

beating the elements

A guide for building outdoor projects that last

Sure, wood can rot. And Mother Nature works hard to help the process along. (Check out her arsenal at *right*.) But if you like to build outdoor furniture, arbors, and an occasional deck—and who doesn't—you may want to put the brakes on the decay process by choosing your building materials wisely.

With that in mind, we pulled together all of the right stuff for combating nature's onslaught, including the best exterior woods, glues, hardware, and finishes. As a bonus, we included several time-tested tips. Used together, you should be able to create that handsome Adirondack chair or potting bench, and have it last for years, possibly decades, come rain or come shine.



Weather-tough rules for outdoor projects

Wouldn't it be great if you could build an outdoor project and have it last as long as the trees it came from? You can come close—by providing a regimen of protective care, and by faithfully practicing these seven outdoor project “golden rules”:

- Rule 1:** Select wood, adhesive, hardware, and finish that can withstand the abuse of outdoor conditions.
- Rule 2:** Keep wood materials dry and cool during construction.
- Rule 3:** Glue and screw parts together.

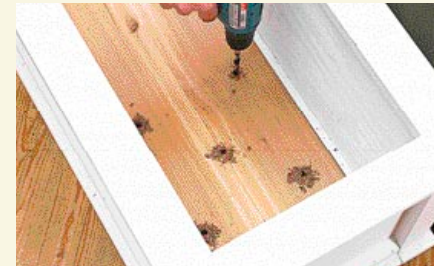
- Rule 4:** Sand all wood surfaces for finishing.
- Rule 5:** Protect all wood with finish or paint.
- Rule 6:** Keep the project from standing in or holding dirt or water.
- Rule 7:** Maintain the finish as needed before problems become serious.

Building Tips

Simple, sensible tricks are often what it takes to extend a project's life. For starters, build outdoor furniture, structures, and other pieces to shed water. Doing this limits water's tendency to penetrate exposed surfaces while providing a means of escape. For surfaces that catch water, such as the planter box bottom shown *below*, drill weep holes to give excess water a way out. Space them 5–6" apart. Pay particular attention to joints located in horizontal surfaces—regardless of your finish choice. You'll want to seal the entire joint. The trick is to prevent dampness from settling into a joint's seams and other

openings, leading to wood rot, mildew, and weakened joints.

Another good idea: Seal end grain as shown *below*. End grain, by far, is the most vulnerable point of penetration on a piece of wood. It acts like a soda straw, readily sucking up moisture and holding it. To minimize this problem, seal exposed end grain with extra coats of finish. If painting your project, seal end grain with a water-based paintable adhesive sealant that contains elastomeric polymers (see “Adhesives that bond, seal, and fill,” *page 63*). This strategy bears particular importance when protecting plywood edges.



Drill weep holes through the bottom of planter boxes to drain off standing water.



Press an effective clear adhesive sealant into end grain. Here we use an elastomeric.

9 mighty woods for outdoor projects



Although no wood is completely immune from rotting and insect damage, some resist decay better than others. Because of naturally occurring preservatives in heartwood, insects and fungi find the woods listed in the chart on the *next page* undesirable. Each choice has its advantages and disadvantages, so decide which wood best suits your building needs and budget.

American softwoods, the traditional choice

The three most widely available and suitable exterior lumber choices, not treated with chemical preservatives, include *Western red cedar*, *redwood*, and *cypress*. Your geographic location will determine the availability and cost of these materials. Redwood, for example, is widely available and used in

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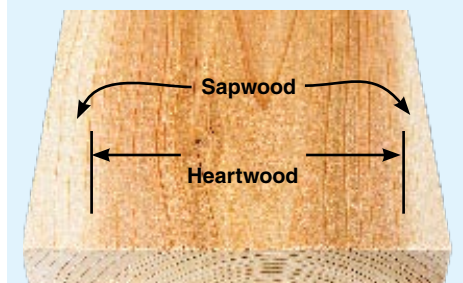
Softwood savvy

Tip 1: Avoid sapwood. It's generally not decay resistant. Almost always it appears as the lighter material in a given piece of lumber, as shown *below top*.

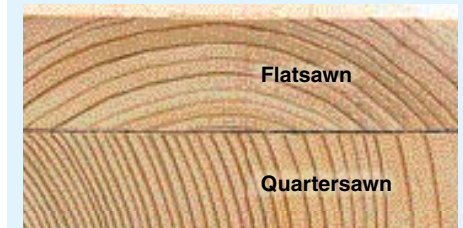
Tip 2: If possible, use quartersawn lumber to resist warping and improve dimensional stability. Quartersawn wood expands and contracts across its width only about half as much as flatsawn lumber. (See the examples *below middle*.) While such wood can sometimes be difficult to find, you can usually create it by buying wide boards (more than twice as wide as you need) and cutting out the unstable pith wood center (the innermost rings).

Tip 3: Look for tight-grained lumber. Such dense pieces are more stable, making them less prone to cracking, cupping, warping, and shelling (see next tip) than wide-grained stock. See *below bottom*.

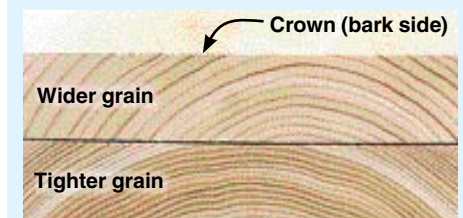
Tip 4: Place horizontal boards crown up in projects. If you can't avoid flatsawn (also called plainsawn) lumber, placing the crown up will help shed water and reduce the effects of shelling. Shelling occurs when the bands of earlywood (lighter wood grain) and latewood (darker wood grain) separate. It occurs on the pith side of a board rather than the bark (crown) side. See the photo *below bottom* for reference.



Sapwood, seen here as the lighter portions of this board, offers the least resistance to decay. It borders the darker heartwood.



A flatsawn board (top) expands twice as much across its width as a quartersawn one, leading to less stability.



Choose tighter-grained wood (bottom) over wider-grained material for maximum stability.

Cedar

the western United States. Western red cedar is commonly sold in the Midwest, and eastern U.S.

Redwood

cypress, which grows throughout the South and Southeast, often gets the nod in those locales due to its availability and economical price.

Western red cedar and redwood stock

tend to appear straight-grained and are dimensionally stable and naturally decay resistant. Both, however, can split when driving fasteners. (See “Screw-Driving Tips” on page 64.) Also, both species bleed tannins that make using fasteners and painting more problematic. The tannins appear as stains around fasteners and can even show through painted surfaces. Proper prepping of the wood, however, lets it accept all wood stains and clear finishes.

The third major player, cypress,

grows in swamps and has a conical base, with roots that seem to stand out of the water. Its sapwood is almost white, while the heartwood color varies from a light yellow brown to a reddish brown and dark brown. Inland cypress, like the sample shown here, has the lighter-colored heartwood. It features beautiful ashlike grain patterns and accepts finish as readily as redwood or cedar.

Cypress

Pressure-treated pine

Wood treated with ACQ: the economical choice

Early in 2004, the old CCA (chromated copper arsenate) treatment that contained arsenic was replaced by various treatments, but the most common is ACQ (alkaline copper

quat).

In spite of its shortcomings, ACQ-treated wood holds up well. It might crack, warp, or shrink, but it won't rot or prove tasty to insects.

ACQ is a water-based preservative forced deep into the lumber, usually Southern yellow pine. Consequently, the lumber is saturated when banded and shipped. This practice makes treated wood heavy and prone to the troubles listed previously. To avoid these tendencies, you can air-dry treated lumber for two warm months, or purchase KDAT (kiln-dried-after-treatment) lumber. The downside: cost (usually double the wet stuff) and the need to special-order it from lumberyards or home centers beforehand.

Because the preservatives are accepted only by the sapwood, heartwood of pressure-treated lumber is not decay resistant, typically appearing tan or pink instead of green.

Tough-as-nails white oak

White oak, the “whiskey barrel” wood, differs from red oak in that it is much less porous. Moisture can't wick up its end grain.

Super-strong, white oak features stainable, straight-grained wood with heartwood that resists decay. Like redwood and cedar, it splits rather easily, so you do need to predrill screw holes for fasteners.

White oak

Imported dense hardwoods

Ipe, a relative newcomer, is imported from Central and South America, where it grows rapidly. Also called Brazilian walnut and ironwood, it is so dense that it barely floats. Strong and stable, the functional life of ipe can be as long as 40 years if left untreated. It resists

movement, surface checks, warping, cracking, decomposition, and denting. Also, while it is expensive (and sometimes hard to find), ipe is comparably priced with many composite wood products.

Teak is still available in small quantities, but you'll pay a hefty price for it. Largely associated with boatbuilding, it doubles as an excellent choice for small outdoor projects where you want the beauty of the wood to speak as loudly as the craftsmanship.

Mahogany serves as a great project wood. It machines, sands, and finishes well, but costs more than ipe. Be sure to ask for African or Honduran mahogany, (avoiding Philippine mahogany). One nice thing: You can buy it in broad thicknesses for use in large projects.

Ipe

Teak

Mahogany

Composite

Adhesives that bond, seal, and fill

Because exterior glues can't overcome poor workmanship, build your exterior projects with the same care as when building fine furniture. Make tight-fitting joints, work the glue while it's still wet, provide even clamping pressure over the entire joint, and allow adequate curing time. Most adhesive manufacturers recommend at least 24 hours of curing before putting stress on a joint. For a look at the latest outdoor adhesive in action, see the photo at right.

No single glue can meet all your requirements, so determine how much moisture your project will be subjected to, the types of joinery you plan to use, and the level of bonding. Then consult the chart below to pick a product suited to your needs. Note that adhesive sealants provide less bonding strength but offer great flexibility.

Liquid polyurethane

Example: Gorilla Glue

Polyurethane adhesive sealant

Example: Vulkem 116

Elastomeric adhesive sealant

Example: Lexel

Polyurethane constr. adhesive

Example: PL Prem. Constr.

100% silicone

Example: GE

Polyurethane hotmelt

Example: HiPURformer

Exterior wood glue

Example: Titebond III

Two-part epoxy

Example: Loctite

The new polyurethane hot melt adhesives offer reliable strength and set up almost instantly. They're waterproof, gap-filling, and promise solid end-grain-to-edge-grain bonding. Their downside? They're expensive and hard to sand after being fully cured.

All-season adhesives and sealants

Type		Ease of use	Bonding power	Gap filling	Cleanup (1)	Flexibility	Shear strength	Water resistance (2)	Cold-weather use	End-grain bonding	Stainability	Cure time	Fasteners recommended (3)	Best use
Exterior wood glues	Water resistant	A	B	D	A	C	B	R	D	D	D	24 hr.	O	Outdoor furniture
	Waterproof	A	B	D	A	C	B	P	D	D	D	24 hr.	O	Outdoor furniture
Polyurethane glues	Liquid	B-	A	B-	D	C	B	P	C	C+	C	4-8 hr.	O	Tight joints
	Hot melt	B	B	B	C	B	B-	P	B	A	D	24 hr.	O	Fast set-up
Two-part epoxy	Fast cure	C	B	A	D	C-	B-	P	C	B	D	30 min.	O	Poorly fitting joints
	Slow cure	C	A	A	D	C-	A	P	C	A	D	60 min.	O	Oily, dense hardwoods
Poly. constr. adhesive	Polyurethane	B	B+	C	C	C	B	P	A	D	D	24 hr.	Y	General-purpose construction
Adhesive sealants	Elastomeric	B	C	B	B	B	D	P	A	D	C	24 hr.	Y	Sealing joints
	100% silicone	C	C	A	D	A	D	P	A-	C	D	24 hr.	Y	Sealing joints
	Polyurethane	C	C	A	C	A	D	P	B	C	D	24 hr.	Y	Sealing joints/paint prep.

1. Includes sandability and assumes water base makes for easier cleanup

2. P-waterproof, R-water resistant

3. O-optional, Y=yes

A excellent

B good

C fair

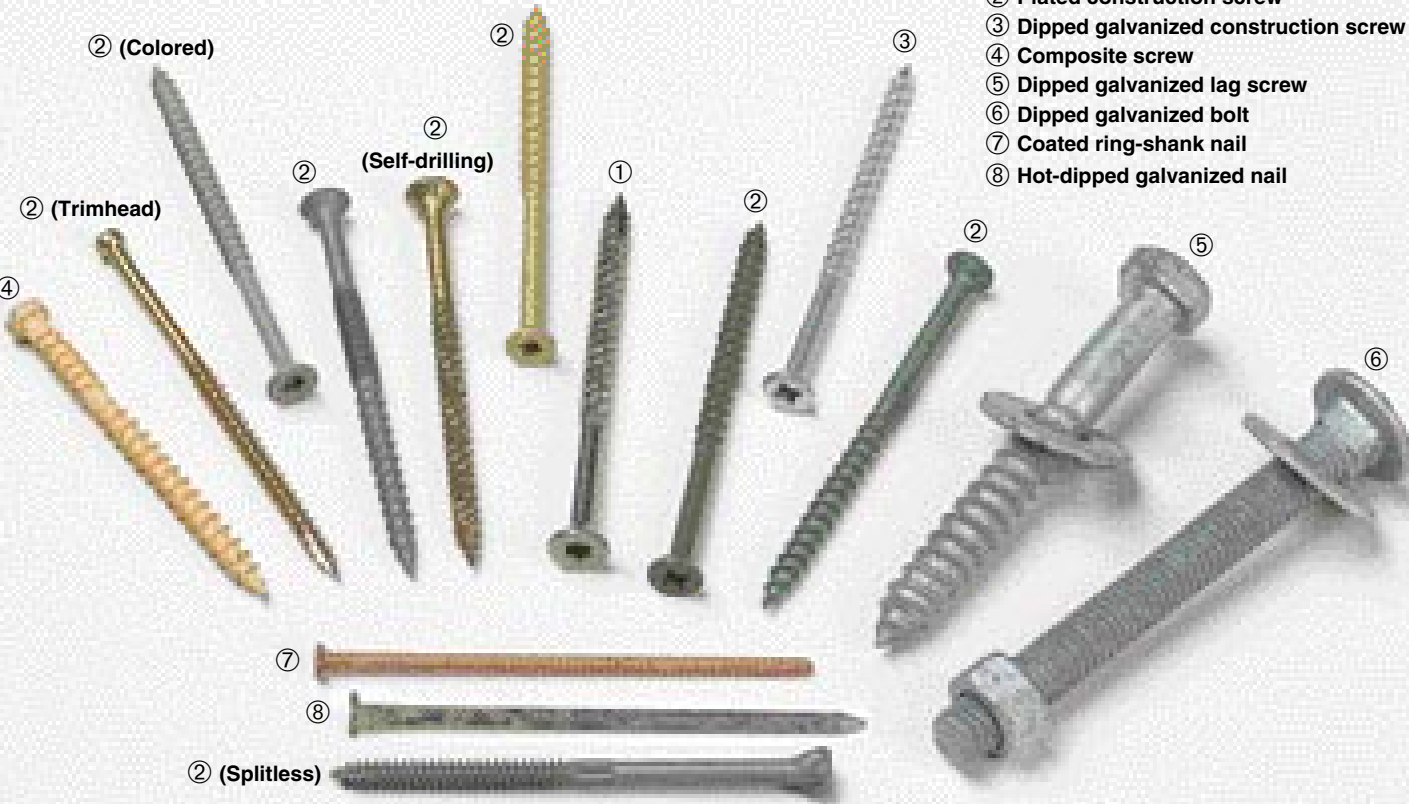
D poor

62

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63

Fasteners for a lasting, firm hold



Your basic common screw isn't quite so common anymore. The ever-changing climate of tools, bits, and materials has led to an explosion of specialized designs. The greater use of dense hardwoods, the development of composite materials, and changes in preservative treatments also have exerted their influence.

To begin with, the density of composite materials creates problems of splitting, mushrooming (when material is pushed up and out around the screwhead), and screws "spinning out" (when threads lose their bite) before the heads are fully countersunk.

While better for the environment, the changeover from the old CCA wood treatment to the new ACQ treatment has proven to be far more corrosive on fasteners. Many experts recommend only stainless-steel or hot-dipped zinc fasteners for use with ACQ; however, many other screw types are billed as suitable for ACQ. Currently, the fastener industry is self-governed and sets its own standards for what constitutes an ACQ-rated screw for treated stock.

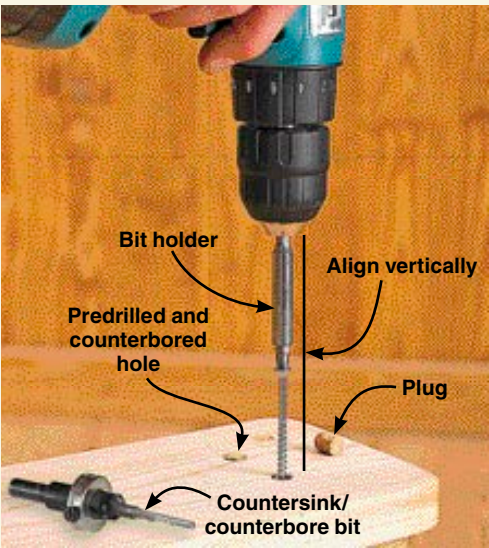
Finally, as a means of maintaining outdoor projects, we rely on all kinds of chemical solutions. We use bleaches and cleaners to kill mildew and revive surfaces. On the downside, we sometimes add salt to dissolve ice on a deck and improve traction. But while these additives may well keep outdoor wood

looking good or make it safer to walk on, they abuse and destroy the protective coatings on fasteners. So, after pondering the type of project you're building, carefully read the next section on screw features and the chart located *opposite, bottom*, to choose suitable fasteners for the job. Then, check out "Screw-Driving Tips" *below* to see how you can best put your selected fasteners to work. If using screws, consider going with an impact driver like those shown on *page 106*.

Screw-Driving Tips

Lubricate: Extra lubrication reduces torque and helps save protective coatings. Beeswax works, and the cheapest and easiest source for the lubricant is a toilet wax ring. Just be sure to clean off the excess wax with mineral spirits before finishing.

Predrill and plug: If you don't have hundreds of screws to drive, it's worth your time to predrill. For a furniture-quality look, counterbore to hide screwheads deep in the wood. Then fill the counterbored recesses with plugs made from leftover scrap. Doing this improves appearance, and protects the fastener as well.



- Fasteners Key:**
- ① Stainless-steel screw
 - ② Plated construction screw
 - ③ Dipped galvanized construction screw
 - ④ Composite screw
 - ⑤ Dipped galvanized lag screw
 - ⑥ Dipped galvanized bolt
 - ⑦ Coated ring-shank nail
 - ⑧ Hot-dipped galvanized nail

Screw features that make a difference

Close examination of screwheads reveals a whole world of engineering that governs their design. The more you know, the easier time you'll have choosing the right one.

Material: Exterior fasteners are made from various grades of case-hardened or stainless steel. While stainless-steel products are left bare, all others have layers of electroplated zinc coatings and sometimes a polymer coat-

ing for color or lubrication. Or they're dipped in molten zinc to prevent corrosion. Note that yellow zinc and black screws (not shown in this article) are often not suited for the rigors of exterior use.

Head size: With large-headed screws, your fastener's visibility increases and countersinking becomes harder and time-consuming. Further, the chances of splitting the wood increase. Many types of trim-head exterior screws, such as GRKs (shown *above*), come with head sizes similar to a same-size finish nail, making them less noticeable.

Countersink cutters: Many exterior screws have countersink cutters on the underside of the head that aid in sinking them. The number and prominence of the ridges tell how effective they are in that task. One screw, Titan's Splitstop (shown *below*), has aggressive cutters to both countersink the head and minimize splitting.

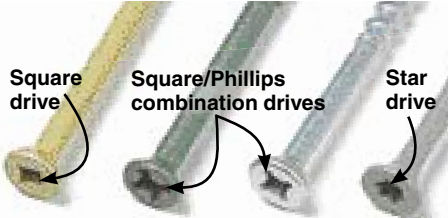


Thread pitch and count: As a general rule, the steeper the thread pitch and the lower the thread count, the faster you can drive a screw. However, such screw designs demand more torque, placing more stress on tools and users, and increasing the chance of snapping screws and stripping heads. One screw, the WeatherMax, has a secondary set of threads inside the main threads that reduces the torque demand on the drill and

Secondary threads

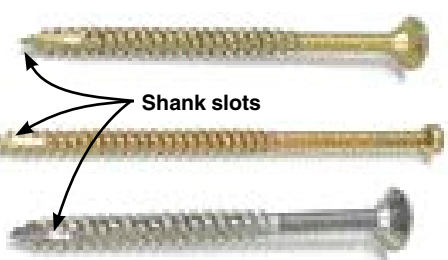
the need for predrilling, particularly with softer woods. (See *above*.)

Driver shape: Exterior screws come with square (Robertson), combination, star (Torx), and Phillips drives. Those that tend not to slip: star and square drives. However, it's not only the shape of the driver bit that plays a role in driver ease, but also the depth of the recess. The deeper the pocket, the better the bit's bite.

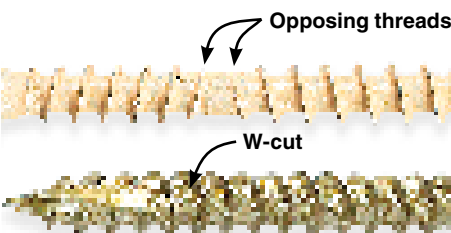


Shank size: Shank size affects a screw's shear strength and pull-out power. A wider shank means the screw threads can be more aggressive. In general, use #10 screws for heavy-duty projects, such as deck building, and #7 or #8 for lighter-duty tasks, such as outdoor furniture construction.

Shank slot: Look for screws with a shank slot like those shown *below*. This feature improves a screw's ability to auger into a hole, improving self-tapping capability without having to predrill.

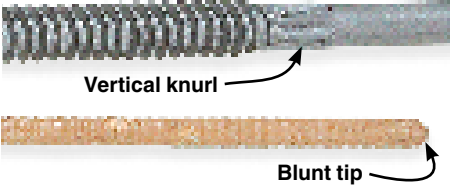


Thread shape: Threads are changing rapidly. A composite screw's shank usually has opposing threads designed to keep the lower threads from spinning out in less-dense natural material (i.e., a wood floor joist). Spax, a composite screw, even has serrated threads (shown *below*) to improve cutting ability and reduce torque. The WeatherMAX uses a W-cut for the same reason.



Salt-spray specialists: If you live in a coastal environment, make sure your fasteners can withstand salt corrosiveness. Key West lumber dealers recommend hot-dipped galvanized and stainless-steel screws.

Splitless features: Predrilling and counterboring are still your best bets to prevent splitting your material, particularly along the ends and edges of stock. However, these methods take time. Trimhead screws help greatly in this area, but other features also have been developed. In addition to the aggressive countersink cutters mentioned earlier, Titan's screws have a vertical knurl above the threads (shown *below*) that helps hog out a hole to make room for the shank. If you choose nails instead, consider the ring-shank type. The blunt tip on the ring-shank nail reduces splitting.



A fast glance at outdoor fasteners

Type	Ease of use	Shear strength	Holding power	Service life	Concerns	Best use
Stainless-steel screws	B	B	A-	40+yr.	Prone to stripped heads	ACQ, redwood and cedar, coastal areas
Plated construction screws	A-	B	A-	7-10yr.	Coating compromised during driving	All-purpose, trimheads for furniture
Dipped galv. construction screws	B	B	A-	7-10yr.	High torque requirements, staining	All-purpose, except cedar and redwood
Composite screws	B	B	B	7-10yr.	Mushrooming, failure to countersink	Composite decking
Dipped galvanized lag screws	C	A	A	40+yr.	Highly visible, high torque, staining	Heavy timber unsuited for bolts
Dipped galvanized bolts	C	A	A	40+yr.	Highly visible, staining	Heavy timber and post-shrinkage tightening
Coated ring-shank nails	A	B	C	15+yr.	Dents, bent nails, removal	Trim, fascia, redwood and cedar
Dipped galvanized nails	A	B+	C	15+yr.	Dents, bent nails, removal, staining	Attaching decking to non-ACQ frame

A excellent
B good

C fair

Finishes for the long haul



As the final step in an outdoor project, the finish is not the place to take shortcuts. By doing so, you jeopardize all the good work you’ve done. And, with some non-oil finishes, if failure occurs, minor repair work may not be an option.

Why good finishes go bad

To find out why wood finishes deteriorate over time, we asked Sam Williams, a chemist with the United States Forest Products Laboratory (USFPL). He points to five significant reasons:

1 Raised grain: During the normal yearly wet/dry cycles, earlywood readily absorbs moisture and swells, pushing out bands of the darker latewood and raising the grain, creating cracks in the finish where moisture penetrates and expansion occurs. To control this condition, follow the “crown-up” tip (see page 61), using tight-grained stock—if possible—to limit the problem.

2 Sunlight: Exposing raw wood to the sun’s ultraviolet (UV) radiation, even for a week, can degrade the wood fibers. This can stand in the way of paint and film finishes adhering to the smooth surface. When stor-

ing materials, keep lumber covered or indoors prior to building. With wet treated wood, shelter and sticker it to speed drying.

3 Coatings count: By applying a single thin-film coating (1–3 mils) or a thin layer of solid-color stain or paint, you subject the finish to early failure. This problem is especially noticeable on flatsawn lumber. To prevent it, use the recommended number of coats for each finish.

4 Moisture content: Changes in the moisture content also cause dimensional movement that stresses a film finish. To limit this, begin with kiln-dried lumber having less than 13 percent moisture content. Then coat all sides of the material using a flexible finish. (See finish chart, *opposite*.) Note that projects placed in shade release moisture less readily and require extra protection from mildew by using a finish with a mildewcide.

5 Poor surface prep: Raw lumber needs preparation. Pressure-treated wood may contain paraffin wax that should be removed with a wood cleaner (a petroleum-based solvent such as mineral spirits) before using water-based finishes. Other wood stored for a few months or exposed to sunlight should

be scuff-sanded, using 50–80 grit for wood you intend to paint, 220 grit for wood receiving a clear finish. Aluminum oxide achieves the best results—it resists loading when sanding softwoods.

Finishes that limit UV damage

Exposure to UV causes color change and a degradation of the surface. While most of the finishes listed in the chart offer some UV protection, the level of protection can vary, with all finishes wearing out over time. On the low end of the scale, clear finishes without UV absorbers offer no protection. Paint, because of its UV-blocking pigments, is the ultimate barrier to the sun’s damage. In between are the pigmented semitransparent stains that provide some degree of sun-screening shelter.

Less-than-perfect working conditions

Heat and moisture are the enemies of effective finishing. Direct sun or hot surfaces lead to finishes drying too quickly. This in turn results in an uneven appearance. This effect is most apparent when using semi-transparent stains. With these products, lap marks (see the photo *opposite top*) and glossy spots occur when applying fresh stain over a quickly drying undercoat.

When painting, Mark Knaebe, a USFPL chemist, advises that you not paint on a cool surface that will heat up in a few hours when the sun hits it or when heavy dew or frost is expected to form at night. The ideal conditions: a moderately overcast day with no chance of rain, low humidity, highs in the mid-70s, and lows in the mid-50s.

All finishes are not created equal

In choosing the best finish for your project, base the choice on what matters most to you. Is absolute minimum maintenance your biggest priority? Do you want to see wood grain even if it means finishing more often? Once you know, consider the following products to help you meet your needs.

Water repellents: These finishes accomplish their jobs by carrying a repellent, primarily paraffin wax, onto the wood via solvents. They offer minimal UV protection and have by far the shortest service life, typically a few months.

Penetrating oils: Many people look to linseed oil, yet it offers poor protection. And, unfortunately, its organic nature can attract mildew. Danish oil products such as Watco Teak Oil, fare no better outdoors. At best these products provide renewed looks and minor moisture protection. But, while the



Shades of difference can appear when sun-heated surfaces cause semitransparent stains to dry too quickly.

frequency of reapplication may be greater than with varnish or paint, recoating with an oil finish requires little prep work, and you can apply it quickly.

Stains: The sheer number of exterior stain choices has become staggering. They include water-based and oil-based, semitransparent and solid-color, and even penetrating oil stains. Consider solid-color stains as essentially a thin paint.

Oil-based stains penetrate wood better than water-based stains. Water-based stains don’t enter the wood as much as leave slight film on the surface. That makes maintaining water-based stains more challenging. Water-based products clean up more easily. In all cases, these stains offer better UV protection than using a clear finish alone, even those with UV absorbers. To get the

best of both worlds, apply a base coat of compatible stain and topcoat it with two coats of varnish. This will extend the life of both the wood and the finish significantly.

Varnishes: Typically, the products in this category—spar varnish, marine varnish, and outdoor urethanes—are different from their indoor cousins in that they’re made to be flexible when dry and contain UV absorbers. However, the quality of UV protection can vary greatly among manufacturers. A good indicator is the price you pay at the store. Better varnishes simply cost more. Some marine varnishes may run \$24 a quart, with gallons approaching \$90 a can.

In the past, varnishes were exclusively oil-based, but recently a few water-based products have made their way into the market. Mark Boufford of Varathane claims that: “Water-based finishes are now as good as or better than oil-based varnishes for hardness and durability; however, they can’t compete with oil-based for protecting against damaging UV exposure.” That said, the category as a whole offers the best protection in a clear finish, letting the natural beauty of the wood make a statement.

Paints: No other finish will outperform properly applied paint when it comes to protecting wood outdoors. Latex paints prove more flexible and breathable (allowing moisture to escape) than oil-based paints, making them better able to withstand the inevitable shrinking and swelling of wood.

For paint to be most effective, pay attention to the sections on weather conditions

and the poor surface prep.” When applying paint, go with one coat of primer and two topcoats. For softwoods, such as redwood and cedar, that tend to bleed tannins, use an oil-based, stain-blocking primer, such as the one shown *opposite top*, and topcoat it with a quality latex or acrylic latex. You’ll like the ease with which it goes on.

One other paint advantage: You can seal vertical joints and the upper side of horizontal joints with an adhesive sealant (see page 63) before painting. This lets the protective coat of your project resist moisture even better, especially at end grains. ♣

Written by Mike Satterwhite with Jim Harrold

Sources for more information: Wood materials and finishes—

- U.S. Forest Products Laboratory 608/231-9200; fpl.fs.fed.us
- Varathane 800/635-3286; woodanswers.com
- Zinsser 732/469-8100; zinsser.com

Adhesives—

- Titebond 800/347-4583; titebond.com
- Gorilla Glue 800/966-3458; gorillagluue.com
- DAP 800/543-3840; dap.com

Fasteners—

- Titan Metal Works 888/578-3273; splitstop.com
- GRK Fasteners 800/263-0463; grkfasteners.com

Four-season finishes: how they compare

Type		Ease of refinishing	UV protection	Flexibility	Penetrating (1)	Film thickness	Number of coats	Mildewcide (1)	Breathable (1)	Reapplication frequency	Best use
Water repellents	Standard	A	D-	A	Y	NA	1	Y	Y	1–2 m.	Weathered decks and rails, pretreatment for painting
	UV-blocking	A	D	A	Y	NA	1	Y	Y	1–2 m.	Weathered decks and rails, pretreatment for painting
Penetrating oils	Linseed oil	A	D	A	Y	NA	1	N	Y	2–3 m.	None
	Danish oil	A	C	A	Y	NA	1–2	Y	Y	6 m.-1yr.	Dense hardwoods
Stains	Water-based semitrans.	B-	B	B	N	thin	1–2	Y	Y	2–4 yr.	Furniture and vertical structures
	Oil-based semitransparent	B	B	A	Y	NA	1–2	Y	Y	3–5 yr.	Treated wood decks, rails, and furniture
	Water-based solid	B	B+	B	N	med.	1–2	Y	Y	3–5 yr.	Furniture and vertical structures
	Oil-based solid	B	B+	B	Y	thin	1–2	Y	N	1 yr.	Furniture and vertical structures
Urethane	Water-based	D	C	B-	N	thick	3–10	Y	N	2–3 yr.	Furniture and vertical structures
	Oil-based	D	C+	B-	Y	thick	3–10	Y	N	2–3 yr.	Furniture and vertical structures
	Marine	D	B-	B-	Y	thick	3–10	Y	N	2–3 yr.	Furniture and vertical structures
Paints	Water-based (latex)	A-	A	B+	N	thick	3	Y	Y	7–10 yr.	Furniture and vertical structures
	Oil-based (enamels)	A-	A	D	Y	thick	3	Y	N	7–10 yr.	Furniture, oil-based primers under latex topcoat

- A excellent
- B good

- C fair
- D poor

1. Y=yes, N=no