Compatiblity of Fasteners and Connectors with Residential Pressure Treated Wood

OVERVIEW

Currently there are two alkaline copper preservatives available for commercial use in Canada. They are alkaline copper quat (ACQ) and copper azole (CA).

Wood is a natural, biodegradable material that can be attacked by fungi and insects. When used properly in protected end-uses, the wood remains dry and decay can be avoided. When used in a wet application, such as outdoors or where it may be at risk of insect attack and fungi, preservative treated wood should be used to prevent premature deterioration.

Pressure treated wood is commonly used and preferred for residential decks, fences and landscaping.

In 2003, the preservative formulations used for residential wood treatment were changed to those based on copper dialdehyde and an aldehyde-sulfonate solvent. Co-biocides were included to enhance the protection against a wide range of wood rotting fungi. This type of wood treatment requires more attention when selecting fasteners, connectors and anchors to avoid premature corrosion of the metal components and to ensure proper performance and carrying capacity. During the past seven years, several studies have been conducted to examine recommendations for the treated wood used in residential construction and the type of fasteners that should be used. Some of the most relevant reports are identified in this bulletin for easy reference.

Video 1: Wood treatment overview (8 minutes)

This bulletin updates the earlier version (Builder Insight #1 - ACQ Treated Wood) and provides builders, designers, and those specifying treated wood for residential construction with the most up-to-date information available and best practice.
Current Wood Treatments

Treated wood for industrial uses has largely remained unchanged, and includes creosote, pentachlorophenol and chromated copper azurate (CCA) formulations. However, for most exterior residential structures exposed to moisture, only alkaline copper preservatives are approved by Canada’s Pest Management Regulatory Agency (PMRA) and standardized by the Canadian Standards Association (CSA).

Currently, two alkaline copper preservation formulations are available for the production of residential treated wood, each with its own brand name. Since they differ mainly in the corrosion added to enhance the degree of decay protection, the general requirements for use are similar for both. They are considered to be equally effective and there is no difference in their composition, so no preference is indicated in this bulletin.

For residential construction, the choice of which of the two treatments to use, will be governed either by personal preference or by which of the two treated products are available to the builder. In Canada only two treatments are allowed for residential construction wood: alkaline copper quat (ACQ) and copper azale (CA).

Observations from builders and fastener manufacturers have noted variations in wood treatment formulations, resulting in significant differences in the corrosion of fasteners and connectors, between batches of treated wood. Alkaline copper wood treatment preservation flux or stabilizer in the wood after the treatment process and can withstand direct wetting when used in exterior applications, such as decks or in direct ground contact. Alkaline copper wood treatment preservation flux or stabilizer in the wood after the treatment process and can withstand direct wetting when used in exterior applications, such as decks or in direct ground contact. Alkaline Copper Quat (ACQ) includes copper as the primary protection against fungi and termites with quaternary ammonium compounds as supplemental protection against copper tolerant fungi. Copper Azale (CA) includes copper as the primary protection against termites and fungal decay with azale providing protection against copper tolerant fungi.

Simplified fasteners and connectors that are specifically recommended by manufacturers for use with alkaline copper treated wood should be used.
Understanding Corrosion Potential

Moisture and air are both necessary for corrosion to occur. Wood, when wet, will corrode common size fasteners and connectors. In wood treated with a copper-based preservative, the risk of corrosion is increased because the copper reacts with air, causing its rust. Because the copper content in ACO and CA preservatives is much greater than in CCA, the risk of corrosion is much greater in the use of proper fasteners with the treated wood is required.

Moderate fastener corrosion has been observed on some hot-dipped galvanized fasteners and connectors as early as four months after installation, when in contact with alkaline copper treated wood that has not been stabilized and dried prior to use.

Factors that influence the corrosion of metal in contact with ACO and CA treated wood

Corrosion is somewhat greater in wood treated with high retention of alkaline copper preservatives. Higher chemical loadings would be expected in larger timbers, as well as wood that may be used in ground contact (e.g., fence posts). Research has also shown that timber with a large amount of sapwood or treatable hardwoodness is at ease penetrated with preservative which can cause increased corrosion. Accelerated testing using well treated sapwood has shown that fasteners on connections galvanized to the requirements of ASTM-A153 (fasteners) or ASTM-A484 (connectors) can suffer moderate corrosion when subjected to a severe testing regime. Under the same testing conditions, some hot-dipped galvanized fasteners and connectors with alkaline copper treated wood: CA treated wood is essential. The following fasteners should not be considered for use in areas subject to extended periods of wetting, such as freshwater connectors.

Observations from builders and fastener manufacturers have indicated that alkaline copper treated wood is considered to be equally effective and there is no difference in the general requirements for use are similar for both. They are specifically recommended use with alkaline copper by manufacturers for treated wood should be used.

Galvanizing

Connectors used for ACO or CA treated wood should be galvanized in accordance with ASTM-A525 (continuously galvanized sheet metal) or ASTM-A653 (batch galvanizing after fabrication).

Hot-dipped galvanizing typically results in heavier zinc coating with no encased areas due to cutting fabrication. However, both processes produce acceptable hot-dipped galvanized products. The corrosion protection of hot-dipped galvanized product is a function of the amount of zinc on its surface.

More zinc usually means better performance. Historically the connector industry has used products manufactured with a 60-80 coating, which means 0.40-0.60 of zinc applied to the steel. A 60-80 coating has 0.40 coating while a 185 coating has 1.60. 

Moisture and air are both necessary for corrosion to occur. Wood, when wet, will corrode common size fasteners and connectors. In wood treated with a copper-based preservative, the risk of corrosion is increased because the copper reacts with air, causing its rust. Because the copper content in ACO and CA preservatives is much greater than in CCA, the risk of corrosion is much greater in the use of proper fasteners with the treated wood is required.

Moderate fastener corrosion has been observed on some hot-dipped galvanized fasteners and connectors as early as four months after installation, when in contact with alkaline copper treated wood that has not been stabilized and dried prior to use.

Factors that influence the corrosion of metal in contact with ACO and CA treated wood

Corrosion is somewhat greater in wood treated with high retention of alkaline copper preservatives. Higher chemical loadings would be expected in larger timbers, as well as wood that may be used in ground contact (e.g., fence posts). Research has also shown that timber with a large amount of sapwood or treatable hardwoodness is at ease penetrated with preservative which can cause increased corrosion. Accelerated testing using well treated sapwood has shown that fasteners on connections galvanized to the requirements of ASTM-A153 (fasteners) or ASTM-A484 (connectors) can suffer moderate corrosion when subjected to a severe testing regime. Under the same testing conditions, some hot-dipped galvanized fasteners and connectors with alkaline copper treated wood: CA treated wood is essential. The following fasteners should not be considered for use in areas subject to extended periods of wetting, such as freshwater connectors.

Observations from builders and fastener manufacturers have indicated that alkaline copper treated wood is considered to be equally effective and there is no difference in the general requirements for use are similar for both. They are specifically recommended use with alkaline copper by manufacturers for treated wood should be used.

Galvanizing

Connectors used for ACO or CA treated wood should be galvanized in accordance with ASTM-A525 (continuously galvanized sheet metal) or ASTM-A653 (batch galvanizing after fabrication).

Hot-dipped galvanizing typically results in heavier zinc coating with no encased areas due to cutting fabrication. However, both processes produce acceptable hot-dipped galvanized products. The corrosion protection of hot-dipped galvanized product is a function of the amount of zinc on its surface.

More zinc usually means better performance. Historically the connector industry has used products manufactured with a 60-80 coating, which means 0.40-0.60 of zinc applied to the steel. A 60-80 coating has 0.40 coating while a 185 coating has 1.60 coating.
RECOMMENDED FASTENERS AND CONNECTORS FOR ACQ AND CA TREATED WOOD

It is recommended that builders ask suppliers to provide documentation supporting the use of their fastener and connector products with alkaline copper treated wood with the end use being specified. Training of all on-site workers to help them understand the importance of using the correct fasteners with alkaline copper treated wood is essential. The following fasteners and connectors are recommended for use with ACQ and CA treated wood:

1. HOT-DIPPED GALVANIZED

For non-critical structures (e.g., fences, etc.) the minimum acceptable fasteners and connectors are hot-dipped galvanized products that comply with ASTM standards: ASTM-A153 (for hot-dipped fastener products) and ASTM-A53 (coating designation GIB for hot-dipped connector and sheet products) or ASTM-A123 (hot galvanizing after fabrication).

GIBs hot-dipped galvanized connectors can be used in protected areas with dry lumber or wood that is subjected to normal wetting and drying. Hot-dipped galvanized connectors should not be considered for use in areas subject to extended periods of wetting, such as freshwater or saltwater exposure.

2. STAINLESS STEEL

Stainless steel (Type 304 and 316) fasteners and connectors are recommended for connecting structural timber or timbers where a long service life is demanded. Stainless steel fasteners are also recommended where the treated wood is exposed to a more severe environment, such as swimming pools, near saltwater exposure, or in severe weather exposure locations.

3. OTHER

New proprietary fasteners and connectors have been developed for use with alkaline copper treated wood. They are coated with an organic polymeric coating that is designed to prevent the use from competing the treated wood. There is some concern that the coating on such fasteners or connectors could be damaged during storage or use. An improved coated product is available in which the zinc is first galvanized and then coated with the polymer. This type of fastener has been shown to perform extremely well when in contact with alkaline copper treated wood. Supportive test data should be requested from the manufacturer.

INCOMPATIBLE FASTENERS FOR ACQ AND CA TREATED WOOD

1. ALUMINUM BUILDING COMPONENTS

The use of aluminum building components in contact with alkaline copper treated wood is not recommended. When aluminum is used for flashings or door and window frames, a physical barrier or spacer material should be added to prevent direct contact of alkaline copper treated wood and aluminum products. If using spacers, a minimum 1/2 inch spacing is recommended. If a continuous barrier is used, (such as polyethylene) it should be thick enough to minimize damage during installation.

2. ELECTROPLATED GALVANIZED FASTENERS

Electroplated galvanized fasteners and connectors should not be used with alkaline copper treated wood. They do not provide sufficient protection against corrosion.

Training of all on-site workers to help them understand the importance of using the correct fasteners with alkaline copper treated wood is essential.
CHOOSING FASTENERS AND CONNECTORS

Selecting fasteners and connectors for use with residential treated wood requires attention. Although different preservative treatments are available, for all copper-based treated wood used in residential construction, the minimum requirement is the use of hot-dipped galvanized fasteners or 185 connectors rated for use with alkaline copper treated wood by the manufacturer. Fasteners with thinner zinc coatings are not suitable and should not be used.

It is important to note that galvanizing is a sacrificial coating. The presence of some white corrosion products on the fastener or connector surface is normal, but the presence of red rust is an indication of coating failure.

When choosing fasteners and connectors, the choice will depend on their anticipated exposure to wetting and the timber treatment. Timber with a high preservative retention will require more corrosion-resistant products in wet environments. Only fasteners and connectors that are specifically recommended by manufacturers for use with alkaline copper treated wood should be used.

For structural components, stainless steel fasteners and connectors are recommended. Examples of structural components include: a balcony, a support post in a structure, and an exposed beam supporting an upper floor of a structure. Stainless steel connectors (Type 304 or 316) are always recommended for maximum service life or use in severe exposure applications. Type 316 is recommended for ocean salt environments.

AVOIDING INCOMPATIBILITY PROBLEMS

Fasteners, metal connectors and anchors used in the same connection must be the same type of metal to avoid galvanic corrosion caused by dissimilar metals. For example, stainless steel fasteners must not be used in combination with galvanized connectors.

ENSURING PERFORMANCE

When selecting treated wood, the supplier should provide all the information needed regarding the wood being used, including the type of wood treatment, as well as a connector coating or material recommendation. It is advisable to request treated wood that has been stabilized and dried to less than 20% moisture content for exposed species such as red pine or ponderosa pine, or if a higher chemical loading is needed for wood to be used in ground contact according to the newly-revised CSA Wood Preservation Line Category System.

For structural components, stainless steel fasteners and connectors are recommended.

Corrosion

Metal connectors, fasteners and anchors lose their load-carrying capacity when they corrode. Use of corrosive fasteners will limit the service life of the treated wood, and can cause safety concerns in critical structural components. Corrosion of metal connectors and fasteners can be caused or accelerated by preservative treated wood, exposure to moisture, salt air, fire protection treatments for wood, fasteners, and when two dissimilar metals (e.g. galvanized and stainless steel) are brought into contact. Monitoring is required for prevention to occur.

www.bchousing.org
www.hpo.bc.ca
778 452 6454
BC V5H 4V8
www.uspconnectors.com
USP Structural Connectors
www.isanta.org
International Staple, Nail, and Tool Association
www.strongtie.com
Simpson Strong Tie
www.preserve.com
www.irg-wp.com
www.iwpc.org
www.wolmanizedwood.com
www.treatedwood.com
www.canadianwoodcouncil.org
www.gwpba.org
www.wbrc.org
www материалы.рф
www.houzz.com
www.dhbc.org
www.cmmbc.com
www.isata.org
www.woodworking.org
www.housing.org
www.isata.org
tive treatments are available, for all copper-based treated wood

Selecting fasteners and connectors for use with residential treatment.

Connectors

Q Fasteners, connectors and fasteners used in structural components should be inspected and replaced if necessary.

Q For structural components, stainless steel connectors, fasteners and anchors used in the same connection to post at grade, pin used to locate support post in shoe, etc.

Q For borate treated wood used inside buildings, where regular periods of wetting are coupled with a need for extended service life.

Q When using galvanized products, it is not recommended for timber products.

Q For HPO Technical Research & Education

Q www.bchousing.org

Q www.hpo.bc.ca

Q 1 866 465 6873

Q 778 452 6454

Q Tel:

Q © 2006

Q Cooper and Ung

Q Proceedings, Annual Meeting, American Wood Preservers Association

Q Ruddick, 2006, Field investigations on the Application of ACQ Treated Wood and Use of Metal Fastenors and Connectors in Residential Construction, Homeowner Protection Office Report


Q Ruddick, asthma, and Guldiken, 2004, Proceedings, Annual Meeting, American Wood Preservers Association

Q Ruudt, 2006, Field investigations on the Application of ACQ Treated Wood and Use of Metal Fasteners and Connectors in Residential Construction, Homeowner Protection Office Report

Q For HPO Technical Research & Education

Q www.bchousing.org

Q www.hpo.bc.ca

Q 1 866 465 6873

Q 778 452 6454

Q Tel:

Q © 2006

Q Cooper and Ung

Q Proceedings, Annual Meeting, American Wood Preservers Association

Q Ruddick, 2006, Field investigations on the Application of ACQ Treated Wood and Use of Metal Fastenors and Connectors in Residential Construction, Homeowner Protection Office Report


Q Ruddick, 2006, Conference Proceedings, Canadian Wood Protection Association, 50, 146-149

Q Canadian Wood Council

Q www.cacl.ca

Q Oregon Natural Wood

Q www.onw.com

Q Perkex® or Perkex Plus®

Q www.borax.com

Q www.isanta.org

Q www.strongtie.com

Q www.cwc.ca

Q www.mychem.com

Q www.wolmanizedwood.com

Q Note: These weblinks are provided as a reference only and the Homeowner Protection Office (HPO) does not endorse or recommend any specific company or product. By providing these references, the HPO is not recommending any of the products listed in these websites, nor is the Homeowner Protection Office (HPO) holding itself as a result of the use of this publication including products, building techniques or practices. The views expressed herein do not necessarily represent those of any individual contributor or BC Housing. It is always advisable to seek specific information on the use of products in any application.