

Preservative-Treated Plywood

INTRODUCTION

Most construction applications don't require preservative-treated wood. But in some uses, and in certain climates, treated wood is recommended or required by local building codes to protect against decay, fungi, termites, carpenter ants or other wood-destroying insects, or from marine borers in sea-water exposure.

Preservative-treated plywood is impregnated with preservatives by a pressure process. The resulting deep penetration of preservative provides protection against decay and insect attack.

Non-pressure preservative treatments are available, but superficial applications provide limited protection. Pressure-preservative-treated plywood is used in a variety of applications.

- Wood foundations
- Bulkheads
- Retaining walls
- Highway noise barriers
- Irrigation structures
- Cooling towers
- Electrical transformer vaults
- Decks, docks, piers and floats
- Tanks
- Liquid manure storage tanks
- Planters
- Food transport, processing and storage
- Roof, wall, and floor sheathing in tropical regions or applications where resistance to termites or decay is required.

Preservative-treated plywood maintains stiffness and strength, thermal properties, workability, light weight and economy.

Wood preservatives and wood treated with these chemicals should be used and handled appropriately (see *Intended End-Use Service Conditions* and *Use and Handling Precautions*). Always follow the recommendations provided by the preservative manufacturer or wood treating company.

APPLICABLE STANDARDS

Applicable standards for preservative treatment of plywood include American Wood Protection Association (AWPA) Standards U1⁽¹⁾ (and all other standards referenced therein) and M4⁽²⁾. Related specifications include U.S. Product Standard PS-1⁽³⁾; and American Association of State Highway and Transportation Officials (AASHTO) (Standard Specification for Transportation Materials and Methods of Sampling and Testing)⁽⁴⁾.

Intended End-Use Service Conditions

The American Wood Protection Association (AWPA) has replaced the Commodity (C) Standards with the Use Category System (UCS). Service conditions are now designated into five basic use categories in AWPA Standard U1. The use categories designations and service conditions that apply to plywood are summarized in Table 1.

TABLE 1

SUMMARY OF USE CATEGORIES FOR TREATED WOOD THAT APPLY TO PLYWOOD

Use Category	Service Conditions	Use Environment	Common Agents of Deterioration	Typical Applications
UC1	Interior construction, above ground, dry	Continuously protected from weather or other sources of moisture	Insects only	Interior construction and furnishings
UC2	Interior construction, above ground, damp	Protected from weather, but may be subject to sources of moisture	Decay fungi and insects	Interior construction
UC3B	Exterior construction, above ground, uncoated or poor water run-off	Exposed to all weather cycles, including prolonged wetting	Decay fungi and insects	Decking, deck joist, railings, fence pickets, uncoated millwork
UC4A	Ground contact or fresh water, non-critical components	Exposed to all weather cycles, normal exposure conditions	Decay fungi and insects	Fence, deck and guardrail posts, cross-ties and utility poles (low decay areas)
UC4B	Ground contact or fresh water, critical components or difficult replacement	Exposed to all weather cycles, high decay potential includes salt water splash	Decay fungi and insects with increased potential for biodeterioration	Permanent wood foundations, building poles, horticultural posts, cross-ties and utility poles (high decay areas)
UC4C	Ground contact or fresh water, critical structural components	Exposed to all weather cycles, severe environments, extreme decay potential	Decay fungi and insects with extreme potential for biodeterioration	Land and freshwater piling, foundation piling, cross-ties and utility poles (severe decay areas)
UC5A	Salt or brackish water and adjacent mud zone Northern waters	Continuous marine exposure (salt water)	Salt water organisms	Piling, bulkheads, bracing
UC5B	Salt or brackish water and adjacent mud zone New Jersey to Georgia, south of San Francisco	Continuous marine exposure (salt water)	Salt water organisms, including creosote tolerant <i>Limnoria tripunctata</i>	Piling, bulkheads, bracing
UC5C	Salt or brackish water and adjacent mud zone South of Georgia, Gulf Coast, Hawaii and Puerto Rico	Continuous marine exposure (salt water)	Salt water organisms, including creosote tolerant <i>Martesia</i> and <i>Sphaeroma</i>	Piling, bulkheads, bracing

Note that in areas subject to Formosan subterranean termite activity, special attention is warranted when specifying preservative treatment. For a list of suitable preservatives, please refer to AWPA Standard U1. When specifying the use of preservative-treated plywood in the state of Hawaii, confirm with city and county building codes that the specified preservative treatments meet the requirements for structural lumber, e.g., for the county of Honolulu (<http://www.honolulu.gov/refs/roh/16a1.htm>).

TECHNICAL DATA

Preservatives

Pressure-preservative treatments listed in AWPA Standard U1 for plywood include organics such as creosote, pentachlorophenol, copper naphthenate, oxine copper and waterborne inorganic formulations. Proprietary preservative treatments that meet AWPA requirements and local building department approvals, are permitted for use.

Organic Preservatives

Organic preservatives listed in AWPA Standard U1 for preservative treating of plywood include creosote, pentachlorophenol, copper naphthenate and oxine copper. The first two are “restricted use” chemicals and not available for residential construction.

Creosote is a coal tar product which is dissolved in a distilled solution or petroleum oil. It is an effective preservative in commercial, industrial or marine applications when there is severe exposure to decay or insect attack, or marine borers in salt water environments. Creosote-treated plywood has an odor and a dark, “oiled” surface appearance and, therefore, is not recommended where painting is required.

Pentachlorophenol (penta) is commonly dissolved in light petroleum oil or solvent, liquid petroleum gas (LPG), or in a petroleum solvent/water solution. It is suitable as a preservative for ground contact or above-ground uses. Plywood treated with penta has an odor, and oil-borne penta has an “oiled” surface appearance and, thus, is not recommended for painting. Plywood treated with solvent- or water-borne penta (including penta in LPG), however, has an oil-free surface and natural wood appearance, and should be specified where staining or painting is desired. **Note: Penta dissolved in methylene chloride should not be used to treat plywood containing synthetic repairs in face veneers, since the solvent can damage the repairs.**

Copper naphthenate (CuN) is suitable for above-ground uses when treated to a proper retention level. CuN is often dissolved in heavy oil solvents or light hydrocarbon solvents for use as preservative carriers. CuN-treated wood may have a light green coloration that diminishes during weathering. After thorough drying, it can be stained or painted but a stain-blocking primer is recommended to minimize discoloration of the finish by the CuN treatment.

Plywood treated with oxine copper (Cu-8-Q) preservative can be used in applications where food is harvested, transported or stored, and is suitable for above-ground use. The preservative is dissolved in liquid petroleum gas or light hydrocarbon solvents so that the treated plywood has a clean surface and is free of solvent odor. Oxine copper solutions may leave a greenish-brown coloration. Check with the company providing the treatment service regarding applicable FDA and USDA acceptances.

Inorganic Preservatives

The most common inorganic preservative currently used for treating of plywood is the leach-resistant, waterborne preservative alkaline copper quat type C and type D (ACQ-C and ACQ-D), which are highly effective in preventing decay and attack by termites, carpenter ants and marine organisms. Other waterborne preservatives that are listed in AWPA Standard U1 for treatment of plywood are ammoniacal copper zinc arsenate (AZCA), ammoniacal copper quat type B (ACQ-B), acid copper chromate (ACC), chromated copper arsenate type C (CCA), copper azole type A

(CBA-A), copper azole type B (CA-B), copper HDO type A (CX-A), inorganic boron (SBX), and copper bis dimethyldithiocarbonate (CDDC). CCA may only be used in applications where frequent human contact will not occur. Consult with local and state building codes prior to specifying the use of CCA-treated wood. These preservatives are forced into plywood under pressure and become insoluble or “fixed” in the wood cells after impregnation and drying. Waterborne preservatives are recommended where clean, odorless and paintable products are required.

Note: Treatment of tongue-and-groove panels with waterborne preservatives may result in difficulty in mating T&G edges. Use of square-edge panels, or milling T&G edges after treatment, should be considered.

TABLE 2

TREATMENT TYPE CHARACTERISTICS*

	Creosote	Penta in Oils	Penta in Light Solvents	Copper Naphthenate	Oxine Copper (Cu-8-Q)	Waterborne Preservatives
Suitable Applications	Saltwater or freshwater applications, wood block floor, bridges, towers, ground contact	Fresh water, ground contact, above-ground uses, including docks, bridges, towers and beams		Ground contact and above-ground uses, should not be used in direct contact with water	Above-ground use only	Fresh water applications and ground contact, may be used indoors provided sawdust and construction debris are cleaned up and disposed by ordinary trash collection
Appearance	Dark, oily odor	Oily, may be blotchy, may have odor	Varies from natural appearance of wood to some darkening of wood	Light green coloration that may diminish during weathering	Varies from natural appearance of wood to some darkening of wood	Green to brown depending on chemicals used and exposure to light
Paintability	Not paintable	Not practical	Can be finished with water repellent or oil-based semi-transparent stain	Can be stained or painted after thorough drying	Follow treater’s recommendations	Can be stained or painted when surface is dry and prepared in accordance with coating manufacturer’s recommendations
Comments	Should not be used in residential interiors, may be used in industrial interiors when two coats of effective sealer are applied	May be used in residential, industrial or commercial interiors as laminated beams or building components that are in ground contact and where two coats of effective sealer are applied		May develop greenish discoloration of light-colored finishes, stain-blocking primer or second topcoat is recommended for finishing to minimize potential discoloration by the treatment, check with supplier for use in high decay hazard applications	Stain-blocking primer will help to minimize discoloration, may be used in residential interiors where frequent human contact will not occur	May develop greenish discoloration of finish, stain-blocking primer will help to minimize discoloration, surfaces may have raised grain and extensive checking may occur

*For treatments suitable for human contact, see Table 4.

Other treatments and processes specified should be agreed to by purchaser, seller and the governing code body. Required retention and penetration levels depend on end use and exposure according to AWPA U1 or other applicable specifications. Table 2 provides a summary of these treatment characteristics and limitations.

Treatment Recommendations

Plywood that is used for permanent wood foundations should be treated to meet UC4B retention levels. Drying of permanent wood foundation plywood after treatment is required by the standard to ensure dimensional stability and structural strength. The moisture content in each piece of permanent wood foundation plywood should not exceed 18 percent per the standard. This treatment process also requires special attention to re-drying to minimize raised grain, checking and warping.

Species

AWPA Standard U1 is only applicable for plywood composed of softwood veneers meeting PS 1. Hardwood plywood and softwood plywood containing hardwood veneers are excluded from AWPA Standard U1.

Retention and Penetration Levels

AWPA Standards specify preservative retention in terms of pounds of retained preservative per cubic foot of wood, and depth of penetration in inches. Specified retention levels vary according to the type of preservative and the severity of exposure. AWPA Standard U1 lists specified retention levels according to the intended end use, and is summarized in Table 3.

TABLE 3

PRESERVATIVE RETENTIONS (PCF) –T PLYWOOD

Preservative System	Use Category						
	UC1	UC2	UC3B	UC4A	UC4B	UC5A, UC5B, UC5C	
Creosote	CR, CR-S	8.0	8.0	8.0	10.0	12.0	25.0
	CR-PS	8.0	8.0	8.0	10.0	12.0	NR
PCP-A PCP-C		0.4	0.4	0.4	0.5	0.6	
	Cu-8-Q	0.02	0.02	0.02	NR	NR	
CuN	0.04	0.04	0.04	NR	NR		
ACC	0.04	0.04	0.04	0.04	NR		
ACZA	0.25	0.25	0.25	0.4	0.6 ²	2.5	
CCA	0.25	0.25	0.25	0.4	0.6 ²	2.5	
SBX	Non-Formosan	0.17	0.17	NR	NR	NR	NR
	Formosan ¹	0.28	0.28	NR	NR	NR	
ACQ-B	0.25	NR	NR	0.4	0.6 ²		
ACQ-C	0.25	0.25	0.25	0.4	NR		
ACQ-D	0.25	0.25	0.25	0.4	0.6 ²		
CDDC	0.1	NR	NR	NR	NR		
CA-B	0.11	0.11	0.11	0.21	0.31 ²		
CBA-A	0.21	0.21	0.21	0.41	0.61 ²		
CX-A	0.206	0.206	0.206	NR	NR		

1. Retentions are suitable for exposure in areas subject to Formosan subterranean termite activity.

2. Retentions of preservatives are suitable for use as permanent wood foundations.

AWPA Standards require that 90 percent of the veneers be penetrated by preservative. A veneer is considered penetrated if there is evidence of diffusion of the preservative into the wood substrate of the veneer. Penetration of lathe checks alone does not qualify as acceptable treatment of a veneer.

Field Cuts

It is strongly recommended that all fabrication, trimming and boring of plywood be performed prior to pressure treating. If there is any field fabrication or surface damage to the plywood, all cuts, holes or damaged areas must be field-treated to protect the exposed wood material. Copper naphthenate may be used to reseal exposed areas of plywood treated with creosote or pentachlorophenol. It may leave a greenish coloration. Field treatments should be applied to saturation by dipping, brushing, spraying, soaking or coating in accordance with AWPA Standard M4⁽²⁾.

Fasteners

Fasteners used to connect preservative-treated plywood should be corrosion resistant to withstand the effects of the high-moisture environment to which these panels are typically exposed. Corrosion of fasteners is influenced by the amount of moisture present, temperature, wood pH, extractives, chemicals in the treatment and environmental factors, such as chlorine, salt and pollutants.

Hot-dip galvanized steel or Type 304 or 316 stainless steel fasteners and connectors are recommended for preservative-treated plywood used in above-ground applications. Hot-dip galvanized fasteners should meet ASTM A 153 and hot-dip connectors should meet ASTM A 653, Class G185 sheet with a minimum of 1.85 ounces of zinc coating per square foot. Fasteners and connectors used together should be of the same type. Do not use standard carbon-steel, aluminum, copper or copper-based fasteners or connectors in direct contact with pressure preservative-treated plywood or lumber. Only stainless steel fasteners are recommended for attaching preservative-treated plywood to lumber below grade in wood foundations. Follow preservative treater's guidelines for recommended fasteners.

Glueability

Plywood can be glued when treated with most of the waterborne preservatives, and with some penta treatments using light petroleum oil or solvent, liquid petroleum gas, or petroleum solvent/water as a carrier. Consult treating firms or their trade associations for specific recommendations.

Structural Properties

The International Building Code (IBC) and International Residential Code (IRC) recognize plywood design values as specified in the latest edition of the APA *Panel Design Specification*, Form D510. Although the APA *Panel Design Specification* specifies no reductions in the dry design values for preservative-treated plywood according to AWPA Standards, it does specify that wet-use design values shall be used whenever the moisture content in service is 16 percent or more. It is important to note that the application of a wet-use design factor is based on the judgment of the designer of record considering the end-use environment to which the member is subjected and is not related to any preservative treatment that may be specified.

USE AND HANDLING PRECAUTIONS

The chemical formulations used for preservative treatment of plywood are registered with the U.S. Environmental Protection Agency (EPA), which has approved guidelines for the use of pressure-treated wood to ensure safe handling and avoid environmental or health hazards.

The use precautions for creosote, pentachlorophenol and inorganic arsenical preservative-treated wood are published in EPA-approved Consumer Information Sheets (CISs) for these treatments. These sheets are available from treaters and should accompany each shipment of treated wood. They can also be obtained from the Western Wood Preservers Institute (WWPI) at their web site, wwpinstitute.org, under the heading, "Safe Use Information." Use precautions are summarized in Table 4.

EPA handling precautions are summarized below. See Consumer Information Sheets for complete information.

TABLE 4

USE PRECAUTIONS FOR PRESSURE-TREATED WOOD¹

Application	Organic Preservatives		Inorganic Preservatives
	Creosote	Pentachlorophenol	
Skin contact applications.	OK ²	OK ²	OK
Residential interiors.	NO	NO	OK
For industrial and farm buildings, interior components, which are in ground contact, and are subject to decay or insect attack. Also see Application 5.	OK ²	OK ²	OK
Laminated beams for commercial or industrial buildings.	NO	OK ²	OK
Interiors of farm buildings when animals can crib (bite) or lick the treated wood.	NO	NO	NO
Agricultural farrowing or brooding facilities.	NO	NO	OK
Applications where preservative may become a component of food or animal feed, such as structures or containers for storing silage or food.	NO	NO	NO
Cutting boards or counter-tops for preparing food.	NO	NO	NO
Decks, patios and walkways if surface is visibly clean and free from residues.	OK	OK	OK
Portions of beehives which may come into contact with honey.	NO	NO	NO
Applications where treated wood can come into direct or indirect contact with drinking water for public or animal consumption.	NO ³	NO ³	NO ³

1. Based on EPA-approved Consumer Information Sheets.

2. Must be painted with recommended sealer (two coats).

3. OK for incidental contact, such as bridges or docks.

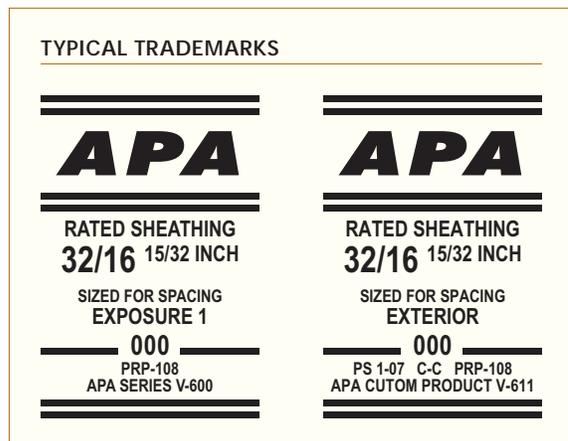
Use and Handling Tips

- Treated wood, in some forms, is considered to be a hazardous waste and, as such, can only be disposed of in an approved hazardous waste disposal site. Contact your local agency for further information.
- Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in special incinerators in accordance with state and federal regulations.
- Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask.
- Whenever possible, operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.
- When power sawing and machining, wear goggles to protect eyes from flying particles.
- Avoid frequent or prolonged skin contact with any form of preservative-treated wood. When handling wood treated with these chemicals, wear long-sleeved shirts and long pants and use gloves.
- After working with treated wood, and before eating, drinking or using tobacco products, wash hands and exposed skin areas thoroughly.
- If preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other clothing.

Suggested Specification

“Preservative-treated plywood for (state application) shall be pressure-treated in accordance with AWPA Standard U1 with (creosote) (pentachlorophenol) (oxine copper) (waterborne) preservatives as required for (salt water marine) (fresh water marine) (wood foundation) (ground contact) (above ground) exposure.”

“Preservative-treated plywood shall be all-veneer APA RATED SHEATHING^(a) (or better, depending on appearance desired) EXP 1 marked Custom Product or APA Custom Product V-600, or EXT marked Custom Product or APA Custom Product V-611.^(b) **Note: For PWF applications, plywood marked PS 1, PS 2, or APA Standard PRP-108 is required.**”



“Preservative-treated plywood shall be marked by an approved inspection agency certified to inspect preservative-treated wood, indicating compliance with the treating, drying, retention and penetration requirements of applicable AWPA Standards or equivalent code-approved preservative-treating and quality control requirements.”

(a) For further information on plywood grades and use recommendations, see APA's *Engineered Wood Construction Guide*, Form E30.

(b) Wording on trademark may be “APA Series” in place of “Custom Product.”

FINISHING

Plywood that has been treated with waterborne preservatives can be finished with oil-based semitransparent stains or film-forming finishes, such as solid-color stains or paint systems. The treatment, however, may leave a green or brown color on the plywood surface that can affect the color and appearance of the finish. Use of an acrylic latex stain-blocking primer beneath latex solid-color stains or house paints will help to minimize such discoloration.

Some slight surface degradation is possible in sanded plywood after drying because of surface checking and/or discoloration. For this reason, Medium Density Overlay plywood gives best results where treated paintable surfaces are required. Unsanded grades of plywood do not require further finishing, but can be finished with two-coat acrylic paints or opaque stains. Stain finishes or two-coat acrylic paints (stain-blocking primer and topcoats) are recommended for textured plywood.

Painting plywood treated with creosote or oil-borne preservatives, such as pentachlorophenol, is not recommended because finishing of these surfaces is difficult and requires extensive care using an aluminum base paint. Paintable pentachlorophenol treatments are available. (See discussion under “Organic Preservatives.”)

For certain interior applications in commercial, industrial or farm buildings, creosote or pentachlorophenol-treated wood may be used if exposed surfaces are sealed by painting with two coats of urethane or epoxy paint or shellac (varnish may also be used for pentachlorophenol-treated wood). For guidelines on use precautions in these cases, refer to Table 4 and the EPA-approved Consumer Information Sheet (CIS) for the applicable preservative treatment.

Identification

The trademarks of APA – *The Engineered Wood Association* appear only on products manufactured by APA member mills. The marks signify that the manufacturer is committed to APA’s rigorous program of quality assurance and testing, and that panel quality is subject to verification through APA audit – a procedure designed to assure manufacture in conformance with APA Standard PRP-108, Performance Standards and Policies for Structural-Use Panels; Voluntary Product Standards PS 1-07 for Structural Plywood; or PS 2-04, Performance Standard for Wood-Based Structural-Use Panels.

APA’s services go far beyond quality inspection and testing. APA’s research and promotion programs play important roles in developing and improving plywood and other panel construction systems and in helping users and specifiers to better understand and apply panel products.

Information in this and all APA publications is based on the use of panel products of known quality. Always insist on panels bearing the mark of quality – the APA trademark.

For More Information

For more information on recommendations and installation of wood structural panels for wall sheathing, engineered shear walls or other applications, contact APA, 7011 So. 19th St., Tacoma, Washington 98466-5333. For a complete list of APA publications, ask for the *Publications Index*, Form B300, contact APA’s Help Desk at (253) 620-7400 (e-mail: help@apawood.org) or, for free downloads, visit APA’s website at www.apawood.org.

LIST OF REFERENCES

- (1) American Wood Protection Association. *U1 – Use Category System: User Specification for Treated Wood*. Birmingham, AL.
- (2) American Wood Protection Association. *M4 – Standard for the Care of Preservative-Treated Wood Products*. Birmingham, AL.
- (3) U.S. Department of Commerce. *Voluntary Product Standard PS 1 – Structural Plywood*. Washington, DC.
- (4) American Association of State Highway and Transportation Officials. *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*. Washington, DC.

Preservative-Treated Plywood

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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