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Whether it’s used for barbecuing or for relaxing in a hot tub, the deck, by my estimation, is the best room of the house. If built the wrong way, though, this asset quickly can become a liability. More often than not, the catalyst for this transformation is a poorly detailed ledger board, usually in the form of bad flashing.

Proper detailing requires two things: selecting the right hardware to attach the ledger to the house; and adequately weatherproofing the house/ledger connection.

**A Ledger Supports and Stabilizes a Deck**

Because it supports floor joists, the ledger carries much of the deck’s load. Its connection to the house transfers this load to the foundation while providing stability. Because the connection is usually a shear load, the fasteners must be strong and well anchored to the house.

Through bolts, such as hex or carriage bolts, are the best choice for anchoring the ledger because they won’t strip out of the wood as lag screws might. But often, due to inaccessible framing, lag screws must be used. As long as they’re installed with care (see the top drawing on p. 17), lag screws work fine. You may want to talk with the building inspector, though. The International Residential Code says, “Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.”

Regardless of which fasteners you use, be sure that they provide a suitable amount of corrosion resistance to the new arsenic-free pressure-treated wood.

**Don’t Let the Ledger Rot the Walls**

In Portland, Oregon, we receive an average of 37 in. of rain every year; the rain here is persistent. If there’s a hole in the siding, rainwater gets into it. Once in the house, water gets to and rots the framing. Flashing, gravity, and sealants are critical to keeping out water.
Because the thought of leaks disrupts my sleep, I use backups when detailing a ledger. Sloping the deck, caulking the vulnerable joints, and flashing properly should prevent water from getting in at the ledger board. Felt paper above the ledger directs any water that has made its way behind the siding to the 2×2 flashing and out. And if water somehow does make it behind the ledger, there’s another layer of paper to protect the house and a space for that water to drain. As with any security program, redundancy is superfluous only when not needed.

Scott Grice is a builder in Portland, Oregon.

The pressure-treated ledger is larger than the joists, in this case to compensate for peculiar floor framing. The top row of fasteners is lag screws attached to floor framing, and the bottom row is bolts running through a beam. In the West, pressure-treated wood (hem-fir) often is stained brown to blend with cedar and redwood and must be incised to allow adequate penetration of the treatment chemicals.
Through bolts are the best choice for fastening the ledger, but they'll do no good if they're fastened to rotten wood. Meticulous water detailing stops rot before it starts. **Note:** If you live in a cold climate, you can step the deck down to avoid water problems caused by melting snow. The International Residential Code allows up to an 8-in. step.
**IF YOU USE LAG SCREWS**

For the threads to engage the wood fibers fully, the pilot hole should be slightly smaller than the root diameter of the lag screw; for a ½-in. screw, a ⅜-in. hole is about right. And the lag screws should penetrate the rim joist by the diameter of the screw, in this case, ½ in.

**IF YOU HAVE SIDING BELOW THE DECK**

Add a drip-cap flashing above the siding, and tuck it behind the housewrap. The detail will match that of the flashing above the ledger.

**JOIST SPAN DRIVES FASTENER SPACING**

Longer floor joists require tighter fastener spacing. Table R502.2.2.1 of the 2009 IRC prescribes maximum fastener spacing for ½ in. lag screws, ½ in. bolts, and ½ in. bolts with ½ in. of stacked washers.

Fastener spacing accurate for the following conditions:
- Combined live and dead load of 50 lb. per sq. ft.
- Spruce-pine-fir rim joist or minimum of 1 in. x 9½ in. Douglas Fir LVL rim board.
- Southern pine or hem-fir deck ledger.

Check with your local building official for different load requirements or when fastening into other rim joist materials.

<table>
<thead>
<tr>
<th>½ in. lag screw</th>
<th>½ in. bolt</th>
<th>½ in. bolt with ½ in. stacked washers</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 in.</td>
<td>23 in.</td>
<td>18 in.</td>
</tr>
<tr>
<td>36 in.</td>
<td>29 in.</td>
<td>24 in.</td>
</tr>
<tr>
<td>36 in.</td>
<td>29 in.</td>
<td>24 in.</td>
</tr>
</tbody>
</table>

**ON-CENTER SPACING**

<table>
<thead>
<tr>
<th>6 ft. and less</th>
<th>6 ft. 1 in. to 8 ft.</th>
<th>8 ft. 1 in. to 10 ft.</th>
<th>10 ft. 1 in. to 12 ft.</th>
<th>12 ft. 1 in. to 14 ft.</th>
<th>14 ft. 1 in. to 16 ft.</th>
<th>16 ft. 1 in. to 18 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 in.</td>
<td>23 in.</td>
<td>18 in.</td>
<td>13 in.</td>
<td>11 in.</td>
<td>10 in.</td>
<td>9 in.</td>
</tr>
<tr>
<td>36 in.</td>
<td>29 in.</td>
<td>24 in.</td>
<td>18 in.</td>
<td>16 in.</td>
<td>14 in.</td>
<td>12 in.</td>
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<td>36 in.</td>
<td>29 in.</td>
<td>24 in.</td>
<td>18 in.</td>
<td>16 in.</td>
<td>14 in.</td>
<td>12 in.</td>
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</tbody>
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Stagger fasteners 2 in. down from the top and up from the bottom of the ledger. Install two fasteners between 2 in. and 5 in. at the ends of ledger sections.
An Explosion of Decking Choices

For homeowners, the day a new deck is finished is a day of celebration, with anticipation of cookouts, family time, and quiet afternoons spent with a book on their pristine outdoor structure. The last thing they’re thinking about is maintenance—or the fact that before the last deck board went down, nature was already hard at work trying to destroy their new prize.

Traditionally, decking has been wood in one of three sizes: 2x4, 5/4x6, or 2x6. That might be redwood, western red cedar, or pressure-treated southern pine, depending on what part of the country you live in.

Over the past 15 years, the tradition has changed. Other types of wood decking have become easier to find: Alaska yellow cedar, rainforest hardwoods such as ipé, and red meranti from Malaysia. Also, a whole new category of synthetic decking has flooded the marketplace. While purists will never accept a plank made of plastics, the latest generation of synthetic decking includes some pretty convincing facsimiles, and many are manufactured with recycled materials.

When building a deck, you choose materials by balancing your budget against durability, maintenance requirements, ease of installation, and aesthetics. It’s not an easy balancing act; the up-front costs don’t always give the whole picture. After considering the time and cost of annual washings and applications of preservative and the life expectancy of the product, a seemingly economical deck might end up costing as much as if you had gone with seemingly unobtainable planks.

This survey of popular decking choices arms you with the knowledge you need to weigh the relative pros and cons of materials. But remember, no matter which type you choose, it will perform as advertised only if the deck is designed and built to resist Mother Nature.

Primary reporting by Chris Green and Scott Gibson, with help from Daniel S. Morrison and Rob Yagid.
More than 60 manufacturers nationwide now produce synthetic decking products. We don’t have space to feature every product, so we’re focusing on those that are widely available, and those with unique features. Choosing won’t be easy. Synthetics look better than ever, with convincing colors, textures, handrail systems, and trim profiles available. That said, distribution is spotty. Product availability will have a big influence on what you buy. Shop prices carefully; they vary, sometimes wildly within the same region.

Polyethylene-based composites
More wood-plastic composite decking is sold than all other synthetic decking combined, and polyethylene-wood blends lead the way. They are durable, strong enough to be used as decking, and easy to work with. They are, however, softer than the other plastics, which limits joist spacing and makes them wear a little more easily.

MOISTURESHEILD
A.E.R.T. Inc.
866-729-2378
www.moistureshield.com

TIMBERTECH
TimberTech
800-307-7780
www.timbertech.com

GEODECK
Green Bay Decking LLC;
877-804-0137
www.geodeck.com

EVERGRAIN
Tamko Building Products Inc.
417-624-6644
www.evergrain.com

TREX
Trex Co. Inc.
800-289-8739
www.trex.com
Polypropylene-based composites
Polypropylene and wood-fiber composites are currently a smaller part of the market. They use a stiff, dense plastic capable of spanning longer distances. Using screws to fasten the decking without drilling pilot holes isn’t recommended. The examples shown here have grooved edges to accept hidden fasteners.

Wood-free plastics
The popularity of plastic decking is growing fast and many major decking manufacturers are adding cellular PVC planks to their offerings. Some are all plastic. Others are mostly plastic with some nonwood fiber added. The benefit is that problems with mold and seasonal movement caused by the moisture in wood are eliminated.
Redwood Comes in Three Grades for Decking

Redwood is available in more than 30 grades, of which only a few are typically used as exterior decking. They are deck heart/construction heart, B heart, and clear all heart.

1. DECK HEART/CONSTRUCTION HEART
   This grade of wood has a fair number of knots.

2. B HEART
   This grade also has knots, but they are less prominent than those in construction heart.

3. CLEAR ALL HEART
   This grade is free of knots.
Resistance to decay and insects comes naturally to some wood species and can be improved chemically in others. But even the hardiest of wood decking requires attention from time to time, especially if you want to maintain the rich colors of a new deck. Wood decking is available in a number of different grades. Clear grades (without knots) are most expensive; the price drops as the number of defects rises. More important, look for planks cut from heartwood, which resists decay. Sapwood, the tree’s soft outer layers, has virtually no natural protection against rot.

Redwood

You can’t blame John Muir for idolizing these giant forest dwellers, some of them 300 ft. or more high. Top grades of redwood decking are equally prized for their performance. Although lighter and not as tough as some decking material, redwood is stable, with little in-service movement and not much pitch. Its heartwood, which has a pleasing reddish-brown color, is highly resistant to insects and decay. Redwood is easy to work, and it holds finishes well.

What more could you want? Well, a lower public profile might be a start. Past battles over logging the remaining old-growth forests were bitter and well publicized, and have probably scared some people away from considering redwood for decking. According to the California Redwood Association (www.calredwood.org), however, nearly all of the redwood on the market is second- and even third-growth wood cut from private land. California forestry laws are stringent, and what little old-growth wood being cut is not as a rule going into decking. The association estimates that 500 million to 700 million board feet of the fast-growing redwood is cut annually. FSC-certified (Forest Stewardship Council) redwood is available.

Although the heartwood in redwood is exceptionally resistant to both rot and insects, sapwood is not. This factor is a key difference in some redwood grades: Construction common contains sapwood, for instance, while deck heart/construction heart does not. Although grades of B heart and deck heart/construction heart both have knots, those in B heart are less prominent.

The California Redwood Association suggests applying a protective finish on a redwood deck every few years. Use one that contains mildewcides, water repellents, and ultraviolet protection.
Wood Decking (continued)

Cedar
Western red cedar and Alaska yellow cedar are a lovely pair of Pacific Northwest woods. The heartwood of both species is highly resistant to decay, and they are both straight-grained, easy to work, and dimensionally stable. Both are readily available as decking, particularly on the West Coast. Despite sharing these attributes, the woods are different.

The heartwood of western red cedar has a red-to-brown color. It is lighter in weight than Alaska yellow cedar or even redwood, and is the softest of the three. Western red cedar has little shock resistance, but it also shows little shrinkage after it has been seasoned. It can be brittle and splintery. Alaska yellow cedar is stronger and heavier with greater shock resistance and bending strength. It has a clear, bright color and is not as brittle. Alaska yellow cedar, which also might be marketed as Alaska cypress, weathers to a silver-gray.

Grades developed by the Western Red Cedar Lumber Association (www.wrcla.org; 866-778-9096) range from architect clear to custom knotty. But as is the case with other species, suppliers can develop their own trade names, a practice that even the Western Wood Products Association admits is “difficult and confusing.”

According to Bear Creek Lumber (www.bearcreeklumber.com; 800-597-7191), Alaska yellow cedar shrinks more than western red as it dries. As a result, it is often kiln-dried to minimize problems after installation. Because the wood is harder than red cedar, it is somewhat more difficult to stain. Even though the heartwood of cedar naturally resists rot, regular application of a water-repellent preservative is a good idea. It helps to protect the wood surface from mildew and weathering.
Cedar Is Commonly Available in Two Species

Alaska yellow cedar and western red cedar are popular species with wide distribution. In some regions, you’ll also find Port Orford and northern white cedar.

1. ALASKA YELLOW CEDAR
Stronger and heavier than its cousin, Alaska cedar has a yellow hue that weathers to a beautiful silver-gray color.

2. WESTERN RED CEDAR
Softer than redwood or Alaska yellow cedar, the red-to-brown heartwood of this species is easy to work and readily accepts stain.
Wood Decking (continued)

Tropical Hardwoods
Lumber grades and designations for tropical woods can be even more confusing than those for more-familiar North American species. You can search in vain for standardized grading rules or span tables. Also, trade names can be confusing, if not downright misleading. Ironwood and Pau Lope, for instance, are not species of trees; they’re trade names like Kleenex or Xerox®.

All that aside, tropical hardwoods can make great decking. Ipé, a related group of South American hardwoods, stands up exceedingly well to very demanding use. Although it is too hard to treat chemically, it is highly resistant to rot and insect damage without treatment. Although ipé is not easy to work, the wood should make an extremely durable decking surface. When newly milled, ipé has a beautiful red-to-brown color. Decking in 1× dimensions spans 16-in. on-center framing; 5/4 stock spans 24 in.

A number of companies in the United States have what’s called “chain of custody” certification for ipé under Forest Stewardship Council guidelines. But according to Jon Jickling of SmartWood, these lumber brokers have nonexclusive contracts, meaning they technically can sell both certified and noncertified wood. You just have to ask for the one you want. Any company selling FSC-certified wood should be able to provide you with a chain-of-custody code to prove it.

Like many products in the green marketplace, demand for certified lumber is growing, even though it costs a little more. Plenty of online dealers like Naturally Durable (www.naturallydurable.com) specialize in certified lumber. The cost for certified wood is roughly 5 percent to 10 percent higher than noncertified decking. Just seven years ago, the premium for certified wood was 20 percent.

Other tropical hardwoods that can be used as decking include cambara and meranti. Cambara is lighter in color and not as hard as ipé. Cambara is stiffer and heavier than any decking produced in North America, and is reported to be resistant to insects and decay. It gained popularity a few years ago when it cost 25 percent to 50 percent less than ipé. The price has risen, however, and it can be hard to find. Dealers recommend that cambara be treated periodically with a water repellent and preservative.

Meranti is a name for a number of species from Malaysia, the Philippines, and other parts of Southeast Asia. Widely available from lumber dealers, it might be called Philippine mahogany or lauan. The Forest Products Laboratory rates this wood as moderately decay-resistant, a step below redwood, cedar, and ipé. Treatment with a water repellent is recommended. Strength properties are comparable to red oak.
Preservative treatments for rot-resistant lumber are something of a moving target. Manufacturers claim the treatments are much less corrosive than ACQ and CA and that it’s OK to use standard joist hangers and aluminum flashings. They also boast that the preservatives are more environmentally benign than CCA. The most widely available, MicroPro®, uses copper as its preservative, but in fine particles that make treated wood no more corrosive than the old CCA.

Wolmanized L³ Outdoor Wood uses a combination of fungicides, insecticides, and water repellents as its preservative, so corrosion isn’t a concern. However, one of the insecticides has been banned in France because it’s suspected of contributing to die-offs in the bee population; the U.S. Agriculture Department is researching the supposed link. PureWood® protects wood via a heating and steaming process that changes the composition of the wood’s sugars into a substance inedible by mold, fungus, and insects.

### MicroPro
**SOURCE** Osmose®
www.osmose.com
**TREATMENT** Copper cobiocides
**USES** Above ground, ground contact, freshwater immersion, saltwater splash
**PRICE/AVAILABILITY** Comparable to ACQ, CA; available east of the Rocky Mountains

### Wolmanized L³
**SOURCE** Arch Wood Protection
www.archchemicals.com
**TREATMENT** Fungicides, insecticides, and water repellents
**USES** Above ground
**PRICE/AVAILABILITY** Comparable to ACQ, CA; limited availability

### PureWood
**SOURCE** Bay Tree Technologies
www.purewoodproducts.com
**TREATMENT** Heat and steam
**USES** Above ground, ground contact, freshwater immersion, saltwater immersion
**PRICE/AVAILABILITY** To be determined; limited availability
Alkaline copper quaternary and copper azole are the two copper-based wood treatments that have been the industry standard for residential use since chromated copper arsenate was phased out in 2003. Readily available, ACQ- and CA-treated lumber products have established a reliable track record against moisture, mold, and insect damage over the past 20 years. However, the transition from CCA to ACQ and CA has not been seamless. Eliminating arsenic and chromium reduced treated lumber’s toxicity but significantly increased the wood’s corrosive effect on steel fasteners and hardware, as well as on some types of flashing. The high copper content means that treated wood is particularly corrosive to aluminum. When building anything with pressure-treated lumber, you need to choose every fastener and flashing that contacts ACQ and CA wood carefully (see “Deck-Fastener Options,” pp. 54–61).

By the way, there’s no need to panic about existing CCA-treated structures. The EPA says that they’re fine. But if you’re nervous about the chances of leaching chromium and arsenic, you can make your deck or swing set safer by coating it with an oil-based penetrating stain every couple of years.

The absence of chromium in ACQ and CA lumber allows more copper to leach out into the environment. That’s a problem for aquatic organisms and could lead to government restrictions in the future. As a result, the industry sees ACQ and CA as a step on the way to third-generation treatments (see the sidebar on p. 75).

Most water repellents can be applied immediately to ACQ and CA pressure-treated wood. But you should wait for the lumber to dry before applying an oil-based semitransparent stain. How long you should wait before applying the stain varies depending on where you live. In New Mexico, you probably should wait six weeks; in New Orleans, six months would be more preferable.
A CQ and CA treatments use more copper than CCA did, so their cost is higher than the old treatment method (5/4 x 6 planks are about 80¢ per lin. ft.). To control costs, companies vary the retention level of the chemicals in the wood to suit its end use. The American Wood Preservers Association (AWPA) sets standards for retention levels, the building code approves the standards, and a third-party inspector verifies compliance by wood treaters. You’ll find this information on a tag stapled to the lumber.

**GROUND CONTACT**
4x and 6x stock used for deck posts and freshwater docks gets a higher level of treatment.

**ABOVE GROUND**
2x stock for framing, rails, and balusters is approved for outdoor use.

**DECKING**
The lowest retention level is used for 5/4 deck boards.

**PWF**
Lumber for permanent wood foundations might have a higher retention level or higher lumber standards, depending on the brand.
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