Controlling Moisture in Deck Lumber

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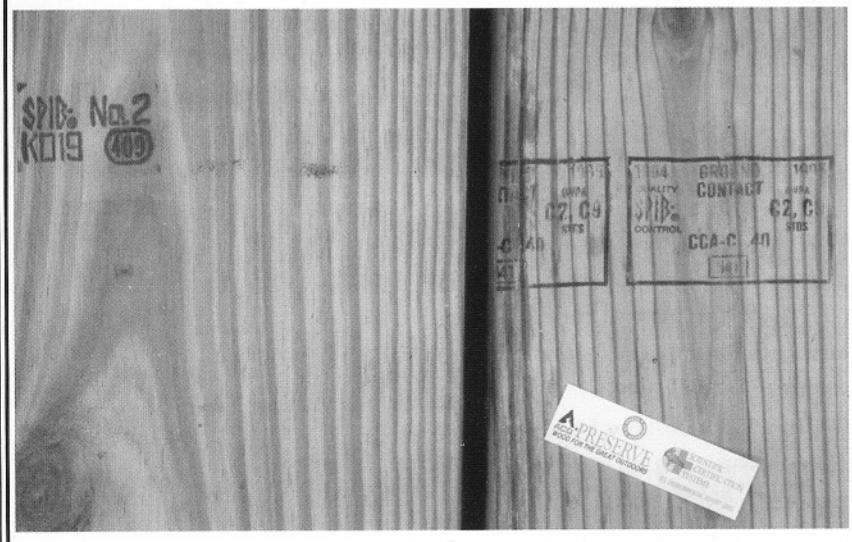

Look for the mark to be sure what you're getting. Grade marks indicate the maximum moisture content of the wood, which is important to know if you're going to use the wood to build a deck. Some pressure-treated wood will carry two marks, one from the mill and one from the pressure treater.

If you've ever inspected, repaired, or torn off an old wood deck, you know what can go wrong with one. Nail heads stick up. Deck boards decay, cup, or twist, and joints that once were tight open up and loosen. Bad construction, the use of unsuitable lumber, the wrong fasteners, or a lack of maintenance are often the sources of the problems. However, there is another important factor that can affect deck performance.

Here at the USDA Forest Products Laboratory in Madison, Wisconsin, we've learned from extensive research into wood behavior that the origin of many of these problems often can be traced to the moisture content (MC) of the wood at the time the deck was built or to the effects of moisture during its lifetime.

The effects of moisture in deck lumber determine how good a deck will look, how well it will hold up, and, often, how long it will last. Obviously, it's impossible to control the amount of humidity and rain a deck is exposed to. (You can limit the amount of moisture that comes in contact with the wood only by applying a proper water-repellent finish or by purchasing lumber that has a

water-repellent finish.) However, you can control the amount of moisture in the wood. Too much—or even too little—moisture in wood can eventually lead to structural problems.

Moisture Content Can Affect a Deck for Years

To minimize warping, splitting, checking, shrinking, and failing finish, the deck boards at the time of construction should be uniform and less than about 20% MC, regardless of the species or whether the wood has been pressure-treated.

In most areas of the United States, we expect lumber in aboveground, protected, exterior applications to reach an equilibrium moisture content (EMC) around 12%. If your specific site is normally either very wet or very dry, the EMC will be higher or lower, respectively.

In general, the moisture content of most treated lumber is high—in the 35% to 75% MC range—and the wood is still wet when it arrives at the job site, unless it has been kiln dried after treatment and marked KDAT. If the wood is stamped KDAT, its moisture content should be about 19% or less. Because redwood and cedar aren't treated with preservatives, they're usually marketed as kiln dried or as air seasoned, which means they will have about a 20% MC. Most deck builders install deck boards on delivery. Although this way is easiest, pressure-treated boards probably will vary greatly in moisture content and often will shrink unevenly.

In the case of preservative-treated wood, we recommend KDAT lumber, when available, because many problems that eventually surface in deck construction are a result of using wet lumber. Another option is to air-dry the treated lumber yourself. In both cases, you'll be able to identify problem deck boards before installation and exclude them from your project.

Air-dry Lumber to Equalize Moisture Content

Treated lumber that's not marked KDAT should be air-dried for several weeks, depending on the type of weather and the extent to which the lumber is exposed.

Usually, pressure-treated wood comes directly from the treater and is bound and shipped wet to the lumberyard, where it often is stored outside and unprotected. Air-drying for several weeks will help even out the moisture-content differences between the pieces of wood and, on average, will lead to a more consistent moisture content at installation.

In the long run, it is worthwhile to order the lumber to arrive at the job site a few weeks early to allow time for air-drying. Air-drying also is recommended if you build a deck with redwood or cedar that contains a moisture content much greater than 20%.

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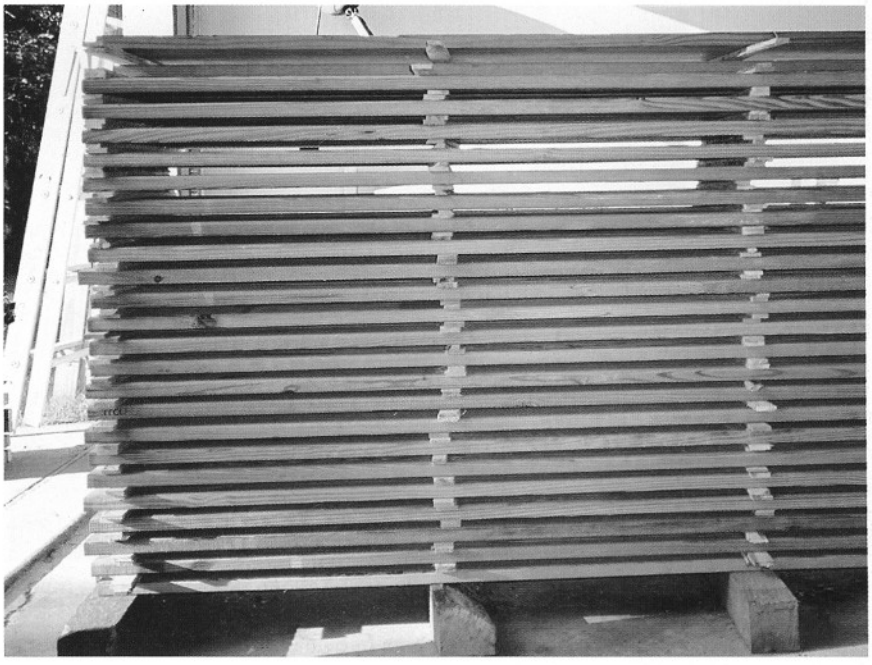
TIP

Place weights, such as concrete blocks, on top of the pile of boards to help minimize twisting of lumber during drying, but avoid iron weights because they can stain the wood if they get wet.



To dry lumber properly, align the stickers, or spacer strips of wood, over pile supports to promote even weight distribution and optimal drying. Place weights on top of the stack of wood to stop the top boards from warping.

Air-drying for several weeks will help even out the moisture-content differences between the pieces of wood and lead to a more consistent moisture content at installation.

The air-drying method we recommend is stacking the lumber in layers separated by narrow strips of wood, or stickers, to allow air to move freely between layers. Care should be taken to align the stickers vertically within the pile. Alignment helps distribute the load evenly and minimize warping during drying. Also, it's a good idea to place weights, such as concrete blocks, on top of the pile to help minimize twisting of lumber during drying. (Avoid iron weights because they can stain the wood if they get wet.)

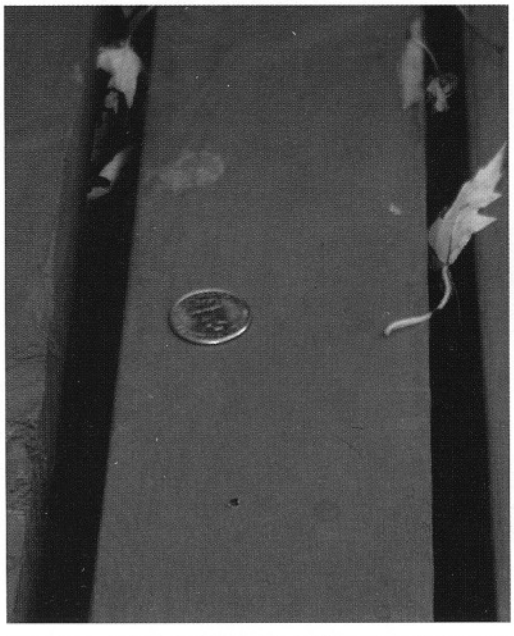
If the pile can be protected from the weather—either by a shed or by plastic sheeting—and is allowed to dry several weeks, the lumber should reach a moisture content of close to 20%.

Using an electronic moisture meter is a simple method of measuring moisture content in wood. This kind of meter typically measures the electrical resistance between two metal pins driven into the wood. Moisture meters must be calibrated, depending on wood species and temperature. You can purchase a moisture meter for around $100.

Moisture content also can be determined by weighing a few representative small pieces of wood, drying the pieces in an oven at 200°F for 24 hours and weighing them again after they're oven dry. Divide the difference between the original weight and the oven-dry weight by the oven-dry weight, then multiply by 100 to get the moisture content in the form of a percentage.

Shrinking Can Be Used to Your Benefit

Wood shrinks only when moisture content falls below about 30%. A 6-in.-wide treated southern pine deck board should shrink by about 3/16 in. if it reaches 12% EMC, so laying wet decking boards tightly against each other should result in a 3/16-in. gap when the boards dry. For redwood or cedar purchased at 20% MC, a nominal 6-in. decking board will shrink only about 1/10 in. when a 12% EMC is reached. If the lumber installed is drier than the local EMC, and if the boards



The gaps between these deck boards are much too great and can result in injury for women wearing high-heeled shoes or for small children. Gaps this wide can result when wet boards are laid with a gap between them. The gap becomes larger as the boards shrink.

Warping and cupping are usually caused by uneven shrinkage between the top surface and the bottom surface of wood. The wrong types or placement of fasteners also can cause wood to warp and cup, as shown above.

are laid tight, there's potential for the wood to pick up moisture, swell, and buckle.

Depending on the lumber species and moisture content—as well as the desired gap between boards—a gap between deck boards can be planned based on the amount of expected shrinkage. We suggest a final gap of about 3/16 in. to 1/4 in.—not big enough to catch a small heel, but big enough to allow dirt, leaves, and other debris to fall through.

Warping and cupping usually are caused by uneven shrinkage between the top surface and the bottom surface of deck lumber. The cupping of individual boards is aggravated because the top surface is usually at a lower moisture content—because of exposure to the sun and wind—compared with the protected bottom surface. This situation means that deck boards installed wet are likely to warp the most, especially when installed during hot months. This shrinkage difference is more pronounced if the bottoms of the boards remain damp, such as when the deck is built low to the ground or near wet soil.

Finally, we don't recommend using deck boards wider than 6 in. because cupping and warping can become excessive.

Don't Forget to Finish the Job

Even though you're using naturally decay-resistant or pressure-treated wood, the horizontal surface of a deck is exposed to foot traffic, sun, and rain, which makes finishing a deck with a water-repellent preservative a necessity. This exposure will degrade the wood's surface, and unless the wood receives the proper finish, discoloration and checking often result, leading to a rough, uneven deck surface and decay in untreated wood. Applying and maintaining a finish on your deck will help minimize problems.

It used to be recommended to wait a year, or a season, to finish a deck. In our experience, this amount of time is too long because surface problems that cannot be corrected later may develop (i.e., checking, cracking, splintering).

For a new deck, apply the finish after the surface of the wood has dried to about 20% MC. Wood stamped S-DRY, KD (kiln dried), MC-15 (average moisture content 15%), or KDAT has been dried and can be finished immediately.

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Even cedar, redwood, and pressure-treated lumber require regular application of a water-repellent preservative (including mildewcide). Note the water intrusion around the long surface check of the leftmost deck board. In a year or two, this board will degrade to the same condition as the center board.