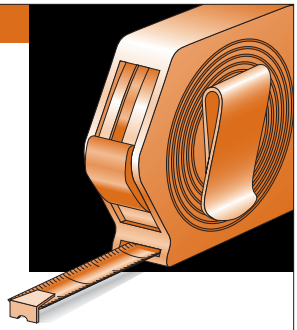
# Selection, Installation and Preparation of Plywood Underlayment



This APA Data File provides recommendations for the installation and preparation of underlayment under finish flooring in residential and light commercial applications. Recommendations are also provided for the selection of APA plywood Underlayment, a plywood panel grade in accordance with *Voluntary Product Standard PS 1, Structural Plywood*. Underlayment provides a smooth base for carpet, tile, sheet flooring and other types of finish flooring.

## APA Plywood Underlayment

Underlayment is a special grade of APA plywood that has enhanced resistance to face-veneer punctures. This is accomplished by imposing special limitations on the face veneer thickness, species of the face veneer and voids beneath the face veneer. Other plywood grades, such as A-C Exterior, are only suitable for underlayment applications if they have the additional Underlayment designation or "Plugged Crossbands Under Face" noted in the trademark. Plywood meeting the Underlayment standard in PS 1 will have the word "Underlayment" in the trademark (see example in Table 1).

Underlayment grades of plywood have a solid, touch-sanded surface for direct application of carpet and pad. For areas to be covered with resilient floor covering, specify panels with "sanded face," or certain other grades as noted in Table 1. Special face and inner-ply construction of Underlayment resists dents and punctures from concentrated loads. Applied as recommended, plywood Underlayment is also dimensionally stable and eliminates excessive swelling and subsequent buckling or humps around nails.

FIGURE 1

**INSTALLATION OF APA PLYWOOD UNDERLAYMENT**

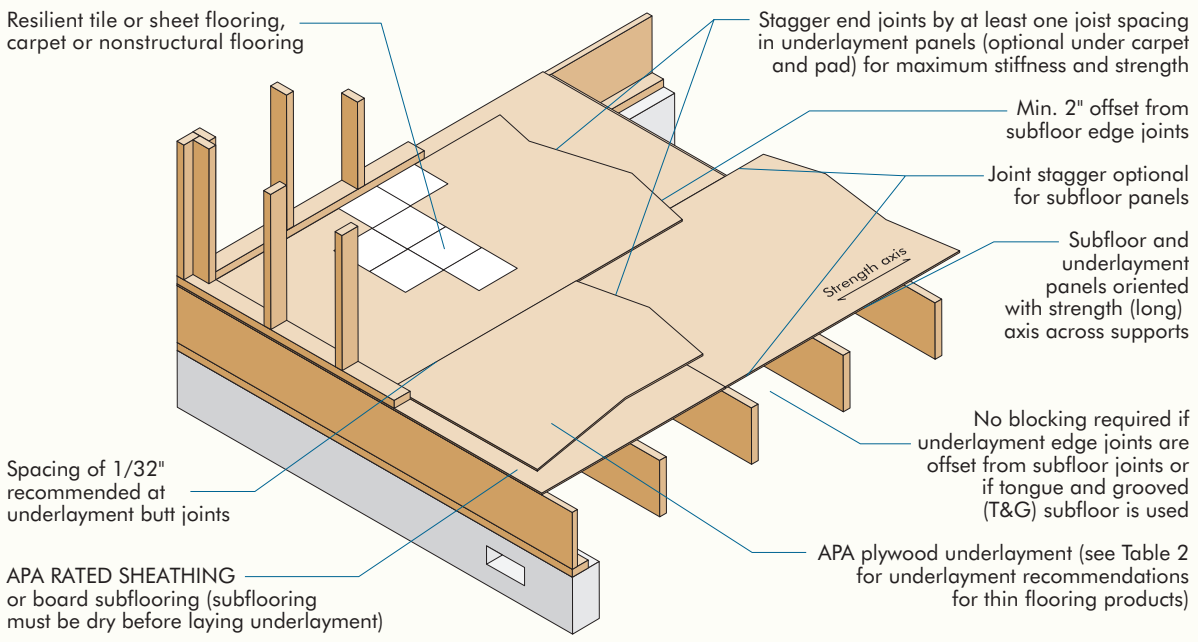



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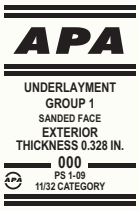
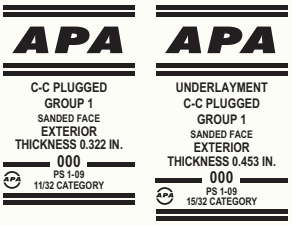
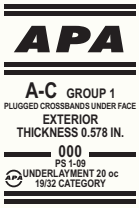
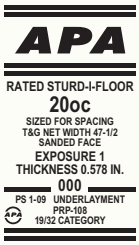
TABLE 1

**RECOMMENDED PLYWOOD GRADES FOR UNDERLAYMENT[1] APPLICATIONS**

| Grade[2][3][4] | Exposure Durability Classification | Look for These Special Notations in Panel Trademark[5] | Typical Trademarks |
|---|---|---|---|
| APA Underlayment[6] | Exposure 1 or Exterior | Sanded Face[7] |  |
| APA C-C Plugged<br>APA Underlayment C-C Plugged | Exterior | Sanded Face[7] |  |
| APA A-C<br>APA B-C<br>APA A-D<br>APA B-D | Exterior<br>Exterior<br>Exposure 1<br>Exposure 1 | Plugged Crossbands Under Face[8] |  |
| APA A-C Underlayment<br>APA B-C Underlayment | Exterior | |  |
| APA Rated Sturd-I-Floor[9] | Exposure 1 or Exterior | Sanded Face[7] |  |
| APA Marine Grade | Exterior | MARINE • A-A • EXT • 0.609 IN. • APA • 000 • PS 1-09 • 5/8 CAT | |

(1) C-D Plugged shall not be used as underlayment.

(2) Plywood APA Rated Sturd-I-Floor with Performance Category of 19/32 or greater and fully sanded face also may be used for underlayment under resilient floor covering.

(3) Specific plywood grades and thicknesses may be in limited supply in some areas. Check with your supplier before specifying.

(4) Marked PS 1-09 and/or PRP-108.

(5) Recommended for use under resilient floor covering.

(6) APA Underlayment is always plywood.

(7) Underlayment grade plywood is typically touch-sanded only. Additional "Sanded Face" notation is recommended for use under resilient floor coverings, including glue-down carpet. Faces of A, B and Marine Grade are always sanded. Touch-sanding is a sizing operation consisting of a light surface sanding to thickness dimension in a sander. Sander skips to any degree are admissible.

(8) "Plugged Crossbands (or Core)," "Plugged Inner Plies" or "Meets Underlayment Requirements" may be indicated as alternate designation in or near trademarks.

(9) APA Rated plywood Sturd-I-Floor is an Underlayment with a Span Rating, marked as PS 1-09, PS 2-10 and/or PRP-108.

## Selecting Underlayment

The recommended plywood grades for various underlayment applications are presented in Table 1. These grades provide a smooth, sanded surface that is suitable for floor coverings. APA C-D PLUGGED is not an adequate substitute for Underlayment grade since it does not have equivalent face veneer puncture resistance.

The type of finish flooring and subfloor will determine the underlayment recommended for an application, as noted in Table 2. The underlayment necessary to bridge an uneven floor will depend on roughness and loads applied. Although a minimum 11/32 Performance Category is recommended, 1/4 Performance Category plywood Underlayment may also be acceptable over smooth subfloors, especially in remodeling work. See Table 3 for APA plywood Underlayment fastening recommendations.

TABLE 2

**TYPICAL PANEL FLOOR SPECIFICATIONS BASED ON FINISH FLOOR INSTALLATIONS**
**(All must meet minimum structural requirements[1] of IBC or IRC)**

| Finish Floor | Subfloor Construction[2] | Example Subfloor Specification[2] | Typical Underlayment Panel |
|---|---|---|---|
| Carpet and Pad | **Single Layer Construction** | | |
| | APA Rated Sturd-I-Floor[3] with T&G edges | APA Sturd-I-Floor 24 oc Exposure 1 T&G (for joists spaced 24 inches o.c. or less) | NA |
| | **Double Layer Construction** | | |
| | APA Rated Sturd-I-Floor **or** APA Rated Sheathing | APA Rated Sheathing 48/24 Exposure 1 (for joists spaced 24 inches o.c. or less) | Any Table 1 panel |
| Hardwood Flooring | APA Rated Sturd-I-Floor **or** APA Rated Sheathing | APA Rated Sturd-I-Floor 24 oc Exposure 1 T&G **or** APA Rated Sheathing 48/24 Exposure 1 (for joists spaced 19.2 inches o.c. or less)[4] | (Optional) |
| Vinyl (or other thin resilient floor covering) or Glue-down Carpet | APA Rated Sturd-I-Floor[5] **or** APA Rated Sheathing | APA Rated Sturd-I-Floor 24 oc Exposure 1 T&G **or** APA Rated Sheathing 48/24 Exposure 1 (for joists spaced 24 inches o.c. or less) | Any Table 1 panel[6] |
| Ceramic Tile[7] | Minimum Performance Category 19/32 APA Rated Sturd-I-Floor Exposure 1 **or** APA Rated Sheathing Exposure 1 | Minimum Performance Category 19/32 APA Rated Sturd-I-Floor Exposure 1 **or** APA Rated Sheathing Exposure 1 (for joists spaced 16 inches o.c. or less)[8] | Minimum Performance Category 19/32 APA Rated Sturd-I-Floor Exposure 1 **or** APA Rated Sheathing Exposure 1[8] |

(1) Floor Span Rating must equal or exceed joist spacing.

(2) Refer to www.apawood.org for installation specifics and alternate installation combinations.

(3) Plywood Rated Sturd-I-Floor is Underlayment with a span rating.

(4) For joists spaced 16 or 24 inches o.c. See *APA Technical Note: APA Performance Rated Panel Subfloors Under Hardwood Flooring,* Form R280.

(5) Plywood Rated Sturd-I-Floor with fully sanded face may serve as single layer construction without the use of an additional Underlayment.

(6) For rough floors, specify minimum Performance Category 11/32 APA Underlayment.

(7) For other specialty flooring products, including marble and slate, please refer to the finish floor manufacturer's recommendations. Enhanced structural performance may be required for ceramic and natural stone floor products. See Tile Council of North America (TCNA) *Handbook for Ceramic Tile Installation* (www.tileusa.com).

(8) Refer to *APA Engineered Wood Construction Guide,* Form E30 and *APA Technical Topics: Ceramic Tile over Wood Structural Panel Floors,* Form TT-006 for detailed assembly specifications.

TABLE 3

**APA UNDERLAYMENT FASTENING RECOMMENDATIONS**

| Application | Minimum Performance Category | Fastener Size and Type[1] | Maximum Fastener Spacing (in.)[2] | |
|---|---|---|---|---|
| | | | Panel Edges[3] | Intermediate |
| Over smooth subfloor | 1/4 | 3d x 1-1/4-in. ring- or screw-shank nails min. 12-1/2 gage (0.099 in.) shank dia.[4] | 3 | 6 each way |
| Over lumber subfloor or uneven surfaces | 11/32 | | 6 | 8 each way |

(1) See *APA Engineered Wood Construction Guide,* Form E30, for nail dimensions.

(2) Fasteners for 5-ply plywood underlayment panels and for panels with a Performance Category greater than 1/2 may be spaced 6 inches on center at edges and 12 inches each way intermediate.

(3) Fasten panels 3/8" from panel edges.

(4) Use 4d x 1-1/2" ring- or screw-shank nails, minimum 12-1/2 gage (0.099") shank diameter, for underlayment panels with a Performance Category of 19/32 to 3/4.

## Handling Underlayment

Always protect plywood underlayment against physical damage or water prior to application. Before installing, allow underlayment panels to acclimatize by standing them on edge and separating them to permit air circulation for several days in the rooms where they will be installed.

## Preparing the Subfloor

Plywood underlayment should be installed only on a dry subfloor. Moisture, which may accumulate when the subfloor is exposed to weather during construction, can cause excessive expansion of the dry underlayment panels if the subfloor is not allowed to dry adequately. A damp subfloor can also contribute to nail pops and squeaks. Normal scheduling, however, usually permits the subfloor to dry out and become conditioned in an enclosed, evenly heated environment prior to installation of the underlayment and floor covering.

To avoid callbacks, inspect the subfloor surface for evenness and flatness before installing underlayment. Uneven floor surfaces may become obvious when smooth or shiny floor covering is installed, especially in large areas which have strong sidelighting from windows, doors or interior lighting. The following precautions should be observed before installing underlayment:

- When the subfloor panels are dry, visually check the subfloor end and edge joints for evenness or variations in panel thickness which might telegraph through the underlayment. A short straight edge – 12 to 14 inches long – provides a quick reference for this purpose. If necessary, sand the subfloor joints with a commercial floor sander to smooth surfaces within the vicinity of joints.
- Visually check the subfloor surface for flatness between floor framing members. Add blocking or plywood cleats under the floor, and fasten the subfloor to them with screws or nails as necessary to flatten panels. For background information on buckling of panel sheathing, see *APA Technical Note: Buckling of Wood Structural Panel Sheathing,* Form D481.

Also check the subfloor for squeaks and refasten as necessary before installing the underlayment. When furnace or hot air ducts are located in close proximity under the floor, the underfloor space should be well ventilated, or insulated above ducts in the joist cavity to avoid excessive drying of the wood floor. Refer to *APA Technical Note: Floor Squeaks: Causes, Solutions and Prevention,* Form C468.

## Installing Underlayment

Install acclimatized plywood underlayment, smooth side up, immediately before laying the finish floor. For maximum stiffness and strength, place face grain across supports. Offset the end joints of underlayment two inches from joists and offset underlayment end joints at least one joist spacing from subfloor end joints. Edge joints of underlayment panels should offset by at least two inches from edge joints of subfloor panels.

Spacing of 1/32 inch at underlayment panel edges and ends is recommended. Edge spacing allows for panel expansion during construction and as the underlayment becomes conditioned to the temperature and humidity which will be typical in service. Edge gaps should be filled just before the floor covering is installed (allowing cure time), when no movement is expected.

The recommended fastener schedule for APA plywood Underlayment, including fastener size, type and spacing, is given in Table 3. Begin fastening at one edge next to adjacent panel. Ensure that the panel is uniformly flat and continue by fully fastening towards the opposite edge. If power-driven fasteners are used, foot pressure should be applied near the fastener to ensure firm contact between the underlayment and subfloor. Make sure fasteners are driven so that the fastener heads are flush with, or just slightly below the panel surface. Do not overdrive or underdrive fasteners, which could result in telegraphing fastener or panel joint location through resilient tile or sheet flooring. Floor squeaks can be caused by movement between underlayment and subfloor panels or by the underlayment sliding on the fastener. Avoid gluing the underlayment to the subfloor with construction adhesives, which could develop installation or staining problems with certain types of resilient sheet flooring products.

Occasionally, fasteners may “pop” or “back out.” In these cases, fastener heads may rise above the underlayment surface and telegraph as bumps through sensitive floor covering materials. The best precautions against nail popping are to use ring- or screw-shank nails which have higher withdrawal resistance; to use a fastener length approximately equal to the total thickness of the underlayment and subfloor; and to ensure that the subfloor is dry before attaching the underlayment. Fasteners that are too long may “ream” a hole through the subfloor when driven, causing them to loosen later. Also, appropriately-sized underlayment fasteners will minimize penetration into lumber joists, reducing the potential for fastener popping problems caused by lumber shrinkage.

## Preparing Underlayment

Shortly before the floor covering is installed, fill all edge gaps, splits, damaged areas and rough spots in the plywood underlayment with a hard, non-shrinking, quick-setting filler. This step also may be necessary when fully-adhered textile (carpet) resilient floor covering is used – check the recommendations of the floor covering manufacturer.

A filler restrains the edges of the panel underlayment from closing and causing wrinkling or ridging of the floor covering over joints between underlayment panels. Tests by APA have shown that some floor covering materials wrinkle or ridge when the underlayment dries out and the joint reopens. If not restrained by filler, such minor panel movement at an edge joint could result from normal seasonal changes in relative humidity. Water-based flooring adhesive also may cause panels to expand temporarily. The filler also prevents flooring adhesive from entering the joint, where it could later be squeezed back out to develop a ridge in the floor covering.

Choose a filler that dries hard, does not shrink and is quick-setting. Most manufacturers call for about a half-hour to cure fully. If the setting time is rushed, the exposed surface of the filler may harden, but not necessarily the interior of the filled joint. Applications of the floor covering further slows the curing, and the underlayment joint closure may squeeze the uncured filler out of the joint, resulting in a raised bead or ridge in the floor covering.

**Note:** Some floor covering manufacturers recommend that edges and ends of underlayment panels be butted to a light contact, or with an edge and end joint spacing of 1/64 inch (approximately the thickness of a matchbook cover), without filling panel joints. In this case, installation over a dry subfloor is essential.

Some fillers expand slightly as they cure, making it important to complete curing before sanding. A ridge that develops in this manner is difficult to see, but it can be detected by feeling across the joint with the fingers or palm of the hand. Even this small amount of ridging may cause joint show-through in resilient floor covering.

Thorough sanding of underlayment panel joints and any surface roughness with a heavy-duty sanding machine is recommended. Hand sanding or scraping usually is not sufficient to correct unevenness between panels and might cause joint show-through, or remove excess filler. Construction adhesive squeeze-out or excess joint filler may cause roughness, or a poor bond between floor covering and the underlayment. Some joint fillers may prevent the flooring adhesive from adhering directly to the underlayment panel. Sanding not only smoothes the joint, but aids good bonding performance.

APA has not evaluated joint fillers and, therefore, does not recommend specific brands. The recommendations of the floor covering manufacturer should be followed.

## Selecting and Applying Resilient Floor Covering

When resilient sheet flooring is installed, consider "loose-laid" perimeter-attached flooring products to minimize exposure of plywood underlayment to moisture from water-based adhesives used for installing flooring; or choose premium-quality flooring adhesives with higher solids content and reduced water content, and allow maximum "open" time within the manufacturer's recommendations before installing flooring. For other types of finish flooring, follow the flooring manufacturer's recommendations for installation.

Shiny, no-wax floor coverings seem to be highly susceptible to telegraphing any irregularities in the floor surface. Impeccable floor surface preparation is necessary when these floor covering products are used. Thicker, and some "loose-laid" floor covering products, are reportedly able to bridge or mask most of these imperfections. The flooring contractor should be consulted for advice on the most suitable floor covering product for a particular application.

If a monolithic appearance is desired, sheet flooring should be specified. If tile flooring is used, consider orienting embossed or inlaid patterns of adjacent tiles at 90 degrees relative to each other to accentuate the tile joint grid. Color is also a consideration, since tile joints are not as obvious in the darker hues.

Even after conscientious preparation, underlayment panel edge joints may later open slightly, such as during the transition from high humidity in summer to lower humidity during the winter heating season. Sometimes, tile flooring joints separate on the underlayment panel module (every 4 feet, for example). To help prevent the tile joints from opening, tile joints should be offset at least 2 inches from underlayment joints.

## APA: The Mark of Quality

The trademark of *APA – The Engineered Wood Association* appears only on products manufactured by APA member mills and is the manufacturer's assurance that the product conforms to the standard shown on the trademark. For panels, that standard may be the *Voluntary Product Standard PS 1-09 for Structural Plywood, Voluntary Product Standard PS 2-10, Performance Standards for Wood-Based Structural-Use Panels* or *APA PRP-108 Performance Standards and Qualification Policy for Structural-Use Panels*. Panel quality of all APA trademarked products is subject to verification through APA audit.

APA maintains a quality testing laboratory and a 42,000-square-foot research center at Association headquarters in Tacoma, Washington. APA's services go far beyond quality auditing, however. APA also operates one of the most sophisticated programs for basic panel research in the world, maintains an international network of field representatives to assist panel product users and specifiers, conducts informational meetings and seminars, publishes a vast inventory of design and application literature, works to secure code acceptance of panel products and applications, develops and maintains performance and industry product standards, and conducts in-depth market research and development programs.

Always insist on panels bearing the mark of quality – the APA trademark. Your APA panel purchase or specification is not only your highest possible assurance of product quality, but an investment in the many trade services that APA provides on your behalf.

## Additional Information

For answers to your questions about plywood Underlayment or other APA panel construction systems, contact APA's Product Support Help Desk at help@apawood.org or (253) 620-7400.

For additional tips and information related to APA plywood Underlayment, refer to the following APA publications, available at www.apawood.org/publications.

- *Engineered Wood Construction Guide*, Form E30
- *Builder Tips: Proper Handling and Installation of APA Plywood Underlayment,* Form R340
- *Technical Note: Buckling of Wood Structural Panel Sheathing,* Form D481
- *Technical Note: APA Performance Rated Panel Subfloors under Hardwood Flooring*, Form R280
- *Technical Topics: Ceramic Tile over Wood Structural Panel Floors*, Form TT-006
- *Builder Tips: Steps to Construct a Solid, Squeak-free Floor System,* Form Q300
- *Builder Tips: Minimize Nail Pops,* Form S300
- *Technical Note: Floor Squeaks: Causes, Solutions and Prevention,* Form C468

# Selection, Installation and Preparation of Plywood Underlayment

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:


**APA HEADQUARTERS**
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