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FOREST PRODUCTS LABORATORY

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COATINGS THAT PREVENT END CHECKS

As wood dries, the surface fibers give up their moisture first and tend to shrink but are restrained from so doing by the interior fibers, which have not begun to shrink; thus drying stresses develop that tend to cause checks. The tendency to check is more pronounced on the end-grain than it is on the side-grain surfaces. A moisture-resistant end coating is often used to protect such surfaces from checking during air seasoning or kiln drying, especially with the more valuable items of wood that are difficult to dry and hardwood logs that are to be stored for long periods of time. End coatings should be applied as soon as possible to the freshly cut end surfaces, for end checks, once started, tend to go deeper into the wood as drying progresses. End coatings are also used to prevent loss of moisture from the ends of short kiln samples, and for this purpose the most highly water-resistant coatings are advisable.

To be satisfactory for large-scale use, an end coating should have the following qualities:

1. Adequate resistance to water movement under all conditions of temperature and humidity to which it may be subjected during the drying of the wood.
2. Ease of application under a wide range of temperatures.
3. Sufficient toughness and adhesiveness to withstand rough handling and to prevent blistering and cracking during kiln drying.
4. Freedom from abrasive substances that may be injurious to saws or cutters during machining of the wood.
5. Low cost to cover a given area.

The degree of water resistance required depends upon the species and size of the wood. In general, greater water resistance is required for the dense hardwoods and stock of large cross-sectional dimensions than for the lighter hardwoods, the softwoods, and ordinary lumber. Highly refractory woods, such as oak and black walnut, require the most highly water-resistant coatings available.

End coatings may be divided into two classes: those that are liquid at ordinary temperatures and can be applied without being heated, and those that are solid at ordinary temperatures and must be applied hot. Cold coatings can be applied readily to logs and lumber as well as to kiln samples and dimension stock. Hot coatings are well suited for use on small stock that can be easily handled, but they are not readily applied to logs and lumber.

Cold Coatings

Ordinary paints and varnishes are too thin for end coatings unless several coats are applied. A number of special end coatings of the cold-coating class are available from various manufacturers and dry kiln companies. Many of these are heavily filled varnishes, but there are other types such as heavy resin solutions, asphalt semimastic, and emulsified asphalt, wax, or synthetic resin. The properties of emulsified preparations vary widely, depending upon the amount of water and type of emulsion. They are not satisfactory when subjected to rain or freezing soon after application.

The effectiveness of commercial end coatings can be tested by comparing them with either of the two end coatings originally developed by the Forest Products Laboratory, an aluminized varnish and filled, hardened gloss oil. Both have certain disadvantages for commercial use, but, when properly made, have a moderately high degree of water resistance and will stand up under a variety of kiln conditions. Filled, hardened gloss oil requires special preparation by a varnish manufacturer. Information on suppliers or the formula for preparation will be supplied by the Forest Products Laboratory upon request.

A wide variety of aluminum paints are available commercially and many of them may be water-resistant enough to serve as end coatings. Ability to form a good adhering coating on wet wood is needed as well as general water resistance. Even with the best coatings, two or more coats are required to prevent end checks. In work at the Forest Products Laboratory, a quick-drying phenolic resin tung-oil varnish was found to be the best vehicle, and 1-3/4 to 2-1/4 pounds of aluminum paste or powder were used per gallon of varnish. Such coatings should not be made up long before use, nor should they be overbrushed, or the desirable "leafing" property of the aluminum particles will be decreased.

For small-scale use, heavy pastes such as roofing cement or white lead in linseed oil can be used.

Cold coatings are usually applied by brush, although they can be sprayed with proper equipment. They also can be applied to small items by holding the ends against a roller that is rotated while partly submerged in the coating. Cold coatings should be allowed to dry a few hours before being subjected to kiln temperatures.

Hot Coatings

Hot coating materials include pitch, asphalt, and paraffin. They are low in cost and high in water resistance when applied in a single coat. They maintain a high degree of water resistance even after prolonged heating if the drying temperatures are kept about 30° F. or more below the softening point of the coating. Standard softening points are determined by the ring-and-ball method (A.S.T.M. Designation: E28-51T).

Hot coatings can be prepared that will withstand any normal kiln temperature, but those with higher softening points tend to be less adhesive, more brittle, and more difficult to apply than those with lower softening points. A coating with the lowest softening point that will safely withstand the temperatures encountered during the drying should be used. Certain combinations of hot-coating materials can be mixed to obtain desired softening-point characteristics and improved adhesiveness and toughness.

Coal-tar pitches are particularly high in water resistance. The pitches with higher softening points are especially brittle. For low kiln temperatures, 155° F. coal-tar pitch is effective. One of the most water-resistant coatings tested at the Laboratory is 213° F. pitch, but it is not readily used alone because it is brittle when cold and does not adhere well to the wood. Asphalt may be added to 213° F. pitch to increase the toughness of the coating. One such combination, formulated at the Forest Products Laboratory, consists of 60 parts (by weight) of 213° F. coal-tar pitch, 25 parts of 155° F. coal-tar pitch, and 15 parts of 225° - 235° F. asphalt. This end coating is suitable for use with kiln temperatures up to 165° F.

Asphalts are tougher and more plastic than pitches having the same softening point. Asphalts are derived from a number of sources, particularly from natural deposits and as a byproduct of the distillation of petroleum. They vary in their softening point and water-resisting properties. Many are suitable as hot coatings for kiln drying.

Paraffin has proved satisfactory as an end coating for stock being air seasoned but cannot be used for stock being kiln dried because of its low softening point.

Hot coatings can be easily applied to material of short length that can be manipulated by hand. The temperature at which hot coatings should be applied varies with the type used; pitch and asphalt coatings are applied at approximately 400° F. and paraffin at approximately 150° F. The coatings can be applied by dipping the ends of the stock into the molten coating to a depth of 1/2 inch, but better results are obtained by firmly holding the ends against a power-driven roller that is rotated while partly submerged in the heated coating. If the coatings are applied uniformly, a thickness of 1/20 to 1/16 inch is sufficient.