



# PRESERVATIVE TREATMENT OF GLUED LAMINATED TIMBER

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## Introduction

Structural glued laminated timbers (glulam) bearing the *APA EWS* trademark are produced by members of Engineered Wood Systems (EWS), a related corporation of *APA – The Engineered Wood Association*. These glulam timbers are manufactured to conform with ANSI Standard A190.1, American National Standard for Structural Glued Laminated Timber<sup>(1)</sup>.

Although glulam does not require preservative treatment for most uses, certain applications may present environmental conditions conducive to decay, insect or marine borer attack. Conditions that favor such attack are the presence of moisture (generally 20 percent or greater moisture content of the wood) accompanied by temperatures ranging from 50 to 90°F. Decay progresses more slowly at temperatures outside this range and virtually ceases at temperatures below 35 or above 100°F.

These hazards are typically controlled through recognized design principles and construction techniques such as use of overhangs, flashings, ventilation and proper joint connection details. Elimination of potential decay hazards through effective design detailing is the preferred method of controlling decay. When hazards of decay or insect attack

cannot be avoided, glulam must be pressure-preservative-treated or a naturally durable species must be used. Examples of construction where such hazards may exist include direct exposure to weather, ground contact (including direct contact with concrete foundations and footings), contact with fresh water or sea water, and exposure to excessive condensation.

Outdoor uses of preservative-treated glulam include bridges, utility structures, marine applications, highway noise barriers, and decks. Indoor uses that may require pressure treatment include environments subject to high humidity or condensation such as indoor swimming pools or greenhouses, where moisture content of the wood may exceed 20%. Indoor applications such as post and beam construction in some farm buildings may also involve ground contact, and thus require preservative treatment for those members in contact with the ground.

## Applicable Standards

Applicable standards for preservative treatment of glulam include American Wood Preservers' Association Standards C 28<sup>(2)</sup> (and all other standards referenced therein) and M4<sup>(3)</sup>. Related specifications include American Forest and Paper Association National Design Specification<sup>(4)</sup>; American National Standards Institute, Inc. ANSI A190.1<sup>(1)</sup>; Federal Specification TT-W-571<sup>(5)</sup>, and American Association of State Highway

and Transportation Officials (AASHTO) (Standard Specification For Preservative Pressure Treatment Process For Timber)<sup>(6)</sup>.

## Preservatives

Pressure preservative treatments listed in American Wood Preservers' Association (AWPA) Standard C 28<sup>(2)</sup> for glulam include creosote, pentachlorophenol, copper naphthenate and waterborne inorganic arsenicals.

### Organic Preservatives

Organic preservatives listed in AWPA Standard C 28 include creosote and pentachlorophenol and are the primary treatments used in glulam manufactured from western species. Creosote is a coal tar product with an oily appearance. It typically has an odor and is not paintable. It is often used when there is severe exposure to decay hazards, insect attack or marine borers such as may be encountered in docks, wharfs, bridges and other marine structures.

Pentachlorophenol (penta) is most commonly dissolved in carriers such as oils or light hydrocarbon solvents. Penta in oil may have an oily appearance and have an odor. It is not recommended for painting but is suitable for above ground uses and ground contact when treated to the proper retention levels. Penta in light hydrocarbon solvents leaves a more natural appearance, and may be specified where staining is desired.

### Inorganic Preservatives

Waterborne treatments such as ammoniacal copper arsenate (ACA) and chromated copper arsenate (CCA) are not recommended for western species but may be used to treat glulam manufactured from southern pine. These types of treatments are usually used to treat the individual laminations prior to gluing. Check with the glulam manufacturer and treater to verify the availability of these treatments. When waterborne treatments are specified for glulam after gluing, the members must be redried after treating. This process may cause dimensional changes such as warping and twisting or may lead to excessive checking, splitting or raised grain resulting, in a finished product with an unacceptable appearance.

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 C 28 or other applicable specifications. Table 1 provides a summary of these treatment characteristics and limitations.

### Treatment Recommendations

Glulam timbers are available in custom and stock sizes. Stock sizes are typically cut to length at a distribution center or on the jobsite. Most glulam to be pressure treated will be custom sizes and should be ordered to exact dimensions when possible to avoid field cuts, which must be retreated. In addition, all fabrica-

tion, cutting and predrilling of holes for fasteners is recommended prior to pressure treating.

Glulam may be treated after gluing or the individual laminations may be treated prior to gluing, depending on the wood species and treatment specified. Treatments such as creosote or pentachlorophenol (penta) in oil are typically only specified for treatment of the finished member. Penta in light hydrocarbon solvents may be specified for the laminations prior to gluing or for the finished member. Waterborne salt treatments may be specified for southern pine laminations prior to gluing. However, glulam manufactured using pre-treated laminations is not available from all manufacturers and availability should be verified prior to specifying.

TABLE 1

TREATMENT TYPE CHARACTERISTICS

	Creosote	Pentachlorophenol in oils	Pentachlorophenol in light solvents	Waterborne Preservatives	Copper Naphthenate
<b>Suitable Applications</b>	Salt water or fresh water applications, wood block floor, bridges, towers, ground contact.	Fresh water, ground contact, above ground uses including docks, bridges, towers and beams.		Salt water or fresh water applications and ground contact. May be used indoors provided sawdust and construction debris are cleaned up and removed.	Ground contact and above ground uses. Should not be used in direct contact with water.
<b>Appearance</b>	Dark, oily, odor	Oily, may be blotchy, may have odor.	Varies from natural appearance of wood to some darkening of wood.	Green to brown depending on chemicals used and exposure to light.	Light green coloration that may diminish during weathering.
<b>Paintability</b>	Not paintable	Not practical	Can be finished with water repellent or oil-based semitransparent stain.	Can be stained or painted when surface is dry and prepared in accordance with coating manufacturer's recommendations.	Can be stained or painted after thorough drying.
<b>Comments</b>	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 interior when two coats of effective sealer are applied.		May develop greenish discoloration of finish. Stain-blocking primer will help to minimize discoloration. Surfaces may have raised grain and extensive checking may occur.	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.

The use of waterborne preservatives for the treatment of finished glulam members is generally not recommended. One waterborne preservative (ACZA) is listed in American Wood Preservers Association Standard C 28 for use with coastal region Douglas-fir, Western Hemlock or Hem-fir after gluing. However, waterborne types of treatments can lead to potential discoloration of the wood, possible raised grain, and excessive checking or warping of the member and their use will void the manufacturer's warranty for western species. Although not specifically listed in AWWA C 28, specifiers may choose to treat glulam with CCA after gluing. This treatment process also requires special attention to re-drying to minimize raised grain, checking and warping.

Glulam that is to be preservative treated should be trademarked with the APA EWS stamp and must be bonded with wet-use adhesives conforming to ANSI A190.1.

Table 2 provides a summary of treatment recommendations.

## Species

Softwood species listed in AWWA Standard C 28 for preservative treatment include Coastal Douglas-fir, western hemlock, hem-fir and southern pine.

Listed hardwood species include red oak, red maple and yellow poplar when treated after gluing. The most commonly available west coast species are Douglas-fir and hem-fir. Other species of glulam may also be available for pressure treatment, subject to agreement by the seller and purchaser, and to approval by the governing code body.

Incising is recommended for Douglas-fir, western hemlock, hem-fir, red maple and yellow poplar. Such incising is normally performed after gluing of the finished glulam. If laminating lumber is to be incised prior to gluing, the mating faces to be glued should not be incised.

Incising is not considered to have a detrimental effect on the strength of glulam. However, the effects of incising on appearance should be considered when ordering glulam where aesthetics are

important. If incising is not specified, difficulties in meeting the specified treatment retention and penetration levels may result. This option should only be considered with caution.

## Retention and Penetration Levels

Retention and penetration levels are specified in AWWA Standards in pounds of retained preservative per cubic foot of wood and depth of penetration in inches. Specified retention and penetration levels vary according to the type of preservative and the level of exposure. Table 3 lists standards referenced in AWWA Standard C 28 for specified retention and penetration levels according to the intended end use.

## Field Cuts

It is strongly recommended that all fabrication, trimming and boring of glulam be performed prior to pressure treating. If there is any field fabrication or surface damage to the glulam, all cuts, holes or damaged areas must be field treated to

TABLE 2

### RECOMMENDED TREATMENTS FOR PRESERVATIVE TREATMENT OF GLULAM

Treatment Type	Western Species		Southern Pine		Hardwoods	
	Glulam Treated Prior to Laminating	Glulam Treated After Laminating	Glulam Treated Prior to Laminating	Glulam Treated After Laminating	Glulam Treated Prior to Laminating	Glulam Treated After Laminating
Creosote	No	Yes	No	Yes	No	Yes
Oil-borne Penta	No <sup>2</sup>	Yes	No <sup>2</sup>	Yes	No	No
Copper Naphthenate	No	Yes	No	Yes	No	No
Cu-8-Q <sup>1</sup>	No	Yes	Yes	Yes	No	No
CCA	No	No <sup>3</sup>	Yes	No <sup>3</sup>	No	No
ACZA	No	No <sup>4</sup>	Yes	No <sup>3</sup>	No	No
ACA	No	No <sup>3</sup>	Yes	No <sup>3</sup>	No	No
ACC	No	No <sup>3</sup>	Yes	No <sup>3</sup>	No	No

1. For above ground use only.

2. Exception when penta in light hydrocarbon solvents is used.

3. Not specifically provided in AWWA Standard C 28. However, if specifiers choose to specify water borne salt treatments after laminating, the treatment can result in excessive checking, raised grain, twisting and warping.

4. Although not recommended, this treatment is permitted by AWWA Standard C 28.

protect the exposed wood material. Copper naphthenate may be used to reseal exposed areas of glulam 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<sup>(3)</sup>.

### Fasteners

Fasteners used to connect preservative-treated glulam should be corrosion resistant to withstand the effects of the high moisture environment to which these members 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. Oil-borne treatments are generally not corrosive whereas the waterborne arsenical treatments can be highly corrosive depending upon environmental conditions. Hot-dipped galvanized connectors are typically adequate but other materials such as stainless steel or monel may be required in certain applications.

TABLE 3

#### PRESERVATIVE RETENTION AND PENETRATION SPECIFICATIONS

Use	AWPA Standard <sup>(2)</sup>
General	C 28
Highway	C 14
Farms	C 16
Marine	C 18
Commercial-Residential Construction	C 15

### Structural Properties

Most building codes generally recognize design values as specified in the latest edition of the National Design Specification (NDS)<sup>(4)</sup>. Although the NDS does not specify reductions in the dry design values for preservative-treated glulam according to AWPA Standards, it does specify that wet-use design values shall be used whenever the moisture content in service is 16% or more.

### Use and Handling Precautions

The U.S. Environmental Protection Agency (EPA) requires registration of pesticides used in pressure treatments. They have approved use and handling precautions for treated wood as published in Consumer Information Sheets. These sheets also list recommended sealers for treated wood used in certain indoor applications. These sheets are available from treaters and should accompany each shipment of treated wood. They can also be obtained from the American Wood Preservers Institute or APA – *The Engineered Wood Association*. Use precautions are summarized in Table 4 and appropriate sealers are listed in Table 5. EPA handling precautions are summarized below. **See Consumer Information Sheets for complete information.**

- 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 uses (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers 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, these 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 pentachlorophenol or creosote-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 exposed skin areas thoroughly.
- If preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other clothing.

### Finishing

Creosote or pentachlorophenol in oil are not paintable on a practical basis. Pentachlorophenol in light solvents can be finished with natural finishes such as a clear water repellent or an oil-based semitransparent stain. Clear film-forming finishes such as lacquers, varnishes or urethanes are not recommended for glulam used outdoors because they have a short service life and require extensive surface preparation prior to refinishing.

Glulam that has been treated with waterborne preservatives such as CCA can be finished with clear water repellents, oil-based semitransparent stains or film forming finishes such as solid-color stains or paint systems. However, the treatment may leave a green or brown color on the glulam surface that can affect the color and appearance of the finish.

TABLE 4

**USE PRECAUTIONS FOR PRESSURE-TREATED WOOD<sup>(a)</sup>**

Application	Organic Preservatives		Inorganic Preservatives (Arsenicals)
	Creosote	Pentachlorophenol	
1. Skin contact applications.	OK <sup>(b)</sup>	OK <sup>(b)</sup>	OK
2. Residential interiors.	NO	OK <sup>(b)</sup>	OK
3. For industrial and farm buildings, interior components which are in ground contact and subject to decay or insect attack. Also see Application 5.	OK <sup>(b)</sup>	OK <sup>(b)</sup>	OK
4. Laminated beams for commercial or industrial buildings.	NO	OK <sup>(b)</sup>	OK
5. Interiors of farm buildings when animals can crib (bite) or lick the treated wood.	NO	NO	OK
6. Agricultural farrowing or brooding facilities.	NO	NO	OK
7. 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
8. Cutting boards or countertops for preparing food.	NO	NO	NO
9. Decks, patios and walkways if surface is visibly clean and free from residues.	OK	OK	OK
10. Portions of beehives which may come into contact with honey.	NO	NO	NO
11. Applications where treated wood can come into direct or indirect contact with drinking water for public or animal consumption.	NO <sup>(c)</sup>	NO <sup>(c)</sup>	NO <sup>(c)</sup>

(a) Based on EPA-approved Consumer Information Sheets.

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

(c) OK for incidental contact such as bridges or docks.

If an opaque coating is desired, the most durable finish is a top-quality paint system such as a stain-blocking acrylic latex primer followed by two all-acrylic latex topcoats, preferably from the same manufacturer. A stain-blocking primer may also be required under light-colored acrylic latex solid color stains to help minimize discoloration of the finish. Always follow the coating manufacturer's recommendations.

If treated wood is to be used indoors, follow the EPA recommendations for appropriate sealing of the wood. See Table 5.

**List of References**

- (1) American National Standards Institute, Inc. American National Standard for Wood Products – Structural Glued Laminated Timber, ANSI A190.1. New York, NY.
- (2) American Wood Preservers' Association. C 28 – Standard for Preservative Treatment of Structural Glued Laminated Members and Laminations Before Gluing of Southern Pine, Pacific Coast Douglas-fir, Hem-fir and Western Hemlock by Pressure Processes. Woodstock, MD.
- (3) American Wood Preservers' Association. M4 – Standard for the Care of Preservative-Treated Wood Products. Woodstock, MD.
- (4) American Forest and Paper Association. National Design Specification for Wood Construction. Washington, DC.

(5) U.S. Federal Supply Service. Wood Preservation Treating Practices. Federal Specification TT-W-571, USFSS. Washington, DC.

(6) American Association of State Highway and Transportation Officials. Standard Specifications for Transportation Materials and Methods of Sampling and Testing. Washington, DC.

TABLE 5

**EPA RECOMMENDED SEALERS FOR TREATED GLULAM**

Creosote	Urethane, epoxy, shellac. Coal tar pitch or coal tar pitch emulsions suitable for wood block flooring.
Pentachlorophenol	Urethane, shellac, latex epoxy enamel, varnish.

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

**APA – THE ENGINEERED  
WOOD ASSOCIATION  
HEADQUARTERS**

7011 So. 19th St. ■ P.O. Box 11700  
Tacoma, Washington 98411-0700  
(253) 565-6600 ■ Fax: (253) 565-7265



[www.apawood.org](http://www.apawood.org)

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(253) 620-7400  
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