All About Thinning Finishes

You don't need a chemistry degree to understand which solvents work with each kind of finish

BY JEFF JEWITT

How much time do you need?

One of the reasons for adding solvents is to control the rate at which the finish dries. This control is desirable for any method of application. When spraying a vertical surface, too slow a drying time may cause the finish to run, while a finish that evaporates too fast may leave an orange-peel appearance. When brushing, the right solvent can maintain a wet edge yet not attract dust by taking forever to dry. In the charts, the drying time of a solvent is rated as slow if it acts as a retarder (slows down the drying time). A rating of medium means that the solvent doesn't significantly change the drying properties of a finish, although the drying time of any thinned finish will speed up somewhat. And fast solvents do just that: speed up the drying time. The actual speed will vary based on application methods and environmental conditions.

***The slow* and the fast.** *Mineral spirits and naphtha were simultaneously brushed onto a board. Three minutes later, the naphtha had almost evaporated, while the mineral spirits was still wet.*

Photo, this page (background): Scott Phillips

It's a rare woodworker who is not intimidated by the cans of solvents lining the shelves in a hardware store. The multisyllabic names are reminders of less-than-productive school chemistry classes, while the dire health warnings are equally off-putting. The temptation is to grab something vaguely familiar, hope that it is compatible with the finish you are using, and leave as fast as possible.

But it need not be like this. I will guide you through the world of solvents—the good, the bad and the unpronounceable. I will show you which solvents are appropriate for water- or oil-based finishes, shellacs or solvent lacquers, whether you are spraying, brushing or wiping on the finish.

A very quick word about chemistry

Almost all finishing materials contain liquids that are volatile, meaning they evaporate during the drying and curing of the finish. These liquids, called solvents and thinners, make the finishing material less viscous for easier application.

Chemists distinguish between solvents and thinners: Solvents dissolve or break up finishing resins and reduce viscosity, while thinners merely reduce the viscosity. Dissolving shellac flakes with denatured alcohol is the only occasion a woodworker is likely to use a solvent as such. For this article I use the terms solvent and thinner interchangeably, as many woodworkers do.

I have divided finishes into four families, roughly in order of the toxicity of their solvents: water-based, shellac, oil-based and solvent-based lacquer. For each family I cover the range of compatible thinners and the points to consider when choosing one.

Thinning water-based finishes takes more than water

The widespread use of water-based finishes is rather new, and in many cases the chemistry behind it is still being fine-tuned. Many woodworkers are aware of water-based versions of lacquer and polyurethane, but water-based varieties of varnish, gel stain and Danish-oil finishes are also available. While the novice might assume they would be the easiest finishes to thin because they are made up mostly of water, their chemical complexity makes them the least-forgiving finishes to tamper with.

You can get into serious problems if you add too much water. Usually 5% to 10% is fine for viscosity adjustments (to make it

WATER-BASED FINISHES

Among the finishing families, the evaporation rate of water-based finishes is the most difficult to adjust. They typically require a specific retarder, while plain water should only be added sparingly.

THINNER	DRYING TIME	COMMENTS
Retarder (water, glycol ether and additives)	Medium	Used to combat lap marks when brushing or orange peel when spraying. Follow the advice of the finish manufacturer carefully and use only the recommended retarder; otherwise, the chemical balance may be upset, rendering the product useless.
Water	Fast	To avoid upsetting the chemical balance, never add more than 10% water. If the product is too thick to atomize properly for spraying or if it streaks when brushing or wiping, thinning may be required. If the humidity is 90% or more, don't add water because it will act as a retarder and lead to excessive drying time.

A *brushed finish should go down without leaving lap marks.* *If you have trouble keeping a wet edge because the finish dries too quickly, which may happen in warm, dry weather, add a small amount of retarder to a water-based finish.*

Photos, except where noted: Mark Schofield; this page (top): Erika Marks

SHELLAC

Most woodworkers use only denatured alcohol to thin shellac, but several other solvents offer slower evaporation rates for brushing shellac or spraying it on a hot and dry day.

THINNER	DRYING TIME	COMMENTS
Pure gum spirit turpentine	Slow	For an effective retarder, add a teaspoon to about 4 oz. of liquid shellac.
Isobutanol	Medium/slow	Acts as a retarder but is difficult to find and has a very strong odor.
Isopropanol	Medium/slow	A suitable retarder when brushing shellac. Auto-parts stores sell it as gas-line antifreeze. Check the label to make sure that isopropanol is the only component. An alternative source for 99% pure isopropanol is www.chemistrystore.com.
Denatured alcohol	Medium/fast	Will slightly speed up drying time and improve the flow and atomization of heavy (3-lb. cut) shellac. It is the main solvent and thinner for shellac. Specific-brand formulas with different additives are available.
Methanol	Very fast	Although no longer available to the consumer market, professional finishers can still obtain the product. Speeds up drying times considerably.

spray or brush better), but more than that can disrupt the chemical makeup of the finish, which will have a negative effect on how the finish forms a film.

For a finish that dries too fast, a better alternative is to use a retarder. A retarder is typically used in hot, dry conditions. It helps you avoid orange peel by giving the finish more time to flow out and achieve a level surface. Be sure to use a retarder recommended by the finish manufacturer. The wrong retarder can upset the chemical balance of the finish;

When spraying a water-based finish, before adding water or a retarder, try to compensate for viscosity by changing to a larger needle/nozzle and making adjustments to your finishing environment or technique. Spray thinner coats when it's hot and humid, and arrange fans so that air blows gently across the finish as it dries.

Shellac is compatible with more than alcohol

Shellac is one of the oldest finishes in woodworking. No other finish can match the depth and clarity it brings to wood, but its lack of durability makes it unsuitable for surfaces subject to heavy use.

Shellac is available in dried flakes that are dissolved in alcohol or in ready-to-use liquid form. For both premixed shellac and shellac flakes, the best all-around thinner is denatured alcohol.

As shellac is sprayed, the solvents evaporate, cooling the surface of the workpiece. If the temperature falls below the dew

More *brushing, less rushing.* *The addition of turpentine slows the drying time of shellac, allowing you to keep a wet edge while brushing a large surface. You can even go back and tip off the surface.*

Photos, this page (top) and facing page: Erika Marks

THINNER	DRYING TIME	COMMENTS
Kerosene	Slow	Used in small amounts, kerosene is very effective as a retarder when brushing on an oil finish in dry weather.
Odorless mineral spirits	Slow	Mineral spirits becomes odorless mineral spirits by removing the aromatics. This product is commonly available at art-supply stores as well as hardware stores. Acts as a retarder.
Mineral spirits/ paint thinner	Medium	Use to change the viscosity without impacting the drying time significantly. Good for adding to a finish that will be brushed. Can also be used to thin gel varnishes that dry too fast and streak.
Pure gum spirit turpentine	Medium	No longer used much in commercial finishing due to the variable quality. The rosin content is not reported on the can, but a batch with high rosin may leave a soft finish. The high price relative to paint thinner is another drawback.
Xylene	Medium/fast	Best used for thinning conversion varnishes.
VM&P naphtha	Fast	Varnish maker's and painter's naphtha is the best solvent for fast evaporation. Use it when spraying in cold weather, on vertical surfaces or when using varnish or polyurethane as a wipe-on finish.
Toluene	Fast	Dries slightly faster than VM&P naphtha but has a very strong odor. For consumers, naphtha is a better choice.
Acetone (ketone)	Fast	Add to a thick varnish when spraying a single, heavy coat, to avoid runs and sags. When applied over a previous coat, may cause wrinkling of the finish.

OIL-BASED FINISHES

The petroleum industry has produced a large range of solvents compatible with oil-based finishes. These range from slow-evaporating kerosene to fast-evaporating ketone.

point, moisture condenses on the surface, causing a cloudy appearance in the finish known as blushing. If you are spraying shellac in hot, humid weather, you need to slow down the drying rate to avoid blushing. Suitable retarders include butanol or isopropanol, the latter being found at auto-parts stores as a gas-line antifreeze. Do not use rubbing alcohol; even though the active ingredient is isopropanol, the other 30% to 50% is water, which will not improve your finish. Glycol ether such as lacquer retarder also slows the drying time of shellac, but the finish may remain soft and be more easily damaged.

A retarder is also useful when you are brushing shellac on a large surface, such as a tabletop. If the shellac dries too quickly, you risk applying the finish to an area adja-

To thin or not to thin. *Some finishes, particularly oil-based ones, come with a warning not to thin the contents. In finishes advertised as having a "clean-air formula," any addition of solvent would place the finish above the emissions limit agreed with the government.*

LACQUER

Besides the generic medium-speed lacquer thinner, slow and fast formulations are also available. The evaporation of lacquer can be slowed by adding a retarder or accelerated by adding acetone.

THINNER	DRYING TIME	COMMENTS
Lacquer retarder	Slow	It's best not to mix retarder directly with a brushing lacquer. Instead, add 1 oz. to 2 oz. of retarder to 1 qt. standard (medium) lacquer thinner; then add small amounts of the mix to a finish.
Slow lacquer thinner	Medium/slow	Most lacquer thinner available in hardware or woodworking stores has a medium-speed evaporation rate. The best place to find slow- or fast-evaporating lacquer thinner is at an auto-finishing supply store. If in doubt about their suitability, an alternative is to add lacquer retarder to a medium-speed thinner. This will produce a slow-evaporating thinner needed on hot days to avoid blushing and when spraying a horizontal surface to improve flow-out.
Medium lacquer thinner	Medium	
Fast lacquer thinner	Fast	Fast-evaporating thinner is recommended for cool weather and when spraying vertical surfaces. This can be made by adding acetone to a medium-speed lacquer thinner.
Acetone	Very fast	Acetone evaporates so fast that it is prone to leave a finish blushed unless the humidity is very low. Woodworkers in Arizona spraying during the summer may get away with using it.

cent to one where the finish has already started to set up, preventing the edges of the brush strokes from blending together. Adding a teaspoon of pure gum spirit turpentine to approximately 4 oz. of liquid shellac acts as a retarder. With a retarder added, the first line of finish will remain wet until the second line can be brushed on and the two can blend together.

Hydrocarbon solvents and oil-based finishes offer the most choices

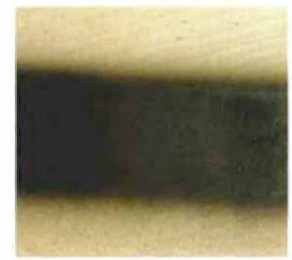
Linseed, tung and Danish oils, oil-based varnishes and polyurethanes, oil paint and waxes make up the largest family of finishes and are the products most woodworkers think of when it comes to finishing. These finishes are thinned with two groups of solvents: hydrocarbons and terpenes.

Hydrocarbons (kerosene, mineral spirits, naphtha, paint thinner, toluene, xylene) are derived from petroleum oil.

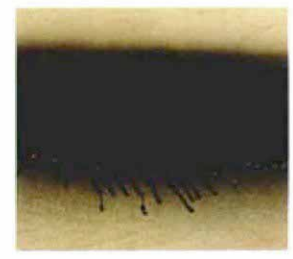
Terpenes (turpentine, d-limonene) are derived from plants, with turpentine coming from pine trees and d-limonene from citrus trees. These two solvents are nearly always interchangeable with hydrocarbons. D-limonene has a pretty distinctive citrus smell that makes it more pleasant to work with, but it's hard to find. Its toxicity and flammability are about equal to mineral spirits, but the evaporation rate is slower.

Because of the high cost of extracting turpentine, this classic thinner has all but been replaced with mineral spirits. A drawback to using turpentine is the rosin content, which can vary depending on what

Adjust your lacquer for every occasion. *When spraying a vertical surface, it is important that the finish dries before it has a chance to sag and run.*



See *how it runs.* *The top bar of black lacquer had fast-evaporating acetone added. The lower bar was thinned with slow-evaporating lacquer thinner, giving the finish time to run before it could dry.*



Photos, this page (top) and facing page: Erika Marks

trees were processed in each particular batch. If the rosin content is high in the can you are using, the finish will remain soft; however, you will not find a measurement on the side of the can.

The two best thinners to use are mineral spirits and naphtha. Mineral spirits is best for maintaining a wet edge when brushing, while naphtha is better for spraying or wiping. Kerosene can be added in very small amounts (6 to 12 drops per pint) to oil-based stains to slow them down for easier application on large surfaces.

The right retarder makes lacquers easier to use

Solvent-based lacquer finishes have traditionally been the mainstays of commercial furniture makers and professional finishers. They are not as popular with hobbyists because of their reputation for needing expensive spraying facilities.

Solvent-based lacquer is thinned with lacquer thinner, a blend of ketones, alcohol and hydrocarbons. By adjusting the ratio of these components, manufacturers can tailor a thinner to be fast, medium or slow evaporating. Most woodworking finish suppliers stock only medium-speed thinner. The best place to find fast- and slow-evaporating lacquer thinners is an auto-finishing store. Fast-evaporating thinner prevents sagging on vertical surfaces, but if you can't find it, use acetone. Unless you are spraying in very low humidity, however, an acetone-thinned finish is susceptible to blushing because of its very fast evaporation rate.

Slow-evaporating thinners allow the finish to flow out and level better on horizontal surfaces. For this reason, slow-evaporating thinner is sometimes called "warm-weather" thinner. An alternative to slow-evaporating thinner is to add lacquer retarder (glycol ether) to a standard lacquer thinner, then add the mix to a finish.

For more information on the dangers of a particular solvent, and to find out what type of respirator to use, check its material safety data sheet (MSDS) available on line at siri.uvm.edu/msds. Another useful source of information is National Institute for Occupational Safety and Health (NIOSH): www.cdc.gov/niosh. □

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The right glove for each solvent

When using solvents, many woodworkers protect their hands with disposable latex or vinyl gloves. Inevitably a particular solvent seems to eat through the glove as if it wasn't there, resulting in chapped skin or even chemical burns.

Shown here are disposable and reusable gloves made of latex, nitrile, vinyl and neoprene. Less important than what the glove is made of is to remember that disposable gloves should be used only for splash protection, such as when blending a finish or brushing one on. For more sustained contact, such as when using a solvent to clean a spray gun or wiping on a finish, use heavy-duty gloves. Unfortunately, no one glove is suitable for all solvents.

Specific information on how different glove materials stand up to various solvents can be found at Mapa Glove's web site (www.mapaglove.com) as well as other manufacturers' sites.

LATEX

Used *primarily for mixing dye powders and applying water-based dyes. The main advantage of disposable latex gloves is their flexibility and feel, which make them good for doing detailed work. Neither type of glove shown will stand up to oils or hydrocarbon derivatives (mineral spirits, naphtha, paint thinner or kerosene).*

NITRILE

Nitrile gloves offer protection from almost any solvent a woodworker is likely to use. The only exception is a solvent that contains a ketone such as acetone. The disposable version offers more protection than the other two types of disposable gloves, but they are harder to find and are more expensive.

VINYL

Okay for powdered dyes and dyes in a water solution. Disposable vinyl gloves are the cheapest protection available, but they tear more easily than disposable latex ones. Avoid contact with ketones and aromatic solvents. The thicker gloves offer good protection but at the expense of a clumsy feel.

NEOPRENE

This is another excellent choice for regular contact with most solvents, except lacquer thinner, where nitrile is a better choice.