Wood Glues:
The good, the bad, and the messy

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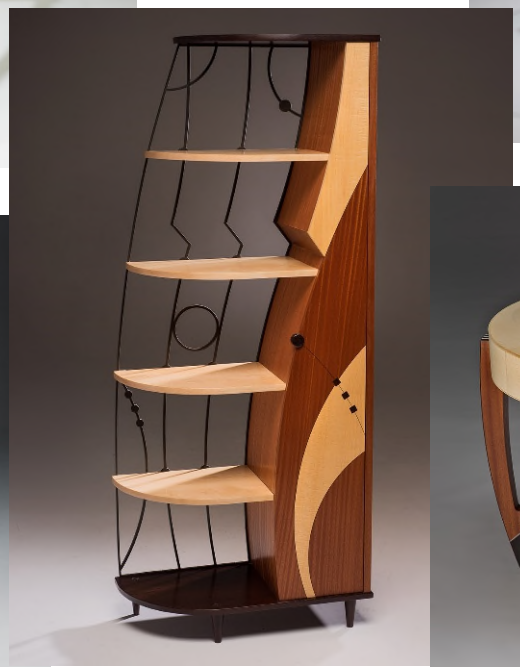

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Woodworking Glues

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Type	Examples	Characteristics	Pros	Cons
PVA –Poly Vinyl Acetate	Titebond, Elmers, “white glue”, “yellow glue”	1-part, ready to use, medium viscosity, Varying levels of water resistance	good open time	can creep over time, can dry out over time
Epoxy	Loctite, West Systems	2-part, liquid/liquid, high viscosity, mix by weight or volume	hard glue line, high strength, gap-filling	short open time
Urea formaldehyde	Unibond 800, Resorcinol, Pro Glue	2-part, liquid (resin or water)/powder, mix by weight, medium(ish) viscosity	hard glue line, long open time	Slow cure time, Toxicity issues
Polyurethane	Gorilla glue	1-part, ready to use, “water activated”, high(ish) viscosity	hard glue line	short(ish) open time, messy
Cyanoacrylate (“CA”)	Crazy Glue	1-part, ready to use, can be “accelerated”, available in very low, medium and high viscosities	Quick grab	Potentially low sheer strength
Hide Glue	Titebond, Old Brown Glue	1-part, either liquid or heat-liquified crystals, medium viscosity	Quick grab, reversible, no creep	Short open time
Hot Glue	“glue sticks”	1-part heat-activated solid sticks, very high viscosity	Easy, quick grab	Low strength


Titebond II
PREMIUM
Wood Glue
Titebond III
ULTIMATE
Wood Glue
Waterproof
GORILLA
GORILLA GLUE
DEVCON.home
5 Minute Epoxy
2P-10
activator
For use with:
Thin
Medium
Thick
DANGER:
Unibond800
H800D
PVA
Polyurethane
Epoxy
CA
Urea formaldehyde


UNIBOND
800
DEVCON
EPOXY
GORILLA
GLUE
TBIII
TBII

User's Guide to PVA Glue

We've sorted through the formulations to help you choose the right yellow glue for any situation

BY MICHAEL FORTUNE

Woodworking isn't cheap, but glue isn't the problem. That's because our most common adhesive, yellow glue, is inexpensive and works for many tasks. We all know it and love it, but a better understanding of how this glue works, and the wide array of formulations available, will help you get the most from it.

Officially called polyvinyl acetate (PVA), this adhesive came into wide use after World War II. Its predecessor, animal-hide glue, reigned for centuries, going back to the furniture in King Tut's tomb. PVA came with a number of advantages: longer shelf life, more working time, and no need for a heated pot. Also, PVAs could be formulated for different jobs and characteristics, such as water resistance and working time.

PVA glues will bond all types of joinery, many bent laminations, and most veneered panels. And they work well on almost all woods, including plywood and MDF. But I avoid using PVAs on most tropical woods, which contain oils that will interfere with the glue's bond.

PVAs prefer fresh surfaces and tight joints

To get the most strength from PVA glue, you need to know how it works. One critical factor is absorption. Suspended in water, the glue particles are absorbed into the surrounding wood fibers. When the moisture dissipates and the glue hardens, the two adjacent pieces of wood are bonded. That's why joints should be glued right after cutting, sanding, or planing them. If a week or more has passed, surface contaminants can rise from inside the wood and stop the water from penetrating.

The other key to a strong bond is having a very thin, continuous film of glue in the joint. PVA glue is not a good gap-filler. That means good mating surfaces, and powerful clamping force when possible. When you can't clamp the faces of a joint together directly—as is the case with dovetails and mortise-and-tenon joints, for example—the joinery must be snug to ensure success.

Apply the right amount

It doesn't really matter what you use to apply PVA glue, as long as you spread it evenly and thinly over the entire surface of the joint.

If all of the surfaces are freshly cut, scraped, or sanded, you don't have to spread PVA on both mating surfaces to get it to soak in. For many years I have applied glue to only one face of each joint—whether an edge joint, dovetail, mortise, or lamination—with unqualified success.

Miters are basically end grain, so glue tends to soak into their fibers, starving the joint. I've tried a variety of approaches to solve this problem. Some woodworkers recommend applying a thin, preliminary layer of glue, and letting it set up and

Conditions for success

PVAS LIKE FRESH WOOD ...

Proper prep. *If more than a day or two has passed since you cut the joints, you should scrape or sand the surfaces to remove oil and other contaminants that can rise from within to prevent absorption.*

Absorption test. *For full strength, a PVA glue needs to soak into the wood. You can test the joint's readiness with water. It beads on a surface that was cut a year ago (left), but soaks quickly into a freshly scraped area (right).*

... AND WARM TEMPS

Too cold. *PVAs only work down to certain temperatures, usually around 50°. If the wood, glue, or air is colder than that, the glue will turn chalky, rendering it useless.*

Photos, except where noted: Asa Christiana

Tools for applying a thin, even coat

Aside from absorption, the other key to achieving full strength with PVA glue is having a thin, continuous glueline.

THE FINGER METHOD

Apply glue straight from the bottle when possible. *If the joints are freshly cut, you only have to apply glue to one of the mating surfaces in each joint.*

The simplest spreader. *Fortune uses his finger to spread the glue on edge joints, bending it a bit to get more glue in the middle than along the edges.*

BRUSH GOES WHERE FINGERS CAN'T

Doctor it first. *Trim the bristles on cheap flux brushes to make them stiffer, and hammer the ferrule to keep the bristles from falling out.*

Reach into mortises. *Squeeze glue into the mortise, and then spread it with the brush. Glue is not necessary on tight-fitting tenons.*

Biscuits and miters, too. *The brush reaches into biscuit slots and spreads glue on small surfaces like these miter joints.*

SMALL STICKS FOR TIGHT SPACES

Dovetail trick. *Thin sticks reach between tails to apply a thin, even coat. You don't need glue on the pins, but a little on the shoulders doesn't hurt.*

NOTCHED SPREADER FOR BIG AREAS

Trowel is better than a roller. *A spreader with 3/32-in. V-notches will deposit the perfect amount of PVA glue for veneering and laminations.*

seal the grain before adding more glue, a process called "sizing" the joint. But I've experienced joint failure with this technique. That's because glue does not stick well to glue that has already skinned over and begun to cure. So instead I move more quickly than usual, touching up dry spots before assembling. For tips on glue-ups of all kinds, read my articles in *FWW* #234 ("Fundamentals: Gear up for glue-ups" and "Great Glue-Ups, Guaranteed") and #243 ("Tame Tricky Glue-Ups").

Working time: The clock is ticking

The most important attributes of any glue are open and closed assembly time. Open assembly time, or open time, is the amount of time you have between spreading the glue and assembling the joint (but not necessarily clamping it yet). Once the glue is spread, the water begins to evaporate and the glue starts to skin over.

Closed assembly time starts after the surfaces are touching, and tells you how long you have to get the pieces aligned and the clamps tightened before the glue starts to fully cure. Adding open and closed time together tells you the working time—how long you have to complete the glue-up without the joints starting to freeze in place.

A warmer, dryer shop speeds up the clock—Keep in mind that manufacturers' specs are based on an environment where the humidity is mid-range and the temperature is about 72°. In general, a colder or more humid shop will slow down the clock, and a warmer or dryer shop will speed it up.

Clamp time is pretty universal—Clamp time—how long you need to wait before you can remove the clamp pressure—varies based on wood species, humidity, and temperature. Clamps force surfaces and joints together, overcoming all sorts of resistance in the workpieces, from warping to unevenness. The moisture needs to evaporate and the glue has to harden, at least partially, before you can trust workpieces not to shift or move when clamp pressure is released.

Easy fixes for squeeze-out

PVA glues will show up under almost all finishes, so don't leave any behind. Here is how to make the job as easy as possible.

Don't apply too much. *On clamped joints like panels (left) and miters (above), you should see a small continuous line of squeeze-out. Big beads or drips will be harder to deal with afterward.*

Scrape it off in stages. *When the glue starts to gel, after half hour or so, remove as much as you can with a flexible scraper (top). After about an hour, remove the clamps and get the rest of the gummy squeeze-out with a cheap, steel-bladed paint scraper (bottom). Grind a fresh edge on each tool for best results, and ease the corners so they don't dig in.*

TIP

DON'T LEAVE ANY BEHIND

The big blotch was a gluey fingerprint. The haze in the corner came from removing glue with a wet rag, which is a no-no.

The right PVA for your project

Standard PVA glues are a shop staple, but there are many reasons to pay more or go online for a special formula.

STANDARD PVA IS CHEAP AND VERSATILE

These have a shorter working time and are less expensive than other varieties, but just as strong.

Price: $4-$5 for 16 oz.
Open time: 5-10 min.
Total working time: 15 min.
Chalk temperature: 50°-55°
Dried color: Translucent yellow

TYPE I OFFERS MORE OPEN TIME

Type I PVA glues are very water-resistant, so they work well for outdoor furniture. They also offer significantly longer working time.

Price: $7-$8 for 16 oz.
Open time: 10-15 min.
Total working time: 25 min.
Chalk temperature: 47°-55°
Dried color: Translucent brown

WHY PAY MORE FOR TYPE II?

These varieties cost roughly $1 more than standard PVA glues, but offer the same amount of working time and only moderate water-resistance.

Price: $5-$6 for 16 oz.
Open time: 5-10 min.
Total working time: 15 min.
Chalk temperature: 50°-55°
Dried color: Translucent orange

TITEBOND ORIGINAL WOOD GLUE | ELMER'S CARPENTER'S WOOD GLUE | TITEBOND III ULTIMATE WOOD GLUE | ELMER'S CARPENTER'S WOOD GLUE MAX | TITEBOND II PREMIUM WOOD GLUE | GORILLA WOOD GLUE

Got 15 minutes? *Standard PVA glue has a relatively short working time, but it's more than enough for many glue-ups. Always do a dry run to get everything set before spreading glue.*

More time makes a big difference. *For complicated glue-ups like this big lamination, a Type I PVA (here Titebond III) allows more time for spreading, positioning, and clamping.*

A few specialists are worth tracking down

You might have to go online to find these products, but they can be lifesavers.

SLOW AND CLEAR

Titebond Extend has the same 25 minutes of working time as Titebond III but a lighter glueline, making it better for whiter woods.

Price: $7.50 for 16 oz.
Open time: 15 min.
Total working time: 20-25 min.
Chalk temperature: 40°
Dried color: Translucent white

NO SQUEEZE-THROUGH

This PVA contains a filler that stops it from squeezing through porous veneers. It should be used for veneering only.

Price: $10.50/qt.
Open time: 15 min.
Total working time: 20 min.
Chalk temperature: 50°
Dried color: Brown

GREAT ON END GRAIN

This PVA is thicker so it won't soak as quickly into miter joints. It also grabs quickly, making it great for rub joints.

Price: $8 for 16 oz.
Open time: 35 min.
Total working time: 10-15 min.
Chalk temperature: 50°
Dried color: Translucent tan

TITEBOND EXTEND WOOD GLUE | TITEBOND COLD PRESS FOR VENEER | TITEBOND NO-RUN, NO-DRIP WOOD GLUE

Perfect for pine. *The glueline is dark (top) using Titebond III, but invisible (bottom) using Titebond Extend.*

Stir it up. *The filler in this PVA tends to settle. So stir it up with a mixing attachment before use.*

Miter master. *On end grain, this glue stays on the surface longer, giving you more time to complete the glue-up.*

If you take off the clamps too soon and a joint opens up, it might be too late to reclamp it without compromising the strength of the joint. Worse, you might not notice the gap, and then let the workpieces freeze permanently in that position. On the other hand, if you wait too long, you won't be able to remove all the glue squeeze-out before it hardens completely. Usually one hour to 90 minutes is about right.

Freshness matters, too

The shelf life of PVA ranges from one year to two, so for most hobbyists, the ubiquitous 16-oz. bottle is the right amount to buy. But if you plan to do laminations or veneering, you can safely buy a gallon or more without much going to waste. If there is no obvious manufacturing date on the bottle, write the date of purchase on it.

Shelf life is shortened if the glue is stored in extreme temperatures: higher than 85° or lower than 55°.

Special situations

I use PVAs most of the time, even for laminations and veneering. But it's not always appropriate. For laminations, I go with Titebond III or Titebond Extend, depending on the color of the wood. The extra open time is invaluable for spreading glue and applying clamps. However, if the lamination will be unsupported for more than 4 ft. and carry a lot of weight, I go with System 3 G2 epoxy, which is much more rigid and offers even more open time.

I also use PVA glues for veneering. If the wood is tight-grained, like cherry or maple, I'll use a normal PVA. But for open-grained, ring-porous woods like ash and oak, or for burls, which have small voids in them, I love Titebond Cold Press for Veneer glue.

However, if the veneer has a lot of patternwork or marquetry on it, PVA is a bad choice. The water in the glue will expand the veneer and distort the pattern. I also avoid PVA for areas over roughly 4 ft. by 4 ft., because I run out of working time. In these cases, I turn to Unibond 800. □

Michael Fortune is a contributing editor. Special Projects Editor Asa Christiana also contributed to this article.