

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^(a)

Use Category	Service Conditions	Use Environment	Common Agents of Deterioration	Typical Applications
UC1 Interior Dry	Interior construction, above ground, dry	Continuously protected from weather or other sources of moisture	Insects only	Interior construction and furnishings
UC2 Interior Damp	Interior construction, above ground, damp	Protected from weather, but may be subject to sources of moisture	Decay fungi and insects	Interior construction
UC3B Above Ground Exposed	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 General Use	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 Heavy Duty	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 Extreme Duty	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 Marine Use Northern Waters	Salt or brackish water and adjacent mud zone Northern waters	Continuous marine exposure (salt water)	Salt water organisms	Piling, bulkheads, bracing
UC5B Marine Use Central Waters	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 Marine Use Southern Waters	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

(a) All listed use categories **except UC4C** apply to treated plywood.

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.

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 (Cu8) 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 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 (ACZA), alkaline copper quat type B (ACQ-B), acid copper chromate (ACC), chromated copper arsenate type C (CCA), copper azole type B (CA-B), copper azole type C (CA-C), 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 (T&G) 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.

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.

TABLE 2

TREATMENT TYPE CHARACTERISTICS

	Creosote	Penta in Oils	Penta in Light Solvents	Copper Naphthenate (CuN)	Oxine Copper (Cu8)	Waterborne Preservatives
Suitable Applications	Saltwater or freshwater applications, wood block floor, bridges, towers and ground contact.	Freshwater, 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.

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 (pcf) 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) – TREATED PLYWOOD

Preservative System	Use Category						
	UC1	UC2	UC3B	UC4A	UC4B ^(a)	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
	Cu8	0.02	0.02	0.02	NR	NR	NR
	CuN	0.04	0.04	0.04	NR	NR	NR
	PCP-A PCP-C	0.40	0.40	0.40	0.50	0.60	NR
	ACC	0.40	0.40	0.40	0.40	NR	NR
	ACQ-A	0.15	0.15	0.15	0.40	NR	NR
	ACQ-B	0.25	NR	NR	0.40	0.60	NR
	ACQ-C	0.25	0.25	0.25	0.40	NR	NR
	ACQ-D	0.15	0.15	0.15	0.40	0.60	NR
	ACZA	0.25	0.25	0.25	0.40	0.60	2.5
	CCA	0.25	0.25	0.25	0.40	0.60	2.5
	CA-B	0.11	0.11	0.11	0.21	0.31	NR
	CA-C	0.06	0.06	0.06	0.15	0.31	NR
	CDDC	0.10	NR	NR	NR	NR	NR
CX-A	0.206	0.206	0.206	NR	NR	NR	
SBX	Non-Formosan	0.17	0.17	NR	NR	NR	NR
	Formosan^(b)	0.28	0.28	NR	NR	NR	NR

(a) Retentions of preservatives are suitable for use as permanent wood foundations.

(b) Retentions are suitable for exposure in areas subject to Formosan subterranean termite activity.

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, pentachlorophenol or waterborne preservatives. 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

AWPA recommends using fasteners that meet the requirements of the major model building codes, which specify that fasteners (including nuts and washers) in contact with preservative-treated wood shall be hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Connectors that are used in exterior applications and in contact with preservative-treated wood shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, a minimum of ASTM A653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

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 moisture content design capacity adjustment factors be used whenever the moisture content in service is 16 percent or more. It is important to note that the application of a moisture content adjustment 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, "EPA Approved Consumer Information and Safety Sheets" and "Consumer Safety Information Sheets."

Refer to Consumer Information Sheets and the treater's Material Safety Data Sheets (MSDS) for specific use and handling precautions.

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.

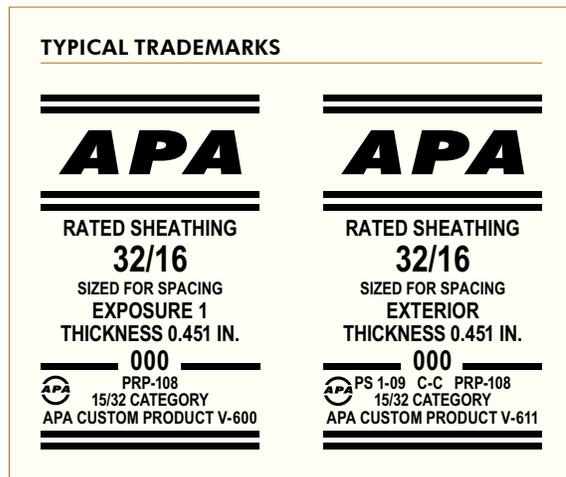
- When power sawing and machining, wear goggles to protect eyes from flying particles.
- Avoid frequent or prolonged skin contact with any form of preservative-treated wood. When handling wood treated with these chemicals, wear long-sleeved shirts and long pants and use gloves.
- After working with treated 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 preservative-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.

“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.”



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 the EPA-approved Consumer Information Sheet (CIS) for the applicable preservative treatment.

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

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 1-09 for Structural Plywood; or PS 2-10, Performance Standard for Wood-Based Structural-Use Panels.

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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.

LIST OF REFERENCES

- (1) American Wood Protection Association. 2013. *U1 – Use Category System: User Specification for Treated Wood*. Birmingham, AL.
- (2) American Wood Protection Association. 2013. *M4 – Standard for the Care of Preservative-Treated Wood Products*. Birmingham, AL.
- (3) U.S. Department of Commerce. 2009. *Voluntary Product Standard PS 1 – Structural Plywood*. Washington, DC.
- (4) American Association of State Highway and Transportation Officials. 2012. *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

7011 So. 19th St. ■ Tacoma, Washington 98466
(253) 565-6600 ■ Fax: (253) 565-7265

PRODUCT SUPPORT HELP DESK

(253) 620-7400
E-mail Address: help@apawood.org

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