the mean.

7.2.2 Bending Strength

Ten tests (specimens taken from at least ten different panels) shall be evaluated for maximum bending moment both along and across the panel strength axis according to the procedures of APA Test Method S-5. The reference value for each panel direction will be the minimum observed value, or the sample mean less 1.8 times the sample standard deviation, whichever is the higher value.

7.3 Physical Properties

7.3.1 Panel Thickness

Finished panel thickness will be evaluated on each of twenty panels by the procedures of APA Test Method P-7. The reference value will be the average less 1.932 standard deviations for 20 panels (ASTM D2915).

7.3.2 Moisture Content

When required by APA, panel moisture content will be measured on one specimen from each of twenty panels according to APA Test Method P6. The reference value will be the maximum panel moisture content. A reference value will be established only if necessary under linear expansion performance testing per Section 7.3.3.

7.3.3 Linear Expansion

Linear expansion shall be evaluated for specimens taken from twenty panels by the procedures of APA Test Method P-1. For composite panels and for mat-formed panels containing non-oriented furnish, one specimen 3 inches by 12 inches shall be prepared from each panel to be tested. For mat-formed panels containing oriented furnish, one 3-inch-by-12-inch specimen parallel and one perpendicular to the panel strength axis shall be prepared from each panel to be tested. Mat-formed lap siding panels shall be tested parallel to the panel length.

For APA Rated Sheathing and APA Rated Sturd-I-Floor, the reference value will be 0.5%, when tested according to APA Test Method P-1, Procedure B.

For APA Rated Siding, the reference value will be the highest observed value, or the sample average plus 1.8 times the sample standard deviation, whichever is the lower value, when tested according to APA Test Method P-1, Procedure A. When other mat-formed panels contain oriented furnish, separate parallel and perpendicular reference values shall be determined.

7.3.4 Thickness Swell

For APA Rated Siding panels, thickness swell shall be evaluated for specimens taken from twenty panels by the procedures of APA Test Method P-1, Procedure A.

The reference value for thickness swell at the panel edge will be the highest observed specimen average, or the sample average plus 1.8 times the sample standard deviation, whichever is the lower value.

7.4 Bond Performance

For Siding, a minimum of twenty samples, one taken from each of twenty panels, shall be moisture cycled according to the procedures of APA Test Method D-5 (Six-Cycle Test) using specimens described in APA Test Method S-6. Immediately following moisture cycling, any panels containing veneer are examined for delamination of veneer-to-veneer or veneer to other wood-based materials according to APA Test Method P-9. At least 95% of the specimens tested shall exhibit no delamination, as defined in Test Method P-9. Moisture-cycled samples are then tested according to the procedures of APA Test Method S-6. The individual panel reference value for each qualification will be the lowest observed breaking load (five-specimen average), or the sample average less 1.8 times the sample standard deviation, whichever is the higher value. In addition, for Exposure 1 panels tested according to APA Test Methods D-4 and S-6, and for siding panels tested according to APA Test Methods D-5 and S-6, the lower 90% confidence interval will be established on the qualification mean.

7.5 Verification

7.5.1 Quality Manual

An approved mill quality manual shall be maintained on file with *APA - The Engineered Wood Association* detailing the day-to-day quality procedures of the qualified mill. In all-veneer mills under the Certified Inspector (CI) Program, the CI Manual satisfies the requirement for a Quality Manual. In addition, compliance to APA policies will be required.

7.5.2 Quarterly Verification by APA

A product qualified and trademarked under this policy shall be subjected to quarterly verification. No less than 10 panels of one product per mill per quarter shall be randomly sampled. These panels shall be tested according to the procedures of Section 7.2.1 and 7.2.2, or other performance requirements such as those found in Section 6.

Exception: Panels composed entirely of veneer shall be verified once every four quarterly cycles.

7.5.3 Change in Mill Specification

Any or all reference values of the mill specification may be changed so long as such a product change is demonstrated to be satisfactory with regard to standard and qualification criteria. Such requalification evaluation will be at the mill's expense.

8. TRADEMARKING

Upon successful completion of qualification testing for the appropriate end-use criteria, APA will authorize use of APA marks that includes reference to Rated Siding, Exterior Bond Classification, Span Rating and Performance Category. Continued trademarking approval shall be contingent upon compliance with APA quality assurance policies.

MANUAL OF APA TEST METHODS FOR WOOD STRUCTURAL PANELS

GENERAL

This manual provides specific test methods and procedures as referenced by APA standards or policies. Where possible, ASTM and/or ANSI standard procedures are referenced with any deviations from these procedures noted.

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APA TEST METHOD D-2 MOLD TEST

General

This test procedure is based on United States Forest Products Laboratory Bulletin No. 1344, "Procedures for Measuring the Mold Resistance of Protein Glues."

Equipment

Cabinets are used to house test specimens under mold producing conditions. Each cabinet is divided into three interconnecting compartments with adjustable specimen trays, each with a sealed door in the front. On each side of the trays, toweling is suspended vertically with the lower ends in a water pan acting as wicking in order to provide maximum wet surface area. These pans rest on the floor of the mold cabinet under each compartment. The water level in these pans is kept 2-1/2 to 3 inches in depth.

In order to maintain a uniform temperature within the mold cabinets, a walk-in housing surrounds the cabinets. The temperature within this housing is maintained to 80°F with a 500-watt heater controlled by a thermostat. Fan-forced air circulation sufficient to avoid stratification insures even temperature in all areas of the housing. No air circulation is used within the mold cabinets since mold growth is dependent upon still air.

Maintenance of a uniform temperature in the housing around the cabinets is essential in order to avoid condensation inside mold cabinets and resulting wet spots.

Specimen Preparation

Test specimens to be used for determination of mold resistance of the adhesive agent in the panel shall depend on the construction of the panels being tested. Panels consisting of all veneer shall be tested by preparing plywood shear specimens as described in Voluntary Product Standard PS 1, Section 6.1.3.1, kerfed to pull lathe checks closed for maximum breaking load.

Test specimens for testing veneered composite panels and mat-formed panels shall be 1 inch by 5 inches in dimension. Veneered composite panel specimens shall be cut with the veneer grain in the 5-inch direction. Mat-formed panels shall be cut with the 5-inch dimension parallel to the major panel axis, except in the case of panels containing oriented furnish, in which case two complete sets of specimens as described below shall be prepared, one set parallel and one set perpendicular to the major panel axis.

The four panels to be mold tested are cut into 100 pairs of specimens (two sets of 100 pairs each in the case of oriented furnish). These paired specimens (mold test specimen and adjacent control specimen) are completely randomized and assembled into 10 groups of 20 specimens each for each direction tested (10 test specimens and 10 controls). The controls and test specimens for each group are then separated.

Test Procedure

Prior to placing all-veneer specimens in the mold cabinet, they and their controls are stickered, given a five-second dip in tap water at room temperature, and then conditioned for one week at 90 to 97% relative humidity and a temperature of 80°F in a separate conditioning chamber. After one week, test and control specimens are removed. Test specimens are dusted with soybean flour and placed flat on green pine sapwood veneer strips that have been stored in the mold cabinet. A stack of these veneer strips and test specimens is then placed in the mold cabinet. The control specimens are allowed to dry at room conditions.

At two-week intervals, the designated mold groupings are removed from the cabinet and allowed to dry at room conditions for one week. Test specimens and corresponding control specimens are then tested as required. Ten of these groups are sufficient to test mold-resistance properties of all-veneer products.

Mold test specimens for veneered composites and mat-formed products shall be subjected to the five-second dip in tap water and the one-week exposure to 90 to 97% relative humidity and a temperature of 80°F in a separate humidity chamber.

Control test specimens from veneered composites and mat-formed products shall be subjected to APA Test Method D-4. At two-week intervals, veneered composites and mat-formed products from the mold test and moisture-cycled control specimens shall be dried at room conditions for one week and then tested according to APA Test Method S-6.

APA TEST METHOD D-3 BACTERIA TEST

General

This method determines if an adhesive system possesses sufficient resistance to bacterial attack to retain bond integrity under conditions which would promote bacterial growth.

Specimen Preparation

Test specimen size depends on panel construction. All-veneer panels use shear specimens described in Section 6.1.3.1 of Voluntary Product Standard PS 1, kerfed to pull lathe checks closed for maximum breaking load. Other panels use a specimen 1 inch by 5 inches. Veneer-containing panels shall be cut with the 5-inch dimension parallel to the grain. The veneer shall be completely free of defects.

Specimens from mat-formed panels shall be cut parallel to the major panel axis, except for panels containing oriented furnish, in which case two complete sets of specimens will be cut, one parallel and one perpendicular to the major panel axis.

Sufficient material is needed to provide 80 specimens per set as required. Specimens within each set are numbered consecutively 1 through 80 as cut, with odd-numbered specimens destined for bacteria exposure and the adjacent even-numbered specimens destined for control. Ten odd-numbered specimens and their matching ten even-numbered specimens then comprise an exposure group and control for that group. Four such groups are made up from the 80 specimens for each direction tested.

Test Procedure

Specimens consisting only of veneer, including the controls, are subjected to one-half hour vacuum and one-half hour pressure under tap water following the cycle used in the PS 1 vacuum-pressure test for Exterior plywood. Control specimens are then tested as required in the wet condition. The breaking load is recorded, and control averages are determined for each of the exposure groups.

For veneered composites and mat-formed products, all specimens are subjected to the vacuum-soak portion of the moisture cycle test of APA Test Method D-4. Control specimens are dried according to the drying provisions of D-4 and broken dry according to the procedures of APA Test Method S-6, with the breaking load recorded and control averages determined for each of the exposure groups.

All specimens designated for the bacteria exposure are floated flat in a slurry of soybean flour, water and alder sawdust consisting of 7% soybean flour, 83% water and 10% alder sawdust (sawdust at 18% moisture content). To this slurry is added 0.3% by weight of a 50% solution of sodium hydroxide. The slurry is poured into trays, filling them to a depth of one inch. (NOTE: DO NOT USE COPPER TRAYS.) These trays containing slurry and specimens are then placed into a cabinet described and maintained according to APA Test Method D-2.

One exposure group is removed from the cabinet every three weeks over the twelve-week period of the test. All-veneer specimens are tested wet according to the standard plywood shear test method. Specimens of veneered-composite and mat-formed products are dried according to the drying cycle of APA Test Method D-4 and broken according to APA Test Method S-6.

APA TEST METHOD D-4 MOISTURE CYCLE FOR OSB QUALIFICATION (SINGLE CYCLE TEST)

General

This moisture cycle test is a quality control method to accelerate bond degradation. Following moisture cycling, a mechanical test is generally performed.

Specimen Preparation

Specimen's size and configuration depend upon the test to follow moisture cycling.

Test Procedure

The specimens are placed in racks to ensure free movement of water and air around the specimens. The specimens are then placed in a vacuum-pressure vessel which is then filled with 150°F water. A vacuum of 15 inches of mercury is drawn on the vessel for 30 minutes. The vacuum is released and the specimens are allowed to soak in the water at atmospheric pressure for 30 minutes.

The vessel is then drained and the specimens dried at 180°F in an oven with fan-forced air circulation of at least 45 to 50 air changes per hour until the specimens achieve the dry condition defined as ± 3% of the as-shipped moisture condition. The specimens are then tested dry according to the appropriate test method.

Note: Drying for 15 hours is generally sufficient time to achieve the dry condition.

APA TEST METHOD D-5 MOISTURE CYCLE FOR DELAMINATION AND STRENGTH RETENTION (SIX-CYCLE TEST)

General

This moisture cycle is used in evaluation of delamination and strength retention of products rated as Exposure 1 and Siding.

Specimen Preparation

The specimen size and configuration depends on the test to follow moisture cycling.

Test Procedure

Specimens are placed in a rack to ensure free movement of water and air around the specimens. The racks are then placed in a pressure vessel and completely submerged in 150°F water. A vacuum of 15 inches of mercury shall be drawn, maintained for 30 minutes and released. Specimens shall then be allowed to soak in the same water at atmospheric pressure for 30 minutes with no additional heating. They shall afterwards be removed and dried for six hours at 180°F in an oven with fan-forced air circulation of at least 45 to 50 air changes per hour. Specimens shall then be returned to the pressure vessel and the vacuum-soak cycle repeated. Following the second vacuum-soak cycle, specimens shall again be placed in the oven and dried 15 hours. This shall complete two cycles. Testing shall be continued for two additional days until six cycles have been completed. The final drying shall be sufficient to achieve the dry condition defined as ± 3% of the as-shipped moisture condition. The specimens are then tested dry according to the appropriate test method.

Note: Drying for 15 hours is generally sufficient time to achieve the dry condition.

APA TEST METHOD D-7 MOISTURE CYCLE FOR QUALITY ASSURANCE BENDING TEST

General

This moisture cycle is a quality assurance method for evaluating bond performance. Following moisture cycling, a mechanical test is generally performed.

Test Procedure

Specimens are placed in a rack, or a similar device, to ensure free movement of water and air around the specimens. The specimens are then placed in a vacuum-pressure vessel which is filled with 65° ± 10°F water. A vacuum of 27 inches ± 2 inches Hg is applied for 30 minutes. Specimens are then soaked for 30 minutes at atmospheric pressure. After exposure, specimens are removed from the cylinder and tested wet.

APA TEST METHOD S-1 SHEATHING AND STURD-I-FLOOR PERFORMANCE UNDER CONCENTRATED STATIC AND IMPACT LOADS

General

The general provisions of the most recent edition of ASTM E661 are followed.

The dry condition shall be within ± 3% of the as-shipped moisture content. The wet test condition shall be exposure to three days of continuous one-sided wetting, followed by drying. The panel moisture content at the time of testing for the wet/dry redry condition shall be within ± 3% of the as-shipped moisture content.

Specimen Preparation

Test specimens are specified in ASTM E661, with the number required given in the Qualification Policy. Specimens shall be moisture cycled as required.

Test Procedure

Concentrated Static. Procedures of ASTM E661 are followed, except the test frame may be of steel rather than lumber, using fasteners that simulate nails. During measurement of deflection, the loading rate shall be 100 pounds per 30 seconds. Following measurement of deflection, the rate of loading shall yield failure within 5 minutes if a hand-pumped hydraulic loading system is used.

Concentrated Impact. Procedures of ASTM E661 Method A are followed, except:

1) The test frame may be of steel rather than lumber, using fasteners that simulate nails.

2) For span ratings greater than 24 oc, the shot bag shall weigh 60 pounds.

The width of individual test pieces shall be at least 24 inches for span ratings up to 24 oc, and 48 inches for greater span ratings.

APA TEST METHOD S-2 SHEATHING AND STURD-I-FLOOR PERFORMANCE UNDER UNIFORM LOADS

General

This method covers a procedure for determining the performance of structural-use panels under uniform loads such as snow, wind and occupancy loads. The uniform load shall be applied by atmospheric pressure as a vacuum is drawn under the test specimen, which is mounted on fully-supported framing members in a vacuum chamber.

Equipment

Vacuum Chamber. (Figures S2-1 and S2-2) The vacuum chamber shall consist of a sealed box with the panel to be tested forming the top. A 6-mil polyethylene sheet or equivalent, the perimeter of which is attached securely with tape, shall seal the top surface of the vacuum chamber. The chamber shall be strong and rigid to resist the applied load without failure or excessive deformation. A vacuum pump shall be used to reduce the air pressure under the specimen. The load shall be measured with absolute pressure gages for electronic data readout, but manometers or vacuum gages shall also be permitted.

FIGURE S2-1

VACUUM CHAMBER TEST EQUIPMENT
Diagram shows strength axis across supports.

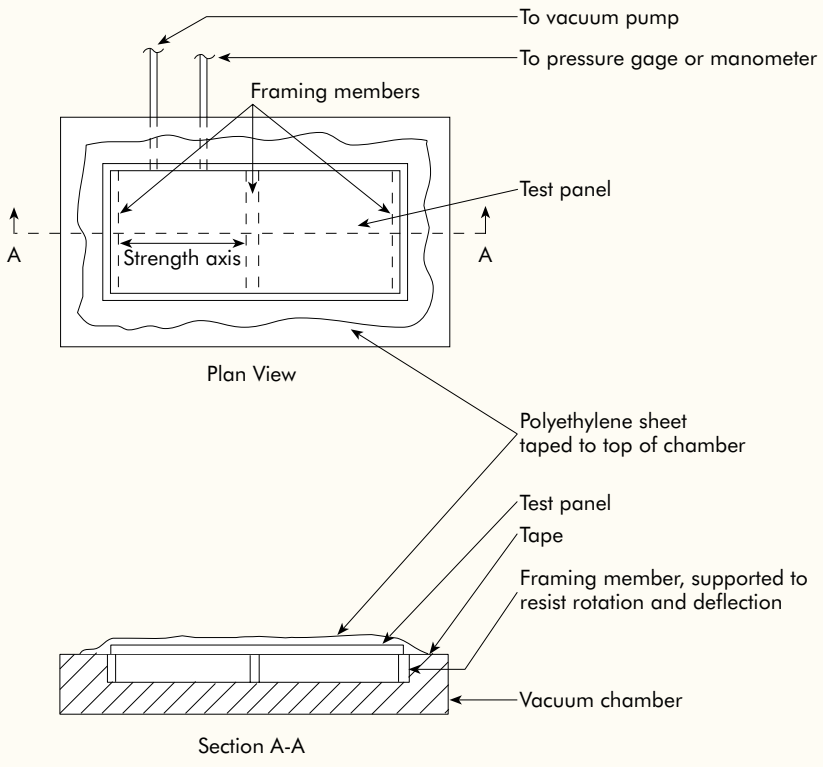
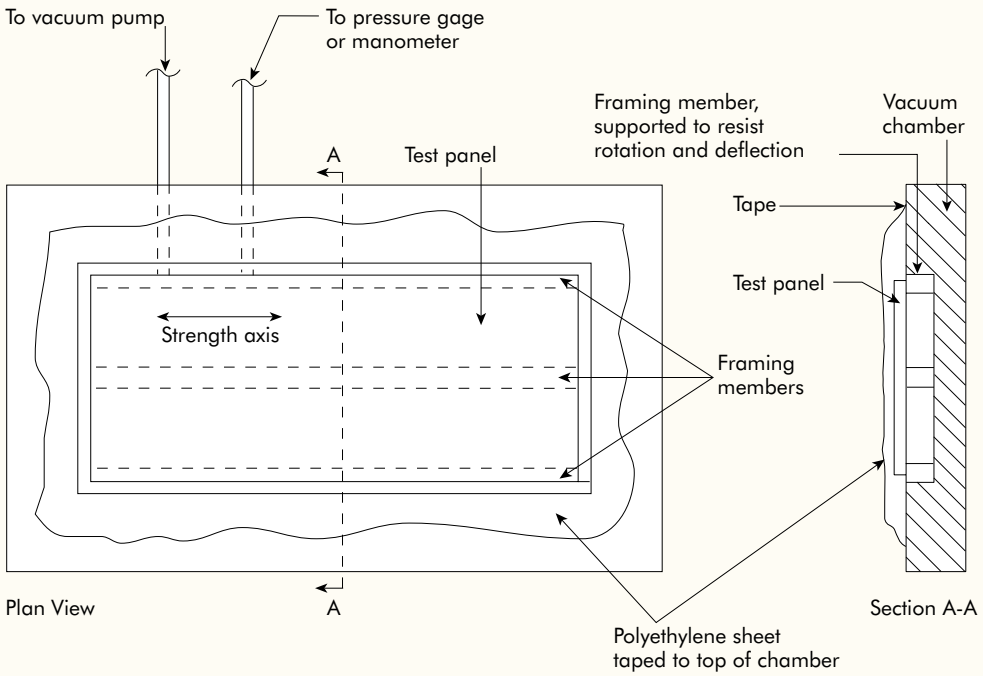


FIGURE S2-2

VACUUM CHAMBER TEST EQUIPMENT

Diagram shows strength axis parallel to supports.



Joist Supports. The framing members shall be supported so as to resist deflection or rotation under applied load.

Deflection Gages. The deflection gages shall be mounted to rigid tripods whose legs rest above the joists. Deflection shall be measured to the nearest 0.001 inch.

Specimen Preparation

Samples shall be representative of the product being tested.

Length. The specimen length perpendicular to the framing member shall be equal to twice the center-to-center spacing.

Width. The specimen width shall be at least 23-1/2 inches.

Thickness. The specimen thickness shall be measured after conditioning and recorded.

Conditioning. Prior to testing, the specimen shall be subjected to conditioning as specified in PS 2.

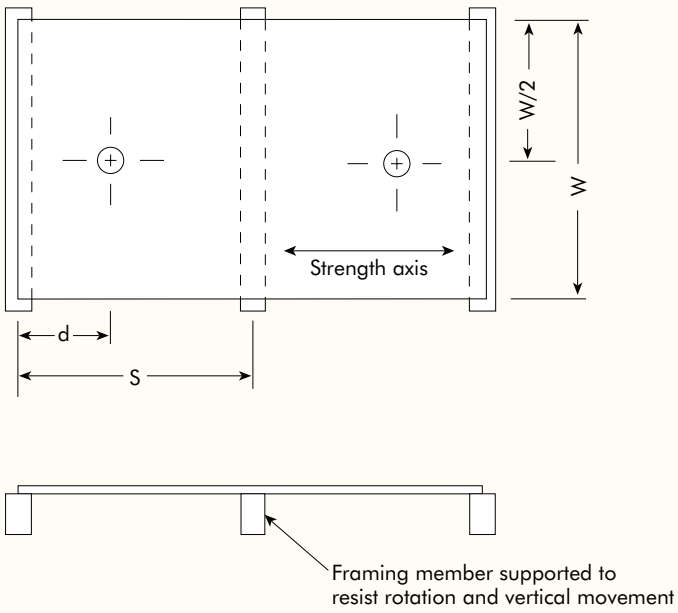
Test Procedure

After conditioning, the specimen to be tested shall be mounted to the framing members in the vacuum chamber at the joist spacing for which the panel is being rated and the recommended nail size and spacing. Framing member width is based on the end use recommendation. The top of the vacuum chamber shall then be sealed with the polyethylene sheet, and the tripod holding the deflection gages shall be set in its proper position with the gages positioned to read deflection at the point of maximum deflection[d] of the two outer spans (Figures S2-3 and S2-4).

The panel shall be loaded at a uniform rate of 50 pounds per square foot per minute, recording deflections at 25 pounds per square foot increments until maximum load is achieved or until the desired proof load is achieved, as required. Deflection data shall be required only in sufficient numbers to develop the straight-line portion of the load-deflection curve. In no case shall the number of data points be less than six. Deflection at a given load shall be determined by translating the slope to pass through the origin, thereby correcting for any settling of the system.

FIGURE S2-3

UNIFORM LOAD TEST SPECIMEN
Diagram shows strength axis across supports.

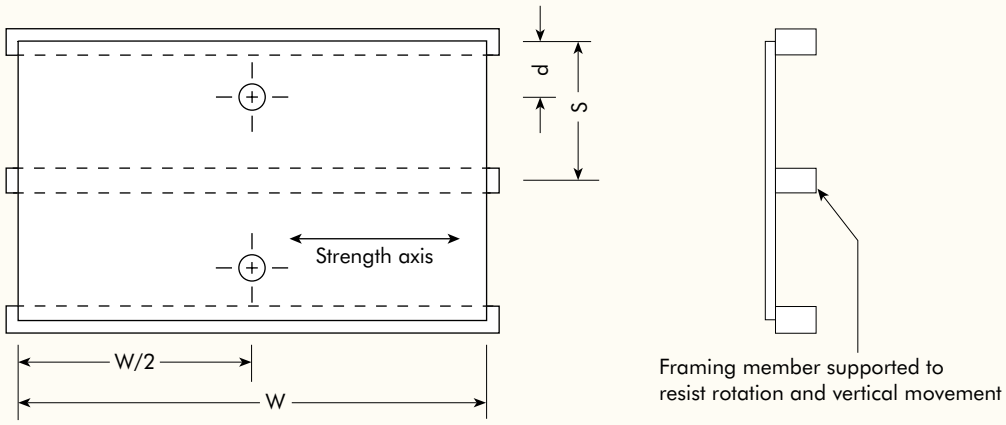


S = Center-to-center support spacing
d = 0.4215 (S) for two span
W = Panel width, minimum = 595 mm (23.5")
⊕ = Location of deflection measurement

d. The point of maximum deflection for a uniformly-loaded two-span system occurs at 0.4215 (S) measured from the centerline of the outer joist, where S equals the center-to-center joist spacing.

FIGURE S2-4

UNIFORM-LOAD TEST SPECIMEN
Diagram shows strength axis parallel to supports.



S = Center-to-center support spacing
d = 0.4215 (S) for two span
W = Panel width, minimum = 595 mm (23.5")
⊕ = Location of deflection measurement.

APA TEST METHOD S-3 WALL PERFORMANCE UNDER RACKING LOADS

General

The general provisions of Sections 14 and 15 of ASTM E72 for wall racking shall be followed.

Specimen Preparation

Test specimens 8 feet by 8 feet shall be prepared as in ASTM E72 except that the 4 x 4-inch timber attached to the upper plate shall be reinforced with a 4 by 6-inch steel tube or plate to prevent excessive deformation. An additional vertical deflection gage is positioned in the lower right corner of the wall (Fig. 7, ASTM E72) to record crushing of the lower plate.

Stud framing shall be No. 1 grade Douglas-fir Larch or Southern Pine, with a moisture content 15% or less. Nail size and spacing shall be as specified in PS 2 for APA Rated Sturd-I-Floor and APA Rated Sheathing Panels and Table 6 of the Performance Standard for APA Rated Siding Panels. When 0.148 x 3.0 inch nails are used, nominal 3-inch wide framing shall be used for the center stud (at panel joint) to prevent splitting of framing member. Specimens shall be tested in the dry (as received) condition. The Rated Siding specimens shall also be tested following the wetting cycle defined in ASTM E72.

Test Procedure

Load shall be applied continuously at a uniform rate. The rate of loading shall be chosen such that the 1-times test load shall be reached in not less than 2 minutes. The loading rate for the subsequent loading cycles shall be the same as the 1-times test load cycle.

Deflection measurements shall be recorded as the wall is being loaded. At least 10 sets of uniformly spaced deflection readings shall be taken prior to failure to establish the load-deformation curve. At 1-times and 2-times the test load specified in the appropriate Standard, the load shall be removed and the wall shall be allowed to recover for 5 minutes. At 2.5-times the test load, the dial gages shall be removed and the wall shall be loaded to failure.

Deflections shall be reported after removing panel uplift, base slip and crushing components from the total deflection measurement. Ultimate load shall be recorded.

APA TEST METHOD S-4 FASTENER-HOLDING PERFORMANCE

General

Tests shall measure the single-shear resistance of a nail to lateral movement of the panel. The procedure shall generate data to be compared to other panel products, but the procedure shall not be used to produce joint design information.

Direct withdrawal and nail head pull-through loads shall also be measured.

Specimen Preparation

Lateral Loads. Each specimen shall measure 6 inches by 6 inches. To serve as test points, four points shall be marked on the centerline of each specimen axis, 1 inch in from each edge. Nail size shall be as required in PS 2.

Specimens shall be conditioned as specified in PS 2.

Nails shall be driven perpendicular to the face of the panel following conditioning. Nail penetration shall be such that the nail head lies flush with the panel face. A backing shall be used to prevent the nail from tearing away the back during driving. All nails shall be driven immediately prior to testing.

Direct Withdrawal Loads. Test specimens shall be of convenient size (at least 3 inches by 6 inches) trimmed from the lateral resistance specimens. Nail size shall be as required. Nails shall be driven through the panel at right angles to the face and at least 1/2 inch of the shank portion shall project above the surface of the material.

Nail Head Pull-Through Loads. Test specimens shall be of convenient size (at least 3 inches by 6 inches). Nail size and type shall be as required. Nails shall be driven through the panel at right angles to the face. Nail penetration shall be such that the nail head lies flush with the panel face. A backing shall be used to prevent the nail from tearing away the back during driving. All nails shall be driven immediately prior to testing. Rated Siding specimens shall be tested in the dry (as-received) condition and following seven days of wetting on one side.

Test Procedure

Lateral Loads. The fastener shall be loaded in single shear. Apparatus similar to that shown in Figure 1 shall be employed. The nail shank shall be rigidly clamped. Rollers shall be present to ensure vertical movement by providing lateral restraint to the panel. Load shall be applied through a yoke-type loading head. This loading head is illustrated in Figure S4-1.

The test specimen shall be loaded continuously throughout the test by uniform motion of the movable crosshead of the test machine at a rate of 0.20 inch per minute.

Direct Withdrawal Loads. Nail holding tests shall be made on nails driven through the thickness of the panel to measure the resistance to withdrawal in a plane perpendicular to the face.

Method of loading shall be in accordance with the most recent edition of ASTM D1761, Section 10.2.

The specimen shall be loaded continuously throughout the test by uniform motion of the movable head of the testing machine at a rate of 0.20 inch per minute.

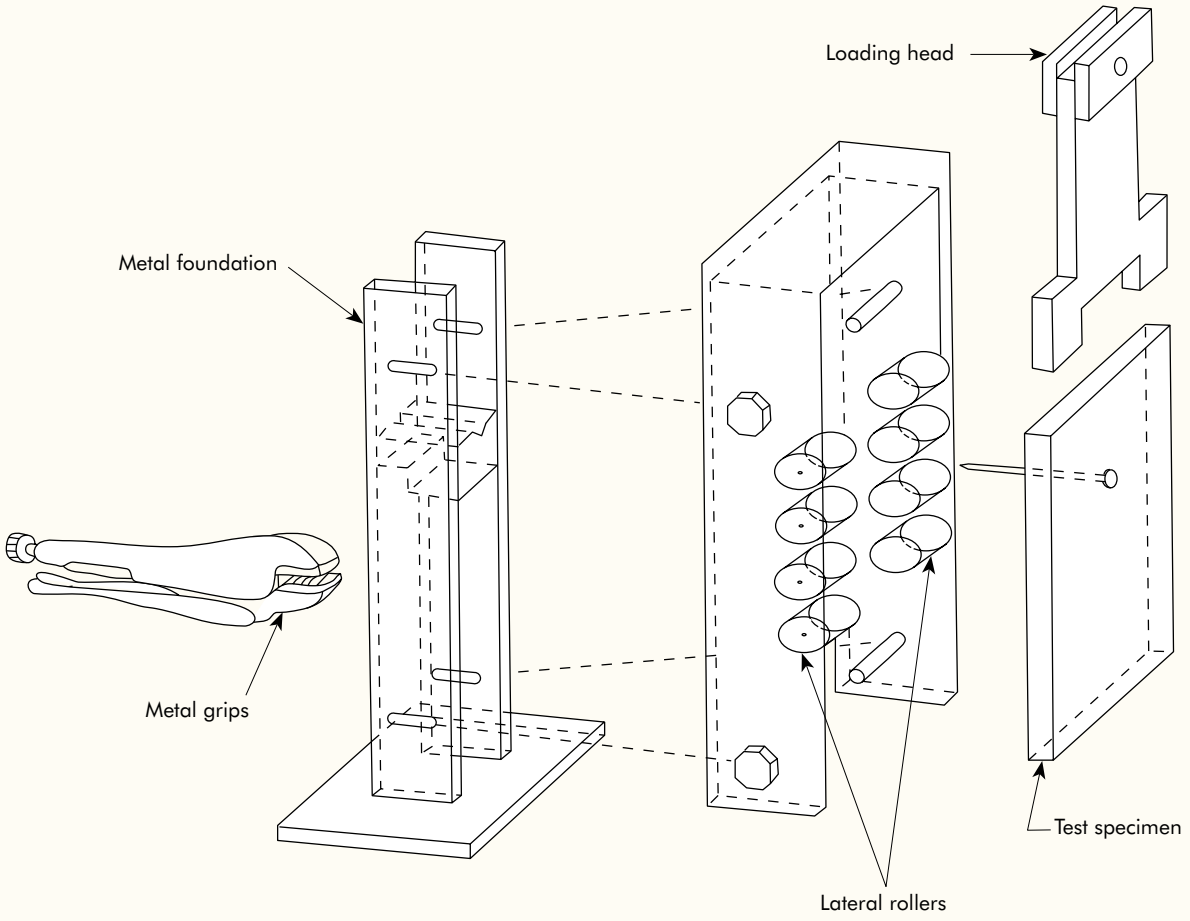
Nail Head Pull-Through Loads. Nail head pull-through tests shall be made on nails driven through the thickness of the panel to measure resistance to nail head embedment in a plane perpendicular to the face.

Method of loading shall be in accordance with the most recent edition of ASTM D1037 Section 15.

The specimen shall be loaded continuously throughout the test by uniform motion of the movable head of the testing machine at a rate of 0.20 inch per minute.

FIGURE S4-1

EXPLODED VIEW OF APA TEST APPARATUS FOR MEASURING THE LATERAL NAIL-HOLDING CAPACITY OF STRUCTURAL PANEL PRODUCTS



APA TEST METHOD S-5 PANEL BENDING

General

This test procedure determines large panel bending strength and stiffness. The general provisions of ASTM D3043 Method C shall be followed.

Specimen Preparation

Specimens shall be prepared according to ASTM D3043 Method C, except specimen sizes not less than 12 inches by 48 inches shall be permitted.

Test Procedure

The procedures of ASTM D3043 Method C shall be followed except specimens shall be tested for stiffness both along and across the panel strength axis, and maximum bending moment shall be determined as required.

APA TEST METHOD S-6 SMALL SPECIMEN BENDING FOR QUALITY ASSURANCE

General

Test method is intended to develop strength information that acts as a measure of bond integrity and adhesive performance. Generally the test is run on moisture-cycled specimens.

Specimen Preparation

Five 1 inch by 5 inch test specimens shall be cut from each sample to be tested. If testing is for qualification, 15 specimens shall be cut from each sample to be tested (15 from each direction in the case of panels which exhibit directional properties). Side-by-side matching shall be observed for comparison of Control, D4 and D-5 exposures. Specimens prepared from veneer-containing panels shall be cut with the grain of the veneer parallel to the 5-inch dimension. Specimens prepared from mat-formed panels shall be cut so that the 5-inch dimension of the specimens is parallel to the panel strength axis except in the case of panels exhibiting directional properties, in which case five specimens shall be cut parallel and five perpendicular to the panel strength axis. Specimens shall then be tested following appropriate treatment.

Test Procedure

Each specimen shall be tested as a beam across a 4-inch clear span with the loading head and supports measuring 3/4 inch in diameter. The load shall be applied at midspan at a rate not to exceed one inch per minute until failure occurs. Specimens from veneered composite panels shall be oriented so that the thickness of the specimen acts as the depth of the beam. Specimens from mat-formed panels shall be oriented so that the one-inch cut dimension acts as the depth of the beam and the panel thickness acts as the beam width. The breaking load for each specimen shall be measured to ± 1 pound. The average breaking load for each panel shall be calculated. In the case of other panels which exhibit directional properties, separate averages shall be determined for each specimen direction. Average values shall be reported.

APA TEST METHOD S-9 SIDING PERFORMANCE UNDER CONCENTRATED STATIC LOADS

General

This method covers a procedure for determining the performance of siding products under concentrated static loads, such as a ladder resting against a vertical wall. Residual indentation and deflection, and puncture resistance are measured. Siding panels are subjected to concentrated loads applied through a 1-inch (25-mm-) diameter loading rod.

Equipment

Supports. The framing members shall be supported in order not to deflect under the applied loads. The support conditions shall include all wall framing elements including top and bottom plates.

Loading Device. Any convenient means may be used for applying a compressive load up to ultimate, and for measuring the load within plus or minus 1% accuracy.

Loading Rod. A loading rod one inch in diameter shall be used. The edge of the loading rod contacting the test specimen shall be rounded to a radius not to exceed 0.06 inch.

Deflection Gages. A deflection gage shall be mounted rigidly to the loading rod. The deflection gage shall have a range exceeding the maximum anticipated deflection, have a maximum error of plus or minus 1%, and be graduated to 0.001 inch.

To measure indentation, a metal sleeve shall be fabricated to fit around the loading rod. The bottom of the sleeve shall be chamfered to create a 1/4-inch-wide bearing ring around the rod. Clearance between the rod and the sleeve shall be approximately 0.0005 inch to prevent the sleeve from tilting, yet allow it to slide freely. The dial gage shall be mounted on the rod with its tip contacting the top of the sleeve.

A second dial gage shall be mounted rigidly beneath the loading rod with its tip contacting the back side of the siding product.

Specimen Preparation

Samples shall be selected that are representative of the product being evaluated. A specimen can usually be made from a single panel, or assembled from a number of boards.

Length. Specimen length parallel to the main framing members shall conform to the intended application.

Width. Specimen width perpendicular to the main framing members shall conform to the center-to-center spacing, S, anticipated in service. Specimen width shall be equal to the minimum number of spans permitted or recommended for the product used in its intended application, multiplied by the center-to-center spacing of the framing members.

Conditioning. Prior to static testing, siding shall be subjected to wetting or drying to simulate possible typical in-service conditions. Siding products may be tested under dry or wet conditions.

Dry tests. Siding shall be conditioned to either constant weight or moisture content, or for at least two weeks at 68 plus or minus 11°F (20 plus or minus 6°) and 65 plus or minus 5% relative humidity.

Wet tests. Siding shall be exposed to a continuous water spray for seven days applied to the top surface of the siding at a rate such that this surface is kept continually wet. The siding shall be positioned so as to preclude water ponding on it or immersion of any portion.

Test Procedure

The concentrated load shall be applied to an outside span. The concentrated load shall be applied at mid-length of the specimen. If the siding product is a lap product, the concentrated load shall be applied at mid-width of a single lap located at mid-length of the specimen. The concentrated load shall be applied midway between the framing members if the siding product is not grooved. If the siding product is grooved, the concentrated load shall be applied to a groove nearest to the midpoint between framing members.

Residual indentation shall be measured relative to the siding product surface using a one-inch-diameter loading rod. Residual deflection shall be measured relative to the framing members.

Indentation and deflection shall be recorded at 0 lbf.

The load shall be applied continuously at a rate of 0.04 inch/minute. The siding product shall be loaded to a 100-lb increment, the load removed, and the specimen allowed to recover for one minute. Indentation and deflection shall again be recorded at 0 lbf. Residual values at the test location are the difference between the original gage reading at 0 lbf and the second gage reading, taken after the 100-lbf proof load.

Following measurement of residual indentation and deflection, the load shall be reapplied at a rate of 0.2 inch/minute, until maximum load occurs.

APA TEST METHOD S-10 SIDING PERFORMANCE UNDER UNIFORM LOADS

General

This method covers a procedure for determining the performance of siding products under uniform loads, such as a wind load, against a vertical wall. Strength and residual deflection are measured. Siding panels are subjected to uniform loads through use of atmospheric pressure in a vacuum test frame.

Equipment

Supports. The framing members shall be supported in order not to deflect under the applied loads. The support conditions shall include all wall framing elements, including top and bottom plates.

Vacuum Chamber. An external frame shall be fabricated large enough to enclose the test specimen. The chamber shall be strong and rigid to resist the applied load without failure or excessive deformation. The floor and walls of the test chamber shall be sealed sufficiently to prevent airflow in and out of the chamber. Following placement of the test specimen within the chamber, a 6-mil polyethylene sheet shall be laid over the specimen and taped to the frame to obtain an airtight seal. Air shall be removed from the chamber through use of a vacuum pump. The load shall be measured with absolute pressure gages for electronic data readout, but manometers or vacuum gages shall also be permitted.

Deflection Gage. The deflection gage shall be mounted on a rigid tripod. The legs of the tripod shall rest on the siding immediately above the framing, adjacent to the span being loaded. The deflection gage shall have a range exceeding the maximum anticipated deflection, have a maximum error of plus or minus 1%, and be graduated to 0.001 inch.

Specimen Preparation

Samples shall be selected that are representative of the product being evaluated. A specimen can usually be made from a single panel, or assembled from a number of boards.

Length. Specimen length parallel to the main framing members shall conform to the intended application.

Width. Specimen width perpendicular to the main framing members shall conform to the center-to-center spacing, S, anticipated in service. Specimen width shall be equal to the minimum number of spans permitted or recommended for the product used in its intended application, multiplied by the center-to-center spacing of the framing members.

Conditioning. Prior to testing, siding shall be subjected to wetting or drying to simulate possible typical in-service conditions. Siding products may be tested under dry or wet conditions.

Dry tests. Siding shall be conditioned to either constant weight or moisture content, or for at least two weeks at 68 plus or minus 11°F (20 plus or minus 6°) and 65 plus or minus 5% relative humidity.

Wet tests. Siding shall be exposed to a continuous water spray for seven days applied to the top surface of the siding at a rate such that this surface is kept continually wet. The siding shall be positioned so as to preclude water ponding on it or immersion of any portion.

Test Procedure

The deflection shall be measured on each outside span. The deflection shall be measured at mid-length of the specimen. If the siding product is a lap product, the deflection shall be measured at mid-width of a single lap located at mid-length of the specimen. The deflection shall be measured at the theoretical point of maximum deflection. The point of maximum deflection for a uniformly loaded two-span system occurs at 0.4215 (S) measured from the centerline of the outer support, where S equals the center-to-center support spacing. The point of maximum deflection for a uniformly loaded three-span system occurs at 0.446 (S) measured from the centerline of the outer support, where S equals the center-to-center support spacing.

Residual deflection shall be measured relative to the framing.

Deflection shall be measured at 0 psf. The load shall be applied continuously at a rate of 25 psf/minute. The siding product shall be loaded to 50 psf, the load removed and the section allowed to recover for one minute. Panel deflection shall again be recorded at 0 psf. Residual deflection at the test location is the difference between the original deflection gage reading at 0 psf and the second deflection gage reading, taken after the 50 psf proof load.

Following measurement of residual deflection, the load shall be reapplied at a rate of 25 psf/minute, until maximum load occurs.

APA TEST METHOD S-11 SIDING PERFORMANCE UNDER HARD-BODY IMPACT LOADS

General

This method covers a procedure for determining the performance of siding products under hard-body impact loads, such as foot kicks, hailstones, or hammer blows to a vertical wall. Residual indentation and puncture resistance are measured. Siding panels are subjected to hard-body impact loads applied through a 2-lb_ steel ball, 2-3/8 inches in diameter.

Equipment

Supports. The framing member shall be supported in order not to deflect under the applied loads. The support conditions shall include all wall framing elements, including top and bottom plates.

Impact Ball. The steel ball shall be 2-3/8 inches in diameter, and shall weigh 2 lbf.

Loading Device. An apparatus shall be designed suitable for holding and releasing the impact ball from predetermined heights.

Measuring Rod. A measuring rod graduated in 6-inch increments and equipped with a sliding pointer shall be used to measure the drop height of the impact ball.

Deflection Gage. A deflection gage shall be mounted rigidly to a tripod. The legs of the tripod shall rest on the siding immediately above the framing members. The deflection gage shall have a range exceeding the maximum anticipated deflection, have a maximum error of plus or minus 1%, and be graduated to 0.001 inch.

Specimen Preparation

Samples shall be selected that are representative of the product being evaluated. A specimen can usually be made from a single panel, or assembled from a number of boards.

Length. Specimen length parallel to the main framing members shall conform to the intended application.

Width. Specimen width perpendicular to the main framing members shall conform to the center-to-center spacing, S, anticipated in service. Specimen width shall be equal to the minimum number of spans permitted or recommended for the product used in its intended application, multiplied by the center-to-center spacing of the framing members.

Conditioning. Prior to hard-body impact testing, siding shall be subjected to wetting or drying to simulate possible typical in-service conditions. Siding products may be tested under dry or wet conditions.

Dry tests. Siding shall be conditioned to either constant weight or moisture content, or for at least two weeks at 68 plus or minus 11°F (20 plus or minus 6°) and 65 plus or minus 5% relative humidity.

Wet tests. Siding shall be exposed to a continuous water spray for seven days applied to the top surface of the siding at a rate such that this surface is kept continually wet. The siding shall be positioned so as to preclude water ponding on it or immersion of any portion.

Test Procedure

The hard-body impact load shall be applied to an outside span. The hard-body impact load shall be applied 4 inches either side of mid-length of the specimen. If the siding product is a lap product, the hard-body impact load shall be applied at mid-width of a single lap located at 4 inches either side of mid-length of the specimen. The hard-body impact load shall not be applied to a span which has been previously tested for soft-body impact resistance. The hard-body impact load shall be applied midway between the framing members if the siding product is not grooved. If the siding product is grooved, the hard-body impact load shall be applied to a groove nearest to the midpoint between framing members.

Prior to impact, a gage reading shall be recorded at the load point. The impact ball shall be dropped at the test location on the top surface of the siding product in 6-inch increments during the test.

Residual indentation shall be measured relative to the framing under the load point. One minute following the 24-inch drop, a deflection gage reading shall be measured at the load point. Residual indentation at the test location is the difference between the initial deflection gage reading and the second deflection gage reading taken after the 24-inch drop.

Following measurement of residual indentation, the hard-body impact test shall be continued at 6-inch drop increments. The test shall stop when a visible fracture occurs at the bottom of the specimen. The height of the drop that produces the first visible fracture shall be recorded.

APA TEST METHOD S-12 SIDING PERFORMANCE UNDER SOFT-BODY IMPACT LOADS

General

This method covers a procedure for determining the performance of siding products under soft-body impact loads, such as a person running or falling against a vertical wall. Residual indentation and load-carrying capacity are measured. Siding panels are subjected to soft-body impact loads applied through a 30-lbf leather shot bag.

Equipment

Supports. The framing members shall be supported in order not to deflect under the applied loads. The support conditions shall include all wall framing elements, including top and bottom plates.

Drop Bag. The drop bag shall be constructed in accordance with ASTM E661 Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads, Sections 5.2.1.1–5.2.1.4.

Measuring Rod. A measuring rod graduated in 6-inch increments and equipped with a sliding pointer shall be used to measure the drop height of the bag.

Deflection Gage. A deflection gage shall be mounted rigidly to a tripod. The legs of the tripod shall rest on the siding immediately above the framing members. The deflection gage shall have a range exceeding the maximum anticipated deflection, have a maximum error of plus or minus 1%, and be graduated to 0.001 inch.

Specimen Preparation

Samples shall be selected that are representative of the product being evaluated. A specimen can usually be made from a single panel, or assembled from a number of boards.

Length. Specimen length parallel to the main framing members shall conform to the intended application.

Width. Specimen width perpendicular to the main framing members shall conform to the center-to-center spacing, S, anticipated in service. Specimen width shall be equal to the minimum number of spans permitted or recommended for the product used in its intended application, multiplied by the center-to-center spacing of the framing members.

Conditioning. Prior to soft-body impact testing, siding shall be subjected to wetting or drying to simulate possible typical in-service conditions. Siding products may be tested under dry or wet conditions.

Dry tests. Siding shall be conditioned to either constant weight or moisture content, or for at least two weeks at 68 plus or minus 11°F (20 plus or minus 6°C) and 65 plus or minus 5% relative humidity.

Wet tests. Siding shall be exposed to a continuous water spray for seven days applied to the top surface of the siding at a rate such that this surface is kept continually wet. The siding shall be positioned so as to preclude water ponding on it or immersion of any portion.

Test Procedure

The soft-body impact load shall be applied to an outside span. The soft-body impact load shall be applied at mid-length of the specimen. If the siding product is a lap product, the soft-body impact load shall be applied at mid-width of a single lap located at mid-length of the specimen. The soft-body impact load shall be applied midway between the framing members.

Prior to impact, a deflection gage reading shall be recorded at the load point.

The bag shall be dropped at the test location on the top surface of the siding product in 6-inch increments during the test.

Residual deflection shall be measured relative to framing under the load point. One minute following the 12-inch drop, deflection shall be measured at the load point. Residual deflection at the test location is the difference between the initial deflection gage reading and the second deflection gage reading taken after the 12-inch drop.

Following measurement of residual deflection, the soft-body impact test shall be continued at 6-inch drop increments until the bag falls through the siding product. The drop height at which this occurs shall be recorded.

APA TEST METHOD S-13 PANEL COMPRESSION

General

This test procedure provides basic data regarding compression properties of panel products. The general procedures of ASTM D3501 Method B are followed.

Specimen Preparation

From each sample, one specimen shall be cut. The specimens shall be tested in the as-received condition unless otherwise specified.

Test Procedure

The procedures of ASTM D3501 Sections 12-14 shall be followed.

APA TEST METHOD S-14 QUALITY ASSURANCE BENDING TEST

General

The method is intended to develop bending strength and stiffness information to be used for quality assurance purposes. The information developed shall not be considered as appropriate for the purposes of developing design data. In general, the procedures of this method follow the principles of ASTM D3043 Method D.

Specimen Preparation

Specimens shall be cut from each sample according to ASTM D3043 Section 8.2, except that specimen width shall be 4.5 inches.

Test Procedure

The principles of ASTM D3043 Sections 8.1–8.7 shall be followed, except that specimens shall be cut to the following length:

14 inches for nominal thicknesses up to and including 1/2 inch,

20 inches for nominal thicknesses greater than 1/2 inch up to and including 3/4 inch,

24 times nominal thickness plus 2 inches for thicknesses greater than 3/4 inch.

Alternatively, all specimens may be cut to 24 times nominal thickness plus 2 inches as specified in ASTM D3043.

APA TEST METHOD P-1 LINEAR EXPANSION AND THICKNESS SWELL MEASURED FROM OVEN DRY OR 50% RELATIVE HUMIDITY TO VACUUM-PRESSURE SOAK

General

This test method provides a quick evaluation of a panel's dimensional stability.

Specimen Preparation

Test specimens shall be cut at least 3 inches wide by at least 12 inches long.

Specimens shall be selected to avoid large characteristics such as knotholes, knots, or splits in the outer veneers (when veneers are present), especially near the eyelet locations. Otherwise, normal grade features shall be included as they occur.

Fixed reference points, which serve as measuring points on the centerline of each specimen, shall be located 1 inch in from each end. Brass eyelets placed in pre-bored holes have been found to be suitable reference points. Use of the reference measuring points permits determination of linear expansion independent of any additional swelling that might take place at the exposed panel edge.

When thickness swell is a requirement, points shall be marked on the edges of each specimen for thickness swell evaluation. Thickness shall be measured according to Test Method P-7, except as modified below.

Test Procedure

Pre-conditioning

Procedure A (for Rated Siding Products)

Specimens shall be oven dried at 217 ± 4°F for 24 hours or until constant weight is attained. Constant weight shall be assumed when two consecutive readings taken at least two hours apart agree within 0.2 percent.

After drying, each specimen shall be allowed to cool to approximately room temperature. The specimen shall then be placed in a flattening jig to remove any out-of-plane distortions, and the distance between gage points measured to the nearest 0.001 inch with a bar-type trammel equipped with a dial gage.

When thickness swell is a requirement, at least two thickness measurements shall be made with a ratchet type micrometer to the nearest 0.001 inch with the anvil edge flush with the specimen edge. The micrometer shall be as described in APA Test Method P-7.

Procedure B (for Rated Sheathing and Rated Sturd-I-Floor Products)

Specimens shall be conditioned at 50% (± 5%) relative humidity and 68°F (± 11°F) until constant weight is attained. Constant weight shall be assumed when two consecutive readings taken at least 24 hours apart agree within 0.2 percent.

After conditioning, each specimen shall be measured by placing in a flattening jig to remove any out-of-plane distortions, and the distance between gage points shall be measured to the nearest 0.001 inch with a bar-type trammel equipped with a dial gage. If specimens are not measured within 30 minutes, wrap in a polyethylene bag, or return to conditioning chamber.

Following the pre-conditioned measurements for either procedure A or B, specimens shall be placed in a pressure cylinder, flooded with 65 ± 10°F tap water and subjected to a vacuum of 27 ± 2 inches of mercury for one hour (time does not begin until full vacuum is achieved). Specimens shall then be subjected to two hours of pressure not to exceed 100 pounds per square inch[e]. After wet exposure, specimens shall be removed from the cylinder and remeasured for length and thickness.

Expansion values shall be calculated as a percentage of the original pre-conditioned dimension, as given in the equation below:

$$\text{Percent change} = \frac{L_w - L_{pc}}{L_{pc}} \times 100$$

where L_w = dimension saturated

where L_{pc} = dimension pre-conditioned

The pre-conditioning procedure shall be documented in the test report.

e For product evaluation and quality assurance testing, atmospheric pressure is used for the pressure-soak cycle of the test.

APA TEST METHOD P-2 LINEAR EXPANSION MEASURED AFTER WETTING ON ONE SIDE

General

This performance test is designed to measure linear expansion as it may occur in service.

Specimen Preparation

Each 4-foot by 4-foot specimen shall have only one cut edge, the remaining three being as prepared by the manufacturer. To serve as measuring points for linear expansion, brass eyelets shall be placed in four pre-bored holes on the centerline of each specimen axis, one inch in from each edge. This results in a nominal 46-inch gage distance both along and across the panel strength axis.

Moisture content (oven-dry basis) shall be measured according to APA Test Method P-6 prior to testing in a panel from the same sample. Should the moisture content of the specimens exceed 12%, they shall be conditioned to constant weight at 68 ± 11°F and 65 ± 5% relative humidity to achieve an equilibrium moisture content. Constant weight shall be assumed when two consecutive readings taken at least 24 hours apart agree within 0.2 percent.

Test Procedure

Linear expansion specimens shall be placed in a flattening jig to remove any out-of-plane distortions, and the distance between gage points measured to the nearest 0.001 inch with a bar-type trammel equipped with a dial gage. Thickness shall be measured along the edge to the nearest 0.001 inch with a dial gage micrometer, applying ratchet pressure during measuring.

Following these as-received measurements, unrestrained specimens shall be mounted within 30 degrees of vertical and shall be wetted on one side with water at 65 ± 10°F. The period of continuous wetting shall be 14 days for Rated Sheathing and Rated Sturd-I-Floor and 21 days for Rated Siding. No liquid water shall impinge on the back. The back shall be exposed to any humidity vapor present. All factory edges shall be exposed to water except the freshly cut edge. The cut edge shall be the top edge and may be protected with an edge sealer. After wet exposure, the specimens shall be remeasured.

Expansion values shall be calculated to express results as a percentage of the original dimension, as given in the equation:

$$\text{Percent change} = \frac{L_{wls} - L_{ar}}{L_{ar}} \times 100$$

where L_{wls} = dimension after wetting one side

where L_{ar} = dimension as received

APA TEST METHOD P-3 LINEAR EXPANSION MEASURED BY EXPOSURE TO RELATIVE HUMIDITY

General

This method measures linear expansion in accordance with ASTM D1037, Sections 108 to 111, Linear Variation with Change in Moisture Content. The exposure to relative humidity change from 50 to 90% is an indication of extreme service conditions.

Specimen Preparation

From each sample, two specimens shall be cut according to the procedures of ASTM D1037, Sections 108 to 111. Test specimens shall be cut 3 inches wide by 41 inches long. Shorter lengths may be used, but specimens shall not be less than 12 inches long. To serve as measuring points for linear expansion, brass eyelets shall be placed in pre-bored holes on the centerline of each specimen, 1 inch in from each end. This results in a nominal 39-inch gage distance.

Test Procedure

The procedures of ASTM D1037 Sections 108 to 111 shall be followed for linear expansion testing, except that specimens shall be placed in a flattening jig to remove any out-of-plane distortions, and the distance between gage points shall be measured to the nearest 0.001 inch with a bar-type trammel equipped with a dial gage.

Expansion values shall be calculated to express results as a percentage of the original "dry" dimension, as given in the equation:

$$\text{Percent change} = \frac{L_{90\%RH} - L_{50\%RH}}{L_{50\%RH}} \times 100$$

where $L_{90\%RH}$ = dimension at 90% RH

where $L_{50\%RH}$ = dimension at 50% RH

APA TEST METHOD P-4 LINEAR EXPANSION MEASURED IN A FULL-SCALE FRAME

General

This full-scale test procedure is an estimate of panel performance in a structure when wet.

Specimen Preparation

Eight 4-foot by 8-foot panels shall be required. No preconditioning or other procedures shall be used on the panels; they shall be used as received. Two panels shall be cut into 4-foot by 4-foot pieces for the assembly.

A 16-foot by 16-foot lumber frame shall be constructed using 2x8 No. 2 or better hem-fir lumber or equivalent. The lumber shall be end nailed through a band joist at the required support spacing with three 16d common or double-headed nails.

Panels shall be installed with major panel axis across the framing and with end joints staggered four feet. End and edge spacing and nailing schedule shall be carefully maintained according to application recommendations prescribed in the specification.

Test Procedure

Overall dimensions of the assembly shall be measured on the panel surface at the ends and middle for both along and across the major panel axis. A continuous water spray shall then be applied to the top surface with a common garden sprinkler for 14 consecutive days. Following wetting, the panel measurements shall be again taken.

Percent expansion for both directions shall then be calculated as follows:

$$\text{Percent change} = \frac{L_w - L_{ar}}{L_{ar}} \times 100$$

where L_w = length wet

where L_{ar} = length as received

The average for each direction shall then be calculated from the individual readings.

APA TEST METHOD P-6 PANEL MOISTURE CONTENT

General

This test procedure defines the method of determining panel moisture content by the oven-dry method according to the principles of ASTM D4442 Method B.

Specimen Preparation

From each panel, a specimen shall be cut at least two inches from any edge using a 3-inch hole saw. If the panel size is less than 6 inches by 6 inches (by panel thickness), the entire panel shall be used.

Test Procedure

The specimen weight shall be obtained (± 0.2%) and placed in a drying oven at 217°F ± 4°F until constant weight is achieved. Constant weight shall be assumed when two consecutive readings taken at least two hours apart agree within 0.2 percent.

The moisture content shall be calculated as:

$$M = \left(\frac{W_w - W_d}{W_d} \right) \times 100$$

where:

M = Moisture content (percent)

W_w = Initial weight (grams or similar units)

W_d = Oven-dry weight (grams or similar units)

APA TEST METHOD P-7 PANEL THICKNESS

General

This method defines the procedure for determining panel thickness.

Specimen Preparation

The readings shall be taken on an as-received panel.

Test Method

For each panel, one thickness reading shall be taken mid-width on each panel edge such that the anvil does not touch the extreme edge. Measurements shall be taken to the nearest ± 0.001 inch using a micrometer with 0.75 (0, +0.050)-inch-diameter anvils. The micrometer shall apply a pressure of not less than 5 psi or more than 10 psi during measurement.

The panel thickness shall be the average of four readings.

APA TEST METHOD P-8 PANEL DENSITY[f]

General

This procedure measures panel density in pounds per cubic foot.

Specimen Preparation

Each sample shall be carefully cut to 12 inches by 12 inches (or other suitable size). The specimen shall be cut such that the diagonals do not vary more than 0.2 percent from each other. Samples shall be measured based on oven-dry weight and the as-received volume.

Test Procedure

Each specimen shall be measured for thickness at the four corners, in from the edge 1/2 inch using the micrometer described in APA Test Method P-7. The panel dimensions shall be measured to the nearest ± 0.05 inch.

The specimen shall then be weighed to the nearest ± 0.10 gram. A 3-inch-wide moisture content sample shall then be cut from the edge and moisture content determined according to APA Test Method P-6.

Panel density shall then be calculated as:

$$D = \frac{3.810\ W}{L1 \times L2 \times T}$$

where

L1 = Average length of side one (inches)

L2 = Average length of side two (inches)

T = Average panel thickness (inches)

W = Weight (grams)

Panel density shall be reported with the associated moisture content.

f Panel density may be determined in accordance with ASTM D1037, Sections 120 to 121, Moisture Content and Specific Gravity, as an alternate method at mill option.

APA TEST METHOD P-9 PROBE TEST FOR DELAMINATION

General

This test method defines a method for the determination of delamination in composite panels.

Equipment

The probe used shall measure 1/4 inch wide at the tip by 0.012 inch thick and shall taper in thickness to about 0.025 inch 1/2 inch from the tip. The 1/4-inch width shall taper to a width of 5/8 inch at 1 inch from the end. The probe can be any convenient length. The end of the probe shall be squared off and not sharp so that when probing delaminations, fibers across the delaminated area will not be cut.

Specimen Preparation

Five specimens shall be cut from each sample to 1-inch by 5-inch dimensions, avoiding veneer defects when present, with grain of the outer plies in the long direction. Measurement shall take place prior to any mechanical test.

Test Procedure

Delamination shall be evaluated according to the following procedure. The specimen shall be examined visually for delamination. Any separations in the specimen periphery in veneer-to-veneer or veneer-to-wood-based material glueline shall be probed to determine depth of delamination. A separation that is 1/4-inch deep for one continuous inch shall be considered as having failed the test for delamination. Use of slight pressure will be necessary when inserting the probe into the delaminated areas. The pressure shall be limited to that which can be applied by gripping the probe between the thumb and first finger. In no case shall any prying action be used.

Number of specimens failing this test shall be reported.

APA TEST METHOD P-10 PANEL STABILITY COEFFICIENT FOR SIDING

General

This method produces an indication of a siding panel's threshold point for buckling when exposed to one-sided wetting.

Specimen Preparation

Each 4-foot by 4-foot siding specimen shall be tested for linear expansion after three weeks of one-sided wetting (see Test Method P-2). Siding specimens shall be immediately tested for bending stiffness in each direction (see Test Method S-5) with the siding face in tension. Specimens shall then be cut for compression testing according to Test Method S-13.

Test Procedure

As an indication of the ability of the siding product to remain flat in service when applied according to the manufacturer's recommendations, a stability coefficient shall be calculated using the panel properties of linear expansion and compressive stiffness after wetting exposure, as well as the intended span between supports.

Linear expansion shall be measured after three weeks of one-sided wetting according to the procedures in APA Test Method P-2.

Bending stiffness shall be measured after three weeks of one-sided wetting according to the procedures in APA Test Method S-5.

Compressive stiffness shall be measured after three weeks of one-sided wetting according to the procedures in APA Test Method S-13.

The stability coefficient for each panel direction shall then be calculated as:

$$B = \frac{\pi^2 EI}{L^2 \, ø \, EA}$$

where:

B = stability coefficient

EI = bending stiffness (lbf-in.^{2} /ft)

ø = linear expansion (inch/inch)

EA = compressive stiffness (lbf/ft)

L = span (inch)

For the cross-panel direction, the span shall be the Span Rating for which the panel is qualified.

For the long panel axis, the span shall be the maximum recommended interior nail spacing (generally 12 inches).

APA TEST METHOD P-11 BUCKLING PERFORMANCE MEASURED ON A LARGE-SCALE WALL

General

This large-scale wall procedure evaluates buckling performance of siding when exposed to one-sided wetting.

Specimen Preparation

A lumber frame measuring at least 8 feet by 12 feet shall be constructed using 2x4 stud grade or better hem-fir lumber. The frame construction simulates the intended end use of the panel, so the support spacing and other construction details will vary.

The frame shall be clad with a sufficient amount of siding to completely cover the wall. Siding shall be applied in the as-received condition. Panel direction relative to supports, end and edge spacing, nail spacing and all other fabrication details shall be carefully maintained according to the application recommendations for the particular end use of the panels.

Test Procedure

Overall dimensions of the assembly shall be measured on the siding surface to the nearest 0.01 inch at the ends and middle for both along and across the major panel axis. A continuous water spray shall then be applied to the top surface for 21 consecutive days. Following wetting, the panel measurements shall again be taken.

Percent expansion for both directions shall then be calculated as follows:

$$\text{Percent Change} = \frac{L_w - L_d}{L_d} \times 100$$

where:

L_w = length wet

L_d = length dry

The average for each direction shall then be calculated from the individual readings.

Buckling between supports shall be measured along at least three horizontal profiles. For siding panels applied parallel to supports on an 8-foot by 12-foot wall, the buckling between studs shall be measured along horizontal profiles at 2, 4 and 6 feet from the top of the wall. Buckling shall also be measured at any other horizontal location showing maximum distortion.

Buckling along supports shall be measured along at least five supports.

Buckling between supports shall be measured as the deviation from a straight line between adjacent supports. Buckling or other distortions along supports shall be measured as a deviation from a straight line between adjacent fasteners.

Buckling measurements shall be made at equally spaced locations along each profile. At least 6 measurements shall be taken between each support along or between each fastener along each support.

Separate data populations shall be formed from distortion measurements between supports and along supports. The upper five percent exclusion limit shall be determined on each population.

APA TEST METHOD P-12 PROBE TEST FOR EDGE CHECKING OF SIDING

General

This method evaluates drip edge checking of siding panels after exposure to one-sided wetting.

Equipment

The probe shall measure 1/4-inch wide at the tip by 0.012-inch thick and shall taper in thickness to about 0.025 inch at 1/2 inch from the tip. The 1/4-inch tip width shall taper to a width of 5/8 inch at 1 inch from the end. The probe can be any convenient length. The end of the probe shall be squared off and not sharp so that when probing delaminations, fibers across the delaminated area will not be cut.

Specimen Preparation

Specimens shall be cut and exposed to three weeks of one-sided wetting according to the procedures of Test Method P-2. Specimens used for Test Method P-11 may be used as an alternate.

Test Procedure

Edge checking shall be evaluated along the bottom drip edge and along any groove walls according to the following procedure. The specimen shall be visually examined for any edge separations in the wood-based panel substrate, excluding those which occur between adjacent veneers. A separation that allows the probe 1/8-inch penetration shall be considered as having failed the test for edge checking. Use of slight pressure will be necessary when inserting the probe into the separated areas. The pressure shall be limited to that which can be applied by gripping the probe between the thumb and the first finger. In no case shall any prying action to be used.

Number of specimens failing this test shall be reported.

APA TEST METHOD F-1 SURFACE CHANGE MEASURED AFTER SOAK-DRY CYCLES

General

This method describes the procedure for determining change in surface profile of wood-based sidings after they have been subjected to five soak-dry cycles.

Equipment

Equipment that is capable of moving a stylus over a test surface at a constant speed of 1 inch per minute and transferring the traced profile to graph paper.

Chamber capable of conditioning test specimens under conditions of 50 ± 5% relative humidity and 68°F ± 11°F.

Container large enough to submerge test specimens in water at 75°F ± 5°F and oven with forced air circulation to dry specimens at 145°F ± 5°F.

Specimen Preparation

Specimens approximately 10 inches by 12 inches, with the long dimension perpendicular to the surface pattern, shall be cut from each product sample. For non-patterned surfaces, the long dimension shall be parallel to the major axis. For panel products, cut one specimen from the center of one quadrant, one specimen from the center of the diagonally opposite quadrant and a third specimen from the center of the panel. For lap siding, cut three specimens, randomly selected along the siding. Apply one light coat of white all-acrylic latex paint to the surface to be evaluated. Draw a straight pencil line down the middle of each specimen parallel to the long dimension.

Test Procedure

Condition specimens to equilibrium moisture content at approximately 50 ± 5% relative humidity and 68°F ± 11°F. Equilibrium shall be assumed when two consecutive readings taken at least 24 hours apart agree within 0.2%.

Record surface roughness along an 8-inch length of the pencil line by moving the stylus over the test specimen at a constant speed of 1 inch per minute and recording a trace of the stylus movement on graph paper.

Submerge specimen in water at 75°F ± 5°F for eight hours and then dry to a constant weight at 145°F ± 5°F in an oven which has forced air circulation. Constant weight shall be assumed when two consecutive readings taken at least two hours apart agree within 0.2%. This is one cycle. Repeat the soak-dry cycle a total of five times.

Retrace the original profile and transfer profile to graph paper.

Calculations

Weighted Roughness

Evaluation of the profile trace involves calculating the "Peak Index" (PI) from a "Weighted Roughness" (WR) factor (refer to Figures F1-1 and F1-2). The WR is the sum of the products of the number of peaks or valleys multiplied by a weighting factor. The weighting factor for peak (valley) height gives more emphasis to the larger peaks (valleys) than the smaller ones.

The roughness of the surface is expressed in a quantitative manner by using the surface profile to develop a "Weighted Roughness" (WR) factor and a "Peak Index" (PI). The method is summarized by an example in Figure F1-2. First, a line shall be drawn through the center of the profile trace. This line shall be located so that it is midway between the highest "peaks" and lowest "valleys" on the trace. Equal zones shall be located above and below the center line. Each zone shall represent 0.003 ± 0.00075 inch actual relief on the panel's surface and be magnified at least 100 times in order to compute PI. Those zones located immediately above and below the center line shall be assigned a weighting factor of 1, and zones located farther away from the center line shall be assigned progressively higher numbers, as shown in Figure F1-2. While the number of zones shown in Figure F1-2 is four, above and below the center line, the number can vary depending on the roughness of the surface.

The equation for weighted roughness is:

$WR = Wf \times Np$ . . . . . [1]

WR = Weighted roughness for that zone

Wf = Weight factor for the zone

Np = Number of peaks within the zone

Peak Index

The Peak Index (PI) for each specimen shall be calculated by:

$$PI = \frac{S_{wr}}{S_{np}} \quad \text{. . . . . [2]}$$

where

PI = Peak Index

S_{wr} = Sum of each zone

WR S_{np} = Sum of number of peaks

Surface Change

Surface change (SC) shall be calculated as the difference between the Peak Index before soak-dry cycles and the Peak Index after moisture cycling. The equation is:

SC = PI (cycled) – PI (dry) . . . . . [3]

Where: SC = Surface change (absolute value)

FIGURE F1-1

TYPICAL PROFILE TRACE

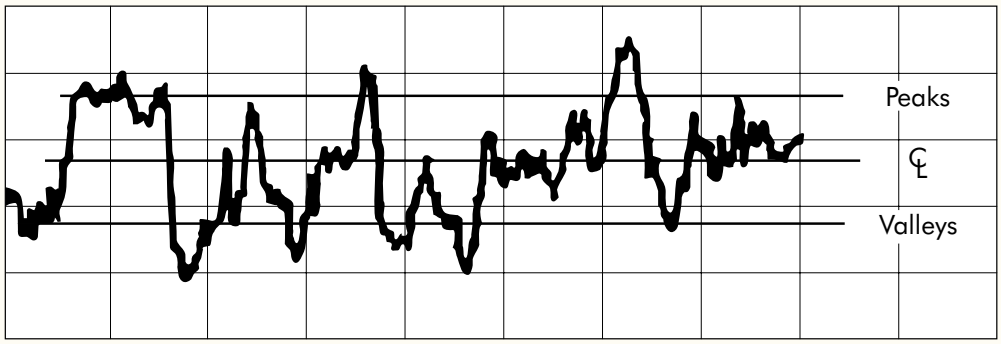
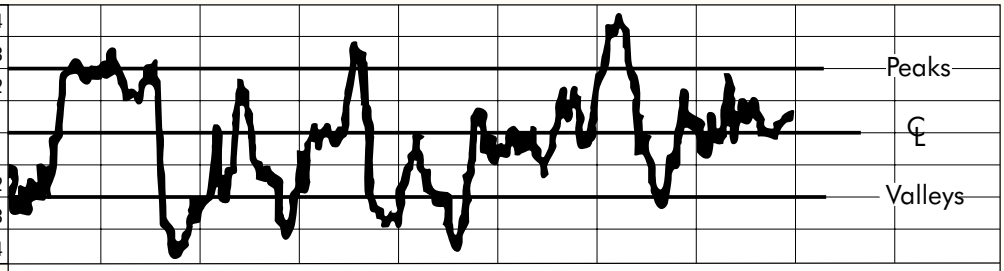


FIGURE F1-2

CALCULATION OF PEAK INDEX (PI) FROM PROFILE TRACE

	Count	Weight Factor	Weighted Roughness (WR)
	8	2	4
	24	8	3
	26	13	2
	14	14	1
	22	22	1
	20	10	2
	39	13	3
	8	7	4
Total	181	89	



$$\text{Peak Index (PI)} = \frac{\Sigma WR}{\text{Total No. of Peaks}} = 2.03$$

APA TEST METHOD F-2 FINISH ADHESION ON WOOD-BASED SIDING

General

This method describes the procedure for determining the average initial adhesion of the standard control finish to sidings.

The adhesion of a standard control solid-color stain to a wood-based siding product is determined by measuring the force required to remove, in an 180° peel, a 1-inch-wide strip of cotton cheesecloth which has been embedded in the stain.

Equipment

Apparatus that is capable of firmly holding test specimens, peeling the cotton cheesecloth from the specimens at a constant machine speed of 1 inch per minute and transferring the peel loads to graph paper or other media from which an average load value can be developed.

A test chamber capable of curing finish on test specimens under conditions of 50% ± 5% relative humidity and 68°F ± 11°F.

Freshly prepared standard control finish. An example formulation of finish is given in Table F2-1.

Specimen Preparation

Specimens approximately 2 inches by 10 inches, with the long dimension perpendicular to the direction of the surface pattern, shall be cut from each product sample. For non-patterned surfaces, the long dimension shall be parallel to the major panel axis. For each test specimen, cut a sample of cotton cheesecloth (not woven synthetic cheesecloth) approximately 1-3/4 inches by 10 inches long made up of at least four single layers.

Apply freshly prepared (one year or less and no visible changes in properties) standard control solid color stain (for example K-64-3, barn red, Rohm & Haas Co.) to one-half of siding specimen in a path approximately 2 inches by 5 inches. Lay one-half of the strip of cheesecloth (composed of at least four single layers) into this wet path and then thoroughly saturate it by brushing additional stain on top.

Cure finish two weeks under conditions of approximately 50 ± 5% relative humidity and 68°F ± 11°F.

Test Procedure

With a sharp knife or razor blade, down the length and along the center of the specimen, cut a 1-inch-wide strip in the cured finish. Hand separate the first 1/2 inch of finish-embedded cheesecloth from the substrate. Place the specimen in a testing machine which is capable of separating the cheesecloth from the substrate at a constant machine speed of 1 inch per minute (resulting in an actual separation rate of 1/2 inch per minute), and which can continuously record the peel load over the specified distance. Peel the cheesecloth for at least 2 inches and record the load curve. (Refer to Figure F2-1.) For adhesion to panel surface repairs, peel cheesecloth from repairs only while recording the load curve.

Calculations

From the load data, determine the average peel load in pounds per inch of width. This may be an average determined visually from graph paper by drawing a line through the load curve so that equal portions of the curve are above and below the line. (Refer to Figure 3.)

TABLE F2-1

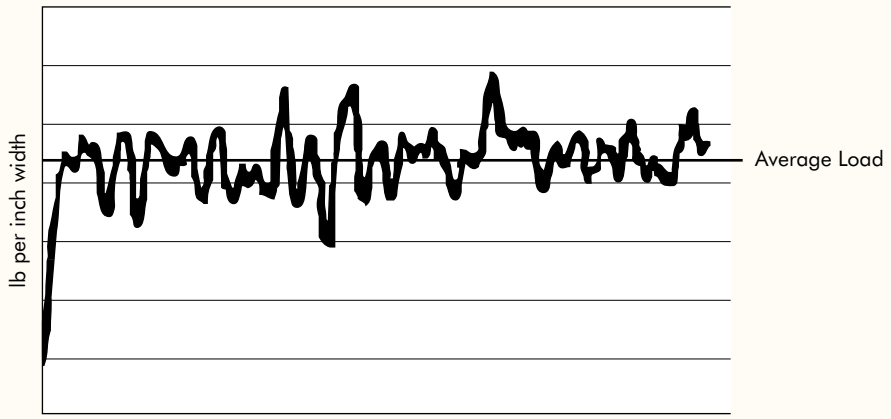
FORMULATION FOR EXAMPLE STANDARD CONTROL FINISH, K-64-3[a]

Materials Weight Ratio[b]	(Volume Basis)	Parts Per Hundred (Volume Basis)
Tamol 731 (25%)	5.8	0.63
Triton CF-10	2.0	0.23
Foamaster VL	1.0	0.13
Ethylene glycol	35.0	3.77
Natrosol 250 MHR (2.5%)	50.0	6.10
Water	125.0	15.00
Red iron oxide, RO-8097	80.0	1.96
Red iron oxide, RO-2899	20.0	0.46
Silica	305.7	13.88
Grind 5 minutes at high speed, then add:		
Attagel 50	10.0	.50
Grind 10 to 15 additional minutes and let down:		
Rhoplex AC-64 (60.5%)	389.3	43.41
Foamaster VL	3.0	0.38
Texanol	3.0	0.38
Super Ad-It	9.0	1.11
Natrosol 250 MHR (2.5% and/or water)	100.5	12.06
	1139.3	100.00
Formulation Constants		
Pigment volume content	40.0%	
Volume solids	42.0%	
pH	9.2	
Viscosity	82 to 86 KU	
ICI viscosity	1.0 to 1.2 poise	

a. Control finish used should be high quality and have similar performance characteristics.
b. Using weight ratio in pound units will yield approximately 100 gallons of paint, while with kilograms, 833 liters will result.

FIGURE F2-1

TYPICAL PEELING LOAD CURVE



APA TEST METHOD F-3 SURFACE REPAIR PERFORMANCE IN WOOD-BASED SIDING

General

This method describes the procedure for determining the acceptability of surface repairs in siding.

Equipment

Container large enough for submerging specimens in boiling and room temperature water.

Oven with forced air circulation.

Metal probe (see equipment description in APA Test Method P-9).

Equipment outlined in APA Test Method F-2.

Specimen Preparation

Test 1—Boil-Dry Specimens

Cut 12-inch-by-12-inch test specimens so that each contains a repair of maximum size intended for product. Test specimens shall have no edge sealing or protective coating.

Test 2—Soak-Dry Specimens

Cut 12-inch-by-12-inch test specimens so that each contains a repair of maximum size intended for product. Test specimens shall have no edge sealing or protective coating.

Test 3—Finishability Specimens

Finish compatibility. To each specimen, apply one coat of a standard acrylic solid-color control stain by brush (for example K-64-3 standard acrylic solid-color stain). If finish shows signs of incompatibility (e.g., alligatoring, crawling, etc.), the test repair is considered to be unsatisfactory for finishing and no further testing of finishability is required. If no signs of incompatibility are observed, prepare additional specimens as detailed in APA Test Method F-2.

Test 4—Machinability Specimens

Cut at least five test specimens containing repairs of maximum size intended for product from siding samples.

Test Procedure

Test 1—Effect of Boil-Dry Cycles on Repair Performance

Subject test specimens to 2 cycles of 4-hour immersion in boiling water followed by 20 hours of drying in an oven with forced air circulation at 145°F ± 5°F. Power saw through repair. Examine the cohesive and adhesive bond of the repair and the repair-substrate interface with the metal probe previously described.

Test 2—Effect of Multiple Soak-Dry Cycles on Repair Performance

Subject test specimens to 10 cycles of 4-hour immersion in water at 75°F ± 5°F followed by 20 hours of drying in an oven with forced air circulation at 145°F ± 5°F temperature. Power saw through the repair. Examine the cohesive and adhesive bond of the repair and the repair-substrate interface with the metal probe previously described.

Test 3—Finishability of Surface Repairs

Subject test specimens to finish adhesion testing, following procedure outlined under APA Test Method F-2.

Test 4—Effect of Machinability on Surface Repairs

Subject repairs to all machining tests or use additional specimens as necessary to provide specimens for each test. Follow good shop practice and use tools in good condition. Examine specimens for the ability of repairs to be machined satisfactorily and remain in place.

1. Sawing
   Cut through the filled defect with a table saw. Use a carbide-tipped general-purpose blade or suitable alternative in good condition.

2. Nailing
   Drive nails of the size recommended by the manufacturer through the panel and the filled area. Back the specimen solidly during nailing.

3. Drilling
   Power drill with a 1/4-inch-diameter machine bit through the filled area. Back the specimen solidly during drilling.

4. Routing
   Power rout a 1/2-inch wide groove through the face and across the filled area.

APA TEST METHOD F-4 OVERLAY PERFORMANCE ON WOOD-BASED SIDING

General

This method describes procedures for determining the acceptability of overlays on siding. An overlay must have an adequate bond to the substrate for the expected life of the siding, must resist the effects of weathering (not crumble, craze or crack), must accept and hold a finish, and must be machinable.

Equipment

Pressure vessel for saturating test specimens with water.

Oven with forced air circulation.

Metal probe (see equipment description in APA Test Method P-9).

Specimen Preparation

Test 1—Multiple Vacuum-Pressure-Dry Specimens

Specimens 6 inches by 6 inches shall be cut from the siding samples. Test specimens shall have no edge seal or protective coating.

Test 2—Machining Specimens

Specimens approximately 12 inches by 12 inches or other size convenient for handling in the test shall be cut from the siding samples.

Test Procedure

Test 1—Effect of Multiple Vacuum-Pressure-Dry Cycles on Overlay Performance

Subject specimens to three cycles of immersion in cold tap water in a pressure vessel under the following conditions. Draw approximately 25 inches of mercury vacuum and maintain it for 30 minutes. Then immediately apply 65–70 psi of pressure for 30 minutes. Dry specimens for 20 hours at a temperature of 145°F ± 5°F in an oven with forced air circulation. This is one cycle.

After each cycle:

Visually inspect the overlay for delamination and cracks.

Probe the edges of the overlay for delamination using a thin metal probe.

Test 2—Effect of Machining on Overlay Performance

Subject each overlay specimen to all machining tests or use additional specimens as required. Follow good shop practice and use tools in good condition. After each operation, visually inspect the overlay for its ability to machine satisfactorily and mechanically probe the overlay for loss of cohesion or adhesion.

1. Sawing
   Cut through the overlay with a table saw. Use a carbide-tipped general-purpose blade or suitable alternative in good condition.

2. Nailing
   Drive nails of the size recommended by the manufacturer through the overlay. Back the specimens solidly during nailing.

3. Drilling
   Power drill with a 1/4-inch-diameter machine bit through the overlay. Back the specimens solidly during the drilling.

4. Routing
   Power rout a 1/2-inch-wide groove through the overlay.

APA PRP-108
Performance Standards and Qualification Policy for Structural-Use Panels

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