



Department of defense: Protecting wood exteriors

Specification of the right coatings is pivotal in formulating initial painting and maintenance-repainting programs for buildings with exteriors that include wood elements. Photo courtesy of Cabot Stains.

Jayson L. Helsel, P.E., KTA-Tator Inc.

Wood is a versatile material that is commonly used in residential and commercial construction, with typical uses that include various types of siding and shingles, in addition to framing for doors and windows. **Successful strategies are built on attention to substrate condition, selection of coating material** on the wood surface. It is important to check any specific guidelines a coatings manufacturer provides for moisture content and instrumentation recommendations.

When used in exterior exposures, wood generally needs to be painted or stained to provide protection from the effects of weathering. When wood is selected for exterior uses, it is important to realize that more frequent maintenance of the coating or stain system is typically required than is the case with steel or concrete substrates. This makes recognition of common problem areas and specification of the proper coatings all the more critical.

Moisture issues

The most common coating problems related to wood can be attributed to excessive moisture content or a degraded wood surface. New or "green" wood generally contains moisture on the order of 20% or greater, which is too high for successful application of paints or coatings; many coatings manufacturers recommend a moisture content of 15% or less before painting. The moisture content can be determined in most cases using a moisture meter that measures the resistivity between two probes held

Once wood has initially dried to sufficient moisture levels for painting, environmental sources of water can continue to be a problem. Wood, being an absorbent material, will readily allow water to penetrate if given the opportunity. In this respect, the design of a structure must allow for proper drainage of rainwater or other sources of moisture. For example, if wood siding is installed on a building, moisture must not be allowed to seep behind the wood planks. Equally important is taking care to apply paint or coatings to all exposed sides of the wood surface such as edges. Even if the edges of wood-siding planks are butted against one another, the smallest gap can allow water to penetrate the wood at these edges.

Edges are particularly vulnerable, since the ends of the wood grain are typically exposed, allowing water to travel into the wood along the grain pattern. Even the back or unexposed side of a wood plank or siding section may need to be painted or primed as recommended by the coating manufacturer.

Effects of moisture

Once moisture gets into the wood, regardless of the source, it becomes a problem for any applied coating. Just as the coating film

prevents penetration of the substrate by water from the exterior environment, the coating also can prevent any absorbed moisture from escaping from the wood. This moisture entrapment eventually causes a failure of the coating due to blistering, peeling, cracking, and general loss of adhesion.

Most moisture problems can be avoided if the moisture content of the wood is sufficiently low before proceeding with painting.

Wood degradation

Aside from moisture, the other major problem area encountered when painting wood is a degraded wood surface. Wood will degrade relatively quickly when left exposed to sunlight. Although the effects may not be immediately obvious, degradation due to ultraviolet exposure from sunlight occurs in some types of wood (e.g. red cedar) in as little as one week, according to studies by the U.S. Forest Service Forest Products Laboratory.

Degraded wood creates a weak surface layer that eventually detaches from an underlying sound wood layer. How quickly this may occur depends on how severely the wood surface was degraded, the exposure conditions, and the type and thickness of coating(s) applied. Regardless of other factors, failure is likely to occur in a relatively short period if the wood surface is unable to tolerate the curing stresses of the coating. In other words, the process of drying and curing of the coating can impose sufficient stress to cause a failure of the system at its weakest link, the degraded wood surface.

The only solution to a degraded wood condition problem is removing the weak surface layer prior to coating application. If the

problem has already resulted in a coating failure, then all poorly adhered coating—along with the degraded wood layer—must be removed. This situation can be problematic in that it may be difficult to remove all of the existing coatings and at the same time avoid damage to the wood surface.

Preparation methods

Pressurized water cleaning of the wood or existing painted surface is the typical method of preparation prior to application of paints, coatings, or stains. Low pressures (less than 2,000 psi) should be used, and care must be taken to avoid damage to the wood substrate by adjusting the nozzle, water pressure, and stand-off distance as needed. Caution is also needed to avoid forcing water into any gaps that may exist in



Excessive moisture in the wood and a degraded wood surface are two primary contributors to coating failure. Photo courtesy Duffy Hoffman, Preservation Specialist.

the structure that would cause intrusion into the interior walls. The cleaned wood surfaces must be thoroughly dry before applying any new paint.

Additional preparation by sanding may also be needed to further remove existing coatings that are not well adhered, or to further prepare bare wood surfaces. If older wood substrates show too much damage,

such as cracking, the surface will need to be repaired or possibly replaced. Wood-repair materials recommended by coatings manufacturers for application of specific coating products should be used. Many wood-repair materials are epoxy based and must be painted relatively quickly when exposed to exterior weathering conditions.

Coatings choices

A variety of coatings can be successfully applied to wood substrates; selection depends in part on the appearance traits desired for the finished surface. Coatings for wood surfaces can be generally categorized into penetrating finishes, such as water-repellent products and pigmented semitransparent stains, or film-forming finishes such as paints, solid-color stains, and varnishes.

The protection and service life that a coating (system) provides is related to factors such as whether the material is opaque and how thickly it is applied. Since water repellents are generally clear materials with little measureable film build, they are known to possess the shortest service life (often just 6 to 12 months), and will require the most frequent maintenance. Other penetrating products, such as pigmented stains, will provide protection for a much longer period before maintenance is required.

The most durable penetrating finish products are semitransparent stains that potentially can rival the service life of typical paint products. Depending on formulation, the pigments in semitransparent stains can absorb much of the ultraviolet radiation that causes degradation in wood. Penetrating finishes are typically applied in multiple thin coats.



*If coating failure is apparent, all poorly adhered coating and the degraded wood layer must be removed prior to application of new paint or coating.
Photo courtesy of Duffy Hoffman, Preservation Specialist.*

coats, resulting in a total dry film thickness of 6 to 9 mils. An acrylic system can deliver a service life of up to 10 years.

Typical paint systems for wood include acrylic and alkyd (oil-based) products. Alkyd paints are usually solvent-based products that result in a harder and less flexible (more brittle) paint film as compared to acrylic paints. Alkyds generally offer moderate to good exterior weathering characteristics, although various modifications to alkyd formulations can be made to improve certain properties. One such modification involves the addition of polyisocyanates to improve drying time and chemical and abrasion resistance. These resins are commonly called uralkyds ("ur" from urethanes), and they generally exhibit excellent gloss and color retention. Uralkyds may also be used for interior floor coatings, where

these types of products may be referred to as "polyurethanes."

Acrylic or latex paints are water-based materials characterized by a more flexible paint film, compared to alkyd coatings. Acrylic coatings also generally provide better exterior weathering characteristics, which translates to better color and gloss retention. Any exterior "acrylic" products should be identified by the manufacturer as containing "100% acrylic" resin versus an acrylic/vinyl or polyvinyl acetate resin.

With wood, performance is built on fundamentals

As emphasized in this review, the moisture content and substrate condition of wood surfaces must be properly evaluated prior to application of paints, coatings, or stains. The selection of these products should be based on appearance objectives, while also taking into account the maintenance frequency required for various products recommended for use on wood.

Film-forming finishes, as the name suggests, result in a thicker, measurable coating film upon curing. These products by nature offer better protection since they are generally opaque and provide a much thicker film build over the substrate than penetrating finishes. Generally, acrylic paints are judged to be the best-performing coatings for wood, with the coating system typically consisting of a primer and one or two finish

ing characteristics, although various modifications to alkyd formulations can be made to improve certain properties. One such modification involves the addition of polyisocyanates to improve drying time and chemical and abrasion resistance. These resins are commonly called uralkyds ("ur" from urethanes), and they generally exhibit excellent gloss and color retention. Uralkyds may also be used for interior floor coatings, where

JAC

JACjournal WEBINAR

AIR BARRIER SYSTEMS For SUSTAINABLE MASONRY WALLS



August 20th 2009, 2pm
Presented by Chris Bupp

"Air Barrier Systems for Sustainable Masonry Walls" will review various types of air barrier systems in today's market. The presentation will examine breathable versus non-breathable, geographical location and environmental aspects of air barriers. Masonry anchor and flashing compatibility with barriers will also be covered.

Sponsored by

HOHMANN AND BARNARD, INC.



A WITEX - BERKSHIRE HATHAWAY CO.

sign up for this *Free* webinar at

www.jacjournal.com/webinars






For more info, return Reader Inquiry Card