Your Glue?

We take six types to the breaking point, shattering some common wisdom in the process

BY MARK SCHOFIELD

Unless they confine their woodworking to knockdown furniture, all woodworkers rely on glue. As a result, there are dozens of types of glue and masses of competing brands all proclaiming their superiority.

To help make sense of it all, *Fine Woodworking* ran a test with three main objectives. The first was to compare six common types of woodworking glue; the second was to see if the type of wood might affect the bonding strength of the different glues; the third was to determine how tolerant the glues are to poorly cut joints.

The results were revealing. Some older glues performed superbly, while a newer glue was less than impressive. The wood type does make a difference, but don't believe the stories that say all dense tropical woods are hard to glue. And, while glue starvation seems to be a myth, so does the gap-filling ability of certain glues.

Selecting glues, woods, and gaps

To see whether an open-grained wood bonds differently from a tight-grained one, we chose white oak and hard maple. Dense tropical woods have a reputation as being difficult to glue. We intended to use teak, but the lumberyard owner suggested ipé, as he had heard many complaints about glue failure with this wood.

We chose a traditional interior polyvinyl acetate (PVA) yellow glue represented by Elmer's carpenter's glue; a newer PVA glue with a Type I waterproof rating in the form of Titebond III; two types of hide glue, a room-temperature version by Old Brown Glue and traditional granules that must be mixed with water and heated; a two-part, slow-set epoxy from System Three; and Gorilla Glue's polyurethane.

If a joint is sloppy, will the glue fill the gaps? Conversely, if the joint is so tight it has to be hammered home, will it be starved of glue? Does a perfectly fitting joint produce the strongest glue bond? To answer these questions, we tested bridle joints with three types of fit: tight, snug, and loose.

Bridle joints: First make 'em, then break 'em

We settled on a bridle joint, also known as an open mortise-and-tenon joint, because it has no mechanical strength and instead relies entirely on the glue bond. It also was easy to adjust the width of the tenon to change the fit of the joint to test each glue's gap-filling ability.

Precise milling—To lessen the impact of a rogue result, John White, *Fine Woodworking's* shop manager, made three samples of each joint for a total of 162 samples.

To keep wood variables to a minimum, he cut

THE TYPES WE TESTED

We picked six brands to represent the spectrum of common woodworking glues, including two types of PVA glue, a polyurethane glue, an epoxy, and two types of hide glue.

PVA glue | Type I PVA glue | Polyurethane glue | Slow-set epoxy | Hot hide glue granules | Liquid hide glue

WHICH GLUE IS THE STRONGEST?

The chart shows the glues ranked by the average force it took to break their joints. To give a guide to each glue's relative performance, its average joint strength is shown as a percentage of that of the strongest glue. We rated Type I PVA as the best overall, with interior yellow glue (PVA) as the best value.

GLUE	JOINT FIT	MAPLE	OAK	IPÉ	AVG. JOINT STRENGTH (LB.)	JOINT STRENGTH AS % OF TYPE I PVA GLUE	COMMENTS
BEST OVERALL — Type I PVA glue (waterproof)	Tight	1842	1843	2554	2024	100%	This proved to be a good all-around glue with no weakness in any of the woods or joint fits. Combined with its ease of use and moderate cost, this glue wins the best overall label.
	Snug	1700	1822	2733			
	Loose	1593	1603	2525			
Slow-set epoxy	Tight	1690	1908	2425	1994	99%	The betting before the test was that this glue would be the strongest. It came in a close second, but given its high cost and longer preparation time, this was disappointing. In particular, it didn't prove to be the clear choice for gap-filling.
	Snug	1680	1832	2712			
	Loose	1635	1557	2503			
BEST VALUE — PVA glue	Tight	1737	1769	2696	1924	95%	Many woodworkers will be relieved to see that their first-choice glue performed so well. Amazingly, it produced the strongest bonds on tight and snug ipé joints. This glue is the best value.
	Snug	1543	1684	2842			
	Loose	1474	1537	2036			
Liquid hide glue	Tight	1468	1850	1716	1595	79%	Not as strong as epoxy or the PVAs, this glue still gave a very credible performance. It performed particularly well on oak, but was relatively less strong on ipé.
	Snug	1516	1699	1779			
	Loose	1436	1521	1374			
Hot hide glue	Tight	1488	1847	1769	1531	76%	Proponents of hide glue have never claimed that it is as strong as PVA, but instead promote its reversibility and compatibility with stains and finish. From this test, it appears that hot hide glue is only a little weaker than yellow glue and is stronger on oak.
	Snug	1412	1765	1459			
	Loose	1485	1618	936			
Polyurethane	Tight	1414	1491	1875	1164	58%	The surprise of the test was this glue's poor showing. The snug joints were poor, and the loose joints were unacceptable. Polyurethane may be a tough finish, but it isn't a tough glue.
	Snug	1336	1055	1455			
	Loose	564	571	716			

THE WEAKEST LINK

The joints failed in three different ways: With the strongest glues, particularly in maple and oak, the failure was usually 100% in the wood. With the weakest glues, particularly in the strongest wood, ipé, the failure was 100% along the glueline, with the wood fibers remaining intact. But the majority of the joints showed some combination of both types of failure.

GLUE FAILURE | WOOD FAILURE | COMBINATION