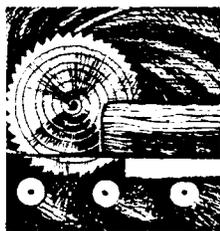


# Wood Industry Fact Sheet



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## How to Minimize Stain, Warp, and Checking

When air drying, solar drying, or kiln drying lumber, it is costly and frustrating to have high quality boards damaged by stain, warp, and checking. These defects all result from biological characteristics of wood but each may be kept at a minimum by following a few common sense recommendations. Before discussing the suggested practices, a basic understanding of these problems is needed.

### Stain

Stain on the surface of lumber, which appears as unsightly purple or blue-black blemishes, is caused by mold or blue-stain fungi. Although the stain may sometimes be removed by bleaching or surfacing, it is especially troublesome since it indicates that the lumber has been exposed to conditions that may promote more serious fungal decay. Fungi thrive in a moist, warm, dark environment. Therefore freshly cut lumber stacked in unstickered piles is especially susceptible to stain.

Protection from fungal infection may be obtained by dipping or coating lumber immediately after sawing with a commercial fungicide. Caution must be exercised by following the manufacturer's instructions for safe handling and application of toxic chemicals!

Sticker marking, a brown discoloration, is caused by chemical change that occurs on the surface of the lumber in contact with the stickers. Maple, white ash, and magnolia are particularly prone to chemical brown stain. Sticker marking may be reduced by using dry stickers and by practices that promote rapid drying.

### Warp

Warp is distortion of a board from a flat plane caused by unequal shrinkage in different directions relative to the wood grain. Most species tend to shrink most in the direction tangential to the annual rings, somewhat less radially from pith to bark (or perpendicular to the annual rings), and a negligible amount longitudinally along the tree trunk. Thus, if a board tends to shrink unequally in any direction during drying, it will tend to warp.

Sometimes distortion will occur in freshly sawed hardwoods. This form of warp is caused by "growth stresses" created by the growth characteristics of living trees and is not developed by shrinkage during drying.

Warp may be reduced by proper stickering and stacking and by top weighting the lumber pile. The old axiom that "if a board dries flat it will stay flat" best describes the logic to reducing warp. Sufficient mechanical restraint to hold a board flat during drying will eliminate warp or straighten distortion caused by growth stresses.

### Checking

Cracks that occur on the ends and surfaces of lumber during drying are known as checks. Checking is caused by shrinkage differences between the surface and core of drying lumber. Since the ends and surfaces dry first, they tend to shrink first but are restrained by the swollen core. This results in stresses building up near the surfaces which, if they become too great, cause the lumber to check. Red and white oaks, sycamore, and beech are highly susceptible to checking.

Generally, rapid drying will cause the build up of stresses that result in checking. Therefore, checking may be minimized by maintaining gentle drying conditions (lower temperatures and higher relative humidities), particularly at the beginning of the drying process. In kiln drying, the operator should follow prescribed kiln drying schedules for the species and thickness of lumber being dried (see Rasmussen 1961 ). Air circulation through the lumber pile also should be monitored and kept within recommended limits.

On hot, sunny days it may be necessary to open vents or partially cover the collectors of a solar kiln. This is especially important in drying oak or other check-prone species. (See Wengert 1980. )

Valuable and check-prone lumber should be sheltered from the elements during air drying. A shed or pile roof will protect lumber from excessive exposure to direct sunshine as well as rain or snow. Orienting piles parallel to prevailing winds will

retard airflow through the pile and slow drying. This may or may not be an advantage depending upon species being dried and seasonal weather conditions. (A more detailed description may be found in Rietz and Page 1971.)

End checking may be greatly reduced by painting the ends of logs or freshly sawed lumber with a commercial end coating or aluminum based paint. The paint will retard drying from the ends of the lumber thus reducing the stress concentrations that cause end checks. Placing stickers as close to the ends of lumber piles as possible also reduces end checking.

### Stacking and Stickers

Lumber should be stacked immediately after sawing in neat, stickered piles. The stickers separate each layer of lumber and allow air to circulate and dry the boards. Stickers should be made from straight, dry wood  $\frac{3}{4}$  inch thick,  $1\frac{1}{4}$  inches wide, and as long as the pile is wide. Although stickers may also be made of other materials such as plywood or aluminum, wood stickers are least expensive and easy to make.

Each layer of lumber in the pile and each layer of stickers should be of uniform thickness in order to minimize warp. Stickers should be aligned in straight, vertical rows spaced 16 to 24 inches apart. Uneven alignment or excessively large spacing will increase the tendency of the lumber to bow.

Lumber piles should rest on firm, level foundations with support directly under each vertical row of stickers. The piles should be placed on dry ground and should be kept free of weeds and debris. Foundations for air drying lumber should elevate the

piles sufficiently to provide clearance and air flow between the lumber and ground. (See Rietz and Page 1971.)

Piles should be top-weighted to reduce warp, particularly in the upper layers in the pile. A plywood panel placed over a layer of stickers on top of the lumber pile provides a base for a layer of concrete block, sand bags or other heavy material.

### Storage of Dry Lumber

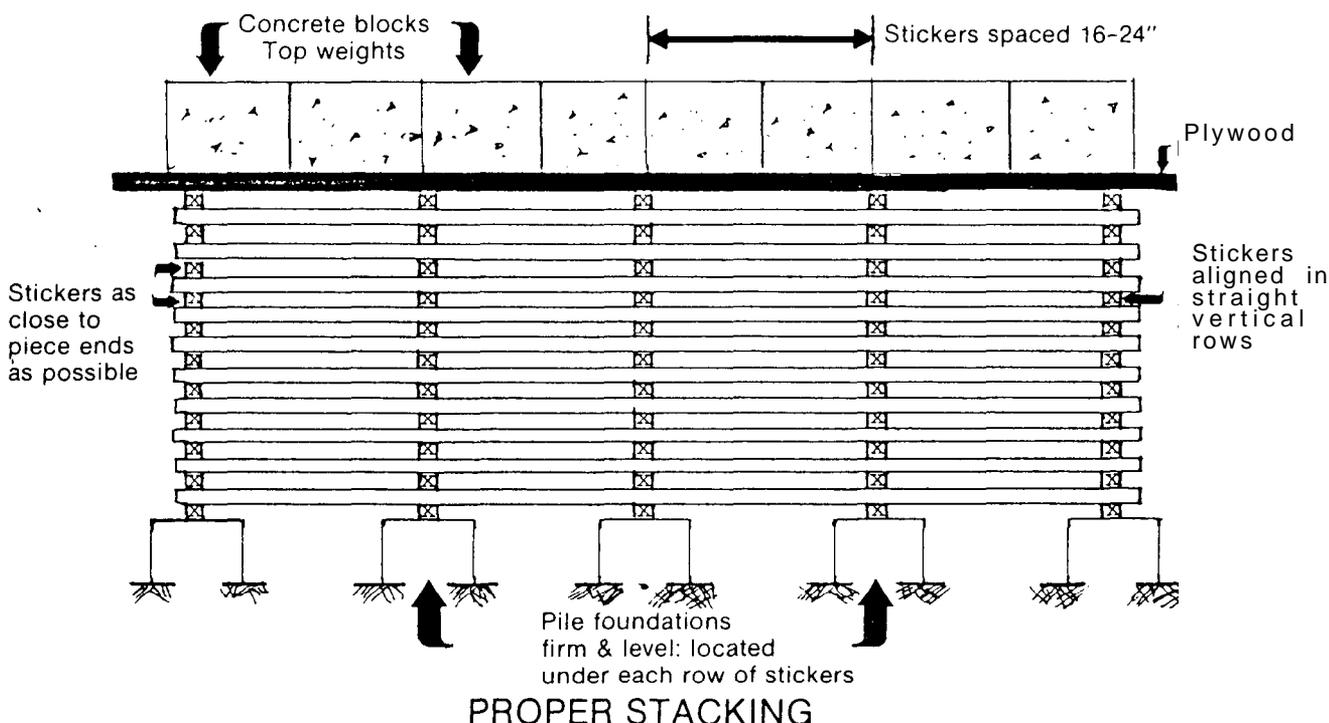
One of the most common mistakes relating to drying defects is improper storage of dry lumber. If dry lumber is exposed to high humidities it will gain moisture. As the lumber is again exposed to drier air it will lose the moisture it has regained. It is not uncommon for "dry" lumber to shrink, swell, warp, check, or stain if subjected to changes in environment. It is recommended that dry lumber be stored flat under the same temperature and relative humidity as it will be exposed to in use. Thus, lumber intended for manufacture into high quality furniture should be stored under the same conditions as expected in a heated home (approximately 6% equilibrium moisture content).

### References

Rasmussen, E. F. 1961. Dry Kiln Operator's Manual. U.S. Dept. Agr. Handbook No. 188. U.S. Forest Service: Forest Products Laboratory; Madison, WI

Rietz, R. C. and R. H. Page. 1971. Air Drying of Lumber: A Guide to Industry Practices. U.S. Department Agriculture Handbook No. 402. U.S. Forest Service: Forest Products Laboratory; Madison, WI.

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