Tip #36 Gluing Up

Next to the wood itself, glue is the most important building material in your shop. Though you rarely should see the glue in a well-built project, it has a lot to do with how professional that project looks . . . how well it performs...and how long it lasts.

A rugged, long-lasting glue bond depends on four primary factors:
1. The type of glue you use
2. The fit of your joint
3. The surface areas you're gluing together
4. The preparation of those surface areas

Choosing the right glue for the job

All glues work pretty much the same way, holding materials together by surface attraction. On wood, the glue grabs onto the wood grains like little fingers to bond the pieces together. But, this is where all similarities end.

There are dozens of glues available to the woodworker, each with different properties that make it more suitable for one application or another. For example, yellow aliphatic resin glues (the most common of the woodworker's glues) comes ready-to-use. Others, such as resorcinols or epoxies are multiple-part glues that must be mixed prior to application. Some are waterproof, while others will actually dissolve in water. Some take hours to dry while others dry in seconds.

When the time comes for you to select the glue you're going to use, you'll need to consider all the things that glue will have to do for you. Does it need to be waterproof? Can it be sanded and machined? Will it react with the finish you're using? Will it stain your wood? Is it strong enough? Will it dry too quickly to allow you enough open time for assembly?

Be sure the glue you're planning to use meets all your needs...then follow the manufacturer's directions explicitly to get the best bond. Even the most strongest, most tenacious glue won't hold if it's applied incorrectly.

Application

Follow the manufacturer's directions for application. Urea resin and resorcinol should be applied in a thin coat. Others, such as mastics, hot melt or contact cements are applied in thick beads or layers. Generally, glues are applied in one of two ways. Either to a single surface (single spreading) or to both surfaces (double spreading).

Figure 1. To get an even glue spread, apply glue to one surface, rub the two mating surfaces together in a circular motion, then check to be sure the glue has spread over the entire gluing surface.

But whether you're applying a thin or a thick coat . . . to one surface or to both...it is of the utmost importance that the application be even. The most common aliphatic resin or polyvinyl resin glues can be spread with a stick, your finger or a brush. Contact cements and some special veneer glues are best applied with a glue spreader -- a flat piece of metal or plastic with a serrated (or grooved) edge. The deeper the grooves, the thicker the glue coat. Again, follow the manufacturer's instructions for the best method.

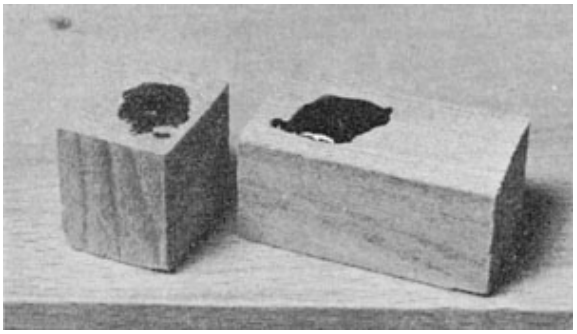

Figure 2. The same amount of glue was applied to two blocks and left wo sand for 5 minutes. Glue soaks into end grains (left) faster than flat grains (right).

When applying glue to a single surface, press and rub the two pieces together for an even spread, then allow the glue to soak into the adjoining surfaces for a strong bond (See Figure 1.)

The end grain of wood soaks up glue like a sponge (See Figure 2). Therefore, when gluing end grains, press and rub the pieces together, then take them apart and apply a little more glue before clamping.

When applying glue inside small holes, cracks, or hard-to-reach joints, try a glue injector (See Figure 3).

Figure 3. A glue injector is used for reaching small holes, cracks and tiny gluing surfaces.

Clamping

Some glues require immediate clamping after application. Yellow (aliphatic resin) and white (polyvinyl resin) woodworking glues should be clamped within minutes of application -- liquid hide glues are left to get tacky before clamping -- and contact cement, cyanoacrylates and quick-set epoxies require no clamping at all.

Clamping, like glue application, must be done correctly. Too much pressure on hard, closed-grain woods like maple and cherry can force the glue out of the joint causing a "starved joint" that's weak. Too little pressure can leave unsightly glue lines showing between your pieces. Always clamp down just enough to make your pieces fit together snugly without "starving" the joint.

Figure 4. A cabinet scraper can be used to knock off glue beads.

Before you apply any glue to your project, dry clamp the pieces together to be sure all the joints fit properly . . .poor-fitting joints will be weak, regardless of how much glue you use. Weak joints will also be the result when you use glue that has become "jellied", before or after clamping...or if the glue dries without bonding to both surfaces. To prevent this, follow the manufacturer's directions carefully.

What to do with squeeze-out -- It is almost inevitable that glue will get into places where it's not welcome. Whether it's squeezed from a joint or accidentally dribbled from the bottle or applicator, an un-

wanted, sticky bead of glue will challenge your patience. Don't give in to your first impulse to grab a dry or damp rag and wipe it up immediately. This approach merely spreads the glue around into an even larger area where it will have to be sanded out later. The best approach is to allow the glue to dry completely, then scrape it off cleanly with a Cabinet Scraper (See Figure 4).

Clamping and Curing Times

With the exception of cyanoacrylates, contact cements and quick-set epoxies, virtually all glues require pressure to achieve the best bond. Aliphatic & polyvinyl resins should be clamped for about an hour -- slow set epoxies, mastics and liquid hides, 2-4 hours -- and liquid hides and urea glues 12-16 hours.

The curing times of glues vary from one minute for hot-melts to 24 hours for practically every other commonly used glue. Most woodworkers would agree that virtually all glue-ups should be left for 24 hours before machining or applying a finish. These curing times, can, of course, be affected by temperature. The warmer it is, the faster the glue will set-up. Applying glue below the manufacturer's recommended temperature will prevent the glue from flowing into the wood grain properly, resulting in a weak joint. Also, glues that normally dry clear, could dry "milky" if the temperature is too low.

Joint reinforcement

A joint that's been properly glued-up will be stronger than the wood itself when dry. Still, glue joints should be reinforced whenever possible. Reinforcement adds to the gluing surface and strengthens the glue bond.

This reinforcement can be done in various ways by using biscuits, dowels, splines or glue blocks. Joints can also be made stronger by choosing specific types of joints such as dovetails, tongue-and-groove, mortise-and-tenon, finger-laps, half-laps and others are stronger than a standard butt joint for one reason -- they increase the amount of gluing surface in the joint substantially. Nails and screws help some, but they make better clamping devices than joint-strengtheners.

Some valuable gluing tips

1. Choose the right glue for the job (see table)
2. Never glue up damp or green wood
3. Prepare your mating surfaces properly. Be sure they're clean, dry and free of foreign materials.
4. Always spread glue evenly
5. Avoid applying too much or too little glue
6. Clamp glue joints snugly, but not too tightly
7. Some projects can be glued without clamps, but clamping is almost always recommended for the best bond
8. Check your glue's shelf life before use

Glue Type	Properties	Use For	Limitations/Comments
Interior Aliphatic Resin (Yellow Carpenter's Glue)	Liquid, ready-to-use. Very strong, tough, durable. Non-staining, bonds quickly. (1-hour clamping -- 24-hours curing).	Gluing wood-to-wood and plywood; veneering; gluing plastic laminates to wood; leather to leather and leather to wood.	Lacks water resistance. Cleans up with water. Keep from freezing in container.
Exterior Aliphatic Resin (Yellow Carpenter's Glue)	Liquid, ready-to-use. Very strong, tough, durable. Non-staining, bonds quickly. (1/2-hour clamping -- 24-hours curing).	Interior woodworking; outdoor projects; kitchen or bathroom projects; oily woods (i.e. teak)	Water resistant. Cleans up with water. Keep from freezing in container.
Polyvinyl Resin (White Carpenter's Glue)	Liquid, ready-to-use. Sets fast. Dries clear. Non-staining. (1-hour clamping -- 24-hours curing).	Gluing wood to wood and plywood; veneering; plastic laminates to wood; leather-to-leather and leather to wood.	Not good for high stress applications. Cleans up with water. Lacks water resistance.Will soften under heat.
Liquid Hide	Liquid, ready -to-use. Reliable. Very strong. Resists heat and mold. (12-16 hours clamping - 24 hours curing).	Gluing wood-to-wood and plywood; veneering; gluing plastic laminates to wood; leather to leather and leather to wood.	Not waterproof. Must wait before clamping
Hot Melt Glue	Must be heated. Sets-up fast. Waterproof. Flexible. No clamping required.	Mass production. Test glue-ups.	Not shock resistant. Will not take stains. Some cannot stand high temperatures.
Resorcinol Resin	2-Part. Must be mixed. Fully waterproof. Extremely strong. (1 to 2 hours clamping -- 24 hours curing).	Gluing wood-to-wood and plywood; veneering; gluing plastic laminates to wood; wood for marine and outdoor use.	Dries to dark color. Highly visible glue lines on light colored woods. Cleans up with water before drying. Uncured vapors and sanding dust can be toxic.
Urea Resin or Plastic Resin	Must be mixed. Water resistant (12-14 hours clamping -- 24-hours curing).	Gluing wood-to-wood and plywood; veneering; gluing plastic laminates to wood; wood for outdoor uses.	Not good for oily woods. Becomes brittle in poor-fitting joints. Uncured vapors and sanding dust can be toxic.
Powdered Casein	Must be mixed. Strong bond. Fairly water resistant. (3-hours clamping -- 24-hours curing).	Gluing wood-to-wood and plywood; veneering; gluing plastic laminates to wood; god with oily woods.	Not good for outdoor applications. Will stain some woods.
Quick-Set Epoxy	Must be mixed. Dries fast. Requires little clamping pressure. Resists moisture and chemicals. (5-minutes clamping -- 24-hours curing).	Gluing wood to non-wood materials; gluing oily woods; bonding non-porous materials; bathroom and kitchen projects.	Not resistant to heat. Cleans up with vinegar. Uncured vapors and sanding dust can be toxic.

Glue Type	Properties	Use For	Limitations/Comments
Slow-Set Epoxy	Must be mixed. Dries fast. Requires little clamping pressure. Resists moisture and chemicals. (2 to 4 hours clamping -- 24-hours curing).	Gluing wood to non-wood materials; gluing oily woods; bonding non-porous materials; bathroom and kitchen projects; bent laminations; architectural structures	Not resistant to heat. Cleans up with vinegar. Uncured vapors and sanding dust can be toxic.
Contact Cement	Liquid. Ready-to-use. Water resistant. Adheres immediately on contact without clamping. (24-hours curing)	Veneering; gluing plastic laminates to wood; leather-to-leather and leather to wood; rubber to wood.	Pieces cannot be shifted once contact is made. Clean-up with acetone. Flammable. Toxic vapors..
Cyanoacrylates (Super-glues)	Liquid, Ready-to-use. Water resistant. Almost instant bonding. (1-minute clamping -- 2 to 4 hours curing)	Securing inlays; small repairs; bonding nonporous materials	Bonds to skin. Cleans up with acetone or special solvents. Harmful vapors. Use with adequate ventilation.
Mastics (Elastomers -- Structural adhesives)	Ready-to-use. Comes in caulk-type tubes.	Securing paneling; structural components (non load bearing); trim; flooring; wainscoting	Cleans up with mineral spirits. Use with adequate ventilation