Job-Site Wood Glues

A Type II yellow glue and a polyurethane adhesive are all you need for most job-site wood joints

by Byron Beck

I've been a carpenter and finish subcontractor for 12 years. Along with a daily dose of the usual interior trim casing and shelving, my crew and I have had the opportunity to work on many unusual woodworking projects. Our tool shed is stocked with more than a dozen products that we use to bond materials together. But for woodwork, we've settled on a few adhesives that we choose from depending on the job.

Before choosing a glue, we consider the following factors: water resistance, gap-filling properties, "open time," clamp time, viscosity, flexibility, sandability, ease of cleanup, and cost. Other attributes like color, shelf life, application temperatures, heat resistance, resistance to freezing, and toxicity are of less importance but sometimes factor into the decision of which glue to use and stock on site (see "Bonding Basics").

Thermoplastics

Every finish carpenter's nail belt is covered with dried smudges of white and yellow carpenter's glues, known as thermoplastic glues. The old-fashioned white glues like Elmer's are *polyvinyl adhesives* (PVAs).

Bonding Basics

Glues, adhesives, and cements are used to bond materials together. Cements are rubber based, glues come from natural materials, and adhesives are made from synthetic materials. For most of the tasks that we do, we join wood to wood with synthetic adhesives that we call "glues."

Water Resistance

In the U.S., a glue's resistance to water is classified as either Type I or Type II. Type I glues can be submerged in water indefinitely. The Type II glues are test-soaked in water for 4 hours followed by 19 hours of drying at 120°F. The process is repeated three times. If the joint survives, the glue is classified as Type II water resistant. Titebond II is a good example; we use it on most outdoor applications where the wood joint won't be submerged in water.

Open Time

The setting rate is the amount of time you have to spread a glue before you must clamp or fasten the pieces together. Also called "open time," it usually depends on temperature and humidity. For small casing or baseboard miters, open time doesn't come into play, but for large glue-ups like shelf edging, you need enough time to get the pieces aligned and secured.

Working Temperature

Closely related to open time is temperature dependence. Glues have optimal working temperatures, usually between 65°F and 75°F, in which they spread easily and have open times as advertised. But as the temperature goes up or down, viscosity and open time change. With lower temperatures, some glues tend to dry slower or not at all. In hot temperatures, many glues become too viscous and set up before you are ready.

Viscosity

The thickness, or viscosity, of a glue is important to a trim carpenter. Glues that are too thick take too long to apply and glues that are too thin won't stay where you put them — like on the slope of mitered casing waiting for its matching piece. Titebond Wood Molding Glue and Elmer's Weather-Tite Wood Glue are no-run, no-drip glues designed just for this problem.

Gap Filling

Gap filling is the property of a glue to fill voids in the wood joint. Some glues, like epoxies, fill gaps well but are so brittle they crack. Others are so flexible they are really just acting as a caulk — the joint is not a "structural" connection.

Color

Some glues absorb stain better than others. When we are doing stain-grade work, the color of the glue line can be a consideration. Elmer's Weather-Tite glue dries clear but contains wood fibers that help absorb stain.

Clamp Time

The time you need to keep the work piece in clamps is called clamp-time. Many finish projects are "clamped" with the fasteners, like screws and nails, so this factor doesn't come into play. On the other hand, if you are gluing up panels or frames on site, clamp time is linked to your production schedule and the number of clamps you own.

Cleanup

To a finish carpenter, "cleanup" usually means wipe with a finger and "let the painter handle it." But squeeze-out not properly removed can create a lot of work for finishers. Some glues can be cleaned with a damp rag, others require mineral spirits or thinner. Purists will argue that glue should be removed with a chisel after the glue has dried. This is because wiping away excess glue with water or solvent dilutes the glue. The watery glue then penetrates deep into the wood grain where it's even harder to remove. We always ask painters and finishers first, and if they want, we clean up the excess glue with a chisel after it dries.

Cost

The cost of glue is usually considered negligible, but the newer glues, if used indiscriminately, can cost you real money. The typical yellow glues cost around 50¢ an ounce, whereas polyurethanes cost around 85¢.

— *B.B.*

Two types of glue can handle most wood joints, both interior and exterior, encountered on the job site: a cross-linked PVA water-resistant glue like Titebond II and a waterproof polyurethane glue like Gorilla Glue or Excel .

Polyurethane glues foam and expand as they set, helping to fill gaps in the joints (left). The squeeze-out can be cleaned immediately with mineral spirits, but the author prefers to use a chisel on the excess after it has dried (right).

The newer yellow carpenter's glues are *aliphatic resins*, represented by Titebond Wood Glue, Elmer's Carpenter's Glue, and others. The newest thermoplastic glues are called *cross-linking PVAs* and include Titebond II and Elmer's Weather-Tite.

White glue. As long as they don't get wet, white glues are cheap, strong, and reliable. They have a rapid set time, a short 30-minute clamp time, a long shelf life, and they are nontoxic.

Compared with some newer glues, however, the white glues come up short. Since they cure by loss of moisture, they need very dry wood for a good bond; their ability to fill gaps, as well as their flexibility, is marginal; and when heated (with a sanding belt, for example), they soften. If you work in extreme cold you need to be aware that PVA glues can freeze in the bottle or when applied to a cold piece of wood. In our experience, when these glues freeze, they are ruined.

Yellow glue. Yellow glues, like Elmer's Carpenter's Glue or Titebond Wood Glue, are somewhat stronger than white glue and more resistant to lacquers and solvents. Since they are also more heat resistant, they don't clog up sandpaper.

The newest yellow glues on the market are the *cross-linking PVAs*. They are stronger than ordinary PVAs and have much better water resistance. Although not "waterproof," cross-linking PVAs are rated as Type II water resistant. They are also tackier and have a shorter drying time but can still be cleaned up with water. On our jobs, Titebond II is considered the "all purpose" glue. We tend to use it instead of ordinary yellow glue, since it costs only pennies more.

Thermoset Glues

Thermoset glues are more costly, but they're more resistant to water and heat than the thermoplastics. This category includes polyurethane glues as well as urea formaldehyde and resorcinol formaldehyde.

Of the thermoset glues, the polyurethanes are the most likely to someday replace yellow glues on the job site. The two we use, Gorilla Glue and Excel, are imported from Europe, where strict environmental regulation has forced the creation of adhesives that are less destructive to the environment.

They're called single-component, moisture-catalyzed adhesives, which means that moisture in the air or wood causes the glue to set. As polyurethane glue sets up, it foams and, in effect, spreads itself. The expanding foam also fills any gaps, although the user should be aware that the joint is not considered "structural."

Polyurethane glues contain little or no solvents, are 100% waterproof, and will absorb stain. (They will also stain the skin, so wear gloves when you use them.) Application temperatures range from 40°F to 130°F. Polyurethanes won't freeze and will bond with "wet" wood (up to 25% moisture content). Formulated as a substitute for epoxy, these glues produce no outgas other than carbon dioxide (CO_2). Polyurethanes dry to a brownish tan and do not become brittle, yet they're hard enough to sand without clogging the sandpaper.

Cleanup. The instructions for cleaning poly glues are to use mineral spirits to wipe up excess. But because we don't always keep mineral spirits around and because the glue keeps foaming out of the joint for up to an hour, we typically just trim the glue with a chisel or scraper after it sets for several hours (above).

Choosing the Right Stuff

When choosing a glue for a specific task, we first consider how water-resistant the application needs to be. Is the glue joint indoors and always dry? If so, white or yellow glues will suffice. If the wood is outdoors but subject to infrequent water, we use Titebond II or a polyurethane. If the glue joint will be submerged for prolonged periods, we opt for two-part resorcinol glue because of its good track record with boat builders — although at some point, after some more testing, we will probably move over to the polyurethanes for these applications as well.

Interior trim carpentry. It would be nice to use one all-purpose glue on all our wood joinery. One of the polyurethanes like Gorilla Glue or Excel would be our choice, except that cleaning up the foam squeeze-out takes more effort than a quick wipe with a

Excel is slightly less viscous than Gorilla Glue. This makes it a good choice for dense materials like MDF because it penetrates better.

The author uses a Type II water-resistant glue as his all-purpose glue.

New from Australia, RooClear will stick to wood, metal, stone, and even such nonporous surfaces as melamine and plastic laminate.

wet rag. So for interior trim work like moldings, crowns, casings, baseboards, and boards that are butted end to end or joined with miters, we use Titebond II.

Wherever we expect extreme wood movement, as on especially long casing miters, which tend to open and close with the changes in relative humidity, we use Gorilla Glue. It fills any gaps in our "perfect" joinery yet remains flexible enough to seasonally expand and contract with the joint.

Because a coped joint for crown molding is normally "backed out," there's only a feather edge of one piece in contact with the other piece. We used to use caulk to fill the joint and hope it would act as a glue. Now we use Gorilla Glue: Its foaming action makes for a very good gap filler.

Cabinetry. Because yellow glue squeeze-out cleans up quickly with a wet rag, we use it for edge-gluing solid wood to solid wood and along the length of complex moldings where the foam squeeze-out of polyurethanes would be difficult to remove. Whenever we make interior doors or built-in furniture and cabinets, we also stick with Titebond II. But on hot days (above 90°F), Titebond II's working time is too short, so we resort to a polyurethane glue.

Interior millwork. One of the nice things about the expanding polyurethane glues is that you can continue to "jostle" the joint and the glue's expansion will continue to fill it. For instance, when you are gluing solid wood facing onto particleboard shelving, the nail gun or hammer impact will "bounce" the edge band. This causes yellow glue to squirt out, leaving a "starved" joint. We use Excel polyurethane for this job instead because it expands into the starved joint and, unlike Gorilla Glue, is thin enough to penetrate and bond to the MDF.

Exterior millwork. In the past, we used urea formaldehyde for water-resistant wood joints (moldings under the eaves, for instance) and resorcinol or epoxy for extremely wet conditions (wood gutters or signs). Now we use polyurethane for both. We are usually working with redwood, a very porous wood that is difficult to bond, and our joints are usually immediately nailed or screwed together. It's good to know that the glue is expanding and filling the joint.

Since polyurethane glues set up by reacting with moisture, the application temperature is not much of a factor, but there must be some moisture present or the glue won't set. Contrary to instinct, the manufacturers recommend that you moisten pieces of dry wood (under 3% moisture content) before you join them. This is especially important if you're bonding wood to metal or stone.

Melamine. We often use melamine sheets for custom closets and recently started using an acrylic glue called RooClear that bonds wood to nonporous surfaces like melamine, vinyl, stone, and metal. It isn't waterproof, but its water resistance is fine for closets and shelving. It cleans up with a wet rag. ■

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Sources of Supply Glue Manufacturers

AmBel Corp.
P.O. Box 819
Cottonport, LA 71327
800/779-3935
Excel Glue

Bordon's Professional Products Group
P.O. Box 16700
Columbus, OH 43216
800/848-9400
Elmer's, Elmer's Carpenter's Glue
Elmer's Weather-Tite Wood Glue

Franklin International
2020 Bruck St.
Columbus, OH 43207
614/443-0241
Tightbond, Tightbond II Wood Glue

Gorilla Group
122 Powers Ave.
Santa Barbara, CA 93103
805/963-2234
Gorilla Glue

Roo Industries
P.O. Box 13574
Salem, OR 97309
503/588-0788
RooClear