A Working Guide to Glues

Choosing the right adhesive for the job might mean more than grabbing that old bottle on the shelf

BY WILLIAM TANDY YOUNG

I worked wood for years before realizing that I knew virtually nothing,about the glues I was depending on to hold my joints together. At the time my attention was focused on things like lumber, tools and machines. I took glue for granted, assuming that it would always work and keep joints tightly bonded for years to come. After experiencing a few nightmare glue-ups and hearing from customers that some of my furniture wasn't holding up as well as it should, I finally realized that to improve as a woodworker I had to learn something about glue.

Once I started to understand more about glue, I became aware of more design possibilities and expanded my range of work. As I learned which adhesives were best for particular jobs, the overall quality of my work also improved. Choosing the right glue helps glue-ups proceed smoothly and successfully. It also ensures that your work will have the structural integrity and durability it needs to survive in the world.

How much do you need to know about glue to choose the best one for your work and become a better woodworker? You should know more than you can learn from ads, sales brochures and container labels, which often contain inaccurate or misleading information, but you certainly don't have to become a polymer chemist. What you really need is some useful, well-organized information on adhesives.

The principles of choosing glue

There is no such thing as a miracle adhesive with magical properties that will tackle any task. When I

Glue or adhesive?

Is there a difference between a glue and an adhesive? Technically, there is. Strictly speaking, glues are based on polymers, such as starch and protein, that are derived from natural sources, such as rice flour or cattle hides. Adhesives are based on polymers that are chemically synthesized, like PVA resins found in white and yellow glues. However, most people use the terms glue and adhesive interchangeably on a casual basis, as we do in this article. In general, you won't encounter a formally observed distinction between glues and adhesives unless you read literature of a highly technical nature, such as engineering standards.

choose glue for a job, I try to take as many things into account as I can, without spending a lot of time dwelling on details and pondering different glues. This article is designed to help you choose glue in just such a fashion, so that your work flow won't be disrupted by endless head scratching.

All glues are carefully formulated products with specific properties, and they perform well only if the conditions in your workshop, such as temperature and humidity, are favorable. Gluing well is a matter of knowing how to get the best performance from the glues you use while also knowing their limitations. By keeping an assortment of glues at your disposal and knowing what to expect from different ones, you can choose the adhesive that best suits your needs in any given situation.

It is also important to keep in mind the condition of your work. Glue joints that are skillfully Crafted and prepared usually can be bonded successfully with one of several types of glues. Glue joints that are poorly Crafted are difficult to bond regardless of the type of glue you use. Gluing surfaces not only have to mate properly, but they also must be free of contaminants (such as oil or grime) and have a moisture content that's appropriate for the work being done and the glue being used.

Although woodworkers have a tendency to seek the strongest glue on the market, glue shouldn't be chosen on the basis of strength alone. While some glues are stronger than others, all of the adhesives discussed in this article—except for wheat or rice paste, hot-melt glue and contact cement—will produce a bond that is "stronger than the wood itself," which means that if a glue joint is stressed to the breaking point, the wood will usually fail before the glue does. For many jobs, all you need to know is that the glue you're using is stronger than your wood. With this in mind, try to choose adhesives based on properties other than strength (such as open assembly time or rigidity), according to the demands of the job.

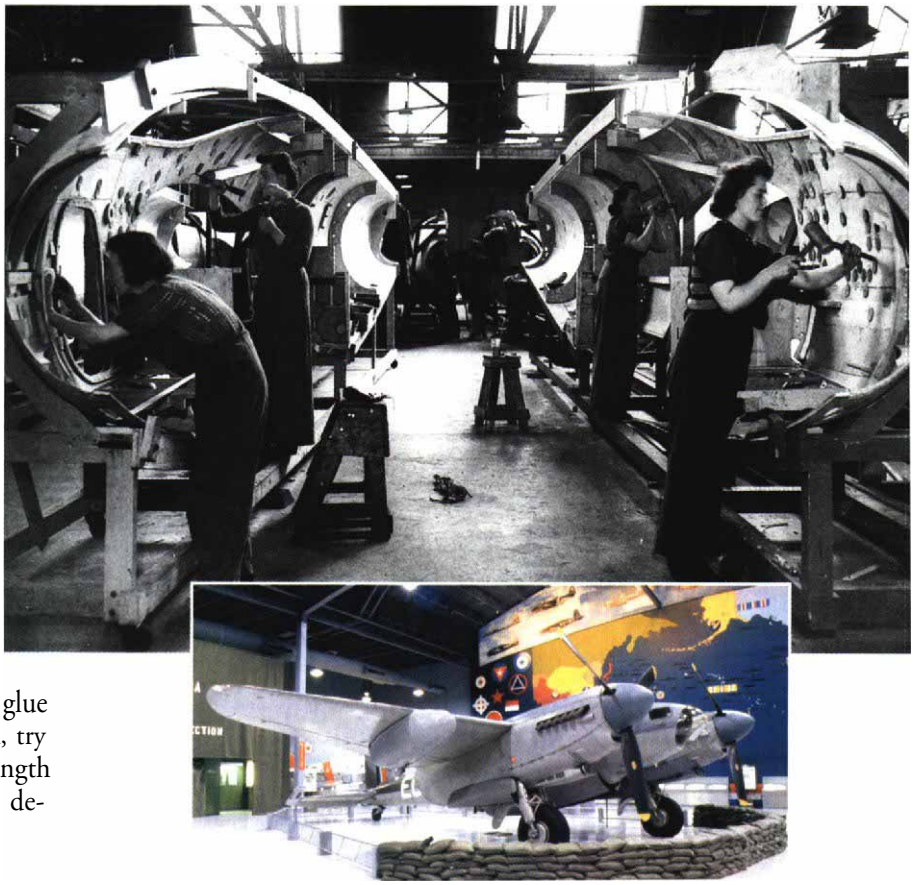
Comparing the properties of adhesives

As you compare the properties of the adhesives listed in the charts on the next few pages, it may be helpful to evaluate different glues by grouping them into the following categories:

Natural vs. synthetic—Most glues that are derived from natural sources, like wheat paste or hide glue, are reversible, meaning they can be reactivated with water after they harden. Adhesives that are based on synthetic polymers, such as urea resin glue, polyvinyl acetate (PVA) or epoxy, generally can't be reversed after they cure, but they may have other properties that are superior to those of natural glues.

Water based vs. non-water based—Even though water-based adhesives are easy to handle, in general, they can add quite a bit of moisture to glued work. There often are instances when this added moisture is unwelcome. If you're face-laminating an unstable wood like beech or sycamore, for example, you're better off using an adhesive that contains less water. Of the glues in this article, most natural and nonreactive synthetic glues (except solvent-based contact cement and hot melt) are high in moisture content. Of the reactive synthetic glues, only a few resorcinols and ureas contain a significant amount of moisture.

Toxic vs. nontoxic—It's common to encounter a trade-off between toxicity and performance: The glues that offer higher levels of performance and power are often more hazardous to use than those that are not as powerful. This is especially true when comparing different variations of the same kind of glue. For example, high-fume urea resin glue (which emits powerful formaldehyde vapors) usually outperforms low-fume urea resin glue, which is safer and less noxious to use.



The "wooden wonder." *This British-designed World War II plane, called the Mosquito Bomber, was constructed mostly from wood and bonded with urea formaldehyde glue, which hadjust been developed.*

Using the charts in this article

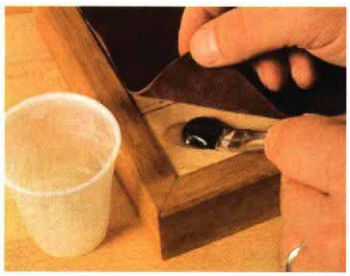
Here's an example of how I might choose the best glue for a job using the charts on the next few pages. Suppose I need to glue down a metal inlay. Many woodworkers use epoxy for this type of work, but it's not a good choice because scraping or sanding metal inlay flush with the surrounding wood usually creates a lot of heat. Most epoxy has low heat resistance and softens as the inlay is being scraped, which can cause the inlay to lift out of its recess.

As you look at the properties of polyurethane glue, you'll notice that it has high heat resistance, long open and closed assembly times and is very easy to clean up with hand tools after it hardens—all of which make it an ideal adhesive for metal inlay. If you want to use a natural glue instead, you'll notice that fish glue's long

Photos: Facing page: Michael Pekovich; this page, top: courtesy of Imperial War Museum; bottom: courtesy of EAA Photo

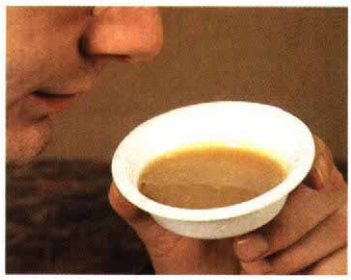
NATURAL GLUES

Glues in this group are made of natural ingredients and cure by moisture loss, heat loss or a combination of both. Casein glue is a slight exception, as it is made of milk curd but accomplishes some of its curing by chemical reaction.



RICE AND WHEAT PASTES

Commercial preblended instant formulas require no cooking and are easy to use. They are best for bonding porous, pliant materials (such as paper, cloth and leather) to wood.



FISH GLUE

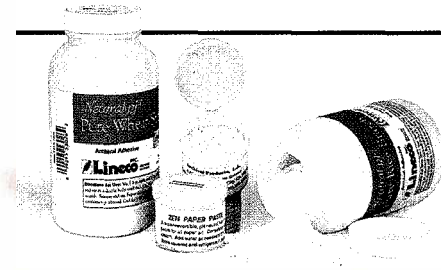
Handy and versatile, without any fishy odor. A good choice for light-duty, wood-to-wood bonding and repairs. Fish glue also bonds natural nonwood materials (such as cloth, metal and bone) to wood.

HIDE GLUE

Unmatched for its combination of versatility, compatibility and strength. Hide glue is much easier to use than most people think. It is used for edge- and face-gluing, assembling joints, veneering, repairing and bonding natural nonwood materials to wood. It also can be used as a sizing, a wood conditioner and a grain filler.

CASEIN GLUE

Casein glue bonds oily tropical woods well and is used for structural lamination, as well as panel and flush door pressing. Its coarse, grainy, mixed consistency may produce glue lines with a thick appearance.



	Rice and Wheat Pastes
Handling	Mix with water and cook before use (if required); add preservative to prevent mold growth; can be tinted with dyes or inks to match wood color
Open assembly time	15 to 20 minutes
Clamp time	3 to 6 hours
Cleanup	**Tools and hands:** use warm water **Glued work:** pare off hardened excess with chisel
Cured working qualities	Easily cut with hand tools when cured; compatible with stains and finishes; reversible with water
Structural properties	Not strong enough for most structural wood-to-wood bonding
Endurance properties	Subject to bacterial and fungal attack unless preservative is added
Health and safety	Nontoxic

assembly time and high heat resistance make it preferable to hide glue for metal inlay.

Water resistant or waterproof

Over the last few years, the distinction between water resistant and waterproof has become hazy. Inaccurate and misleading claims have been made about the water resistance of various glues. Vague alternative terms like weatherproof and weather resistant have also come into use. To be rated properly for water resistance, a glue must be tested in accordance with established technical standards. There are various moisture-resistance tests for adhesives, such as intermittent exposure to water, continual immersion and boiling. On a practical basis, here's how the most widely used moisture-resistant woodworking adhesives stack up.

Type-II PVA glues are moisture resistant and will withstand intermittent exposure, but they aren't recommended for work that will be fully immersed in water. Polyurethane and urea resin glues are extremely water resistant and are better able to withstand periods of immersion. Resorcinol resin glues and marine epoxies are considered waterproof and can withstand prolonged periods of immersion. Of these last two, epoxy is a better all-around choice because it can be used as a sealant and coating as well as an adhesive, allowing wood to be shielded from moisture to keep it from cracking, splitting or rotting. When choosing glue for a project that will really put glue to the test (like a boat), review your glue's technical specifications carefully to see that it's up to the task.

Altering, combining and customizing glues

You don't always have to use glue right out of the bottle, the way it was formulated. Many adhesives can be altered and customized

Photos: Matthew Teague, except where noted

Fish Glue	Hide Glue	Casein Glue
Ready to use; can be tinted with dyes or inks; refrigerate to extend shelf life	Mix granules with water and heat to 140°F before use; add water if glue thickens; add urea or salt to retard gel rate; add glycerin to plasticize cured glue line; can be tinted to match wood color; premixed, ready-to-use liquid hide glues also available	Usually requires careful two-step mixing with water to prevent lumping
15 to 30 minutes, depending on working temperature	1 to 10 minutes, depending on gram strength, condition of glue and working temperature	15 to 45 minutes, depending on working temperature
2 to 4 hours, depending on setting temperature	10 to 90 minutes, depending on gram strength, condition of glue and setting temperature; some glue-ups, like hammer veneering, don't require clamping	2 to 8 hours, depending on setting temperature
Tools and hands: use warm water **Glued work:** use warm water, either when glue is wet or hardened	**Tools and hands:** use warm water **Glued work:** peel off excess once it gets to rubbery state, then swab area with warm water; remove hardened excess with hot water and heat gun	**Tools and hands:** use soap and warm water **Glued work:** remove hardened excess with power sander
Cures hard; machines and sands well; compatible with stains and finishes; reversible with water	Cures very hard; machines and sands well	Cures hard, sands readily, but dulls cutting tools rapidly; permanently stains the surface of high-tannin woods such as oak and mahogany
Good strength, rigidity and creep resistance; not as strong as hide glue	Excellent strength, rigidity and creep resistance; thick glue layers can be brittle	Excellent strength, rigidity and durability; highly creep resistant; has some gap-filling ability
Excellent heat and solvent resistance; poor water resistance; glue layers desiccate, become brittle with age	Surprisingly resistant to moderate heat and moisture levels, despite reversibility; good solvent resistance and shock resistance; glue layers may desiccate, become brittle with age	High-grade formulas have good moisture and solvent resistance; low-grade formulas have lower moisture resistance; can be subject to bacterial and fungal attack unless preservative is added
Nontoxic	Nontoxic	Dry glue powder can irritate respiratory tract during measuring and mixing

to better meet the needs of the job. For example, I often retard the cure rate of hide glue by adding a gel depressant, such as granular urea. (It can be added in amounts up to about 30% of the weight of the glue granules.) I also regularly tint epoxy and other adhesives with specialty adhesive colorants or aniline dyes and inks to match wood color. Some adhesives, such as epoxy, can be altered and customized to a great extent; other products, like polyurethane glue, shouldn't be altered at all.

Also, glues can be combined to create mixtures that have enhanced properties and performance. For example, I sometimes add a small amount of fish glue to hide glue as a retarder, or some ethylene vinyl acetate (EVA) to PVA as a plasticizer. One of my favorite combinations is a mixture of PVA and urea resin glue. Lots of different results can be obtained by varying the types of glue you mix together and the proportions in which you mix them. You can experiment to find out what works well by making small batches and testing them on scrap wood.

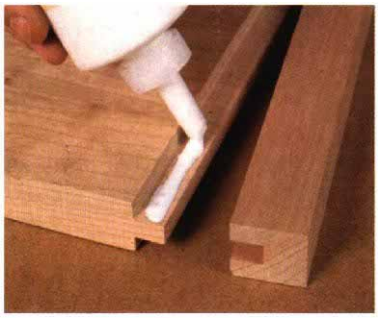
To minimize clamp time, the hardening of some glues can be accelerated. For instance, urea resin glue and resorcinol will harden more quickly if heated to 80°F or 90°F while your work is clamped up. Joints assembled with hide glue can be chilled during clamping to make the glue gel faster. You can also use alcohol, baking soda or an accelerator to speed up cyanoacrylate glue. With polyurethane glue, lightly moistening the gluing surfaces before applying glue promotes faster hardening.

Myths and facts on filling gaps

Many glue manufacturers claim that their products will fill gaps. Whether the products really will or not depends on what sort of gaps you have to fill. Most of the glues featured in this article can

NONREACTIVE SYNTHETIC GLUES

The glues in this group are formulated from synthetic ingredients but cure much like natural glues—by releasing water, solvent or heat.



ETHYLENE VINYL ACETATE GLUE (EVA)

EVAs are very versatile and useful for specialty jobs that rigid glues can't handle. EVA is a good choice for bonding melamine-faced cabinet parts and for gluing cross-grain solid-wood assemblies where wood movement is likely. It's also handy for consolidating wormy or damaged wood.

POLYVINYL ACETATE GLUE (PVA)

Both white and yellow glues are PVAs. "Aliphatic resin" is a meaningless marketing term coined to help identify yellow glue as a distinct product. The two types are low grade (craft, school or hobby glue) and high grade (professional/industrial glue). PVAs are useful for a wide assortment of tasks: edge-and face-gluing, bonding structural joints, bonding plastic laminates, as well as for biscuit joinery.

CONTACT CEMENT

Some of the new water-based cements now available are fast drying and give high performance. Applying significant pressure to the work with clamps or a press greatly increases the strength of the bond. Contact cement is best used for bonding plastic laminates, for installing decorative overlays and for gluing up other rigid sheet materials.

HOT-MELT GLUE

Hot-melt glues and guns are available with high, low or dual melt-point temperatures. High-melt systems are widely available and are commonly used; low-melt systems are safer and less likely than high-melt systems to harm the materials being glued. Hot melt is useful for edge-banding sheet stock and for the rapid assembly of jigs and other temporary fixtures.

	EVA Glue
Handling	Ready to use; can be tinted with dyes or inks to match wood color
Open assembly time	10 to 15 minutes, depending on glue formula and working temperature
Clamp time	30 to 120 minutes, depending on glue formula and setting temperature
Cleanup	**Tools and hands:** use warm water **Glued work:** clean wet excess with warm water; chisel or scrape when partially set; or scrape or machine after hardening
Cured working qualities	Soft and pliable when cured; can be worked with hand tools; machines well; sands moderately well; reversible with water and/or heat; compatible with some stains and finishes
Structural properties	Cures with acceptable strength but with little rigidity and creep resistance (which is an asset when gluing assemblies that incorporate seasonal wood movement)
Endurance properties	Low resistance to heat and moisture; fair resistance to acids and solvents; fair shock resistance; will gradually degrade if exposed to intense UV light
Health and safety	Generally safe to use; some formulas are fairly acidic and can be harsh on skin; clean glue from skin before it hardens

be used to fill small cosmetic gaps, with varying degrees of success. But of the glues discussed here, only epoxy will fill gaps in joints with true structural strength.

Other glues just aren't up to the job of structural gap filling. For instance, PVA and hide glue lose water and shrink in volume as they cure. Two-part urea resin and cyanoacrylate become brittle when they are made to cure in thick bond layers. And regular hot melt simply lacks the adhesive power needed for structural gap filling. Polyurethane glue does expand into gaps as it cures, filling them with a spongy foam, but this foam has little or no structural strength. In most cases, the best way to fill a gap in a bad joint is to shim the joint with wood or veneer.

Work safe, work smart

Many woodworkers think that adhesives are benign and treat them casually, which is a mistake. Avoid skin contact whenever possible when using synthetic adhesives, and be cautious with glue, both when it's in liquid form and after it hardens. Often it's the smaller, less obvious hazards of glue that can cause the most trouble. For instance, thin glue can come streaming out of an ap-

PVA Glue	Contact Cement	Hot-Melt Glue
Ready to use; high in moisture content and can be thinned with water up to 5% to extend working time; can also be tinted with dyes or inks; premixed urea resin glue can be added to strengthen mix	Ready to use; can be thinned before application	Must be applied hot, according to product specifications; low-melt glue shouldn't be used in a high-melt gun
5 to 30 minutes, depending on glue formula and working temperature	Must dry prior to assembly; open drying times: 10 to 20 minutes (water based), 2 to 15 minutes (solvent based), depending on working temperature and humidity; aerosol cements usually have shorter assembly times	5 to 30 seconds, longer if parts are preheated
20 to 90 minutes, depending on glue formula and setting temperature	Briefly clamping or pressing (for 1 to 5 minutes at room temperature) will increase bond strength	No clamping needed; press parts together as firmly and quickly as possible
Tools and hands: use warm water **Glued work:** clean wet excess with warm water; chisel or scrape when partially set; or scrape or machine after hardening	**Tools and hands:** use soap and water for water-based cement; solvent for solvent based **Glued work:** clean excess with solvent or machine it off after assembly	**Glued work:** clean excess with scraper, naphtha or a chisel (soften glue with heat gun) or machine it off after hardening
All PVAs resist stains and finishes and can be softened or reactivated with heat up to several days after application; low grade is fairly soft and workable when cured, can be cut with hand tools, machines well but loads paper when sanded and is reversible with water for 2 to 6 weeks after curing; high grade cures hard, machines and sands well and is not reversible with water after curing	Soft and elastic when cured; can be machined and sanded but will gum up cutting edges and sandpaper; may be softened or dissolved by solvents in stains and finishes	Can be cut with hand tools when hardened; machines and sands adequately but can gum up cutting edges and sandpaper; reversible with heat; may be softened or dissolved by some stains and finishes
Low grade has adequate strength, low rigidity and creep resistance; high grade has much greater strength, rigidity, creep resistance and durability; top-grade PVAs have creep resistance comparable to some epoxies	Does not produce bonds with permanent structural strength but develops increased strength when pressed into thin layer; no rigidity; little or no creep resistance	Does not have enough strength to produce permanent structural bonds; develops increased strength when pressed into thin layer; limited rigidity and creep resistance; has some gap-filling ability but with limited strength
Low grade has low to moderate resistance to heat, moisture, acids and solvents (acetone, etc.) and good shock resistance; high grade has much greater resistance to heat, moisture, acids and solvents and very good shock resistance; type-II PVAs have good to excellent moisture resistance; all will gradually degrade if exposed to intense UV light	Good to excellent heat resistance once pressed into thin layer and cured; poor to fair moisture resistance if subjected to prolonged exposure; poor solvent resistance	Good moisture resistance; no heat resistance; poor solvent resistance; poor to fair shock resistance; will gradually degrade if exposed to intense UV light
Generally safe to use, but some formulas are fairly acidic and can be harsh on skin; clean glue from skin before it hardens	Water based is generally safe to use; solvent based contains elements that are health and environmental hazards; fumes are toxic and explosive	Heated glue guns and glue can burn skin; using low-melt glue in high-melt gun may cause glue to ooze out of the infeed port and burn your hand

plicator tip and douse your face if you squeeze the bottle too vigorously. Hardened excess glue on the surface of your work can fracture and fly about like shards of glass as you scrape it off. Gloves, safety glasses and a respirator are all standard gluing gear in my shop.

Some adhesives have short shelf lives and are sensitive to heat, light and humidity. Others may keep well for years in less-than-ideal conditions. Buy sensitive glues like urea resin and cyanoacrylate in small amounts and check them for freshness by looking for dates of manufacture on containers. Once you buy any glue, store it as well as you can so that it will be in good shape when you need it. Otherwise, you'll end up regularly disposing of spoiled glue and replacing it with fresh material.

Different glues have different life expectancies

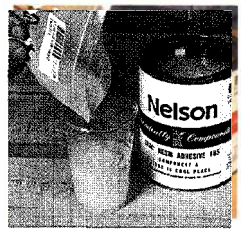
While you want your best work to be long lasting, a glued assembly such as a jig may only have a useful life of a day or so. There's no point in carefully bonding the parts of a jig together with epoxy when a few quick dabs of hot melt will do. Similarly, if you expect a plastic laminate kitchen countertop to last only 5 to 10 years,

REACTIVE SYNTHETIC GLUES

The glues in this group are formulated from synthetic components and cure primarily by chemical reaction.

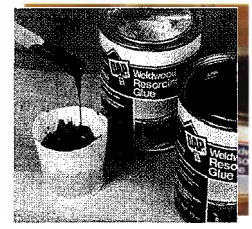
	Urea Resin Glue	Resorcinol	Epoxy
Handling	One-part glue: mix powder with water; two-part glue: mix liquid resin and powdered catalyst; either glue can be mixed slightly off ratio; can be tinted with dyes or inks; can be mixed with PVA	Mix liquid resin and powdered catalyst; shouldn't be thinned; can be tinted black with dye or ink	Mix resin and hardener; can be mixed slightly off ratio; can be thickened with various additives; can be tinted with specialty epoxy tints
Open assembly time	15 to 35 minutes, depending on glue formula, mix ratio, dispersal of glue volume and working temperature	12 to 25 minutes, depending on glue formula, mix ratio, dispersal of glue volume and working temperature	2 minutes to 2 or more hours, depending on epoxy formula, mix ratio, dispersal of epoxy volume and working temperature
Clamp time	4 to 10 hours, depending on glue formula and setting temperature	5 to 10 hours, depending on glue formula and setting temperature	4 minutes to 48 hours, depending on epoxy formula and setting temperature
Cleanup	**Tools and hands:** use soap and warm water (don't use hot water—it will gum up the excess glue) **Glued work:** machine or scrape off hardened excess	**Tools and hands:** use soap and warm water (don't use hot water—it will gum up the excess glue) **Glued work:** machine or scrape off hardened excess	**Tools and hands:** Use hand cleaner, vinegar, alcohol or acetone **Glued work:** machine or scrape off hardened excess
Cured working qualities	Cures very hard; hand-scrapes, machines and sands well but dulls cutting edges quickly; resists stains and finishes	Cures hard to very hard, depending on formula; hand-scrapes, machines and sands well but dulls cutting edges; resists stains and finishes	Cures hard but can be cut with hand tools if warmed with a heat gun; scrapes, machines and sands well; doesn't dull cutting edges as quickly as urea resin glue; resists stains and finishes
Structural properties	Very strong, rigid and creep resistant; good durability; two-part systems (liquid resin and powdered catalyst) have moderate gap-filling ability	Very strong, rigid and creep resistant; slightly less rigid, more durable than urea resin glues when cured	Excellent combination of strength, rigidity, creep resistance and durability
Endurance properties	Fair to good shock resistance; good heat resistance; excellent solvent resistance, depending on formula. Low-grade formulas may craze, become brittle with age (especially in thick bond layers)	Waterproof; excellent heat and solvent resistance; good to excellent shock resistance	Waterproof; may gradually degrade if exposed to UV light; can be weakened, broken down by some solvents; fair to adequate heat resistance; superior shock resistance
Health and safety	Contains furfuryl alcohol and formaldehyde; squeeze-out can harden into sharp edges; cured glue can fracture into dangerous shards when scraped or machined; airborne dust can be hazardous	Contains phenols and formaldehyde; squeeze-out can harden into sharp edges; cured glue can fracture into dangerous shards when scraped or machined; airborne dust can be hazardous	Contains compounds that are respiratory tract and skin irritants; can cause acute irritation with repeated use

UREA RESIN GLUE



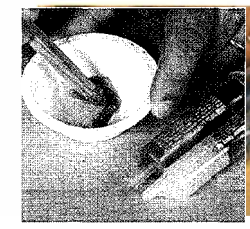
High water resistance makes this a good choice for exterior wood bonding, bent laminating, veneering and pressing plastic laminate. In general, one-part ureas are easier and less hazardous to use than two-part ureas. But two-part ureas have better performance and cured properties.

RESORCINOL



Among the best choice for waterproof exterior and marine wood bonding, but the dark red color creates highly visible glue lines in light-colored woods. It is a fine choice for bent laminations or veneering.

EPOXY



Properties can vary greatly from one brand to the next—choose according to the job at hand. Best uses include waterproof exterior and marine wood bonding, bent laminating and veneering. Epoxy is also used for sealing, topcoating, casting and embedding hardware.

Polyurethane	Cyanoacrylate
Ready to use; don't alter glue; work can be moistened before applications to speed hardening; to prolong shelf life, squeeze air out of bottle, keep tightly capped and keep away from moisture and humidity	Ready to use; separate accelerator can be used to speed hardening, but for best results, it's not recommended
10 to 40 minutes, depending on glue formula, moisture content of workpieces, working temperature and humidity	30 seconds to 5 minutes, depending on glue formula, volume of glue applied, moisture content of workpieces, working temperature and humidity
45 minutes to 10 hours, depending on glue formula, moisture content of workpieces, setting temperature and humidity	2 seconds to 4 hours, depending on glue formula, volume of glue in joint, moisture content of workpieces, working temperature and humidity and use of accelerator
Tools and hands: use hand cleaner, alcohol or acetone **Glued work:** pare, scrape or machine hardened excess	**Tools and hands:** swab with acetone or debonder **Glued work:** machine or scrape off hardened excess
Cured foamout is soft and cuts easily with hand tools; scrapes, machines and sands well; compatible with stains and finishes	Cures hard to very hard, depending on formula; scrapes adequately but can be brittle; machines and sands well; resists stains and finishes
Good strength, rigidity, creep resistance and durability; fills gaps but only with foamed glue, which has no structural strength	Very strong and rigid, with fair durability, when used to bond small surface areas
Excellent moisture, solvent and shock resistance; superior heat resistance; not completely waterproof, as advertised	Good moisture and heat resistance; poor solvent resistance and shock resistance; yellows, may degrade with exposure to UV light
Contains di-isocyanate compounds that can acutely irritate skin and respiratory tract	Bonds human skin to itself and workpieces (accidentally bonded skin will release with debonder); fumes of most formulas are noxious and can affect skin and respiratory tract; glue squirted in eyes causes permanent vision damage

POLYURETHANE

Polyurethane is useful for water-resistant exterior wood bonding, laminating, veneering and for bonding nonwood materials, but it's a poor choice for biscuit joinery. It develops full strength only in well-fit, tightly clamped joints. New formulas cure faster than the older ones.

CYANOACRYLATE

Widely sold as all-purpose glue but is best used for rapidly bonding small wood and nonwood workpieces. Not as effective when bonding highly porous materials or large surface areas. Cyanoacrylates are sensitive to joint surface conditions like pH, moisture and grime.

there's no need to bond the laminate to the substrate with urea resin glue when contact cement should hold up sufficiently for that length of time.

As you choose glues for various jobs, it's important to consider how long you expect your work to last once it has been glued up. Unfortunately, there is no such thing as a truly permanent glue joint. Even perfectly Crafted and prepared joints made from superb materials and bonded with the strongest adhesives eventually fail. The concept that all joints eventually fail is bothersome to many woodworkers, especially since the adhesives that are rated as being stronger than wood are commonly called "permanent" adhesives—an unfortunate misnomer. This doesn't mean that your best work is going to fall apart in your lifetime, though. Your glue joints may endure for centuries, as other joints have.

Joint failure occurs for a number of reasons—abuse, glue deterioration from ultraviolet light, humidity or just the inevitable seasonal movement of wood. There are, however, things you can do to combat failure. To begin with, design and make the best joints you can. Then bond them together with the highest-quality glue you can get. When you're choosing an adhesive, whenever possible consider using a reversible glue, such as hide glue, rather than a nonreversible synthetic adhesive, such as PVA or urea resin glue.

Reversible glue is easy to remove from the gluing surfaces of failed joints using hot water. This allows joints to be properly cleaned before being reglued. If older joints can't be disassembled, dry, brittle hide glue inside joints can be reconstituted by injecting water with a syringe. On the other hand, it's much harder to clean synthetic adhesives like PVA or urea resin glue without altering or damaging the gluing surfaces—they can't be reactivated with water or other agents.

I'm convinced that the best way to ensure the longevity of your work is to bond it with a reversible glue whenever possible. After all, the reason why so many antiques have survived for hundreds of years is not because the glue joints never failed; it's because those glue joints were easy to repair when they did fail. □

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