



Performance Rated Panels

PRODUCT GUIDE



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WOOD

The Natural Choice



Engineered wood products are a good choice for the environment. They are manufactured for years of trouble-free, dependable use. They help reduce waste by decreasing disposal costs and product damage. Wood is a renewable resource that is easily manufactured into a variety of viable products.

A few facts about wood.

- **We're growing more wood every day.** Forests fully cover one-third of the United States' and one-half of Canada's land mass. American landowners plant more than two billion trees every year. In addition, millions of trees seed naturally. The forest products industry, which comprises about 15 percent of forestland ownership, is responsible for 41 percent of replanted forest acreage. That works out to more than one billion trees a year, or about three million trees planted every day. This high rate of replanting accounts for the fact that each year, 27 percent more timber is grown than is harvested. Canada's replanting record shows a fourfold increase in the number of trees planted between 1975 and 1990.



- **Life Cycle Assessment shows wood is the greenest building product.** A 2004 Consortium for Research on Renewable Industrial Materials (CORRIM) study gave scientific validation to the strength of wood as a green building product. In examining building products' life cycles – from extraction of the raw material to demolition of the building at the end of its long lifespan – CORRIM found that wood was better for the environment than steel or concrete in terms of embodied energy, global warming potential, air emissions, water emissions and solid waste production. For the complete details of the report, visit www.CORRIM.org.

- **Manufacturing wood is energy efficient.** Wood products made up 47 percent of all industrial raw materials manufactured in the United States, yet consumed only 4 percent of the energy needed to manufacture all industrial raw materials, according to a 1987 study.

Material	Percent of Production	Percent of Energy Use
Wood	47	4
Steel	23	48
Aluminum	2	8

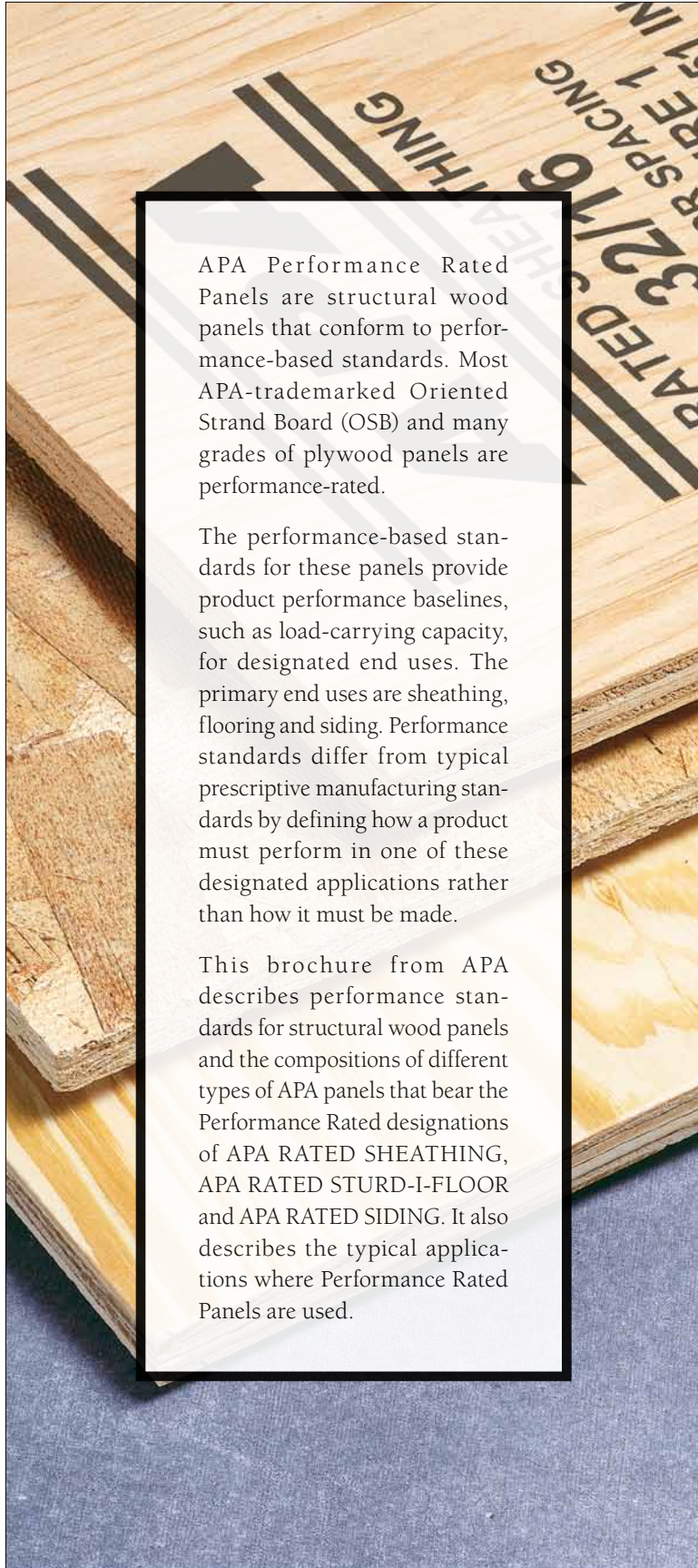


- **Good news for a healthy planet.** For every ton of wood grown, a young forest produces 1.07 tons of oxygen and absorbs 1.47 tons of carbon dioxide.

Wood: It's the natural choice for the environment, for design and for strong, lasting construction.



NOTICE:
The recommendations in this guide apply only to products that bear the APA trademark. Only products bearing the APA trademark are subject to the Association's quality auditing program.



APA Performance Rated Panels are structural wood panels that conform to performance-based standards. Most APA-trademarked Oriented Strand Board (OSB) and many grades of plywood panels are performance-rated.

The performance-based standards for these panels provide product performance baselines, such as load-carrying capacity, for designated end uses. The primary end uses are sheathing, flooring and siding. Performance standards differ from typical prescriptive manufacturing standards by defining how a product must perform in one of these designated applications rather than how it must be made.

This brochure from APA describes performance standards for structural wood panels and the compositions of different types of APA panels that bear the Performance Rated designations of APA RATED SHEATHING, APA RATED STURD-I-FLOOR and APA RATED SIDING. It also describes the typical applications where Performance Rated Panels are used.

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PERFORMANCE STANDARDS: DEFINITIONS AND HISTORY

A performance standard sets requirements based on a panel's end use while a prescriptive standard defines minimum manufacturing requirements. The objective of a performance standard is to provide flexibility in manufacturing while assuring that a product will satisfy the requirements of the intended end use.

The wood products industry is by no means the first to use performance standards and testing. The electronics, automotive, and aircraft industries all use performance standards for a variety of parts and products.

Why Performance Standards?

APA Performance Standards were born out of necessity – answering changes in wood resources, manufacturing, and construction trends.

In the early days of plywood manufacture, every mill worked with the same species and technology. Manufacturing techniques didn't vary much from mill to mill. APA's quality assurance program was geared toward this uniformity in manufacturing. To produce panels under APA's prescriptive standards, a member mill used wood of a certain species, peeled it to veneer of a prescribed thickness, then glued the veneers together in a prescribed manner using the approved adhesives.

Keeping In Step With Technology and Resources

As technology changed, mills started using a broader range of species and different manufacturing techniques. By the mid-1960s, APA was maintaining and cross-referencing three major product standards and several minor ones.

With the development of Product Standard PS 1-66, the three standards were combined into one. And, for the first time, Span Ratings were incorporated in the standard. The Span Rating concept would later be used as a basis for the development of APA Performance Standards.

Maximizing the Resource

At the same time, there was growing concern over efficient use of forest resources. Working in cooperation with the U.S. Forest Service, APA tested panels manufactured with a core of compressed wood strands and traditional wood veneer on the face and back for use in structural applications. By using cores of wood strands, manufacturers were able to make more efficient use of the wood resource and use a broader range of species. These composite panels were called COM-PLY®.

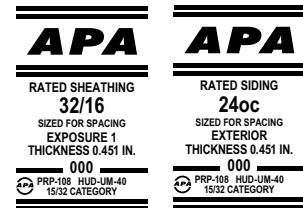
While composite panels are not commonly found today, the research and development led to development of performance standards and APA's system of Performance Rated Panels. Soon, manufacturers were making structural panels composed entirely of wood strands. Most current production of these panels is referred to as oriented strand board, or OSB.

THE PERFORMANCE STANDARD ADVANTAGE

Performance standards provide several advantages:

- They provide a common baseline for all panel types. All panels, regardless of manufacturing method, must meet the same minimum performance criteria to receive a Span Rating.
- Panel products have more freedom to use innovative manufacturing technology. As long as the finished product meets performance standards, a variety of species and manufacturing methods may be used.
- More efficient use of resources encouraged innovative manufacturing techniques use greater percentages of each log, and allow for the utilization of a wide range of species.
- Because performance standards are directed toward the end use, builders, engineers, and architects are assured that the panel satisfies the requirements of the job at hand.

Throughout decades of product and standard development, one fact has remained unchanged: the APA trademark on a wood structural panel signifies that the manufacturer subscribes to recognized, industry wide standards and APA's rigorous quality auditing program. The APA trademark is still the premier mark of quality.



APA PERFORMANCE RATED PANEL COMPOSITIONS

Plywood

Plywood is the original wood structural panel. It is composed of thin sheets of veneer, or plies, arranged in layers to form a panel. Plywood may have an even number of plies, but it always has an odd number of layers, each layer consisting of one or more plies, or veneers.

In plywood manufacture, a log is turned on a lathe and a long knife blade peels the veneer. The veneers are clipped to a suitable width, dried, graded, and repaired if necessary. Next the veneers are laid up in cross-laminated layers. Sometimes a layer will consist of two or more plies with the grain running in the same direction, but there will always be an odd number of layers, with the face layers typically having the grain oriented parallel to the long dimension of the panel.

Adhesive is applied to the veneers which are to be laid up. Laid-up veneers are then put in a hot press where they are bonded under pressure to form panels.

Wood is strongest along its grain, and shrinks and swells most across the grain.

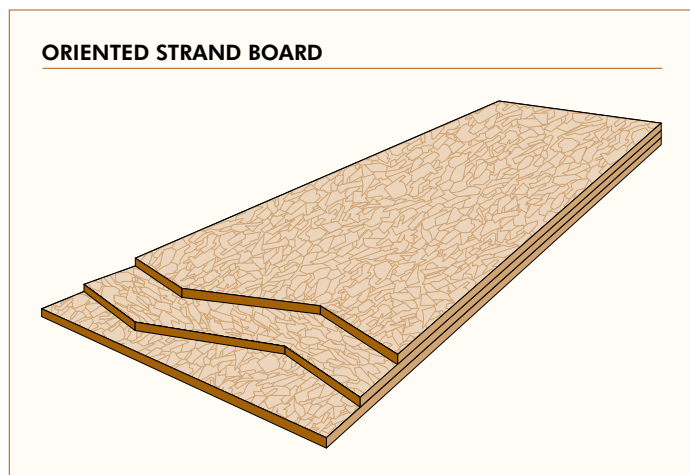
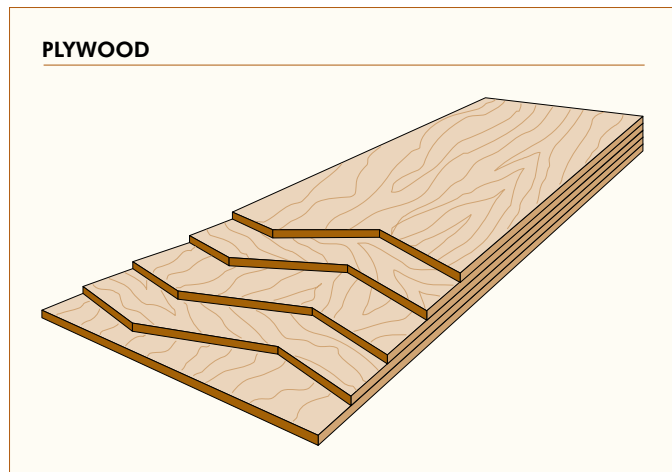
By alternating grain direction between adjacent layers, strength and stiffness in both directions are maximized, and shrinking and swelling are minimized in each direction.

Oriented Strand Board

Panels manufactured of compressed wood strands have been marketed with such names as wafer-board and oriented strand board. Today, all APA nonveneer wood structural panels are manufactured with oriented strands and are called oriented strand board (OSB).

OSB is composed of compressed strands arranged in layers (usually three to five) oriented at right angles to one another. The orientation of layers achieves the same advantages of cross-laminated veneers in plywood. Since wood is stronger along the grain, the cross-lamination distributes wood's natural strength in both directions of the panel. All APA manufacturers orient the raw material to achieve maximum performance.

Most OSB sheathing panels have a nonskid surface on one side for safety on the construction site.



PERFORMANCE RATED PANELS FOR FLOORS, WALLS, AND ROOFS

APA Performance Rated Panels are rated for three end uses: single-layer flooring, exterior siding, and sheathing for roofs, floors and walls. The categories are further broken down into bond classifications, and an additional sheathing category (Structural 1) denoting additional strength in the cross-panel direction and in racking.

In order to qualify for a particular end use, panels must be submitted for testing and meet performance criteria in three critical areas: structural performance, physical properties and bond performance.

Panels are typically classified in one of two bond classifications:

- **Exterior** panels have bonds capable of withstanding repeated wetting and redrying or long-term exposure to weather or other conditions of similar severity.
- **Exposure 1** panels are suitable for uses **not** involving long-term exposure to weather. Panels classified as Exposure 1 are intended to resist the effects of moisture due to construction delays, or other conditions of similar severity. Exposure 1 panels may also be used when exposure to the outdoors is on the under-side only, such as at roof overhangs, although appearance characteristics of the panel grade should also be considered. Exposure 1 panels are made with the same exterior adhesives used in Exterior panels. However, because other panel compositional factors may affect bond performance, only Exterior panels should be used for long-term exposure to the weather.

C-D Exposure 1 APA Rated Plywood Sheathing, sometimes called “CDX” in the trade, is occasionally mistaken as an Exterior panel and erroneously used in applications for which it does not possess the required resistance to weather. “CDX” should only be used for applications as outlined under Exposure 1 above. For sheathing grade panels that will be exposed long-term to the weather, specify APA Rated Sheathing Exterior (C-C Exterior plywood under PS 1).

APA Rated Sheathing is rated for use as subfloor, wall or roof sheathing. It is used in a myriad of construction and miscellaneous applications where strength and stillness are required. For outdoor use, be sure to select panels with an Exterior bond classification.

Rated Sheathing is also available as APA Rated Sheathing/Ceiling Deck, where one surface has an overlay, texturing or grooving.

Common Performance Categories for sheathing panels are 5/16, 3/8, 7/16, 15/32, 1/2, 19/32, 5/8, 23/32, and 3/4.

- **Structural 1** is a designation applied to APA Rated Sheathing where enhanced racking and cross-panel strength properties are of maximum importance. Structural 1 panels are typically used in demanding applications such as structural shear walls and panelized roofs.

APA Rated Sturd-I-Floor is a combined subfloor/underlayment single-layer flooring for use under carpet and pad. It can be used in place of separate subfloor and underlayment layers. The panel surface has extra resistance to punch-through damage. Panels are available with square or tongue-and-groove (T&G) edges.

T&G panels are typically 47-1/2 inches wide; check with local suppliers. Where resilient flooring such as vinyl will be used, an additional layer of thin, sanded underlayment is recommended. APA Rated Sturd-I-Floor is available in both Exterior and Exposure 1 in panel Performance Categories of 19/32, 5/8, 23/32, 3/4, 7/8, 1, and 1-1/8.

APA Rated Siding is available as both panel and lap siding. Panel siding may be applied over sheathing or directly over studs in Sturd-I-Wall (single wall) application. APA panel siding is available in a variety of surface textures and patterns, including Texture 1-11, rough sawn, reverse board and batten, channel groove, and brushed. Panels are available in typical 4 x 8, 4 x 9, and 4 x 10-foot dimensions.

Lap siding is available in lengths of up to 16 feet and widths of up to 12 inches.

APA Rated Siding is manufactured in panel Performance Categories of 11/32, 3/8, 7/16, 15/32, 1/2, 19/32, and 5/8.

PERFORMANCE TESTING

Field data and laboratory testing were used to develop the APA Performance Standards for APA Performance Rated Panels. Once a mill's panels have qualified for the Performance Rated Panel trademark, APA's quality auditors check the mill's quality program by selecting panels from production for tests, reviewing mill documentation and records, and interviewing mill personnel. Specified quality-assurance tests are run on an ongoing basis. APA verifies product performance through independent quarterly tests.

There are three basic criteria for qualifying wood-based panel products under APA performance standards: structural adequacy, dimensional stability and bond performance. In addition, APA Rated Siding is evaluated for surface characteristics, including overlay adhesion and ability to accept different kinds of finishes.

Performance criteria in each of these categories were established by building code requirements and through tests of panel products with known acceptance in the marketplace. The tests evaluate a panel's ability to perform to the expected and necessary level for the end-use application or market.

Not all performance tests apply to all panels and their applications, but a partial list of typical tests includes:

- **Linear expansion.** Measurements are taken between brass eyelets installed in a specimen to test dimensional change due to moisture exposure.
- **Racking.** A wall section built with dimension lumber and structural panels is tested. A lateral load is applied to one corner, and deflection and ultimate load on the wall are measured.
- **Uniform load.** A panel is applied to joists. The unit is sealed to permit a vacuum to be drawn beneath the panel. Atmospheric pressure then provides a uniform load. Deflection at a specified load is measured. A proof load for strength is also applied.
- **Concentrated static load (APA Rated Sturd-I-Floor and Sheathing).** Load is applied through a one- or three-inch diameter disc mid-span between joists at a panel edge. Deflection and ultimate load are measured.
- **Concentrated impact load (APA Rated Sturd-I-Floor and Sheathing).** A bag of steel shot weighing 30 or 60 pounds, depending on span, is dropped on the panel midspan between joists, to determine impact load performance.
- **Concentrated static load (APA Rated Siding).** The end of a one-inch diameter rod is pushed into the panel, and the indentation measured.
- **Hard-body impact loads (APA Rated Siding).** A steel ball is dropped on the panel from several feet, and the indentation measured to determine surface toughness.
- **Direct fastener withdrawal.** Nails are driven into the panel, then the force needed to pull them out is measured.
- **Lateral fastener strength.** A nail is driven through the panel, and through a hole in a steel block behind the panel. Force is then applied to move the panel laterally.
- **Surface profile (APA Rated Siding).** The decorative surface on the exposed siding face is measured before and after going through moisture cycles to determine stability of the decorative pattern.
- **Peel test (APA Rated Siding).** A strip of cheese cloth is painted on the decorative surface of a siding panel. After it dries, the force required to peel it off is measured to test the suitability of the siding's surface to accept paint and stain.



SPAN RATINGS

The Span Ratings in the trademarks on Performance Rated Panels denote the maximum recommended center-to-center spacing of supports, in inches, over which the panels should be installed.

For APA Rated Sheathing and Sturd-I-floor, the Span Rating applies when the long panel dimension is across supports, unless the strength axis is otherwise identified. The Span Rating for APA Rated Siding panels is for vertical installation; for lap siding, the rating applies with the long dimension across supports.

For APA Rated Sheathing, the Span Rating looks like a fraction, such as 32/16. The left-hand number denotes the maximum spacing of supports (in inches) when the panel is used for roof sheathing, and the right-hand number denotes the maximum spacing of supports when the panel is used for subflooring.

Sheathing panels with roof Span Ratings of 24 or greater may be used vertically or horizontally as wall sheathing over studs at 24 inches on center (o.c.). Those with roof Span Ratings of less than 24 may be used vertically or horizontally over studs at 16 inches o.c.

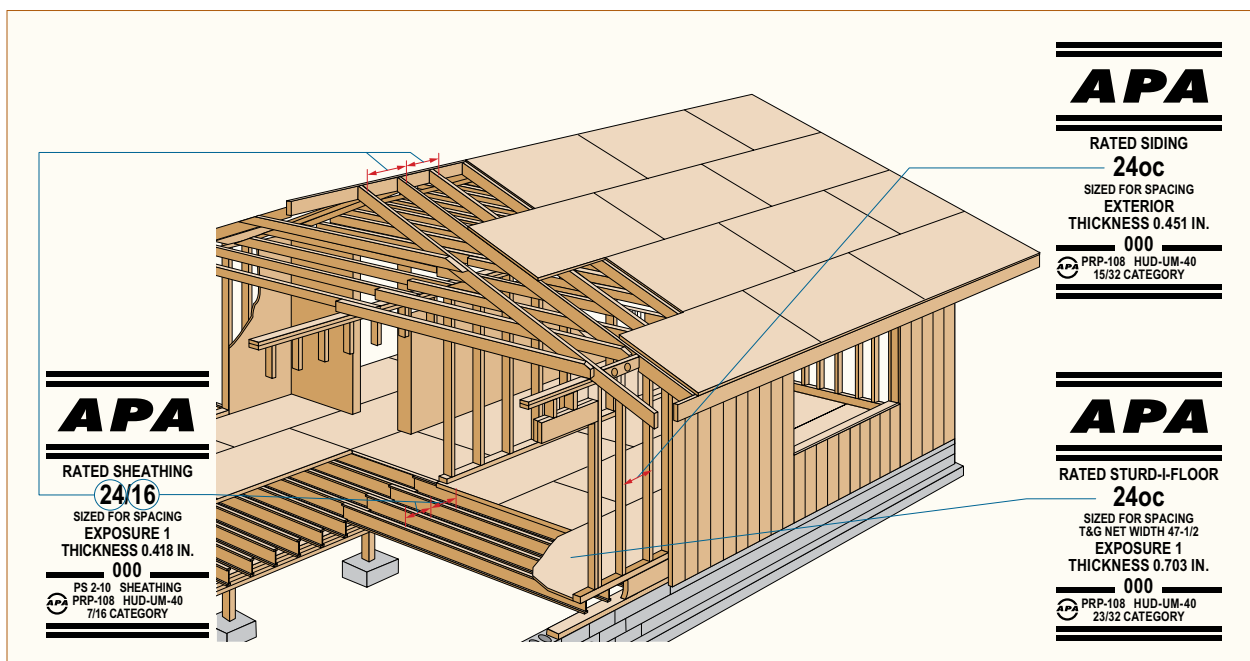
APA Rated Sheathing may also be manufactured specifically for use as wall sheathing. These panels are identified with Span Ratings of Wall-16 or Wall-24.

Horizontal edges of all wall sheathing must be blocked when panels are used as bracing.

APA Rated Sturd-I-floor panels are designed specifically for single-floor (combined subfloor-underlayment) applications under carpet and pad and are manufactured with Span Ratings of 16, 20, 24, 32, and 48 oc.

APA Rated Siding is produced with Span Ratings of 16 and 24 oc. Both panels and lap siding may be used direct to studs or over non-structural sheathing (Sturd-I-Wall construction) or over nailable panel or lumber sheathing (double wall construction). Veneer-faced APA Rated Siding panels may be applied horizontally over studs 24 inches o.c., provided horizontal joints are blocked.

Spacing supports precisely at Span Ratings will meet minimum code requirements. For structures that will exceed minimum code requirements, space supports closer than the recommended Span Ratings.



Allowable uniformly distributed live load at maximum span for APA Rated Sturd-I-Floor and APA Rated Sheathing is 100 psf for floors plus 10 psf dead load (65 psf total load for Sturd-I-floor 48 o.c.) and 30 psf for roofs (35 psf for Rated Sheathing 48/24 or greater) plus 10 psf dead load. Higher live load levels can be achieved by placing supports closer than the maximum span indicated on the APA Rated Sheathing or Sturd-I-Floor trademarks. Refer to APA's *Engineered Wood Construction Guide*, Form E30 for these live load levels.

ENGINEERED APPLICATIONS

Engineering design capacities for APA Rated Sheathing and APA Rated Sturd-I-Floor are given in *APA Panel Design Specification*, Form D510.

Some grades of veneered panels are manufactured under the detailed manufacturing specifications or under the performance testing provisions of *Voluntary Product Standard PS 1-09, Structural Plywood*, Form L870 and *Voluntary Product Standard PS 2-10, Performance Standard for Wood-Based Structural-Use Panels*, Form S350 developed cooperatively by APA, the wood structural panel industry and the U.S. Department of Commerce. The PS 1 and PS 2 grade conformance, where applicable, is given in the lower portion of the APA trademark.

Design stresses and section properties for plywood conforming to PS 1, including sanded panels, are given in APA's *Plywood Design Specification*, Form Y510. Design capacities for performance-rated APA Rated Sheathing and APA Rated Sturd-I-Floor wood structural panels conforming with PS 1 and PS 2 are given in APA's *Panel Design Specification*, D510.

For specific construction grade and installation recommendations, see APA's *Engineered Wood Construction Guide*, Form E30.

Industrial use recommendations for bins, slave pallets and other materials handling applications are also available. Request information from APA's Product Support Help Desk or visit APA's industrial website at www.performancepanels.org.

PANEL SIZE AND SPACING

Square-edge Performance Rated Panels are typically manufactured 48 by 96 inches, with a plus 0, minus 1/8-inch tolerance. Tongue-and-groove Sturd-I-Floor panels are 48 inches wide, but net width installed is typically 47-1/2 inches.

Recommended spacings between panels are 1/8 inch at end and edge joints, except where otherwise indicated by the manufacturer.

The simple precaution of properly installing the panels with correct spacing will help reduce complaints and callbacks, especially on roofs.

CODE RECOGNITION

Recognition of panels conforming to PS 1 and PS 2 is contained in the *International Building Code (IBC)* and *International Residential Code for One- and Two-Family Dwellings (IRC)*.

The International Code Council – Evaluation Service, recognizes the APA Performance Standard PRP-108 in Report number ESR-2586. APA is accredited as an inspection agency under ISO 17020 by the International Code Council – International Accreditation Service (IAS). APA is also accredited as a certification body under ISO Guide 65 by the Standards Council of Canada (SCC).

ORDERS AND SPECIFICATIONS

To order APA Performance Rated Panels, designate the panel Performance Category, APA trademark, grade, Span Rating, bond classification, dimensions and number of pieces. For example:

- 15/32 Performance Category APA Rated Sheathing, 32/16, Exposure 1, 48" x 96", 100 pcs
- 23/32 Performance Category APA Rated Sturd-I-Floor, 24 o.c., Exposure 1, 48" x 96", 100 pcs.
- 19/32 Performance Category APA Rated Siding, 303-18-S/W*, 16 o.c., Exterior, 48" x 96", 100 pcs.

Standard dimensions for structural panels are 48" by 96", but others are available. Some mills manufacture plywood to 10-foot lengths or longer, and nonveneer panels can be furnished in some parts of the country to lengths of 28 feet. Check local availability.

*Face grade is one of several that can apply to plywood Rated Siding 303.

STORAGE AND HANDLING

Like all building materials, APA trademarked structural wood panels should be properly stored, handled and installed to assure in-service performance.

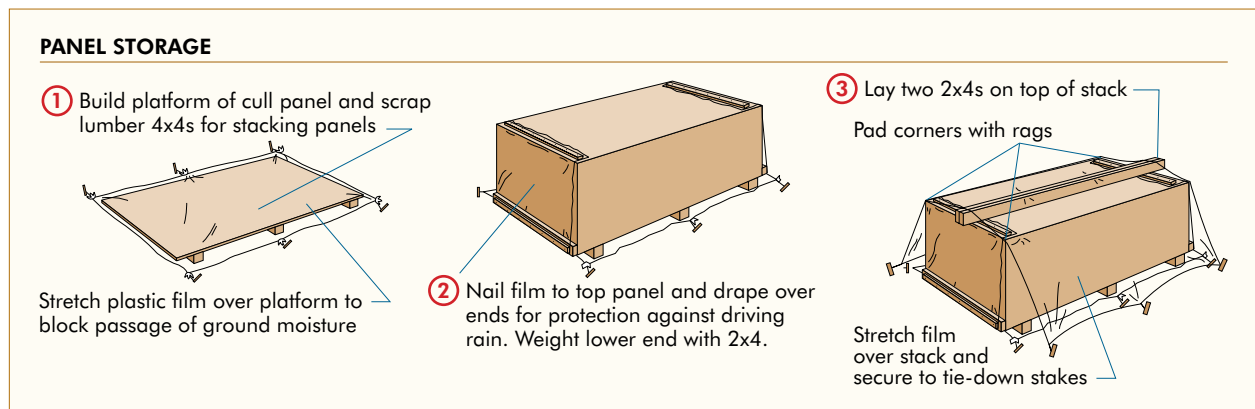
Protect the edges and ends of panels, especially tongue-and-groove and shiplap-edged panels. Place panels to be moved by forklift on pallets or bunks when received to avoid damage by fork tines.

Panels to be transported on open truck beds should be covered with standard tarpaulins or "lumber wraps." For open railcar shipment, use "lumber wrap" to avoid extended weather exposure.

Whenever possible, store panels under a roof, especially if they won't be used soon after received. Keep sanded and other appearance grades away from open doorways, and weight down the top panel in a stack to help avoid any possible warpage from humidity. If moisture absorption is expected, cut steel banding on panel bundles to prevent edge damage.

Panels to be stored outside should be stacked on a level platform supported by 4x4 stringers or other blocking. Never leave panels or the platform in direct contact with the ground. Use at least three full-width supports along the 8-foot length of the panel – one centered and the others 12 to 16 inches from each end.

Cover the stack loosely with plastic sheets or tarps. Anchor the covering at the top of the stack, but keep it open and away from the sides and bottom to assure good ventilation. Tight coverings prevent air circulation and, when exposed to sunlight, create a "greenhouse" effect which may encourage mold formation.



SUMMARY

Development of performance standards brings four major advantages to manufacturers, specifiers, architects and users of structural panels:

- Performance standards permit more efficient use of natural resources by expanding the range of panel composition and configuration. Abundant wood species which do not lend themselves to use under traditional prescriptive standards may now be used in structural panels.
- Performance standards encourage manufacturing and product innovation, since manufacturers are freed from prescriptive requirements. This innovation helps assure the future availability of adequate supplies of manufactured wood products at affordable cost.
- APA performance standards establish baseline criteria for qualifying new products and provide a means for their recognition by building codes. Plus, extensive qualification testing and ongoing quality auditing assures the user that the product will perform in its intended end use.
- Finally, performance standards, along with descriptive APA panel trademarks simplify the specification, identification and use of structural wood panels in strong, safe building construction.

ABOUT APA



APA – The Engineered Wood Association is a nonprofit trade association of and for structural wood panel, glulam timber, wood I-joist, structural composite lumber, and other engineered wood product manufacturers. Based in Tacoma, Washington, APA represents approximately 150 mills throughout North America, ranging from small, independently owned and operated companies to large integrated corporations.

Always insist on engineered wood products bearing the **mark of quality** – the APA or APA EWS trademark. Your APA engineered wood purchase is not only your highest possible assurance of product quality, but an investment in the many trade services that APA provides on your behalf. The Association's trademark appears only on products manufactured by member mills and is the manufacturer's assurance that the product conforms to the standard shown on the trademark. That standard may be an APA performance standard, the *Voluntary Product Standard PS 1-09 for Structural Plywood* or *Voluntary Product Standard PS 2-10, Performance Standard for Wood-Based Structural-Use Panels*. APA maintains two quality testing laboratories in key producing regions, and a 42,000-square-foot research center at Association headquarters in Tacoma, Washington.

But quality validation is only one of APA's many functions. The Association also:

- Operates one of the most sophisticated programs for basic panel research in the world.
- Maintains a network of field representatives to assist panel product users, specifiers, dealers, distributors and other segments of the trade.
- Conducts informational buyer and specifier seminars.
- Publishes a vast inventory of publications on panel grades, applications, design criteria and scores of other topics.
- Works to secure acceptance of wood structural panel products and applications by code officials, insuring agencies and lending institutions.
- Develops and maintains performance and national product standards.
- Conducts in-depth market research and development programs to identify and penetrate new panel markets in the U.S. and abroad.
- Works in conjunction with other wood product industry organizations on solutions to problems of common concern.

For More Information

For more information about APA panel products and applications, contact APA, 7011 So. 19th St., Tacoma, Washington 98466. A complete listing of other APA product and design/construction guides can be found on the Association website at www.apawood.org.

Performance Rated Panels

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying engineered wood products, contact us:

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