

Three Tough Glues for Outdoor Use

The right adhesive will keep joints tight and wood from rotting

BY JOHN MICHAEL DAVIS

In the early 1990s, I moved back to New Orleans after spending many years working as a carpenter in California. At that time, my knowledge of adhesives could be summed up in two words: yellow glue. Wherever I needed to join two pieces of trim—whether inside or outside—I'd squeeze out a dab of glue, nail the wood securely, and forget about it—only for a while, as it turned out. My cavalier approach to joinery may have been acceptable for the benign California environment, but not for the sweaty pressure cooker that New Orleans residents laughingly call a climate. After a year or two of seasonal movement, many of the joints I was so proud of had separated, giving moisture and rot a clear shot at vulnerable end grain.

Since then, I've experimented with more than a dozen adhesives marketed for exterior use, and I've regularly monitored my creations to see how they've held up. Although other glues have their advantages, I've settled on three that are particularly effective for my work and my location:

For simple, tight-fitted joints, I use polyurethane glue; for clamp-free assemblies and gap-filling, I use hot-melt polyurethane; and for extreme conditions, I use marine epoxy.

No glue is totally waterproof

As far as I can tell, old-time carpenters never used any kind of glue outside. They, however, had the advantage of building with old-growth lumber species that were rock stable and highly rot-resistant.

Gluing exterior joints gives the inferior grades of lumber that we have to work with nowadays a fighting chance by sealing the grain of the wood and keeping the joint from opening up to allow water to get to that grain.

But you can't rely on glue alone. Despite what some manufacturers might claim, no glue is 100% waterproof. Engineers tell me that the best glues are merely more water-resistant than their competitors. Given enough water and time, every glue joint will fail. So no matter what adhesive you choose, you always should design the joint to shed water, and you should keep it well painted.

I'm a working carpenter, not a scientist. I can't provide a technical article full of formulas and properties of each glue type. But I can offer a hands-on account of what works best for me in an unforgiving climate. If you're building in Pasadena, *yellow glue* might be the only two words you need to know.



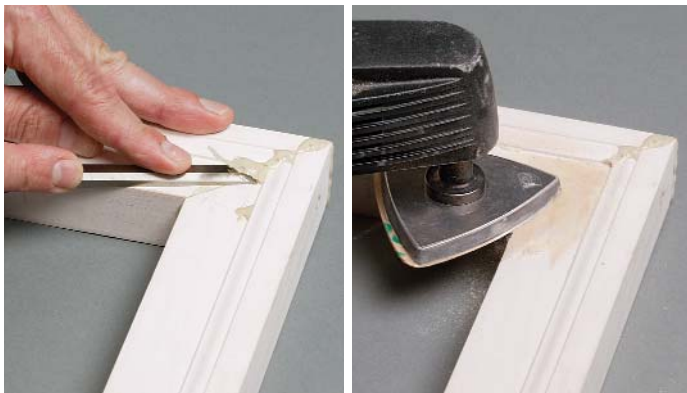
Dried polyurethane glue won't come off your hands until the skin cells flake off, so always wear gloves.

No mixing, no waiting. Although it's not the strongest exterior adhesive, its all-in-one-bottle convenience makes polyurethane glue the perfect choice when your time is limited.

POLYURETHANE GLUE IS CONVENIENT BUT MESSY

Dry wood won't bond.

Polyurethane glue requires moisture to cure. If the moisture content of the wood is below 10% or if the wood just looks dry, mist one surface (or wipe it with a damp cloth), then apply glue to the other surface.



Let dry overnight, then sand normally. Until it cures, it's a foamy mess, but after it has had time to dry, the squeeze-out from polyurethane glue can be trimmed with a sharp blade and then sanded smooth.

Polyurethane glues first appeared about 10 years ago. The Gorilla brand (Lutz File & Tool Co.; 800-966-3458; www.gorillagluce.com) is the most prominent player in the market, but I haven't found any difference between it and less-expensive choices, such as Probond (Elmer's Products Inc.; 800-848-9400; www.elmers.com). As a single-part glue that's ready to use right out of the bottle, polyurethane is the most user-friendly adhesive in my arsenal. When I'm trimming a cornice 2½ stories up, I particularly appreciate the convenience.

By the numbers, polyurethane is not quite as strong as a premium-quality type II carpenter's glue (sidebar p. 52), but it's much more water-resistant. Among its other advantages, polyurethane glue is easily sanded (photo bottom right); dries quickly, especially in heat and humidity; and bonds to wet wood.

Polyurethane requires moisture to cure, so dry wood must be wetted before glue-up (photo top left). As it's curing, the glue expands considerably (photo bottom left), but the foam has no structural strength. A high-strength bond requires tight, well-clamped joints.

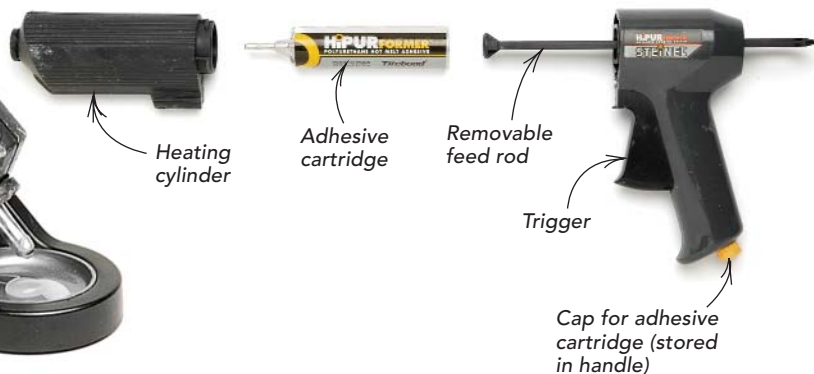
Despite its benefits, polyurethane is the messiest glue I've ever used. The amount of squeeze-out from the foaming action is unpredictable and all but impossible to clean up until it's cured. Any finished surfaces beneath the joint should be covered to protect them from drips. Latex gloves are a must; if you get wet glue on your skin, it's going to stay there for days.

Polyurethane is expensive. It costs at least twice as much as standard yellow glue, and the shelf life is much shorter, especially once the bottle has been opened. In fact, when I started using it, I kept having problems with it hardening in the bottle, often just a day or two after the bottle had been opened. These days, I buy the smallest bottles I can get and store open containers in the refrigerator; I keep them upside down to prevent the tips from clogging and also to make sure that I don't get them mixed up with the hot sauce.

HOT-MELT POLYURETHANE IS FAST-BONDING BUT NOT SANDABLE



Cordless base station generates heat for cordless glue gun.



Heating cylinder

Adhesive cartridge

Removable feed rod

Trigger

Cap for adhesive cartridge (stored in handle)



Fast-setting
(30 second) wood glue



Multipurpose glue
bonds a wide variety of materials.



Slower-setting
(60 second) wood glue

Polyurethane hot-melt adhesive systems, which have been used in industrial applications for years, only recently turned up on residential projects, but these systems already have carved out a niche. The HiPURformer system that I use (Franklin International; 800-347-4583; www.titebond.com) is like a beefed-up version of a hobbyist's hot-glue gun (photo above). Instead of glue sticks, this system uses proprietary adhesive cartridges that resemble tiny caulk tubes. Unlike typical glue guns, this one is cordless, in operation at least: Parking the gun in its corded base station for 10 to 15 minutes heats the glue enough to allow about 15 minutes' working time before the glue must be reheated.

As with standard polyurethane glue, the hot-melt variety is very strong and highly water-resistant. Unlike the bottled variety, there is no foam-out with hot-melt polyurethane, so it's much less messy. If any glue does squeeze out of a joint during assembly, it should be wiped off immediately because it won't sand clean once it dries. The

Type II yellow glue is strong but not so water-resistant



What we know as carpenter's glue is technically called polyvinyl acetate (PVA). Type I PVA, or standard yellow glue, is intended for interior applications. Type II, which is somewhat water-resistant, is intended for exterior use. For the most part, I've abandoned this product in favor

of polyurethane glue, which has much greater moisture-resistance. But that doesn't mean you have to.

I've never found any exterior adhesive easier to use than type II PVA. It offers the single-part convenience of polyurethane glue, but without the messy foaming



Permanent bond, almost instantly. A polyurethane hot-melt gun applies professional-strength glue that cures in as little as 30 seconds. A spring miter clamp (www.right-tool.com) draws the joint tight during the brief time it takes for the glue to cure.

viscosity is perfect: stiff enough to resist running, yet thin enough to work itself into the grain. Its extremely fast dry time—from 30 to 75 seconds, depending on the cartridge you choose—often eliminates the need for nails or heavy-duty clamps. Hot-melt poly also can fill small gaps without loss of strength, and it retains a high degree of flexibility after it cures.

The major downside to hot-melt polyurethane is the cost. The starter kit, which includes an applicator gun, a base station, three cartridges, and a carrying case, requires a \$100 investment. On top of that, the teeny replacement cartridges cost \$8 each plus shipping. I expect that local suppliers will eventually stock these items, but in my area, they're available only from major mail-order suppliers such as Woodworker's Supply (800-645-9292; www.woodworker.com) and Amazon.com (www.amazon.com). The manufacturer claims that a single cartridge will yield about 71 lin. ft. of a 1/8-in. bead of glue. That makes the material cost significantly higher than any other adhesive

I've used, including epoxy. But no mixing is involved, and pot life is not a concern as it is with epoxy. So when I've got a complicated assembly that involves lots of small parts (photo above), I've found that the hassle-free advantages offered by the hot-melt system more than make up for the expense.

The manufacturer claims that an unopened cartridge should have a one-year shelf life, as long as it's kept sealed in its protective foil pouch until ready for use. They also claim that a partially used cartridge should be good for as long as a month. In the beginning, I had trouble when I tried to reuse partial cartridges, but that was due to inexperience and poor housekeeping. Nowadays when I've completed a glue-up, I break the gun apart immediately (top photo, facing page), I wipe hot glue off the end of the feed rod, and with a glove or rag to protect me from the heat, I take the barrel and plop the cartridge out right-side up and allow it to cool in that position. This practice seems to keep the nozzle of the cartridge from clogging.

I've always been concerned that the cheap-looking plastic gun might not last long, but so far, it has done fine. For those times when I'm working on a ladder, I've made a crude holster (photo right) that isolates the hot barrel and ensures that I won't drop the expensive tool. I've also purchased a few replacement feed rods because it's only a matter of time before that flimsy plastic thing is broken.

Homemade holster for hot melt. To free his hands when working on a ladder, the author made a holster for his polyurethane glue gun using scrap fencing material.



action. Its viscosity is perfect for a non-gap-filling adhesive: It's thin enough for easy application, but thick enough to prevent most runs and drips. Any drips that might occur are wiped up easily with a wet rag.

Type II PVA is also incredibly strong stuff; its tensile

strength is actually equal to that of some types of epoxy. If you're not building in a harsh environment and if the joint you assemble is protected adequately from the weather and is well painted, type II PVA probably will work fine.

—J. M. D.



It starts as a liquid. One squirt each of the resin and hardener components is pumped into a clean container, and the epoxy is stirred vigorously for at least one minute.

MARINE EPOXY IS STRONG AND VERSATILE, BUT COMPLICATED

Mini-pumps make the mixing process almost idiotproof.

The epoxy recipe requires significantly more resin than hardener, but these dispensing pumps are calibrated to deliver the precise ratio in an equal number of squirts.



If time and money were never a consideration, I'd probably use epoxy for all my glue-ups. A top-grade marine epoxy such as the West System product that I use (Gougeon Brothers Inc.; 989-684-7286; www.westsystem.com) fashions the most weatherproof bond and the strongest adhesive strength possible.

With a variety of hardeners, fillers, and additives, marine epoxy is also the most versatile adhesive available today (photos above): Mix up the liquid components (resin and hardener), and you've got a bullet-proof adhesive for gap-free joints. Stir in a thickening additive, and it becomes the best gap-filling adhesive available. Choose different combinations of additives to enhance bond strength, flexibility, or sandability. Choose different hardeners to control curing speed.

Compared to the other adhesives I use, epoxy has a steeper learning curve, but it's not as difficult to use as some people assume. West System offers an excellent free technical manual, as well as an outstanding telephone support network.

In the large quantities I buy, epoxy requires a much larger investment than polyurethane alternatives, but it has a much longer shelf life, meaning I can stock up without fear of losing my investment. If I do run short, West System is readily available over the counter at many marine-supply stores in my area. If you're working in the desert, it's also available by mail order (Jamestown Distributors; 800-423-0030; www.jamestowndistributors.com).

The downside of epoxy is that you can't just reach for a bottle of glue or even a hot-glue gun and start sticking things together. Epoxy work requires a full kit of tools and supplies. I have several canvas riggers bags that are dedicated solely to epoxy work (photo bottom left, facing page). In addition to the materials themselves, these bags are stocked with mixing cups and stirrers, plastic putty knives, disposable paintbrushes—I mainly use ½-in.-wide plumbers' flux brushes—sol-



Wet the joint before thickening the epoxy. To ensure a strong bond, both sides of a joint are coated with liquid epoxy. Disposable flux brushes (available wherever plumbing supplies are sold) are ideal for this task.



Thickener improves workability and fills gaps. Adding a small amount of epoxy filler yields an all-purpose adhesive that won't run or sag. Adding larger amounts increases gap-filling ability without significantly affecting bonding strength.



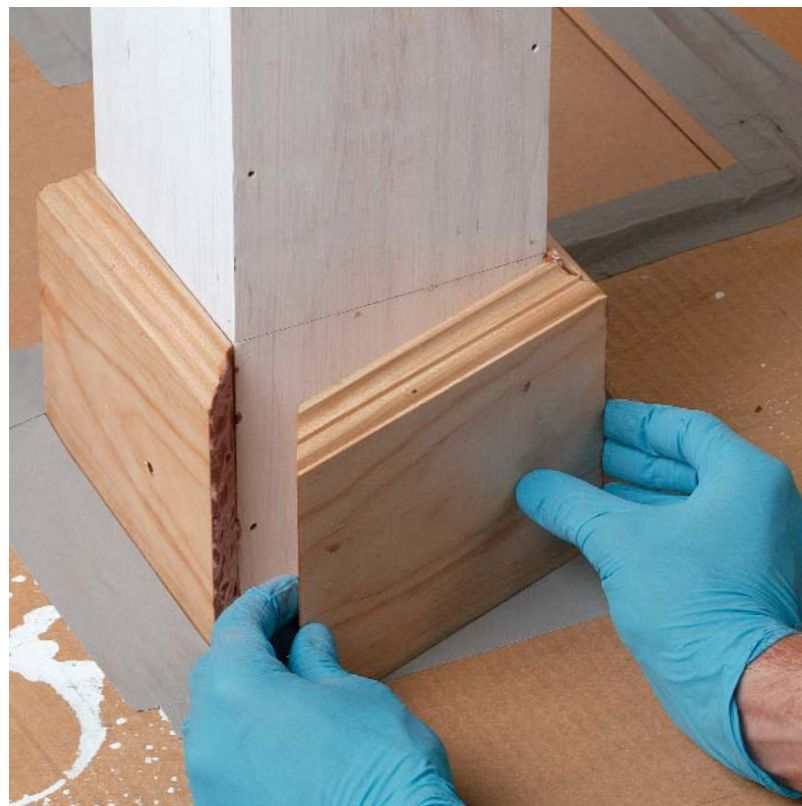
A dedicated epoxy kit. Epoxy work requires a myriad of materials and supplies. A canvas riggers bag (Duluth Trading Co.; 800-505-8888; www.duluthtrading.com) keeps all of it well organized and close at hand.



vents such as toluene and MEK, and plenty of rags and nitrile gloves (strong solvents will eat through the latex variety).

Even if you're fully outfitted, epoxy is tedious work. A mixed batch of epoxy has a limited working life. To avoid wasting material, I often make many small batches over the course of a day, then rush to complete as many glue-ups as possible before the adhesive sets up. □

John Michael Davis is a restoration carpenter in New Orleans. Photos by Scott Phillips.



A little squeeze-out is good.

To ensure the strongest bond, heavily coat the joint surfaces and squeeze out a small amount of excess adhesive during assembly. The excess can be scraped off with a putty knife or wiped smooth with a dry rag. After the epoxy is cured, a light sanding makes the glue line disappear completely.