Tips for a Perfect Floor Finish

To ensure proper curing of oil or water-based finishes, keep the site warm, dry, and traffic-free

I once watched a Boeing jetliner being sprayed with a new coat of protective finish. Inside the finishing bay, heat, humidity, and air quality were tightly regulated by state-of-the-art controls. Millions of dollars had been spent on a special facility for this purpose, so that the sprayed finish would adhere and perform as it should, giving proper protection to these very expensive airplanes.

Whether it be airplanes, automobiles, cabinetry, or furniture, manufacturers recognize that a proper finishing environment is essential if a coating is to look good and give lasting protection to the substrate.

The same rules apply to the finishing of wood flooring. The performance demanded of these surfaces makes this the most critical coating application in the entire house. But as we all know, typical job-site conditions are much less stable than finishing-room conditions. Good floor finishers have learned how to make the best of these less-than-ideal conditions, but there's generally plenty that a GC can do to improve the situation. The purpose of this article is to help you understand how temperature and humidity affect finishes, and to give some tips on how to prepare for the finishing process.

Drying vs. Curing

The question a flooring contractor hears most often is "When will the floor be dry

by Michael Purser

Tools of the finisher's trade. *The author uses two diagnostic tools on every job: a combination thermometer/hygrometer (left) and a moisture meter (right) to measure the wood flooring's moisture content. If conditions are not within the proper range, the finish may fail.*

enough to walk on?" The question betrays the common misconception that once a coating is dry, it is ready to be put into full service. Following the application of the floor finish, there is usually a flurry of activity at the job site. Punch lists, final inspections, walk-throughs — the list goes on. If everything is in order, the owner is backing trailers up to the door and unloading furnishings or the real estate agent is tying balloons to a sign in the yard that invites the free world inside to buy the house of their dreams.

Unfortunately, the fact that the finish is dry to the touch simply means that it's no longer tacky and will not stick to your hand or shoe. But only when the coating is fully *cured* will it reach maximum hardness. Until then, the finish is susceptible to scratching, abrasion, and chemical damage.

The curing of a floor finish is like the curing of concrete: It's a chemical process that continues for days after the floor finish is dry, until the finish is as hard as it's going to get. With concrete, moisture drives the process; with flooring finishes, oxygen is typically the crucial ingredient.

Until the curing process is complete, all activity on the surface should be minimal. Depending on the product, *drying time* can vary from two to eight hours. However, *curing* can take from five to thirty days, depending on the product. And these figures are for ideal conditions — the type seldom found at the job site. As the conditions become less than ideal, the curing times will be extended.

Effects of Excessive Humidity

There are two basic variables that can extend the drying and curing time of finishes and coatings. One is *moisture*, which includes the relative humidity in the air and the moisture content of the wood being finished. The second is *temperature*, which includes the temperature of both the air and the wood being finished.

Excessive humidity on a job site slows down the drying and curing of coatings; this is the single greatest threat to proper finishing. As floor coatings dry, the solvents escape and fill up microscopic voids in the surrounding air. As humidity increases, the air becomes "crowded " with particles of water and will not allow the solvents to evaporate, or "flash off." Solvent that does not flash off the coating just sits there.

Since drying occurs from the top down, any solvents left in the product are released at a much slower rate. Combine this with the fact that you are usually applying more than one coat and you begin to see how excess humidity can prolong drying.

Theoretically, as the coating cures, all the solvents should percolate through the various layers and eventually make their way out of the coating and into the air. The key word here is "eventually." When the curing process is delayed from too much humidity, the coating will remain soft for a much longer time.

If humidity levels exceed 75%, the curing time can easily be doubled. The real danger with extended curing times is the damage that can — and will — occur to the soft finish if normal construction activities are allowed to take place. (In fact, according to a staff chemist at one of the finish manufacturers, if curing is extended over too long a time, the finish may *never* reach its maximum hardness.)

Thick vs. thin coats. There are a number of application devices that allow a finisher to apply a thicker coat of finish. The desired final thickness can be achieved in fewer applications, saving time for the finisher. But if curing is slowed by excessive humidity, thicker coats of finish will produce greater amounts of solvent that will take even longer to flash off. This approach saves time for the finisher but increases drying and curing time.

Watch out for stains. Stains applied before the final finish are also affected by excessive humidity. Even under ideal conditions, many popular brands of stains actually have longer drying times than the coatings applied on top of them. Also, if the solvent base of the finish and the stain are the same (oil-based, for example), you are walking on thin ice if you apply finish to stain that has not dried. In areas where the stain has not dried completely, the finish coat will not bond properly to the flooring. But if the solvent bases are different (waterborne finish over oil-based stain, for example), you're going right through that thin ice and will most likely see a complete failure of the coating to adhere to the stain. The irony is that the failure is usually blamed on the products, when the real problem is the failure to provide the right conditions for drying and curing.

Recognizing Sources of Moisture

With the emphasis on building tighter homes, controlling humidity at the job site has become a much more important issue. In older, drafty homes, humidity introduced by job-site activi-

Edge-Bonding: You Have to See It to Believe It

by Carl Hagstrom

Water-based floor finishes have a number of advantages over oil-based finishes: They dry quickly, release less toxic vapors as they dry, and form a stronger bond to the wood flooring. But as with a many new products, unpleasant side effects are often discovered as they are used more extensively in the field.

Last year, I agreed to install 350 square feet of ash flooring in a 100-year-old home. Since the house was occupied during the installation, I made every effort to keep the dust down and arranged to have the flooring presanded. My floor finishing contractor and I both agreed to finish the floor with a water-based product, since it would produce less objectionable fumes.

The floor turned out beautifully, the customer was satisfied, and I went on my way. About eight months later, though, I received a call from the customer, complaining that cracks were appearing in the flooring, so I stopped by to take a look. What I found was not a pretty picture.

The joint between every sixth or seventh course of flooring had opened up, in some cases as much as 5/16 inch. In certain places, the actual ash board had split, creating large, unsightly cracks (see photo at right).

After a few days of phone calls, I found out that this floor was a victim of *edge-bonding*. When edge-bonding occurs, the floor finish acts like an adhesive, effectively gluing the boards together. In December, well into the heating season, the humidity in the house had dropped significantly, and the flooring was adjusting to this change by shrinking. Typically, each individual floor board would shrink between 1/32 and 1/16 of an inch. In this case, however, the entire floor was behaving like a glued-up panel and was trying to absorb more than 3 inches of combined shrinkage. As the staples resisted this movement, the flooring broke into smaller "panels" of six or seven courses.

My floor finisher had used this product on more than a hundred floors and never encountered the problem. So what caused edge-bonding to occur in this situation?

The edges of these ash floor boards were effectively glued together by the flooring finish. As the floor shrank in the winter, large gaps and splits occurred every six to seven courses.

The only reference material I found on the subject was from the National Oak Flooring Manufacturers Association (NOFMA), which prefaced its explanation of edge-bonding by stating that the phenomenon is not fully understood. When I questioned a technical representative at NOFMA, he explained that a "latex filler" should be troweled into the joints of the flooring to prevent edge-bonding. (There was no mention of this procedure, or edge-bonding in general, on the instructions found on the finish container.)

After reviewing what little available information there was and describing the event to product representatives and other tradespeople, I concluded that three circumstances contributed to the edge-bonding.

Presanded flooring. Because the flooring was presanded, the sanding fines that would normally sift between floor boards and discourage the finish from bonding to the edge of the boards were absent.

Eased edging. The flooring was machined with an eased edge. The resulting small V-groove probably had a funneling effect, directing additional finish into the joint.

Ambient humidity. The flooring was installed in late spring, when humidity levels were high, so the moisture content of the flooring increased after it was installed. The slight swelling caused by the increase in moisture content produced a clamping effect that forced the floor boards together immediately after the finish was applied.

The outcome? The NOFMA reference offered some hope. It mentioned that with time, many floors affected by edge-bonding tend to release at the joints, thus spreading the effect of shrinkage more evenly among more joints. In some cases, the finish will release its grip as the flooring expands and contracts through the annual heating and cooling cycle. At this point, the clients and I are waiting to see what happens; with any luck, I may have to replace only a few boards.

Hidden source of moisture. *Think twice before setting up a portable combustion heater to warm the site for floor finishing. For every 28,000 Btus such heaters produce, they release 1 1/2 pints of water as a byproduct of combustion. Use them only in conjunction with a dehumidifier.*

ties is quickly reduced by rapid air exchanges. In tighter homes, however, this humidity will remain. Before you can hope to control humidity at the job site, you must first learn to recognize the sources of moisture that will raise humidity levels.

There are two main moisture sources: activity-induced and site-induced. Site-induced moisture could come from a damp basement, lack of gutters, or poor grading and drainage. These sources tend to be more of a problem during periods of high rainfall.

Activity-induced moisture most often comes from trade activities that take place before and, in some cases, during the floor finishing process. The most common sources are drywall mud and latex paints. Water-based replacements for petroleum-based adhesives and mastics are another source of job-site moisture. Recently completed tile and masonry work — a tile floor over a mud bed or a recently poured basement slab — will also release large amounts of moisture as they cure. The moisture generated by these products means there is less "room" in the air for the floor finish to dry.

You Can't Beat Heat

Lack of heat has similar consequences for drying and curing: The lower the temperature, the longer it will takes for an application of finish to dry. This tends to be less of a problem than excessive humidity, since job sites are usually kept at a reasonable temperature range for the comfort of the workers. But when temperatures fall below 60°F, drying time increases significantly. I remember a project where temperatures fell below 50°F during the evenings, and I had to wait *four days* for each coat of finish to dry.

As temperatures decrease, air density increases, and the solvents escaping from the floor finish have fewer places to go. When what little air space there is becomes filled, all drying and curing of the finish stops.

Beware combustion heaters. When the temperature drops, many builders bring out a kerosene "torpedo" heater or a propane "salamander" heater. This seems like a good idea, except that a typical 150,000-Btu kerosene or liquid propane heater produces about a gallon of water per hour as a byproduct of combustion. So instead of improving drying conditions, these heaters can actually make matters worse by significantly raising the relative humidity at the site! If you must use this type of heater, use it only in conjunction with a dehumidifier. A better choice is to use an electric heater, which adds no humidity to the air. (For more on portable heaters, see "Beating the Big Chill," 11/95).

Air conditioning. In summer, when outside temperatures and humidity are high, crank up the A/C if possible. That will dry the air and keep the temperature in a workable range. High temperatures (above 85°F) cause the finish to dry so quickly that it doesn't flow and level as well. If there's no air conditioner, apply finish early in the morning when the temperatures are lower.

Simple Precautions

As complicated as this may sound, there are some simple steps you can take to ensure proper conditions for floor finishing.

- The surest approach is to have all hvac systems operational and running three to four weeks before any finishing work begins. This will help keep excessive humidity in check and prevent unfinished wood from absorbing any moisture from the surrounding air.
- Many contractors and homeowners object to the use of the heating system during construction out of fear that the duct system will become contaminated with dust. If a forced-air heating system is being used, place prefilters on all air return vents, and change the furnace filters regularly during sanding and screening operations. I use a paper towel over the air return vents and I have never stressed a heating system yet.
- If your only source of heat is a torpedo heater, be sure you have a simple dehumidifier on the project to remove the moisture that the heater introduces. The dehumidifier should be in place when the flooring is installed. Unfinished wood flooring acts like a sponge;, it will absorb any excess moisture when humidity levels are high.
- Purchase a good moisture meter and use it. Mine goes with me everywhere; I am constantly taking readings. If the cost seems high ($200 to $300), just think how much you'll lose going back to correct mistakes. A moisture meter is worth every penny.
- Monitor the temperature and humidity levels. You'll need a hygrometer to measure the relative humidity. The ideal range for drying and curing coatings is between 45% and 75% RH at 65°F to 85°F.

Controlling job-site conditions will always be a challenge. But the next time your flooring finisher makes some special demands, don't just assume he's a whining pain-in-the-neck. Remember, it's your product and your reputation he's protecting. ■

Michael Purser is a second-generation wood flooring contractor in Atlanta, Ga. He owns and operates the Rosebud Company.